Boulder Amateur Television Club
TV Repeater's REPEATER
May, 2020

BATVC web site: www.kh6htv.com

ATN web site: www.amateurtelevisionnetwork.org

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

Future Newsletters:

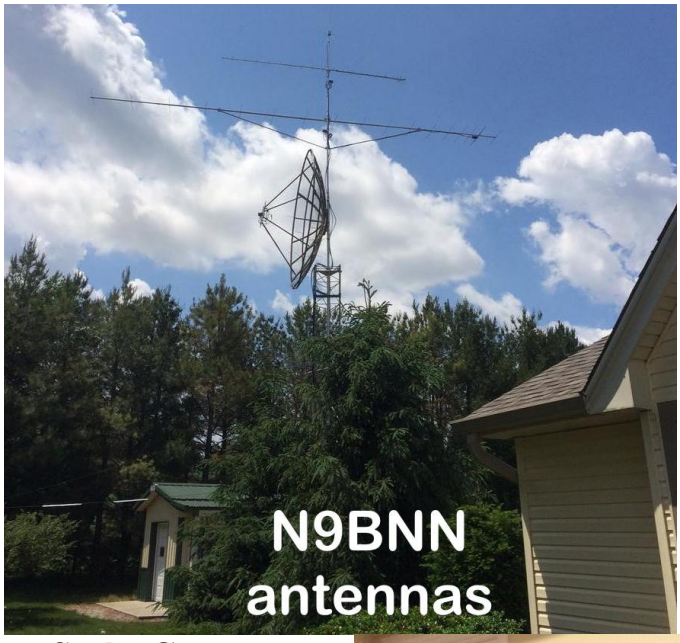
If you have contributions for future newsletters, please send them to me. This is starting to become a national ATV newsletter. We now have a circulation approaching 200. We also welcome news from other ATV groups around the USA. We encourage you to forward this newsletter on to other ATV ham friends in your clubs. Also, if you have friends that want their own copy of the newsletter, please send us their e-mail address.

(photo at right -- KH6HTV having fun on the tower !)

ATV ?? from Tulsa

Andy, KA5BBC, in Tulsa, Oklahoma writes --
Good morning Jim. --- Have you or anyone else you know of tested or reviewed the Sat-Link, Edision or Technomate modulators? I've been looking at them entirely due to the price starting about $90 plus shipping. From what I have seen they have HDMI inputs, and composite inputs on some models, encode at MPEG 2 and 4, and have outputs up to 90 dBuV. This is one in particular that was interesting and I have seen it at a lower price. https://satlink-uk.com/products/satlink-modulator-dvb-t-ws-6990

Also.. I suspect you are already aware of it but there is a free TV broadcast automation package called **CasparCG** which may be useful in feeding a repeater when it's not in use.



New ATV Ham Seeks Contacts

Thanks for your article about DVB-T for ham TV. I purchased a UT-100B dongle transceiver and a DEM 7025PA amplifier. I then acquired a used Larcan TTC XLS1000MU UHF transmitter. I have been unable to retune the big PAs down to 70cm but can use the 80 watt intermediate PA. I tried this combo out with analog and transmitted a stable picture with my M2 432-6WL yagi. I could produce 90 watts. without heating up the four power transistors. I then hooked up the UT-100B and worked it up to 60 watts with no problem. Beyond that the transistors started getting warm

I am excited about getting on the air except the nearest repeater is in Dayton over 100 miles away. Are you aware of any ATV operators in central Indiana? Its no fun if I cannot get a QSO.

Thanks, Mike Glass, N9BNN, Lebanon, IN n9bnn@hotmail.com

Midwest ATV Hams -- Looks like Mike has a whopper of an ATV station. Hopefully, you all will be able to hook up with him. ---- kh6htv

FAMOUS TRAIN RIDE VIDEOS: Several of the BATVC group have shown videos of either their home railroads or neat train rides from around the world. Don, N0YE, has found a neat collection of train ride videos to share. They are found at: https://www.travelandleisure.com/trip-ideas/bus-train/virtual-train-rides?utm_source=pocket-newtab
There are trains from Norway, Switzerland, Montenegro, U.K., Peru, Japan, plus two from right here in Colorado, our own Pike's Peak cog RR and the Durango-Silverton RR.

CALLING From the COCKPIT


CALLING FROM THE COCKPIT

The open cockpit of a World War I biplane was not exactly conducive to easy conversation. Intense noise, vibration, and often-violent air disturbances drowned out the crew's voices. The muscles of the face had trouble retaining their shape. Yet the clear benefits of timely aerial reconnaissance stimulated wartime research into wireless telephony, to allow pilots to communicate with one another and the ground. During the summer of 1915, Charles Prince, an engineer and officer in the British Royal Flying Corps, successfully tested the first air-to-ground voice communication at Brooklands Aerodrome. Three years later, Prince's team unveiled the throat microphone [below], which when used with the aircraft's radio telephony transmitter allowed pilots to talk hands free, keeping their hands on the stick and their eyes on the sky. ■

↗ For more on the early history of airborne wireless communication, see spectrum.ieee.org/pastforward-apr2020

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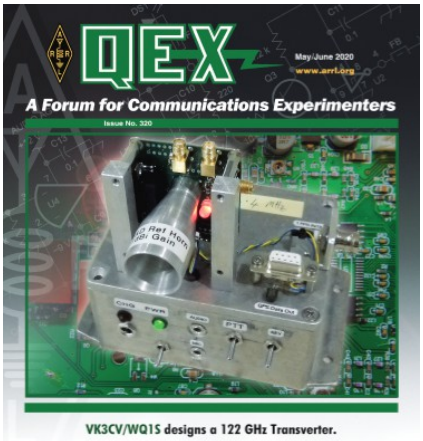
ARRL FREE MAGAZINES

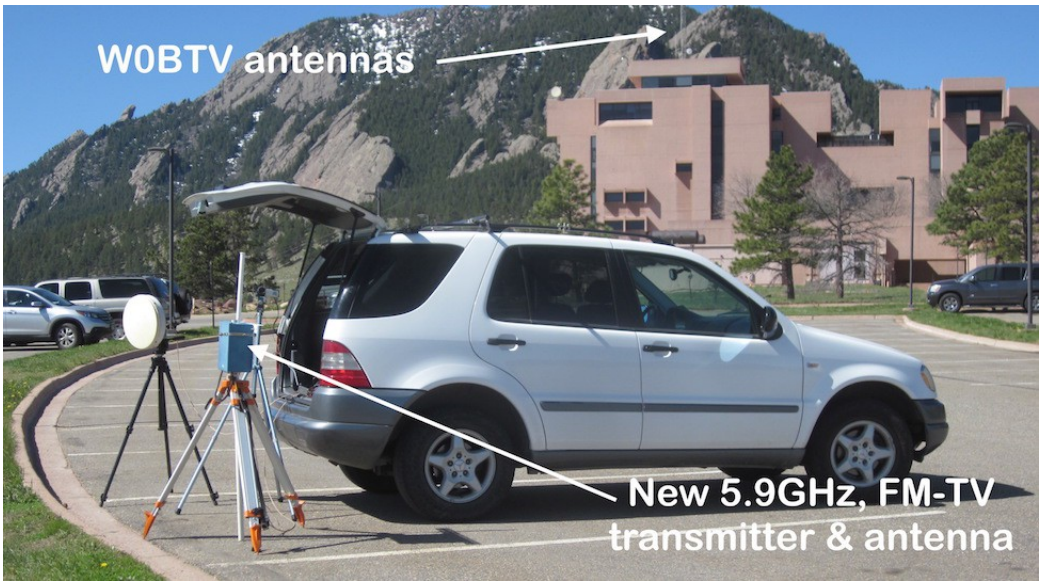
The ARRL has just announced that they now are making available, at no extra charge to members, on-line, digital versions of their four printed magazines. QST, QEX, On the Air, and National Contest Journal. Especially good news is the availability of QEX, which was their more technical journal for experimenters. Previously, the ARRL charged a very stiff fee for this bi-monthly magazine. ---- So judging by the cover photo of the most recent May-June issue, the bar has been raised for Don, N0YE, our local microwave guru. Don previously had made it to 47 GHz. Don, see the cover photo. Can you now do 122 GHz ? Plus with DVB-T ???



VK3CV has worked 36 miles on 122 GHz with -3 dBm

Spring Time = Microwave Outings !

Now, that spring has finally arrived, Don, N0YE, was able to get his microwave fix. He has been itching to get outdoors and radiate some GHz waves. On Monday, 27 April, he, Bill, AB0MY, and Jim, KH6HTV fired up their 5.8GHz, FM-TV gear. Don drove up the mesa to the NCAR parking lot. Bill sat up on his roof top deck in north Boulder and Jim sat up in his back yard, out on the prarie, south-east of Boulder. A key item that Don wanted to test out was the new 5.9GHz, FM-TV transmitter and antenna which he had built for the ATV repeater. Unfortunately, due to the pandemic quarantine orders, we have still been



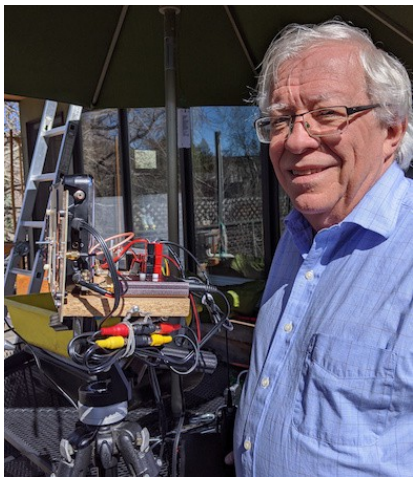
unable to access the repeater site building to install it. Don still wanted to verify it worked and get some feel for coverage. So he sat up the gear instead in the parking lot at the repeater site. See the above photo. Conclusion: **It Worked !** Jim was able to receive it as a P4.5 picture at his QTH, 6 miles away using only a simple, 5.8GHz, rubber duck antenna. When we finally get access to the building in the background, this will then be installed on the roof top along with our other ATV antennas.

New 5.9GHz repeater transmitter as received 6 miles away on a rubber duck antenna.

Jim's signal as received by Don after reflecting off the Flatirons

Jim then transmitted to Don on 5.8GHz, FM-TV with 2.2 Watts into a 23dBi dish antenna (i.e. 400 Watts, ERP). Don got a very strong P5+ picture. Jim then lowered his power until Don's receiver reached video squelch threshold (P2). At that point Jim was only transmitting -5dBm of power! Don next wanted to see if he could receive any signals reflecting off of the Flatiron mountains. You can see them in the above photo in the background. Jim went back up to 2.2 Watts (+33.5dBm). Don then turned his dish antenna around looking at the mountains and adjusted it until he found a good reflected signal. Don found a good P4 reflection, as shown in the above photo.

Bill, AB0MY, from his location at his QTH in north Boulder was in a less favorable postion. He is surrounded by a lot of trees and they are now leafing out. He was unable to either send to Don nor receive Don's signals from NCAR. He was able to receive a good picture from Jim when he was running high power (2.2W). When Bill tried to transmit to Jim, Jim's receiver was just barely able to break video squelch without a useable picture. Bill was running +35dBm into his home-brew, Double, Bi-Quad antenna. This antenna was described in the BATVC newsletter, issue #27, p. 2 Bill had all of his gear assembled and mounted on a camera tripod, including his monitor.



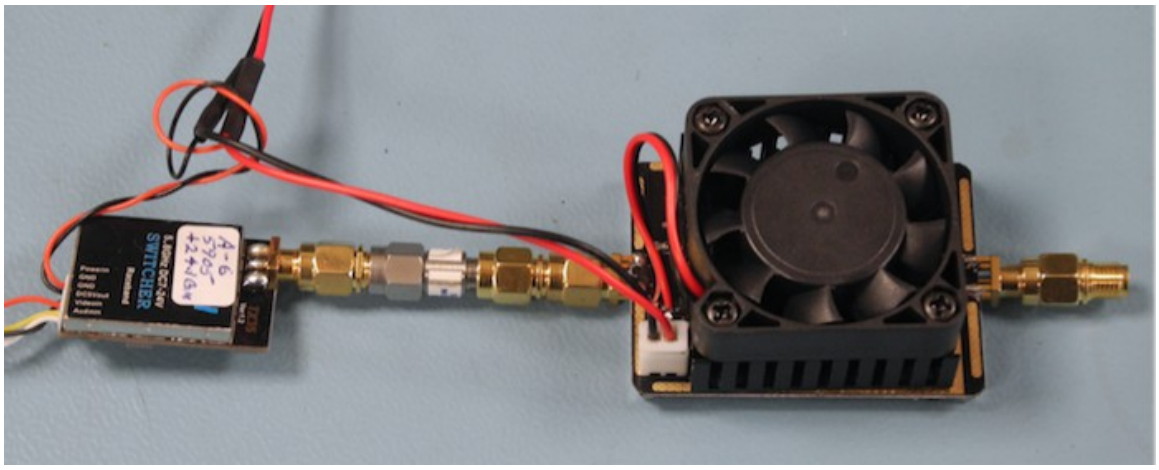
Note: *The following article was actually written way back in November, 2019. Jim, KH6HTV and Don, N0YE, had designed and built the new 5.9 GHz, FM-TV transmitter for our ATV repeater. We were delayed in getting it installed due to recurring snow storms which prevented us getting access to the repeater site's roof-top. Then the corona-virus pandemic struck and all access to the government building was forbidden. Todate, this new equipment has yet to be installed. However, with Don's demo of it working from the parking lot, described in the above article, we have decided to go ahead and release the details of the new transmitter, along with RF coverage maps which show where we expect to be able to receive it's ATV signals*. ---- kh6htv

NEW, 5.9 GHz, FM-TV W0BTV-TVR, TRANSMITTER

Jim, KH6HTV

Our W0BTV ATV repeater now has a new, additional TV transmitter. This is our first microwave transmitter, since the mid 90s. At that time, we briefly had a 2.4 GHz, FM-TV transmitter, but removed it due to severe part 15 RFI. This time we are going to try out another FM-TV transmitter at 5.9 GHz. This transmitter uses the new, low cost transmitters and receivers marketed for the drone market. They are available from many sources on the internet, including Amazon, E-Bay, etc. The transmiter is analog, transmitting standard definition, NTSC, 480i video and mono audio. It uses FM-TV modulation with a 6.5 MHz sound sub-carrier. The transmitter consists of a model TX-35, mini-xmit module. It is frequency synthesized with 40 channels. The TX-35 also has programmable power levels. It then drives a 2 Watt power amplifier. The amplifier is a model TXPA-58002W5. The transmitter's frequency is 5.905 GHz and it's rf output power is +33dBm (2 Watts). The antenna is an omni-directional, horizontally polarized monopole with 10dBi gain. Thus the ERP is about 20 Watts. This transmiiter will be operating as a 24/7 permanent, ATV Beacon. When the ATV repeater is not actively repeating ATV signals, this transmitter will continuously transmit the repeater's ID slide show. When the repeater is keyed up, this transmitter will rebroadcast the incoming ATV

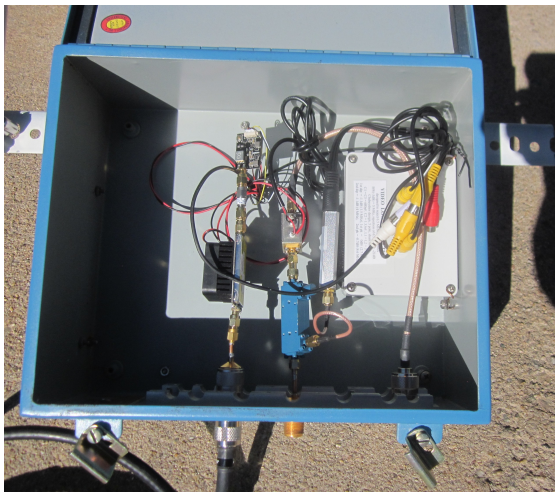
video and audio, same as the present, 70cm transmitter. As a beacon, it is thus intended for amateurs to use as an experimental signal source to test out your microwave ATV receivers and antennas. If necessary, this 5cm Beacon can be toned off by a repeater control operator.

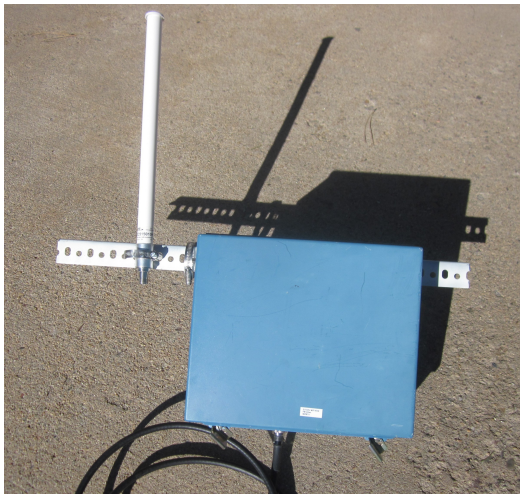


The 5.9 GHz, FM-TV, 2 Watt Transmitter - TX-35 exciter on left, power amp on right

The TX-35 transmitter module was reviewed in the Nov. 2020 issue #25 of this newsletter. The power amplifier was reviewed in the Dec. 2020 issue #30 of this newsletter with additional comments from Mike, WA6SVT, in the next issue #31.

The block diagram at the end of this article, shows all the components used in the transmitter. We are not permitted by our host to run additional cables to the rooftop. Thus, we needed to be inovative in how we added this additional transmitter. Note, there are two seperate portions. The equipment on the left in the block diagram is installed in the repeater's 19" rack and located in the radio room. The radio room is on the top floor of the tower, immediately below the roof-top antennas.



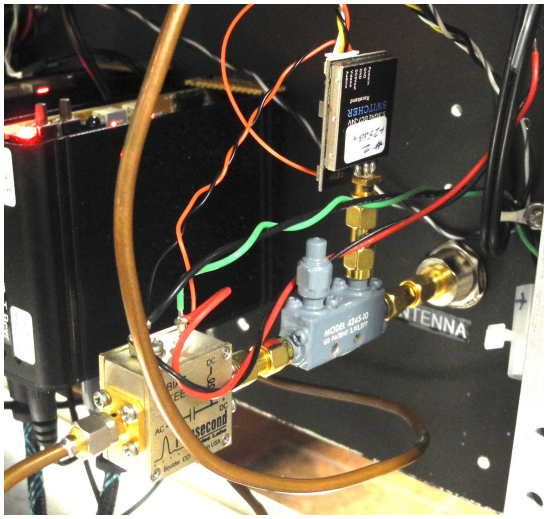


5.9GHz, FM-TV Transmitter enclosure & antenna -- roof top mounted.

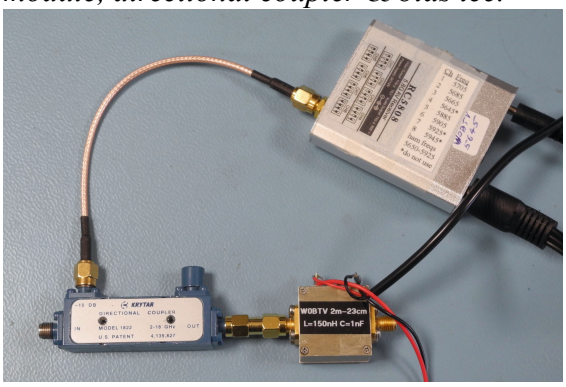
The actual transmitter is seperate from the rest of the 19" rack mounted repeater. It is housed in a weather-proof enclosure and will be mounted on the roof of the repeater site's south tower building at about 100 ft above ground level. Don, N0YE, assembled this box and antenna bracket and will be installing it soon (*We Hope !*)

+13.8Vdc power for the transmitter is fed up to the transmitter box from the radio room using the repeater's receive antenna's coaxial cable. There are Bias Tees in the repeater rack and also in the 5.9 GHz transmitter box to insert and pick-off the dc power. The bias tees are Picosecond Pulse Labs, model 5587. They were modified to optimize their performance for very low insertion loss (< 0.1dB) for both 70cm and 23cm.

The A/V modulation for the FM-TV transmitter is also fed up the receive antenna's coaxial cable. It is done in a unique, "repeater within a repeater" scheme. Down in the radio room, in the repeater 19" rack, we have a mini, TX-35, FM-TV transmitter module which is driven by the same analog A/V signals which drive the 70cm analog transmitter. This mini transmitter module is on 5.645 GHz and was set for low rf power of +13dBm. This 5.645 GHz signal is then coupled onto the receive antenna coaxial cable using a 10dB directional coupler. Up on the roof-top, in the transmitter box, there is another 10dB directional coupler to pick off this 5.645 GHz FM-TV signal. It is then demodulated by an FM-TV receiver tuned to 5.645 GHz. The receiver is a model RC-5808. The composite video plus audio from this receiver then is used to again A/V modulate the 5.905 GHz FM-TV transmitter. Using this scheme, we are able to get multiple service out of the repeater's receive antenna coaxial cable. Plus, our repeater site host, would not allow us to install more cables. Thus, it was to only way for us to add this new transmitter.

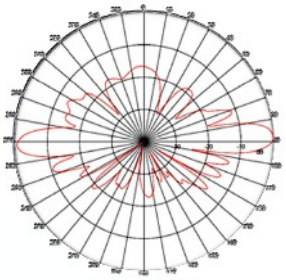


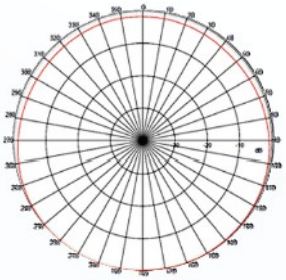
FM-TV Up-Link showing mini transmitter module, directional coupler & bias tee.



Up-link FM-TV receiver, directional coupler & bias tee

5.9 GHz ANTENNA:

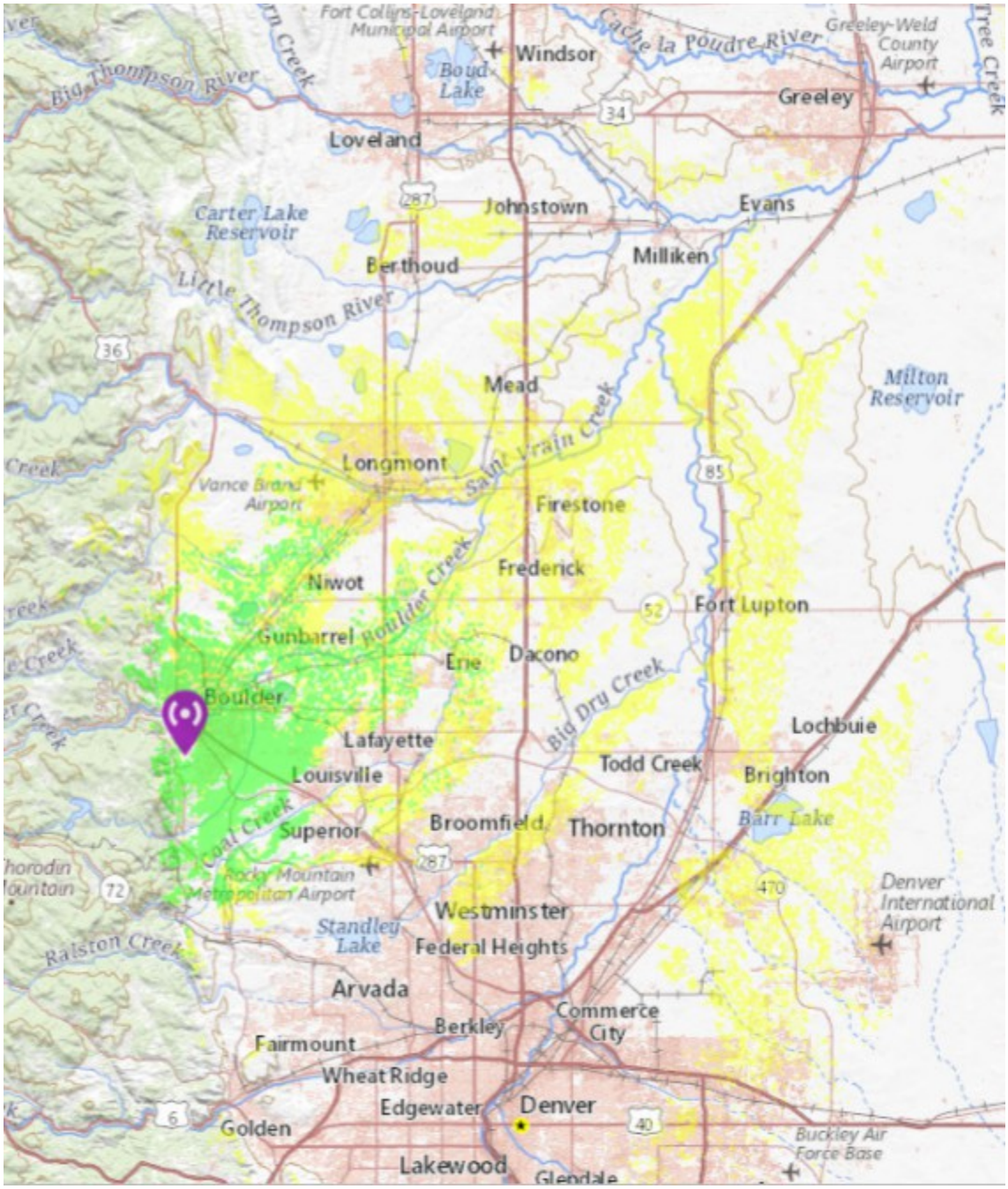




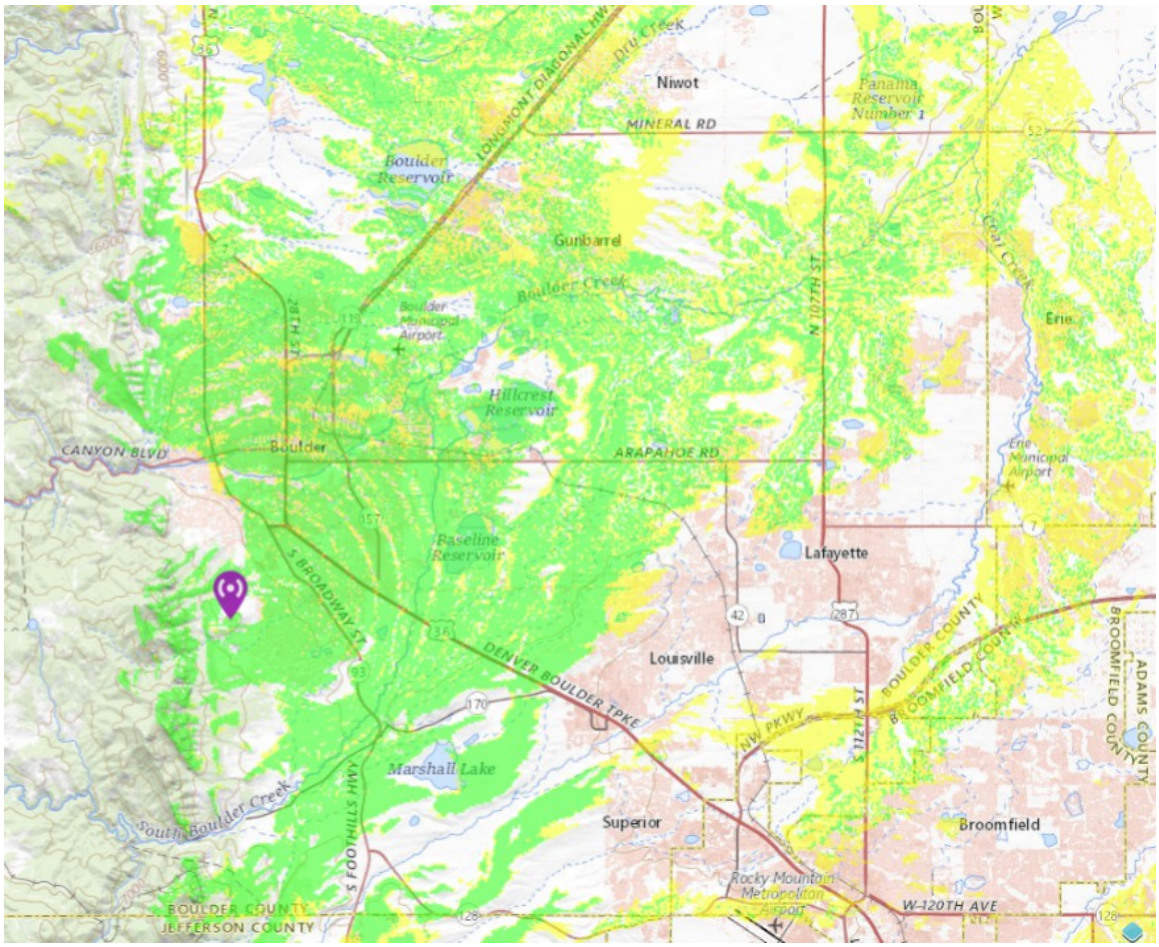
For an antenna, we wanted to have a 180 deg pattern to only cover the eastern prarie. We also wanted to use horizontal polarization. We felt that most Wi-Fi, ISM, etc. activity was probably using vertical polaization. By going to horizontal, we would miniize the RFI from these sources. It took us awhile to find an appropriate antenna. Don, N0YE, first wanted to go with a slotted waveguide antenna. But after he built such an antenna, he had disappointing results. His antenna was very narrrow-banded and had only 4dBi of gain. After much searching of the internet, we finally found a suitable antenna. We had to compromise and go with an omni-directional pattern. We purchased the Laird model OC515010H from Digi-Key for $60. The mfgr's spec. is 10dBi gain with an omni-directional pattern. 10dBi has been confirmed by Don, N0YE, in his antenna range tests. Polarization is horizontal. 9.5 deg., 3dB beamwidth. The antenna height on the building roof-top is approximately 100 ft. above ground level. The coax feedline is LMR-400. The approximate length is 3 ft. Coax loss is approximately 0.4 dB.

5cm FM-TV BEACON COVERAGE MAPS

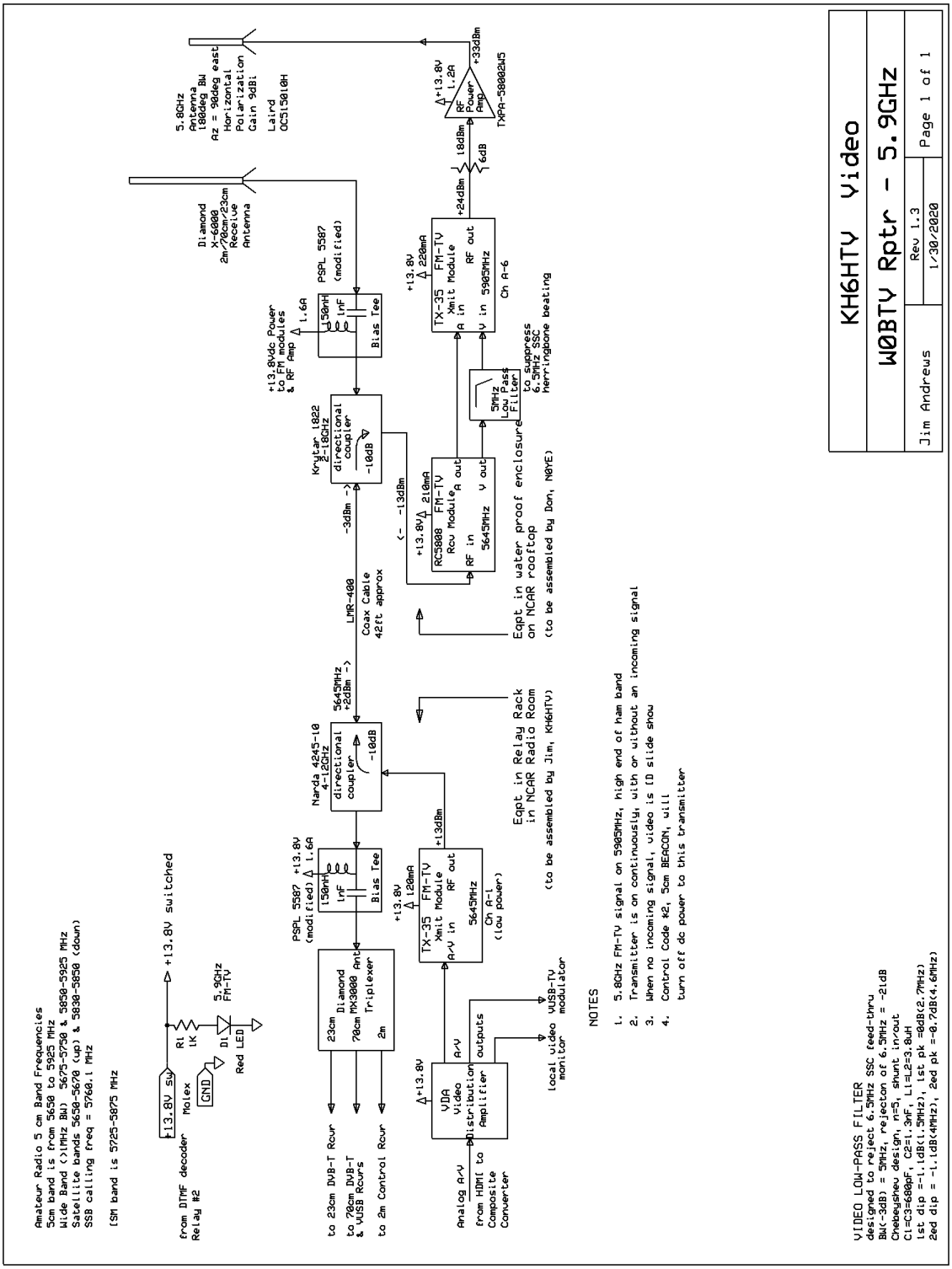
The newly added 5cm, 5.9 GHz, FM-TV transmitter will be a new service, as of 2020, to BATVC members interested in experimenting with microwave amateur radio & TV. This transmitter is on 5905 MHz (5.905 GHz) with 2 Watts (+33dBm) of rf output power into a 10dBi horizontally polarized, omni-directional antenna. The rf coverage maps were computed assuming the receive station is using a parabolic dish antenna of +23dBi gain at a height of 6 ft. with the FM-TV receiver mounted directly on the antenna and no feed-line loss. The minimum received signal strength used in the Radio Mobile program was -80dBm. This is the level required at the receiver for a perfect P5, FM-TV picture. For microwaves, it is very important to have an un-obstructed, line-of-sight, path to the transmitter. Trees and vegatation will stongly absorb the microwave signal. The computer program does not account for any local tree obstructions. Use your binoculars to see if you have a visual line-of-sight path to the repeater.



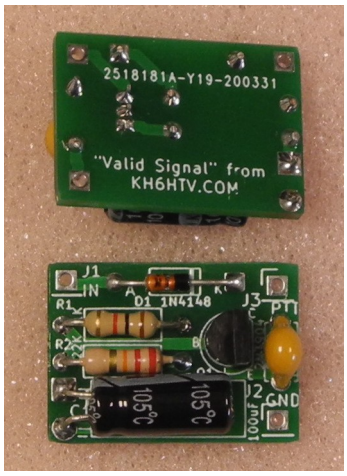
5.9 GHz, FM-TV Beacon Coverage Area to a 23dBi dish antenna at 6 ft. Green > -70 dBm Yellow = -80 to -70 dBm. The purple teardrop is the TV repeater location.



5.9 GHz, FM-TV Beacon Coverage in the Boulder Valley to a 23dBi dish antenna at 6 ft. Green > -70 dBm Yellow = -80 to -70 dBm. The purple teardrop is the TV repeater location.


Amateur Radio 5 cm Band Frequencies
5cm band is from 5650 to 5925 MHz
Wide Band (>1MHz BW) 5675-5750 & 5850-5925 MHz
Satellite bands 5650-5670 (up) & 5830-5850 (down)
SSB calling freq = 5760.1 MHz
ISM band is 5725-5875 MHz
+13.8V switched
from DTMF decoder Relay #2
+13.8V sw
Molex
GND
R1 1K
D1 Red LED
5.9GHz FM-TV
to 23cm DVB-T Rcvr
to 70cm DVB-T & VUSB Rcvrs
to 2m Control Rcvr
23cm
70cm
2m
Diamond MX3000 Ant Triplexer
PSPL 5587 (modified)
+13.8V 1.6A
150nH
1nF
Bias Tee
Narda 4245-10 4-12GHz directional coupler
-10dB
5645MHz +22dBm ->
LMR-400 Coax Cable 42ft approx
-3dBm ->
Krytar 1822 2-18GHz directional coupler
-10dB
<- -13dBm
+13.8V 1.6A
PSPL 5587 (modified)
150nH
1nF
Bias Tee
+13.8V 120mA
TX-35 FM-TV Xmit Module
A-V in
RF out
5645MHz
Ch A-1
(low power)
+13dBm
+13.8V
VDA Video Distribution Amplifier
A-V
outputs
Analog A-V from HDMI to Composite Converter
Local video VUSB-TV monitor
VUSB-TV modulator
Eqpt in Relay Rack in NCAR Radio Room
(to be assembled by Jim, KH6HTV)
Eqpt in water proof enclosure on NCAR rooftop
(to be assembled by Don, N6YE)
RC5808 FM-TV Rcv Module
RF in
A out
V out
5645MHz
+13.8V 210mA
5MHz Low Pass Filter
to suppress 6.5MHz SSC herringbone beating
+13.8V 220mA
TX-35 FM-TV Xmit Module
A in
V in
RF out
5905MHz
Ch A-6
+24dBm
18dB
6dB
+13.8V 1.2A
RF Power Amp
TXPA-5800W5
+33dBm
5.8GHz Antenna 180deg BW Az = 90deg east Horizontal Polarization Gain 9dBi
Laird OC5150180H
Diamond X-6000 2m/70cm/23cm Receive Antenna
+13.8Vdc Power to FM modules & RF Amp
NOTES
1. 5.8GHz FM-TV signal on 5905MHz, high end of ham band
2. Transmitter is on continuously, with or without an incoming signal
3. When no incoming signal, video is ID slide show
4. Control Code #2, 5cm BEACON, will turn off dc power to this transmitter
VIDEO LOW-PASS FILTER
designed to reject 6.5MHz SSC feed-thru
BW(-3dB) = 5MHz, rejector of 6.5MHz = -21dB
Chebeysheu design, n=5, shunt in/out
C1=C3=680pF, C2=1.3nF, L1=L2=3.8uH
1st dip =-1.1dB(1.5MHz), 1st pk =0dB(2.7MHz)
2ed dip = -1.1dB(4MHz), 2ed pk =-0.7dB(4.6MHz)
KH6HTV Video
W0BTV Rptr - 5.9GHz
Jim Andrews
Rev 1.3
1/30/2020
Page 1 of 1

A CUTE PC BOARD:



I received a pleasant surprise in the mail yesterday. Mel, K0PFX, (mel@melwhitten.com), in St. Louis, MO, sent me this nice little (0.6" x 0.8") printed circuit board. Mel made up these boards to incorporate the simple circuit I had designed to pick off the "Valid Signal" from the Hi-Des model HV-110 receiver's Red/Green, valid DVB-T signal indicator. I used it to generate a PTT (Push To Tranmit) logic signal to key our ATV repeater. The circuit diagram is shown below from my app. note, AN-23e, pages 5-6. Mel also added to his p.c. board an extra 220pF cap across C1 for extra rf by-passing.

Mel wrote that this was a covid-19 project to keep himself busy. He said he made up 15 of them. Mel says his pcb could be used to "trigger on an alarm" in a home DATV station to notify one when their local DATV repeater comes up on the air.

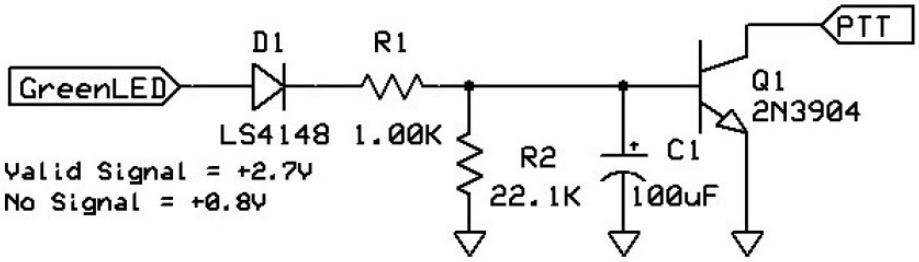


Fig. 8 Simple circuit modification to obtain *"Valid Signal"* from HV-110 receiver.

Note: This circuit can also be used with the Hi-Des model HV-120A, however, the dc voltage levels are a bit different and an additional series diode, D2, is required.

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.**

For Sale cheap: --- 3 **Panasonic AJD850 VCRs** and 2 **Panasonic AJD450s**.

All are in good working order. All 5 have had most of the electrolytic caps replaced which was the main down fall of these machines. I had put them in very good shape prior to shipping to a TV mission station in Haiti cause I didn't want to fix them when I got there. The station failed due to financial and other problems prior to shipping so I got stuck with them. Once the capacitor problem was fixed they became a good format albeit the now orphaned, DVC-pro.

An AJD850 and an AJD450 with appropriate cables will make a good editor. I have about $50 in caps in each which is what I'll sell them for plus, of course shipping. 37 Lbs for the 850, 35 for the 450 plus the container. Or they can be picked up in Omaha.

John Gebuhr, 402 932 3443, WB0CMC@cox.net

For sale: Tektronics WFM 601A

Serial Digital Component (SDI) wave form monitor. I have never used it but I think it works. It is something I will never use since I have nothing with SDI except a DVC pro deck that has an SDI output but also has several NTSC ins and outs. No case. $25 OBO plus shipping.

John Gebuhr, WB0CMC@cox.net , 402 932 3443

I also have 2 **Marshal flat screen SDI monitors** that do work well. Again, I have no use for them with no other SDI source. Complete with wall warts. $100 each + shipping. Might be a bit dusty from sitting idle so long.

John Gebuhr, WB0CMC@cox.net , 402 932 3443