HPT135*

VHF Modem

Operator's Manual

Version 1.1
Last Revised October 13, 2010

* Other names for marketing purposes are AW135, HPT135BT, AW135BT

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PREFACE

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Note: Please read these Terms and Conditions carefully.

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governed by, and construed in accordance with, the laws of the State of California, without reference to conflict of laws.

Regulatory Information

The following sections provide information on this product's compliance with government regulations.

FCC Class A Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

> **Note:** Any changes or modifications to the equipment not expressly approved by the party responsible for compliance could void your authority to operate such equipment.

Canadian Emissions Labeling Requirements

This Class A digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe A respecte toutes les exigences du Réglement sur le matériel brouilleur du Canada.

WEEE Directive

The following information is for EU-member states only: The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly, you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more

detailed information about the take-back and recycling of this product, please contact your supplier where you purchased the product or consult.

Manual Conventions

This manual uses the following conventions:

Example	Description
File ▶ Exit	Click the *File* menu and click *Exit*
Link Space	This format represents titles of dialog windows/boxes, names of menu options, identifies program interface objects, such as checkboxes, edit boxes, radio buttons, etc.
`Temp`	This format is used to enter various string information (e.g., file and directory names) as well as operator commands.

Screen Captures

This manual includes sample screen captures. Your actual screen can look slightly different from the sample screen due to the modem you have connected, operating system used and settings you have specified. This is normal and not a cause for concern.

Technical Assistance

If you have a problem and cannot find the information you need in the product documentation, contact your local dealer. Alternatively, request technical support using the JAVAD GNSS World Wide Web site at: www.javad.com.

INTRODUCTION

External extra rugged digital high power VHF radio transceiver programmable in frequency ranges from 138 to 174 MHz. It has GMSK, DBPSK, DQPSK, 4FSK, D8PSK, and D16QAM modulations with advanced forward error correction and data scrambling. The output power is programmable from 320 mW to 35 W.

Figure 1-1. HPT135

It takes incoming data, modulates it with GMSK, FSK, PSK or most spectrum efficient QAM modulation and transmits it at RF power output levels from 25 dBm up to 45 dBm operating in VHF frequency band 138 to 174 MHz.

The VHF transceiver is also capable of receiving RF signals through a 50 Ohm impedance external antenna port. These signals are demodulated and output to the JAVAD GNSS receiver.

HPT135 delivers a reliable radio link at up to 38.4 kbps over the air for the 25 kHz channel spacing, 19.2 kbps for 12.5 kHz, and 9.6 kbps for 6.25 kHz.

The unmatched features of HPT135 include data scrambling, frequency hopping, user selectable transmit output power level, low power consumption sleep modes, autoscanning for base.

The unit's user settings can be changed through the built-in Command Line interface (CLI), Tracy Software or through ModemVU.

1.1. Getting Acquainted

The HPT135 is a rugged and very powerful external radio transceiver 152 mm wide 84 mm deep 72 mm high, weighs 900 g.

1.1.1. LEDs

External LED's (see Figure 1-2) are used for Link and Line status indication:

Position	LED Name	Color	Description
1	PWR	Green	Active if Power connected to modem
2	SYNC	Red	Active whenever a signal with a level exceeding the level required for reception exists on the radio channel (min. light on 200ms).
3	TX/RX	Green	Active if modem receives or transmits Data over serial interface (min. light on 200ms)
4	ALARM	Red	Reserved

1.1.2. Data and Power Ports

The HPT135 data and power port are placed on the front of the unit (Figure 1-2).

Figure 1-2. HPT135 front side

Through the data port the HPT135 can be connected to PC with Data-Ser Cable, DB9/DB15 (6ft/1.8m), or with JAVAD GNSS receiver with Data-Ser Cable, ODU-7/DB15 (6ft/1.8m).

Through the power port the HPT135 can be powered. See "Powering HPT 135" on page 114 for detailed information.

1.1.3. External Antenna Connector

The external antenna connects to the BNC external antenna connector (Figure 1-3).

Antenna Connector

Figure 1-3. HPT135 back side

1.1.4. Mounting Bracket

The mounting bracket (Figure 1-3) connects the modem to a standard pole/adapter (Figure 1-4).

Mounting Bracket

Figure 1-4. Mounting Bracket

1.1.5. Cables

The HPT135 package includes standard communication and power cables for configuring the modem and providing a power source to the modem.

Data-Ser Cable, ODU-7/DB15 (6ft/1.8m) p/n 14-578108-01	
Data-Ser Cable, DB9/DB15 (6ft/1.8m) p/n 14-578110-01	
Power Cable, PL-700/Battery Clips (8.2 ft./2.5m) p/n 14-578111-01	

1.1.6. Literature

HPT135 literature, including manuals and other product information are available on the JAVAD GNSS website (http://www.javad.com):

- *HPT135 Operator's Manual*
- Functional specifications

1.1.7. External Antenna (not included)

Antenna type depends on the site requirements, and may be directional or omni-directional.

1.1.8. Storage Precautions

1. Always clean the instrument after use. Wipe off dust with a cleaning brush, then wipe off dirt with a soft cloth.
2. Store in a location with a temperature of -40° - +85°C, and no exposure to direct sunlight.
3. Use a clean cloth, moistened with a neutral detergent or water, to clean the modem. Never use an abrasive cleaner, ether, thinner benzene, or other solvents.

Always make sure the instrument is completely dry before storing. Dry the modem with a soft, clean cloth.

CONFIGURATION

2.1. Powering HPT 135

To Power the HPT135, you can use the Battery kit 2 (p/n 99-587100-10).

Figure 2-1. Powering HPT435

2.1.1. Power supply requirements

A single external power supply is necessary to operate HPT135. The external power supply needs to be Listed for US and Certified for EU countries, it needs also to be a Limited Power Source and rated for Outdoor Use and have an output rated for +12V, 10A. This may not be the same range as other JAVAD GNSS products with which you are familiar.

CAUTION: *To avoid the introduction of hazards when operating and installing, before connecting of the equipment to the supply, make sure that the supply meets local and national safety ordinances and matches the equipment's voltage and current requirements.*

CAUTION: *Never attempt any maintenance or cleaning of the supply while plugged in. Always remove supply from AC power before attempting service or cleaning.*

Warning: *If the voltage supplied is below the minimum specification, the modem will suspend operation. If the voltage supplied is above the maximum specification, the modem may be permanently damaged, voiding your warranty.*

Make sure cords are located so that will not be stepped on, tripped over, or otherwise subjected to damage or stress. Do not operate equipment with a damaged cord or plug – replace immediately. To reduce the risk of damage to the equipment, pull by the plug body rather than the output cord when disconnecting the equipment.

Do not operate the supply if it has received a sharp blow, been dropped, or otherwise damaged. Do not disassemble the supply.

Warning: *Before connecting the external power source and the modem, make sure that the power source matches the modem's voltage and current requirements.*

2.2. Configuring HPT135

ModemVU is JAVAD GNSS's configuration utility for external modems and modems embedded in JAVAD GNSS modems. ModemVU provides the following functions:

- Connecting a computer to an VHF modem via a serial port.
- Displaying information about the radio modem installed in the modem.
- Programming the radio modem's settings.
- Loading the new modem firmware.

See the *ModemVU Software Manual* available on the JAVAD GNSS website for details on configuring the VHF modem. To configure the HPT135 modem, have the following ready:

- Computer running Windows®;
- ModemVU Software installed on the computer;
- A serial cable.

2.3. Installing ModemVU

ModemVU^{TM} is a Windows® application is a configuration program for the radio modem. ModemVU is available from the JAVAD GNSS website.

Note: Refer to the *ModemVU Software Manual* for full details on installing and using ModemVU Software.

1. If downloading the program from the website, extract the program files into a folder on your hard drive.
2. Navigate to the location of the ModemVU program and double-click the Setup.exe icon.
3. Follow the on-screen installation instructions. Click *Next* to continue, *Back* to get back to previous step, or *Cancel* to quit the installation.
4. Keep the default installation location or select a new location.
5. Click *Finish* to complete the installation.
6. If desired, create a shortcut on the computer's desktop for quick access to ModemVU.

To uninstall ModemVU use the *Start* menu on your computer:

1. Navigate to the location of the ModemVU program and double-click the Setup.exe

2.4. Connecting HPT135 and Computer

Figure 2-2. Data-Ser Cable, DB9/DB15

Once you have established a connection between the modem and the computer, you will be able to:

- Configure the modem and its components
- Send commands to the modem
- Use ModemVU to load new firmware to the modem

2.5. Configuring HPT135

1. Connect the computer and HPT 135, as described in "Connecting HPT135 and Computer" on page 18. Turn on the HPT 135.
2. Start ModemVU.
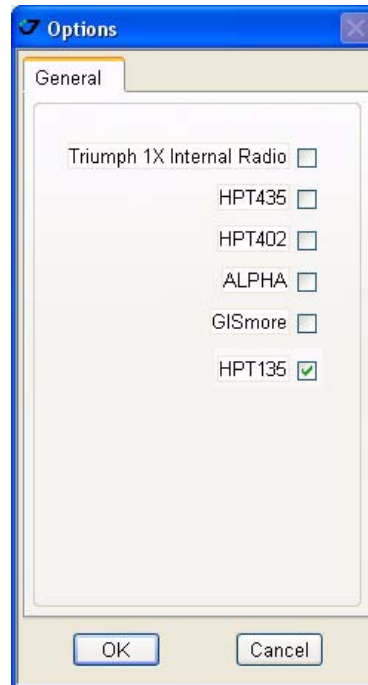3. Select the HPT135 (Figure 2-3), and click *OK*:

Figure 2-3. Options window

4. Select the COM port the HPT135 modem is connected to (Figure 2-4). Click *Connect*.

Figure 2-4. Connect to ModemVU

5. On the *Radio Link* tab, set the following parameters (Table 2-1) and click *Apply* (Figure 2-5 on page 21).

Table 2-1. Modem Parameters for the Radio Link Tab

Parameter	Base Modem	Repeater	Rover Modem
Protocol	Simplex Transmitter or Simplex Transmitter to Repeater	Simplex Repeater	Simplex Receiver
	For Base, Repeater, and Rover modems the protocol type must be the same.		
Mode receiver/ Echo to serial port	-	ON- enables echoing to serial port; OFF - disables echoing to serial port	Auto - allows receiving data from base and repeater in auto mode[1]. Only from Repeater - allows receive data only from repeater[2]. Only from transmitter to Repeater - allows receive data from base transmitter[3].
Frequency	Set the frequency in band 138-174 MHz with 6.25 kHz channel spacing. For both Base and Rover modems the frequency must be the same.		
Output power	Select the transmission power for the radio modem.		n/a
Modulation type	Specifies a modulation scheme that will be used by your modem. DQPSK is recommended. For both Base and Rover modems the modulation type must be the same.		
Link Rate	The link rate is selected automatically		
Link Space	For both Base and Rover modems the link space must be the same.		
Forward Error Correction	Enable		Enable
Scrambling	Enable		Enable

1. In Auto mode rover receives the data from both base transmitter and repeater. The sophisticated algorithm of data receiving allows the modem to eliminate any data doubling.
2. In this mode the incoming data from base transmitter will be ignored.
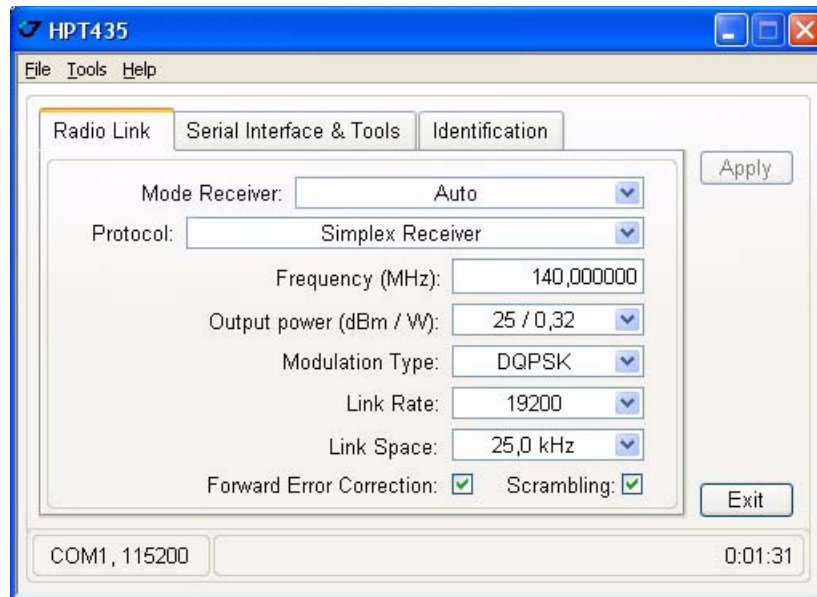3. In this mode the incoming data from repeater will be ignored.

Figure 2-5. Radio Link tab

6. When finished, click *File* ▸ *Disconnect*.

2.6. Checking Firmware Version

Use ModemVU to check the firmware version of your HPT135.

1. Connect your modem and computer. See "Connecting HPT135 and Computer" on page 18 for this procedure.
2. Start ModemVU. Select the HPT135 and than the COM port and click Ok (see "Configuring HPT135" on page 19).
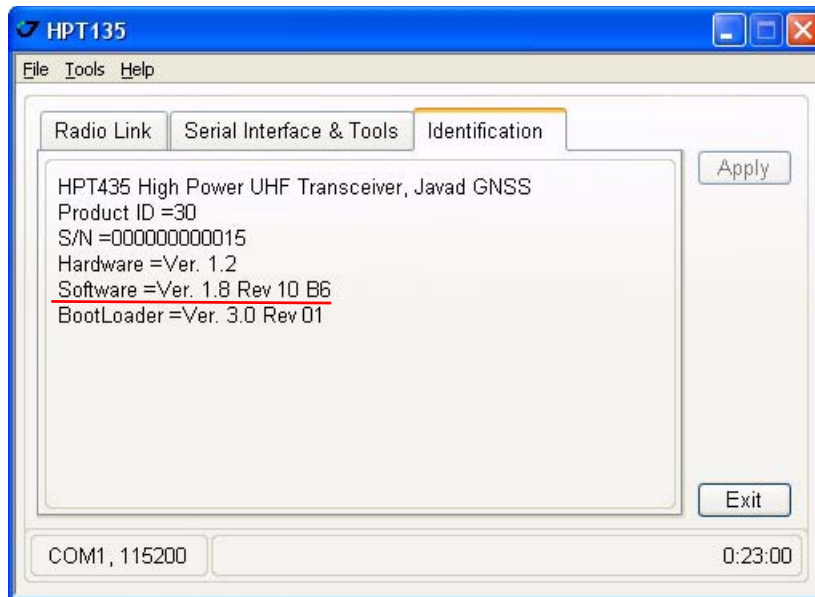
3. Click on *Identification* tab (Figure 2-6).

Figure 2-6. Identification tab

This tab lists important information about the hardware accessories and software properties.

4. Click *File ▶ Disconnect*, then *File ▶ Exit* to quit ModemVU.

2.7. Loading New Firmware

The modem uses ModemVU to load firmware onto the modem. For more information, refer to the *ModemVU Software Manual*, available on the JAVAD GNSS website.

1. Download the new firmware package to your computer.
2. Connect your modem and computer, as described in "Connecting HPT135 and Computer" on page 18.
3. Start ModemVU. Select the HPT135 and than the COM port and click Ok (see "Configuring HPT135" on page 19).
4. Click the *Serial Interface &Tools tab;*
5. Click *Download Firmware button* (Figure 2-7).
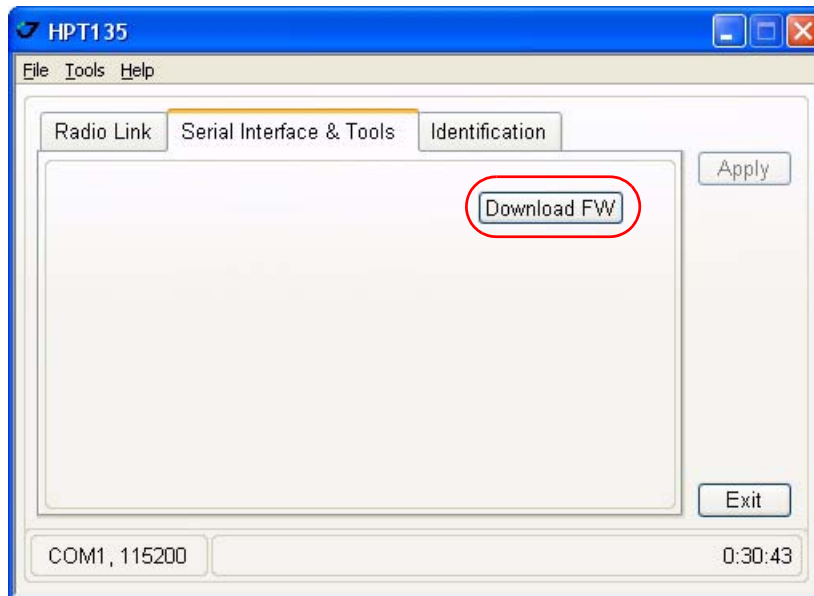
Figure 2-7. Serial Interface & Tools tab

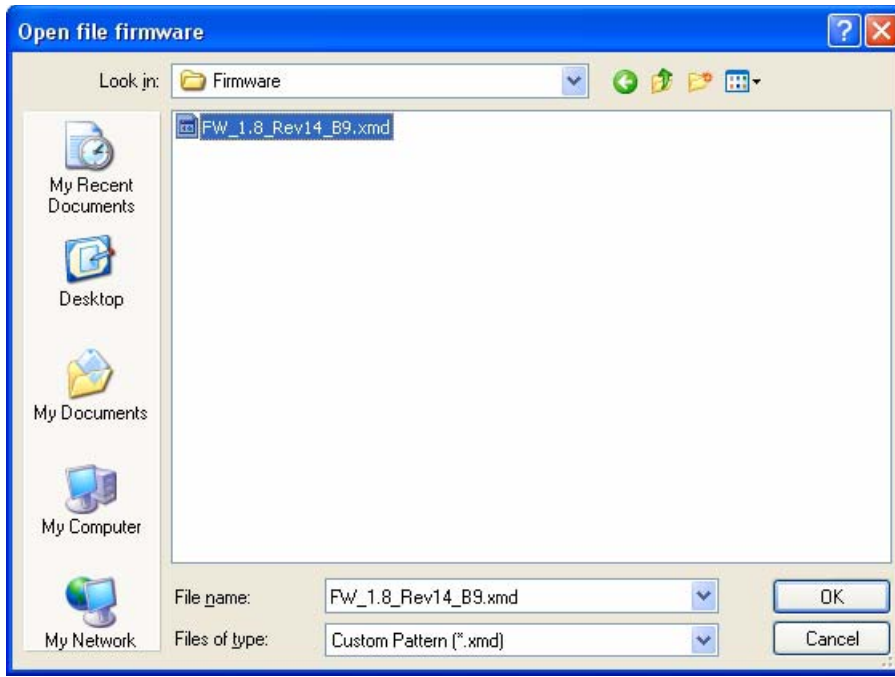6. Open the required firmware folder. Select the *.xmd* file and click OK (Figure 2-8):

Figure 2-8. Load New Firmware

7. Wait until the new firmware version process will be complete.
8. Click *File ▸ Disconnect*, then *File ▸ Exit* to quit ModemVU.

SPECIFICATIONS

A.1. HPT135 VHF Modem Specifications

The following sections provide specifications for the modem and its internal components.

A.1.1. General Radio Specifications

Table below lists the modem's general specifications.

Table A-1. General Radio Specifications

Parameter	Specification
Operating Frequency Range	138 - 174 MHz
Channel Spacing	25/12.5/6.25 kHz (USA) 30/15/7.5 kHz (Canada) 25/20/12.5 kHz (EU)
Data Rate (25kHz Channel Spacing)	9600 bps – DBPSK/GMSK 19200 bps – DQPSK/4FSK 28800 bps – D8PSK 38400 bps – D16QAM
Data Rate (12.5kHz Channel Spacing)	4800 bps – DBPSK/GMSK 9600 bps – DQPSK/4FSK 14400 bps – D8PSK 19200 bps – D16QAM
Data Rate (6.25 kHz Channel Spacing)	2400 bps – DBPSK 4800 bps – DQPSK 7200 bps – D8PSK 9600 bps – D16QAM
System Gain for DBPSK modulation (Antenna gain is not included)	161 dB (for 25 kHz Channel Spacing) 163 dB (for 12.5 kHz Channel Spacing) 164 dB (for 6.25 kHz Channel Spacing)
Roaming Speed for DBPSK modulation	75 mph / 120 km/h
Modulation	GMSK/4FSK/DBPSK/DQPSK/D8PSK/D16QAM
Nominal Impedance	50 Ohms
End to End delay	60 ms

Communication Mode	Time Division Duplex (TDD) Time Division Multiple Access (TDMA)
Maximum Distance Range	48 miles / 77 km
Serial port	Serial (RS-232) up to 115200 bps. Serial port configurable as RS-232 and RS-422, or RS-485
USB	USB 2.0 device port (12 Mbps)

A.1.2. Environmental Specifications

Table A-2 lists the modem's environmental specifications.

Table A-2. Environmental Specifications

Parameter	Specification

Temperature	Operating -30°C to $+50^{o}$C (USA)
	                      -20°C to $+55^{o}$C (EU)
	                      -40°C to $+60^{o}$C absolute rating
	Storage -40°C to $+85^{o}$C

Environmental	IP 66
Dimensions (H x W x D)	152 mm x 84 mm x72 mm
Weight	900 g
Power Supply Voltage	+12VDC nominal
Power Consumption (Average)	120W/38W/300mW – Continuous Transmit/ Transmit with 30% duty cycle/Sleep
Housing/Color	Aluminum / Two-tone JAVAD GNSS Green / Gray
Antenna Connector	BNC, 50WΩ

A.1.3. Transmitter Specifications

Table A-3 lists the transmitter specifications.

Table A-3. Transmitter Specifications

Parameter	Specification
Output Power USA EU	25 dBm to 45.44 dB m in 1 dB steps (320 mW to 35W) 25 dBm to 41.76 dBm in 1 dB steps (320 mW to 15W)
Output Power Control Accuracy	±1.5 dB (at normal test conditions)
Carrier Frequency Stability	±1.5 ppm initial stability over temp with ±3.0 ppm aging/year
Max. Frequency Error	±1.0 kHz (at normal test conditions) ±1.5 kHz (under extreme test conditions)
Adjacent Channel Power (Conducted) 25/12.5/6.25 kHz CS USA, Canada EU	Part §90.210 (C, D, E) Clause 4.2.4 EN 300 113-2 (60 dBc)
Spurious Emission (Conducted)	-36 dBm (9 kHz – 1GHz) -30 dBm (1GHz – 4 GHz)
Spurious Emission (Radiated)	-36 dBm (9 kHz to 1 GHz) -30 dBm (1 GHz to 4 GHz)

A.1.4. Receiver Specifications

Table A-4 lists the receiver specifications.

Table A-4. Receiver Specifications

Parameter	Specification
Noise Figure	4 dB
Receiver Sensitivity DBPSK BER 1x10-4, 25 kHz CS DQPSK D8PSK D16QAM GMSK	-116 dBm 25kHz / -117 dBm 12.5kHz -115 dBm 25kHz / -116 dBm 12.5kHz -110 dBm 25kHz / -111 dBm 12.5kHz -106 dBm 25kHz / -107 dBm 12.5kHz -113 dBm 25kHz / -114 dBm 12.5kHz
Dynamic Range	-115 to –15 dBm
Max. Input Signal Level	-10 dBm
Co-channel Rejection	-8 dB for 25 kHz Channel Spacing -12 dB for 12.5 kHz Channel Spacing -16 dB for 6.25 kHz Channel Spacing
Adjacent Channel Selectivity	70 dB for 25 kHz Channel Spacing 60 dB for 12.5 kHz Channel Spacing 50 dB for 6.25 kHz Channel Spacing

A.2. Connector Specifications

Power Connector

Table A-5 gives specifications to power connector type 23-500153-01 CONN, HIGH CURRENT PL-700 RECEPT ALDEN 300906.
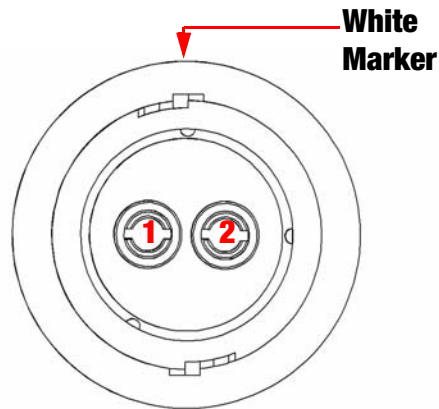

Table A-5. Power Connector Specifications

Number	Signal Name	Dir	Details
1	Power_INP	P	12 volts DC input
2	Power_GND	-	Ground, power return

DB15 Connector

This connector provides DB15 connectivity for the HPT135 with DTE.

About using and configuration RS-485 please contact JAVAD GNSS Customer Support support@javad.com.
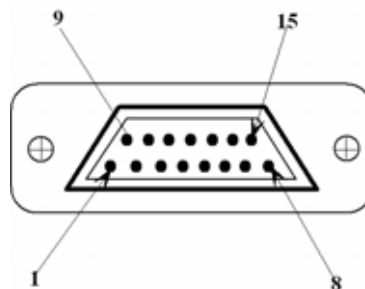

Figure A-1. DB15 Connector

Table A-6. DB15 Connector Specifications

Number	Signal Name	Dir	Details
1	DCD_OUT	O	Data Carrier Detect (RS-232)
2	DTR_OUT	O	Data Terminal Ready (RS-232)
3	RX+/CTS_IN	I	Receive Data positive line (RS-422)/ Clear to Send (RS-232)
4	RX-/RX_IN	I	Receive Data negative line (RS-422)/ Receive Data (RS-232)
5	Not used	-	Do not use
6	USB_PWR	I	Power Input line (USB)
7	Ground	-	Power Ground
8	Not used	-	Do not use
9	DSR_IN	I	Data Set Ready (RS-232)
10	TX+/RTS_OUT	O	Transmit Data positive line (RS-422) / Request to Send (RS-232)
11	TX-/TX_OUT	O	Transmit Data negative line (RS-422) / Transmit Data (RS-232)
12	Ground	-	Power Ground
13	USB_D+	I/O	Positive line (USB)
14	USB_D-	I/O	Negative line (USB)
15	Ground	-	Power Ground

External Antenna RF Connector

The external antenna connector type is a BNC RF connector AEP Connectors p/n 6501-7051-003.

VHF RADIO USAGE

Many countries require a license for radio users (such as the United States). Be sure you comply with all local laws while operating a VHF radio.

Surveying in RTK mode has made VHF the most popular choice for communications between base and rover receivers. Know the strengths and weaknesses of this technology to get the best use out of your receiver.

The quality and strength of the VHF signals translates into range for VHF communications.

The system's range will greatly depend on the local conditions. Topography, local communications and even meteorological conditions play a major role in the possible range of RTK communications.

If needed, use a scanner to find clear channels for communication.

SAFETY WARNINGS

Read these instructions.

- Keep these instructions.
- Heed all warnings.
- Follow all instructions.
- Clean only with a damp cloth.
- Do not block any of the ventilation openings. Install in accordance with the manufacturer's instructions.
- Do not install near any heat sources such as radiators, heat registers, stoves, or other apparatus (including amplifiers) that produce heat.
- Protect the power cord from being walked on or pinched particularly at plugs, convenience receptacles, and the point where they exit from the apparatus.
- Only use attachments/accessories specified by the manufacturer.
- Refer all servicing to qualified service personnel. Servicing is required when the apparatus has been damaged in any way, such as power-supply cord or plug is damaged, liquid has been spilled or objects have fallen into the apparatus, or has been dropped.
- Apparatus shall not be exposed to dripping or splashing and no objects filled with liquids, shall be placed on the apparatus.

C.1. General Warnings

HPT135 is a wireless device used in a mobile application, at least 120 cm from any body part of the user or nearby persons.

Note: Minimum separation distance of 120 cm between the antenna and persons must be maintained.

This product should never be used:

- Without the user thoroughly understanding operator's manual.
- After disabling safety systems or altering the product.
- With unauthorized accessories.
- Contrary to applicable laws, rules, and regulations.

DANGER: THE HPT135 SHOULD NEVER BE USED IN DANGEROUS ENVIRONMENTS.

WARRANTY TERMS

JAVAD GNSS electronic equipment are guaranteed against defective material and workmanship under normal use and application consistent with this Manual. The equipment is guaranteed for the period indicated, on the warranty card accompanying the product, starting from the date that the product is sold to the original purchaser by JAVAD GNSS' Authorized Dealers[1].

During the warranty period, JAVAD GNSS will, at its option, repair or replace this product at no additional charge. Repair parts and replacement products will be furnished on an exchange basis and will be either reconditioned or new. This limited warranty does not include service to repair damage to the product resulting from an accident, disaster, misuses, abuse or modification of the product.

Warranty service may be obtained from an authorized JAVAD GNSS warranty service dealer. If this product is delivered by mail, purchaser agrees to insure the product or assume the risk of loss or damage in transit, to prepay shipping charges to the warranty service location and to use the original shipping container or equivalent. A letter should accompany the package furnishing a description of the problem and/or defect.

The purchaser's sole remedy shall be replacement as provided above. In no event shall JAVAD GNSS be liable for any damages or other claim including any claim for lost profits, lost savings or other incidental or consequential damages arising out of the use of, or inability to use, the product.

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1.   The warranty against defects in JAVAD GNSS battery, charger, or cable is 90 days.

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