In this issue

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Editorial

Welcome to 2020. The ghosts of Christmas Past Present and Future are behind us now and we all hope the guy on the step ladder adjusting his aerial has also made it into 2020.

What is to come in 2020? There will be 12 more issues of CQ-DATV magazine, starting with this one issue 79.
We have all the news and articles, not only from the usual suspects, but also from some new contributors as well, who have taken the plunge and submitted copy. I cannot stress how much work goes into CQ-DATV and how important is for everyone to take the opportunity share their activities with our readers. Please don't just leave it all to someone else! This is your magazine and will only survive if you contribute.

This issue starts with Jim Andrews KH6HTV who is looking at 5cm ATV, its potential and measurements of any possible RFI problems there may be hiding in the shadows.

For those of you not aiming as high as 5cm Trevor has written Part 12 of his GVG mixer control panel and is looking at the secondary panel which provides the wipe selectors and the LED displays that sets the duration of auto wipes, fades and cross mixes. Trevor has put some video on our Facebook page that shows the auto transition and the control over the duration as set by the 7 segment display and the latest source code, GVG12, is available for download from *https://www.cq-datv.mobi/downloads.php*.

Mike Stevens G7GTN has been looking at Vmix with a view to externally controlling this popular software without the price tag that goes with commercial control surfaces. Mike has designed a PCB to deliver this interface and a small sample batch is away being etched. Mike has high hopes for the new PCB which will be able to drive Vmix from a home constructed control surface and even possibly Trevor's GVG panel. Fingers crossed, this could have an interesting future.

Don Nelson N0YE is looking at 5.6GHz. Don's kit consists of ADF4351 frequency synthesiser, Frequency West brick 6 GHz LO, diode mixer, amplifier & PIN modulator (1kHz square wave). A 13-inch dish with two different feeds. One feed is a home brew dipole element with a back-splash plate one quarter wave behind the driven element. The second feed is a WA5VJB log periodic antenna.

Mike Collis WA6SVT is investigating microwave activity in Arizona, California and Nevada. There is some impressive hardware running here with the largest linked repeater system in the south-western state with seven linked repeaters and three linked ATV repeaters.
Don N0YE has also reported a failure of his 10GHz dish feed. I won't spoil the story, but there is a happy ending to this sad tale of woe.

Trevor has started a new series of articles to mark the start of the new decade by winding the clock back 50 years to see what happened in the same decade 50 years ago. In this issue Trevor is reviewing Intel's first commercially available CPU the 4004 and the development through to the Z80 and the impact this new technology had on professional television.

Ian has chipped in to remind everyone that in the middle of all the development the 6502 was also born, so the 1970's was the age of the Micro Processor. Trevor is planning to look at the humble VCR in the next issue, which was also born in the 70's.

Continued on page 4...

DATV-Express Project

Ken W6HHC reports

Art WA8RMC reported that he receives orders and ships units for MiniTiouner-Express receiver/analyzers at a rate of about about 2 units / week. Current inventory is about 50 units.

See *www.DATV-Express.com* for ordering details (see the ORDER A PRODUCT page). The price is US$75 + shipping for a fully assembled/tested unit. All shipping is from the US.

Ken W6HHC reported that the Yahoo Group DigitalATV will be relocating to groups.io facilities/hosting in December.

Ken explained that the capabilities of the old Yahoo Group site was being reduced to only provide an "e-mail reflector function" (without allowing any attachments or archiving). More details will follow. Co-moderator Mark WB6QZB is heading up the move to groups.io.

Art WA8RMC also reported that the DATV-Express.com site was down for several days in November, because the hosting company was attacked by "ransomware". All is working again.

Finally, Art is looking into designing a new DATV receiver that will receive DVB-S, DVB-S2 and DVB-T protocols. He has found a low cost receiver module that will receive both DVB-S, DVB-S2 and DVB-T. "All" that is needed is to add a printed circuit board and add some software.

The board is envisioned to run on a RaspberryPI. Art can finish the hardware board design and board production. What is really needed is a software designer for the software side of the DATV receiver.

A lot of existing software code can be offered to act as "models" for the new code. Is anyone out there interested in joining in on this project?? Please contact the project team.

Project speed set to slow...de Ken W6HHC

Yahoo now Boo Hoo!!

We have been advised by Yahoo that public groups will no longer exist.

The following is an extract from their email:-

The following changes were made since our last communication:

- *Users can now only join a Yahoo Group through an invite or group request approval by the Group Moderator.*
- *New Groups can't be public. They can only be private (not listed in Groups directory, membership by invitation only) or restricted (listed in Groups directory, membership requests must be approved by a Group Moderator).*
- *Members must share all content via email, and can no longer upload or host new content on the Yahoo Groups website itself.*

The following changes will be made on December 14, 2019:

- *Public groups will no longer exist. All existing public Groups will become restricted Groups that require Group Moderator approval to join.*
- *Any content that was previously uploaded via the website will be removed.*

We would advise all people interested to use our *Facebook* pages instead.

How NOT to adjust your aerials!

Source: Boulder Amateur Television Club TV Repeater's REPEATER

WELL READ THE WORLD OVER

CQ-DATV

Editorial continued...

One from the Vault looks back at CQ-DATV issue 8 and is Ken Kochechy W6HCC looking at hand soldering surface mount devices

From everyone at CQ-DATV can we wish you a happy new year and assure you our team is all geared up to produce another 12 issues in this coming year starting with this issue (CQ-DATV 79).

They will all be available as free downloads along with all the back issues via the CQ-DATV online library. You can also download the CQ-DATV omnibus which contains every issue so far in one download. The library is also home to the several TV handbooks which although dated are still worth reading. A cumulative of all articles and authors is also available.

We would also like to welcome you to our Facebook site *https://www.facebook.com/groups/285807174898375* where we can discuss anything ATV related just press the join button, everyone is welcome.

For now, just sit back and enjoy CQ-DATV 79

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

5 cm Band Spectrum Analysis

Written by Jim Andrews, KH6HTV

As part of a potential project to put amateur DTV on the 5cm band, I first performed some measurements of what potential RFI I might encounter.

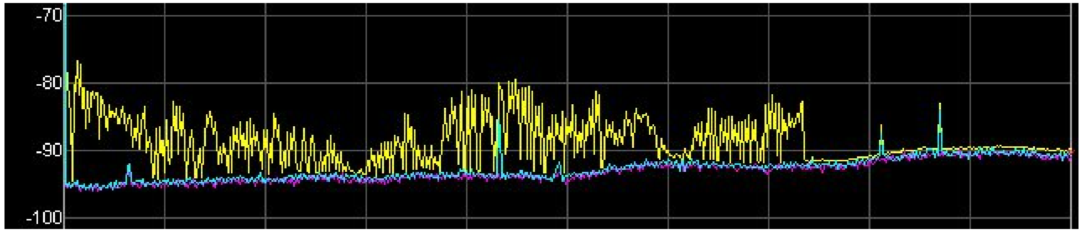
5 cm Ham TV Frequencies

The 5 cm amateur radio band covers from 5.65 to 5.925 GHz. The ARRL band plan allows wide-band modes (> 1 MHz bandwidth) in two, 75 MHz, segments: 5.675 to5.75 GHz and 5.85 to 5.925 GHz. It should be noted that this is another band shared with unlicensed, ISM transmitters. The ISM band is from 5.725 to 5.875 GHz. The 5.8 GHz band is not quite as heavily used by unlicensed Wi-Fi, etc. as the 2.4 GHz band. However, this will not last long and it may soon be another "junk" band, lost to radio amateurs, if not already. To avoid 5.8 GHz Wi-Fi, we should probably first put our TV operations in the 50 MHz segments of 5.675 to 5.725 GHz or 5.875 to 5.925 GHz. I have purchased some inexpensive, import, FM-TV transmitters for the 5.8 GHz band and found they were using frequencies from 5.645 up to 5.945 GHz. They included the following frequencies which fall in the amateur band at 5.665, 5.685, 5.705, 5.885 and 5.905 GHz.

I propose we channelize the lower 5.675-5.725 segment into 6 MHz channels as follows: Ch 5cm-1 = 5675-5681, fc = 5678MHz Ch 5cm-2 = 5681-5687, fc = 5684MHz, etc.
So, all things considered, my first choice for experimenting with DTV at 5 cm would be 5cm-1 at 5678 MHz. Will it work?

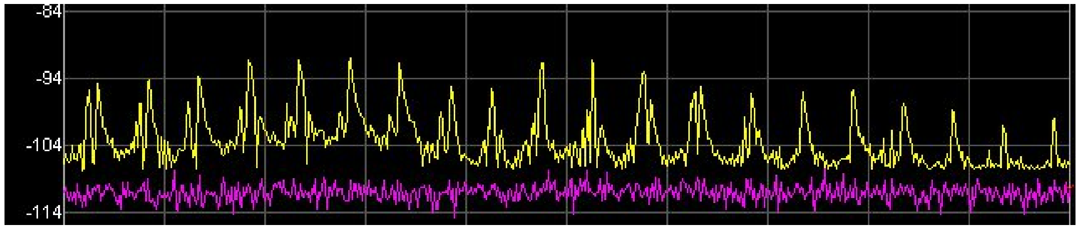
To first determine what background RFI exists on the 5cm band, I set up an experimental receiver with a spectrum analyzer to monitor the band. I used an L-Com, 5.8GHz, BBQ grill antenna (23dBi) with horizontal polarization. I feed this to a lash-up receiver consisting of an Avantek, 4-8GHz, 13dB amplifier feeding an Anzac 4-18GHz diode mixer. The LO for the mixer was a Frequency West brick running at 6.092GHz. The IF output from the mixer went to my Rigol DSA-815, 1.5GHz, Spectrum Analyzer.

I have a good view of the city of Boulder from the window of my ham shack. The city is about 5 miles to the west with empty open space prairie between us. I placed the antenna looking out the window towards Boulder to see what, if any, RFI I would be able to detect on the 5cm band.
Unfortunately, I found it!!!



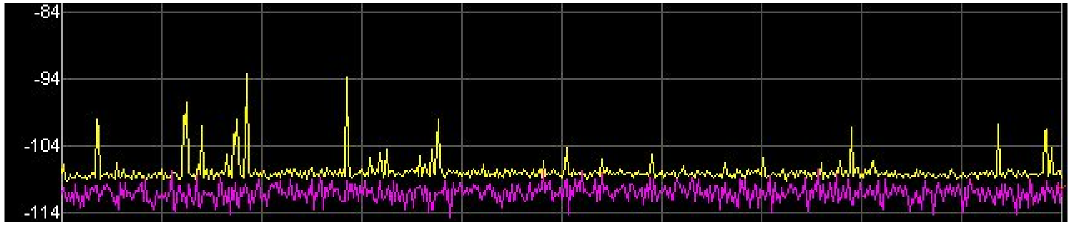
5cm Band Activity from the city of Boulder 1.5 GHz sweep from 6.1(left) to 4.6GHz(right)

Looking at the lower sideband from the mixer 0 MHz (left side) on the analyzer display was thus 6092MHz while 1.5GHz (right side) on the analyzer display was 4592MHz. This first measurement shown above was doing the full 1.5GHz sweep from 6.1 down to 4.6GHz with the analyzer put in the Peak Hold mode and allowed to run for a 1/2 hour. Yellow trace is the peak hold result. Magenta trace is the system noise level with the antenna disconnected and a 50 Ω termination on the receiver input. Cyan trace is one single sweep. The vertical scale in each plot is 10dB/div. (Note: Some of what is being seen could also be upper-sideband from 6.1 to 7.6GHz as there was no 5.8GHz band- pass filter used, except for the selectivity of the antenna.)



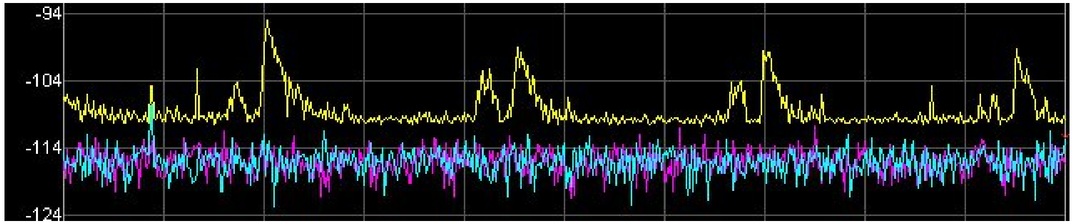
5cm RFI in 5.675-5.750 ATV band (peak hold 1/2 hour) center = 5717MHz, 100MHz

The 2ed measurement was then to see what RFI was in the desired 5cm ATV band. In the photos, the center frequency is 5717 MHz. The span is 100 MHz covering from 5767(left) to 5667(right). The yellow trace is again the Peak Hold for a duration of 1/2 hour. The magenta trace is the system noise level.



5cm RFI in 5.675-5.750 ATV band (peak hold 1 minute) center = 5717MHz, 100MHz

Needless to say, I was dismayed at what I saw. So, my next measurement was to repeat this, but only do the Peak Hold for a short duration of about one minute. This was more encouraging, because the signals were not always there. The last measurement was to narrow in the sweep and only look at ATV channel 5cm-1 (5678 MHz). see below photo. The signals captured on the 1 hour acquisition are fortunately not always present.

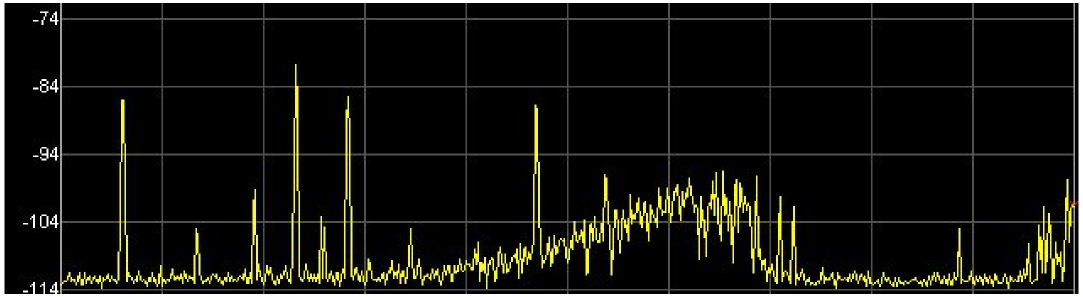


RFI detected in desired ATV channel, 5cm-1, center freq = 5678 MHz, 20 MHz span. yellow trace is Peak Hold mode with 1 hour accumulation. Cyan trace is single sweep while magenta trace is no antenna, system noise level

Conclusion

We will encounter RFI in the 5cm band to our ATV transmissions. But they should be intermittent and not be a permanent problem. However, we will need to chose our operating frequency carefully. Now our next project is to actually go out in the field with 5cm DTV gear and see what we can accomplish (winter weather permitting!).

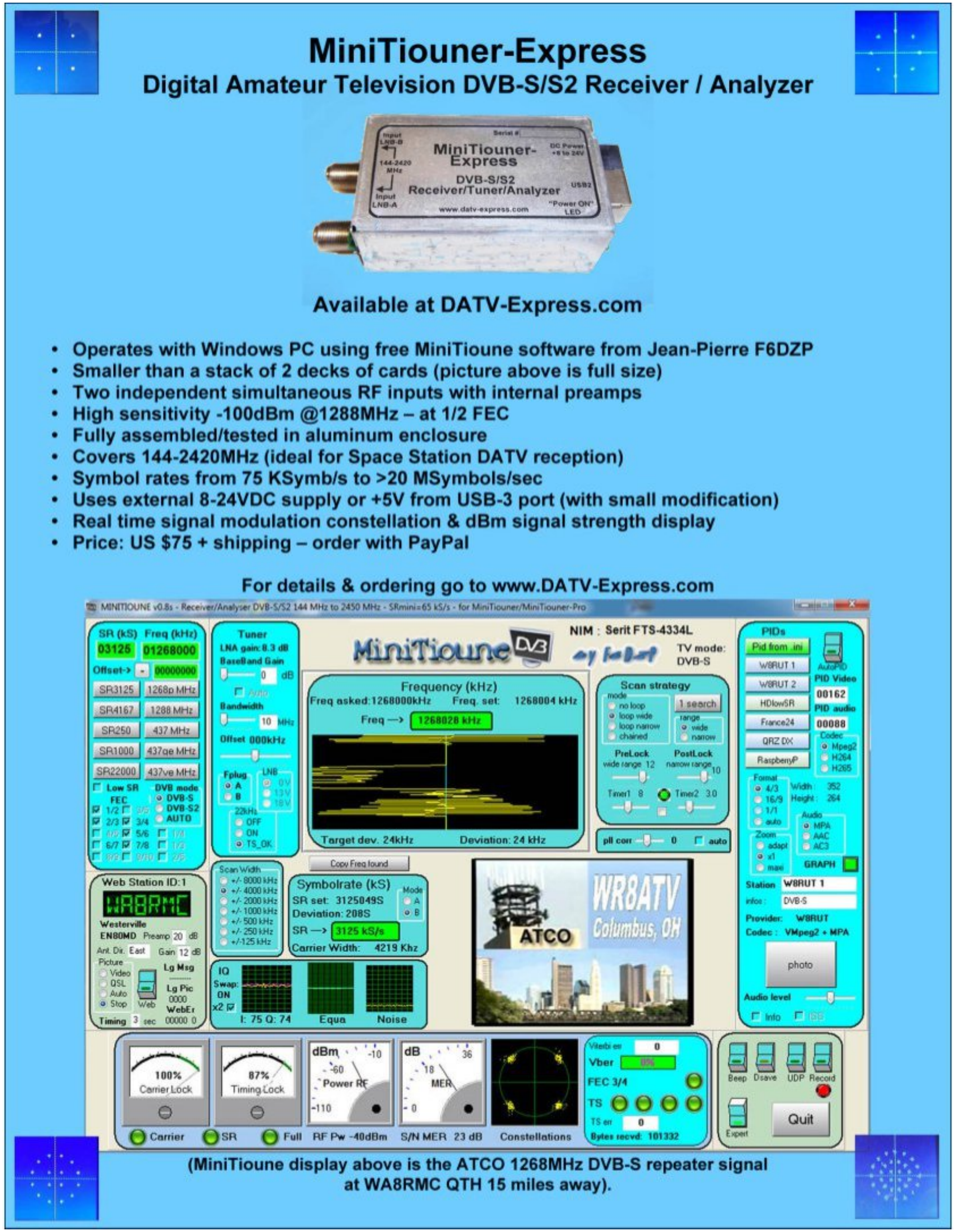
5 cm Comments from Bill, K0RZ: The narrow band portion of the 5 cm band is the 2 MHz slot from 5759 to 5761 MHz. The center portion 5760 to 5760.1 is dedicated to EME activity. Bill said "The 5 GHz amateur band, particularly 5760.1 is a loss for any future DX SSB activity here. The S meter is constantly pulsing S9 to 20 dB over S9 depending on where my dish is pointed."



5cm SSB band - center = 5760 MHz, 2 MHz span

After receiving Bill's comments, I then used my 5cm receiver and spectrum analyzer to see what RFI in the SSB band I got with my antenna. The above plot is looking at the SSB band from 5761 (left side) to 5759 (right side). Center frequency is 5760MHz. This is Peak Hold for a 1 hour acquisition time.

Bill's antenna is in a much higher location than mine. Bill lives on the top of Davidson Mesa with a commanding, almost 360 degree view. Plus his 5cm dish antenna is located on the top of his tower with a rotator.



Grass Valley Mixer Conversions - Part 12

Written By Trevor Brown G8CJS

In this issue I would like to start by looking at the secondary control panel module. That's the small PCB at the top of the panel with the wipe buttons and the 4 small 7 segment displays. I don't have a circuit of this PCB, so I am flying a little blind. The PCB is connected to the main PCB by connector J1. So the first thing is to map in the buttons and produce a larger button map than previously published.

Port 4 read	BS0	BS1	BS2	BS3	BS4	BS5	BS6	BS7	BS8	BS9
254	E - MEM	KEY 0	PGM 0	PST 0	PGM 8	NORMAL	KEY 1	EXTRUDE		
253	AUTO SELECT	KEY 1	PGM 1	PST 1	PGM 9	BORDER	KEY	OUTLINE		
251	PST PTN	KEY 2	PGM 2	PST 2	KEY 8	DROP SHADOW	BKGD			
247	LUM KEY	KEY 3	PGM 3	PST 3	KEY 9	EFFECTS SEND	EFFECT		POSITIONER	REVERSE
239	LINEAR KEY	KEY 4	PGM 4	PST 4	PST 8	BUS AUX	DSK CUT			
223	CHROMA KEY	KEY 5	PGM 5	PST 5	PST 9	WIPE	DSK MIX			
191	KEY MASK	KEY 6	PGM 6	PST 6	CUT	MIX	FTB	SELECT COPY	FRAMES 2	FRAMES 3
127	ASPECT ON	KEY 7	PGM 7	PST 7	AUTO TRANS	KEY INVERT	DSK PVW	FRAMES 1	KEY DEL SELECT	EDITOR ENABLE

The Button Map

These were mapped via software routines that I have not shown as all we are really interested in the results they produced. The four seven segments were also mapped via a short software routine that I have called 'External Timer' and this I have documented.

The chip that drives the display is a custom one so there was no data available on the internet. The display driver is driven by a single 8-bit data word that uses D0 to D2 to select which of the four displays we wish to manipulate and the rest of the 8-bit word is the data to select what the selected display illuminates. This composite word is put on the data bus and then stored by setting "display clock" low and then high again. Display clock is a line out of the original CPU and is now replaced by a PCF 8574 called Port1 or control. The experimental software has a "for next loop" that cycles through various options and uses the wlog function to put the value of et (External Timer) (phone home? ed) in the in the editor display panel.

```
for et =0 to 255
 i2c.begin PRT4        'data port'
  i2c.write et
  i2c.end
 i2c.begin PRT1        'Control port'
 i2c.write ck         'ck low
  i2c.end
  i2c.begin PRT1        'Control port'
  i2c.write tristate    ` CK high
  i2c.end
wlog disply
pause 2000
next et
```

External Timer - experimental software to demonstrate the display options the resultant video is on the CQ-DATV Facebook. This is not part of the programme but might be useful if you wish to explore this part of the GVG panel.

We next need to decode the three buttons below the seven segment displays that are used to advance each individual display. I have ignored the first of the displays as there is no button to control it and a 999 frame duration mix seems more than enough.

The three button calls are

```
If b=7 and e=127 then gosub sevenseg1 'frame one button
pressed   (line 140) rev 12 software
If b=8 and e=191 then gosub sevenseg2 'frame one button
pressed   (line 141)       "
If b=9 and e=191 then gosub sevenseg3 'frame one button
pressed  (line 142)       "
```

The b is the BS value along the top of the button map and the numbers are down the left hand side of the same map. The unusual number is the way we decode things in BASIC which uses decimal and would probably make more sense in hex. Now we go to subroutines at line 711, 727, 747

```
let et = et + 8
if et = 81 then  let et = 1
 i2c.begin PRT4        'data port'
  i2c.write et
  i2c.end

 i2c.begin PRT1        'Contol port'
 i2c.write ck           'ck low
  i2c.end

  i2c.begin PRT1        'Contol port'
  i2c.write tristate         '  CK high
  i2c.end
pause 400
return

sevenseg2:

 let et2 = et2 + 8
if et2 = 82 then  let et2 = 2

 i2c.begin PRT4        'data port'
  i2c.write et2
  i2c.end

 i2c.begin PRT1        'Contol port'
 i2c.write ck           'CK low
  i2c.end

  i2c.begin PRT1        'Contol port'
  i2c.write tristate         '  CK high
  i2c.end
pause 400
return

sevenseg3:

 let et3 = et3 + 8
if et3 = 83 then  let et3 = 3

 i2c.begin PRT4        'data port'
  i2c.write et3
  i2c.end

 i2c.begin PRT1        'Contol port'
 i2c.write ck           'ck low
  i2c.end

  i2c.begin PRT1        'Contol port'
  i2c.write tristate         '  CK high
  i2c.end
pause 400
return
```

et, et2 and et3 are the values which appear in the seven segment displays. The first value, et, is multiplied by 100 the second column is multiplied by 10 and the last is left as units so we can pre-set any value between 0 and 999 as a mix duration. Mixduration (Line 764) is a subroutine to add the digits together to produce the necessary mix duration called durtotal.

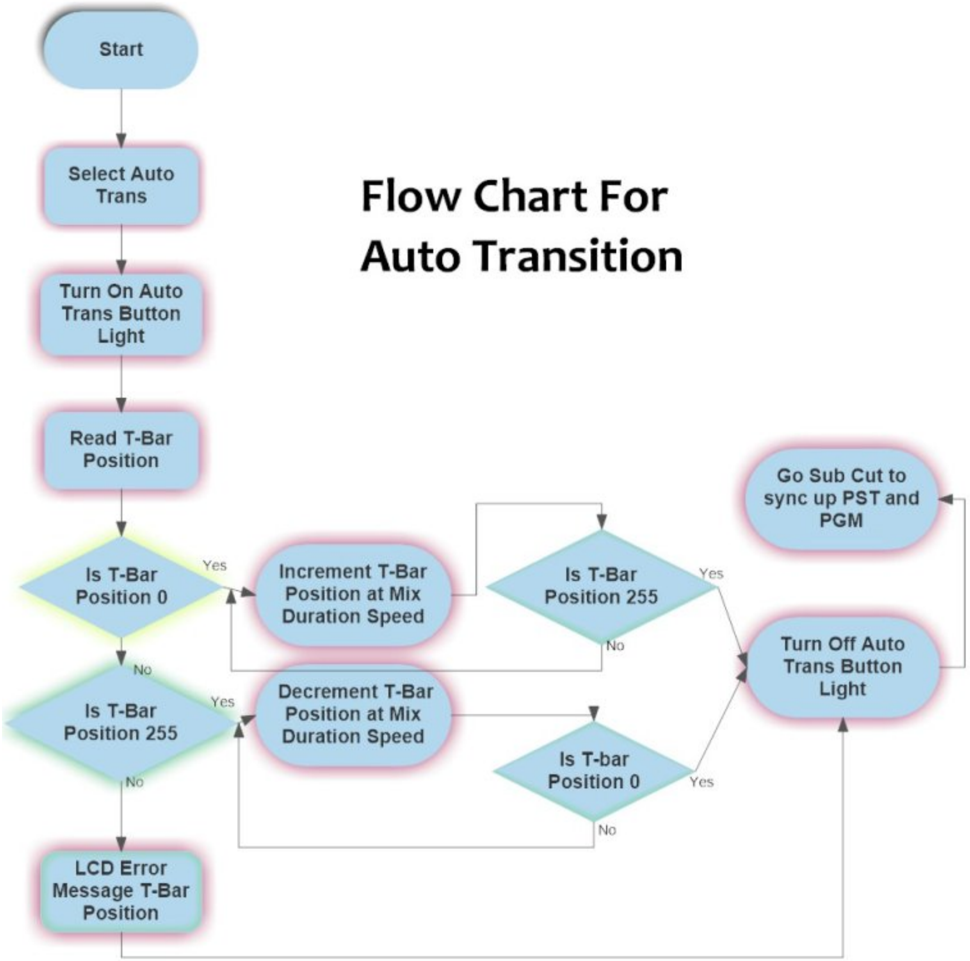
Remember anything after the ` is a comment and has no bearing on the program

```
mixduration:
let dur= et/8*100-12.5
let dur2 = et2/8*10-2.5
let dur3 = et3/8
let durtotal= dur+dur2+dur3
 wlog INT (durtotal)
return
```

Now we have a mix duration we need to start on the Auto Trans button. This should be a Mix or Wipe and should just be the same as pulling the T-Bar from end to end at a speed set by the durtotal adjusted to equal the correct number of frames.

It would be nice if Fade to Black and DSK Mix could share the same duration. I suspect that originally these were independent durations as set by the three LED's and the selector button below them. This function button selector and display are located to the right of the seven segment displays.

I don't want to waste processing power on these functions as I think there are far more important things to concentrate on. Lets keep these three functions locked to the same duration.



The revised software called GVG12 has the Auto Trans Button re-vectored from the previous software and will illuminate for the duration of the mix and then the PST and PGM banks will behave as they do for the cut button eg the Auto Trans will illuminate to show a mix is in progress along with the T-bar limit lights, the PST and PGM will be locked.

At the end of the transition the Auto Trans illumination will go out and the PGM selection will move to match the PST selection.

The revised software also has a Fade to Black. This brings up source 0 on the PST and then calls the Auto Transition routine. While Auto Transition is in progress the button lights as do the T-Bar limit lights. In addition to this, when Fade to Black is pressed, all these lamps light for the duration of the mix or Fade which is set by the three buttons under the 7 segment displays.

This routine is located at line 530 for revision 12 software

```
fade2black:
if B=6 and e = 191 let s=s+1' turn on FTB lamp
let B = 3 'set PST bank to 0 'PST to black
let e = 254
gosub PSTlatch   '    PST 0
gosub auto
let s=s-1  'light off
gosub strobes
return

 auto:
let s=s+192  'arrow lights on
let t=t+4     'auto trans light on
gosub strobet
gosub strobes

if Tbarpos = 255 then goto down  'virtual T-Bar down
if Tbarpos = 0  then goto up     'virtual T-Bar up

autotranoff:
if (t and 4)    <>  0 then let t = t -4    'autotrans off
if (s and 128)  <>  0 then let s=s -128 'arrow lights off
if (s and 64)   <>  0 then let s=s -64  'arrow lights off
gosub strobes
gosub strobet
gosub cut
return

up:
for Tbarpos = 0 to 254  ' step Tbar up
let z= durtotal         'value set in 7 segs
doo:
let z=z-1               'loop that steps through the 7 seg delay
if z  >  0 then goto doo
next Tbarpos            'end of T-Bar  loop
goto autotranoff        'go to auto light off and arrow light off

down:
for x = 1 to 255         'Step T- Bar down
let  Tbarpos = Tbarpos-1 'decrement T-Bar position
let z= durtotal          'value set by 7 segs
dooo:
let z=z-1                'Delay loop set by 7 segs
if z  >  0 then goto dooo
next x                   'terminate T-Bar
goto autotranoff            'light off
```

Software rev 12 also operates the illuminate Wipe and positioner buttons on the sub panel. These do not at the moment have any attached I/O but could easily be connected to an I2C port address, lets leave that to a future edition. Like the button map the lamp latch map had to be revisited to control the inbuilt LED’s in wipe selector push buttons the revised Lamp map now looks like:-

The Global variable where the latch data is stored eg n to w and the GVG latch address to put the data to control the lamps with strobe routine

The addresses of the individual lamps to up-date soft copy

PORT 4 single row word (decimal)	PORT 3 ADDRESS 0 latch LS0 soft copy n	PORT 3 ADDRESS 1 latch LS1 soft copy o	PORT 3 ADDRESS 2 latch LS2 soft copy p	PORT 3 ADDRESS 3 latch LS3 soft copy q	PORT 3 ADDRESS 4 latch LS4 soft copy r	PORT 3 ADDRESS 5 latch LS5 soft copy s	PORT 3 ADDRESS 6 latch LS6 soft copy t	PORT 3 ADDRESS 7 latch LS7 soft copy u	PORT 3 Address 8 Latch LS8 Soft Copy V	PORT 3 Address 9 Latch LS9 Soft Copy W
1	PGM 8	KEY 5	KEY INVERT	KEY 3	PST 3	FTB	KEY 1	KEY ON GREEN LEFT	Rev	
2	PST 4	KEY 4	KEY MASK	ASPECT ON	PGM 0	WIPE	KEY ON GREEN	BOARDER	Wipe 3	
4	PGM 9	KEY 7	LINEAR KEY	KEY 2	PST 2	DSK GREEN	AUTO TRANS	OUTLINE	Positioner	
8	PST5	KEY 6	E-MEM	Nb key lamp power	PGM 1	MIX	KEY 8	NORMAL	Wipe 8	Wipe 5
16	PST9	PGM 7	AUTO SELECT	KEY 1	PST 1	DSK PVW	EFFECT	EXTRUDE	Wipe 6	Editor Enable
32	PST6	PGM 4	PST PTN	NB PGM lamp power	PGM 2	?	KEY 9	EFFECTS SEND	Wipe 2	Wipe 10
64	PST 8	PGM 6	CHROMA KEY	KEY 0	PST 0	UPPER LIMIT	BKGD	DROP SHADOW	Wipe 1	Wipe 9
128	PST 7	PGM 5	LUM KEY	NB PST lamp power	PGM 3	LOWER LIMIT	KEY ON GREEN RIGHT	AUX BUS	Wipe 7	Wipe 4

The lamp map for the mixer

The routine to control these additional functions is also in GVG12 software.

Adding these extra lines of code does change the line numbers, so if you are following the routines in the last issue stick to the older version of the code!

The new code has the I2C routines in a single subroutine that is called latchmanager. The software latches are given letters n to w, because you need to keep track of which buttons are illuminated on the panel and as said before it is not possible to read the GVG latches. So we can change the contents of the latch mirrors stored as variables that are declared a global in the software. Then by anding the latch value with the number on the left. Thus we can can manipulate the stored variable followed by a gosub to stroben through to strobew ie the last letter is the latch we need to update.

My panel being a GVG 1000 might be slightly different to the 100-110 in the naming of the buttons. I also have two buttons with non functioning lamps (DSK Cut and DSK Mix) so they are not in the map until I locate some lamps. If you want to experiment with the button lamps you can light any button on the panel providing you have its address (from the Lamp map). Insert the code into the do loop at line 96 . E.G.

```
let s=8 gosub
strobes
```

This will light the mix light. The co-ordinates came from the lamp chart 8 and S are where the mix lamp is. Strobes will move the data into the s latch. So you can amend the above chart to match your panel should it be dissimilar mine.
The software polls around the buttons, decides which one is pressed, goes to the variable, (n through to w) amends the data and sends the contents to the designated GVG hard latch.

Remember sometimes we need to turn other lamps out at the same time. So for example PGM bank when a button is pressed we clear all the PGM lights (and they are not all in the same latch), add the new button press and update the GVG latch using new latchmanger which is a subroutine and in tern called by a subroutine strobe+ the end letter of it is the latch we need to update.

The analog1 subroutine at line 663 (software version 12) reads the software.

Analog2 at line 686 can be used to read any analogue device E.G. enter the device at line 689 which is at the present set to 00 and it will read the Joystick horizontal value.

This can be displayed in the editor log panel as a scrolling value by editing line 96 which is set to ‘wlog analogpot and needs editing to wlog analogpot e.g. remove the ‘ and it is now active The address of any device is shown in the table line 47 to 60. This will work for the T-bar too, but will not read the T-bar in the AutoTrans. This loop does update the T-bar position, just you cannot read it outside the subroutine.

This may or may not be a problem. Without some video hardware connected to the panel it is difficult to tell.
The revised software also enables the Wipe selection buttons and has a push on push off for the positioner and reverse buttons. It really is starting to feel like a working GVG mixer! Just needs to connect to something that produces video. Yes I know the original crate did this but only for sources locked to the same SPG which is really so 80s.

The revised GVG software is on the CQ-DATV download site *https://cq-datv.mobi/downloads.php* and is called GVG12.

If you don’t have a panel all I can say is keep watching e-bay. They do turn up from time to time and cost around £50 although they may be going up in value as they are a very adaptable device. They maybe from the 80’s and started with a composite crate and then GVG brought out a component crate. Both appear on e-bay from time to time.

The next development was from a company called Ross that brought out a digital mixer called the synergy 100 which was marketed with a crate only option that could be connected to the GVG 100/110/1000 panel. There have also been add-ons marketed to connect the panel to the Blackmagic ATEM and ATEM mini. Then I waded in and explored how it works and in doing so, I hope opened the door to others. I know Mike G7GTN is keen to produce an interface to the Vmix software that I know many of you use.

Sorry to write all the code in BASIC but that came along and I was keen to explore the ESP micro. My first attempts were with ESP BASIC before I subsequently switched to Annex BASIC which is a big improvement.

I have kept all the routines as simple as possible. I could condense the code but that would make it a little more difficult to follow. I have added more comments than I suspect you would find in any programme in a effort to encourage people to follow my work.

I hope that this has been of interest. I will be working on better code and at the moment considering changing the hardware to the ESP32 module which now has an Annex BASIC available. If this happens I will continue with the I2 interface, which I think is ideal for simple experimentations and that has been more than well documented in CQ-DATV and the I2C handbook in the CQ-DATV library.

The code can be downloaded and viewed in notepad , but this will not show the line numbers *(use Notepad++ and it does - Ed)*. If you download and use the fee Annex Basic editor you will see the line numbers which I hope makes this something that can be followed by everyone.

Yes you might have to brush up on BASIC, but Annex is very friendly. If you do not understand a command, highlight it and press F2 for an explanation.

Useful links for Annex Basic

https://www.esp8266.com/viewtopic.php?f=39&t=19745

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

Lino's Vmix control panel

https://www.youtube.com/watch?v=lBawephM1dA

Micro Corner - Ethernet VMIX Controller Experiment

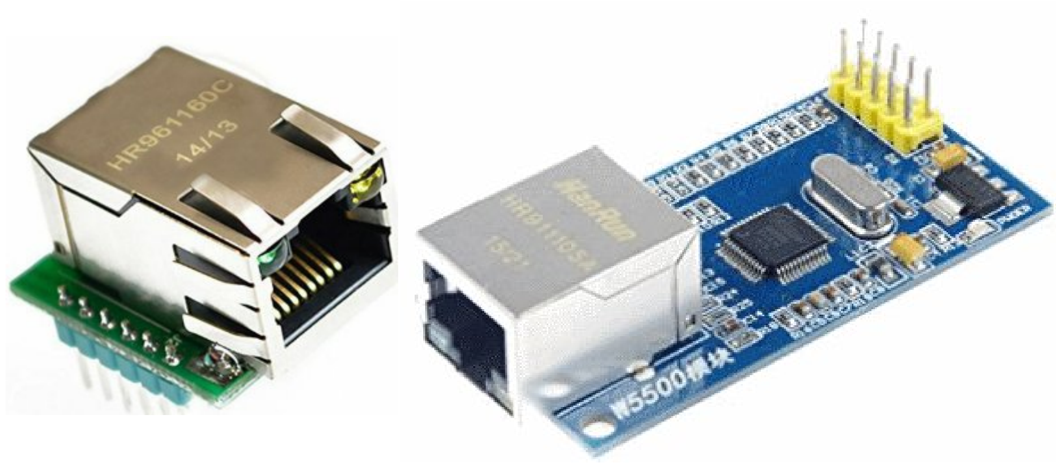
Written by Mike Stevens G7GTN

Introduction

Using VMIX as a video switching solution is a popular option for our small television shacks; the real versatility comes from being able to access external control systems. Commonly MIDI via USB is used such as on the actual VMIX Branded control panel (Figure 1).

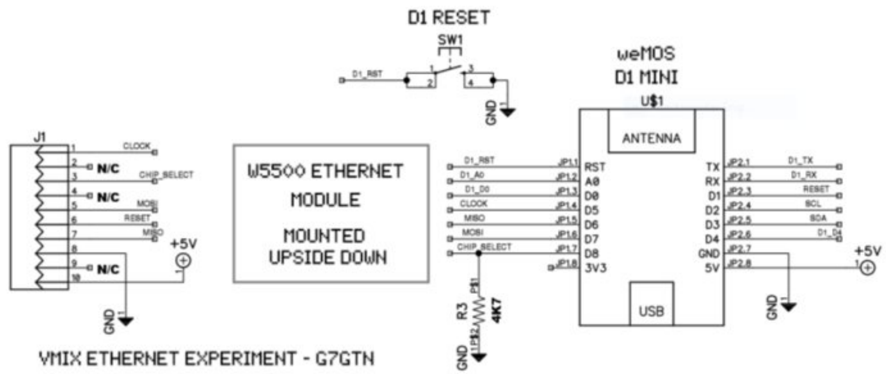
Figure 1

We can also control the PC Software using our known Ethernet networking protocol via an RJ45 jack. So here I have connected an Ethernet module based on the Wiznet W5500 integrated (10 – 100MB) controller device. These can be purchased from our usual auction type sites for around £3.50 as a dedicated SPI bus controlled module.



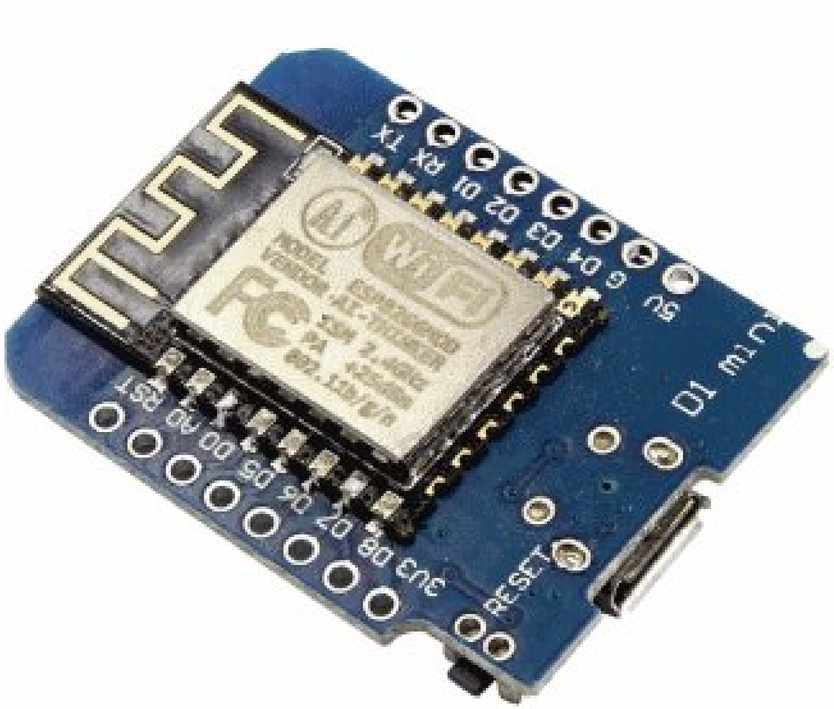
Basic Test Hardware

The control processor I used on this test setup is a wemos D1 ESP8266 module (mainly for additional code space as opposed to an Ardunio type board) this was put together on a breadboard to allow some code development to take place. One thing we need to make a note of is the Chip Select line from the W5500 module to the SPI Pins on the processor. The GPIO15 pin is one of the pins that have an effect on being able to programme our ESP8266 module. The R1 4.7K resistor pulls this Chip Select Line low to allow uploading of code. You could equally just disconnect this pin via a jumper to do a code upload and then re-connect afterwards. The W5500 module and processor connection circuit as used for this experiment.



VMIX Application programming Interface

The functions we use from our desktops can also be called from an interface via Ethernet. The first thing we need to do is check the IP address that we have assigned to the VMIX software, this is found from the Settings Tab and then Web Controller. This is shown in (Figure 2)



D1 Mini Code

For operation on our Network we require an IP address for our Wiznet W5500 Module, the code is configured for DHCP operation from your router.

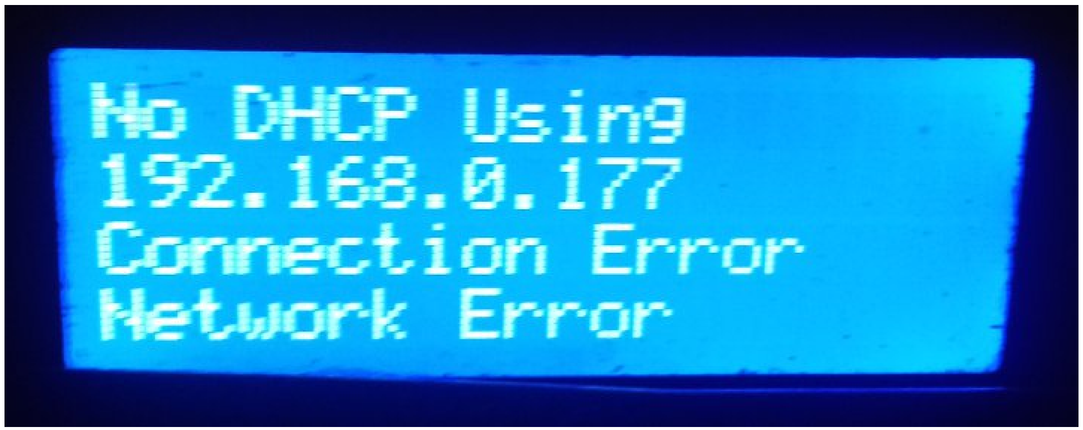
If this fails then a backup fixed IP address will be used. This is hard coded as 192.168.0.177, which you can of course change if required.

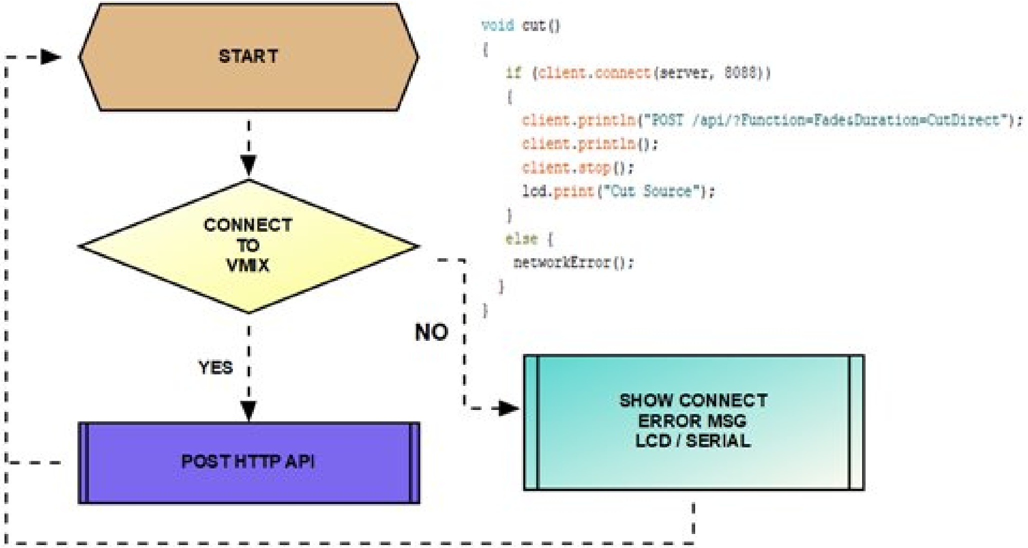
Next we include the IP address that was assigned and checked in (Figure 2) the last four digits of this address relate to the Port Number used to communicate.

VMIX uses a series of Application Programming Interface (API for short) calls that define the function we wish to call.

These are fully documented in the VMIX help document under the developer information section. Knowing we need both the VMIX IP number and also the port number, we can easily set up our own client Server using this information.

Looking at the flowchart we can see this http post function in action, if this fails a Network Connection Error message is shown on the LCD and Serial Monitor.





Test Code Usage

Using a serial monitor, either the Ardunio IDE built in one, or an option of your choice we can send numeric commands from (0-9) at 9600 baud rate to send our HTTP requests to VMIX. I have set up a few obvious options, which you can of course change in reference to the developer document. These are to prove that we can send commands via Ethernet and that VMIX does process them. Sending a 9 will restart the ESP8266 module.

Looking at http packets with Wireshark

Using some free to download Windows based software called Wireshark we can look at the traffic being sent from our ESP8266 and Wiznet W5500 Ethernet controller and responses sent back from VMIX.

Conclusion

Whilst this might seem like a slightly random project, with no real end goal in sight. We are quite in the opposite direction moving forward. What we are working towards is a single PCB Solution to interface the GVG Switcher Panel conversion coding being conducted by Trevor G8CJS in his series of interesting articles.

An interesting engineering project, both located in different Cities and using two different programming languages (Basic and C++) for the elements we are working on in isolation, with email and Skype to keep us on track.

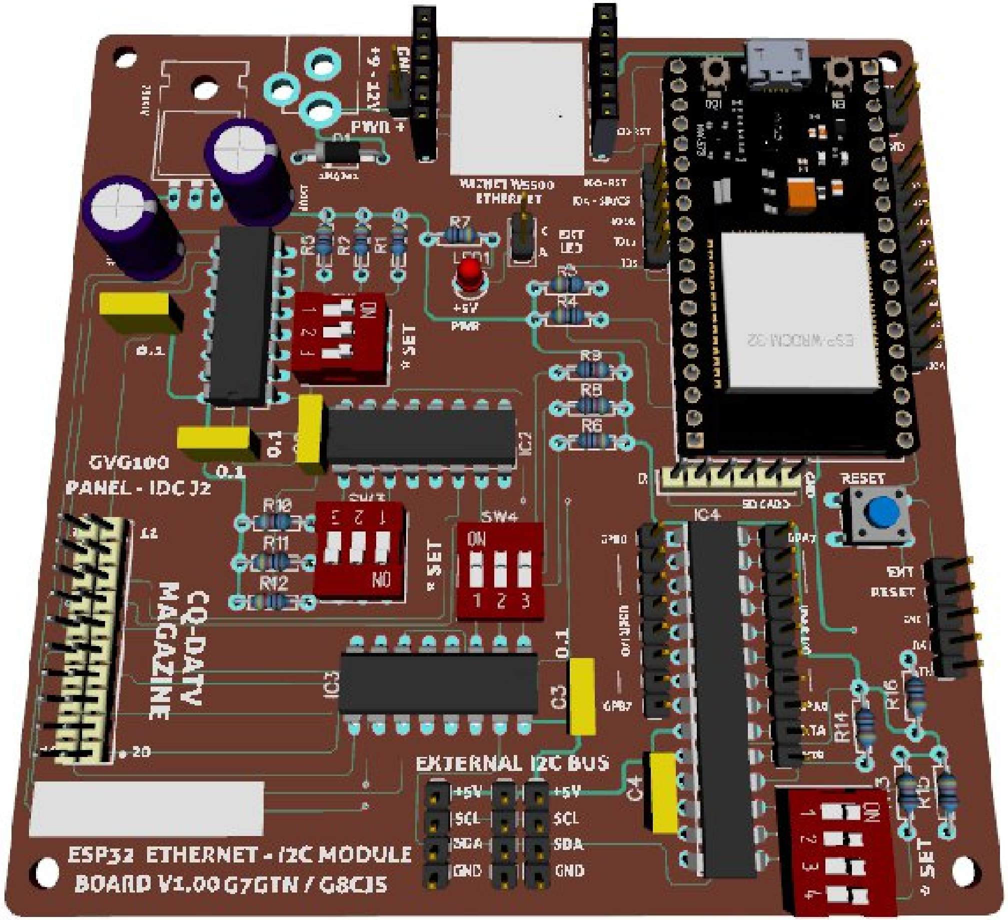
We have to be aware the GVG Switcher Panels are slightly tricky to obtain so a solution that can be used in other projects forms a part of our joint design thinking. If we generate a fairly multipurpose module that can be used for several different projects we are not tied in to one possibly specific project.

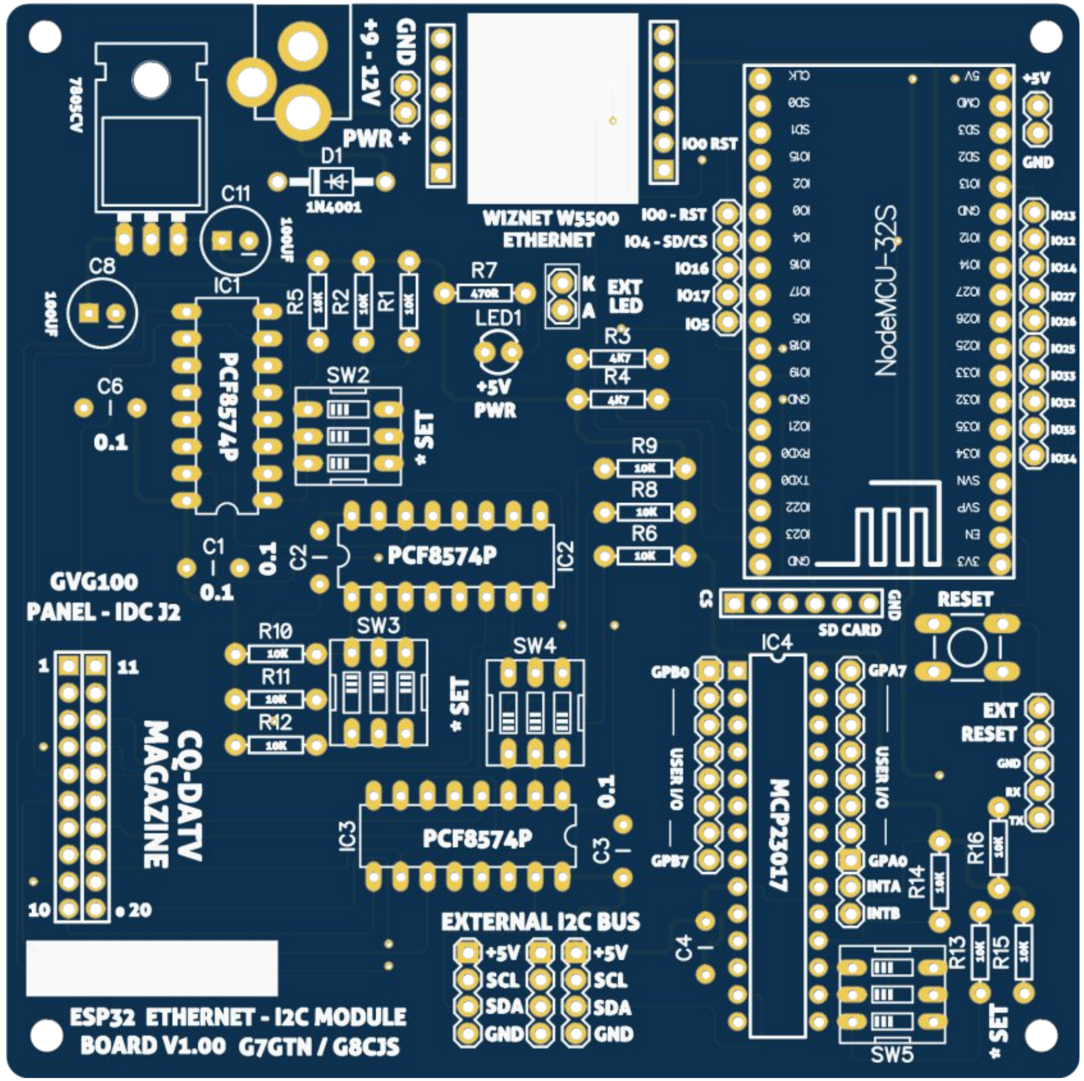
Trevor has had the harder part of this project, decoding the original workings at TTL level and creating working code via I2C from his ongoing discoveries.

An option now on the horizon has appeared in the form of a new Version of Annex Basic for the ESP32 range of modules, the author has now also added support for the W5500 wired Ethernet modules so opens up the way to create a full working development type board which can be coded still in our familiar ESP Basic or indeed C++ if we wish to change language.

With the power of the VMIX API and what becomes reasonably simple hardware we can create our own custom but flexible controllers during 2020.

The software, VMIX2.zip, is available from the CQ-DATV downloads site *https://cq-datv.mobi/downloads.php*





Web References

https://www.wiznet.io/product-item/w5500/

https://www.vmix.com/

https://www.vmix.com/help19/index.htm?DeveloperAPI.html

https://www.wireshark.org

Microwave Antenna Tests

Written by Don Nelson, N0YE

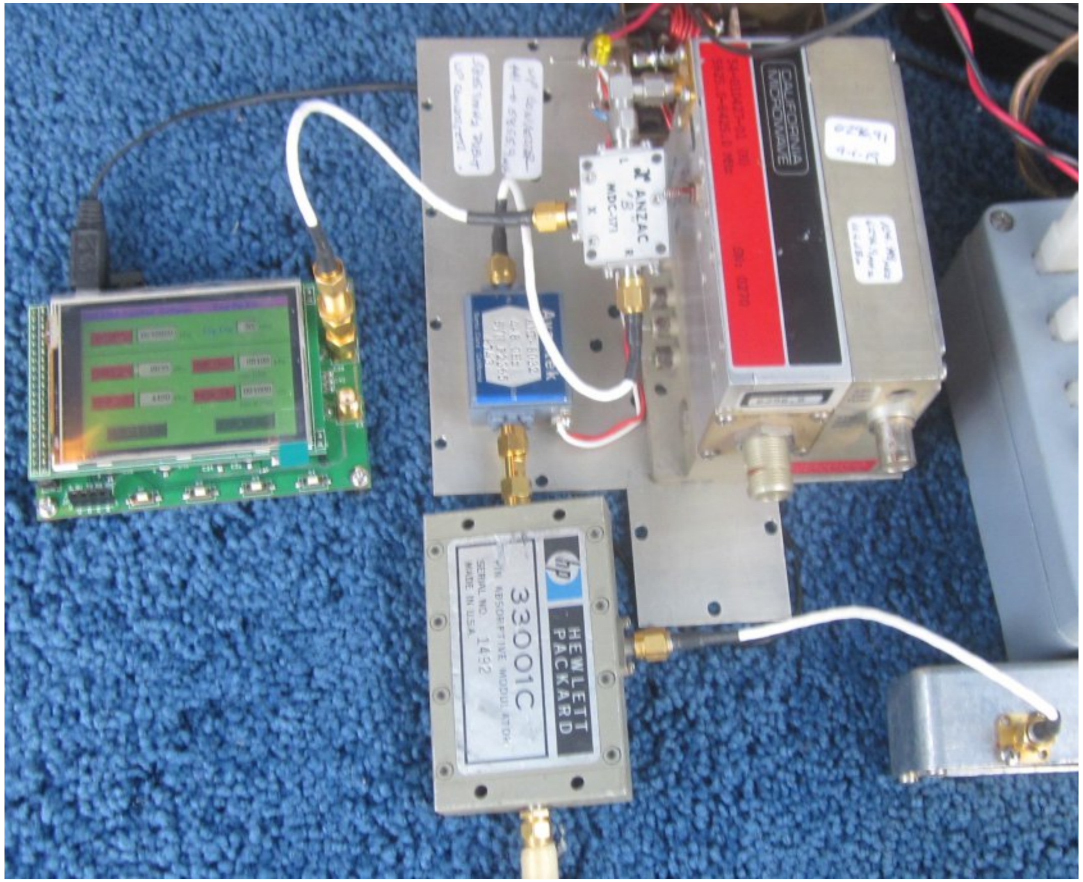
5.7 GHz Antennas

The test frequency was 5678 MHz. The source antenna was a 13 inch dish with a log periodic antenna constructed on a circuit board and made by Kent Britain, WB5VJB, as the feed. The antenna test range was 70 feet. The source antenna was 10 inches off the ground and the antenna under test were 61 inches off the ground.

The reference antenna for the test is a Radiowaves SP1-2/5 dual band antenna that is 12 inches in diameter. The published gain for the lowest measured frequency of 5750 MHz is 23.2 dBi. The gain for this antenna rose slightly at higher frequencies. Because the tests were run at 5678 MHz, the antenna gain for the test will be assumed to be 23.0 dBi.

The antennas tested are in the table further on. The table has the antenna tested with the observed gain in dBi. The second column in the table has the measured antenna aperture in square inches. The next column shows the ratio of aperture to the Radiowaves antenna. That ratio then is shown as a number in dB. The final column computes what the tested antenna gain could be by adding the aperture ratio in dB to the gain of the reference antenna.

The 13 inch dish had two different feeds tested. One feed was a home brew (HB) feed that was a driven dipole element with a back splash plate one quarter wave behind the driven element. The second feed was a WA5VJB log periodic antenna. The home brew feed was surprisingly close to the computed gain for the dish. Although the WA5VJB antenna feed came up a little short of the computed gain for the dish, it is a reasonable feed to use when another antenna may be needed.



Don, N0YE's, 5.7 GHz source consists of ADF-4351 frequency synthesizer, Frequency West brick 6 GHz LO, diode mixer, amplifier & PIN modulator (1kHz square wave)

The 20 inch dish antenna is a Dish Network 500 dish. This dish worked with two LNBs which says the surface is not a section of a parabola but some other shape that was designed to serve the two LNBs, and is less efficient per surface area than a parabolic surface.

The first generation Dish Network dishes were 18 inch dishes with a single LNB and had a surface that is a section of a parabolic surface. This 20 inch dish is a later generation of Dish Network dish.

Receive setup

So thus in my opinion this is a dark horse as how to characterize it. The feed for this dish was a WA5VJB log periodic antenna. The gain is good and makes the dish an asset when another antenna is needed.

10 GHz Antennas

My 10 GHz antennas were compared. on two antenna ranges. The first was at close range of 29 feet separating the source antenna and the antennas under test. The second antenna range was over a distance of 70 feet that was long enough for the source antenna to be in the far field of the antennas under test.

The height of the source antenna and the height of the antennas under test were adjusted for each test range for a satisfactory gain measurement. Interestingly these heights h1 and h2, for the source antenna height and test antenna height were computed and did not compare with what actually was found to be needed on each antenna range test. The test frequency was 10368 MHz. The source antenna was a 17 dBi, waveguide horn. The standard gain, waveguide horn was a Narda 16.5 dBi gain antenna. This was the antenna used as a reference for the other antennas tested.

The antennas test results are in the table on the next page.

Dish Antennas: 13” dish with log-periodic feed

13” dish with dipole & disc reflector feeds

Antenna	Gain dBi	Aperture Sq. Inches	Aperture Ratio	Ratio in dB	Computed Gain dBi
Ref Dish	23	113	-	-	-
13 in HB	21.9	133	1.18	0.7	23.7
13 in VJB	20.3	133	1.18	0.7	23.7
20 in dish	23.6	314	2.92	4.6	27.6

I have two Dish Network dishes. The 10 GHz dish is 18 inches and has a feed that housed the LNB and was modified to be just the feed by adding an SMA probe into the wave guide.

The 20 inch dish is what requires a feed and was used for 5.6 GHz. All computed gain numbers compare well to the observed gain with the exception of the 13 inch dish. This dish has a home brew feed which is not performing as well as it could/should.

20” dish with log-periodic feed

The antenna range testing was done in part to get a handle on how well the 13 inch dish and feed perform. The home brew horn antenna was only tested on the shorter range and so the measured gain may not be accurate (below what it may be).

Antenna	Gain dBi	Aperture Sq. Inches	Aperture Ratio	Ratio in dB	Computed Gain
Narda	6.1	-	-	-	-
HB Horn	22	33.8	5.54	7.5	24
12 in dish	27.5	113	18.5	12.5	29
13 in dish	24.5	133	21.8	13.5	30
18 in dish	32.5	225 (est)	37	15.5	32

Editor's Note: The pc board log-periodic antenna, less coax cable, can be purchased for $9 direct from Kent, WA5VJB. For more info, check out his web site for this and other microwave antennas, *www.wa5vjb.com*

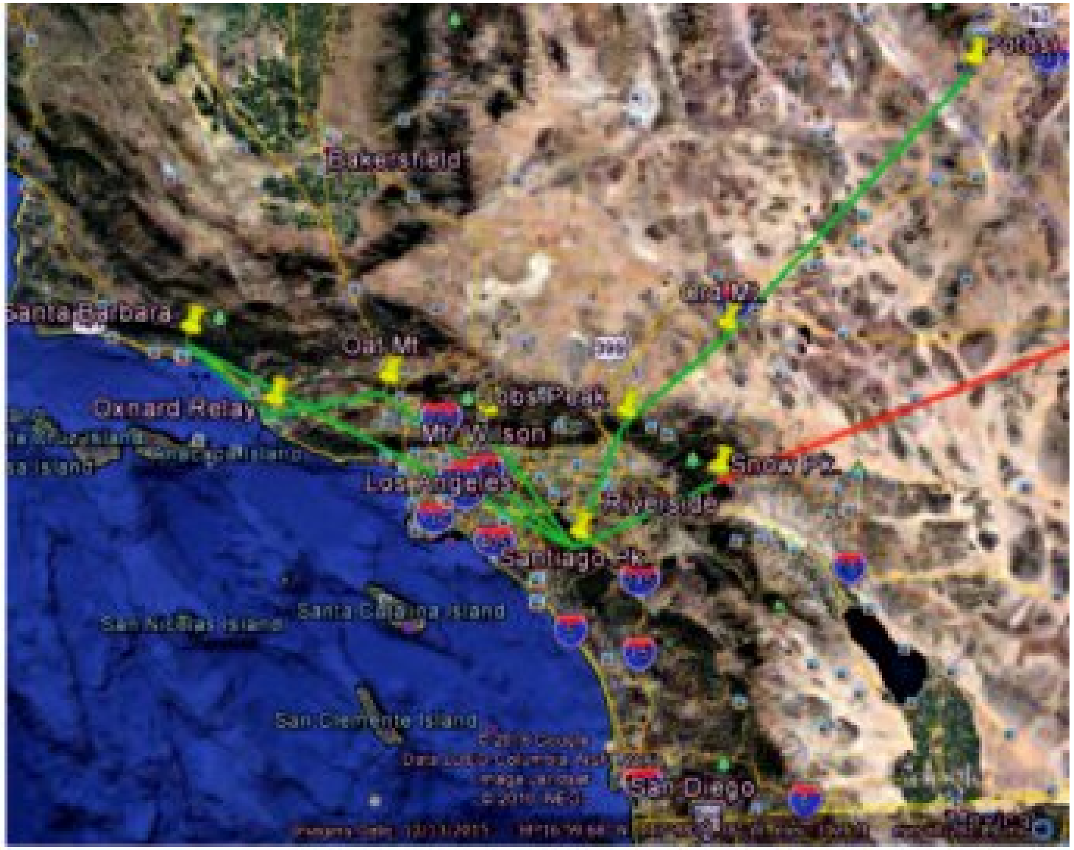
Amateur Television Network Microwave Band Use in Arizona, California & Nevada

Written by Michael Collis WA6SVT

Background

Amateur Television Network (ATN) is a group of amateur television clubs (chapters) in many of the states within the United States. Most chapters have repeaters, many of them are linked via microwave. Most repeaters have an input or output within the microwave bands using both analog and digital modes.

Arizona Link Map

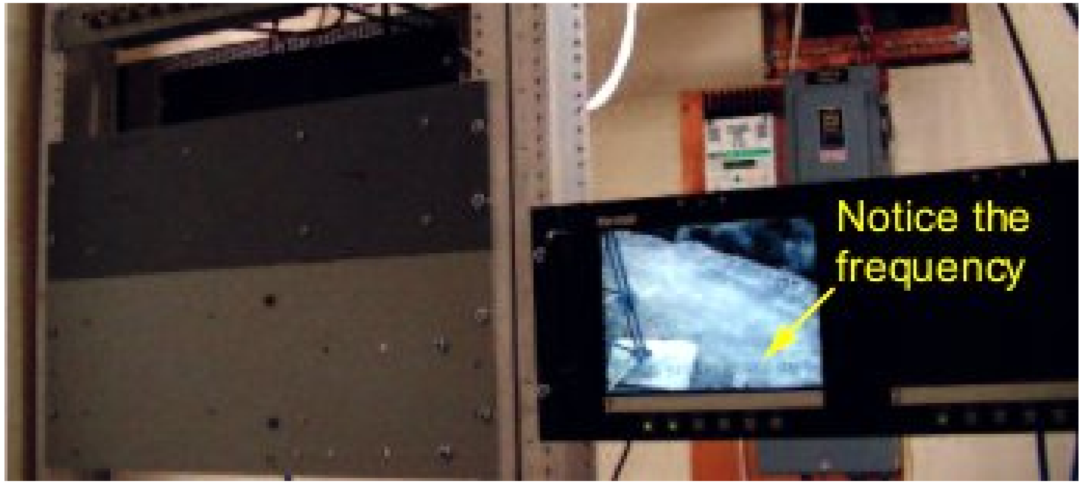


California - Nevada Link Map

We have chapters in the following states: Alabama, Arizona, California (a north and a south chapter), Delaware, Florida, Georgia. Illi nois, Indiana, Kentucky, Missouri, Nevada, New Mexico and Ohio.

Most of our chapters support public service to provide pictures during drills, disaster and large public events where crowd control is important to public safety officials.
UHF and Microwave band usage 70 cm, 33 cm, 23 cm, 13 cm, 9 cm, and 5 cm. Linking is primarily in the 13 cm, 9cm bands and 5 cm bands. VSB (filtered AM) analog and DVBT digital are the modes used as repeater inputs and outputs in the 70 cm, 33 cm and 23 cm bands and FM used in the 23 cm and higher bands.

Ord Mt. Link & Repeater Site



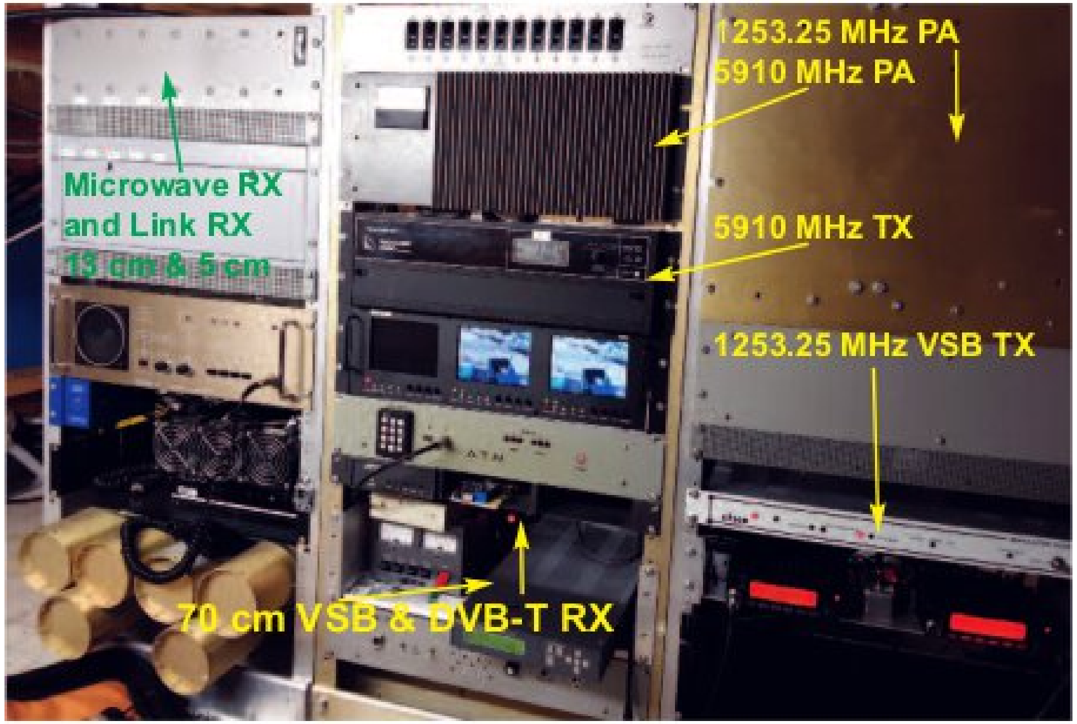
Most linking uses FM mode allowing up to 600 line resolution and no latency.

Our largest linked repeater system is in the southwestern states with seven repeaters linked in Southern California and Nevada and Arizona with three linked ATV repeaters.

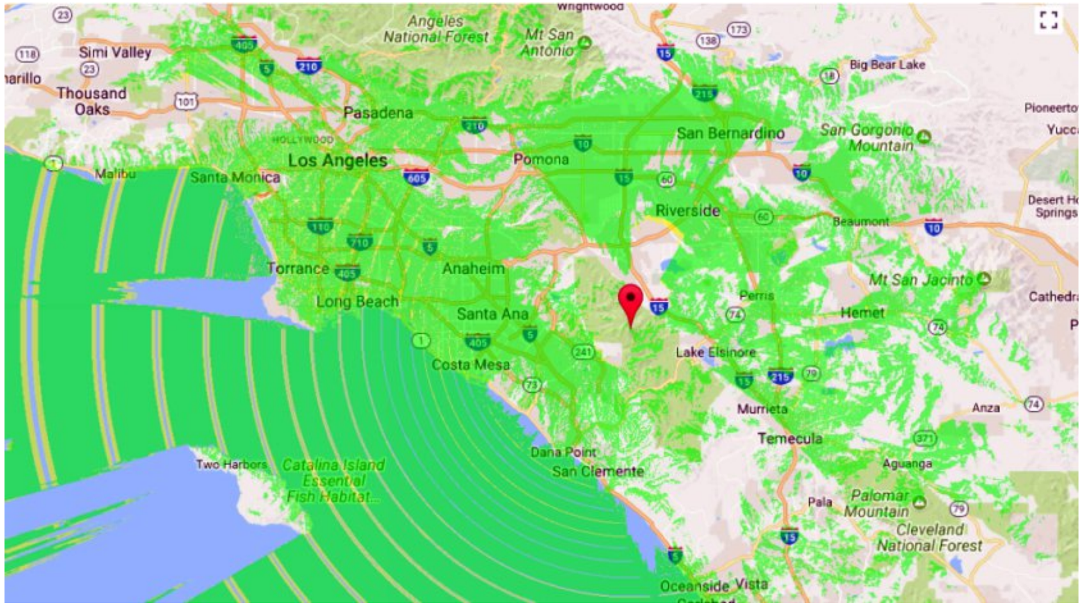
Ord Mt. Link Equipment

Arizona is currently building their microwave system towards California to join the California Nevada system.

The image in the monitor is from Santiago Peak's 5910 MHz FM output (omni) received at Jobs Peak 39 miles distance then relayed on 5737.5 MHz to Ord Mountain 41 miles distance. The image is then link to Mt. Potosi 103 miles distance on 2417.5 MHz to service Las Vegas.

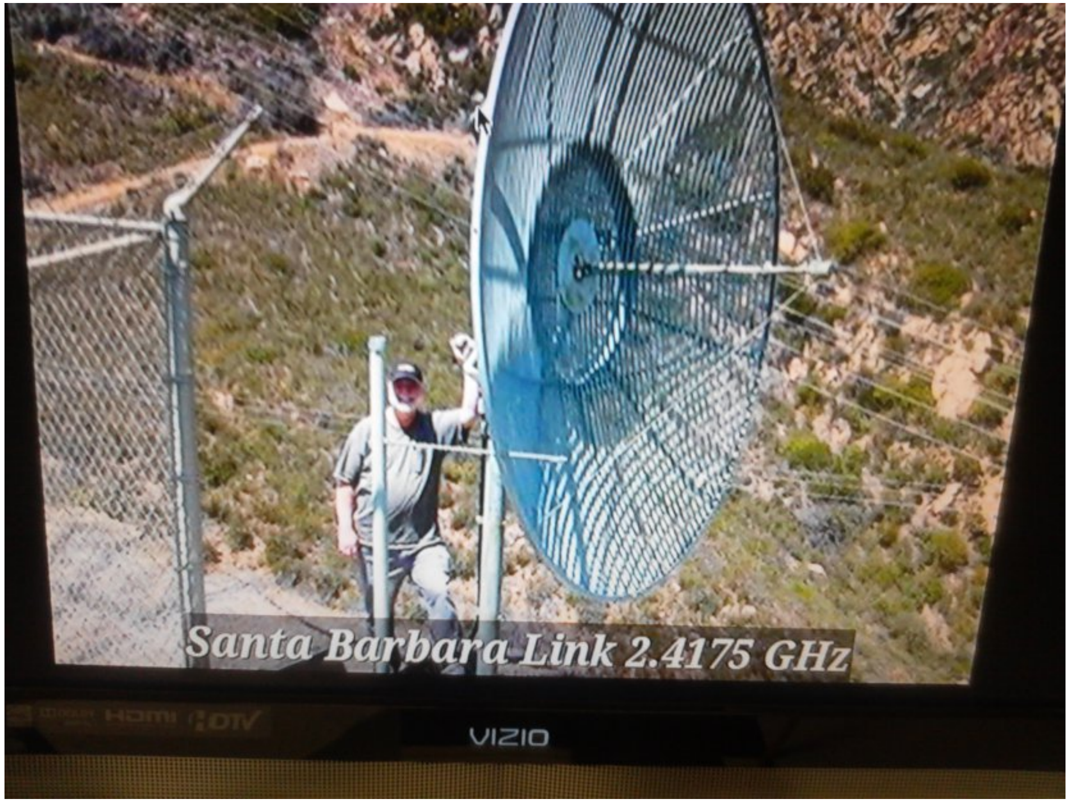


Santiago Peak (ATNCA Hub)



Santiago 5910 MHz Coverage Map

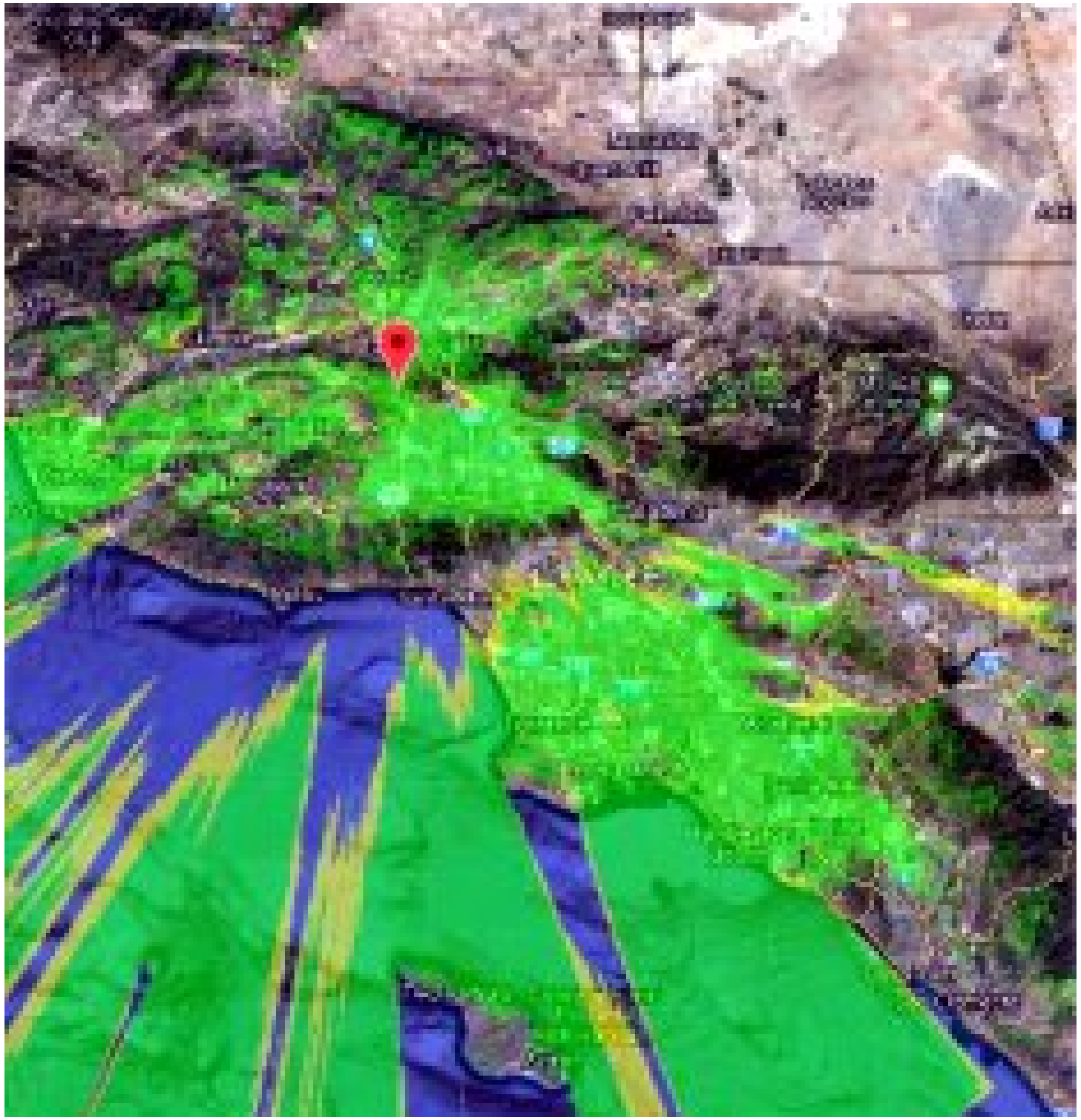
Santiago Peak is the hub for the Southern California system. All of the non hub repeaters use the Santiago Peak 5910 MHz Oat Mt. Jobs Pk, and Snow Pk. transmit back to Santiago Peak on 2417.5 MHz and Mt. Wilson on 5712.5 MHz. Jobs covers the High DesertVictorville and Snow covers the Low Desert Palm Springs.



Oat Mt. 8' Link dish to Santiago Peak

Oat Mountain has a 3380 MHz FM output with 100 watts ERP that has no QRM as compared to it's older 919.25 MHz VSB output with 800 watts ERP due to part 15 and WiFi devices in the band.

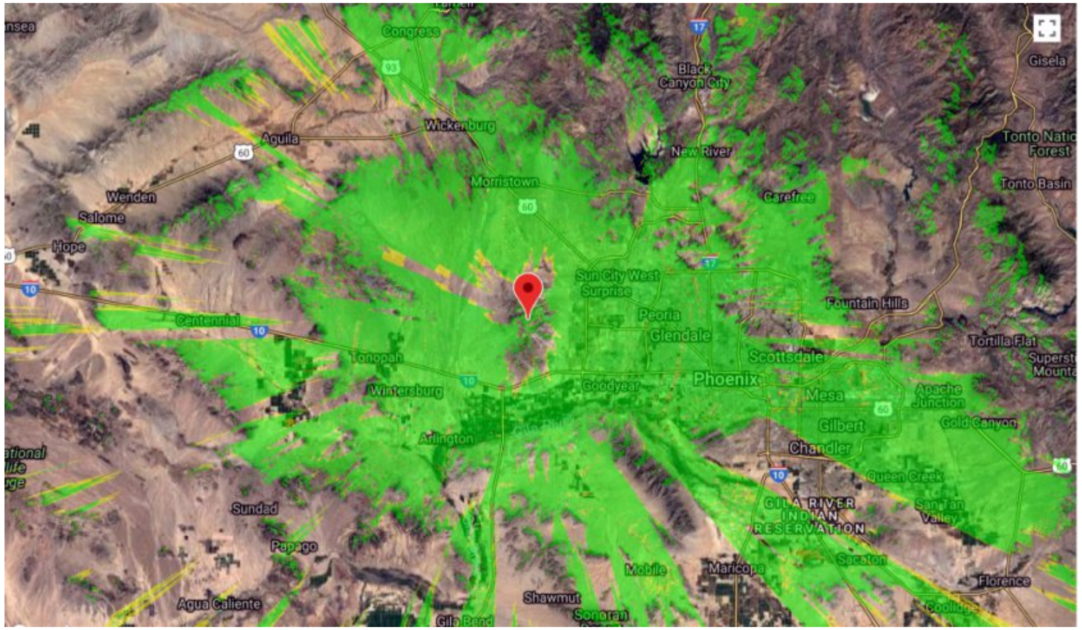
Oat Mountain picks up the Santiago Peak 5910 MHz FM and links back on 2417.5 MHz.



Oat Mt. 3380 MHz Coverage Map

Oat Mountain's 3380 MHz FM output covers a large area of LA and Ventura counties.

Below is the longest ATN link at 124 miles from Santa Barbara to Santiago Peak, ATN uses a 10 ft dish and a 20 watt 2417.5 MHz link transmitter mounted at the dish to make the long path work.



White Tank 5910 MHz Coverage Map

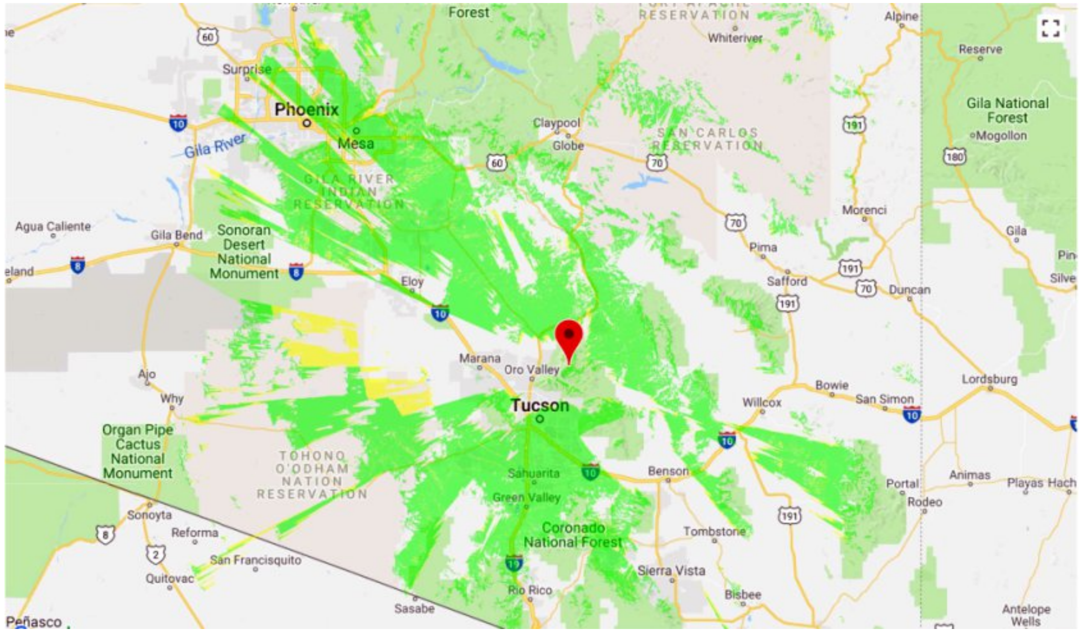
Another link at Oxnard relay's Oat's 3380 MHz to Santa Barbara on a dedicated point to point 5910 MHz link. ATN's Arizona chapter has a 5910 MHz FM out put on White Tank Mountain that covers the Phoenix area and west half way to California.

Our Mesa ATV repeater in the East Phoenix valley picks up the 5910 MHz FM output from White Tank Mountain and fills in the shadows from the back side of Camelback and Shaw Butte mountains.

Mesa then links via 2417.5 MHz to Mt. Lemmon and back to White Tank on 5712.5 MHz FM.

Mt. Lemmon at 9015 ft elevation covers Tucson and Southern Arizona.

Green's Peak at 10,070 ft. not shown covers Eastern Arizona and parts of Western New Mexico.



Mt. Lemmon Coverage Map

A new link between Arizona and California is under construction that when finished will bring both linked systems into a giant 3 state linked ATV net work.

Our Delaware chapter has added a 2nd repeater in Pennsylvania at Darby south of Philadelphia and they are now linked. Our Ohio chapter that is part of Dayton ARC W8BI, is finishing a linking project with an other ATV club ATCO to connect Dayton to Columbus. Microwave is a part of both these systems too.

ATN is also using MESH on 3.4 and 5.8 GHz bands for telemetry for some of our sites and connection to video over MESH.

There are many very large MESH networks connected to ARDEN with hundreds of linked nodes just in southwest and many other areas not covered here that use the 9 cm and 5 cm bands.

ATN has a very large investment in equip ment using UHF and microwave including the 9 cm and 5 cm bands.
This three page presentation is a summary of our systems. Our chapters as well as other ATV and MESH groups are ready to team up with the League to fight to save out microwave bands.

Respectfully submitted on behalf of Amateur Television Network, Michael Collis WA6SVT

A Tower Mounted 10 GHz Off-center-fed Dish Failure

Written by Don Nelson, N0YE

Bad News - Part 1: sometime this summer the flexible wave guide wrapped around the rotor feeding the 10 GHz dish antenna on the tower came away from the WR90 to which it was attached. What failed was a WR90/flange solder joint not the flexible wave guide. I saw this over a couple of months ago and did not fix it right away. I did eventually take down the failed parts and re-soldered them.

N0YE's VHF / UHF / Microwave Antennas

Part 2: Later I tested the repair and found no signal. I measured the return loss. One watt out and nothing back - it does not get better than this. So back up the tower.

I pulled the repaired flange off. Yup, something, a bird or whatever, had stuffed the WR90 with pieces of grass. I could pull out about 2 inches of grass up to a 90 degree wave guide bend. Nope this did not fix the failure.

So back up the tower again, when I opened up more of the wave guide and pulled grass out of the 12 plus inches of straight wave guide. I did not trust that I was done and so I removed the feed horn and attached short piece of straight WR90. There was grass pieces all the way to the horn. There is a plastic window at the horn flange/flange joint. So nothing came into the wave guide from the horn end. All of the grass pieces were put into the wave guide from the broken flange end.

Good News - Part 1: the 10 GHz off-center-fed dish on the tower appears to be working now. I can hear SSB and see DVB-T signals again.

Part 2: The return loss is now a believable 13 dB. Having a "perfect" attenuator at the dish end of the wave guide that gave me a stunning good return loss, tells me that the wave guide from the rig to the dish is very good.

Here are a couple of notes on the 10 GHz tower antenna system. The dish is a first generation off-center-fed Dish Network dish with a home brew horn antenna at the feed point. These first generation dishes used only one LNB and so the dish surface is a section of a parabola. The horn was designed by Paul Wade, W1GHZ, to properly feed this type of dish. The feed horn is attached to WR90 wave guide that goes to and around the rotor to a fixed wave guide that goes down the tower.
(*http://www.w1ghz.org/10g/10g_home.htm*)

This picture shows the wave guide going up the feed holding arm of the off-center-fed dish. The dish is upside down to keep water from entering the horn. The right side of WR90 wave guide has been opened up in this picture to allow the wave guide to be cleaned out.

This picture shows some of the grass pieces removed from the wave guide. The whole wave guide was full of grass pieces like these pieces.

The fixed piece of wave guide going down the tower is 3/4 inch water pipe about 20 feet long. At the bottom of the water pipe, there is a transition back to WR90. The WR90 then goes over a few feet and then through the house wall. Inside the house the WR90 goes up to the 10 GHz rig which I use for both SSB & DVB-T.

Written by Trevor Brown G8CJS

THE 1970s

As 2020 heralds in a new decade, I thought it would be interesting to wind the clock back and look what came along in the same decade 50 years ago, starting with the microchip or CPU.

In 1971 Intel released the first commercially available CPU the 4004. By any standard this was a humble beginning for a microchip. The maximum clock rate was 740kHz, yes that's kHz. The data bus was just 4-bits wide and it had a 12-bit address bus that was multiplexed with the data bus i.e. it presented one or the other, but not both at the same time (it was a 16-bit dual in line package).

The technology was MOS (Metal-Oxide-Semiconductor) and it lasted until 1981 and implemented a giant leap in TV hardware. At those sort of speeds it was never going to get into the image manipulation business.

It was just something that made control application more flexible and introduced the concept of software engineering and to somebody that started with valves, made it into transistors and then onto logic, industry lost engineers at all these stages, but the last leap did make me feel I was hanging on by the skin of my teeth.

From memory the chip itself proved very reliable. It was the other technology that went with this brave new world that gave the problems. Memory being at the top of the list. Both RAM (4002) and ROM (4001). RAM was dynamic based e.g. it stored data by charging capacitors that had to be constantly refreshed by one of two clocks RAS and CAS (Row address and Column Address). The ROM was another source of pain it used to die frequently and I still remember sending large PCB's full of multiple chips across the pond to be looked at back in the factory from whence they came. On the plus side this new technology brought a level of sophistication and control that had not previously been possible.

In video tape, (my home turf) the impact was on edit controllers. Until then the technology was comprised of slow large cumbersome units that navigated their way along the tape by recording benchmarks on the tape cue track and then counting forward in frames using TTL logic to enable the edit points to be selected loaded and modified. Edits could be previewed modified and ultimately performed, but access was via thumb wheel switches. Counters could store a maximum of 10 mins and then a new benchmark or tone burst would need to be recorded on the tape. This was slow and painful but did deliver results - the micro changed all this.

The 4004 enabled time code technology where clock data could be recorded as hours, minutes, second and frames on the tape as both longitudinal data LITC and VITC in the vertical interval. This opened up VT Post-production, which was always the poor relation to film production, something I could never grasp as winding through pictures, cutting and Sellotaping your work back together so somebody else could follow your work by edge numbers and cut a negative to match never looked like the way to go either.

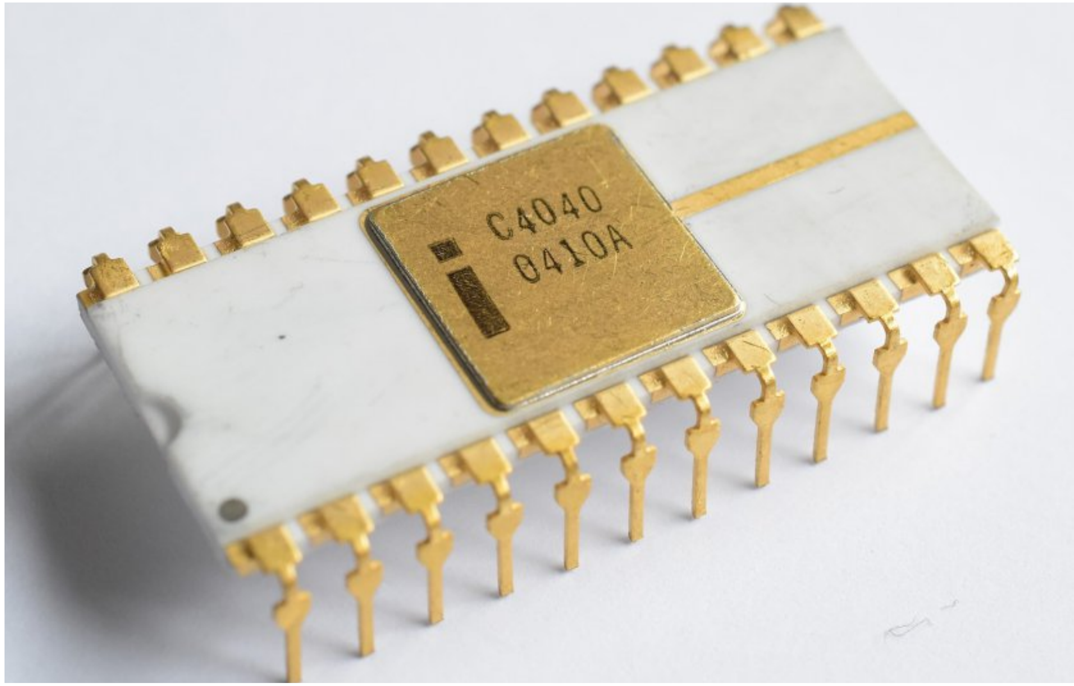
Four machine VTR edit suite (three playin one inch machines) with an Electra edit control system (not a thumb-wheel in sight)
My thanks to BBC Old Boys for the picture

The new technology allowed sound to be lifted off and processed in a dubbing suite and more importantly put back in lip sync, something that film had been doing for quite a while.

My day to day problems were less about purpose and more about how to keep the wheels turning. This new technology was opening doors, perhaps a little faster than I could navigate. It was not necessarily where the doors were leading to, more how to keep the hinges oiled and the locks turning. The 4004 had 12 instructions (if you could get around to understanding what an instruction was). The joke at the time was instruction 1 power down, instruction 2 replace the chip, instruction 3 pray and power up. This never fixed any of the problems as the CPU was never the problem.

These were, believe it or not, the most reliable of devices in the chain.

Then Intel released the 4040 in 1974. This was PMOS technology, the CPU speed was still 740kHz, but it could execute 62,000 instructions per second, (yes, we had not learnt the word MIPS Million Instructions Per Second back then, the way we measure embedded micro controllers' speeds today). This was a giant leap in technology! The device had 24 pins and a much better internal architecture that would support some new external devices, General Purpose 8-bit Output Port (4207), General Purpose 8-bit Input Port (4209) and a General Purpose 8-bit I/O port (4211). Although the ports were 8-bit, the processor had to deliver the data to them as two 4-bit words and there was still address bus and data bus multiplexing so it couldn't make the best of the clock cycles. The device had the equivalent of 3000 transistors as Intel was always expounding at the time. Not sure if that's how I wanted my transistor serving up, as if I had a choice.

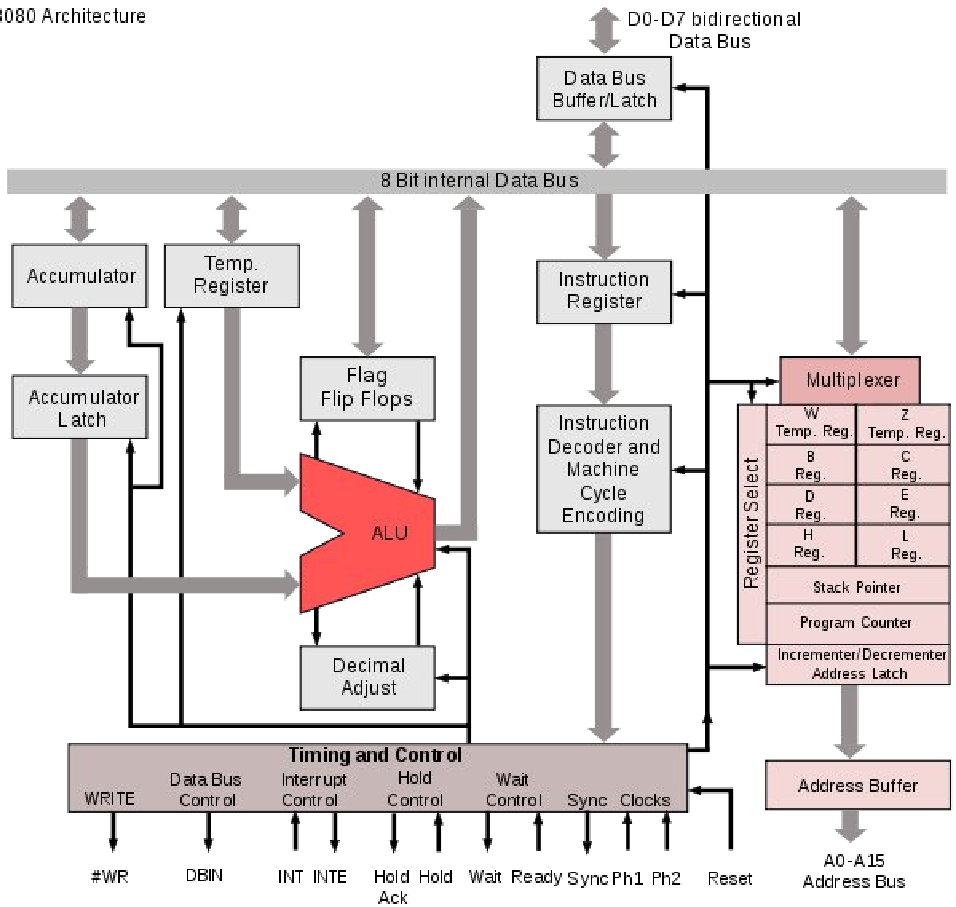


The new architecture enabled single stepping so as the function implies, programmes could be stepped through one instruction at a time.

I remember the popular electronics magazine Elector bringing out a self-build PCB project to support a home constructed project, based on the 4040 technology, with keyboard access so you could develop your own programmes.

The next step was 8-bit architecture the first step was the 8008 this had an 8-bit data bus and a 14-bit address bus with little improvement in CPU speed.

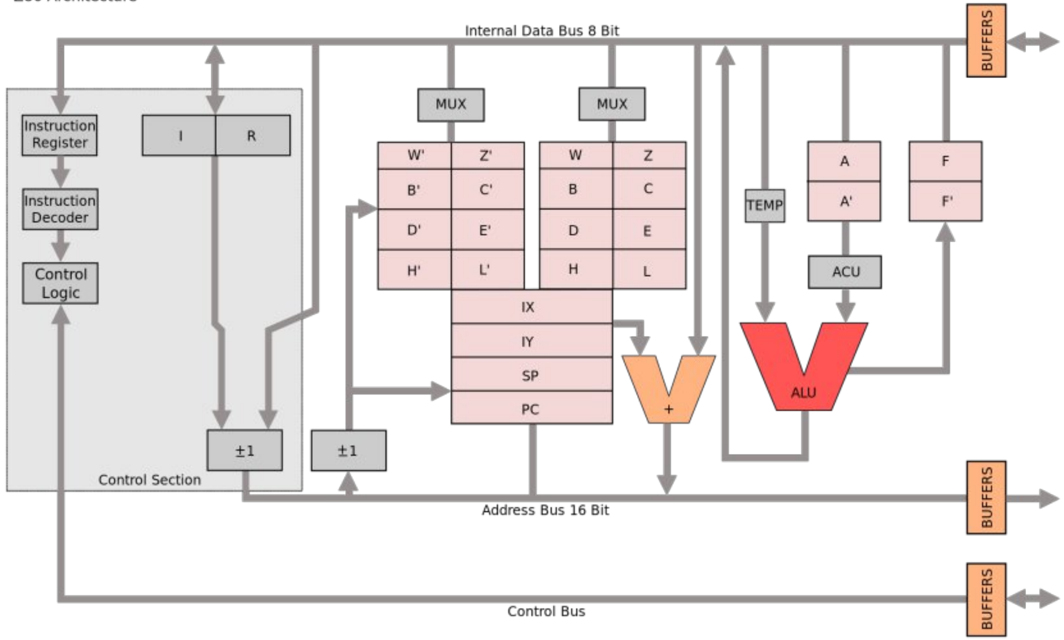
Intel 8080 Architecture



The major drawback was the absence of direct memory addressing. To access data in memory the memory address had to be stored in H and L registers, and then the processor could indirectly access the memory. This limitation was removed in the 8080 which could handle a 3.125MHz clock speed and had a 16-bit address bus. The 8080 used the same instruction set as the 8008 but was not source code or binary code compatible.

By the mid 70's the well loved Z80 appeared, but from a new company called Zilog and was the first product from this start up company headed by Federico Faggin.

Z80 Architecture



Interesting perhaps, but there were creative differences in Silicone Valley. Federico Faggin had been until now the motivating force at Intel, but perhaps not any longer. His new company started with only 11 employees and delivered the first working product by March 1976. The Z80 was probably the most popular CPU of the late 70's and early 80's, it was an interesting chip.

It had compatibility with the 8080, but Intel would not allow their mnemonics to be used, so Zilog had to create there own which were actually a lot more friendly. The Z80 code could be run on the 8080 although it had extra instructions that were Z80 only. This meant a little care was needed when porting code across, but no problem the other way round. It also had the ability to provide a refresh on the address bus for dynamic RAM although Static was starting to appear. The Z80 was one of the most popular CPU's for home computers. Intel carried on and went 16 bit with the 8086 which opened the door to the PC and well we are moving on to the 1980's here.

So the decade that began 50 years ago was perhaps one of the most exciting for CPU development. I think when you follow all the steps it was all home grown and not the result of alien technology, as some would have us believe.

My thanks to Appaloosa - for the above diagrams, CC BY-SA 3.0, *https://commons.wikimedia.org/w/index.php?curid=2933572*

Vt Old Boys *http://www.vtoldboys.com/* for keeping the dream alive, and more sources on the internet than I can name. Any errors are purley mine for which I will blame the passage of time.

Next issue I will be looking at the coming of the VCR another humble beginning that, became part of our every day lives.

Ian Pawson comments:-

An interesting article from Trevor as usual. However, I would like to challenge the statement "The Z80 was probably the most popular CPU of the late 70's and early 80's". This position was, of course, held by the wonderful 6502.
The MOS Technology 6502 (typically "sixty-five-oh-two" or "six-five-oh-two") is an 8-bit microprocessor that was designed by a small team led by Chuck Peddle for MOS Technology. When it was introduced in 1975, the 6502 was, by a considerable margin, the least expensive microprocessor on the market. It initially sold for less than one-sixth the cost of competing designs from larger companies, such as Motorola and Intel, and caused rapid decreases in pricing across the entire processor market. Along with the Zilog Z80, it sparked a series of projects that resulted in the home computer revolution of the early 1980s.

Popular home video game consoles and computers, such as the Atari 2600, Atari 8-bit family, Apple II, Nintendo Entertainment System, Commodore 64, Atari Lynx, BBC Micro and others, used the 6502 or variations of the basic design. Soon after the 6502's introduction, MOS Technology was purchased outright by Commodore International, who continued to sell the microprocessor and licenses to other manufacturers. In the early days of the 6502, it was second-sourced by Rockwell and Synertek, and later licensed to other companies. In its CMOS form, which was developed by the Western Design Center, the 6502 family continues to be widely used in embedded systems, with estimated production volumes in the hundreds of millions.

One of the first "public" uses for the design was the Apple I microcomputer, introduced in 1976. The 6502 was next used in the Commodore PET and the Apple II, both released in 1977. It was later used in the Atari 8-bit family and Acorn Atom home computers, the BBC Micro, Commodore VIC-20 and other designs both for home computers and business, such as Ohio Scientific and Oric. The 6510, a direct successor of the 6502 with a digital I/O port and a tristate address bus, was the CPU utilized in the best selling Commodore 64 home computer. Commodore's floppy disk drive, the 1541, had a processor of its own — it too was a 6502.
In the 1980s, a popular electronics magazine Elektor/Elektuur used the processor in its microprocessor development board Junior Computer.

One from the Vault

Some Discussion on hand-soldering SMT Amplifier Kits
First published in issue 8

Written by Ken Konechy W6HHC

A funny thing happened while trying to select the first-stage PA for the W6HHC DATV station. The first choice was not the Kuhne. Our first-choice was a very low-cost kit for a 1 Watt 1.2 GHz model using an ATF50189 PHEMT from MiniKits in Australia. The kit was only about US$50, but offered a big challenge...it was a Surface Mount Technology (SMT) kit.

Now, Ken W6HHC has built more than his fair share of building the famous Heathkit ham gear. Including the really terrific SB-301/SB-401 SSB station. But, Ken was no match for hand-soldering SMT components.

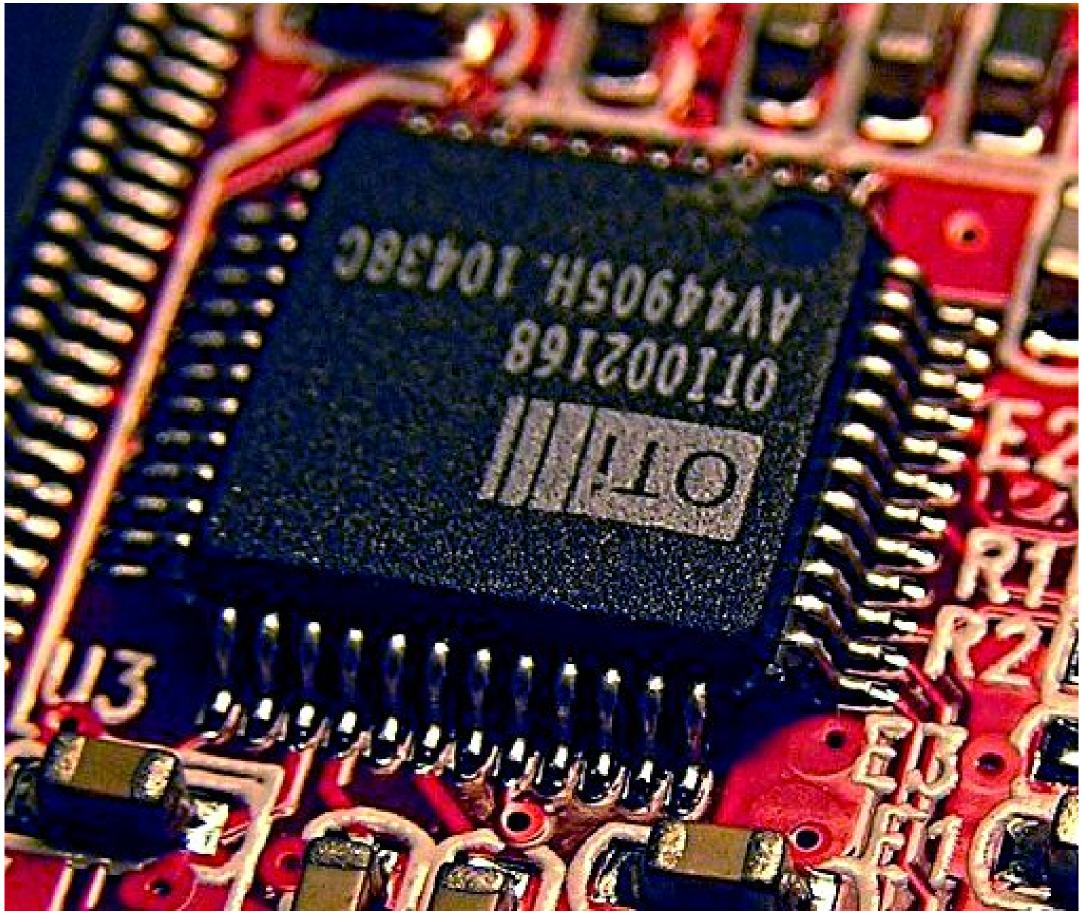
The first trick learned for easy hand-soldering was to buy a tube of solder-paste (used by automated SMT soldering).

This works very well. It is very easy to control the amount of solder. Normal solder-wire tended to melt too much solder on the board for Ken. Solder-paste also nicely keeps the part in position on the board while you get ready to use solder-iron.

The big SMT problem was losing parts while trying to get them onto the PCB. These SMT parts are small.

1) Tweezers could shoot an SMT part half-way across the lab. Sometimes Ken searched the lab floor on “all fours” for a half-hour without success.

2) Pressing an SMT part into the finger-tip and lifting it into position seemed to work better. But, parts still “disappeared” before they reached the magnifying glass view of the PCB.



3) Dipping a toothpick in solder rosin worked even better for picking up and placing SMT components.

Finally, purchasing an assembled-and-tested 1 Watt amplifier from Kuhne Electronics was the very best solution.

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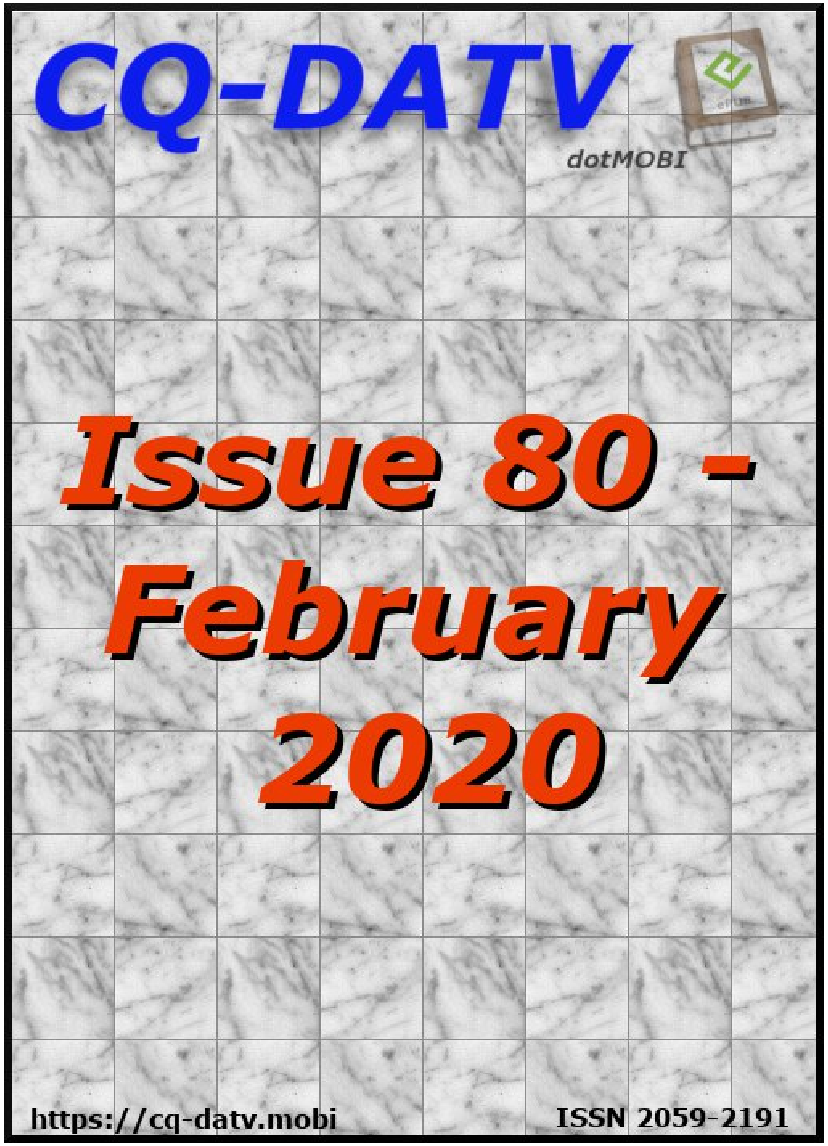

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