In this issue

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

Production Team

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All issues of CQ-DATV magazine are available for free download at *https://cq-datv.mobi/ebooks.php*

Editorial

Welcome to CQ-DATV 63.

It's been a record hot summer here in the UK, but that's not stopped CQ-DATV production. Several of us have been slaving over a hot computer to bring you this issue. We are not sure about Terry as its winter in Australia, but nothing stops the CQ-DATV production team.

In this issue we have the full listing for the Region One ATV contest. In the last issue we just had the UK results so our congratulations goes to Francesco Zanatta IK3HHG, this year's winner.

Trevor has been adding to Richard VK4XRL's ITS generator which appeared in CQ-DATV 62 and was an update on a much older circuit by Dave Long G3PTU for putting a test signal in the vertical interval. Richard brought the idea up-to-date by re-engineering the design to use modern chips to replace some of the older parts which were getting a little hard to source.

Now we have the full series of ATV handbooks in the library which date back to the 1980's. Perhaps we can blow some of the cobwebs off and revisit some of the early circuits which also have difficult to source and obsolete components. Trevor's addition to Richards design is to replace the test signals with an electronic character generator to display your name or call sign. You need to reduce the picture height to see it and that's not easy on a flat panel, but we know some of you still have a CRT in the shack.

Richard has another instalment of his digital world for this issue, this one is looking at switching TV signals using domestic switchers some of which have in-buidt synchronisers to add the bells and whistles of picture in picture displays.

Mike has been adding hardware to the very popular Vmix software, for those not familiar with this software it is not free, but the are various options including a time limited full working version down to a limited free copy which does not expire. Vmix allows vision mixing of video sources on a PC. What Mike has done is to interface a 16 key matrix pad to provide buttons we can assign. The keypad is read via I2C, this provides the ability to add extra keypads on different addresses if desired for your application. A small pre-assembled module can be obtained from eBay (or similar sites) containing a PCF8574, these cost just over £1 each.

Also new to CQ-DATV is "One From The Vault" where we will be looking back on previously published circuits. We start in this issue with the very popular Teletext Pattern Generator designed by Trevor for an ATV display in Scotland and later used as a beacon screen for GB3ET, the Yorkshire ATV repeater, which is sadly no more.

Our technical department have been working on file download problems, yes we have had complaints due to poor internet connections that timed out due to the HTTP protocol. The short term solution implemented by Terry was to increase the compression of the PDF version to reduce the file size. The problem would have been solved by the use of HTTPS which does not time out in the same way, but there were costs to this. Ian has now found a way of implementing the HTTPS protocol in a way that has not been so prohibitively expensive as it was in the past. Wwe actually introduced this protocol several issues ago and well so far so good, perhaps now we can back off the PDF compression. Trevor's back up plan was to store the back issues on the CQ-DATV Face book site, these may now no longer be required, but well you can never have too many backups.

We also provided CQ-DATV on the free ISSUU publication site along for online viewing analog with a lot of other expensive magazines who use the site to promote their productions.

We stopped this service when fees were introduced, not sure how many of you used the site to read CQ-DATV but there was one complaint and to Andy Keir our ISSUU reader we apologise.

There has now been a policy change at ISSUU and once again CQ-DATV can be published free of charge so if this was your preferred way of viewing our publication then please follow the link *https://issuu.com/cq-datv*

So as we always say:-

Please sit back and enjoy the CQ-DATV magazine

CQ-DATV Production team

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

DATV-Express Project

Art WA8RMC reports that during July, most of his sales of MiniTiouner-Express receivers occured outside the U.S. Art also reports that there will be a pause in shipping MiniTiouner-Express units from USA from August 07 through August 18, while Art enjoys a vacation. Charles reports there are currently five units in inventory for shipments to customers in the European Union.

Ken W6HHC reports that the NOTES file for DATV-Express v1.25LP9 software has been updated to show a SR comparison among the four supported hardware boards. The Symbol Rate supported by the four exciter boards varies and all rates show below are dependent on how fast is the CPU and the USB-architecture of your computer. The approximate SR maximums (or achievable channel-RFbandwidth for DVB-T protocol) are shown below:

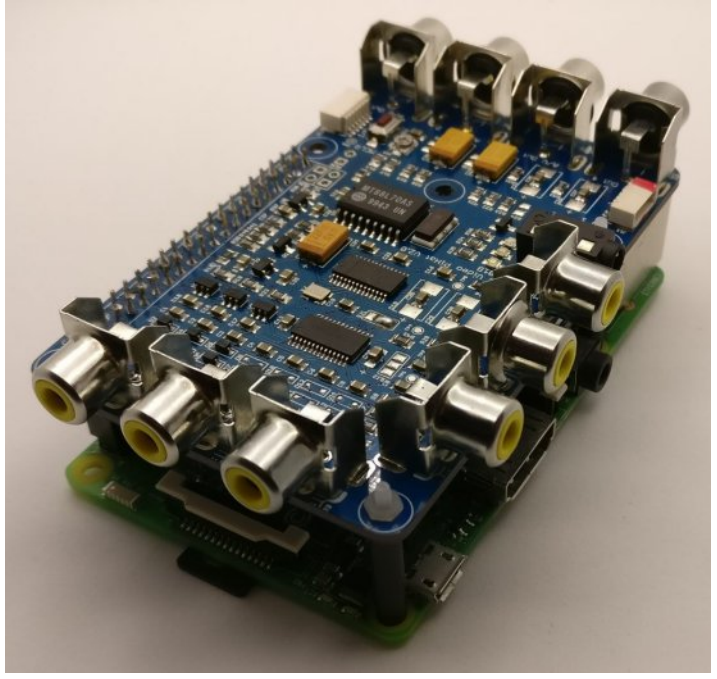
Exciter	DVB-S	DVB-S2	DVB-T
DATV-Express (USB-2)	100K-20M S/sec	100K-20M S/sec	2MHz-7MHz RFbw
Lime SDR (USB-3)	100K-20M S/sec	100K-20M S/sec	2MHz-7MHz RFbw
Lime SDR-mini (USB-3)	100K-20M S/sec	100K-20M S/sec	2MHz-7MHz RFbw
PLUTO (USB-2)	100K-~2M S/sec	100K-~2M S/sec	2 MHz RFbw

The NOTES file can be downloaded from the DOWNLOADS page on the *www.DATV-Express.com* web site.

Charles G4GUO reports that he has been spending a lot of time designing an RF amplifier for the newly opened 70.5-to-71.5 MHz DATV band in England.
Project Speed is set to slow....de Ken W6HHC

New HAMKit VMAC PiHat ATV Logic v2 released

Following in the success of the original HAMKit VMAC PiHat, coupled with the developer interest in the new v2, the design has been finalised and VMAC PiHat v2.4 PCB size 85mm x 56mm x 15mm and the software is open source.



Example VMAC PiHat mounted on a Raspberry Pi (not supplied)

The new VMAC PiHat v2 features:

- *Audio and Video Matrix (FMS6501)*
- *On-Screen-Display (MAX7456)*
- *Video Detectors (MAX7461)*
- *DTMF Decoder (CM8870)*
- *EEPROM (24LC64)*
- *I/O ports, Audio/Video from Pi*
- *User Status LEDs*
- *On-board 3v3 regulator*

With easy programming via Python scripts, many examples on our Wiki pages, the HAMKit VMAC PiHat can be applied to a number of typical applications and projects such as:

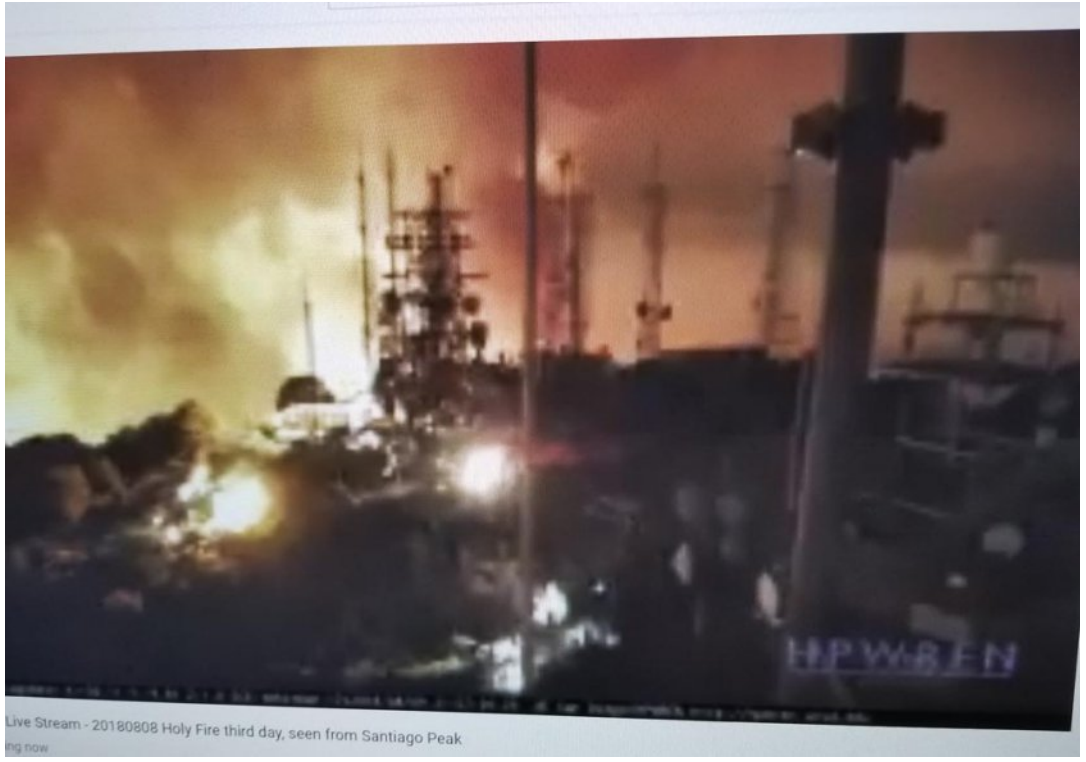
- *ATV and DATV Repeater Control Logic*
- *ATV home, mobile or portable stations*
- *FM Repeater Control Logic*
- *Audio / Video matrix controller ATV/DATV*
- *CCTV (Matrix or Auto Cycle Select)*
- *FPV (5GHz Video Camera Receivers)*
- *Video remote switching*
- *Audio remote switching*

Source: *https://hamkit.co.uk/product/hamkit-vmac-pihat-v2-built/*

"Holy Jim" fire approaches Repeaters on Santiago Peak

A fire started on August 06 at the base of Santiago Peak in Holy Jim Canyon in Orange County in Southern California. By Thursday, Aug 09) the fire approached the commercial and ham radio repeaters on top of Santiago peak.

On Thursday afternoon, water tankers dropped fire retardant on the edge of the repeaters on top of Santiago Peak.



By Thursday night, the fire was approaching the towers of the repeaters on Santiago Peak (streaming video quality).

The fire continued to burn in Cleveland Nation Forest between Orange & Riverside Counties and at its peak on Friday, more than 22.700 acres (92 square KM) of brush and trees had burned, and there was a mandatory evacuation of 7,400 homes (20,000 people) near Lake Elsinore.

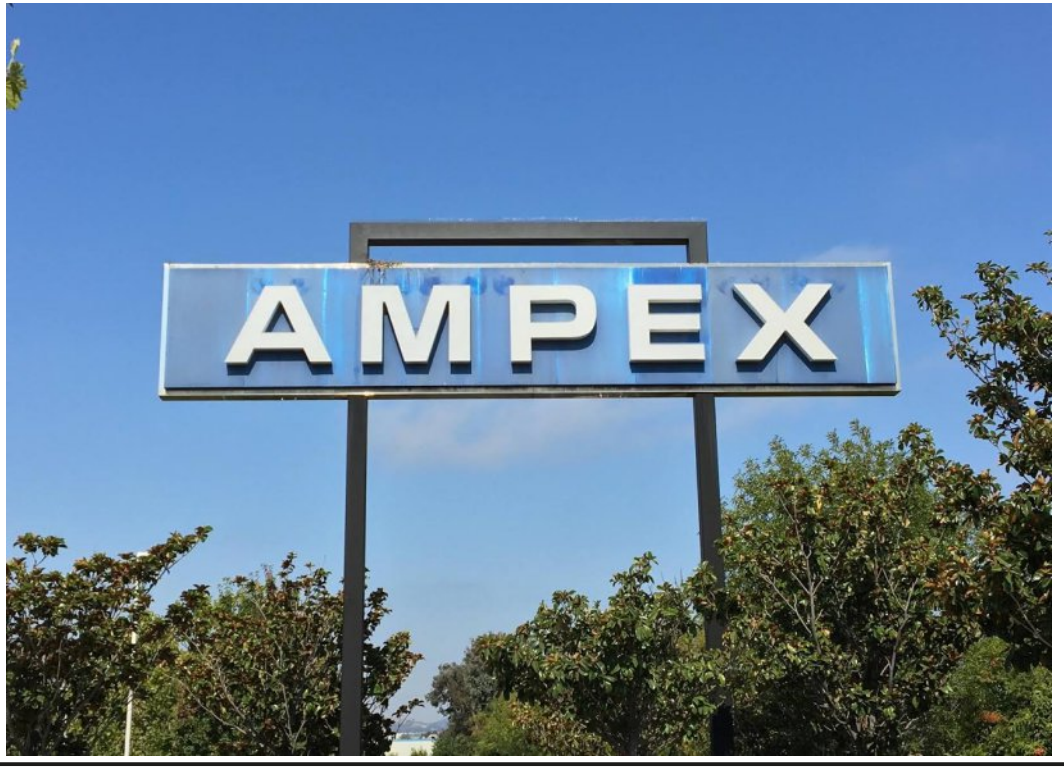
The fire was battled by 1,200 fire fighters supported by many "water tanker aircraft"; including a 747 super-tanker and super-scoopers tankers…as well as 10 water-dropping helicopters. Thanks to the hard work by firefighters and aircraft, none of the radio repeaters were lost and none of the threatened homes near Lake Elsinore were destroyed. On Aug 13, homeowners were returning and schools were open again.

73…de Ken W6HHC

Ampex sign comes down

The long-standing Ampex sign in Redwood City has been taken down and is sitting in storage, waiting for a new home. The letters were removed earlier this week and the entire apparatus should be removed by the end of next week for construction of Stanford's new satellite campus to proceed. Assistant City Manager Aaron Aknin said the sign was deemed non-historic during the development review process. Stanford tried to find someone to take the sign, but no one was interested.

"Stanford has reached out to a variety of local historic societies to see if they had interest in taking possession of the letters," Stanford spokesman E.J. Miranda said in an email. "We also offered the sign to Ampex, who vacated the property years ago. To date, no one has offered to take the sign."



Miranda said it has been placed in storage in the event that a "qualified group" comes forward to take it.
"We are primarily interested in groups that have some affiliation to preserving historic and/or technological elements of the Peninsula," he said.

The sign has stood between Ampex's former headquarters and Stanford's outpatient centre — visible from Highway 101 — for as long as anyone can remember.
Ampex, which is now headquartered in Hayward, was founded in San Carlos in 1944 and relocated to Redwood City in the 1950s. It was one of the first American companies to make magnetic tape recorders.

Numerous Ampex documents, photographs and artefacts area already part of Stanford's Special Collections Department and accessible to people researching Ampex's role in the history of technology, Miranda said, adding that the new Stanford development will continue to honour area history.

"As part of the Redwood City project, we will commemorate important periods of land use on the project site — farming, flower fields, one of the Peninsula's first airfields and a centre for technology innovation — in one of the outdoor plaza areas," he said.

Portable ATV Repeater Tests

Contributed by Mauro Cok IV3WSJ

My thanks for all the help this morning testing the portable ATV repeater.

As we all know only too well, there will always be some problems, this morning's tests were no different as can be seen by the colour of my hair (grey).

Both Rudi and Graziano's 13cms signals did not measure up to expectations.

I tried moving the two antennas further apart , but there was no marked improvement, but at least this was eliminated as a problem, what a relief.

I have had the impression for some time now that perhaps 13cm may not have been the ideal choice of band for this ATV repeater, due to the power required to overcome the ever present Wi-Fi signals and the gain requirements of the RX converters, these also need to be equipped with a suitable filter, not to mention the antennas and getting them centred on the required frequency.

The 10GHz performance is better and I had some excellent reports.

I was pleasantly surprised by Dolfe who was, using a 40cm dish and gave me a glowing report from the Korada. Not easy carrying all his equipment there for this test, the warm weather helped and made it all the more enjoyable, once the kit was in place.

The TX power of the portable repeater is 1W on both 13cm and 3cm. The 13cm power could be increased further, but the space available inside the box is shrinking to almost nothing. The portable repeater is designed to work with a 12.7V battery and it is important to keep power consumption as low as possible as this unit was designed and built for use during a calamity, something we hope will never happen.

Now the repeater has been tested, it is available for deployment by the Slovenian Civil Protection, but also for amateur use.

Thank you again for all the help testing this unit

See you soon, 73 … Mauro … IV3WSJ

CAT18 draft agenda

The draft program is as follows:

Saturday 15th doors open 9.30am
Show and tell and demo area
Members bring and buy
Lunch available to purchase in the museum tea shop

Saturday talks program starts at 1:30am:

Sat PM 1 = Portsdown (Dave G8GKQ)
Sat PM 2 = Activity round up including 71 MHz and 5665MHz
Sat PM 3 = DATV over Optical communications)

We have arranged a provisional booking for 30 people for a Saturday evening meal at 7:30 at the Baginton Oaks http://www.thebagintonoak.co.uk/ - this will be an informal do and you will pay for your meal on the night.

Sunday 16th doors open 9.30am and talks program starts at 10:00am:

Sun AM 1 = Outside broadcasts and the MCR21 restoration project (Brian Summers)
Sun AM 2 = Space / satellites including Es'hailsat updates (Graham G3VZV)

We are still looking for 1 more topic on Sunday morning - please let us know if you have any suggestions…

The BATC general meeting will be held at 2pm on Sunday.

The CAT18 ticket price will include full access to the museum and free passes will be available for those only attending the General meeting on Sunday afternoon. Please remember that you need to buy your tickets from the BATC on-line shop before the event - *https://batc.org.uk/category/cat18/*

The Midland Air Museum

http://www.midlandairmuseum.co.uk/about.php is a small aircraft museum run by enthusiasts on the perimeter of Coventry Airport, where BATC will have exclusive use of the lecture room seating 60+ people and a small hanger where the demo area, test and fix it area, members bring and buy and a few trade stands will be held.

There is plenty of car parking and access in to the site will be available for any special interest vehicles.

The venue is centrally located with good transport links and close to the M1, M6, M42, M40 and M69 giving easy access from most areas of the country and there are a number of competitively priced hotels nearby.

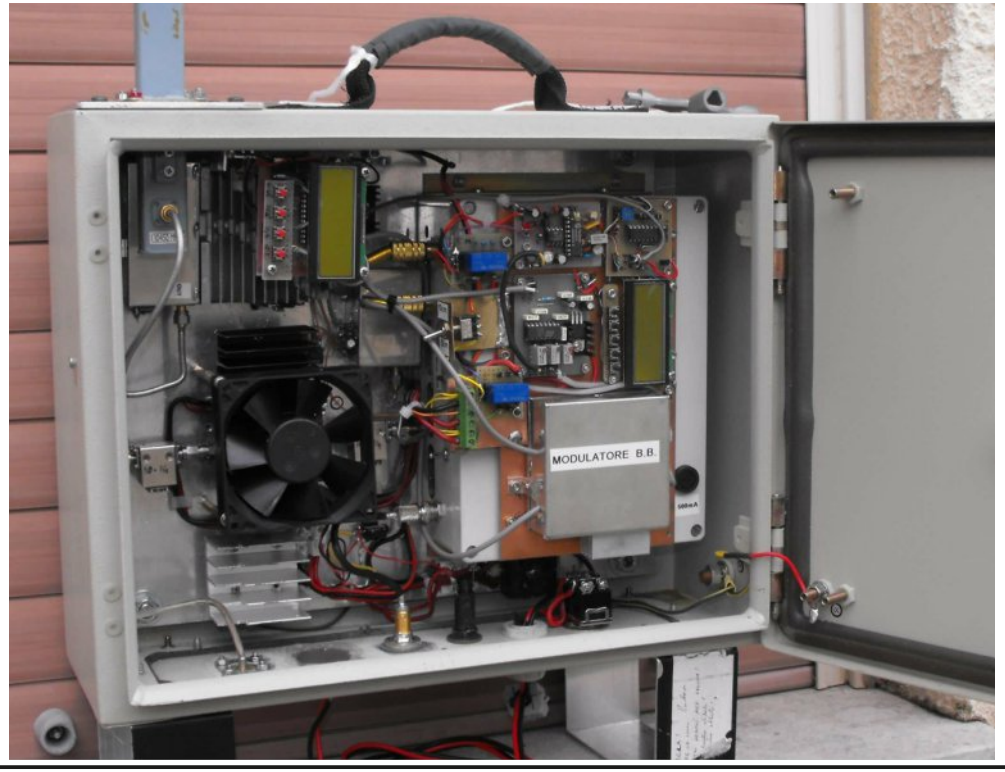
73 Noel - G8GTZ on behalf of the BATC committee

Tilen's alive!

I am Dolfe S52DS and I participated in the testing of themobile ATV repeater at Tinjan.

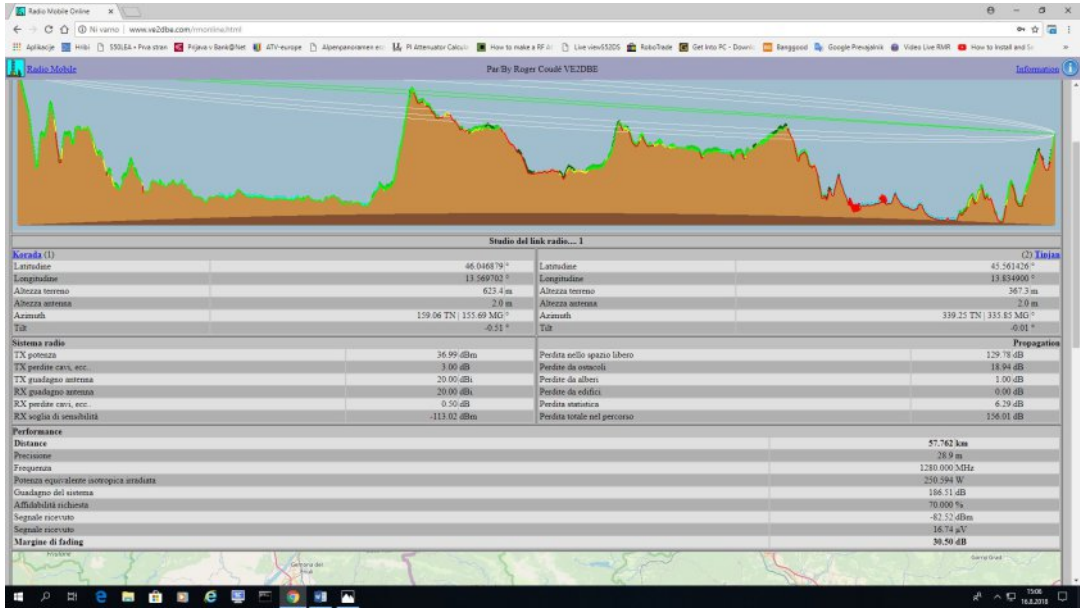
Rudi S58RU sent you pictures and asked me to write to you about the progress of the experiment.

I was on Korada 58 km from Tinjan. Despite the distance and low power of the RPT I took 13 cm and 3 cm without a problem.



Perhaps 3 cm better than 13 cm. Then I broadcast from 0.8 W at 23 cm towards Tinjan and received myself at 3 cm. The return image was of the same quality as the one I was broadcasting.

73 Dolfe S52DS



The Terrain Profile

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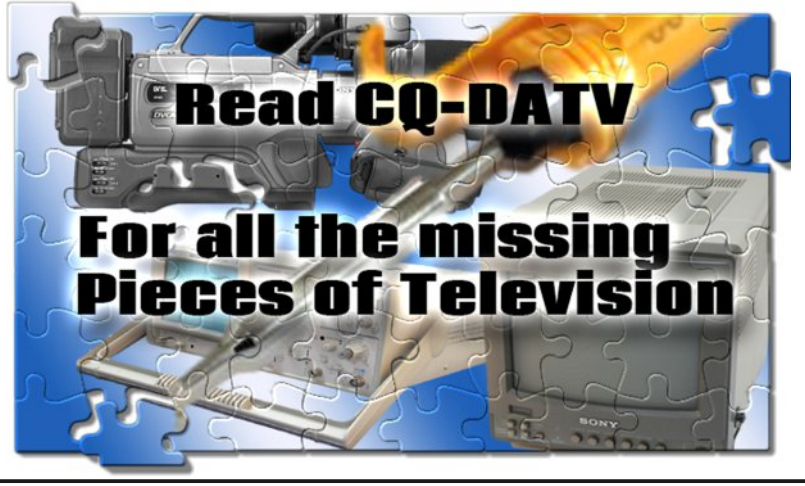


2018 Region 1 ATV Results

The winner, Francesco IK3HHG

The full Region 1 results of the ATV Contest, as supplied by Dave G8GKQ, are attached as an appendix to the end of this issue of CQ-DATV.

TV Amateur is a German Language ATV Magazine. It is published 4 times a year and if you would like to subscribe go to *http://agaf-ev.org/*

A look at Repeater Control Hardware and Software

Written by Richard Carden VK4XRL

We have over this past year looked at circuits for repeater controllers using both discreet components and special IC's. There is a push amongst some amateurs to move away from the analog conversion used normally for 23cm receiver reception to a pure digital interface.

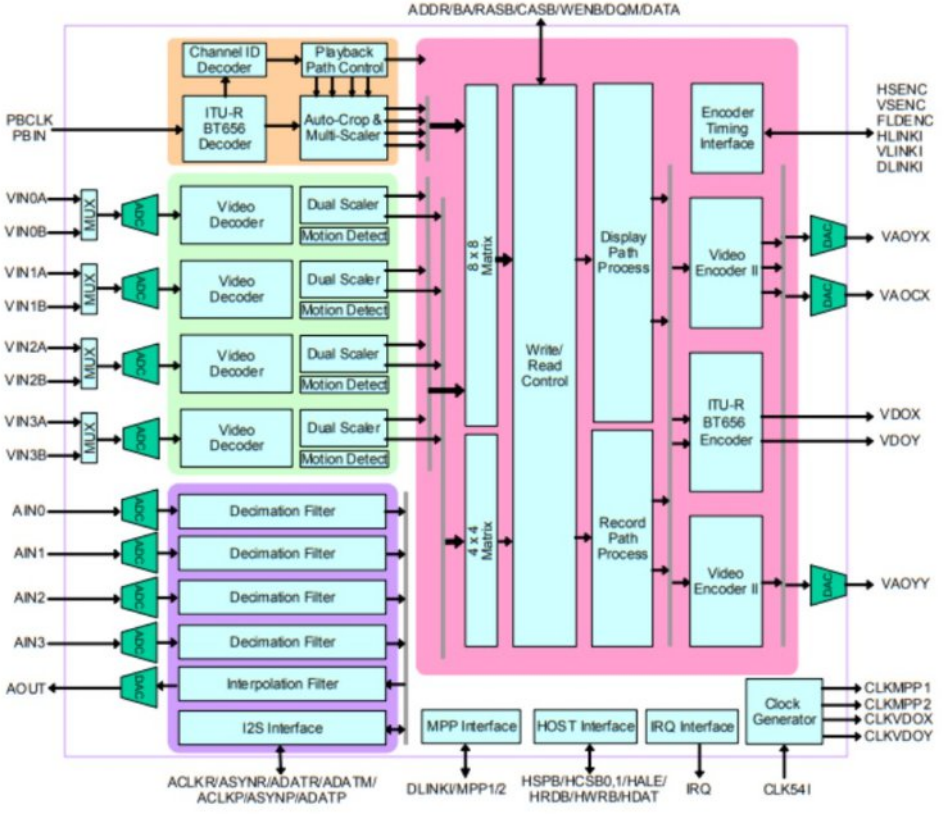
This is still under consideration and therefore before we jump into that (if that is at all possible) I will review the work that has been done by myself and the various directions taken, however it does still retain the analog switching.

This is only a concept to prove that this method can be used. Please note that no audio switching has been looked at. Re-capping, the following signals can be used for repeater switching each with there own advantages and disadvantages;

1. *Analog PAL or NTSC*
2. *HDMI - https://en.wikipedia.org/wiki/HDMI*
3. *SDI - https://en.wikipedia.org/wiki/Serial_digital_interface*
4. *ASI - https://en.wikipedia.org/wiki/Asynchronous_serial_interface*

The last three are especially interesting in maintaining the digital signal path within the repeater system, but more on that later.

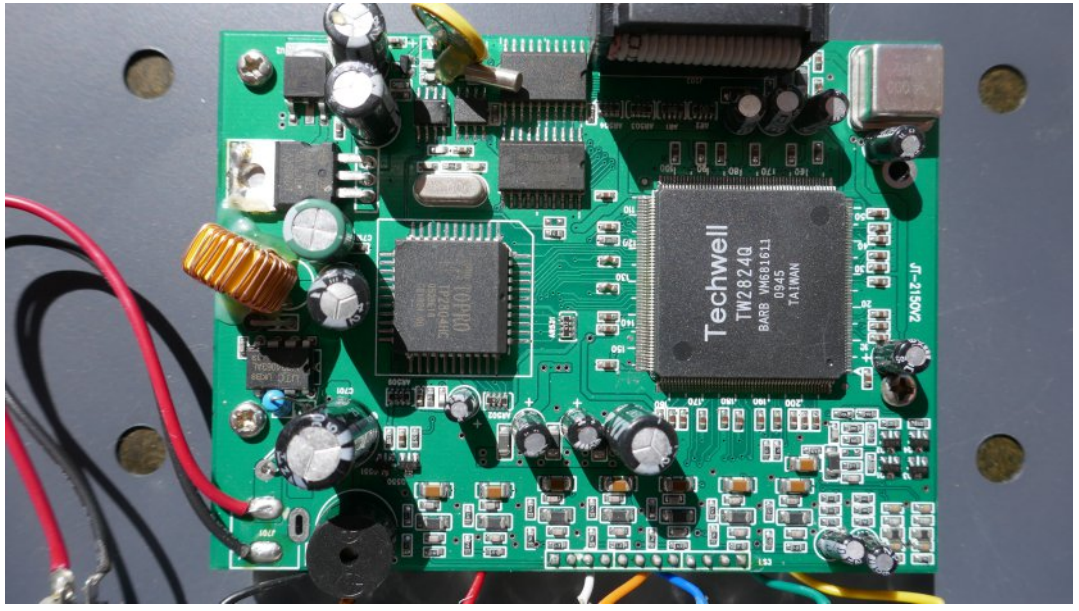
Now the Quad PAL switchers that are equipped with picture in picture have internal frame store synchronisers built in on each input. The special IC in the unit I have is a TW 2824Q as shown.



A look at the TW 2824Q which is the workhorse in the quad switcher

I already had two of these switchers for PAL inputs in my possesion. So I thought it was time I put them both through their paces to see if the concept of using them for a repeater controller was possible. I used Multiburst on input one and colour bars on input two. When first switched on the Quad screen was present with the two inputs showing in there respective quadrants.

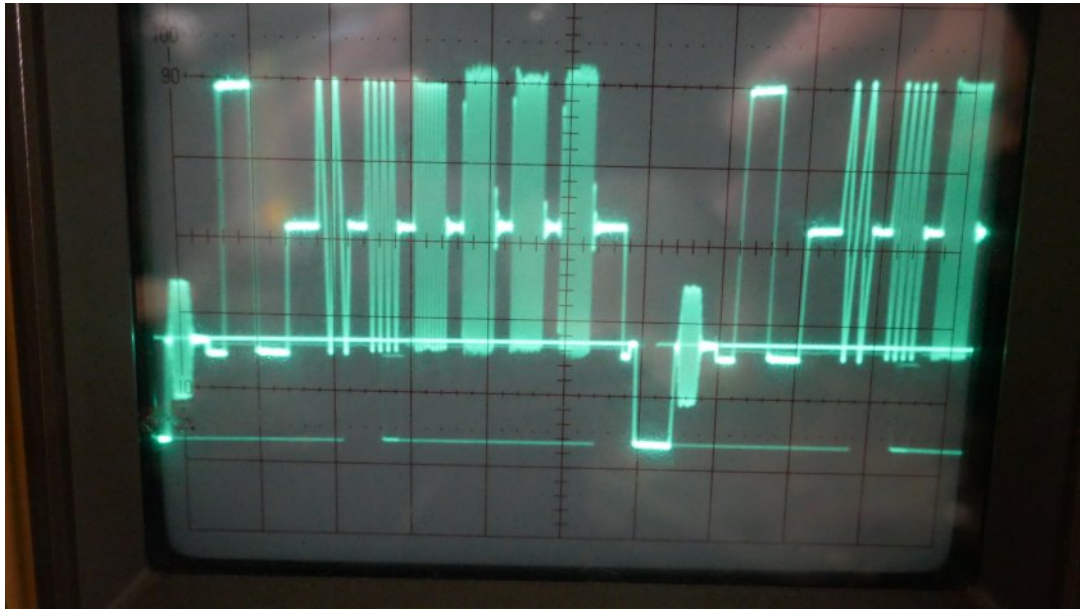
HDMI Four Input Video Switcher



Inside the Quad Switcher

The overall vision output level was low so the output from the Quad unit was feed into a VDA and then to a waveform monitor and video monitor to see what the overall response was through the system.

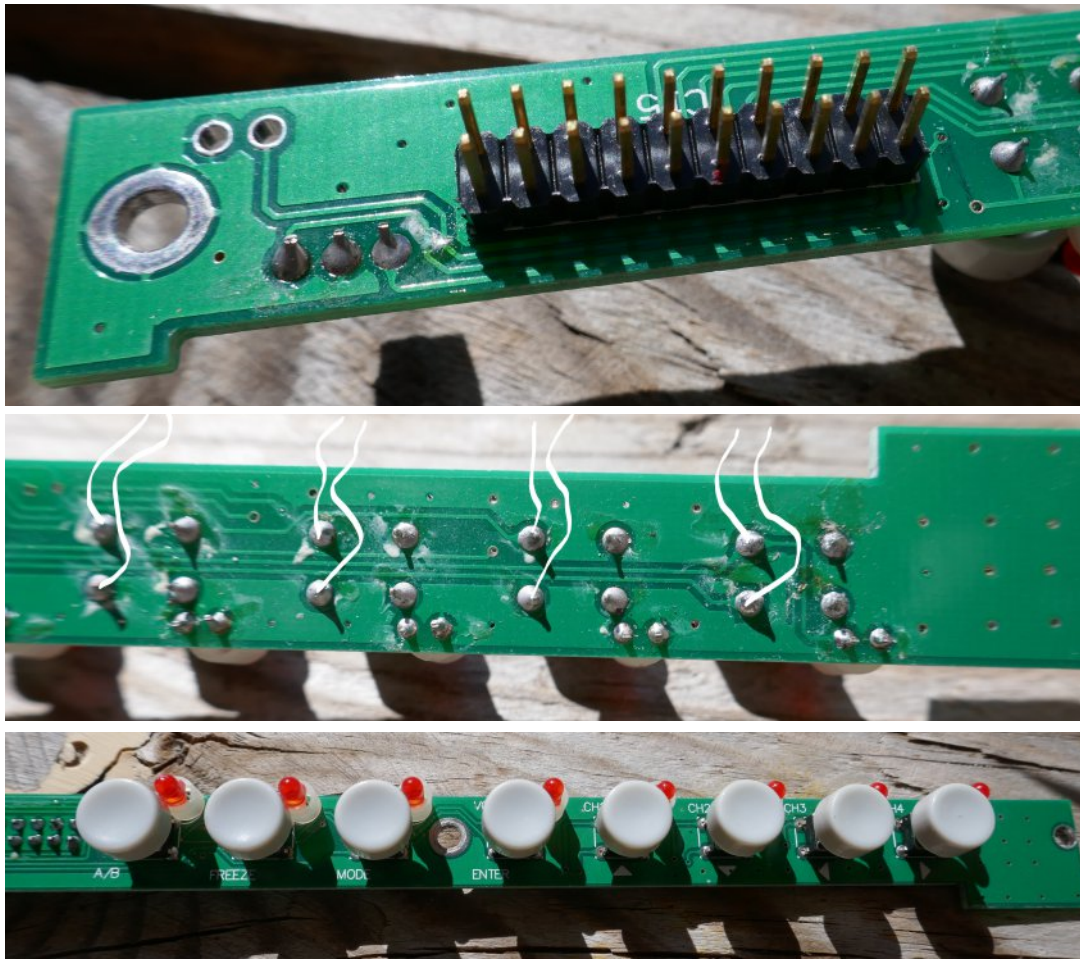
The results now looked promising, and the multibust had reasonable frequency response.



Multiburst after going through the Quad HDMI Switcher

The next thing was to check out the switching arrangement which plugs into the main circuit board. As no circuit was available it was trace out time, the two pins shown go to the 20 pin IDE socket which connects to the main board. (Note all switchers are not orientated the same way).

This enabled control of the Quad unit and I therefore resisted changing the internal wiring. Four relays (or 8 relays depending on your requirements) were added with control from a PicAxe 28x2 micro controller. The two relay pins are then connected across the existing control switcher board as indicated by the white lines.



External switching for the HDMI Controller

The inputs are arranged as follows across these buttons;
- Input one (TESTCARD)
- Input two (FM)
- Input three (DATV)
- Input four (SPARE)
- VCR (IDENT)
- Menu (QUAD)

The TX `on` Relay would control the switch on of the repeater if required.

Each relay is controlled from an out from the PicAxe 28x2 and can either be a board of 8 relays using opto-isolators or discrete transistors diving the relays.
You may ask why relays? Well it was the easiest way to provide an engineering means to an end for control where no other way was possible.

Selecting inputs one to four only require a momentary push button action (around 200ms). Likewise the menu button (Quad Selection) requires only the same touch operation. The VCR operation is a little more complex in that it requires the button to be held for around two seconds and for two seconds to switch off where it goes direct to the quad screen. Other units may differ from this so some extra work maybe required. The software there will have to be changed to accomplish any changes encountered with the hardware.

Conclusion:

This idea will work for PAL so the next step is looking at a HDMI switcher to see if it can also be done and should have audio attached with it. There are SDI switchers available but not sure if the same method can be used, the ASI I haven't seen switchers available at any reasonable price.

The editor would love to receive copy on any other experiments in this area, thank you.

Reference Material

https://datasheet.octopart.com/TW2824Q-RB-Intersil-datasheet-23692105.pdf

https://www.intersil.com/content/dam/Intersil/documents/tw28/tw2835.pdf

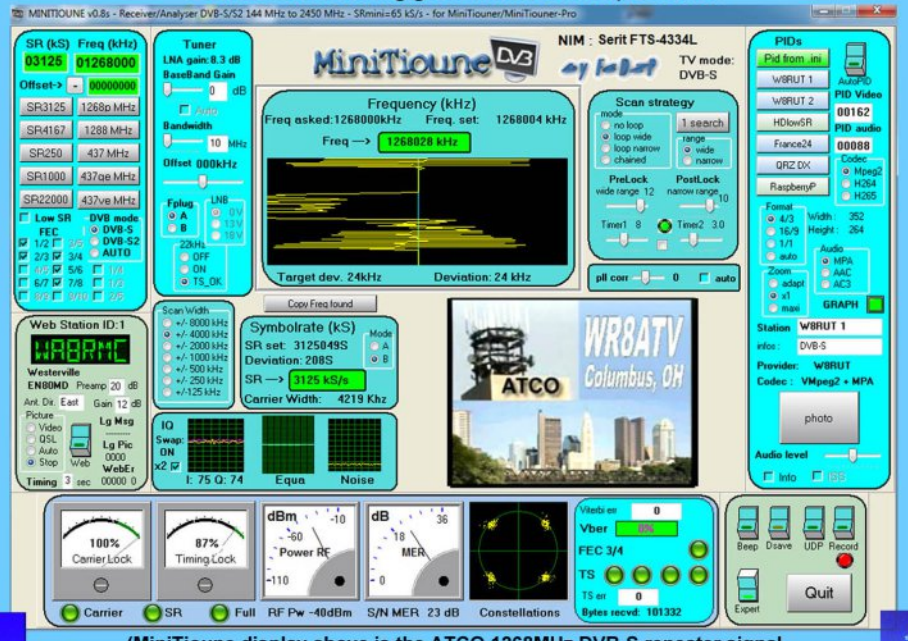
MiniTiouner-Express

Digital Amateur Television DVB-S/S2 Receiver / Analyzer

Available at DATV-Express.com

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

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



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

What you can't see is an article by a fellow ATV'er.

Why, well, we don't know. Nobody is telling us what they want to see or where there is something interesting that we can spread to a wider audience.

And yes, there is a wider audience. That is well evident by the thousands of downloads of this magazine every month.

But, if you, the reader, don't start helping us, soon there wont be a magazine and the ATV part of our hobby will drift back into the darkness.

Oh, there will be the occasional isolated bright spot, but that bright spot will be disconnected from the others without the flow of information between them that magazines like ours provides.

Club newsletters only go so far, mainly to members in a small geographical area, but there may just be that one little gem, a spark of an idea, that somebody else is looking for hiding there somewhere.

So please, send us your ideas, your club newsletters, even may I dare say it - an article for inclusion in this magazine.

Remember, this magazine is for you and it is FREE.

VIT Character generator

Written by Trevor Brown G8CJS

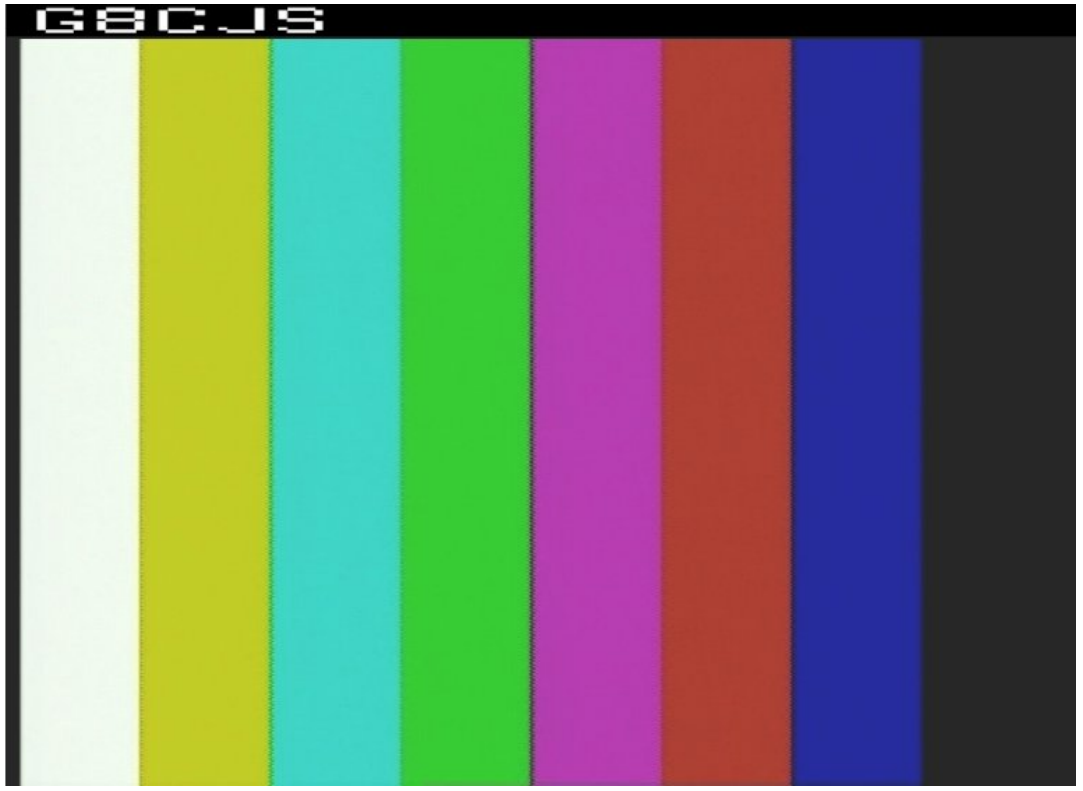
In CQ-DATV Richard VK4XRL had a look at inserting test signals into the 25 blank lines at the top of the TV picture. The blank lines at the top of the picture were originally left blank to give the line oscillator time to recover from frame fly back.

Set manufacturers got over any problems a long time ago. Since then the blank lines have been used for Teletext, test signals and in the UK for subtitles. Also in the broadcast industry they have been used for time code, a digital code to identify where the picture were coming within the ITV network and one company even had a vertical interval sound meter, presumably they suffered arguments as to if they were sending the correct levels. Most of these signals were removed before transmission to make room for local Teletext.

I thought we could take Richards design a step further and insert a character generator that could display a call sign that could be read on a TV set or monitor with the height reduced. It's not a new idea, I have seen it used on election nights to identify where the remote sources were coming from. In a TV gallery one presenter talking to camera with people counting votes in the background looks very much like any other and some way of identifying where they are might have been useful.

The Hardware

In this simple design the call sign is stored in an EEPROM. The circuit provides a horizontal resolution of 64 pixel blocks by vertical 32 pixel blocks. That's sufficient for 9 characters across the screen. The design hardware has been kept as simple as possible, while retaining the ability to be used with any video source.



Call Sign In Vertical Blanking

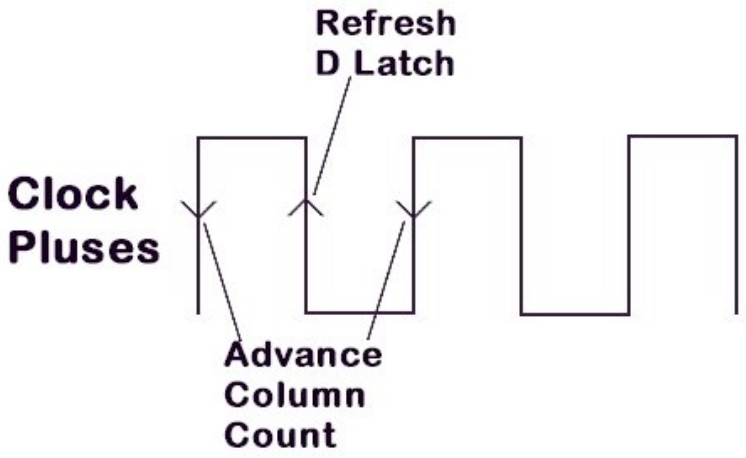
The circuit uses two 4040 counters, one is column counter incremented by a column clock which runs at about 1.5MHz. This is used to address the vertical columns of the EEPROM, when the count reaches 64, Q6 of the counter goes high and stops the clock, which then waits for a TV line sync pulse to reset the counter and advance the Row counter. The process repeats for the next row of data.

The TV Row counter advances every two TV lines, so the call sign is small and fits into the vertical blanking. When the Row counter reaches 32 the TV line sync pulses are stopped by an AND gate from advancing the Row count and it then waits for the next vertical sync pulse which resets the counter, so the process repeats.

Avoiding Glitches caused by Ripple counters

The Row and Column clocks are both 4040 ripple counters and these can produce transient invalid counts on their Q outputs, due to propagation delays in their design.

Synchronous counters would have avoided this, but at an increased cost. The fix is the D cleanup latch which stores data on the clock positive pulses edges only so any glitches from the counters are not transferred through to the latch output.



The required frame and TV syncs are stripped from the incoming video by an LM1881 sync separator IC. The MC14053 and EL2030 combine the data and picture as per Richards design in CQ-DATV 62.

The EEPROM is at the heart of the circuit, with every character generator there are choices to make at the design stage, the simple generators fall into two design categories Bit Mapped and Custom ROM.

Let's take Custom ROM where somebody has mapped all the pixels for you and all you have to do at the character address is call up the character.

Always nice to go for the easy option. The first character generator I ever designed worked this way.

The ROM was a 2513 and I used a diode matrix to select the characters. Everyone can solder diodes into place, no programming, just a bunch of diodes and a soldering iron, why do it any other way. If you require keyboard character selection then this is really the only way to go unless you want to write your own font library for the whole character set so they can be keyboard selected and well I wish you luck with that one.

Bit map is a pain and you need to programme every pixel into a EPROM or EEPROM and what do you gain. The first gain is flexibility, you are not limited to what is in the ROM so you are not stuck with pre set ASCII characters, you can have a simple LOGO. Also you can programme a MAT (a shape which will cut a clean hole removing picture so the characters can be inserted over a black background), often better than just sitting the characters on top of the picture.

These generators use less complex hardware designs.

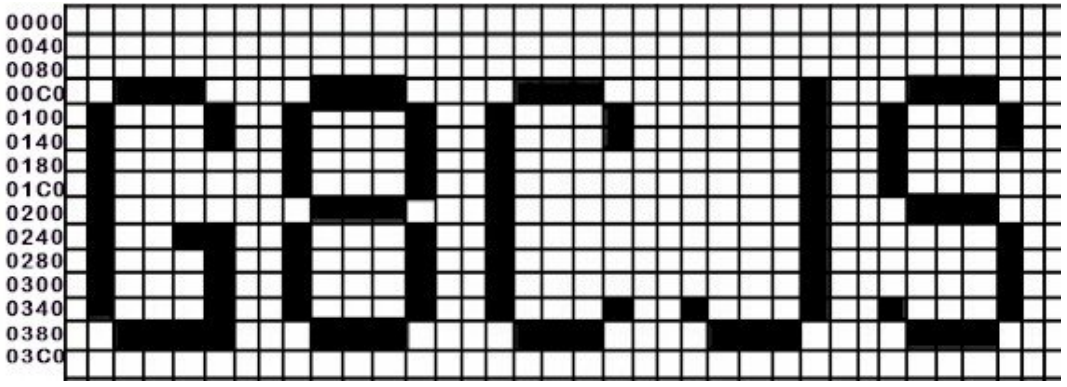
The Custom ROM design requires the ROM and a way of storing the character selection, in a modern world this means memory storage, bit mapped requires only one of these.

The Bit Map downside is drawing your design on graph paper shading in the characters, and then the really painful part, converting the drawing to numbers and programming them into the EEPROM. Remember you only have to do this once and then only for the characters you require. The following design is a bit map, so deep breath let's look at the map

This is best done in Hex and for this design there are three number required 01 which is MAT only or a black background, 03 which is black background and a white character and 00. The 01 will be produce a logic 1 at the D0 of the EEPROM and

an 03 will produce logic 1 at both D0 and D1 MAT and Character. 00 will produce logic 0 at both the MAT and the character generator lines. This will result in the normal picture content being displayed, this is useful when the generator is being held in reset awaiting a line or frame pulse.

So it's good practice to terminate the column data and to fill the first two Rows and the last row with 00. The reason for two rows at the start is when the frame reset is removed there will still be four half line pulses which will offset the character rows and so are best blanked out.



02 will produce a character but without the background hole, this sort of defeats one of the advantages of this design, but worth knowing there may be an application for this.
0000 and 0040 best left blank (00) to avoid the half line problem

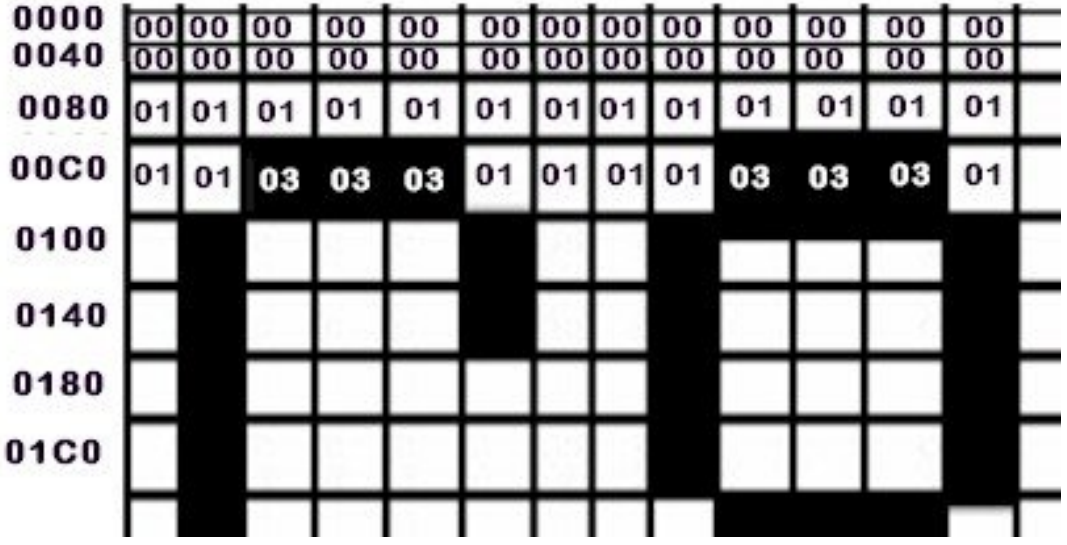
Yes this could be expanded to produce characters on other data outputs of the EPROM , EG 05 for a character on data line 02 with a MAT but you need to add in the first character data, gets messy maths wise. There is an alternative, you can use spare EPROM address lines to switch to a part of the EPROM not being used (EG Paging) and well then you can just use 01 and 03 for your new Call sign

Laying out the EEPROM Data

I have used G8CJS my own call sign as an example and I have set the MAT to cover the unused character spaces (the design will cope with 9 Characters. This covers 30 TV lines, 2 TV lines is one character row.

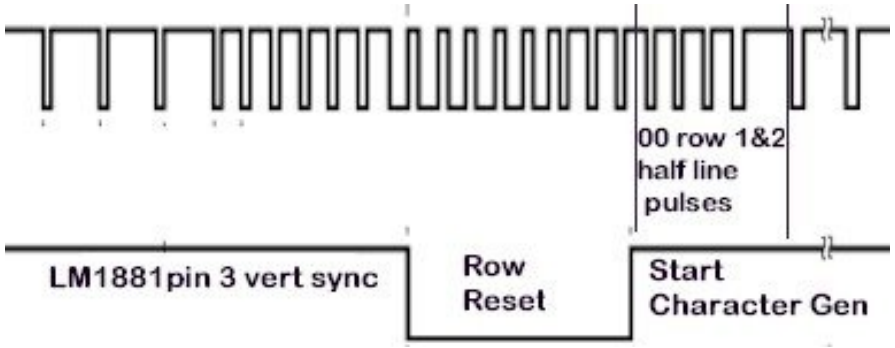
For the first 2 rows of the EEPROM I have programmed to leave the picture in by programming 00 (only there is no picture just blank lines). The third Row I have set to MAT only.

The fourth Row starts the characters. The first two squares in the matrix are empty so I have put in 01, 01, followed by 03,03,03 for the top bar of the G four spaces 01,01,01,01 and then 03,03,03 top of the 8 and so on. Carry on for 63 spaces and you have the top row, the second row starts at 0100



Programming the EEPROM

The area available for programming is 64 by 16 (remember 0000 is a valid location) so cut your graph paper accordingly.



Those Annoying Half Line pulses that will false clock the column counter

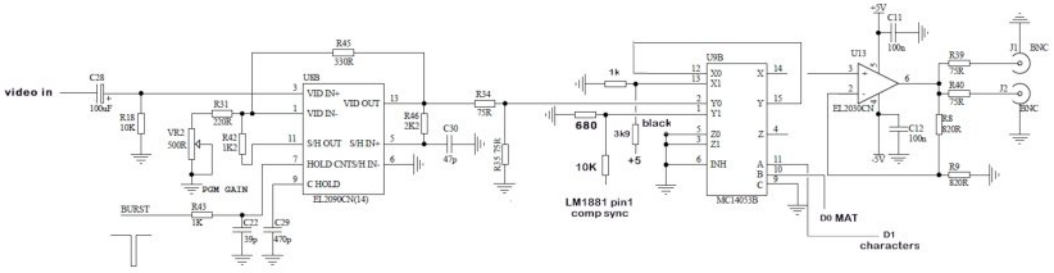
The 16 rows is 32 TV lines so you will need to not use the whole of the vertical matrix if you want the finished result to not encroach on the active picture.

This is a little more than will fit into the 25 blank lines in the vertical interval, but you do not have to use all the matrix, you always have the 00 option available or you can use the MAT to blank out some of the picture. Next time I will start the active data at 0080 and move the characters up one row.

I used Richards combining circuit to add the MAT and the characters together. D0 switches the Y change over switch between black and video, the output Y is then one input to the switch X the other is 1volt derived from +5 and the switch toggles back between this 1v (peak white) and the Y output which is either black or video depending on the D0 MAT.

The incoming video is processed by an EL2090 which has an in built DC restorer which is necessary so that the Video MAT and the video signal both have the same black levels . This is achieved by a sample and hold logic. When the hold logic input is set to a logic 0 during a horizontal sync, the sample and-hold amplifier may be used as a general-purpose op-amp to null the DC offset of the video amplifier.

When the hold input goes to a logic 1 the sample-and-hold stores the correction voltage on the hold capacitor to maintain DC correction during the subsequent scan line. Richard's used burst gate pulses (pin 5 of the LM1881) as a hold pulse..

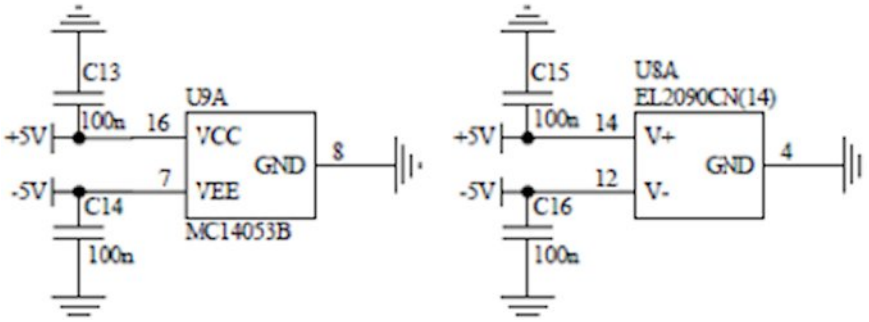


Character and picture combiner

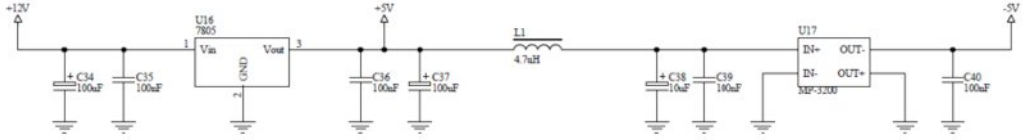
TRUTH TABLE

Control Inputs				ON Switches		
	Select					
Inhibit	C	B	A	MC14053B		
0	0	0	0	Z0	Y0	X0
0	0	0	1	Z0	Y0	X1
0	0	1	0	Z0	Y1	X0
0	0	1	1	Z0	Y1	X1
0	1	0	0	Z1	Y0	X0
0	1	0	1	Z1	Y0	X1
0	1	1	0	Z1	Y1	X0
0	1	1	1	Z1	Y1	X1
1	x	x	x	None		

MC14053 B Truth Table



The MC 14053B and the EL2030 both require a -5 supply. These can be derived from the MP3200 as per Richard ITS generator



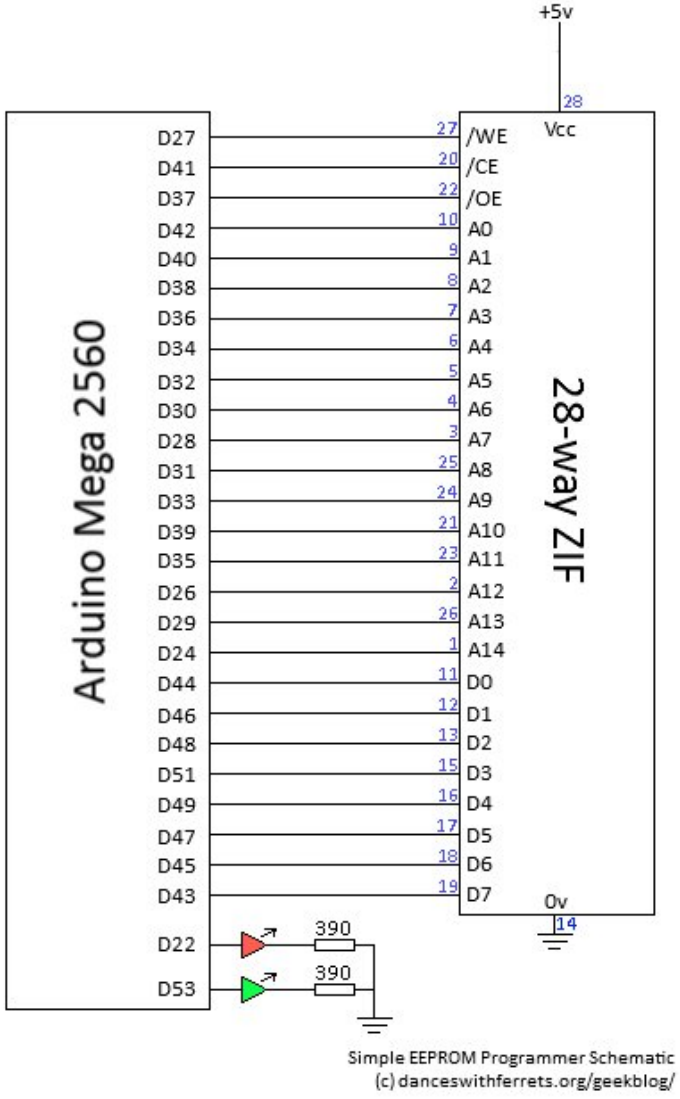
Richards original power distribution from CQ-DATV 62

Last but not least there are some interesting effects to be had by some slight juggling of the counters. The Row counter output Q5 that connects to Nand gate and stops the Row clock after the last Row count, if moved to Q6 will allow the characters to repeat down the screen a further 15 times. This makes good use of the MAT signal which has so far being of little use only to put a black background over the otherwise black vertical blanking.

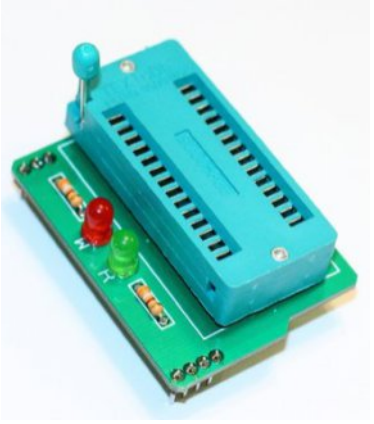
The Characters can be vertically enlarged by shuffling the EEPROM Lines A6 A7 A8 A9 along the Column Counter to Q2 Q3 Q4 Q5 or even to Q3 Q4 Q5 Q6 which might have a value for ATV contest numbers.

The Grounded A10 A11 A12 lines on the EEPROM can be used to add extra pages to the ROM so that additional Call signs or locations can be paged in.

The last problem is how to programme the EEPROM or EPROM and I could point you to the EPROM programmer in the Micro and Television Handbook in the CQ-DATV library, but that interfaces to the Sinclair Spectrum and one or two of you may have moved on. That also requires that the data is entered in Decimal and the table following is in Hex as are all the instruction for programming. There are other more modern programmers around and this one might be the answer.



Simple EEPROM Programmer Schematic
(c) danceswithferrets.org/geekblog/



Simple EEPROM programmer for the Arduino Mega 2560

It's based on one of the Arduino modules and is describe as a simple project for reading 28-pin ROMs, and for reading or writing 28-pin EEPROMs. It works with the pin out of ROMs and EEPROMs like 28c64, 28c128, 28c256, and so on.

It won't programme EPROMS so not quite up there with the Micro and Television Projects Spectrum Programmer, but EEPROMS are the way to go, no nasty UV light boxes that remind you of the 60's disco's when your white shirt positively glowed.

I have included a github link for the code to run this programmer.

https://www.tindie.com/products/Oddblk/simple-eeprom-programmer-shield-for-arduino-mega/

https://github.com/oddblk/eeprom-writer

As a final note I have listed the EPROM data I used to create my Call sign in a hope that with CQ-DATV being an electronic publication that you could lift the text and use it for programming purposes. I realise that my Call Sign may not be the one you want to use, although I am personally quite happy with it, but it may form the basis of what you require and has a value in enabling you to test the hardware.

The EPROM Data for G8CJS

0000 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00

0040 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00

0080 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

00C0 01 01 03 03 03 01 01 01 01 03 03 03 01 01 01 01 03
03 03 01 01 01 01 01 01 01 03 01 01 01 03 03 03 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0100 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01 03 01
01 01 03 01 01 01 01 01 01 03 01 01 01 01 01 01 03 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0140 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01 03 01
01 01 03 01 01 01 01 01 01 03 01 01 03 01 01 01 03 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0180 01 03 01 01 01 01 01 01 03 01 01 01 03 01 01 01 01
01 01 01 01 01 01 01 01 01 03 01 01 03 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

01C0 01 03 01 01 01 01 01 01 03 01 01 01 03 01 01 01 01
01 01 01 01 01 01 01 01 01 03 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0200 01 03 01 01 01 01 01 01 01 03 03 03 01 01 01 03 01
01 01 01 01 01 01 01 01 01 03 01 01 01 03 03 03 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0240 01 03 01 01 03 03 01 01 03 01 01 01 03 01 01 03 01
01 01 01 01 01 01 01 01 01 03 01 01 01 01 01 01 01 03 01

01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0280 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01 03 01
01 01 01 01 01 01 01 01 01 03 01 01 01 01 01 01 01 03 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

02C0 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01 03 01
01 01 01 01 01 01 01 01 01 03 01 01 01 01 01 01 01 03 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0300 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01 03 01
01 01 03 01 01 03 01 01 01 03 01 01 03 01 01 01 03 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

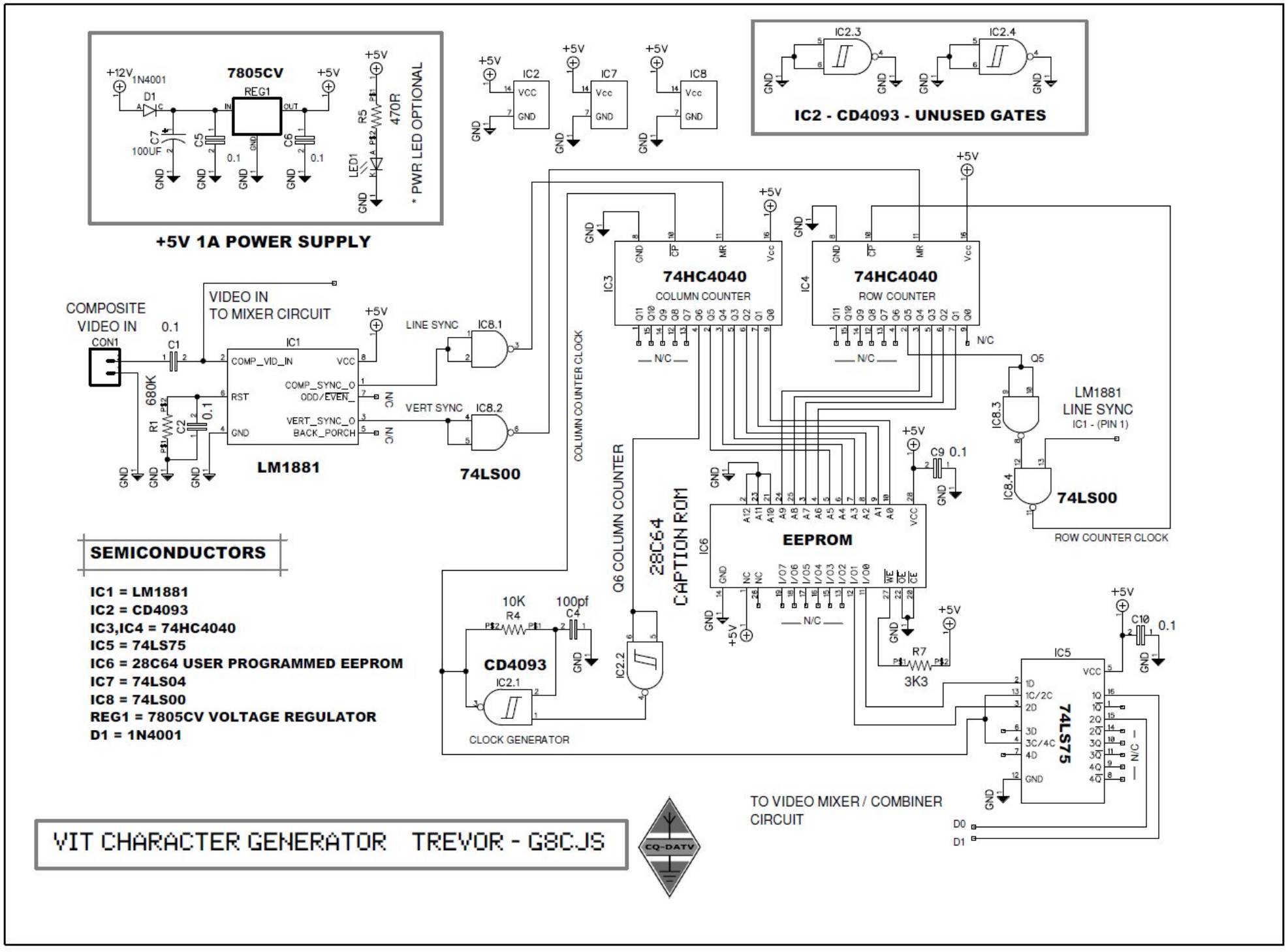
0340 01 01 03 03 03 03 01 01 01 03 03 03 01 01 01 01 03
03 03 01 01 01 01 03 03 03 01 01 01 01 03 03 03 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

0380 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01 01
01 01 01 01 01 01 01 00

03C0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00

Continued next page...

Check out the DKARS website at:-
http://dkars.nl/


+5V 1A POWER SUPPLY
* PWR LED OPTIONAL
IC2 - CD4093 - UNUSED GATES
COMPOSITE VIDEO IN
VIDEO IN TO MIXER CIRCUIT
LM1881
74LS00
74HC4040
COLUMN COUNTER
ROW COUNTER
COLUMN COUNTER CLOCK
Q6 COLUMN COUNTER
28C64 CAPTION ROM
EEPROM
CD4093
CLOCK GENERATOR
74LS75
TO VIDEO MIXER / COMBINER CIRCUIT
ROW COUNTER CLOCK
LM1881 LINE SYNC IC1 - (PIN 1)
SEMICONDUCTORS
IC1 = LM1881
IC2 = CD4093
IC3,IC4 = 74HC4040
IC5 = 74LS75
IC6 = 28C64 USER PROGRAMMED EEPROM
IC7 = 74LS04
IC8 = 74LS00
REG1 = 7805CV VOLTAGE REGULATOR
D1 = 1N4001
VIT CHARACTER GENERATOR TREVOR - G8CJS
CQ-DATV

VMIX Matrix 16 Way Keypad Controller

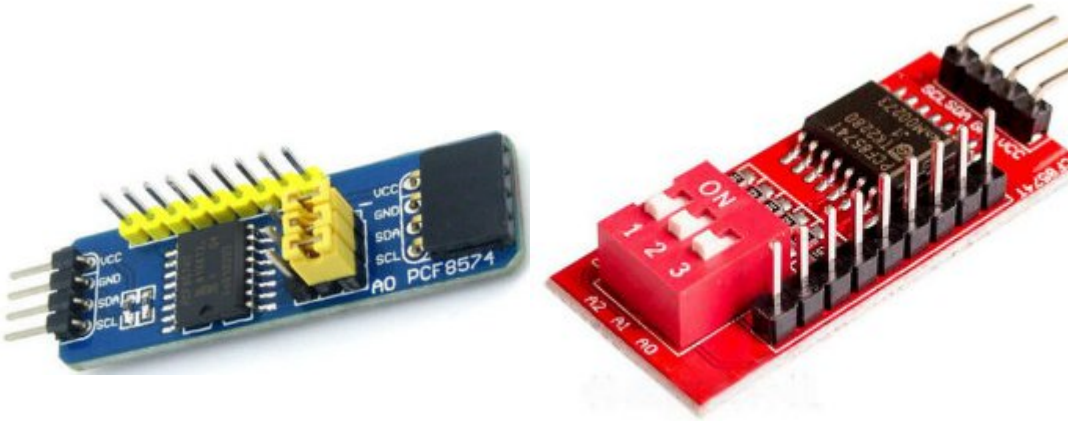
Written by Mike Stevens G7GTN

Introduction

As we know we can control the VMIX Software using shortcut keys as in from our desktop PC Keyboard. We can also use external control via various means. If money is not an object we can purchase one of the readymade solutions. In previous magazine articles we looked at adding a shift register to encode up to 8 push buttons. In that incarnation we used an ATTINY85 and the ability to communicate via USB.

In this project use is made of a 16 key matrix pad to provide 16 buttons we can assign. The keypad is read via I2C, this provides the ability to add extra keypads on different addresses if desired for your application. A small pre-assembled module can be obtained from eBay (or similar sites) containing a PCF8574, these cost just over £1 each and worth having a few in your parts stock.

The Micro controller is changed for an Ardunio Pro-Micro based on a MEGA32U4 which allows us a little more scope for some later additions.



Different PCF8574 I/O Expander modules

The whole concept is based on the ability of the PC to see this as a USB Human Interface Device (HID) which for us just means a standard keyboard protocol.

The matrix keypad used has an eight way connector, pin numbers are indicated on the plastic shell if you look very closely.

Knowing this Pin 1 goes to port P0 on the I/O expander. That completes the hardware setup. Next you need to provide a supply of +5V and off course also the data connection to the I2C Pins. SCL goes to PIN 3 on the Ardunio Pro-Micro, with SDA going to PIN 2

You need to set up an I2C Address (using either the pin header blocks or DIP Switch) within the software we can run a small bus scan to 9600 baud serial terminal to determine what address we have selected.

With this information we can assign the hexadecimal address as seen within the code, as already hinted at you could run two instances of the keypad decoder library at a different address to add additional keypads.

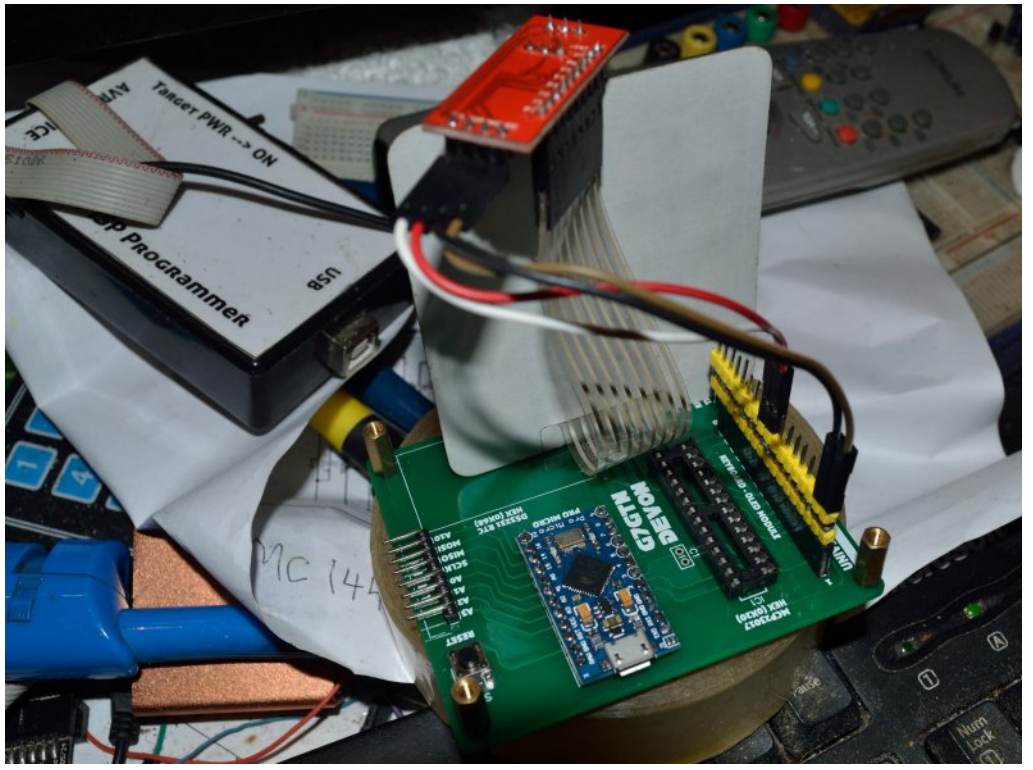
Construction

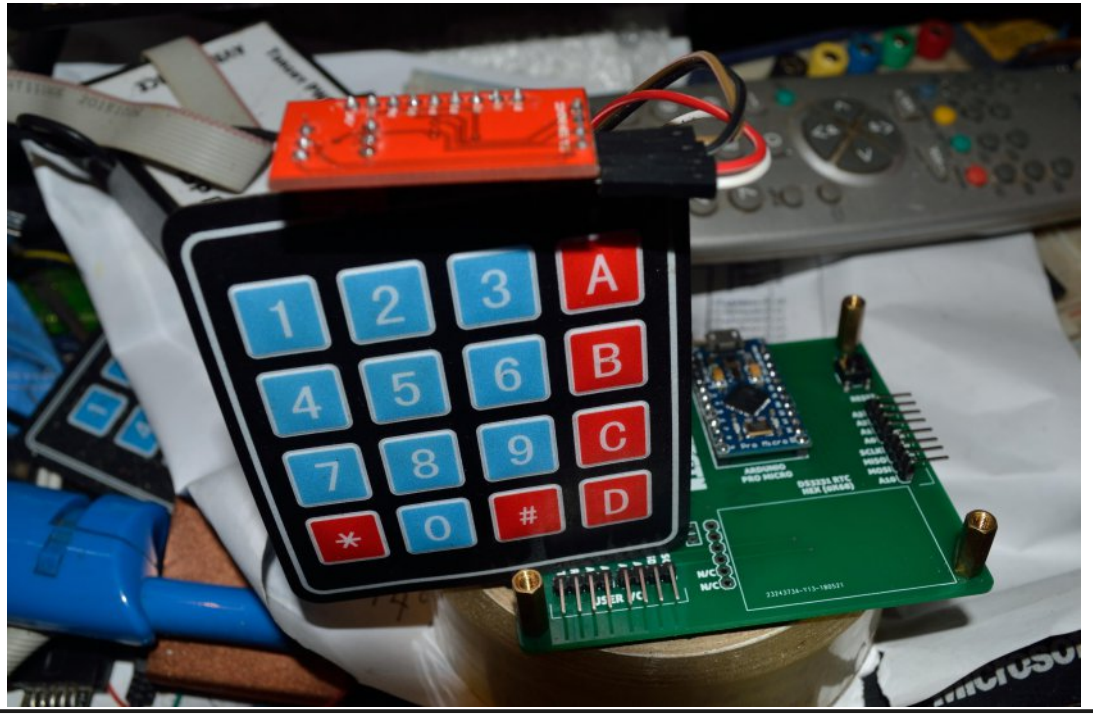
Whilst I used one of my own custom development type PCB's since these were already sat here, there are no construction requirements. You can use your own creativity on your build, after all we just need four connections (Power and I2C back to the Ardunio Pro-Micro) If you wish a small section of stripboard or similar and some female headers would allow you to re-use the Ardunio module in other things if required. The Matrix keypad has an adhesive peel off backing so mechanical mounting is made very simple on your chosen type of enclosure. A small slot to pass through the 8 way female socket is the only requirement.

Software

The Prototype →

The Ardunio IDE requires that you download and install the software keypad library from the github link given. Each individual key sends a VMIX Control key combination, in my example I have used (CTRL-A to CTRL-P) which you can change to send your own required shortcut. From the VMIX shortcut section you match up the function you wish to perform, that is where you create your custom settings. A small tutorial video is linked where this is described in detail if you need this assistance. For reference the module type you need to select from the Ardunio IDE is called a Genunio Micro. The required source code can be downloaded from the Magazine software download area.





Internet References

https://www.arduino.cc/en/Main/Software?

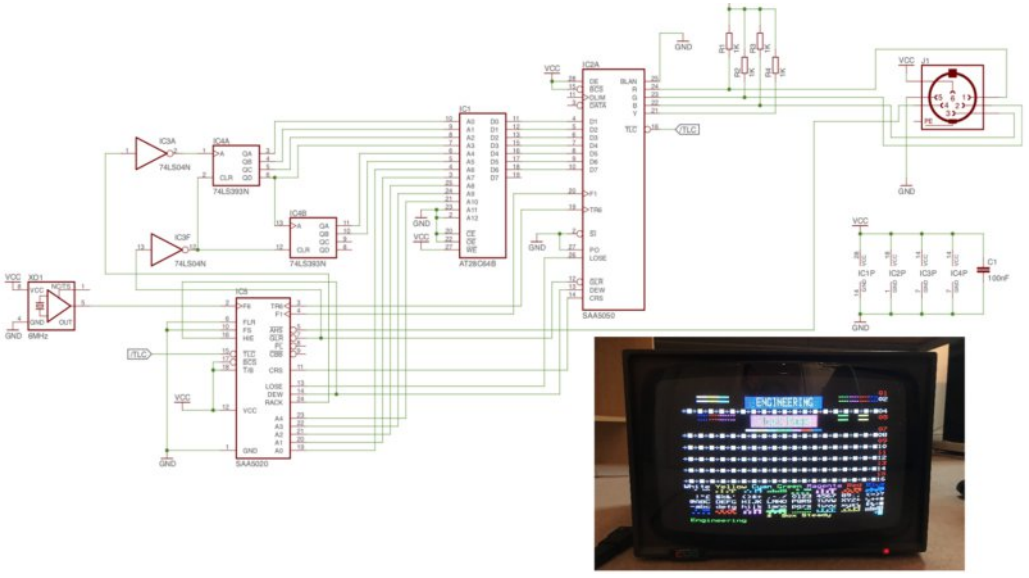
https://github.com/joeyoung/arduino_keypads

https://www.vmix.com/knowledgebase/article.aspx/83/shortcuts

One from the Vault

One from the vault is a new addition where we look back at some of the past articles.

Teletext Pattern Generator



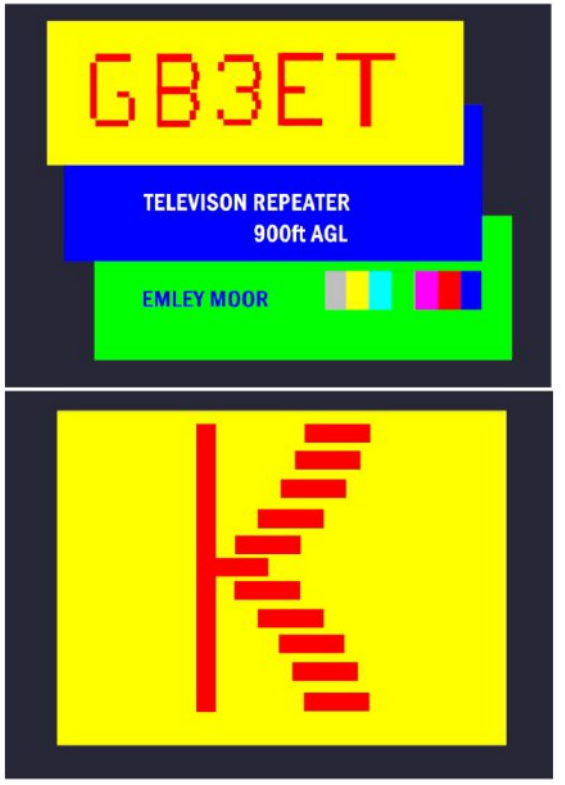
This first circuit was not designed for CQ-DATV, it was put together by Trevor before this publication had been even thought of. Like all good circuits it was designed out of necessity to support an ATV display in Scotland.

Short of working kit to display, it came down to what can you put together on a very tight schedule, which from memory was only a few days. The circuit uses two of the three chips that make up a teletext display and were called TIC TAC and TROM. The design used external RAM memory which would normally be refreshed with the data from the selected Teletext page. This was replaced by a an EPROM. The map was also redesigned to save on components as it no longer had to comply with a rigid design format.

Teletext is 40 characters across the screen and then where one line finished in memory the next one starts. The economy of chips left a little blank space in the EPROM which could not be accessed by the revised counters, but this was not a problem there was an abundance of space in the EPROM.

The RGB output was used to drive a TV with a SCART input and later a PCB design was added. The circuit became very popular and many different EPROM designs appeared in many of the subsequent publications.

It goes without saying it will only display Teletext characters which were hard programmed in the EPROM Memory.



The most famous design was the screen transmitted by GB3ET, the Emley Moor ATV repeater, which sadly is no more, but for several years sat at the top of a 1200ft TV Tower and could be received all through Yorkshire.

This was initially programmed with an Ident Screen and a K as an invite to others to join a QSO. These were simply switched between by paging the spare address lines of the EPROM.

The full story behind GB3ET can be read in CQ-DATV issue 9 *https://www.cq-datv.mobi/9.php*

External links

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

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

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

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

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

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

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

Coming up in CQ-DATV

Is this the latest issue of CQ-DATV? *Click here* to go to our web site to check to see if there is a later edition available.

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

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

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IARU Region 1 ATV Contest 2018 Results

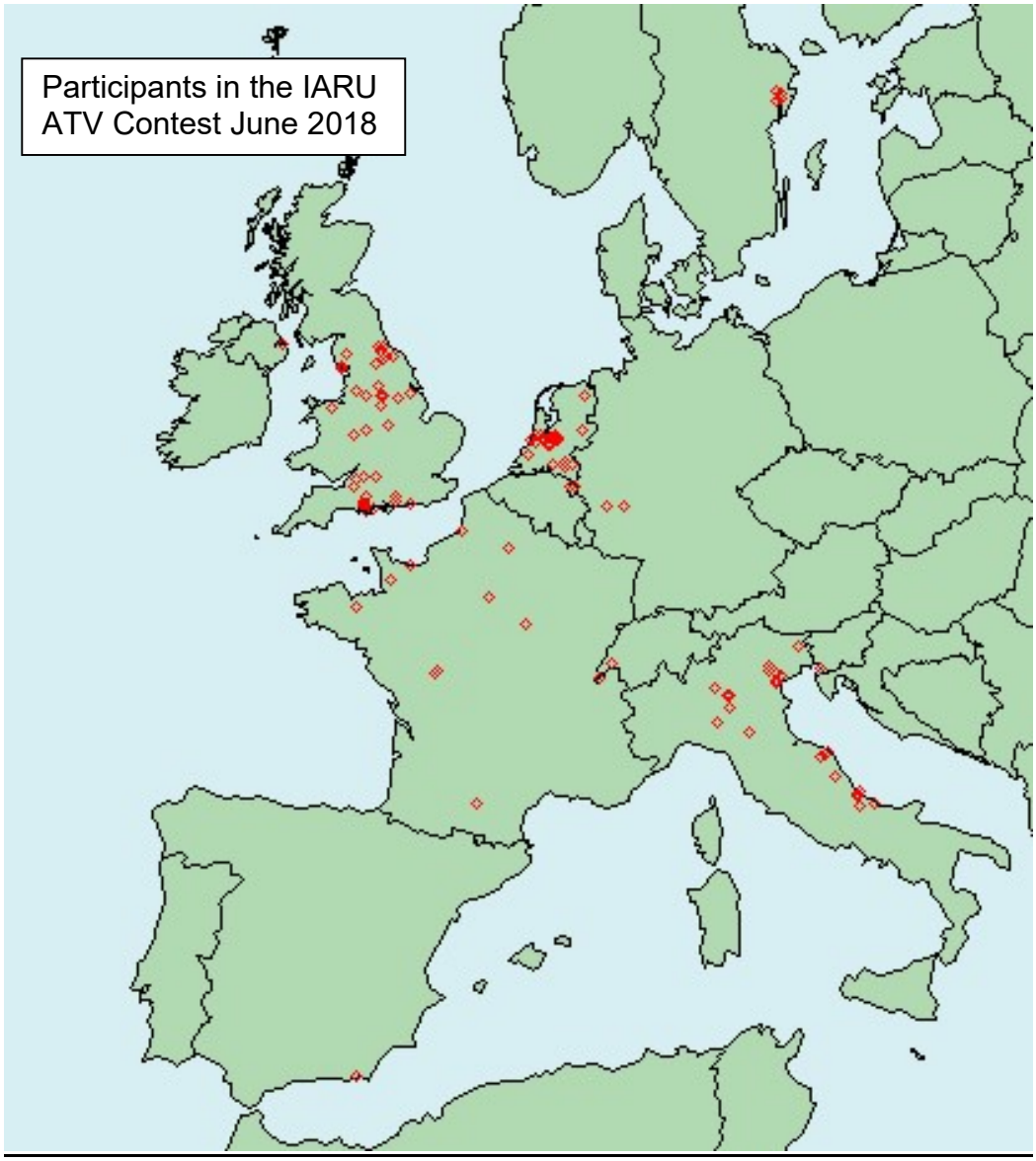
The IARU Region 1 ATV Contest was held on 9/10 June 2018. One hundred entrants from 8 countries competed using all bands from 432 MHz to 76 GHz.

The overall winner (for the second year running) was Francesco IK3HHG. The best DX was a 70 cm ATV Contact between Rolf F9ZG and Jean-Claude F1AHR at 449 km.

It was good to see an increase in participation from last year (82 to 100) and also that there were entries on 47 GHz and 76 GHz.

Full results are presented in the following pages. Please don't forget next year's IARU ATV Contest on 8/9 June 2019.

Dave, G8GKQ



Overall Rankings

Pos	Call	Locator	Score
1	IK3HHG	JN65AW	23450
2	PE1EZU	JO22LE	18984
3	PE1ASH	JO22KF	11528
4	PA0BOJ	JO21ON	11194
5	M0DTS	IO94MJ IO94DF	10000
6	G8GTZ	IO90LX IO81QF	9601
7	G8GKQ	IO80WP IO80UU	8616
8	PA1RHQ	JO22MD	8330
9	G1LPS	IO94EQ	7269
10	GW4CBW/P	IO83FD	6940
11	F9ZG/P	IN88RH	6575
12	PE2TV	JO32GH	5996
13	G3NWR/P	IO84ML	5650
14	IW6OCN	JN72BD	4890
15	IV3WSJ	JN65VO	4838
16	PE1JMZ	JO21DU	4269
17	PA3CRX	JO022OF JO22QE	3933
18	M1EGI	IO93FL IO93GL	3764
19	F5AGO	JN06DP	3646
20	PA0T	JO33JC	3577
21	PA3CWS	JO22RG JO22RE	3424
22	IW6ATU	JN63QN	3372
23	PA3DLJ	JO20VW	3370
24	PE1RQM	JO22RD	3302
25	PE1MPZ	JO22NB	3265
26	PE1CVJ	JO22KG	3223
27	G8AGN	IO93FF IO93FK	3150
28	IW3RMR	JN66OF	3024
29	F4BNF	IN98JW	2829
30	F6AQO	JN18EK	2730
31	G7AVU	IO93OJ	2664
32	PA7HV	JO21TK	2640
33	PA2TG	JO22FE	2467
34	F6BGR	JO00SC	2178
35	F1CSY	JN03SK	1894
36	IK3ERO	JN65CL	1880

Pos	Call	Locator	Score
37	G0ATW	IO93UL	1830
38	F1AIW	JN06ER	1766
39	PE1APH	JO21XM	1725
40	HB9IAM	JN36BF	1710
41	IW6CHN	JN62SW	1684
42=	G0HIK	IO84KD IO84JE	1650
42=	M0KPW	IO84KD IO84JE	1650
44	PC2F	JO22QE JO22QF JO22RG	1648
45	F6ESU	JN19OO	1572
46	PA1AS	JO20XW	1450
47	PE1OLR	JO21UN	1406
48	G3KJX	IO94HI IO94IJ	1358
49	G4FVP	IO94GQ IO94FM	1272
50	IW4APQ	JN54LK	1084
51	I2MUT	JN55FJ	1080
52	IW4CPP	JN44XT	1012
53	I2CIC	JN55FC	988
54	G4LDR	IO90LU IO91CL	920
55	F6FZU	IN99SH	852
56=	IZ3ALW	JN65EP	779
56=	IZ3NVR	JN65EP	779
58	IK6DTA	JN72BL	703
59	G4BVK	IO81RK	678
60	F1AEA	JN17TR	666
61	PA7ML/P	JO22OA	650
62=	DK7UP	JO30NI	630
62=	DC8UG	JO30UH	630
64	HB9AFO	JN36GN	620
65	IK2AXV	JN55AO	512
66	PA0RWE	JO22HC	499
67	I3GXC	JN65DR	420
68	IZ3CLH	JN65CN	396
69	SA0BDC	JO89TF	340
70	IZ6MVK	JN72BJ	336

Continued...

Pos	Call	Locator	Score
71=	G6OXW	IO83WK	330
71=	G8AFC/P	IO83RO	330
73	G4GUO	IO90ST	328
74	G4KLB	IO90BR	326
75	G8EOP	IO93EQ	316
76	SM0OFV	JO99AI JO89XI	306
77	IW6NOD	JN72HD	287
78	G7JTT/P	IO80WX	260
79	SM0VPJ	JO89VK	252
80	SM0WLL	JO89WF	224
81	G6AUR/P	IO81UL	216
82	PA3GNZ	JO22NB	215
83	GI3VAF/P	IO74EQ	210
84	IU3IOU	JN65AT	186
85	SA0CCA	JO89XG	170
86	PA1G	JO22HH	162

Pos	Call	Locator	Score
87	GI7UGV/P	IO74DQ	160
88	I6DQD	JN72CL	152
89	PA1EBM	JO20XW	130
90=	EA7KA	IM86SU	120
90=	EA7GLU	IM86SU	120
92	PE1JXI	JO20VX	90
93	IZ6PNK	JN63OM	56
94=	EA7EAH	IM86SU	40
94=	EA7CU	IM86SU	40
96	2E0XAY/P	IO92IR	35
97	I6CXB	JN63RO	32
98	M0YDH	IO82WO IO82QL	30
99	IW2MBA	JN55GJ	28
100	G7MEG	IO82WO	15

Band Winners:

Band	Call	Score
70 cm	F9ZG/P	5803
23 cm	IK3HHG	5920
13 cm	PE1EZU	8305
9 cm	GW4CBW/P	1540
6 cm	IK3HHG	4260
3 cm	IK3HHG	6655
1.2 cm	G8GTZ/P	2110
0.6 cm	PE1CVJ PE1ASH	40
0.4 cm	G4LDR G8GTZ	140

Country Winners:

Nation	Call	Points	Entries
Italy	IK3HHG	23450	24
Netherlands	PE1EZU	18984	25
UK	M0DTS	10000	28
France	F9ZG/P	6575	10
Switzerland	HB9IAM	1710	2
Germany	DK7UP	630	2
	DC8UG	630	
Sweden	SA0BDC	340	5
Spain	EA7KA	120	4
	EA7GLU	120	

Notes:

1. There are some very minor inconsistencies in the scores caused by the varied use of 6, 8 and 10-character locators. Where possible, I have equalised positions, even if the scores are a few points different.

2. The best DX columns may occasionally record contacts that were attempted, but not achieved. This does not affect the points or the rankings.

3. Thanks to Hans PA0WYS for the excellent scoring software and to Chris PA3CRX for his help and advice.

4. Please send future logs to IARU_ATV@uba.be

Dave, G8GKQ

70 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	F9ZG/P	5803	F1AHR	IN94VO	449
2	F5AGO	3082	F1CYS	JN03SK	370
3	F4BNF	2829	F5AGO	JN06DP	278
4	F6AQO	2730	F9ZG/P	IN88RH	363
5	F6BGR	2178	F9ZG/P	IN88RH	357
6	F1CSY	1894	F1AIW	JN06ER	377
7	F1AIW	1766	F1CSY	JN03SK	377
8	F6ESU	1572	F9ZG/P	IN88RH	443
9	PE1EZU	966	PA0T	JO33JC	158
10	PA0BOJ	948	PA0T	JO33JC	202
11	F6FZU	852	F9ZG/P	IN88RH	189
12	G8GKQ/P	816	G4GUO	IO90ST	119
13	F1AEA	666	F6ESU	JN19OO	211
14	G8GTZ/P	573	G8GKQ/P	IO80WP	85
15	PE2TV	537	PE1JMZ	JO21DU	162
16	PE1JMZ	461	PE2TV	JO32GH	162
17	PA0T	391	PA0BOJ	JO21ON	202
18	PA7HV	390	PA1AS	JO20XW	60
19	G4GUO	328	G8GKQ/P	IO80WP	119
20	HB9IAM	286	HB9AZN/p	JN36GU	77
21	PA3DLJ	279	PE1OLR	JO21UN	70
22	G7JTT/P	260	G4BVK	IO81RK	59
23	PA2TG	255	PE2TV	JO32GH	142
24	G4KLB	246	G8GTZ/P	IO81QF	76
25	G4BVK	238	G8GKQ/P	IO80UU	68
26	PE1APH	221	PA3DLJ	JO20VW	68
27	G1LPS	210	M0DTS/P	IO94MJ	54
28	PE1OLR	206	PA3DLJ	JO20VW	70
29	M0DTS/P	204	G1LPS	IO94EQ82	52
30	PE1ASH	190	PA0BOJ	JO21ON17JV	74
31	PA1AS	177	PA7HV	JO21TK	60
32	HB9AFO	130	HB9IAM	JN36BF	49
33	PA1RHQ	102	PA2TG	JO22FE	38
34	PE1CVJ	65	PA1RHQ	JO22MD14UR	19
35	PA3CRX	64	PE1ASH	JO22KF40OE	35
36	PA1G	54	PE1EZU	JO22LE93OW	27
37	PC2F	52	PE1EZU	JO22LE93OW	26
38=	PE1MPZ	50	PE1ASH	JO22KF40OE	23
38=	PA7ML/P	50	PE1EZU	JO22LE	25

Continued ....

70 cm Results Continued

Nr	Call	Points	BestDX	QTH	Distance
40=	DK7UP	42	DC8UG	JO30UH	42
40=	DC8UG	42	DK7UP	JO30NI	42
42	PE1JXI	18	PA1AS	JO20XW	13
43=	EA7GLU	10	EA7KA	IM86SU	5
43=	EA7KA	10	EA7GLU	IM86SU	5
43=	PA1EBM	10	PA1AS	JO20XW	5
43=	M0YDH/P	10	G3UKV/P	IO82QL	5
47	G7MEG	5	M0YDH	IO82WO	5

23 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	IK3HHG	5920	IW6ATU	JN63QN	284
2	PE1EZU	4578	PA0T	JO33JC	158
3	PA1RHQ	3858	PA0T	JO33JC	160
4	PA0BOJ	3716	PA0T	JO33JC	202
5	IW6ATU	3372	IW3RMR	JN66OF	297
6	IW6OCN	3350	IW3RMR	JN66OF	459
7	PA0T	3186	PA0BOJ	JO21ON	202
8	IW3RMR	3024	IW6OCN	JN72BD	459
9	PE1ASH	2988	PA3DLJ	JO20VW	155
10	PA3CWS	2504	PA3DLJ	JO20VW	139
11	PE2TV	2404	PA0BOJ	JO21ON	124
12	G7AVU	2284	G1LPS	IO94EQ	153
13	M0DTS/P	2206	G7AVU	IO93OJ	112
14	PA3DLJ	2186	PE1ASH	JO22KF	157
15	PA7HV	1750	PA0T	JO33JC	201
16	PE1APH	1504	PE1ASH	JO22KF40OE	108
17	G1LPS	1424	G7AVU	IO93OJ	153
18	PA2TG	1302	PE1NKT	JO33EE	170
19	PE1JMZ	1088	PE2TV	JO32GH	162
20	IW4APQ	1084	IK3HHG	JN65AW	187
21	IW4CPP	1012	IK2AXV	JN55AO	88
22	PA1AS	978	PE1EZU	JO22LE	155
23	M1EGI/P	974	M0DTS/P	IO94MJ	110
24	G8GKQ/P	880	G8GTZ/P	IO90LX	85
25	G8GTZ/P	828	G8GKQ/P	IO80WP	85
26	PE1RQM	812	PA0BOJ	JO21ON17JV	65

Continued.....

23 cm Results continued

Nr	Call	Points	BestDX	QTH	Distance
27	F9ZG/P	772	F5AGO	JN06DP	282
28	I2MUT	760	IW4CPP	JN44XT	76
29	PE1OLR	700	PA1AS	JO20XW	72
30	IW6CHN	684	IW6OCN	JN72BD	100
31=	I2CIC	668	IW4APQ	JN54LK	84
31=	PE1CVJ	668	PA0BOJ	JO21ON17JV	81
33	IV3WSJ	608	IK3HHG	JN65AW	141
34	F5AGO	564	F9ZG/P	IN88RH	282
35	PE1MPZ	540	PE1CVJ	JO22KG16ST	30
36	IK2AXV	512	IW4CPP	JN44XT	88
37	G4BVK	440	G8GKQ/P	IO80UU	68
38	PA3CRX	404	PE1ASH	JO22KF40OE	35
39	G3KJX/P	368	G1LPS	IO94EQ	40
40	SA0BDC	340	SM0OFV	JO99AI27	27
41	G8EOP	316	G7AVU	IO93OJ	64
42	SM0OFV	306	SA0BDC	JO89TF70	27
43	IK3ERO	290	IK3HHG	JN65AW	53
44	G3NWR/P	280	G3ZGZ	IO83LU	70
45	SM0VPJ	252	SA0BDC	JO89TF70	26
46	PC2F/P2	236	PE1EZU	JO22LE93OW	33
47	SM0WLL	224	SM0VPJ	JO89VK33	21
48	G6AUR/P	216	G8GTZ/P	IO81QF	36
49	G4FVP	212	M0DTS/P	IO94DF	34
50	IZ3CLH	176	IK3HHG	JN65AW	44
51	SA0CCA	170	SA0BDC	JO89TF70	19
52=	DC8UG	168	DK7UP	JO30NI	42
52=	DK7UP	168	DC8UG	JO30UH	42
54=	PA0RWE	164	PA1RHQ	JO22MD14UR	25
54=	IZ3NVR	164	IK3HHG	JN65AW	41
54=	IZ3ALW	164	IK3HHG	JN65AW	41
57	HB9IAM	154	HB9AZN/p	JN36GU	77
58	I6DQD	152	IW6OCN	JN72BD	38
59	IK6DTA	148	IW6OCN	JN72BD	37
60	I3GXC	120	IK3HHG	JN65AW	30
61	IU3IOU	116	IK3ERO	JN65CL	39
62	PA1G	108	PE1EZU	JO22LE93OW	27
63	PA7ML/P	100	PE1EZU	JO22LE	25
64	IW6NOD	82	IW6OCN	JN72BD	41
65	G4KLB	80	G8GKQ/P	IO80WP	20

Continued....

23 cm Results continued

Nr	Call	Points	BestDX	QTH	Distance
66	PE1JXI	72	PA1AS	JO20XW	13
67=	EA7KA	60	EA7GLU	IM86SU	5
67=	EA7GLU	60	EA7CU	IM86SU	5
69=	IZ6MVK	56	IW6OCN	JN72BD	28
69=	IZ6PNK	56	IW6ATU	JN63QN	14
71=	EA7EAH	40	EA7KA	IM86SU	5
71=	EA7CU	40	EA7GLU	IM86SU	5
73	I6CXB	32	IW6ATU	JN63QN	8
74	IW2MBA	28	I2MUT	JN55FJ	7
75=	PA1EBM	20	PA1AS	JO20XW	5
75=	M0YDH	20	G7MEG	IO82WO	5
77	G7MEG	10	M0YDH	IO82WO	5

13 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	PE1EZU	8305	PA3GCN	JO32MG	139
2	IK3HHG	6615	S58RU	JN65WM	150
3	PA0BOJ	5545	PE2TV	JO32GH	124
4	PE1ASH	4290	PA3DLJ	JO20VW	155
5	PE2TV	3055	PAOBOJ	JO21ON	124
6	PA1RHQ	3010	PE1DWQ	JO22VW	103
7	PE1JMZ	2720	PE2TV	JO32GH	162
8	PE1RQM	2490	PE1DWQ	JO22VW	92
9	PE1MPZ	2150	PE1DWQ	JO22VW	109
10	PA3CRX	1660	PE1DWQ	JO22VW	90
11	PE1CVJ	1530	PA0BOJ	JO21ON17JV	81
12	IV3WSJ	1410	IK3HHG	JN65AW	141
13	G8GTZ/P	1400	G8GKQ/P	IO80WP	85
14	G8GKQ/P	1330	G8GTZ/P	IO90LX	85
15	IW6OCN	1170	IW6CHN	JN62SW	100
16	G1LPS	1050	M0DTS/P	IO94MJ	54
17=	HB9IAM	1020	HB9AZN/p	JN36GU	77
17=	M0DTS/P	1020	G1LPS	IO94EQ82	52
19	IW6CHN	1000	IW6OCN	JN72BD	100
20	PA3DLJ	905	PE1ASH	JO22KF	157
21	PA3CWS	750	PE1DWQ	JO22VW	87
22	PA2TG	740	PA1RHQ	JO22MD	40
23	PC2F/P2	590	PE1EZU	JO22LE93OW	33

Continued....

13 cm Results continued

Nr	Call	Points	BestDX	QTH	Distance
24	IK3ERO	530	IK3HHG	JN65AW	53
25=	PA7HV	500	PA0BOJ	JO21ON17JV	35
25=	PE1OLR	500	PA0BOJ	JO21ON	35
27=	DC8UG	420	DK7UP	JO30NI	42
27=	DK7UP	420	DC8UG	JO30UH	42
29	PA0RWE	335	PA1RHQ	JO22MD14UR	25
30	IZ6MVK	280	IW6OCN	JN72BD	28
31	HB9AFO	245	HB9IAM	JN36BF	49
32	PA1AS	220	PA3DLJ	JO20VW	12
33	IW6NOD	205	IW6OCN	JN72BD	41
34	IK6DTA	185	IW6OCN	JN72BD	37
35	I3GXC	150	IK3HHG	JN65AW	30
36	PA1EBM	50	PA1AS	JO20XW	5

9 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	GW4CBW/P	1540	G3NWR/P	IO84ML	154
2	G3NWR/P	1530	GW4CBW/P	IO83FD	153
3	G1LPS	1345	M0DTS/P	IO94MJ	54
4	G8GTZ/P	1330	G8GKQ/P	IO80WP	85
4=	G8GKQ/P	1330	G8GTZ/P	IO90LX	85
6	M0DTS/P	1190	G1LPS	IO94EQ82	52
7	PE1EZU	615	PA3CRX	JO22QE51EF	26
8	PA3CRX	465	PE1ASH	JO22KF40OE	35
9	PE1ASH	345	PA3CRX	JO22QE51EF	35
10	G4FVP	320	M0DTS/P	IO94DF	53
11	PE1CVJ	230	PE1EZU	JO22LE93OW	15
12	G3KJX/P	200	G1LPS	IO94EQ	40
13	PA7ML/P	125	PE1EZU	JO22LE	25

6 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	IK3HHG	4260	S58RU	JN65WM	150
2	M0DTS/P	3950	G8AGN/P	IO93FF40	138
3	GW4CBW/P	3860	G3NWR/P	IO84ML	154
4	PE1EZU	3645	PE1NKT	JO33EE	145
5	G8AGN/P	3150	M0DTS/P	IO94MJ	138
6	M1EGI/P	2790	G4FVP/P	IO94GQ	136
7	G3NWR/P	2310	GW4CBW/P	IO83FD	153
8	G1LPS	1950	M0DTS/P	IO94MJ	54
9	G8GTZ/P	1890	G8GKQ/P	IO80WP	85
10	G0ATW	1830	M1EGI/P	IO93FL	83
11=	M0KPW/P	1650	GW4CBW/P	IO83FD	116
11=	G0HIK/P	1650	GW4CBW/P	IO83FD	116
13	G8GKQ/P	1600	G8GTZ/P	IO90LX	85
14	IV3WSJ	1410	IK3HHG	JN65AW	141
15	PE1ASH	1380	PE1NKT	JO33EE	149
16	PA3CRX/P	930	PE1ASH	JO22KF40OE	23
17	PA1RHQ	815	PA0BOJ	JO21ON17JV	64
18	PC2F/P2	770	PE1EZU	JO22LE93OW	33
18	PA0BOJ	665	PE1EZU	JO22LE93OW	69
20	G4FVP/P	570	M0DTS/P	IO94MJ	46
21	IK3ERO	530	IK3HHG	JN65AW	53
22=	IZ3NVR	410	IK3HHG	JN65AW	41
22=	IZ3ALW	410	IK3HHG	JN65AW	41
24	G3KJX/P	790	G1LPS	IO94EQ	40
25=	IW6OCN	370	IK6DTA	JN72BL	37
25=	IK6DTA	370	IW6OCN	JN72BD	37
27=	G6OXW	330	G8AFC/P	IO83RO	33
27=	G8AFC/P	330	G6OXW	IO83WK	33
29	PE1MPZ	275	PE1ASH	JO22KF40OE	23
30	PA7ML/P	250	PE1EZU	JO22LE	25
31	PE1CVJ	230	PE1EZU	JO22LE	15
32	PA3GNZ	215	PE1EZU	JO22LE93OW	16
33	GI3VAF/P	210	GI0GDP/P	IO74BR40KS	15
34=	PA3CWS/P	170	PA3CRX/P	JO22OF	17
34=	PA2TG	170	PE1EZU	JO22LE	34
36	GI7UGV/P	160	GI0GDP/P	IO74BR40KS	10
37	2E0XAY/P	35	G8DKC/P	IO92HQ	7

3 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	IK3HHG	6655	S58RU	JN65WM	150
2	PE1ASH	1895	PE1NKT	JO33EE	149
3=	GW4CBW/P	1540	G3NWR/P	IO84ML	154
3=	G3NWR/P	1530	GW4CBW/P	IO83FD	153
5	IV3WSJ	1410	IK3HHG	JN65AW	141
6=	G8GTZ/P	1330	G8GKQ/P	IO80WP	85
6=	G8GKQ/P	1330	G8GTZ/P	IO90LX	85
8	M0DTS/P	930	G1LPS	IO94EQ82	52
9	G1LPS	780	MODTS/P	IO94MJ	54
10	PA1RHQ	545	PA0BOJ	JO21ON17JV	64
11	IK3ERO	530	IK3HHG	JN65AW	53
12	PE1EZU	485	PA7ML/P	JO22OA	23
13	G7AVU	380	G6ZVE	IO93IF	38
14=	I2CIC	320	I2MUT	JN55FJ	32
14=	I2MUT	320	I2CIC	JN55FC	32
16	PA0BOJ	320	PE1RHQ	JO22MD14UR	64
17=	PE1MPZ	250	PE1ASH	JO22KF40OE	23
17=	HB9IAM	250	HB9AFO	JN36GN	50
19	HB9AFO	245	HB9IAM	JN36BF	49
20=	PE1CVJ	230	PE1EZU	JO22LE93OW	15
20=	IZ3CLH	220	IK3HHG	JN65AW	44
22=	IZ3NVR	205	IK3HHG	JN65AW	41
22=	IZ3ALW	205	IK3HHG	JN65AW	41
24	G4FVP	170	M0DTS/P	IO94DF	34
25	I3GXC	150	IK3HHG	JN65AW	30
26	PA7ML/P	125	PE1EZU	JO22LE	25
27	PA1AS	75	PA1EBM	JO20XW	5
28	IU3IOU	70	IK3HHG	JN65AW	14
29=	EA7GLU	50	EA7KA	IM86SU	5
29=	EA7KA	50	EA7GLU	IM86SU	5
29=	PA1EBM	50	PA1AS	JO20XW	5

1.2 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	G8GTZ/P	2110	G8GKQ/P	IO80WP	85
2	G8GKQ/P	1330	G8GTZ/P	IO90LX	85
3	G4LDR/P	780	G8GTZ/P	IO81QF	64
4=	G1LPS	510	M0DTS/P	IO94DF	51
4=	M0DTS/P	500	G1LPS	IO94EQ82	50
6	PA3CRX/P	410	PE1ASH	JO22KF40OE	23
7	PE1ASH	400	PA3CRX/P	JO22OF43TW	23
8	PE1EZU	390	PE1CVJ	JO22KG16ST	15
9	PE1CVJ	230	PE1EZU	JO22LE93OW	15

0.6 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	PE1CVJ	40	PE1ASH	JO22KF40OE	8
2	PE1ASH	40	PE1CVJ	JO22KG16ST	8

0.4 cm Results

Nr	Call	Points	BestDX	QTH	Distance
1	G4LDR	140	G8GTZ/P	IO91LX	14
2	G8GTZ	140	G4LDR/P	IO90LU	14