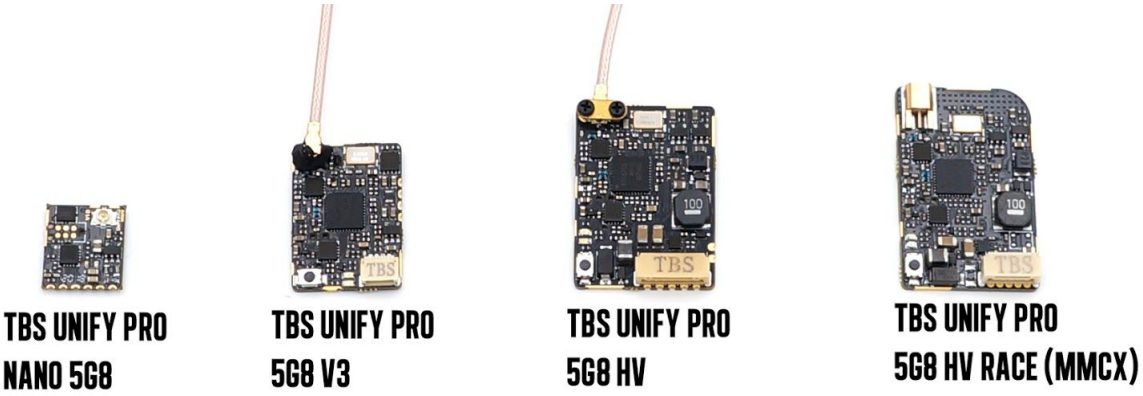
TBS UNIFY PRO 5G8 (HV)
Video Transmitter



High quality, license-free, ultra-tiny, race ready vtx

Revision 2018-10-01

The TBS UNIFY is a new line of video transmitters, optimized for compatibility across multiple “platforms” and reduced to a small form factor, completely redesigned and tailored for FPV use. Perfect for small multirotor platforms where flight times are critical.

Key features

- World’s lightest 37ch video transmitter line (unlimited channels via smartaudio)
- Extremely powerful - with integrated heatsink
- 25mW (up to 800mW with HAM license*)
- One button frequency and power setup
- OSD configuration using TBS SmartAudio (via PNP PRO OSD)
- SMA connector with frame mounting holes integrated
- 5V input or 2-6S input with 5V output versions available
- Solder-on module dimensions available on request (Unify PRO 5G8 V3)
- **NEW:** improved noise filtering on HV version (Batch >1004)
- **NEW:** optimized heat dissipation on HV version (Batch >1004)
- **NEW (Q3 2018):** 7-pin connector for dedicated audio channel and smartaudio (data)
- **NEW (Q3 2018):** Separated GND for Vin and for Camera
- **NEW (Q3 2018):** Screw secured U.FL connector

Specifications

	TBS UNIFY PRO nano	TBS UNIFY PRO V2 5G8	TBS UNIFY PRO 5G8 HV	TBS UNIFY PRO HV RACE
Input voltage:	Regulated 5V Voltage peaks max 6.0V!!! (Unify PRO V3 max. 13V peaks) *(Only use DCDC converter with proper LC filtering!* *Example: PNP25/PNP50/PNP PRO)*		6V to 28V (2S - 6S) VBat, peak max 31V *Please connect directly to battery voltage!*	
Power Output	None		5V for Camera @ 0.5A max.	
Extra features:	CleanSwipe PitMode			
Remote software protocol	SmartAudio V2.0 LITE (***requires 3.3V level and soft- or hardware pull low***),	Batch No <2xxx: SmartAudio V1.0 Batch No >2xxx: SmartAudio V2.0	SmartAudio V2.0	
Output Power	14dBm (25mW) 17dBm (50mW*)	14dBm (25mW) 23dBm (200mW*) 27dBm (500mW*) 29dBm (800mW*)		14dBm (25mW) 23dBm (200mW*)
Pit mode	**Activate:** press button during powered up. **LED:** in menu for channel setting			**Activate:** press button during powered up. **LED: red**
	Deactivate: automatic with next power up (without pressed button)			**Deactivate:** press button during powered up. **LED: blue** (red & blue when unlocked)
Pit mode -> flight mode	Reboot VTX			After boot up, press button for 8sec
Channels:	Band A (8ch), B (8ch), E (5ch) Fatshark 8ch Race Band 8ch			Band A (8ch), B (8ch), E (5ch) Fatshark 8ch Race Band 8ch Low Race Band 8ch **
Audio on 6.5MHz	No	Yes		
Power consumption	25mW: 250mA 50mW: 300mA	25mW: 250mA 200mW: 320mA 500mW: 460mA 800mW: 600mA		25mW: 250mA 200mW: 320mA
Range:	1km	Up to 4 km with omnidirectional RHCP antennas		Up to 2 km
Antenna connector:	U.FL high strength	SMA RP-SMA	SMA	SMA or MMCX

Port connector	Castellated holes, 2mm pitch	JST-SH socket, 4 pin	JST-GH, 7 pin (5pin until June 2018)	SMA: JST-GH, 7 pin MMCX: JST-GH, 5 pin
Dimensions:	14.5(H) x 13(W) x 3(D) mm	18(H) x 25(W) x 4(D) mm	22 (H) x 30 (W) x 4 (D) mm	
Weight:	1g	5g excluding antenna	7g excluding antenna	
Special Connections:	5V output filtered for Camera		**New:** Audio, connect to Microphone or other audio source **New:** Data, connect to Smartaudio serial control source	
Kit contents:	U.FL Antenna Silicon Cables pre-tinned	1x TBS UNIFY 5G8, 1x 5V cable	1x TBS UNIFY 5G8 HV, 1x VTx/Cam cable	

** requires HAM license, special unlocking procedure!*

** only for RACE version where authorization has been granted

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TBS UNIFY PRO 5G8

TBS UNIFY PRO 5G8 HV (RACE)

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TBS UNIFY PRO 5G8 nano
The UNIFY PRO 5G8 nano comes with pre tinned silicon wires for easy installation in your build.

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Button menu control

There are categories in the menu, and settings. Pressing the button for 3 seconds will toggle between categories, pressing it for a short (1 second) press toggles between settings. To enter the menu, hold the button for 3 seconds. LED colors will signal the state of the menu, for an overview see the following table.

Channel select mode

Enter menu by pressing the button for 3s. Red LED will flash 1 time. Select channels by simple short presses.

Band select mode

Press button for an additional 3s. Red LED will flash 2 times. Select band by simple short presses.

Unlock & power select mode

(FOR HAM USERS ONLY!) Press button for 20 to 25 seconds. The Red LED will flash 3 times to confirm. You have unlocked the video transmitter for use with all frequencies (see frequency table below).
NOTE: Unlock only works if you are inside the band selection menu

The power select mode is now accessible. Once unlocked, you can select the power level according to the table below. To lock the transmitter, go back into band select menu and press the button for 20 to 25 seconds again.

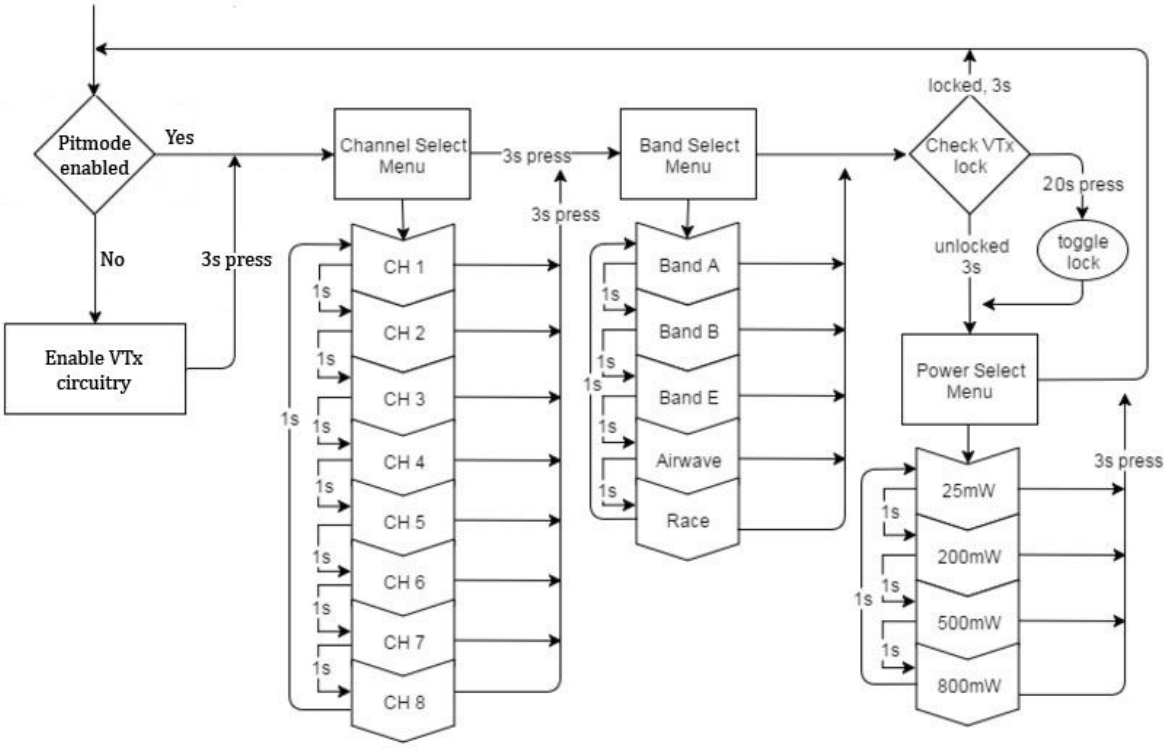
PitMode

While in PitMode you can change channels and set power levels without affecting other pilots signal.
Pit mode function explained HERE

Save and exit

Press button for 3 seconds. Blue LED will turn on, settings are saved and it will exit the menu.

Button menu structure



LED Flash Codes for Channel, Band and Power

The TBS UNIFY PRO 5G8 signals selected channel, band and power levels using a startup sequence of LED codes. The same sequence is also repeated in the menu to make it unified. First the RED LED flashes to indicate the item being shown. One flash for channel, two flashes for band, three flashes for power level. Subsequently, the BLUE LED will indicate the value.

Red LED:	Indicate item - Channel, band or power setting
Blue LED:	Indicate value

For example, Channel 6, Band B, Power of 500mW, will have the following startup LED code:

- 1x Red and 6x Blue = Channel, 6
- 2x Red and 2x Blue = Band, 2 (=B)
- 3x Red and 3x Blue = Power, 3 (= 500mW)

Once the Video transmitter has successfully booted up, it will show a constant BLUE for locked state, and a constant RED + BLUE for unlocked state.

For reference, see the following menu table.

Installation / Mounting

When installing the Unify Pro, please ensure adequate airflow and - most importantly - heat transfer. This means mounting the Unify Pro with a bit of pressure against a flat piece of carbon will give you the best results. Proper mounting will allow the video transmitter to run for extended periods of time while sitting on the ground, both with 25mW and 200mW power levels. On 500mW / 800mW power levels, we recommend to start flying after a maximum of 1 minute, so that the airflow can begin to provide adequate cooling.

When video transmitters heat up they start transmitting with less output power. There is also chance of the power supply circuit overheating. Don’t worry, the Unify Pro will detect excess heat and shut down until it recovers. But that will also mean the video transmitter will not transmit. If you are experiencing that the video transmitter shuts down, check your installation. Ensure that heat can be drained well and make sure that there is a bit of airflow access to your VTx.

Menu Table

RED LED		BLUE LED							
		1x	2x	3x	4x	5x	6x	7x	8x
1x	Channel	1	2	3	4	5	6	7	8
2x	Band	A	B	E	Airwave	Race	Low Race		
3x	Power Level	25	200	500	800				

Frequency Table

Channel	1	2	3	4	5	6	7	8	
Band A	5865	5845	5825	5805	5785	5765	5745	5725	MHz
Band B	5733	5752	5771	5790	5809	5828	5847	5866	MHz
Band E	5705	5685	5665	5645	5885	5905	5925	5945	MHz
Airwave	5740	5760	5780	5800	5820	5840	5860	5880	MHz
Race Band	5658	5695	5732	5769	5806	5843	5880	5917	MHz
Low Race Band*	5621	5584	5547	5510	5473	5436	5399	5362	MHz
PowerLevel	25	200	500	800					mW

The selections in orange requires HAM license to operate legally. Black selections are only available on special request (custom firmware for large events with prior legal body approval). The video transmitter ensures that you cannot select illegal channels or power levels by accident:

- When controlled by the push button, you will need to confirm having a HAM license by following the steps described above to unlock your video transmitter
- Through the CORE PRO, you are required to enter your HAM license number under the “Callsign” menu before you can access the high power transmission settings and the locked out channels

* Unify PRO HV Race Special Edition only

OSD control via CORE PRO

The TBS UNIFY PRO was built with the TBS CORE PRO in mind. Controlling your drone via the R/C joystick was a concept first introduced by the BrainFPV FC. TBS has extended this functionality to the entire POWERCUBE, allowing you to change not only the flight controller settings but also the UNIFY video transmitter channels and output power.

In order for the CORE PRO to detect the video transmitter, the CORE PRO must be equipped with TBS SmartAudio technology. You are most likely in luck and as we have rolled this out on the CORE PRO long before we ever made the video transmitters. Unfortunately, there is no real way to know if your CORE PRO is compatible. The first batch, 3rd batch and all subsequent batches are compatible, but it is hard to know if your CORE PRO supports TBS SmartAudio without plugging in the video transmitter. If your CORE PRO does not support TBS SmartAudio, you can either get a new one or open up a ticket with us to have it sent to one of our service stations around the globe to have it revised for free.

Channel, Band and Power control

If your CORE PRO supports TBS SmartAudio and the TBS UNIFY PRO is plugged in, you will see the "VIDEO TRANSMITTER" setting in the main OSD menu:

The menu itself is very straightforward, allowing you to choose Channel, Band and Output power. A HAM Callsign is required to enter high power modes or use frequencies outside the ISM band.

The video frequency does not change instantly. It will wait for you to exit the menu and then change to the new frequency as indicated in the last line.

Video transmitter pinout

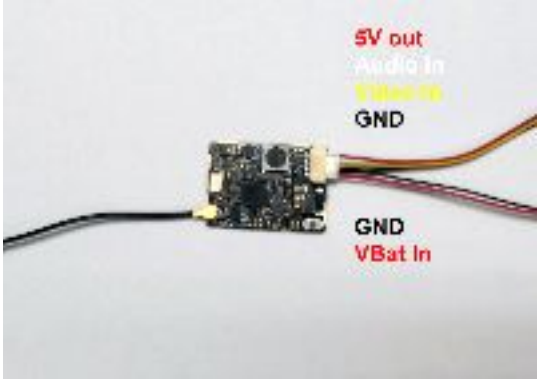
TBS UNIFY PRO 5G8

Despite being plug and play with the TBS CORE , TBS CORE PNP PRO , PNP25, PNP50 - the UNIFY PRO can also be directly soldered to cameras or custom power distribution boards.
See the pin-out below:

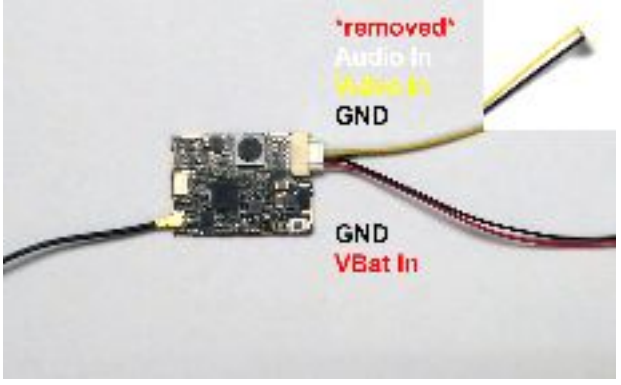
TBS UNIFY PRO 5G8 HV (RACE)

The UNIFY PRO 5G8 HV comes with wires ready to be assembled into your own projects. Should you want to connect it to TBS products such as the TBS CORE , TBS CORE PNP PRO, PNP25/PNP50, etc, you will need to modify the camera pin-out to match the UNIFY VTx input socket. You will also need to remove the red wire (5V) from the connector, to avoid voltage supplies fighting each other.

Connection to DIY drone build



Connection to TBS CORE products



TBS UNIFY PRO 5G8 HV (RACE)

>Q3 2018

- **7V-26V (red cable)** - Connect directly to Battery voltage, 2S to 6S LIPO
- **GND (black)** - Ground connection
- **5V out (orange)** - Supply for your camera. <u>Never connect to Battery or it will permanently damage your VTX!</u>
- **GND (black)** - Ground connection for camera
- **Video (yellow)** - Video input. Make sure video cable is short and not routed near any noisy source like ESC, motor cables or RX Receiver which has a back channel (this causes video distortion).
- **Audio (green)** - connect to microphone or any other audio source.
- **Data (white)** - Smartaudio VTX remote control input.

TBS UNIFY PRO 5G8 nano

The UNIFY PRO 5G8 nano comes with pre tinned silicon wires for easy installation in your build.
There is a filtered 5V input with a 5V output for your camera.

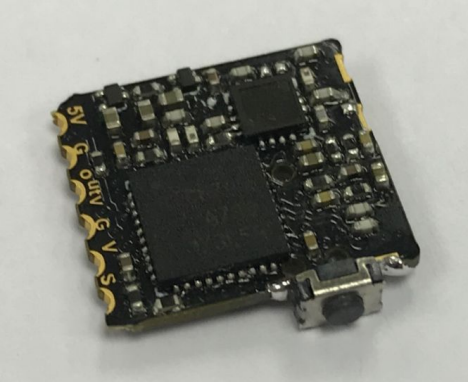
The ideal camera for this VTX is: http://team-blacksheep.com/products/prod:tbs_tiny_cam

This Camera is able to supply 5V to the VTX which is required for any 1S Setup.

*Please take care when soldering to the tabs, do not solder with temperatures higher than 350°C for more than 3-5sec.

*The optional tactile switch installation is optional and not required in any case.
On the side there is a touch surface which works with slightly humid finger surface. However much easier is to solder on the switch or solder it to any remote location using two wires.
For max. flexibility we did not install it by default.

For remote control the VTX channels we suggest to use smartaudio interface



Technology showcase

PitMode

A new feature introduced with the TBS UNIFY PRO 5G8 HV is PitMode. It allows racers to power up their video transmitters during race events without interfering with other racers and still having the ability to change VTX settings or do some testing.
There are two types of PitMode supported:

- **In-Band PitMode:** Range is limited to 2-3m, but transmission happens on the selected frequency
- **Out-Band PitMode:** Range is limited to 2-3m, transmission is on 5584MHz until leaving PitMode. Only available in custom firmware for large events, with prior legal body approval.

There are three subcategories:

- **Unify Pro HV RACE using push-button:**
  Activate PitMode: push-button needs to be hold while the Unify Pro RACE is powered up. This will permanently enable PitMode even during power cycle. Powering up the Unify pro RACE in PitMode is indicated by a solid red LED only.
  Activate VTX to fly: wait until it's up and running and press the push-button for 8 seconds. The Unify Pro RACE will set the output power according to the power settings and is ready to fly.
  Deactivate PitMode: push-button needs to be hold while the Unify Pro RACE is powered up. This will permanently disable PitMode even during power cycle. The LED will show blue in case the Unify Pro RACE is locked and blue and red in case it's unlocked

- **Unify Pro HV and 5V supporting SmartAudioV2 using push-button:**
  Activate PitMode: push-button needs to be pressed and hold the Unify Pro RACE is powered up. This will temporarily put the Unify Pro into PitMode. The Unify Pro is now inside the menu and all settings can be changed.
  Activate VTX to fly: just power cycle the system without pressing the push-button on the next power up

- **Unify Pro HV, 5V and RACE supporting SmartAudioV2 used with TBS CORE PRO:**
  The TBS CORE PRO, it will provide you with full access to PitMode functionality using the OSD menu. By default the VTX is locked and only In-Band PitMode can be selected. To select Out-Band PitMode the call sign need to be changed to a custom one and show time need to be set to always. Using the TBS CORE PRO the PitMode is permanently enabled or disabled (even during power cycle)
  To fly power up the system, wait until the OSD has booted and hold your roll stick right for 3 seconds. A timer will appear on the screen counting up to 3 before enabling your VTx according to

your power settings.

CleanSwitch

A new feature introduced with the TBS UNIFY PRO 5G8 HV is CleanSwitch. When video transmitters power up or change frequency, they usually send a burst across the entire band which disturbs fellow flying pilots. All UNIFY PRO 5G8 video transmitters will remain in their lowest power output (25mW for UNIFY PRO 5G8, less than 0.1mW for TBS UNIFY PRO 5G8 HV) while changing channels and powering up. This ensures interruption-free racing, even with multiple video transmitters changing channels, or powering up.

SmartAudio

SmartAudio is a protocol developed by TBS for OSD to VTx communication. All newer generation OSDs at TBS, and all UNIFY PRO series VTX support SmartAudio V1.0, with the UNIFY PRO HV line we have launched SmartAudio V2.0. The new version supports control for the new features (e.g. PitMode). SmartAudio is a single-wire UART protocol, running over the Audio-wire. If you are a OSD or VTx developer interested in adding support for SmartAudio, please create a support ticket with us so we can supply you with the technical documentation:

- http://team-blacksheep.freshdesk.com/

SmartAudio LITE

SmartAudio LITE is used on the tiny Unify PRO nano. The software protocol is the exact same as on Smartaudio V2.
However there are two limitations/caveats:

- It requires 3.3V level. The standard SmartAudio accepts 0.9V audio level. This means SA Lite is not compatible with TBS CORE PRO, but compatible with all FC and other devices.
- Some FC targets have hardware incompatibility which does not sufficiently pull logic to zero on idle or start of SA commands. According to the SA specification, each command has to start with logic zero. The Unify Pro Nano is more susceptible to incompatibility with SA standard due to different hardware layout

Declaration of Conformity

EU - DECLARATION OF CONFORMITY

We affirm that the electrical equipment manufactured by us complies with the requirements of the EC Council Directive on electromagnetic compatibility 2004/108/EC

Manufacturer:

TBS Avionics Co Ltd
44-46 Hung To Rd, 12/F
Unit 1204, Century Centre
Kwun Tong, Hong Kong

Tel: +852 5685 2608
Fax: +852 5685 2608
E-Mail: rpirker@team-blacksheep.com

Description of the appliance:
Electronics

Trade name and model of appliance:
TBS UNIFY PRO 5G8 V3 (SMA) (A-TX58-UPRO2)
SNR 0741587429050

Applicable Standard (s):

- EN55022:2010 EN61000–3–2:2006+A1:2009+A2:2009
- EN55024:2010 EN61000–3–3:2008

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

June 1st, 2017
CE 1856

Raphael Pirker, CEO
TBS Avionics Co Ltd.

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Description of the appliance:
Electronics

Trade name and model of appliance:
TBS UNIFY PRO 5G8 HV (SMA) (A-TX58-UPHV2)
SNR 0741587429104

Applicable Standard (s):

- EN55022:2010 EN61000–3–2:2006+A1:2009+A2:2009
- EN55024:2010 EN61000–3–3:2008

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E-Mail: rpirker@team-blacksheep.com

Description of the appliance:
Electronics

Trade name and model of appliance:
TBS UNIFY PRO 5G8 HV - RACE (SMA) (A-TX58-UPHV3)
SNR 741587429128

Applicable Standard (s):

- EN55022:2010 EN61000–3–2:2006+A1:2009+A2:2009
- EN55024:2010 EN61000–3–3:2008

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Unit 1204, Century Centre
Kwun Tong, Hong Kong

Tel: +852 5685 2608
Fax: +852 5685 2608
E-Mail: rpirker@team-blacksheep.com

Description of the appliance:
5G8 System

Trade name and model of appliance:
TBS Unify PRO NANO 5G8 (A-TBSS-UPNA1)
SNR 0741587426103

Applicable Standard (s):

- EN55022:2010 EN61000–3–2:2006+A1:2009+A2:2009
- EN55024:2010 EN61000–3–3:2008

Assumption of conformity is based on the application of the harmonized standards and, when applicable or required, a European Community notified body certification, as shown in the attached schedule.

January 24th, 2018

CE

Raphael Pirker, CEO
TBS Avionics Co Ltd.

TBS UNIFY

Good practices

We have compiled a list of all of practices which have been tried and tested in countless environments and situations by the TBS crew and other experienced FPV pilots.

Follow these simple rules, even if rumors on the internet suggest otherwise, and you will have success in FPV.

- Start with the bare essentials and add equipment one step at a time, after each new equipment was added to proper range- and stress tests.
- Do not fly with a video system that is capable of outperforming your R/C system in terms of range.
- Do not fly with a R/C frequency higher than the video frequency (e.g. 2.4GHz R/C, 900MHz video).
- Monitor the vitals of your plane (R/C link and battery). Flying with a digital R/C link without RSSI is dangerous.
- Do not use 2.4GHz R/C unless you fly well within its range limits, in noise-free environments and always within LOS. Since this is most likely never the case, it is recommended to not use 2.4GHz R/C systems for longer range FPV.
- Do not fly at the limits of video, if you see noise in your picture, turn around and buy a higher-gain receiver antenna before going out further.
- Shielded wires or twisted cables only, anything else picks up RF noise and can cause problems.
- When using powerful R/C transmitters, make sure your groundstation equipment is properly shielded.
- Adding Return-To-Home (RTH) to an unreliable system does not increase the chances of getting your plane back. Work on making your system reliable without RTH first, then add RTH as an additional safety measure if you must.
- Avoid powering the VTx directly from battery, step-up or step-down the voltage and provide a constant level of power to your VTx. Make sure your VTx runs until your battery dies.
- Do not power your camera directly unless it works along the complete voltage range of your battery. Step-up or step-down the voltage and provide a constant level of power to your camera. Make sure your camera runs until your battery dies.
- A single battery system is safer than using two dedicated batteries for R/C and FPV. Two batteries in parallel even further mitigate sources of failure.
- For maximum video range and “law compatibility”, use 2.4GHz video with high-gain antennas.
- When flying with R/C buddies that fly on 2.4GHz, or when flying in cities, it is perfectly possible to use 2.4GHz video provided you stick to the channels that do not lie in their band (CH5 to CH8 for Lawmate systems, available from TBS).
- Do not use diversity video receivers as a replacement for pointing your antennas, diversity should be used to mitigate polarization issues.
- Improving the antenna gain on the receiver end is better than increasing the output power (except

in RF-noisy areas). More tx power causes more issues with RF on your plane. 500mW is plenty of power!

- Try to achieve as much separation of the VTx and R/C receiver as possible to lower the RF noise floor and EMI interference.
- Do not buy the cheapest equipment unless it is proven to work reliably (e.g. parts falling off, multitudes of bug fix firmware updates, community hacks and mods are a good indicator of poor quality and something you do NOT want to buy for a safe system). Do due diligence and some research before sending your aircraft skyward.

Manual designed by ivc.no, written by TBS and ivc.no.