Boulder Amateur Television Club
TV Repeater's REPEATER

August, 2020
3ed edition

BATVC web site: www.kh6htv.com

ATN web site: www.amateurtelevisionnetwork.org

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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.

ARRL - 10 GHz & Up Contest

This is the big weekend of the year for microwave hams. The ARRL sponsors a 10 GHz and higher contest on two weekends. The first is August 15-16 and the second will be September 19-20. Microwave hams will be taking their dish antennas out in the field to as many high points as possible and try to rack up lots of contacts. The key exchange for a valid contact is the grid square of the operating location. Historically, this has been a CW and SSB contest. This year the Boulder ATV hams hope to also make it a Digital TV event. Here on the Front Range of Colorado, Saturday, the 15th has been set aside as SSB day. Then on Sunday, the 16th, the ATVers will light up the either with 10GHz beams of high-definition, digital TV. The Boulder ATVers plan to participate on both days, first SSB, then DVB-T. The next issue of this newsletter will report the results.

World Wide ATV QSO Party

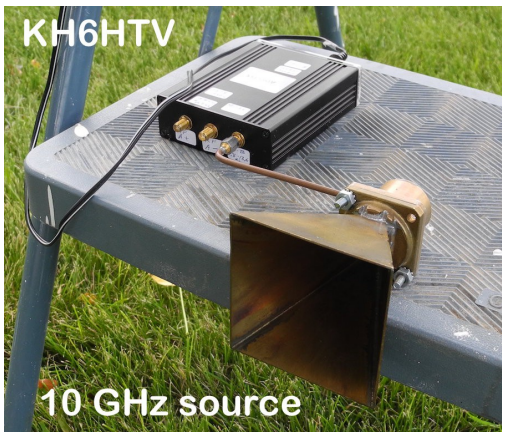
Peter, VK3BFG, and the VK3RTV, Melbourne, Australia ATV group are again hosting a world wide ATV QSO party. Peter says " I have set Friday, August 28th and Saturday the 29th for the event. (These are local times Melbourne Eastern Standard Times …. We are UTC +10). Friday the 28th here will be a local event and Saturday 29th hopefully a trip across the US. The date/times are local here but we would start on our Saturday morning (which would be your Friday night)."

The ATV QSO party will be inter-connected using ZOOM on the internet. But each local ATV group will have a central host/coordinator and is expected to input to the QSO party via your local ATV repeater. The local host will then up-link the ATV repeater's signal to the international ZOOM meeting. Doing this versus all Zoom is to encourage the use of ATV.

International participants may watch the ATV QSO party by connecting via the internet to the British Amateur Television Club's server https://batc.org.uk/live/ Then select "Repeaters" and then VK3RTV-1 for the Melbourne ATV repeater.

Here in the USA, the party will first start in Ohio with the ATCO group. They have been assigned 00:00Z Sat. Aug 29th (local Columbus time, 8pm, Friday the 28th). The party will next move to Boulder, Colorado on 01:30Z, the 29th (local Boulder time, 7:30pm, Friday the 28th). After Boulder, it will then move to the west coast with ATN-CA. Then it will jump over the pond to London, U.K.

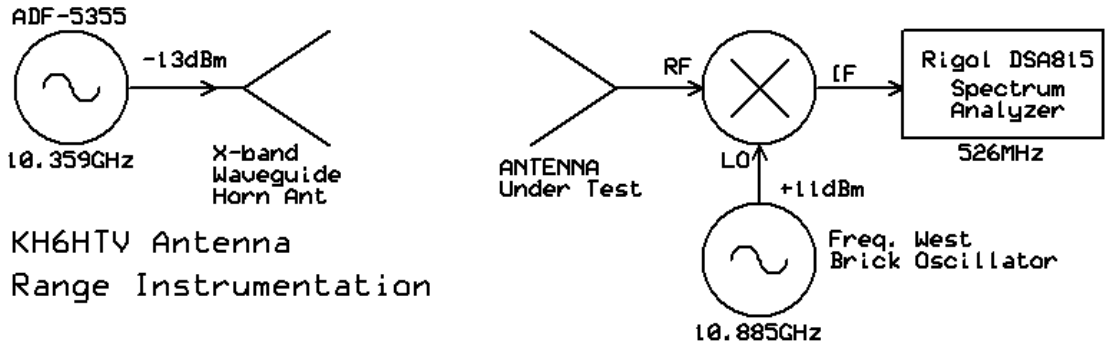
For the Boulder ATV group, Don, N0YE, will be our local host & coordinator for the QSO party. Don will be our local net control and he will be streaming the output of our W0BTV repeater to the QSO party ZOOM meeting. Don requests all BATVC members to check into this special net on Friday evening, August 28th, at 7:30 pm. As usual, we will be using the BCARES, 2m, FM repeater on 146.76 MHz (-600kHz, 100 Hz PL tone required). for our voice intercom and net control. To also watch the other world-wide participants, we will need to view the ZOOM meeting. Jim, KH6HTV, also plans to broadcast the entire QSO party over our ATV repeater for those portions where we are not the active participants.

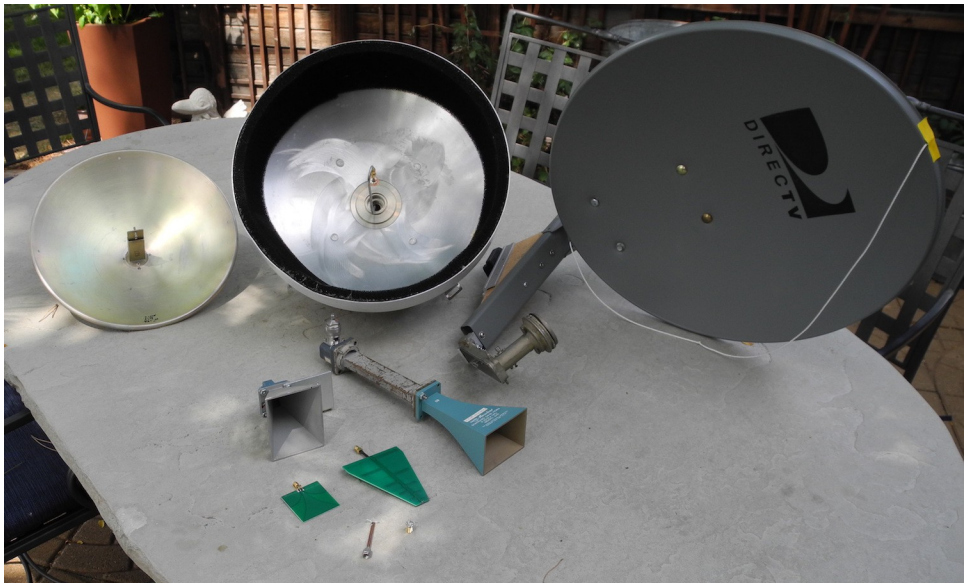


10 GHz Antenna Testing:

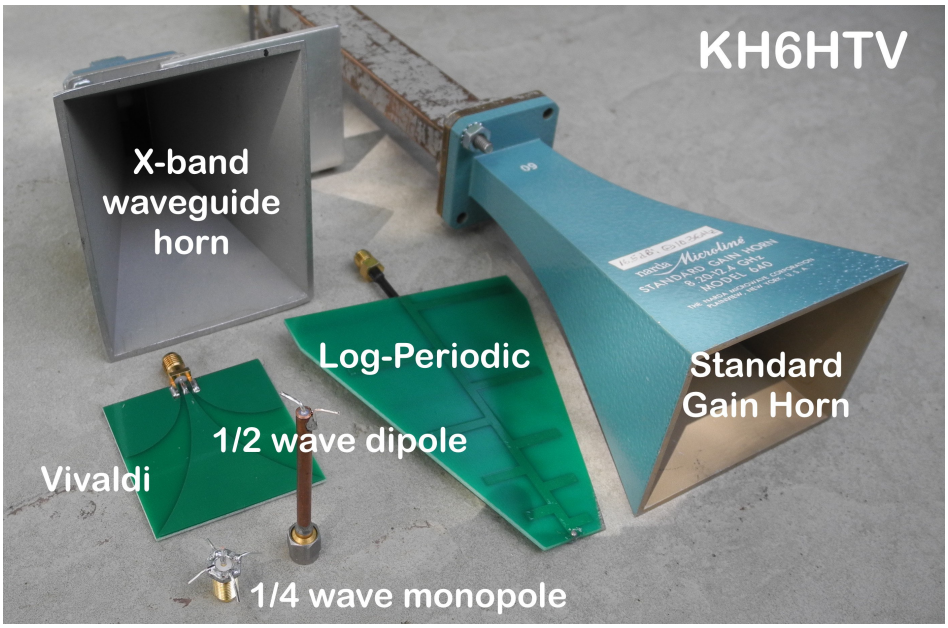
Both Jim, KH6HTV, and Don, N0YE, have set up ranges for antenna testing. Jim set up his in his backyard. The test source was a frequency synthesizer (54MHz - 13..6GHz) which uses an Analog Devices ADF-5355 IC. (available from China for $155). It was set to 10.359 GHz and put out -13dBm to an X-band waveguide horn antenna. The receiver consisted of a Frequency West brick, local oscillator driving an Anzac mixer. The 526 MHz IF was then measured using

a Rigol DSA-815 spectrum analyzer. The source and receive antennas were separated by about 45 ft. The spectrum analyzer was put in the Peak Hold mode and the antenna under test was moved in small increments in both azimuth and elevation to sweep through the "sweet spot" of maximum gain. The analyzer's cursor was then set to the highest level captured. The value in dBm was recorded. For later data analysis, the Narda Standard Gain Horn antenna was used as the absolute reference. It's gain value was given as +16.5dBi on it's calibration chart. Gain calculations were then made on the difference in dBm from that measured on the Narda horn (-63.1dBm)





Assortment of 10 GHz antennas tested -- from an big, 18" dish to a tiny, 3/4 cm monopole whip antenna.



The smaller 10 GHz antennas tested.

KH6HTV Antenna Measurement Results

Antenna	Gain	Antenna	Gain
Narda model 640 Std. Gain Horn	16.5 dBi per calib. chart	1/2 λ Dipole	1.5 dBi
Ar^2 MA-86551 X-band Horn	16.6 dBi (*)	N0YE feed for 15"dish. dipole with disc reflector	2.6 dBi
12" Dish with wave-guide feed	25.5 dBi	1/4 λ Monopole with 4 drooping radials	4.1 dBi
15" Dish #1 with N0YE feed	24.5 dBi	Vivaldi omni-directional on pc board	2.0 dBi
18" Direct TV Dish with offset feed	28.5 dBi	Log-Periodic on pc board 1.4-9.5GHz, (from Banggood.com, China)	-0.3 dBi

(*) Using Paul Wade, W1GHZ's, computer program HDL_ANT32_V4p1.exe, to calculate the gain of waveguide horns, the theoretical gain of this Ar^2 MA-86551 horn is 16.7dBi. Thus the measured value was off by only 0.1dB.

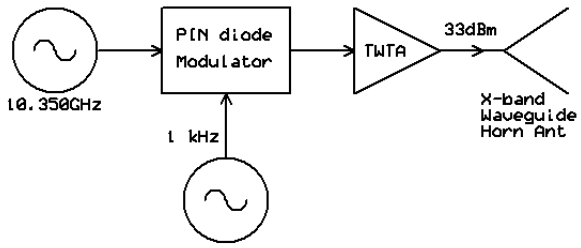
The following are comments from Ed, K0JOY. Ed is our resident antenna expert. He is an EE Professor Emeritus from Georgia Tech, where he taught courses in antennas.

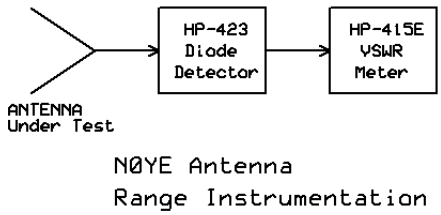
"Jim and Don, ---- The measurements seem realistic. Unfortunately at 10 GHz we can not assume that the earth is flat or smooth to a tenth of a wavelength, so ground reflection will be very diffuse (not necessarily a bad thing). Even in diffuse ground reflection, the ground reflection will cause interference at the test location. The direct and ground reflection will add in and out of phase depending on the length of the direct and reflecting paths. Ground reflection can be averaged out by performing gain measurements for various heights of the range antenna or the antenna under test and

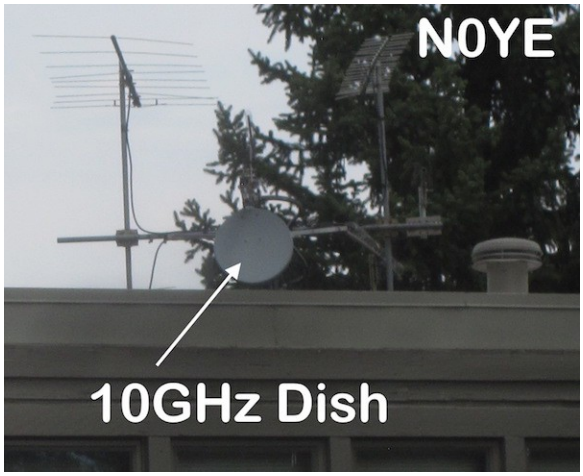
averaging the gain values or simply moving one or the other vertically and recording the peak value. (Job security for antenna measurement people !)"

Left to Right: N0YE, WB2DVT, N0FZB & WB2DVT

Expert Antenna Pointer - Debbie, WB2DVT with the Narda standard gain horn







View of N0YE's tower mounted dish antenna. as seen from across the street at receive site.

HP VSWR meter

On Wed, August 5th, Don, N0YE, organized a group session to test a bunch of 10 GHz antennas. ATV hams participating were: Debbie, WB2DVT, Pete, WB2DVS, Mike, N0FZB, Jim, KH6HTV, & Don, N0YE. Don fired up his 2 watt, ham shack 10 GHz transmitter. It uses waveguide to an outside, tower mounted dish antenna on a rotator. Don pointed his antenna to the vacant lot across the street from his house where other ATV hams set up their antennas to be tested. Don's antenna test equipment used an HP

VSWR meter as his basic measurement instrument. The VSWR meter is basically a 1 kHz tuned amplifier and detector. Don modulated his 10 GHz signal at 1 kHz using a PIN diode modulator. On the receive antenna, he detected the RF using an HP diode detector. Don also used the Narda model 640, standard gain horn as his reference standard. All other antennas were compared against it. The results of Don's measurements on the various antennas is tabulated below.

N0YE Antenna Measurement Results

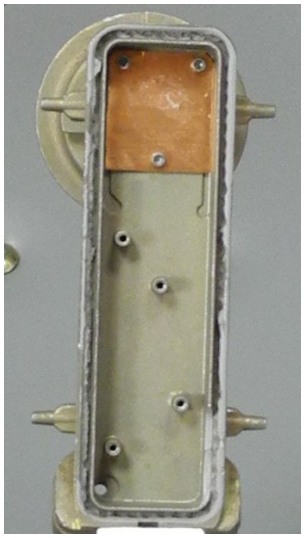
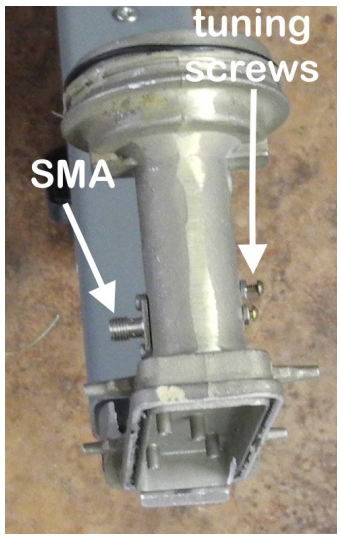
Antenna	Gain	Antenna	Gain
Narda model 640 Std. Gain Horn	16.5 dBi per calib. chart	1/2 λ Dipole	1.5 dBi
Ar^2 MA-86551 X-band Horn	17 dBi	N0YE feed for 15"dish. dipole with disc reflector	not measured
12" Dish with wave-guide feed	25 dBi	1/4 λ Monopole with 4 drooping radials	3 dBi
15" Dish #1 with N0YE feed	23 dBi	Vivaldi omni-directional on pc board (China)	1 dBi
18" Direct TV Dish with offset feed	26 dBi	Log-Periodic on pc board 1.4-9.5GHz, (from Banggood.com, China)	-3 dBi
Other 10 GHz Antennas measured by N0YE			
15" Dish #2 with N0YE feed	27 dBi	WA5VJB, 9-25 GHz, Vivaldi PC board Horn	6.5 dBi
18" RCA-DSS Dish with offset feed	27 dBi	WA5VJB, 2-11 GHz, pc Log-Periodic	2 dBi

* WA5VJB printed circuit board antennas available at: www.wa5vjb.com

CONCLUSION: There was good agreement between the independent N0YE & KH6HTV measurements made on separate antenna ranges and with different measurement instruments. Most agreed within 1dB. The worst case was 2.5dB difference on the high gain, 18" Direct TV dish.

DirecTV Antenna Modifications

Don, N0YE, recently undertook a project to adapt a surplus DirecTV, satellite TV antenna for use on the 3cm (10 GHz) ham band. This particular dish was originally designed to be used with a triple feed horn assembly to look at three different satellites. Don modified it to accept a different feed horn and to be suitable for terrestrial, microwave use, looking at the horizon instead of into the sky.

The feed horn was one Don had salvaged from another satellite TV dish antenna. It originally contained the block down-converter electronics. Don ripped those out and put a copper cover plate over the spot where the circular waveguide horn feed into the electronics. Don also added an SMA connecter to the side of the waveguide along with a couple of tiny tuning screws. The SMA probe was placed 1/4 λ in front of the copper back plate.

The next step was to determine where to place the feed horn ? The first time, we simply stuck it into the existing feed horn support arm. When the antenna was then tested, it was found to have whooping -2 dBi of gain ? (loss really - more like a dummy load !). Back to the drawing board. Don then consulted the web site of the world famous, ham radio microwave expert, Paul Wade, W1GHZ. (www.w1ghz.org) Paul writes the monthly column in the ARRL's QST magazine, entitled "Microwavelengths".
(editor's note: It is a must for all hams interested in microwaves to check out Paul's web site. It contains a huge amount of useful information for us.)

On Paul's web site, Don found some extremely useful software of Paul's for calculating all sorts of things related to antennas. See - http://www.w1ghz.org/antbook/contents.htm Then scroll down to the bottom of this long page to "Software" -- Downloads: Don used the program there called HDL_ANT32. This is new version of Paul's previous 2003 HDL_ANT.exe This new version runs on Windows 7 & 10, but it looks like you are running an old 1980s DOS program. There are many different sub-programs within this program. Don used option "O" to calculate where to place the feed horn antenna on the DircTV dish. The program also specified for optimum performance, the feed horn should have a 3dB beamwidth of 46°. With this feed horn and a 60% efficiency, it predicted the antenna would have +32dBi of gain.

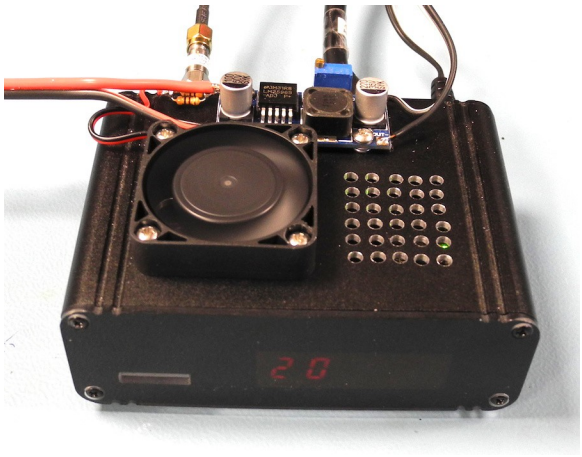

Once Don had the location and angle of the feed horn calculated from Paul's program he then devised a simple trigonometry method of physically determining the location. It was a simple matter of using a piece of string with a knot offset from the middle. Simple trig math then determined the lengths of the two ends of the string. The string was attached to the dish with tape on the major axis of the dish. Knowing the precise location, Don was then able to fabricate a suitable metal bracket to hold the feed horn in the proper spot.

The last item to be dealt with was building a wedge to align the dish on a horizontal axis when mounted on a camera tripod. The satellite DirecTV dish was not intended to look at the horizon, but up in the sky at satellites. Thus, the mounting brackets on the back side of the dish are not suitable for terrestrial microwave applications. With an offset feed dish, the true pointing axis is not at all obvious. So how did Don determine what it was ? Don said *"An ellipsoid dish - when viewed on axis appears as a pure circle."* Thus Don set up the dish on a camera tripod on a horizontal surface. He then walked out in front of the dish and looked at the dish. When he finally saw it appear to be a "true circle", he knew he had found the correct angle. He measured the angle of the support arm. He then cut a block of wood in a wedge shape of the same angle. The angle Don found for this particular DirecTV dish was 25 degrees. The mounting bracket could have been used, but the wooden wedge saves weight.

So - How well did the resultant modified dish antenna work ? The antenna measurements reported earlier in this newsletter showed a measured gain of +28.5dBi. Not too shabby ! Great work Don.

Don adds these parting comments -- *"The feed was from another dish and may not properly illuminate this dish. The beam width may not be quite right for this dish. The pointing of the feed was not optimum. As good as the performance is with this dish and feed, these details may diminish the best performance that could be obtained from this dish."*

Hi-Des Model HV-110 Receiver Modifications



I have always lamented the fact that the original Hi-Des DVB-T receiver ran off of +5Vdc instead of +12Vdc. I finally decided to do something about it. As shown in the photo, I added a DSN-2596, 12V to 5V switching regulator. These are available for about $1 to $1.50 from Amazon, E-Bay, etc. While I was at it, I also decided to add a cooling fan. I had a dead, $25, 2 watt, amplifier module which I had been using for 5.8GHz, FM-TV. I had burned it out driving it too hard trying to get 5 watts of RF. It had a nice 12Vdc, 40x40mm cooling fan on it. So I salvaged the fan. I drilled a set of vent holes in the HV-110's extruded aluminum housing and mounted the fan on the top along with the DSN-2596 switcher. At 12Vdc, the fan was noisy, and moved much more air than needed, so I added a 150 Ω series resistor to quiet it and slow it down. At 5Vdc, the HV-110 pulled 600 mA. Now powering it and the fan from 12Vdc, it pulls 330 mA.

Jim, KH6HTV

FEEDBACK: (reference AN-50a, "Is DVB-T Sideband Sensitive?", in previous newsletter #52) Ron, K8DMR , of Jenison, Michigan writes --- "Jim -- On your FM and phase noise tests for normal DVB-T you say

"With a 1 kHz test tone, the receiver worked only up to about 600 Hz deviation. With a lower 400 Hz test tone, it was worse. 200 Hz deviation caused pixelization and anything higher, the receiver failed."

So I suppose then that if you increased the test tone to, say, 10 kHz you could have gone to even high deviation than 600 Hz and the Rx would still lock on the DVB-T picture. To me this means the receiver is simply acting as a LPF to your synthetic phase noise. Right? Of course real phase noise is spread out but and usually has highest amplitude near the carrier."

Ron, K8DMR

A Quick Look at a USB Interface Dongle that Serves as a Video (NTSC) Capture Device for PCs

All of the Midwest regional ATV hams are still using analog cameras in the shack and in order to use the cameras for Zoom or for other computer-related purposes, an "analog video to PC" converter becomes a necessary hamshack item. In the past, employment of ION Video-to PC- adapters or employment of "EASY CAP" dongles with PC operating systems other than Win 10 has been a challenge. Please note that there is a current solution for WIN 10 computers to port-in NTSC video into your PC for use on Zoom. This particular NTSC video capture device will automatically loads/install its own driver

for seamless operation with a computer. Combined with the free Open Broadcaster Software (OBS) software, this unit has proven to be a reliable and easy method for in-shack NTSC camera use on Zoom. As it works so well, this represents a real bargain at $10.99 with free shipping on e-bay. Here is the eBay link. https://www.ebay.com/itm/USB-2-0-Audio-TV-Video-VHS-to-DVD-VCR-PC-HDD-Converter-Adapter-Capture-Card/203017529763?

Dave, AH2AR

48 Vdc in Future Automobiles

With the additional electronics, motors, and actuators increasingly being added to internal combustion engine vehicles, the conventional closed-circuit 12 V automotive electrical system—based on a lead-acid battery charged by the alternator—is revealing its limitations. For example, when using a 12 V system, high power applications such as electric steering draw a high current, necessitating bulkier, heavier wiring looms. That extra weight becomes significant in a modern vehicle, which can have several kilometers of wiring.

An alternative approach employs higher voltage systems for the power-hungry applications to lower the current draw and allow for lighter wiring. Commercial implementations feature a conventional 12 V network supplemented by a 48 V system based on lithium-ion (Li-ion) batteries. The 12 V system is used for applications such as engine management, lighting, and seat and door adjustment, while the 48 V system takes care of heavy-duty demands from functions such as electric steering, starting, and HVAC

The transition to 12/48 V systems is largely being encouraged by the need to drive high power consumption devices while ensuring the vehicle still meets stringent economy and emissions regulations. For example, the switch from mechanical to electric drive for things like steering or superchargers dramatically reduces friction losses and boosts fuel economy. According to some auto manufacturers, a 48 V electric system results in a 10 to 15 percent gain in fuel economy with a proportional reduction in noxious emissions. The 12 V side of the system continues to be needed because of the large volume of legacy 12 V devices that will be fit into autos for years to come.

A newly proposed automotive standard—LV 148—describes the combination of the 48 V bus with the existing automotive 12 V system. The 48 V system incorporates an integrated starter generator (ISG) or belt start generator and the Li-ion battery. The system is able to deliver tens of kilowatts (kW) and is targeted at conventional cars, as well as hybrid electric and mild hybrid vehicles.

adapted from Digi-Key newsletter 8/12/2020

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.**

Garage Clean Out: I have the following items for sale that should be of interest to fellow ATVers. The price does not include shipping. Shipping would be by USPS Priority Mail, flat rate cartons. If interested call me at 303-594-2547 (mobile), or shoot me an e-mail at kh6htv@arrl.net --- Jim Andrews, KH6HTV

23cm RF POWER AMPLIFIER: $60 Mitsubishi M57762, class AB, 20 Watt amplifier brick module. Built into die-cast Al enclosure with large heat sink and cooling fan. 6" x 4 1/2" x 4". Ideal for AM-TV, FM-TV, FM, CW or SSB. NOT linear enough for use with DTV. Small signal gain = 18dB. Max. output power = 20 Watts. Runs on 13.8Vdc. Pulls 0.7A in idle state. Pulls 4 Amps at max. 20 W output.

TD SYSTEMS - 23cm Down-Converter: $40 -- Designed to be remotely installed on your antenna tower. In 4 3/4" x 3 3/4" x 1 1/2" die cast aluminum, sealed, weather-proof enclosure. RF Input = 23cm band. IF output is 70 MHz (-3dB BW 40 to 110 MHz) The VFO tunes from 1163 to 1255 MHz. The RF seems to be peaked on 1270 MHz. The box will need to be opened and the RF stage will need to be retuned for other 23cm frequencies. This down-converter would be ideal for receiving AM-TV on the 23cm band with an output on channel 3 to a conventional, NTSC, TV receiver, or for 23cm FM-TV with a 70 MHz IF amplifier/demodulator. Type N antenna connector. Type F, IF output connector. DC power and VFO tuning voltage are sent up the coax cable from the shack. Includes in the shack 120Vac power supply, bias inserter and VFO frequency tuning control in a separate metal enclosure.

ELKTRONIXs VIDEO ID GENERATOR: $10 -- Model VDG-1. This pc board was designed and built by Bill Brown, WB8ELK. There are a selection of 4 different NTSC video ID screens. They are programmed into an EPROM. This unit presently is programmed for W0BCR and would need to be reprogrammed. Formerly was used in the Boulder, CO ATV repeater. Bill, WB8ELK, will still sell custom programmed EPROM chips for $20. He sells the VDG-1 board for $150. Contact Bill at wb8elk@gmail.com For more info go to: www.elktronics.com

23cm BAND-PASS FILTERS: $100 each - Spectrum International model PSF-1296. Covers entire 23cm band (1240-1300 MHz) Very rugged construction, 3 pole, inter-digital band-pass filter. Made of machined brass and copper. Has tuning screws for fine adjustment. One unit has type N connectors, while the other has BNCs. < 1/2 dB insertion loss. -3dB BW = 125 MHz, -10dB BW = 165 MHz, -20dB BW = 225 MHz & -40dB BW = 500 MHz. Formerly used in Boulder, CO ATV repeater.

70cm BAND-PASS FILTERS: $150 each - Spectrum International models PSF-421-ATV & PSF-439-ATV. 6.5 MHz bandwidths for use in an ATV repeater. Center frequencies are 423 MHz & 441 MHz. Very rugged construction, 5 pole, inter-digital band-pass filter. Made of machined brass and copper. Has tuning screws for fine adjustment. BNC connectors. Approx. 1.5 dB insertion loss. Greater than -90dB rejection of signals ± 18 MHz from center frequency. Formerly used in the W0BCR, Boulder, Colorado, ATV repeater.

70cm BAND-PASS FILTER: $50 -- home-brew by John, W0KWR (SK), in his machine shop. 4 pole, inter-digital design. Made of machined brass and aluminum. BNC connectors. For channel 60 (439.25 MHz), 8.5 MHz -3dB band width. Was originally in service in Boulder ATV repeater, W0IA, in the late 1970s and 1980s.