

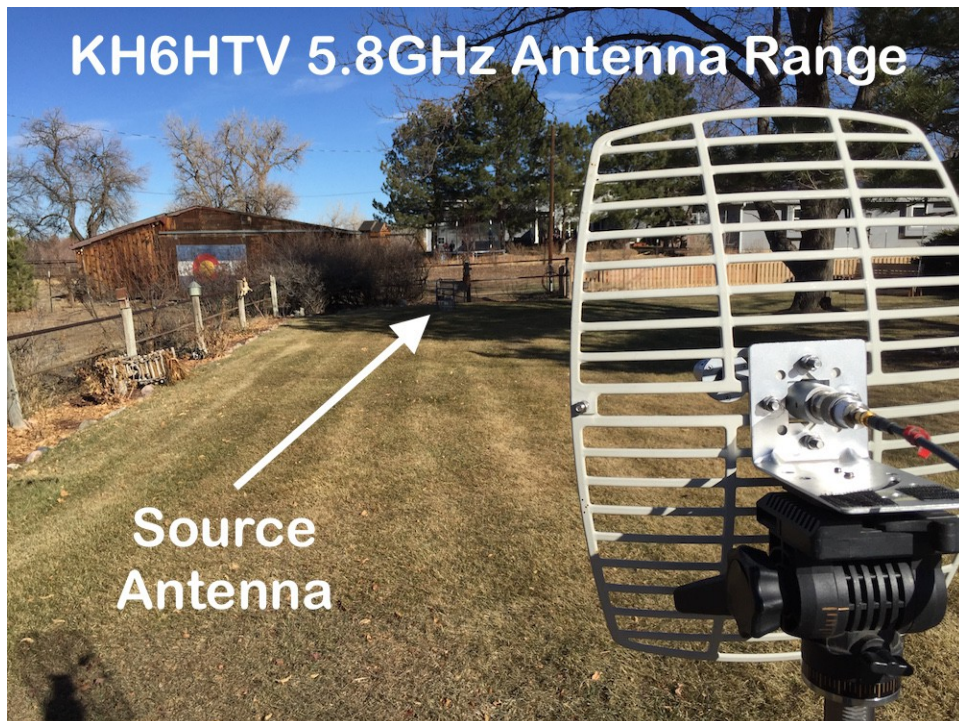
Boulder Amateur Television Club TV Repeater's REPEATER

January, 2021
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



Antenna Range Tests of 5 cm Antennas Jim, KH6HTV

Following Don, N0YE's example of testing microwave antennas, I decided to try my hand at doing it for a collection of 5.8 GHz antennas. I set up my range in my backyard where I had a clear, unobstructed path. Being winter time, I had to wait a long time before the weather cooperated with a warm day and no wind.

I laid out the range using W1GHZ, Paul Wade's microwave design program. HDL_ANT32 (version 4.1). (www.w1ghz.org) One inputs the test frequency, the largest diameter antenna to be tested, and the range separation distance. It then tells you the Rayleigh distance, the height of the source antenna and the height of the antenna to be tested. I made my measurements at the same frequency we have been using for DVB-T on 5cm band, i.e. 5.678 GHz. The separation between my source and measurement antennas was about 70 ft. across a very flat portion of my backyard, which was covered with dried bluegrass. Paul's program thus said to place my source antenna at a height of 7 1/2" and the antenna under test at 4 3/4 ft. Also following Ed, K0JOY's, advice I used a high gain dish antenna as the source, rather than a low gain dipole. Prof. Ed is our local resident antenna expert.



Source Antenna



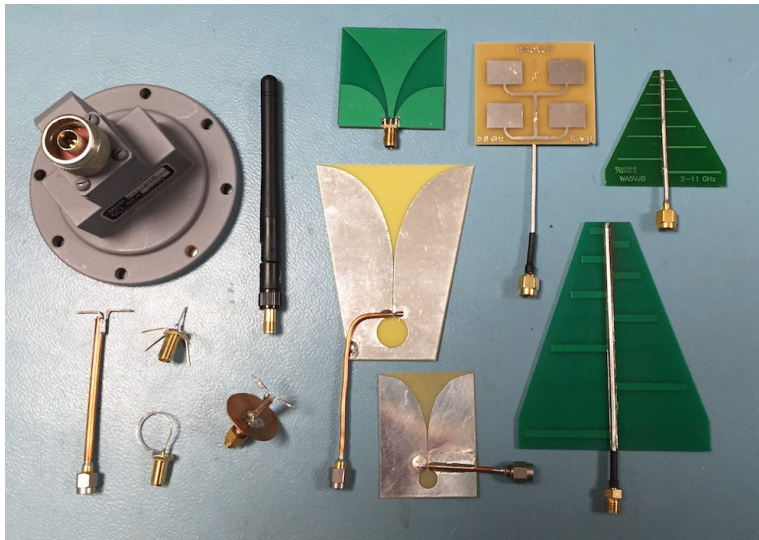
Receive Antenna under test + supervisor

The CW signal source was an Analog Devices ADF-5355 frequency synthesizer set to 5.678 GHz. It's output power was -3dBm. This was then boosted to +20dBm using two Avantek AMT-8052, C-band amplifiers. The source antenna was a horizontally polarized, L-Com HF5822EG, BBQ grill, dish antenna.



For my receiver, I used my 5 GHz transverter. The 414.4 MHz IF output was viewed on a Rigol DSA-815 spectrum analyzer. The analyzer was set up to display two traces. The yellow trace was the "live" signal while the magenta trace was put in the peak hold mode.

The antenna under test was placed at a nominal height of 4 3/4 ft. and then scanned in all x, y, & z planes to optimize the received signal. The peak hold trace then captured the highest level. The Rigol's marker then found the peak of the held trace and gave a readout in dBm which was recorded in a notebook. The reference antenna used was a 1/2 λ dipole (2.15 dBi gain). The IF output, received level on the dipole was -26.6dBm. The gain in dBd of all of the other antennas tested were then computed as the difference in the max. signal strength readings compared to the dipole. Here are the results.



Assortment of small, 5.8GHz Antennas tested

ANTENNA	Return Loss measured	Gain Mfgr's Spec.	Received Signal Level dBm	GAIN (dBd)
1/2 λ Dipole (KH6HTV's reference antenna)	-40 dB	2.2 dBi	-26.6dBm	0 dBd REF
L-Com model HG5822EG, BBQ grill style dish, 12" x 16" (KH6HTV's)	-21dB	23 dBi	-8.6dBm	18dBd
Radio Wave model FP1-2-5NS, 12" dish	-13 dB	23 dBi	-8.9dBm	17.7dBd
ValuLine VHLP1-220-W01, 12" dish with carbon foam side-lobe suppression. Modified by N0YE to use a WA5VJB, 2-11GHz log-periodic antenna as the feed	-7 dB		-13.3dBm	13.3dBd
WR-187 open flange waveguide - MicroLab/FXR model 601-D98, N coax to waveguide adapter	-10dB		-23.0dBm	3.6dBd
1/4 λ monopole with 4 dropping radials - SMA	-18 dB		-27.0dBm	-0.4dBd
Pro 5.8G, 4 1/4" rubber duck, RP-SMA	-20 dB	??	-26.2dBm	0.4dBd
NOYE 1/2 λ dipole with disc reflector	-9 dB		-25.3dBm	1.3dBd
1 turn loop antenna on SMA			-29.9dBm	-3.3dBd
WA5VJB, 2 - 11 GHz, Log-Periodic	-11 dB		-24.6dBm	2.0dBd
WA5VJB, 5.8 GHz, Quad Patch	-15 dB	11-12 dBi	-23.4dBm	3.2dBd
WA5VJB, 5 - 18 GHz, Vivaldi Gain	-11 dB	8 - 10 dBi	-21.2dBm	5.4dBd
WA5VJB, 9 - 25 GHz, Vivaldi Gain	-6 dB		-27.5dBm	-0.9dBd
Chinese 1.4 - 9.5 GHz, Log-Periodic	-2.6 dB	??	-30dBm	-3.4dBd
Chinese 3-20 GHz, omni-directional Vivaldi	-15 dB	3 - 5 dBi	-27.5dBm	-0.9dBd

FEEDBACK: Thanks for another informative newsletter. I have read Fischer's book twice and refer to it often. I have two other digital TV books by Massel and Benoit, but Fisher's is the best. Dave AH2AR also has Fisher's book.

Mel, K0PFX

Great Issue, Jim! Lots of good info, especially since I have long been scratching my head on some of the topics you covered. Of course, I've been impressed with the various news (and how much you folks have been doing) all along. Again, wonderful stuff; you're doing us all a great service.

Enjoy SoCal. All Dot and I can do to mitigate the cabin fever is come up from Marlborough to the "other cabin" here in New Hampshire.

Skip, K1NKR

DTV POWER MEASUREMENT FEEDBACK:

The BIRD APM-16 "digital" modes meter reads one half the power of a Bird 43 on DVB-T.

Mel, K0PFX

Hi Jim --- Thank you for the informative newsletter. I like the article about measuring DATV power. Bird makes a APM-16 wattmeter that looks similar to a model 43 that is designed for use with digital transmitter power measurements. They also have a model 5010B power sensor that is used along with DPM slugs to measure digital RF power. We had to change over to the new meters when we switched to DTV several years ago.

Mike, WA6SVT

BIRD WATTMETER: The classical Bird wattmeter most hams are familiar with is the model 43 which was designed over 60 years ago. --- From the Bird web site www.birdrf.com "The APM-16 RF Wattmeter is designed to keep pace with the ever growing complexity of digitally-based communication systems. [Bird's Model 43 and most other wattmeters available today were designed to measure power of constant amplitude, sinusoidal waveforms.](#)

Modern wireless communication systems can use a variety of digital techniques to combine many voice data channels into a complex, composite RF signal. [Measurement of such signals with a conventional wattmeter may yield unacceptable errors.](#)

The APM-16 employs active circuitry to deliver accuracy of $\pm 5\%$ for multiple-access technologies such as CDMA, TDMA, FDMA and other digitally-encoded communication systems. The APM-16 is equally effective for measuring RF power in conventional analog systems. It uses APM-series plug-in elements to cover a wide range of frequency and power levels."



APM-16

USB TV TUNER DONGLES - FEEDBACK:

The USB TV Tuner article in the previous issue (#66, Jan. 2021) has already been re-printed in the Surrey, B.C., Canada ham club newsletter, "The Communicator". It has thus triggered considerable correspondence from Daniel, VE7LCG, Vancouver, B.C. about his experiences with these dongles. Daniel's major complaint about our USB TV tuner article was that we didn't make it clear that these particular dongles will NOT receive North American, broadcast digital TV using the ATSC system.

I wrote the article for the USA, ATV community, not the general public. Most of the USA, ATV groups, including our own Boulder, Colorado group, experimenting with digital TV are using the European terrestrial, broadcast, digital TV standard called DVB-T and not the inferior USA standard ATSC. So in my detailed instructions on how to use the dongle, I naturally said to select DVB-T as one of the options in the media program called VLC. VLC does include in it's menu choices ATSC. But if you do select ATSC in VLC with these particular dongles, you will immediately get an error message stating "The selected digital tuner does not support the specified parameters" and then lists ATSC.

Daniel has submitted to our newsletter an article describing his experiences using these dongles and does include a lot of good information. So, I have agreed to publish his article. If you have further questions, contact Daniel directly. ---- Jim, KH6HTV

Software drivers for RTL8232 based SDR dongles

Daniel, VE7LCG

ve7lcg@yahoo.com

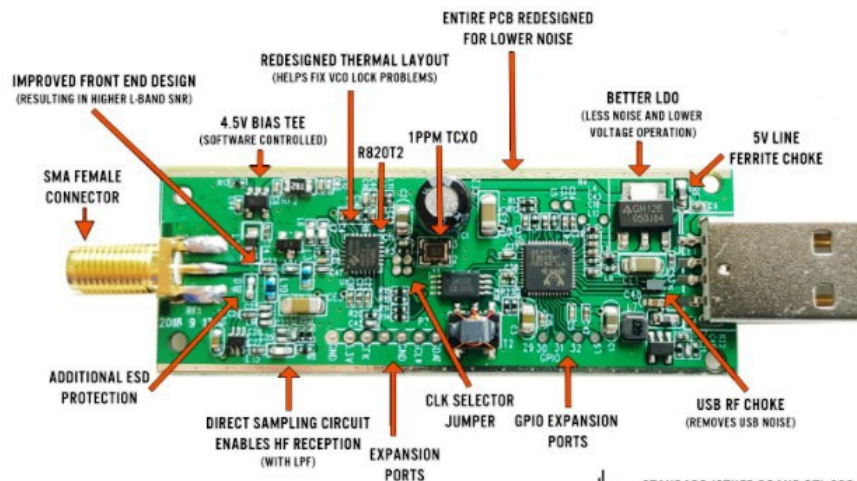
One of the cheap things to buy and to play with for ham radio activity (and not limited to that) are the SDR dongles based on the Realtek chip RTL8232 (several versions) and the Rafael Micro 820T chip (several versions). They work together. Rafael Micro declared already in 2018 it stops the production of RF820T chips, and it will produce only for mass quantity orders, if any. It seems the orders kept coming, because we are in 2021 and we still can buy this kind of SDR dongles. They can be in various packages, smaller or bigger.



I personally remained with only one (after trying several of them, just for fun, and seeing that they are practically the same, no matter what version are the chips inside). It is a knock-off Noolec: It has an MCX antenna connector, which is fragile, so I use it with an antenna connector adapter, as you see in the above picture of my SDR dongle. There are dedicated forums on the Internet where users swear a certain SDR dongle, based on a certain version of RTL8232 chip and its “associate(s)” is better than the other models. Based on those forums maybe I am right, that the differences among them are so small that they do not matter, at all, since they all keep the specifications declared on Realtek website:

<https://www.realtek.com/en/products/communications-network-ics/item/rtl2832u#:~:text=The%20RTL2832U%20is%20a%20high,%2C%207%2C%20and%208MHz%20bandwidth>

In plain English, it is a radio kind of device “a high-performance DVB-T COFDM demodulator that supports a **USB 2.0** interface.” The original purpose was to use it as commercial FM receiver and also to receive TV stations in some parts of the world (not North America, not North America ATSC and NTSC television standards). *(That part with receiving TV stations it is very debatable, for any system in the world, especially now in 2021 when almost all systems are digital, but it is not the purpose of this article.)* It is still the best for this purpose – FM receiver -, and works for receiving signals between 25 MHz and 1750 MHz. Users successfully tuned it outside those limits, especially above 1750 MHz. Mine does not work under 23 MHz. Because it knows to receive such a wide band of frequencies, hobbyists adapted it for other purposes, like ham radio receiver and amateur TV receiver.



Here is a kind of block real drawing from RTL-SDR Blog Store

As any device, it has its limitations. It works on 8 bit (not 12, not 16). So no matter what a genius software developer would do, it will remain an 8 bit device, and it will not sound so good as a dedicated FM receiver one can buy today. It will never work for the North American TV standard, which now is all digital. There are many articles on the Internet explaining why. You might see various bandwidths declared for this chip, bigger than 3 MHz. They are not the bandwidth that counts. That 3 MHz is the limitation. A good article, written in 2016 by R. X. Seger, a self-declared 12 minutes read, explains with

some pictures and measurements:

<https://medium.com/@rxseger/receiving-atsc-digital-television-with-an-sdr-76b03a863fea>

You can skip the article, and here I copied only one paragraph: “This SDR mode only supports a bandwidth of 3 MHz, at best, not nearly enough for receiving DVB-T, nor ATSC (6 MHz) for that matter.”

(editor's note: I dispute this statement as I have definitely proven that these dongles do in fact work for 6 MHz bandwidth DVB-T. The photo shown on page 1 of the Jan. 2021 issue (#66) of the BATVC newsletter was a screen grab of an actual 6MHz, DVB-T transmission which played flawlessly with live video and audio --- Jim, KH6HTV)

The SDR dongles mentioned in this article are USB pluggable. That means one cannot use them as they are, because they do not have buttons, no audio outputs, no display. They require a computer and an operating system to become usable. It can be Windows, Linux, Android and so on – if you can find the driver/software for it.

My experience with SDR dongles on Android was not great. It did not work for me and I did not insist to make it work, since I have a big 23 inches Windows 10 tablet. Whatever operating system one might use, one needs first a driver – a piece of software telling the computer if the dongle is there or not, and how to communicate with it. On top of that will be the actual receiver software.

There are only 3 categories of drivers out there for RTL SDR dongles, for Windows operating system:

1. The driver made by the manufacturer Realtek. The most recent version is from 2012, with the official code number 86.001.0521.2012. This is the best driver to use for FM commercial radios and amateur TV (apart some programs for radio amateur ATV/SSTV which specifically mention they want the next presented here driver). The manufacturer does not make available the download of this driver. Some links where one can find it:

https://mega.nz/file/EMcwGZDJ#vO16gvNF6Q4W_dM4aujKN73CkHOcoPOKAqhfdRLMsw

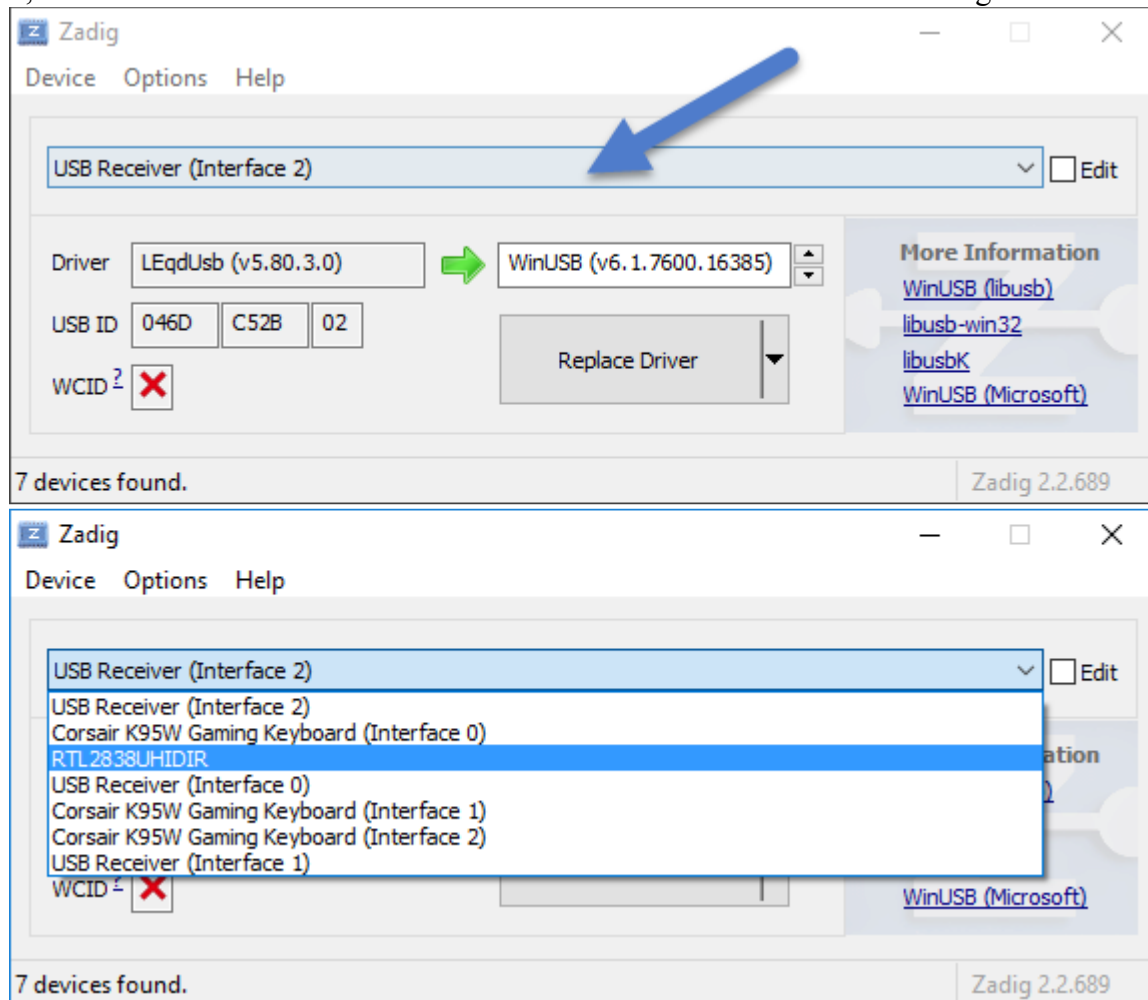
<https://www.ukwtv.de/cms/downloads-aside/281-dab-player-von-andreas-gsinn.html>
(Use Treiber 2 – declared as being from 2013 – from this German website.)

It works for me, in January 2021, in Windows 10, and the operating system (at least in its version, today) does not try to change it – on my computer, with my settings. The 2011 version of the driver (for Windows XP, Vista and 7) can be downloaded – for example – from:

<http://deviceinbox.com/drivers/1599-realtek-rtl2832u-irhid-driver.html>

This kind of driver is old and did not have any development in the last 8 years. One can find it on some German sites with a last date of 2013, but all the files inside are from 2009 up.

2. The second category of driver(s) is the most used today, and continues to have various developments in 2021. It is the driver that one needs in order to use SDR sharp, HDSDR and similar receiver software. This kind of driver(s) is continuously menaced by Windows 10 operating system. There are utilities with graphic user interface, like Zadig 5, which “convince” Windows 10 to use the wanted driver for the SDR dongle.



One of the DSR dongle manufacturers have a quick and simple tutorial at:

<https://www.nooelec.com/store/qs>

Once this driver is installed all programs meant to work with the original Realtek driver no longer work. The reception of commercial FM stations sounds better with the original manufacturer's driver.

3. The third category of driver(s) is what Microsoft Windows wants to install. It mistakes the SDR dongle for something else, and it is not usable for anything. Worse, it tries to replace at least the drivers from the second category (not the first category of

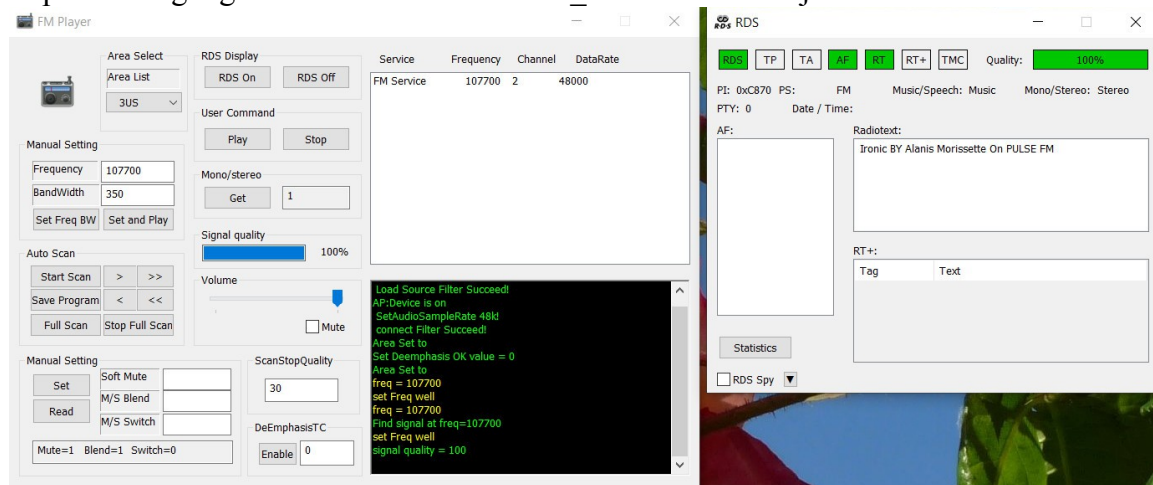
manufacturer Realtek driver, at least not now, in January 2021, and not on my computer, with my settings, which might change anytime; I just had the unpleasant surprise a harddisk computer backup program that worked many years suddenly does not work anymore, after the last Windows 10 update).

So, after buying an SDR dongle based on RTL2832 chip one has to decide what he/she wants to do with it. If you are like me and want to experiment all kind of programs, most probably you would switch between the Realtek original manufacturer's driver and the "community" drivers. I could not find a work around switching or installing and uninstalling the drivers. For example I found a simple FM player, with scanning and RDS, described at:

<https://www.onetransistor.eu/2017/08/fmplayer-realtek-rtl2832u.html>

And downloadable from:

https://drive.google.com/file/d/0B-RbkSUB_3IUSFF6RW5xcjFXRFE/view



People complain in the page describing the software that they have to switch between drivers, back and forth: Realtek original driver for this simple FM player and the "community" driver for SDR Sharp.

An exhausting article, with screenshots and links (that worked for me in January 2021, either the provided direct link, either the provided mirror link) was written in 14th March 2017 by Dalvik and posted at:

<https://dalvikplanet.blogspot.com/2017/03/how-to-get-working-rtl2832u-r820t2-on.html>

Dalvik gives there plenty of explanation, with screenshots, how to handle the drivers, and links towards free and paid receiver software applications, with some useful comments. Between others, he mentions his experience with Windows 10 regarding the SDR drivers, which I confirm is also mine:

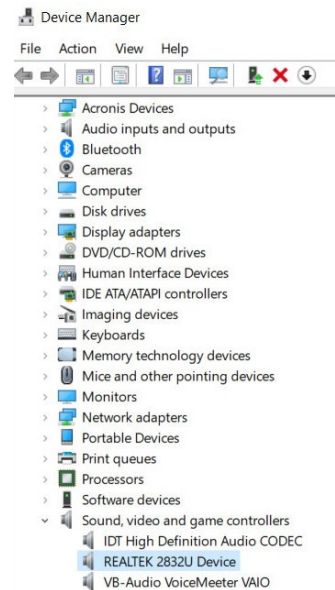
"Windows 10 build 10586 (Threshold 2) allows to install latest Realtek drivers. Windows 10 build 14393 (Anniversary update) DOES NOT allow proper Realtek drivers. Windows 10 build 15063 (Creators Update) allows it again."

Davlink wrote his article in 2017, and in 2021 some software developers do not exist anymore, and the given software program is no longer developed. That was the polite for saying some programs might crash your computer, as ProgDVB x64 7 did it for me.

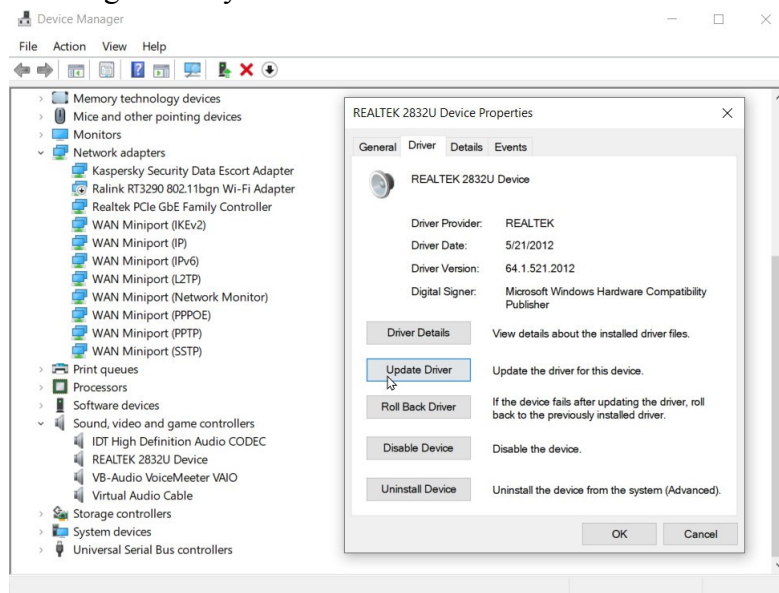
While writing this article I installed the Realtek driver from 2012, to take a screenshot for the simple FM player I was writing about. Obviously, now SDR Sharp no longer works in this computer (it says there is no SDR dongle connected, although it is):



One can ask “what does it mean switching between the drivers”? Well, that means you have already installed on your Windows computer the Realtek manufacturer’s driver (I installed 2 versions of it – see next screenshots) and also the “community” driver. You already have them both on your computer and because some programs work with one of them, but not with the other you have to select which one to use. You need to go into Control Panel > Hardware and Sound> Device Manager. From there you have to right click REALTEK 2832U device:



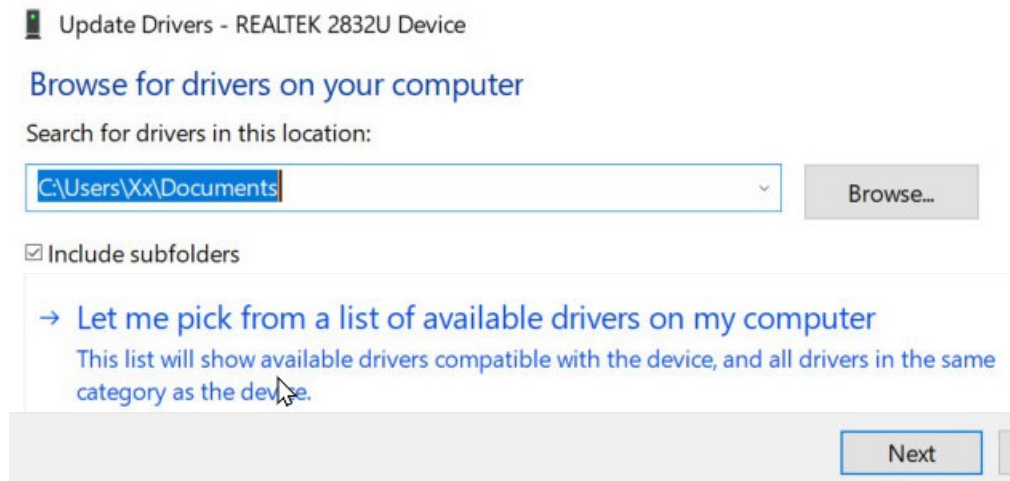
After right click you will have on the screen



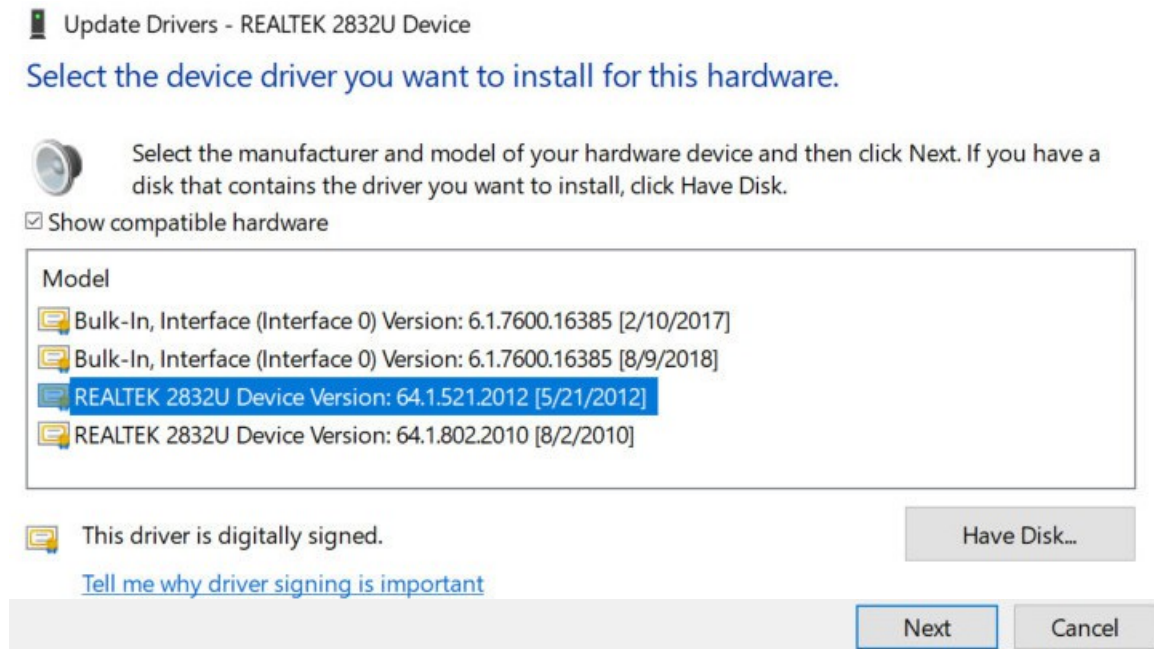
Click “Update Driver” and next select the option “Browse my computer for driver software”



Next choose the bottom option, as you see below:



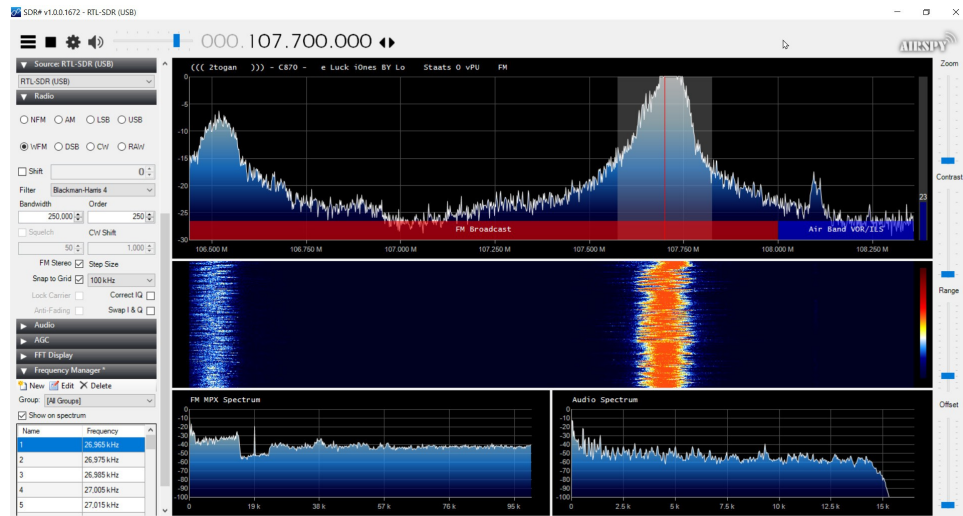
This is finally the place where to select the driver. If I want to use SDR Sharp I will select the first one, "Bulk-in Interface...".



Believe it or not, you need to click “Next”, and it shows that it does the installation, each time.

The Realtek driver is very stubborn, and remains in the system until an uninstall procedure is done with its original Realtek package. I had previously installed the “community” driver, and after uninstalling the Realtek driver my computer comes back to the community driver and I do not need to use again Zadig 5, as you saw in the previous screenshots. This might be or not the behavior of your computer, too, but very close to 100% you will have the same. SDR Sharp works again.

73 de Daniel, VE7LCG



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.

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ATV HAM ADS

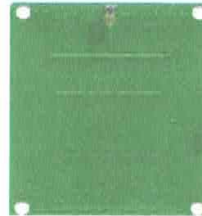
Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear **For Sale - or - Want to Buy.**

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Thank you for buying Kent Electronics antennas. Consider visiting our website or eBay store to see our latest offers. There are tons of references and educational information on our website www.wa5vjb.com.



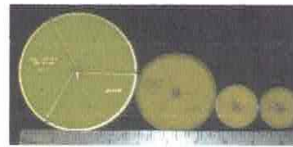
Log Periodic Antenna



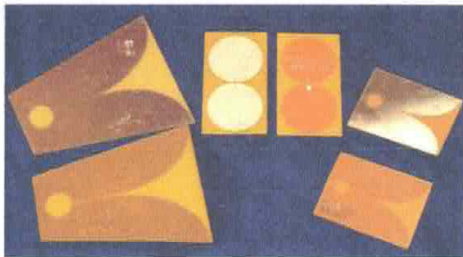
Yagi Antenna



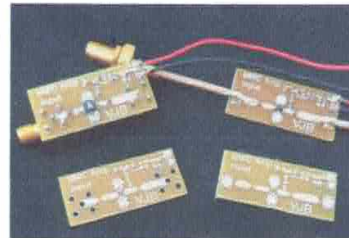
Custom



Wheels



Ultra Wide Band (UWB)



Generic MMIC

KENT ELECTRONICS (WA5VJB)

WWW.WA5VJB.COM

KB5RYE@WA5VJB.COM (sales)

www.eBay.com/str/calcmengineering



Patch Arrays



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Buy - Sell - Trade - Giveaway

(web site: http://www.slatsatn.net/?page_id=713)

Check it out. New items listed every week

Items listed include: Rig-Blaster; complete DVB-T ATV station including transmitter, receiver, etc.; HF Modem Digital Voice Adapter for SSB; ATV IDer; Hi-Des UT-120; Tektronix NTSC waveform monitor & vectorscope; SMD repair station; etc.

KH6HTV NOTICE: I now back in Boulder and open for business. Janet & I gave up on S. California. We got too scared of the extreme covid situation there and were not comfortable staying. So we have given up and returned back to Boulder, Colorado. At least we are now again close to our own doctors, family & friends. ---- Jim, KH6HTV



Quality Products & Application Notes for the Amateur Radio/TV market www.kh6htv.com