User Guide: Radio module 450MHz

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Product overview

The ArduSimple 450MHz Radio Module is a compact UHF data radio in XBee form factor, based on the **Ebyte RD400D** transceiver. It operates in the 410–470 MHz band and is optimised for sending GNSS correction data over the air in surveying, precision agriculture and drone applications.

The module connects directly to any board via the standard XBee socket — no additional wiring or adaptors needed. The 450MHz Radio Module can be used in two different ways:

- Standalone connected to a PC using a USB-C to XBee carrier board (not included in the package).
- Plugged in one of the ArduSimple RTK boards connected directly to its XBee socket.

Main features:

- Radio module comes pre-configured to send corrections over the air at 19200 bps in low power mode (27 dBm) and allowing frequencies from 433.050 to 434.790 MHz matching european regulation.
- Simply plug onto your base and rover ArduSimple boards and they will synchronize with each other automatically at up to 5.6 km in open sky conditions.
- Configurable via serial commands — frequency, power, protocol and baud rate.
- Half-duplex operation — point-to-point and point-to-multipoint supported.
- Industrial temperature range: ?40 to +85°C.

The module is sold without antenna (use the appropriate antenna for 450Mhz radio)

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Top view

Bottom view

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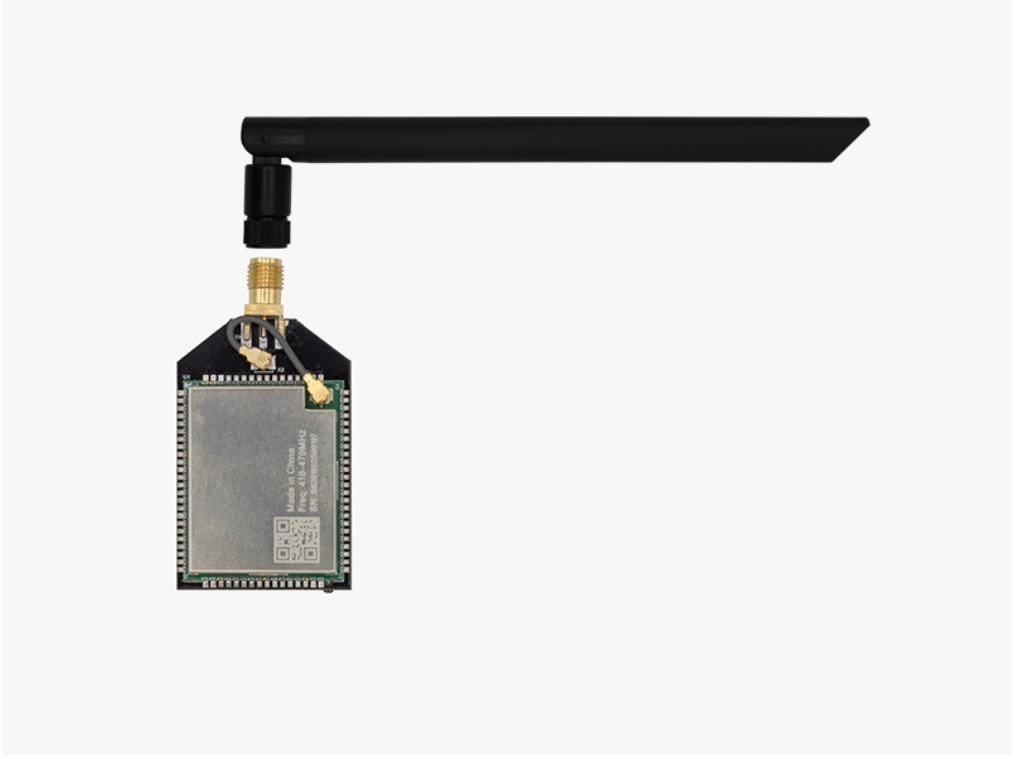
Get started

Step A: Connect antenna

The 450MHz Radio module can be connected to any dipole antenna, but a specific 450MHz antenna is required for best performance. The antenna should include an SMA female connector for connection. Cable antennas are useful if you want to keep the radio module indoor while the antenna is placed outdoors.

1. Align and screw the dipole antenna SMA connector to the radio module antenna connector by hand, do not use any tools as overtightening it might damage the module.

Always make sure to have the antenna connected before powering the radio module, otherwise it might overheat and get damaged.



Step B: Insert into the XBee socket

To use the radio module you will have to insert it into an XBee interface of one of the Ardusimple RTK boards or USB-C Carrier Board for XBee Plugins.

2. Orient the radio module board with the label **MOUNT XBEE LIKE THIS** (diamond shape) of the hosting board, and align the pins with its corresponding holes of the XBee socket headers.
3. Insert the radio module in the XBee socket.

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Step C: Power the radio module

4. To start using the radio module just power the hosting board:
    - By any of the power sources available on your RTK board, please check its specifications for power limitations.

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    - By connecting the carrier board USB port to a computer.
5. Once powered the XBee interface is fully transparent: data written to the serial port is transmitted over the air and delivered to the receiving unit unchanged.
6. Power level is configurable for compliance with regional regulations. Frequency, protocol and baud rate can be changed via serial commands using any serial terminal, please check the Configuration section of this guide.

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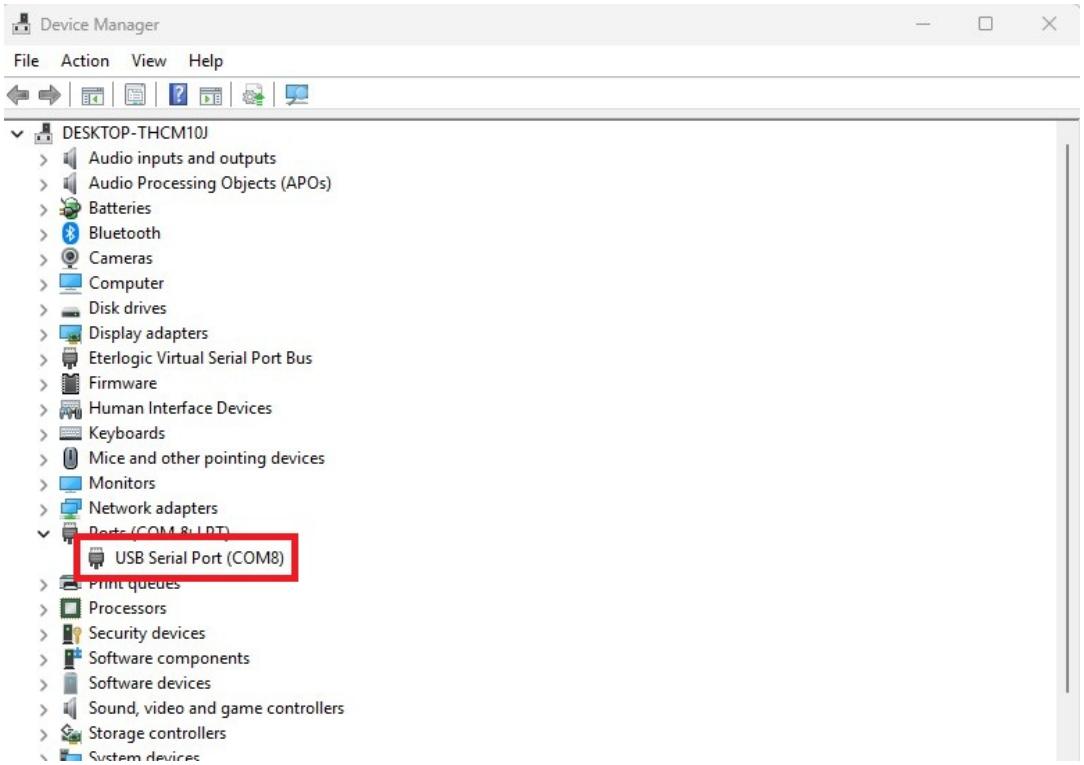
Advanced functionality

Configuration

To configure the module you will have to insert it into the XBee interface of one of the Ardusimple RTK boards or USB-C Carrier Board for XBee Plugins. Then use a USB cable to connect to a PC and Serial Port communication software as RealTerm Serial/TCP Terminal (Windows) to send commands to the radio module.

1. Connect the USB-C cable to the RTK board (USB port beside the XBee interface) or carrier board, and the other end to a **Windows PC**.
2. Check your device manager to find the **COM port** assigned to the connection.



3. Open **RealTerm** and go to **Port tab**. Set **Baud** to default 115200 (or whatever serial baud rate you previously configured) and **COM Port** to the number you found on the previous step. Press the **Change** button.

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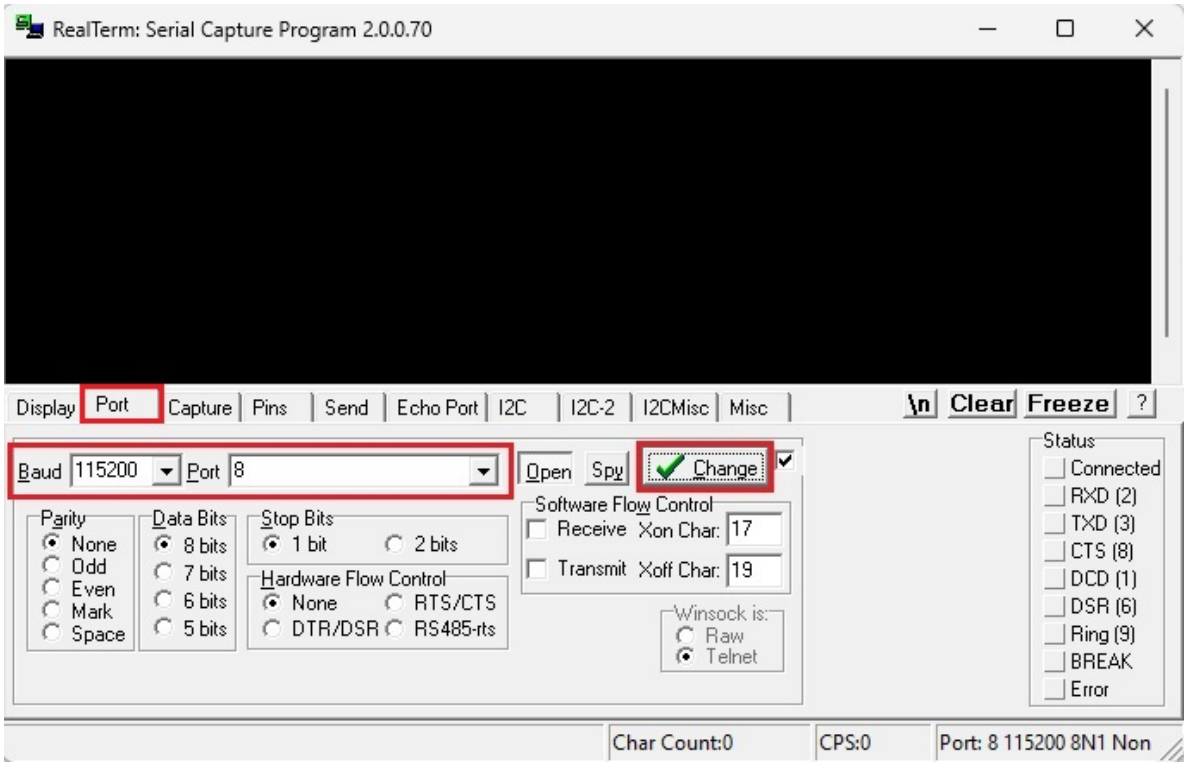
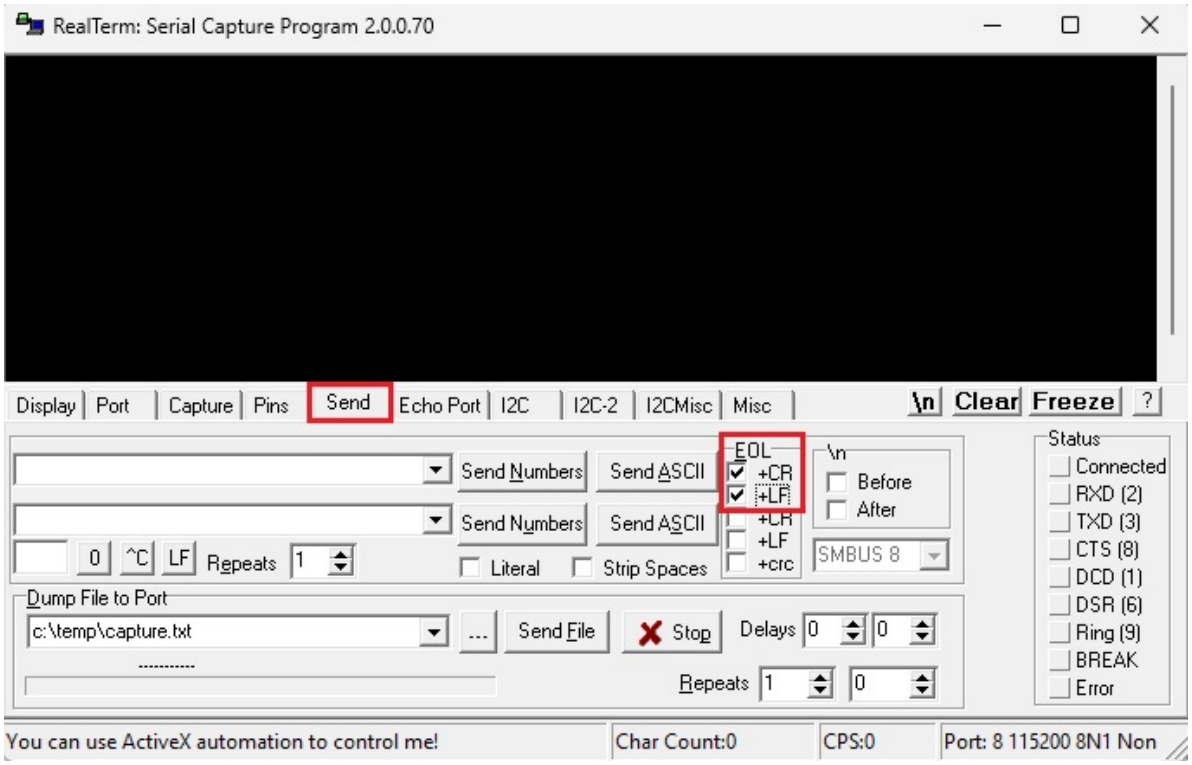


4. Go to **Send tab** and activate the **EOL +CR +LF** checkboxes.



Now you are ready to start sending configuration commands to the radio module. All commands are sent via the **UART interface** at the configured **serial baud rate** (115200

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bps by default), terminated with a **CR+LF (\r\n)** end of line.

Commands are space-separated from their parameters. A successful write returns **PROGRAMMED OK** and sending a command without parameters queries the current value.

5. Hold the **CONFIG** button before sending any command, and release it to return to data transmission mode.

Power

Sets the power level:

- **H: 30 dBm (1 W)** — High power mode (check local regulations before using it).
- **M**: Normal power mode.
- **L: 27 dBm** — Low power (default).

Command	Example	Response
PWR H M L	PWR L	PROGRAMMED OK
PWR (query)	PWR	PWR L

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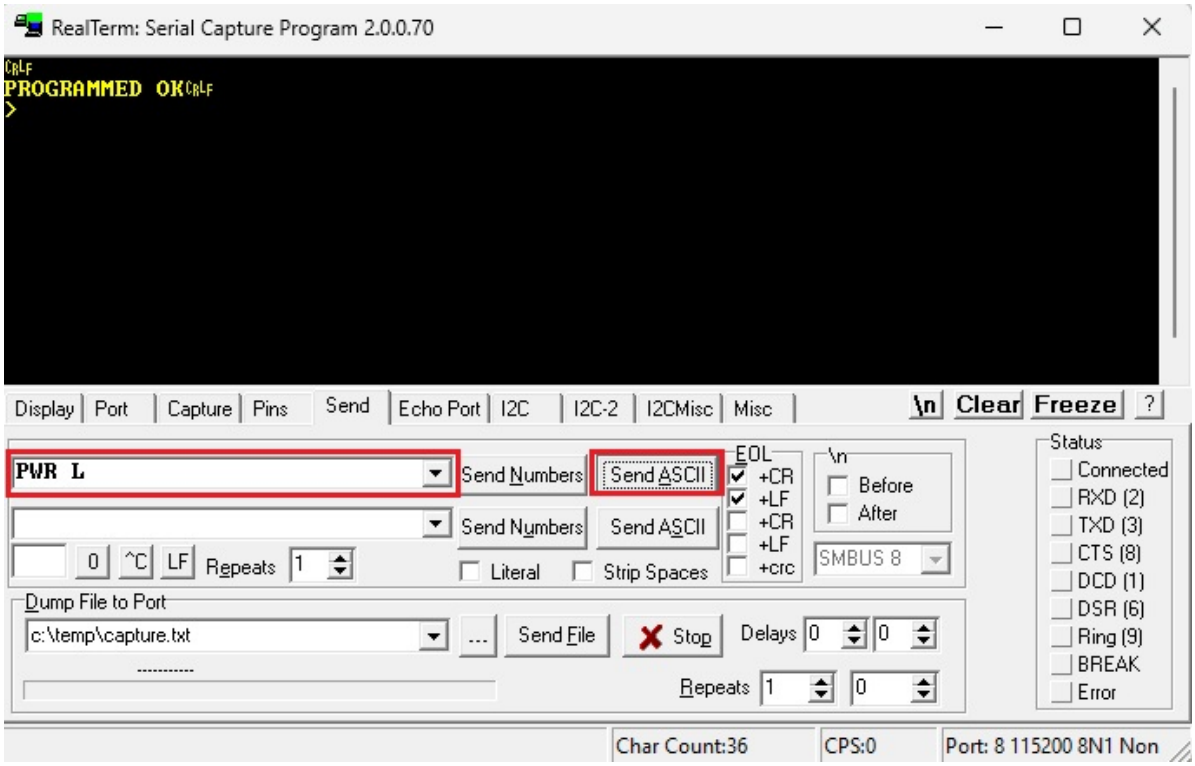

Protocol

Sets the **over-the-air protocol**. Both ends of the link must use the same protocol and matching air baud rate:

- **TRIMTALK — 9600 bps** only.
- **TRIMMK3 — 19200 bps** only (default).
- **TRANSEOT— 4800 or 9600 bps**.

Command	Example	Response
PRT TRIMTALK TRIMMK3 TRANSEOT	PRT TRIMMK3	PROGRAMMED OK
PRT (query)	PRT	PRT TRIMMK3

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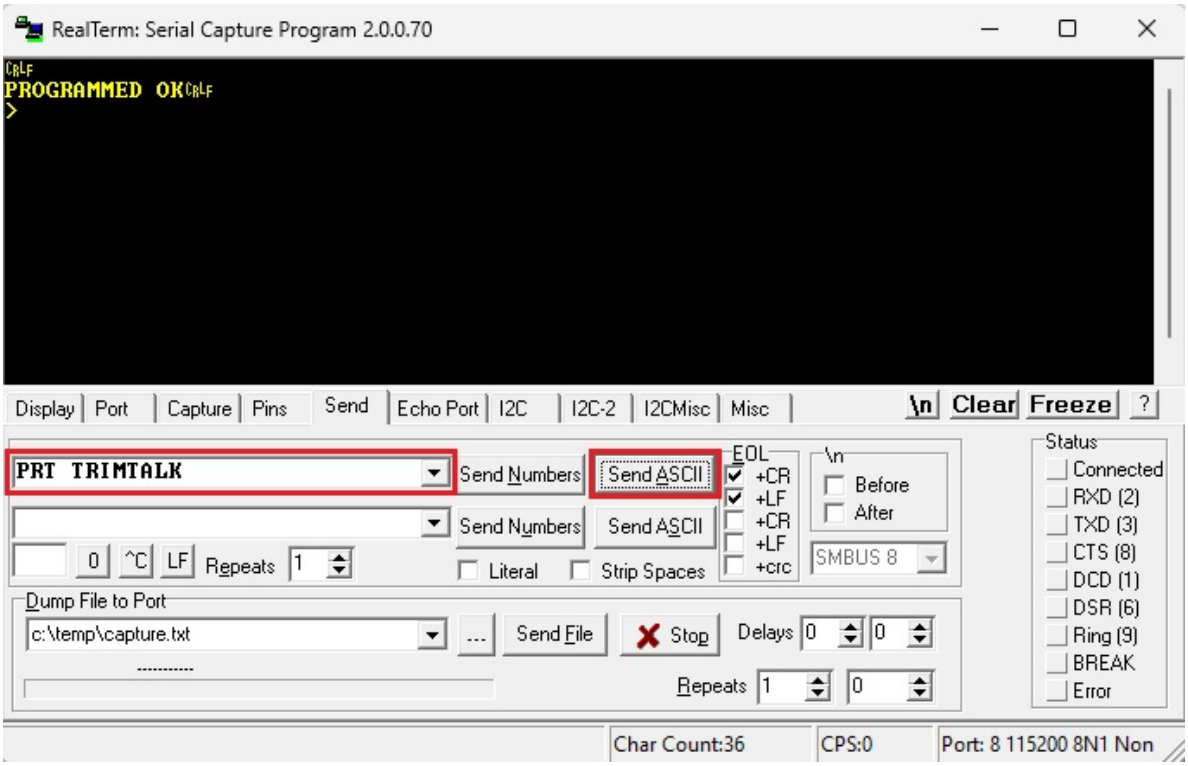

When using **TRANSEOT protocol at 4800 bps** data rate is reduced, and therefore you can only send correction data for 2 constellations of satellites.

Air Baud Rate

Sets the **over-the-air baud rate**. Must match the protocol in use — see protocol table above. Default is **19200 bps**.

Command	Example	Response
BAUD 4800 9600 19200	BAUD 19200	PROGRAMMED OK
BAUD (query)	BAUD	BAUD 19200

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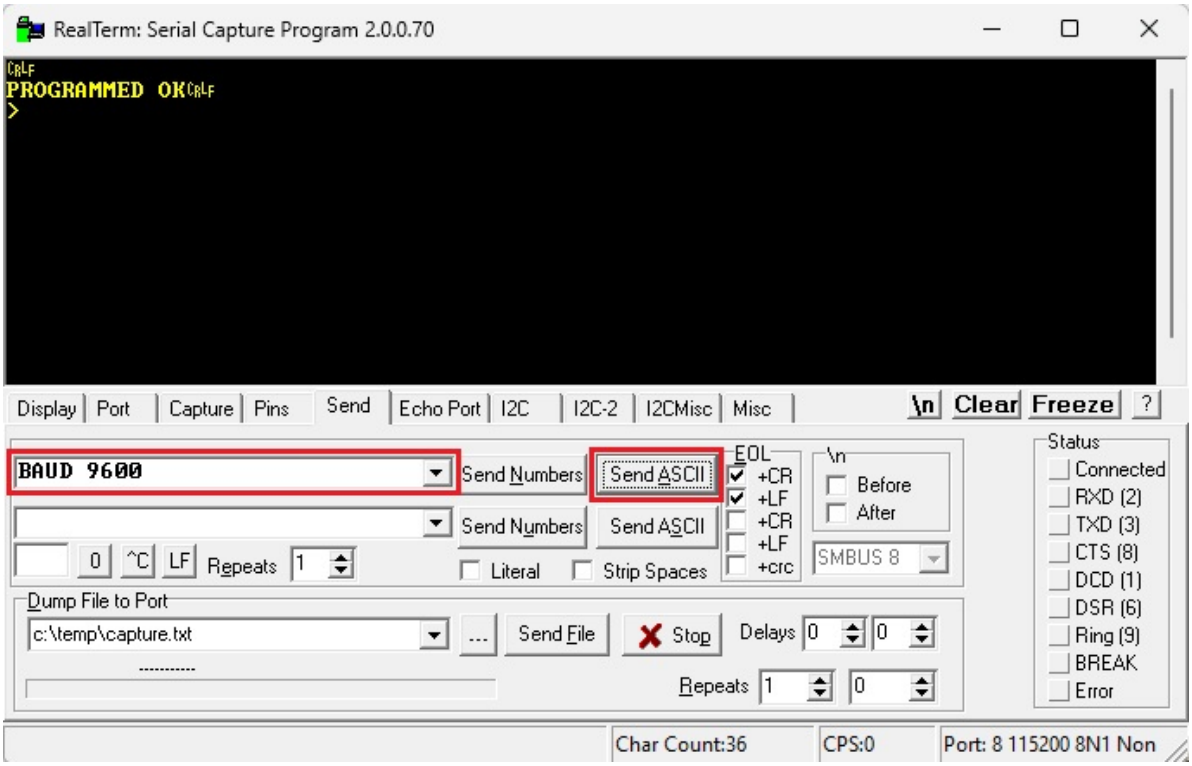

Serial Baud Rate

Sets the **UART baud rate** between the module and the host. Default is **115200 bps**. If you change this, reconnect your terminal at the new rate before sending further commands.

Command	Example	Response
SBAUD 9600 19200 38400 57600 115200	SBAUD 115200	PROGRAMMED OK
SBAUD (query)	SBAUD	SBAUD 115200

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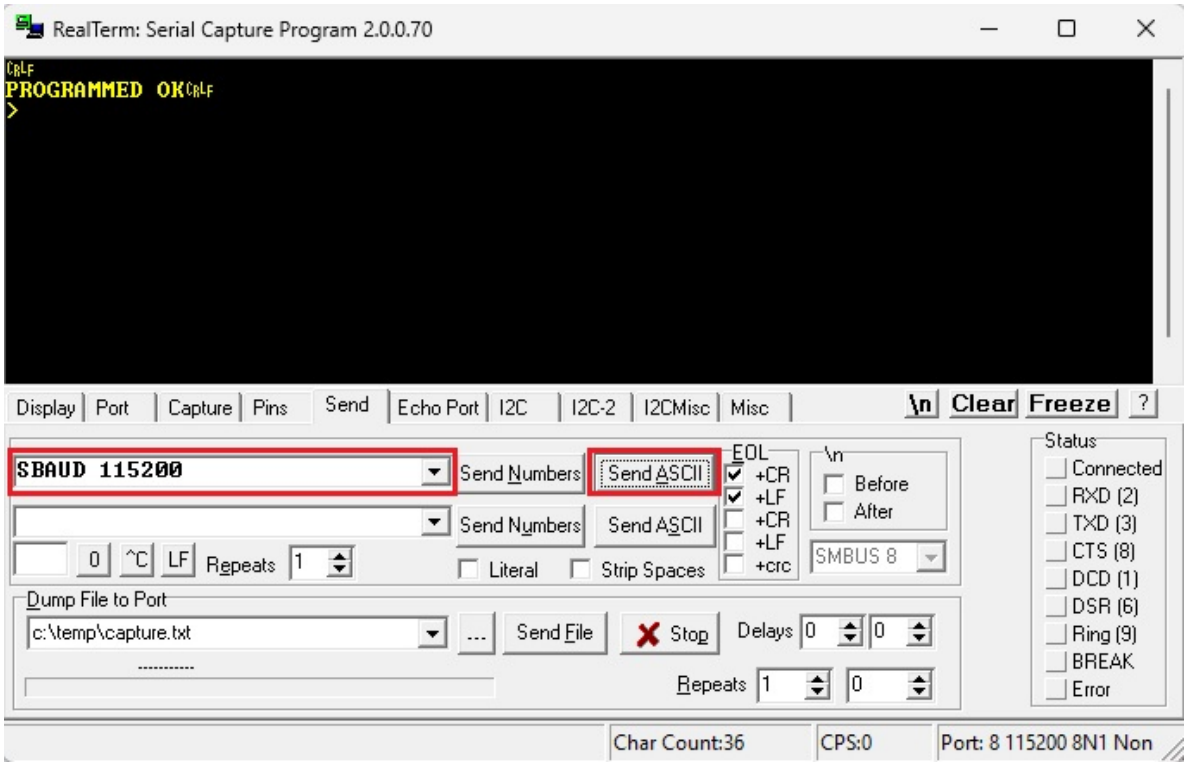

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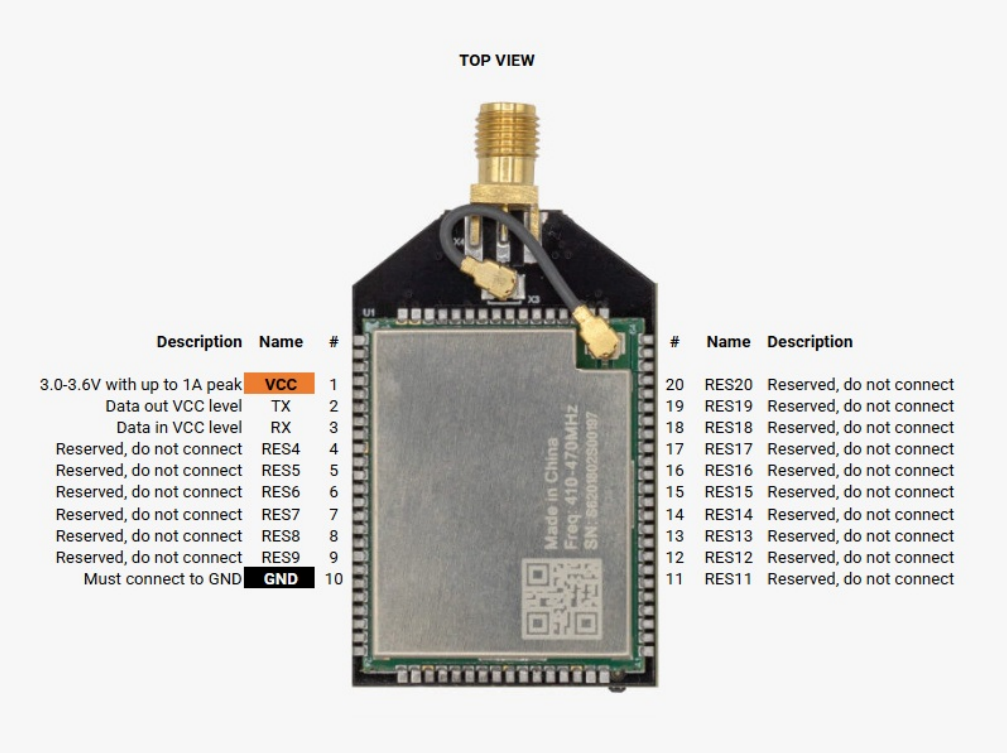
Hardware

Pinout

The **Radio Module 450MHz** uses the standard **XBee 2mm pitch 20-pin** footprint. Only **VCC, TX, RX** and **GND** are connected — all others are reserved and must not be connected.

- **Pin 1 – VCC**: Power supply 3.3–3.6 V. Must be connected.
- **Pin 2 – TX**: Serial data out (3.3 V logic). Connect to host RX.
- **Pin 3 – RX**: Serial data in (3.3 V logic). Connect to host TX.
- **Pin 10 – GND**: Ground. Must be connected.
- **Pin 4 to 9 and 11 to 20**: Reserved. Do not connect.



Antenna

The **Radio Module 450MHz** requires a good quality **dipole antenna**, if you use a generic dipole antenna you will not achieve the expected performance. The antenna has to be specific for the 450 MHz frequency, as the ArduSimple Dipole antenna for 450MHz radio.

Always connect the antenna before powering the board to avoid overheating, specially if configured at the maximum output power of 1 Watt. That being said, just connect the antenna to the **SMA connector** without using tools (the strength of your fingers is

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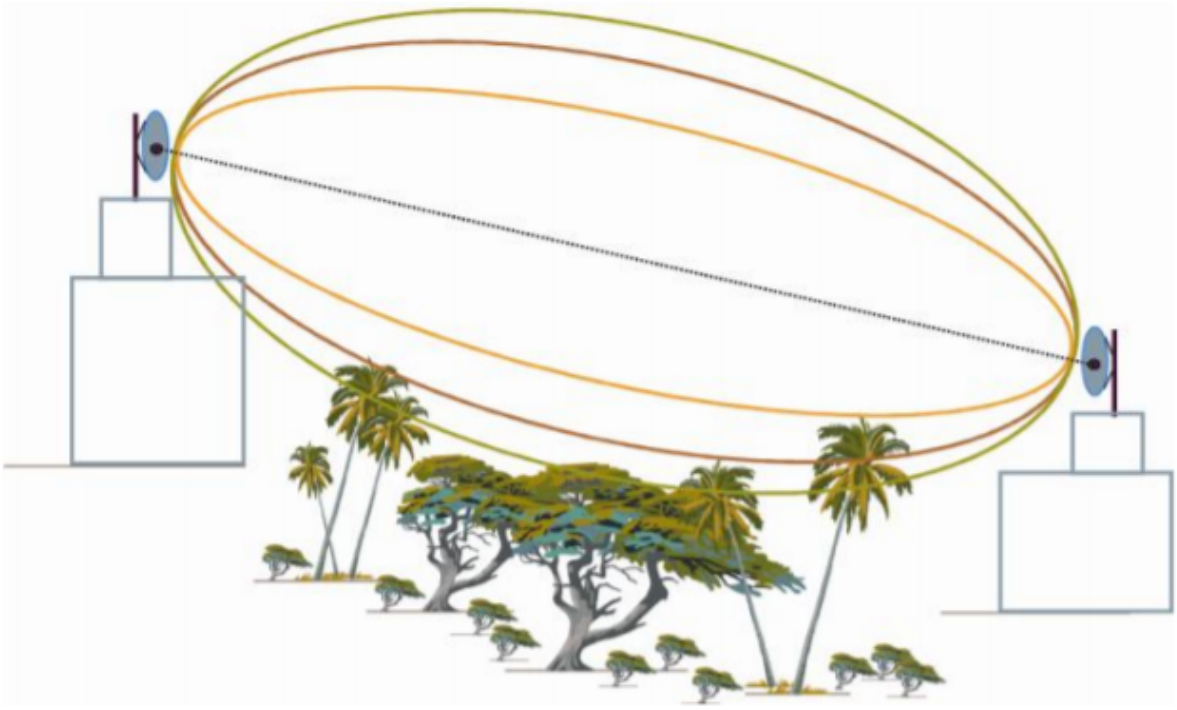
enough).

The placement of the antennas is also key to achieve best results. The antennas on both emitter and receivers should have diret line of sight to each other, without any obstructing objects (buildings, trees, laptop screen, …) in-between them. Also as much separation from the ground as possible is recommended for best performance. Please check our tutorial on Visual vs. RF Line-of-Sight – What is the difference?



Buttons

Holding the **CONFIG button** on the PCB puts the module into configuration mode, allowing the user to send commands, and releasing it returns to data transmission mode. See the Configuration section to find the commands.

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Related tutorials

- LR/XLR radios global country compatibility list
- XLR radios range test: 18km, 28km and 41km baseline
- How to connect your phone remotely via radio to GNSS receiver which is 10 kilometers away
- How to send NTRIP corrections to ArduPilot with MissionPlanner, QGroundControl and MAVProxy
- How to connect to the Base station and see the Rover's position in real time with the Base+Rover Kit

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Accessories and spare parts

Here you can find affordable accessories for your radio module.

Accessories
USB-C Carrier Board for XBee Plugins

Accessories
JST Carrier Board for XBee Plugins

Accessories
Dipole antenna for 450MHz radio

Accessories
mPCIe Carrier Board for XBee Plugins

Accessories
RS232 Carrier Board for XBee Plugins

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