Boulder Amateur Television Club
TV Repeater's REPEATER

Febuary, 2021
3ed edition

BATVC web site: www.kh6htv.com

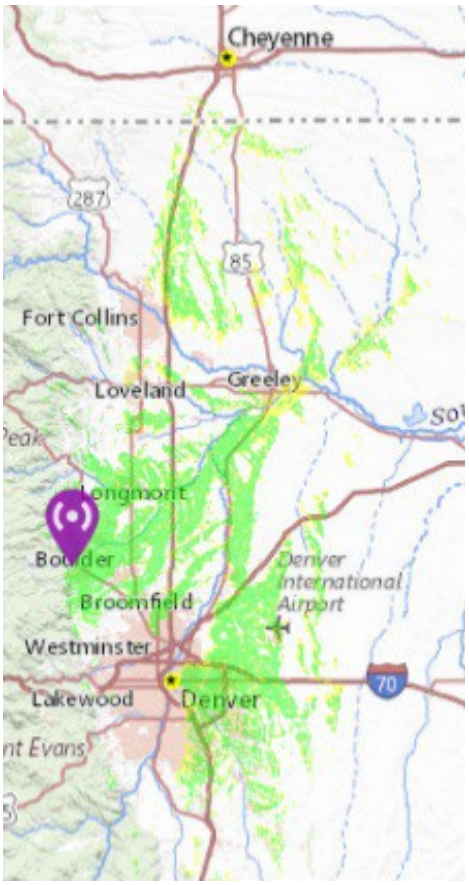
ATN web site: www.atn-tv.com

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

5.9 GHz, FM-TV -- How Far Can You Go ?

W0BTV - 5GHz, FM-TV BEACON

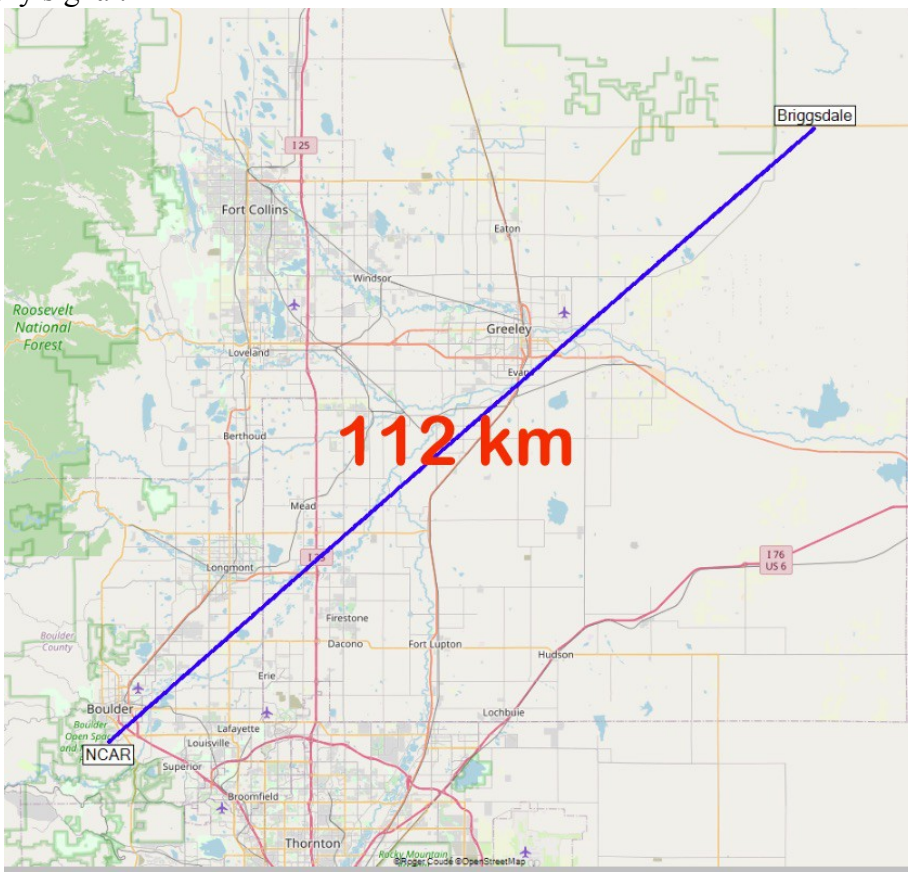
Back in September, we reported in our newsletter, issue #58, that we had finally been able to get our new 5.905 GHz, FM-TV beacon transmitter on the air from the repeater site. The transmitter now radiates on a 24/7 basis, 2 watts of power via a 10dBi, omni-directional, horizontally polarized antenna. On page 2 of issue #58, we published a map generated by *Radio Mobile*, showing the predicted coverage area of the beacon. Then in our October issue #60, we published an article with a table showing the various locations where we had verified reception of the beacon's signal. The farthest distance reported then was 62 km to Daniels' Park, south of Denver, by Gary, WB5PJB. Gary used a 30 dBi dish antenna and received a P5 picture. All of the rest of the sites tested were using a 23 dBi dish antenna. The other farthest sites tested in October were to the north-east at Twin Mounds (47 km, -88dBm) and Loveland Airport (56 km, -95dBm). The *Radio Mobile* map prdicted that our coverage area should be almost twice what we had verified in October.

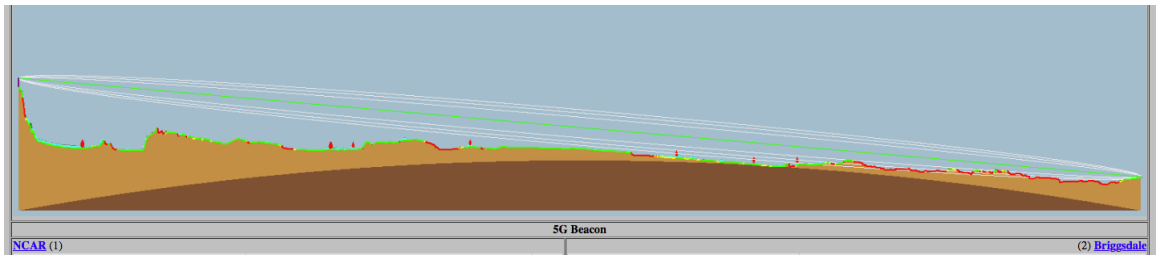


W0BTV 5.9GHz coverage map

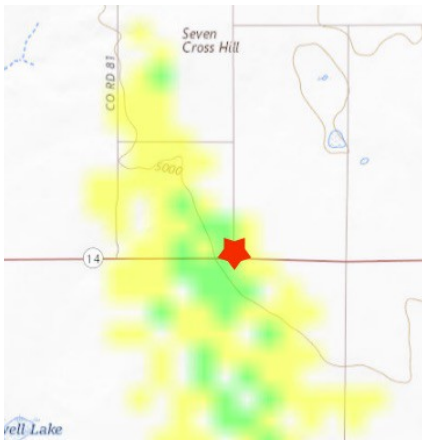
On January 31st, Jim, KH6HTV, & Janet decided to take a long Sunday drive to break out of covid-19 induced cabin fever. So Jim asked Janet if it was ok to drive north-east and check out the beacon coverage. Janet agreed. Two sites were picked to check out. The first site was north-east of Greeley at the intersection of highways CO-263 & CO-392. The second, farthest site away on the *Radio Mobile* map was east of the tiny town of Briggsdale on highway, CO-14 and the intersection of Weld County road 83.

The first site was 83 km from the ATV repeater. *Radio Mobile* predicted the signal strength to a 23dBi dish antenna would be -90dBm. Arriving at the site, I didn'like the immediate surroundings, so I drove about 1/2 mile further north on a county road to higher ground. I set up the 23 dBi, BBQ grill, dish antenna and FM-TV receiver, but did not find any signal.

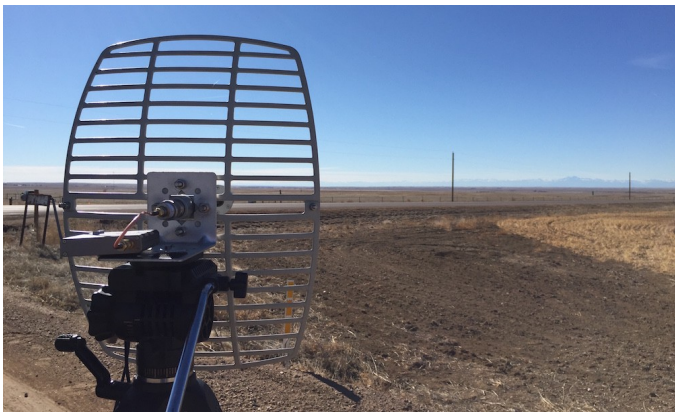




TV Repeater to Briggsdale site -- RF path profile, from *Radio Mobile*

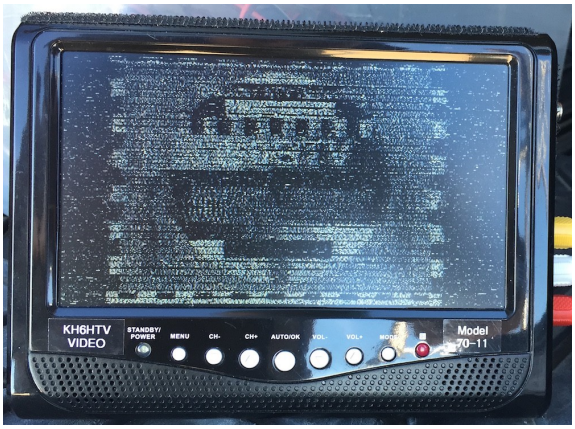


Briggsdale site: Yellow shaded area is -95 to -85dBm. Green area is > -85dBm



23dBi Dish Antenna looking south-west

We then drove on to the second site, east of Briggsdale. We were now 112 km from the repeater and had a very clear view, everywhere. Although the topo maps said we were on Seven Cross Hill, at an elevation of 5,050 ft. it certainly didn't feel like a hill. We were on very flat, treeless prairie for 360 degrees. The photo shows the view through the BBQ grill antenna looking to the south-west back towards Boulder, The Rocky mountains are visible low on the horizon. After setting up the dish antenna and as soon as I connected it to the FM-TV receiver, I exclaimed to Janet -- "I already have a signal!" It was P0, sync only at that point, but a TV signal which opened video squelch.



I had not yet even gotten the compass out to orient the antenna, but had just pointed it in the general direction of Boulder. I then tried to optimise the antenna pointing. It was very touchy and I lost the signal with just minor movements of only a few degrees. After locking the antenna down, I noted that there were definite flucuations in the rf path propagation and the quality of the image varied fairly rapidly from P0 to P2 at best. I tried taking a lot of photos of the various images in the repeater's 30 second slide show. The two shown here were the best photos, I was able to grab. I did see a few images that were slightly better with some color. The dish antenna was at a height of about 1.5 meters. When I cranked the antenna tripod up to about 2 meters, I lost the signal completely. *Radio Mobile* had predicted the signal strength would be -84dBm. But

based upon, the pictures I received, I estimate the best signal was perhaps -95 dBm. The video squelch, weak signal threshold on the 7" Haier video monitor I used with the 5 GHz, FM-TV receiver had been measured on my test bench at -100dBm.

Conclusion: **YES, we can go at least 112 km (≈70 miles) with our 5.9 GHz, FM-TV beacon !**

Jim, KH6HTV

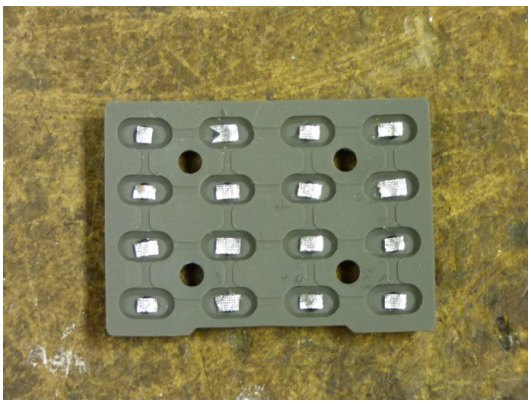
HF SUPER STATION: After leaving Briggsdale and the above 5GHz quest, Janet & I drove west on highway CO-14. We soon passed by a house out on the flat prarie with a half dozen, tall towers with HF yagi antennas. I said to Janet "Whow, look at that ham station". I thought to myself, I wonder if that is BARC member, Rob's station. So upon returning home, I fired up the computer and checked out haminfo.tetranz.com/map (recall we mentioned it in the Oct. 2020 newsletter issue #60) Well sure enough it was in fact, NC0B, Rob Sherwood's station. Want to find out more ? Go to Rob's web page on www.qrz.com (NC0B) for more photos and description of his super station. Rob is famous in the ARRL for his extensive reviews of HF transceivers, dating back to mid 70s with the Drakes. The ARRL has accepted and now uses Rob's test proceedures, etc. for their evaluations of new HF gear.

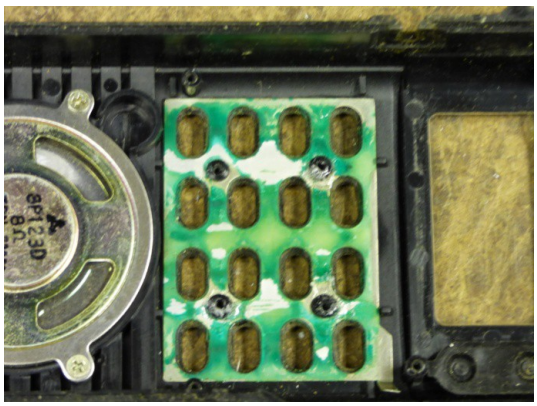
ATVer Publishes in QST

Last spring, John, WB0CMC, from Omaha, Nebraska, sent us a short article for this BATVC newsletter. At the time, I told John, this is great, but it needs a bigger audience. You should send it instead to QST for their "Hints & Hacks" section. So, John sent it to QST. Well, guess what? QST accepted it and it is published in Feb. 2021 issue on page 54. So now, here is what John sent us. It is very similar to what was published in QST.

A Fix for Conductive Rubber Key Pads

I have found a good way to fix key pads that use the conductive rubber contacts. I have an Icom 24AT that the buttons had gotten really flakey. I've fixed other key pads so I did it on the 24 AT today. It requires a bit of dexterity but works well. I cut a thin strip from a gum wrapper and cut that into small squares. Next, using the tip of an exacto knife, or something equally fine, I put a tiny bit of silicone caulk (RTV) which cures flexible and attached the foil to each button. See pic. Let it cure for several hours and it is a permanent fix. Gum wrapper is ideal since it has a thin paper backing that adheres well with RTV.





The inside of the front needed a bit of repair to the 4 plastic rivets holding the shield with some good plastic cement and it was ready to re-assemble. The key pad works great again. Just remember: Foil side out, heh heh.

I also replaced the PTT switch a while back which had nearly quit. It was available from Mouser for under a buck. Even with shipping, cheaper than from Icom.

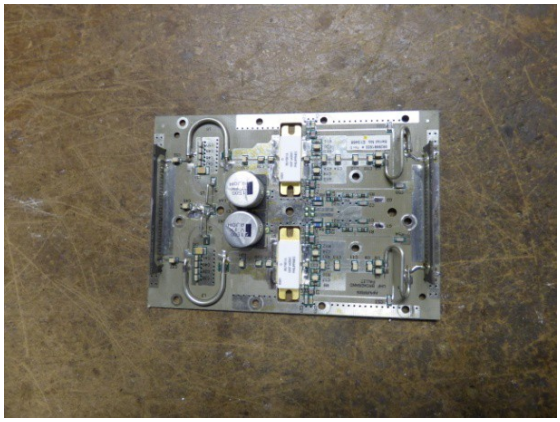
73 de John, WB0CMC

A Cheap ATV Amp for 420-450 MHz

John, WB0CMC

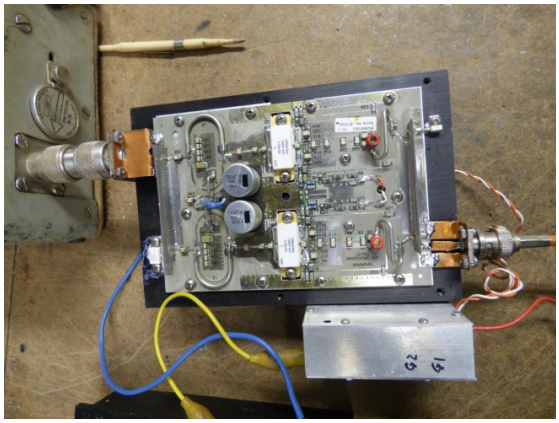
A few weeks ago I acquired a UHF module from a digital transmitter that is being retired. It contained 9 amplifier boards, each with a 300 watt capability. One drove the other 8 for a combined output of about 2400 watts. They were speced from 470-800 MHz. I wondered if they would work down in the Ham band. There were also 5 DC-DC power supplies to run them. The boards run on 32 VDC

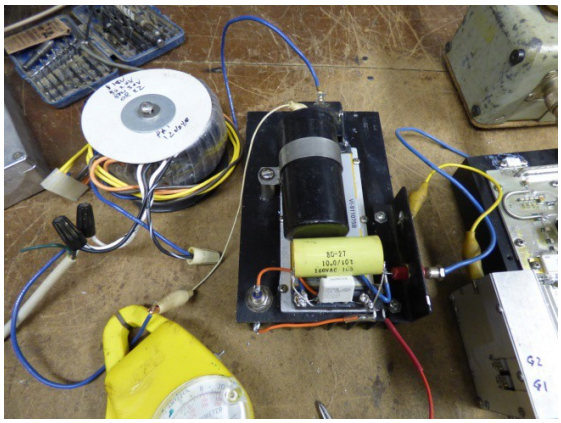
Power supply, 375VDC in
32VDC out @ 18 A max.



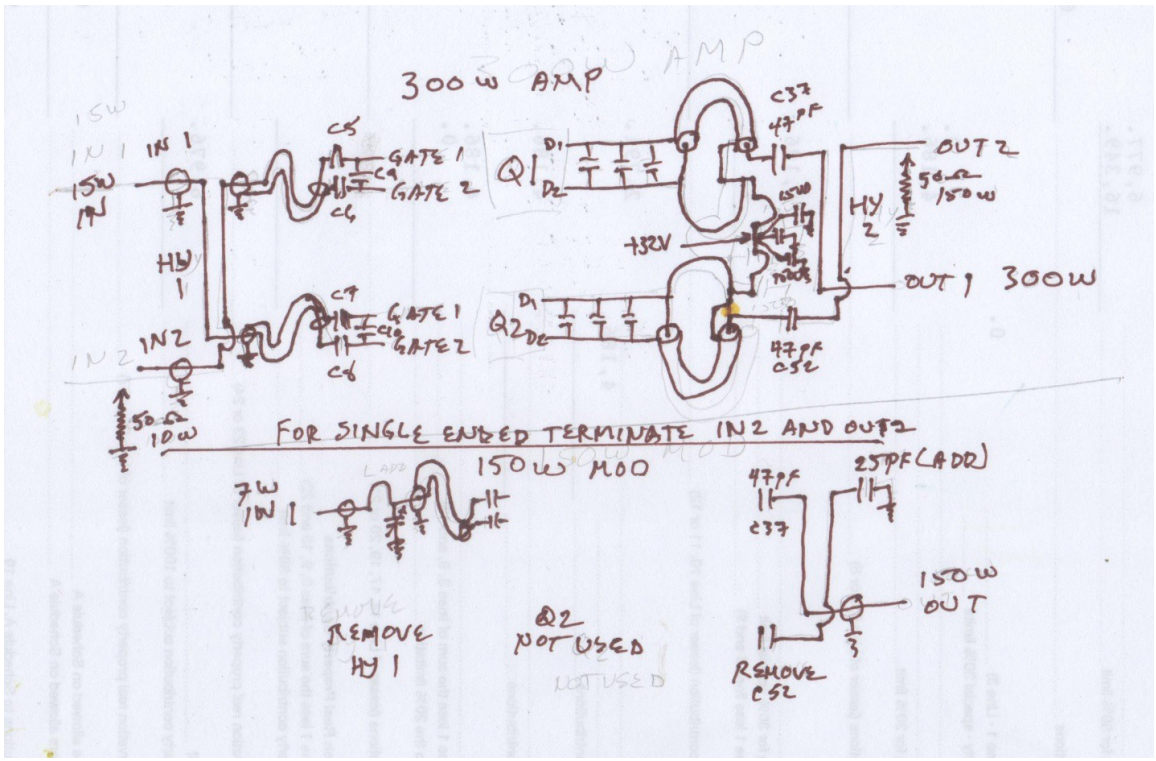
Original 300 watt board.
It takes 15 watts of drive.

With minor modifications they do work fine at 434MHz. Each board will operate either single ended or dual IO. They have a 13-14dB gain and run class AB. For ATV I found a static bias of ½ A per device is adequate for good linearity and gain. Efficiency is about 25-30%. A 300 watt board modified for 434 is shown below. This is connected for single ended operation. The unused in and out are terminated in 50 ohms mounted to the heat sink. The two trimmers (red) are 3-20 pF caps and optimize the input match. No other mods are necessary. The box on the side is the gate bias control. The blue wire is the 32 Volt supply line. Power supply for this amp is on the right.

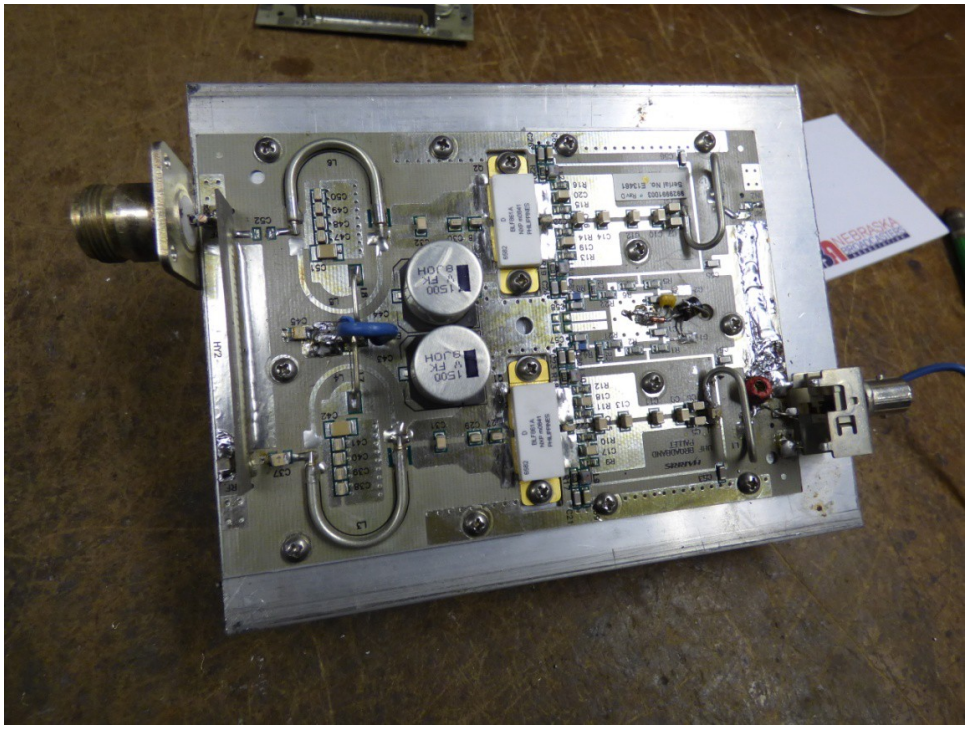




Primary power at 240 volts is about 2.5 A at 300 watts CW. I used a dual primary transformer to get 240 VAC to rectify. I also added the 20 volt winding in series to get 260 AC which gives about 355 DC filtered for the converter. A 15 watt PC electronics TX with color bars gives 175 watts on the bird. Killing the ped and video it goes to 300+ watts. I will have to add a fan to this for longer transmit times since it does get pretty warm. Following is briefly what the amp is.



For a single 150 watt amp and a lot less heat to dissipate, it only draws about 9 amps at 150 watts CW, remove the input hybrid (HY1)and put a small loop and trimmer shown as the 150 W mod. Remove C52, the output cap of the unused half and add a 25pF at the out 2 terminal.



The little circuit in the middle is a 78L05 for biasing the gates. It needed a diode to ground from the regulator to get the 5.7 volts needed to give about ½ A static bias. The input cap is, again for matching and will have some effect on sync level but it is a set and forget adjustment. The unused side should have no gate bias.

The transmitter that these came out of was a Harris and ran on 480 VAC. The rectifier for the module used a "Y" connected bridge rectifier and cap to give the 375 volts DC for the inverter. The inverter will put out 32 volts with only 240 DC in but I doubt it would have much current capacity. At 350 it will run any of the configurations shown here.

I've got 3 of these 150 watt mods out there now with my 7 watt ATV transmitters and they do work well. 7 watts seems to be a perfect match for the 150 watt mod. It's been fun.

John, WB0CMC

Editor's Note: *John says he has talked to the engineer from whom he got these amplifiers. The engineer told John he can have more modules if he wants them. So John is offering to obtain them for other ATVers. If you are interested in one of these amplifiers, contact John directly for details. His e-mail is: wb0cmc@cox.net*

NEWS from other ATV Clubs:

VK3RTV -- Peter, VK3BFG, reports in the North East Victoria Amateur Radio Club newsletter, upgrades he is making to their ATV repeater. They will be replacing their SD encoders with HD and moving to DVB-T2 for their transmitter. There are also new combo receivers for the input which will accept both DVB-S and DVB-S2 seamlessly.

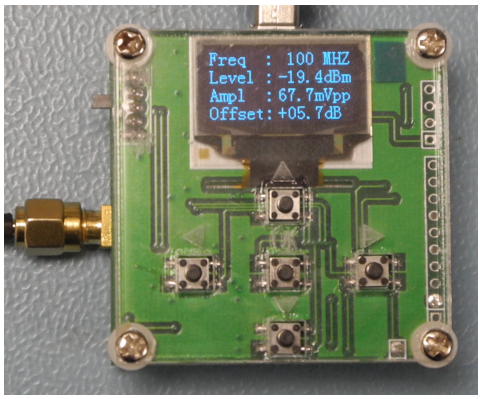
FEEDBACK:

SDR TV Dongles -- Daniel, VE7LCG, has sent us a You-Tube video he has found on how to use these dongles for DVB-S. It is entitled " RTL-SDR HackRF ETC Decoding DVB-S DATV on Windows with SDRAngel" The video is posted by a group called Signals Everywhere. The URL is:

https://www.youtube.com/watch?v=Bb8S_J9peD8

If you have questions? - contact Daniel at danielromila@gmail.com

DATV RF Power Measurement



This is an add-on to my article in the Jan. 2021 issue #66 on measuring DATV power. A power meter that was omitted was the IC log power detector from **Analog Devices**, their **AD8318**. It is specified to operate from 1 MHz to 8 GHz, over a 70 dB range. It has a spec of high accuracy (±1dB) from -50dBm to 0dBm up to 6 GHz. I reviewed a Chinese pc board AD8318 meter in the Dec. 2019, issue #29, of this newsletter. It sells for about $25. In that review, I reported -- *"The AD power meter read the DTV power about -2 dB low."*

Another similar RF power meter is the **Keysight model V3500A**. It's specs. are 10 MHz to 6 GHz and a range from -63dBm to +20dBm. It sells for about $2.6K. While Keysight does not divulge the internal technology, it might very well also use the AD8318 or a similar log amplifer + detector IC ?? Keysight is the current name for the old Hewlett-Packard company, which then spun off as Agilent, and again more recently as Keysight.

I have inquired to Keysight as to whether this meter will measure digital signals, such as DVB-T. It took over a month to finally get an answer from Keysight. This was their reply from a Keysight salesman. "I apologize for the delayed response. I just got the feedback from our factory support team. The V3500A is not able to measure true RMS. So, it is not suitable for your test application unfortunately."

I shared this info with Dave, AH2AR, Dayton, Ohio, who I knew owned one of these meters. Here is what Dave sent me.

Jim,
Some interesting measurements.....

I compared the readings I get on a DVB-T signal using an old HP-432A power meter with a thermistor power head to my Agilent V3500A. I used the same interconnecting cable for all the measurements.

I checked the calibration of the HP-432 against my Agilent 8648D signal generator at a +5dBm level. They only differed by about 0.14dB.

Next, I set up my Hi-Des HV-320 to put out a 2 MHz bandwidth, DVB-T signal on 1280 MHz with about +5dBm of rf power. The DVB-T power I measured with the HP-432 was **+4.64dBm.** Now look at the photo of what I measured on the V3500A. It reads **+4.46 dBm !**

There is thus very good agreement between the 432A and the V3500A measuring DVB-T signals. Defintiely good enough for amateur radio purposes.

Cheers, Dave, AH2AR

The ultimate Ham Porcupine Mobile --- tnx Ken, KV5Y, for these photos. No it is not Ken's car.

W0BTV Details: Inputs: 439.25MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T Output: 423MHz/6MHz BW, DVB-T, or optional 421.25MHz, analog VUSB-TV. Operational details in AN-51a Technical details in AN-53a. Available at: https://kh6htv.com/application-notes/ We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time and an ATV activity night on Wednesday evenings at 7pm. ATV nets are streamed live using the British Amateur TV Club's server, via: https://batc.org.uk/live/kh6htvtvr or n0ye.

Newsletter Details: This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 400. 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

Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear **For Sale - or - Want to Buy.**

SLATS

ST. LOUIS AMATEUR TELEVISION SOCIETY

Buy - Sell - Trade - Giveaway

(web site: http://www.slatsatn.net/?page_id=713)
Check it out. New items listed every week

Items such as: Flex Radio Amp, 2 meter transceiver, Antenna Bridge, D104 Mic, RIGblaster, ATV ID-Maker, NTSC Waveform Monitor, NTSC Vectorscope & More!