In this issue

DATV News.....2
Editorial..... 5
DATVtalk13 – DatvExpressServerApp.....7
A Home Constructed 2M Transceiver..... 14
CAT15.....18
Colour Test Card Generator Software 19
HDMI Made Easy: Converters..... 29
Stand Alone SSTV for the Raspberry Pi.....37
Samsung NX 500 and non-Samsung Lenses..... 39
Skills Test, a Puzzle.....44
RF Breakout Kit for the Raspberry Pi..... 45
DATV Session Report (part 2)..... 48
How to Use a Testcards Features..... 51
Information.....53
Coming up in CQ-DATV..... 54

Production Team

Ian Pawson - G8IQU Trevor Brown - G8CJS
Terry Mowles - VK5TM

Contributing Authors

Trevor Brown - G8CJS
Ken Konechy - W6HHC
Witold Kaczurba
Noel Matthews - G8GTZ
John Hudson - G3RFL
Klaus Kramer - DL4KCK
Brett Li
Richard Russell - G4BAU

DATV News

2015 ARRL/TAPR DCCThe weekend of the 15th 16th of August saw Tom w5kub.com at the Huntsville Hamfest.

The live webcast of the Huntsville Hamfest began Friday, August 14th at approximately 8:00 AM CT (1300 UTC Friday) with Tom's 3.5 hour drive live from Collierville, Tennessee to Huntsville, Alabama, to Von Braun Civic Center.

TheHuntsville Hamfest officially began Saturday at 9:00 AM CT (1400 UTC) and ended at 4:30 PM CT. and continued Sunday at 9:00 AM CT and ended at 3:00 PM CT. followed by a return 3.5 hour drive home.

The young lady is Anna Veal W0ANT, young HAM of the year.

Forty-three prizes were awarded to random participants in the chat room during the hamfest. The prizes included a wide range of products including Yaesu handi-talkies and MFJ antenna analyzers, just to mention a few!

The Young Ham of The Year awards was also webcast Saturday afternoon from Huntsville Hamfest. The award program was sponsored by the Los Angeles, California-based Amateur Radio Newsline™ with corporate support from Yaesu USA Corporation of Cypress, California, CQ Magazine of Hicksville, New York, and Heil Sound of Fairview Heights, Illinois.

Is free electronic publishing the future? Well we are not alone and as they say, there is safety in numbers.

DATV News

On August 7th, DKARS will have been running for its first year and, like CQ-DATV, they are also providing a free magazine.DKARS (Dutch Kingdom Amateur Radio) is dual a language (Dutch and English) it's a cracking read and not to be missed.

Get your copy from:-
http://downloads.dkars.nl/DKARS%20Magazine%20201508.pdf

Your drone flight might be illegal!

Drone flying laws in the US won't be defined until 2017, which means that some commercial drone flights might be illegal. See:- http://goo.gl/uqoZ2d

The JARL Ham Fair 2015 was held at Tokyo Big Sight, Ariake, Tokyo on August 22nd (Saturday) and 23rd (Sunday)

CQ-DATV dotMOBI

Like us on Facebook

2015 ARRL/TAPR DCC

DoubleTree Hotel Arlington Heights, IL - October 9 - 11, 2015

The Digital Communication Conference is the premiere annual Digital Conference covering all Digital Modes & Techniques including Data, Voice & Television and SDR.

The DCC has two full days of Technical presentations on Friday & Saturday, concurrent Introductory forums on Saturday, a Saturday night Banquet with a Guest Speaker and a Sunday morning Seminar deep dive into a technical subject.

There are also Friday & Saturday Lunches and a Friday Night Social.

Those who have submitted a Technical Paper to be included in the Conference Proceedings have priority to present a presentation during the Technical Forums, however if you didn't submit a technical paper and want to present a Technical or Introductory presentation please contact the TAPR Office at: https://www.tapr.org/inforequest.php

The 2015 DCC will be held at the DoubleTree Hotel in Chicago northwest suburb of Arlington Heights not far from O'Hare airport with a free hotel shuttle to O'Hare.

Be sure to register for the DCC and reserve your hotel room early.

The DCC Early Bird Pre-Registration Discount ends on September 19th. DCC Registration is available at: http://www.tapr.org/dcc#registration

The DCC Hotel Special Rate ends on September 15th. DCC Hotel Information is available at: http://www.tapr.org/dcc#hotel

Look forward to your participation in the DCC.

Editorial

First of all welcome the USA's new ham of the Year Anna Veal (15) who now holds the call sign W0ANT, she was interviewed by W5KUB on his webcast from the Huntsville Ham feast and also on the is month's Ham Nation webcast, always good to see some young blood entering the hobby.

Also the DKARS has celebrated its first Birthday on August the 7. For those of you not reading their monthly e-publication magazine we have only one question why, its free and you can download it from:-
http://www.dkars.nl/index.php?page=algemeen

The team here at CQ-DATV would like to pass on their congratulations to both Anna Veal W0ANT and the editorial team behind DKARS.

Not to be outdone CQ-DATV is still going strong and we would like to welcome you to issue 27. Our download counter is fast approaching 112,000 and we keep signing new people every day to our Facebook site.

In this issue Ken has produced DATV talk issue 13, (unlucky number for some) we hope that does not reflect on the success of his project, getting a webcam to work through windows and into his DATV express transmitter.

Klaus Kramer, DL4KCK *www.agaf.de* has produced part 2 of his report from Friedrichshafen.

John G3RFL has been working hard on making a home built 2m Transceiver, based on the low cost Dorji modules and has come up with a design driven by a PIC micro controller and constructed on a simple single sided home etched PCB.

Richard Russell G4BAU has also produced the second part of his programmable electronic test card

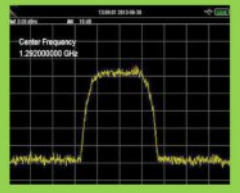
Trevor G8CJS has been digging further into the Samsung NX 500 camera and is experimenting re-using an old Olympus OM1 Lens on the this very modern camera.

Plus lots more so on behalf of the CQ-DATV editorial team, welcome to CQ-DATV 27.

The CQ-DATV Production team

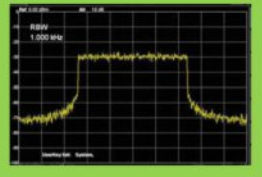
Digital Amateur TeleVision Exciter/Transmitter

now available from



DATV-Express

- A more affordable DATV exciter can now be ordered
- Fully-assembled and tested PCBA
- DVB-S protocol for DATV (using QPSK modulation)
- Can operate all ham bands from 70 MHz-to-2450 MHz
- RF output level up to 10 dBm (min) all bands (DVB-S)
- Software Defined Radio (SDR) architecture allows many variations of IQ modulations
- "Software-Defined" allows new features to be added over the next few years, without changing the hardware board
- As extra bonus, the team has been able to get the board to transmit DVB-T 2K mode, however we cannot guarantee the performance of that protocol. Caveat Emptor!
- Requires PC running Ubuntu linux (see User Guide)
- Price is US$300 + shipping – order using PayPal



For more details and ordering

www.DATV-Express.com

register on the web site to be able to see the PURCHASE page

TV Amateur is a German Language ATV Magazine It is published 4 times a year and if you would like to subscribe go to http://www.agaf.de/

DATVtalk13 – Webcams and UDP and DatvExpressServerApp on Windows

by Ken W6HHC
Reproduced from the Orange County Amateur Radio Club newsletter. *www.W6ZE.org*

[*Please Note – This is the thirteenth article in a series of DATVtalk articles to introduce Digital-ATV to hams and to explain various aspects of this new area of ham radio. In the CQ-DATV5 issue, the DATVtalk02 article was an introduction article about basic Digital-ATV.*]

Ever since December of 2014, I have been interested in using a web camera with DATV and the DATV-Express exciter board instead of my trusty-but-old NTSC video camera. And for a very long time, the entire DATV-Express project team has wanted to avoid using Hauppauge video-capture units to perform MPEG encoding. Another "wish list" item asked for by hams using DATV-Express board is to be able to send video stream to the board over ethernet or internet. Finally, many hams who want to use DATV do not want to learn how to use Linux…they like the Windows operating system.

This article describes progress that has been made in all four areas mentioned above.

Testing UDP feature without Express_Server

The current DATV-Express software has been implemented with the desire to choose an UDP IP address for the video source that is sending a stream to the CPU running DATV-Express. See Figure01 for the HW-Tab setting that is planned for this feature. The first set of tests that I tried sent UDP packets with video and audio stream over WiFi from a Windows PC to ODROID configured for UDP video source. I could NOT get this set-up to work.

Charles G4GUO encouraged me to abandon this configuration for now and start testing the Express_Server code installed on ODROID U3

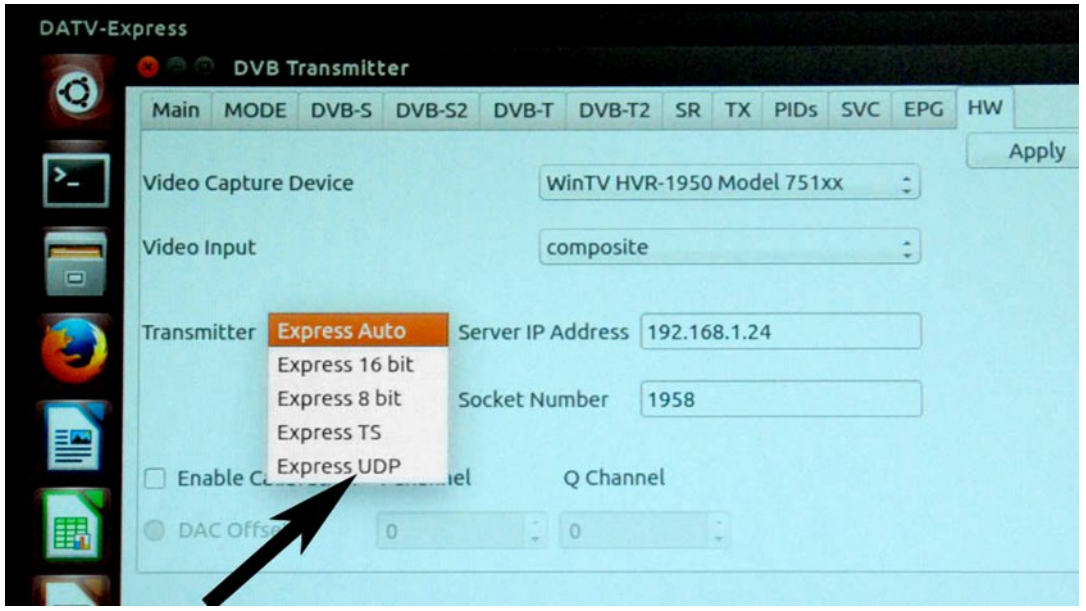


Figure 1 – HW Tab in DATV-Express software GUI has setting planned for UDP stream

Testing UDP feature using Express_Server

The Express_Server software was written by Charles G4GUO to better control the receiving of UDP packets by the computer connected to the DATV-Express transmitter board. In this test set-up shown in Figure02, A Windows computer has a LogiTech web camera attached and running software called GraphStudioNext to encode the webcam video and use a another piece of software called MajorUDP-Sender to aim the UDP packets to the IP address of the ODROID U3 computer.

The ODROID computer is running Lubuntu OS, has the Express_Server software installed and is connected to the DATV-Express transmitter board by USB.

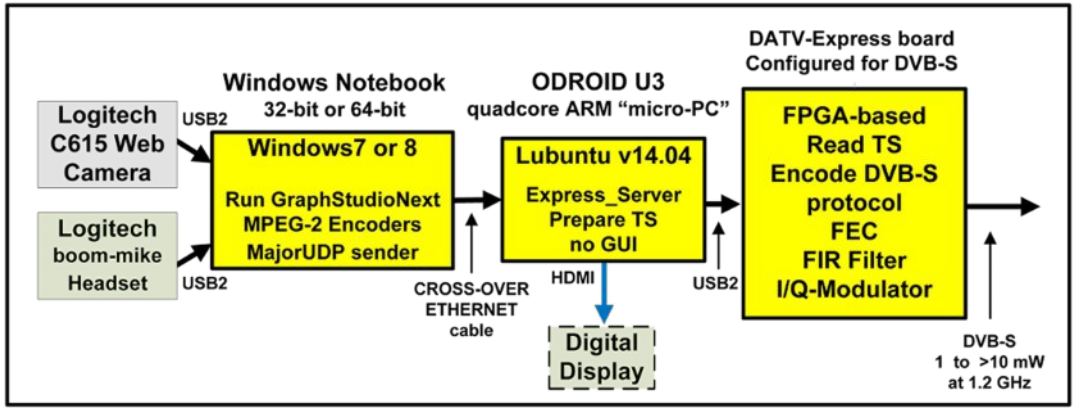
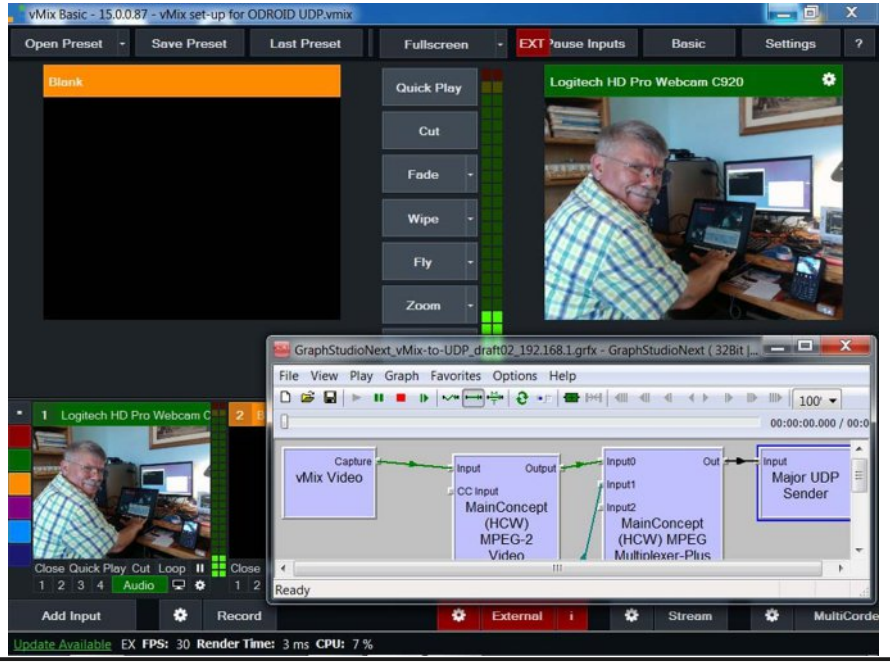


Figure 2 – Block Diagram for sending LogiTech web cam video by UDP to ODROID running Express_Server

The first testing configuration I tried with the Express_Server software used a LogiTech model C920 webcam, a video-editing software called vMix, encoders configured in a DirectShow Graph called GraphStudioNext installed on a Windows7 notebook computer (see Figure03). My initial tests tried to use my home WiFi between the Win7 notebook and the ODROID computer.



There were two areas of problems with this first testing configuration that I tried on the Win7 computer:
1. The LogiTech model C920 webcam outputs video that has already encoded using H.264 video compression (aka MPEG-4). Initial tests showed close to 12 seconds of latency delays to receive the video on my receiver. When I reported my C920 results on a DATV internet forum, Jean Pierre F6DZP reminded me that my test set-up was forcing the Win7 computer to first decode the H.264 video stream back to a non-encoded stream and then finally using GraphStudioNext to encode to the MPEG-2 standard. F6DZP recommended that I try using an earlier non-H.264 webcam.

2. The free video editor I was using, vMix BASIC SD (Standard Definition) model, was nice (even allows "green screen" magic) but added a level of complexity that I did not really need. It turns out that Charles had used it in one of his testing set-ups only because it was an easy tool to use to overlay his call letters on top of the video stream…to use during a DATV contest. But vMix added some operational complexity and also prevented me from controlling directly the source-filters settings for the LogiTech equipment.

The next Win7 testing configuration I tried with the Express_Server software was to change the webcam to an older LogiTech model C615 that I owned and to eliminate the vMix video editing software. Figure04 shows the configuration of "filters" that I now used in GraphStudioNext (I use the latest free version, V0.7.0.430).
(img,, alt: Fig04_W6HHC_C615_Win7-MPEG2-Graph src: ../Images/Fig04_W6HHC_C615_Win7-MPEG2-Graph.png)

The MajorUDP-Sender software block is aiming packets to ODROID IP address

Figure 3 Left - vMix manages the C920 video and GraphStudioNext allows MPEG2 encoding and aims the UDP packets to the Wi-Fi port on ODROID

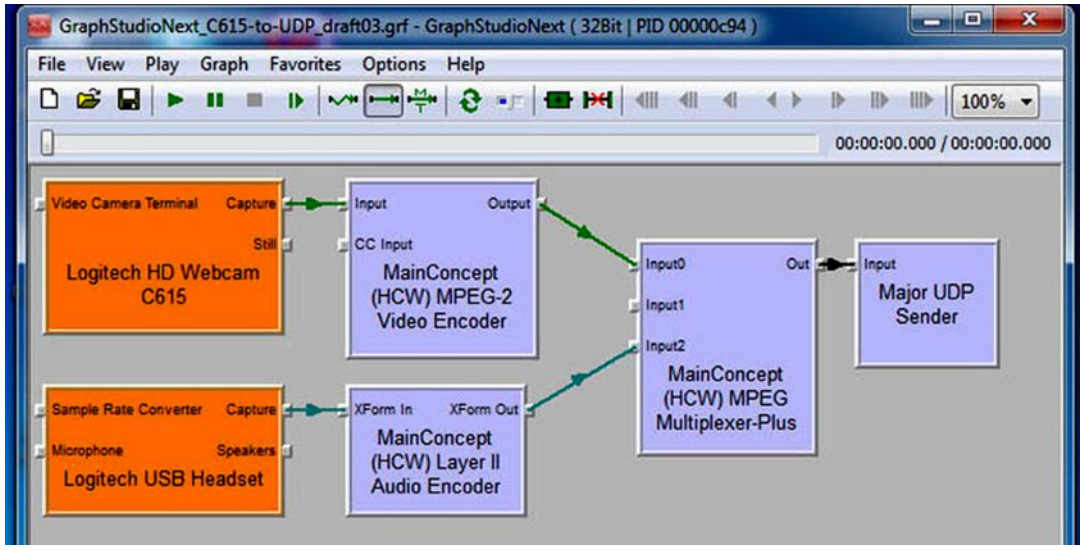


Figure 4 - Configuration of DirectShow filters using GraphStudioNext filter for using C615 webcam on Windows.

With the C615 camera, the latency was much improved (perhaps less than using Hauppauge video capture units), but the video would freeze after a minute or two while using a WiFi configuration between the two computers. I suspected perhaps buffer overflow somewhere? G4GUO encouraged me to switch to an ethernet "cable" connection…Charles pointed out he also had poor results with WiFi even though he had "line of sight".

I chose to use a "cross-over ethernet" cable between the two computers. The only tricky part of the "cross-over ethernet" cable installation is that you have to configure both computers for static IP addresses. Setting Windows for a static IP adr was straight forward through the Win Control Panel.
But setting a static IP address on the ODROID was difficult to sort out…I had to "Google For It" and sort through adding the code below to the INTERFACES system file in the NETWORK folder.

auto eth0
iface eth0 inet static
address 192.168.1.10
netmask 255.255.0.0
gateway 192.168.1.20 (this is the static IP address of the Win7)

Confirm IP addresses are working by pinging from Win7 to ODROID at 192.168.1.10. The static IP addresses cable connection worked perfectly and video was stable in testing lasting more than 8 hours.

One significant difference when using the Ex-press_Server software is that there is NO Graphic User Interface (GUI). There is only a command line user interface to show you the server is running (see Figure05). The configuration settings that you configure for DATV-Express board DVB-S parame-ter settings are editable in a text file called, ex-press.txt

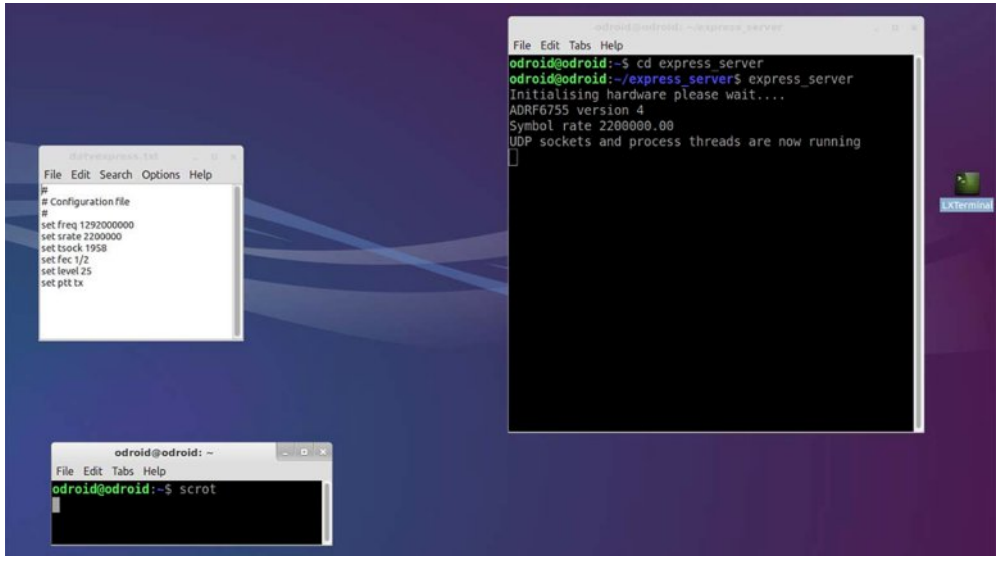


Figure 5 – The express_server software is installed and runs (terminal window is on right) on ODROID. It captures incoming internet UDP packets and sends Transport Stream to DATV-Express board. The configuration settings text file is shown on left.

There are two notes about express_server. First, I had to build the express_server software on the ODROID computer from source code that G4GUO makes available on his github (see URL at end of article). G4GUO points out that although I tested the express_server on an ODROID U3 (see Figure02), the Express_Server software will run on any linux system.

Figure 6 - First stable video received using the express_server and cross-over Ethernet cable for UDP packets

Testing DatvExpressServerApp on Windows (no linux used)

A constant request by hams wanting to use the DATV-Express transmitter board was "when will Windows be available?". I then tested the soft-ware that Charles G4GUO has written, called the DatvExpressServerApp, that allows the DATV-Express board to be connected directly to a Windows computer running Win7 or Win8. Figure 7 shows the block diagram for my testing set-up.

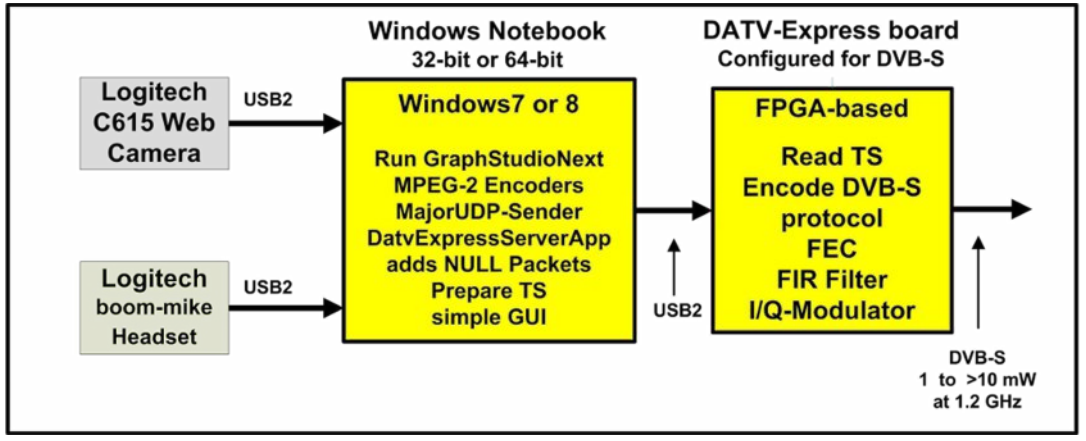


Figure 7 – Block Diagram showing the DatvExpressServerApp software runs completely on a Windows machine and connects to DATV-Express board

This testing configuration uses the same GraphStudioNext set of filters that had been used in Figure02 and Figure04. The only difference is that the Major-UDP-Sender software now aims UDP packets to the internal loopback IP address on the Windows PC, 127.0.0.1.

I did have to sort through installing libusb and driver for the DATV-Express board onto the Windows computer. Libusb(0).dll and the signed Windows driver are publicly available and comes from another Amateur Radio project (HPSDR).

Make sure that you use the readme file for DatvExprssServerApp called HELP.txt. Figure08 shows the simple GUI that DatvExpressServerApp provides on Windows.

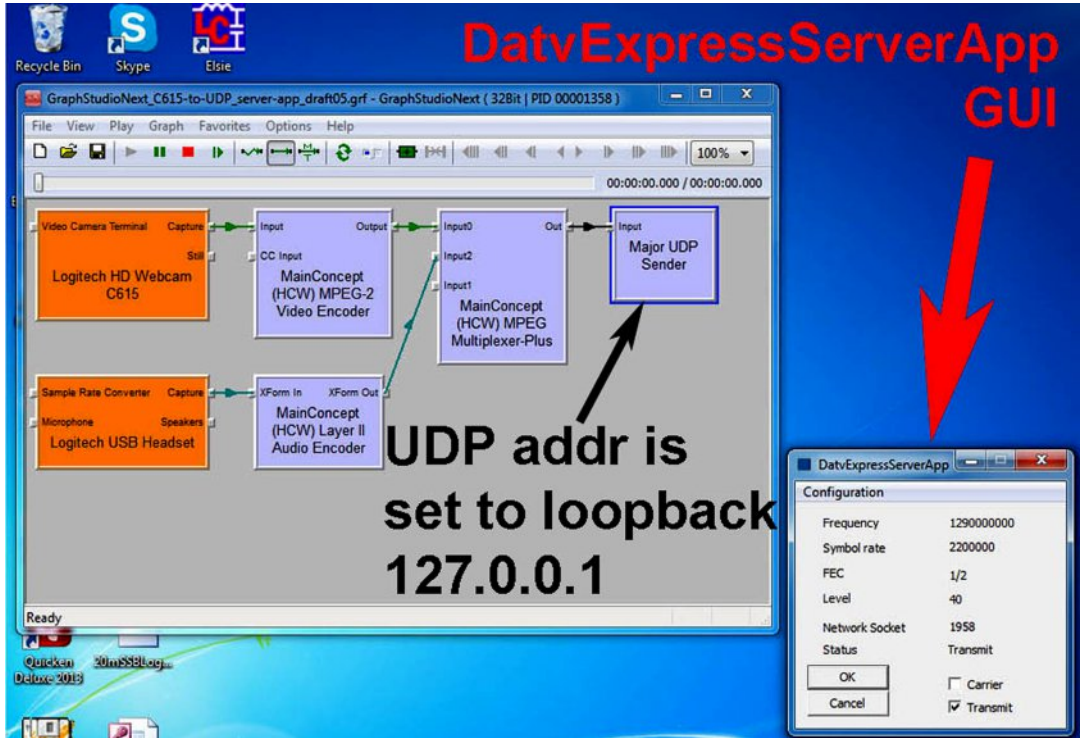


Figure 8 - Windows running GraphStudioNext graphs and simple GUI for DatvExpressServerApp

Again notice in Figure07 that the Hauppauge video-capture board/unit is not used by DatvExpressServerApp. The MPEG-2 audio and video encoder filters in Figure08 are from MainConcept (HCW). I obtained my copy of the three MainConcept filters from the Hauppauge installation CD-ROM that came with my Hauppauge usb-based video-capture unit.

The properties display of the MainConcept filter in Figure09 shows that I have currently set the CBR rate of the desired video bit-rate to 1500 Kbps to not overrun the SymbolRate of 2.20 MSymb/sec that I want to use.

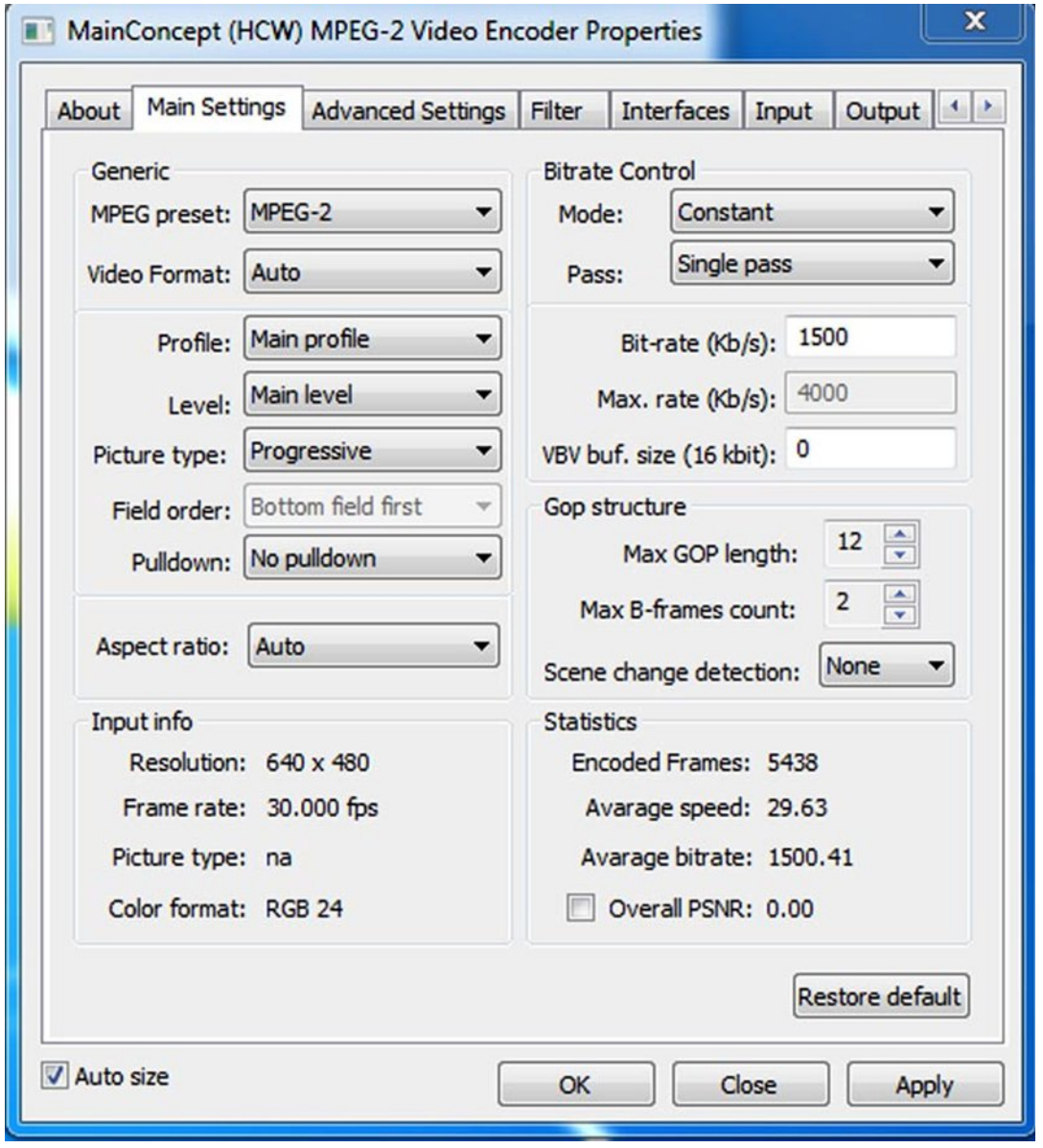


Figure 9 – Properties of MainConcept video encoder filter used in my current testing using ConstantBitRate (CBR)

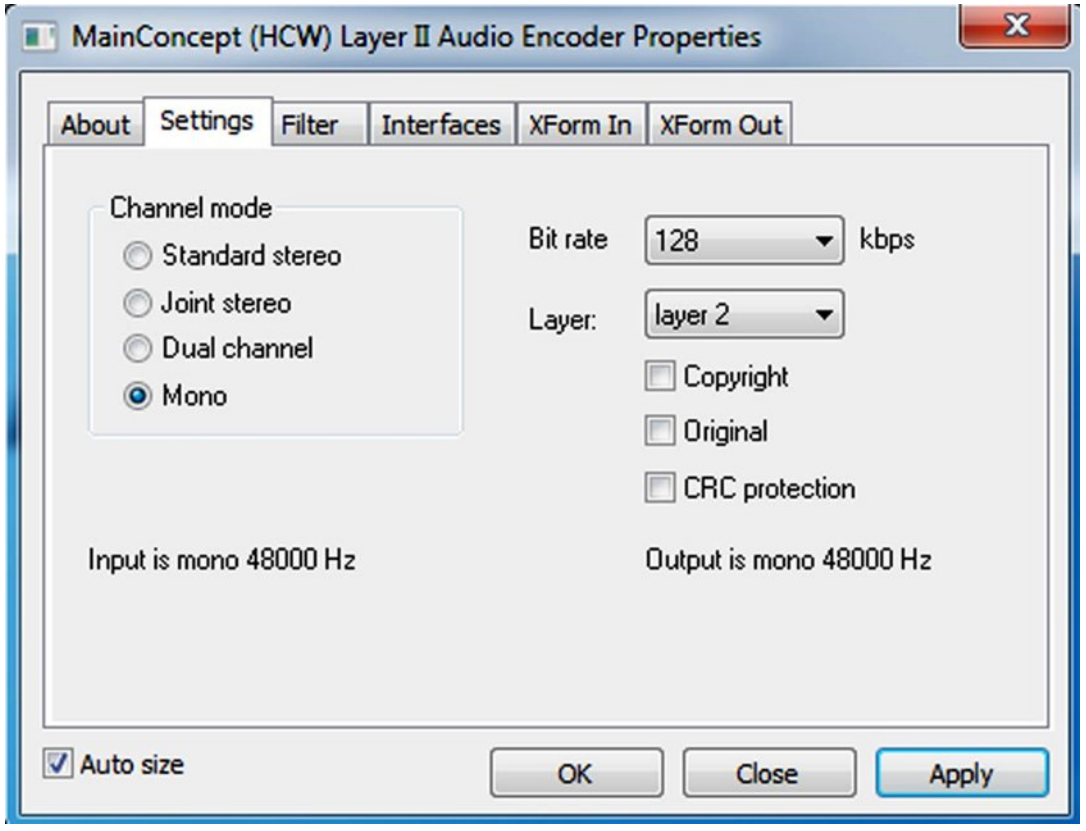


Figure 10 – Properties of MainConcept audio encoder filter used in my current testing

One small issue exists with the VideoPID and Audio-PID. The MainConcept MPEG MUX filter defaults to values of 1001 and 1002 (as compared to values of VidPID = 256 and AudPID = 257 used for most DVB-S installations). You can change the PIDs to another set of values, but I have not determined how to SAVE those new values as default values.

Conclusions

This report is the result of a lot fun trying to break out of the "handcuffs" created by the NTSC/PAL camera, Hauppauge encoder-boards, and Linux that have somewhat limited the appeal and limited possible applications of the DATV-Express project hardware board.

Using a USB-webcam from Logitech shows that endless cameras can be chosen with many possibilities for other camera interfaces rather than me being restricted to my hand-me-down old (becoming obsolete) home NTSC video camera. I can move to modern cameras now for DATV-Express.

This report also provides a roadmap for using DirectShow filters as software encoders, like the Main-Concept ones used

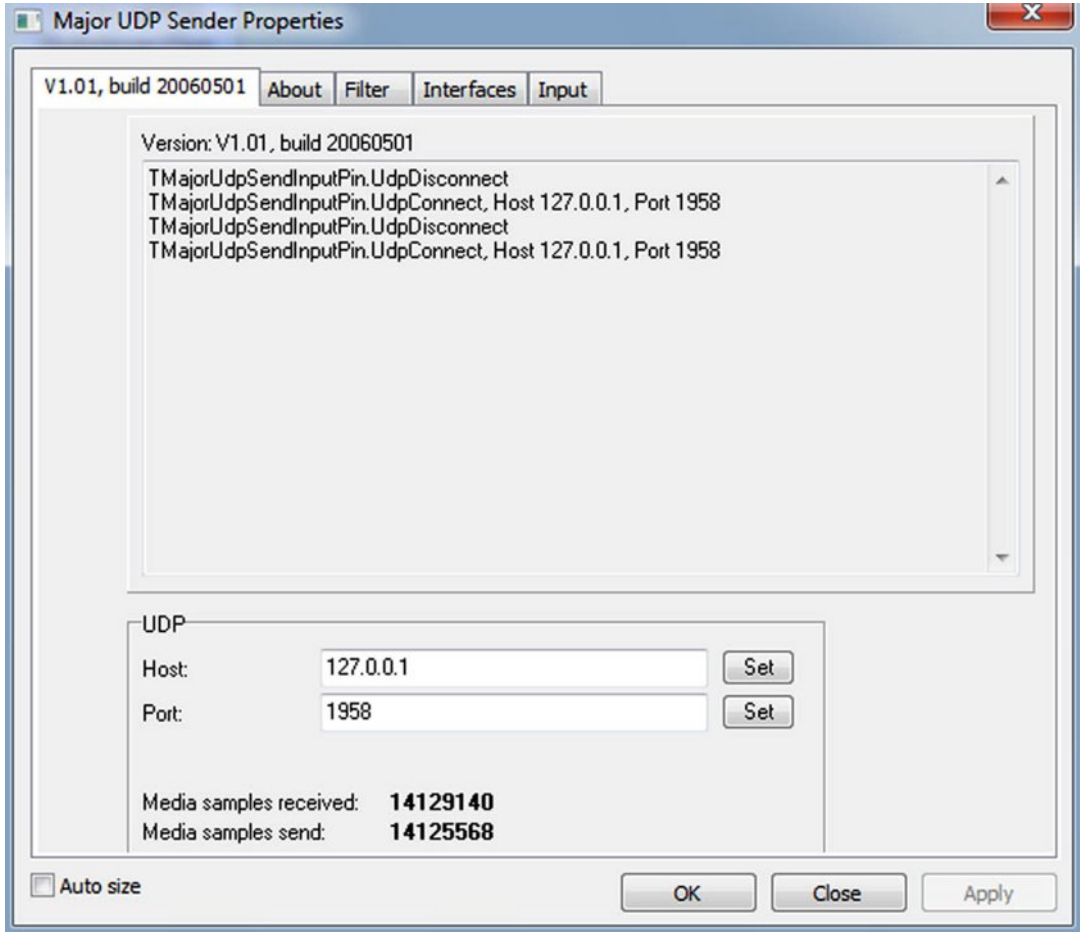


Figure 11 – Properties of MajorUDP-Sender software with IP destination address aimed at loopback 127.0.0.1 and socket chosen for an arbitrary 1958

in this report. The iron-clad hand-cuffs to Hauppauge video-encoders for many hams has been broken. It does not take too much imagination to see that other encoder filters for MPEG-4/H.264 can be found and substituted for the MPEG-2 encoders in this report to reduce the video-bit-stream-rate and allow smaller RF Bandwidths for DVB-S transmitters in SD (Standard Definition) mode.

Or transmit HD video if your application really needs true HD with the corresponding increase in RF Bandwidth over SD.

The ability to send video UDP packet streams over ethernet and even internet to the DATV-Express transmitter board (instead of being tied to the plugged-in-camera) opens up a thousand new possible applications that were not possible before.

Not being able to use Windows operating system and being forced to deal with Linux has been a learning challenge and a "barrier" for many hams.

The new DatvExpressServerApp software from Charles G4GUO will eventually allow Windows to be your choice if that is what you want. G4GUO is quick to point out that the DatvExpressServerApp software is still in a highly "experimental stage". But it is a great start.

Other hams may be willing to volunteer to make improvements to the source code and add new features to DatvExpressServerApp in an open source spirit.

Finally, if any readers know how to change and save the default PID/PIS values for video and audio in the MainConcept MPEG MUX filter…please send me an e-mail.

Contact Info

The author may be contacted at *W6HHC@ARRL.net*

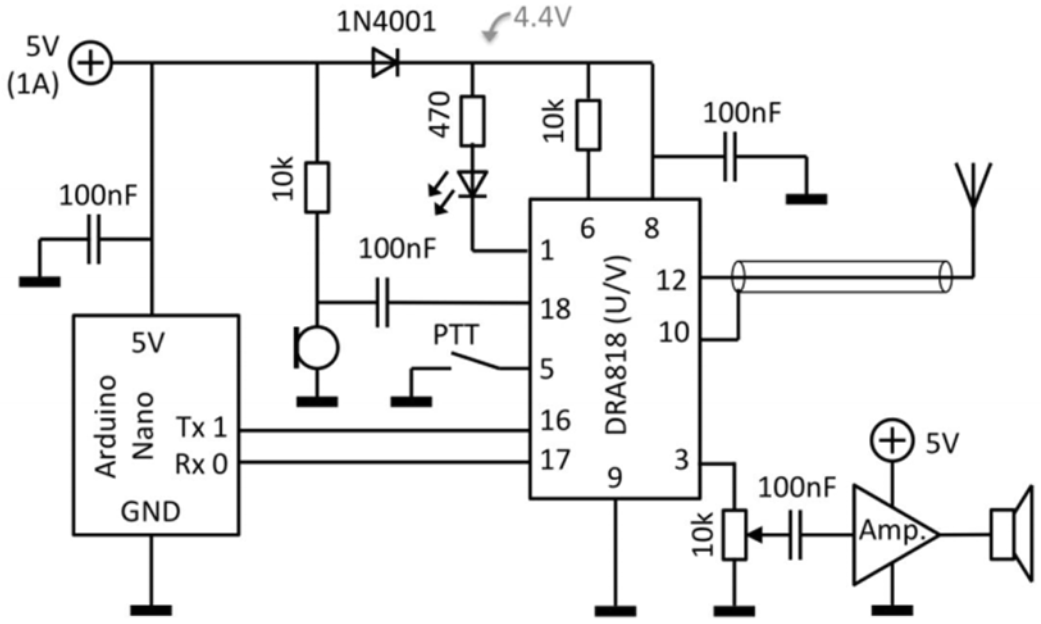
Useful URLs

- *British ATV Club - Digital Forum – www.BATC.org.UK/forum/*
- *CQ-DATV online (free monthly) e-magazine – www.CQ-DATV.mobi*
- *DATV-Express Project for Digital-ATV (User Guide and downloads) – www.DATV-Express.com*
- *G4GUO github for DATV-Express source code – https://github.com/G4GUO/datvexpress_gui.git*
- *G4GUO github for express_server source code – https://github.com/G4GUO/express_server.git*
- *HardKernel web site for ODROID U3 – www.hardkernel.com/*
- *HardKernel USA Sales for faster shipping – www.ameridroid.com*
- *HardKernel web site for free ODROID Magazine – http://Magazine.Odroid.com*
- *Chris MWØLLK discussions on vMix and FFMPEG software on Windows to create transport stream – http://www.tannet.org.uk/using-ffmpeg-to-generate-a-transport-stream-more-details-and-how-to-add-text-overlays/*
- *Orange County ARC entire series of newsletter DATV articles and DATV presentations – www.W6ZE.org/DATV/*
- *Yahoo Group for Digital ATV - groups.yahoo.com/group/DigitalATV/*

A home constructed 2M hand-held Transceiver

by John Hudson G3RFL

In the June DKARS magazine appeared a very simple home build 2M transceiver by Rolf, PE1PTP using the inexpensive "Dorji modules".



Original DKARS Design

These are small transceiver modules for the 144MHz and 430MHz bands and are very well suited for home-brew projects. They need control and the original design used an Arduino module.

Rolf says in his original article that this project is very easy to bread-board, but requires attention to the 5 Volts supply voltage and the 1N4001 diode is necessary because the AD818 modules are rated for 4.7 Volts input voltage which is solved by the 0,6 Volts threshold voltage drop of the diode. At full power the AD818 produces approximately 1 Watt of output and consumes about 0.5 Amps.

Rather than build the Dutch version I wanted to design my own variant using a PIC module for control and what has now become my standard I2C driven display. So my circuit is a little different.

The original diagram looks deceptively simple and it soon started to grow additional components. The electret mic provided sufficient level to drive the Dorji module direct. For an audio amplifier I used the well proven LM 386 and I added a small LFP to the RF Output: you can never be too careful.

Some minor teething problems, including finding out the module required to initialise before performing frequency lock. The software was actually the easy part, but then I am now becoming quite adept at PIC code and driving the I2C display.

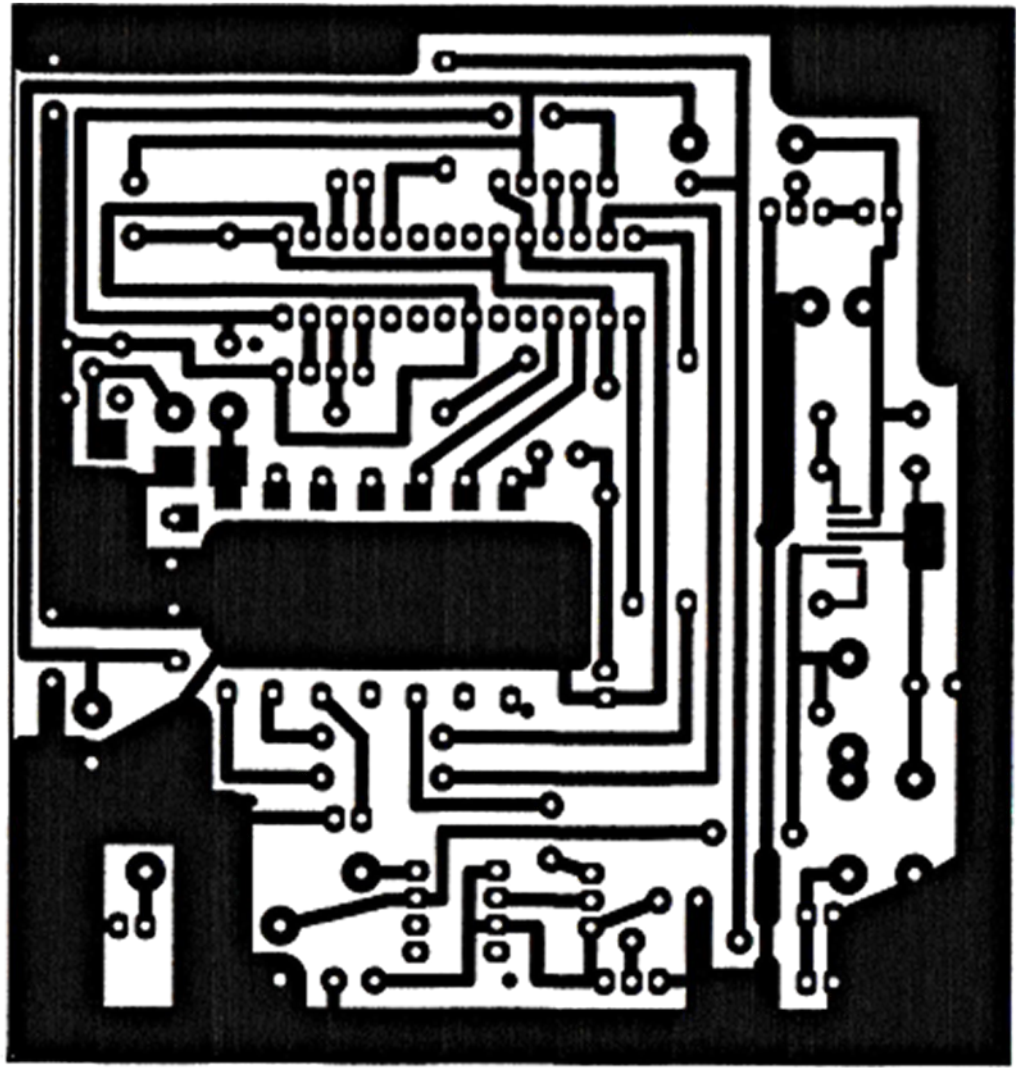
The regulators proved a little more complex than I first thought. I started with a trip to CPC in Preston and bought 10 LM317 REGs to drop the supply from the 7.5v battery to the transceiver + u/P + Display - I was going to use two. The LM317 ticked a lot of the boxes but on test I found, off load, the output volts went up to a dangerous level. So back to the drawing board! I needed a regulator to supply 1 amp that can go below 5V and does not require more than 100µA for the control.

Then I found one that was ideal! It was in an MCP 1826 Quiescent 120µA or 1µA in shutdown and 1 amp output, also a shutdown pin. Adjustable from 0.8 to 5V output. The only snag was its maximum input is 6V, so I needed to lose 2V from my battery - nothing a couple of diodes could not take care of.

I am delighted with the sleep mode. With the display off and the audio amp and PIC in sleep, the unit draws just 300µA.

(Circuit diagram at end of article)

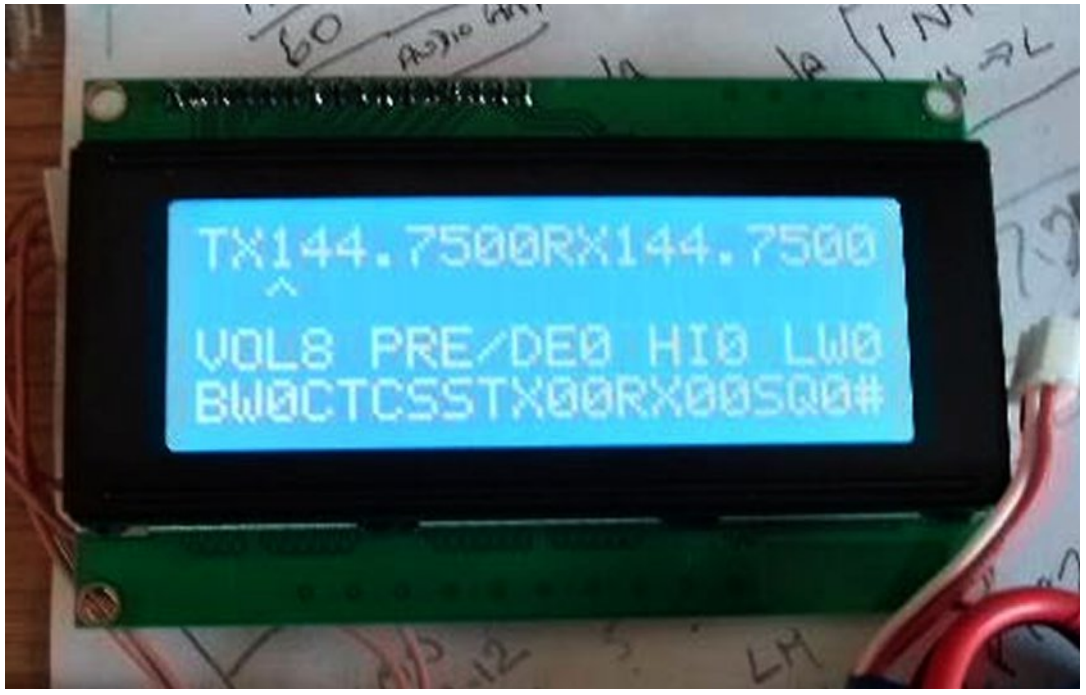
Confident in my design, I laid out a simple single sided home etched PCB.



PCB Drawing (NOT TO SCALE)

Populated PCB and I2C display

For a battery I used a 7.5v 2200A LiPo battery. Modern Lithium Polymer batteries (LiPo, Li-Poly) are able to store and deliver large amounts of energy from lightweight packs. Think of and treat LiPo batteries as fuel.



Close up of the I2C display

Lithium Polymer cells, as with any high energy source (petrol, electricity, gunpowder etc) must be handled with appropriate precautions and care - see:-

http://www.4-max.co.uk/pdf/dos-and-donts-LiPo.pdf

For this reason I have decided against adding battery charging to the final design. These batteries do not lend themselves to experimentation with home chargers, so I thought it best to remove it and charge it with the recommended charger.

I do need to add a battery TEST facility to warn of low LiPo Volts and stop it being switched on.

The software is tamed and works as follows:-

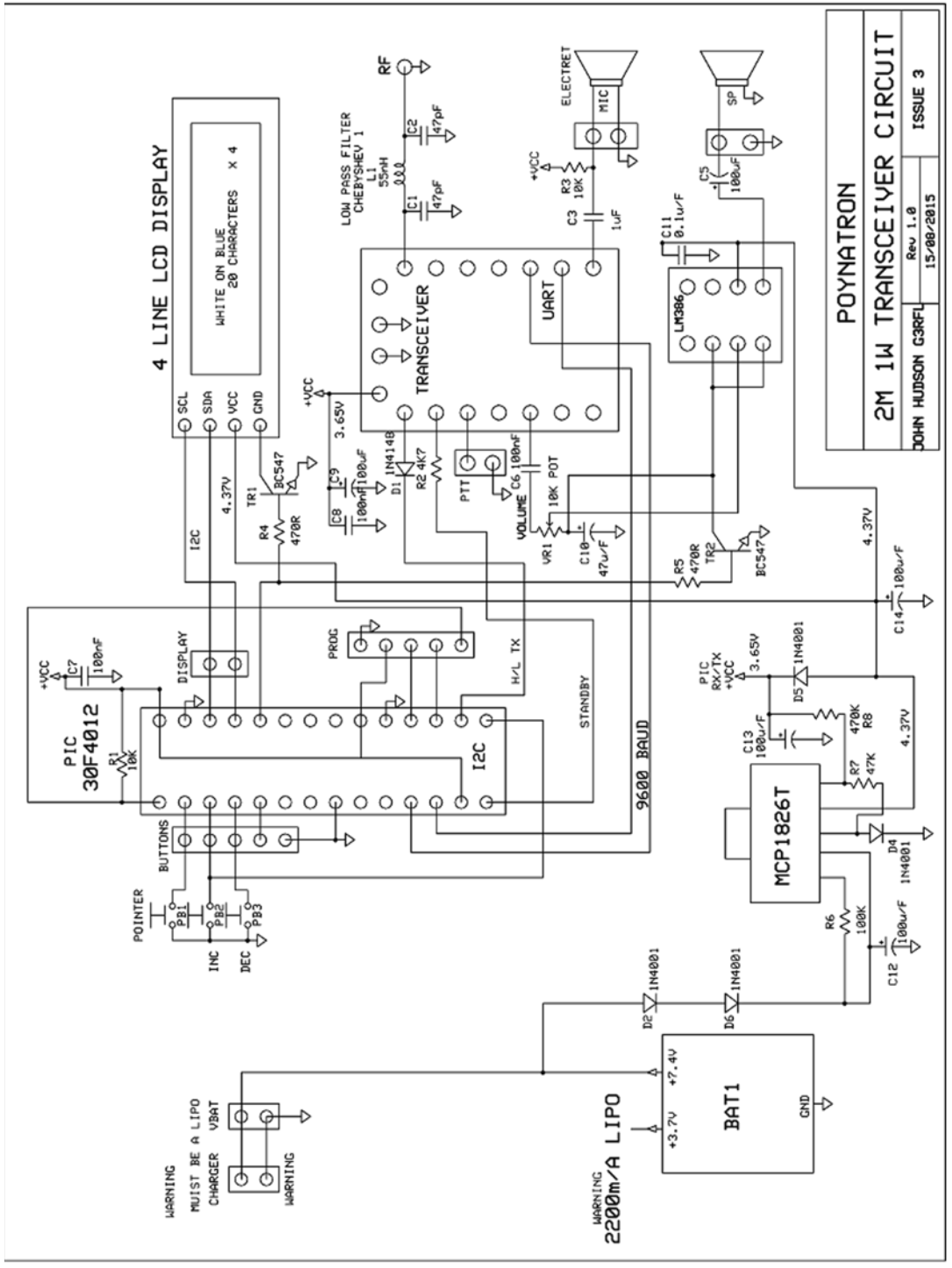
- *At switch on you just press INC and DEC to turn it ON and OFF*
- *The POINTER button has 24 positions to change*
- *FREQ of TX (7 digits)*
- *FREQ of RX (7 digits)*
- *Bandwidth 25 or 12.5KHz*
- *VOLUME 0 to 8*
- *SQUELTCH 0 to 8*
- *TX CTCSS TONES 0 to 38*
- *RX CTCSS TONES 0 to 38*
- *PRE/DENPH ON/OFF*
- *HIGH PASS ON/OFF*
- LOW PASS ON/OFF

All these settings are also stored in EEPROM and it would appear in the Transceiver too. On power up these values are restored. There can be an extra HARDWARE switch to put the TX into LOW POWER TX 3db down.

The PIC software is available on the *CQ-DATV download site*.

My thanks to DKARS and Rolf, PE1PTP for bringing these modules to my attention, now I have a very inexpensive, home constructed 2m hand-held.

There is also a 70cms module available from Dorji modules, so I could have engineered this as a dual band unit for another 12 Euros. *http://www.dorji.com/pro/RF-module/Low_power_transceiver.html*



Commercial LiPo Charger (courtesy e-fliterc)

Only a week to go to CAT15 and more than 35 people have already registered - If you intend to come please register at *http://www.g0ghk.com/events/cat-15/* to enable Finningley radio Club to judge how many people to cater for. Make sure you tick the box if you would like to attend the informal meal on Saturday night.

Admission is £10 per day (payable on the door) which will include free tea and coffee all day and lunch provided by Finningley Radio Club - this goes directly to FRC towards up keep of this great facility and ALL visitors will be expected to pay this, even if you are not stopping for the whole day and or having lunch.

The agenda is now confirmed and includes something for everyone including RB-TV, ffMpeg and Vmix, HAM-TV on the ISS and classic cameras.

There will be a full range of RF test equipment, lots of space for demos and full workshop facilities so don't forget to bring along your latest project, whether finished or not. There will be an opportunity to talk about it and your latest on air activities and share ideas with others during the final session on Saturday afternoon.

There will be a members bring and buy area, so use this opportunity to re-cycle all that stuff you bought but haven't had time to use!

We will be attempting to stream the event but please be aware there is NO reliable Internet connection on site and we will be using a mobile dongle - this means the stream may be intermittent. All the presentations will be recorded and available to watch after the event.

Look forward to seeing you all there.
Noel – G8GTZ

Saturday

Start	Duration	Title	Who	Comments
11:00:00	02:00:00	Doors open		
13:00:00	00:30:00	Welcome & review of year	G8GTZ	Review of what's happened in the ATV world
13:30:00	00:15:00	Introduction to RB-TV	G8GTZ	Intro to RB-TV and BATC trophy awards
13:45:00	00:30:00	Digithin hardware	G4EWJ	Presentation and demo of the Digithin hardware project
14:15:00	00:15:00	RpiDATV software	G8GTZ	Overview of the RpiDATV software for the Raspberry Pi
14:30:00	00:30:00	Coffee		
15:00:00	00:15:00	DTX 1 for RB-TV	M0LDZ	Using the DTX1 with Rpi to generate RB-TV on 146 and 437 MHz
15:15:00	00:45:00	Tutuione	F6DZP	Overview of the Tutuione Software
16:00:00	00:30:00	Mini USB tuner	F6DZP & G4EWJ	Presentation on the Mini USB tune rproject
16:30:00	01:00:00	ATV on air and what's on my bench	G8GKQ	Roundtable & discussion - bring along the bits you've built!
17:30:00	02:30:00	Back to hotel / beer		
20:00:00		Meet for Dinner		

Sunday

Start	Duration	Title	Who	Comments
08:30:00	01:00:00	Doors open		
09:30:00	00:30:00	A beginners guide to FFMPEG	Chris MW0LLK	What it is and what it can be used for
10:00:00	00:30:00	The Ham-tv project on the ISS	G3VZV & F6DZP	Tim Peake on a telly near you!
10:30:00	00:30:00	DATV via Space - workshop	G3PYB & G3VZV	How will we manage usage of the WB transponder on EsHailSat2
11:00:00	00:30:00	Coffee		
11:30:00	00:30:00	Classics	Brian G8GQS	
12:00:00	00:30:00	Challanges of LCD displays	Kevin KK6JPN	Kevin Hempsonpresents on back lighting & Gamma correction in LCD displays
12:30:00	01:00:00	Lunch		
13:30:00	00:40:00	DATVexpress and what next?	Charles G4GUO	More thought provoking ideas from Charles!
14:10:00	00:30:00	Using Vmix for smarter ATV productions	Chris MW0LLK	Why we all need a green wall in the shack!
14:40:00	00:15:00	Close		

Colour Test Card Generator Programming Software

By Richard Russell G4BAU

In CQ-DATV 26 we looked at the hardware that was behind the third in a series of the authors electronic tests card designs spanning more than twenty two years. Unlike the previous designs, this third design is programmable from a custom .bmp file and thus enables you to design your own test card or select from other preset designs. In this issue we will be looking at the software and how to download, install and drive it from within windows.

Introduction

The Test Card Generator programming software has the normal features which make up the modern Windows® interface: a title bar, a set of drop-down menus, an editing pane and a status bar. You can move its window wherever you like on your Windows® desktop, but you cannot re-size or maximise it.

When run, the software initially loads a default image and a default set of teletext pages. You can configure these defaults using the Options menu selection.

The title bar

The title bar contains the name of the application (TCGEN), the version number, a **minimise** button, a (disabled) **maximise** button and a **close** button. If an image and teletext pages have been loaded, their filenames are also displayed. If you right-click in the title bar you will get a context menu containing the **Move, Minimise** and **Close** items.

If you close the window (by clicking on the close button, selecting Close from the right-click menu or using the keyboard shortcut Alt-F4) you will be prompted to save the current teletext pages if any changes have been made.

The menu bar

The menu bar contains the drop-down menus **File, Edit, View, Generator** and **Help**. These menus may be activated by clicking on the appropriate menu name or by using a keyboard shortcut (hold down Alt and press the key corresponding to the underlined character). If any of the menu items are unavailable, they will be 'greyed out' and clicking on them will have no effect.

The status bar

When a menu item is highlighted, the status bar displays a brief description of the function of that command. Otherwise, the status bar is split into three regions: a **message region**, a **status region** and an **information region**.

The message region

The message region displays **"Please wait..."** when the program is busy and will not respond to user input.

The status region

The status region displays the status of the current operation, if any:

- *When an image is being loaded it displays the name of the image file.*
- *When a teletext page is displayed it gives instructions on graphics editing*

- *When a time-consuming task is in progress (for example erasing or programming the generator) it displays a progress bar.*

The information region

When an image is displayed, the information region shows the **R**ed, **G**reen and **B**lue values of the pixel pointed at by the mouse. Note that the values use the Rec.601 coding range where 16 corresponds to black and 235 to peak white.

When a text page is displayed the information region shows the ASCII code of the character at the text cursor (caret) position.

File menu

The **file menu** is concerned with loading, saving and printing

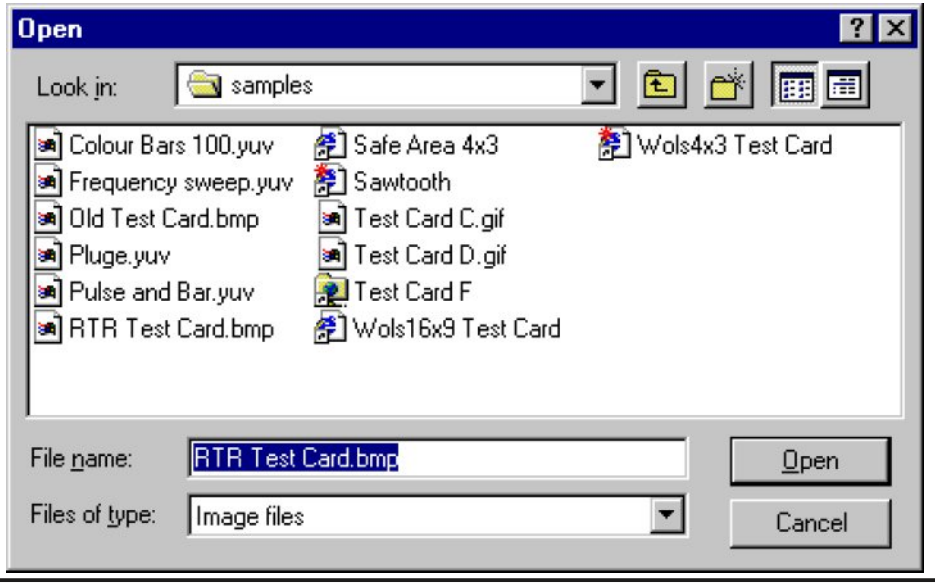
the test card (or other) image and the teletext pages. The file menu can be accessed by clicking on its name in the menu bar or by means of the keyboard short-cut Alt-F.

Load image

The **Load image** command loads the image you want to program into the Colour Test Card Generator. It will accept files in raw YUV format, in BMP (Windows bitmap) format, in JPEG (.jpg) format or in GIF format.

In the case of the BMP, JPEG and GIF formats the image is assumed to have square pixels, and will be scaled to fill the television frame (if the image shape isn't 4x3 it will be centred and cropped as necessary). In the case of the YUV format the image is assumed to correspond to the Rec.601 standard. If you are designing your own graphics specially for the Colour Test Card Generator it is probably best to create an image with dimensions 624 x 468. This will ensure that no horizontal scaling is required and therefore give the highest quality results.

The command calls up the Open File dialogue box:
Image names shown with a web-browser icon are links to files on the internet. When selected they will be downloaded automatically; if you use a dial-up internet service you will be prompted to make a connection.



Load teletext

The **Load teletext** command loads the required teletext page or pages. It will accept either a file containing a single page (.VID) or a *carousel* file containing all four pages (.CAR). If a single page is loaded it replaces the page currently displayed; if a carousel file is loaded it replaces all four pages.

Save teletext

The **Save teletext** command saves the four teletext pages as a carousel file. The filename used is the same as that from which the pages were loaded (i.e. the contents of the file are replaced). If the pages were not loaded from a carousel file (i.e. they were typed in, imported via the clipboard or loaded individually), the Save command will display the Save As dialogue box so you can enter the desired filename. If the current teletext pages are unchanged, so don't need to be saved, the Save command is inhibited.

Save teletext as

The **Save teletext as** command saves the four teletext pages as a carousel file. You are prompted to select a file name; the .CAR extension will be automatically added. Use Save As rather than Save if you need to change the disk, directory (folder), or filename to something different from their current values.

Print Setup

The **Print Setup** command allows you to do the following:

- *Select the printer to use.*
- *Set the printer's properties (for example paper type and printing quality).*
- *Set the paper size and orientation (portrait or landscape).*

These affect subsequent uses of the Print image and Print teletext commands.

Print image

The **Print image** command prints out the current image. Best results will be obtained with a 'photo quality' colour printer.

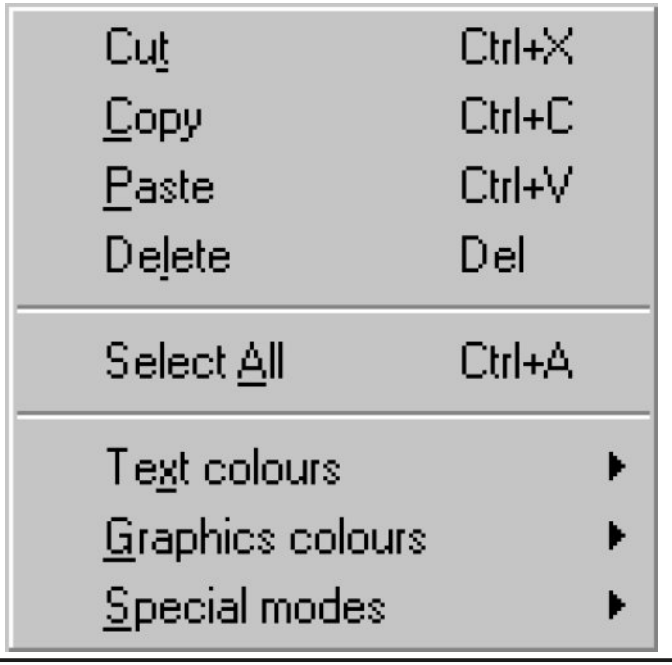
Print teletext

The **Print teletext** command prints out the four teletext pages.

Exit

The **Exit** command quits from Test Card Generator and closes its window. If the current teletext pages in memory have not been saved, you are first prompted to save them.

Edit menu



The **edit menu** is concerned with editing the current teletext pages. The edit menu can be accessed by clicking on its name in the menu bar or by means of the keyboard short-cut Alt-E.

Cut

The **Cut** command transfers any selected text to the clipboard, and deletes it from the teletext page. If no text is selected, the Cut command is inhibited. Once the selected text is in the clipboard, you can Paste it either elsewhere in a teletext page or into any other application which supports pasting of text from the clipboard. Any previous contents of the clipboard are discarded.

Selcted text is highlighted in reverse-video. You can select text in the following ways:

- *Holding down the left mouse button and 'dragging' it selects a block of text. Dragging the mouse horizontally selects part or all of a line. Dragging the mouse vertically selects a block of lines (only entire lines may be selected).*
- *Holding down the Shift key and moving the cursor with the arrow (or other cursor-movement) keys selects a block of text. Moving the cursor horizontally selects part or all of a line. Moving the cursor vertically selects a block of lines (only entire lines may be selected).*
- *The Select all command selects the entire page.*

Once a block of text has been selected, you can alter the selection by holding down Shift and moving the cursor. If you want to change the start point of a selection, make the initial selection from right to left or from bottom to top.

If you want to change the end point of a selection, make the initial selection from left to right or from top to bottom.

Copy

The **Copy** command transfers any selected text to the clipboard, but unlike Cut it leaves the teletext page unchanged. If no text is selected, the Copy command is inhibited. Once the selected text is in the clipboard, you can Paste it either elsewhere in a teletext page or into any other application which supports pasting of text from the clipboard. Any previous contents of the clipboard are discarded.
See **Cut** for details of how text may be selected.

Paste

The **Paste** command inserts the contents of the clipboard into the teletext page at the current position of the text cursor (caret). If the clipboard contains no text, the Paste command is inhibited. You can use Paste to transfer a block of text from elsewhere in a teletext page, or to insert a block of text which has been placed in the clipboard by any other application.

Note that the paste operation may cause some of the existing contents to be pushed off the right or bottom of the page. In this case they are lost.

Delete

The **Delete** command deletes any selected text, without copying it into the clipboard. See Cut for details of how text may be selected. The delete command has an identical effect to pressing the Delete key on the keyboard. Text which is deleted can only be recovered by reloading the teletext pages from a file.

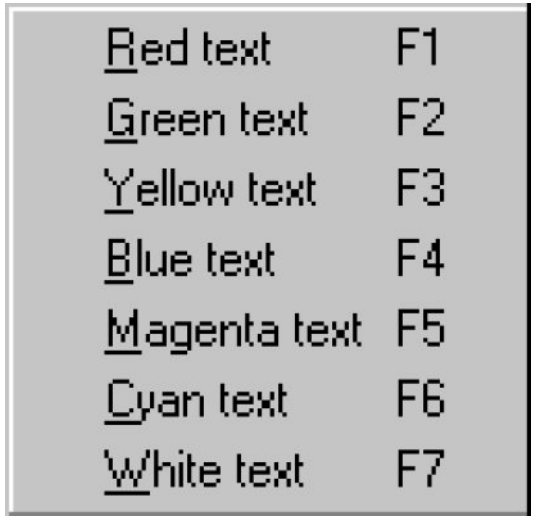
Select All

The **Select All** command selects the entire teletext page. It is useful if you want to transfer the page into another

application (e.g. a word processor) via the clipboard.

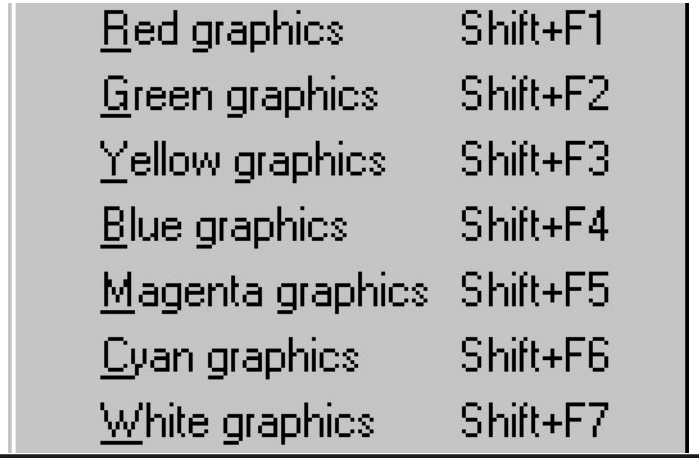
Text colours

The **Text colours** menu lists the possible text colours. Clicking on the menu item or pressing the specified function key selects the appropriate colour of text:



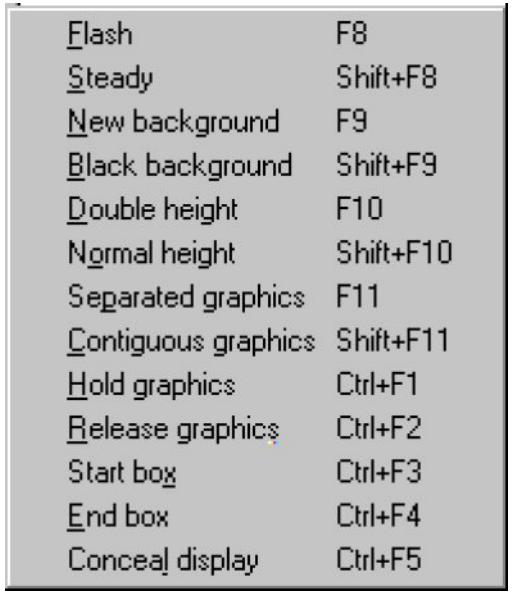
Graphics colours

The **Graphics colours** menu lists the possible graphics colours. Clicking on the menu item or pressing the specified function key selects the appropriate colour of graphics:



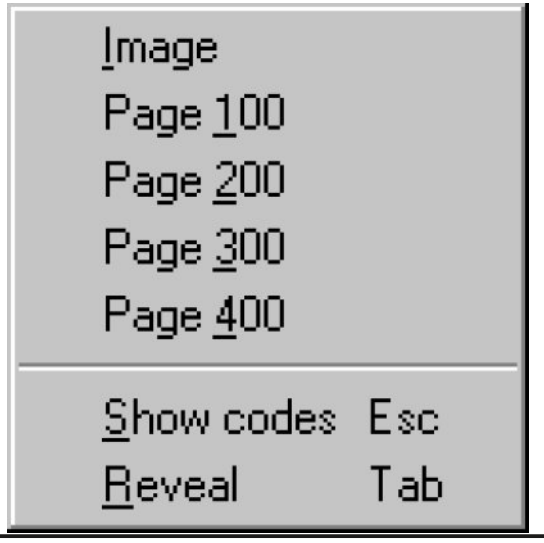
Special modes

The **Special modes** menu lists the special display modes. Clicking on the menu item or pressing the specified function key selects the appropriate mode:



For details of these modes see the *Teletext Codes* section.

View menu



The **View** menu is used to select what is displayed: the test card image or one of the four teletext pages.

It also controls special display modes useful when editing teletext pages.

The view menu can be accessed by clicking on its name in the menu bar or by means of the keyboard short-cut Alt-V.

Image

The **Image** command displays the current test card (or other) image.

Page 100

The **Page 100** command displays the first teletext page (usually the index page). This page corresponds with the red fastext button on your TV remote control.

Page 200

The **Page 200** command displays the second teletext page. This page corresponds with the green fastext button on your TV remote control.

Page 300

The **Page 300** command displays the third teletext page. This page corresponds with the yellow fastext button on your TV remote control.

Page 400

The **Page 400** command displays the fourth teletext page. This page corresponds with the blue fastext button on your TV remote control.

Show codes

The **Show codes** command alternates between the normal teletext page display and a mode in which the control codes are shown as two-letter mnemonics rather than being acted upon. The mnemonics are as follows:

NU	NUL*	DL	DLE*
AR	Alpha red	GR	Graphics red
AG	Alpha green	GG	Graphics green
AY	Alpha yellow	GY	Graphics yellow
AB	Alpha blue	GB	Graphics blue
AM	Alpha magenta	GM	Graphics magenta
AC	Alpha cyan	GC	Graphics cyan
AW	Alpha white	CW	Graphics white
FL	Flash	CD	Conceal display
ST	Steady	CG	Contiguous graphics
EB	End box	SG	Separated graphics
SB	Start box	EC	ESC*
NH	Normal height	BB	Black background
DH	Double height	NB	New background
SO	SO*	HG	Hold graphics
SI	SI*	RG	Release graphics

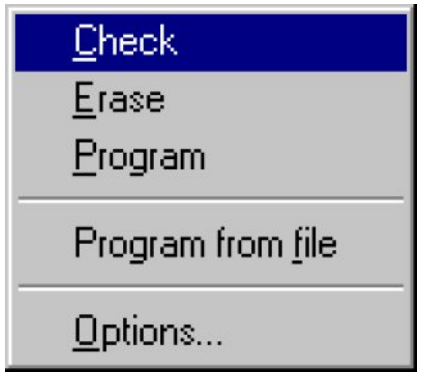
*These control characters are reserved for compatibility with other data codes. They should not normally appear in a teletext page.

Reveal

The **Reveal** command alternates between concealing and revealing any parts of the page affected by a *Conceal display* control code.

Generator menu

The **Generator** menu is concerned with the programming of the hardware Colour Test Card Generator. It can be accessed by clicking on its name in the menu bar or by means of the keyboard short-cut Alt-G.



Check

The **Check** command tests the connection to the generator, including the PC's serial port, the cable and the generator itself.

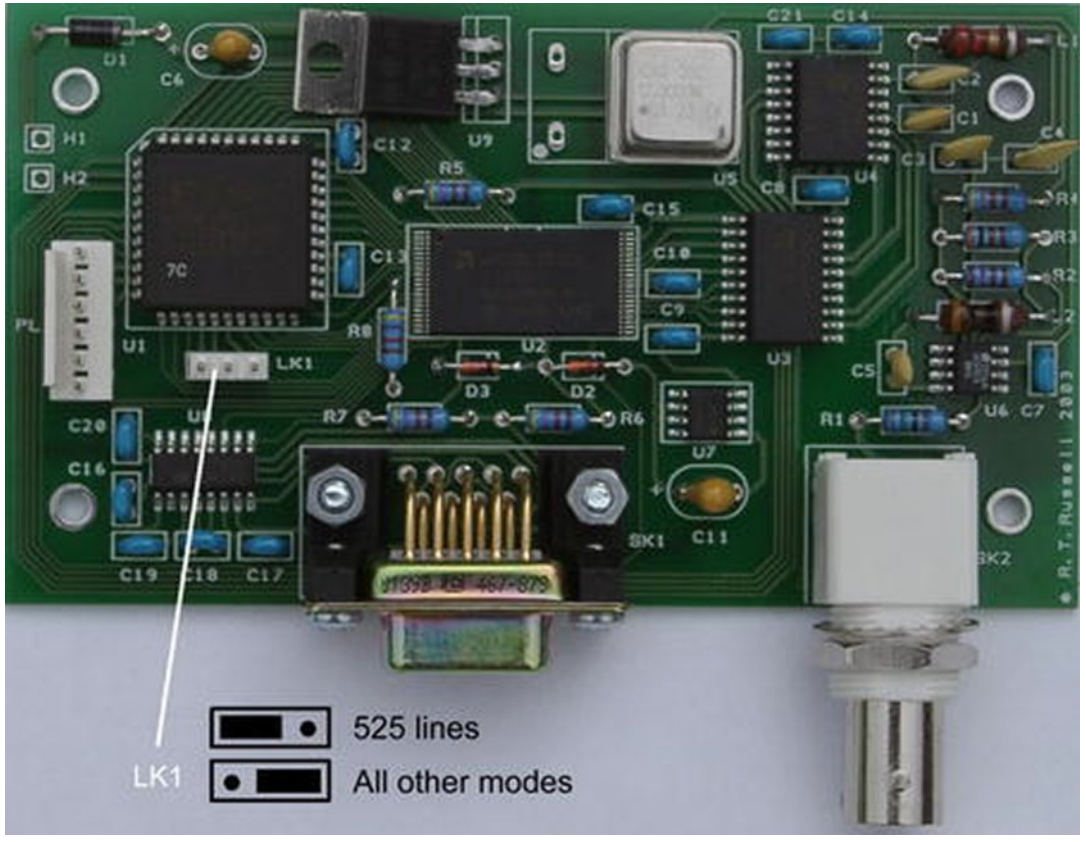
Erase

The **Erase** command erases the current contents of the generator. This takes approximately thirty seconds.

Program

The **Program** command programs the current image, teletext pages etc. into the generator. It automatically performs the **Check** and **Erase** operations before starting the programming, which takes approximately six minutes.

If you have selected the 525-lines standard a message will be displayed reminding you that for operation in this mode an internal link must be changed. To do this disconnect the power supply from the generator and remove the four fixing screws (accessible from underneath). Carefully separate the top and bottom of the case, noting that they will still be joined by the power connections. For operation at 525 lines set link LK1 to the left position (as viewed with the connectors towards you, as per the illustration below); for operation at 180, 405, 441, 625 or 819 lines set link LK1 to the right position. Reassemble the case, taking extreme care not to trap or damage the power connections. Fit the fixing screws and reconnect the power supply.

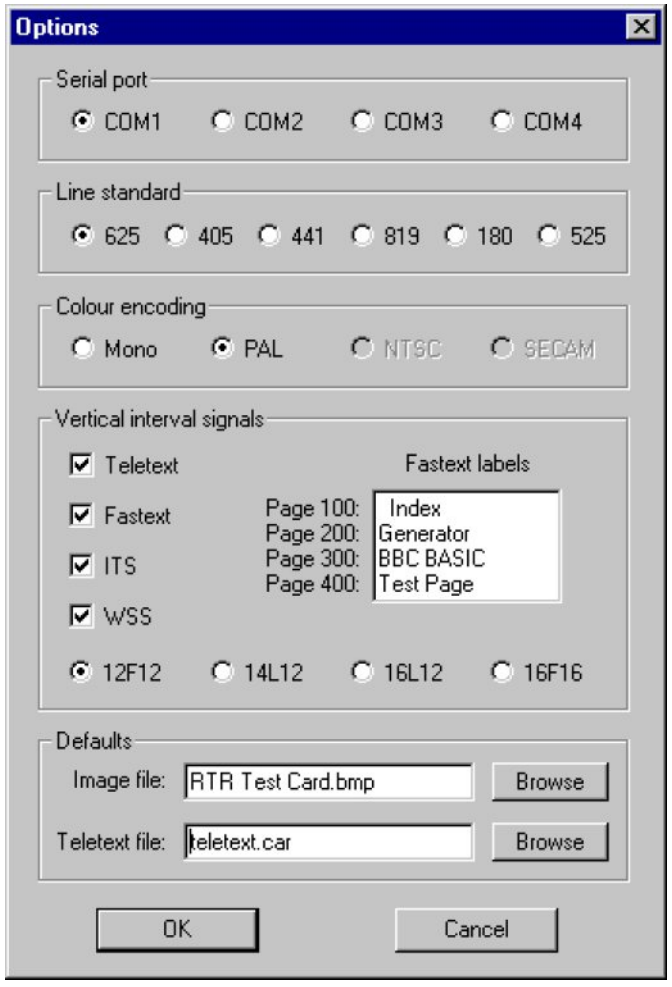


Program from file

The **Program from file** command programs the generator from a ROM data file rather than from the currently loaded image and teletext pages. This allows the generator to be used for specialised purposes, such as to generate non-standard signals or animated patterns.

Options

The **Options** command opens a dialogue box which allows you to set various options controlling what gets programmed



into the generator, and to determine the default test card and teletext pages which are initially loaded.

The various options are as follows:

- *The serial port used for connection to the generator can be selected to COM1, COM2, COM3 or COM4.*
- *The television line standard can be selected as 625, 405, 441, 819, 180 or 525 lines.*
- *The colour encoding can be selected as monochrome, PAL (625 lines), NTSC (405 and 525 lines), PAL-N (625 lines), PAL-M (525 lines) or NTSC-4.43 (525 lines).*
- *The various vertical-interval signals (teletext, insertion test signals, widescreen signalling) can be enabled or disabled. In the case of teletext, the fastext labels can be specified. In the case of the widescreen signalling, the signalled aspect-ratio can be chosen; the alternatives are:* 12F12 *A 4:3 image filling the raster,* 14L12 *A 14:9 image letterboxed within a 4:3 raster,* 16L12 *A 16:9 image letterboxed within a 4:3 raster &* 16F16 *An anamorphic 16:9 image filling the raster*
- *The default image and teletext pages, which are loaded automatically when the software is run, can be selected.*

Help menu

The **Help** menu gives access to the Colour Test Card Generator documentation, provides links to information via email or from the R.T.Russell website, and displays version information. The help menu can be accessed by clicking on its name in the menu bar or by means of the keyboard short-cut Alt-H.

Help Topics

The **Help topics** command calls up the main help window, from which you can browse or search the online Colour Test Card Generator documentation.

Email

The **Email** command calls up your default mail program (if any) so that you can send a message to request help or information about the Colour Test Card Generator.

Website

The **Website** command calls up your default web browser (if any) and automatically directs it to the R.T.Russell home page.

About TCGEN

The **About** command displays the version number of the Test Card Generator programming software.

The editing pane

The **editing pane** is where the current test card image or a teletext page (if any) is displayed for viewing or (in the case of a teletext page only) for editing.

Keyboard commands

When a teletext page is displayed the following operations are available using the keyboard:

Key	Operation
Insert	Toggle between insert and overtype mode. In overtype mode any character typed will over-write the existing character at that position on the line. In insert mode any character typed will 'push' the rest of the line to the right to make room. The insert/overtype status is indicated by the shape of the text cursor (caret): in overtype mode it is an underline and in insert mode it is a solid block.
Delete	If any text is selected (highlighted) this key has an identical effect to the Delete command: the selected text is deleted, without being copied to the clipboard. Otherwise, the character to the immediate right of the cursor (caret) is deleted and the rest of the line is moved left to fill the gap.
Home	Move the cursor (caret) to the start of the current line.
Ctrl/Home	Move the cursor (caret) to the start of the top line.
End	Move the cursor (caret) to the end of the current line.
Crtl/End	Move the cursor (caret) to the start of the bottom line.
Page Up	Display the previous teletext page. If page 100 is displayed, Page Up has no effect.
Page Down	Display the next teletext page. If page 400 is displayed, Page Down has no effect.
	Move the cursor (caret) one character to the left, wrapping to the end of the previous line as required. If Shift is held down, select (or de-select) a character. If the cursor is already at the beginning of the page, the key has no effect.
	Move the cursor (caret) one character to the right, wrapping to the beginning of the next line as required. If Shift is held down, select (or de-select) a character. If the cursor is already at the end of the page, the key has no effect.

↑	Move the cursor (caret) up one line. If Shift is held down, select (or de-select) a line. If the cursor is already on the top line, the key has no effect.
↓	Move the cursor (caret) down one line. If Shift is held down, select (or de-select) a line. If the cursor is already on the bottom line, the key has no effect.
Backspace	Delete the character immediately to the left of the cursor (caret), and move the cursor left one position. The rest of the line, to the right of the cursor, is moved left to fill the gap. If the cursor is at the beginning of a line, concatenate the contents of the present line onto the end of the previous line.
Return (Enter)	Insert a 'new line' at the current position of the cursor (caret). Everything to the right of the cursor will be moved onto the next line, and the rest of the page is moved down one line to make space (causing the bottom line to be lost). By this means you can split an existing line into two or more lines.
Esc	This has the same effect as the Show codes menu option.
Tab	This has the same effect as the Reveal menu option.

The 'printing' keys (letters, numbers and symbols) and function keys cause the appropriate character or control code to be entered at the position of the cursor (caret), and the cursor is then moved right by one position. If anything is selected (highlighted) when the key is pressed, it is first deleted. See the *Teletext Codes* section for the effects of control codes.

Mouse commands

When a teletext page is displayed the following operations are available using the mouse:

Action	Operation
Left click	Clicking in the editing pane with the left mouse button causes the text cursor (caret) to be moved to the character position nearest to the mouse pointer. If Shift is held down, the region between the previous position of the text cursor and the new position will be selected.
Left drag	Holding down the left mouse button and 'dragging' the mouse pointer over the program displayed in the editing pane causes a section of text to be selected. Dragging the mouse horizontally selects part or all of a line; dragging the mouse vertically selects a block of lines (only entire lines may be selected).
Right click	Clicking in the editing pane with the right mouse button causes the Edit Menu to be displayed at that position.
Ctrl+ left button	Holding down the Ctrl key and pressing the left mouse button causes the graphics sixel at that position to be 'lit' (assuming that a graphics mode has been selected). By holding down the left button you can draw with the mouse.
Ctrl+ right button	Holding down the Ctrl key and pressing the right mouse button causes the graphics sixel at that position to be 'unlit' (assuming that a graphics mode has been selected). By holding down the right mouse button you can erase with the mouse.

The file, TCSETUP.EXE (712 Kb), can be downloaded from *http://www.bbcbasic.co.uk/tccgen/download.html*

HDMI Made Easy: HDMI-to-VGA and VGA-to-HDMI Converters

By **Witold Kaczurba** and **Brett Li**

The consumer market has adopted High-Definition Multimedia Interface (HDMI®) technology in TVs, projectors, and other multimedia devices, making HDMI a globally recognized interface that will soon be required in all multimedia devices. Already popular in home entertainment, HDMI interfaces are becoming increasingly prevalent in portable devices and automotive infotainment systems.

Implementation of a standardized multimedia interface was driven by a highly competitive consumer market where time to market is a critical factor. In addition to improved market acceptance, using a standard interface greatly improves compatibility between projectors, DVD players, HDTVs, and other equipment produced by various manufacturers.

In some industrial applications, however, the transition from analog video to digital video is taking longer than in the consumer market, and many devices have not yet moved to the new digital approach of sending integrated video, audio, and data. These devices still use analog signaling as their only means of transmitting video, possibly due to specific requirements of a particular market or application. For example, some customers still prefer to use video graphics array (VGA) cables for projectors, while others use an audio/video receiver (AVR) or media box as a hub, connecting a single HDMI cable to the TV instead of a batch of unaesthetic cables, as outlined in Figure 1.

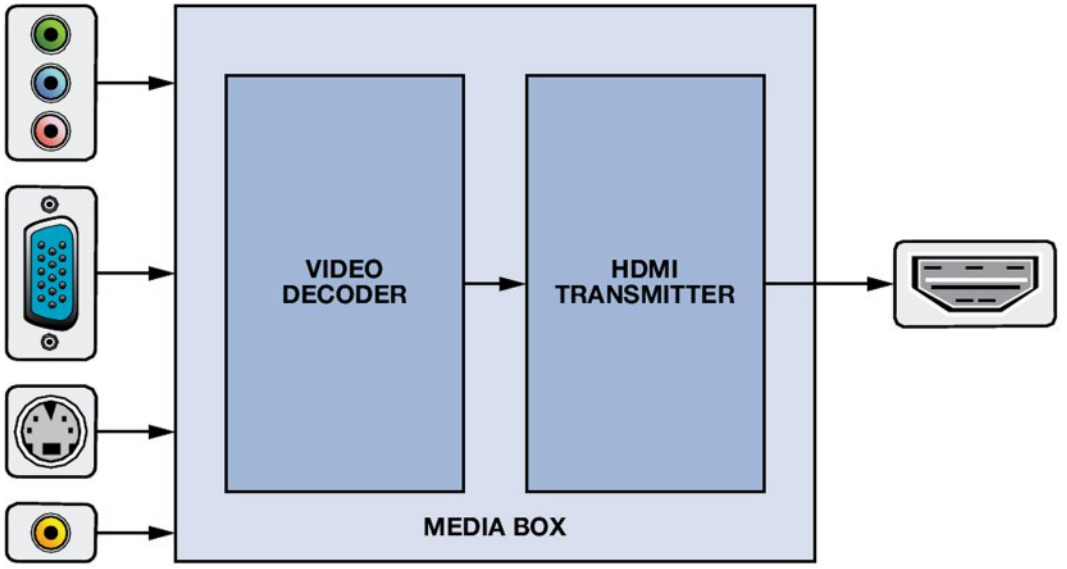


Figure 1. Media box converts analog signal to HDMI

New adopters may see HDMI as a relatively complicated standard to implement, requiring a validated software driver, interoperability checks, and compliance testing to guarantee proper behavior of one device with various other devices. This might seem a bit overwhelming—as is often the case with new technology.

However, advanced silicon solutions are increasingly available to tackle the problem of implementation complexity, achieving improvement in both analog and digital domains; they include higher performance blocks to equalize poor differential signals and more complex algorithms to reduce software overhead and correct bit errors.

This article shows how advanced silicon solutions and smartly implemented software can facilitate HDMI implementation. Two basic devices—HDMI-to-VGA ("HDMI2VGA") and VGA-to-HDMI ("VGA2HDMI") converters—provide engineers familiar with video applications with an easy way to transition between analog video and digital video.

While HDMI has become a defacto interface for HD video, VGA is still the most common interface on a laptop. This article also shows how to interconnect these video technologies.

Introduction to HDMI Application and Video Standards

HDMI interfaces use transition-minimized differential signaling (TMDS) lines to carry video, audio, and data in the form of packets. In addition to these multimedia signals, the interface includes display data channel (DDC) signals for exchanging extended display identification data (EDID) and for high-bandwidth digital content protection (HDCP).

Additionally, HDMI interfaces can be equipped with consumer electronics control (CEC), audio return channel (ARC), and home Ethernet channel (HEC). Since these are not essential to the application described here, they are not discussed in this article.

EDID data comprises a 128-byte long (VESA—Video Equipment Standards Association) or 256-byte long (CEA-861—Consumer Electronics Association) data block that describes the video and (optionally) audio capabilities of the video receiver (Rx). EDID is read by a video source (player) from the video sink over DDC lines using an I2C protocol. A video source must send the preferred or the best video mode supported and listed in EDID by a video sink. EDID may also contain information about the audio capabilities of the video sink and a list of the supported audio modes and their respective frequencies.

Both VGA and HDMI have the DDC connection to support the communication between source and sink. The first 128 bytes of EDID can be shared between VGA and HDMI. From the experience of the HDMI compliance test (CT) lab at Analog Devices, Inc. (ADI), the first 128 bytes of EDID are more prone to error, since some designers are not familiar with the strict requirements of the HDMI specification, and most articles focus on EDID extension blocks.

Table 1 shows the portion of the first 128 bytes of EDID that is prone to error. The CEA-861 specification can be referenced for details of the CEA extension block design that may follow the first 128 bytes of the EDID.

Address	Bytes	Description	Comments
00h	8	Header:(00 FF FF FF FF FF FF 00)h	Mandatory fixed block header
08h	10	Vendor and product identification	
08h	2	ID manufacturer name	Three compressed ASCII character code issued by Microsoft®
12h	2	EDID structure version and revision	
12h	1	Version number: 01h	Fixed
13h	1	Revision number: 03h	Fixed
18h	1	Feature support	Features such as power management and color type. Bit 1 should be set to 1.
36h	72	18 byte data blocks	
36h	18	Preferred timing mode	Indicates one supported timing that can produce best quality on-screen images. For most flat panels, the preferred timing mode is the native timing of panel.

Table continued next page

48h	18	Detailed timing #2 or display descriptor	Indicates detailed timing, or can be used as display descriptor. Two words should be used as the display descriptor, one as the monitor range limit, and one as the monitor name. Detailed timing block should precede display descriptor block.
5Ah	18	Detailed timing #3 or display descriptor	
6Ch	18	Detailed timing #4 or display descriptor	
7Eh	1	Extension block count N	Number of 128-byte EDID extension blocks to follow.
7Fh	1	Checksum	1-byte sum of all 128 bytes in this EDID block shall equal zero.
80...		Block map or CEA extension	

Table 1. EDID Basic Introduction

VESA (Display Monitor Timing)	CEA-861
640 × 350p @ 85 MHz	720 × 576i @ 50 Hz
640 × 400p @ 85 Hz	720 × 576p @ 50/100 Hz
720 × 400p @ 85 Hz	640 × 480p @ 59.94/60 Hz
640 × 480p @ 60/72/75/85 Hz	720 × 480i @ 59.94/60 Hz
800×600p @ 56/60/72/75/85 Hz	720 × 480p @ 59.94/60/119.88/120 Hz
1024 × 768i @ 43 Hz	1280 × 720p @ 50/59.94/60/ 100/119.88/120 Hz
1024 × 768p @ 60/70/75/85 Hz	1920 × 1080i @ 50/59.94/60/100/200 Hz
1152 × 864p @ 75 Hz	1920 × 1080p @ 59.94/60 Hz
1280 × 960p @ 60/85 Hz	1440 × 480p @ 59.94/60 Hz
1280 × 1024p @ 60/75/85 Hz	1440 × 576p @ 50 Hz
1600 × 1200p @ 60/65/70/75/85 Hz	720(1440) × 240p @ 59.94/60 Hz
1920 × 1440p @ 60/75 Hz	720(1440) × 288p @ 50 Hz

Table 2. Most Popular VESA and CEA-861 Standards (p = progressive, i = interlaced)

The timing formats for VGA and HDMI are defined separately by the two standard-setting groups mentioned above: VESA and CEA/EIA. The VESA timing formats can be found in the VESA Monitor Timing and Coordinate Video Timings Standard; the HDMI timing formats are defined in CEA-861. The VESA timing format covers standards, such as VGA, XGA, SXGA, that are used mainly for PCs and laptops. CEA-861 describes the standards, such as 480p, 576p, 720p, and 1080p, that are used in TV and ED/HD displays. Among the timing formats, only one format, 640 × 480p @ 60 Hz, is mandatory and common for both VESA and CEA-861 standards. Both PCs and TVs have to support this particular mode, so it is used in this example. Table 2 shows a comparison between commonly supported video standards. Detailed data can be found in the appropriate specifications.

Brief Introduction to Application and Section Requirements

The key element of HDMI2VGA and VGA2HDMI converters is to ensure that the video source sends a signal conforming to proper video standards. This is done by providing a video source with the appropriate EDID content. Once received, the proper video standard can be converted to the final HDMI or VGA standard.

The functional block diagrams in Figure 2 and Figure 3 outline the respective processes of HDMI2VGA and VGA2HDMI conversion. The HDMI2VGA converter assumes that the HDMI Rx contains an internal EDID.

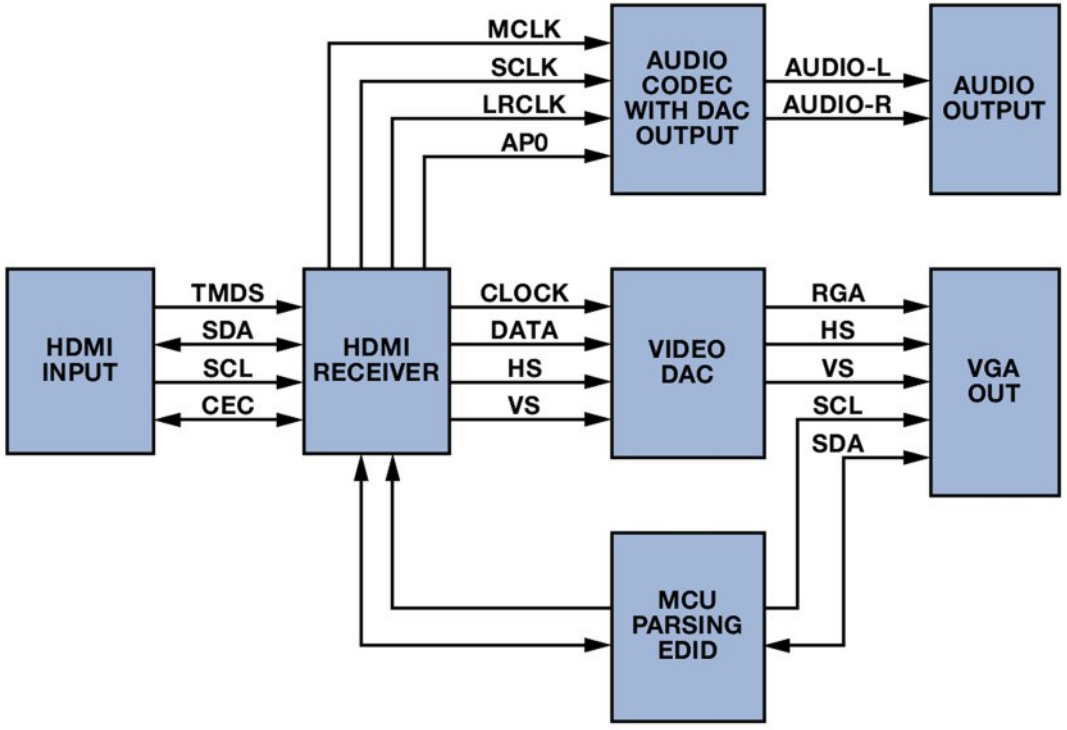


Figure 2. HDMI2VGA converter with audio extraction.

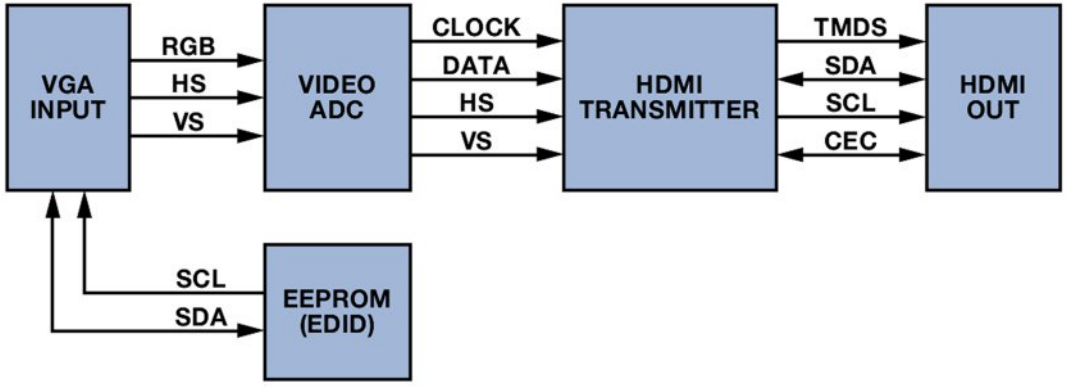


Figure 3. VGA2HDMI converter.

Theory of Operation

VGA2HDMI: a VGA source reads the EDID content from the sink to get the supported timing list using t he DDC lines channel, and then the video source starts sending the video stream. The VGA cable has RGB signals and separate horizontal (HSYNC) and vertical (VSYNC) synchronization signals. The downstream VGA ADC locks to HSYNC to reproduce the sampling clock. The incoming sync signals are aligned to the clock by the VGA decoder.

The data enable (DE) signal indicates an active region of video. The VGA ADC does not output this signal, which is mandatory for HDMI signal encoding. The logic-high part of DE indicates the active pixels, or the visual part of the video signal. A logic-low on DE indicates the blanking period of the video signal.

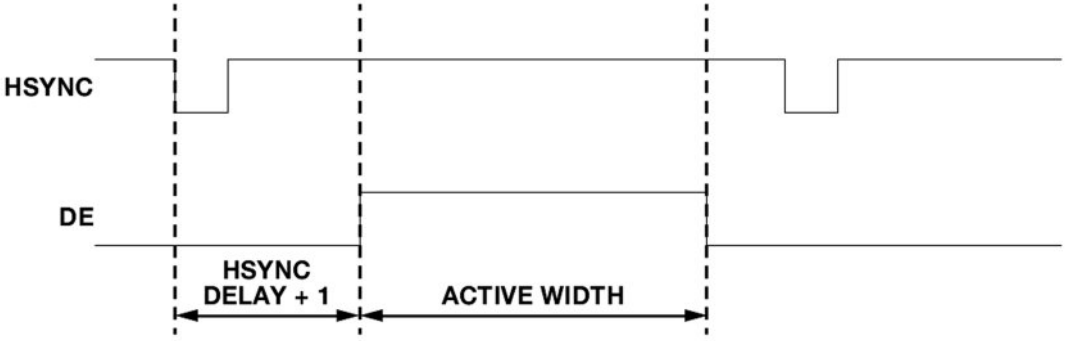


Figure 4. Horizontal DE generation.

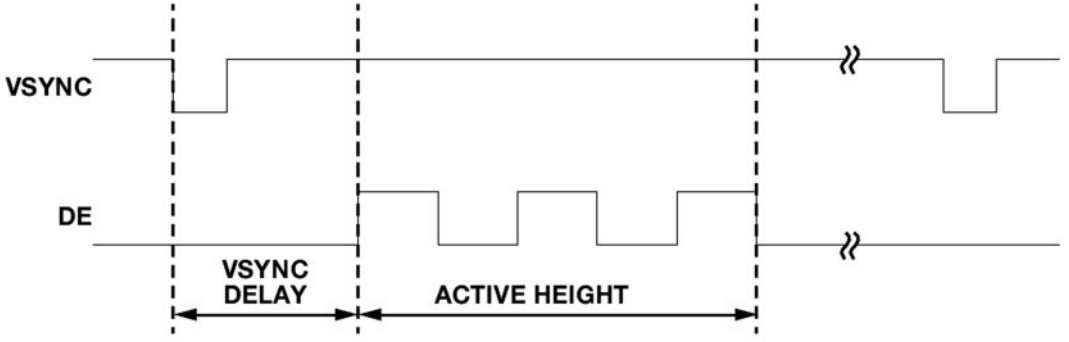


Figure 5. Vertical DE generation.

The DE signal is critical in order to produce a valid HDMI stream. The lack of a DE signal can be compensated for by the HDMI transmitter (Tx), which has the capability to regenerate DE.

Modern HDMI transmitters can generate a DE signal from the HSYNC and VSYNC inputs using a few parameter settings, such as HSYNC delay, VSYNC delay, active width, and active height—as shown in Figure 4 and Figure 5—ensuring compatibility for HDMI signal transmission.

The HSYNC delay defines the number of pixels from the HSYNC leading edge to the DE leading edge. The VSYNC delay is the number of HSYNC pulses between the leading edge of VSYNC and DE. Active width indicates the number of active horizontal pixels, and active height is the number of lines of active video. The DE generation function can also be useful for display functions such as centering the active video area in the middle of the screen.

Display position adjustment is mandatory for VGA inputs. The first and last pixel of the digitized analog input signal must not coincide with or be close to any HSYNC or VSYNC pulses. The period when the DE signal is low (such as the vertical or horizontal blanking interval) is used for transmitting additional HDMI data and audio packets and, therefore, cannot be violated. The ADC sampling phase can cause this kind of misalignment. An active region misalignment may be suggested by a black stripe on the visual area of the screen. For a composite video broadcast signal (CVBS), this phenomenon can be corrected by overscanning by 5% to 10%.

VGA is designed to display the whole active region without eliminating any area. The picture is not overscanned, so the display position adjustment is important for VGA to HDMI conversion. In a best-case scenario, the black stripe can be automatically recognized, and the image can be automatically adjusted to the middle of the final screen—or manually adjusted according to the readback information. If the VGA ADC is connected to the back-end scaler, the active video can be properly realigned to the whole visible area.

However, using the scaler to fix an active video region misalignment increases the cost of the design and the associated risks. With a scaler and a video pattern, for example, a black area surrounding a small white box inside the active region could be recognized as a useless bar and removed. The white box would become a pure white background when the black area was removed. On the other hand, an image with half white and half black would result in distortion. Some prevention mechanism must be integrated to prevent this kind of incorrect detection.

Once the HDMI Tx locks and regenerates the DE signal, it starts sending the video stream to an HDMI sink, such as a TV. In the meantime, the on-board audio components, such as the audio codec, can also send the audio stream by I2S, S/PDIF, or DSD to the HDMI Tx. One of the advantages of HDMI is that it can send video and audio at the same time.

When a VGA2HDMI conversion board powers up and the source and sink are connected, the MCU should read back the EDID content of the HDMI sink via the HDMI Tx DDC lines. The MCU should copy the first 128 bytes of EDID to the EEPROM for the VGA DDC channel with minor modification since the VGA DDC channel does not usually support the CEA extension used for HDMI. Table 3 (next page) provides a list of required modifications.

HDMI2VGA: the HDMI2VGA converter has to first provide proper EDID content to the HDMI source prior to receiving the desired 640 × 480p signal—or other standard commonly supported by the video source and display. An HDMI Rx usually stores the EDID content internally, handles the hot plug detect line (indicating that a display is connected), and receives, decodes, and interprets incoming video and audio streams.

Since the HDMI stream combines audio, video, and data, the HDMI Rx must also allow readback of auxiliary information

Modification	Reason
Change EDID 0x14[7] from 1 to 0	Indicates analog VGA input
Modify established timing, standard timing, preferred timing, and detailed timing	Timing beyond the maximum supported by the VGA converter and HDMI Tx must be changed to maximum timing or below
Set 0x7E to 00	No EDID extension block
Change 0x7F	Checksum has to be recalculated based on above changes

Table 3. List of Modifications Needed for a VGA2HDMI Converter

such as color space, video standards, and audio mode. Most HDMI receivers adapt to the received stream, automatically converting any color space (YCbCr 4:4:4, YCbCr 4:2:2, RGB 4:4:4) to the RGB 4:4:4 color space required by the video DAC. Automatic color space conversion (CSC) ensures that the correct color space is sent to a backend device.

Once an incoming HDMI stream is processed and decoded to the desired standard, it is output via pixel bus lines to video DACs and audio codecs. The video DACs usually have RGB pixel bus and clock inputs without sync signals. HSYNC and VSYNC signals can be output through the buffer to the VGA output and finally to the monitor or other display.

An HDMI audio stream can carry various standards, such as L-PCM, DSD, DST, DTS, high-bit-rate audio, AC3, and other compressed bit streams. Most HDMI receivers do not have a problem extracting any audio standard, but the further processing might. Depending on the backend device, it may be preferable to use a simple standard rather than a complex one to allow easy conversion to the analog output for speakers. HDMI specifications ensure that all devices support at least 32 kHz, 44.1 kHz, and 48 kHz LPCM.

It is, thus, important to produce EDID that matches both the audio capability of the HDMI2VGA converter that extracts the audio and the original capabilities of the VGA display. This can be done by using a simple algorithm that retrieves EDID content from the VGA display via DDC lines. The readback data should be parsed and verified to ensure that the monitor does not allow higher frequencies than those supported by the HDMI Rx or video DAC (refer to Table 4). An EDID image can be extended with an additional CEA block that lists audio capabilities to reflect that the HDMI2VGA converter supports audio only in its linear PCM standard. The prepared EDID data containing all the blocks can, therefore, be provided to the HDMI source. The HDMI source should reread EDID from the converter after pulsing the hot plug detect line (part of the HDMI cabling).

A simple microcontroller or CPU can be used to control the whole circuit by reading the VGA EDID and programming the HDMI Rx and audio DAC/codec. Control of the video DACs is usually not required, as they do not feature control ports such as I2C or SPI.

Modification	Reason
Change 0x14[7] from 0 to 1	Indicates digital input
Check standard timing information and modify if necessary (bytes 0x26 to 0x35)	Timing beyond the maximum supported by the converter and HDMI Rx must be changed to maximum timing or below
Check DTD (detailed timing descriptors) (bytes 0x36 to 0x47)	Timing beyond the maximum supported by the converter and HDMI Rx must be changed to maximum timing or below (to 640 × 480p, for example)
Set 0x7E to 1	One additional block must be added at end of EDID

Continued next page

Change 0x7F	Checksum must be recalculated from bytes 0 to 0x7E
Add extra CEA-861 block	
0x80 to 0xFF describing audio	Add CEA-861 block to indicate audio converter capabilities

Table 4. List of Modifications Needed for an HDMI2VGA Converter

Content Protection Considerations

Since typical analog VGA does not provide content protection, standalone converters should not allow for the decryption of content-protected data that would enable the end user to access raw digital data. On the other hand, if the circuit is integral to the larger device, it can be used as long as it does not allow the user to access an unencrypted video stream.

Example Circuitry

An example VGA-to-HDMI board can use the *AD9983A* high-performance 8-bit display interface, which supports up to UXGA timing and RGB/YPbPr inputs, and the *ADV7513* high-performance 165-MHz HDMI transmitter, which supports a 24-bit TTL input, 3D video, and variable input formats. It is quick and convenient to build up a VGA2HDMI converter using these devices. The ADV7513 also features a built-in DE generation block, so no external FPGA is required to generate the missing DE signal. The ADV7513 also has an embedded EDID processing block and can automatically read back the EDID information from the HDMI Rx or be forced to read back manually.

Similarly, building an HDMI2VGA converter is not overly complicated; a highly integrated video path can be built with the *ADV7611* low-power, 165-MHz HDMI receiver and the *ADV7125* triple, 8-bit, 330-MHz video DAC. The Rx comes with built-in internal EDID, circuitry for handling hot plug assert, an automatic CSC that can output RGB 4:4:4, regardless of the received color space, and a component processing block that allows for brightness and contrast adjustment, as well as sync signal realignment. An *SSM2604* low-power audio codec allows the stereo I2S stream to be decoded and output with an arbitrary volume through the DAC. The audio codec does not require an external crystal, as the clock source can be taken from the ADV7611 MCLK line, and only a couple of writes are required for configuration.

A simple MCU, such as the *ADuC7020* precision analog microcontroller with a built-in oscillator, can control the whole system, including EDID handling, color enhancement, and a simple user interface with buttons, sliders, and knobs.

Figure 6 and Figure 7 (next page) provide example schematics for the video digitizer (AD9983A) and HDMI Tx (ADV7513) essential for a VGA2HDMI converter. MCU circuitry is not included.

Conclusion

Analog Devices audio, video, and microcontroller components can implement highly integrated HDMI2VGA or VGA2HDMI converters that can be powered with the small amount of power provided by a USB connector.

Both converters show that applications using HDMI technology are easy to apply with ADI components. HDMI system complexity increases for devices that are supposed to work in an HDMI repeater configuration, as this requires handling the HDCP protocol along with the whole HDMI tree. Neither converter uses an HDMI repeater configuration.

Applications such as video receivers (displays), video generators (sources), and video converters require a relatively small software stack and, therefore, can be implemented in a fast and easy way. For more details and schematics, refer to ADI's *EngineerZone* Web pages.

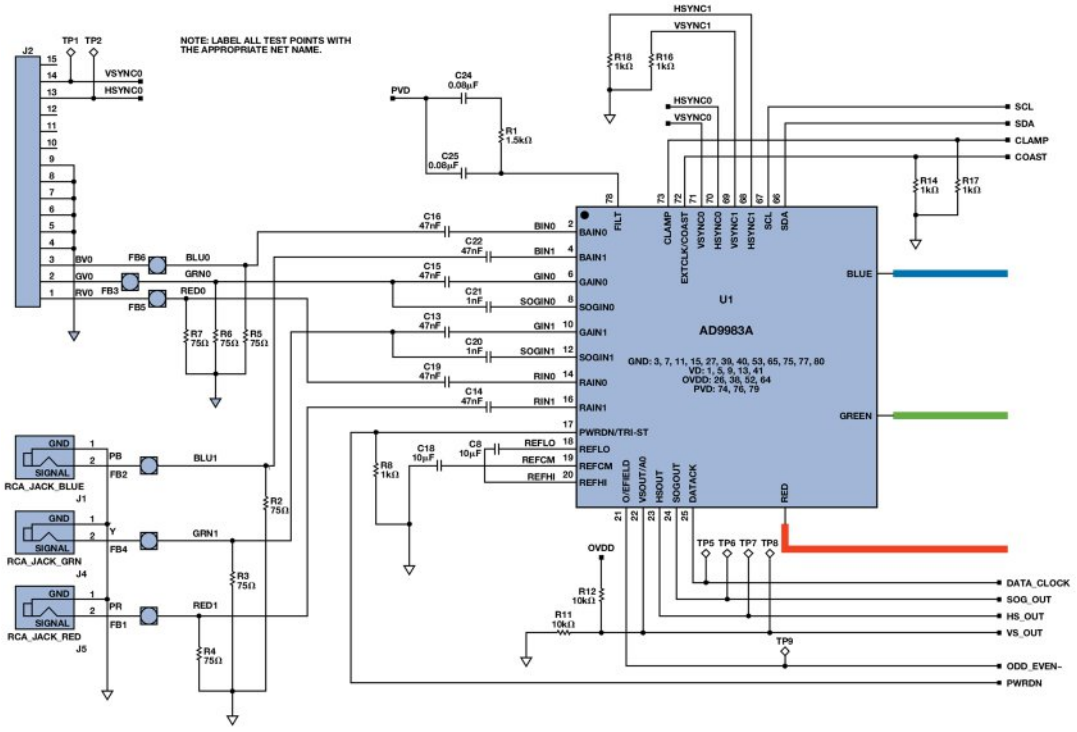


Figure 6. AD9983A schematic

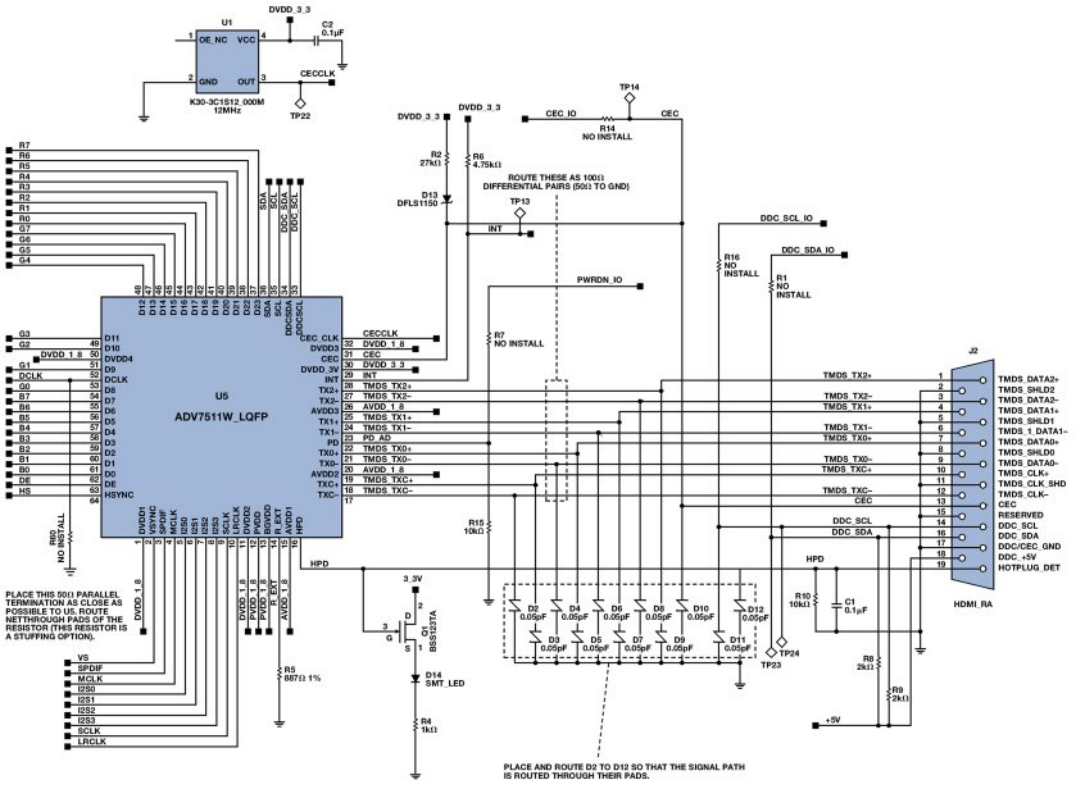


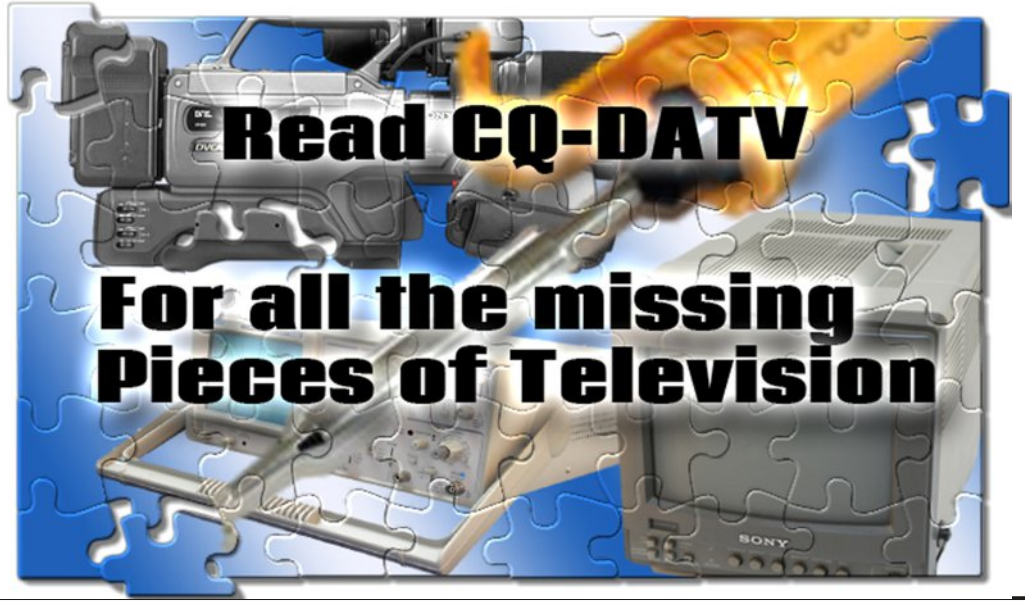
Figure 7. ADV7513 schematic.

References

A DTV Profile for Uncompressed High Speed Digital Interfaces (CEA-861-E).

Display Monitor Timing (DMT), Coordinated Video Timings (CVT), and Enhanced Extended Display Identification Data (E-EDID) standards are available from *VESA* .

Original article and author bio's:
http://www.analog.com/library/analogDialogue/archives/47-02/HDMI_VGA.html



Stand alone SSTV for the Raspberry Pi

This directory:

https://github.com/JennyList/LanguageSpy/tree/master/RaspberryPi/rf/sstv

contains proof-of-concept code to use the Raspberry Pi as a stand-alone slow-scan television (SSTV) transmitter generating low-level RF using the Pi's internal clock generator on pin 7 of the expansion connector.

It builds on the work of others, in particular the following:

- *beacon.py from http://hsbp.org/rpi-sstv*
- *freq_pi from http://panteltje.com/panteltje/newsflex/download.html*
- *It relies upon PySSTV https://github.com/dnet/pySSTV to generate tone, duration pairs.*

Overview

There are two pieces of software in this package.

1. *beacon.py takes a jpeg image hard-coded as test.jpg, passes it through PySSTV, and returns tone and duration pairs to stdout.*
2. *tones-to-rf takes a CSV file hard-coded as test.csv containing tone(Hz) and duration(mSec) pairs generated by beacon.py, then adds each successive tone to an RF carrier generated on GPCLK0 for each duration.*

If you have an appropriate amateur radio licence this RF can be fed through a low-pass filter to an antenna to make a simple QRP (less than 10mW) SSTV transmitter.

Installation and config

You will first need to install PySSTV, if you do not already have it. The following commands worked for me on a stock Raspbian install.

```
sudo apt-get install python-setuptools
sudo apt-get install python-imaging
sudo easy_install pip sudo pip install
setuptools --no-use-wheel --upgrade
sudo pip install PySSTV
```

Then you will need to configure and compile tones-to-rf.c

The version of tones-to-rf.c distributed is pre-configured for the Raspberry Pi 2. If you have a Raspberry Pi 1, find the lines that define BCM2708_PERI_BASE, and uncomment the line relevant to your platform.

Compile tones-to-rf as follows:

```
gcc -Wall -O4 -o tones-to-rf tones-to-rf.c -std=gnu99 -lm
```

Usage

First, set up your RF output and HF receiver. It is suggested that you use a DC blocking capacitor on pin 7 of the expansion connector, and feed it into a dummy load for testing. This software was written to demonstrate the RF breakout board at:

https://www.kickstarter.com/projects/2001938575/rf-breakout-kit-for-the-raspberry-pi

with that board an old 50 ohm BNC Ethernet terminator was used. The HF receiver was loosely coupled with a short piece of insulated wire from its antenna terminal looped round the Ethernet terminator. SSTV was demodulated using an Android SSTV app on a tablet next to the speaker. The SSTV mode is set as Martin2 in beacon.py.

Save the JPEG image you wish to transmit as test.jpg. You could add Python code to put your callsign in as the original beacon.py did, however I used the GIMP. Run beacon.py as follows, piping output to a file.

```
python beacon.py  >  test.csv
```

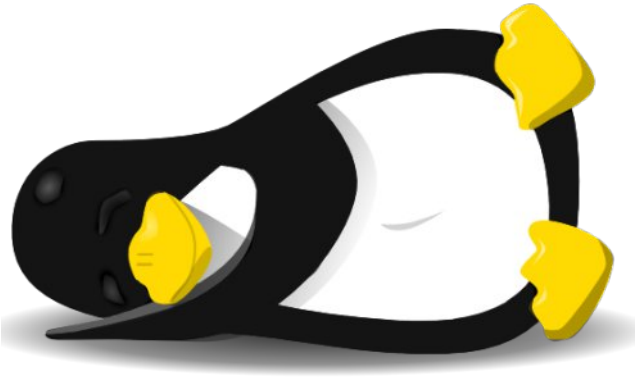
You should find test.csv, containing frequency,duration pairs.

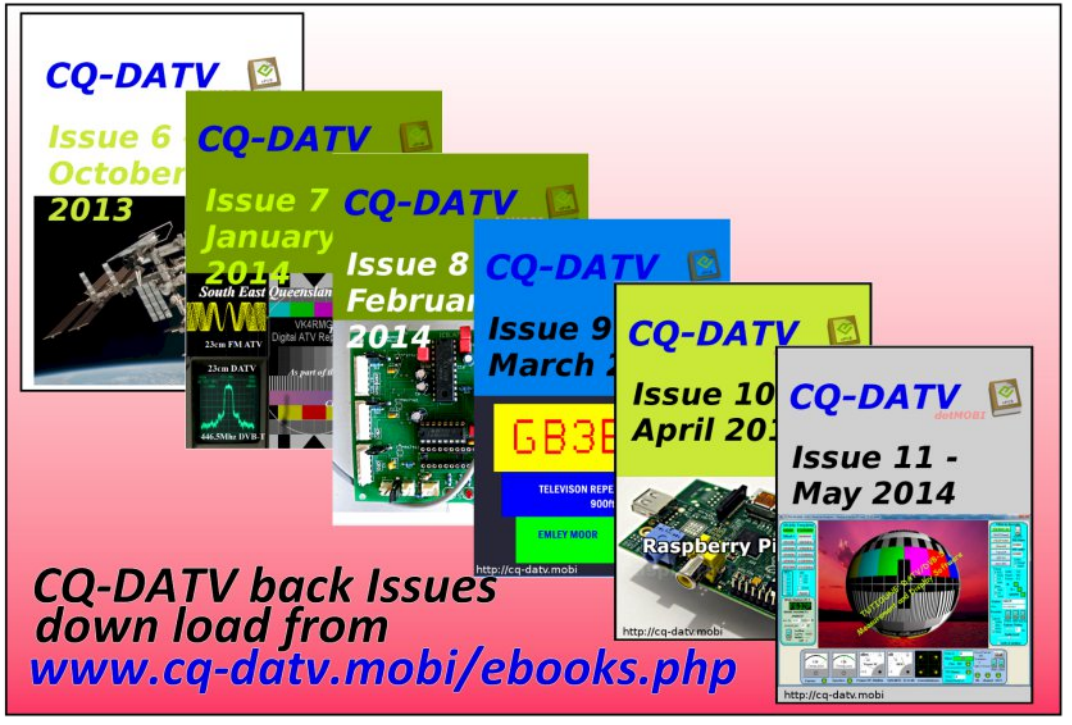
Then run tones-to-rf to generate the transmission. Specify a frequency as below, in this example the 20m SSTV calling frequency. Tune your receiver to the frequency.

```
sudo ./tones-to-rf -f 14230000
```

You should hear the SSTV tones in your receiver's speaker, and all being well your SSTV decoder should give you your image.

There is a fudge factor with comments in the CSV-reading loop of tones-to-rf.c. This is to compensate for the time taken by each iteration of the loop, and was found by trial and error for best picture decoding. It therefore should work for a Raspberry Pi 2, but may not work for a Raspberry Pi 1. You may have to experiment with this figure. This is proof-of-concept code only.





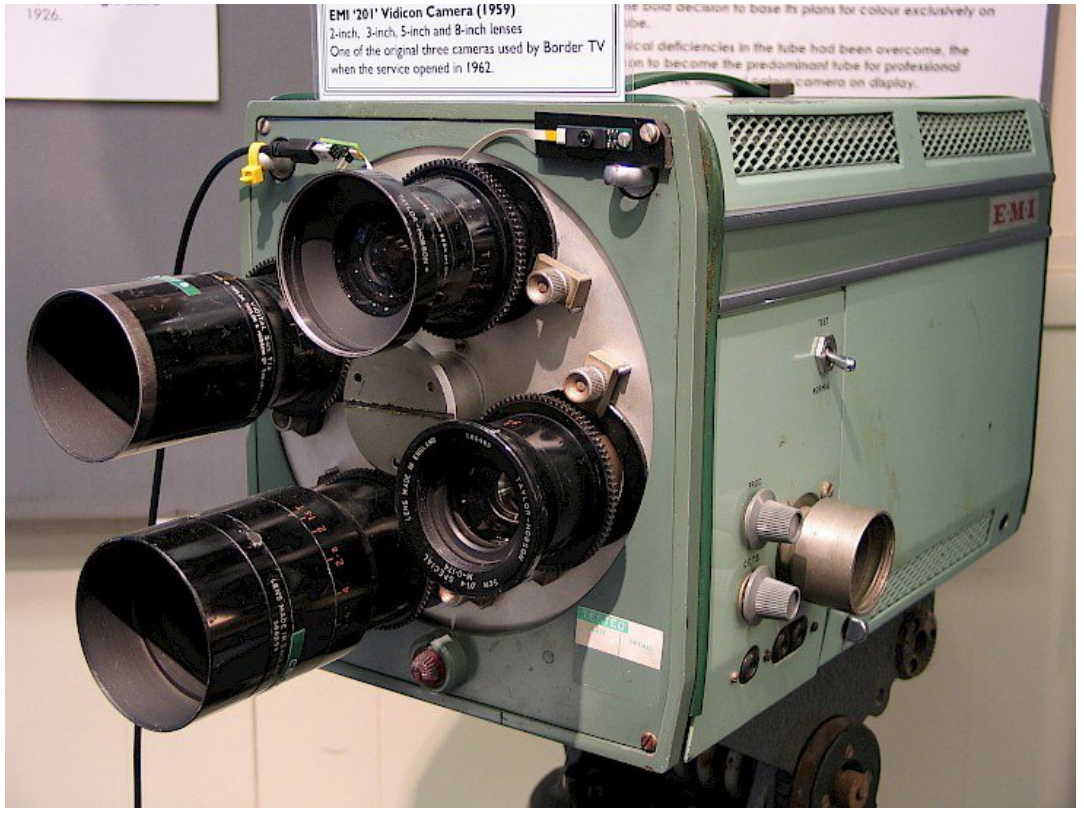
Using non-Samsung Lenses on the Samsung NX 500 Camera

By Trevor G8CJS

My journey into TV camera lenses started in the 60's with a Pye Lynx camera and a Cosmicar C mount lens. My lens had a focal length of around 1" that's 25mm these days. It was a prime focus (IE no zoom), although we did not call them that back then. If you pointed the camera out of the window and set the focus ring to ∞ (infinity) and then moved the tube for sharp focus. The camera would re focus down to about a metre by readjusting the lens focus. If you wanted to focus on something closer then it was unscrew the lens a few threads, to increase the distance between the lens and the tube, or reset the tube position and lose infinity focus.

Pye Lynx and Cosmicar lens, although not the original that's long gone

When I started working in a TV studio, the professional cameras had a better arrangement. They had several lenses of different focal lengths in a turret arrangement, so you could crank anyone of them in front of the tube and also rack the tube back and forwards with an external handle for optimum focus.



EMI turret studio camera - the focus control is on the other side

The individual lenses did not have a focus adjustment. The turret could not be revolved on air (well it could, but it did not look attractive) so there had to be more than one camera for a live shoot or you were stuck on the same lens for the whole show. The skill was to select the required lens for the shot and crank it into position and then adjust the focus. The watch word was speed so knowing which way to move the focus control as people moved around the set also helped.

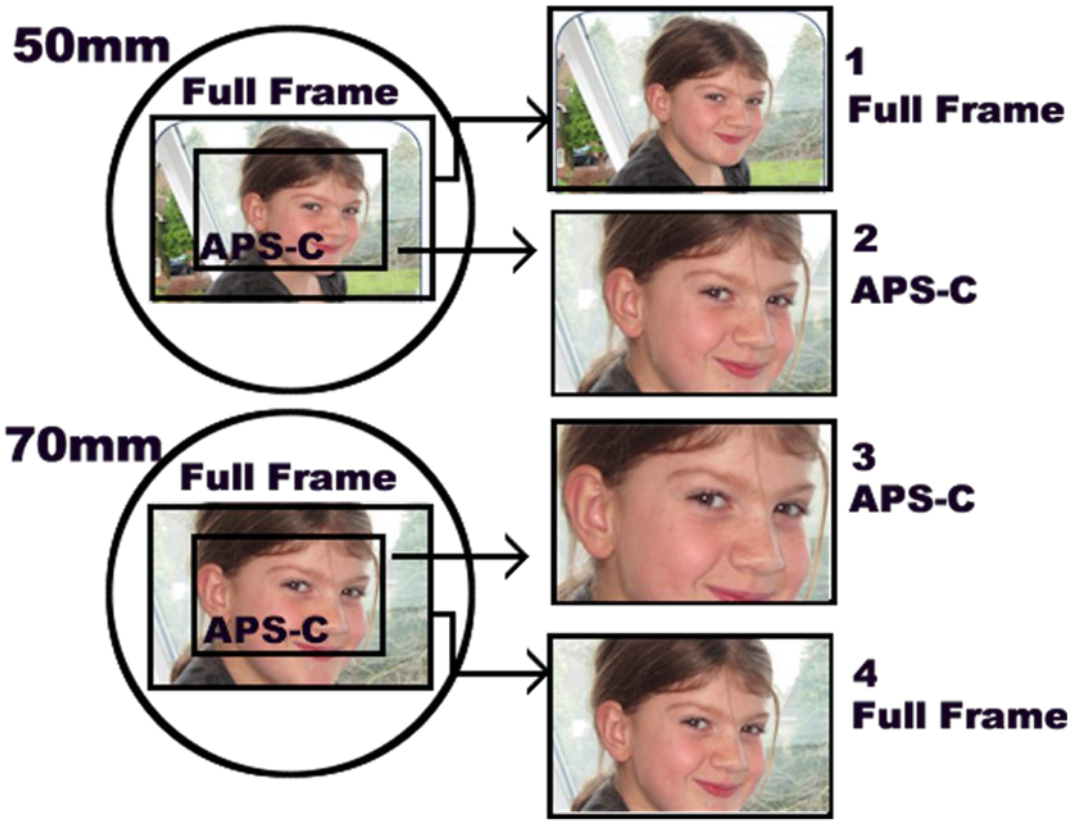
The widest or shortest focal length lens on the turret usually had a focal length of 1" or 2", this allowed the camera to be tracked (wheeled) across the floor to change the picture size on shot, but again this involved being rather nifty with the focus which changed as you pushed the camera nearer or pulled it back from the scene. The 1" lens on the studio camera was physically much larger than the C mount Cosmicar on the lynx, but so was the camera tube (4 1/2") and the presented scene was much wider than I would have expected from my Lynx and its 1" lens.

Defining this picture size from a given focal length lens is a problem that has persisted in lens optics for both TV, Film and stills, and now seems to have a potential solution, in that two things need to go into the equation, the first is the focal length of the lens and the second is the size of the sensor. First we quote all lens focal lengths in mm (25mm approximates to one inch, if you are not in a metric country) and also adjust the result as if the lens was working with 35mm film size sensors. The word we use is 35mm equivalency. This is a photographic rather than TV standard, but as all photographic cameras now shoot TV pictures it is not a bad standard to adopt and takes care of the problem that for a given focal length of lens, the picture angle of view will vary with sensor size.

Therefore as sensors reduce or increase in size from the standard 35mm frame we can calculate the lens performance, from a picture size or angle of view (if you prefer it), by applying a crop size.

A sensor smaller than 35mm would have a crop factor of more than 1 and will increase the focal length of the lens. Sensors bigger than 35 would have the opposite effect.

Zoom lenses or lenses with a variable focal length are a little more complex to define. We use the term ratio to define the focal length range. If the maximum range through which a

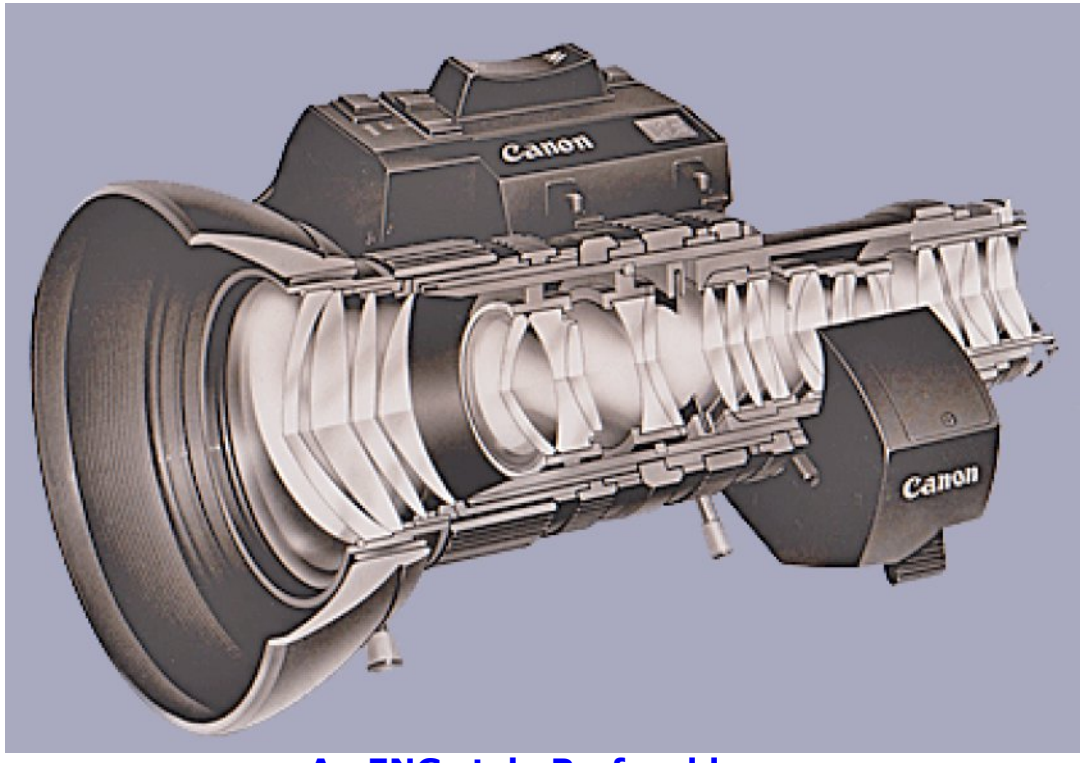


particular lens can be zoomed is 10mm to 100mm, it's said to have a 10:1 (ten-to-one) zoom ratio (10 times the minimum focal length of 10mm equals 100mm).

That may tell you something significant, but it doesn't tell you the minimum and maximum focal lengths of the lens. A 10:1 zoom lens could have a 10 to 100mm, or a 100 to 1,000mm lens, and the difference would be quite dramatic.

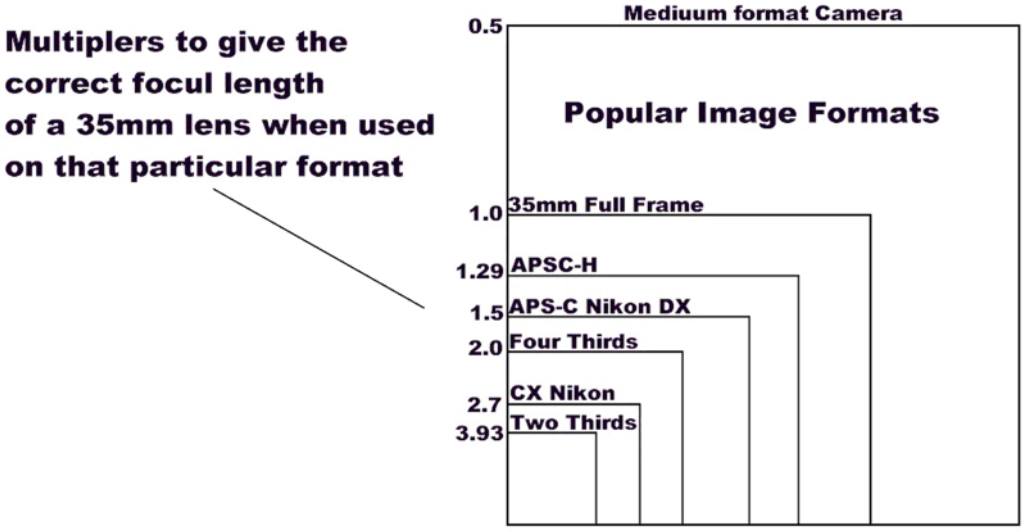
To solve this problem, we refer to the first zoom lens as a 10 X 10 (ten-by-ten) and the second as a 100 X 10. The first number represents the minimum focal length and the second number the multiplier. So a 12 X 20 zoom lens has a minimum focal length of 12mm and a maximum focal length of 240mm. Beware this logic has exceptions E.G. a Canon J15x9.5 lens has a ratio of 15 times, from 9.5mm to 143mm

On a professional TV camera equipped with a zoom lens, you will often find a front and rear focus. On domestic models and what is now becoming called bridge cameras (stills cameras that will shoot movies too) you only get one focus. This was because back in the pre auto focus days lenses need to track focus from the tight shot to the wide shot. The rear focus was set on wide and the front focus was set on close up and the lens would then track focus and is technically a parfocal lens. Single focus lenses were called varifocal and did not track focus as this is not a requirement of stills photography although with modern auto focus and face recognition a varifocal lens will auto adjust and often present a reasonable focus track.



An ENG style Parfocal lens

Hand held camera work will always require a wide angle lens, for a professional 2/3 camera equipped with a 5mm minimum zoom this will crop to 20mm (35mm equivalency) see the crop chart.



Crop Chart

There are other considerations to lens size:-

If the sensor is too large for the lens you will get the effect known as Vignetting, which is a reduction of an images brightness or saturation at the image periphery, compared to the image centre. The word actually means a decorative boarder and is derived from the French word Vignette. You may have seen it if you have tried filming projected movies. It can look attractive, and is often added to pictures, but you want to retain the option to add it or remove not be saddled with it whether you like it or not.

I own a professional B4 camera lens which was designed for a 2/3 ice block (the optical splitter for cameras which have three sensor or three tubes if you go back far enough). The lens is 10mm at its widest and this will crop to almost 40mm and is not what I want for handheld camera work, but could have merits for other work, particularly because it will maintain the largest F stop (aperture), throughout its zoom range, something that you do not find on inexpensive bridge cameras. *Adaptors* are available and also power packs for the zoom motors, but are not cheap.

Beside my B4 lens, I have a set of 35mm prime focus lenses which belong to my Olympus OM1 (35mm film camera from the 70's).

If I could overcome the mechanical mounting problems then they might have other uses. A search of EBay revealed a Pixco adaptor for this range of lenses at a modest £12 so yes I bought one. The Olympus is a full frame 35mm camera, (no crop) so only 70% of the lens will be used by our Samsung (APS-C) so I expected vignetting free images and that's what I got.

PIXCO Adapto

Because you are only using around 70% of the image derived by the lens and displaying it full screen there will be a magnification or crop factor of around 1.5 (see the crop chart). So my 135mm lens will become 135x1.5 a lens with a focal length of just over 200mm.

Lens and adaptor fitted to the NX 500

It might have TV uses if you have to film a TV presentation from a distance or you are into wildlife, but you will need a good steady tripod and don't expect any smooth camera work. For stills well you will need a fast shutter speed, which will reduce light.

Another snag is manual focusing, the OM1 Lenses were all manual focus, but even if they were not, then every camera body has its own way of communicating focus information with the lens, for auto focusing and this information will not be presented to a camera with a third party adaptor between the camera and lens. The same goes for auto exposure, so the best stills mode for one of these lenses is aperture priority, where you set the aperture and the camera figures out the shutter speed.

The last problem or advantage (depends on your point of view) is depth of field, this reduces as you increase the focal

length of the lens. So at 200mm there won't be much. Depth of field also reduces as you open up the aperture, so F1.8 will have less depth of field than F16.

The original Olympus camera helped out with focusing, by letting you set the aperture, but as a preset, it always displayed the picture at full aperture. So you saw the brightest and most critical focused display in the viewfinder and then when you trip the shutter, it would stop the lens down take the picture and open the lens back up, but again this function is inhibited by the Pixco, so what you see is what you get.

The Samsung lens does have a manual focus setting and focus assist, which works by magnifying the picture size by up to 8 times (size preset able in the menu). This kicks in when you turn the focus ring on the Samsung lens, in manual focus, but alas with this lens removed you cannot invoke this focus assist.

So is it possible to use a 200mm lens for a portrait, yes you will need to stand a long way back, have good focusing skills and a patient model, but you can really get a great reduction in depth of field and produce a very soft background.

Olympus 135mm lens on a Samsung NX500 (Model Georgina)

Let's return to TV mode as there is also an unexpected effect on the Samsung Camera dependent on the filming resolution.

When this high pixel camera (28 M pixels for the Samsung) is put into movie mode, the sensor is often under scanned as even 4k filming does not require 28M pixels. So changing the picture standard from SD to HD to 4k can change the crop multiplier, so my 135mm lens might become 200mm for a still or HD movie (2048 x 1024), but for a 4K movie (4096 x 2160) the crop unexpectedly increases.

This I have to say was unexpected, 4K requires more pixels then HD, so I would expect to be using a larger part of the sensor and the crop factor to reduce and the lens present a wider picture. Because of this unwanted digital zoom, which increases the focal length of the lens, I have decided to only film in HD (2048x1024) when attempting had held movie shots. So I can use the Samsung zoom at 16mm (widest setting) which crops to 1.5 (APS-C Sensor size) and I have 24mm which does allow some handheld work (more next issue).

Last problem is my OM lenses and by B4 lens follow the TV standard and anything moving towards the camera will require the focus to be rotated clockwise from the rear, the Samsung lens requires anticlockwise. This is not a problem in movie mode as you cannot select manual focus on the Samsung lens, only auto focus, but you can in stills mode.

Bottom line I love the camera I think it represents excellent value for money. I like the picture quality and can forgive H265 in movie mode as it is probably essential to get 4k onto an SD card, with the only other alternative been an increase in compression which is always accompanied by picture degradation.

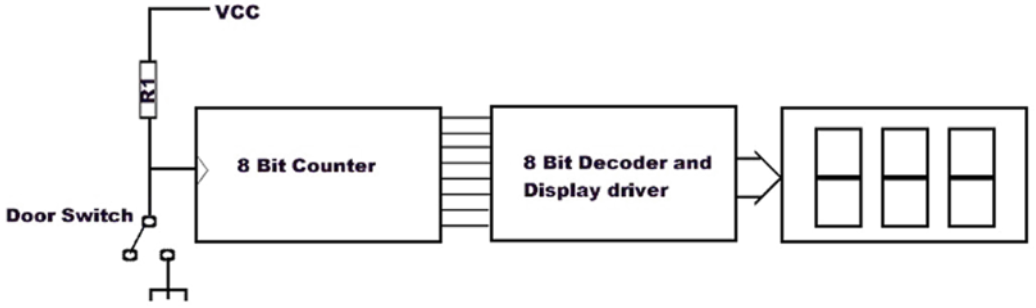
In CQ-DATV 28 I will get to grips with H265, how to process the results and why Samsung have implemented it and why they deserve a pat on the back for this brave move. In CQ-DATV 26 I provided a link to some H265 pictures on my cloud for would be experimenters, so you might be ahead of me on processing this format.

Skills test, a puzzle

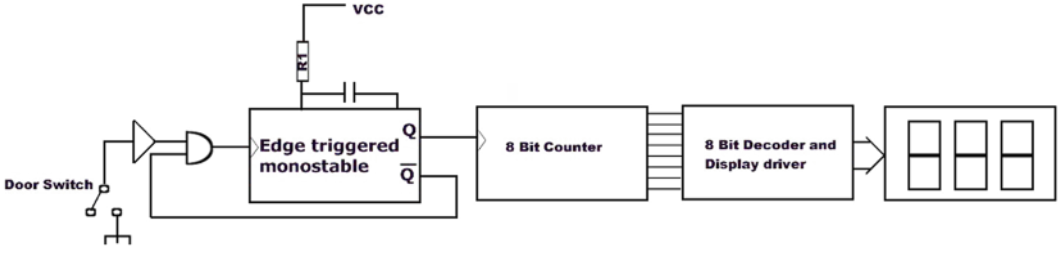
For the last issues puzzle, we set you a logic problem and asked you to assume you had a built a simple counter connected to set of door contacts driving a counter and decoder to display how many times the door was opened in a day.

The problem was the counter was inaccurate and always displays more door openings than actually happen. You traced this down to switch bounce and needed to re design the door switch logic to eliminate contact bounce.

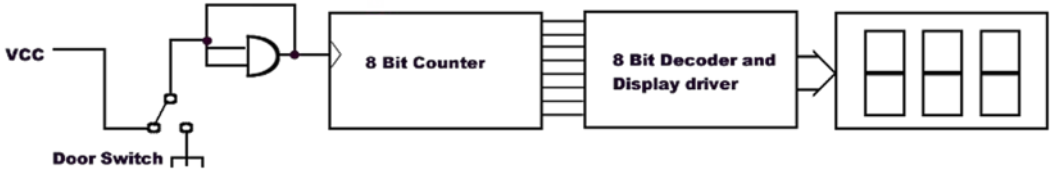
What we had in mind was a simple monostable timer edge triggered:-



The monostable needs to fire on positive going edges. The AND gate is fed with a logic 1 from the Q bar of our monostable, when it is resting, the door contact logic is inverted so when the door opens it to presents a logic 1 to the AND gate input. The output goes high and triggers the monostable, which delivers a logic 0 to the AND gate and inhibits its action until the switch has stopped bouncing. The CR time constant needs to be longer than the duration of any switch bounces.

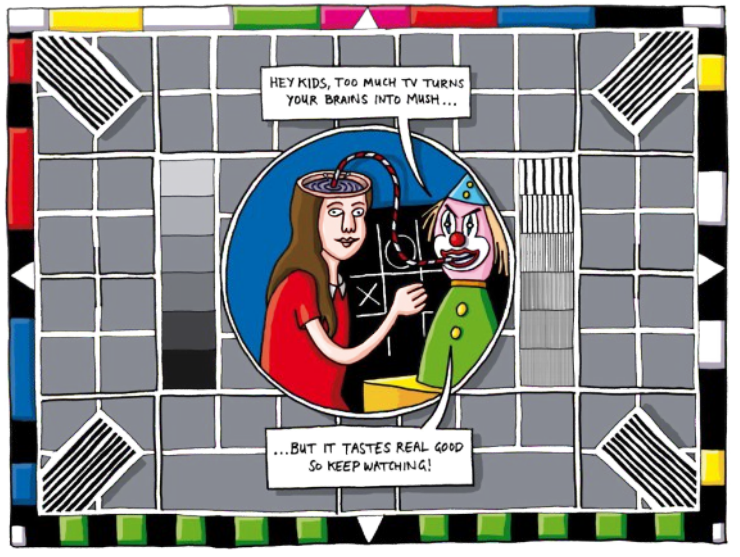


We did have a different solution from one of our readers:-



A shorted out AND, plus a switch rewire so we have a high on the counter which the switch will pull low and the output of the AND gate will hold it there providing the switch only bounces back to open circuit and not all the way back to logic 1. The AND gate will act like a latch and hold either a 1 or a 0 if presented with on open circuit. This is a little hard on the AND gate as it is in a destruct mode for the time it takes the input signal to propagate to the output and it needs a change over door switch not just one that goes open circuit, otherwise it has the merit of simplicity.

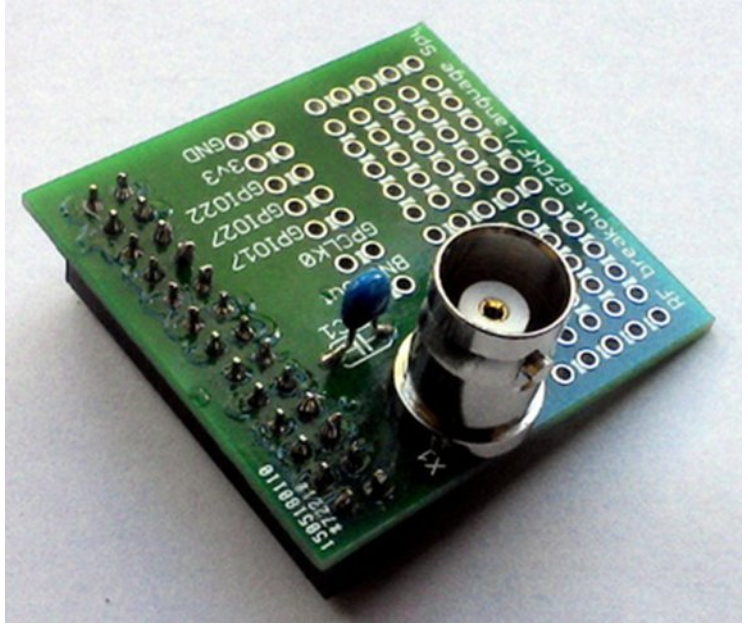
An alternative test card courtesy GB3FY - see Test card article elswhere in this issue



RF Breakout Kit for the Raspberry Pi

What is it?

An expansion board supplied as a self-assembly kit, designed for experiments with the Raspberry Pi as a radio frequency source or radio transmitter using the programmable clock generator built into the Pi's processor.



An assembled kit

Who is it aimed at?

This kit is aimed at radio amateurs and electronics experimenters with an interest in radio.

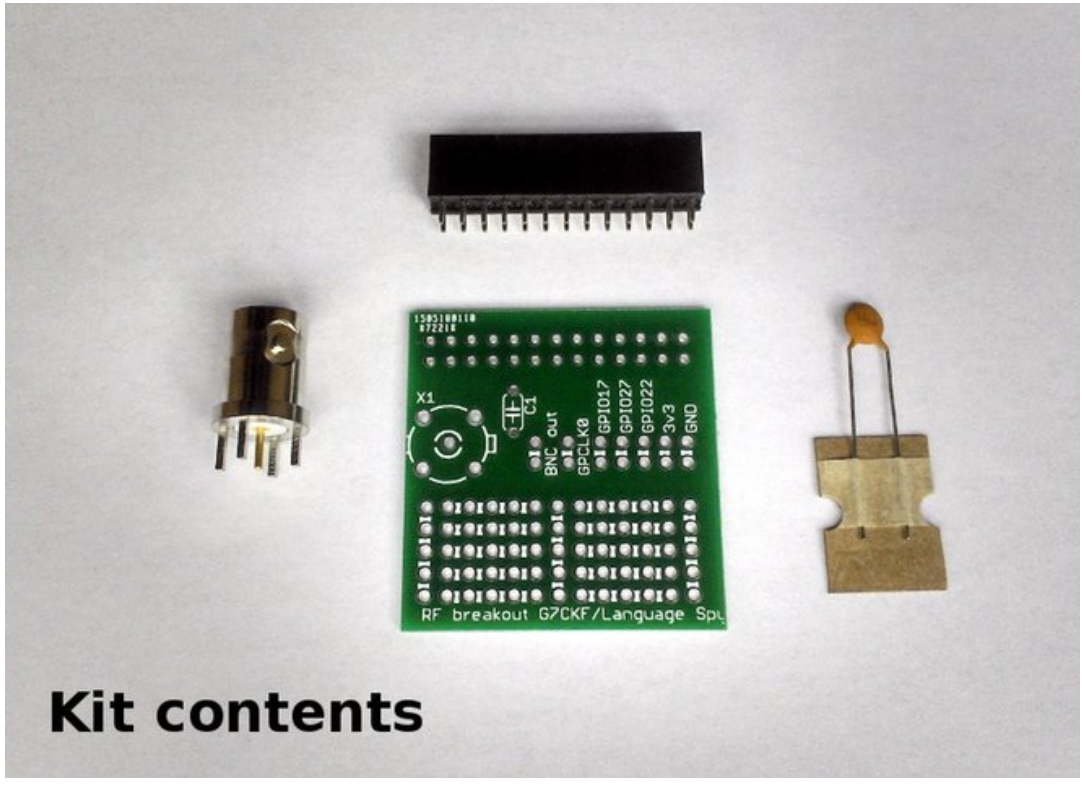
It has plenty of scope for interesting the Pi's primary audience of younger people in the world of electronics and radio by showing them that a Pi can achieve long-distance communication and talk to something in the real world rather than on a breadboard.

Background

The Raspberry Pi clock generator is a powerful frequency synthesiser which can generate frequencies up to 250MHz at the Pi's 3.3v logic levels. This is enough to provide a useful RF signal source for experimentation, or given suitable filtering and antennas to allow the Pi to be used as a low-power radio transmitter by users with an appropriate licence.

The kit brings the clock generator as well as three GPIO lines and the 3.3v supply to solderable headers on a PCB. It also provides a BNC socket for RF output, and a DC blocking capacitor to protect the Pi processor from damage. A prototyping area is provided for the construction of RF filters or transmitter control logic.

What you will get:-



The components of the kit

The kit will be supplied as a self-assembly kit of four parts, the PCB, GPIO connector, BNC connector, and blocking capacitor. The kit instructions cover assembly and software, and provide pointers and background for filter design (See update number 4 for more details on filters). Soldering skills are required for assembly.

Compatibility and software

The clock generator appears in both BCM2835 (A, B, and B+) and BCM2836 (Pi 2) Raspberry Pi boards, and this kit should work with all boards except the Compute Module development board which does not have the standard GPIO header. This kit will not work with single board computers from other manufacturers that use the Raspberry Pi form factor.

The open-source community has produced several pieces of software for experimenters using the Raspberry Pi clock generator. There are signal generators, FM transmitters, and WSPR beacons for amateur radio. With a low-pass filter on this board and a dipole antenna the 10mW of RF produced by the Raspberry Pi WSPR beacon can be heard thousands of miles away. The table below shows some reception spots we've seen for our Raspberry Pi on the 20m amateur band here in the UK. At the top is K9AN in Illinois, a distance of 4001 miles.

At the time of writing not all community software supports the Pi 2. This is due to the BCM2836 having a different internal address for its GPIO than the BCM2835 rather than a fundamental incompatibility. Some GPCLK0 software already works on the Pi 2, and we will be spending some time working to extend that support while this campaign is running.

WSPRnet

Weak Signal Propagation Reporter Network

Database

Specify query parameters

27 spots:

Distance between stations

Timestamp	Call	MHz	SNR	Drift	Grid	Pwr	Reporter	RGrid	km	az
2015-06-25 03:58	G7CKF	14.097156	-25	0	IO91lw	0.01	K9AN	EN50wc	6440	296
2015-06-25 04:36	G7CKF	14.097088	-18	0	IO91lw	0.01	LA9JO	JP99gb	2163	21
2015-06-25 04:18	G7CKF	14.097202	-26	0	IO91lw	0.01	OH8GKP	KP24rt	2078	36
2015-06-25 16:02	G7CKF	14.097035	-24	0	IO91lw	0.01	OH2SWL	KP20vk	1891	50
2015-06-25 17:18	G7CKF	14.097088	-28	0	IO91lw	0.01	DF6MK	JN68ik	1051	106
2015-06-25 19:30	G7CKF	14.097178	-29	0	IO91lw	0.01	DC7JZB	JO62qj	983	81
2015-06-25 21:48	G7CKF	14.097032	-28	0	IO91lw	0.01	DL8HAF/P	JO53dm	782	73
2015-06-25 21:56	G7CKF	14.097179	-18	0	IO91lw	0.01	DG3OO	JO52bp	763	80
2015-06-25 22:42	G7CKF	14.097064	-26	0	IO91lw	0.01	DL1GCD	JN48ar	736	115
2015-06-25 17:36	G7CKF	14.097102	-26	0	IO91lw	0.01	DK4ZP	JO40lb	729	103
2015-06-25 09:34	G7CKF	14.097099	-24	-1	IO91lw	0.01	DL8FCL	JN49jx	722	104
2015-06-25 22:42	G7CKF	14.097064	-13	0	IO91lw	0.01	DK6UG	JN49cm	704	109
2015-06-25 06:11	G7CKF	14.097153	-28	0	IO91lw	0.01	DJ1AN	JO43ja	676	76
2015-06-25 11:36	G7CKF	14.097167	-26	0	IO91lw	0.01	F5OIH	JN06ci	627	171
2015-06-25 20:34	G7CKF	14.097167	-17	-3	IO91lw	0.01	DF9DU	JO31ok	571	92
2015-06-25 22:28	G7CKF	14.097052	-23	0	IO91lw	0.01	DL8EDC	JO31le	559	95

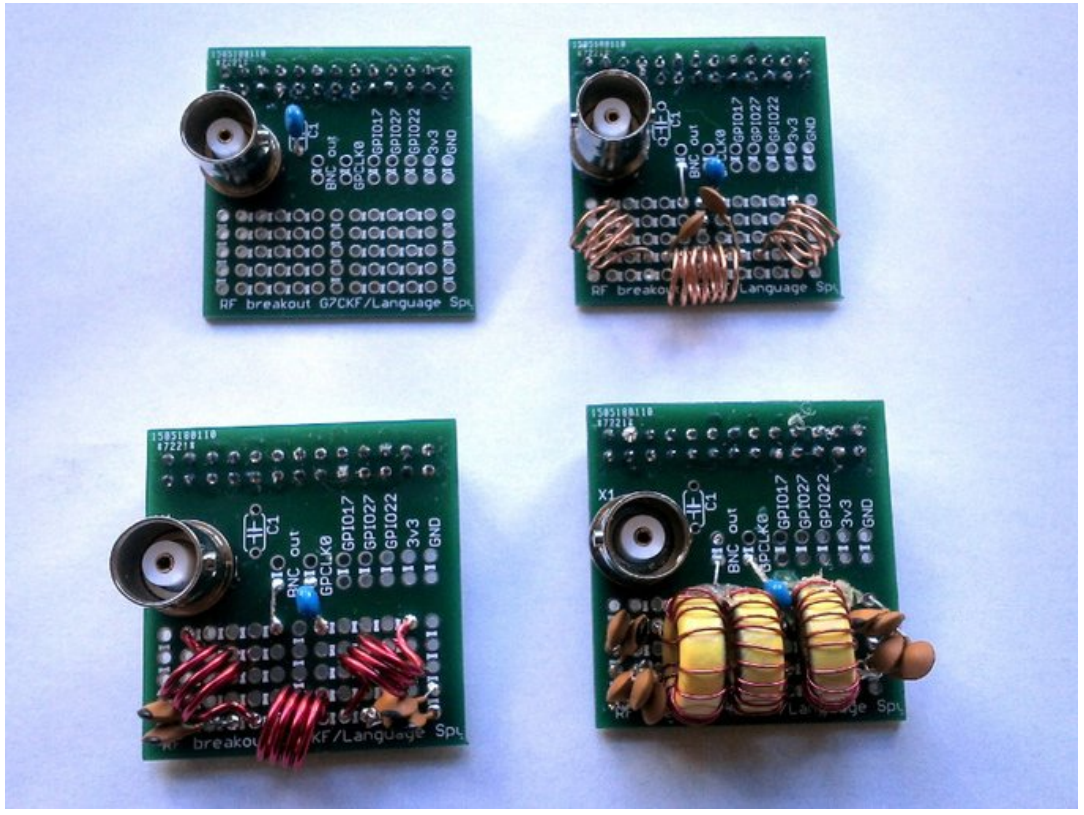
WSPR spots sorted by distance, furthest at the top

UPDATES: We have produced a Raspberry Pi 2 version of Jan Panteltje's freq_pi signal generator, which can be found at this link on *GitHub*, and an SSTV transmitter for both Raspberry Pi versions which can be seen *here*.

This kit does not include any software but its instructions name some of the more popular packages and provide links to the code. If the kit is being used as a radio transmitter then it is the responsibility of the user to ensure that they possess the relevant licence for their transmission.

Shipping to anywhere in the world is included in the rewards, however you are responsible for any local taxes or excise duties payable in your country.

Progress so far



Prototype boards

The first RF breakout was built on a general-purpose prototyping board in early 2015. In May 2015 a PCB was designed and a small run of prototypes was made with and without different filters. These boards were then tested as WSPR beacons on VHF (4m) and HF(20m) and proven to be effective.

Timing

Some of the components used in this kit have a bulk lead time quoted as between four and six weeks. We would therefore expect to start shipping rewards more than six weeks after a successful conclusion to this campaign and receiving the funds from Kickstarter. Thus you should expect to see your rewards around the middle of October 2015.

Risks and challenges

We have proved with our prototypes that the kit works as expected and that our component suppliers can deliver the goods in small numbers. Though a low component count minimises supply risk there is still a possibility that the quoted lead times for larger orders of our components could be exceeded or that we could be supplied with faulty PCBs or other parts. If this proves to be the case we will secure returns or replacement parts, however this would incur a delay to our shipping date. It's a remote possibility, but we have to point it out.

We are a small organisation with some experience of product fulfilment in the software industry so we think we have accounted for all eventualities when getting your rewards to you. In the happy event that this kit proves to be hugely more popular than we expected though it will place a strain on our resources and it may take us longer than we anticipated to ship your rewards to you. In that event we will provide regular updates as to our shipping progress and we will work as hard as we can to ship your rewards as soon as possible.

(ED: Sadly this is a failed Kickstarter project with currently nowhere to actually get a hold of it! Keep a check at the designers blog, http://thekeywordgeek.blogspot.co.uk/ as it may become available in the future)

DATV Session Report (part 2)

Klaus Kramer, DL4KCK *www.agaf.de*

Friday 26th June 2015, 12:00 16:00h at Messe Friedrichshafen, Conference Center West, Room Oesterreich. There were less guests in the auditorium (about 30) than last year, possibly because of the English only talks.

Pierre-Andre, HB9AZN, from SwissATV once again proved his multi-language skills during the introduction.

The first lecturer Uwe, DJ8DW, from AGAF Germany explained the beginning of DATV from the stimulation by his old friend and TV engineer Manfred, DJ1KF (sk) in 1995 over the very first transmitted GMSK DATV picture with the Golden Gate Bridge motif (no FEC yet) to the present generation digital ATV transmitters devised at Wuppertal university and the latest version of a mono-board receiver for GMSK and QPSK DATV.

Then Noel, G8GTZ, from BATC described the manifold DATV activities in Great Britain and surrounding countries like France and the Netherlands.

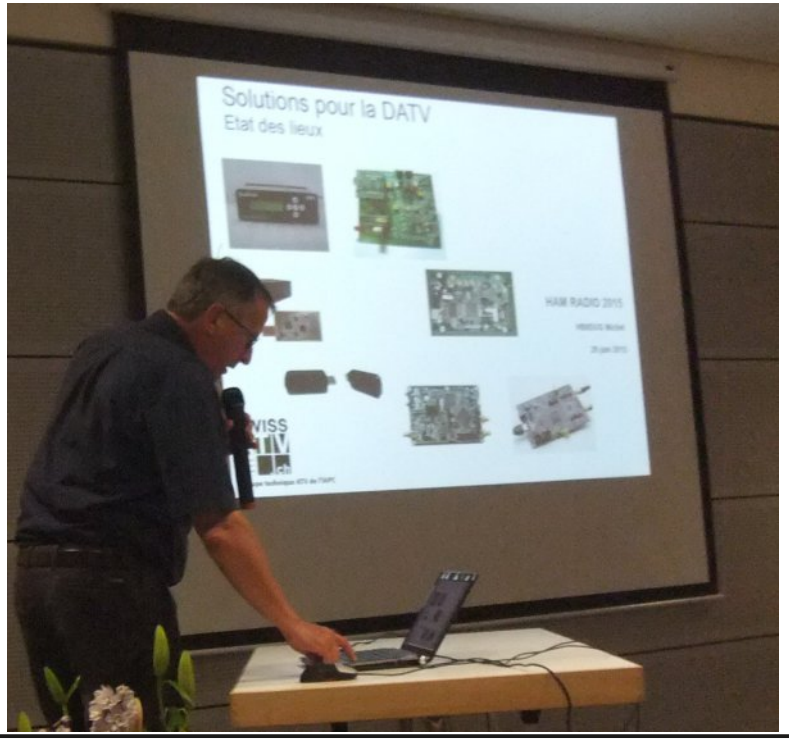
In the UK there are 35 active ATV repeaters, many of them with a 70cm DATV input (DVB-S, 2 MS/s). On 23cm (1240-1325 MHz) only DVB-S outputs are active and on 6cm (3400-3410 MHz) 3 DVB-S repeater outputs with 2 MS/s.

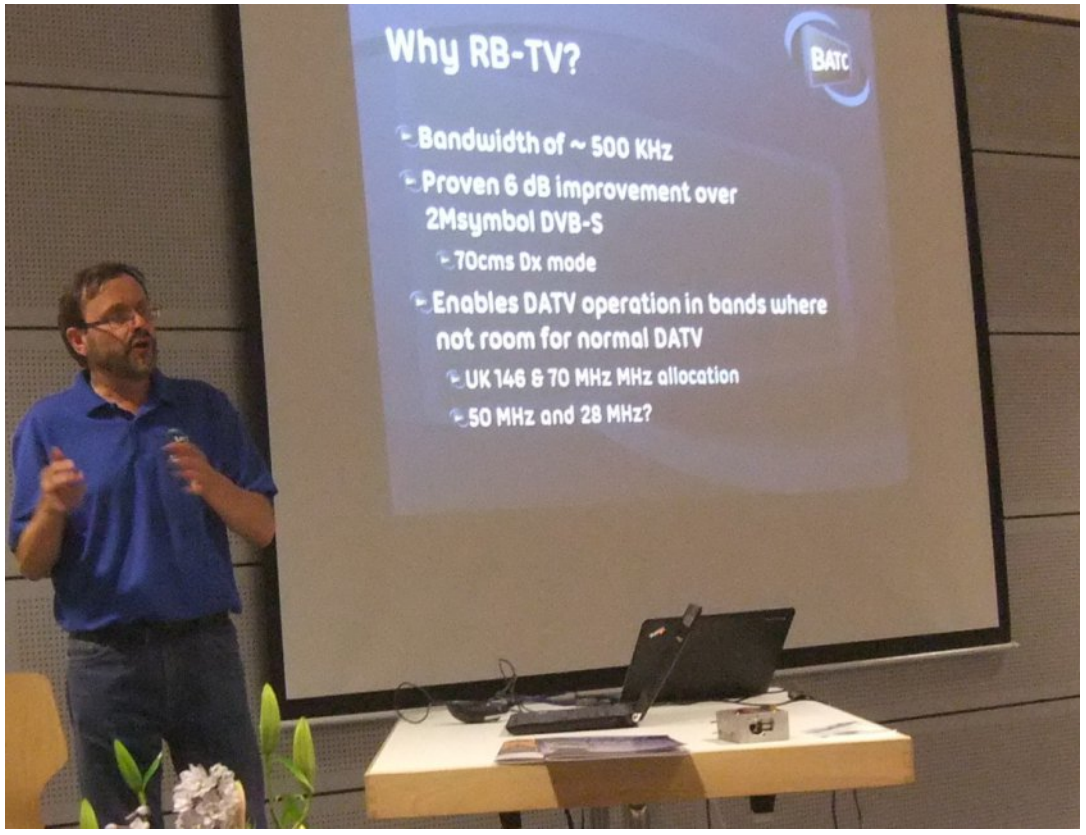
On 3cm only analog FM-ATV is usual. The BATC has about 950 members worldwide.

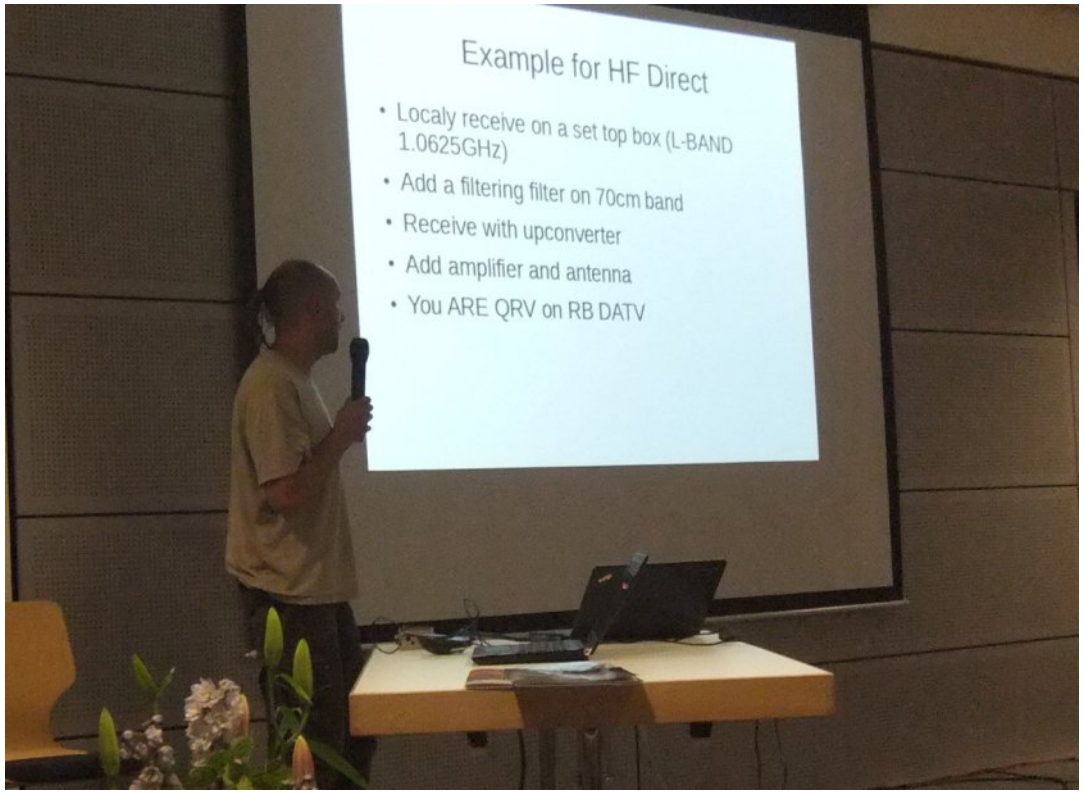
In absence the NetherlandŽs VERON ATV manager Chris, PA3CRX, illustrated their ATV activities in a video projection from a laptop file. (Photo top right)

After that Michel, HB9DUG, from SwissATV gave an overview on different DATV systems devised in Germany, GB, France and USA. (Photo bottom right)

Following the coffee break Noel, G8GTZ, proved the recent effectivity rise with RB-DATV (reduced bandwidth below 500 KHz especially for the new british experimental band around 146,5 MHz).
In a video recording he showed the really good video quality, but also a reduced movement resolution.







An example of the portable future visions with RB-DATV was demonstrated in a tiny RaspberryPi mini-computer with a "Digithin" plug-in board.

Then Evariste, F5OEO, explained his development of the "Digithin" board and suggested a simple 70cm DATV receiving installation called "HF Direct".

At the end Jean-Pierre, F6DZP, defined his way to optimize the RB-DATV receiving functions in his "Tutioune" software together with a DVB-S PCi card TT-1600. So the 70cm operating distance got expanded to more than 100 km with 333-KS/s-RB-DATV signals.

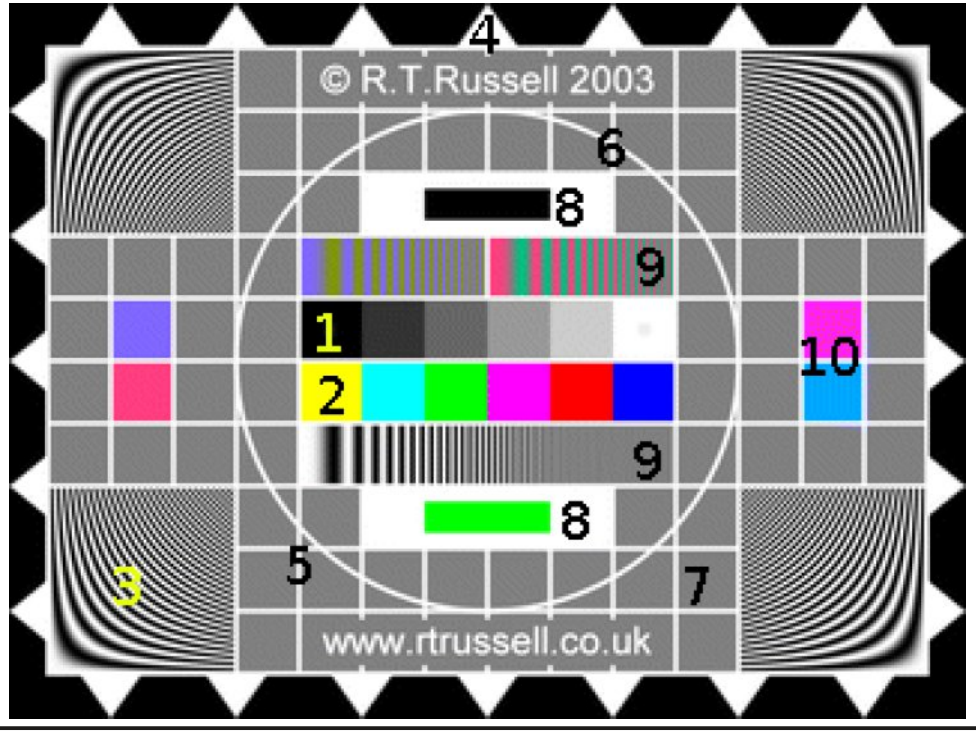
Sample video online from G3PYB
https://www.youtube.com/watch?v=58c0MC_k_-A

How to use a testcards features

Electronic test cards might be a thing of the past as far as broadcasters are concerned, unless somebody decided to sponsor them that is, but once upon a time when there were restrictions on how long a broadcast channel could transmit. The shortfall was made up by an electronic test card for the engineers to adjust your set with. The broadcasters may have moved away from this, but many of the ATV stations and repeaters still use the technology.

This is the third in a series of colour generator board designs. This latest design is colour-capable, multi-standard and user-programmable. (See the software article elesewhere in this issue) It was developed in 2003.

Below is a picture of the Default test card in Richards article (from the last issue - 26) and an explanation of what all the individual parts of the test card are there for.



1 - Grey scale

The six squares contain a range of grey tones from black to white in equal steps: 0.0, 0.2, 0.4, 0.6, 0.8, 1.0. The brightness and contrast controls should be adjusted so that the slightly lighter spot in the centre of the black square and the slightly darker spot in the centre of the white square are just visible. There should be no trace of colour in any of the grey scale squares.

2 - Colour bars

The six squares contain 100% colour bars with relative YUV levels as follows:

	Y	U	V
Yellow	.886	.437	.100
Cyan	.701	.147	.615
Green	.587	.289	.515
Magenta	.413	.289	.515
Red	.299	.147	.615
Blue	.114	.437	.100

When PAL-decoded it is normal for crawling dot patterns to appear at the transitions between the bars. This is cross-luminance

3 - Zone plates

The four corners of the test card consist of hyperbolic luminance zone plates running from 0 to 3 MHz horizontally and from 0 to 117 cycles-per-picture-height vertically. These are useful for testing complex processing technologies. The curves should be smooth with no 'stepping', raggedness or spurious patterning. Any cross- colour in these areas indicates deficiencies in the PAL decoder.

4 - Picture size and position

On a perfectly adjusted display the tips of the arrow heads around the edge should be just visible, although it is common for a little to be lost. If properly centred the same amount of arrow head should be visible on the left as on the right, and at the top as at the bottom.

5 - Convergence and distortion

Colour television pictures are displayed by laying red, green and blue pictures on top of one another. A convergence error shows up as colour fringing on the horizontal and vertical grille lines. The grille lines should be straight: curvature at the edges of the picture indicates pincushion or barrel distortion.

6 - Aspect ratio and linearity

The circle should appear truly circular and the background squares should be exactly square and of equal size. If the circle appears as an ellipse (oval) the aspect ratio is wrong; if it appears pear-shaped the horizontal or vertical linearity is poor.

7 - Colour purity and shading

Colour purity errors show up as patches of colour appearing in the grey background squares. This can occur as the result of stray magnetism from devices such as nearby loudspeakers. The background should be a uniform level of grey over the entire picture.

8 - Streaking and ringing

Poor low-frequency response will cause streaking or smearing from the black and green rectangles into the surrounding white areas. Ringing (high- frequency reflections) will cause multiple repetitions at the edges of the rectangles.

A chrominance-luminance delay error will make one edge of the green rectangle bright and the opposite edge dark.

9 - Frequency response

The luminance frequency sweep runs from 0 to 6 MHz and the U and V chrominance sweeps from 0 to 3 MHz (all sinusoidal). It is normal for cross-colour to appear in luminance frequencies near to the PAL colour sub-carrier (4.43361875 MHz).

Because of spectrum folding the higher chrominance frequencies may appear as complementary colours with a large amount of cross-luminance patterning when PAL-decoded.

10 - PAL decoding

The four coloured squares test the U and V colour-difference signals. They have relative YUV levels as follows:

	Y	U	V
U	.500	.247	0
V	.500	0	.439
U+V	.500	.247	.439
U-V	.500	.247	.439

- U: Y=.500 U=.247 V= 0
- V: Y=.500 U= 0 V= .439
- U+V: Y=.500 U=.247 V= .439
- U–V: Y=.500 U=.247 V=–.439

Hanover bars or crosstalk between the U and V signals indicate deficiencies in the PAL decoder.

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 too 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.

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 - *http://cq-datv.mobi*

Author Guidelines

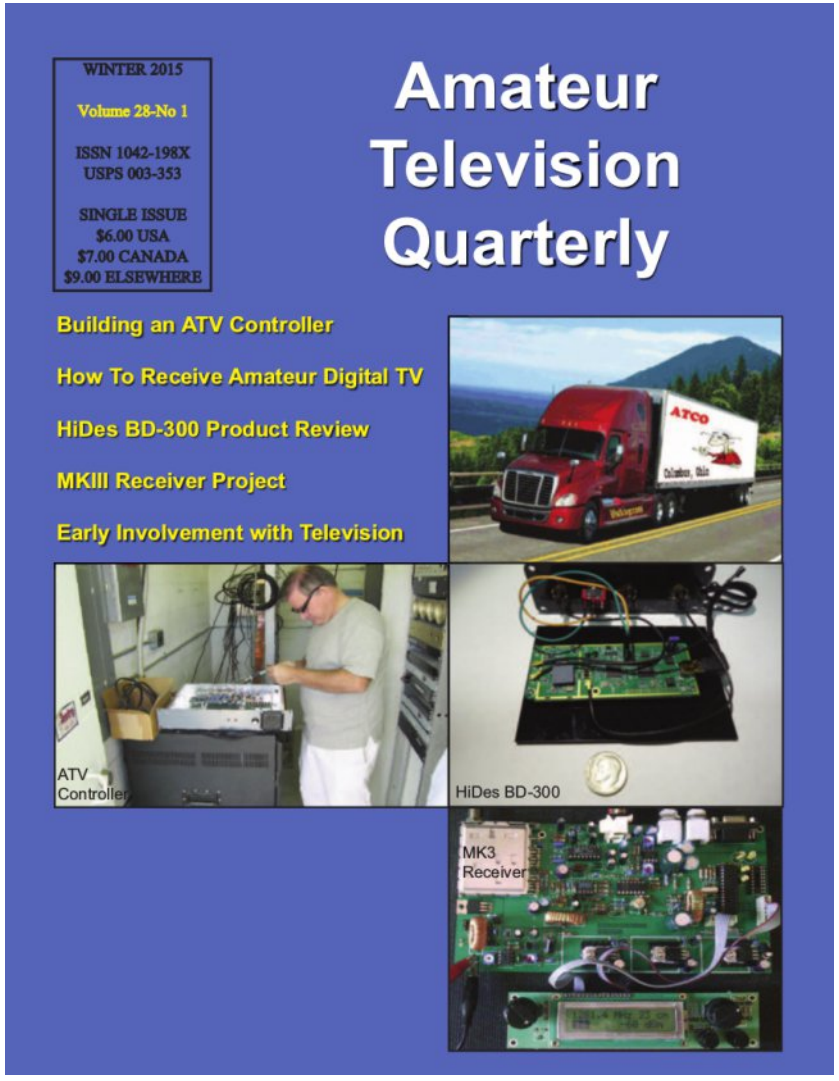
CQ-DATV welcomes contributions from our readers. It does not necessarily have to be on ATV, as long as it is of interest to our readers.

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.



ATV Quarterly - Don't miss another issue! Subscribe Today

USA $22.00 year, Canada/Mexico $25.00 year DX $32.00 year (US $) Cyber: $15/yr. Visa, M/C, AMEX, PayPal via Internet: www.atvquarterly.com
Cheques or Money Orders to P.O.Box 1594 Crestline CA 92325
Published by ATV Quarterly tel (909) 338-6887 email: wa6svt@atvquarterly.com

Coming up in CQ-DATV

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.