CQ-DATV

dotMOBI

Issue 3 - June 2013

http://cq-datv.mobi

Cabinet Re-Shuffle at The BATC

For those of you that do not know, a BATC committee meeting was convened last Sunday 21st April this meeting removed our long standing Chairman and replaced him with Noel. I have written to Trevor to try and find out why, and although Trevor is reluctant to say what happened and why for fear of fragmenting the batc I have put the following together.

Trevor originally suggested a face to face meeting of the committee to sort out some problems he thought would be better solved in this manner.

Trevor set about selecting the best date and only ring fenced one day when he was not available the 21st April as he was hosting an 85 Birthday party for his mother in law.

The date was then set by other committee members for this date when Trevor could not attend.

Dave Mann the secretary set the agenda and telephoned Trevor to inform him he had set item 1 as

Club chairman

Several committee members have requested that we ask Trevor, our Chairman, to step down. I have discussed this with Trevor by telephone and he says that If he is asked to step down he would not wish to remain on the committee in another role and he would not wish to continue to run the shop or run the Live Events Studio. I can also confirm that if the vote of no confidence is carried, Noel Matthews is prepared to take on the position of Club Chairman if elected by a majority of committee members.

Perhaps a little unusual for such a drastic move in view of Trevor's long service and dedication to the club. This did not give Trevor any opportunity to meet the "several un named committee members" and discuss the problem or defend his position.

This meeting was un constitutional under rule 4.7 *http://www.batc.org.uk/club_stuff/const.html* in that only

one officer Dave Mann himself was present. His fix was to telephone the Treasurer another officer, I do not know what was said but this does not in my view mean he was present at the meeting.

Trevor was contacted Monday and duly stood down.

I think this is not the way to run the batc and I personally want someone of Trevor's experience and standing at the helm particularly as we consider the move to a ltd company. I know Trevor has concerns as he was the only committee member to abstain in the committee voting, a fact that has not been reported to the members.

I think that this issue is so important we ought to risk any fall out that may occur and the Sunday meeting should be deemed unconstitutional.

If the committee do not do this then we the members should call an EGM to reverse the outcome of this un constitutional committee and amend the club constitution to make the club officer selection a matter for the BGM and not the committee. So we can insure our club is run by those we trust. Again see *http://www.batc.org.uk/club_stuff/const.html* section 8 EGM which requires 20 signatures. We the members are the highest decision level makers in the club and Trevor who has always done his best for the club now deserves our support.

Apple reader fix

Ken, W6HHC, reports that he obtains best reading of CQ-DATV on an iPad or iPhone using the iBook ePub reader app in the "scroll mode". Although the iBooks user manual never mentions it, there is a "scroll" mode buried under the "font settings icon" in iBooks reader. Open the icon – select "themes" - select the "slide" setting.

Good by British Amateur Television Club, and hello BATC LTD

Yes the votes are in for this move proposed in CQ-TV 239 and are as follows

- *For: 128*
- *Against: 4*
- *Abstain: 6*

Not many votes for a 800+ members, perhaps more facts or even a proper discussion is needed and the reason given, of being able to deal on a more equal footing, with larger/commercial organisations, such as the CAA, as they are more comfortable dealing with a peer, aka another company, rather than a "club". ???

Does anyone think this will cut ice with the CAA.

Does anyone want to lose British Amateur Television Club as our title, we have after all, just had our 60th Birthday

I would have preferred some discussion in CQ-TV and preferably before the BGM so members could have had some input.

I think this is reflected in the low turnout and that more consultation with members is required.

BATC eBooks download now works

If you visit *http://www.batc.org.uk/cq-tv/archive/index.html* you can download back issues of CQ-TV magazine in eBook format, this was my parting present to batc, before standing down last October, they suffered technical problems when I transferred the ownership of the site and this has now been fixed, so lots of ATV for your eBook, well done BATC.

MHW2723 PA

DigiLite drives straight into the 70cm PA units (see CQ-DATV2) and gives up to 5W from the MHW boards.

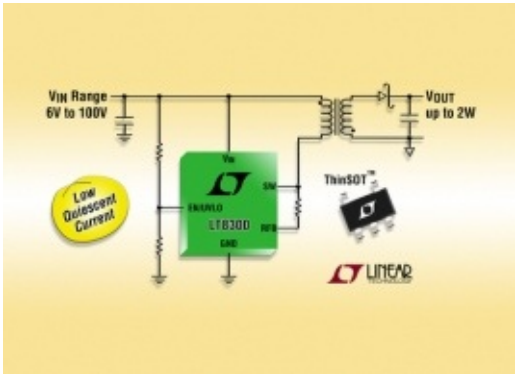
Replacing the MMIC on the DL5.8 board with a better device will boost the output and need an 8dB attenuator

but can deliver over 10W PCB's are available from the batc On-line shop *https://www.batc.org.uk/shop/hardware-and-kits.html*

Simple and efficient sub-2W isolated power supply

Linear Technology Corporation

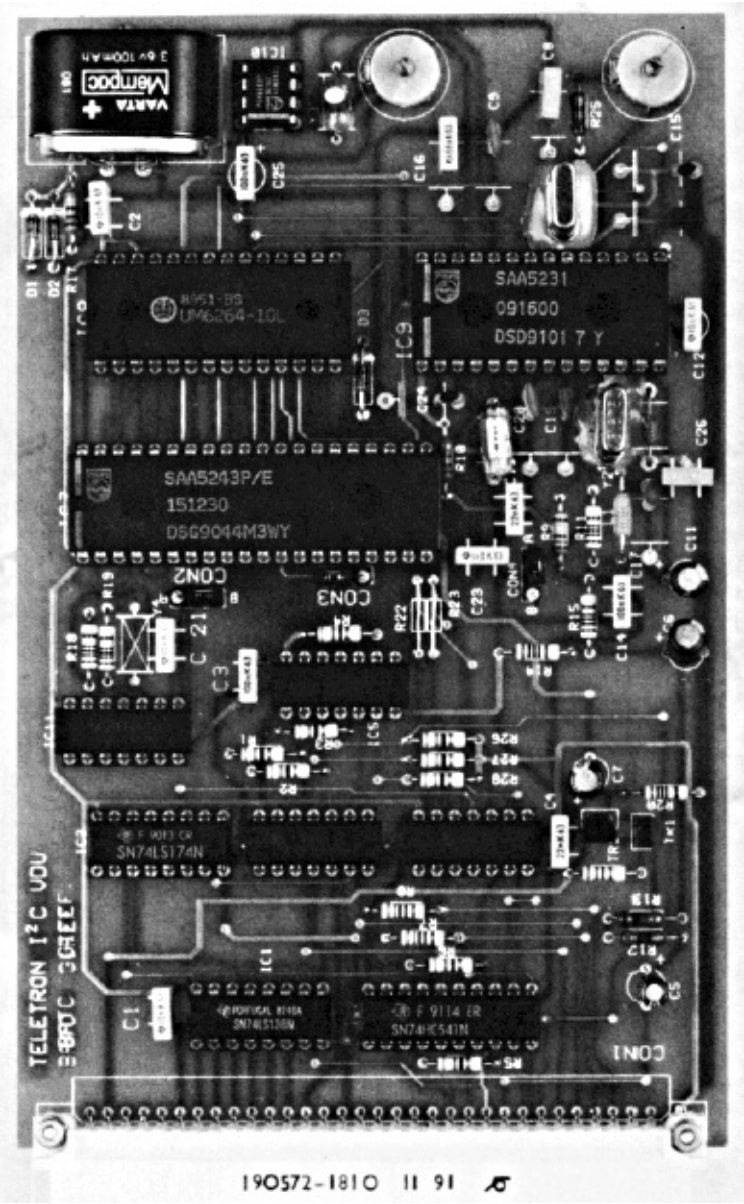
The non-synchronous flyback topology is widely used in isolated power supplies ranging from sub watt power levels to tens of watts. With more green-mode standards emerging around the world, improving light load efficiency and reducing no-load input standby current are more demanding than ever. Unfortunately, the traditional isolated power supplies using optocouplers can no longer achieve the performance requested.



The new LT®8300 builds a 5V/300mA low IQ isolated Power Supply from a 36V to 72V input with only five external components (input capacitor, output capacitor, transformer, feedback resistor and output diode).

Free PCB's

Some time ago BATC ran an I^2C project in CQ-TV which involved several PCB's CPU VDU and Relay cards, if you have an ATV repeater using these cards for logic control and would like to populate some PCB's for use as spares, then BATC are clearing there PCB stock FOC to worthy causes. Please send an SAE suitable for posting out Euro Card PCB's to 14 Stairfoot Close, Adel Leeds, LS16 8JR and state your requirements - Trevor, g8cjs



The I²C VDU board

Did you know?

There is a very active group of digital ATVers to be found over at Yahoo. Point you browser at *http://groups.yahoo.com/group/DigitalATV/*

BATC online shop

New to DATV? Start here

By Trevor Brown

When I first started transmitting ATV it was AM modulation (negative) I missed out the 405 line positive modulation, so I am not that old. The PA's were valves and grew from QQV02/6 to QQV06/40 and finally a pair of 4CX250B's. You turned up the modulation until the sync pulses crushed, not easy for portable operation as it meant running an oscilloscope in the car, this soon got replaced with a waveform display superimposed on the outgoing monitor.

AM TV on 70 CMS

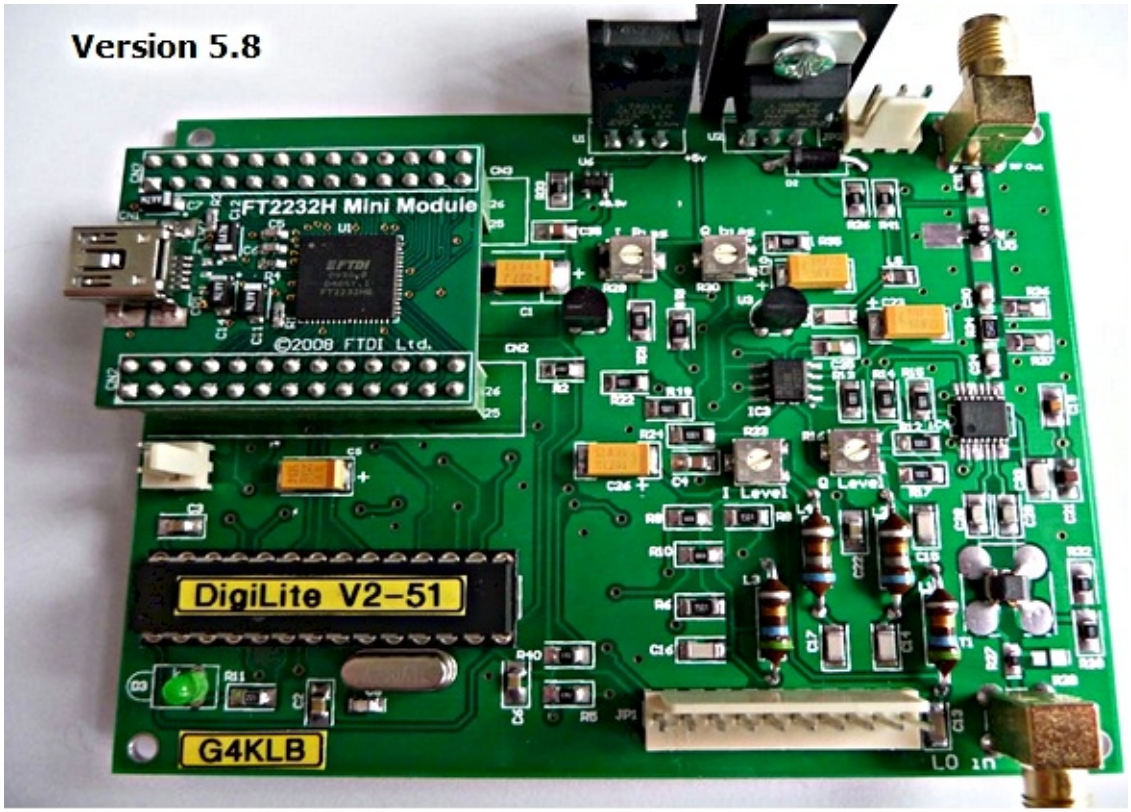
Then FM came along, my first demonstration was from units built by G3PYB running on 70cms, no linearity problems, or sync crushing, and 6MHz sound too. Unfortunately there were no satellite receivers around so both the TX and RX were home brewed. The bandwidth was, well increased, that's a good word for it. In theory FM sidebands have very little energy, but carry the high frequency video content. so to reduce HF picture noise pre –emphasis was added. As amateurs we probably only ever recovered the low order sidebands in these homemade receivers, which may have limited the HF picture content, never mind just turn up the chroma gain in the receiver, yes it was colour, and we were probably outperforming VHS.

What was good about this well, seeing a picture appear out of the noise and to slowly improve as aerials were aligned. Now we are on the cusp of a digital revolution, we may never get that buzz again, but there is still development to be done.

The first Digital kit I saw was from the AGAF, BATC bought several units for evaluation, and also to get this transmitter into production, it was PAL in and 70cms out, and was the first experience of encoder delay, it worked and we were able to roll it out as a DATV demonstration.

Then there was F4DAY and his cost effective solution, using a PC to Mpeg 2 encode (the AGAF transmitters were expensive), this evolved into DigiLite, and at present the BATC On-line shop has sold going on for 200 kits.

DigiLite



Let me wind the clock back and very briefly explain Digital Television. The modern TV screen is now composed of Pixels and in Digital Television we transmit each pixel as a binary number, minimum of 8 digits per pixel. That's a lot of data, and requires a lot of bandwidth, so we handed this problem over to the mathematicians to see if they could reduce this bandwidth, and they in turn came up with Mpeg 2, where still frames and picture updates are transmitted, and yes the bandwidth came down, and we could transmit it.

Several modulation systems grew out of this, the main two being DVB-S and DVB-T, the first being used for satellite broadcast the second for terrestrial broadcast. We adopted the satellite system for ATV and used it for terrestrial ATV. Why well it was easy, more efficient and set top boxes were around. It is not wrong and you have to start somewhere. We can now squeeze a colour picture into 2 MHz and as a result the rest of the amateur radio population are talking to us again, no small feat in these days of reducing band space, which is never going to improve, because the government have found out just how much it can be sold for on the open market.

But what about DVB-T well as amateurs we must experiment and try different systems otherwise we might just as well bin the kit and go skype or Face Time. DVB-T was designed to cope with multipath reflections that would be inevitable in a terrestrial transmission (unlike satellite transmission) and it worked well, just watch the pictures from the cars in the grand prix. So why not adopt it for ATV, well it's a more complex system and initially was designed for TV broadcast where more than one channel was encoded onto the same carrier, single channel systems now exist, and perhaps it should be explored, and when DATV express becomes available, later this year it will become an option. One thing you will not like is it needs extreme linearity much more than DVB-S, so PA's will have to be de rated with initial predictions being as high as a factor of 10 (10 watt PA's producing as little as 1 watt).

The receivers for reduced bandwidth single channel systems will be special, it is unlikely that it is just going to be tune down your terrestrial TV or build a frequency converter. Enter OE7DBH who has put a lot of energy into working with HiDes Inc to define a receiver that is useful for ham radio, the UT-100B see *http://www.hides.com.tw*, the price is reasonable so when DATV express arrives we can start experimenting.

(*http://www.hides.com.tw/product_cg74469_eng.html#310685*)

UVT100B

Is that the end? Mpeg 2 using either DVB-T or DVB-S ? No, there is more on the horizon . DigiLite originally

used a Hauppage card driven by a PC to produce Mpeg 2 encoding, but many are now using the external USB2 Hauppage version that does not require the PC. To avoid misleading anyone it should be pointed out that the PC is no longer required either for encoding or serialising if a MK809 or the Raspberry Pi is used instead. DigiLite is also quite happy with H264.(This was the mathematicians improved version and is a better system for putting better quality pictures into less bandwidth). The simplicity of the DigiLite makes it simple to re-jig for other frequencies and data rates and Rob M0DTS has been busy adapting the MK802 USB device software for use with the DigiLite.

The main advantage with the DATV Express is probably that the FPGA software can be rewritten to make it useful for some other digital formats and also that it is ready-built. We need not lock ourselves into on-board Mpeg 2 encoders (the SR systems approach) derived from a PAL input, we need to keep with open systems, and we need to develop and workout the ideal system for our precious ATV mode. DATV express and its multimode software based approach to ATV, may be one of the tools we need to further explore and improve DATV so we can reap its full potential.

UART 232 TO USB Converter

By John G3RFL, an old ATVer

The FT232R

As technology advances so fast many different DATA interfaces take place it becomes harder and harder to keep up. Nowadays the equipment seems to have steadied down to using the USB format and that's what you get on most modern PC's

So I came up with a problem when I wanted to use RS232 the sort of previous standard but find no PC's uses it now and it's a bit slow.

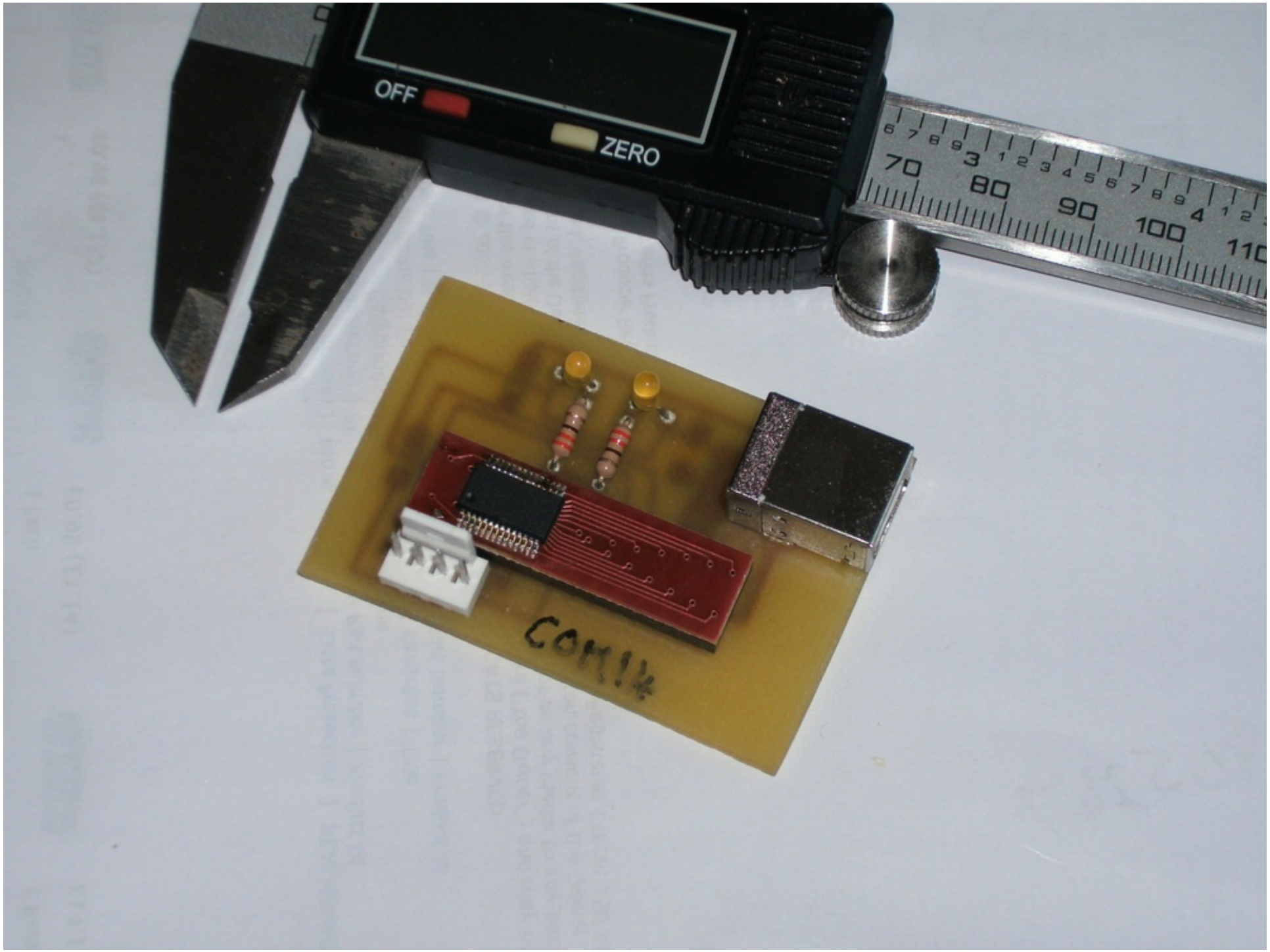
I love writing in Assembler language and using PIC u/P and all have a serial UART type of output some later ones will drive USB direct but need a lot of overhead software understanding to get it correct until I found a little chip that converts UART to USB and does all the fancy set-up logic for you just UART in and USB out it's the FT232RL and its Bi-directional and better still its addressable given many options.

Because I like to make things in building blocks I set out to make a PCB just to run this interface has a test unit for my developments and can be plugged into a DEV PCB with ease.

Now on it we have a TX led and an RX led to show it is working and it is all powered from the USB lead I have two 10k isolation resistors on the UART lines to protect the chip from the unit it goes into (u/P).

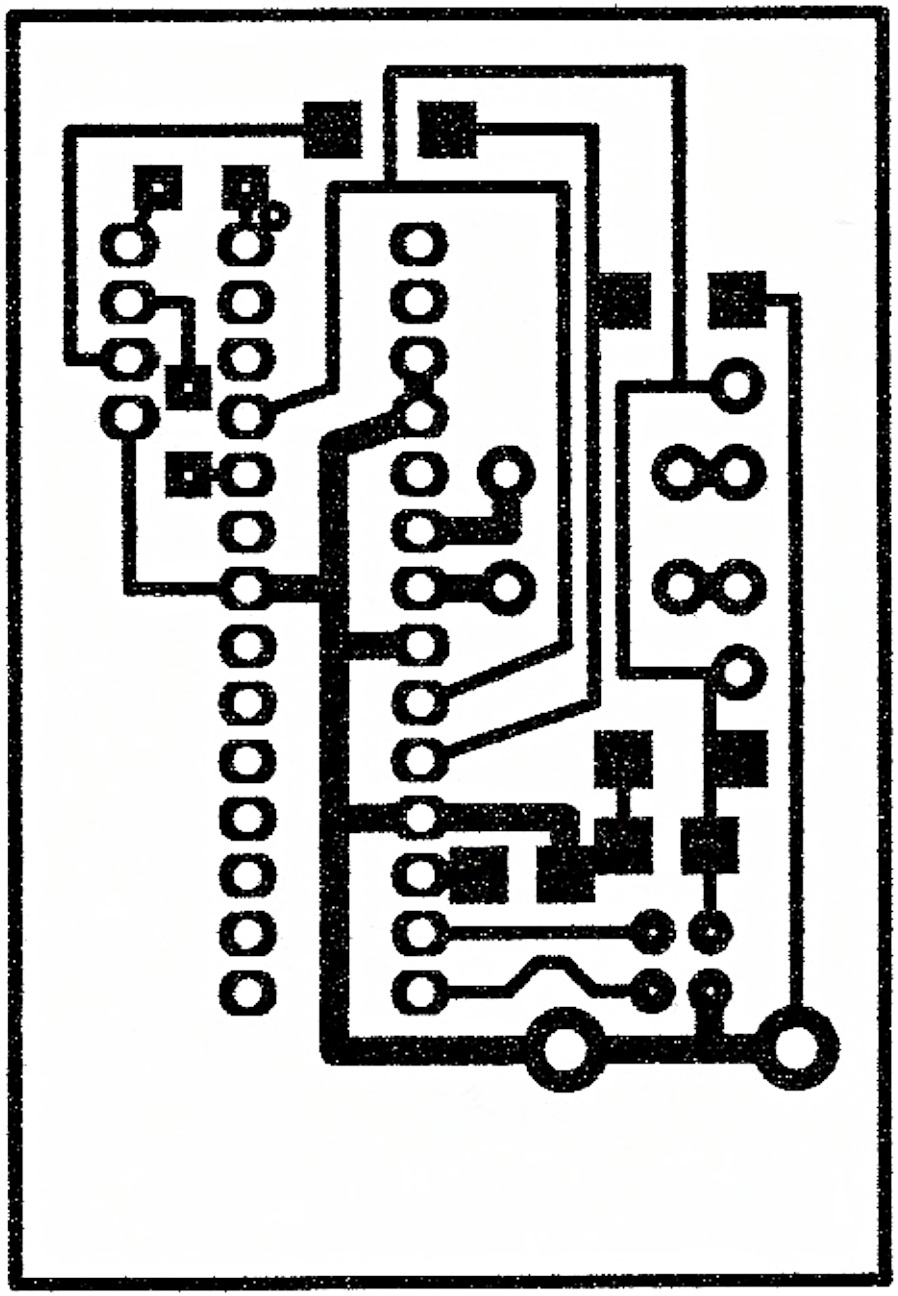
When you plug the PCB into a USB lead the PCB leds flash has the PC sets things up all by magic registers and you just talk at whatever baud rate you want to the chip and off it goes. It took a lot of time and headache out of doing it.

The circuit was even made easier by buying a ready made 28 pins SSOP to 20 pins DIL Socket then I can make it plug-able (my eyes are going now 67).



Just look at devices internal block diagram a really well designed unit by FTDI

It runs on its own internal Oscillator at about 48MHz (see diagram).



The PCB design

There are more complex chips in this series that will do whatever standard you want.

2 FT232R Block Diagram

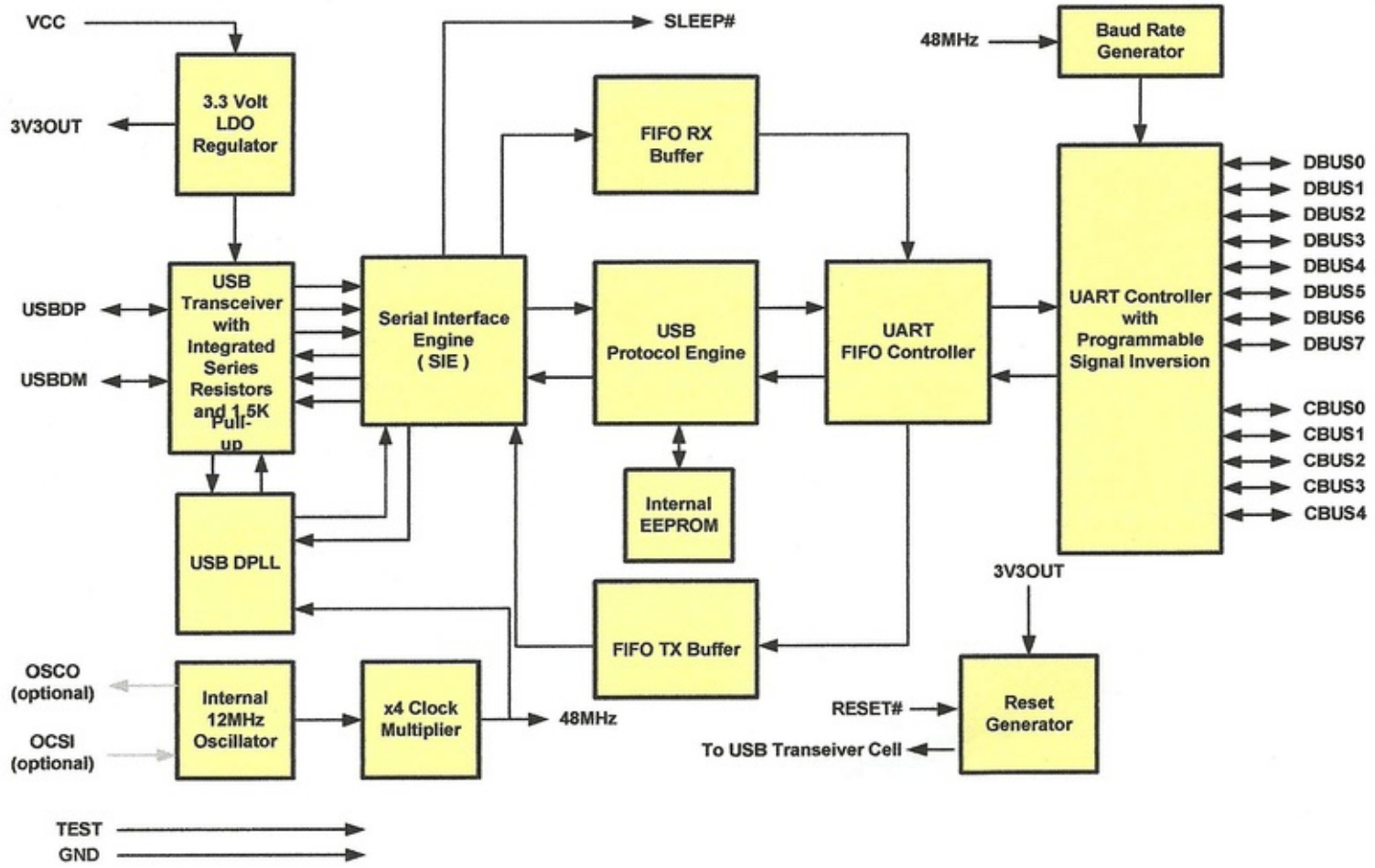


Figure 2.1 FT232R Block Diagram

DATVtalk#1 - Looking at the DATV-Express Digital-ATV XMTR Project

by Ken Konechy, W6HHC

This article is reprinted, with kind permission, from the newsletter of the Orange County Amateur Radio Club series of newsletter articles on DATV, www.W6ZE.org

Most people involved with Amateur TV (ATV), now recognise the advantages of digital-ATV technology over analog-ATV. The digital modulation and Forward-Error-Correction of D-ATV provides superior video quality and robustness against ghosting.

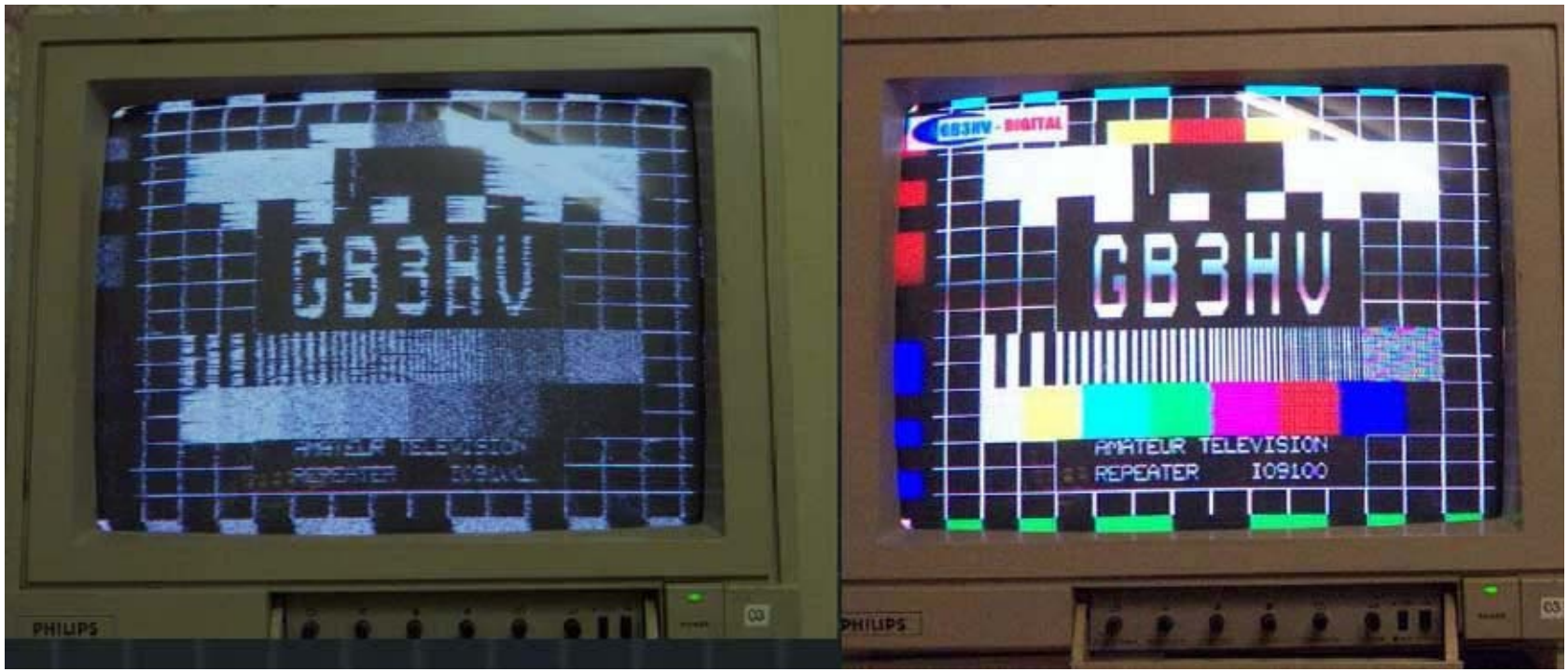


Fig 01 - Comparison of analog-ATV video and D-ATV video using the same antennas with weak sigs (courtesy of G7LWT & GB3HV)

For several years, hams have also recognized that the cost to buy ham-grade MPEG2 encoders boards and Digital-ATV exciter boards is too expensive. A ham-grade set of MPEG-2-and-DVB-S boards from SR-Sys in Germany cost about US$875. The cost of commercial-grade digital-TV boards is even higher. This high cost is known to prevent many hams from "trying Digital-ATV". A group of hams in US and England got together at the end of 2010 to start a project that will lower the cost of DATV considerably.

The open-source project is known as DATV- Express. The team members are:

- *Art Towslee WA8RMC – electronics design*
- *Charles Brain G4GUO – software design*
- *Tom Gould WB6P – PCB layout design*
- *Ken Konechy W6HHC – project mgmt & pubs*

System Block Diagram for DATV-Express

The most important concept about the DATV- Express board is that it is software-based SDR radio. While the system block diagram for a typical Digital- ATV DVB-S transmitter using the DATV-Express board is shown in Fig 2, the modulator chip and software can also produce several other types of modulations and protocols, such as COFDM for DVB-T and 32APSK for DVB-S2. The analog output of a video camera is sent to an MPEG2 encoder unit (made by Hauppauge) to compress the video stream. The video file is stored on a PC and a Windows-based or Linux-based PC does much of the "heavy lifting" to provide real time processing of the Program Stream from the MPEG2 Encoder into a Transport Stream to be used with DVB-S protocol.

The PC processes most of the protocol streams down to the IQ symbol bit-stream that is output via USB2 to the DATV-Express board. Then an FPGA manipulates the data and sends an I-stream and a Q-stream to a modulator. The operating frequency for the DATV transmitter is determined by the PLL within the IQ modulator chip and can be selected by the PC GUI for 70 cm, 23 cm, or 13 cm bands.

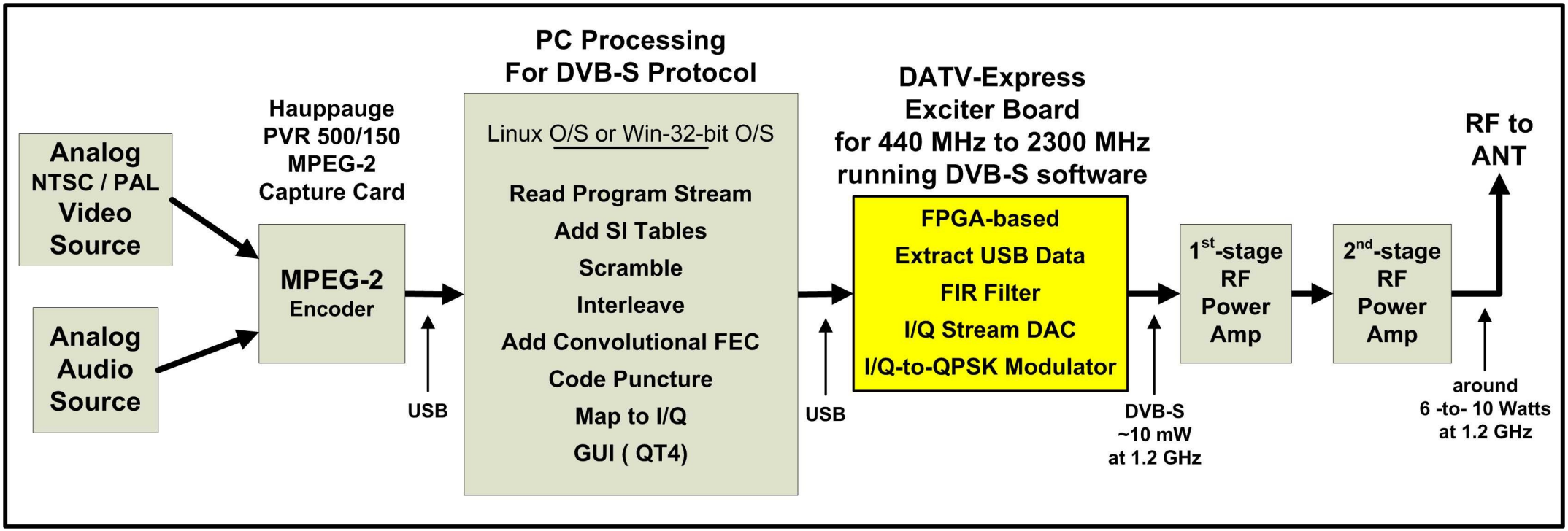


Fig 02 – System Block Diagram of Typical DATV-Express Project DVB-S Digital-ATV Transmitter PC can also run software for DVB-T and DVB-S2 DATV protocols

The RF output level from the DATV-Express board is fairly low, usually around 0-to10 dBm. So the typical DATV station will probably follow the DATV-Express RF output with about two stages of RF amplifiers to get up to a normal transmitter power level. The DATV-Express project team also recommends using an external band-pass filter to get rid of harmonics.

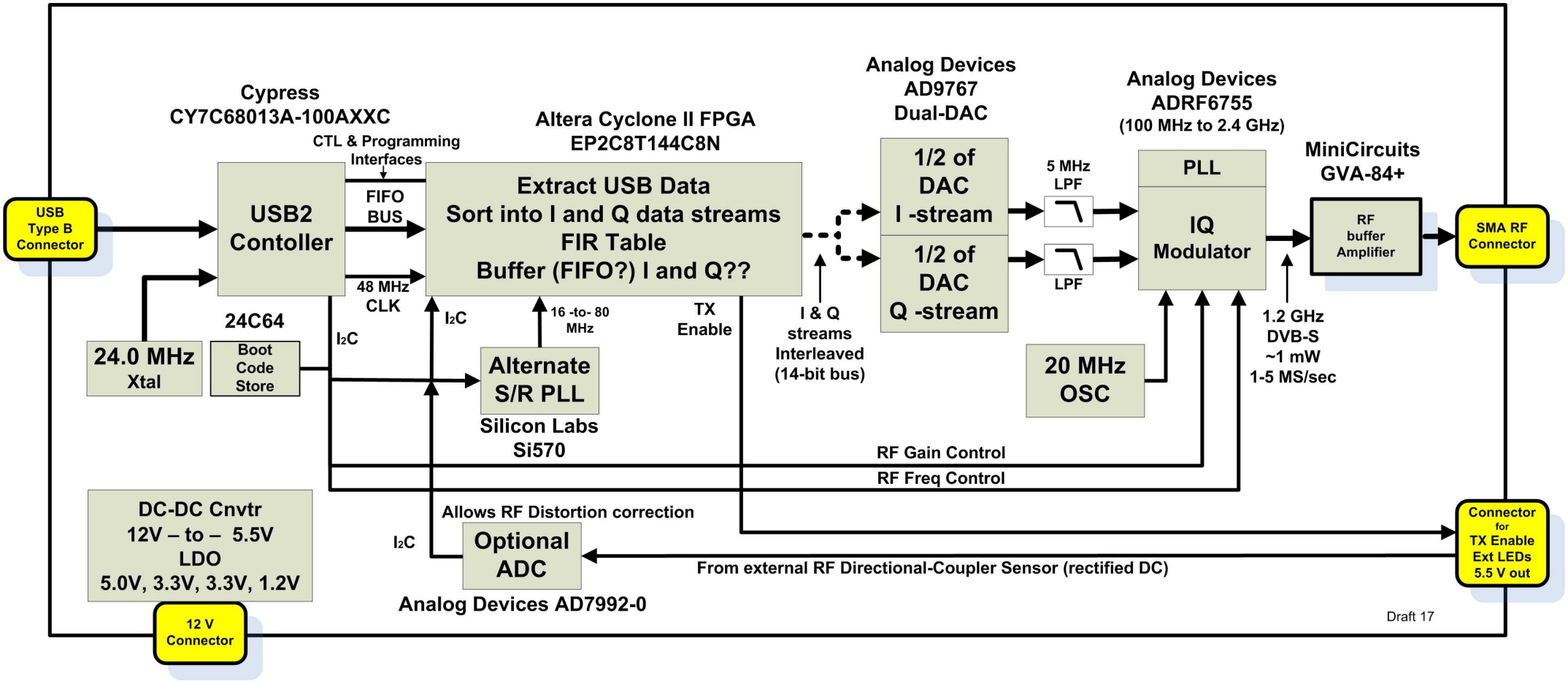


Fig 03 – Block Diagram of DATV-Express Project Digital-ATV Exciter Board

The DATV-Express Board

The DATV-Express exciter is a single printed circuit board shown in Figure 4. Hand-soldering fine-pitch SMT components requires extraordinary skills in my opinion. I complement Art WA8RMC on his ability to hand-solder the "first-article" prototype board you see in Figure 04. The 4-layer board dimensions are 5.3 x 3.18 inches. Tom WB6P used a schematic-capture tool called DX- Designer and layout tool called PADS to create PCB.

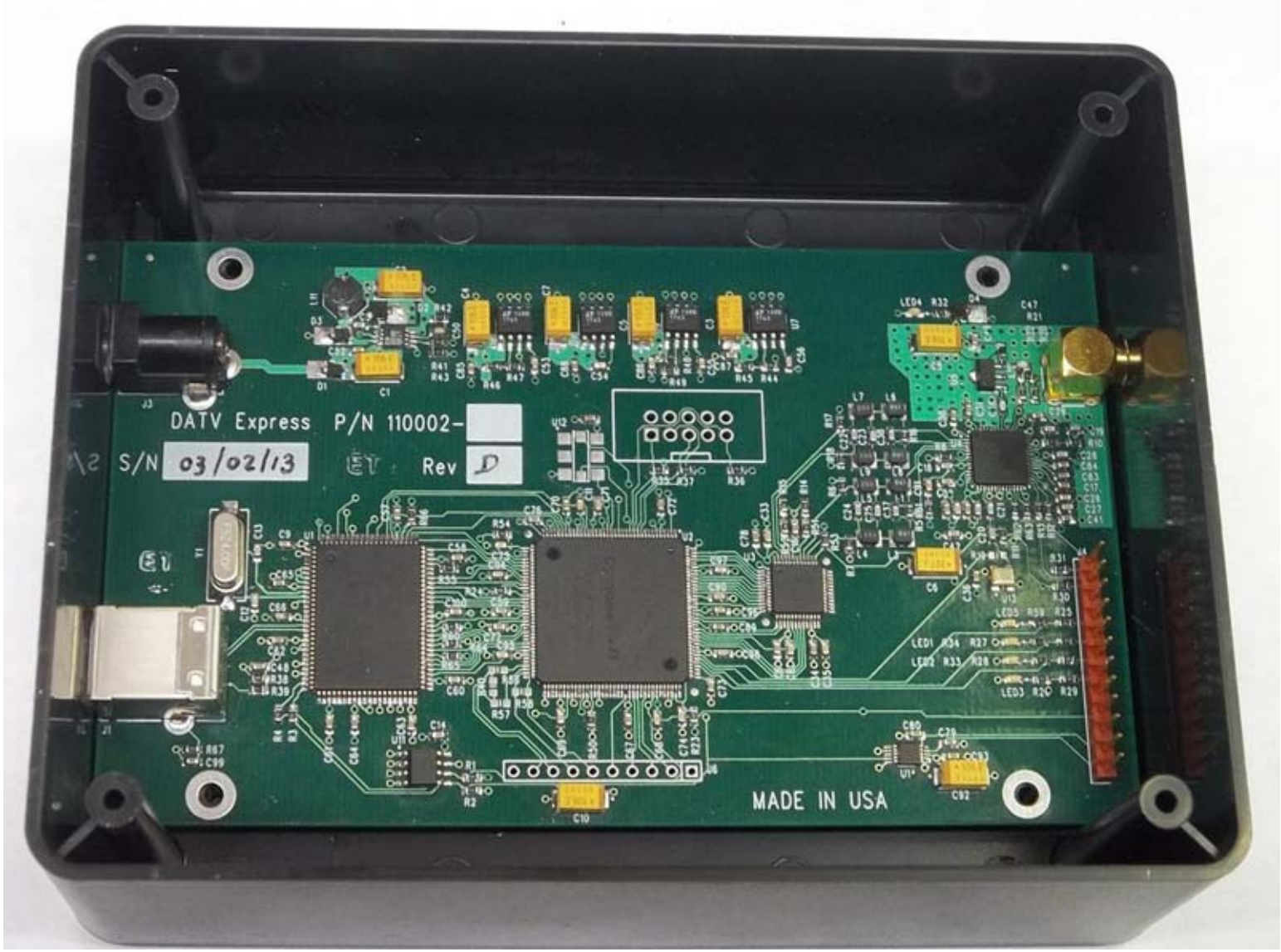


Fig 04 – the DATV-Express exciter board is a single printed circuit board.

The connector for USB2 is on the left side. The RF SMA connector is on the right side of the board. Fig 3 shows a more detailed block diagram for the DATV- Express board design. The PLL on the Analog Devices ADRF6755 IQ modulator allows defining an RF frequency between 72.5 MHz and 2480 MHz. The board contains a total of five DC regulators providing DC outputs between 5.5 VDC to 1.2 VDC for the various chips.

Fig 05 - On the left is the clean QPSK modulation Constellation from new second board etch layout. On the right is the noisy QPSK Constellation from the original board etch layout.

A small MiniCircuits GVA-84+ RF buffer amplifier follows the IQ-modulator chip. Initial bench tests on the first prototype board measured output of 18 dBm on 1.3 GHz. The initial RF etch layout was not done well and resulted in a noisy output and tended to self- oscillate. These RF problems were cleaned up in an etch-update called Version 2. Figure 5 shows the cleaned-up RF modulation (QPSK constellation) output, compared to the original etch layout. Figure 6 shows the fairly clean 1.3 GHz RF spectrum. The spurs are down about 55 dB from the CW carrier.

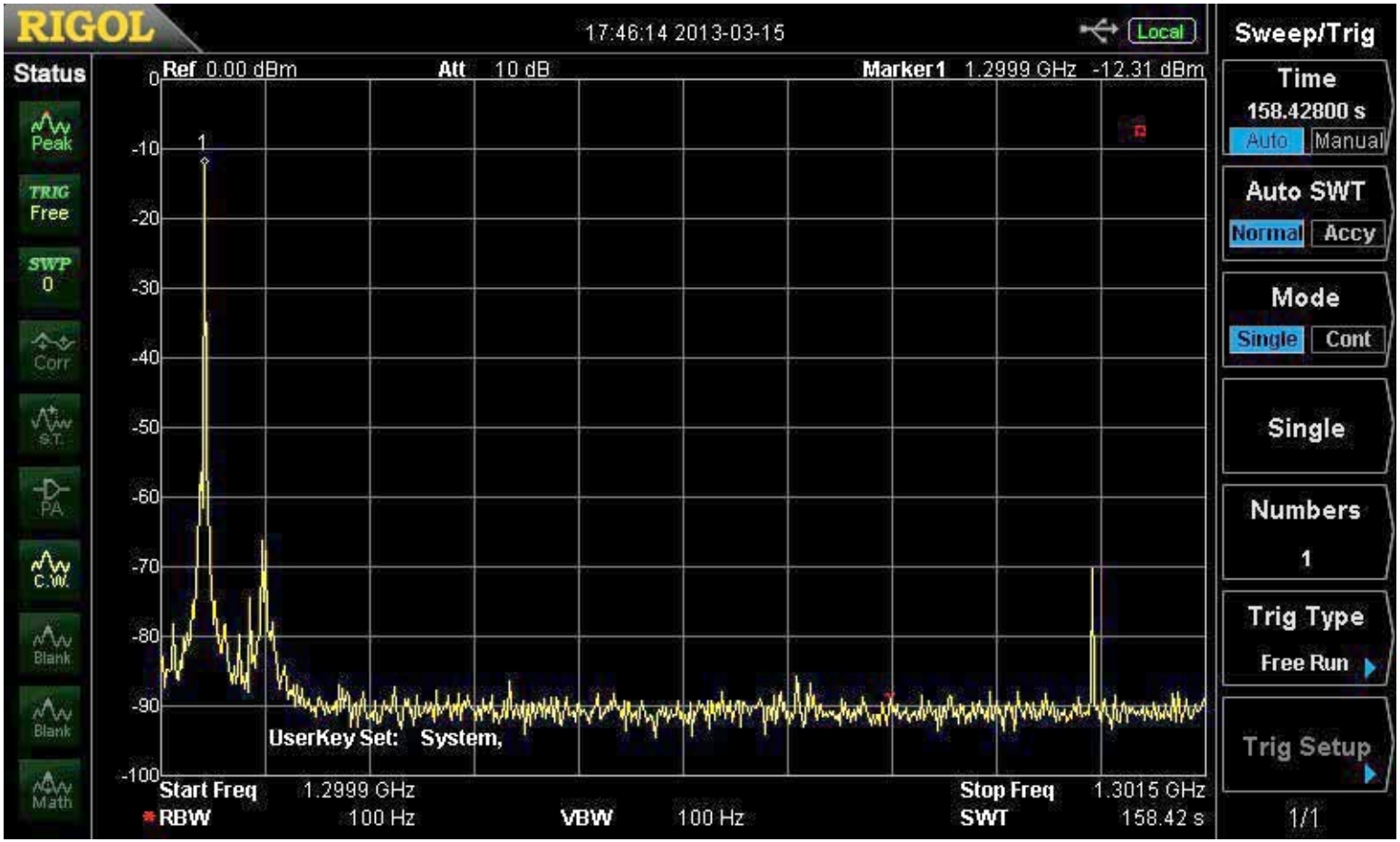


Fig 06 - Spectrum of new board with 1.299 GHz unmodulated carrier signal

Software for DATV-Express

The DATV-Express project uses three sets of software:

- *Software that runs on the external PC or Raspberry-Pi, etc.*
- *Software that runs on the 8051 (inside FX2 USB controller)>*
- *Verilog code that defines the FPGA functions*

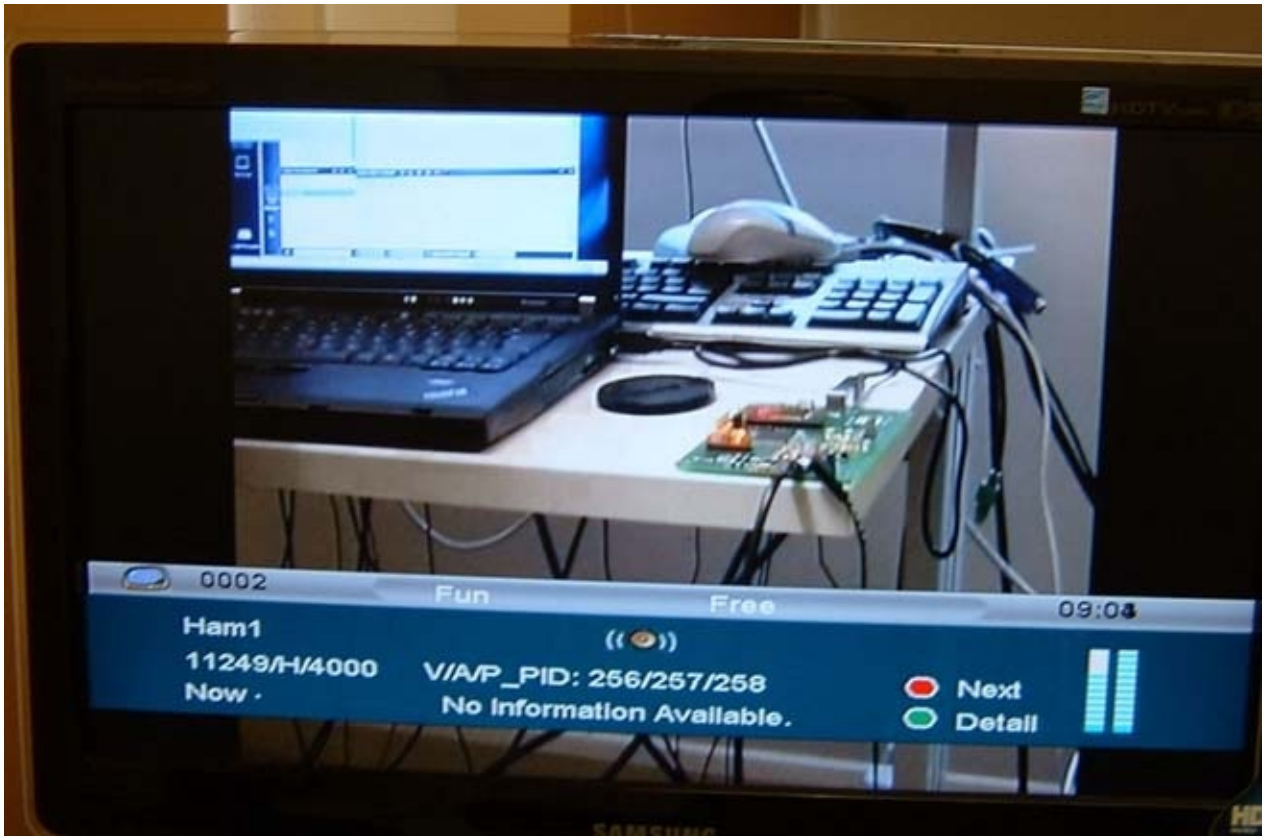


Fig 07 – The first DVB-S video ever transmitted by the DATV-Express board

The main focus of the project currently is getting to release the PC software using 32-bit Linux (Ubuntu Ver12.04.02 distribution). Currently the PC software does most of the protocol processing. An important function of the PC is to keep symbol rate constant, no overruns or under runs by adding Null transport packets as needed. The PC software also can download the firmware for the 8051 microcontroller. There is an on-board boot-ROM chip for storing firmware, but the project has not utilized it, yet. Finally, the PC downloads the code that goes into the FPGA.

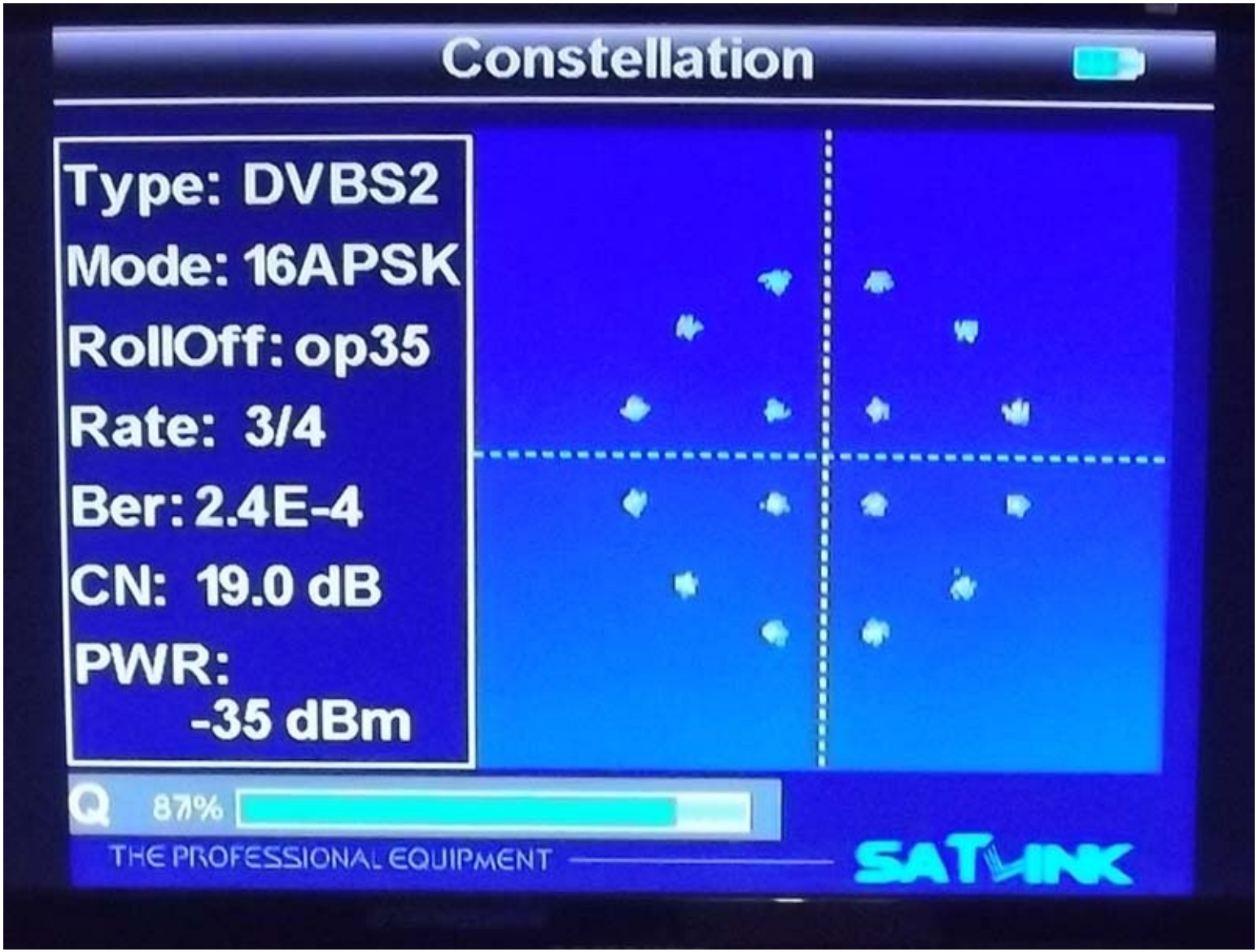


Fig 08 – This constellation of 16APSK digital modulation is being used on a DVB-S2 protocol transmission

The USB controller delivers the IQ symbol stream to the FPGA using a 16-bit FIFO on the EP1 bus. The FPGA firmware does a number of shaping functions of the IQ streams as well as calibrating for any IQ modulator offset mismatches in gain.

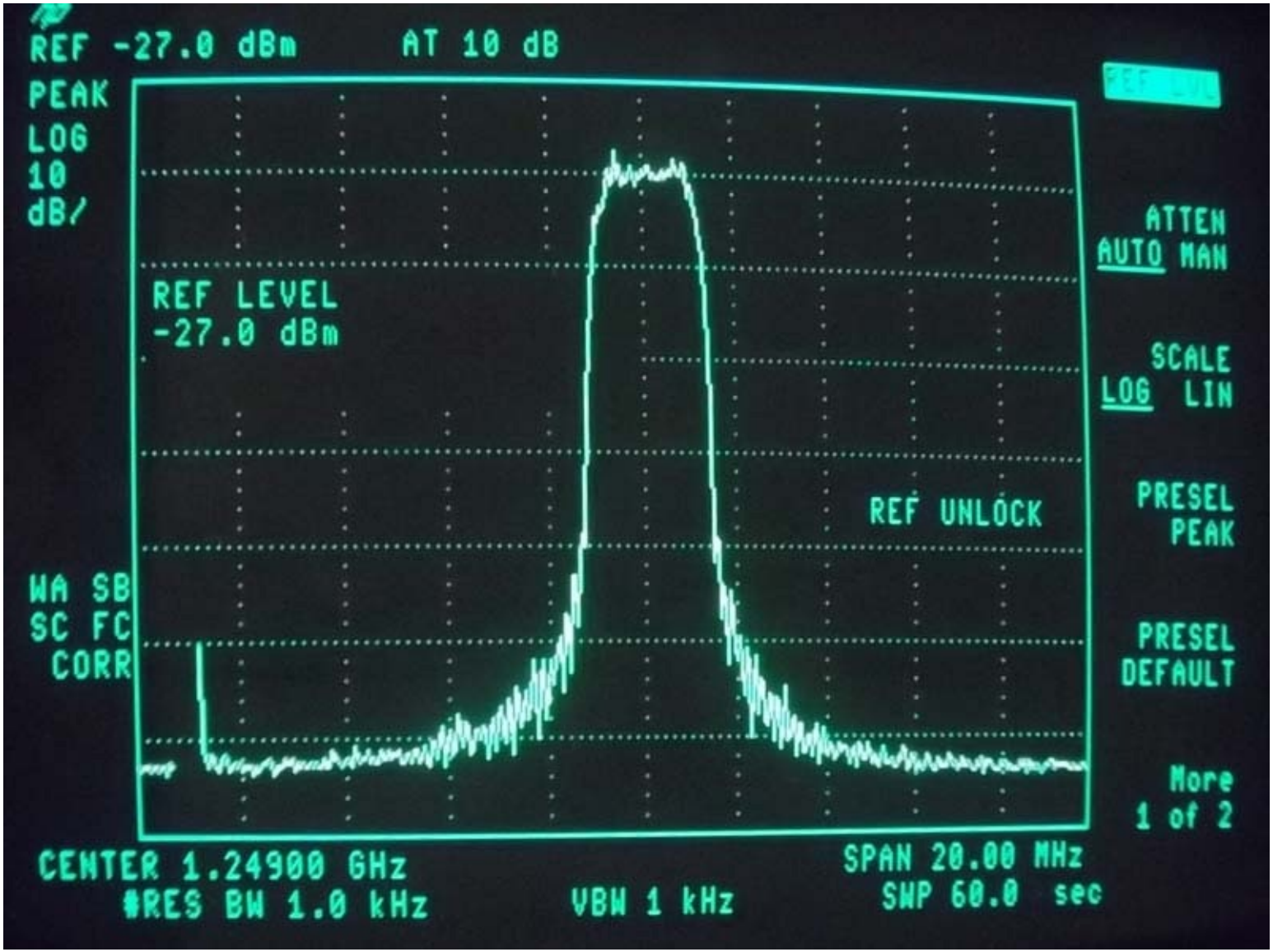


Fig 09 – 2 MSymbols/sec symbol-rate spectrum achieved using DVB-S2 protocol on 1.249 GHz

Figure 9 shows a DVB-S2 signal using 32APSK modulation being filtered by a 95 tap x8 interpolating filter with a rolloff of 0.35 and a compensated root raised cosine response. The filter takes the DVB-S2 symbols and interpolates them by a factor of 8 to put the aliases outside the LC Nyquist filter response. It is difficult to believe that 6 Mbits/s of video is crammed into that piece of spectrum approximately 2.5 MHz wide. The blip on the left hand side at 1.24 GHz is probably a multiple of 20 MHz reference clock signal on the board. The

blip remains stationary when the operating frequency changes.

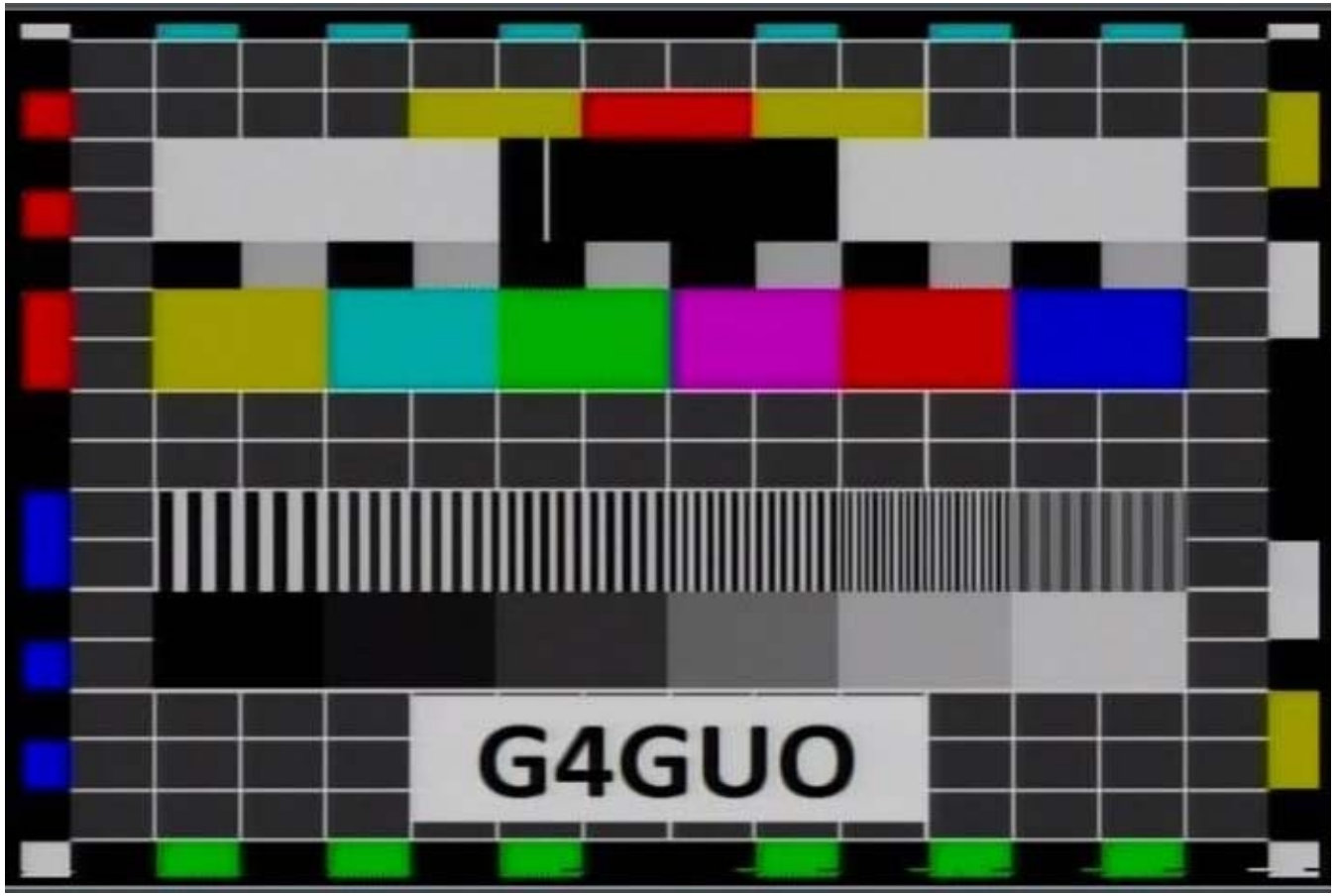


Fig 10 – Test pattern received using DVB-T protocol with 7 MHz bandwidth on 1.3 GHz

The QT4-based GUI on the PC (see Fig 11) controls which protocol to download, the PLL frequency, Symbol-Rate, the FEC configuration settings, and the RF power output level.

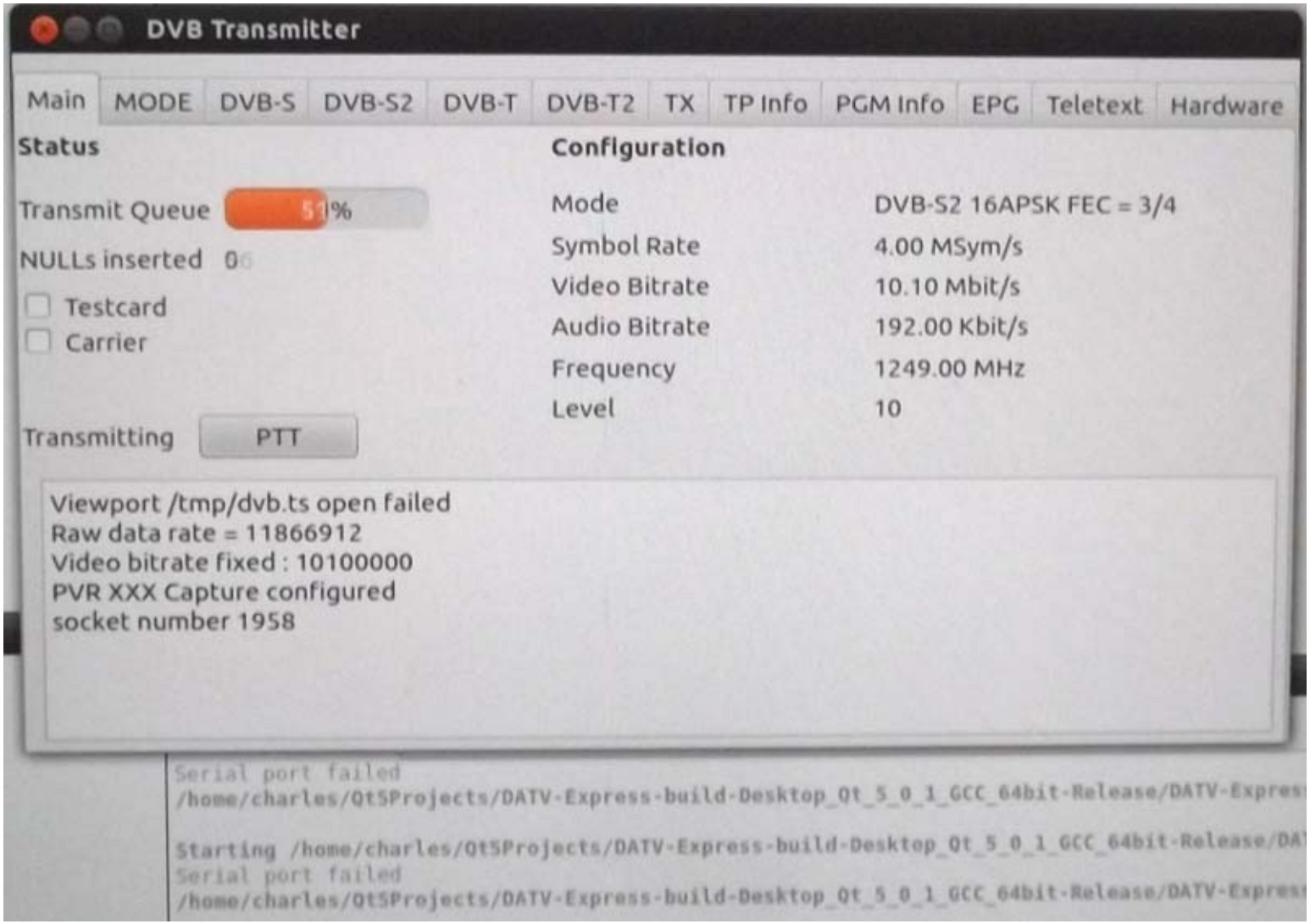


Fig 11 – The simple GUI being used by the DATV-Express software

Project Plans

The primary goal right now is to get the board and software ready to distribute into the hands of hams. The team is working towards a "final" etch-update for pre-production to resolve some inner-layers etch clearance issues and make some silk screen changes like adding the CE Mark symbol. The pre- production run will also confirm the correctness of the solder-paste stencil file and the pick-and-place file. The first release of software will run on 32-bit Linux. A little later, further releases of software will run on 32-bit Windows OS. Right now

the team hopes to have a few boards ready towards the end of this year, probably in October.

Another plan is to make the design files of this open source project available to anyone. This includes hardware design (like schematic capture and gerber files) as well as software source code for PC and Verilog. In this way, other hams can experiment and extend SDR and even manufacture the boards if that is their commercial goal.

Finally, Charles G4GUO has also been looking at what might be done using the Raspberry-Pi (ARM based) single-board-computer and/or the MK808 media player (also ARM based) to interface with the DATV-Express board as an alternative to using a normal PC. With the help of Rob MØDTS, Charles has played with a modularised version of his DATV host software. It turns out that the Reed-Solomon FEC encoder software consumes a large portion of the ARM resources. Charles has tried porting the Reed-Solomon code to run inside the FPGA. This seems to work well. Also, the project is lucky that Brian G4EWJ has written an optimised version of this module in ARM assembly language. Brian's module uses about 1/4 of the processing cycles that the G4GUO C module does. So we have managed to get the whole thing down from 60% to about 20% of cycles. Further improvements can be made.

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

Interesting DATV URLs

- *YouTube Video on DATV-Express board – see http://youtu.be/OXh-anABYaU*
- *British ATV Club - Digital Forum – see www.BATC.org.UK/forum/*
- *Yahoo Group for Digital ATV - see groups.yahoo.com/group/DigitalATV/*
- *Orange County ARC newsletter entire series of DATV articles – see www.W6ZE.org/DATV/*
- *DigiLite Project for DATV (derivative of the "Poor Man's DATV" design) see www.G8AJN.tv/dlindex.html*
- *SR-Systems D-ATV components (Boards and complete XMTR) – see www.SR-systems.de*
- *CQ-DATV online (free bi-monthly) e-magazine – see www.CQ-DATV.mobi*

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SSDV

by Phil Heron (MI0VIM)

SSDV (Slow Scan Digital Video) is a packetised digital form of SSTV (Slow Scan TeleVision). It can be used to transmit small images along with the regular telemetry transmitted by a payload during flight. Any digital mode that can carry text or data can be used, although the current implementation is limited to 8-bit RTTY (Radio TeleTYpe).

Packet Format

Offset	Name	Size	Description
0	Sync Byte	1	0x55 - May be preceded by one or more sync bytes
1	Packet Type	1	0x66
2	Callsign	4	Base-40 encoded callsign. Up to 6 digits
6	Image ID	1	Normally beginning at 0 and incremented by 1 for each new image
7	Packet ID	2	The packet number, beginning at 0 for each new image (big endian)
9	Width	1	Width of the image in MCU blocks (pixels / 16) 0 = Invalid
10	Height	1	Height of the image in MCU blocks (pixels / 16) 0 = Invalid
11	Flags	1	000000xx: 000000 = Reserved, xx = Subsampling Mode (0 = 2×2, 1 = 1×2, 2 = 2×1, 3 = 1×1)
12	MCU offset	1	Offset in bytes to the beginning of the first MCU block in the payload, or 0xFF if none present
13	MCU index	2	The number of the MCU pointed to by the offset above (big endian), or 0xFFFF if none present
15	Payload	205	Payload data

220	Checksum	4	32-bit CRC
224	FEC	32	Reed-Solomon forward error correction data. This may be omitted for storage, or if the mode already provides FEC

Sizes and offsets are in bytes, with each packet being 256 bytes in total (or 224 bytes with no FEC data).

Image Format

The image should contain just the scan data from a JPEG image (an "Abbreviated image" in JPEG terminology), with none of the markers or headers that normally make up a JPEG image. Because there are no headers, the image must conform to the following rules:

- *Y'CbCr colour format*
- *Width and height must be a multiple of 16 (up to a resolution of 4080 x 4080)*
- *The quantisation and huffman tables are fixed*
- *Baseline DCT only*
- *Total scan data must not exceed 13434880 bytes (~12.8 MB) in length (205 payload bytes per packet, 65536 packets max)*
- *The first MCU of each packet is byte aligned*
- *The first DC values for each component in the first MCU of a packet are relative to 0*
- *The scan data does not need byte stuffing (0xFF bytes do not need to be followed by 0x00)*
- *The total number of MCU blocks must not exceed 65535*

Error Correction

Each packet ends with 32 bytes of Reed-Solomon codes, calculated from the 223 bytes beginning with the packet type (offset 1) to the end of the payload data. These codes allow the receiver to correct up to 16 byte errors in a received packet (including the Reed-Solomon codes themselves).

Whilst the Reed-Solomon decoder is able to handle incorrectly received bytes it is useless when it comes to missing bytes. When a byte is dropped for any reason all subsequent bytes will be in the wrong position and the decoder will see most as errors. To better handle this the receiver should be able to detect and insert an

appropriate number of padding bytes, allowing the decoder to see them as errors and correct.

C code to generate the Reed-Solomon codes is available here: *rs8encode*

Lost Packets

When a packet is lost there are a number of scenarios that may need to be handled:

- *An MCU block from the previous packet was incomplete. If the break occurs during the AC coefficients of a component, emit the EOB symbol to end them early. For each remaining component in the MCU emit an EOB symbol for both the DC and AC coefficients. This should end the incomplete MCU cleanly.*
- *Subtract the MCU index value from the index of the last decoded MCU block to calculate how many blocks have been lost. For each lost block emit an empty MCU block.*
- *The current packet will likely begin with the end of one of the missing MCU blocks. This data cannot be used and needs to be discarded. The MCU offset field in the header indicates the number of bytes to skip before resuming decoding.*

Once these conditions have been dealt with, normal decoding can resume.

Modulation / Mode

The current implementation uses 8-bit RTTY at various baud rates. A more appropriate method should be used in future.

One idea is to pack the SSDV packets (sans-FEC) into an AX.25 frame for transmission over standard amateur radio packet networks. It may even be possible to do this in such a way that the format is compatible with the APRS network.

Software

dl-fldigi

dl-fldigi contains a decoder built in, that listens to the RTTY stream for packets and decodes when received. It also can upload the packet to a central server where the data from multiple distributed listeners can be combined - often filling in gaps.

http://ukhas.org.uk/projects:dl-fldigi

NOTE: Versions prior to DL3.1 contained an older version of the SSDV decoder which can not handle the finalised format described above.

ssdv

I have written a small command line application that can encode and decode the packet data. It is used by the server to produce the images from the data uploaded by multiple dl-fldigi users.

https://github.com/fsphil/ssdv

hadie flight software

An example of how I used the code on the hadie flights can be seen in the flight software, available on github:

https://github.com/fsphil/hadie

The camera used on these flights was a C328-based UART camera.

Future

- *Dynamic or adaptive huffman and quantisation tables.*
- *Try 1200 baud on a future flight. (Tim did this, and it mostly worked. Requires very careful tuning)*
- *BPSK modulation via fldigi.*
- *Add an interface to dl-fldigi for sending images.*

History

- *Some final changes made to the format 2012-03-04. Images produced with this version of the encoder will be compatible with all future decoders.*
- *TU Delft launch in Holland transmitted images at 600 and 1200 baud. Two receiving stations where decoding data, and at 600 baud almost all data was received. Some of the 1200 baud images where also received, but with more gaps in the data.*
- *hadie:3 tested the latest version at 300 baud and was a full success. Every image was decoded completely, with only a few missing packets near the ground when I was changing antenna. Although each station missed a couple of packets the combined uploaded images where complete.*
- *The new version was used on the hadie:2 HAB flight 2011-01-09 with the updated error recovery and correction code. An antenna problem meant the signal was very weak and contact was lost with the balloon shortly after launch, but despite this three full images where returned from the air. Missing packets had no impact on the rest of the image, which continued decoding as data came in.*
- *An early version was used on the Cirrus/Hadie HAB flight 2010-04-16. This version transmitted the entire file returned by a C328 serial camera but flaws in the reception code left the error correction ineffective and a number of packets where lost. Lacking the ability to correct the stream, the lost packets prevented the image from decoding after that point.*

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- Universelle Spannungsversorgung für PAs
- 10-GHz-FM-ATV-TX im Eigenbau-Teil 4
- DB0ZU-ATV-Projekt abgeschlossen
- Neue Entwicklungen im HAMNET
- Norddeutsches ATV-Treffen 4.5.

HDTV-NEWS

Der 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/*

The current issue covers:-

- *Intelligent Power for power amplifiers*
- *Campfire romance in amateur television*
- *10-GHz FM ATV TX Build Your Own Part 4*
- *A low-cost-AM ATV receiver*
- *DB0ZU ATV project completed*
- *IPTV to broadcast - From the cut and thrust to terrestrial TV channels*
- *First experiments with the integration - ATV applications in HAMNET*

Updating your Input Sources for ATV.

By Richard L Carden VK4XRL

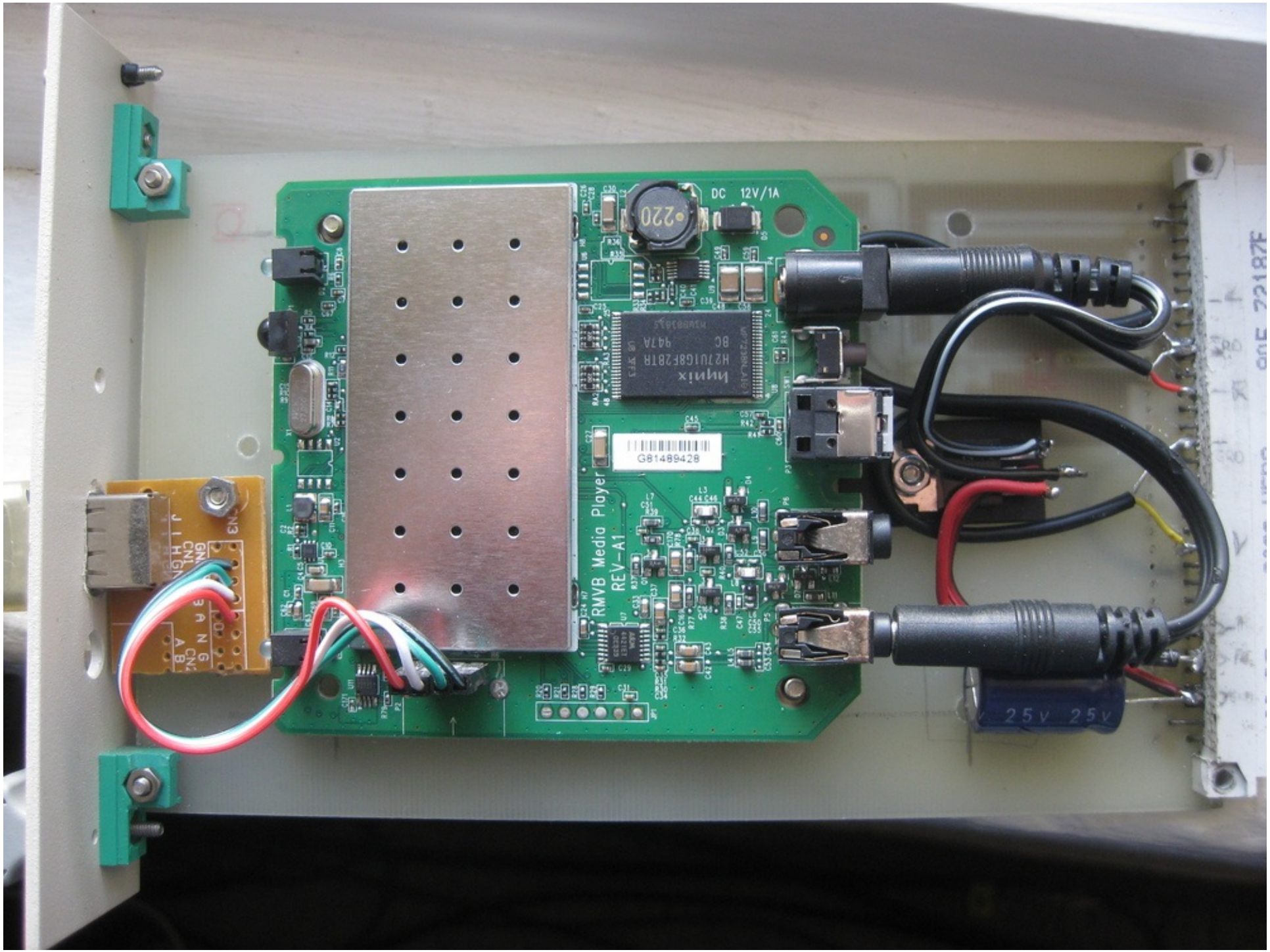
After some time playing with ATV either Analogue or digital we may need to update how we do things. With digital it's a good time to do this.

When I started out in ATV I started to use the BATCs coder and circle testcard generator. Added to this was another unit that produced bars or any number of test signals.

The technology used for these are getting a bit long in the tooth so we need to replace them. Since then a

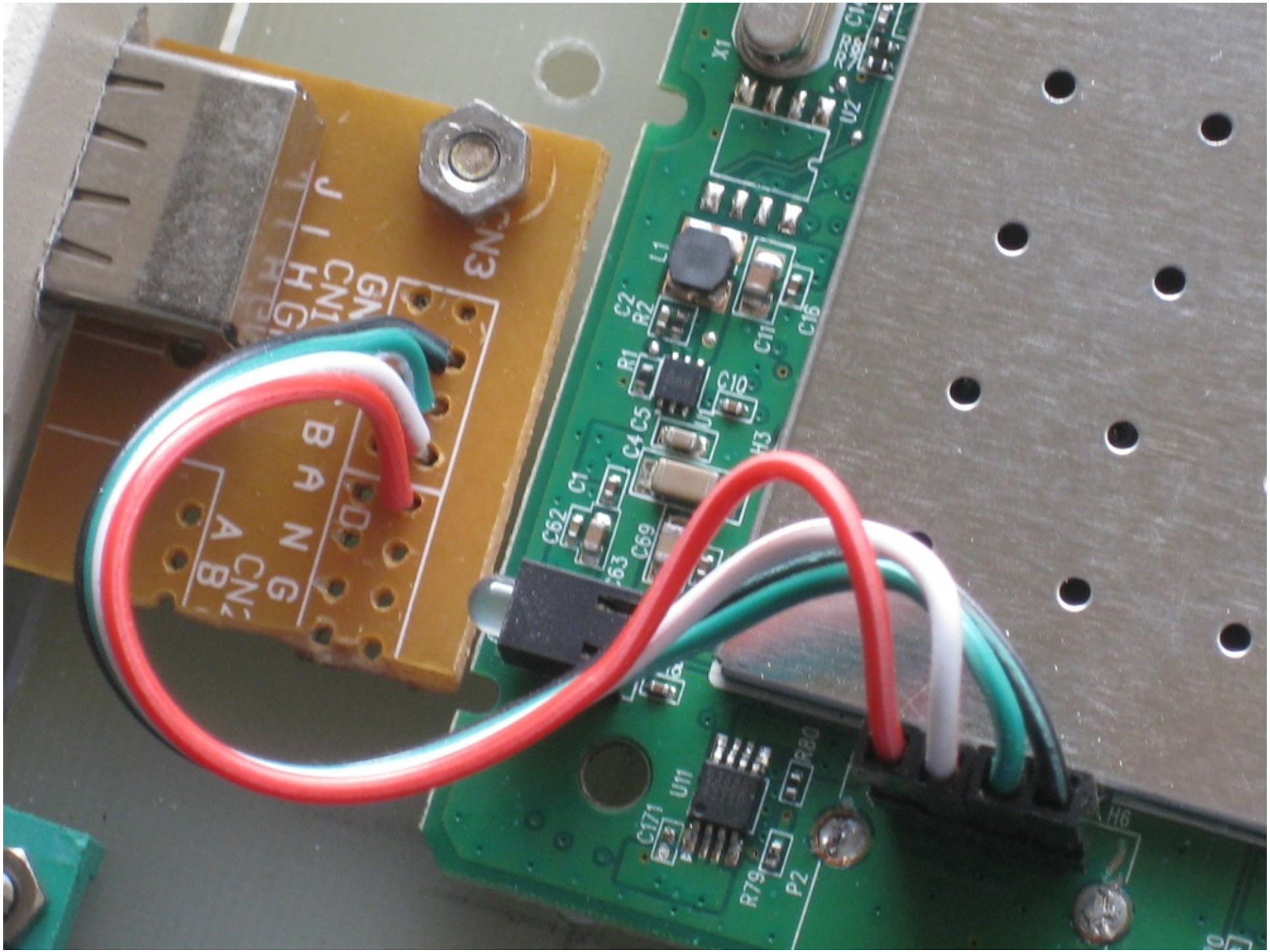
number of commercial coders have become available such as the Cox 153. Also SPG's have become very cheap and you can either update these by dedicated chips, PIC's or the commercial units. This now brings most stations up to some form of commercial standard. One of my aims has always been when building repeaters for ATV to have them as transparent as possible. Over the past decade or so computers have been used for generating test-cards and idents such as the Sinclair, BBC Micro, Commodore 64 and Vic20. It's also possible to use the old PC or Mac to do this to. Likewise the EPROM unit from Trevor was put into use as well as many colour Cropredy units.

Since playing around with digital I started to investigate another source to produce such inputs. The first unit used was the SanDisk unit, however these had serious problems with levels. Some were modified but I felt weren't that successful. Also these units were only limited to video images. Jaycar here in Australia also had a unit that worked in a fashion but allowed audio as well. With the advent of digital repeaters another method was required, and around this time WD produced the Mini Media Player. I have used these in the local church for pre-service music and idents and they work very well indeed. I started using them in my own home ATV system quite a few years ago now when Dick Smith electronics had them on sale for around $49A.



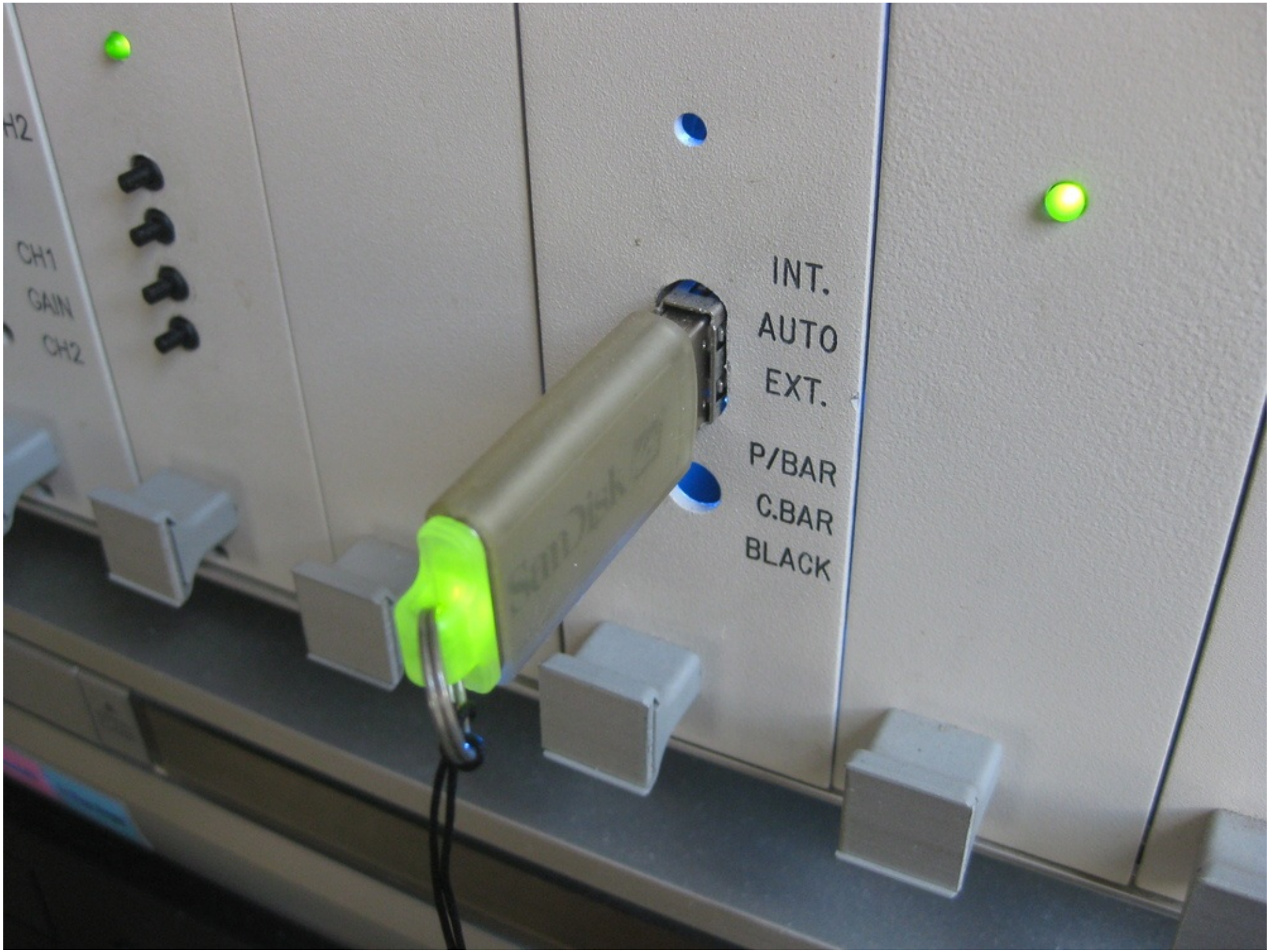
In both the digital repeater and home system I have removed them from their cases and mounted them on

plug in modules. The USB input was modified also to allow the unit to fit into the module. A USB stick now holds both the audio (tome etc.) and video idents or test-cards. Some Video photo frames may also be modified to provide the same idea. The mini media play was limited as to what video format it could play so the newer WD video player can be used to provide almost all video format replays.



To use this system one needs a PC or Mac to produce these jpeg images. I also use photo shop to help in

editing and providing text. The rest is up to your imagination. Another programme that can be used is the Testcard Generator. I have used this to produce the Cropredy test-cards as well as the Eprom style test-cards.

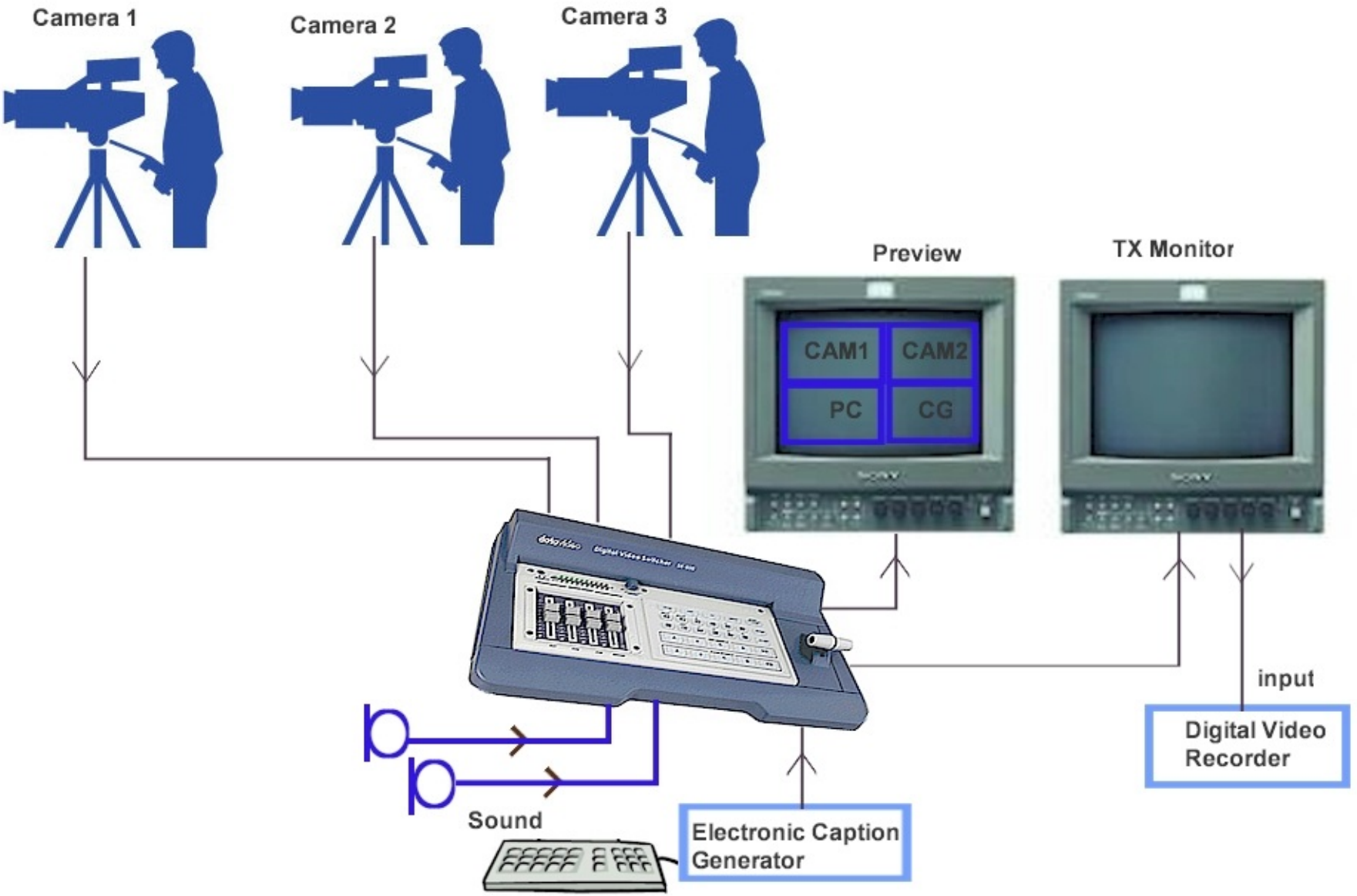


Going this way saves on precious rack space and in the long run more reliable.

Multi Camera Shoot

By Trevor, G8CJS

In the last two issues I have covered two different single camera shoots, that can be edited together and made into a DVD with Wondershare video editing software. In this issue I want to have a look at a multi camera shoot. The first one of these I tackled was for an RSGB AGM. I used three cameras and a video caption generator. One was a professional camera and did most of the work the other two were CCTV camera's that filled in, while the pro camera was re-framing and focusing.

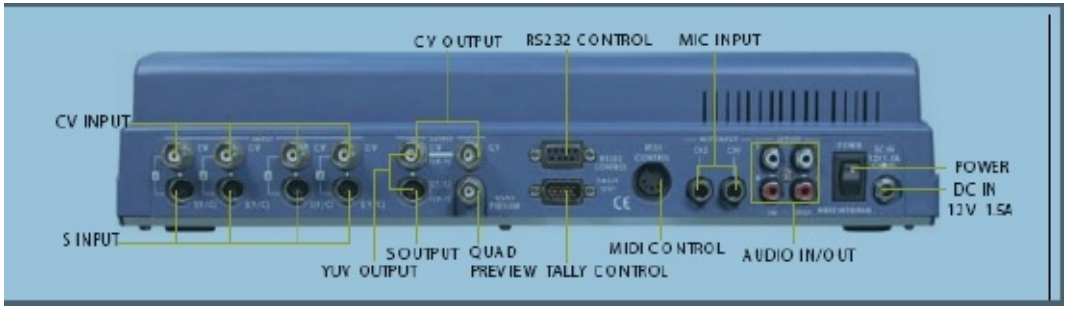


The heart of the shoot was a vision mixer, and this was a datavideo SE500 bought especially to make the event work. There are lots of video mixers around and they often turn up on eBay, but not every mixer is suitable, as the cameras were not synchronised, so a mixer that would work with non sync sources was essential. If your budget will not stretch to the SE 500 then mixers such as the Panasonic MX50 often turn up

on eBay, but they are getting old and are a complex item should they need repairing.

The RSGB AGM was recorded and transmitted live on the BATC streamer; I think there is still a recording in the BATC film library if you did not see it. All the video connections shown in the diagram are PAL and it was recorded in 4 by 3 formats.

The first problem was the sound, this was provided by another company and we were given a courtesy feed at line level on an XLR, I had anticipated this and made an adaptor XLR to Phono, but the SE 500 did not like the feed an added a loud buzz, so an isolation transformer was fitted and cured the problem and is now carried as a standard kit item for use with this mixer. The event was recorded and streamed. I have not shown the streaming computer, it was looped off the video recorder, which again is another expensive item, but I did wonder about a DVD recorder had I not already owned the Digital Video recorder.



Rear view of the datavideo SE 500mixer

Why the expensive datavideo mixer, well it is important to be able to see all the camera's so as to choose the best picture and not cut to a camera which is being re-framed or adjusted. To this end the four video sources controlled by the mixer are displayed on a single video monitor as a quad display.

This was really useful and worked well, secondly it has a tally light output which will put a red light on the camera that is on air, unfortunately this was not implemented on this shoot, but with only one camera that could be moved and two CCTV camera's one showing a wide shot of the top table and speakers and the other, the audience, this was less of a problem.

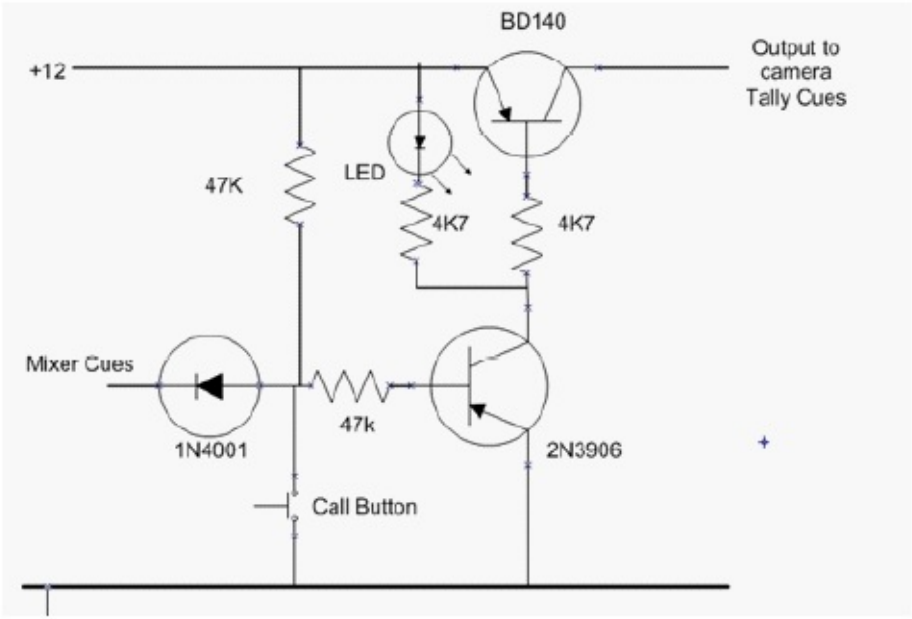
The next outing was Budbrook School and a streaming event of a link with the International Space Station.

This time we got to do our own sound and then the RSGB AGM again with three professional camera, so cues were essential this time.

LED A3	= pin 1	= 1R (Main1)
LED A2	= pin 2	= 1G
LED A1	= pin 3	= 1Y (Sub1)
Ground	= pin 4	= GND
LED D3	= pin 5	= 4R (Main4)
LED B3	= pin 6	= 2R (MAIN2)
LED B2	= pin 7	= 2G
LED B1	= pin 8	= 2Y (Sub2)
Ground	= pin 9	= GND
LED D2	= pin 10	= 4G
LED C3	= pin 11	= 3R (Main3)
LED C2	= pin 12	= 3G
LED C1	= pin 13	= 3Y (Sub3)
Ground	= pin 14	= GND
LED D1	= pin 15	= 4Y (Sub4)

Video Channel	Red LED (On Air)	Green LED (Off line)	Yellow LED (Next)
1	Pin 1	Pin 2	Pin 3
2	Pin 6	Pin 7	Pin 8
3	Pin 11	Pin 12	Pin 13
4	Pin 5	Pin 10	Pin 15

The manual for the SE 500 had the following info on the VGA connector on the rear of the mixer; we were only interested in the Red on air LEDS which were logic low when selected. We decided to go with logic of supplying +12 to the cameras when on air, this is more standard in broadcast cameras and for non broadcast cameras we could supply them with a small camera box with an LED and serial current limit resistors that did not need power. Brian Kelly designed the interface from the VGA connector to the camera boxes.



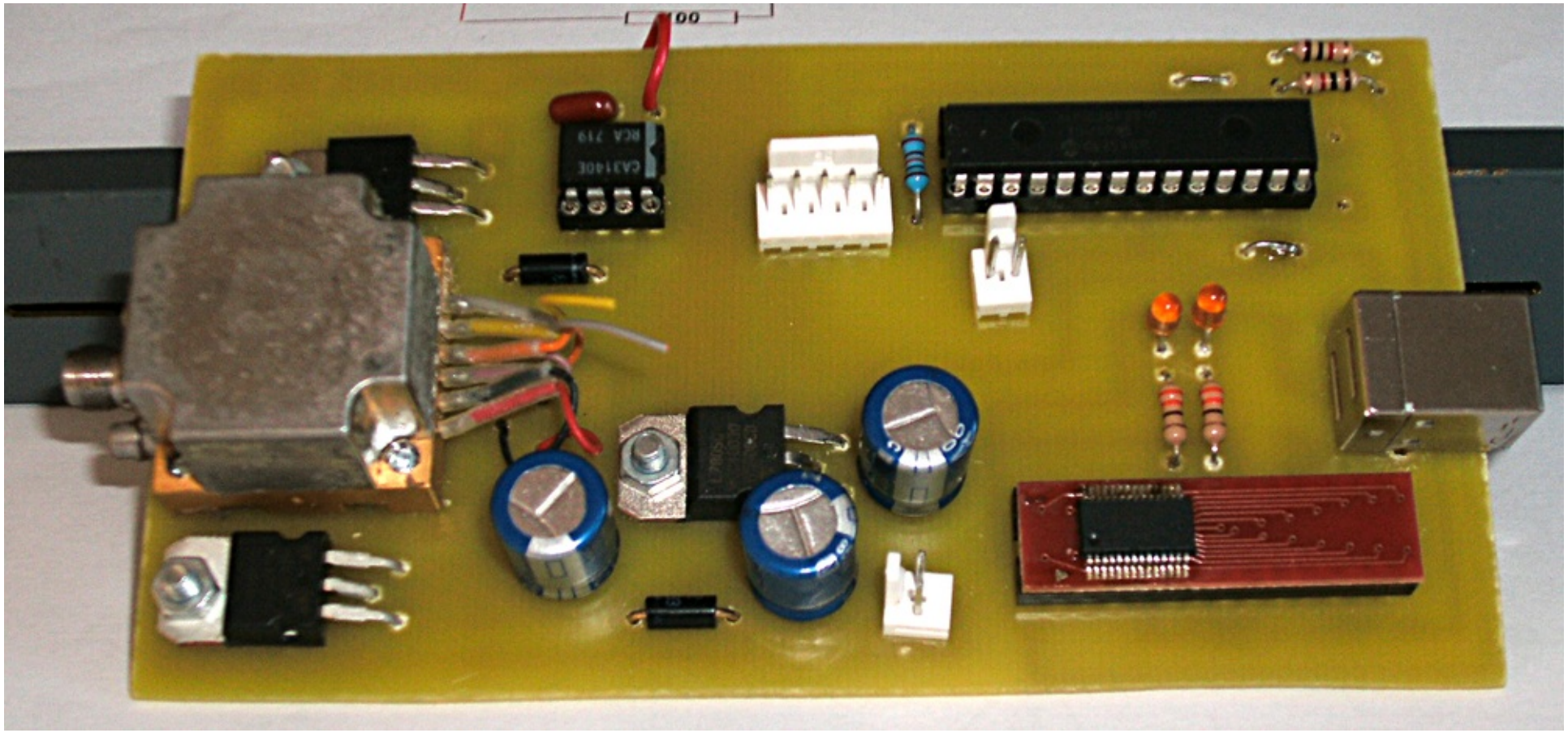
Four of these were required and I added an illuminated LED push button so they could be seen working from the mixer and the push button could be used to attract the camera ops attention without cutting to him. We used XLR connectors to wire the camera boxes to the interface unit, with a standard of pin 1 ground pin 2 cues and that left pin 3 free for one way talkback from the mixer to the camera boxes, to which a jack plug was added so the camera operator could listen to the director on cans. (A Small Maplin amplifiers was used to feeding pin 3 on all the Camera box XLR's),It worked well and to communications both audio and camera cues were a blessing for the second RSGB AGM.

The SE500 has been in operation for several years now and the last outing was the EME (Earth Moon Earth) which was the first wide screen operation I had attempted. Strictly speaking PAL should not be used for wide screen, but for streaming resolution you can get away with it, but if you are considering a wide screen multi camera shoot then perhaps PAL might not be the way, so in the next issue I will look at digital options rather than the PAL SE500 mixer.

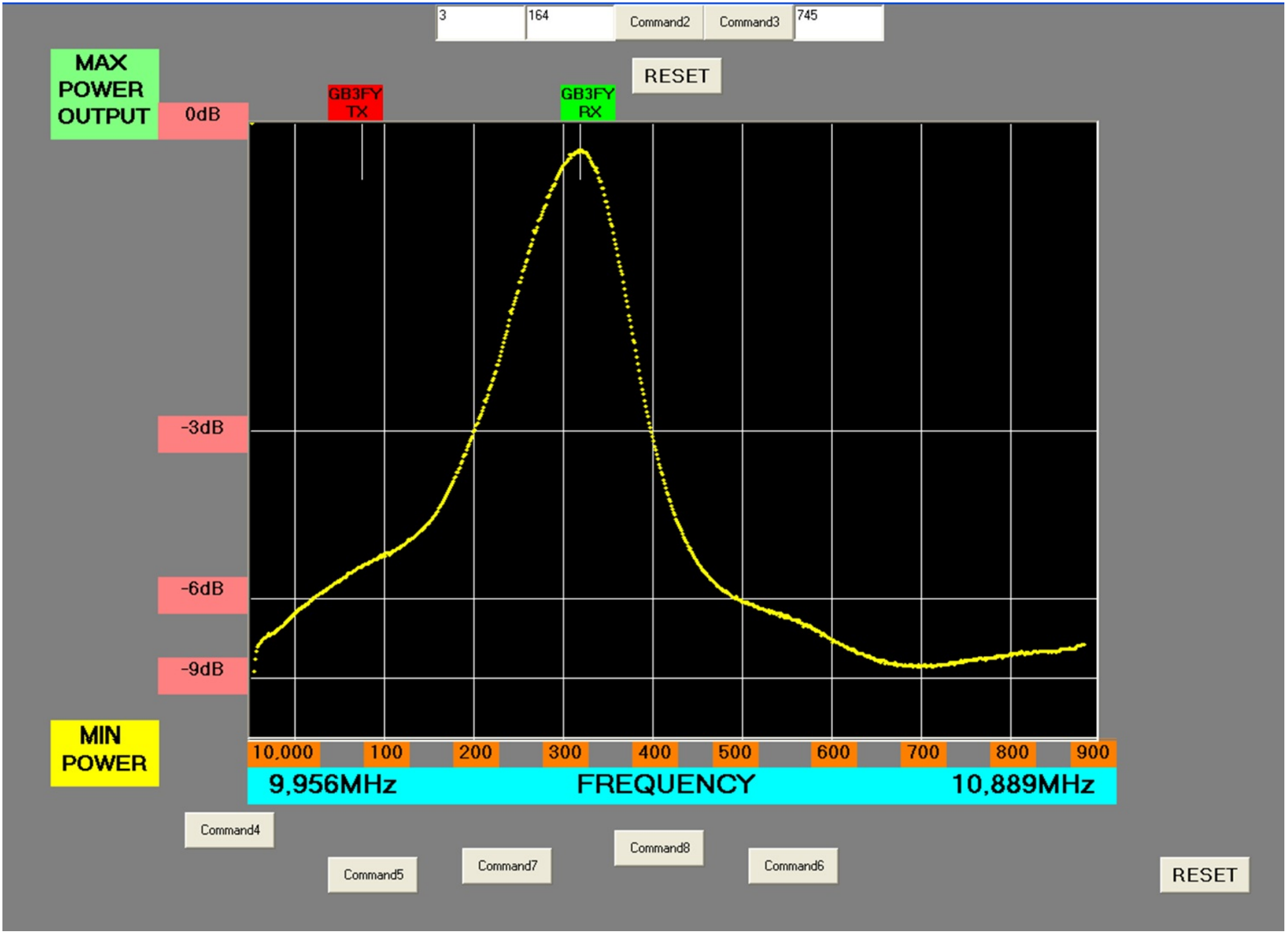
10GHz PC controlled scanner using YIG technology

By John Hudson G3RFL

This was my last adventure into experimenting with the eBay yigs, which indecently seem to be disappearing fast. I hope that means that some of you are purchasing them and following in my footsteps and not the commercial sources of these units are drying up. The sweeper uses a programmed PIC DSP30F2010 and Ian has made the code available as a downloadable file. The FT 232RL is available from *www.Ftdichip.com*. I have produced a single sided PC layout, that can be home etched, and some visual basic which will run on a PC and again this is in the download section of *www.cq-datv.mobi*.

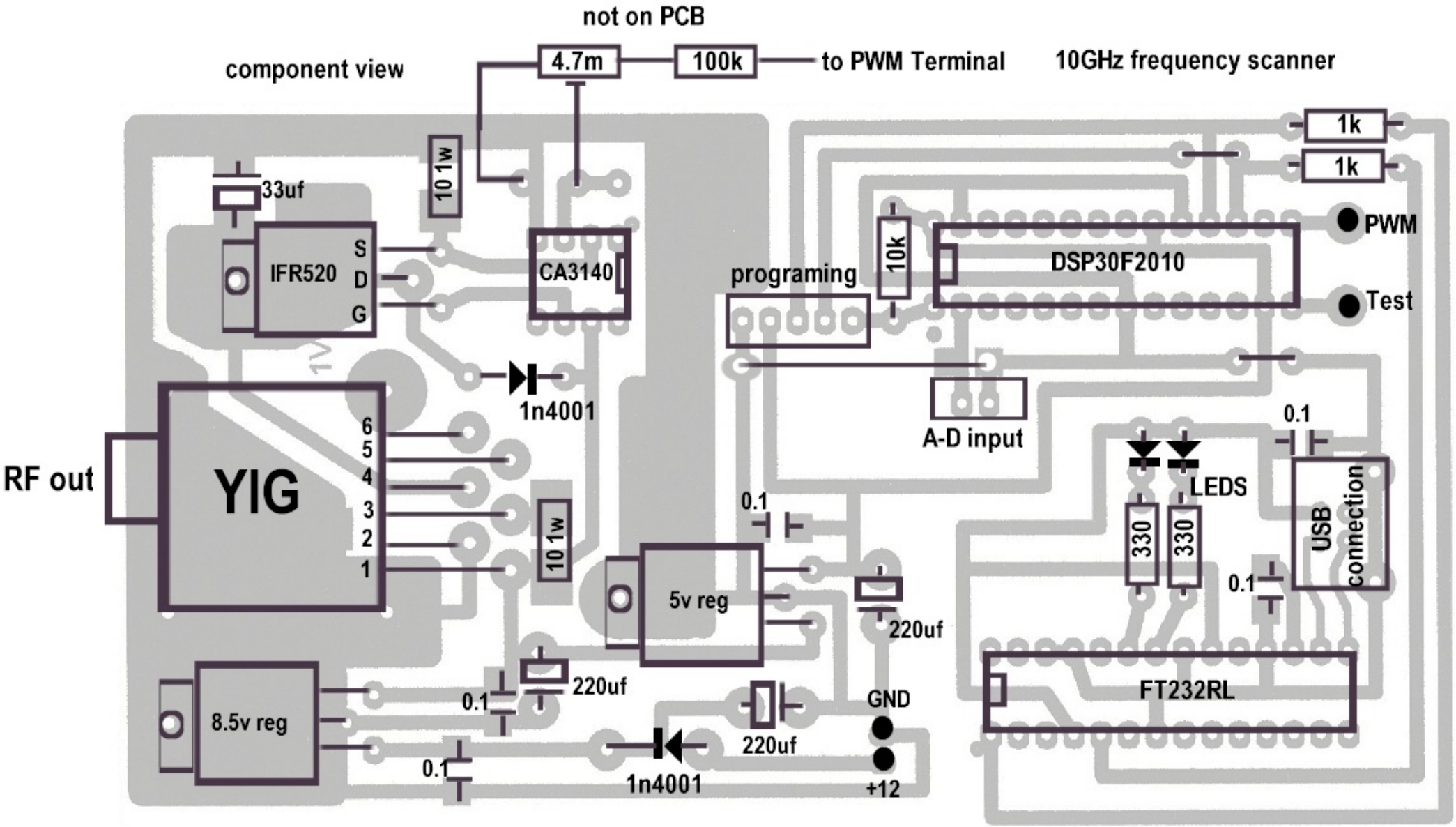


The scanner connects to a PCB via a USB connector and a frequency sweep is provided by the YIG and controlled by the PC under the control of the visual basic programme. This can be used to drive passive devices such as filters and aerials or active devices such as power amplifiers. The output of which picked up with my HP 6460 power meter and is fed into the DSP30F2010, but a simple diode probe will do the same thing, the scanner expects a signal that is between O to 5V on the input to the PIC A/D for full Y deflection so it may be a diode and a small DC amplifier you need. As the YIG provides an RF sweep it is plotted on the screen of the PC as an X sweep and it will respond in the Y direction to the RF being provided by the pickup, so you will get a display that looks something like this.

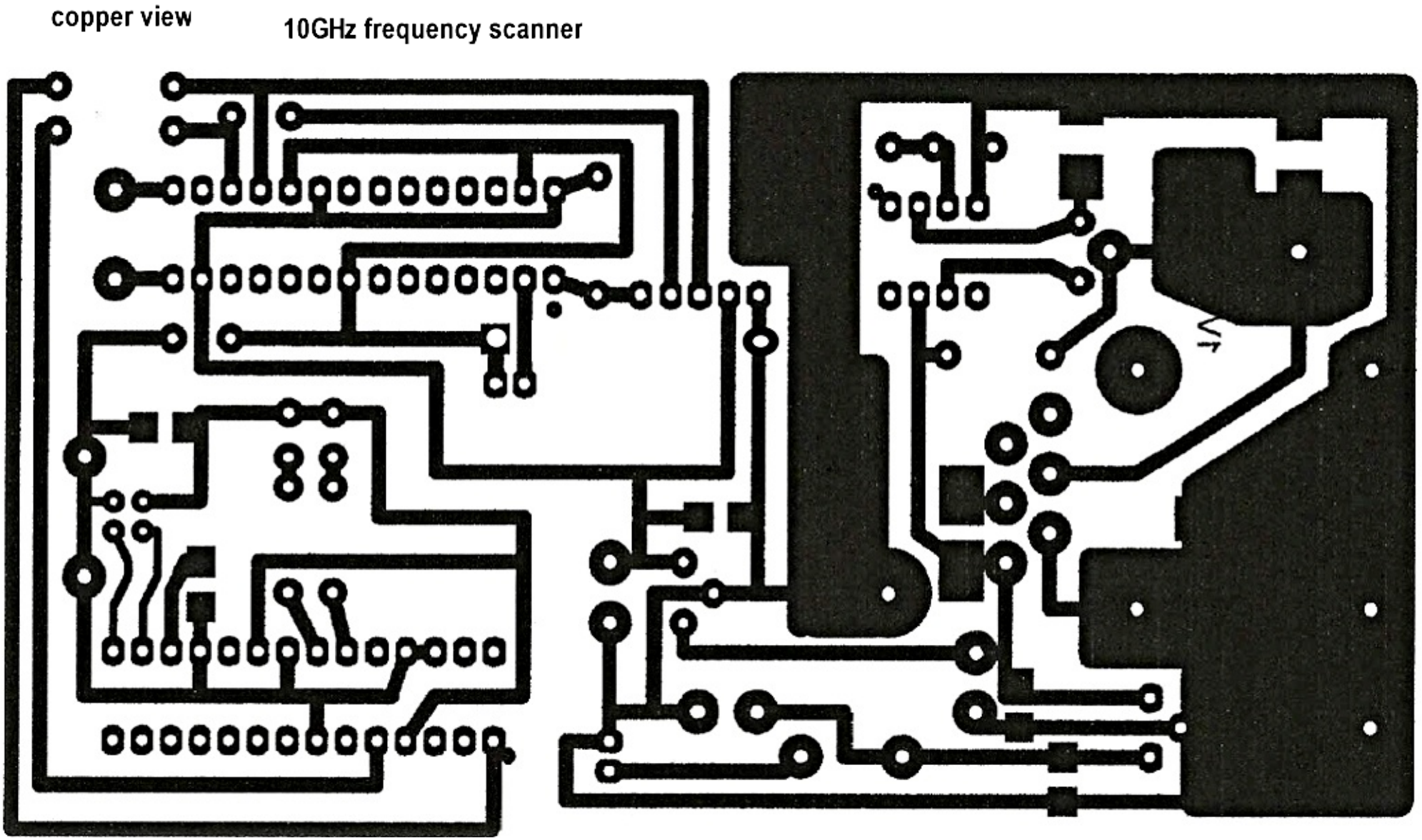

3
164
Command2
Command3
745
MAX POWER OUTPUT
RESET
GB3FY TX
GB3FY RX
0dB
-3dB
-6dB
-9dB
MIN POWER
10,000
100
200
300
400
500
600
700
800
900
9,956MHz
FREQUENCY
10,889MHz
Command4
Command5
Command7
Command8
Command6
RESET

Construction.

This was simple most of the components came out of my Junk box, there the 10 ohm 1w resistors mount on the coppers side of the PCB as does the SMC capacitors which are shown connecting to square pads.

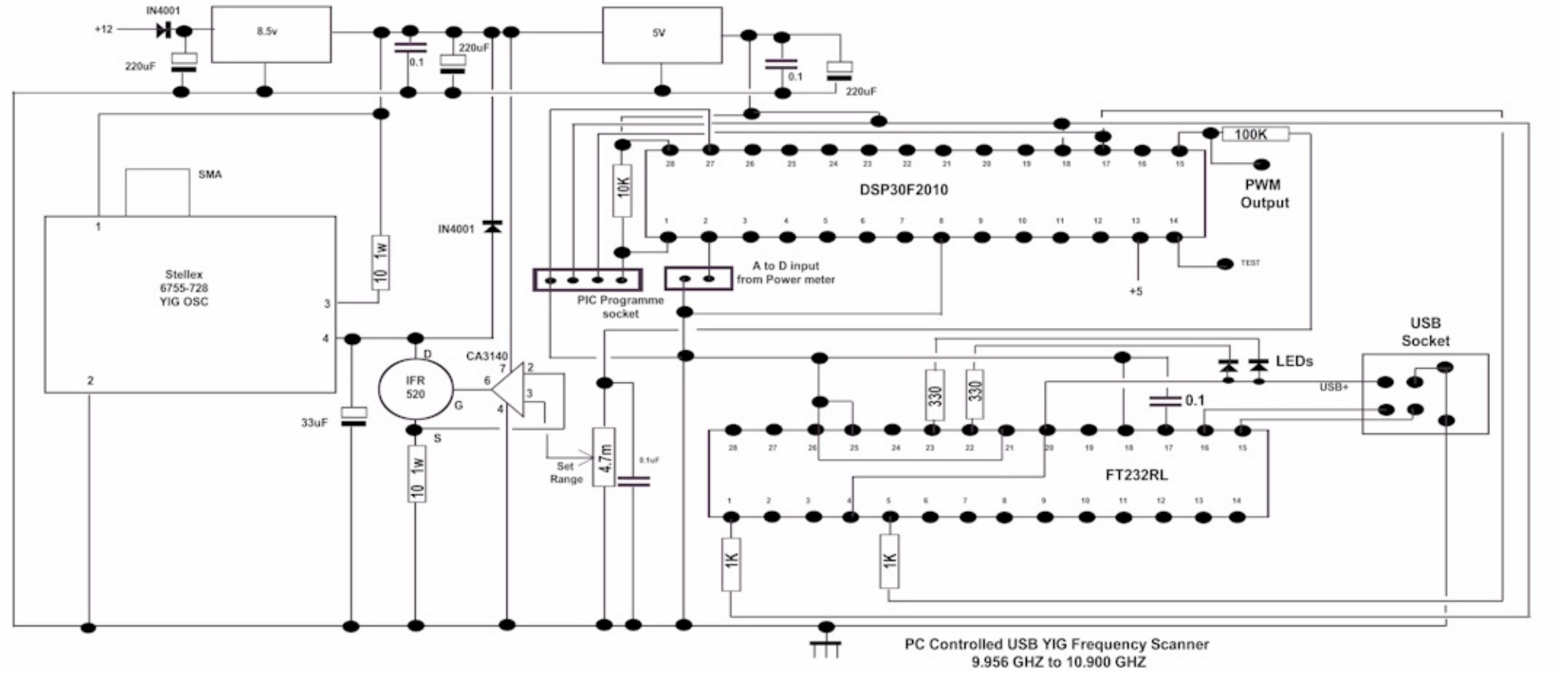


PCB layout view



PCB copper view

Software install for the PCB was a little fiddly as it is not just run the exe file which has been renamed on the download to.TXT so it can be downloaded, so rename it as .exe. Before you run the exe file you need to and there is a visual basic file to load so read the instructions with the download.



Power requirements the unit requires an external +12v which is reduced to +8.5v and +5v via onboard regulators. When running the current is 110m/A to 280m/A at the Top Freq.

2 FT232R Block Diagram

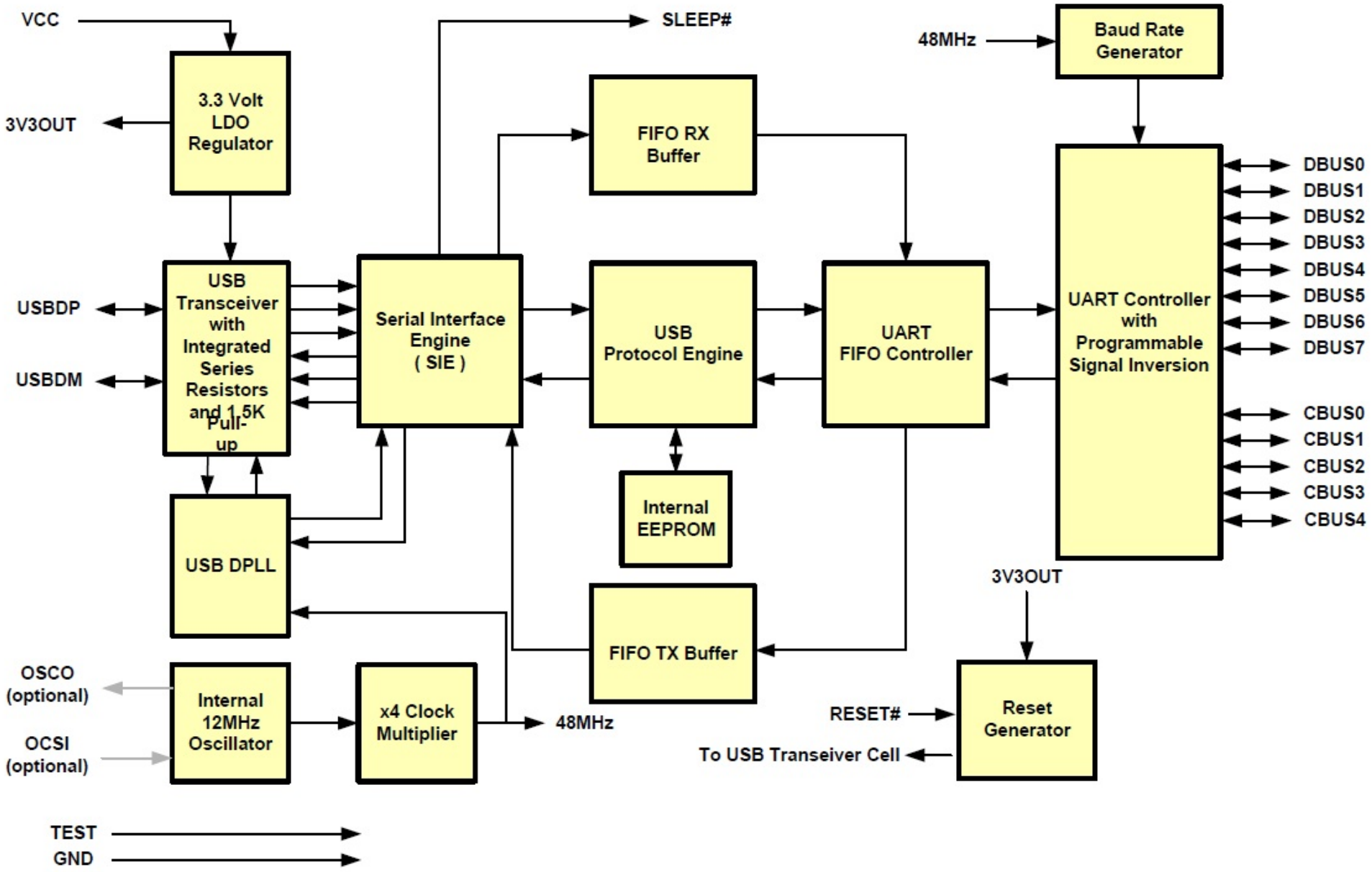
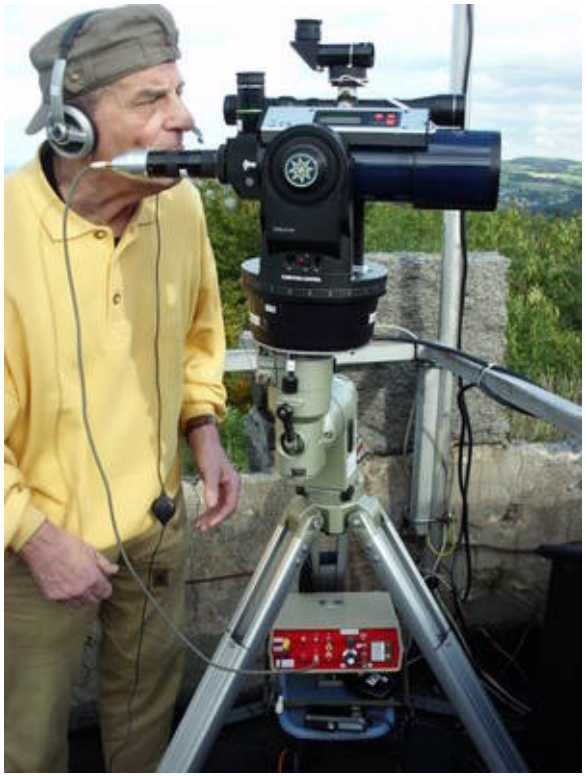


Figure 2.1 FT232R Block Diagram

For a description of each function please refer to Section 4.

It's communication Jim, but not as we know it!

If you have ever wondered if it is possible to transmit ATV via laser, the answer is "yes" and there is a current world record of 101km, which was set on 3 October 2012. The transmission was from the 27 metre high Ohlyturm tower in Odenwald, Germany. The tower is 514m above sea level with a QRA location of JN49IR25DD. The record holders are Martin DL8TP and Jürgen DL8TO. The transmission was received by Nobi DF6IY and Marita DC3IT in the Black Forest, 526m above sea level, QRA JN48EU52KP - not bad for 20mW.



Martin, DL8TP, on the tower

The original tests were done from Freiolsheim with visible lasers on 780 nanometres, but there has been a lot of hysteria from pilots over visible lasers. The tests have now moved to 384 THz, which means they have to be viewed by cameras mounted on the receiving telescopes.

The tower from below

Good communications were essential to line up the lasers and these were provided by good old hand held C568's which are set for duplex mode. Nobi, who received on 2m (144.75 MHz) suffered some disruption by French stations, 70cms was little better due to QRM from a 70 cm repeater.

Fairly early on in the test, Nobi reported a "flash" on one of the monitors connected to the telescope camera. There are two cameras mounted on the telescope, both of which see through the telescope. The big question was, "is the flash our signal?" Nobi convinced me that it was - he was right! There were flashes, but no picture.

If there is no video signal at the receiver, it turns off the monitor. This information is not available at the transmitter, and at the receiving end you're clueless as to what has happened.

Nobi, DF6IY, when receiveing at Freiolzheim

Some time ago, therefore, I installed a 36 MHz crystal oscillator that could be switched to replace the FM modulated IF in the laser receiver. This switch is operated by a video detector circuit, so as to switch on the crystal oscillator in the absence of a signal. I decided that it would be helpful to also have this information at the transmitter end, so I added a video detector controlled bleeper to the transmitting side of the hand held transceiver alongside the laser receiver, and in this way 'camera is off' can be reported to the transmitting station.

However, the camera had been changed, and the crystal oscillator was being heard before the receiver's limiting circuit had operated. Preliminary discussions with Nobi revealed that he had fitted his SDR receiver with 3Hz optional filters, so that signals could be located in the noise. This stopped the video detector and made this logic redundant. The 3Hz filter produced a signal which is 40dB above the noise, so what was preventing a picture being seen?

A noise-free image in 101km

The laser signal at a distance of 100 km has a diameter of 100 metres, so it might be assumed that the receiver would not need any optimisation if it was located within this area. This turned out to be a big mistake!

The beam from the laser diode must pass through the lens of the transmitting telescope, the lens of the receiving telescope and be seen by the photo-diode, all in a direct line and not land obliquely on the receiver's lens.

It took some persuasion to convince Nobi to try and adjust the focus knob. Nobi was afraid that we would lose contact again, but this was not the case. We improved the signal up to well over 60 dB signal to noise ratio, and when we switched to image reproduction there was NOISE FREE video! What had happened?

In retrospect, it was actually quite logical. The received signal had a bandwidth of 3 Hz at 40 dB which could also be toggled to a bandwidth of 18 MHz (the bandwidth of the FM transmission).

It turned out that this gave us a reserve of 20 dB reserve. Mathematically, the transmission path could be at least triple to still achieve video contact.

The equipment on the RX side

Another problem was the occasional wind gusts that shook the tripod, and also, a flutter fading occurred, which was probably caused by strong wind air turbulence on the transmission, which all had a negative effect. A further negative factor was that the miniature connector used for the video output of the camera had been damaged, leading to a continuous switching of the two oscillators.

To conclude, I am grateful to Nobi DF6IY for his energy and his optimism. He was the real driving force behind the initial Freiolsheim contact.

Now for the record. Originally we wanted to use Melibokus, for the transmitting site, but that was only 99.6 km, not quite the magical 100 km, and it had poor car access. Ohlyturm fitted the bill, but was not open to the public, otherwise it was ideal, with a 101km path to Nobi.

Martin (DL8TP), Jürgen (DL8TO), Marita (DC3IT) and Nobi (DF6IY) after the deed was done

"Nothing ventured nothing gained!" After 5 phone calls, I made contact with the person responsible for the tower, who turned out to be very helpful. Nobi Elmar and I gained tower access to determine if a clear tree free path was possible in the required direction. The answer was "yes", so everything then had to wait for weather conditions. We now had a key to the tower, so could swing into action on the first clear day Monday October 1st message from Nobi: No clear view.

Tuesday October 2nd same.

Wednesday October 3rd morning same, but by 12.30 Nobi could see the rocky mountain! Here we go.

The reception equipment was already with Nobi after the Freiolsheim test.

The full story of the contact is reserved for a separate story, but at this point, yes, the 101km record was achieved.

German Amateur Radio Club *http://www.darc.de/index.php?id=24358*

A brain teaser

Someone has dropped a clock onto the floor and its face has broken into four pieces. When all the pieces were picked up, it was noticed that the numbers on all the separate pieces added up to the same amount.

Firstly, what was the amount? Secondly,on the above clock face, mark out how the broken pieces were shaped.

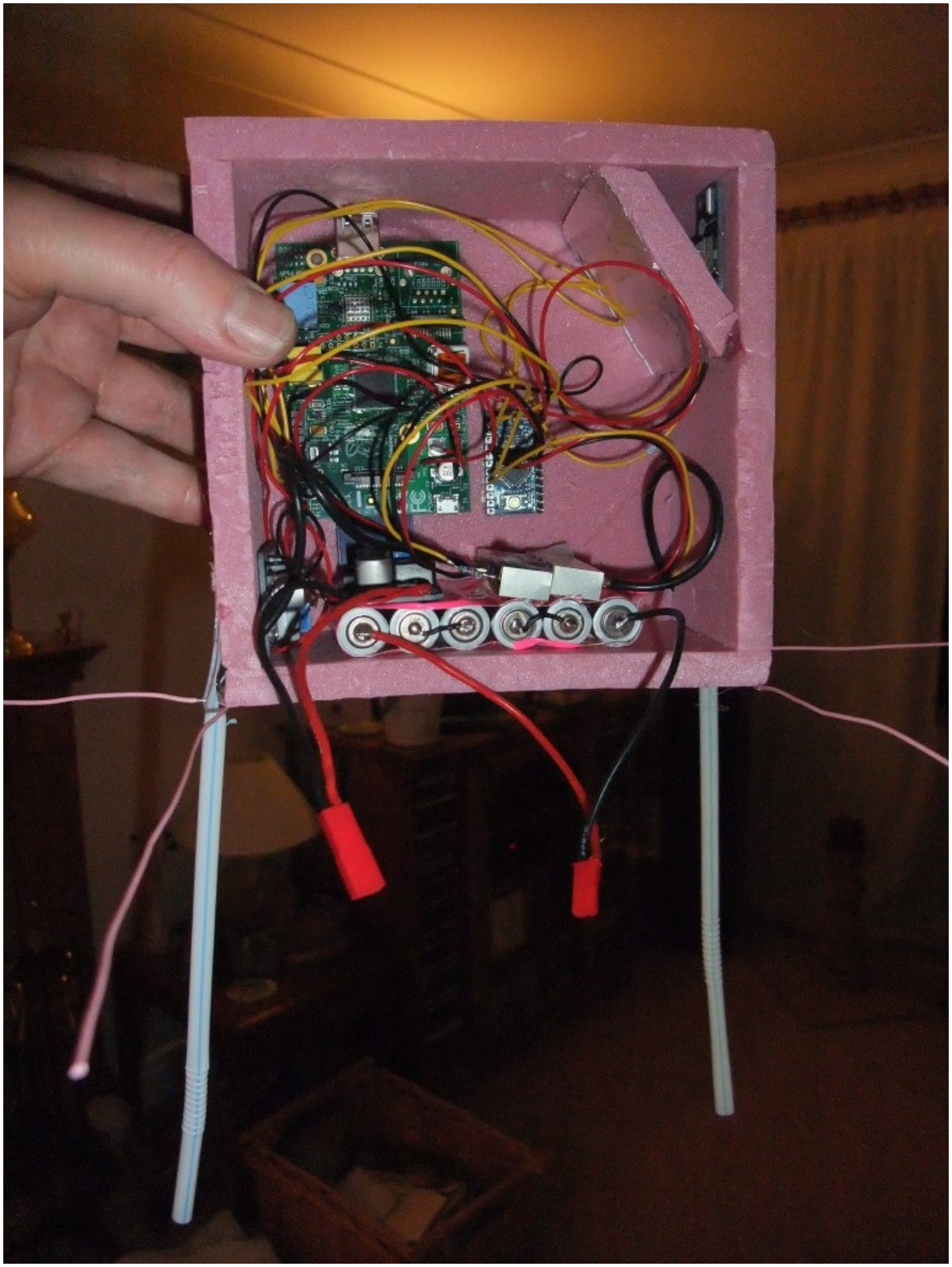
Solution in the next issue.

Watching A Big Cheese Over Switzerland

By Dave Akerman

This was my fifth "Pi In The Sky" flight and originally was to be an altitude record attempt using an *extremely light photographic payload*, however such a flight this time of year is likely to end up in the North Sea. Been There Done That don't want to do it again. Now, most flights (nearly all of them actually) follow a simple profile – go up –> burst –> come down, but there's another option which is to go for a "float" (in the air, not the sea). The simplest method of achieving a float is to under fill a large balloon, and what happens is that as the balloon approaches the stretch limit of the latex, the tiny amount of free lift reduces to zero at which point the balloon stops ascending continuously and instead just bobbles up and down. If the balloon survives until sunset then it cools and drops substantially in altitude to float at a lower level, before ascending again after sunrise. Typically the balloon then bursts but it is possible for it to float another day.

As far as I'm aware, no previous floaters have carried cameras, and my plan was to do just that with a Raspberry Pi camera using the live image transmission system (SSDV) that I've used before. I decided to take fairly large images and to send those at 300 baud which is known to work over large distances, but to use 2 radio transmitters to effectively double the bandwidth. Essentially the hardware was the same as in my *Raspberry Pi-shaped tracker* (which will fly very soon) but in a better insulated container with more batteries for the longer flight. I was expecting a flight beyond Poland and for the tracker to run for about 24 hours by which time it would be out of range of our receiver network anyway.



With a workable flight I contacted Liz and Eben Upton of the Raspberry Pi foundation to see when they were free to to launch with me – something all of us have wanted to do for some time. Saturday was that day, and with predictions from my home looking a bit risky (a fly-past of some minor provincial airfields called Luton and Stansted) I asked Steve Randall if it would be OK to use his site in Cambridgeshire (convenient for the RPi guys of course!). He said yes, and Anthony Stirk was available to come and launch his AVA payload, so the plan had come together. I love it when that happens …

The weekend approached quickly and I didn't get time to make the tracker till the Thursday, and then built the payload container on the Friday evening. No rush then! I even managed to find time to program in a late Easter Egg (more on that later). Liz publicised the launch on the *RPi site* and Lester Haines did the same on *The Register*. I didn't get much sleep on Friday night, having to get up in time to finish packing the 4×4 and then leave for Cambs at 7am. We needed to get there in time to launch in the morning as the winds were going to get up in the afternoon.

We arrived first, a few minutes early to find the wind rather stronger than expected. Anthony was next and we waited for Steve to arrive as he's launched there many many times before and knows the best spots to launch according to the wind direction. Here he is using his patent-pending wind-direction-finding technique:

Eben and Liz were next, then Tom from Bloomberg who was recording the event for a news item, Graham (another balloonist) and James (Pi Camera Coder).

With the video streaming and tracking stations set up, we put our payloads together. Here Eben's holding PIE5 for me whilst Anthony works on his AVA payload at the front:

With payloads working and tied to the parachutes, it was time to get inflating those balloons. You'd have thought that a hydrogen cylinder would be lightweight what with all that hydrogen in it, but apparently not …

Now, a normal flight (one intended to burst) has a "neck lift" in the range 1-5kg, typically about 2kg, and those are usually easy to measure by hanging a suitable weight from the balloon filler. here though we wanted a neck lift of around 300g, which becomes a problem when your filler weighs nearly twice that! So we had to use the scientific method known as "guessing", followed up by removing the balloon and hanging a weight (2 reels of duct tape!) below. Here Anthony is helping me at a delicate part of the procedure:

We filled Anthony’s balloon first, and then asked Eben to hold it whilst we worked on my balloon:

Once my balloon was ready and both payloads tied to their respective balloons, I handed my balloon to Liz and we got the two of them to pose for us:

After checking that both payloads were still running fine, we were ready to launch. Steve called Air Traffic Control for clearance, and they said we had 5 minutes to launch in or wait a short while. We were ready, and after waiting a minute for the wind to drop we both launched:

Whilst my flight ascended at the expected rate, Anthony's didn't. See *his exciting write-up* for details, but suffice to say that it **just** cleared a tree 500 metres from the launch point!

With that over I did a piece to camera:

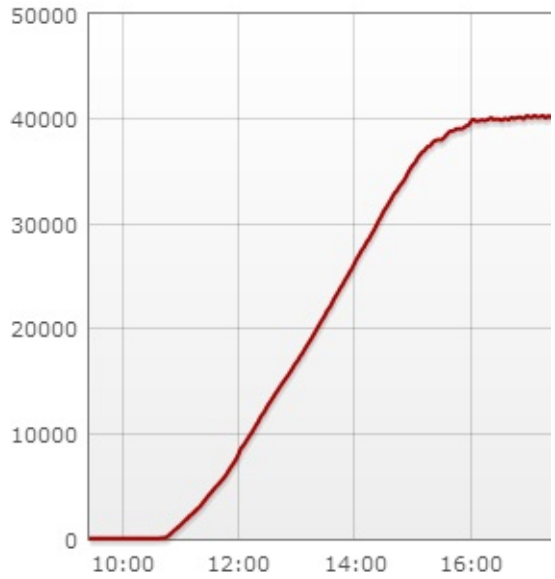
and Eben did a piece too. We all then packed up, and Anthony, Liz, Eben, Julie and myself made our way to Milton Keynes (why, you may ask?) to an excellent Dim Sum restaurant that Liz and Eben recommended (there's your answer) and is probably the only reason to visit that place.

In between the many, many rounds of dishes we talked ballooning and Raspberrying, and kept tabs on progress of our flights. PIE4 was out over the North Sea transmitting some nice images as it went.

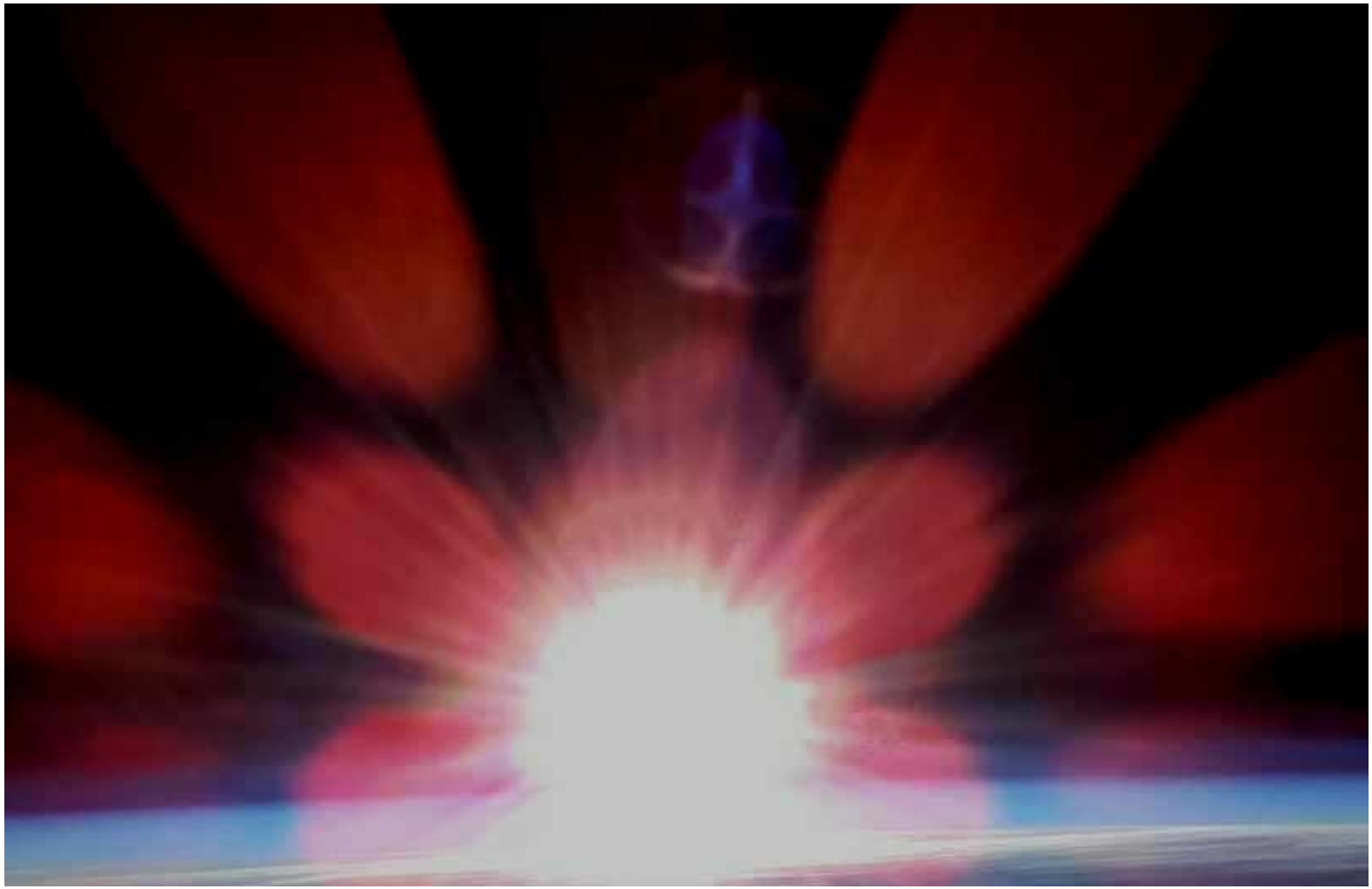
We then noticed that AVA had stopped transmitting and that uXABEN (Steve's flight) had lost GPS. That was running a pre-preduction unit and a failure wasn't a big surprise, but we were disappointed that AVA had hit

trouble so early. After the meal we all set off to our respective homes, and during a short stop for fuel Julie and I noticed that AVA had updated on the map again and was near the Dutch coast. AVA carried 2 radio transmitters one of which is not allowed over the UK and was programmed to switch itself on only when legal to do so. We called Anthony with the good news, then went home.

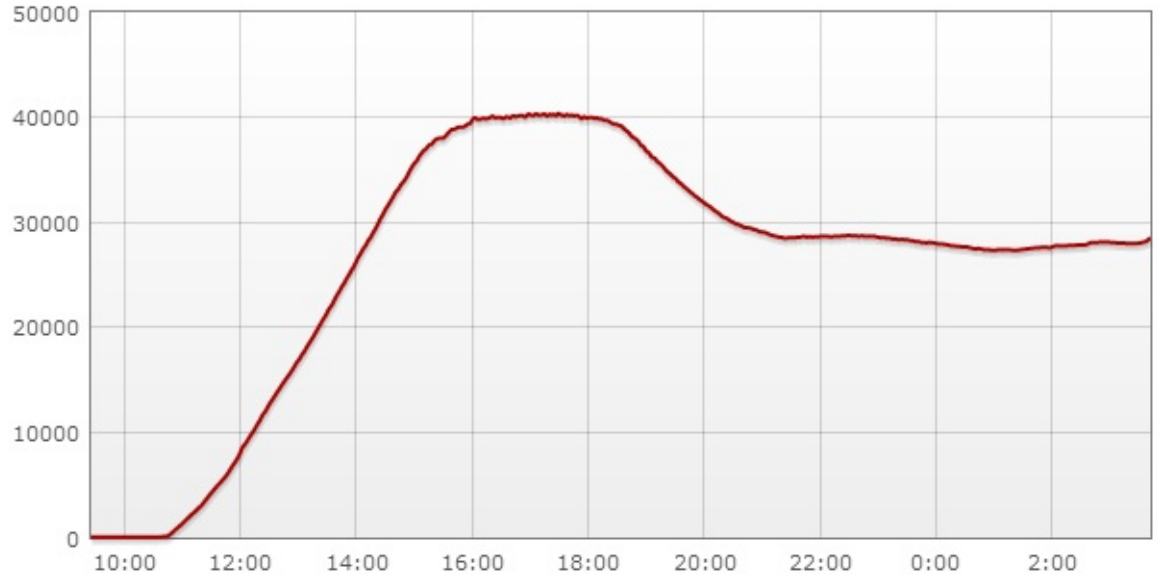
At home I spent pretty much all the rest of the day watching the progress of both flights. PIE5 settled into a float at around 40km, gently going up and down with a peak altitude of 40,350 metres, comfortably above my previous "live images" record of just under 40km!



The images weren't all as good as I'd hoped, principally because I'd used auto exposure and that faces an enormous challenge to find the correct settings with the vast difference in luminance between the clouds and the blackness of space. The flight was over a lot of cloud which makes that task almost almost impossible, and I've seen many poor images before with other cameras in this situation. It would have been better if I'd used manual settings, which I will do next time! Also, the flight seemed unusually stable (normally the payload swings around a lot) resulting in a lot of images with a lot of black and a little cloud. So in the even it would have been better to have the camera aimed downwards slightly. Nevertheless there were some interesting images including these apparently of a gigantic raspberry!

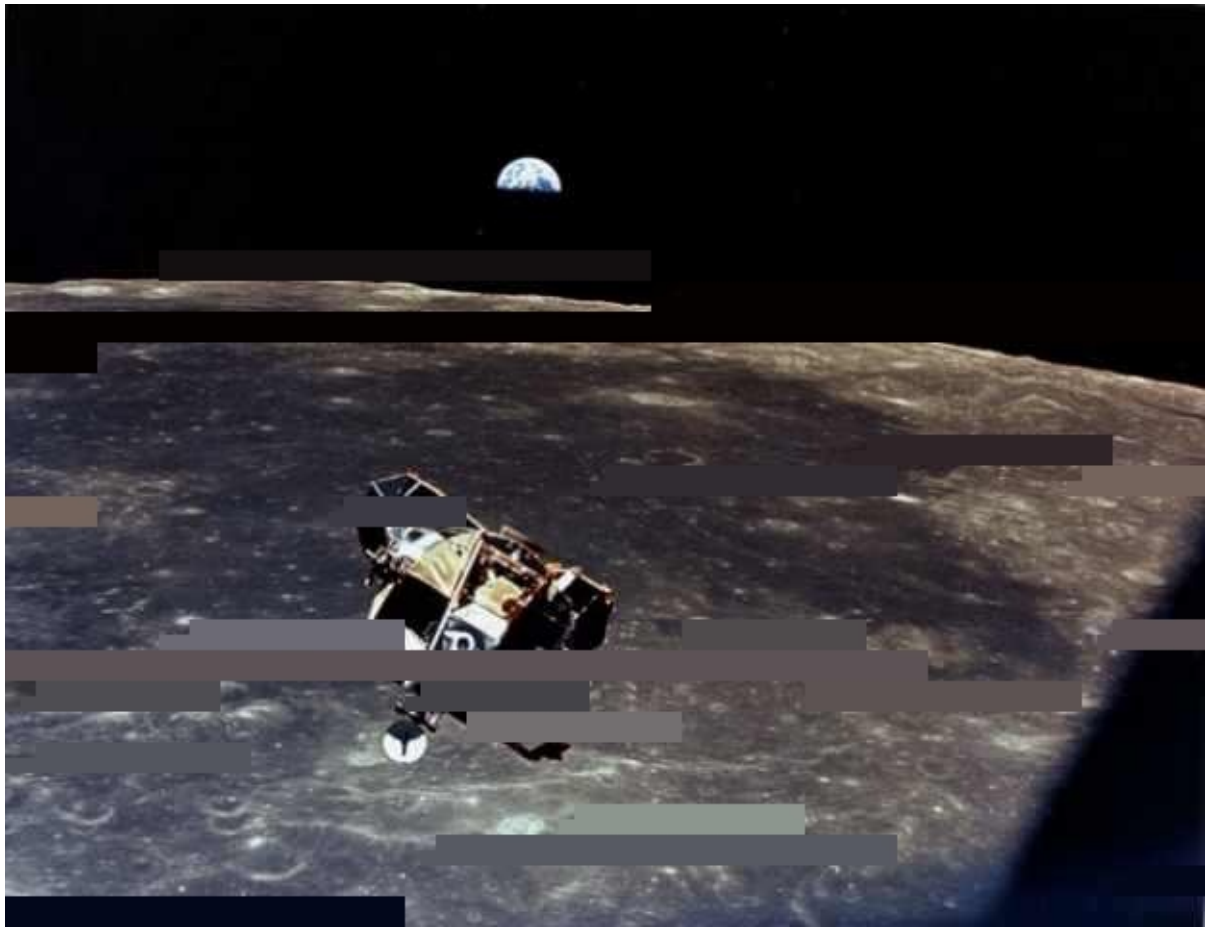


By now AVA had apparently died altogether, with neither RTTY or APRS transmitters running. After sunset my balloon descended as I'd hoped, achieving an excellent second float:

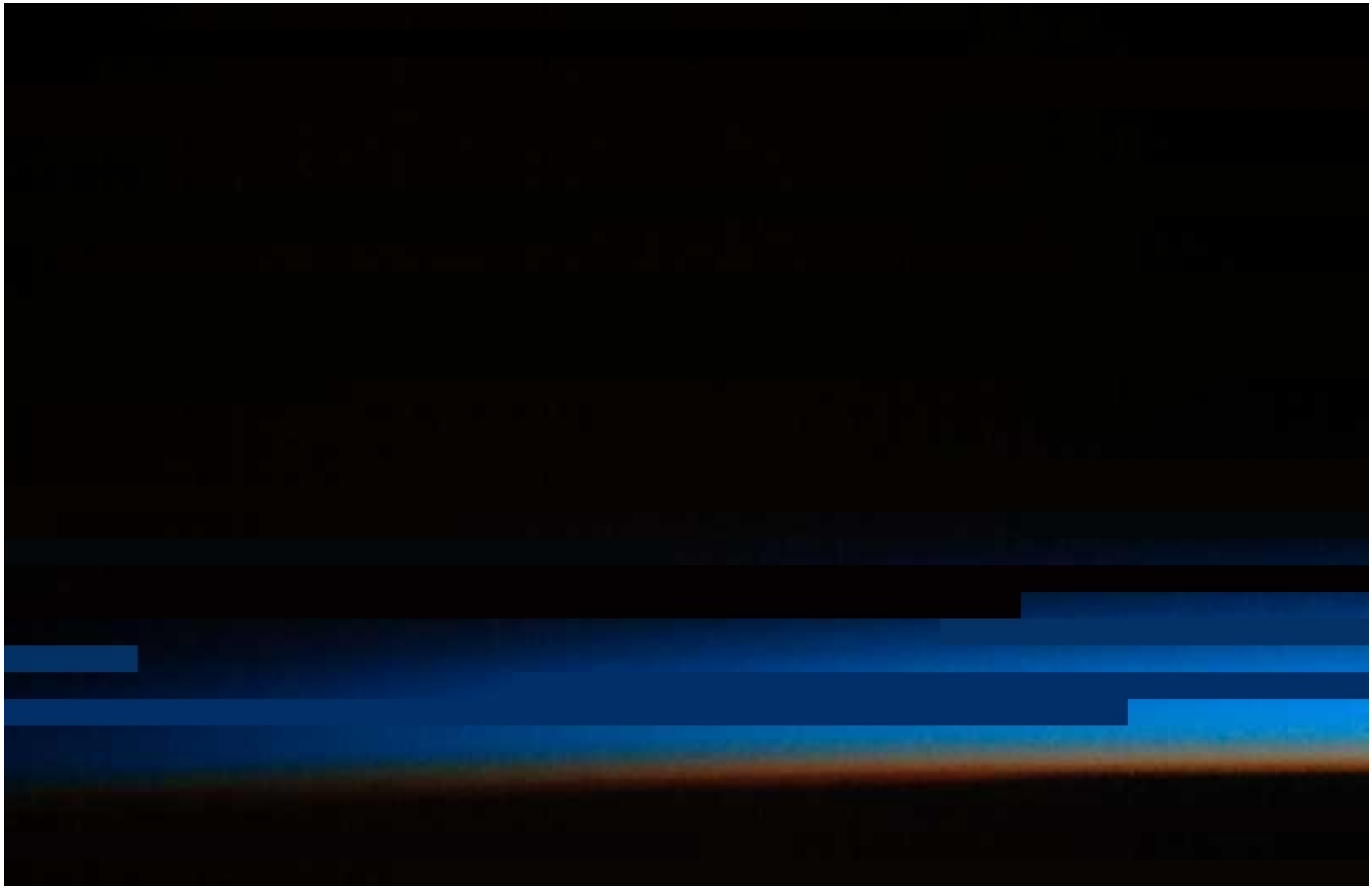


After that I waited eagerly for 9pm to arrive. Why? Because knowing that the sky would be completely black by then, I'd copied some specially chosen space-related images to the SD card the night before, and programmed the Pi to select and transmit images from the set. Needless to say this caused some confusion, consternation and amusement, as intended of course!


UNDERBIRD 5



The missing segments are down to the fact that by now the flight was a long way from home and we only had a couple of listeners in range. I'd expected the flight to go towards Poland, but it had floated so high that the winds brought it south over Switzerland instead! When I awoke in the morning the last listener reported that PIE5 had finally stopped transmitting data, and that would have been because the batteries had given up. Here's the last image it managed to transmit:

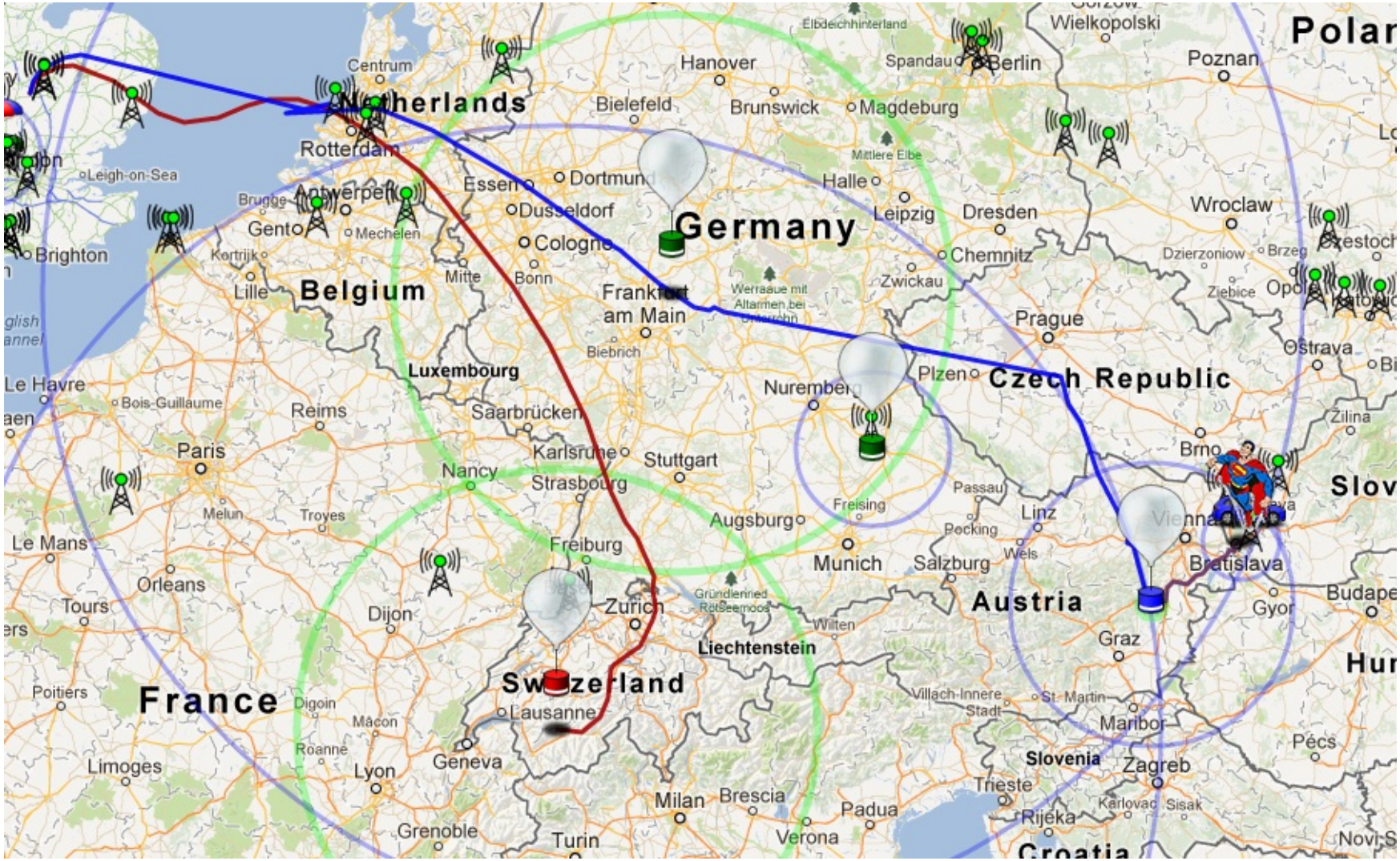


By now it was still over Switzerland and beginning to rise in the sun. Most likely it then burst, with a landing across the border in France. It does have contact details on it so it’s possible though unlikely it’ll find its way home!


LAUNCH-O-GEDDON WEEKEND
Saturday 13/04/2013
Cambridge, UK 1000 UTC
Live Stream from Launch / SSDV Images
AVA 434.450Mhz 7N2 50 baud
PI Dual TX 434.068/434.074Mhz 8N2 300 baud
XABEN 434.350 7N1 50 baud
Regensburg, Germany 0730 UTC
PYSY 434.650Mhz 7N2 50 baud
Come chat to us: #highaltitude on irc.freenode.net
Liestal
Baden
District 11
Zurich
Aarau
Olten
Wohlen
Küsnacht
Zofingen
Horgen
Wynau
Langenthal
Solothurn
Zug
Willisau
Einsiedeln
Emmenbrücke
Immensee
Arth
Lucerne
Schwyz
Burgdorf
Lützelflüh-Goldbach
Neuchatel
Sugiez
Murten
Berne
Worb
Thörishaus
Münsingen
Stans
Sarnen
Altdorf
Fleurier
Grandson
Payerne
Fribourg
Schwarzenburg
Yverdon-les-Bains
Lungern
Titlis
Brienz
Thun
Meiringen
Romont
Spiez
Interlaken
Bulle
Diemtigen
Grindelwald
Andermatt
Frutigen
Eiger
Crissier
Lausanne
Châtel-Saint-Denis
Vanil Noir
Zweisimmen
Finsteraarhorn
Obergoms
Airolo
Quinto
Jungfrau
Saanen
Adelboden
Montreux
Le Bouveret
Wildstrubel
Fiesch
Parco dell'Alpe Veglia e dell'Alpe Devero
Aigle
Diablerets
Sommet des Diablerets
Sierre
Leuk
Visp
Brig
Monthey
Lens
Sion
Morzine
Nendaz
St Niklaus
Saxon
Dents du Midi
Haute Cime
Martigny
Verbier
Samoëns
Dom
Domodossola
Villadossola
Lake Neuchâtel
Lake Sempach
Lake Brienz
Lake Geneva

Of course, if you do find the payload or know of its whereabouts, please contact me (details in the *About* page!

With PIE5 "lost in space", attention turned to AVA which wasn't as doomed as it had seemed. It suddenly appeared on the map over the Czech Republic, and was then tracked down into Austria where it burst and landed atop a 1500m high hill! Here's the map showing the paths of both balloons – note how different they are despite both being launched from the same place at the same time!



We all assumed that was that, but we weren't banking on International Rescue arriving in Austria in the form of a Slovak balloonist called Radim and his intrepid team. After driving from Bratislava they hiked up the snow-covered hill to rescue AVA! See *Anthony's account*.

So, an awesome ballooning weekend, with records broken (highest live images, highest landing spot) and the most incredible recovery I've seen. Now we just need PIE5 to be found!

For more photos see my flickr set

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Caption contest

Just for fun….

Last issues picture is shown below.

“Nothing good ever came out of a cloud, but a cellar now you are talking” - Trevor Brown

“Controlled rate Streaming on IPA port” - Mike G8CPF….Hic!

“This stuff will etch pcb’s” - G8KZN, Wesley Clinton

“I could never get a decent head, using those southern ISP’s, then I found Plusnet” - Trevor

“I had to flash it with a new BIOS……. Beer Installed Operating System and add the universal sparkler port on the front otherwise no problem” - Brian

“This device would revolutionise the workplace.” - Matt Shaw ·

“Brilliant…. I want one!” - Simon

And the winner is ….. G8KZN, congratulations.

This issues picture is shown below.

Please send your entries to *caption@cq-datv.mobi*

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Next issue…

- *Alan Critchley's homemade 23 cms Yagi array*

- *Trevor looks at digital mixing on a multi camera shoot*
- *Using the Black Magic ATEM and a free software equivalent*

- *and much more…*

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