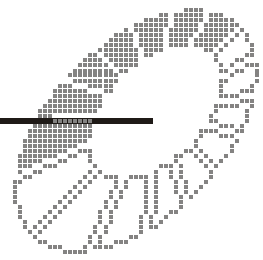
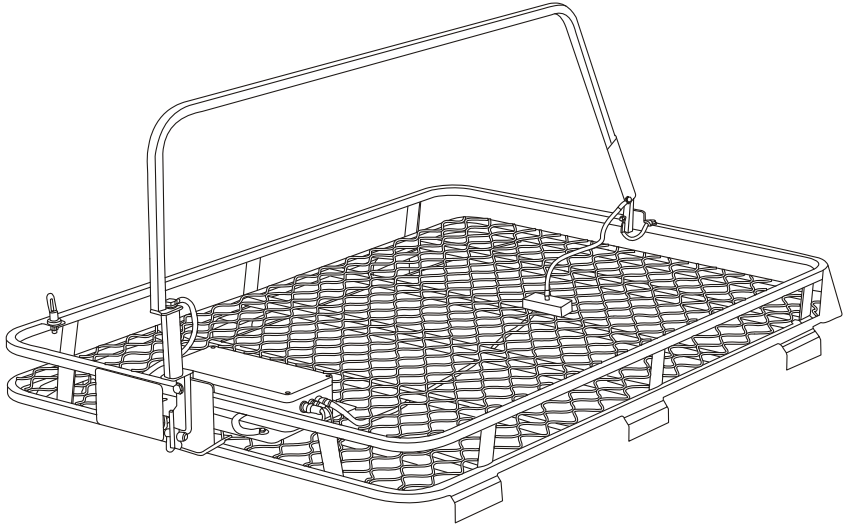




BARRETT 2018
MOBILE MAGNETIC LOOP HF ANTENNA



Operating and Installation Manual



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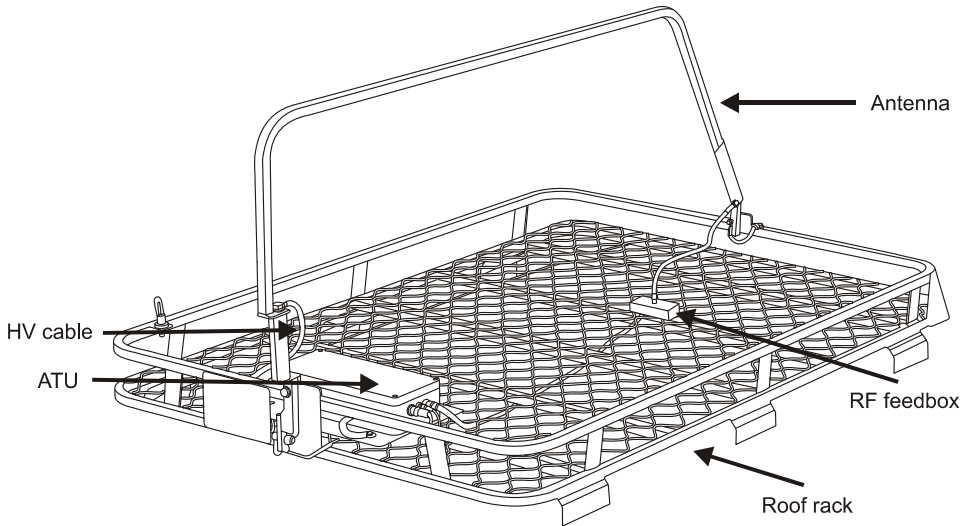
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Introduction



Features

- Highly efficient antenna, radiating 10 dB to 14 dB more than whip antennas.
- Simpler installation – no need to weld on a mounting plate for a whip, and no separate tuner to install. Installation is therefore quicker and cheaper, and the system can be moved simply between vehicles.
- Free roof rack with every package. The antenna can be used as a conventional roof rack for storing luggage.
- Eliminates Skip Zones. A HF system that can be used in ranges from 0-1,000 km and more.
- Increased immunity to ignition and power line noise.
- Broadband low-noise scan amplifier.

General

The 2018 Mobile magnetic loop HF antenna is a technological breakthrough in vehicle-based HF radio communications.

The 2018 Mobile magnetic loop HF antenna is available in a range of packages for fixed or removable installations and can be used with Barrett 2000 Series transceivers. The removable package can be installed without any drilling of holes in the vehicle.

The 2018 Mobile magnetic loop HF antenna is without doubt the best type of antenna for vehicular NVIS (Near Vertical Incidence Skywave) operations. Skip zones are eliminated and coverage (with the correct selection of frequency) is from 0 to 1000 km or more. Within this range it is significantly more efficient than any whip-type vehicle antenna; producing considerably more transmit and receive strength. The actual gain over whip antenna systems varies between +10 dB and +14 dB. The benefit to the user is that it radiates significantly more power, and magnifies received signal strength, giving overall performance much higher than can be achieved from any vehicle whip antenna system.

The 2018 Mobile magnetic loop HF antenna tuner unit is a highly efficient, continuously variable capacitor unit which is driven by a stepper motor to give the best VSWR reading.

When tuned the 2018 antenna has a very narrow bandwidth for transmission. This characteristic is also beneficial for reception since interfering signals separated from the tuned frequency by just a few percent are greatly attenuated, protecting the front end of the receiver from intermodulation and blocking effects.

During scanning the tuning capacitor is bypassed and a low-noise high-linearity amplifier is inserted in the signal path. This allows the loop to retain its desirable NVIS characteristics whilst offering broadband receive capability.

About this Guide

The main purpose of this guide is to provide you with all the information you require to ensure optimum performance from your 2018 Mobile magnetic loop HF antenna.

The Guide explains in detail how to operate the 2018 antenna once it has been installed by an authorised Barrett Communications representative.

The Guide also covers the basic principles of installation. However, we recommend that the installation of your 2018 be carried out by a qualified Barrett Communications representative.

Glossary of Terms

| | |
|---------|---|
| ATU | Antenna Tuning Unit |
| HF | High Frequency |
| kHz | Kilohertz (measure of frequency) |
| km | Kilometre |
| MHz | Megahertz (measure of frequency) |
| PEP | Peak envelope power |
| PTT | Press To Talk |
| Selcall | Selective Call |
| Telcall | Selective Call with Telephone Call facility |
| VSWR | Voltage standing wave ratio |
| W | Watt |

Warnings and Advice

High Radio Frequency Voltages



When transmitting, radio-frequency voltages up to 1500 V RMS are present on the radiating arm and associated cables of the 2018 Barrett Mobile Magnetic Loop Antenna. These voltages are sufficient to cause electrocution or severe radio frequency burns. Personnel must not under any circumstances come into contact with the radiating arm of the antenna or the associated cables when the unit is in operation.

Power Supply Cables



High Frequency transceivers require adequate supply current. It is essential that the supplied cables are utilised to reduce the likelihood of system malfunction. **Please use the specified cables.**

Radio Frequency Field Exposure



The 2018 Barrett Mobile Magnetic Loop Antenna produces high localized radio frequency fields. As long as personnel are beneath the level of the roof rack, exposure to fields will be well below safe operating levels.

Explosion Hazard



Highly flammable materials (e.g. gasoline, petrol, butane, propane, etc) **should not be stored on the roof rack when the equipment is in operation.** The induced RF field during transmission may cause spark discharges between adjacent metal objects which could cause the material to ignite.

Storage of Other Goods



Goods of normal flammability (for example, tyres, suitcases, tents, etc) may be safely stored on the roof rack, however metallic items like tent poles should be secured away from the radiating arm to avoid degrading the ATU's performance. They should be secured so that no movement occurs during transport.

Important:- Do not use the antenna arm to tie any object down. Keep goods at least 0.3 m away from antenna arm and feed cables.

Frequency Hopping Use



Due to the narrow operating bandwidth of the loop antennae, they are not ideally suited for frequency hopping use. However, at higher frequencies (approximately 7 MHz) and when there is adequate signal to noise ratio, adequate results may be obtained.

Operation in Rough Terrain



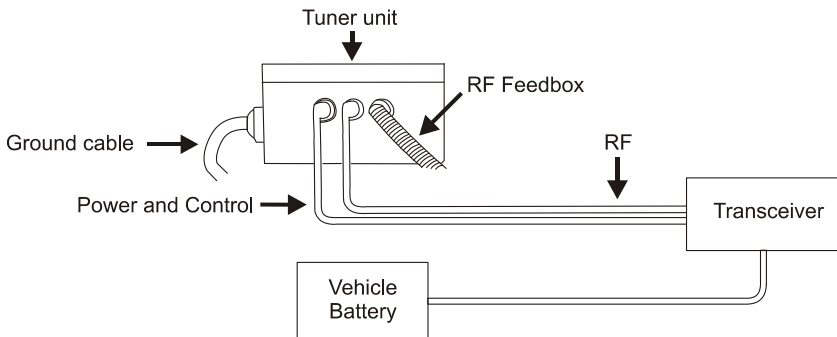
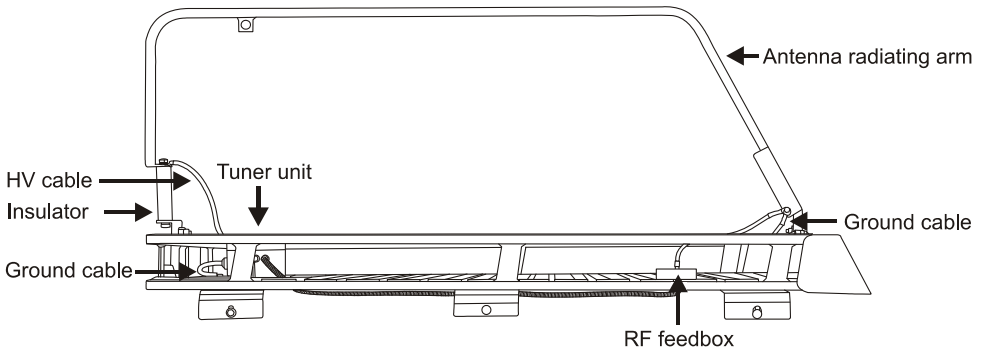
Following operation in rough terrain, the mounting leg fixings should be checked and re-secured as necessary.

Overview

The roof rack has been designed by Barrett Communications Pty. Ltd. as an integral part of the antenna system. The ground plane is a heavy-duty aluminium mesh floor, welded to an enclosing frame which maximises current in the radiating loop. The 2018 Barrett Mobile Magnetic Loop Antenna shields and isolates vehicle ignition noise and interference from adjacent power lines providing greater communication clarity.

The 2018 Barrett Mobile Magnetic Loop Antenna can be fitted to almost any surface. The roof rack comes in a range of mounting bracket options. Solutions are available that will allow clamping to the roofs of 4WD's, sedans, buses, trucks and prime movers. It is designed to minimise head wind noise with an angled deflector mounted on the front of the unit.

A simplified diagram of the parts that make up the 2018 Mobile magnetic loop HF antenna is shown below.



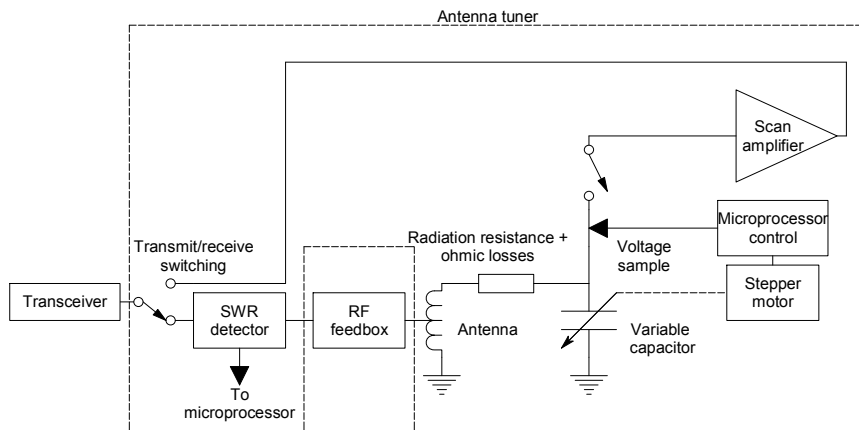
The antenna consists of a looped aluminium arm hinged to an aluminium roof rack which forms an effective ground plane.

RF and DC power is supplied to the 2018 Barrett Mobile Magnetic Loop Antenna system from the transceiver. The vehicle battery supplies the transceiver with its DC power.

The RF Feed box receives its RF input from the transceiver via the ATU box and an RF coaxial cable (supplied). The output is connected to the antenna.

The scan amplifier and the associated receive-transmit switching are incorporated within the ATU.

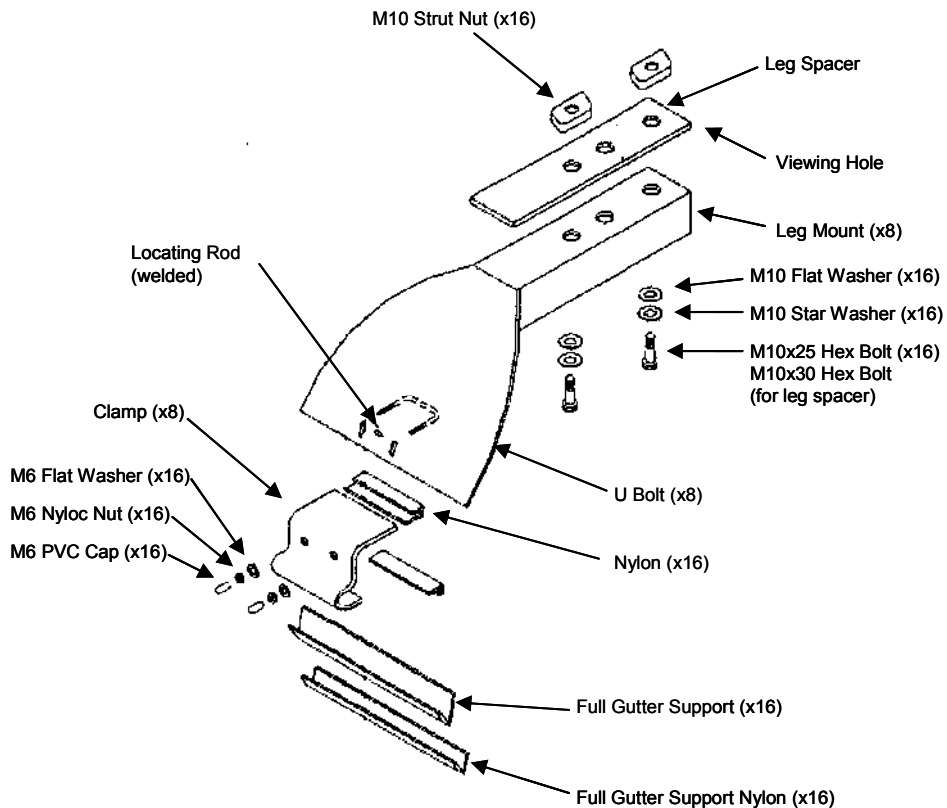
A simplified block diagram of the circuit is shown below:



The antenna is effectively a parallel tuned resonant circuit, with the feed-point forming an auto-transformer in the inductive arm of the tank. Resonance is achieved through a stepper driven variable capacitor. An on-board microprocessor monitors loop current, with final tune based on system VSWR.

Installation

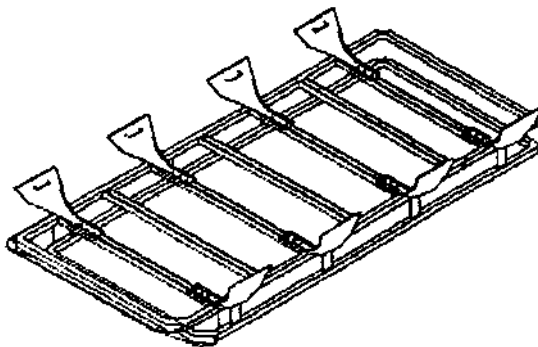
Fitting on Vehicles With Gutters



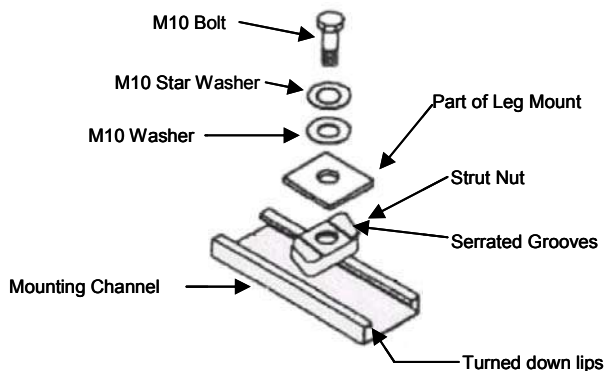
Exploded Diagram of the Leg Mount Assembly

Setting Up the Roof Rack

Turn the rack upside down on either a bench or soft, non-abrasive surface.

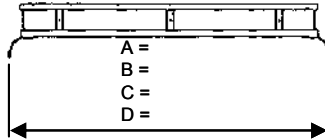


The diagram below illustrates how the strut nut works. Position the legs in the correct channels and tighten to the correct tension.

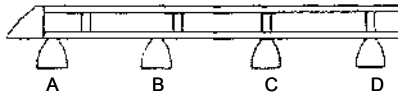


Important:- Ensure each strut nut is rotated 90° and the serrated grooves in the strut nut located into the channel's turned down lips. There is a viewing hole located on the leg mount to check that the strut nut has rotated correctly. If it has not turned, insert a screwdriver into the hole and turn the strut nut appropriately.

First set and tighten legs A & D, use the supplied packing pieces as necessary.



Use legs with packers at positions A & D
if necessary



The measurements A-D vary according to the vehicle type. Use the supplied chart (in the above diagram) to determine these.

Use a straight edge to line up the centre legs before tightening.

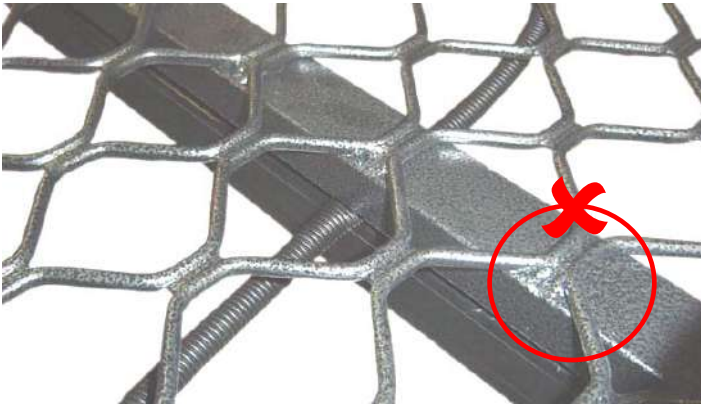


Double check the tension on all bolts.

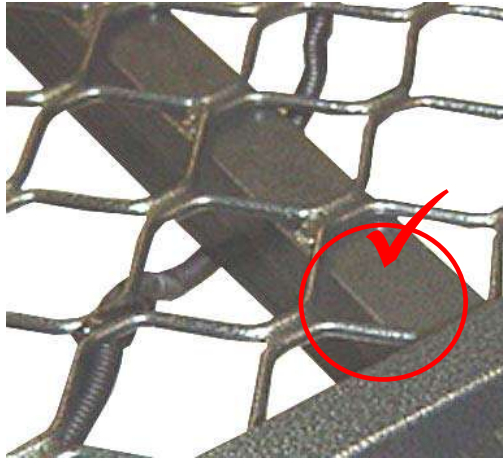
Note:- Nylon channel pieces should be fitted to the tops of each clamp as shown in the exploded diagram on page 11.



Important:- Ensure the feed cable is not damaged by being trapped between the ski bar mount and the roof-rack, shown below:-

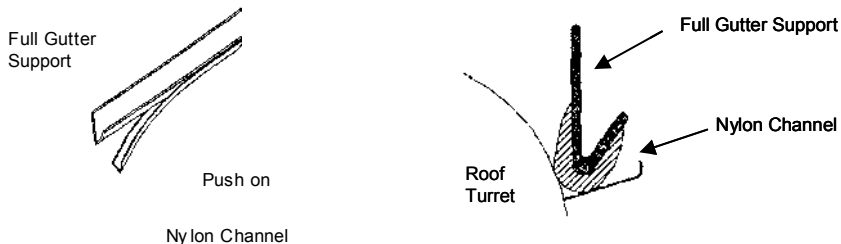


The correct position for the cable, running underneath the ski-bar mount, is shown below:-

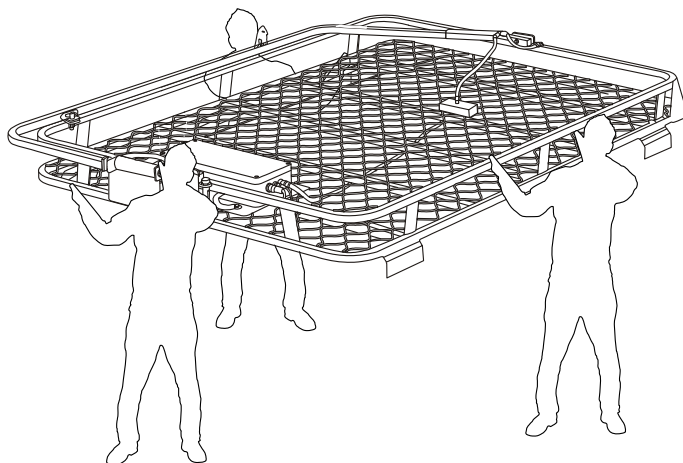


Preparing the Vehicle

Press the nylon channel to the bottom of the full gutter support and place in the gutter of the vehicle with the long edge against the vehicle and the short edge facing outwards. The following diagrams illustrate this.



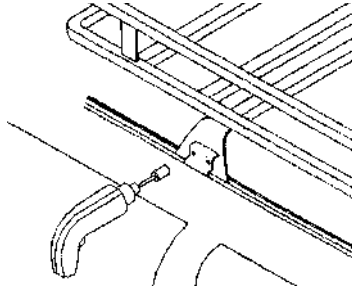
The rack may be lifted onto the vehicle by two people, one either side. However, it is preferable for a third person to help at the rear of the rack. Lift by the bottom of the leg mounts.



Note:- The sloped edge of the antenna faces towards the front of the vehicle, i.e. the RF Feedbox is at the front and the Tuner Box is to the rear.

Position the rack into the full gutter support and tighten the clamps using an M10 socket driver

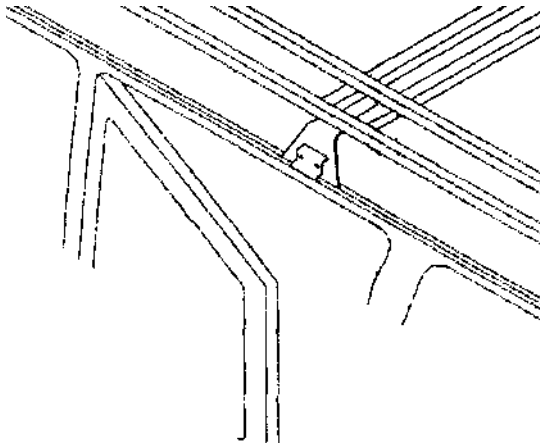
The Nyloc® clamp nuts are easily tightened using an M10 socket using a cordless drill/driver.



Caution: *Be careful not to over tighten the clamps. The clamps should be firm but not deformed.*

Re-check the tightness of all mounting hardware when done.

Important:- *Ensure the door seals at the top of the door do not catch on the clamp when fitted. If they do, check the clamps are sitting flat against the underside of the surface and tighten until the door seals clear. See the illustration below.*



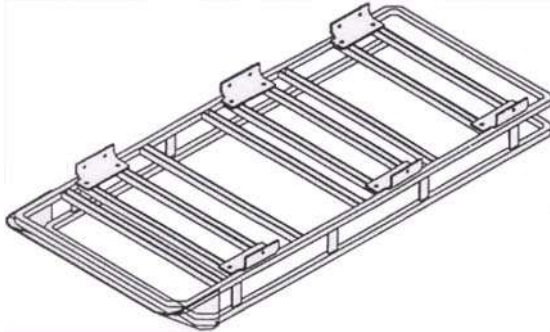
Note:- On some vehicles, the hinge bolts of the doors may require loosening and the door and latch lowering. Contact your Barrett Communications representative if you have any problems.

Barrett Communications Pty Ltd accepts no liability for damage to door seals, as correct fitting will ensure door seals are protected.

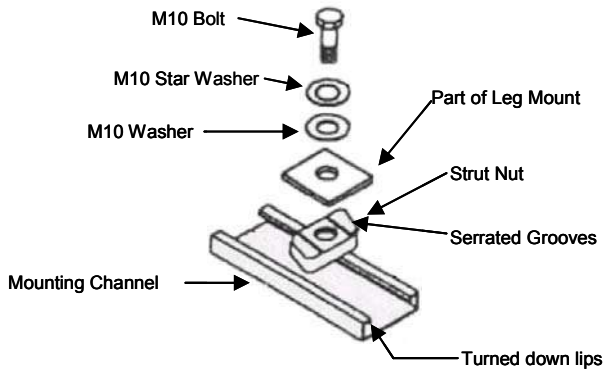
Fitting on Vehicles Without Gutters

Setting Up the Roof Rack

Turn the rack upside down on either a bench or a soft non-abrasive surface.

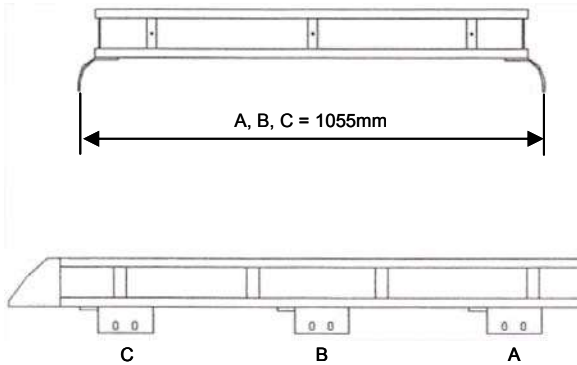


The diagram below illustrates how the strut nut works. Position the legs in the channels and tighten to the correct width.



Important:- Ensure each strut nut is rotated 90° and the serrated grooves in the strut nut have located into the channel's turned down lips. There is a viewing hole located on the leg mount to check that the strut nut has rotated correctly. If it has not turned, insert a screwdriver into the hole and turn the strut nut appropriately.

Use the following measurements to set the rack up correctly and tighten the bolts.

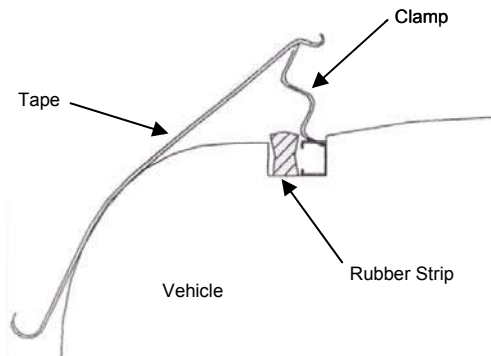


Important:- Double check the tightness of all the bolts.

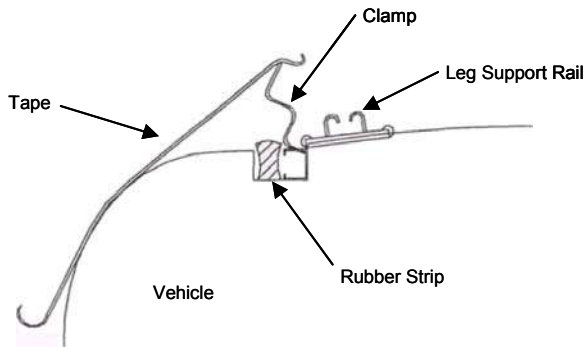
Preparing the Vehicle

There are six fitting points on the vehicle, positioned at the front, centre and rear of the roof. The standard size roof rack uses all six points.

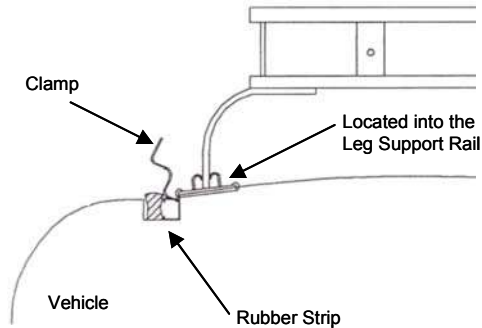
Locate the hooks on the inner side of the rubber strips on the roof. There are three hooks per side. The roof rack clamp has a slot at the bottom which the hook passes through. Make sure the hook is the correct way round. Temporarily hold the clamp in an upright position with the masking tape as shown in the following diagram, so the rack can be placed on the roof top without interference.



Place the leg support rails on the inner side of the clamp (which have been hooked in position and are taped back, now standing upright). Pull the leg support rail gently against the clamps, ensuring that the rail is protruding the same distance forwards and backwards from the front and rear clamps. See the following diagram.

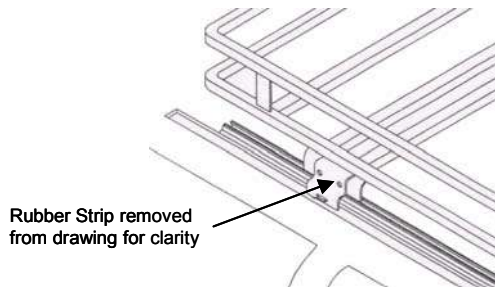


The rack may be lifted onto the vehicle with two people (one either side), but it is ideal to have a third person at the rear for extra stability. Lift the rack carefully over the roof from the rear and position the legs into the leg support rails. Refer to the following diagram.

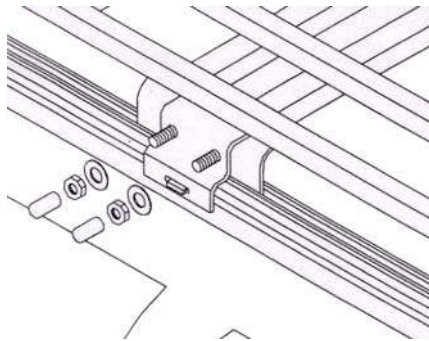


Note:- The sloped edge of the antenna faces towards the front of the vehicle, i.e. the RF Feed box is at the front with the ATU to the rear.

Align the leg mounts with the clamps and check that the rack is centred on the vehicle. Place the “U” bolts through the slots in the leg mounts from the inside, and pass the threaded ends through the holes in the clamp. Re-attach the M6 washers and nuts. See the following diagram.



Ensure the “U” bolt is hooked above the welded locating rod on the inside of the leg mount, then tighten firmly without deforming the clamp bracket. Place PVC caps over the threaded ends of the “U” bolt. Refer to the following diagram.



Note:- The Nyloc® clamp nuts can easily be tightened using an M10 socket driver with a cordless drill.

Maintenance

Clean the roof rack with a mild detergent (car washing detergent) and water. Do not use solvents or abrasives.

Check the tension of all fasteners periodically and before and after every journey over rough terrain.

Clean the roof rack with a mild detergent (car washing detergent) and water. Do not use solvents or abrasives.

Removal of Rack

When removing, spray WD-40 or similar penetrating oil on the thread of exposed fasteners giving it time to be absorbed before attempting to loosen them.

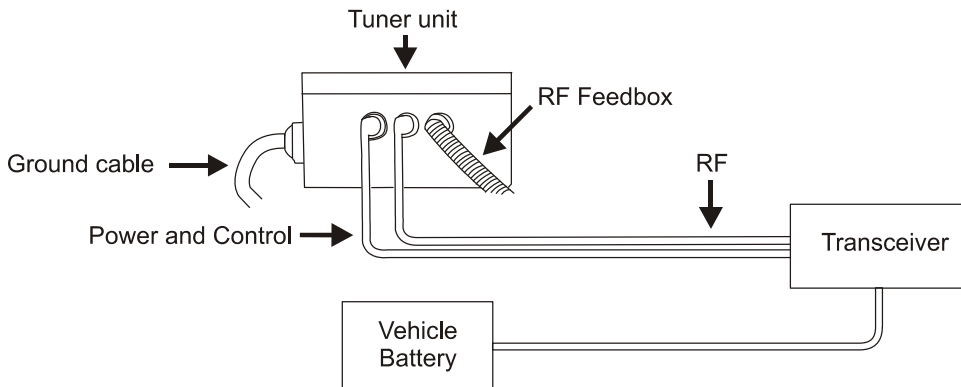
Remove the Nyloc® nuts slowly, to stop the threads from binding.

Retrofitting the 2018 Barrett Mobile Magnetic Loop Antenna

If you are fitting the 2018 Barrett Mobile Magnetic Loop Antenna system to your existing rack, ensure that there is no paint or corrosion between the cable connectors and the antenna arm mount points. Use an abrasive contact grease (e.g. Alminox ALM325G manufactured by Tyco Electronics) to improve the connection and prevent corrosion.

Cabling

After the roof rack has been fitted to the vehicle the control/power and RF cables (supplied), must be connected from the transceiver to the 2018 Mobile magnetic loop HF antenna system.



Determine the location of the entry point of the cables into the vehicle. A suggested point of entry for a 4WD is through the rear door next to the hinge, as this door is generally the least used and a clearance hole is not required. The two cables should be threaded underneath the rack to an area close to the point of entry into the vehicle and then cable tied to the rack. Both cables should then be passed through the split convoluted conduit for protection before being fed through the entry point into the vehicle.

Once the cables have been mated with the connectors on the 2018 HF antenna, seal them with self-amalgamating tape to prevent water ingress.

The coax cable from the RF feed box is connected directly to the TNC socket on the 2018 Mobile magnetic loop HF antenna tuner unit.



Note:- The 2018 Barrett Mobile Magnetic Loop Antenna is designed to be powered from the transceiver and not directly. Attempting to do this may cause damage to the unit.

Operation



Normally, when not in use, the antenna is in the folded down position. To use the system, the antenna must first be erected as shown in the above image.



WARNING - The transceiver must not be transmitting whilst the antenna arm is being raised or lowered. It also must not be operated in the down position.

To Deploy the Antenna

Undo the clip that secures the antenna to the roof rack, located on the rear right hand edge (looking at the vehicle head on).



Unhinge the antenna from the roof rack to the fully upright position by releasing the clip at the bottom of the high voltage insulator and swinging the arm upwards.



Unfold the antenna
From the
roof rack

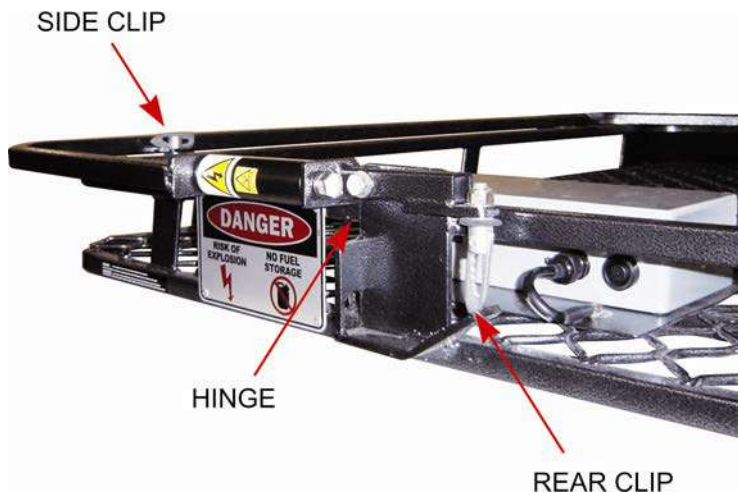


Rear Clip

Reset the clip to its locked position when the boom is vertical to prevent it falling over during operation.

To Stow the Antenna

Simply reverse the directions for elevating the antenna. The image below shows the antenna folded down and secured using the side clip.



Barrett Transceiver to 2018 Barrett Mobile Magnetic Loop Antenna Setup

When using the 2018 Barrett Mobile Magnetic Loop Antenna with a Barrett transceiver refer to the “**Antenna Type**” section of the 2000 series operating and installation manual or the “**External Control Options**” section of the 950 s operating and installation manual.

Select the “**Loop Antenna**” ATU option when using a Barrett 2000 Series transceiver or “**510-910**” for the 900 Series of transceivers.

Supported Barrett Transceivers

Barrett 900 and 2000 series transceivers

Testing and Troubleshooting

When switching on the transceiver the 2018 antenna will enter into scan mode.

Select a channel with a frequency inside the tuning range of the unit (see “**Technical Specifications**” located at the end of this manual) and initiate a tuning sequence by pressing the “Tune” key on the transceiver or pressing the PTT button on the microphone. You should hear the motor in the ATU cycle back and forth briefly. Following this tune cycle, the receiver noise level may be increased and if the signal level meter is active on the transceiver, an increased signal level may be observed.

When switching on, the ATU will set itself for operation at its highest frequency, if not already in that position, and the scan amplifier will be activated.

After observing that the 2018 antenna tuning motor is running correctly, check that the correct tuning is obtained. Initiate a tune cycle as described above. If receiver noise does not increase or receive signal is not increased then a failed tune has occurred. Try initiating a tuning sequence again. If the tuner cannot find a tune point a timeout will occur and the transceiver will display a “Tune Failed” message. The transceiver also displays the VSWR of the tune.

In the event of the transceiver transmitting during scan mode the 2018 antenna will protect the scan amplifier by switching into transmit mode. The 2018 antenna will stay in this condition until the power is interrupted, this will occur when the next tune is performed.

Troubleshooting

The 2018 tuning motor does not run briefly after switching on the transceiver:-

- Check all cables.
- Check that DC is available to the ATU by using a multimeter on the pins of the connector on the DC lead.

The 2018 antenna tuning motor runs but a tune failure signal occurs:-

- Check that the selected channel is in the range 3.9 to 12.5 MHz.
- Check that the transceiver is producing correct output power when initiating a tune sequence. The input power must be between 2 W and 10 W for the ATU to be able to tune.
- Check that all heavy ring tag connections on the roof rack and ATU are securely fastened.
- If the unit still does not tune, unplug the 6 pin control cable, undo the four lid screws, and remove the lid, ensuring no water or other contaminants fall inside.
- Check all connectors are plugged into their sockets on the PCB Assembly.
- Replace the lid, checking the condition of the lid seal before securing the screws.



Important:- The high current connection must be maintained in good clean condition. When transmitting, it can carry up to 20 amperes of RF current

Testing

Note: To be conducted by qualified service personnel only.

Operation of the 2018 can be checked using an optically isolated RF current meter (contact Barrett Communications for the appropriate equipment).

The unit consists of a toroidal sensor head attached by an optical cable to an analog meter movement. The instrument is only capable of taking relative measurements and generally calibrated against a known light source. It can be used to determine the magnitude of the antenna current in the radiating arm of the antenna.

To perform the test, undo the bolt holding the high voltage cable fitted between the tuner box and the antenna arm (at the rear). Slide the toroidal sensor over the cable and refit it securely in place. Attach the optic fibre to the meter. Choose a frequency within the 2018's operational band, initiate a tune sequence and observe the reading on the meter. Take measurements over the band noting the deflection remains greater half scale of the meter display. Once tuned, key the radio and talk into the microphone noting the deflection continues to remain within specification.

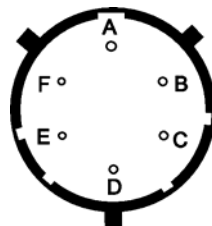
Low meter readings could be a sign of tuner failure, problems with the interconnecting cabling, poor grounding or transceiver output.

Alternately a VSWR power meter (e.g. Bird or Daiwa CN-801 cross needle) with DC feed through capability can be inserted in-line with the RF cable to take more accurate measurements. Ensure the meter chosen does not bypass DC to ground.

External Connectors

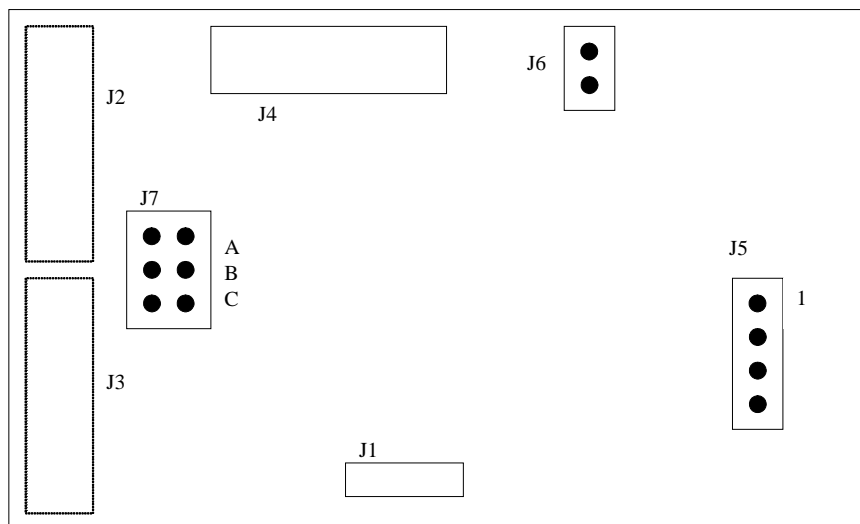
ATU 6 Pin Connector Functions

| Pin | Description | Signal |
|-----|-------------|--|
| | +12 V DC | Interrupted 12V supply |
| B | GND | Signal Ground |
| C | TUNE | Pulled low when tuning, returns high when tuning completed |
| D | SCAN | Indicates scan amplifier on. Active high |
| E | N/C | |
| F | N/C | |

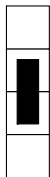


Internal Jumper Configurations

View of 2018 Mobile magnetic loop HF antenna PCB Component Side Overlay



J5 Jumper Settings

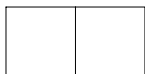


+24V

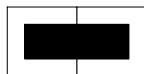


+12V

J6 Jumper Settings (DC Supply on RF Cable)

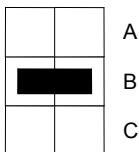


No DC supplied



DC supplied

J7 Jumper Settings



A

B

C

BARRETT

Parts List

| Description | Barrett Part N° |
|--|----------------------------|
| RF Feed box, including cable | SA-57510 |
| Antenna Arm – Feed box Cable | SA-55060 |
| Antenna Arm Ground Cable | SA-55061 |
| Antenna Arm | |
| HV Cable | SA-55062 |
| ATU Ground Cable | SA-55059 |
| Delrin® Insulator | PW-57136 |
| 2018 Mobile magnetic loop HF antenna | 2018-00-01 and BC201801 |
| 2018 Mobile magnetic loop HF antenna to transceiver control cable to suit 2050 transceiver | 2018-01-01 |

Technical Specifications

| | |
|------------------------|---|
| Frequency range | 3.9 to 12.2 MHz |
| Power supply | 12 V – 13.8 V DC (provided from the transceiver) |
| Supply current | ≤ 1.5 A peak, ≤ 400 mA standby |
| Input impedance | 50 Ω typically with <2:1 SWR |
| Power rating | 125 W PEP |
| Polar radiation | Less than 5 dB variation at angles above 45°, maximum power radiated towards zenith |
| Tune signal | Varies depending on transceiver used |
| Tune power | 2 to 30 W |
| Control | From transceiver |
| Tune time | Within 3 seconds |
| Tuning method | Continuously variable tuning |
| Drive method | Precision stepper motor |
| Tune point | Best VSWR reading |
| Antenna bandwidth | 40 kHz @ 3.9 MHz 280 kHz @ 12.5 MHz |
| Scan amplifier noise | <11 dB above thermal |
| Rx 3rd order intercept | >25 dBm |
| 1 dB compression | >+10 dBm |
| Temperature | Operating: -30°C - 60°C Storage: -30°C - 80°C |
| Humidity | 95% non-condensing |
| Dimensions | 1900 mm x 1250 mm x 170 mm (stowed) 1900 mm x 1250 mm x 780 mm (deployed) |
| Environmental rating | MIL-STD-810F (immersion). Fitted with a pressure equalising breather to equalise pressure without allowing the ingress of moisture. |

Barrett Communications Pty Ltd reserves the right to change the specifications without notice.