

Boulder Amateur Television Club TV Repeater's REPEATER

March, 2020
3ed edition

BATVC web site: www.kh6htv.com

ATN web site:
www.amateurtelevisionnetwork.org

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



Future Newsletters: If you have contributions for future newsletters, please send them to me. We also welcome news from other ATV groups around the USA. We encourage you to forward this newsletter on to other ATV ham friends in your clubs.

Newsletter Growth: The BATVC newsletter is starting to gain nation-wide distribution. While the number of active ATV members in Boulder is 18, our newsletter is now being distributed to over 140 hams nation-wide. If your ATV club would like to be included in our electronic distribution, send your list of members along with their e-mail addresses to us. We do not give away any of the names, etc. on our distribution list.

BARC MEETING CANCELLED

The March meeting of the Boulder Amateur Radio Club was cancelled due to the pandemic medical crisis. We were all looking forward to this meeting as our fellow ATVer, Roger, K0IHX, was going to give a talk about his 70 year career in telecommunications. It started as a teenager in the late 40s working at a local Connecticut TV relay station, HF ionospheric propagation research here at the Boulder labs, then working in the White House office of telecom creating telecom policy during the critical days of breaking up the Bell Telephone system.



LARC-FEST Cancelled: Also the Longmont Amateur Radio Club (LARC) is cancelling their annual, spring Swap-Fest. It was scheduled for the first Saturday in April

DAYTON Cancelled: If you haven't heard the news yet, the 2020 Dayton Hamvention has been cancelled. Exercising an abundance of caution, most large outdoor gatherings are being postponed or cancelled to help prevent the spread of COVID-19. There will continue to be inconveniences due to this pandemic as we move forward and we need to work together as a community. The watch words are 'patience' and 'flexibility'.



Planning for the August 2020 Rocky Mountain Division Convention continues and it is hoped that by August, the need for social distancing will have passed and we look forward to a great event to be held in the Denver Metro area in Parker (Lone Tree), Colorado on August 8th and 9th. The convention will be preceded by a DX University class on August 7th. Invited speakers to the RM Convention include ARRL President Rick Roderick, former FCC special counsel Riley Hollingsworth, ARRL Lab Manager Ed Hare, and WWV Chief Engineer Matt Deutsch. Registration is open at the HamCon Colorado web site noted above.

73, Jeff Ryan, K0RM, ARRL Rocky Mtn. Div. Director

5.9 GHz FM-TV on HOLD: We will not be able to install our new 5905 MHz, FM-TV repeater transmitter at the repeater site anytime soon. With the world-wide pandemic raging and everything being shut down, the govt. building where we have our DATV repeater is also on lock-down. We were previously waiting for the snow on the roof of the building to disappear. That has happened, but now the much, much bigger issue is to kill off the CoronaVirus (COVID-19). (Ops - as I was writing this another 10"+ of heavy wet snow just dumped on Boulder !)

ATN on Ham Nation: Thanks to Bill, K0RZ, for this lead. The Wed. March 4th, podcast of Ham Nation, episode #443, featured Gordon West, WB6NOA, interviewing Roland Hoffman, KC6JPG, of ATN. The link is:
<https://twit.tv/shows/ham-nation/episodes/443?autostart=false>

Updated App. Note: Based upon my recent experiences building my home-brew, DVB-T, 5.8 GHz Transverter, I have revised and up-dated my older application note, AN-36, "**Microwave TV Transmitters & Receivers**". It is available on: www.kh6htv.com

NEW, FREE, ATV BOOK: Back in 2017, Tom O'Hara, W6ORG, was writing the chapter 32 on ATV for the ARRL handbook. He asked me for some input on DTV to include in his chapter. Tom's chapter in the 2018 handbook was 31 pages in length and covered well the subject. This past fall, Bill, AB0DH, loaned me his 2019

ARRL Handbook to look at. I was dismayed by the extremely brief writeup given in it to ATV. I expressed my displeasure at the Friday ham breakfast. Larry, K0PYX, made the suggestion -- "Jim, if you are that displeased, why don't you write your own ATV Handbook?" Well, Larry, I have taken up your challenge. I have just finished writing it. I have entitled it

"ATV HANDBOOK - an Introduction to Amateur TV".

I have just posted it on my web site: www.kh6htv.com as my application note, AN-55. My new book is 39 pages in length. I broke it into the following chapters covering: Basics of TV Video Signal, TV Video Sources, Amateur TV bands, TV Signal Quality Reporting, TV Modulation Methods, TV Receivers, TV Transmitters, TV Antennas, TV Propagation, TV Repeaters, TV in ARES, and a list of ATV Suppliers. --- KH6HTV



Jim's picture received by Don



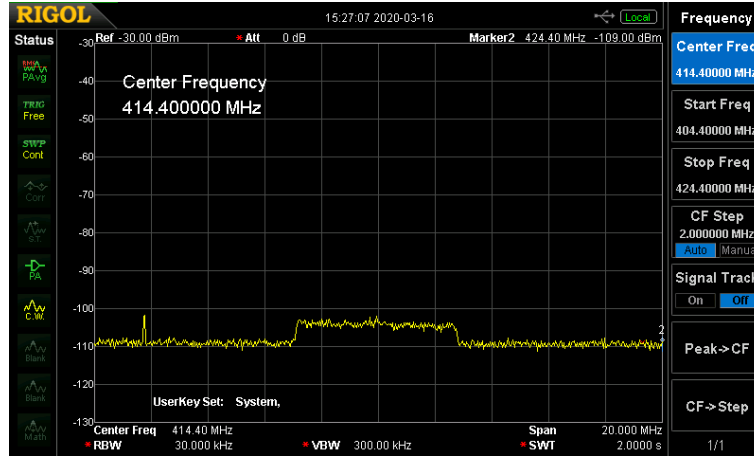
Don's picture received by Jim

5.7 GHz DVB-T -- We Keep Trying !

On Mon, March 16th, Don, N0YE, & Jim, KH6HTV, tried again to exchange DVB-T pictures on 5.7 GHz. Don had worked on his receiver and thought it would now work better for him. So we had a relatively warm, sunny day, and Don offered to drive to Flagstaff Mtn. and asked Jim to work from his QTH. This is a clear, line-of-sight, 6 mile (10km) path. We were partially successful this time. Don received a strong signal from Jim with a s/n of 21dB. Jim was radiating 5 watts ERP (+37dBm). He was using the transverter described in the previous March newsletter, #37, pp. 6-9. Going the other way was a different story. Don was having issues with his transmitter. Only his exciter was working. His 1 watt "After-Burner" had apparently "flamed out." Jim got a very marginal picture from Don with some freeze frames and s/n of 8 sometimes 9dB. We were running "normal" digital parameters, at which digital threshold is 8dB.

During the exercise, Jim connected his Rigol spectrum analyzer to his transverter. See the screen shot below. Running the analyzer for a whole hour before we started transmitting, I never saw any signals other than the tiny one on the left side of the screen. The analyzer's center frequency was 5678 MHz with a span of 20 MHz (i.e. 2MHz/div). Don's DVB-T signal measured -104dBm. After applying a +22dB correction factor for the narrow 30kHz band-width used, this says the signal from the transverter was actually

-82dBm. The transverter gain was 9dB, thus Don's signal from the receive antenna was -91dBm.



Don's micro-QRP, 5.7 GHz signal as received by Jim.

Afterwards, back in Don's ham shack, he put his transmitter up on the test bench and was dismayed to find that his exciter was only putting out a puny +2dBm of power. So, back to Radio Mobile to try to make sense out of what happened. I then took Don's numbers of +2dBm transmitter power, -4dB coax cable loss, and his estimate of +23dBi for his antenna gain, along with my received power number of -91dBm. After tweaking Don's antenna gain number to +22dBi, I got a match with Radio Mobile saying I should receive -91dBm. So that worked -- I then ran the numbers with Radio Mobile to see what power my signal would be at Don's receiver on Flagstaff. The result was -79dBm.

The Saga Continues: So, after this microwave outing, both Don & Jim went back to their ham shacks and worked some more on their 5 GHz rigs. Don reports that he now has his transmitter working again and pumping out +19dBm of DVB-T power on 5678 MHz with a -30dB spectrum shoulder and at least -15dB suppression of the LO. Jim reports that he has now boosted his 5678 MHz, DVB-T power from +14dBm to +16dBm, also with a -30dB spectrum shoulder. He also reported his LO suppression was -13dBc and the undesired upper side-band suppression was -26dBc. Jim also reports improving his receiver sensitivity by 3dB from -96dBm to -99dBm (for normal digital parameters of QPSK, 6 MHz BW, 1080P, 5/6 FEC, etc.). So far, Don wins with highest rf output power by 3dB and Jim wins with best receiver sensitivity.

So there is another "sleeper" that has not yet reported in. We know Bill, AB0MY, is also working on a 5 GHz, DVB-T rig. His must be a "Top Secret - Skunk Works" project. Bill is keeping awful quiet about his progress. He will probably surprise us all with a 10 Watt rig & -102dBm sensitivity !

A NEW 23cm, 18dBi ANTENNA is COMING ! On the March 19th, BATVC net, Ed, K0JOY, showed us his new antenna project. Ed is building a new parabolic dish antenna for the 23 cm band. He is using a commercial 2.4 GHz, BBQ grill antenna and replacing the feed dipole antenna and reflector with a new one of his own design for 23 cm. Ed says the dish dimensions give a +24 dBi gain antenna on 2.4 GHz.

These same dish dimensions at 1.25 GHz will result in a +18 dBi antenna. This will be an improvement of 5-6 dB over his present antenna. He thus hopes to hit the Boulder DATV repeater with a stronger ATV signal with fewer freeze frames. Hopefully, Ed will share more details about his new antenna in a future newsletter.

DSN2596 DC/DC SWITCHING

REGULATOR: It is built around an LM2596 IC switching regulator. The LM2596 is a 150kHz switcher rated at up to +40V input and 3 Amp output current. It is made by both TI and ON. At Mouser, the IC alone sells for about \$2.25 and up. But the complete DSN2596 stuffed pc board can be purchased for much less. However, shop carefully on the internet. I have found prices all over the place ranging from as low as \$1.25 to \$11. These are very useful items to have a lot of in the ham shack. They work nicely and I have used them in many projects.

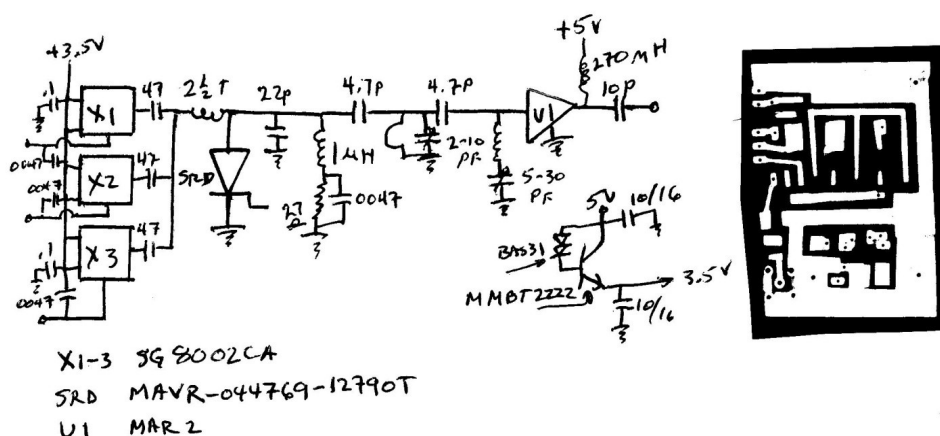


EPSON PROGRAMMABLE OSCILLATORS

John Gebuhr, WB0CMC, Omaha, Nebraska (wb0cmc@cox.net)

After seeing the article on the Epson programmable crystal oscillators I did some checking to see if they would work to multi-channel my new ATV transmitters. They don't at the 27 MHz range the exciter uses. Too many artifacts that confuse the PLL in the chip I'm using in it. After some experimenting I found it takes a fairly pure signal to make it work right. My sig-gen will drive it and works over the entire ATV portion of the band. I then tried some at the 100 MHz range and tried quadrupling them and driving the amp/modulator directly. Here is the result using 3 of the most common frequencies.

A three channel frequency quadrupler using a step recovery diode and a buffer amp. Circuit below.

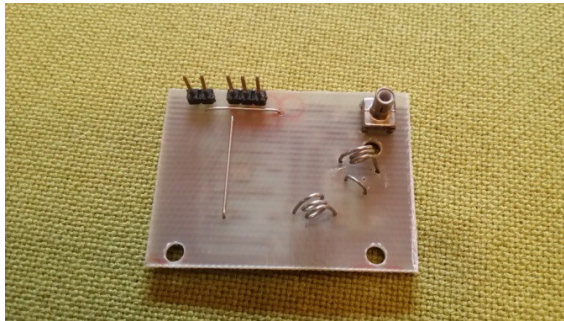


The 2 pins are ground and +5V, the 3 are channel select and the SMB is output of about +8dBm. Swaged stand-offs not yet installed. Connected to the amplifier in the transmitter I noted that the power dropped slightly from 439.25 to 421.25 by about a watt,

probably due to the pass band of the amp. It is specified from 440-470 MHz so not surprising. The pedestal level also changed somewhat but video didn't change noticeably. The series L-C on the input of U1 is 3rd harmonic trap. The hairpin and trimmer cap is the pass band tuning. It will tune the 5th harmonic @ 530 MHz or so but at 430 the 5th is about -20 dBc. Other harmonics are even lower. With no tuning the harmonics are significant to at least 1.5 GHz. Nice comb generator, huh? The harmonics don't make it through the transmitter nor do the subs and fundamental. A second hair pin and 2-10 pf cap can be added right at the output for more attenuation of other than the desired 4th harmonic. All top inductors are #22AWG on 1/8 inch diameter air core. The highest harmonic other than shown below is the 14th @ about -30dBc. I think with some retuning modifications it should work fine for a 1.2GHz source. Likewise on 902-928.



Foil & component side with the 3 Epson chips

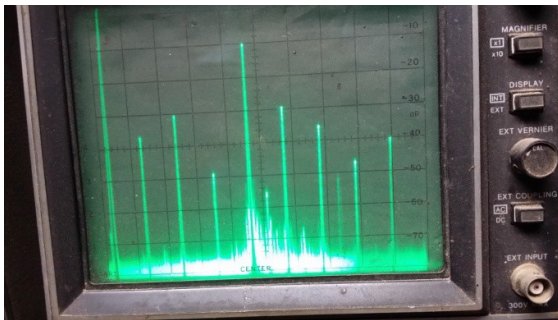


Top of board showing the 3 RF inductors

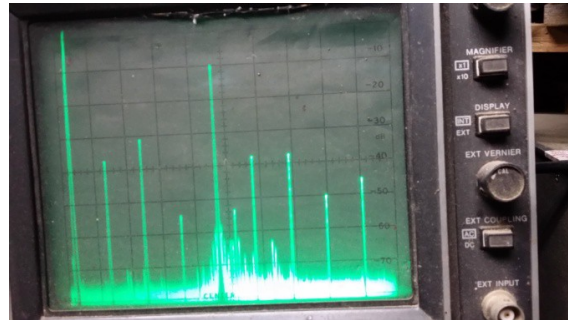
X1-3 are available from Digikey and are ordered to frequency. $421.25 = 105.3125$. $427.25 = 106.8125$, $434 = 108.5$ and $439.25 = 109.8125$.

The 2 trimmer caps I got from Mouser: P# 768-JZ300, 5-30pf & 768-JZ100, 2-10 pf.

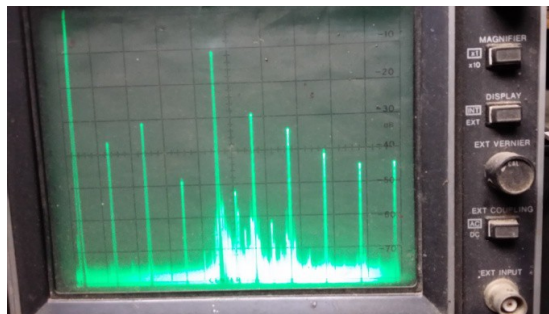
The step recovery diode is also from Mouser: P# 937-MAVR-O44769-12790T.



0 - 1GHz with 434 near center



0 - 1GHz with 439.25 near center



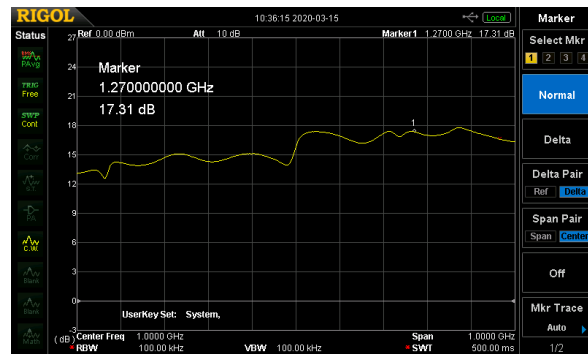
427.25 near center

ATV HAM ADS

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

For Sale: Down-East Microwave 23 cm LNAs

--- These are old DEM model 23-LNAs that are surplus. They are in working order. Unit #1 had a noisy FET, which I have just replaced. They use an HP ATF-10136 GaAs FET. These preamps have a very wide open front end with no band-pass filtering. The S21 plot on the right sweeps from



0.5 to 1.5 GHz and shows a flat response. They require +12Vdc power at 60mA. I have just tested both of them on Don, NOYE's, HP noise figure meter. The results are:

Unit #	1243 MHz	1270 MHz	1296 MHz
1	17.7dB, 0.72dB NF	17.3dB, 0.65dB NF	18.0dB, 0.62dB NF
2	18.8dB, 0.76dB NF	16.3dB, 0.70dB NF	18.1dB, 0.67dB NF

The DEM price for a new L23LNAH is \$150. I am offering these 23-LNAs for \$50 each, plus \$8 shipping via USPS priority mail. If interested, contact:

Jim, KH6HTV e-mail = kh6htv@arrl.net

NEW PRODUCT ANNOUNCEMENT

I recently developed a new broadband, LNA which covered from 6 meters to 13cm bands. It was my model WB-LNA-3. It featured a low 0.8 dB noise figure from 2m through 23cm bands.

I now have taken that basic LNA and refined it be an ultra-low noise, LNA, Pre-Amplifier for the 70 cm band. I added a Band-Pass Filter to it. It has 80 MHz bandwidth, centered on 435 MHz. This new LNA features **0.5 dB noise figure** and gain of 21 dB. It is designated as my new, model 70-LNA. The detailed specs. are on the following page. I will be selling it for \$100. Each 70-LNA will be supplied with a test report including the noise figure as measured on an HP noise figure meter.

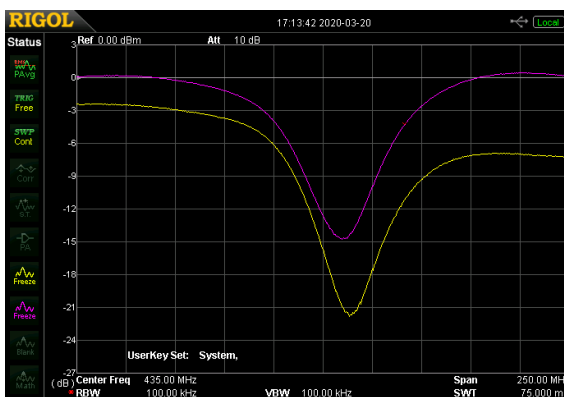
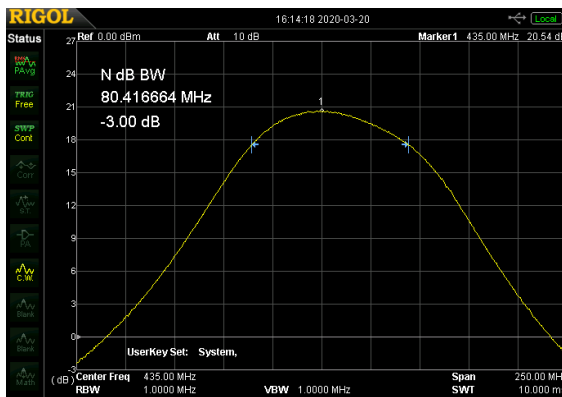
Jim, KH6HTV, kh6htv@arrl.net



The KH6HTV VIDEO Model 70-LNA is a low noise Pre-Amplifier for the 70 cm (420-450 MHz) amateur radio band. **The noise figure is a very low 0.5 dB** with a gain of 21 dB and high output, -1dB gain compression of +21 dBm. This amplifier has decent return loss on both input and output. It is offered in

two options. Option -1 has the lowest noise figure of 0.5dB. It has a low loss, 90 MHz high-pass filter on it's input and a 70cm band-pass filter on it's output. Option -2 is for those situations where more RFI protection on the input is required. It has the 70 cm band-pass filter on it's input and thus has a higher noise figure of 1.7 dB

Model 70-LNA 70 cm, 0.5 dB NF Pre-Amplifier



S21 Gain (left photo) & Return Loss (right photo) S11 = yellow trace, S22 = magenta trace
center freq = 435 Mz, 250 MHz span, 3 dB/div & 25 MHz/div.

PARAMETER	Typical Performance	Notes
Frequency Range	420-450 MHz	70 cm amateur radio band
Noise Figure	0.5dB (opt. -1), 1.7dB (opt-2)	measured on HP-8970A
Gain, S21	21 dB	
Bandwidths	80 MHz & 135 MHz	-3 dB & -10 dB BW
Max. Output Power	+21 dBm	at -1 dB gain compression
Input Return Loss, S11	> -10 dB	
Output Return Loss, S22	> -10 dB	
DC Supply Voltage	+12 Vdc, nominal at 100 mA	11-15 Vdc range
RF Connectors	SMA (f)	
DC Power Connector	Feed-Thru, By-Pass Capacitor	Optional -- DC feed via RF output
Dimensions	1.5" x 3.6" x 1.25"	fully shielded, die-cast enclosure
Test Report	included	includes S21, S11, S22 & NF