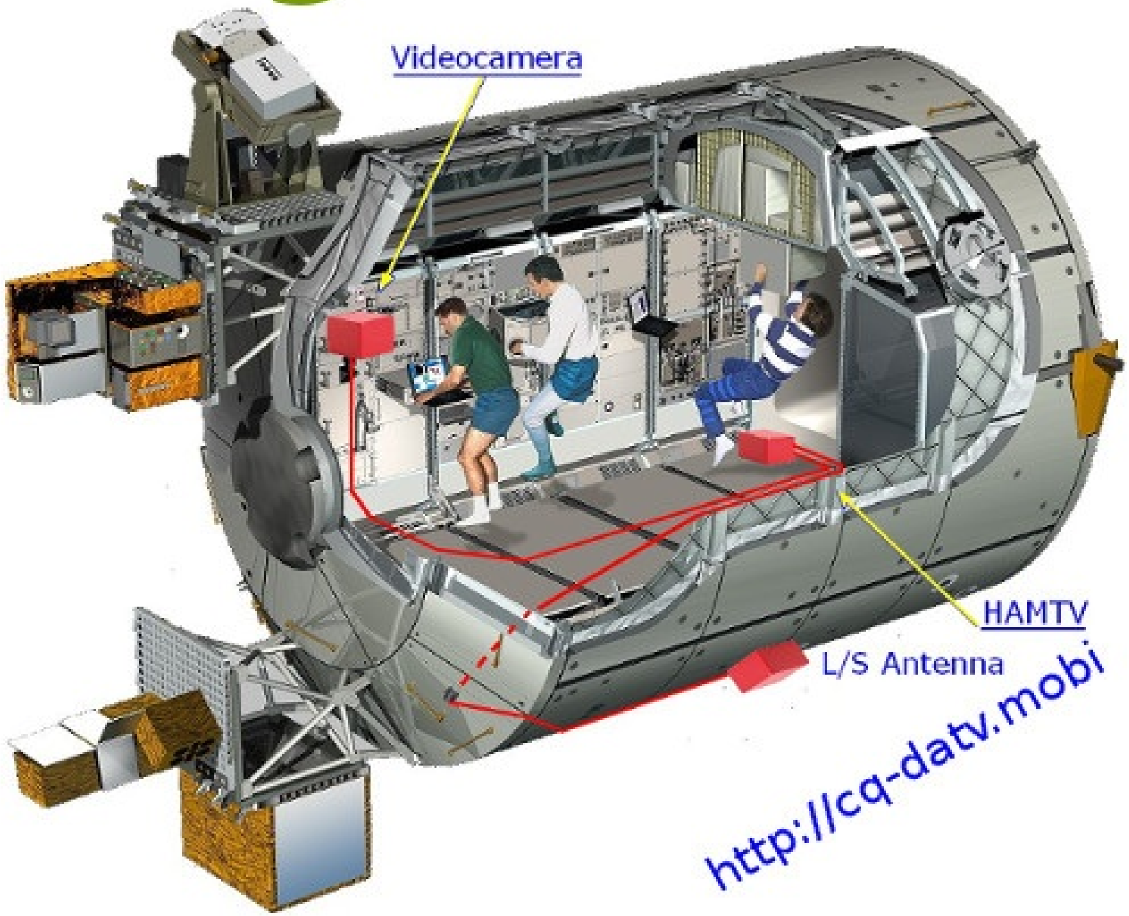
CQ-DATV

dotMOBI

Issue 4 - August 2013



http://cq-datv.mobi

CQ-DATV4 Production Team

- *Ian Pawson - G8IQU*
- *John Hudson - G3RFL*
- *Mike Stevens - G7GTN*
- *Ken Konechy - W6HHC*
- *Alan Critchley - G3SXC*
- *Paul Wade - W1GHZ*
- *Trevor Brown - G8CJS*

In this issue

Another bumper issue and this time there is a strong RF flavour coupled with some excellent home construction projects.

- *With the kind permission of Andy at VHF communications we have reproduced a thermal power meter, which is a brilliant step forward from the popular dummy load that we started with in DATV1.*
- *John Hudson G3RFL has produced a very nice aerial direction indicator, that can be again home constructed.*
- *Paul Wade W1GHZ has another home construction project a Ratiometer, so that leaves no excuses for not tuning up your power amplifiers and aerials.*
- *Leaving RF behind Mike G7GTN has produced a Sony handset decoder that enables easy control over captions and various other devices in the shack.*
- *Trevor has weighed in with using HDMI for vision mixing and found some interesting links for a home constructed control panel for the ATEM.*
- *DATV start here has concluded with a non mathematical look at QSPK DATV and Ken has kept us all up to date on DATV express, there is a full report on the proposed DATV transmission from the International Space Station and a look at the problems we face with 13 cms*

My thanks to all on the production team for all their work on DATV4

Ian Pawson, CQ-DATV Editor

Mission Accomplished

Welcome to CQ-DATV4, when we set out to produce this magazine we had several objectives. The first being to use electronic only delivery and the second to publish exclusively using only eBook formats, both of these are a first for an ATV publication. We also set out to deliver 6 issues a year making it a bi monthly publication, again this has never been done before. Finally we wanted to deliver CQ-DATV at no cost, so far it looks like it's mission accomplished, CQ-DATV5 is already in production and will be available early September.

Providing a fee magazine has significant advantages, in that everybody on the production team has one objective to create copy for CQ-DATV. We do not have accounts to process, or membership renewals to deal with, nothing gets in the way of creating the UK's widest read ATV magazine. Also producing a bi-monthly publication it keeps the news topical, the electronic format is able to exploit http links, which give electronic publishing a significant advantages over hard copy. Deep links which take you to the heart of Internet based information are used extensively, but these links which expand topics, have a habit of disappearing, frequent publication is the only answer. At the time of going to press these are all working and current, but beyond the control of CQ-DATV as one popular broadcaster never fails to point out.

This has to be the formula for the future, hard copy is expensive to print and post and so inevitably leads to infrequent publication. It's also not very green to use paper which eats into our natural resources, and is often posted out in that most evil of carriers the plastic bag, see *http://www.plasticoceans.net/* and what Sir David Attenborough has to say. Hard copy also requires a fixed amount of copy to fill the pages, this electronic format allows us to produce any amount of copy, depending on what is available on publication day. Before eBooks electronic publishing relied on the PDF file which was fine if you wanted to read an electronic publication on a PC, and some years back publishing in that format was somewhat of a revolution, but electronic publishing has moved on and the requirement for a PC to read the publication is now not mandatory, because we now have eBooks and iPads, yes they will read a PDF files, but the format does not get the best out these modern devices.

So at CQ-DATV we chose to launch our new publication using ePub and .mobi formats, which if you read the front page of our site can be engineered to be read on a PC in seconds, using a whole host of free downloadable software. So we make no apology, for providing up to date ATV copy at no cost and in green format. All we ask is that you down load and read our publication, no need to log-in or supply your email address, that can inevitably lead to junk mail and no need to pay a subscription. Just visit the site every other month, download, read and enjoy CQ-DATV. This has to be the winning formula for expanding and developing ATV, something our production team is passionate about.

We have started with the bar above all other ATV magazines in both cost and frequency of publication, we want to raise that bar and to that end we need your support. We have a team but there is always a space for anyone who wants to help by creating copy, by designing constructional projects, reporting activity, or just proofing copy. We have had almost 3000 downloads and various feedback items from our readers, if I am to publish just one letter, let it be from Ian DJ0HF/G3ULO, which I think brings home that we are on track.

Ian Pawson, CQ-DATV Editor

Hi,

I just wanted to say a very big thank you for CQ-DATV. I've really enjoyed reading the first 3 issues and can't wait for the next. Especially having it in Mobi format is a super bonus as it looks so much better on my Kindle Paper white than PDF's normally do. Just one comment, you mention that the Kindle 3 can't use the links within the mobi magazine which is probably true. But the Kindle Paper white has no problem, clicking on a link starts the browser and goes directly to the wanted page, I even downloaded CQ-DATV3 directly to my Kindle using the Kindle browser.

Fantastic job and again my heartfelt thanks.

73,Ian, DJ0HF/G3ULO

Thanks Ian, the point I was trying to make about the Kindle was that the links only work if you are in a Wi-Fi area and not generally over 3G. I think that I will have to re-word that section. I also use a paper white, my third Kindle and by far the best in my opinion.

Ian Pawson, CQ-DATV Editor

DATV News

AMSAT-UK

July 20/21st is the AMSAT-UK Colloquium and will be held at the usual venue Holiday Inn Hotel on the A3 at Guildford. This event has been streamed in previous years on *www.batc.tv*. If you cannot make it along to Guildford it might be worth checking this site for coverage of the event.

Further information at *http://amsat-uk.org/colloquium/colloquium-2013/*

BATC

October 26/27th The BATC are planning an event to be held at Finningley it is being billed as a flagship event and will have trade stands and a full supporting lecture programme

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DATV for ARISS

Digital Amateur Television equipment is due on board the International Space Station next month will use the 2400 MHz band to provide mainly vision for the ARISS program.

The main mission of the technology will be an expansion of the Amateur Radio of the International Space Station (ARISS) project so that schools will see as well as hear from astronauts.

The new equipment can broadcast images during ARISS contacts or other pre-recorded images.

The plan is to transmit DVB-S signals on 2.4GHz at either 1.3Msps or 2.3Msps with 10 watts of RF from the ISS Columbus module.

The IARU Amateur Satellite Frequency Coordination Panel has coordinated the frequencies of 2422.0 MHz and 2437.0 MHz, and the equipment is understood to be due for launch on June 5, 2013.

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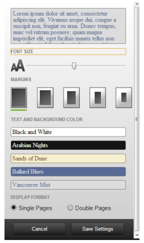


Readium®, a project of the International Digital Publishing Forum (IDPF) and supporters, is an open source reference system and rendering engine for EPUB publications. EPUB is the industry-standard open format for eBooks and digital publications. The latest version, EPUB 3, is based on Web Standard technologies such as HTML5, CSS, JavaScript, SVG, and the DOM. The overall aim of the Readium project is to ensure that open source software for handling EPUB 3 publications is readily available, to accelerate adoption of EPUB 3 as the universal, accessible, global digital publishing format.

This advanced reader is now available for Chrome web browsers just follow the link *https://chrome.google.com/webstore/detail/empty-title/fepbnnnkkadjhjahcafoaglimekefifl*

Launch of www.dxspot.tv

Modelled on the highly successful ON4KST chat rooms, *http://www.dxspot.tv* presents easy to use DX cluster spotting for ATV (analogue and digital) contacts on all bands between 70cms to 3cms and a dedicated chat room using IRC, which will run over a very basic mobile connection, for talkback.

Designed for mobile and PC use and the site provides the following:

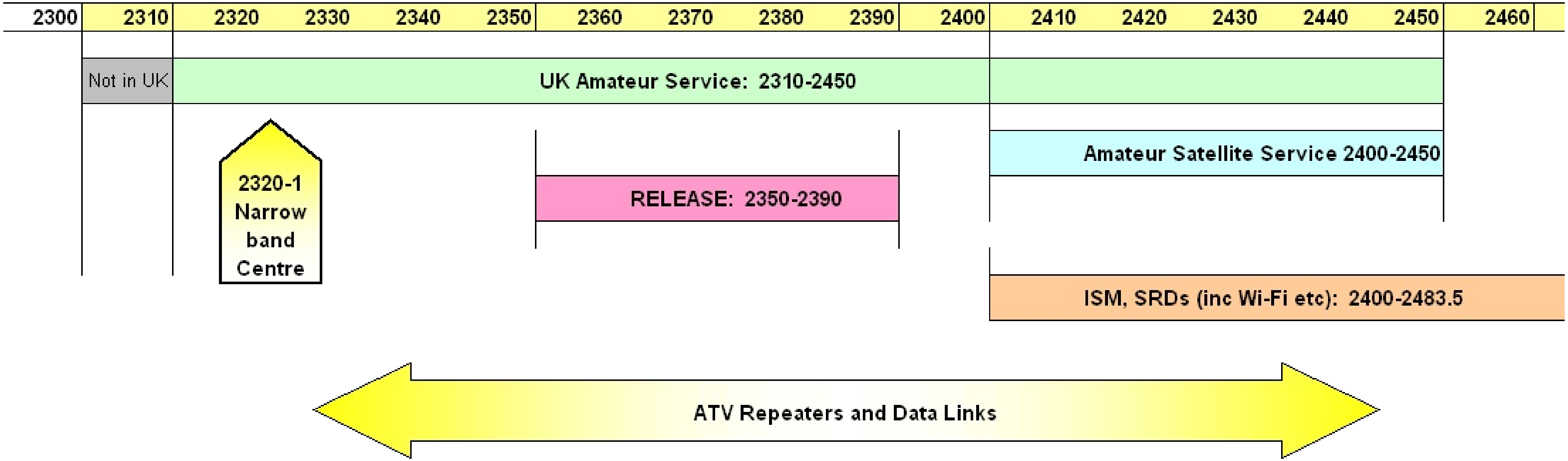
- *ATV DX cluster spotting for 70cms and 3cms ATV and DATV*
- *Interactive map showing all active ATVers worldwide*
- *Dedicated instant messaging IRC channel for ATV DX working*
- *Open source environment with github for full development cooperation*

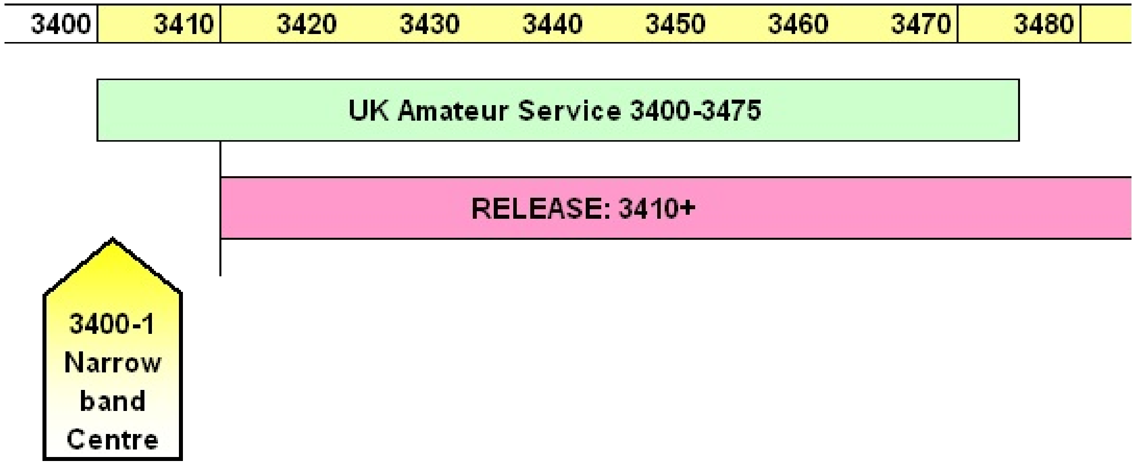
Note, it is not just for G stations but intended for use by ATVers around the world to work more stations in their own countries and it will be great to see it used for contests / portable and rover expeditions in the USA, Australia and other countries;-)

Band Plan changes

The Ministry of Defence (MoD) plan to release 40 MHz of spectrum between 2350 and 2390 MHz (the 2.3 GHz release band) and a further 150 MHz from 3410 to 3600 MHz (the 3.4 GHz release band) for new civil uses.1

The technical and regulatory aspects of this release will be the subject of a full consultation in due course.





(Diagrams courtesy of the RSGB)

This has serious implications for ATV; the full document can be downloaded from *http://cq-datv.mobi/archive/PSSR-amateur.pdf* you will note there is a section just for ATV the data was provided at the open day, at Baldock/Luton. This is unprecedented in an OFCOM document and here at CQ-DATV raises fears for our hobby.

The document goes on to say:-

This document also details the uncertainty about continued amateur access to the adjacent bands (i.e. 2310 to 2350 MHz, 2390 to 2400 MHz and 3400 to 3410 MHz). This is based on the likelihood that other existing uses will be concentrated in the adjacent bands and on the conclusions drawn from our technical assessments. Three options are proposed:

- *i) Remove access to the adjacent bands*
- *ii) Retain access to the adjacent bands on the current terms but with clarification of the notice period required for future amateur use to cease if amateurs cause interference to other users in the release band or the adjacent band.*
- *iii) Restrict amateur access to a smaller part of one or more adjacent bands.*

Please take the time to download and read the PDF and respond there are various options.

http://stakeholders.ofcom.org.uk/consultations/public-sector-spectrum-release/?utm_source=updates&utm_medium=email&utm_campaign=pssr-amateur-condoc

Perhaps the quickest is this on-Line form:-

https://stakeholders.ofcom.org.uk/consultations/public-sector-spectrum-release/howtorespond/form

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International Space Station adopts Debian Linux, drops Windows & Red Hat into airlock

It's nothing to do with Windows 8 and the lack of a 'Start' button (or orb) at all.

But reports from the Linux Foundation confirm that the International Space Station's (ISS) laptop installation is to drop Windows into the airlock in favour of a new deployment of Linux for its machines.

Manager of the Space Operations Computing (SpOC) for NASA Keith Chuvala is on the record saying, "We migrated key functions from Windows to Linux because we needed an operating system that was stable and reliable — one that would give us in-house control. So if we needed to patch, adjust, or adapt, we could."

Laptops on the International Space Station's serve a large number of users in groups known as "constellations"…

Previously, some of the Space Station's machines has run Scientific Linux, a Red Hat Enterprise Linux (RHEL) clone.

… the astronauts will now move to using Debian 6 — while Debian 7 is already available, the team will run "one release back" for reasons relating to stability and strength.

Along with this laptop installation, Chuvala's team is also working on Robonaut (R2).

Designed to take over some of the astronaut's responsibilities, R2 will be the first humanoid robot in space.

Running on Linux, the robot can be manipulated by onboard astronauts with ground controllers commanding it into position and performing operations.

The Linux Foundation has said that it will help NASA developers ensure that R2 can be a productive addition to the ISS. Still in the fine-tuning phase, R2 will eventually carry out tasks too dangerous or mundane for astronauts in microgravity.

“Things really clicked after we came to understand how Linux views the world, the interconnecting of how one thing affects another. You need that world view. I have quite a bit of Linux experience, but to see others who were really getting it, that was exciting,” said Chuvala.

In space, no one can hear you scream at the Windows 8 Metro screen.

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DATV-Express Project – update report

by KenW6HHC » Sun Jun 02 2013

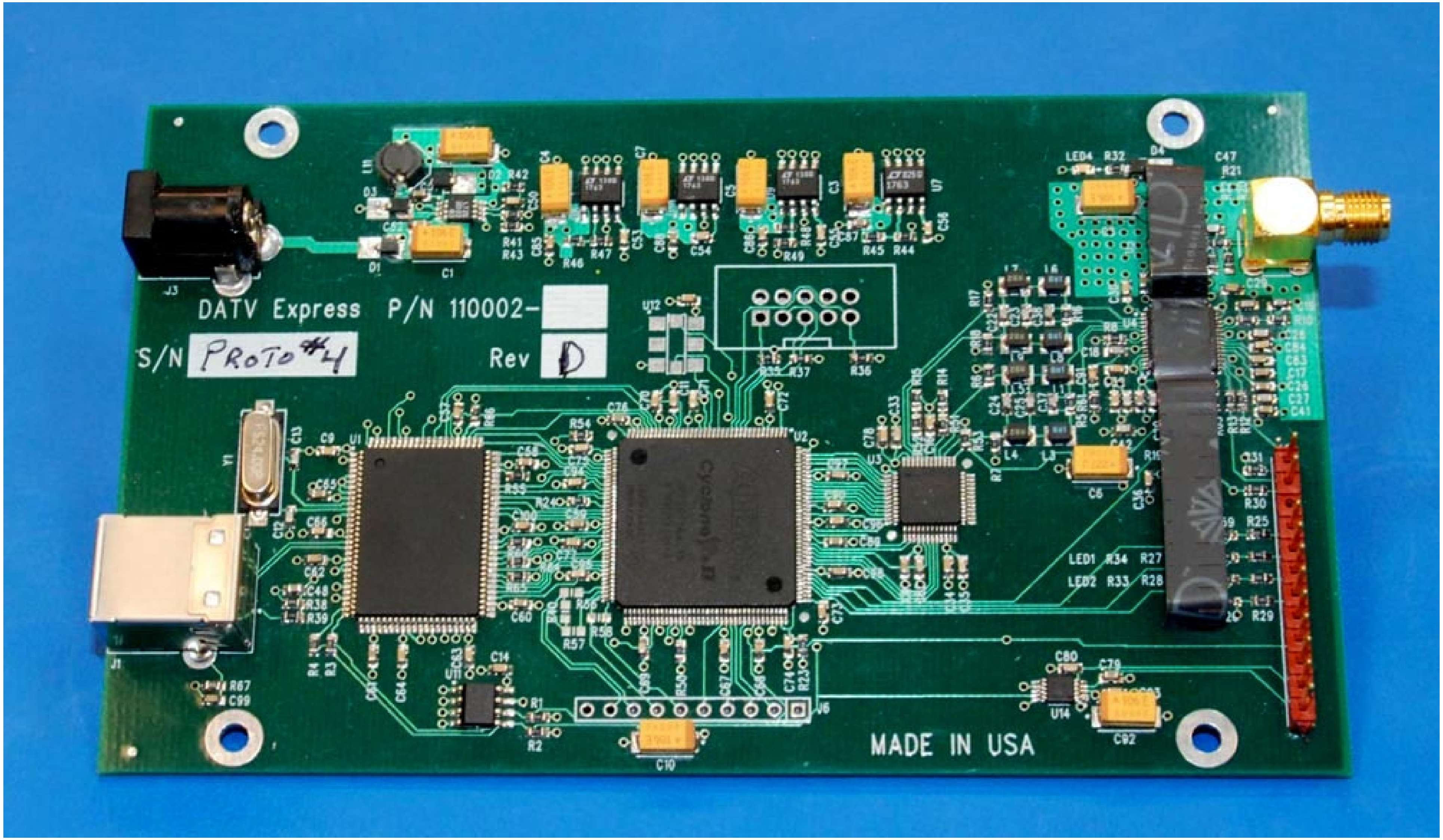
Art, WA8RMC, was able to finish assembling and testing prototype #4 board. Art took this board to the Dayton Ham Convention in the middle of May to demonstrate and answer questions. There were many interested people. Some wanted to buy the board Art had on display. All said they will buy one when they are for sale.

After Dayton, Art used this board to finish up a few tests. The maximum RF power output of this prototype board is 10 dBm. Proto #3 board had an output of 18 dBm. The modulator chip runs hot. The case temperature of the IQ modulator chip runs at +165 degrees F (74º C) with air ambient at 75 degrees F…if no heatsink is used. 165º F is hot but certainly within design limits.

Art then tested with a low profile copper strip unit from Aavid called a “thin-fin” heat sink which looks like a small band aid. The area where the band aid gauze pad is located is a self adhesive peel and stick area. Just press it on to the IC top. [NOTE - the band-aid heatsinks can be seen as black strips on the right side of the board in the photo below…next to the RF connector.]

The addition of one about 3/8” wide and 2” long lowered the IC case temperature to about +128 degrees. Charles G4GUO had also tested that a metal chassis (box) with metal-standoffs for mounting the board reduces the modulator case temperature nicely.

After these tests, Art shipped the Proto#4 board off to Ken W6HHC. Now the pressure is on for getting Ken’s Ubuntu skills up to speed to help beta testing the 32-bit version of code that Charles has been working on. Art plans to begin assembling Proto #5 board this coming week.



Prototype #4 board arrives at QTH of Ken W6HHC

The team was able to obtain confirmation from two different CE Mark EMI testing labs (one lab in Europe and one lab in USA) that the DATV-Express exciter board does NOT have to undergo EMI testing. The board-level exciter module product is excluded by the R&TTE Directive 1999/5/EC because it is considered a Ham radio component for a kit (add power-supply and comb band-pass filter and RF amplifiers and cabinet and software….etc.).

The directive states that licensed “radio amateurs are considered qualified in radio communications, and it is a condition of their licence that they will not cause interference to others (kits of components sold for assembly by radio amateurs are not regarded as ‘commercially’ available, ie they are not sold to the general public, so they do not have to meet the provisions of the regulations).

Charles, G4GUO, has been mainly working on the libusb-1.0 interface as he is/was unhappy with its performance. Back in March under Ubuntu 32 bit, Charles was getting the occasional hang at start up. However under Ubuntu 64 bit it was not working at all. This all worked fine when using Fedora Linux and an earlier version of libusb. Charles now reports that he is beginning to see the light at the end of the tunnel… and has it working much better now.

Other than that Charles has added software to provide 2/3/4 MHz DVB-T. Until he buys a receive dongle for those Modes, he will not be able to test them but they are scaled versions of standard DVB-T so they should work.

Finally, Charles has also been using the 47 dB attenuator built into the DATV-Express modulator chip to provide a weak signal on 70 cms to test his 70 cms DATV RX setup.

The open-source project is known as DATV- Express. The team members are:

- *Art Towslee WA8RMC – electronics design*
- *Charles Brain G4GUO – software design*
- *Tom Gould WB6P – PCB layout design*
- *Ken Konechy W6HHC – project mgmt & pubs*

The Author may be contacted at *W6HHC@ARRL.net*

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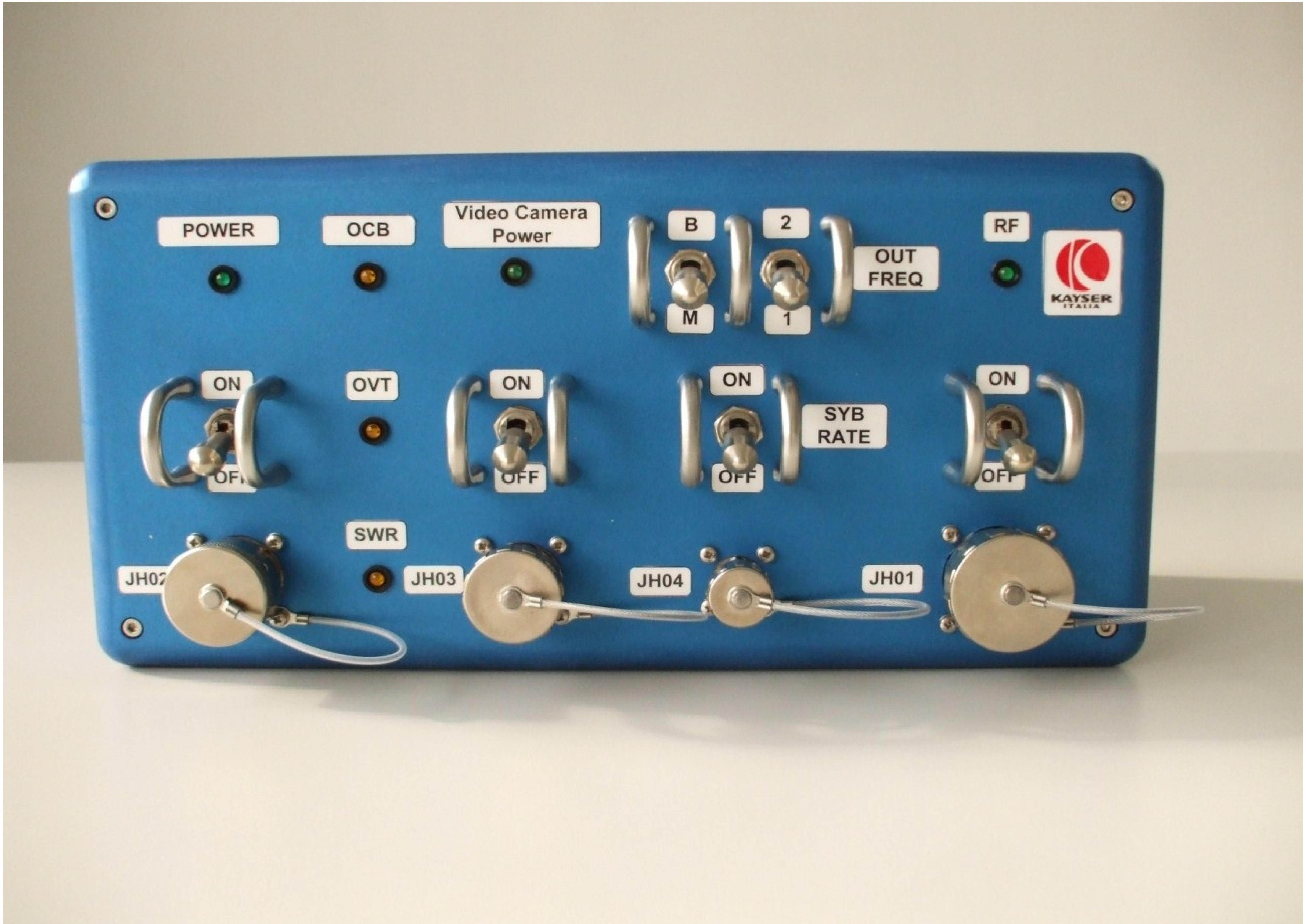
HamTV Experiment on-board ISS

Amateur digital television transmitter on-board the International Space Station

HamTV is an Amsat-Italia project developed within the ARISS/ArCOL WG, its purpose is to transmit digital video from the International Space Station as a complement of the half-duplex voice link carried out within the ARISS school contacts activities.

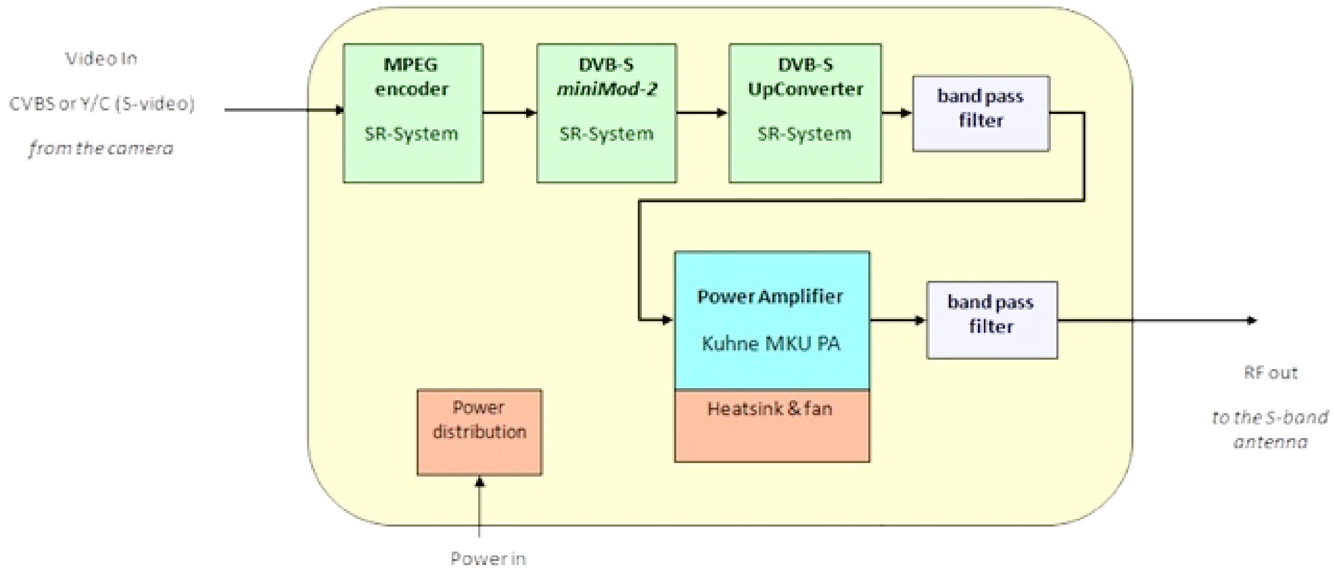

POWER
OCB
Video Camera Power
B
M
2
1
OUT FREQ
RF
KAYSER ITALIA
ON
OFF
OVT
ON
OFF
ON
OFF
SYB RATE
ON
OFF
SWR
JH02
JH03
JH04
JH01

The payload is intended to be embarked on the Columbus module of the ISS where an amateur station will be installed and operated. It will use S-Band antennas already installed outside the European module.

The sequence of voice and video transmitted towards the Earth will be captivating, procuring a very intense experience of the pass of the ISS over the ground stations.

Payload – HamTV Transmitter

The HamTV transmitter concept is outlined here

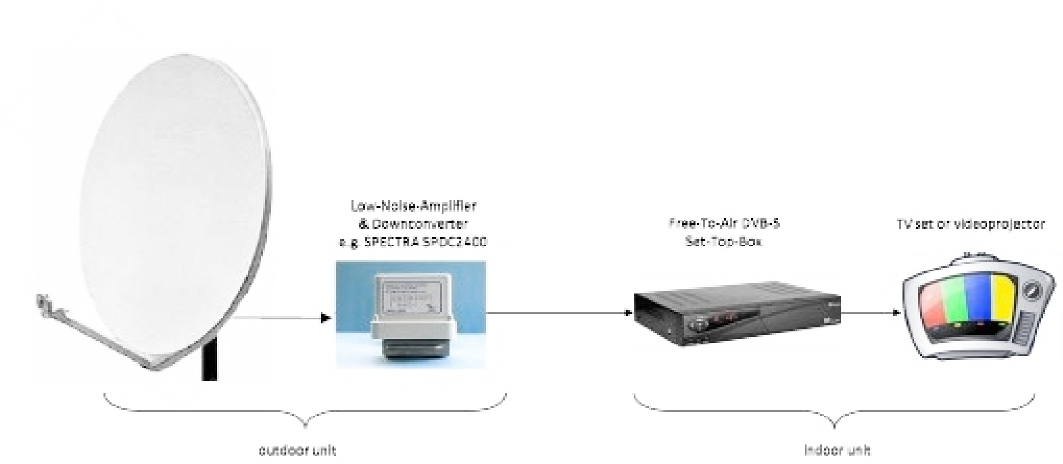


The video source will be a camcorder that will feed the HamTV system. The encoder translates the input in a MPEG stream which will be modulated onto the S-band with the selected modulation scheme and then transmitted towards the Ground Stations.

The entire transmitter will be based on COTS components properly modified to achieve the human space flight qualifications needed to be placed and operated on-board the Space Station.

Ground Station

A basic radio amateur station able to receive HamTV from ISS is proposed in the following panel.



The receiving system is designed taking into account link budget calculations. A 1m dish with proper feeding should be adequate enough to reach minimum system requirements. Since patch antenna on-board ISS are circularly polarised (RHCP), also ground stations must be equipped with circular polarised antenna feeds.

An example of a typical ground station antenna with a tracking system is shown below.

I0ELE's Ground Station antenna system Authors

P. Tognolatti IØKPT, E. D'Andria IØELE, T. Giagnacovo IZ8YRR, F. De Paolis IKØWGF, F. Azzarello

For a deeper description please refer to the Amsat Symposium 2010 proceedings.

W6HHC comments:-

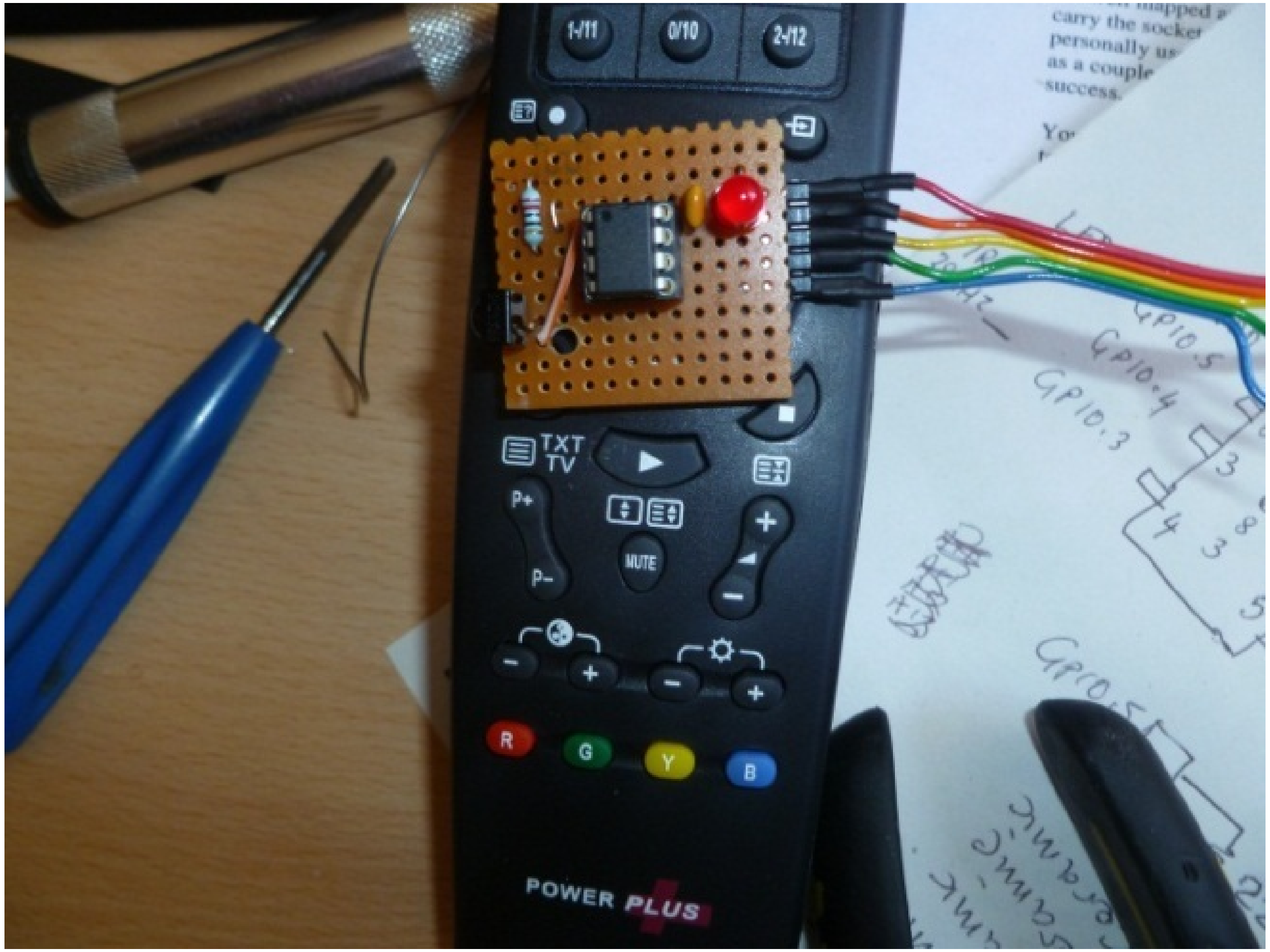
No ill will towards the ISS authors, but it would be useful for me and any DATV newbies to list the actual frequency (band) described in the Transmitter Block Diagram. I know that "S-Band" is mentioned in the diagram….but that is MEANINGLESS to someone (like me) who is NOT a MICROWAVE GURU.

A quick sorting of ISS postings on the Yahoo Group for DigitalATV reveals that the ISS will transmit in the 2.4 GHz ham band.

Flipping captions on the PIC based OSD generators via Sony IR Remote.

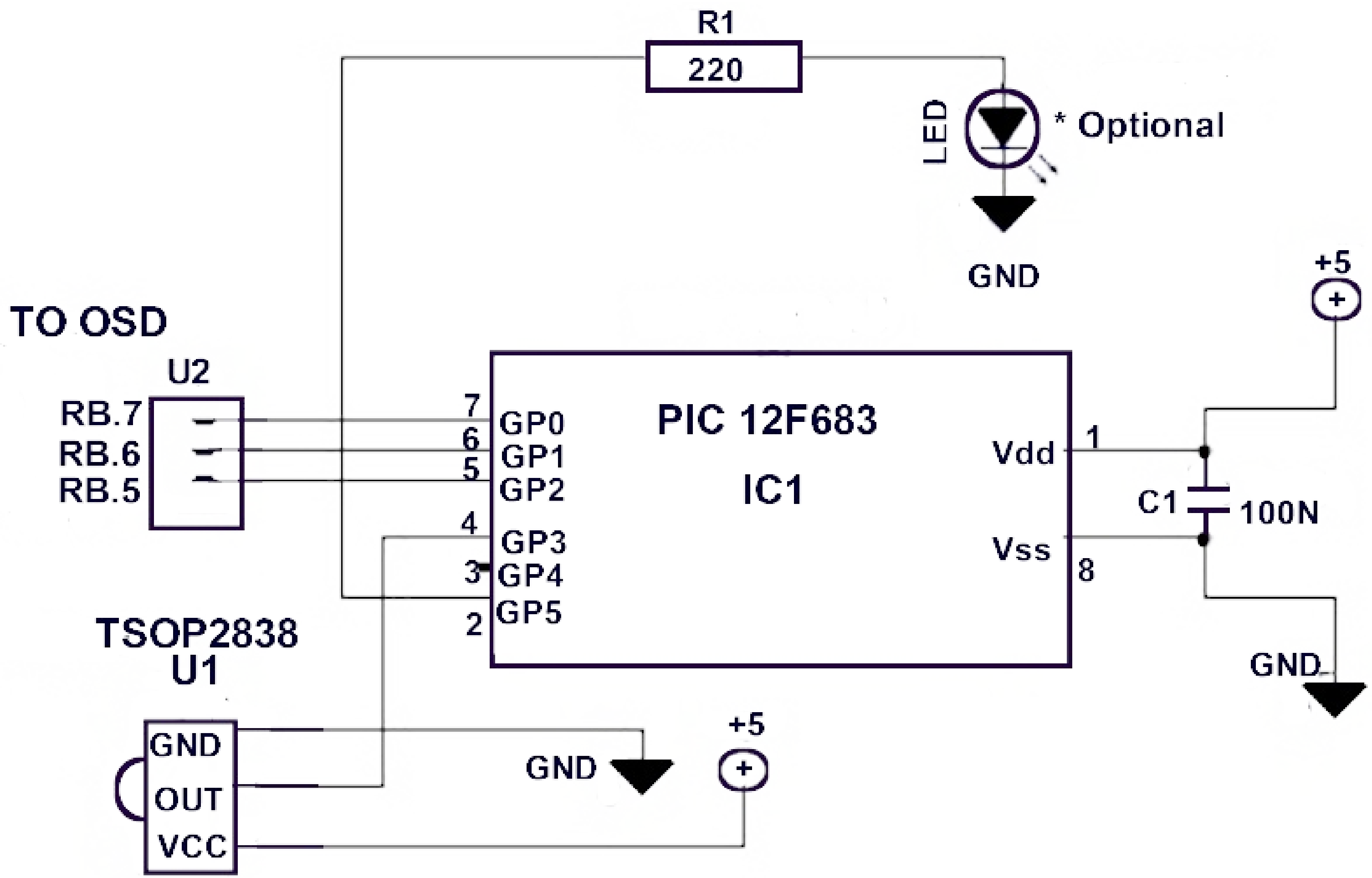
Mike G7GTN.

We have probably all seen the PIC based OSD generators that grew out of the work of Alan F1CJN and the PIC Dream circuit & the software which he created. He later designed an OSD based on much of this excellent work. Through the Internet many other examples can be found of this quite classic design generally with a few added 16F84 software tweaks being made by the end user.



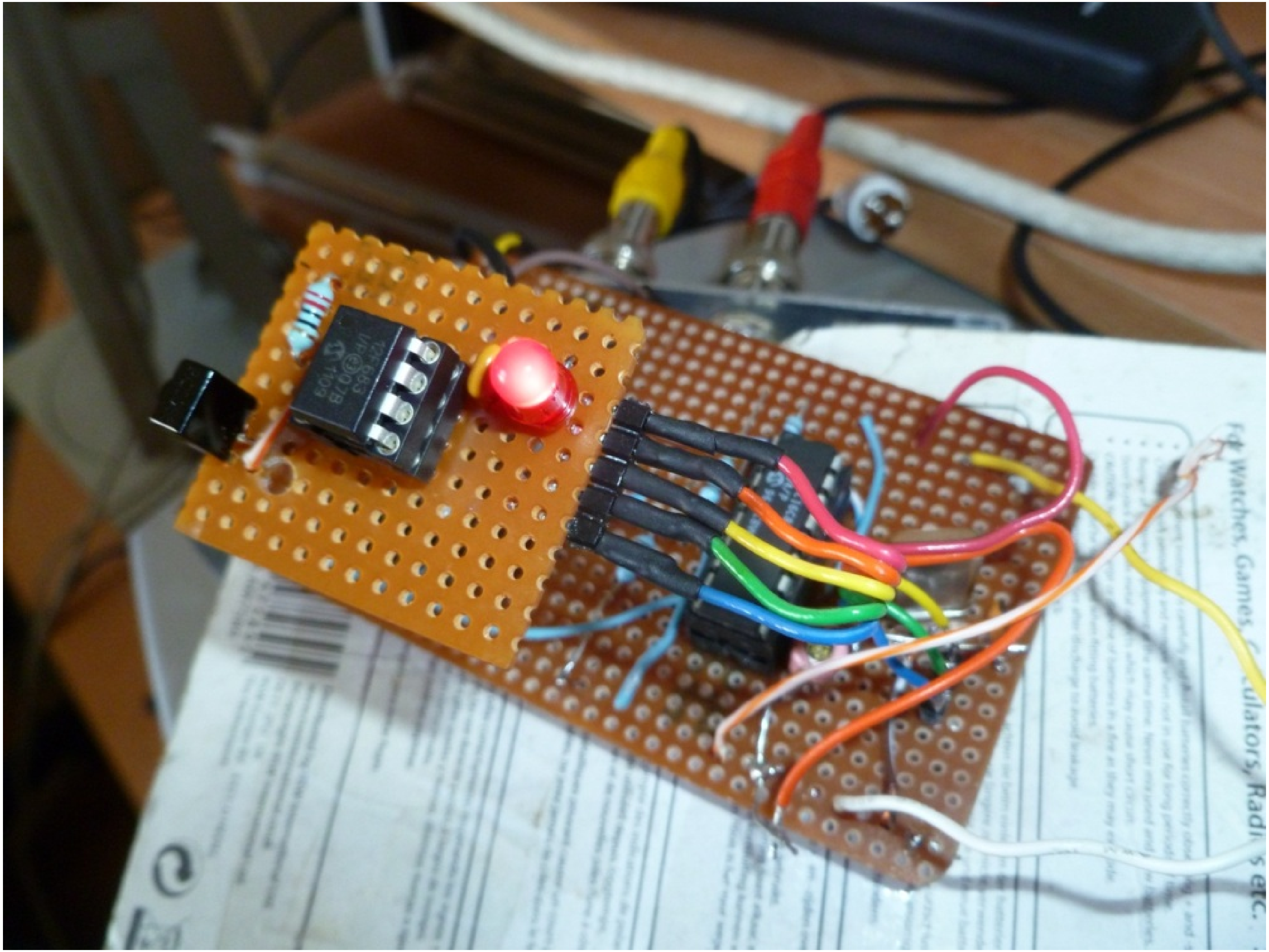
Of more recent times have been building up a quite rugged portable setup, all packaged in diecast boxes. Ready early next year to get out portable and actually operate some Amateur TV again after giving up this interesting hobby around early 2001. I determined that for myself having a single IR remote might be a more useable direction to go, instead of having to press multiple buttons. At the home QTH buttons are great and always totally expected. A must have item to create a sense of user involvement and additional viewer excitement!

I had a PIC 12F683 in stock so spent an hour putting this very simple project together to allow flipping captions on one of these generators via a standard Sony or cheap replacement remote. Our PIC decodes the Sony IR commands sent in software via a low cost 38 KHz IR detector device. Use has been made of the PICs internal oscillator to save the requirement of an external Xtal and associated capacitors.



We drive the RB.5 – RB.7 pins of the OSD circuit, this places logic levels on the pins and hence flips your pre-set captions.

We could further easily multi-purpose this circuit and remove the 38KHz IR detector and drive this via Serial One pin operation to flip captions on for example a Cropedy style test card generator by driving the required Eprom lines. The code written in basic is also available along with this project.

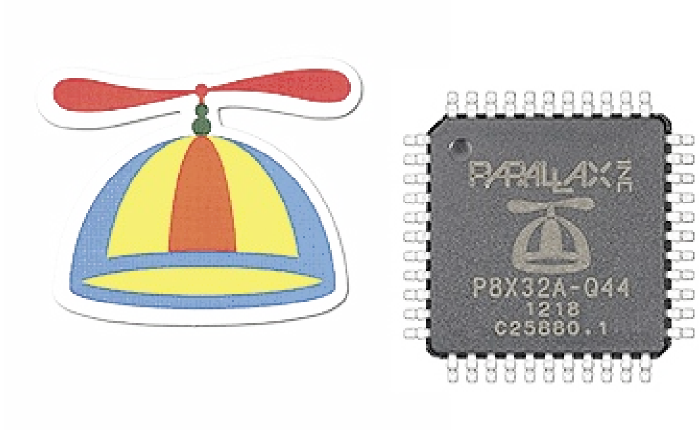


Photograph of my prototype setup

The PIC hex code and BASIC source can be downloaded from the downloads area of the CQ-DATV.mobi web site.

What is the Parallax Propeller?

By Mike, G7GTN



You certainly cannot travel very far in the world of electronics today before coming across the fascinating subject of Embedded Micro Controllers. We have all certainly seen by now electronic circuits based on Microchip and Atmel processors to name but just two suppliers from very many available devices and differing technologies in the market place. Where some of these devices might fall down slightly is that pin functions are often set in stone by the manufacturer, as in I2C, Analog in happens here etc. Sure we all are somewhat familiar with this.

What if we had a controller to work with that allowed us to make these decisions for ourselves where we want our peripherals within Software alone? Nothing is built in apart from I^{2}C on two Pins, and outside communication on a further two pins. If this processor had 8 cores (Processors) and no user interrupts to handle could also make for quite an interesting device to use.

I feel sure by now we have all heard of the Basic Stamp range of controllers, well this processor is from the same people and was fully custom designed in house around 2006. When this was launched some quite ground breaking concepts were introduced in the approaches and methods taken. The processor is slightly unusual in that the compiled byte code is stored in an external Eeprom 32K in size and downloaded to the processor on actual start up. So unlike many current offerings we have no Flash memory at all on board. One of the processors which they actually refer to as COGS is responsible for start up and running of this whole process.

Where this concept becomes interesting is as already mentioned having no interrupts to have to service and process within your coding. It is quite possible to have 8 processes running one in each COG all independently or communicating with each other back and forth as required. The 32K of external Eeprom is relevant as the processor has an internal memory of 32K which is shared across the 8 available COGS in 4K Blocks.

The Clock Modes

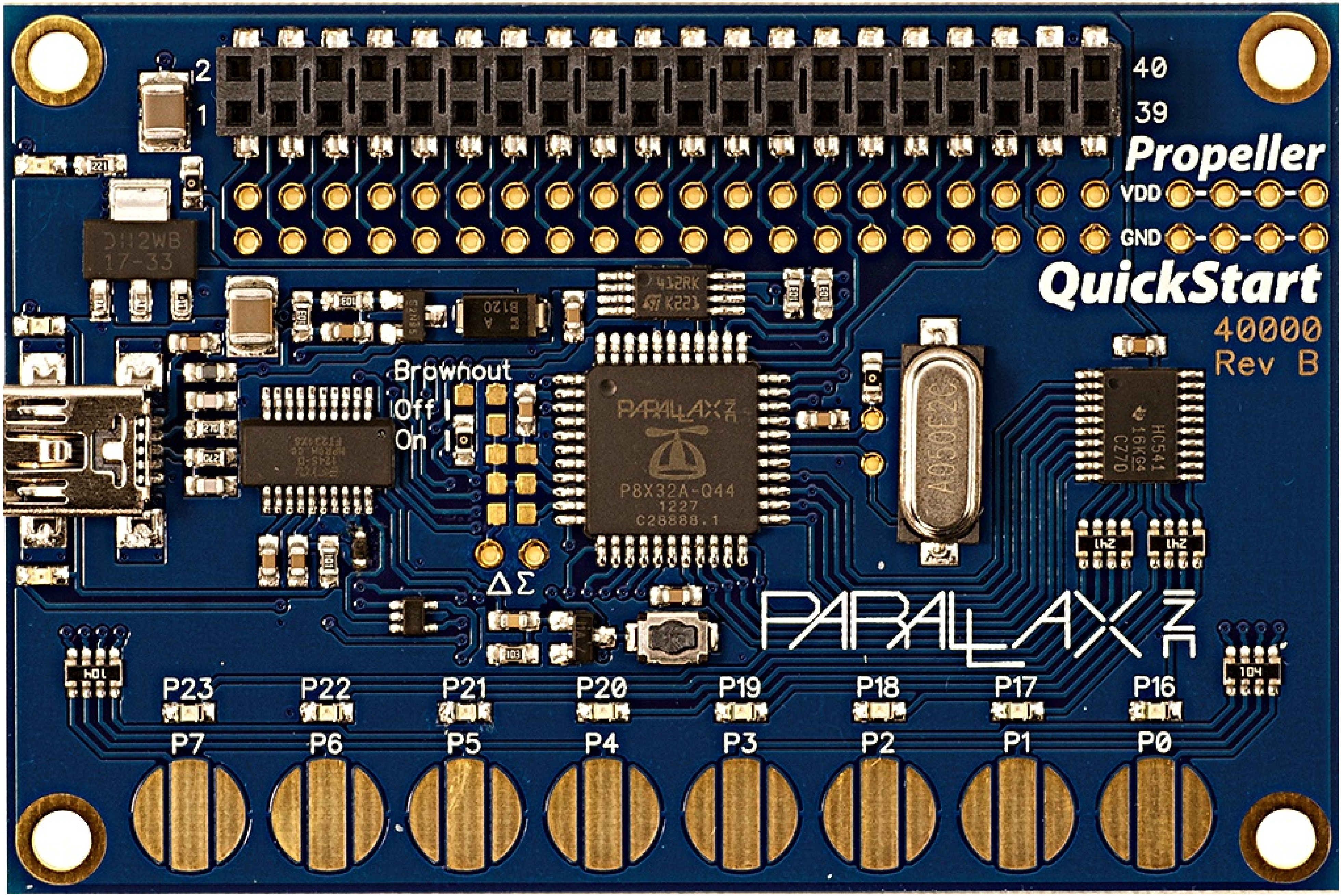
The Propeller is capable of running in several different clock modes, from using an internal Oscillator at 12MHz all the way up to 100MHz with an external 6.25MHz Crystal and the PLL set in software to 16X. More generally the device is operated with a 5MHz crystal for 80MHz clock speed.

I/O Pins

As we have noted none of the pins have any internal peripherals attached to them, well apart from the I2C SDA & SCL pins that communicate with the required Eeprom. The only other pins that have a dedicated function are the two required for serial communications. The Propellers attached I^2C driven Eeprom is programmed in this fashion. The I/O pins on the Propeller are all operated at 3.3 Volts and a common approach taken for interfacing 5 Volt devices or parts is the use of dropper resistors of a suitable value to provide us with pin protection. We are by now getting used to these core voltage levels in many of the devices that we use in our home projects. The device has the I/O quite logically split into 4 sets of 8 pins in each block.

Hardware Platforms

The Propeller is available in both conventional 40 pin DIL packaging alongside the surface mount versions both LQFP & QFN. Possibly the best route to take when using the device is to make use of a pre-assembled development type board that has breakout connections to all available I/O pins along with built in USB communications to your host computer system. One such board fairly recently introduced by Parallax is the quite affordable Quickstart as pictured here



(Picture supplied courtesy of Parallax)

Programming and Software Objects

The Propeller chip can be programmed in SPIN which is interpreted and the native language of the device along with PASM their own version of assembly language. Of course many other languages have been heavily community developed such as C, Basic, Forth to name but a few. We have to come back to the use of Objects, which are not as you might be familiar with in other languages. Objects are very simply expressed pieces of pre written code or Drivers to provide a specific function. Common examples of these would be Serial, LCD, VGA, I^2C, SD Memory, RTC etc. Generally within our start up routines we specify which I/O Pins we actually want these objects to make use of. This is how we end up with our software peripherals.

Imagine the ease and flexibility for laying out printed circuit boards, all external I/O can be pulled from one side of the device downstream or internal come from another set of I/O pins.

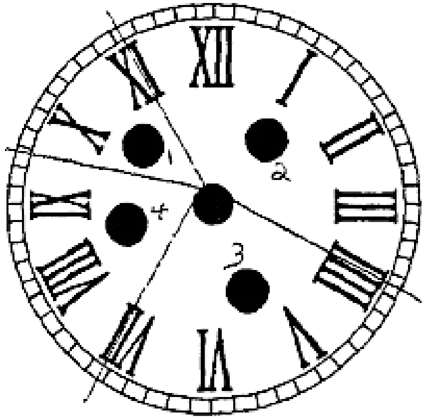
Conclusion and a project next time

Think of a device that can be easily programmed, for near instant results and gratification. Imagine an extensive user contributed pre written software library that helps you to concentrate on just doing your own designing and then building your project.

In the next edition of CQ-DATV I will present an 8 Channel video switching project where we see the device in a real world practical example applicable to Amateur Television, that is both easy to build and fun to operate using multiple input control sources.

I hope this will feed your imagination and encourage you to also look at this device for yourself and dream up some practical projects of your own. Have fun learning and also making things.

A brain teaser solution



In issue 3 we asked:-

Someone has dropped a clock onto the floor and its face has broken into four pieces. When all the pieces were picked up, it was noticed that the numbers on all the separate pieces added up to the same amount.

Firstly, what was the amount? Secondly,on the above clock face, mark out how the broken pieces were shaped.

and the solution is....

Each piece of the clock face had figures adding up to **twenty**:

- *Piece number 1 had printed on it X and the X of XI.*
- *Piece number 2 had the I of XI, then XII, I, II, III and the first I of IIII on it.*
- *Piece number 3 contained the last three ones of IIII, then V, VI and the VI of VII.*
- *Finally, piece number 4 had the last I of VII, VIII and IX, the latter when read upside down being XI.*

Introducing Project Loon: Balloon-powered Internet access

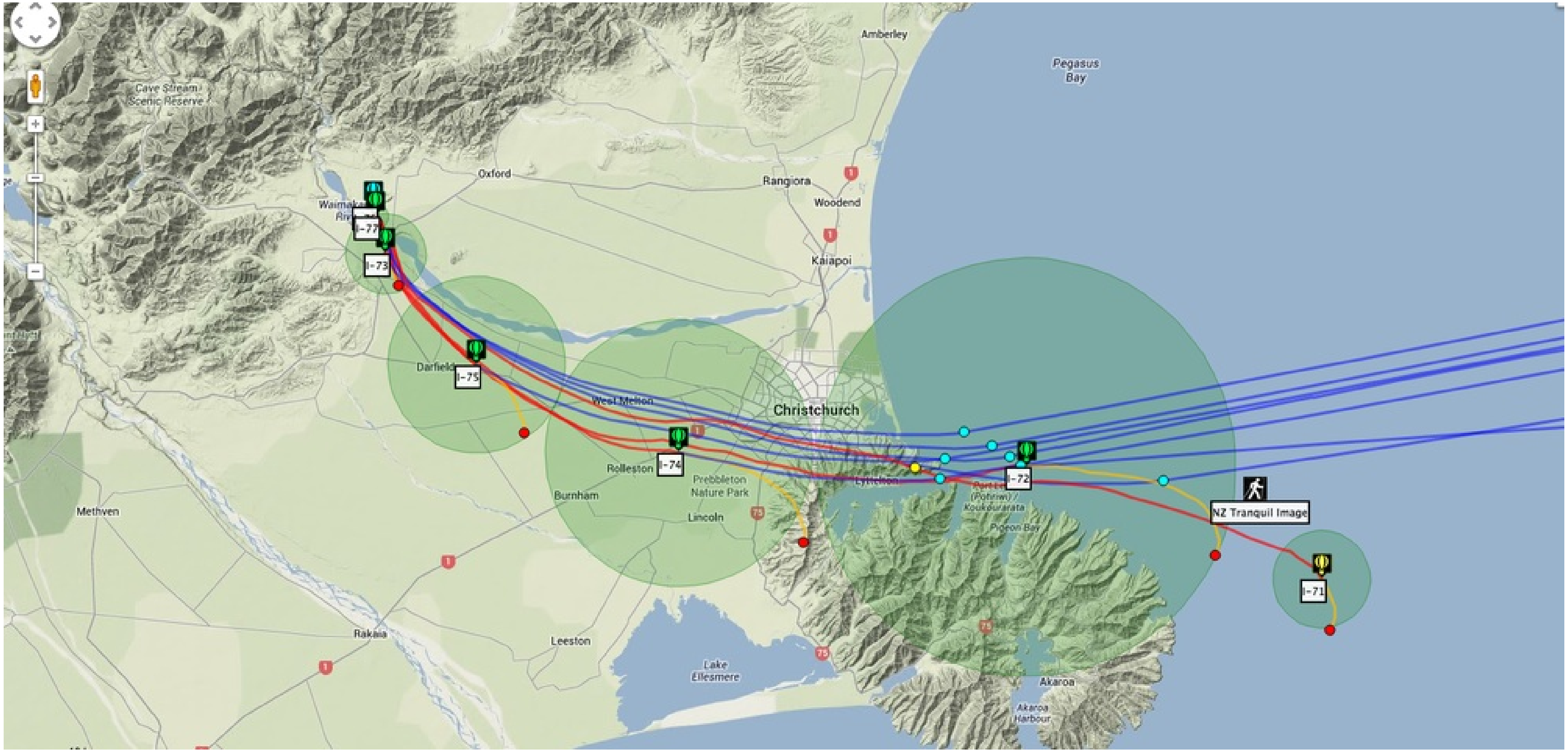
The Internet is one of the most transformative technologies of our lifetimes. But for 2 out of every 3 people on earth, a fast, affordable Internet connection is still out of reach. And this is far from being a solved problem. There are many terrestrial challenges to Internet connectivity—jungles, archipelagos, 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

Multi camera - part 2

By Trevor Brown

In the last issue I used the Data Video SE500 mixer for a multi-camera shoot; these mixers have been around for 3 or 4 years and are starting to appear on eBay for around £300. The older MX50's are more of a bargain, but being older are starting to show problems, probably nothing that changing all the electrolytic capacitors will not fix, but there are a lot of them, vision mixers that will mix between free running cameras are complex units.

The other problem is they were all designed for PAL operation, and this is not really suitable for wide screen. Like it or not we are in the digital age, camcorders with HDMI outputs are plentiful and inexpensive often starting at around £100. So let's investigate using HDMI for a multi-camera shoot.

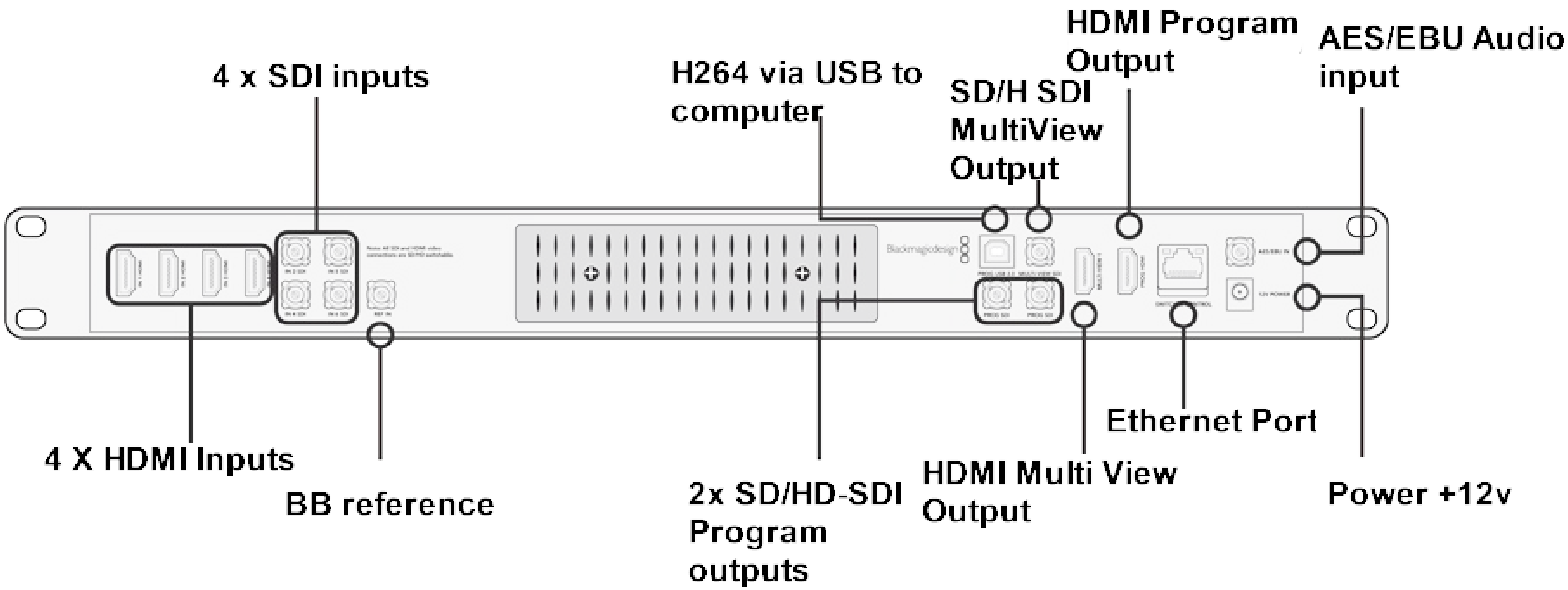
First the cables, these usually have a limit of around 25m, don't start daisy chaining them, they are 25m for a reason, but for a small lecture room style shoot these are adequate. If you are planning something larger then this might not be the way to go. There are fixes to get around the cable length problems but I will not be covering them in this article.

Once we have our cameras in position and powered up, perhaps with additional cabling for cues and communications, depending if we have camera operators or if we are using, remote Pan and Tilt or just locked off cameras, in which case a simple HDMI connection will be sufficient. The HDMI will not provide power to the camcorders so external power or batteries will be needed. If you run the camcorders on internal batteries be aware of how long they last.

So now we have our HDMI sources, wide screen and no nasty PAL subcarrier on our pictures, how do we mix these sources down into a single video feed? Well I am afraid it is dig into the piggy bank time, so let's look at the Black Magi ATEM.

Broadcast control panel

Stop drooling, it comes in various options and the picture above would require a very understanding bank manager. It is a control panel for the largest option ATEM. Let's look at the affordable version.



ATEM Television Studio

This is the budget version £655 still needs an understanding bank manager, It's a small 1u unit and if you are setting up a small live production company it's the way to go. The ATEM Television Studio Provides 4 HDMI video inputs, and 4 SDI inputs 2 HDMI outputs, and some digital audio inputs, 2 program outputs, real time H264 coding for the Internet, SDI and HDMI multi view outputs.

You can only use 6 of the inputs, but two of the SDI inputs could be converted to HDMI with external adaptors and provide you with 6 HDMI inputs.

.

MultiView

Multiview is so you can monitor all your video sources on a single panel, £699 does not include the Broadcast panel that's an extra £10k so how do you control it.

There are two more modest options, the first one being the smaller control panel.

ATEM 1 Control panel

That will set you back a little over £3k but there is the really affordable option, use your Laptop. There is software available for both Mac and PC's that will enable control of the basic £699 switcher not quite as easy to handle, but you may already have a laptop and the software is bundled with the mixer hardware, and well if things take off, you can add a control panel later.

Soft Panel

The screen shot of the soft panel, imagine that on your laptop.

The third option is to build your own panel and although I do not have a full circuit diagram of how to do this, there is a lot of development going on and details are starting to appear on the Internet. They are based on the Arduino module.

See *http://www.arduino.cc*/

There are numerous solutions on the net, this is just a few

http://www.youtube.com/watch?v=Ot8CBcXT8D8

http://www.youtube.com/watch?v=ZsLvn7gnvPI

http://www.youtube.com/watch?v=FlyyhGyPClE *http://skaarhoj.com/case-stories/atem-arduino-case-stories/*

No I am not paid by Black Magic, but if Black Magic has any free samples you can always contact me care of the CQ-DATV editor.

For more information *http://www.blackmagicdesign.com/uk/products/atem*

DATV start here part 2

By Trevor Brown

In CQ-DATV3 I outlined the difference DVBS and DVBT. In this issue I would like to look into DVBS in more detail. In the last issue I pointed out that sampling an analogue signal and converting the samples into digital words substantially increases the bandwidth of the signal, and that by the use of Mpeg encoding which transmits a mixture of still frames and movement information to update those still frames the bandwidth is reduced. I am trying desperately not to break into mathematics, but for those of you that the mathematics approach works, the Internet is full of suitable explanations.

Mpeg2 was the first digital TV compression algorithm and was improved on by the newer video CODEC, H.264, which can be also used with DVB-S2. This CODEC is sometimes called H.264, sometimes called MPEG-4-Part-10, and sometimes called Advanced Video Coding (AVC), but, all of these terms mean the same standard, technically. H 264 will often deliver the same signal into half the bandwidth of an Mpeg2 compressed signal with no loss of quality. Video compression has been around quite a while, in fact interlaced scan was the first example of video compression, we just did not know to call it compression at the time.

Mpeg compression has presented problems to many amateur applications and has perhaps held back home constructed DATV equipment. Many of the amateurs using DATV relied on donated out of date broadcast encoders. Now we have DigiLite and it adopted the F4DAY solution of carrying out the process in the PC, well in the PC and in some Hauppauge hardware. This is about to change as Rob M0DTS has compression running on an MK808 smart stick see *http://www.m0dts.co.uk/index.php?tag=DATV&item=85*.

The next stage is modulation of the digital signal onto a carrier using QPSK, which is an advance on PSK (phase shift keying), where two carriers exist with two different phases, but the same frequency. The data modulates the signal by switching between the phases dependent on if it is logic 1 or Logic 0 The decoder compares the received signal with a reference and detects the phase of the modulation and reproduces either a logic 1 or logic 0 depending on phase.

This simple system was improved on by differential phase-shift keying DPSK, this can be significantly simpler to implement than ordinary PSK since there is no need for the demodulator to have a copy of the reference signal to determine the exact phase of the received signal.

QPSK (Quadrature Phase shift keying) takes this one step further and uses four modulation phases which equates to two binary digits, so effectively two binary digits can be transmitted at once; another step in reducing the bandwidth.

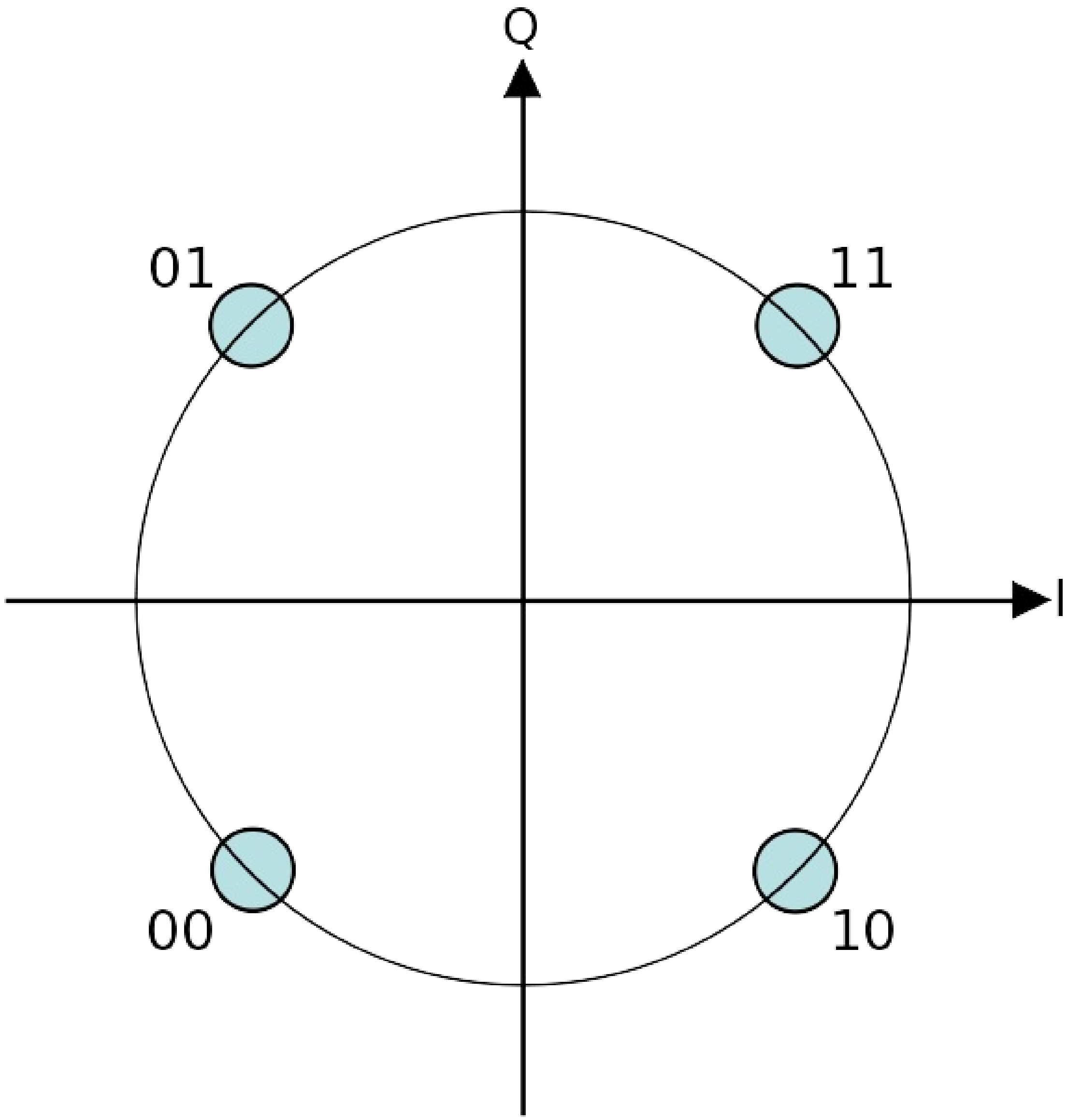


FIG 1 – The four points of a QPSK Constellation

Fig 1 shows the four phases of the carrier known as constellations. You will often see this signal when working with QPSK but probably not quite as clean as the theoretical Fig 1 due to noise.

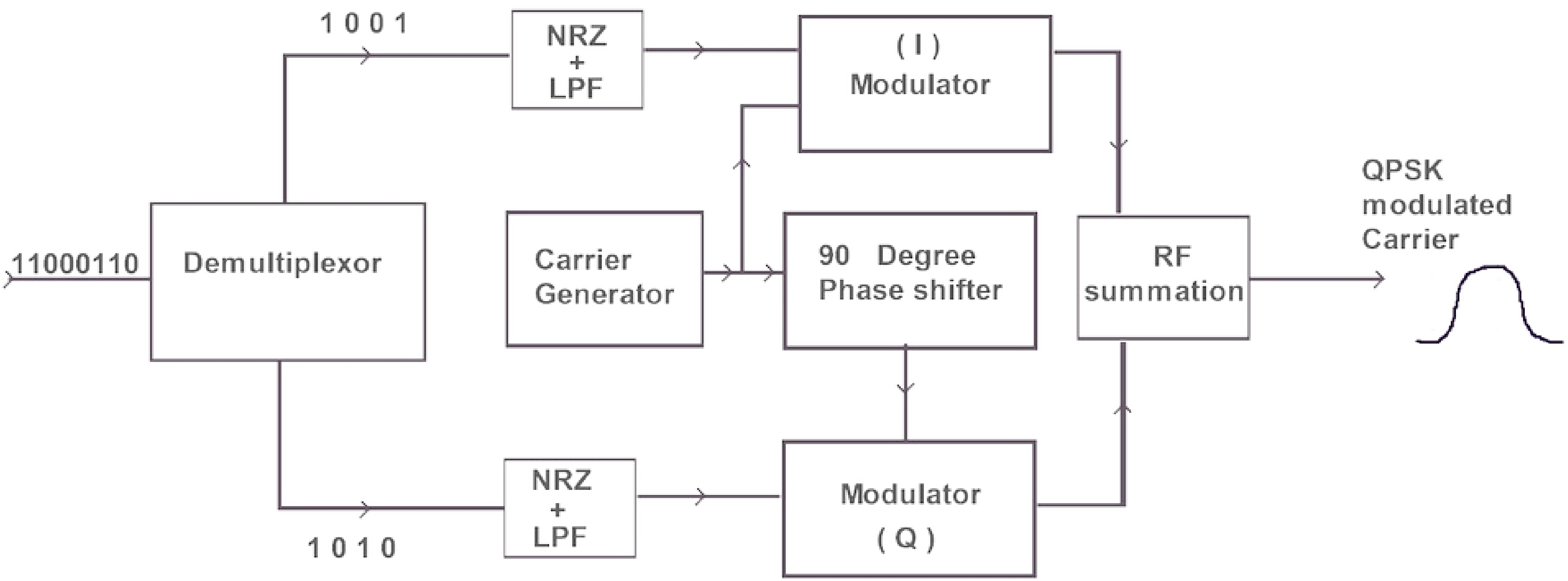


FIG 2 – Block Diagram of typical IQ-Modulator

Fig 2 shows how we achieve QPSK, first the demultiplexor which converts the serial data into two streams, with the first digit going to the I modulator and the second digit going to the Q modulator (both at the same time) hence we get twice the data into the same bandwidth. The I and Q modulators are identical and are fed with the carrier that we are going to modulate, but the Q modulators carrier is phase shifted by 90 degrees The two carriers are summed together and we get our signal, modulated with two binary digits, this pair of digits is called a symbol and the data speed is the symbol rate.

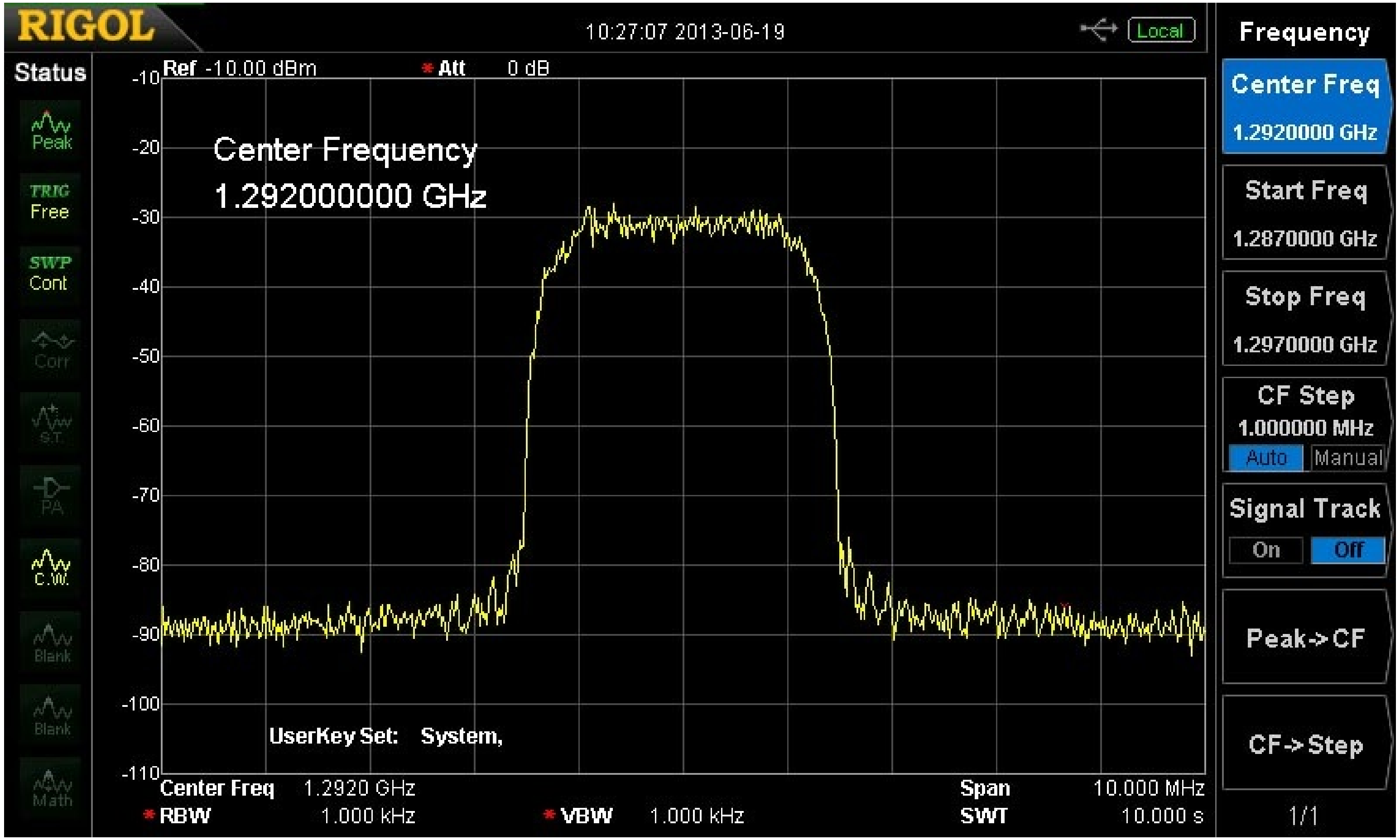


Fig 3 – An actual QPSK modulated DATV signal spectrum (Symbol Rate = 2.2 MSymb/sec) (courtesy of W6HHC)

There is also one last bandwidth reduction in the chain; the demultiplexed data is changed into an NRZ code (non return to zero)

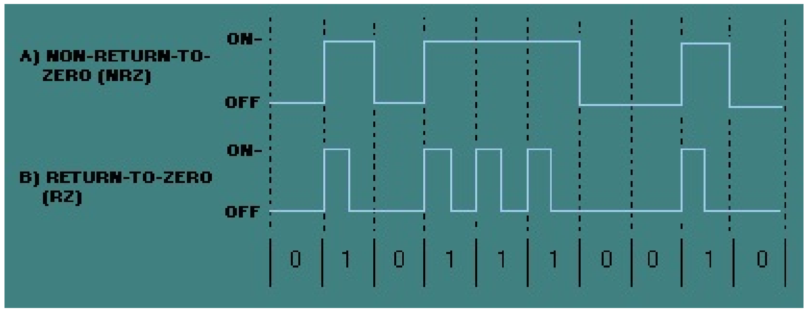


FIG 4 - Comparing Return-to-Zero waveform with NRZ waveform

In an NRZ code, rest states are removed so if B in Fig 4 is the output of our Mpeg encoder and we remove the rest states as per A I think you will agree that if we get several 1 or 0's together the code does not change and thus it is the same, data but lower in frequency, as one supermarket "says every little bit helps". It does make it harder to recover in the decoder because the required clock is not naturally part of the data. The data is also passed through a low pass filter to make it sinusoidal and transmission friendly.

The last problem was system noise; the constellations never look like Fig1 and more often than not look like figure 5 where digital data can be corrupted by system noise.

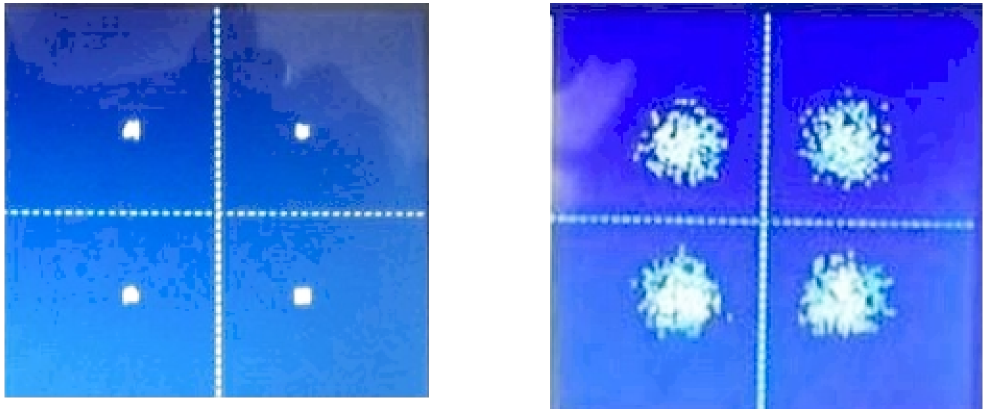


FIG 5 - On the left is a clean QPSK modulation Constellation. On the right is a noisy QPSK Constellation (Courtesy of G4GUO)

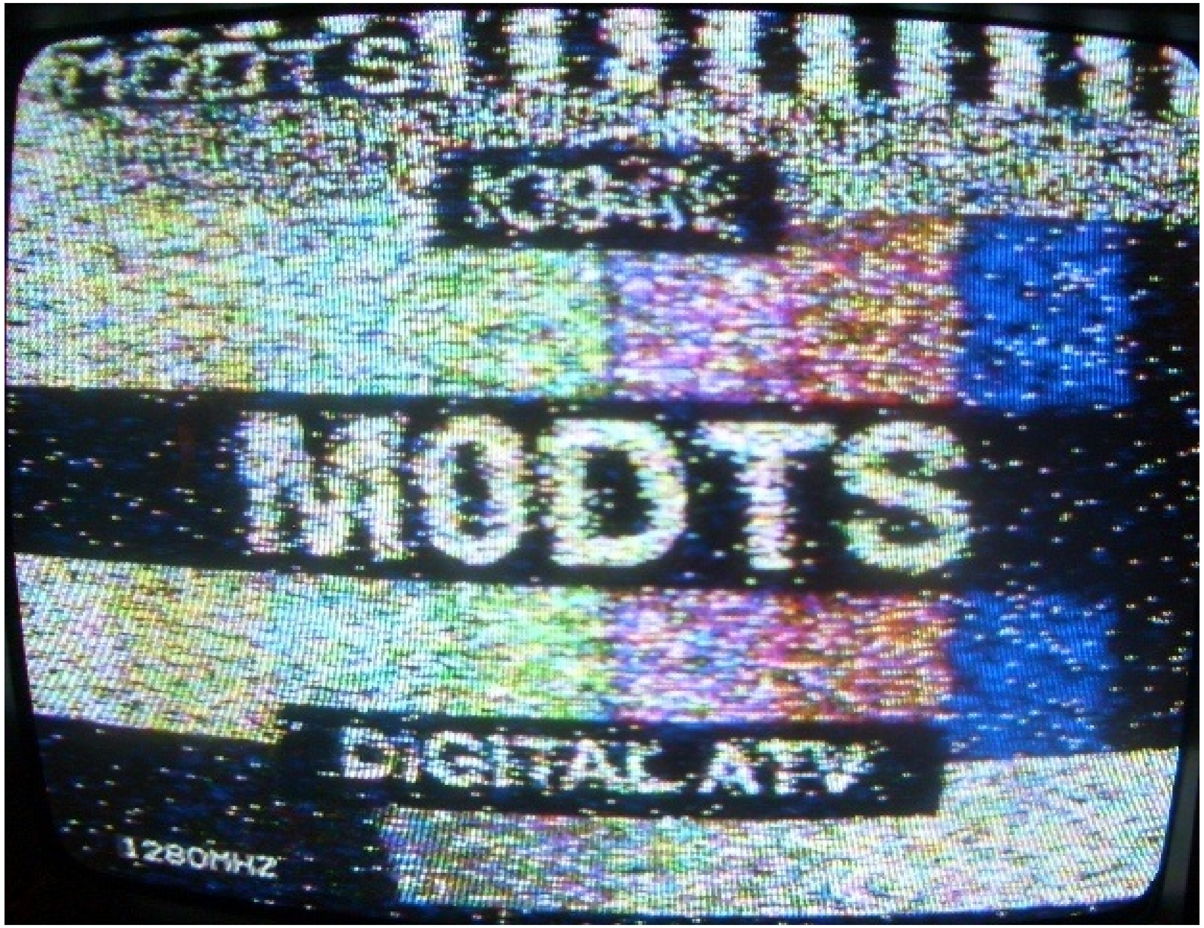
On the left is the clean QPSK modulation Constellation. On the right is the noisy QPSK Constellation

Mathematicians stepped in with a way of correcting corrupted digital codes as early as the 50'. The leading light,being the American mathematician Richard Hamming, see https://en.wikipedia.org/wiki/Richard_Hamming Richard invented the first error-correcting code in 1950. Again if you would like the mathematical approach see https://en.wikipedia.org/wiki/Hamming_(7,4)_code.

So to avoid the math's can I describe FEC (Forward Error Correction) as a mathematical description of the video data, added to the signal to enable the decoder to check the data and repair any faults. The repair information can be simple or more complex giving the signal different levels of noise immunity. The problem is that FEC adds to the bandwidth, because it is data that is added to the signal in addition to the video data, the more repair data we add the better the noise immunity, but it is counterproductive in that it increases the bandwidth of the signal. FEC is expressed as two digits ie 1/2 or 7/8 etc The first digit is video data and the second the data after FEC has been added so1/2 is a doubling of the data by adding some heavy FEC correction 7/8 by comparison is the addition of some light FEC correction.

If we are to fit DATV into 2MHz, which is less than half the analogue bandwidth of the video signal, before digitisation then we needs to use H264 coding, set the FEC to 7/8 and keep symbol rates down around 1.3Msps. Increasing the Msps will improve picture quality and increasing the FEC data will increase noise immunity and both will increase the transmission bandwidth.

It is as you would expect a trade off, but compared with the original AM or FM ATV we are on a winner in quality, noise immunity and reduced bandwidth. The only down-side maybe we will never see a signal emerging from the noise again, but we will have television on the amateur bands that uses considerably lower bandwidth’s to produce better pictures and is keeping ATV alive by making it DATV.


MODTS
DIGITAL ATV
1280MHZ

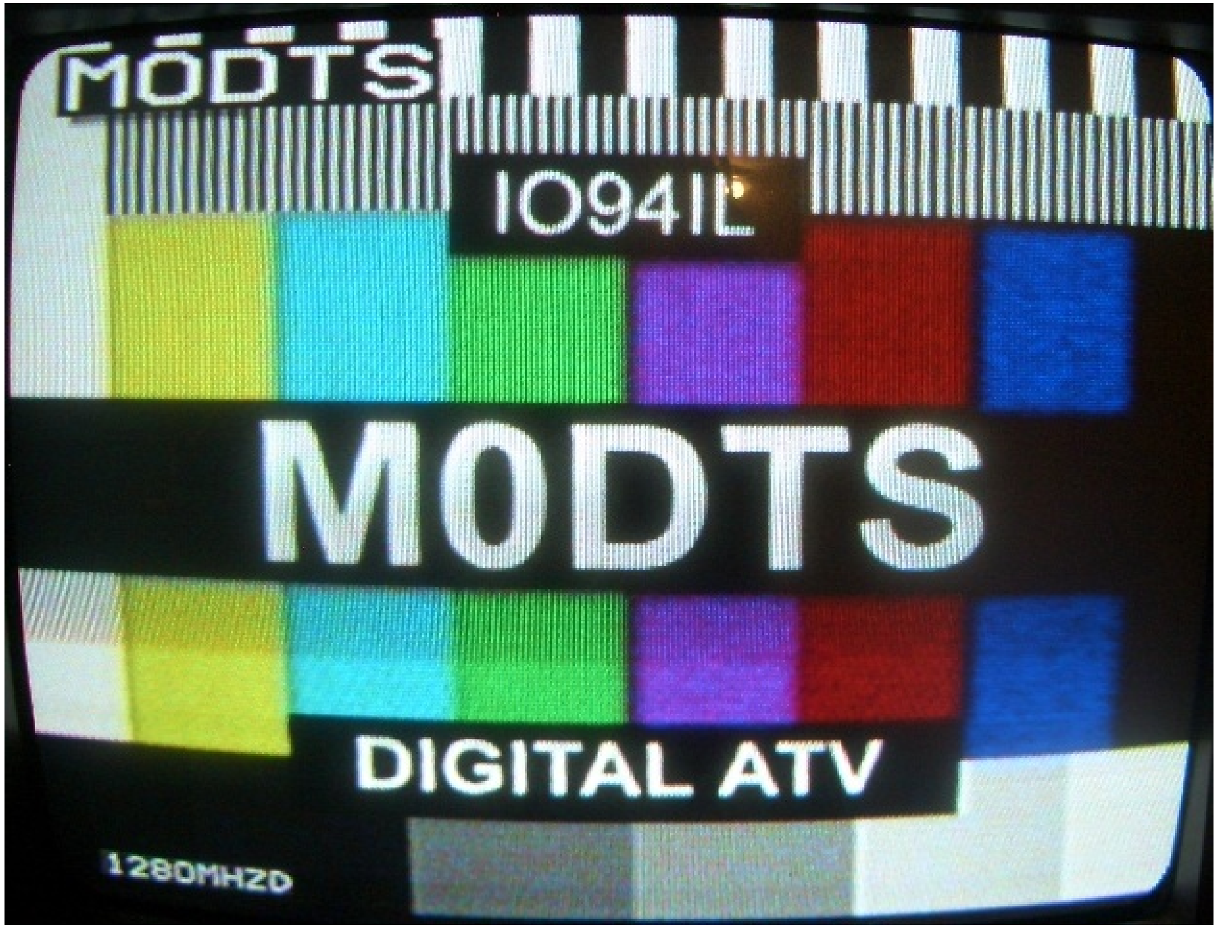


FIG 6 – Comparing weak Analogue ATV reception (top) with same power DATV reception (bottom)

Pictures kindly reproduced with the permission of Rob M0DTS see *http://www.m0dts.co.uk/index.php?tag=DATV&item=80*

These pictures show what DATV can achieve, but static test cards do not tell it all, the compression algorithms are all about movement so remember that when looking at DATV.

I hope this puts DATV into some sort of perspective for newcomers to the hobby; it is full of difficult concepts to grasp and new terms which you may not have previously encountered. Apologies for any over simplification, but you have to start somewhere and as I said at the beginning, the Internet is full of explanations that will build on this article and I hope will help you get to grips with the change from ATV to

DATV which is essential if we are to retain our hobby.

My thanks to Ken, W6HCC and Rob, M0DTS for helping checking and adding to this copy.

Construction of a simple electronic magnetic compass

By John Hudson, G3RFL

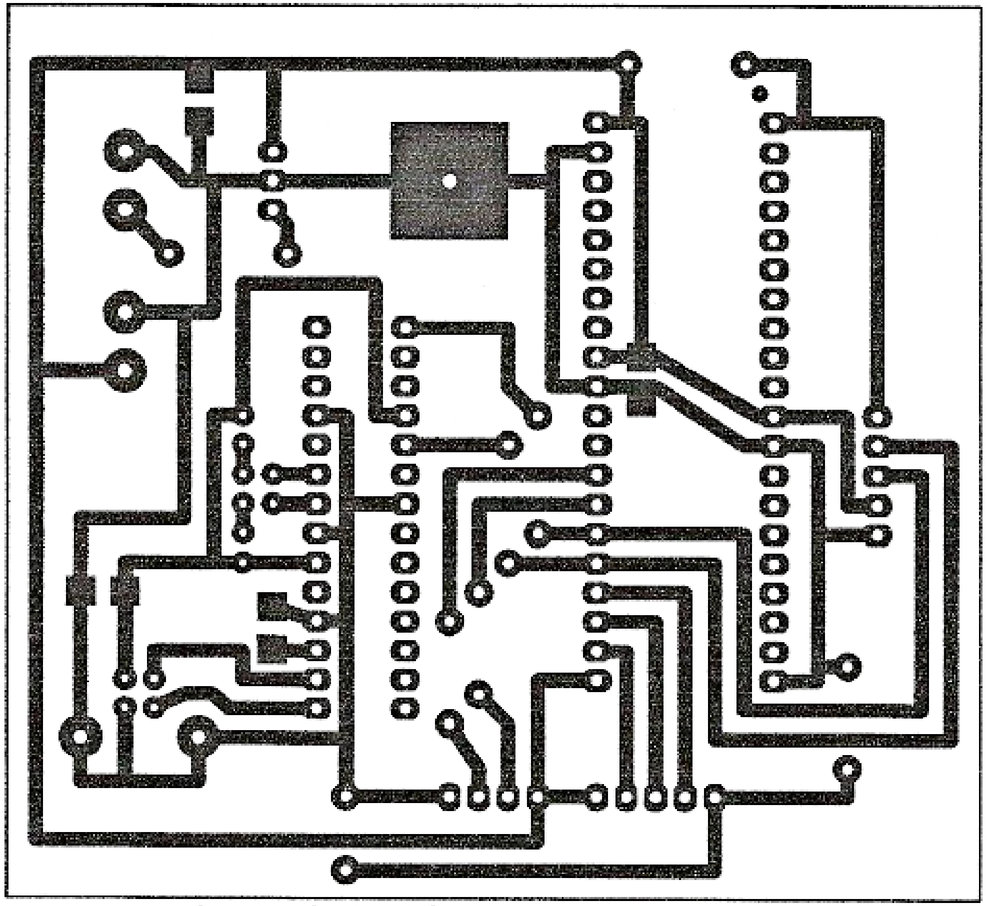
Over the years I have purchased lots of Aerial rotators and found that the noise from the controller used to drive both me and the XYL daft so I built an electronic one and all you could hear was the relays that then solved the problem. But you do get slip on the motor so an error crept in.

Living here very near to the sea soon took the rotators out with very fine sand blowing into the units and then they internally rot….every 2 years.

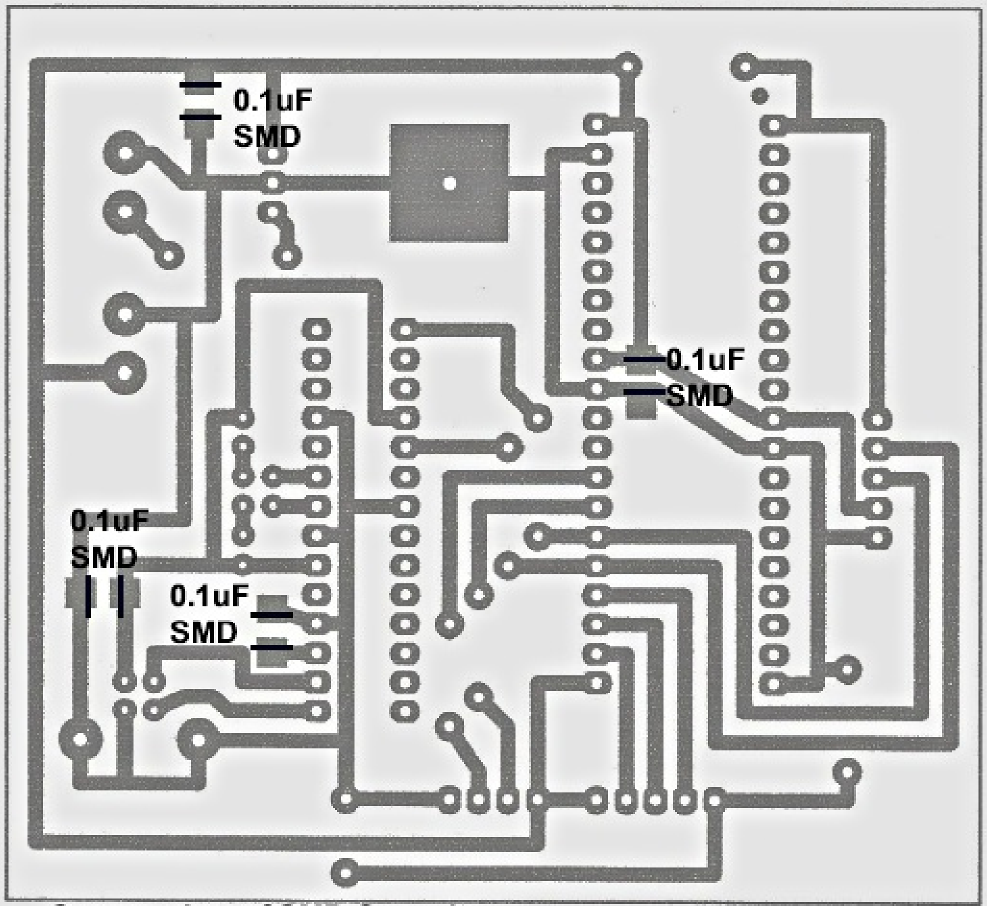
So I now have a 50ft pump-up mast, but NO ROTATOR, but I still need to know where exactly where my aerials are pointing, this was the lead-up to this project to resolve the direction problem with no mechanics.

CMPS10 is a postage sized PCB with two special chips on-board that do rotation, tilt and even velocity. *http://2r-he.blogspot.co.uk/2011/12/cmps10-tilt-compensated-compass-module.html*

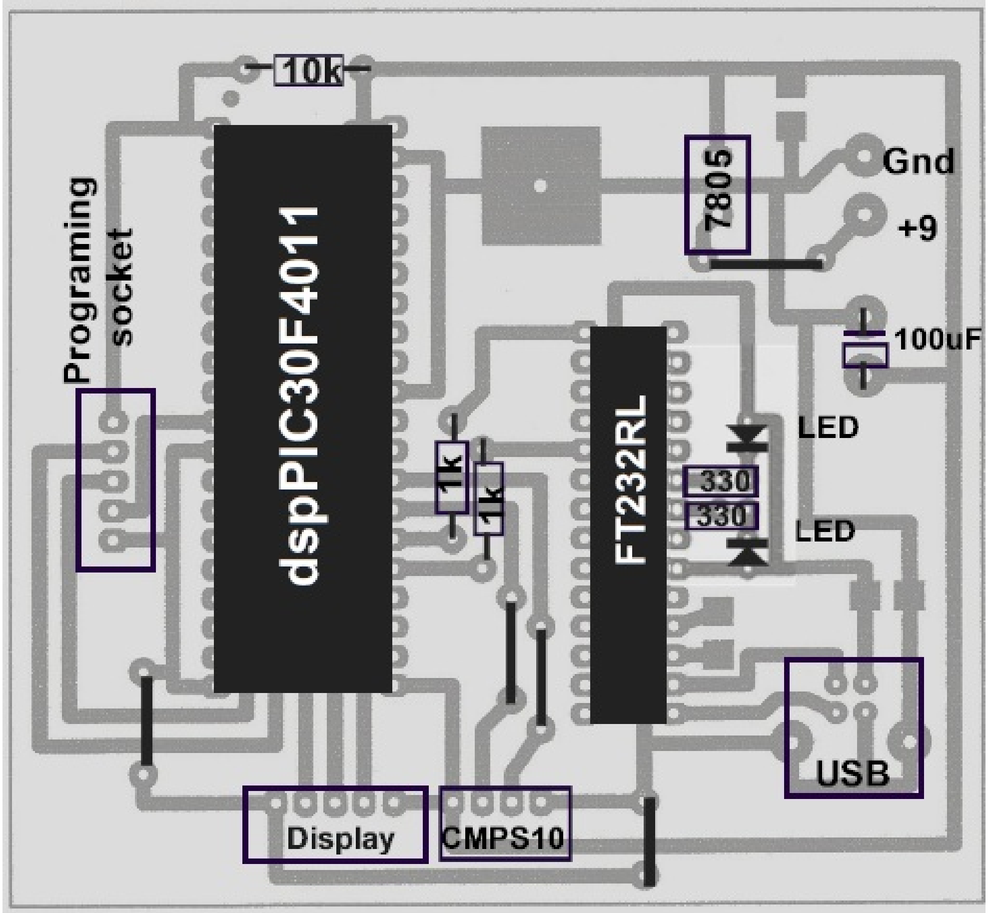
The full data sheet can be read at *http://pishrobot.com/files/products/datasheets/cmps10.pdf*



copper view to photo etch



Copper view of SMD Capacitor s



I used a dspPIC 30F4011 u/P,5V reg,4 digit display and that’s all a remarkably elegant electronic solution.

The readout is 0 to 359.9 DEG in my case yellow LED display so my intention is to place the sensor up a plastic tube seal it then a 4way cable down into the shack and the device mounted about 8feet up the mast at the top of the first section stuck out about 12” from the mast.

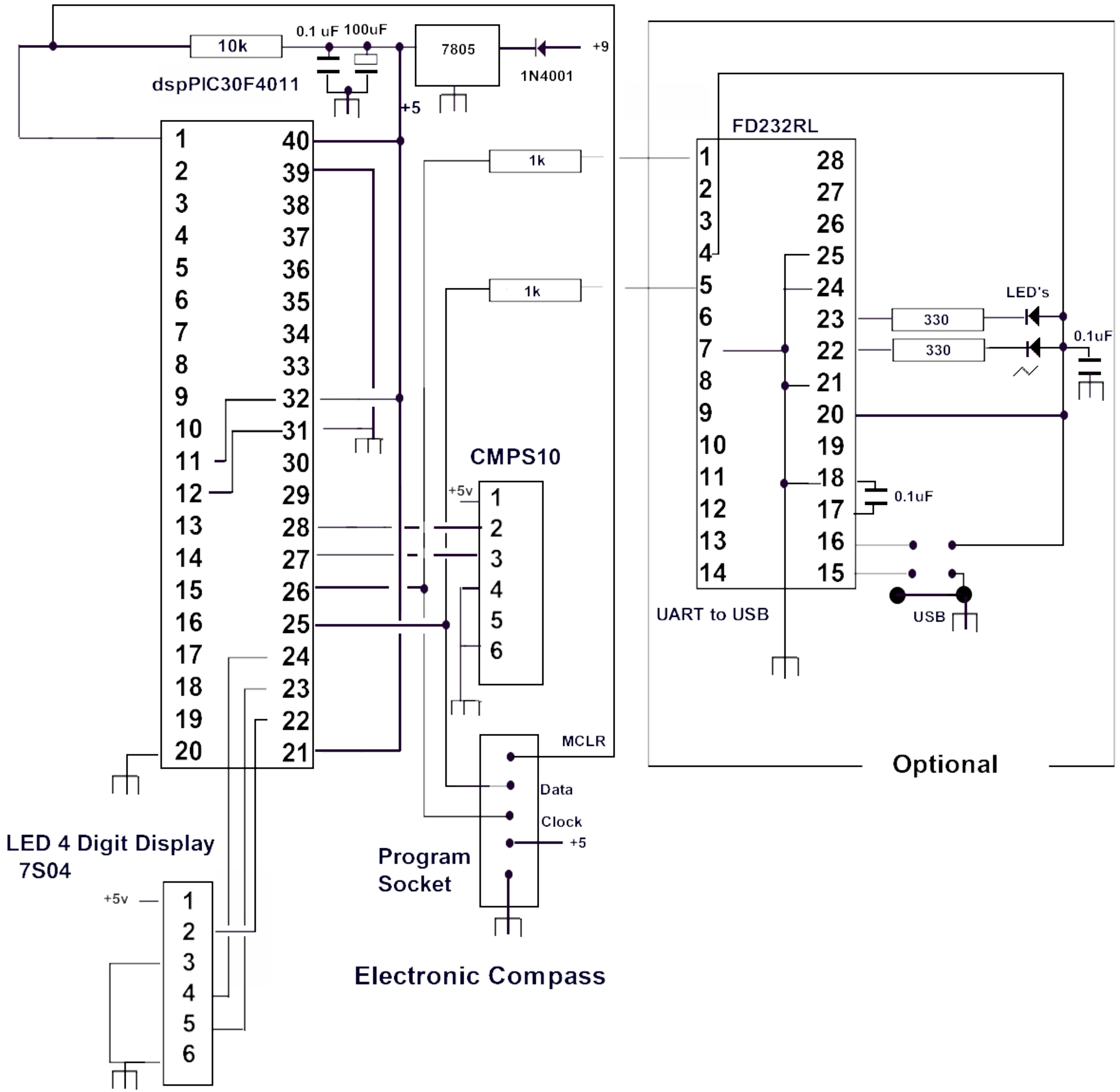
Results so far in the shack are looking good the last digit tenths of a deg roll around a bit but I think I can change the software later on the average out several readings. I did try extra decoupling but had no effect.

Because the unit can draw max 600m/A a good heatsink is required all the current is going to the LED display. 9 to 12V input best to keep it lower due to the heat on the 5V REG.

I also fitted the standard G3RFL programming socket on the PCB to download the assembler HEX file to the u/P from my MPLAB ICD2.

Also I added the optional FT232RL *http://uk.rs-online.com/web/p/interface-development-kits/0406568/* which connects the unit to a USB socket.

The USB socket feeds a VB PC based display program this optional addition sends the two bytes that are recovered from the sensor the MSB byte to the PC where you multiply by 256 the add the second byte giving you a max of 3599 count.

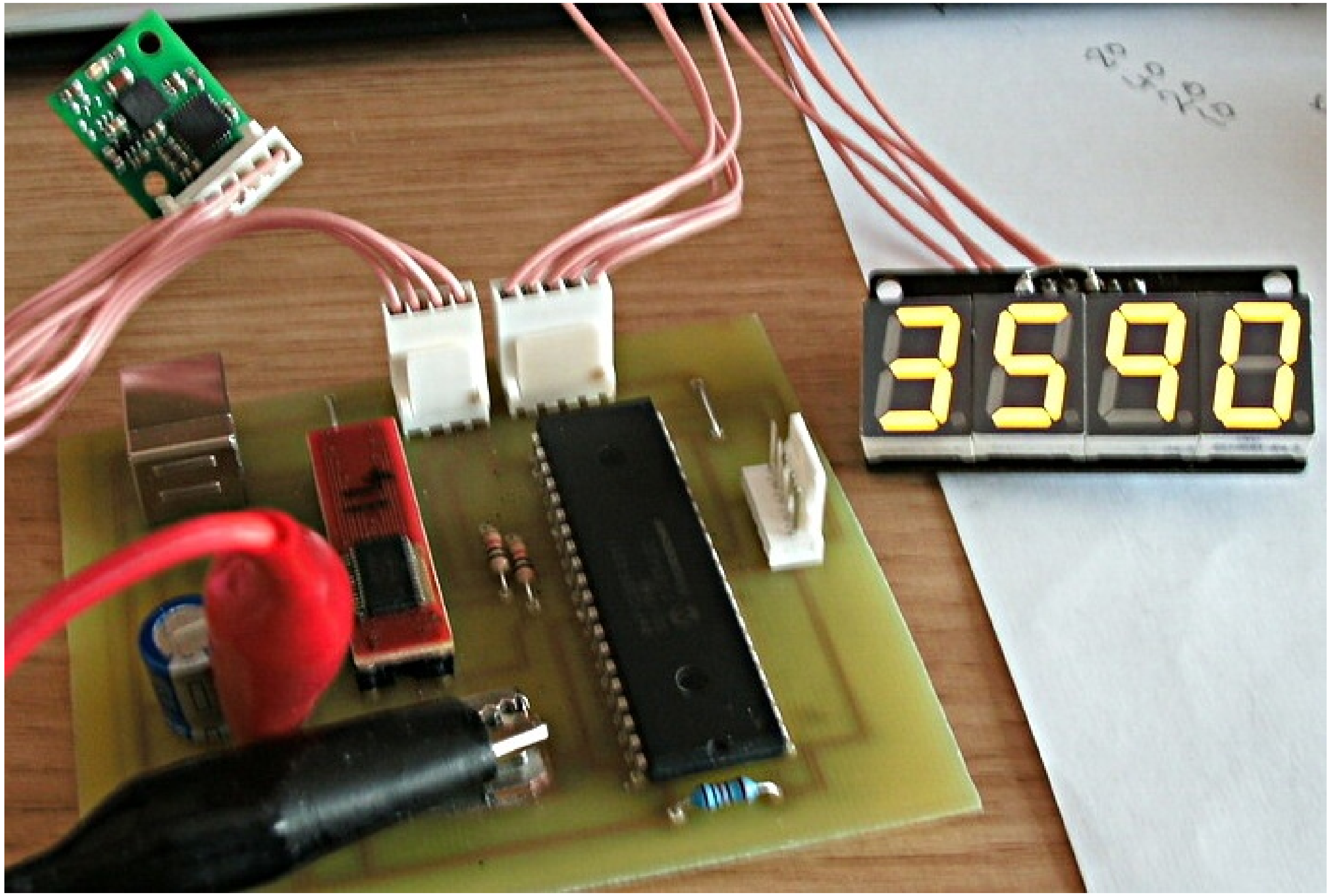

10k
0.1 uF
100uF
7805
+9
1N4001
dspPIC30F4011
+5
FD232RL
1k
1k
LED's
330
330
0.1uF
0.1uF
CMPS10
+5v
UART to USB
USB
MCLR
Optional
Data
Clock
+5
Program
Socket
LED 4 Digit Display
7S04
+5v
Electronic Compass

So while TX is on and show the direction on the video the RX station can tell me what the peak direction is because its mandrolic turning the mast up to press this is also for 10GHz where I need to know exact direction..

The PIC source code is available from the web site, *http://cq-datv.mobi/downloads.php*

Components:-

- *CMPS10 sensor*
- *dspPIC30F4011 u/P*
- *7805 Reg plus heatsink*
- *330R,330R,10K,1K,1K resistors*
- *small LED x 2*
- *4 Digit Led Display DSP-7s04*
- *in4001 diode*
- *2 pin power socket*
- *USB socket*
- *FT232RL IC usb interface mounted on a 28pin DIL socket PCB adaptor*
- *28 way DIL socket*
- *100u/F 16V electrolytic*
- *4 x 0.1u/F SMD caps*
- *Main PCB (homebrew)*
- *5 way socket and plugs*
- *4 way socket and plug*


3590

A Sensitive Thermal Power Meter

Carsten Vieland, DJ4GC

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A measuring instrument is to be described that has seven measuring ranges from 100µW to 300mW, and whose upper frequency limit is way up in the X band. Construction should not be difficult for those readers having adequate mechanical skill and a magnifying glass. Only a few special parts are required which are easily available.

Power Measurement Problems

For radio amateurs, power measurement is probably one of the most difficult areas in radio frequency measuring technology. The various types of diode voltmeters, see Fig 1, have three distinct disadvantages:

1. *The junction capacitance of the test diode (1-4 pF) represents a parallel capacitance to the load resistance. For instance, the amount of the capacitive reactive impedance will be less than the 50Ω load resistor when using a Schottky diode HP 2800 even at 1.6GHz. In conjunction with the unavoidable circuit inductivity, this will lead to noticeable resonance effects, which limit this type of power measurement to frequencies up to approximately 1GHz, if a special scale calibration is not used.*
2. *The non-linearity of the diode characteristic will be noticeable at low AC voltages. This leads to a non-constant mathematical scale calibration in spite of subsequent amplification and de-loging. If one is to avoid the very extensive compensation method, it will be necessary for the scales to be calibrated point by point, for instance by calibrating it against a precision meter.*
3. *The calibration of the diode voltmeter is made in RMS values; however, the measurements are made with peak voltages. In the case of subsequent measurements on amateur equipment, the required sine wave signal will be superimposed with harmonics, sub harmonics, conversion products, and unwanted oscillations. When the maximum values of the individual voltages coincide, peak voltages are provided to the diode, which have no relationship to the RMS value. The output power of oscillating stages can be*

even higher than the power consumption from the power line

The described disadvantages of diode voltmeters can be avoided or at least reduced when using the bolometer principle (see Fig 2), since the load resistance is only to be found in the RF circuit. The heating is a linear function of the RMS value of the RF power, at least at low temperatures. The temperature increase is measured with the aid of a NTC resistor, which will lead to a power linear scale calibration. Calibration and accuracy measurements on such a unit can be made with the aid of DC voltages.

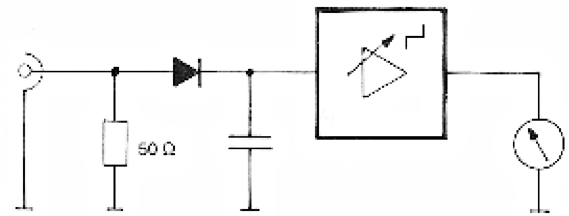


Fig 1: A diode voltmeter as power meter.

Fundamental considerations were made in [1], [2], [3] and [4]. A suitable construction was described in [1]. Higher sensitivities can be achieved with the aid of thermo-elements using thin film technology [5].

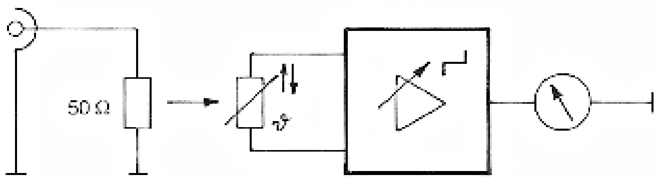


Fig 2: Principle of a thermo power meter operating according to the bolometer principle.

The described meter has seven measuring ranges from 100µW to 300mW (FSD). Its upper frequency limit is in the X band. One disadvantage is the somewhat long transient time of this method (50% of full scale after 1s), which means that no modulation measurements can be made

Component Selection

The 50Ω load resistor should be as small as possible. A small mass results in a short thermal transient time, as well as a high temperature coefficient (meter sensitivity), and has a positive effect on the upper limit frequency. The smallest, inexpensive, and available resistor (51Ω) uses a flat metal-glazed conductor and is sometimes designated as micro-miniature resistor (62.5mW). It is in the form of a bead-type microchip resistor that has been dipped in lacquer, and they are usually used in layer circuits. After carefully removing the lacquer, one will obtain a ceramic chip whose dimensions are 2.2mm x 1.2mm x 0.8mm.

The temperature probe resistor should also have a low mass and thus a short transient time. In addition to this, high impedance resistors are preferable, since these exhibit the lowest intrinsic heating as result of the connected test voltage. The Siemens Thernewid NTC resistor type K 19 is very suitable. This component comprises a glass bead of 0.4mm diameter and possesses virtually invisible connection wires. This component is so sensitive that it will react to the radiation heat of one's hand without delay, even at a spacing of 1 meter.

Unfortunately, this resistor, which can also be supplied in pairs, is not inexpensive, but it is also offered by several other manufacturers.

Experiments made with the thermoprobes SAK 1000 and KTY 11 resulted in an inferior limit sensitivity, and the transient time was at least ten times longer.

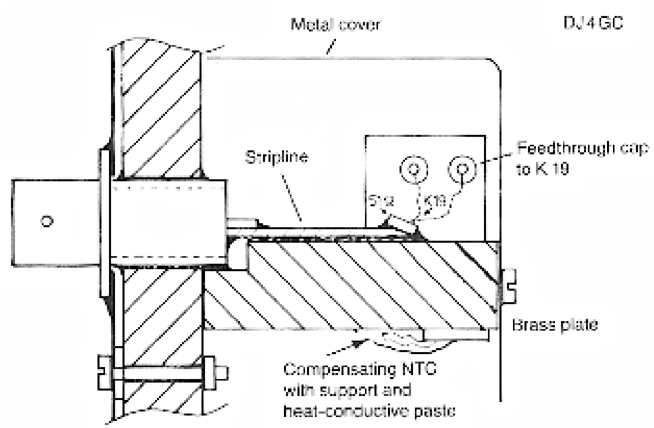


Fig 3: Suitable construction of the bolometer.

Construction of the RF Circuit

Of course, the NTC resistor must be directly glued to the load resistor (with very little two component adhesive). However, due to its high sensitivity, it should be thermally decoupled from the input connector. For this reason, it is not recommended for the load resistor to be directly soldered to the RF connector, since the mechanical tension passed via the inner conductor could destroy the chip resistor. A favourable solution was found by using a 50Ω stripline in conjunction with a heat sink (brass plate) for interconnecting the load resistor to the input connector. This type of construction is shown in Fig 3.

In order to ensure a high cut off frequency, the stripline should be ideally on a PTFE material (double coated). A stripline width of 2.3mm will result when using 0.8mm thick RT/duroid 5870 material. In the author's prototype, the stripline is 12mm in length. Of course, epoxy PC boards can be used up to several GHz without problems due to the non-resonant conductor lane. When using 1.5mm thick epoxy PC board material, the stripline width is 3.1mm.

Special care must be taken in the transition between the coaxial connector and the stripline. Although N connectors have more favourable RF characteristics than BNC connectors, the former will exhibit are more noticeable in continuity at the transition. Professional users specify SMA connectors up to 18GHz.

In order to achieve the shortest possible transient time of the bolometer, a good heat dissipation is obtained at the cost of maximum sensitivity. Heat conductive paste should be provided between the stripline board and the brass heatsink, which is also placed around the chip r e s i s t o r. Te mp e r a t ur e fl uc t ua t i o ns coming from the input connector are compensated for with the aid of a second brass plate (Fig 4). Since the thermal probe still reacts to the radiation heat reaching the case, the whole bolometer is surrounded in a metal case.

Any excessive solder on the stripline should be removed with a file in order to ensure a low heat delay. The NTC resistor should be glued into position only after this has been carried out.

The fragile connection wires of the K 19 are supported on the RF side with the aid of feedthrough capacitors, and on the lower side with the aid of a small board that has been glued into place.

Fig 4: RF circuit with bolometer and heat sink.

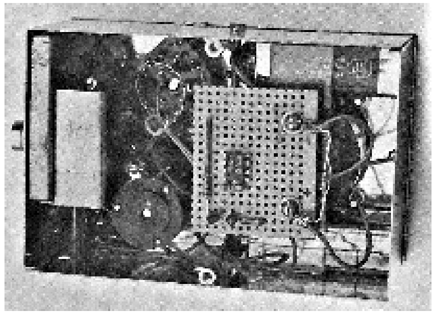


Fig 5: Photograph of the author’s prototype; RF portion under the metal cover.

Measuring Amplifier

In order to maintain the zero point stability and the calibrated meter sensitivity it is recommended that a bridge circuit be used together with a second K 19 (paired to have the same temperature coefficient) in order to compensate for ambient temperature fluctuations (see Fig 6)

The first operational amplifier, maintains a constant current via the test NTC resistor,which allows a linear transfer of its resistance value to the actual test amplifier. The zero point should be adjusted before commencing the measurement with the aid of a low-impedance, shunted, ten turn helical potentiometer If a larger case is used, it is also possible for less expensive coarse and fine controls to be used.

The reference voltage is provided by a LED, which is connected as zener diode. Higher voltages than 1.5V will, however, improve the sensitivity of the reading. however, will lead to considerable intrinsic heating of the thermal probe.

In order to change the measuring range the feedback resistors of the second operational amplifier are switched.

The resistance values and measuring ranges (full-scale deflection) are:

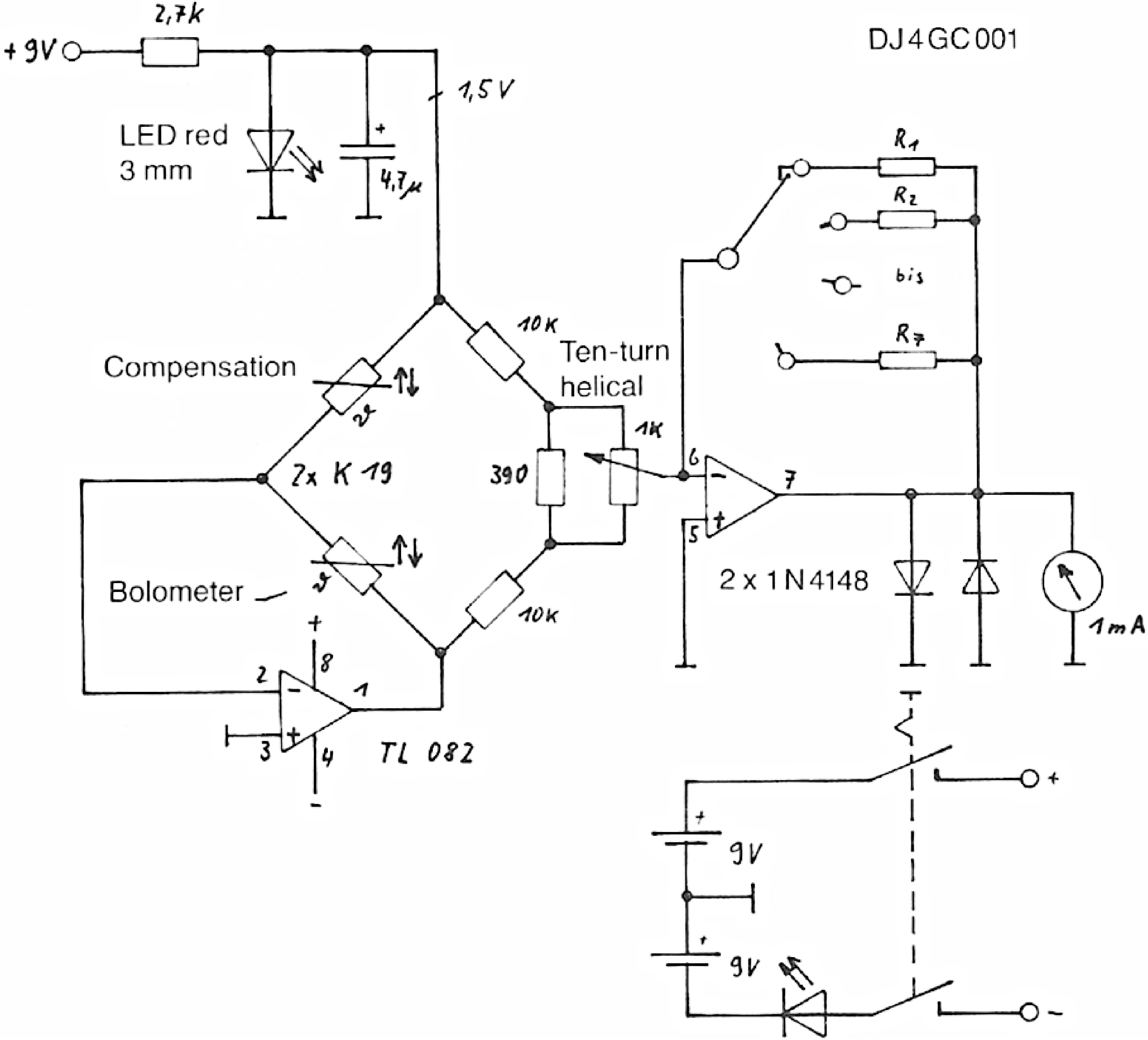
- *R2 = 680kΩ (0.3mW)*
- *R3 = 220kΩ (1mW)*
- *R4 = 68kΩ (3mW)*
- *R5 = 22kΩ (10mW)*
- *R6 = 6.8kΩ (30mW)*
- *R7 = 1.4kΩ (300mW)*

The meter cannot be overloaded since the operational amplifier possesses an internal current limiting. Since an offset alignment is not required, it is advisable to use a low drift dual operational amplifier in an eight pin case, such as the TL 082. In the most sensitive range, the flicker noise of the operational amplifier will cause a certain fluctuation of the meter reading. The operating current is only in the order of 5mA, which means that two 9V batteries can be used as power supply. The meter will also operate perfectly at ±5V.

Alignment

Calibration of the meter is made with direct current. It is advisable to adjust the full scale deflection current of the appropriate range with a digital multimeter.

The feedback resistors R1 to R6 of the test amplifier are selected to have the highest accuracy from a large selection of resistors. Since the sensitivity of the bolometer is greatly dependent on the mechanical construction, the given values are only for orientation.



DJ4GC001
+9V
2,7k
1,5V
LED red
3 mm
4,7μ
R1
R2
bis
R7
10K
Ten-turn
helical
1K
Compensation
2x K 19
390
Bolometer
10K
2
8
1
3
4
TL 082
6
7
5
2 x 1N4148
1mA
9V
9V

Fig 6: Circuit of the thermo power meter.

Due to the non-linear relationship between the temperature and the resistance value of the NTC resistor, it is necessary for the highest range of 300mW to be calibrated independently on the scale, (see Fig 7). In the 30mW range, the deviation is still only a maximum of 4%, and should thus be acceptable.

Measured Values

It was possible before manufacturing the power meter to measure the input return loss of the RF circuit with the aid of a network analyser. It was found that a return loss of 20dB (corresponding to approximately 1.2 VSWR) can be achieved up to a frequency of 2.1GHz. The return loss of 10dB (approximately 2 VSWR) is only exceeded at 11GHz.

A 3GHz oscillator having an output power of 25mW with an accuracy of ± 0.1dB was now connected to the meter and this power was indicated with an accuracy of the meter needle.

The Gunnplexer manufactured by Microwave Associates (15mW at 10.36GHz) provided 12mW of heat after being adapted from waveguide to BNC.

The meter reaches 50% of the full scale value after approximately 1 second; 90% of the final value is passed after 3.4s. The transient time t (63% of the final value) is in the order of 1.5s.

Practical Experience

Due to the short length of the stripline used, a certain temperature sensitivity exists via the inner conductor of the input connector, since both NTC resistors are not heated simultaneously. In the very low power range, it is advisable to work together with an intermediate cable which remains connected to the meter. Otherwise, the zero point stability is so high that it is possible to carry out measurements directly after switching on. In the case of the two most sensitive ranges, it is advisable to leave a warm up time of approximately three minutes.

The calibration was made at 20°C. A further test in a refrigerator at 5°C did not show large deviations.

The speed of the reading is approximately as high as that of a dampened laboratory meter. Taking all advantages of this measuring system into consideration, it will not be found that alignment work is made more difficult due too slow an indication.

The dynamic range of the power meter can be increased by adding wideband amplifiers (e.g. as described by DJ7VY), attenuators, or directional couplers. However, the frequency range will be limited by this. It is possible, for instance, to use a directional coupler with an attenuation of 40dB to increase the measuring range up to 3kW. The exact value of the loss can be measured previously using this meter./p>

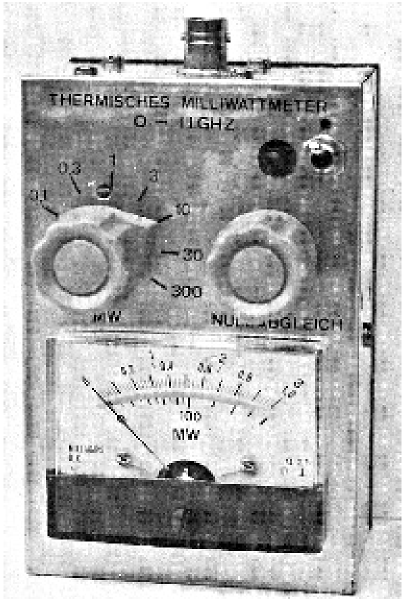


Fig 7: This photograph shows the scale calibration with the 300mW scale at the bottom

The high sensitivity of this meter (the resolution is in the order of 1pW) allows one to also measure the frequency, or attenuation characteristics of filters, bandpass filters, directional couplers, frequency multipliers, mixers, low signal amplifiers, etc., in addition to purely power measurements, and its high dynamic range can be used right up to X band.

References

[1] 0. Frosinn, DF7QF, A Home Made UHF/SHF Power Meter, VHF Communications Magazine 13, Edition

4/1981, Pages 221-229

[2] A. Kraus, Einführung in die Hochfrequenz Meßtechnik, Pflaum-Verlag München 1980, Pages 21 9-227

[3] A. Hock, u.a., Hochfrequenz-Meßtechnik Part 1 Volume 31a, Kontakt & Studium, Expert Verlag, Grafenau 1981, Pages 121-129

[4] VHF-UHF Manual, 3rd Edition, Chapter 10

[5] Marconi Instruments Catalogue of Microwave Instruments, Components and Waveguides 1981/82

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Caption contest

Just for fun….

Last issues picture is shown below.

“Should have gone to specsavers” - Jim Brown

“On a clear day, you can see my quadrifilar helix antenna.” - G8KZN

“Told you not to sit on that phone mast…now look at you” - Trevor

Three from Mark, G0NMY

“Mother always said you were not evolved enough for a serious relationship!”

“I don’t care if Darwin liked you!”

“Im running DVB-S and your still running 8 second black 7 White sstv!”

“Late Night again, was it, not another bunga bunga party” ? - G3ZIS

And the winner is Mark, G0NMY

This issues picture is shown below.

Please send your entries to *caption@cq-datv.mobi*

Antenna Ratiometry Measurements for the 21st Century

By Paul Wade W1GHZ ©2005

w1ghz@arrl.net (reproduced by kind permission)

Using a Home-brew Ratiometer

Antenna gain measurement by ratiometer has been the preferred and most accurate technique since it was described for the amateur by K2RIW[1] in 1976. However, antenna ratiometry has not been frequently used for amateur antenna ranges in recent years – the probable reason is lack of suitable instrumentation. By taking advantage of some new integrated circuits developed for "wireless" networking, a simple, inexpensive, home-brew ratiometer has been developed for improved antenna measurement. It also functions as a hand-held network analyser with many uses.

Background

Ratiometry measurements use the simultaneous comparison of an unknown quantity. In antenna ratiometry, the comparison is between a TEST antenna and a REFERENCE antenna, side-by-side, illuminated by the same source over similar paths. Any drift or variation in test conditions is seen by both antennas, so the comparison is not affected. As a result, even small differences may be resolved accurately and consistently.

The traditional instrument for antenna ratiometry was the HP-416 Ratiometer, a classic vacuum tube boat anchor. This instrument compared two channels of detected 1-KHz audio. When hams started using ratiometry for antenna contest ranges, the HP-416 was already long obsolete – I acquired one for $3. It provided good service for many years, but had a number of shortcomings. Like all vacuum tube equipment, it was large and heavy, and drift was a problem. The source had to be AM modulated at a 1 KHz rate, and microwave crystal detectors were used to sense the RF. As a result, dynamic range was limited, with a "magic-eye" tube to indicate that the signals were near the proper level. Readout was on an analogue meter, so frequent range switching was required to keep the needle on scale as an antenna was peaked. The biggest problem was that a matched set of microwave crystal detectors was required – a rare and fragile commodity.

Eventually, the antenna measurement responsibility and equipment for the Eastern VHF/UHF Conference was passed on, and the HP-416 stopped appearing. Since then, various other equipment has been used. The only other instruments capable of ratiometric measurements were HP Network Analysers, kindly lent by Joe Reisert, W1JR, of Antennaco and Dave Olean, K1WHS, of Directive Systems (www.directivesystems.com). For Microwave Update 2002, we were able to borrow a fancy 50 GHz Automatic Network Analyser from Agilent (www.agilent.com).

A network analyser is a modern ratiometer, comparing two channels with far greater accuracy and dynamic range than the old HP-416, plus the additional capability for phase measurements. The latest computer-controlled ones are far too expensive for hams, and the older ones, affordable as surplus, are too bulky and too fragile. I have an old HP-8410, the first real network analyser; if I could even lift it and carry it out for field measurements, I wouldn't expect it to work on arrival.

Lacking a ratiometer or portable network analyser, I experimented with using a Noise Figure meter, the AIL 75 PANFI. It operates at 30 MHz, so external converters are required. By adding an external switch, it was possible to make good ratiometric measurements[2]. Since the meter is specifically calibrated for Noise Figure measurement, the results required post-processing to get the true ratio in dB. The complete set-up, with switch and converters, is still large and bulky.

Home-brew Ratiometer

Since there are no really suitable surplus instruments for antenna ratiometry measurements, is it possible to build something? After pondering this question for a few years, and watching new integrated circuits developed for wireless networking, I discovered a chip with potential, the AD 8302 Gain Phase Detector (www.analog.com). This chip measures the ratio of two channels, with both amplitude and phase outputs, at frequencies up to 2.7 GHz. Sounds a lot like a ratiometer. I acquired a few and tried them out. They worked well over a limited dynamic range, but it wasn't obvious how to stay within the proper range for good, reliable measurements.

I was working with some other new ICs, intended for power measurement, to make a portable power meter[3], when I thought of the "magic-eye" on the old HP416. The best dynamic range for the AD8302 is with a reference channel level of −30 dBm; at this level, the test channel range is ± 30 dB, more than adequate for antenna measurements. A power measurement IC could be used to keep the reference channel within a few dB of −30 dBm, so we could trust any reading within ± 20 dB. This is probably sufficient for any amateur antenna range – an antenna with gain more than 20 dB higher than the reference antenna is probably too big for the range, and more than 20 dB lower is probably defective.

Now we have a strategy: monitor the reference power, keep it near −30 dBm, and display ± 20 dB for the ratio measurement. I chose a digital panel meter for the display: a ± 2 volt range, with the proper decimal point inserted, would cover the full range with excellent precision. A simple op-amp circuit amplifies the AD8302 output so that 20 dB = 2 volts. Another section of a quad op-amp inverts the phase output so it reads directly in degrees, and a third section shifts the return side of the digital power meter to adjust the meter zero.

For the power measurement IC, I experimented with several and settled on the LT5534 (www.linear.com) for wide dynamic range over the full frequency range. This chip detects powers lower than −50 dBm and is quite linear up to about −10 dBm. The output goes to a pair of comparators: one lights a green LED at −40 dBm, about the minimum power needed for usable readings, and the other lights a yellow LED at −20 dBm, about the maximum power before the maximum reading is compressed. The power detector output also goes to an LED bargraph indicator to operate as a “magic-eye”, using a circuit from WW2R[4]. I set the levels so that when half the bars are lit, the power is within 3 dB of −30 dBm.

An extra quad comparator section is wired as a peak-hold circuit, to make it easy to find the maximum gain.

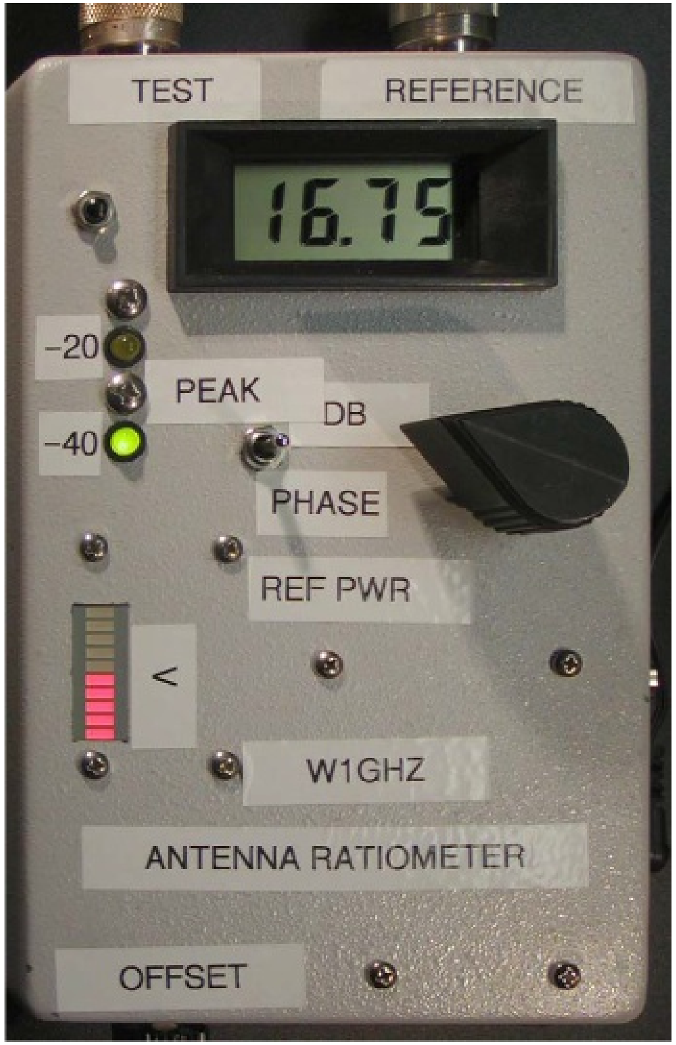


Figure 1

The completed antenna ratiometer is shown in Figure 1. The die-cast aluminium box is small enough to be hand-held, and the LCD digital power meter display is large enough to be read easily in any lighting. The rotary switch selects between ratio in dB, phase, and the REFERENCE power detector output. A toggle switch selects the peak-hold reading, and a push button clears the peak by discharging a capacitor. At one end of the box is the zero or offset knob, and the other has coax connectors for the two input channels. On one side are a power connector and a ratio output, intended to drive a Tonemeter[5] to enable antenna pointing by ear. Inside the box, Figure 2, are a circuit board containing the ratiometer circuit, a small board containing the LED bargraph circuit, and the digital power meter. Most inexpensive digital power meters must be isolated from the circuit being measured, so that a separate 9-volt battery would be required, but the stock no. 14505 ME from www.mpja.com is capable of being connected to the circuit being measured, so a separate battery is not needed.

For the LED bargraph circuit, I would recommend the RFPM from Down East Microwave (www.downeastmicrowave.com); I would have used one, but the die-cast box already had a cut-out for the LED bargraph and the RFPM board didn't fit, so I made my own smaller board.

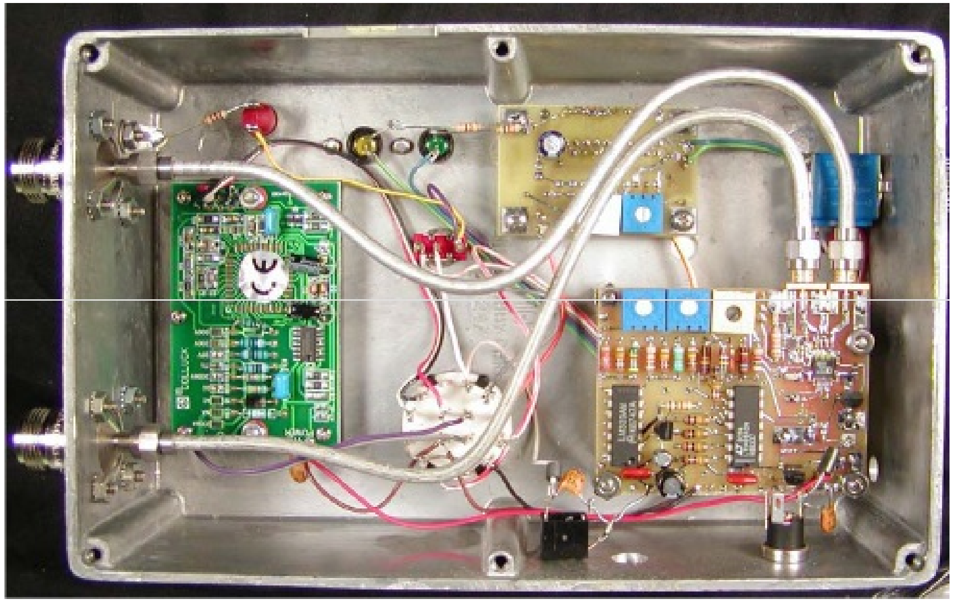


Figure 2

A close-up of the RF section, with the AD8302 and the tiny LT5534, is shown in Figure 3. All the chip components are the very small 0603 size except for C14, a 1µf capacitor.

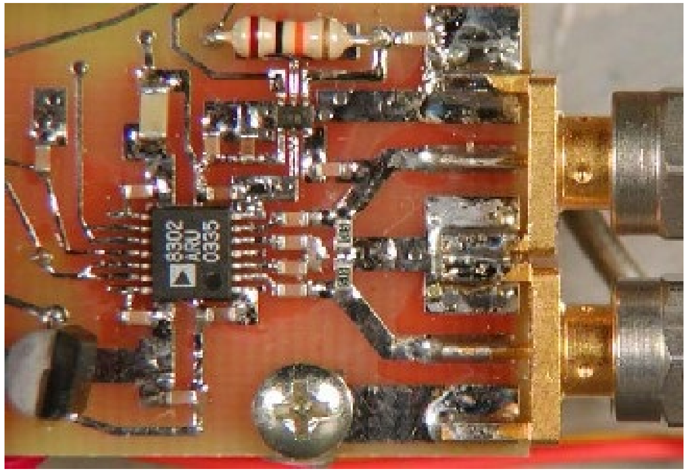


Figure 3

The first real test of this meter was at the 2005 Eastern VHF/UHF Conference, where it was used for antenna measurements from 144 to 1296MHz, and performed well while running from just a small battery. The test scheme is shown in Figure 6.

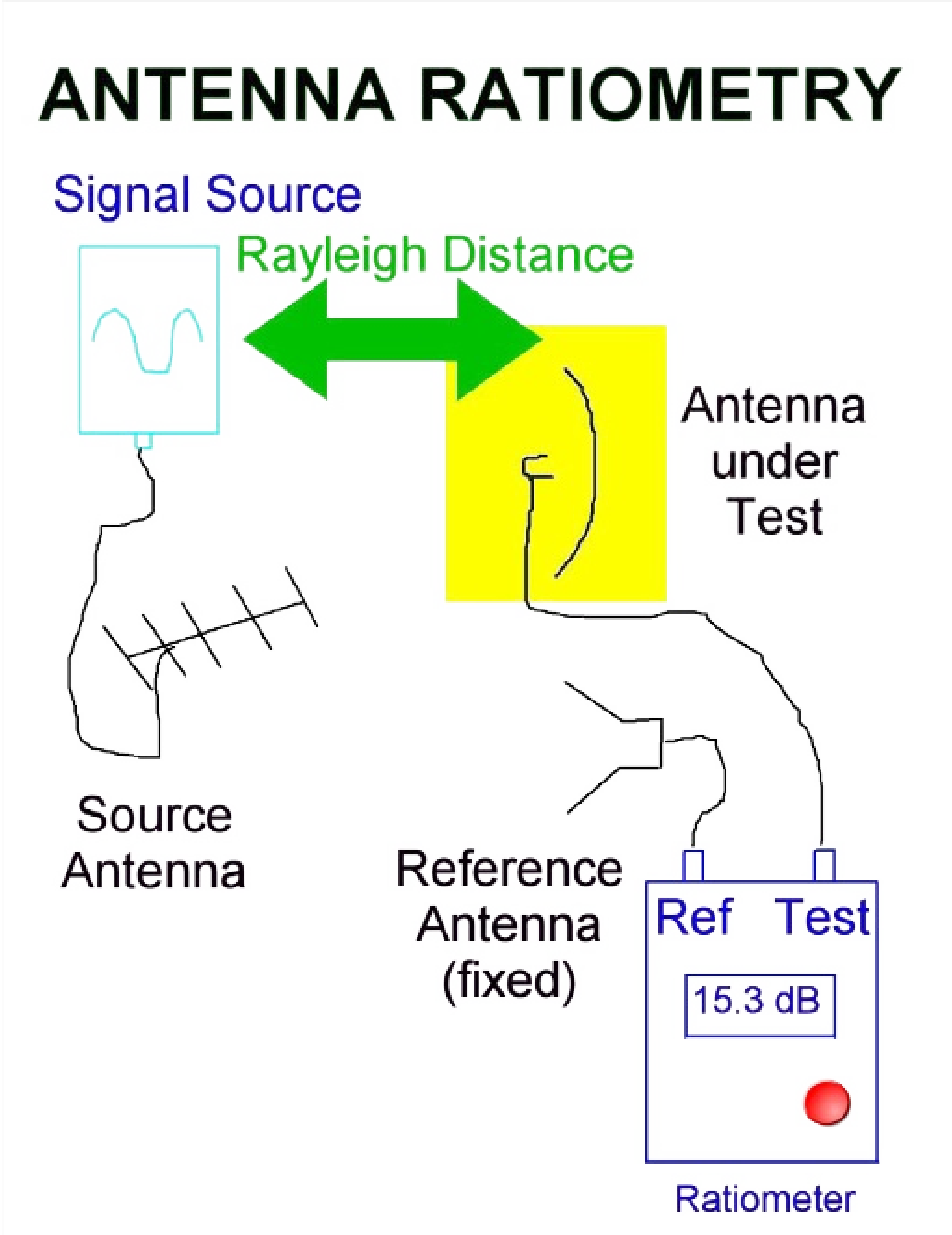


Figure 6

The ratiometer has a very broadband input; at this location, within line-of- sight of a cell tower, connecting antennas directly would be asking for trouble. On each band, filters were added in front of each input to eliminate unwanted signals. A photograph of the actual test set-up for 432 MHz is shown in Figure 6a, with the beer-can filters plainly visible. I made these about 30 years ago, and they still work well. Unfortunately, most cans are now made of aluminium.

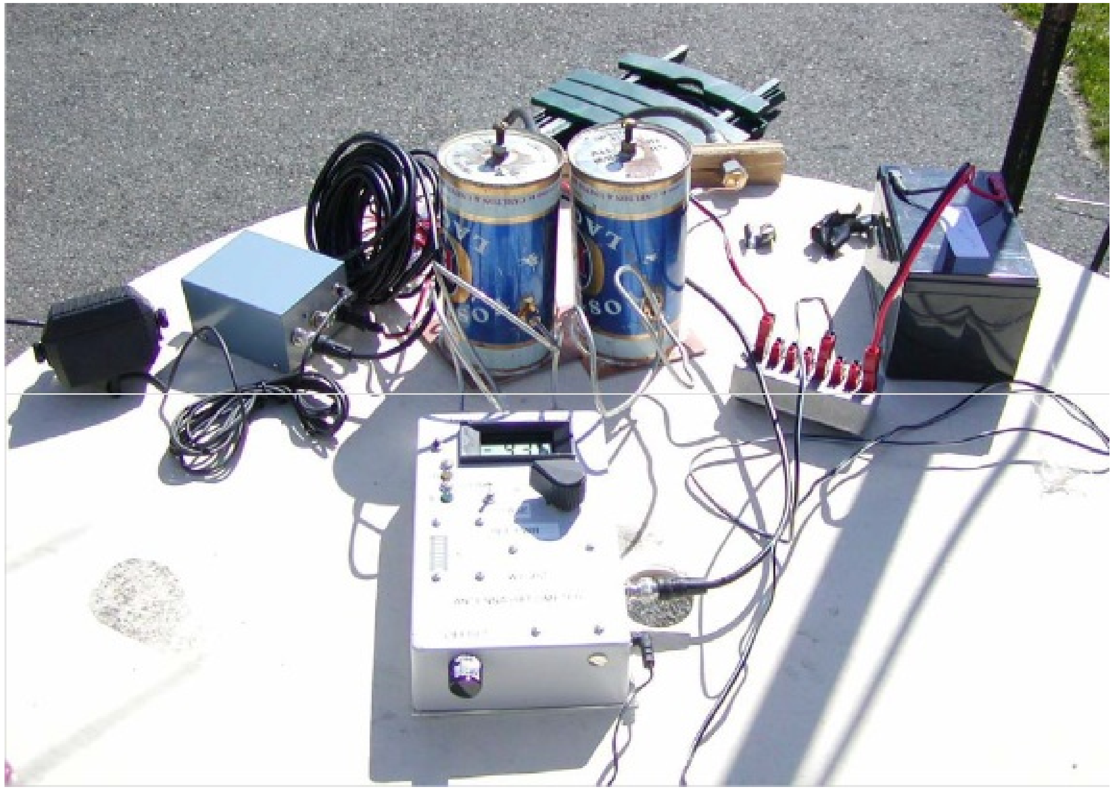


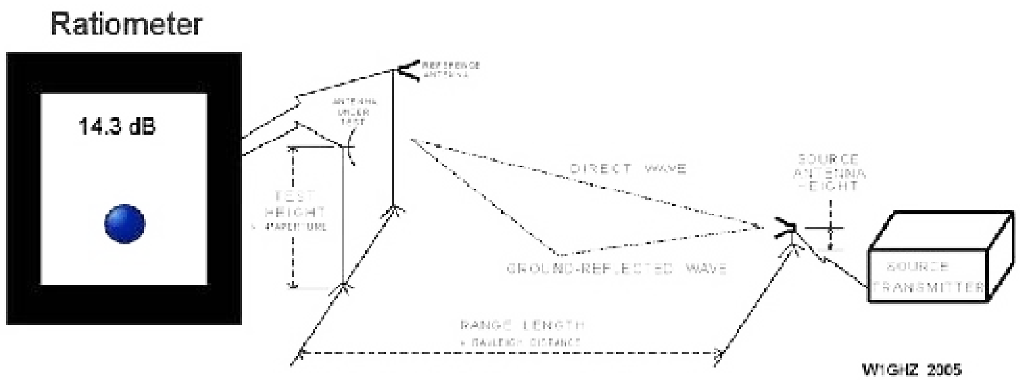
Figure 6a – Antenna measuring at 432 MHz

Antenna Range

Few of us have the luxury of a permanent antenna range, so we must set up a temporary range, sometimes at a remote location like a VHF conference. High antenna support structures are not usually available, so we must work near ground level and use a ground-reflection range, designing the range to account for ground reflection and to control it, as described by W2IMU[6],[7]. The most common measurement goal is simply maximum antenna gain, typically with relatively high gain antennas. Other measurements, like pattern plots or phase-centre, require more difficult antenna ranges.

For an antenna to operate with maximum gain, it must receive a wave front with constant phase. Thus, the length of the antenna range is important — if it is too short, there will be significant phase difference over the aperture of the antenna being tested, resulting in low measured gain. The minimum range length to minimize this error is the Rayleigh distance.

Longer range lengths will reduce the phase error and improve accuracy. A few trial calculations will show that miles of range can be required for large dishes. Fortunately, the Rayleigh distance for most transportable VHF and microwave antennas is less than 100 meters, so sites with sufficient open space are available. Note that this is the minimum length for gain measurement; for focusing adjustments, like the feed placement on a parabolic dish, a much longer distance, at least 50 times the Rayleigh distance, is required[8].



Antenna Range With Ratiometry

Figure 7

A ground-reflection range is sketched in Figure 7. In order for the phase error to be as low in the vertical plane as in the horizontal plane, the height of the antenna being measured must be at least four times its aperture diameter[9]:

Test height ≥ 4 • Aperture diameter

For example, 4 meters high for a one-meter dish. Most amateur antenna ranges have insufficient antenna height, and consequently have had trouble measuring higher-gain antennas accurately. For a Yagi-Uda antenna, the aperture diameter is roughly the same as the stacking distance; for a long boom 2-meter beam, the stacking distance might be 4 or 5 meters, so the antenna height must be 15 or 20 meters for accurate measurement.

The received energy should be at a maximum at the height of the antenna being measured. For a ground-reflection antenna range, this is controlled by the height of the source antenna:.

For example, for a 30-meter long range at 1296 MHz, if we desire the maximum energy at a height of 4 meters, then the source height is about 0.4 meters, or roughly knee-high.

So the source antenna is relatively low, while the receiving antennas, test and reference, need to be elevated – some sort of structure may be necessary.

Power

The good sensitivity of the home-brew Antenna Ratiometer means that only modest radiated power is needed for an antenna range. We can calculate the power using the path-loss for the range calculated by the Friis transmission formula.

For reasonable range lengths, less than 100 meters, the path loss for each VHF, UHF, and microwave band is shown in Table 1. I estimated the gain for reasonably-sized source and reference antennas for each band to calculate the source power required. Less than 1 watt is needed for a 100 meter range, which is long enough for a 0.75 meter dish at 24 GHz, a 1.2 meter dish at 10 GHz, and larger antennas at lower frequencies.

Gain Standard

In order to measure meaningful antenna gains, an antenna with known gain is required for comparison. Recall that all measurements are relative to a known standard. A dipole is useless as a standard — its broad pattern receives so many stray reflections that repeatable readings are nearly impossible, and its gain is much lower than a 30+ dB dish that equipment accuracy is a problem; few instruments are accurate over a 30 dB (1000:1 power ratio) range. What is required is an antenna with a known gain, preferably gain of the same order of magnitude as the antennas to be measured. For VHF and UHF frequencies, the EIA standard gain antenna6 is easily reproduced. At microwave frequencies, the gain of a horn antenna can be calculated quite accurately from the physical dimensions. The algorithm used in the HDL_ANT program[11] will be accurate within about 0.2 dB if good construction techniques are used. For even better accuracy, several companies make standard gain horns with good calibration data – these occasionally show up as surplus.

Antenna Range Pathloss Calculator

W1GHZ 2005

Freq	λ	Path = 1 meter		Path = 10 meters		Path = 100 meters		Antenna Gain	
		Pathloss	Source Power	Pathloss	Source Power	Pathloss	Source Power	Source	Reference
144 MHz	2.08 m	**15.6** dB	**-26.4** dBm	**35.6** dB	**-6.4** dBm	**55.6** dB	**13.6** dBm	6	6 dBi
222 MHz	1.35 m	**19.4** dB	**-22.6** dBm	**39.4** dB	**-2.6** dBm	**59.4** dB	**17.4** dBm	6	6 dBi
432 MHz	0.69 m	**25.2** dB	**-20.8** dBm	**45.2** dB	**-0.8** dBm	**65.2** dB	**19.2** dBm	8	8 dBi
903 MHz	0.33 m	**31.6** dB	**-18.4** dBm	**51.6** dB	**1.6** dBm	**71.6** dB	**21.6** dBm	10	10 dBi
1296 MHz	0.23 m	**34.7** dB	**-15.3** dBm	**54.7** dB	**4.7** dBm	**74.7** dB	**24.7** dBm	10	10 dBi
2304 MHz	0.13 m	**39.7** dB	**-10.3** dBm	**59.7** dB	**9.7** dBm	**79.7** dB	**29.7** dBm	10	10 dBi
3456 MHz	0.09 m	**43.2** dB	**-12.8** dBm	**63.2** dB	**7.2** dBm	**83.2** dB	**27.2** dBm	12	14 dBi
5760 MHz	0.05 m	**47.7** dB	**-10.3** dBm	**67.7** dB	**9.7** dBm	**87.7** dB	**29.7** dBm	13	15 dBi
10368 MHz	0.03 m	**52.8** dB	**-11.2** dBm	**72.8** dB	**8.8** dBm	**92.8** dB	**28.8** dBm	17	17 dBi
24192 MHz	0.01 m	**60.1** dB	**-10.9** dBm	**80.1** dB	**9.1** dBm	**100.1** dB	**29.1** dBm	20	21 dBi

Table 1

Range Measurements

Once the antenna range is designed and set up, it must be checked out before making actual measurements. This is best done with an antenna with a fairly broad pattern, like a medium-sized horn or Yagi, as the test antenna. First, the attenuators are adjusted for a convenient meter reading. Then the field uniformity is probed by moving the test antenna horizontally and vertically around the intended measurement point. The indicated gain should peak at the centre and should not vary significantly over an area larger than any antenna to be tested; the variation should be less than one dB. Usually, the height of the source antenna needs to be adjusted to get the vertical peak at the desired receiving height. Finally, the test antenna is held stationary and calibrated attenuation steps are added in the test path to make sure the indicated gain changes by the amount of attenuation added.

Now the range is ready to make measurements. The standard gain antenna is inserted as the test antenna, aimed for maximum indication, and the attenuators and offset adjusted for a meter reading that will keep expected gains within the range of the meter. All gain measurements will be the difference from this standard reading added to the gain of the standard gain antenna. The standard gain antenna is replaced by an antenna to be tested, the new antenna aimed for maximum gain, and its indicated gain recorded. The difference between this indicated gain and the standard reading, added to the known gain of the standard gain antenna, is the gain of the test antenna. The reading with the standard gain antenna should be checked frequently to correct for instrumentation drift; ratiometry with the reference antenna corrects for other sources of drift.

Hand-held Network Analyser

It may have occurred to you already that the Antenna Ratiometer described above is really a modest network analyser. It only has 40 dB of dynamic range, vs. >70 dB for computer-controlled lab models, but there aren’t really many amateur measurements that require the full range or absolute accuracy of the fancy ones.

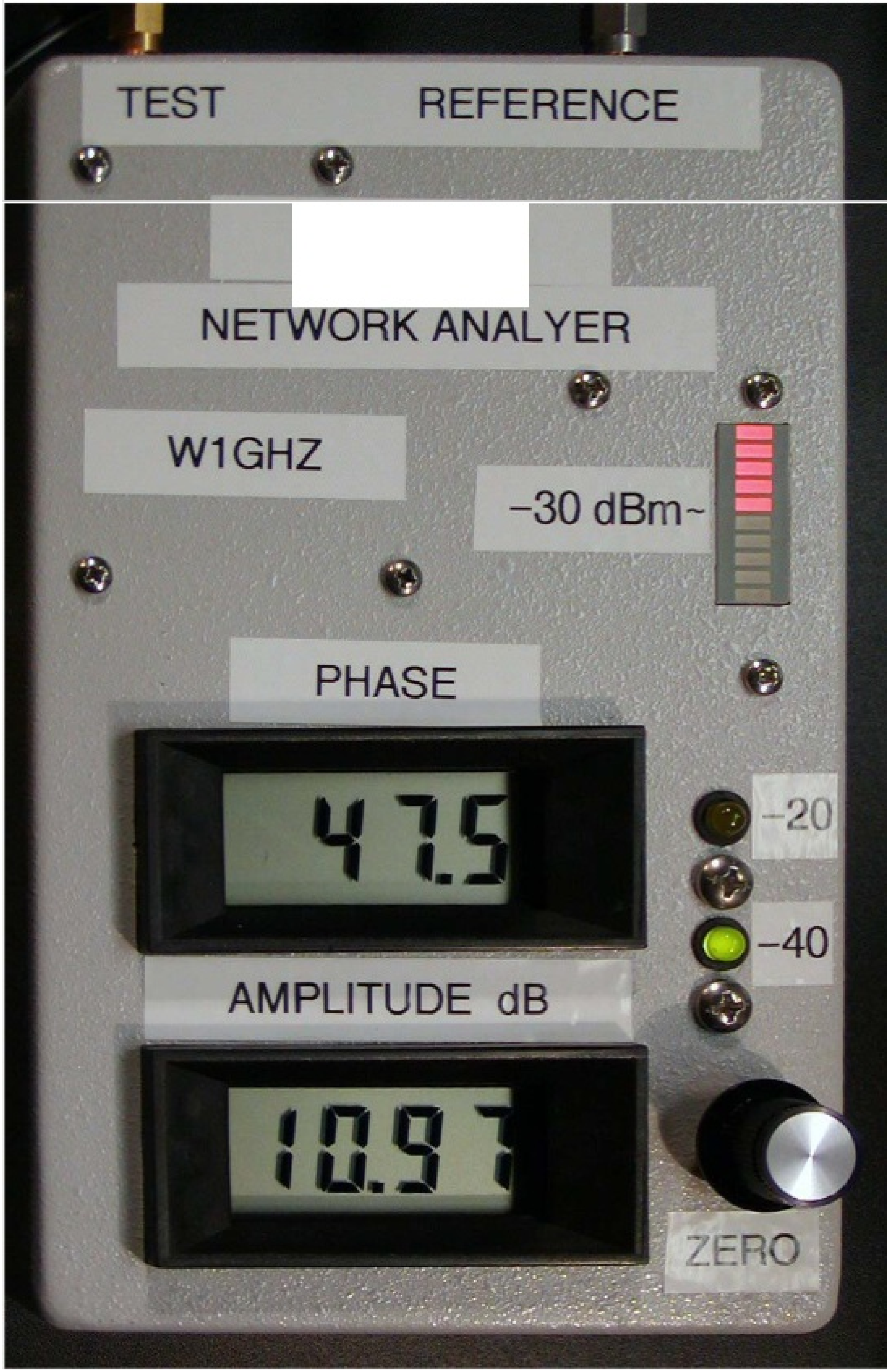

TEST
REFERENCE
NETWORK ANALYER
W1GHZ
-30 dBm~
PHASE
47.5
-20
-40
AMPLITUDE dB
10.97
ZERO

Figure 8

Accurate measurements over wide dynamic range require a lot of computer correction, which in turn requires precise frequency control for repeatability. Over a wide frequency range, an expensive synthesised signal generator is required – in surplus markets, this is often more valuable than the network analyser and is sometimes removed and sold separately, making the rest of the network analyser available at a reasonable price. For most ham work, fast swept-frequency measurements are not necessary and most measurements are in ham bands, so a much more affordable synthesised generator may be used. Mine is a Yaesu FT-817, as small and portable as the hand-held network analyser – it is also the IF rig for my microwave equipment. Of course, nearly any signal generator or sweeper is also usable; since only –30 dBm (one microwatt) is required, attenuation is the problem, not power.

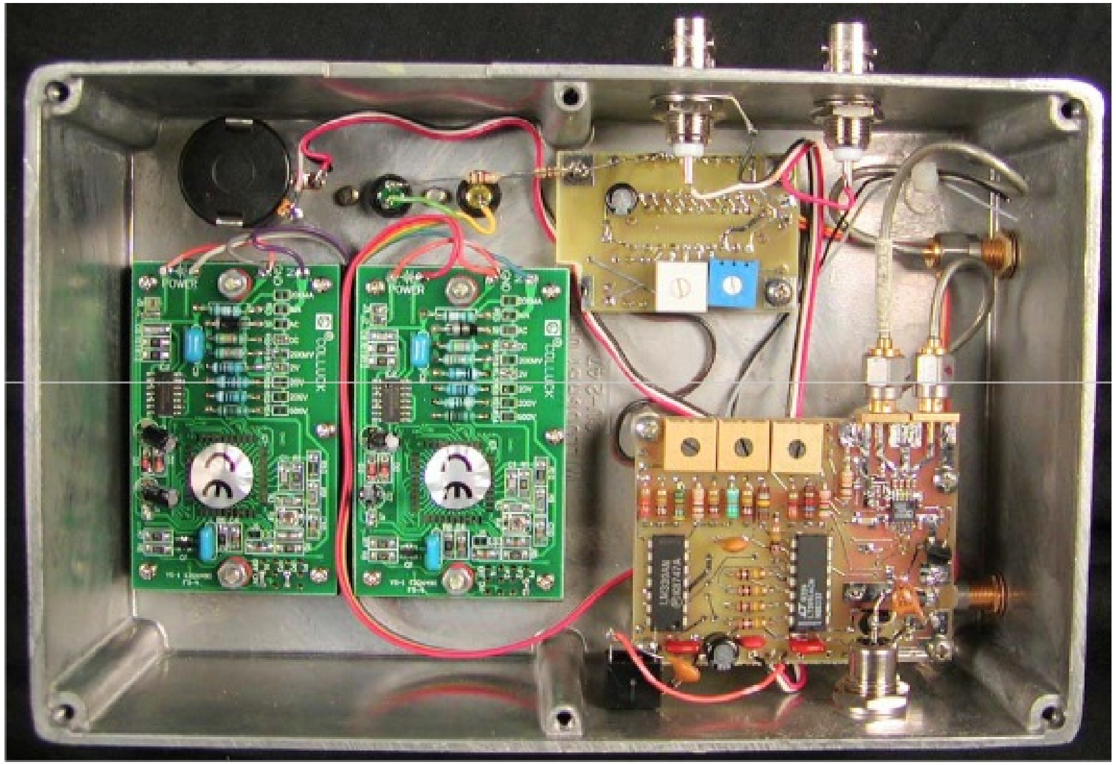


Figure 9

For network analyser use, I made a second version, shown in Figure 8, with two digital readouts to simultaneously display dB and phase. The digital panel meters are hardly more expensive than the rotary switch. The inside, Figure 9, is very similar to the other version. Two additional BNC connectors on the side bring out ratio and phase to an oscilloscope for swept measurements. An example, a swept filter response, is shown in Figure 13.

A network analyser, or a ratiometer, has many uses besides antenna gain measurements. One of the more obvious, sketched in Figure 10, is to measure the VSWR (as Return Loss) of an antenna, or anything else. A directional coupler is used to sample the Forward power for the REFERENCE port and the Reflected power for the TEST port. Since we also measure phase, actual complex impedance may be found with a bit of calculation. Before connecting the antenna, the output is connected to a short circuit and the meter is set to Zero.

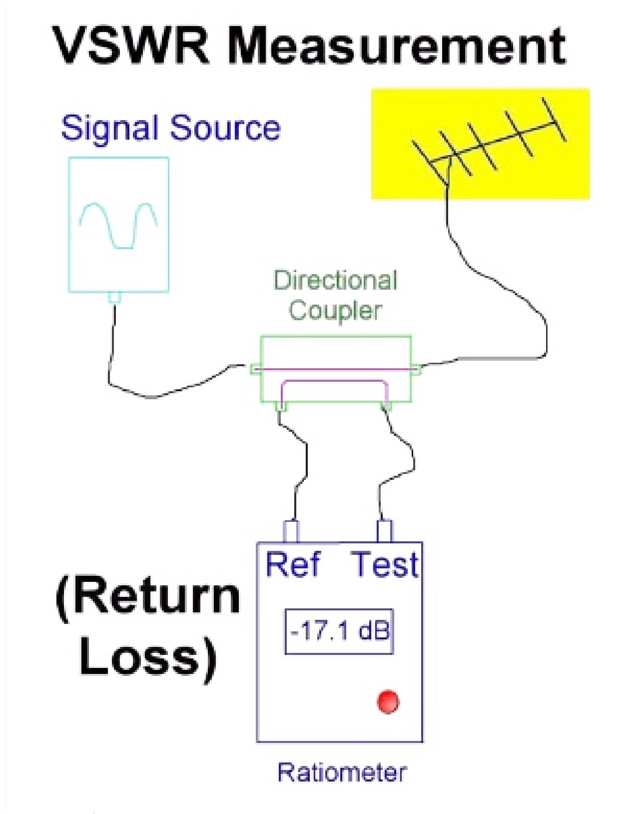


Figure 10

Since we can also measure phase as well as VSWR, it is possible to calculate complex impedance, using a

Smith Chart or calculator. This can take the guesswork out of impedance matching.

A trick I use to check on the feed lines on my tower is to measure the Return Loss over a wider frequency range. Many antennas, like Yagis, are quite narrowband, so the Return Loss is high within the band but low at nearby frequencies. I look for the minimum return loss and guess that the antenna is reflecting nearly 100% of the power at that frequency, so that the measured Return Loss is just the loss of the coax going up to the antenna and back down. Thus, the coax loss is half the Return Loss. I keep track of the loss for each feed line and check them occasionally, so that I can catch any problems and not just wonder why I'm not hearing so well on one band.

The gain of an amplifier, Figure 11, or the loss of a passive component such as a cable or filter, Figure 12, may also be measured. A directional coupler is used to sample the input power, and an attenuator or a directional coupler for the output power. If the gain or loss exceeds 20 dB, a step attenuator is useful to bring the TEST reading within range. The added attenuation is added to the gain or loss. The meter is zeroed without the component in the circuit, with the output connected directly to the input.

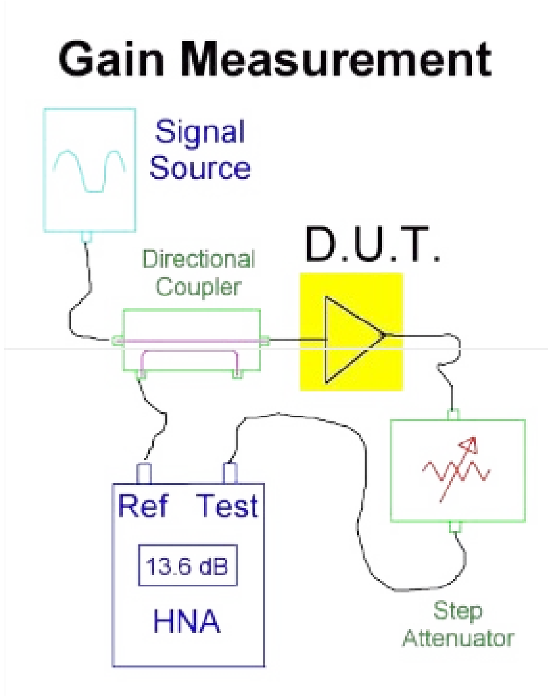


Figure 11

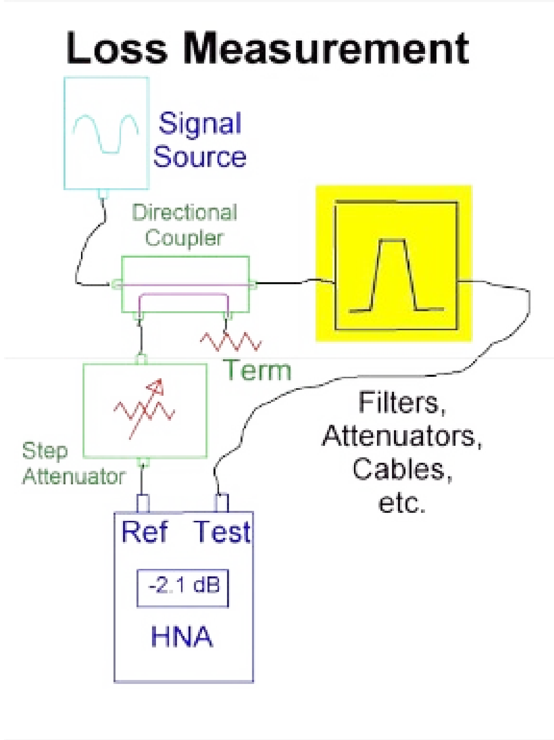


Figure 12

With a sweep signal source, we may sweep the frequency response of a circuit. Figure 13 shows an example: the swept frequency response of a Toko 144 MHz helical filter, swept from roughly 120 to 180 MHz. Both the amplitude and phase responses are shown. The amplitude is a smooth bandpass response, but the phase changes rapidly near the resonant frequency.

Figure 13

A common amateur problem is matching phasing lines for an antenna array. With the network analyser, the lines may be directly matched for phase, comparing two at a time or comparing each one to a reference line, Figure 14. Note that the phase reading is compressed near zero and 180º, so it may be necessary to add a short length to one channel to read an intermediate value. I didn't include a zero set for phase, since relative measurements are usually sufficient.

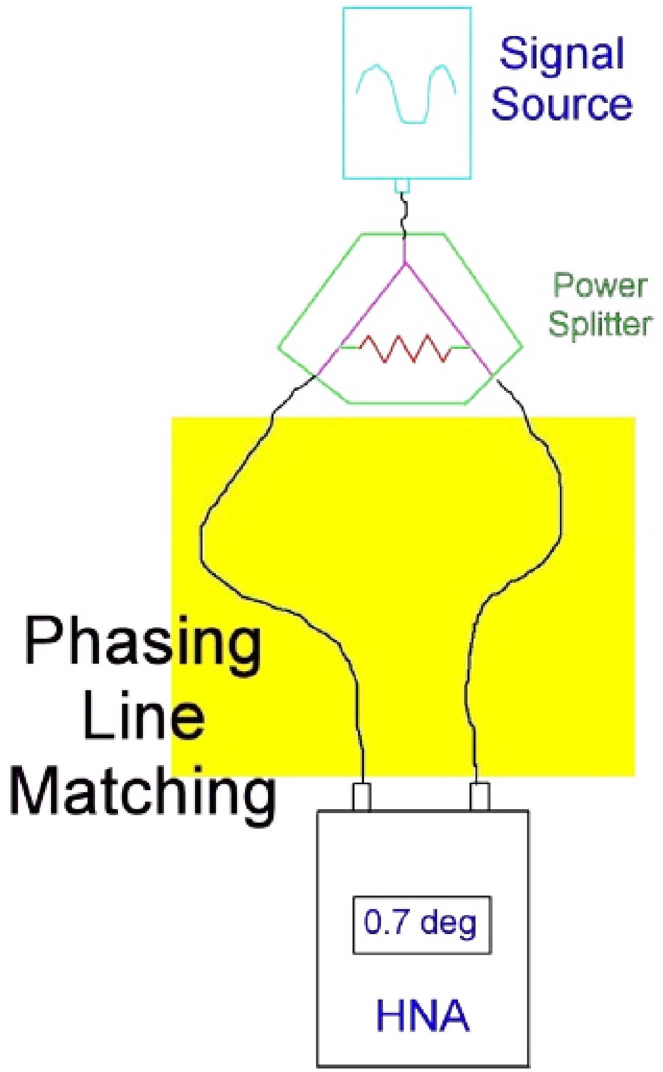


Figure 14

The AD8302 phase output is 0º to 180º. There is no sign output, so we don't know whether the phase difference is positive and negative. This doesn't matter when we are matching phases, but may require some thought for other measurements.

Another problem made easier is checking an antenna for circular polarisation, or a hybrid coupler to get the 90º phasing required to generate circular polarisation. There are two possible ways to make this measurement. One, in Figure 15, is to use a source antenna providing known good circular polarisation, like a helix or septum feed: the two outputs should have equal amplitude. The other is to use a linear source antenna and look for 90º phase shift as the antenna is rotated. If the range has significant ground reflections, then the linear antenna should be left horizontal and the circular antenna rotated; with vertical polarisation, ground reflections can have rapid phase shift.

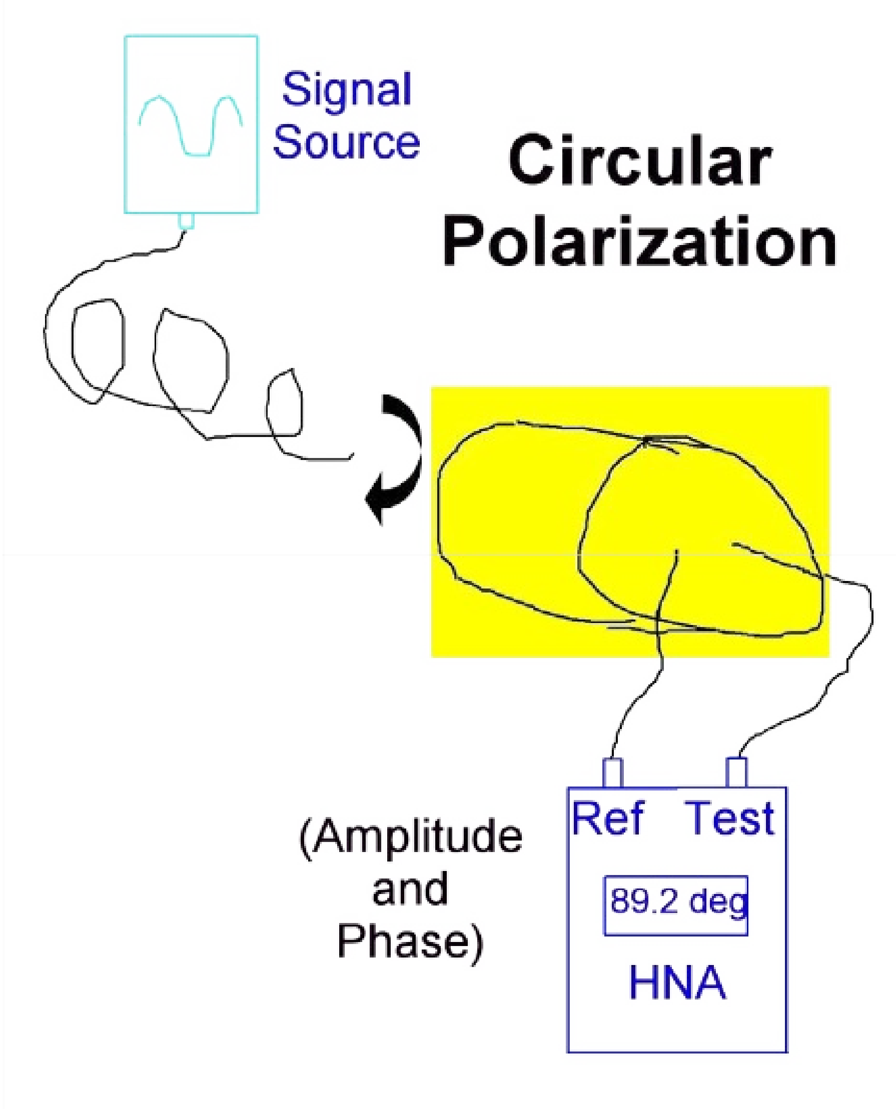


Figure 15

Higher Frequencies

The maximum frequency limit of this instrument is 2.7 GHz – that's the limit for the AD8302 chip. However, with a pair of mixers, one for each channel, and a local oscillator, we can convert both test and reference signals to frequencies below 2.7 GHz and thus extend the usable frequency as high as needed. The configuration is shown in Figure 15. The LO requirements are not too stringent – it just has to be within about 2.5 GHz of the measurement frequency, so that the IF outputs are suitable for the HNA. Only moderate stability is required, at least for amplitude measurements, so crystal control is not necessary. A DRO (Dielectric Resonator Oscillator) should be sufficient – many common TV LNBs for DSS have a DRO running at about 10.75 GHz, ideal for 10 GHz use.

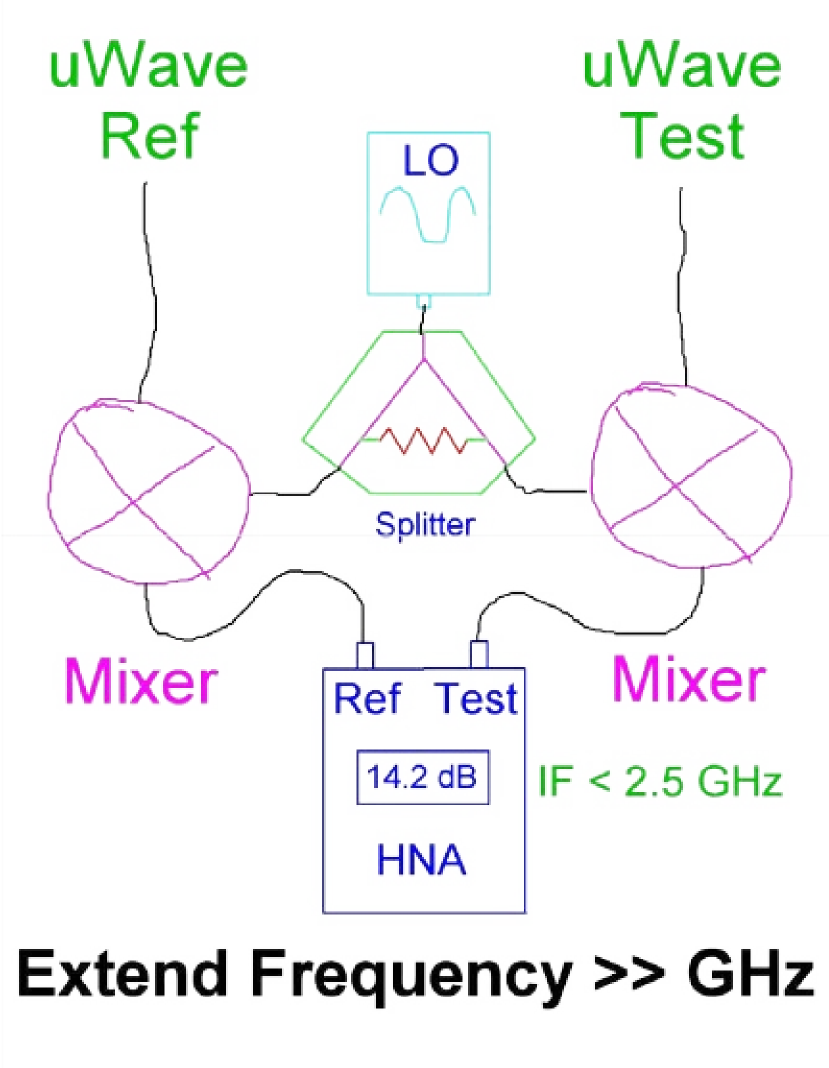


Figure 16

The mixers need not be matched. Since the dynamic range is only 40 dB, and the nominal output level is -30 dBm, almost any mixer would be suitable. The only precaution is that good isolation is required at the IF frequency between the two mixer outputs. Dual mixers on a single PCB may not have enough isolation.

With suitable mixers, we have a network analyser usable at 24 GHz or higher. While mixers may be hard to come by, network analysers for these frequencies are really rare and very expensive.

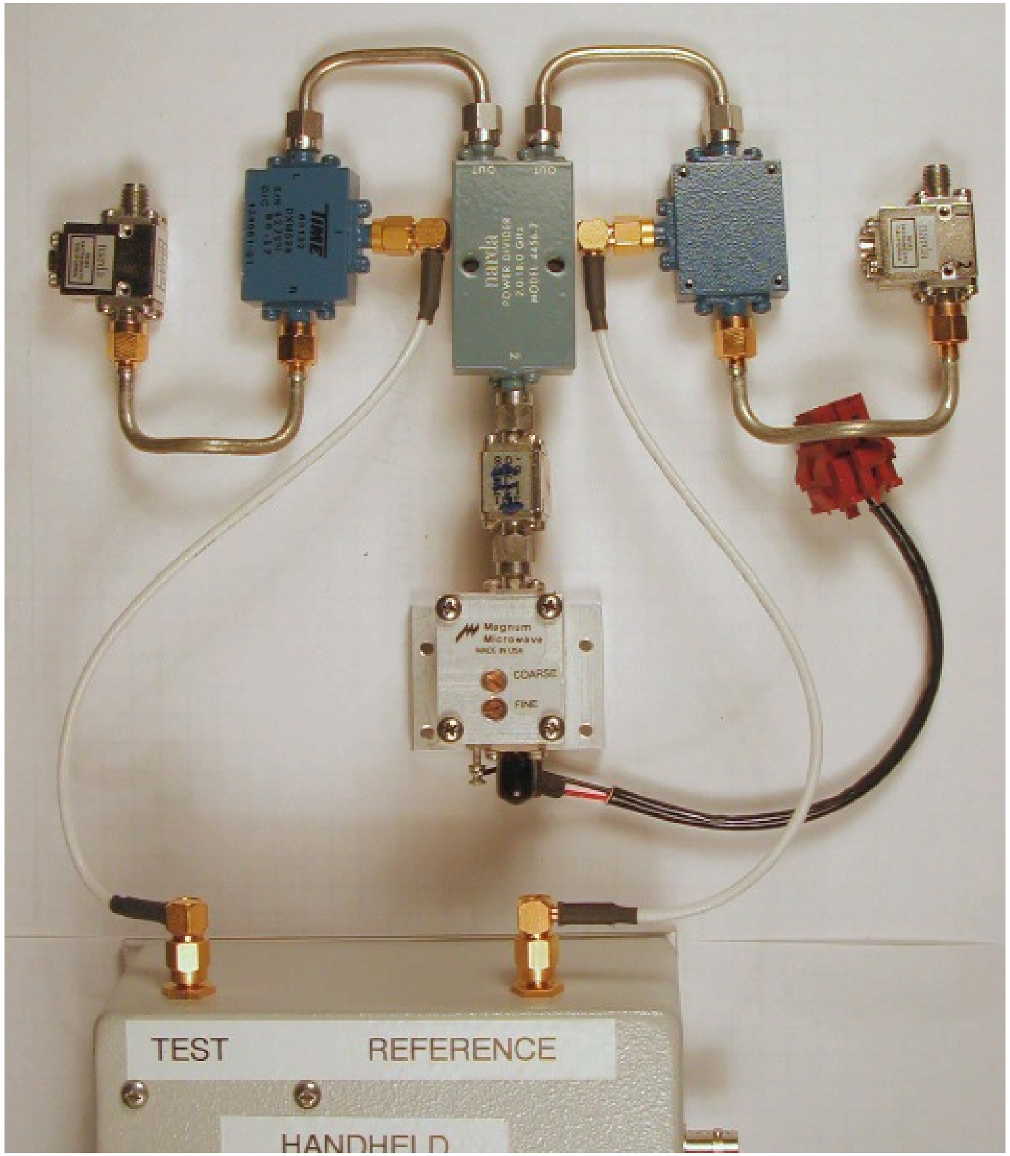


Figure 17 – 10 GHz Frequency Extender Breadboard

My breadboard of a 10 GHz frequency extender is shown in Figure 16 – try it out before doing metalwork! The LO is an 11 GHz DRO donated by W1AIM, and the rest of the components came from the junk box, the results of scrounging at many hamfests. The DRO output is about +10.5 dBm, so it provides about +6 dBm to the mixers after the splitter – an ideal LO level for a mixer. The circuit is like Figure 15, with the addition of a couple of isolators to provide a good input match. Since the mixers have some conversion loss, a bit more signal is required for operation, about -23 dBm at 10 GHz to get a -30 dBm indication on the Hand-held Network Analyser. Thus, the mixer conversion loss is about 7 dB, as we would expect from a good mixer.

Summary

The combination of Antenna Ratiometer and Hand-held Network Analyser is a versatile and useful piece of test equipment, particularly for the VHF and microwave antenna experimenter. It should be possible to reproduce for under $100 – many hams spend far more than this on a piece of surplus test equipment – but it isn't absolutely necessary to have one. I'm amazed that some hams are able to accomplish impressive results with no test equipment at all, while others spend an impressive amount on test equipment that only gathers dust.

Further information, and the complete version of this document, can be found on the authors we site www.w1ghz.org.

References:

[1] Richard T. Knadle, Jr., K2RIW, "UHF Antenna Ratiometry," QST, Feb. 1976, pp. 22-25.

[2] Paul Wade, N1BWT, "Secrets of Parabolic Dish Antennas," Proceedings of Microwave Update '94, ARRL, 1994, pp. 34-56.

[3] Paul Wade, W1GHZ, "Portable RF Sniffer and Power Meter," Proceedings of the 30th Eastern VHF/UHF Conference, ARRL, April 2004, pp. 60-69.

[4] Dave Robinson, WW2R, "A LED Power Meter for Roving Operations," Proceedings of the 29th Eastern VHF/UHF Conference, ARRL, 2003.

[5] Paul Wade, W1GHZ, "An Audio Tone Indicator for Tuning or Antenna Measuring," Proceedings of the Joint Conference – Microwave Update 2002 and the 28th Eastern VHF/UHF Conference, ARRL, 2002. (also www.w1ghz.org)

[6] Dick Turrin, W2IMU, "Antenna Performance Measurements, QST, Nov. 1974, pp. 35-41.

[7] The ARRL Antenna Book, ARRL, 1991, pages 27-43 to 27-48.

[8] W.A. Imbriale, P.G. Ingerson, and W.C. Wong, "Experimental Verification of the Analysis of Umbrella Parabolic Reflectors," IEEE Transactions on Antennas and Propagation, September 1973, pp. 705-708.

[9] E.S. Gillespie, "Measurement of Antenna Radiation Characteristics," in Antenna Handbook: theory, applications, and design, Y.T. Lo and S.W. Lee, editors, Van Nostrand Reinhold, 1988, page 32-22.

[10] H. Jasik, Antenna Engineering Handbook, First Edition, Mcgraw-Hill, 1961, p. 33-3.

[11] Paul Wade, W1GHZ, The W1GHZ Microwave Antenna Book – Online *www.w1ghz.org*.

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DATV-Express Project – June update report

by Ken, W6HHC » Mon Jul 01, 2013

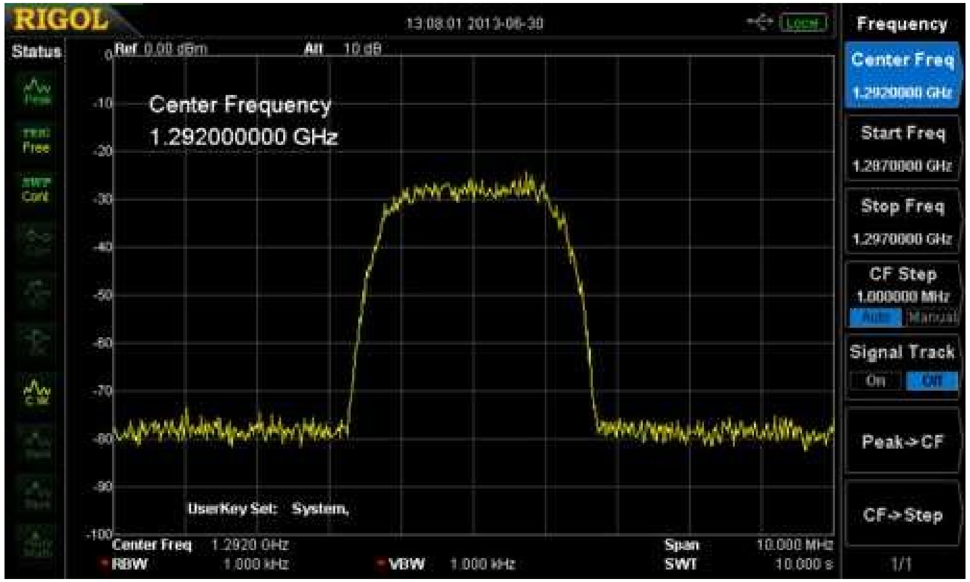
Charles G4GUO was having some problems with DATV-Express during May. Initially he thought it was the software and spent a couple of weeks debugging it to no avail. In the end he found there was a dry joint (in USA I would call it "cold solder" joint) on one or more of the FPGA pins on Proto#3 board. He re-soldered the chip and now it is all working much better. There is still a minor issue with the Kernel USB drivers where it seems to loose all knowledge of the capture card and DATV-Express if the program closes badly. That is a minor issue.

Charles did invest about a week of programming efforts to create a "demo" version of the DATV-Express software program. The nice feature of the demo program is that the connection to the hardware board does not need to be working and the connection to the video-capture Hauppauge does not have to be working, yet…but the DATV-Express program will be running (not crashing) and list out meaningful error messages about status of MPEG and hardware board.

Linux-newbie Ken W6HHC finished up some conflicts (editor of club newsletter in June and huge Americas Field Day effort by local club) and started to get the Ubuntu V12.0.4 (32-bit) to play and run the project software. I am using an old Pentium, 1.8 GHz PC to see how slow the computer can be for the project. I partitioned the hard drive to keep half as old WinXP and a new half in Ubuntu.

The project does not have an "install" for the software yet, so with plenty of guidance and instructions from Charles, I had to do a build of the DATV-Express software program using Qt5 Creator. The trickiest part of using Qt Creator is configuring "kits" associated with the project software. But I documented the steps needed to configure the kits…so the next project-tester can have an easier go of it if we continue having linux-newbie users build the software at their locations.

Once I got the software talking to the Proto #4 hardware board, I was able to look at my new RIGOL Spectrum Analyzer and capture the DVB-S spectrum on 1.292 GHz. This RIGOL is really economical (compared to Agilent and used HP units) and works up to 1.5 GHz. The screen-shot below shows clean spectrum of the first DVB-S test transmission running 2.2 MSymb/sec at QTH of W6HHC. Shows a nice clean signal that has a RF allotted-BW of 3 MHz running robust FEC=1/2



Clean DVB-S spectrum of Prototype #4 board running 2.2 MSymb/sec

I then connected up my Hauppauge model HVR-1950 video-capture USB-2 device to the Ubuntu computer. (HVR means “hybrid” and can receive both analog TV and digital TV as well as receive NTSC camera output.) The Hauppauge unit does the MPEG2 encoding of the camera video and audio for the hardware board. I had an initial problem that I did not have the firmware for this Hauppauge model on my computer. Charles easily found the correct Hauppauge firmware file on the internet, I put the file on my computer….and the Hauppauge unit now loaded the firmware on start up. Below is the first video reception that I screen-captured using my DVB-S SetTopBox that outputs to my Win7 notebook computer.

First DVB-S video received on STB at W6HHC QTH

So now it is Art WA8RMC's turn to bring up Qt5 and the next proto board.

"Full speed ahead"…de Ken W6HHC

The open-source project is known as DATV- Express. The team members are:

- *Art Towslee WA8RMC – electronics design*
- *Charles Brain G4GUO – software design*
- *Tom Gould WB6P – PCB layout design*
- *Ken Konechy W6HHC – project mgmt & pubs*

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Next issue…

- *I'm sure we will think of something, so……*

If you would like to contribute then please contact *editor@cq-datv.mobi*

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