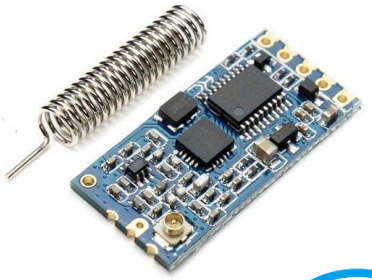
Telemetry

There are Several Options but they are all practically same operation , the Means to communicate information between your Robotic Vehicle and your ground station.

The most acceptable cross compatible means of communication is thru UART Serial for much of the devices , Serial Radio , LORA , Infrared , Bluetooth

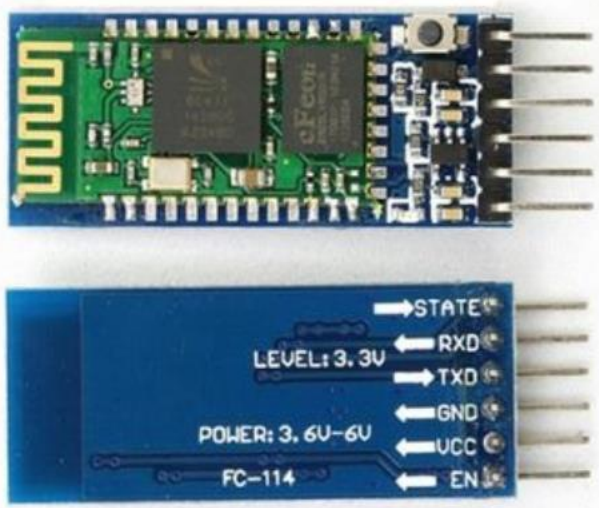


Bluetooth®

LoRa

SiK

XBee™



BLUETOOTH

Bluetooth setup with the USB TTL and Arduino IDE

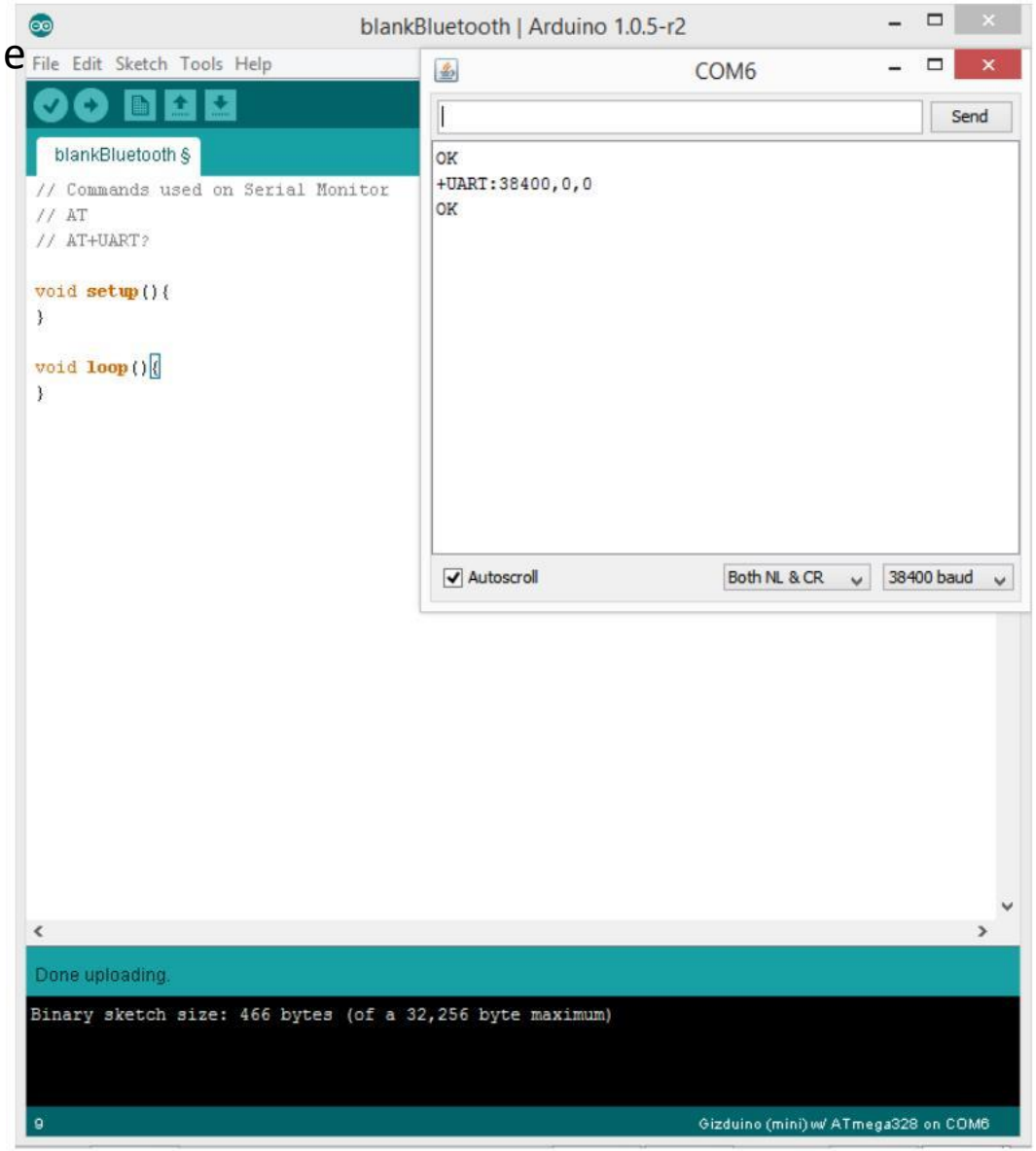
Arduino IDE>Tools>Serial Monitor (Push Button Before Connecting the USB) Set (Baud 38400) (Both NL & CR)

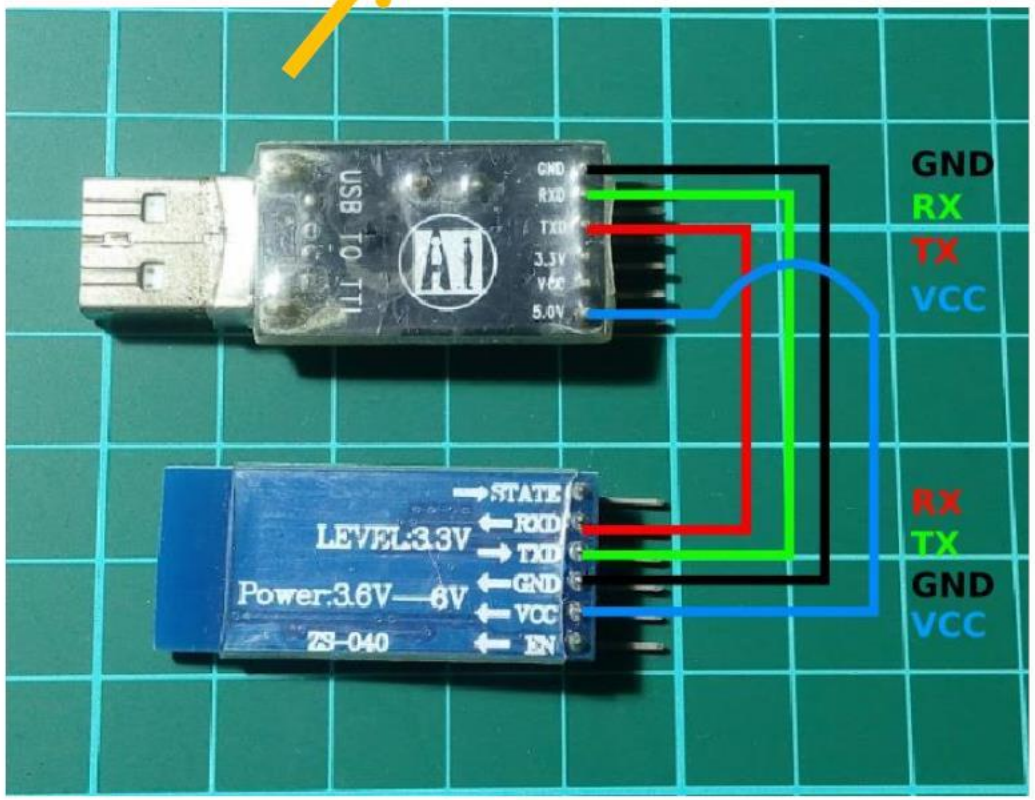
AT : check the connection
AT+VERSION : Check Version

HC-05 (Recommended)

AT+NAME=ArduinoDrone
AT+PSWD=1234 (Version 2)
AT+PSWD="1234" (Version 3)
AT+PIN "1234" (Version 5)
AT+UART=115200,1,0

HC-05 (Recommended)





Bluetooth setup with the USB TTL and Arduino IDE

Arduino IDE>Tools>Serial Monitor (hold the Button while Plugging USB) to go programming mode Set (Baud 38400) (Both NL & CR)

Hold Press when sending AT command (Version 5)

AT : check the connection
AT+VERSION : Check Version

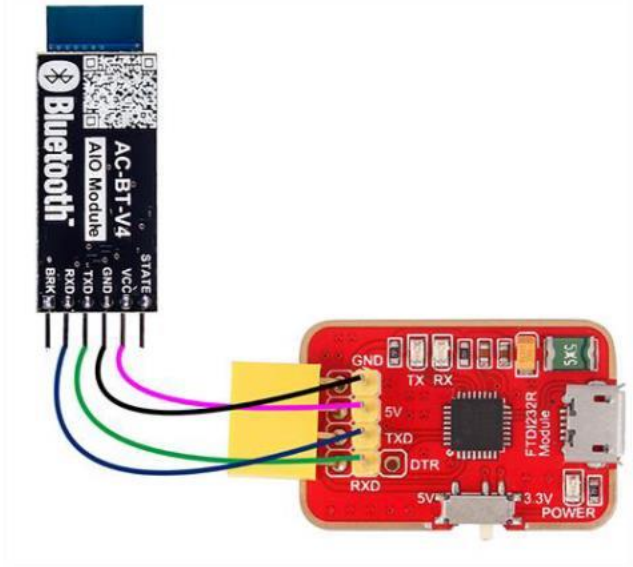
HC-05 (Recommended)

AT+NAME=Change name (Synerduino)
AT+PSWD=1234 (Version 2)
AT+PSWD="1234" (Version 3)
AT+PIN"1234" (Possibly works on Version 5)
AT+UART=115200,1,0 (115200 FOR BLUETOOTH)

HC-06

AT+NAME: Change name
AT+PIN: change pin, xxxx is the pin, again, no space.
AT+BAUDX, where X=1 to 9
1 set to 1200bps, 2 set to 2400bps, 3 set to 4800bps
4 set to 9600bps (Default)
5 set to 19200bps,6 set to 38400bps, 7 set to 57600bps
8 set to 115200bps

HM-10 Bluetooth



Setup with FTDI + Arduino Serial Monitor + AT Command

AT+NAME? (Query name)
AT+ADDR? ((Query Mac address)

First you will need to Query the native MAC address using AT Command **AT+ADDR?**
You will get something like this 20C38FF61DA1, each BLE has a unique MAC address.

Use **AT+CON[param1]** and **AT+ROLE[param1]** to pair to another device.

Example
BLE A has Mac Address 11C11FF11DA1, I used **AT+ADDR?** to figure it out BLE B has Mac Address 22C22FF22DA2, I used **AT+ADDR?** to figure it out
Send **AT+CON**22C22FF22DA2 to BLE A Send **AT+CON**11C11FF11DA1 to BLE B (Send the B address to A, A address to B)
Send **AT+ROLE0** to BLE ASend **AT+ROLE1** to BLE B (Doesn't matter which one)
Now it's ready to use on you ATMEGA 328P, Arduino or Attiny. **The red light will stay solid after the connection has been made on both BLE. This should take less than a second.**

HM-10 (Original)

AT (Check if new configuration is working)

AT+NAME (Query name)

AT+ADDR (Query Mac address)

AT+BAUD (Query Baud)

AT+PASS (Query current Pincode)

AT+PIN **(Query current Pincode on some BL module)**

AT+TYPE (Query authentication mode)

AT+ROLE (Query Peripheral (Slave) or Central (Master) mode)

AT+TYPE

0:Not need PIN Code

1:Auth not need PIN

2:Auth with PIN

3:Auth and bond

AT+BAUD

0 – 9600:

1 – 19200

2 – 38400

3 – 57600 (Some BL its 4800)

4 – 115200

5 – 4800

6 – 2400

7 – 1200

8 – 230400 (Some BL its 115200)

AT+NAMEArduinoDrone

AT+BAUD4 set baud to 115200 (we want this for high speed)

AT+BAUD8 set baud to 115200 (on some BL module)

AT+PASS123456 Set password to 123456

AT+PIN123456 Set password to 123456 (on some BL module)

AT+ROLE

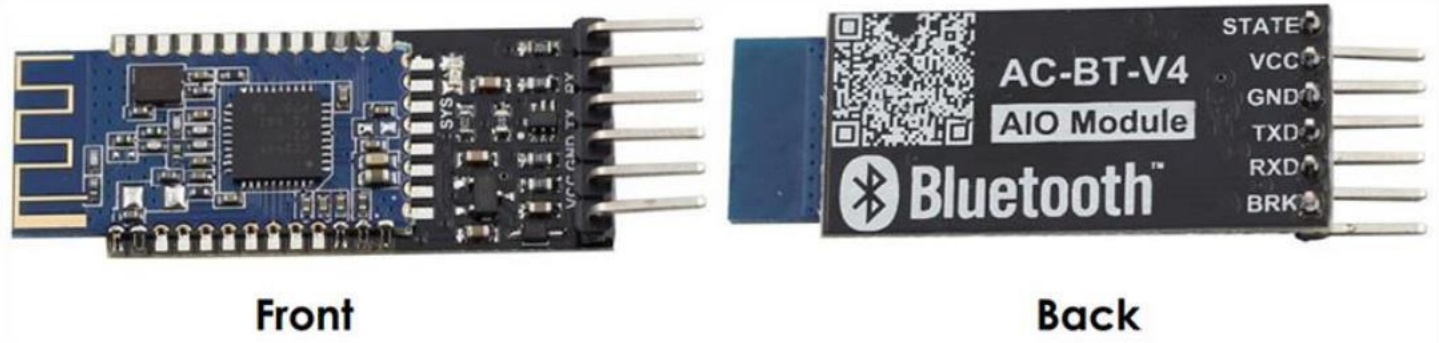
0 = Slave or Peripheral

1 = Master or Central.

AT+TYPE2

AT+TYPE1 (on Some BL modules)

AT+ROLE0



Front Back

Note : there are several clones of this type in the market that can be very difficult to setup

HC12

HC-12 Long Range Wireless Communication Module

HC12

Same you would be using an Arduino IDE as Serial Monitor

1. AT – Test command.
Example: Send “AT” to module, and the module returns “OK”.

2. AT+Bxxxx – Change the serial port baud rate.
Available baud rates: 1200 bps, 2400 bps, 4800 bps, 9600 bps, 19200 bps, 38400 bps, 57600 bps, and 115200 bps. Default: 9600 bps.

Example: Send “AT+B38400” to module, and the module returns “OK+B19200”.

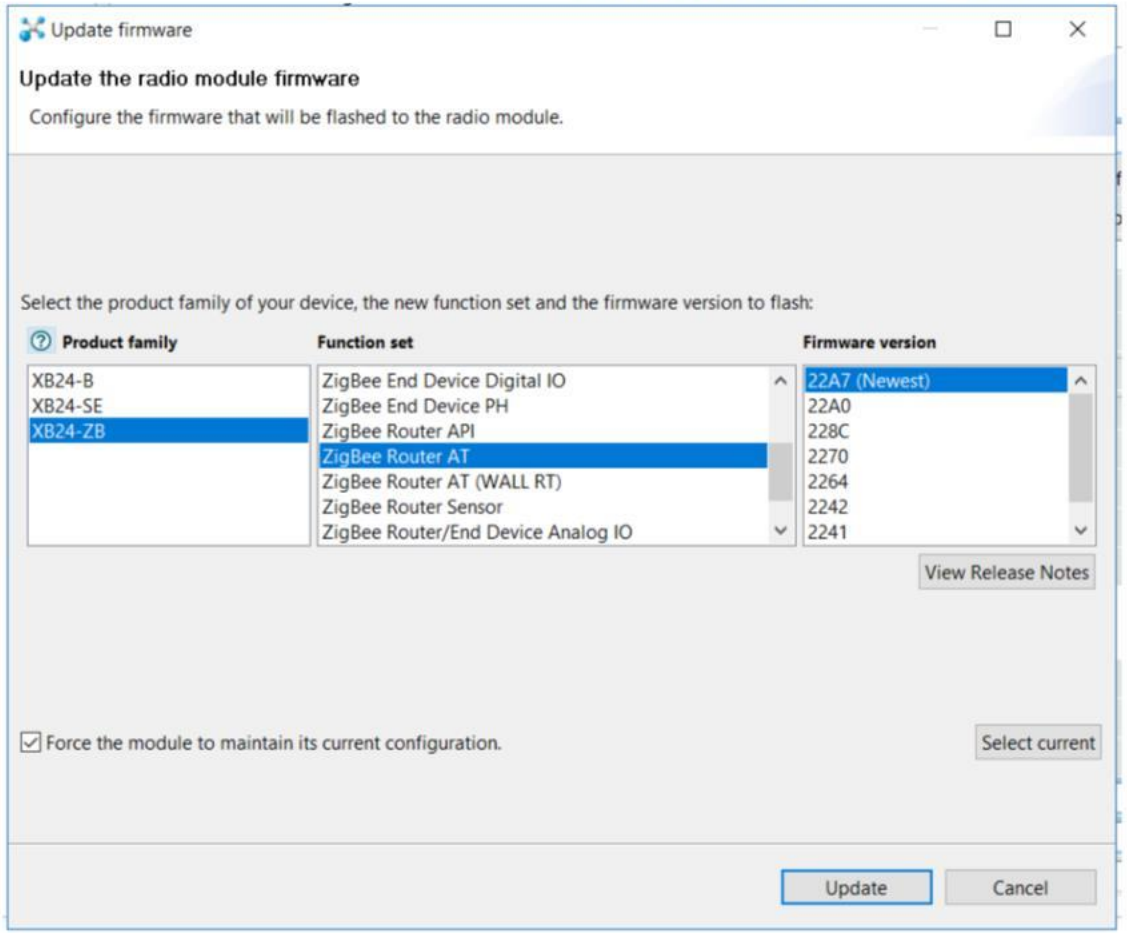
3. AT+Cxxxx – Change wireless communication channel, from 001 to 100.
Default: Channel 001, with working frequency of 433.4MHz. Each next channel is 400KHz higher.
Example: If we want to set the module to channel 006, we need to send “AT+C006” command to the module, and the module will return “OK+C006”. The new working frequency will be 435.4MHz.

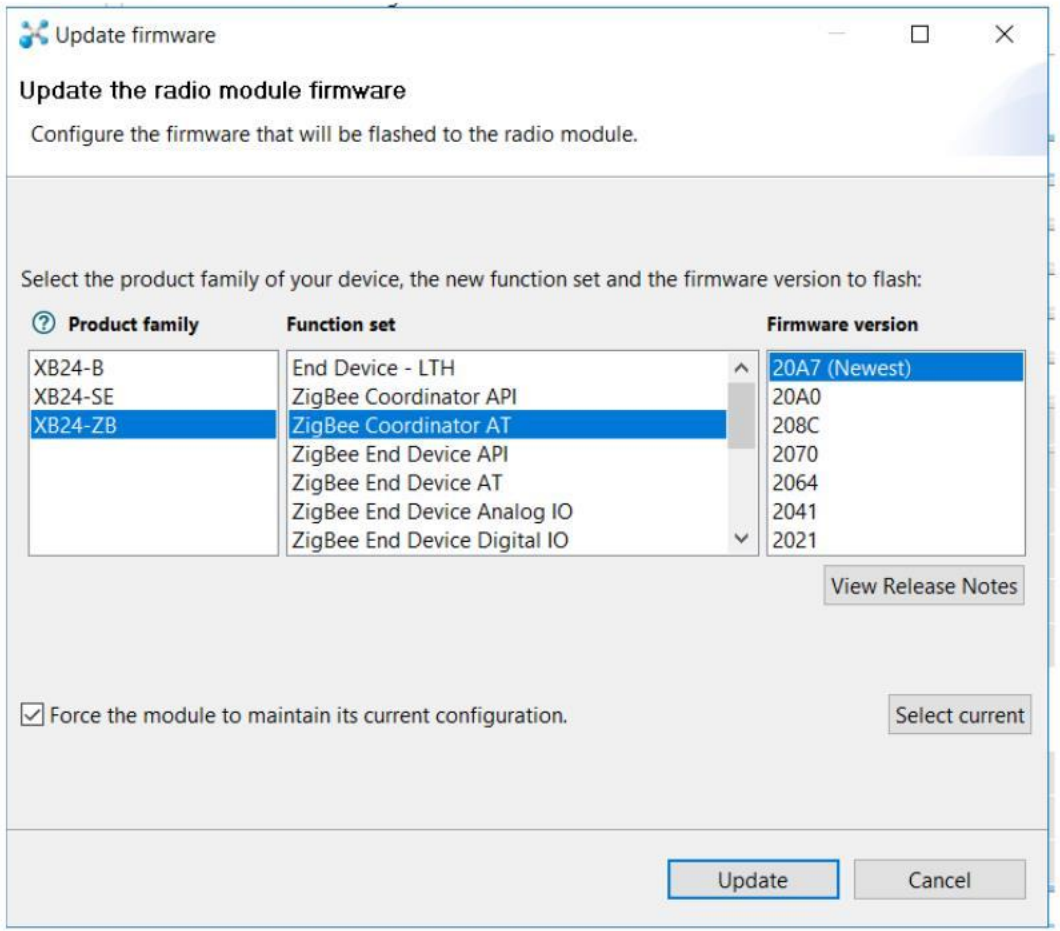
Download [40003026_CXCTU-1.zip](#)

XBEE S2 RADIO

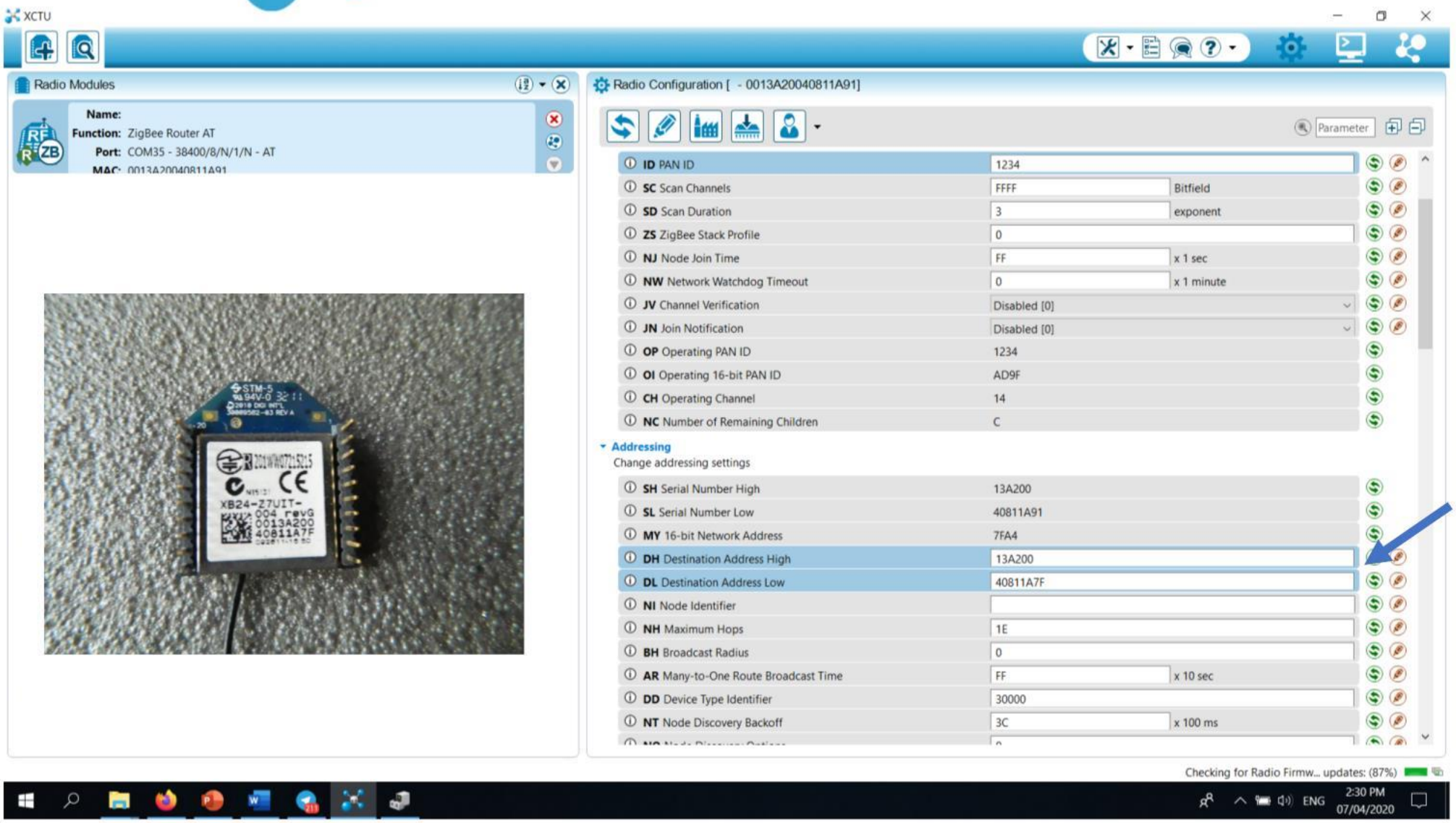
GROUND STATION ROUTER
38400 8/N/1/N - AT

AIRCRAFT COORDINATOR
38400 8/N/1/N - AT

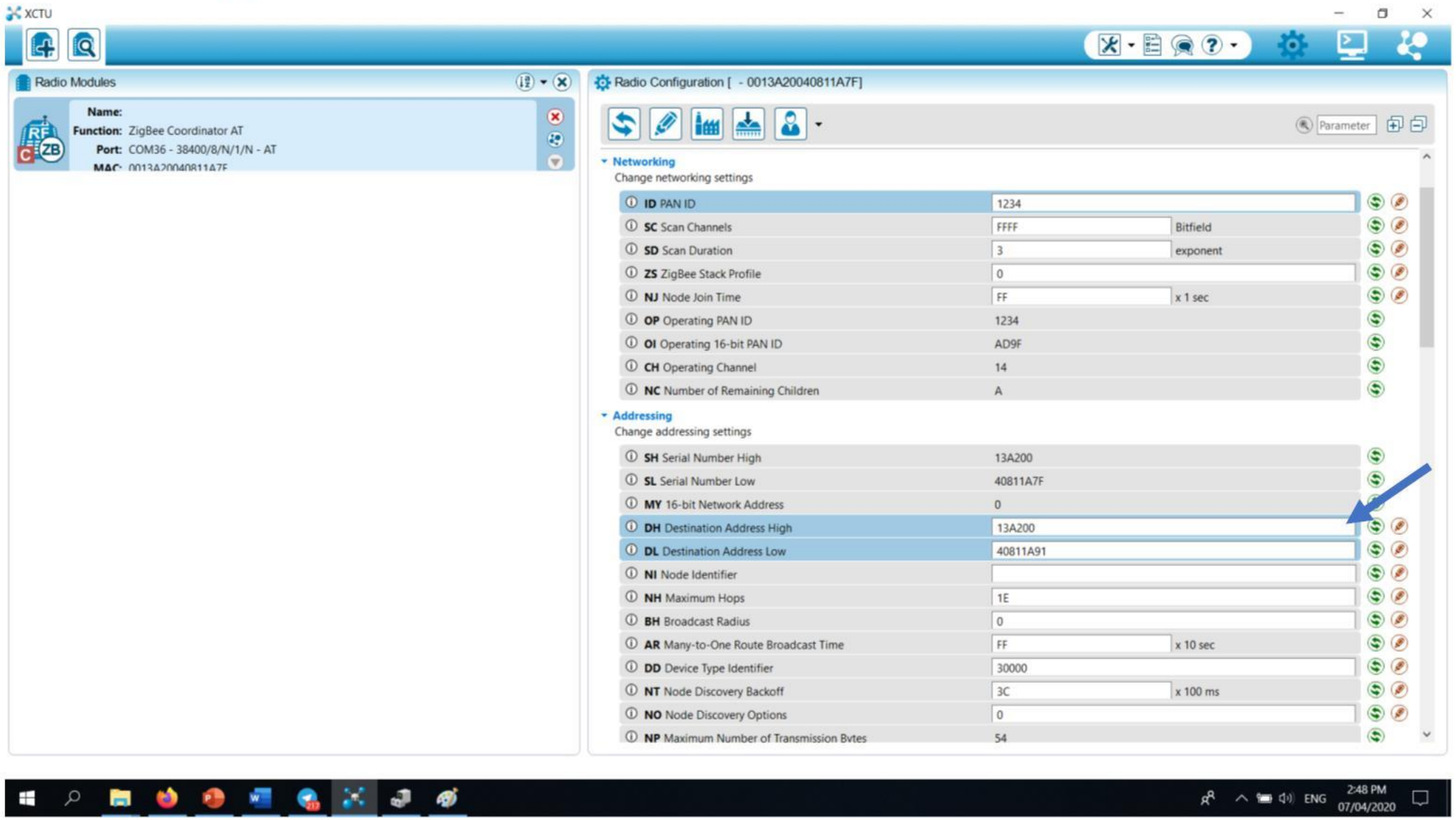




GROUND STATION



AIRCRAFT


XCTU
Radio Modules
Name:
Function: ZigBee Coordinator AT
Port: COM36 - 38400/8/N/1/N - AT
MAC: 0013A20040811A7F
Radio Configuration [- 0013A20040811A7F]
Parameter
Networking
Change networking settings
ID PAN ID 1234
SC Scan Channels FFFF Bitfield
SD Scan Duration 3 exponent
ZS ZigBee Stack Profile 0
NJ Node Join Time FF x 1 sec
OP Operating PAN ID 1234
OI Operating 16-bit PAN ID AD9F
CH Operating Channel 14
NC Number of Remaining Children A
Addressing
Change addressing settings
SH Serial Number High 13A200
SL Serial Number Low 40811A7F
MY 16-bit Network Address 0
DH Destination Address High 13A200
DL Destination Address Low 40811A91
NI Node Identifier
NH Maximum Hops 1E
BH Broadcast Radius 0
AR Many-to-One Route Broadcast Time FF x 10 sec
DD Device Type Identifier 30000
NT Node Discovery Backoff 3C x 100 ms
NO Node Discovery Options 0
NP Maximum Number of Transmission Bytes 54
ENG
2:48 PM
07/04/2020

SIK SERIAL RADIO

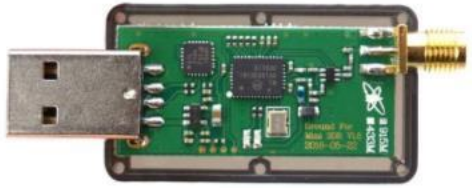
Originally Develop by 3D robotics
This Radio supports both Mavlink and MSP Raw formats

38400 OR 57600 FOR SIK RADIO DEPENDING IF USES 433MHZ OR 900MHZ

3drradioconfig Download

[3drradioconfig.zip]

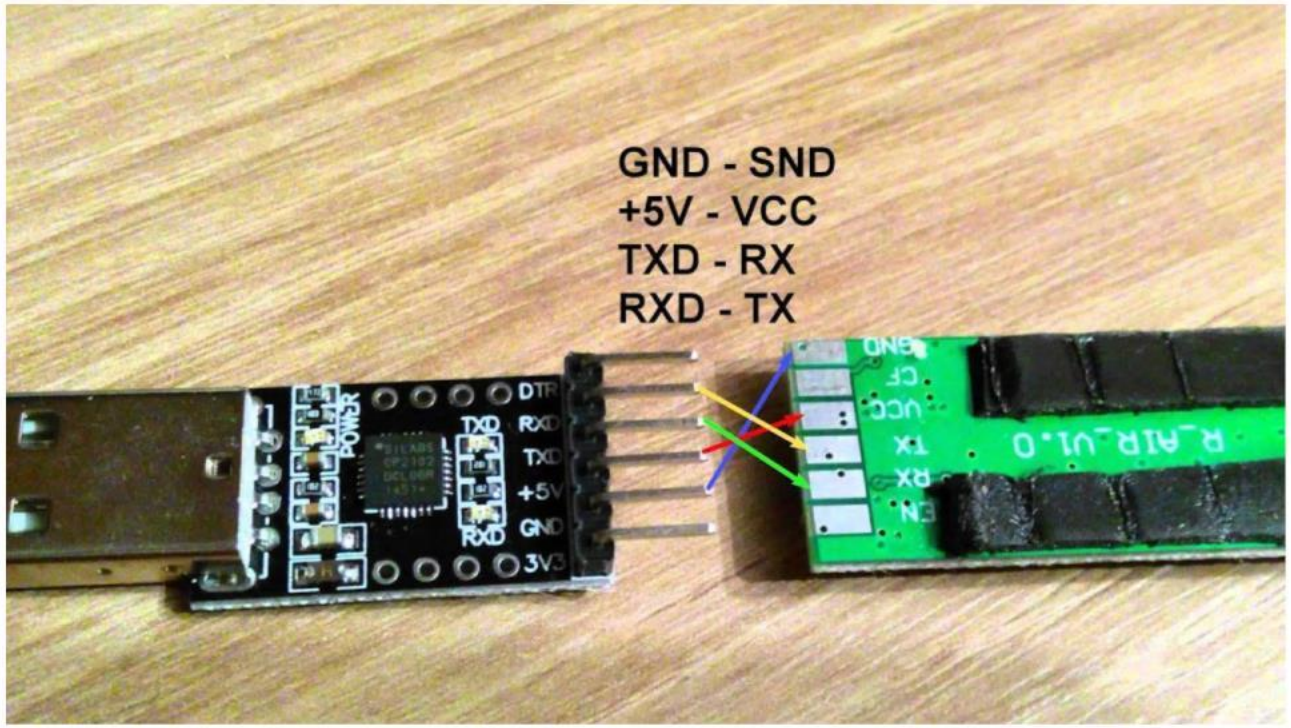
RadioTelemetry Air Module



RadioTelemetry Ground Module

Again to setup you require an USB-TTL module to connect to the serial port to configure both the module how ever mostlikely you only need to do this for the vehicle unit as the

Ground Unit has an USB build into



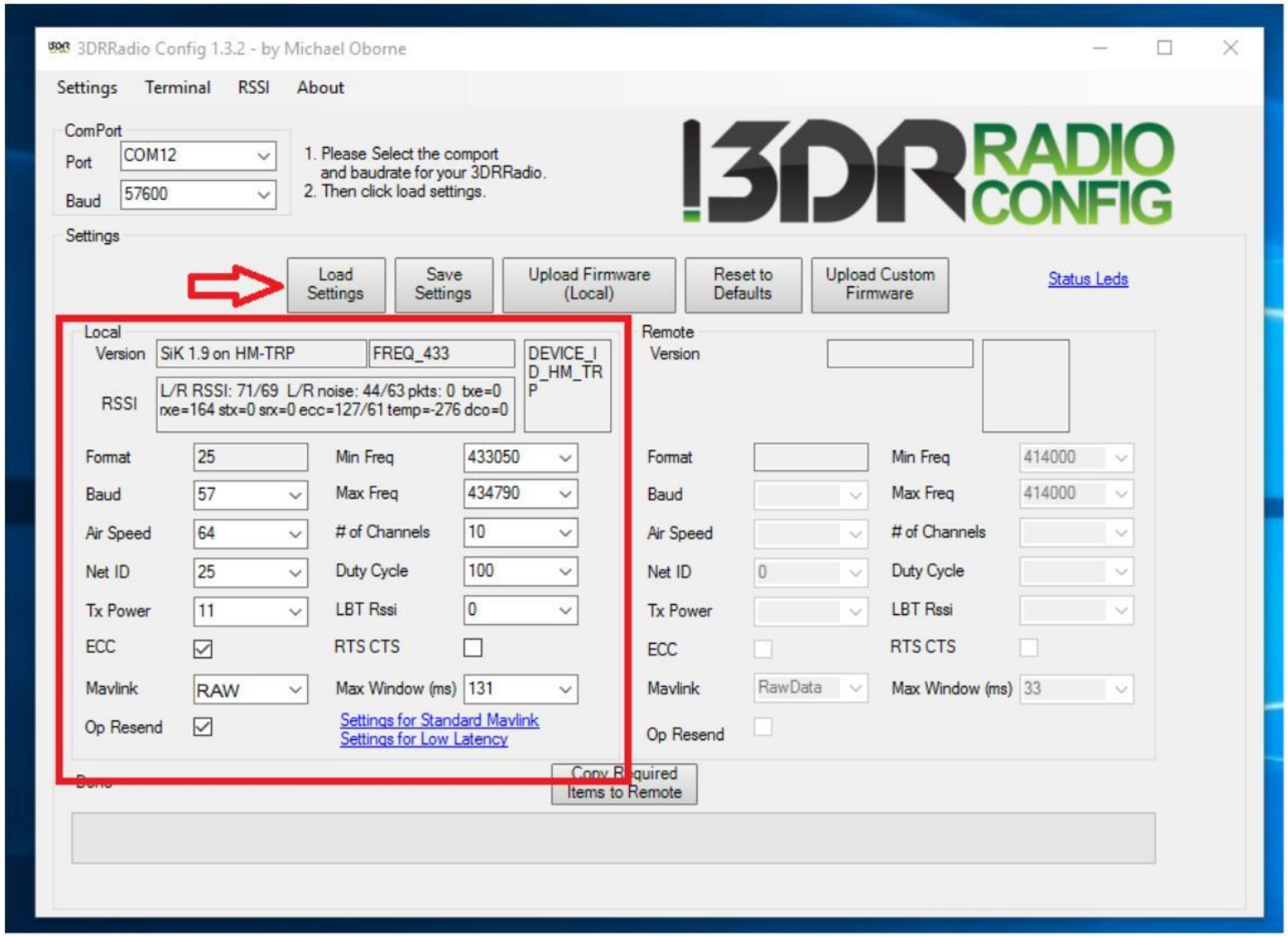
Manually configuring the telemetry kit for Synerduino uses the 3DR radio Config

http://vps.oborne.me/3drradioconfig.zip

Also available in the synerduino page

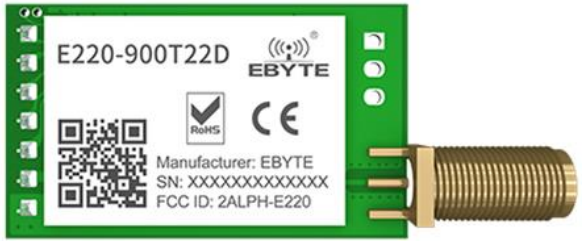
Both Vehicle and Ground station unit must have similar in the following

- Versions
- Frequency
- Baud (38400 or 57600 ensure)
- Airspeed 64K generally fast for most app.
- Net ID (in cases you need to assign multiple drones each having their own ID)
- Tx power
- Mavlink (RAW –Synerduino uses Format)

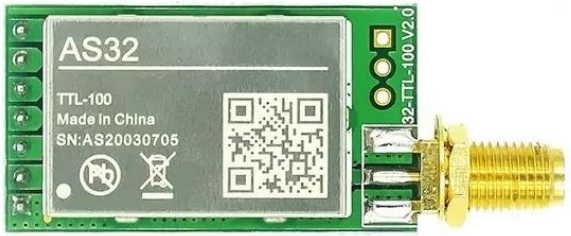


SX1278/SX1276 RF Wireless Module 433Mhz LORA 3000M UART

SX1278E32-TTL-100



EBYTE E220-900T22D



SX1278 AS32-TTL-100

SX1276 A39-T230A30D

based on SX1278 or SX1276 from SEMTECH(can be transmitter and receiver both). It adopts LoRa spread spectrum technology, with this technology the transmitting distance and penetration ability of the module improved more than 1 times compared with traditional FSK. The module features FEC (forward error correction) algorithm, which ensure it's good anti-interference ability.

Lora are suited for those Long range communication

However require more wattage if Airspeed of radio is concern

3KM Range 100mw 3db-5db antenna

Baud Rate (bps / Air Speed (bps)	1200	2400	4800	9600	19200	38400	57600	115200
0.3K								
1.2K	√	√						
2.4K	√	√	√					
4.8K	√	√	√					
9.6K	√	√	√					
19.2K	√	√	√	√				
√ means supporting transmission of infinite data packet								

5KM Range 1000mw 5db-8db antenna

(bps) / air speed (bps)	1200 baud rate	2400	4800	9600	19200	38400	57600	115200
1.2k								
2.4k	√							
4.8k	√	√						
9.6k	√	√	√					
19.2k	√	√	√	√				
38.4k	√	√	√	√	√			
50k	√	√	√	√	√			
62.5k	√	√	√	√	√			

SX1278/SX1276 RF Wireless Module 433Mhz LORA 3000M UART / USD TTL Programming

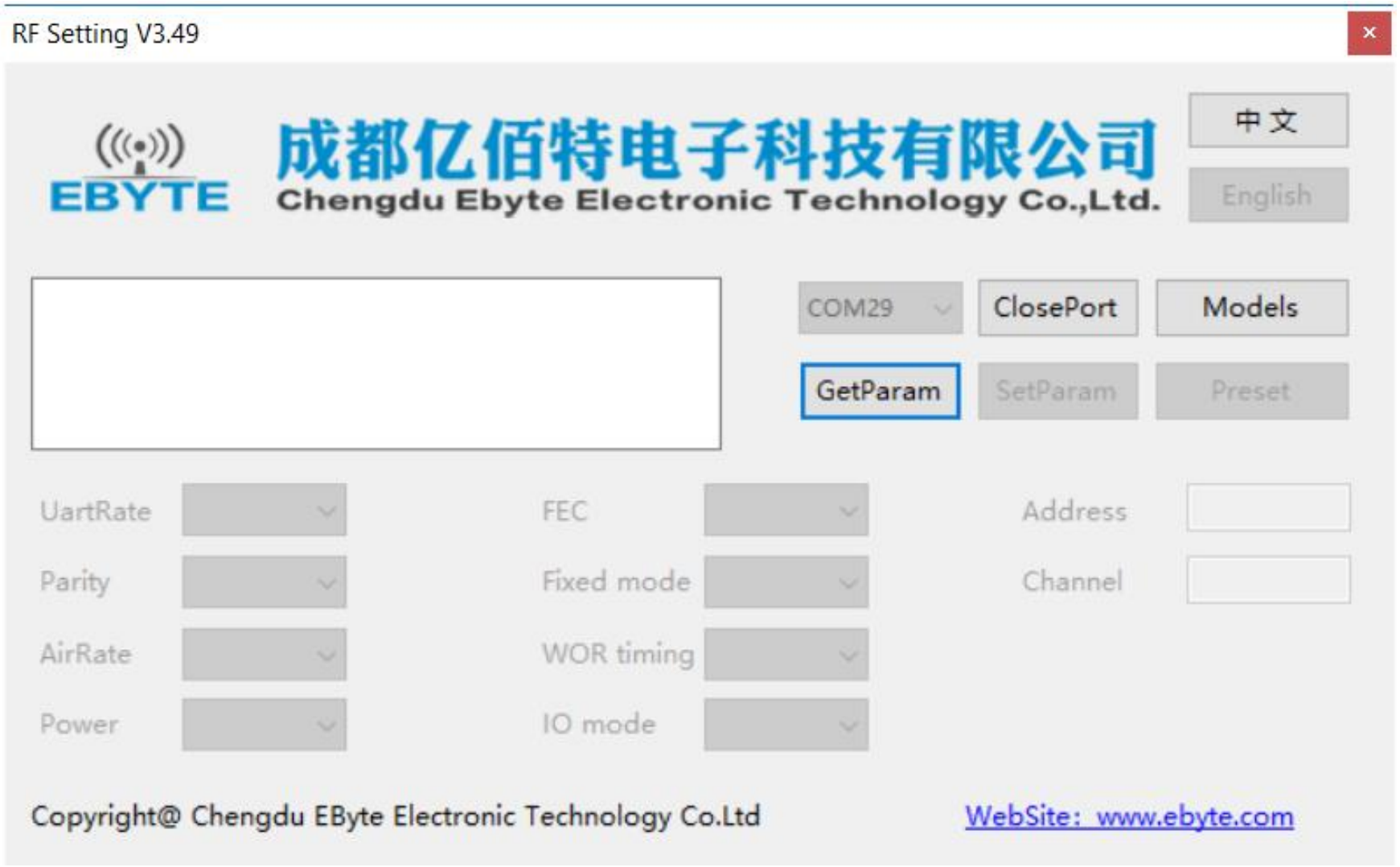
M0	M1	Mode	Description
GND	GND	**Normal Operation**	This for regular send and Receive on Radios with Similar BAUD, Address, Channel ID
V5	GND	**Wake-up mode**	This use on energy conservation only turns on the radio when transmitting. But radio is Listening for signal on receiving
GND	V5	**Power-saving mode**	Disable receiving and only be trigger by waking up the module by the other in wake-up mode
V5	V5	**Sleep mode**	Radio is Disable for Programming – this is where you hook up the USB TTL for Configuring

433 Mhz Antenna must be installed before powering the Radio for safe operation

EBYTE ES32 TTL100

Ebyte_v3.49-Configuration-tool-E30-to-E71.rar

http://synerflight.com/wp-content/uploads/2024/02/e32-ttl-100-datasheet-en-v1-0.pdf

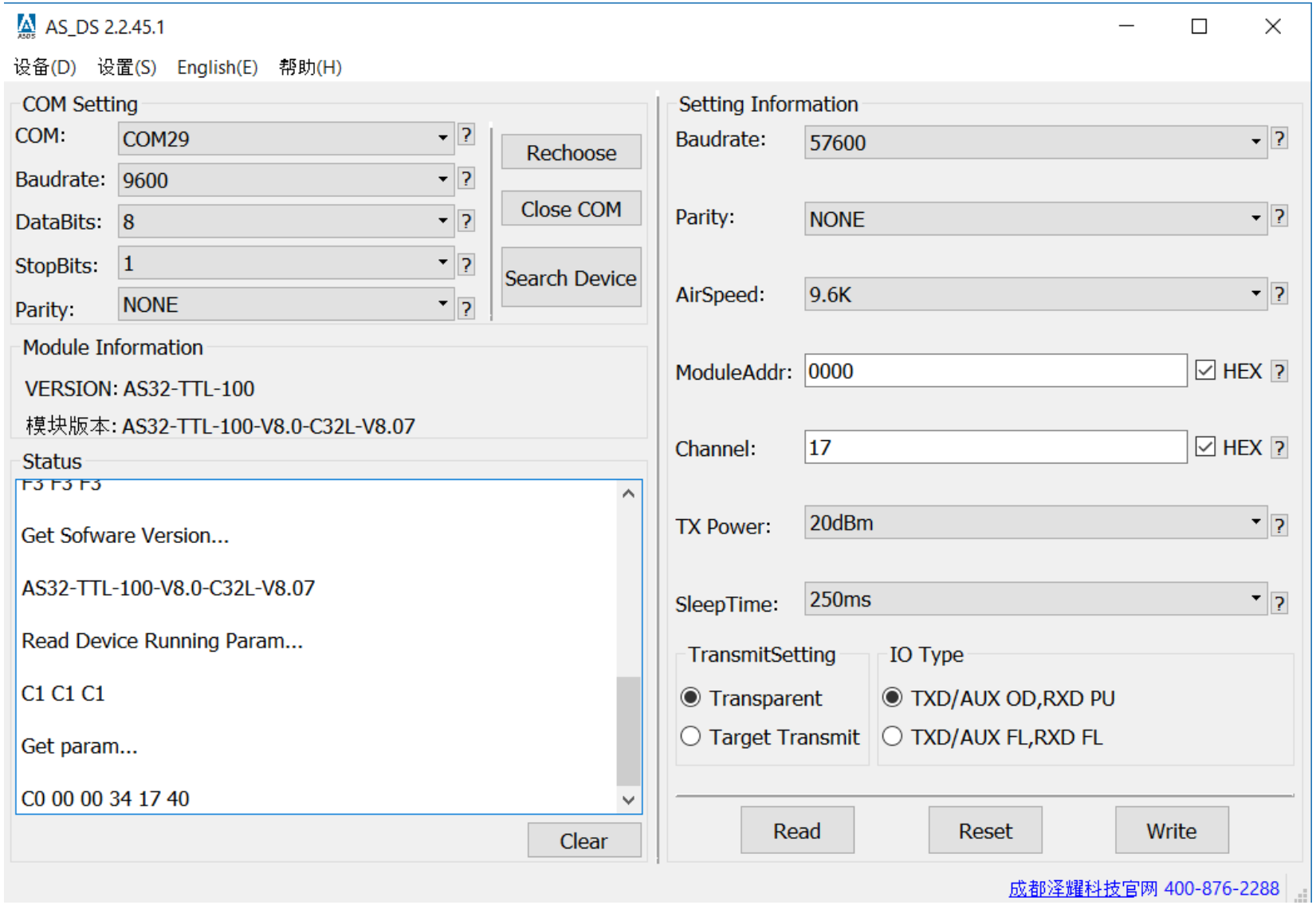


Both Vehicle and Ground station unit
must have similar in the following

- Software Versions
- Frequency
- UART Rate (38400 or 57600 ensure)
- AirRate (9.6K)-(62.5K)
- Module Address
- Channel (in cases you need to assign multiple drones each having their own ID)
- Tx power (20dBm)

[AshiningConfig-Software-Config-UART-document.rar]

http://synerflight.com/wp-content/uploads/2024/02/How-to-config-UAR-TTL-parameters.pdf

Both Vehicle and Ground station unit
must have similar in the following

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- BaudRate (38400 or 57600 ensure)
- Airspeed (9.6K) – (62.5K)
- Module Address
- Channle (in cases you need to assign multiple drones each having their own ID)
- Tx power (20dBm)