In this issue

The CQ-DATV editors gratefully acknowledge all those authors that have contributed articles for this free magazine.

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Editorial

Welcome to CQ-DATV 93, bringing you all the latest ATV news.

A cubesat, made of wood, for launch in 2023, yes this is the March issue, not the April issue, we have checked.

COVID has not stopped ATV propagation experiments, although the Italian team behind the PLUTO beacon do look very suspicious in their masks.

This being the March edition and Equinox time, the Clarke belt and the sun are one and the same as seen from the earth, so why not have a look at 26°E and see if you have a clear spot to see the sun when it is at this position. If so you could site a dish to receive QO-100. We have two articles on how to receive DATV from the geosynchronous satellite relaying ATV pictures from an area covering almost a third of the planet.

The first article is written by Lucien Serrano F1TE and the second one is from Dave Woodall G3ZGZ. So no excuses, they both use similar hardware but also bring different skills to solving some of the problems. The Walls soft Scoop container is the CQ-DATV production teams favourite, although we must point out other available brands can be used.

Jim Andrews KH6HTV has provided an evaluation of the Hi-Des HV 310 Dvb-T modulator and compared it with the HV 100EH and HV320E, interesting reading, but Jim thinks there is still somewhere to go with these units. Jim has also extended his article from the last issue on modifying CATV modulators for 434 & 426.25 MHz.

Trevor has populated and tested the MK 2 PCB for his GVG mixer, and now the software to self-start the unit now runs from a single 19V using a laptop PSU. The self-start is important for GVG panels using filament lamps as the default to the software not running is 58 lamps illuminated at the same time.

Daniel Romila, VE7LCG has also added to his previous article on SDR plug in adaptors, these very small units can receive TV signals from 24MHz to 1.6GHz.

We have 2 stories in “From the Vault”, Trevor is using lockdown to sort out his loft, not a moment too soon as it seems to have 50 years of accumulated projects, most just faded paperwork now. This ATV time capsule covers building an oscilloscope back when he was in his teens with a definite 'don’t build this PSU at home' warning. The second part looks back at an ATV graphic produced on a Sinclair ZX80 computer.

It would seem that Trevor should really have started this loft clearing process a little sooner, any longer and it might qualify for lottery funding as a heritage site, but it does provide an interesting look back into ATV and how it was 50 years ago and this is “From the Vault” after all.

Please sit back and enjoy CQ-DATV 93

CQ-DATV Editorial team

A Cubesat made entirely of wood, or almost

The materials that will be used to build the Japanese satellite Lignosat, the first space probe made mainly of wood, whose launch is scheduled for 2023, are still being defined. We talk about it with one of the experts involved, Professor Yosuke Alexandre Yamashiki of Kyoto University

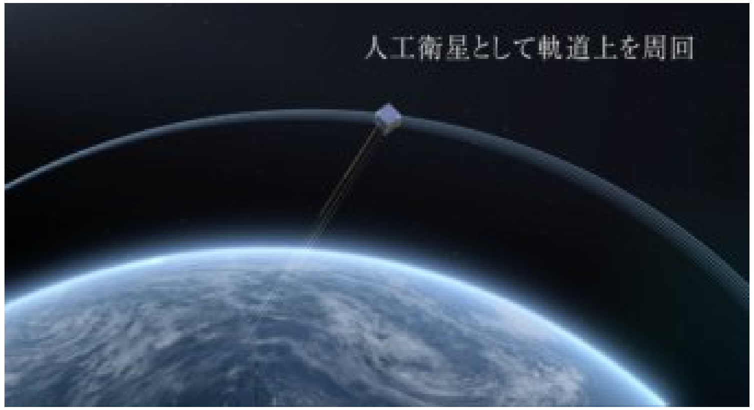
Yosuke Alexandre Yamashiki, of the University of Kyoto, in a photo taken in Stockholm. Credits: YA Yamashiki

The announcement, a few weeks ago, of LignoSat, a wooden satellite prototype under development by a Japanese company and the University of Kyoto , aroused curiosity and interest all over the world. The use of a highly biodegradable material such as wood material has clear advantages when you think the space debris , the space junk , but it also poses many challenges, we talked with Alberto Buzzoni , expert INAF space technologies.

To deepen some technical aspects of this innovative project, Media Inaf reached out to one of the experts involved, Professor Yosuke Alexandre Yamashiki , engineer and researcher at the head of the Human Spaceology Center and of the Earth & Planetary Water Resources Assessment Laboratory at the University of Kyoto in Japan.

Professor Yamashiki, what kind of tests are needed to ensure that the wood survives the harsh conditions during launch and in space?

"There will be a series of tests before the official launch of the probe determined by the protocol of the Jaxa launcher [the Japanese space agency - ed] . We have to make sure that all the components of our wooden satellite meet their requirements, which are very strict".



Artist's impression of the Lignosat satellite in orbit. Credits:space.innovationkyoto.org

Will the satellite be made entirely of wood, or will there be a small fraction of other materials as well? What is the main material that will be replaced by wood?

"We are planning to make everything with all wood material, but on the other hand, to satisfy the strict regulation established by Jaxa for the launch, we have to use a portion of metal. We are trying to reduce this portion so that we can still say that the satellite is made of wood".

Do you already know the type of wood that will be used?

"This is yet to be established and yet to be announced."

What is the expected size of the LignoSat satellite?

"The prototype of the experiment will be the size of a Cubesat , very small but standardized."

Will it be covered with solar panels or other reflective material?

"This is yet to be established. However, it all depends on the sensor that will be used. Obviously we will need a solar panel, however according to the current plan it will be installed inside the box".

In which orbit will the satellite be launched? Is there any technology for deorbitation?

"We will initially launch in a normal satellite orbit around 400 kilometers asl. However, as the initial launch of the prototype will be challenging, we don't expect to have deorbitating technology as the satellite is small."
Source: https://tinyurl.com/y4mjty8h

Luigi D'Arcangelo

Verification of the propagation of an RF signal 1298 MHz video modulation 1280x720 DVBS2 500 Ks fec 3/4 in the absence of optical range through the use in mobile of an autonomous beacon that uses the patch in "Static Beacon" of IS0GRB. Inside the case there is the SDR Adalm Pluto modulator, pre amplifier, 3.5 W final, 12 / 5v DC voltage reducer.

The antenna adopted by the beacon in TX is a double Bi Quad panel built while the receiving antenna is a 1m grid parabola with home made feed built on the pylon at an altitude of 13 m. To check reception and to orient the rotor we adopted the remote desktop towards the two PCs in the radio station.

It was very interesting to evaluate the propagation characteristics of DVBS2 in less than ideal conditions and with Qrg around 13 km, not a considerable but significant distance considering the conformation of the territory and the various obstacles (houses, hills, trees and small wooded areas)

present between transmitting antenna (mounted on the off-road vehicle) and receiving antenna. Despite this and despite the received signal did not exceed -70 dbm the reception and demodulation of the transmitted video signal (monoscope and audio tone) was excellent with C / N Mer = 20. By chance we meet for a take away coffee with IW7ECA, IK7LSE and IZ7ZKV halfway and we complete the test in two different spots.

Thank you all for your cooperation and availability best 73 de, IZ7PDX Ham Radio Station, Luigi.

Source: CQ-DATV Facebook

DATV Reception on QO-100 for Dummies

Written by Lucien Serrano F1TE

Preamble

The expression “For Dummies” has now passed into everyday language by losing its derogatory meaning. It now applies to the curious who want to research a particular area.

The dummies in this provocative title, are of course all the OM’s that tell us “DATV is not for them because they cannot master microwaves or satellites, it's too technical, and they don't want to know anything about digital or video modes.”

We want to prove to them that on the contrary they have all the necessary skills and qualities needed to approach this field as long as they know what a soldering iron, adjustable wrench and screwdriver are, and they still know how to surf the net on a computer. They must still have amateur radio in their blood, the one thing that always pushes us to be interested in new communication techniques.

We are sometimes criticised for not publishing articles for beginners and with all due respect to fans of Veroboard and other past nostalgia, this article is solely aimed at beginners in DATV. Much progress has been made in the field of digits since their liberalisation by a decision of ARCEP in 2012! At the moment, we have found senior managers attentively listening and open to our arguments.

Before 2012 these modes, which use coding, were not allowed. The REF obtained a temporary exemption in 2003 for Wi-Fi experiments in our band 2400 MHz, but this has not been renewed.

Obviously, television did not escape this digital evolution and, even if analogue television spread over 5 MHz is still used terrestrially by some “aficionados”, it is necessary to recognise that digital television or “DATV” (Digital Amateur Television) brings exceptional spectral moderation, using a hundred times less space than analogue, television for the same moving pictures. Quality transmissions in a 35 kHz mask are currently being tested, with some degree of success.

The purpose of this article is not to explain to you all the theories surrounding the transport flow, of a TS (transport stream) as the specialists say, but to show the simple user side of how to set up a receiving station for DATV on the QO-100 satellite, since it is equipped with a transponder which rebroadcasts images from, potentially, a third of the planet, including, Europe, Africa, and Asia, without any distance or propagation constraints.

To set up a broadcasting station, is a bit more complicated and that does requires understanding of a certain number of concepts on the different systems of data compression and encoding and of modulation in QPSK, 8PSK, 16APSK even 32APSK, which requires amplifiers with a perfect linearity. We will not be covering these and we will be limiting ourselves to just DATV reception from the QO-100 satellite.

The same principles apply to the reception of land links, but the satellite allows us to see broadcasts 24 hours a day, as a beacon television signal is always present. If you have already installed a commercial satellite television setup, you already know almost everything of the techniques involved.

You will need:

- *a dish like the one we find in all DIY stores.*
- *a standard 10-12 GHz or LNB head,*
- *a 75-ohm coaxial cable,*

- *a decoder,*
- *a receiver for displaying the received images, the receiver being a PC using Windows.*

You see, it’s quite simple familiar kit.
The band we want to receive is between 10,490 and 10 499.5 MHz.

Ku band commercial frequencies cover 10,700 to 12,750 MHz commercial equipment is therefore adaptable, the heads in use, already cover our band. Let me stress no modification of the LNB head will be necessary for DATV reception.
The budget

We will set at a maximum of €200 (£175 at today’s exchange rates) this amount does not include a computer that every good radio amateur already owns.

The Dish

An 80-centimetre dish is a good choice to start with, but of course, the gain is proportional to the size. If you can, stretch to a 100 or 120 cm. There is a wide choice available on the internet expect to pay 50 to 100 € (£45 to £90). If you have it delivered, check the package carefully before you accept it, badly packaged sheet metal models in cardboard are easily deformed. Beware of bargains, parabolic dishes have a precise shape along with the precise positioning of the source at the focus.

Some of these bargains may be adequate for commercial satellites but may disappoint when receiving QO-100. Don't forget the second-hand market, there are often sellers of specialised dishes for sale near you. You just need check the integrity of the parabolic shape. If this is an “offset” model which is a section of a paraboloid, then there are advantages as LNB source is positioned to avoid the shadow losses of a “prime- focus”.

Figure 1: DATV satellite dish

The difference is visible in this diagram, an offset dish must be much more selective than a prime focus. This is the role of the concentric rings in the horn at the end of LNBs, designed for offset dishes, these LNB’s are not suitable for a prime focus dish, as there is a risk of losing part of the surface.

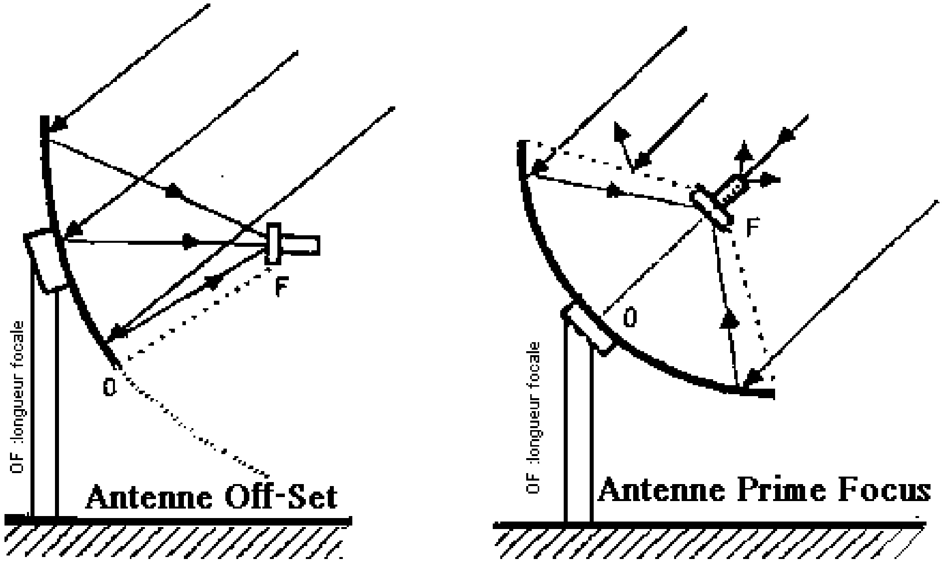


Figure 2: Offset versus prime focus

Figure 3: Commercial offset dish

This kind of offset dish is widely used in commercial satellite television.

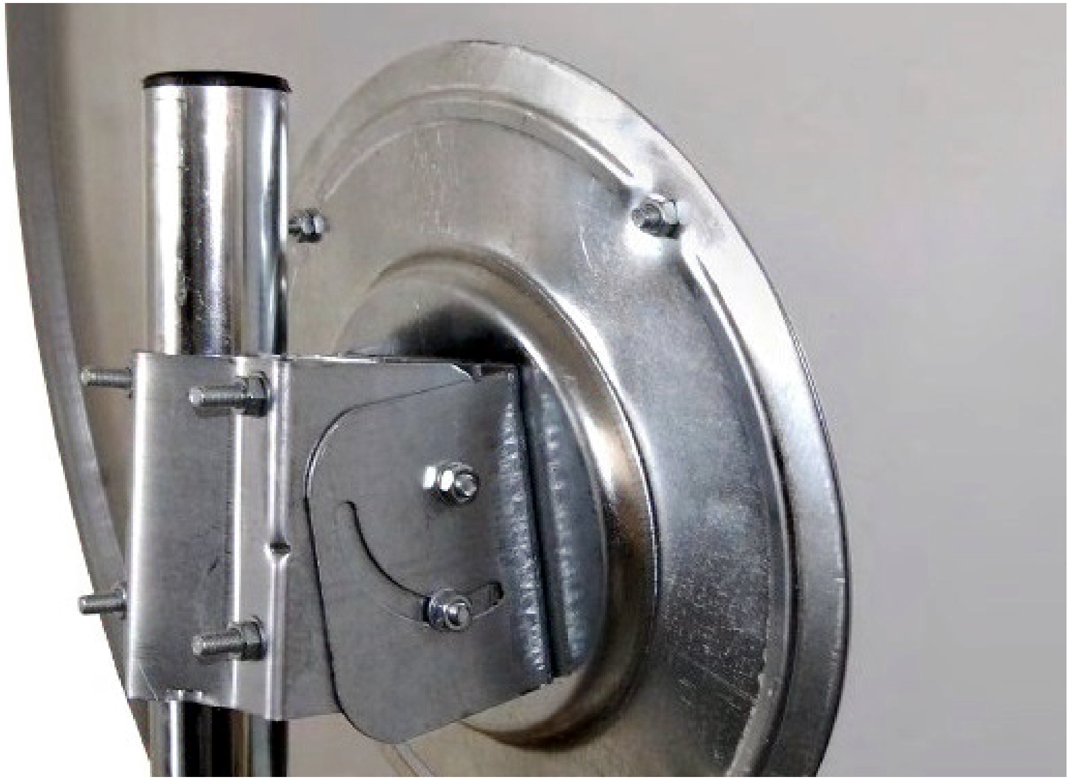


Figure 4: Elevation adjustment

Note the mounting flange and its adjustment of elevation (more later) 10 GHz head or LNB (Low Noise Block-Converter).

You can often find an LNB included with the dish. We recommend a dual outlet head; this helps if you want to extend satellite reception to include narrow band modes like SSB and CW. You will find dual LNB’s for less than 20 €, (£17) all designed for parabolas of all type offset and prime focus.

The standard LNB is a frequency converter equipped with a local oscillator, in our case based on 9750 MHz, and will down convert our 10 GHz band to an intermediate frequency between 740 and 750 MHz It's this intermediary frequency which will be transported via a coaxial cable to the decoder.

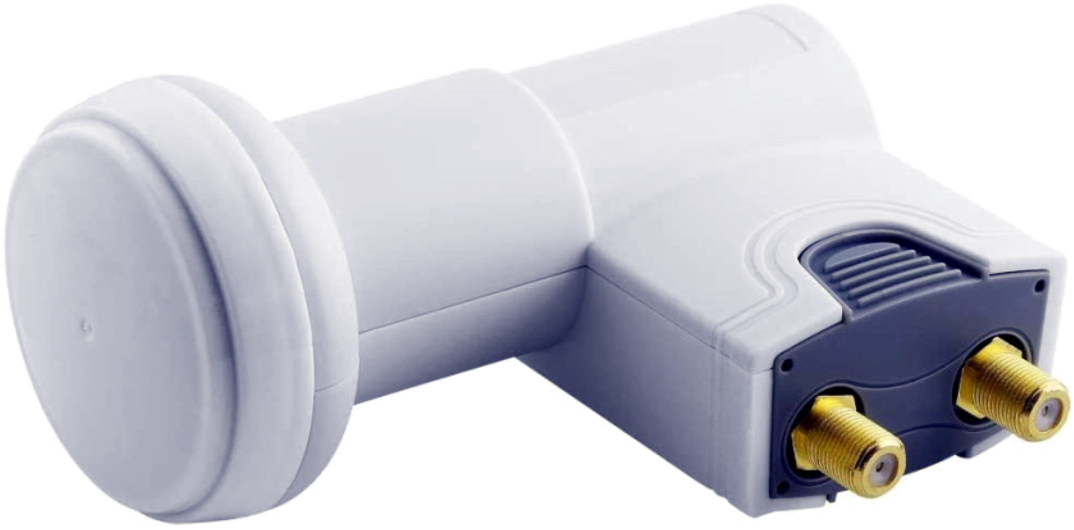


Figure 5: Dual LNB

The conversion gain of the LNB, the losses in the coaxial are of little importance for lengths usually used by amateurs. We will not explain the purchase of a coaxial cable, just use special 75-ohm satellite television cable, nor will we go into fitting F plugs at both ends, you will surely find tutorials on the WEB.

The decoder

For years Jean-Pierre F6DZP has been working on decoders for DATV based on the DVB-S standard used for digital satellite television. The main module is the DVB-S tuner or “NIM” (Network Interface Module).

After a lot of testing of numerous versions, the choice of NIM fell on the model FT-4334L manufactured by SERIT.

It covers from 144 to 2450 MHz, which allows direct receptions on four of our amateur bands, and can be used for QO-100 reception, where the intermediate frequency is 740-750 MHz.

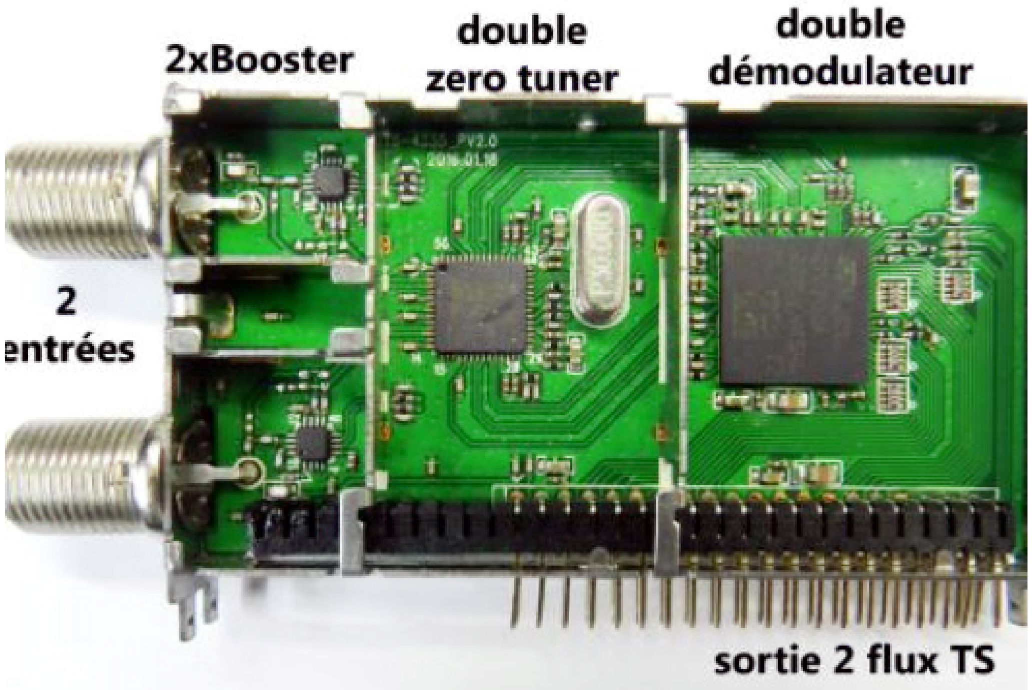


Figure 6: Tuner or NIM

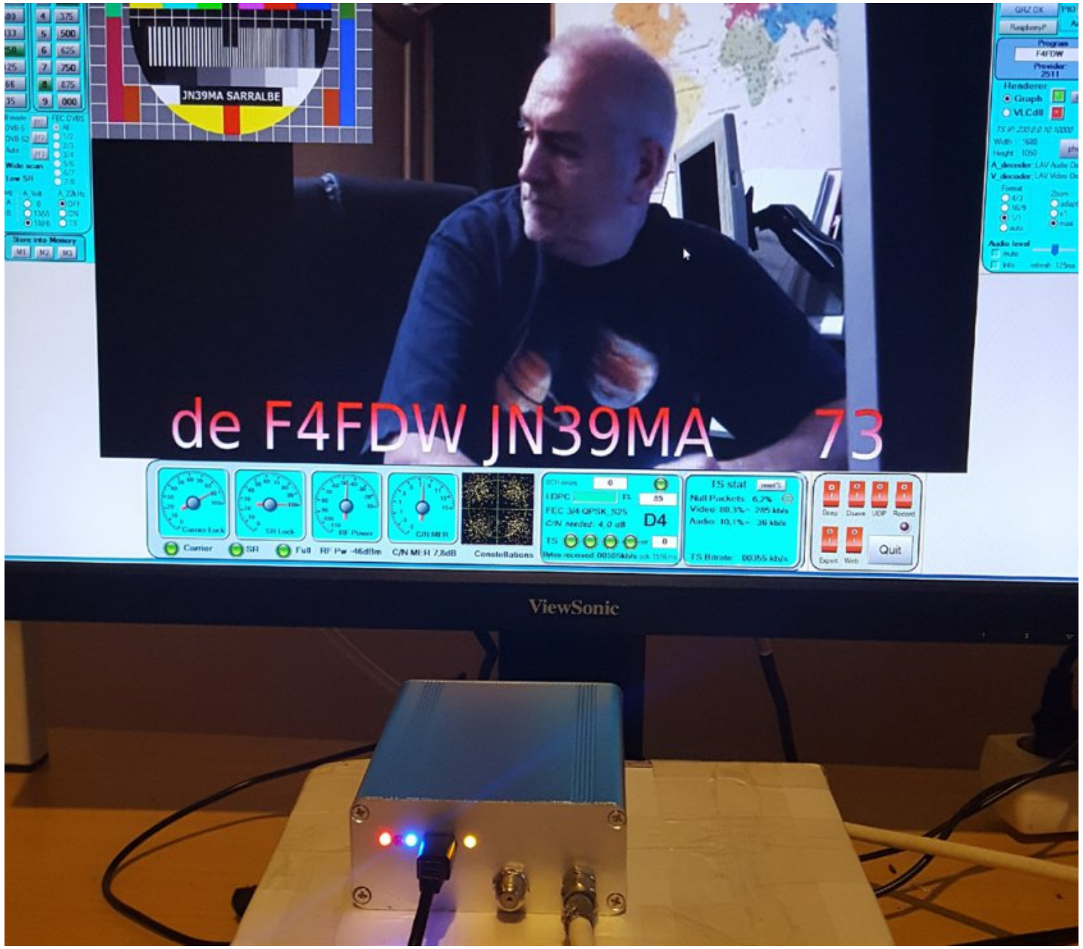


Figure 7: The decoder in operation, image in 125 Ks

The decoded TS stream will then be processed by the rest of the decoder logic to provide a USB connection of video and audio information required by the display software.
The complete decoder was designed, manufactured, and distributed in France by the REF,(Réseau des Émetteurs Français) in connection with the designer F6DZP, to provide an easy to assemble kit.

In order avoid surface mount components and further reduce costs we introduced the "Minitiouner-S" model.
This decoder has been described in the Radio-REF of September 2020 and repeated in CQ-DATV issue 92.

Figure 8: Composition of the KIT

Details have also been published on the WEB: *http://urls.r-e-f.org/nm931za*.

The kit consists of an electronic card mounted NIM, a box with its front faces and back pre-drilled and laser-printed, and 4 x 3 mm LED diodes.

The receiver

As we have already said, the receiver connects to a PC type computer running Windows. Here software processing of the "TS" stream will be used to decode the digital streams (H264 or H265 standards) and display the received images. This software is designed by Jean-Pierre F6DZP and is constantly evolving. The software recognises the type of Minitiouner connected to the PC and configures accordingly, the LNB coaxial connection for power to the LNB, to set polarization and the appropriate band.

Figure 9: Populated PCB

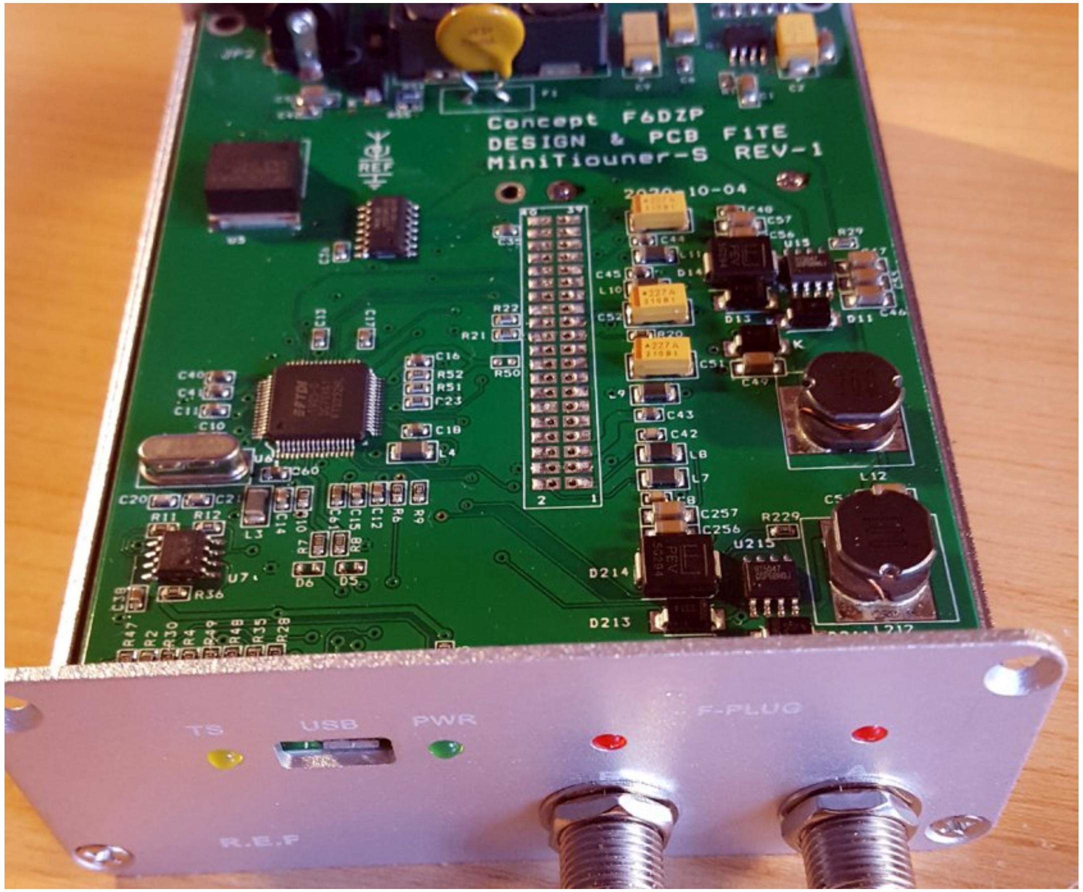


Figure 10: Installed in the case

Figure 11: 12 V 1A power supply unit

Figure 12: Micro-USB cable

These standards are now universally adopted around the world for DATV reception.

There are two types of software. The first is called “Minitioune” and the second Scan & Tioune, because it incorporates a scanner of the QO-100 band to identify active stations and automatically calibrates using the correct settings.

The software also incorporates measurement tools for the analysis of received and decoded video streams. The software is free and can be downloaded from the VIVADATV site managed by F6DZP, after prior registration.

A dedicated section of this forum “Download” allows you to download the latest versions of software. The forum is open to everyone, and it's a wealth of information on DATV.

Equipment installation

As a first step, we invite you to read our QO-100 online manual at *https://tinyurl.com/yyjflf9k* Pages 3 to 6 will give you valuable information on the satellite and its pointing. This satellite is geostationary on the equatorial plane, the orientation of the dish will depend on the position of the ground station.

For the most of us, the azimuth is between 146 ° and 157 ° depending on your longitude, the elevation will depend on your latitude and will be for the most of us between 27 ° for the most north and 37 ° for the most southerly. The more we travel towards the south, the more you must “raise your head”, at the equator the elevation will be 90 °. To refine the pointing, the Minitioune software provides hearing aid with a BEEP function.

Mount the dish on as stable base as possible fit the LNB on its mount and orient the head 15 ° clockwise to compensate for the SKEW, this setting will have to be refined with the software's hearing aid.

Connect the coaxial cable between the head and the entry marked “A” of the Minitiouner-S.

Connect the USB cable to the PC and turn on the Minitiouner.

A Windows beep indicates the connection of a new device.

Start-up of the Minitioune software. Firstly you need to register an account on the VIVADATV platform: *https://tinyurl.com/y3d4o8d3*

Once registered, you will have access to the software download as a ZIP file. Unzip this in a suitable directory on your hard drive. Together with the executable file, you will find an .INI file that will allow you to configure the software.

The software.

As a first step, we recommend that you change only your callsign, your Locator and your city as well as possibly the password you have provided for connection to the VIVADATV platform. Tempting as it maybe before touching the other parameters, wait until you are familiar with the software.

Once these changes are made using the Windows Notepad editor you can launch the executable Minitioune-xxxx.EXE.

After a few seconds, a screen appears. Don't be surprised at the amount of information on this screen, we are in “expert” mode and as indicated previously, the software is also a tool to measure and help to point the dish.

Here, on this capture, the dish is already oriented and an image of the DATV tag appears. At the bottom of the screen, you will find the signal information received, its relative strength and signal / noise (C / N) as well as a display of the modulation, here in QPSK, (Quad Shift Keying), modulation of the 4 phase states, which will enable us to see the grouping of points on the 4 quadrants.

Then follow the information on the quality of the digital stream along with the video, audio, and other information about the TS. Further information appears on this Airbus A380 version of the dashboard.

These relate to locking the tuner onto a signal. You will notice these are at the top left of the display and allows you to figure out the SR (Serial-Rate), which is to say the binary flow of the data to be able to decode a program. The pre-set buttons allow you to set the tuner reception frequency. Here the table is configured for the pre-sets of QO-100, the first column from 1 to 9 indicates the mega-hertz digit, the one on the right the kilohertz.

At the top left of the screen there are buttons that allow the setting of the symbol rate (SR) and reception frequency. The software assumes that you are using a normal satellite LNB with a local oscillator frequency of 9750MHz.

At launch, by default, this is the frequency and the SR of the beacon which is pre-programmed. The mode here is DVB-S2, input A of the NIM is selected and a voltage of 18 V is supplied to the LNB to power it and will set the polarization to horizontal.

The BATC MiniTiouner runs off 12volts and allows this voltage to be put on the coax to the LNB by placing a suitable jumper on the board. In order for a standard LNB to be used for AO-100 reception you can turn the LNB round by 90 degrees plus the skew angle. This means the coax will exit the LNB horizontally and care needs to be taken in waterproofing the LNB connections.

Careful reading of the file “read me” which is part of the downloaded zip file, will then give more meaning to all other information on this interface. What does a signal showing as D6 mean? In the "old"analogue video world a report was given using a P code. The D code is the digital equivalent. Depending on the encoding parameters, the signal to noise ratio (called Modulation Error Rate or MER) for decoding must be in theory be 4.7 dB. In the example the received signal (MER) is 10.9 dB, so we have a positive margin of 6 dB, hence the report of D6. Once the software is installed, fine orientation of the dish and settings will enable a more accurate pointing of the dish in order to get the MER as high as possible. When reporting the reception to a transmitting station it is usual to give either the MER or D values. The MER you see will depend on the size of the dish you are using as well as the transmitting stations power. The D report will depend on the MER and, more importantly, the modulation characteristics being used..

The last box at the bottom right contains a display of switches, one of which is marked "BEEP”: This is really helpful when pointing the dish. As soon as a signal is received the BEEP rate changes according to signal strength. This earpiece will allow the best orientation possible of the dish. At this stage, it will then be necessary to adjust the skew, which is to say the inclination of the LNB source compared to the vertical axis of the dish.

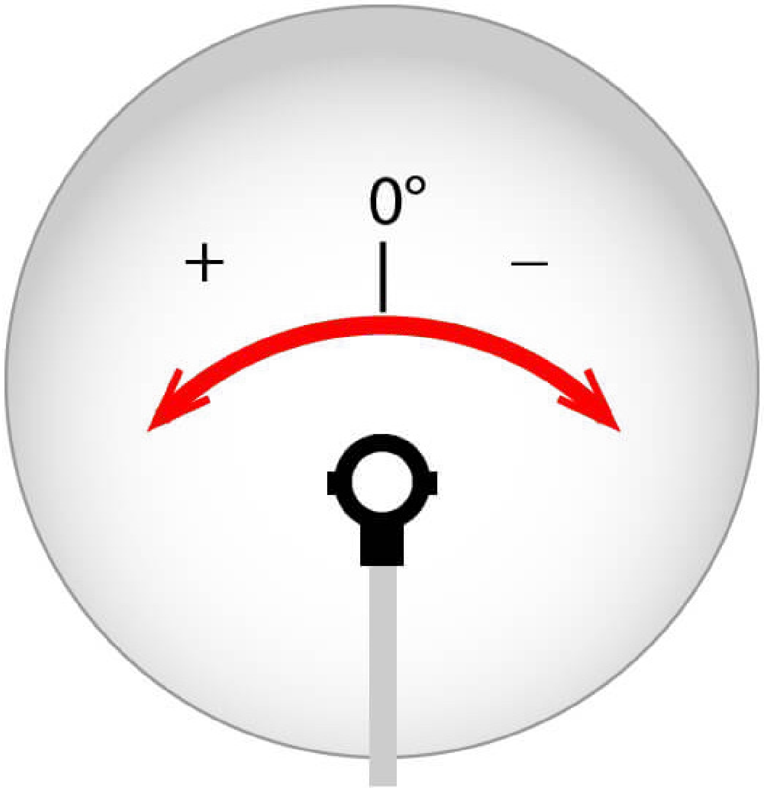


Figure 15: Skew adjustment

For our QO-100 satellite is about 15 to 20 ° negative, as shown in the figure. Set to maximum signal using the beeper or MER indication on a decoded station.
Getting started with the software.
Scan & Tioune. This second package must also be downloaded from the platform VIVADATV, section “Download”.

The same as for the Minitioune.exe program, you will need to customize the .INI file, then launch the executable. This program can also serve as an aid in pointing the dish.
The visual interface is a little different: what at once attracts attention is the spectrum analyser integrated into the software which scans the satellite band, locates stations, and identifies them.

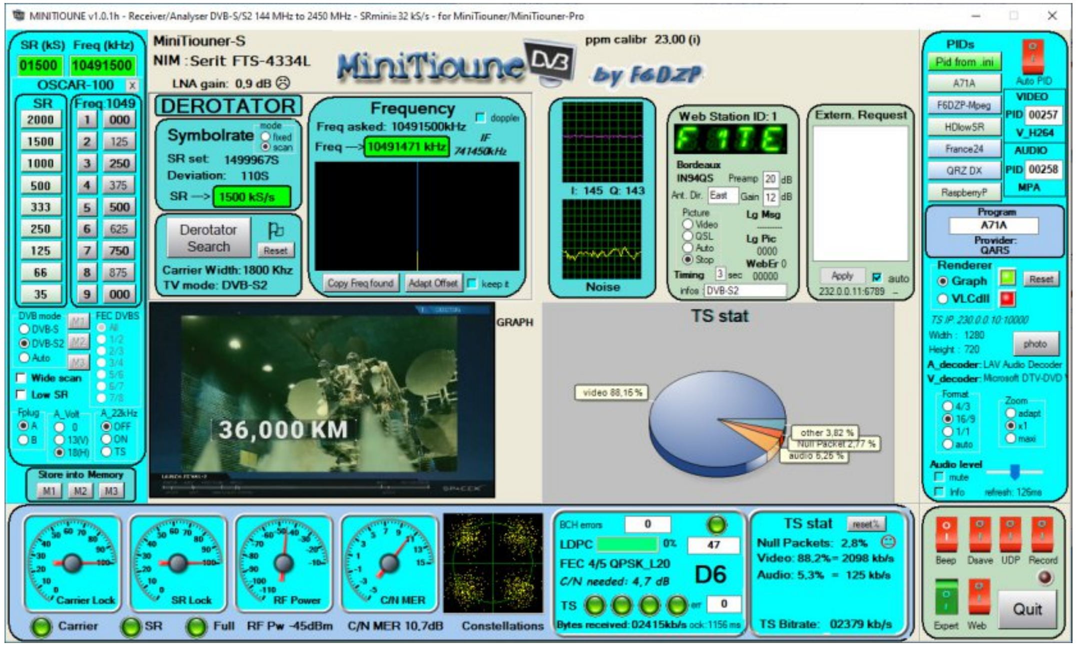


Figure 13: Receiver screen in expert mode

Figure 14: Normal mode

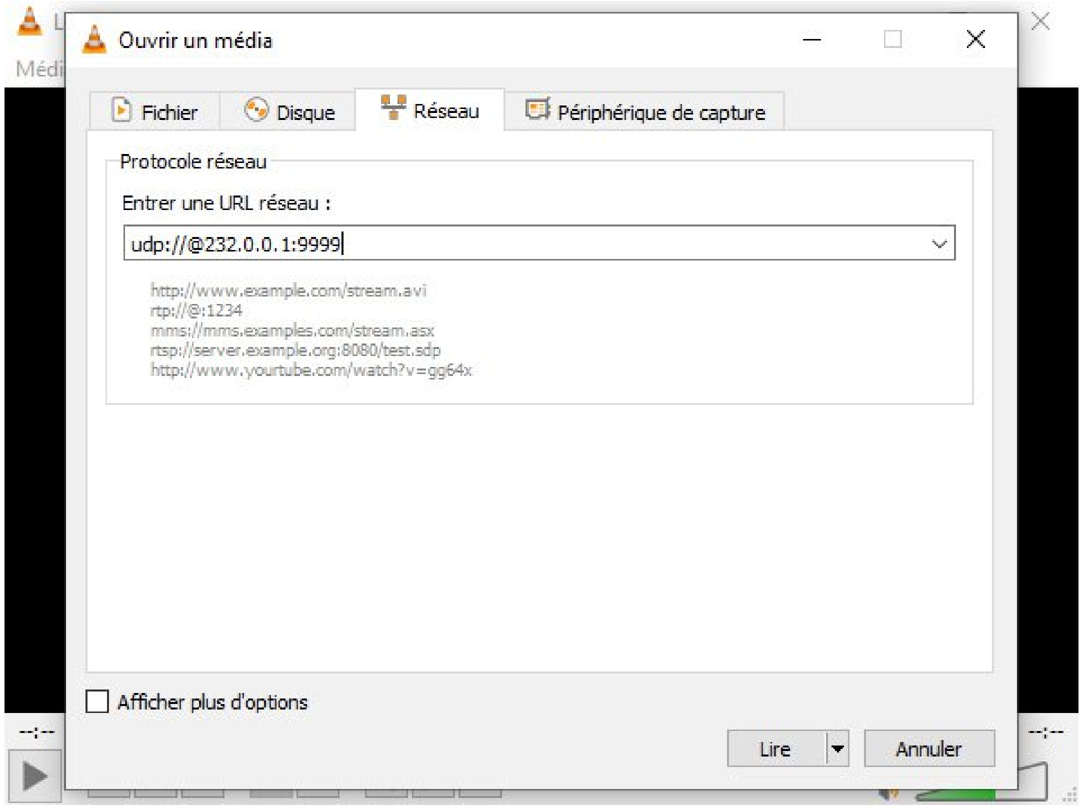


Figure 16: Via a VLC connection coupled with the VLC software by a UDP link indicated in the section located in the upper right corner, you can pass the full screen streaming to your PC or to any another in the network

If you want to view one of them, just click on the code in the scan, or on the station identification buttons to the right. The advantage of Scan & Tioune is that it doesn't need an internet connection to locate a station.

Scan & Tioune is a remarkable program which enables the handling of satellite reception by beginners, remember we have all been there once. Click on the image to change the format.

In the same astral position is a commercial satellite and via this you can receive France 24.

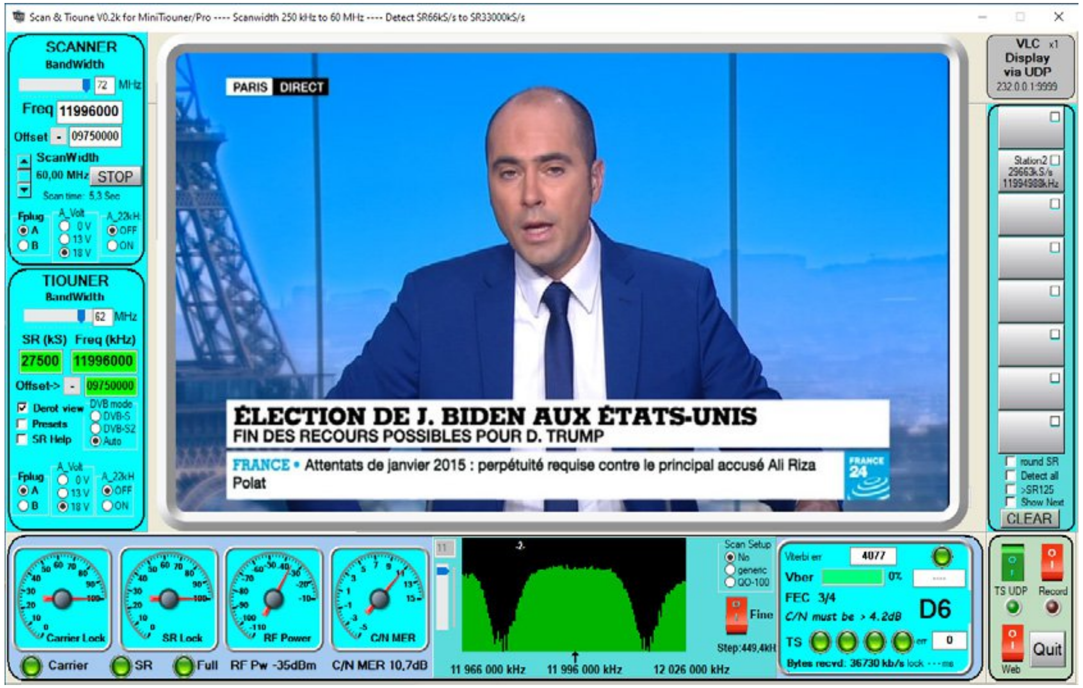


Figure 19: France 24 reception

To do this input the zone and for Scan & Tioune frequencies shown in this capture.

Tuner frequency: 11,996,000 kHz SR: 27500, DVB-S for the scanner and set the width of the scan at 60 MHz to view the commercial transponder.

Of course, there would be a lot more things to say about this software, but we will not go into that here: To receive amateur television on the QO-100 satellite, a simple program like Scan & Tioune allows you to start. It will then be time to refine the settings and improve your knowledge of DATV.

Conclusion

Apart from receiving amateur transmissions we can use this satellite to relay the broadcasting of programs scheduled during events or international conferences.

Since its launch in early 2019, we were able to attend conferences organised during the Friedrichshafen fair, during the annual Amsat meeting at Electrolab in Nanterre or at the HAMEXPO 2019 trade fair.

The amateur radio community now has its own satellite TV channel. From now on you will have access for a reasonable sum, to this tool available to all radio amateurs and would be a shame not to use it. In summary, what do we need for reception of DATV broadcasts on QO-100?

- *A satellite dish: 60 € on the Web.*
- *A 75-ohm extension cord + F plugs: € 20.*
- *A Minitiouner-S decoder: 89 € + port REF shop.*
- *A 12 V 1 A jack output power supply unit 2.1 mm: eBay € 5.*
- *A Micro-USB <=> Type C cord: € 3 at your favourite supplier.*

We have kept within the planned budget, and the assembly of all this equipment is part of the pre-requisite skills listed at the beginning. We hope that this article has achieved its objective, which is to show you that amateur television is not reserved for an elite group but for all amateurs.

Bibliography

VIVADATV Forum: *https://tinyurl.com/y3d4o8d3*

REF Publications website: *https://tinyurl.com/yxll7qur*

BATC WEB-SDR: *https://tinyurl.com/y4nc7xcm*

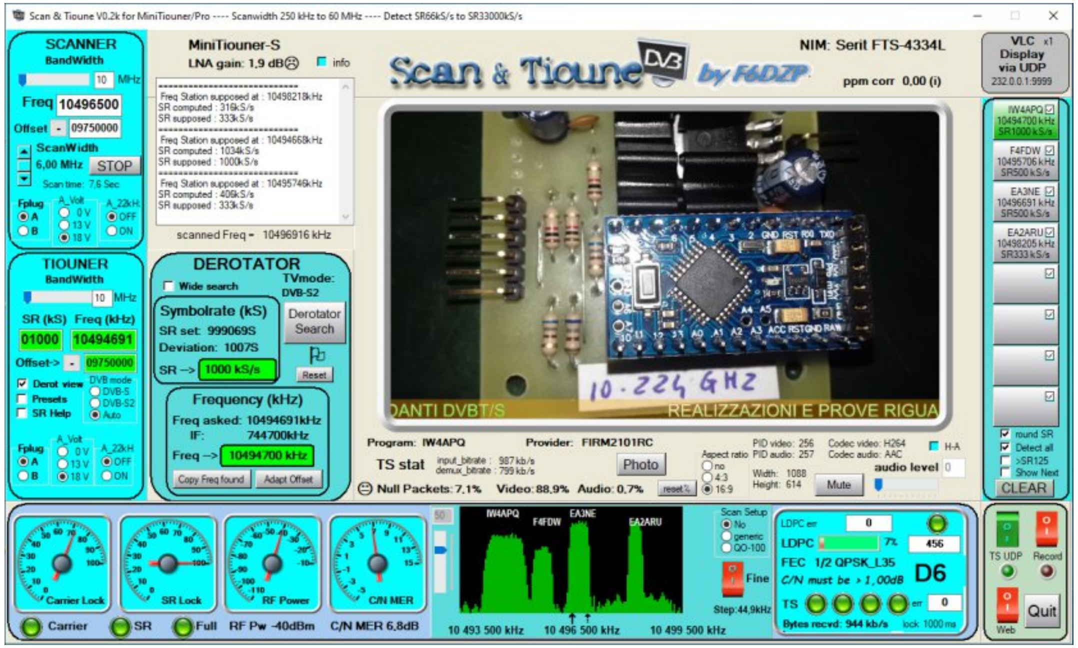


Figure 17: Scan & Tioune

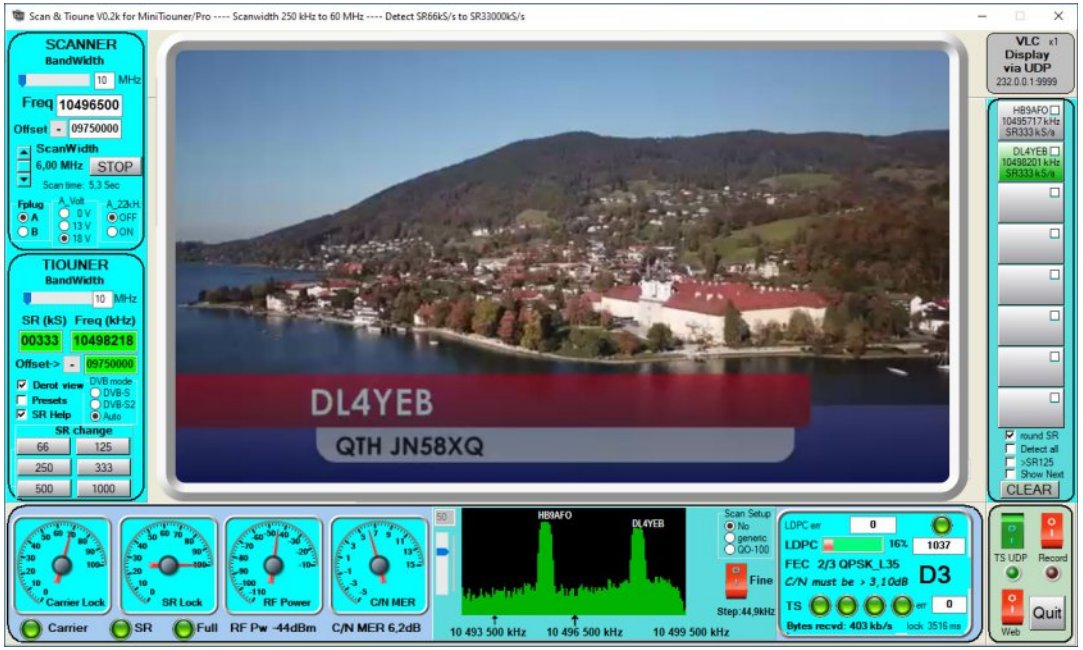


Figure 18: Scan & Tioune

Using the MiniTioune software. (MiniT)

Written by Dave Woodhall, G3ZGZ

Having just read Luciens contribution (Yes I got to see an advanced copy), I thought I would pen my set up for QO-100. We are both on the same page, I just did things a little differently. Ignore the Helix around the LNB in the picture. I also have uplink capabilities to QO-100. The uplink is on 23cms. I use the same dish and the Helix is fed by my 23 cms DATV TX (about 20 watts is required).

I have a 1.1m offset dish and would recommend nothing smaller although I accept others have managed to get away with less. I used the same Software and Minitioune hardware as Lucien they are highly recommended.

Software

Download and install the 32 bit version of VLC - even if you have a 64bit PC *https://tinyurl.com/p4awpbb*. This is necessary to decode the video and sound.

Download and install the MiniT software *https://tinyurl.com/y5g8gxcb*

You WILL need to register before you can download the software. After logging in click on board index, software useful for datv, download.

The current version (Feb 6th 2021) is 1.0.1.0r

Configure the software

Run the MiniT software.

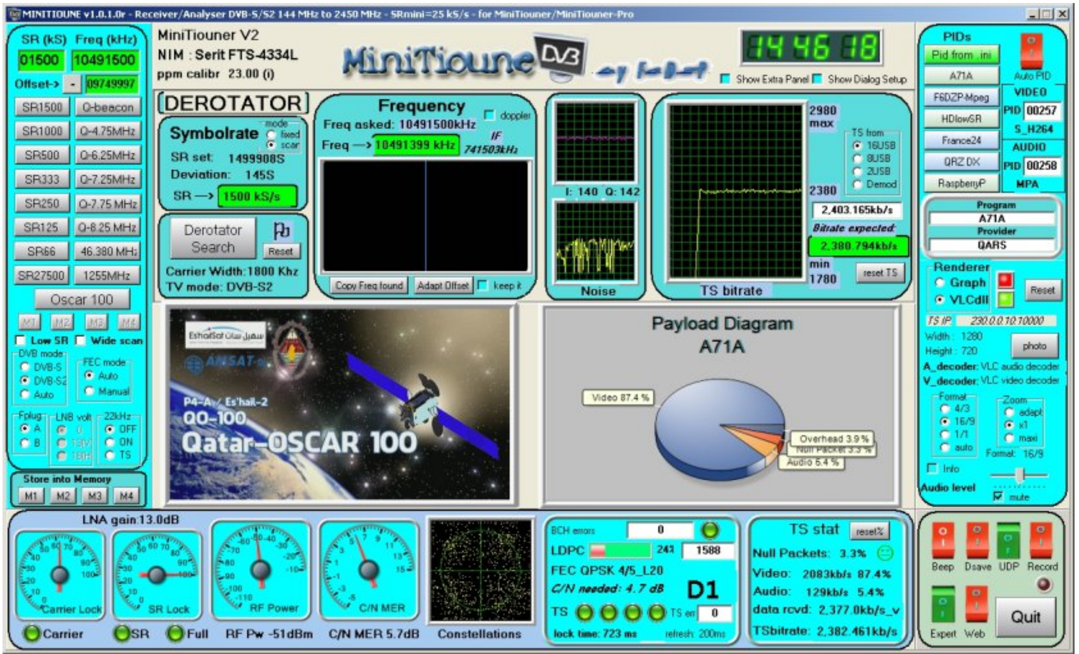
At some stage you will probably want to configure some aspects of the software such as your call sign.

This defaults to MYCALL and is only used when sending your received pictures to the web MiniT monitor page. For the moment don't bother about changing anything. When you are ready to change parameters they are stored in the .ini file and this can be edited with simple text editors such as notepad.

The software defaults to the settings required to receive and display the beacon signal from Oscar-100 which at the moment is a video about the launch of Oscar-100.

The dish

Now is the time to install and align your dish.



This is reception of Oscar-100 using a 60cm dish which is just big enough for the beacon, but not for weaker stations. A dish 1.1m is a good size to use.

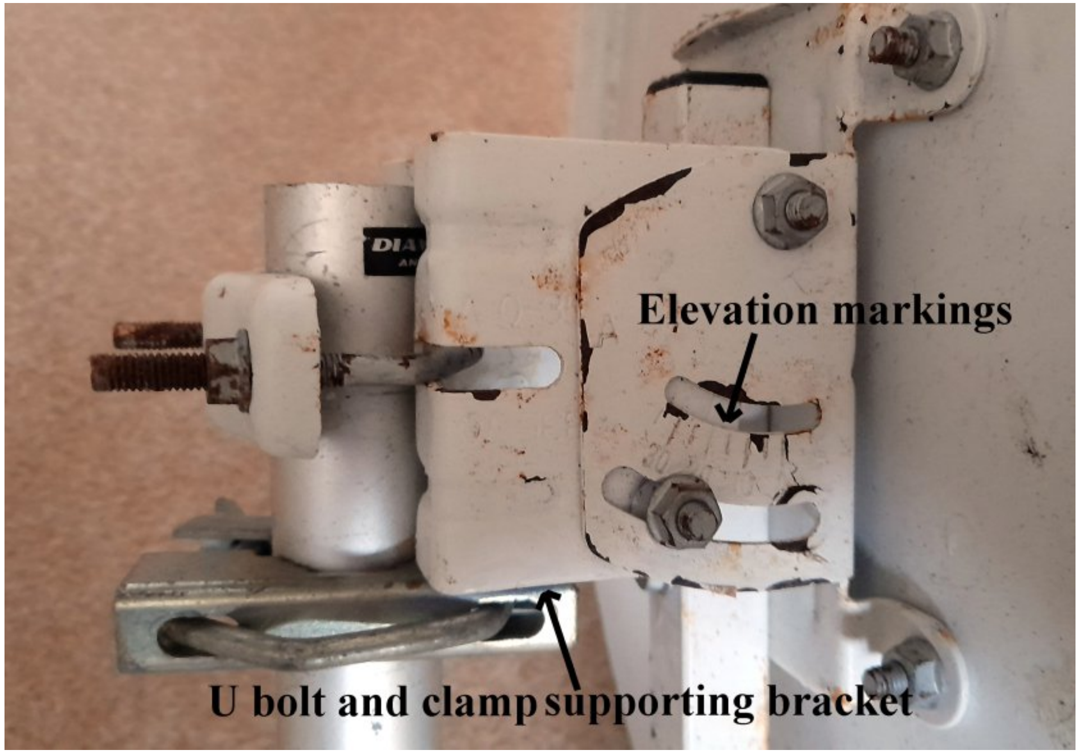
At the bottom of the screen there is a meter marked C/N MER (Modulation Error Rate).

This shows the strength and quality of the received signal. If you dish is not aligned this will be hovering around 1 to 3dB. When receiving the beacon you will need 5dB or more.

Your dish does not need to be mounted very high so long as it clears local obstructions. The satellite elevation is around 23 degrees for the UK and I used a bright torch and protractor at night to make sure I cleared the house next door.

My 1.1m dish used for transmitting and receiving Oscar-100

You do need to be able to get to the mounting bolts and move the dish easily. I have a 1.1m dish on a 50mm pole and can get to the back of the dish for adjustment. This size of dish is not easy to pan and tilt so I put a spare U bolt and clamps on the pole first and then rested the dish mount bracket on this. This allows me to pan the dish without it slipping down the pole.



Old dish showing mounting idea and elevation markings

Obtaining the dish settings

Go to *https://tinyurl.com/yyfggyo8* and input your post code in the left box. In the right box select the satellite at 26E - ARABSAT. Click on the search button near your post code and you will get the azimuth and elevation to the satellite for your QTH.

Set the azimuth using a compass (watch out - the dish is probably steel and may effect the compass).

Set the elevation as needed. This is not so easy if you have an offset feed dish as the dish does NOT pick up the maximum signal when pointed up to the sky!

Often the mounting bracket has markings to allow the elevation to be set and that is a good starting point. Dishes bought in the UK will probably have been sold for use with the Sky/Freesat satellite and you may find that the front face of the dish is more or less vertical when correctly aligned.

This gives the appearance that the dish is picking up signals parallel to the ground but in fact the '"offset" angle takes care of that.

Mount your LNB on the bracket. If your receiver can send 18v up the coax to the LNB it should be mounted with the cable at the bottom. If you are working off 12v it is necessary to rotate the LNB so the cable comes out parallel with the ground on the right hand side of the dish as seen from the front of the dish. (the LNB can receive either vertical or horizontal polarisation and this is selected by feeding the LNB with different voltages).

Now your dish and LNB are in approximately the right position and if you are lucky you will get a picture on your PC. BUT, you probably have as much chance of this happening as winning the lottery!

Loosen off the dish mounting bracket and adjust the dish az/el for the maximum reading on the MER meter. What, your PC is in the shack and you cant see it from the dish?

Same at my QTH, so what I did was use my XYL's phone and mine on a video call with WhatsApp or Facetime etc. Just remember there is a delay in what you see and also a delay in the MER meter responding to a change in signal. I've also used a camera in front of my PC to a small LCD monitor that I took into the garden.

SLOWLY move the dish left/right/up/ down for maximum MER. This is made much easier if the additional U bolt and bracket are under the dish bracket as the dish will not slide down the pole. Lock the dish in position.

Now turn the LNB very slowly clockwise when seen from the front of the dish to get the best MER - you are now setting the skew angle. This will be about 20 degrees clockwise.

Feed from the bottom

The pictures show my "installation" whilst I was testing! Since then the cables have been routed through glands into the box below the dish and properly waterproofed with self amalgamating tape. In there is my 2.4GHz PA and power supply that are remotely controlled from the shack!

The "bullet" LNB I use had its cap cut off so I could use a short piece of 22mm copper pipe to allow the LNB to be adjusted easily. The LNB body is epoxied to the tube and the original cap is fixed to the opposite end of the tube. The tube needed "panel beating" to make the LNB end square before being glued in place.

The excellent waterproofing Walls box remains - it needs replacing every so often and John G3RFL reluctantly (?) helps by emptying the ice cream out!

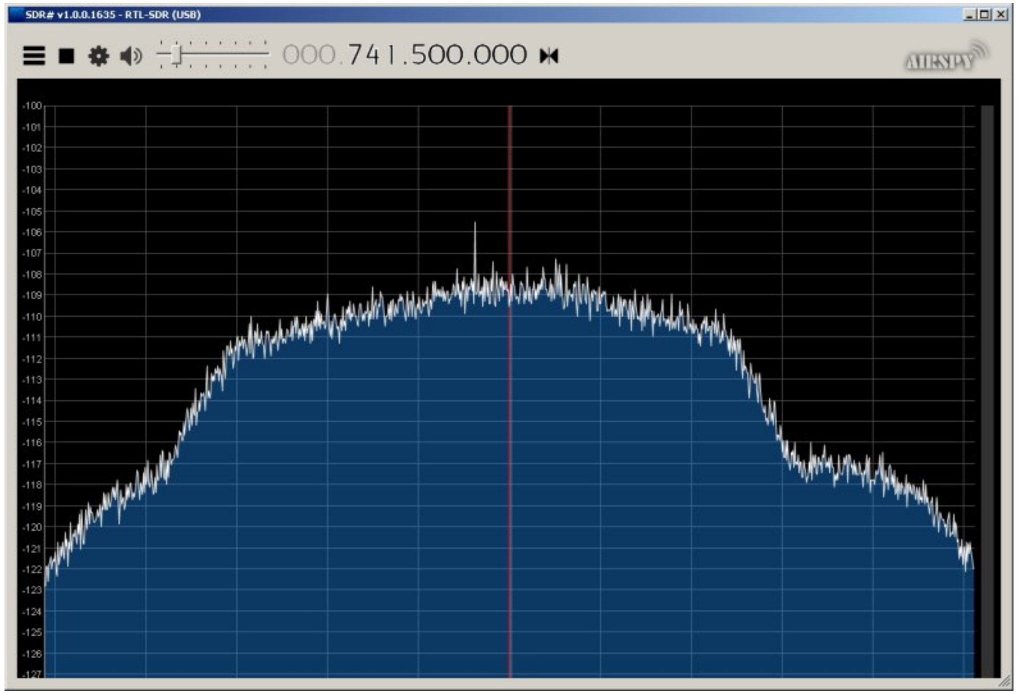
Alternative ways

If you have a satellite installation meter set it to 741.5MHz and use that to get the strongest signal. If you own one, you probably know all this anyway!

If you have a SDR then connect it via a 2 way splitter that has one leg with power pass-through. Connect the SDR to the NONE power leg and a 18v (or 12v if you turned the LNB horizontal) to the power pass leg. You don't need to use coax - just use a wire poked into the centre connector for positive and the case for the negative.

Set the SDR to 741.5MHz and move the dish and skew angle for the biggest hump! Remember the phone trick if you don't have a laptop that you can take to the dish with your SDR.

Again there is usually a delay in the response of a SDR to signal level changes so move the dish SLOWLY!



The SDR display

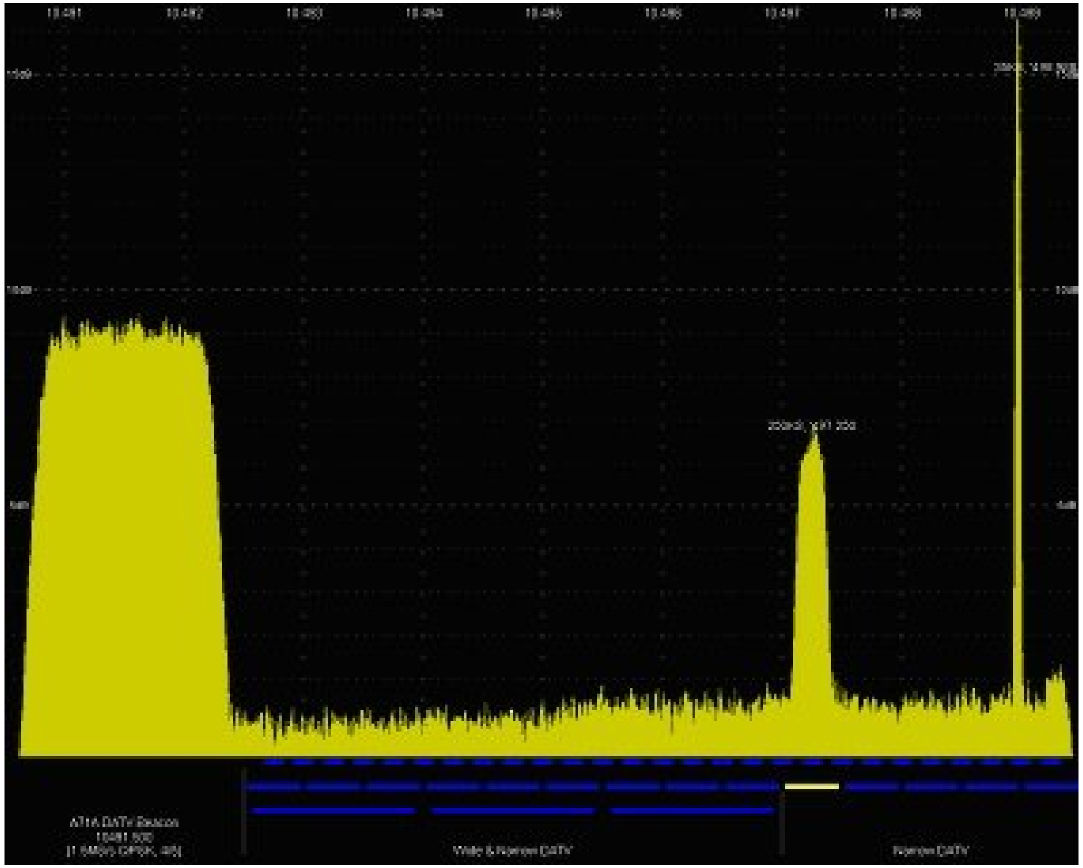
Other Stations

When you are tired of watching the launch of Oscar-100 you will want to look for other stations.

Go to *https://tinyurl.com/y4nc7xcm* and you will see a spectrum display that Goonhilly is receiving. The big hump on the left is the beacon signal. Other humps to the right are amateur signals.

At the top of the humps there should be a SR and frequency displayed. Setting this in your MiniT program will allow you to decode those signals (if they are strong enough on your dish).

Make a note of the SR and frequency - ideally bring the web page up on another screen or computer if you can as the signal may have turned off before you set up MiniT.



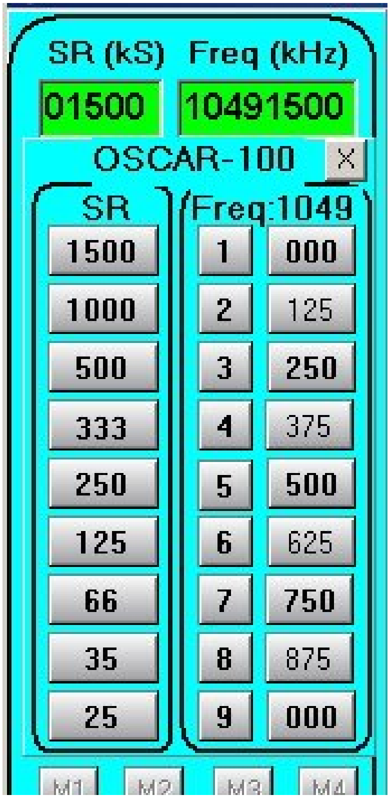
If you put your mouse on the blue line under the signal (shown here in yellow) a pop up screen will give you the correct frequency as the spectrum display is not always spot on.

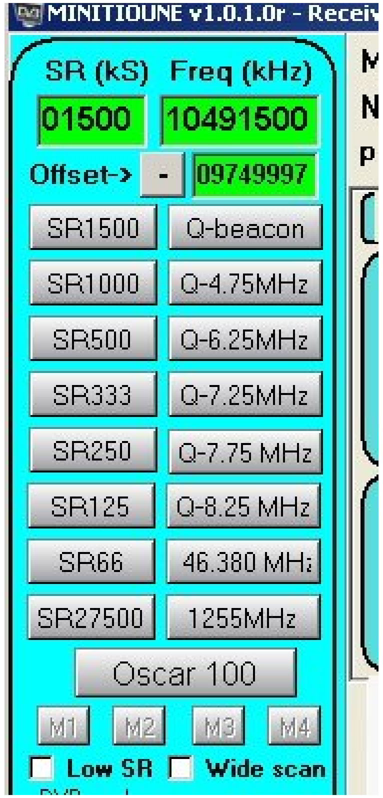
The picture above shows 10497.250 and SR 250. The big narrow signal on the right is a station running a low SR.

Go to the frequency panel at the top left of MiniT.

- Click on the SR 250 box To set the SR.
- Click on the 7 box to set the frequency to 10497
- Click on the 250 box to set the KHz to 10497.250

If you don't see three columns then click on the Oscar 100 box at the bottom of the preset channels.





Now watch the picture!

Most stations are using DVB-S2 and the MiniT program defaults to this setting.

If you are getting a good signal but there is no audio or video, it is possible that the station is running in DVB-S mode. Under these circumstances you will probably see two green lights at the bottom left (Full will be red), the MER is higher than necessary for a decode and the box to the right of the constellation display shows a D number equal or greater than zero. If there is no D number the signal is too weak to decode and you need a bigger dish, or better alignment!

Try clicking on either Auto or DVB-S in the DVB mode box under the frequency selection panel on the left.

Memory

There is a temporary memory facility available in MiniT. When you are receiving a station if you click on one of the "store in memory" boxes at the left just above the meters, all the settings will be stored whilst the program is running.
If you have clicked on these memory boxes for different stations you can recall them by clicking the M1 to M4 buttons at the bottom of the frequency panel.
Picture

A picture can be saved by clicking on the photo button on the right hand side in the centre. This will be saved to same folder where MiniT is installed.

Evaluation Of Hi-Des Hv-310E Dvb-T Modulator & Comparison With HV-100EH & HV-320E

Written Jim Andrews, KH6HTV

Reproduced from Boulder Amateur Television Club TV Repeater's REPEATER Febuary, 2021

Fig. 1 — Hi-Des, DVB-T, Modulators. Front View. Bottom is HV-100EH. Top Left is HV-310E. Top Right is HV-320E

About six years ago, Hi-Des in Taiwan (www.hides.com.tw) introduced their model HV-310E DVB-T transmitter. Note: Hi-Des calls them "transmitters", but I prefer to call them "modulators" because of the relatively low milli-watt output powers from them. So in 2015, Jack, K0HEH, purchased one of the HV-310Es. Jack let me evaluate it. I ran a few tests on it and was un-impressed. My reaction at the time was "Do Not Buy !". However, I did not fully evaluate it, nor publish my results. More recently, Chris, K0CJG, purchased an HV-310E and he has kindly loaned it to me to again evaluate and this time publish the results of my tests.

Again after this most recent evaluation, my conclusion remains the same, i.e. "Do Not Buy" for ATV service.

This evaluation focuses on the HV-310E, but also compares it against two other Hi-Des DVB-T modulators. They are the original model HV-100EH and a later one which came after the 310, the model HV-320E. The 100 & 320 were evaluated in 2016 & 2017 and documented in AN-28a and AN-42 [1, 2] which are also recommend reading. The table on page 3 summarizes the results of the current tests for these three models.

Hi-Des sells the model HV-310 in several different versions. The difference being the final rf amplifier installed. All versions cover from 0.1 to 1.35GHz. Different amplifiers are optimized for different frequency ranges.

For amateur TV (ATV), the bands of most interest are the 70cm (420-450MHz) and 23cm band (1240-1300MHz).

Fig. 2 — Hi-Des, DVB-T, Modulators. Rear View. Bottom is HV-100EH. Top Right is HV-310E. Top Left is HV-320E

The one tested for this app. note was the model HV-310E which is optimized for the 70cm band with +15dBm of rf power. The other versions available are: the HV-310EH with power peaked for 23cm band (+5dBm) and the HV-310EH-PA1200 with extra power peaked for 23cm and +20dBm max. output. The 310 also includes a rear panel switch to allow the final amplifier to be switched in and out of the circuit. In the HV-310E, this amplifier had a gain of 21dB at 70cm.

CAUTION: Hi-Des has in it’s HV-310 instruction manual this warning:- Never operate the transmitter without a 50 Ohm antenna or dummy load connected to the antenna port. Never operate the Hi/Low gain switch when the power is on. Doing either will burn out the final amplifier.

RF Power

The major selling point for Hi-Des for the HV-310 is it's rf output power compared to the HV-100EH or HV-320E. The secondary selling point is cost as it is their lowest cost modulator at $279.

RF power is mainly a selling point for people wanting to install it as a stand-alone, digital TV transmitter in an R/C aircraft, or drone.

For ATV operators, we are usually wanting and needing much higher powers in the watt region, not milli-watts. Thus, we are using these Hi-Des units as modulators driving, high gain, high power amplifiers.

The higher power of the 310 is not an issue. In the comparison table, the max RF output power was measured for the three different modulation modes of QPSK, 16QAM and 64QAM.

The rf power measured is the RMS value. I used an HP-432A power meter with HP-8478B thermistor power head.

Comparison Table - Hi-Des models HV-100EH, HV-310E, & HV-320E

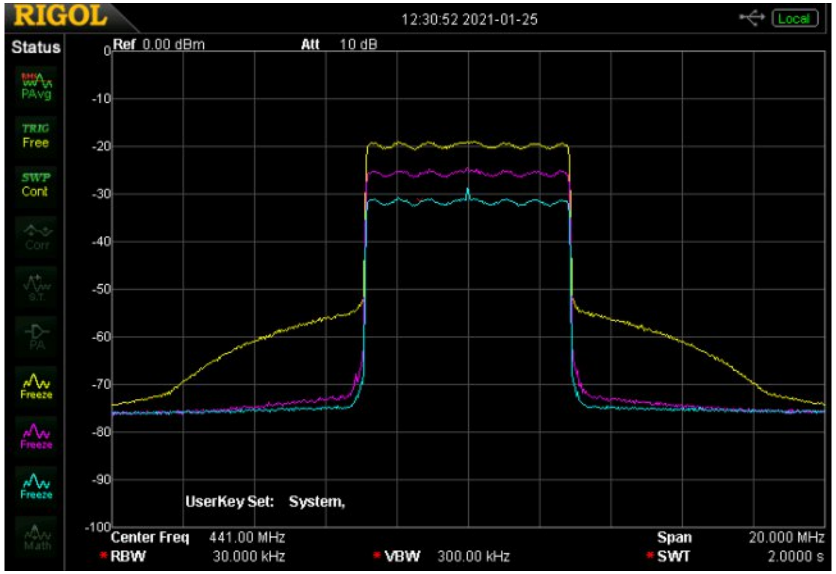
Parameter	HV-100EH	HV-310E	HV-320E
Price	$560	$279	$369
Frequency Coverage	50-950MHz & 1.2-1.35GHz	90-950MHz & 1.09-1.35GHz	100MHz - 2.5GHz
Bandwidth	1, 1.5, 2, 2.5, 3, 4 5, 6, 7 & 8 MHz	1, 1.5, 2, 2.5, 3, 4 5, 6, 7 & 8 MHz	1, 1.5, 2, 2.5, 3, 4 5, 6, 7 & 8 MHz
Pout (430MHz)	3.2, 5.0 & 3.3dBm	14.7, 16.4 & 13.6dBm	7.4, 9.1 & 6.4dBm
Pout (915MHz)	0.9, 2.8 & 0.0dBm	14.2, 16.0 & 13.6dBm	5.4, 7.1 & 4.3dBm
Pout (1.27GHz)	-5.0, -3.0 & -5.7dBm	0.2, 2.0 & -0.7dBm	5.2, 7.0 & 4.3dBm
Pout (2.4GHz)	NA	NA	0.2, 1.9 & -0.8dBm
Internal switchable Amplifier	No	Yes, 21dB gain (70cm) 18dB gain (23cm)	No
Attenuator Range	+6 to -40dB	+6 to -40dB	0 to -47dB
Attenuator useful range	+6dB to -10dB	+6dB to -6dB	0 to -47dB
QPSK, 16 & 64 QAM	Yes	Yes	Yes
Carrier Leakage	Yes, -32dBm	Yes, -35dBm	No
Out of Channel Spectrum Suppression > 40dB	Yes, except for gain of +5 or 6dB	NO ! even in best setting, humps of -35dB noted	Yes
QPSK,16QAM & 64QAM - Signal/Noise	22, 26, & 29dB	20, 24 & 28dB	23, 26 & 32dB
HDMI Input to 1080P	Yes	Yes	Yes
Composite Video + Line Audio In	Yes	Yes	Yes
MPEG-2 & H.264	MPEG-2 & H.264	H.264 only	H.264 only
Adj. Resolution	480i to 1080P	480i to 1080P	480i to 1080P
Boot-Up Time	35 seconds	12 seconds	15 seconds
HDMI loop-thru	Yes	No	No
Front Panel Channel Select Buttons	Yes	NO, must use remote control	Yes
PC control port	USB	RS-232	UART
Ethernet	Yes	No	No
Ventilating Fan	No	No	Yes
Current @13.8Vdc	420 mA	400 mA	450 mA
Conclusion	2ed choice to buy	**NO - do not buy**	**1st choice to buy**

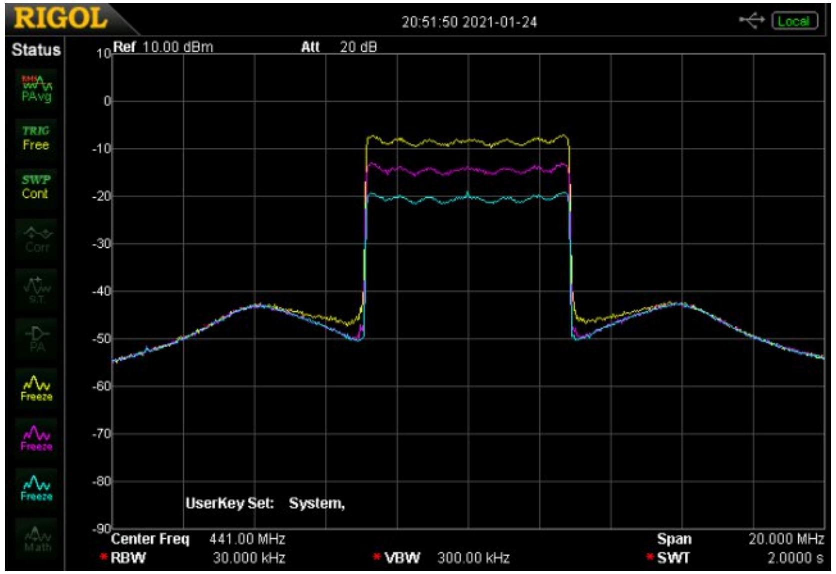
RF Spectrum

This is the one area with major differences between the three models. It is also the area I found the most objectionable on the HV-310E and my reason for my “Do Not Buy” recommendation.

Fig. 3 compares the spectrums of the HV-100EH, HV-310E & HV-320E. The three colored traces are for the maximum rf output and with the internal attenuator set to lower the output by -6dB & -12dB.

These were measured at 441 MHz in the amateur 70cm band. Most of the evaluations were performed at this frequency. Operation was also verified in the 23cm band.





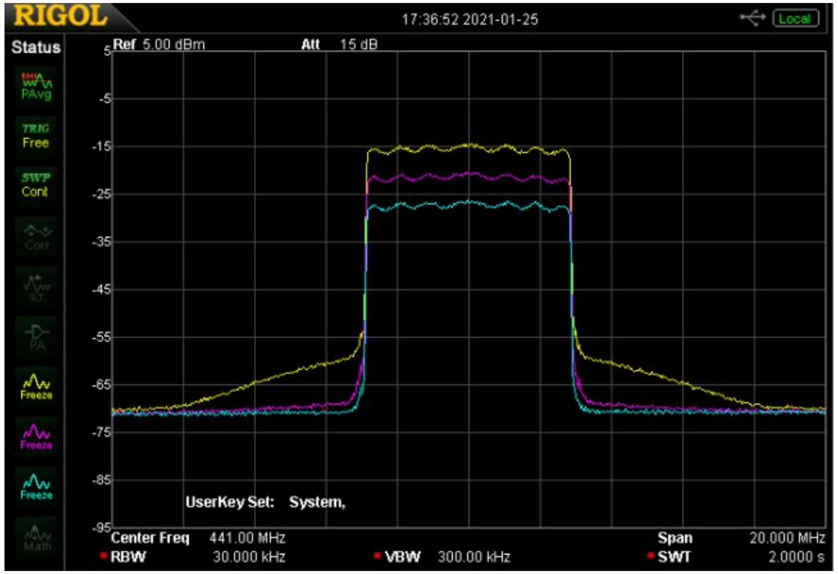


Fig. 3 (above & left) - Comparison of modulator spectrums for a 70cm DVB-T signal with 6 MHz bandwidth. Top = HV-100EH, Middle = HV-310E & Bottom = HV-320E. Spectrum analyzer settings per ITU specs. Center frequency = 441 MHz, 10dB/div & 2 MHz/div. Yellow = Max. RF output Magenta = -6dB & Cyan = -12dB

The spectrums were measured using the spectrum analyzer settings specified by the ITU [3] for DVB-T.

They are: Center Frequency = channel center frequency, Span = 20 MHz, Detector = RMS, Resolution Bandwidth = 30kHz, Video Bandwidth = 300kHz, Sweep scan = 2 seconds. In addition, I use 10 signal averages. The ITU specifies that the out of channel spectrum shoulder be measured at 200kHz beyond the channel edges. Thus for a 6 MHz channel, it should be measured at ± 3.2 MHz from the center frequency.

The Hi-Des advertised specifications for the Spectrum Shoulder (adjacent channel) is -45dB (HV-100EH), 40dB (HV-310E) and >48dB (HV-320E) Their spec. for Carrier Suppression is: >42dB for all three models.

HV-100EH

This is the top photo in Fig. 3. At the max. rf output, the spectrum shoulder breakpoint is -35dB. It only meets shoulder spec. when the output is dropped with the internal attenuator by -3dB or more. The major spectrum defect of the HV-100EH is carrier frequency leakage. It is just noticeable as a small spike on the cyan trace. Increasing the internal attenuator setting more does not lower this leakage spike. It remains at -32dBm, far worse than spec. by 10dB. Because of carrier leakage, I do not recommend the internal attenuator be set any lower than -10dB. This carrier leakage also compromises the ultimate signal to noise ratio, especially for 64QAM.

HV-310E

This is the middle photo in Fig. 3. It does not meet the >40dB spec. At the max. rf output, the spectrum shoulder break-point is -38dB, but the far worse situation is the broad hump in the spectrum occurring ± 6MHz from the center frequency. At max. rf output, it is -35dB down. But when lowering the rf output using the internal attenuator, it remains unchanged and thus becomes even worse relative to the in-channel spectrum. I also was able to measure carrier frequency leakage of -35dBm which was the same regardless of attenuator setting. I got essentially identical results when using the low power switch setting and also on the 23cm band. Because of the humpy spectrum, I do not recommend the internal attenuator be set any lower than -6dB. The signal to noise (S/N) of the rf output is also compromised by both the poor spectrum and carrier leakage.

HV-320E

This is the bottom photo in Fig. 3. This modulator has a very clean spectrum. The out-of-channel spectrum shoulders were virtually non-existent.

Even at max. rf output with the internal attenuator set to 0dB, the shoulder break-point was -44dB. The internal attenuator has a range of 0 to -47dB and can be used with no issues over it's entire range. No carrier leakage was detected.

Spectrum Pollution

I have always been an advocate for spectrum conservation and cleanliness. This is especially important for ATV where we use very wide bandwidths for our signals. To be a good neighbor with our fellow hams, we should not use any more bandwidth than absolutely necessary.

Thus in the old, NTSC, analog TV days, I was a strong advocate for using Vestigial Side-Band (VUSB-TV), following commercial broadcast standards. I refused to use AM-TV. I even published an article in QST [4] advocating VUSB-TV over AM-TV.

All analog ATV in Boulder, Colorado has been VUSB-TV since the early 90s as a result. Now, in the current, digital TV era, we can have very clean DTV signals and keep our spectrums within the designated 6 MHz (or less) TV channel.

With clean spectrums, it is now even possible to operate DVB-T on adjacent TV channels. This has been shown in lab bench experiments in my app. note AN-19 [5]. We have also with our Boulder ARES group successfully operated simultaneously DVB-T on all four, 70cm, 6 MHz, TV channels (423, 429, 435 & 441 MHz on actual field operations without interference.

So, now with the HV-310E, this would not be possible. If one lowers it's rf output to properly drive an RF linear power amplifier, the ± 6 MHz “Hump” as seen in Fig. 4 (middle photo) will start to dominate and also be amplified. These humps will directly impact and prohibit operation of any other TV transmitter, or other RF service, in both the lower and upper, adjacent TV channels.

They pollute the spectrum. For this reason, I say again – "Do Not Buy".

Out of Date Specs

The spec. sheets on the Hi-Des web site for these various models are all somewhat out of date. With more recent versions of firmware installed, I have found that all three modulators have enhanced capabilities. In particular, the bandwidths of all can now be adjusted down to 1 MHz and include 1.5 MHz, 2 and 2.5 MHz, in addition to 3, 4, 5, 6, 7 & 8 MHz. Now the output resolution is also adjustable, independent of the input resolution.

Recommendations

My personal recommendation for a DVB-T modulator is the Hi-Des model HV-320E for use on both the 70cm and 23cm band for ATV service. For a DVB-T receiver, see my app. note, AN-57a, [6] for a review of the various Hi-Des receivers. My recommendation for a 70cm receiver is the model HV-100. It is also a good buy at $99. For a 23cm receiver, I recommend the model HV-120, but with the addition of a KH6HTV Video model 23-4LNA pre-amplifier (0.9dB NF). If the HV-120 is unavailable, then instead use the HV-100 receiver with a KH6HTV Video model 23-7 Down-Converter.

References

[1] "Second, Re-Evaluation of Hi-Des, Model HV-320E, DVB-T Modulator", Jim Andrews, KH6HTV Video Application Note, AN-42, Dec. 2017, 7 pages.

[2] "Evaluation of New, Hi-Des, Model HV-320E DVB-T Modulator" Jim Andrews, KH6HTV Video Application Note, AN-28a, April, 2016, 14 pages.

[3] "Digital Video and Audio Broadcasting Technology", W. Fischer,3ed edition, 2010. Springer Heidelberg Dordrecht, London & New York, ISBN 978-3-642- 11611-7. See Chapter 21 "Measuring DVB-T Signals"

[4] "Modern ATV System Design", Jim Andrews, QST, Feb. 2013, pp. 46-47.

[5] "Analog & Digital TV Co-Channel & Adjacent Channel RFI Measurements", Jim Andrews, KH6HTV Video Application Note, AN-19, Sept. 2014, 8 pages.

[6] "Comparison of Hi-Des DVB-T Receivers", Jim Andrews, KH6HTV Video Application Note, AN-57a, Sept. 2020, 6 pages

More of Jim's application notes can be found on his web site *https://tinyurl.com/y3hykntb*

Feedback

Since the above review was first published, Jim has received the following feedback.

Hi-Des HV-310E Modulator: I reviewed above the three Hi-Des, DVB-T, modulators (HV-100EH, HV-310E & HV-320E). In this review, I, gave a "Do Not Buy" recommendation for the HV-310 primarily due to it's poor out of channel spectrum. In response, I have gotten this e-mail letter from Dave, AH2AR, of the Dayton Ohio Amateur Radio Assoc. (DARA).

Jim, I personally have several HV310's and an HV320 I use for testing. I wanted to somewhat challenge what you stated about staying away from HV310s due to the hump artifacts as noted with a spectrum analyzer.

I would venture to say there are probably 15, HV310s being used in this tristate region.

Note that the HV 310 is used in the MidWest region and its employment is successful for for three primary reasons:

We all use 2MHz bandwidth here in the midwest due to its advantage for DX point-to-point contacts. Consequently, any spectral artifacts outside of the 2 MHz bandwidth is centered on the bandwidth that may be alternately occupied by the bandwidth of an A5 signal. Any humps are well within the bandwidth used for video transmissions for ATV use here on 70cm.

The DARA, ATV repeater uses an HV310 that works appreciably well. SNR from its output is 23dB, so the waveform humps do not obviously adversely affect de-coding, as the received signal quality from the repeater is not affected... We routinely have tropo openings and the HV310 provides signal decoding conditions out to 90 miles.... no mountaintops here!

From a practical standpoint, there will not be a realistic condition where you will find an operating situation when the in-channel spectral energy from these humps interfere with a secondary amateur radio user employing a narrowband mode. The -30dB lower spectral energy as exhibited by these humps may at-worst slightly raise the noise floor of a third party receiver, only IF that receiver was operating within the bandwidth of the humps; IF the third party receiver was extremely close to the offending signal, and IF the two stations' antennas were aligned with each other. But more importantly, there will not be any narrowband amateur radio operators using this bandwidth in this region. Again, keep in mind we are using bandwidth normally occupied by an A5 signal.

The DARA, ATV repeater is using a DCI filter for DVB-T that is slightly wider than 2 MHz, so the humps are further suppressed on the ATV repeater here.

The HV310 is considerably less cost. This is a biggie for many people. Under the aforementioned conditions, the lower cost is an excellent trade off.

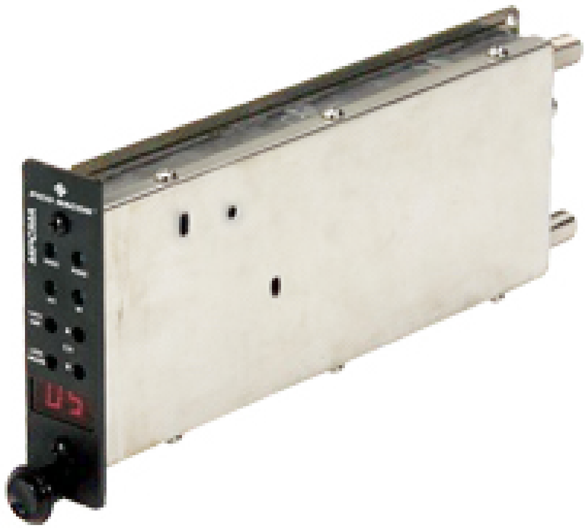
Cheers, Dave, AH2AR

This is your free ATV magazine.
Please consider contributing an article!

CATV MODULATOR - Modification for 434 & 426.25 MHz

Written by Jim Andrews, KH6HTV

I have written in the past about using commercial grade, CATV modulators for generating really pure, Vestigial Side-Band TV, for ATV. My first was in the Feb. 2013 issue of QST. More recently, I discussed them in our newsletter in the Dec. 2020, issue #65. My earliest product for KH6HTV Video back in 2011 was a 70cm, VUSB-TV transmitter which used a Pico-Macom, CATV modulator. These were modulators used by the cable TV folks in the head-ends of their cable systems. They were also used widely in closed circuit TV systems, such as in hotels, etc.



These CATV modulators are fully synthesized to work on all standard, 6 MHz, broadcast TV and also CATV channels. CATV channels 57-61 fall in the amateur 70cm band. For example channel 57 is from 420 to 426 MHz with the video carrier at 421.25 MHz. This however poses a problem for some ATV groups in the USA that have historically chosen, non-standard frequencies for their ATV operations.

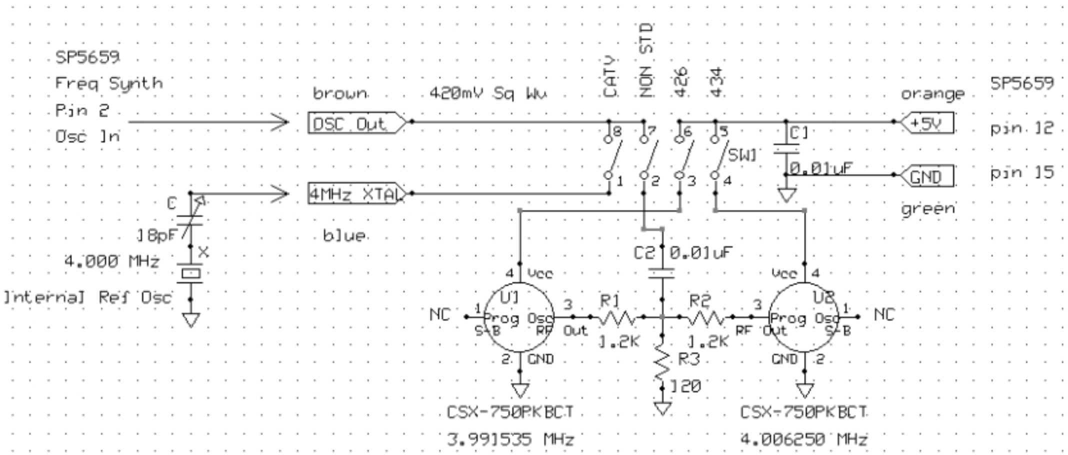
Soon after I introduced my 70cm, VUSB-TV transmitter, Mike, WA6SVT, contacted me and encouraged me to also offer such transmitters with non-standard frequencies. Mike said the most commonly used, non-standard frequencies in use were #1 - 434.000 MHz and #2 - 426.250 MHz.

Thus, back in 2011, I studied the problem of how to modify a CATV modulator to work on frequencies, such as 434 or 426.25 MHz. I had previously bought several modulators from different companies, including: Pico-Macom, Holland, Drake and Blonder-Tongue. I ran exhaustive tests on these modulators to determine their overall performance. As a result I had chosen the Pico-Macom model MPCMA as the best modulator to use in my model 70-10 TV transmitter. So, I went back to all of these modulators and proceeded to open them up and carefully examine their internal circuitry to see how I might be able to alter their output frequency from the standard CATV channels. There was only one which appeared to have a simple enough frequency synthesizer circuit that could be modified easily. It was the Pico-Macom model MMA860.

The MMA860 modulator used a Zarlink SP5659 frequency synthesiser IC. The frequency reference used was a 4 MHz crystal connected to the IC's oscillator terminal. By cutting the crystal circuit trace and injecting from a signal generator a 4 MHz sine wave, and then diddling the frequency slightly, I was able to determine precisely what reference signal I would need to be able to generate either a 434 MHz or 426.25 MHz ATV signal. For 434 MHz, the reference required was 4.006250 MHz. For 426.25 MHz, the reference required was 3.991535 MHz.

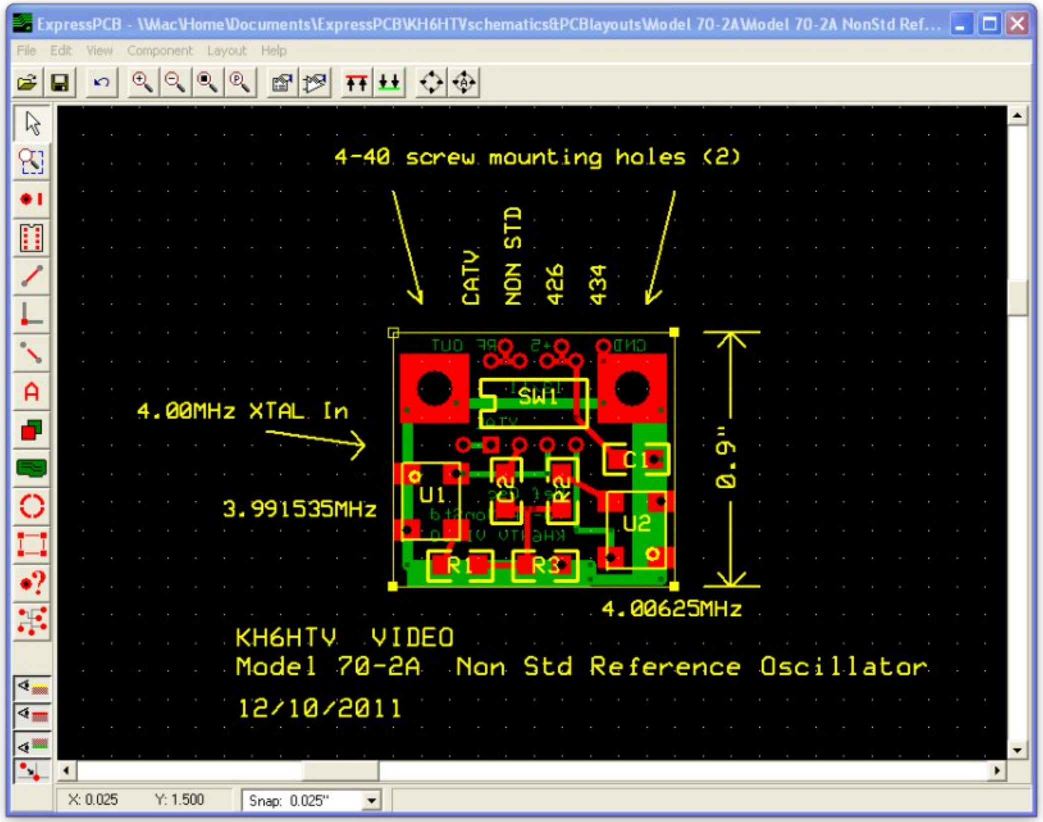
I then researched where to obtain crystals for these frequencies. By then International Crystal was going out of business. But I discovered programmable cyrstal oscillators were available from Digi-Key and Mouser. I ordered the appropriate PXOs as Citizen model CSX-750PKBCT.

Digi-Key custom programs them in their warehouse.



This is the circuit I designed to build into the Pico-Macom MMA860, CATV modualator. I first built it in breadboard fashion on 0.1" perf board with copper tape. All of the components are surface mount (SMD). The switch was an IC style DIP switch. The SP5659 required a 100mV(rms) drive signal, so the resistor voltage divider, R1-R3 is necessary. I then laid out a printed circuit board as shown in below photo. I installed this tiny pc board inside of the MMA860. I removed the side panel and cut a small rectangular hole as access to the DIP switch and drilled two holes for 4-40 screws to mount the PXO pc board on the side panel. This was done immediately over the SP5659 IC. Tiny wire-wrap wires were then used to connect the PXO board to the main modulator board.

Depending upon the settings of the DIP switch, SW1, the modulator functioned normally with the internal 4 MHz crystal on the standard CATV channels with SW1-a closed. With SW1-a open, SW1-b closed, and either SW1-c or SW1-d closed, a PXO's signal was instead injected into the SP5659 synthesizer. For 426.25 MHz, the modulator's front panel control was set to Ch 58 and SW-1c was closed. For 434 MHz, the modulator's front panel control was set to Ch 59 and SW-1d was closed.



After coming up with this design, I then proceeded to advertise it as a product for sale. I offered to sell a modified Pico-Macom MMA860 as my model 70-2A, VUSB-TV Modulator. To be perfectly honest, sales were a bust ! I only ever sold two of them, one five years later in 2016 and one installed in a 70-10 transmitter in 2013.

So there is obviously, not a market for such a product. I have thus quit offering it for sale. But, for ATV hams out there that want to roll your own, this is how you can do it. Good Luck !

Grass Valley Mixer Conversions - Part 26

Written by Trevor Brown, G8CJS and Mike Stevens, G7GTN

In this edition I want to concentrate on populating a MK2 PCB, connecting it to a GVG panel and communicating with the free version of Vmix. Several of these MK2 PCB's are out there with beta testers and as results come in, I will include any information at the end of each article. Between issues I will keep you informed on the CQ-DATV Facebook site.

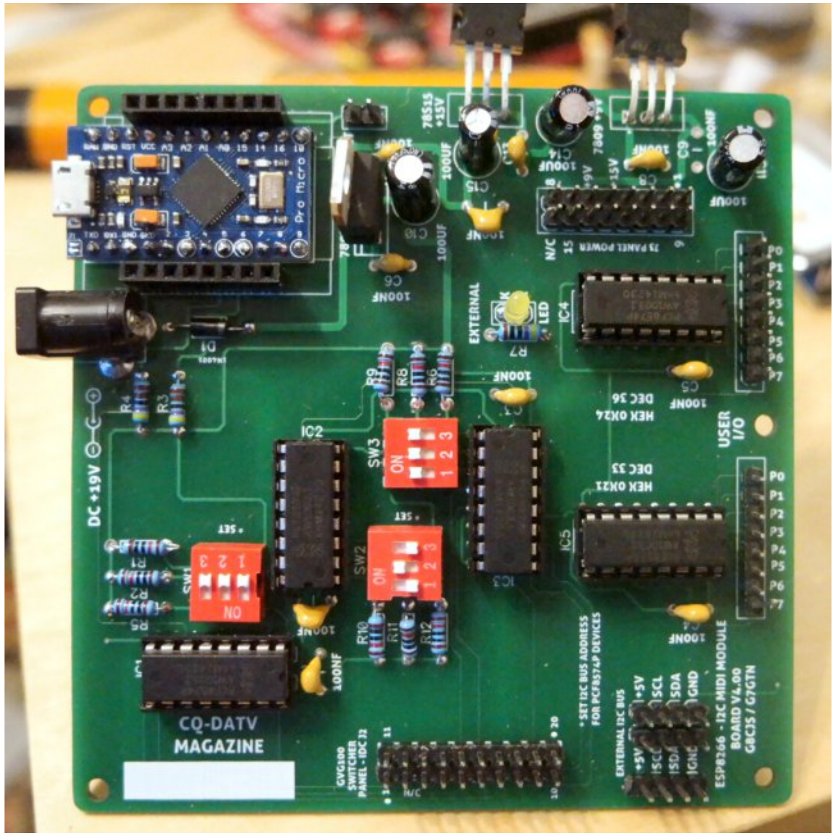
I have now populated and installed a MK2 PCB inside my own GVG panel so it is now a self-contained unit. I still have a couple of PCB's and If you would like to become a beta tester now is a good time to speak up. You will have to cover the costs that's £5 for the PCB + postage and can contact me either via our Facebook site or on email at *editor@cq-datv.mobi* (it's a group email for the production team, not my title).

The new MK2 PCB has onboard power regulation. This enables the panel to be powered from a single 19v supply. To this end I am using an old laptop PSU, these are commonplace on eBay. The PCB took about two hours to populate. I installed the three regulators, switches, sockets, connectors, and capacitors, but none of the chips or either of the micro's and then powered it up to test the rails. I had no heatsinks on any of the regulators at this point, but as no current was being drawn, they were not necessary.

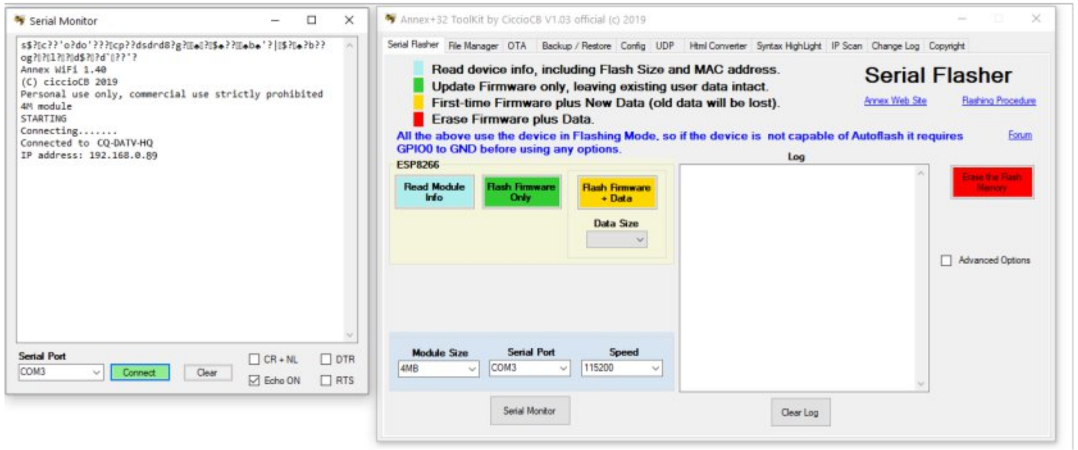
The 15V and 9V were present on the correct pins of J3 and the +5V was present on the correct pins of the PCF 85754's. Happy with this I fitted the PCF 8574 chips and the Arduino Pro and D1 mini.

The Arduino had been programmed and the D1 mini flashed with Annex BASIC as per the instructions in the on-line manual. I have included the On-line manual in the latest GVG 18 zip file.

The Arduino Pro was not socketed as it needs to be fitted as flush to the board as possible. I worry about removing it should it prove necessary so at this point I only soldered up the I^2C pins the Vcc, ground and reset pins. The D1 mini was socketed and fitted above the Arduino and I can just about get USB leads into both modules. Take care as you can easily pull a socket off the PCB's. I set the address selector switches on the PCB as per the picture, this info is also documented in the online manual.



Populated MK2 PCB D1 mini not yet in place so you can see the Arduino Pro



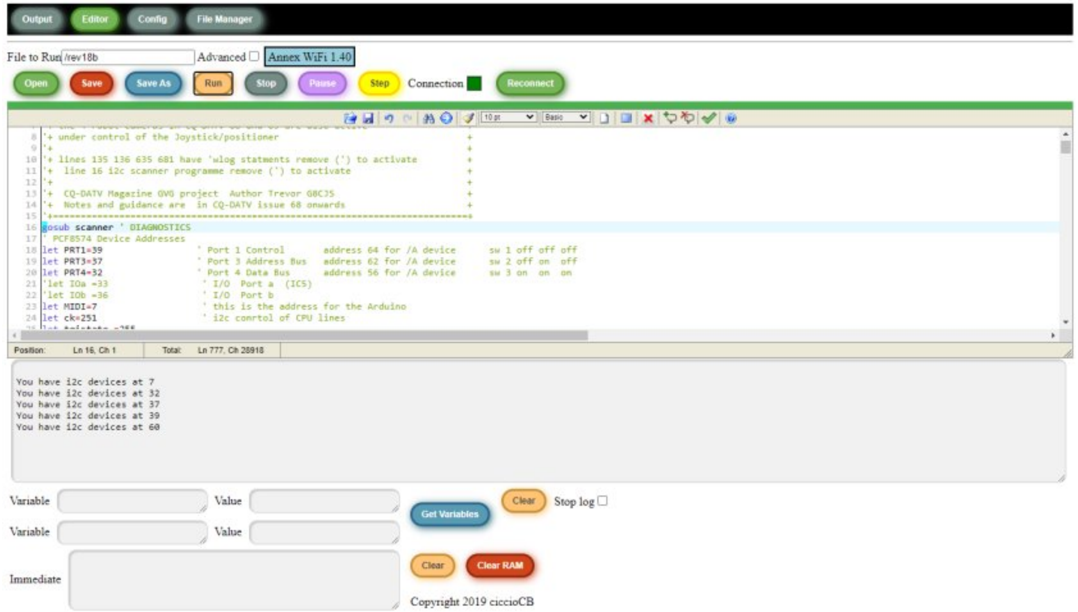
ANNEX Tool kit used to find the IP address

Both USB leads from the Arduino and D1 mini were connected to the PC but no connections to J3 or J2 were made at this point. I ran the Annex editor by entering its IP address into the browser. The Annex Toolkit will deliver the IP address in the serial monitor (see the on-line manual)

(In the ANNEX tool kit, I entered the 4MB and speed 115200, USB serial port was selected from the drop-downs. There are prompts to enter information along the way one of which is your Wi-Fi password. I did not use either of the Flash Firmware buttons as Mike had already done this and has documented it in the on-line manual.)

In the editor I loaded the software release 18 and in line 16 I removed the (‘) and saved the programme and pressed Run. Activating Line 16 in this way stops the GVG software running, but instead will list the I^{2}C addresses of everything on the bus in decimal.

- *7 is the address of the Arduino.*
- *32, 37,39 are the PCF 8574 Port chips I have not at this point fitted the expander port IC’s.*
- *60 is the OLED display.*



Enter the IP address in the browser and the editor will appear

Robot camera module is also not connected at this point. If you don’t have these address showing or the PCF 8574 chip address are different, e.g. you have the switches set incorrectly or PCF 8574A chips fitted, you can correct the switches or in the case of PCF8574A’s edit lines 18, 19, 20 of the programme to suit. Do not proceed without the port addresses being displayed correctly.

Next, power down and fit J3 and J2. Take care to get the red line on the connecting cable the correct way round, this is pin 1.

If you make up these connecting cables yourself, using ribbon cable and ribbon sockets, take care to get Pin 1 onto the red end of the cable. Also take care not to deform the plug connectors. Once you have the cables covered with the second part of the plug then it’s time to squeeze. Check the cables have end to end continuity before you connect them between the panel and the PCB.

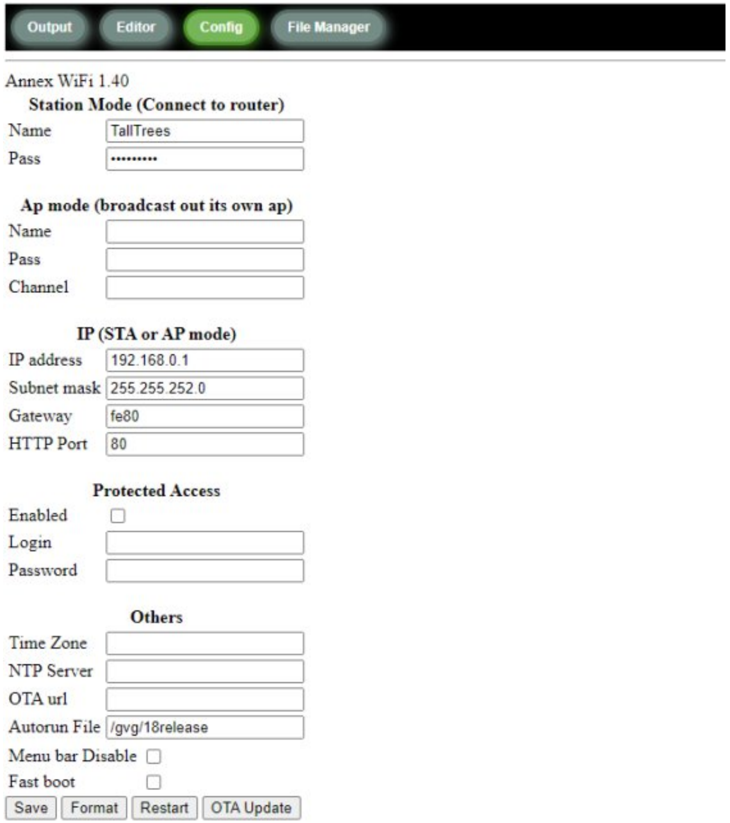
You can now connect J3 and J2 to the GVG panel. If your panel is fitted with LED's (later models) you can proceed. All the lights on the panel will be illuminated at power up. Restore the (') at the start of Line 16, Save and Run on the software editor. This will change the illumination to 4 push buttons only being illuminated PGM 0, PST 0, Key 9 and wipe. The +9V and the +15V regulators will also need adequate heatsinks at this point as they are working hard. I used the GVG base panel. (this is where the PCB was designed to fit. Some cutting is necessary for USB and power access)

Early model panels may be fitted with filament lamps and this is a worry as for the few seconds of power up before the software runs these are all lit and may overload the 15V regulators. This is an unknown as I have not been able to get my hands on a filament lamp to do any calculations. The LED's in my panel are 12V and draw 10 mA each. The 15V regulator will cope with 58 illuminated LED lamps.

The PCB silk screen has the legend 78S15. Let my quote from the data sheet:

'This embeds internal current limiting, thermal shut-down and safe area protection making it essentially indestructible. If adequate heat sinking is provided, it can deliver over 2A output current.'

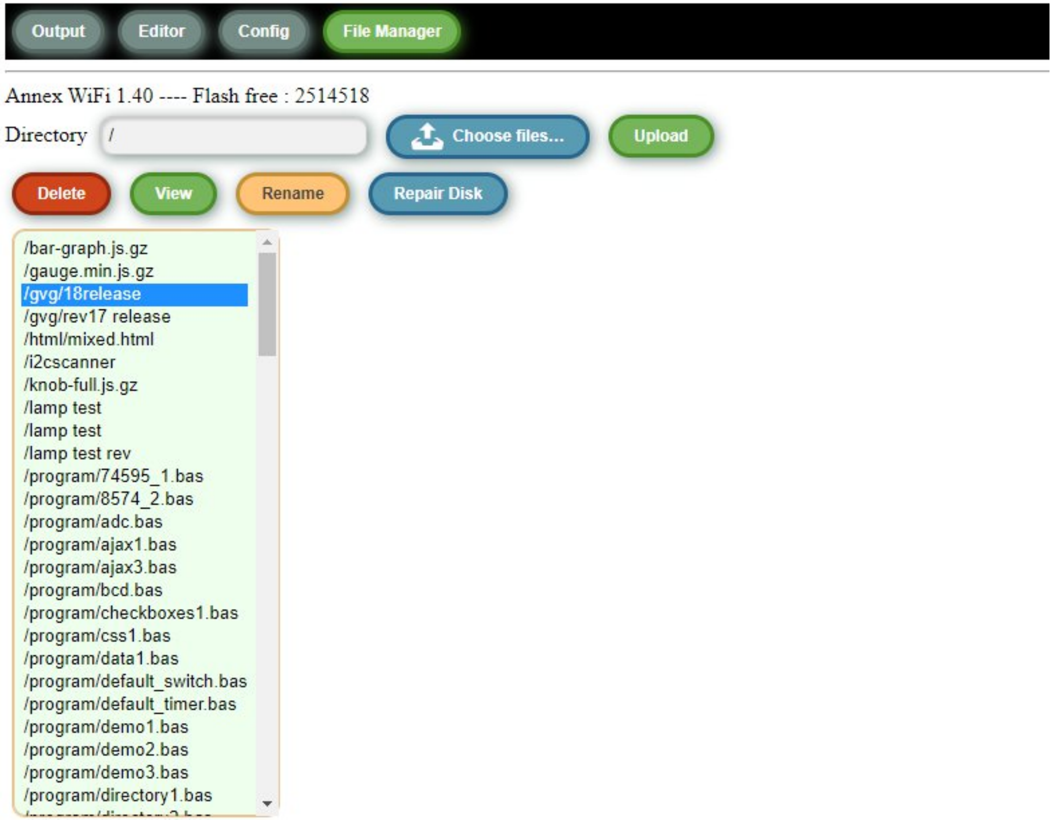
The GVG software will never illuminate all the lamps at the same time so it is important to set it to Autorun at power up then, if you have filament lamps, you will not overload the +15V rail. This is done in the editor software. If you have a panel with filament laps it might be wise to leave the +15V disconnected until you have the Autorun working. You can prove the Autorun is working by looking at the Wipe select buttons - these illuminate without the +15V and if only the first one is lit it's a good sign and you can connect the +15V - take care.



The Annex Autorun menu

Enter the file name at the bottom and press save. I did have problems with Autorun so check that your file is detected in file manager.

If the View tab does not display your software listing, then it will not Autorun (even if it runs in the editor). This was my problem and it returned an error message "file not found". It worked for other files just not mine, so I cut and pasted my file into one of the files it would list, edited out anything not pertaining to my file and re-named it. View showed the listing and the Autorun now starts at power up, so I never see the condition with all the panel lamps illuminated at once. This happens without the editor, but at this point the D1 mini still requires a USB lead connected to the PC to provide power (something I am still investigating).



File Manager (highlight and View will produce your listing)

The only lamps lit will be just the home position lamps KEY9, PGM 0, PST 0, and MIX. This is useful if your mixer has filament lamps.

Fingers crossed that everything works for you as it did for me, but in my case only for about 10 mins when everything stopped. Employing Occam's razor to find what was different from the MK1 PCB, I even resorted to replacing the D1 mini with its big brother the ESP 8266 module on flying leads. The problem in the end was a bad batch of PCF 8574's. The clue was to re-run the I^{2}C scanner software by activating line 16 in the software and finding the ports were no longer present, something was hogging the I2C bus.

A new set of branded PCF 8574's sorted the problem.

Release 18 of the software also has other diagnostic lines, that like line 16, are inhibited from working by a ('). Only line 16 will stop the software, the other lines work with the program to show what is happening.

- *Line 135 'wlog "gvg key pressed"*
- *Line 136 'pause 100'.*

Remove the (') from both lines 135 and 136 and save the program, this will then report if a key press is detected by the software. This information indicates that the 3 PCF 8574's are working. Line 136 is a pause to wait for the key bounce to stop so multiple reports are not generated. If the keys are not working and this message does not appear then activate line 16 to run the I^{2}C address scanner software and check the ports are still present, double check the ports match the addresses set in lines, 18, 19 and 20 and that the correct address is assigned to the correct chip.

Line 636 'wlog"GVG read only, lamp latches updated" again remove the (') to activate this. The lamp latches updated message will appear after each key press. This is the process of illuminating a GVG button lamp. Button presses will be recorded as a change in the soft memory lamp map held within the D1 mini's memory as a series of global variables. A subroutine called latches, then updates the read only latches on the panel (it is important for the software to know the state of the panel and it cannot read the actual latches so a mirror copy is stored in the D1 mini).

This can be used at the same time as line 135 and 136 messages to show a button has been pressed and the lamp latches updated.

Line 681 is the monitoring line used to see what the Annex Basic is feeding down the I^{2}C bus to the Arduino.

These numbers are translated in the Arduino to MIDI commands to work in conjunction with the Vmix short cut menu. Remove the (') again so it becomes an active command and will display the data to the Arduino just like the comment explains. Again, remember to save and run.

With all the buttons working you will be connected to Vmix, remember the communication is via the short cut menu so you will need to match the shortcuts in Vmix to the MIDI commands delivered by the Arduino.

The Arduino has an LED which flashes whenever it sends out a command and is a clear indication commands are leaving the GVG mixer.

The best way to set up the Vmix menu is to import the setup file, again in the GVG18 zip file.

Several PCB's are out with our readers and I will report any feedback. In the meantime, anyone want a populated MK1 PCB note the blue tac or should that be pink tac mounting of the Arduino. Everything has to start somewhere, my thanks to Mike G7GTN for both MK1 and MK 2 PCB and for the Arduino programming.

Notes from a Beta tester

Other than myself. Ian Morrish in New Zealand has a MK2 PCB and it is, at the close for press, displaying port numbers. The Port Chip addresses are different from the software and look more like PCF 8574A chips.

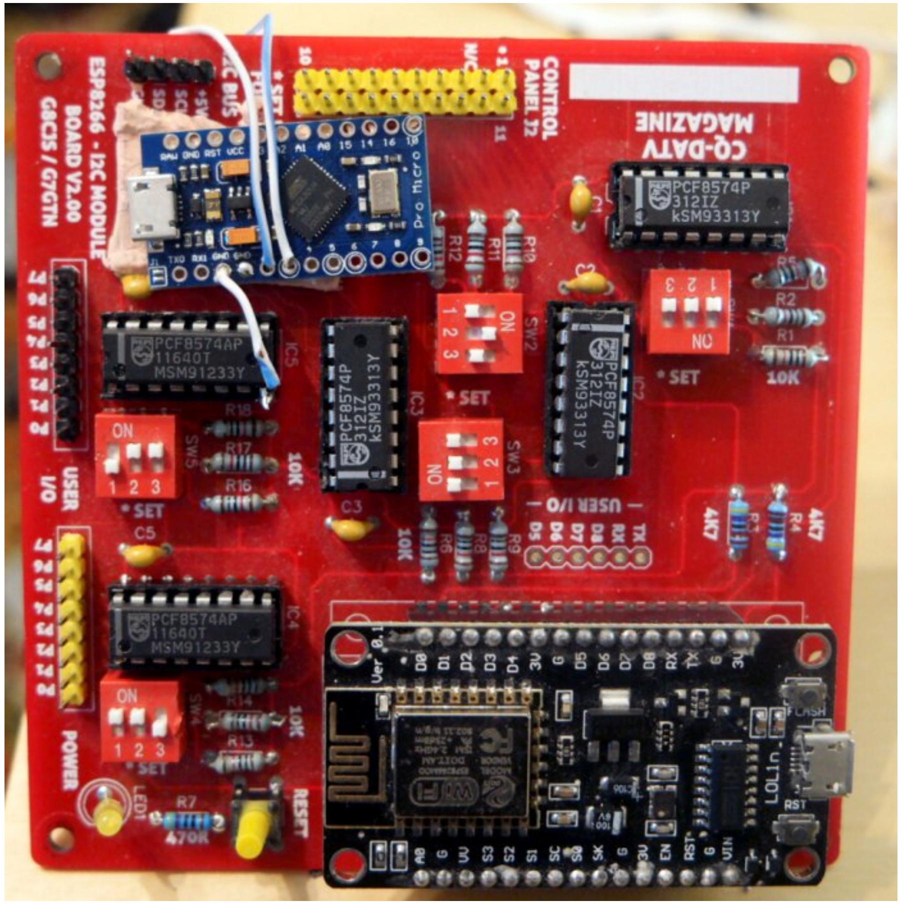
Ian's GVG Panel is modified for a single +9V rail operation and has LED's fitted (I think I have seen this mod elsewhere I will track it down) so Ian has bypassed the +15V and +9V regulator and is using a +9V PSU. At the time of going to press Ian has not reported his panel as working.

There are several MK2 PCB's in Greece and we have not as yet had any feedback, but its early days.

The file, gvg18.zip contains:-

- *The revised BASIC V18 and I have edited the on-line manual*
- *The GVG diagrams from the previous release*
- *And the Vmix MIDI export from the previous release*

and it is available for download from the cq-datv.mobi web site.



The original MK1 PCB it was powered from 5v supplied from the GVG panel. +9 and +15 were supplied from a bench power pack (not shown) and hardwired to the GVG panel

Add TV plug-in for SDR

Written by Daniel Romila, VE7LCG

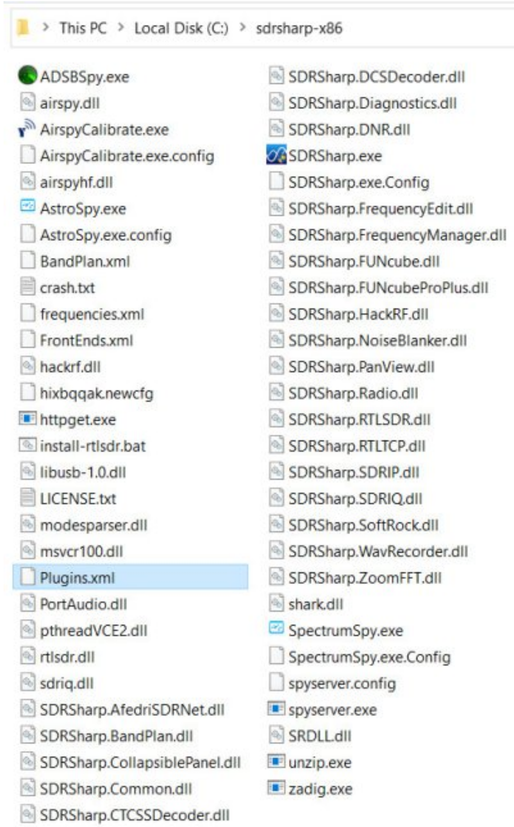
In a previous article I described there are 3 kinds of drivers for SDR RTL2832 USB dongles and that the original RTL driver is still useful, although not updated from 2012. Jim, the editor, successful uses it for Amateur TV in combination with VLC media player.

This method is OK if one knows exactly where the frequency of the transmitted TV signal is.

Everything that follows from now on requires the "community driver", that can be installed with Zadig, and discussed in a previous article. See *https://tinyurl.com/ybbpluds*
Many of us are used with SDR sharp, a computer program that makes an SDR dongle to be capable of receiving signals from as low as 24 MHz up to 1.6 GHz. I wrote this interval on the safe side, because users reported SDR dongles that work far beyond those limits, especially above the 1.6 GHz limit. The SDR dongle I have no longer receives anything under 23 MHz.

The SDR sharp program has the ability to show in a waterfall an interval of frequencies, so the user can see on the screen various signals in the ham amateur bands and decide to jump on them, demodulate them and listen to, or watch to. It is not necessary to know in advance where the signaled to be received will be – on which frequency it will be. I showed to Jim a nice youtube video posted by somebody about adding a TV plugin, for PAL/SECAM, only for black and white video. That youtube video is in Turkish, so probably not many people can understand it and repeat it. It is posted at: *https://tinyurl.com/y7phvs9v* and it is from 2015.

Here is a very short procedure updated to the situation from February 2021. Whatever version of SDR# one would have, the structure of the files in its folder is similar to:
First of all one needs to go at the SDR# website

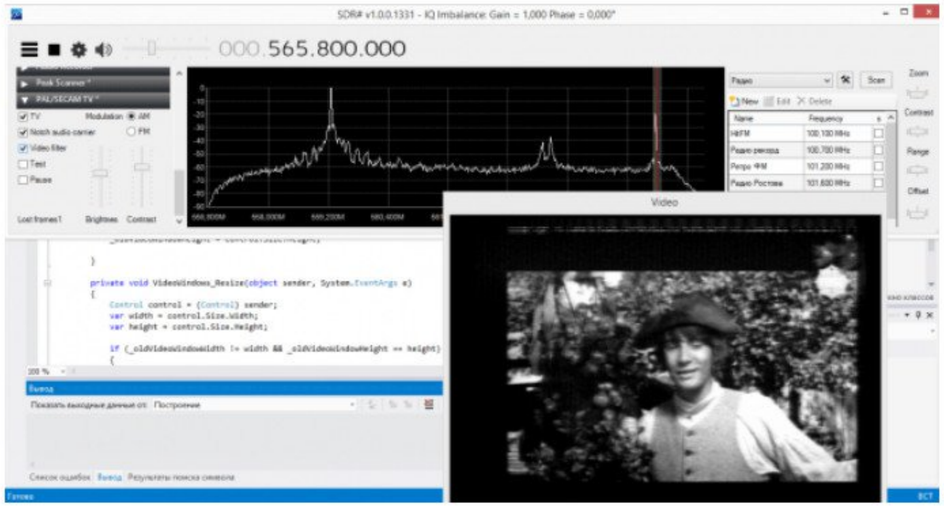


https://tinyurl.com/yc5occe5 and scroll down up to the wanted plugin for TV:

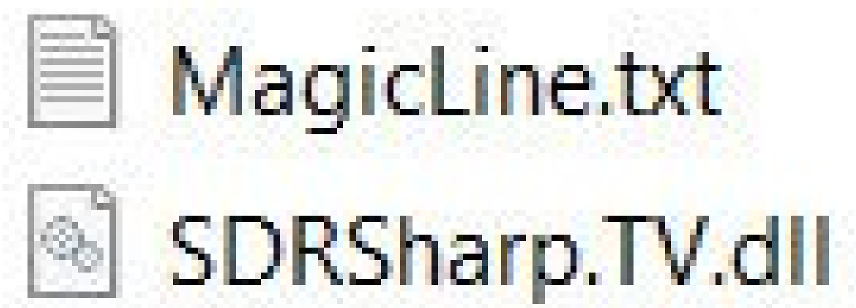
PAL/SECAM TV Plugin

Allows you to watch analogue PAL TV channels in black and white through SDR#.

Download Here



Click the "Download Here" and you will have the archive tv.zip downloaded on your computer. Unzip the archive, and there are 2 files in it:



Copy the 2 files into the folder where you have the SDR# installed on your computer, as you could see in the second picture from this article. The MagicLine.txt is just a file for the user to know to add a line into the Plugins.xml file. Confusing? Open the MagicLine.txt with a text editor. It is written in it:

<add key="TV" value="SDRSharp.TV.TVPlugin,SDRSharp.TV" />

Copy the whole thing. Open the file Plugins.xml, which was already in the installation folder of SDR#. One can open it with any text editor, like Windows's itself NotePad. Here it is mine, with the plugins I already had:


Plugins.xml - Notepad

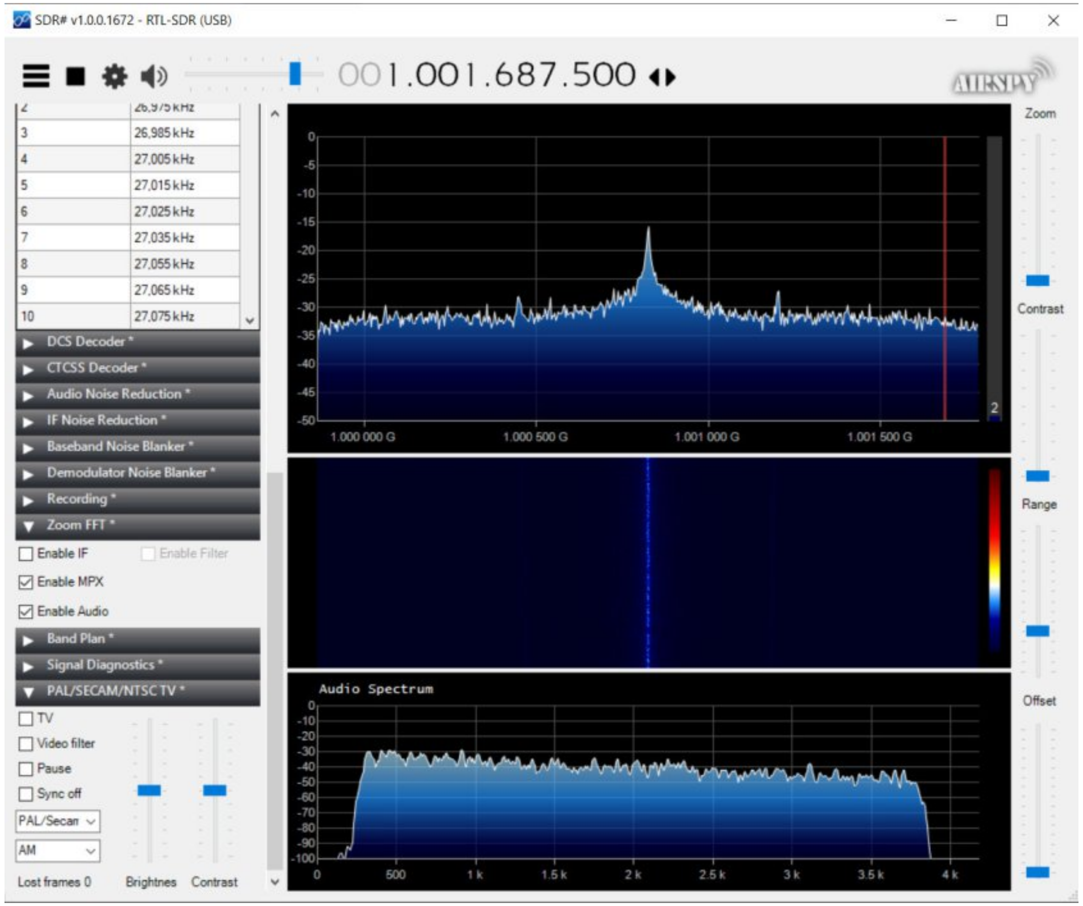
File Edit Format View Help

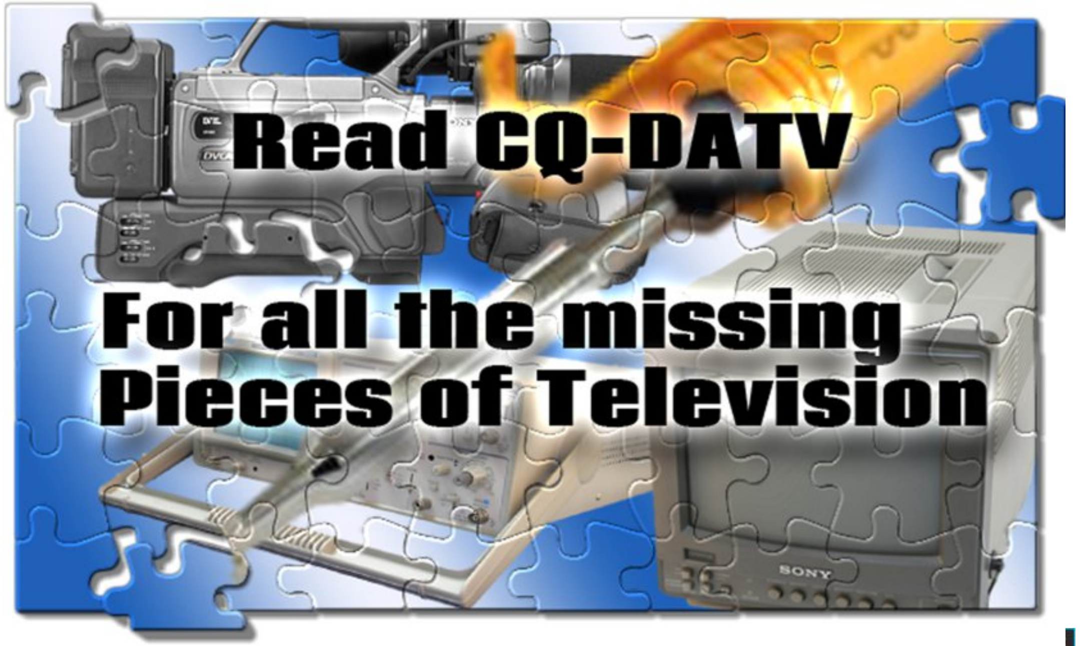
```
<?xml version="1.0" encoding="utf-8" ?>
<sharpPlugins>
  <add key="Frequency Manager" value="SDRSharp.FrequencyManager.FrequencyManagerPlugin,SDRSharp.FrequencyManager" />
  <add key="DCSDecoder" value="SDRSharp.DCSDecoder.DCSDecoderPlugin,SDRSharp.DCSDecoder" />
  <add key="CTCSSDecoder" value="SDRSharp.CTCSSDecoder.CTCSSDecoderPlugin,SDRSharp.CTCSSDecoder" />
  <add key="AF DNR" value="SDRSharp.DNR.AFNoiseReductionPlugin,SDRSharp.DNR" />
  <add key="IF DNR" value="SDRSharp.DNR.IFNoiseReductionPlugin,SDRSharp.DNR" />
  <add key="Baseband Noise Blanker" value="SDRSharp.NoiseBlanker.BasebandNoiseBlankerPlugin,SDRSharp.NoiseBlanker" />
  <add key="Demodulator Noise Blanker" value="SDRSharp.NoiseBlanker.DemodulatorNoiseBlankerPlugin,SDRSharp.NoiseBlanker" />
  <add key="Wave Recorder" value="SDRSharp.WavRecorder.WavRecorderPlugin,SDRSharp.WavRecorder" />
  <add key="Zoom FFT" value="SDRSharp.ZoomFFT.ZoomFFTPlugin,SDRSharp.ZoomFFT" />
  <add key="Band Plan" value="SDRSharp.BandPlan.BandPlanPlugin,SDRSharp.BandPlan" />
  <add key="Signal Diagnostics" value="SDRSharp.Diagnostics.DiagnosticsPlugin,SDRSharp.Diagnostics" />
</sharpPlugins>
```

Add the new line, for the TV plugin (paste what you already copied) before the last line. It will be nicely put, as the lines for the other plugins, already existing – if you already have any – or just your single plugin line (not likely, because SDR# comes with pre-installed plugins). Save the file.

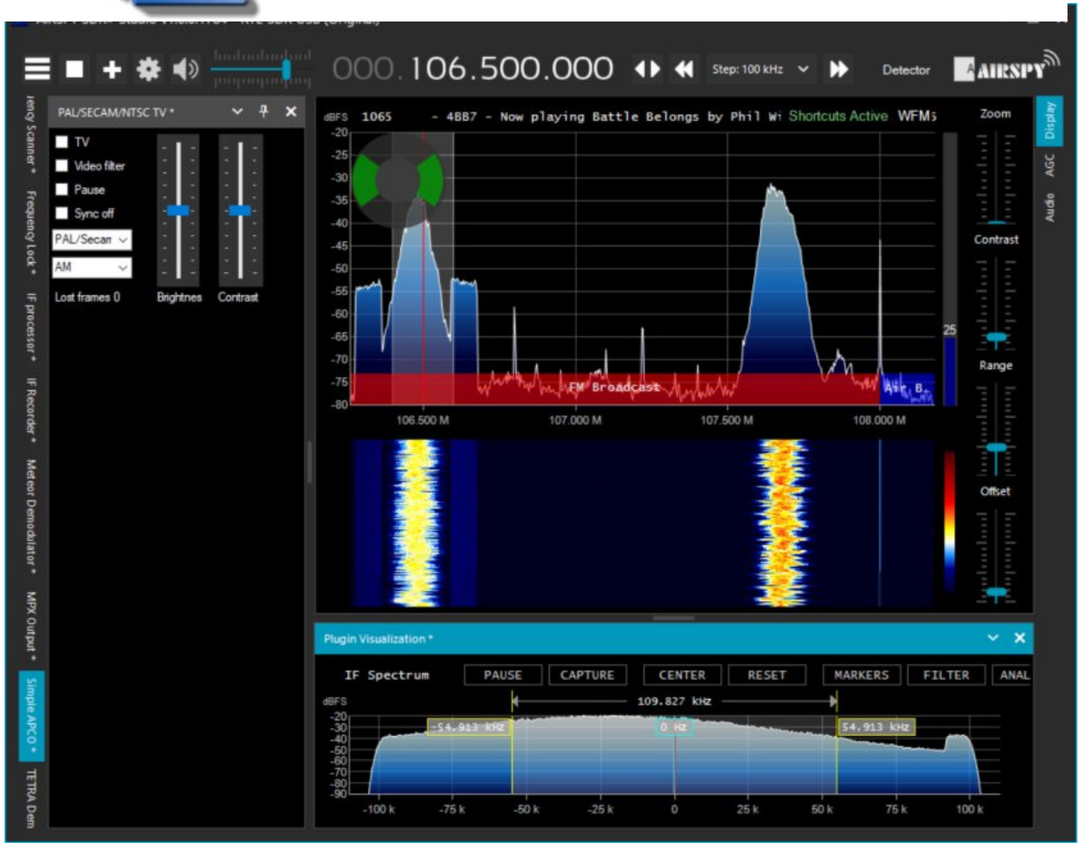
So, now we have the Plugins.xml file modified, and the SDRSharp.TV.dll copied into your SDR# installation folder. If you start now SDR#, in the lower left corner you have a dialog box for the new TV plugin you just installed:

Continued next page...





I use the program SDR# v1.0.0.1672. If you have the AIRSPY Studio v1.0.01784 it will look like:



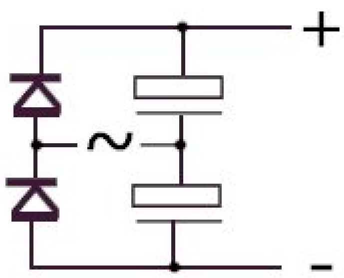
This AIRSPY Studio version is more complicated to use, and scrolling for various windows on the left side bar and on the right side bar is slow. It is not clear, by default installation, from one view, which plugins are available, because their labels are written vertically, and take more space, and have to be spread on several scrolling pages.

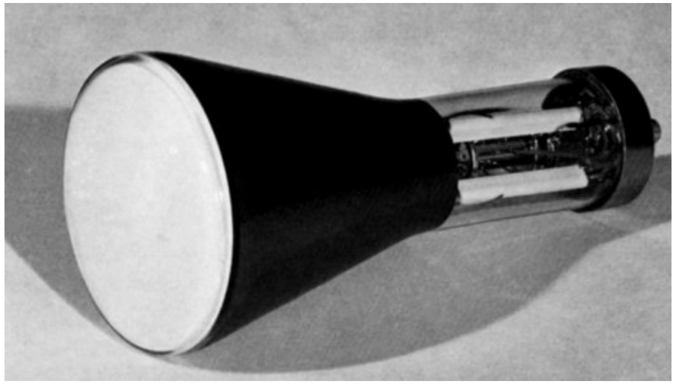
One can count only on black and white and PAL/SECAM use of the TV plugin, although the plugin knows more for the cases when more advanced SDR devices are connected, having more capabilities than RTL2832.

From the vault - Voltage Doubler

Written by Trevor Brown G8CJS

I keep trying to clear my loft of what seems to be the accumulation of a life of time electronic engineering. This sketch was redrawn from the faded contents of a folder that's more than 50 years old, so it really is entitled to be called "From the Vault", yes its nothing cutting edge, it's the circuit of a voltage doubler. Whatever AC you apply is rectified and doubled to a DC output more than twice the AC input. It was part of a project I built back on a day release course in my teens.





The project was to build an oscilloscope with a small surplus tube I think was a DG7-5. I bought the tube in M&B's, an electronic surplus shop in Leeds.

The college had no components, so I had to provide everything and being one day a week, there was probably only two hours spare to work on a project each week. The project was to build an oscilloscope using the tube and it was valve technology. The problem was I had mounted the mains transformer in the wrong place and being the kind that drops through the chassis, it was an immovable object! Everything worked but the trace was not what you would describe as clean. The beam was modulated by the stray magnetic field from the badly placed transformer.

What helped was increasing the voltage on the tube, hence the voltage doubler. The capacitors were actually several in series as they were old domestic TV parts and 275V max.

Connecting electrolytics in series is never a good idea as you need to override and balance the internal leaks with external potential dividing resistors. Then you have to float several of the electrolytic cans from the chassis so conventional mounting clip are out and epoxy resin is in. The end result was more than 1kV derived from the mains.

Yes, the tube trace became cleaner, sharper and brighter, but other problems started to show. Some of the pots that control X and Y shift, brightness and focus etc are just standard pots, the sort used for controlling volume etc and they are not designed to be bolted through a chassis and then have more than 1kV applied to the track or wipers. There were a few crackles and bangs and definitely some arcing and burning smells. The really hot ones got mounted in a more creative way and knobs without grub screws was a good idea.

The project was marked, and I remember getting good marks, I think there were comments about problem solving, nobody mentions solving the problems I had created, or the potentially lethal construction. I avoided any serious electric shocks and I am pleased to report I am still alive.

Can you imagine anyone being allowed to put something like this together in a college today!

Its more than 50 years ago, but this is From the Vault, a chance to look back at some of the early days.

I only bring it up as I was clearing my loft and came across the folder of the tube data and a lot of faded sketches of X and Y amplifiers along with a miller transitron time base generator.

Sorry I don’t have any pictures. I am sure the project I left behind was safely disposed of many years back, but the scrappy notes I have left probably say it all.

Also in the same box were some photographic negatives, one is an off screen shot of an ATV transmission of a computer-generated video signal. I know we see these all the time, but this one may have been one of the first.

One of my colleagues came up with the idea as a video source to use on portable ATV transmissions, (we only had a mains operated CCTV camera at the time).

He used a Sinclair ZX80 computer, cutting edge in the 1980’s.

The ZX80 had a Z80 CPU running at a staggering speed of 3.25 MHz. The machine was housed in a small white plastic case, with a one-piece blue membrane keyboard. The display was an RF only connection so the one we used was modified to produce an external video output, which displayed small black-and-white characters, but also included some simple larger block-based graphics, allowing this larger display to be created from a BASIC programme. Happy days but this computing will never take off!

ZX80 Computer

Information

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Although a formatted article showing the layout can be sent, we prefer an unformatted text file of the script, along with annotations of where important images should be placed. All images should be identified as Fig 1 etc and sent seperately.

Images should be in PNG format if possible and the best quality available. Do not resize or compress images, we will do all the rework necessary to publish them.

If you are sending a construction project, please include the dimensions of any pcb's and make the pcb image black and white, not greyscale.

CQ-DATV reserves the right to redraw any schematics and pcb layouts to meet our standards.

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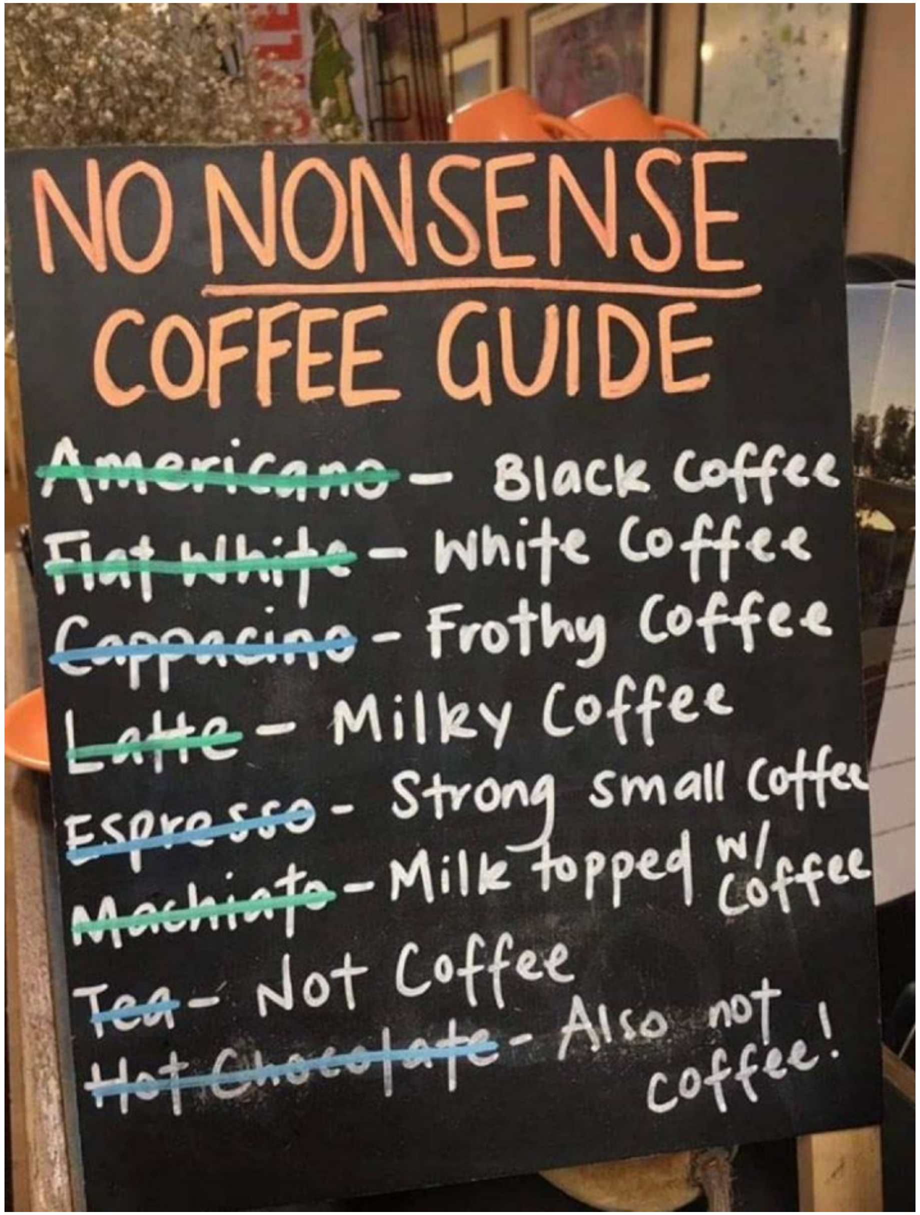

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