HPT435BT

UHF Modem

User manual

Version 2.2

Last Revised April 17, 2017

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Preface

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Note: Please read these Terms and Conditions carefully.

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SAFETY – Improper use of HPT435BT can lead to injury to persons or property and/or malfunction of the product. The HPT435BT modem should only be repaired by authorized JAVAD GNSS warranty service centers. Users should review and heed the safety warnings in Appendix C.

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Regulatory Information

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.

CAUTION: 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.

Industry Canada

The term "IC:" before the equipment certification number only signifies that the Industry Canada technical specifications were met.

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:

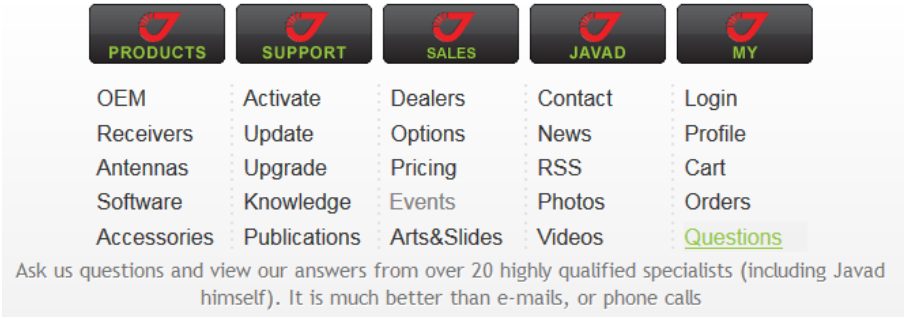
Example	Description
File ▸ *Exit*	Click the *File* menu and click *Exit*
Link Space	This format represents titles of dialog windows/boxes, names of menu options, identifies program interface objects, such as checkboxes, edit boxes, radio buttons, etc.
`Temp`	This format is used to enter various string 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 UHF radio transceiver programmable in frequency ranges from 406 to 470 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. HPT435BT

The HPT435BT radio transceiver provides a high-speed Point-to-Point and Point-to-Multipoint wireless data transfer at up to 38.4 kbps. HPT435BT supports user selectable modulation techniques (GMSK, 4FSK, DBPSK, DQPSK, D8PSK, or D16QAM), which allows the user to achieve the highest data speed for a given range (up to 48 miles / 77 km). It also includes a selectable error correction, which improves the functioning of the radio modem under interference.

The sophisticated features of HPT435BT include data scrambling, frequency hopping, user selectable transmit output power level, low power consumption sleep modes, autoscanning and plug-and-play installation for remote terminals.

The built-in software tools provide the wireless link testing, unit's status and error statistics monitoring as well as unit's settings change over the air. The firmware of the HPT435BT radio transceiver resides in a flash memory. The updating of the radio modem programs is entirely software-based. The flash memory is re-programmable through an RS232 interface, USB, Bluetooth, or over the air. The unit's user settings can be changed through the built-in Command Line interface (CLI), FieldCAD, Tracy Software or through ModemVU.

Getting Acquainted

The HPT435BT is a rugged and very powerful external radio transceiver 152 mm wide 84 mm deep 72 mm high, weighs 900 g.

LEDs

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

Position	LED Name	Color	Description
1	PWR	Green	Active if Power connected to modem
2	RX	Green	Active if modem receives Data
3	TX	Green	Active if modem transmits Data
4	BT	Blue	Off - means Bluetooth module is off; Solid blue - means Bluetooth module is on; Blinks if modem receives or transmits Data over Bluetooth

Data and Power Ports

The HPT435BT data and power port are placed on the front of the unit.

Figure 2. HPT435BT front side

Through the data port the HPT435BT modem can be connected to RS-232 serial port with Data-Ser Cable, DB9/DB15 (6ft/1.8m), or this port can be configured as RS422/485 and connected to the RS-422 or RS-485 ports. With Data-Ser Cable, ODU-7/DB15 (6ft/1.8m) the modem can be connected to the JAVAD GNSS receiver.

Through the power port the HPT435BT modem can be powered. See "Powering HPT435BT" on page 17 for detailed information.

External Antenna Connector and Bluetooth Antenna

The external antenna connects to the TNC external antenna connector on the back panel of HPT435BT.

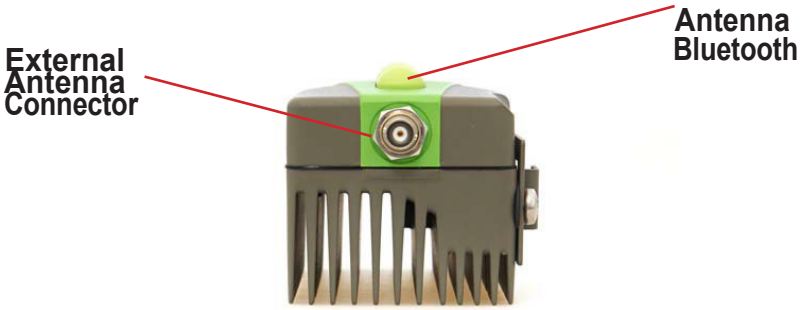


Figure 3. External antenna connector and Bluetooth Antenna

Mounting Brackets

The mounting bracket (p/n 10-587102-01) connects the modem to a standard pole/adapter.

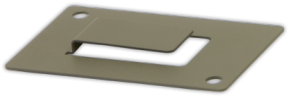


Figure 4. Mounting Bracket

There is special bracket (p/n 99-587303-10) to connect a JAVAD GNSS radio to the geodetic pole.

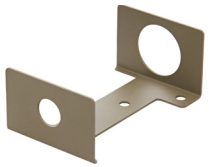


Figure 5. Bracket for radio

Note: How to use it see http://www.javad.com/downloads/javadgnss/how-to/hardware/Mounting_Bracket_for_Radio.pdf

Cables

The HPT435BT package includes standard communication and power cables for configuring the modem and providing a power source to the modem.

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

External Antenna

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

Warning: Do not use HPT435BT without antenna our attenuator to avoid serious damage of your device.

Configuration

Powering HPT435BT

To power HPT435BT use the Battery kit 2 (p/n 99-587100-10).

Figure 6. Battery Kit 2

Warning: Powering HPT435BT please observe polarity!

Power supply requirements

A single external power supply is necessary to operate HPT435BT. 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 +9 ... +16V, 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 equip- ment 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.

Warning: 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.

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

Antenna Installation

Warning: To avoid the equipment serious damage, do not switch the modem to transmit mode if RF antenna is not connected!

Select the type of antenna that best fits your application and the one that offers the highest dB gain. In addition, setup your system in the highest possible location to minimize obstacles between the transmitting and receiving systems. Always place the antenna on the highest point available. At a minimum, set the antenna to at least ten feet above the terrain using an antenna mast.

Some antennas intended to be attached to the pole mount adapter (p/n 14-578117-01) are designed to be operated with a ground plane and some without it. Antennas operating without ground plane marked in our catalogue as NGP, e.g. UHF NGP Antenna 1/2, 2.4 dB gain, NMO:

- UHF NGP Antenna 406-430 MHz, 1/2, 2.4 dBd gain, NMO
- UHF NGP Antenna 430-450 MHz, 1/2, 2.4 dBd gain, NMO
- UHF NGP Antenna 450-470 MHz, 1/2, 2.4 dBd gain, NMO

Theses antennas are NO GROUND PLANE antennas with gain 2.4 dB and NMO specified connector type with should match with your antenna adapter (pole mount or magnet mount). Antennas designed to be operated with ground plane

- UHF Antenna 406-430 MHz, 5/8, 5 dBd gain, NMO
- UHF Antenna 430-450 MHz, 5/8, 5 dBd gain, NMO
- UHF Antenna 450-455 MHz, 5/8, 5 dBd gain, NMO

- UHF Antenna 455-460 MHz, 5/8, 5 dBd gain, NMO
- UHF Antenna 460-465 MHz, 5/8, 5 dBd gain, NMO
- UHF Antenna 465-470 MHz, 5/8, 5 dBd gain, NMO

provide better gain, but to achieve the best performance of your antenna, add a UHF Antenna Ground Plane Disk (p/n 10-587400-01) to the bottom of the antenna for a ground plane. UHF antenna Ground Plane disk improves VSWR and as result increase RF power delivered from transmitter to antenna and system distance range.

To install antenna with ground plane disc (see pictures below):

- Unscrew the cone-shaped cable part;
- Place the ground plane disc between cable parts and screw all parts together;
- Attach cable with ground plane to the UHF antenna;
- Place the antenna on the pole.

Use coaxial cable and connectors that are impedance-matched with the radio equipment, and make sure to use the shortest length of cable to move the signal between the radio and the antenna:

- UHF Ant Cable TNC/Pole Mount, 12ft
- UHF Ant Cable TNC/Magn Mount, 12f [Substract $55]
- UHF Ant Cable TNC/Mini-Magn Mount, 12ft [Substract $55]

Fan for radio

The most efficient way to increase duty cycle of the HPT435BT transceiver is using the Fan kit (p/n 02-587101-31) shown on the picture below:

Figure 7. Fan for radio

Note: How to install the Fan see http://www.javad.com/downloads/javadgnss/how-to/hardware/Fan_For_Radio_install_and_use.pdf

Installing ModemVU

ModemVUTM 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.

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 UHF 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.

To configure the HPT435BT modem, have the following ready:

- Computer running Windows®;
- ModemVU Software installed on the computer;
- A serial cable.
- If downloading the program from the website, extract the program files into a folder on your hard drive.
- Navigate to the location of the ModemVU program and double-click the Setup.exe icon.
- Follow the on-screen installation instructions. Click Next to continue, Back to get back to previous step, or Cancel to quit the installation.
- Keep the default installation location or select a new location.
- Click Finish to complete the installation.
- 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:
- Navigate to the location of the ModemVU program and double-click the Setup.exe icon.
- Follow the on-screen installation instructions.

Connecting HPT435BT and Computer

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.

Connecting through serial port

To configure, or maintain HPT435BT, you need to connect the modem and a computer using RS-232, RS-422/4851 ports with Data-Ser Cable, DB9/DB15 (6ft/1.8m) p/n 14-578110-01 and start ModemVU.

Figure 8. Data-Ser Cable, DB9/DB15

Connecting through USB port

Make sure the computer has special USB driver installed (available from www.javad.com) before continuing. To configure, or maintain HPT435BT using USB port, you need to connect the modem and a computer using special cable (not included in the standard kit) Access Data-Ser Cable, USB/DB15 (1,8m) (p/n 14-578123-01).

Figure 9. Cable p/n 14-578123-01

- Download the zip-archive with USB driver from www.javad.com;
- Extract the archive to the new empty folder;
- Connect the USB port of the computer to the USB port of the modem at the switched off power supply by using of a cable.
- Turn on your computer.
- Power HPT435BT.
- Widows will detect USB driver automatically. Otherwise it will ask to specify driver location. Select the folder with extracted file.

Note: To have additional information how to configure serial port as RS-422 or RS-485, please contact JAVAD GNSS customer support using QUESTIONS System at www.javad.com

Connecting HPT435BT and TRIUMPH-1

Connecting through Bluetooth®

The HPT435BT modem contains Bluetooth® wireless technology that allows synchronization between the modem and any other external device that supports Bluetooth® wireless technology; for example, an IPAQ, or a computer with USB-to-Bluetooth® adapter or PCMCA-to-Bluetooth® adapter installed, etc.

HPT435BT and external device connection procedure varies slightly depending on the type of external device used. In general, the connection procedure is as follows:

Note: Refer to your Bluetooth®-enabled external device documentation for more detailed connection information.

- Turn on a Bluetooth®-enabled external device and your receiver. The default external device mode is Master; the modem's Bluetooth® module mode is Slave.
- Instruct the external device (Master) to search for the modem (Slave).
- Once the Master device detects the modem, use the procedure described in the external device's documentation to connect it with the modem.

Connecting HPT435BT and TRIUMPH-1

Connect the external HPT435BT UHF radio to receiver's port B with cable Accessory Data-Ser cable, ODU-7/D15 (1.8 m) p/n 14-578108-01.

Once you have established a connection between the modem and the TRIUMPH-1, you will be able to:

- Configure the modem and its components through receiver;
- Send commands to the modem trough receiver;
- Use ModemVU to load new firmware to the modem
- Transmit/receive GNSS data.

Configuring HPT435BT

- Connect the computer and HPT435BT, as described in "Connecting HPT435BT and Computer".
- Turn on the modem.
- Start ModemVU.
- Select the HPT435/HPT435BT (Figure 5) in the *Options window*, and click OK:

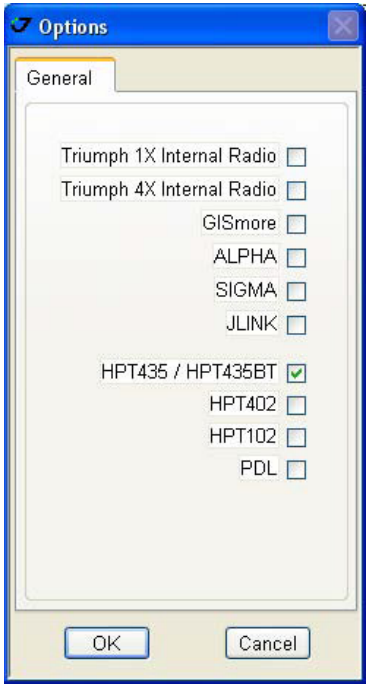


Figure 10. Options window

- Select the COM port the HPT435BT modem is connected to. Click *Connect.*

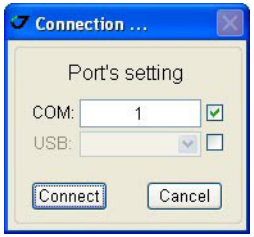


Figure 11. Connect to ModemVU

Simplex Protocol

When the HPT435BT modem is loaded with special firmware which supports Simplex protocol, the ModemVU general window will be like below:

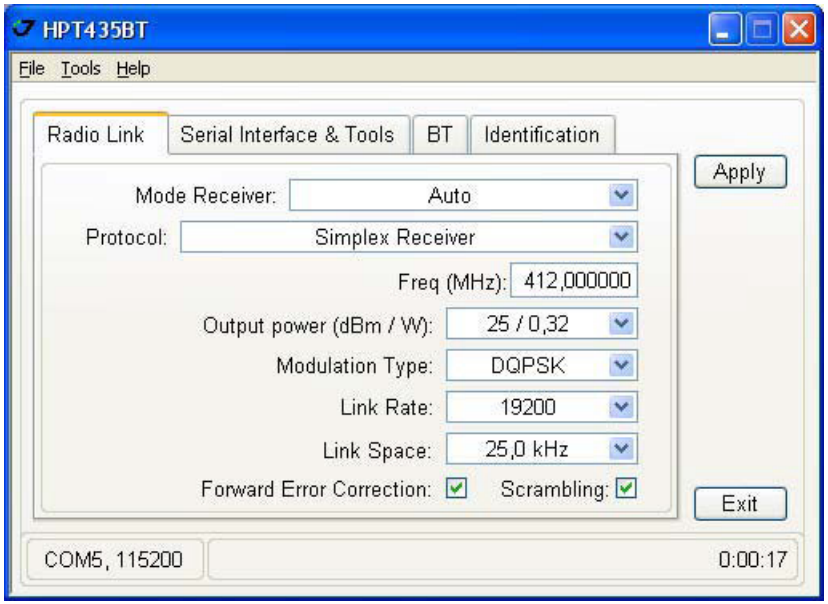


Figure 12. Radio Link tab. Simplex protocol

Note: Simplex protocol is a communications protocol that is purely one-way, and where acknowledgments are not part of any application protocol.

• On the Radio Link tab, set the following parameters (Table 1) and click *Apply*.

Table 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 406-470 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

Parameter	Base Modem	Repeater	Rover Modem
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.

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

Half-Duplex Protocol

When the HPT435BT modem is loaded with special firmware which supports Half-duplex protocol, the ModemVU general window will be like below:

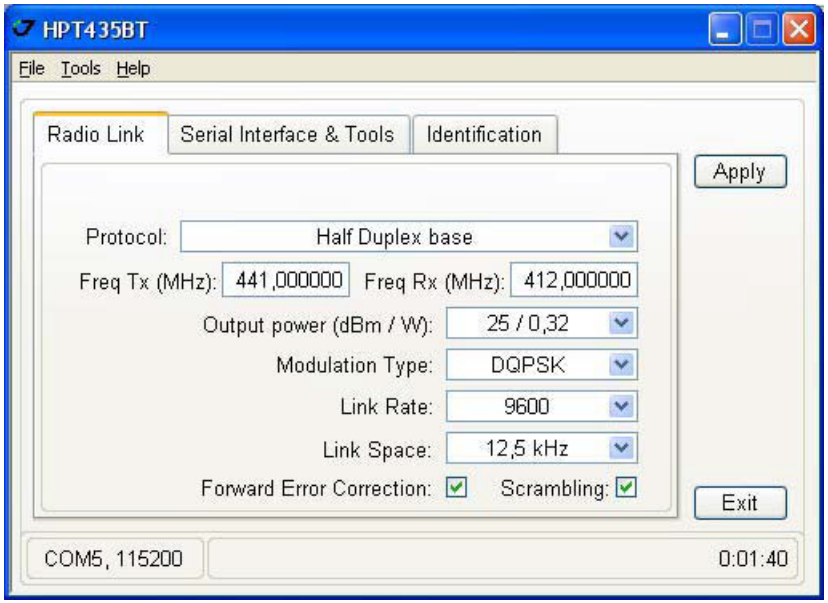


Figure 13. Radio Link tab. Half-duplex protocol

Note: Half-duplex (HDX) operation means such operation in which communication between two terminals occurs in either direction, but in only one direction at a time.

On the *Radio Link* tab, set the following parameters and click *Apply*:

Parameter	Mode
Protocol	Half-duplex Base or Half-duplex Remote For Base, Repeater, and Removed modems the protocol type must be the same.
Frequency	Set the frequency in band 406-470 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.
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 Remote modems the link space must be the same.
Forward Error Correction	Enable
Scrambling	Enable

Checking Firmware Version

Use ModemVU to check the firmware version of your HPT435BT.

- Connect your modem and computer. See "Connecting HPT435BT and Computer" for this procedure.
- Start ModemVU. Select the HPT435BT and than the COM port and click Ok (see "Configuring HPT435BT").
- Click on *Identification* tab.

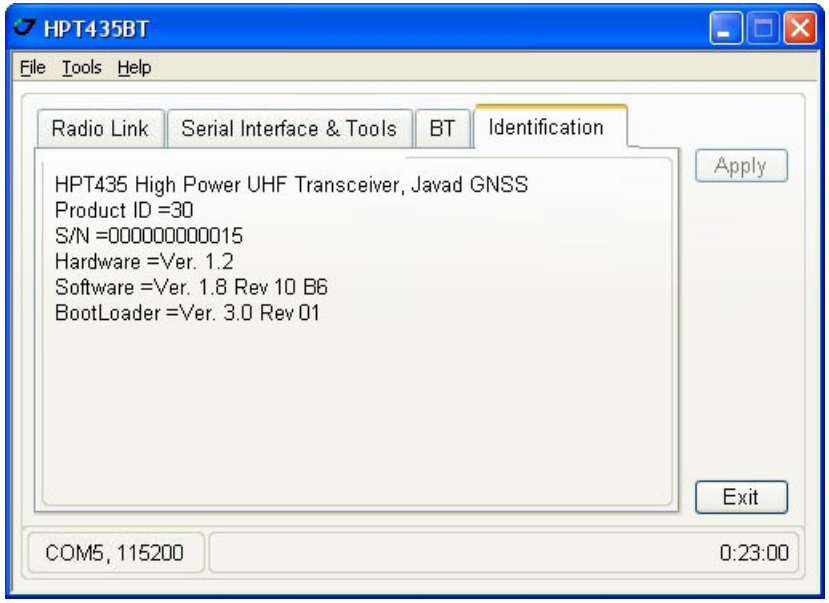


Figure 14. Identification tab

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

Click *File* ▸ *Disconnect,* then *File* ▸ *Exit* to quit ModemVU.

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.

- Download the new firmware package to your computer.
- Connect your modem and computer, as described in “Connecting HPT435BT and Computer”.
- Start ModemVU. Select the HPT435BT and than the COM port and click Ok (see “Configuring HPT435BT”)
- Click *Download Firmware* button.

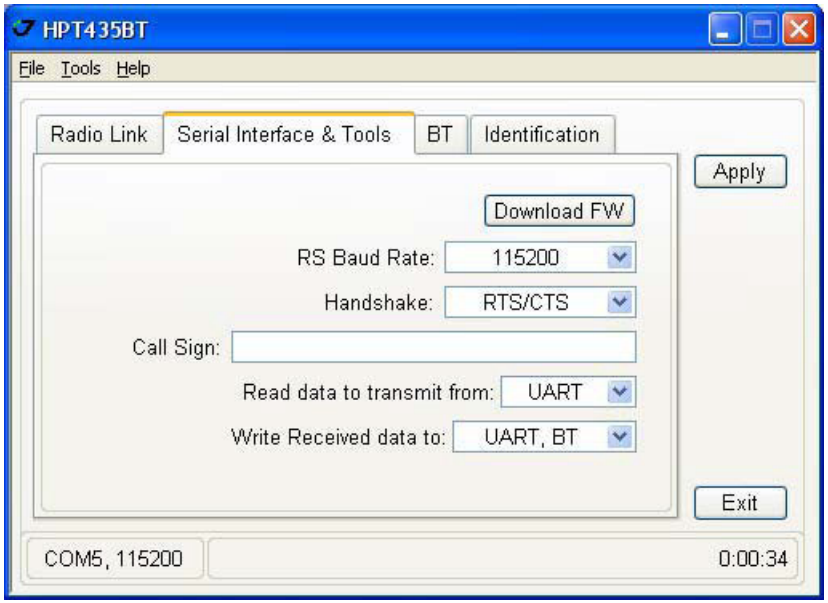


Figure 15. Serial Interface & Tools tab

- Open the required firmware folder. Select the .xmd file and click OK.
- Wait until the new firmware version process will be complete.
- Click *File* ▸ *Disconnect*, then *File* ▸ *Exit* to quit ModemVU.

Bluetooth Configuration[1]

Bluetooth module of HPT435BT can be configured in the BT tab.

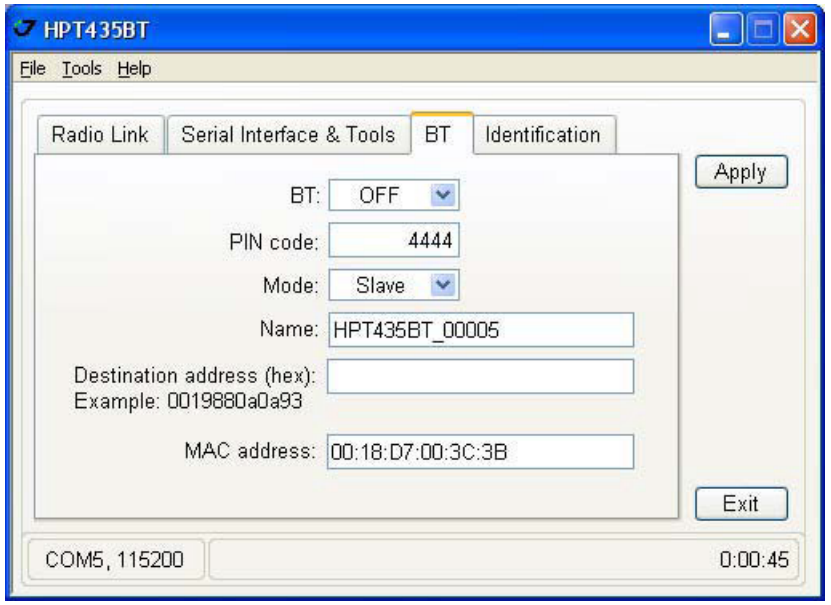


Figure 16. BT tab

Use the BT drop down list to switch on/off the module. The PIN code can be inserted in the PIN code field.

Click *Apply* to save settings and apply configurations.

1. Now is supported for Simplex mode only

Command Line Interface

The built-in user-friendly Command Line Interface (CLI) allows user to perform a full configuration of the unit and read the statistics and alarm status. It is the most powerful tool to configure the unit. It makes changes to all possible settings that system will not be able to determine automatically.

The CLI commands allow user to configure and reconfigure the unit's settings. The user configuration parameters that could be changed through the CLI are:

- Data Port Settings
  - Baud Rate
  - Data Bits (8, 7)
  - Parity (Odd, Even, None)
  - Flow control (None or RTS/CTS)
- Alarm Settings
- Radio Operation Modes
- Sleep modes
  - On/Off
  - Activate by internal real-time clock
  - Activate through RTS/CTS lines
  - Activate by external sense lines
  - Activate by any combination of the parameters mentioned before

Note: The unit's configuration that is set or modified through the CLI will be lost after unit's reboot, unless the saving operation is used to store a new setting in the unit's configuration file.

The CLI commands also provide filing operations, which include:

- Downloading Unit's Configuration files
- Software Images
- Uploading Unit's Configuration files
- Saving into the configuration files the configuration parameters modified through the CLI.

Command Line Interface Convention

The following convention is implemented in HPT435BT Command Line Interface (CLI):

- The Carriage Return/Line Feed (CR/LF, 0x0D/0x0A) is a command delimiter.
- The Carriage Return/Line Feed (CR/LF, 0x0D/0x0A) is a reply delimiter followed by the "CLI>" prompt if Echo option is On.
- The Carriage Return/Line Feed (CR/LF, 0x0D/0x0A) is a reply delimiter if Echo option is Off (default option).
- The 2-digit number followed by "@" in the unit's reply indicates the error code (refer to Table 3 for description), if Echo Off is selected, otherwise the error message is displayed.
- A successfully performed command is replied by @00 code, if Echo Off is selected, otherwise the set value is replied.
- A command with the certain [Parameter Name] and blank [Parameter List] displays the current settings for a given parameter.
- To set the mode ordered by CLI commands as permanent User Setting (the setting automatically selected for the boot-up unit) the SAVE command must be asserted.
- A command followed by "/F" option displays the Parameters in the predefined frame format. The display frame format is unique for each command supporting "/F" option.

Table 1. Command Line Interface Error Codes

Error Code	Short Description
0x01	Command Syntax Error. A command followed by "/?" displays a command usage.
0x02	The parameter has a format error. A command with the certain [Parameter Name] followed by "/?" displays the format and range of the variable.
0x03	The parameter is out of allowed range. A command with the certain [Parameter Name] followed by "/?" displays the format and range of the variable.

0x04	The command is not valid for specific radio model. To display the list of available commands, the HELP command must be used.
0x05	Unspecified Error

Software Switching to Command Mode

On power-up the radio modem is in data-mode. To switch to command mode the special byte-sequences with special meanings are used:

- Escape-Sequence: "+++" with 20 ms guard time before and after the command characters
- Escape-Acknowledge: "@00<CR><LF>"

20 ms toggling on CTS control line needed to acknowledge switching from Data to Command mode and vice versa.

Happy Flow

- In data-mode the unit starts looking for the Escape-sequence if there is no data from DTE (Data Terminal Equipment) for more than 20 ms (Start Guard Time).
- If the unit detects the Escape-Sequence:
- The transmitter continues sending over the air the data received from DTE before Escape- Sequence and buffers the data from DTE;
- The Receiver immediately stops forwarding to DTE the data received over the air and buffers it instead.
- The radio unit waits for 20 ms and then sends Escape-Acknowledge to DTE if there is no data from DTE during 20 ms of Stop Guard Time.
- The unit goes to command mode and discards Escape-Sequence from input buffer. The modem is immediately ready to receive commands. At the same time it continues buffering the data received over the air since step 2.

Escape-Sequence in Data

During its waiting in step 3, the unit receives data from DTE:

- The unit sends buffered Escape-Sequence from DTE to the air;
- The unit sends all buffered data received from the air since step 2 to DTE and stays in data-mode (i.e. transmits data received from DTE over the air – including the just received, unexpected, data and forwards data received over the air to DTE.)

Hardware Switching to Command Mode

As alternative to Software Switching, the switching through the MP/DP (Data Terminal Ready, DTR) control line can be used. To set Command Mode, the DTE must assert DTR signal active and then passive. By falling edge of DTR signal the unit goes to command mode and then sends Escape- Acknowledge to DTE ("@00<CR><LF>").

20 ms toggling on CTS control line needed to acknowledge switching from Data to Command mode and vice versa.

Note: The powered up radio modem by default goes to Data Mode regardless of DTR control line polarity.

Switching to Data Mode

- DTE sends the CLI command "DATAMODE<CR><LF>" to the unit.
- Unit answers with Escape-Acknowledge („@00<CR><LF>") and immediately goes to datamode, so that the DTE can start sending data as soon as the Escape-Acknowledge has been received.
- If no valid CLI commands received from DTE within 1 minute, the unit will automatically switch back to data-mode.

Networking Commands

LINK

The LINK command is responsible for configuring radio's operation mode. It has parameters listed below.

Note: In parentheses is shown firmware version, which supports this parameter. If the firmware version is not specified, it means that this parameter is supported in both versions.

LINK *[Parameter Name] [Parameters List] [/?]*

Parameter Name	Parameter List
PROT	1 - Simplex Transceiver 2 - Simplex Transceiver 7 - Trimtalk 450S transceiver 8 - Trimtalk 450S transceiver 9 - Transparent w/EOT Repeater 10 - Repeater (ArWest Proprietary protocol 11 - Transparent - Trmb Repeater 12 - Transparent w/EOT timeout Transceiver 13 - Transparent w/EOT timeout Transceiver 14 - STL Transceiver 15 - STL Transceiver 19 - Transparent w/EOT character Transceiver 20 - Transparent w/EOT character Transceiver 23 - TT450S(HW) Transceiver 24 - TT450S(HW) Transceiver 25 - Trimmark3 Transceiver 26 - Trimmark3 Transceiver 27 - Trimmark ||/||e Transceiver 28 - Trimmark ||/||e Transceiver
MOD	1- DBPSK 2 - DQPSK, a default settings 3 - D8PSK 4 - D16QAM 5 - GMSK 6 - 4FSK
SPACE	0 - 25 kHz (12.5 kHz for Trimmark3 protocol) = 9600 symbols/s 1 - 12.5 kHz = 4800 symbols/s 2 - 6.25 kHz = 2400 symbols/s 3 - 20 kHz = 7500 symbols/s 4 - 25 kHz = 19200 symbols/s (available for Trimmark3 protocol only)
PWRB / PWRW	(25 - 46) / (320 - 35000) - RF output Power in dBm / mW
FHOP (only for firmware ver. 1.8)	(0 - 32) - Frequency Hoping Pattern number LINK FHOP command can be processed only if the Channel Map (up to 32 channels)
SCRAM	0 - No Scrambling (a default setting) (1 - 255) - Seed for Pseudo-Random Sequence Generator
FEC	0 - Disable Forward Error Correction (FEC), a default setting 1 - Enable Reed-Solomon encoding
RTR	Base Unit 0 - No Retransmission in the wireless cluster 1- There is Repeater Remote Unit Rover Unit 0 - Auto Detect (Base or Repeater) 1 - Receive from Repeater 2 - Receive from Base
CLKCORR	1 - Enable 4FSK clock correction 0 - Disable 4FSK clock correction
SNST	0 - active AGC signal finding algorithm 1 - HIGH sensitivity level, -70...-117 dBm 2 - MIDDLE sensitivity level, -40...-90 dBm 3 - LOW sensitivity level -10...-60 dBm 4 - Keep last successfully received packet state
SYNRT	0 - default value = 4 sec. 1 - do not reset the LNA and ADC gain N - Set Demodulator reset in sec.
CSIGN	sets/gets string type value representing the call sign of transceiver. The length of entered call sign can be less or equal to 10 characters. A-Z letters and 0-9 digits are accepted.
CMPT	sets/gets the compatibility with: 0 - Satel 3AS 1 - Satel Easy 2 - ADL
RXTX	sets/gets the Transceiver mode: 0 - Transceiver 1 - Receive Only 2 - Transmit Only
SNRM	sets/gets the SNRM packet send option: 0 - Off (default) 1 – On

Note: The frequency defined by CHAN parameter is not valid if Frequency Hoping mode is selected. In the Frequency Hoping mode, the Frequency Pattern generator must generate the random numbers smaller than the number of frequencies listed in the unit's

frequency list.

Serial Interfacing Commands

DPORT

The DPORT is an object that responsible for data port interface configurations like Bit Rate, Flow Control, etc.

DPORT *[Parameter Name] [Parameters List] [/?]*

Parameter Name	Parameter List
RATE	0 – Maintenance Port baud rate, a default setting 1 – 1200 baud 2 – 2400 baud 3 – 4800 baud 4 – 9600 baud 5 – 14400 baud 6 – 19200 baud 7 – 38400 baud 8 – 57600 baud 9 – 115200 baud, a default setting
BITS	Set number of bits in one byte (8 or 7) 8 is a default setting
PARITY	0 – None, a default setting 1 – Odd 2 – Even
FLOW	0 – None, a default setting 1 – Not used 2 – HW (RTS/CTS)
RS	0 - RS232, a default setting 1 - RS485 2 - RS422; use save, boot commands to activate modification
DATATX	0 - UART, a default setting 1 - USB 2 - BT
DATARX	0 - UART, a default setting 1 - USB 2 - BT
STOPBIT	0 - 1 stop bit, a default setting 1 - 2 stop bits for non-5-bit word length or 1 1/2 stop bits for 5-bit word length
DTR	0 - Disable DTR line interrupt 1 - Enabled DTR line interrupt
BUF	0 - Buffering is disabled 1 - Buffering is enabled

The response of command without Parameter Name indicates all values:

```
RATE =9
BITS =8
PARITY =NONE
FLOW =HARDWARE
STOPBIT =0
DTR =0
RS =RS232
DATATX =UART
DATARX =UART
BUF =0
```

IMPORT

The MPORT is an object that responsible for maintenance serial port interface configurations such as data rate and number of bits in a byte.

MPORT *[Parameter Name] [Parameters List] [/?]*

Parameter Name	Parameter List
RATE	0 – Auto 1 – 1200 baud 2 – 2400 baud 3 – 4800 baud 4 – 9600 baud 5 – 14400 baud 6 – 19200 baud 7 – 38400 baud 8 – 57600 baud 9 – 115200 baud, a default setting

Note: JAVAD GNSS radio modem's does not support data flow and parity on the maintenance serial port.The radio modem with none-dedicated maintenance serial port must keep CTS line always active in MPORT mode (DP/MP is low).

Special Commands

BOOT

The factory software image and default configuration is set for the new unit. The BOOT command is intended to reboot the unit using specified software image and selected configuration.

BOOT IMAGE BOOT CFG

The BOOT command with no parameters selects the user settings defined by the prior "parameterized" BOOT commands.

HELP

The HELP command types the list of all available commands:

```
HELP- Display this usage
BOOT- Reboot the unit
LINK- Set RF Link Operation Mode
DPORT- Set Data Port Configuration
MPORT- Set Maintenance Port Configuration
ALARM- Alarm Indication and Alarm Control Configuration
SLEEP- Set Sleep Mode Configuration
STATE- Display Status and Statistics
SAVE- Save Current Configuration into Configuration File
INFO- Display Product ID along with Hardware/Software Versions
ATI- Display Product ID along with Hardware/Software Versions
MAP- Operates with Channel Map
DATAMODE- Exit Command Mode
[COMMAND] /?- Display Command Usage
```

SAVE

The SAVE command is intended to store the unit's currently used configuration into the User Configuration file. The configuration stored in the User Configuration file is activated by automatically after unit's reboot.

SLEEP

The SLEEP command determines the sleep mode parameters. The sleeping AW435BT can be activated by real-time CLK, DTR/RTS lines, and command received through TTL inputs. The user can select one, two, or all three conditions.

SLEEP *[Parameter Name] [Parameters List] [/?]*

Parameter Name	Parameter List
CLK	0 – Do not activate by internal real-time clock (1 – 255) – Activate by internal real-time clock after 100 to 25500 msec of sleeping
HW	0 – Do not activate through DTR/RTS lines 1 – Activate through DTR/RTS lines
TTL	0 – Do not activate by external sense lines 1 – Activate by external sense lines
GTS	0 – Disable Sleep mode (default) (1 – 255) – Go to sleep mode if there is no activity in 10 to 2550 msec

Diagnostics and Identification Commands

INFO

The INFO command is used to retrieve the Radio ID along with its Hardware version, the loaded real- time software version/revision and BootLoader's version/revision.

INFO [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	Parameter List
ID	Product ID: 35 - HPT435BT; 43 - AW435BT;
SN	Six bytes Serial Number (SN)
HW	1.0 - hardware version in numeric "Major.Minor" format
SW	Ver. 1.0 Rev. A - displays software's version in numeric "Major.Minor" format and revision in numeric format (range from 01 to 99) for engineering releases and alphabetic format (A to Z) for manufacturing releases

BL	Ver. 1.0 Rev. A - displays BootLoader's version in numeric "Major.Minor" format and revision in numeric format (range from 01 to 99) for engineering releases and alphabetic format (A to Z) for manufacturing releases
BT	Bluetooth serial number

The INFO command without Parameter Name indicates all values:

```
HPT435BT High Power UHF Transceiver, Javad GNSS Product ID =35
S/N =0000000123BB
Hardware =Ver. 3.3
Software =Ver. 1.8 Rev 04 B24
BootLoader =Ver. 3.0 Rev 03 BT addr =00:18:D7:00:3C:C7
```

STATE

The STATE command is used to check the state of the wireless link, the unit in the link, and the alarm control lines. To specify a radio unit (local or remote), the CONNECT command must be used in prior of STATE command using.

STATE [*Parameter Name*] [*Parameters List*] [*/?*]

Parameter Name	Parameter List
RSSI	-52 to -116 dBm - Indicates the Receive Signal Strength in dBm
BER	1.0E-6 to 9.9E-3 - Indicates the BER level
RXFREQ	Displays the receiving frequency
TXFREQ	Displays the transmitting frequency
CHAN	1 to 32 – Displays the selected or currently scanned receiver frequency channel
CHANTX	1 to 32 – Displays the selected or currently scanned transmitter frequency channel.
TEMP	-30°C to 100°C – Displays the temperate inside of enclosure.
SYNC	0 - if link is not established yet 1 - indicates the link established
MODE	AUTO/FHOP/FIXED
VHPA	VCC V.
BT	On/Off
TXBYTE	Transmitted byte count
RXBYTE	Received byte count

The STATE command without *Parameter Name* indicates all values as shown below:

```
RSSI =-147 dBm
BER =0E-0
RXFREQ =410.000000 MHz
TXFREQ =410.000000 MHz
CHAN =-4
CHANTX =-4
TEMP =36
SYNC =0
MODE =FIXED
VHPA =11.87 V
BT =ON
TXBYTE =0 B
RXBYTE =0 B
```

Specifications

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

General Radio Specifications

Parameter	Specification
Operating Frequency Range	406 - 470 MHz (EU) 406.1 - 470 MHz (USA) 406.1 - 430;450-470 MHz (Canada)
Channel Spacing	25/12.5/6.25 kHz (USA, Canada) 25/20/12.5 kHz (EU)
Data Rate (25/20/12.5/6.25 kHz Channel Spacing)	9600/7500/4800/2400 bps – DBPSK/GMSK 19200/15000/9600/4800 bps – DQPSK/4FSK 28800/22500/14400/7200 bps – D8PSK 38400/30000/19200/9600 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	Built-in USB to RS232 FTDI converter. 12Mbps USB 2.0 Full-Speed
Bluetooth	Bluetooth V2.0 Class 2 supporting SPP Slave and Master Profiles
Bluetooth Antenna	Internal

Environmental Specifications

Parameter	Specification
Temperature	Operating –40oC to +60oC Storage –40oC to +85oC
Environmental	IP 66
Dimensions (H x W x D)	152 mm x 84 mm x72 mm
Weight	900 g
Power Supply Voltage	+9... +16VDC nominal
Power Consumption (Average)	120W/38W/300mW – Continuous Transmit/ Transmit with 30% duty cycle/Sleep
Housing/Color	Aluminum / Two-tone JAVAD GNSS Green / Gray
UHF Antenna Connector	TNC, 50Ω

Transmitter Specifications

Parameter		Specification
Output Power	USA, Canada EU	25 dBm to 45.44 dB m in 1 dB step (320 mW to 35W) 25 dBm to 41.76 dBm in 1 dB step (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 25/20/12.5 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)

Receiver Specifications

Parameter	Specification
Noise Figure	3 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 Bandwidth 60 dB for 12.5 kHz Channel Bandwidth 50 dB for 6.25 kHz Channel Bandwidth

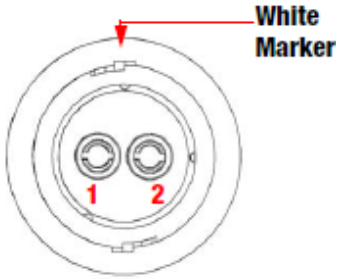
Compliance

Parameter	Specification
FCC	Part 90
Industry Canada	RSS-119
R&TTE	ETSI EN 300 113-2; ETSI EN 301 489-5; EN 60950-1:2006

Connector Specifications

Power Connector

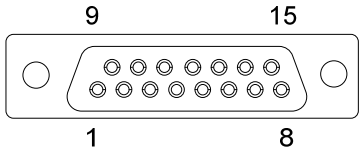
The table below gives specifications to power connector type 23-500153-01 CONN, HIGH CURRENT PL-700 RECEPT ALDEN 300906.



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

DB15 Connector

This provides DB15 connectivity for the HPT435BT with a DB9 for connection to a PC/CE Device for configuration.



This connector provides DB15 connectivity for the HPT435BT with DTE. About using and configuration RS-485 please contact JAVAD GNSS support.

Number	Signal Name	Dir	Details
1	DCD	O	Data Carrier Detect (RS-232)
2	DSR	O	Data Terminal Ready (RS-232)
3	RTS	I	Receive Data positive line (RS-422)/ Clear to Send (RS-232)
4	DATAIN	I	Receive Data negative line (RS-422)/ Receive Data (RS-232)
5	Reserved		Do not use
6	USB_PWR	I	Power Input line (USB)
7	Ground		Power Ground
8	Reserved		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	Reserved		Do not use
13	USB_D+		Positive line (USB)
14	USB_D-		Negative line (USB)
15	GND		Signal to Ground

External Antenna RF Connector

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

Appendix

UHF RADIO USAGE

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

Surveying in RTK mode has made UHF 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 UHF signals translates into range for UHF 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.

General Warnings

HPT435BT is a wireless device used in a mobile application, at least 100 cm from any body part of the user or nearby persons.

Note: Minimum separation distance of 100 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.

Note: THE HPT435BT SHOULD NEVER BE USED IN DANGEROUS ENVIRONMENTS.

Storage Precautions

Always clean the instrument after use. Wipe off dust with a cleaning brush, then wipe off dirt with a soft cloth.

Store in a location with a temperature of -40°... +85°C, and no exposure to direct sunlight. 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.

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.

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

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