Boulder Amateur Television Club
TV Repeater's REPEATER

August, 2020
4th edition

BATVC web site: www.kh6htv.com

ATN web site: www.amateurtelevisionnetwork.org

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

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

ATV QSO PARTY: We have previously announced that Peter, VK3BFG and the Melbourne, Australia ATV group were sponsoring a world-wide ATV QSO party for the weekend of August 28-29th. We now have the final details. Peter was unable to generate interest in the E.U. or U.K. to participate. At this time it appears that only three ATV groups in the USA and Melbourne will be participating. The event will occur on August 28th starting at 00:00Z (6 pm in Boulder, Colorado). It will run for four hours till 04:00Z (10pm, Boulder time). It will start in Columbus, Ohio with the ATCO, ATV group in the 6 - 7pm time slot. Next, from 7 - 8pm, our Boulder ATV group will be on. We will be followed by the ATN-Calfornia group from 8 - 9pm. Australia will then have the final hour.

We will hold our portion as an on-the-air, weekly ATV net, using our Boulder, W0BTV, ATV repeater. We will, as usual, use the BCARES, 2 meter FM repeater, 146.76MHz as our inter-com frequency. Don, N0YE, will stream our repeater's A/V to Peter in Melbourne. From there, Peter will coordinate inputs and then up-load the A/V to the BATC in the U.K. Viewers world-wide will then be able to watch the event as a live stream from VK3RTV-1

We will broadcast on our local ATV repeater, W0BTV, the BATC stream for the 1st hour and the 3ed & 4th hours. We will be live locally on our repeater for our segment (7-8pm).

Don encourages all of us to be thinking ahead what we each might do and say for our time slot on the QSO party. We will have a much bigger audience for our ATV net. Plan your "show-n-tell" with that in mind.

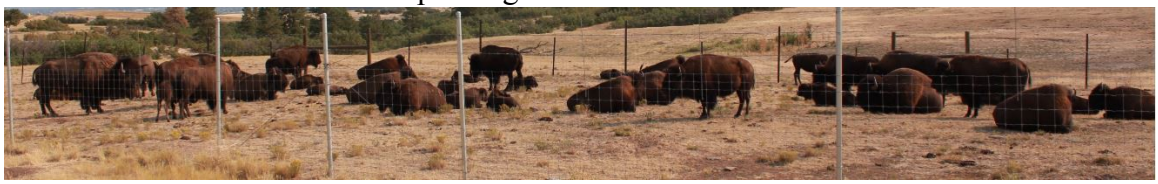
Pete, WB2DVS & Debbie, WB2DVT, working 10 GHz, SSB on a high spot on the lonesome Colorado prarie. Highway, CO-128 near the NEL research wind farm.

ARRL 10 GHz Contest Results

The first session of the contest was held the weekend of August 15-16. Front Range of Colorado, microwave hams worked SSB on Saturday, the 15th. Overall, we counted ten stations on the air with the following hams participating. They were: K0RZ, W6OAL, WB5PJB, W6HCC, N0SP, KB0LP, NOYE, AB0MY, WB2DVS, WB2DVT, K0PYX, K0JOY, & KH6HTV. The hams were spead out from Gary, WB5PJB, at Daniel's Park, west of Castle Rock, in the south to Phil, W6HCC, who was a rover from Wellington on north to Cheyenne, Wyoming. A south to north spread of about 115 miles. The longest distance contact was between Bill, K0RZ, and Phil, W6HCC. Bill was at his Boulder home QTH, (DM79JX) while Phil was just south of Cheyenne in DN71NB. This was 120 km (about 75 miles).

Gary, WB5PJB, dish setup in Daniel's Park.

Gary' 2 meter, SSB rig listening to Bill, K0RZ's 10,368.100 MHz SSB signal, peaking at S9 +40dB ! ! !



Gary's buffalo neighbors in Daniel's Park --- Go University of Colorado Buffalos ! ! !

Unfortunately, Dr. Murphy paid several calls to 10GHz hams also. Don, N0YE's IF rig totally gave up working after his first contact. Pete & Debbie had big issues getting theirs to transmit. So, Dr. Don, N0YE, had to make a AAA roadside call to service it. Jim, KH6HTV & Ed, K0JOY, working from Mt. Joy (i.e. Ed's mountain top QTH) had a booming S9 +40dB signal out onto the prarie sites, but were totally deaf and unable to hear incoming SSB calls. Later bench testing showed issues with the PTT interconnect cable between the FT-817 IF rig and the 10 GHz transverter for Jim. Don later discovered that his high power input protective circuit had failed and thus when he again transmitted, he blew out his mixer. Thus, due to these failures, the plans to follow up on Sunday with 10 GHz, digital TV were postponed until the September contest weekend.

Gary, WB5PJB, suggests that we should use sanitizer in the future on our rigs to discourage Dr. Murphy.


Phil, W6HCC's 10 GHz rover setup. 4 ft. dish with waveguide feed and 8 watts of RF power from a solid-state amplifier.

≈700 km on 10 GHz

Bill, K0RZ, Boulder, Colorado

I thought readers of the Boulder ATV newsletter would find it interesting and perhaps inspiring to see what can be done using 10 GHz from my home QTH in Boulder, Colorado (DM79JX) to the mobile truck of Phil, W6HCC.

Over the past two decades, Phil, W6HCC, has been driving to each of these grid squares colored in red and completing a two way contact with me operating from home. Phil has also driven to a few more distant grid squares and we have not successfully completed a two-way contact. 10 States, and 79 grid squares have been worked successfully with the best DX of 699 km to EN05AA in north-east, South Dakota.

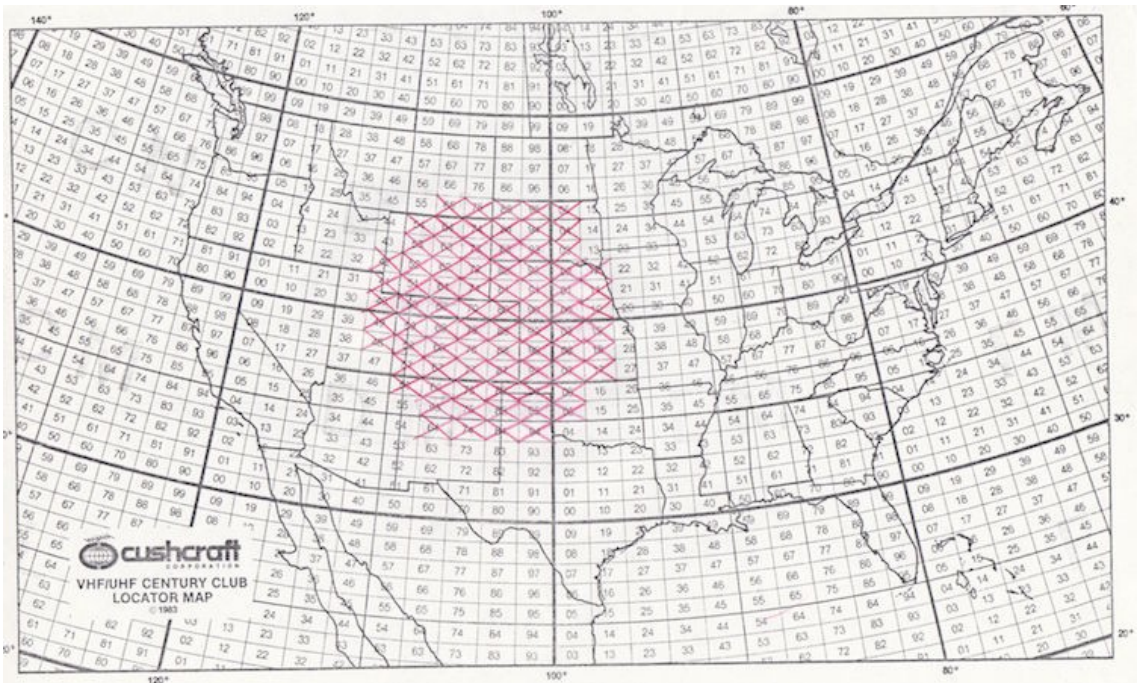
K0RZ's antennas
222 MHz thru 10 GHz

A majority of the propagation modes have been tropospheric scatter and particularly aircraft scatter to the more distant grid squares. SSB, CW and recently a weak signal modulation and detection method developed by Phil, W6HCC has been used to establish a two-way QSO. WSJT has never been used.

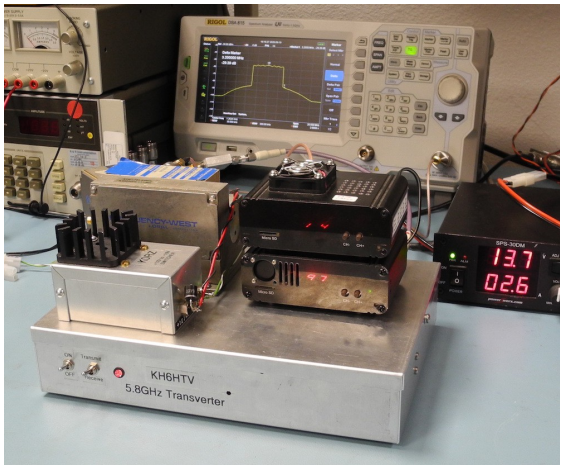
To increase the chance of a QSO, the question of the operating frequency has been removed by both of us by using frequency references good to a few parts in 10^9 or better. Dish pointing is controlled by computer at my station and at Phil's end he uses a spotting scope to site local geographic landmarks to establish a pointing reference. Both of us have optimized our station parameters for weak signal operation as best we can. Typically a transmit ERP of greater than 25 KWatts and a receive system noise figure less than 1.5 DB. Phil has a 40" dish and an 8 watt solid-state amplifier. I have a 32" dish antenna with waveguide feed line and a Hughes, 10 watt, TWTA.

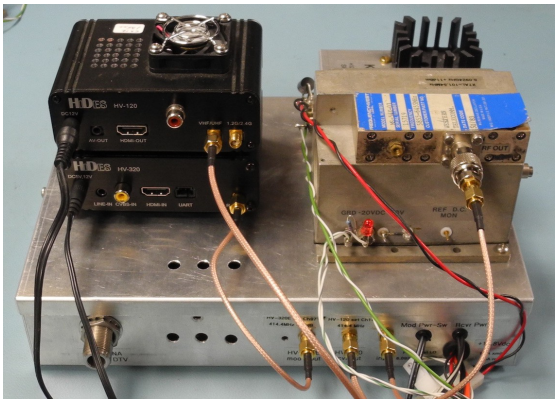
The longest distance SSB DX was probably about 200+ km to squares in the plains. CW was used with almost all the western areas except a few in western Wyoming and into Utah where we used Phil's weak signal method. As I recall the 699 km contact was on CW and receiving on both ends using a freeware program called Spectran written by I2PHD (https://www.i2phd.org). The program will display a signal in a waterfall that is better than 15 dB below the noise. Phil's weak signal detection scheme used in later grids used Spectran to observe the transmitted multi-tone signal that was used to identify a call or grid square as well as Roger and 73.

73 de Bill, K0RZ



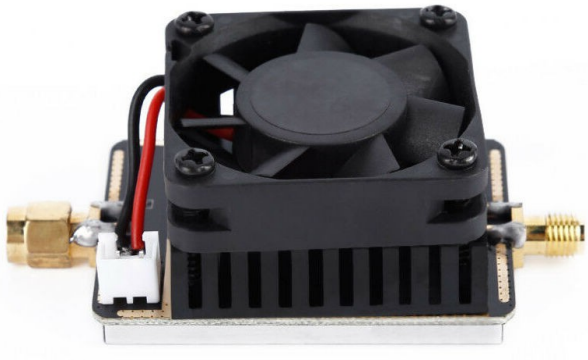
Grid Squares worked on 10 GHz between Bill, K0RZ,
in Boulder, Colorado and roving Phil, W6HCC.



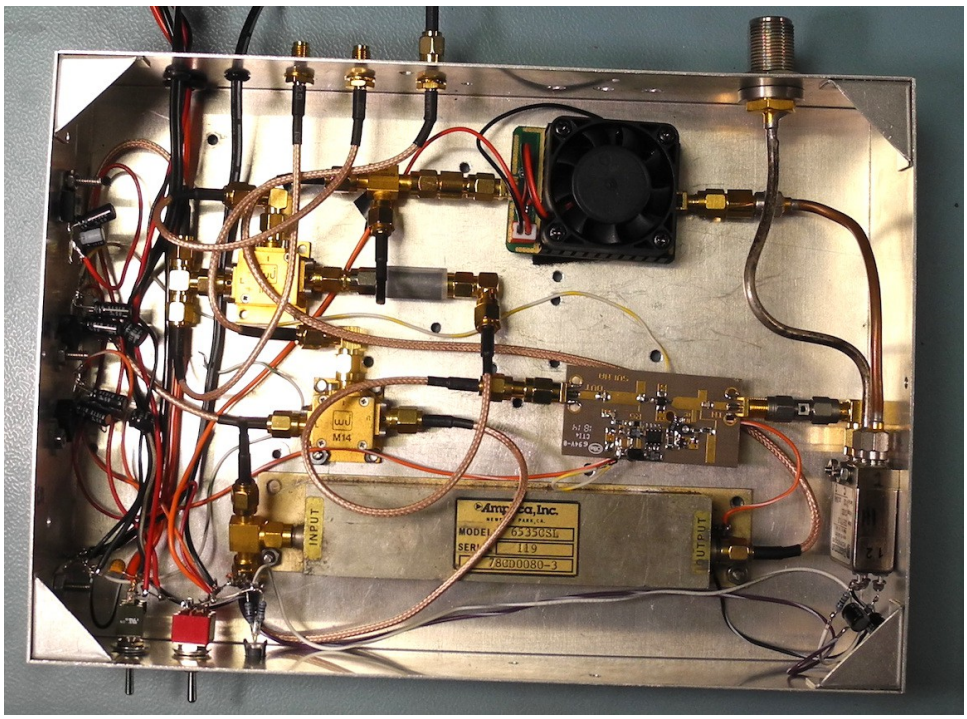


5.8 GHz Transverter Contd. In the March BATVC newsletter, issue #37, I discussed the home-brew transverter I had built for the 5cm, 5.8GHz, band for DVB-T use. From it I was able to achieve a whopping +14dBm rms (25mW) of rf power for DVB-T. Not much really. Since then, I have been looking for some way to increase the rf power output.

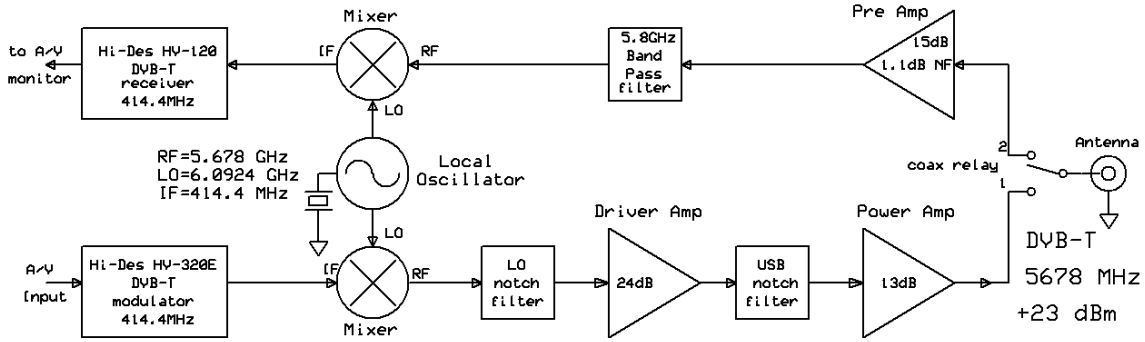
Well last fall, when we started investigating the really low cost, 5.8GHz, FM-TV gear intended for R/C aircraft (i.e. drones), we found a really low cost ($25), 2 Watt amplifier from China. The Boulder ATV hams this past spring have been experimenting with 5.8GHz, FM-TV, using this gear along with this amplifier. This amplifer was reviewed in the December, 2019



issue of this newsletter, issue #30a. It is the model TXPA58002W5. It is sold by Banggood.com (Chinese version of Amazon.com) So recently, I decided to see what the amplifier would do with DVB-T. I was pleased with the result. So, several Boulder ATV hams, put together a quantity order to China for more of these amplifiers.



Modified 5.8GHz Transverter with 2 watt amplifier & new mixer installed



New block diagram of KH6HTV, 5.8GHz Transverter for DVB-T service

It was a simple modification to add the amplifer into the existing transverter. The above photo and block diagram show the changes. The amplifier is the large black block in the top part of the photo. What is visible is the heat sink and cooling fan of the amplifier. The amplifer adds 13dB more gain in the transmitter. The max. DVB-T power I was able to get from the Amplica amplifer was +14dBm. Now with the Chinese 2 watt amplifier installed the max. DVB-T power has been boosted to a respectable +23dBm rms (200 mW). This number is comparable to what I have found for other amplifiers in DVB-T service. The max. rms output power for DTV service has been found to be typically 8 to 10dB below the maximum rf power rating of the amplifier. This "Head-Room" is required to allow for the random peaks in the digital TV signal. The +23dBm is -10dB below the max. +33dBm output of the Chinese amplifier. In all cases, the rf input drive level was adjusted to maximize the rf output power until the out of channel, spectrum regrowth grew to have a shoulder break-point of -30dB.

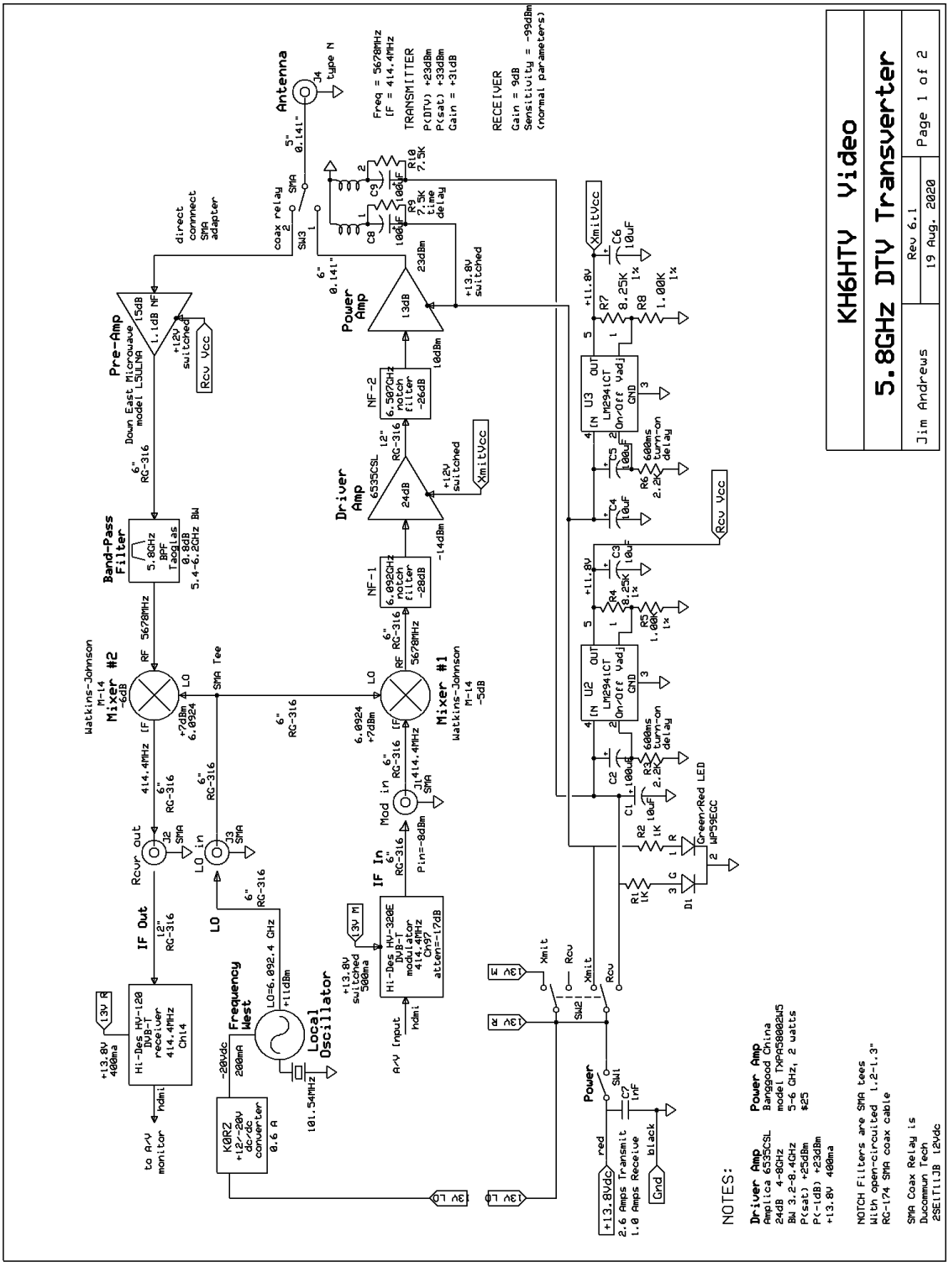
The transverter was tested with both QPSK and QAM DVB-T signals. It was found to work fine with both QPSK and 16QAM with rf output power of +23dBm for QPSK and +22dBm for 16QAM. The 2 watt amplifier had too much non-linearity to work well with 64QAM. The rf output had to be dropped back to +11dBm to have no loss in S/N.

A word of caution regarding these Chinese 2 watt ampifiers -- Be careful to not drive them too hard. I myself have burned out two of them when doing CW measurements on them. Every Boulder ATV ham that has bought them has also lost at least one of them by whacking them too hard with input rf. The one consolation from burning out the amplifier is one can salvage a useful 40x40mm, 12Vdc cooling fan from it.

The other change in the transverter I made was to replace the "crummy", el-cheapo, Chinese HMC219N which was used as the transmitter mixer. I replaced it with a surplus, aero-space quality, mixer from Watkins-Johnson. It is the model M-14, which was identical to the one I already used in the receiver portion. The HMC219N mixer had poor -13dB conversion loss and only -22dB LO rejection. The M-14 requires +7dBm LO drive and has -6dB conversion loss and a much improved -45dB LO rejection. With the new M-14, I was thus able to eliminate the first amplifer in the transmitter chain and also the LO power amplifier required to provide the +12dBm drive for the old HMC219N. In the process, the transmitted LO leakage was dramatically reduced from +16dBm to -35dBm.

KEY PERFORMANCE PARAMETERS

RF Output Power	+23 dBm (rms)	Transmitter Gain	31 dB
RF Frequency	5,678 MHz	LO Frequency	6,092.4 MHz
IF Frequency	414.4 MHz	USB Suppresion	-40dBc
Receiver Gain	9 dB	Receiver Noise Figure	1.1 dB
Receiver Sensitivity	-99 dBm (Normal Parameters, QPSK, 5/6 FEC, etc.)		
DC Current @ 13.8Vdc	1.0 Amp (receive) & 2.6 Amps (transmit)		


KH6HTV Video
5.8GHz DTV Transverter
Jim Andrews
Rev 6.1
19 Aug. 2020
Page 1 of 2
Antenna
Type N
Freq = 5678MHz
IF = 414.4MHz
TRANSMITTER
P(DTV) +23dBm
P(sat) +33dBm
Gain = +31dB
RECEIVER
Gain = 9dB
Sensitivity = -99dBm
(normal parameters)
Power Amp
13dB
Pre-Amp
Down East Microwave
model LSULNA
15dB
1.1dB NF
Band-Pass Filter
5.8GHz BPF TaoglLas
0.8dB
5.4-6.2GHz BW
Driver Amp
6535CSL
24dB
Mixer #2
Watkins-Johnson M-14
-6dB
Mixer #1
Watkins-Johnson M-14
-5dB
Local Oscillator
Frequency West
LO=6.092.4 GHz
+11dBm
141.54MHz
Hi-Des HV-120 DVB-T receiver 414.4MHz Ch14
Hi-Des HV-320E DVB-T modulator 414.4MHz Ch57
atten=-17dB
K0R2 +12-28V dc-dc converter
0.6 A
Power
SW1
SW2
SW3
coax relay
direct connnect SMA adapter
Rcvr Vcc
XmitVcc
+12V switched
+13.8V switched
U2 LM2941CT
U3 LM2941CT
On-Off Vadj
turn-on delay
Green/Red LED
WP59EGC
NOTES:
Driver Amp
Amplica 6535CSL
24dB 4-8GHz
BW 3.2-8.4GHz
P(sat) +25dBm
P(-1dB) +23dBm
+13.8V 400ma
Power Amp
Banggood China
model TXPA5800BW5
5-6 GHz, 2 watts
$25
NOTCH Filters are SMA tees
with open-circuited 1.2-1.3"
RG-174 SMA coax cable
SMA Coax Relay is
Ducommun Tech
25E1T1J3 12Vdc

KH6HTV as received by N0YE N0YE as received by KH6HTV
5.8 GHz DVB-T test over 5 mile path

So, the final question remaining -- Will it really work for 2 way ATV QSOs. On Tuesday, August 18th, I and Don, N0YE, went out in the field for a real test. Don took his 5.8GHz rig up the mountainside to NCAR and I set up mine in the back yard. We had visual line of sight of each other over a 5 mile rf path. Bottom Line - It worked !

Both Don & I were using L-Com, BBQ grill, dish antennas with 23dBi gain. Don was transmitting with +17dBm of rf and I was transmitting with +23dBm. Using the Hi-Des receiver's built-in rf power meter (i.e. S meter) and correcting for our transverter's gain, Don calcuated that he received my picture with -81dBm. I received Don's P5/Q5 picture & audio with -83dBm. At both ends the received signal to noise was a perfect 23dB for our QPSK signals using "normal" digital parameters of 5/8 FEC, etc.

73 de Jim, KH6HTV

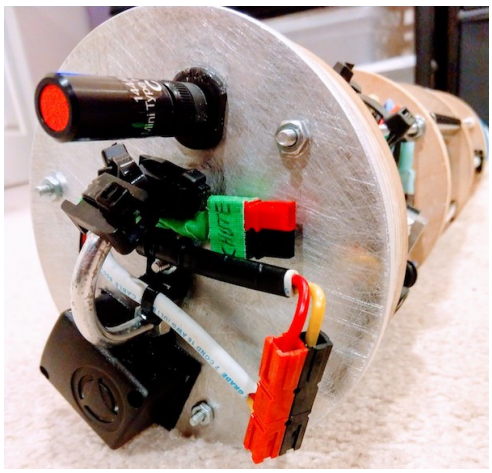
Ken, KD5HEH, holding the transmitter package with the rib-cage antenna.

Amateur Rocket ATV Transmitter

Ken Goldstein, KD5HEH
Rio Rancho, New Mexico kd5heh@gmail.com

The goal of this project was to create an ATV transmitter carried aboard a high altitude amateur rocket that would broadcast flight video and audio to a receiver and recording device on the ground. I've put video cameras on rockets before that record flight video which could be viewed after being retrieved from the onboard camera. The problem with that method of video recording is that if the rocket is lost, malfunctions, or the parachute does not deploy properly, there is a good chance that the video is lost too. With an ATV transmitter, you would at least be able to view the flight in real-time and record the view from the rocket up until any mishap.

The heart of the ATV package is an MFJ-8709 Analog ATV transmitter. I found that the maximum power I could get out of mine was close to 4 watts. These run super hot, and the instructions warn not to let the temperature get over 149 F. I attached a heat sink from an old Pentium processor to it, but that was not sufficient. Below the heat sink, I added a 12 volt 2.5 amp four inch diameter Attwood 1749-4 Turbo 4000 Series II In-Line marine bilge fan which pulls 200CFM of air over the transmitter and heat sink. There are 2 x 1.25" air intake holes near the top of the tube housing the ATV package and 2 x 1.25 exhaust holes near the bottom. The fan caused noise to display on the video transmission. That was resolved through the combination of using a Delta FL75L07 filter module on the fan motor, wrapping the fan motor and filter in RF blocking Farady tape, and placing an aluminum plate below the antenna. Since I didn't want the fan to run continuously, a HiLetgo W1701 12V DC temperature switch was set to turn on the fan when the case temperature of the MFJ-8709 reaches 122 F.



Powering everything is a Maxpacks.com 13.2V 5000mah NiMH battery. It fits inside the PVC pipe below the Eggbeater antenna.

The antenna is a homemade 70cm Eggbeater design made from #8 gauge copper wire based off of Anton, ZR6AIC notes at:
http://zr6aic.blogspot.com/2013/03/building-my-eggbeater-ii-omni-leo.html

For remote control of the ATV transmitter I used a WJ9J DTMF repeater controller connected to an old small Standard brand 2 meter 5 watt HT. Two DTMF controlled automotive relays are wired to the controller. One controls power to the ATV transmitter and the other can power a sonic beacon and also fire a backup parachute ejection charge if the altimeter based parachute ejection fails. The controller transmits high or low tones on the 2 meter simplex controller frequency to indicate the status of the connected relays. The WJ9J controller automatically transmits my call sign every 10 minus over the ATV audio as well as on 2 meters. It can also be remotely commanded to broadcast a long tone on 2 meters to be used for radio direction finding if the packets from an onboard APRS tracker cannot be received by the search and recovery crew. When the recovery crew is in the vicinity of the downed rocket, the sonic beacon can be remotely turned on to make locating the rocket easier as they would just need to home in on the loud siren sound.

Newsletter Details: This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to almost 350. 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. The past 52 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.**

For Sale: Complete ATV Station.

(1) KH6HTV Video, model 70-1, 10 Watt, 70cm, ATV transmitter,
(2) 7" color Haier video monitor / TV receiver
(3) Panasonic SD-S50 camcorder, with camera tripod - standard definition, NTSC, 480i analog video plus stereo audio. 33mm wide angle lens, 70X optical zoom, records on SD memory cards in H.264, 2.7" LCD monitor,
(4) Diamond RH951S 2m/70cm/23cm Antenna, 14", BNC, with mounting bracket
(5) NV0N Video ID board for callsign, time, temp, lat long, and altitude), (code at https://github.com/rinchen/nootropicVE)
(6) All necessary cables, and hard case to hold it all. Cigarette lighter and power pole compatible. You supply battery or 12Vdc power supply.

Asking $300, or best offer + $30 domestic delivery (Alaska & Hawaii extra).
Interested ? -- contact Joey Stanford, NV0N, at nv0n@rmham.org

Editor's note: The model 70-1 is a Vestigial Side-Band, TV transmitter. It was built in Jan. 2011 for Joey. The 70-1 was described recently in this ATV newsletter. See the July issue #48, pp. 11-13. It is frequency synthesized and operates on cable channels 57-61 in the 70cm band. The original materials cost for the transmitter alone was $350. The major cost item being the Pico-Macom model MMA-860, CATV modulator. New the MMA-860 is presently selling for $220. The Haier 7" TV receiver is used to directly receive either AM-TV or VUSB-TV signals on the amateur 70cm band on cable channels 57, 58, 59, 60 & 61. For someone wanting a turn-key, ATV station, this is a good deal.

W6ORG Surplus

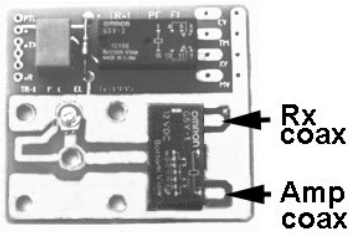
Hey, we are still around and you can ask us for any of the **P.C. Electronics** Manuals and data sheets by dropping us an email to W6ORG@HAMTV.com

Products are long gone since 2015, but we have kept up the hamtv.com web site with all the app notes, ATV info, Videolynx, and a lot of parts left over that I would rather have in your garage than mine - Check out the Surplus page.

Building an amp?

Use our TR-1b Antenna relay board - *$15*
Mounts on a Type N UG58 Jack
Switch between Amp and receiver
Switch up to 25 W 70cm but can be modified for 33 and 23cm.

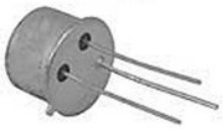
Download data sheet on hamtv.com



Parts, we got parts:
Make us an offer we cant refuse for larger quantities.

2N5770 NPN used in most all of our gear. Great general purpose transistor to 70cm. Similar to 2N918, 2N2222 and 2N3904 - *5 for $1, bag of 100 $10*

2N2907 PNP also used in our gear, general purpose - *10 for $1, 100 for $8*



MM3725 Motorola TO39 NPN used as the video modulator in our KPA5, TX, TC, RTX, and TXA5-RC transmitters and replaces 2N3734 and 2N3553 - *$3 ea, 25 for $2ea*

100 Ohm Pot, Carbon, Panel Mount - Used for video gain control in our P. C. Electronics TC-1, TC70 transceivers, TX70 transmitters, etc. 100 Ohm carbon panel pots are hard to find, most pots at this resistance are wire wound which are too inductive at higher video frequencies. 3/4" shaft length half of which is the 3/8" bushing, 1/4 inch dia round shaft, 1/2W - *$1.50 ea, 25 at $1.25 ea*

Ceramic Trimmer Capacitor, tuning range 2-8 pF - Sprague GKU6R000 RF peaking cap (red top) used in our transmitters and downconverters. *$1ea, 10 for $8, 100 for $65*

Feed Through Capacitor - .001 mF.
Used to keep RF from riding in/out on DC, audio and control lines in shielded enclosures such as repeater transmitters, receiver and control boxes - *$2ea, 10 at $1.50 ea.*

Data sheets on the web page

Email Tom at W6ORG@hamtv.com if interested in any of the items listed on the W6ORG Surplus web page - www.hamtv.com/surplus.html. Ship USA only, USPO flat rate box add $8.