In this issue

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

Production Team

Ian Pawson G8IQU
Trevor Brown G8CJS
Terry Mowles VK5TM
Jim Andrews KH6HTV

Contributing Authors

Roberto Abis IS0GRB
Jim Andrews KH6HTV
Trevor Brown G8CJS
John Hudson G3RFL
Mike Stevens G7GTN

Editorial

Welcome to issue 95 of our electronic ATV magazine.

GB3ET was the callsign of the defunct analogue Emley Moor ATV repeater located 1200ft AGL on top of the Emley Moor TV mast. Now it's a digital ATV repeater and located near the village of Edgehill on the border of Warwickshire and Oxfordshire, CQ-DATV has the latest results of this transformation.

BECG has two new films on their Facebook site (we use the word new sparingly!). This time it's about the Independent Television Authority or IBA as it later became. I think BECG films are shaking off their reputation for old BBC stories, not a moment too soon.

The second is a film of what is believed to be the first videotaped show. This was also telerecorded so you can compare the two technologies rust verses silver, spoiler alert it looks like rust-based technology is winning.

Roberto Abis, IS0GRB describes how to build a DATV repeater, using the Adalm Pluto and the Octagon SF- 8008 decoder. This project is the result of multiple tests carried out for over a month and with the modifications made on different 1.2GHz analogue ATV transmitters of I2ROM, G4WIN and Ari-Bra, thus creating a DATV transmitter with little expense.

Trevor is back with what reads as his final instalment of the Grass Valley Mixer panel conversion "Now this may not be the end. It is definitely not the beginning, but it is, perhaps, the end of the beginning" (apologies for this dreadful mis quoting).

This project may have been held up by the lack of donor panels, but one in Bridlington just changed hands on eBay for £75, we do not know as yet if it was one of our readers, but it shows these panels are not yet extinct and should anymore appear we will put up a link on the CQ-DATV Face Book site.

Jim Andrews, KH6HTV investigates (Do It Yourself) microwave up and down converters for the amateur 23cm, 13cm and 9cm bands, up to 3.4 GHz. The total parts cost is of the order of $100 or less.

John G3RFL has bought a new solid-state scope and revisited the scope strobe trigger units of which there have been many. John has added software engineering so no more thumb wheels or hardware counters. John's unit is controlled by a touch screen and works surprisingly well with a solid-state scope.

In the Vault Trevor has been scanning 35mm negatives to create modern jpgs and looks back on twin lens reflex cameras as does Ian who has been keeping that part of his life quiet.

Please read and enjoy CQ-DATV 95.

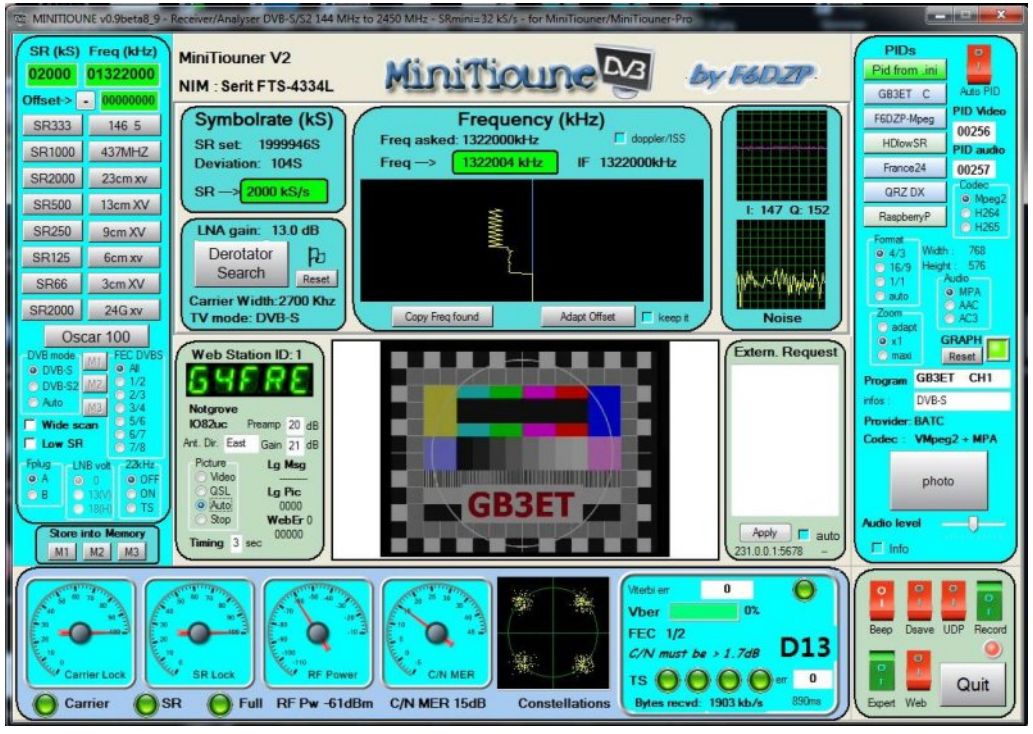
CQ-DATV Production Team

PS, CQ-DATV 96 is now open for your copy at:-

editor@cq-datv.mobi

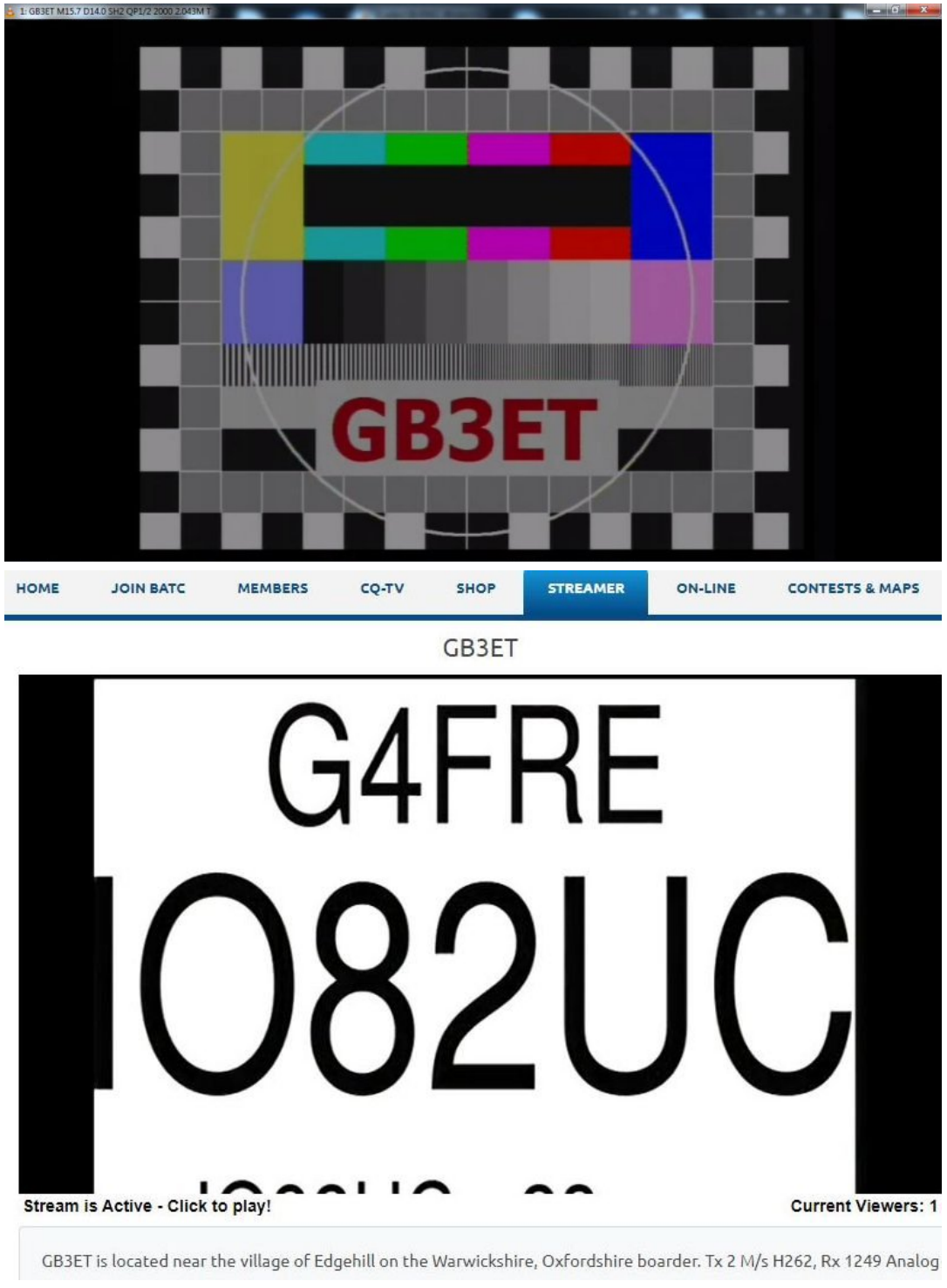
GB3ET: Success finally!

G4FRE reports, Mon April 05, 2021
With the 23 ele Tonna pointing out of the bedroom window GB3ET is now a decent signal when using the G4DDK preamp/BPF.



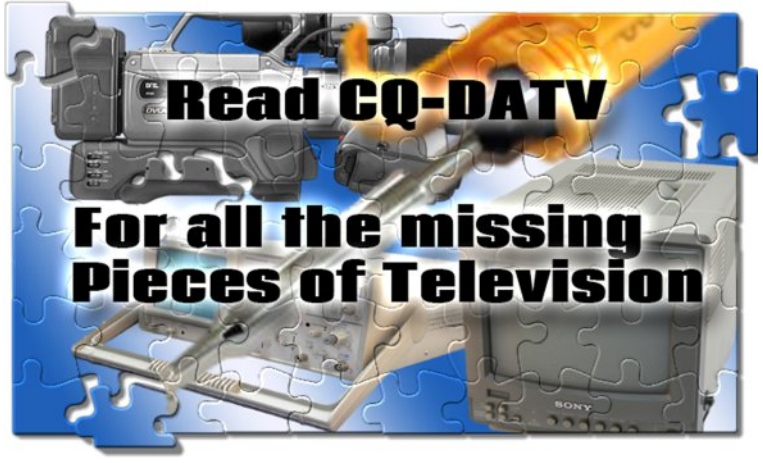
I also had a chance to try out my (unboxed) Winterhill single nim receiver, finished yesterday afternoon on a real signal. Its now possible to use it for purposes other than QO100 thanks to the Receiver commander software of G4EWJ.

Transmitting at it using the Portsdown 4 and 2 amplifiers to give 10W I managed to gain access. The only issue was that the streamer chops off the bottom 15% of the screen hence I had to replace the contest numbers in the middle of the screen with the locator.



This picture, received through the repeater shows my takeoff towards GB3ET. The path length is 60km.

Source: *https://tinyurl.com/yvyrpvtf*



Broadcast Engineering Conservation Group

Two new films on the BECG (Broadcast Engineering Conservation Group) Facebook site. If you are not a member, use the YouTube links, but we would like to welcome anyone who has an interest in broadcast equipment conservation to the site.

Film 1 is a rare, IBA promo film footage Story a Network. The new EMI 203's feature in the film - but unfortunately are not referred to! *https://tinyurl.com/55xezj7c*

Film 2 the Edsel Show - CBS-TV (October 13, 1957) This may be the oldest Videotape recording in existence and it was also Telerecorded so you can compare the old system used for time shifting TV programmes with the modern replacement. *https://tinyurl.com/e8fa62w*

Source: *https://tinyurl.com/7f3zm9af*

Guide for the creation of a DATV repeater with Adalm Pluto and Octagon SF-8008 decoder

Written by Roberto Abis, IS0GRB

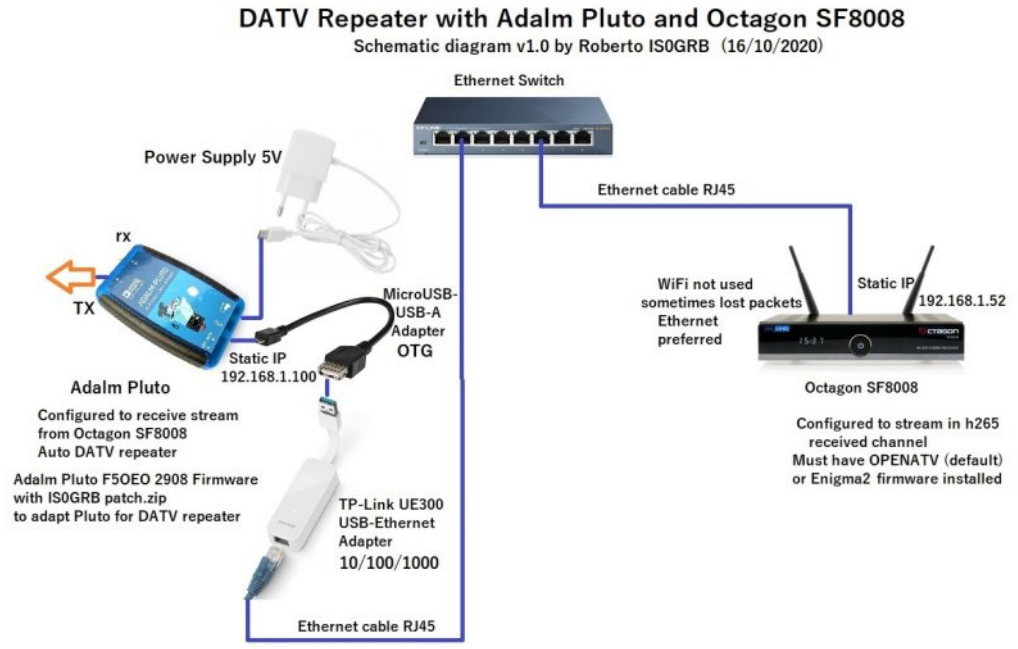
This article describes how to build a DATV repeater, using the Adalm Pluto and the Octagon SF- 8008 decoder.

This project is the result of multiple tests carried out for over a month and with the modifications made on different 1.2GHz analog ATV transmitters of I2ROM, G4WIN and Ari-Bra, thus creating a DATV transmitter with little expense; it is a question of disabling the video oscillator, the audio oscillator and the PLL and inserting the Pluto signal, set at + 1dBm, first amplified with a model SPF5189Z amplifier card, to correctly drive the amplifier stages of the old analog ATV transmitter and get the same transmission power. Here you can find the modifications for the 3 types of analogue ATV transmitters shown: *https://tinyurl.com/fz8s4u7s*

At the request of some colleague I share this experience, so that today it becomes easier to create a DATV repeater based on DVB-S / DVB-S2; among the possibilities offered by this project there is also the retransmission of an event on the local repeater or on the QO-100 satellite via the Internet.
To create the DATV repeater you need to have the following components available:

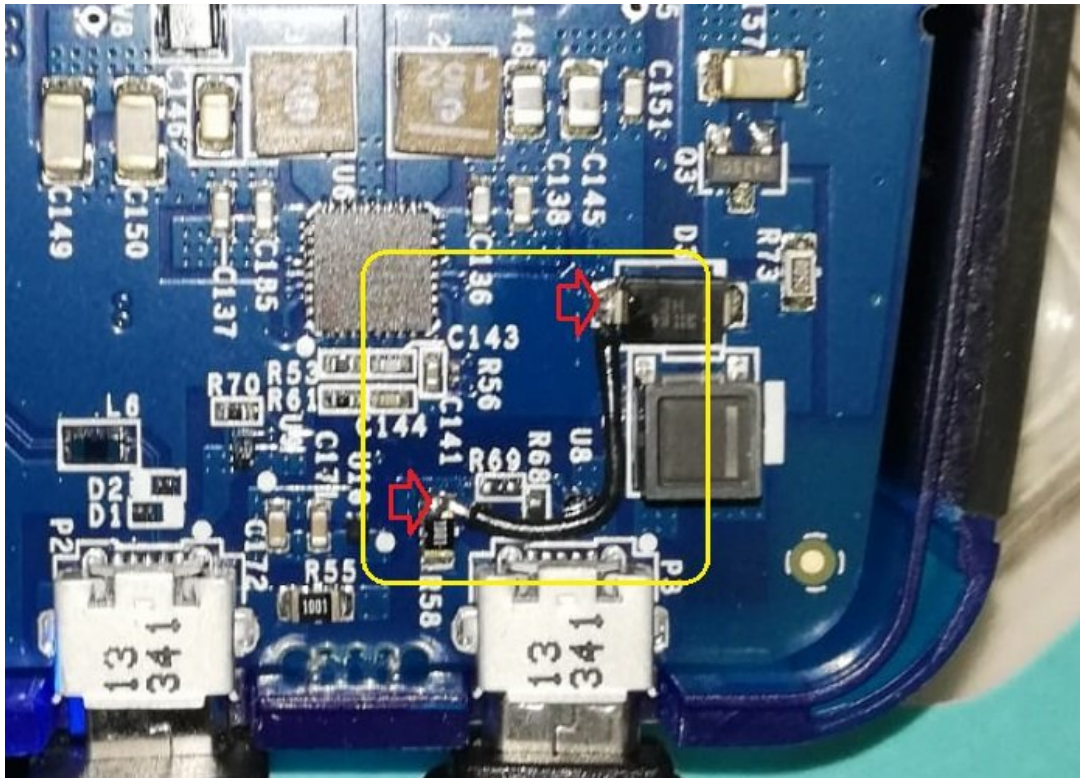
- *Adalm Pluto SDR interface*
- *Octagon SF-8008 decoder, with OpenATV (default) or Enigma2 firmware and OpenWebIf web Plugin*
- *100 / 1000M Ethernet switch*
- *Micro USB to USB-A OTG cable*
- *USB-Ethernet adapter TP-Link UE-300 model*

Below is the connection diagram of the DATV repeater:



Pluto setup

For the stability of the Pluto and the Ethernet adapter it is absolutely necessary to modify the GNDs, as it has been noticed that often the Pluto, following spikes or mismatches, changes state, passing from HOST mode to CLIENT mode and the connected peripherals via USB stop working. If the installation is done in the mountains, losing the connection with the Pluto means losing the management of the same and also the repeater functionality; it has always been necessary to unplug the USB device and plug it back in to restore the connection; furthermore, in the mountains, due to the high concentration of RF present, the phenomenon will be more accentuated and if possible it is advisable to insert the Pluto in a metal container to shield it from radiofrequency; the problem was noticed randomly even when connected via USB directly to the PC; on the Internet the change is described on several sites; below is the photo of the modification I made:



The transmitting part involves the use of Adalm Pluto, with the latest alpha firmware installed on 08-29-2020, released by Evariste F5OEO on which my patch for enabling a DATV repeater will be inserted, which also integrates other functionalities, useful for the management of the repeater and that may be useful in other situations, which we will discuss later.

Installation of the USB-Ethernet adapter on Pluto

In order to make the Pluto interact with the Octagon receiver it is necessary to install an Ethernet adapter connected to the central USB socket. It is also necessary to interpose an OTG adapter cable first, see diagram above, to ensure that the Pluto is set up in HOST mode.

As a USB-Ethernet adapter i used the TP-Link UE-300, with internal RTL8153 chip, correctly supported with the drivers from this firmware version and capable of making a link to 1000M; a 100M adapter will do as well.

Static IP address configuration and Ethernet Default Gateway

In order to manage the Pluto via the internet, but above all to have a reference IP even within the local network and to be able to access it via SSH, a static IP address must be configured.

Access with the SSH protocol on Pluto, using the client Putty, downloadable from the internet:
https://tinyurl.com/25ynhspu

Connect to the address 192.168.2.1 (login: root / pass: analog) Now send the following commands:

fw_setenv ipaddr_eth 192.168.1.100

(the IP address 192.168.1.100 was chosen by me, you can use a different one).

This configuration requires that your local network is 192.168.1.0 and netmask 255.255.255.0 (/ 24); if your local network is 192.168.0.0, you can use the IP address 192.168.0.100.

Now enter the IP address of the Default Gateway of the local network, which will typically correspond to the IP address of your ADSL or FTTC or FTTH router (for example: 192.168.1.1 or 192.168.1.254 or 192.168.0.1 or 192.168.0.254); check the IP address on which your router responds in the local network.

fw_setenv gateway_eth 192.168.1.1

Through these direct commands the entered parameters will be automatically saved on the Pluto and you will not have to do anything else

Now restart the Pluto with this command:

reboot

Now connect the Ethernet adapter; the Pluto will now be reachable at the new IP address. Check with your web browser, type: http://192.168.1.100/pluto.php

What can be done with the IS0GRB patch applied on Pluto

The dedicated patch v.1.0 for the Pluto that i made foresees:

1 - Enabling the Pluto to build a DATV repeater; in addition to being able to use it as originally for the DATV, listening on UDP port 8282, you will have the possibility to modify the Transport Stream input, in order to select the streaming coming from another server within the local network, for example from the Octagon decoder, from the Minitiouner receiver etc., thus creating a DATV repeater, or from outside the local network via the Internet, to retransmit, for example, the streaming of an event, a fair, a meeting of radio amateurs etc., both on the local repeater and possibly on the QO-100 geostationary satellite.

2 - In order to receive streaming from the Internet, Pluto will be set up to be connected to the Internet, by entering the Ethernet Default Gateway (typically the IP address of the ADSL, FTTC or FFTH router); if the Ethernet adapter is not available, alternatively, it will still be possible, using the USB direct connection to the PC and activating internet sharing between the interface that sees the local network and the Pluto interface, to be able to connect the Pluto on the internet. See the guide i made to activate internet sharing on Windows: *https://tinyurl.com/7up3c3fk*

Both the Default Gateway of the USB interface (usb0), on the 192.168.2.0 network, and that of the local network, for example for the local network 192.168.1.0, will be present on the Pluto, which will be configured manually, as indicated above; in the Default Gateway settings, the one relating to the ethernet interface (eth0) will have a lower metric (preferred by Pluto for routing packets to the Internet), compared to that of the higher USB interface (usb0); i have set metric 10 for the usb0 interface, so if the Ethernet adapter is present, Pluto will use the Ethernet Default Gateway to route the packets to the Internet, otherwise to connect to the internet it will use the USB interface Default Gateway (usb0).

This configuration, in addition to 2 rules set in the "Virtual Server" section of your router (necessary to redirect the external ones to the internal ones associated with a static IP of the local network), will allow you to reach the Pluto also via internet on port 80 (http) and 22 (ssh)

3 – Reduction of Pluto transmission times after receiving the first packets; a few seconds of delay have been eliminated before the Pluto starts transmitting the data stream; in the DATV repeater function the translation delay must be as low as possible; however, this setting may also be useful during normal DATV transmissions on QO-100.

Pluto configuration

Install the latest alpha firmware from F5OEO for DATV dated 08/29/2020 on Pluto. The firmware can be downloaded from the author's website at this address:
https://tinyurl.com/j2jn6mhr

1- Then install my DATV Repeater Patch, available at this address: *https://tinyurl.com/mz9ctm* via the Pluto page (http://192.168.2.1/pluto.php) or (http://192.168.1.100/pluto.php) "Upload a new firmware or new patch" section, to enable Pluto to function as a DATV repeater.

Now rename the downloaded patch file to patch.zip and upload by clicking on the "Upload" button.

Now access the Pluto web page to configure all the Modulator parameters: (http://192.168.2.1/pluto.php) or (http://192.168.1.100/pluto.php

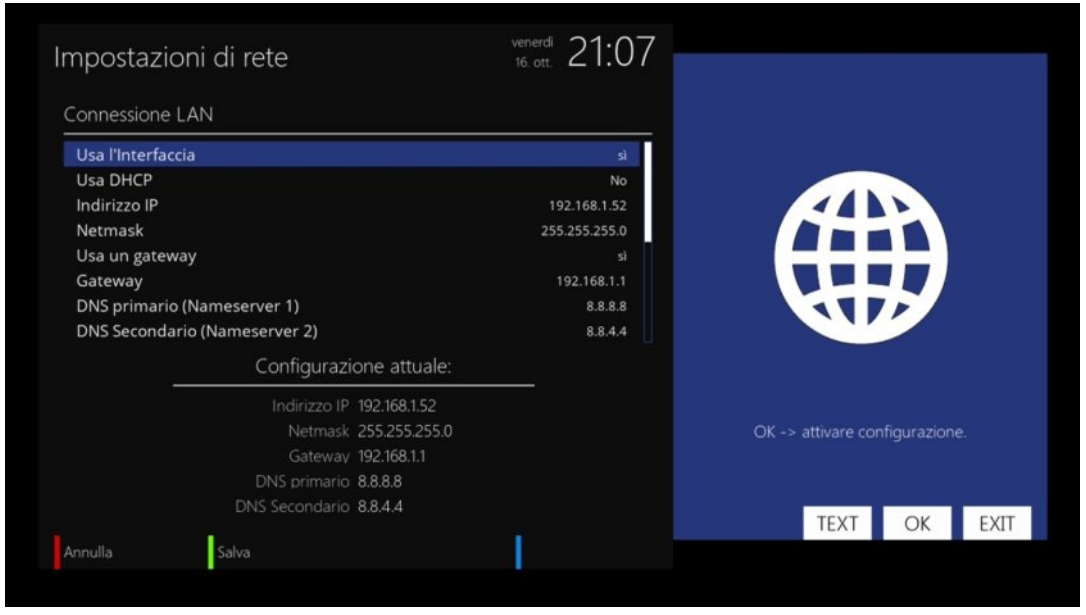
Now insert the flag on "DATV Rptr" to activate the new mode. A field will be shown where you can enter the external link of the streaming that the Pluto will have to transmit; see the Decoder configuration section, described below, to understand how to identify the link of the decoder channel to be retransmitted and insert it in this field; leaving the DATV Rptr function disabled, the original function of the Pluto listening on UDP port 8282 will be automatically re-enabled, so that it can be used in DATV in the usual way with OBS Studio or VMIX programs

Configuration of the Octagon SF-8008 receiver

The receiving part involves the use of the Octagon SF-8008 decoder, capable of decoding DVB-S2 signals with a minimum of 125k Symbol Rate; the decoder must be connected via ethernet cable to the ethernet switch and you must set a static IP address on the LAN interface; i suggest not to use the Wi-Fi connection for this purpose as after multiple tests a random loss of packets was noticed and this can compromise the quality of the streaming towards the Pluto.

Static IP address configuration on Octagon SF-8008 decoder

By pressing the Menu button on the remote control, select SETTINGS, SYSTEM, NETWORK, NETWORK CARD SETTINGS, LAN Connection, Interface Configuration; on the decoder I entered the static IP address 192.168.1.52.
Below is an example of a static IP address configuration on the Octagon decoder:



Save by pressing the green "Save" button and exit everything by pressing EXIT on the remote control several times.
Tuner setting of the Octagon SF-8008 decoder

By pressing the Menu button on the remote control, select SETTINGS, TUNER & CHANNEL SEARCH, Tuner Setup and select Tuner-A (Si2166D).

Above is an example of Tuner configuration.

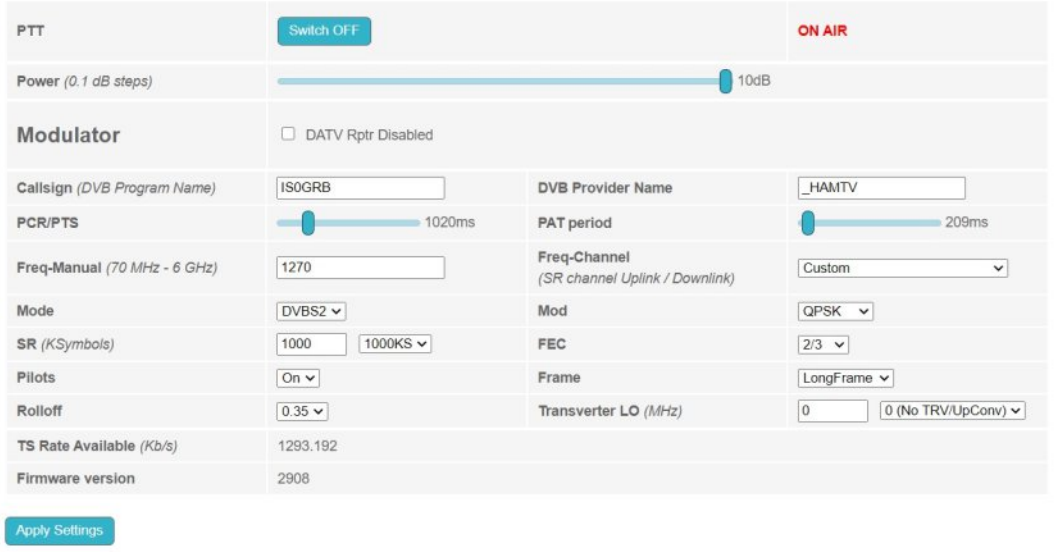
Since we will typically use the 1.2GHz band decoder and therefore without LNB set 10000 as the value of the local oscillator LOF / L, so that entering the frequency to be entered for tuning is more intuitive; for example for 1270 MHz, as we will see later, we will enter 10000 + 1270 = 11270.

Save by pressing the green "Save" button and exit everything by pressing EXIT on the remote control several times. Prerequisite for tuning the channel corresponding to the DATV repeater input frequency

To proceed with the tuning of the reception frequency, which will be the one that the repeater will receive during normal operations, it is necessary to have a transmission on the same frequency and with the same Symbol Rate as the one to be received.

You can set up the Pluto in TX with all the configured modulator parameters and send it in transmission together with the OBS or VMIX program for the generation of the streaming towards the Pluto, in order to make it switch to transmission.

Below is an example of the configuration of the DVB-S2 modulator of Pluto for transmission:

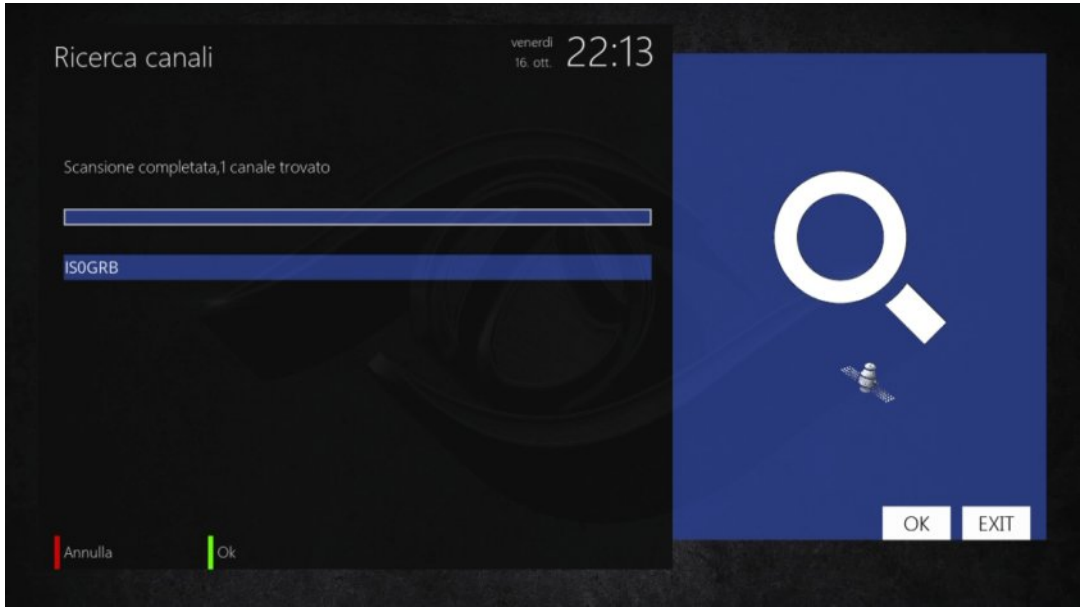


Setting the decoder for receiving on the repeater input frequency

By pressing the Menu button on the remote control, select SETTINGS, TUNER & CHANNEL SEARCH, Signal Search and set the parameters as indicated on the screen; note the frequency of 1270 (10000 + 1270) and the Symbol Rate of 1000k which must be the same as those set on Pluto and which will be the ones that radio amateurs will use to access the repeater; the Symbol Rate must be identical to that of the Pluto transmission, to make the flow of received and retransmitted data conform; it makes no sense to set the Pluto to 1000k SR and the decoder to 250k SR.

Change the “Search type” parameter, set “User default transponder” and enter the other parameters as follows:

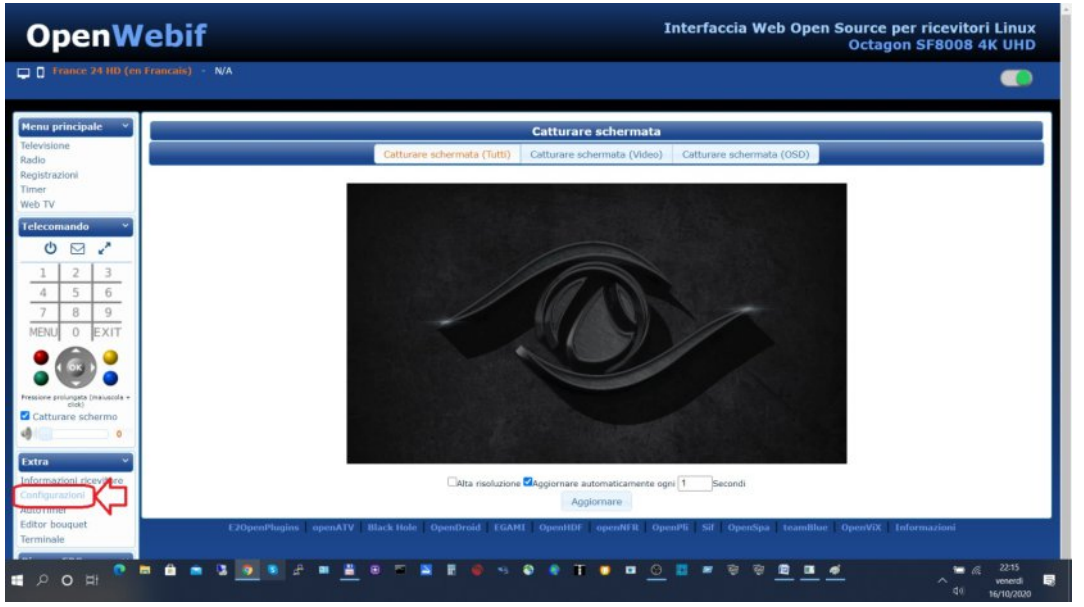
By pressing the green “SEARCH” button now, the channel you transmit will be searched:



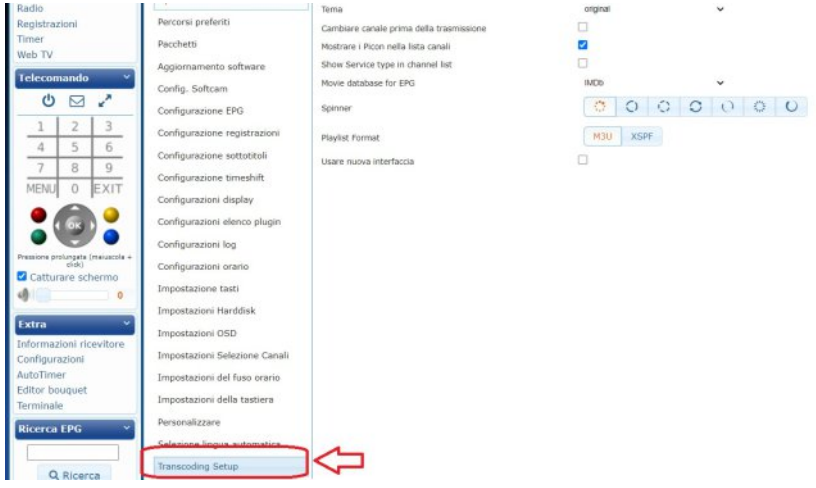
Your channel has been tuned

Configuration of the streaming parameters on the Octagon decoder

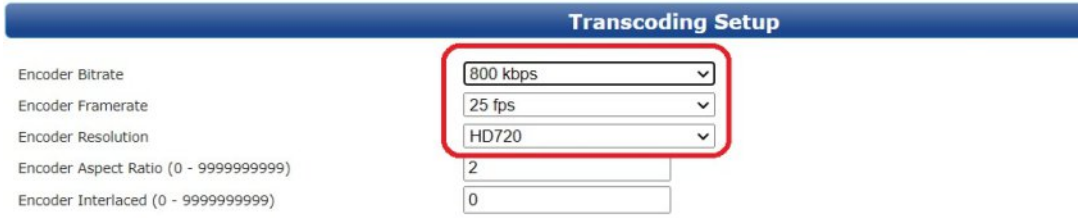
Now access the IP address that you have set on the LAN configuration of the decoder via the web; in my case 192.168.1.52 (http://192.168.1.52)
Click on the "Configurations" item at the bottom left



and then on "Transcoding Setup":

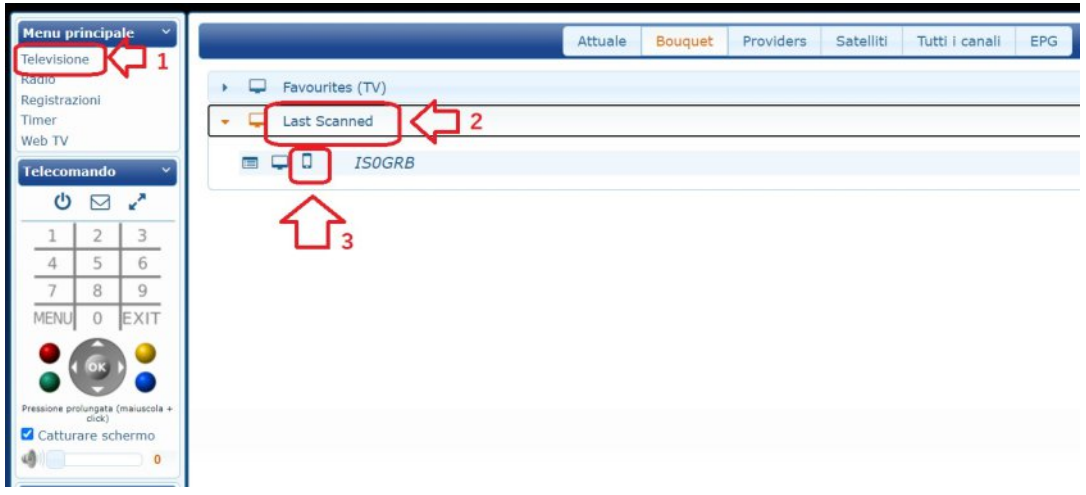


Now set the Bitrate value (if you have set SR 1000k on the Pluto, always set 80% / 90% = 800k / 900k), Framerate 25fps and HD720 resolution:

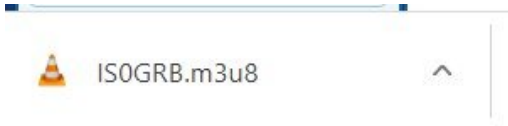


It is not necessary to save any parameters, as soon as they are changed they are automatically saved.

Identification of the streaming link of the receiving channel. Also via the web on the decoder page, at the top left select "Television", then "Last scanned" and finally click on the smartphone icon, next to the name of the channel received.

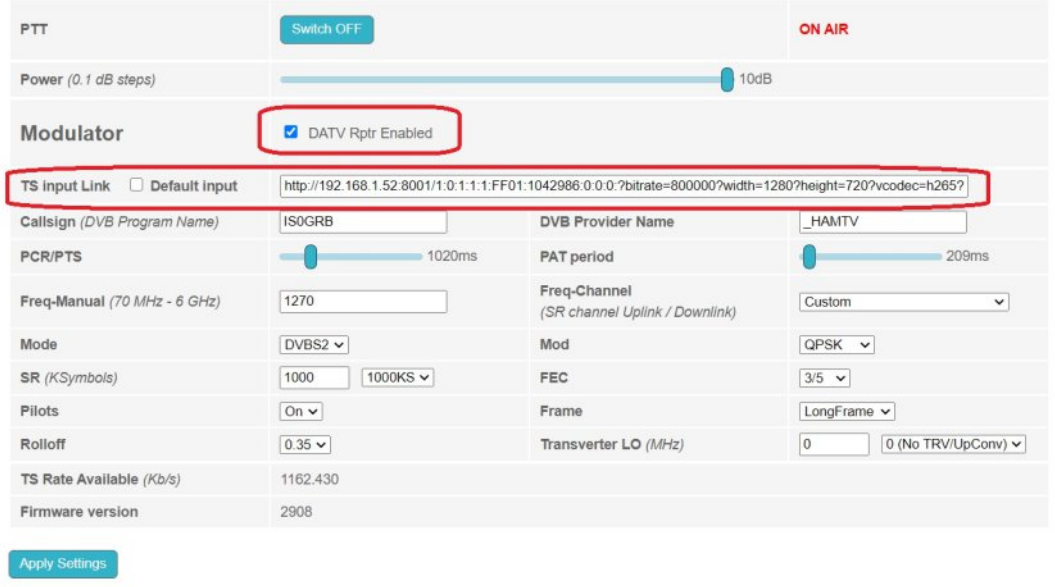


An automatic link will be downloaded that will allow you to see the channel directly from VLC; what interests us is to identify the link of the streaming; open this file with the NOTEPAD and you will find the link of the streaming, which must be inserted in the field that will appear by enabling the "DATV Rptr" flag on the Pluto page.



After opening it with Windows NOTEPAD this is the streaming link:

Now go back to the pluto.php page and insert the streaming link in order to enable it as a DATV repeater; note that the link includes the parameters you have set in the Transcoding Setup section and moreover, by default, the Octagon decoder uses the h265 codec for streaming, with all the resulting advantages; you can change it by setting for example h264.



Now apply the settings and save on the Flash, using the appropriate button below. Your Pluto is now ready to function as a DATV repeater; as soon as the decoder receives a signal, Pluto will retransmit it on the set frequency; when the signal

being received on the decoder ceases, the Pluto, after having emptied the buffer, will stop retransmitting; also the PTT switching will then become automatic and managed by the presence of the data.

End

As indicated at the beginning of this guide, the possibilities of this project are different; you can insert the link of a streaming on the Internet instead of the one sent by the decoder; for example, by activating a streaming at a fair or in the place where a meeting is held, it will be possible to retransmit it on the repeater you made or on the QO-100 satellite; it is also possible to create a link between 2 DATV repeaters, the decoder will receive the Primary repeater and Pluto will retransmit it to the Secondary repeater; the possibilities of using this project, as you can imagine, can be different.

I hope this project will contribute from today to the creation of new DVB-S2 DATV repeaters.

Roberto IS0GRB

Please check Roberto's site for any updates to this article at *https://tinyurl.com/5aky3zpk*

Low Cost DIY Microwave Up & Down Converters

Written by Jim Andrews, KH6HTV
Reproduced from Boulder Amateur Television Club TV Repeater's REPEATER April, 2021

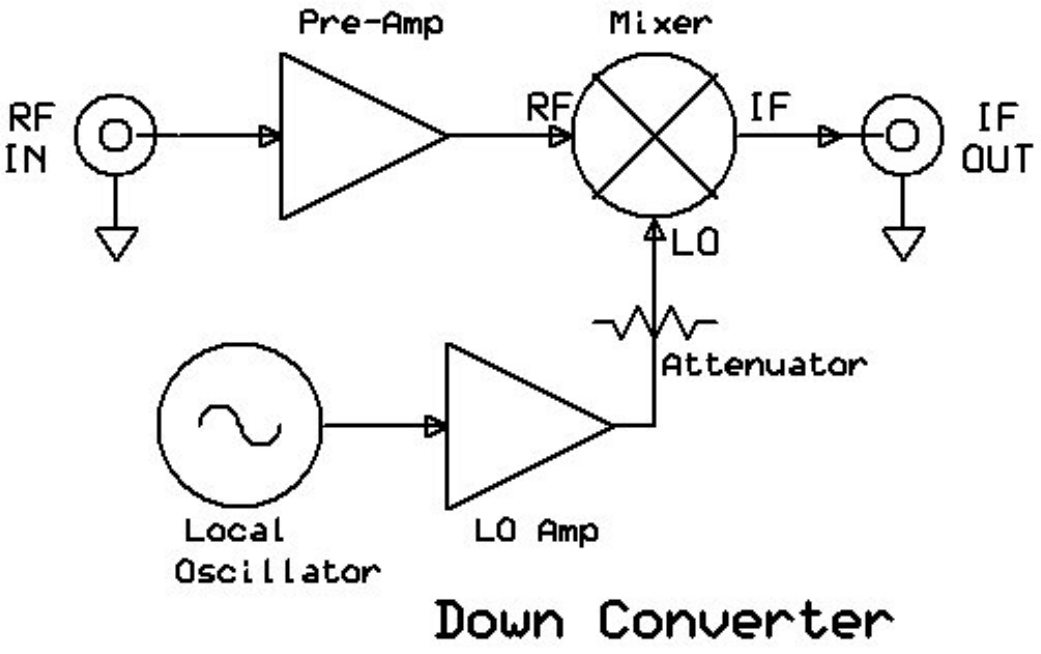


Fig. 1 Block Diagram for a microwave down converter

Down-Converter

This is the basic diagram showing the key components required for a down converter. The most basic down-converter consists of only two components, namely a Local Oscillator and a Mixer. The other items shown are "frosting on the cake" to improve performance. Today, there are a lot of RF and microwave components available from China at low cost. They can be found by searching on the internet on Amazon, E-Bay, etc. This application note will discuss how to DIY (Do It Yourself) assemble both up and down converters for the amateur 23cm, 13cm and 9cm bands, i.e. up to 3.4 GHz. The total parts cost is of the order of $100 or less.

For higher quality, better performance up/down converters, there would be added to the basic circuit additional filtering. Band-Pass filters would be beneficial on the RF & LO circuits. A low pass filter would be beneficial on the IF circuit. Unfortunately, these filters will increase the total cost. They can be omitted with a sacrifice in performance, but for some hams on tight budgets, this is a necessary sacrifice.
It should be noted that a down-converter, and the up-converter presented later in this app. note (see Fig. 7) are linear devices. They will work with any signals, be they analog, VUSB-TV, analog FM-TV, digital TV, SSB, etc.

Fig. 2 Three versions of a Chinese, ADF-4351, Frequency Synthesizer board

LO

The key element, and typically the most expensive, is to find a good Local Oscillator (LO). The recent availability of the Analog Devices frequency synthesizer ICs has made a quantum leap forward in designing, microwave gear, such as a down converter. For the low end of the microwave band, the Analog Devices model ADF-4351 is ideal. It covers from 35 MHz up to 4.4 GHz. It can be set to any arbitrary frequency to 1kHz resolution. It is available from China already mounted on a printed circuit board, complete with the support electronics to enable the user to easily set the desired frequency.

The photo, Fig. 2, shows examples of several different versions found on Amazon. Prices range from about $25 to $55.

These ADF-4351 boards typically require +5Vdc for power. I highly recommend that you do NOT use the typical wall-wort 5V supply as they are usually switching regulators which put out a lot of switching transient noise on the 5V line. It is important, especially for DVB-T, that the phase noise of the LO be kept to an absolute minimum. A clean, no noise, power source is key to keeping the phase noise down on these synthesizers. I recommend that you use a linear voltage regulator, such as a 7805, or an even lower noise, linear. I even put a 470 µF cap. on the output of my 7805 for the LO supply to further suppress noise.

Fig.3 Typical low cost, RF/Microwave Mixers from China

Mixer

The mixer is used to beat the RF signal against the LO and creates sum and difference products IF = RF - LO, IF = RF + LO, etc. For our example, we want to down convert signals in either the 23cm (1240-1300 MHz) or 13cm (2.4 GHz) bands down to a suitable lower frequency where we have an ATV receiver.

For analog TV signals we typically want to use an IF in the VHF Hi-Band of channels 7-13 (174 - 216 MHz). For digital TV (such as DVB-T) we want to use an IF in either VHF Hi-Band or the amateur 70cm band (420-450 MHz). Most mixers for microwaves are semiconductor diodes (usually GaAs) and use the double-balanced, diode design. The typical conversion loss of a good double-balanced diode mixer is of the order of 6-8 dB. They come typically in a couple of categories requiring either +7dBm or +13dBm of LO drive power.

On Amazon, we find a couple of suitable, and really low cost, microwave mixers. They are advertised under the model ADE-25 and HMC-213. These are actually model numbers from Mini-Circuits and Hittite respectively. You can download the spec. sheets from them. The Chinese units come assembled on pc boards or in a nice metal enclosure with SMA connectors. Prices range from $7 - $20. Both mixers require +13dBm of LO drive power. The ADE-25 is specified for RF/LO (5 MHz - 2.5 GHz) and IF (5 MHz - 1.5 GHz). The HMC213 is specified for RF/LO (1.5 - 4.5 GHz) and IF (DC - 1.5 GHz). The exact drive power level is not critical and can range from +10dBm to +16dBm.

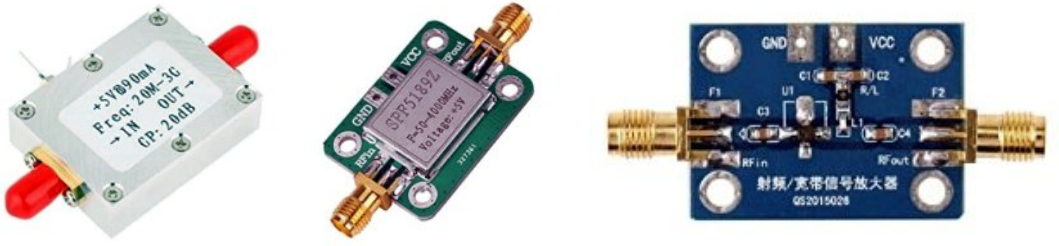


Fig. 4 Typical, low cost, amplifier modules from China

Amplifiers

We need two different type amplifiers for a down converter. Typically, the output from an ADF4351 LO is of the order of 0dBm (1 mW) and is insufficient to drive a mixer, so we need

to boost the LO power to at least +7 or +13dBm, depending upon the mixer used. This requires a driver amplifier capable of at least that much output power. Plus, it also beneficial to use a low noise preamplifier in front of the mixer to improve the noise figure and the receiver sensitivity. Most of the amplifiers from China, such as shown in Fig. 4, all require DC voltage of +5Vdc. I recommend that a +5V linear voltage regulator, such as a 7805 be used to power them.
An attenuator is shown in the block diagram, Fig. 1. This may or may not be necessary. It depends upon the actual RF output power you get from your driver amplifier. Use it to limit the RF drive power to a +13dBm mixer to no more than +16dBm. SMA attenuators are now available on Amazon. They are typically specified up to 6GHz and do work quite well up to 6. Typical cost is about $10 each.

Total Parts Cost

So what are we looking at for total cost for a down-converter ? ADF-4351 LO ($50), LO driver amp ($10), preamp ($10), mixer ($15), attenuator ($10), three SMA cables ($3), two 7805 voltage regulators ($1)
Total estimated cost ≈ $100

It should be noted that this is only the cost for the basic components, suitable for bread-board style construction such as shown in the below photo. The cost for packaging in a nice enclosure is additional.

23cm, 1.2GHz, Down-Converter

Fig. 5 shows an actual down-converter built for both 23 & 13cm bands with these low cost, Chinese microwave components. There are two 7805, 5V regulators. One for the LO and the other for the amplifiers. They are mounted on the metal plates for heat sinking. The LO, ADF-4351 synthesizer is the module on the separate metal plate on the lower right. The LO output drives a 20dB gain amplifier which puts out

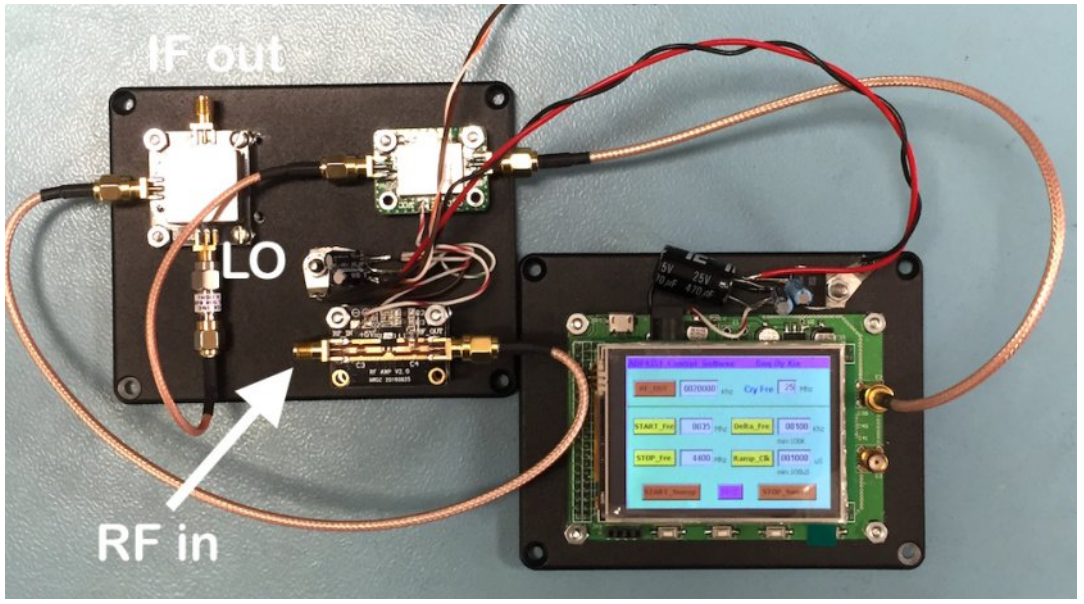


Fig. 5 Prototype, 23cm & 13cm Down-Converter made from low cost, Chinese microwave components

about +20dBm of rf power. This is attenuated with a 6dB, SMA pad to +14dBm to drive the mixer. The mixer is an ADE-25. The mixer's conversion loss was about -7dB. The preamp is a low noise amp module on a bare pc board. It has a gain of about 15dB at 23cm. The LO frequency is set to 820 MHz. For 23cm band the frequency is from 1240 to 1300 MHz. Thus the IF comes out on the 70cm band from 420 to 480 MHz.

So, how well does it perform for digital ATV service with DVB-T? I set up on my test bench to measure sensitivity. I used a Hi-Des HV-320E modulator to generate a test DVB-T signal on 1243 MHz. I set up the digital parameters for typical, ham service. They were: 6 MHz BW, QPSK, 1080P resolution, 5/6 FEC, 1/16 guard, and 5.5 Mbps data rate. I ran a DVD with "live" typical video and audio. The rf output from the HV-320 was +5dBm on 23cm band. I used fixed SMA attenuators and a rotary step attenuator with 10 & 1dB steps to attenuate the test signal in known amounts.

I dropped the signal level to just above digital threshold. At this level, a solid P5 picture and Q5 audio was obtained. One more dB and the video and audio started breaking up. At this level the S/N is about 8dB. I tested using three different receivers. They were a Hi-Des HV-110, HV-120A and a GT-Media V7 Plus. I got the same results on each. They were set to receive 423 MHz / 6 MHz BW.

23cm (1.2GHz) DVB-T Receiver Configuration	DVB-T Sensitivity
Hi-Des HV-120A Receiver (*reference*)	-93dBm
ADE-25 Mixer Only	-85dBm
Generic Chinese low noise Pre-Amp + ADE-25 Mixer	-92dBm
KH6HTV 23-4LNA Pre-Amp (2 stage) + ADE-25 Mixer	-100dBm
KH6HTV 23-4LNA Pre-Amp (1 stage) + HV-120A	-98dBm
KH6HTV 23-7 Down Converter	-99dBm

The first test for comparison purposes was a Hi-Des model HV-120A, DVB-T receiver. The above table shows the results for various configurations. It should be noted that there is no band-pass filter in the setup of Fig. 1, nor on the input to the Hi-Des HV-120A receiver. Thus the mixer passes through to the IF the noise contributions of both the upper and lower sideband mixer products. If the input preamp is replaced with a low noise preamp which includes a band-pass filter, such as the KH6HTV model 23-4LNA, the sensitivity is improved dramatically. The last item in the table, the model 23-7, is a completely assembled, commercially available, 23cm down-converter.

13cm, 2.4GHz, Down-Converter

The same components can be used for the 13cm (2.4 GHz) band. One simply needs to change the LO frequency. An LO of 1970 MHz is suggested. With it, the most useable 2.4 GHz frequency of 2.393 GHz will down convert to 423 MHz in the 70cm band. The Chinese generic preamp has about 10dB of gain at 2.4 GHz. I tried two different mixers for 13cm. The ADE-25 mixer was found to have about -13dB conversion loss. The Mini-Circuits spec. is -7dB with max. of -10dB.

I tested two of these mixers from Amazon and found that both were about -13dB and thus out of Mini-Circuits spec. They did work fine at 23cm. Thus, the Chinese mixes may have been using factory rejects?

For the HMC213 mixer, I found it's conversion loss to be a bit better at about -10dB. The Hittite spec. at 2.5GHz is -7.5dB (max. -10dB). It was thus at the extreme limit of Hittite's spec. and may have also been a factory reject ?

The sensitivity was tested in the same fashion as previously for 23cm. I used a Hi-Des HV-320E modulator to generate a test DVB-T signal on 2393 MHz. The results are shown in the following table. The ADE-25 mixer was found to perform worse than the HMC-213 by 4dB. This is consistent with the differences found measuring their conversion loss. Similar sensitivities as 23cm were obtained using the generic preamp, but with the HMC-213 mixer replacing the ADE-25.

13cm (2.4GHz) DVB-T Receiver Configuration	DVB-T Sensitivity
Hi-Des HV-120A Receiver (*reference*)	-93dBm
ADE-25 Mixer Only	-81dBm
HMC-213 Mixer Only	-85dBm
Generic Chinese low noise Pre-Amp -> ADE-25 Mixer	-87dBm
Generic Chinese low noise Pre-Amp -> HMC-213 Mixer	-91dBm
KH6HTV WB-LNA-3 PreAmp -> ADE-25 Mixer	-87dBm
KH6HTV WB-LNA-3 PreAmp -> Taoglas BPF -> ADE-25Mixer	-89dBm
KH6HTV WB-LNA-3 PreAmp -> HMC-213 Mixer	-91dBm
KH6HTV WB-LNA-3 PreAmp -> Taoglas BPF -> HMC-213 Mixer	-92dBm
KH6HTV WB-LNA-3 PreAmp -> Taoglas BPF -> HV-120A	-99dBm

Also tested was the KH6HTV model WB-LNA-3 preamplifier. Both amplifiers are wide-open, broad-band, with no band-pass filtering. They thus pass through noise from both the upper and lower sideband mixing products. Adding a 2.4GHz band-pass filter on the output of the preamp before going to the mixer is thus beneficial. A low cost ($24) BPF is the Taoglas BPF24.01. It has 100 MHz bandwidth and 1.3dB insertion loss. It is available from both Digi-Key and Mouser.

Fig. 6 A Band-Pass Filter for 2.4 GHz

The only drawback to this filter is it comes with reverse polarity SMAs. Thus you will have to also purchase RP-SMA to SMA adapters to use it. Adding the WB-LNA-3 preamp plus the Taoglas BPF improved the Hi-Des model HV-120A's receiver sensitivity from -93dBm to -99dBm.

The improvement was not as dramatic with the DIY setup using the ADF-4351 LO and the HMC-213 mixer. If the wide-band preamp is overloaded with out of band signals, then the BPF can be installed instead on the input with a slight decrease in sensitivity due to the insertion loss of the filter.. 9cm, 3.4GHz, Down Converter

To receive 3.4 GHz, the LO frequency should be chosen to put the IF in the 900 MHz (33cm) band. LO = RF - IF = 3400 - 900 ≈ 2500 MHz. The HMC213 mixer should be used. I measured it's conversion loss at about -11dB. The Hittite spec. is -8dB nominal. The generic preamp used for 23 & 13cm is not suitable for the 9cm band.

Up Converter

The same components can be used to up-convert ATV signals (or others) from < 1 GHz to the microwave bands. A typical example would be to generate a VUSB-TV signal in the 23cm or 13cm band. An excellent source for a VUSB-TV signal are the analog modulators used in older cable TV systems and closed circuit TV systems. See Fig. 8.

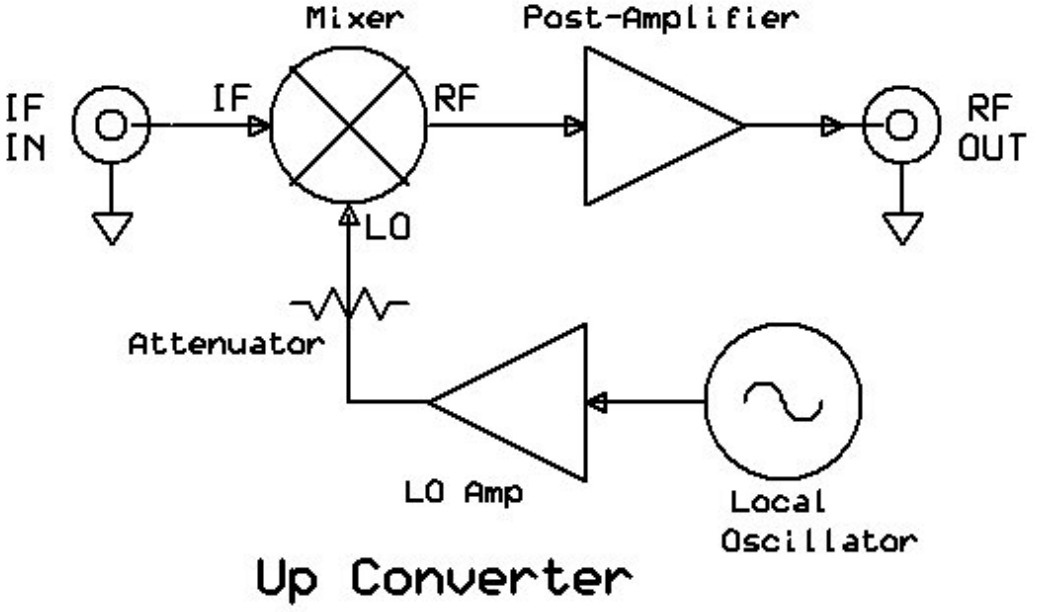


Fig. 7 Block Diagram for an Up-Converter

Fig. 8 CATV analog VUSB-TV modulator

CATV modulators from firms such as Pico-Macom, Drake & Holland cover all of the cable TV channels from 50 to 850 MHz. They typically cost about $125 for a single channel unit and $175-$225 for units which will cover all CATV frequencies. Used units can be obtained for even less money on E-Bay. A commercially available, 23cm up-converter built according to this block diagram is the KH6HTV Video model 23-6. It has additional band-pass filtering.

Whereas a down-converter is used to receive very weak signals, an up-converter is typically used for medium level signals that will be further amplified to higher power levels in a transmitter. In this case, the LO amplifier and the Post-Amplifier will be the same type amplifier. For the proto-type system shown in Fig 7, the generic amplifier has 20dB of gain and +20dBm max. output power.

For linear operation, it is important to keep the input power to the IF port low enough such that the RF output from the mixer is well below the -1dB compression point. The -1dB compression point occurs typically for an input about -3dB below the LO drive power level. Fig. 9 shows an example of using the prototype system of Fig. 5 to up-convert a 70cm, 421.25 MHz VUSB-TV signal to 23cm, 1241.25MHz. Again, the LO was set to 820 MHz. The up-conversion gain is +13dB. (mixer loss + amplifier gain = -7dB +20dB = 13dB)

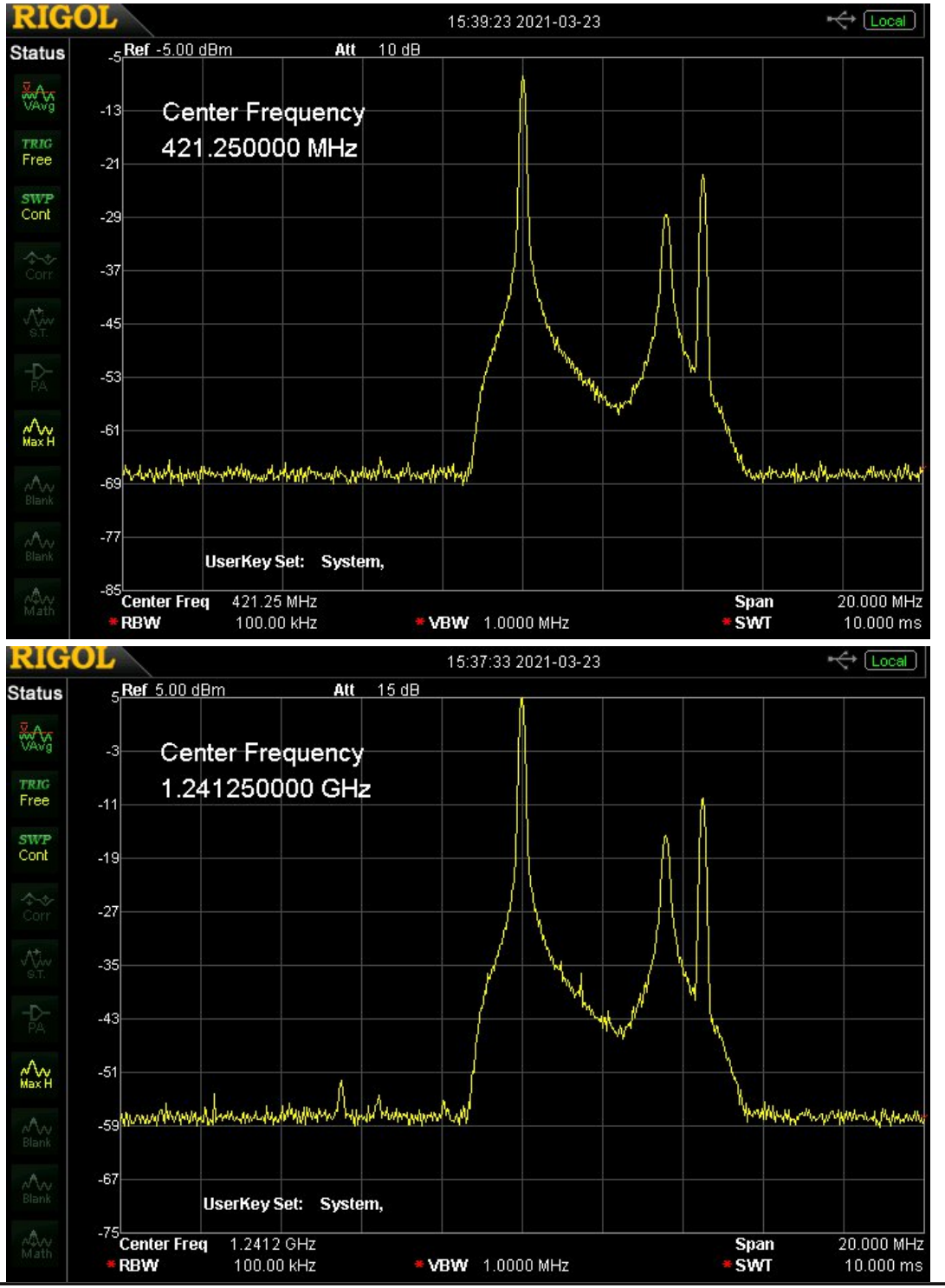


Fig. 9 (Right) Up-Conversion of VUSB-TV signal from 70cm band to 23cm band. Top photo is IF input at 421.25MHz. Bottom photo is RF output at 1241.25 MHz. 20 MHz span, 8 dB/div & 2 MHz/div. The video test signal was NTSC color bars. The up-conversion gain is +13dB

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

Grass Valley Mixer Conversions - Part 28

Written by Trevor Brown, G8CJS and Mike Stevens, G7GTN

Since the last issue everything has gone quiet, so I assume everybody is happy. Personally I am delighted that my panel powers up runs, has no bugs and has done this on every occasion over the last month.

The software self-starts and the USB connection to the PC is only necessary for it to work with Vmix. The 19V laptop PSU provided the power and makes for a simple two connection unit power and USB.

The T-Bar has a good feel and it's a pleasure to see it working Vmix. The remote pan and tilt of my web cam is possible, yes it adds another couple of connections, two mini jack plugs, but its brilliant to be able to joystick control it.

The auto focus sometimes lets me down, but it's an old camera that came out of my junk box and I am sure there are better, more responsive units, around and we cannot blame any camera shortcoming on the GVG panel. It was just a spin-off from finding out how to connect the two and put the code in place. This is beyond my wildest dreams when I started this project, which really only came about from a loft clearance that produced the panel.

The code ANNEX is I know a little unusual, but I think if we want to call ourselves engineers, we need to have a grasp of both software and hardware and as long as I can write text on the screen that delivers the necessary control over the I2 C bus at least I can bask in the title, or at least muddle through and make something work.

The panels were available on eBay when I started this epic, but they seem to have now dried up. I am sure that's not because of my articles, just they are old and unfortunately a lot of old kit gets broken up without any investigation as to if it could be reused. Sometimes that might be a wise decision, but Grass Valley always stood head and shoulder above other manufacturers in both construction, design and delivering what the customer actually wanted, when so much broadcast kit fell at that last hurdle.

Just as I started to write this article another Grass Valley panel appeared on eBay! It was a GVG100 but looks in particularly good condition and the seller lives in Bridlington in the UK. There are always panels available in the USA, but they are not cheap and to import one would almost double the cost.

I did put the details up on the CQ-DATV Facebook page, and as the CQ-DATV magazine closes for copy there were no bids, but so often with eBay, everyone bids in the last few minutes. *https://tinyurl.com/sj85bjef*

I have to say it looks very smart has all the button tops present (my own is missing one of the Preset Background key tops)

So where do we go from here? I suspect this is the end of the column. I have included all the circuit diagrams, the Annex BASIC software, and the Arduino programming in the GVG 18 download. So if at a future date someone comes across a panel, providing our download site is still flying, the information to get it working and controlling Vmix is available.

Was it a good project? Well I would like to think so, the panels cost extraordinarily little to convert and they then double as a control surface for Vmix these are not cheap? Could it do more? Well Ian Morrish in New Zealand has already been using the CQ-DATV PCB to control an ATEM so let's see if something pops up from the Southern Hemisphere in a future edition.

It won't stop me tinkering with the software. I have a few things I would like to explore and one of them is to make the software self-configuring for the port chips (remember there are two series PCF 8574 and PCF 8574A with different I2 C addresses) . The software has a built-in scanner for the i2c addresses, but these then need entering into the statements at lines 17, 18,19. I suspect it's not beyond the wit of man to make this happen automatically.

This would then mean that the D1 mini could be supplied pre-programmed and it would not matter what port chips are fitted. You would not need the software editor, it would be just plug and play or should that be populate the PCB and play. I also have a couple of switches on the GVG top panel that can select Key1, Key2 and DSK along with editor enable and a select copy function. These have not been programmed and I would like to investigate and implement them; I will be looking into this.

As I said at the start of the world's longest running video project, I am working on the panel and documenting my progress each month, rather than just presenting the usual here it is and this is what it does, style of article. I started using ESP BASIC, I changed to ANNEX. There was no PCB, everything was on a breadboard that often required a brain switch from software to hardware to find the problem.
My thanks go to Mike G7GTN who produced the MK1 PCB which took the strain of the breadboard and under him evolved into the MK2 PCB with the Arduino and onboard regulators. With that I will close the longest running video project that has appeared in this or any TV magazine. My thanks also to the beta testers and all the PM message writers that have kept me motivated and at one point, sane. Together we have triumphed, and I am sure this will not be that last project CQ-DATV readers tackle.

I also hope that this series of articles might encourage others to look at these small, very reasonably priced micros that are appearing and get to grips with writing code for them. Both hardware and software can be engineered to work together. They compliment each other and we should be able to explore both worlds and not be afraid of the challenges they present.

Stop Press

The Bridlington Grass Valley 100 mixer sold on eBay for £75, just the one bidder, but I have no idea if its been bought by one of our readers. It would be really nice if that was the case.

Ian Morrish now has the CQ-DATV PCB controlling the Black Magic ATEM video switcher. Ian also has his panel and interface running from 9 volts with the panel +5V internal regulators powering the standard LED's that he inserted in place of the lamps. As a result Ian's PCB interface board only requires the 5V regulator.

The Grass Valley lamps currently sell on e-Bay for £46.89 for 10, *https://tinyurl.com/yudk2btm* so a worthwhile modification, particularly if you have some faulty bulbs.
Ian is working on bringing the T-bar out of the panel as an analogue signal so he can connect it to the Arduino analogue input to get 10-bit resolution.

Using the GVG digital output as I have done, limits it to an 8-bit word.

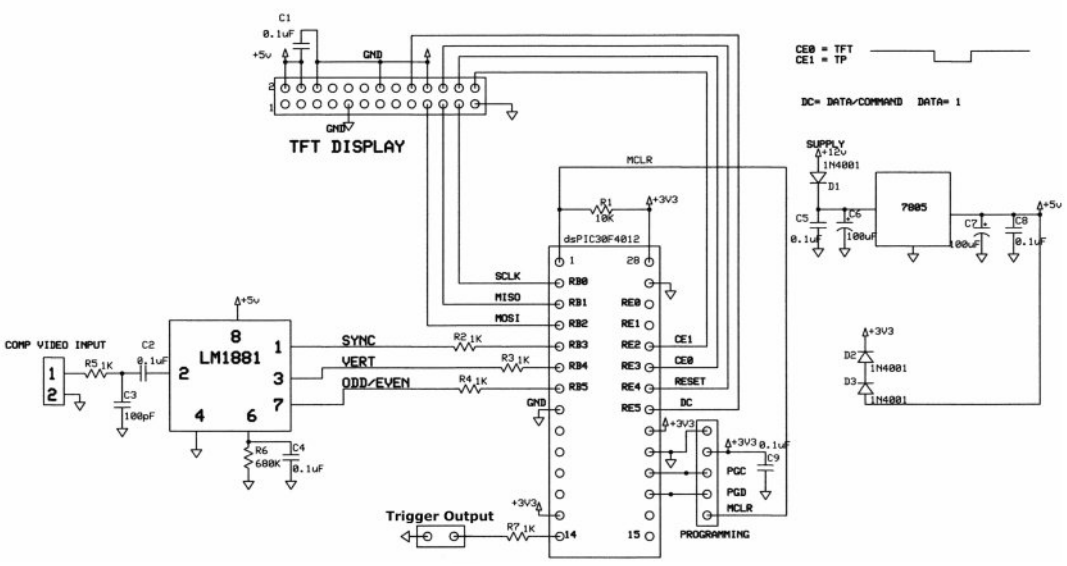
John's new 'scope

Written by John Hudson, G3RFL

Yes, I know oscilloscopes have been around a long time and we all have one and know how to use it, but they are changing gone is the tube, which used to produce dim images when you strobe out the VITS, gone the huge footprint that took up half the work bench and all the other problems welcome to the new age of solid-state oscilloscopes. The one I bought, well I say one I actually bought two (don't ask) is the Daniu ADS 1013D digital sampling scope costing less than £100 and it's double beam if that the right word for this new world of oscilloscopes.

No Need for tedious manual adjustment, one button automatic adjustment, built in fuzzy control algorithm, high adjustment accuracy, the adjusted waveform appears in the centre of the screen (when dual channels are activated, the channel one waveform is in upper half centre). It only takes to less than 1 second to automatically adjust the 1v peak to peak signal, a typical desk top oscilloscope takes about 5 seconds. The larger the measured amplitude the shorter the time required for adjustment. Both sets of inputs channels have built in high voltage protection modules which can tolerate up to 400V input. Don't worry about the oscilloscope burn out accident caused by not measuring the high voltage probe without moving the probe to the 10x position.

I mostly only used my old scope for video work, so I put this this scope through its paces, and yes, its brilliant but it not too good a strobing out single TV line. Now not too far back in time I am sure we have all built scope trigger units that enable you to select pre-set TV lines. I wanted to revisit this technology but in a high tec way. No TTL counter and thumb wheel selectors I went for a simple LM1881 sync separator and a PIC that could emulate all the counters in software and instead of all the old thumb-wheels I added a touch screen display to allow the line to be chosen, no thumb-wheel groves in your fingers any more.



The scope does not have an external trigger, but you could connect my line selector to input 2 and trigger from that and use it as a single beam device. The software is still evolving as I add features, but it works in harmony with the ADS1013D beyond my wildest hopes. I am sure you are all familiar with programming a PIC and I have put the programme on the CQ-DATV download site. If you are not up to speed drop me a line via the cq-datv editor email address *editor@cq-datv.mobi* (it's not my title, but it will be forwarded). Construction was simple I home etched a simple single sided PCB (some of us still remember how).

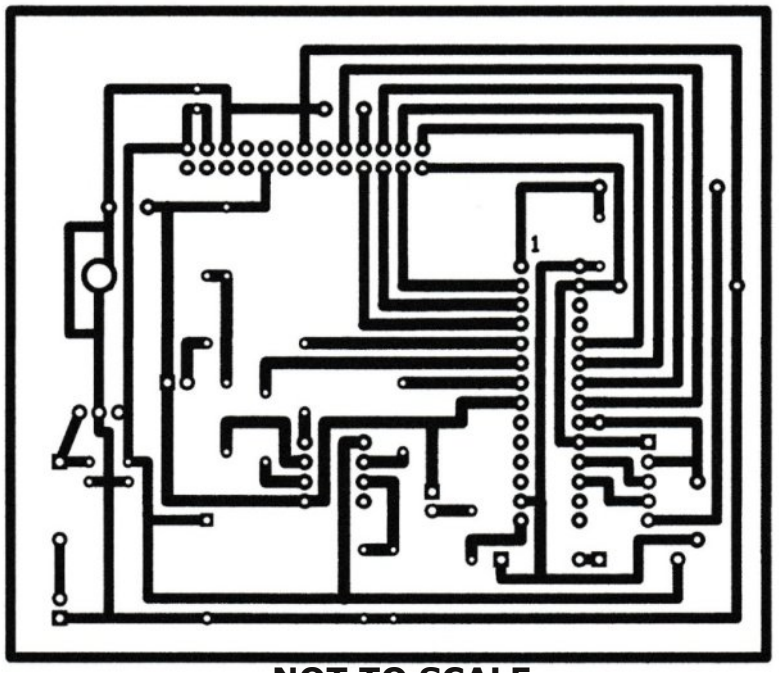
This is it strobing out my VITC (Vertical Interval Test signal), remember its digital sampling and storage in RAM, not storage on the CRT where the phosphor is getting dim by the time it refreshes every 20MS. Line strobing is just as bright as normal scan where every line sits on the top of every other line. The luminance staircase shows up well all the steps are the same amplitude. The addition of a spike filter might remove the horizontal parts of the staircase and just produce the vertical risers so they can easily be amplified and compared, I might give that some though for a later article. The Chroma and the burst could benefit from a high frequency sampling, but this is a sub £100 unit.

In both systems, line numbers 17 and 18 are assigned for VIT signals in each field. (These line numbers are used just for the first field. For second field, they correspond to line 280 and 281 in system M, and line 330 and 331 in system B.) Usually the following test signals are used:

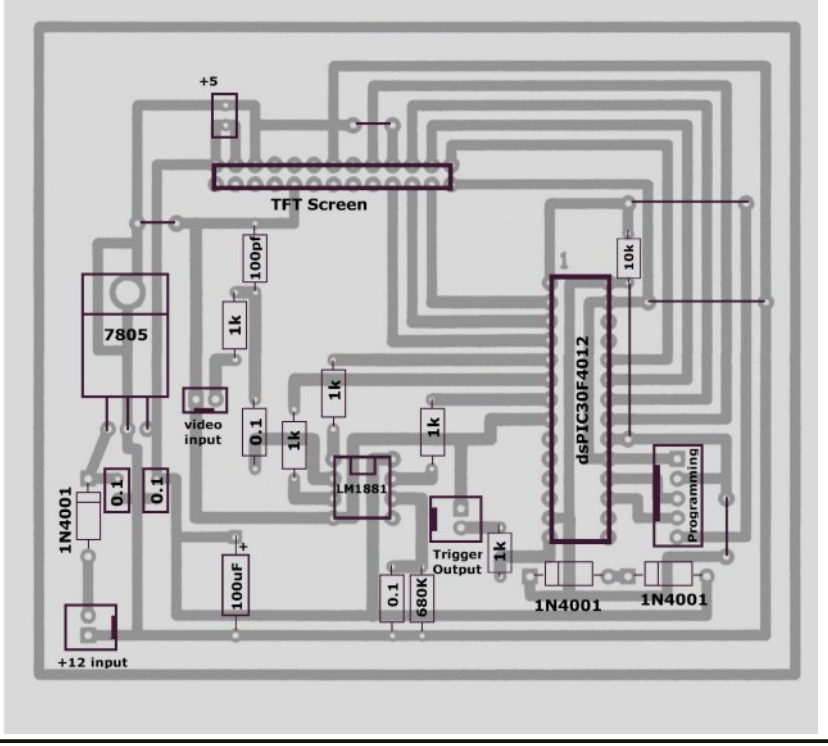
- *Luminance bar (low frequency tilt)*
- *2T signal (Overshoot)*
- *20T signal (differential gain and phase)*
- *Staircase (luminance linearity)*
- *Group of sine waves with different frequencies (video characteristics)*
- *Color carrier superimposed on staircase (differential gain and phase)*
- *Group of color carriers with different amplitudes (intermodulation of luminance and color)*

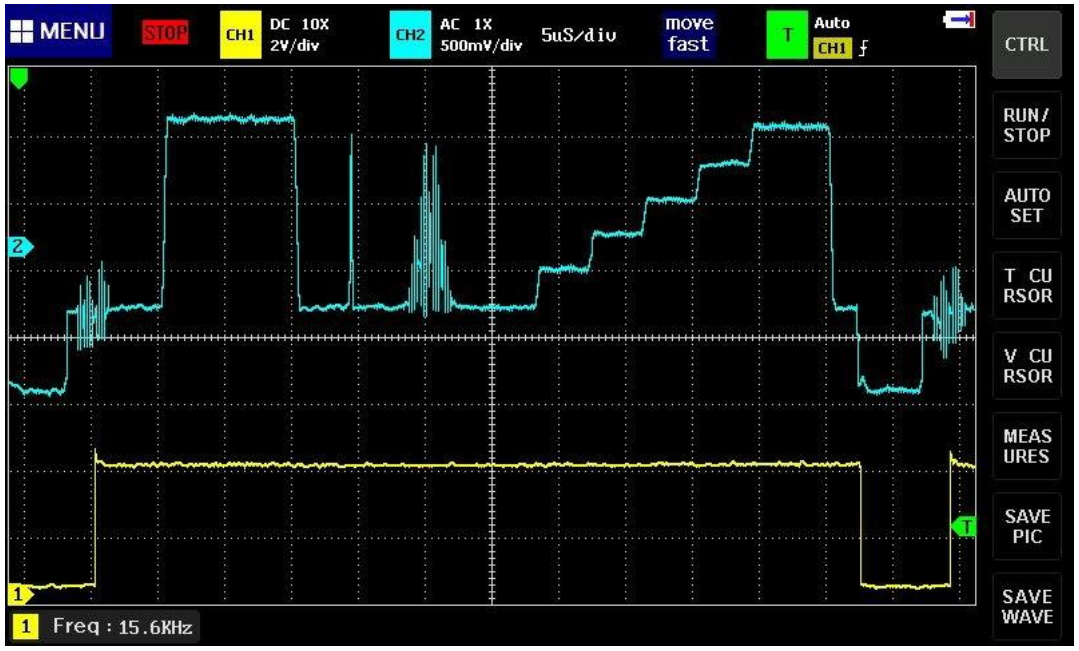
If we expand the horizontal time base, we can see the 10 cycles of colour burst and its position on the back porch.

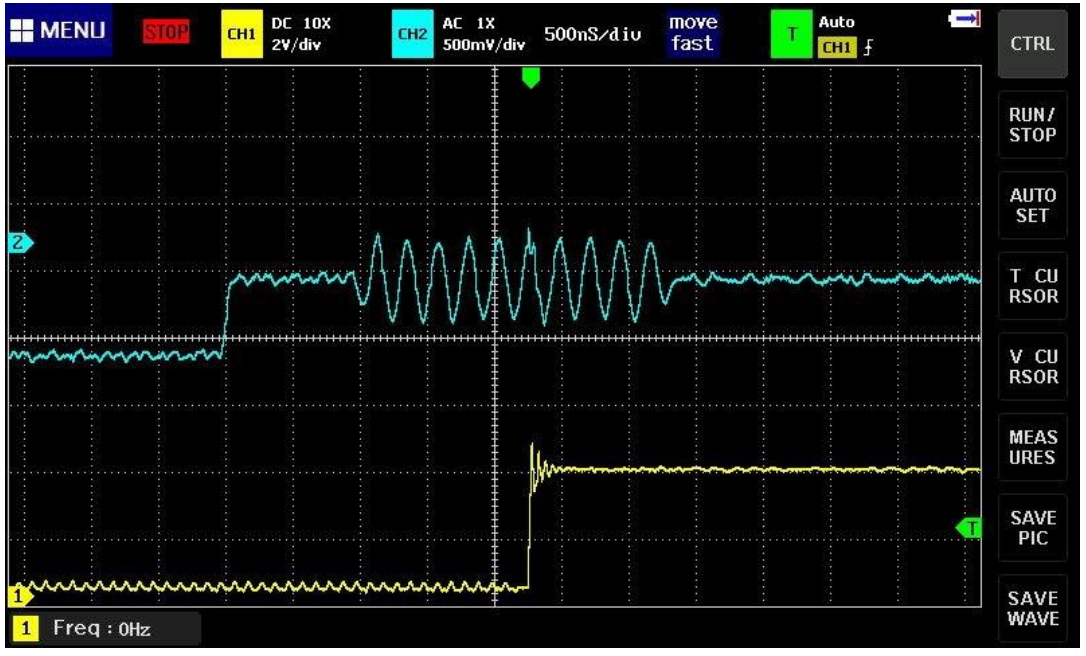
Not too bad at the vertical interval, you can see the eq pulses the broad pulses and identify the odd from the even field all at full display brightness. The bottom yellow trace shows the triggering pulses provided by the line selector.



NOT TO SCALE



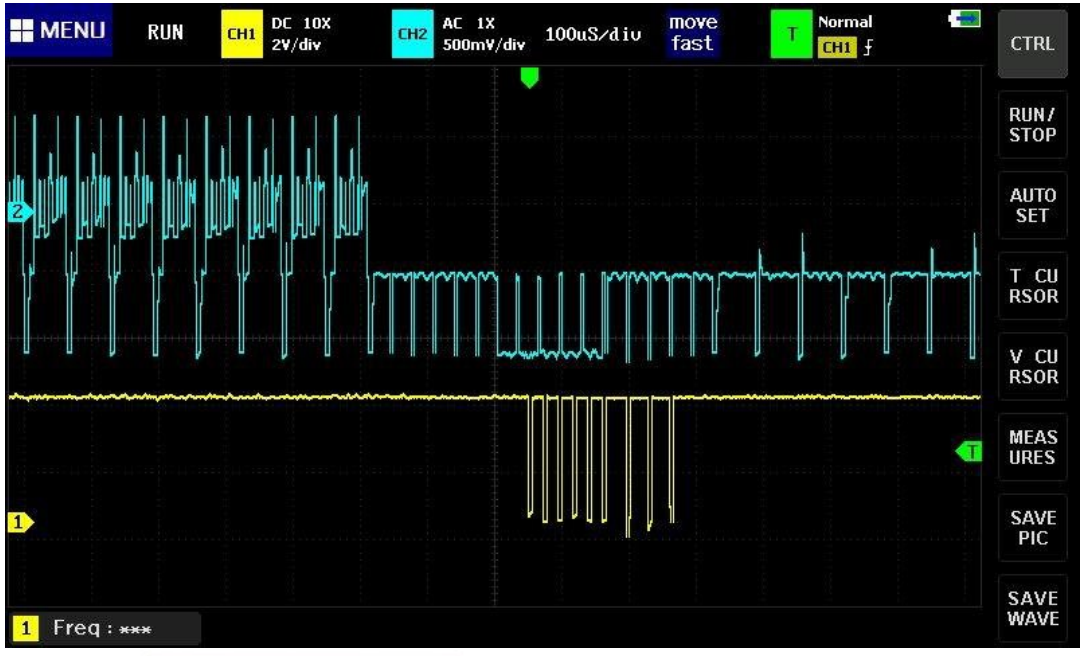




As video companion to show up tilt, on linearity and vertical triggering problems it is a really useful item and takes up so little desk space.

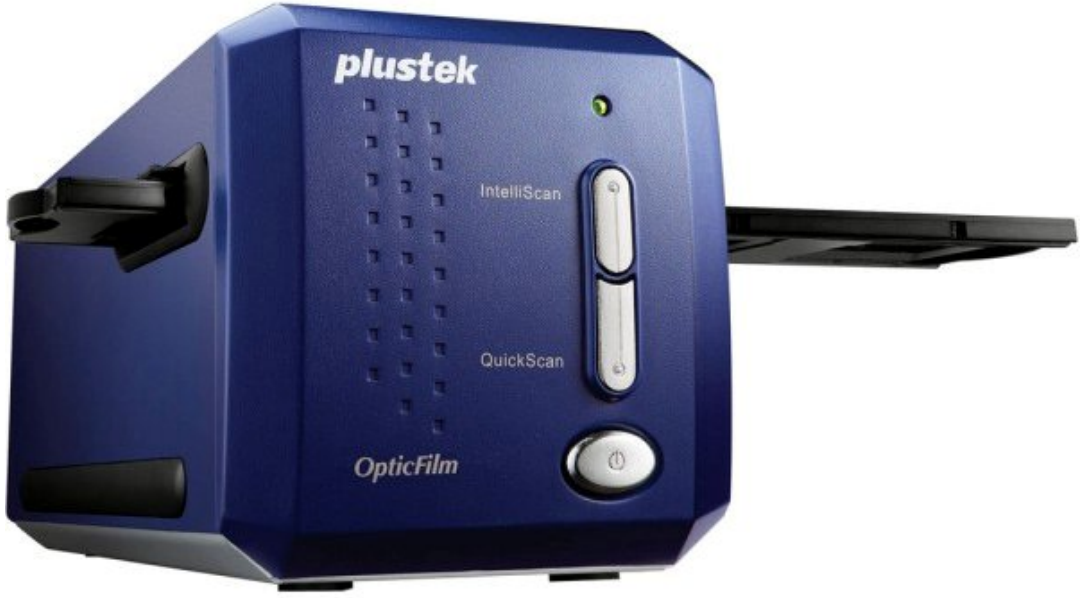
If I need to look in high frequency problems egg local oscillators and such yes, I still have my trust CRT based device, but I find I am using it less and less and have really taken the very clever responsive unit and at sub £100 what more can I say.

Yes, the trigger unit really adds to it and delivers better strobing and storage of TV waveforms than the trusty old CRT which is actually getting quite dim these days or is that just my eyes coupled with my age.



From the vault - Microcord

Written by Trevor Brown, G8CJS



One of my many lock-down projects has been going through the family archive of negatives, remember those funny pieces of plastic that came back from the chemist along with your pictures, well of course we all now want electronic images that we can share on social media.

To that end I now own a Plustek dedicated film scanner with 7200 dpi optical resolution that works for both slides and negatives. It has two slider carriers, one for positive slides, and another for 35mm negatives. You can bodge some of the older formats, 126 and 127 into the 35mm carrier but it is a fiddle. What you cannot scan is the older 120 film that is most often used to produce 2 1/4 square pictures.

Yes I am going back in time to my Microcord camera which I still have and was second-hand back in the 70's when I bought it, so for the time being these negatives are on hold unless somebody out there has found a solution.

What does turn up is the odd ATV picture in-between the children growing up and me growing older, gradually loosing hair and going grey. Who was it that said "Youth was wasted on the young"!

Scanning produces a picture in about 30 seconds and you can colour correct and fine tune, or in some cases coarse tune the exposure. Poor lighting is less correctable and out of focus, well you are definitely stuck with that.

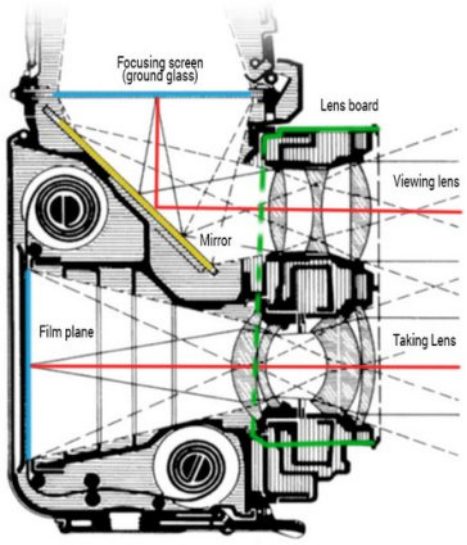
Once you have this sorted you can instruct the Plustek to scan the image in more detail, correcting noise and filling in blemishes. This is a multi-scan process including an infrared scan. It can take up to 3 minutes and if you are not happy with the result, you can adjust then rescan with different settings to change the outcome.

The final result can be one of several formats, I usually go for jpeg, but if I need a better result for something that will end up in a picture frame. I can scan as a TIFF and then go over it in Photoshop with the more advanced tools like clone pen and spot healing.

The picture shows Bob Platts G8OZP waving a dish at I think

Harlaxton and the other, well answers to editor@cq-datv.mobi. Sorry no prizes other than the honour naming the unknown celebrity with all the ATV kit and probably in need of a push start to get the car moving again.

Another problem with the Microcord negatives, apart from their size, is the difficulties that occurred when I took the pictures. It's a twin lens reflex camera and these cameras have a viewing lens and a lens to project the picture onto the film.



Both lenses move together for focus, but have slightly different view points - ok for things distant from the camera, but for taking pictures of ATV contacts where the camera is near to the TV receiver then the different views can spoil the picture e.g. cut off the part you really wanted to see!

Focus is also a problem as the camera was not expected to be used to photograph things near to the lens so won't focus. I used to get around this with a dioptre lens which moves the focusing nearer. I only had the one so it was put is in front of the viewing lens, set the focus and then move it to the photographic lens and take the picture, sometime it worked other times not.

It did win out on the type of shutter as it did not produce the strobing that is associated with focal plane shutters which are the staple diet of the later Single Lens Reflex (SLR) cameras. At fast shutter speeds they become a travelling letter box across the screen which plays havoc with TV pictures.

But when I get the rest of ATV pictures into electronic format I will post them in future issues.

Ian P comments

On reading this article from Trevor it brought back memories of a holiday to Greece I took in the early '70s when I lugged a Mamiya C330, with lenses and other bits and pieces, in an aluminium flight case all around the country.

The C330 was an 'improved' version of the C220. Some of the differances are that the 330 cocks the shutters on the lenses when the film is advanced. On the 220, the shutter has to be cocked separately. Also, the 330 has a large crank for film advance, the 220 has a knob, with a small fold out crank.

The 220 is lighter in weight. The 220 does not take interchangeable viewing screens, the 330 does. There are also other minor differences. They both take all the same lenses. Somewhat usefully the 330 series has a floating parallax indicator.

The most useful accessory was the prism viewfinder that enabled you to take pictures at eye level rather than having to look down into the camera viewfinder at waist level.

I still have the colour slides that I took. The problem I found with trying to convert them to digital was the they had to be removed from their mounts to enable proper scanning.

See images next page.....


MAMIYA C220


MAMIYA C330
Professional f


MAMIYA C330
Professional f


MAMIYA-SEKOR
1:4.5 f=55mm
No.26058
MAMIYA-SEKOR
1:2.8

External links

If you have an eBook reader that does not have WiFi then you will not be able to use the hyper-links in this publication. If you have an eBook reader that has WiFi then you will be able to providing you are in a WiFi zone.

But if you have a Kindle 3G then yes, but only to Amazon, and there is not a lot of ATV material on their site.
Smart phone reading apps are ok providing that you have a 3G data connection.

Note: These links will fire up your devices browser and if you are using 3G/4G then you will incur data usages charges.

Legal Niceties (*the small print*)

E&OE. Whilst every care is taken in the production of this publication, dotMOBI accepts no legal responsibility for the advice, data and opinions expressed. dotMOBI neither endorses nor is it responsible for the content of advertisements or the activities of those advertisers. No guarantee of accuracy is implied or given for the material herein. dotMOBI expressly disclaims all liability to any person in respect of anything and in respect of the consequences of anything done or omitted to be done wholly or partly in reliance upon the whole or any part of this publication.
As the regulations for the operation of radio frequency equipment vary in different countries, readers are advised to check that building or operating any piece of equipment described in dotMOBI will not contravene the rules that apply in their own country.
All copyrights and trademarks mentioned in this publication are acknowledged and no infringement of the intellectual copyright of others is intended.

Copyright

Notice to Contributors

Authors are alone responsible for the content of their articles, including factual and legal accuracy, and opinions expressed by them may not reflect the editorial stance of the publication. Material submitted to dotMOBI should not infringe the copyright of other writers or bodies.
Contributions are accepted for publication on this basis alone.
dotMOBI publications - *https://cq-datv.mobi*

Author Guidelines

CQ-DATV welcomes contributions from our readers. It does not necessarily have to be on ATV, as long as it is of interest to our readers.

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.

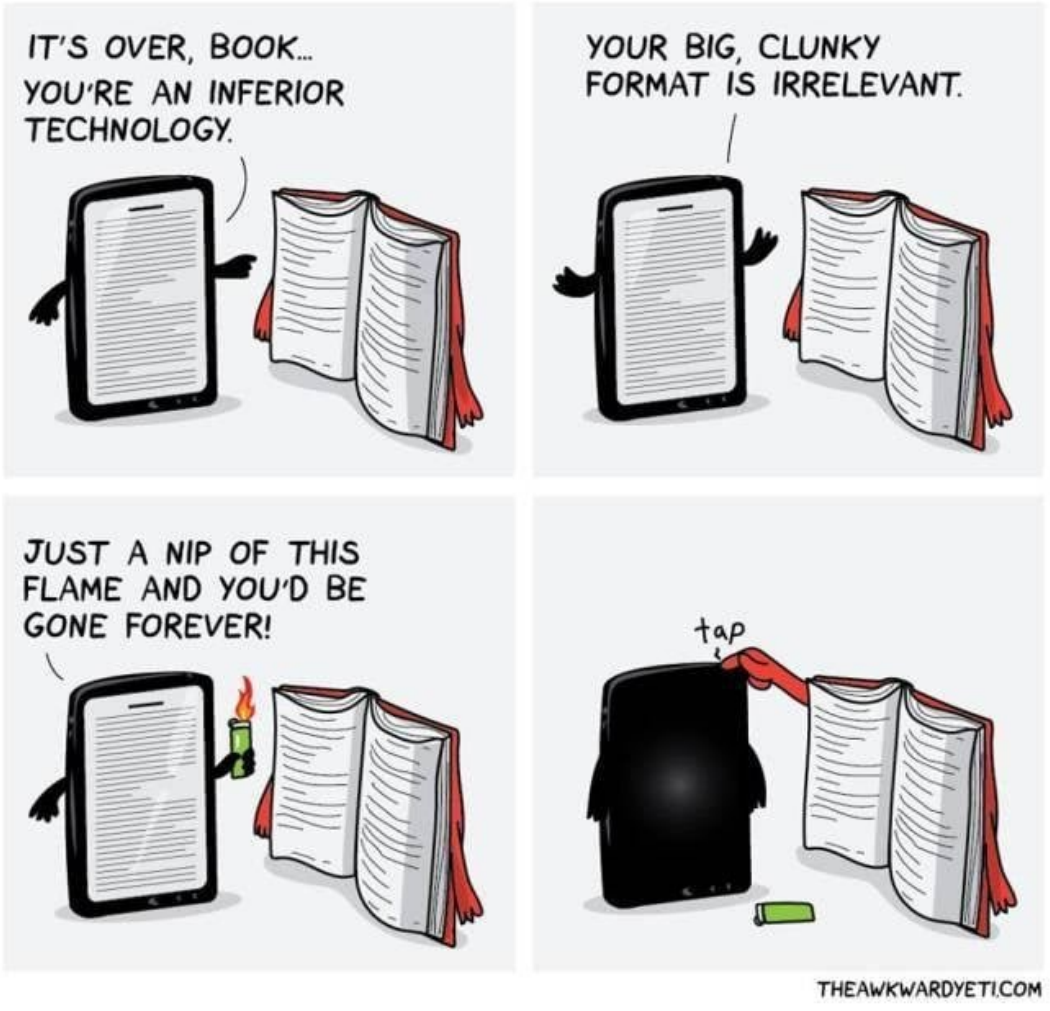
Images should be in PNG format if possible and the best quality available. Do not resize or compress images, we will do all the rework necessary to publish them.

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.

Is this the latest issue of CQ-DATV? *Click here* to go to our web site to check to see if there is a later edition available.

CQ-DATV is published on the last day of the month. The cut-off day for submissions/corrections/alterations is 5 days before the day of publication.



Please note that this mailing list is only used to advise interested people about the availability of new issues of CQ-DATV magazine. The list is not, and never will be, shared with any other organisations.

Want to be notified when issues of CQ-DATV are published? Join our *mailing list*.