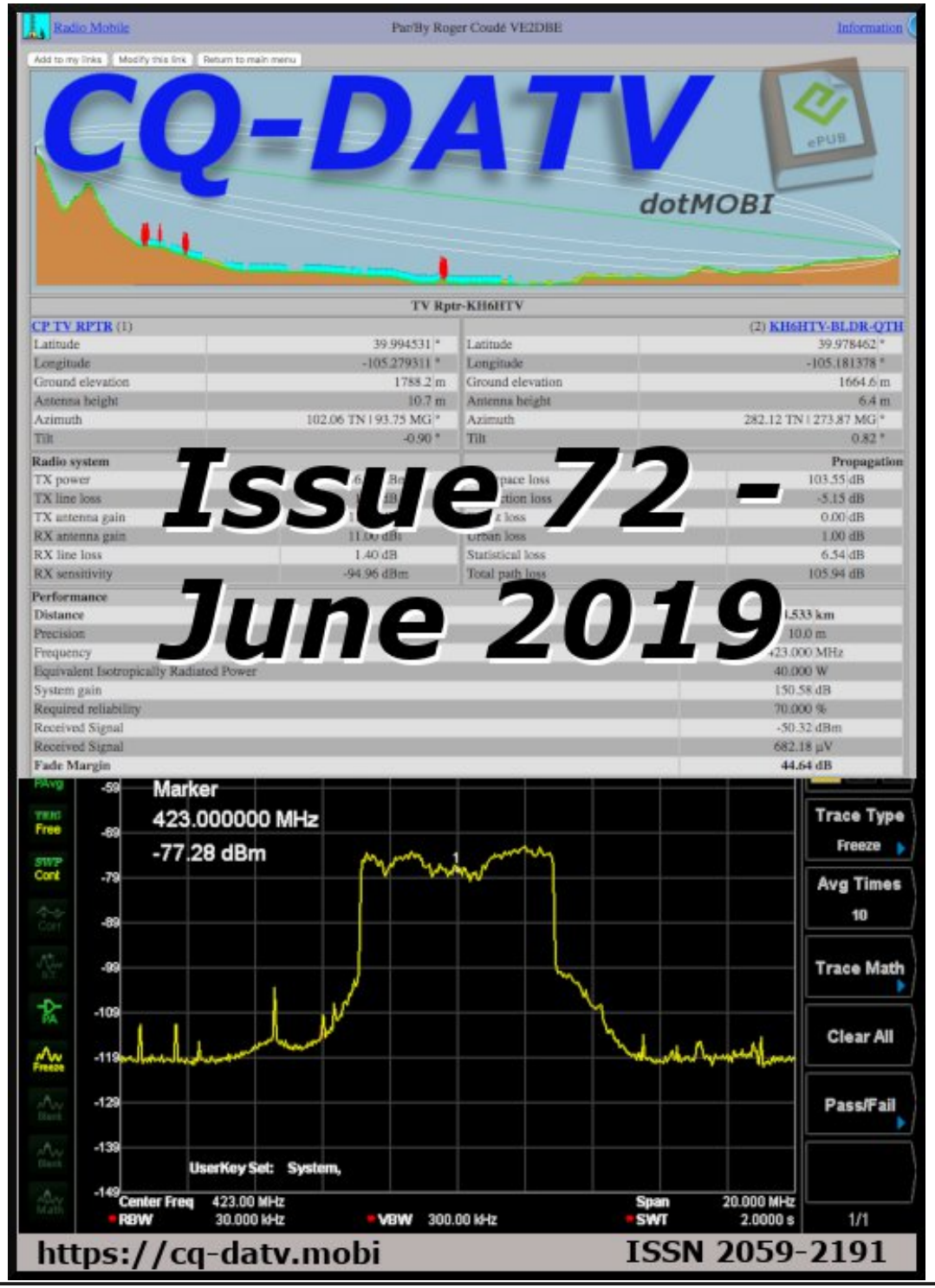

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The CQ-DATV editors gratefully acknowledge all those authors that have contributed articles for this free magazine.

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Editorial

Welcome to issue 72 of our electronic ATV magazine.
Can I start by reminding everyone that the annual IARU Region 1 International Amateur TV Contest will be held from 1300 BST on Saturday 8 June until 1900 BST on Sunday 9 June. ATV contacts on all amateur bands above 432 MHz are valid.

In this issue Jim Andrews, KH6HTV has added part 3 of using Radio Mobile for rf path predictions. In this final part Jim will discuss using a free, on-line, computer program to compute point-To-point rf path predictions.

Mijo Kovačevič, S51KQ has been looking at the Adoption of narrowband DVB-S and S2 signals software. It probably goes without saying that a fast computer is required. At least a 4-core processor running 64-bit Windows, but it does not stop there. Mijo goes on to explain that you should be careful not to install the drivers and programs that came with the SDR on the CD! If they are already installed, they must be uninstalled and removed from the system. Mijo has lots more advice and download links for the necessary software for DVB-S and S2

Trevor G8CJS is still working on his GVG mixer panel and this time its a look at how the button can be decoded. Since Trevor started this project four of these panels have changed hands on e-bay and that's just in the UK, so if you are one of the owners then please let Trevor know by emailing the *editor@cq-datv.mobi*. We are now in possession of a limited number of PCB's for this conversion dongle and are looking for other readers to try out some of the software and hardware associated with this project.

It would seem we can't get through an issue, and why would we want to, without mentioning Es'hail-2 / QO-100.

It seems to have captured everyone's imagination with lots of you reporting activity and many more of you building the necessary equipment to operate through this exciting new satellite. Well in this issue Mike Willis GØMJW, Remco den Besten PA3FYM, Paul Marsh MØEYT have come up with some easy to build 2.4 and 10 GHz dish feed using commonly available materials. The feed consists of a LHCP patch antenna for 2.4GHz and a waveguide feed for 10GHz, to be placed in the focal point of commonly available cheap units for offset satellite TV dishes.

One from the vault looks back at balloon-powered Internet access. The Internet is one of the most trans-formative technologies of our lifetime. But for 2 out of every 3 people on earth, a fast, affordable Internet connection is still out of reach. Solving these problems isn't simply a question of time, it requires looking at the problem of access from new angles. So we are looking back at project moonshot from Google[x] for balloon-powered Internet access. This first appeared in CQ-DATV issue 4 and if you missed it then we have reproduced it here. The CQ-DATV library has every issue of CQ-DATV and many ATV handbooks that are now out of print so well worth a visit *https://www.cq-datv.mobi/ebooks.php*

CQ-DATV also operates a Facebook site *https://www.facebook.com/groups/285807174898375/* if you are interested in what is happening between issues and would also like to be informed when every new issue is available for down loading, then please come along and sign up. But please be aware of the privacy concerns when using a site like Facebook, so do so at your own risk!

So lots for you to read.

And as we always say, sit back and enjoy CQ-DATV issue 72
CQ-DATV Production team

W6ATN – Mobile Electronic News Gathering Van *(Reprinted from ATN spring 2019 newsletter)*

The ATN group in southern California now have their own ATV-ENG van. Thanks to Frank, N7ZEV for arranging the donation of the truck by the Red Rock search & rescue.

The equipment bays were filled mostly with equipment donated by Roland, KC6JPG, Gary, W6KVC, and Mike, WA6SV. The three of them also put in a lot of hours of work bringing the truck back to good working order.

The next task it to add a mast - mounted 2.4GHz amplifier and give the truck a custom paint job.

The truck is capable of transmitting 2.4 GHz FM, 434 MHz

DVB-T digital, and receive in the 1.2 and 5.8 GHz bands. 2019 plans are to outfit the truck to receive IP-video via the MESH and the internet to connect with other ATV systems around the world.

ATN, the Amateur Television Network, (*http://atn-tv.org/*) is trying to recruit other ATV groups to join them as affiliated ATN Chapters. The Dayton, Ohio and Panama City, Florida clubs are affiliated with ATN of California, Nevada & Arizona.

DATV Talk at DAYTON

Mel Whitten, K0PFX, of St. Louis, MO, gave a talk on DATV at this year's ARRL - Dayton Hamvention. He has generously offered to share with others his power-point slide show, complete with embedded videos. It is a large (275 MB) .pptx file and available from his dropbox.

https://www.dropbox.com/s/xmy4hrs8qm3gjsz/K0PFX%20DATV%20Dayton%20May%202019.pptx?dl=0

Mel is the Guru behind the St. Louis DATV repeater, WD0FCH. 440 MHz in / 426 MHz out, with 4 MHz band-width, DVB-T.

Mel purchased Don's, NOYE, inter-digital, band- pass filters for use in their repeater.

Mel has also given other talks about DVB-T at other hamventions and on ham radio webcasts. Mel can be reached at k0pfx@arrl.net

His web site is: *www.melwhitten.com*

IARU Region 1 ATV Contest 8/9 June 2019

Written by Dave G8GKQ, IARU Region 1 ATV Contest Coordinator

The annual IARU Region 1 International Amateur TV Contest will be held from 1300 BST on Saturday 8 June until 1900 BST on Sunday 9 June. ATV contacts on all amateur bands above 432 MHz are valid. In parallel, the BATC will be running a UK-only contest, with the same basic rules, on the 71 and 146 MHz bands. You don't have be on the air throughout the contest – single-contact entries are welcomed!

To participate in the contest, ATV stations simply need to exchange a 4-number code by video and then exchange reports and locators by voice. Logs should be submitted to the BATC at *contests@batc.tv* who will compile the National rankings and then pass the logs on for the international rankings. Logs need to be submitted before Monday 24 June.

International Certificates will be awarded to the highest scoring station overall and the highest scoring station in each band. The IARU Certificates will be presented at HamRadio 2020 in Friedrichshafen, or forwarded to contestants who can't get there.

Different 4-number codes should be used for each band. If a station changes location he should restart his serial numbers from 1, and change all his codes; if he works a station that he worked from his previous location, he should ask them to send a different code as well. A separate set of logs should be submitted for each new location.

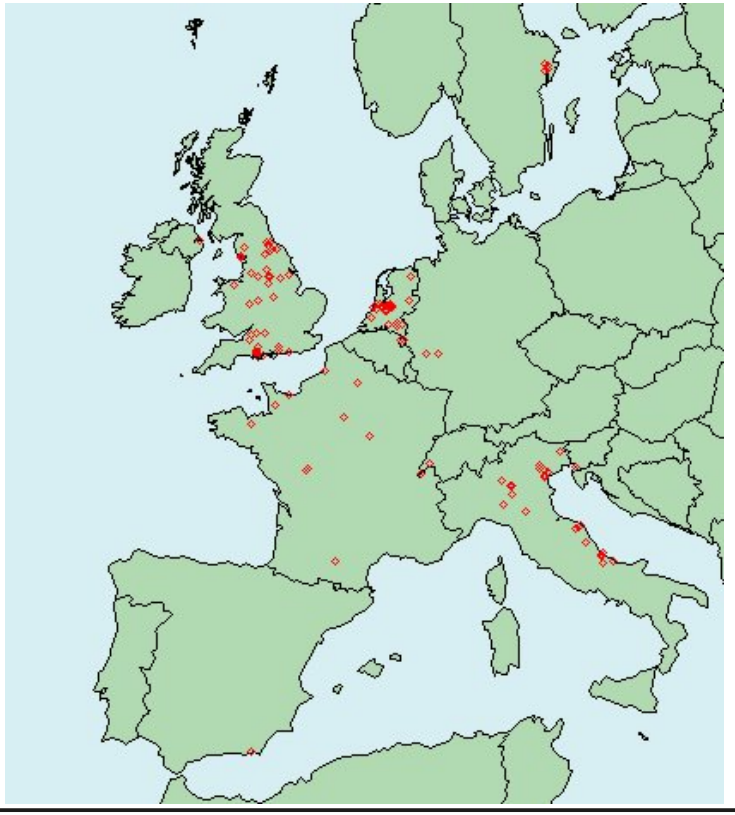
Logs should be submitted using the Excel template that can be found here *https://www.iaru-r1.org/images/VHF/atv/ATV-contest-log-callsign-20190608.xls*. If you have problems with Excel, simply submit all the information by e-mail – we will not exclude anyone from the contest just because they can't do Excel!

The Contest rules are here:
https://www.iaru-r1.org/images/VHF/atv/ATV_rules.pdf

Details of planned activity can be found on the BATC Forum here:
https://forum.batc.org.uk/viewtopic.php?f=75&t=6100

and more detail on how to participate can be found here:
https://wiki.batc.org.uk/IARU_ATV_contest

Remember – it's not the winning that matters – it's the taking part. 100 participants did last year, as shown on the map – please don't miss out!



TV Propagation - Part 3 (using Radio Mobile to create rf coverage maps)

Written by Jim Andrews, KH6HTV *www.kh6htv.com*

In part 1 of this CQ-DATV series on TV propagation, I disussed the basic equations used to predict rf path loss. In part 2, I discussed computer programs which allow us to easily compute the anticipated path loss for a particular, real world path and showed how to create an rf coverage map. In this final part 3, I will discuss using the free, on-line, computer program, Radio Mobile, [1] to compute Point-To-Point rf path predictions.

This series of papers is based upon my application note, AN-33a [2].

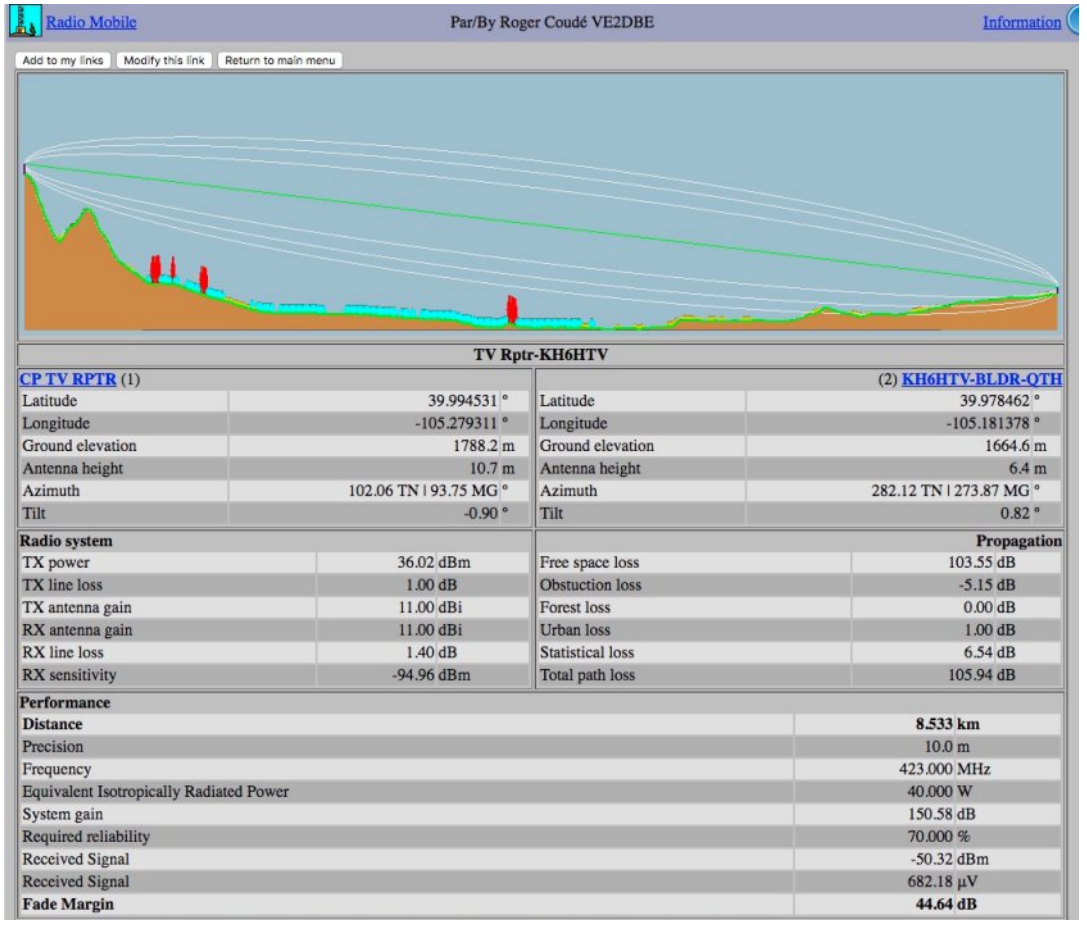
Point - to - Point Path Profile:

In addition to rf coverage maps, Radio Mobile can also generate a single point-to-point profile and display the actual path, along with a tabulation of the results. The transmitter and receiver locations are spotted precisely using an interactive Google Earth map or aerial photo in which the map location and magnification are controlled by the computer mouse.

When the cursor is located at precisely the correct latitude and longitude, the mouse is clicked and the location stored in memory. Figs. 1 & 3-7 show some typical examples calculated for the Boulder TV repeater (from it's old 2016 location) to various ham's locations.

They demonstrate a wide variety of propagation conditions.

The first test run to verify the accuracy of the Radio Mobile program was to calculate the signal strength received from



TV Rptr-KH6HTV

CP TV RPTR (1)		(2) KH6HTV-BLDR-QTH	
Latitude	39.994531 °	Latitude	39.978462 °
Longitude	-105.279311 °	Longitude	-105.181378 °
Ground elevation	1788.2 m	Ground elevation	1664.6 m
Antenna height	10.7 m	Antenna height	6.4 m
Azimuth	102.06 TN | 93.75 MG °	Azimuth	282.12 TN | 273.87 MG °
Tilt	-0.90 °	Tilt	0.82 °

Radio system		Propagation	
TX power	36.02 dBm	Free space loss	103.55 dB
TX line loss	1.00 dB	Obstuction loss	-5.15 dB
TX antenna gain	11.00 dBi	Forest loss	0.00 dB
RX antenna gain	11.00 dBi	Urban loss	1.00 dB
RX line loss	1.40 dB	Statistical loss	6.54 dB
RX sensitivity	-94.96 dBm	Total path loss	105.94 dB

Performance	
Distance	**8.533 km**
Precision	10.0 m
Frequency	423.000 MHz
Equivalent Isotropically Radiated Power	40.000 W
System gain	150.58 dB
Required reliability	70.000 %
Received Signal	-50.32 dBm
Received Signal	682.18 µV
Fade Margin	**44.64 dB**

Fig. 1 Radio Mobile - Path Profile prediction for TV Repeater to KH6HTV-QTH. Direct line-of-sight, 5.3 mile path between transmitter and receiver. The transmitter is always plotted on the left and the receiver is always plotted on the right side. The green trace is the direct ray. Note: 1st, 2ed & 3ed Fresnel zone ellipsoids (white lines) and intermediate path obstructions are also shown

the Boulder TV repeater at my own QTH which was 5.3 miles distant. I input my particular receive antenna parameters into the p-t-p program along with the repeater parameters and the computed results are shown in Fig. 1.

I use a KLM, 70cm, 6 element yaggi (11dBi) at 25ft.(6.4m) with 47ft. of 3/8" hardline coax (1.4dB loss). I have a good line-of-sight path to the repeater, as verified by Radio Mobile. I can visually see the repeater's tower. Fig. 1 is the printout from Radio Mobile and plots both the intermediate terrain and obstacles, and also gives a table listing all the input data, plus the results of various computations.

The DVB-T - QPSK, DTV signal from the TV repeater received in the KH6HTV ham shack was received with a low noise preamp (18.5dB gain, < 1dB NF), 4:1 splitter (-7dB loss) and a Hi-Des model HV-120A DVB-T receiver and also simultaneously a Rigol DSA-815 Spectrum Analyzer. The on-screen-display (OSD) of the HV-120A measured (with suitable offset, correction factor of -14dB) the input signal strength to be -40dBm.

The OSD also showed a perfect s/n of 23dB. Correcting for the preamp/splitter gain, the actual measured input power was thus -51.5dBm. This compares very favorably, within about 1dB, with the -50.3dBm predicted by Radio Mobile, see Fig. 1.

As further verification, the incoming repeater DVB-T signal was also displayed and measured on the Rigol DSA-815, see Fig. 2 below. The analyzer settings were as recommended by the EU-ITU [3]. Due to the wideband (6 MHz BW) nature of the DVB-T signal and the narrow resolution bandwidth of the analyzer (30 kHz), a correction factor of +22dB must be applied to the signal levels displayed.

The actual received signal does not have the flat spectrum of the transmitter, but instead shows evidence of some multi-path distortion. The highest level seen is about -75dBm. With the correction factor of +22dB, the received signal level is thus about -53dBm which is still in excellent agreement with both the HV-120A measurement (-51.5dBm) and the Radio Mobile prediction (-50.3dBm).

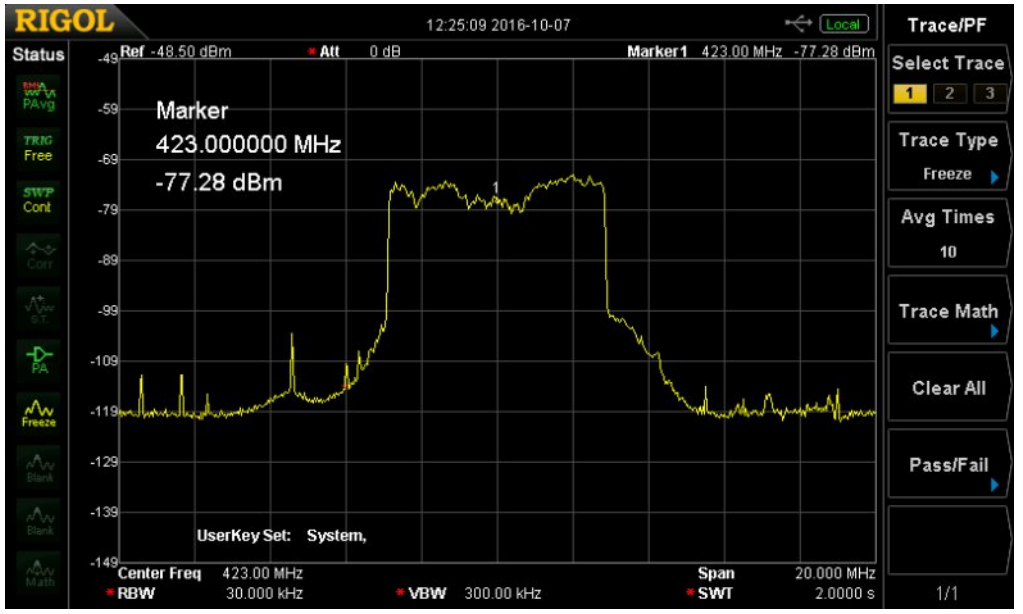


Fig. 2 TV Repeater signal received at KH6HTV QTH as displayed on the Rigol DSA-815 spectrum analyzer. Spikes seen outside the 6 MHz channel (420-426MHz) are other narrow-band signals. Non-flat spectrum is due to some multi-path distortion

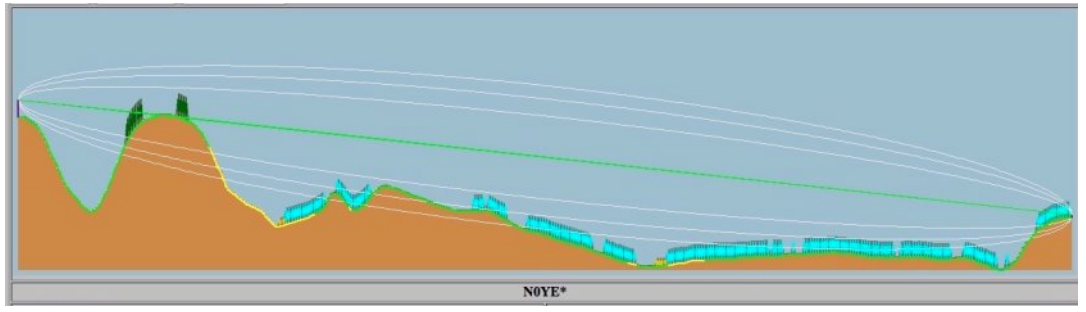


Fig. 3 TV repeater to N0YE — this is an example of the direct, 2.3 mile path making a grazing pass over an intermediate obstruction. Also note the presence of forested areas on this ridge line (dark green trees). Also noted is urban clutter represented by the small turquoise colored cubes down in the valley and also at the receive site. Pr = -70.7dBm (calculated) & -70dBm (measured). +0.7dB difference

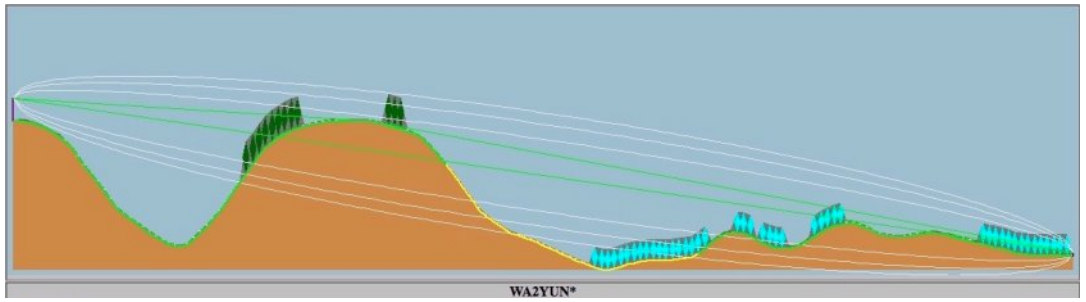


Fig. 4 TV repeater to WA2YUN – this is an example of an obstructed, short, 1 mile path in which a signal can still be received via diffraction. Pr = -85.9dBm (predicted) & -81dBm (measured) +4.9dB difference

Fig. 5 TV repeater to K0HEH – this is an example of the direct, 1.6 mile path being obstructed by tall buildings on the University of Colorado campus. They are indicated by the bright red structures. In this case reception was possible due to diffraction in the first Fresnel zone. Pr = -53.7dBm (predicted)

FIELD SURVEY

In Sept, 2016, a mobile field survey was performed to verify the coverage area of the new Boulder, CO, DVB-T repeater [4]. Field strength data was recorded at over 150 different locations. The farthest distance tested was out to 35 miles from the TV repeater. Data was recorded for both "in motion" and "fixed" locations. At fixed locations, the actual OSD values for dBm and s/n were recorded along with GPS latitude and longitude.

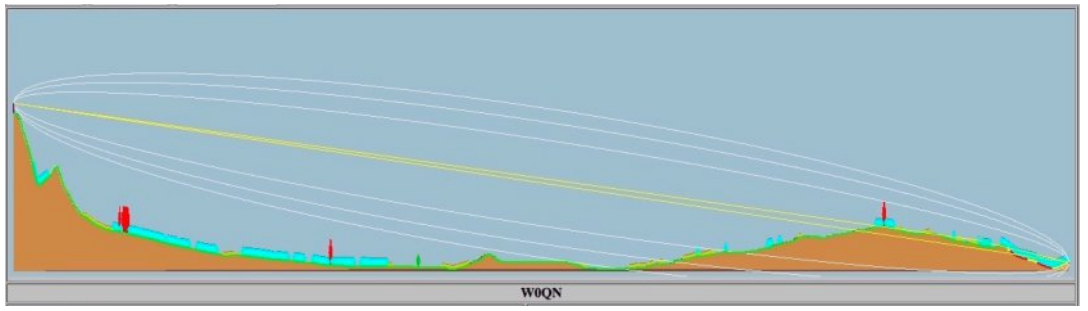


Fig. 6 TV repeater to W0QN – this is an example of an obstructed, 8.2 mile path in which the received signal is within ±3dB of receiver sensitivity threshold. This is indicated by the direct rays being plotted in yellow. Pr = -89.3dBm (predicted) & -92dBm (measured) -2.7dB difference

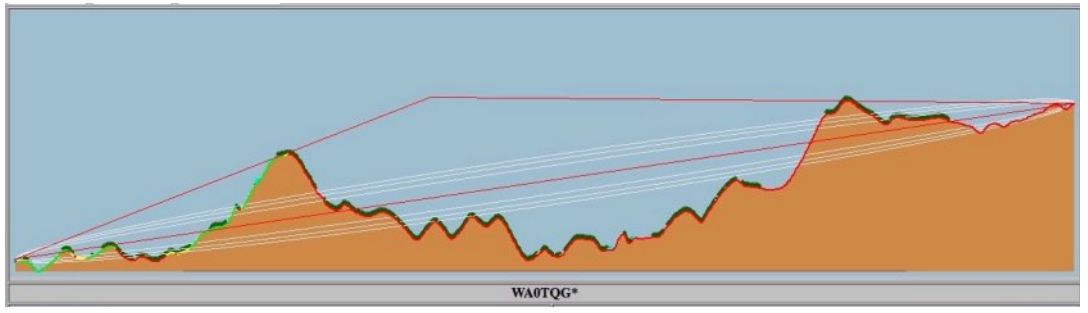


Fig. 7 TV repeater to WA0TQG – This is an example of an impossible, 6.2 mile path over tall mountains. Transmitter on left at 5,900ft. Receiver on right at 7,400ft. When the direct rays are plotted in red, it indicates the signal strength is below threshold by more than -3dB. Pr = -130dBm (predicted)

For the in-motion situation, the nominal value and the max./min. values in the OSD were noted while driving in particular areas. The coverage area of the repeater is the city of Boulder and the eastern half of Boulder County with predominantly prairie land with rolling hills. Due to the transmitter location, it's signal does not penetrate into the mountains in the western half of the county.

While driving through relatively flat, rural areas without a lot of trees, the signal level was fairly steady. In urban environments with lots of houses and trees, signal variations of up to ± 10dB were very commonly encountered within a relatively short distance.

While driving, the vehicle sometimes reached speeds up to 65mph. In strong signal areas, no dropouts were observed even at high speeds. In no case was a signal weaker than -92dBm ever able to produce a picture. This was 7dB worse than the sensitivity of the receiver measured in a perfect signal (i.e. no multi-path), lab environment.

The extensive field survey data has been carefully analyzed. The first analysis was to determine the excess loss over that predicted by the free space path loss equation. The second analysis was to compare the received signal strength (in dBm) predicted by Radio Mobile vs. the actual measurement. The data was broken into three distinct groups. The first was for true Line-of-Sight paths. The second was for Rural (prairie) areas. The third was for Urban (Boulder, Colorado) areas. The results are summarized below:

Excess Path Loss

1. *For locations with true Line-of-Sight paths, the excess loss mean was -7.9dB with a standard deviation (σ) of 4.5dB for 13 observations. Worst case was -16dB, Best was +4dB (meaning 4dB higher enhancement than predicted for free space propagation)*

2. *For Rural (prairie) Areas the excess loss mean was -13.9 dB with a σ of 7.8dB for 47 observations. Worst case was -29dB, Best was +4dB.*

3. *For the Urban (Boulder) Area, the excess loss was 21.8dB with a σ of 10.7dB for 37 observations. Worst case was -39dB, Best was +2dB.*

Radio Mobile

Predictions vs. Measurements [difference in Prcvr (measured) - Prcvr (predicted)]

1. *For locations with true Line-of-Sight paths, the mean difference was +8dB with a standard deviation (σ) of 5.7dB for 13 observations. The extremes were -3.4dB and +17.5dB i.e. Radio Mobile was pessimistic by about -8dB for true line of sight paths.*

2. *For Rural (prairie) Areas the mean difference was +4.8 dB with a σ of 7.3dB for 43 observations. The extremes were -14.5dB and +17.5dB. i.e. Radio Mobile was pessimistic by about -5dB for rural environments. For the Urban (Boulder) Area, the mean difference was -6.4dB with a σ of 9.9dB for 37 observations. The extremes were -21dB and +14dB. i.e. Radio Mobile was optimistic by about 6dB for urban environments.*

Conclusion

Radio Mobile can give you valuable insight into the various obstructions in a particular rf path. However, it is a statistical estimate of path loss and not an absolute answer.

References

1. *Radio Mobile - Online, Rodger Coudé, VE2DBE. http://www.ve2dbe.com/*

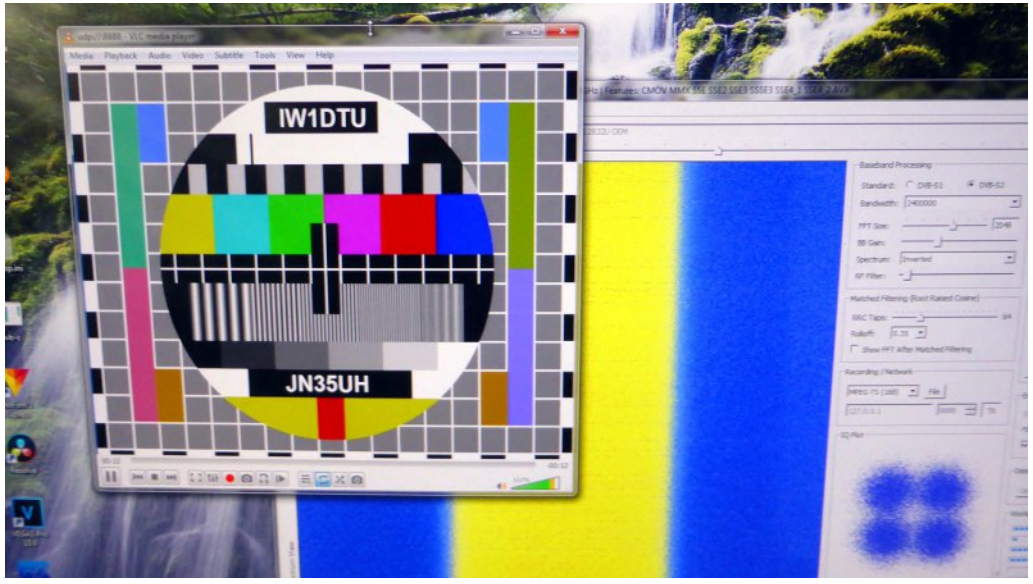
2. *"TV Propagation", Jim Andrews, KH6HTV Video Application Note, AN-33a, Oct. 2016, 12 pages*

3. *"Digital Video and Audio Broadcasting Technology", W. Fischer, Springer, London-New York, 3ed edition, 2010 – see chapter 21.2 "Measuring DVB-T Signals Using a Spectrum Analyzer", pp. 425-428.*

4. *"Boulder, CO - DTV/ATV Repeater Coverage", Jim Andrews, KH6HTV Video Application Note, AN-32, Sept., 2016, 10 pages*

Adoption of narrowband DVB-S and S2 signals software

Written by Mijo Kovačevič, S51KQ



Equipment

- *sufficiently fast PC computer, 64 bit Win7 or Win10 installed*
- *SDR key RTL238 compatible*
- *PLL LNB, processed or original*
- *SAT breaker for LNB power supply*

Software

- *dvb-s_gui_amsat http://v.1337team.tk/dvb-s_gui_amsat.zip*
- *VLC media player https://www.videolan.org/vlc/download-windows.html*
- *Zadig and SDR Drivers https://www.rtl-sdr.com/rtl-sdr-quick-start-guide/*

Installation procedure

A faster computer is required, at least a 4-core 64-bit Window processor is recommended. To use the SDR key, it is necessary to install Zadig and SDR drivers (instructions on the link). However, you should be careful not to install the drivers and programs that came with the SDR on the CD! If they are already installed, they must be previously uninstalled and removed from the system.

Whether Zadig and RTL SDR drivers were correctly installed - or the system recognizes the RTL SDR key, we can test it with the SDR-sharp program. The program is now supported by LimeSDR.

We now install the main program dvb-s_gui_amsat. The program will automatically recognize the attached SDR key and use the "open device" key to start receiving.

Using dvb-s_gui_amsat

By clicking on the spectrum view or by moving the frequency, the DVB-S signal is set so that it is in the FFT center of the display.

- *set SR to be as accurate as possible*
- *you can change Timing Recovery Loop Gain and Dumping until you see a circle in IQ knstation window.*
- *set the appropriate intensification of the inter-frequency, not too high! with Baseband-Gain slider*
- *Enable Carrier recovery coarse (fine - not in use). You can change the loop gain to boundaries when the QPSK constellation begins to degrade. Better results should be lower reinforcement. Loop Dumping is also more useful with lower value.*
- *in the Error correction window, set the correct FEC and rotate the constellation until it is synchronized*

- *the counter does not start the growth counter.*

Help

To receive low SRs in the Time Recovery: Gardner filter window instead of Mueller and Mueller ted (WB).
For SR under 500 hp, then (333, 250, 125, 66) changes the samplers from 240000 to 960000.

Video old versions of the program
https://www.youtube.com/watch?v=zW7RBvFgfc0
https://www.youtube.com/watch?v=buDBgbPNAZk

The program does not allow viewing directly, for this purpose we need to install the latest version of the VLC player. Let's start VLC and under the Open Network Stream we enter the address: **udp://@:8888**

The program is still quite complicated to use, but it allows for the deafness of RTL-SDR keys, an easy way to receive narrowband DVB-S and S2 signals.

Simple dual band dish feed for Es'hail-2 / QO-100

Written by Mike Willis GØMJW, Remco den Besten PA3FYM, Paul Marsh MØEYT

Reprinted from DKARS magazine, April 2019 by kind permission

Abstract

An easy to build 2.4 and 10 GHz dish feed, using commonly available materials, for Es'hail-2 / QO-100 deployment is presented.

The feed consists of a LHCP patch antenna for 2.4GHz and a waveguide feed for 10 GHz, to be placed in the focal point of commonly available and cheap offset satellite TV dishes with f/D's of around 0.6.
Design

The 2.4 - 10 GHz dual band feed was designed and modelled with CST Studio (student edition) and comprises of a LHCP patch feed with a circular waveguide passing through it.

Because the (free) student version of CST Suite has limitations there initially was some concern if the modelled results could be realised in practice. Modelling and optimising the patch feed meant adjusting the patch size, patch spacing, cut-out size and feed point location.

All variables were iterated towards the final dimensions to let the patch generate LHCP and a sufficient match to Z = 50Ω resistive at 2400MHz.

Figure 1 depicts the final impedance response (red line) on a Smith Chart.

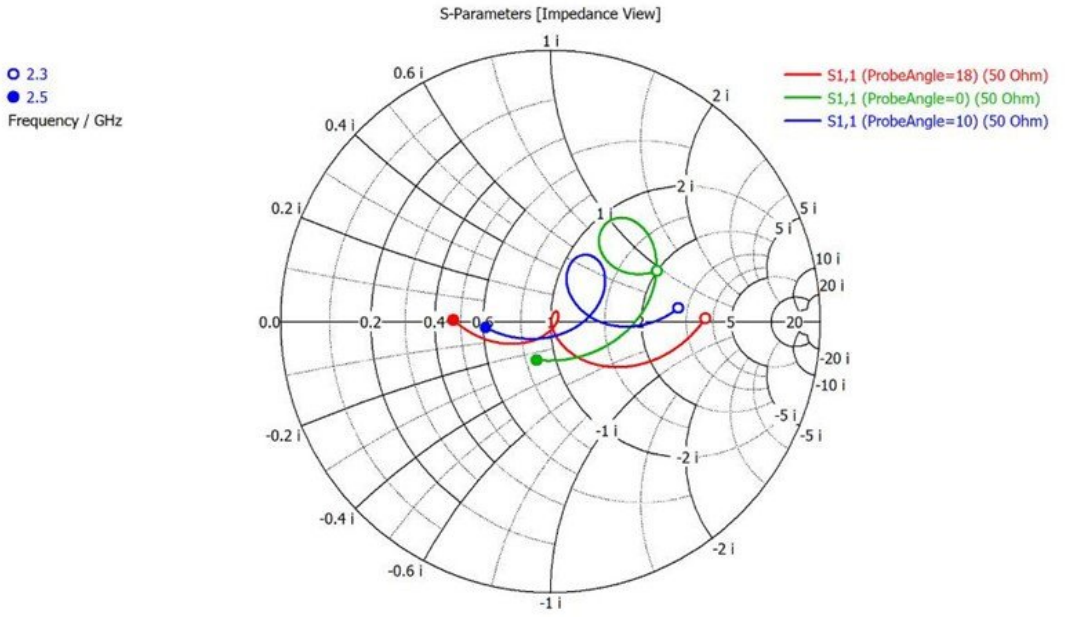


Figure 1 - Smith chart of various feed point positions

Getting good LHCP depends on two resonances being properly set up through the geometry of the patch.
The patch may be considered as two antennas having resonant frequencies lagging and heading 45° in phase to produce the desired 90° phase difference at the design frequency (2400 MHz).

Dimensions

Figure 2 displays the dimensions of the dual band feed. It contains a 105 mm diameter circular reflector but a square reflector with cropped edges (25mm) is also suitable.

The patch itself is square with two opposite corners cropped. Material is ca. 1mm thick copper or brass plate.

The waveguide is made from standard copper 'plumbing' tube (22 OD / 20 mm ID), ca. 120mm long and protrudes ca. 5mm above the patch surface.

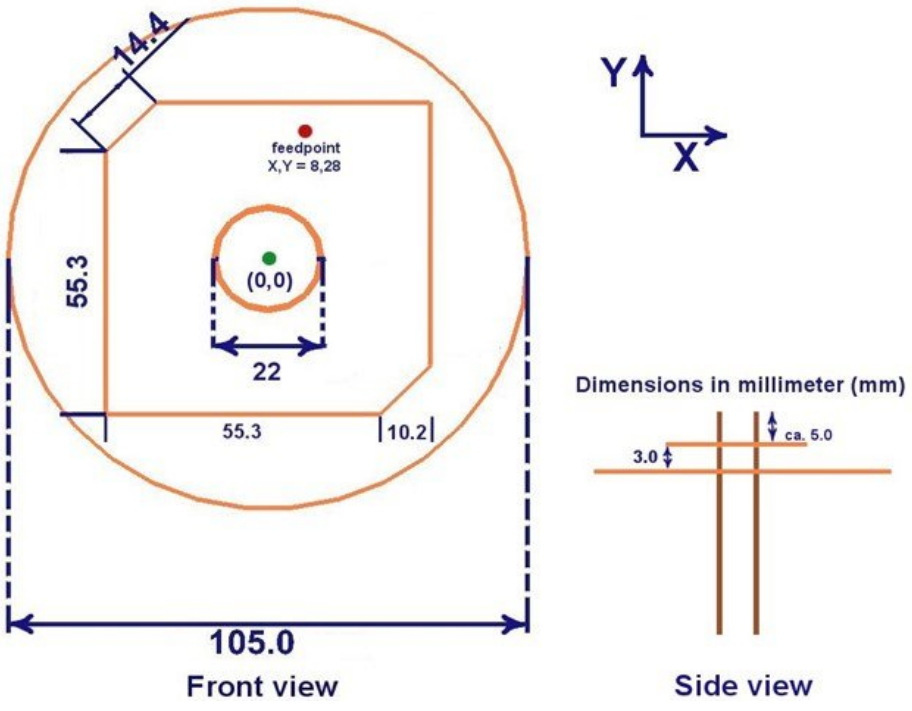


Figure 2 - Dimensions of the 2.4 – 10 GHz dual band feed. The patch is spaced 3mm from the reflector

The centre (green dot) of the construction is marked as (X=0,Y=0) and the feed point position (red dot) is at (X=8mm, Y=28mm), thus 8mm right and 28mm above the centre.

Construction

Cut the material according to the dimensions given in Figure 2.

Drill or punch 22mm holes in the respective centres of the plates.

Cut the waveguide with a pipe cutter and deburr the ends.

Position the plates onto the waveguide so that they are centred.

Drill a 1 mm diameter hole through both plates at the feed point position (X=8mm, Y=28mm).

Mark out, drill and tap the mounting holes for your chosen connector on the reflector

Prior to soldering, degrease all parts with hot soapy water and clean with Scotchbrite or wire wool to ensure the surface will solder perfectly.

First solder the reflector on the waveguide, see Figure 3.

Keep the plate aligned at 90° to the 22mm tube at the right place (e.g. with an olive or clamp ring underneath), hold the assembly in a vice, taking care not to crush the copper tubing and ensure 9 - 10mm of 22mm tube is protruding above the reflector. Don't use excessive solder. Flux paste will aid the process.

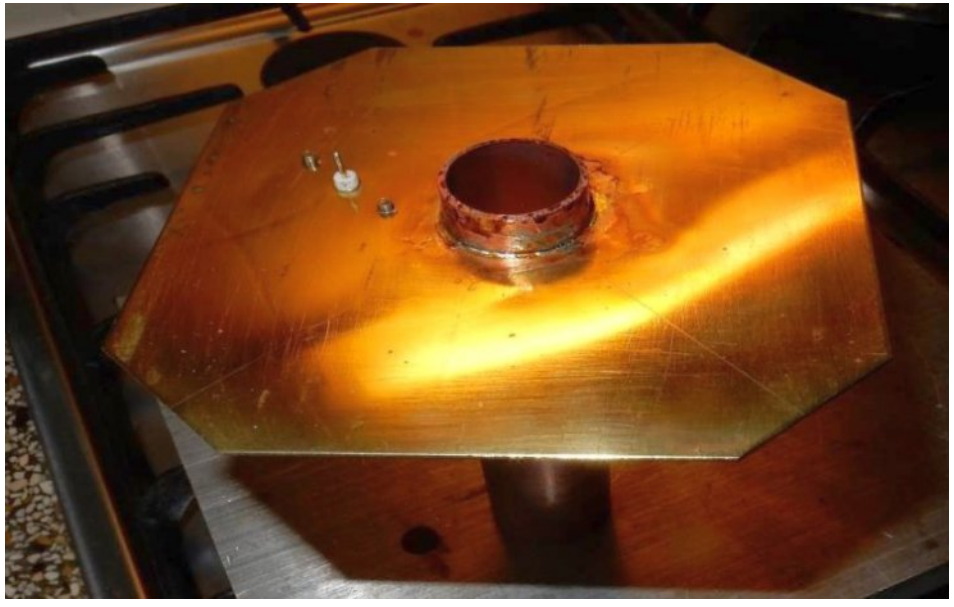
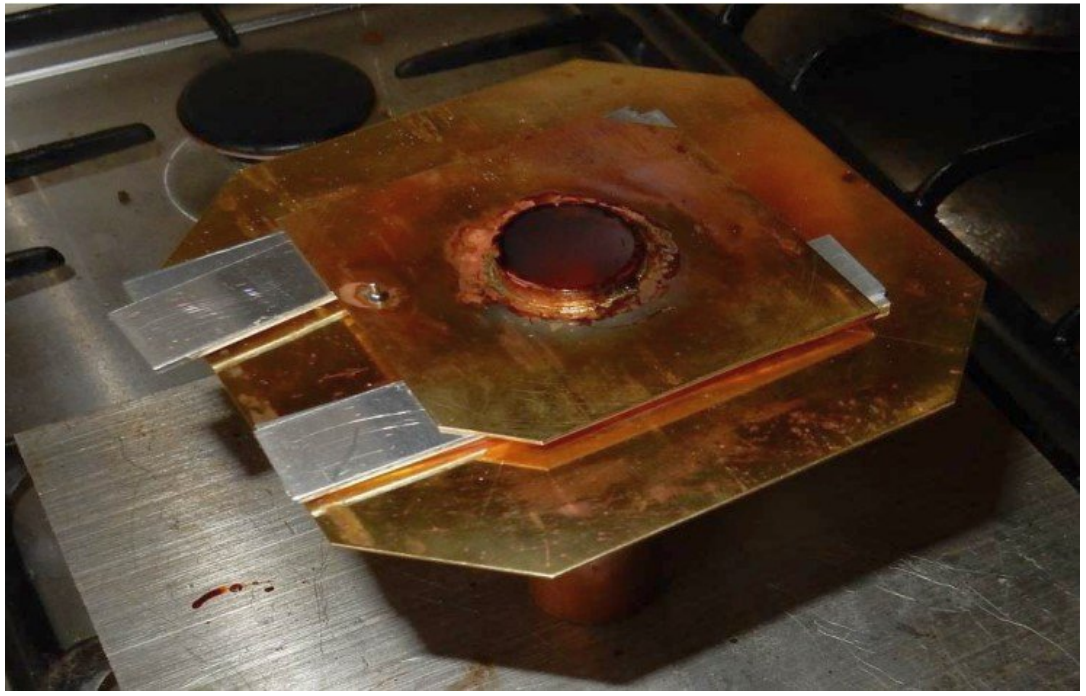


Figure 3 - Reflector soldered on the waveguide



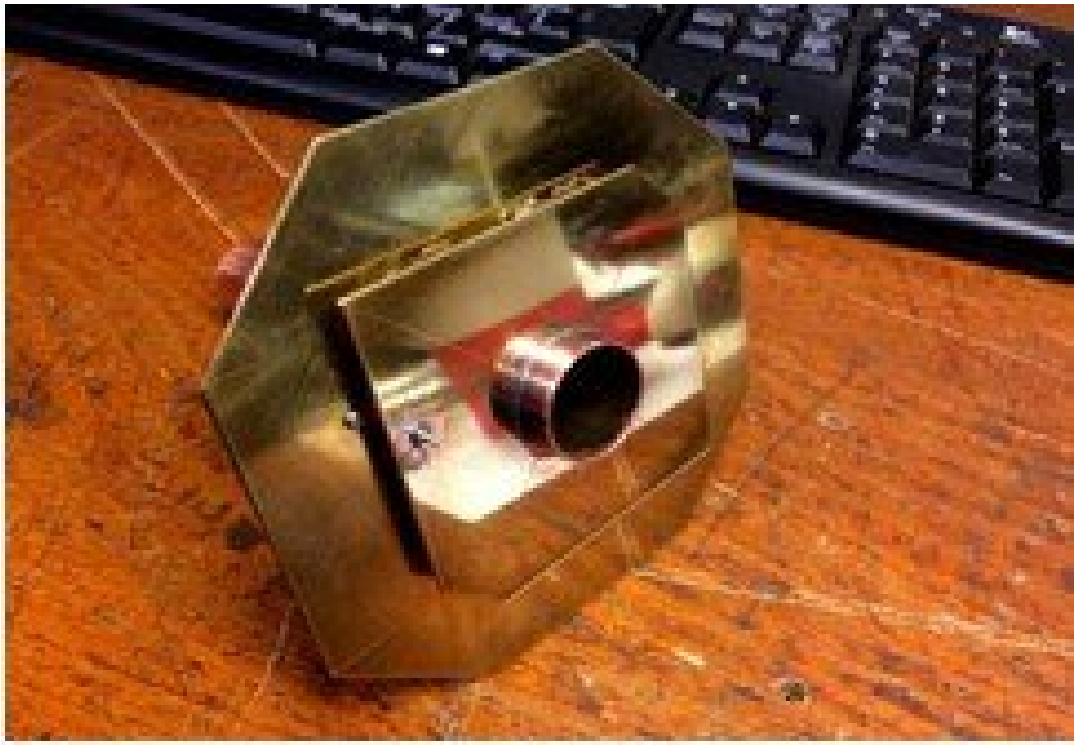


Figure 4 - Soldering the patch using 2 x 1.5mm thick aluminium plates as spacers

Next, attach the feed connector. Connector mounting screws should not protrude above the reflector surface or they will act as unwanted tuning screws. If they protrude, grind them down or they will affect the matching of the patch.

Finally, press the patch itself around the waveguide and use 3mm thick metal spacers to solder the patch and feed point, see Figure 4. It is important to get the spacing accurate. Aim for 3.0mm, not "about 3mm".

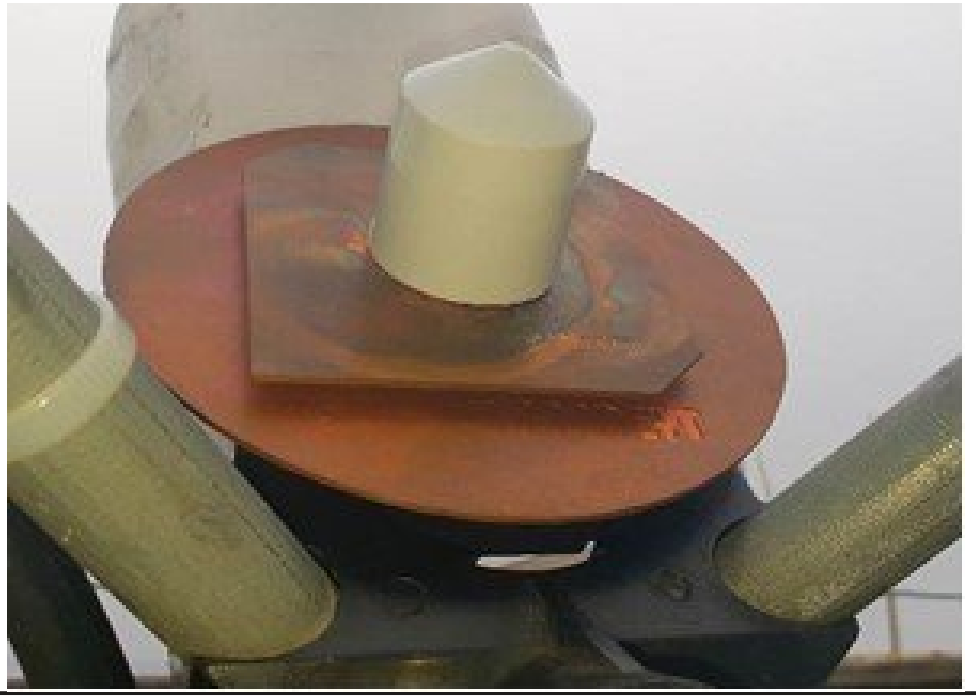
Clean and deflux the feed and your result should look like the following examples.

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

PE9RX

Above: GI7UGV Below: PE1CMO

Above: PA3FYM Below: MØEYT



Above: GØMJW (note olive/clamp ring behind reflector)
Below: OE8HSR

Mounting the LNB

How to mount the LNB to the waveguide depends on its inner or outer diameter.

If the LNB has a horn (like most do) this horn has to be cut off. LNB's having an outer diameter of 20mm are also available. Using some sandpaper it can be squeezed into the waveguide. Most LNB's have a somewhat larger outer diameter. In these cases the waveguide internal diameter of the copper pipe has to be increased (e.g. swaged out on a lathe) prior to soldering the plates.

As alternatives a 22 – 22 mm solder 'socks' or compression couplers can be used, or even another olive/clamp ring, see Figures 5 and 6.

Figure 5 – Compression fitting for a decapitated LNB

Figure 6 – Mounted LNB

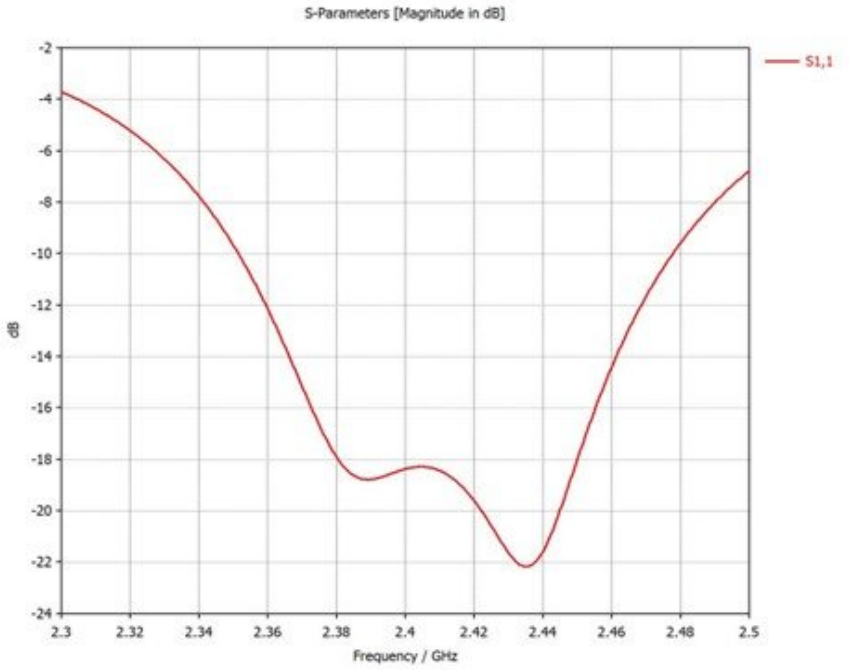


Figure 7 - Modelled return loss

Adjustments

If the patch is made precisely enough it should show two resonances just below and above 2400MHz.

When the overall maximum return loss is too low or too high in frequency, bending the distances of the patch corners from or to the reflector plate helps centering the maximum return loss around 2400MHz.

In practice, there will probably be only a single shallow dip of around 20 dB. Any higher is suspicious as it implies that both resonances are the same frequency, which will not give good circular polarization.

Figure 7 displays modelled return loss and Figure 8 measured return loss of a sample.

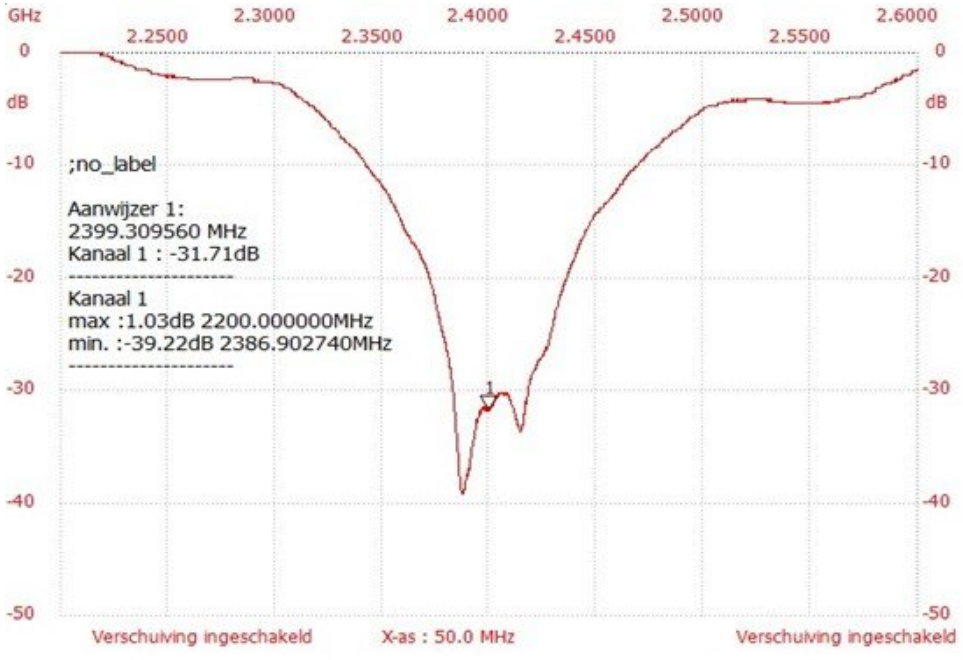


Figure 8 - Measured return loss of PE9RX's feed

Waveguide 10 GHz dielectric lens

The waveguide alone over illuminates a standard f/D = 0.6 offset dish and also presents a poor match. In order to illuminate properly most LNB's have horns.

However, there are LNB's on the market destined to be placed close to each other so that with multiple LNB's multiple satellites can be received simultaneously using a single dish.

These LNB's are known as 'rocket LNB's' because their shape resembles a rocket. These LNB's use a dielectric lens and are useful in this application as they do not disturb the 2.4 GHz patch.

They are complex structures designed to optimally illuminate the dish. Options are to buy a (cheap) rocket LNB and use the lens only, or to buy a PLL rocket LNB (rare).

Figure 9 – Rocket LNB

Figure 10 – Rocket LNB lens on patch

Another approach is to produce a lens yourself on a lathe. In Figure 11 an experimental lens is depicted, made from 20mm diameter Nylon-6 (PolyAmide 6, or PA6).

The final dimensions of the lens is still work in progress. Figure 12 shows a sample.

Conclusion

One month after the first successful prototypes were built and measured, almost 100 of this dual band dish feeds have been sent out and/or made by a large diversity of persons. The design is reproducible and strikingly simple.

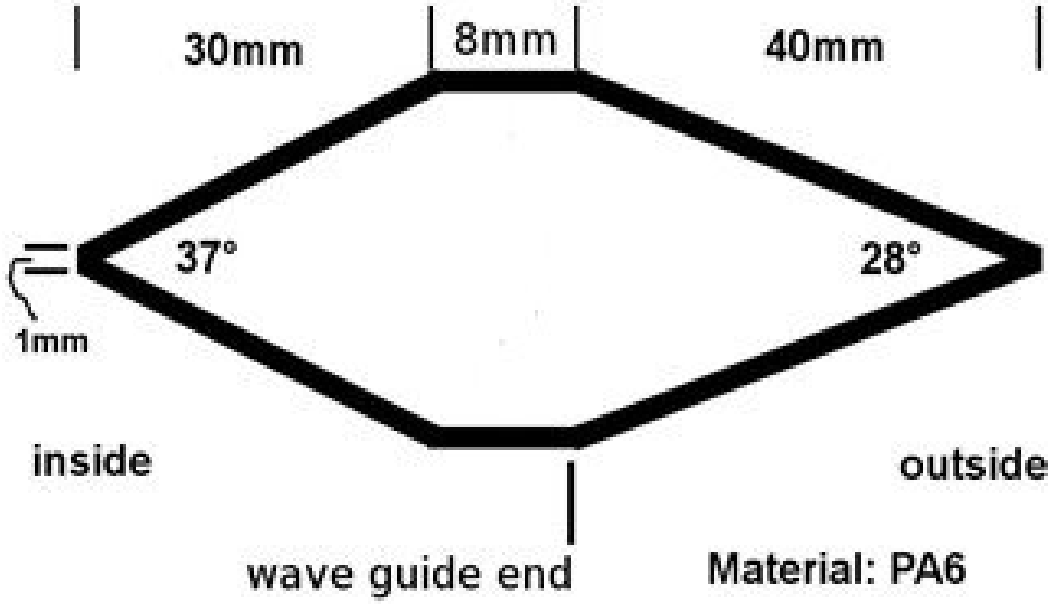


Figure 11 - Experimental lens dimensions

Figure 12 - Prototype of Figure 11

Although precision is the main virtue, this dual band feed already serves as the de facto standard for a single QO-100 dish. The modelled -10 dB opening angle of the 2.4 GHz LHCP patch amounts ca. 105° and illuminates standard/consumer satellite dishes with f/D's of around 0.6 (which require ca. 90°) sufficiently, bearing in mind the patch is only used to transmit.

Appendix / hints and tips

Connectors

Use panel mounts with flanges and PTFE (Teflon) dielectric as depicted in Figure 13. Don't use chassis connectors which protrude the reflector plate (too much)..

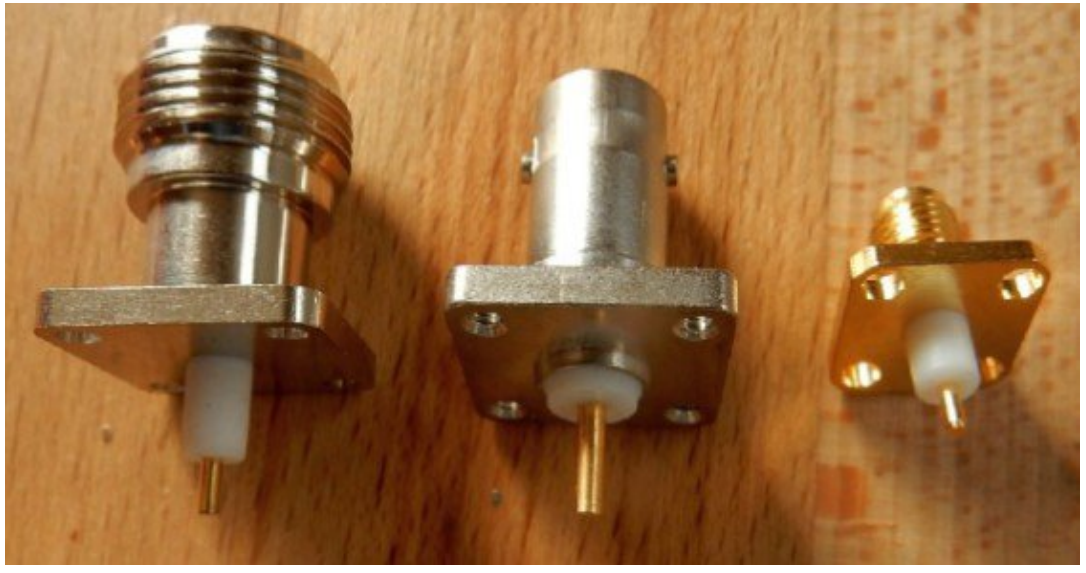


Figure 13 - Examples of suitable panel mount flanges

Radomes

We leave it up to the builders creative imagination how to construct a suitable radome to protect the feed against weather influences. It is important that the (plastic) material does not heat up in a microwave oven. Test before usage! Figure 14 shows an example.

Figure 14 - A more weatherproof setup

Materials

Copper and brass give similar results and performance. Double sided FR4 PCB has not been tried (yet).

Aligning feed/phase point

When the feed point of the waveguide is in the optimal position (tweak the dual band feed for maximum signal or SNR listen to the QO- 100 beacon on 10489.550 MHz) the 2.4 GHz LHCP patch is also in the focal point of the dish.

A convenient method to optimise the feed position is to use a SDR and maximise the transponder noise floor by looking at the waterfall.

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

Grass Valley Mixer Conversions - Part 5

Written by Trevor Brown G8CJS

In this issue I have sorted the GVG buttons into groups on the basis that only one button in each group will be illuminated at any one time. This is obvious for the PGM, PST and PST banks, but less obvious for the keys, E.G, KEY MASK and KEY INVERT, (I have put those buttons into one single group).

The programme should be run using the debug selection in the BASIC menu and it will then print the button top legend you have selected or not, if it is incorrect then change the wprint statement in the software and correct the button map.

The programme will not light any of the panels, lamps but it will print on the screen the legend printed on the button top. It will not latch, it will just indicate which button was pressed. This is a halfway house and still needs the lamp drivers connecting to the programme.

I have explained before that the lamp drivers and associated latches are the last remaining problem, because some of the functions of one group share the same lamp latch with other groups. This programme kicks that problem into the long grass until the next issue.

The programme follows the flow chart in the previous issue, but I have to admit that was a little simplistic in that it only had the three main banks or groups, where in reality there are more buttons and more grouping.

I have used subroutines which is useful if you need to use a routine several times. There are limits in BASIC to this way of working, this particular BASIC has a limit of 50 so I don't expect any problems.

The button legend should match the print statement, if it does not then you can correct the statement along the button map in the previous issue to match your mixer, remember my panel is a GVG 1000, but there are also GVG 100 and GVG 110 panels around which are interchangeable also my panel has unknown pedigree and may have had wrong button tops fitted or even button tops changed around.

I understand BASIC is not everyone's preferred choice of language, but I hope the software guru's amongst us can follow my work in particular the two maps (buttons and lamps) revealed in this series of articles, which are essential to getting this project up and running in any language. Sorry it's been very software intensive, but I cannot even think of how we would have approached the problem in any other way.

There have been one or two problems along the way, the most unexpected was the reliability of the ESP modules.

I started with the NODE MCU units and am now using LOL.1n which are interchangeable and pin compatible, both share a reliability problem in that the wi-fi connection does tend to stop working (I now own six modules).

Mike G7GTN has proved that only one of the rejected modules has actually become terminal, the others all respond to a C++ compiled wi-fi scanner programme which is loaded via terminal software, down the USB and will scan the band and display any local wi-fi connections including those belonging to my neighbours.

It could be just the wi-fi transmitters that suffer the problem, but this module was never meant to be the final solution, hence I named it an "exploratory dongle", but if a solution to this annoying problem is forthcoming rest assured you will read about it here in CQ-DATV.

Sorry for the BASIC. I realise, like me, it's a little old but may not have aged quite as well. It has the advantage of the ability to cut and paste into the ESP editor from our electronic publication.

I come from an age where we used to buy hard copy computer magazines and then copy type the programs into the micro, this was time consuming, tedious and often introduced errors, so I hope this shows an advantage to the new age of electronic publication.

I also have to admit since I started this series of articles only three GVG panels have shown up on eBay one is now with Mike G7GTN and the other two have new homes that are not known to your scribe, so let's hope more turn up to justify all the magazine space, and allow you to benefit from this series of articles.

The programme below is best run using the ESP BASIC debug option and it will then pause and print the selected button legend.

Until the next issue if you have a panel or understand the problems of ESP wi-fi or would like to be involved in the final solution of using the GVG panel as a standalone unit to interface to something like Vmix then we would love to hear from you at *editor@cq-datv.mobi* .

```
' GVG Panel
let PRT1=63    'control port
let PRT3=61  'address
let PRT4=56  'data bus
 i2c.setup(4,5)
'gosub   [lamp test]
gosub [clearlights]
let m = 255
      i2c.begin(PRT1)        'control port
       i2c.write(61)       'scan buttons
         i2c.end()
           i2c.begin(PRT4)           'data bus
            i2c.write(255)
              i2c.end()
Do
  for B=0 to 7

       i2c.begin(PRT3)        'address port
        i2c.write(B)              'scan buttons bs2 low
          i2c.end()

       i2c.requestfrom(PRT4,1)
            d = i2c.read()
  i2c.end
        let e = val(d)              'change to a value
if e<255 then gosub [groupsort]
'if e<  255 then delay 5000
next B
loop until 0
end
```

```
'      sub routines
 [groupsort]
if B=1 then gosub [KEY]
if B=4 and e = 251 then gosub [KEY]
if B=4 and e = 247 then gosub [KEY]
if B=2 then gosub [PGM]
if B=4 and e = 254 then gosub [PGM]
if B=4 and e = 253 then gosub [PGM]
if B=3 then gosub  [PST]
if B=4 and e = 239 then gosub [PST]
if B=4 and e = 223 then gosub [PST]
if B=0 and e = 253 then gosub [KEY CTRL]
if B=0 and e = 251 then gosub [KEY CTRL]
if B=0 and e = 247 then gosub [KEY CTRL]
if B=0 and e = 239 then gosub [KEY CTRL]
if B=0 and e = 223 then gosub [KEY CTRL]
if B=0 and e = 191 then gosub [KEY CTRL]
if B=5 and e = 127 then gosub [KEY CTRL]
if B=5 and e = 254 then gosub [BORDERLINE]
if B=5 and e = 253 then gosub [BORDERLINE]
if B=5 and e = 251 then gosub [BORDERLINE]
if B=7 and e = 254 then gosub [BORDERLINE]
if B=7 and e = 253 then gosub [BORDERLINE]
if B=5 and e = 247 then gosub  [AUXCNTRL]
if B=5 and e = 239 then gosub  [AUXCNTRL]
if B=6 and e = 239 then gosub  [DSK]
if B=6 and e = 223 then gosub  [DSK]
if B=6 and e = 191 then gosub  [DSK]
if B=6 and e =254 then gosub [TRANSITION]
if B=6 and e =253 then gosub [TRANSITION]
if B=6 and e =251 then gosub [TRANSITION]
if B=6 and e =247 then gosub [TRANSITION]
if B=5 and e =223 then gosub [TRANSITION]
if B=5 and e =191 then gosub [TRANSITION]
if B=4 and e =191 then gosub [TRANSITION]
if B=4 and e =127 then gosub [TRANSITION]
if B=0 and e = 254 then gosub [E MEM ]
if B=0 and e = 127 then gosub [ASPECT ]
if B=6 and e = 127 then gosub [DSK PV]
return

 [KEY]
if B = 1 and e = 254 then wprint "Key 0 "
if B = 1 and e = 253 then wprint "key 1 "
if B = 1 and e = 251 then wprint "key 2 "
if B = 1 and e = 247 then wprint "key 3 "
if B = 1 and e = 239 then wprint "key 4 "
if B = 1 and e = 223 then wprint "key 5 "
if B = 1 and e = 191 then wprint "key 6 "
if B = 1 and e = 127 then wprint "key 7 "
if B = 4 and e = 251 then wprint "key 8 "
if B = 4 and e = 247 then wprint "key 9 "
return
[PGM]
if B = 2 and e = 254 then wprint "PGM 0 "
if B = 2 and e = 253 then wprint "PGM 1 "
if B = 2 and e = 251 then wprint "PGM 2 "
if B = 2 and e = 247 then wprint "PGM 3 "
if B = 2 and e = 239 then wprint "PGM 4 "
if B = 2 and e = 223 then wprint "PGM 5 "
if B = 2 and e = 191 then wprint "PGM 6 "
if B = 2 and e = 127 then wprint "PGM 7 "
if B = 4 and e = 254 then wprint "PGM 8 "
if B = 4 and e = 253 then wprint "PGM 9 "
return
[PST]
if B = 3 and e = 254 then wprint "PST 0 "
if B = 3 and e = 253 then wprint "PST 1 "
if B = 3 and e = 251 then wprint "PST 2 "
if B = 3 and e = 247 then wprint "PST 3 "
if B = 3 and e = 239 then wprint "PST 4 "
if B = 3 and e = 223 then wprint "PST 5 "
if B = 3 and e = 191 then wprint "PST 6 "
if B = 3 and e = 127 then wprint "PST 7 "
if B = 4 and e = 239 then wprint "PST 8 "
if B = 4 and e = 223 then wprint "PST 9 "
```

```
return
[KEY CTRL]
if B=0 and e = 253 then wprint "AUTO SELECT "
if B=0 and e = 251 then wprint "PST PTN "
if B=0 and e = 247 then wprint "LUM KEY "
if B=0 and e = 239 then wprint "LINEAR KEY "
if B=0 and e = 223 then wprint "CHROMA KEY "
if B=0 and e = 191 then wprint "KEY MASK "
if B=5 and e = 127 then wprint "KEY INVERT "
return
[BORDERLINE]
if B=5 and e = 254 then wprint "NORMAL "
if B=5 and e = 253 then wprint "BORDER "
if B=5 and e = 251 then wprint "DROP SHADOW "
if B=7 and e = 254 then wprint "EXTRUDE "
if B=7 and e = 253 then Wprint "OUTLINE "
return
[AUXCNTRL]
if B=5 and e = 247 then wprint "EFFECTS SEND "
if B=5 and e = 239 then wprint  "BUS AUX "
return
[DSK]
if B=6 and e = 239 then wprint "DSK CUT "
if B=6 and e = 223 then wprint "DSK MIX "
if B=6 and e = 191 then wprint "FADE TO BACK "
return
[TRANSITION]
if B=6 and e =254 then wprint "KEY1 "
if B=6 and e =253 then wprint "KEY "
if B=6 and e =251 then wprint " BKGD "
if B=6 and e =247 then wprint " EFFECT "
if B=5 and e =223 then wprint " WIPE "
if B=5 and e =191 then wprint " MIX "
if B=4 and e =191 then wprint "CUT"
if B=4 and e =127 then wprint "AUTO TRANSITION "
return
[E MEM ]
if B =0 and e = 254 then Wprint " E Mem"
return

[ASPECT ]
if B=0 and e =127 then wprint "ASPECT ON "
return

[DSK PV]
if B=6 and e =127 then wprint "DSK PV"
return

  '[writelamps]
i2c.begin(PRT1)       'contol port
  i2c.write(62)     'writelamp
    i2c.end()
 gosub   [enablelamps]
i2c.begin(PRT4)       'data bus
  i2c.write(y)        'y address
    i2c.end()
       i2c.begin(PRT3)  'address bus
        i2c.write(x)   'x address
          i2c.end()
             i2c.begin(PRT3)  'address bus
                i2c.write(15)  'latch number
  i2c.end()
return



      [clearlights]
i2c.begin(PRT1)       'contol port
  i2c.write(62)     'writelamp
    i2c.end()
for a =1 to 8
i2c.begin(PRT4)          'data bus
  i2c.write(0)
     i2c.end()
       i2c.begin(PRT3)  'address bus
         i2c.write(a)
```

```
            i2c.end()
              next a
i2c.begin(PRT3)  'address bus
          i2c.write(16)
            i2c.end()
              return
          [enablelamps]
i2c.begin(PRT4)        'data bus
   i2c.write(168)
    i2c.end()
     i2c.begin(PRT3)  'address bus
        i2c.write(3)  'latch number
          i2c.end()
i2c.begin(PRT3)  'address bus
       i2c.write(15)  'latch number
          i2c.end()
           return
```

So far we have tested the lamps and progressed to lighting individual lamps, now we have tested and grouped the buttons and in the next issue, we will be tacking the thorny subject of connecting the two together. I suspect it's going to be a tough month for me, but nothing that cannot be solved with a little engineering know how (please don't quote me).

First published in issue 4

Introducing Project Loon: Balloon-powered Internet access

The Internet is one of the most transformative technologies of our lifetimes. But for 2 out of every 3 people on earth, a fast, affordable Internet connection is still out of reach. And this is far from being a solved problem.

There are many terrestrial challenges to Internet connectivity—jungles, archipelagos, mountains. There are also major cost challenges. Right now, for example, in most of the countries in the southern hemisphere, the cost of an Internet connection is more than a month's income.

Solving these problems isn't simply a question of time: it requires looking at the problem of access from new angles. So today we're unveiling our latest moonshot from Google[x]: balloon-powered Internet access.

We believe that it might actually be possible to build a ring of balloons, flying around the globe on the stratospheric winds, that provides Internet access to the earth below. It's very early days, but we've built a system that uses balloons, carried by the wind at altitudes twice as high as commercial planes, to beam Internet access to the ground at speeds similar to today's 3G networks or faster.

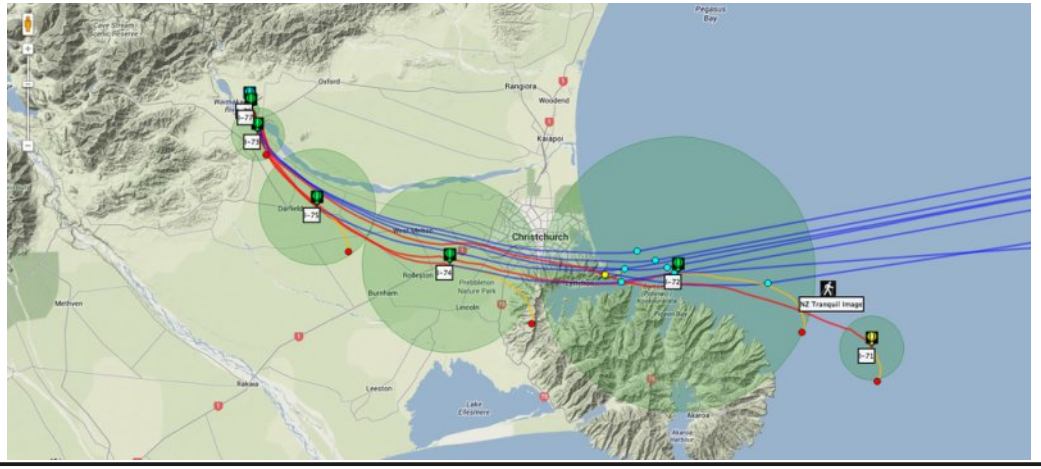
As a result, we hope balloons could become an option for connecting rural, remote, and under served areas, and for helping with communications after natural disasters. The idea may sound a bit crazy—and that's part of the reason we're calling it Project Loon — but there's solid science behind it.

Balloons, with all their effortless elegance, present some challenges. Many projects have looked at high-altitude platforms to provide Internet access to fixed areas on the ground, but trying to stay in one place like this requires a system with major cost and complexity.

So the idea we pursued was based on freeing the balloons and letting them sail freely on the winds. All we had to do was figure out how to control their path through the sky.

We've now found a way to do that, using just wind and solar power: we can move the balloons up or down to catch the winds we want them to travel in. That solution then led us to a new problem: how to manage a fleet of balloons sailing around the world so that each balloon is in the area you want it right when you need it. We're solving this with some complex algorithms and lots of computing power.

Now we need some help—this experiment is going to take way more than our team alone. This week we started a pilot program in the Canterbury area of New Zealand with 50 testers trying to connect to our balloons. This is the first time we've launched this many balloons (30 this week, in fact) and tried to connect to this many receivers on the ground, and we're going to learn a lot that will help us improve our technology and balloon design.



Over time, we'd like to set up pilots in countries at the same latitude as New Zealand. We also want to find partners for the next phase of our project - we can't wait to hear feedback and ideas from people who've been working for far longer than we have on this enormous problem of providing Internet access to rural and remote areas. We imagine someday you'll be able to use your cell phone with your existing service provider to connect to the balloons and get connectivity where there is none today.

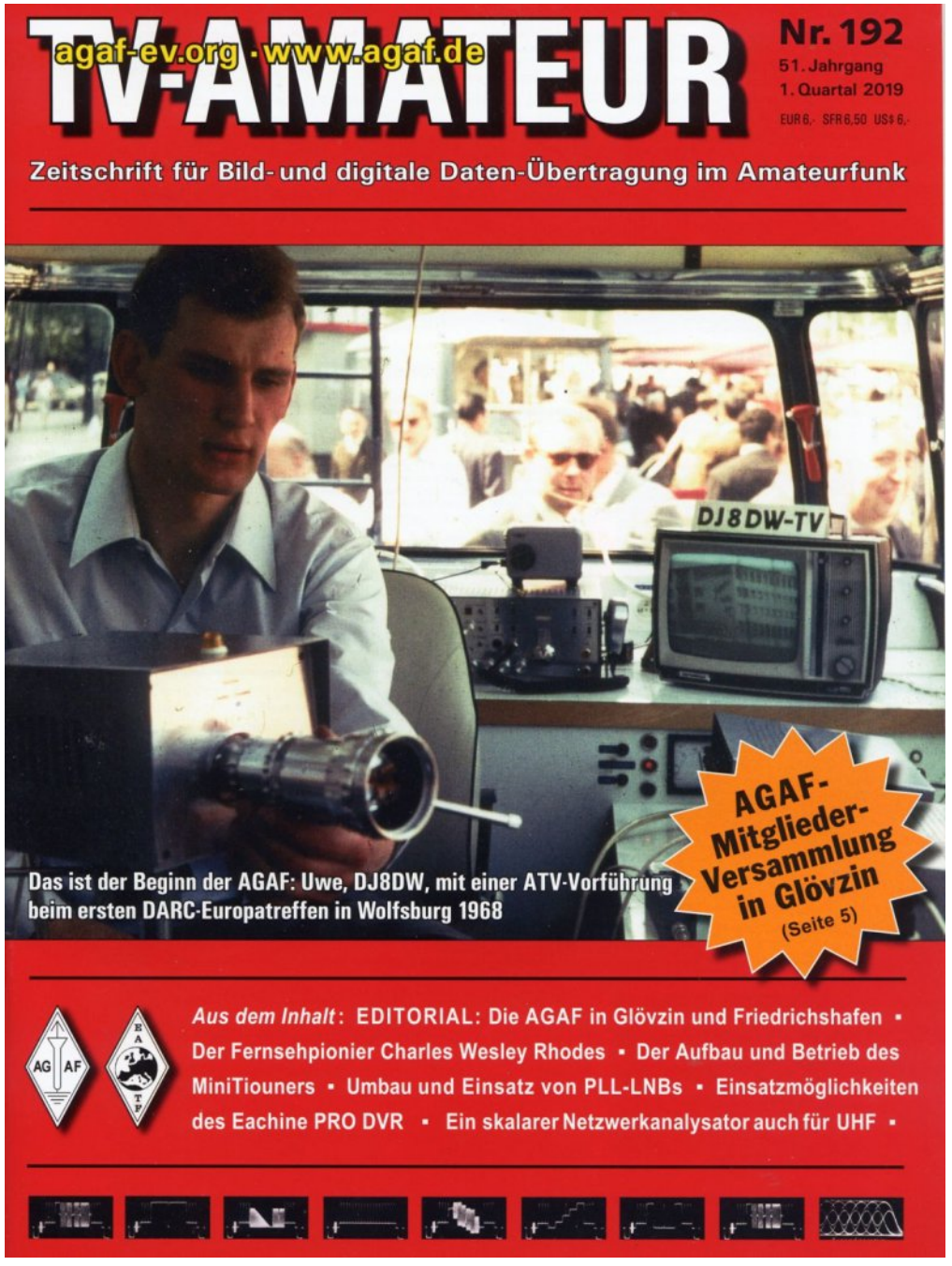
This is still highly experimental technology and we have a long way to go - we'd love your support as we keep trying and keep flying! Follow our Google+ page to keep up with Project Loon's progress.

Onward and upward.

Posted by Mike Cassidy, Project Lead
http://googleblog.blogspot.co.uk/2013/06/introducing-project-loon.html

For a 2015 update, see:

https://www.blog.google/inside-google/alphabet/indonesia-loon-internet/



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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.

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