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TVC-4S 420-450 MHz ATV DOWNCONVERTER

The TVC-4S is a ready to go ATV downconverter designed to mix the 5 standard ATV frequencies in the 420-450 MHz amateur band down to TV channel 3, or 4 with 20 to 30 dB gain. The preamp stage uses a HJ-FET with a <.4 dB noise figure. A TVCX-4S board is mounted in a shielded enclosure ready to go with external +12 Vdc or 120 Vac 60 Hz power supply adapter.

TVC-4S: For short runs (<20 ft) to a coax T/R relay or antenna, a good grade of RG58/U coax can be used with a type N connector on the TVC-4S 50 ohm 70cm antenna input end. Some have used ready made 75 ohm TV coax with F connectors and F to N adapter for short distances and accept the reduced sensitivity. Ready made coax cables and connectors are available from NemaI (305) 899-0900. For longer runs and lower loss, use either the Belden 8214 (3.8 dB/100') or better Belden 9913 (2.6 dB/100') or LMR-400 coax with N connectors. In all cases, the antenna you connect to should be as high up as practical, same polarity, and designed for the 420-450 MHz frequency range. Weather proof all outside connectors. Run a RG-6 75 Ohm cable with F plugs from the downconverter TV output to the TV antenna input jack. Set the TV to channel 3 or 4, whichever is not used for over the air TV in your area. Standard output is channel 3, but if channel 4 is desired, jumper to ground solder pad 7 on the board inside. Other connectors, coax cables and adapters are available from Radio Shack, NemaI or your favorite ham store. The TVC-4S can be powered by the 120 Vac 60 Hz/12 Vdc adapter provided or an external 11 to 15 Vdc @ 120 ma with a 2.1 mm power plug (RS 274-1569 center is +) for battery or mobile operation. See other side of this sheet for setup and antenna info.

TVCX-4S: The board layout is shown below. It must be mounted in a shielded enclosure to keep strong adjacent channel TV broadcast interference out like we do in the Hammond 1590C box for the TVC-4S. The HJ-FET preamp and GaAsfet mixer stages have more than enough gain and low noise figure that adding preamps (except at the antenna) will not significantly improve sensitivity further, infact will only increase intermod interference. Oscillator trimmer cap C6 should not be touched unless outside +.5 / -.2Vdc from .5 Vdc on channel 1, the lowest frequency. Use only an insulated tuning tool. Output is TV channel 3, 61.25 MHz with no jumper or TV ch 4 if 7 is jumpered to ground. Pad 8 is jumpered for 45.75 MHz IF but other parts are changed also. If no jumpers at all, the default is channel one downconverted to TV ch3. The lowest channel jumpered to ground is always selected if more than one are selected. Therefore, if you only want to select between two channels, jumper the higher channel solder pad on the board and run a toggle switch to the lower channel solder pad. Channel 6 is only for special ordered frequencies. For all 5 channels, run wires from pads 1-5 to a panel mounted rotary switch and wiper to ground or board soldered digiswitch. Output can be just a wire up to 4" long and the input no longer than 1/4" or else run coax with the shields connected directly to the board ground plane and connector shell on the other end respectively.

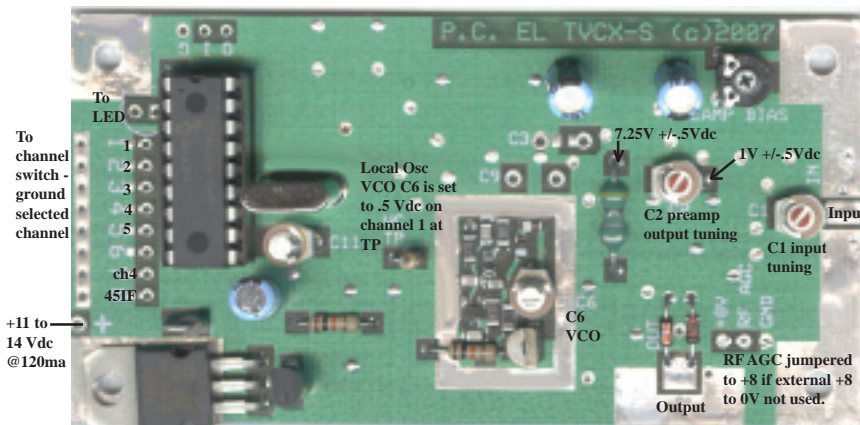
TVCX-S Board



Ch	Freq.
1	421.25
2	426.25
3	427.25
4	434.0
5	439.25

RF AGC (optional) designed for use with VRC-45 receiver board. For manual RF gain an external 10K pot to vary from 0 to 8 Vdc can be added to reduce strong signals as may be found during demos or public service operations. 8V at the RF AGC solder pad is the highest gain and the preamp bias pot on the board is set for that. If the no signal AGC is less such as when connected to the VRC-45 receiver RF AGC (6V nominal) the Preamp Bias is reset for max gain on a weak signal. C1 can also be fine peaked for best picture on a weak signal.

LED Run leads from the LED solder pads to a panel mount LED to indicate power on. Square pad is the + side.or anode.



C11 is used to net the local oscillator to within +/-10 kHz of center frequency. **C9** peaks the local oscillator injection to the mixer when high side LO injection is used for IF output.

Trouble Shooting: check all coax and power connections. Moisture in coax? Rotor calibrated? TV on open channel? Try receiving a different station known to be line of sight? If the panel lamp is out, check the external power supply voltage and polarity at the inside of the jack. Check VCO TP for .5 Vdc +.5/- .2 Vdc on channel 1. Check C2 and inductor DC Voltage at arrows on left. Note that the RF input is DC ground through a RFC to discharge static buildup if checked with an Ohm meter and the output has back to back diodes as protection against leakage from a hot chassis TV set. See service policy on ordering page 9 in the catalogue or on our web site - Repair Authorization Form.

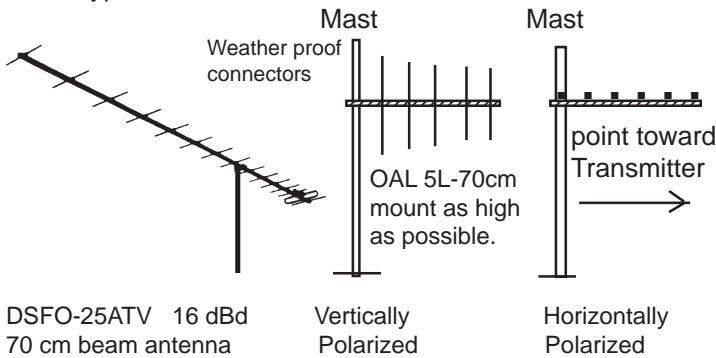
ANTENNA SYSTEMS

The antenna system is *the most important* part of your ATV system. The antenna must be the same polarity as the transmitting antenna and line of sight between them if at all possible. Trees, foliage, houses, etc. greatly absorb UHF energy. Compared to FM voice systems with the same power, antenna, etc. just the system bandwidth going from 15 KHz to 3 MHz in the receiver will decrease your sensitivity 23 dB. With this bandwidth the noise power floor is around .8 μ V. So you can see quality coax and high gain antennas up as high as possible are necessary to make up this difference compared to the DX you are used to with FM simplex.

Find out from local hams which polarity is in use. Performance in the 70 cm band is the same for horizontal or vertical, but cross polarization can cost you up to 20 dB. Areas which have had most hams come to ATV from 432 MHz weak signal CW or SSB will tend to be horizontal, and those that were on UHF FM or more into public service and mobile will be vertical. Most repeaters will be vertical due to the lower cost and ease of buying omnidirectional gain antennas.

Antenna separation should be at least 7 ft, in line, driven element end to end spacing with 33 or 23 cm antennas for duplex ATV or crossband repeater work.

Antennas for ATV work must also have broad bandwidth as well as gain. Most high gain Yagi types have only 1% bandwidth, or 4 MHz at 70 cm. This will give less gain and higher VSWR to the most important color and sound subcarriers assuming that the antenna was cut for the exact video carrier frequency in the first place. The best true reference for antenna gains and performance is the results of the various VHF/UHF Conferences antenna measuring contests held annually and publicized in the ham magazines. Advertising claims have become mostly wishful thinking and sales hype.



Some beams designed for broad bandwidth that have proven out on ATV over the years are the OAL 5L-70cm and the DSFO-25ATV. The 5 element antenna is only 31" long, end mounted, but has 8 dBd gain. The DSFO-25ATV is highest gain at 16+ dBd and a 17 ft boom. See page 20.64 in the ARRL Handbook for info on the K1FO antennas. Omni antennas can be used but are less gain and more susceptible to multipath ghosting. There are circular polarized crossed Yagi antennas mostly used for amateur satellite work that can be used. Circular polarization lets you work all modes & antenna polarities plus has the added advantage of less multipath dropouts and ghosts than a fixed polarity. Check our catalogue and web site for other antennas and vertical omni antennas that have been checked out by us for ATV.

ANTENNA CABLE

Use only new or tested low loss coax that has at least 95% shielding. We suggest Belden 8214 (3.8 dB/100' loss), 9913 (2.5 dB loss at 400 MHz) or LMR-400. RG 213 or 214 is fine but has a loss of 4.7 dB/100'. For runs over 100' you may want to consider investing in some good copper hard line and/or an antenna mounted low noise preamp such as the Mirage KP-2 which also has automatic T/R switching. An antenna mounted preamp can increase receive sensitivity by an amount equal to the coax loss.

Use type N connectors for all outside coax connections. Take care to properly put them on the cable. Prevent moisture contamination of the coax by wrapping all connections with two layers of vinyl tape. Coax Seal is also good. Then spray all connections and antenna with *clear epoxy* paint. Colored paint may have conductive particles in them that will affect the antenna gain or match, or give intermods. Moisture in the coax results in increased loss and greater possible intermod interference. If moisture contamination is suspected, peel back the braid and look to see if it is still bright. If it is oxidized, replace it. VSWR will actually look better with the higher loss from moisture contamination.

DX "What kind of distance can I expect?" is the most asked question. There is no pat answer because of all the variables. But for a practical snow free picture with a 42 dB sync to noise ratio it is over 100 miles if you have line of sight. This is based on line of sight, DSFO-25ATV beams, 3 dB coax loss, and using the TC70-20 20 watt transceiver. 27 miles with 20 watts and 8 dBd antennas like the F718 omni and 5L-70cm.

For greater DX most of your time and effort should be in the antenna system... greater antenna height, lower loss coax or bigger antenna. This will improve both transmit and receive conditions. DX will double for every 6 dB of change. Antenna placement should be away from and above trees and roof tops. The RF horizon on flat terrain for an antenna at 50' above ground is 10 miles - Miles = square root of 2 times the height in feet. Foliage greatly absorbs 70 cm energy. You can experience non-line of sight DX depending on reflections, temperature inversion skip, and use of ATV repeaters. See the ATV DX graph on our web site which gives line of sight DX given antenna gains and transmit power.

TV SETUP

Any TV set or VCR tuner should work well with the ATV downconverter. 75 Ω coax must be used between the downconverter and TV sets antenna terminals. Do not use twin-lead as it can act as an antenna. Set the TV tuner to channel 3 or 4, which ever is not used in your area. With the downconverter connected but *not on* that there is no adjacent channel interference. Then turn on the downconverter and set the downconverter channel knob for a known close by strong line of sight station that is on the air using that frequency. A 2 meter simplex ATV coordination channel is very handy for talking in the stations picture for antenna alignments while talking full duplex on the sound subcarrier. 144.340 (439.25) and 146.430 (434.0) simplex are the most popular. You may have to auto rescan for valid channels on newer sets if your TV was not already set for channel 3 analog NTSC video. Same if transmitting digital ATV.