Boulder Amateur Television Club
TV Repeater's REPEATER

March, 2023
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BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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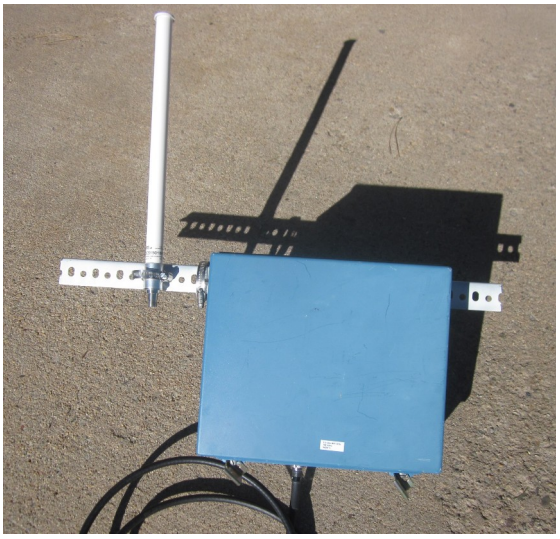

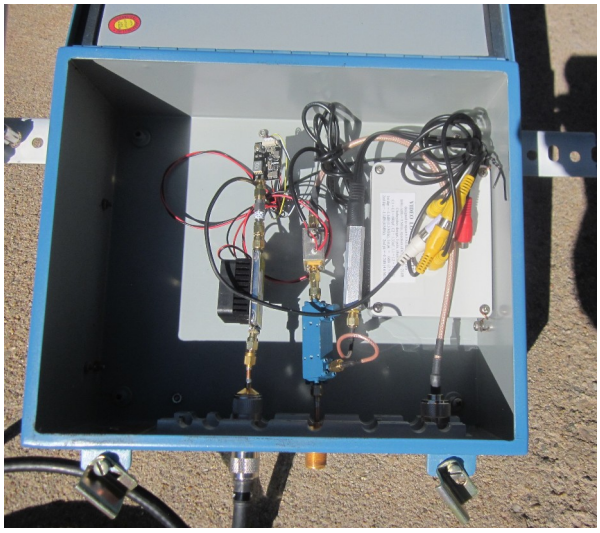

W0BTV, 5.9 GHz, FM-TV Transmitter enclosure & antenna -- roof top mounted.

W0BTV NEWS

We have had quite reliable performance so far from our Boulder, Colorado, ATV repeater, W0BTV. However, several users recently have reported that our 5 cm, 5.905 GHz, FM-TV beacon transmitter is "sick". Low output power and vertical rolling indicating lack of vertical sync. It was our latest addition to our repeater and it was installed back in Feb. 2020. It has been on the air 24/7 ever since thus putting in three years of continous service.

We have been wanting to do some other modifications to the repeater, but have been waiting until we had a failure to make a trip up the hill to the repeater site. The major mod we have planned is to

remove the 70 cm, analog, NTSC, 439.25 MHz receiver. Joe, AD0I, was the last hold-out using analog TV, and he has given up transmitting anymore. He still sometimes watches our repeater's digital ATV nets. So obviously we now have zero demand for analog TV input.

Our 70 cm, DVB-T receiver is on 441 MHz with a 6 MHz wide TV channel (438-444 MHz). We have found that we suffer a lot of RFI from other ham's in-band signals to this receiver. The only users who successfully access it are near-by within the city of Boulder and also running high power to overcome the RFI. ATV repeater groups elsewhere in California and Ohio have reported success running 2 MHz band-width, DVB-T on 70 cm band. We thus want to give it a try here in Boulder. So our plan is to replace the 70 cm analog receiver with a Hi-Des model HV-110 set up for 439 MHz / 2 MHz BW. We will continue to use the existing 70 cm pre-amp, 6 MHz (438-444) channel filter, 3 dB power splitter and the 441 MHz / 6 MHz BW DVB-T receiver. Thus, we will have simultaneous DVB-T receive capability on 70 cm for both 6 and 2 MHz band-widths.

While the W0BTV-ATV repeater is removed from the site for modifications, we are considering trying out the BCARES portable, 70 cm DVB-T in it's place. Granted it will also suffer the same RFI issue.

Don, N0YE, will be contacting our host at the repeater site soon to arrange for us to gain access to the site to remove the repeater and install the temporary repeater. We will be letting all repeater users know via e-mail the status when this happens.

73 de Jim, KH6HTV, trustee for W0BTV

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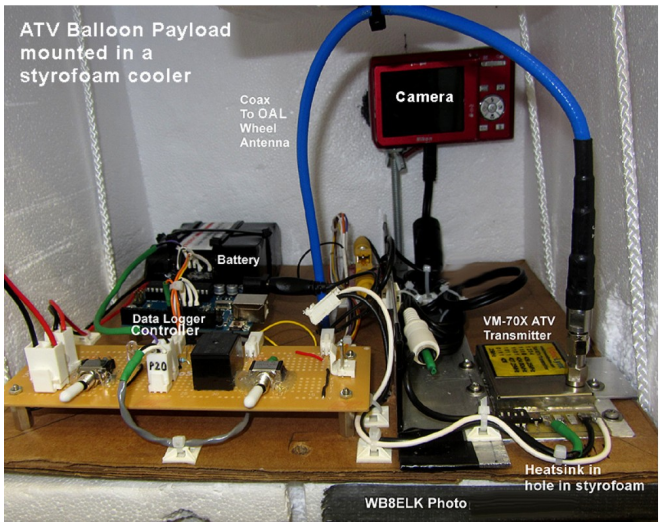
More Feed-Back on ATV from Balloons

Balloon at 80,000 feet WB8ELK
Camera looking thru hole in foam box



Tom O'Hara, W6ORG, has a wealth of information relative to ATV from amateur balloons and rockets available as application notes from his web site: ***WWW.HAMTV.COM*** He also includes lots of links to other relevant web sites. Check it out. He also has a lot of other ATV related info there. However, now that Tom has retired, some of the items and URL links are out of date.

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Tom, W6ORG, Arcadia, CA writes --- "Jim -- RE Balloon ATV -- The limiting factor today is the weight of a single payload which is 6 pounds per FAA Rules 14 CFR 101.1(4)(ii). However (iii) says up to 12 pounds for a free balloon with 2 or more packages. Also there are a number of restrictions and practices in Subpart D - ***https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-101***
I don't know what the logic of the weight difference for multiple packages but I do remember years ago there was a bird strike experiment with a jet engine to see what it took to do serious damage. They threw frozen chickens into the intake of an operating turbine engine on a test stand.... amazing - ***https://www.youtube.com/watch?v=sT7NLGflFSo*** Maybe that is where the 6 pound limit came from? Battery weight will be a significant weight factor depending on expected or desired flight time vs. electronics Amp hour draw. Heat sinking and antenna is another. We prefered the OAL Little Wheel antenna hanging down on 70cm. They have a good horizontal omni pattern on the horizon and circular directly below. Often forgotten in the path loss and expected receiver power level is the antenna pattern as the balloon rises and encounters various winds aloft and the jet stream.

Our old KPA5 and later TXA5-RC 1W ATV transmitters were used on many balloon flights including some by NASA for a Mars project where we had good video out 100 miles from the south end of the Big Island of Hawaii. Later we went to the Videolynx VM-70X which we set to 4W pep out and added a 50K thermister to the power control line to automatically regulate the heat as the package went from warm sea level temperatures and dense air to cold thin air.
On our ***hamtv.com*** web site we have some app notes on Balloon ATV - ***https://hamtv.com/info.html#balloon*** - and ATV Antennas in Amateur Rockets and Balloons that might be of interest to your readers. There is also a link there for the video Bill WB8ELK mentioned where we found the balloon package from a helicopter out in the Mojave desert. I think the hidden transmitter club that was out there to find it thought we were cheating by tracking it in the air."
Tom O'Hara, W6ORG
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Klaus, DL4KCK, Cologne, Germany writes **---** "Hello Jim, this is Klaus, DL4KCK, from Germany. Many thanks for your monthly newsletter, I am regularly translating some parts of it for our German readers at ***www.agaf.de.*** Until 2019 I was editor of our AGAF member magazine "***TV-AMATEUR***", where I brought for years many informations, i.e. from ATVQ and CQ-TV to our German speaking readers. Because of lack of member activity and rising paper as well as printer costs the magazine was stopped.

Like at our European neighbours also in Germany some ATV balloons have been launched, so I thought at least the first successful flight printed in our magazine could be of interest to the newsletter readers, see the text and picture attached."

Stratospheric balloon mission with ATV at Pforzheim University of Applied Sciences


bursting balloon at 30 km hight

On 14.11.1998 at about 11:00 h local time a weather balloon was launched from the campus of the university with an electronic payload. The balloon was filled with helium and rose after the launch with a speed of approx. 5m/is; i.e. after a time of 10 min. it reached an altitude of 3000 m (Zugspitze/Alps), after a good half hour it was at the altitude at which normal airliners fly. The 2 balloons were connected at a distance of up to 10 m by ropes, to which the other components were attached in order: the parachute for re-entry into the dense atmosphere and landing, the radar reflector, and the two payload sections. (Such balloons can reach about 25...30 km at summit altitude. For comparison: a space shuttle orbited the earth at an altitude of only 200 km altitude. From an altitude of 30 km the view reaches already 700 km to the horizon, the earth is recognizable as a sphere, the sky is no longer blue, but almost black as in space. At this altitude - the range from 15 to 50 km is called the stratosphere - the atmospheric pressure is only a few percent of the atmospheric pressure at ground level.

The carried payload allowed various information to be recorded during the flight. In addition to metereological measurements, as with ordinary weather balloons, the balloon also carried a satellite navigation system (GPS) that enabled precise position and altitude determination. These data were acquired by a microprocessor system on board and transmitted as error-proof digital signals by radio to the ground station. In addition, the position was regularly broadcast in human language by means of a speech synthesizer. This was particularly convenient for the search team that was to recover the landed payload after the mission was completed.

Finally, a remote-controlled color television camera flew along, which constantly transmitted images to the ground station at the university. It allowed to look downwards, to the horizon and also upwards to the balloons. The images were transmitted in full (PAL) TV resolution, analogous to television satellites, via an FM video transmitter in the 13 cm band with a stubbed slot antenna. This payload was created by students of the electrical engineering department of the university, and the balloon mission was organized by us in cooperation with AATIS. We are jointly committed to arousing interest and enthusiasm in young people for technical issues, especially from the field of communications and information technology, and thereby motivating them to study engineering or pursue technical vocational training. We are convinced that the continuous education of a qualified new generation of engineers is of decisive importance for the future of our highly industrialized country.

The payload had no flight-physical but other tasks - in our mission mainly as demonstration and training objects for the development of wireless transmission technology and sensor technology. However, such a balloon could just as well carry a measuring platform with gas sensors for the analysis of the composition of the upper atmosphere (topic "ozone hole"). One of the reasons for splitting the payload in two was to reduce mutual interference between the different radio systems - after all, two receivers and two transmitters were operated simultaneously. The entire payload is mounted in a Styrofoam box in order to achieve sufficient mechanical stability and good thermal insulation at low weight.

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Dave, AH2AR, Dayton, Ohio writes --- "Jim -- Maybe the best DVB-T camera/ transmitter to use, weight-wise, for ATV balloon flights is the DC-101 HiDes unit. I have one that I purchased a while back. The transmitter and camera weighs only 1.2 ounces. The unit unfortunately has been discontinued, but it would be the perfect camera/exciter for such a project. Hi-Des offers the DC-105 as it's replacement.

My additional thought is that along with a Mitsubishi RF moduleand light lithium ion polymer batteries , this would make for an excellent balloon payload. In order to save weight on the payload, the heat sink for the RF amplifier module could be extra small if it was mounted on the outside of the package as the ambient temperatures at altitude would help keep the module's operating temperature down.

In the early 1990's, DARA got together and flew three balloons. All had 70cm ATV transmitters on board. My good friend Tom White worked for the National Weather Service and we had an ideal launch site as it was where Tom would launch radiosondes every 12 hours from the Huber Heights NWS location. One of ATV packages DARA launched contained a simplex 2 meter repeater, and a 20 meter 10 milliwatt CW beacon was flown on another payload that was heard in Europe. That was before the days of FT-8. One of the packages was lost for about six months, in spite of an active search that included an aircraft. Unfortunately, it went down in a very remote section of the Wayne National forest, Southeast of Dayton, 120 miles away, and it was finally found by a turkey hunter . The package was hanging in a tree, and the hunter initially thought it was a device set-up to find moonshiners. When I got the call from the gentleman about the found payload, I was very surprised, as I initially figured the payload was lost forever. The $100 reward that was on the outside of the payload was also a welcome surprise to the lucky hunter."

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Tom, N8ZM, Tipp City, Ohio writes --- "HI Jim…Great newsletter topic of Balloon ATV! Just wondering how much weight would be added with the now necessary missile defense system?" Hi Hi !

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IC-905 Feed-Back:

from **Rudi, S58RU** ---- "More and more there is talk of the RTX Icom IC-905 which is arriving at our distributors, even in Europe. Has me, among the technical data, liked the data: amateur ATV. Here, if I understand correctly, we are not talking about DVB-T, DVB-T2, DVB-C, DVB-S nor DVB-S2. Here we are talking about ATV FM, which can be used on 23 cm, 13 cm, 6 cm, 3 cm. I don't know if the 3 GHz range will also be available but we'll see. Reception will be possible on the display of the apparatus. Frequencies will be much more accurate.
The Icom IC-905 will be very interesting for contests, for portable work, to give new luster to FM modulation. You will be able to use FM RPTs, which have almost disappeared and not been replaced by digital RPTs."

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from **Don, N0YE** -- "Ham Radio Outlet is now listing the price for the new ICOM microwave transverter, model IC-905, at $3,500. The companion, 10 GHz add-on, model CX-10G, is listed at $1,000. Availability is unknown."

FM-TV RECEIVER

Jim Andrews, KH6HTV

In our Feb. issue #122, we included an article on FM-TV. It described the design of a 23cm, FM-TV transmitter. Before digital, most ATV activity on the 23 cm and higher microwave bands used FM. It was the preferred modulation technique for TV broadcasters for their remote news gathering and studio to transmitter microwave links.

Today, about the only place and ham band where you will still find FM-TV and gear available for sale is our 5.8 GHz band. This is due to the extreme popularity today of drones with on-board video cameras for FPV. FPV is the jargon buzzword which stands for First Person View with a video link to send live images back to the drone pilot on the ground.

For hams wanting to get their feet wet with ATV and not wanting to spend big bucks $$$ -- 5.8 GHz, FM-TV is the way to go. Amazon has a deal you really can't resist. For only $30, you can have delivered to your door step a complete transmitter / receiver package. This is great, high quality stuff and the price is absolutely amazing. You get frequency syntheized, 40 channels. Note: some are not in the ham band. The TS-832 transmitter puts out 600mW. The RC-832 receiver is very sensitive. If you use microwave, dish antennas with these, you will get amazingly long distance ATV-DX. Previous issues of this news letter have reported on some of these ATV-DXpeditions.

I wrote this in previous issue #122 -- *"12 years ago, prior to my discovery of low cost Hi-Des DVB-T products, I was focused on VUSB-TV and FM-TV. Even then, it was very difficult to find any quality FM-TV gear for us ATVers. So I set out the goal to design my own and offer it to the ATV market. I designed for the 23 cm band a 3 Watt transmitter and also a companion receiver. The receiver consisted of two separate units. First a low noise, down-converter with an IF output of 70 MHz. The second unit was a 70 MHz IF amplifier and FM-TV demodulator. The IF amp/demodulator could then be used for any other microwave band with a suitable down-converter. Sales were a bust to say the least. In addition to the prototypes, I only sold 2 of the transmitters and 2 of the receivers. The down-converter did a bit better, but still over a 10 year period I only sold 9 of them."*

Now, I would like to show you the design of the FM-TV receiver. It was designated as my model 23-6. The following are portions lifted from the detailed 23 page instruction manual.

Model 23-6
70 MHz IF AMPLIFIER & FM-TV DEMODULATOR

INSTRUCTION MANUAL

The model 23-5 is a 70 MHz IF amplifier and FM-TV demodulator. It is intended to be used with a microwave down-converter with a 70 MHz IF output. The model 23-7 is the matching companion down-converter for the amateur radio 23 cm (1240 - 1300 MHz) band. The 23-5 demodulates standard definition (480i), composite video and also stereo audio.

The 23-5 is a "Universal" unit and was designed with a lot of flexibility to meet varying local standards. FM-TV is not completely standardized like broadcast, NTSC, VUSB-TV. Thus, several different parameters can be reset by the user by moving internal jumpers and adjusting trim pots and caps. They include: video polarity, video bandwidth, video de-emphasis (in/out), video gain, stereo audio sub-carriers' frequencies, audio de-emphasis (in/out), and audio gain.

The following table summarizes the performance specs. of the FM-TV demodulator. The 23-5 is most sensitive when using pre/de-emphasis as noted in the specifications table. For the best overall, highest resolution, video performance, the 23-5 works best when no audio sub-carriers are used, the 4.8 MHz low-pass video filter is by-passed and pre/de-emphasis is not used.

Model 23-5 70 MHz IF Amplifier & FM-TV Demodulator Specifications

PARAMETER	Typical Performance	Notes
Input Sensitivity - at 23cm with model 23-7, Down-Converter (flat response)	-95 dBm -88 dBm -79 dBm	P2 picture P4 picture P5 picture
Input Sensitivity - at 23cm with model 23-7, Down-Converter (with pre/de-emphasis)	-95 dBm -89 dBm -84 dBm	P2 picture P4 picture P5 picture
Input Sensitivity - model 23-5 IF Amp alone at 70MHz (flat response)	-88 dBm -83 dBm -79 dBm	P2 picture P4 picture P5 picture
Input Sensitivity - model 23-5 IF Amp alone at 70MHz (with pre/de-emphasis)	-97 dBm -92 dBm -84 dBm	P2 picture P4 picture P5 picture
IF Input Frequency	70 MHz	
IF Bandwidth	16 MHz	
IF Input Impedance	50 Ω	
IF Gain	60 dB	
max. IF input	+15dBm	
Video FM Deviation	4 MHz	
Video Polarity	positive or negative	internal jumper select
Video Frequency Response	5 Hz to 4.6 MHz - or 7.8 MHz	internal jumper select
Video De-Emphasis	CCIR 405-1 - or - flat response	internal jumper select
Video Output	1 Vptp into 75 Ω	2 Vptp open circuit
Video Output Source Impedance	75 Ω	
Sound Sub-Carrier Demodulators	two -- for left & right stereo	
SSC Frequencies	5 to 7 MHz	internally tunable
Audio FM Deviation	75 kHz	
Audio Frequency Response	< 5 Hz to >15kHz	
Audio De-Emphasis	75µs - or - flat	internal jumper select
Audio Output	standard line level to 600 Ω	0 VU
Connectors	SMA (f) standard RCA (f)	IF Input, BNC or F optional A/V outputs
DC Supply Voltage	+12 Vdc, nominal at 400 mA	+11 to +15 V range
Dimensions & Weight	4.2" x 1.8" x 7.4" (w x h x d)	1.1 lbs

CIRCUIT DESCRIPTION: The block diagram of the model 23-5 is shown in Fig. 3, while Fig. 4 is a photograph of the actual interior of the unit. Three, 20 dB, MMIC amplifiers are the basic IF amplifier. Between the first and second stage is a 16 MHz wide band-pass filter. IC, U4, is a PLL FM demodulator tuned to 70 MHz. It's output contains both the video signal and also the stereo sound sub-carriers (SSC). The SSCs are in the range from 5 to 7 MHz. A 4.8 MHz, Chebyshev low-pass filter is inserted in the video chain to filter off the SSCs. If there are no SSCs present, this 4.8 MHz low-pass filter can be by-passed with internal jumpers to achieve a higher video bandwidth of 7.8 MHz with a more Gaussian response and higher video resolution. Video amplifier, U5, has differential outputs. With an internal jumper setting, either positive or negative polarity video can be selected. The output video driver amplifier, Q1-Q2, drives a 1 Vptp standard video signal into a 75 Ω load from a 75 Ω output impedance. A de-emphasis filter is on the output of the driver amplifier. It provides standard CCIR 405-1 de-emphasis for NTSC signals. If the 23-5 is used for PAL video, then different de-emphasis filter component values are required. If the video signal has not already had pre-emphasis put on it, then this filter should be bypassed by moving two internal jumpers. The output

from U5 also included the SSCs. They are passed through a 5.2MHz, Chebyshev high-pass filter to the SSC demodulator ICs, U6 & U8. These are also PLL FM demodulators. They are tunable over the range from 5 MHz to 7 MHz. Standard stereo SSC frequencies are either 5.8 MHz & 6.2 MHz - or - 6.0 MHz & 6.5 MHz. Op. amps, U7 & U9 amplify the detected audio up to standard line levels (i.e. 0 VU). Broadcast audio usually has 75µs pre-emphasis put on it. A 75 µs de-emphasis filter is provided in the first audio amplifier stage. It can be disabled by moving an internal jumper. Conventional linear voltage regulators are used to provide +9 Vdc and +5 Vdc to power the various circuits. Figs. 16-19 are the detailed schematic diagrams. They are found at the back of this manual.

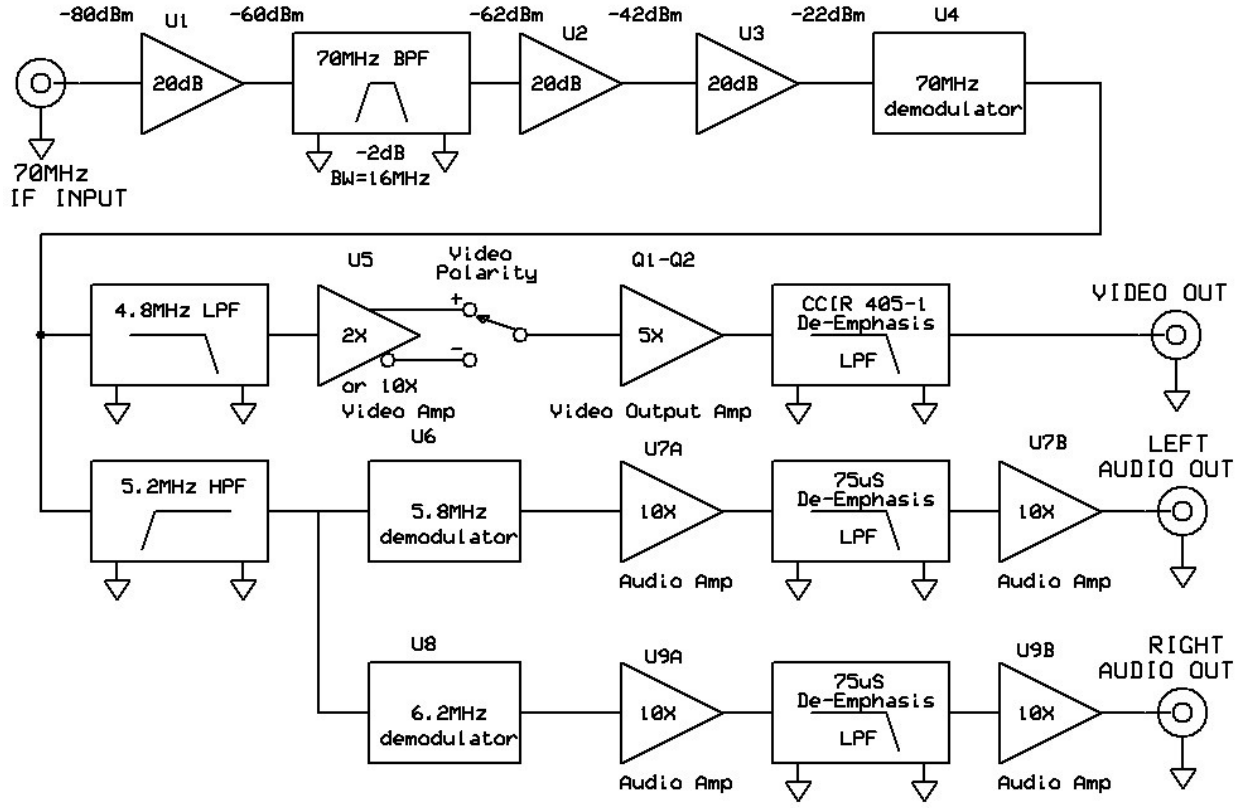

Fig. 3 Block Diagram of Model 23-5 FM-TV Demodulator

I will describe the various circuits in detail in future ATV newsletters. I will include detailed schematic diagrams and performance data.

73 de Jim, KH6HTV, Boulder, Colorado

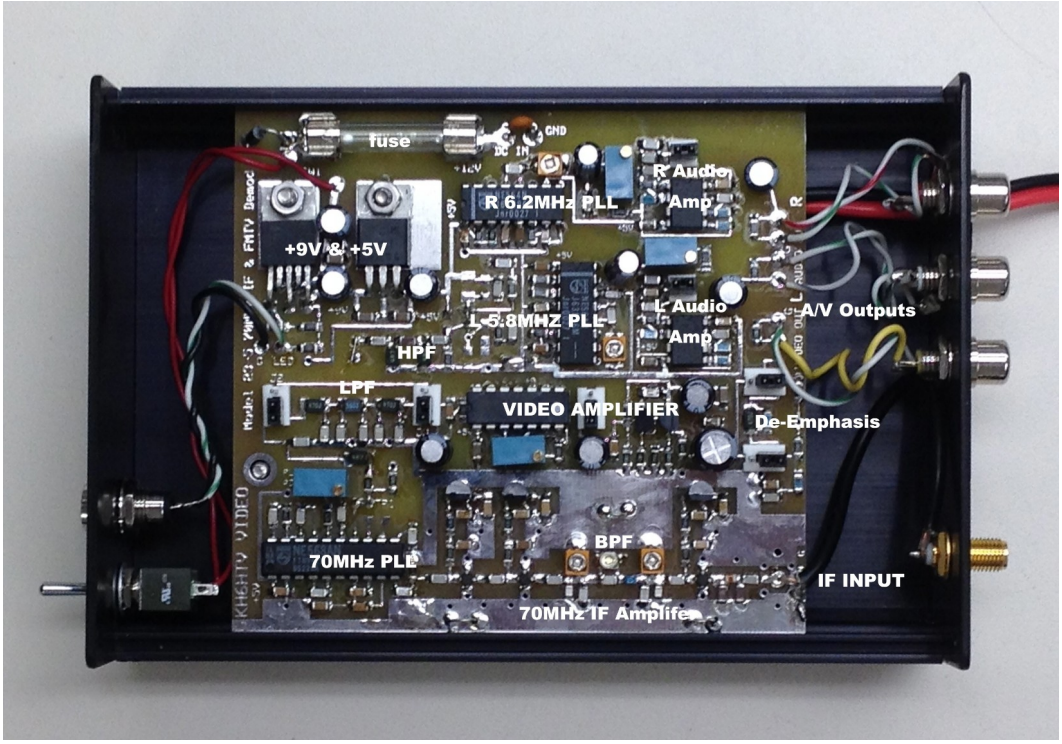

Fig. 4 Interior View of Model 23-5 showing location of major circuits

W0BTV Details: **Inputs:** 439.25 MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243 MHz/6MHz BW, DVB-T

Outputs: Channel 57 --- 423 MHz/6MHz BW, DVB-T, or optional 421.25 MHz, analog VUSB-TV. Also, secondary transmitter, FM-TV output on 5.905 GHz (24/7).

Operational details in AN-51a Technical details in AN-53a. Available at: *https://kh6htv.com/application-notes/*

W0BTV ATV Net: 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. A DVD ham travelogue is usually played for about one hour before and 1/2 hour after the formal net. 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*).

Newsletter Details: *This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to about 500. 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. All past issues are archived at: https://kh6htv.com/newsletter/*

ATV HAM ADS

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For More Info go to:
https://wøeno.org/larcfest/
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Check out the SLATS web site for lots of "goodies" for sale. Items include: microwave components, such as adj. attenuators, directional couplers, etc.; 1 MHz to 8 GHz signal generator, 5 GHz pulse generator, Tektronix TDR & sampling o'scope, K&E slide rule, VHF/UHF sweep generator, Marconi digital RF power meter (-70dBm min. up to 4 GHz); Hallicrafters remote antenna tuner, HP HF probe; 23cm Transverter with pre-amp and 30W power amplifier; Millen Antenna Bridge; Tek NTSC Waveform Monitor & Vectorscope; etc. etc etc