Boulder Amateur Television Club
TV Repeater's REPEATER
January, 2021

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

ATN
The Amateur Television Network

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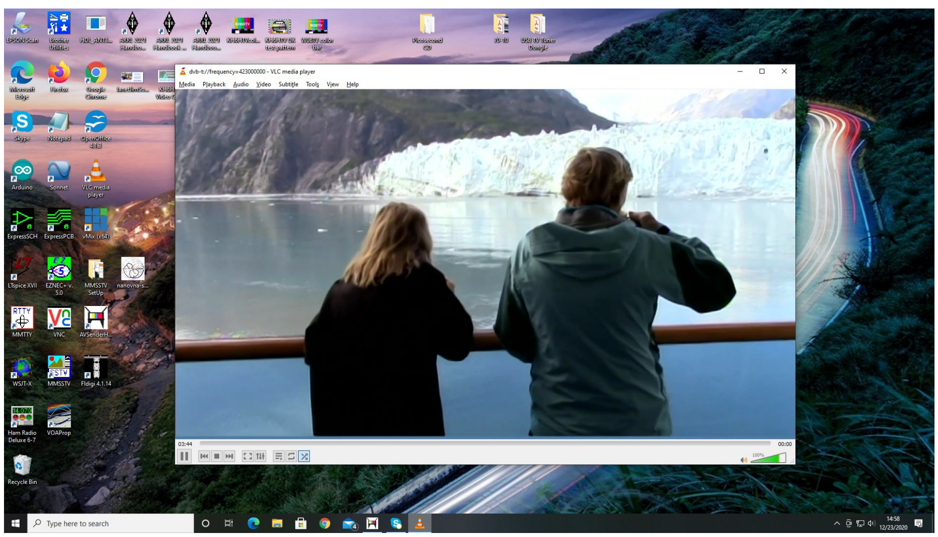


USB TV TUNERs -- Now Work on Windows 10 !

Thanks to Gary, K7HYB, of the West Washington ATV Society, in Seattle, WA, he has now solved the problem of how to make the USB TV Tuner dongles work with Windows 10. The dongles we are referring to use the RTL2832U & R820T2 chips. The internet is overflowing with complaints from many disgruntled users of these dongles that used to work with Windows XP & Windows 7, but will now not work with Windows 10. The major reason for the failure is Windows 10's habit of automatically searching the internet for drivers and loading an old, obsolete driver from 2009. What Gary found was the required driver is called

REALTEK 2832U Device Version 64.1.521.2012 dated 21 May 2012.

He found it on a German web site *www.ukwtv.de* Go to this part of the site:
https://www.ukwtv.de/cms/downloads-aside/281-dab-player-von-andreas-gsinn.html
Scroll down to find **Treiber2.zip** and down-load it. It contains the correct driver.

I then with further searching on the internet found a good set of instructions on how to install the correct driver, plus tell Windows 10 to use it and not automatically keep reloading the wrong driver. I am rewriting some of it below as I found useful.

Re-installing correct Realtek drivers on Win10 for RTL-2832U/R820T2 Dongle

1. First, download the driver (i.e. Treiber2.zip and unzip it)

2. Connect your USB TV Tuner dongle to a USB port on your computer.

3. Then disconnect your computer from the internet.

4. Next, right click on the Windows start button and click Device Manager.
In Device Manager, Under Sound Video & Game Controllers, Right click the "Realtek 2832U device" and uninstall it, be sure to put the tick in the box to delete driver software. If you don't find a driver there, then just close out the Device Manager.

5. Now you can install the correct driver, *version 64.1.521.2012 dated 21-May-12*
The wrong not working driver installed by Windows is dated 2009 or 2010.
When you unzipped Treiber2, it created a file folder called *86.001.0521.2012.* Open this folder and click on the "setup" application to start the installation. The driver will be stored in:

C:\Program Files (x86)\Realtek\REALTEK DTV USB DEVICE

6. You can check the installed driver version by right clicking on "REALTEK 2832U Device" in Device Manager and clicking Properties and then Driver.

7. Now it is time to try it out and see if your dongle really works. For this I used the program **VLC**. See below for a separate description on how to use **VLC** with the TV tuner.

8. Assuming you got the dongle working, then re-connect your computer to the internet.
After a few minutes windows will update the working 2012 driver with the not working 2009 driver again.

9. To reinstall the 2012 driver and stop this happening again: In Device Manager, Under Sound Video & Game Controllers, Right click the Realtek 2832U Device then click "Update Driver", Click "Browse My Computer for Driver Software", Click "Let me pick from a list of available drivers on my computer". This will now show a list with both the bad 2009 and the good 2012 drivers Click on the 5/21/2012 driver so it is highlighted. Then click on NEXT. This then reinstalls the correct driver. It also prevents Windows from replacing it automatically.

VLC: One free program to run a USB TV Tuner dongle is VLC Media Player. It is a powerful media player program which will do much more than just run your dongle. It can be downloaded free from www.videolan.org

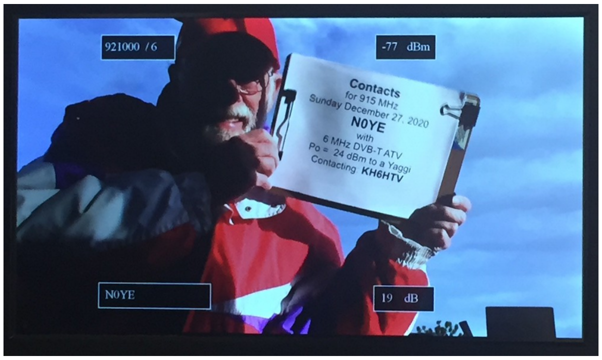
To check out the operation of your dongle, you need to first supply it with a good DVB-T RF signal. I used my Hi-Des HV-320E modulator hardwired to the antenna input on the dongle. Set at least 20dB of attenuation in the modulator (or use an external pad) to prevent overloading the dongle's tuner. I set my modulator to one of our normal ham DATV channels. It is best to then feed "live" video and audio into the modulator to verify performance. I used a pre-recorded DVD as my "live" A/V source.

1. Launch VLC
2. On the upper taskbar, click on "Media" - select "Open Capture Device"
3. On the Open Media menu, Capture Mode - select "TV-digital"
4. Device Selection - set Tuner card to "0", select Delivery System as DVB-T
5. For Options: enter the center frequency and bandwidth of the test signal you are using. For example, I used 423MHz, but it must be entered in kHz as 423000. It is best not to leave Bandwidth in the default Automatic, but to in fact chose the correct bandwidth. Choices are 1.712, 5, 6, 7, 8 or 10MHz.
6. Now click on "Play"
7. IF everything has been installed correctly, then you now should see your live video being received by the USB dongle. CONGRATULATIONS ! You have made it work.

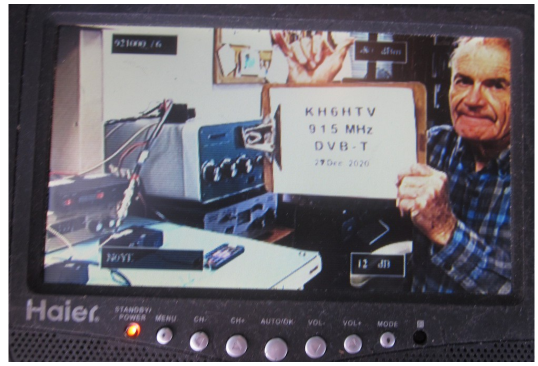
CAUTION: Both Gary, K7HYB, and Pete, WB2DVS, report that the USB dongle will now only work as a digital TV tuner. It will no longer work as an SDR receiver for other applications, such as SDR-Sharp. If you want to still use these apps, you will need to go into your Windows 10 menu and select a different driver.

OBSERVATIONS on USE: I have tested the dongle with VLC under various digital parameters and it seems to work OK in all cases. I tried it with resolutions of 480i, 720P and 1080P and with QPSK, 16QAM & 64QAM. The max. bit rates ranged from 5.5MB (QPSK), to 11MB (16QAM) up to 17MB (64QAM). I also observed that if the RF signal drops out and then comes back on, VLC will not always reacquire the signal. To reacquire, one needs to first click on the "Stop Playback" button (black square), then click on the "Play" button (right facing triangle).!

73 de Jim, KH6HTV



N0YE as received by KH6HTV



KH6HTV as received by N0YE

DVB-T QSO on 33cm Band

Don, N0YE & Jim, KH6HTV

On December 27, 2020, Jim, KH6HTV, and I made a 921 MHz contact between his QTH and the NCAR parking lot. We started by trying 915 MHz and then 909 MHz. The signal strengths were good from Jim to me. However the freeze frames were more freezing than not. (plus the weather was also !) So we tried 921 MHz. The signal strength was close to the same at -78 dBm with a S/N of 12 dB. There were still freeze frames on this frequency - but much less frequent. The signal allowed Jim and I to exchange audio and video well enough to qualify as a valid contact.

I brought along a preamp and put it into the receive circuit. With no transmitted signal the receiver reported about a -87 dBm received "energy" and no S/N. When I put the preamp in front of the receiver, the received "energy" became -67 dBm and no S/N. With the preamp in the receive path with a transmitted signal, the received S/N was worse than the S/N without the preamp. I therefore did not use the preamp. My take away from testing with the preamp is that the background noise from other energy in that band is significant and the wideband nature of the preamp without a narrow bandpass filter made the preamp less than useless (this is not a fault of the preamp).

My receiver was the Hi-Des HV110. The modulator was the HV100. The power amp (probably from DEMI) was a 900 MHz amplifier that put out 24 dBm with a pedestal that was nominally 30 dB. The HV100 parameters were the standard set. The antenna was a 6 element home brew yagi tuned to nominally 915 MHz. The coax connecting the antenna and power amp had a loss of about 1 dB. The antenna was about 4 feet above the ground with a clear view to Jim's QTH.

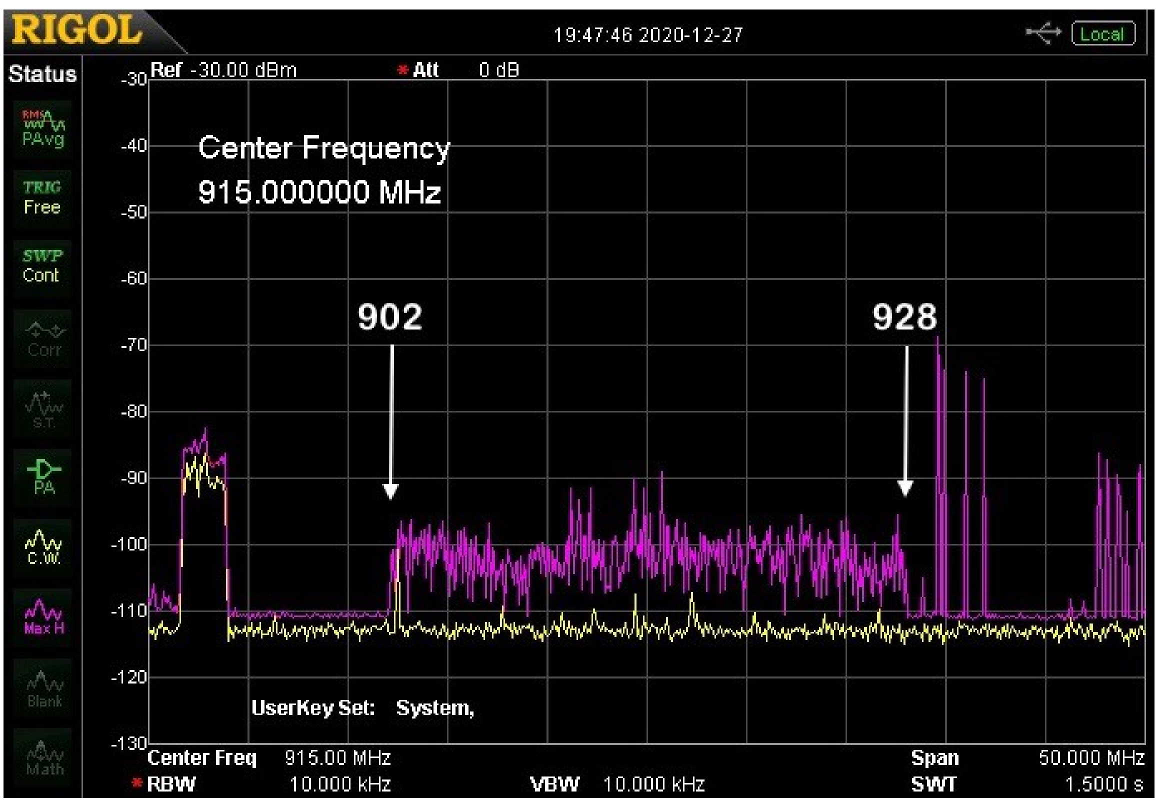
It was cold and windy. The wind blew the antenna tripod over twice. I fixed that by adjusting the tripod to take a more aggressive stance (Bogen makes a good adaptable tripod). There after the antenna was stable.

Don, N0YE

From tests several years ago, we have shied away from the 33cm, 900MHz, "Junk Band". This fall, we decided we needed to add it to our log books anyway. After several false starts that were cancelled by winter weather, we finally made a 2 way, DVB-T, contact on 33cm. Don summarized it well. My setup was a temporary lash-up. I put a 7 element, L-Com yagi antenna at the 20ft. level on my 50ft. tower in place of my 2 meter yagi. The coax was very old RG-8 with probably 4dB loss at 900MHz. Like Don, I used the HV-100EH modulator and HV-110 receiver. I used "aggressive" digital parameters of 720P, 3.5 Mb, & 1/2 FEC. The final amplifier used a CATV line amplifier and put out +19dBm (rms) with -35dB shirts. I got a P5 picture & Q5 audio from Don with -77dBm and 19dB s/n. We had a good line-of-sight, 4.9 mile (7.9km) path, but it did pass over the southern part of the city of Boulder with numerous unlicensed emitters.

Afterwards, I hooked up the L-Com antenna to my Rigol spectrum analyzer to see what the 33cm spectrum looked like that we had to wade thru with our DVB-T signals. See the photo below. The yellow trace is a single sweep, "live" capture. The magenta trace is with the analyzer set in peak hold mode and left running for 1/2 hour. The unlicensed "crap" was seen to raise the noise floor by 10-13dB above what is seen outside of the 902-928MHz band. Stronger signals are seen in the 912-916 region which account for our inability to communicate on either 914 or 909MHz.

Jim, KH6HTV



33cm Spectrum as measured at KH6HTV QTH. 915 MHz center frequency, 50 MHz span. 10dB/div & 5MHz/div. 10kHz BW -113dBm noise floor.

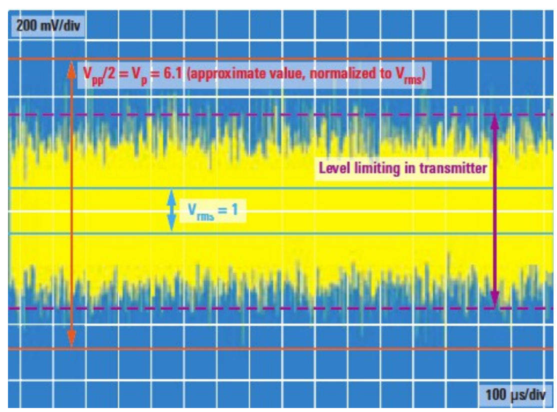
RF POWER MEASUREMENT of DIGITAL SIGNALS

Jim, KH6HTV

There is a lot of controversy among hams about RF power specs. and claims when it comes to non-sinusoidal rf signals, such as digital TV, D-Star, DMR, etc. The most common rf power meter in ham shacks is one such as a Bird or similar meter. These power meters use a semiconductor diode as the basic detector element. The diode detects the peak value of the rf input signal. Then depending upon the R-C filtering after the diode, the resultant DC voltage can represent either the rf peak or average power. These diode detector meters are all calibrated using CW sine waves. These types of power meters do not accurately measure noise-like digital signals.

Bird RF Power Meter

Now for measuring a digital signal, it is not a simple matter because it's time domain waveform looks just like random, white noise and is no longer a simple sine wave. There are many peaks and valleys to the signal. It is only really meaningful to characterize it by it's RMS power. A very good document discussing this is found in the newsletter from Rohde & Schwarz, called "News from Rohde & Schwarz. See issue #172, pages 44-48, "Measurements on MPEG2 and DVB-T Signals".



oscilloscope display of DVB-T signal - R&S

The Crest Factor is an important concern for digital signals. It is the ratio of the peak to the rms value. It tells you the max. amount of drive to which an rf amplifier can be used in a DVB-T transmitter and still remain in the linear range without signal limiting. While theoretically the crest factor could be very high, R&S says "*Investigations have shown that for a crest factor of approximately 13dB there is no appreciable impairment of the bit error rate (BER)*." R&S also says -- *"For economical reasons, the crest factor in DVB-T transmitters is usually limited to 10 or 11dB."* Thus for a transmitter capable of putting out 100 Watts (PEP), allowing for a crest factor of 10dB, it's DVB-T, rms power would be 10 Watts (rms).

R&S goes on further to state --- "*Thermal power sensors supply the most accurate results for measuring the power of a DVB-T transmitter. Plus, they can easily be calibrated by performing a highly accurate DC voltage measurement*."

The classic Hewlett-Packard model 432A is such a power meter. It uses thermistor power sensor heads. The meter has a self-balancing bridge which compares DC power to the unknown RF power.

POWER METER TESTS: I have run some test bench experiments to see what answers we might expect to get with different RF power meters. I first started out with low, milli-watt signals to do a comparison of several test instruments of mine to verify accuracy. They were an HP-8656A signal generator, an HP-432A power meter with an HP-8478B thermistor power sensor head, and a Rigol DSA-815 spectrum analyzer. I generated a 441 MHz, CW, pure sine wave with my HP-8656A signal generator and adjusted it's rf level to read exactly +5.0dBm on the HP-432A. The interconnecting cable had 0.2dB of loss and the HP signal generator was set to +5.2dBm. Thus the two agreed exactly. Then using the same cable and generator setting, I measured the CW signal on the Rigol. It's marker read +5.16dBm, i.e. 0.16dB high, but still excellent agreement. I tested the Rigol on two bandwidths of 300kHz and 30kHz and got the same result.

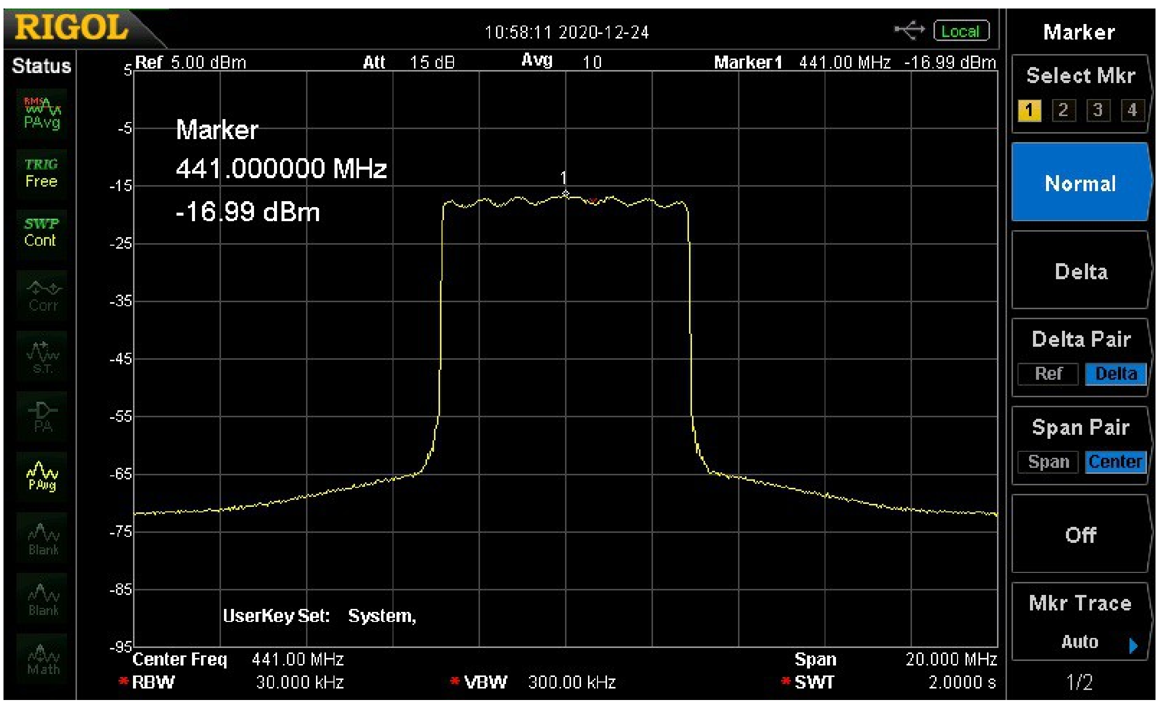
The next test was at high power of 3 Watts (34.77dBm) at 441 MHz with both a pure CW sine wave and also DVB-T signal. The DVB-T signal source was a Hi-Des model HV-320E modulator set to 441MHz with 6 MHz bandwidth and QPSK modulation. A KH6HTV model 70-7B, 70cm amplifier was used to amplify either the CW sine wave or the DVB-T signal to the 3 Watts (rms) power level. The power level was set and measured using the HP-432A thermistor power meter, plus a calibrated 30dB, 50 Watt, Narda 776B attenuator.

I then inserted between the amplifier and the 30dB attenuator two conventional rf power meters which use semiconductor diode detectors. The first one was an M.C. Jones, Micro-Match, 70-500MHz, in-line power meter. I also borrowed from Bill, K0RZ, a Bird model 4300-400 with both average and peak reading capability. I used a Bird, 10 Watt, 200-500MHz power sensor in the Bird meter.

Both the Micro-Match and the Bird were quite accurate measuring the 3 Watt, CW sine wave. The Micro-Match was -0.3dB low. The Bird was only -0.1dB low. But when they were used to measure the 3 Watt DVB-T signal, both meters read too high. The Micro-Match reading was +1.3dB too high. The Bird's reading was +2.1dB too high in CW mode and +2.3dB too high in peak mode. Thus either of these meters would give erroneous, optimistic, readings of DVB-T rf power. They were obviously responding to more of the peaks in the DVB-T signal than the rms value.

SPECTRUM ANALYZER MEASUREMENT OF DVB-T POWER: Another technique to measure the power in a DVB-T signal is to use a calibrated spectrum analyzer. The analyzer should first be set-up exactly as specified by the ITU. A good reference book is "Digital Video and Audio Broadcasting Technology" by W.Fischer (an engineer for Rhode & Schwartz). I refer you in particular to chapter 21.2, "Measuring DVB-T Signals Using a Spectrum Analyzer", pages 425-428. The analyzer settings must be as follows:

Center Frequency: center of the DVB-T channel
Span: 20 MHz
Resolution Bandwidth: 30 kHz
Video Bandwidth: 300 kHz
Detector: RMS
Sweep: slow, 2 seconds
I also recommend using signal averaging of at least 10 averages



This photo shows the proper setup for measuring a DVB-T signal. The signal was direct from a Hi-Des HV-320E modulator set for 441 MHz, 6 MHz bandwidth and QPSK. The RMS power of this signal was +5.3dBm as measured with the HP-432A power meter.

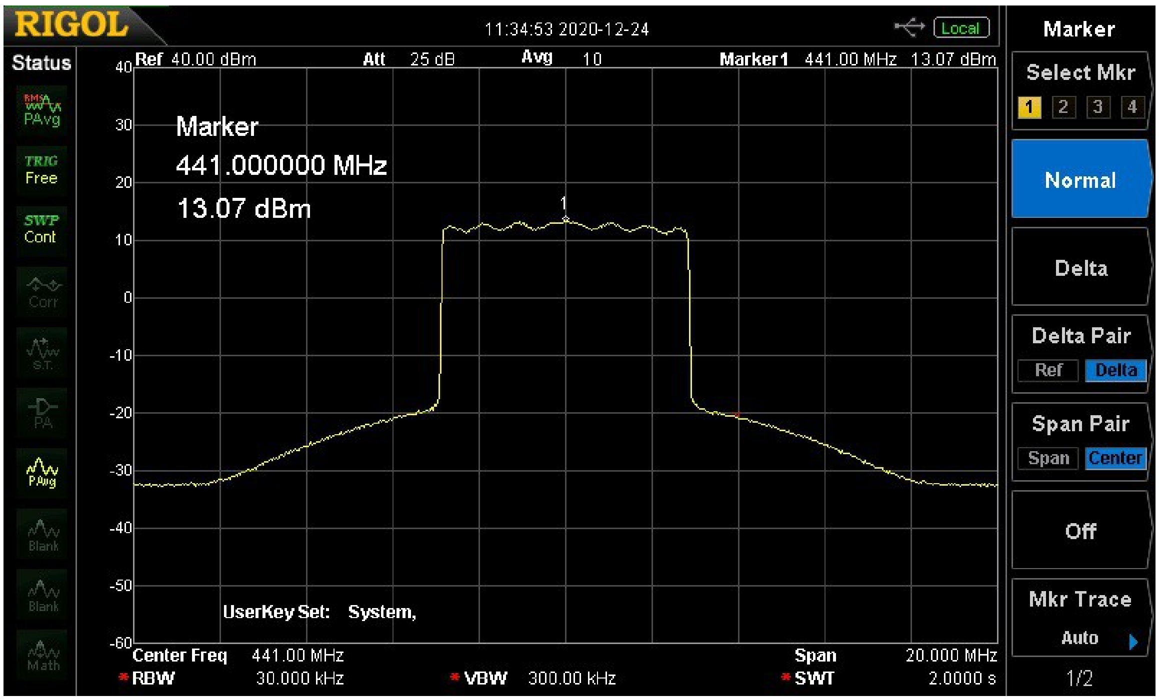
Use the analyzer's marker to measure the power at the center frequency. In this example, the value measured was -17dBm.

Thus the correction factor to be used is +5dBm - (-17dBm) ≈ +22dB

There is some uncertainty in where to make this measurement, due to the ripple in the in-channel power, plus there are some fluctuations in the observed value.

So why doesn't the analyzer measure the true +5dBm power ? The reason is the analyzer is only measuring the power in a narrow 30kHz bandwidth, while the thermistor power meter is measuring the total power spread over a 6 MHz bandwidth.   An extra cost optional measurement firmware can be purchased for the analyzer which will in fact integrate the power over the entire displayed span.

The +22dB correction factor is only good for measuring 6 MHz bandwidth signals. If you are using other bandwidth signals, then you need to determine a different correction factor value.



This photo now shows doing the measurement on the 3 Watt output from the 70-7B amplifier. This was the same signal used to evaluate the Bird and Micro-Match power meters.   Applying the +22dB correction factor to the above measured +13dBm, we can estimate the rf power to be about +35dBm (3.2 Watts).   This technique is not as accurate as using a thermistor rf power meter, but will give close correlation.

It should be noted that another critical measurement of DVB-T transmitter is the out of channel, spectrum skirts. This is done with the same setup as shown in the above photos. The ITU spec. is to measure the skirt, shoulder, break-points ±200 kHz outside of the channel edges.   For a 6 MHz bandwidth, this is ± 3.2MHz from the center frequency. On the photos above, the shoulders from the modulator are seen to be about -45dB down and for the amplifier's 3 Watt output, they are -33dB down.

Pre-Distortion RF Power Amplifier Linearizer

Thanks to Chris, K0CJG, for alerting us to this new product from Maxim. It is their model number SC1894. This looks like an ideal solution for improving the performance of ATV repeater transmitters.

The Maxim SC1894 is a fully adaptive, RFin - RFout predistortion linearization solution optimized for a wide range of amplifiers, power levels, and communication protocols. The SC1894 uses the PA output and input signals to adaptively generate an optimized correction function in order to minimize the PA's self-generated distortion and impairments. Using RF-domain analog signal processing enables the SC1894 to operate over wide-signal bandwidths and consume very low power. The SC1894 goes beyond linearization and provides accurate RF power measurement of RFIN and RFFB. Design support features including spectral monitoring and ACLR alarm are also available. These design support features are accessed through the SC1894's serial peripheral interface (SPI) bus.

The specified frequency range for the SC1894 is 225 MHz to 3.8 GHz. Checking with Digi-Key, they are offering to sell the basic IC for $68 or an evaluation board for $420. The evaluation boards come for specific bands. The lowest band covers 225 to 470 MHz.

CATV BOOK: Mike, W3DIF, has called our attention to a free handbook for cable TV techs from Comm-Scope. It has over 300 pages of worthwhile info. The link to it is: https://www.commscope.com/globalassets/digizuite/1695-cable-technician-pocket-guide.pdf

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 a social ATV net on Thursday afternoon at 3 pm local Mountain time and an ATV activity night on Wednesday evenings at 7pm. 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/

BOULDER ATV-MICROWAVERs ARE WHIMPS !

The cover photo on the January issue of QST shows members of the Rochester, New York VHF club participating in the Jan. 2019 VHF contest. (photo by N2MKT).

No way would you find us Boulder ATVers out in such weather. We like our warm ham shacks too much. For our microwave, DX-peditions, they are summer time activities. And even in the middle of the summer, Don, N0YE, and Jack, K0HEH, complained about the cold and strong winds on the summit of 14,000 ft. Pike's Peak while ATV SOTAing.

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.**

KH6HTV Video Announcement: Janet & I are heading to southern California for a winter break. Janet has a severe case of "cabin fever" due to the covid social isolation, plus the cold Colorado winter. Hopefully a change in scenery and climate will help her. As a result, I will be temporarily shutting down the ham shack work-shop. I do have two completed amplifiers in stock for sale (models 70-9B & 23-11A). Otherwise, any other orders will have to be put on hold until we return to Boulder on May 1st.