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

Let's start with the new kid on the block BECG (Broadcast Engineering Conservation Group).

We featured their work in CQ-DATV 85. It's a nice warm feeling to know that somebody is looking after yesterday's TV technology and we should all remember that without yesterday's technology, we would not have today's technology.

Everything must start somewhere and it would seem BECG is the answer to restoring and preserving this aged kit. They are a registered charity and are open for donations. All the money goes on the kit as the team are all volunteers. We will try to keep you up to speed with the progress of the various projects.

The reason we have brought it up today is the first edition of their newsletter, which is called Line-Up, has landed on the editorial desk. It is being circulated by email and this first edition introduces the team and their objectives. CQ-DATV is proud to be supporting them. You need to know that our production team is behind you and any way we can help, please don't hesitate to ask.

In the last edition Rudi S58RU sent in a wakeup call to what needed to happen in ATV. Dave Crump G8GKQ, the current BATC chairman, has asked us to publish his reply and we have done so in full, with no editorial cuts. Dave is wearing his BATC hat, but CQ-DATV is open to everyone, you don't need to ask for permission Dave.

CQ-DATV also believes we need to secure a digital future for ATV and to develop a project that can be home constructed and that can support software updates. Rudi is quite right, this is a major investment for amateurs, and Analogue, DVBS, DVBT, DVBS2, DVBT2 is not helping.

Digilite was the first DATV project and was supported both by the BATC and direct to non-members via the Digilite website. Dave is happy to endorse Portsdown as its successor. This may or may not be the answer, but as he points out, the support from the BATC shop is only available to BATC members. Please Dave open this up to everybody.

In this issue:-

Don Nelson, N0YE adapts surplus Direct TV, satellite TV antenna for use on the 3cm (10 GHz) ham band. Don has also written an article investigated bouncing of FM ATV Flatirons and other rock structures. This has worked for SSB so why not on 5678 MHz ATV.

John Gebuhr, WB0CMC investigates direct frequency modulation of the Silicon Labs PXOs. Apparently, there are pads that until now have not had external connections, but John has extended the connections and the results are in this issue.

Trevor G8CJS looks back to his early days as a broadcast television engineers and one of the problems he was sent out sort was Lip Sync in TV sound.

Trevor has also written another instalment on his GVG panel and looks at the LEDS in his panel compared with earlier panels equipped with bulb illumination. Trevor also explains the T- Bar issues and outlines what will be in the software Version 16 when he gets it finished.

One from the Vault is also by Trevor (will this lockdown never end). This is a look back at streaming the RSGB AGM from CQ-DATV issue 3 now that really is looking deep in the vault. The production team would also like to apologies for the mis spelling of the word Slovenia in the PDF version of CQ-DATV 86. The e-book version was corrected at the proof stage, we just ran out of time when it came to proofreading the PDF version.

If anyone would like to help with proof reading CQ-DATV copy, please contact the editor@cq.datv.mobi.
We also have a Facebook site CQ-DATV if you would like to join us you are more than welcome, you will be asked questions, this is necessary as we do get applications that don't know the answers so please don't laugh when you read them.

On behalf of all the contributors and the editorial team, please sit back and enjoy CQ-DATV 87.

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.

Full HD D-ATV 10.2GHz & 5.7GHz 167Km Test report 2020/8/10

This time, even at 10.2 GHz, communication with a mutual distance of about 167 km went well.
At 5.7GHz, the 287km communication using the Sea of Japan duct has already succeeded many times, but isn't this the first record of 167km Full HD communication in the 10.2GHz band?

The 5G & 10G communication recording video is below.
https://tinyurl.com/y2hssmey

Japan's Full HD D-ATV, "ISDB-T system" (64QAM OFDM), which is equivalent to Japan's terrestrial digital TV broadcasting system, is mainly used, but both MPEG-4 and MPEG-2 are used in the encoding system. I also wrote these on my blog with photos.

DE JA0RUZ

Source *https://tinyurl.com/yagt3ja9*

BATC Weekly QO-100 Net

The BATC organises a weekly ATV net on QO-100 every Thursday evening at 8 pm UK local time. The uplink frequency/parameters are:

2409.75 MHz, DVB-S2, QPSK, 333kS, FEC 2/3, H264 encoding.

This means that the downlink is on 10499.25 MHz. The net uplink parameters have been chosen so that they can easily be generated from an SDR-based DATV transmitter, and can easily be received using a 90 cm dish and any of the MiniTiouner-based receivers. For those who cannot yet receive the downlink, the net is also streamed live on the BATC Streamer at *https://tinyurl.com/yyyojsv8*

The net is controlled through the chat channel on the QO-100 Wideband Spectrum Monitor *https://tinyurl.com/y4nc7xcm* and anybody is welcome to participate. Just announce in the chat that you want to transmit, and wait for the controller to call you in. Participants are encouraged to spend up to 3 minutes talking about their latest DATV projects.

Continued page 17...

ATV Contests and Digital ATV

Written by Dave Crump G8GKQ

I read Rudi S58RU's letter in CQ-DATV 86; he is clearly not getting the support that he expects from his National Society, but I do take issue with a number of his other points.

As Chairman of the British Amateur Television Club, and also the IARU Region 1 ATV Contest Coordinator, I will try to address each of Rudi's points in order:

1) "We had eleven repeaters, our own electronic newspaper, one day a year dedicated to ATV, and then DVBS arrived". I am not sure that it was the arrival of DVB-S that caused the problem, more the easy availability of video-related internet technologies; these have caused a general decline in amateur radio activity. The IARU still organises one weekend a year dedicated to ATV.

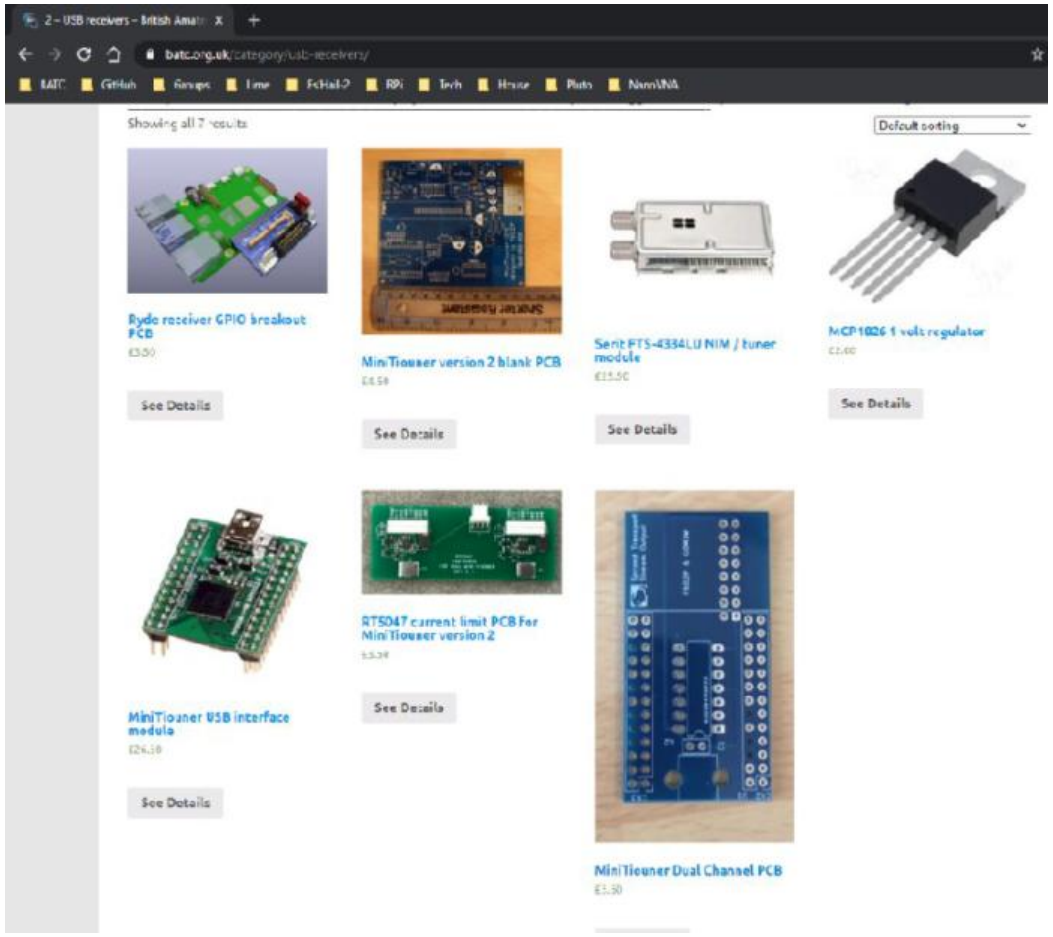
2) "The prices of the TX DVBS has skyrocketed. DVB technology has gone to the factory labs and the Radio Amateur has little say." As Trevor points out, homebuild equipment for DVB-S has been available since Dave G8AGN's DigiLite was produced in 2014. The BATC continues to support homebuilt DVB-S and DVB-S2 transmit and receive equipment with the Portsdown project – a direct descendant of DigiLite. It supports the amateur designers of such systems and then sells hard-to-obtain parts to BATC Members. So far, over 475 amateurs throughout the world have bought Portsdown parts from the BATC, and we continue to sell the USB modules that Trevor mentions – well over 1000 so far!

3) "The radio club eliminated the builders from their ranks, as did the national associations and the IARU. Without constructors, the Radio Amateurs must buy what is on the market, but here there are only goods for large bulk buyers.

The Prototype Homebuilt Portsdown DVB-S Transmitter

Nothing is found for the ATV niche and the ATV contests are almost all gone." The BATC continues to support amateur designers and constructors, buying in bulk and selling hard-to-get items to members at no-profit prices. See the BATC Shop here: *https://batc.org.uk/shop/*

4) "The IARU is a "static, plastered" organization. For any positive changes, in the amateur radio field must takes at least five years." It only took 2 weeks to change the ATV Contest rules in response to the COVID 19 Crisis this year. Please tell us what other changes are required? The 80+ entrants in this year's contest seemed to enjoy it.



One of the BATC Shop Webpages

5) "National associations and radio clubs lag behind IARU, leaving Radio amateurs confused and embittered. They don't know what route to take: Analogue, DVBS, DVBT, DVBS2, DVBT2, nothing, …". Amateur radio and television is full of choices. Different modes are better for different purposes. In UK, there is a mix of FM ATV and Digital ATV – mainly because we have problems with spectrum allocation. In other countries Analogue may be better. The BATC advice is that UK repeaters should use digital: DVB-S2 1 MS 2/3 FEC H264 encoding. Many simplex contacts use 333 kS as this has nearly double the range, and is far more resilient than FM ATV.

6) "The DVBS was presented to me at an ATV day in 2005. Is it mentioned in the regulations of the IARU ATV contest of this year? How do we recover? It will be difficult, if not impossible." The IARU contest rules allow both analogue and digital. The UK entries were mainly digital, the French entries were mainly analogue. Everybody seemed happy.

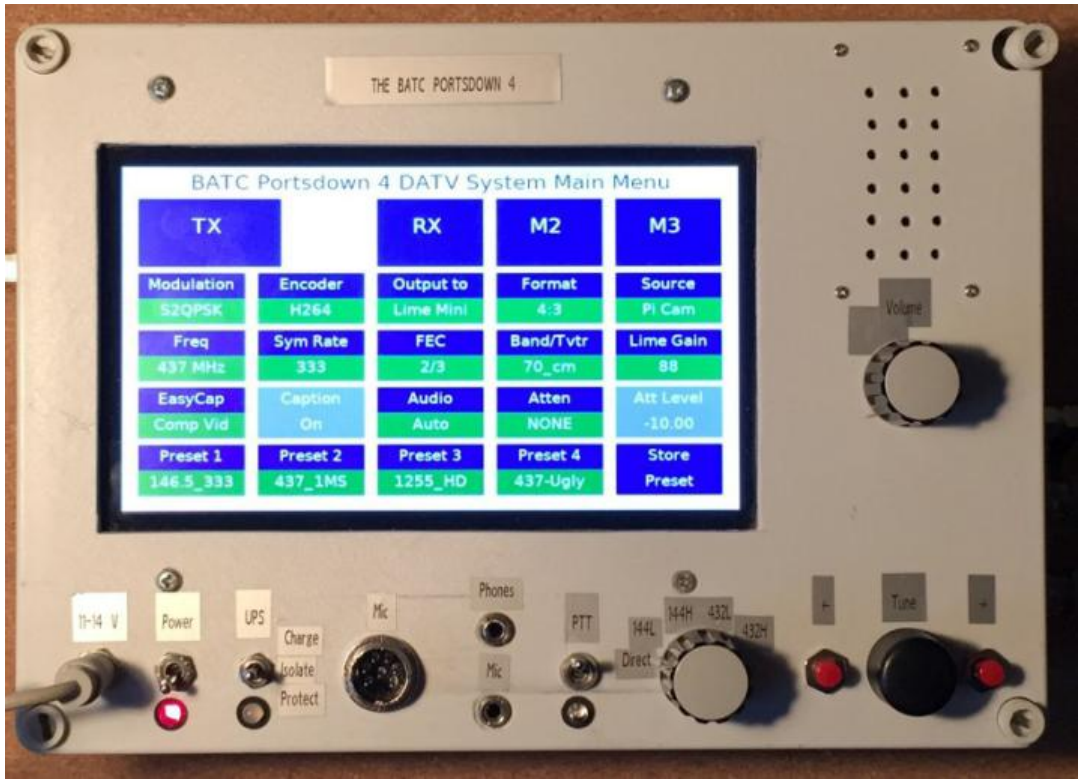
7) "I do not see ATV as a competition for professional stations, I only see contests a possible outlet." There were a few well-equipped stations in the UK contest – but only because we have been doing it for many years. Like Trevor, I started with valve transmitters and 405 line black and white AM transmitters. There were younger guys with better equipment than us (homebuilt), and some newcomers operating single-band. What matters is that they enjoyed it. Those of you who follow the BATC Forum will have noticed that there is a lot of development going on with the Ryde Receiver *https://forum.batc.org.uk/viewforum.php?f=130*. A set-top box receiver for Digital Amateur TV that you can build on the kitchen table.

Similarly, it is possible to build the latest Portsdown Digital ATV Transmitter/ Receiver (which is based on a Raspberry Pi 4 and touchscreen) with only basic construction skills. The parts are easily available from the BATC Shop and online retailers.

So, all I would ask is that you keep an eye on what the BATC is doing, and make the effort to take part in the International contests. It's more fun to play with ATV than to sit and write letters!

More Pictures next page...

The Ryde DATV Set-top Box Receiver



The Portsdown 4 DATV Transceiver

Comparison of Hi-Des DVB-T Receivers

Written by Jim Andrews, KH6HTV

Reprinted form TV Repeater's REPEATER August, 2020

HV-110 Receiver (170 - 950 MHz)

HV-120A Receiver (100 - 950 MHz & 1.15 - 2.65 GHz)

HV-122, Diversity Receiver (170 - 862 MHz)

The major supplier of DVB-T equipment for USA, ATV hams is Hi-Des in Taiwan (*http://www.hides.com.tw*). They supply both modulators and receivers. App. note, AN-42 reviewed the most popular modulator, the model HV-320E, and compared it to the older HV-100EH [1]. App. note, AN-27a, reviewed the HV-120 receiver and compared it to the original HV-110 [2]. Since then Hi-Des has added a newer receiver, their model HV-122.

This application note reviews the Hi-Des models HV-110, HV-120A & HV-122. It also discusses in more detail the HV-122.

Comparison Table for the 3 Hi-Des Receivers

Parameter	HV-110	HV-120A	HV-122
List Price	$169 (sometimes on sale for $125)	$209	$269
Frequency Coverage	170-950MHz	100-950MHz & 1.15-2.65GHz note: 2 separate SMA antenna inputs	170-862 MHz
ATV Amateur Bands covered	70cm & 33cm	70cm, 33cm, 23cm& 13cm	70cm only
Measured Sensitivity, ** see note	-95dBm, 70cm - 93dBm, 33cm	-95dBm, 70cm - 96dBm, 33cm - 91dBm, 23cm - 92dBm, 13cm	-95dBm, 70cm
Measured Sensitivity -- with low noise preamp	-98dBm, 70cm	-98dBm, 70cm - 97dBm, 23cm	-98dBm, 70cm
Bandwidths supported	2, 3, 4, 5, 6, 7 & 8 MHz	2, 2.5, 3, 4, 5, 6, 7 & 8 MHz	1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, & 8 MHz diversity, 2.5 MHz or higher
Inverted Spectrum supported	Yes, Automatic	Yes, Automatic	NO
Diversity Reception	NO	NO	YES, 2 antenna inputs
Video Coding Formats supported	MPEG-2, MPEG-4 H.264	MPEG-2, MPEG-4 H.264	MPEG-2, MPEG-4 H.264
A/V Outputs	HDMI & composite video + stereo line level audio	HDMI & composite video + stereo line level audio	HDMI & composite video + stereo line level audio
Control	IR remote control only	IR remote control & Up/Down channel push buttons	IR remote control & Up/ Down channel push buttons
Front Panel Display On Screen Display S meter in dBm	2 digit Channel # Yes	2 digit Channel # Yes	2 digit Channel # No
On Screen Display Signal/Noise dB	Yes	Yes	Yes
Cooling Fan	No	Yes	Yes
DC Voltage	+5 V	+12 V	+12 V
DC Current	600 mA	390 mA	450 mA

** Note: The sensitivity was measured using "Normal" ATV digital parameters. They are: QPSK modulation, 1080P resolution, 5/6 code rate (i.e. FEC), 1/16 guard, 6 Mbps.

For detailed comments on the earlier models HV-110 & HV-120A, see AN-27a, reference [2]. The following comments are for the newest model, HV-122.

Frequency Coverage:

The HV-122 worked at the low spec. limit of 170MHz, but would not work at the high spec. limit of 862 MHz. It did function properly at 850 MHz. The HV-122 only covers the amateur 70cm band for ATV. The HV-110 & HV-120A cover more amateur bands.

Low Bandwidths:

The HV-122 did work all the way down to 1 MHz bandwidth. I used the HV-320A to generate low bandwidth, DVB-T test signals. At 1 MHz, I was only able to use 360x480 resolution video at 400 kbps. 2 MHz bandwidth worked with 720x480 video at 2 Mbps. 4 MHz bandwidth worked with 1280x720 video at 4 Mbps.

Spectrum Inversion:

There is no Hi-Des specification given on the ability to work with inverted sideband DVB-T signals. The HV-122 was tested and found that it would not work with an inverted sideband. Both the HV-110 and HV-120A work fine with inverted sideband spectrum and they do it automatically. For details on the measurement to test spectrum inversion, see AN-50a, [3]

Sensitivity:

The HV-122 was found to have the same identical sensitivity on the 70 cm band as the HV-110 & HV-120A. For details on the measurement procedure to test sensitivity, see reference [4].

dBm S Meter:

The HV-122 does not have an On-Screen-Display (OSD) capability for displaying the RF input power level in dBm. Both the HV-110 and HV-120A do have this capability. What the HV-122 does have is a relative signal strength bar graph which can be activated, via the remote control, along with a lot of other digital parameters. This appears as a semi-transparent, gray over-lay on the video image. A calibration curve was run on the HV-122 bar graph. The bar graph has values ranging from 0 to 100%. With no input signal, the background, residual noise level indicated 9%. When performing the sensitivity measurements, the P5 picture digital threshold indicated 15% (at -95dBm, 70cm). From that point on upward, I found that for each 10dB increase in input power level, the bar graph increased 10%. It maxed out at 100% with -4dBm input. Thus, with this calibration curve, one could calculate the actual rf input power in dBm.

Diversity Reception:

I set up an experiment to verify if the diversity feature really worked on the HV-122. Using the same setup as I used to measure sensitivity, I split the DVB-T test signal into two paths using a 6dB resistive power divider. I put a 20dB, SMA attenuator in one path and connected that to one of the two antenna inputs. In the other path, I put a rotary step attenuator (0-69dB in 1 dB & 10dB steps) and connected it to the other antenna input. I intentionally used different cable lengths to alter the incoming phase between the two antenna inputs. I set the overall test signal level so that the max. input signal to the receiver was about 10dB above the digital threshold. I then rapidly switched the step attenuator through it's range. At 0dB setting, it's signal was the strongest input. When it was 20dB, both antenna signals were equal. When the step attenuator was set > 20dB, it's signal was weaker. As I changed the attenuator settings, the HV-122 receiver never lost lock on a signal.

However, I noted that the switching back and forth from one antenna receiver to the other was not seamless. There was always a jerkiness in the displayed video when switching between antenna inputs.

Low Latency Mode:

Both the HV-120A and HV-122 are capable of working in a low latency mode. This feature is important IF one if using the equipment to actually fly an R/C aircraft, such as a drone, using the on board camera to actually pilot the aircraft. Otherwise, the typical DTV long latency is a major safety issue. Thus Hi-Des has included this option. One needs to go into the setup menu to activate this feature in the receiver firmware. However, it only works when used with a matching Hi-Des modulator (Hi-Des calls them transmitters) in which the same low latency mode in the firmware has been activated. For general ATV activity with multiple transmitters being used by various ATV hams, one should stay with standard DVB-T coding and not use the low latency mode.

Encryption:

The Hi-Des modulators and receivers are capable of having their DVB-T transmissions encrypted. This feature should never be activated as it is illegal for USA radio amateurs to use encrypted transmissions.

CONCLUSION:

I do not recommend the HV-122 receiver as a 1st choice for amateur radio/TV (ATV) usage. It is more suitable for use with remote control (R/C) aircraft, such as drones. In that environment, the diversity reception is an important feature to be able to track a moving aircraft with constant doppler shift and fading rf signals. Other reasons for my conclusion include: Cost -- it is the most expensive of the 3 receivers. Frequency Coverage -- it only covers the 70cm amateur band. Spectrum Inversion -- For ATV use at microwave frequencies, it restricts the options on available local oscillators. S Meter -- the other receivers have a direct reading dBm S meter.

AVAILABILITY:

Unfortunately, at the present time (Aug., 2020), Hi-Des seems to be trying to push the HV-122 in preference to the older HV-110 and HV-120A. They are obviously trying to market it to the drone market (the buzz word is FPV for First Person View). Plus they sell it for a higher price. Oftentimes, when checking the Hi-Des, E-Bay web site, they do not list for sale the HV-110 or HV-120A. They only offer the HV-122. If you really want to purchase the HV-110 or HV-120A, I thus recommend that you contact Hi-Des customer service directly via e-mail. (sales@hides.com.tw [2]) The customer support from Hi-Des is excellent. If you ever encounter any issues with your Hi-Des equipment, do not hesitate to contact them. They respond to e-mail inquiries within 24 hours or less.

Other Hi-Des Receivers:

Hi-Des sells several other options for the receivers reviewed here along with several other receiver products.

HV-110: There are no other options. The 110 was Hi-Des' original, stand alone, DVB-T receiver.

HV-120: Besides the "A" version reviewed here, Hi-Des also offers two other options (-1.2G & 2.4G) which include a SAW band-pass filter on the front end of the High Band SMA input. With the SAW filter, the high band, frequency coverage range is thus limited to only the 23cm or 13cm band.

HV-122: The standard HV-122 version is reviewed here. The -2.4G version includes a SAW filter and only works on the 13cm band (2.1 - 2.55GHz).

The "A" version covers a very wide band from170MHz to 2.7GHz. But Hi-Des warns in a small footnote on their web site, it has very poor sensitivity, down -20dB, from 170 to 700MHz. Thus it is only really useful from 0.7 to 2.7GHz. Thus I feel it is not worth considering.

USB TV Tuner Dongles: Hi-Des also sell several USB dongles with model numbers of UT-100, UT-120, UT-130 & UT-160. The USB dongles all require a supporting PC computer. Thus, I feel they are only useful for ATV service in the ham shack. They are not as generally useful as the stand alone units. Plus they are quite expensive, compared to the garden variety of TV tuner dongles, which can be purchased for $25 or less.

REFERENCES:

1. "Second, Re-Evaluation of Hi-Des, Model HV-320E, DVB-T, Modulator", Jim Andrews, KH6HTV Video Application Note, AN-42, Dec. 2017, 7 pages

2. "Evaluation of New Hi-Des, Model HV-120A, DVB-T, Receiver", Jim Andrews, KH6HTV Video Application Note, AN-27a, March 2016, 5 pages

3. "Is DVB-T Sideband Sensitive ?", Jim Andrews, KH6HTV Video Application Note, AN-50a, July, 2020, 3 pages

4. "Measuring ATV Receiver Sensitivity & Received Signal Strength", Jim Andrews, KH6HTV, -- Boulder Amateur TV Club -- TV Repeater's REPEATER, club newsletter, issue #46, June, 2020, pp. 6-9. available at: *https://kh6htv.com/newsletter/*

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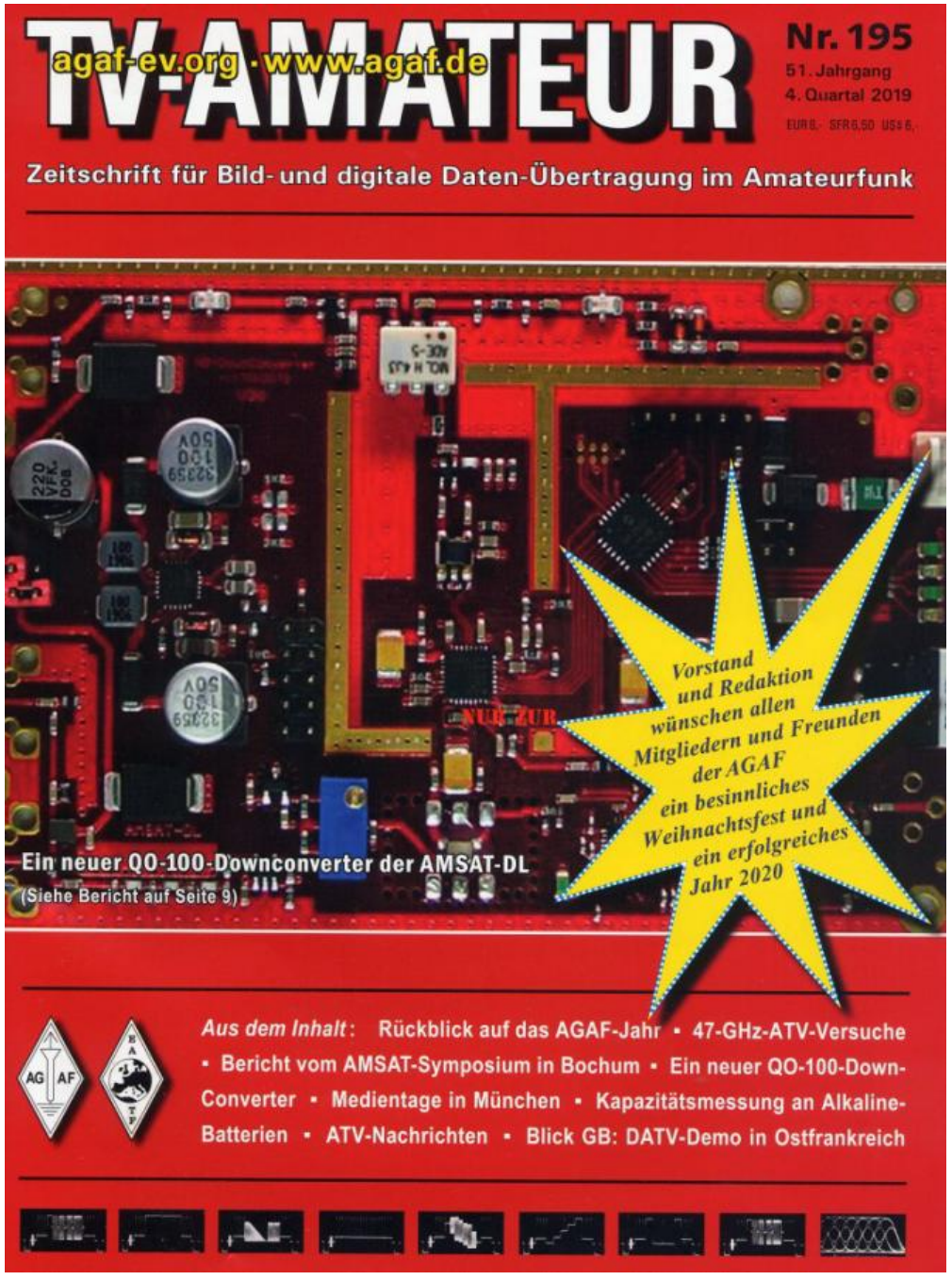

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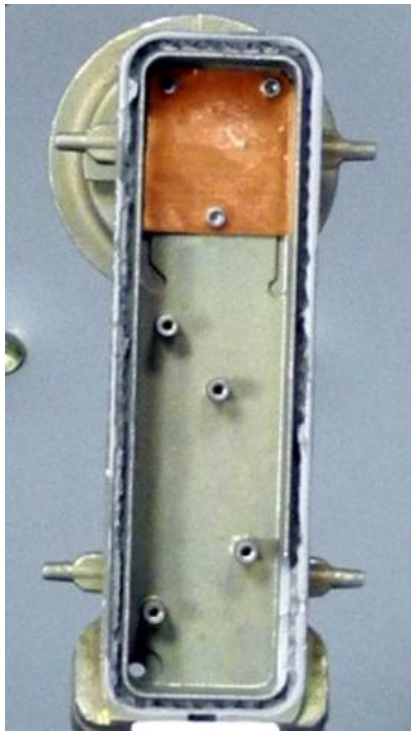
DirecTV Antenna Modifications

Written by Don Nelson, N0YE
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER August, 2020

Don, N0YE, recently undertook a project to adapt a surplus DirecTV, satellite TV antenna for use on the 3cm (10 GHz) ham band. This particular dish was originally designed to be used with a triple feed horn assembly to look at three different satellites. Don modified it to accept a different feed horn and to be suitable for terrestrial, microwave use, looking at the horizon instead of into the sky.

The feed horn was one Don had salvaged from another satellite TV dish antenna. It originally contained the block down-converter electronics. Don ripped those out and put a copper cover plate over the spot where the circular waveguide horn feed into the electronics.

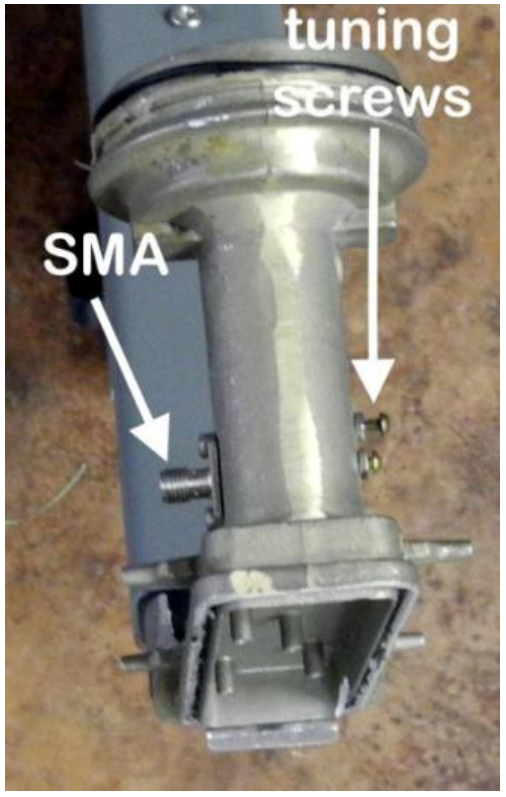


Don also added an SMA connecter to the side of the waveguide along with a couple of tiny tuning screws. The SMA probe was placed 1/4 λ in front of the copper back plate.

The next step was to determine where to place the feed horn? The first time, we simply stuck it into the existing feed horn support arm. When the antenna was then tested, it was found to have whooping -2 dBi of gain (loss really - more like a dummy load!). Back to the drawing board.

Don then consulted the web site of the world famous, ham radio microwave expert, Paul Wade, W1GHZ. Paul writes the monthly column in the ARRL's QST magazine, entitled "Microwavelengths".

(**editor's note:** It is a must for all hams interested in microwaves to check out Paul's web site *www.w1ghz.org*. It contains a huge amount of useful information for us.)



On Paul's web site, Don found some extremely useful software of Paul's for calculating all sorts of things related to antennas.

See - *http://www.w1ghz.org/antbook/contents.htm*

Then scroll down to the bottom of this long page to "Software" -- Downloads: Don used the program there called HDLANT32. This is new version of Paul's previous 2003 HDLANT.exe This new version runs on Windows 7 & 10, but it looks like you are running an old 1980s DOS program. There are many different sub-programs within this program. Don used option "O" to calculate where to place the feed horn antenna on the DircTV dish. The program also specified for optimum performance, the feed horn should have a 3dB beamwidth of 46^{o}. With this feed horn and a 60% efficiency, it predicted the antenna would have +32dBi of gain.

Once Don had the location and angle of the feed horn calculated from Paul's program he then devised a simple trigonometry method of physically determining the location. It was a simple matter of using a piece of string with a knot offset from the middle.

Simple trig math then determined the lengths of the two ends of the string. The string was attached to the dish with tape on the major axis of the dish.

Knowing the precise location, Don was then able to fabricate a suitable metal bracket to hold the feed horn in the proper spot.

The last item to be dealt with was building a wedge to align the dish on a horizontal axis when mounted on a camera tripod.

The satellite DirecTV dish was not intended to look at the horizon, but up in the sky at satellites. Thus, the mounting brackets on the back side of the dish are not suitable for terrestrial microwave applications. With an offset feed dish, the true pointing axis is not at all obvious. So how did Don determine what it was ? Don said "An ellipsoid dish - when viewed on axis appears as a pure circle."

Thus Don set up the dish on a camera tripod on a horizontal surface. He then walked out in front of the dish and looked at the dish. When he finally saw it appear to be a "true circle", he knew he had found the correct angle. He measured the angle of the support arm. He then cut a block of wood in a wedge shape of the same angle. The angle Don found for this particular DirecTV dish was 25 degrees. The mounting bracket could have been used, but the wooden wedge saves weight.

So - How well did the resultant modified dish antenna work? The antenna measurements reported earlier in this newsletter showed a measured gain of +28.5dBi. Not too shabby ! Great work Don.

Don adds these parting comments:-

"The feed was from another dish and may not properly illuminate this dish. The beam width may not be quite right for this dish. The pointing of the feed was not optimum. As good as the performance is with this dish and feed, these details may diminish the best performance that could be obtained from this dish."

Grass Valley Mixer Conversions - Part 20

Written by Trevor Brown, G8CJS and Mike Stevens G7GTN

For those of you that asked, GVG rev 15 is the current release of software and is on the download site. GVG rev 16 has not been released as there are still features I want to include that are not yet finished.

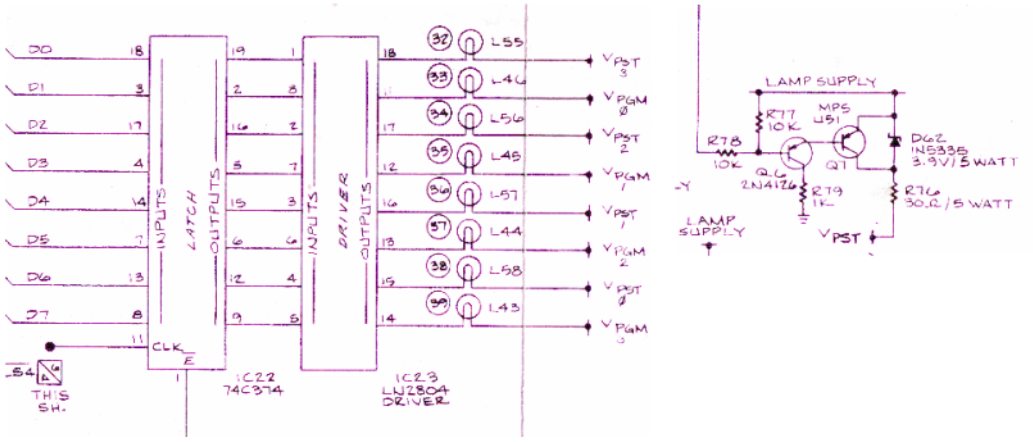
In 16 so far

The OLED screen is performing well, and the old LCD screen will not be supported by the rev 16 software. The camera tallies will also be going as VMIX supplies these via Wi-Fi. Mike G7GTN has this in hand and is planning an on camera receiving unit. This will free up two 8-bit I2C ports that have been kept on the new PCB. We have 5 prototype boards on order, but they have not yet arrived.

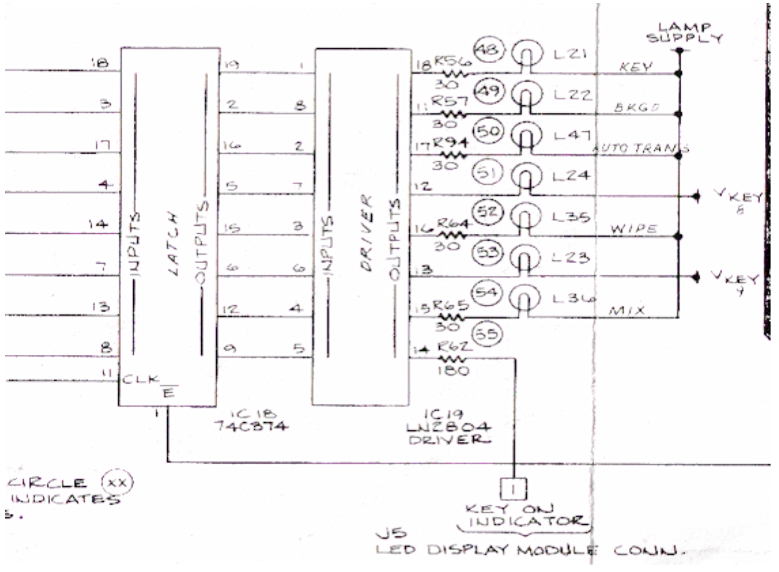
These revised boards have everything that is on the MK1 PCB and more. The new MK2 PCB's includes more I2C connectors and pads to mount the Arduino I/O, which is the gateway to Vmix, where all the heavy lifting takes place for everything video, from switching to effects.

On board regulation of the 14V supply will also be included, so the PSU requirement will be a simple single rail input that can be powered by a plug top PSU or a laptop PSU. More on that when we get the PCB running. The single rail will be compatible with the original lamps or the GVG LED's that are part of my panel, the voltages are the same just the current demand is greater for lamp populated panels.

I now have scans of the GVG schematics and I will include them in the rev 16 download.



How the bank selector lamps are driven in the GVG panel including the on-off switch. One switch for each of PST, PGM, Key bank



The other lamps have the same driver chips, no soft on/off switch, but the schematic shows a series resistor. Too low in value to be an LED series shunt. But they could be replaced with a higher value enabling an LED without a built-in shunt resistor to be used and avoiding PCB surgery

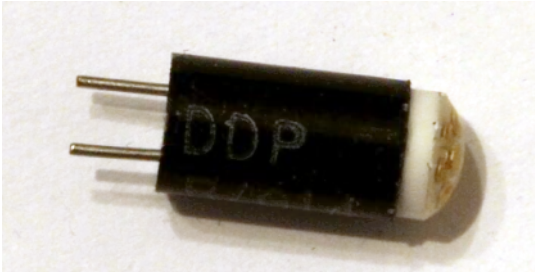
The GVG lamps are available, but at £40 for 10 it might be worth looking at LED conversions. The LED's in my panel are direct replacements for the lamps. They are constructed of several LED's and a built-in shunt resistor, so no PCB surgery is needed. The extract from the GVG schematic shows how the PST bank lamps are driven and the lamp supply switch that I have enabled on permanently in software. Replacing the lamps with LEDS that do not have a built-in shunt resistor looks fraught, so if anyone finds a source please shout up.

(10) REPLACEMENT BULBS FOR GRASS VALLEY 110 CONTROL PANEL 1.12W 14V

£41.27

The Standard GVG lamps in the 100 and 110 mixers (not cheap are they)

Rev16 will have an operational T-bar. I know I have talked about it and its operation has been a thorn in my side. Mike opened an analogue port in the MIDI interface. This was MIDI note number 76 and the protocol is to send 76 down the I2C to the Arduino at address 7 and set this in the Vmix MIDI shortcuts menu to be a fader. The next value on the I2C bus after 76 is the value of the position of the fader.



Left: Top View of the Lamps in my GVG 1000 panel

Right: Side view DDP R/G14 (could we fabricate something?)

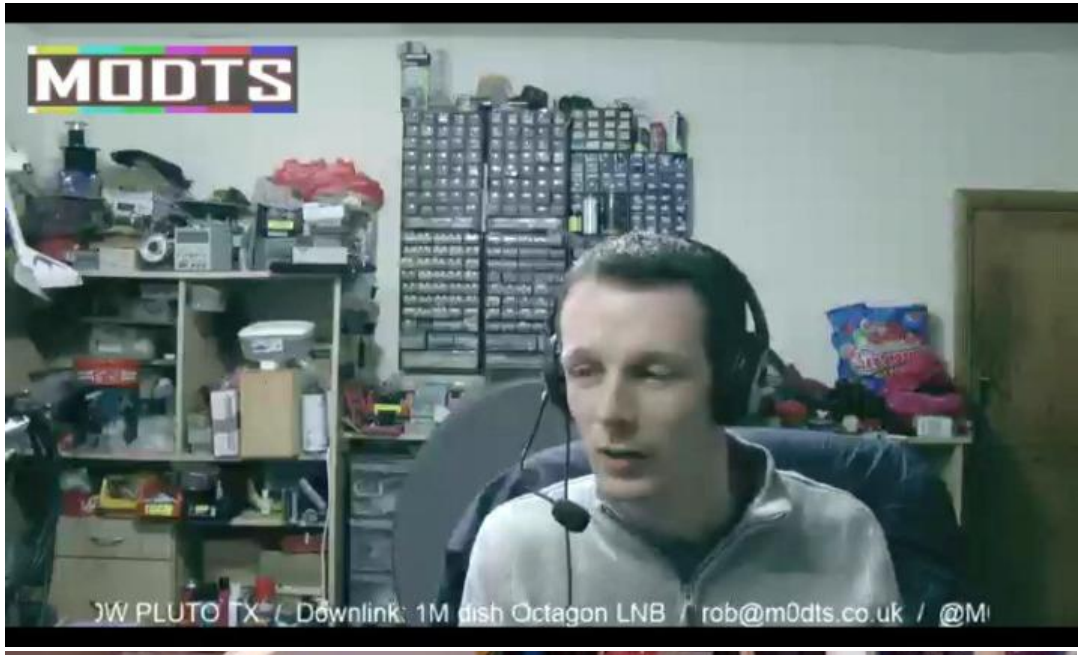
I started by simulating this in a simple soft counter that incremented its value. Repeating the count causes a cut to preview. I tried a countdown that worked fine and then the next time it produced the same cut followed by the required dissolve or DVE effect. Why the cut? The answer is the on-screen fader which moves across the screen left to right and when it reaches the end the graphic resets to the left. This is misleading. If the MIDI value resets, we get a cut. The fact that the on-screen graphic resets is wrong. An increment is followed by a decrement and in turn followed by an increment. Ignore the on-screen graphic. The fader is now working, no cuts and just needs the code writing. The 254 steps the GVG produces seems to be too many as part of the fader travel does nothing. I will sort this but am a little worried as I feared 254 steps would be a little jerky, but I can only create the data Vmix wants, after that it is out of my control. This means that software rev 16 will have an active T-Bar.

I have also moved the presets that will activate the strap lines. They used to be controlled by the borderline controls. I now have them on the Key Bank where they belong. The free software only brings in Key1. I can only point you to the Vmix site where all the attributes of the various versions of the software are listed along with the price list for the more featured laden versions. The keys are push on, push again for off and the straplines will animate on and animate off with the last source button being the cut button to remove the straplines (panic button).

I now have a redundant joystick, that is implemented on the paid versions of VMIX or I could vector it out to the two redundant I2C ports so I could generate an 8-bit word for horizontal and again an 8-bit word for vertical joystick position. This would miss out Vmix and enable remote camera movements with the free version of Vmix. This could be expanded to include more than one camera by using one of the spare button banks to select the required camera and signal the choice to the outside world with spare I/O commands on port 1 (remember I only used 5 lines. Display clk, Read Buttons, Write Lamps, Read Analogue, Convert. Leaving 3 lines spare to signal which camera is going to be under joystick control.

The problem would be first to put my hands on a remote pan and tilt head, preferably one with a built-in Vmix friendly camera and secondly, would a 254-bit word produce a smooth action that could be used on shot or would it jerk and be restricted to camera's that were best moved off shot. That is assuming I can translate an 8-bit word into remote camera movement protocol. I think that one might be for software revision 17.

Continued from page 4

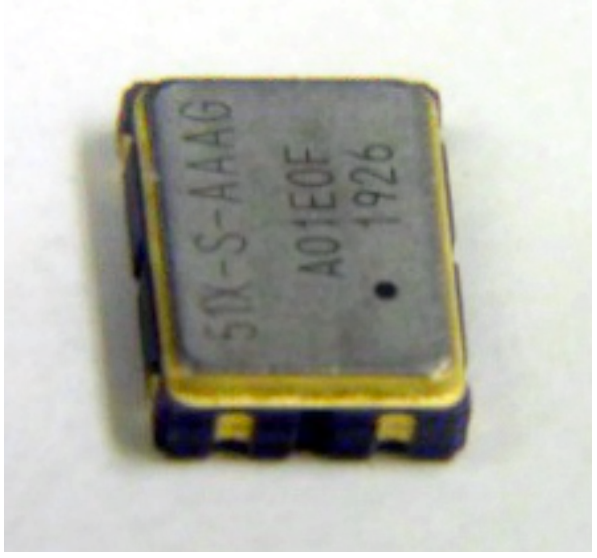


Source: Dave G8GKQ

Direct FM with Programmable Crystal Oscillators

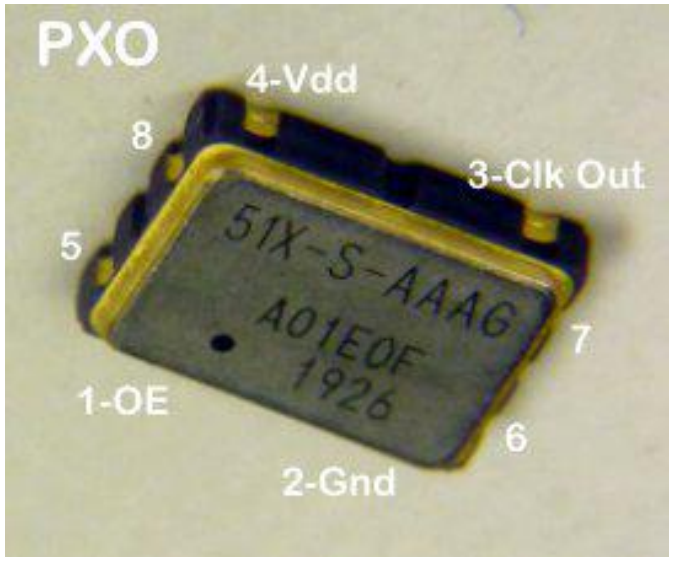
Written by John Gebuhr, WB0CMC
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER July, 2020

I have found it is possible to directly frequency modulate the Silicon Labs PXOs. There are four additional contacts on the end of each PXO other than the four intended connections. These do not connect to a pad under the chip. They are not shown, nor mentioned on the Silicon Labs PXO data sheet. I have added the additional terminal numbers 5-8 myself.



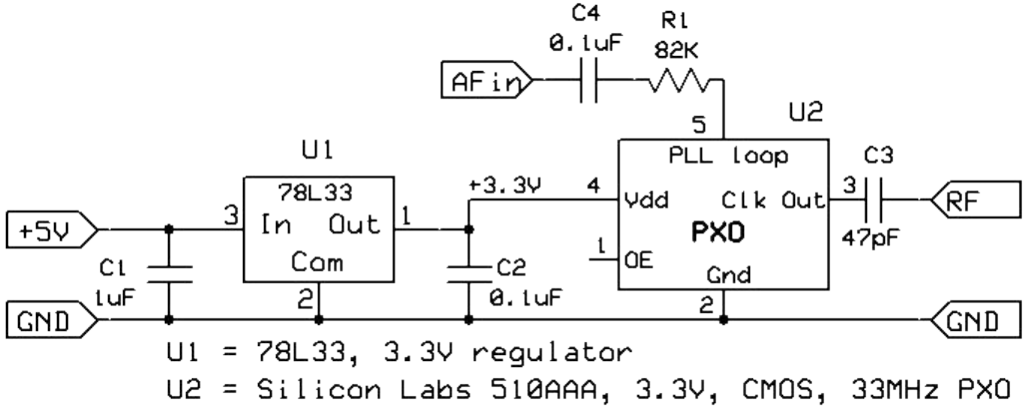
Two of the end connections

These four mystery terminals are obviously for programing and other internal signals. One of them, #5, appears to be the loop filter, or at least access to it. Pins 6 and 7 (my #s) appear to be open and may be CK and DATA for programing? Pin 8 has a 0.555 Volt potential on it and pin 5 a 0.33 V static level. The later will probably be higher at higher PXO frequencies since it is the loop voltage.



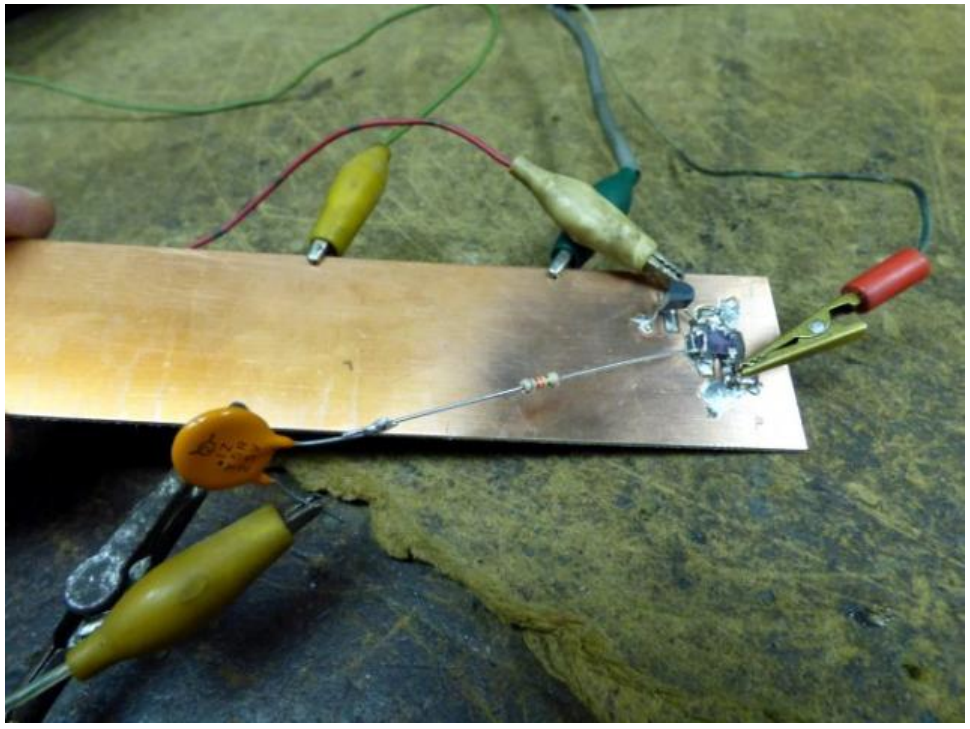
2 of the main terminals and 2 of the internals

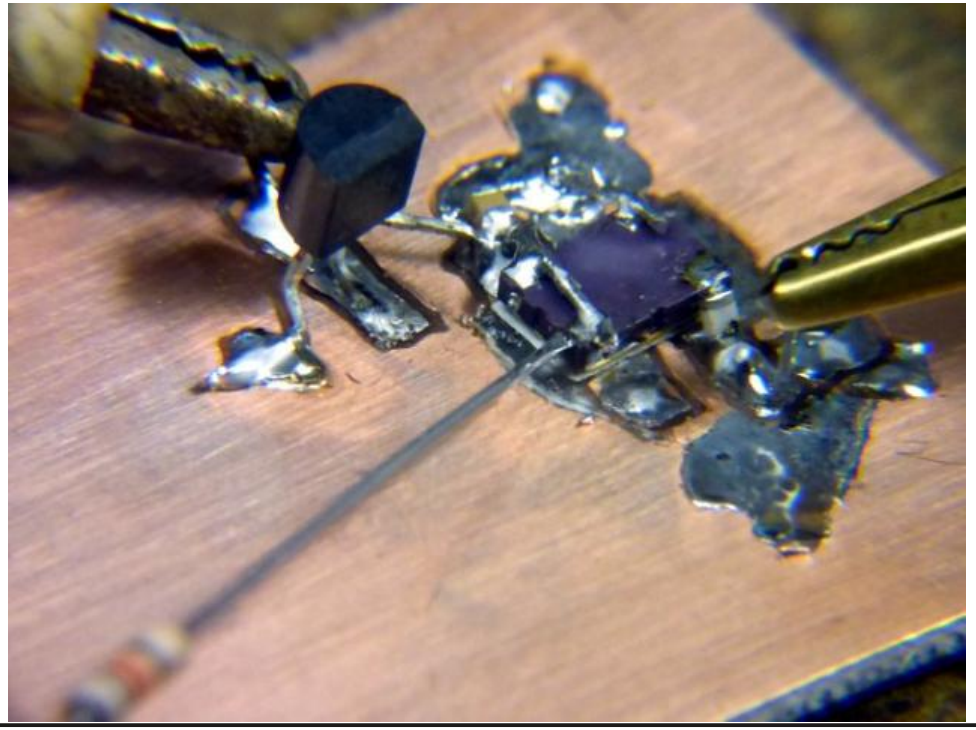
Pin 8 may take part in the programming as well. I didn't do anything with it except measure it.



With an 18k resistor and a 0.1µF cap in series with one of these terminals, #5, I was able to FM modulate the PXO with a 400 Hz tone. I did change the resistor to an 82 K which didn't change anything but the drive level.

My lash up, in the next photo with a close-up following. The TO92 is a 3.3 V regulator. The PXO is upside down with jumpers to the copper on the board.





Output cap is 47pF next to the right clip lead, 0.1µF bypass at the output of the regulator. 82 K resistor tacked to the end connection. Left clip lead is +5 Volt input. The PXO chip I used was programmed for 33.0166666 MHz.

I used my Cushman CE-5 communications service monitor to measure the FM modulation. I looked at the 13th harmonic at 429.215MHz Modulation frequency response was good. It is flat from about 50 Hz to 5kHz. I used a -13dBm audio input. With a 400 Hz tone, it started to clip at ±15 kHz deviation with a 4 kHz down shift in frequency (not surprising). More than about 12 KHz deviation at the fundamental can cause the PXO to go out of lock and won't come back till the audio drops to where it is at 10 KHz. It is also noteworthy that there are almost no even order harmonics with this PXO. Only the second is significant on my analyzer.

The real trick to adding FM modulation to these PXOs is going to be how to solder a connection to that really tiny end pin?

Any one still have a cat whisker?

John's parting comment "It pays to diddle and tweak, sometimes!"

Editor's Notes

1. For more information about Programmable Crystal Oscillators (PXOs) see our May, 2020 newsletter, issue #43, pp. 5-12.

2. These PXOs are made by Silicon Labs. They can be purchased from Digi-Key in single piece quantities for about $5 each. They are programmed for you by Digi-Key. Specify the desired frequency when ordering. They are available for any frequency from 100 kHz to 212 MHz.

3. John's comment about almost no even order harmonics from his PXO. This is because the output waveform is a square wave. Fourier analysis of a pure square wave shows nulls at all even order harmonics.

Bouncing Microwave Signals Off of Mountains

Written by Don Nelson, NOYE
Reprinted from Boulder Amateur Television Club TV Repeater's REPEATER July, 2020

SSB signals have been bounced off of the Front Range, Rocky Mountains for years. SSB signal on 2304 MHz and 10368 MHz have been bounced off of the Flatirons and other rock structures on a weekly basis for a multitude of QSOs.

So why not try to do microwave signal bounces for other modes and frequencies?
On June 15, 2020 such an exercise was conducted in Boulder Colorado between hams at three locations in and near Boulder. The rocks used as a reflector were the Flatirons formations on nearby Green mountain. The signals used in the test were FM modulated ATV signals at a frequency of 5678 MHz.

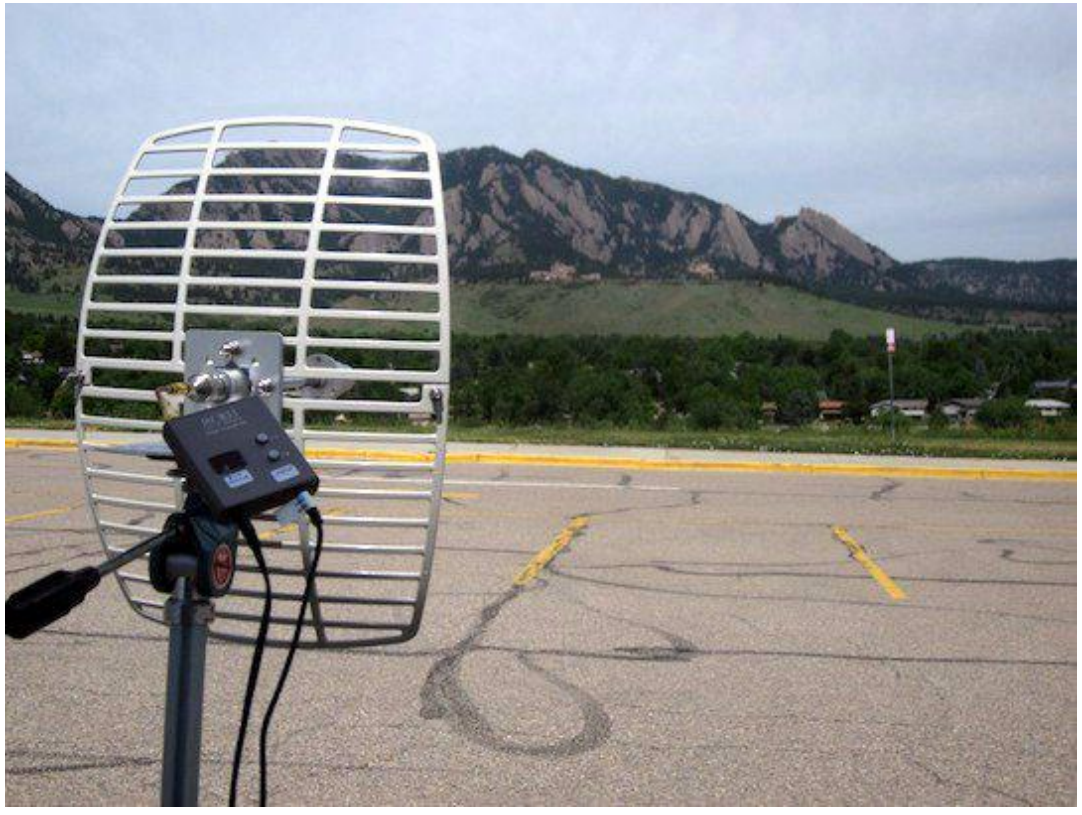
KH6HTV, Jim, was east of Boulder nominally 5 miles east of the Flatirons. WB2DVS, Peter, and WB2DVT, Deb, were together in Boulder at a parking lot about 1.5 miles from the Flatirons. N0YE, Don, was also in Boulder at Fairview High parking lot about 2 miles from the Flatirons. The spots chosen for this exercise were done so no player could receive a direct signal from any other player.
The Flatirons were visible to every player without neither any obstruction nor any reflecting surface other than the Front Range Mountains.

All players had 5 GHz dish antennas with a gain of 23 dBi. Don was transmitting about +23 dBm of rf power. Pete & Deb were transmitting about +24 dBm. Jim was transmitting a signal with +33 dBm of power.

There was a very modest amount of success in the exercise. Don received P2 signals from both Pete/Deb and Jim. Pete/Deb on the other hand received only a P0 signal from Don and nothing from Jim. Jim unfortunately received no signals.

The power output levels of each player can help explain what signals were received and what was not received. Jim had the strongest signal and the greatest distance to reach a reflector. The greater distance and the greater power help explain why Jim's signal was just slightly better than Pete/Deb's signal for Don. The P0 signal and P2 signal received respectively by Pete/Deb and Don may be explained by the greater signal loss Pete/Deb had in front of their receiver. They had a longer coax cable in front of their receiver while Don had a very short coax. Jim receiving nothing could be explained by the lesser power from Pete/Deb and Don.

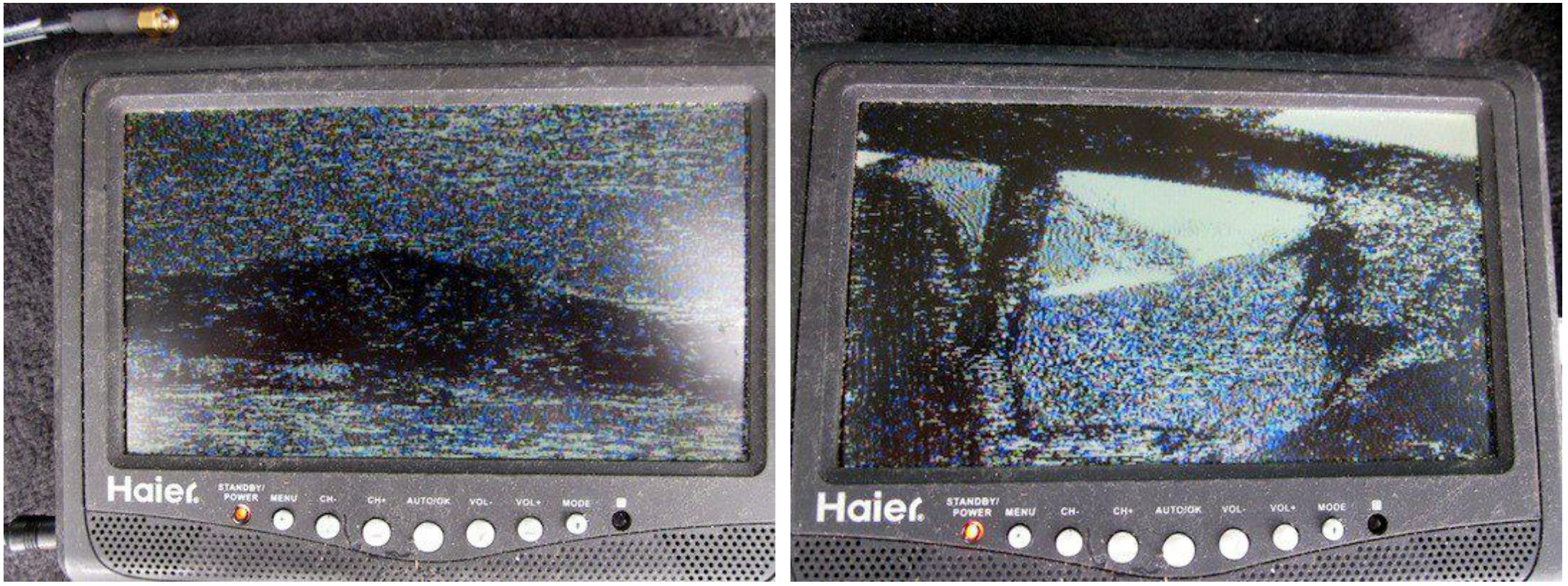
Don's roving microwave ATV setup with dishes for receive and transmit



A view of Green mountain Flatirons

For my 5760 MHz, SSB contacts in the past, I have used the same dish antenna and my SSB transmitter's output power was +26 dBm (400mW pep). Thus essentially the same as we used for our recent FM-TV experiment.

Why were the SSB contacts so much stronger? Well, the answer thus is in the relative noise floors for the bandwidths of the different modes. The thermal noise floor for a 2.4 kHz SSB receiver is a low -140dBm. FM-TV requires a 16 MHz bandwidth. Thus it's noise floor is a much higher -102 dBm.



5 GHz, FM-TV images received by N0YE from WB2DVS/WB2DVT (left) & KH6HTV (right)

This is a whopping 38dB difference. Our P2 picture reception was thus just a bit above the noise floor limit.

So what is the take away from this exercise? Simply put, we can bounce microwave ATV FM signals off the Rocky Mountains as we have done with SSB microwave signals.

The reality is that the signal loss, because of the scattering off of the random surfaces, are quite significant. The estimate for this exercise is that the signal loss was in the neighborhood of 30 dB. "Your mileage will vary".

Depending on the nature of the reflecting surface, the angle of the transmitter and receiver to the surface, and the distances from the surface of both the transmitter and receiver, the loss can vary.

Lip-Sync

Written by Trevor Brown G8CJS

Valentine's day 1972, day one of my new employment as a Broadcast Television engineer. I had passed an interview some weeks earlier (nobody more surprised than me). Having shown that I could "talk the talk", it was now down to, "could I walk the walk"? Slightly scary as my employment contract was subject to a three month trial period.

I was working in the electronic repair department. There was broken kit on all the shelves, racks of test equipment and service manuals, with the task of the day being to get kit from the not working shelves to the ready for collection shelf. You were somehow cut off from all the television activity going on in the rest of the building. The exception was when the phone rang - something that needed attention in situ. This was a chance to leave the workshop and visit the television production process.

The problems all needed the basic application of electronic engineering, the problem was understanding what the broken link was supposed to do and how it fitted into the rest of the chain.

Success meant building a reputation so that when the phone rang you were asked for by name. I developed a warm glow when it happened! It went a long way to the three-month probationary period being a formality. The memo turned up 3 months to the day and that problem went away.

TV programs originated as film, video tape or from a live studio. They were completely different approaches to the same result. The most interesting was film production and how they processed material through the system. This was compartmentalized so I had to build a picture of the complete production chain.

There was the hurried TV news film, shot on reversal film like slides so you could see it when it came back from the labs, this was hurriedly cut into stories so they could be transmitted the same day. These items shared the same sound transfer process as the more prestigious programs. The stories were edited and the assembled into one of two big rolls. A and B and onto Telecine to play into the studio. There reason for two rolls was so you could drop a story. Telecine machines could not fast forward so to drop a 3-minuet story took 3 minuets as you played the item. During this period only the other roll was available and of course the studio contribution.

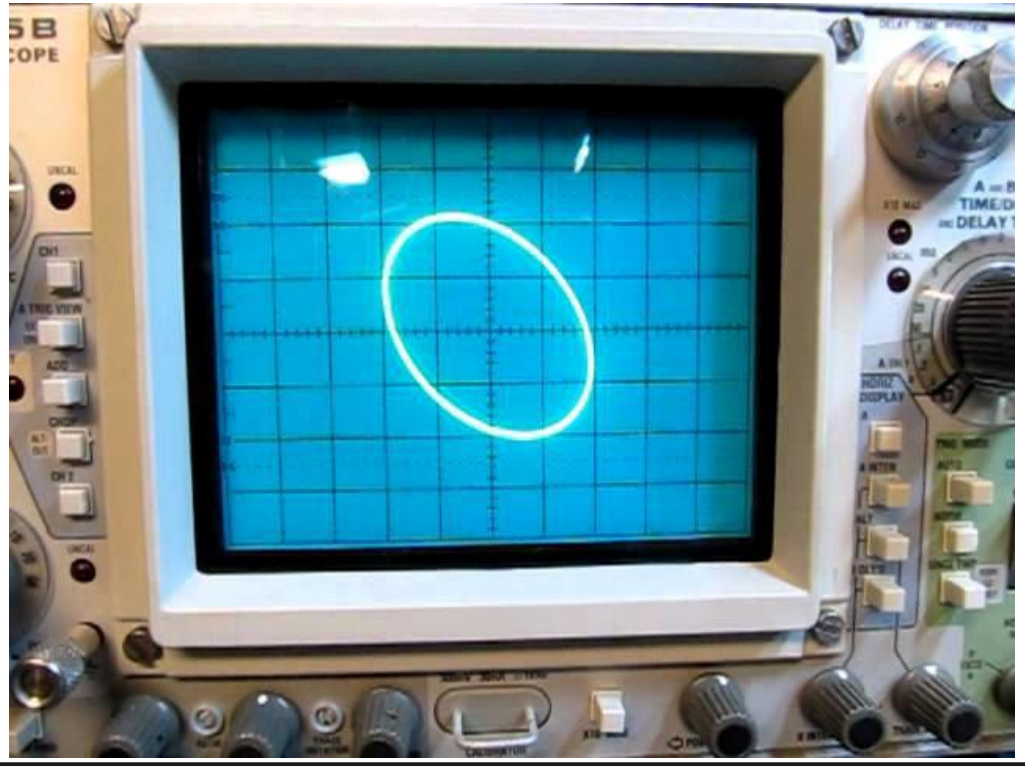
The more prestigious documentaries and dramas were shot on negative film but came back as cutting copies which in effect were prints from the negative that could be used to edit up into a final production. Then the negative was cut the same way by following edge numbers. This went back to the lab for print making, and through a process called answer prints, where different colour gradings were applied until the print assumed the desired look and a show print was made ready for transmission.

Film edits were held together by sticky tape and this was still in place when the news film hit telecine. Negative film had the pos cutting copy edited this way too along with the negative, but the show print produced from the negative was now free of these joins, unless some emergency last minute cut had been made.

The film sound transfer process was the first link in the chain for all film sound. If it had sound it came in on ¼" audio tape and was transferred to magnetic film stock that was just like the film stock sprocket holes but no pictures, only magnetic audio called separate magnetic sound or sep mag for short. Film sound was a path from ¼" audio tape recorded in the field with a Nagra tape recorder being the recorder of choice.

The ¼" tape was then passed to film sound transfer where it was copied to sep mag. Copying was a simple matter of loading the ¼" audio tape onto an audio deck and copying to a sep mag recorder, monitoring and adjusting sound levels, adjusting eg. often to minimise wind noise. The other function of the transfer suite was lip sync so when the magnetic film track was combined with the film pictures, they would be in lip sync. The use of battery tape recorders on site and another number of variables could create speed or velocity errors.

This is best described as two cars travelling down the motorway. They can both travel at the same speed (Velocity) but may not be side by side (Phase). To achieve this, velocity control is required to speed up or slow down one of the cars until they are side by side, and then to maintain the correct velocity once the cars are in phase. Ok, enough of the Jeremy Clarkson approach.

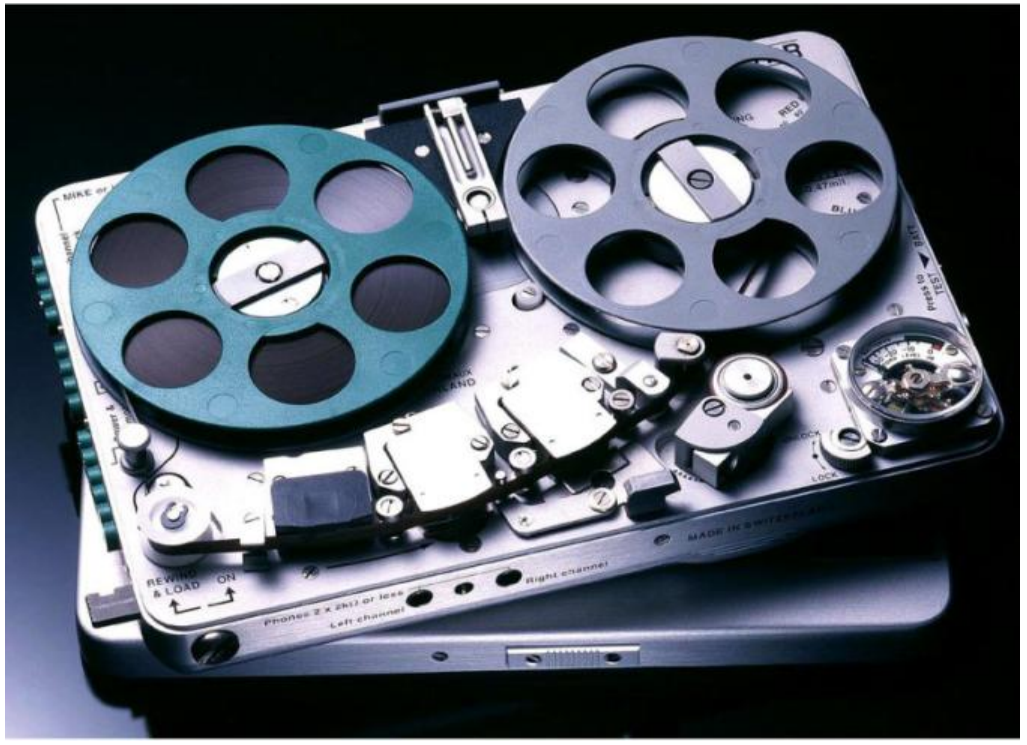


The fix was interesting, but crude. The ¼" tape had also a set of pulses recorded on a separate track supplied by the camera, presumably related to the sprocket holes. The 16mm sep mag recorder produced the same and the these were brought up as a Lissajous figure on an oscilloscope. The speed of the ¼" tape was adjusted to get a circle. (often a variable voltage transformer on the tape deck motor) This gave a variable that could be jockeyed into a crude lock in the transfer. The clapper board was the key to phase locking the two. The soundtrack had the click of the clapper board and the picture track showed the board being shut. Put these together and if the velocity of the transfer was jockeyed into a circle correctly the two should be in and stay in lip sync.

I would have thought by now that a simple servo loop could have taken over this task. Film has been around longer than television and the KISS principle of keeping it simple was a dominant feature. Film was always viewed as a craft.

Later kit used the approach of Xtal locking the speed of the capstan motors in audio kit and took over from pulse lock as there was no need to wire the camera op to the sound op or monitor Lissajous in the transfer.

The beloved Nagra audio recorder, the staple diet of film sound recording for many decades



NAGRA SNN Audio recorder.
http://www.bassboy.com.au/getreel/site/samples/cc/snn/snn.htm
Despite its small size, it produced exceptionally high-quality audio recordings, and a Xtal lock of the speed so no pulses required. It could easily be concealed during filming in an artists pocket. Often used by the Australian wildlife presenter Steve Irwin who was a little unpredictable at jumping out of the film truck for an unscripted tussle with a dangerous animal. If he was mic'd up and the SNN running, the camera op could work from a safer distance - wise if you saw him in action.

Video Tape was lip sync free if all you did was record the live studio sound and pictures onto the audio and picture tracks.

How about if it were an orchestra and the sound was also recorded onto a multi-track recorder so the mix could be

Nagra also went on to produce a portable video recorder, the VPR 5. Again the industry loved it and took it to heart. They had an extremely well-deserved reputation and always lived up to it.

adjusted after the studio record. Yes, it could be adjusted via the sound desk when the recording was being made, but you only got one chance at that.

The multi-track enabled a more relaxed approach to the final mix and for some programmes sound effects could also be added. The problem was replacing the VT audio track with the post produced multi-track mix. Both machines in theory were locked to station sync so the only problem was to phase them up and re-record the audio and stay in lip-sync.

Enter time code and a different technology. Timecode was a system where every electronic frame is given a unique code of hours, minutes, seconds, and frames as a linear audio track. LITC for short.

Record timecode on the multi-track audio recorder and same on the VT machine cue track, adjust the entry points until

8 track multi-track recorder, these evolved to 16 and eventually 32 track record machines using 2" tape

you have phase lock, rehearse and when you are sure it is all in sync put the VT into audio record and replace the studio audio with post produced enhanced sound. If the multi-track could be controlled by an edit controller, then they could be pulled into lock and the VT audio re-recorded.

This was a big if as Multi-track machines were not normally equipped with an edit controller interface, so various Heath Robinson modifications were the order of the day!

All edit controllers produce what is called an external event (usually a relay closure.) This could have been used to cue a multi-track and the parking position adjusted until sync was achieved. We went for the more complex full edit control and it had its moments particularly as the multi-track machine lived in the production gallery one floor above VT editing.

There were other solutions and one ITV station produced a different low-tech solution, again lock both machines to station sync, but record a full one-minute VT clock at the head of the recording, with speaking clock as the sound source. Wire up a pair of headphone with VT sound in one and ear and multi-track audio in the other, roll them from the same point and listen for echoes, speed up or slow down one of the sources with momentary disruptions until the echo goes, now they are in sync and the VTR can be put into audio record and the multi-track sound used to replace the audio.

I think we were back at Heath Robinson level or KISS if you prefer, not a bad place to be when the pressure was on.

It was interesting to escape the repair benches and see how the problems were solved in different sections. Lip Sync was the tip of the iceberg. The dull bits were when the phone did not ring. On the brighter side I had passed my three-month probation and found another job in video tape, moved up an engineering grade. Still solving problems, but much nearer to the hub of television production. I was learning and seeing all the problems first-hand.

Like all jobs the wind of change blew through and I was able to talk the talk on VT editing and made the jump to tech ops, another jump in grade and a new learning curve. The sad bit was handing my sonic screwdriver on to somebody else! It was metaphorical but had served me well. The new job also had its moments, it was after all, television.

Reference:

http://en.wikipedia.org/wiki/Nagra.

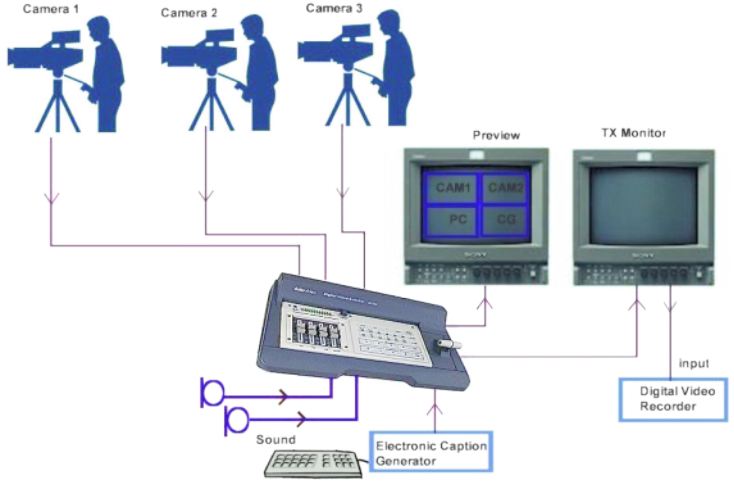
The company was based in Switzerland and had developed a reputation for quality and reliability throughout the film industry. Their equipment technology design and construction was outstanding as was the reliability.

One from the vault - Multi Camera Shoot

First published in issue 3
By Trevor Brown G8CJS

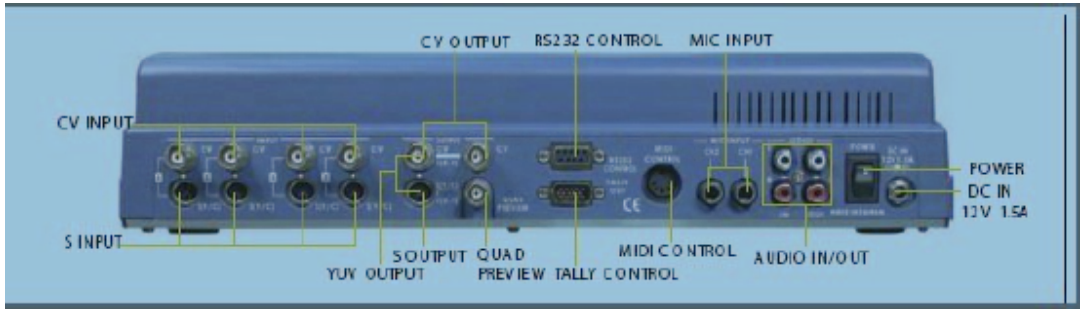
In the last two issues I have covered two different single camera shoots, that can be edited together and made into a DVD with Wondershare video editing software. In this issue I want to have a look at a multi camera shoot. The first one of these I tackled was for an RSGB AGM. I used three cameras and a video caption generator. One was a professional camera and did most of the work the other two were CCTV camera's that filled in, while the pro camera was re-framing and focusing.

The heart of the shoot was a vision mixer, and this was a datavideo SE500 bought especially to make the event work. There are lots of video mixers around and they often turn up on eBay, but not everyone is suitable, as the cameras were not synchronised, so a mixer that would work with non sync sources was essential. If your budget will not stretch to the SE 500 then mixers such as the Panasonic MX50 often turn up on eBay, but they are getting old and are a complex item should they need repairing.



The RSGB AGM was recorded and transmitted live on the BATC streamer; I think there is still a recording in the BATC film library if you did not see it. All the video connections shown in the diagram are PAL and it was recorded in 4 by 3 formats.

The first problem was the sound, this was provided by another company and we were given a courtesy feed at line level on an XLR, I had anticipated this and made an adaptor XLR to Phono, but the SE 500 did not like the feed an added a loud buzz, so an isolation transformer was fitted and cured the problem and is now carried as a standard kit item for use with this mixer. The event was recorded and streamed. I have not shown the streaming computer, it was looped off the video recorder, which again is another expensive item, but I did wonder about a DVD recorder had I not already owned the Digital Video recorder.



Rear view of the datavideo SE 500mixer

Why the expensive datavideo mixer, well it is important to be able to see all the camera's so as to choose the best picture and not cut to a camera which is being reframed or adjusted. To this end the four video sources controlled by the mixer are displayed on a single video monitor as a quad display.

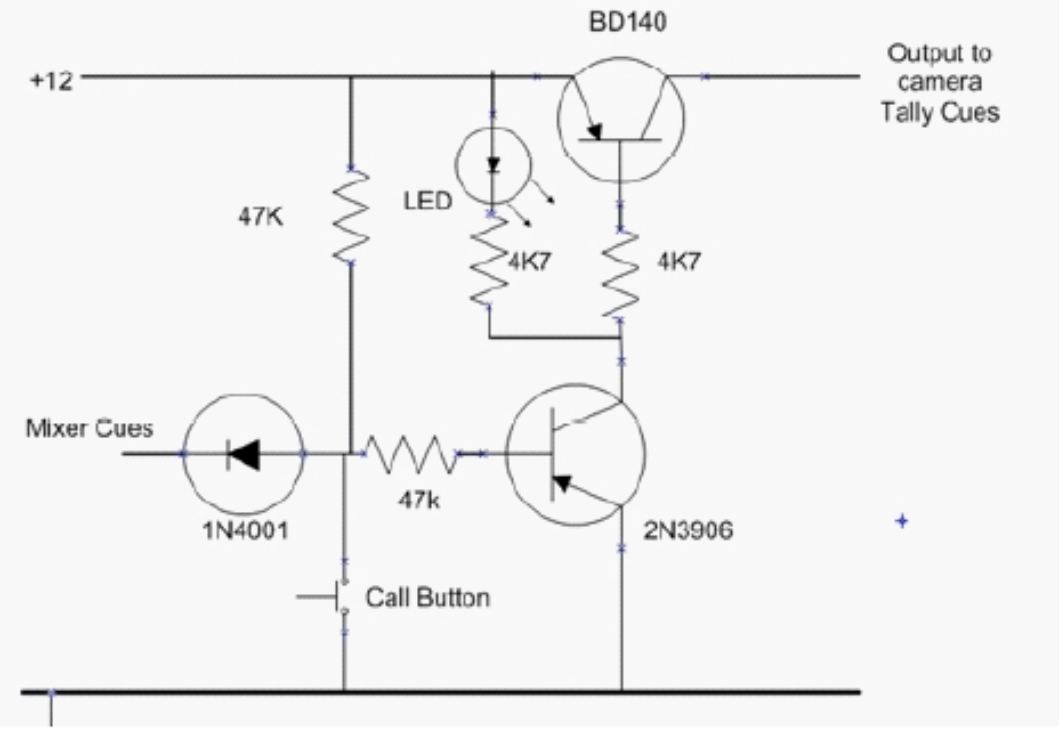
This was really useful and worked well, secondly it has a tally light output which will put a red light on the camera that is on air, unfortunately this was not implemented on this shoot, but with only one camera that could be moved and two CCTV

camera's one showing a wide shot of the top table and speakers and the other, the audience, this was less of a problem.

The next outing was Budbrook School and a streaming event of a link with the International Space Station. This time we got to do our own sound and then the RSGB AGM again with three professional camera, so cues were essential this time.

LED A3	= pin 1	= 1R (Main1)
LED A2	= pin 2	= 1G
LED A1	= pin 3	= 1Y (Sub1)
Ground	= pin 4	= GND
LED D3	= pin 5	= 4R (Main4)
LED B3	= pin 6	= 2R (MAIN2)
LED B2	= pin 7	= 2G
LED B1	= pin 8	= 2Y (Sub2)
Ground	= pin 9	= GND
LED D2	= pin 10	= 4G
LED C3	= pin 11	= 3R (Main3)
LED C2	= pin 12	= 3G
LED C1	= pin 13	= 3Y (Sub3)
Ground	= pin 14	= GND
LED D1	= pin 15	= 4Y (Sub4)

Video Channel	Red LED (On Air)	Green LED (Off line)	Yellow LED (Next)
1	Pin 1	Pin 2	Pin 3
2	Pin 6	Pin 7	Pin 8
3	Pin 11	Pin 12	Pin 13
4	Pin 5	Pin 10	Pin 15



The manual for the SE 500 had the following info on the VGA connector on the rear of the mixer; we were only interested in the Red on air LEDS which were logic low when selected. We decided to go with logic of supplying +12 to the cameras when on air, this is more standard in broadcast cameras and for non broadcast cameras we could supply them with a small camera box with an LED and serial current limit resistors that did not need power. Brian Kelly designed the interface from the VGA connector to the camera boxes four of these were required and I added an illuminated LED push button so they could be seen working from the mixer and the push button could be used to attract the camera ops attention without cutting to him.

We used XLR connectors to wire the camera boxes to the interface unit, with a standard of pin 1 ground pin 2 cues and that left pin 3 free for one way talkback from the mixer to the camera boxes, to which a jack plug was added so the camera operator could listen to the director on cans. (A Small Maplin amplifiers was used to feeding pin 3 on all the Camera box XLR's),It worked well and to communications both audio and camera cues were a blessing for the second RSGB AGM.
The SE500 has been in operation for several years now and the last outing was the EME (Earth Moon Earth) which was the first wide screen operation I had attempted. Strictly speaking PAL should not be used for wide screen, but for streaming resolution you can get away with it, but if you are considering a wide screen multi camera shoot then perhaps PAL might not be the way, so in the next issue I will look at digital options rather than the PAL SE500 mixer.

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