BOULDER TV Repeater's REPEATER

July, 2019

Jim Andrews, KH6HTV, editor - kh6htv@arrl.net

REPEATER STATUS: The TV repeater is again functioning normally.

Both Don and Jim are now streaming the TV repeater's weekly, Thursday afternoon, ATV nets over the BATC server (https://batc.org.uk/live/) under the call signs N0YE and KH6HTV-TVR. Details about the repeater are available on our web site: www.kh6htv.com AN-43 gives all the technical details. If you have any questions about the current operations or status of the repeater, contact either Jim, KH6HTV or the assistant. trustee, Don, N0YE.

ATV Net: The Boulder ATV group meets every week on Thursday afternoons for an informal A/V net. The net starts at 3 pm local time and usually runs for 1 to 1 1/2 hours. There is usually a DVD playing a travel video both preceding and following the net for about 1/2 to 1 hour. The net uses the Boulder ATV repeater in all modes. The net is called initially and uses as our audio intercom the BCARES, Gunbarrel Hill, 2 meter, FM voice repeater. (146.76 MHz, - offset, 100 Hz PL tone required). When checking in tell Don, net control, the band and mode you want to use for your video input. Don will then configure the repeater accordingly. The repeater accepts DVB-T signals on either 23cm (1243 MHz) or 70cm (441 MHz) with 6 MHz bandwidth. The repeater can also receive analog TV on either 23 cm (FM-TV on 1247 MHz) or 70 cm (VUSB-TV on 439.25 MHz). The repeater typically operates in the digital output mode with DVB-T on 423 MHz, 6 MHz bandwidth. It is also capable of outputting in analog mode, VUSB-TV on 421.25 MHz, but is rarely used in this mode. In the normal, stand-by mode, the repeater is configured to receive 23 cm DVB-T and output 70 cm DVB-T.

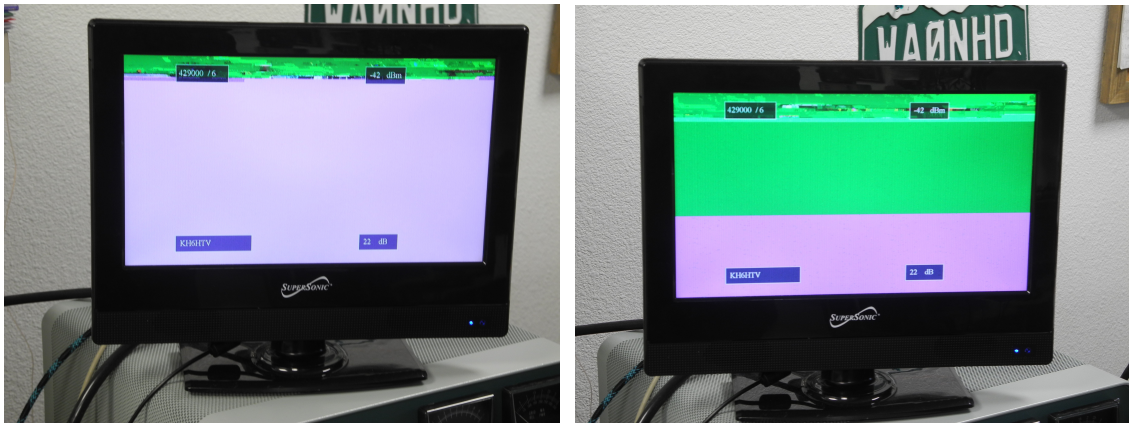
Future Newsletters: If you have contributions for future newsletters, please send them to me. Jim Andrews, KH6HTV, email = kh6htv@arrl.net

Hi-Des Firmware and AV-Sender Issues

Jim Andrews, KH6HTV

I recently gave a talk about DVB-T for amateur television to the Pueblo, Colorado amateur radio club. In my ATV talks I always give a strong endorsement for the DVB-T products from Hi-Des in Taiwan. As a result of my talk, the Pueblo ham club became extremely interested in starting to use ATV, in particular DVB-T, as support for emergency communications for the sheriff, police and fire agencies in their city and county. Immediately after I gave my talk, they ordered from Hi-Des an HV-110 receiver and HV-320E modulator, to start experimenting with DVB-T. They also immediately starting planning a future DVB-T repeater.

HV-320E Upon receiving the equipment from Hi-Des, they had issues trying to install a custom channel table in the HV-320E modulator. After discussing their problems on the telephone, I offered that they could send me their equipment and I would check it out for them. What I found was the HV-320E modulator worked fine, but their problem was the same both K0RZ and AA6TV here in Boulder encountered last year. Apparently the version of the PC computer program AV-Sender furnished by Hi-Des on the CD was not compatible with the HV-320E. I thus used the version, V4-18, which Hi-Des had furnished me last fall to fix K0RZ & AA6TV's modulators to also fix the new HV-320E for Pueblo. With V4-18, I was able to easily install a custom channel table.



HV-110 Reception Problem (a firmware issue)

HV-110 A new problem arose with Pueblo's receiver. I was able to train it to receive DVB-T signals direct from their new HV-320E modulator and store in it a channel table for the various 70cm DTV channels. The HDMI video output gave acceptable pictures and audio. However, I then proceeded to test the new HV-110 receiving DVB-T signals from my older HV-100EH modulator on the same channel, same bandwidth, and all other identical transmission parameters. The new HV-110 recognized a valid DVB-T

signal was present, but it's HDMI A/V output refused to display a valid image. It kept making weird, colored screens. I took a couple of photos to document what happened. See the above photos. The on-screen display showed that the receiver was getting a strong signal (-42dBm) with a perfect S/N (22dB). When I then used my old HV-110 receiver, I found that it received perfect pictures from both the old HV-100EH and new HV-320E modulator. Why ? I carefully examined all of the various settings and parameters of both modulators and also both receivers. I made sure they were all set up identical. The only difference I was able to note was different firmware versions installed in the HV-110s. In my old HV-110, it was: 0.0.1.72.101.000, while in Pueblo's new HV-110, it was: 0.0.1.79.103.000

I thus sent off an e-mail to Hi-Des's technical support, Mr. Calvin Yang, calvin@hides.-com.tw . Calvin immediately replied back (note: he always does very promptly). Here is his explanation:

"As for the HV-110, we do have released two versions. V0.0.1.72.xxx is generic for all transmitters. V0.0.1.79.xxx is optimized for HV-310 and HV-320 Tx for lower latency, but the picture would be abnormally decoded for other Tx'. If you also use other Tx's such as HV-100/-102/ -200/-202, please install 0.0.1.72.xxx.

Obviously, we are wrong to ship the HV-110 with V0.0.1.79.xxx if the order comes with HV-310 or HV-320. We will install V0.0.1.72.xxx in HV-110 by default from now on.
Thank you again for your support and valuable feedback."
Best regards, Calvin Yang

Bottom Line: If you ever encounter issues you can't resolve with your Hi-Des gear, send Calvin an e-mail and he can usually, easily answer your questions and solve your problem. For example, on the above issues, he then gave us links to drop-box locations to download the proper software and firmware.

RF Interference Potential of Digital TV

Jim Andrews, KH6HTV

There has been concern expressed by some radio amateurs using FM voice radios to the possible interference to their 70 cm repeaters by radio amateurs transmitting digital Television signals. A 10 watt, DVB-T transmitter will be equivalent to transmitting a weak, 44 milli-Watt (+16dBm) signal on any single FM voice channel.

A digital TV (DTV) signal due to the random nature of the COFDM modulation appears as if it were white noise. When viewed on a spectrum analyzer, it appears as if the

"grass" from the noise baseline is raised upon a rectangular pedestal. When one tunes in a DTV signal on a single sideband receiver, it just sounds like white noise, except that the receiver's S meter indicates the presence of additional RF power above the noise floor of the receiver.

So the question remains, just how strong will the DTV signal actually be when received by an ordinary amateur, 70 cm FM mobile, or hand-held radio, or FM repeater ?

First what are the bandwidth requirements for an FM voice radio? Carson's Bandwidth Rule (CBR) for FM modulation is: $CBR = 2 (\Delta f + f_m)$, where Δf is the peak frequency deviation, and f_m is the highest frequency in the modulation signal. Thus for a typical band-limited voice signal maximum of 3 kHz and 5 kHz deviation, the required bandwidth is about 16 kHz. Per the FCC, for 5 kHz deviation, the channels are 25 kHz wide.

A typical amateur DTV transmitter puts out at most about 10 watts (rms) of RF power. In the USA, we use TV channels that are 6 MHz wide. For DVB-T modulation, there are actually guard bands of 145 kHz at the channel edges and the actual DTV signal occupies 5.71 MHz. The DTV transmitter's power is uniformly spread over this whole signal bandwidth.

Thus the DTV transmitter's power density, P_d ,in Watts / Hertz is:

$$P_d = 10 \text{ Watts} / 5.71 \text{ MHz} = 1.75 \times 10^{-6} \text{ W / Hz}$$

Thus the equivalent transmitter power in a single 25 kHz FM voice channel is:

$$P(\text{FM equiv}) = P_d \times \text{FM-BW} = 1.75 \times 10^{-6} \text{ W / Hz} * 25 \text{ kHz}$$
$$= 0.044 \text{ Watt} = 44 \text{ mW} = +16\text{dBm}$$

While this is not infinitesimally small, it is still much weaker than any typical 5 Watt hand-held radio or a 50 Watt mobile radio. Thus I argue that the RFI potential to FM voice repeaters is minimal.

Update on Bill - K0RZ:
Bill, K0RZ, has not been seen on the TV repeater recently. A recent inquiry to him got this response. "I still watch the Thursday ATV activity when I remember the time, but do not have a transmit antenna that is vertically polarized. I did have the KLM 1296 short Yagi temporarily on the tower. I've ordered a Loop-Yagi for 1270 from Directive Systems however it has been backordered for 6 weeks so far and still no delivery date." I offered to loan Bill a loop yagi in the interim. His reply was "Thanks for the offer, however I'll wait to receive the antenna from Directive Systems. I have some antenna removal on the tower top to do before I can install the 1270 MHz loop Yagi. Also have some transmission line work to do as well. I don't want to climb the tower and do another temporary installation like I did previously." We are looking forward to Bill's return to our Thursday afternoon ATV nets.

FRIDAY HAM BREAKFAST

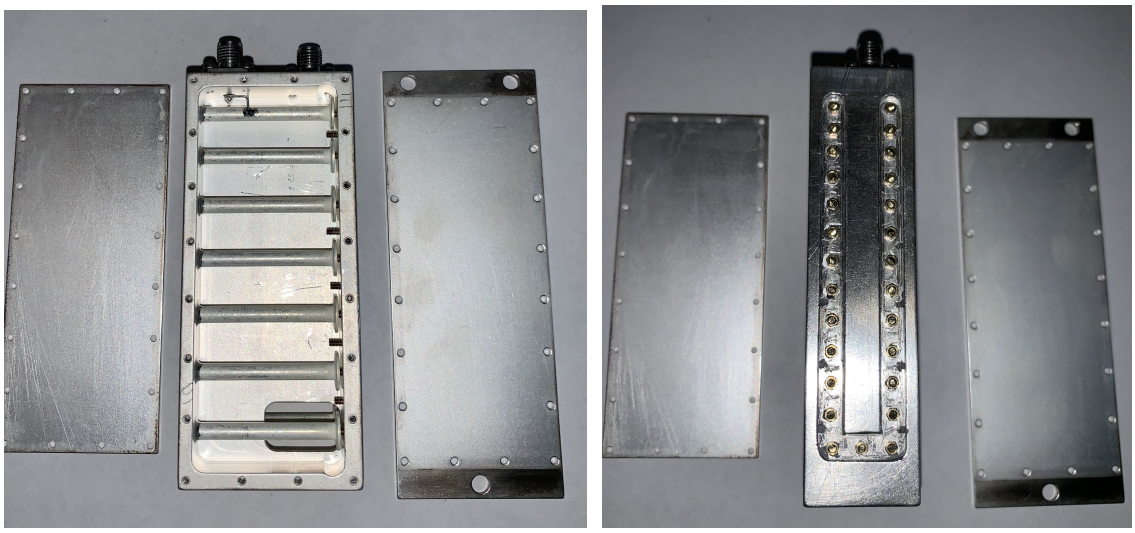
Many Boulder area "Hams" gather for breakfast weekly on Friday mornings. Many of the ATVers are in the group. In addition to "Ham & Eggs", there are many other breakfast items on the menu. We meet at Doug's Diner on the south-east corner of Folsom and Arapahoe in Boulder. We all sit at a large community table. Most start to arrive around 7 am and breakfast orders are placed from the menu around 7:30 - 7:45 am. All interested hams are encouraged to join us.

23 cm BAND-PASS FILTERS

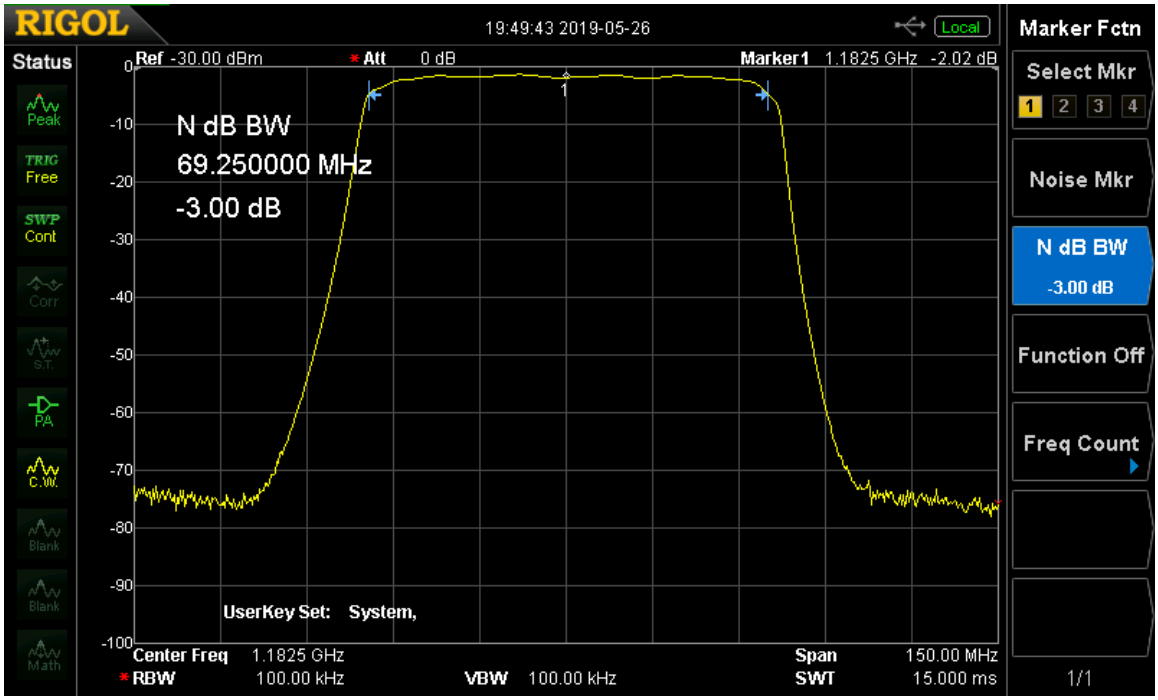
Colin Bradley, WA2YUN

In the last 3 weeks I obtained four FSY, 23cm bandpass filters. They were tuned to 1182.5MHz with a nominal 60MHz bandwidth. The insertion loss was around 2dB. The first job was to clean them up and remove the epoxy that covered the adjustment screws. The next item was to loosen the retaining nuts that secured the tuning screws. They are 3/32” and required getting a new driver from Amazon. There was no issue with getting them loose. Having the right tool is always a good move. Of the 4 units, 1 did not pass anything with the remaining 3 working fine. The defective unit now became my test unit to open up. There are 20 screws on each side of the filter. They are very small. Smaller than a SAE #1. Possibly a metric M1. Several of them were too tight. By tapping on the end of the screw driver with a small hammer I was able to get them loose. Internally everything is silver plated. I did not see anything that would explain why this particular filter did not work. Perhaps one of the tuning screws is touching the inside of the inductor. The inductors all have capacity hats on the top similar to what is present on the duplexer. Another problem with the tuning screws is that before the epoxy was applied the tops of some, were cut or ground down leaving no slot to use for tuning. The next step I will try tuning the 14 elements. With the problem with some of the tuning screws, this might be a difficult. Attached are photos of the unit with the covers off of both the top and bottom. There is also a scan of the frequency response of the three good units before any tuning. I’ll report on how it all turns out.

73 de Colin, WA2YUN



The 23cm Band-Pass Filter opened up.



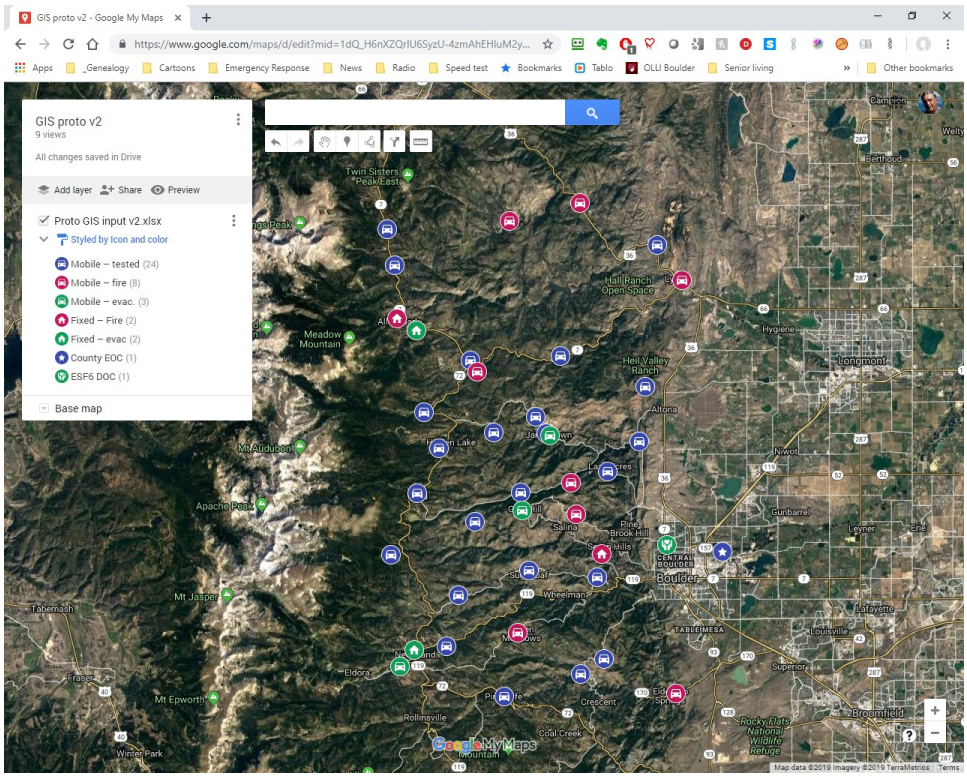
S21 Insertion Loss of Colin's 23cm Band-Pass Filter (prior to retuning)

BCARES Mountain Radio Site Survey

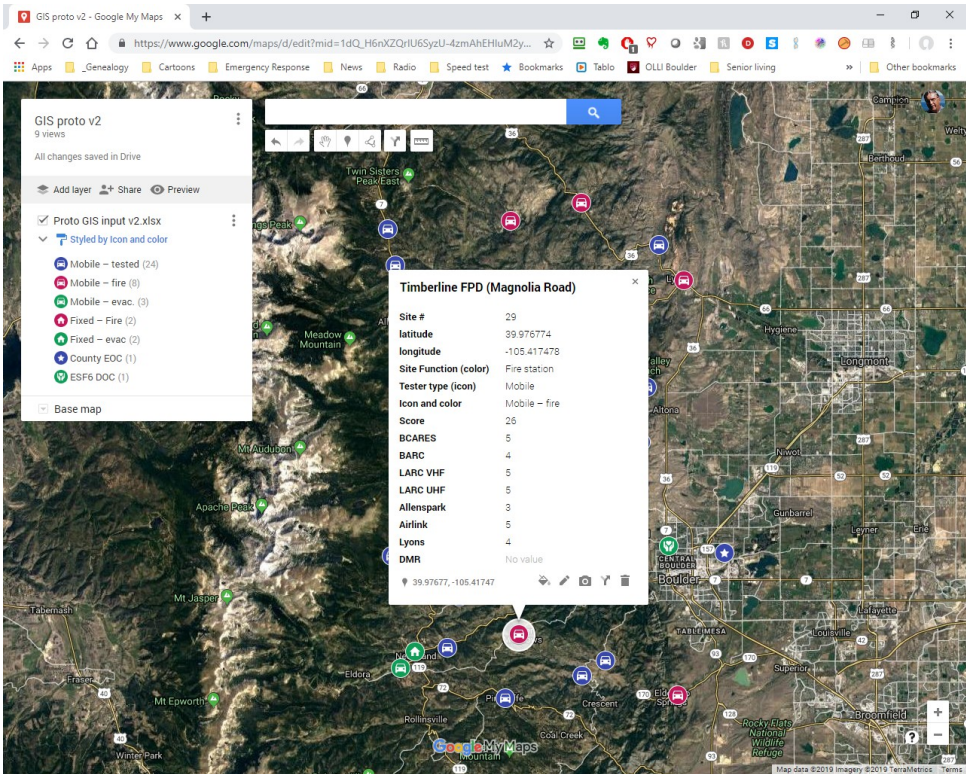
In May, BCARES conducted a survey of the 2 meter, FM repeaters' coverage of the mountainous western half of Boulder County. This survey was done at the request of the Boulder County Office of Emergency Management (OEM). The test sites picked were know to be of interest to emergency management, plus others to sample coverage in otherwise untested areas. There were 40 sites to be checked out. BCARES volunteers were solicited to drive to the various sites. Each site was tested with a 2 meter, mobile radio of at least 25 watts and a decent mobile antenna. The test was run on Saturday morning, May 25th from 9 am to noon. 23 volunteers assisted in the testing. Separate net control stations were manned during this period on each of the six, main, Boulder County amateur 2 meter repeaters. They were: BCARES (146.76), BARC (146.70), LARC (147.27), Airlink (146.91), Allenspark (147.03), and BARC-Lyons (146.61). In addition optional testing was done on the LARC UHF repeater and the DMR repeater. Each mobile attempted to contact each of the six, 2 meter repeaters. The signal quality of each contact was recorded. The site survey was organized by Joe Callahan, KC0JCC. The resulting data was then organized by Joe and given to the OEM. Joe did an outstanding job of organizing and running the survey. Below is Joe's report to the participants.

"Here are screen captures of a prototype of the map of our coverage in the mountains that County Emergency Management asked us to provide. These are from MyMaps on Google and are about what we expect to see the County GIS group have as a "layer" that can be applied over maps that are used in the EOC during disaster events. In use, all the background image will be from other layers (terrain, incident perimeter, road closures, etc.), and ours will add just these icons and the detailed information the pops up when an icon is clicked. The spreadsheet used to create this has been sent to County GIS and I will be meeting with them later this week to work out the details. The legend in the upper right will not be in the GIS version. In MyMaps the legend shows the categories of test sites that control the generation of icons (tested from a fixed or mobile station, and the type of facility: fire station, evacuation point or shelter, or just a coverage test point). On the popup, you get a list of the signal qualities recorded for that location by the NCS for each repeater. This popup is amazing (to me at least) with a mobile on Magnolia Road being able to use repeaters in Allenspark and Lyons. We set out to test 40 locations and got 39 done, either right where we intended or very nearby. All of them were able to reach at least one repeater. The one we were unable to do had a locked gate on the access road and we will see what we might be able to do about that in the follow up activity, which you will be hearing about if we need volunteers when we have firmed up the plans for it."

Thanks to everyone and 73, Joe Callahan KC0JCC



Map of the mountains in the western half of Boulder County showing the radio sites tested.



Clicking on a site brings up this table of data

NEW -- Boulder Amateur Television Club

Don, N0YE, and Jim, KH6HT, recently were discussing setting up an informal ATV club for the Boulder TV repeater users. The major advantage of such would be that we could then have a unique call sign for the TV repeater. An informal survey of the TV repeater users found support for the idea. Researching the requirements, we found that club call signs are now administered by the ARRL on behalf of the FCC. The major requirements for an approved club are:

1. The club must be composed of at least four persons and must have a name, a document of organization, management, and a primary purpose devoted to amateur service activities consistent with this part.

2. A club station license grant may be held only by the person who is the license trustee designated by an officer of the club. The trustee must be a person who holds an FCC issued amateur radio operator/primary station license grant.

3. The responsible official must not be the same person as the club license trustee.

4. The application form, 605-C, must be signed by both the designated trustee and also the responsible club official.

Thus Jim and Don drew up organization papers and on the 11th of June filed a form 605-C application for an amateur club license with the ARRL. After it is approved by the FCC, an arbitrary call sign will be issued by the FCC. The second step in the process will then be to file for a "Vanity" call sign. According to a search on www.qrz.com there are presently available several suitable call signs which we might apply for. We will keep you posted on our progress towards getting our own call sign for the TV repeater.

On the next page is the "organization document" which Jim and Don submitted to the ARRL-FCC for the new club which we are calling "Boulder Amateur Television Club" or BATVC for short.

BOULDER AMATEUR TELEVISION CLUB

(Organization & Members)

1. **PURPOSE:** The purpose of the Boulder Amateur TeleVision Club (BATVC) is to encourage the use and experimentation of Television (TV) on the amateur radio UHF and microwave bands of 70 cm and higher. The BATVC also supports the Boulder County ARES in providing TV communications for the various Boulder County public safety agencies in times of emergency.

2. **MEMBERSHIP:** The membership of BATVC consists of all licensed radio amateurs residing in Boulder County and the Front Range of Colorado, who also own their own amateur TV transmitting stations and are active users of the Boulder ATV repeater. Associate members are those persons who do not own their own amateur TV transmitting station, but participate in the club's activities.

3. **MEETINGS:** The BATVC holds weekly meetings on the air with a weekly TV net. The net consists of members exchanging TV pictures via the TV repeater and holding discussions on topics of interest to the group.

4. **OFFICERS:** The officers of BATVC consists of the Trustee and the Assistant Trustee.

5. **REPEATER:** The BATVC shall maintain an amateur TV repeater with coverage of at least the eastern half of Boulder County. This repeater shall be an "Open" repeater. Any licensed radio amateur may use the repeater. The control operators of the repeater are the Trustee and the Assistant Trustee. The access codes to the repeater are given to each Full member. The access codes are also given to the officers of BCARES for use in an emergency.

6. **CALL SIGN:** The repeater shall be identified with a unique call sign issued by the FCC to the club.

7. **FINANCES:** There are no annual dues for membership in BATVC. Financing for repeater maintenance, and improvements will be by donation.

8. **OFFICE:** The registered office with the FCC shall be that of the Trustee, 1025 Paragon Drive, Boulder, Colorado, 80303.

9. **INITIAL MEMBERSHIP:** The appendix on page 2 lists the original members of BATVC.

Adopted this the 11th day of June, 2019

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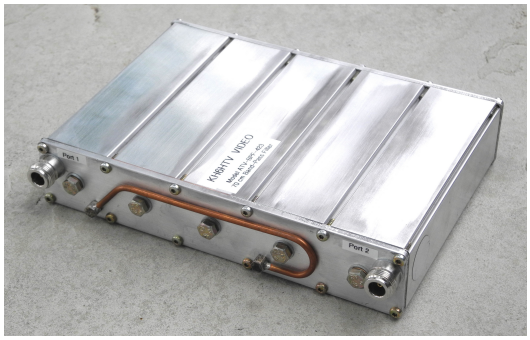
James R. Andrews, KH6HTV	Donald Nelson, N0YE
Trustee	Assistant Trustee

Appendix I -- List of Initial Members

Call Sign	NAME
KH6HTV	Jim Andrews
N0YE	Don Nelson
K0HEH	Jack Quinn
KC0PYX	Larry Nelson
K0IHX	Roger Salaman
KD0PDZ	Naomi Salaman
N0RUX	George Kretke
KB0NAS	Doshia Kretke
WB2DVS	Pete Goldman
WB3DVT	Debbie Goldman
WA2YUN	Colin Bradley
AD0I	Joe Woods
AB0MY	Bill Eberle
WA0TQG	Steve Maddy
K0RZ	Bill McCaa
K0JOY	Ed Joy
WB5PJB	Gary Sutton
K0DVB	Matt Holiday

KH6HTV VIDEO ANNOUNCES NEW PRODUCTS



70 cm ATV Band-Pass Filter

70 cm ATV Duplexer

KH6HTV Video announces two significant new products intended for building amateur TV repeaters. The first is an improved 70 cm, Band-Pass Filter which replaces the older Model 70-BPF-5P-6M-xxx. The new model number is ATV-BPF-XXX. The band-pass filter can be supplied for any desired center frequency from 423 to 447 MHz.

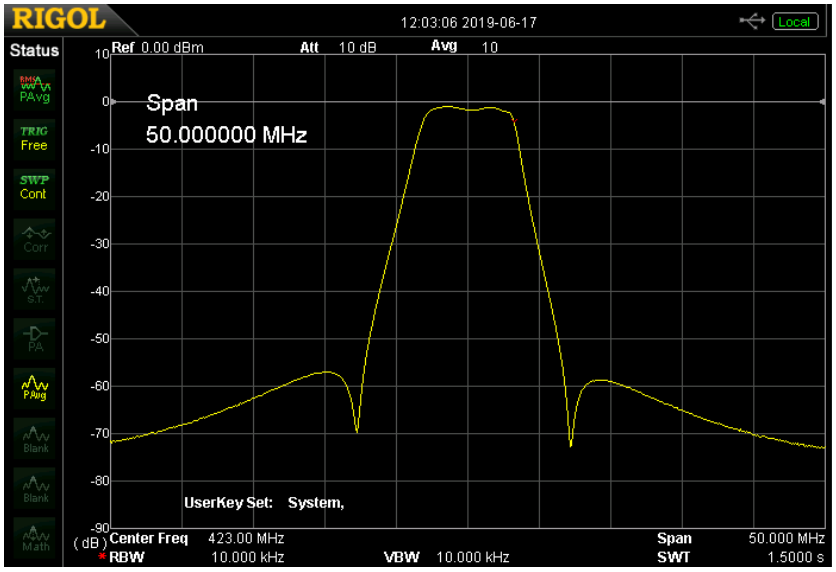
The second new product is a 70 cm Duplexer. The model number is ATV-DPX. The purpose of a duplexer is to allow the use of a single common antenna for both receive and transmit. Duplexers designed for FM voice repeaters were not used for TV repeaters. We had to use two separate antennas along with separate band-pass filters. One antenna for receive and another antenna for transmitting. A duplexer is a 3 port device consisting of two band-pass filters with a common input port. The ATV-DPX is a different design duplexer with much wider pass-bands than an FM voice radio duplexer. It has two band-pass filters, each with 10 MHz bandwidths, clean pass-bands, and steep stop-band skirts. The ATV-DPX comes pre-tuned for Ch 57 (420-426) and Ch 60 (438-444).

The detailed specification sheets for the NEW models ATV-BPF-XXX and ATV-DPX are found on the following pages.

As a result of the introduction of the new duplexer, the KH6HTV Video application note, AN-23, "DVB-T Television Repeater" has been revised. The new version, AN-23b is now available on the web site: www.kh6htv.com

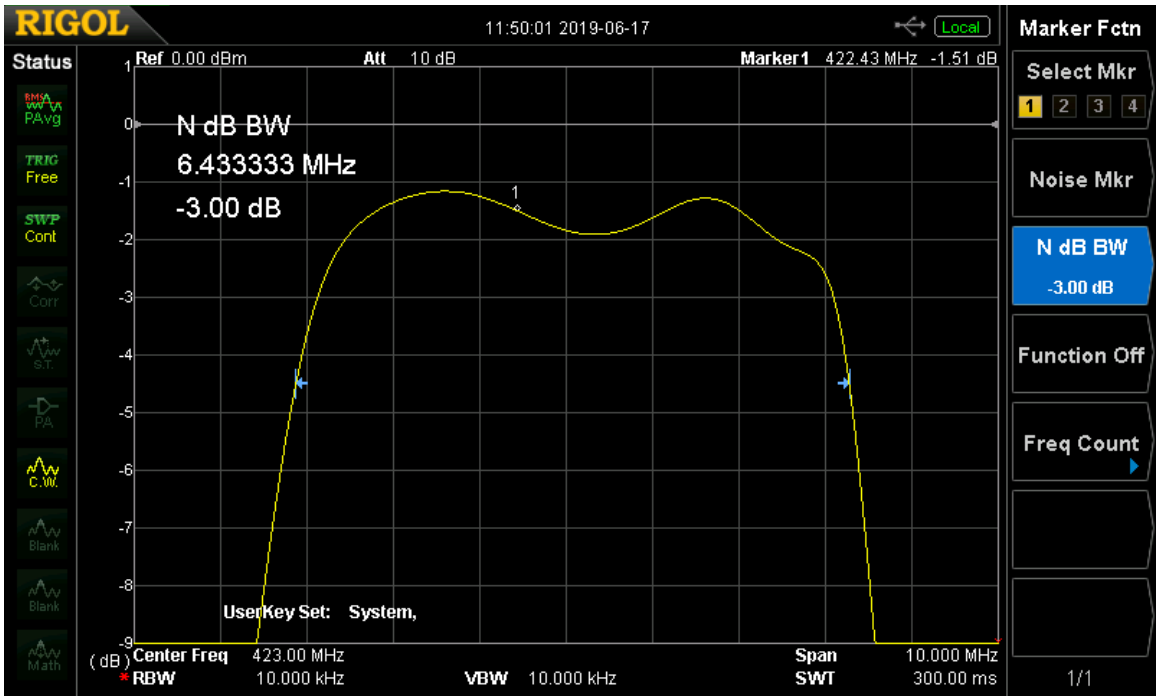
Model ATV-BPF-XXX
70 cm
Band-Pass Filter

The KH6HTV VIDEO Model ATV-BPF-XXX is a 70 cm, Band-Pass Filter. The standard -3 dB bandwidth is 6 MHz for use in amateur television service. They are ideal for use in a Television Repeater, either for analog or digital TV. The filter has a nice pass-band and steep stop-band skirts. When ordering specify the desired center frequency, XXX.

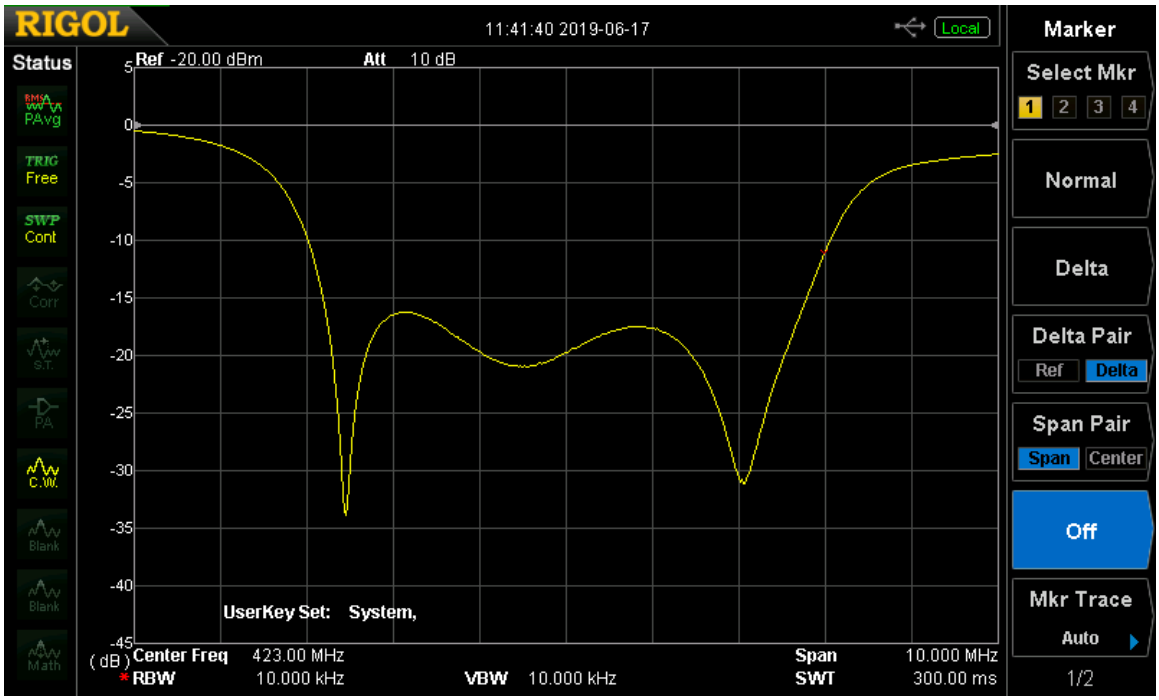


S_{21} (insertion loss) of a Ch 57, TV Channel Filter
Center freq = 423 MHz, span = 50 MHz (5 MHz/div), Vert = 10 dB/div.

PARAMETER	Typical Performance	Notes
Center Frequency	423 to 447 MHz	specify XXX when ordering
Standard ATV Channels	57 (420-426 MHz), 58 (426-432 MHz) 59 (432-438 MHz) & 60 (438-444 MHz)	center frequencies of: 423, 429, 435 & 441 MHz
Bandwidth	6.5 MHz	-3 dB
Passband Insertion Loss	1.6 dB	see plots
Stopband Rejection on adjacent channels	45 dB 60 dB 68 dB	$f_c \pm 6$ MHz $f_c \pm 12$ MHz $f_c \pm 18$ MHz
Size & Weight	8 3/4" x 1 3/4" x 6 3/8", 3 lbs, 2 oz.	not including connectors
RF Connectors	type N jacks (female)	
Documentation	Test Report included	includes freq. response photos



Typical Pass-Band S_{21}, Insertion Loss, Swept Frequency Response
1 dB/div & 1 MHz/div

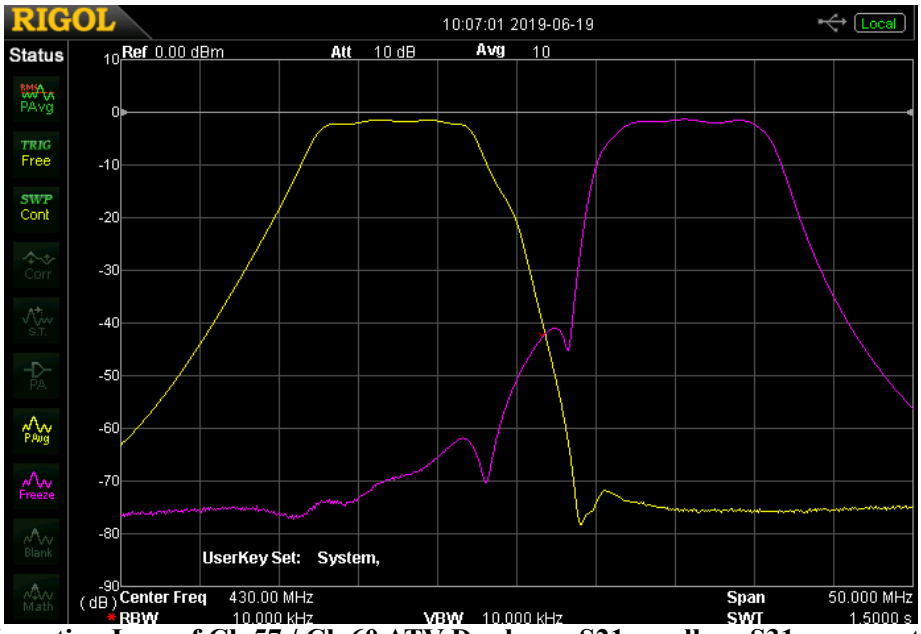


Typical Pass-Band, S_{11}, Return Loss, Swept Frequency Response
3 dB/div. & 1 MHz/div.

KH6HTV-VIDEO www.kh6htv.com e-mail: kh6htv@arrl.net
Boulder, Colorado, USA

Model ATV-DPX
70 cm
DUPLEXER

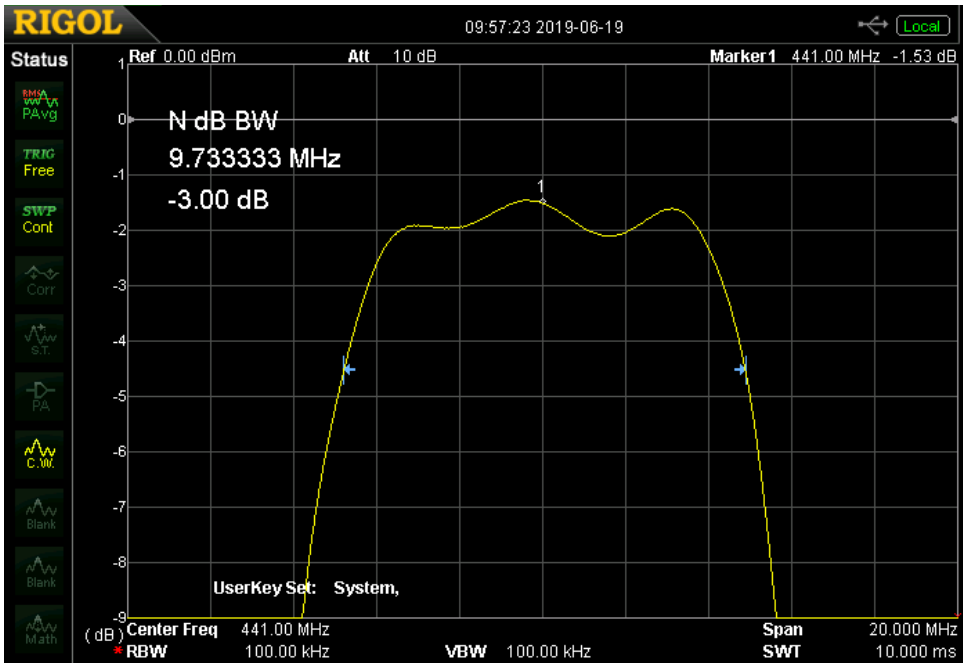
The KH6HTV VIDEO Model ATV-DPX is a 70 cm, Duplexer. It is ideal for use in a Television Repeater, either for analog or digital TV. The purpose of a duplexer is to allow the use of a single, common antenna for both receive and transmit. The filters have nice pass-bands and steep stop-band skirts. The standard duplexer is pre-tuned for ATV channels 57 (420-426 MHz) and 60 (438-444 MHz).



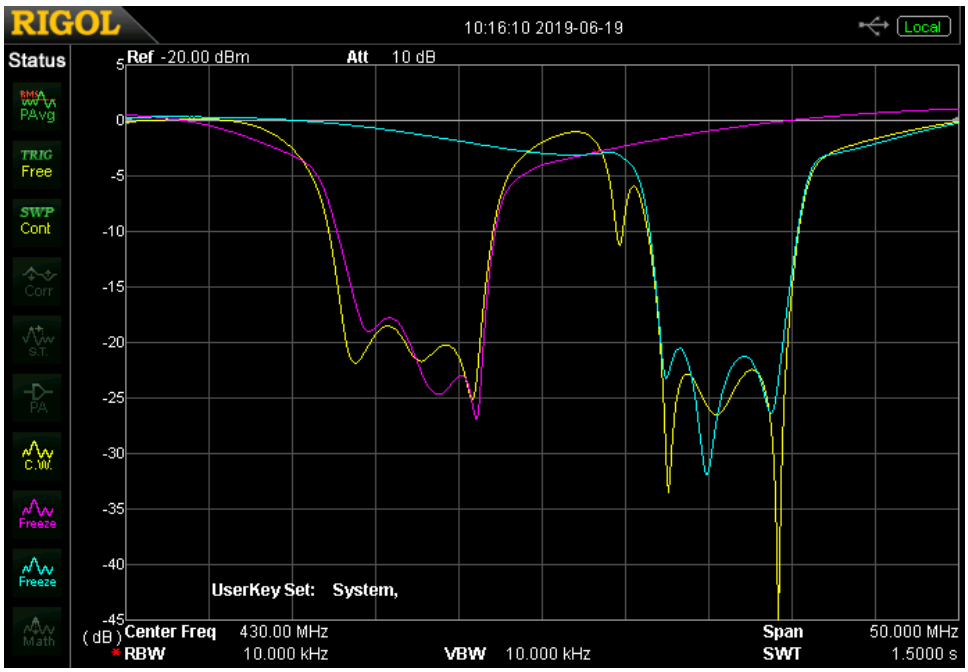
Insertion Loss of Ch 57 / Ch 60 ATV Duplexer, S21 = yellow, S31 = magenta
Center freq = 430 MHz, span = 50 MHz (5 MHz/div), Vert = 10 dB/div.

PARAMETER	Typical Performance	Notes
Standard ATV Channels	57 (420-426 MHz) & 60 (438-444 MHz)	center freq = 423 & 441 MHz
Bandwidth	10 MHz	-3 dB
Passband Insertion Loss	1.7 dB	for 6 MHz BW, DVB-T signal
Ch 57 Stopband IL	-15dB (429), -85dB (435), -95dB (441)	S21
Ch 60 Stopband IL	-10dB (435), -60dB (429), -70dB (423)	S31
Size & Weight	9 1/8" x 2 1/8" x 5" 5 lbs, 2 oz.	not including connectors & tuning screws
RF Connectors	type N jacks (female)	
Documentation	Test Report included	includes freq. response photos

KH6HTV-VIDEO www.kh6htv.com e-mail: kh6htv@arrl.net



Typical Pass-Band Insertion Loss, Swept Frequency Response
Ch 60, S31 shown 1 dB/div & 2 MHz/div



Typical Return Loss, Swept Frequency Response
5 dB/div. & 5 MHz/div. S11 = Yellow, S22 = Magenta S33 = Cyan

KH6HTV-VIDEO www.kh6htv.com e-mail: kh6htv@arrl.net
Boulder, Colorado, USA