In this issue

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Jim Andrews KH6HTV

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Brian Beezlet K6STI
Trevor Brown G8CJS
Richard Carden VK4XRL
John Hudson G3RFL
Ken Konechy W6HHC
Mike Stevens G7GTN

Editorial

Welcome to issue 66 of our electronic ATV magazine.

CQ-DATV would like to send it's congratulations to AMSAT-DL after the successful Es'hail-2 launch. On board the Es'hail satellite is AMSAT-DL's Phase-4A transponder.
The successful launch was on Thursday, November 15th from Launch Complex 39A (LC-39A) at NASA's Kennedy Space Centre in Florida.

You can watch the launch at *https://www.youtube.com/watch?v=PhTbzc-BqKs&feature=youtu.be*.

AMSAT-DL describes their commissioning procedures at: *https://amsat-dl.org/p4-a-eshail-2-launches-in-a-few-days*

Phase-4A operating frequencies and modes are documented at: *https://amsat-dl.org/eshail-2-amsat-phase-4-a*
More on the service Es'hail 2 further down this issue.

Other news - We now have a 70cm RBTV beacon installed in Catalonia, located at the top of Montjuïc mountain in Barcelona (JN11BI).

Finally some news of our own. CQ-DATV now has another member on the team. Jim Andrews KH6HTV has joined the CQ-DATV team and will be submitting articles each month starting in this issue with a bumper 2 articles "70cm vs 23cm Band Activity" and 70cm antennas for "ATV".

Jim lives in Boulder Colorado from where he edits the Boulder ATV repeater news letter, when he is not fixing and improving the actual repeater. Jim does admit to escaping the Boulder winters to his bolt hole QTH in Hawaii.
This snow birding may impact repeater repairs but not his planned series of articles for CQ-DATV!

Also in this issue

Ken W6HHC reports Art WA8RMC has tested the first Mini Tiouner Express unit's design called "Rev B" from the assembly house. All units fired up…although one unit needed to have the USB chip solder refluxed, Art will explain.

Trevor has followed up his broadcast VTR story with the introduction of C format and the changes it brought to the television broadcast industry, from Slo-Mo to portable recordings.

Brian Beezlet K6STI has come up with a simple home constructed 50 ohm to 75 matching unit for test equipment and explains why this is necessary.

Richard VK4XRL and Mike G7GTN have produced the final part of the 8 input 4 output mini router series, Richard explains why he needs 4 outputs for all the equipment in his shack along with the hardware design and Mikes Code.

One from the Vault features a frequency counter project by John G3RFL from CQ-DATV issue 2.

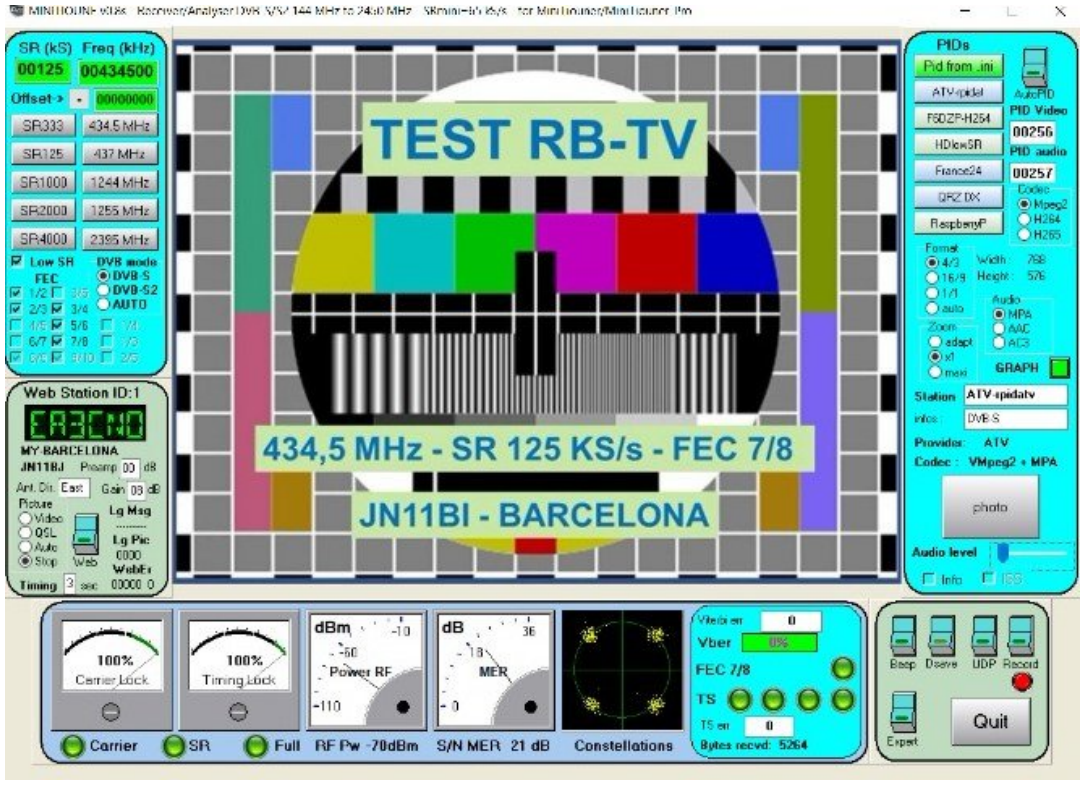
As we always say, sit back and enjoy CQ-DATV 66.

From the enlarged production team in the UK, USA and Australia.

Please note: This is the last issue of CQ-DATV that will be published on the last Friday of the month. Future issues will be published on the last DAY of the month!

70cm RB-TV beacon in Catalonia

On October 23rd a 70cm RB-TV beacon was installed in Catalonia.

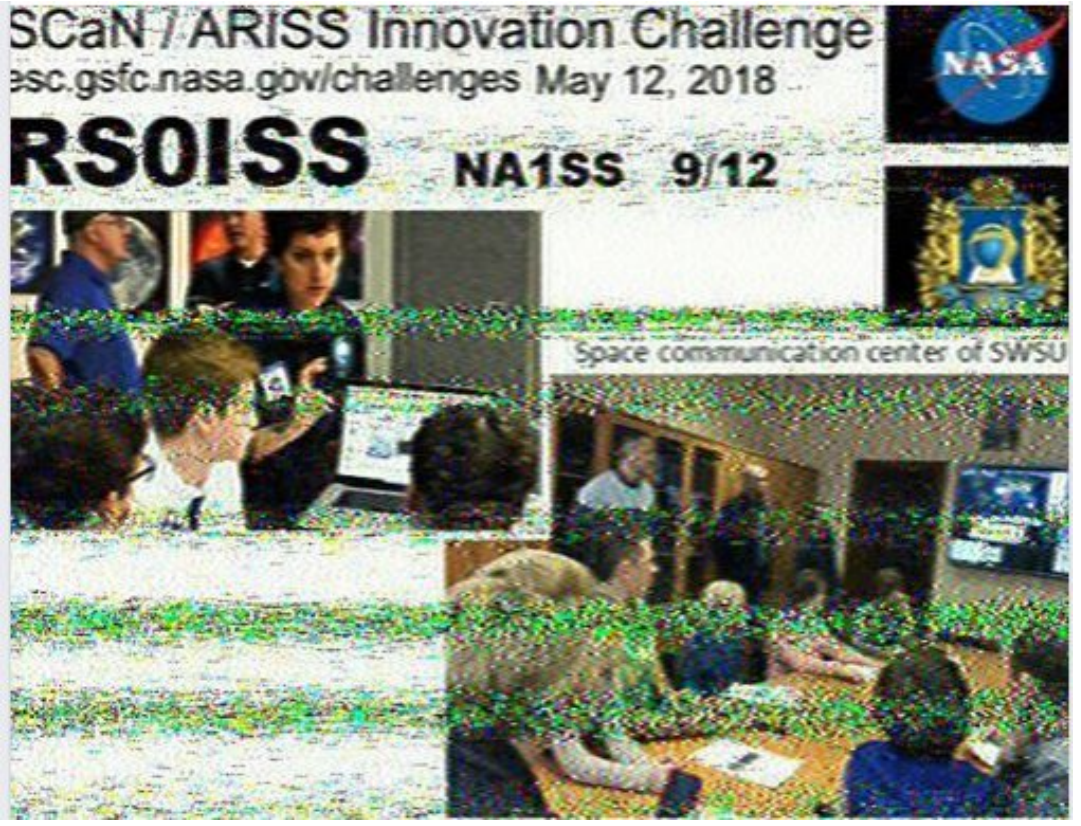


The beacon is based on a remote controlled raspberry pi with F5OEO software, located at the top of Montjuïc mountain in Barcelona (JN11BI).

Transmission frequency 434,5MHz, power 1w, 2 element Yagui, F5OEO software. Project was conducted by EA3CNO (Antoni) and EA3ANS (Joaquim). There has been reception reports from Terrassa, 25Km north of Barcelona.

Source: *http://www.radioaficionats.cat/radioaficionats/baliu-rb-tv-a-catalunya/*

SSTV from the International Space Station



Source: Southgate Amateur Radio news

SpaceX drops plans to make Falcon 9 rockets more reusable

For a while, SpaceX has dreamed of making its Falcon 9 rocket as reusable as possible, and not just the first stage.

Now, though, it's having a change of heart. SpaceX has scrapped plans to make the rocket's second stage reusable. Instead, Elon Musk said, it's focused on "accelerating" development of the BFR. Musk also teased a significant design shake-up, calling it "delightfully counterintuitive" and a "radical change" compared to the previous design.

Musk didn't say when he expected the BFR to be ready in the wake of the strategy shake-up. In March, SpaceX aimed for early orbital launches by 2020.

It's not completely surprising that SpaceX might shift focus. The company's ultimate aim is to retire Falcon 9 in a few years once the BFR is ready. It would be pouring resources into a rocket whose shelf life could be quite limited by the time it's truly reusable. BFR, meanwhile, represents SpaceX's long-term future. What the spaceflight firm loses in near-term cost-cutting and waste reduction could be worthwhile if it speeds up the arrival of a long-term solution.

Elon Musk@elonmusk

Btw, SpaceX is no longer planning to upgrade Falcon 9 second stage for reusability. Accelerating BFR instead. New design is very exciting! Delightfully counter-intuitive.

6:45 PM - Nov 17, 2018

Source: Elon Musk (Twitter)
https://twitter.com/elonmusk/status/1063865779156729857

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

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

SpaceX launch of a Falcon 9 Block 5 Rocket

SpaceX was scheduled to launch a Falcon 9 Block 5 rocket as part of the Es'hail 2 mission. The launch window for the Communications mission was on Thursday, Nov 15th, 2018, 8:46 PM from Launch Complex 39A, Kennedy Space Center, FL. The status of the launch is GREEN.

A video of the launch can be seen here:
https://www.spacex.com/webcast?fbclid=IwAR2Q95AMXVJNvX5VPNpYPRjEEBanf6haB_Mu9weTfwDTNWS1RxrrXbrm00U

Darko OE7DBH comments:

Finally the wait has come to an end after more than three years. Es'hailSat2 with the ham radio transponder has been successfully promoted into space.

Here is a video recording -
https://www.youtube.com/watch?v=krABDyhBujM

UHF and SHF friends are pleased, finally a geostationary satellite.

https://amsat-dl.org/category/eshail-2-p4-a

No antennas tracking more and no minutes operating times like the orbiting satellite. Now it will be easy, antenna direction stops and never move again. Half world listening at all times.

Great, never again "nobody is on it".

Good luck and good satellites QSO wishes you Darko OE7DBH

https://www.oe7forum.at/viewtopic.php?f=42&t=468#p2441

Es'hail-2

Es'hail-2 is a new communication satellite **originally** scheduled to be placed into the geostationary transfer orbit in the fourth quarter of 2016. It will be launched aboard the Falcon-9 launch vehicle from Cape Canaveral Air Force Station, Florida, US.
The satellite will be positioned at 26° east orbital position and will provide TV broadcasting and direct-to-home (DTH) services across the Middle East and North Africa. It will be the first Amateur Radio communication satellite in Qatar.

Es'hailSa, a company based in Qatar, is the owner and operator. Es'hail-2 will become Qatar's second communications satellite, following the launch of Es'hail-1 in August 2013.

Satellite development

"Es'hail-2 has a mass of approximately 3,000kg."

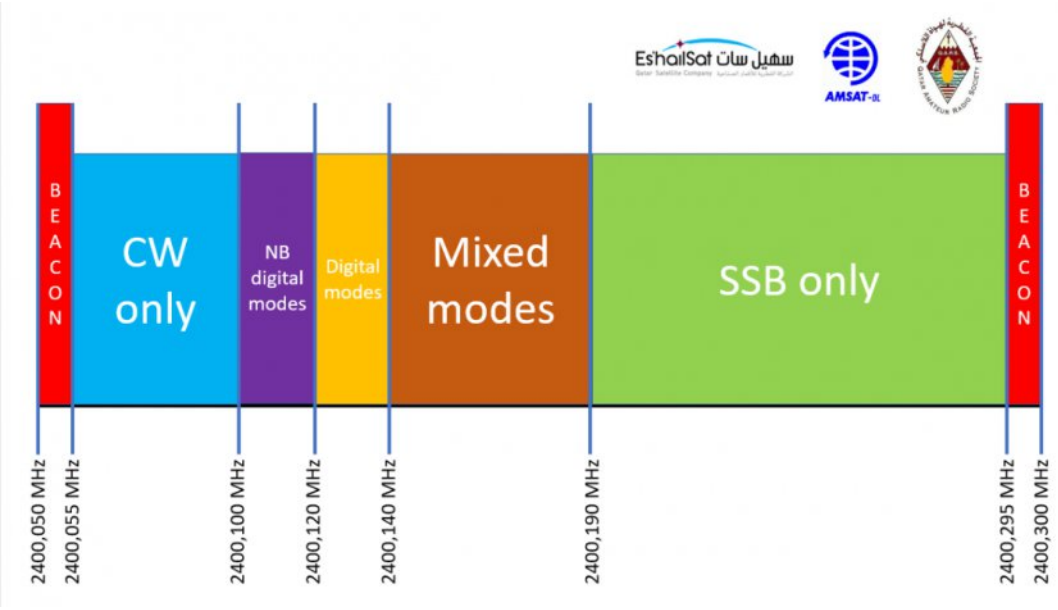
Es'hailSat awarded the design and build contract of the satellite to Japan-based satellite manufacturer, Mitsubishi Electric (MELCO) in September 2014.

MELCO will also supply the ground systems and provide the required training under a complete turnkey solution. This makes Mitsubishi the first Japanese satellite supplier to enter Arab's commercial communications satellite market.

Es'hail-2 has a mass of approximately 3,000kg and will have a lifespan of more than 15 years.

Communication capabilities

The satellite will feature 24 Ku-band and 11 Ka-band transponders to provide direct broadcasting services for television, government and commercial content distribution.



In addition, it will carry two phase four Amateur Radio transponders, which will provide Radio Amateur Satellite Corporation the first geostationary communication capability to directly link Brazil to India in a single hop in real-time. It will also allow the AMSAT community to corroborate and exhibit their digital video broadcasting standard.

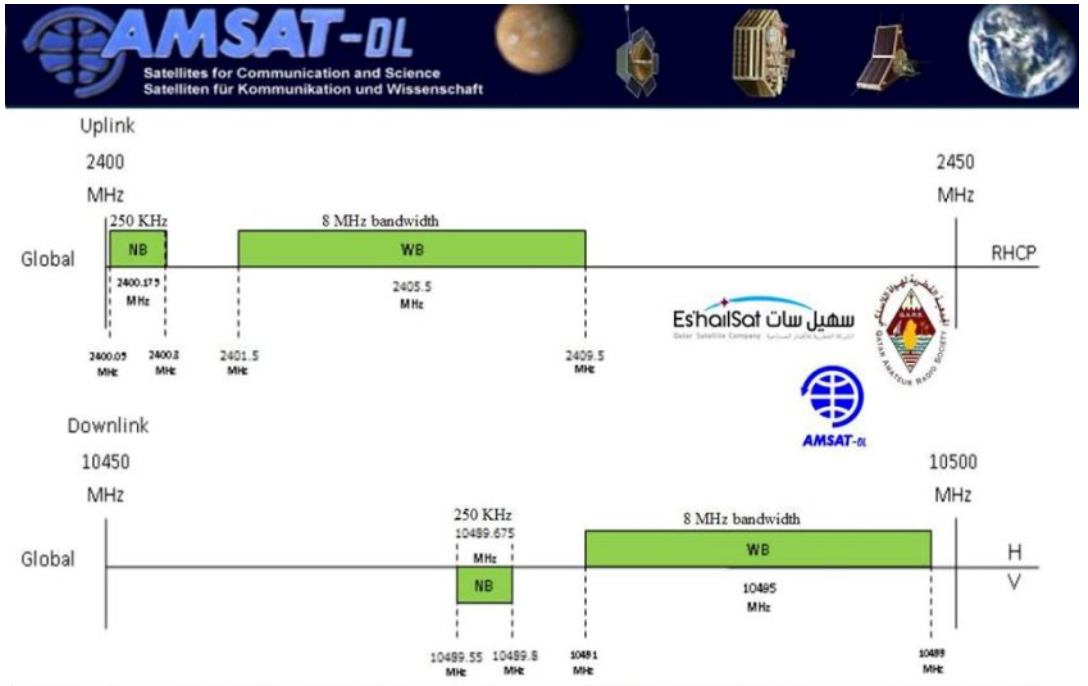
Satellite bus

Al Yah 3 Communication Satellite, Al Yah 3 is an all Ka-band communications satellite .

Es'hail-2 will be based on the DS2000 satellite bus platform developed by MELCO.

The satellite bus handles a broad range of communications payloads and can provide an output of up to 15kW, which is sufficient to power multiple payloads.

Its flexible design suits various payload applications, including hybrid communication payloads, multiple spot-beam broadband communications and meteorological satellites.



Xpdr	U/L FREQUENCY (MHz)				D/L FREQUENCY (MHz)				LO	BW
No	Pol	Begin	Center	End	Pol	Begin	Center	End	(MHz)	(MHz)
NB	RHCP	2400.05	2400.175	2400.3	V	10489.55	10489.675	10489.8	8089.5	0.25
WB	RHCP	2401.5	2405.5	2409.5	H	10491	10495	10499	8089.5	8

The electrical power system includes 100V-regulated dual bus with silicon, multi-junction Gallium arsenide solar array and NiH2 or Li-Ion batteries.

Launch vehicle

In December 2014, Es'hailSat selected Space Exploration Technologies to launch the satellite.

SpaceX will launch the satellite aboard Falcon 9, its own launch vehicle, from SpaceX's launch complex 40 at Cape Canaveral Air Force Station.

Falcon 9 is a two-stage rocket weighing 505,846kg and standing 68.4m tall. It can carry a payload of 13,150kg to LEO and 4,850kg to GTO.

Its first stage features nine Merlin engines and aluminium-lithium alloy tanks carrying liquid oxygen and rocket-grade kerosene (RP-1). It generates 1.3Mlb (million pounds) of thrust at sea level and 1.5Mlb in the vacuum of space.

The second stage incorporates a single Merlin vacuum engine that delivers the payload to the respective orbit. The engine can be restarted multiple times to place different payloads into different orbits.

This stage generates a thrust of 180,000lbf and an intermediate stage between the first and the second holds the release and separation system.

From *http://www.aerospace-technology.com*

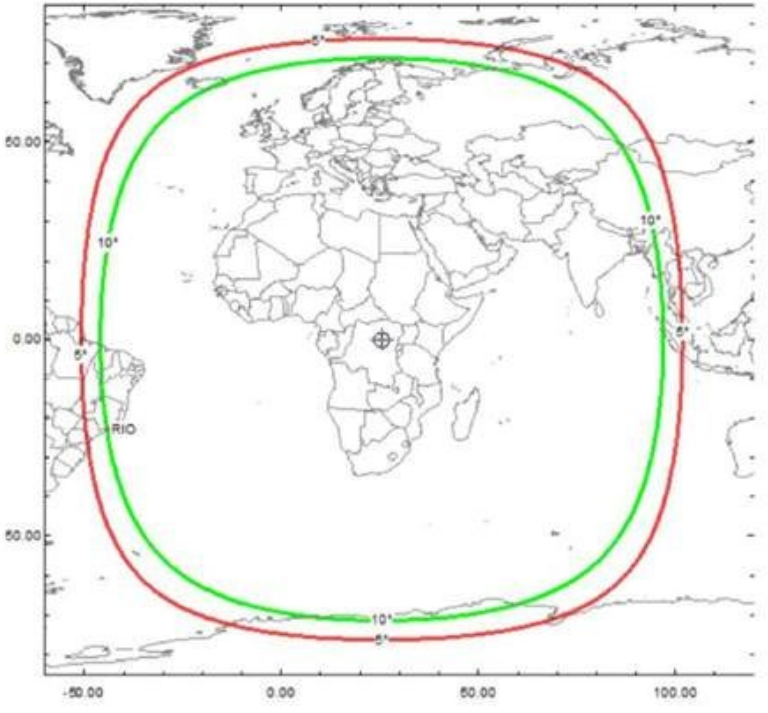
Setup for **SSB** communications:

RX Antenna	60-90 cm SAT-TV dish
Receiver	LNB with power injector and DVB-T dongle + SDR software (for example SDR#) OR 3 cm LNA with downconverter to 70cm
Transmitter	10W PEP in 60-90 cm dish plus upconverter from 144 MHz

Setup for **DATV** (DVB-S2) communications:

RX Antenna	60-90 cm SAT-TV dish
Receiver	modified LNB with standard satellite receiver box (DVB-S2) OR modified LNB with PCI DVB-S2 cards for PC use
Transmitter	100W PEP in 2.4m dish plus DVB-S2 modulator

Coverage from orbital position of 26 deg East



70cm vs 23cm Band Activity

Written by Jim Andrews, KH6HTV

Extract from BOULDER TV Repeater's REPEATER November, 2018

From my QTH with my Rigol spectrum analyser, I have monitored the relative activity on both the 70cm and 23cm bands. Dramatic differences!

The screen shots shown below were taken under the same analyser settings on both bands. The analyser was set to the Peak Hold mode to capture everything which occurred in the 10 minute acquisition interval.

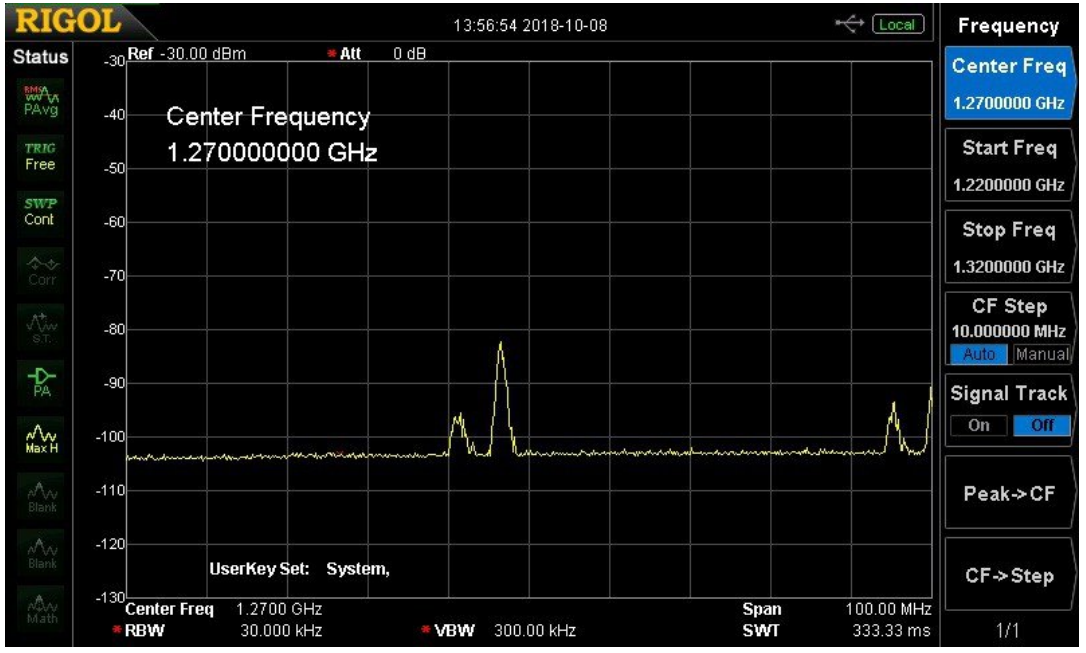
The measurements were made on a weekday in the middle of the day. On 70cm, the span of 50 MHz includes the government band 410-420MHz (bottom 2 divisions) and the commercial / FRS band 450-460MHz (top 2 divisions).

A lot of amateur, 70cm, FM repeater outputs are noted in the 445-450 MHz portion.

Also a lot of unlicensed activity is seen in the 434 MHz region. On 23cm, the span of 100 MHz includes government bands below 1240 and above 1300MHz.

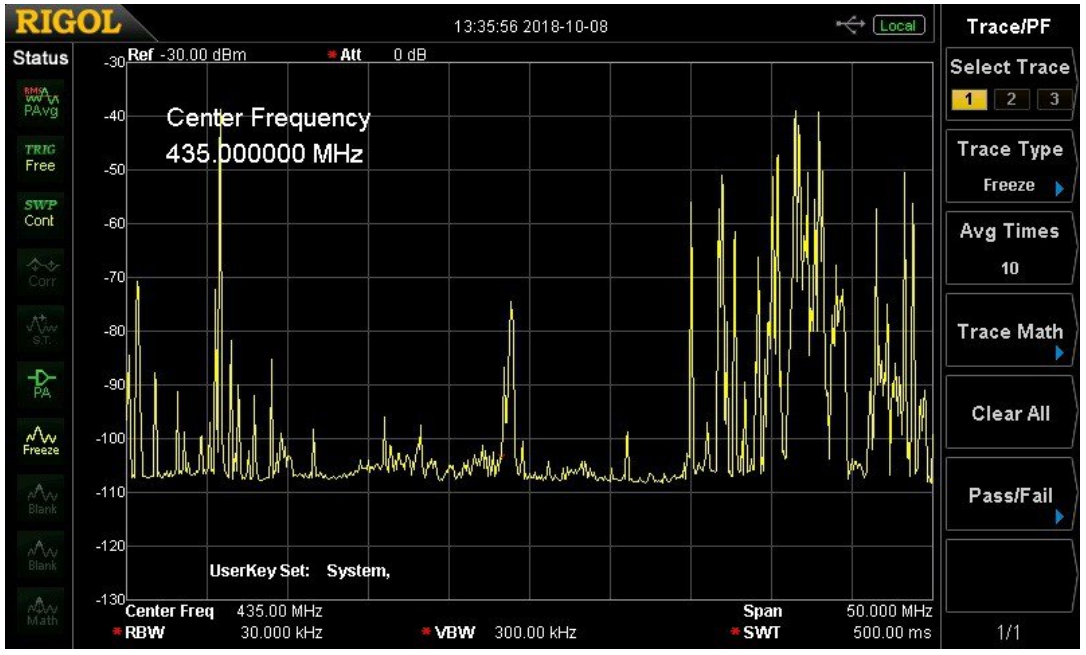
Absolutely the only activity detected were the government radars in the vicinity of 1265MHz and 1318MHz.

23cm monitoring over extended 1/2 day periods also showed essentially an empty, quiet band, except for the radar signals.

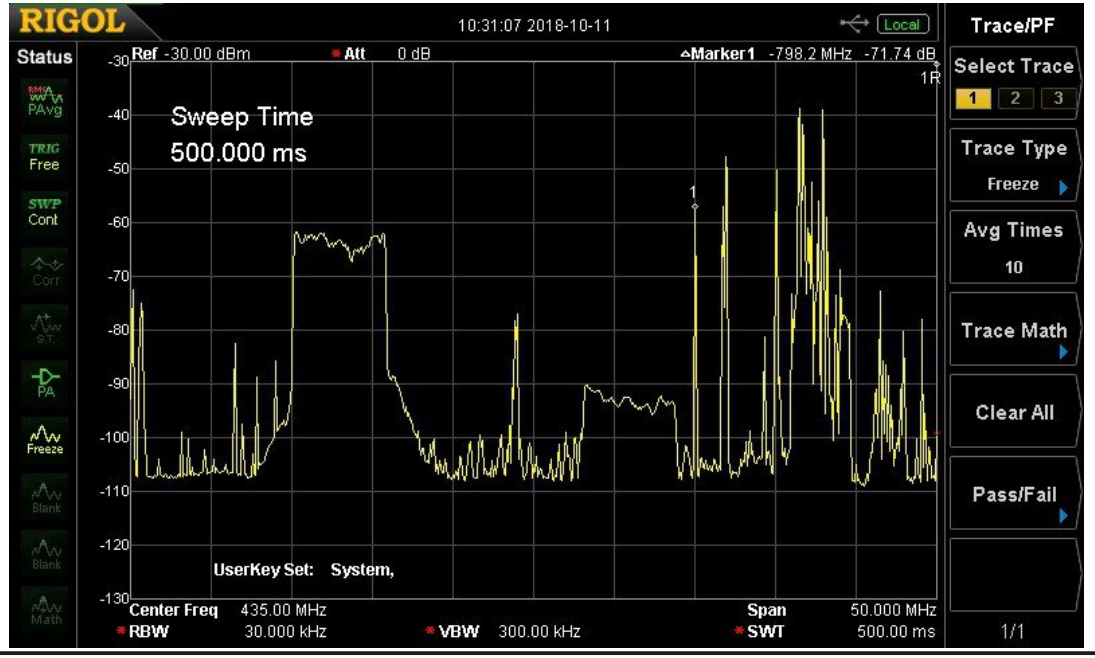


23cm Normal Band Activity – 1270MHz centre frequency, 100 MHz span, 10MHz/div data acquired in max. hold for 10 minutes. The only signals seen are government radars

Next page: 70cm Normal Band Activity – 435MHz centre frequency, 50 MHz span, 5MHz/div data acquired in max. hold for 10 minutes



Below: 70cm Band Activity with ham DTV signals. TV repeater at 423 MHz & another ham's signal at 441 MHz – 435 MHz centre frequency, 50 MHz span data acquired in max. hold for 1 minute



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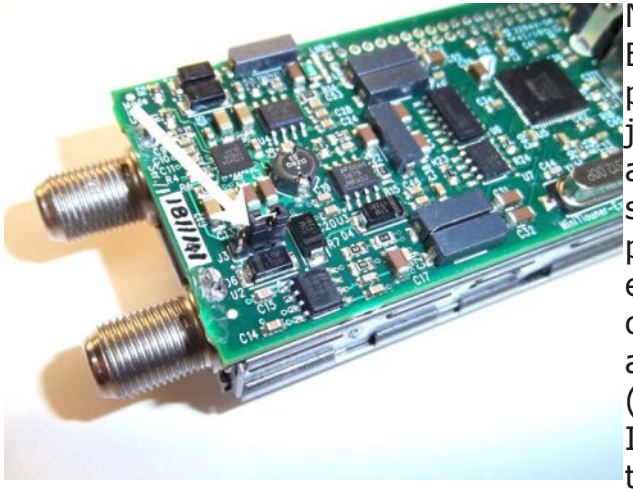
DATV-Express Project Report

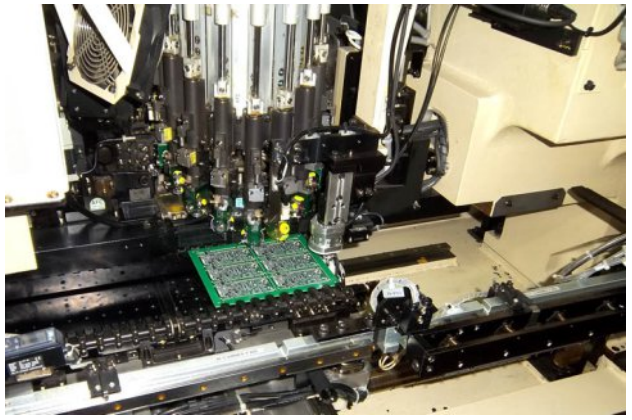
Written by Ken W6HHC

Art WA8RMC reported he picked-up and tested the "first articles" of MiniTiouner-Express unit's design called "Rev B" from the assembly house. All units fired right up…although one unit needed to have the USB-chip solder refluxed. Art observed that he observed some voltage drop at the end of the USB cable plugged into the computer USB-3 port. Use a short USB cable if you plan to obtain power from a USB-3 port using the new jumper. Quality brand USB-3-grade cables are not longer than 2 meters and are recommended.



New RevB of MiniTiouner-Express with arrow pointing to the new J3 jumper set-up that was added. The push-on shorting plug is shown positioned (away from end of the board) to configure power supplies as the original design (not USB-3 powered). It important to note that the new RevB units will ship with J3 configured to work like the original design.

Charles G4GUO had fixed one bug for PLUTO units with the v1.25LP10 software release. v1.25LP11 of the software was released to the *www.DATV-Express* web site DOWNLOADs page after Ken independently tested at his lab. No new problems have been reported with v1.25LP11. Charles did say he also improved his GPU LDPC decoder using a modification to the algorithm he read about in an academic paper.



The photo right is the Fuji "pick-and-place robot" for SMT PCBAs. The PCB panel-array is designed to hold six boards.

The assembly house started to complete the rest of the 100 unit production run on Friday, Nov 02.

The fast FUJI "Pick-and-Place" robot can complete each unit in 5 seconds, 30 seconds for the PCB-array of six boards.

Ken W6HHC Plans to upgrade the MiniTiouner-Express User Guide to include the new power supply options available with the addition of J3 in RevB. Ken is also working to update the DATV-Express User Guide to emphasize that DATV-Express has transitioned to become solely a software product for the future.

Project Speed is set to slow….de Ken W6HHC

G4GUO comments

If anyone is interested the improvement to my GPU LDPC decoder uses the Self Corrected Min-Sum algorithm.
https://arxiv.org/pdf/0803.1090.pdf
It improves decoder performance by about 0.4 dB

Charles

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

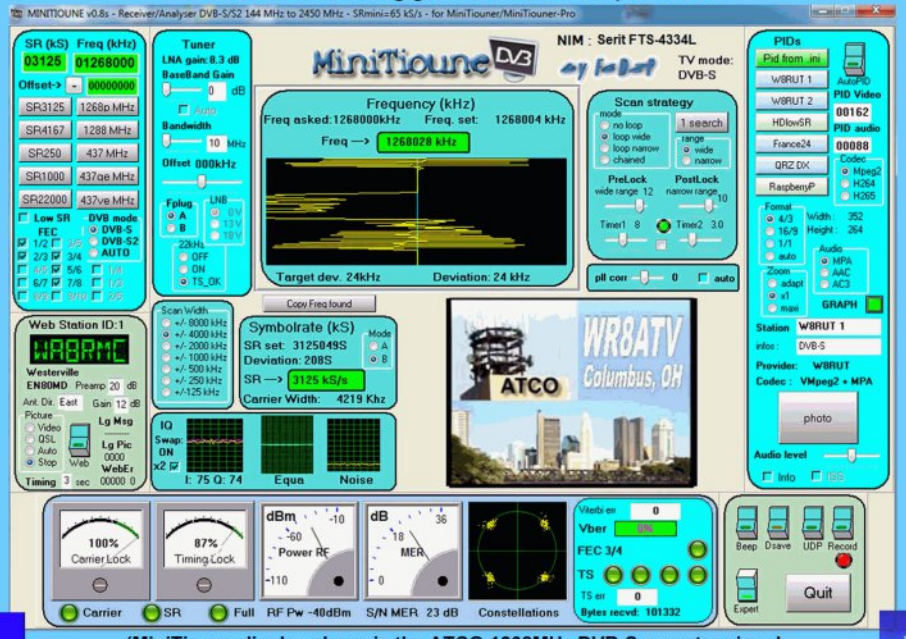
MiniTiouner-Express

Digital Amateur Television DVB-S/S2 Receiver / Analyzer

Available at DATV-Express.com

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

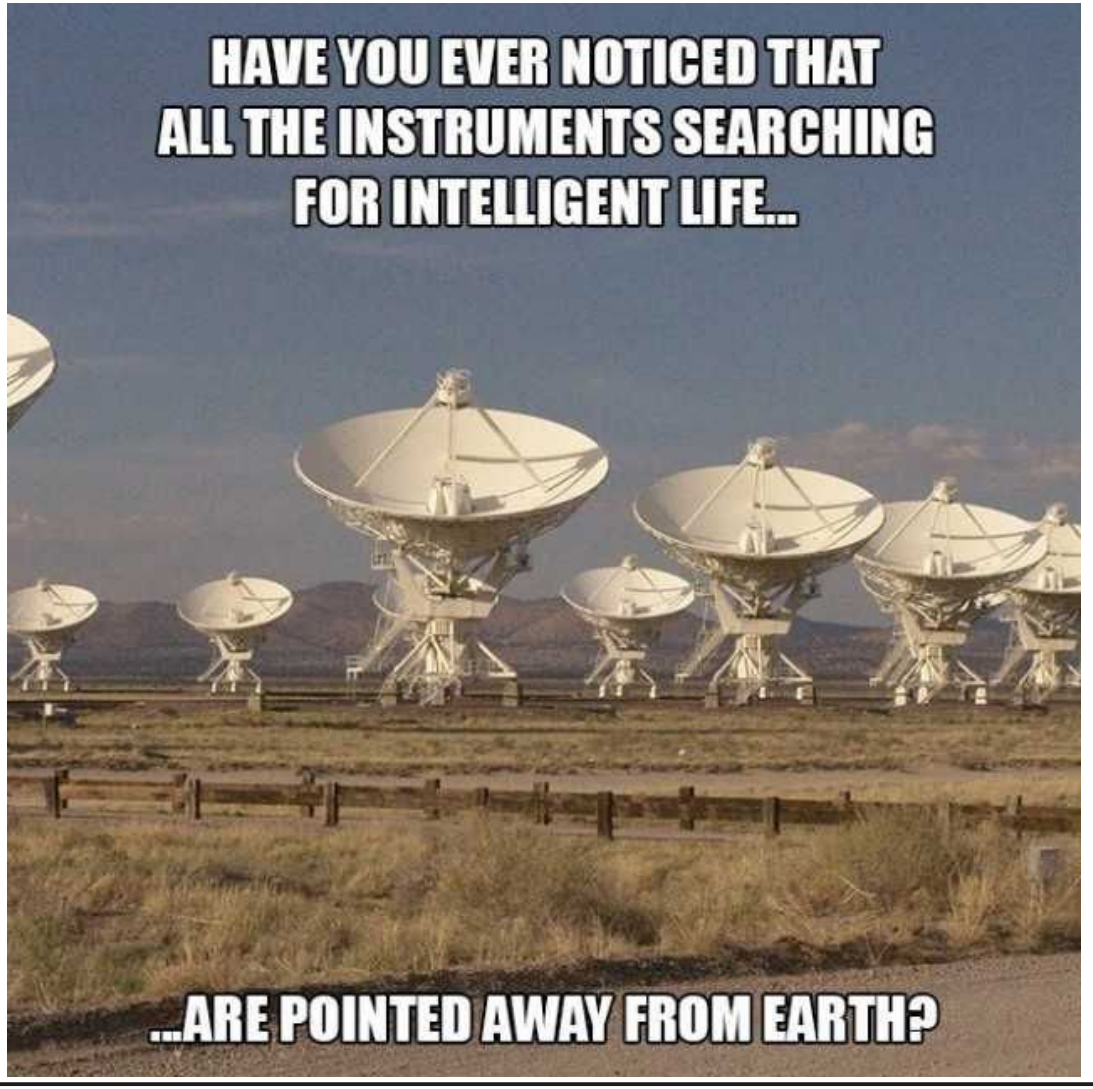
For details & ordering go to www.DATV-Express.com



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

CQ-DATV

ALL BACK ISSUES AVAILABLE



The ABC of Broadcast Video Tape Recording

Written by Trevor Brown G8CJS

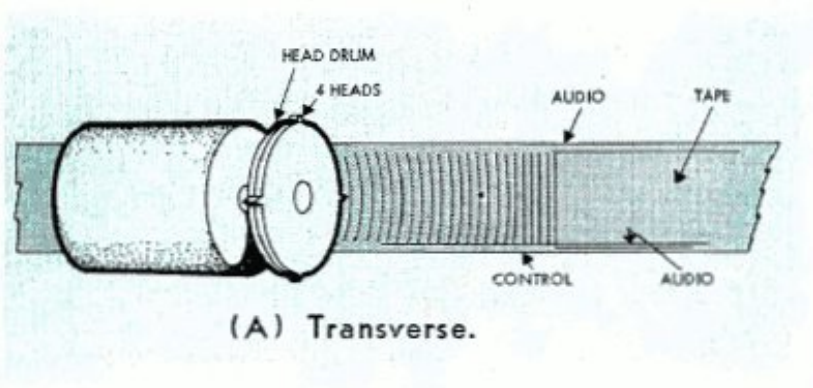
In the last two issues we have looked at the way video tape recording evolved. We started with Quadruplex and then moved onto B format developed by Bosch who were the only manufacturer of this format. The next format was C and strangely enough was not a step forward but a step backwards.

C format grew out of Helical Scan, video recorders. These formats used a head drum that rotated at the slower speed of one revolution per field. The head to tape speed was slower and instead of scanning across the tape, it scanned diagonally down the tape producing longer scans to accommodate the increased data of a full field as opposed to 17 lines of Quad or 50 lines of B format. The head drum was much larger in an attempt to keep the head to tape speed high.

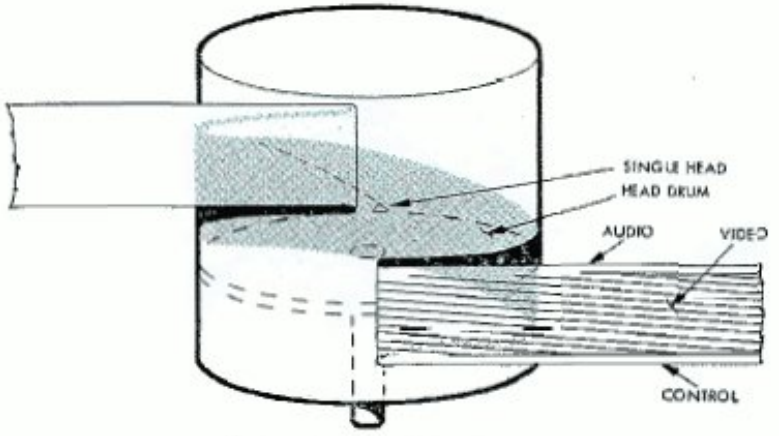
There were various options: IVC produced a single head Alpha wrap, Ampex started with the 180° Omega wrap which required two heads so one was always in contact with the tape. The tape was 2” and the heads were singularly replaceable, but were difficult to align, which was critical to achieve interchange.

The pictures were poor and the signal to noise left a lot to be desired. This machine was never considered to produce broadcast pictures, although NASA did use it to record the Moon landings.

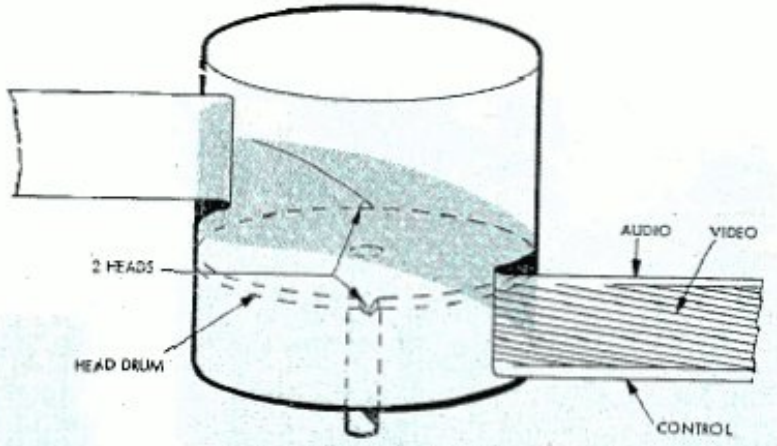
Ampex switched to a one inch, single head full helical omega wrap machine, which was even less of a broadcast format because single head omega wrap has the problem of missing



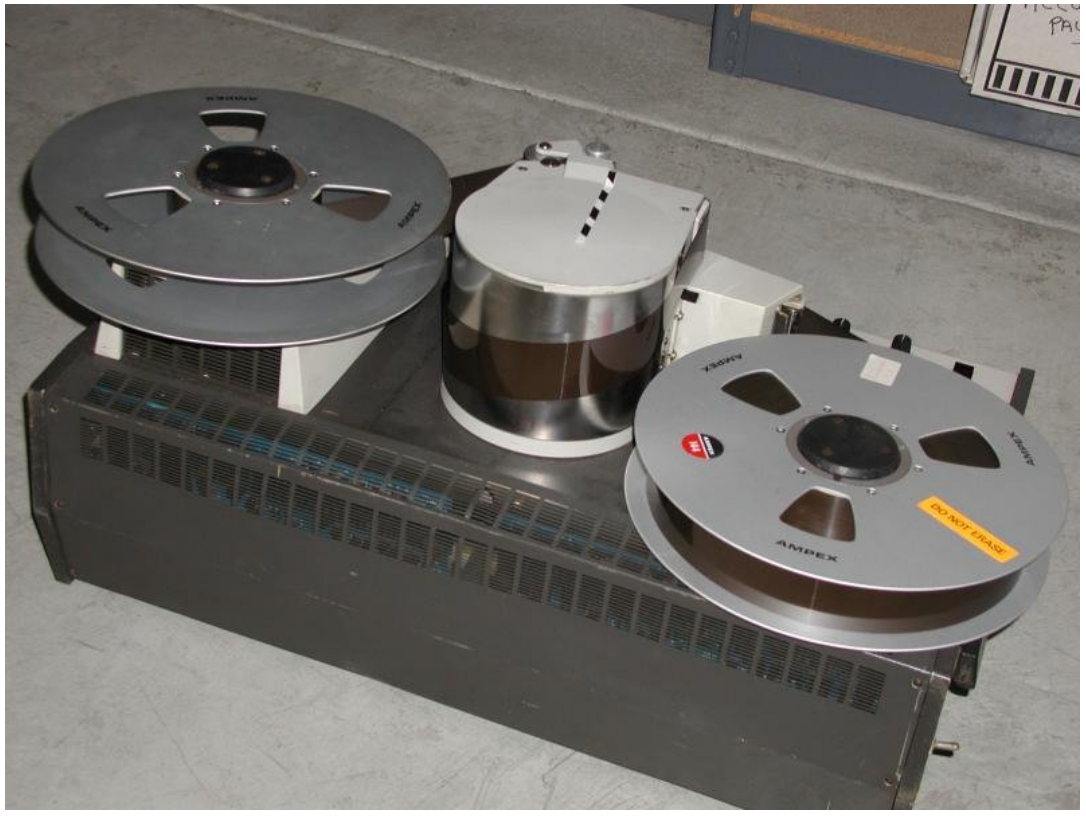
(A) Transverse.



(B) Full helical.



(C) Half helical.



Ampex VR660 2” omega wrap Helical Scan VTR Granada tried this in the UK for a mini OB unit before the days of ENG

information when the head leaves the tape at the end of a scan. Resulting in about 10 lines of picture missing, seen as a band at the bottom of the picture, something the broadcaster would never tolerate.

This was a another main stumbling block, dimensional instability of the actual tape, which would vary in length, with temperature so the angle of the recording would change when the tape was stored making control track phase adjustment difficult and frequent.

Quad and B format with their slant tracks were much less affected.

VR7800 early Ampex Helical VTR..not Time Base Corrected and missing about 10 TV lines at the bottom of the picture

The world changed when AST Automatic Scan Tracking was developed. The video replay head was mounted on a transducer that could dynamically follow any changes in scan angle, the tape could even be slowed or stopped, which would cause a dramatic change in track angle. This opened the door to pictures in wind - slow motion and even freeze frame and the broadcast world suddenly started to love helical scan.

The poor signal to noise was revisited with better filters, tape jitter was improved by better servo’s and the addition of time base correction. The band of missing information was moved to the vertical interval where a TBC corrected picture could use a processing amplifier to repair the vertical interval.

Suddenly Ampex had a broadcast Helical Scan machine called the VPR 1. This had broadcast potential. Slo mo, freeze frame, pictures in wind, and a separate play head following the record head so the recordings could be verified while the recording was in progress.

Then politics and the world of committees such as SMPTE, raised its head. Sony wanted a piece of the action and wanted a common standard so they could produce a compatible broadcast helical. They insisted from the outset that the missing band of information was unacceptable, even though it was now in the vertical interval and came up with a proposal of extra heads on the scanner to record when the video head was not in contact with the tape.

The argument was that a machine without a TBC could be produced. The problem was then compounded that the extra heads caused incompatibility with machines that did not have them and so dummy heads needed to be fitted and Ampex had to change the scanner design to add the extra heads and produce a SMPTE compliant VTR called the VPR 2. The VPR 1 although it did sell was not C compliant. The VPR2 was, as was the Sony BVH 1100.

BVH 1100 and the later BVH 2000 entered the broadcast market as Ampex's main competitor. RCA initially declined to enter the C format market, but then later reversed that decision and produced the TR800, which like RCA soon disappeared as a broadcast manufacturer.

The non TBC machine requiring the extra heads never appeared. The dummy heads made little difference to the interchange, but running without them did off balance the scanner. Sony's BVH 1100 was soon replaced with the BVH2000 and was the better machine because it had a serial interface that was excellent at interfacing to linear edit controllers.

BVH 2000 Sony C format machine

Ampex head drums gave problems and often required and expensive overhaul, costing several times the cost of a Quad head rework.

Ampex sold the VPR2 manufacturing rights to the Marconi corporation who were desperate to have a VTR machine in there stable and called it the MR2B. They made modifications, but blew the budget on power supply improvements and producing a combined waveform and picture monitor display, but neglected the serial interface that was limiting the potential of this machine. Ampex went on to develop the VPR3 and VPR6, which had a serial interface and longer tapes, demanded by the USA market, while Sony developed the much loved BVH 3100.

C format also opened the door to small portable recorders for field recording Ampex built the VPR 20 and Sony the BVH 500 these were useful and both machines were on a power with each other, but Ampex also licensed Nagra to build portable recorder.

Above: Sony BVH 500 and the RCA badged version along with the Ampex VPR 20 portable battery recorders

Left: Sony BVH 3100 the only reel to reel VTR that would self thread, sounds a good feature, but it was a little slow at performing this task and refused to be rushed. Fortunately it could be manually threaded and faster..something that was often done when transmission tapes arrived late from the edit suite for a sporting event. Auto thread also required a custom take up spool with air holes to suck the tape to the spool

VPR 5 developed by Nagra for AMPEX, note the aluminium extruded case, the picture has oversized reels, with the smaller tape reels it has a cover and can be carried by the sound engineer on a two man shoot. The spool motors were built into the hubs a rather nice Nagra touch

Nagra had long since had a reputation for excellent portable field audio recorders loved by the film industry and what they produced was the VPR 5 which really blew everyone's socks off as the portable 1" VTR to end all portable 1" VTR machines.

C format delivered Slo Mo, freeze frame and pictures in wind along with practical field recorders. The broadcast industry was happy, but these were still analogue recorders and composite at that!

Multiple generation copying and editing still added considerably to picture degradation.

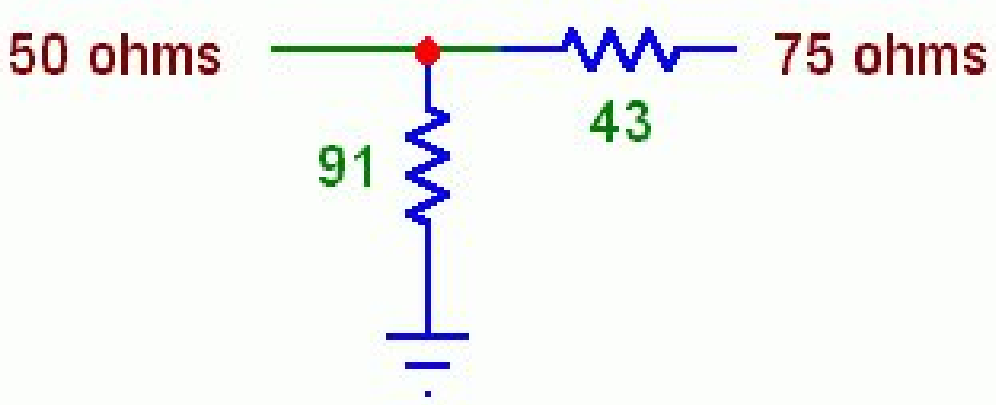
Believe it or not this was once my garage, which became Edit Suite 1 when I set up my TV production company. Three Sony BVH 2000 machines, two external TBC's mounted below. One Sony SP VTR, the edit controller caption generator, switching and monitoring rack. Not shown is the production desk that controlled all of this hardware or the electric supply meter in fast forward night and day. But clients came, cost were covered and the family got to eat and live in doors. The journey to work was also less arduous

Matching 50Ω to 75Ω

Written by Brian Beezlet K6STI
http://www.ham-radio.com/k6sti/
Reprinted by kind permission.

Most signal generators have an output impedance of 50Ω. To align an FM tuner or measure its performance, it's best to match this to the tuner's 75Ω input impedance. Mismatch loss is only 0.2 dB, but a source impedance that differs from the design value may alter the RF input circuit bandwidth or resonant frequency. This can degrade front-end tracking and affect intermod or desensitization measurements.

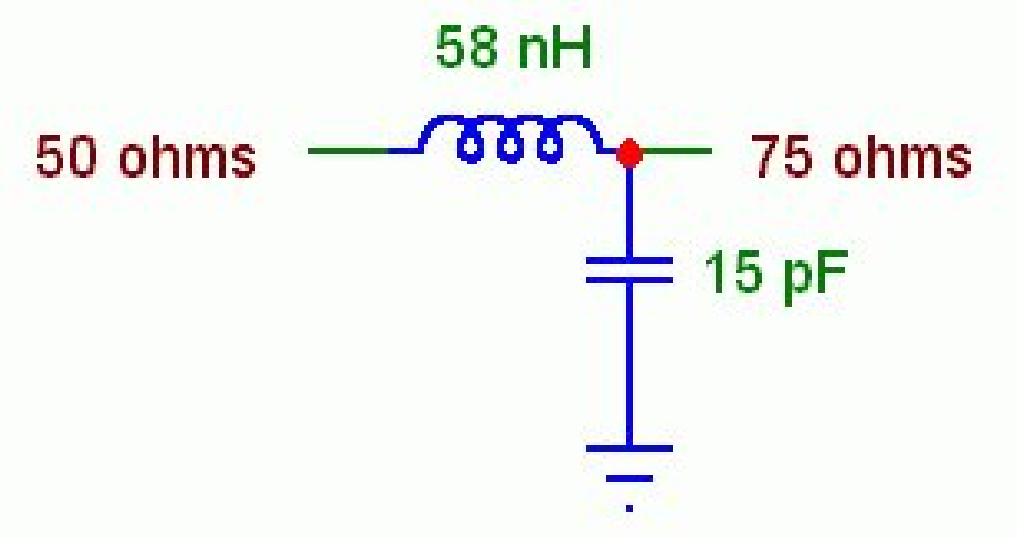
Minimum-Loss Pad



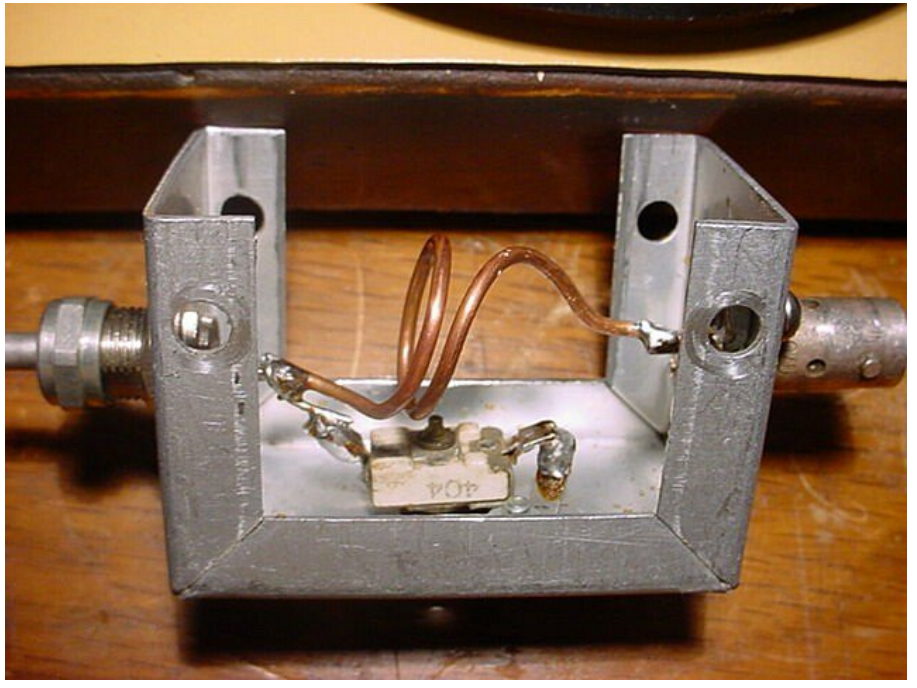
A simple minimum-loss pad provides a broadband match. Use chip resistors or the shortest possible lead lengths to minimize stray inductance and pickup of local broadcast signals. Loss is 5.6 dB for the 5% values shown.

For calibrated voltage output, set the signal generator to 1.55 times the desired output level in microvolts. (For 1% resistors, use 43.2Ω and 86.6Ω. Loss is 5.7 dB.)

L-Network

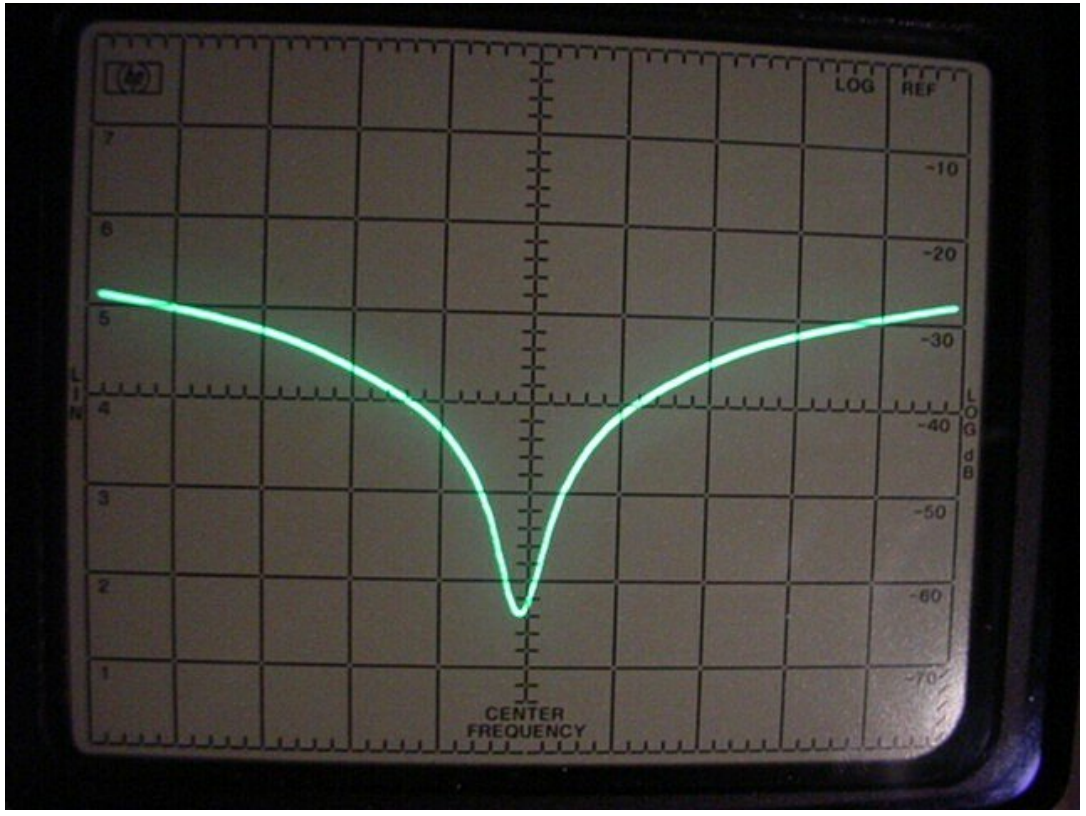


An L-network is nearly lossless. This circuit isn't broadband like a minimum-loss pad, but it easily covers 88–108 MHz.



This shows an L-network in a small metal box. The inductor is made of #14 wire and the capacitor is a small mica trimmer.

I adjusted the turns spacing and the trimmer for best return loss over the FM band. Response must be checked with the box cover in place.

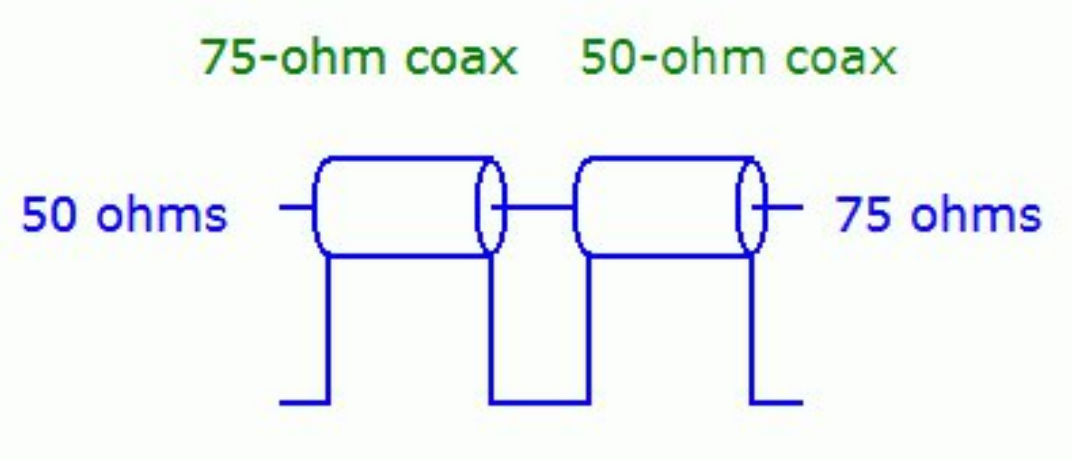


This shows the return loss of the L-network with a coaxial 75Ω load from 88 to 108 MHz. I used an HP 141T/8553B/8552B spectrum analyzer, 8443A tracking generator, and Anzac THV-50 power splitter. The return loss of the power splitter with a 50Ω load was a constant 30 dB across the FM band. This is the limit of the test setup. Results beyond this figure indicate cancellation of the residual return loss.

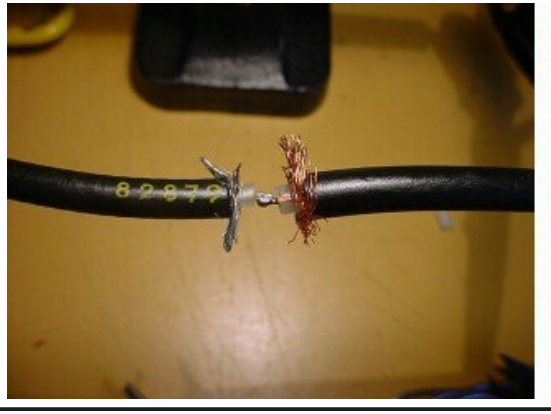
The L-network loss measured 0.05 dB. For calibrated voltage output, set the generator to 0.83 times the desired output level in microvolts.

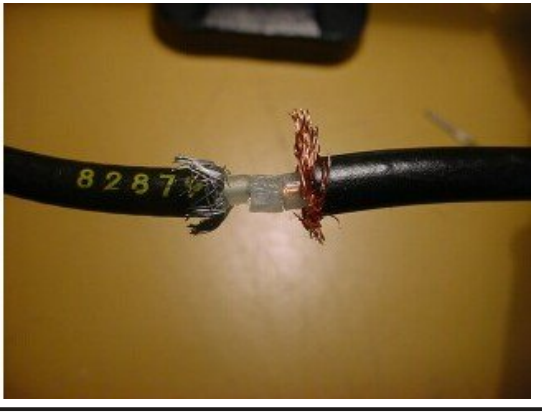
Twelfth-Wave Transformer

A *twelfth-wave* transformer can match 50Ω to 75Ω with negligible loss and no adjustment. It is a special case of a series-section transformer.



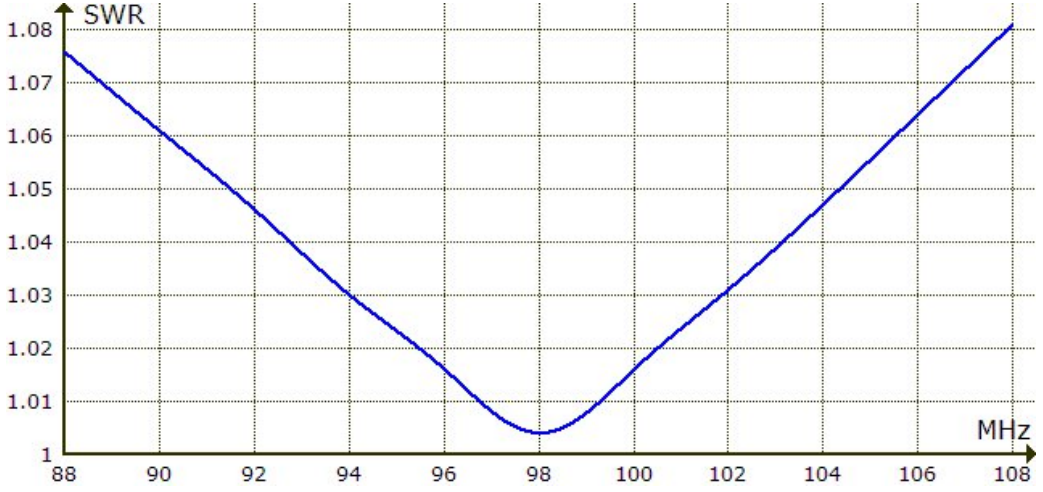
The transformer consists of a 75Ω coax section in series with a 50Ω section, each about 1/12-wavelength long. At 98 MHz the section length for solid-dielectric coax with a velocity factor of 66% is 6½”. For foam dielectric at 83%, it is 8⅛”. For best accuracy, obtain the manufacturer’s specified velocity factor for your cable. Then use the twelfth-wave transformer calculator in this set of transmission line utilities to find the section lengths and to analyze performance over the FM band.





To splice the sections, cut the cable jackets back ¼", strip the dielectric ⅛", overlap the center conductors, and solder them. Place a ⅛" piece of slit dielectric over the joint, put a dab of superglue in the slit, overlap the shields, and solder them. Cover the splice with heat-shrink tubing.

For lab use, install a BNC connector on the 75Ω cable and an F-connector on the 50Ω cable. I assume the impedance changes ½" from the end of the BNC and ¼" from the end of the F. When cutting the cables, account for this, for the center-conductor length each connector requires, and for the splice overlap, which effectively shortens the 75Ω section ⅛".

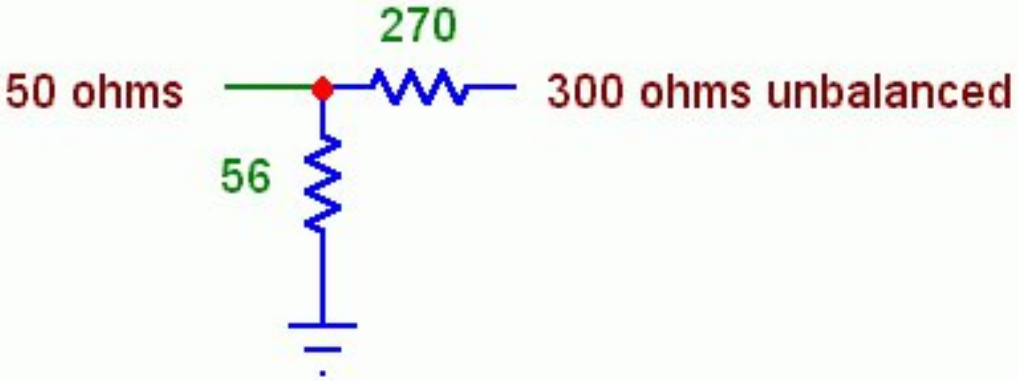


This shows SWR for a twelfth-wave transformer cut for 98 MHz.

Like the L-network, the twelfth-wave transformer loss measured 0.05 dB. For calibrated voltage output, set the generator to 0.83 times the desired output level in microvolts.

Matching 50Ω to 300Ω

Vacuum tube tuners provide 300Ω antenna terminals. They may connect to a balanced RF transformer with a floating or grounded centertap, or to an unbalanced input circuit with one terminal grounded. For a grounded centertap, connect a 50:75Ω matching network to one antenna terminal and nearby chassis ground. For an unbalanced input, use the following matching network. Use it also for a balanced floating input by grounding one antenna terminal.



Loss is 13.3 dB. For calibrated voltage output, set the generator to 1.88 times the desired output level in microvolts.

The Mini Router Switcher

Richard Carden VK4XRL and Mike G7GTN

How many times have you wanted to switch different video and audio sources to different parts of your television plant.

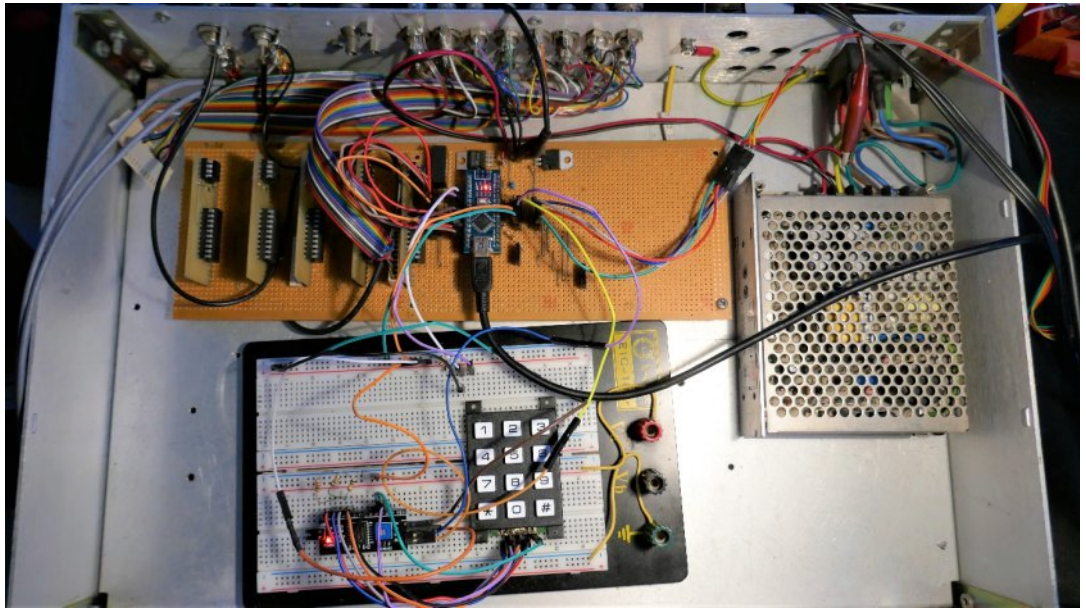
In my situation I wanted at least two channels via dongles to feed vMix, also to the PortsDown which needs separate input as well for streaming or to the 23cm digital transmitter for local live transmission. Another could be a preview channel therefore at least 4 outputs would be required so armed with this information and with the information we have seen in CQ-DATV regarding switcher hardware we now are looking at a eight by four mini routing switcher.

Because of the number of connections the video 8 x 4 is on one board, however because most connections are been used only one of the two output feeds are available on the back panel. Two boards are required for the audio, left and right and again only one output for the separate 8 x 4 audio switchers are available. Suitable separate VDA's can be utilized for the extra feeds that you may require. Similar separate audio SDA's can be used to supply the extra audio feeds.

Having separate VDA"s and SDA's allows some adjustment of levels and you could also feed the outputs form the the four VDA's to a Quad split unit for monitoring.

The video and audio switchers are the same ones used in past articles in CQ-DATV so we won't repeat here only to say other switcher IC's could be used. The selection of the required input source is via a 4 x 3 switch-pad (see article on this subject) and is feed to the Nano via I2C which in turns produces S0, S1 and S2 to feed the switcher and is feed to all four switchers. The switcher now only requires a latch pulse to feed the selected source to the required output.

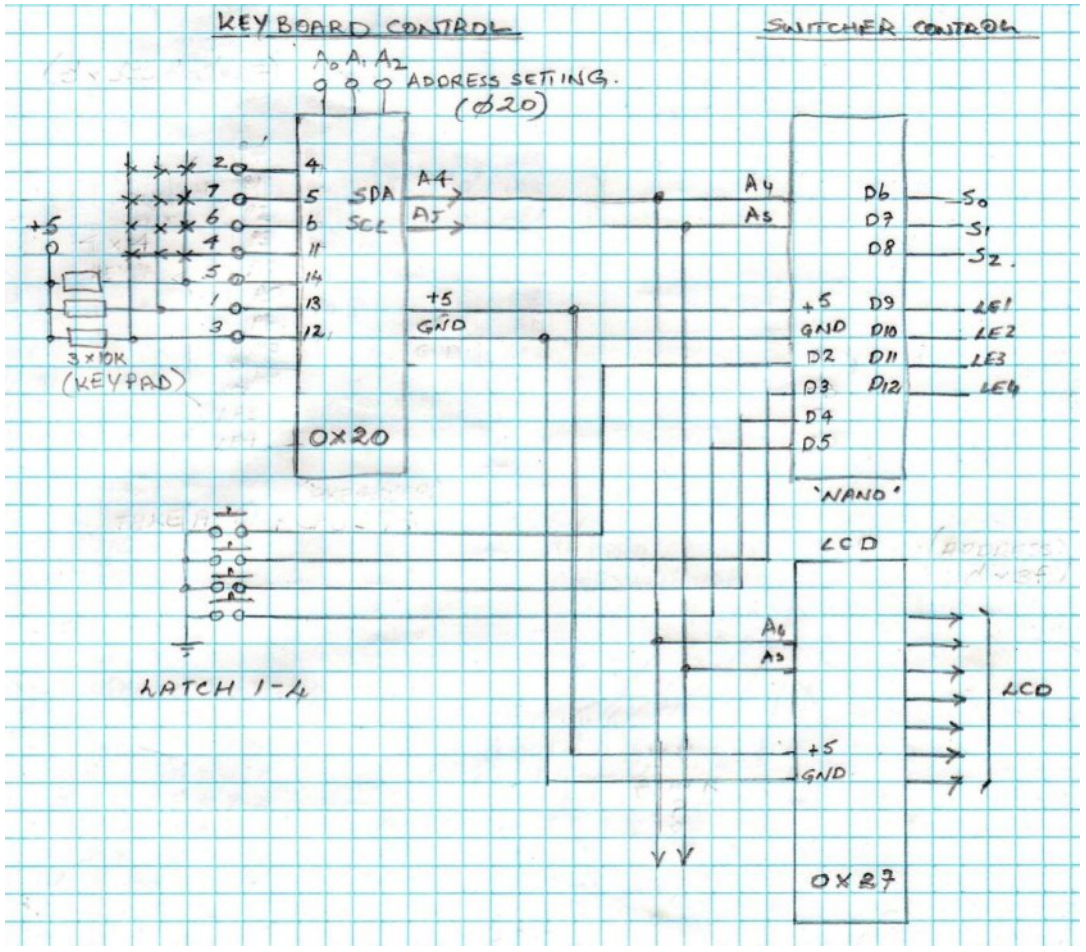
You will note that a file called setup stores all the text that maybe changed depending on the inputs and outputs that you use. Now the Latch buttons can be called what ever you like and as you can see I have opted to call them as to what function they perform. The picture below shows the prototype under construction.



The LCD screen is also operated via I2C and works as follows.

Upon switching on you should see the screen below and then a screen with SELECT which allows you to select the required input source to the switcher.

The block Diagram (next page) shows you the intended arrangement.



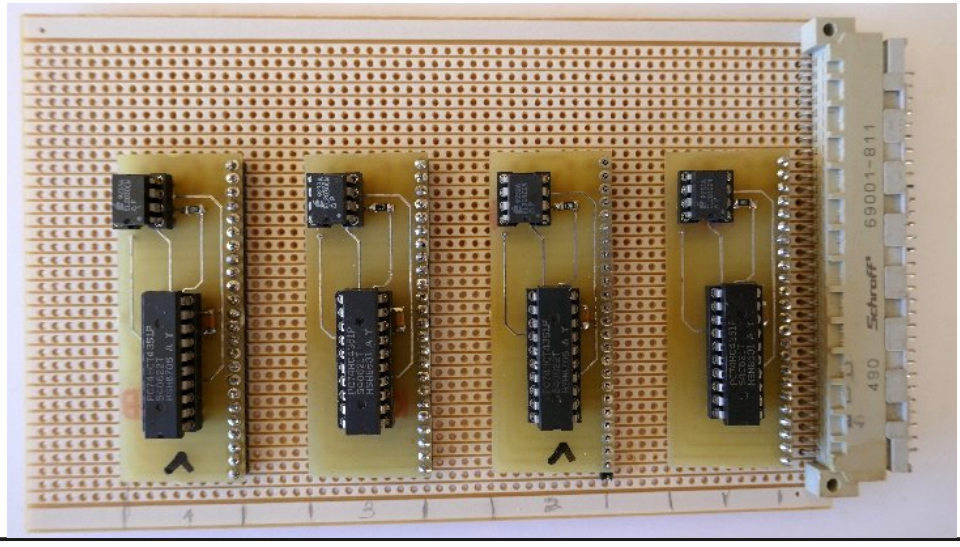
The source you have selected may now be sent to the required output by switching one of the four latch buttons were confirmation is read out to the LCD (see below). After about 5 seconds this output selection will drop off so that another input and output selection can take place.

Also using the serial monitor you can see the address allocation for the keypad interface and the LCD in case you need to change them. Likewise pressing any of the source buttons confirms that button select and same with the four latch switches.

Construction can either be rack mounted boards although it maybe a tight squeeze to place 12 BNC's on a back panel and as we have to drop off the extra output from the 4 switchers, VDA's maybe needed depending on you own system design. You could also use two 1RU rack frames, one for video and another for audio. DB9's can be used for the control signals and the the control circuit can be fitted in with the video switcher if required.

Well that's all for this series on DIGITAL WORLD we hope you have enjoyed these series of articles and don't forget feedback to the editor. Also thanks to Mike G7GTN for putting up with me doing this from around the other side of the world where our times are nearly 12 hours apart and to Trevor G8CJS for proof reading including suggestions for improvement.

Happy ATVing.....VK4XRL



70cm Antennas for ATV

Written by Jim Andrews KH6HTV

Recently, I moved out of the city of Boulder to a rural, residential area on the prairie I now own a 2 1/4 acre lot with a very large, open, flat, pasture with no obstructions. Ideal for setting up an antenna measurement range.

I thus decided to make measurements on a selection of 70cm antennas for possible use for ATV. This was a repeat of earlier measurements which I made in 2011 on a less than desireable antenna range in my then much smaller back yard ref [1].

For ATV, the major criteria for an antenna is Bandwidth. It must be capable of handling at least a 6 MHz wide TV channel and preferably the entire amateur band.

Many 70cm yagi antennas were designed for weak signal work at strictly 432 MHz and were quite narrow band. Also many other 70cm antennas, especially vertical antennas, were designed strictly for the upper 10 MHz, (440-450 MHz), FM voice portion of the band. Unfortunately, most antenna manufactuers rarely give data on specific operating frequency or bandwidth.

Fig. 1 View of the Antenna Test Range from the transmitter location

Fig. 1 above shows the large open pasture used for the antenna range. The small blue car seen in the far distance on the right side of the photo is at the test antenna receive site. The distance between the transmitter and receiver sites was 75 yards. For visual reference, my 50 ft. tower with an HF hex beam antenna is on the left side of the photo.

The test signal source was a synthesized signal generator driving a KH6HTV Video, model 70-7B, 70cm, rf linear power amplifier. The output power was set to +34dBm. The antenna was a junk box, 6”, BNC rubber duck, which was found to work well with good vswr over both 23cm and 70cm bands.

The antenna was mounted on a bracket supported by a camera tripod. This source was set up in the north-west corner of the pasture.

Fig. 2 Andrew, model DB-411, 70cm, four folded dipole, co-linear antenna under test

Fig. 3 Ground Plane test platform for testing hand-held radio antennas

At the receive site, 75 yards away, in the south-east corner of the pasture, a 12” dia. concrete “bulls-eye” was planted on the ground for use as a positioning reference point. Fig. 2 shows a DB-411, four element, co-linear antenna positioned over the bulls-eye and pointing toward the transmitter which is at the far end of the field on the left side of the photo near the large tree.

The front range of the Rocky mountains are visible on the horizon. Figs. 1 & 2 show that the test range is very open, flat and free of obstructions. Most test antennas were mounted at 6 ft. on a 5 ft. mast supported by a 3 ft. antenna tripod.

For testing hand-held radio antennas, I mounted them on a 13”x17” aluminum ground plane resting on top of the 3 ft. antenna tripod, Fig. 3. For testing mobile antennas, I positioned my Saab convertible over the bulls-eye and mounted the antennas on the trunk lid using their own magnetic mounts. The rear end of the Saab was pointing towards the transmit antenna.

The Reference Antenna, Fig. 4, used for all the measurements was a 1/4 λ ground plane. It consited of a #8 solid copper vertical radiating element plus four, #12 solid copper wires drooping at a 45o angle, all mounted on a type N jack. The antenna was tuned for a resonance frequency of 430MHz with a return loss of -30dB.

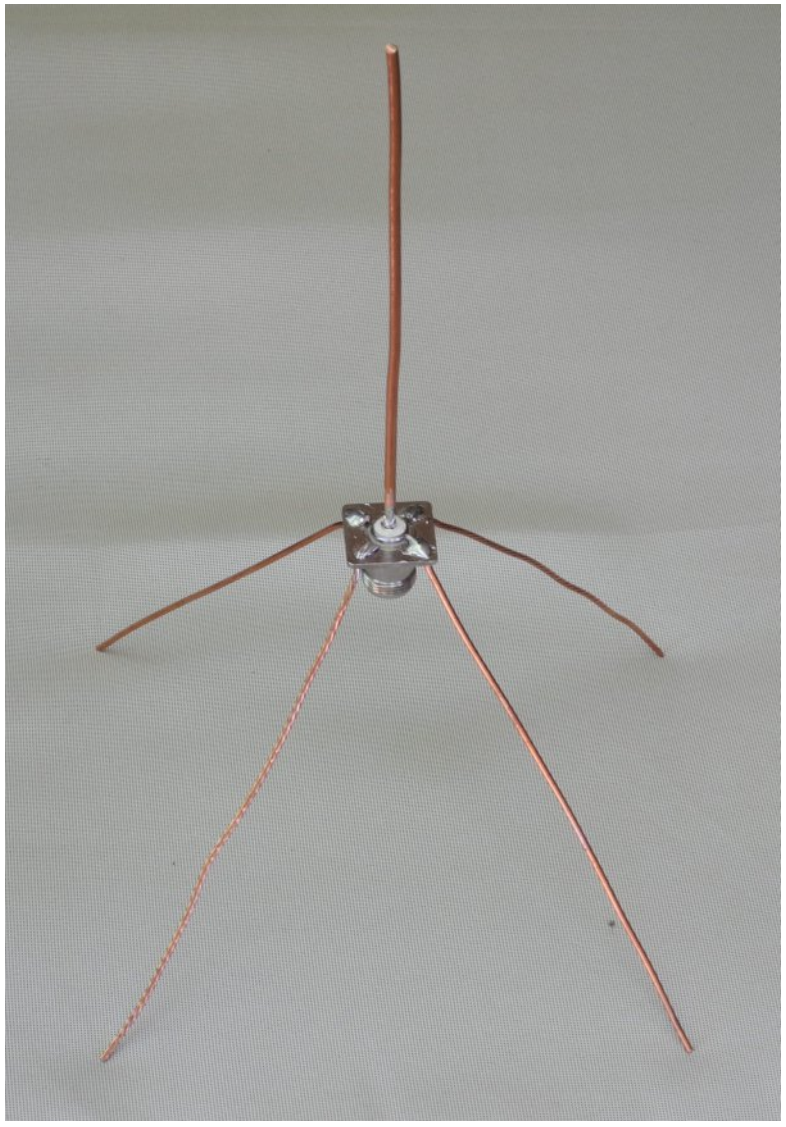


Fig. 4 Reference Antenna, Gain = 2.2dBi

The return loss at the band edges was -14dB. The reference gain of this antenna is +2.2dBi.

Received signal strengths were measured using my Rigol DSA-815 spectrum analyzer. The analyzer was positioned some distance away from the antenna under test and connected to the antenna with a 30ft. LMR-400 coax cable.

There were some atmospheric instabilites due to fluctuating wind, etc. Thus for each measurement, ten readings were taken and averaged. The typical σ of measurements ranged from 0.05 to 0.2dB. Depending upon the antenna being tested, signal levels ranged from -60dBm to -20dBm. Measurements were taken at the center of each of the five, 6 MHz, 70cm, TV channels. (i.e. 423, 429, 435, 441 & 447 MHz). No RFI was noted on any of the test frequencies.

Quite a few different antennas were tested. The results published here in Table 1 are only for those antennas which I found suitable, and recommend for use for wide-band, 70cm amateur TV, and which are also presently commercially available.

Note: this list in not all inclusive of the many possible antennas which could be used for ATV. It is only a summary of those I personally tested and recommend. For more details on this test and also the 2011 antenna tests, I refer you to references [1 & 2].

Table 1 — Antenna Gain in dBi

ANTENNA (frequency in MHz)	423	429	435	441	447
Base Station Antennas:					
Diamond X-50, 2m/70cm, omni	8.9	7.1	10.6	10.1	10
Diamond X-6000, 2m/70cm/23cm, omn	2.8	6	10.6	13.4	12.7
M Squared, 6 element, Yagi, directional	10.3	10.3	11.5	13.4	9.9
Mobile Antennas:					
Diamond NR2000NA, 2m/70cm/23cm	3.1	3.5	3.3	6.9	3.1
Larson NMO-440C, 70cm	1.9	1.8	2	5.1	-0.1
HT whip Antennas:					
Diamond RH951S, 2m/70cm/23cm, BNC	-2.6	-3	0	-2	-6.4
Nagoya NA-771, SMA(f)	-3.2	-4.8	1	-0.7	-3

Comparison to MFGR's SPECS:

Not all antenna manufacture's give very complete specifications. Most are quite vague. Some give gain in dB without specifying if it is dBi or dBd, or what their reference really was. Most all also do not specify gain measurement frequency, nor bandwidth. The following is the data I have gleaned from on-line search of specification sheets for the above antennas.

Diamond X-50NA dual band 2m & 70cm Omni, Gain = 4.5dBi(2m) & 7.2dBi(70cm), 5.6ft., $95 I got similar gain values, but a bit higher. Excellent antenna, useful over whole 420-450 band. This is my preferred antenna for a 70cm ATV base station.

Diamond X-6000 tri band 2m/70cm/23cm Omni, Gain = 6.5dBi(2m) / 9dBi(70cm) / 10dBi(23cm),10.5 ft., $170 I got similar (10.6 vs. 8dBi) at 435, lower at low end of band and higher at top of band. NOT recommended for use below 435MHz. I have included it because it is a useful antenna at 23cm with about +7dBi across entire band [1]. On 70cm, it should only be used for Ch 60 (438-444MHz).

M-Squared 440-6SS 70cm Yagi Gain = 11dBi (420-450MHz), 3 ft., 3 lbs, $95 Excellent match to my measurements of 11dBi over whole band

Diamond NR-2000NA tri band 2m/70cm/23cm Mobile, Gain = 3.7dBi/6.4dBi (which bands ??, assume 2m & 70cm), 39", $85 Tested using Diamond DPK-4NM-N, mobile magnetic mount, N connectors, 13ft. coax with 0.8dB loss. I got good agreement at 443MHz with 6.9dBi vs. 6.4dBi spec. Nominal +3dBi gain over rest of band.

Larsen NMO440C 70cm Mobile whip. 5.6dBi, 430-450MHz, 5/8λ, NMO mount, 31", $25. Tested using Larsen, 3" dia. mobile magnetic mount, NMO connector, 12ft. RG-58 coax with 1.2dB loss. I got good agreement of 5.1dBi vs. 5.6dBi at 443MHz. Decent, low cost, antenna over whole 420-450 band.

Diamond RH951S 2m/70cm HT flexible whip. Gain = +6dB relative to typical stock HT antennas, what band? i.e. no real world spec. given ! ! BNC, 14" flexible whip, $45 I measure roughly -2dBi.

Nagoya NA-771 2m/70cm HT flexible whip. Gain = 2.15dBi 2m/70cm, which band is spec. for ??, 15" flexible whip, SMA, $17 I measure -3 to 0 dBi over band.

REFERENCES:

1. "Antennas for Ham TV", Jim Andrews, KH6HTV Video Application Note, AN-4, Sept. 2011, 3 pages

2. "70cm Antennas for ATV", Jim Andrews, KH6HTV Video Application Note, AN-40, August, 2018, 6 pages,

The above app. notes are available in .pdf format from *www.kh6htv.com*

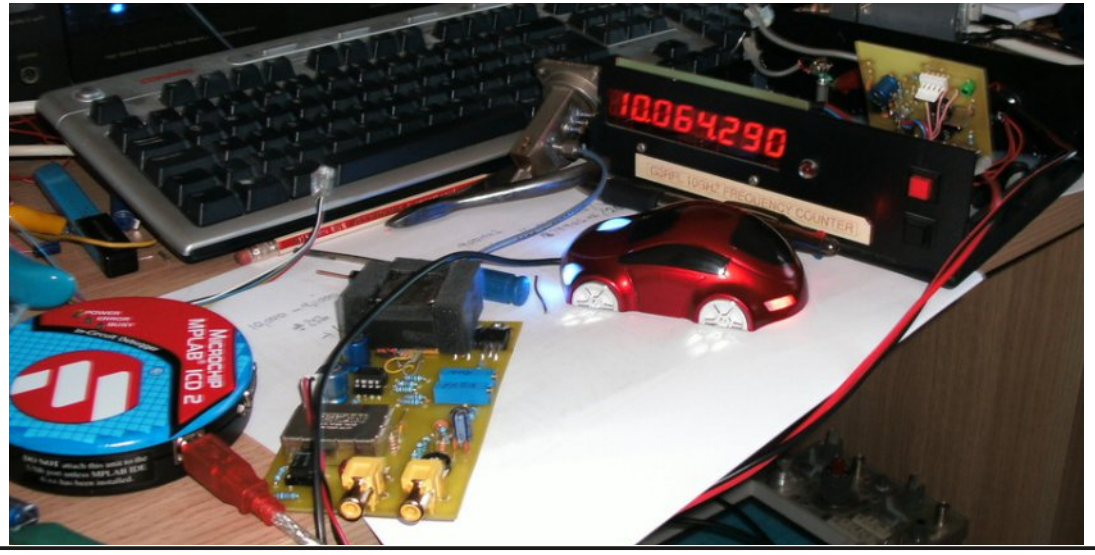
First published in Issue 2

Making a simple Frequency Counter for 10GHz - 3cm

Written by John Hudson G3RFL

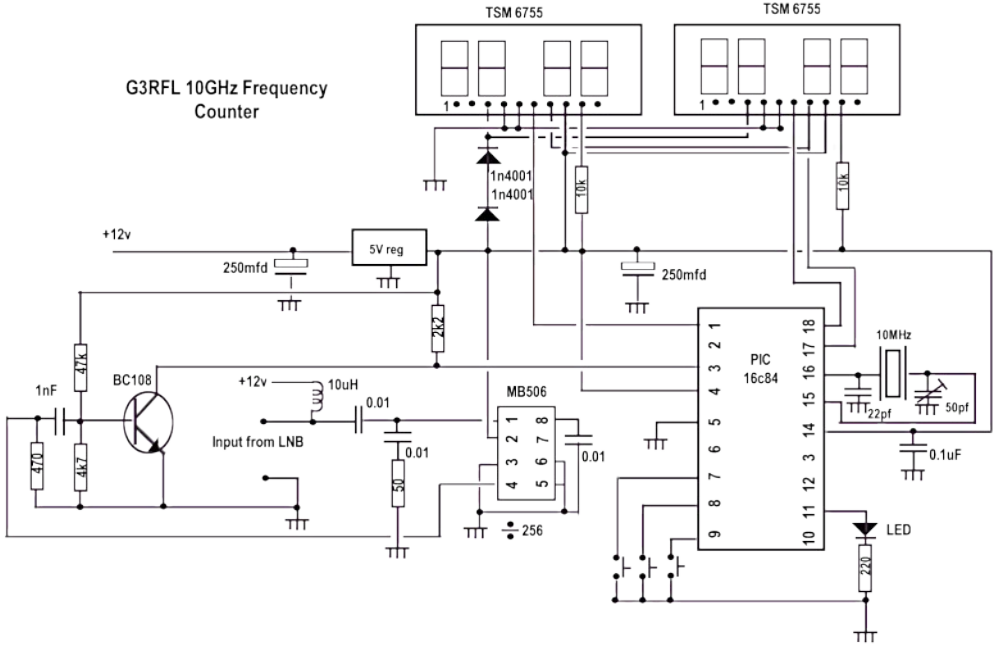
Having built and tested the video transmitter for GB3FY, I needed some way to accurately check its frequency and to monitor its stability, looking around the shack all I had was a simple frequency counter built back in 1997. It was a little limited and would not cover the 10GHz band, but perhaps I could add pre-scaler and extend its range.

Quick look at eBay and I found a plentiful supply of MB 506's, for around £2, which could easily be configured to divide by 256 and be capable of working in the 10GHz band. So I committed myself to a £2 investment and a rebuild for this old unit. I also decided to add an optional phantom power feed so LNB's could be driven directly from the counter. The end design was a very sensitive frequency counter that could be connected to an LNB, and used to receive GB3FY, across the shack.



Setting up GB3R

The frequencies counter displays (TM 6755's are the older displays using LED's yes they are bright, but I am old and this is a definite plus! The circuit revolves around a PIC16F84 with a 10MHz XTAL. This needs calibrating to a known 10MHz source once built, otherwise the accuracy is impaired.
The LNB 900MHz input divided by 256 gives 3.515625MHZ so it's just a pure maths calculation, something that micro processor do well to get to 900MH.



The new three additional push buttons provide a choice of LNB PUCK offsets, Button 1 resets it to no offset button two sequences through software presets and the third button is a spare, you can never have enough buttons. Switching off will NOT reset the offset, it is stored in EEPROM

Other things going on are converting the Counter to Decimal digits adding offset and serially sending up to the two LED displays and adding some decimal points leading zero blanking was added as well.

The rebuild was on a new PCB and for the constructors with home photo etching I have reproduced the single sided PCB foil and component layout, copies of which can be downloaded from *http://cq-datv.mobi/downloads.php*.

It was relatively simple build and could easily be built in a single evening. I omitted the 10uH choke from the PCB as not everyone will want to feed phantom power to an LNB's, this can easily be added, off the PCB

The New Software

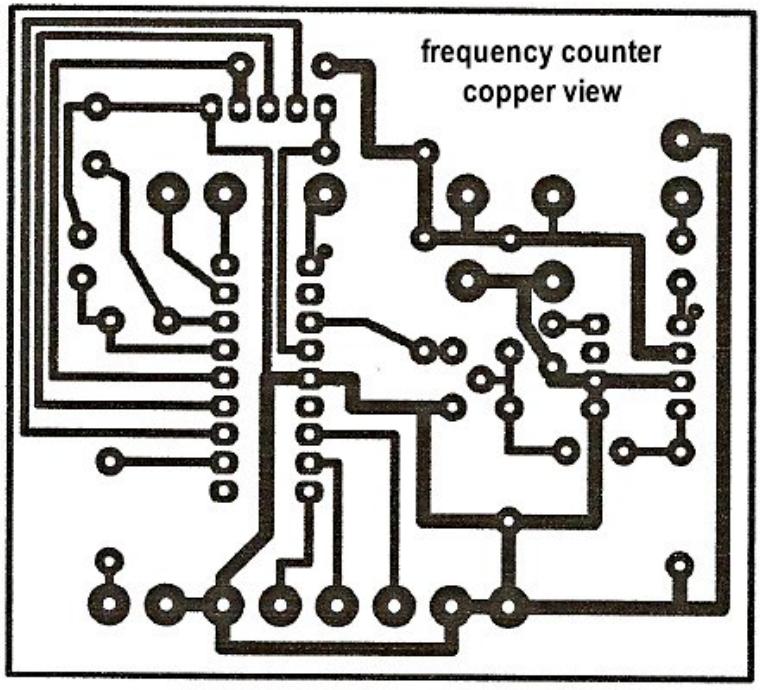
The PIC Software has avoided interrupts and the lower freq goes into TMR0 timer counter with a DIV 4 pre-scaler via PORTA, 4 TOCK1

A background software counter counts for 1 SEC and keeps polling the timer for an overflow situation. This overflow feeds three counters Count0 Count1 and Count2 also the remainder in the TIMER is added. After it has stopped we take all the 24 bits and start to add them up in a 5-byte register starting with bit 0 in freqtab.
- Bit 00 = 0.000,001,024 GHz
- through to
- Bit 23 = 8.589,934,592 GHz
- Then add the offset, in this case 9.1GHz

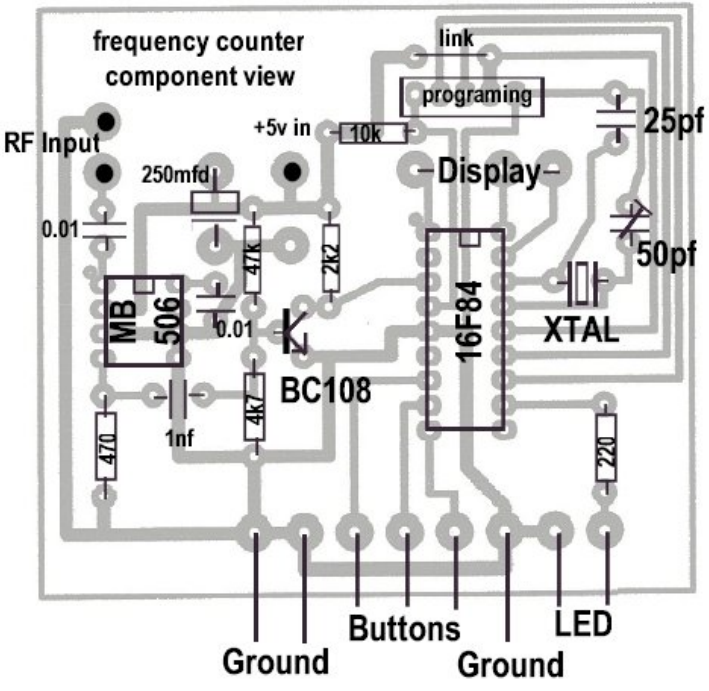
Software is called picfreq3.asm run it under MPLAB to produce HEX code.

This software (picfreq3.asm) is downloadable from the eBook site *https://cq-datv.mobi/downloads.php* so for those of you with an understanding of PIC code the hardware can be customised to your own requirements.

Cheers - Have fun, I did!
John G3RFL Cleveleys



Above: PCB foil layout Below: Component Layout



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

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

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

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