

# Boulder Amateur Television Club TV Repeater's REPEATER

2ed edition  
July, 2019



Jim Andrews, KH6HTV, editor - [kh6htv@arrrl.net](mailto:kh6htv@arrrl.net)

**REPEATER STATUS:** The TV repeater is again functioning normally. However, due to the rebuilding of the repeater currently in process, a temporary repeater is in service. Thanks to Jack, K0HEH & Don, N0YE. It is a portable unit, 70cm in-band only. Ch 60 in / Ch 57 out. DVB-T only. No control functions. i.e. it can not be toned off.

Don is streaming the TV repeater's weekly, Thursday afternoon, ATV nets over the BATC server (<https://batc.org.uk/live/>) under his own call sign N0YE. 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 is called initially and uses as our audio intercom the BCARES, Gunbarrel Hill, 2 meter, FM voice repeater. (146.76MHz, - offset, 100 Hz PL tone required ).

**BATVC TYPO !** - My apologies to Debbie. In the list of charter members of BATVC, my fat finger hit a 3 instead of a 2. Sorry Debbie. I should have listed your call sign as WB2DVT.

**BATVC UPDATE:** Both the ARRL & FCC have approved our application to become an official amateur radio club. On the 19th of June, the FCC issued us a club call sign of KE0WCI. Obviously, we do not want to use this generic call sign. By the 24th, I was able to go on-line with the FCC and apply for a vanity call sign. The choic-

es I submitted in order of preference were: 1. W0BTv (i.e. Boulder TV) 2. K0HTV (i.e. High-Definition TV) or 3. W0HTV (i.e. High-Definition TV). Other nice choices involving TV, ATV, DTV, etc. were not available. As of July 5th, the application was still pending with the FCC.

### **NEW ATV Activity in Colorado Springs:**

The Village 7 ARC in Colorado Springs is putting on a demonstration of amateur television this weekend. Field Day activities will be televised live. The transmission covers most of El Paso county and will be continuous for the most part with a few hour long breaks in the morning and evening. It may be received with a vertically polarized antenna, preferably a yagi, hooked to a TV tuned to cable channel 59. Audio will be on 434.0, 438.5, and 146.85 MHz FM. Talk in on the AD0TP repeater 146.85 PL 156.7.

This operation is only temporary for this weekend. Input is on 2434 FM vertical sector panel. Output is 434 AM vertical at about 10 watts into a 4el yagi. No plans to keep it up because of site issues. Working well so far. You may try listening to 434 NFM on a yagi up there see if you can pick up the carrier up there in the north land. CWID every 10 min and repeater audio on there.

73 de Dan KE7TBB (e-mail to kh6htv on 6/22/19)

### **NEW ATV Repeater Soon in Pueblo:**

The Pueblo, Colorado ham club is moving forward with their new ATV/DTV activities. They are now planning to install an ATV repeater. It will be installed on a high hill to the north-east of the city on the CSU-Pueblo campus. The call sign will be the club's historic call sign of W0PHC (i.e. Pueblo Ham Club). The trustee is Bill, K0CGQ. They just



recently placed an order with Jim, KH6HTV, to build for them a basic, 70cm, in-band, DVB-T repeater. It will use a single 70cm antenna along with the new, ATV-DPX Duplexer. Other key components will include the Hi-Des models HV-110 receiver and HV-320E modulator, KH6HTV model 70-9B, 10 Watt amplifier, ATV-BPF-441, ARR P432VDG preamp and Astron 13.8Vdc power supply. It will all be assembled on a single 19", relay rack, open shelf.



thanks for photo from Bill, K0CGQ, Pueblo

This is inside our club comm. trailer on Field Day, in a parking lot at CSU-Pueblo. I installed the overhead hi.def. monitor a couple of days before. The image is from our ATV system (If you look closely, you can see the HiDes receiver on the shelf on the far left). The camera was just outside the trailer pointed at the setup of some other club members, under a popup shelter.

73 de Bill, K0CGQ

**FAREWELL to KH6 ISLANDS:** It is with a heavy heart that Janet & I have made the decision to sell our Maui home and stop being "snow birds" there in the winter time for half the year. Advancing age and the inherent medical issues have forced our hand earlier than we had hoped. Doing so, however will certainly help our cash position as living there certainly came with considerable added expenses of maintaining two homes, cars, etc.

The major compelling factor was medical care. There is a hospital on Maui and doctors. But, for most all major problems, patients are immediately referred to Honolulu or southern California. Going to Honolulu is not as simple as hopping in your car and driving to Denver ! Lots of open ocean between the islands of Maui & Oahu. No highways, no bridges, no ferry boats -- only option is an expensive airliner trip. Plus once you get there you have to rent hotel room, car, etc.

It has been a good ride. We have had many pleasant years there since retiring in 2001. Over the years there, we made many great friends -- through tennis, ham radio, Maui Country Club, lady's clubs, etc. We actually had a more active social life on Maui than we have here in Boulder. Plus, we had family there. Our middle son, Steve and his wife, Victoria live in



Capt. Steve with 40 lb. Ono

Lahaina, Maui where Steve is a luxury, deep-sea, fishing boat captain. Steve moved to Maui many years ago right out of UNC-Greeley. We will miss all of them dearly. We hope to be able to fly back to Maui occasionally to visit Steve, Victoria and friends, but only for very brief visits in the future.

I do plan to retain my KH6 call sign. It is now too strongly associated with my small, hobby business of KH6HTV Video ( [www.kh6htv.com](http://www.kh6htv.com) ). I have already filed a change of address with the FCC and it was approved. I got the KH6 call sign originally because calling on HF, "CQ from WA0NHD" while out in the middle of the Pacific ocean, almost no one would ever answer me. Even adding /KH6 didn't help. That was simply a ho-hum W0 call from the central US. Once I got the KH6 call and called "CQ from KH6HTV", the number of HF contacts went up exponentially ! KH6 worked magic. I suddenly became DX to most hams. To be perfectly honest, I have the exact opposite problem operating HF from here in Boulder, Colorado. Calling "CQ from KH6HTV/W0", I get a whole lot of disappointed HF contacts where the other ham says "Gee, I had hoped I was working Hawaii, not Colorado." Oh well, such is life.

Jim Andrews, KH6HTV

p.s. A great article about Capt. Steve & his boat, the Jayhawk, is in the Hawaiian Airlines magazine, *Hana Hou* !, June-July issue, pages 78-89. You need to go about 2/3eds through the article to find Capt. Steve. Great underwater photos in the article. You can also find it on-line at: <https://hanahou.com/22.3/land-down-under>



## CHINESE RADIOS -- You Get What You Pay For !

Jim Andrews, KH6HTV



Mike McMynn & Dan Berg's Baja-500 Race Car - complete with Kenwood VHF radio

In the previous issues of this newsletter, I discussed a couple of Chinese, VHF/UHF mobile FM transceivers. They were the Baofeng (a.k.a. B-TECH) model UV-50X2 and it's little brother the model UV-25X2. I got the UV-50X2 radios originally for my son-in-law, Mike, to use for his support vehicles in the recent Baja-500 off-road motor race. I then later purchased for myself the UV-25X2. So now, we have some operating experience with them. How did they work out ? In some respects OK, others ?? so-so. The primary criteria for going with these radios in the first place was the fact that they could be programmed to work on ANY frequency in the VHF/UHF bands, without making any internal modifications. In that respect, they did meet that criteria. Plus they were CHEAP! \$170 for the 50 W & \$115 for the 25 W radios. They could be considered "throw-aways".



A peek inside the UV-50X2. This one has a blown final amp. No visual evidence of damage, but no RF out. Guess all the magic smoke got let out !

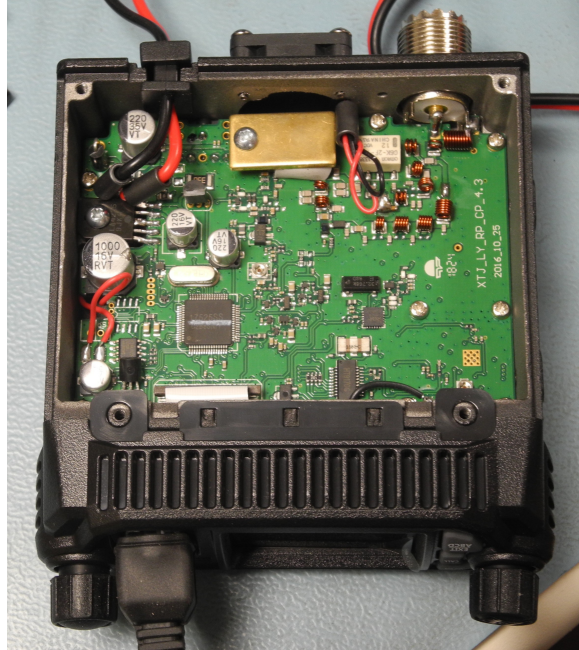
Issue #1: The radios obviously do not have any built-in high VSWR protection. A couple of Mike's support trucks lost their antennas due to low laying tree branches whacking them off. Then when they transmitted into an open antenna connector --- POOF !, the finals burned out. (granted, B-Tech warns about this in their instruction manual, page 17)

Issue #2: The radio's receivers are definitely NOT bullet-proof and up to the quality standards of a much more expensive Motorola radio. I have previously found the el-cheapo (\$30 or less), Baofeng UV-5R, dual-band (2m/70cm), hand-held was worthless when used in an intense RF active environment. When I tried to use mine for example with BCARES TV operations at the CU football stadium, it got clobbered by the multitude of various radio signals flying around the stadium. The squelch just stuck open with hash. Next to another ham transmitting on his HT, the receiver would totally block. My favorite radio for such an environment is still my old, trusty, rugged Motorola MT-1000. Built like a brick ! Only 16 channels and easy to use, but difficult to program. You have to have a friend with a special Motorola programmer.

So what happened with the mobile ? To learn how the UV-25X2 worked, I set it up in my ham shack and connected it to my Diamond X-6000 (2m/70cm/23cm) omni antenna which is mounted high up on my antenna tower at 45 ft and fed with 5/8" hard-line. Up there it can really hear a lot of stuff. With it I was able to even hit the Pike's Peak repeater in Colorado Springs, plus a whole lot more repeaters up & down the Front Range. So for the receiver, I then started listening to other stuff, such as FRS, GMRS, MURS, public safety, etc. When I set it up to scan the VHF MURS (5, unlicensed channels in the 150-160 range), I started to hear some weird stuff. What I heard was occasionally some garbled police and / or sheriff dispatch transmissions, and also sometimes bursts of the NOAA weather radio. These obviously were not MURS transmissions. Obviously, some nasty inter-mod and signal mixing was occurring in my receiver when certain combinations of strong signals were present. This would not have occurred using a higher price, higher quality Motorola, ICOM, Yaesu, or Kenwood radio.

Issue #3: This one is more minor in nature, but still an aggravation. The two small knobs on the front panel for controlling Volume and Channel Selection are not firmly attached. They kept falling off with use. There were no set screws in them.

**Bottom Line:** If cheap is the first requirement -- buy Chinese and live with the results. If you want quality, spend more \$\$ . These B-Tech (i.e. Baofeng) radios are in the throw-away class. \$115 for the 25 W radio and \$170 for the 50 W radio.



A peek inside the smaller UV-25X2

**FRIDAY HAM BREAKFAST:** Many Boulder area hams meet weekly for "ham & eggs" breakfast & eyeball QSOs at Doug's Diner. SE corner of Folsom & Arapahoe. The list has grown to over 20 by now. They include: Jim, KH6HTV; Gary, W0QN; Don, N0YE; Don, KR0E; Larry, K0PYX; Bill, AB0DH; Jim, W8ERI; Colin, WA2YUN; Ed, K0JOY; Pete, WB2DVS; Debbie, WB2DVT; Michael, KD0FDJ; Tommy, W0IVJ; Fred, N0OLZ; Mike, NJ0L; Jonathan, N3AJB; Gerry, WB6IVF; Dave, AD0MR; Jeff, KD0TLB; & Dan, WB0AIA. Many Boulder ATVers are in the group.

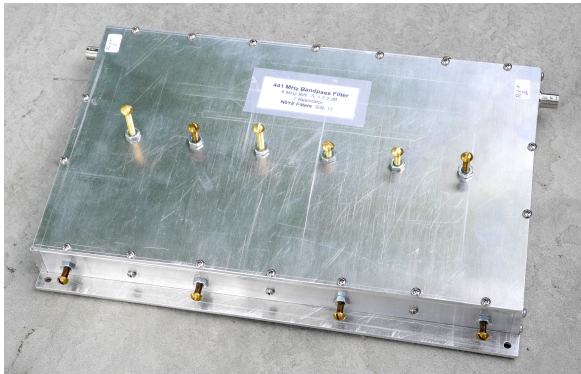
**PIKE's PEAK DTV DX-PEDITION:** On the July 4th, Boulder ATV Net, Don, N0YE, announced that he is planning to do an ATV DX-pedition to the summit of Pike's Peak sometime in July. His plans are to follow the SOTA (Summits On The Air) rules which require two way, simplex contacts with an exchange of information. He plans to do DVB-T definitely on the 70cm band, and possibly also on the 23cm band. He is looking to organize ahead of time a network of other ATVers to do 2-way ATV QSOs with him, or at least receive his DTV signals from Colorado's signature mountain. Later, if time permits, he will also try to hit the Boulder ATV repeater. If you are interested in participating, contact Don directly and get into his planning. Don's email is: [don80303@gmail.com](mailto:don80303@gmail.com)

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

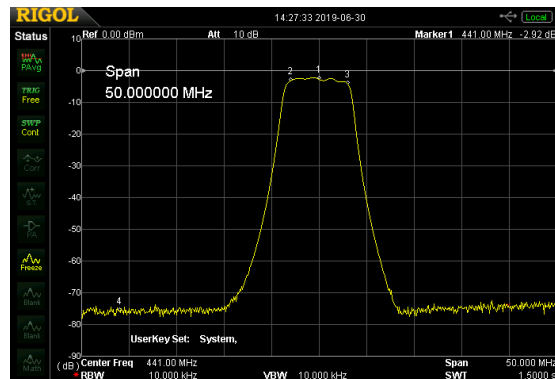
**BOULDER TV REPEATER REBUILD UP-DATE:** In the June, 2ed edition newsletter, pages 3-4, we reported on the discovery of a new HDMI Quad Viewer / Switch which also included an RS-232 interface. With this discovery, Don & I realized that we could probably solve a lot of the major input/mode switching issues we have with the old ATV/DTV repeater. That repeater was needlessly complex due to needing to have elaborate work-arounds for the old HDMI switch. In the meantime, Don, N0YE, has mastered how to write Arduino code to control, via RS-232, the new HDMI Quad box. Thus, Don has now removed the old TV repeater from the repeater site on Table Mesa and it is now in "bits & pieces" scattered all over the floor and work-bench in my ham shack. It is now being completely rebuilt to incorporate the new HDMI Quad Box.

In the meantime, Don installed at the repeater site, a temporary, portable ATV repeater. It was built several years ago by Jack, K0HEH, and Don. It is an in-band, 70cm only ATV repeater. Ch 60 input & Ch 57 output. It only functions in DVB-T mode. The transmitter output is about 1 watt. There are no control functions on it. It simply keys up when receiving a valid DVB-T signal and turns off rapidly when the signal disappears. There is no way to tone it down.

So far, I have rebuilt the repeater's receiver panel and the transmitter panel. Photos of the rebuilt receiver and transmitter along with schematic diagrams are on the following pages.



Don's NEW, 7 pole, 441MHz, BPF

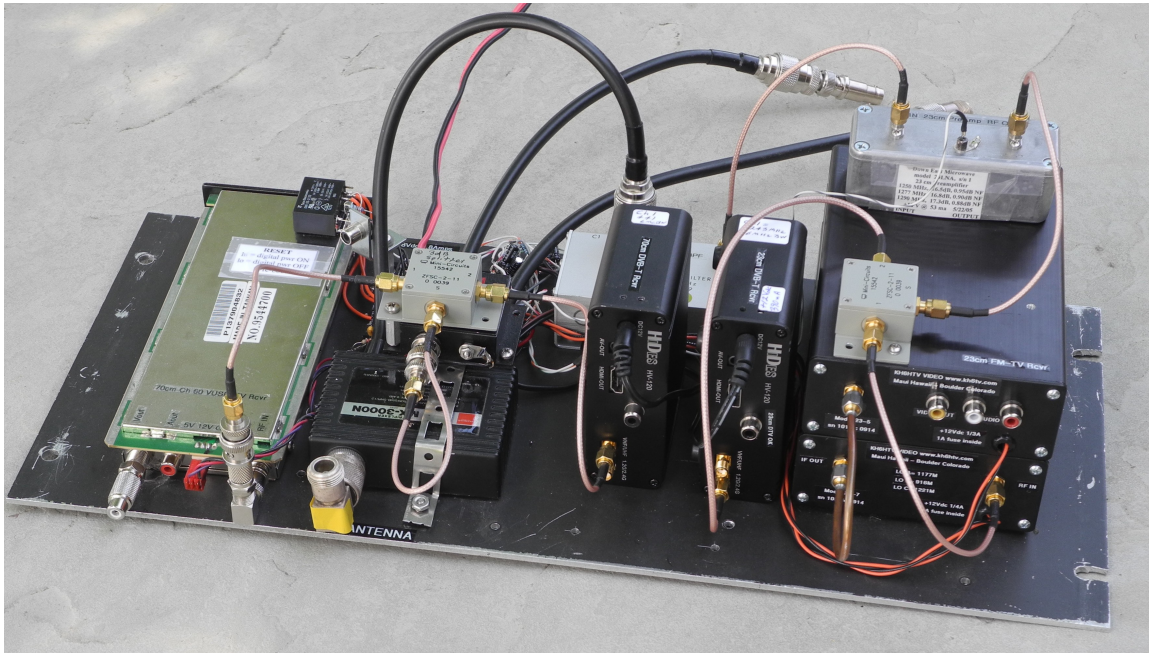


10dB/div & 5MHz/div -76dB noise floor

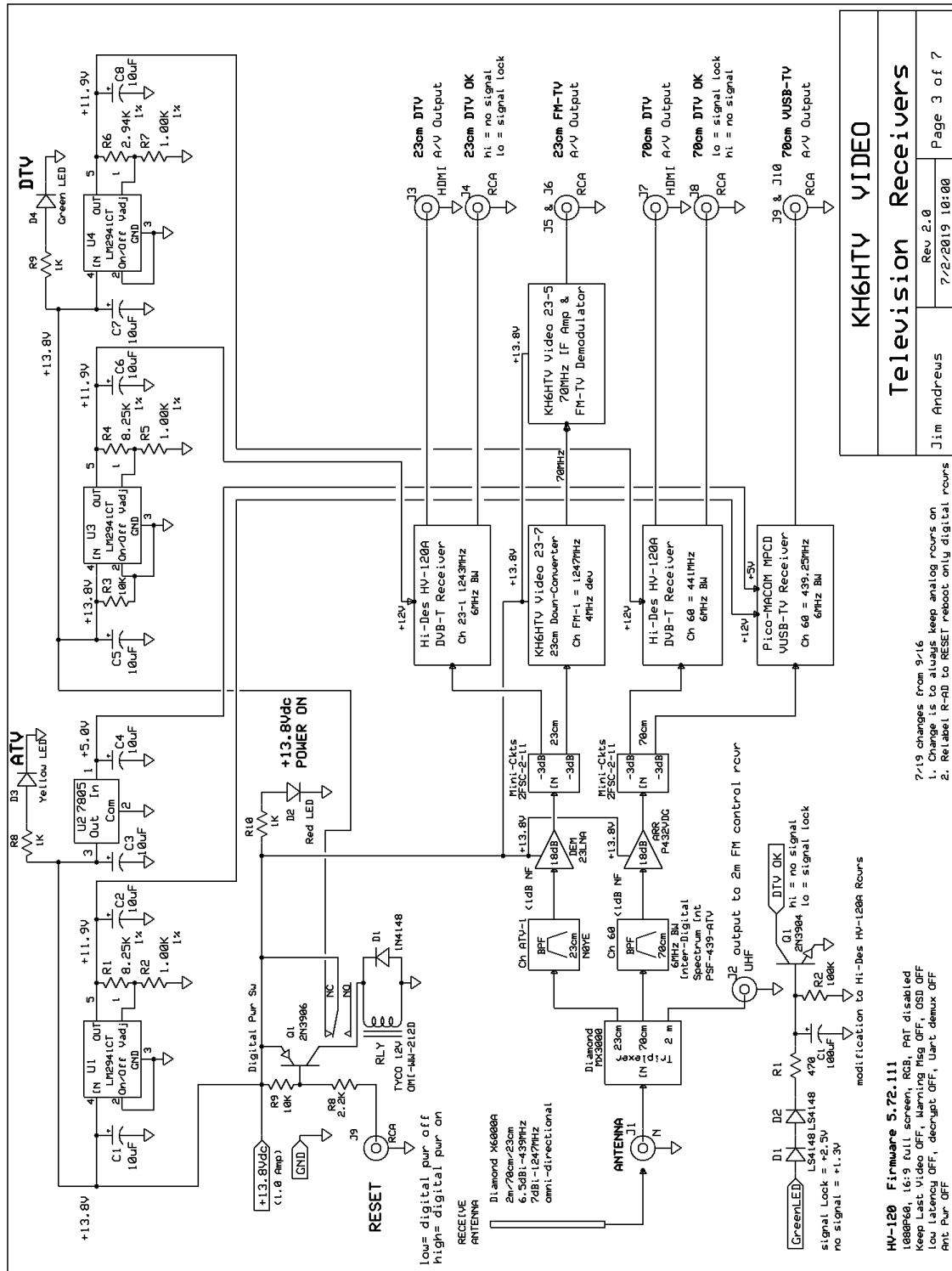
I removed the old Spectrum International, inter-digital, band-pass filters ( Ch 57 & Ch 60). I replaced the 70cm, Ch 60 receive filter with a new, home-brew, 7 pole, BPF built by Don. It has much steeper skirts on it. Particularly important for filtering out the severe 70cm RFI we have been encountering from strong ham FM repeaters in the 446-450 range and commercial FM signals in the 450-460MHz range. Don's new filter has 40dB rejection at 446MHz and up to 130dB rejection at 460MHz. Don's new filter is consider-

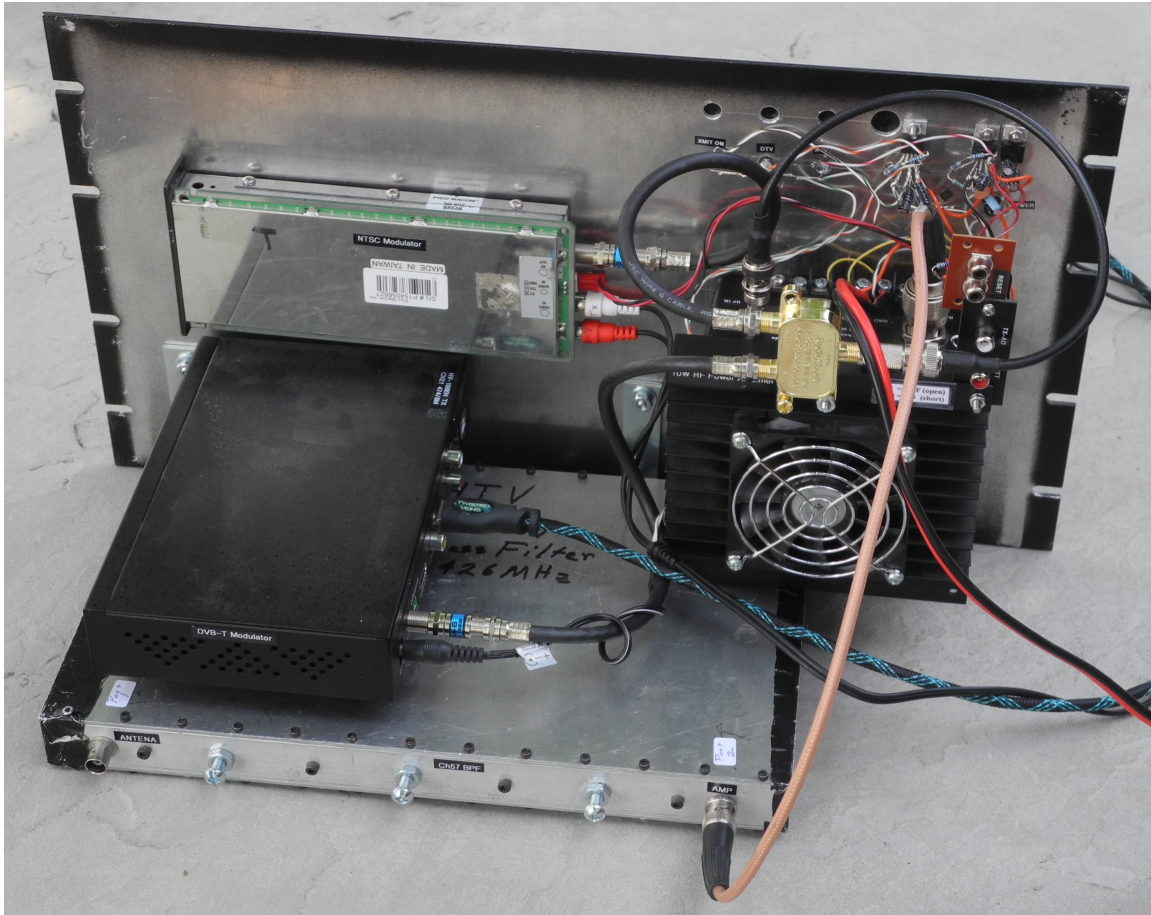


ably larger than the old SI-BPF. There was not room for it on the existing 19" rack panel. It will be mounted on a separate 19" shelf.

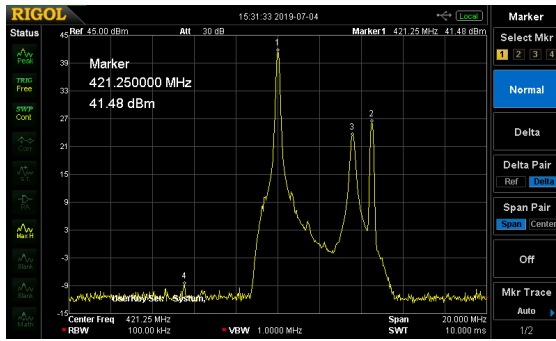


**ATV/DTV RECEIVER:** The receiver is dual-band and dual-mode. It has one common antenna input which goes to a Diamond triplexer which splits the receive signals into 2m (control), 70cm (TV) & 23cm (TV). There is a BPF following for each band. For 70cm & 23cm, there next is a low noise pre-amp which is followed by a 3dB power splitter. The outputs from the power splitters feed Hi-Des 70cm & 23cm DVB-T receivers and also analog TV receivers. For 70cm, we use a commercial Pico-Macom CATV, NTSC receiver. For 23cm, we use a KH6HTV Video FM-TV receiver.

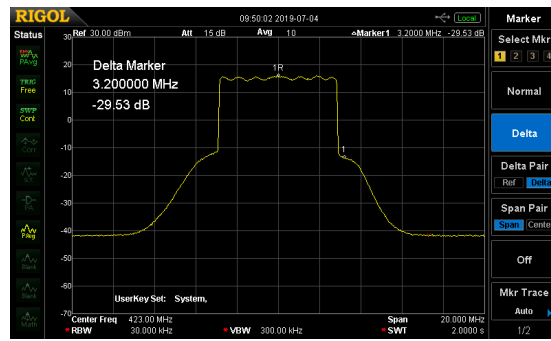




**ATV/DTV TRANSMITTER:** The transmitter is 70cm only on channel 57 (420-426MHz). However, it is dual-mode. It can transmit either analog or digital TV. The analog TV signal is created by a Pico-Macomm CATV modulator. It creates perfect VUSB-TV with nothing outside of the 6 MHz TV channel. The digital, DVB-T signal is created by a Hi-Des, DVB-T modulator. Likewise it is a very pure signal with essentially nothing outside of the TV channel. Both modulators feed a 75Ω, 3dB splitter used in the reverse direction as a combiner. The selection of either analog or digital is done simply by applying DC power to only the desired modulator. 75Ω pads are on the output of each modulator to provide Z back matching when a modulator is turned off. The output of the 3dB combiner then goes to a KH6HTV Video model 70-9B, RF Linear Power Amplifier. In analog TV mode, the amplifier puts out 22 Watts (PEP). In digital TV mode, the amplifier puts out 10 Watts (rms). The output of the amplifier is then routed to a Ch 57, 6 MHz, band-pass filter which has about 2 dB of insertion loss.

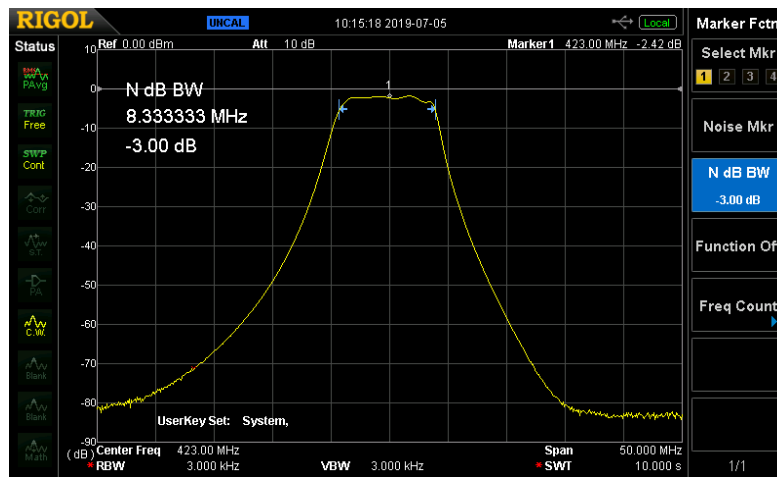


ATV spectrum with color bars  
6dB/div & 2MHz/div



DVB-T spectrum 10dB/div & 2MHz/div

note: spectrums drop well below the indicated noise floor on the spectrum analyzer

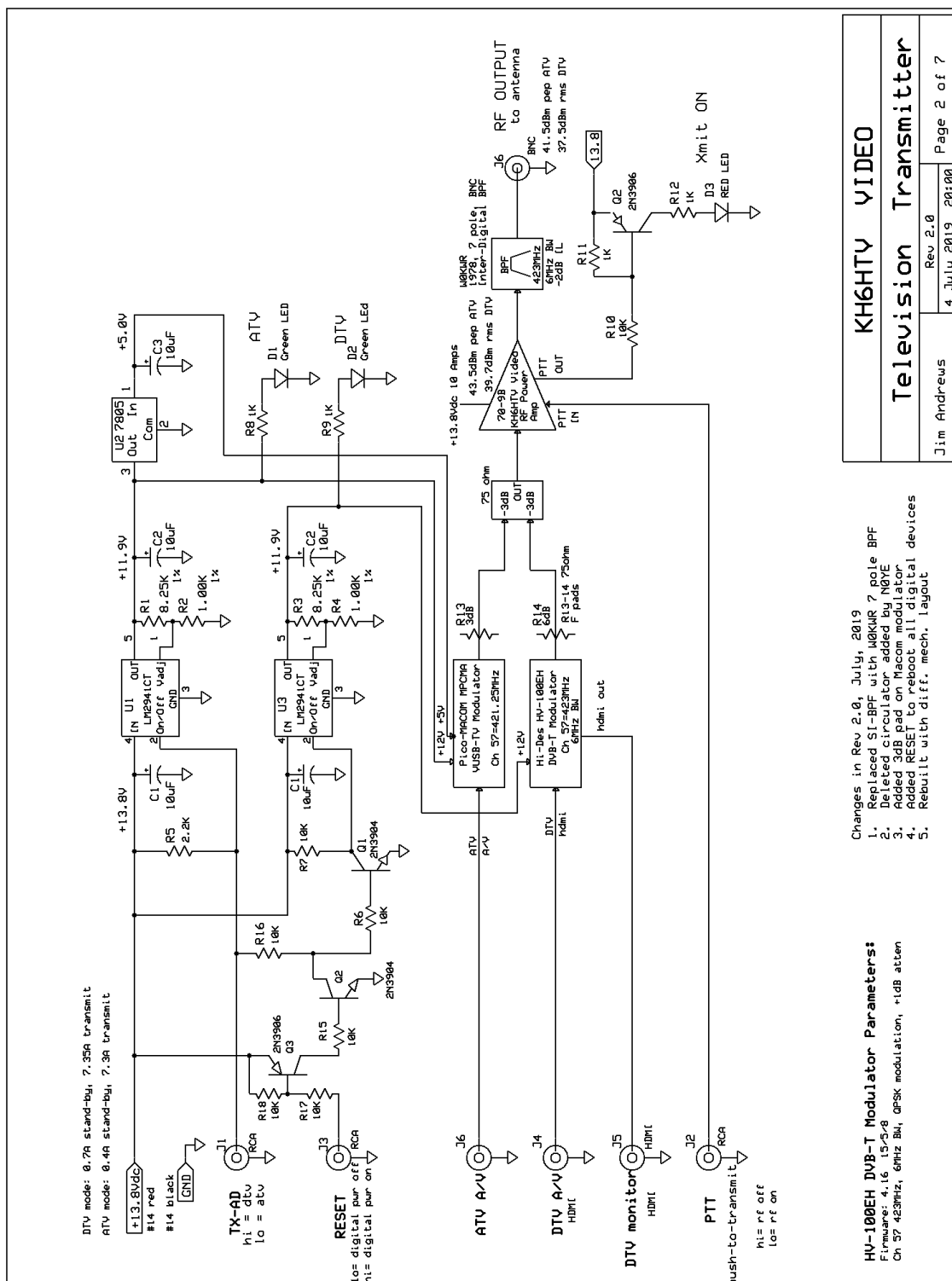


W0KWR, 7 pole, 423MHz, BPF 10dB/div & 5MHz/div.

Since the early 90s, the TV repeater has used a pair of inter-digital, band-pass filters made by Spectrum International. Like the receiver, I also removed the SI, Ch 57 filter from the transmitter this time. I have replaced it with actually a much older, but better filter. The filter I installed was made by John Shafer, W0KWR, (now SK) in the late 70s. John built it for the very first Boulder ATV repeater. It was a 7 pole design. I have just retuned it on my Wiltron 5447A Network Analyzer (10MHz - 20GHz). Tuning a filter is easier on the Wiltron compared to the Rigol spectrum analyzer because I can view simultaneously both S21 (insertion loss) and S11 (return loss). This 7 pole, Ch 57 filter does not have as steep skirts compared to Don's new Ch 60 filter. However, it still gives 31dB (429), 75dB (435) and 117dB (441) rejection for the upper adjacent TV channels.

The two Spectrum International, TV Channel Band-Pass Filters which I pulled from the repeater, I intend to resell. I will be listing them on my web site for sale at \$200 each.





1. Replaced SI-BPF with WOKUR 7 pole BPF
2. Deleted circulator added by N8YE
3. Added 3dB pad on Macom modulator
4. Added RESET to reboot all digital devices
5. Rebuilt with diff. mech. layout

**HV-100EH DVB-T Modulator Parameters:**  
Firmware: 4.16 15/5/8  
Ch 57 423MHz, 6MHz BW, QPSK modulation, +1dB atten

KH6HTY VIDEO	
Television Transmitter	
Jim Andrews	Rev 2.0
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