

TVMAX 3000+ 4W UHF TV TRANSMITTER - MANUAL



CYBERMAXTV+ 4W UHF TV TRANSMITTER - MANUAL

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Introducing TVMAX3000+

Finally an affordable UHF TV transmitter

Our customers have been asking for this for a long time and now it is finally here, this UHF TV transmitter is your ticket into the world of TV. Build your own TV studio and broadcast your own TV program! Transmit movies from your PC to your living room, re-transmit the TV program you've never been able to receive in your valley, run a college TV station, cover rural areas of Africa with TV signal from satellite TV stations, run a hotel cable system info pages or just have fun; this unit will keep you busy during the cold winter evenings and is sure to provide lots of fun for many months to come!

What makes this TV transmitter so great?

TVMAX3000+ supports all existing analog TV standards and all existing analog TV sound standards. It includes a simple built-in test signal generator. Unit is available as a populated and tested board or a 1H rack-mounted ready-to-use transmitter, which is than called CyberMaxTV+. Both units run from 12-15V DC. Optional stereo encoder board is also available and provides stereo sound. 4W of output power offers from several hundred meters up to about 5km of range depending on antenna type used on both transmitting and receiving side. High-gain yagis on both sides might offer even more range in favorable conditions. Unit was designed for 24/7/365 operation. Each unit has a wide-angle high contrast backlit LCD display. Output power can be adjusted with LCD control unit (TVMAX3000+).

What is the DSP Stereo Encoder for USA/NTSC?

This add-on card enables stereo sound, it was designed for NTSC system, used in USA and most of South/North America. Check our website for prices and availability.

What is the PAL/SECAM stereo encoder?

This add-on card enables stereo sound for PAL/SECAM TV standard. Check our website for prices and availability.

Antenna options

We have provided a suitable antenna with 5 meters of coaxial cable with installed connectors, the directional antenna (wideband VHF/UHF) is suitable for transmission in one direction and offers lots of gain. It is perfect for 2-way transmission from one point to the other. You can of course check our website, new antennas are added from time to time.

Quick Technical specifications

- Supports PAL/SECAM/NTSC (all world standards)
- Supports all sound standards (4.5-6.5MHz, adjustable)
- Output power: 4W typ (varies 2.5W-6W depending on channel.), adjustable from 0 to max via LCD
- Audio connectors: RCA (cinch)
- Audio level: 1Vpp
- Video level: 1Vpp
- Audio input impedance: 10K resistive, unbalanced
- Pre-emphasis 50 or 75µSec (adjustable with a jumper, installed jumper = 75µS)
- EU TV Channels: channel 21 to channel 69 (EU),
- USA TV Channels: channel 14 to 69
- Above channel 35 (EU and USA) output power starts dropping and is low at channel 69, we do not guarantee performance above channel 35.
- HAM TV Channels: 421.25, 426.25, 427.25, 434.00, 434.125, 434.25, 434.375, 439.25 and 444.25MHz
- Warning: Output is tuned for best performance in low end of UHF band, may require retuning for higher part of UHF band!
- Output impedance 50 Unbalanced, VSWR less than 2:1 for full output
- Output connector BNC female (rear panel)
- RF Spurious > -50 dBc @ +/- 10MHz min. out of carrier
- RF Harmonics > -50 dBc Standard
- Modulation type: DSB, occupies close to 2x the standard TV channel space, add notch filter for full compliance
- Monitoring Led: Power on
- Harmonic distortion (THD) <0,1% typ
- Stereo Channel Separation 25 dB min 20Hz to 15kHz (USA)
- Voltage power supply DC 15V/3A
- Built-in CPU for controlling and monitoring
- Easy changing of frequency (UP/DOWN keys) and other parameters
- Stereo sound possible (with plug-in board for USA or extra board for other countries)
- Friendly user interface
- Cost effectiveness
- Standard 19" rack 1HE high
- External rack dimensions (W x D x H) 19" x depth (170mm) x height 1HE (44mm)
- Weight rack 2.5kg, board 0.32kg

Thank you for purchasing TVMAX 3000+

We hope you will enjoy it as much as we do and remember to tell your friends about it. Please feel free to leave your comments at our website or post your experience in our forum. From all of us we wish you happy broadcasting!

Your PCS Electronics team

Before you start

It is recommended that you read this section before you power your unit up for the first time. Let us clear up some basics you should know about. You will also find some useful tips in our guides and forum at <http://www.pcs-electronics.com>. Here is what you need to get your TV transmitter on the air:

Antenna

Preferred type of antenna is affected by several factors, but mostly by desired radiation pattern, space available and your budget. If you are located in the middle of the area you want to cover you'll need an omni-directional antenna which transmits equally in all directions. If you are located at the edge of your desired coverage area you can beam the signal into the target area with a directional antenna. Directional antennas are also practical for point-to-point communications. Another thing to consider is that directional antennas usually have much higher gain than omni-directional antennas since the power which is radiated in all directions with omni antenna is concentrated mainly into one direction with directional antenna. Antennas with more gain thus have narrower beam. A compromise is usually made depending on budget and space available, higher gain antennas are often bigger and often more expensive.

Once you've chosen and installed your antenna there is another thing to consider. You can read more about it in the next section (So what is this SWR everyone talks about). Before powering up your transmitter on the air you should tune your antenna to get minimal SWR. This is typically done by adjusting the position of the antenna and any adjustable pieces. Aim for 2:1 or less. Use low power into the antenna when tuning it up and making adjustments. If you were using full power and a bit of the antenna came off in your hand the VSWR could be so bad as to blow the final transistor. For the same reason check the DC continuity of the antenna with an ohmmeter before plugging it in, to be sure it's what it's meant to be, either a short circuit or an open one, depending on the antenna type. For instructions regarding construction of antennas please see our website: <http://www.pcs-electronics.com> (guides section - antennas).

Antenna is a crucial part of the system so take special care. It is usually a good idea to place antenna away from your transmitter, power supply and audio system. Also any transmitter should be in a metal case which shields circuitry from the radiation of the antenna. If you cannot meet these requirements, you could experience feedback and other RF problems. We cannot guarantee proper operation of any transmitter/amplifier unless suitable antenna system is used and transmitters are in ventilated metal enclosure! This applies to any transmitter. Interestingly, strong RF field can make CD players and other digital devices go bezerk. Try placing antenna next to yours and see what happens. Most of the modern audio gear is not RF shielded – reducing costs is unfortunately the mantra today. This is why keeping antenna away from audio gear is a good idea, too.

If you are going to place your antenna outside, on your roof, please take care of the grounding. This should be done to prevent lightning hazard and should be done by a company specializing in lightning protection. You can read more about lightning protection in the book recommended below or many of the websites (google up “lightning protection ham radio” for example).

I hope this basic introduction will not scare you too much, it should be sufficient for the time being although we encourage you to explore this exciting subject further with the help of a book such as the ARRL Antenna Book:

<http://www.amazon.com/exec/obidos/ASIN/0872598047/mightyspiraterad>

So what is this swr (vswr) everyone talks about?

SWR is a measure of how well two devices are impedance matched to each other. Typical radio/TV transmission equipment is designed for 50 ohm load impedance, so we usually use 50 ohm cables and build or buy antennas that are specified for 50 ohm. While most cables have flat impedance over frequency (they measure 50 ohm at all frequencies you are likely to use) the same is not true of the antennas.

A 1.0:1 VSWR is a perfect match. That means the load impedance is exactly 50 ohms. A 2.0:1 VSWR is obtained when the load impedance is either 25 ohms or 100 ohms.

Because most transmitters will deliver full power with a load VSWR of up to 2.0:1, this value is usually considered the limit for acceptable operation. Many prefer to keep their VSWR below that however, but for all practical purposes, it is unnecessary to spend time or money trying to get much below a VSWR of 1.5:1. The benefits will be hard to measure and even harder to notice.

On the other hand, coaxial cable losses increase rapidly, for a given frequency of operation, when the antenna VSWR exceeds 2.0:1. This can even, in some extreme cases, result in the coaxial cable burning, even when running 100 W. Using a higher grade of cable will definitely improve things, but even high quality coaxial cable becomes very lossy when VSWR exceeds 3.0:1 at higher HF frequencies (or VHF and higher).

Coaxial cable

Coaxial cable is an electrical cable consisting of a round, insulated conducting wire surrounded by a round, conducting sheath, usually surrounded by a final insulating layer. The cable is designed to carry a high-frequency or broadband signal, usually at radio frequencies. Coaxial Cabling is a two conductor closed transmission medium that is often used for the transmission of RF energy. It yields excellent performance at high frequencies and superior EMI control/shielding when compared to other types of copper cabling. Coaxial cabling is commonly found in broadcast and networking systems. Most coaxial cables have a characteristic impedance of either 50 or 75 ohms. The RF industry uses standard type-names for coaxial cables. The U.S military uses the RG-# or RG-#/U format (probably for "radio grade, universal", but other interpretations exist).

The common RG-58 from Radio Shack is NOT the best you can do and can eat a lot of your effective power out! Use it only for short runs. BELDEN makes terrific coaxial cable in various qualities and with very low loss (measured in dB's...decibels). 3 dB loss = 1/4 of your signal strength - either lost or gained. Watch out for the correct impedance; RG58, RG213, H-500 and H-155 have 50 Ohms, RG-59 and RG-6 have 75 Ohms. Most antennas and transmitters including ours are 50 ohm. Check our website for good coax. Don't buy more than you need to make the long run to your antenna and don't make up a few "jumpers" to go between your exciter, VSWR meter and your antenna as all you'll do is create higher SWR and more line losses. H-155 or H500 are good choices! RG-142 with Teflon is recommended for wiring inside cabinets, for baluns, Wilkinson couplers and everywhere where resistance to heat is required as insulation won't melt during soldering or operation.

Mains power supply and mains power cable

Do not underestimate the importance of mains power supply, despite abundance of all kinds of cheap units available today they unfortunately do not always meet requirements. What you need is a well stabilized DC 15V mains power supply that can supply at least 2 amps of continuous current without overheating, introducing buzzing, dropping the voltage down to 12V or lower (a classic case) or acting up in other way. Whenever in doubt please buy our mains power supply. One final note, if you use less than 15V this effectively lowers your output power. The lower the supply voltage the lower the power.

If you ordered and received our mains power supply (which is recommended) you'll notice the mains cable is not included, but can be obtained in any radio/computer/hardware shop at the cost of about 1 US\$. It is the type used in your PC for mains power. Since these cables vary from country to country and we had trouble getting the exact type locally we decided against including them, especially since finding them is so easy locally.

How to wire everything together and use TVMAX3000+

Wiring things up and first power-up

Wiring the TVMAX3000+ or CyberMaxTV+ is easy, just make sure you read the previous chapter first and setup antenna, coaxial cable, and mains power supply correctly. Then proceed with the following:

- The board (if you purchased your unit without enclosure) should be mounted inside a metal enclosure. Metal serves as a large heatsink for the output transistor and ensures cooling and electromagnetic shielding. A small fan is recommended!
- Connect your 50ohm antenna (tuned) to the antenna connector (BNC) at the back. If you have SWR/POWER meter, wire that one inline as well. Make sure it supports the frequency band required (400-700MHz or more).
- Connect audio/video signals to audio and video RCA jacks (VIDEO and AUDIO on PCB or at the back of 1H rack).
- Connect mains power supply into the power jack at the back.
- Flip the switch and wait for the unit to turn on, enter menu system by pressing the bottom key and set TV channel, TV standard & audio standard for your country and tune your TV receiver to the same TV channel. Select a free TV channel that is not occupied. The two neighboring channels should be free as well for best results and minimal interference. You can use built-in test signal generator to verify operation. This signal produces a beep on the sound carrier and vertical BW bars similar to your VCR setup test signal.
- If needed, set the output power higher or better yet to minimum needed (to prevent unneeded interference). Power can be adjusted via LCD module with up/down keys.

Using the TVMAX 3000+ or CyberMaxTV+

Here are some additional tips and valuable info related to using TVMAX3000+ or CyberMaxTV+ :

- There are three push-buttons available on the front panel. The top two are **UP** and **DOWN** while the third one at the bottom is used to invoke **MENU**. You can change any of the available settings by pushing the **UP** or **DOWN** button inside any of the available menus.
- Green LED on the LCD module is always lit and signals power on. RED led is not used in this product.
- Sound volume can be adjusted with the audio trimmer (on the circuit board, close to audio input).
- Stereo operation requires stereo encoder. If you want stereo sound for PAL/SECAM or NTSC please purchase appropriate stereo encoder. It is best that you buy tv transmitter and stereo encoder together (preferably the rack box version) so we can wire these together for you saving you trouble.
- The two on-board trimmer capacitors should not be touched unless you have suitable test equipment to verify operation. Otherwise they can be used to optimize operation for particular TV channel used and to maximize output power.
- Another trimmer exists to adjust the output stage bias. This should not be touched either unless you really really know what you're doing and even then you probably should not touch it.
- Sufficient cooling is crucial for optimum output power. Unit starts powering down if it overheats. It is thus of utmost importance that you mount this transmitter into a metal enclosure and bolt the output stage heatsink to the enclosure and also use a small fan.

Troubleshooting

We hope you'll never get to this step. We all know bad things happen but do not despair! First, TVMAX 3000+ is protected with a fuse and TEMP protection. Fuse is the first thing to check. Make sure your coaxial cable leading to the transmitter and antenna is not shorted or open. Next check the troubleshooting table below. If you have problems you cannot solve yourself, please see our website for contact information and support resources in our forum.

PROBLEM DESCRIPTION	POSSIBLE SOLUTIONS
Unit produces very poor range	<ol style="list-style-type: none"> 1. Check power supply, is it 15V? Less? Get another power supply. 2. Is the unit running very hot? Mount it into metal enclosure and use a small fan to cool it. 3. Check coaxial cable and connectors 4. Check antenna 5. Are you using high part of the UHF band? Unit produces low power output at high UHF band, try to use channels around 23 (EU). 6. You can try to tune trimmers for more output power, but this requires power/swr meter.
Unit is very hot and its output fell to zero	If you take extremely poor care of cooling (no metal enclosure, no fan of any kind) it will eventually become hot and reduce output power. In normal operation unit typically runs at 50-60 degC max. Please ensure proper cooling and unit will stop shutting off.
Unit blows fuses and draws excessive current	You have managed the impossible: You have burned the output transistor. You've probably tried to squeeze out too much output power by increasing the bias voltage. You may have used more than 15V supply voltage. It is time to order a replacement final transistor and get the soldering iron. Next time think twice about doing these things.
Power supply is blinking	Probably the same thing as above. Blinking power supply means its protection is shutting it off and back on, probably due to excessive current draw caused by burned final.
Repetitive noise/sound can be heard on the radio.	1. Check your antenna and cable, you have a serious SWR problem, SWR protection is kicking in. Usually there is a short on your coaxial cable or antenna.
Audio too quiet	- Increase audio level with the audio level trimmer. It is located on transmitter circuit board next to audio input
There is HUM in audio	<ul style="list-style-type: none"> - Get a proper mains power supply, stabilized type! - Move antenna as far away from the transmitter and audio gear as possible - Make sure SWR is low - Form a coil from coaxial cable going to the antenna, make a few turns. This stops RF currents that might be flowing on the outer braid of the coaxial cable. This usually happens when you connect unbalanced cable to balanced antenna without proper BALUN (balanced-unbalanced converter) resulting in coaxial cable becoming part of the antenna and radiating RF energy as well...causing hum.



Do you think you can handle it ??

Figure 4: So, do you think you can handle it? We think you sure can!

Appendix A – Frequency tables (UHF)

<i>PAL Channel</i>	<i>Frequency (MHz)</i>	<i>NTSC Channel</i>	<i>Frequency (MHz)</i>
21	471,25	14	471,25
22	479,25	15	477,25
23	487,25	16	483,25
24	495,25	17	489,25
25	503,25	18	495,25
26	511,25	19	501,25
27	519,25	20	507,25
28	527,25	21	513,25
29	535,25	22	519,25
30	543,25	23	525,25
31	551,25	24	531,25
32	559,25	25	537,25
33	567,25	26	543,25
34	575,25	27	549,25
35	583,25	28	555,25
36	591,25	29	561,25
37	599,25	30	567,25
38	607,25	31	573,25
39	615,25	32	579,25
40	623,25	33	585,25
41	631,25	34	591,25
42	639,25	35	597,25
43	647,25	36	603,25
44	655,25	37	609,25
45	663,25	38	615,25
46	671,25	39	621,25
47	679,25	40	627,25
48	687,25	41	633,25
49	695,25	42	639,25
50	703,25	43	645,25
51	711,25	44	651,25
52	719,25	45	657,25
53	727,25	46	663,25
54	735,25	47	669,25
55	743,25	48	675,25
56	751,25	49	681,25
57	759,25	50	687,25
58	767,25	51	693,25

59	775,25		52	699,25
60	783,25		53	705,25
61	791,25		54	711,25
62	799,25		55	717,25
63	807,25		56	723,25
64	815,25		57	729,25
65	823,25		58	735,25
66	831,25		59	741,25
67	839,25		60	747,25
68	847,25		61	753,25
69	855,25		62	759,25
			63	765,25
			64	771,25
			65	777,25
			66	783,25
			67	789,25
			68	795,25
			69	801,25

Appendix B – Frequency tables (HAM RADIO)

<i>Channel</i>	<i>Frequency (MHz)</i>
<i>1</i>	<i>421,25</i>
<i>2</i>	<i>426,25</i>
<i>3</i>	<i>427,25</i>
<i>4</i>	<i>434</i>
<i>5</i>	<i>434,125</i>
<i>6</i>	<i>434,25</i>
<i>7</i>	<i>434,375</i>
<i>8</i>	<i>439,25</i>

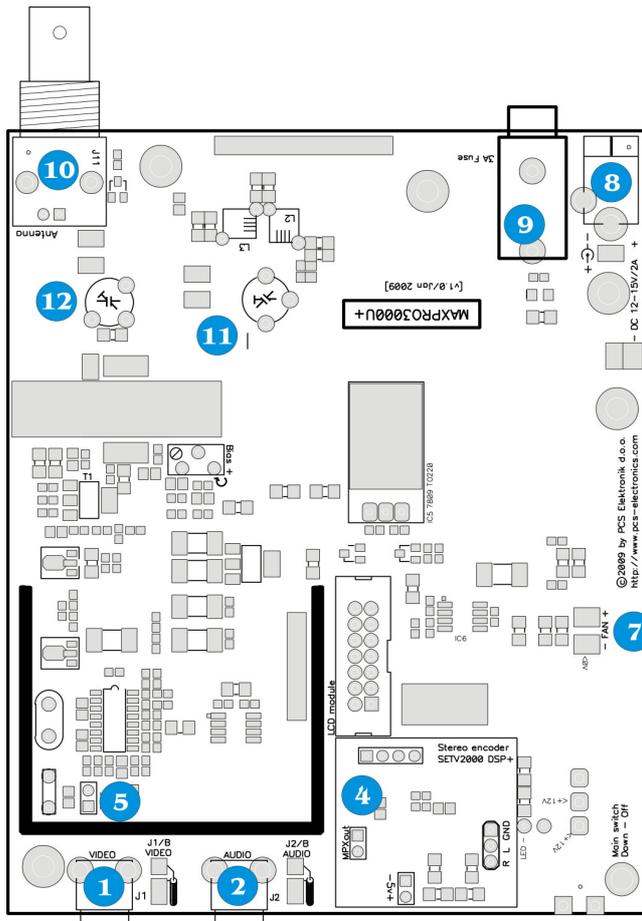


Appendix C – Frequency tables (VHF HI + VHF LO)

<i>PAL Channel</i>	<i>Frequency (MHz)</i>	<i>NTSC Channel</i>	<i>Frequency (MHz)</i>
5	175,25	7	175,25
6	182,25	8	181,25
7	189,25	9	187,25
8	196,25	10	193,25
9	203,25	11	199,25
10	210,25	12	205,25
11	217,25	13	211,25
12	224,25		

Note: If you need another frequency please let us know and we will do our best to add it to our list.

Appendix D – Circuit board layout



Reference	Function
1	Video input
2	Audio input
3,6	Only in 2000+
4	DSP stereo encoder
5	Pre-emphasis
7	Pads for cooling fan
8	Power supply
9	Fuse
10	Antenna, BNC
11,12	Output tuning trimmers

TVMAX3000+ TV transmitter circuit board with a short description of its connections and controls.

Appendix E – Warranty and legal info

Important notice!

Please remember to turn off the transmitter/amplifier when not in use! This goes especially for high powered transmitters. Remember that anything you broadcast through the transmitter can be heard by anyone tuning in to that frequency. Although it is unlikely certain weather conditions may allow the signal to go further than your immediate listening area so please don't broadcast anything you don't mind anyone else hearing.

Warranty and servicing!

Within one (1) year of receiving your order, if any product proves to be defective; please contact us via e-mail or our feedback form. Please **DO NOT** ship the product back to us without contacting us first and receiving return instructions. After we receive the defective merchandise, we will test it if need be, and we will ship back to you a non-defective replacement product. Please note that this doesn't cover final RF transistor as it can be damaged by using defective or poorly matched antenna. An exception is as well any mishandling or abuse by the customer. If the product is defective, you will receive a replacement. If you choose to return the defective item, rather than replace it, we will charge a 20% restocking fee and your original shipping and handling charges will not be refunded. The return of the product is at your expense. We believe that this is a fair policy because lower overhead results in lower prices for all of our customers.

Legal info

It may be illegal to operate this device in your county. Please consult local authorities before using our products! PCS Elektronik d.o.o. is not responsible for any damage to your PC arising from use of this product and will not be held responsible for any violation of local laws pertaining to the use of this product. It is entirely your responsibility that you make sure you operate in accordance with local laws and/or regulations.

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- Various accessories for professional and hobby FM radio stations
- A large assortment of hard to obtain RF components (RF transistors; MRF, 2SC, coils, silver plated wire, coaxial cable, capacitors, quartz crystals and many others)
- PC based FM transmitters (PCI MAX pc based FM transmitter turns your PC into a radio station)
- A large number of beginners guides to get you started
- A large selection of free schematics is as well available at our website.

If you can't get much range with your homebrew antenna, have a look at these: <http://www.pcs-electronics.com>

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Revisions and errata

V2.0 (Nov 28th, 2009): Entirely new format, lots of additions

V1.0 (Sep 2009): Release version

Please report any errors you see in this manual, you will be helping us and many other users out there. Thank you!

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