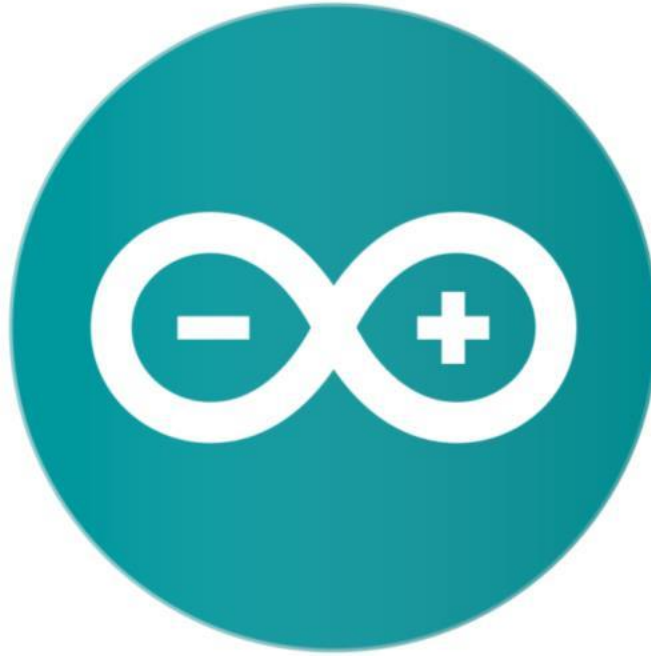
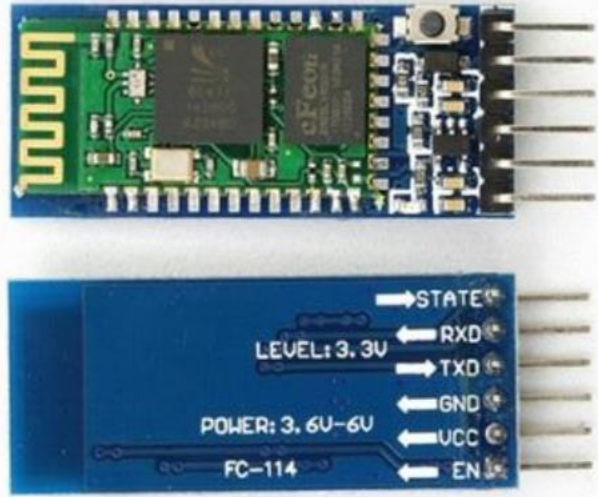


Telemetry

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

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)

The screenshot shows the Arduino IDE interface with a sketch named "blankBluetooth" and a Serial Monitor window connected to COM6. The sketch code is as follows:

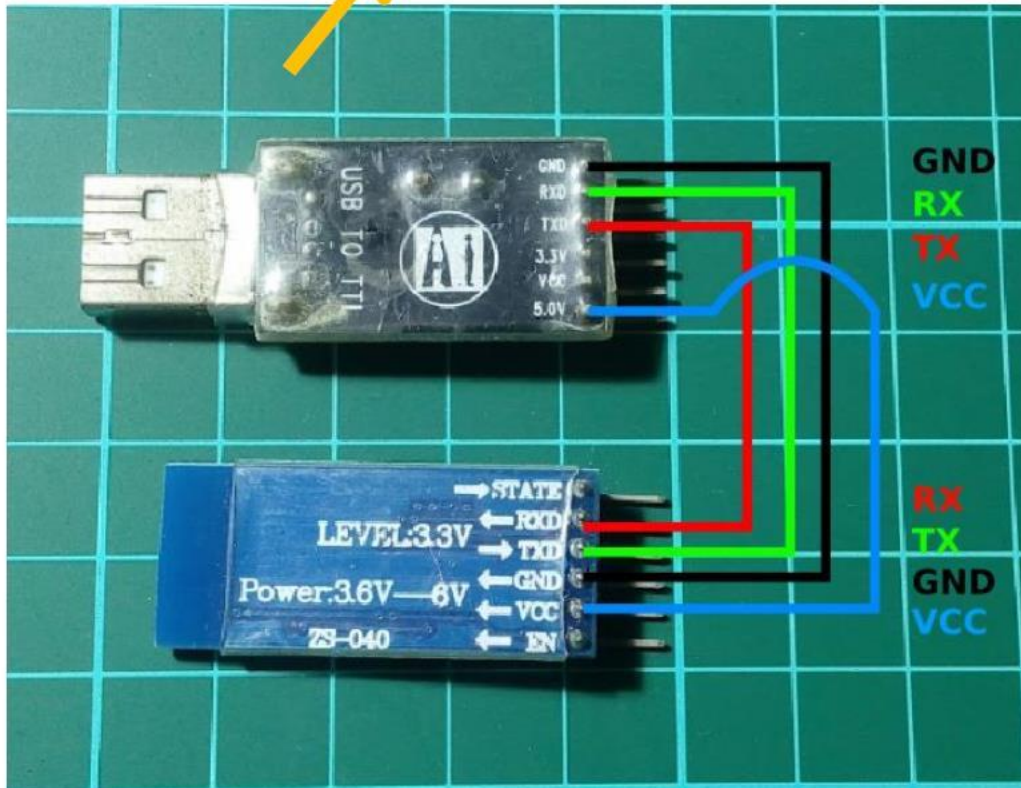
```
blankBluetooth $  
// Commands used on Serial Monitor  
// AT  
// AT+UART?  
  
void setup(){  
}  
  
void loop(){  
}
```

The Serial Monitor window shows the following output:

```
OK  
+UART:38400,0,0  
OK
```

The Serial Monitor settings are set to "Both NL & CR" and "38400 baud".

The screenshot shows the Arduino IDE interface with the Tools menu open. The "Serial Monitor" option is selected, which is highlighted in blue. The menu also shows other options like "Auto Format", "Archive Sketch", "Fix Encoding & Reload", "Serial Plotter", "WiFi101 Firmware Updater", "ArduBlock", "Board: 'Arduino/Genuino Uno'", "Port", "Get Board Info", "Programmer: 'AVRISP mkII'", and "Burn Bootloader".



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.

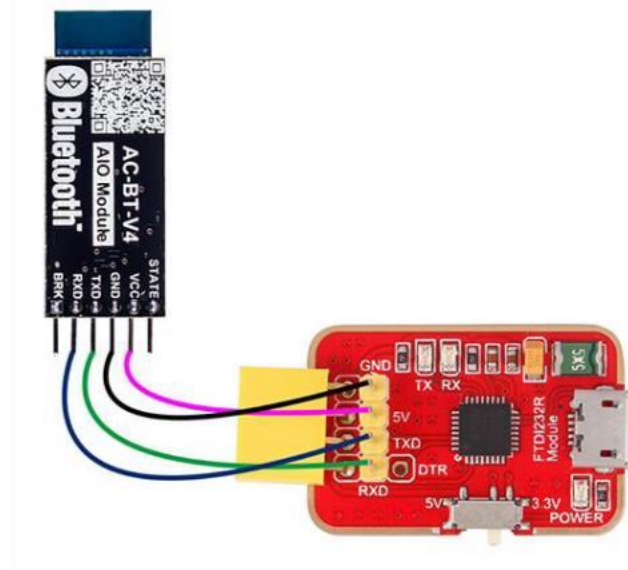
Example

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+CON22C22FF22DA2** to BLE A Send **AT+CON11C11FF11DA1** to BLE B (Send the B address to A, A address to B)

Send **AT+ROLE0** to BLE A Send **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+NAME **ArduinoDrone**

AT+BAUD **4** set baud to 115200 (we want this for high speed)

AT+BAUD **8** set baud to 115200 (on some BL module)

AT+PASS **123456** Set password to 123456

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

AT+TYPE **2**

AT+TYPE **1** (on Some BL modules)

AT+ROLE **0**

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

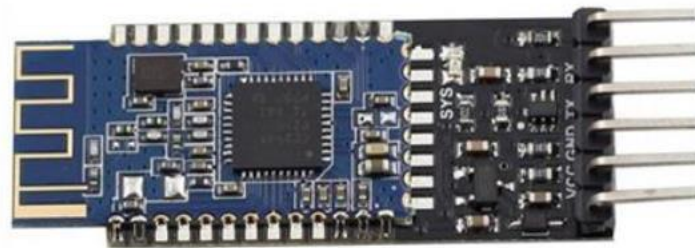
7 – 1200

8 – 230400 (Some BL its 115200)

AT+ROLE

0 = Slave or Peripheral

1 = Master or Central.



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

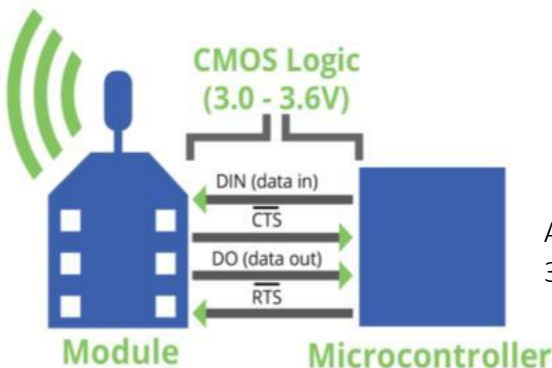
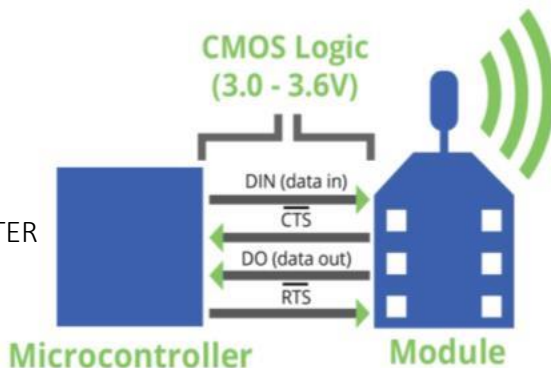
[40003026 CXCTU-1.zip](#)



XBEE S2 RADIO



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



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

Update firmware

Update the radio module firmware
Configure the firmware that will be flashed to the radio module.

Select the product family of your device, the new function set and the firmware version to flash:

Product family	Function set	Firmware version
XB24-B	ZigBee End Device Digital IO	22A7 (Newest)
XB24-SE	ZigBee End Device PH	22A0
XB24-ZB	ZigBee Router API	228C
	ZigBee Router AT	2270
	ZigBee Router AT (WALL RT)	2264
	ZigBee Router Sensor	2242
	ZigBee Router/End Device Analog IO	2241

Force the module to maintain its current configuration.

[View Release Notes](#) [Select current](#)

[Update](#) [Cancel](#)

Update firmware

Update the radio module firmware
Configure the firmware that will be flashed to the radio module.

Select the product family of your device, the new function set and the firmware version to flash:

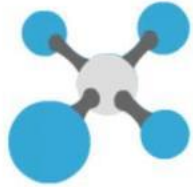
Product family	Function set	Firmware version
XB24-B	End Device - LTH	20A7 (Newest)
XB24-SE	ZigBee Coordinator API	20A0
XB24-ZB	ZigBee Coordinator AT	208C
	ZigBee End Device API	2070
	ZigBee End Device AT	2064
	ZigBee End Device Analog IO	2041
	ZigBee End Device Digital IO	2021

Force the module to maintain its current configuration.

[View Release Notes](#) [Select current](#)

[Update](#) [Cancel](#)


GROUND STATION



XCTU

Radio Modules

Name: ZigBee Router AT
Function: ZigBee Router AT
Port: COM35 - 38400/8/N/1/N - AT
MAC: 0013A20040811A91



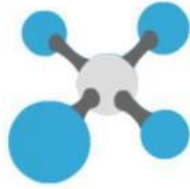
Radio Configuration [- 0013A20040811A91]

ID	Parameter	Value	Unit	Icon
① ID	PAN ID	1234		🔄 🗑️
① SC	Scan Channels	FFFF	Bitfield	🔄 🗑️
① SD	Scan Duration	3	exponent	🔄 🗑️
① ZS	ZigBee Stack Profile	0		🔄 🗑️
① NJ	Node Join Time	FF	x 1 sec	🔄 🗑️
① NW	Network Watchdog Timeout	0	x 1 minute	🔄 🗑️
① JV	Channel Verification	Disabled [0]		🔄 🗑️
① JN	Join Notification	Disabled [0]		🔄 🗑️
① OP	Operating PAN ID	1234		🔄 🗑️
① OI	Operating 16-bit PAN ID	AD9F		🔄 🗑️
① CH	Operating Channel	14		🔄 🗑️
① NC	Number of Remaining Children	C		🔄 🗑️
Addressing				
Change addressing settings				
① SH	Serial Number High	13A200		🔄 🗑️
① SL	Serial Number Low	40811A91		🔄 🗑️
① MY	16-bit Network Address	7FA4		🔄 🗑️
① DH	Destination Address High	13A200		🔄 🗑️
① DL	Destination Address Low	40811A7F		🔄 🗑️
① NI	Node Identifier			🔄 🗑️
① NH	Maximum Hops	1E		🔄 🗑️
① BH	Broadcast Radius	0		🔄 🗑️
① AR	Many-to-One Route Broadcast Time	FF	x 10 sec	🔄 🗑️
① DD	Device Type Identifier	30000		🔄 🗑️
① NT	Node Discovery Backoff	3C	x 100 ms	🔄 🗑️
① ND	Node Discovery Backoff	0		🔄 🗑️

Checking for Radio Firm... updates: (87%)

2:30 PM 07/04/2020

AIRCRAFT



XCTU

Radio Modules

Name: ZigBee Coordinator AT
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	

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](#)



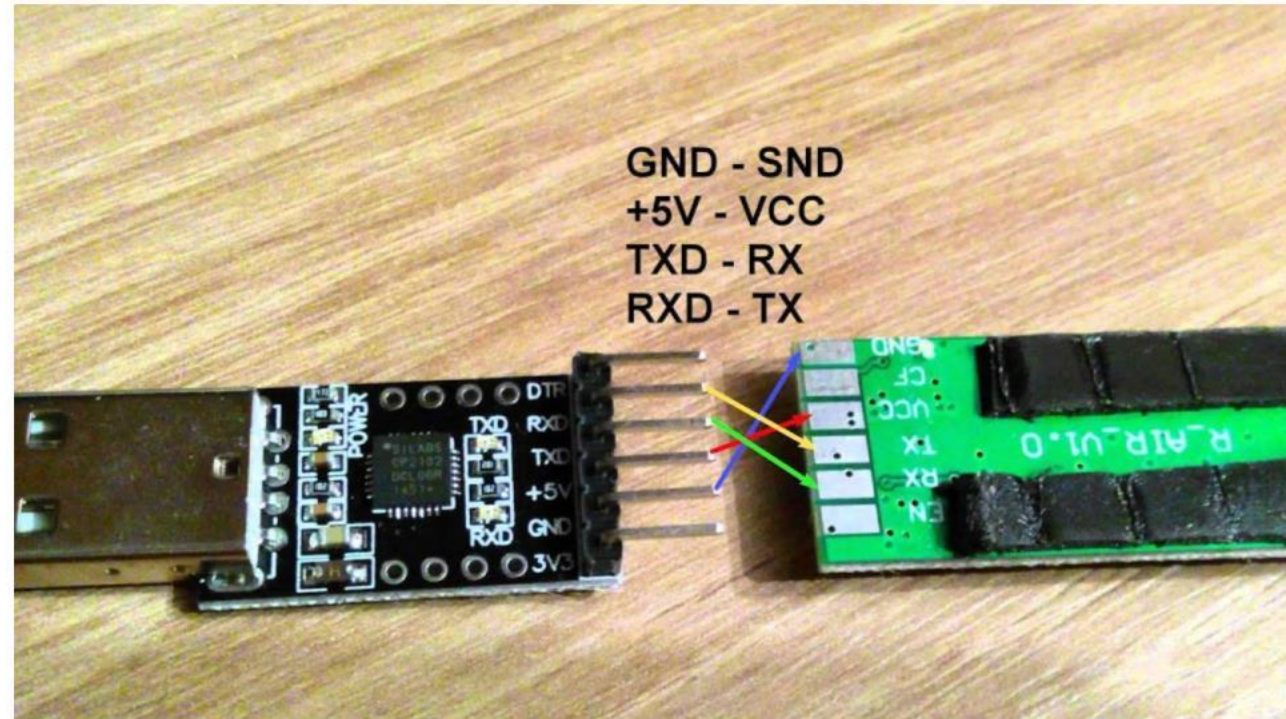
RadioTelemetry Air Module



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



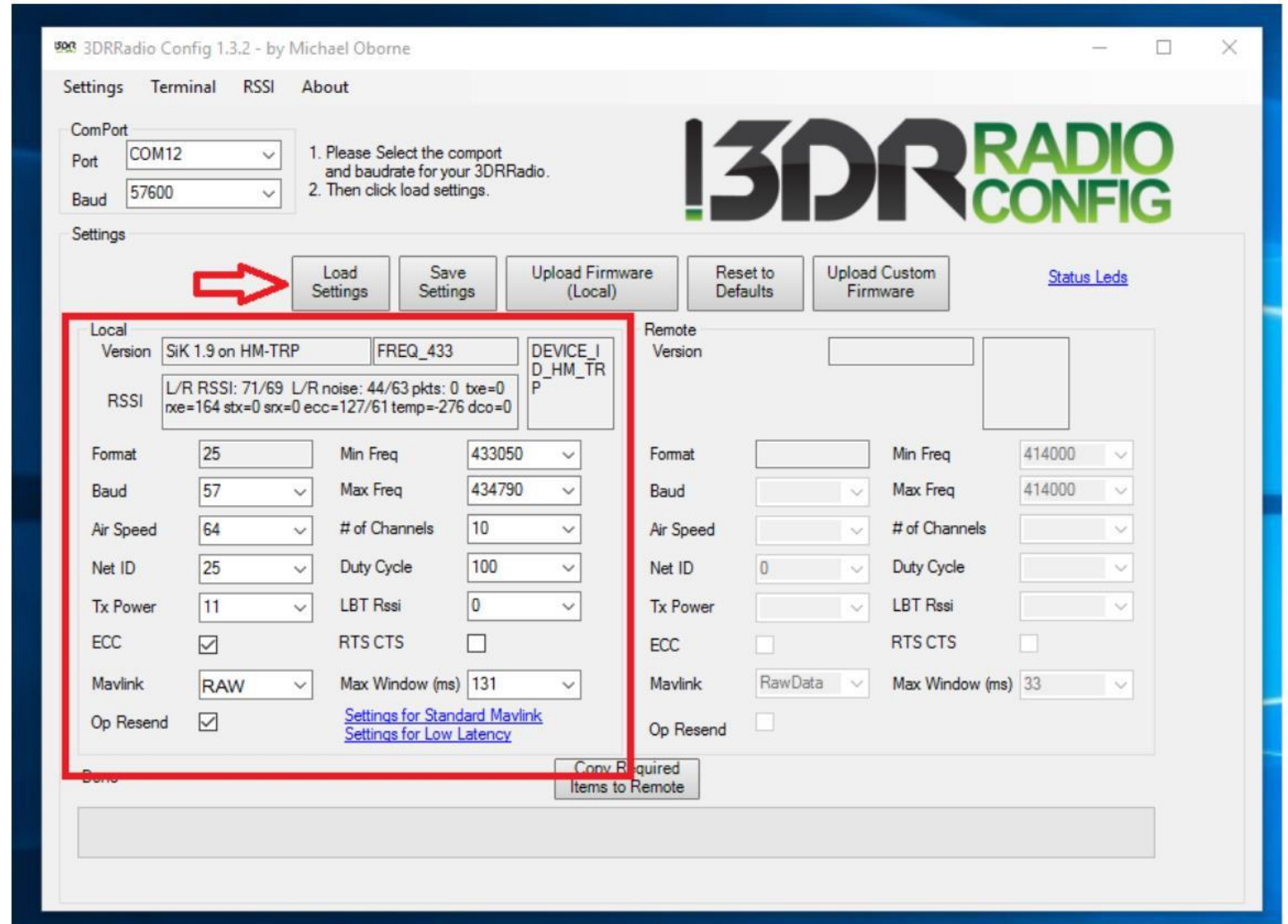
Manually configuring the telemetry kit for Synerduino uses the 3DR radio Config

<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.

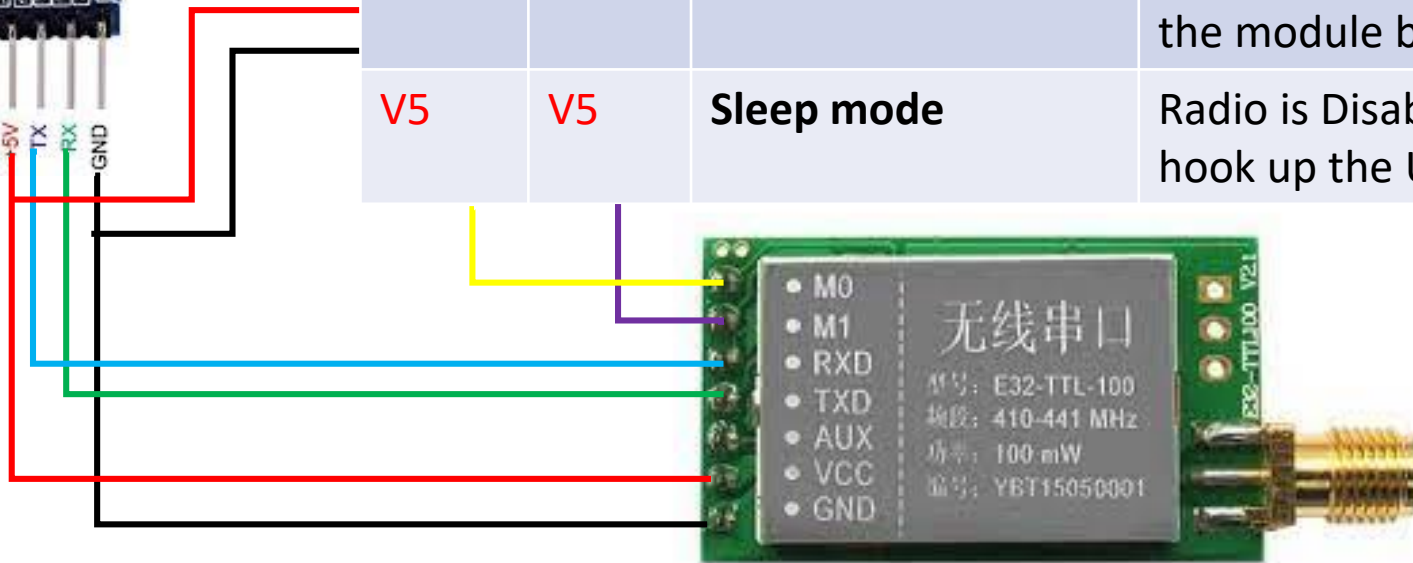
Lora are suited for those Long range communication

However require more wattage if Airspeed of radio is concern

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)

RF Setting V3.49

EBYTE 成都亿佰特电子科技有限公司 Chengdu Ebyte Electronic Technology Co.,Ltd.

中文 English

COM29 ClosePort Models

GetParam SetParam Preset

UartRate FEC Address

Parity Fixed mode Channel

AirRate WOR timing

Power IO mode

Copyright@ Chengdu EByte Electronic Technology Co.Ltd WebSite: www.ebyte.com



Both Vehicle and Ground station unit

must have similar in the following

- Software Versions
- Frequency
- 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)

AS_DS 2.2.45.1

设备(D) 设置(S) English(E) 帮助(H)

COM Setting

COM: ?

Baudrate: ?

DataBits: ?

StopBits: ?

Parity: ?

Module Information

VERSION: AS32-TTL-100
模块版本: AS32-TTL-100-V8.0-C32L-V8.07

Status

```
F3 F3 F3
Get Software Version...
AS32-TTL-100-V8.0-C32L-V8.07
Read Device Running Param...
C1 C1 C1
Get param...
C0 00 00 34 17 40
```

Setting Information

Baudrate: ?

Parity: ?

AirSpeed: ?

ModuleAddr: HEX ?

Channel: HEX ?

TX Power: ?

SleepTime: ?

TransmitSetting

Transparent

Target Transmit

IO Type

TXD/AUX OD,RXD PU

TXD/AUX FL,RXD FL

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