DATAWAVE

RS-485 Wireless Bridge

USERS MANUAL

R02

Contents

Overview

The RS-485 wireless bridge is designed to be a transparent RS-485 cable replacement. The RS-485 Wireless Bridge has a five pin screw terminal connector that can be configured for either RS-485 two-wire or four-wire communications mode. The RS-485 Wireless Bridge is available in three different frequency and RF power options differing by frequency and RF output power options.

It is possible to mix and match wireless bridge products. The RS-485 Wireless Bridge will communicate with the RS-485, RS-232, Analog and Digital I/O and USB wireless bridge products that share the same radio configuration. By using an RS-485 Wireless Bridge at point A and a RS-232 Wireless Bridge at point B, the wireless bridges can act as a RS-485 to RS-232 over-the-air converter.

Specifications

Performance

	24LP	24HP	09SX
OVER-THE-AIR DATA RATE	250 Kbps	250 Kbps	Low: 10Kbps Mid: 110Kbps High: 250Kbps
INDOOR/URBAN RANGE	Up to 200ft.	Up to 300ft.	Up to 1000ft.
OUTDOOR/ RF LINE-OF-SITE RANGE	Up to 4000ft.	Up to 2 miles	Up to 10 miles
TRANSMIT POWER	6.3 mW	63 mW	1 Watt
RECEIVE SENSITIVITY	-101 dBm	-101 dBm	Low: -113 dBm Mid: -106 dBm High: -103 dBm

Table 1. General Performance Specifications

Power Requirements

	24LP	24HP	09SX
INPUT VOLTAGE	7-30VDC	7-30VDC	7-30VDC
TRANSMIT CURRENT	12mA @ 12V	40mA @ 12V	270mA @ 12V
RECEIVE CURRENT	12mA @ 12V	12mA @ 12V	17mA @ 12V

Table 2. Power Requirements

Mechanical

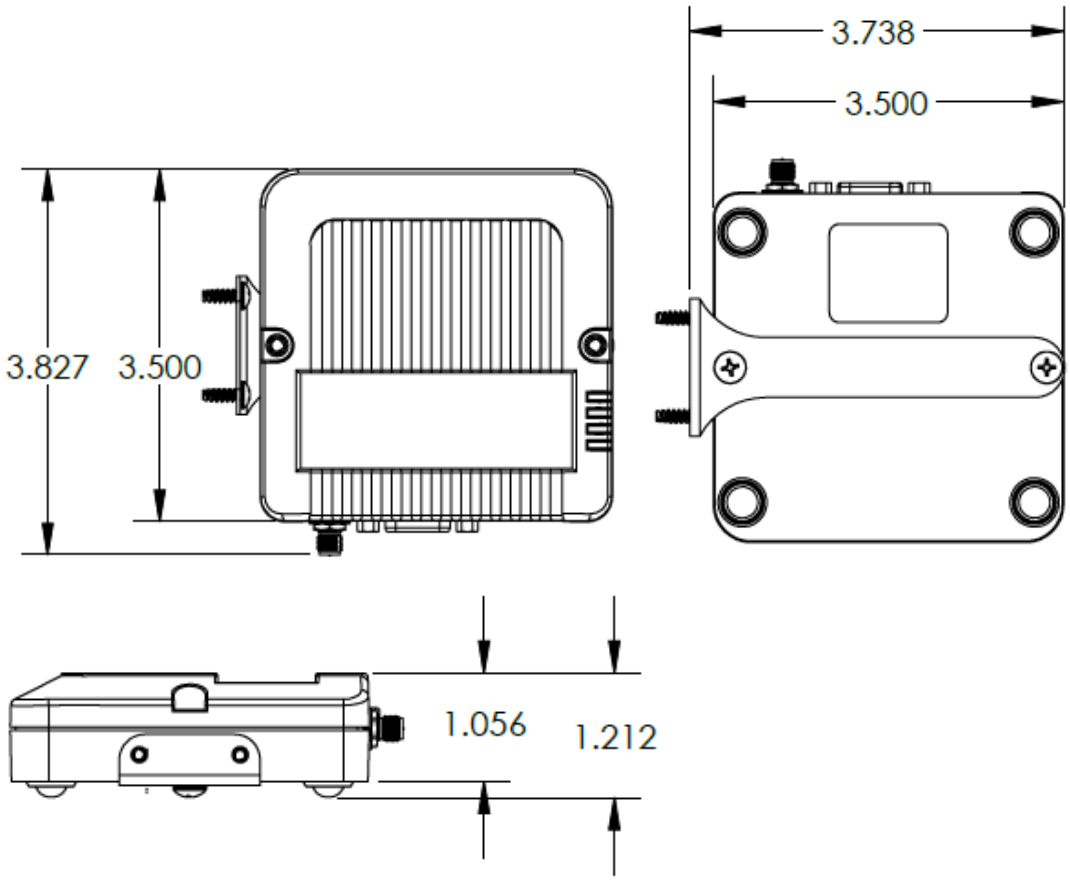

Fig. 1 Mechanical Dimensions

The mechanical dimensions for the wireless bridge are shown in Figure 1. The mechanical dimensions are shown with the optional DIN rail mount bracket which is not included with the standard part number. Mechanical data for the antenna is not shown.

Pinout and Wiring

The RS-485 Wireless Bridge uses RS-485 2-wire mode by default. In a normal 2-wire scenario only pin 1 (T/R+), pin 2(T/R-) and pin 5 (Signal GND) are used. The RS-485 Wireless Bridge can be set up to use 4-wire mode. Also, the device can be configured to use an internal termination resistor if needed. Commands and examples are given in the configuration section of this manual. Figure 2 & Figure 3 show the wiring and connectors for the RS-485 Wireless Bridge.

SCREW TERMINAL RS-485 PINOUT		
PIN	Name	Description
1	T/R+	T/R+ (Default 2 wire mode) RX + (4 wire mode input)
2	T/R-	T/R- (Default 2 wire mode) RX- (4 wire mode input)
3	TD-	Transmit - (4 wire mode only) – Device output
4	TD+	Transmit+ (4 wire mode only) – Device output
5	Ground (GND)	Signal Ground

Fig 2. RS-485 Screw Terminal Pinout

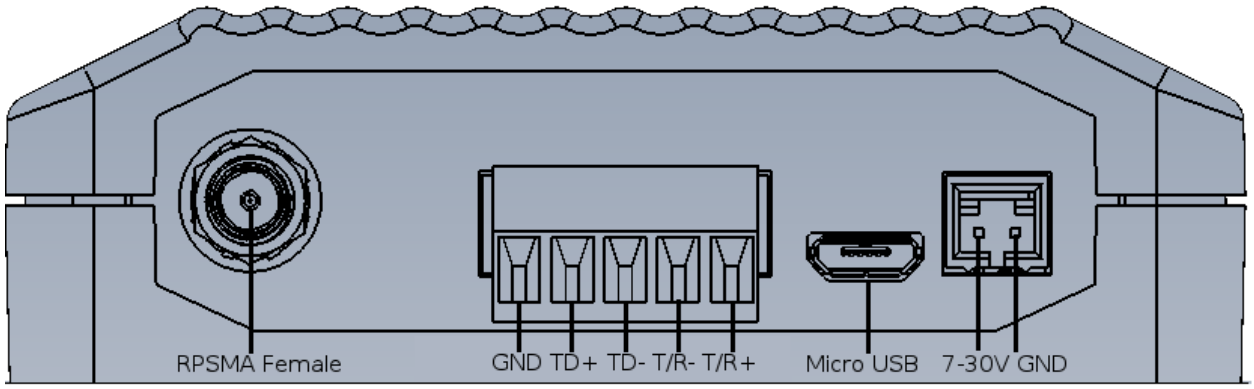

Fig 3. RS-485 Wireless Bridge Connectors and Pins

Operation

Standard Operation

The RS-485 Wireless Bridge is designed to be data transparent. By default, any data sent into one device is broadcast and received by all other Wireless Bridge devices within range. Any device that receives the transmitted data packet will send the received data out the serial port to its host. Without any configuration the Wireless Bridge will operate in a point-to-point or point-to-multipoint mode making it easy to replace an RS-485 multi-drop cable. Additional addressing can be used to isolate communication between specific devices or to create unique networks.

The Wireless Bridge device is equipped with a micro USB connector. When the micro USB connector is plugged into a USB host device such as a computer, the Wireless Bridge enumerates as two standard serial COM ports. One port is a data port and can send and receive data. The second COM port is the device's information port.

The Wireless Bridge uses standard composite device drivers which are preinstalled in Windows 10 and MAC computers. Drivers will need to be installed for Windows 7 machines. While not every machine will enumerate exactly the same, as a general rule the lower numbered COM port is for Wireless Bridge configuration. The higher numbered COM port can be used to transmit or receive data over the USB port.

LED Indication

The wireless bridge has four LEDS for indication. The Blue Power LED is lit any time the Wireless Bridge is properly powered. A green TX LED and yellow RX LEDs indicate activity on the serial port of the device. They do not necessarily reflect all activity that may be occurring over the air as they will only blink when a properly addressed data packet is received. The Special function LED is lit when the USB port is in use.

Data Formats and Baud Rates

The default baud rate and data format is 9600 baud, 8 data bits, no parity and one stop bit. The baud rate and data format can be adjusted by adjusting the BD and NB parameter of the radio module (See the Changing the Baud Rate section). Baud rates can be set from 1200 to 115200 bps. If the data of the sending or receiving devices do not correspond with the data settings of the Wireless Bridge then the output data will appear garbled.

Common Configurations and Use Cases

Radio Architectures

Point-to Point

Fig. 4 Typical RS-485 2-Wire Point-to-Point Configuration

The most basic architecture is a 2-wire point-to-point. In this mode, one Wireless Bridge Device communicates with a second Wireless Bridge Device. If more than one pair of radios are within range of each other, then certain addressing commands should be set within the on board Digi XBee radio to isolate the individual pairs. The commands that control addressing are:

ID – Controls the network identification number.

CH- Controls the channel (frequency) of the device.

DH & DL – Sets the destination address. For point-to-point mode DH & DL on Radio A should be set to the SH & SL values of Radio B and vice versa.

See the XBee S2C manual and X-CTU program for complete details.

XBee S2C Users Manual

https://www.digi.com/pdf/ds_xbee-s2c-802-15-4.pdf

X-CTU Program – Digi's XBee Configuration and Test Utility

https://www.digi.com/products/xbee-rf-solutions/xctu-software/xctu

Point-to-Multipoint

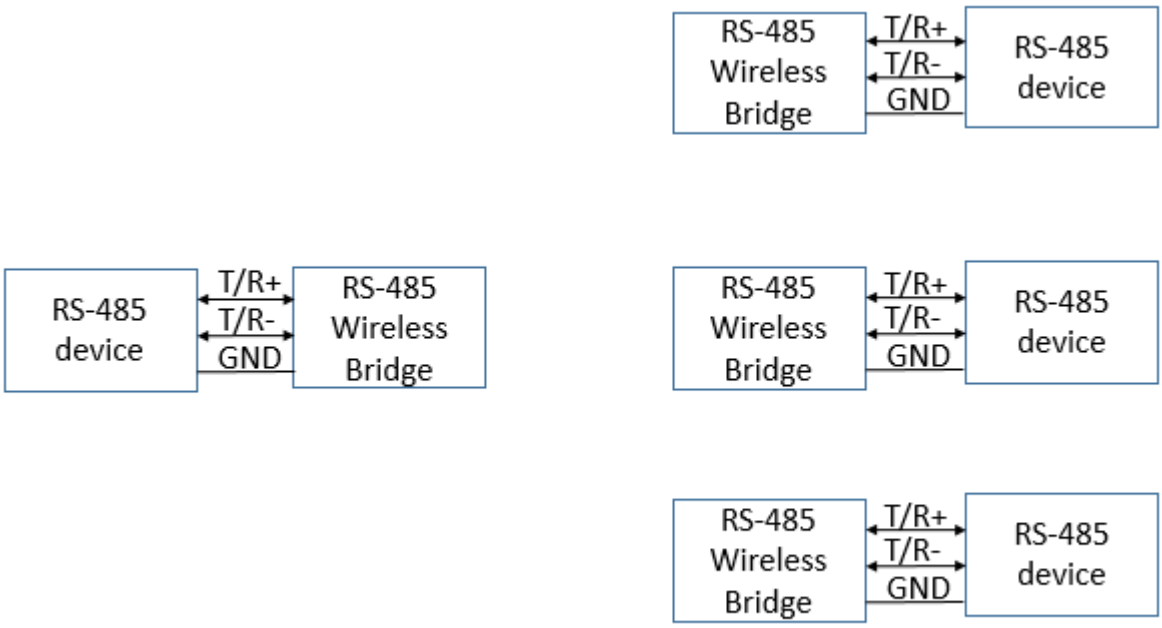

Fig. 5 Point-to-Multipoint Configuration

Figure 5 shows a typical point-to-multipoint configuration. By default, all the Wireless Bridge devices will broadcast their data meaning that point-to-multipoint mode will work without any configuration. Used this way, the Wireless Bridges are connected to devices that typically work in a poll/response protocol such as MODBUS. If there is the potential for other Wireless Bridge networks to be in the same area, then all devices in a given network may want to be set to a non-default PAN ID.

Communicating with the Wireless Bridge

The Wireless Bridge device can be connected to a PC through the micro USB port. Figure 6 shows the device manager view of an example connected device. Note that a single device shows up as two separate COM ports. In Figure 6, the COM ports are COM43 & COM44. The COM port numbers will vary from machine to machine depending on what COM port device drivers have been previously installed.

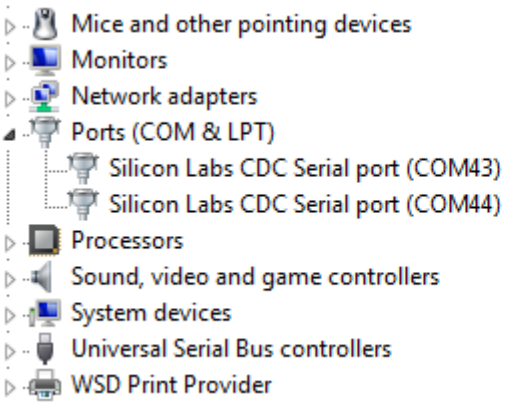

Fig. 6 Example COM port Device Manager View

COM ports can be opened with any terminal program. Putty, Tera term and X-CTU may all be used to send data and communicate with the Wireless Bridge. Links to some terminal programs can be found on the Datawave website.

Once a COM port has been opened, pressing the ENTER key can determine which port is the *data* terminal and which port is the *information* terminal. If a command prompt appears, then that port is the *information* terminal. The command prompt for the RS-485 Wireless Bridge indicates the Wireless Bridge type and appears similar to the text below.

RS485>

Typing 'help' at the command prompt will display the list of available commands as shown in Figure 7. Any data typed into the data terminal window will result in the data being transmitted. This can be confirmed by watching the TX LED blink when data is sent.

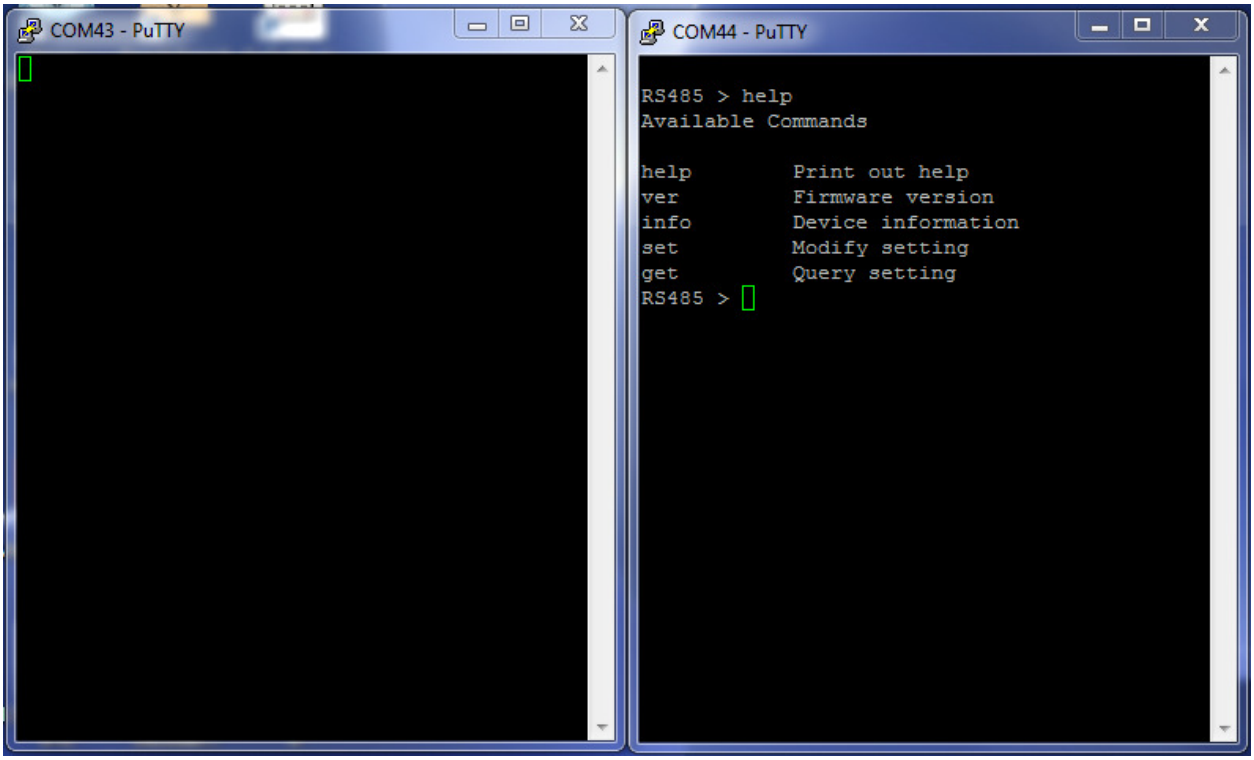

Fig. 7 Data and Information Terminals

RS-485 Command Reference Table

Main command	Function Command Name	Command Description	Default Value	Value Range
help		Displays list of main commands	NA	No parameters
info		Displays device serial number	NA	No parameters
set & get	defaults	Restores factory default settings.	NA	No parameters
	mode	mode 2 = RS-485 2-wire mode 3 = RS=485 4-wire	2	2 or 3
	pkts.en	Enables JSON output format when used with an ADIO Wireless Bridge when en = 1	0	0 or 1
	store	Stores settings to non-volatile memory.	NA	No parameters
	uart.rate	Changes the host to internal radio baud rate. This command should be used in conjunction with changing the radio baud rate.	9600	1200 - 115200
	uart.tr	Enables the termination resistor when tr = 1.	0	0 or 1
ver		Displays loaded firmware version	NA	No parameters

Fig 8. List of RS-485 Wireless Bridge Commands

Figure 8 lists the available commands for the RS-485 Wireless Bridge. The help, ver & info commands are issued at the command prompt and have no function commands or parameters. Set and get are used to set and read values for the various commands. Figure 9 shows an example of issuing the different commands in a terminal program. The set uart.tr 1 command enables the internal termination resistor.

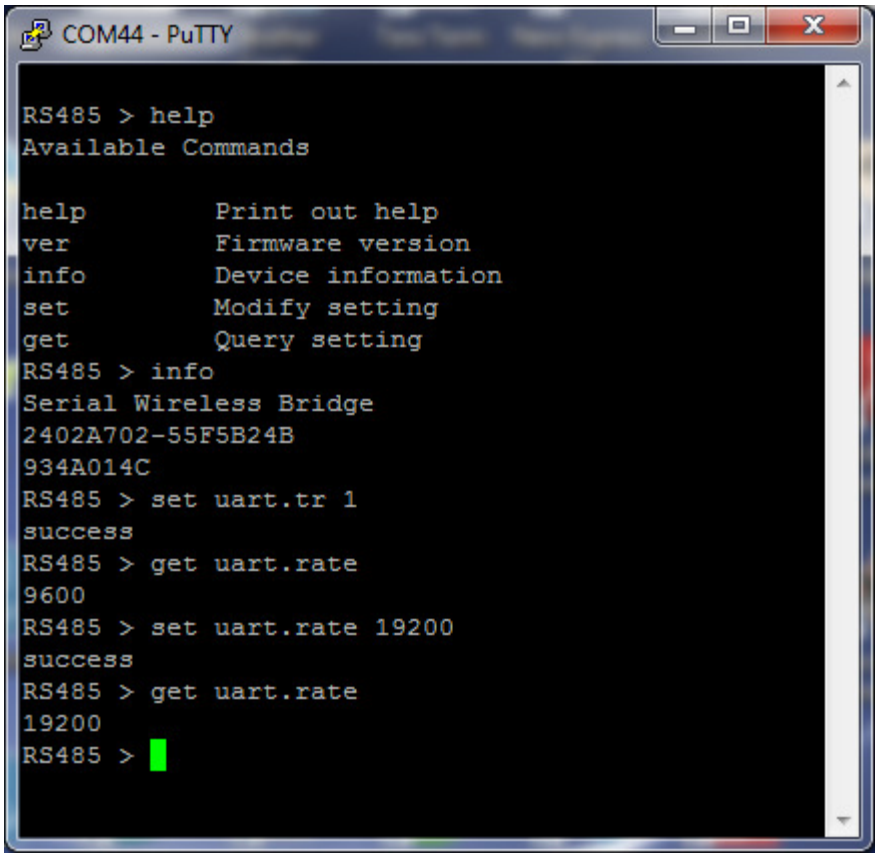

Fig. 9 Terminal Session Command Example

Configuring Two-wire or Four-Wire Mode

The default setting for the RS-485 Wireless Bridge is two-wire mode. The communications mode is controlled by the uart.mode command. To change to four-wire mode set the uart.mode to 3.

RS485> set uart.mode 3

Use the store command to write any changed parameters to non-volatile memory.

Changing the Baud Rate

The Wireless Bridge device is made up of two main components:

1. The host processor
2. XBee radio module

The host processor manages the USB interface, the information menu and communication to and from the XBee radio module. Changing the device's baud rate is a two-step process. In order to change the baud rate successfully, the following steps must be followed *in order.*

1. Change the baud rate on the XBee module through the ***data*** COM port using AT commands or the X-CTU program. Write the parameter to non-volatile memory.
2. Change the Wireless Bridge device baud rate through the ***information*** COM port using the set uart.rate command. Write to non-volatile memory using the set store command.

Example:

Changing the baud rate from the default 9600 to 115200 bps.

Step 1: Using the X-CTU program, the XBee radio module is discovered on the data port – in this case COM43. The baud rate is changed to 115200. The “Write” button is used to store the setting.

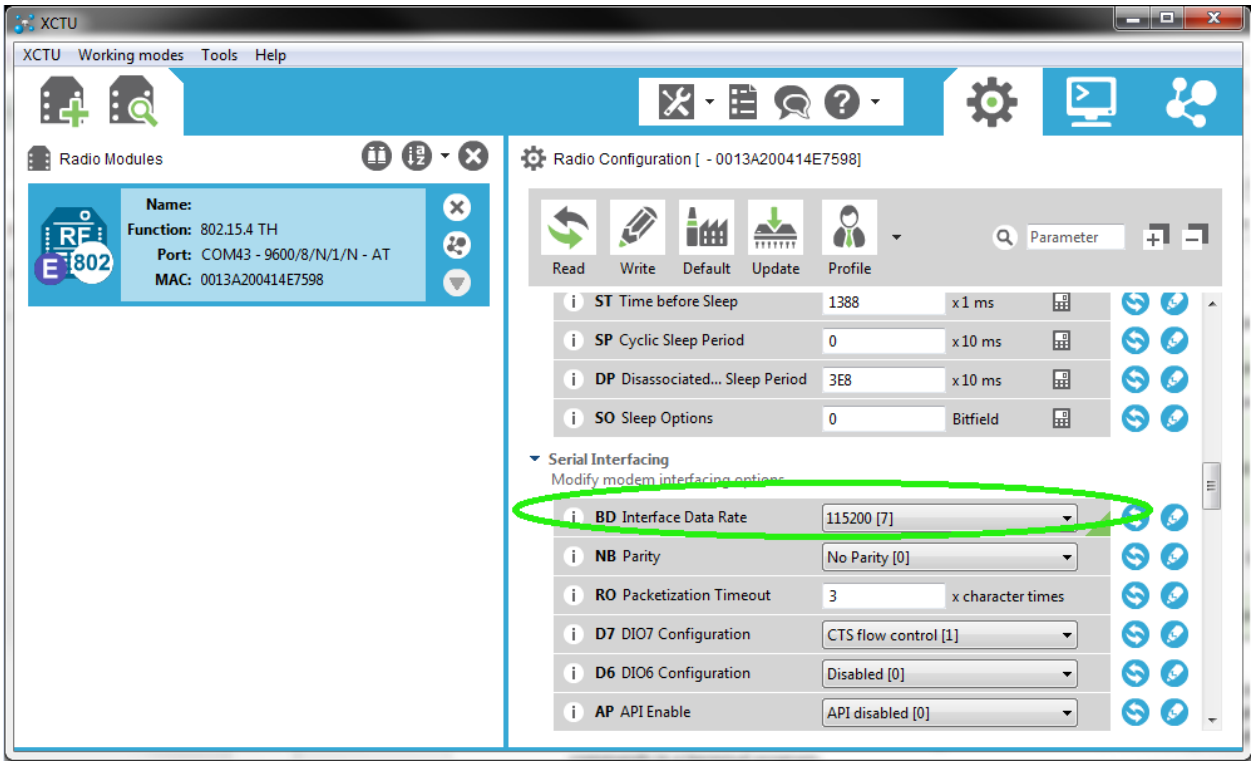

Fig. 10 X-CTU Baud Rate Setting

Step 2: On the Wireless Bridge information terminal (COM44 in this example) the set uart.rate 115200 is issued followed by set store.

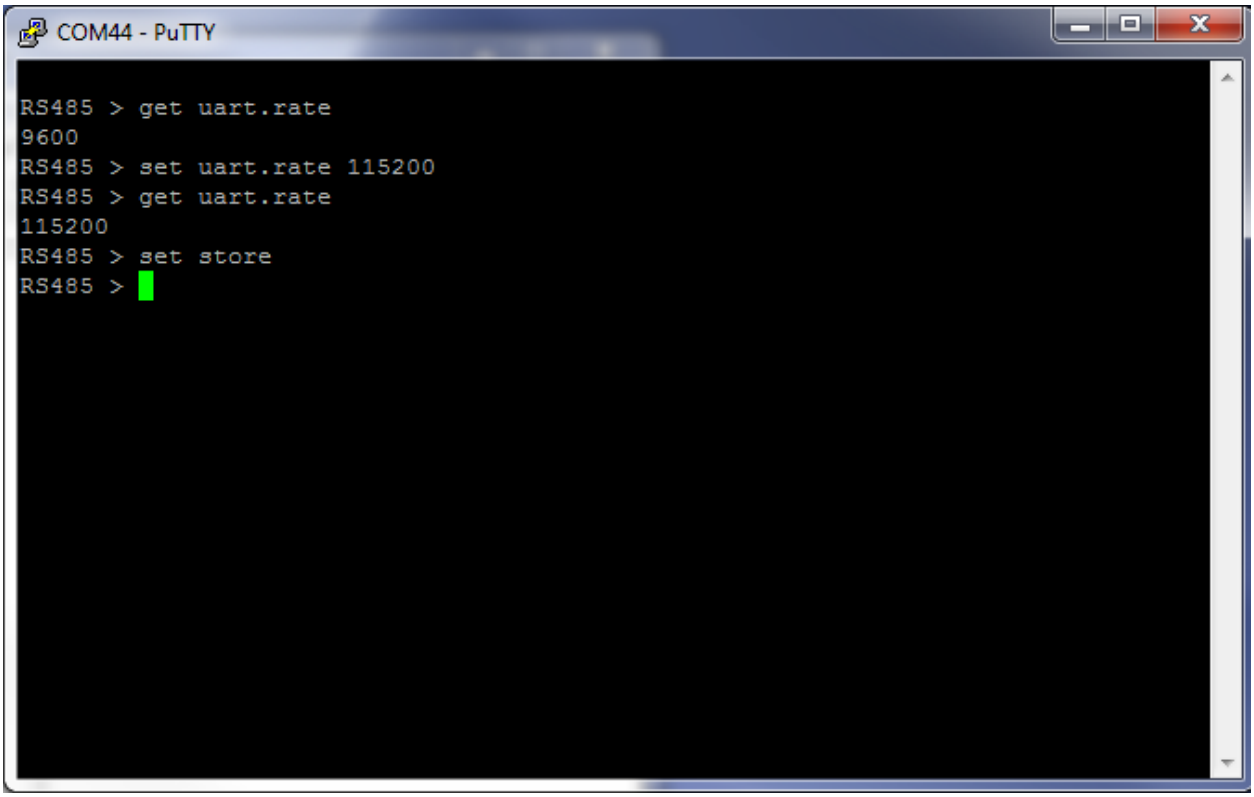

Fig. 11 Uart Rate Setting Example

Configuring the XBee Module

The RS-485 wireless bridge utilizes the Digi XBee module. Consequently, all radio settings can be read or set with Digi AT commands or Digi X-CTU software. As a general rule the only commands that might need be set are the Networking and Serial Interfacing commands. Any I/O commands or other features are not used. See Digi's website at www.digi.com and the XBee user manual and discussion forums for more information.

Antennas

The Wireless Bridge uses an RP-SMA Female connector. The Wireless Bridge is approved to be used with any 2.1dBi RP-SMA Male antennas that are frequency compatible. Datawave antenna part numbers include:

Part Number: ANT-2400-RP-2-A (2.4 GHz for the 24LP & 24HP variants)

Part Number: ANT-900-RP-2-A (900 MHz for the 09SX variant)

Part Numbers and Compatibility

The RS-485 Wireless Bridge comes with three basic options depending on range requirements. The 24LP and 24HP operate at 2.4 GHz and the 09SX operates in the 902-928MHz band. Any 24xx device can transmit and receive data from an 24xx RS-232, USB or ADIO Wireless Bridge. Likewise for the 09SX families.

Orderable Part Numbers	Description
WB-RS485-24LP-A	2.4 GHz 6.3mW Wireless Bridge RS-485
WB-RS485-24HP-A	2.4 GHz 63mW Wireless Bridge RS-485
WB-RS485-09SC-A	900 MHz 1W power Wireless Bridge 485

Certifications

United States (FCC)

The Datawave Wireless Bridges comply with Part 15 of the FCC rules and regulations.
Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required.

FCC notices

IMPORTANT: The RF device has been certified for remote and base radio applications.
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.

Parts manufactured by Datawave Wireless meet the specific requirements of the EU directive (Directive 2011/65/EU of the European Parliament and of the Council of 8 June 2011 on the restriction of the use of certain hazardous substances in electrical and electronic equipment) for the following banned substances:

Cadmium (Cd)
Mercury (Hg)
Polybrominated Biphenyl (PBB)
Lead (Pb) (per exemption 6)
Hexavalent Chromium
Polybrominated Diphenyl ether (PBDE)