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3DRadio

[zh-Hans](#) , [ru](#) , [en](#), [zh-Hant](#)Updated Apr 14, 2013 by [analogue...@gmail.com](#)

Using the 3DR Radio for telemetry with APM 2

 3DRobotics

The 3DRobotics [3DR Radio](#) is the ideal way to setup a telemetry connection between your APM and a ground station. Small, inexpensive and with great range, the 3DR radio uses an open source firmware which allows us to do things that cannot be done with other radios.

Radio Features

- supports point-to-point half duplex communication
- very small size
- light weight (under 4 grams without antenna)
- available in 900MHz or 433MHz variants
- receiver sensitivity to -121 dBm
- transmit power up to 20dBm (100mW)
- transparent serial link
- air data rates up to 250kbps
- MAVLink protocol framing and status reporting
- frequency hopping spread spectrum (FHSS)
- adaptive time division multiplexing (TDM)
- support for LBT and AFA
- configurable duty cycle
- builtin error correcting code (can correct up to 25% data bit errors)
- demonstrated range of several kilometres with a small omni antenna
- can be used with a bi-directional amplifier for even more range
- open source firmware
- AT commands for radio configuration
- RT commands for remote radio configuration
- adaptive flow control when used with APM
- based on HM-TRP radio modules, with Si1000 8051 micro-controller and Si4432 radio module

Connecting your 3DR Radios

Important note: You cannot connect via the radios when your APM 2 is also connected via USB (they share the same port). Make sure you disconnect your USB cable from the APM 2 board before attempting a wireless connection.

You will need two 3DR radios, one for your aircraft, and the other for your ground station.

ArduPlane Instruction

June 2013
UPDATE: The
ArduPilot
manual has now
moved [here](#). The
manuals here are
for legacy
hardware and
will no longer be
updated or
maintained.

[Introduction](#)[Get it!](#)[Project news](#)[Project history](#)**Instructions:**[Quick Start Guide](#)[Setup](#)[Flying](#)[Simulation](#)**Optional additions**[Using wireless data for telemetry and in-flight commands](#)[Some tips on picking frequencies](#)[APM 1](#)[APM 2](#)[3DR Radio](#)[RFD900 Long Range Radio](#)[Xbee](#)[Automatic Ground Antenna Tracking](#)[On-screen display \(OSD\) board](#)[Camera control \(stabilization, tracking\)](#)[Camera control \(autopilot control of shutter\)](#)[Airspeed sensor](#)[Voltage and Current sensors](#)[Automatic Flaps](#)[Differential Spoilers on Flying wing](#)[Adding an external magnetometer](#)[Using joystick/gamepad control instead of RC](#)[Scripted autonomous acrobatics](#)[Connecting a PPMSum RC Receiver](#)[Multiple aileron channels](#)

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Troubleshooting

Appendix

[The DIY Drones Dev Team](#)

[Glossary](#)

Looking at the above picture you will see that typically the "ground" radio module has a USB connector, making it easy to connect them to your ground station. It uses a D2XX FTDI driver that you can get [here](#). This driver is built into Windows 7 and above, so it is only necessary if you are using Windows XP or below.

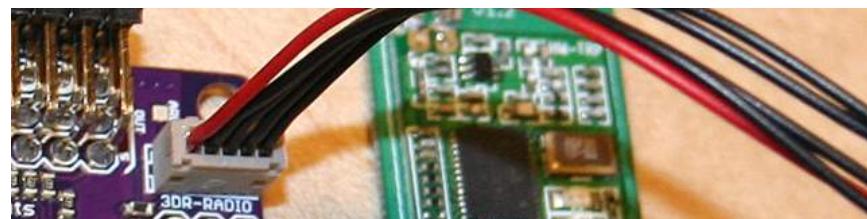
The 'aircraft' model has a FTDI six pin header, allowing it to be directly connected to your APM telemetry port.

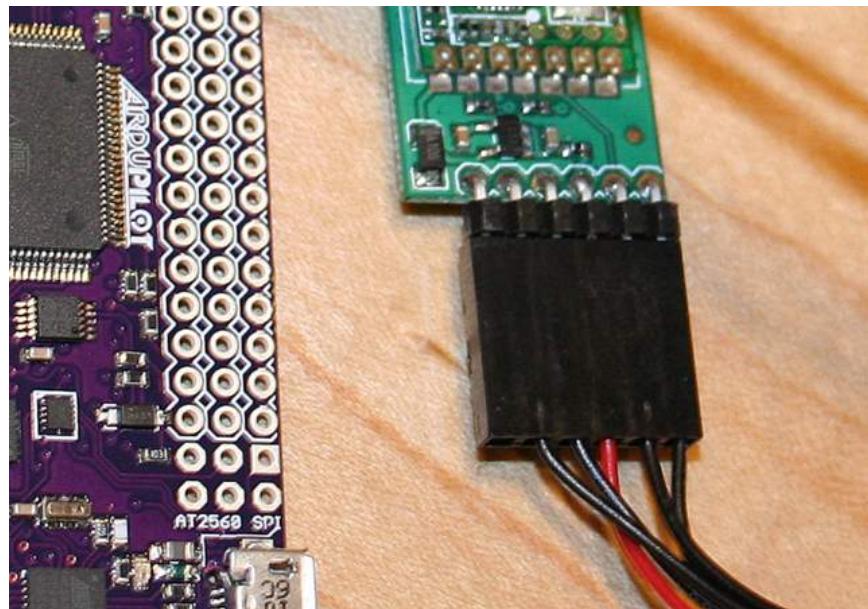
For APM 2.5

Use the included cable:

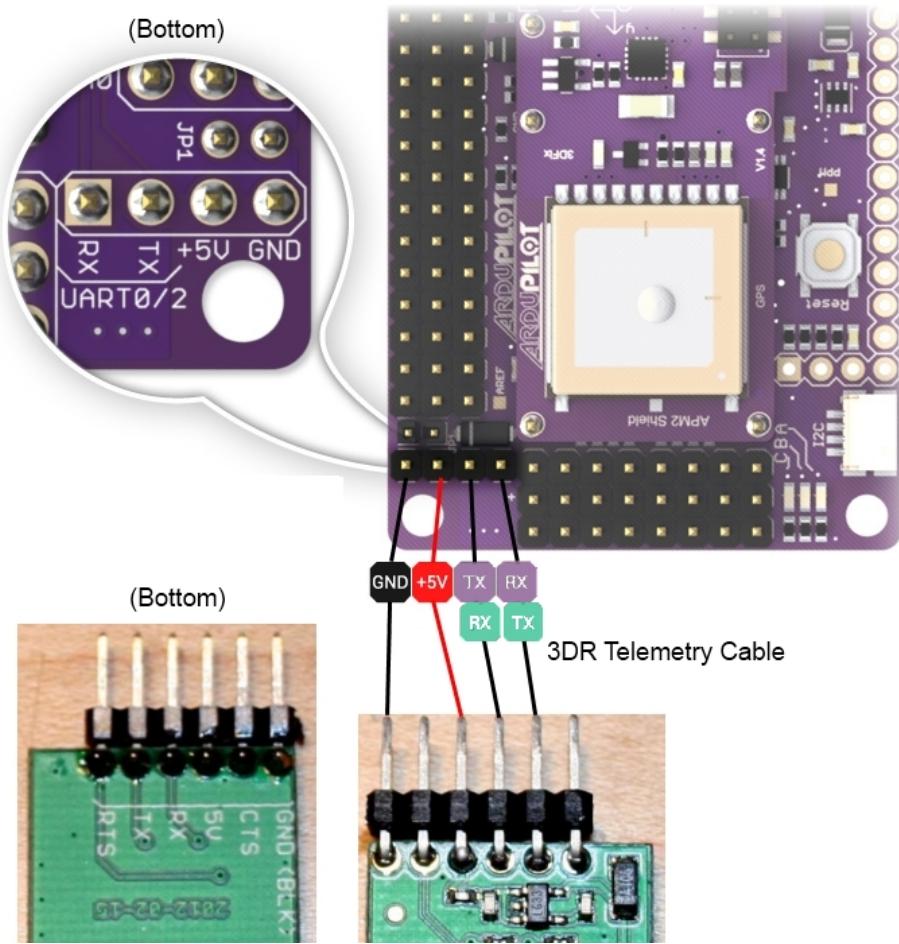


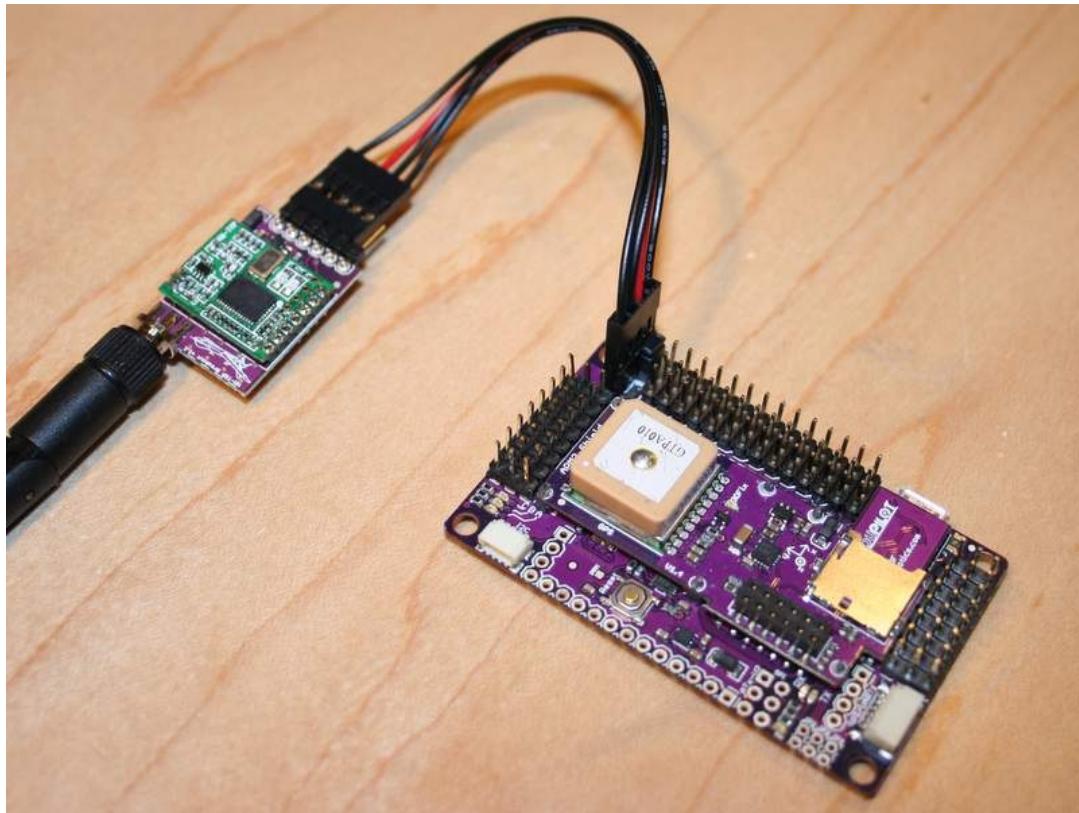
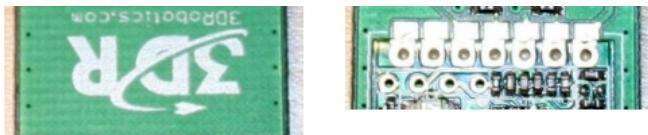
Plug it into the telemetry port on APM 2.5 and on the 3DR radio side, plug the connector with the red cable on the +5v pin and the black cable on the end on GND as shown:





For APM 2.0





The radios come pre-configured for a serial rate of 57600, which is the default rate that APM uses for telemetry, but you can change this to any rate you like, either using the AT command set, the APM Mission Planner radio setup interface, or the [3DR Radio Configuration Utility](#).

Status LEDs

The 3DR Radios have 2 status LEDs, one red and one green. The meaning of the different LED states is as follows:

- green LED blinking - searching for another radio
- green LED solid - link is established with another radio
- red LED flashing - transmitting data
- red LED solid - in firmware update mode

Configuring using the Mission Planner

The latest versions of the APM Mission Planner support configuring your 3DR radios using a simple GUI interface. In the Mission Planner (top right) select the Com port that your "ground" 3DR radio is connected to and 57k as the baud rate.

Then switch to the Configuration screen. Choose the 3DR radio tab in the list at left, and click on "Load Settings" and it will populate it with data similar to that shown (the remote radio's settings will only show if it is also powered on and connected to APM running current ArduPlane or ArduCopter code).

3DR Radio		Load Settings	Save Settings	Upload Firmware (Local)	Reset to Defaults	Status Leds
Antenna Tracker						
Planner						
Planner Adv Config						
Local Version		SiK 1.6 on HM-TRP FREQ_915				
RSSI		L/R RSSI: 190/183 L/R noise: 36/19 pkts: 207 txe=0 rxe=0 stx=0 srx=0 ecc=0/0 temp=-276 dco=0				
Format	25	Min Freq	915000			
Baud	57	Max Freq	928000			
Air Speed	64	# of Channels	50			
Net ID	99	Duty Cycle	100			
Tx Power	20	LBT Rssi	0			
ECC	<input checked="" type="checkbox"/>					
Remote Version		SiK 1.6 on HM-TRP				
Format	25	Min Freq	915000			
Baud	57	Max Freq	928000			
Air Speed	64	# of Channels	50			
Net ID	99	Duty Cycle	100			
Tx Power	20	LBT Rssi	0			
ECC	<input checked="" type="checkbox"/>					



This is the recommended configuration method for most users.

Using a FTDI-to-USB cable to configure 3DR radios

If the previous paragraphs don't work try the following...

Connect everything, Configure 3DR ground radio

- Connect your 3DR air radio with FTDI-to-USB cable to your computer USB port & note Com port #
 - Use Windows > Device Manager > Ports to identify com port #
 - You'll know the FTDI cable is correctly oriented on the air radio when a green LED blinks.
- Connect the 3DR ground radio to a USB port on your PC & note Com port #
- In MP Flight Data tab, at top right, set baud to 57600 & select ground radio com port #
- In MP Flight, press Ctrl + A to open the radio configuration window
- Click on Load Settings (from the **ground** radio)
- In Mission Planner radio configuration window, (MP) check the Advanced Options box
- If loaded values aren't the same as above recommended settings, make it so, then click on Save

Configure 3DR air radio

- In MP at top right, select the 3DR **air** radio's com port
- In MP radio configuration window, click on Load Settings (from **air** radio)
- Edit the air radio's settings (including Advanced Options) so they are **exactly** the same as the ground radio's, then click on Save Settings (to air radio)
- You may not be able to add a value in the Format field, that's OK
- In Mp, press Configure > 3DR Radio > enter exact same settings including advanced > click Save Settings.

Wait for both radios to connect (solid green LED)

Update firmware if above doesn't work

- Click on Update Firmware while connected to each radio in turn. Then repeat the above.
- Keep in mind that while to are physically connected to a radio via a specific Com port, you can't use the 'Copy Required items to Remote' button (there is no remote until you go wireless)

To verify wireless telemetry

- Remove the FTDI to USB cable from APM
- Connect the air radio to APM & LIPO
- In MP > Flight Data tab > select the ground radio com port then click on Connect

This section of the 3DRadio wiki was contributed by the Documentation User Group (DUG)

Serial and air rates 'one byte form'

The SERIAL_SPEED and AIR_SPEED parameters are in the same form that APM uses for the SERIAL3_SPEED EEPROM parameter. It is the rate in kbps, truncated to an integer. So '9' means 9600 baud, '38' means 38400, '115' means 115200 etc.

Choosing the air data rate

The key parameter that controls the range of your radios is the AIR_SPEED. The default is 64 (which is 64kbps) will give you a range of over a kilometre with small omni antennas. The lower you set the AIR_SPEED the longer your range, although lowering the AIR_SPEED also lowers how much data you can send over the link.

The radio firmware can only support 13 possible air date rates, which are 2, 4, 8, 16, 19, 24, 32, 48, 64, 96, 128, 192 and 250. If your application needs a different air rate for some reason then we can potentially add it to the register tables. If you choose an unsupported air rate then the next highest rate from the supported list will be chosen.

What air data rate you choose will depend on the following factors

- what range you need
- what data rate you will be sending
- whether you primarily send in one direction, or both

- whether you have ECC enabled
- whether you have an APM firmware with adaptive flow control

For most telemetry applications you will primarily be sending data mostly in one direction, from the aircraft to the ground station. For most people, the amount of data sent from the ground station to the aircraft is small, just an occasional control packet plus heartbeat packets.

If you are using a joystick to control your aircraft then you will be sending a lot more data from the ground station to the aircraft, and in that case you may find a higher AIR_SPEED is needed, although your range will be reduced.

The ECC parameter makes a big difference to the data rate you can support at a given AIR_SPEED. If you have ECC set to zero, then no error correcting information is sent, and the radio uses a simple 16 bit CRC to detect transmission errors. In that case your radio will be able to support data transfers in one direction of around 90% of the AIR_SPEED.

If you enable ECC (which is highly recommended), then the data rate you can support is halved. The ECC system doubles the size of the data sent by the radios. It is worth it however, as the bit error rate will drop dramatically, and you are likely to get a much more reliable link at longer ranges.

If you have the latest APM firmware (ArduPlane 2.33 or later, or ArduCopter 2.54 or later) then the APM will automatically adapt its telemetry rates to what the radio can handle, by using MAVLink RADIO packets injected into the MAVLink streams by the radios firmware. That allows you to 'oversubscribe' your link, by setting up a SERIAL_SPEED larger than what the radios can actually handle.

The other factor in choosing the air data rate is the TDM 'sync time'. The two radios need to work out each others frequency hopping pattern. They do this by slowly changing the receive channel while rapidly changing the transmit channel. This process of getting in sync with the other radio takes just a few seconds at high air data rates, but gets slower for low air data rates.

For most amateur UAV applications the default AIR_SPEED of 64 with ECC enabled will be good.

Error Correction

As mentioned above, the radios support a 12/24 Golay error correcting code if you set the ECC parameter to 1. This means that for every 12 bits of data the radio will send 24 bits, calculating the bits using Golay code lookup tables. The process is reversed on the receiving end, and allows the radio to correct bit errors of up to 3 bits in every 12 bits sent (i.e. 25% bit error rate).

The downside of the ECC option is that it halves your available data bandwidth, but in most cases this is worth it, as you are able to sustain a reliable link over longer ranges. You will also get a lot less 'noise' in the serial stream.

MAVLink framing

If you set the MAVLINK option to 1 then the radio will do 'MAVLink framing'. The MAVLink protocol is used by APM for transmitting telemetry date to a ground station. When MAVLink framing is used, the radio will try to align radio packets with MAVLink packet boundaries. This means that if a packet is lost you don't end up with half a MAVLink packet being seen by the receiver. That partial packet would appear as line noise on your ground stations console.

The radio firmware will try to fit multiple MAVLink packets into one radio packet where possible for maximum efficiency. The highest radio packet size is 252 bytes.

The radio firmware supports both the MAVLink 0.9 and the MAVLink 1.0 transmission formats.

MAVLink reporting

If you have MAVLINK set to 1, then the radio firmware will also look for MAVLink HEARTBEAT messages coming from the serial connection. If it sees a HEARTBEAT message then it knows that the MAVLink protocol is in use, and it will start injecting MAVLink 'RADIO' status packets into the the serial stream.

The RADIO packets contain information about the RSSI (Received Signal Strength Indicator) level at both ends of the link, allowing the ground station or aircraft to take action in case the link quality falls too low.

The RADIO packets also contain information about error rates, and how full the serial transmit buffer is (as a percentage). The latest APM firmware can use this information to automatically adapt the telemetry stream rates to the data rate that the radios can sustain.

Power levels

You need to be very careful to configure your radios to stay within the legal power limits of the country you are operating in. The default power level of 20dBm is fine for the US and Australia, as up to 30dBm is allowed by the LIPD class licenses there in the 915-928MHz frequency band for a frequency hopping radio. So as long as your antennas have a gain of less than 10dBi you should be within the ISM rules.

The radio cannot support arbitrary power levels. It can only support the power levels given in the following table

Power (dBm)	Power (milliWatts)
1	1.3
2	1.6
5	3.2
8	6.3
11	12.5
14	25
17	50
20	100

If you choose an unsupported power level the radio will choose the next highest power level from the above table.

Please carefully check the EIRP (Equivalent isotropically radiated power) power limits for your country, making sure you take into account the antenna gain. The 3DR radio is a 'DIY' radio part and it is entirely your responsibility to ensure any use of it is compliant with local rules.

For example, if your local rules allow for a maximum of 30dBm (1W) EIRP, then if you use a amplifier with a 12dB transmit gain, and an antenna with 3dBi gain, then you will need to set TXPOWER to at most 14.

If you don't know how to calculate it, we've made a tutorial for you here: [Understanding dB, Watts and dBm](#).

Using the AT command set

The 3DR radios support a variant of the Hayes 'AT' modem command set for configuration.

If you connect with a serial console to a 3DR radio at the current serial baud rate, you can tell the radio to enter AT command mode by entering the sequence '++'. To prevent data being seen as the command sequence there is a guard time required, so make sure you type nothing on the serial link for 1 second before and after you enter the sequence.

When you enter AT command mode you will receive a 'OK' prompt from the radio and it will stop displaying data sent from the other radio.

Once in AT command mode, you can give the radio either 'AT' commands to control the local radio, or (if successfully connected) you can use 'RT' commands to control the remote radio.

The AT commands available are:

- ATI - show radio version
- ATI2 - show board type
- ATI3 - show board frequency
- ATI4 - show board version
- ATI5 - show all user settable EEPROM parameters
- ATI6 - display TDM timing report
- ATI7 - display RSSI signal report
- ATO - exit AT command mode
- ATSn? - display radio parameter number 'n'
- ATSn=X - set radio parameter number 'n' to 'X'
- ATZ - reboot the radio
- AT&W - write current parameters to EEPROM
- AT&F - reset all parameters to factory default
- AT&T=RSSI - enable RSSI debug reporting
- AT&T=TDM - enable TDM debug reporting
- AT&T - disable debug reporting

all of these commands, except for ATO, may be used on a connected remote radio by replacing 'AT' with 'RT'.

Perhaps the most useful command is 'ATI5' which displays all user settable EEPROM parameters. That will produce a report like this:

```
S0: FORMAT=22
S1: SERIAL_SPEED=57
S2: AIR_SPEED=64
S3: NETID=25
S4: TXPOWER=20
S5: ECC=1
S6: MAVLINK=1
S7: OPPRESEND=1
S8: MIN_FREQ=915000
S9: MAX_FREQ=928000
S10: NUM_CHANNELS=50
S11: DUTY_CYCLE=100
S12: LBT_RSSI=0
```

The first column is the S register to set if you want to change that parameter. So for example, to set the transmit power to 10dBm, use 'ATS4=10'.

Most parameters only take effect on the next reboot. So the usual pattern is to set the parameters you want, then use 'AT&W' to write the parameters to EEPROM, then reboot using 'ATZ'. The exception is the transmit power, which changes immediately (although it will revert to the old setting on reboot unless you use AT&W).

The meaning of the parameter is as follows:

- FORMAT - this is for EEPROM format version. Don't change it
- SERIAL_SPEED - this is the serial speed in 'one byte form' (see below)
- AIR_SPEED - this is the air data rate in 'one byte form'
- NETID - this is the network ID. It must be the same for both your radios
- TXPOWER - this is the transmit power in dBm. The maximum is 20dBm
- ECC - this enables/disables the golay error correcting code
- MAVLINK - this enables/disables MAVLink framing and reporting
- MIN_FREQ - minimum frequency in kHz
- MAX_FREQ - maximum frequency in kHz
- NUM_CHANNELS - number of frequency hopping channels
- DUTY_CYCLE - the percentage of time to allow transmit
- LBT_RSSI - Listen Before Talk threshold (see docs below)

For two radios to communicate the following must be the same at both ends of the link:

- the radio firmware version
- the AIR_SPEED
- the MIN_FREQ
- the MAX_FREQ
- the NUM_CHANNELS
- the NETID
- the ECC setting
- the LBT_RSSI setting

the other settings may be different at either end of the link, although you will usually set them up the same at both ends.

Support for different countries/regions

It is very important that you find out what the local country or region regulations are on frequency, hopping channels and power levels and configure your 3DR Radios correctly for your local rules.

Here is some general information to help you get started.

Region	Radio Model	Settings	Standard
USA	3DR 900	MIN_FREQ=902000 MAX_FREQ=928000 NUM_CHANNELS=50	FCC 15.247
Canada	3DR 900	MIN_FREQ=902000 MAX_FREQ=928000 NUM_CHANNELS=50	RSS-210 Annex 8.1
Australia	3DR 900	MIN_FREQ=915000 MAX_FREQ=928000 NUM_CHANNELS>=20	LIPD-2000 item 52
Australia	3DR 433	MIN_FREQ=433050 MAX_FREQ=434790 TXPOWER<=14	LIPD-2000 item 17
Europe (most countries)	3DR 433	MIN_FREQ=434040 MAX_FREQ=434790 TXPOWER<=8 NUM_CHANNELS>=30	ETSI EN300 220 7.2.3
Europe (most countries)	3DR 433	MIN_FREQ=433050 MAX_FREQ=434790 TXPOWER<=8 DUTY_CYCLE=10	ETSI EN300 220 7.2.3
United Kingdom	3DR 433	MIN_FREQ=433050 MAX_FREQ=434790 TXPOWER<=8 DUTY_CYCLE=10	IR2030/1/10
New Zealand	3DR 900	MIN_FREQ=921000 MAX_FREQ=928000	Notice 2007, Schedule 1
New Zealand	3DR 433	MIN_FREQ=433050 MAX_FREQ=434790	Notice 2007, Schedule 1
Brazil	3DR 433	MIN_FREQ=433000 MAX_FREQ=435000 TXPOWER<=8	Resolução ANATEL nº506/2008
Brazil	3DR 900	MIN_FREQ=902000 MAX_FREQ=907500 NUM_CHANNELS>=11	Resolução ANATEL nº506/2008
Brazil	3DR 900	MIN_FREQ=915000 MAX_FREQ=928000 NUM_CHANNELS>=26	Resolução ANATEL nº506/2008
Argentina	3DR 900	MIN_FREQ=902000 MAX_FREQ=928000	Comisión Nacional de Comunicaciones
South Africa	3DR 433	MIN_FREQ=433050 MAX_FREQ=434790 TXPOWER<=10mW	2008 RR 5.138, Government Gazette No 31127, Notice No 713 of 2008 and Government Gazette No 31290, Notice No 926 of 2008 refer

We'd be delighted to add more countries to this table! Please post the information on the forums, giving links to the applicable regulations and information on what it all means. Also, please point out any inaccuracies in the existing table.

Note that the above table is for most users without any special license. If you are have an application specific license or have a HAM license then you should know what rules are applicable to you.

Finally, compliance is your responsibility. The 3DR radio is a 'DIY' radio part and you need to ensure what whatever you build meets local regulations. Please check your local rules carefully.

Available Frequency Ranges

The following table may be helpful matching your local radio regulations to the two radio models available

Radio	Minimum Frequency (MHz)	Maximum Frequency (MHz)
3DR 433	414.0	454.0
3DR 900	895.0	935.0

Duty Cycle setting

Most users will want to set the DUTY_CYCLE to 100. The DUTY_CYCLE is the maximum percentage of time that the radio will transmit packets.

The reason the duty cycle is included is that some regions of the world allow for higher transmit power or more frequencies if you have a duty cycle below a given threshold. So for example in Europe you can transmit on a wider range of frequencies in the 433 band if your duty cycle is below 10%.

When you set a duty cycle below 100% then your available bandwidth will be reduced, so you will find it will only work well for telemetry at higher baud rates. It is still quite practical to get good telemetry from an APM with a 10% duty cycle, as telemetry traffic is quite 'bursty', so the average transmit time is not generally high anyway.

For example, you can easily receive all telemetry streams at 2Hz with AIR_SPEED set to 128, ECC enabled and a DUTY_CYCLE set to 10.

You can also set a radio to receive only by setting the DUTY_CYCLE to 0. That will work best if you set NUM_CHANNELS to a low number, as otherwise the clock synchronisation will be poor.

Listen Before Talk (LBT)

The 3DR Radio can implement 'listen before talk' (LBT) functionality to allow it to comply with a wider range of regional regulatory requirements. LBT is a system where the radio is required to listen for a period of time and see no signal from other radios before it is allowed to transmit. By using a non-zero LBT_RSSI value your radio will become more 'polite', by waiting until everyone else has stopped transmitting before starting to transmit itself.

To enable LBT in your radio you need to set the LBT_RSSI threshold. This is the signal strength that the radio considers to be an indication that the channel is busy. If you set LBT_RSSI to zero then LBT is disabled.

The minimum non-zero setting is 25 which is a few dB above the receive sensitivity of the radio (-121 dBm). To setup LBT_RSSI you need to know what signal level your local radio regulations require for LBT functionality. Each increment in LBT_RSSI above 25 is roughly equal to 0.5dB above the radios receive sensitivity. So if you set LBT_RSSI to 40 then the radio will consider the channel to be free if the signal strength is less than 7.5dB above the receiver sensitivity.

Alternatively, you can use this formula to get the received signal strength in dBm:

$$\text{signal_dBm} = (\text{RSSI} / 1.9) - 127$$

This formula is approximate, but quite close. See the Si1000 data sheet for a more precise graph.

You will need to lookup your local regulatory requirements to see what LBT_RSSI setting you should use.

The LBT implementation in the 3DR radio uses a minimum listen time of 5ms, plus randomised listen time as per the European 9.2.2.2 rules.

Note that in many regions you need to implement LBT in conjunction with AFA (Adaptive Frequency Agility). The 3DR Radio implements AFA as long as you have NUM_CHANNELS set to more than 1.

Technical Details

When evaluating if this radio meets your local regulations it may be helpful to know what technology it uses.

The firmware implements frequency hopping spread spectrum (FHSS) with synchronous adaptive time division multiplexing (TDM).

Specifically, the radio divides up the frequency range between MIN_FREQ+delta and MAX_FREQ-delta into NUM_CHANNELS channels. The 'delta' value is a guard range to ensure that we stay well away from the edges of the allowed band. The guard range is set to half a channel width. The channel width is defined as:

$$\text{channel_width} = (\text{MAX_FREQ} - \text{MIN_FREQ}) / (\text{NUM_CHANNELS} + 2)$$

Additionally, the radio skews the base frequency by up to one channel using a random seed based on NETID. This means that two radios using different NETID numbers use slightly different frequencies.

The radios use GFSK (Gaussian Frequency Shift Keying) for transmission on a particular frequency.

The TDM works by dividing up time into slices, based on multiples of 16 microsecond ticks. The time slicing is designed to give a maximum dwell time on any frequency of 0.4s (this is to meet US regulations). The TDM algorithm then works as follows:

- the EEPROM parameters determine a set of TDM parameters, particularly the transmit window and silence period, both are in 16 microsecond units. You can view the results using ATI6.
- the transmit window is scaled to allow for 3 full sized packets to be transmitted
- the silence period is equal to twice the packet latency, for the given data rate
- The two radios synchronise their clocks automatically by adding 13 bits of timestamp information to all packets. The timestamp is in 16 microsecond units.
- Each radio only transmits when it is 'their turn'. So a radio gets one transmit window worth of time, then there is a silence period when neither radio transmits, then the other radio gets its turn. We never have the situation where both radios transmit at the same time
- the transmit channels are organised into a random sequence based on the NETID
- the frequency is changed to the next channel twice for each full TDM round, during the silence periods
- when not transmitting, data that comes in over the serial port is buffered in a 2048 byte buffer
- to prevent the buffer from getting too much data (which increases latency and risks overflow) the radios send information on how full the buffer is to the connected device. The APM code adapts its telemetry rates by small amounts to keep the amount of buffered data reasonable.
- The TDM algorithm is also adaptive, in the sense that when it is the turn of radio A to transmit, it can send a small token to radio B saying "I don't need to send anything right now, you can take the rest of my timeslice". That is how the link auto-balances for asymmetric loads
- during the initial search for another radio, and any time the link is lost, the radios go into a mode where they move the receiving frequency very slowly but move the transmit frequency at the normal rate. This allows the two radios to find each other for initial clock sync. How long this takes depends on the number of channels, the air data rate and the packet loss rate.

In some regions you may need to know the distribution of radiated energy within each channel. That depends on a number of factors, but mostly the frequency deviation used for the GFSK modulation. The following formula will give you an estimate of the frequency deviation:

$$\begin{aligned}\text{frequency_deviation} &= \text{air_data_rate} * 1.2 \\ \text{min freq deviation} &= 40 \\ \text{max freq deviation} &= 159\end{aligned}$$

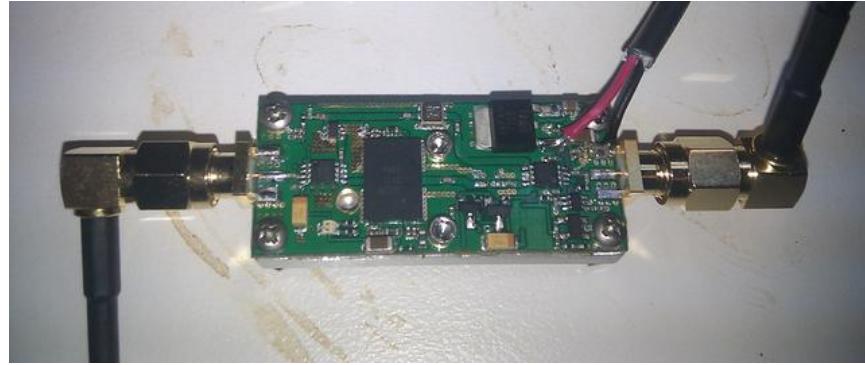
where frequency_deviation is in kHz and the air_data_rate is in kilo bits per second.

Using a bi-directional amplifier for very long range

You can combine a 3DR Radio with a bi-directional amplifier in order to extend the range to very long distances.

We have had a lot of success testing amplifiers made by [Shireen](#). In particular, Shireen were kind enough to donate a 900MHz amplifier which we tested with a pair of 900MHz 3DR radios.

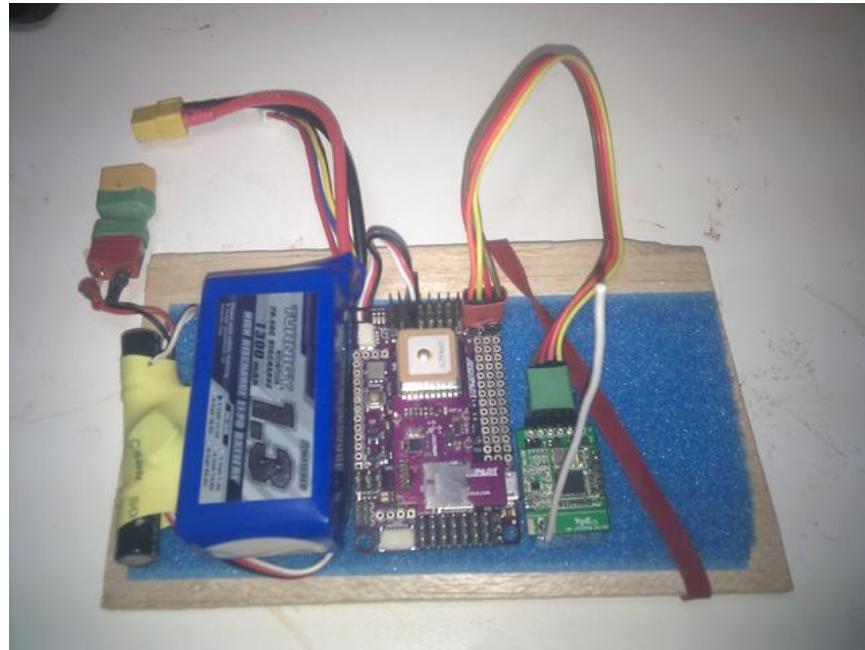




This amplifier gives 12dB transmit gain, and 18dB receive gain, automatically switching between transmit and receive modes when the radio starts and stops transmitting. It can either run on 5V from a UBEC, or can use a builtin switching regulator with a 2S or 3S LiPo.

We tested this amplifier at one end of a 7.6km link between two hills in Canberra, Australia. At one end we had a simple wire antenna, and at the other end we had a cheap eBay 3.5dBi omni antenna, plus the Shireen amplifier.

This was the test rig at the end without the amplifier



With the following setting:

```
S0: FORMAT=22
S1: SERIAL_SPEED=9
S2: AIR_SPEED=24
S3: NETID=25
S4: TXPOWER=14
S5: ECC=1
S6: MAVLINK=1
S7: OPPRESEND=1
S8: MIN_FREQ=915000
S9: MAX_FREQ=928000
S10: NUM_CHANNELS=50
```

we found that we got a great link at 7.6 km range. We then progressively lowered the transmit power at each end of the link in order to measure the 'fade margin', which allows us to estimate how far the radios could transmit at full power. We found that the fade margin was about 12dB at both ends, which implies that the radios should have been able to sustain a link at approximately 4x the range we tested over.

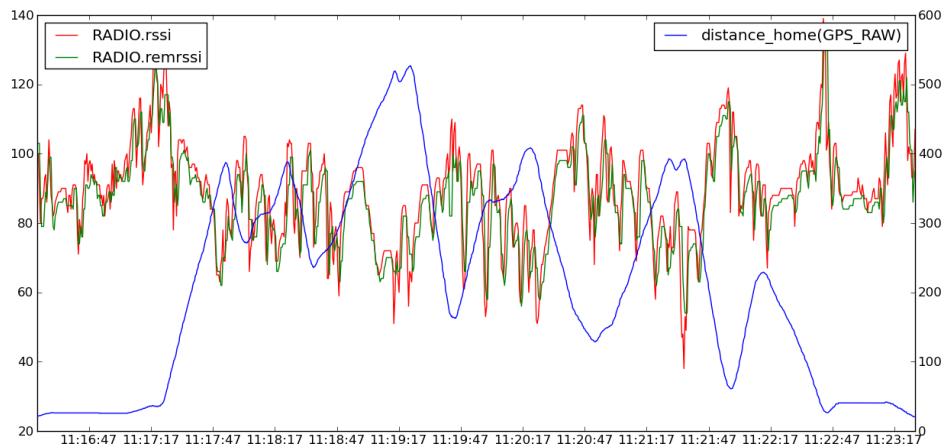
Note that if you use an amplifier (or high gain antenna) you need to be very careful not to exceed the EIRP level that your local rules allow.

Monitoring the link quality

You can use the MAVLink support in the 3DR Radios to monitor the link quality while flying, if your ground station supports it.

The two key message parameters are RADIO.rssi and RADIO.remrssi. The first is the RSSI (signal strength) level that the local radio is receiving at. The remrssi parameter is the RSSI that the remote radio is receiving at.

Here is a typical graph of the RSSI levels for a flight at my local flying field.



The RSSI value scales approximately as $1.9x$ the dBm signal strength, plus an offset. See the Si1000 data sheet for the exact mapping between RSSI and dBm received signal strength, or use this approximate formula

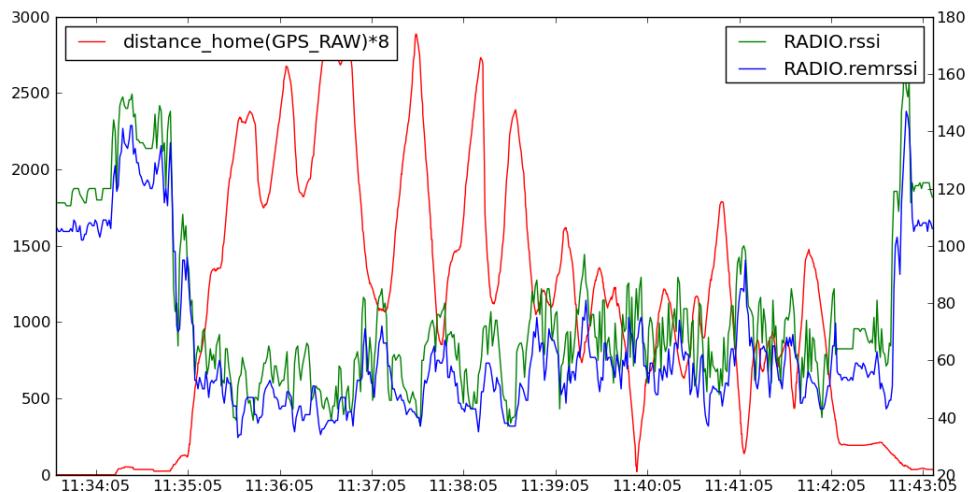
$$\text{signal_dBm} = (\text{RSSI} / 1.9) - 127$$

The reason the RSSI varies so much during this flight is that the signal is attenuated when the plane is rolled over in a turn as I was using a simple wire antenna in the plane. The RSSI values for this flight were plenty high enough for the link quality to be excellent throughout the flight using the default radio parameters.

What range can I expect?

The most common question about a telemetry radio is what range you can get with it. It is also a difficult question to answer, as it depends on so many factors.

We have done a lot of test flights to try to gauge what the practical range of these radios is with small omnidirectional antennas and no amplifiers. Here is a typical result:



In this case the 3DR 900 radios were setup with default parameters, except that the TXPOWER had been set to 2 dBm, which means they were transmitting with just 1.6% of their maximum power. Theoretically, a radios range doubles with each additional 6 dB of transmit power, so the range achieved with this test should be about 1/8 of the range that the radios can achieve at an air rate of 64kbps. That is why the above graph shows the distance in meters times 8. This was on a tiny SkyFun model, and I wanted to keep the plane where I could see it, which is why I did the test with reduced transmit power rather than just flying it a long distance.

The radios kept a perfect link throughout this flight, so we are confident that these radios will achieve a few kilometers range in practice. In this particular case I was flying with a small 'wire' antenna in the SkyFun and was using a cheap eBay 3.5dBi antenna on the ground station.

Of course, the range would be considerably better if I had dropped the air data rate. I find 64kbps to be a good rate for general use, but I tend to use 24 kbps if I am wanting to test at longer ranges.

The range of these radios has also been confirmed by other users. For example, I was sent a log showing a good link kept over a flight of 4.5km from the base station, using default radio settings for a 3DR 900 radio. That was using a small omni antenna in the plane, and a 8dB patch antenna on the ground station. The signal level in the log suggests it could have gone quite a bit further.

Diagnosing range problems

If you get less range than you would expect from the above information then what you need to do is graph the noise and signal levels from a flight to work out what the problem is.

The most common source of range problems is noise. Noise is unwanted radio emissions in the same frequency range that your radio is using that interferes with the operation of your radio. The 3DR radios have telemetry logging built in to help you diagnose the source of the noise.

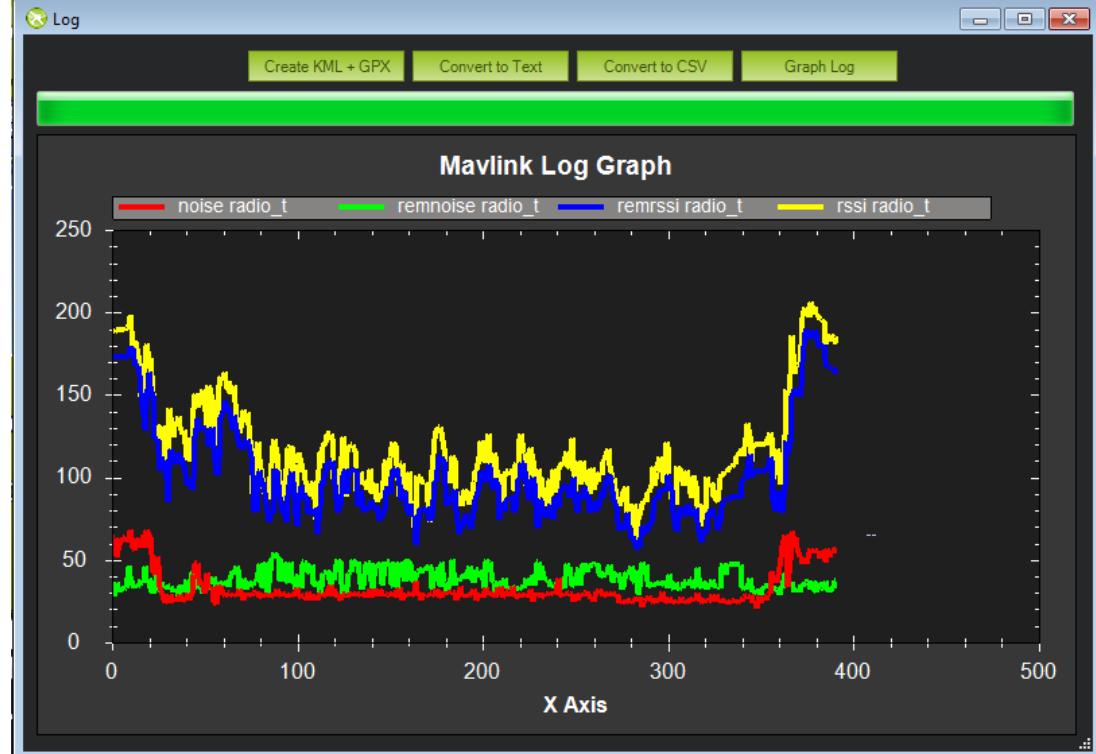
There are three key types of noise that are likely to affect your 3DR radios

- noise from the electronics in your aircraft (such as your motor, ESC, APM etc)
- noise from your ground station computer, especially its USB bus
- noise from other people operating radios nearby that are on the same frequency as your 3DR radios

To work out what sort of noise you have, open up mission planner and choose the "telemetry logs" tab. Then choose "Tlog>Kml or Graph". When the window pops up choose "Graph Log" and select a log from a test flight with your radios. Wait for the log to load, then choose the following items to log:

- rssi
- remrssi
- noise
- remnoise

Put all 4 values on the one graph. You will end up with a plot like this:



That graph shows you 4 things:

- the amount of signal being received on the ground
- the amount of signal being received in the aircraft
- the amount of noise being received on the ground
- the amount of noise being received in the aircraft

For the best possible range you want the two noise lines to be low, and the two signal lines to be high. In the above graph (taken from my SkyFun with a pair of 3DR-433 radios) you can see that the noise levels in the plane are higher than the noise levels on the ground. Also note that at the start of the flight (before I started the motor) the noise levels on the plane were lower, then they went up after I started the motor. That shows I'm getting some noise from my motor. If I wanted more range I would need to move the radio further from the motor and ESC.

Perhaps the most common source of noise with the 3DR 433 is noise from the USB bus on your ground station. That shows up as high values for

Perhaps the most common source of noise with the SDR-435 is noise from the USB bus off your ground station. That shows up as high values for the RADIO.noise value. If you get this, then you could try using a different USB cable, or a different laptop. You can also try using a USB hub between your laptop and your radio.

If the 'rss' and 'noise' levels meet on the graph then you will lose the link. To determine what your range would be, a rough rule of thumb is to subtract the 'rss' and 'noise' numbers, then divide by 2. That tells you your "fade margin" in decibels. For each 6dB of fade margin your range doubles. So if you have 18dB of fade margin, then you will be able to do roughly 8x whatever range you were at when you measured the margin.

Another key source of range problems is the antenna placement. Your ground station antenna should be well clear of obstructions and a couple of meters off the ground. You may need to build a stand to hold it to get the best range.

Upgrading your radio firmware

The firmware for the 3DR radios is open source, and new features are regularly added. You should check for new releases regularly to get the most from your radios.

The easiest way to upgrade is using the APM Mission Planner. Go into the 3DR Radio configuration screen and use the 'Upload Firmware' button.

After you upgrade please carefully check all your settings. A firmware update may change your settings to the default values if the EEPROM format has changed.

We also encourage you to get involved in the development of the firmware. Start by looking at the [firmware source code](#) and contribute some patches!

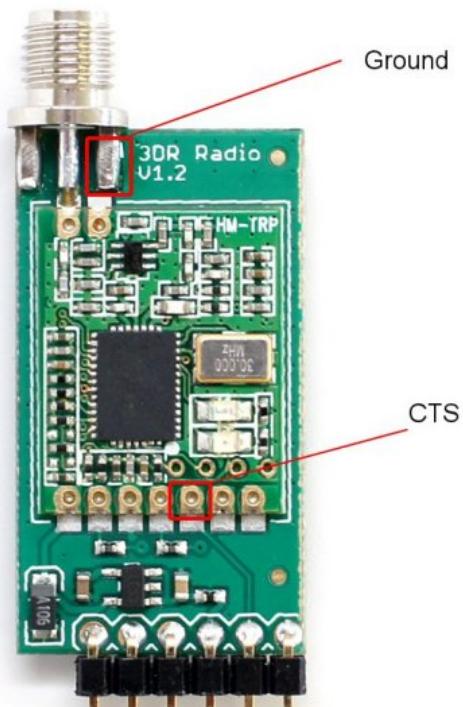
Forcing bootloader mode

If you somehow manage to get your radio in a state where you can't upload a new firmware via the Mission Planner then you may need to force the radio into bootloader mode.

The way firmware upload normally works is the planner connects to the radio and sends a AT&UPDATE command to put the radio into bootloader mode ready to receive a new firmware. That only works if the planner can send AT commands to the radio.

If you can't send AT commands, then you can force bootloader mode by shorting the CTS and GROUND pins on the radio while powering on. The red LED will light up when in bootloader mode.

On the air radios the CTS and GROUND pins are easy to find, as they are marked on the back of the radio (they are two of the FTDI connector pins). On the USB radios it isn't as obvious, so this diagram may help:





After you have the radio in bootloader mode you should be able to upload a firmware.

3DR Radio Discussion Forum

The best place to get involved with the development or tuning of these radios is the [3DR Radios forum](#). Join in on the forum to help make these radios even better!

Comment by [pdrsanto...@gmail.com](#), Apr 7, 2012

Hello,

Could the "Air" module be configured in Mission Planner using the FTDI Cable 5V (or the FTDI Basic 5V)? Thank you.

Pedro

Comment by project member [trido...@gmail.com](#), Apr 7, 2012

@Pedro, yes, you can configure using either a FTDI cable, or even configure remotely with the radio in your plane and a USB radio on your PC.

Comment by [Byakuts...@gmail.com](#), Apr 13, 2012

Is this plug and play like the Xbees kit?

Comment by [sebis...@gmail.com](#), Apr 22, 2012

Hello,

Does Ardustation and compatible with 433 3DR Telemetry?

I want to use a tracking antenna with my quadcopter (APM 2.0, Telemetry 3DR, Ardustation and the Mission Planner)

Is this possible?

Sincerely,

Seb

Comment by [hertral...@gmail.com](#), Apr 27, 2012

Hi

When I try to connect my APM 2 with the 3Dr Telemetry system the mission planer says no heartbeat Packets received, I just bought it and I'm kinda new to all this. anyone who can help me ?

Comment by project member [analogue...@gmail.com](#), Apr 27, 2012

sw33tdude: Make sure your USB cable is not connected when trying to use the radio.

Comment by [mkraw...@gmail.com](#), Apr 27, 2012

I'm trying to compile SiK to get bootloader and firmware, but with no success... On both Linux and Mac I've got "ImportError: No module named argparse". Seems that there's problem with Python version. Does anyone have HEX files for HM-TRP SiK mod?

Comment by [hertral...@gmail.com](#), Apr 28, 2012

I have tried without the usb cable connected and it still won't work.

Comment by [sebis...@gmail.com](#), Apr 28, 2012

Can you answer me please ? Ardustation Kit Compatible Telemetry 433 3DR ?

Thk,

Seb

Comment by project member [analogue...@gmail.com](#), Apr 28, 2012

Seb: I don't think they've released the version with an Xbee footprint yet, so no, not yet.

Comment by [sebis...@gmail.com](#), Apr 28, 2012

You probably want to say "version with a footprint 3DR"

Anyway thank you very much for your response ;-)

Comment by project member [analogue...@gmail.com](#), Apr 28, 2012

No, I meant Xbee footprint. The ArduStation² radio connector is designed for Xbees. The 3DR radios have a built-in adapter so they don't use all those Xbee pins. 3DR will be releasing a version with an Xbee footprint in a few weeks, so they can be used as a plug-and-play replacement in such situations.

Comment by [rcg12345...@gmail.com](#), Apr 30, 2012

someone said this set will work for mikroopter, can anyone advise? thanks if so is there a hookup schematic anywhere? thanks and great work either way!

K

Comment by [ine...@gmail.com](#), May 4, 2012

433 radio air to air module does not work...faild to enter comand mode...or no heartbeats received...or faild to identify radio

Comment by [ine...@gmail.com](#), May 4, 2012

ITS WORKING NOW...after endless trying i found what was problem...missing driver for FTDI windows XP drivers downloads here
<http://www.ftdichip.com/Drivers/D2XX.htm>

Comment by [azm...@gmail.com](#), May 7, 2012

so nobody have try it with Mikroopter yet? okay, so i'll give it a try. In fact, my 3dr is on the way now to Malaysia.

Comment by Zulkarna...@gmail.com, May 10, 2012

Yup. Mine have arrived. Quadro selling them for mk I guess....:-)

Comment by [jonathan...@gmail.com](#), May 11, 2012

Is the firmware compatible with : http://www.seeedstudio.com/depot/grove-serial-rf-pro-p-794.html?cPath=139_140 Looks like same module ? Thanks

Comment by [michalpa...@gmail.com](#), Jun 25, 2012

Hello, is there any additional power amplifier for 433 mhz recomendend?

Comment by project member [cr...@3drobotics.com](#), Jun 25, 2012

You can transmit up to the legal power limits using the radio without any additional amplification.

Comment by [point...@gmail.com](#), Jul 2, 2012

@jonathan Considering that both uses same hm-trp (http://www.hoperf.com/upload/rf_app/hm-trp.pdf), I think that is possible

Comment by [jason.m....@gmail.com](#), Sep 7, 2012

Are the modules paired in any way? If I have two airplanes each with their own set operating close by are they going to interfere with each other?
Thanks

Comment by project member [analogue...@gmail.com](#), Sep 7, 2012

Jason: Yes, they are paired. As long as you don't use the same ID as the other guys, there is no risk of interference.

Comment by [johnwbak...@gmail.com](#), Sep 25, 2012

Can anyone recommend the best antenna setups for these?

Comment by zhanyi...@gmail.com, Oct 2, 2012

Can it be used as a video telemetry device for FPV?

Comment by project member [cr...@3drobotics.com](#), Oct 2, 2012

@ zhanyiduo, bandwidth is 57k - high speed serial, but not video

Comment by [ramiros...@gmail.com](#), Oct 3, 2012

In order to update the table with countries an the regulations, in argentina we can use 915MHZ.

And following you can view the link to the CNC (Our entity which regulates communications)

<http://www.cnc.gov.ar/infotecnica/espectro/uso/destacados01.asp>

Comment by zhanyi...@gmail.com, Oct 5, 2012

@craig@3drobotics.com Thank you for your reply. Is it available to connect the ardu autopilot to OSD and use any video telemetry to monitor the status of the UAV on the FPV screen?

Comment by [pcworksp...@gmail.com](#), Oct 12, 2012

Nice! I soldered the connector, followed the directions above and it worked the very first time! Thank you!

Comment by [TylerGiv...@gmail.com](#), Nov 12, 2012

I'm using windows XP and the 3DR Radio 433MHz kit which came with two units. I soldered the connectors and connected one radio to my PC using the supplied cable. I connected the other radio to my APM 2.0. Both radios are showing solid green and blinking red LEDs, which indicates they are paired and communicating. I downloaded the drivers as directed above and used the setup executable file to install them. I'm using COM 5, which appears in my device manager only when the radio is connected. Via both Mission Planner 1.2.19 and the 3DRadio Config 0.9 utility, I get a "Failed to enter command mode" error when I try to "Load Settings" from the radio.

A few times, Windows has tried to install a Serial Mouse when I plug the radio into the USB port. Anybody got any ideas about what's happening here?

Comment by project member [cr...@3drobotics.com](#), Nov 13, 2012

Windows is detecting the serial data from the radio and assigning it as a mouse. You have to disable the serial mouse in the device manager (not delete or it will just be re-detected) and then you should be able to connect to the radio after that at 57.6KB

Comment by [floza...@gmail.com](#), Nov 14, 2012

Hi I have APM 2.5, and 3DR Radio 900Mhz yesterday I installed all for the first time, I made some flights (Arduplane), and Telemetry works excellent, today I updated my mission planner on one computer, and my 3DR Radio don't connect anymore, I tested in another computer with the old mission Planner, and have the same problem, The radio Link works, two solid green Lights, and I can configure and get the settings, but when I try to connect I receive the error "No Heartbeat Packets received" and no red lights.

Comment by [hemicro...@gmail.com](#), Dec 1, 2012

I just received my 3dr 900mhz and installed it. The ground radio hooks up fine and is found in the device manager. The green light is blinking (looking for another radio) but never links to the air radio. The air radio is powered up and has a solid green light as soon as power is applied and when powered up the a and c lights on the apm no longer operate. I don't have an ftdi to usb cable, so I can't check it on the computer. Is there anything I should look for until I get a cable? The air unit may be bad I guess.

Comment by [hemicro...@gmail.com](#), Dec 1, 2012

I might add that I do not have the usb port on the apm hooked up when I am using the air radio.

Comment by project member [analogue...@gmail.com](#), Dec 1, 2012

hemi: did you change any settings on the ground radio? If not, it should see the air one (settings of both shown in the MP)

Comment by [hemicro...@gmail.com](#), Dec 1, 2012

The only settings I changed were the com port number and the baud rate in MP. It seems that the air radio is not running since the green light just comes on and stays on.

Comment by [hemicro...@gmail.com](#), Dec 1, 2012

When I go to the 3dr setup screen I can load the settings from the ground unit, but nothing for the air unit.

Comment by [ride...@gmail.com](#), Dec 4, 2012

Hemi- I might be wrong but if you changed the baud rate on the local radio and not on the remote radio also, they are not talking at the same speed and will not connect. Change the local back and it should work.

Comment by typicala...@gmail.com, Dec 12, 2012

Can we add a section for "PANIC radio_initialise failed" under the troubleshooting part of the wiki? A few people have had this problem and it leads to a dead HM-TRP module..

<http://divdrones.com/forum/topics/panic-radio-initialise-failed>

I experienced the same problem and ended up working with support to RMA a module.

Comment by rodol...@yahoo.fr, Dec 19, 2012

Hi, On Window 7. The ground radio has one red led solid, that is all. the air one has its red and its green led flashing. Com5 selected 57600. Load setting gives "failed to enter command mode". Upload firmware gives "failed to identify radio". What shall I do? Cheers Rodolphe

Comment by project member cr...@3drobotics.com, Dec 19, 2012

The solid red LED indicates the radio is in bootload mode. Read the documentation above about the LED modes and bootloading. A power cycle should get it out of bootload mode

Comment by rodol...@yahoo.fr, Dec 21, 2012

Hi, by power cycle do you mean unplugging and plugging again the local radio? I have also shortened the ground and the CTS. After many attempts I obtained a solid green light and a very weak blinking red one. "Load settings" gives "failed to enter command mode" Upload Firmware" gives "failed to identify radio" When I unplug and plug again, the led goes solid red again. The remote radio have a solid green led and a flashing red one. what shall I do? Regards Rodolphe

Comment by project member cr...@3drobotics.com, Dec 21, 2012

@rodolp92 please contact help@3drobotics.com

Comment by fun...@singnet.com.sg, Dec 31, 2012

Hi I also got the same problem - I almost always get the solid red light on the air module. I unplug and re-plug again and sometimes I get the solid green light and a very weak blinking red one, where the data transfer is fine. I have tried and succeeded in uploading the firmware to the two modules.

Comment by alan.pow...@googlemail.com, Jan 4, 2013

Hi, I can't be the first to consider this so the answer is out there even if it is laughter!

I want to install a MinimOSD in my video ground station fed from a 3DR in receive mode but have a separate 3DR data link i.e. two ground station radios. Is this possible?

Regards

Alan

Comment by project member cr...@3drobotics.com, Jan 4, 2013

@alan you don't need 2 ground station radios. It might be tricky with the USB radio to access the serial TX & RX lines but if you used one of the air radios you could just pick up the serial signal off the pins on the radio and feed it to the MinimOSD. It should be pretty easy to do.

Comment by alan.pow...@googlemail.com, Jan 4, 2013

Craig,

Thank you. The only issue is that my video system is cased and separate from the mission planner case. I use low power 5.8GHz tx/rx communication from my antenna tracker setup to both goggles and the DVR and monitor in the video case. The 3DR is 433MHz so I already have two air units and the manual is very clear about the connections to the OSD. Will a second 3DR receiver in the video case cause any issues with the remaining telemetry i.e. can it be made passive and just process OSD data?

Regards Alan

Comment by project member cr...@3drobotics.com, Jan 4, 2013

@alan the OSD is the passive device. It just needs the serial data being output from the radio and it will decode the MAVlink messages and display the data onscreen. You just need to add some pins and make an adapter cable to go from the radio to the OSD.

Comment by alan.pow...@googlemail.com, Jan 5, 2013

Craig,

Thank you. I will test it and get back in a few weeks.

Regards

Alan

Comment by Polleke1...@gmail.com, Jan 11, 2013

Just a range question. I'm having this for a week now and tried a range test. When I'm in my hobby room (upstairs) I'm having good contact, but this is only 3 meters from my quad. When I put my quad in the living room (downstairs +/- 6 meters) I loose contact..... Is this normal and will I have better range outsite (not possible at the moment because the weather is to bad)

Comment by C13Brenn...@usa.edu, Jan 24, 2013

Craig/Alan,

Are you sending the video feed to your goggles through a 3DR? If so, can you add some details as to how you did that? I am trying to get one 3DR to send both video (from an Android Camera Phone with image processing) and flight data (from APM 2.5) to the mission planner. Any ideas? Thanks.

-Brennan

Comment by kalvinru...@gmail.com, Jan 26, 2013

Hello all!

I have a 3DR radio and had a few questions about using it in combination with a normal stick controller before I integrate it into my setup. I want to be able to use both interchangeably to give instructions while my multicopter is in flight, is this possible? Say I was flying my copter with my Turnigy 9x and switched the flight mode to loiter and turned off my transmitter. Could I then turn to my laptop and specify waypoints, and switch the flight mode to follow those waypoints from my laptop or other device? When the copter reached its final destination could I then pick up my 9x, switch it back on, change the flight mode back to stabilize or manual using the 3 position switch and continue on my merry way?

Thanks!

Comment by project member analogue...@gmail.com, Jan 26, 2013

Kalvin: It depends on how you have set your RC failsafe. If you have set it not to RTL or otherwise engage when the RC signal is lost then yes, you could do that.

Comment by www.west...@gmail.com, Jan 26, 2013

Are there some basic instructions on how to operate the radios? How do I know it's recording or not? How do I set up MP so I can see something? Where should the output be going? The screen? A file somewhere? A separate monitor? You guys have done a great job of describing all the features but nothing on how to make it work. How about a small schematic drawing? All the lights are solid green and blinking red but I have no idea where to go from here. Unfortunately we are not all electronic experts. Thanks

Comment by project member analogue...@gmail.com, Jan 26, 2013

Neil: All those questions are answered elsewhere in the manual. The MP auto records missions when it is connected to an APM via MAVLink. I don't know what "How do I set up MP so I can see something?" means.

Have you started at the beginning of the manual, with the quickstart guide?

Comment by waltercl...@roadrunner.com, Jan 30, 2013

It seems like the 3DR radio telemetry is an accessory to a more expensive autopilot. Is it also possible to use the 3DR radio with a much simpler Arduino? Or even a single Atmega chip? If it is only for the APM, perhaps you can suggest another product to buy? My bandwidth-need is very low, just DC values.

Comment by jmeadows...@gmail.com, Feb 7, 2013

Does anybody know if it is at all possible to downgrade firmware on the local radio? I upgraded it without really thinking, but lack the USB-FTDI cable to do the same for the air radio, so now they're on different versions and aren't really communicating properly. Is there any way to revert the ground firmware to 1.5 SiK?

Comment by tripwi...@gmail.com, Feb 25, 2013

I have the same problem as "jmeadows...@gmail.com"

"Does anybody know if it is at all possible to downgrade firmware on the local radio? I upgraded it without really thinking, but lack the USB-FTDI cable to do the same for the air radio, so now they're on different versions and aren't really communicating properly. Is there any way to revert the ground firmware to 1.5 SiK?"

Can't update the in air radio and can't find no way to downgrade the ground radio.

Comment by ppe...@gmail.com, Mar 3, 2013

Hi

Is it possible to use the 3DR Radio on a PixHawk² autopilot? Would the connection be easy?

Thanks in advance for your help! Pietro

Comment by thezenpi...@gmail.com, Mar 20, 2013

Hello, I've tried for many hours now to set up the radios as described above (433MHz kit) to my apm. So far I've loaded successfully on both radios and they are the same, but when I try to connect to the apm directly I've the famous "No heartbeat packets received". Any idea/ suggestion to make it work? Many thanks

Comment by project member cr...@3drobotics.com, Mar 20, 2013

@thezenpilot Connect them up between 2 computers or 2 ports on a computer with a terminal program and you can verify if you have the radios working or if there is a problem with communication to the APM

Comment by thezenpi...@gmail.com, Mar 24, 2013

Hello Craig, I ordered another FTDI cable to test that as I had only one with the 433MHz kit. I noticed as well the red led on the ground radio is very weak compared to the one on the air radio. Could this indicate something? Btw when I'm in terminal mode in MP I see a lot of strange characters like question marks, commas etc

Comment by project member cr...@3drobotics.com, Mar 25, 2013

@zen The strange characters mean that the link and the radios are working but depending on if you are looking at raw MAVLink messages or if you have the CLI terminal open you may have the wrong baudrate. For USB the baudrate is 115. For radio it is 56.7.

Comment by kds.kart...@gmail.com, Apr 2, 2013

Can I get more info on the type of bi-directional amplifier you used, I have a 3DR radio with 900 MHz and I am not going to be transmitting video's. Please suggest....

Comment by thezenpi...@gmail.com, Apr 4, 2013

Hello All, I finally found what was wrong! The baud rate from the ardupilotmega on the telemetry was not configured properly. So as me, if you're starting with 3DR radios, configure the Baudrate on the computer (adaptor, under the config panel of windows), MP connexion (port and baudrate, top right corner of MP)) the 3DR radios (both local and remote), and finally on the APM the telemetry baudrate in the MP config section (standard param). Hope this will help ;)

Comment by nublihas...@gmail.com, Apr 5, 2013

hello, I may be missing something, what is the baud rate for connection? 57K? thanks

Comment by kullb...@gmail.com, Apr 8, 2013

Also could not get the APM to connect to the RFD900 (3DR) radio - reduced the baud from 115k down to 57k6 and all went smoothly. Now I can configure the local and remote radio via APM - FANTASTIC. Debugging info on RSSI and Noise is really useful here in Sydney too due to 900MHz mobile tower density and noise.

Comment by emstei...@gmail.com, Apr 27, 2013

Hi Guys, I am connected to my APM 2.5 finally thru 3DR 900MHz radios and when I try to upload firmware or load settings it says Invalid ComPort² or in use. I am new at this and realize it's probably something simple. Since it's connected I'm guessing the problem is that it's in use. Any help would be much appreciated as well as where to get good info other than here.

Thanks Eric

Comment by project member cr...@3drobotics.com, Apr 27, 2013

@Eric you can only load firmware to the APM using the USB connector.

Comment by marcoabu...@gmail.com, Apr 29, 2013

Hello!

I'm having troubles with my 3DR radios, particularly with the onboard radio. In some point I upgraded the firmware of my radios using the Mission Planner and I also changed the baudrate to 115k, after this, I have never connected my 3DR again. When I connect the onboard 3DR to my computer to reload the firmware the green LED stays on all the time, actually, when I try to use it on my APM 2.5 it also stays on.

Does anybody know how to fix this?

Thanks!!

Comment by project member cr...@3drobotics.com, Apr 29, 2013

@marco You can reload the firmware at 115kbaud but you can only connect to the radio or between the radios at 57.6kbaud

Comment by marcoabu...@gmail.com, Apr 30, 2013

@craig

Shure! I have already reload the firmware to my 3DRadios, but i can only get bootloader access to the onboard radio by wiring the third pin (from right to left) to ground. In any other way i can't read the firmware or the configuration of this radio. As i say before, the onboard radio stays with the green led turned on, never blinks, i can't get connection. Is there any other way to reset my radios?

Thanks for your help!

Comment by project member cr...@3drobotics.com, Apr 30, 2013

@marco Sounds like the firmware is corrupted. See above about Forcing bootloader mode and try loading it again

Comment by marcoabu...@gmail.com, Apr 30, 2013

@craig

Yeah, i have already force the bootloader mode and reaload the firmware with the 3dR software and mison planner (are practically the same), the problem remains.

I think that my radio doesn't working any more.

Comment by project member cr...@3drobotics.com, Apr 30, 2013

Then you have probably damaged the bootloader. Contact help@3DRobotics.com and get an RMA for it.

Comment by marcoabu...@gmail.com, Apr 30, 2013

@craig

Thanks!

Comment by marcoabu...@gmail.com, Apr 30, 2013

@craig

Haha, i'm afraid to ask this but... Sorry

RMA?

Comment by project member cr...@3drobotics.com, Apr 30, 2013

http://en.wikipedia.org/wiki/Return_merchandise_authorization

Comment by didavid...@gmail.com, May 6, 2013

Hi all I have 433 telem working ok but when I change to 915 I can't enter command mode I can get air radio to read and update firmware but the ground radio won't do anything just says failed to identify radio and fail to enter command mode can anyone suggest the correct action thanks Dave

Comment by project member cr...@3drobotics.com, May 6, 2013

@david do you mean you are trying to reprogram your 433 to become a 915?

Comment by didavid...@gmail.com, May 7, 2013

NO I HAVE BOTH TYPES MY 433 WORKS GOOD BUT I CANT GET THE 915 TO WORK I CAN GET THE AIR UNIT TO LOAD AND UPDATE FIRMWARE BUT GROUND UNIT WONT IT JUST SAYS UNABLE TO IDENTIFY RADIO ITS A 3DR RADIO USB V1.0 IT HAS 433MHZ AND 915MHZ WRITTEN ON THE BOARD

Comment by project member cr...@3drobotics.com, May 7, 2013

@David, it sounds like the bootloader may be corrupted. Please clarify so I understand. Do you have 2 USB radios, one that says 433 and one that says 915?

Comment by vmvideob...@gmail.com, May 17, 2013

Hello! Is tx/rx IO of this unit compatible with 5V? or it 3.3V? (433 mhz version) I'm use included FTDI cable to normally work with module, but when I'm change to another HW USB-RS232 converter, radio only send (TX) but not receive anything from PC... Currently I'm use 3.3 level...

Comment by project member billbon...@gmail.com, May 17, 2013

@vmvideoboss: it's 5V

Comment by erikwon...@gmail.com, May 20, 2013

Hi all! I can't connect to the Air Radio from my laptop. I've got a solid red light on the Air radio and a blinking green light on the ground radio. I use a 433 version and all settings seem ok. I try to make a connection on COM9 with 57k baud rate. Any ideas what could be wrong?

Comment by gwall...@gmail.com, Jun 1, 2013

Are the tx and rx somehow bound together or secure? What would happen if another user with the same type of radio hardware was running alongside at the same field?

Comment by gerard.a...@gmail.com, Jun 11, 2013

I build a cheap variometer. I used a simple 433 MHZ transmitter-receiver-combo. But it interfered with other members of our modelfly-club. Can I use this system to send audio from my plane to the ground? It's TTL-audio. And I want to use a simple receiver on the ground (not a laptop).

Comment by lynda...@gmail.com, Jun 13, 2013

what makes this technology better than Xbee radio?

Comment by project member billbon...@gmail.com, Jun 13, 2013

@Lynda: Price, The support for MAVLink radio packet for RSSI information. And Open Source FW . The team here <http://store.rfdesign.com.au/rfd-900-radio-modem/> and see <http://diydrones.com/forum/topics/rfd900-new-long-range-radio-modem?commentId=705844%3AComment%3A1259365> have added multipoint comms as well

Comment by pl.ruffi...@gmail.com, Jun 24, 2013

Do I rightly understand: rx of APM has to be connected with tx of 3dr telemetry module and tx of APM with rx of telemetry module? I thought it was a mistake in my cable so I crossed the two cables by me, but I still cannot link it to the computer.

Comment by project member billbon...@gmail.com, Jun 24, 2013

@pl.ruffieux: TX goes to RX and RX to TX as marked on the APM and 3DR Radio. The world of serial comms was always confused due to DCE (Data Circuit-terminating Equipment) and DTE (Data Terminal Equipment) the DCE has TX/RX swapped, which meant everybody is confused ;-) see <http://en.wikipedia.org/wiki/RS-232>

Comment by pl.ruffi...@gmail.com, Jul 22, 2013

Thank you. Now I have another problem. It used to work. But somehow now both on my ground and air radios, green LEDs flash at 1Hz and red ones flash at about 5Hz. I cannot connect anymore between both radios. I have tried to change baud rates on the ground radio, but it doesn't change anything. Any idea?

Comment by pl.ruffi...@gmail.com, Jul 23, 2013

Now I am stuck one step further: I have put my air radio into bootloader mode but I cannot get it out of it. It stays with solid red LED and do not communicate with my ground radio. Any idea? Thanks

Comment by project member cr...@3drobotics.com, Jul 23, 2013

@pl if it is stuck bootloader mode you will need to reload the firmware

Comment by estian.m...@gmail.com, Aug 6, 2013

These radios use the HM-TRP modules from HopeRF. You can see that in the last picture above.

I purchased the HM-TRP modules separately from HopeRF and, using a Microcontroller, I managed to completely lock myself out of the device by setting the UART baud rate to an invalid value. This has resulted in rendering the device completely useless and unusable. According to HopeRF, there is no way to restore/reset this device without sending it back to them for reprogramming. I find this rather ridiculous!

From the instructions above, it seems that the CTS pin on the 3DRRadio is connected to the CONFIG pin of the HM-TRP. This means that if you ground this pin at power-up, it should still be able to force the bootloader mode (i.e. red LED on), correct?

Well, sadly, upon trying this, nothing happens. Does this mean that perhaps 3DR flashes these devices with their own firmware before shipping them out? In this case, it might be well worthwhile flashing the modules with this firmware before attempting to change the baud rate, just in case things go wrong and you have to force boot loader mode again..

Any comments on this? I would like it if someone from 3DR could give me more insight.

Thanx!!

Comment by uwebserv...@gmail.com, Aug 8, 2013

Hello, Is there any version to send video and telemetry data at same time ? Thank you in advance.

Comment by project member cr...@3drobotics.com, Aug 8, 2013

@uweb you can send video with a video transmitter but only telemetry with this radio.

Comment by [ROett...@woh.rr.com](#), Aug 9, 2013

Hi guys, I think I've lived 70 years just to this kind of stuff. I'm afraid I haven't done much research so I hope my questions aren't to lame. I plan on building both a plane and quad in fact the fuselage for both will be very similar. My first question is it possible to program a plane so that it has 3 or 4 different alternative flight paths in other words several sets of way points? One advantage I see is that the plane could pick the best runway for landing. As a multi engine commercial pilot I'm quite able to handle x-wind landings but I thought I'd like to leave that up to the plane. What do you think?

Comment by [izzuddin...@gmail.com](#), Aug 21, 2013

Can this thing used to send a text data from microcontroller to computer?

Comment by [pl.ruff...@gmail.com](#), Sep 4, 2013

My radio set used to work. But I played a bit with the parameters and could not control the air radio anymore. So I forced it into bootloader mode. Now the red LED stays on (normal) So I bought a USB to FTDI cable. Should I also swap Tx and Rx between the air radio and the FTDI cable? Now from the 3dr config utility, when I select the COM9 port for my FTDI, which Baud should I set? So far I have understood, the only thing I should do is to click on "Upload Firmware (local)". Is this correct? Because like this I get the error message "Failed to identify Radio". Any idea to bring back my ground and radio back on communication? Thank you for your help

Comment by [marsh3...@gmail.com](#), Sep 14 (4 days ago)

Same boat here. Air radio is in bootloader. Waiting on Ebay FTDI cable arriving on slow boat from China. Anyone know where those things are available state side?

Comment by [pl.ruff...@gmail.com](#), Sep 14 (4 days ago)

@rmash3: tell me when you have it if you find the way to get out of this trap mode...

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