Boulder Amateur Television Club
TV Repeater's REPEATER
December, 2019

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Future Newsletters: If you have contributions for future newsletters, please send them to me. We love to also include news from other ATV groups.

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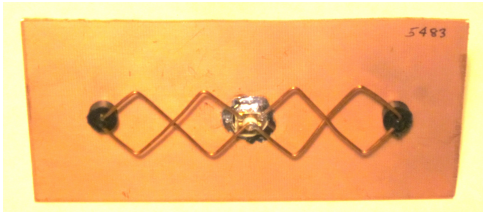
News from San Diego

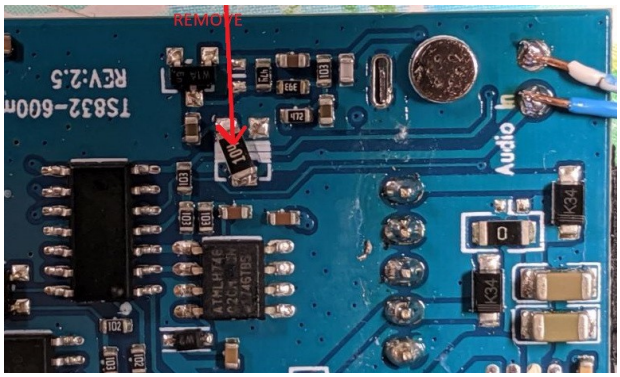
I thought I'd share this with the group, our RPA HL {Heavy Lift} Drone we call "SARDRONE". We did a test flight early this morning near a experimental field near Chula Vista, we did stay just below 350' since we were also testing new motors for more lifting with the upgraded HD camera payload, 5.8Ghz FM transmitter package and smart phone as an airborne hot spot and extra eyes using, Vsee, video conferencing link. 73 de Mario, KD6ILO

More 10 GHz - DVB-T Progress

Bill, AB0MY, and Don, N0YE, were able to have a successful, two way, QSO on Sunday, Nov. 17th with DVB-T on 10.359GHz. The photo was taken by Don of Bill's TV signal. Bill set up a temporary rig and antenna, borrowed from Don, on his deck in north Boulder. Don used his permanent, tower mounted dish antenna at his south Boulder home. See the article on pages 3 & 4 for more about Don's X-band, microwave, antenna.



A CUTE ANTENNA: Bill, AB0MY, showed off at the Nov. BARC meeting's home-brew night, his latest antenna construction. It was a Double Bi-Quad antenna with back reflector for 5.8 GHz. The theoretical gain was 13 dBi with 30º beam width and 23dB F/B. Now we need to see how far Bill can radiate his 5.8 GHz, DVB-T or FM-TV signals with it. He found the instructions on how to build it at:
https://buildyourownantenna.blogspot.com/2014/07/double-biquad-sector-antenna-for-5-ghz-wifi.html



TS-832 FM-TV Transmitter Modification: In the Nov. newsletter, 4th edition, vol. #25, article on 5.8GHz FM-TV, I recommended not purchasing the TS-832 transmitter because of audio issues. Bill, AB0MY, has found a cure. Bill says "The TS832 onboard audio can be disabled by removing a single chip resistor. External audio can then be applied to the pad marked audio on the back. I have done this and tested using a 1 kHz sine wave generator. 1V p-p seems to work fine."

QST DISAPPOINTMENT

Jim Andrews, KH6HTV

I always look forward to finding the next issue of QST in my mailbox. I especially like the very thorough Product Review section. The ARRL staff does a great job of checking out new products. In the Dec. issue, the contents page listed a product review of the Diamond X-6000 tri-band antenna and the companion MX-3000 triplexer. We use both of these in our Boulder ATV Repeater. I thus immediately turned to p. 38 to see what the ARRL had to say about them. A big disappointment ! The review was not in fact by the ARRL, but by Pascal, VA2PV. It really was not a technical review. All he did was repeat Diamond's specs. and talk about installing the antenna at his QTH. The only measurements he made were of VSWR and then only at 5 points each on each band, plus he was able to make a contact using the antenna. In addition, his 23cm, VSWR measurements were meaningless because he made them at the far end of a really long, lossy coax cable. He said the cable had 5 dB loss on 23cm. Sorry ARRL, but you goofed on this one. You could have printed it as a ham's experience with a new antenna, but don't call it a product review. My measurements on the X-6000 antenna in my app. notes, AN-4 & AN-40 gave a hell of a lot more useful information than your article.

NOYE's VHF / UHF / Microwave Antennas

A Tower Mounted 10 GHz Off-center-fed Dish Failure

Don Nelson, N0YE

Bad News - Part 1: sometime this summer the flexible wave guide wrapped around the rotor feeding the 10 GHz dish antenna on the tower came away from the WR90 to which it was attached. What failed was a WR90/flange solder joint not the flexible wave guide. I saw this over a couple of months ago and did not fix it right away. I did eventually take down the failed parts and re-soldered them.

Part 2: Later I tested the repair and found no signal. I measured the return loss. One watt out and nothing back - it does not get better than this. So back up the tower. I pulled the repaired flange off. Yup, something, a bird or whatever, had stuffed the WR90 with pieces of grass. I could pull out about 2 inches of grass up to a 90 degree wave guide bend. Nope this did not fix the failure. So back up the tower again, when I opened up more of the wave guide and pulled grass out of the 12 plus inches of straight wave guide. I did not trust that I was done and so I removed the feed horn and attached short piece of straight WR90. There was grass pieces all the way to the horn. There is a plastic window at the horn flange/flange joint. So nothing came into the wave guide from the horn end. All of the grass pieces were put into the wave guide from the broken flange end.


The picture on the left shows the wave guide going up the feed holding arm of the off-center-fed dish. The dish is upside down to keep water from entering the horn. The right side of WR90 wave guide has been opened up in this picture to allow the wave guide to be cleaned out. The next picture shows some of the grass pieces removed from the wave guide. The whole wave guide was full of grass pieces like these pieces. The third picture shows the horn taken down for cleaning. Note the grass still in this section wave guide. The last picture shows the dish antenna on the tower with other antennas.

Good News - Part 1: the 10 GHz off-center-fed dish on the tower appears to be working now. I can hear SSB and see DVB-T signals again.

Part 2: The return loss is now a believable 13 dB. Having a "perfect" attenuator at the dish end of the wave guide that gave me a stunning good return loss, tells me that the wave guide from the rig to the dish is very good.

Here are a couple of notes on the 10 GHz tower antenna system. The dish is a first generation off-center-fed Dish Network dish with a home brew horn antenna at the feed point. These first generation dishes used only one LNB and so the dish surface is a section of a parabola. The horn was designed by Paul Wade, W1GHZ, (http://www.w1ghz.org/10g/10g_home.htm) to properly feed this type of dish. The feed horn is attached to WR90 wave guide that goes to and around the rotor to a fixed wave guide that goes down the tower. The fixed piece of wave guide going down the tower is 3/4 inch water pipe about 20 feet long. At the bottom of the water pipe, there is a transition back to WR90. The WR90 then goes over a few feet and then through the house wall. Inside the house the WR90 goes up to the 10 GHz rig which I use for both SSB & DVB-T.

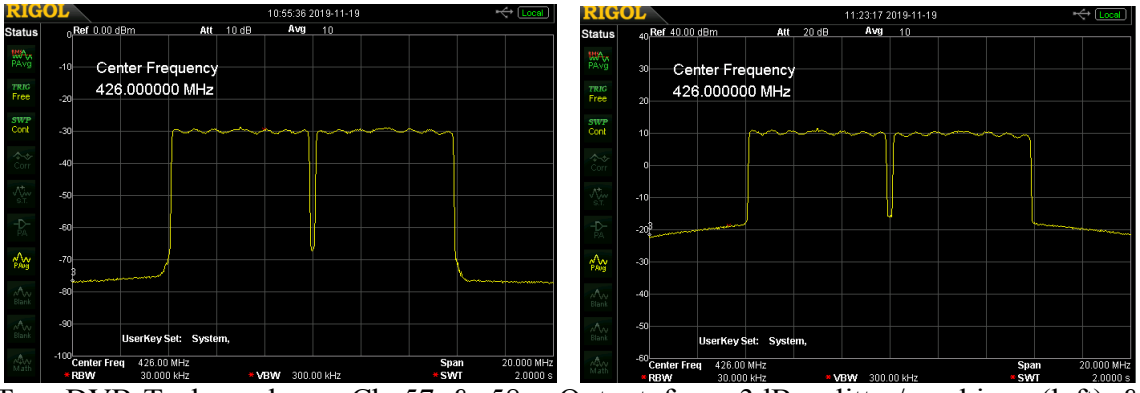
Multiple DVB-T Channel Operation on KH6HTV Video RF Amplifiers

Jim Andrews, KH6HTV

In response to an inquiry from an ATV customer, a test was run to confirm that KH6HTV Video RF Power Amplifiers are linear enough to amplify several, adjacent, digital TV channels simultaneously. The test was successful.

To perform this test, I used two Hi-Des, DVB-T modulators. "Live" audio and video was input to the modulators via HDMI from a pair of DVD players. One was on Ch 57 (423MHz) and the second was on Ch 58 (429MHz). I set the output levels of both to -3dBm. I then combined them in a Mini-Circuits 3dB splitter. The combined output was then -3.7dBm. I then passed this combined, 2 channel, rf signal through a Weinschel step attenuator into a KH6HTV Video model 70-7B rf linear power amplifier.

To test the output of the 70-7B amplifier, I attenuated it first with a 30dB, 150 W power attenuator. RF power out of the 30dB attenuator was measured with an HP-432A power meter with an HP-8478B thermistor power head. To observe the rf spectrum and the DTV signals, I placed a 20dB directional coupler on the output of the 30dB power attenuator. The thru path of the coupler went to a Rigol DSA-815 spectrum analyzer. The sidearm of the coupler went to a 20dB SMA attenuator and then into a Hi-Des HV-120 DVB-T receiver. It was particularly important to monitor the signal to noise ratio on the DVB-T signal. With the QPSK modulation used, a perfect signal gives a S/N of 23dB.



Two DVB-T channels on Ch 57 & 58. Output from 3dB splitter/combiner (left) & Amplifier output (right) center frequency = 426MHz, span = 20MHz, vert = 10dB/div.

The figure above shows the two channel spectrums. The photo on the left is the output from the 3dB combiner while the right photo is the amplifier's output. Note that DVB-T signals do not occupy the entire 6MHz channel. They have small guard bands at both band edges. Thus the center notch at 426MHz.

For normal operation of KH6HTV Video amplifiers, the rf drive level is increased until the shoulder break-points (measured at ± 3.2MHz from center frequency) rise up to

-30dB below the in band spectrum. This is the typical point for DTV transmitters. It is a good compromise between maximizing output power, controlling distortion to an acceptable level and minimizing out of channel RFI. Commercial broadcasters then add an additional very sharp cut-off band-pass filter to chop off the out of channel spectrum skirts.

The above photo shows the rf output spectrum from the model 70-7B amplifier after the input drive power was adjusted properly to give -30dB break points on the shoulders. At this point the rf power output was measured to be +36dBm (4 Watts, rms). The center notch at 426MHz rose from -36dB to -27dB. On the monitoring DVB-T receiver, NO degradation was noted in the S/N. It remained at 23dB.

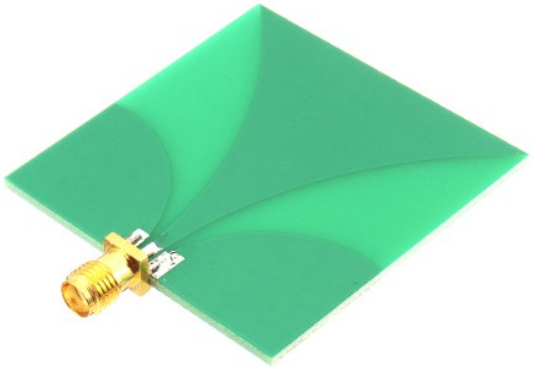
CONCLUSION: The amplifier works the same whether amplifying one channel or two. The only difference is the rf power in each channel is thus down by 3dB. Knowing the bandwidth of this amplifier to be quite flat over the entire 70cm amateur band, it could easily be extended to amplifying 3 or 4 channels simultaneously. In a similar fashion, using 2 MHz bandwidth, DVB-T signals, 3 or 4 of them could easily be crammed into a 6 or 8 MHz wide TV channel.

MEDIA PLAYER: While working on the BR-101 Repeater project with Dave, AH2AR, we were discussing other items used in a TV repeater. I mentioned we used a Raspberry-Pi microcomputer to generate our video ID slide show. Dave said, they had an even better, simpler, and less expensive approach. They used a "Media Player". He gave me a link for it. A great find. And the price ? A very low $27 on E-Bay. It is a tiny magic box which plays video, audio, or picture files and provides multiple A/V outputs of HDMI, composite video & component (Y/Pb/Pr). It is extremely tiny, smaller than a pack of cigarettes (2.5"x2.35"x0.5") As a matter of fact, the IR remote control supplied with it is bigger than the media player. It accepts as input media, either a USB memory stick or an SD card. It's output can be either NTSC or PAL with selectable resolutions from 480i up to 1080P. It requires 5Vdc power with a wall wart supplied. I also found that if the video monitor used put 5V onto the HDMI cable, then the media player would run on that and the wall wart was not even required. The unit can be put

in a mode to play continuously looping which is appropriate for use in a TV repeater. It also is dc power failure proof. This means if you lose power, the unit will automatically start running again when power is restored. Also a necessary feature for use in remotely based TV repeaters. I tested the unit with several different types of video files. My Apple Mac-Book Pro computer, running i-Movie creates videos in H.264 as .mp4 files. The media player did not like these. I then used the VLC program to convert my test .mp4 file to 3 other formats which did run ok. The first was to convert to MPEG2+MPGA as a .ts file. It worked but the resolution was quite grainy. The second was to convert to H.264+MP3 again as a .ts file. This worked fine. The third was to convert to H.264+MP3 as a .m4v file. This also worked fine and was a smaller size file than the .ts version. This media player is great for TV repeaters, or simply as a video accessory in the shack to generate test videos, or even in the living room with your giant screen TV set.

Jim Andrews, KH6HTV

CHINESE MICROWAVE COMPONENTS: As several of the ATV hams in Boulder are now interested in moving up to the 5 & 10 GHz ham bands, we need the necessary hardware to build our transverters. There seem to be a lot of new, low cost, microwave components now available from China on Amazon, E-Bay, etc. Unfortunately, the specs. on them are very minimal, to non-existent. Plus some is "junk" and some is good. Which is which ? I have thus ordered in a bunch of the stuff to evaluate. I am still awaiting a lot of the items as they are coming by slow boat from China. I will be reporting on my finds in future newsletters. --- 73 de Jim, KH6HTV



VIVALDI UWB ANTENNA: The first item to arrive from China was this printed circuit board antenna. It was simply advertised as an UWB, Ultra-Wide-Band antenna. It cost all of $6, postage included. Our local antenna expert, Georgia Tech Professor Ed Joy, K0JOY, explains this antenna as follows: " This is the monopole version of the Vivaldi Notch antenna. When mounted vertically with the connector straight down it acts as a broad band monopole, with vertical polarization. It is approximately omni directional in the horizontal plane with gain between 3 and 5 dBi. It is very well impedance matched. Typically with a bandwidth of at least five (Fmax/Fmin)." A test on my 20 GHz, Wiltron network analyzer showed it to have a pass band extending from 2.8 GHz to beyond 20 GHz with S11 always being better than -6 dB. Jim, KH6HTV