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VK3RTV Evolution: left to right -- Analog at Olinda, Digital at Canterbury, & Mount View

The Melbourne ATV Repeater VK3RTV

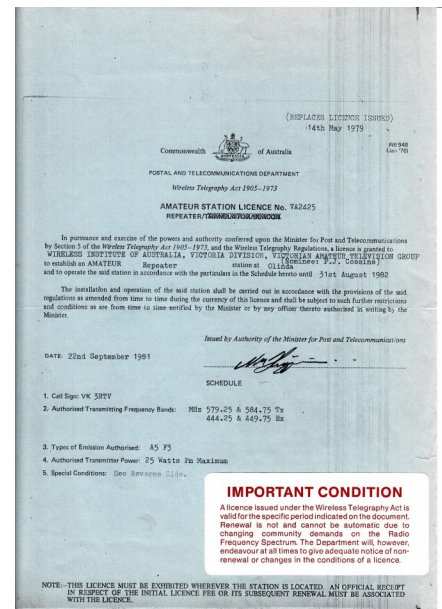
A Brief History - the journey from Analogue AM to High Definition Television

Peter Cossins, VK3BFG

The initial application to the Superintendent, Regulatory and Licencing, Telecom Australia was made by the Wireless Institute of Australia (Victorian Division) on the 25th July 1977. It detailed a simple AM Transmitter of output power less than 25 watts to be located at HSV7's Transmitter's ' Barnes

Lookout' site. It was a cross band system with input on 444.25 MHz A5, 449.75F3 and output on 579.25 MHz A5 and 584.75 MHz F3. The person responsible for terminating transmission was Lou De-Stefano VK3ZYD/AQZ and the person responsible for the station was Kevin Callagan VK3ZVJ. Approval was granted finally on September 5 1978.

The installation at Channel 7 did not go ahead as a more suitable site at Olinda was offered by Brian Baker VK3HB (SK). Brian was the Chief Technical Officer for the Education Department Special Services Division at the time. As a result, Amateur Station Licence VA2425 was issued dated 14th May 1979 with the person responsible for all operations Peter Cossins VK3BFG. The association with Brian proved to be very fruit-full in the future as he was able to obtain resources in support of the developments over time.

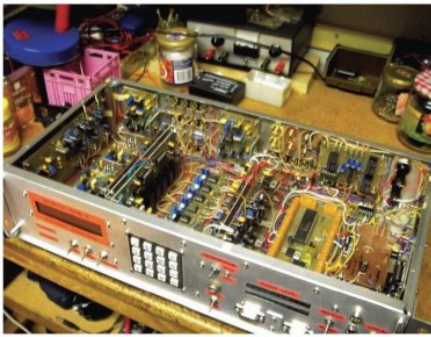


First License !

The first repeater consisted of a domestic TV receiver and a 10 watt high level modulated transmitter and simple control system built by Les Jenkins VK3ZBJ (SK). The antennas were also designed by Les, and members of the Melbourne ATV Group built both the receive and transmit arrays in one day at Les' factory. The antennas were installed right at the top of the tower and hence the coverage around Melbourne was excellent with the exception of a shadow cast locally by One Tree Hill. After a short time the Education Department Special Services Division purchased a Hirshmann Translator which was made available for use by VK3RTV . This Translator had a European IF of 38.9 MHz with a co-axial cable loop between the Receiver and the Transmitter.

A decoding circuit was built to extract video and audio for control purposes. A 38.9 MHz Video Modulator with a 33.4 MHz FM Sub Carrier designed by DJ4LB was also built together with a VSB filter to drive the input IF circuit of the Translator. The Translator was delivered with its receiver tuned to 444.25 MHz and its Transmitter tuned to 579.25 MHz. A preamplifier was added to assist in reception. With the advent of colour it became evident that the FM Sub Carrier was producing annoying inter-modulation effects. To eliminate this, a separate 1 Watt FM Transmitter was built and another array of antennas installed. Many amateur operators followed this work- around fix with a separate Sound Transmitter.

Included in a new control system was a basic graphics generator that provided a simple signal report and also information pages about the repeater systems. This graphics system was later replaced by a DVD player generating dynamic ID splash screen graphics and also DTMF requested signal reports S1 to S5 calibrated from the receivers AGC line. Appropriate recorded responses were made by my daughter, Shani Cossins. Later the CD player was replaced by an RS232 Controlled Video Player which also contained various video clips. (These players came out of commercial displays used in Theme Parks and Retail Outlets.)



The ATV Analogue Controller



The RS232 digital player



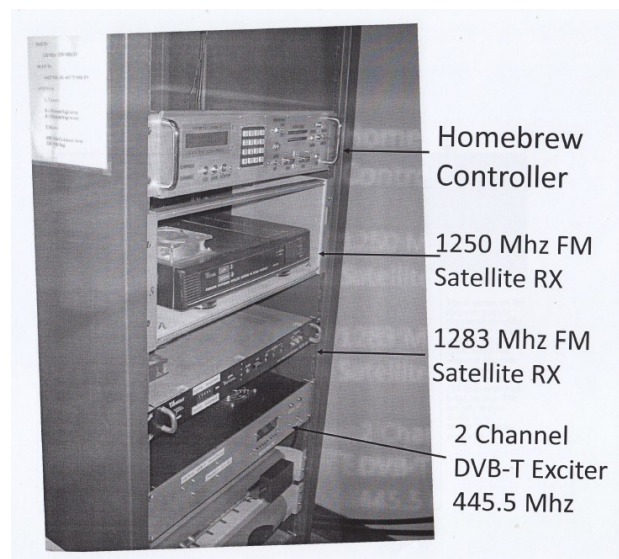
The Olinda co-linear antenna

With the eventual loss of the 50 cm band the Transmitter was re-tuned to 444.5 MHz and the Hirshmann based receive system was replaced by Analogue FM Satellite Receivers which had a tuning range of 950 to 2150 MHz. ATV Operators moved to 1250 MHz FM, many building the South East Queensland's ATV Group's transmitter with Loop Yagi's being popular for transmitting purposes. A new pre-amplifier was again used to improve receive performance. The Co-Linear antennas were built when we converted to 23 cms FM. Ended up with two, one for 1250 MHz Westerly direction and one for South East Corridor @ 1283 MHz.

The First Stage of Digital Conversion

Around 2010 a submission to Amateur Radio Victoria and the Wireless Institute of Australia was made to convert the output of VK3RTV to DVB-T Digital. The submissions were successful and the conversion to a digital two channel multiplexed system was installed. The digital exciter consisted of two CVBS Encoders, a Multiplexer and a Modulator. A small Mitsubishi RA7N4047 RF amplifier was included as the output of the DVB-T modulator was a modest 1 milliwatt. The final PA used was a Mitsubishi RA60H4047M1 60 W Module and a final filter from the Hirshmann Translator, the rest of which was then redundant.

The channel output power was still a very modest 10 watts to minimise intermodulation products in the output. As there were two channels now available a separate antenna was installed to better serve the south eastern corridor of the metropolitan area. VK3RTV1 (1250 MHz) serviced all points west and VK3RTV2 (1283 MHz) the south eastern corridor. Two identical analogue controllers were built to manage the new system.



Olinda ATV Repeater
FM input - DTV output



**New 70 cm Transmit Antennas
(l to r) VK3BCU, VK3BFG & VK3AIC**



Peter Cossins with the Digital Exciter Unit

The next development was to replace the Analogue FM Satellite receivers with Humax IR-5410Z and IRC1-5400Z DVB-S Digital Satellite Receivers completing a total conversion to digital technology. After a brief period of operation a 500 Watt W6PQL Amplifier was built and installed running with an output of 100 watts. During this time a new design transmit antenna was also built and installed. In 2016 the site was de-commissioned and the tower removed from the Olinda site.

The First Metropolitan Test Site --- Telstra Canterbury ---

The historic Canterbury communications hub was de-commissioned with the exception of one or two commercial providers. The site hosted the video link between Melbourne and Sydney in the past and housed operational suites from the ABC and the commercial channels. There were many racks filled with a variety of de-commissioned systems.

A dipole array recovered from the Olinda site was used as an omni-directional 445.5 MHz transmit array and two 23 cm Quads basically facing east and west were used for receive. Many spare LDF 5-50 cables were available from the prior occupants of the site. Unlike Olinda, it was found that the final low pass filter in use



Canterbury Antenna Site

was not fit for purpose in this environment, so only a few days of operation were undertaken. The site certainly would suit our operation with the addition of a DVB-T Filter to enable co-existing with existing commercial services. A search was made for such a device and one was identified from Comm Tech, an Italian communications provider. They were prepared to re-tune one of their filters to accommodate a centre frequency of 445.5 MHz. Funding for the purchase of this filter was supplied by members of the Melbourne ATV Group and Amateur Radio Victoria.



Comm Tech ATV 70 cm Band-Pass Filter

In the interim, Amateur Radio Victoria had obtained the lease for another metropolitan site at Mount View, Glen Waverly and VK3RTV was re-located around 2019.



ATV Quad Antenna



ATV quads on the tower

Mount View Installation

The antenna plan for the new Mount View site provided for 4 horizontally polarised antennas with modest gain to cover the greater metropolitan area together with a vertical Omni BA 80-67, 6 dB Gain antenna for 445.5 MHz Transmit. Double dual quads were built for the receive system as this design possessed modest gain and wide bandwidth. 3 dB Couplers were made with hobby brass stock and the inner stripped from 75 ohm cable. The dual quads were extensively tested in a flood basin near the Knox City Shopping Centre.(Much to the bemusement of people around the walking tracks.) The initial standard definition tests at Mount View were very encouraging with only one active station really disadvantaged by the move. Of course a metropolitan site is not as good as one on Mount Dandenong but the coverage was actually surprising given the lower location. The digital signals from some stations were not that far above the noise floor, but of course this did not matter with digital technology and is not evident in the picture quality with the exception of drop-outs. As a result of measurements made, it was concluded that an analogue FM service would not really be practical at the site.

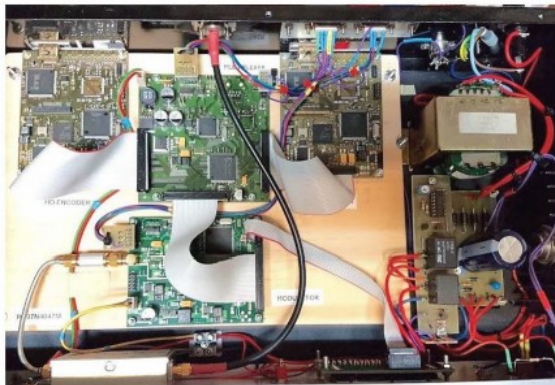
The four digital inputs followed the WIA Band Plan frequencies of 1246 MHz, 1255 MHz, 1278 MHz and 1287 MHz. 1246 and 1255 were paired to VK3RTV1 and 1278 and 1287 to VK3RTV2. The controller design was programmed on a first in best dressed basis and the frequency separation between the two groups meant a minimal de-sense of the respective receivers would occur between concurrent users of VK3RTV1 and VK3RTV2. The 1246 MHz service covered Melbourne's South east, the 1255 the North East, the 1278 the South West and Geelong and 1287 the Western suburbs. The funding for all the costs of re-establishment were supplied by Amateur Radio Victoria, the Western and Northern Suburbs Radio Club and the Melbourne ATV Group.

Pre-amplifiers were used on all inputs and the Humax DVB-S Receivers were again used. After a short period of operation it was decided to sweep the final filter as this is a critical component of working in a hostile RF environment in proximity to a wide range of commercial operations. (Lessons learnt a Telstra Canterbury). To our dismay the results were really bad !! Somehow moisture had got in although there was none evident in the antenna cable or connector and no source of moisture in the environment which warm from all the equipment running in a confined space. Weeks of bathing in a weak acidic solution and careful hand cleaning restored the filter to some extent although much of the plating had been lost. After careful adjustments, a sweep of the filter saw a reasonable semblance of the documented original response. The main detraction as far as can be seen is a 1 dB increase in insertion loss bringing it to a total of about 2dB+ .

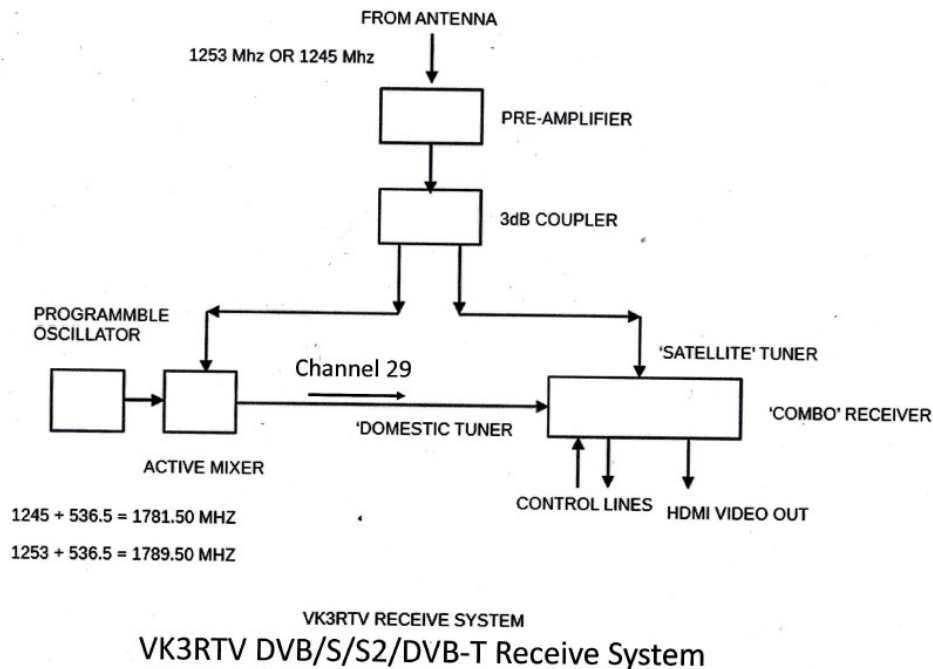
The Conversion to Hi-Definition: Not to be satisfied with standard definition and with the availability of new a high definition Encoder and Modulator boards from SR Systems, members of the group decided to upgrade their own stations and VK3RTV as well. The result was that a significant number of stations now had high definition DVB-S2 capability and VK3RTV DVB-T2 with the same multiplexed two channel output. (DVB-T2 was the latest development of terrestrial digital television. Our commercial stations did undertake some testing of this new development but decided against it, I assume as the current domestic receivers in Melbourne were not DVB-T2 compliant at the time.) For the Melbourne ATV stations and their viewers, suitable Set Top Boxes were identified for use. In addition of course, these needed to have a manual tune capability as 445.5 MHz is not a standard TV frequency. In the analogue days TV sets would scan continuously across the band but this is now not the case. TV sets only look for the published TV frequencies for the country selected.



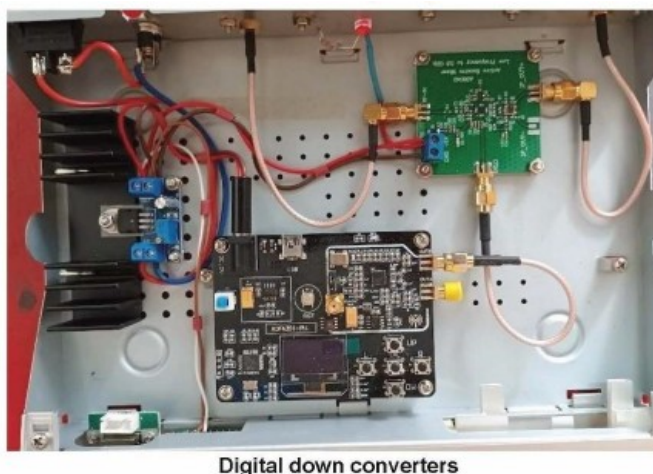
ATV Combo Receivers



The ATV encoder boards



All the SR Systems Boards came with no documentation, however the parameters did not radically differ from the SD systems possessed previously. This was not the case for VK3RTV which of course included a multiplexer with its own requirements. To be honest, it took trial and error over a few days to achieve any sort of a result. Settings were refined over time to optimise the system. Two new controllers were built to manage the switching and control of the HD HDMI video and other duties. The Humax SD receivers were replaced with HD 'Combo' receivers. These receivers have a Satellite Tuner which is DVB-S and DVB-S2 compliant and a separate Domestic Tuner, DVB-T and DVB-T2 compliant. As some stations were still SD DVB-S, these receivers were ideal for the 23 cm input frequencies. Stations generated DVB-S2 HD signals using SR Systems Exciters or the very versatile British Amateur TV Club's 'Portsdown' system. As early adopters and using European and British products, stations in Melbourne were DVB-S and DVB-S2 compliant. Digital technology uptake lagged behind in the US but when pockets started experimentation, they adopted DVB-T rather than DVB-S/S2 as frequency versatile transmitters and receivers became available from Hi Des, a very customer focused company based in Taiwan. As the Portsdown system was the only practical option for DVB/S/S2, it was decided to include a DVB-T receive capability in VK3RTV. An innovative solution was offered using a Down Converter constructed of an active mixer and local oscillator boards which were sourced on the internet. The Down Converters would take the 23 cm DVB-T signal to say 536.5 MHz, CH29 in the range of the domestic tuner. A 3 dB Coupler was installed on the output of the pre-amplifier with one of the outputs of the coupler to the input of the Satellite Tuner and the other to the input of the Down Converter. The output of the Down Converter then connects to the Domestic Tuner input of the Combo Receiver. The advantage of this arrangement is that there is only one HDMI video output and switching is done internally in the receivers.



The internal IR line was identified in the Combo Receiver and interrupted with some logic and a Picaxe 08M Microprocessor. When commands were received from the respective Controller, the Picaxe 08M would generate the IR code for Channel 1 (the Satellite Tuner) or Channel 2 (the Domestic Tuner) in turn scrolling between each other waiting for an input signal. The Picaxe 08M could also generate the IR code to produce a detailed signal report on demand.

Included in the current rack is an RS232 controlled Media Player which generates the Splash Screens seen and also selected video files of interest.

The RS232 control system for both the Video Player and the Combo Receivers is based on Texas Instruments 'Ascii Protocol'. (This is a very simple system where components on a network respond to a single or sequence of Ascii Characters sent along a RS232 or RS422 line.) In this case, an Ascii '1' sent to the Picaxe 08M from the Controller results in the corresponding IR code generated for selection of Channel 1 in the Combo Receiver. Similarly an Ascii '2' sent to the Picaxe 08M from the Controller results in the corresponding IR code for Channel 2 in the Combo Receiver. An Ascii 'b' sent will bring up a signal report on 1246 and 1255 and an Ascii 'c' similarly for the 1278 and 1287 Mhz receivers. Only two codes are necessary for the signal report as if 1246 is active 1255 cannot be and similarly if 1278 is active 1287 cannot be and vice versa. (1246 and 1255 serve VK3RTV1 and 1278 and 1287 VKR3TV2.)

The signal report requests are user generated by sending a DTMF code. The polling between the two tuners is conducted by the Controllers when there are no input signals.

VK3RTV's upgrade was funded by members of the Melbourne ATV Group.

The most recent development is to change the four input frequencies to 1245 MHz for the easterly stations and 1253 MHz for the westerly stations. (VK3RTV1 serves the east and VK3RTV2 the west.) This change in frequencies (losing two channels) was to move away from the Galileo allocation as we are a secondary service in the 23 cm band. This change was to mitigate against any of the problems encountered in the northern hemisphere recently.

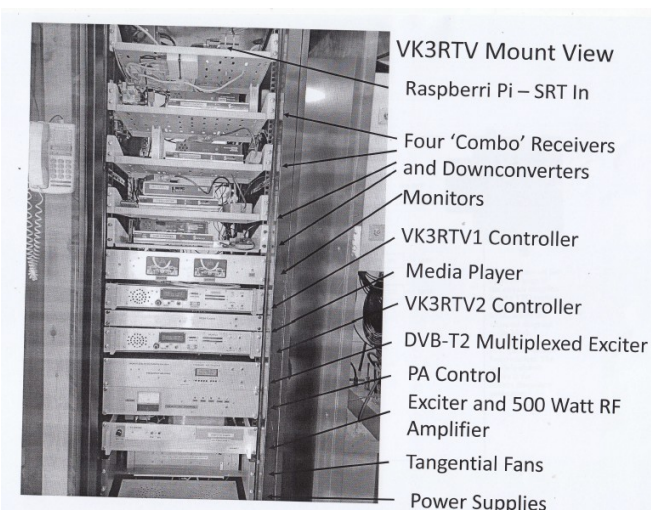
VK3RTV has an SRT service which is available 24/7 with an output currently on VK3RTV1. SRT is an internet protocol which produces quite high quality video. This service is used extensively in the annual DATV QSO party.

VK3RTV has always been experimental in its development but I am unsure of where we may go next ... up to higher receive frequencies or a lower one using narrowband DATV ???

73 de Peter Cossins VK3BFG

(Editor's Note: Similar papers were previously published recently in Sept. 2026, "Old Timers News" and Sept/Oct 2026, "NEVARC NEWS". This is a revised, undated, enhanced version supplied to ATV Journal by Peter.)

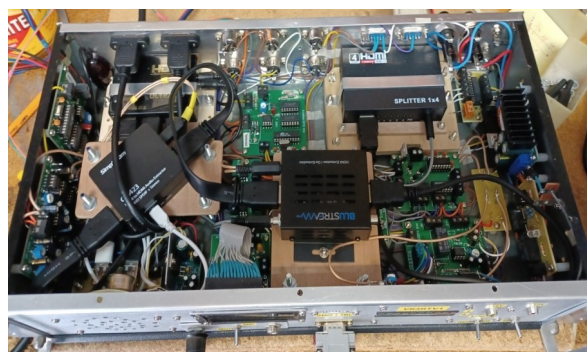
Below are a collection of block diagrams and photos showing the current VKRTV repeater.



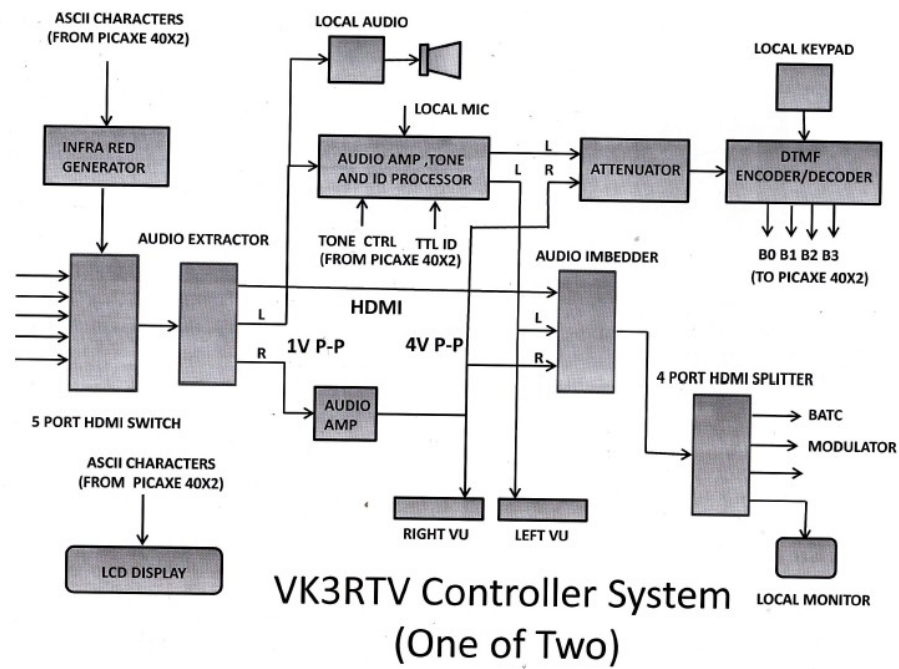
VK3RTV relay rack identified



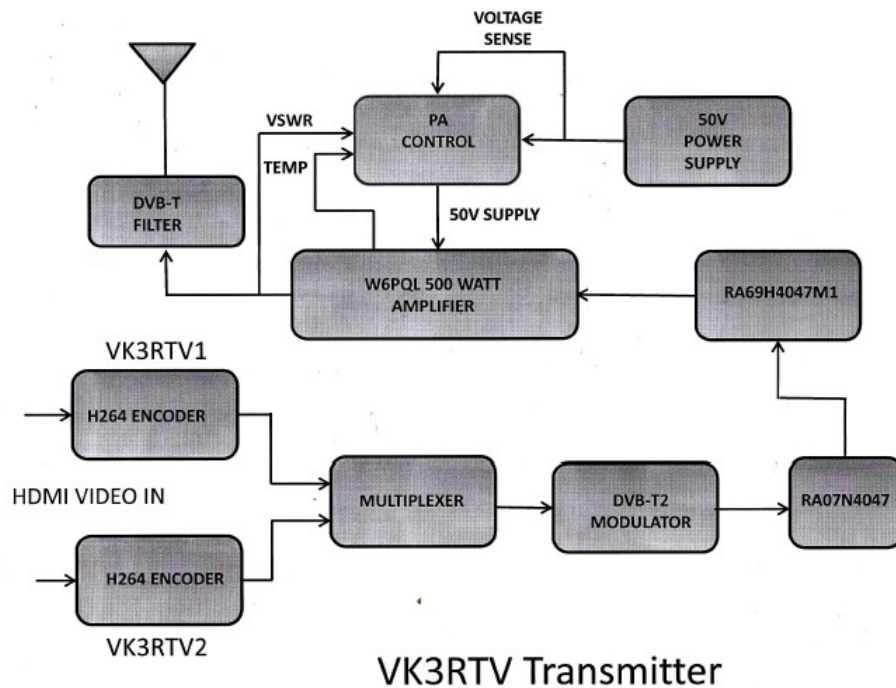
The digital controller



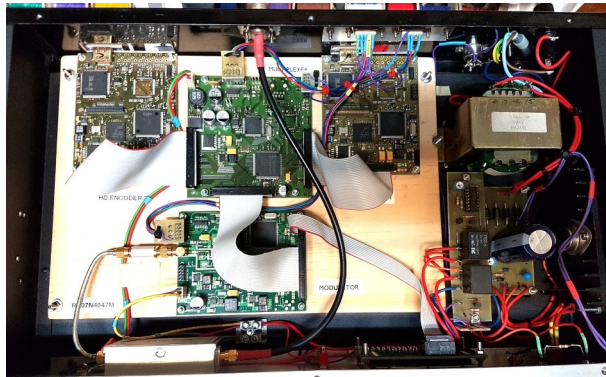
Digital Controller, inside view



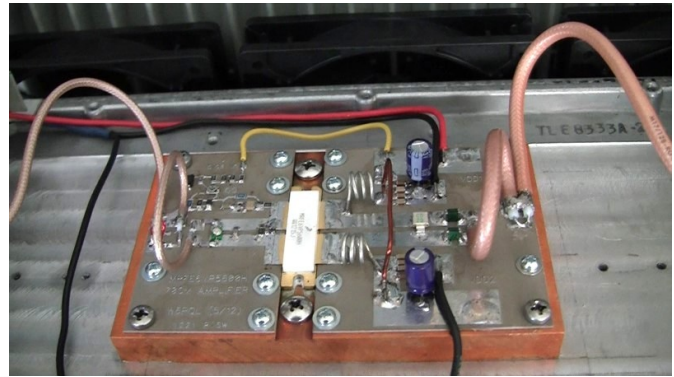
HDMI Controller - Block Diagram



VK3RTV DTV Transmitter -- Block Diagram



HD-DTV Exciter



500 Watt Final Power Amplifier

W6RZ Typo Correction: Our apologies for typing Ron's name wrong in the previous edition. It is Ron Economos, W6RZ, of Mountain View, California

Newsletter Details: This newsletter was started in 2018 and originally published under the title "*Boulder Amateur Television Club - TV Repeater's REPEATER*". Starting with issue #166, July, 2024, we have changed the title to "*Amateur Television Journal*." This reflects the fact that it has grown from being simply a local club's newsletter to become the "de-facto" ATV newsletter for the USA and overseas hams. This is a free ATV newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 900+, both in the USA and overseas. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source.

Newsletter Archive: All past issues of the newsletter are archived on the web site: <https://kh6htv.com/newsletter/> A free DVD with all past issues is available upon sending an e-mail request to the editor.

Boulder CO - W0BTV Details: **Inputs:** 23 cm Primary (CCARC co-ordinated) + 70 cm & 3 cm secondary all digital using European Broadcast TV standard, DVB-T with standard 6 MHz wide TV channels. Frequencies listed are the center frequency of the TV channel.

23 cm = 1243 MHz (primary), 70 cm = 441 MHz & 3 cm = 10.380 GHz

Outputs: 70 cm Primary (CCARC co-ordinated), Channel 57 -- 423 MHz with 6 MHz BW, DVB-T

Also, secondary analog, NTSC, FM-TV output on 5.905 GHz (24/7 microwave beacon).

Operational details in AN-51d Technical details in AN-53d. Available at: <https://kh6htv.com/application-notes/> We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time (22:00 UTC). The net typically runs for 1 to 1 1/2 hours. ATV nets are streamed live using the British Amateur TV Club's server, via:

<https://batc.org.uk/live/> Select *ab0my* or *n0ye*. We use the Boulder ARES (BCARES) 2 meter FM voice repeater for intercom. 146.760 MHz (-600 kHz, 100 Hz PL tone required to access).

ATV HAM ADS -- *Free* advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear

For Sale - or - Want to Buy

ANALOG TV Modulators --- For Sale

RL Drake model VM2450B modulator: Professional grade analog TV modulator, made in USA. It powers up but no other testing done. frequency agile. A yellow note attached to the top indicates that some channels are not working. (Ch 00-01, 62-94), max. out = +10dBm. Accepts analog NTSC video via an "F" connector, and analog mono audio via an "RCA" connector, and modulates both onto a user-selected RF channel. Has front panel LED indicators and adjustments for levels. The front panel vinyl is peeling in spots, and one of the rack flanges is bent (should be easily hammered out). Otherwise there are some scuffs and scrapes. ----- Asking \$50 plus pirate ship.



Dynair TX-3A Channel 6 analog TV modulator: Another professional grade analog TV modulator, made in USA by Dynair. Pulled from a working installation. It powers up but no other testing done. For USA channel 6 only (not adjustable). This modulator has no digital circuits so maybe it could move to another channel with a crystal change and adjustments? Accepts analog NTSC video via a "BNC" connector, and analog mono audio via a terminal block, and modulates both onto RF channel 6. Has front panel meters and adjustments for setting modulation levels. Includes full operation and service manual. Otherwise there are some scuffs and scrapes, see above photos for condition.

----- Asking \$60 plus pirate ship.

Contact Mark, KB9VKE at: msalbert@aol.com