Boulder Amateur Television Club
TV Repeater's REPEATER

October, 2020
2ed Edition

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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

FCC Orders Amateur Access to 3.5 GHz Band to "Sunset"

10/08/2020 -- from the ARRL weekly e-mail newsletter

Despite vigorous and continuing opposition from ARRL and others, the FCC has ordered the "sunsetting" of the 3.3 – 3.5-GHz amateur radio secondary spectrum allocation. The decision allows current amateur activity on the band to continue, "grandfathering" the amateur operations subject to a later decision. The FCC proposed two deadlines for amateur operations to cease on the band. The first would apply to the 3.4 – 3.5 GHz segment, the second to 3.3 – 3.4 GHz. The FCC will establish the dates once it reviews additional comments.

"We adopt our proposal from the Notice of Proposed Rulemaking to remove the amateur allocation from the 3.3 – 3.5 GHz band," the FCC said in its R&O. "We adopt changes to our rules today that provide for the sunset of the secondary amateur allocation in the band, but allow continued use of the band for amateur operations, pending resolution of the issues raised in the Further Notice."

The Report and Order (R&O) and Further Notice of Proposed Rulemaking in WT Docket No. 19-348 adopted on September 30 followed a 2019 FCC Notice of Proposed Rulemaking (NPRM) in which the FCC proposed re-allocating 3.45 – 3.55 GHz for "flexible-use service" and auctioning the desirable "mid-band" spectrum (generally defined as between 1 GHz and 6 GHz) to 5G providers. These and other recent spectrum-repurposing actions stem from the MOBILE NOW Act, enacted in 2018, in which Congress directed the Commission to make additional spectrum available to auction for mobile and fixed wireless broadband. The FCC action is consistent with worldwide allocations adopted by the ITU for these frequencies.

In the run-up to the Commission's decision, ARRL met with the FCC's professional staff to explain its concerns and to answer questions. Subsequently, ARRL met with the wireless advisors to the FCC Chairman and two Commissioners. In those meetings, ARRL

reiterated that continued secondary status for amateurs will not impair or devalue use of this spectrum by the primary licensees intending to provide 5G or other service. ARRL noted amateur radio's long history of successful coexistence with primary users of the 9 cm band, sharing this spectrum with the federal government users and secondary, non-federal occupants. ARRL pointed out that vital links in amateur television and amateur radio high-speed mesh networks using the band have been especially valuable during such emergency situations as the wildfires currently raging on the west coast. Deleting the amateur secondary allocation will result in lost opportunities for experimentation and public service with no public interest benefit to make up for that.

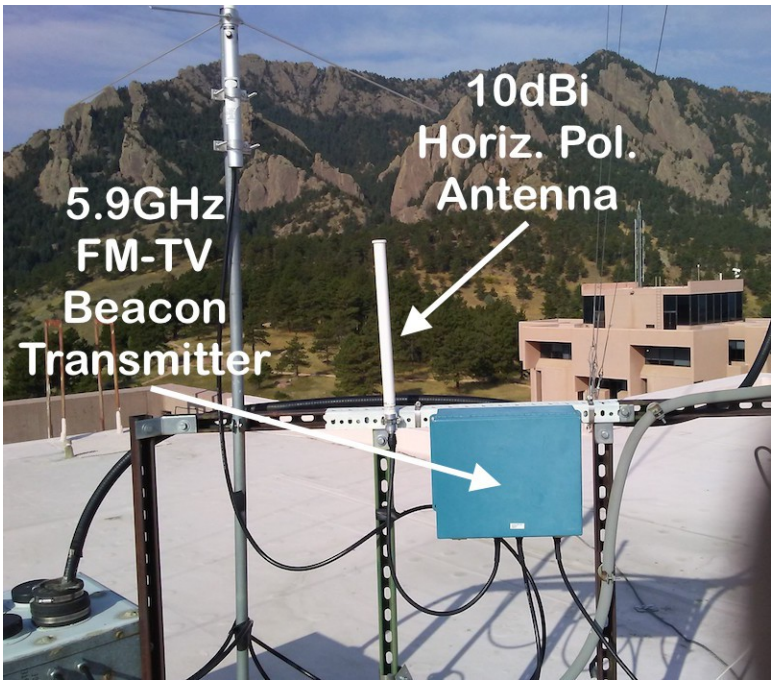
ARRL argued that deleting the secondary allocation would waste the scarce spectrum resource, particularly in areas where commercial services often do not construct full facilities due to small populations. The FCC action means that amateur radio will lose access to the 3.5-GHz secondary allocation even where commercial operations do not exist. ARRL told the Commission that it should not intentionally allow this spectrum to be vacant and unused, wasting the public resource, when amateurs can use some portion of it in many geographic areas with no detriment to any other licensee, just as it has in the past. ARRL argues that amateur operations should be permitted until and unless an actual potential for interference exists.

Deletion of the 3.3 – 3.5 GHz secondary amateur allocation will become effective on the effective date of the FCC's order, but amateur radio operation as of that date may continue while the FCC finalizes rules to license spectrum in the 3.45 – 3.55 GHz band and establishes deadlines for amateur operations to cease. The FCC proposed allowing amateur operation in the 3.3 – 3.4 GHz portion of the band to continue "pending further decisions about the future of this portion of the spectrum," the timing for which is unknown. The Commission proposed to mandate that operations cease in the 3.4 – 3.5 GHz portion when commercial licensing commences for the new 3.45 – 3.55 GHz "5G" band, which is predicted to begin in the first half of 2022.

"We seek comment on whether it is in the public interest to sunset amateur use in the 3.3 – 3.55 GHz band in two separate phases, e.g., first above 3.4 GHz, which is the focus of [the *R&O*] and later in that portion of the band below 3.4 GHz," the FCC said.

ARRL expressed gratitude to the many members and organizations that joined ARRL in challenging the FCC throughout this nearly year-long proceeding. They included multiple radio clubs, weak signal enthusiasts, moonbounce participants, and the Amateur Radio Emergency Data Network (AREDN), the **Amateur Television Network (ATN)**, AMSAT, and Open Research Institute (ORI).

ARRL will continue its efforts to preserve secondary amateur radio access to 3.3 – 3.5 GHz. Members are invited to share comments by visiting www.arrl.org/3-GHz-Band



WHY a BEACON ? After announcing that we had finally been able to get access to the govt. building and installed our new 5.9 GHz, FM-TV beacon transmitter -- I was asked by several hams -- "Why have a beacon ?" We have multiple answers.

1. To encourage microwave experimentation.

2. To encourage hams to try ATV, especially with the really low cost, FM-TV gear now available for drones.

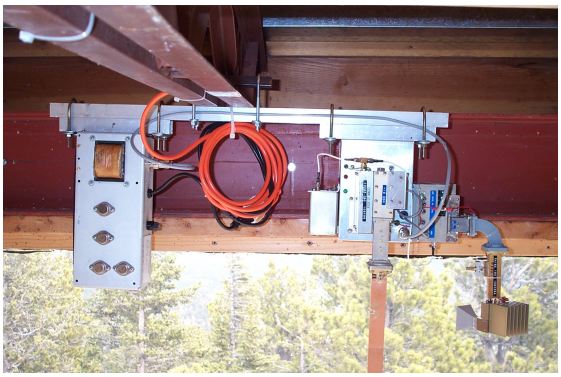
3. To be used as a known signal source for testing antennas and receivers.

4. To increase usage of our microwave bands, to help prevent their being taken away from us.

The idea of beacons is not new. They are in use by hams world-wide, not just at microwaves but on the LF, MF, HF, VHF & UHF bands for propagation experiments. They are also used as signal sources to test and calibrate antennas and receivers. The most well known beacon network is on HF, (20m, 17m, 15m, 12m & 10m) and sponsored by the Northern California DX Foundation. (www.ncdxf.org/beacon/) My Maui club, Maui Amateur Radio Club, KH6RS, sponsors the Hawaii beacon in this network Check out the following:

https://en.wikipedia.org/wiki/Amateur_radio_propagation_beacon

https://www.qsl.net/co8tw/beacons.htm --- among other sources for info on beacons.


K0RZ, 10 GHz Beacon Transmitter

Here in Colorado, Bill, K0RZ, has maintained a 10 GHz beacon on Mt. Thorodin since 2001, which is used by the SSB hams. Being high up on Mt. Thorodin, hams up and down the Front Range are all able to see the beacon with their dish antennas. The beacon is on 10,368.0184 MHz. It is extremely stable and the SSB hams use it as a frequency marker to calibrate their rigs. They are then able to tune up on the SSB calling frequency of 10,368.100 MHz knowing they are on the correct frequency. Bill's beacon puts out a CW carrier, plus IDing with Morse code


View from the K0RZ, 10 GHz transmitter site on Mt. Thorodin

Our, W0BTV, beacon transmits continuously, 24/7, on the 5 cm ham band. It transmits our ID video slide show with info about our ATV repeater. The slide show repeats about every 1/2 minute. Every slide is IDed with our call sign, W0BTV. There is no audio with the slide show. Whenever the ATV repeater is keyed up, the beacon then transmits the live, incoming video and audio. The modulation mode is FM-TV with a 6.5 MHz mono sound sub-carrier. This can be received by an inexpensive ($15) drone receiver. Plus in strong signal areas, only a rubber duck whip antenna is required.

The W0BTV, ATV beacon frequency is 5.905 GHz. The 5 cm amateur band covers from 5.65 to 5.925 GHz. The center of this band is shared with unlicensed ISM users from 5.725 to 5.875 GHz. Thus the center of our ham band is essentially unusable for ham purposes. Don, N0YE, our local microwave guru, has coordinated our microwave ATV activities in the bottom part of the band, but below the ISM band. He has put our DVB-T activities at 5.678 GHz. We are using the low cost, drone, FM-TV gear which is synthesized on 40 channels with frequencies ranging from 5.645 to 5.945 GHz. Not all of them land within our ham band, plus they far exceed the ISM band. For our simplex ham FM-TV, we are using the drone channel 5.685 GHz. To avoid any interference with our simplex operations, we chose to put our beacon at the high end of the ham band, but above the ISM band. We picked the highest drone channel of 5.905 GHz, which still kept our wide FM spectrum within the authorized ham band upper limit of 5.925 GHz.

BEACON COVERAGE AREA VERIFICATION

Now that we have a beacon, we are in the process of verifying what the real coverage area is. In our newsletter, issue # 58, page 2, we included a map showing the potential coverage area as predicted by the computer program, Radio Mobile. The previous newsletter, issue #59, p. 9-10, Gary, WB5PJB, reported that he was able to receive a signal 39 miles away at the extreme southern fringe area predicted by Radio Mobile, in Daniel's Park, near Castle Rock, Colorado. We are now testing out numerous locations to see what works and what doesn't work. The table below lists those locations tested so far. The first test at each site was to see if a signal could be picked up on a simple 1/2 λ dipole antenna. Then a 23dBi gain dish antenna was set up on a tripod for an accurate field strength measurement.

The field test technique used to determine the actual field strength is to use a calibrated step attenuator mounted directly on the L-Com, BBQ grill, dish antenna. With a very short 6", SMA cable then routed to the RC-832, FM-TV receiver. The A/V output goes to a 7", flat screen, Haier monitor. This combination was calibrated on the test bench to have a video squelch, digital threshold of -100dBm with a P2 picture. Thus after aligning the dish antenna properly, the step attenuator is cranked in to determine the threshold. It is the minimum signal level to just open the video monitor's video squelch.

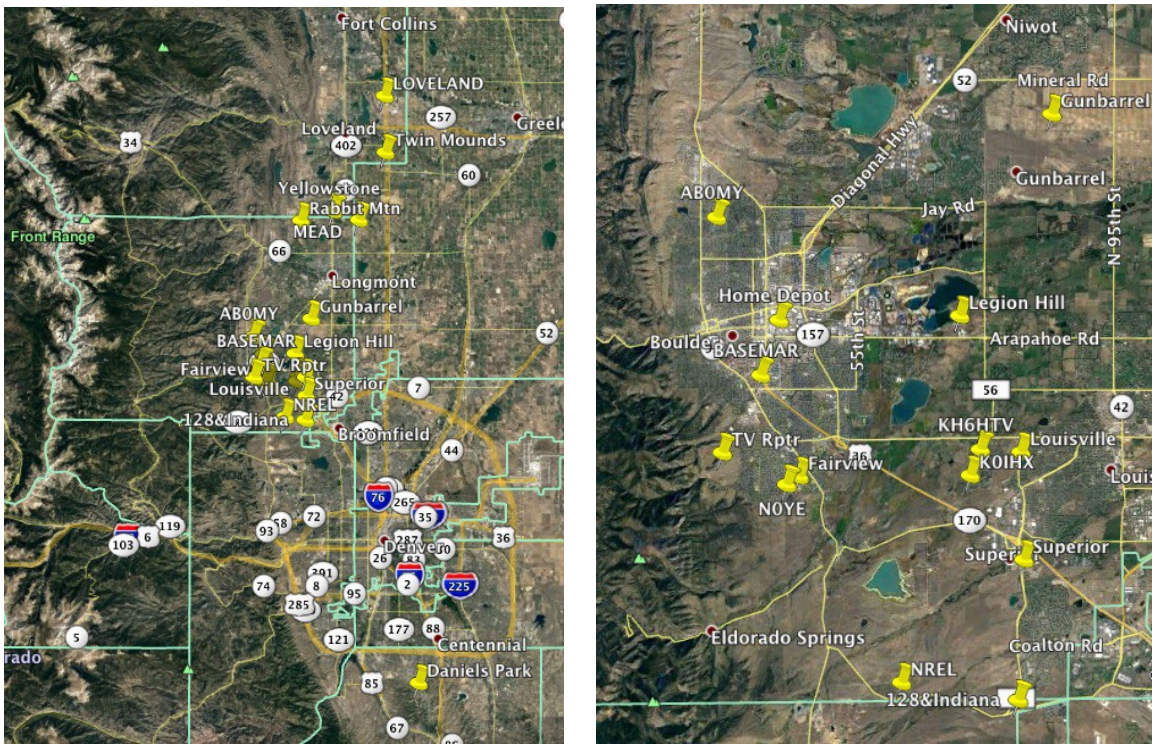
Location	**Distance**	**1/2 λ dipole**	**Power 23dBi Ant Measured**	**P computed Radio Mobile 23dBi Ant**	**Notes**
Daniel's Park	62 km	---	P5	-84 dBm	WB5PJB, 30dBi dish Radio Mobile = -77dBm
AB0MY	7.2 km	---	P 5	-83 dBm	23dBi dish + LNA, some tree limbs
N0YE	2.2 km	---	P 4	-83 dBm	thru trees - used WA5VJB 2-11GHz log-periodic ant
KH6HTV, Spanish Hills	7.9 km	P4	-69 dBm -84 dBm	-69 dBm	clear view thru trees 1/4 m W
K0IHX, Davidson Mesa	7.7 km	P4	-66 dBm	-68 dBm	
Louisville Davidson Mesa Trailhead,McCaslin Blvd.	9.2 km	P2	-85 dBm	-69 dBm	
Superior, Oerman-Roche trailhead, McCaslin Blvd	9.9 km	P3	-69 dBm	-74 dBm	
CO-128 & Indiana	11.9 km	P3	-70 dBm	-71 dBm	
CO-128 NREL	9.1 km	P4	-66 dBm	-70 dBm	
Fairview High	2.5 km	P4+	-59 dBm	-70 dBm	
Basemar Shopping Center	2.6 km	P2-3	-83 dBm	-89 dBm	
Boulder Home Depot	4.4 km	NO	-94 dBm	-71 dBm	thru trees
Legionnaires Hill	8.4 km	P1	-79 dBm	-66 dBm	thru trees 1/4 mi SW

GunbarrelHill-LookoutRd	14.6 km	P4	-75 dBm	-72 dBm	
Rabbit Mtn - 75th St	29.4 km	NO	-96 dBm	-80 dBm	thru trees 1/2 mi S
Yellowstone Rd - US287	33.0 km	P1	-82 dBm	-76 dBm	
E. County Line Rd - Weld CR34 -- Mead	33.9 km	NO	-86 dBm	-78 dBm	
Twin Mounds	46.8 km	NO	-88 dBm	-81 dBm	some RFI
Loveland Airport	55.7 km	NO	-95 dBm	-85 dBm	

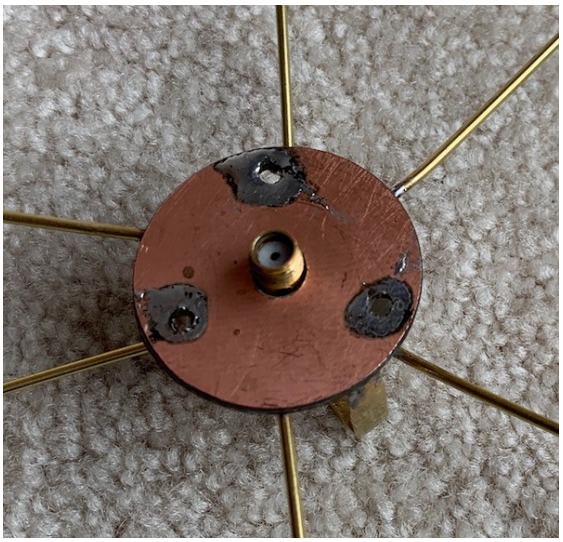
Notes:
Green shading means agreement ± 3dB agreement between measured and Radio Mobile
Red shading means Radio Mobile was too optimistic by >= +10dB
Turquoise shading mean Radio Mobile was too pessimistic by >= -10dB

Conclusions: So far, some conclusions about 5 GHz propagation can be drawn from our tests.

1. If there are any obstructions, blocking a direct view to the beacon transmitter, then severe attenuation results over that predicted by Radio Mobile.
2. Simply having a few trees 1/4 to 1/2 mile away from the receiving antenna, but blocking the signal path results in about 15 dB of added path loss.
3. The Radio Mobile predictions for the urban area of Boulder in the near vicinity of the beacon are very optimistic. Within the city, it is difficult to find a spot with an un-obstructed view of the beacon transmitter.
4. For situations with very clear views to the beacon, the Radio Mobile predictions are usually quite close, within ± 3 dB.



5.9 GHz, FM-TV Beacon Coverage confirmed sites.
Castle Rock to Loveland (left) & Boulder Valley (right)



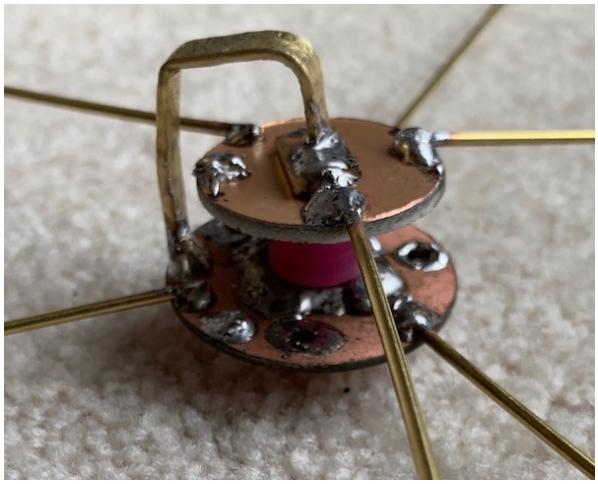
Big Wheel Antenna: Dave, W6OAL, Parker, Colorado, for many years built and sold Big Wheel antennas to ATV hams. His company was called Olde Antenna Labs. He has since retired from building antennas. The Big Wheels were horizontally polarized, omni-directional antennas. They were especially suitable for ballon borne, ATV transmitters. Dave, AH2AR, Dayton, Ohio recently contacted me for help finding W6OAL's original documents on the Big Wheel. We found them in the archives of Amateur TV Quarterly magazine. The main article was in the Jan., 1990 issue, pp 45-47. A correction for the matching section was in the April, 1990 issue, p. 3. W6OAL, said they were originally developed in the 1950s by W1FVY & W1IJD. It consists of three, 1/4 λ elements in parallel, arranged like a three leaf clover. Because of the parallel connection, the impedance is of the order of 12-16 Ohms. Thus a matching, inductive stub is required to up the impedance to 50 Ohms.

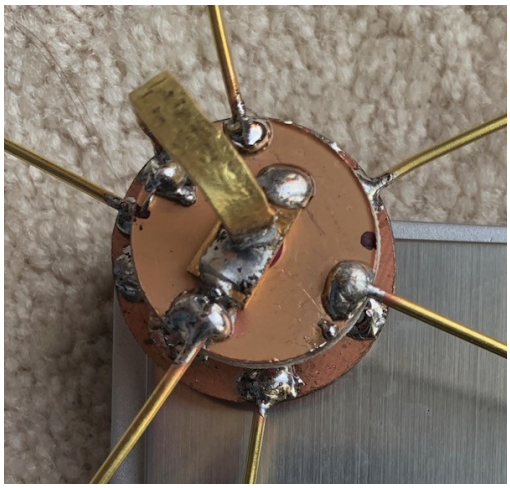
Dave, AH2AR, has recently finished building his own 70cm, Big Wheel. He writes --- "Ugly but operational. VSWR 1.8 to 1 on 439. It greatly favors the lower portion of the band. I could not get the center VSWR dip on 439 but it's as close as I could get it after multiple trimmings. The central hub of the antenna and balun dimensions are my own mess/design. The antenna only weighs 1.8 ounces. What a pain in the butt to get this on frequency. I abandoned two different stub dimensions provided by documentation from W6OAL and D07PSL articles and I simply went with what looks right (the engineers are grimacing!) and it got me in-band, as I believe the central hub that I am using must be introducing significant impedance changes to the original designs. The stub I made is relatively enormous compared to what it is "supposed" to be. Also the brass stub is relatively thick dimensionally. I burned my fingers twice on this one!

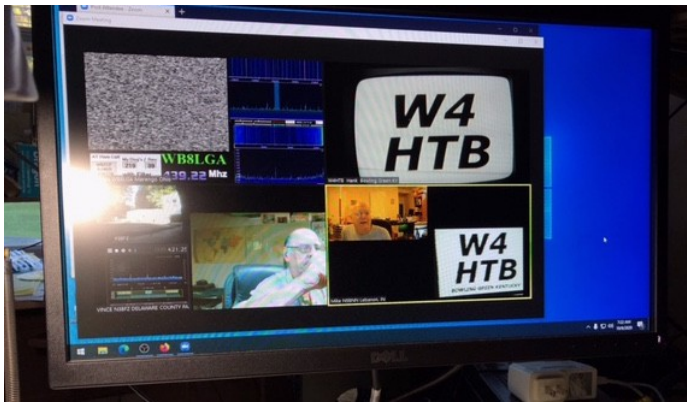
My first attempt was a real disaster. I scrapped the evidence and tried with a fresh approach, once more. Note that the stub length is 1.75 inches long, significantly longer than what would normally be called for. The width is 0.21 inches. The stub is made out of a piece of bar stock brass: I cut it down the middle, and then beat it with a hammer to

its dimensions. The thickness measures about 0.06 inch, pretty thick, but it ends up providing rigidity and support for the two copper PCB discs and it also performs an important function by keeping the discs in-place. Lastly, the PCB "discs" were cut from a PC board with a carpentry hole saw. Sometimes, necessity is the mother of invention..."

Dave plans to eventually fly this along with a 2 watt, 70cm, AM-TV transmitter with his heavy lifter drone. It will be interesting to hear from Dave, what ATV-DX contacts he will be able to make with his air borne, 400 ft. antenna.







ZOOM screen - lower left shows W4HTB as seen at N9BNN, distance of 220 miles

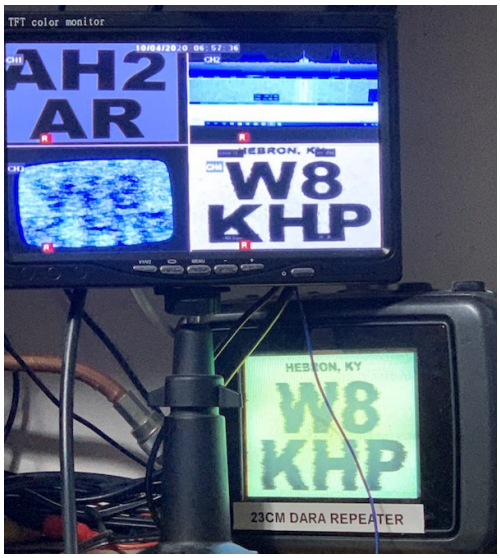
N9BNN as seen at W4HTB

220 Mile, 70cm, Analog TV Band Openings:

Hank, W4HTB, in Bowling Green, Kentucky reports ---- "Hi Jim -- This morning (Oct. 6th) we had exceptional opening from my QTH in Bowling Green KY into Mike, N9BNN, QTH in Lebanon IN some 220 miles as you can see above. This was A5 and I didn't have my digital transmitter in line, that would have been great too.

The Midwest ATV group meets on zoom each morning from 6:30 til 7:30am CDT
We all use the same zoom meeting ID as the DARA and ATCO net."

Dave, AH2AR, in Dayton, Ohio also reports --- "Earlier on Sunday (Oct. 5th), Al W8KHP in Hebron Kentucky had an excellent path into the DARA W8BI repeater, and I am providing a snapshot here of that band opening. The lower left quadrant of the upper monitor shows his W8KHP callsign as received direct from Vandalia Ohio, and on the lower right quadrant, his repeated callsign on 70cm through the ATV repeater in Huber Heights, Ohio. The lower monitor is crosslinking his 70cm ATV signal out through the DARA W8BI repeater on 1258 MHz, FM"



ATCO & DARA Zoom Meetings:

Art, WA8RMC writes --- "
The ATCO net meets Tuesdays at 9 PM EDT on 147.48 MHz. and ZOOM. All are welcome. Join us with video, audio or ZOOM on your computer. The DARA ATV Net meets Wednesdays at 8 PM using this same ZOOM link.

To join ZOOM for the first time, type https://zoom.us/join then download the .exe program and run it. ZOOM will start. Click on join, enter 9670918666 meeting ID then 191593 password. Use video or just audio if you don't have a camera.

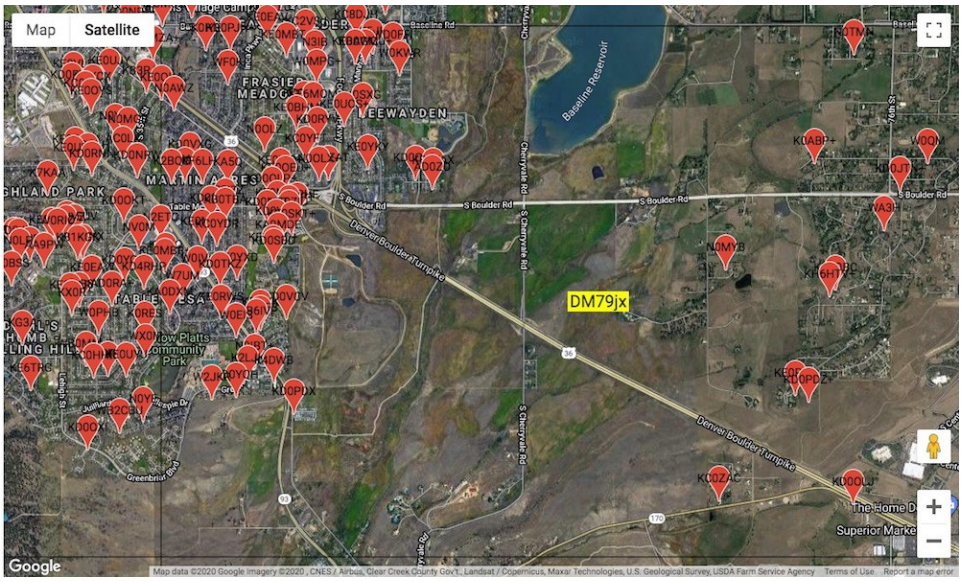
Editor's Note: **ATCO** stands for Amateur Television in Central Ohio. It is the Columbus, Ohio ATV repeater group. Check out their web site for the details on their very impressive ATV repeater. www.atco.tv Their repeater is located on a very tall building in downtown Columbus at a height of 650 ft. above street level.

DARA stands for Dayton Amateur Radio Assoc., in Dayton, Ohio. They are world famous for sponsoring the annual Dayton Hamfest. Their call sign is W8BI. Check out their web site at www.w8bi.org

More Feedback on Horiz Sync Detector:

John, WB0CMC, writes -- "What is an LM357? I can't find it anywhere in my data sources, books or google. I've always used an LM567 tone decoder with appropriate input filtering."

Richard, WD0GIV, replies -- "Yep I made a typo. The LM567 is what I use after an LM1881. The big difference in what was published by the other sync detector is the use of the LM1881. It has a very good way to pull sync out of noise."



HAM LOCATOR: In the ARRL's weekly newsletter for Oct. 1, they had a useful tidbit of info. Want to know what hams live in your neighborhood? Check out Amateur Radio License Map. You may have hams nearby you never knew about. Check out the web site: https://haminfo.tetranz.com/map You can search by callsign, grid square, zip code or street address. The above example shows the grid square DM79jx of south Boulder. Clicking on any of the teardrops gives name, call sign and address of the ham at that location.

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 an ATV net on Thursday afternoon at 3 pm local Mountain time. ATV nets are streamed live using the British Amateur TV Club's server, via: https://batc.org.uk/live/kh6htvtvr or n0ye.

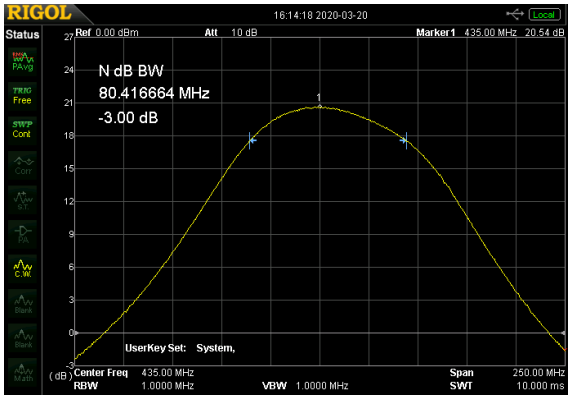
Newsletter Details: This is a free newsletter distributed electronically via e-mail to ATV hams. The distribution list has now grown to over 400. News and articles from other ATV groups are welcomed. Permission is granted to re-distribute it and also to re-print articles, as long as you acknowledge the source. All past issues are archived at: https://kh6htv.com/newsletter/

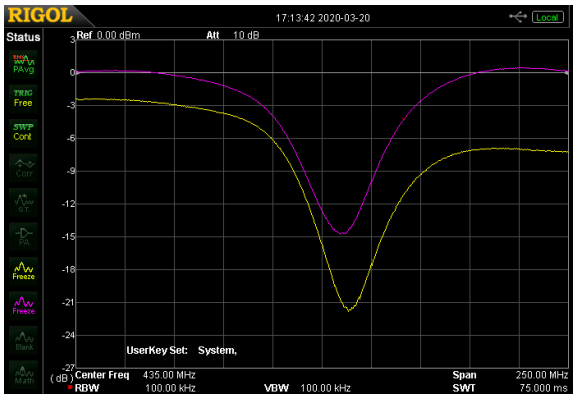
ATV HAM ADS

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.**

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

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





S21 Gain (left photo) **& Return Loss** (right photo) **S11** = yellow trace, **S22** = magenta trace
center freq = 435 MHz, 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	0.5 dB (opt. -1), 1.7 dB (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

KH6HTV-VIDEO www.kh6htv.com e-mail: kh6htv@arrl.net Boulder, Colorado, USA