In this issue

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

Production Team

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

Contributing Authors

Jim, KH6HTV, Pete, WB2DVS, Bill, AB0MY & Don, N0YE
Trevor Brown G8CJS
Ken Goldstein KD5HEH
Steve Marshall M0SKM
Paul Marshall PhD G8MJW
Dave Pelaez AH2AR
Mike Stevens G7GTN

Editorial

Welcome to issue 88 of our electronic ATV magazine.

In a previous issue we presented a 5.8GHz transverter developed by Jim, KH6HTV. Now we have Don N0YE providing details on how he designed and built his home-brew digital TV transverter for the 5cm band. Don has taken a totally different approach. The key components came from his microwave junk box (a coaxial cross-over relay).

For anyone using the Ryde Software there is now a minor revision that introduces a hardware shutdown facility. This is primarily for repeater installations. While on the subject of repeaters, Clive G3GJA has found a problem with the BATC I2C testcard and compatibility with the DTX1 transmitter. Thanks Clive.

I think Trevor had a hand in the design of that I2C testcard, but it was back in the 80's when Teletext chips were an inexpensive solution to many ATV testcards and patterns. I suspect there are still ATVers using them today, anyone tried them with the DTX1?

Speaking of Trevor, yes we have another edition of the GVG panel and how to implement the T-bar which is part of GVG 16 software and also the start of how to add control of a remote Pan and Tilt head by extending out the I2C bus to a PCA 9685.

I2C, now where have we heard that before ops, sorry Clive I think you are safe, its only being used as a control bus, if you find a bug in 40 years time be sure to let Trevor know.

We have reported previously of the use of 2watt power amplifiers from China for the 5.8GHz band for FM ATV and DVB-T.

There have been problems with at least one or more of these amplifiers burning out. Now Jim, KH6HTV, Pete, WB2DVS, Bill, AB0MY & Don, N0YE have jointly carried our autopsies on several of these deceased amplifiers and the verdict is in.

There are many ways to provide portability for DVB-T receive capability when the need arises at remote sites or during Field Day Operations. This solution is brought to you by Dave Pelaez, AH2AR.

Steve Marshall M0SKM has taken the brave step of scraping his power hungry Spectrian 23cms power amplifier and re-using the XRF 286S transistors in a new design. This is not for the faint hearted but Steve had a little help from his friends, well one in particular that milled him some 6mm copper.

"Houston, we have a problem" is a popular but erroneous quotation from the radio communications between the Apollo 13 astronaut John ("Jack") Swigert and the NASA Mission Control Centre ("Houston") during the Apollo 13 spaceflight. Not Houston but New Mexico Ken Goldstein, KD5HEH is engineering an ATV transmitter to be carried aboard a high altitude amateur rocket. The heart of the ATV package is an MFJ-8709 analog ATV transmitter with a power of 4 watts. Ken is in New Mexico, fingers crossed for you Ken and a successful launch. We don't have a launch date yet, but please keep CQ-DATV in the loop and we can start a countdown on our Facebook site.

On Sunday, September 13th, Jim, KH6HTV, Larry, K0PYX, Don, N0YE, Pete, WB2DVS & Debbie, WB2DVT headed out onto the Colorado prairies with their 5.7 GHz, BBQ grill dish antennas and transverters to see what ATV records they could set. P5/Q5 signal reports from over a distance of 50.9 km (31.6 miles) were possible and we suspect there are some longer paths being planned.

We hear a lot about the history of broadcast TV cameras, sometimes VT and even telecine from time to time. But what of some of the less headline grabbing parts of the chain? An example of this unrecorded broadcast TV history is the video mixer – a vital but often unnoticed piece of production hardware. Paul Marshall takes us back to see how the techniques developed in the 1950s giving us the classic A/B mix and fade format.

BECG's (ed Broadcast Engineering Equipment Group see CQ-DATV 85) 1950s Project Vivat vision mixer is now restored and working and its features help reveal the origins of familiar terms and operating practice.

One from the Vault looks back at CQ-DATV issue 2 and John G3RFL's frequency counter for 10GHz. This uses a PIC 16C84 and the software is one of the top downloads from the CQ-DATV site. The project has a simple home etched PCB that does really aid in the construction.

An action packed edition of CQ-DATV, with we hope, something for everyone - download, sit back and enjoy!

CQ-DATV is always looking for copy. If you have something you would like to share with our readers then now might be the time to email the *editor@cq-datv.mobi*.

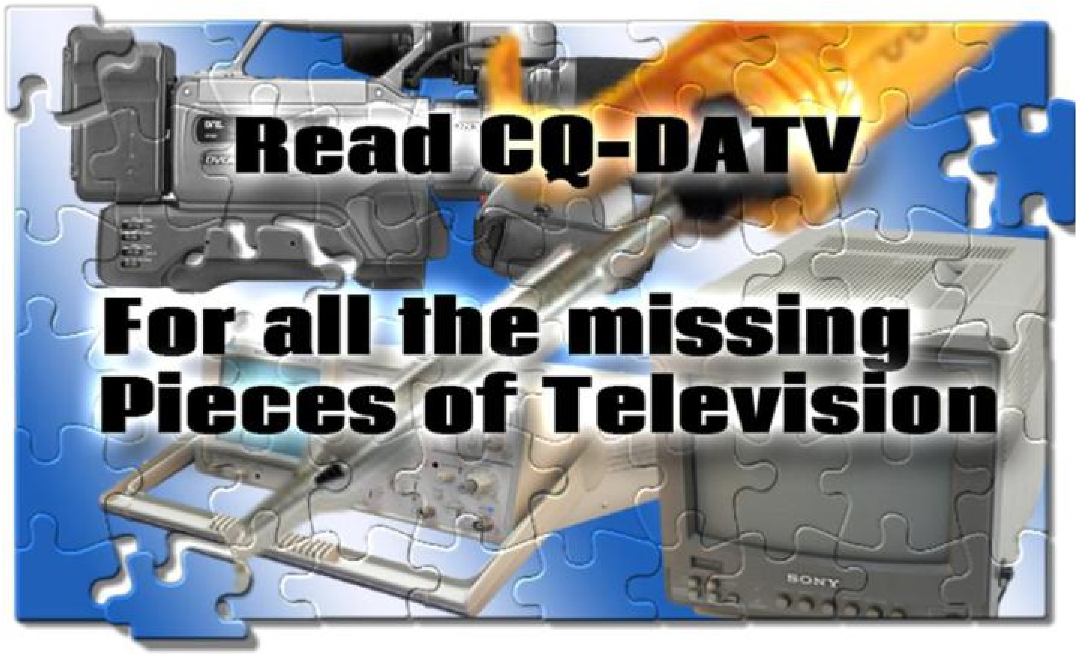
If you enjoy reading our magazine then why not join the CQ-DATV Facebook.

CQ-DATV Production team

Please note: articles in this magazine are provided with absolutely no warranty whatsoever; neither the contributors nor CQ-DATV accept any responsibility or liability for loss or damage resulting from readers choosing to apply this content to theirs or others computers and equipment.

"No Shakespeare plays yet, but we have gotten some pretty good blog posts."

Courtesy of Breakthrough Visuals



GB3EY off - nearly ready for full repeat mode

GB3EY's beacon mode is off air because the DTX1 DVB-S modulator it was using is needed for integration into the digital GB3EY repeater hardware.

This has shown up an issue on the repeater logic based on the BATC I2C project. This is the original analogue/FM repeater logic used by GB3EY that has been substantially modified to make it work in a digital system. It was found that the DTX1 was only producing a blue screen when fed from video derived from the logic. Any through video was repeated normally.

Eventually, this was traced to the sync pulse train coming from the I2C's VDU that is not interlaced, despite assumptions and assurances that it was interlaced. As the knowledge and facilities do not exist to modify the software in the EPROM that would possibly allow an interlaced output, it was decided to explore a hardware solution.

A separate SPG, built from the £1 goody bags from the last CAT containing 2 x ZNA134 and a 2.5625MHz crystal, has been built that produces broadcast standard syncs. That is then fed to the PAL coder, an AD724. The syncs are also fed to the video input of the VDU used for genlocking and the SAA5231 teletext data slicer chip fitted that does the genlock function.

Surprisingly, it works; the video from the PAL coder is excellent despite interlaced syncs being used with non-interlaced RGB video but it is good enough to fix the blue screen problem on the DTX1.

Without this problem the repeater would have been on for the second anniversary of its NoV being issued, which is what we were working to achieve but weather permitting it should be on by the end of the month.

Clive G3GJA
Source: *https://tinyurl.com/yxgpjraf*

Update for Known DATV DX Records

The PDF records sheet on the BATC wiki has been updated with six new DX records of note for DATV.
See *https://tinyurl.com/y449vlml* or the pdf file *https://tinyurl.com/y5nhmgm7*

- *27 GHz RB-DATV QSO of G8GTZ and G4LDR on 2019-01-28 35.6 KM*
- *10 GHz RB-DATV QSO of F1MPE and HB9AFO on 2019-09-14 258 KM*
- *10 GHz DATV QSO of JA0RUZ and JA0DAE on 2012-07-28 463 KM*
- *5.7 GHz DATV QSO of JA0RUZ and JA0DAE on 2012-07-28 463 KM*
- *144.600 MHz (experimental) PI4D to G4YTV 2020-08-22 403 KM*
- *145.300 MHz (experimental) PA0JCA to G4YTV 2020-08-22 380 KM*

Please send me an e-mail if you know of a DATV QSO that should be added to this list (via *W6HHC@ARRL.net*)

73...de Ken W6HHC

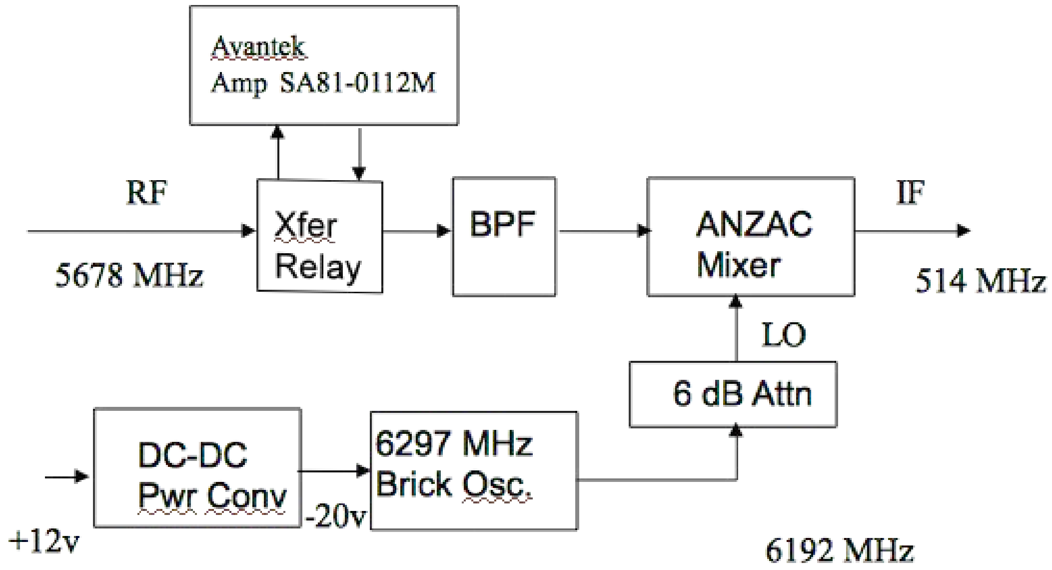
N0YE - 5.7 GHz TRANSVERTER

In a previous newsletter, issue #54, we presented a 5.8GHz transverter developed by Jim, KH6HTV. So Don has provided us with some details on how he designed and built his home-

brew, digital TV transverter for the 5cm band. Don has taken a totally different approach. Key was having in his microwave junk box a coaxial cross-over relay. This allowed him the freedom to use all of the major components for both receive and transmit modes. As seen in the block diagrams, the only difference is the direction of the signal flows.

The local oscillator (LO) is a Frequency West brick operating on 6.297 GHz and outputting +13dBm of rf power. The RF frequency is 5.678 GHz and the IF frequency is 514 MHz. The mixer is an Anzac model MDC-171 which requires +7dBm of LO drive power. It is rated for RF/LO (4-18 GHz) and IF (DC-4GHz). The mixer has 6dB conversion loss. The amplifier is an Avantek model SA81-0112M. It is a C band amplifier with 29dB gain. The band-pass filter is an unknown commercial filter with a pass-band from 5.15 to 5.85 GHz and -2dB of insertion loss.

So how well does it perform? Don set it up with sufficient IF drive power to maximize the rf output with the out of channel, spectrum shoulder break-points set at -30dB.



N0YE 5.7 GHz Transverter -- Receive Mode Block Diagram

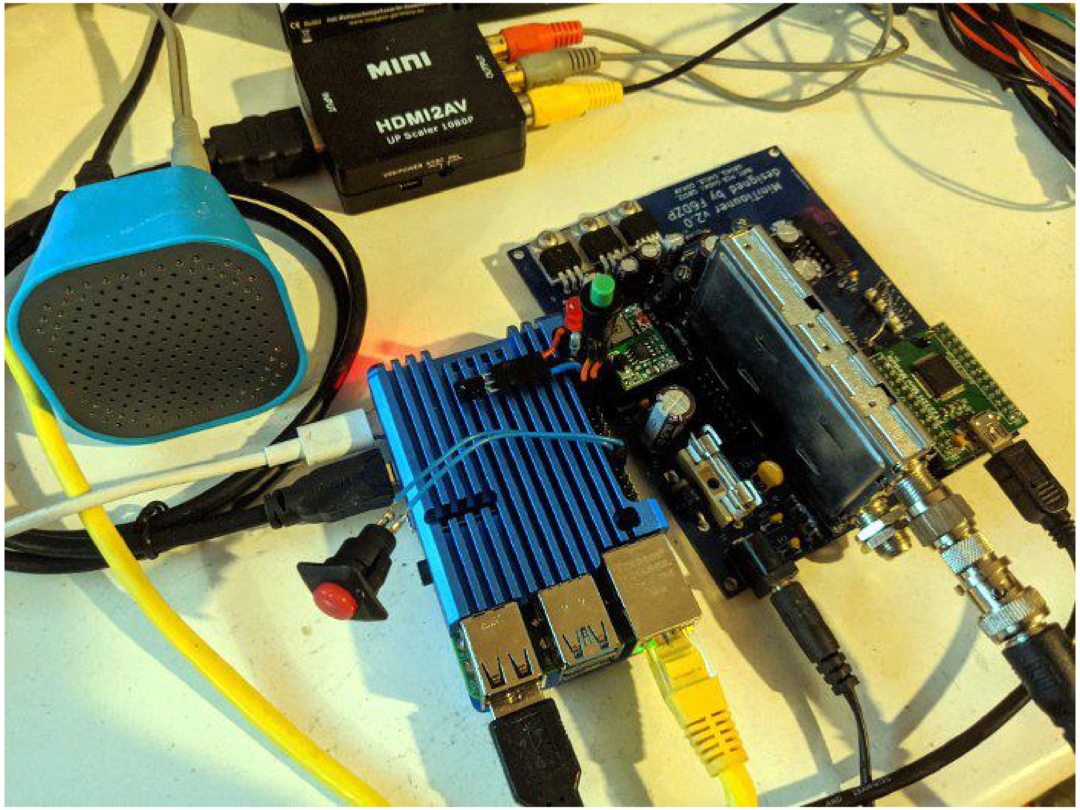
The required IF drive at 514 MHz was thus -4dBm rms from his Hi-Des HV-100EH modulator. The resultant RF output power was +17dBm rms (50mW). The gain of the transverter is 21dB for both transmit and receive. The noise figure of the Avantek amplifier is 5.9dB. It obviously works, as Jim, KH6HTV, and Don exchanged DVB-T QSO contacts on August 18th over a 5 mile rf path with Don set up at NCAR. See the previous newsletter, issue # 54, p. 9. Both Jim & Don received P5 pictures with perfect 23dB S/N.

Source: *https://www.kh6htv.com*

Minor Ryde Software Update 202009160

Wednesday September 16th

I have just published a minor revision to the Ryde software that introduces a hardware shutdown facility, primarily for use in repeater installations.



To use this facility, a pull-up resistor (1k to 3v3) should be fitted to GPIO pin 26.

Shutdown is initiated by grounding pin 26 continuously for over one second. The facility is disabled by default; to enable it, go to the console menu and select Settings, Hardware Shutdown, and press the space bar to mark "SHUTDOWN".

PLEASE NOTE THAT INSTALLATION OF THIS FACILITY REQUIRES A NEW CARD BUILD - IT IS NOT AVAILABLE AS AN UPDATE.

On the same settings menu, I have added the ability to display the on-screen debug menu and to select the response to the Power button.

Lastly, I have added another remote control to the Library, from the Opticum HD AX150 Satellite Receiver.

Thanks to Shaun G8VPG for asking for the hardware shutdown and to Thomas DL5BCA for the remote control information.

Please report any bugs here

Dave, G8GKQ
Source: *https://tinyurl.com/y3cjumpp*

Grass Valley Mixer Conversions - Part 21

Written by Trevor Brown G8CJS and Mike Stevens G7GTN

I reported in last month's CQ-DATV that the T-bar is now working and it just needs its code completing and putting into the GVG 16 release of the software. I have now added it and implemented it as a constantly active device. Just pull the T-bar - no button pushes required to select it.

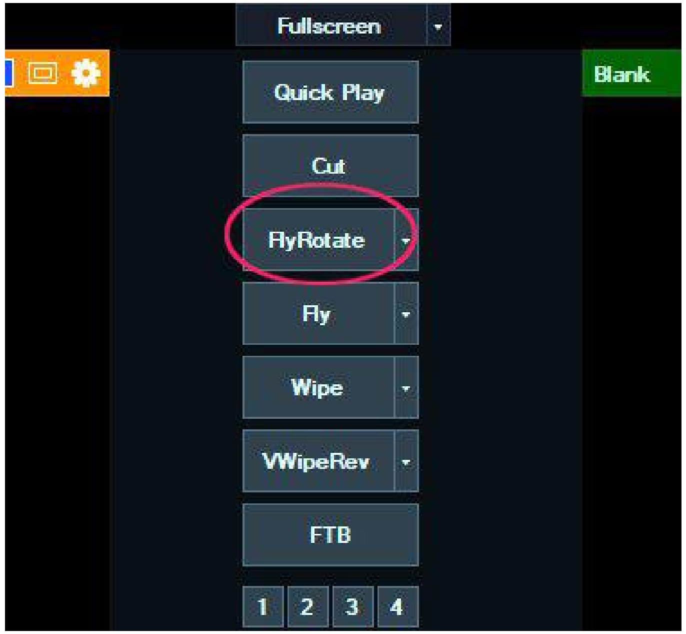
This is achieved by parsing the call in the button scan loop and if the analogue value produced by the T-bar falls below 253 or rises above 3 it becomes active. The arrow lights indicate that it is active and everything else is inhibited until it is parked at the top or the bottom positions at which point the arrow lights go out.

```
if (tbarpos  <253) and (tbarpos  >3) then gosub fader 'check
if T-bar is active
```

The code that goes in the button pole loop to indicate the T-Bar is active. tbarpos is a variable where the analogue read routine stores the value fader:

```
let ww = tbarpos    'Stop pst PGM swap on incomplet T-Bar
moves
let s=s+192         'set arrow lights to on
gosub latches       'refresh lights latches
do
gosub analog1        'read t-bar position
  i2c.begin MIDI    'address of Arduino
  i2c.write 76      'next byte analogue data
  i2c.write tbarpos 'analogue position of T-Bar
  i2c.end
if tbarpos = 255 and ww  <  240 then gosub cutt  'swap PST
PGM fader up
if tbarpos =0  and ww  >  20  then gosub cutt   'swap PST
PGM fader down
gosub latches                        'update the GVG lamp latches
if tbarpos =255 then let s=s-192    'Arrow Ligts off
if tbarpos =0    then  let s=s-192  'Arrow lights off
gosub latches                        'refresh lamp latches
if tbarpos =255 then return          'effect complete
if tbarpos =0 then    return         'effect complete
loop
return
```

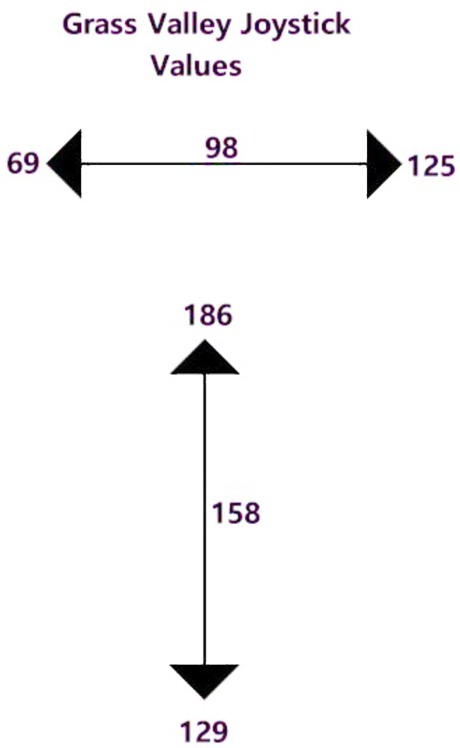
The transition effect it produces is preset by the top effects button on the Vmix screen and not by the wipe effects buttons, they control the auto trans function only. This arrangement works well but it was not by choice! I can only deliver MIDI commands to Vmix, after that the logic it follows is beyond my control.



The T-Bar will always perform the function set by this button on the Vmix screen

One of the problems with the T-bar that was not a problem with the Auto-Trans is that you can pause the T-Bar and return it to the start position so the original starting picture is still on the PGM screen. This is not possible with the Auto Trans mode and requires the extra code to detect this effect and inhibit the PGM and PST banks from switching as their contents remain unchanged. This switching function is reserved for the T-bar being moved from one end to the other, a little more head scratching in the coding and this has also been implemented.

Moving on, let us tick the T-bar as done and look at the Joystick. Reading the analogue values produced by the Joystick, we come up with Horizontal detent 98, full left 69 and full right 125. Vertical detent 158, full up 186 and full down 129. These values can be read by the I2 C bus.



The joystick is spring loaded to detent position, so if we go for operating a remote pan and tilt head a position proportional servo control will not be possible. Remember this was not the original function of the Joystick, it was to centre up or offset wipe effects.

There are Joystick functions in Vmix, but they are not accessible in the free version of the software, so I thought let's explore connecting it to a remote camera pan and tilt head without using Vmix and if possible use I2 C bus along with everything else in our rejuvenated GVG panel.

The mechanical design of the Joystick can be adapted to a speed control servo, e.g. the camera moves when you move the Joystick and the further you pull it the faster it moves, let go of the stick and it returns to detent and the camera stops moving. This is a speed positional servo and is different to the joystick parking the camera when it reaches a pre-set position where the Joystick remains until a different position is required i.e. a positional servo.

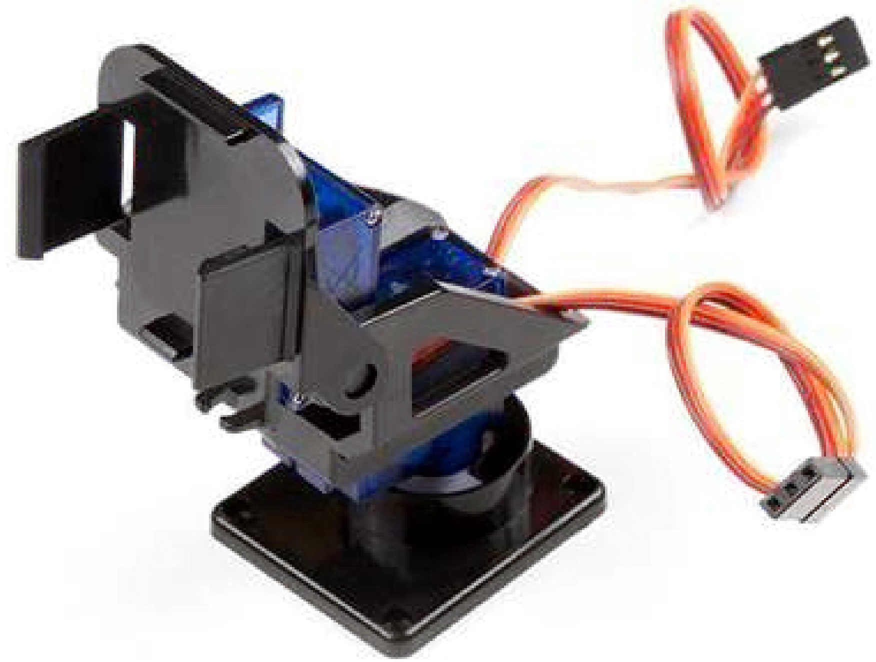
I did investigate the Pelco D protocol as used by the CCTV industry. This is very smart and requires several bytes of data sent via RS 485 and involves generating CRC (Cyclic Redundancy Checksums). I thought let's go with something more fun and less expensive.

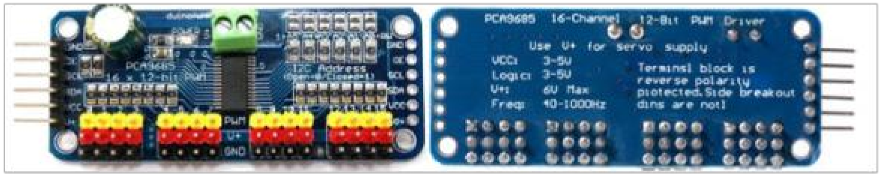
The internet is full of home-made pan and tilt heads and not all of them require metalworking skills. This one was my favourite; the author not only puts my woodworking skills to shame but goes on to design a PCB and explain the software *https://tinyurl.com/y4adkgc5*

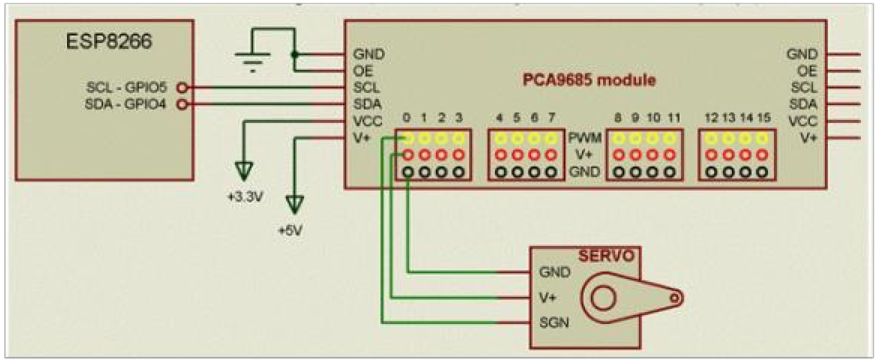
Its down to horses for courses but that is the sort of camera size I had in mind. There are also some inexpensive small ready built designs that would move a small webcam around. *https://tinyurl.com/y4pxv686*

The least expensive again for a small webcam is this, given CQ-DATV's mean budgets lets go with it and see where it takes us. If it performs, we can investigate beefing up the servos to something more substantial, perhaps not quite the size of the BECG (Broadcast Engineering Conservation Group) kit, something approaching a hundred weight under I2C control might be a tad too far. *https://tinyurl.com/y5awvb2l*

The fallback position for any new device is the Annex BASIC help file and it has BASIC commands for servo operations written around PCA 9685 pre-existing hardware.







For £8 this is an easy-to-assemble pan/tilt kit that utilises servos to move on two axes for camera applications

The hardware is inexpensive £8 for the pan and tilt head and £3 for the servo board and responds to I2C commands

This hardware can be found on e-bay and should allow the joystick to be interfaced to the small pan and tilt head via the I2 C bus of our GVG panel. The system operates on PWM (Pulse Width Modulation) The Annex BASIC commands are

```
PCA9685.SETUP address [,freq]
PCA9685.SETFREQ freq
PCA9685.PWM pin, value
```

The frequency needs setting at 50Hz for a servo, the faster speeds are reserved for light displays; lovely idea but let us stay with pan and tilt heads.

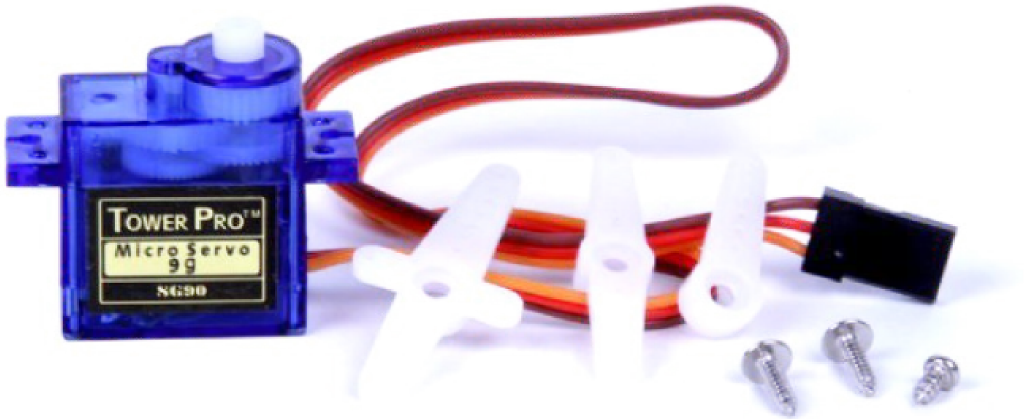
I have placed an order for the hardware, at the time of going to press the pan and tilt head kit has arrived and is now assembled, but I am still waiting for the PCA 9685 module.

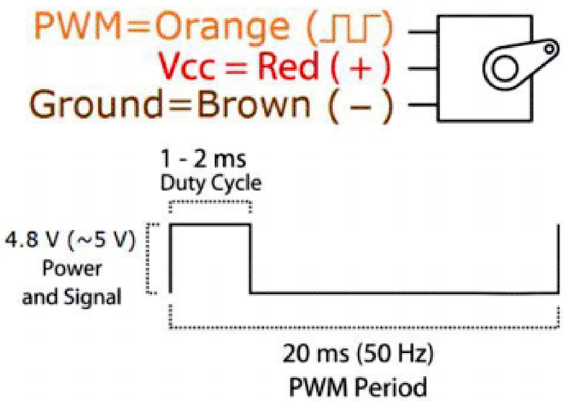
For those of you that remember the film Short Circuit I think it has a number five look

The kit construction went together ok although some adaptation was needed with the base that does not work with either a Go-pro or tripod mount. I fell back on a scuba weight and some rubber bungees to secure it; everybody has the odd scuba weight in the bottom of a cupboard don't they! or perhaps just me then.

The SG90 servo's are small, but larger servos do exist and I may leave others to the scaling up. It's down to your camera preference. If it involves a turret lens change you may be on your own. My desk webcam was a simple adaptation with a couple of cable ties.

The next stage is the SG90 servo motor control which is a three-wire interface, power, and a mark space ratio control.





I will let you know how I get on in the next issue. I will delay the GVG 16 software release until I have this working or I have given it up! I have written the Joystick reader routine and like the T-bar, it is live by a polling routine in the button scan part of the programme. The ESP 8266 is not complaining and the buttons all still appear to be operating in real time so with the famous last words of "this all looks possible" watch this space.

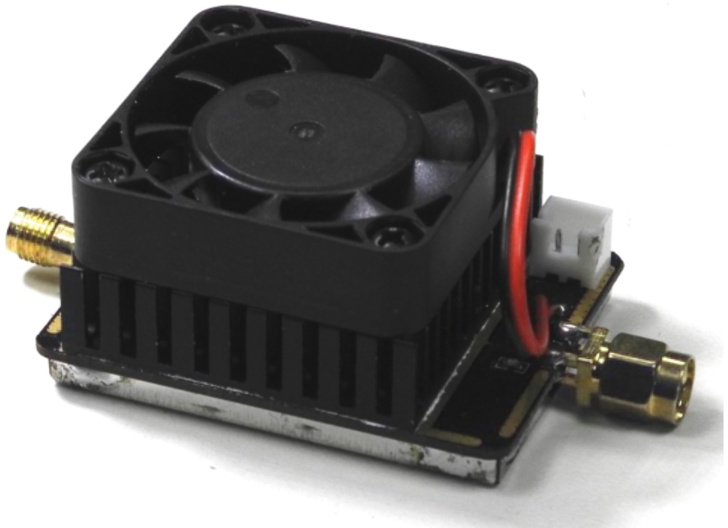
The MK 2 PCBs test batch of the GVG interface boards have not yet arrived at Mike's desk at the time of writing, so using the time to develop this pan and tilt head seems a good idea and if the I2 C control proves a success the PCB will not need any changes for the Joystick additions as Mike has already added extra I2 C connectors to the MK 2 design.

Software Rev 16 should be featured packed from the OLED screen to live T-bar and possibly remote control over a small camera.

To be continued in the next issue of CQ-DATV...

5.8 GHz, 2 Watt AMPLIFIER Reliability Issues & Fixes

Jim, KH6HTV, Pete, WB2DVS, Bill, AB0MY & Don, N0YE

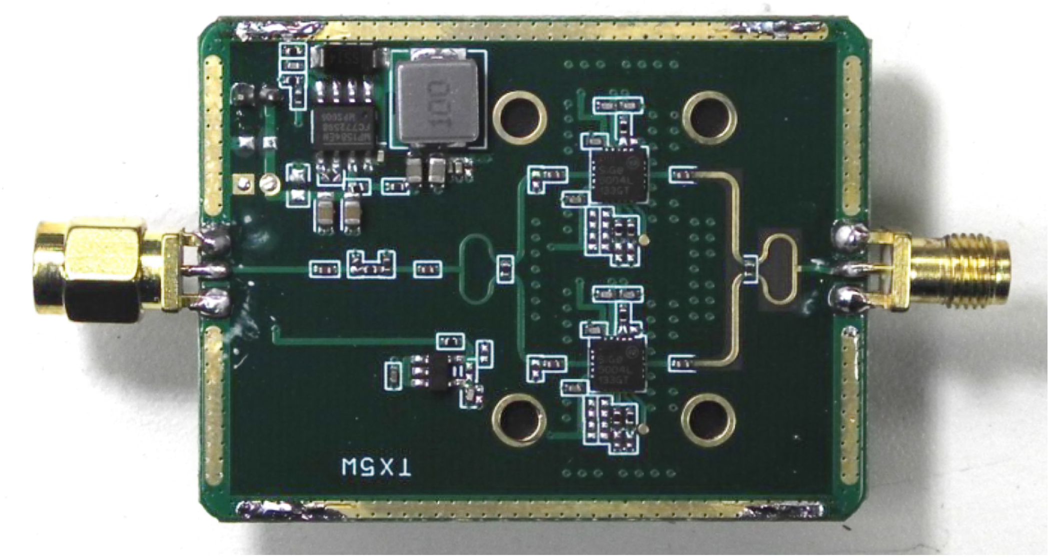


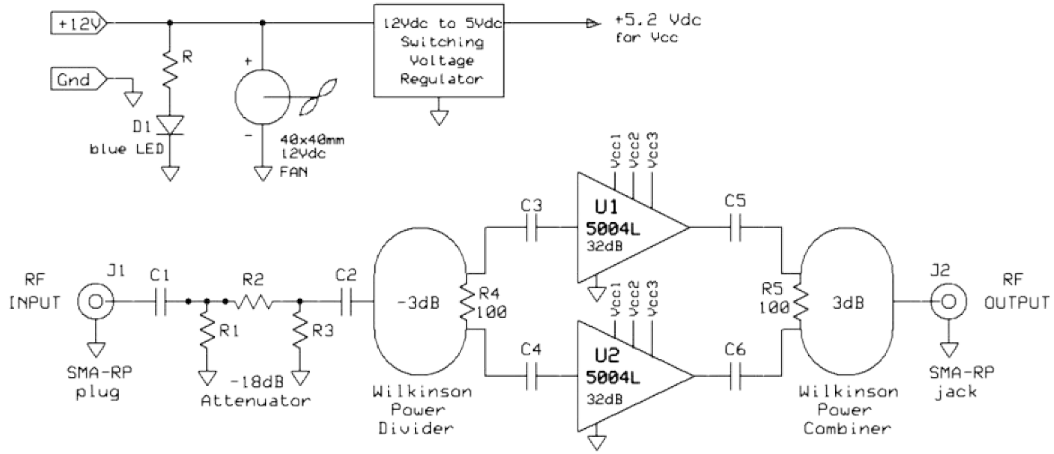
We have reported in several previous issues of this newsletter, using a low cost ($25), 5.8GHz, 2 watt amplifier from China for our microwave, FM-TV propagation experiments, and also as the final power amplifier in a DVB-T transverter.

The amplifiers were purchased from the Chinese, Amazon style vendor, Banggood.com. They cost about $25 with shipping from China. The link to them is *https://tinyurl.com/y5h793mh*

The amplifiers have the model number TXPA58002W5. The model number alone implies operation at 5.8 GHz with 2.5 Watts power. The web site says the amplifier will operate from 5 to 6GHz. DC input voltage 12 to 16Vdc. The web site further claims the amplifier will put out 3 Watts with 200mW drive and 4.5 Watts with 600mW drive. They say do not exceed 600mW of rf drive power.

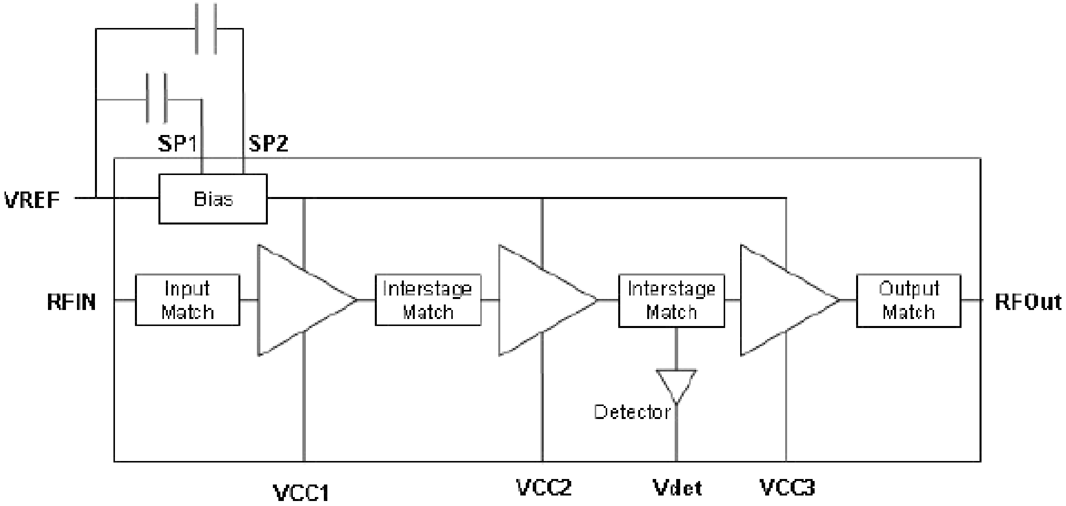
We have also mentioned in previous newsletters having reliability issues with all of us experiencing burning out at least one or more of these amplifiers. We have jointly done autopsies on our dead amps. In the process of opening up our amplifiers, we have discovered what the internal workings are of these amplifiers.





What we discovered is shown in the above photo, and simplified schematic diagram. There are two paralleled RF ICs as the key active devices. They are labeled as SiGe 5004L.

Pete has found that these are made by Skyworks and the complete model number is: SE5004L. This is a high gain, high power, RF MMIC for the 5-6 GHz, WLAN service. This is the block diagram of the SE5004L.



RFIN and RFOUT include DC shunt to Ground. External blocking capacitors are recommended.

The key specs for the SE5004L are: 5.15 - 5.85 GHz frequency coverage, 32dB gain, Pout = +26dBm (for 64QAM Wi-Fi), +34dBm (-1dB gain compression), Vcc = 5 Vdc, idle current = 300mA.

The p.c. board, block diagram shows the presence of a pi network resistive attenuator. I made measurements on it and found it to be about -18dB. Thus the overall gain of the TXPA58002W5 is degraded to be about +14dB. The input attenuator was obviously added by the Chinese engineers to enable the amplifier to be directly driven by moderately powered FPV, FM-TV transmitters. The MMIC amplifiers are operated in parallel by the use of Wilkinson 3dB power dividers / combiners.

So, how well do they work? The plot of small signal, S21 vs. frequency was measured on a Wiltron 5447A, 10MHz - 20GHz, network analyzer. S21 is seen to be fairly flat from 5 to 6 GHz at about 15dB gain.

S21 of TXPA58002W5 amplifier: Vertical = 5dB/div. center line = 0dB, Sweep from 4 to 8 GHz, 500 MHz/div.

The gain drops to 0dB at 4.6 & 6.8 GHz. The first amp purchased in Dec. 2019 was operated at 5.685 GHz with +37dBm (5 Watts) output for several days, before burning out. (see Jan. 2020 issue # 30a, p. 5). Mike, WA6SVT, then recommended that we never run them over +33dBm due to the small size of the heat sink and fan (issue #31, p. 9). Since then, it has been our policy to follow Mike's advice and keep the output to a max. of +33dBm (2 watts).

Reliability Issues:

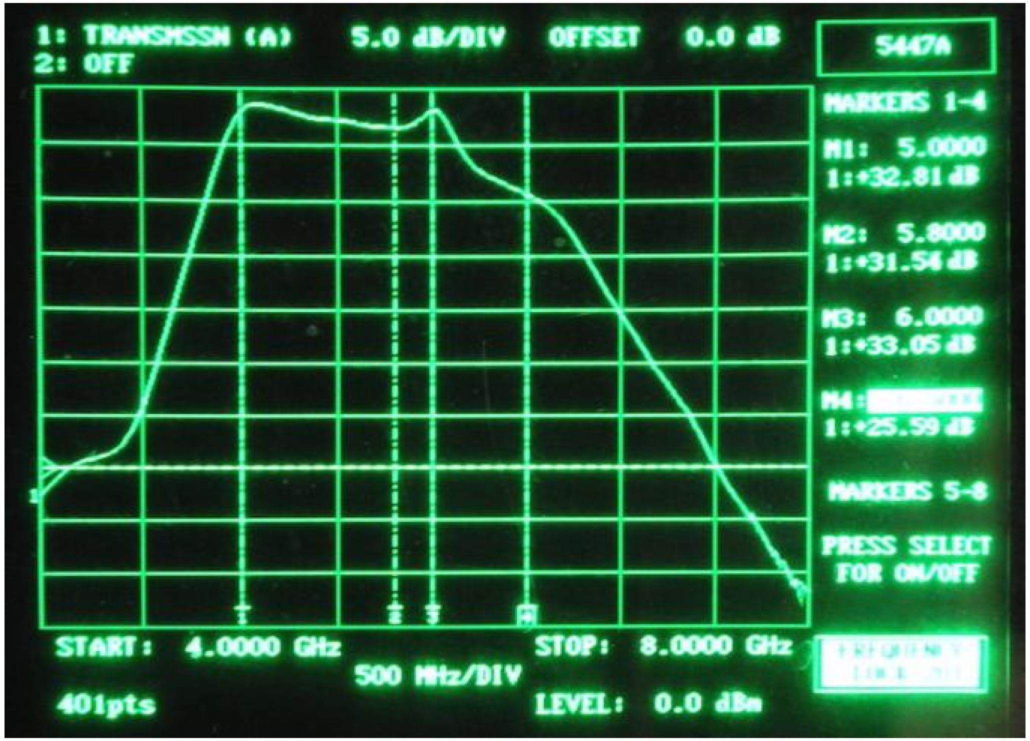
So why have we still lost so many of these amplifiers? Issue #1 - Heat --- From our mutual autopsies, we have all come to the conclusion that the unknown Chinese manufacturer(s) have skimped on their production line(s) in not adhering to good heat sink practices. The basic engineering design of the pc board was good.

Four holes were provided to mount a heat sink. Plus there were lots of tiny vias in the ground plane under the power MMICs to help conduct heat from the MMIC to the opposite side of the pc board where the heat sink is located. However, the builders only used two screws, not four, to attach the heat sink. Plus it was a dry mount, i.e. they did not use any heat sink grease. In one case we found a heat sink mounted with only one screw even and in some other cases the screws were loose and not tightened properly.

The solution to this is simple. First un-solder and remove the cover shield. Then remove the fan and heat sink. Drill and tap four new holes in the heat sink for 2-56 screws. Apply a good coating of thermal joint compound to the heat sink and reattach to the pc board. Use lock washers on the screws and tighten firmly. Remount the fan and re-solder the cover/shield in place. We have done this as a preventive measure on several new amplifiers and then burned them in for many hours at +33dBm RF output, with no failures. Plus the cover shield and heat sink are now just warm to the touch.

The amp draws about 0.5 Amps at +13.8Vdc when idling. At +33dBm RF output, it pulls about 1.2 Amps. The -1dB gain compression point was found to be +33dBm.

Issue #2 - Excessive RF Input --- Examining the Skyworks data sheet for the SE5004L, we find that the spec. for the max. RF input power is +6dBm. If we work back from the input to the MMIC through the -3dB of the Wilkinson power divider and the -18dB input attenuator, this computes to a max. allowable input to the TXPA58002W5 of +27dBm (500mW). The Banggood web site advertises a max. allowable input of 600mW (+28dBm). Thus, it is likely that anyone trying to whack the amplifier with anything greater than 500mW stands a very good chance of blowing out the MMICs.



S21 of TXPA58002W5 amplifier with input attenuator removed Vertical = 5dB/div. 0dB is 3ed line from bottom Sweep from 4 to 8 GHz, 500 MHz/div

Extra Modification:

An optional modification while having the cover shield removed, is to also remove the input 18 dB attenuator. This gives one a much more versatile amplifier with 32dB of gain. Otherwise the performance is essentially unchanged. Caution: the max. allowable rf input power now needs to be kept below +9dBm (i.e. the +6dBm spec. + the 3dB input power splitter). This mod needs to be done with care. The resistors used for the 18dB attenuator are tiny 0204 surface mount. Remove all three resistors. I then soldered a tiny piece of bare wire-wrap wire across the R2 pads. Plus, if you really feel brave, you could replace the objectionable, reverse polarity SMA connectors with conventional SMAs.

A Portable Test DVB-T Receiver with Monitor and Power Supply

Written by Dave Pelaez, AH2AR

Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER September, 2020

There are many ways to provide portability for DVB-T receive capability when the need arises at remote sites or during Field Day Operations. One idea for configuring a DVB-T Test Receiver/monitor for such requirements is presented here. Keep in-mind that this approach can use the same hardware as presented, or you could opt to use other hardware items that could easily serve this same purpose. This configuration integrates an FT-817 Lexan stand, a TalentCell Rechargeable Lithium battery pack, and a Liliput HD test monitor along with a Hi-Des, DVB-T receiver.

Key Components for the AH2AR, DTV Receiver, FT-817 stand, Battery, Hi-Des DVB-T Receiver & HDMI monitor

Lexan Stand

Note that the Lexan stand is available either through Amazon or E-bay. Using the search terms --Support Bracket Mount FT-817 Black Stand-- will provide a number of links where this bracket can be purchased. Typical cost is about $18. A photo of the stand by itself is provided above.

Power Supply

The power supply being used for this application is a TalentCell 12vdc/9vdc/5vdc Rechargeable Lithium Power Bank. Note that there are a number of different TalentCell models that can be employed. For this project, I opted to use a YB1208300-USB Power Bank with a capacity of 12Vdc & 8.3 Amp/hours. The 12Vdc power output connection is used to power the HV122A and the 9VDC output is used to power the Liliput video monitor.

For this application, the 5Vdc USB output isn't needed, but still could be used to power an HV110 receiver that requires 5Vdc. Typical cost is about $50.

DVB-T Receiver

For the DVB-T Receiver, an HV122A is used in this configuration as I needed a DVB-T test receiver that would provide receive capabilities on 23cm at 1 MHz bandwidth. The receiver requires 12Vdc, and for this application, the HDMI output is ported into the 7", Liliput HD (1920 x 1080) monitor. Typical cost for the HV-122A is $300 (or $170 for an HV-110). Typical cost for the 7" Liliput monitor is $160 (new). Note there are a large number of used Liliput monitors for sale on eBay since the units are used in the videography and movie industries and they are continuously upgrading them or dumping them after a certain amount of use. The prices of the new Liliput usually scare the hobbyist away, but there are normally some reasonably priced used monitors available for sale on eBay.

Integrated Configuration

Coincidentally, the "side wings" on the Lexan stand that normally is supposed to center a QRP transceiver on the stand, ended up perfectly cradling the Lithium Battery pack. Keep in mind that this "coincidental fit" to the lexan stand will only work with the YB1208300 Power Bank. Other power banks will work but the power banks would have to be afixed to the Lexan stand in a different manner. I secured the HV-122A with Velcro hook-and-loop tape to the back of the monitor, and also used a very short six inch HDMI cable to interface between the monitor and receiver.

Lastly, all Liliput monitors normally come with a ¼ inch threaded tripod mount interface. A ¼ inch bolt used in tripods afixed the monitor securely to the Lexan stand.

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

The A to B of Early Video Mixer Technology

Written by Paul Marshall PhD G8MJW
Broadcast Engineering Conservation Group *www.becg.tv*

Following Trevor Brown's excellent work in breathing new technology into a vintage Grass Valley video mixing console, I began to think about the even older history of video mixers generally. When it comes to audio mixers you can find lots of material about the famous REDD 'Beatles' desks, stories about the legendary Neves, how Sun Studios recorded Elvis with a 5 channel Presto and everything in between. When it comes to video mixing in the 1950s and the early 1960s there is almost nothing to be found. It's as if the core technologies and techniques that we now carry out as a piece of software emerged from nowhere. The classic A/B arrangement of picture source selectors and fader (T Bar) came from somewhere, but when, and how? This article aims to start the ball rolling in finding out how this particular piece of video technology and practice evolved. There are as yet no truly definitive answers and it is a work in progress. It spans pre-war practice to the beginning of the 1960s and uses the Broadcast Engineering Conservation Group's (BECG) 1950s Marconi BD841 Video Mixer as a reference. This unit has recently been restored and is operational, although it still requires some further work to be fully complete. If the A to Z of video mixer history is from pre-war to the current day, this really is just the A to B.

Pre-war video mixing

Looking back to the days of electro-mechanical television – the period of J L Baird and the rest of the international pioneers – there was little in the way of video mixing to be done. You were lucky to have one working camera and so mixing picture sources was hardly a priority.

Figure 1 KDYL TV Remote Truck Picture credit: author

In the case of flying spot scanners working with a reflected scanning light picked up by photocells, there was the opportunity to mix the outputs from various sensors but this was really a form of lighting, not video mixing. The BBC with their experimental 30-line studio did venture into mixing the output of a live studio camera with that of a caption scanner but that was about as far as it went. The video signals were constrained to be within an audio channel bandwidth so provided the sources were synchronised, an approximate fade could be made using conventional equipment.

Come the mid-1930s and the dawning of the electronic era of television technology pioneered by RCA in the USA and adapted by Marconi-EMI in the UK, the need for some form of video mixing arose.

The film industry was already mature and film productions were already heavily edited, giving the impression of multi-camera working even though it typically wasn't. TV had – at least superficially – to compete with the standards of production set by their established rival. In the case of 'direct TV' (live studio/OB), the new all-electronic technology embraced the idea of multi-camera shooting. There was no recording or editing – not even tele-recording with film – so a live production had to use several cameras. Operationally, production staff were still feeling their way through new practices and there were really only conventions borrowed from the film and radio industries to base things on.

Mixing wide-bandwidth video in the late 1930s was no trivial matter – even with fully system synchronised cameras. It was new territory with video bandwidths reaching to 3 MHz and beyond. The video mixers of the day could not 'cut' (that really messed up the sync for the home-viewer) and only a slow cross-fade was practicable. This was because the video mixer was of the 'knob a channel' type – one for each picture source – which controlled a variable-mu channel valve amplifier sharing its anode load resistor with all the other channels. In principle this should have worked but it didn't due to the ageing of the valves affecting the gain slope, DC transients and not terribly well controlled input sources. A fade between channels could be done safely and cleanly in about 8 seconds. Cutting was out of the question. In essence, the video mixer was still a sound mixer but with much increased bandwidth.

Figure 2 RCA A/B Video Mixer Picture credit: author

Post-war video mixing

In September 1939, British television faded to black and didn't resume until 1946 using pretty much all the same pre-war technology. The USA managed to continue with television during the war and made some significant advances, including the Image Orthicon tube for a new generation of TV cameras. It's perhaps not surprising to find that the first major post-war development that I can find in video mixing technology is from RCA in the USA.

Representative hardware of the new technique can be seen at the Early Television Foundation and Museum in Hilliard, Ohio. This is a real, physical museum where you can go and see up-close a whole range of artefacts, including working pre-war British TVs and even an operational iconoscope TV camera. The museum has on show what has to be the oldest and absolutely most completely original TV Remote Truck (Outside Broadcast Van). Originally built for KDYL of Salt Lake City in 1948, it carries three 3" Image Orthicon TV cameras and all the necessary support equipment including the video mixer. Figure 1 shows a picture of the truck and Figure 2 a close-up view of its video mixer. This is a radically different piece of equipment – it has an A/B bus and split faders as we recognise today. This is the oldest A/B video mixer that I've ever seen and I would be pleased to hear of anything earlier.

Figure 3 Marconi BD633 Video Mixer Picture credit: The Marconi Company – Product Catalogue 1952

I have no information about why the RCA engineers developed it or how they overcame the still significant technical problems. It was probably driven by the needs of production staff, but there are no references to be had yet. Looking at Figure 2, you could be forgiven for calling it a black/white mixer (the button rows are coded black and white), but that would be confusing! A/B seems like a good way to describe it but the terminology seems to come later. It has the classic split fader bar mixing between the A and B rows enabling not just a cross-fade, but two sources to appear together at full amplitude. This is useful in situations such as interviews with one person facing left and the other facing right.

Back across the Atlantic, the Marconi Company was developing a lot of new TV technologies with cameras using the new Image Orthicon tube based on RCA's work.

For video mixing, the BBC 'knob a channel' faders still seemed to be the technique of choice. The BD633 Video Mixer, first seen in the 1951 Catalogue and shown in Figure 3, harks back to the past – likely because of BBC preferences. The company had automatic rights to any RCA 'transmission' technology (that included cameras and all ancillary equipment), so the RCA 'A/B' technology could have been adopted without payment but 'knob a channel' was what the state broadcaster wanted.

Another two years goes by before what appears to be the first British made A/B mixer appears in the form of the Marconi 8 channel BD841 introduced in 1953. It is this model that we have in BECG's Project Vivat and the video mixer system is now nearing completion as a fully operational example. The desk unit, shown in Figure 4, contains only the control and fader amplifiers, the electronic processing being carried out in a separate large unit, the BD813 Line Clamp Amplifier (LCA) or 'Stabilising Amplifier', in BBC jargon. The BD813 is a sophisticated unit in its own right in that it strips incoming syncs, clips peak white, re-blanks and adds sync back-in as well as controlling gain and black level. It can also add pedestal (USA market) and provides four outputs. Most of these functions can be controlled remotely with cable linked panels enabling control from the vision mixer desk unit. Figure 5 shows the internal construction revealing the vast quantity of valves. There's 41 in total and a lot of work went into its restoration to operational status.

By comparison, the A/B mixer desk-top control unit is quite simple, even with its preview panel and cues/communication section. Interestingly, this unit is almost certainly ex-ITV because it has a modification – a top-left and top-right cue dot insertion facility – something the commercial break free BBC never needed! The A/B banks are there, as is an overall fade-to-black control and a preview selector. There's also a pair of ashtrays mounted in the top (now missing) – not something you see these days!

Figure 4 Marconi BD841 Video Mixer Picture credit: author

None of the cutting takes place in blanking and there's no wipes – that comes in the next series of video mixing equipment.

Another interesting feature is its green cue light system in addition the normal red ones. The green cue indicates the availability of a source and in the case of Marconi cameras of the period, this is controlled from the Camera Control Unit (CCU) in the form of a front panel switch. Operating the switch lights local lamps and also causes the appropriate video mixer channel to light-up green in the centre section. A channel push button turns to red if selected to go to air, but when faded down, turns to amber. This use of coded colour cues is an early example of new operating methodology being applied to video mixing.

The BD813/BD841 video mixer system installed in Project Vivat is running 625 lines 50 field rather than the BBC standard of the time, 405 lines, 50 field. For pragmatic reasons, the whole project (with only two exceptions) is based on 625 lines operation. The equipment was designed to work with all TV systems of the time and operation at this rather more demanding TV format is not a major issue. Later in the decade, Pye produced a similar A/B mixer and presumably EMI did too, but the Marconi unit does appear to be first in the UK. A 'first' is always a difficult claim, but until something to the contrary appears, it will stand. Practice and technology in other countries is not known – what was happening in France and Germany? I do not (yet) know.

This article has only been a brief foray into what appears to be an area of TV technology history which has not been investigated and much further research will be needed to produce a more definitive and nuanced account.

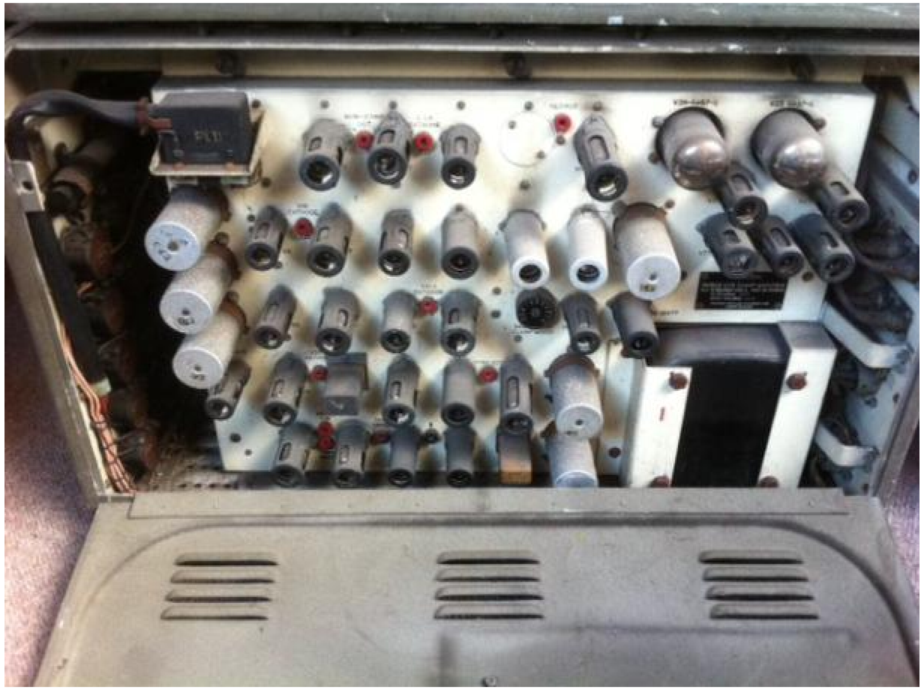


Figure 5 Marconi BD813 Line Clamp Amplifier Picture credit: author

150 Watt Power Amplifier for 23cms

Written by Steve Marshall, M0SKM *https://m0skm.tv*

Following my recent amplifier build for QO-100 I decided to scrap the power hungry Spectrian board. It wasn't faulty but I had decided to put the XRF 286S transistors to better use in a 23cm amplifier.

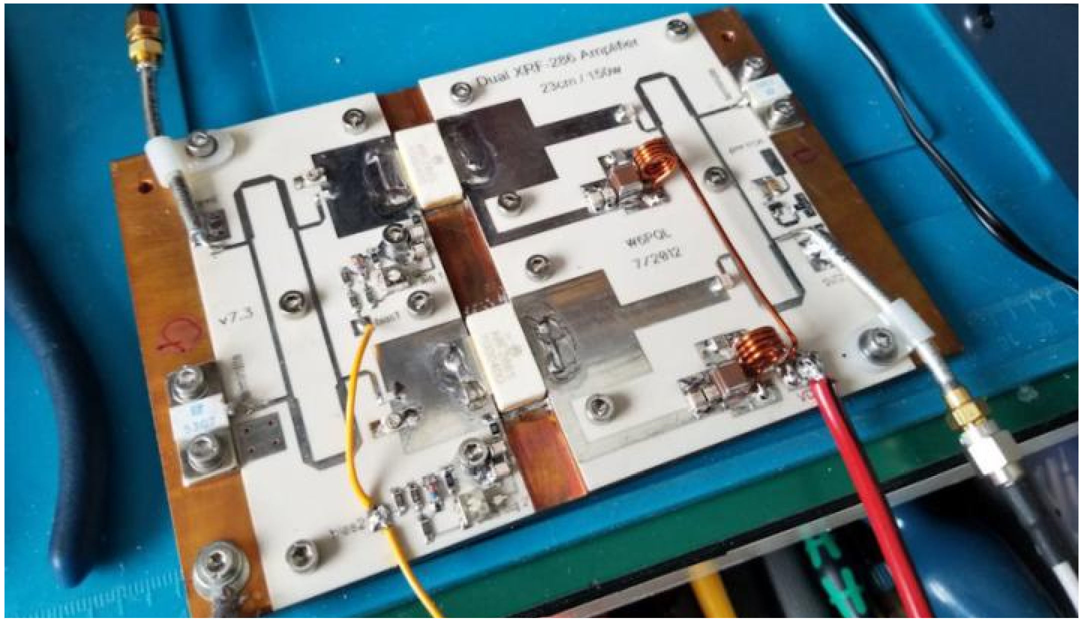
Nervously I fired up my hotplate and raised the temperature to 235 centigrade, the trick is to turn the plate off when you drop the board onto it. If you leave the power on the hotplate it will continue to rise in temperature to a destructive level. Using a pair of ceramic tipped tweezers I removed the transistors very rapidly and put them to one side to cool naturally.

I had heard stories about the XRF 286 being damaged during removal/re-soldering in this way, so I wasn't too surprised when I found one of the three read short circuit gate to source. Luckily the two remaining devices had survived; reading fine when tested with a multimeter. My plan was to use a PCB which I bought from Jim W6PQL, fixing holes were sized in US inches but 3mm screws fitted nicely.

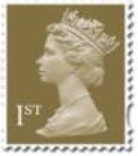
My engineer friend milled some 6mm thick copper for me; he also drilled and tapped all fixing points including those for mounting to the heat-sink. I planned to reuse the aluminium chassis and heat-sink from which I had just removed the Spectrian board. Using a nibbling tool I removed a bit more of the chassis to get the new larger PCB assembly to mate with the heat-sink.

So the assembly sequence is important; once the PCB is screwed to the copper heat soak It's difficult to get enough heat onto the board to solder. Initially the board is fitted to the copper with a few screws, at this point I slid the transistors into position and marked the position for soldering. After soldering the transistors to the copper and checking for any bridges I placed the PCB sections under the drain and gate tabs to check for correct alignment. When satisfied the fit was good I populated the two sections with the rest of the components including power cables, bias feed and coax. Ensuring the bias pots were adjusted for minimum/no bias I screwed the boards onto the copper heat-soak and soldered the gate and drain tabs. These tabs are thin and usually solder to the board quite easily.

Using 6mm copper allowed me to power up the amplifier prior to housing, I was able to check voltages and set the bias without generating much heat. I set the bias at one amp each transistor as this was the setting for the Spectrian amplifier, I'm still pondering whether to experiment further with the setting. Up till now I have run it at over a hundred Watts and a friend monitoring my DATV on a spectrum analyser said it was clean with spectral regrowth 30dB down. On this occasion I only took these two pictures. You can see a good video showing the hotplate soldering process on YouTube, look for W6PQL.



I knew had forgot to send my latest article.



Oops............ but wait

There is a different method

editor@cq-datv.mobi

Amateur Rocket ATV Transmitter

Written by Ken Goldstein, KD5HEH - Rio Rancho, New Mexico

Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER August, 2020

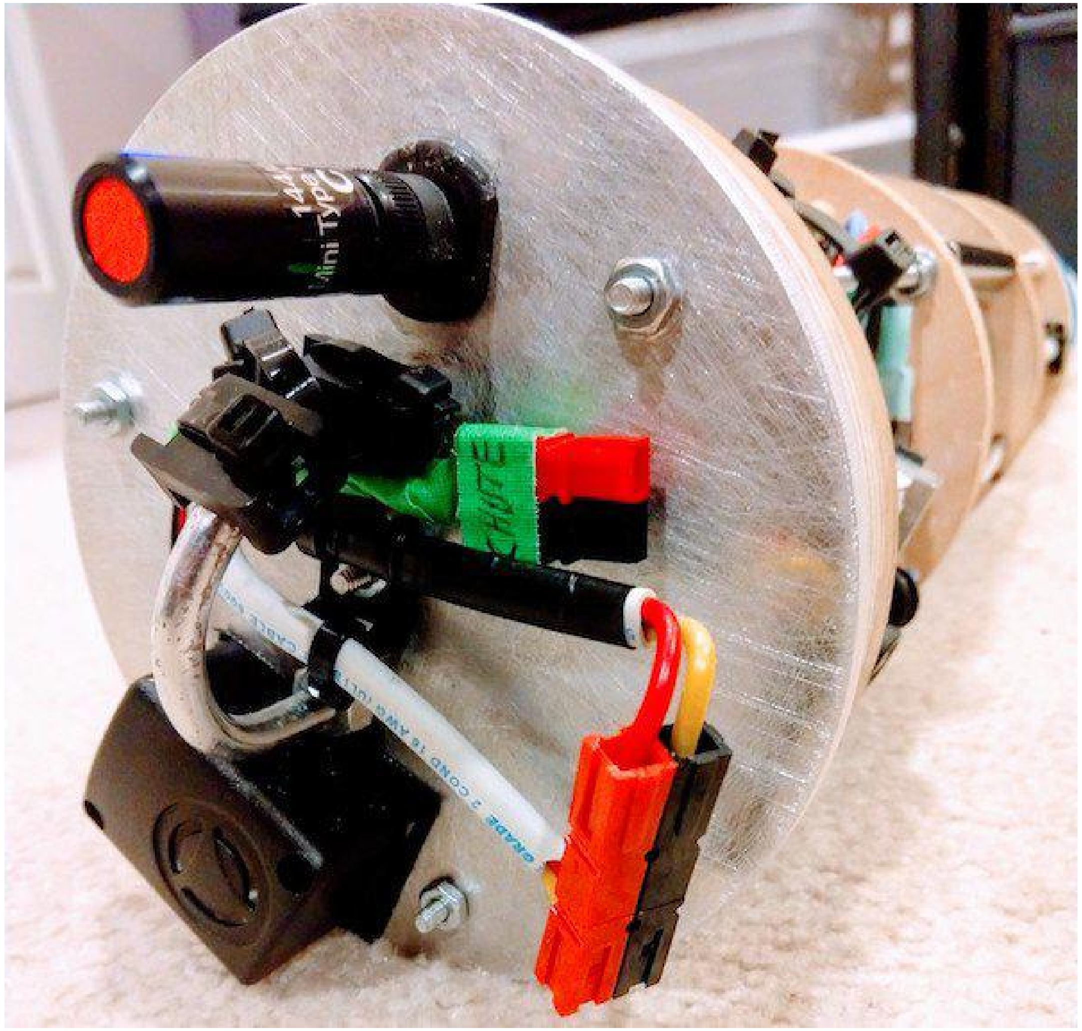
The goal of this project was to create an ATV transmitter carried aboard a high altitude amateur rocket that would broadcast flight video and audio to a receiver and recording device on the ground. I've put video cameras on rockets before that record flight video which could be viewed after being retrieved from the onboard camera. The problem with that method of video recording is that if the rocket is lost, malfunctions, or the parachute does not deploy properly, there is a good chance that the video is lost too. With an ATV transmitter, you would at least be able to view the flight in real-time and record the view from the rocket up until any mishap.

Ken, KD5HEH, holding the transmitter package with the rib-cage antenna

The heart of the ATV package is an MFJ-8709 Analog ATV transmitter. I found that the maximum power I could get out of mine was close to 4 watts. These run super hot, and the instructions warn not to let the temperature get over 149 F. I attached a heat sink from an old Pentium processor to it, but that was not sufficient. Below the heat sink, I added a 12 volt 2.5 amp four inch diameter Attwood 1749-4 Turbo 4000 Series II In-Line marine bilge fan which pulls 200CFM of air over the transmitter and heat sink. There are 2 x 1.25" air intake holes near the top of the tube housing the ATV package and 2 x 1.25 exhaust holes near the bottom.

The fan caused noise to display on the video transmission. That was resolved through the combination of using a Delta FL75L07 filter module on the fan motor, wrapping the fan motor and filter in RF blocking Farady tape, and placing an aluminum plate below the antenna.

Since I didn't want the fan to run continuously, a HiLetgo W1701 12V DC temperature switch was set to turn on the fan when the case temperature of the MFJ-8709 reaches 122 F.

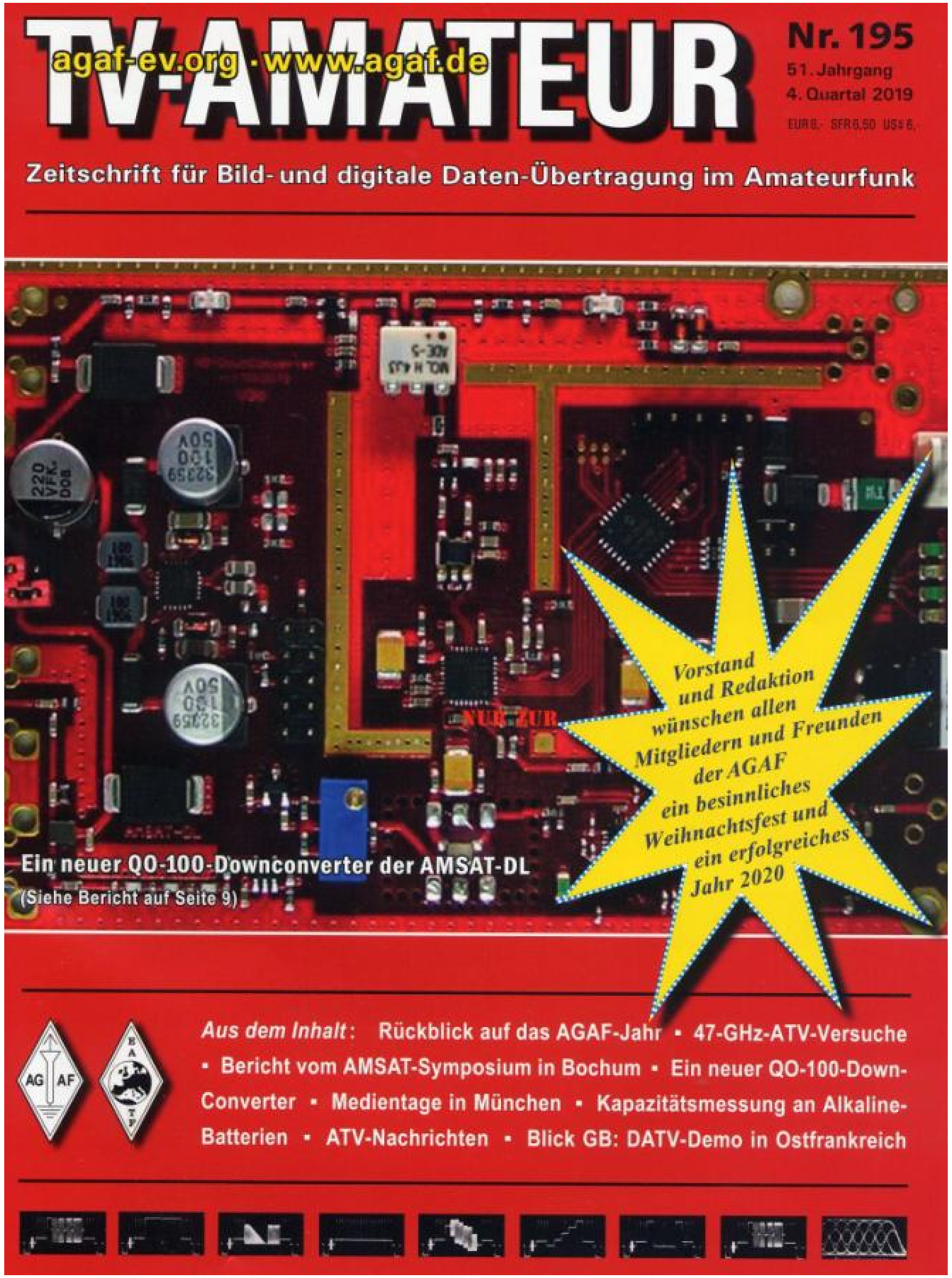


Powering everything is a Maxpacks.com 13.2V 5000mah NiMH battery. It fits inside the PVC pipe below the Eggbeater antenna

The antenna is a homemade 70cm Eggbeater design made from #8 gauge copper wire based off of Anton, ZR6AIC notes at *https://tinyurl.com/lz6btkh*

For remote control of the ATV transmitter I used a WJ9J DTMF repeater controller connected to an old small Standard brand 2 meter 5 watt HT. Two DTMF controlled automotive relays are wired to the controller. One controls power to the ATV transmitter and the other can power a sonic beacon and also fire a backup parachute ejection charge if the altimeter based parachute ejection fails. The controller transmits high or low tones on the 2 meter simplex controller frequency to indicate the status of the connected relays. The WJ9J controller automatically transmits my call sign every 10 minus over the ATV audio as well as on 2 meters.

It can also be remotely commanded to broadcast a long tone on 2 meters to be used for radio direction finding if the packets from an onboard APRS tracker cannot be received by the search and recovery crew. When the recovery crew is in the vicinity of the downed rocket, the sonic beacon can be remotely turned on to make locating the rocket easier as they would just need to home in on the loud siren sound.



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://agaf-ev.org/*

5.7 GHz, DVB-T SUCCESS!

Written by Jim Andrews KH6HTV
Reproduced from Repeater's REPEATER September, 2020

For our first real, serious, attempt at sending high-definition, digital TV on the 5cm band, we had great success. 51km (≈ 32 miles). At 32 miles, we beat our own 10 GHz, DVB-T record of 23 miles. This was reported in the previous newsletter (issue # 57).

On Sunday, September 13th, Jim, KH6HTV, Larry, K0PYX, Don, N0YE, Pete, WB2DVS & Debbie, WB2DVT again headed out onto the Colorado prairies with their 5 GHz, BBQ grill dish antennas and transverters to see what records they could set. Don, Pete & Debbie headed to their favorite hang-outs on CO-128 south of Boulder near the Rocky Flats NREL windmills. (39^{O} 54' 50.31" N x 105^{O} 12' 33.24"W)

Jim & Larry first headed north to previously used site at Rabbit Mtn open space north-west of Longmont. (75th St & Woodland Rd.). Pointing their dish antenna due south along 75th St. for 22 miles to where Don, Pete & Debbie were set up. They had success with two way DTV QSOs. So, Larry & Jim then packed up their gear and moved further north-east. They tried out a new site never used before for ham microwaves.

Jim had discovered it by carefully studying USGS topo maps. It is called Twin Mounds, north-east of Berthod, and west of I-25 (40o 20' 33.39"N x 104o 59' 56.83"W). They found a commanding view from there, especially to the south-west. Pointing their dish to about 200 degrees and turning on their transmitter, they immediately got P5/Q5 signal reports from Don, Pete & Debbie.

This time the distance was 50.9 km (31.6 miles). Antenna alignment was then peaked up. They then exchanged two way DTV, QSOs over this new path. Coordination was done using the BARC, 146.70 MHz FM voice repeater.

Technical Details

Jim was using his new, home-brew, 5 GHz transverter which has been described in earlier newsletters. It puts out +23dBm rms of DVB-T power. The receiver has a 1.1dB noise figure. It's sensitivity is about -99dBm for normal coding and about 3dB better with "aggressive" coding parameters. He used the L-Com model HG5822EG, BBQ grill, dish antenna with +23dBi of gain. His coax feedline was 40" of 1/4" heliax with -1dB of loss.

Don was using his home-brew 5 GHz transverter which was described in the previous newsletter (issue #57). It consisted of a single mixer and amplifier with a transfer, coaxial relay. His DVB-T output was +17dBm rms. He also was using the L-Com BBQ grill dish antenna and had -1dB of coax loss.

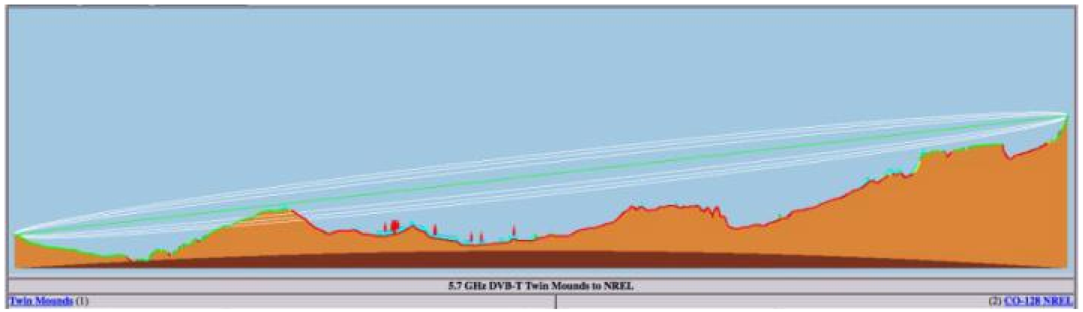
In the previous week, Don had also whipped together another similar transverter for Pete & Debbie. Their rig put out +13dBm rms to another L-Com BBQ grill antenna and had about -2dB of coax loss.

We have standardized on using 5.678 GHz for DVB-T and 5.685 GHz for FM-TV. We are using horizontal polarization.

For DVB-T, we are running high-definition video and CQ quality audio with 6 MHz bandwidth and QPSK modulation. For our long distance experiments, we have been using "aggressive" coding parameters of: 720p resolution, 3.5 Mbps, 8K FFT, 1/2 code rate (i.e. FEC) and 1/16 guard. "Normal" QPSK parameters are 1080P, 6 Mbps, 8K FFT, 5/6 FEC & 1/16 guard. We are using either Hi-Des, HV-100EH or HV-320E modulators on our IF frequencies.

For receiving, we all are using Hi-Des receivers on our IF frequencies.

Don, Pete & Debbie were using HV-110s, while Jim was using an HV-120A. These Hi-Des receivers include a built-in RF power meter (i.e. S meter) which provides an on screen display that reads out directly in dBm. The HV-100 reads correctly. The HV-120A has a built-in offset in it's reading which needs to be corrected for in measurements. Then knowing each transverter's receiver gain, it is possible to obtain true received signal power levels in dBm at the transverter antenna input.



Results

When KH6HTV transmitted with +23dBm from Twin Mounds to the CO-128 NREL site, N0YE reported receiving the signal at -84dBm with a 17dB s/n. WB2DVS reported -77dBm with a 12dB s/n. Radio Mobile computer rf path prediction for this was -85dBm.

Next when N0YE transmitted with +17dBm back to KH6HTV -- Jim reported P5/Q5 reception and a received signal strength of -91dBm with a 10dB s/n. Radio Mobile prediction was also -91dBm.

Finally WB2DVS/WB2DVT transmitted with their +13dBm back to KH6HTV -- Jim reported receiving a freeze framing image and broken audio. The received signal strength was -95dBm with 7dB s/n. Radio Mobile's prediction was -96dBm

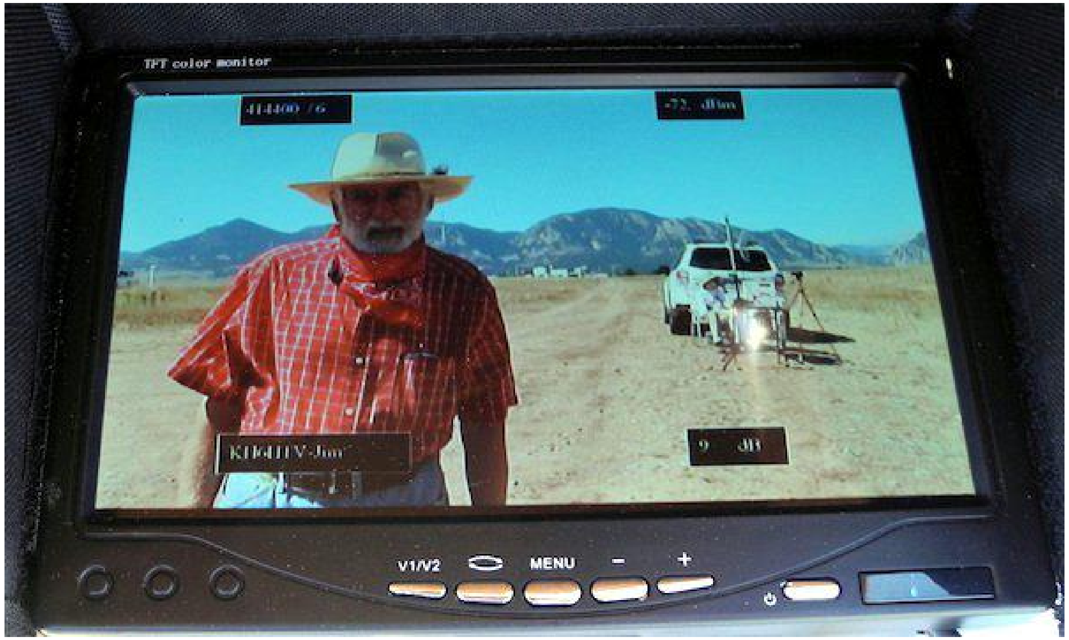
One conclusion drawn from these 5cm propagation experiments was that the computer program Radio Mobile is quite accurate in most all cases. To read more about Radio Mobile, we refer you to the KH6HTV Video application note, AN-33a, "TV Propagation". It is available at: *https://tinyurl.com/y3hykntb*

More next page...

Debbie at CO-128 NREL site

WB2DVS/WB2DVT

Larry at Twin Mounds site



N0YE - images received by KH6HTV, Twin Mounds

One from the vault - Making a simple Frequency Counter for 10GHz - 3cm

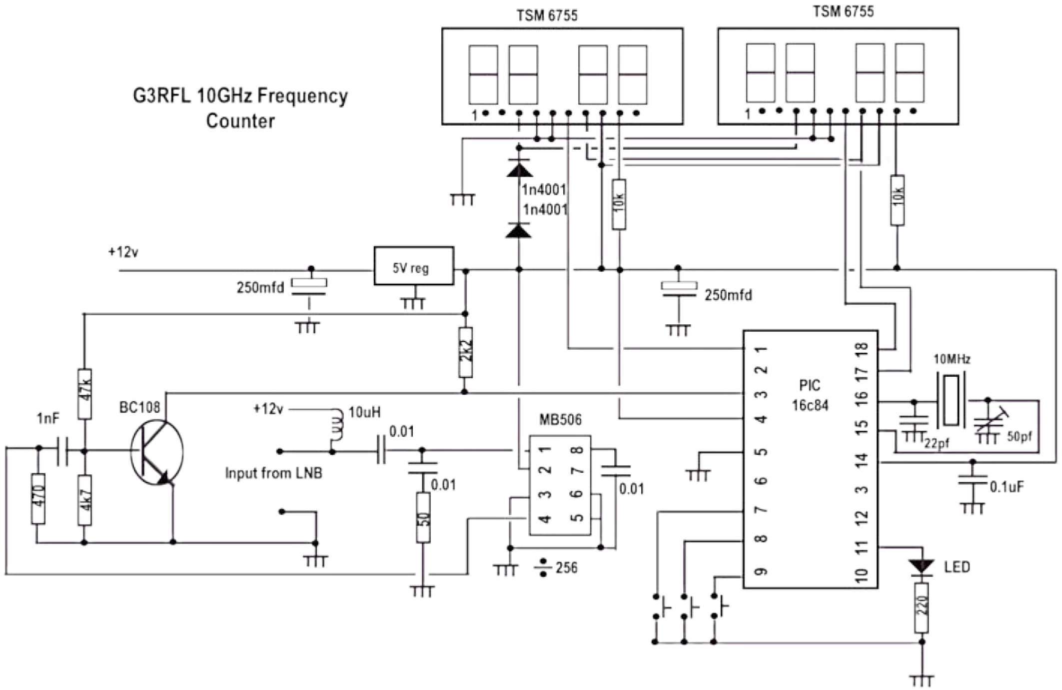
Written by John Hudson G3RFL
First published in issue 2

Having built and tested the video transmitter for GB3FY, I needed some way to accurately check its frequency and to monitor its stability, looking around the shack all I had was a simple frequency counter built back in 1997. It was a little limited and would not cover the 10GHz band, but perhaps I could add pre-scaler and extend its range.

Quick look at eBay and I found a plentiful supply of MB 506's, for around £2, which could easily be configured to divide by 256 and be capable of working in the 10GHz band. So I committed myself to a £2 investment and a rebuild for this old unit. I also decided to add an optional phantom power feed so LNB's could be driven directly from the counter. The end design was a very sensitive frequency counter that could be connected to an LNB, and used to receive GB3FY, across the shack.

Setting up GB3R

The frequencies counter displays (TM 6755's are the older displays using LED's yes they are bright, but I am old and this is a definite plus! The circuit revolves around a PIC16F84 with a 10MHz XTAL. This needs calibrating to a known 10MHz source once built, otherwise the accuracy is impaired.
The LNB 900MHz input divided by 256 gives 3.515625MHZ so it's just a pure maths calculation, something that micro processor do well to get to 900MHz.



The new three additional push buttons provide a choice of LNB PUCK offsets, Button 1 resets it to no offset button two sequences through software presets and the third button is a spare, you can never have enough buttons. Switching off will NOT reset the offset, it is stored in EEPROM
Other things going on are converting the Counter to Decimal digits adding offset and serially sending up to the two LED displays and adding some decimal points leading zero blanking was added as well.

The rebuild was on a new PCB and for the constructors with home photo etching I have reproduced the single sided PCB foil and component layout, which can be downloaded from the CQ-DATV web site (see below).

It was relatively simple build and could easily be built in a single evening. I omitted the 10uH choke from the PCB as not everyone will want to feed phantom power to an LNB's, this can easily be added, off the PCB

The New Software

The PIC Software has avoided interrupts and the lower freq goes into TMR0 timer counter with a DIV 4 pre-scaler via PORTA, 4 TOCK1

A background software counter counts for 1 SEC and keeps polling the timer for an overflow situation. This overflow feeds three counters Count0 Count1 and Count2 also the remainder in the TIMER is added. After it has stopped we take all the 24 bits and start to add them up in a 5-byte register starting with bit 0 in freqtab.

- *Bit 00 = 0.000,001,024 GHz*
- *through to*
- *Bit 23 = 8.589,934,592 GHz*
- *Then add the offset, in this case 9.1GHz*

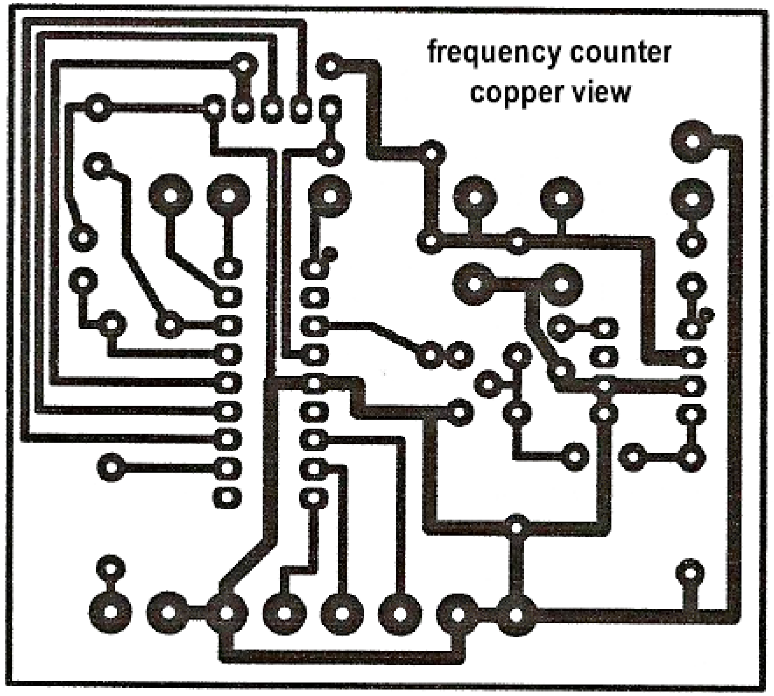
Software is called picfreq3.asm run it under MPLAB to produce HEX code.

This software and pcb layout is downloadable from the eBook site *https://tinyurl.com/y65qymue* so for those of you with an understanding of PIC code the hardware can be customised to your own requirements.

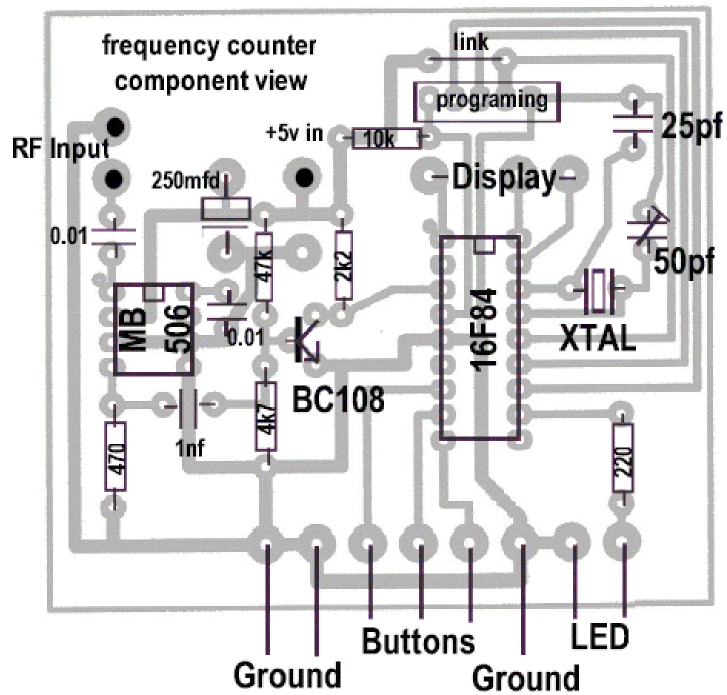
Cheers - Have fun, I did!

PCB foil layout

NOT TO SCALE



Component overlay



Information

External links

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

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

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

Legal Niceties (the small print)

Copyright

Notice to Contributors

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

Author Guidelines

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

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

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

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

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

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.

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

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

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