

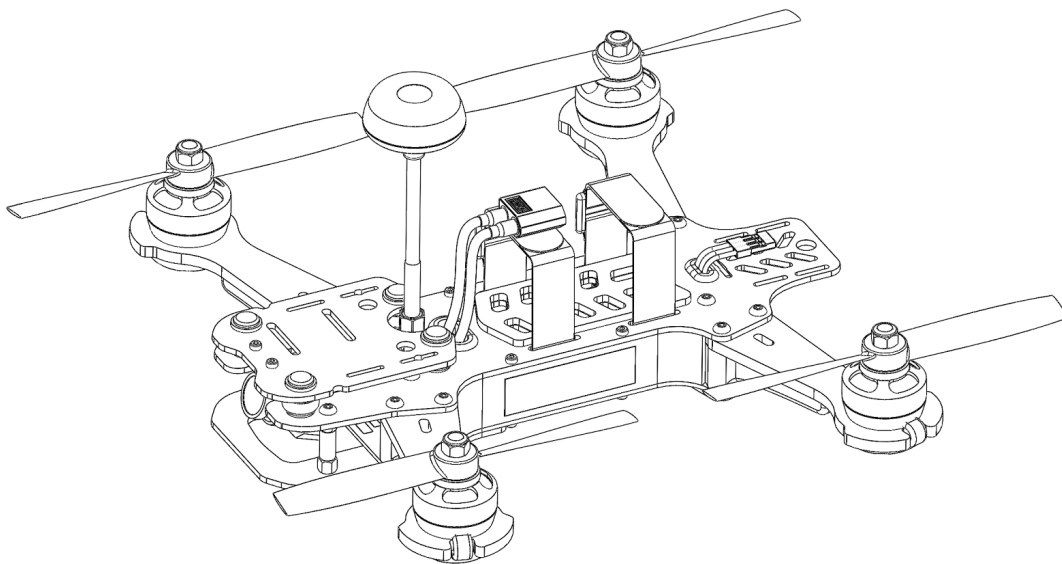
VORTEX

250 Pro

250 Pro Getting Started Guide

International edition

Rev 1.0 - Dec 2015



Every Vortex 250 Pro is flight tested before leaving the factory.

Flight Tested By:

IMMERSION RC
REAL VIRTUALITY

 **WARNING**

Congratulations on your purchase of one of the hobby's first ARF pure-bred racing quadcopters. A product designed by FPV Racers, for FPV Racers.

Do not expect it to fly like a DJI Phantom™. It does not have a return-to-home feature, no GPS, and it does not have stabilization features that will allow your little brother to fly.

Take it easy if you are new to the world of FPV racing, try to avoid slamming the quad into the first wall before you have mastered slaloming through the trees on the way to the wall.

Acro mode is something that should be learned as soon as possible, flying any other mode is a bit like driving a Lamborghini around a parking-lot in reverse... not exactly what you bought the Lambo for.

Please carefully read the recommendations in this getting started guide, as far as equipment/battery selection, and how to run the Vortex 250 Pro Wizard.

 **REMOVE PROPS**

Mini-quad props can do serious damage when coming in contact with human skin, risk of deep cuts and lacerations should be avoided at all cost.

So when you are working on a quad with the battery connected, it is highly recommended to **REMOVE ALL PROPS**, unless you are just about to fly. Keep in mind that when setting up mini-quads, there is always a remote chance that a configuration change can spin up motors unexpectedly.

ImmersionRC accepts no responsibility, or liability, for any injury, or damage, to persons or property, caused by the use of the Vortex.

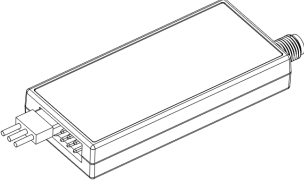
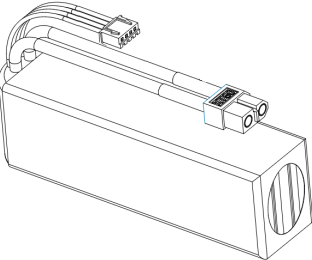
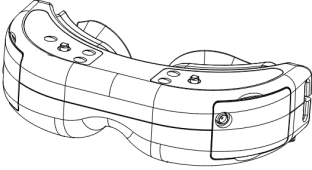

 **INSTALL ANTENNA**

The Video Transmitter included in the Vortex may be damaged permanently if run without the supplied SpiroNET Antenna. Please take care to install this antenna before every flight, and when powering up the Vortex for even a short time period.

ImmersionRC accepts no responsibility for damage caused to the Vortex by operating without a suitable Tx antenna installed.

4 Steps: Unboxing to Racing

To get your ARF Vortex ready to race, follow the simple 4-step process below.

1) Install Compatible R/C Receiver	
2) Install suitable battery	
3) Setup the video link	
4) Run the wizard	

1) Install Compatible R/C Receiver

The Vortex 250 Pro is shipped with three receiver interface cables, one for CPPM, one for S-Bus, and one for the Spektrum receivers.

Cleanflight provides a list of receivers stated as working, so please check if yours is listed here: <https://github.com/cleanflight/cleanflight/blob/master/docs/Rx.md>

CPPM

As it ships, the CPPM cable is pre-installed in the quad. If a CPPM receiver is to be used (such as the EzUHF, or other CPPM receivers on 2.4GHz) the receiver can simply be attached to the rear mounting plate, and the cable connected. No other cabling is required.

CPPM sends all PPM channels down a single cable, and eliminates the mass of wiring that most mini-quads have to contend with.

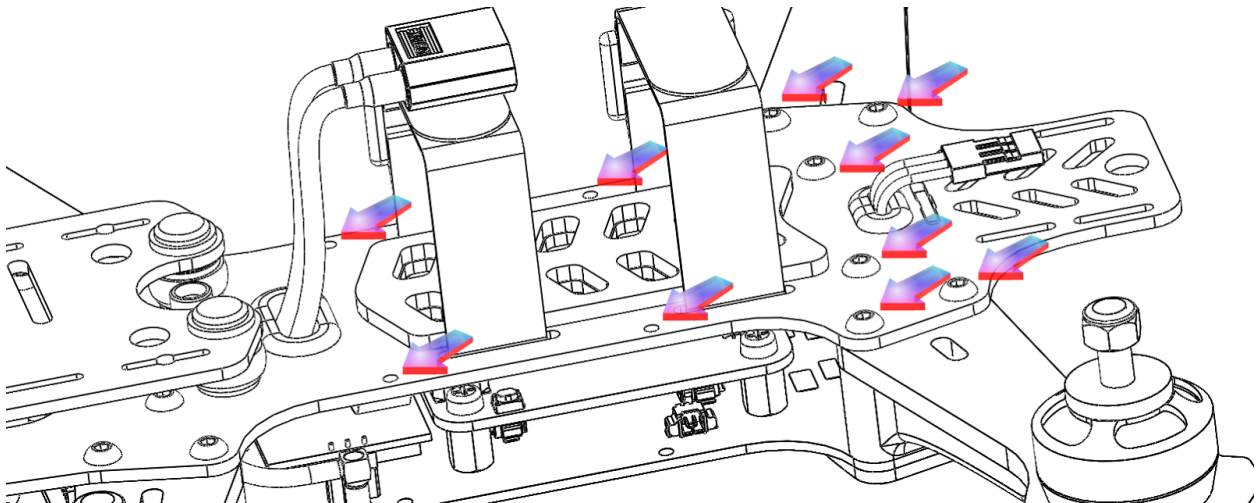
Note that the Vortex 250 Pro is not compatible with standard R/C receivers with multiple channels of PWM, each connected via a separate cable.

The receiver should be mounted on the rear of the quad, on the shelf provided. A velcro strap, or a piece of double-sided tape is the best way to mount the a receiver.

SBus, or Spektrum

To support one of these receivers, a cable must be installed in the quad, which does require removing a few screws to access the connector.

- 1) Remove the screws pointed to below:

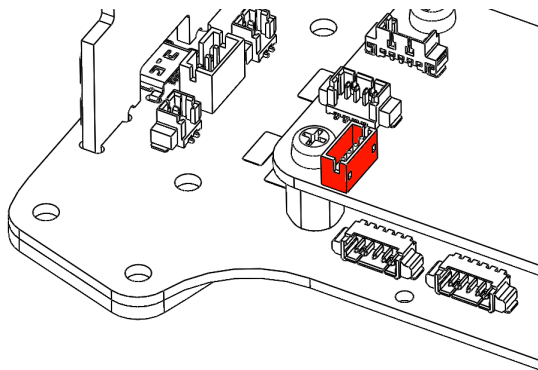


2) Also remove the two screws at the bottom of the right-hand side-plate, and remove the side-plate.

3) Remove the installed CPPM cable.

4) Looking in the right side of the quad, a white connector is visible on the fusion (flight controller) board.

Install the included S-Bus, or Spektrum cable, as required. Note that the fact that the top plate screws are removed on the rear of the quad means that the top plate can be eased up a few millimeters to allow the connector to be installed. Don't force the two apart too much, or risk damaging the PDB.



Notes on Receiver Selection

One critical parameter to keep to a minimum in a race quad setup is latency. Latency from what the camera sees to the display device, and also from the control stick to the flight controller.

For minimum latency, with reasonable range, the Spektrum™ radios and satellite receivers are a great choice. Another good (and quite common) choice is the FrSky Taranis radio with a matched S-Bus receiver (X4R for example).

For longer-range FPV, the EzUHF system is a good choice. Due to the close proximity of the electronics and Video Transmitter on a mini-quad, and the lack of a suitable ground-plane, a diversity receiver, with dipole antennas is highly recommended.

Note: An update to all existing EzUHF systems will be available early Dec. 2015, which will enable an S-Bus output, as opposed to the more traditional PPM. This will greatly reduce latency.

Receiver Auto-Detection

A unique feature of the Vortex family of quadcopters is that the receiver type is auto-detected by the OSD when running the wizard.

With the Vortex 250 Pro, it is no longer necessary to manually specify the receiver type with the ImmersionRC Tools before running the wizard.

R/C Transmitter Configuration

Depending upon the R/C transmitter in use, certain parameters need to be modified in order to ensure compatibility with the Vortex 250 Pro, and more importantly with the Cleanflight Flight Controller firmware.

In all cases, during the wizard setup, the current 'PPM Value' is shown on-screen beside each control. This value must be as close as possible to a min. of 1000, center of 1500, and max. of 2000.

It is highly recommended to start with a 'clean' configuration (new model) for all radios.

Spektrum™ Radios

Spektrum radios need the following configuration:

- Two channels need reversing, AIL, and RUD.
- Map channel 5 to a 2 or 3-position switch to control flight mode (Acro/Horiz or Acro/Level/Horiz).
- Verify that the endpoints are 1000/1500/2000 as described above.

FrSky Taranis Radio

- Map channel 5 to a 3-position switch to control flight mode (Acro/Level/Horiz).
- Verify that the endpoints are 1000/1500/2000 as described above.

Futaba S-Bus Radios

- Map channel 5 to a 3-position switch to control flight mode (Acro/Level/Horiz).
- Reverse channels ELE and THR
- Change subtrim to -31 for THR, AIL, ELE, RUD
- Change travel to +/- 119 on all channels.
- Verify that the endpoints are 1000/1500/2000 as described above.

2) Install a Suitable Battery

The Vortex has a flexible battery mounting system, and uses an industry-standard XT-60 connector. This allows it to use a wide range of different batteries.

To help select a suitable battery for your flying-style, read this section carefully:

Voltage

First things first, voltage. For starting out with the Vortex, a **3s** (11.1V) pack is recommended.

A Vortex running **4s** (14.8V) is an extremely fast race-quad, which can easily get a pilot into trouble.

A **3s** pack calms things down a bit, and is a good way to ease into the hobby, hence novice pilots should certainly start out on **3s**.

Note that the 20A ESCs installed in the Vortex 250 Pro do support 'LiHV' packs, with a cell voltage of 4.35V as opposed to the standard 4.20V cell voltage with LiPo packs.

Capacity

For capacity, there are a few things to remember. Firstly, keeping weight down on a mini-quad is the best way to increase crash survivability as well as improve acceleration, climb speed and general agility of the quad.

Also remember that most races are just a few laps, so a huge capacity battery is just dead weight, and will never be drained in the typical race.

1300mAh packs, or similar, are ImmersionRC's choice for racing. 3s for beginners, 4s for pros.

'C' Rating

For 'C' rating, the Vortex in stock setup, with 5045 props, can pull over 80 Amps during fast pull-outs. A 1300mAh pack, with a 25C rating, is good for about 32A, and will have it's usable life reduced when pulling much more than that.

These packs have been tested for the 3s configuration

- Turnigy nano-tech 1300mAh 3S 45~90C Lipo Pack
- Lumenier 1300mAh 3s 60c Lipo Battery (XT60)

And these for the 4s

- Turnigy nano-tech 1300mAh 4S 45~90C Lipo Pack
- Lumenier 1300mAh 4s 60c Lipo Battery (XT60)
- ReadyMadeRC 'Orange Series', 60C 1300mAh, 4s

- Aerial Visions Inc, 4s 1300mAh 60C

When installing the selected battery, pay attention to the Center of Gravity mark on the bottom of the Vortex. The COG is not that critical on a quad of this class, but it doesn't hurt to respect it if possible, especially when racing.

The addition of a heavy GoPro, on the nose of the quad may need a heavier battery to re-balance the quad.

Note that the largest battery that can be installed safely on the Vortex is approx. 86mm long, by 50mm wide. These larger packs are not generally recommended, due to the damage that the extra mass can do in a crash.

NOTE: Ensure that the battery is securely mounted on the anti-slip pad, with at least two battery straps installed. The battery should not be able to move around in flight. Also make sure the plastic liner on the anti-slip pad is removed!

ANOTHER NOTE: Ensure that your main battery cables, and also the balance leads are secured in the straps, and cannot, under any circumstances, touch the props.

Sliced battery cables and/or balance leads are a cause of expensive shorts, fires, and crashes!

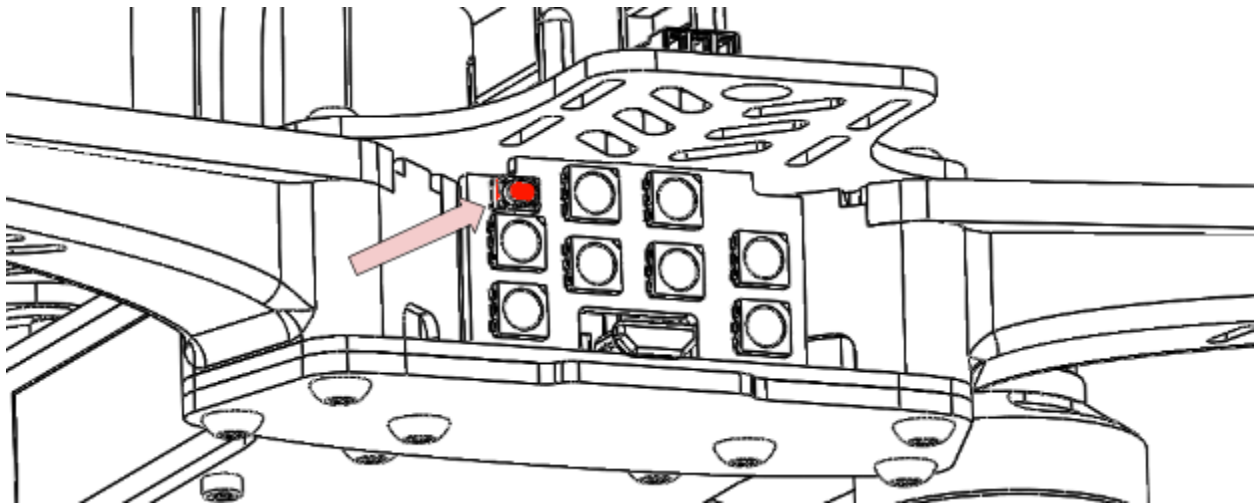
3) Setup the Video Link

To avoid the traditional 'dip-switch chaos' at race events, the Vortex does not use a DIP switch to define Video Tx channels. Instead, the OSD is responsible for setting the channel, and band.

The Vortex ships with a default Tx frequency of **5740MHz**, which corresponds to ImmersionRC/FatShark frequencies, Channel 1.

If you are running ImmersionRC receivers, or a FatShark headset using the standard 5.8GHz module, just select Channel 1, and the wizard image should be shown.

If you are running non-ImmersionRC/FatShark gear which cannot tune to 5740MHz, it may be necessary to switch bands on the Vortex before the wizard image is displayed. To do this, set your receiver to Channel 1, and use the button on the LED board (rear of the quad).



To switch bands, press the button on the LED board for approx. 2 seconds until you hear the first beep, and release. .

The Vortex will beep a number of times, representing the band number. Each time the button is pressed, the band number will be incremented.

The band/beep order is as follows:

Band 1: IRC/FS (5740MHz)

Band 2: RaceBand (5658MHz)

Band 3: Band E (5705MHz)

Band 4: Band B (5733MHz)

Band 5: Band A (5865MHz)

For a full list of channel frequencies for each band, please refer to the full [Instruction Manual](#).

4) Run the Wizard

In the world of R/C, there is little standardization between equipment manufacturers as far as control stick to channel mapping. There is also little agreement between users as to which of the 4 control modes should be used.

Since in the Vortex, both the OSD, and the Flight Controller need to know the channel mappings, a 'Tx Setup Wizard' is included to greatly simplify the process.

This wizard also configures various flight controller parameters which would normally require a personal computer, with a USB connection to the quad copter.

NOTE: The wizard should allow a brand-new, unconfigured Vortex, to be removed from its shipping box at a race event, and prepared for flight in less than a minute, with no tools, or USB hookups required.

For the techies, there is a full description of the configuration steps performed near the end of the full user's manual, under 'Appendix A: The Wizard - Details'.

The first time the Vortex is powered up, the **Tx Setup Wizard** is presented, as shown after the mode 1/mode 2 control descriptions below.

Following the instructions on-screen, 5 simple steps, will configure the 4 flight channels, and one auxiliary control (CH5) which will control the flight mode.

Mode 2 Controls

Mode 2, arguably the most common stick mode, is common in the USA, and is a natural fit to helis, and multirotors.

A Mode 2 transmitter is easily identified with the un-sprung (i.e. doesn't return to center) throttle control on the left stick.

For this mode, the multi-rotor controls are typically as follows:



Mode 1 Controls

Mode 1 is common in Europe.

A Mode 1 transmitter is easily identified with the un-sprung (i.e. doesn't return to center) throttle control on the right stick.

For this mode, the multi-rotor controls are typically as follows:



Note: Modes 3 and 4 are intentionally left out of this abbreviated Getting Started guide. It is assumed that pilots flying these more 'uncommon' modes, are already very familiar with their remote, and their control mapping.

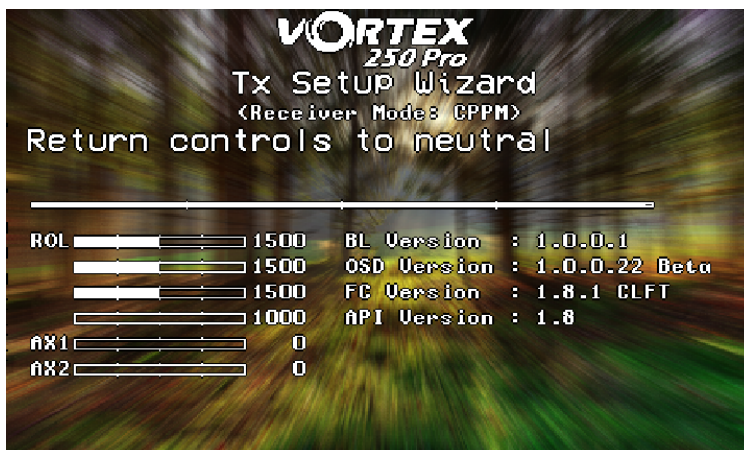
Following the Wizard

The wizard is used primarily to let the Vortex learn the flight channel order, and R/C Tx mode (1, 2, 3, 4). 'Left' refers to moving the stick left, and 'Back' refers to moving the stick back towards you.



Follow the prompts, ensuring that the correct stick is moved each time. As each control is recognized, it's name will appear to the left of the servo bar.

Take your time with this step, if the wrong stick movements are fed to the wizard, it will be difficult to navigate the OSD to complete the setup.



Once the four primary flight controls have been learned, place the quad on a flat and level surface and move the right stick back. This will calibrate the accelerometer.

It is important that the quad is level when this step is performed, or the auto-level flight modes will not function correctly.

NOTE: Use the value displayed beside the bar to adjust the endpoints of your R/C transmitter to have min@1000, center@1500, and max@2000. This is critical for correct OSD and flight-controller operation.



NOTE: To restart the wizard at anytime, power up the quad, press and hold the button on the led board until vortex beeps 2 times (first beep after ~3 seconds, second beep after ~5 seconds). Alternatively you can also enter tx Wizard via OSD menu

Once the wizard is finished, various Cleanflight settings will be configured, including enabling oneshot, motor_stop, and failsafe.

Another setting which is automatically made is the assignment of CH5 to the flight mode, Acro, Horiz, and Angle. To complete the setup, configure your R/C Tx to link CH5 to a 3-position switch.

Ensure that the switch correctly switches between the three flight modes, reflected in the top-right corner of the OSD main landscape .

Note that It is highly recommended to attempt the maiden flight in either **Angle**, or **Horiz** mode. **Acro** takes a little getting used to.

NOTE: Even though the flight controller failsafe has been set by the wizard, it is important to also set the R/C Rx failsafe.

see <https://github.com/cleanflight/cleanflight/blob/master/docs/Failsafe.md> for cleanflight specific failsafe test procedure.

On the EzUHF this is as easy as setting the controls in a 'safe' position (very low throttle for example) and holding down the bind button on the EzUHF Tx until a beep is heard.

Flyaways with mini-quads are almost always caused by incorrect failsafe settings!

NOTE: Currently there is no 'servo reverse' feature in Cleanflight. This means that if one of the R/C transmitter channels is reversed, the wizard will not complete correctly.

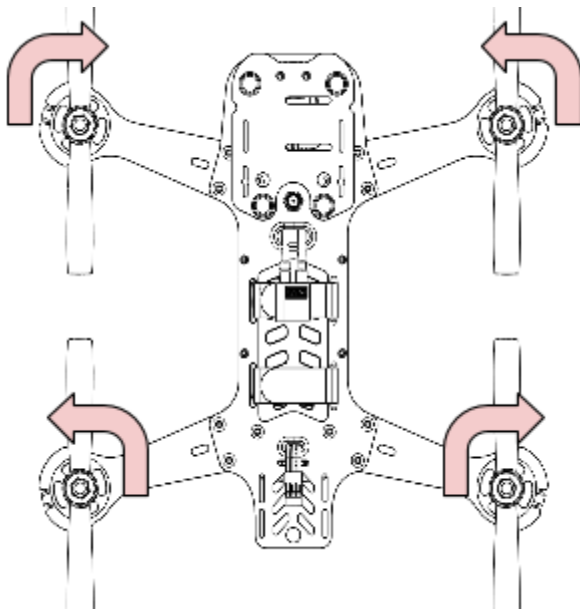
It is highly recommended to start the wizard with a 'new' profile in the R/C radio, without any channel reversing, and also without any expo. Expo is all handled within the Pro-Tuning profiles.

All Done, Time To Fly

At this point in the Getting Started manual, the Vortex should be ready for its maiden flight.

The Wizard has setup the flight controller with our default Pro-Tune, generated by one of our expert team pilots. PIDs and gains are unlikely to require major changes to achieve precise flight.

If the props were removed during setup (as we highly recommend), please re-install taking care of the prop directions below:



Take it easy for the first few LiPos, and get used to your new Vortex.

P.S. To arm the flight controller after running the wizard, for mode 2, move the throttle stick down and to the right. See 'Flight Controller Stick Commands' in the main manual.

The ImmersionRC Team wishes you many hours of enjoyment with your new Race Quad, and welcome any feedback that you may have at: feedback@immersionrc.com

The Getting Started Manual should have got you airborne. It is a good idea to read the full [Instruction Manual](#) also, which contains many more details than this abbreviated manual.

Note: The default 'pro-Tune' loaded is a 'beginner' tune created by Bewweb. For experienced racers, who require more 'crisp' flight characteristics, it is recommended to load the more advanced tunes by UmmaGawd, or BorisB, each with different characteristics.

Specifications

Flight Controller	
IMU	Invensense 6050, 3 axis Gyro, 3 axis Accelerometer
Altimeter	Bosch BMP180
CPU	STM32F303 32-bit ARM processor
Firmware	Cleanflight compatible (<i>with API version matching that of the OSD</i>)
OSD	
CPU	STM32F373 32-bit ARM processor
Resolution	440H x 280V
Style	White, with black surround around all pixels
Output	Programmable Black/White levels
Video Tx Features	
Transmitter Module	Socketed, Custom NexWaveRF 5.8GHz module
Channels	40 Initially, programmed via OSD
Bands	5, including the ImmersionRC/FatShark bands, and RaceBand
Frequency, IRC/FS	5740, 5760, 5780, 5800, 5820, 5840, 5860, 5880 MHz *
Frequency, RaceBand, CH1..8	5658, 5695, 5732, 5769, 5806, 5843, 5880, 5917 MHz *
Frequency, 'A' Band, CH1..8	5865, 5845, 5825, 5805, 5785, 5765, 5745, 5725 MHz *
Frequency, 'B' Band, CH1..8	5733, 5752, 5771, 5790, 5809, 5828, 5847, 5866 MHz *
Frequency, 'E' Band, CH1..8	5705, 5685, 5665, 5645, 5885, 5905, 5925, 5945 MHz *
Power Output	350mW +/- 1dB (25mW module available for License Free EU use)
Audio	Stereo, Right channel used for Telemetry, Left channel unused
Recommended Antenna	Supplied SpiroNET Omni, Skew Planar, 4 leaf

Power Train	
Standard Prop	Gemfan 5045BN
Maximum Prop Size	6" without a GoPro, 5" with a GoPro, optional arms for 6" with a GoPro.
Race Motors	OEM 2204-2300kV, single-strand, 3mm axle
Recommended Battery	1300mAh 3S 45~90C, or 1300mAh 4S 45~90C
ESC	
Type	ImmersionRC EzESC 20A
Rating	20A continuous, 25A peak
Features	OneShot125, and Motor Braking
Processor	32-bit ARM running custom ImmersionRC ESC Firmware
R/C Receiver	
Channels Required	Absolute minimum four. Five recommended to support mode switch.
Interfaces	3.3v-5v PPM Sum, SBUS, Spektrum, XBus, SumD, SumH
Receiver Power	+5V or +3.3V @ 200mA max.
Flight Characteristics	
Flight Time	Depends upon battery, and flight style
Maximum Range	Highly dependent on battery, and flying style
Maximum Speed	TBD (Fast!)
Camera Support	
Onboard GoPro Supply	+5v at 1A
Video Standard	Composite, PAL or NTSC, switchable using a camera-mounted jumper
Weight and Size	
Weight, as Shipped, ARF	~415g
Size	250mm between diagonal motors

** Note: Certain 5.8GHz channels may be restricted depending upon the target region, and reseller requirements.*