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 CQ-DATV issue 99. We have now been producing this magazine every month for 8 years. This is a green publication, produced in electronic format only. We provide three formats of e-book and one version of PDF for every issue. We also have in the library an electronic index which allows a search for all the articles by description and author, also the omnibus PDF, which is every issue in one single file. These are both updated after each publication is published.

In the 8 years of our magazine there have been in excess of half a million downloads, which makes us the most widely read ATV publication. This is no mean feat for the small production team who are now all eight years older than when we launched this publication! This is taking its toll and this is the penultimate issue! CQ-DATV 100 will be published next month and then we are going to rest this work. We have proved the demand is there and we have brought the ATV community closer together and proved that the support of a monthly magazine, freely available to everyone, is of immense value. The magazine works and we would love to see it continue but alas, we are and have been for some time, desperately in need of people to create, produce, contribute and proof read. We had hoped that others would join, but this has not happened.

The concept of an electronic only magazine was an idea from Ian our editor in chief, but in order for it to continue we needed more people to take on all the tasks so we could rotate the workload and we are sad to say this has not happened. The Facebook site will continue, the library will be maintained for at least another 12 months and possibly longer. It's a cost that has come out of Ian's personal pocket. The mailing list is still intact and should something emerge in the future you will be contacted via this list or our Facebook, so please join either or both now.

In this issue we have all the latest up-to-date news for you and also updates on our contributors continuing projects:-

Following on from Jim Andrews article 'What is in the Cable TV Spectrum?' in CQ-DATV 97, we have been contacted by a Director of Engineering working in the CATV industry. He has enlarged on Jim's article and introduce some data that although has been previously published, was never reproduced in one place until now.

TFT Touch screen project. Trevor is now the proud owner of an ESP32s, and now has it running on an ILI9846 TFT touch screen. This is this second part of the article which started in CQ-DATV 98. Trevor's ESP 32 is a 38-pin device. There are also 30 pin devices around.

Trevor will be covering interfacing the TFT to the 38-pin version in this issue and the 30-pin version in CQ-DATV 100 as it is still work in progress. This article includes the code for a Splash screen written by Fernando Perez. The code is also in the e-book version of CQ-DATV and can be cut and pasted into the Annex editor. The PDF version has thrown up a few errors that the error handler will flag. The problem line just needs retyping into the editor and the software will run. t's just a PDF thing and beyond our control as they say.

SSTV from the International Space Station. Disappointment instantly turned to excitement for Chris Grund, K0CJG when he managed to capture SSTV images from the ISS. Yes, there were problems of patterning which he reduced by unplugging lots of kit in the shack. The RX a Yaesu FT991A set to FM mode, with a 16kHz bandwidth, fed by a Diamond X50 vertical antenna on the roof and a Windows 7 PC running MMSSTV software. We have the full story and the pictures in this issue.

Microwave Ocean Ducting of 5 & 10 GHz, Hi-Def, Digital TV 287 km across the Sea of Japan (178 miles).

On July 22nd and 23rd Fumio Sekizaki JA0RUZ using 10.2GHz ISDBT method FHDATV succeeded in communication of 287km. This ducting took place across the Sea of Japan.

Two Way DATV Translator. WA0TQG's project to relay his DVBT signal from out of the Rocky Mountains and into the Boulder ATV repeater, W0BTV is now a reality. Steve lives on Sugar Loaf mountain and he is totally shielded from W0BTV by Flagstaff and Green mountains. So, Steve's solution was to design and build a 2 way, crossband, translator. Chris Grund, K0CJG has the full story.

From the vault - Simple Video Pattern Generator. In the CQ-DATV library there are a number of TV handbooks. These are a little dated now as they were written back in the 80's. But then this is the vault.

On Page 22 of the Introduction to Amateur Television is a very simple video pattern generator using the ZNA 234 IC. This chip is still available and does not cost the earth. Mike G7GTN has continued his PCB design work and included a PCB for this chequerboard design created by Richard Carden. The PCB will again be half Eurocard design with a DIN 41612 edge connector. There is a lot of work going into this range of PCB modules, the half Eurocard format will keep the cost down and so far this has been funded out of Mikes own pocket. The prototype boards are starting to fall through Mike letterbox and he is busy populating and testing the designs.

Mike assures us that when CQ-DATV stops, the work will continue and that we will find a way to contact everyone once they are tested and available. So please join our Facebook and our mailing list.

CQ-DATV Production team

DATV repeater, VK3RTV now on the air

WIA News report that Amateur Radio Victoria's DATV Repeater, VK3RTV commenced high definition television transmissions on Thursday 15th July with a two channel multi-plexed downlink using the DVB-T2 protocol.
It is believed that this is a first in Australia.

The system uplinks are on 1246, 1255 and 1278 MHz. using either high definition DVB-S2 or standard definition DVB-S. All video trunking is via HDMI with the exception of the Media Box which generates the local callsigns and information. This will be converted to a HD version on the near future.

DVB-T2 is a second generation protocol with many enhancements over DVB-T. Stations are reporting increased ease of reception and one station, VK3GMZ is accessing and receiving the system via knife edge diffraction over Mount Dandenong. Very high quality pictures are being seen which can be viewed on larger television sets. Small print is easily read.

The two multiplexed channels, VK3RTV1 and VKRTV2 are also streamed via the British Amateur Television Club.
As this is a new protocol to Australia only Set Top Boxes which are DVB-T2 enabled can be used to receive VK3RTV.
The conversion was funded by members of the Melbourne Amateur Television Group.

The annual DATV QSO Party is scheduled for Friday 27th August and Saturday 28th August which may now include additional Repeaters in the USA. The principle is that DATV Stations transmit to their local Repeaters and a local Anchor ports the signal internationally. More details of this event will follow in subsequent broadcasts.

TX antenna at the top of the tower

Source: *https://tinyurl.com/8zwsmbwa*

British Vintage Wireless Society (BVWS)

RetroTechUK is the new name and image for the National Vintage Communications Fair, (NVCF) established in 1992.
Since then, the event has evolved and outgrown its previous title!

Held every May, at the Warwickshire Event Centre in the heart of the country near to Royal Leamington Spa, you'll find over 220 stalls of dealers, clubs and private sellers offering vintage items, including radio, televisions, hi-fi and audio, records (LP's, 45's, 78's), gramophones, telephones, communications equipment, spares, early video games, early computing, small appliances, indeed anything techy from the early 20th century right up to the millennium and beyond. And all stalls are indoors!

A new date for the event is the 26th September.

Full details can be found here *https://tinyurl.com/3bf8bs9t*

Unlike some club events, this one is open to ALL and not just BVWS members!

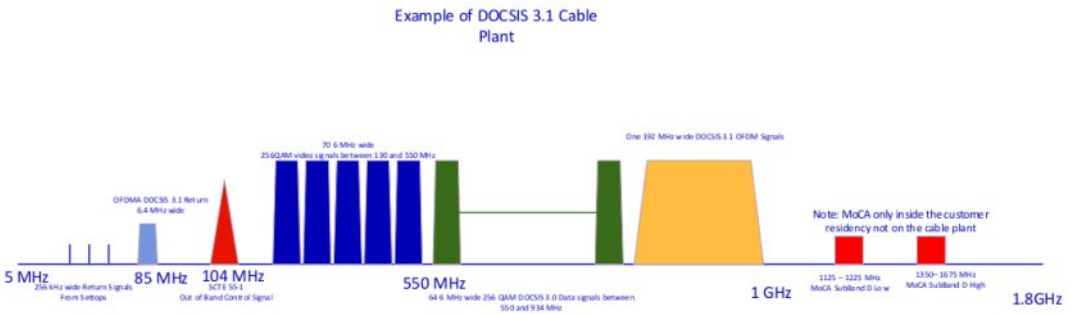
Feedback...

Following on from Jim Andrews article 'What is in the Cable TV Spectrum?' in CQ-DATV 97, we have received the following interesting comment from an 'insider'.

Hello Jim,
First I would like to say I enjoy reading your articles and the work you are doing for Digital TV in the amateur community.
I am a Director of Engineering in the CATV industry.
My comments are meant to be educational and are about your article "What is the Cable TV Spectrum" and are my own, not those of my employer. Though any comments below are general knowledge that can be found in industry forums and specifications.

Digital CATV in the US was initially rolled out in roughly the 1994–1995time frame. There were two competing systems – the DigiCable system by General Instrument and a system by the then Scientific Atlanta (I don't recall their trade name for the system). At the time these systems were somewhat closed, i.e., they did not interoperate. You either bought a GI system or an S/A system. Over time as the industry grew one could buy different parts of the system from various manufacturers and they would all interoperate.

Eventually the GI system got the largest market share, and it is the basis of the system in use in the USA today. As I am sure you know with digital television, the source coding (video/audio encoding e.g., MPEG 2/4) and the channel coding (the FEC and modulation) are separate. So, any "type of data", not just video could be placed in a QAM signal. The specs I will mention below all pertain to the channel coding. There are two bodies who have specifications for the system. The ITU (International Telecommunications Union) and the SCTE (Society of Cable Telecommunications Engineers), The overall ITU spec is labelled J.83 and has 3 subparts: J.83A which is essentially DVB-C, J.83B which is the US system



Example of how a DOCSIS 3.1 Cable plan MIGHT be laid out

developed by General Instrument and J.83C the Japanese system. The SCTE has their own standard which is a subset of J.83 and is essentially J.83B. They label their standard as SCTE 07.

With J.83B the raw payload rate for 64QAM is 26.970 Mbs and for 256 QAM it is 38.810 Mbs. Those are the rates of data/video that can be carried in each modulation type. Of course, in the US we have to fit our channels in a 6 MHz channel BW. So the symbols rates of the signals have to be selected with consideration of the bit shaping filter excess BW. For 64QAM, the filter alpha is 18% so the symbol rate is 5.057 Mbaud. For 256QAM the filter alpha is 12% with a symbol rate of 5.3605 Mbaud. With the DVB-C system, they have 6, 7, or 8 MHz channel BW's available to them based on the country, so the data rate for each channel could be greater. As I recall, you can have 51 Mbs using 256 QAM in an 8 MHz channel.to your article in Issue 97 of CQ-DATV
The DVB-C system uses just a Reed-Solomon block FEC. The US/J.83B system uses a concatenated code with Convolutional Coding and R-S Block code. This provides a 2 dB better C/N threshold in AWGN.

Here is a good link to a set of R&S whitepapers discussing DVB-C, ITUJ.83B, DVB-S etc. *https://tinyurl.com/ykspz668*

You can think of a cable system as a Frequency Division Duplex system. Much like we have an uplink and downlink in an amateur repeater (e.g., 146.04/146.64), a cable system has a downstream path from Cable Headend to customers and an upstream path from the consumer to the cable headend. In looking at your spectrum analyzer plots it appears your cable system is based on a more traditional design that uses a 42 MHz/54 MHz diplexer. All those QAMs above 54 MHz are video and data to your home. And the signals below 42 MHz are upstream from the consumer to the cable headend. The return band is moving away from stopping at 42 MHz. Modern cable systems are moving to 85 MHz and some 250 MHz return band.

The downstream bandwidths have expanded over the decades from 450 MHz, to 550 MHz, to 750 MHz, to 860 MHz, to 1 GHz . Today operators are using/looking at using 1.2 GHz to 1.8GHz downstream bandwidths. Bleeding edge research has talked about a 3GHz maximum frequency on the plant. The signal you are seeing between 70 and 120 MHz has a BW of 1.8 MHz. It is a data signal sending control info to your video settops. It follows the SCTE 55-1 specification. Today, more and more of those downstream carriers are likely data not video. The "arms race" for bandwidth between the Fiber-to-the-Home providers and the CATV system is making the CATV industry look for more and more innovative ways of using the CATV bandwidth to deliver 1Gbs or greater to the consumer's home. The data system to your cable modem follows the DOCSIS (Data over Cable Service Interface Spec) specification. The modulation and FEC are the same as J.83B. Cable operators have stopped using 64QAM in favor of 256 QAM about 2 decades ago.

The DOCSIS specification for the most current version is 3.1. In general cable systems are likely running DOCSIS 3.0/3.1 systems. The 3.0 specification introduced "channel bonding". And DOCSIS 3.1 introduced OFDM/OFDMA modulation. The next generation of DOCSIS with Version 4.0 is looking toward 10Gbs delivery. This specification talks about Full Duplex DOCSIS where there is no diplex filter separating the Upstream and Downstream frequency bands, but the full cable plant BW is used for both signals simultaneously. This is done through various timing techniques.

Since the data from a DOCSIS QAM is not just for your home and must be shared between homes in your area, it becomes harder and harder to delivery high downstream bandwidths to everyone constantly when a single QAM has only 38.81 Mbs of data capacity. Users want 100's of Mbs for just their use. So DOCSIS 3.0 calls out channel "bonding" where a group of QAMs' (8, 16,32) are all treated as one big pipe from which a set of cable modems can share the bandwidth. As an example, if you bond 8 QAM's you will have 310 Mbs to share as opposed to 38.81 Mbs. Now not all of the cable modems listening to those 8 QAMs all wto your article in Issue 97 of CQ-DATVant 300Mbs at the same time, but it is a statistical balancing act. To get to 1 Gbs DOCSIS 3.1 calls out OFDM modulation. This signal has much higher bitrates to share among users, but it is wider bandwidth and not a traditional single carrier QAM. An OFDM signal is composed of many smaller data rate carriers each of which might be 1024 QAM all working together to deliver the bandwidth. The OFDM signal could be anywhere between 24 MHz and 192 MHz wide.

This is all for the increased demand on cable modem downstream traffic which is also requiring higher upstream bitrate. The online game players are pushing the demand for higher upstream BW and low latency. When they shoot their opponent, they want an instant reaction as if they were playing locally and not across the net. So the DOCSIS spec handles this via higher upstream frequency ranges i.e., moving from a 42 MHz return band to 85 MHz, etc. And with higher order modulations - from QPSK to 16 QAM to OFDMA . There could also be return signals from your video settop in that band also.

If you do pay-per-view, Video on Demand or interactive TV, DVR, etc. the return signals from your request at the settop are in that band. All signals in that band whether from data or video are burst in nature (e.g., TDMA) so you will have a hard time seeing them on a spectrum analyzer sweep.

Here is a link to some data on OFDM and OFDMA in DOCSIS
https://tinyurl.com/2cbbvvj4

IF you did your measurement of the plant right at the cable coming into your home, not after your settops, there could be a 192 MHz wide signal which is an OFDM DOCSIS data signal from the cable operator. These are usually placed in the spectrum at or above 900 MHz, plant dependent. There are no cable system control carriers there.

IF you did your measurement in your house with your settops online, that 90 MHz signal at 1GHz you are measuring is called MoCA (Multimedia over Coax). It is, like your tech explained, a communications path between the Gateway (master settop) and the other settops or routers in your home. The model in the CATV business today is to have a GW that tunes all your video and data and then delivers an

individual video to the "slave" settop via MoCA or data to a router via MoCA. That Gateway could have 6 or more QAM tuners in it to receive all the signals of interest. An advantage here is you don't have to run CAT 6 enet cable around your house and can use "existing" coax line (though I would not try a 50 year old piece of RG59 with crimp connectors). There will be a MoCA LPF in your house so NONE of those signals get onto the cable plant.

Here is a link to some info on MoCA
https://tinyurl.com/2nxbwp6t

Regards, A Ham in the CATV Industry.

Touchscreen using ANNEX BASIC

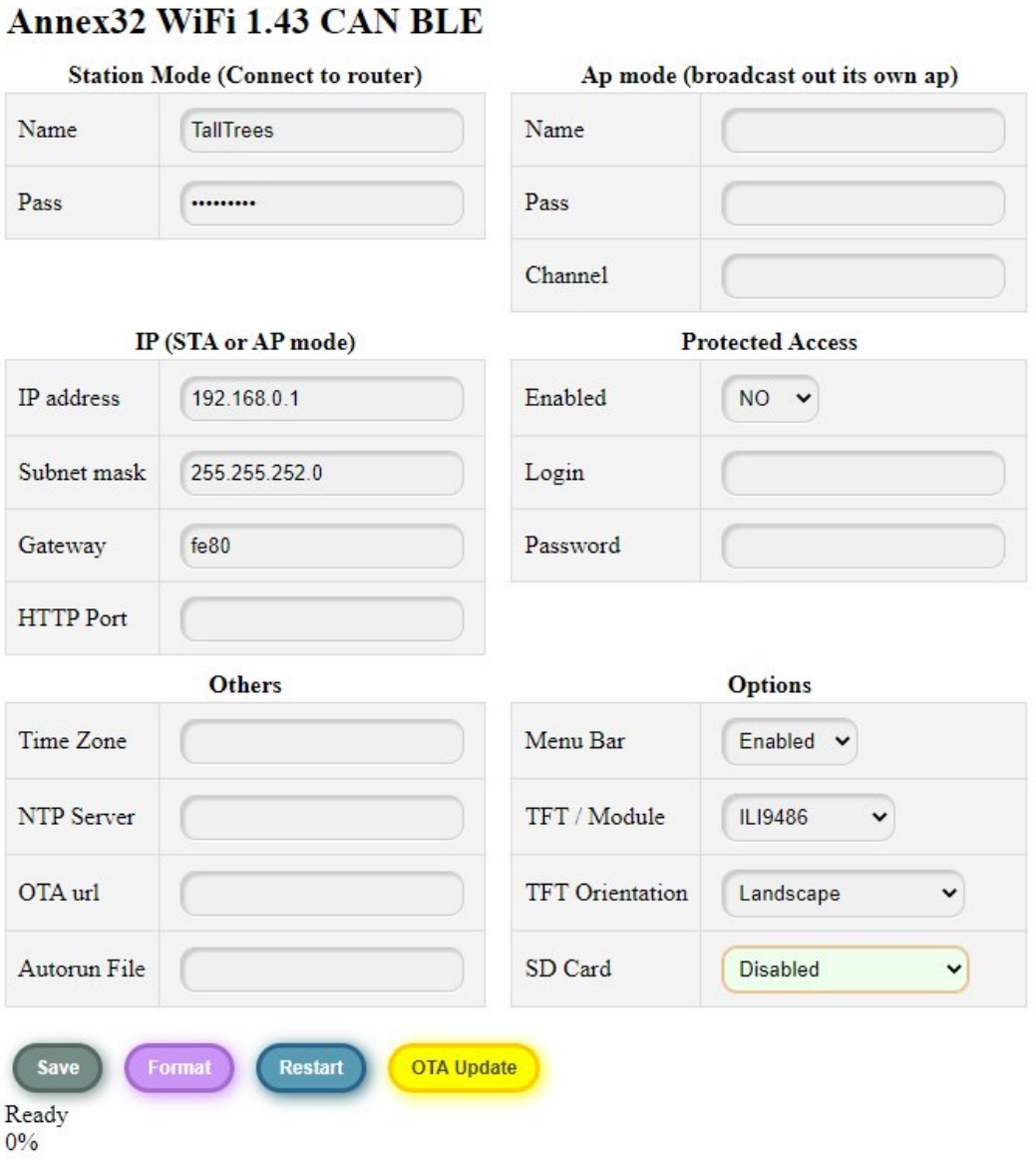
Written by Trevor Brown G8CJS

In CQ-DATV 98 we looked at some of the options for driving a touch screen with an ESP micro and ANNEX BASIC. The ESP 8266 was one option. When this micro was launched it was meant to be used as a Wi-Fi bridge for other microcontrollers.
Then someone noticed it had more processing power and memory than those microcontrollers it was linking too. This was back in August 2014. It was all new territory to me and the GVG project was developed using an ESP 8266 running ANNEX BASIC.

The world has changed and in September 2016 the ESP 32 was launched. It has more GPIOs, ADCs, and a DAC. It has a faster dual-core, running at twice the speed of the ESP8266, not to mention Bluetooth.

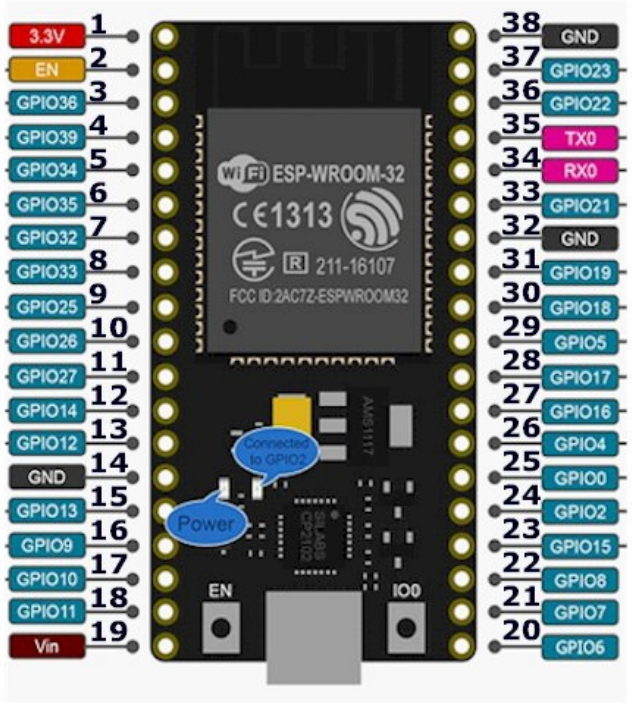
ANNEX BASIC has been quick to support this new micro and has a dedicated touch screen menu supporting all the different variations of this technology. This menu is accessed via the config button in the editor. Just set it to ILI9486 for my chosen screen (see the picture at the head). This menu option was not available with the ESP8266 and is a unique feature of the ESP 32 variant of the revised ANNEX BASIC. The menu options cover a wide range of TFT touch screens, if in doubt, try them all. You need to be connected to ESP32 flashed with ANNEX BASIC to see the menu.

This TFT support tipped the scales and I am now the proud owner of an ESP32s, (note the S on the end) the diagram is my actual module,but beware there are variations, but they all have the pin functions printed on the PCB.

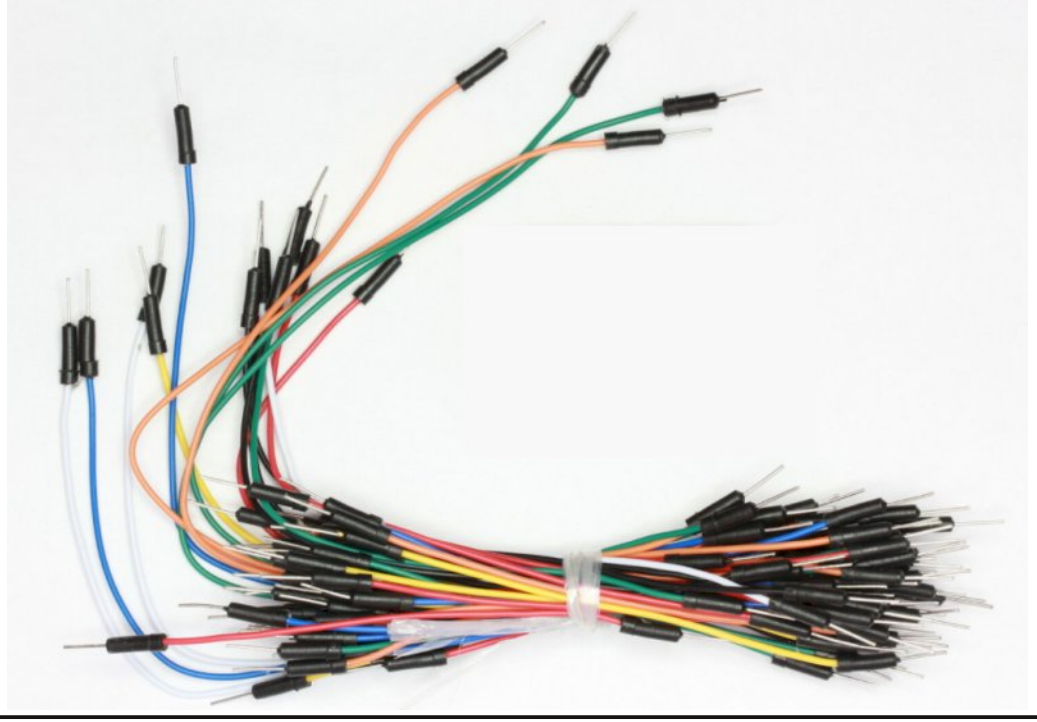


The config menu

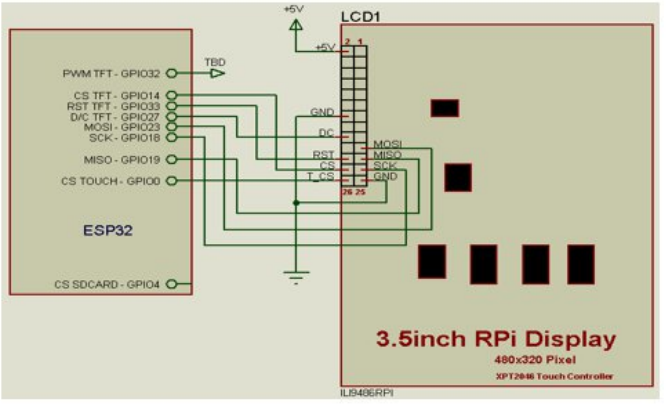
If yours is different, then you will need to create a different interconnect diagram. Mine is a 38-pin device there is also a 30-pin device, so beware.



The ESP 32 I used



TFT PINS	ESP 32s PINS
26	GPIO 0 — 25
24	GPIO 14 — 12
22	GPIO 33 — 8
18	GPIO 27 — 11
14	GND — 38
2	Vin (+5) — 19
25	GND — 14
23	GPIO18 — 30
21	GPIO19 — 31
19	GPIO 23 — 37



The ESP TFT Connections I used

I used flying leads with male and female ends to connect the ESP 32 and TFT together, no soldering, just plug them together as per the interconnect or revise the interconnect if your ESP 32 pin out is different.

At switch on there is a very pleasant display on the TFT screen. The ANNEX wasp and a QR code. The QR code will not connect you to track and trace, so there is no requirement to self-isolate required or any social distancing, it will however take you to the ANNEX editor at the IP address for your module, with your smart phone, you can then write an ANNEX programme. This is not my preferred way of programming; my fingers are definitely too large.

The next stage is to test the Editor. Click on the programme part of the screen and press F2 and this will bring up the very helpful ANNEX BASIC online help. This short program is part of that on-line help. It's a really clever little programme that delivers a circular pattern with a progressive circular fill and shows how powerful the ANNEX BASIC is, in that it can deliver this display from such a short programme. I used cut and paste to get the programme into the editor. I gave it the title '/circle' followed by save and run. This is ANNEX BASIC delivering so much from so little coding.

Back view of the TFT

```
Tft.init 1
tft.fill 0
for r = 0 to 30000 step 0.02
 d=r/6
 s=sin(r)*sin(5*r+d)*140+160
 c=cos(r)*sin(5*r+d)*100+120
 tft.circle s,c,10,rnd(65535),1
next r
```

ANNEX Circular TFT Pattern, code listing is from the online help

High level programming does produce something that will run slower than machine level coding. If you really feel the need for speed, you need machine code. If you prefer to use the more powerful words and speed is not an issue and you are in the right place. Remember we are just pressing buttons on a control panel and speed is not of the essence.

The Annex home screen as seen on the TFT module, note the IP of the ESP32 module

If we expand into multi-level menu's then the shorter listings of high-level programming should be easier to manage.

The touch part of the screen is the next voyage of discovery and again we can write some very simple BASIC to detect a screen button press. This example is again part of the F2 help file and again was a simple cut and paste.

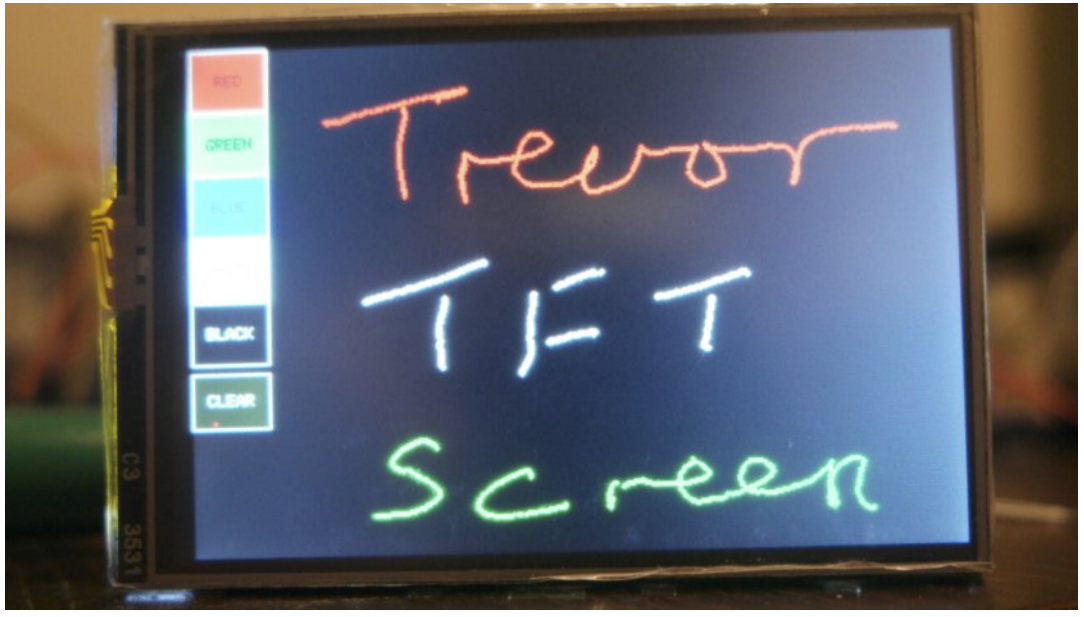
```
OnTouch touchme
wait

touchme:
  touch.read 'Read the calibrated position
  wlog "touched", touch.x, touch.y, touch.z
return
```

This programme will return the X, Y and Z coordinates of the screen presses so all we have do is layout the graphics of the TFT screen and then detect which part of the screen was touched.

```
touched   38   26    1
touched   461   258   1
touched   153   112   1
touched   433   128   1
touched   226   90    1
```

This was me just randomly stabbing the screen with a stylus to test the system.

The last TFT problem I had was to get the touch matrix and the TFT display screen working together. ANNEX has a very useful command called touch.calib. If you run this command then it produces four sequential crosses at the touch screen corners. If you touch each one as it is presented (there is an on-screen prompt, I used the stylus) then the TFT screen and touch matrix will be registered together and will remain locked in the memory banks (even when power is removed).

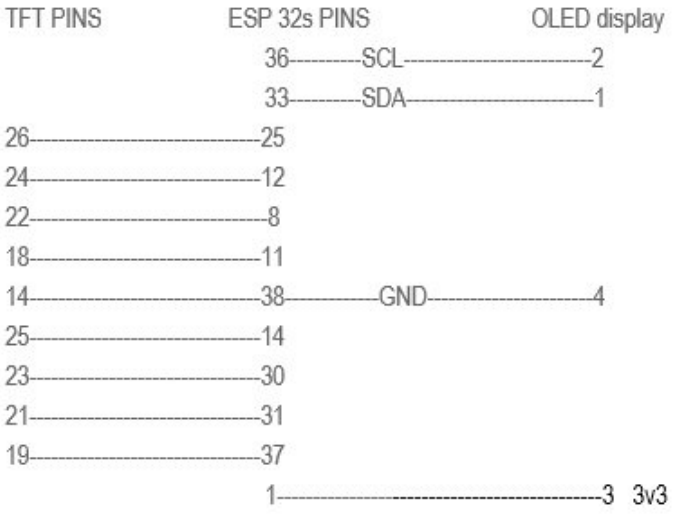


Keen to run a programme on my new hardware I found this screen writer programme on the Annex forum. This forum is an invaluable source of hints, tips and help. The programme can be found in the ESP 32 section of the forum and converts the touch screen into a writing tablet. Just select the required colour from the virtual ink pots on the left and write your desired message. Excuse my handwriting it never was good *(keyboard typing not much better - ED)*, something I was hauled over the cobbles for many times in my school days and it has not improved by the access to the TFT screen which is balancing on the corner of a table with jumper leads connecting it to the ESP 32.

I have not shown the programme code, but it is a simple cut and paste from the ANNEX BASIC forum, *https://tinyurl.com/t76tdcn5*

I saved the programme as /paint.bas, you will see why later. We now have a working touch screen hardware or at least I have a working touch screen; I hope I am not the only one. I have not made any soldered connections, it's just two modules with a jumper wire interconnect.

Moving on from the TFT touch screen, let's have a look at the I^2C bus which on my 38-pin ESP 32 is clock on pin 36 and data on pin 33. In my junk box I had a small 0.91 inch OLED display, the same one I used in the GVG project. I hooked it up to the ESP 32 using the 3v3 rail provided on pin 1 of my ESP 32 I did not include the I^2C series resistors or the pull up resistors associated with I^2C distribution as they were a little difficult to include using hook up connector wire.



Connections for adding an I²C Device

I used the I²C scanner software to prove my connections and it reported a device at a decimal address of 60.

```
'I2C Address Scanner ESP32s
'print in the console the address of the devices found
I2C.SETUP 21,22  ' set I2C port on pins 21 and 22
for i = 0 to 120
  i2c.begin i
  if i2c.end = 0 then
    wlog "found decimal address  "; i
    pause 10
  end if
next i
end
```

Note this is a different programme to the one we use for the ESP8266 as the GPIO pins used are 21, 22 not 4 and 5 as is the case for the ESP 8266. This useful programme is worth saving in your ESP 32 memory for developing I2C hardware. I tested the I²C bus by sending a message to the OLED display.

I used the following programme just to demonstrate how simple it is to send to an I²C display in ANNEX BASIC

```
I2C.setup 21, 22  ' set I2C port on pins 21 and 22
oled.init1 ' init the OLED upside-down
oled.cls ' clear the screen
oled.font 3
oled.colour 1
oled.print 1,1, "CQ-DATV"  'start position X, Start position Y
"message"
oled.print 1,30, "ATV Rules"  ’ position for second line
end
```

Now we have proved both the ESP 32 TFT interconnect and the I²C hardware, let’s get back on course with the project.

The opening screen is called a splash screen and it is at the top of the tree. The splash screen will then in turn allow menu selection of all the other screens we create to control anything else in the shack. This could be the Robot Camera from CQ-DATV 91, perhaps an aerial rotator, the TX RX kit.

We all have customised ATV stations, no two will be the same. The benefit of ANNEX BASIC is that we can easily write control screens or modify existing ones to interface to shack hardware.

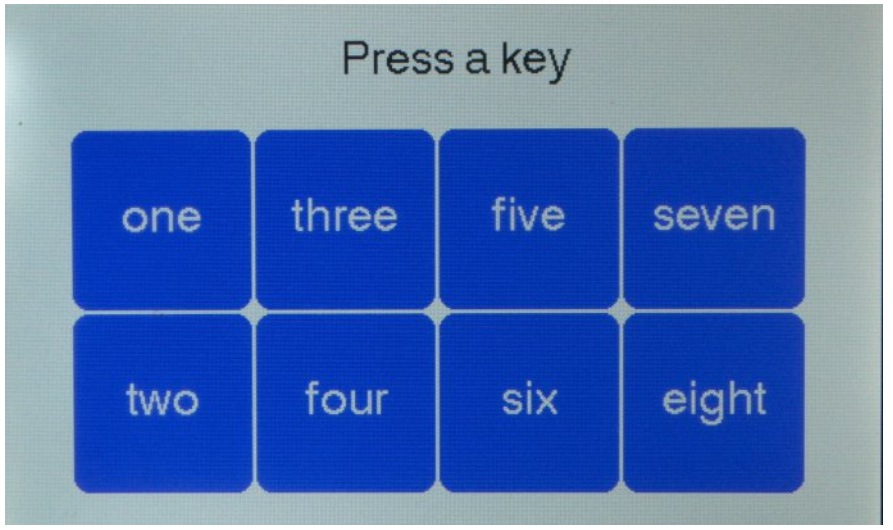
The splash screen was written by Fernando Perez and is again on the ANNEX forum *https://tinyurl.com/4taw9r2y*

```
dim gui(7)
dim text$(7) = "one", "three", "five", "seven", "two", "four",
"six", "eight"

gui.init 10, white
control = gui.textLine(150, 20, 200, 30, "Press a key", 4,
black, white)
```

```
oX = 40 : oY = 70
for col = 0 to 3
  for row = 0 to 1
    x = (100 * col) + oX
    y = (100 * row) + oY
    i = (row * 4) + col
    gui(i) = gui.Button(x, y, 100, 100, text$(i), 4, 10)
    gui.setEvent gui(i), touch, readTouch
  next row
next col

gui.autorefresh 50, 1
wait

readTouch:
  id = gui.target
  key$ = "Pressed key " + str$(id)
  gui.setText control, key$

  select case id
    case 1: wlog bas.load "/paint.bas"
    case 2: wlog bas.load "/program2.bas"
    case 3: wlog bas.load "/program3.bas"
    case 4: wlog bas.load "/program4.bas"
    case 5: wlog bas.load "/program5.bas"
    case 6: wlog bas.load "/program6.bas"
    case 7: wlog bas.load "/program7.bas"
    case 8: wlog bas.load "/program8.bas"
  end select
return
```

The splash screen displays eight buttons on the TFT screen which can be customised in the editor to the name of the function they perform in your shack, eg. Rotator, Robot Camera, etc.

The bottom of the software listing has the case statements and this is where you call and run other TFT software stored



on the ESP 32.
My ESP 32 has been loaded with the /paint.bas programme that I provided the link to. If you stored it as /paint.bas too, then button one will load and run this programme. Button two could be my Robot Camera screen which is still a work in progress. The circle generator is another. The code for this splash screen is also on the forum
https://tinyurl.com/e9592x

The Annex forum is a good place to visit and get your questions answered and receive help with your projects.

Annex forum *https://tinyurl.com/4hdxwc28*

ESP32s *https://tinyurl.com/yb45a2f5*

ESP32s (38 pin) *https://tinyurl.com/ukwncp2y*

In the next issue of CQ-DATV we will look at interfacing more I^2C controlled hardware to our TFT touch screen and creating custom menu's that can be saved to the ESP32's memory. The ESP32 and the TFT touch screen can then become part of a standalone unit that only requires a PC to create and modify the screens.

SSTV from the International Space Station

Written by Chris Grund, K0CJG
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER July, 2021

As reported in the ARRL Space Bulletin ARLS007, from June 21-26, 2021, the ISS planned to host a SSTV special event. Information provided by ARISS *https://tinyurl.com/hhehw7yp* indicated transmissions would be on 145.8 MHz FM using PD120 (2 minutes per image). Twelve different images were to be broadcast more or less continuously during that period. As a relatively new ham (since August 2020), this looked like a fun opportunity to try something new. To get started, I looked up the ISS overpass times for my QTH grid square DN70JA, at: *https://tinyurl.com/4v6sc6yp* on 6/22, and tuned my rig to 145.8 MHz, just to listen for the signals during a predicted overpass. The first couple minutes after the AOS (acquisition of signal) time given by the tracker yielded only static. Then, faintly, I could hear the unmistakable "diddle" sound of an SSTV transmission preamble followed by the melodic chirp of an image being transmitted an example can be found at: *https://tinyurl.com/wrr4xye9*. Disappointment instantly turned to excitement, and I resolved to attempt to capture the entire image series, if I could.

My receiving station consisted of a Yaesu FT-991A set to FM mode, with a 16kHz bandwidth, fed by a Diamond X-50 vertical antenna on the roof of my shack, with the audio signal fed via USB to a Windows 7 PC running MMSSTV software *https://tinyurl.com/225dfwj5*. MMSSTV and the PC provided demodulation and image capture (the MMSSTV AFC should be engaged to compensate for Doppler shifts due to the high relative ISS velocity). Between 6/23/21 1624Z and 6/26/21 1856Z, 21 full or partial images were captured with

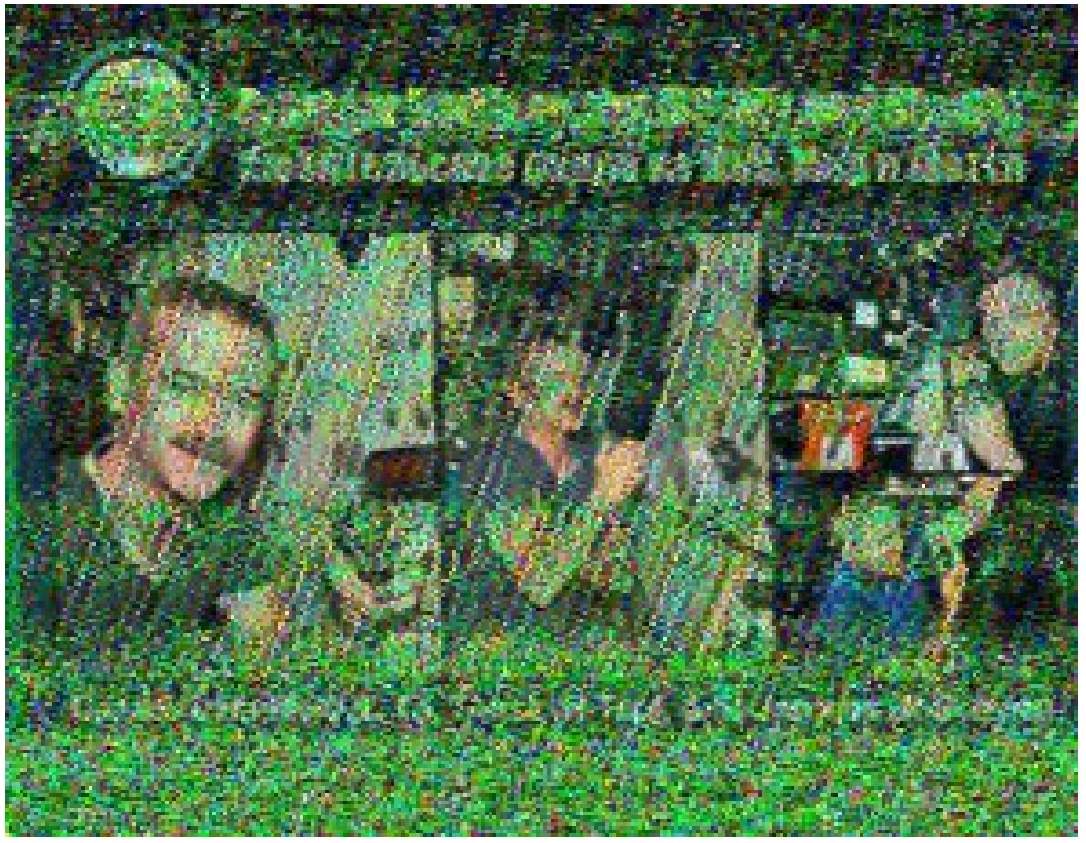


Figure 1. 6/23/21 1624 Z: Strong S6 SSTV signal, but radiated noise from two HDMI switchers operating in the shack caused copious herringbone interference. Once the sources were located, they were disconnected during all subsequent captures.

picture quality P0-P5, and 10 of the 12-image-set were captured with ~P4 quality or better. Several images were captured multiple times, but not all images in the set were seen. The first image captured exhibited a herringbone interference pattern (see Fig. 1) due to locally generated RF noise.

Figure 2 shows some examples of captured images judged to be P5 (occasional narrow signal dropouts are ignored for simple picture quality comparison ratings).

Figure 2 Examples of "P5" SSTV image captures from the ISS.
Left: 6/26/21 1223 Z Right: 6/24/21 1849 Z

In an attempt to understand parameters that most affected image quality, an Excel spread sheet was used to log each image time along with the corresponding ISS maximum line-of-sight (LOS) elevation and maximum elevation azimuth angles.

A linear interpolation in time was used to approximate the actual maximum elevation angle from my station to the ISS at the time corresponding to the center of each image. The images were then graded on a quality scale from P0 to P5, see *https://tinyurl.com/avuemuuf* for details, The latter being a perfect central image and the former being some indication of a transmission but no discernable picture. The quality ratings were plotted against the corresponding elevation and azimuth angles. There was no discernable relationship to the azimuth at maximum elevation, but higher central image ISS LOS path elevation angles largely corresponded to the higher P4 and P5 image quality factors as shown in Figure 3.

It is not clear why there are short duration dropouts in otherwise strong signals with a clear LOS (as can be seen in Figure 2). My antenna is vertically polarized and omnidirectional, so perhaps polarization variations or multipath reflections from the nearby foothills are involved. In either case, antenna improvements should address the issue. On one occasion, there was a strong signal, but the image was torn as though horizontal sync could not be achieved, and no signals were received at all on 6/25,

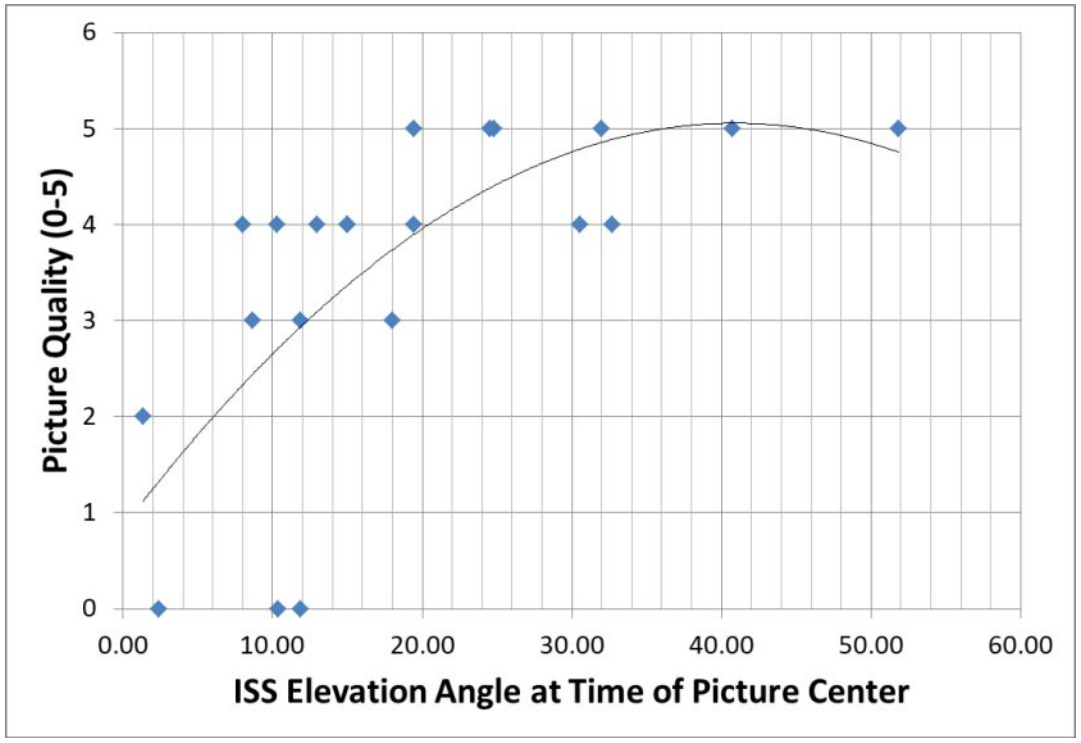
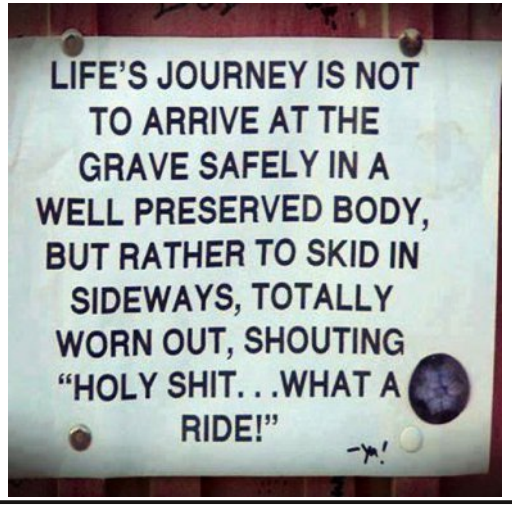


Figure 3 Picture Quality vs. Elevation Angle

presumably because none were transmitted during overpasses of my QTH. In any event, this was a toughly enjoyable exercise, and I look forward to future ISS SSTV special events.



Microwave Ocean Ducting of 5 & 10 GHz, Hi-Def, Digital TV 287 km (178 miles)

Written by Fumio Sekizaki JA0RUZ

10.2GHz ISDB-T method FHD-ATV - succeeded in communication of about 287km (Propagation of the Sea of Japan duct)

On July 22nd and 23rd, I went to Ishikawa and Toyama administrative district for the "10.2GHz Full HD ATV DX Challenge" using the Sea of Japan duct.

On July 22nd we left Nagano after 7 am, took the Hokuriku Expressway from Itoigawa IC via Hakuba, and arrived at Mt. Hodatsu from Kanazawa Morimoto IC via "Noto Satoyama Kaido". (Approximately 5 hours duration, including rest etc.) From the perspective of Nagano people, this journey is very nice and comfortable! !!

At the site, the JA9BPH station in Kanazawa City is operating on a secure a place by raising some antennas, etc., and we ate together at noon before the start of construction, and since we arrived earlier than planned, we prepared with plenty of time.

We waited for the preparation of 4 areas.

When the test was started at 5GHz FM around 13:00, it was said that two 5GHz beacon stations permanently installed in 9 areas could be received by M5 even in Tottori City, which is about 270km away. This is amazing!!!

The JH9TJT station, which was first moved to the coastal edge of Ishikawa Prefecture, also communicated with Tottori via FS at 5.7GHz FM. I was delighted with the success of the Sea of Japan Duct DX QSO for the first time.

Since I first experienced the Sea of Japan duct more than 20 years ago, I am still drowning in this excitement.

After that, 5.7GHz FHD-ATV could be done in both directions, and it was in the 10.2GHz band... FM was FS, and it seemed a little weak to FHD-ATV, but I changed it to FHD-ATV and tested it.

After all there is no image...

After a while, I tried several times. Eventually, a glimpse of the image will appear even at 10.2GHz!... maybe it can be done? ?? After a few more challenges, I was persistent until around 16:00 and succeeded in two-way FHD video communication without any problems! !!.. (However, the recorded data at this time becomes an "error", and the recorded video is lost...)

However, I managed to play the video that had no problem in the previous half, so I uploaded it to YouTube as evidence.
https://tinyurl.com/4septe2j

The video in the reverse direction (transmitted by JA0RUZ / 9 and received by JA4JKE / 4) will be uploaded as soon as the received video data from 4 arrives.

Added on July 31st . This is a video in the reverse direction (JA0RUZ / 9 transmission JA4JKE / 4 reception).
https://tinyurl.com/4frdauvb

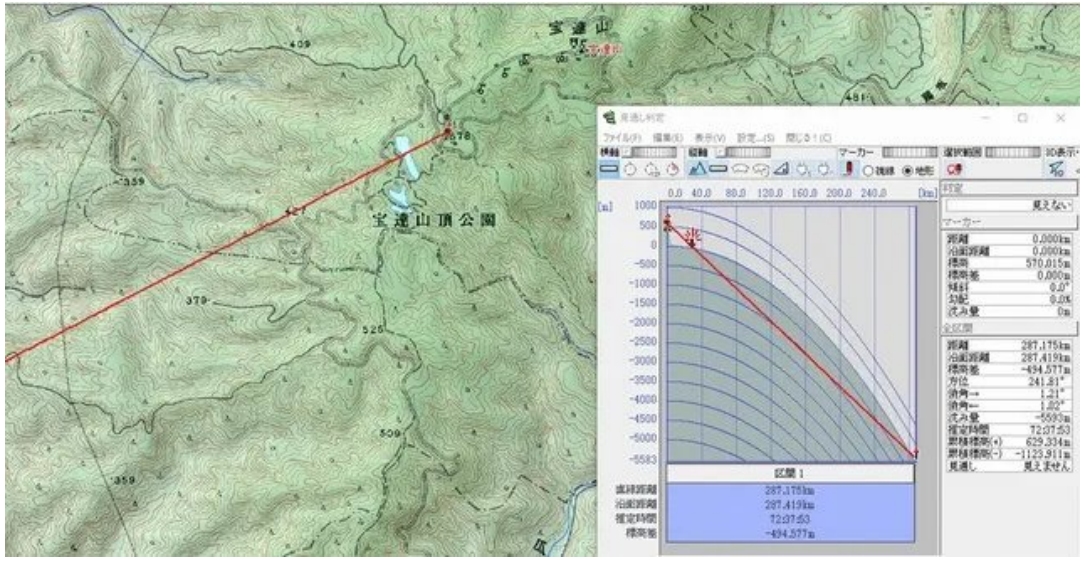
In addition, the JA9SNG station (9 area 5.7G beacon operation) was also seen on the way, and communication was

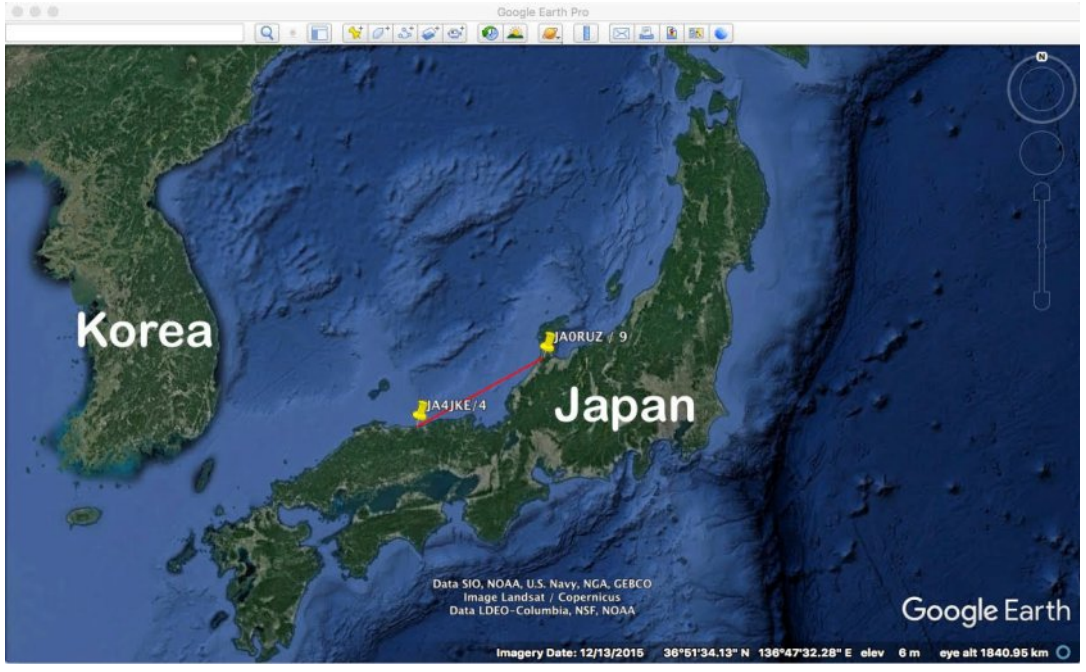
made with 4 areas and FS with only a small handy of 430. This is also the real thrill of the Sea of Japan duct!

We do not think that communication recording in TV mode is "successful only by instantaneous communication" unlike voice, CW, and data. The hurdle is quite high because I think that it can be said that it is "success" when a normal image is "displayed continuously for several tens of seconds". I think it's strange to see "59 even when you can hardly hear it" that you often see in contests! !!

For the first time in the fifth year since the development of the 5.7GHz FHD-ATV, we were able to reach the successful communication of the 10.2GHz FHD-ATV Sea of Japan duct 287Km.

The profile is as follows.
This aerial photo (bottom right) from Google Earth Pro shows the locations of JA4JKE / 4 and JA0RUZ / 9 and the rf path between the two sites. JA4JKE at 35.524254o x 134.017122o JA0RUZ at 36.778638o x 136.806837o . (Picture created by Jim KH6HTV.)





On the 23rd, at Iozen Hakakudo, Murakami City, Niigata Prefecture: I challenged about 300km, but the duct weakened and I ended up communicating with 5.7GHz FM FS.

If the lid Once upon a time before even this is Banbanzai, but requires a strong propagation as further 40dBm case of FHD-ATV and will. (At least -80dBm is required at 10GHz antenna output level)

Since the duct is a natural phenomenon, we have no choice but to grasp the luck as well as the quality of the equipment... But there is still more fun to do, so the challenge will continue! !! Hi

When I accessed the Hijiriyama repeater (JR0WS: 439.38MHz) in Nagano, which I tested, I opened it at 53 and was able to communicate with stations in Nagano city without noise. In addition, there is 1292.30MHz, but it is abandoned because it has the same frequency as the Oyabe repeater. (Several people such as us also manage and operate the JR0WS Holy Mountain Repeater)

This is also a challenge with partner stations, but FHD-ATV, which has very few partner stations and can only QRV a small number of stations, is difficult to record! !!
(ED: This text was produced by Google Translate from the original Japanese text)

I would like to explain a little about Japanese D-ATV. When I started FHD D-ATV in Japan, I adopted the same "ISDB-T system" as Japanese commercial broadcasting stations and the same as terrestrial digital TV broadcasting. There are two video formats, MPEG-4 and MPEG-2, but now I mainly use MPEG-2. MPEG-4 is the easiest way to make a transceiver. Also, in Japan, the ISDB-T system D-ATV is licensed for a 5.7MHz bandwidth only in the microwave band above the 2.4GHz band. By transmitting in microwaves, there is no need to compress and narrow the bandwidth. Also, with microwaves, it is possible to fly 500km 700km in calculation even if the power is small due to the antenna gain. (But I can't get that line of sight) Also, the transmission power of Japanese amateur stations is only allowed up to 1W (mobile station) in the 1.2GHz band and up to 2W in the 2.4GHz to 24GHz band. And even if the same amplifier is used, the OFDM / 64QAM signal can only be output cleanly with a power that is about 13 dBm to 16 dBm lower than that of FM etc. due to its characteristics.

It is such a Japanese D-ATV. I look forward to working with you. Thank you. JA0RUZ. Fumio

Two Way DATV Translator

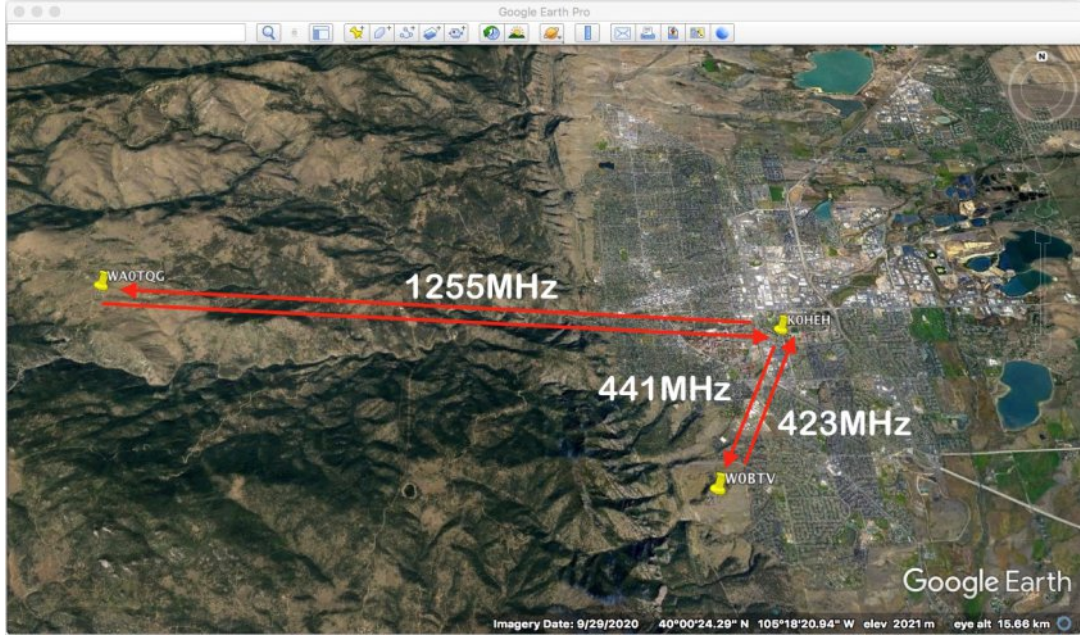
Written by Jim Andrews, KH6HTV
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER, August 2021

Back in May in issue #76, we announced Steve, WA0TQG's project to relay his DVB-T signal from out of the Rocky mountains and into our Boulder ATV repeater, W0BTV. Steve lives on Sugar Loaf mountain and he is totally shielded from W0BTV by Flagstaff and Green mountains. So Steve's solution was to design and build a 2 way, cross-band, translator. He recently installed his finished translator at Jack, K0HEH's QTH in the city of Boulder. Jack has line-of-sight paths to both WA0TQG and W0BTV. Steve and Jack installed at Jack's QTH a 23cm yagi antenna pointing west to Steve's QTH. They also installed an omni-directional 2m/70cm vertical base station antenna with a duplexer. Steve's inagural, successful test of the system was on the Thursday ATV net on August 12th.

Front panel

The W0BTV repeater has two digital inputs on 70cm (441MHz) and 23cm (1243MHz). It's digital output is on 70cm (423MHz). Steve's translator receives his down-link signal on 1255MHz and passes it on to W0BTV on 441MHz.

For receiving the W0BTV repeater's signal, his translator receives it on 423MHz and passes it up to Steve on 1255MHz. The translator includes a 2 meter control receiver. Steve sends DTMF tones to it to control the function of his translator. The output power of the 23cm transmitter is +20dBm. The output power of the 70cm transmitter is +40dBm. This much higher 70cm power was required to be able to reliably override 70cm RFI on the W0BTV's 441MHz receiver. At it's high location, W0BTV sees 70cm amateur signals from all up and down the Front Range and the metro Denver area.



RF Paths: WA0TQG <--> K0HEH = 7.7 miles K0HEH <--> W0BTV = 2.3 miles

If you are interested in the real details of Steve's Translator, he has made his documentation available in his drop-box.

Go to:
https://www.dropbox.com/s/zr6xeabedy6qvqb/Video%20Repeater.pdf?dl=0

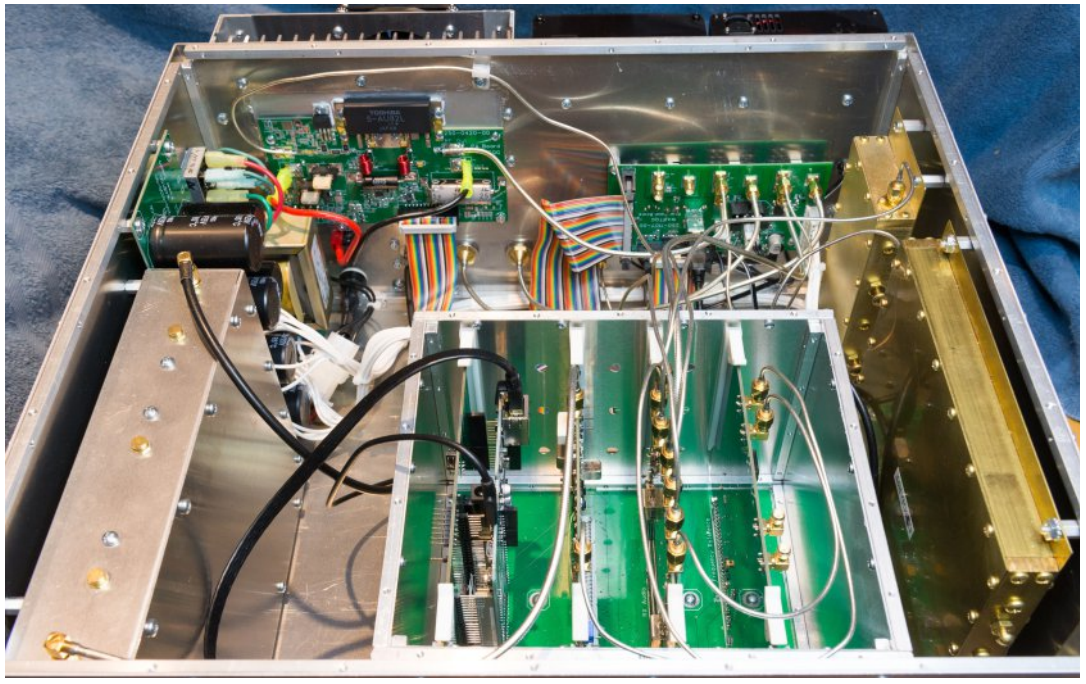
Steve's translater also reports it's status and any error conditons via APRS. To see it's reports, go to *www.aprs.fi* and enter wa0tqg-8

This is how Steve describes his creation. "This DVB-T repeater is intended as an extender to the existing W0BTV Boulder video repeater. It operates in a "half-duplex" mode where one frequency will be repeated to another, one at a time. All frequency settings are done using frequency synthesizers so that all transmitters and receivers are frequency agile, however; the receivers inputs contain rather tight preselection filters that limit the frequencies that may be used.

Rear panel

The settings of the unit are controlled by configuration files that reside in the system memory (SD card). Several different configuration files may be created and called up on command to configure the unit for various modes and frequencies of operation.

No local controls are available, however; a USB and an Ethernet port are available on the front panel that may be used for troubleshooting and local control of the unit.



Inside from the front

Several front panel LEDs are available to show the current status of the unit."

Features

DVB-T Repeater
- From 70cm to 23cm
- From 23cm to 70cm
- Selectable receive and transmit frequencies

DVB-T Modulator / Demodulators
- TX Modulator is a HiDes HV-320E
- RX Demodulator is a HiDes HV-110
- Devices are mounted externally on the rear of the chassis for optimum cooling
- DC power and controls are all generated and controlled from circuitry within the chassis
- Video is connected between the two devices using an HDMI cable

2 meter Control
• Selectable receive frequency
• Many DTMF commands accepted
• Administration (password protected) and open commands available

2 meter APRS transmitter
• Station is geo-located on the APRS map
• Selectable transmit frequency
• Listen before talk data protocol
• Position beacon sent for all major system mode changes
• Telemetry data for system temperatures and optional PA data
• Position beacon and email sent for any device error

Local Indicators
• Front panel LEDs for system modes and transmitter enables
• Front panel LED for any system error

Local control
• Front panel USB port for software download, system control and software debug output
• Front panel USB port can be switched, using Ethernet control, to connect to the HV-320E DVB-T modulator control port
• Front panel Ethernet port for system control and monitoring (using Telnet session)
• Local control may be secured by requiring an administrator password for access

Log Files
• ASCII files that show system events for debug purposes
• Can set the types of events that are logged
• Can set the method of file creation / overwriting
• Real time clock and event time stamps

8 CPU
• 8.1 Arduino DUE processor programmed using C++
• 4GB SD drive to store all internal files
• EEPROM to store fixed system constants
• Up to 99 configuration files may be created to define system operation
• Default configuration file set in EEPROM
• Other configurations may be loaded using Ethernet or DTMF commands
• Button is location on the rear of the chassis that when pressed when the unit is powered up will force loading of the internal default values for the configuration. This allows recovery from a faulty configuration file.

Power supply
• Internal 115VAC power supply all major systems
• External 12.5VDC power supply required for optional internal PA
• When the unit is not in use, most circuits are powered down to minimize power consumption

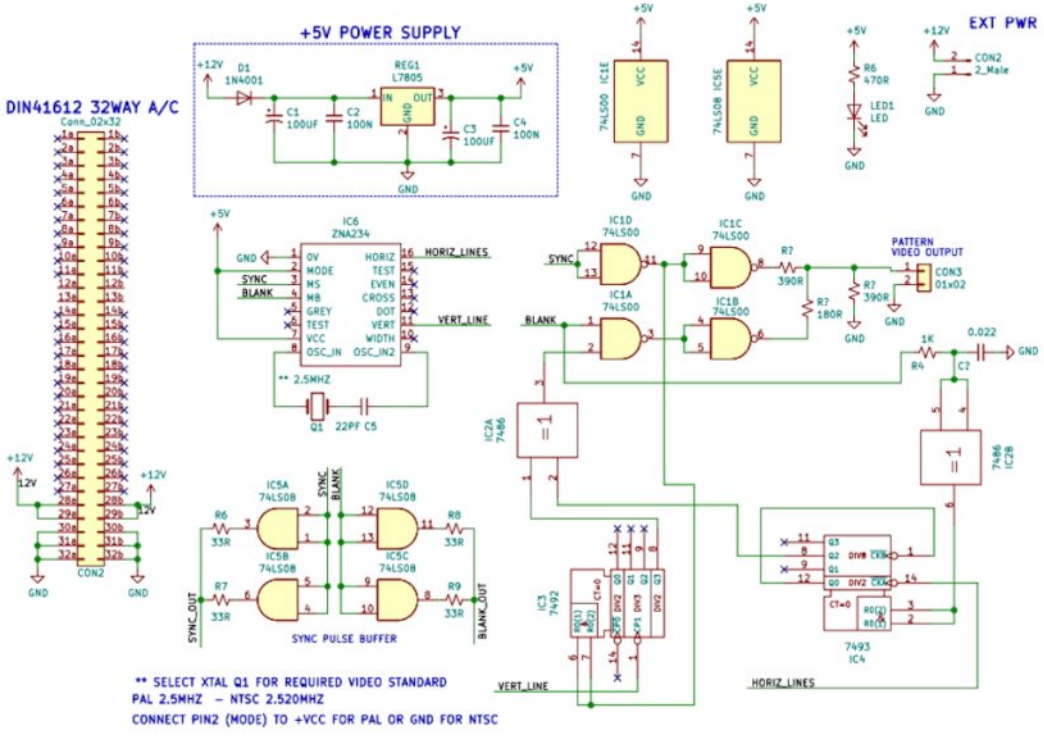
Chassis
• Rack mount or desktop
• Once the top panel has been removed any other single panel (front, back or either side) may be removed without any soldering required. This makes repair or modification to the unit easier.

Controller Unit

From the vault - Simple Video Pattern Generator

Written by Mike Stevens G7GTN

In the CQ-DATV library are a number of TV handbooks. These are a little dated now as they were written back in the 80's. On Page 22 of the Introduction to Amateur Television is a very simple video pattern generator using the ZNA 234 IC. The patterns were designed around setting up a shadow mask CRT and are, Grey Scale, Horizontal Lines, Crosshatch and Vertical Lines.



There were several refinements added to this simple design my favourite was the Chequer Board which was the brain Child of Richard Carden VK4XRL this appeared in many of the ATV publications of the time and I thought it worth revisiting in our "From the Vault".

I wanted to do more than just reproduce the circuit diagram so I decided to design one of my half Eurocard PCB's for it using a ZNA 234. This is old but still available on e-Bay from numerous providers and it won't break the bank.

I have had designed a test batch of PCB's that is with me and as I type I am busy populating the first one. The reason for the half card is price. A full Eurocard becomes a lot more than twice the cost of the half card. The edge connector of the PCB is a DIN 41612 and is the same one used by a full Eurocard.

Once I get a few more designs up and running I will investigate taking orders and producing some PCB's. There is a lot of work involved in creating these PCB's and also in keeping down the costs as the prototypes are all coming out of my pocket.

Construction has changed over the years and some of the techniques we used in the past, Veroboard to mention one, have fallen into disrepute. At the same time, the cost of PCB manufacture has fallen considerably, so I feel PCB support may be the way to go. Yes, some of the circuits are old and some that I would have liked to use are not possible due to obsolete chips. Some are still around and just need an update to give them a modern twist. I have a keen eye on a vision switcher and keep talking to Trevor over providing touch screen control, but its early days. I will publish the designs as I go here in the 'From the Vault' and when I have sufficient, I will investigate producing a production run of PCB's.

External links

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

But if you have a Kindle 3G then yes, but only to Amazon, and there is not a lot of ATV material on their site.
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Images should be in PNG format if possible and the best quality available. Do not resize or compress images, we will do all the rework necessary to publish them.

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

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

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