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BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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KH6HTV's signal as received by N0YE

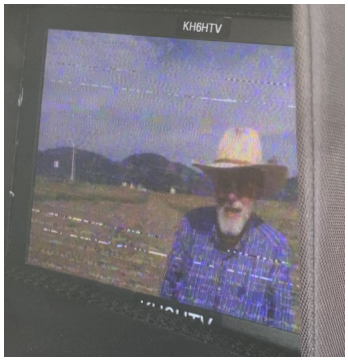
Summer Time is Microwave ATV Time !

The members of the Boulder ATV Club are not content to just use their 70cm DATV repeater for their ATV activities. Several members also have put together microwave rigs to do ATV, both analog and digital, on the various bands up to 3cm (10 GHz). Being blessed with high mountains to work from,

we also like to get out in the field and setup our microwave antennas and see how far we can go with our ATV signals.

On a recent Saturday, July 19th, WB0NRV, AB0MY, N0YE and KH6HTV, were on the air transmitting analog FM-TV signals on 5.685 GHz. Bob, WB0NRV, set up at the library near his QTH in Firestone. Bill, AB0MY, went to Legionaire's Hill, east of Boulder. Don, N0YE, tried two locations. First near the NREL windmills on Rocky Flats south of Boulder and then the T-Mesa RTD Park-n-Ride garage in south Boulder. Jim went to his favorite spot, the Panorama Point lookout on Flagstaff mountain west of Boulder. The longest distance covered that day was 34 km (21 miles) from Bob in Firestone to both the NREL windmills and also Flagstaff mtn. Over most paths, we had P 4 to P5 pictures. This time, for the first time, we encountered some Wi-Fi, data like, RFI on our operating frequency. We tried to take photos of our monitor screens, but it was a challenge getting good photos out in the bright sun light.

WB0NRV as rcvd by KH6HTV



N0YE rcvd by KH6HTV


KH6HTV as rcvd by WB0NRV

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Egg on My Face --
A Good Idea gone Bad !

My apologies for publishing miss-leading information. In a previous newsletter, I published the idea of using a tri-band mobile antenna and a triplexer for a 23cm to 70cm cross-band DATV repeater. I had lashed together initially a prototype which did work using the idea. So, I mentioned it in our newsletter. --- Now fast forward, I needed to actually build an operational 23 to 70cm DVB-T repeater. When I put it together and used the single tri-band antenna and triplexer, it didn't work! The higher power transmitter leaked too much energy back into the Hi-Des receiver desensing it seriously. Bummer ! I had to redesign the repeater and go back to using two separate antennas, one for 23cm receive and one for 70cm transmit. I documented the final repeater in my recent application note, AN-70. I am reprinting AN-70 here in this issue to show what does work.

Unfortunately, others have now tried the idea and got the same bad results. I just heard from Jim, W6US, Sparks, Nevada. He is currently building a 23/70cm cross-band repeater and had the same bad experience. Sorry Jim !

73 de Jim Andrews, KH6HTV, editor

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RTL-SDR for DVB-T:

There are a number of GNURadio-based DVB-T software receivers usable with Windows 10/11, mostly at lower symbol rates (up to 1-2 M symbols/sec), all using the RTL-SDR dongle. I've tried software receivers by DDØCW, F4FDW, HB9DUG, SV1BDS, and others. I'm currently using the SV1BDS 2K5 software receiver at 1M symbols/sec). Details of my setup are in a PDF document at https://www.qsl.net/wa6nut/Higher%20SR%20DVB-T%20by%20SV1BDS.pdf The setups for other software DVB-T receivers (along with my OBS/DATV-Easy/F5OEO 0303/Pluto transmitting setup) are at https://www.qsl.net/wa6nut/WA6NUTpublications.html (look for the [ATV] tag).

The 1M symbol rate is compatible with some HiDes receivers, but I'm not aware of any ATV repeaters in the U.S. running 1M symbols/sec.

3, Rick, WA6NUT, Buena Vista, Colorado

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NASA Small Spacecraft Systems Institute

San Diego DVB TV Society ITG has been welcomed as part of NASA's Small Spacecraft Systems Institute at NASA Ames Research Center here in California. We are very pleased and they are very pleased with our technology innovations.

Mario_KD6ILO, ITG, Aerospace Science & Technology Team

Notice: As of August 1, 2025, San Diego DVB Society/ITG will no longer use terrestrial RF transponders {repeaters}. All our sites will use RF/FSO Gateways [12 Zones] throughout San Diego counties and our newly NEN-Near-Earth-Network [LEO-FSO] linking San Francisco DVB Society/ITG and Hawaiian DVB Society/ITG. Our nets in 4K UHD

Our CubeSat FSOC consolation is working well for our San Diego DVB Society and will be growing in 2026 from 2 to 4. We are no longer using terrestrial DVB-T/S repeater(s) just simplex into our 12 RF/FSOC Gateways than to our ground station uplink to our cubesat constellation at 1200 km they are 10 km apart. Laser communications are now and will be used more. in space no limit in bandwidth. Data compression carries delivers more data than RF.

----- Mario, KD6ILO

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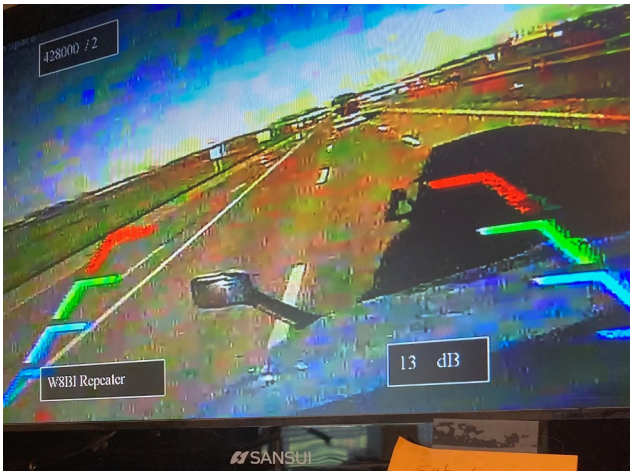
ATV Interference Being Experienced within the Ohio Region has been Resolved



During Mid April 2025, the Midwest ATV group had been receiving analog television signals, on an intermittent basis, during weekdays. The video signals had been in the form of a live video feed (see photo) of a front-facing camera from a moving vehicle. These signals had been observed by ATVers located in Englewood, Ohio and throughout the Columbus, Ohio region. The signals were emanating from semi-trucks in motion on the Interstate highway thoroughfare.

PHOTO: Note that this is a snapshot of the 439.250 MHz A5 transmission being re-transmitted by the W8BI ATV repeater via the DVB-T ATV repeater output, and then received at the W8CWM (Bill McCoy) QTH. Since Bill lives adjacent to Interstate 70, he has experienced very strong simplex signals as the trucks have passed by. Note that other ATVers have received the video, likely out to distances of 40 miles or more. The above photo helped narrow the source down as the semi-truck mirror is the same mirror mounted on the semis involved in the platooning test. We speculated that it appeared that the video link on 439.250 MHz is being used for the situational awareness of the "trailing" semi driver in the platoon. It was further speculated that the video was likely not being used for in-lane navigation, but just for situational awareness since the trailing truck follows very closely behind the lead truck and the additional view provides the trailing driver a "front seat" view of what the lead driver is experiencing.

The source of these signals were associated with two large Semi-trucks, and the signals have been only noticed during the Weekday Midwest ATV nets.

We determined that the TV signals were part of a test involving an Ohio Department of Transportation $8 million dollar grant to test "Semi-Autonomous Truck Platooning". A pair of tractor-trailers with automated truck platooning technology began traveling Interstate 70 between Columbus, Ohio, and Indianapolis, Indiana. Note that the trucks have drivers and are not fully autonomous.

I notified the entities involved, along with the FCC to let them know the signals were being detected through the ATV repeater in Dayton, and also by amateur radio ATV operators (mainly within Ohio) involved in simplex operation.

JULY UPDATE: The FCC contacted me in early May, as the field agent was in the Ohio region and was able to subsequently contact the company involved in the test activities. The interference

immediately ceased. The FCC couldn't comment or address closed, ongoing or future investigations, so other than the cessation of the interference, no other further details were provided.

73 de David Pelaez, AH2AR, DARA, Dayton, Ohio

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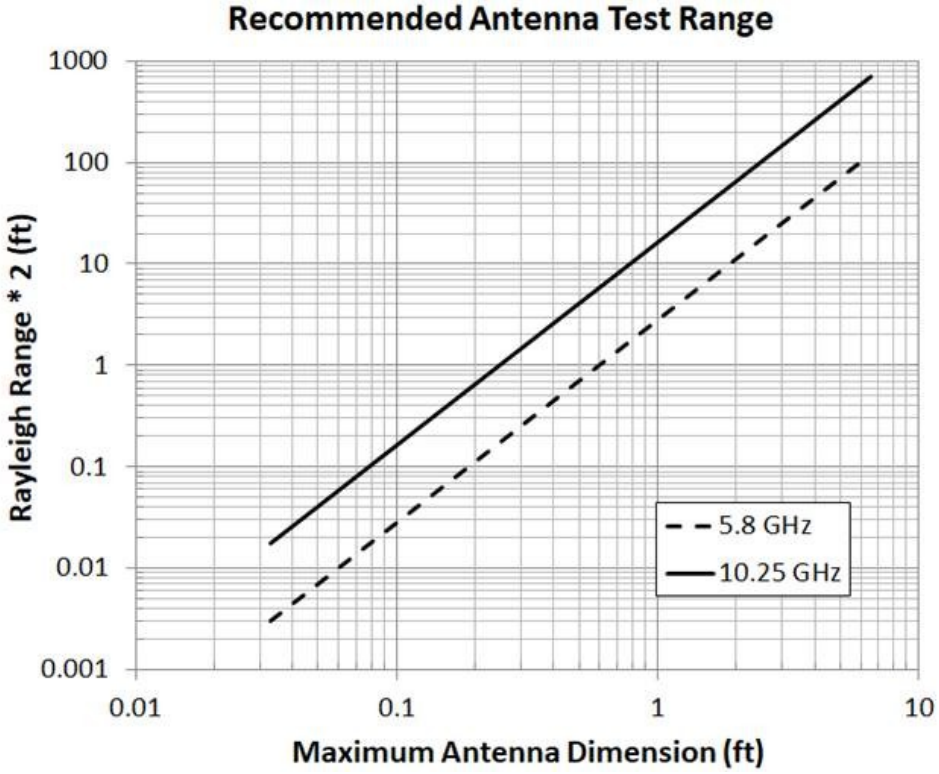

The maximum antenna dimension refers to the largest dimension of the largest antenna receive or transmit used in the test (rule of thumb regardless of shape). The *2 factor on the Rayleigh range is because there are still some ripples in the pattern at the r1X the Rayleigh range, especially if testing gain pattern. I think the largest antenna we have discussed using for 10 GHz was 2 ft., so at 10 GHz a range length of ~70 ft. should be adequate.

73, Chris K0CJG, Boulder, Colorado

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Application Note
AN-70

23cm to 70cm Cross-Band, DVB-T Repeater

Jim Andrews, KH6HTV

Does your local ATV group need a TV repeater? Are you debating should it be an in-band 70cm repeater, or instead perhaps a cross-band repeater? Tight budget? Technically complex with lots of "bells & whistles" or KISS (Keep It Simple Stupid) ?

Fig. 1 This photo shows a proto-type 23cm to 70cm cross-band repeater All the components were assembled onto two 1U, 19", relay rack shelves. This proto-type used the 70-9B, 10 Watt, rf power amplifier. It also included a 2m FM receiver, ABOMY - Aruduino DTMF decoder / relay, video monitor and +13.8Vdc power supply.

70cm In-Band Repeater: This will be more complex to make work right and costly. Why? You need really great, ATV channel band-pass filters for both the receiver and transmitter to make it function properly without serious de-sense. These filters are not easy to come by, nor in-expensive.

KH6HTV app. note AN-22b, "Inter-Digital Band-Pass Filters" discusses such filters and how you might build your own. Most builders of ATV repeaters are using ATV channel filters from DCI in Canada (***www.dcifilters.com***). Note: DCI has been purchased recently by the Kavveri Telecom Products in Bangalore, India and communications with them now need to be addressed to ***mktg@kavveritelecoms.com*** For 70cm, ATV, DCI offers a 6 MHz filter in either 8 or 10 pole configuration. The price tag is not inexpensive. They are currently quoting $850 for the 8 pole filter and $1,050 for the 10 pole. Plus USA import duties. A 70cm TV repeater will need two filters.

Another alternative is Don Nelson, N0YE. In his home shop, he has built 70cm ATV filters using the design calculator discussed in AN-22b. Don's filters have more insertion loss than the DCI filters, but they are smaller and less expensive.

23cm to 70cm Repeater: A cross-band repeater is much simpler to build and less expensive. The exotic, $$$ BPFs are not required. Figure 1 is a photo of an example which I recently built. Fig. 2 is the fundamental block diagram showing the basic elements for a KISS repeater. Such a repeater could even be patched together in a few minutes in an emergency. Simply taking the HDMI output from a 23cm DVB-T receiver and patching it directly into the HDMI input of a 70cm transmitter. Attach appropriate antennas and bingo, you are on the air with a cross-band repeater.

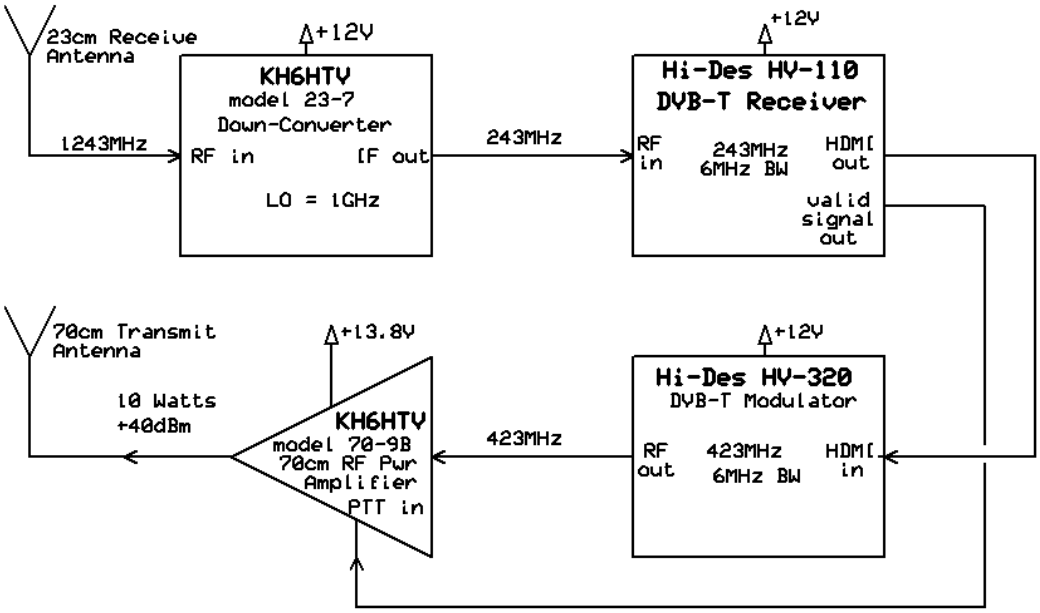

Fig. 2 Block Diagram of a basic, KISS, 23cm to 70cm DVB-T ATV Repeater

DVB-T Receiver and Modulator: I recommend using the specified Hi-Des units, the HV-110 receiver and HV-320 modulator. For an automatic controlled repeater, it is necessary to have a "Valid Signal" detector to key on/off the transmitter. A simple modification to the HV-110 receiver provides this logic signal for the PTT line. For details on this modification, see KH6HTV app. note, AN-23.

For a very simple repeater thrown together on the fly, even this is not required. Simply have an on-site control operator manually turn on/off the transmitter.

23cm Receiver: The HV-110 receiver does not work up to the 23cm band. It works only up to the 33cm band. Thus a down-converter is required. The KH6HTV model 23-7 is used. It includes a low noise pre-amp, double balanced mixer and a frequency synthesized local oscillator. The LO is programmable. For this application, the LO was set to 1.0 GHz. For a 1243 MHz input, the IF output is thus 243 MHz.

RF Power Amplifier: The amplifier shown is the KH6HTV model 70-9B which produces a 10 Watt (+40dBm) DVB-T signal. Another suitable amp, if less power is required would be the model 70-7B with 3 Watts (+35dBm) output.

Performance? So what performance can be expected. The 23cm receive sensitivity is of the order of -95dBm (measured with "normal" DVB-T signal [1080p, 5.5Mbps, H.264, 6 MHZ BW, QPSK, 5/6 code, 1/16 guard]). RF output power of 10 Watts.

DC Power Required: The repeater is designed for +12Vdc operation (10-15V). At 13.8Vdc, the stand-by current draw is 2 Amps. When transmitting, it is about 9 Amps with the 70-9B amplifier.

Extra Features: As the basic repeater, Fig.2, it will operate independent of human direct control with the automatic Valid Signal detector driving the amplifier's PTT line. For FCC control purposes, a separate control capability is required. This could be accomplished by adding a 2 meter FM receiver. This receiver then drives a DTMF touch-tone decoder / relay driver to add remote control capability. This is shown in the expanded block diagram of Fig. 3. The actual prototype shown in Fig. 1 is an example. An additional nice feature is to have a local video monitor to look at the incoming signals.

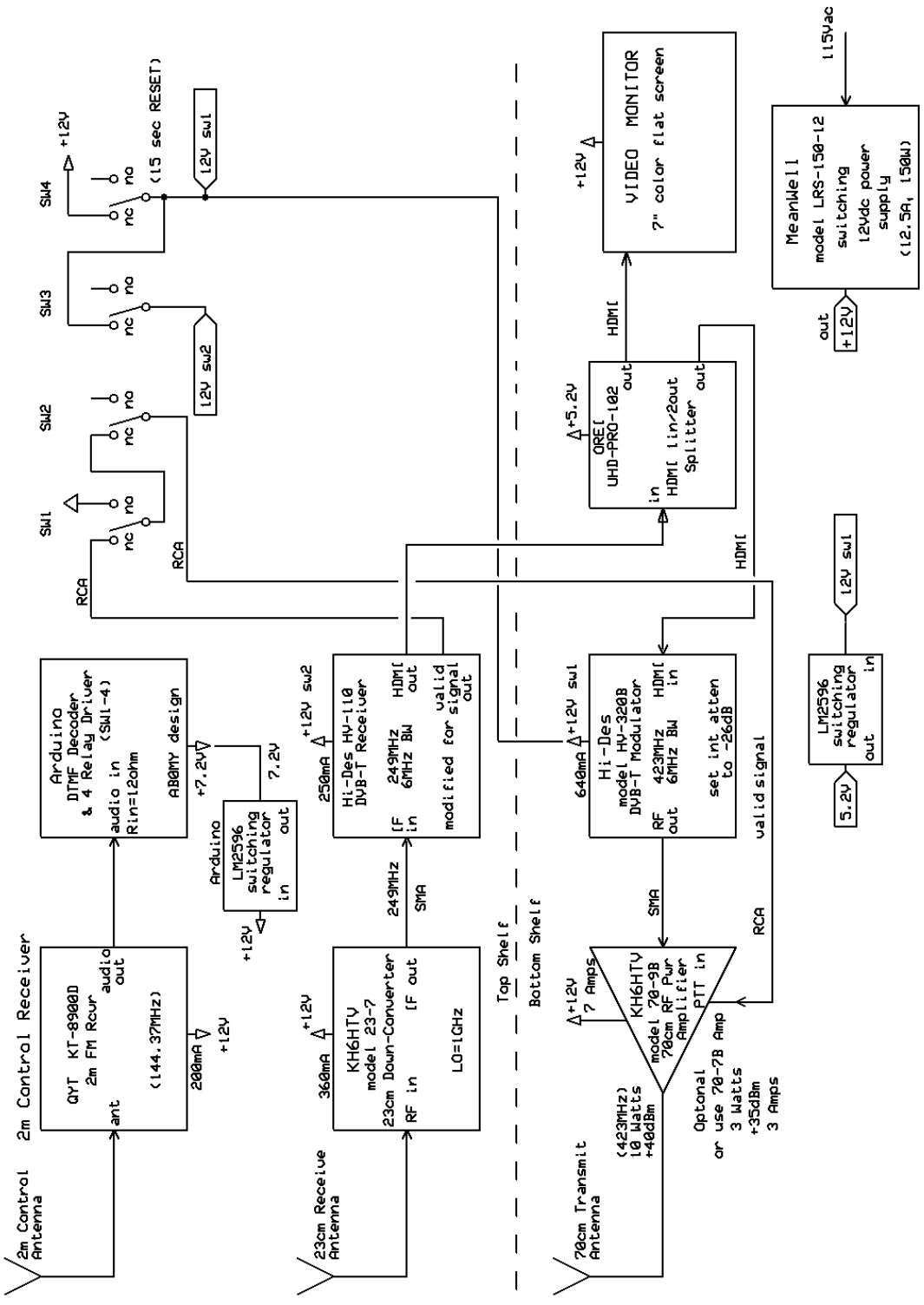

Fig. 3 Block Diagram of 23cm to 70cm Cross-Band, DVB-T repeater complete with 2 m control capabilities and video monitor.

Cost Break-Down: The total list price cost for major components is about $1,750. Table I gives a breakdown of the various major components required. These numbers do not include sales taxes, import duties nor shipping. Not included is the antennas, packaging, nor misc. cabling, etc. Also the cost of assembly / integration labor is not included.

Table 1 -- Major Components for 23-70 Repeater

Item	Mfgr.	Model #	Description	Price
1	Hi-Des	HV-110	DVB-T receiver	$120
2	Hi-Des	HV-320	DVB-T modulator	$400
3	KH6HTV	70-9B	70cm, 10W, rf linear power amplifier	$450
4	KH6HTV	23-7	23cm Down-Converter	$450
5	Meanwell	LRS-150-12	12Vdc, 150 W Power Supply	$20
6	AB0MY	TT-4relay	Arduino with custom touch-tone (DTMF) decoder & 4 relays + programming as desired	$150
7	QYT	KT-8900D	2m FM mobile transceiver	$80
8	Amazon	various	Video Monitor, 7" flat color screen, HDMI input, +12Vdc	$60
9	OREI	UHD-PRO-102	HDMI A/V splitter -- 1 in, 2 out, +5Vdc	$20
			Basic System Repeater Total Cost =	**$1,750**

Repeater Remote Control: To meet FCC requirements for an unattended repeater an alternate means of controlling or disabling the repeater is required. For the W0BTV, NCAR, ATV repeater this is done using touch-tones (DTMF) on a 2 meter control frequency. I suggest the same be used for this cross-band repeater. In years past, we have used a DTMF decoder / relay board from Intuitive Circuits. However, we no longer recommend them as we have had several failures. Their product dates back to the 1990s. We also had issues buying similar ones from Amazon. So recently Bill, AB0MY, has designed a new decoder using as it's basis an Arduino micro-controller. So we now recommend Bill's unit. It also has the advantage that Bill can custom program it to the user's specific control functions. For the prototype, the AB0MY DTMF decoder works as shown in Table II.

Table II --- Repeater Remote Control Functions

Function 3	Description	(*)	(#) normal state
1	Transmitter ON	ON	xmitter enabled
2	Transmitter Disabled	OFF	xmitter enabled
3	Color Bar Beacon	receiver OFF	receiver ON
4	Digital Reset	Reset (15 sec)	-- NA --

T-T Command Control Sequence = Password + Function # + either * or #
Password is CONFIDENTIAL (programmed as desired by AB0MY)
2 meter FM control frequency is CONFIDENTIAL (as desired, set on 2m receiver)
Normal State is with transmitter in enabled state awaiting a Valid Signal PTT
Function #1 forces the transmitter on even without an incoming signal
To transmit a Color Bar test pattern requires enabling function 3 plus function 1

If issues arise requiring the receiver and or modulator to have a system reset, then function #4 REST should be used. This removes the DC power from the receiver, modulator and HDMI splitter for 15 seconds and then reapplies power. It also resets the other relays back to the (#) normal state.
Relays 1 thru 3 are latching, Relay 4 is momentary (15 sec.)

Repeater ID: The FCC requires that all transmissions be identified, at least once every 10 minutes. For this repeater, we ID it continuously. As part of the A/V data stream there is also sent out a Metadata file with info about how the data is encoded. Included in this meta file is the transmitter's call sign. This is pre-programmed into the HV-320 modulator. The HV-110 receiver decodes the call sign of valid incoming DVB-T signals. The HV-110 receiver is set up to provide a permanent On Screen Display (OSD) of the call sign of the incoming signal along with the received signal strength in dBm and the signal to noise ratio in dB. This in then rebroadcast on the outgoing signal.

Additional BPFs: Depending upon your local RFI environment on the 23cm band, you may / or may not need to add an additional narrow-band, band-pass filter on the input to the receiver. Here in the Boulder / Denver metro area we are plagued with the presence of a very strong FAA radar operating in the middle of the 23cm band (1265-1270 MHz). The radar pulses overpower our DVB-T receivers and cause freeze-framing of the images. To solve this problem with our W0BTV DATV repeater we had to resort to a custom engineered and manufactured exotic band-pass / band-reject filter. This filter is discussed in detail in our application note, AN-53e. See pages 13-17. The application note also deals with N0YE's, 70cm BPFs.

Also depending upon local needs, you might also consider adding an ATV channel BPF on the output of the 70cm transmitter to clean up the out of channel skirts.

Antennas: This repeater is intended for use with three separate antennas. One for 23cm receive, one for 70cm transmit and one of 2 meter control. The selection of antennas is open to the user depending upon the coverage area desired, etc. There is a wide choice of antennas possible. Suggested reading is our application note, AN-67 "Comparison Tests of Various 70 & 23cm Antennas for ATV".

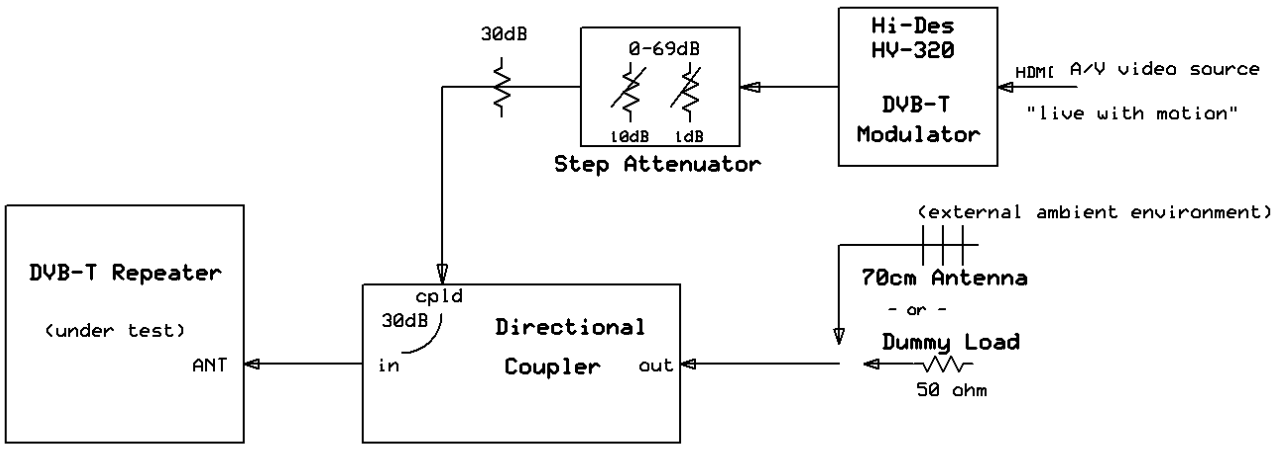

Fig. 4 Test Set for measuring the sensitivity of a DVB-T receiver

Final Test of Sensitivity: Fig. 4 above shows how to measure the sensitivity of a repeater's receiver both on the test bench and in a real world environment. A directional coupler is used to inject a known DVB-T test signal into the antenna port of the repeater. Using a large coupling value, such as -30dB, is an insurance policy against accidently transmitting back into the test set and blowing out attenuators or the modulator. Likewise, the dummy load needs to be able to handle the transmitter's rf output power.

Most DTV receivers tend to retain the last valid image decoded and display it on the screen. Thus if only a still image is transmitted as a test signal, it is difficult to know when the receiver is actually receiving properly -- or --- one is simply seeing a "Freeze-Frame". Thus it is important to use an A/V video source containing a lot of live motion and audio sounds. Playing back a DVD movie is ideal.

The first step is to set the modulator to a known RF output power level in dBm. Then knowing the amount of added attenuation in dB, it is straight forward to know the amount of rf power injected into the receiver under test. Pin = P(mod) - Attenuators - Directional Coupler.

Digital Receiver's Sensitivity is defined as the Digital Threshold which is the minimum rf signal level which results in a perfect P5 / Q5 picture & audio with no defects such as freeze framing. When using the Hi-Des HV-110 receiver a good visual indicator is also it's front panel red/green Valid Signal LED. It glows solid red with no signal. It glows solid green with P5/Q5 signal. It will flicker red - green with a weak signal just below digital threshold. Record the weakest signal level (in dBm) at which you get solid green. Also record the resultant signal to noise ratio S/N in dB.

Final Field Test: Using the above technique to measure receiver sensitivity the prototype cross-band repeater was tested. First on the test bench with a 50 ohm dummy load in place of an antenna, the 23cm sensitivity was found to be -96dBm (note: measured with "normal" DVB-T signal [1080p, 5.5Mbps, H.264, 6 MHZ BW, QPSK, 5/6 code, 1/16 guard]).

For the second test, in a real world environment, the dummy load was removed and replaced by the Diamond NR2000 mobile antenna mounted on an antenna mast outdoors. In this case, the repeater's receiver is going to be exposed to what ever other rf is flying around, other ham signals, FM repeaters, broad-band noise souces, etc. For the test at the qth of KH6HTV, the rf background degraded the sensitivity to about -65dBm. This was due to the strong Denver FAA radar pulses. Your actual sensitivity will vary depending upon your local RFI environment. This test showed that the basic 2370 repeater is unusable in the Boulder area without an additional BPF on the receiver input.

For the third test, a KH6HTV Video model 23-NB BPF, narrow band-pass filter was added to the input of the receiver. This filter has a 15 MHz -3dB band-width. The filter used was tuned for a center frequency of 1240 MHz. Thus for ATV-Ch 1 on the 23cm band (i.e. 1243 MHz). this put the upper roll-off of the filter at about 1248 MHz. For the FAA radar at 1265-1270MHz this filter added > 30dB of attenuation. With a dummy load for an antenna, the receiver's basic sensitivity was degraded slightly by the filter's insertion loss to -94dBm. Then when the outside 23cm antenna was used, there was absolutely no degradation due to the FAA radar anymore. The basic repeater's over the air sensitivity remained at -94dBm. This was an extremely significant improvement of about 30dB over the performance without the BPF.

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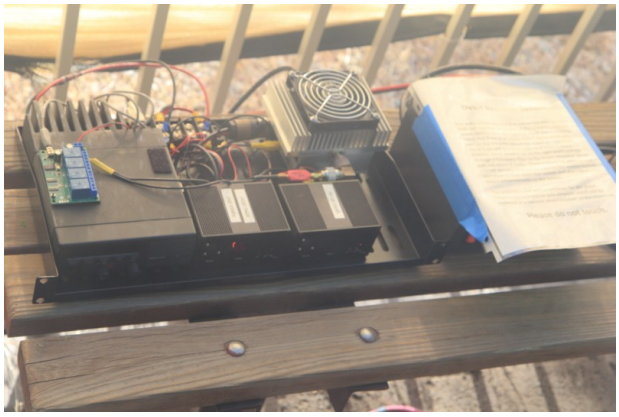

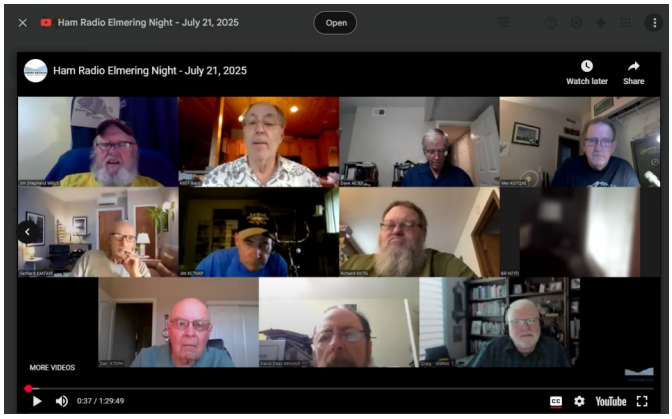

You-Tube Video on ATV

Jim, W6US, recently gave a talk about his new DATV repeater project to the Sierra Nevada Amateur Radio Society. It was a Zoom meeting and was recorded on You-Tube. It can be viewed by going to: https://www.youtube.com/watch?v=4p4g2Rlvnj8

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Annual DATV QSO Party:

We all appreciate the Newsletter you circulate that is for sure ... the **DATV QSO Party** is on again at about 0000 UTC Saturday August 30. (your Friday night) We will be starting as usual with Art Towslee in Columbus and his Zoom group. Rowland Hoffman KC6JPG will anchor his Los Angeles based networks as well. --- 73 de Peter Cossuins, VK3BFG,
note: for more info about the QSO party, contact Peter at pcossins@bigpond.com

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/*

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. 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 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 800+, 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. All past issues are archived at: https://kh6htv.com/newsletter/

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