ZL2VH Newsletter – August 2015

President's Report

Clubroom Working Bee – Sat 8th August

Anyone going down to the clubrooms would have noticed a list of jobs on the whiteboard
that Mike ZL2NSA has put up. A lot of those are housekeeping tasks at the clubrooms. It would be good to have a
small working bee one Saturday morning to go through some of the tasks.
I suggest Saturday the 8th of August at 9.30am to 12pm, so if you want to help please let
us know.

Newsletter Editor

Due to commitments David ZL2BDP has stepped down as editor of QST. Eric ZL2SET
kindly stepped in to take up the Editor role. I'd like to thank David for his great work.

David will continue to maintain the club's website www.zl2vh.org.nz. With this change the club is therefore looking
for a person to take the assistant editor's role. Its not very onerous – just there just in case Eric is unavailable. If you'd
like to take the role please drop me an email.

We are always looking for articles to fill the pages of newsletter. Please forward anything
no matter how large or small to the editor - Eric ZL2SET – eric.wilby@gmail.com.

73's and good DX

Simon ZL2BRG

President.

Branch 63 Repeater Update – July 2015

Climie Maintenance – South Hut

Recent Inspections have shown that water is still leaking into the South Hut via cracks in
the walls. We are committed to keeping the South Hut watertight, therefore a working bee
will be required ro fix before spring.

<u>3cm Beacon</u>

Was Installed at the end of June.

I would like to thank the following for help Mancolm ZL2UDF for organazing machining of the Antenna's. Simon Cook-Willis ZL1 for the waveguide. Gavin ZL2ACT for some hardware and John ZL2TWS for some connectors and finally Wayne ZL2BKC for loan of a directonal coupler.

<u>Repeaters</u>

1292 23cm	On Air.	860 Dstar	On Air.
5425 DStar	On Air.	730 2m FM Repeater	On Air.
	53.950 6m FM Repeater	On Air.	

Fred Johnson ZL2AMJ SK

It is with sadness that I learned of the death of Fred last Thursday the 23rd of July 2015.

When I first joined Branch 63 around 1979, Fred was one of the many likeable and most helpful of Branch members. As I got more involved in Branch activities, I began to realise the huge contribution Fred had made to the Branch.

He was responsible for the design and build of our first repeater, "Channel C" on Mt. Climie. This venture cemented our standing with Civil Defence, and secured our position on Climie, which surely must be the best Radio site in the district. Because of this initial work by Fred and his cohort, we are still able to provide excellent service to the Amateurs of the greater Wellington region.

Also during my early days with the Branch, Fred's brother Hugh ZL2BHK, and son Donald ZL2GA, were active, supportive members of the Branch.

Fred also designed the "Tucker Tin" transceiver and other DIY kits which the Branch marketed to the Amateur fraternity as fund raisers. At the 1979 NZART Conference in Upper Hutt, he was instrumental in securing Hart Postlethwaite as the keynote speaker. Hart demonstrated his Happy Flyers RDF kit, and gave the New Zealand distribution rights of it to Br 63.

Not content with being a strong supporter of Branch 63, Fred applied himself to serve NZ Amateurs as an NZART councillor, becoming NZART President, and held many officer roles on behalf of NZART. He was a life member of NZART, and in 2002 was made a Member of the New Zealand Order of Merit (MNZM) by Dame Sylvia Cartwright, for his services to Amateur Radio.

On the International scene, Fred rose to become President of the International Amateur Radio Union, Region 3 and later Chairman. Fred has had articles published by both RSGB and ARRL.

To Marjory, and her family, on behalf of the Branch, I would like to extend our sincere condolences

Gavin Smith
ZL2ACT

ZL2VHX Climie 3cm Beacon

Simon Eatough ZL2BRG

Introduction

I felt that the New Zealand and Wellington ham community in particular was desperately in need of a modern 3cm beacon. I decided to take on the task of building one and thanks to the support of Upper Hut Branch63 club ZL2VHX 10368.275 MHz Beacon was installed in early July at Branch 63's repeater site at Mt Climie. This beacon is the only operational 3cm beacon in New Zealand and hopefully will encourage activity on the 3cm band. Branch 63's site at Climie Mount is a prime location to site it being 850m ASL with excellent take-off in all directions.

The Beacon oscillator is locked to a 10Mhz GPS locked reference which gives it exceptional frequency stability and accuracy. In addition the beacon outputs both JT4G and CW messages. JT4 is a digital modulation method designed for weak signal reception and the G variant being designed to cope with the rain scatter propagation that often occurs on 3cm.

Design

Feeder losses at 10Ghz make long runs of coaxial impractical therefore the transmitter is mounted as close to the antenna as practical. So the Beacon Transmitter and PA are housed up the mast in a separate outdoor unit feeding the antenna via a short length of wave-guide. The Beacon low frequency source being fed up the mast via RG213 coax
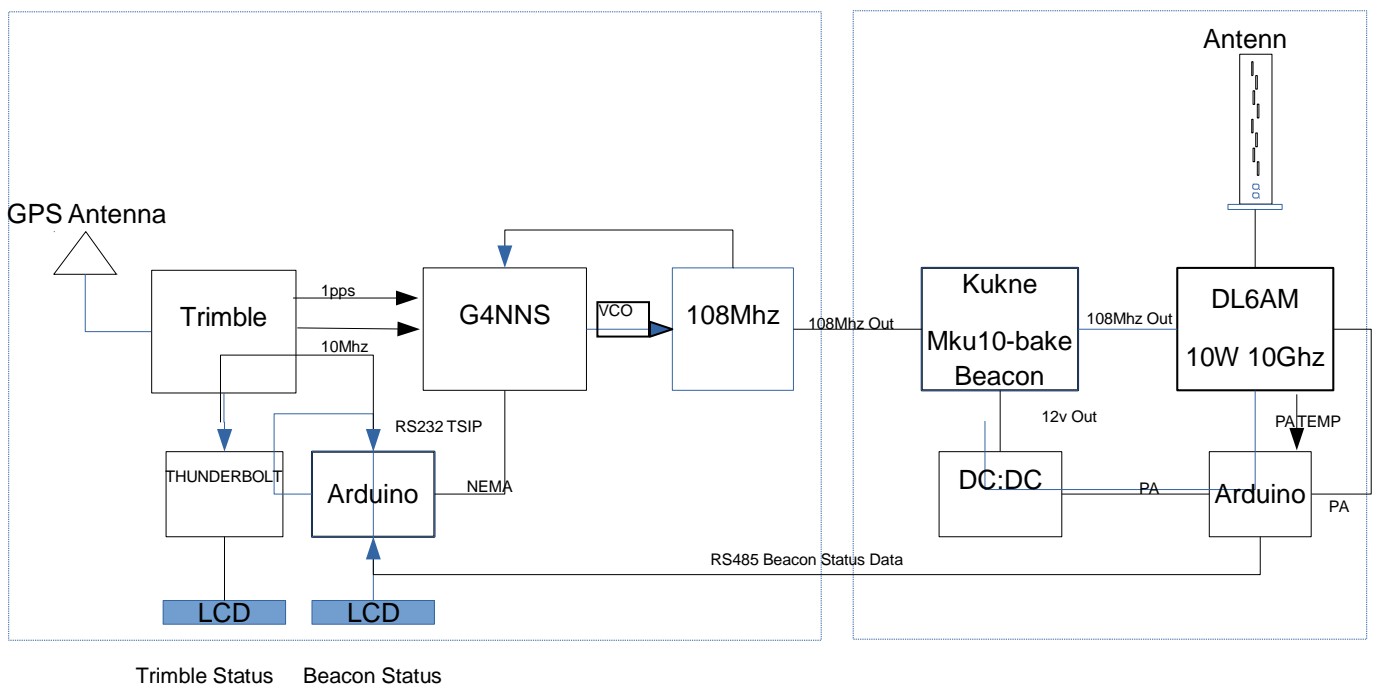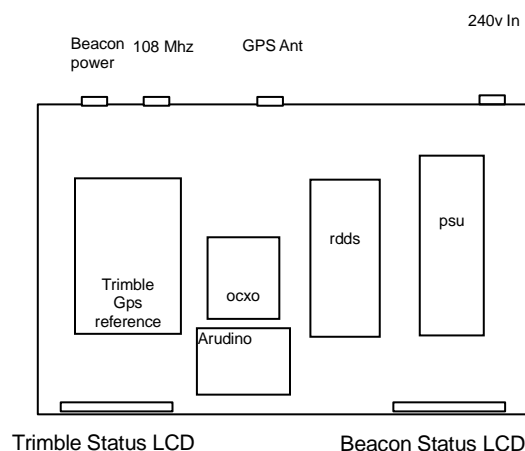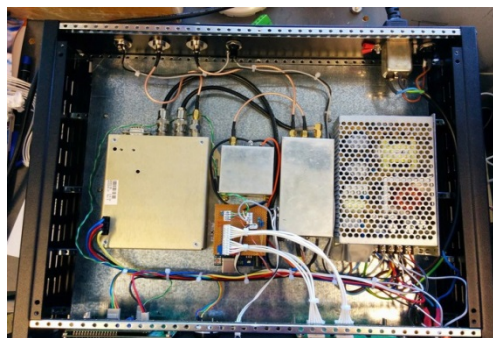
Indoor Unit

Located in the South Hut this generates the modulated 108Mhz signal which is fed via coax to the outdoor box.

Trimble Thunderbolt GPS Locked 10MHz Reference

This unit generates a very high stability high quality 10Mhz reference frequency source which is used to lock the Beacons 108 MHz oscillator. Typical performance of a GPS clock's 10-MHz output is better than 1E-10 at a 100-second time scale -- often much better -- and of course there's no long-term drift at all. It also provides timing signals to synchronise the JT4 Messages

RDDS Module.

The G4NNS Reverse DDS Module controls the OCXO which is the Beacon master oscillator. What is Reverse DDS ? Normal Direct Digital Synthesisers use a reference oscillator usually multiplied up to, for example, 1000MHz, to clock the DDS device which then generates the required frequency. For microwave applications, this is then multiplied up to the required frequency for a Local oscillator or signal source. One problem with DDS is that the multiplication process increases phase noise and unwanted spurs. In reverse DDS the wanted frequency is derived from a crystal oscillator in the usual way, and multiplied up as required. A sample of the crystal frequency is used to clock the DDS device (AD9851 in the RDDS Module) which is programmed to generate the reference frequency e.g. 10 MHz. So it is Direct Digital Synthesis but in reverse! This synthesised reference frequency is then phase compared with the high quality reference and the difference signal is used to control the OCXO using varicap(s) that would normally be used for fine tuning. The resulting signal, when multiplied to microwaves, has much lower phase noise than a signal generated by conventional Direct Digital Synthesis. To Generate the JT4 Message the pic micro controller reads the nema format gps status messages to synchronise transmission on the start of the even UTC minute.

OCXO

The G8ACE ocxo module contains a 108.0028646MHz Crystal source and is the frequency source for the beacon. The OCXO is contains a low noise crystal oscillator along with a temperature controlled 60 deg.c oven.

Beacon Status Monitor - ARDUINO

The Popular Arduino Uno boards were chosen as the beacon status monitor controller. The Arduino is an inexpensive and powerful open source hobbyist micro controller development platform with a wide range of support libraries and hardware extensions which make it relatively easy to develop complex applications. Here the Arduino was used to drive a 4 x 24 character LCD display. Along with a RS485 interface to receive status information from the outdoor unit.

The Beacon status information consists of:-

1. Indoor Unit DC PSU Voltage

2. Outdoor Unit PA Voltage

3. Outdoor Unit PA Current

4. Outdoor Unit PA Temperature

5. Outdoor Unit PA Output level Monitor

Data from the Outdoor unit is sent over two wire RS485.

The Indoor Unit Arduino controller is also used read the TSIP gps data from the Thunderbolt , converts it to TTL level NEMA message at 9600 baud suitable for the RDDS to sync the JT4G Message.

The components are mounted in a Jaycar 19 Inch Rack.

**Thunderbolt Beacon Status Display**

A VK4GHZ Thunderbolt monitor module displays the state of the Trimble Thunderbolt GPS locked 10MHz Reference. Four Pages of status are available , selectable by using a rotary switch.

PSU

Since the Beacon PA draws 3.6A at 12v it was decided to run 24vDC to the head unit to remove the problem of DC losses in the power cables. An Meanwell multi output Switching supply is used to power the beacon. The PSU supplies the relevant +12 -12 and +5v power requirements for the indoor unit plus the +24v feed to the outdoor unit

Outdoor Unit

A die-cast aluminium wifi enclosure was used to house the beacon outdoor unit. The enclosure came with mounting hardware and cable entry glands, but required the addition of a heatsink on the back face to cool the PA.
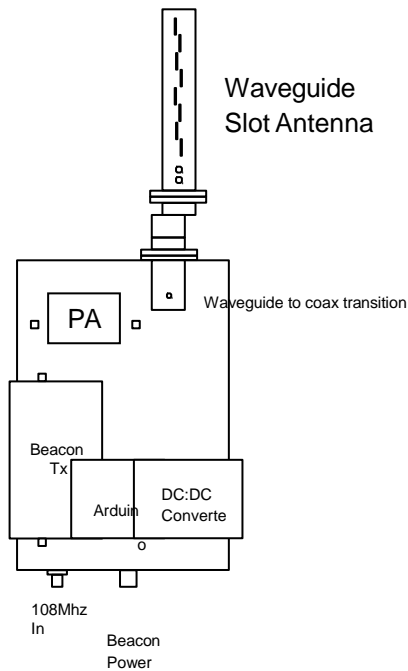
Kuhne Beacon Transmitter MKU10-bake

The Beacon transmitter takes the 108 MHz @0dbm signal , multiples it by 96 , amplifies and outputs at the final beacon frequency 10368.275 MHz.

The mku10 is designed to output 200mW @ 3cm but is has been reduced to 120mW to suite the DL6AM Power amplifier input requirements.

Power Amplifier -DL6AM

The Beacon PA amplifies the rf to the final Power level. The PA module draws 3.6A at 12v and dissipates 35 Watts to get rid of the hear a heatsink was mounted on the back face of the cabinet

Arduino Status Monitor

Another Arduino Uno board is used here with a current sensor module to read PA current, PA Temperature and Voltage are read using the Uno's AtoD inputs with the relevant voltage divider. The thermistor is glued to the side of the PA. The temperature is converted to Celsius by the Uno and the data is sent in plain ASCII @9600Baud serial over a two wire RS485 Connection to the Indoor Unit.
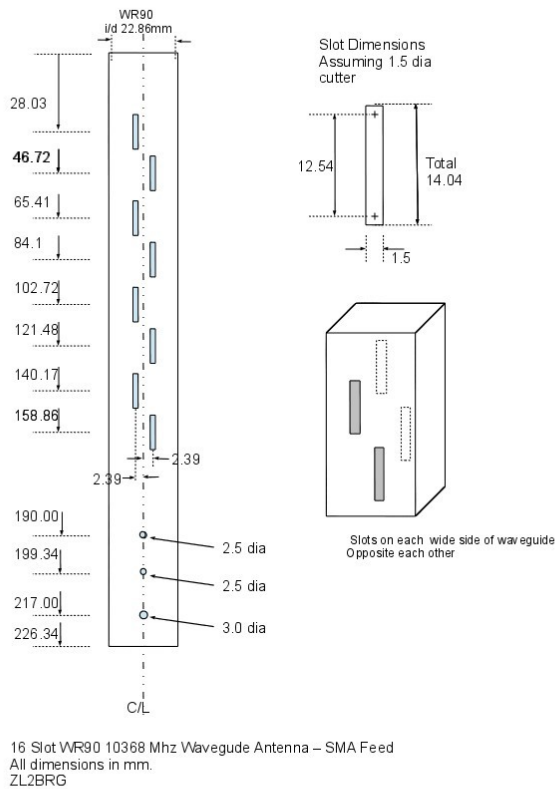
DC:DC Converter

A Chinese sourced DC:DC step down converter was originally used to convert the nominal 24v DC feed to the required 12v for the outdoor unit electronics. However tests showed that this module was found to be extremely noisy RF wise and unusable. The guts were stripped out and replaced by a LT1074 buck converter which does the same thing but with much less radiated RF.

Antenna

For a beacon a omni directional antenna is required and was constructed by machining slots in a length of WR90 wave guide. The 2x8 wave guide slot antenna has a gain of 10dbi and is horizontally polarized. Flanges were soldered onto one end and the other was blanked off with a piece of brass. Two versions were made, one with tuning screws and the other without.

Wave guide Transition

WR90
i/d 22.86mm

28.03

46.72

65.41

84.1

102.72

121.48

140.17

158.86

2.39

2.39

190.00

199.34   2.5 dia

217.00   2.5 dia

226.34   3.0 dia

C/L

Slot Dimensions
Assuming 1.5 dia
cutter

12.54   Total
             14.04

1.5

Slots on each wide side of waveguide
Opposite each other

16 Slot WR90 10368 Mhz Wavegude Antenna – SMA Feed
All dimensions in mm.
ZL2BRG

The Coax to wave guide transition was made from another piece of WR90 wave guide and flange,

Installation

The beacon was installed on the on a cold Sunday in early July 2015. The GPS antenna is mounted temporarily on the side of the Hut. Weather permitting a visit is intended to finalise the gps antenna installation check the thunderbolt configuration.

The Outdoor Unit is mounted at the top of the wifi link antenna pole. With the indoor unit mounted in the Dstar Rack in the South Hut.

JT4 Overview

 The JT4G data mode, part of the WSJT Suite by Joe Taylor, K1JT, has proved its capability for getting through under extremely weak signal conditions, and can cope with fading, frequency drift and up to several hundred Hz of frequency scattering. Its weak signal performance alone appears to show about 6dB advantage over aural copied CW. JT4 in all its variants (A-G) consists of a four tone Multi Frequency Shift Keyed (4-MFSK) waveform, with the spacing between the tones chosen depending on the frequency band and expected spreading. On microwaves the widest spacing, the G variant, has been adopted. Conversely, at HF the narrowest is used with 4.375Hz tone spacing The MFSK message consists of 207 symbols (one of four sequential tones) transmitted at a rate of 4.375Hz, the whole message therefore taking about 48 seconds to send. A rigid timing structure is in use, and the start of the transmission must coincide with the UTC minute interval. For beacon usage, the even minute has been universally chosen as the reference start time. For the decoder to work correctly, this start point must be accurately defined, being no more than a few seconds late, and no more than one second early (the protocol was originally designed for EME with its 2 seconds delay). For beacon use the entire message contains exactly 13 characters taken from an alphabet of letters, numbers and a few punctuation symbols.

The JT4 message is stored as a series of 207 two-bit symbols in a 16F627 PIC micro controller. The symbols are generated off-line using a utility 'GENJT4.EXE' and stored in the PIC in compressed form at four symbols per byte. The GPS receiver delivers serial time coded data and a one pulse-per-second signal to the PIC. At the appropriate interval (every even minute) the JT4 message is replayed with each symbol is sent via two data lines to control the DDS frequency generation. Timing for the JT4 message, at 4.375Hz, is derived asynchronously from dividing-down the PIC clock and leads to no more than 4ms timing error over the 48 second transmit interval – insignificant when compared with the symbol interval of 229ms. During the Odd Minute, the

controller is used to generate the CW ident. The sequence is : Odd minute + 0s, 'ZL2VHX RE78NU' sent at 10WPM. Plain carrier is transmitted between these and from the end of the JT4G   signalling at the Even minute + 30s. FSK keying is used for the CW and switches two of the four pre-stored frequencies. Frequencies The JT4 modulation consists of four tones separated by 315Hz.

JT4G Decoding

Joe Taylor's WSJT Software is used for the decoding. Audio from the receiver is fed in to the line   input on a pc.
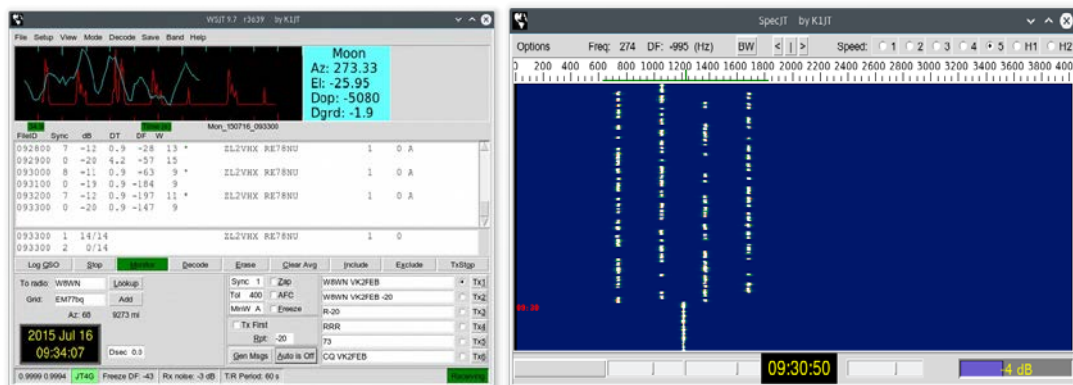
In Conclusion

In the time taken to complete the beacon hardware technology progressed somewhat, High quality gps locked oscillator boards became available, some with built in Jtxx encoding which would have   considerably simplified the indoor unit.

D-Star (and other) Miscellany

http://www.portableuniversalpower.com/our-products/ham-radio-power/dhap-mini/

 "This unit was recently purchased by Steve ZL2YD for portable D-Star operation where ever he travels. Steve will interface this to his cell phone network. Then use his hand held or mobile rig to operate D-Star where he has cell phone coverage. This allows out of town operation where there is no repeater coverage."

73, John ZL2TWS, Mark ZL2UFI, Steve ZL2YD

D-Star Party invitation (John ZL2TWS):

www.southgatearc.org/news/2015/july/dstar_qso_party.htm

This month's saying, (also from John)：

Guys

Just came across a great saying that aptly refers to DRM users and real hams prepared to experiment.

"I'd rather live in a world full of eccentric thinkers than one full of unthinking consumers"

This was posted by Brice Given who is the distributor of the DVRPTR-V1.

The "unthinking consumers" is a good way of labelling DMR users.

Editorial apologies

Owing to a bit of a communications "cock-up" (in our hobby???) the following photos from John ZL2TWS (Dayton Hamfest) did not get into the last issue of the newsletter. Apologies for the omission.

While apologies are flying around, if any of the formatting of this issue is a bit suspect, I would like to say sorry. My command of converting from .pdf to .docx files and vice versa needs to be improved. I guess I need to convert everything to a standard font as well.

Next time perhaps.

73 de Eric ZL2SET.

D-Star forum was packed with 250 people, and standing room only.

Queue for the Friday opening flea market as far as the eye can see.

Who are these strange fellows?

Mark ZL2UP and Mark ZL2YFI at the Internet Labs stand.

Simon ZL2FAE with Joe K0NEB (Cat in the Hat).

Hiro (President of ICOM America), John ZL2TWS, Simon ZL2FAE and Carla ZL2???

DZkit HF transceiver "build it yourself" like Heathkit used to be.

Yaesu Fusion C4FM Digital / FM repeater.