



# XBee/XBee-PRO<sup>®</sup>

900HP RS-232/RS-485/USB RF Modem

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User Guide

## **XBee/XBee-PRO 900HP RF Modem User Guide—90002200**

<b>Revision</b>	<b>Date</b>	<b>Description</b>
A	December, 2013	Baseline release.
B	May, 2016	Updated to include new Customer Support information. Corrected the USB connector pin assignments and implementation table.
C	May 2018	Added explanation of range estimates.

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Range figure estimates within this guide are based on free-air terrain with limited sources of interference. Actual range will vary based on transmitting power, orientation of transmitter and receiver, height of transmitting antenna, height of receiving antenna, weather conditions, interference sources in the area, and terrain between receiver and transmitter, including indoor and outdoor structures such as walls, trees, buildings, hills, and mountains.

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## Overview of the 900HP RF Modem

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The XBee-PRO 900HP RF Modem is a small, low-power solution that uses the XBee-PRO 900HP 900 MHz RF Module in an enclosure to communicate with systems using RS-232, RS-485, and USB interfaces. It allows you to easily make your existing wired systems wireless simply by connecting to this product.

When a system is connected to the XBee-PRO 900HP RF Modem, it can transmit and receive data from multiple radios on the same wireless network. This is achieved by using Digi's XBee-PRO 900HP RF Module.

This manual is not a comprehensive manual that provides a full description of the 900HP RF Modem. This manual only covers the interfaces needed to communicate with the 900HP 900 MHz RF Module. For an extensive guide on use of the 900HP 900 MHz RF Module, see the XBee-PRO 900 HP/XBee-PRO XSC RF Modules User Guide.

## Features of the 900HP RF Modem

The following table highlights the key features of the XBee 900HP RF Modem:

Long range data integrity	Low power
Range Indoor/Urban: 200kbps: Up to 1000' (305 m), 10kbps: Up to 2000' (610m) Outdoor line-of-sight: 200kbps: Up to 4 miles (6.5km), 10kbps: Up to 9 miles (15.5km) Transmit power: Up to 24 dBm (250 mW) (software selectable) Receiver sensitivity: -101 dBm (200kbps), -110 dBm (10kbps) RF data rate: 200kbps, 10kbps	Receive current: 60 mA (@9V) Transmit current: 140 mA (@9V)

Advanced networking and security	Easy to use
<p>True peer-to-peer (no “master” required) communications. Mesh, point-to-point and point-to-multipoint topologies supported.</p> <p>Retries and acknowledgments.</p> <p>8 hopping channels, each with over 65,000 available network addresses.</p> <p>FHSS (Frequency Hopping Spread Spectrum).</p>	<p>No configuration required for out-of-the-box RF data communications</p> <p>Free XCTU software (Testing and configuration software)</p> <p>RS-232 and RS-485 variants configurable via the mini USB port</p> <p>Advanced configurations available through standard AT and binary commands</p> <p>Built in RS-232/RS-485/USB interfacing</p> <p>Small form factor</p> <p>Software-selectable serial interface baud rates</p> <p>Support for multiple data formats (parity, start and stop bits, etc.)</p> <p>Free and unlimited Technical Support</p>

## Worldwide acceptance

FCC Approved (U.S.A). See [Agency certifications](#) on page 21 for FCC requirements. Systems that include XBee®/XBee-PRO® 900HP RF modems inherit Digi Certifications.



ISM (Industrial, Scientific and Medical) 900 GHz frequency band

Manufactured under ISO 9001:2000 registered standards

XBee®/XBee-PRO® 900HP (900 MHz) RF Modems are approved for use in U.S, Canada, and Australia.

## Specifications of the 900HP RF Modem

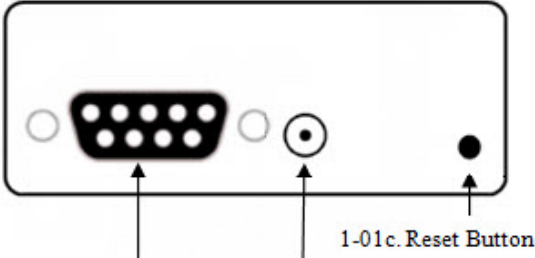
**Note** Range figure estimates are based on free-air terrain with limited sources of interference. Actual range will vary based on transmitting power, orientation of transmitter and receiver, height of transmitting antenna, height of receiving antenna, weather conditions, interference sources in the area, and terrain between receiver and transmitter, including indoor and outdoor structures such as walls, trees, buildings, hills, and mountains.

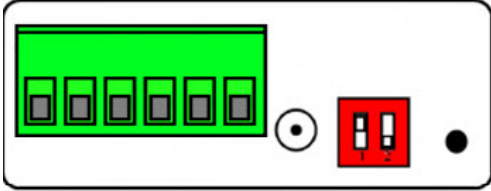
The following table highlights the specifications of the XBee-PRO 900HP RS-232/RS-485/USB RF Modem.

Specification	XBee-PRO
<b>Performance</b>	
Indoor/Urban Range	200kbps: Up to 1000 ft (305m) 10kbps: Up to 2000 ft (610m)
Outdoor line-of-sight Range	200kbps: Up to 4 miles (6.5km) w/ 2.1 dB dipole antenna 10kbps: Up to 9 miles (15.5km) w/ 2.1dB dipole antenna
Transmit power output	Up to 24 dBm (250 mW) software selectable

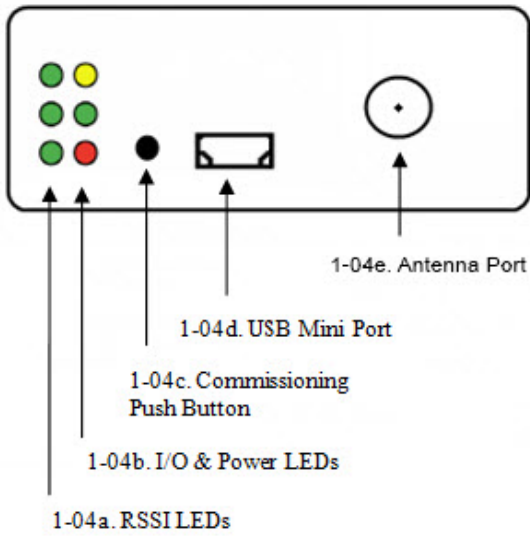
Specification	XBee-PRO
RF Data Rate (High)	200kbps
RF Data Rate (Low)	10kbps
Interface data rate	9600-230400kbps (Software selectable, includes non-standard baud rates)
Receiver sensitivity	-101 dBm (200kbps), -110 dBm (10kbps)
<b>Networking and security</b>	
Frequency	902-928MHz (located in the 900MHz ISM Band)
Spread spectrum	Frequency hopping
Supported network topologies	Mesh, point-to-point, point-to-multipoint, peer-to-peer
<b>Antenna</b>	
Connector	RPSMA (reverse polarity SMA)
Impedance	50 ohms unbalanced
<b>Power requirements</b>	
Power supply	7-30 VDC
Receive current	60 mA (@9V)
Transmit current	140 mA (@9V)
<b>Physical properties</b>	
Size	4.500" x 2.750" x 1.125" (11.4cm x 7.0cm x 2.9cm)
Weight	5.25 oz. (150 g)
Data connection	Female DB-9, RS-485/422 screw terminal, USB Type B, USB Mini-B
Operating temperature	-40 - 85° C (Industrial)
<b>Certifications (partial list)<sup>1</sup></b>	
United States (FCC Part 15.247)	MCQ-XB900HP
Industry Canada (IC)	1846A-XB900HP
Australia	RCM
RoHS	Compliant
1. See <a href="#">Agency certifications</a> on page 21 for region-specific certification requirements.	

## External interface of the 900HP RF Modem

Front view of the RS-232 interface	Description
 <p>1-01a. Serial Port</p> <p>1-01b. Power Connector</p> <p>1-01c. Reset Button</p>	1-01a. RS-232 Serial Port
	Standard female DB-9
	1-01b. RS-232 Power Connector
	7-30 VDC power connector
1-01c. RS-232 Reset Button	The reset button resets (re-boots) the XBee-PRO 900HP RF Modem. This button only applies when using the configuration tabs of Digi's XCTU Software.

Front view of the RS-485 interface	Description
 <p>1-03a. Serial Port</p> <p>1-03b. Power Connector</p> <p>1-03c. DIP Switch</p> <p>1-03d. Reset Button</p>	1-03a. RS-485 Serial Port
	Phoenix 6-pin connector.
	1-03b. RS-485 Power Connector
	7-30 VDC power connector.
1-03c. RS-485 DIP Switch	120 ohms termination for the receiving differential pairs if switch is in the up position. Switch 1 is for half duplex (2 wire) termination. Switch 2 is for full duplex (4 wire) termination.
1-03d. RS-485 Reset Button	The reset button resets (re-boots) the XBee-PRO 900HP RF Modem. This button only applies when using the configuration tabs of Digi's XCTU Software.

Back view of the RS-485 interface



Description

1-04a. RS-485 RSSI LEDs

RSSI LEDs indicate the amount of fade margin present in an active wireless link. Fade margin is defined as the difference between the incoming signal strength and the modem's receiver sensitivity.

- 3 LEDs ON = Very Strong Signal (> 30 dB fade margin)
- 2 LEDs ON = Strong Signal (>20 dB fade margin)
- 1 LED ON = Moderate Signal (>10 dB fade margin)
- 0 LED ON = Weak Signal (<10 dB fade margin)

1-04b. RS-485 I/O and Power LEDs

LEDs indicate RF modem activity as follows:

- Yellow (top LED) = Serial Data Out (to host)
- Green (middle) = Serial Data In (from host)
- Red (bottom) = Power/TX Indicator (the red light is on when powered, off briefly during RF transmission)

1-04c. RS-485 Commissioning Push Button

The commissioning push button provides a variety of simple functions to aid in deploying devices in a network. See "Commissioning Push-button" in the XBee-PRO 900HP/XBee-PRO XSC RF Modules Product Manual for more detail.

1-04d. RS-485 USB Mini-B Port

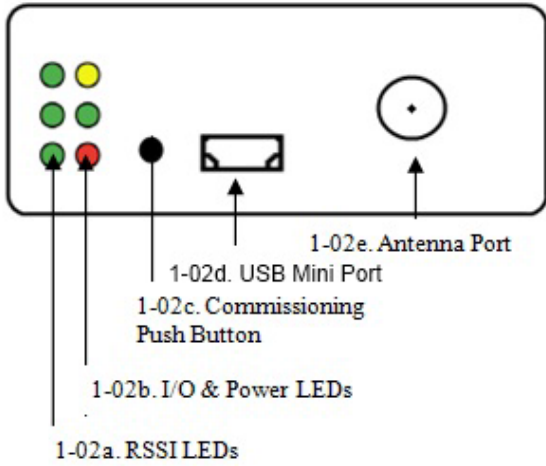
When the USB Mini-B is plugged in, all RS-485 communications to and from the XBee are disabled. The USB is to serve as a configuration port. The XBee should not transmit if USB is plugged in.

1-04e. RS-485 Antenna Port

The antenna port is a 50 $\Omega$  RF signal connector for connecting to an external antenna. The connector type is RPSMA (Reverse Polarity SMA) female. The connector has threads on the outside of a barrel and a male center conductor.



Back view of the RS-232 interface



Description

1-02a. RS-232 RSSI LEDs

RSSI LEDs indicate the amount of fade margin present in an active wireless link. Fade margin is defined as the difference between the incoming signal strength and the modem's receiver sensitivity.

3 LEDs ON = Very Strong Signal (> 30 dB fade margin)

2 LEDs ON = Strong Signal (>20 dB fade margin)

1 LED ON = Moderate Signal (>10 dB fade margin)

0 LED ON = Weak Signal (<10 dB fade margin)

1-02b. RS-232 I/O and Power LEDs

LEDs indicate RF modem activity as follows:

Yellow (top LED) = Serial Data Out (to host)

Green (middle) = Serial Data In (from host)

Red (bottom) = Power/TX Indicator (the red light is on when powered, off briefly during RF transmission)

1-02c. RS-232 Commissioning Push Button

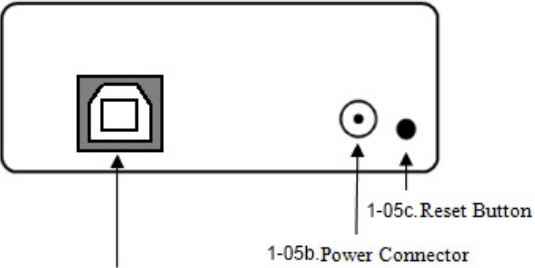
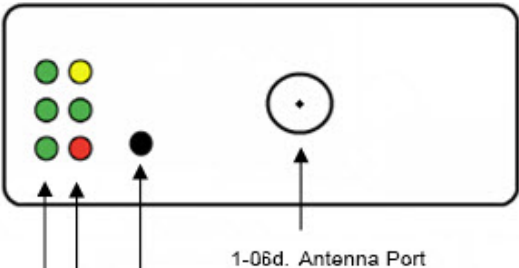
The commissioning push button provides a variety of simple functions to aid in deploying devices in a network. See "Commissioning Push-button" in the XBee-PRO 900HP/XBee-PRO XSC RF Modules Product Manual for more detail.

1-02d. RS-232 USB Mini-B Port

When the USB Mini-B is plugged in, all RS-232 communications to and from the XBee are disabled. The USB is to serve as a configuration port. The XBee should not transmit when the USB is plugged in.

1-02e. RS-232 Antenna Port

The antenna port is a 50 $\Omega$  RF signal connector for connecting to an external antenna. The connector type is RPSMA (Reverse Polarity SMA) female. The connector has threads on the outside of a barrel and a male center conductor.

Front view of the USB interface	Description	
 <p>1-05a. USB Port</p> <p>1-05b. Power Connector</p> <p>1-05c. Reset Button</p>	<p>1-05a. USB Port</p>	
	<p>Type B USB port.</p>	
	<p>1-05b. USB Power Connector</p>	
	<p>7-30 VDC power connector.</p>	
<p>1-05c. USB Reset Button</p>	<p>The reset button resets (re-boots) the XBee-PRO 900HP RF Modem. This button only applies when using the configuration tabs of Digi's XCTU Software.</p>	
Back view of the USB interface	Description	
 <p>1-06a. RSSI LEDs</p> <p>1-06b. I/O &amp; Power LEDs</p> <p>1-06c. Commissioning Push Button</p> <p>1-06d. Antenna Port</p>	<p>1-06a. USB RSSI LEDs</p>	
	<p>RSSI LEDs indicate the amount of fade margin present in an active wireless link. Fade margin is defined as the difference between the incoming signal strength and the modem's receiver sensitivity.</p> <ul style="list-style-type: none"> <li>3 LEDs ON = Very Strong Signal (&gt; 30 dB fade margin)</li> <li>2 LEDs ON = Strong Signal (&gt;20 dB fade margin)</li> <li>1 LED ON = Moderate Signal (&gt;10 dB fade margin)</li> <li>0 LED ON = Weak Signal (&lt;10 dB fade margin)</li> </ul>	
	<p>1-06b. USB I/O and Power LEDs</p>	
	<p>LEDs indicate RF modem activity as follows:</p> <ul style="list-style-type: none"> <li>Yellow (top LED) = Serial Data Out (to host)</li> <li>Green (middle) = Serial Data In (from host)</li> <li>Red (bottom) = Power/TX Indicator (the red light is on when powered, off briefly during RF transmission)</li> </ul>	
	<p>1-06c. USB Commissioning Push Button</p>	<p>The commissioning push button provides a variety of simple functions to aid in deploying devices in a network. See "Commissioning Push-button" in the XBee-PRO 900HP/XBee-PRO XSC RF Modules Product Manual for more detail.</p>
	<p>1-06d. USB Antenna Port</p>	<p>The antenna port is a 50<math>\Omega</math> RF signal connector for connecting to an external antenna. The connector type is RPSMA (Reverse Polarity SMA) female. The connector has threads on the outside of a barrel and a male center conductor.</p>

## RF Modem symbols

The following symbols are found on top of the RF Modem. The description of the symbol is next to the symbol.



RSSI LEDs



Reset Button



RS-232 Serial Port

**A.T.R**

I/O LEDs  
 Red-Association  
 Green- Transmit from Host  
 Yellow- Receive from Host



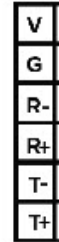
Switch 1-Termination  
 for 2-wire configuration  
 Switch 2-Termination  
 for 4-wire configuration



Commissioning Button



Power Supply (7-30  
 VDC)



RS-485 Serial Port



Antenna Port



USB Port

## Interfacing protocol

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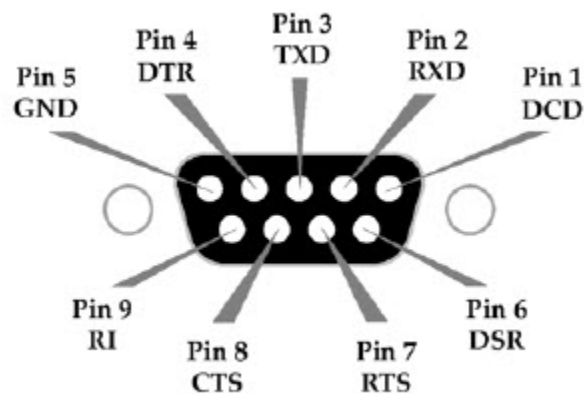
The XBee-PRO 900HP RS-232/485/USB RF Modem supports the following interfacing protocols:

- RS-232
- RS-485 (2-wire) half-duplex
- RS-485 (4-wire) and RS-422
- USB

### RS-232 operation

#### RS-232 pin signals

The following figure shows the pins used on the female RS-232 (DB-9) serial connector:



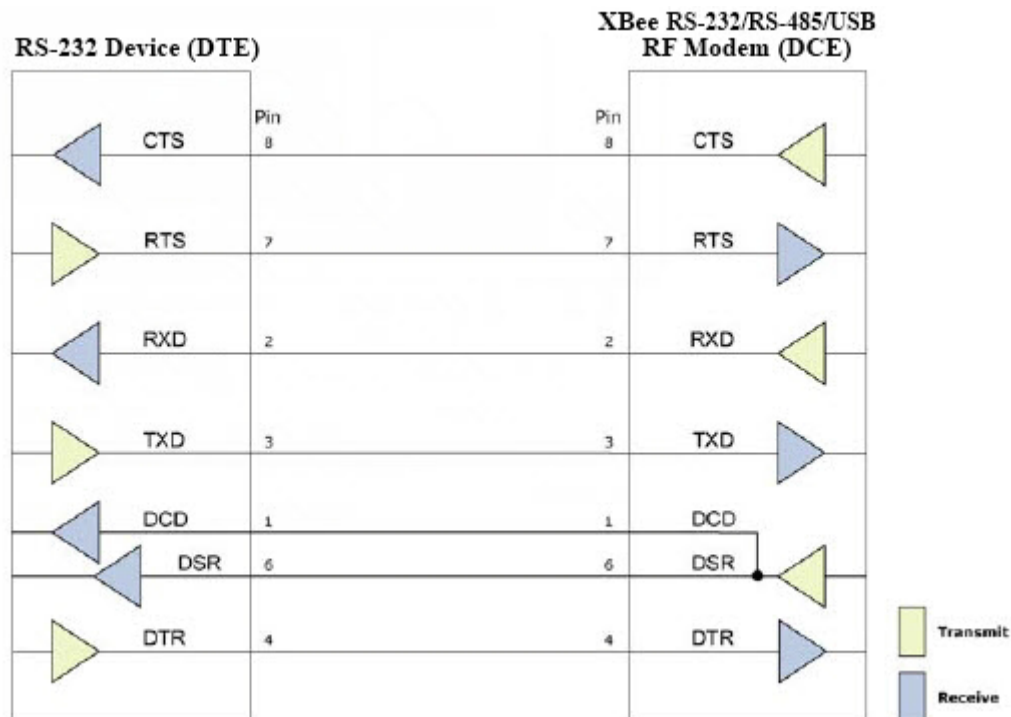
The following table describes the RS-232 pin assignments and implementation.

DB-9 pin	RS-232 Name	Description	Implementation
1	DCD	Data-Carrier-Detect	Connected to DSR (pin 6)
2	RXD	Received Data	Serial data exiting the RF modem (from host)
3	TXD	Transmitted Data	Serial data entering into the RF modem (from host)

DB-9 pin	RS-232 Name	Description	Implementation
4	DTR	Data-Terminal-Ready	2 – 0xFFFF [x 100 msec]
5	GND	Ground Signal	0x20 – 0x7F
6	DSR	Data-Set-Ready	0 - 4
7	$\overline{\text{RTS}}$ / CMD	Request-to-Send/ Command Mode	$\overline{\text{RTS}}$ (request-to-send) flow control: By default, this pin is not used. To configure this pin to regulate the flow of serial data exiting the modem, refer to the Serial Communications and RT command section.  CMD: Refer to Binary Commands and RT Command Sections to enable binary command programming.
8	$\overline{\text{CTS}}$	Clear-to-Send	$\overline{\text{CTS}}$ (clear-to-send) flow control –When pin is driven low, UART host is permitted to send serial data to the modem. Refer to the Serial Communications and CS Command sections for more information.
9	RI	Ring Indicator	Optional power input (protection circuitry to prevent back flow from other power sources internal to the board)

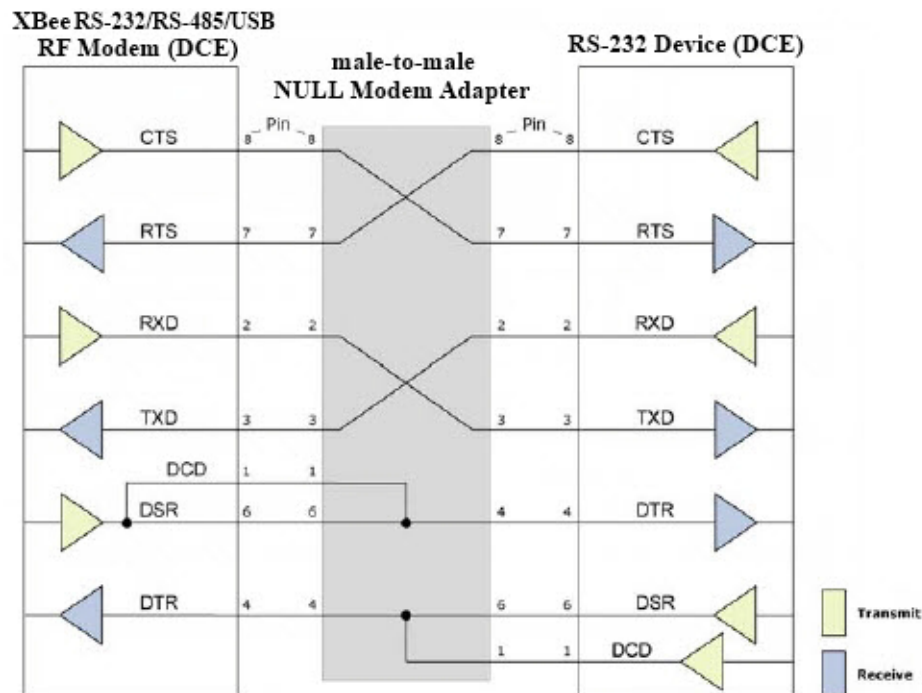
## RS-232 wiring diagram

The following figure shows the RS-232 Device DTE Device (male DB-9 connector) wired to a DCE RF modem (female DB-9) XBee-PRO RF Modem:



## DCE RF Modem to a DCE RS-232 device

The following figure shows the DCE RF Modem (female DB-9 connector) wired to an RS-232 DCE device (male DB-9) XBee-PRO RF Modem:



## Sample wireless connection: DTE <--> DCE DCE <--> DCE

The following figure shows a typical wireless link between DTE and DCE devices:



## RS-485 (2-wire) operation

XCTU that with the RS-485 variant of the 900HP RF Modem, the RF Modem is defaulted with the D7 command (AT parameter) to 7. This parameter controls the TX enable signal and allows the modem to output any data in the DO buffer to the host device for the RS-485 interface. In the event that the parameter is accidentally changed, which would halt RS-485 communication, a USB mini cable should be plugged into the modem to reconfigure it. You can reconfigure by using Digi's XCTU.

With the USB plugged in:

1. Open XCTU and select the Com port of the USB.
2. Select the Terminal tab and type '+++'. The system will respond with 'OK'.

3. Type “ATD77” then <Enter>, and the system will respond with 'OK'. Type “ATWR” then <Enter>, and the system will respond with “OK”.
4. Type “ATCN” then <Enter> to exit command mode, and the system will respond with “OK”.
5. Unplug the USB and return to the existing RS-485 interface. The 900HP RF Modem is now ready to communicate in RS-485 model.

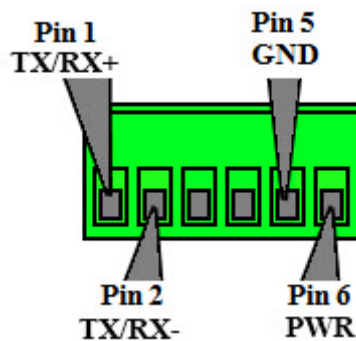
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**Note** Failure to enter AT Command Mode is most commonly due to baud rate mismatch. Ensure the “Baud” setting on the “PC Settings” tab matches the BD (Interface Data Rate) setting of the RF modem (by default, BD parameter = 3, which is associated with 9600 baud).

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## RS-485 pin signals

The following figure shows the pins used on the RS-485 (2 wire) Phoenix 6-pin connector:

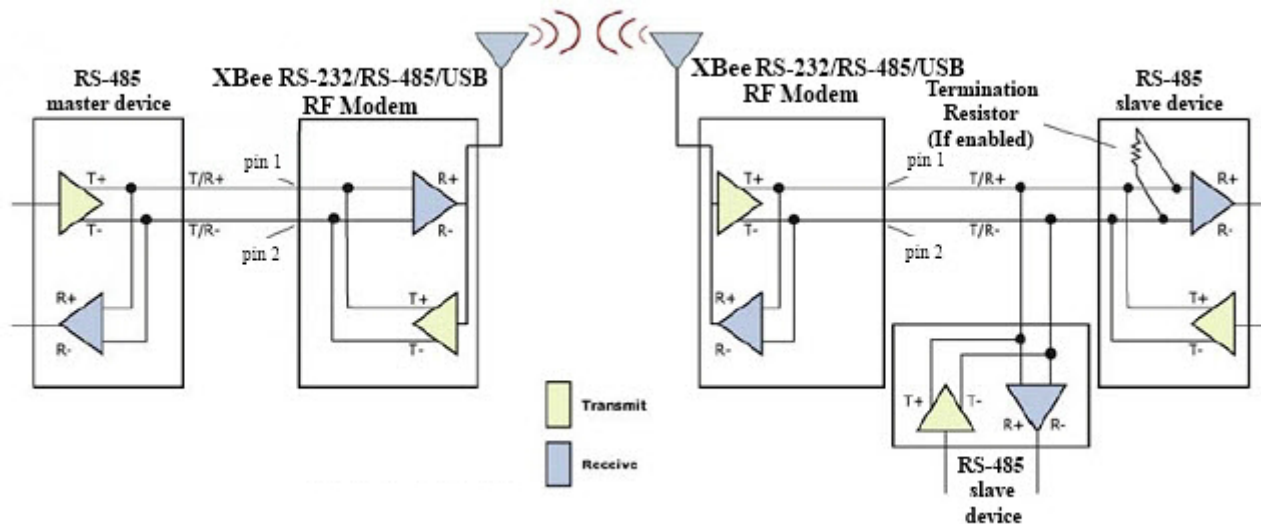


The following figure shows the pins used on the RS-485 (2 wire) Phoenix 6-pin connector:

Phoenix 6 pin	RS-485 name	Description	Implementation
1	TX/RX+	Negative Data Line	Transmit serial data to and from the RF modem
2	TX/RX-	Positive Data Line	Transmit serial to and from the RF modem
5	GND	Ground Signal	Ground
6	PWR	Power Signal	Optional power input (protection circuitry to prevent back flow from other power sources internal to the board)
3, 4	Not Used		

## RS-485 wiring diagram

The following figure shows the RF Modem in an RS-485 (2 wire) half duplex:



## RS-485 (4-wire) operation and RS-422 operation

XCTU that with the RS-485 variant of the 900HP RF Modem, the RF Modem is defaulted with the D7 command (AT parameter) to 7. This parameter controls the TX enable signal and allows the modem to output any data in the DO buffer to the host device for the RS-485/422 interface. In the event that the parameter is accidentally changed, which would halt RS-485 communication, a USB mini cable should be plugged into the modem to reconfigure it. You can reconfigure by using Digi's XCTU.

With the USB plugged in:

1. Open XCTU and select the Com port of the USB.
2. Select the Terminal tab and type “+++”. The system will respond with “OK”.
3. Type “ATD77” then <Enter>, and the system will respond with “OK”.
4. Type “ATWR” then <Enter>, and the system will respond with “OK”.
5. Type “ATCN” then <Enter> to exit command mode, and the system will respond with “OK”.
6. Unplug the USB and return to the existing RS-485/422 interface. The 900HP RF Modem is now ready to communicate in RS-485 mode.

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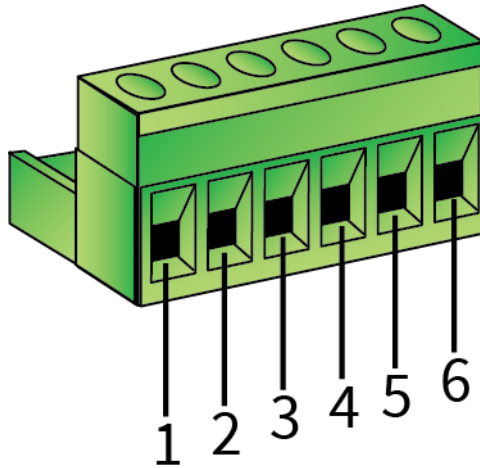
**Note** Failure to enter AT Command Mode is most commonly due to baud rate mismatch. Ensure the 'Baud' setting on the “PC Settings” tab matches the BD (Interface Data Rate) setting of the RF modem (by default, BD parameter = 3, which is associated with 9600 baud).

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## RS-485 pin signals

The numbers in the following figure correspond to the Phoenix 6 pins listed in the table that follows the figure:

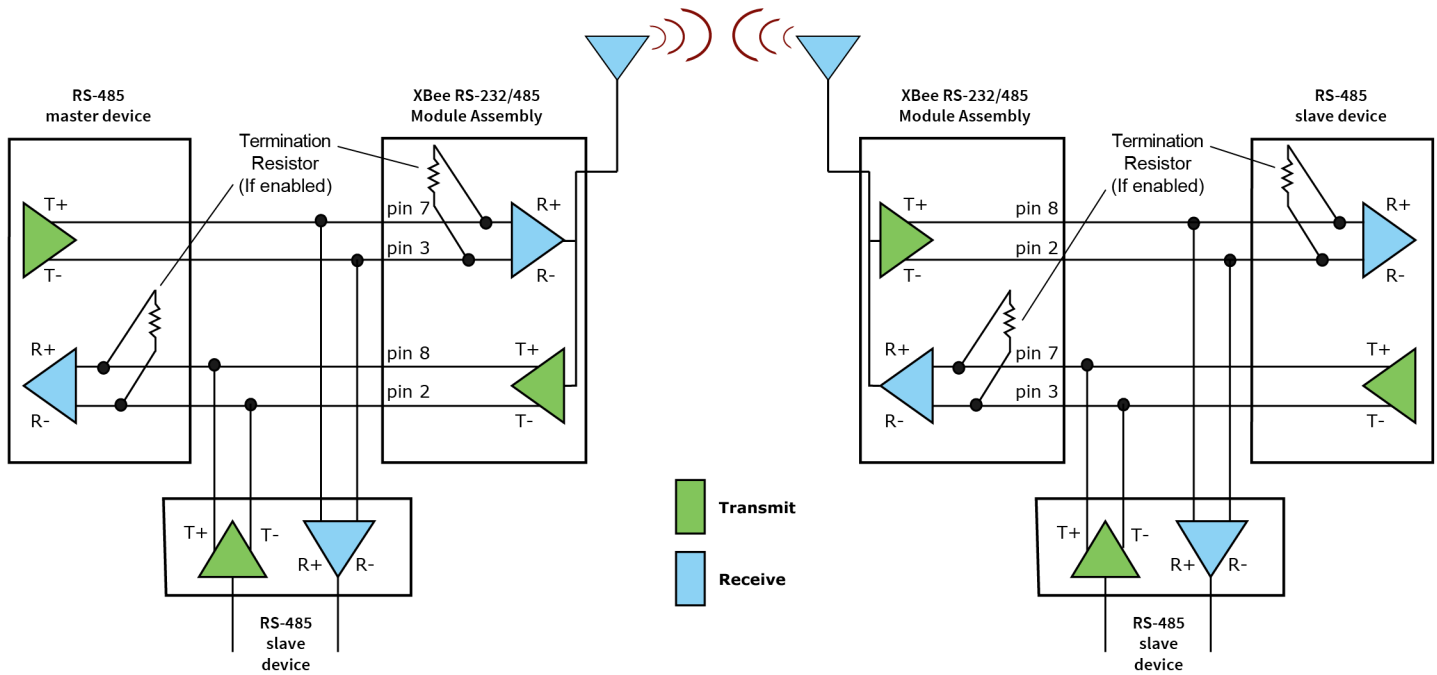


The following table describes the RS-485 (4-wire) 6-pin connector pin assignments and implementation:

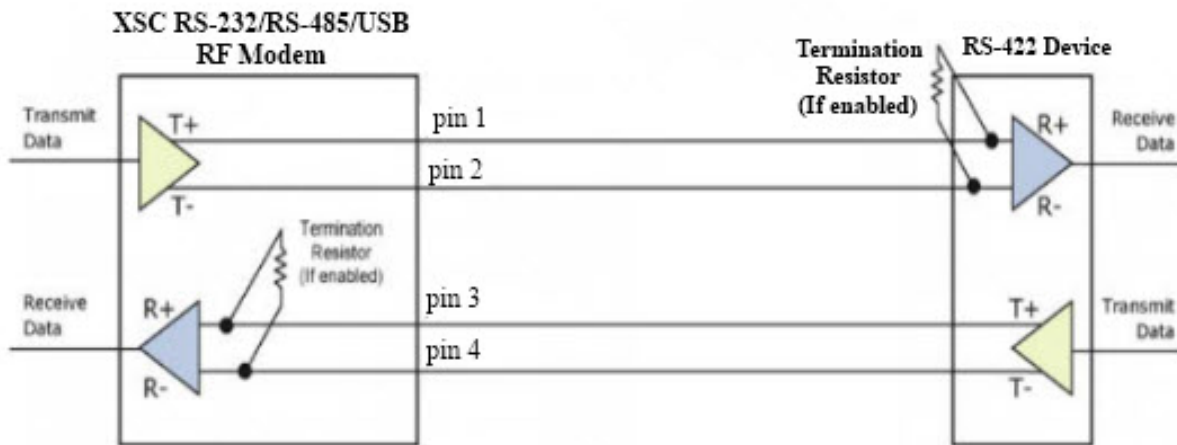
Phoenix 6 pin	RS-485 name	Description	Implementation
1	TX+	Transmit Positive	Serial data sent from RF modem
2	TX-	Transmit Negative Data Line	Serial data received by the RF modem
5	RX+	Receive Positive Data Line	Serial data received the RF modem
4	RX-	Receive Negative Data Line	Serial data received by the RF modem
5	GND	Ground Signal	Ground
6	PWR	Power Signal	Optional power input (protection circuitry to prevent back flow from other power sources internal to the board)

## RS-485 wiring diagrams

The following figure shows the RF Modem in an RS-485 (4-wire) environment:



The following figure shows the RF Modem in an RS-422 environment:



## RS-485/422 connection guidelines

The RS-485/422 protocol provides a solution for wired communications that can tolerate high noise and push signals over long cable lengths. RS-485/422 signals can communicate as far as 4000 feet (1200 m). RS-232 signals are suitable for cable distances up to 100 feet (30.5 m).

RS-485 offers multi-drop capability in which up to 32 nodes can be connected. The RS-422 protocol is used for point-to-point communications.

Suggestions for integrating the 900HP RF Modem with the RS-485/422 protocol: Twisted pair cabling is used for the positive and negative data lines. An Ethernet cable is good for twisted pairs.

When using Ethernet twisted pair cabling:

Select wires so that TX+ and TX- are connected to a twisted pair. Likewise, select wires so that RX+ and RX- are connected to a twisted pair. (For example, tie the green and white/green wires to TX+ and TX). This reduces the amount of noise on the data line.

## USB operation

Note that when a Mini-USB cable is plugged into the 900HP RF Modem, communication to and from the RS-232 interface and the RS-485/422 is halted. USB communications take precedence over all other interfaces when you plug it in. To restore communication with other interfaces, the USB cable should be unplugged.

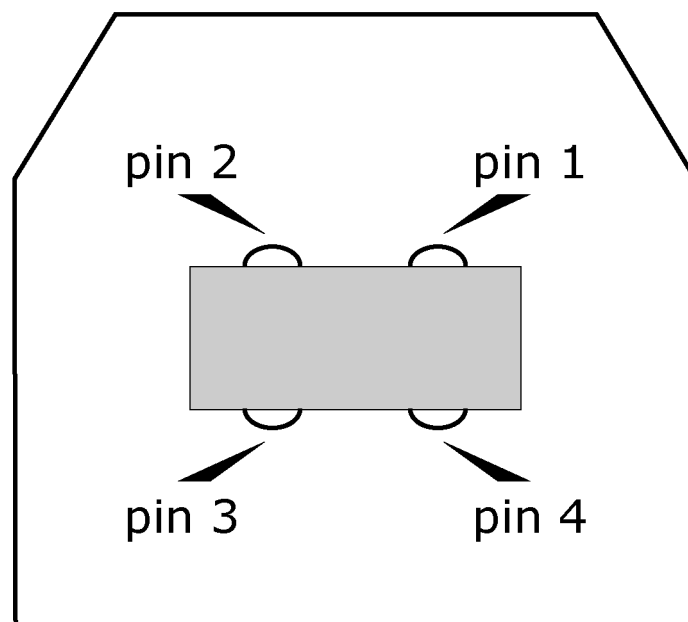
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**Note** The Mini-B USB connector is intended as a configuration port. The RF Modem should not transmit data when the Mini USB cable is connected.

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## USB pin signals

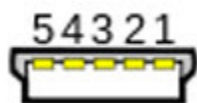
The following figure shows the pins used on the Type B USB connector:



The following figure shows type B USB connector pin assignments and implementation:

Phoenix 6 pin	Name	Description	Implementation
1	VBUS	Power	Power with external jack
2	D-	Negative Data Line	Transmit data to and from the RF modem
5	D+	Positive Data Line	Transmit data to and from the RF modem
4	GND	Ground Signal	Ground

The following figure shows the pins used on the Mini-B USB connector:



The following table describes the Mini-B USB connector pin assignments and implementation:

Pin	Name	Description	Implementation
1	VBUS	Power	Power the RF modem
2	D-	Negative Data Line	Transmit data to and from the RF modem
5	D+	Positive Data Line	Transmit data to and from the RF modem
4	ID	Permits distinction of host connection from slave connection	Not connected
5	GND	Ground Signal	Ground

## Agency certifications

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### FCC (United States) certification

The XBee-PRO<sup>®</sup> 900HP RF Modem complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required.

RF Modems/integrators must comply with the following regulations:

1. The system integrator must ensure that the text provided with this device [Figure A-01] is placed on the outside of the final product and within the final product operation manual.
2. The XBee-PRO<sup>®</sup> 900HP RF Modem may only be used with antennas that have been tested and approved for use with this modem (refer to the antenna table in this section).

### Labeling requirements



**WARNING!** The Original Equipment Manufacturer (OEM) must ensure that FCC labeling requirements are met. This includes a clearly visible label on the outside of the final product enclosure that displays the text shown in the figure below.

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Required FCC Label for OEM products containing the XBee-PRO<sup>®</sup> 900HP RF Modem.

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**WARNING!** Contains FCC ID: MCQ-XB900HP  
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: *(i.)* this device may not cause harmful interference and *(ii.)* this device must accept any interference received, including interference that may cause undesired operation.

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### FCC notices

**IMPORTANT:** The XBee-PRO<sup>®</sup> 900HP RS-232/RS-485/USB RF Module has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by Digi could void the user's authority to operate the equipment.

**IMPORTANT:** OEMs must test final product to comply with unintentional radiators (FCC section 15.107 and 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.

**IMPORTANT:** The RF Module has been certified for remote and base radio applications. If the module will be used for portable applications, the device must undergo SAR testing.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: Re-orient or relocate the receiving antenna, Increase the separation between the equipment and receiver, Connect equipment and receiver to outlets on different circuits, or Consult the dealer or an experienced radio/TV technician for help.

## Limited modular approval

This modem contains an RF module approved for Limited Modular use operating as a mobile transmitting device with respect to section 2.1091 and is limited to OEM installation for Mobile and Fixed applications only. During final installation, end-users are prohibited from access to any programming parameters. Professional installation adjustment is required for setting module power and antenna gain to meet EIRP compliance for high gain antenna(s).

Final antenna installation and operating configurations of this transmitter including antenna gain and cable loss must not exceed the EIRP of the configuration used for calculating MPE. Grantee (Digi) must coordinate with OEM integrators to ensure the end-users and installers of products operating with the modem are provided with operating instructions to satisfy RF exposure requirements.

The FCC grant is valid only when the device is sold to OEM integrators. Integrators are instructed to ensure the end-user has no manual instructions to remove, adjust or install the device.

## FCC-approved antennas



**WARNING!** This device has been tested with Reverse Polarity SMA connectors with the antennas listed in the tables of this section. When integrated into OEM products, fixed antennas require installation preventing end-users from replacing them with non-approved antennas. Antennas not listed in the tables must be tested to comply with FCC Section 15.203 (unique antenna connectors) and Section 15.247 (emissions).

## Fixed base station and mobile applications

Digi RF modules are pre-FCC approved for use in fixed base station and mobile applications. When the antenna is mounted at least 20cm (8") from nearby persons, the application is considered a mobile application.

## Portable applications and SAR testing

If the module will be used at distances closer than 20cm to all persons, the device may be required to undergo SAR testing. Co-location with other transmitting antennas closer than 20cm should be avoided.

## RF exposure

This statement must be included as a CAUTION statement in OEM product manuals.



**WARNING!** This equipment is approved only for mobile and base station transmitting devices. Antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## IC (Industry Canada) certification

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes: (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement

### Labeling requirements

Labeling requirements for Industry Canada are similar to those of the FCC. A clearly visible label on the outside of the final product enclosure must display one of the following text:

Contains IC: 1846A-XB900HP

The integrator is responsible for its product to comply with IC ICES-003 and FCC Part 15, Sub. B-Unintentional Radiators. ICES-003 is the same as FCC Part 15 Sub. B and Industry Canada accepts FCC test report or CISPR 22 test report for compliance with ICES-003.

### Antenna options: 900 MHz antenna listings

The antennas in the tables below have been approved for use with this product. Digi does not carry all of these antenna variants. Contact Digi Sales for available antennas.

Antennas approved for use with the XBee-PRO 900HP RF Modem

Part number	Type	Connector	Gain	Application	Cable loss or power reduction for S3B Radio
Omni-directional antennas					
A09-F0	Fiberglass Base Station	RPN	0 dBi	Fixed	0dB
A09-F1	Fiberglass Base Station	RPN	1.0 dBi	Fixed	0dB
A09-F2	Fiberglass Base Station	RPN	2.1 dBi	Fixed	0dB
A09-F3	Fiberglass Base Station	RPN	3.1 dBi	Fixed	0dB
A09-F4	Fiberglass Base Station	RPN	4.1 dBi	Fixed	0dB
A09-F5	Fiberglass Base Station	RPN	5.1 dBi	Fixed	0dB
A09-F6	Fiberglass Base Station	RPN	6.1 dBi	Fixed	0dB
A09-F7	Fiberglass Base Station	RPN	7.1 dBi	Fixed	0dB
A09-F8	Fiberglass Base Station	RPN	8.1 dBi	Fixed	0dB

Part number	Type	Connector	Gain	Application	Cable loss or power reduction for S3B Radio
A09-F9	Base Station	RPSMAF	9.2dBi	Fixed	0dB
A09-W7	Wire Base Station	RPN	7.1 dBi	Fixed	0dB
A09-F0	Fiberglass Base Station	RPSMA	0 dBi	Fixed	0dB
A09-F1	Fiberglass Base Station	RPSMA	1.0 dBi	Fixed	0dB
A09-F2	Fiberglass Base Station	RPSMA	2.1 dBi	Fixed	0dB
A09-F3	Fiberglass Base Station	RPSMA	3.1 dBi	Fixed	0dB
A09-F4	Fiberglass Base Station	RPSMA	4.1 dBi	Fixed	0dB
A09-F5	Fiberglass Base Station	RPSMA	5.1 dBi	Fixed	0dB
A09-F6	Fiberglass Base Station	RPSMA	6.1 dBi	Fixed	0dB
A09-F7	Fiberglass Base Station	RPSMA	7.1 dBi	Fixed	0dB
A09-F8	Fiberglass Base Station	RPSMA	8.1 dBi	Fixed	0dB
A09-M7	Base Station	RPSMAF	7.2dBi	Fixed	0dB
A09-W7SM	Wire Base Station	RPSMA	7.1 dBi	Fixed	0dB
A09-F0TM	Fiberglass Base Station	RPTNC	0 dBi	Fixed	0dB
A09-F1TM	Fiberglass Base Station	RPTNC	1.0 dBi	Fixed	0dB
A09-F2TM	Fiberglass Base Station	RPTNC	2.1 dBi	Fixed	0dB
A09-F3TM	Fiberglass Base Station	RPTNC	3.1 dBi	Fixed	0dB
A09-F4TM	Fiberglass Base Station	RPTNC	4.1 dBi	Fixed	0dB
A09-F5TM	Fiberglass Base Station	RPTNC	5.1 dBi	Fixed	0dB
A09-F6TM	Fiberglass Base Station	RPTNC	6.1 dBi	Fixed	0dB
A09-F7TM	Fiberglass Base Station	RPTNC	7.1 dBi	Fixed	0dB
A09-F8TM	Fiberglass Base Station	RPTNC	8.1 dBi	Fixed	0dB
A09-W7TM	Wire Base Station	RPTNC	7.1 dBi	Fixed	0dB
A09-HSM-7	Straight half-wave	RPSMA	3.0 dBi	Fixed / Mobile	0dB
A09-HASM-675	Articulated half-wave	RPSMA	2.1 dBi	Fixed / Mobile	0dB
A09-HABMM-P6I	Articulated half-wave w/ 6" pigtail	MMCX	2.1 dBi	Fixed / Mobile	0dB
A09-HABMM-6-P6I	Articulated half-wave w/ 6" pigtail	MMCX	2.1 dBi	Fixed / Mobile	0dB



Part number	Type	Connector	Gain	Application	Cable loss or power reduction for S3B Radio
A09-HBMM-P6I	Straight half-wave w/ 6" pigtail	MMCX	2.1 dBi	Fixed / Mobile	0dB
A09-HRSM	Right angle half-wave	RPSMA	2.1 dBi	Fixed	0dB
A09-HASM-7	Articulated half-wave	RPSMA	2.1 dBi	Fixed	0dB
A09-HG	Glass mounted half-wave	RPSMA	2.1 dBi	Fixed	0dB
A09-HATM	Articulated half-wave	RPTNC	2.1 dBi	Fixed	0dB
A09-H	Half-wave dipole	RPSMA	2.1 dBi	Fixed	0dB
A09-HBMMMP6I	1/2 wave antenna	MMCX	2.1dBi	Mobile	0dB
A09-QBMMMP6I	1/4 wave antenna	MMCX	1.9 dBi	Mobile	0dB
A09-QI	1/4 wave integrated wire antenna	Integrated	1.9 dBi	Mobile	0dB
29000187	Helical	Integrated	-2.0 dBi	Fixed/Mobile	0dB
A09-QW	Quarter-wave wire	Permanent	1.9 dBi	Fixed / Mobile	0dB
A09-QRAMM	3 "Quarter-wave wire	MMCX	2.1 dBi	Fixed / Mobile	0dB
A09-QSM-3	Quarter-wave straight	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QSM-3H	Heavy duty quarter-wave straight	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QBMM-P6I	Quarter-wave w/ 6" pigtail	MMCX	1.9 dBi	Fixed / Mobile	0dB
A09-QHRN	Miniature Helical Right Angle solder	Permanent	-1 dBi	Fixed / Mobile	0dB
A09-QHSN	Miniature Helical Right Angle solder	Permanent	-1 dBi	Fixed / Mobile	0dB
A09-QHSM-2	2" Straight	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QHRSM-2	2" Right angle	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QHRSM-170	1.7" Right angle	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QRSM-380	3.8" Right angle	RPSMA	1.9 dBi	Fixed / Mobile	0dB
A09-QAPM-520	5.2" Articulated Screw mount	Permanent	1.9 dBi	Fixed / Mobile	0dB
A09-QSPM-3	3" Straight screw mount	Permanent	1.9 dBi	Fixed / Mobile	0dB
A09-QAPM-3	3" Articulated screw mount	Permanent	1.9 dBi	Fixed / Mobile	0dB

Part number	Type	Connector	Gain	Application	Cable loss or power reduction for S3B Radio
A09-QAPM-3H	3" Articulated screw mount	Permanent	1.9 dBi	Fixed / Mobile	0dB
A09-DPSM-P12F	omni directional permanent mount w/ 12ft pigtail	RPSMA	3.0 dBi	Fixed	0dB
A09-D3NF-P12F	omni directional magnetic mount w/ 12ft pigtail	RPN	3.0 dBi	Fixed	0dB
A09-D3SM-P12F	omni directional w/ 12ft pigtail	RPSMA	3.0 dBi	Fixed	0dB
A09-D3PNF	omni directional permanent mount	RPN	3.0 dBi	Fixed	0dB
A09-D3TM-P12F	omni directional w/ 12ft pigtail	RPTNC	3.0 dBi	Fixed	0dB
A09-D3PTM	omni directional permanent mount	RPTNC	3.0 dBi	Fixed	0dB
A09-M0SM	Mag Mount	RPSMA	0 dBi	Fixed	0dB
A09-M2SM	Mag Mount	RPSMA	2.1 dBi	Fixed	0dB
A09-M3SM	Mag Mount	RPSMA	3.1 dBi	Fixed	0dB
A09-M5SM	Mag Mount	RPSMA	5.1 dBi	Fixed	0dB
A09-M7SM	Mag Mount	RPSMA	7.1 dBi	Fixed	0dB
A09-M8SM	Mag Mount	RPSMA	8.1 dBi	Fixed	0dB
A09-M0TM	Mag Mount	RPTNC	0 dBi	Fixed	0dB
A09-M2TM	Mag Mount	RPTNC	2.1 dBi	Fixed	0dB
A09-M3TM	Mag Mount	RPTNC	3.1 dBi	Fixed	0dB
A09-M5TM	Mag Mount	RPTNC	5.1 dBi	Fixed	0dB
A09-M7TM	Mag Mount	RPTNC	7.1 dBi	Fixed	0dB
A09-M8TM	Mag Mount	RPTNC	8.1 dBi	Fixed	0dB
Yagi antennas					
A09-Y6	2 Element Yagi	RPN	6.1 dBi	Fixed / Mobile	0dB
A09-Y7	3 Element Yagi	RPN	7.1 dBi	Fixed / Mobile	0dB
A09-Y8	4 Element Yagi	RPN	8.1 dBi	Fixed / Mobile	0dB

Part number	Type	Connector	Gain	Application	Cable loss or power reduction for S3B Radio
A09-Y9	4 Element Yagi	RPN	9.1 dBi	Fixed / Mobile	0dB
A09-Y10	5 Element Yagi	RPN	10.1 dBi	Fixed / Mobile	0dB
A09-Y11	6 Element Yagi	RPN	11.1 dBi	Fixed / Mobile	0dB
A09-Y12	7 Element Yagi	RPN	12.1 dBi	Fixed / Mobile	0dB
A09-Y13	9 Element Yagi	RPN	13.1 dBi	Fixed / Mobile	0.8dB
A09-Y14	10 Element Yagi	RPN	14.1 dBi	Fixed / Mobile	1.8dB
A09-Y14	12 Element Yagi	RPN	14.1 dBi	Fixed / Mobile	1.8dB
A09-Y15	13 Element Yagi	RPN	15.1 dBi	Fixed / Mobile	2.8dB
A09-Y15	15 Element Yagi	RPN	15.1 dBi	Fixed / Mobile	2.8dB
A09-Y6TM	2 Element Yagi	RPTNC	6.1 dBi	Fixed / Mobile	0dB
A09-Y7TM	3 Element Yagi	RPTNC	7.1 dBi	Fixed / Mobile	0dB
A09-Y8TM	4 Element Yagi	RPTNC	8.1 dBi	Fixed / Mobile	0dB
A09-Y9TM	4 Element Yagi	RPTNC	9.1 dBi	Fixed / Mobile	0dB
A09-Y10TM	5 Element Yagi	RPTNC	10.1 dBi	Fixed / Mobile	0dB
A09-Y11TM	6 Element Yagi	RPTNC	11.1 dBi	Fixed / Mobile	0dB
A09-Y12TM	7 Element Yagi	RPTNC	12.1 dBi	Fixed / Mobile	0dB
A09-Y13TM	9 Element Yagi	RPTNC	13.1 dBi	Fixed / Mobile	0.8dB
A09-Y14TM	10 Element Yagi	RPTNC	14.1 dBi	Fixed / Mobile	1.8dB
A09-Y14TM	12 Element Yagi	RPTNC	14.1 dBi	Fixed / Mobile	1.8dB
A09-Y15TM	13 Element Yagi	RPTNC	15.1 dBi	Fixed / Mobile	2.8dB
A09-Y15TM	15 Element Yagi	RPTNC	15.1 dBi	Fixed / Mobile	2.8dB

#### Transmitters with detachable antennas

This radio transmitter (IC: 1846A-XB900HP) has been approved by Industry Canada to operate with the antenna types listed in the table above with the maximum permissible gain and required antenna impedance for each antenna type indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Le présent émetteur radio (IC: 1846A-XB900HP) a été approuvé par Industrie Canada pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal et l'impédance requise pour chaque type d'antenne. Les types d'antenne non inclus dans cette liste, ou dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

### **Detachable antenna**

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.