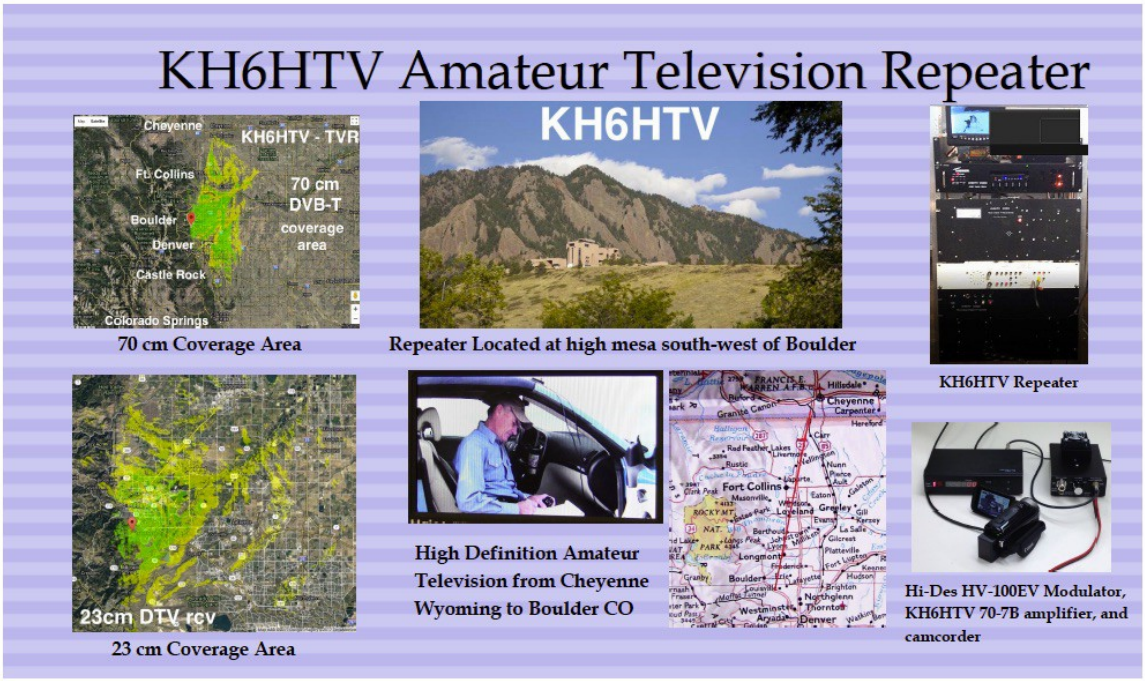
BOULDER TV Repeater's REPEATER

October, 2018

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

REPEATER STATUS: The repeater is alive and well and functioning normally. Details about the repeater are available on our web site: www.kh6htv.com AN-43 gives all the technical details.



Roger & Naomi's TV Repeater Banner

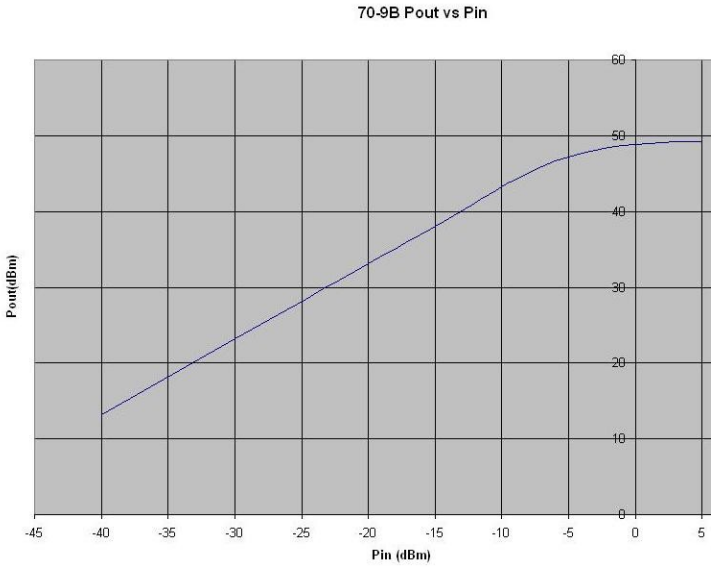
BARC SWAP-FEST: The annual Boulder Amateur Radio Club's Swap-Fest will be held this next Sunday morning, October 7th. It will be in the usual location of the Boulder County Fairgrounds, Hover & Nelson Roads, in Longmont. For more information, or table rentals, contact Mike Derr, W3DIF, at mderr44995@aol.com

The TV repeater will have a display table at the swap-fest. If you can help out at the table recruiting new ATV hams, then plan to drop by the table and talk up ATV to table visitors. Roger, K0IHX, & Naomi, KD0PDZ, have graciously donated a new, large, banner to be displayed behind the table. See above.

Amplifier Output Power for Various Modulations

The question often arises, for a typical class A-B, linear, RF power amplifier, how much power can I get for various types of modulation ? I performed a set of tests on one of my KH6HTV Video, model 70-9B, 70cm, amplifier to obtain some representative values. The tests were all performed on TV channel 60 (438-444MHz) with a center frequency of 441 MHz, or 439.25MHz for VUSB-TV. The table below summarizes the results I obtained. Full details are reported in my new application note, AN-46, available from my web site: www.kh6htv.com

I sent a complimentary copy of AN-46 to the BATC in the U.K. The editors of the monthly, electronic, U.K. newsletter, ***CQ-DATV***, immediately wrote back and requested permission to publish it in their next newsletter. It is now available in full in issue 64, Oct. 2018, on pages 17-27. This and all past issues of ***CQ-DATV*** are available from their web site: https://www.cq-datv.mobi/ebooks.php



Model 70-9B Amplifier Output Powers

MODULATION	P(out) dBm	P(out) Watts	Power type	notes
CW	49	80	rms	
FM	49	80	rms	
AM	41	12.5	rms	
AM	47	50	PEP	@99% mod.
SSB	47	50	PEP	@ -1dB
VUSB-TV	44.5	28	PEP	
QPSK - DTV	39	8	rms	
16QAM - DTV	38.5	7	rms	
64QAM - DTV	37.8	6	rms	

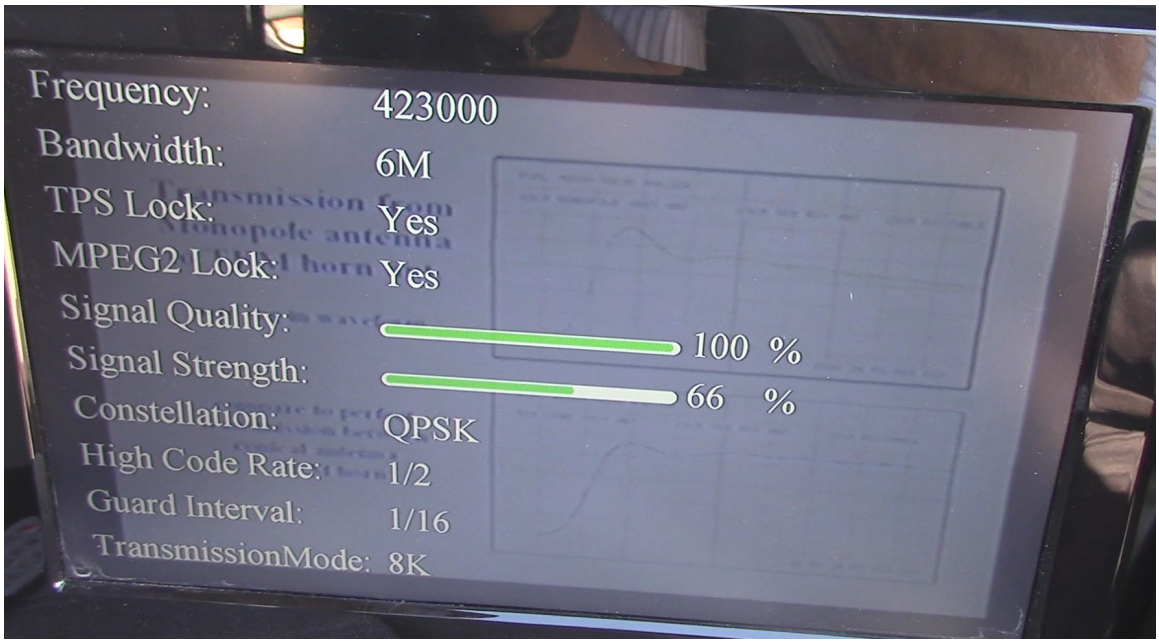
NEW VIEWER: We welcome another new DTV viewer. He is Gary Sutton, WB5PJB, from Castle Rock. During our Thursday afternoon net on the 13th of Sept., I received a "chat" request on the BATC streamer from Gary, asking that we please leave the TV repeater on after the net so he could set up and try receiving the picture in south Denver. Later that evening, Gary sent me the following e-mail.

Jim and Don, thank you for leaving the repeater running after the net today. That allowed me time to stop at the Cabela's parking lot near I-25 and Ridgegate Pkwy., which is a little over 38 miles from the repeater, and see if I could receive the repeater's transmission. That location has a clear view in the direction of the repeater, and has always been an easy location to receive the 2.4 GHz mesh node at NCAR.

I used a 5-element OAL 70 cm Yagi as the antenna and the HV-110 receiver, with a DEMI preamp inline. I got a signal right off the bat, so it didn't take a lot of work. The copy wasn't great at first, but then I did some antenna placement adjustments and it got to be quite good with just occasional dropouts. It seemed like the HV-110 had issues when displaying on-screen stats overlayed on the video, as if it has trouble doing both things at once. Get rid of the stats overlay and the video reception improved.

A couple of photos attached. I recorded some video, as well, but those files are too big to email.

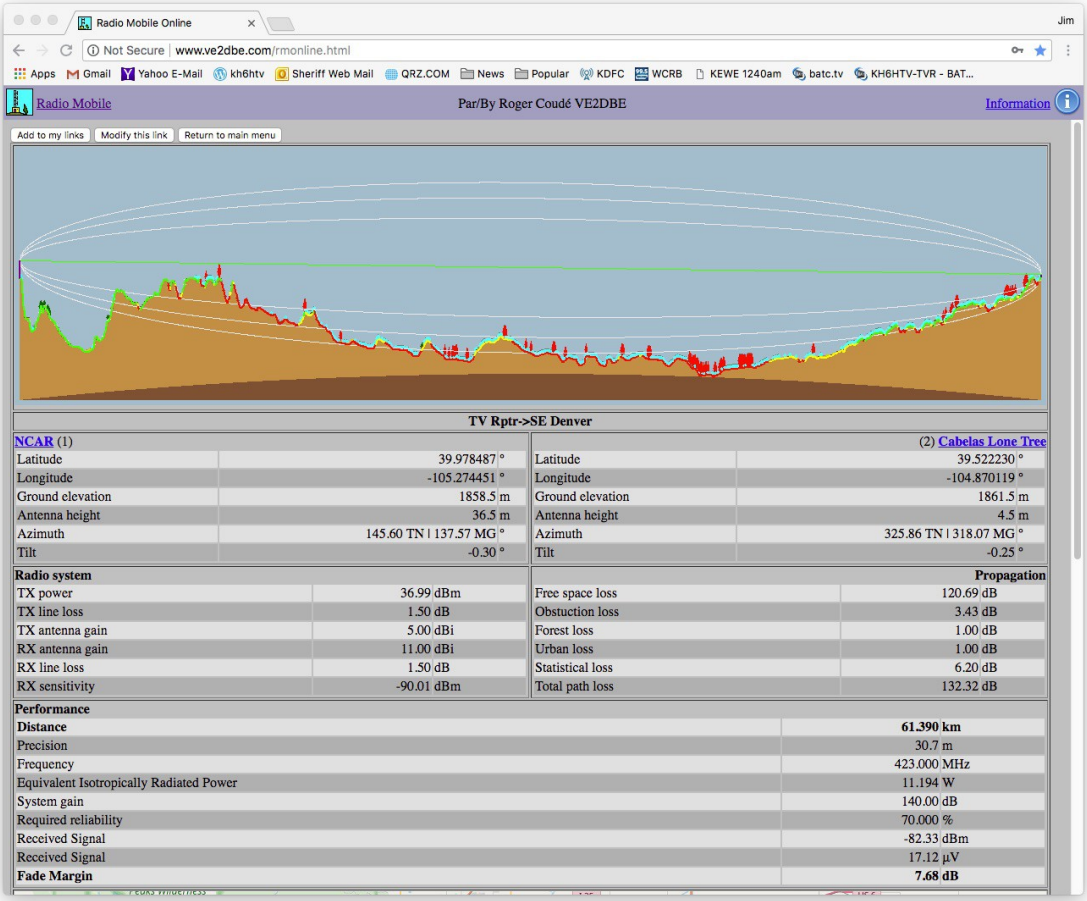
The repeater seems to be working quite well! I will have to try transmitting to the repeater some day. 73, Gary, WB5PJB



Confirmation photo of WB5PJB's reception of the TV repeater on 13 Sept.

Gary's Yagi in Cabela's parking lot

telephoto view from Cabela's to Boulder



Radio Mobile Online

Not Secure | www.ve2dbe.com/rmonline.html

Apps Gmail Yahoo E-Mail kh6htv Sheriff Web Mail QRZ.COM News Popular KDFC WCRB KEWE 1240am batc.tv KH6HTV-TVR - BAT...

Radio Mobile Par/By Roger Coudé VE2DBE Information

Add to my links | Modify this link | Return to main menu

TV Rptr->SE Denver

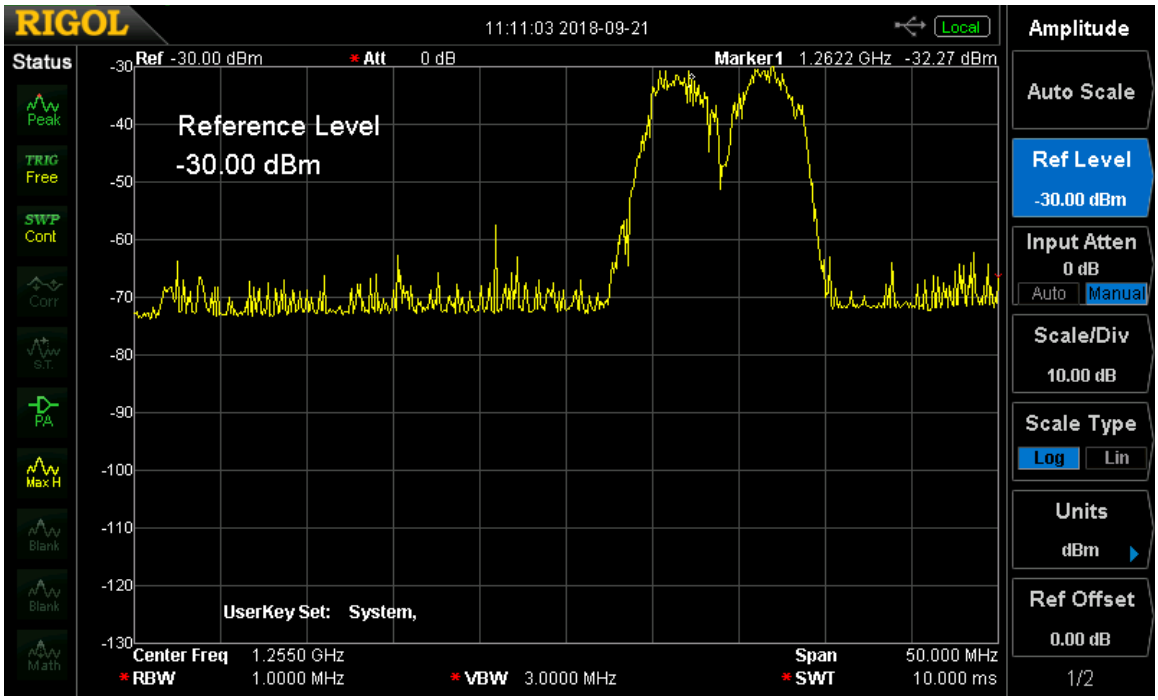
NCAR (1)		(2) Cabelas Lone Tree	
Latitude	39.978487 °	Latitude	39.522230 °
Longitude	-105.274451 °	Longitude	-104.870119 °
Ground elevation	1858.5 m	Ground elevation	1861.5 m
Antenna height	36.5 m	Antenna height	4.5 m
Azimuth	145.60 TN | 137.57 MG °	Azimuth	325.86 TN | 318.07 MG °
Tilt	-0.30 °	Tilt	-0.25 °

Radio system		Propagation	
TX power	36.99 dBm	Free space loss	120.69 dB
TX line loss	1.50 dB	Obstuction loss	3.43 dB
TX antenna gain	5.00 dBi	Forest loss	1.00 dB
RX antenna gain	11.00 dBi	Urban loss	1.00 dB
RX line loss	1.50 dB	Statistical loss	6.20 dB
RX sensitivity	-90.01 dBm	Total path loss	132.32 dB

Performance	
Distance	**61.390 km**
Precision	30.7 m
Frequency	423.000 MHz
Equivalent Isotropically Radiated Power	11.194 W
System gain	140.00 dB
Required reliability	70.000 %
Received Signal	-82.33 dBm
Received Signal	17.12 µV
Fade Margin	**7.68 dB**

Radio Mobile -- RF path loss prediction from TV repeater to Cabela's in S. Denver

I later did a *Radio Mobile* path loss calculation for Gary's location and it predicted the received signal strength would be -82dBm. Gary later confirmed that in fact -82dBm was what his Hi-Des receiver measured.



Results of 12 hour band scan of 23cm band. Center frequency = 1255 MHz. Span = 50 MHz, 10dB/div & 5MHz/div.

23cm Radar RFI In general, the 23cm band is very quiet with very few users, except for our occasional ham TV activity at the bottom end of the band. The sole exception is a military radar at Buckley field, east of Denver. The above photo shows a band activity measurement I made recently from my QTH in Spanish Hills, SE of Boulder. I used my Diamond X-6000, tri-band antenna at 40ft. feeding into my Rigol DSA-815 spectrum analyzer. The spectrum analyzer was put in the peak hold mode and left running continuously for about 12 hours. The two large peaks seen in the above photo are the radar signal.

I made several measurements on the radar signal and came to the following conclusions:

1. The radar is dual frequency at 1261.25 & 1266.5MHz.
2. The radar's -3dB BW is about 2 MHz
3. The radar's PRR is 286 Hz, T = 3.5 ms, thus it's range is about 500km ≈ 300 miles
4. The radar's antenna rotation period is 12 seconds, i.e.5 rpm
5. The radar's antenna front to back ratio is about -33dB

My location is shielded by Davidson Mesa from direct exposure to the Denver radar. What I am seeing is reflections off of the Flatiron mountains to the west of me. Even so, the radar's mega-watt power is very strong at my QTH. At the TV repeater's location on the high mesa, south-west of Boulder, it has a direct line of sight path to Buckley field and the radar. The repeater is thus exposed directly to the extremely strong radar pulses.

The TV repeater used to use 1277.25 MHz as it's CCARC assigned input frequency. When the new Buckley radar came on line in 2012, it immediately rendered the 23cm input to the repeater inoperatable. We solved the RFI issue by (1) petitioning the

CCARC to move our input frequency to the bottom 6 MHz channel of the 23cm band and (2) installing a new, band-pass, band-reject filter on the repeater's 23cm receiver. The new filter came from Don, N0YE's, microwave junk box. With it we were able to have a pass band from 1240 to 1252 MHz and -60dB notches in the 1260-1270 band. In general, this filter seems to be working well for us and protecting the repeater's 23cm receiver.

23cm Amp Modification -- Most Boulder ATV hams are now using the 23cm, DVB-T input to the repeater. Also most of these hams are also using my model 23-11A rf linear power amplifier. I recently did a recall notice to the Boulder area ATV hams on this amp offering an upgrade in output power. Here is the background history on this amplifier.

I originally designed the 23-11A in 2016. I used a MOSFET brick amplifier module as the major component. It was rated for operation from a 12V power supply with a gate voltage of +5V. The manufacturer's specs. said the brick should run at a drain current of 4 Amps and put out in excess of 30 Watts saturated power. The prototype amp which I built did in fact meet these specs. For linear service with DVB-T signals, I got about +35dBm (3 watts) rms power output of the amplifier.

Fast forward to 2017, trying to build more of these amplifiers, I ran into a problem of burning out several very expensive ($$$) brick modules. What I discovered was that running the mfgr's recommended gate voltage of +5V, caused thermal runaway. As the gate voltage was slowly brought up from zero, the drain current started rising very rapidly as one approached 5V. Thus, to be able to build a reliable amplifier, I found it necessary to limit the gate voltage to < 5V. The next amplifiers, I built in 2017-18, I built all with a control on the gate voltage limiting the idling current to the 4 Amps of the original prototype. Unfortunately, the result was I no longer was able to achieve +35dBm output power for DVB-T service. Instead it was more of the order of +33dBm (2 Watts), a loss of 2dB. Obviously something had changed in the more recent production runs of the brick amp module.

Recently, with a new order for another 23-11A, I decided to experiment with higher drain currents to see if I could get back up to the +35dBm level for DVB-T. This involved carefully setting the gate voltage higher, but not up to +5V. Pushing the idle drain current up to about 6 Amps, I was in fact able to again get to about +35dBm. Thus the recent recall to the Boulder DTV hams. This past week, I have done the Vg mod to a total of 6 amplifiers. I ran the amplifiers key down at 100% duty cycles for long periods of time to verify they would survive typical ATV 100% duty cycle service. All of the amps performed very similarly. They were all set to idle currents of about 6.5 Amps

All of the amps were carefully tested for many different parameters and they were all found to perform similarly. I tested them over the entire 23cm band from 1240 to 1300MHz. The gain curve peaked on all of them at 1270 MHz with the best performance on all parameters peaking at 1270MHz. I have analyzed the data on this test run of six amps and found the average performance to be: small signal gain, S21 = 51dB, -1dB gain compression = +43dBm (20 watts), saturated output power = +45dBm (32

watts), and DVB-T output power = +35dBm (3.2 watts). The dc current draw at +13.8Vdc was 6.6-7 Amps for DVB-T service and about 10 Amps for saturated output.

Hi-Des Service: I recently had a HiDes HV-320 failure. I confirmed the failure with a friend (to be sure it wasn't my error) before I e-mailed HiDes. My warranty repair request went to Calvin Yang. He promptly replied and gave me the address to send the HV-320. The USPS indicated it would take 3 or more weeks to arrive in Taiwan. I was very surprised to see the repaired HV-320 arrive at my home in less than 2 weeks!! It powered up immediately and works normally. A warranty repair that was a nice experience. I thought you all would like to hear. The only cost to me was shipping.

73, Fred Merker, K3TAZ, k3taz@hotmail.com

Off to Maui Janet & I will be leaving soon for our winter home on the island of Maui, in Hawaii. We will return next May. I would appreciate it if you do not discuss our absence on the 2m BARC voice repeater. It is a large "party line" with unknown listeners, including potential crooks. During my absence, if there are any issues with the TV repeater, please contact the asst. trustee, Don, N0YE. I will try to check into the TV net occasionally using the BARC remote base station and hopefully watching the BATC streaming video.

BATC STREAMER Volunteer Needed In my absence, the streaming of the TV repeater's video to the BATC will be discontinued, unless another member is willing to step forward and take over the streaming. Any volunteers ? ? ? If you are interested, please contact me soon and I will give you instructions on how to set up the steaming service from your home QTH. The steaming does not need to be 24/7, but can be done only during the Thursday afternoon TV nets and any other time you notice the repeater is in use.

Remote Receiver Volunteer Needed Likewise, in my winter time absence, the remote 70cm to 23cm receiver link to the TV repeater will be off the air. For any DTV ham with 70cm receiver and 23cm transmitter, the set-up is very simple. You only need to do a simple mod to either your "combo" receiver or your Hi-Des receiver to pick off a Valid Signal logic to drive the amplifier's PTT line. I can help you make this mod. Interested ? -- please contact me soon. Bill, AB0MY, is planning to set up doing this from his QTH in north Boulder. Are there any other volunteers, especially from further out on the plains with views back into the mountains ? We could easily use multiple receive sites.

FREE 70cm ANTENNA: I have a surplus, 70cm, yagi antenna. It is free to an interested local ATV ham. It is an old KLM yagi with 10 elements on a 6 ft. boom with a type N connector. It is end mounted. It is broad band and covers the whole 70cm band with about 14dBi gain. It is missing the mounting, U-bolt hardware.

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