

# TBS UNIFY PRO 5G8 (HV) Video Tx

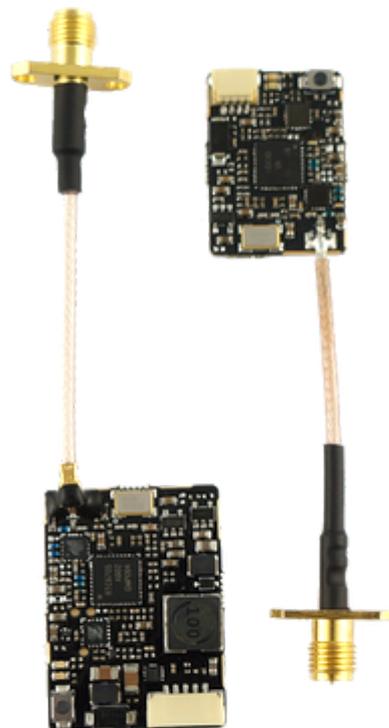
*High quality, license-free, ultra-tiny, race ready vtx*

Revision 2017-01-07

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 multi rotor platforms where flight times are critical.

## Key features

- World’s lightest 40ch video transmitter line
- 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)
- RP-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



## Specifications

	TBS UNIFY PRO 5G8	TBS UNIFY PRO 5G8 HV / RACE
<b>Input voltage:</b>	Regulated 5V	6V to 26V (2S - 6S) VBat, peak max 31V
<b>Extra features:</b>	SmartAudio V1.0	SmartAudio V2.0, CleanSwipe, PitMode
<b>Power Supply</b>	None	5V Camera @ 0.5A max.
<b>Output power:</b>	13dBm (25mW), 23dBm (200mW*), 27dBm (500mW*), 29dBm (800mW*)	
<b>Channels:</b>	24Ch, 5733MHz - 5866MHz and 40ch, 5658MHz - 5917MHz*	
<b>Power consumption</b>	25mW: 250mA, 200mW: 320mA, 500mW: 460mA, 800mW: 600mA	
<b>Range:</b>	Up to 4 km with omnidirectional RHCP antennas	
<b>Antenna connector:</b>	RP-SMA Female	
<b>Port connector:</b>	JST-SH socket, 4 pin	JST-GH, 6pin
<b>Dimensions:</b>	17 (H) x 24 (W) x 4 (D) mm	22 (H) x 30 (W) x 4 (D) mm
<b>Weight:</b>	5g excluding antenna	7g excluding antenna
<b>Kit contents:</b>	1x TBS UNIFY 5G8, 1x 5V cable	1x TBS UNIFY 5G8 HV, 1x VTx/Cam cable

*ial unlocking procedure!*



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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).

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

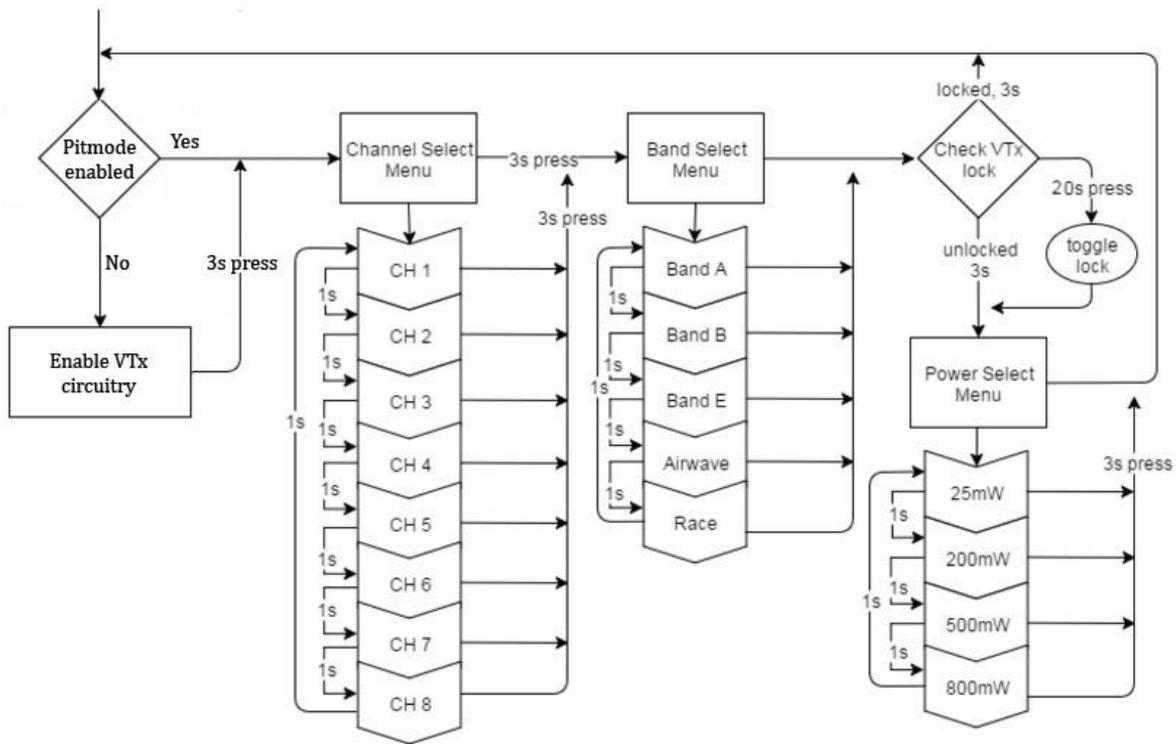
While in PitMode you can change channels and set power levels with the button, but none of these changes will take effect until next power cycle. By default, PitMode will send a very weak signal on 5584MHz when the VTx is unlocked, or transmit nothing at all when locked. The signal on 5584MHz is barely enough for you to adjust parameters or test functionality of the quad - it provides extremely short range and NOT meant for FPV flying! New receivers such as the TBS TANGO will provide support for this channel.

### 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.

<b>Red LED:</b>	Indicate item - Channel, band or power setting
<b>Blue LED:</b>	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.



## 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			
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
PowerLevel	25	200	500	800					mW

The selections in orange requires HAM license to operate legally. 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



## 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.

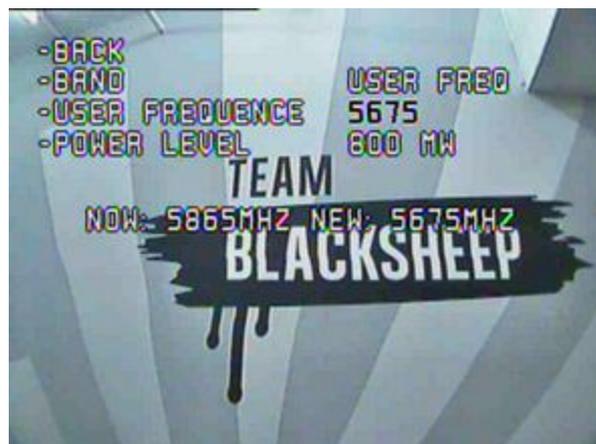


The video frequency does not change instantly. It will wait for you to exit the menu and then change to the new frequency as indicated in the last line.



## Custom frequencies

The latest CORE PRO software unlocks something truly revolutionary. Finding empty channels - or ones that are not accidentally stomped upon - is nearly impossible with the big number of new FPV pilots storming into the hobby. With the custom frequency feature by TBS (requires a HAM license callsign) you can choose a frequency of your liking, away from anyone else. For the real pro's, you can make your custom Cloverleaf antennas that match your private channel! The menu should be self-explanatory. Instead of any of the predefined bands, select "USER FREQ" and the subsequent channel selection will turn into a freely-definable frequency input.



TBS will be working on receivers that make use of this technology. For now, it is a proof of concept, that is available to the public to test. We hope this allows video receiver manufacturers enough time to adapt.



## Video transmitter pinout

### TBS UNIFY PRO 5G8 unit

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:

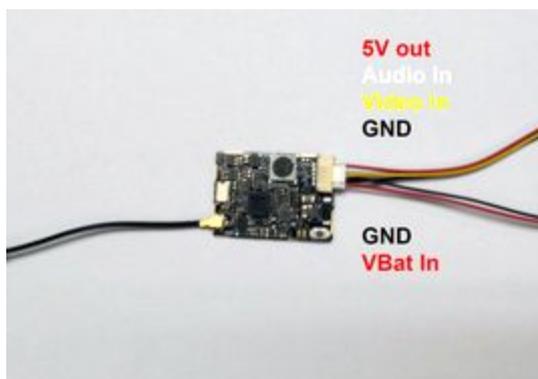
**RED** 5V (regulated and filtered)  
**BLACK** GND  
**WHITE** Audio (or Smart Audio)  
**YELLOW** Video



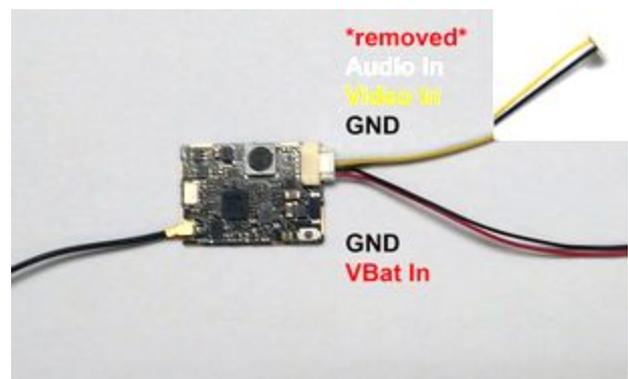
### TBS UNIFY PRO 5G8 HV unit

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



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# 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. PitMode can be entered either by pushing down the button while powering up your drone, or by enabling PitMode via the CORE PRO OSD.

There are 2 types of PitMode supported:

- **In-Band PitMode:** Range is limited to 2-3 meters, but transmission happens on the selected frequency
- **Out-Band PitMode:** Range is limited to 2-3 meters, transmission is on 5584MHz until leaving PitMode

When using the SmartAudio V2.0 protocol via the CORE PRO, it will provide you with full access to PitMode functionality. By default (and when the VTX is unlocked), your VTx will send a very weak signal on 5584MHz. This is called "Out-Band PitMode". When the VTx is locked, you will only have "In-Band PitMode" available. In-Band PitMode sends on the currently-selected VTx channel, but at a very low output power. Separation between you drone powered on in PitMode and the racer's video receiver is necessary to avoid interference. As a rule of thumb, 50 feet or 20 meters provides enough clearance. For race events, we suggest "Out-Band PitMode".

To exit any PitMode when used in conjunction with the CORE PRO, hold ROLL-RIGHT for 3 seconds to exit PitMode - a timer will appear on the screen counting up to 3 before enabling your VTx. Your quad needs to be disarmed, and not in any OSD menu. To disable PitMode permanently, you need to go back into the "Video Transmitter" menu and turn "PitMode" OFF, and then cycle power.

To quit PitMode when entered via the button menu, cycle power of your drone - without pressing the button while turning it back on, obviously :)

## 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



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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/>



# Declaration of Conformity



## EC - DECLARATION OF CONFORMITY

We affirm that the electrical equipment manufactured by us complies with the requirements of the R&TTE Directive 1999/5/EC

### Manufacturer:

TBS Avionics Co Ltd  
55 Hung To Rd, 4/F  
Unit G, Winner Fly Bldg  
Kwun Tong, Hong Kong

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

### Description of the appliance:

5.8 GHz Video Tx/Rx

### Trade name and model of appliance:

TBS UNIFY PRO 5G8 (A-TX58-UPRO)  
0741587428022

### Applicable Standard (s):

- EN 300 440-1 V1.6.1; EN 300 440-2 V1.4.1 Article 3.2
- EN 301 489-1 V1.9.2; EN 301 489-3 V1.6.1 Article 3.1b
- EN 62311:2008 Article 3.1(a) - Health
- EN 60950-1:2006+A11:2009+A12:2011+A2:2013 Article 3.1a Safety

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.

February 27, 2015  
**CE 1856**

Raphael Piker, CEO  
TBS Avionics Co Ltd.

# FCC Information

## FCC Label Compliance Statement

This device complies with ANSI C63.4 and Part 15 Subpart C Paragraph 15.249 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference
2. This device must accept any interference received including interference that may cause undesired operation.

## RF Exposure Statement

This device has been evaluated to meet the FCC RF exposure requirement when used in combination with the genuine TBS CORE accessoires and operated with a minimum distance of 20 cm between the antenna and your body.



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## 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!



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- 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.

