In this issue

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

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Editorial

Welcome to issue 82 of our electronic ATV magazine.
We find ourselves in very serious and troubled times. Our thoughts go out to all our readers around the world, and their loved ones.

We hope CQ-DATV 82 supplies a little escape from these problems and brings a little enjoyment into the lock down that most of the world is now under. What have we got to distract you? well in this issue?

Jim Andrews KH6HTV has written an ATV handbook. You can get your free copy from Jim's Web site (see News item for details). Jim has also found time to visit his back-burner projects and revive and finish his microwave transverter. This has put him on 5.8GHz's but not with FM, but with DVB-T. The output power +25dBm and a receiver sensitivity of -96dBm. Jim has also revived a 2.4 GHz 2-watt transmitter again for DVB-T. Jim describes it as the BEAST, but Jim is good at taming beasts. The PA used to be 10w, but it's now down to 2.5 watts delivering DVB-T signals and can be driven directly with the Hi Des 320E modulator.

John Hudson G3RFL has found his way back to the shack and has made the decision that his old test card generator is getting a little long in the tooth, with some of the parts now becoming obsolete (we were struggling too John). The solution is to go back to the drawing board and design a new one. This one can store a Jpeg picture. John has sent in a family photo stored in this new design and is working on software so that we can all follow suite. Thanks John, can't wait to try it with the Test Card Maker software.

Mike Stevens G7GTN has been looking at electronic speech. Some of you may remember the SPO265, well Mike is on the case and takes us back through earlier incarnations, including the commodore 64 and SAM Speech.

Move over commodore the ESP 8266 is here and the new project has been costed out at under £5.

John Gebuhr, WB0CMC is looking at Epson programmable oscillators. The problem is he needed one to work at 27MHz so he could multi-channel his new ATV transmitters, but too many artefacts were confusing the PLL. John was not put off and has some solutions.

Trevor G8CJS has produced another chapter in his GVG mixer modifications and unfortunately has not yet got it producing the MIDI data that was discussed in the last issue. The Arduino has not made it through from Mike G7GTN. Only a pause in the development and Trevor is using the time to recap the project and explain where he hopes to go with it.

No issue of CQ-DATV would be complete without "One from the vault". This is a look back at issue 25 and answers the question of why there are so many codec's.

I hope this issue has spread a little light into your lives at this difficult time and that by the time CQ-DATV 83 is published that things are starting to improve.

From everyone at CQ-DATV we hope that you and your loved ones are safe from this horrific virus.

Take care - the CQ-DATV editorial team

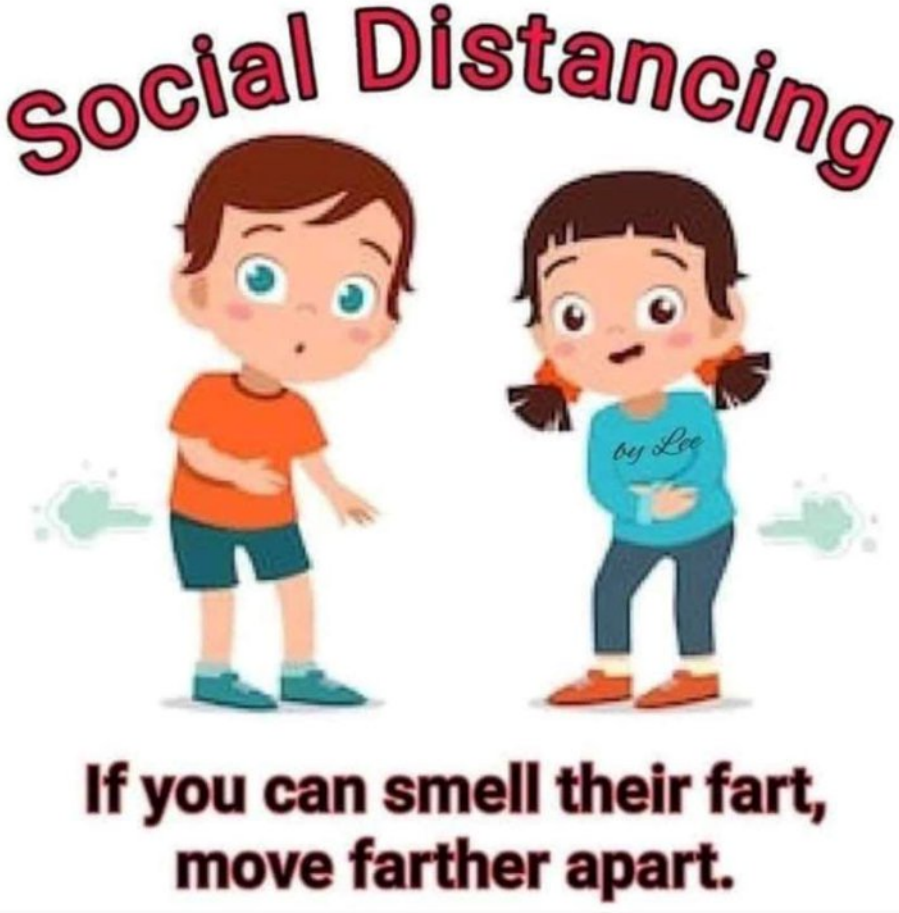
Please note: articles in this magazine are provided with absolutely no warranty whatsoever; neither the contributors nor CQ-DATV accept any responsibility or liability for loss or damage resulting from readers choosing to apply this content to theirs or others computers and equipment.

People of all ages can be infected by the new coronavirus (nCoV-2019).
Older people, and people with pre-existing medical conditions (such as asthma, diabetes, heart disease) appear to be more vulnerable to becoming severely ill with the virus.
WHO advise people of all age to take steps to protect themselves from the virus, for example by following good hand hygiene and good respiratory hygiene.

World Health Organization

#Coronavirus

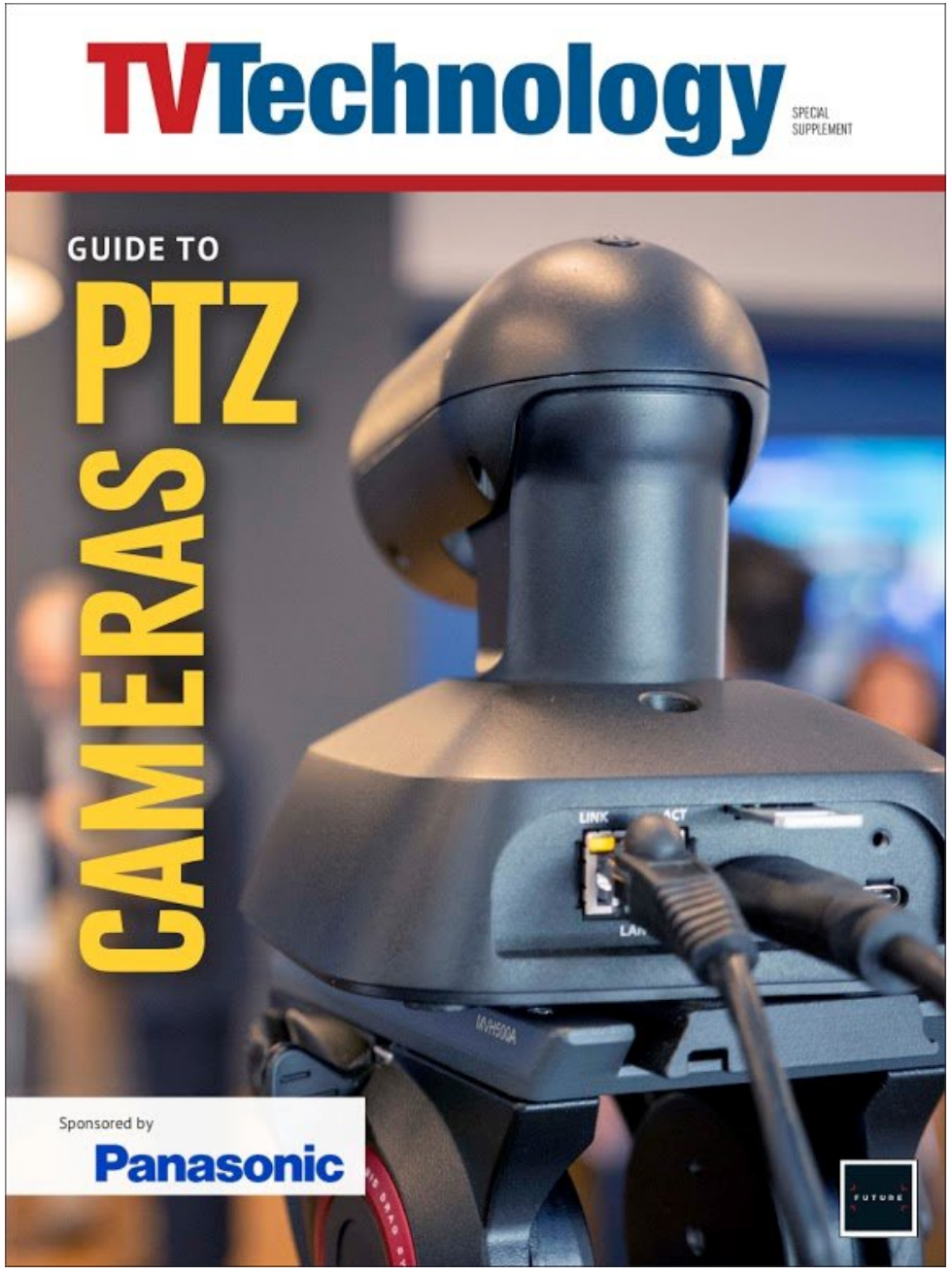
Does the new coronavirus affect older people, or are younger people also susceptible?



TV Amateur is a German Language ATV Magazine.
It is published 4 times a year.
Please note the website is currently off-line.

Guide To PTZ Cameras eBook Is Now Available

Produced by the editors of TV Technology.



Advances in robotics, IP and image sensors over the past decade have lead to expanding markets for PTZ (pan-tilt-zoom) cameras. These workhorses have moved beyond traditional surveillance to inside studios and sporting arenas, giving new and unique points of view for viewers.
In our new ebook on PTZ cameras, we take a look at their potential uses on the set and in the concert venue as well as take a look at how AI will enhance PTZ production.
Learn more in the latest free Guide to PTZ Cameras eBook.
Read it free now - *click here*.

New ATV Handbook

Back in 2017, Tom O'Hara, W6ORG, was writing the chapter 32 on ATV for the ARRL handbook. He asked me for some input on DTV to include in his chapter. Tom's chapter in the 2018 handbook was 31 pages in length and covered well the subject.

This past fall, Bill, AB0DH, loaned me his 2019 ARRL Handbook to look at. I was dismayed by the extremely brief writeup given in it to ATV. I expressed my displeasure at the Boulder Friday morning ham breakfast. Larry, K0PYX, made the suggestion – "Jim, if you are that displeased, why don't you write your own ATV Handbook?" Well, I took up Larry's challenge. I have just finished writing it. I have entitled it "ATV HANDBOOK - an Introduction to Amateur TV".

I have just posted it on my web site: *www.kh6htv.com* as my application note, AN-55. My new book is 39 pages in length. I broke it into the following chapters covering: Basics of TV Video Signal, TV Video Sources, Amateur TV bands, TV Signal Quality Reporting, TV Modulation Methods, TV Receivers, TV Transmitters, TV Antennas, TV Propagation, TV Repeaters, TV in ARES, and a list of ATV Suppliers.
73 de Jim Andrews, KH6HTV

BATC and Corona

In order to support the worldwide amateur radio community during the COVID-19 virus pandemic, the BATC is offering free use of its video streaming service and chat facility to any radio club or group of radio amateurs.

This will enable clubs to hold talks, presentations amd virtual meetings with HD video and audio streaming and a membership chat window for real time feedback and discussion.

To enable this, we are offering free one-year "cyber membership" to any radio club or group of radio amateurs.

Full details of how to apply are here on the BATC Wiki.
https://wiki.batc.org.uk/Radio_Club_membership_2020n

Australian (Ham Radio) Corona Casulties

No news presentation seem complete these days without some mention of the COVID-19, the Novel Coronavirus that has driven panic and fear into the worlds economic and social engines.

And this broadcast is no exception

The health and well being of the Amateur cohort and our members is of the highest priority. Out of an abundance of caution, consideration for the health and wellbeing of our members, and in an effort to deliver certainty to the Amateur community (not to mention a federal government mandate), the board of the WIA met last Wednesday and endorsed the recommendation of the 2020 WIA Conference Organising committee to cancel this event.

The 2021 WIA Conference will take place in Hobart.

The WIA board would like to encourage all operators to practice social separation, wash and dry your hands regularly and promptly seek advice if you feel you are affected by COVID-19.

One event that would have gone over the 100 'guest rule' as to take place just north of Brisbane in VK4 so REDFEST 2020 has been cancelled.

"Greetings from the Redcliffe & Districts Radio Club VK4RC, right here in south East QLD. Robert Thomson VK4TFN here, with a REDFEST 2020 update.

This is indeed a sad turn of events. However, the Executive has had no choice but to cancel REDFEST 2020, due to the current public health concerns.

Next year, there will be a REDFEST 2021, circumstances permitting.

Along with the many other cancellations of events throughout the country where there are a number of people likely to attend them Amateur Radio New South Wales has done likewise and cancelled the scheduled Sunday March the 29th Trash and Treasure event along with the Experimenters Group lecture which would have been held later in the day.

Other ARNSW activities of members at the Dural site are under review. Interested parties are reminded to listen to the Sunday VK2WI News sessions for updates.

Notice of cancellation of The Urunga Radio Convention

The Urunga Radio Convention Committee advises that the Field Days to be held at Easter weekend, 11 and 12 of April 2020 has been cancelled due to the restrictions and

conditions placed upon the Convention by the various government authorities in the light of COVID-19 pandemic.

It is the first Urunga Convention that has failed in 72 years and it is a personal blow to the organising committee. We wish to thank all our supporters and we will return at Easter in 2021.

VK3 - EMDRC Committee after due consideration, have decided to cancel/postpone 2020 EMDRC HamFest on Sunday 29 March.

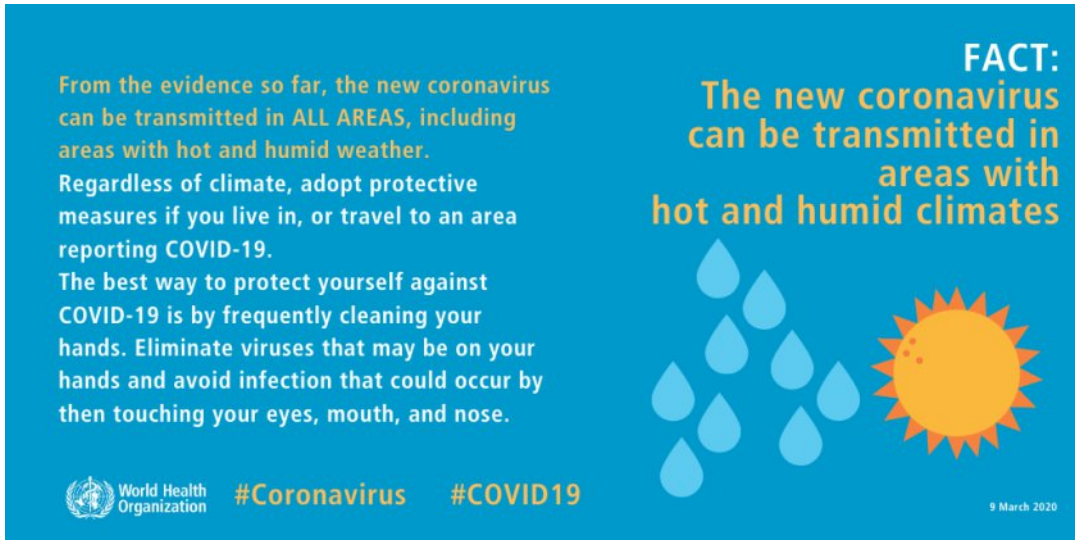
VK3 - GippsTech 2020 has been cancelled

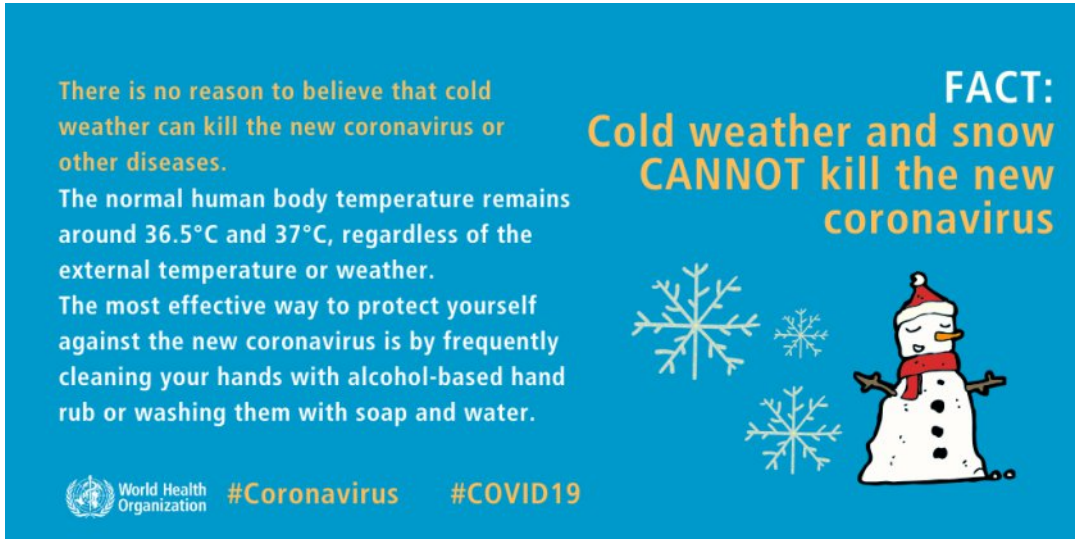
VK6 - Bob VK6POP in a phone hookup has told how PerthTech at Bassendean is to be cancelled.

VK7 - Meet the Voice organiser Dani VK7FREQ also has made the decision to cancel the Meet the Voice gathering.

ZL - For our Kiwi friends your Conference 2020 is cancelled. NZART Council has made the decision to cancel the Conference in Shantytown this year. This is due to the COVID-19 situation and taking on board all the advice for doing so.

Source: Excerpts from VK National News Broadcast MARCH 22 2020



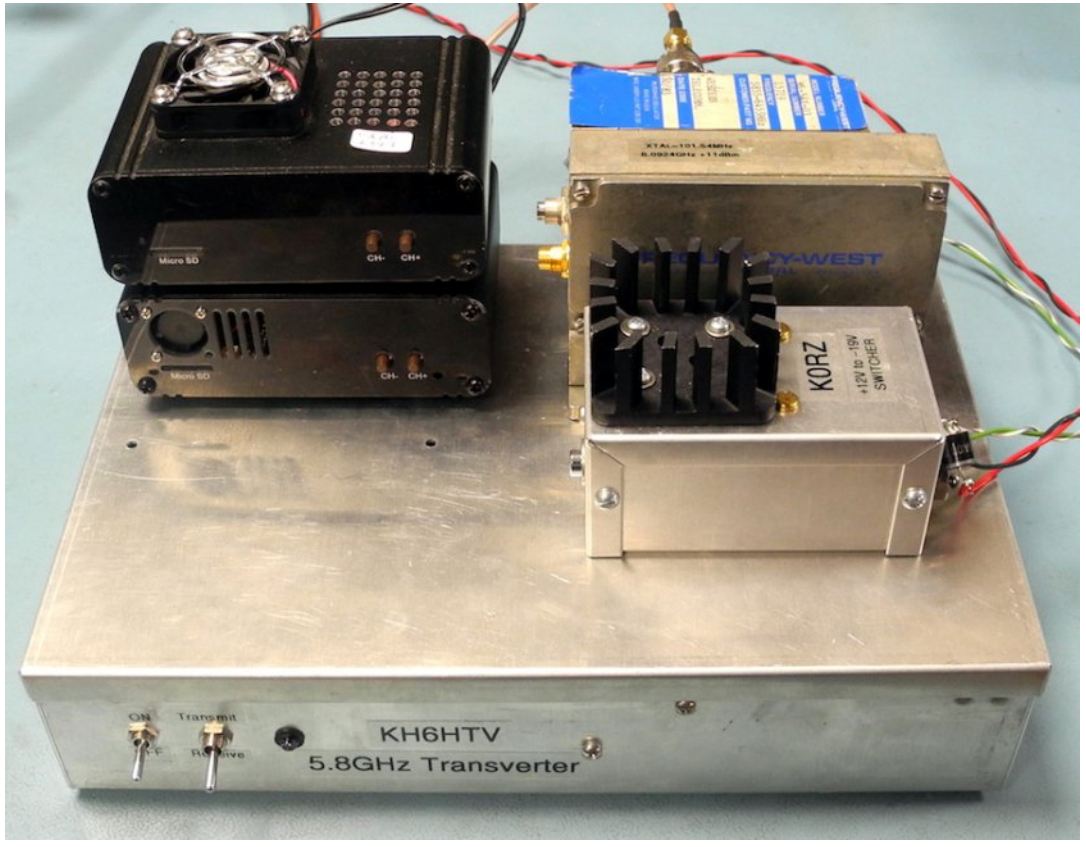


This is your free ATV magazine.
Please consider contributing an article!

5.8 GHz Transverter

Written by Jim Andrews, KH6HTV

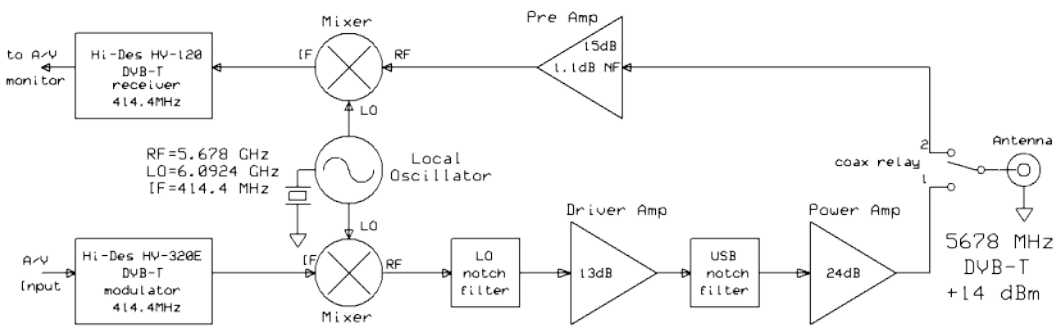
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER March, 2020



Back in August, shortly after my ATV Repeater article appeared in QST, I got an e-mail from Fumio, KA0RUZ, in Japan. He described their microwave DX-preditions where they achieved a distance of 287 km on 5 GHz using the Japanese equivalent of DVB-T (ISDB-T). Fumio also included a link to You Tube to see them in action on 5 GHz. This immediately triggered an interest here in Boulder among several ATVers to get busy pushing DVB-T to the higher microwave bands, beyond 23 cm. See the Sept. newsletters, issue # 19 & 20, Oct. #22.

Don, N0YE, had previously built over the years, several home-brew, 10 GHz, SSB rigs. He loaned these out for some initial 10 GHz, DVB-T, outings this past fall.

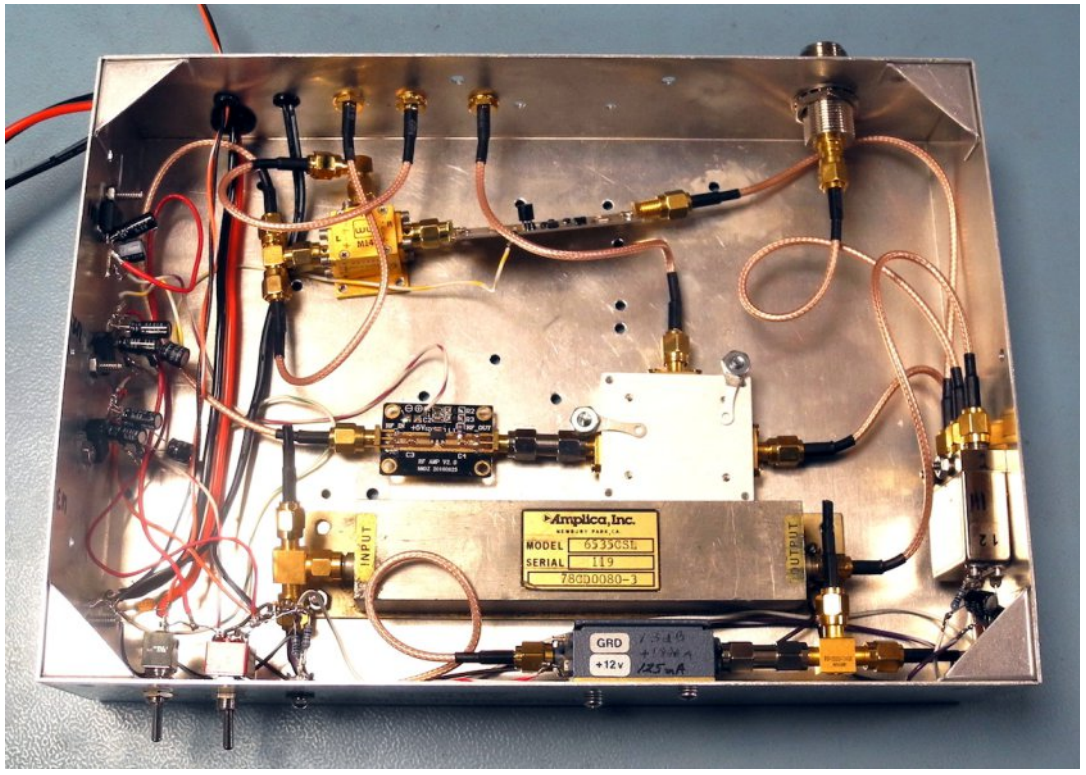
I got interested in what I might be able to throw together for a microwave DTV rig. My junk box is pretty sparse for 10 GHz stuff, but I did have an assortment of misc. C band (4-8 GHz) components. So, I decided to try to build a 5.8 GHz transverter for DTV. My initial plan was was to use my Hi-Des HV-320E modulator and HV-120 receiver as the IF transceiver and to use the new Analog Devices microwave frequency synthesizers as my LO for up/down converting. I discussed these AD synthesizers in the October newsletter, # 21. I took the old 2.4 GHz transverter I had built a couple of years ago and gutted it for parts and rebuilt it for 5.8 GHz service. This past fall, then Don, N0YE, and I took to the field to test it out. Don set up his rig on Flagstaff Mtn. and I set up mine in my back yard where I had a direct line-of-sight path to Flagstaff. Don immediately reported seeing my DVB-T signal.



Then he proceeded to transmit to me. NOTHING ! We were both running similar rf power levels and similar antennas, but I was not able to see anything. Bummer ! – Back to the lab.

The project then ended up on the back burner for awhile as I worked on other projects. I intermittently went back to it trying different combinations of IF frequencies, different local oscillators, mixers, etc. I concentrated on the 5.8 GHz receiver sensitivity. What I discovered was very "eye-opening". After many false starts, I realized that a major issue was poor phase noise in the Analog Devices frequency synthesizers. While they worked fine for receiving high level DVB-T signals, when one really got down to the -80 -90dBm range, NO Picture ! The poor phase noise destroyed the signal to noise ratio. Another eye opener was the discovery that some diode mixers also were crummy performers for really weak signals.

So after many hours (really days & weeks) of trying various combinations, I finally hit upon a workable solution. It is shown in the above block diagram and also the detailed schematic on a following page. I scrapped out the idea of using the Analog Devices synthesizers. I am now using a low noise, Frequency West brick oscillator as my LO (see Oct. newsletter #23). Because it was a gift from Don, N0YE, there was no choice of the LO frequency. I had to take what I was given. The LO crystaled to work on 6.0924 GHz. Thus to operate on 5.678 GHz, my IF frequency had to be 414.4 MHz.



For my receiver, I found an old Watkins-Johnson mixer from my junk box worked well. I used a Down-East Microwave, model L5ULNA, as my pre-amplifier. Testing it on an HP noise figure meter, I found the DEM-LNA had 15dB of gain and a 1.1dB noise figure. With this receiver, if I only used the W-J mixer, the DVB-T sensitivity was -92dBm. Adding the LNA, the sensitivity was improved to -96dBm.

For the transmitter chain, I used the new HMC219N mixer from China. It was a very poor performer for a receiving mixer, so I used it instead in the transmitter chain. The amplifiers used in the transmitter chain were from my microwave junk box. The driver was an Avantec AMT-8052. The final amp was an Amplica 6535CSL. Using a mixer one gets as the output, the desired sideband, in this case the lower sideband, plus the undesired upper sideband and also some leakage of the LO frequency. I thus needed to filter out the LO and USB.

I accomplished this using a pair of simple tee notch filters. They were SMA tees with a short piece of open-circuited, RG-174 coax cable on the third arm. I used my Wiltron network analyser to fine tune these filters. I made the coax initially too long and then using wire cutters to carefully trim the coax length to put the notches on the desired frequencies. The notches were about -26 to -28dB in depth and I had less than 1dB loss at the transmitter frequency of 5678 MHz.
An SMA coax relay (again from the junk box) was used as the antenna switch. I controlled the timing of the turn on / turn off of the various amplifiers to avoid transmitting back into the receiver. I used LM2941 low drop-out voltage regulators. I added an R-C circuit to the enable pin on these regulators to slow their turn-on.

In operation, I leave the Hi-Des receiver powered up all the time. I only power up the Hi-Des modulator when I want to transmit. There is sufficient rf leakage to the receiver when transmitting that I am able to use the receiver to monitor the transmitted video.

So, how well does it work? The transmitter is definitely NOT high power. It is a milli-QRP rig. For DVB-T, with the modulator's rf drive power adjusted so the spectrum skirts break-points are set to -30dB, the output power is a whopping +14 dBm ! The max. saturated output from the Amplica amplifier is +25dBm. The receiver is quite good (finally !) with a sensitivity of -96dBm when tested with "Normal" digital parameters (1080P, 5/6 FEC, etc.). The final acid test was to go out in the field and exchanging pictures with Don, N0YE. The following photos are proof that it really works !

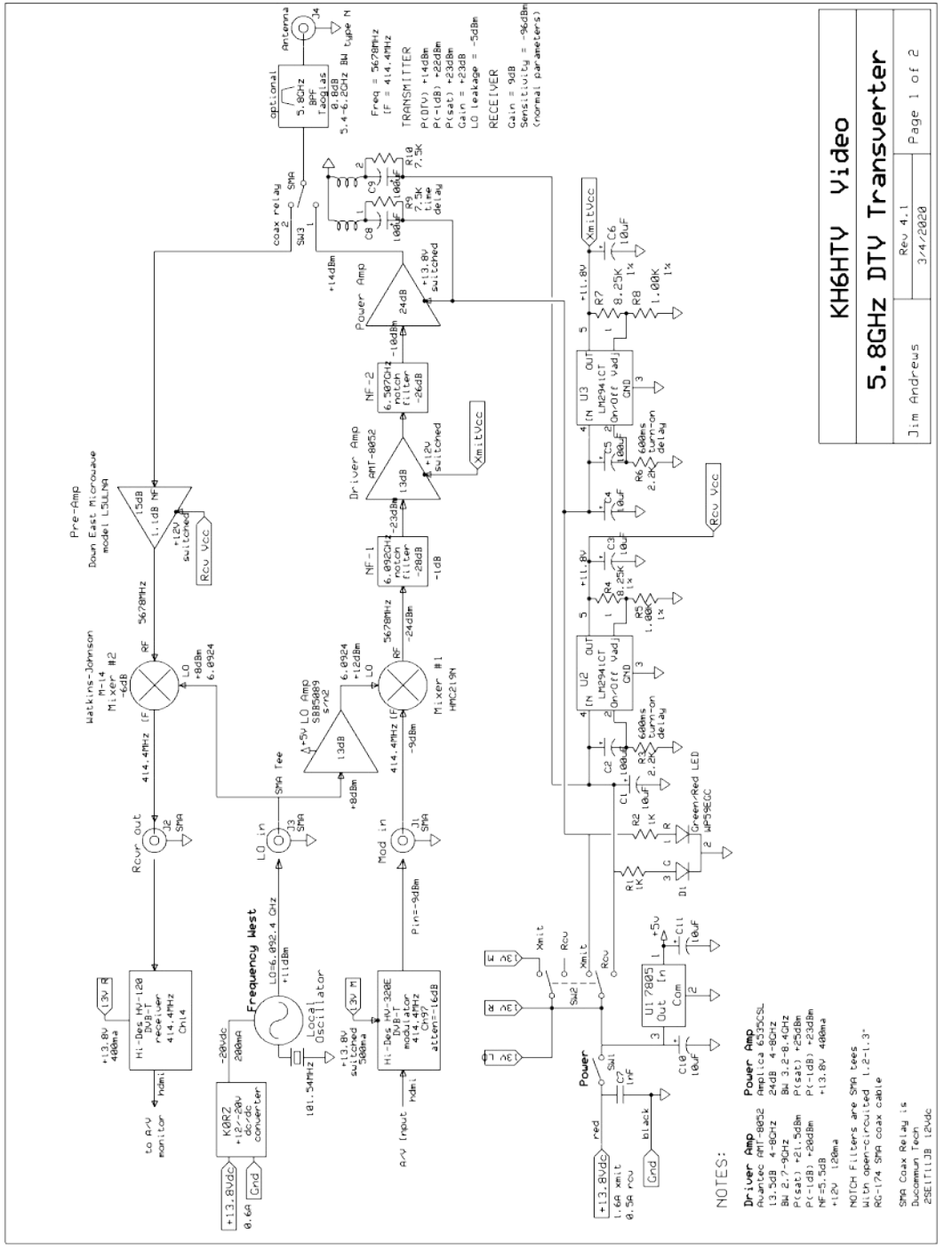
I set up my rig at the Boulder 911/EOC near the Boulder airport looking south toward's N0YE's QTH. Don lives on a high ridge line on the south side of town. We have a good line-of-sight path between the two locations. The path distance was 7.4 km. We both used +23dBi dish antennas.

Don was transmitting +10dBm with -4dB coax cable loss. I was transmitting +14dBm with 0.3dB cable loss. I was able to receive Don's picture, as shown in the photo.

The received power was measured to be -83dBm with a s/n of 14dB. Radio Mobile computer program predicted that I would get -79dBm from Don.

Don was not so lucky. He did not receive my signal. Don said he was having issues with his HV-110 receiver locking up. His receiver stopped receiving even his own transmitted signal a few minutes before I started transmitting to him. Re-booting several times didn't solve the problem until much later back in the ham shack on the work bench.

Whew ! – you know this microwave DVB-T stuff was a lot more work and required an awful lot more parts than doing this with the el-cheapo 5.8 GHz, FM-TV gear ! ! !



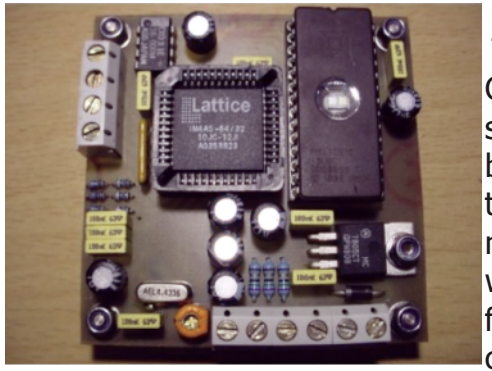
Simple Video Testcard

Written by John Hudson, G3RFL

The station test card

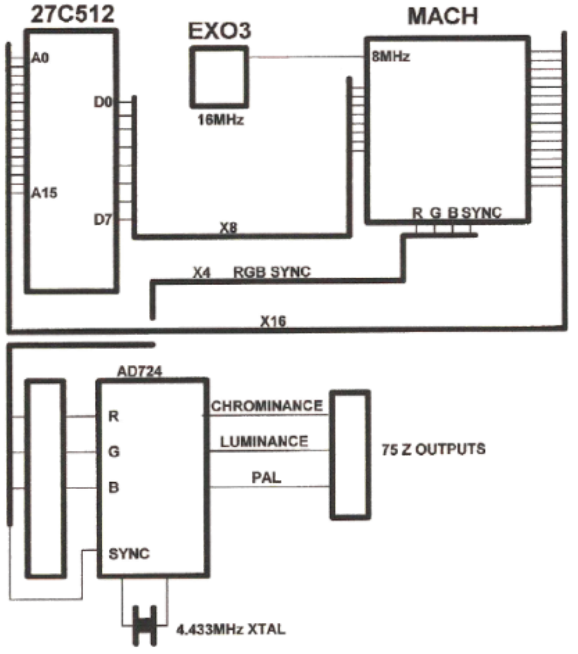
I often have a requirement for a simple video pattern generator and for a long time I used my old favourite, my electronic test card that used a MACH or Lattice field programmable array. It originally appeared in CQ-DATV 8.

It used two programmed chips the MACH and a 27C512 EPROM. The logic was programmed into the 44 pin MACH. This was shown has a block diagram rather than the more conventional circuit diagram which would show all the TTL gates of the array. This had several counters such as Pixel, Character Column, Sub Character, Line and Character Row. The main clock was at 8MHz and was sub divided down to 4, 2 and 1 MHz the next section was the EPROM multiplexer unit having a latch and 11 x 4 multiplexer that controlled the Column, Line, Row Character and Palette. Also, in the MACH was the bit pattern generator that had an 8 x 2 multiplexer, 4 D type latches a further 8-way multiplexer and a 250 nano second digital delay line.



The final module assembled and tested, the AD724 PAL coder is on the underside

The final part of the MACH was a Colour/ Control latch which switched between the background/Foreground Palettes, this had another 6 x 2-way multiplexer and 6 D type latches with extra logic for control, plus field reset with interlace. Then we come to the video output stage buffering the RGB and supplying a Teletext input if required. There was also page selector for stepping through the pre-set test cards on an external push button. The RGB and sync signals fed a modern AD724 surface mount RGB to PAL encoder mounted under the PCB.

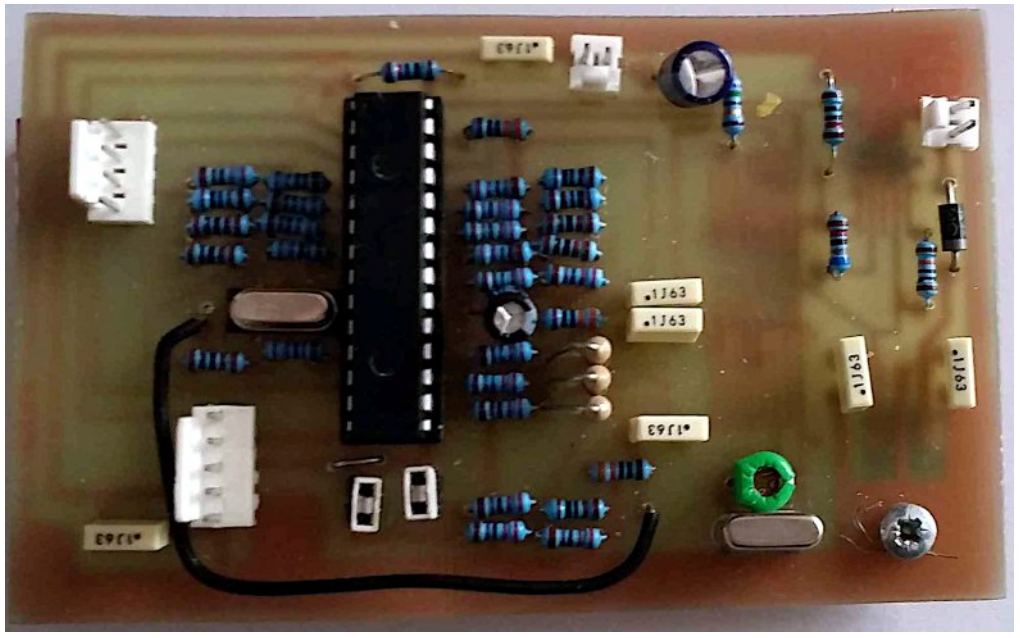


The problem was It was not easy to programme the MACH and the EPROM. I made many of these units and the programming alone took about 2 hours.

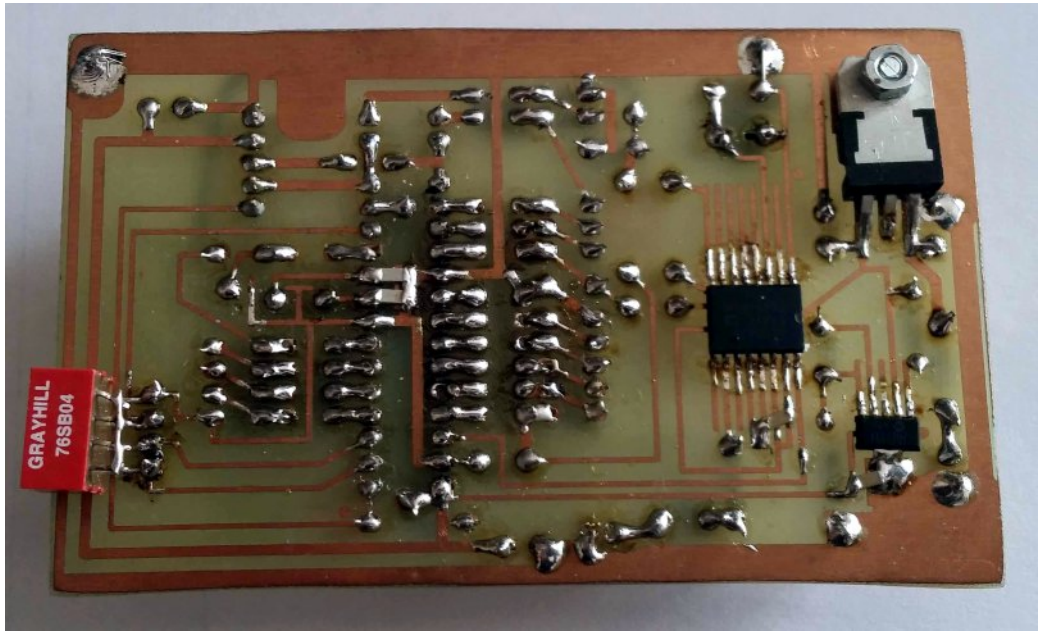
This unit now getting a little dated and at least one of the chips (EXO3) has become obsolete. I thought it might be time to go back to the drawing board and come up with a new design. I settled for a PIC design, yes it would mean writing some fresh code, but into everyone's life a little rain must fall.

The new unit still uses the same PAL/NTSC coder, the AD724 as this produces some pleasing results, is not too expensive and still available from several sources although now the broadcasters have gone wide screen PAL is technically obsolete, but many of us still live in the world of yellow, red and white phono plugs, but it might be time to stock pile some of the coder chips, before they also start to disappear.

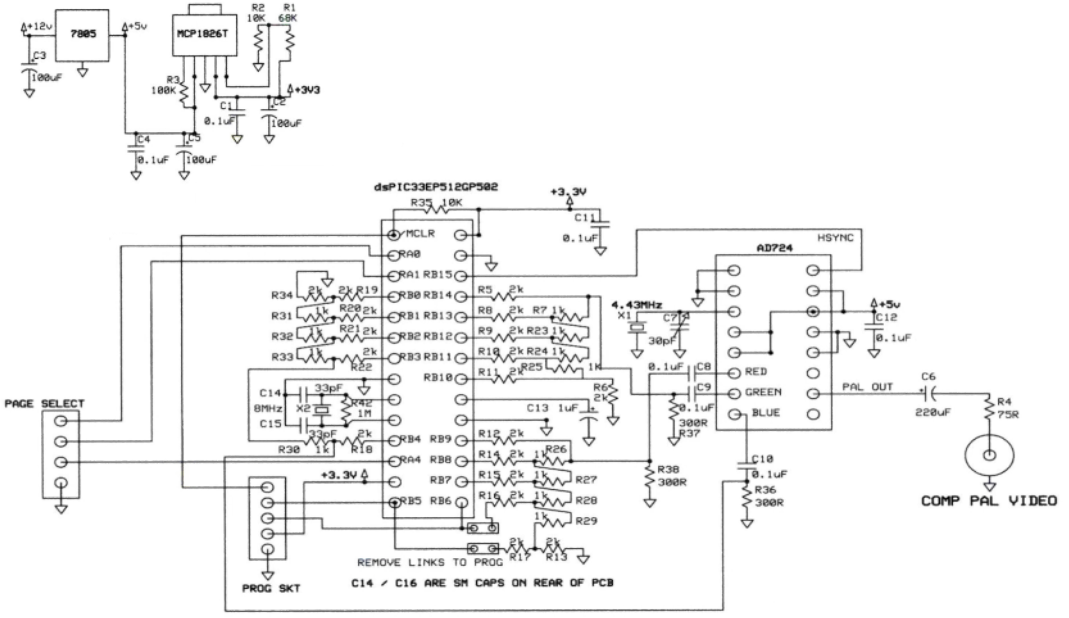
I think the AD724 is my preferred choice for all future PAL/NTSC projects. I also like the ability to use subcarrier xtals or 4 times subcarrier xtals by changing the logic level on pin 12. I have both in my junk box.



The new design is at present on a home etched PCB



Some of the components are also mounted on the underside



In the new design the PIC is the only custom programmed chip, while in the old design I had to programme individual details into an EPROM and batch programme the MACH chips which thankfully were all the same.

The new testcard is easier to programme than the old one, I have developed software which will take a Jpeg file and convert it to PIC code, which can then be programmed into the unit. The new generator also produces a VITS (Vertical Interval Test Signal) on lines 17,18,330,331. The results are very encouraging, with an enlarged colour pallet, which is composed of 5 bit red, 5 bit blue and 5 bit green, or 32 levels or shades of all three primary colours if you prefer to look at it that way. So, 32 x 32 x 32 = 32,768 colours if I have done my sums correct.

This is considerably more than the old Testcard Generator, so how does it look, if you programme it with a picture, the answer is remarkably good, no sign of digital puddling and it really pushes the AD724 with the enlarged colour pallet which was not produced by the previous design.

Jpeg picture stored in the PIC of a group of family friends

I have put a hex file (PIC_TCG5. hex) on the CQ-DATV site that will allow you to programme the PIC with this same picture and I will make available the programme to convert your own pictures into PIC code, it is at the moment being revised to include some additional features, but in the meantime you can test your hardware.

The output is 625 line and the PAL coder which is PAL/NTSC is hard wired into PAL by the grounding of pin 1.

The data sheet also insists on C6 to block the DC, which is a pity, but I suspect it's a casualty of single rail working.

I am hoping that this design will work with the Test Card Maker software from the previous issue of CQ-DATV so that you can design your own testcard and then convert your design into PIC code and programme it into the new unit. A pity the Test Card Maker seems to have disappeared or I would be onto the author to add a menu choice to export a design to G3RFL format file. Ian has put the programme on the CQ-DATV download site, so all is not lost, just it is frozen to future enhancements without the source code.

This is a giant leap for me as I dread to think of the number of hours I spent working out QTH details and converting them to hex to programme the old design and that is excluding the large callsign letters at the top of the old testcard.

My thanks to Dave G3ZGZ for all his work with the pictures, time to build a new Testcard Generator Dave and I won't need to programme it for you (once I get the Jpeg converter software running).

The full AD 724 data sheet can be found at *https://www.analog.com/media/en/technical-documentation/data-sheets/AD724.pdf*

Micro Corner - ESP8266 Based ASCII Speech Module

Written by Mike Stevens G7GTN

For some of our television shack projects a requirement might be that of having some speech output available.

Back in 1981 we had devices such as the SPO256AL2 speech allophone processor from General Instruments. This was a fully custom device that had the data loaded in a parallel fashion. The speech phrases are made up in segments called "allophones" to create words that we might understand.

The quality of output was always a little dubious. So we had a good measure of tweaking and adding in little delays in our built up strings. I still have an original SPO256AL2 chip alongside two other custom chips stored in my secure vault.

Instead of making use of this device and the requirement of using all I/O pins on available micro controllers I did some searching to see what other options existed in this Century. I found that the author of Annex RDS Basic also created a custom project called "SAM SPEAKER" that allows text to be spoken via 115200 baud rate pure ASCII serial. That seemed like a good idea to escape now quite rare speech devices where the possibility of buying fakes will be higher than back when these were actually available and under manufacture.

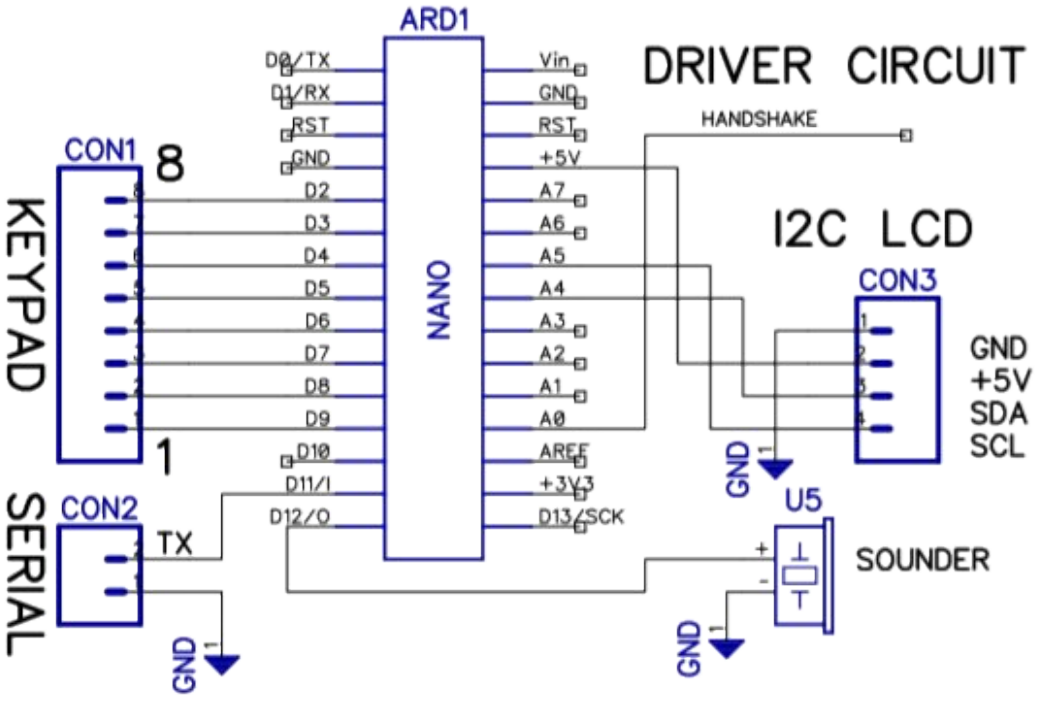
Enter SAM Speech

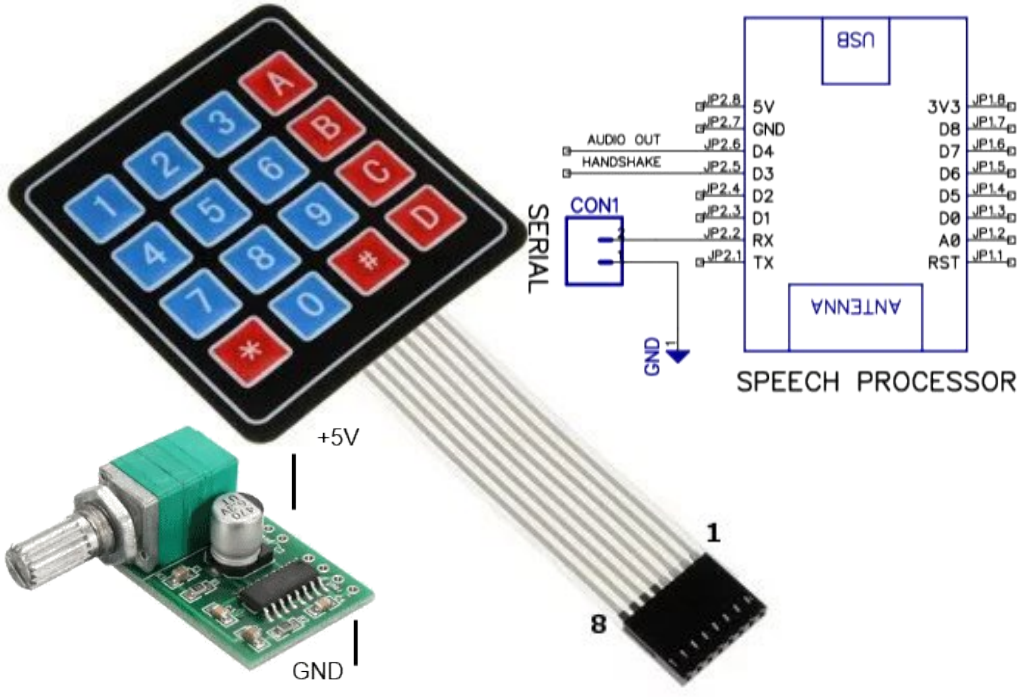
Software Automatic Mouth shortened to SAM was originally developed to run on the Commodore 64 computer and is a fully software implemented algorithm requiring no additional hardware for speech generation.

VOWELS		VOICED CONSONANTS	
IY	f(ee)t	R	red
IH	p(i)n	L	allow
EH	beg	W	away
AE	Sam	W	whale
AA	pot	Y	you
AH	b(u)dget	M	Sam
AO	t(al)k	N	man
OH	cone	NX	so(ng)
UH	book	B	bad
UX	l(oo)t	D	dog
ER	bird	G	again
AX	gall(o)n	J	judge
IX	dig(i)t	Z	zoo
		ZH	plea(s)ure
DIPHTHONGS		V	seven
EY	m(a)de	DH	(th)en
AY	h(igh)		
OY	boy		
AW	h(ow)	UNVOICED CONSONANTS	
OW	slow	S	Sam
UW	crew	Sh	fish
		F	fish
		TH	thin
SPECIAL PHONEMES		P	poke
UL	sett(le) (=AXL)	T	talk
UM	astron(omy) (=AXM)	K	cake

Hardware

The main speech module requires an ESP8266 module that is loaded with the custom speech firmware. I used a wemos D1 mini alongside a PAM8306 amplifier module as the custom speech module. Using my keypad project as a simple test driver to send the custom text as serial data the hardware ended up as being simple to implement.





Basic Control Software

Using the free Basic for Ardunio a software serial port on Digital I/O pin 11 was implemented to run at 115200 and simple text strings sent with the following command format on a keypad button press.

```
87  Sub getKey (Key As String)
88      If Key = "1" Then
89          Log("1")
90          lcd.SetCursor(0,1)
91          lcd.Write("Speech for 1    ")
92          astream.Write("SPEECH ONE")
```

A handshake signal is available on the speech processor GPIO0 (D3) that is logic HIGH when the module is waiting for data and goes LOW when the speech is being processed or spoken. The analog A0 pin is monitored for this logic level change and used to indicate the status on the first line (position 15) of the LCD. Use is made of an internal resistor to always pull this pin high.

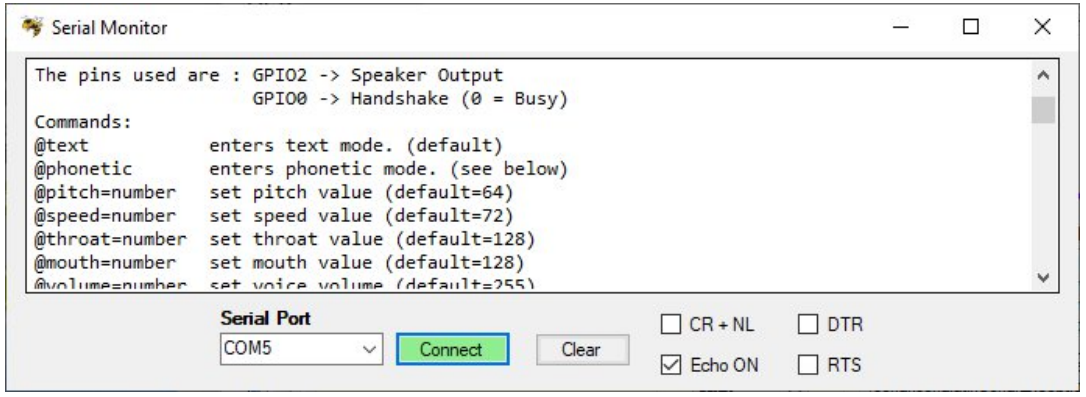
As long as your projects processor is able to send data at the required baud rate then the control could not be much simpler.

```
'|============================================================
'| I/O A0 Handshake Ready for Speech?
'| Using Internal Pullup Resistor
'|============================================================
Sub Handshakepin_StateChanged (State As Boolean)
    Log("Handshake State: ", State)
    If State = True Then            ' Pin High = Ready
        lcd.SetCursor(15,0)
        lcd.Write("R")
    Else If State = False Then      ' Pin Low = Busy
        lcd.SetCursor(15,0)
        lcd.Write("B")
    End If
End Sub
```

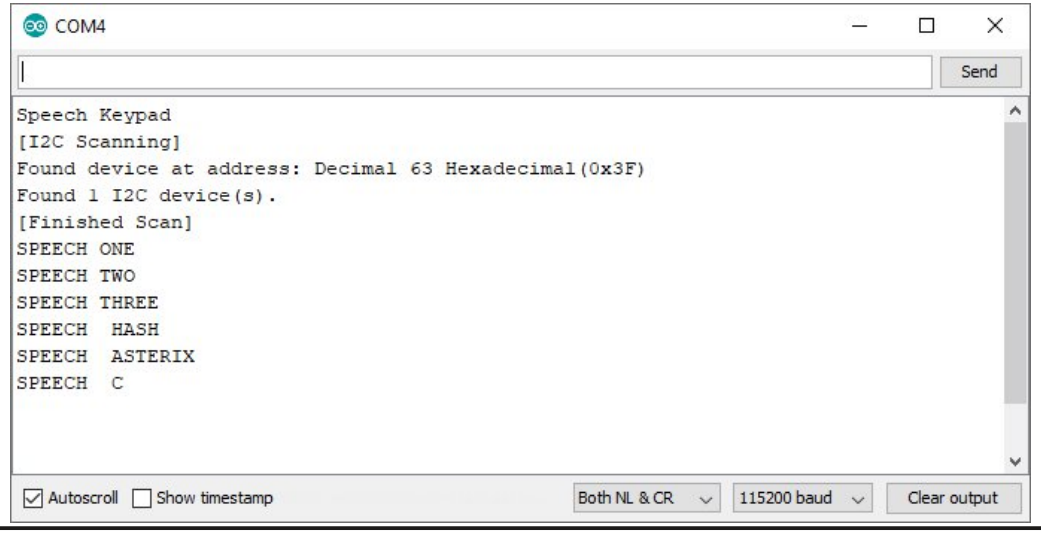
Follow the link to obtain the custom ESP8266 firmware and following the instructions to install this on to your chosen module. Since we cannot make use of any additional I/O pins on the ESP8266 using a WeMos D1 Mini made sense as a quite compact dedicated platform.

Options and quick testing

With the ESP8266 module flashed and connected a terminal set to 115200 can be used to look at available options and also to send text for testing purposes.



I have also created the exact same project in Ardunio C++ if you prefer this software IDE and programming language.



They both make use of a Software Serial library that allows the use of a different custom set of I/O pins to send our defined messages. Both are available from a single ZIP file called SPEECH from the download page.
image

Conclusion

We still have very 1980's robotic style speech and so this might fit in more with personal shack projects where the speech is not actually put on air with repeaters for example. Using MP3 style SD based modules would of course provide a better option in that use case. You can check out the quality of the generated speech *https://simulationcorner.net/index.php?page=sam* before you decide whether to flash an ESP8266 Module. You can also easily experiment by sending data using your favourite terminal software via the USB Connection. An added bonus which has not been covered here is the ability to also control the speech processor via a network connection.
The cost of parts should be under £5.00 if you use suppliers such as eBay or similar sources.

References

https://sites.google.com/site/annexwifi/projects/sam-speaker-network

https://simulationcorner.net/index.php?page=sam

https://www.smbaker.com/counterfeitfakejustplainbad-sp0256a-al2-chips

https://en.wikipedia.org/wiki/General_Instrument

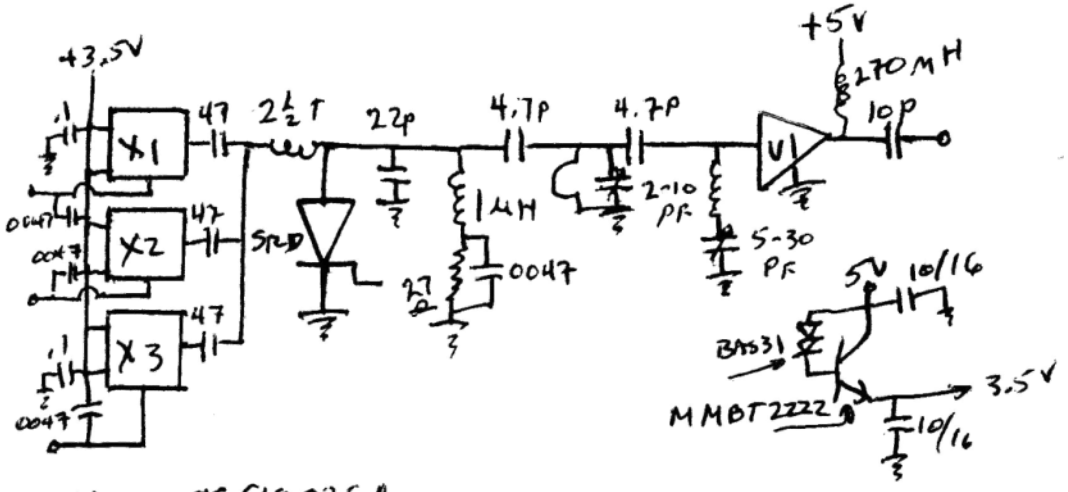
https://www.b4x.com/b4r.html

Epson Programmable Oscillators

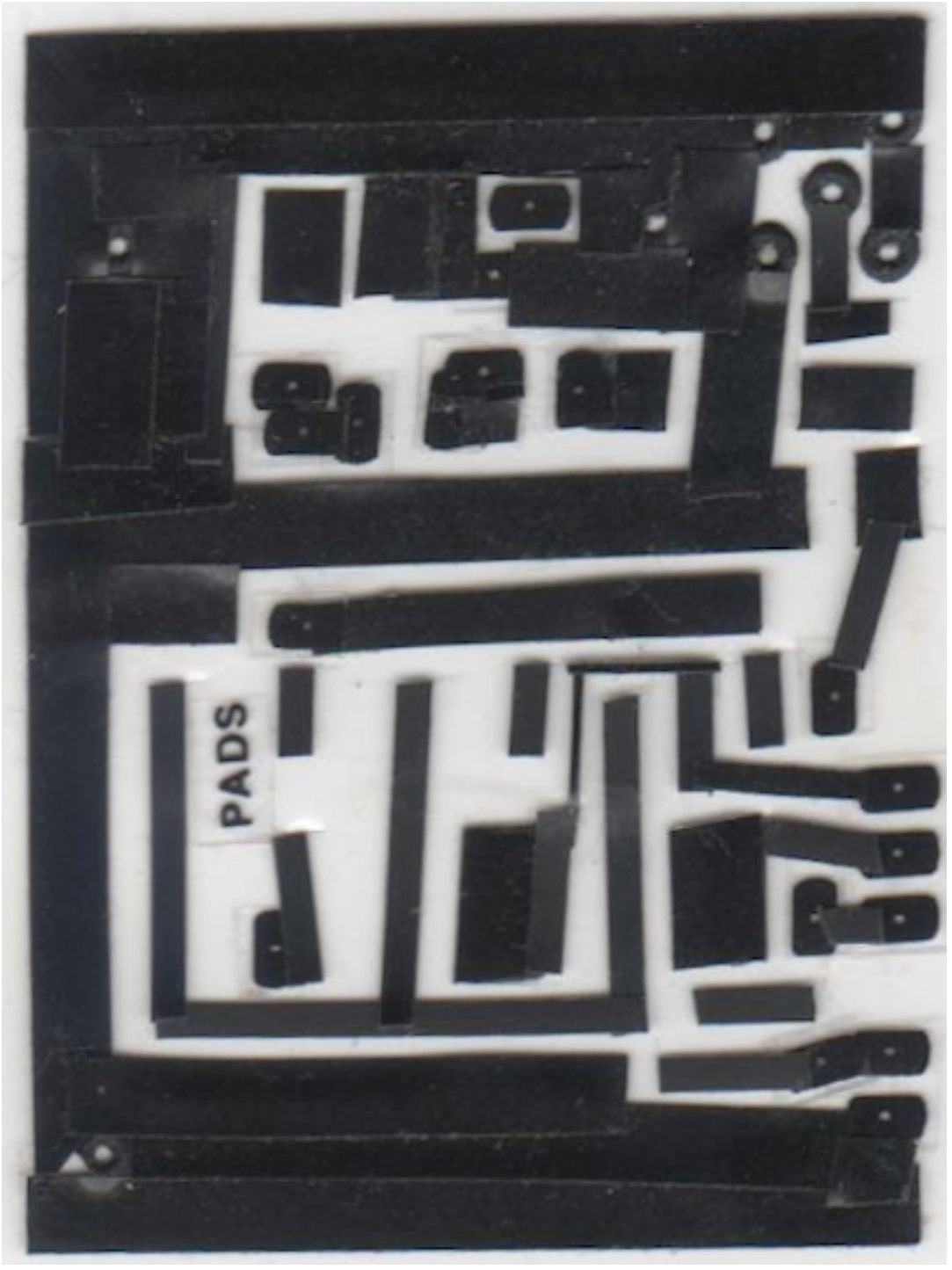
Written by John Gebuhr, WB0CMC

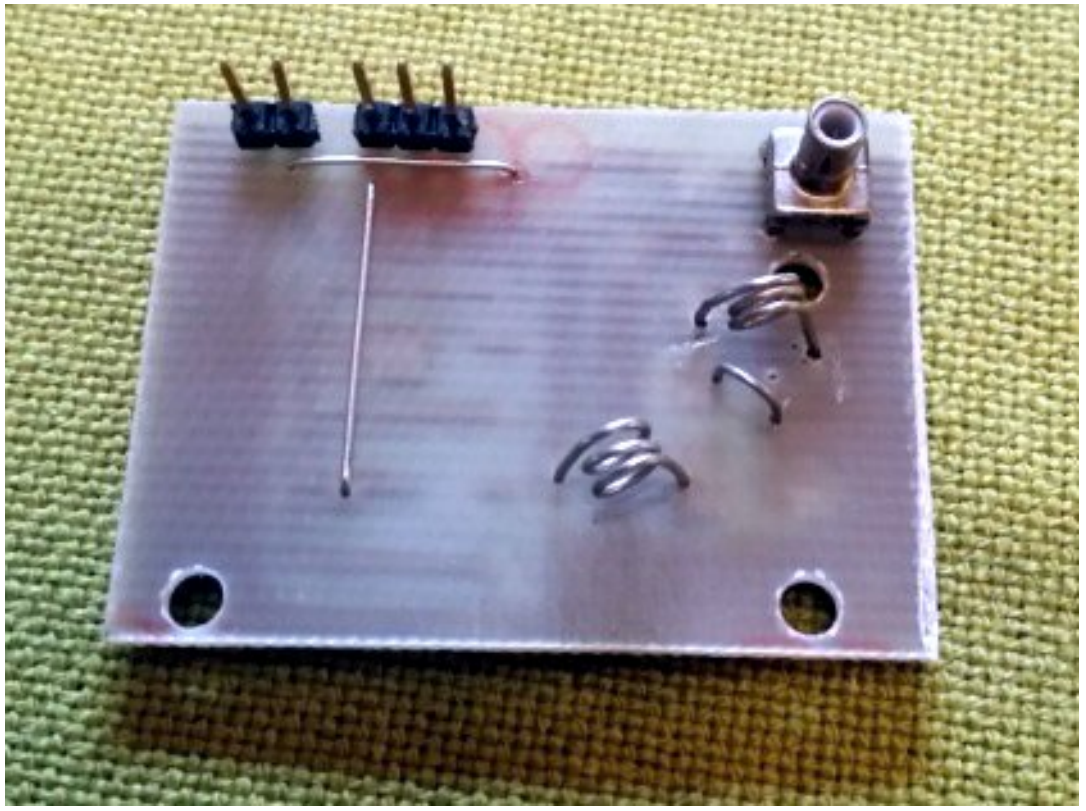
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER *www.kh6htv.com*

After seeing the article on the Epson programmable crystal oscillators I did some checking to see if they would work to multi-channel my new ATV transmitters. They don't at the 27 MHz range the exciter uses. Too many artifacts that confuse the PLL in the chip I'm using in it. After some experimenting I found it takes a fairly pure signal to make it work right. My sig-gen will drive it and works over the entire ATV portion of the band. I then tried some at the 100 MHz range and tried quadrupling them and driving the amp/modulator directly. Here is the result using 3 of the most common frequencies. A three channel frequency quadrupler using a step recovery diode and a buffer amp. Circuit below.

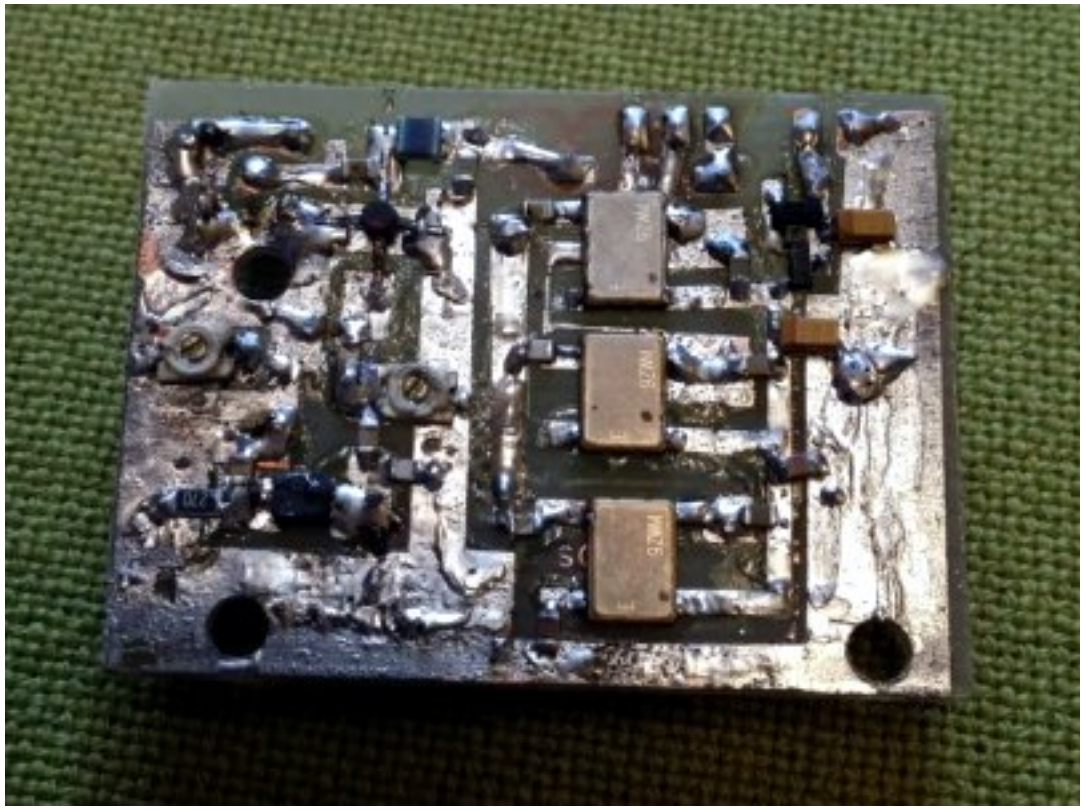


X1-3 SG 8002CA
SRD MAVR-044769-12790T
U1 MAR 2





Top of board showing the 3 RF inductors



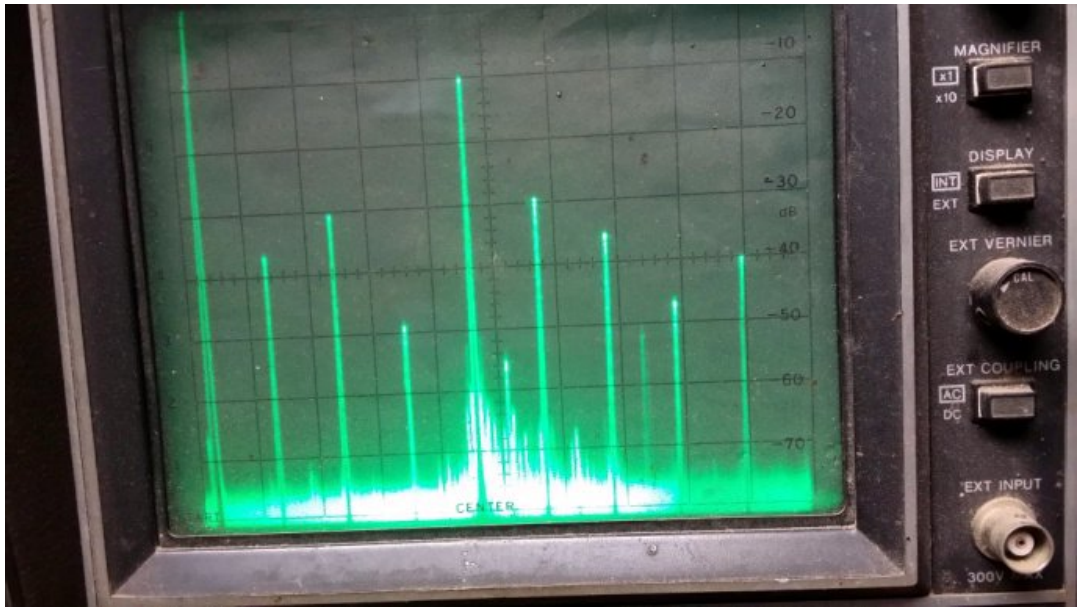
Foil & component side with the 3 Epson chips

The 2 pins are ground and +5V, the 3 are channel select and the SMB is output of about +8dBm. Swaged stand-offs not yet installed. Connected to the amplifier in the transmitter I noted that the power dropped slightly from 439.25 to 421 25 by about a watt, probably due to the pass band of the amp. It is specified from 440-470 MHz so not surprising. The pedestal level also changed somewhat but video didn't change noticeably.

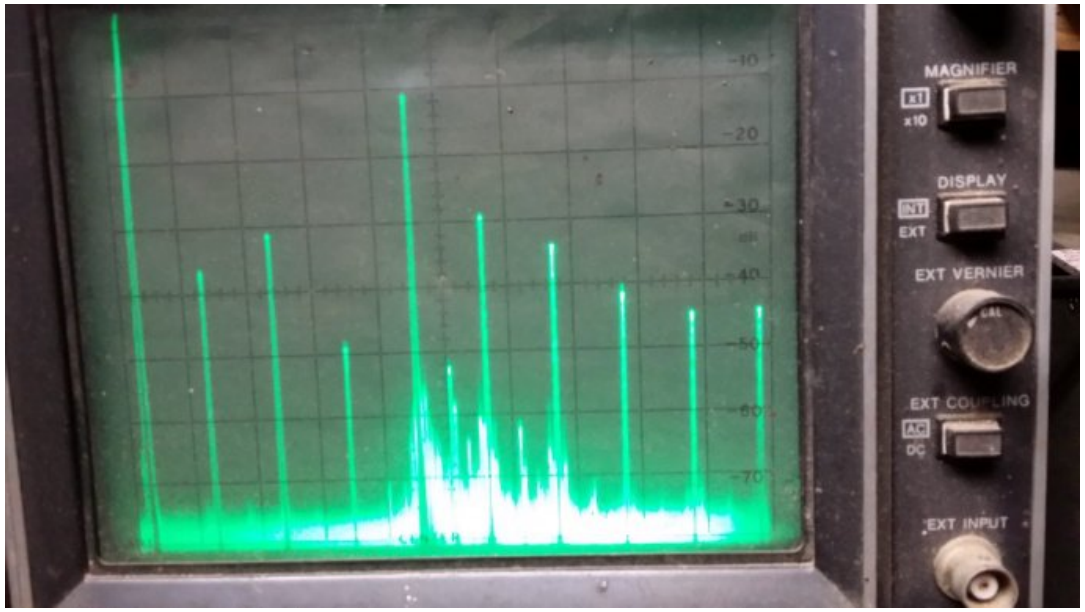
The series L-C on the input of U1 is 3rd harmonic trap. The hairpin and trimmer cap is the pass band tuning. It will tune the 5th harmonic @ 530 MHz or so but at 430 the 5th is about -20 dBc. Other harmonics are even lower. With no tuning the harmonics are significant to at least 1.5 GHz. Nice comb generator, huh?

The harmonics don't make it through the transmitter nor do the subs and fundamental. A second hair pin and 2-10 pf cap can be added right at the output for more attenuation of other than the desired 4th harmonic. All top inductors are #22AWG on 1/8 inch diameter air core. The highest harmonic other than shown below is the 14th @ about -30dBc. I think with some retuning modifications it should work fine for a 1.2GHz source. Likewise on 902-928.

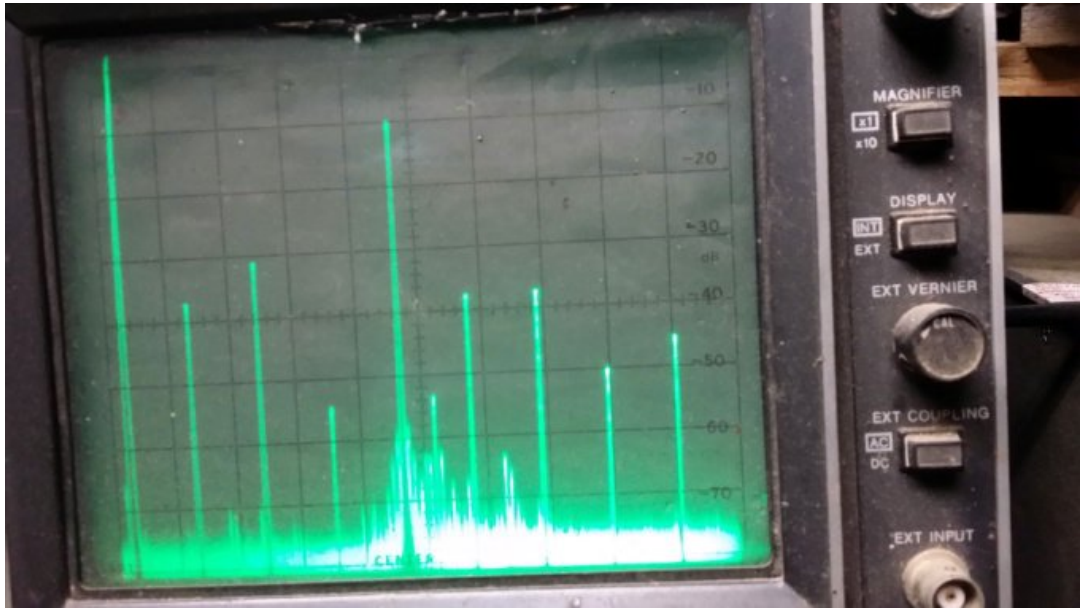
X1-3 are available from Digikey and are ordered to frequency. 421.25= 105.3125. 427.25= 106.8125, 434= 108.5 and 439.25=109.8125.
The 2 trimmer caps I got from Mouser: P# 768-JZ300, 5-30pf & 768-JZ100. 2-10 pf. The step recovery diode is also from Mouser: P# 937-MAVR-O44769-12790T.



0 - 1GHz with 434 near center



427.25 near center



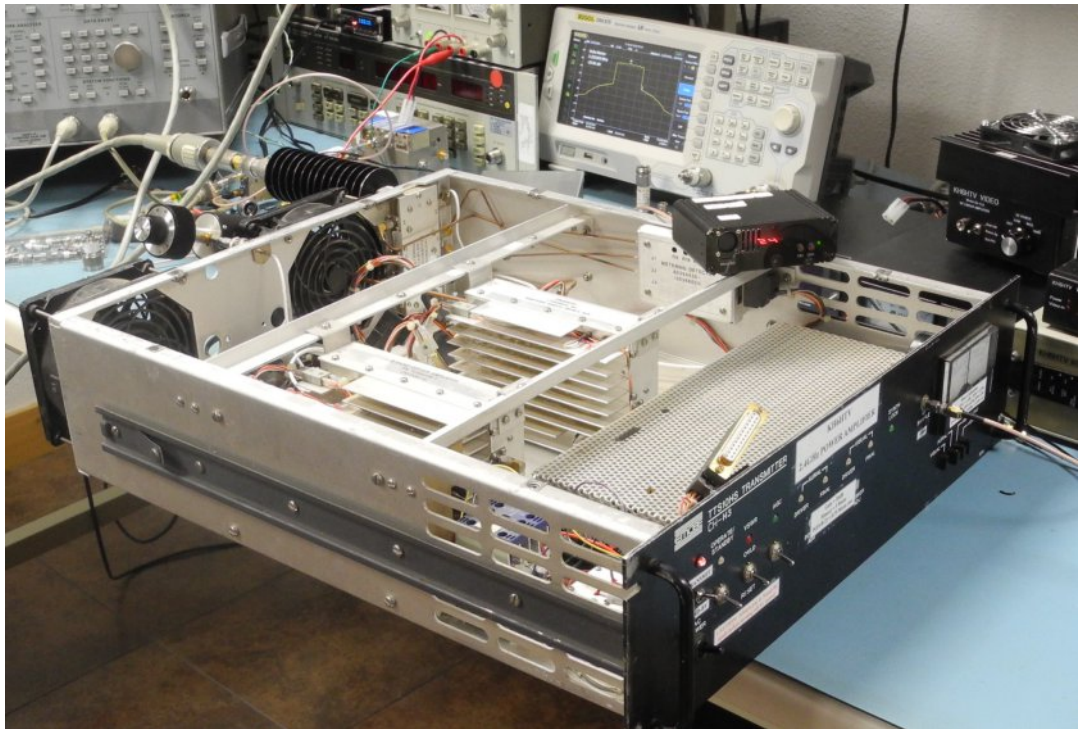
0 - 1GHz with 439.25 near center

Since its original publication, John says, I discovered to late for the article that the bypass for the 3 oscillators is recommended to be .1mfd. I used .0047 which at 100 MHz should be fine. I swapped them out today and the .1s did improve the noise floor by about 5 or 6 dB. Don't know how I missed that but I did. I don't think it's a big deal but worth mentioning.

2 Watt 2.4 GHz DVB-T Transmitter

Written by Jim Andrews, KH6HTV

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

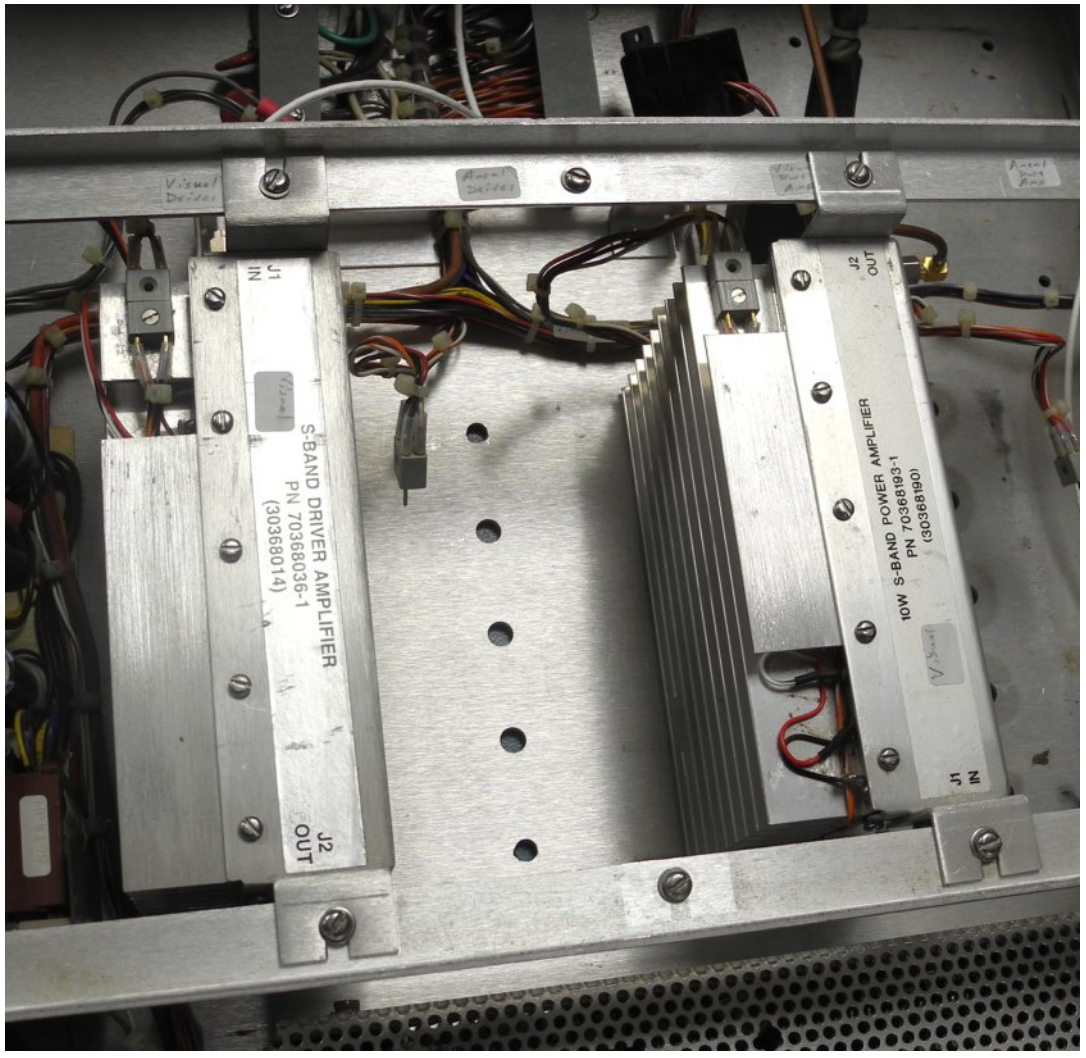


Transmitter - after "Gutting"

Several years ago, Bill, K0RZ, gave me a surplus ShowTime MDDS, analog TV transmitter. It was used on the commercial MDDS, 2.5-2.7 GHz band. It was built by EMCEE and was their model TTS10HS and labelled to work on channel H3. It was found to contain two identical transmitters, one Visual and the other Aural. Each transmitter was rated for 10 watts. It was a BIG Beast with two very noisy cooling fans. I didn't know what to do with it for a long time, so it sat gathering dust on a shelf in my garage for an extended period of time.

When I eventually became interested in trying out the 2.4 GHz ham band for DVB-T, I decided to see what I could do with this transmitter. Opening the box, I found a whole lot of stuff. Most of it was unusable for my purposes. So, I proceeded to gut out most of it. Included was pulling out the second, Aural transmitter, which I then gave to Don, N0YE. All that was left was the one driver amplifier, the final 10 watt amplifier, the metering circuits, and the necessary, big, heavy, linear dc power supplies and one very noisy cooling fan. It was still big, bulky and heavy. So would it work ? Read on.

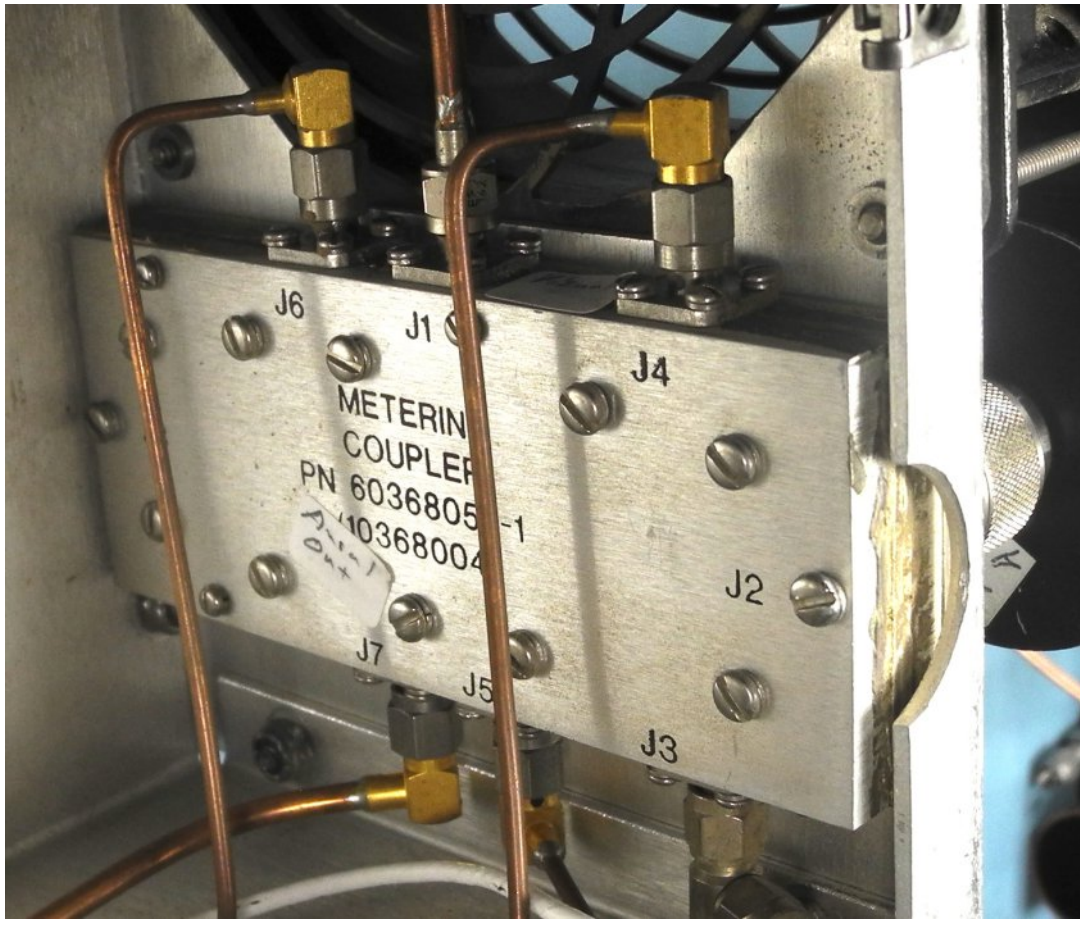
I have just completed some evaluation tests on the "Beast". I used a Hi-Des, model HV-320E, DVB-T modulator as my DTV signal source. I used 2393 MHz as the test frequency. To measure the output power, I used a Narda, 30dB, 50 W attenuator and my HP-432 power meter with an rms responding, HP thermistor head. To look at the output spectrum, I lashed together a down-converter consisting of a Vari-L, 3 GHz mixer, a frequency synthesized Local Oscillator set to 2.0GHz, +7dBm and the IF went to my Rigol DSA-815 spectrum analyser (0.1-1500MHz). Setting the Rigol to 393 MHz allowed me to thus look at the 2393 MHz spectrum.



Driver & 10 W Final Amplifier

All tests were at the desired 13cm operating frequency of 2393 MHz. I first ran a CW test of the power curve of the amplifier and found the small signal gain to be 57.5dB. The -1dB gain compression, Pout(-1dB) occurred at +38.5dBm = 7.1 Watts.

The max. saturated power output was +39.7dBm = 9.3 Watts. I then ran tests for digital TV. I used the HV-320E modulator.



Output Directional Coupler

It was set for "Normal", amateur digital parameters with 6 MHz BW, 1080P resolution, QPSK, 5/6 FEC, etc. I used a step attenuator on the output of the HV-320E to carefully set the input rf drive level. I monitored the resultant spectrum on the Rigol. I increased the rf drive upwards until the spectrum shoulder breakpoints (measured at ± 200 kHz beyond the band edges) hit -30dB. I then used the HP power meter to measured the output power. I found it to be +33 dBm = 2 Watts (rms). At this level, the front panel power meter indicated 50%. This amplifier will work well as a 2.4 GHz After-Burner and can be driven directly by the Hi-Des HV-320E modulator.

Front Panel Metering

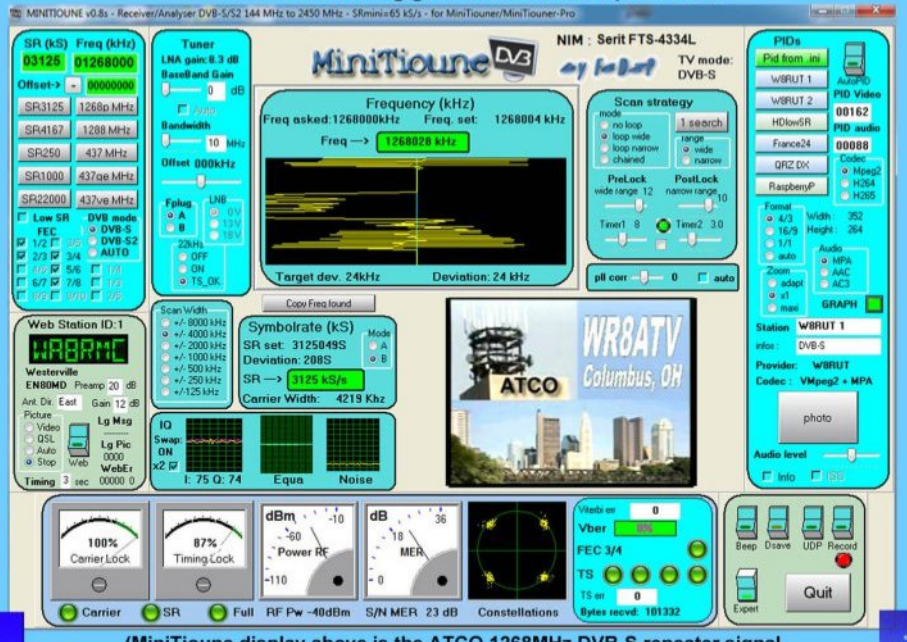
MiniTiouner-Express

Digital Amateur Television DVB-S/S2 Receiver / Analyzer

Available at DATV-Express.com

- Operates with Windows PC using free MiniTioune software from Jean-Pierre F6DZP
- Smaller than a stack of 2 decks of cards (picture above is full size)
- Two independent simultaneous RF inputs with internal preamps
- High sensitivity -100dBm @1288MHz – at 1/2 FEC
- Fully assembled/tested in aluminum enclosure
- Covers 144-2420MHz (ideal for Space Station DATV reception)
- Symbol rates from 75 KSymb/s to >20 MSymbols/sec
- Uses external 8-24VDC supply or +5V from USB-3 port (with small modification)
- Real time signal modulation constellation & dBm signal strength display
- Price: US $75 + shipping – order with PayPal

For details & ordering go to www.DATV-Express.com



(MiniTioune display above is the ATCO 1268MHz DVB-S repeater signal at WA8RMC QTH 15 miles away).

CQ-DATV
Also available to read on ISSUU
https://issuu.com/cq-datv/docs
FREE

Grass Valley Mixer Conversions - Part 15

Written by Trevor Brown, G8CJS

Recap

The Grass Valley mixer project revolves around three basic models the GVG100, GVG 110 and GVG 1000. The mixer appeared in the 80's and consists of two parts, a crate which is available in two options, component and composite (various standards PAL and NTSC included). Both crates and all three panels are interchangeable, unless you know differently.

The crates are all a little dated in that they will only mix synchronous sources, the control panels are connected to the crate by a 15-way lead using D connectors. The two D connectors are connected one to one, thanks Heiner Juers for that information.

The mixer was designed so that it could be run by pushing buttons on the panel as you would expect, or by a RS 422 link for remote operation, eg an edit controller. This was a 9-pin interface that was very popular at the time and allowed other kit to be interconnected eg RS 422 sound mixers. The protocol for this is often called P2 or Sony protocol.

In this series of articles, we have discarded the crate and concentrated on the panel alone. Powered it with +14 and +10 from an external power source, removed the internal microprocessor and fitted a dongle in its place. The dongle is based on an ESP micro with the addition of 5 external 8-bit ports (PCF 8574). The port chips are I2c controlled and are interfaced to the lamps, buttons T-Bar and analogue pots.

I have written a script in Annex BASIC that has enabled me to map out the addresses of the lamp's buttons and pots. The script requires the ESP to be flashed with the BASIC interpreter, there is a lot of help available on the Annex site. The buttons now control all the lamps without the crate, so we have a standalone panel. The software is on the CQ-DATV download site.

Vmix

The next stage is to connect this panel up to Vmix which is a software package that will run on a PC and allows mixing of non-synchronous sources. Vmix far outshines the original GVG crate with digital moves, electronic captions and the ability to manage clips as VT inserts, providing they are on the hard drive of the PC. The only downside is that conventional external cameras need an interface or capture cards to interface to the host PC. Webcams can be brought up as vision sources. Vmix software is not free, but there is a free demo version which controls a limited number of sources.

There are paid versions that enable more sources and there is a 60-day option that enables the full version of the software to be evaluated.

Vmix control screen

I have downloaded the 60-day full package and looked at externally controlling this software, with the GVG panel. Vmix can be controlled by a PC keyboard, a mouse or a MIDI interface. The ESP BASIC does not support MIDI commands, so Mike G7GTN stepped in and interfaced the software to an Arduino, which can deliver the necessary commands (see last month's issue). The micro Mike programmed will also talk I2c so the plan is that it can be located down stream of my ESP micro and translate I2C commands into MIDI.

The video interface

Mike and I live at different ends of the country and the Arduino is now in the postal service having left Mike, but not yet arrived with me. These are extraordinary times that were not with us when we started this project and there is a lot more to worry about, rather than getting a micro to me. It does leave us with a problem as CQ-DATV is going to press and perhaps some of our readers are wondering how we have progressed. The other problem is that I downloaded the Vimix 60-day package two magazines ago and soon it will stop working. I don't expect it to drop to the free limited source version and from memory some of the features such as chroma key don't work on the free version. I want to deliver more than the cut and mix version as the pots on the GVG panel are all delivering digital values via the I2c Bus. Yes, we have worries about latency, having two micro's daisy chained, we will find out. Other potential problems such as the digital steps of the GVG pots, T-bars and joysticks may be too large for some applications. The problems you think about are often not the problems that bite.

The Panel history

I also wanted to get this project up and running before all these control panels disappear, they were very popular in the broadcast industry for several reasons. The number one being their RS 422 control. This was possible because of the micro control which could not be added to older AB mixers.

TV production has moved a long way from the traditional model of put the VT in record, cue the studio and punch around on the vision mixer, which was how TV production functioned in the 60's with a perhaps a little scene to scene editing if required.

By the 70's TV production was becoming more film orientated with more sophisticated editing, sound dubbing, some could even argue that by the time three machine editing arrived, that enabled takes to be mixed in the edit suite that perhaps it had features above film editing. This was still slow with its neg cutting, AB rolls and print the mixes in the film processing lab. With the emergence of single camera shoots using camcorder's in the 80's, the two were almost on a level, using similar production techniques. The ace in the hole was VT mixes happened in the edit suite and the GVG 100 was the key.

The larger UK equipment manufactures were a little slow to respond to these changes and often had the old 60's model of TV production as their equipment target. Many of the ITV studios engineered their own solutions. Grass Valley changed that and the GVG100 was at the head of edit suite mixing as P2 protocol equipment appeared. The Studio galleries also took to GVG products (using the larger mixers). The push buttons that could be customised with overhead projector gels to create legends within the illuminated buttons, became an industry winner. Gone were the china graphs pencils used to mark up the sources.

The future

I worry industry may have junked this pleasing control panel, with the move out of analogue TV. Ross did produce a digital crate that was compatible with the GVG panel, but I have never had my hands on one to evaluate so am unsure of the market penetration. The digital nature of the panel, with very few electrolytic caps, marked for future replacement, all the chips are socket mounted, so low maintenance, (fingers crossed). There are also changes on the net where the lamps have been changed to LEDs and the 14-volt rail eliminated, something I plan to do later.

Big Brother

GVG produced much larger mixers, some a little too large for the average shack or workshop. They all have the same look, use the same push buttons. It's a long time since I tinkered with the innards of these. Are the i2c changes compatible with the larger range of mixers? I am unable to report.

Star Wars

The larger mixer will always be remembered for the Star Wars film where Darth Vader used one to blow up Princess Leia's home planet, (Alderaan). George Lucas has never released that interface, perhaps that's for the best.

If you see a panel at a reasonable price it might be worth a punt as I suspect the button and lamp maps I have re-produced in the previous issues will enable you to press them into service. I will continue with the software as soon as Mikes Arduino turns up and report back to you in CQ-DATV.

If you see a scrap one, I am short of cut button and a couple of lamps, should they be harvestable, otherwise keep an eye out on e-bay for one, three have appeared since I started this series of articles.

One of GVG 100's big brother, no I have no intention of reverse engineering one for your ham shack

https://www.vmix.com/

https://sites.google.com/site/annexwifi/home

https://www.reddit.com/r/MechanicalKeyboards/comments/3ltscc/grass_valley_video_switcher_in_star_wars_1977/

https://www.youtube.com/watch?v=l7l4MY9u7pA&feature=youtu.be

WELL READ THE WORLD OVER

CQ-DATV

Video Codec's and why so many

Written by Rovert Nworb
First published in issue 25

If ever there was a recurring question in Digital Television it's what is a Codec and why are there so many different kinds.

Let's start with the name Codec it stands for COmpressor DECompressor, that the easy part, what do they do well in our case (Television) they convert the TV signal into 1 & 0, OK so it's an A to D and D to A, no its much more. If we take a 6MHz video signal and sample it at 3 times subcarrier (4.433 MHz in the UK we get over 13MHZ) and then convert it to 10 digital bits 130 MB/second that's for 625 PAL if we go for 1080p and 12 bits we are up at 155MB/Second, that's 560Gb to store for 1 hours worth of video, as for 4K Television well let's not go there. We are at a bit rate that hard disks struggle with, but what we wanted is to record video on an SD card.

Television pictures are not the only medium, with digital problems, that are solved by Codecs.

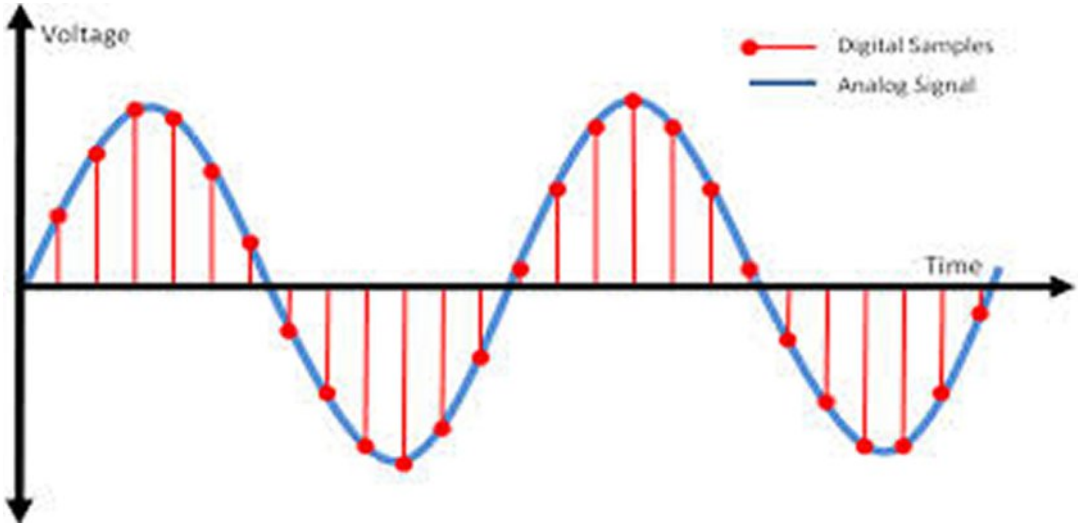
Audio and still images, with the MP3 being the most familiar with AAC and AIF not far behind and JPG, PNG and TIFF for still images. Until fairly recently, the compression algorithm used in JPG files was copyrighted, whereas PNG is an open, public domain format.

These are digital files that have been compacted in different ways. The problem is each format has its short comings.

JPEG is a single layer so it's not got an Alpha layer to define transparency, PNG does have a layer to define transparency, but the file size is larger (but is lossless!). JPEG degrades every time you edit/re-size. BMP and Tiff are better files but can be quite large.

Let's start TV pictures from a camera and AVCHD compression. This compression will get the data rate down to about 7 to 10MB/second, so it can be stored on an SD card. But at what cost and how does it do it.

Let's go back to sampling, it's a little like those children's puzzles where we join up numbered dots to create a picture, the more detailed the picture the more dots you need. So for PAL think about the subcarrier and a single sine wave cycle sampled three times. Chose where you take the samples you are not going to draw a sine wave with three dots.



The dots carry binary amplitude information that indicate amplitude, so 8 binary bits would present 256 analogue levels. Still we are going to get a lumpy sine wave picture. Increase the samples and the analogue levels and the data will be coming so fast that we will have storage problems.

Codec's

Moving images create too much data for the memory card to store

Video Codec's remove lots of the pictures

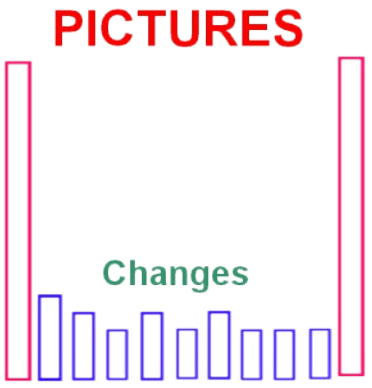
The Pictures are sent as data

Mpeg2 was the first Codec

Mpeg4 followed it

AVHCD

All these files are different



Reduce it and we will see ether quantisation puddling or artefacts caused by low sample rates. Filtering is essential and nor something software does well.

Once over that hurdle we come to the next stage: removing the redundant part of the picture to save on space and reduce data rates.

This is done by looking at a group of pictures, transmitting the first one and the last one and then the rest of the pictures in the group as the difference between the first and last picture.

Does it work well providing there is not too much movement in the picture? Yes, the more movement there is in the picture the more it is likely to not work.

In the early days all you had to do was put the camera into record and shake it to give maximum picture change for each frame and your Codec would be in trouble, but we have had considerable improvements and yes, they do now hold together. This is because there is prediction software built into the codec that guesses how the pictures are going to change throughout the GOP (Group of Pictures), but of course, it never guessed you were going to shake the camera.

Compression Codec's work best if you do not feed them with coded pictures. Otherwise you are PAL coding and then digital coding and you get the worst out of both worlds. But some DATV transmitters give you very little option as they have only PAL or SVHS inputs. Also we have moved into a wide screen world and PAL coding or NTSC for that matter was never designed for the wide screen world, so pictures are best sourced as component pictures.

This is ok if you start today, but particularly in the broadcast world where they want to inflict programmes made in an older analogue world that were stored as 12 by 16 in PAL.

This can be aspect ratio converted by removing part of the picture and stretching other parts and the can be converted to component with high quality comb decoders, but they still suffer and can be found every day on some of the less well-off digital channels.

Codec's are very much horses for courses. They have specific uses, some are ideal for transmitting pictures and will cope with reduced bandwidth, such as Mpeg 4, little difficult to edit with as you do not have a group of pictures to scrub past and chose edit points, but software can create the illusion of the whole group of pictures being there, but this can be very demanding on your CPU.

Also, for equipment manufactures, there are copyright issues as Codec's might be in use everywhere but they were all developed by somebody and that process might not be in the public domain which leads manufacturers to implement various versions of common Codec's.

There are also Transcoders, which will convert between the various codec formats but these are not necessarily lossless and can again lead to picture degradation.

Summing up, choosing the right horse for the course. Not that we always have much choice, avoiding sourcing a picture that will be in a digital domain from a coded source. The old computer adage of rubbish in rubbish out still holds and just because it is digital does not mean it is good.

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

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