It is recommended that the transceiver chassis is connected to ground using the bolt on the rear panel to stop pick-up of unwanted noise from local power supplies and electrical equipment.

Power supply

All Barrett transceivers require a supply voltage of 13.8 VDC. In most vehicles or vessels this is available from the battery, in the case of vehicles with a 24V system a 24V to 12V converter rated at 25 amps should be used (Barrett P/N BCA90014). In fixed station installations where mains power between 88VAC and 256VAC is available, a Barrett 2022 power supply should be used.
In base station installations where no mains supply is available a Barrett 2001 solar power supply is available.

Note:- Some installations use an AC battery charger to float charge the supply battery. Battery chargers can produce electrical noise from the rectifier diodes. This noise causes a static type of interference in the receiver. It may be necessary, therefore, to switch off the battery charger whilst the transceiver is in use. If float charging of batteries is required for installations with unreliable AC power supply, it is recommended that a Barrett 2022 be used as this provides a boost and float charge facility to maintain a battery without the noise problem described above.

Voltage drop

The average current consumption of the transceiver is low but during transmission of voice peaks, high current is needed for short intervals. This means that the power supply cable must be heavy enough to supply these short duration current peaks without excessive voltage drop. Preferably use only the power cable supplied with the transceiver. If extra cable is required use a cable with a conductor square area of no less than 8mm. Unwanted voltage drop will also occur if incorrect wiring techniques such as poor choice of connection points and incorrect use of terminal lugs are used.

Protection fuse

The transceiver is provided with adequate internal protection. However, the fitting of an external fuse is considered necessary, not for protection of the transceiver itself, but to ensure that in the event of damage to the cable, a fire risk does not exist. The fuse used must be installed in the active wire as close as possible to the battery, and must be of a type which has a low voltage drop at the peak currents expected.

Note:- in-line 3AG glass fuses are not suitable. An ATC automotive blade type fuse rated at 25A with a suitable high current ATC fuse holder rated at 30A or more should be used. These type of fuses and holders are contained in our standard installation kit (Barrett P/N BCA20004) or are available individually (Barrett P/N BCA20021)

Antenna

The antenna is a most critical part of the complete radio installation. It must accept the output power from the transmitter, radiate that power with minimum loss and in the receive mode, accept weak signals for input to the receiver.

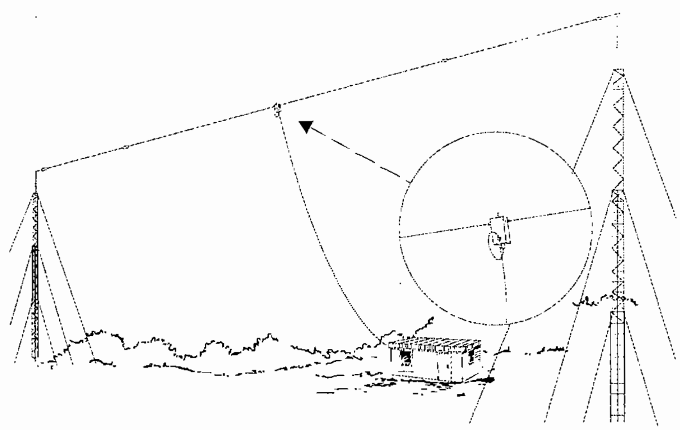
Incorrect antenna installations will yield poor system performance and are often the cause of complaints of poor transceiver performance.

A range of antennas is available from Barrett to suit most small fixed stations. Detailed instructions are included with each antenna.

912 Single Wire Broadband Dipoles - Barrett P/N BC91201

Barrett 912 single wire broadband dipoles are ideal for base stations that require operation on multiple frequencies throughout the HF spectrum using a single antenna.

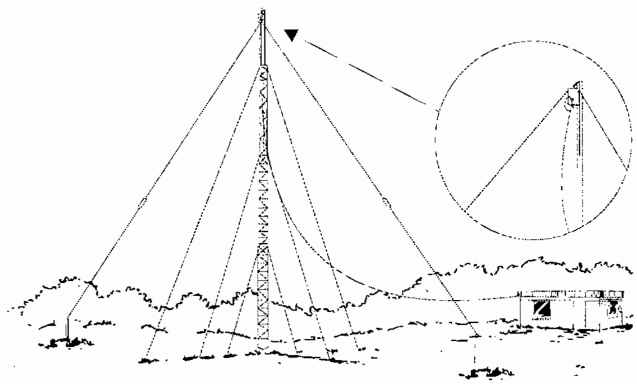
The 912 antenna can be mounted either in a horizontal or inverted 'V' configuration as illustrated in the following diagrams. In the horizontal configuration the major radiation direction is broadside to the antenna. When mounted in the inverted 'V' configuration the antenna becomes fairly omni directional. In the horizontal configuration the minimum distance between the masts is 49 metres and the recommended mast height is 15 metres. In the inverted 'V' configuration the recommended mast height is 15 metres and



125 watt standard single wire broadband dipole

at this height the 2 metre stub masts are each installed at a minimum of 19 metres from the mast base. In locations with limited space the antenna can be mounted with the ends past the load resistors drooped down towards the ground. White nylon supports located just past the load resistors are provided to attach halyards for this configuration. In this configuration the minimum distance between masts is reduced to 33 metres. Support towers may be either lattice masts as illustrated, tubular telomasts or other support structures that may be available locally. It is recommended that the halyards used to support the antenna be either UV stabilised Dacron cord or wire rope and that pulleys should be of stainless steel construction.

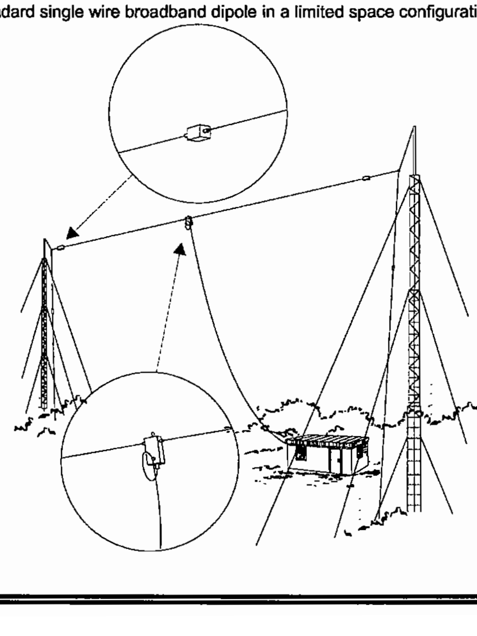
Install the antenna as illustrated in the diagrams, in the inverted 'V' configuration the eye on the top of the balun is used to attach the support halyard.



125 watt standard single wire broadband dipole in an inverted "V"

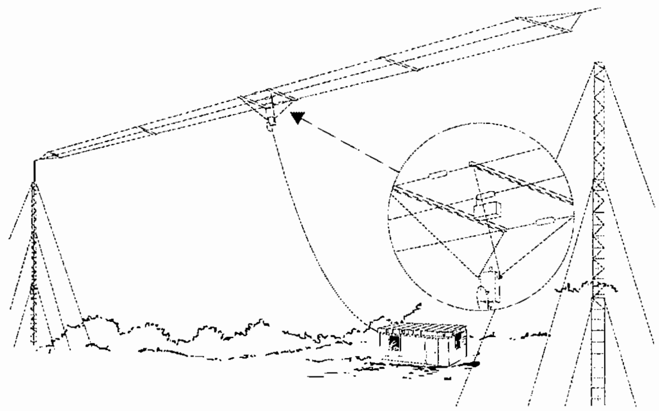
As with all antenna installations ensure the antenna is as far from sources of electrical interference as possible and in a position that makes it impossible for the antenna to come in contact with high voltage overhead mains wiring.

125 watt standard single wire broadband dipole in a limited space configuration



912 Multiwire Broadband Dipoles - Barrett P/N's BC91200, BC91202 and BC91203

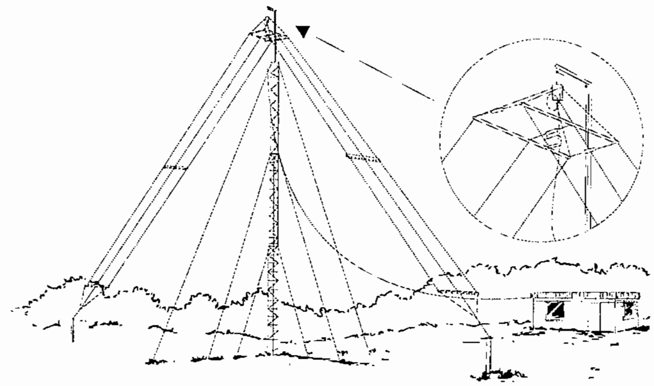
Barrett 912 broadband dipoles are ideal for base stations that require operation on multiple frequencies throughout the HF spectrum using a single antenna.



125/500 watt multi wire broadband dipole

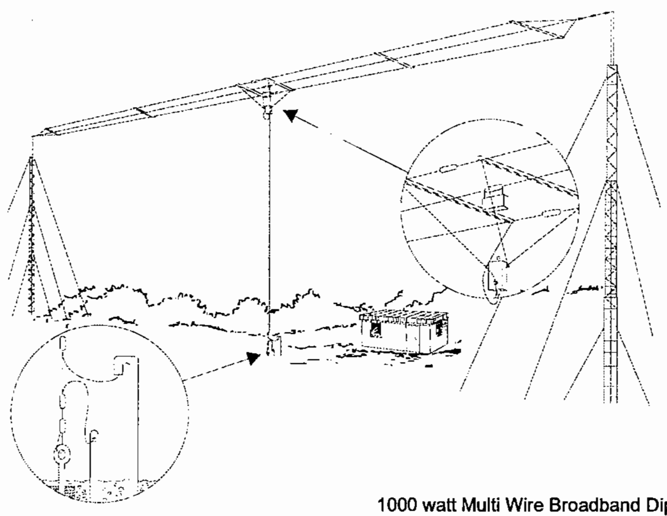
The Barrett 912 antenna can be mounted either in a horizontal or inverted 'V' configuration as illustrated in the following diagrams. In the horizontal configuration the major radiation direction is broadside to the antenna. When mounted in the inverted 'V' configuration the antenna becomes fairly omni directional. In the horizontal configuration the minimum distance between the masts is 32 metres and the recommended mast height is 15 metres. In the inverted 'V' configuration the recommended mast height is 15 metres and at this height the 2 metre stub masts are each installed at a minimum of 19 metres from the mast base. In this configuration the mast must have an offset or out-rigger bracket, at least 0.8 metres long, to hold the antenna away from the mast. Support towers may be either lattice masts as illustrated, tubular telomasts or other support structures that may be available locally. It is recommended that the halyards used to support the antenna be either UV stabilised Dacron cord or wire rope and that pulleys should be of stainless steel construction.

Install the antenna as illustrated in the diagrams, in the inverted 'V' configuration the eye on the top of the balun is used to attach the support halyard. In the horizontal configuration the balun hangs below the antenna.



125/500 watt multi wire broadband dipole in an inverted "V" configuration

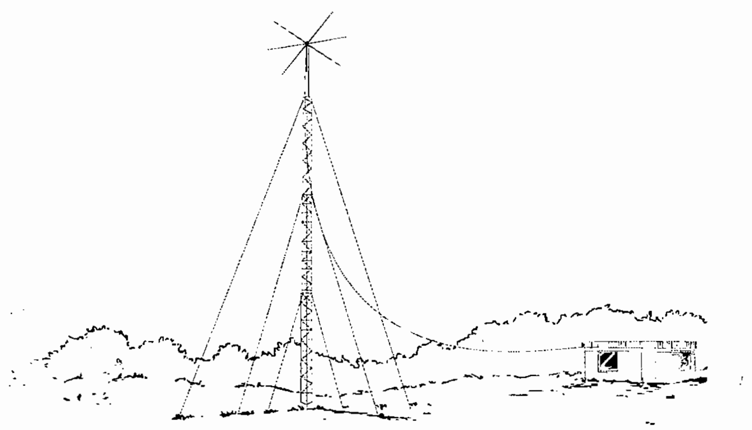
As with all antenna installations ensure the antenna is as far from sources of electrical interference as possible and in a position that makes it impossible for the antenna to come in contact with high voltage overhead mains wiring.



1000 watt Multi Wire Broadband Dipole

913 series helical dipoles - Barrett P/N's BC91301 to BC91305

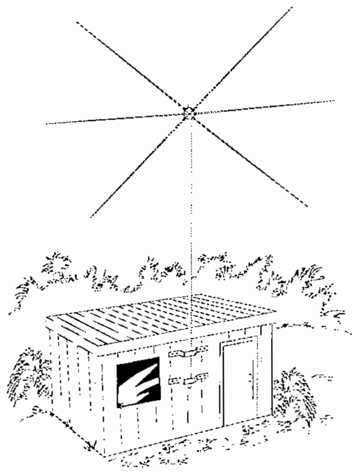
913 series helical dipole antennas are compact and easily installed, having extremely narrow bandwidth characteristics and a performance approaching that of a wire dipole when used at frequencies over 4.5 MHz. The helical dipole antenna is fed by a single coaxial feeder and can accommodate up to 5 frequencies.



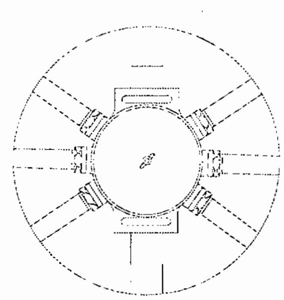
3 frequency helical dipole

The 913 helical dipole requires a 50mm diameter mounting pole. This pole should be long enough to place the helical dipole at least 5 metres above any obstruction. Alternatively the helical dipole can be mounted on top of a mast or tower. Make sure that the site selected for the antenna is as far from any source of electrical interference as possible and that under no circumstances it can come in contact with high tension power lines.

After mounting the helical dipole hub on the mounting pole, remove the front circular cover, pass the coaxial cable through the hole at the bottom of the hub. Screw the UHF connector into the balun. Now screw the helical dipole elements onto the hub. Each element has its frequency marked on the brass ferrule used to screw the element onto the hub. Assemble the helical dipole elements in the positions on the hub as indicated by the diagram enclosed in the hub. Failure to assemble the helical dipole as indicated in this diagram will cause tuning problems.



3 frequency helical dipole

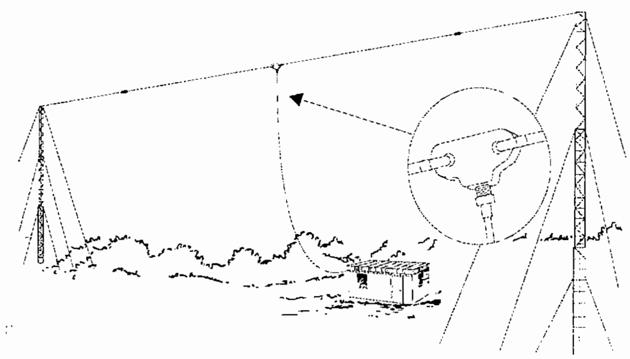


Hub detail

Helical dipoles are manufactured to specific frequencies, but may require fine tuning after installation. To enable this the dipole elements have an adjustable length tip to allow fine tuning for optimum VSWR during installation. Install the antenna in its final position and check the VSWR on each of the frequencies that the antenna was manufactured for. Should the VSWR be greater than 1.5:1 the antenna will require adjustment. If a tunable transmitter is available, determine on each frequency the helical dipole was manufactured for, at what frequency the best VSWR is obtained. If this occurs at a frequency below the required frequency then the tips will have to be shortened on the pair of elements corresponding to that frequency. If the best VSWR occurs on a frequency higher than the required frequency then the tips will have to be lengthened. Adjust both ends by an equal amount and repeat the above sequence until an optimum VSWR is obtained. If a tunable transmitter is not available use a method of trial and error to adjust the length of the tips, a little at a time, until an optimum VSWR is obtained. Remember always adjust each pair of elements by the same amount at each adjustment.

915 wire dipole - Barrett P/N BC91500

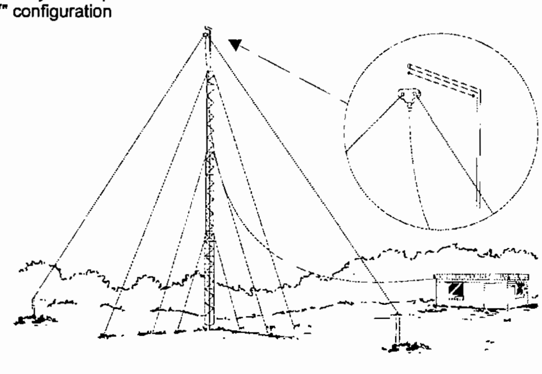
Single frequency wire dipole antennas, spot-tuned to the required operating frequency(s), are the most efficient antennas for use in HF base stations. They are simple to install and have a relatively narrow bandwidth.



Single frequency wire dipole

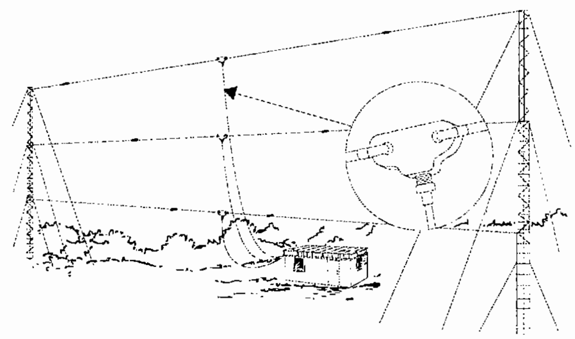
Dipole antennas should be mounted at least 1/2 wavelength from the ground. Dipoles may be mounted either between two towers or in an inverted "V" configuration (requires only one mast). As a guide, when installing the masts, the length between insulators of a half wave wire dipole is 142/(frequency of dipole in MHz) metres. To this an allowance should be made for extra insulators and halyards.
i.e. a 3.7MHz dipole - length between the insulators = 142/3.7 =38.38 metres.
Wire dipoles supplied by Barrett are pre-cut to a specified frequency but have adjustable ends. These adjustable ends allow fine tuning for optimum VSWR during installation. To fine tune a dipole install the antenna in its final position and check the antenna VSWR. Should the VSWR be greater than 5:1 the antenna will require adjustment.

Single frequency wire dipole in an inverted "V" configuration



If a tunable transmitter is available, determine at what frequency the best VSWR is obtained. If this occurs at a frequency below the required frequency the dipole is to long, if it occurs on a frequency higher than the required frequency then the dipole is to short. Drop the dipole and adjust both ends by an equal amount and repeat the above sequence until an optimum VSWR is obtained. If a tunable transmitter is not available use a method of trial and error shortening or lengthening the dipole ends, a little at a time, until optimum VSWR is obtained. Remember to always adjust each end by the same amount as the other every time.

Several single frequency wire dipoles positioned between two towers.



Barrett 911 Automatic Antenna Tuner for base station installations

Antenna

Various antenna configurations, such as vertical whips, long-wires and loops, can be used for base station installations, using the Barrett 911 automatic antenna tuner. In general however the following points should be considered:-

The antenna should be mounted as far away as possible from buildings, trees, vegetation and sources of electrical interference. If metallic masts or supports are used, arrange insulators to ensure the antenna is spaced at least 2 metres from the mast. Remember the radiating part of the antenna starts at the tuner. The location of the bottom portion of the antenna is very important.

Horizontal wire antennas have maximum radiation broadside to the antenna when the frequency is less than 1/4 wavelength. Radiation is at a minimum at the end points of the antenna. Inverted "V" installation of horizontal antennas minimises the directivity and is recommended for omni-directional coverage.

High voltages are present on the antenna system. The antenna tuner and antenna should be located or protected so that there is no possibility of accidental contact.

Transceiver and tuner mounting

The transceiver should be mounted in a suitable position allowing easy operator access. The antenna tuner should be mounted, preferably out of the weather, and as close to the ground (earth) point as possible. The interconnect cable supplied with the antenna tuner should be routed, away from other cables, back to the transceiver and connected as indicated in the diagram. The maximum interconnect cable should be less than 25 metres.

Ground (earth) system

The ground (earth) system is a key part of the overall antenna system and consequently the system operation. An inadequate ground system is the primary cause of poor performance and tuning problems. There is little point in installing the antenna unless a good ground system can be provided. In areas of good ground conductivity (ie. ground always damp), an effective ground can be made through a grounding rod. This should be approx. 3 metres in length and should be installed as close to the tuner as possible. Several rods bonded together will improve the ground contact. In some cases metal water pipes may be used as a ground providing:-

- The water pipe is close to the tuner and the water pipe enters the ground close to the tuner.
- There are no joints or couplings in the pipe that will increase the resistance path to ground.
- The water pipe enters soil with good conductivity.

- A low resistance joint is made with the water pipe.

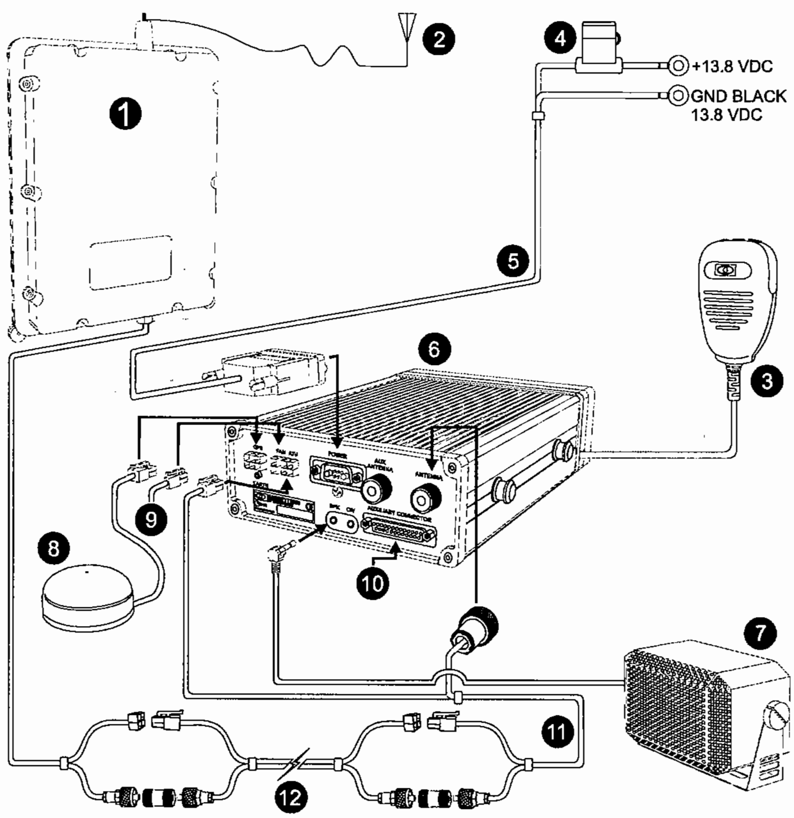
Frequently the ground conductivity will not be sufficient to provide a satisfactory ground for the Barrett 911 tuner. This will almost certainly be the case in well drained sandy soils or on rock. In these cases a counterpoise must be used as a ground system. This will also be the case in rooftop installations where no existing ground plate (such as metal roofing exists). A counterpoise can consist of radial wires or a mesh made of materials such as chicken wire. If radial wires are used the counterpoise should consist of at least 8 to 10 radial wires, each radial being at least 5 metres in length. When radials or mesh are used at ground level it is recommended that they be buried a few centimetres below the surface.

Electrical checkout

After mechanical installation is complete select the highest frequency to be used on the transceiver. A directional watt-meter such as a bird model 43 should be inserted in the coaxial transmission line between the transceiver and the tuner. The tune mode on the transceiver is then energised (refer to the transceiver user manual). Upon application of RF energy, the tuner should start to tune, indicated by the 'clattering' of the tuner relays. After a few seconds the relay noise will cease, the transceiver should indicate a successful tune and the watt-meter reflected power should indicate a low value consistent with a VSWR of better than 2:1. Now select the lowest desired frequency on the transceiver and repeat the above procedure. The result should be the same, except that the tune cycle may take somewhat longer. If the above procedure does not give the results as indicated check that the antenna length and connections are correct and re-check all ground (earth) connections.

Note:- When received, the Barrett 911 automatic antenna tuner memory system will usually not have any pre-stored tuning information appropriate to your installation. To allow the 911 to 'learn' its tuning information simply proceed from one channel to the next allowing the normal tune cycle to take place. Each successful tune is 'memorised' so that when that channel is re-selected the tuner will almost instantaneously retune to that frequency.

Connection details - 2050 transceiver and 911 automatic antenna tuner in a base station configuration.



1. 911 automatic antenna tuner
2. Antenna
3. Microphone
4. Heavy duty fuse & holder P/N BCA20021
5. 6 metre power cable supplied with transceiver
6. 2050 transceiver body
7. Extension speaker supplied standard with 2050 transceiver
8. External GPS receiver option
9. Connection for external fan unit option
10. Auxiliary connector
11. Coaxial/control cable P/N BCA90032
12. Optional 6 or 10 metre extension cable with connectors P/N BCA90032/40

Mobile installations

Transceiver position

The following points must be considered when mounting the transceiver.

Safety

It is essential that the transceiver be mounted in a place where it cannot cause injury to the occupants of the vehicle in the event of a motor vehicle accident.

For this reason overhead mounting is not generally recommended and "under dash" mounting must take into account the possibility of injuring the legs of front seat occupants.

Convenience

The chosen position for the transceiver or control head, (if a remote controlled model is used) should be one which allows convenient operation.

Positions which are often used are:

- on the transmission hump
- in place of the glove box
- behind the seat
- under the dash board (if safe)

Where a remote controlled transceiver is used, only the control head need be mounted convenient to the operator. The transceiver may be mounted under a seat, in the luggage compartment or any other out of the way place within the vehicle (which allows for sufficient cooling).

All equipment should be positioned in such a way that convenient access for maintenance is provided.

Strength

It must be assumed that the vehicle will be used on rough roads and in many cases off road. Hence mounting of equipment must take into account the severe vibration and shock that can be expected.

Transceivers may only be mounted to structural components of the vehicle body and not on dress panels or plastic interior panels. In some cases, the area around the transceiver mounting may need reinforcement.

Precautions should be taken to ensure fixing screws etc. cannot vibrate loose.

Air circulation

Most transceivers rely on air flow around cooling fins to dissipate heat generated by the transmitter. The mounting position must allow free airflow around these fins.

Obstruction

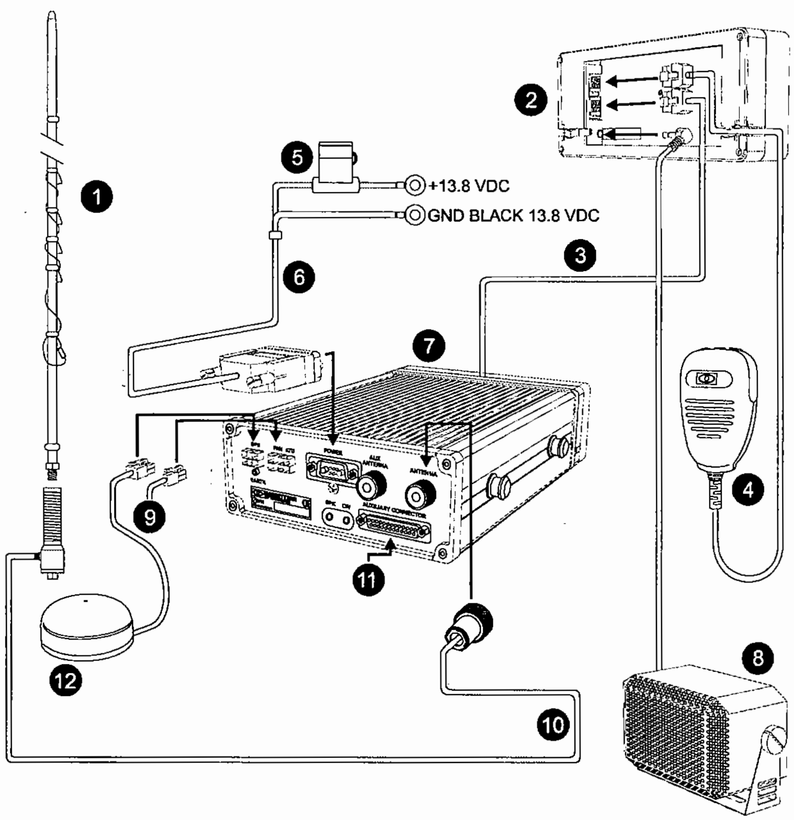
The installation of a transceiver into a vehicle should not inhibit the normal use of the vehicle. Before finally selecting equipment positions, check that normal operation of steering, foot pedals, gear change, hand brake etc. are not impeded, and that heater or air-conditioning outlets, glove box and doors are not obstructed. Always check that the drilling of mounting screw holes will not damage electrical wiring, heater hoses or hydraulic lines.

Power wiring

Connect the red positive and black negative wires from the transceiver power cable to the positive and negative terminal of the battery. Do not connect to the ignition switch or internal fuse panels as vehicle wiring to these points is of insufficient current capacity, causing voltage drop and possible noise interference.

- fit a suitable 25A ATC fuse and holder (Barrett P/N BCA20021), as near as practicable to the battery connection in the positive (red) wire.
- route the power cable away from high tension ignition wiring.
- secure the power cable, either to other wiring or the vehicle body, with suitable cable ties.
- where wiring passes through bulkheads, provide appropriate protection to prevent insulation being damaged.

Connection details - 2050 transceiver with mobile pack and 914 manual tapped mobile antenna



1	914 Manual tapped whip antenna	7	2050 Transceiver body
2	2050 Control head supplied	8	Extension speaker supplied with 2050 transceiver
3	Cable with RJ45 connectors P/N BCA20005	9	Connection for external fan unit option
4	Microphone	10	Coaxial cable and connectors P/N BCA90013
5	Heavy duty fuse & holder P/N BCA20021	11	Auxiliary connector
6	6 metre power cable supplied with transceiver	12	External GPS receiver option

Antenna

In any radio system an effective antenna installation is essential. Because of the need to reduce the size of HF antennas so that they can be fitted to a vehicle, mobile antenna bandwidth becomes quite narrow and hence tuning is critical. In most cases the only tuning adjustment that can be effected is adjustment to position. Particular attention must be given to the antenna position if satisfactory performance is to be obtained. Refer to the instructions supplied with the antenna you have selected.

Antenna mounting

The antenna mounting must provide a strong secure anchorage for the base of the antenna. To obtain maximum radiation, the antenna base **must** be well bonded electrically to the vehicle chassis. Paint, dirt, rust, etc. should be removed from the respective fixing points. The mounting point must provide a low resistance electrical path to the main vehicle metallic structure.

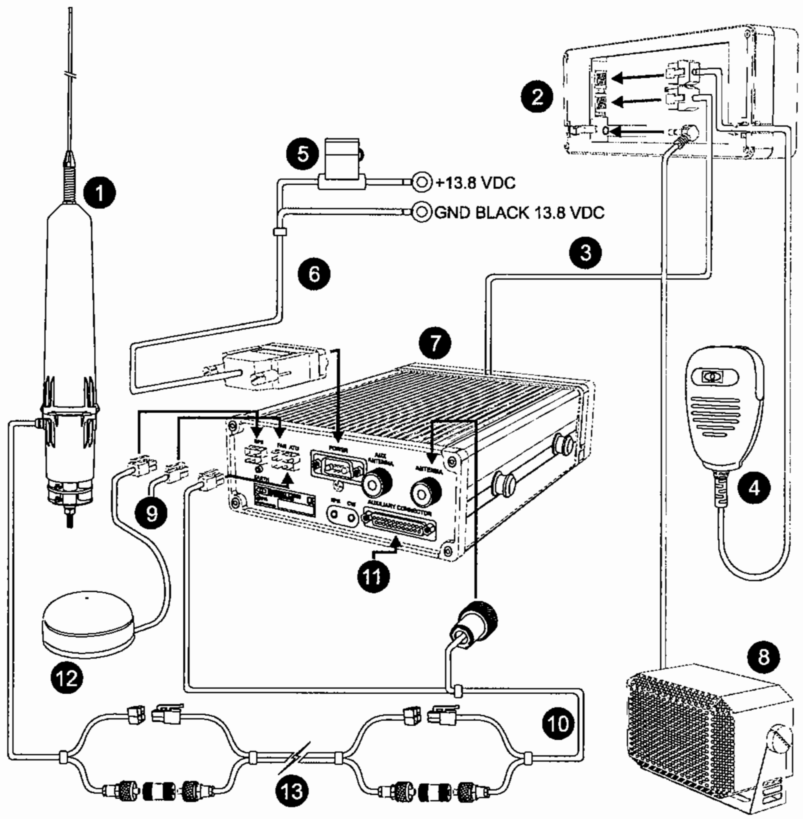
Antenna feed cables

Antenna feed cables should be run (as far as possible) away from other vehicle wiring and especially away from ignition high tension wiring. Where passing through body panels or internal bulkheads, grommets must be used to protect the cables. Water-proof connectors must be used when they are outside the vehicle.

Voltage standing wave ratio (VSWR)

After installation it is recommended that the VSWR of the antenna should be measured for each channel. The instructions supplied with the antenna selected will detail this operation.

Connection details - 2050 transceiver with mobile pack and 910 automatic tuning mobile antenna



1. 910 automatic tuning mobile antenna
2. 2050 control head
3. Cable with RJ45 connectors P/N BCA20005
4. Microphone
5. Heavy duty fuse & holder P/N BCA20021 supplied in mobile pack
6. 6 metre power cable supplied with transceiver
7. 2050 transceiver body
8. Extension speaker supplied with 2050 transceiver
9. Connection for external fan unit option
10. Coaxial/control cable P/N BCA90032
11. Auxiliary connector
12. External GPS receiver option
13. Optional 6 or 10 metre extension cable with connectors P/N BCA90032/40

Noise suppression

Noise generated by motor or electrical accessories on the vehicle may cause objectionable interference to the received signal. This noise enters the receiver either by means of the battery leads or the antenna system. Providing that the recommendations concerning battery wiring given earlier in this book are followed, noise injected via the battery lead is unlikely to be significant. Most noise problems result from pick-up by the antenna. Practical cures involve either preventing the noise from being generated or minimising it from being radiated by the wiring connected to the noise source.

Interference suppression kit (Barrett P/N BCA90017) is available to assist in noise suppression and contains filters, suppressing capacitors, earth straps and fitting instructions.

The techniques involved in noise suppression include re-routing of wiring, screening and the use of filters. It is also necessary to maintain all electrical equipment in good working order as worn brushes, loose connections and the like, will increase the amount of noise generated.

Before attempting to cure a noise problem, the source (or sources) of noise must be identified. Ideally, there should be no difference between background noise in the receiver with motor and accessories on and that with motor and accessories off.

If a detectable difference does exist, turn off all accessories one by one until a change in noise results. Continue, noting each contributing unit until there is no detectable difference from the "all off" noise level. (For accessories such as alternator, motors, instruments etc. a wire or drive belt may have to be temporarily removed for this assessment). After identifying each noise source, they can be worked on one at a time until an acceptable level of suppression is achieved.

Another approach to this problem is to remove or disconnect all possible sources of noise then replace and suppress them in turn.

Some suggestions for suppressing particular noise sources follow:-

Ignition systems

All high tension wiring from the ignition coil through to the spark plugs should be kept as short as practicable, clean, and as close to the engine block as possible. The cable should be an impregnated neoprene resistive type and the coil must be either mounted on, or immediately adjacent to, the engine block. The low tension wire from the coil to the distributor contact breaker points must be as short as possible, and not included with other wires in a harness or loom. This wire must be shielded if more than 300mm long. Twin flex or 'figure eight' cable provides a suitable shield when connected in lieu of the original wire. This method is useful for shielding other wires suspected of radiating noise. Do not ignore the wire to an electric tachometer if one is fitted.

Coil to battery wiring

A low pass filter such as that supplied in the interference suppression kit or similar should be fitted at the coil end of this wire. The earth connection of the filter should be short and well-bonded to the coil body.

Battery charging system

The charging system circuit, consisting of either generator or alternator and a regulator may also be split into three parts:-

Alternator / generator to battery wiring

A low pass filter such as that supplied in the interference suppression kit or similar should be fitted to the main battery lead at the alternator. The filter must be rated for the maximum current available from the charging system. The earth lug of the filter should be attached to the alternator body or the engine block.

Alternator to regulator control wire (generator field wire)

This wire carries switching pulses that often contribute noise to the receiver. Suppression using capacitors or filters must not be attempted since damage to the regulator may result. Separate the wire from all other wiring, keep it as short as possible and, if longer than about 300mm it should be shielded as described above.

Other regulator wires

These are normally adequately suppressed using good low-inductance bypass capacitors. To be effective, these capacitors must connect to the wires to be suppressed and to chassis with very short leads. For this reason, the 'pigtail' style of suppressor capacitor often used with MF broadcast receivers is generally ineffective at HF.

Other noise sources

Electric motors (windscreen wipers, fans etc.)

Small electric motors can usually be suppressed with good low inductance bypass capacitors.

Engine instrumentation

Certain types of oil-pressure sensors and voltage regulators used in instrument systems contain a vibrating or thermal cycling contact. These devices can only be suppressed by isolating and screening or wiring in the same way as described for the alternator to regulator control wire. Disc ceramic capacitors with short leads (protected with insulating sleeving) are frequently useful but to prevent damage to instrument contacts, where the use of bypass capacitors is attempted, values larger than 1nF should not be used.

General noise suppression tips

When searching for sources of noise, some of their characteristics can be helpful in identification:-

Petrol engine ignition noise and contact breaker noise is a sharp staccato 'plop' varying with engine speed. It is only with this class of noise that the impulse noise limiter incorporated within some transceivers is effective

Noise from other sources generally has a more 'mushy' sound. That from the alternator/generator may only be troublesome over a limited range of engine speed and can also be influenced by the state of charge of the battery.

The noise from instrument regulators may depend on the battery voltage, the reading of the instrument and the length of time the system has been switched on. For this reason, the search for noise sources must be done thoroughly to prevent noise from apparently reappearing after the installation has been completed.

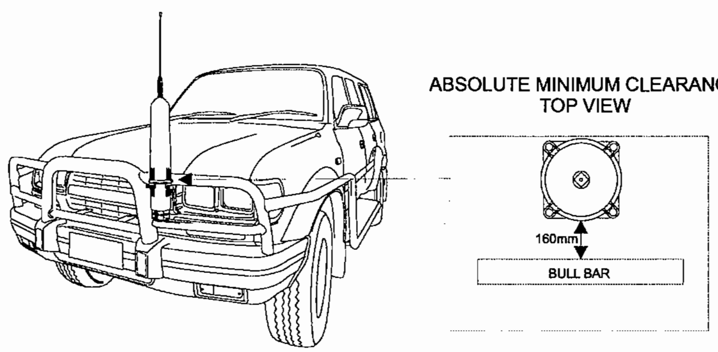
Electric motors generate a 'whining' sound. Do not forget to check windscreen wipers, electric fuel pumps, heater and air conditioning fans and other motors which operate only on an intermittent basis.

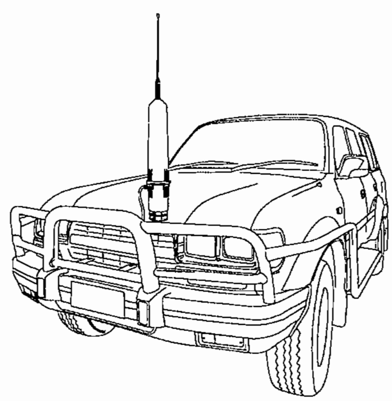
910 automatic tuning mobile antenna - Barrett P/N BC91000

The 910 antenna plugs directly into the rear of a 2050 transceiver using the cables supplied. **Important:-** 2050 transceivers must have the 910 antenna option set during programming.

The 910 antenna should be mounted in positions similar to those illustrated in the diagrams below. Select a position free from excessive vibration. A bracket, fabricated to withstand the forces and vibration that can be expected during off-road driving, should be used to mount the antenna to the vehicle. When locating the mounting position for the antenna ensure that the antenna body, when flexing on its vibration mount, cannot come into contact with other parts of the vehicle. The antenna should be mounted as far from surrounding objects on the vehicle as possible.

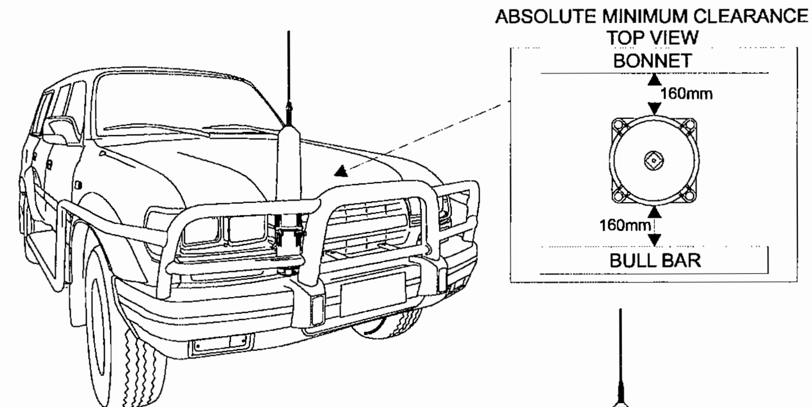
Preferred Mounting Positions

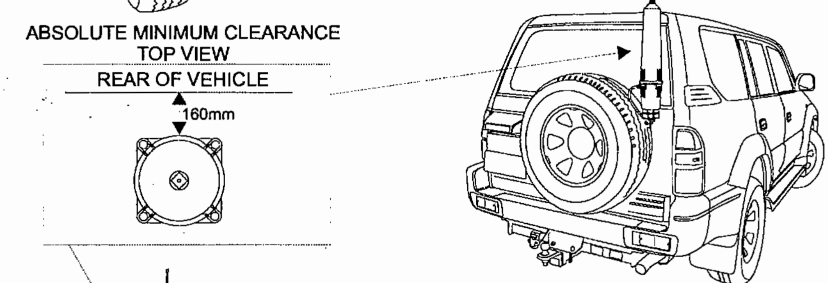


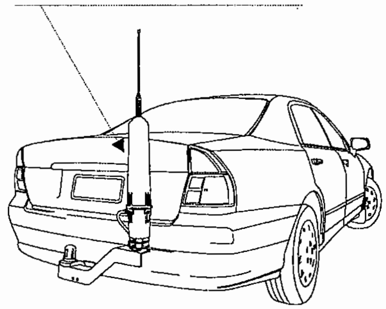


Important:
Please note that the mounting of a 910 Antenna on the front of a vehicle may be considered illegal in some areas/countries. Please check with your local transport/vehicle authority prior to installation on the front of your vehicle.

Acceptable Mounting Positions







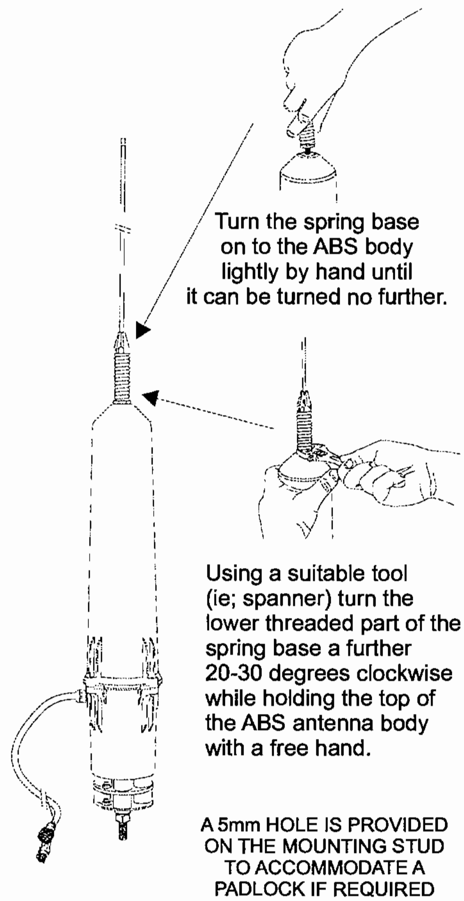
Important:
Please note that the mounting of a 910 Antenna on the front of a vehicle may be considered illegal in some areas/countries. Please check with your local transport/vehicle authority prior to installation on the front of your vehicle.

Caution:- Whilst the 910 automatic tuning mobile antenna is designed to withstand vibration to military specifications on tyred vehicles, some mounting positions on large prime-movers, particularly front mounted bull-bars, are subject to vibration that far exceeds this specification. Do not mount the 910 antenna in positions such as these as damage to the antenna may result.

A good earth (ground) to the main body of the vehicle is essential for efficient operation of the antenna. To achieve this clean all joints to bare metal and use copper braid earth straps if any non-metallic joints are encountered.

After mounting the main body of the antenna, screw the black coil onto the antenna body followed by the stainless steel whip.

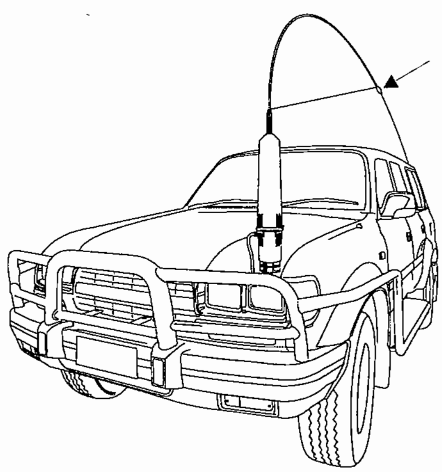
Note:- Some models of the 910 antenna have a one piece spring and a stainless steel whip in place of the coil and whip.

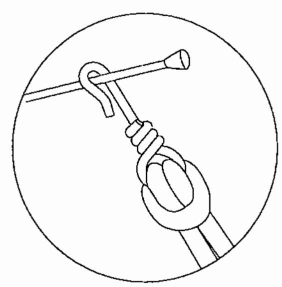


The antenna is supplied with a pre-terminated 1.5 metre cable tail. This should be routed into either the engine compartment or boot (trunk) of the vehicle. A 6 metre pre-terminated extension cable is supplied to connect the antenna to the transceiver (this cable may be extended to 12 metres by use of another extension cable). If the joint between the antenna stub cable and the extension cable is in an exposed position, a butyl rubber self amalgamating tape should be used to seal the joint. Do not wrap this joint if it cannot be made completely water tight as water will collect in the joint and cause it to corrode.

To test the antenna, attach a VSWR meter in line with the coaxial cable at the transceiver. Select any channel on the transceiver and activate PTT or use the tune function # on the transceiver. The antenna should tune (indicated by the sound of relays clattering), within 2 seconds. Use the tune function to check the VSWR of the antenna, it should be less than 2:1. If the tune sequence does not occur check all wiring thoroughly and check that the transceiver is programmed for use with a 510/910 antenna. If the VSWR is not within an acceptable limit check the earth (ground) bonding of the antenna base to the vehicle.

To secure the whip if driving under low objects or for use of the 910 in an NVIS mode (for short range communication) secure the whip as illustrated in the diagram below with the steel wire clip and lanyard supplied.





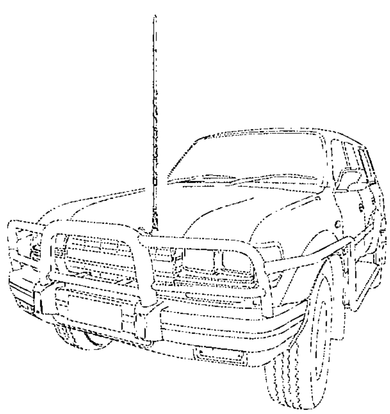
Important:
Please note that the mounting of a 910 Antenna on the front of a vehicle may be considered illegal in some areas/countries. Please check with your local transport / vehicle authority prior to installation on the front of your vehicle.

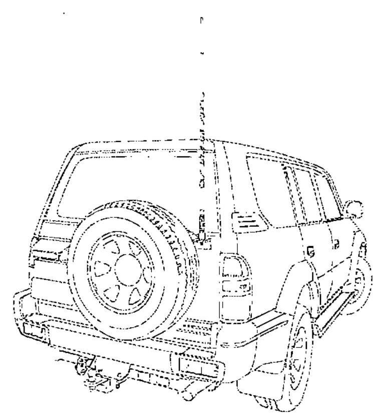
914 series manual tap whip antenna - Barrett P/N BC91401 to BC91424

Installation

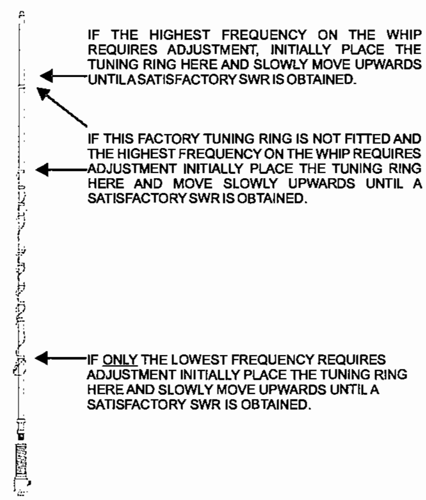
914 series manual tapped whip antennas are mounted on vehicles using a heavy duty base and spring (Barrett P/N BCA91400). The whip should be mounted on the vehicle in positions such as those illustrated in the diagrams below. A bracket, fabricated to withstand the forces and vibration that can be expected during off-road driving, should be used to mount the antenna base and spring to the vehicle. When locating the mounting position for the antenna, the ring located above the label at the bottom of the whip should be level with the surrounding ground plane, e.g. the bonnet of the vehicle or the roof of the vehicle. Ensure that the mounting bolt on the base and spring is electrically bonded to the chassis of the vehicle via a very low resistance path, i.e. clean all joints to bare metal and use braid earth straps if any non-metal joints are encountered. Use only good quality coaxial cable and water proof UHF connectors (such as those supplied by Barrett Communications). **Do not use PL-259 UHF connectors.**

When running the coaxial cable from the antenna to the transceiver avoid sharp corners and heat such as that generated by the manifold of the engine. After installing the antenna check the antenna VSWR on each channel. Generally if the antenna has been mounted in the positions as illustrated, the VSWR will be less than 1.6-1 and no adjustment is necessary. If the VSWR is not lower than 2:1 the antenna to ground capacitance in that installation is probably outside of the design range of the factory set tuning. Consideration may be given to retuning the whip if the VSWR is so high as to cause the transmitter ALC system to begin to reduce power (to protect the transmitter).





For each frequency which will not tune correctly you will need to determine whether the tuning is high or low in frequency. Generally any frequencies which will not tune will always be out the same way. When the antenna is made most frequencies are deliberately made on the low frequency side and adjusted upwards by the placement of "tuning rings". Tuning rings are single short circuit rings of 20 amp fuse wire placed on the windings of an individual part of the antenna. A tuning ring inductively raises the frequency of the section of antenna over which it is placed.
It must be understood that the tuning of an antenna on a particular vehicle or installation may not hold for other vehicles or installations. To determine whether any particular frequency tap is high or low hold the tune key down on the relevant frequency and observe the VSWR on a suitable meter. Get an assistant to slowly move his outstretched arm closer to the antenna tap in use.



If the VSWR gets better then the antenna is too high in frequency. This indicates that there is insufficient antenna to ground capacity. Usually this happens when the antenna is mounted too far away from the body of a vehicle. Either re-site the antenna closer to the vehicle or remove any tuning rings which are already on the antenna.

If the VSWR gets worse when following the above procedure then too much capacity is already present, this is frequently encountered when mounting the antenna too low on a vehicle bumper bar or when mounting close to bodywork as in cab-over type vehicles. In this case either re-site the antenna further away or add extra tuning rings to the frequency sections affected until a suitable VSWR is obtained.

Note:-Truck cab-over installations usually produce distorted radiation patterns even when the VSWR looks good.

When tuning is complete any new rings added should be coated with epoxy resin to secure and protect the ring from damage. Five minute quick setting type epoxy is suitable. If rings need to be removed they may be cut off using a sharp pair of side cutters. Take care not to cut into the body of the antenna.

Note:- If the wander lead is damaged or lost and requires replacing, the number on the first tap indicates the length of the replacement wander lead required.

Example:- WI-60 indicates the length of the wander lead was 60cm. When making a replacement wander lead ensure it is made to this length to obtain optimum performance.

Operation Instructions

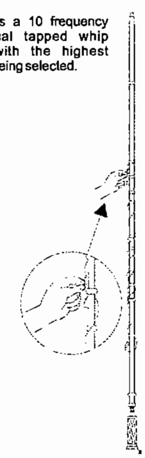
The 914 manual tapped whip antenna should now be screwed into the base and spring mounted on the front of the vehicle.

The **operation frequency being used on the transceiver should now be selected on the antenna**. This is done with the supplied jumper lead as indicated in the diagram below and the following example (Note:- this is an example only and your antenna will be manufactured with different frequency taps.)

The 914 manual tapped whip antenna used in the example has the following frequencies:-

Channel 1	**4030 kHz**	**Channel 2**	**4760 kHz**
Channel 3	**5190 kHz**	**Channel 4**	**5254 kHz**
Channel 5	**7180 kHz**	**Channel 6**	**8199 kHz**
Channel 7	**9134 kHz**	**Channel 8**	**9145 kHz**
Channel 9	**10567 kHz**	**Channel10**	**14567kHz**

Illustrated is a 10 frequency 914 manual tapped whip antenna with the highest frequency being selected.



When using **Channel 1**, frequency **4030kHz**, the jumper lead should be removed from the bottom antenna socket and stored in the vehicle.

On all other channels the jumper lead is required:-

For **Channel 2**, frequency **4760kHz**, the jumper is plugged into the bottom socket then wound tightly around the antenna and the other end plugged into the socket marked **4760**.

For **Channel 3**, frequency **5190kHz**, the jumper is plugged into the bottom socket then wound tightly around the antenna and the other end plugged into the socket marked **5190**.

An so on to **Channel 10**.

Note:- It is important for correct operation of the whip antenna to have the right frequency tap selected as indicated above and that the jumper lead is wrapped tightly around the antenna between sockets.

Marine Installations

General

The Barrett 911 automatic antenna tuner is designed for use in land base station and maritime HF services. Primarily designed for operation with end-fed un-balanced antennas such as whips and long-wires, the tuner is built in a waterproof impact resistant, moulded ABS plastic enclosure.

Antenna selection

The 911 automatic antenna tuner will operate into almost any end-fed antenna with a length exceeding 2.5 metres, providing an effective ground (earth) is used. The antenna efficiency will be proportional to the length of the antenna and will be maximum when the length of the antenna approaches 1/4 wavelength. It is advisable to limit the wire antenna to 1/4 or 3/4 wavelength at the highest frequency to be used.

Antenna

On sailing vessels the antenna can either be an insulated backstay or a whip antenna mounted vertically, usually on the stern. Best performance will be achieved by using an insulated backstay as the radiating length will be longer than that available when using a whip. The top insulator on the backstay should be approximately 300 mm from the mast and the bottom insulator should be at eye level above the deck. The distance between insulators should be greater than 10 metres and less than 35 metres. A whip antenna is generally used on small to medium sized power vessels. There are different length whips to suit the vessel length.

Transceiver and tuner mounting

Select a suitable position in the vessel to mount the transceiver. It should be a position that is out of the weather and easily accessible to the operator, whilst as close as practical to the 13.8V DC power source. Mount the transceiver to a solid fixing point using the mounting cradle. Make sure there is sufficient space at the rear of the transceiver to connect the power and antenna cables.

The antenna tuner should be mounted as close to the antenna feed point as possible. In metal vessels the length of the feeder from the antenna tuner to the feed-through insulator, inside the vessel, should be kept less than 1 metre.

The antenna feed cable should be a suitable high voltage cable. Care should be taken to avoid sharp points when terminating the cable to prevent corona discharges.

The interconnect cable supplied with the antenna tuner should be routed away from other cables back to the transceiver and connected as indicated in the diagram overleaf.

Ground (earth) system

The ground (earth) system is a key part of the overall antenna system and consequently the system operation. An inadequate ground system is the primary cause of poor performance and tuning problems. There is little point in installing the antenna unless a good ground system can be provided.

Metal hulled vessels provide an almost perfect ground. The tuner ground terminal should be connected directly to the hull using the shortest possible ground strap. The point of connection to the hull should be prepared so that it is free of paint and rust to ensure a good contact area with minimum electrical resistance.

Wooden or fiberglass vessels present more of a problem to ground. Ideally the vessel should be fitted with an external copper ground sheet, connected to the interior of the vessel by suitable stud or an earth plate ("E" plate Barrett P/N BCA91700)

If the vessel is yet to be constructed, then in the case of fibreglass vessels a thin copper sheet with an area of not less than 4 square metres should be moulded into the hull during lamination. A suitable heavy strap should be connected to the sheet and left free for earth connection.

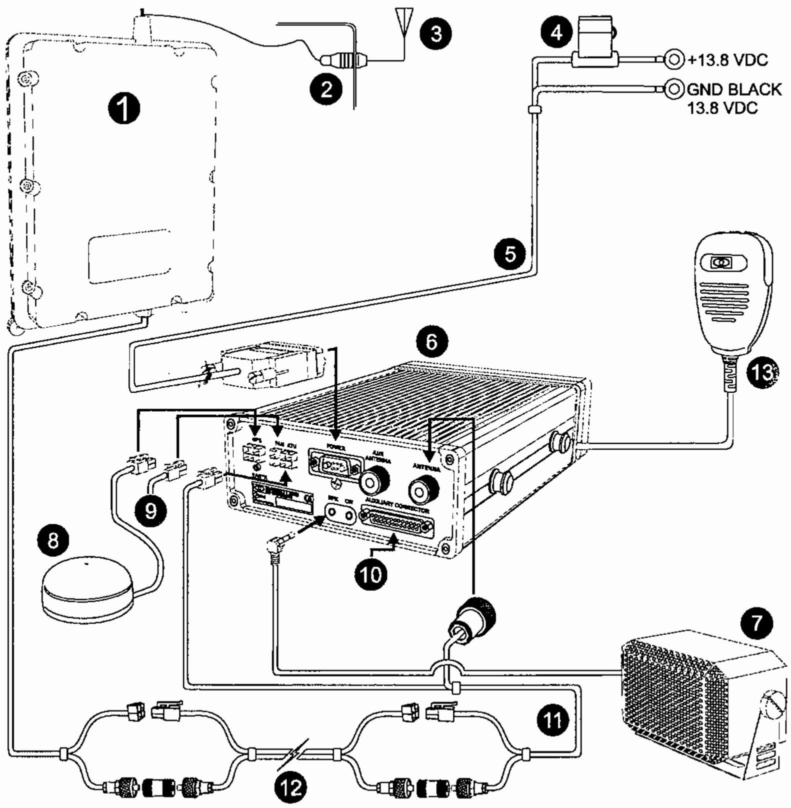
Should neither of these methods be available it will be necessary to bond as many large metallic objects, such as the engine and propeller shaft, together to form a ground.

Whichever method is used the ground run from the ground system to the antenna tuner should be as short as possible and use copper strap at least 50mm wide (wider if available). Consideration must always be given to the problem of electrolysis. Severe structural damage may occur if electrolysis is present.

Corrosion

All connections in marine situations are subject to corrosion and oxidation. To minimise this all joints should be cleaned and have silicon grease applied before assembly. Under severe conditions joints should be protected with self vulcanising rubber tape.

Connection details - 2050 transceiver and 911 automatic antenna tuner in a marine installation.



1. 911 automatic antenna tuner
2. Feedthru insulator P/N BCA91701 (If required)
3. Antenna
4. Heavy duty fuse & holder P/N BCA20021
5. 6 metre power cable supplied with transceiver
6. 2050 transceiver body
7. Extension speaker supplied standard with 2050 transceiver
8. External GPS receiver option
9. Connection for external fan unit option
10. Auxiliary connector
11. Coaxial/control cable P/N BCA90032
12. Optional 6 or 10 metre extension cable with connectors P/N BCA90032/40
13. Microphone

Electrical checkout

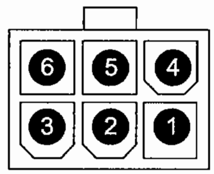
After mechanical installation is complete select the highest frequency to be used on the transceiver. A directional watt-meter such as a Bird Model 43 should be inserted in the coaxial transmission line between the transceiver and the tuner. The tune mode on the transceiver is then energised (refer to the transceiver user manual). Upon application of RF energy, the tuner should start to tune, indicated by the 'clattering' of the tuner relays. After a few seconds the relay noise will cease. The transceiver should indicate a successful tune and the watt-meter reflected power should indicate a low value consistent with a VSWR of better than 2:1. If the cover of the tuner is removed the PCB mounted 'tuned' LED should be illuminated. Now select the lowest desired frequency on the transceiver and repeat the above procedure. The result should be the same, except that the tune cycle may take somewhat longer. If the above procedure does not give the results as indicated check that the antenna length and connections are correct and re-check all ground (earth) connections.

Note:- When received, the Barrett 911 automatic antenna tuner memory system will usually not have any pre-stored tuning information appropriate to your installation. To allow the 911 to 'learn' its tuning information simply proceed from one channel to the next allowing the normal tune cycle to take place. Each successful tune is 'memorised' so that when that channel is re-selected the tuner will almost instantaneously retune to that frequency.

Connectors

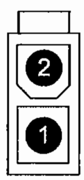
Note:- All connectors below viewed looking at the rear of the transceiver

GPS connector



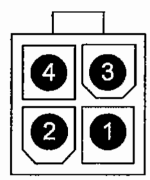
1	NMEA -	-12 VDC data input NMEA 0183 format
2	+5V	+5 VDC supply max 75mA
3	NMEA +	+12 VDC data input NMEA 0183 format
4	Ground	Ground 0V
5	1PPS	1PPS timing pulse TTL level from GPS
6	GPS RX	GPS TTL data input

Fan connector



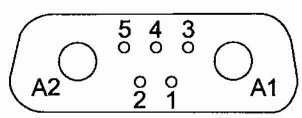
1	+13.8VDC
2	Fan control - active low

Automatic antenna



1	Tune initiates tune 911, preamp active low 910
2	+ 13.8VDC (interrupted for 910 tune initiate)
3	Tuned -tune successful low going pulse.
4	Ground 0V

Power connector



1	Fan control out	Active low 0V
2	Speaker out	External speaker 0-10V
3	N/C	
4	N/C	
5	N/C	
A1	+13.8 VDC input	+13.8 VDC
A2	-13.8 VDC/Ground	13.8VDC/Ground

Auxiliary connector (25 pin female "D" connector on rear panel)

Pin	Name	Description of function	Level
1	Ground	Ground	0V
2	Rx Data	RS-232 data input	True RS-232
3	Tx Data	RS-232 data output	True RS-232
4	External Power On	For use with ancillary equipment.	Low to activate
5	External Speaker	External speaker output	0-10V
6	Aux dig in 0	Future use	Active low 0V
7	RS-232 Gnd	RS-232 Ground	0V
8	ALC In	Ext. ALC from Linear Amp	0-10V
9	PTT In	Auxiliary PTT input	Active low 0V
10	Aux dig in 1	Scan stop input from external modem	Active low 0V
11	Bal. Tx Audio In	Balanced Tx audio input (with pin 24)	600 Ω -24dBm to 0dBm
12	Bal. Rx Audio Out	Balanced Rx audio output (with pin 25)	600 Ω -6dBm to +9dBm
13	Ground	Ground	0V
14	Aux dig out 0	Linear LPF select	Active low 0V
15	Aux dig out 1	Linear LPF select	Active low 0V
16	Aux dig out 2	Linear LPF select	Active low 0V
17	Aux dig out 3	Linear LPF select	Active low 0V
18	Aux dig out 4	Linear LPF select /Selcall alarm	Active low 0V
19	Aux dig out 5	Linear LPF select /Audio mute	Active low 0V
20	Aux dig in 2	Future use	Active low 0V
21	PTT / C-Mute	PTT Out / Receiver Cross Mute	Active low 0V
22	Not Used	Not Used	
23	+13.8 V Fused Out	+13.8V Output to power auxiliary equipment	13.8V @ 2 Amp.
24	Bal. Tx Audio In	Balanced Tx audio input (with pin 11)	600 Ω -24dBm to 0dBm
25	Bal. Rx Audio Out	Balanced Rx audio output (with pin 12)	600 Ω -6dBm to +9dBm

Note 1:- Pin 18 and Pin 19 – Function depends on programming:- If Linear Amplifier selected in I/O configuration these lines are programmed to control the linear LPF selection of 2075 linear amplifiers. Otherwise Pin 18 becomes the selcall alarm output pin and pin 19 follows the audio mute condition.

Note 2:- Balanced Rx audio out on Pin 25 and Pin 12 can be un-muted or follow the audio mute depending on the configuration in the protected menu "I/O section"

Overview of HF operation

HF (High Frequency) is the radio spectrum with frequencies between 1.6 and 30MHz. Within this radio spectrum an efficient form of transmitter modulation, SSB (Single Side Band), is used. This, combined with the use of the ionosphere - a layer of ionisation gases that resides between 100 and 700km above the earth's surface, provides efficient, cost effective communications over short, medium and long distances - without the need for expensive re-transmission devices, such as the VHF or UHF repeaters or satellites, all of which have on going operational costs and a reliance on a physical infrastructure.

In many remote areas, HF/SSB is the only form of communication possible.

HF propagation

When HF/SSB radio waves are generated by the transceiver there are usually two components:-

- The ground-wave, which travels directly from the transmitting antenna to the receiving antenna following the contours of the earth.
- The sky-wave, which travels upward and at an angle from the antenna, until it reaches the ionosphere (an ionised layer high above the earth's surface), is refracted back down to earth, to the receiving antenna.

Generally speaking, ground-wave is used to communicate over shorter distances usually less than 50km. Because ground-wave follows the contours of the earth, it is affected by the type of terrain it passes over. Ground wave is rapidly reduced in level when it passes over heavily forested areas or mountainous terrain.

Sky-wave is used to communicate reliably over medium to long distances up to 3,000km. Whilst the nature of sky-wave propagation means it is not affected by the type of terrain as in ground waves it is affected by factors involving the ionosphere as described below.

Radio wave propagation illustrated

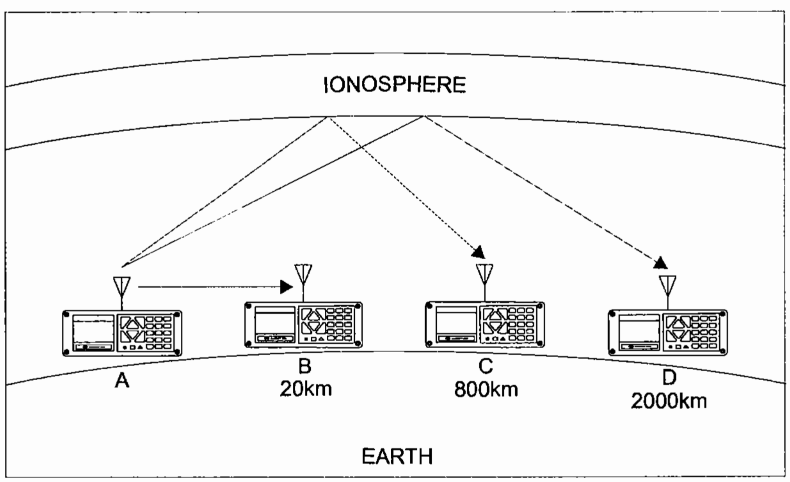
The following illustrations show the characteristics of ground-wave and sky-wave propagation during day and night time. In each illustration the height of the ionosphere above the ground is shown.

In both illustrations Station A communicates with Stations B, C and D. Propagation from Station A to B is by ground-wave. The diagrams illustrate that the ground wave is not affected by the time of day and the height of the ionosphere above the ground.

Propagation from Station A to C and D, however, is by sky-wave and as the diagrams illustrate the sky wave is significantly affected by the time of day and the height of the ionosphere above the ground.

Under each diagram there are recommended working frequencies listed. Please note that these will vary according to time of year and other factors. They are intended only as a guide and are subject to change.

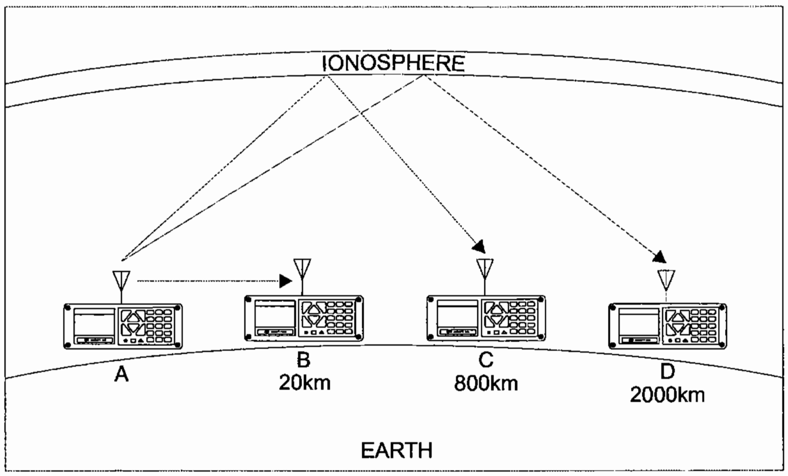
Day



The sun is higher, the ionosphere is higher, the best frequency to use is higher

A to B - Possible optimum working frequency is 3 MHz
A to C - Possible optimum working frequency is between 7 - 9 MHz
A to D - Possible optimum working frequency is between 13-16 MHz

Night



The sun is lower, ionosphere is lower, best frequency to use is lower

A to B - Possible optimum working frequency is 3 MHz
A to C - Possible optimum working frequency is between 5 - 7 MHz
A to D - Possible optimum working frequency is between 9 -12 MHz

Factors which affect HF/SSB communications

There are a number of different factors which will affect the success of your communications via HF/SSB radio. These are outlined below:-

Frequency selection

Frequency selection is perhaps the most important factor that will determine the success of your HF/SSB communications.

Generally speaking the greater the distance over which you want to communicate, the higher the frequency you should use.

Beacon call, a Selcall (selective call) function built into the Barrett 950 transceiver, makes finding the correct frequency to use easy. Beacon call is based on the network transceivers all having a selection of frequencies that will accommodate most ionospheric conditions. When in standby the network transceivers scan these frequencies waiting for a call (Selcall or beacon call) from another transceiver. The transceiver wishing to check for the best frequency to operate on sends a Beacon Call to the station he wishes to contact. If his call to the other station is successful he will hear a revertive call from the station he is calling, indicating the channel he selected was suitable for the ionospheric conditions prevailing. If he does not hear this revertive call or it is very weak, he tries on another channel until a revertive call of satisfactory signal strength is heard.

(Refer to Selcall (selective call) section of this manual for full details on Beacon call operation.)

Time of day

As a rule, the higher the sun, the higher the frequency that should be used. This means that you will generally use a low frequency to communicate early morning, late afternoon and evening, but you will use a higher frequency to cover the same distance during times when the sun is high in the sky (e.g. midday). You will need to observe the above rule carefully if your transceiver has a limited number of frequencies programmed into it, as you may only be able to communicate effectively at certain times of the day.

Weather Conditions

Certain weather conditions will also affect HF/SSB communications. Stormy conditions will increase the background noise as a result of 'static' caused by lightning. This background noise could rise to a level that will blank out the signals you are trying to receive.

Man-made electrical interference

Interference of an electrical nature can be caused by overhanging power lines, high power generators, air-conditioners, thermostats, refrigerators and vehicle engines, when in close proximity to your antenna. The result of such interference may cause a continuous or intermittent increase in the level of background noise.

System configuration and installation

The method in which your system is configured and installed will also affect the success of your HF/SSB communications. Your choice of antenna system and power supply is critical. Correct installation is also extremely important. An HF/SSB transceiver is generally installed using different rules to those used to install VHF or UHF transceivers. Failure to correctly install an HF/SSB system will greatly affect the communications quality you will obtain. Refer to the installation section of this manual for details.

Your local Barrett representative will be able to assist with your system configuration and/or installation.

Special note - HF communications compared with VHF or UHF short distance communications

Communications on any HF/SSB transceiver will sound different to that on a VHF (Very High Frequency) radio or UHF (Ultra High Frequency) radio or telephone. This is because of the nature of HF propagation and the modulation methods used. On HF/SSB transceivers there will always be background noise evident behind the signal you are receiving and this will increase when there is electrical interference or thunderstorm activity in the area.