Noise Reduction (NR)

Selecting **NR** from the front panel allows the Digital Signal Processor (DSP) noise reduction depth to be adjusted to suit the operator's requirements.

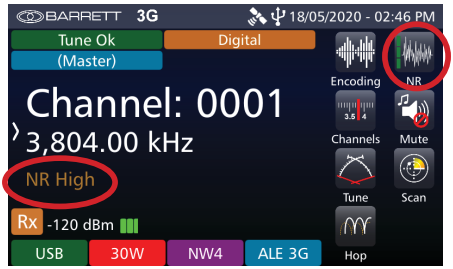
Tap **NR** from the Home screen to cycle through the options: Off, Low, Medium, or High.

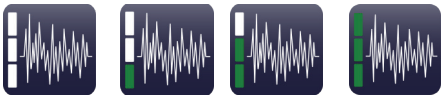
The example shows a NR set to High.

After two seconds, the NR indicator is hidden and is replaced by the channel label.

When the noise reduction system is active (low, medium or high) the NR icon displays an indication of the setting.

NR





NR Off | NR Low | NR Medium | NR High

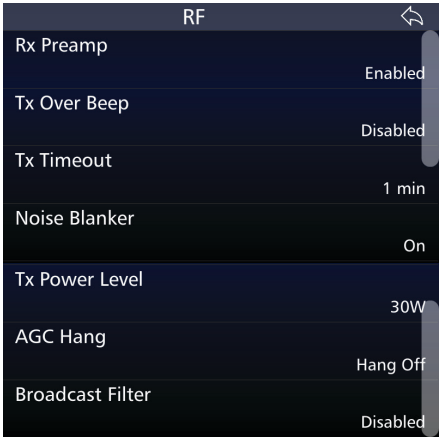
RF Settings

Tap **RF** from the **Settings** menu to access the RF menu.

A list of items that may be configured displays.

The current status of each of the items is displayed to the right.

To reveal more items, either swipe down on the touch screen or press  .



Rx Preamp

Enables or disables the Rx pre-amplifier. The pre-amplifier provides an additional receiver gain of 5 dB. Generally, the RF pre-amplifier is switched off when an automatic mobile antenna is in use as these antennas have a built-in RF pre-amplifier.

Tx Over Beep

When this option is selected, the transceiver transmits a short tone after the PTT button is released. The tone provides an audible indication to the Operator at the remote station that the local station has stopped transmitting.

Tx Timeout

When this feature is enabled, the transceiver will stop transmitting if the PTT button is held on for more than the allowed time limit eg. if the handset is accidentally wedged under a seat. Releasing the PTT button will re-enable transmission.

Set the maximum transmit time to either one, two, or three minutes. Alternatively, this transmit timeout can be disabled.

Noise Blanker

This setting allows the predictive noise blanker to be switched on or off. The noise blanker is useful to reduce repetitive vehicle related electrical interference eg. noise from a windscreen wiper motor.

Note: The noise blanker will not be effective in situations where for example, external power line noise is blanketing the receiver.

Select either: Off or On.

Note: In certain situations, noise blankers can cause intermodulation in receivers. In these cases the noise blanker should be disabled.

Tx Power Level

This section sets the global RF power output for all channels in the transceiver.

Select either: 10 W, 30 W, 125 W, or 150 W.

AGC Hang

Automatic Gain Control (AGC) Hang delays the AGC system's gain response after a signal level decreases to zero. This prevents receiver noise for the hang period.

Select either: Hang Off or Hang AGC.

Broadcast Filter

With the Broadcast Filter enabled, strong broadcast signals below 1.6 MHz will be filtered out.

Select either: Disabled or Enabled.

Scanning

Scanning allows the transceiver to monitor several channels for incoming calls. It is particularly useful as the nature of HF signal propagation means that not all channels are available for communications at one time. For example, a station calling a station that is in scanning mode can send a Beacon Call on any channel knowing the station it is calling is monitoring all its available channels. A response from the scanning station will only occur on channels that are open for communication.

Stations in scan can also monitor channels for voice activity or signals received that has a signal strength over a preset level.

The transceiver will come out of scanning mode for the following reasons:

- A Selcall is received.
- Signal Strength Level (SSL) mute is selected and a signal with a level greater than the pre-set threshold is received.
- Audio (syllabic) mute is selected and a voice signal is detected.

The **Scan icon** on the Home screen, once pressed, initiates scanning channels according to the currently selected scan table. If no scan tables are available, see Scan Settings page 91.

Scan

Whilst scanning, several options on the screen are hidden (Channels, Hop and Tune) and the Scan icon is animated.

To stop scanning, press BACK or the scan icon.

Pressing the Scan icon for longer than 1 second will bring up 1 of 3 possible screens:

- The Scan Settings menu (see “Scan Settings” section on page 91) when ALE 2G or 3G are not enabled.
- A list of the available ALE 2G Preset Maps when ALE 2G is enabled (See Barrett ALE 2G and 3G User Guide (P/N BCM40524)).
- A list of the ALE 3G Pool entries (See Barrett ALE 2G and 3G User Guide (P/N BCM40524)).

Scan Settings

To display the Scan Settings, select **Scan** from the **Settings** Menu.

Tap **Scan** from the Settings screen to display the Scan screen.

A list of items that may be configured is displayed. To reveal more items, either swipe up on the touch screen or press .

Scan Rate

This defines the rate of which the scanning should be performed.

Select the scan rate applicable to non-Selcall scan channels, either: 300, 500, 700, 1000, 1500, 2000, or 5000 ms.

Dwell Time

Select the length of time the transceiver dwells (waits) on a channel after scan has been stopped by signal strength level (if signal strength level mute is set) or voice activity (if audio mute is set).

Select between 1 and 10 seconds.

Resume Time

Set the time period after which the transceiver will automatically resume scanning from the last operation eg. after a key press or PTT.

Select either: Off, 1, 2, 3, 5, 10, 15, 20, or 30 minutes.

Scan Table

Select the Scan Table to be used when the transceiver is put into scan mode, or if enabled, when scan resume occurs.

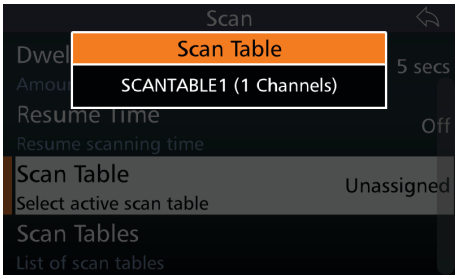
There can be up to eight Scan Tables with 30 channels in each.

Note: When scrolling through the Scan Tables to make a selection, only Scan Tables with channels entered will display. If none of the Scan tables have any channel entries, the message "All Scan Tables Empty" displays.

Tap **Table Selection** from the Scan screen to display the Table Selection screen.

To reveal more items, either swipe up on the touch screen or press  .

Each entry shows the name of the table and the respective number of channels.

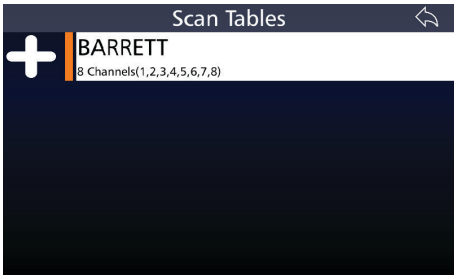


Scan Tables

Note: All channels are displayed in numerical order within the scan table with respect to the entry number. There are a maximum of 30 entries in each table.

Tap **Edit Scan Tables** from the Scan screen to display the Selcall Scan Tables screen.

The example shows two scan tables which may be edited. Each table reveals the name of the table, the antenna, the number of channels in the table and the channel numbers.



Add a Scan Table

To add a Scan Table, tap  from Scan Settings < Edit Scan Tables.

Scan Table Name

This is the name of the scan table. Without setting this, the name will default to “TABLE”.

Scan Table Channels

Tap the checkboxes adjacent to the channels you wish to choose and then tap  .

After configuring the above items, tap  to add the table.

A confirmation message displays.

Tap **Yes**.

Delete a Scan Table

Select the table to be deleted, then tap and hold for three seconds.

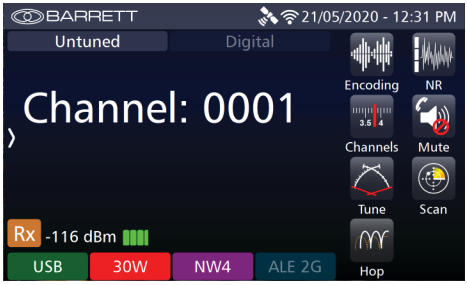
A confirmation message displays.

Tap **Yes**.

Secure Display Mode

This mode hides the display of frequencies on the front panel. Channel frequencies are uneditable, as are labels. The pack and diagnostic information becomes irretrievable and cannot be exported.

This mode can only be enabled or disabled using the Barrett Communications 4000 Series Programming Software.



Security Settings

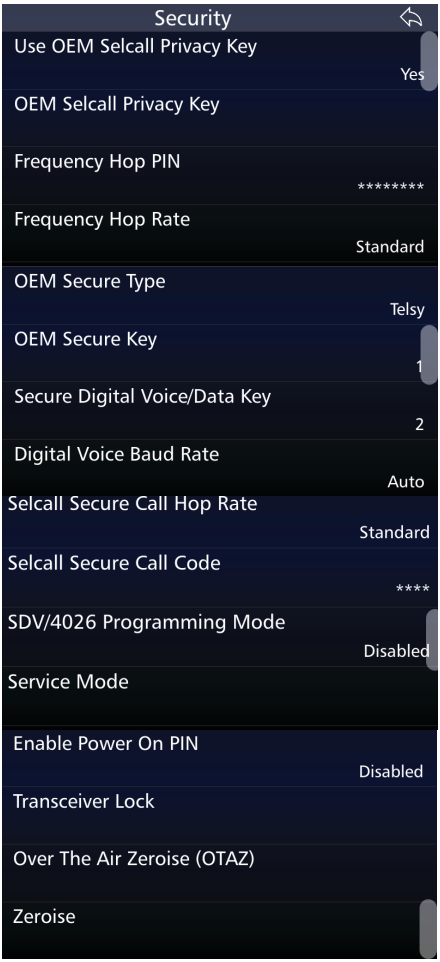
This section is used to configure the security settings for the transceiver.

Tap **Security** from the **Settings** menu to access the Security menu.

A list of items that may be configured is displayed.

The current status of each of the items is displayed to the right.

This menu is dependant on the Options installed in a transceiver (see page 55).



Use OEM Selcall Privacy Key

This setting indicates whether the OEM Selcall Privacy Key is active.

OEM Selcall Privacy Key

Turning this on allows data type Selcalls (Pagecall, GPS, Status, Telcall) on OEM channels to be encrypted with DES-56 encryption.

See page 25 for more information on OEM Selcall.

Frequency Hop PIN

The Hopping PIN (if the Frequency Hopping Option is enabled on the transceiver) is 8 digits long and is usually provided by a network administrator. The Hopping PIN determines the Hop bandwidth. For instance:

Hopping PINs 00000000 to 19999999 are used for hopping ± 2 kHz

Hopping PINs 20000000 to 49999999 are used for hopping ± 16 kHz

Hopping PINs 50000000 to 99999999 are used for hopping ± 128 kHz

Hopping up to ± 128 kHz can be used with wideband antennas such as base station broadband antennas.

Please note that all transceivers that wish to communicate via Hopping need to have the same Hopping PIN and frequency hop rate configured.

Note that once entered, the PIN can never be retrieved or viewed for security reasons.

Frequency Hop Rate

The Frequency Hop Rate changes the number of hops per second used by the encrypting algorithm.

Select either Standard (5 hops per second) or High (25 hops per second).

OEM Secure Type

This displays whether a scrambler has been installed and the name of the scrambler.

OEM Secure Key

If keys are installed, keys can be selected from this menu.

Secure Digital Voice/Data Key

The Secure Digital Voice and Data Key is used for secure digital voice and 3G Data calls. Keys need to be entered into the transceiver's SDV module using the Barrett Communications Key Management Software.

Select between 1 and 255.

All transceivers in the network must have the same key number in order to communicate.

For more information, consult the Digital Voice manual (P/N BCM40504).

Digital Voice Baud Rate

The Digital Voice Baud Rate setting fixes the baud rate at 600/700bps, 1200bps, 2400bps or Auto. Setting this rate to Auto will allow the transceiver to automatically adjust the baud rate.

Selcall Secure Call Hop Rate

The Selcall Secure Call Hop Rate is the rate at which the secure call hopping moves between transmission frequencies. Unlike frequency hopping, it doesn't utilise GPS.

Select either Standard (4 hops per second) or High (15 hops per second).

Selcall Secure Call Code

Enter a four-digit number. Both the transmitting and receiving stations must have the same code.

SDV/4026 Programming Mode

If the transceiver is fitted with an SDV module, this option enables the SDV to be programmed.

Select either Disabled or Enabled.

When enabled, the functionality of the transceiver is disabled. After programming the SDV, reboot the transceiver.

For more information, consult the Digital Voice manual (P/N BCM40504).

Service Mode

A mode for use when servicing a transceiver. Only accessible by PIN.

Enable Power On PIN

Selecting this menu option allows a user to manually change whether the transceiver asks for a password upon start-up. This password is set using the Barrett 4000 Series Programming Software.

Transceiver Lock

The Transceiver Lock function locks a remote transceiver via Selcall and uses the remote transceiver's pre-set Transceiver Lock/OTAZ PIN. This function does not remove any settings and can be reversed by entering the Transceiver Lock/OTAZ PIN on the front panel of the transceiver.

Over the Air Zeroise (OTAZ)

OTAZ will clear the following information from a remote transceiver via a Selcall and the entry of the Transceiver Lock/OTAZ PIN for that station:

- all channel information
- all Options
- all ALE 2G and 3G information
- ALL security PINs apart from the Transceiver Lock/OTAZ PIN
- encryption keys

Zeroise

Zeroise will clear the following information from the local transceiver:

- all channel information
- all Options
- all ALE 2G and 3G information
- ALL security PINs apart from the Transceiver Lock/OTAZ PIN
- encryption keys

Remote Access Password

This allows a user to set a password used when accessing the transceiver remotely via serial or network connections e.g. when using the Barrett Remote Control App, the Desktop console or programming via PC.

Stealth Mode

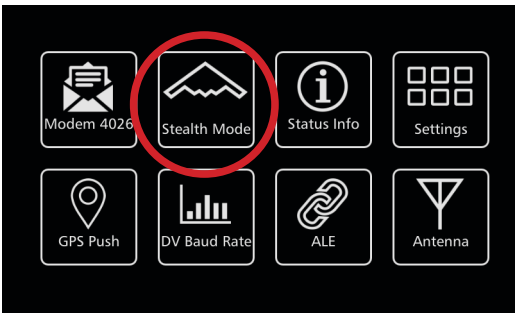
Stealth mode operates as a quiet or silent mode of operation. When active, all transceiver noises are muted, key lights are disabled and the backlight is set to the lowest setting.

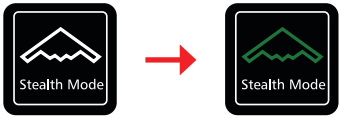
To enable stealth mode, tap the icon in the swipe menu.

When active, the icon will be green.

Pressing PTT while stealth mode is active will temporarily deactivate stealth mode, reinstating lights and audio.

Stealth mode will re-activate after 30 seconds of inactivity.





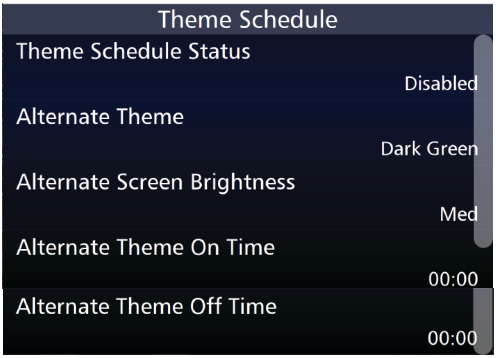
Off On

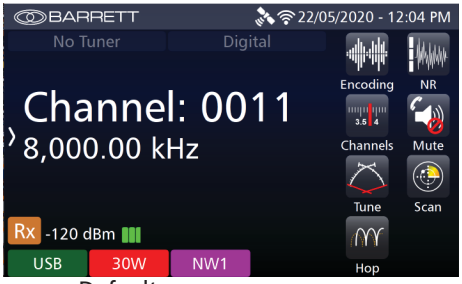
Theme Schedule

The Theme Schedule allows for automatic transition between display themes. This change of themes can be of use for changing, for instance, between a daytime theme and a nighttime theme.

To set a theme schedule, select an alternate theme, the time when the theme will switch on and when it will switch off.

Finally, enable the Theme Schedule by changing the Theme Schedule Status to Enabled.





Default

Dark Green

Green

Red

Tuning

Tuning occurs automatically when PTT is pressed and if the appropriate antenna tuner type has been selected in RF Settings. Tuning can also be activated by pressing and holding the tune icon on the front screen.

Tune

Tuning from the tune icon on the front screen will vary in response depending on the tuner type selected.

If a non-ATU antenna is selected, the transceiver will transmit - at the power level selected - on the current channel. This is transmitted at 1.6 kHz above the Suppressed Carrier Frequency (SCF) (displayed frequency) of the channel until the tune icon is released.

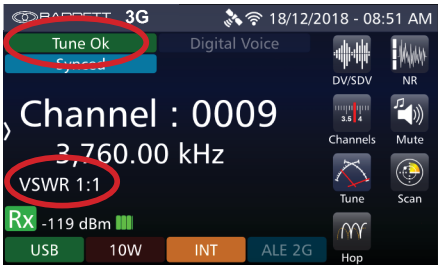
If an ATU antenna has been selected, pressing the tune icon will begin a tune cycle. Tune Tx power (usually between 10 and 30W) is automatically set by the transceiver for the duration of the tune cycle. When the tune cycle begins, the tune icon can be released.

Once the tune cycle has finished, the transceiver transmit power will return to set levels.

The keypad will illuminate red whilst the transceiver is tuning.

When the tune process is completed the display will show “Tune Ok”, or “Tune Failed” in the top left-hand corner. “No Tuner” will display if the “Base Station Antenna” option is selected.

The VSWR briefly displays below the frequency indicating the efficiency of the selected antenna.



INSTALLATION 7

This chapter contains the following sections:

- Introduction
- Base Station Installations
- Mobile Installations

Introduction

It is recommended that the installation be performed by a suitably qualified technician. In some equipment configurations, technical adjustment is required for the equipment to operate correctly.

Note: Some equipment has specific instructions supplied with it. Those instructions over-ride the general guidance of this manual, and must be followed in detail.

For further information on these installations, please consult the guide provided with your antenna or contact your Barrett dealer.

Please note: When unpacking your order, check the contents against the packing notes provided. Before discarding the cartons, check that all accessories have been removed and are not mislaid in the packing material. Inspect the equipment for any transit damage. If damage has occurred, notify your supplier immediately. Failure to do this could affect the warranty covering the equipment.

Base Station Installations

This section provides instructions for the installation of land based HF communication equipment.

Site Selection Recommendations

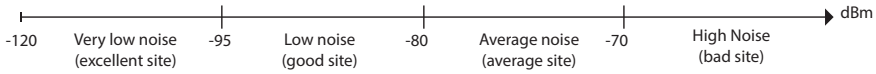
Site selection and system design go hand in hand and should be considered before any equipment is purchased. The success of every HF Radio system is primarily measured by its ability to receive weak signals and to transmit RF power efficiently. A number of important factors need to be considered to achieve success. These include: frequency selection, time of day and ambient noise at the receiver site. Frequency and time of day are factors which can be used to calculate the maximum usable frequency (MUF) and lowest usable frequency (LUF) using prediction software freely available on the internet. A typical example of this is VOACAP, http://www.voacap.com/prediction.html.

Local Area Noise

Forcing the radio system into an unsuitable site will undoubtedly result in disappointing if not unworkable performance of the system. Little can be done to improve an installed system if, for example, the ambient RF noise is unacceptably high.

Ideally, the received signal strength indication (RSSI) in Rx mode should show no more than -100 dB to indicate an acceptably quiet receiver site.

Typically, a noisy site, (beyond suitability) will show a RSSI level greater than -70 dB. As a rule, anything more than -80 dB would be of concern.



It is recommended that site evaluation be done before any system designs are finalised to avoid system performance disappointment.

The following should be considered when choosing a position for the transceiver:

Operating Convenience

The transceiver should be placed so that the operator is comfortable and any required facilities are easily accessible.

Air Circulation

The 4050 relies on air flow around cooling fins to dissipate heat generated by the transmitter. The mounting position must allow free air flow around these fins.

Proximity of Transceiver to Antenna

When using RG-58 coaxial cable from the transceiver to the antenna, a cable length of no more than 30 metres is recommended. Should a run of more than 30 metres be required, it is recommended that a low loss coax such as RG-213 or RG-8 be used.

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

Power Supply

When either a 12 or 24 V DC is supplied to the 4050 transceiver, the PEP Voice output power will achieve 150 W.

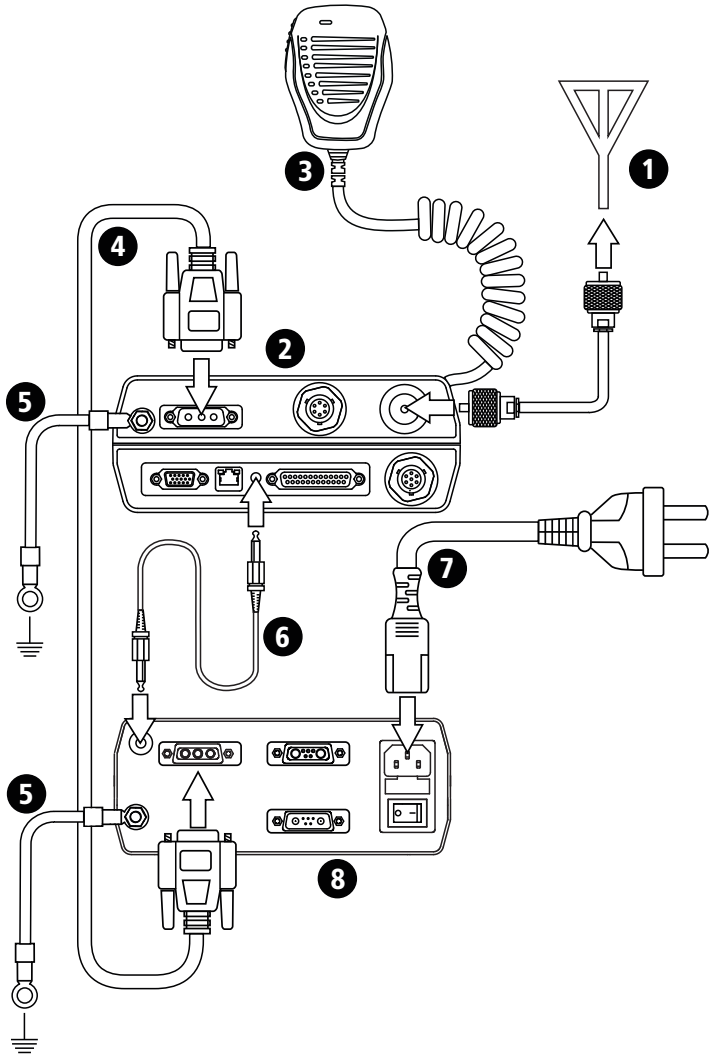
Power output regulation is performed automatically based on the DC voltage presented to the transceiver DC input connector. The Barrett 4022 Power Supply is available in the BC402201 (24 V DC) version. This power supply version is capable of operation with AC mains input voltage between 88 and 256 V AC.

In base station installations where no mains supply is available, various Barrett solar power supply solutions are available depending on the system configuration requirement.

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 BC402201 be used as it provides a three stage charge facility to maintain a battery without the noise problem described above.

Connection Details for a 4050 Transceiver with a Battery Backup Using the 4022 Power Supply

For further information regarding the Barrett 4022 Power Supply, refer to the 4022 Power Supply / Charger Operating Manual (P/N BCM402200).



1. 4050 transceiver to 4022 Power Supply Cable (P/N SA-42020)
2. Barrett 4050ip HF SDR Transceiver (P/N BC405000ip)
3. Ground (earth)
4. IEC mains cord (P/N SA-00020)
5. Speaker cable (P/N SA-45010)
6. Ground (earth)
7. Barrett 4022 Power Supply (P/N BC402201)
8. In-line Fuse
9. 3 metre battery back-up cable for 4022 Power Supply (P/N BCA402201)
10. 12 V Sealed Lead Acid Battery (P/N BCA92203)

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, only use the power cable supplied with the transceiver. If extra cable is required, use a cable with a conductor square area of no less than 8 mm^2. 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

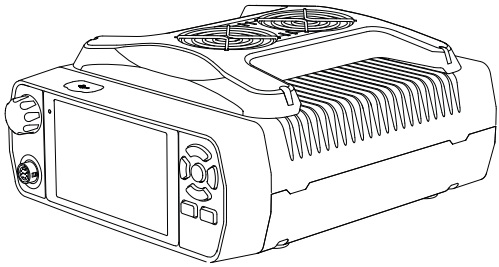
The transceiver is provided with adequate internal protection from over-current or short-circuit. The fitting of an additional external fuse is still considered necessary for both the protection of the transceiver and to ensure that in the event of damage to the cable, a fire does not occur. The fuse 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 25 A with a suitable high current ATC fuse holder rated at 30 A or more should be used. These type of fuses and holders are contained in our standard installation kit (P/N BCA40004) or are available individually (P/N BCA20021).

Cooling Fan

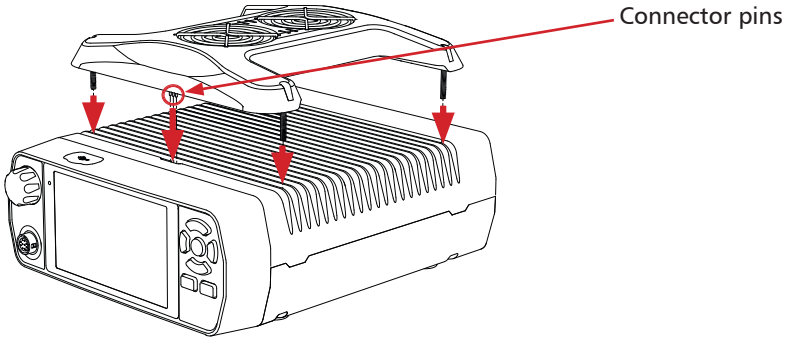
The cooling fan is an optional extra which may be added to the 4050 transceiver for situations where high volumes of data or Digital Voice transmissions may cause the transceiver's internal temperature to rise above 65°C.

The cooling fan requires no user input as it is temperature controlled by software, automatically activating when necessary.



Installing the Cooling Fan

Attach the cooling fan to the transceiver by carefully aligning the connector pins located beneath the cooling fan with the socket on top of the transceiver as shown below.



Four screws (located in the four corners of the cooling fan) are used to secure the cooling fan to the transceiver.

To uninstall the cooling fan, reverse the installation procedure.

Antennas

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.

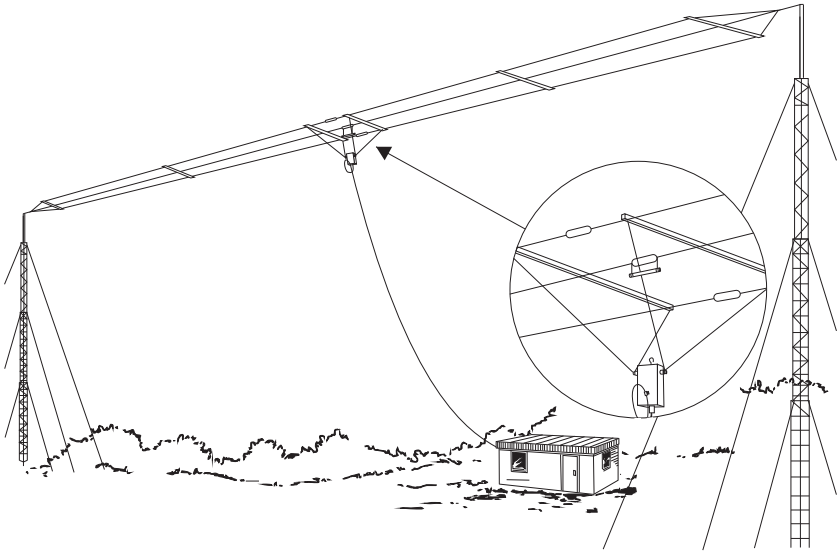
A range of antennas is available from Barrett to suit most small fixed stations. Detailed instructions are included with each antenna.

912 Broadband Dipoles

(P/N BC91200 and BC91201)

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

Please consult the relevant guide for each 912 base station antenna for further information. These can be downloaded from barrettcomms.com.



Barrett 912 antennas can be mounted in a horizontal configuration with a 12-15m mast or in an Inverted V configuration with a 10-15m mast.

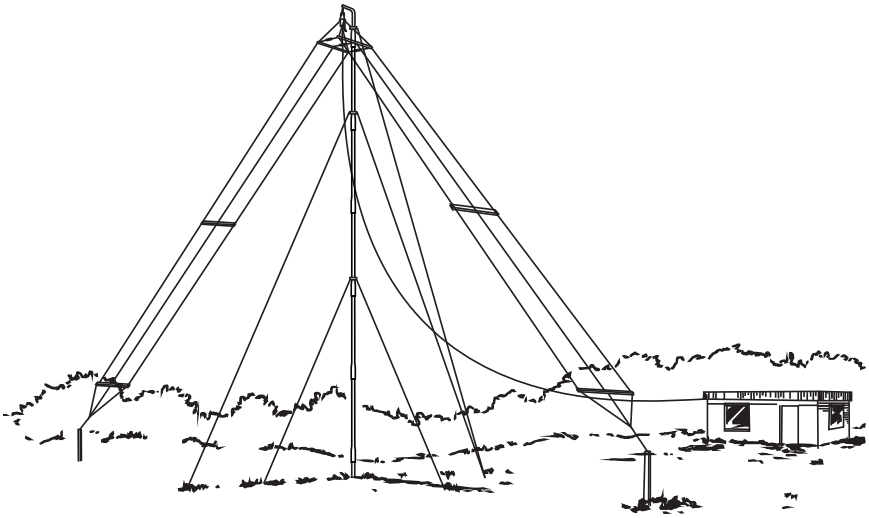
The required minimum distance between the masts is 32 metres for horizontal configuration.

Halyards and pulleys required to hoist and support the antenna are not supplied, however they can be purchased separately from Barrett Communications (Halyard and Pulley Kit P/N BCA91201). It is recommended that the halyards used to support the antenna be either UV stabilised Dacron cord or wire rope and that pulleys be of stainless steel construction.

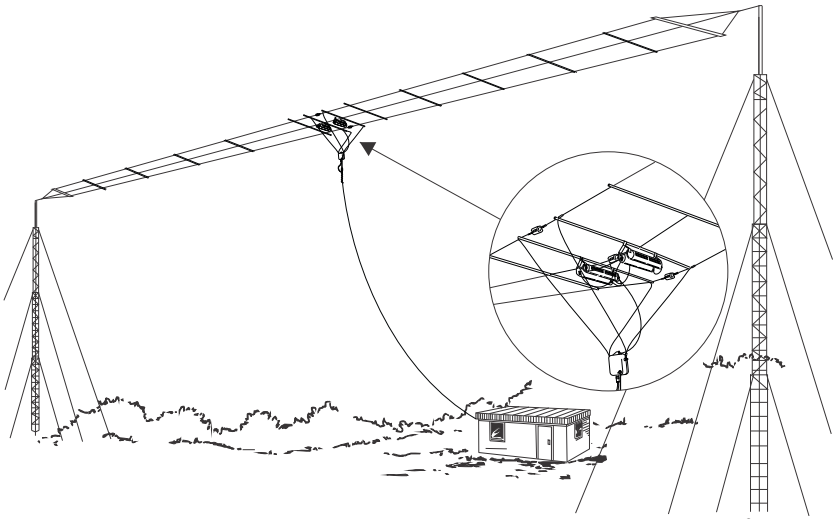
For a 10-15m mast with an antenna in inverted V configuration, rods or stakes should be inserted into the ground at least 9m away from the mast in order to secure the antenna ends.

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.

It is highly recommended that antennas be installed by suitably qualified personnel.



Inverted V Configuration



Horizontal Configuration

4047 Automatic Tuning Horizontal Dipole Antenna

The Barrett 4047 Automatic Tuning Horizontal Dipole Antenna is designed for conditions where area is limited but a high performance base station antenna is still required. It consists of composite radiation elements driven by an automatic antenna tuner to allow operation from 3 to 30 MHz. The tuner provides broadband impedance matching during scan mode (receive) operation, for reliable link establishment using modern radio protocols.

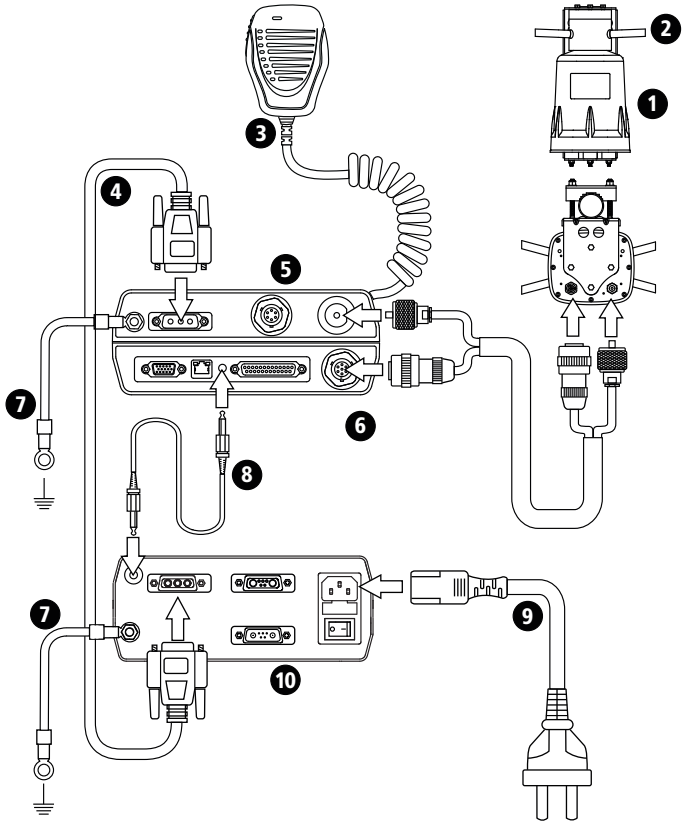
The antenna is designed for operation on a 6 to 10 metre standard 50 mm mast making it simple to install. With a packed length of 2.1 metres the antenna can be easily transported by air.

Assembly fixtures are supplied to assist in mounting the antenna to an existing mast, tower or pole. Alternatively, a range of suitable masts can be supplied with the antenna.

The tuner has a memory system that stores tuning information for each channel after an initial tune sequence with unlimited capacity.

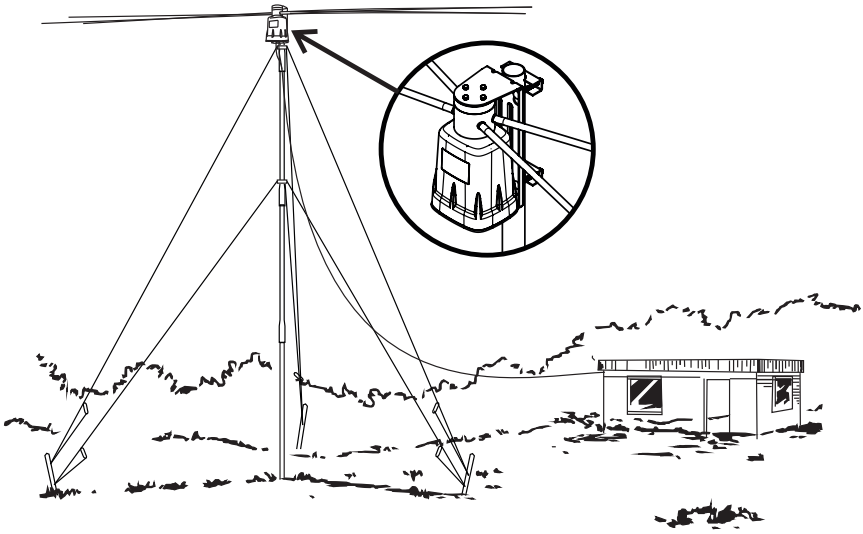
For further information regarding the 4047 Automatic Tuning Horizontal Dipole Antenna, please consult the 4047 Automatic Tuning Horizontal Dipole Antenna User Manual (P/N BCM404700).

Connection Details for a 4050 Transceiver and 4047 Automatic Tuning Horizontal Dipole Antenna



1	Barrett 4047 Automatic Tuning Horizontal Dipole Antenna (P/N BC404701)
2	Horizontal Dipoles and Mounting Assembly
3	Microphone (P/N MI-45001)
4	Power cable 4022 to 4050 (P/N SA-42020)
5	Barrett 4050ip HF SDR Transceiver (P/N BC405000ip)

6. Coaxial / Control Cable (P/N 4017-01-01)
7. Ground (earth)
8. Speaker cable (P/N SA-45010)
9. IEC Mains cord (P/N SA-00020)
10. Barrett 4022 24V Power Supply (P/N BC402200)



4045 Automatic Antenna Tuner for Base Station Installations

Antennas such as long-wires, vertical whips and loop configurations require an Antenna Tuning Unit to operate correctly.

Housed in a fully weatherproof enclosure, the 4045 will tune long wire antennas effectively up to a length of 10 metres and wire loop antennas or whip antennas over a frequency range of 2 to 30 MHz. Tuning is rapid, typically less than one second the first time RF is applied, either whilst the operator is talking or when the "Tune" control is activated on the transceiver (see page 101).

The 4045 tuner features a memory facility that stores the configuration required to tune to a frequency. On any subsequent use of that frequency, the 4045 reconfigures to the stored settings in typically less than 130 milliseconds. Following initial tuning, the antenna's VSWR is monitored. If any significant variation occurs, the 4045 will re-tune the antenna automatically.

The 4045 is supplied complete with coaxial / control cable having an overall length of 30 metres (P/N 4017-01-01). The cable is a composite design incorporating coaxial, power supply and control cables.

For further information regarding the 4045 Automatic Antenna Tuner, please consult the 4045 Automatic Antenna Tuner User Manual (P/N BCM404500).

Antenna

The following points should be considered when mounting an antenna with the 4045:

- 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 two metres from the mast.
- The radiating part of the antenna starts at the tuner. The base of the antenna should be centrally located as per above criteria.
- 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 or danger of RF burns.

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 (earth) system is the primary cause of poor performance and tuning problems. Unless a good ground (earth) system (counterpoise) can be provided, there is little point in installing the antenna. In areas of good ground (earth) conductivity (i.e. the terrain is always damp), an effective ground (earth) can be made through a grounding (earthing) rod. This should be a minimum 1.5 metres in length and should be installed as close to the tuner as possible. A suitable grounding (earthing) kit can be purchased from Barrett Communications (P/N BCA90056). Several rods bonded together will improve the ground (earth) contact. In some cases metal water pipes may be used as a ground (earth) 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 (earth) conductivity will not be sufficient to provide a satisfactory ground (earth) for the Barrett 4045 ATU. 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 (earth) system. This will also be the case in rooftop installations where no existing ground plate (such as metal roofing) exists.

The number of radials required for an effective counterpoise depends on the soil quality, dampness and other factors which affect the conductivity of the soil. The more radials used, the better the performance of the antenna/ATU combination especially at lower frequencies. This manual suggests a minimum of 20 radials, but optimum performance at low frequencies is not guaranteed.

The radials of the counterpoise need only be of much thinner cable i.e. 5.48mm^2 (#1 #2 SWG) preferably copper wire. RG58 Coaxial cable may be used. At the base of the antenna, the radials all couple together at a common well bonded antenna ground (earth) point. The radials should be buried into the ground to a minimum of 200 mm depth.

Note: To accomplish reliable ATU tunes at frequencies below 5 MHz, it is not uncommon, with poor conductive soil conditions, to require up to 120 radials each of up to 70 m length, requiring thousands of metres of cable and a lot of trenching. This is impractical and is the reason Whip/ATU antennas are NOT recommended for land based systems.

Post-Installation Performance Test

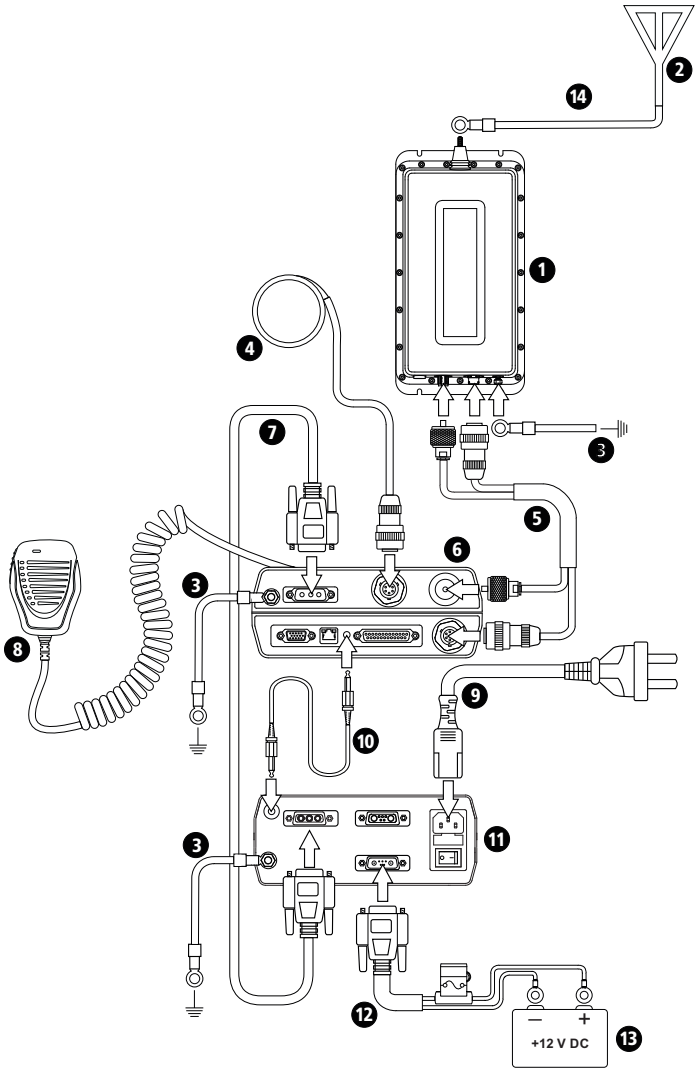
After the mechanical installation of the system is complete as per the system diagram:

1. Select the highest frequency to be used on the transceiver.
2. A directional wattmeter should be inserted into the coaxial transmission line between the transceiver and the tuner. If one is not available, the internal metering of the Barrett 4050 Transceiver could be used for this test.
3. Press the TUNE button on the transceiver front panel to begin a tune cycle. This will key the system with modulation and the exciter will provide a low RF level to the tuner for the period of the tune cycle. On detection of this 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 "Tune OK" and the watt-meter and 4050 front panel should show a low value of reflected power, consistent with a VSWR of better than 2:1.
4. 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 indicated, check that the antenna length and connections are correct and re-check all ground connections. If a successful tune is achieved, the exciter will raise the excitation power to achieve the full output power from the system.

Note: When shipped, the Barrett 4045 automatic tuning antenna memory system will not have any pre-stored tuning information appropriate to your installation. To allow the 4045 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 for a 4050 Transceiver and 4045 Automatic Antenna Tuner in a Base Station Configuration



1. Barrett 4045 Automatic Antenna Tuner (P/N BC404501)
2. Appropriate antenna
3. Ground (earth)
4. External GPS receiver option (P/N BCA40009)
5. Coaxial / Control Cable (P/N 4017-01-01)
6. Barrett 4050ip HF SDR Transceiver (P/N BC405000ip)
7. Power cable 4022 to 4050 (P/N SA-42020)
8. Microphone (P/N MI-45001)
9. IEC mains cord (P/N SA-00020)
10. Speaker cable (P/N SA-45010)
11. Barrett 4022 Power Supply (P/N BC402201)
12. Battery backup cable 3m (P/N BCA402201)
13. 12 V Battery (P/N BCA92203)
14. Antenna feeder cable

411 Automatic Antenna Tuner for Base Station Installations

The Barrett 411 Automatic Antenna Tuner is designed for use in land base station and maritime HF services. Primarily designed for operation with end-fed unbalanced antennas such as whips and long wires, the tuner is built in a waterproof impact resistant, moulded ABS plastic enclosure.

Antenna

Various antenna configurations, such as vertical whips, long-wires and loops can be used for base station installations using the Barrett 411 Automatic Antenna Tuner.

In general however, the following points should be considered:-

1. 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.
2. Remember the radiating part of the antenna starts at the tuner. The location of the bottom portion of the antenna is very important.
3. 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.
4. Inverted "V" installation of horizontal antennas minimises the directivity and is recommended for omni-directional coverage.
5. 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 back to the transceiver (away from other cables) and connected as indicated in the diagram.

Ground (Earth) System

The ground (earth) system is a key part of the overall antenna system and consequently the system operation. An inadequate ground (earth) system is the primary cause of poor performance and tuning problems. Unless a good ground (earth) system (counterpoise) can be provided, there is little point in installing the antenna. In areas of good ground (earth) conductivity (ie. the terrain is always damp) an effective ground (earth) can be made through a grounding (earthing) rod. This should be minimum 1.5 metres in length and should be installed as close to the tuner as possible. A suitable grounding (earthing) kit can be purchased from Barrett Communications (P/N BCA90056). Several rods bonded together will improve the ground (earth) contact. A least preferred method and one that should be avoided if possible is to use existing metal water pipes as a ground (earth) providing:-

1. The water pipe is close to the tuner and the water pipe enters the ground close to the tuner.
2. There are no joints or couplings in the pipe that will increase the resistance path to ground.
3. The water pipe enters soil with good conductivity.
4. A low resistance joint is made with the water pipe.

Frequently the ground (earth) conductivity will not be sufficient to provide a satisfactory ground (earth) 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 (earth) system. This will also be the case in rooftop installations where no existing ground (earth) plate (such as metal roofing) exists. The radials of the counterpoise need only be of much thinner cable i.e. 5.48mm^2 (#1 #2 SWG) preferably copper wire. RG58 Coaxial cable may be used. If radial wires are used the counterpoise should consist of at least 8 to 10 radial wires. When radials or mesh are used at ground level it is recommended that they be buried a minimum of 200mm below the surface.

Post-Installation Performance Test

After the mechanical installation of the system is complete as per the system diagram:

1. Select the highest frequency to be used on the transceiver.
2. A directional wattmeter should be inserted into the coaxial transmission line between the transceiver and the tuner. If one is not available, the

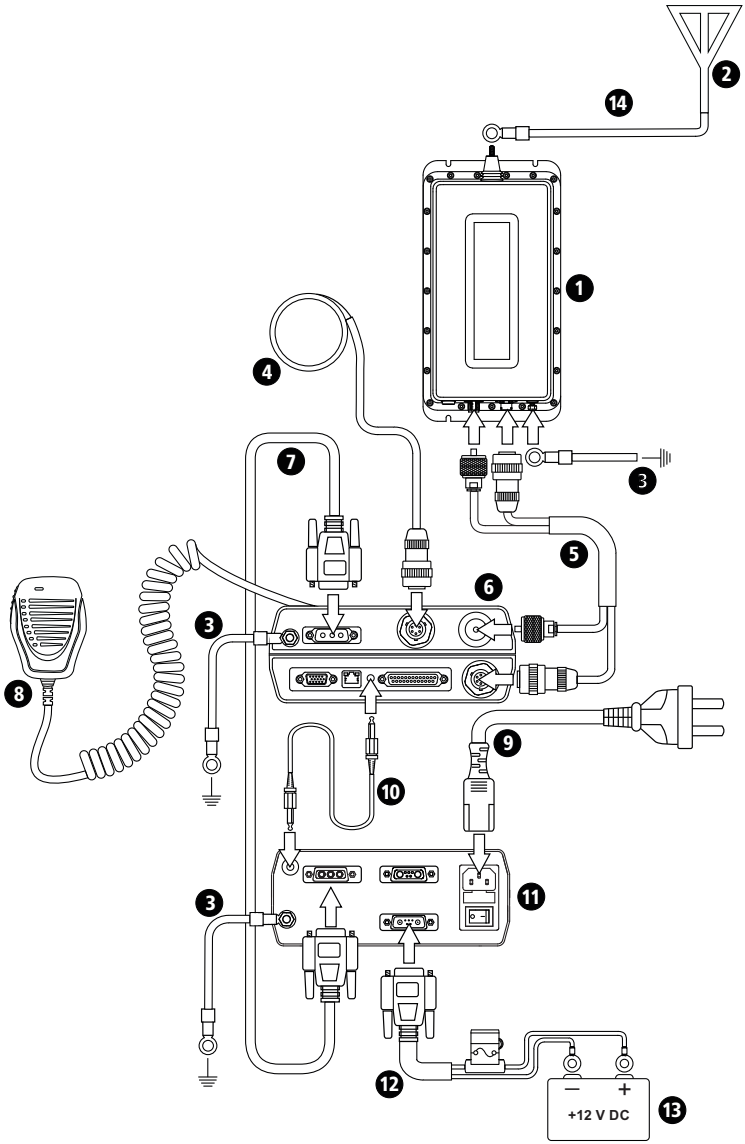
internal metering of the Barrett 4050 Transceiver could be used for this test.

3. Press the TUNE button on the transceiver front panel to begin a tune cycle. This will key the system with modulation and the exciter will provide a low RF level to the tuner for the period of the tune cycle. On detection of this 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 "Tune OK" and the watt-meter and 4050 front panel should show a low value of reflected power, consistent with a VSWR of better than 2:1.
4. 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 indicated, check that the antenna length and connections are correct and re-check all ground connections. If a successful tune is achieved, the exciter will raise the excitation power to achieve the full output power from the system.

Note: When received the Barrett 911 Automatic Antenna Tuner memory system will 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 re-tune to that frequency.

Connection Details for a 4050 Transceiver and 411 Automatic Antenna Tuner in a Base Station Configuration

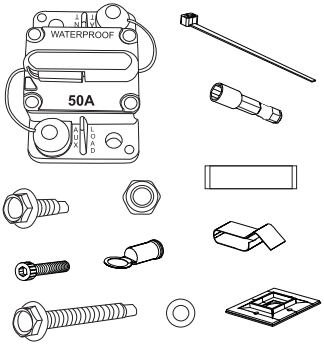
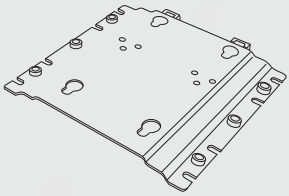
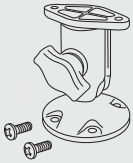


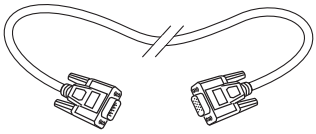
1. Barrett 411 Automatic Antenna Tuner (P/N BC41100)
2. Antenna
3. Ground (earth)
4. External GPS receiver option (P/N BCA40009)
5. Coaxial / control cable (P/N BCA90055)
6. Barrett 4050ip HF SDR Transceiver (P/N BC405000ip)
7. Power cable 4022 to 4050 (P/N SA-42020)
8. Microphone (P/N MI-45001)
9. IEC mains cord (P/N SA-00020)
10. Speaker cable (P/N SA-45010)
11. 4022 Power Supply (P/N BC402201)
12. Battery backup cable 3m (P/N BCA402201)
13. 12V DC external battery
14. Antenna feeder cable

Mobile Installations

This section describes how to change the 4050 transceiver from a desktop unit (as supplied) to a remote control (trunk mount) unit using the Mobile Pack P/N BCA40501.

Mobile Pack

	Barrett installation kit	BCA40004
	Universal mounting cradle	SA-45060
	Screws and capstans	MW-45027
	RAM Mount	PW-33334



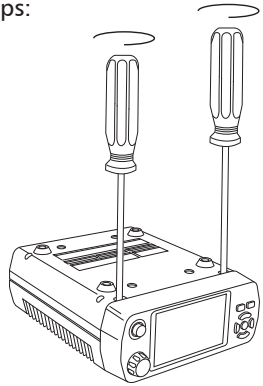
Six metre control head cable with DB-15 connectors

SA-45100

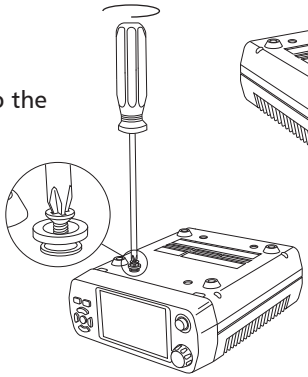
Removing the 4050 Primary Control Head

To install the mobile pack, complete the following steps:

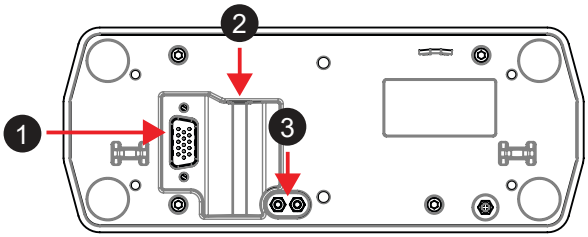
1. Invert the transceiver and use a Posidrive #2 screwdriver to loosen (but not remove), the two front panel securing screws located immediately behind the front panel.
2. Gently pull the front panel from the transceiver to remove it.



3. Fit the supplied capstans to the four holes as indicated.

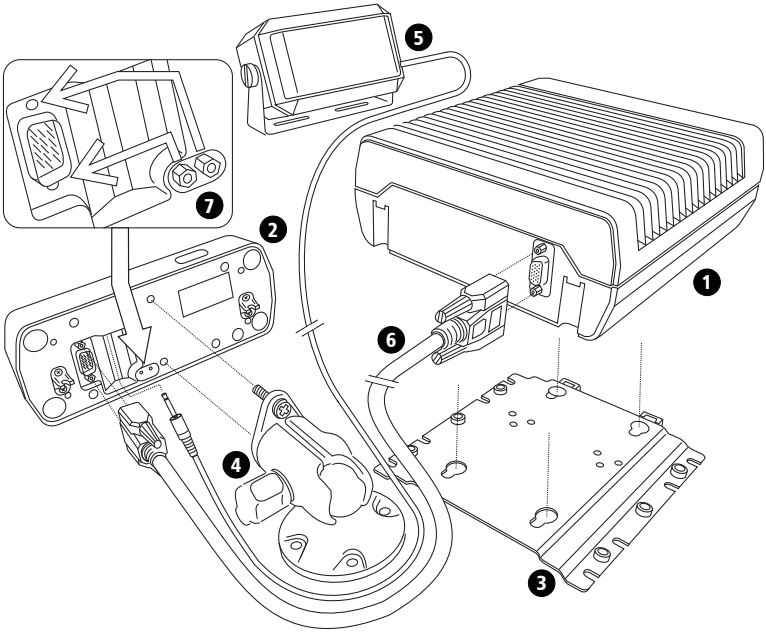


4050 Control Head - Rear View



1. 15-way transceiver plug for remote front panel interface cable
2. Speaker jack
3. Stand-offs (supplied) to enable the front panel to be detached and a control head cable to be secured in position.

Installing the Mobile Pack



1. Attach the universal mounting cradle ❸ to the desired location using the fixings provided.
2. Align the transceiver's capstans into the key holes on the universal mounting cradle and slide to secure it.
3. Attach the RAM Mount ❹ to the desired location and affix the front panel to it using the two screws provided.
4. Plug the six metre control head cable ❻ into the socket located at the front of the transceiver and secure using the strain relief screws.
5. Remove the two stand-offs ❼ from their storage location as indicated and fit securely in position above and below the control head connector. *CAUTION: Do not over tighten.*
6. Plug the other end of the six metre control head cable into the rear of the front panel ❷ and secure using the strain relief screws.
7. Plug the loudspeaker connector into the socket located at the rear of the front panel ❺ as indicated below or the audio jack on the back of the transceiver body.

Transceiver Mounting

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 in mobile configuration) should be one which allows convenient operation.

Positions which are often used are:

On the centre console

In place of the glove box

Behind the seat

Under the seat

Under the dash board (if safe).

In a mobile configuration, only the control head needs to be mounted in a position convenient to the operator. The transceiver may be mounted under a seat, in the luggage compartment or any other appropriate place within the vehicle (which allows for sufficient air flow).

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, the mounting of equipment must take into account the severe vibration and shock that may be encountered.

Transceivers may only be mounted to structural components of the vehicle body and not on 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

The 4050 relies 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 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, possible noise interference and damage to cables through overheating. To prevent this, consider the following:

- 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.
- If an isolation switch is fitted between the battery's negative terminal and the vehicle chassis then it is important to connect the radio's negative supply cable to the chassis side of the isolation switch.

Grounding

Ideally the radio should be mounted as close as possible to the antenna with a common grounding (earth) point being used for both the antenna's ground (earth) connection and the radio's ground (earth) connection. See page 133, page 121 and page 142 for additional information regarding appropriate antenna grounding (earthing).

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.

Due 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 affected 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 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 each antenna will detail this operation.

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 manual 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.

Please note that some newer fuel injected engines emit very strong EMI (Electromagnetic interference) noise levels across the HF radio band, which is near impossible to suppress. For these installations, moving the position of the antenna to another position on the vehicle may reduce the noise effect but full elimination of noise while the engine is running may never be achieved. Please note that this is not unique to the Barrett 4050 transceiver as all transceiver makes will suffer similarly from the effects of this noise under these conditions.

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.

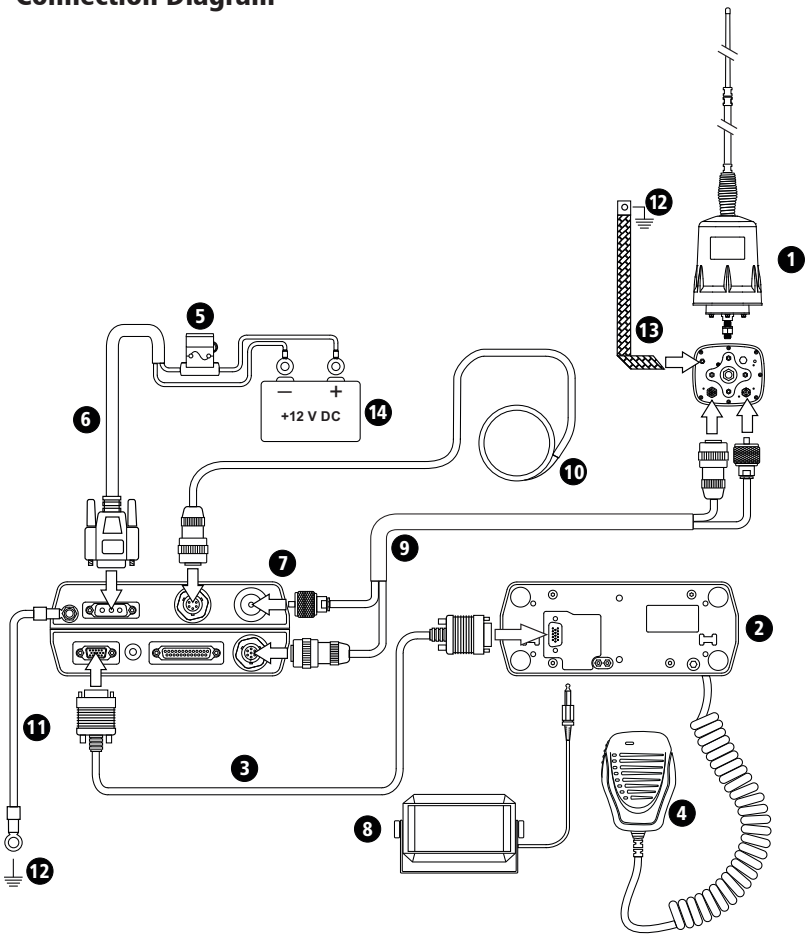
4049 Automatic Tuning Mobile HF Antenna

(Barrett P/N BC404900)

The Barrett 4049 automatic tuning mobile HF antenna plugs directly into the rear of a 4050 transceiver using the cables supplied.

For further information regarding the 4049 Automatic Tuning Mobile HF Antenna please consult the 4049 Automatic Tuning HF Antenna User Manual (P/N BCM404902).

4050 HF SDR Transceiver to 4049 Automatic Tuning HF Antenna Connection Diagram



1. 4049 Automatic Tuning HF Antenna (P/N 4049-00-01 or BC404901)
2. 4050 HF SDR Transceiver control head (P/N BCS40005)
3. 6 m Control cable (P/N SA-45100)
4. Microphone (P/N MI45001)
5. Fuse in-line with spare
6. 6 metre power cable supplied with transceiver (P/N BC405006)
7. 4050 HF SDR Transceiver (P/N BC405000)
8. Extension speaker supplied with 4050 transceiver (P/N BCA40015)
9. Interface cable – integral coaxial and control (P/N 4019-00-02)
10. External GPS receiver option (P/N BCA40009)
11. Earth strap between 4050 transceiver and main body of vehicle
12. Ground (earth)
13. Earth strap between 4049 ATU and main body of vehicle
14. 12 V DC external battery

Mounting the Barrett 4049 Automatic Tuning HF Antenna

The Barrett 4049 antenna should be mounted in positions similar to those illustrated in the diagrams on the following pages. 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.

The antenna is supplied standard with a two section whip antenna (Barrett P/N: BCA201901), a bulb spring (P/N 4049-00-04), an antenna installation guide and a pre-terminated six metre control cable to suit the Barrett 4049 antenna to transceiver.

The following extension cables for the control cable, are also available:

Extension Cable	Barrett P/N for the 4050/4090
10 m	4019-00-05
30 m	4019-00-07

The control cable should be routed into either the engine compartment or boot (trunk) of the vehicle. If the joint between the antenna control cable and the extension cable is in an exposed position, a 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.

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 additional copper braid earth straps if any non-metallic joints are encountered.

After mounting the main body of the antenna, screw the black base spring onto the antenna body followed by the whip section.

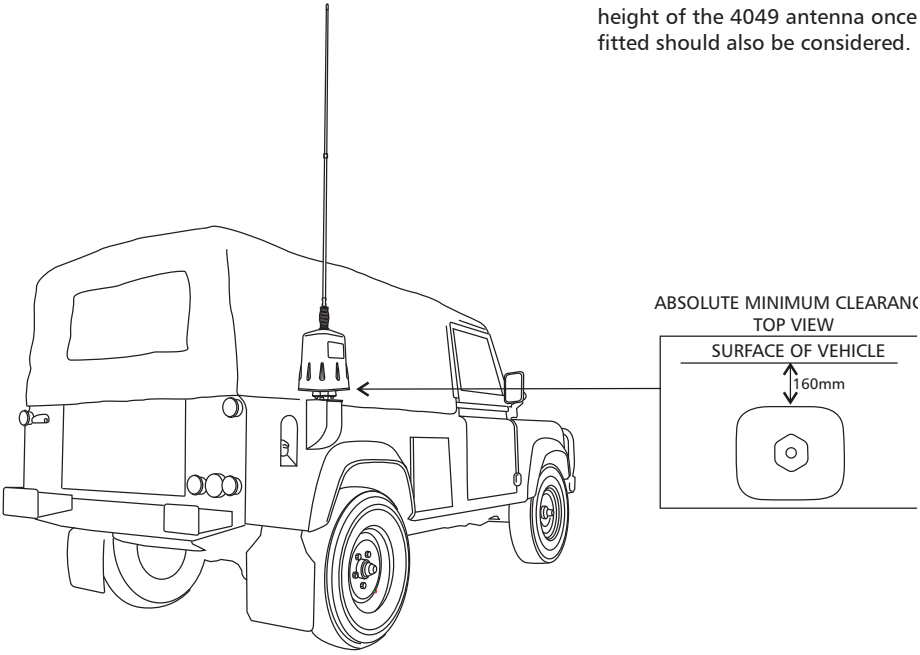
Note: If the antenna is being fitted to a rear door, extra bonding straps should be added from the rear door to the main body / chassis of the vehicle.

Important Information

It is ESSENTIAL to maintain the minimum clearances between the antenna and surrounding metal work as indicated in the diagrams. FAILURE TO MAINTAIN THESE CLEARANCES WILL NOT ONLY REDUCE THE EFFICIENCY OF THE BARRETT 4049 AUTOMATIC TUNING MOBILE HF ANTENNA BUT MAY ALSO LEAD TO INTERNAL RF ARCING AND FAILURE.

Important:

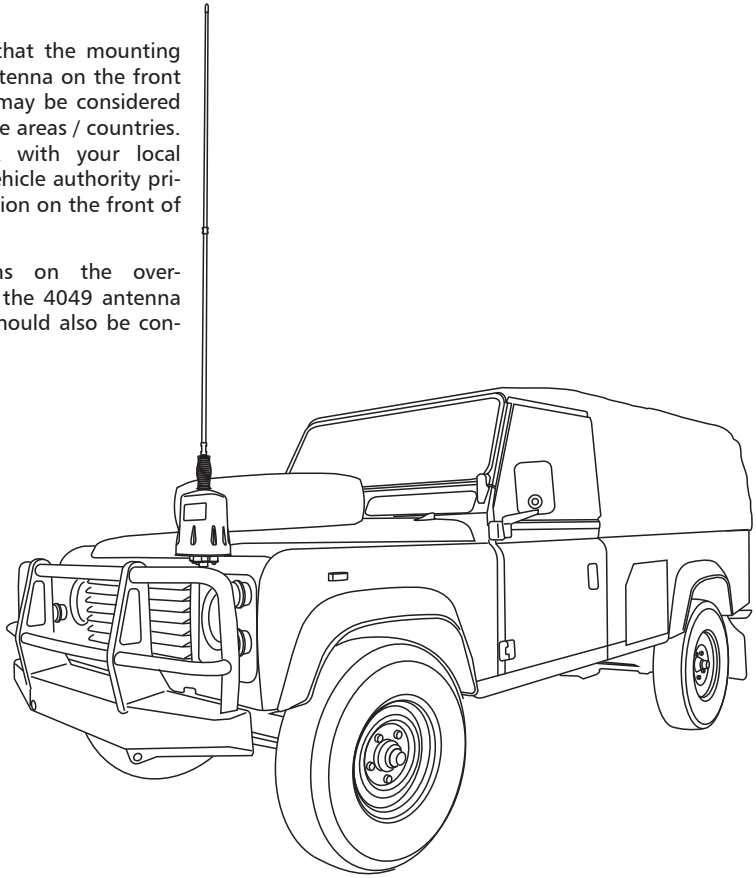
Considerations on the overall height of the 4049 antenna once fitted should also be considered.



Important:

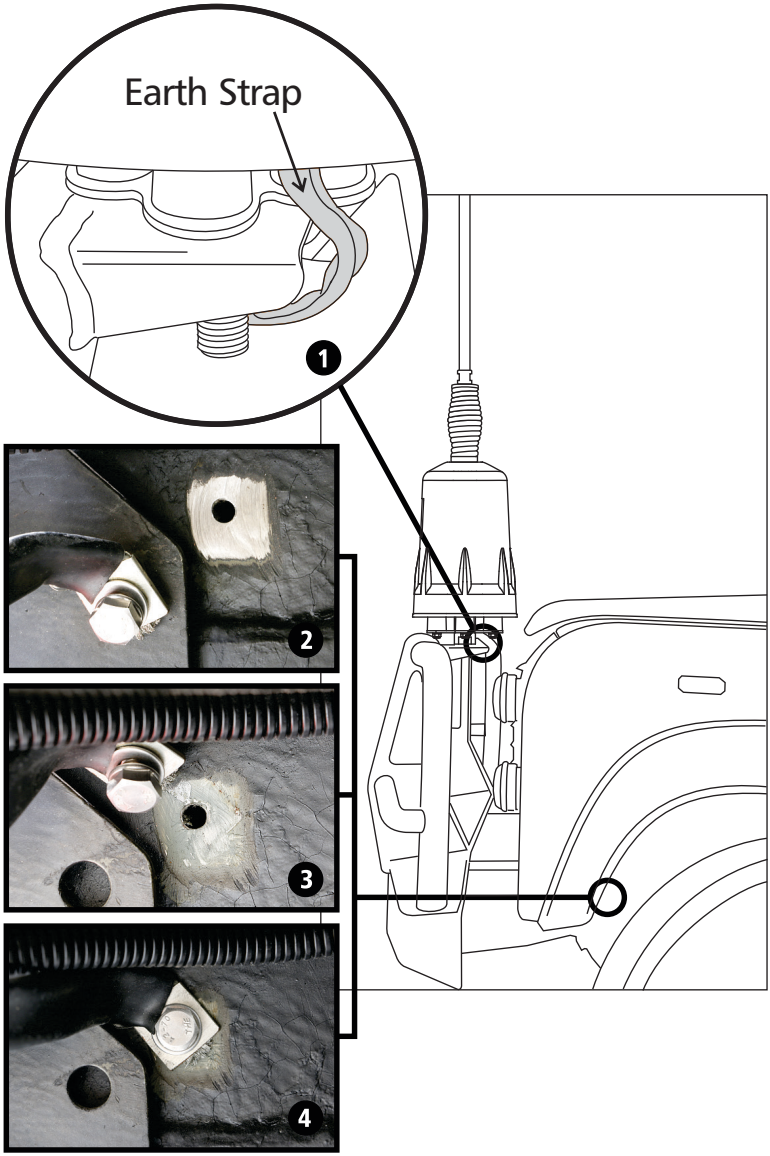
Please note that the mounting of a 4049 antenna on the front of a vehicle may be considered illegal in some areas / countries. Please check with your local transport / vehicle authority prior to installation on the front of your vehicle.

Considerations on the overall height of the 4049 antenna once fitted should also be considered.



Caution:- Whilst the 4049 automatic tuning mobile HF 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 4049 antenna in positions such as these as damage to the antenna may result.

Earthing the Antenna

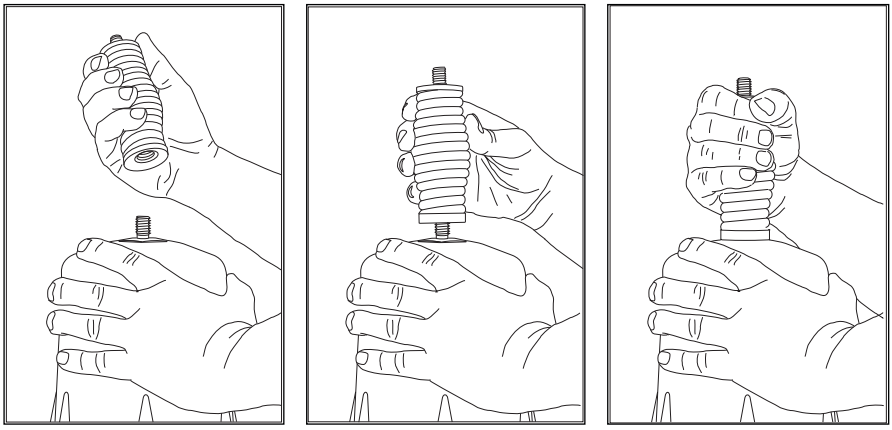


Notes:

1. Connect an earth strap to the base of the antenna
2. Grind away any paint or coating at the earthing point on the chassis to expose the bare metal
3. Apply electrical contact grease to prevent rust and corrosion and maintain the integrity of the earth connection
4. Attach the earth strap lug securely with an appropriate fastener.

IMPORTANT: If the antenna is mounted in a high position on the rear door of a vehicle, multiple earth straps must be used to reach the vehicle chassis' earthing point. Earth conductivity from the antenna to the chassis must be maintained for correct operation of the antenna.

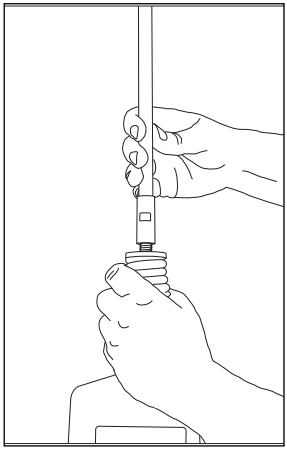
Mounting the Base Spring

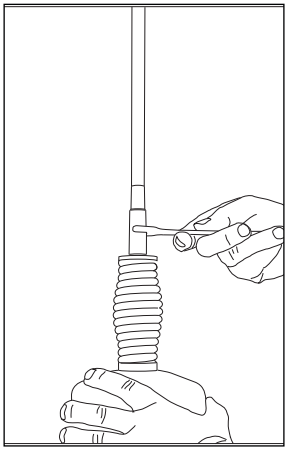


The base spring should only ever be tightened by hand. If a tool is used it may damage the spring base.

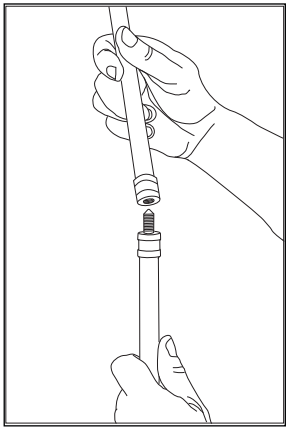
Mounting the Whip Sections

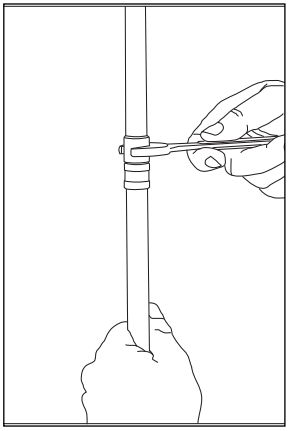
To mount the whip section it is recommended that only one section of the whip be screwed onto the antenna at a time. The whip section should be hand tightened fully then a suitable tool (e.g. a spanner) can be used to tighten the section a further 10 to 20 degrees clockwise while holding the antenna body with a free hand.





To mount the two whip sections together, the unattached whip section should be hand tightened fully then a suitable tool (e.g. a spanner) can be used to tighten the section a further 10 to 20 degrees clockwise while holding the already attached whip section with a free hand.





Testing the 4049 Automatic Tuning Mobile HF Antenna

Note: Do not test unless the whip antenna is connected. Minimum 2 sections.

To test the Barrett 4049 antenna, first select the lowest transmit frequency in the transceiver and press the Tune icon until the display shows the word "Tuning". After a few seconds "Tune Passed" should be displayed briefly and an indication of the measured VSWR (Voltage Standing Wave Ratio) value. Check this reading against a VSWR meter.

Repeat the above test on the highest frequency in the transceiver and on a selection of frequencies in between at approximately 2 MHz intervals. If the tune passes at all times, the 4049 antenna is working correctly.

However, if the display shows "Autotune Fail" accompanied by low pitched beeps at any point, the 4049 antenna has failed to tune.

Check the following:

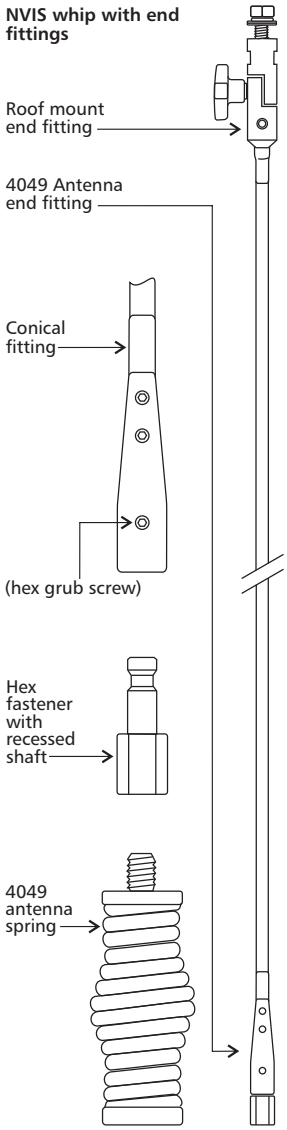
- Confirm the "Antenna Type" is selected in the transceiver's Antenna Type setting (see previous page).
- Check all cables are correctly connected
- Check the earth cable from the base of the 4049 antenna has a good connection to the vehicle body or chassis (not directly to the battery terminal)
- Check that the whip fitted is not faulty or incorrect
- Move the vehicle if the 4049 antenna is close to any metal fences, buildings etc.

If the problem cannot be resolved, contact your dealer or Barrett Service Department for advice.

NVIS Kit for 4049 antenna - P/N BCA201910

The Barrett Near Vertical Incidence Skywave (NVIS) antenna whip is designed to enhance the short range communications efficiency of the Barrett 4049 Automatic Tuning Mobile HF Antenna. The increased whip length combined with its horizontal orientation (once installed) provides a significantly higher take off angle and radiation efficiency. Communications paths over the range 20 - 500 kms, particularly in hilly and mountainous terrain, can be greatly improved through the use of the NVIS kit.

The NVIS kit comprises of a single flexible whip section of 4 metres in length which replaces the two section whip (BCA201901) supplied with the Barrett 4049 Antenna. It has fittings at each end to attach to the 4049 antenna and the optional NVIS Kit Magnetic Mounting Base (BCA201911). The whip can also be secured to the vehicle without the magnetic mounting base by using a custom made bracket with a 13mm hole (sourced by end user). This option may be preferable if the vehicle is fitted with a roof rack for example.



The NVIS kit can be installed as follows:

1. Remove the existing 4049 antenna whip, leaving the spring in place.
2. Unscrew the lowest hex grub screw on the 4049 antenna end of the whip so that the hex fastener with recessed shaft can be removed.
3. Tighten the hex fastener with recessed shaft onto the top threaded stud of the antenna spring with an appropriate tool.
4. Place the conical fitting over the recessed stud and tighten the hex grub screw enough so that the conical fitting can rotate but can not be separated from the recessed shaft. This will allow the conical fitting to rotate while the roof mount end is being attached and also prevent antenna end fitting damaging the vehicle by becoming detached while attaching the roof mount end.
5. Attach the roof mount end of the whip to an appropriate location (see figure 1 as a guide). It could be attached to the optional NVIS kit magnetic mounting base (see figure 3), optional NVIS kit gutter mount bracket (see figure 4) or to a custom fabricated bracket (with 13mm hole). If the magnetic mounting base is used the roof mount end must be locked into one of three angle positions by locating the pin on the surface of one side of the fitting into the hole on the surface of the other side of the fitting (see figure 2). Once the correct angle is achieved tighten the knob firmly by hand.
6. Once the roof mount end is securely in its final position, tighten the hex grub screw that was loosened in step 2.

Figure 1 Example of front and rear antenna mounting using optional Magnetic Mounting Base (P/N BCA201911).

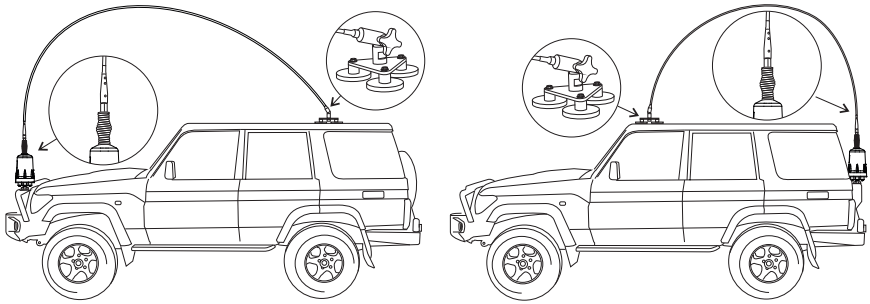


Figure 2
Adjustable roof mount fitting showing locating pin and locating holes.

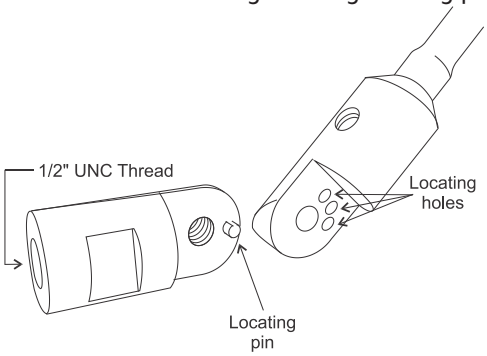


Figure 3
NVIS Kit Magnetic Mounting Base (optional) P/N BCA201911.

Base shown here with roof mount fitting attached.

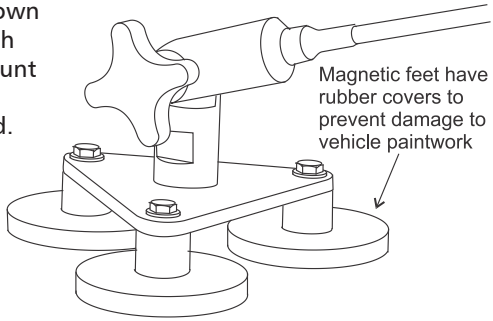
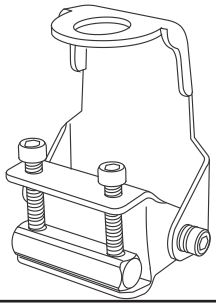


Figure 4
NVIS Kit Gutter Mount Bracket (optional) P/N BCA201912.

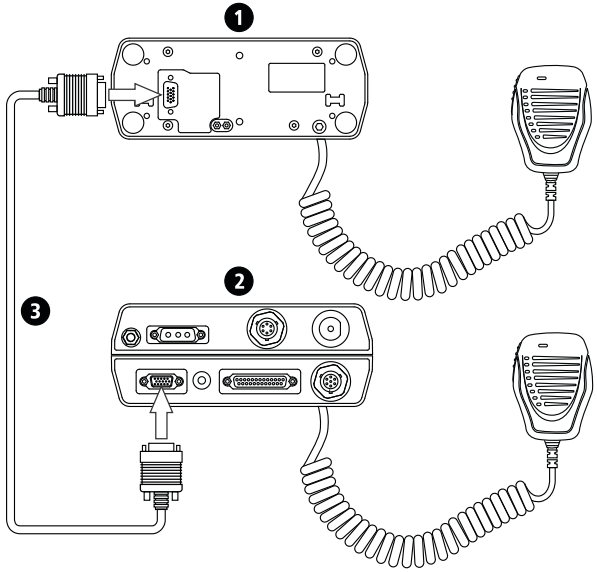


Installing a Secondary Control Head

The 4050 can support a secondary control head through the IP/AUX Control head port on the rear of the 4050. This secondary head can be purchased on its own from Barrett Communications (P/N BCS40005) and controls the radio in the same manner as the primary. This may be useful in multiple situations such as for security reasons, a secondary head may need to be located in another room; personnel carriers may require a head be accessible for those in the back of the vehicle; or marine installations where a secondary head may need to be away from the primary body.

IMPORTANT NOTE:

THE SECONDARY HEAD IS NOT TO BE CONNECTED WHILST THE TRANSCEIVER IS POWERED UP. THIS MAY CAUSE DAMAGE TO THE TRANSCEIVER.



Number	Description
1	4050 Control head (rear) (P/N BCS40005)
2	4050 HF SDR Transceiver (rear)
3	Control Head cable (P/N BCA40005)

APPENDICES 8

This chapter contains the following sections:

- Appendix 1- Specifications
- Appendix 2 - Connectors
- Appendix 3 - Overview of HF Operation
- Appendix 4 - BITE Test

Appendix 1 - Specifications

General

Transmit frequency range	1.5 MHz to 30 MHz
Receive frequency range	250 kHz to 30 MHz
Frequency stability	±0.5 ppm (±0.1 ppm optional)
Frequency resolution	10Hz Program Mode 1Hz Tunable Receiver
Operating modes	J3E (USB, LSB) - H3E (AM) - J2A (CW) - CF (Custom Filter) - ISB
Filter bandwidth	Fully software defined standard and custom filter range from 300Hz to 3000Hz (6kHz ISB option)
Operating temperature	-30°C to +70°C relative humidity 95% , non-condensing
Frequency hopping	Barrett HF Frequency Hopping algorithms - 25, 15 or 5 hops per second with GPS External Synchronisation Unit (ESU) supplied when the option is fitted. Improved internal clock to maintain clock synch without GPS signal for extended periods in the field (Minimum 48 hrs w/o GPS Signal)
Digital Voice Encryption	Enhanced Digital Voice and Secure Digital Voice options with choice of autobauding "Low Rate" vocoder option (TWELP/MELP Non-proprietary - customisation available) providing superior voice recovery on poor channels down to -3dB. - AES 256 Digital Encryption with 600/1200/2400bps Vocoder - DES 56 Digital Encryption with 700/1200/2400bps Vocoder
Supply voltage	+11 to +28 VDC operation

Selcall system	Based on CCIR 493-4, four and six digit systems. Protocol available for free distribution. Fully compatible with other major HF manufacturers' four and six digit systems including encrypted systems Optional ICAO Annex 10 Selcall Encode (ARINC)
ALE Standards	2G and 3G
Current consumption	350 mA standby (muted)
Channel capacity	Up to 1000 programmable channels (depending on the 4050 variant (simplex or semi-duplex))
Switching speed	<10msec
Weight	2.75 kg (local control configuration)
Width	188 mm
Depth	251 mm (local control configuration)
Height	83 mm

Receiver

Sensitivity	-125 dBm (0.126 μV) for 10dB SINAD (reduced sensitivity between 250kHz and 500kHz)
Selectivity J3E	-1 kHz and +4 kHz better than 70dB -2 kHz and +5 kHz better than 70dB -5 kHz and +8 kHz better than 75dB
Selectivity J2B (optional)	-500 Hz and +500 Hz better than 60 dB
Blocking	Max usable sensitivity -20kHz and +20kHz: better than 95dB
Intermodulation distortion	Better than 110 dBμV
Spurious response ratio	Better than 95 dB
Reciprocal mixing	Better than 110 dBμV (As defined in ITU-R F.612)
In-band IMD	Better than 40 dB
Audio output	4 W into 4 ohm at less than 2% distortion

Audio response -6dB for 300Hz to 2700 Hz (adjustable bandwidth)

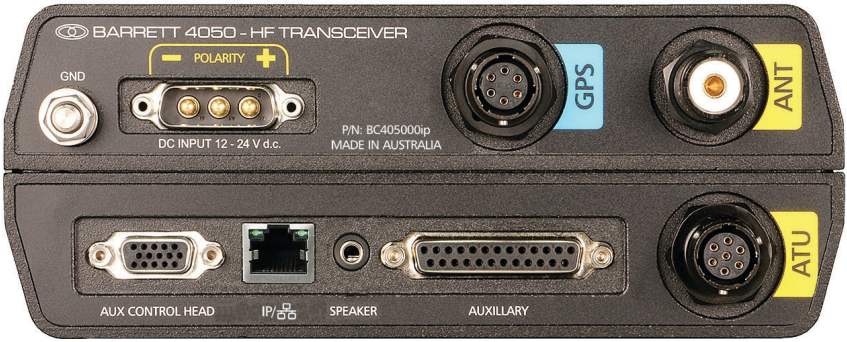
Transmitter

RF output power	150 W PEP (Max 180 W) (Australia 100W PEP)
Duty cycle	100% 2 tone input with fan option (-30°C to +50°C relative humidity 95%, non-condensing)
Intermodulation Products	Better than 32dB below PEP (26dB below two-tone peak)
Audio frequency response	Less than 6 dB variation 350 Hz to 2700 Hz
Current consumption	Voice average less than 10 amps typical Two tone less than 12 amps typical 13.8 V DC - Max 20.5A (Full power 125W) 13.8 V DC - Max 20.5A (Full power 150W) 24 V DC - Max 11.5A (Full power 125W) 24 V DC - Max 11.5A (Full power 150W)

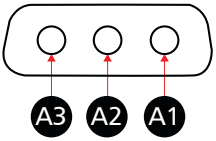
Specifications are typical. Equipment descriptions and specifications are subject to change without notice or obligation.

Appendix 2 - Connectors

Note: All connectors described below are viewed looking at the rear of the transceiver.

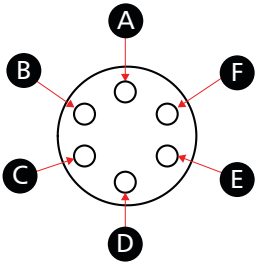


Power Connector



A1 12 V DC - 28 V DC
A2 Reserved
A3 Ground

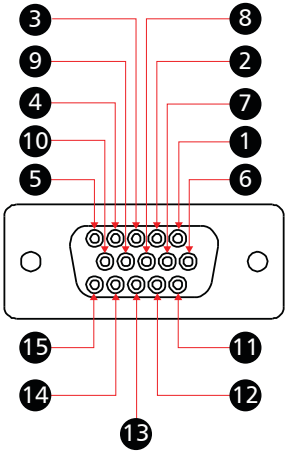
GPS Connector



	Signal	Level
A.	1PPS	1 Pulse per second
B.	NMEA+	NMEA Data positive
C.	5 V GPS	GPS Voltage 5 V
D.	CW Key	Active Low
E.	GND	Ground
F.	Reserved	

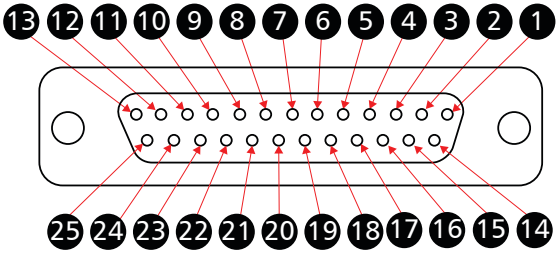
Aux Control Head

These pins are dependant on hardware revisions. Revisions are marked in the table below as Ax where x is the revision number. The revision number can be viewed under Settings < System Info < Version Information. See page 54 for more information.



1. VCC
2. CAN Bus positive pin
3. CH Audio+
4. Not Connected
5. Ground
6. Ground
7. CAN Bus negative pin
8. CH Audio-
9. Not Connected
10. Line Out
11. Linear amp ALC for Break out Box
12. 13V8 Out
13. Line In+ (rev. A10 or earlier) USB+ (A11 or later)
14. Line In- (rev. A10 or earlier) USB- (A11 or later)
15. 1PPS (rev. A10 or earlier) USB 5V (A11 or later)

Auxiliary Connector

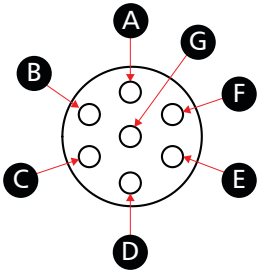


Pin	Name	Description of Function	Level
1	Ground	Ground	0 V
2	Rx Data	RS-232 data input	True RS-232

Pin	Name	Description of Function	Level
3	Tx Data	RS-232 data output	True RS-232
4	Reserved		
5	Reserved		
6	ARINC PTT In	ARINC PTT Input	
7	RS-232 Gnd	RS-232 Ground	0 V
8	Reserved		
9	PTT In	Auxiliary PTT input	Active low 0 V
10	Scan Stop	Scan stop input from external modem	Active low 0 V
11	Bal. Tx Audio In	Balanced Tx audio input (with pin 24)	600 Ω -24 dBm to 0 dBm
12	Bal. Rx Audio Out	Balanced Rx audio output (with pin 25)	600 Ω -6 dBm to +9 dBm
13	Ground	Ground	0 V
14	Reserved		
15	Reserved		
16	Reserved		
17	Reserved		
18	Alarm Out	Selcall alarm	Active low 0 V
19	Mute State Out	Audio mute state	Active low 0 V
20	Reserved		
21	PTT / C-Mute	PTT Out / Receiver Cross Mute	Active low 0 V
22	CW Key In	CW Key input	
23	+13.8 V Fused Out	+13.8 V Output to power auxiliary equipment	13.8 V @ 2 amp
24	Bal. Tx Audio In	Balanced Tx audio input (with pin 11)	600 Ω -24 dBm to 0 dBm
25	Bal. Rx Audio Out	Balanced Rx audio output (with pin 12)	600 Ω -6 dBm to +9 dBm

Note: 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.

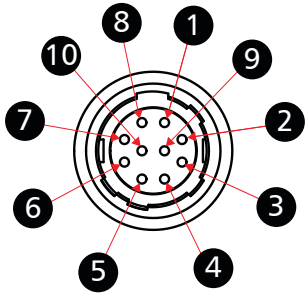
ATU Connector



	Signal	Level
A.	GND and shield	Ground and cable shield
B.	RS-232 RX / GPS Data	Receive data line of RS-232
C.	1PPS	1 Pulse per second
D.	Scan	ATU Scan line
E.	Tuned	ATU Tuned signal
F.	ATU V+	ATU Voltage 13V8
G.	RS-232 TX	Transmit data line of RS-232

Microphone Connector

Located on the Front Panel.

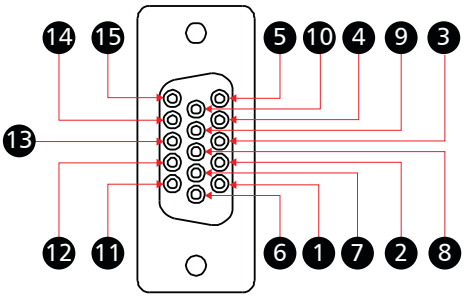


	Signal	Level
1.	MicH	Microphone audio high
2.	MicL	Microphone audio low
3.	GND	Ground
4.	PTT	Low going PTT
5.	CH UP	Channel up
6.	CH DN	Channel down
7.	Reserved	Reserved
8.	Reserved	Reserved
9.	SPKR+	Speaker microphone positive
10.	SPKR-	Speaker microphone negative

Control Head Rear Panel Connector

Plug located on the rear of the Front Panel.

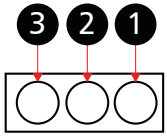
These pins are dependant on hardware revisions. Revisions are marked in the table below as Ax where x is the revision number. The revision number can be viewed under Settings < System Info < Version Information. See page 54 for more information.



1. VCC
2. CAN Bus positive pin
3. CH Audio+
4. SPKR-
5. Ground
6. Ground
7. CAN Bus negative pin
8. CH Audio-
9. SPKR+
10. Head Detect (A10 or earlier) CAN Bus Termination (A11 onwards)
11. Not Connected (A10 or earlier) Head Detect (A11 onwards)
12. Not Connected
13. Not Connected (rev. A10 or earlier) USB+ (A11 or later)
14. Not Connected (rev. A10 or earlier) USB- (A11 or later)
15. Not Connected (rev. A10 or earlier) USB 5V (A11 or later)

Cooling Fan Connector

Socket located on the top of the SDR.



(Viewed from the rear of the SDR)

1. Ground
2. + 12 V DC
3. Fan detect

Appendix 3 - Overview of HF Operation

HF (High Frequency) is the radio spectrum with frequencies between 1.6 and 30 MHz. 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 700 km 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 ongoing 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), and is then refracted back down to Earth, to the receiving antenna.

Generally speaking, ground-wave is used to communicate over shorter distances usually less than 50 km. 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 3,000 km. 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

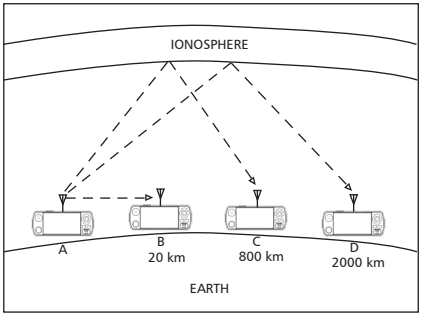
The following illustrations show the characteristics of ground-wave and sky-wave propagation during day and night time. In each illustration the height of the ionosphere above the ground is shown.

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, 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



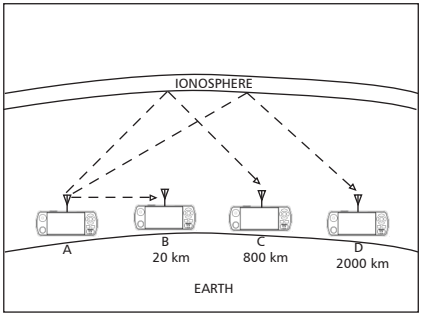
The sun is higher
The ionosphere is higher
The best frequency to use is higher.

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
The ionosphere is lower
The 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 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 4050 Transceiver, makes finding the correct frequency to use easy. A Beacon Call is based on the network of 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 to be contacted. If the call to the other station is successful, a revertive tone from the station being called will be heard, indicating the channel selected was suitable for the ionospheric conditions prevailing. If the revertive tone is not heard or is very weak, another channel may be tried until a revertive tone of satisfactory signal strength is heard.

(Refer to Beacon Calls on page 32 for more details.)

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 (for example, 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.

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

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.

Appendix 4 - BITE Test

It is recommended that any accessories (ATU, linear amplifier, Dual Antenna Switch Unit, secondary control head, GPS etc.), auxiliary port connections and the antenna be disconnected from the SDR to get consistent BITE test results. Additionally do not touch the control head and the microphone buttons while the tests are running.

Each test is outlined below as are possible causes for a failed result. If the fault is interfering with the everyday operation of the system, please contact your local Barrett dealer or Support at www.barrettcommunications.com.au.

Tests

Real Time Clock

This test checks if the real time clock on the microboard responds to commands. A failed test indicates an issue with the I2C bus on the **microboard** or a defective real time clock.

Pre Amplifier I/O

This test checks if the pre amplifier board is accessible by checking if the port expander responds to commands. A failed test indicates an issue with the I2C bus on the **microboard**, the **pre amplifier board** or a **loose connector** between the two transceiver halves.

Rear I/O

This test checks if the rear interface board is accessible. A failed test indicates an issue with the I2C bus on the **microboard**, the **rear interface board** or a **loose connector** between the two boards.

Local Oscillator

This test checks if the oscillator on the microboard is accessible. A failed test indicates an issue with the SPI bus on the **microboard** or a defective oscillator.

Audio Codec

This test checks if the audio codec on the microboard is accessible. A failed test indicates an issue with the I2C bus on the **microboard**, a failed DSB bootup, an ISP bus issue to the DSP or a defective audio codec.

Analog to Digital Converter

This test checks if the A/D converter for measuring the final stage voltage is accessible. A failed test indicates an issue with the I2C bus on the **microboard**, the **pre amplifier board**, a **loose connector** between the two transceiver halves or a defective A/D converter.

Temperature Sensor

This test checks if the temperature sensor for measuring the final stage temperature is accessible. A failed test indicates an issue with the I2C bus on the **microboard**, the **pre amplifier board**, a **loose connector** between the two transceiver halves or a defective temperature sensor.

Digital to Analog Converter

This test checks if the D/A converter for controlling the boost converter is accessible. A failed test indicates an issue with the I2C bus on the **microboard**, the **pre amplifier board**, a **loose connector** between the two transceiver halves or a defective D/A converter.

Rx Current

This test checks if the overall current draw while in receive mode (idle) is below 1A. This test can fail if too many accessories (Dual Antenna Switch Unit, ATU, linear amplifier etc) are connected to the SDR or if the accessories are faulty. Disconnect all accessories and rerun the tests. If the test is failed again, there is an issue with the **pre amplifier board**.

Tx Current

This test checks if the overall current draw while in transmit mode (BIAS current added) is between 1A and 4A. A failed test indicates the same issues as with the "Rx Current" test. Additionally, there may be an issue with the final stage on the **pre amplifier board**.

Final Voltage

This test checks if the voltage of the final stage is between 28V and 32V. A failed test indicates a defective **pre amplifier board** (port expander fails to configure the pre amplifier board, the D/A converter fails to set voltage, the boost converter fails or the A/D converter fails to read the voltage).

EEPROM

This test checks if the EEPROM allows read/write access. A failed test indicates a faulty EEPROM on the **microboard**.

Rx Test

This test checks the receiver chain with a synthetic signal. A failed test indicates a defect on the **microboard** (e.g. synthesizer, digital IF, etc).

Automatic Gain Controller

This test cycles through the attenuators and checks if the AGC adjusts itself accordingly. A failed test indicates a defect on the **microboard** (e.g. attenuators).

Warranty Statement

Barrett Communications (hereafter referred to as 'Seller') provides a three (3) year warranty on all Barrett products from the date of shipment from the Seller. A one (1) year warranty from the date of shipment from the Seller is provided for all batteries.

Each warranty guarantees acceptable performance of the product under normal recommended conditions for the duration of the warranty period. In cases of accident, abuse, incorrect installation or maintenance by a non-Seller representative, subjection to abnormal environmental conditions, negligence or use other than those in accordance with instructions issued by the Seller, the warranty shall be voided. In addition, this warranty shall not cover low performance – specifically the distance or quality of transmission and reception - due to unfavourable environmental or locational conditions. Nor shall this warranty cover the quality of transmission and reception of transceivers mounted in vehicles or vessels that have not been sufficiently electrically suppressed.

Should any fault due to bad design, workmanship or materials be proven at any time within the warranty period, the Seller will rectify such fault free of charge provided that the equipment is returned, freight paid, to Barrett Communications Pty Ltd head office or to an authorised service centre. The repaired or replaced product will remain covered under and throughout the term of the original warranty period up to its expiration. No repair or replacement will extend the warranty term past the original thirty-six (36) month anniversary of the original date of shipment from the Seller.

Firmware and software (pre-installed, stand-alone or provided as an update), hereafter referred to as 'Software', is guaranteed to perform acceptably within the specifications provided by the Seller, provided that the Software is within the warranty period.

Should Software not perform acceptably, the Seller will use all commercially reasonable efforts to correct such nonconformity as reported to the Seller directly or via a support representative. The Seller is not obliged to update Software under warranty if the nonconformity is caused by a) the use or operation of the Software in an environment other than intended or recommended by the Seller in relevant documentation, or b) modifications made to the Software not authorised or undertaken by the Seller or a representative of said Seller.

Subject to the matters set out in this warranty, no liability, expressed or implied is accepted for any consequential loss, damage or injury arising as a result of a fault in the equipment and, all expressed or implied warranties as to quality or fitness for any purpose are hereby excluded.

This warranty does not extend to products supplied by the Seller which are not designed or manufactured by it. The Seller will however make every

endeavour to ensure that the purchaser receives full benefit on any warranty given by the original equipment manufacturer.

This warranty is restricted to the original purchaser except where the original purchaser is a reseller authorised by the Seller who has purchased for the purpose of resale, warranty shall be extended to the reseller's customer.

Contact Details

Our customer / dealer technical support department can be contacted via land mail, email, telephone or via support ticket on the technical support web page.

https://www.barrettcommunications.com.au/support/

Barrett Communications Pty Ltd Head Office:

PO Box 1214, Bibra Lake WA 6965 AUSTRALIA

Toll Free Tel: 1800 999 580 (Within Australia)
Tel: +618 9434 1700
Fax: +618 9418 6757
email: support@barrettcommunications.com.au

Telephone support from the Australian office is available from 7:30 am to 4:00 pm local time Monday to Friday.

Barrett Communications – Europe:

Unit 9, Fulcrum 2 Victory Park, Solent Way,
Whiteley Hampshire PO15 7FN United Kingdom

Tel: +44 (0) 1489 880 332
Fax: +44 (0) 1489 565 422
email: support@barrettcommunications.co.uk

Telephone support from the UK office is available from 8:30 am to 5:00 pm local time Monday to Friday.

Barrett Communications Corporation USA:

190 Office Parkway
Pittsford, N.Y. 14534

Tel: +1 585 582 6134
email: support@barrettusa.com

Telephone support from the USA support office is available from 8:30 am to 5:00 pm local time Monday to Friday.

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AUSTRALIA

(Head office and Manufacturing)
Barrett Communications Pty Ltd
47 Discovery Drive, Bibra Lake, WA 6163 Australia
Tel: +61 8 9434 1700
Email: info@barrettcomms.com

UK

(European office)
Barrett Communications - Europe
Unit 9, Fulcrum 2, Solent Way, Whiteley, Hampshire, PO15 7FN United Kingdom
Tel: +44 (0) 1489 880 332
Email: uksales@barrettcommunications.co.uk

USA

(US office and Manufacturing)
Barrett Communications USA Corp.
190 Office Parkway, Pittsford, NY 14534 United States of America
Tel: +1 585 582 6134
Email: sales@barrettusa.com