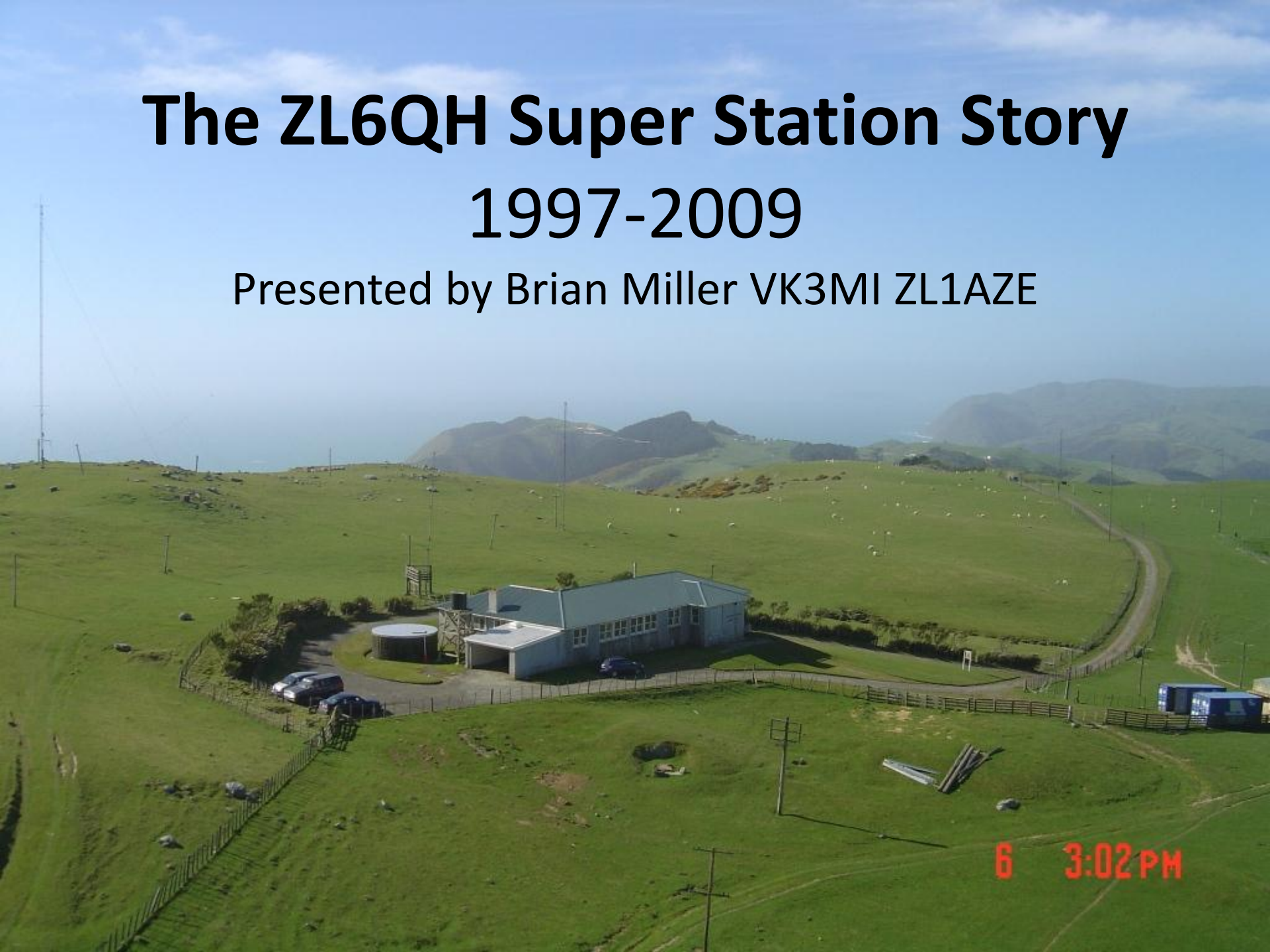
The ZL6QH Super Station Story

1997-2009

Presented by Brian Miller VK3MI ZL1AZE



Agenda

- How it all started
- What we achieved
- Impact of wind farm development

ZL6QH Location – Quartz Hill

Why ZL6QH?

- 100 acres of existing antenna infrastructure
- Rural land on coast – very low noise level
- 300m ASL with low take off angle in all directions (< 5 deg)
- Close to Wellington city
- 2WD access
- Substantial building
- Underground power
- Secure site

QH security guard!

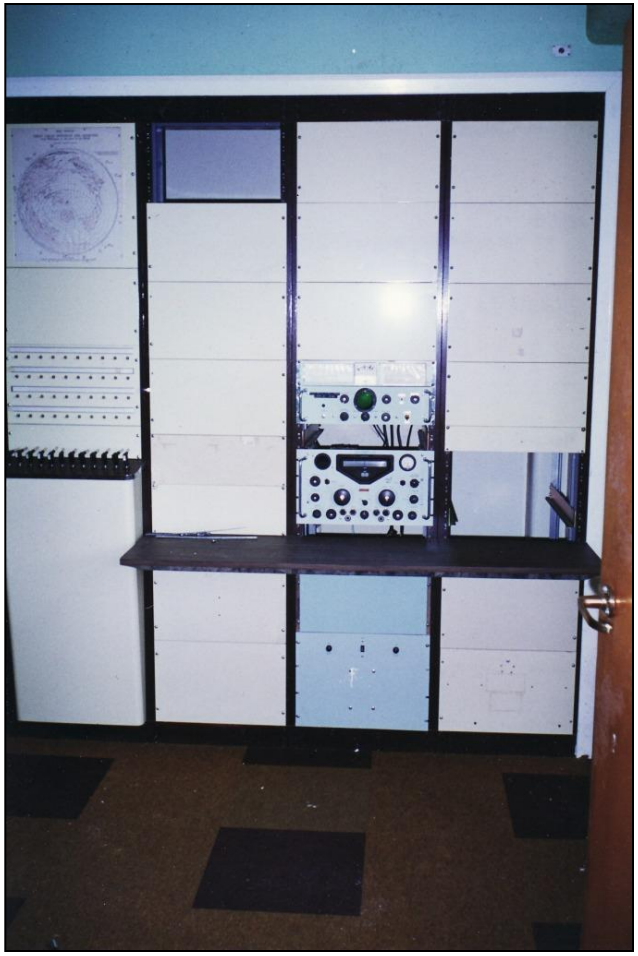
The beginning

- 1997 – Radio NZ exit from Quartz Hill
- ECNZ takes over site to build a future wind farm
- Negotiation with Radio NZ and ECNZ
- Incorporation of Wellington Amateur Radio Club
- Signing of property lease with ECNZ (Now Meridian Energy Ltd)
- Establish QH Committee and Supporters Group
- The clean up starts!

The kitchen – prior to cleaning!

Main RNZ control room

The last RNZ receiver



Treasure in the Riggers Hut

Water tank about to burst?

Lots of rigging maintenance work

Antenna farm considerations

- Contest winning antennas - all bands 160M-10M
- Antennas for 137/180 kHz tests
- Safety first - personnel and farm animals
- Harsh coastal environment and 150 km/hr winds!
- Open wire feeders for low loss - up to 500m
- Antennas laid out to minimise QRM between stations in multi-op multi-band contests
- NEC modelling to test ideas and save time
- Working bees and more working bees …

Reversible 3-wire Rhombic

Vee beam pole

Vee beam feeder terminations

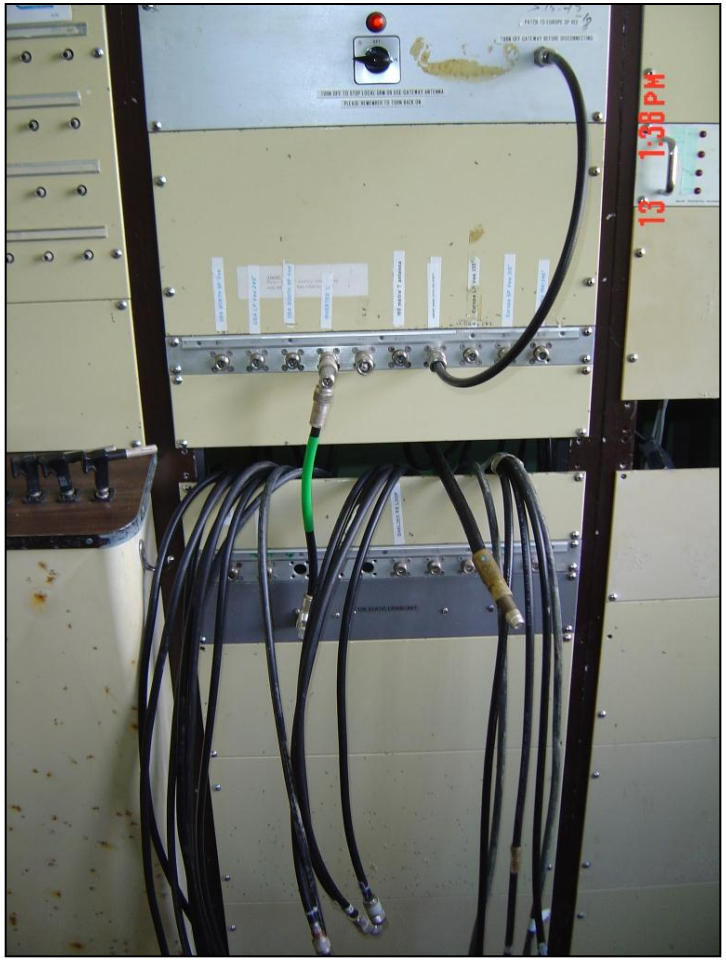
ZL1AZE having a closer look

Open wire feeder connections

South gantry baluns

600:50 Ohm Balun Transformer

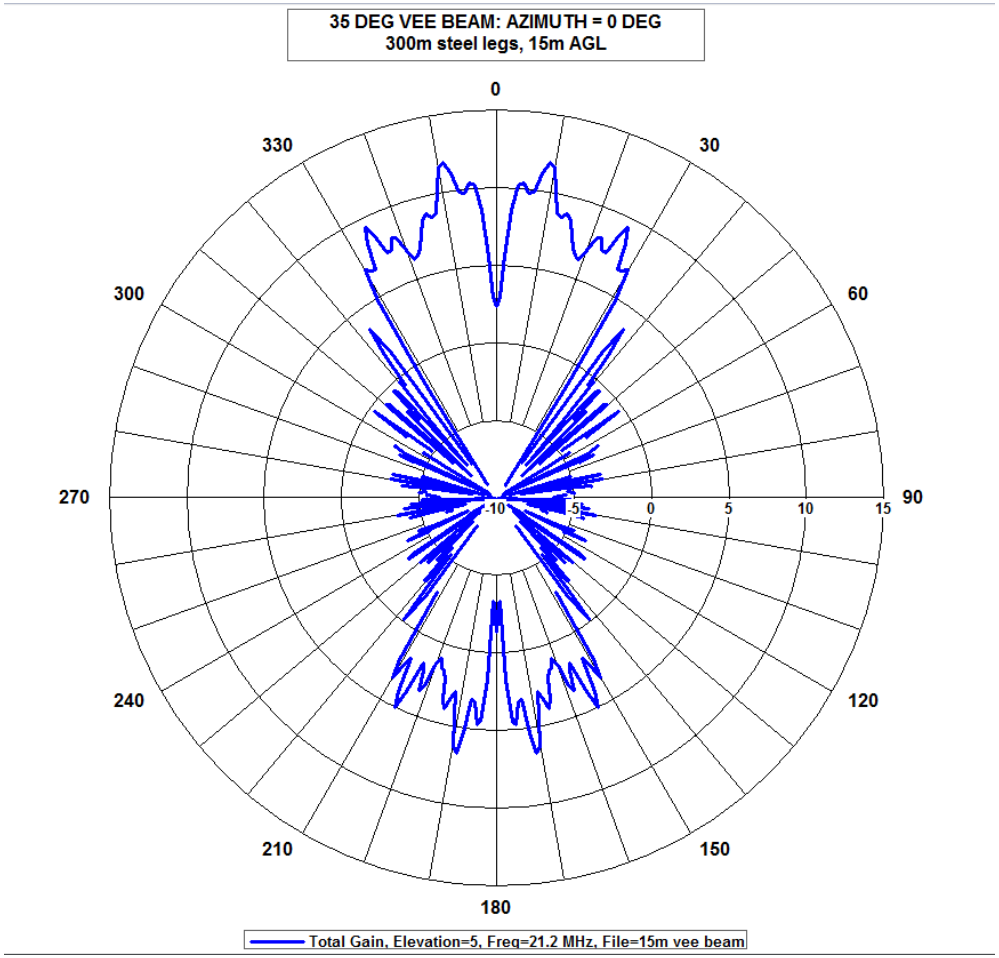
Antenna patch panel



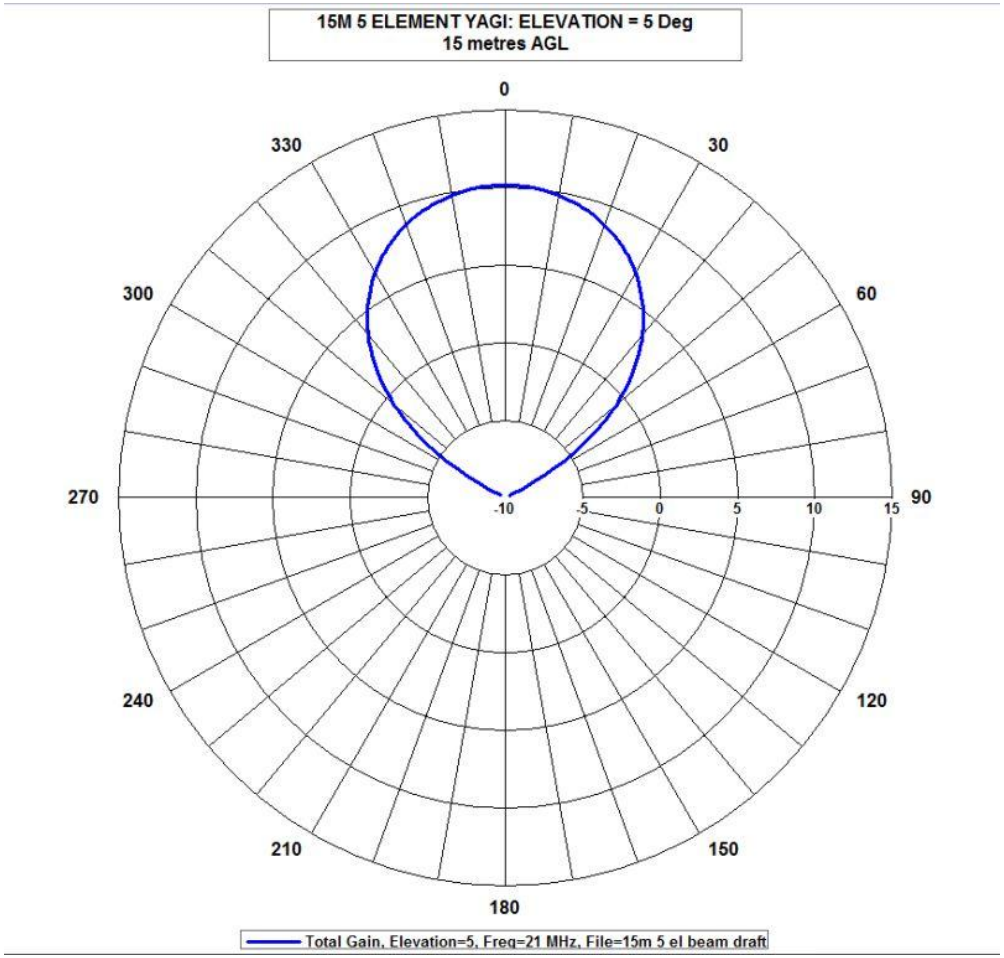
Stay wire terminations

42 metre LF mast for 80M/160M

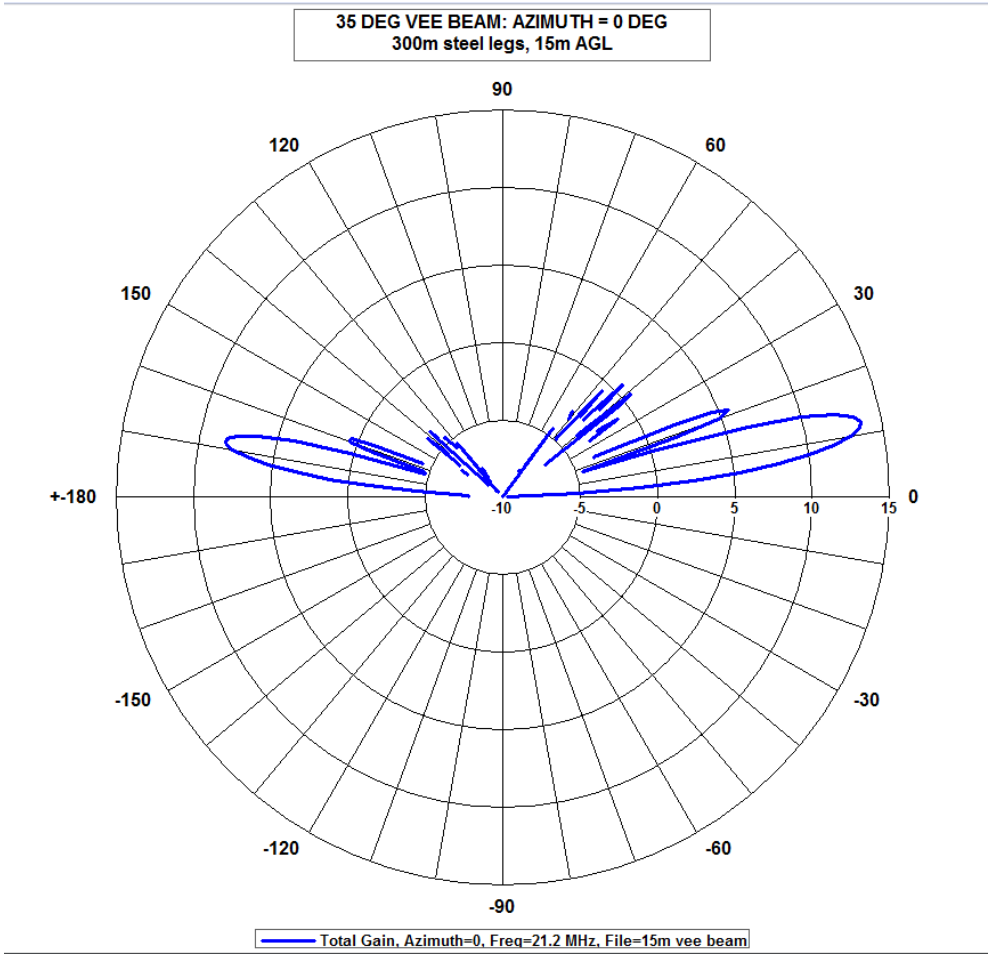
15M vee beam horizontal pattern



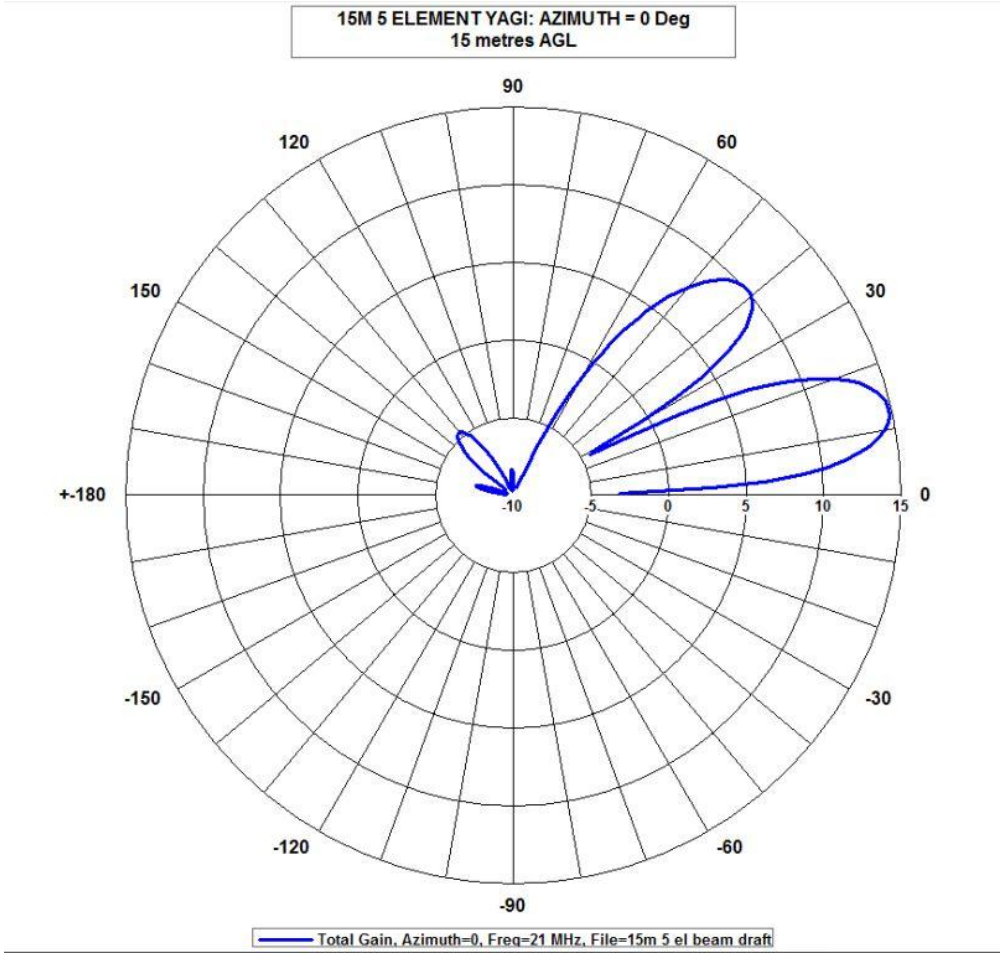
15M 5el yagi horizontal pattern



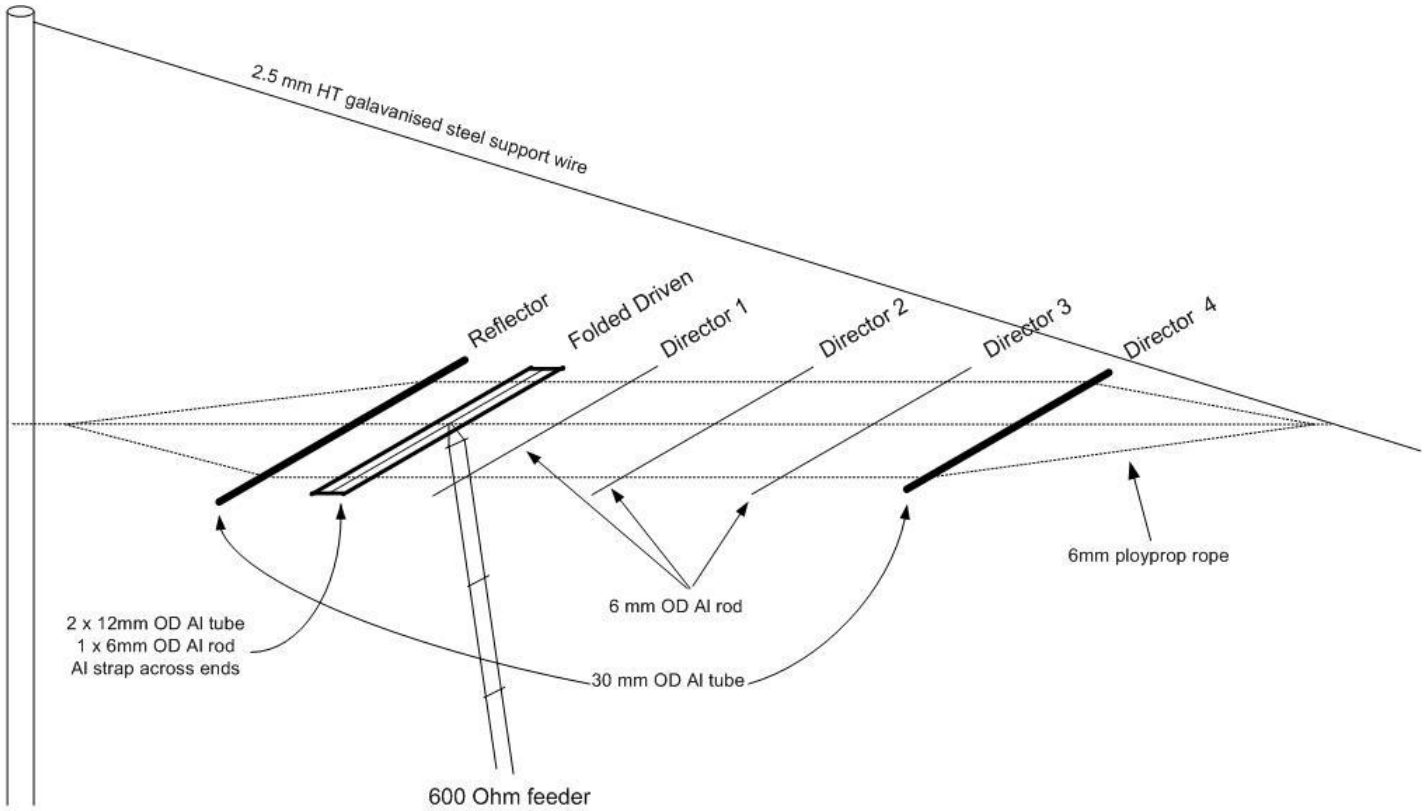
15M vee beam vertical pattern



15M 5el yagi vertical pattern



ZL6QH yagi construction



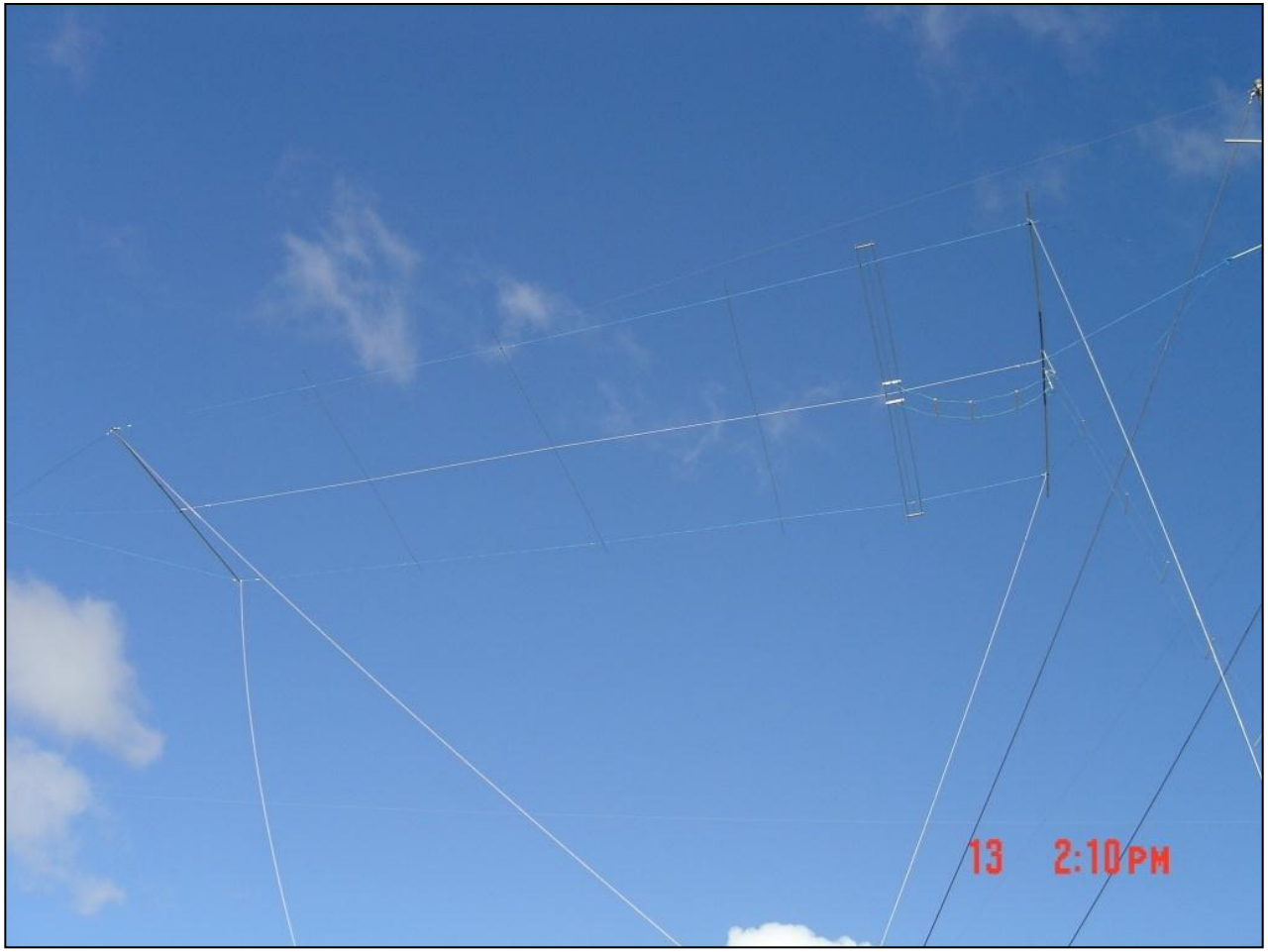
10m Yagi Design Concept using Aluminum tube and rod

20M yagi assembly

Fitting the driven element

Men at work on 10M yagi

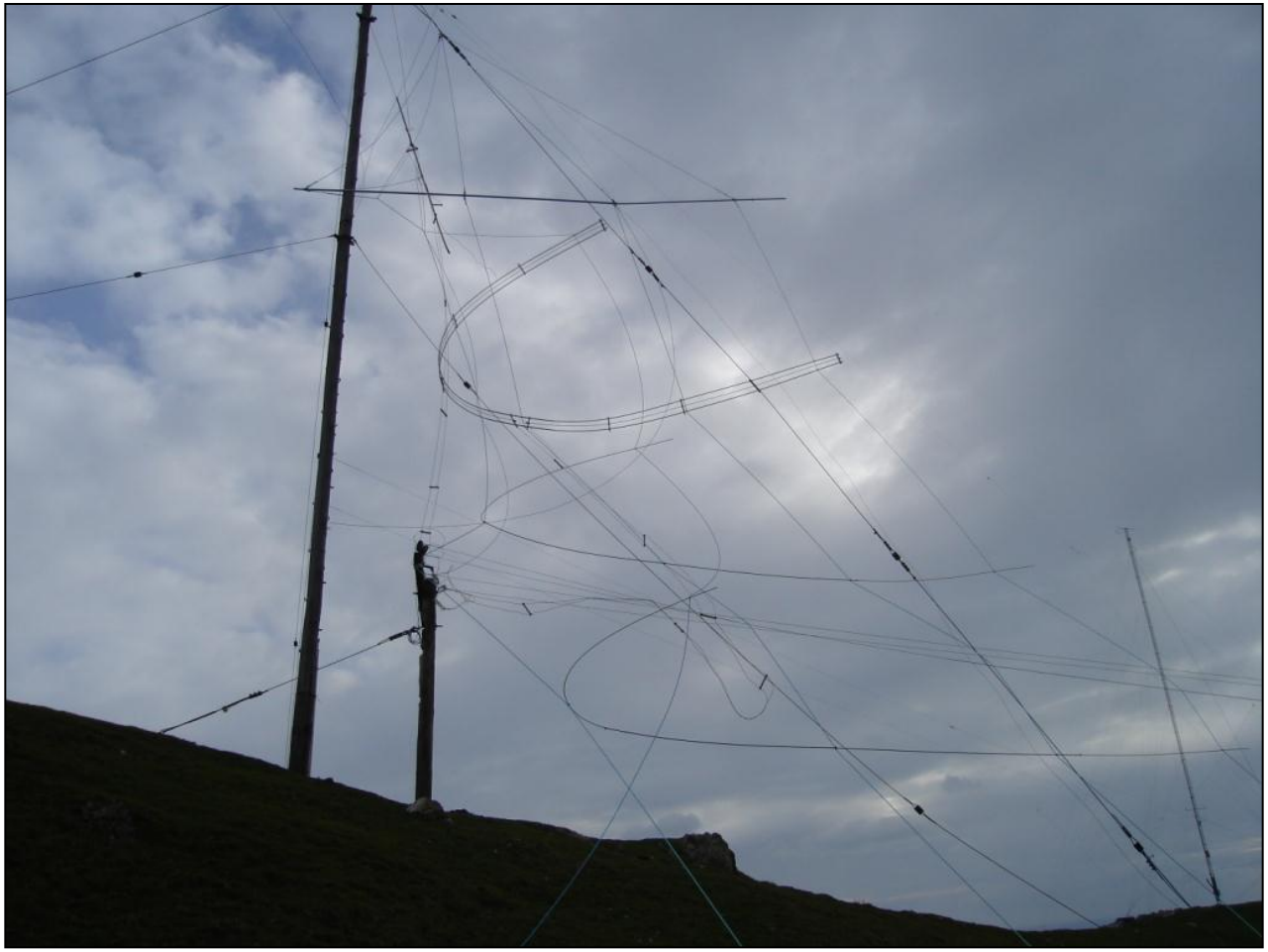
10M 6 element yagi



15M 5 element yagi

Monster 20M 5 element yagi

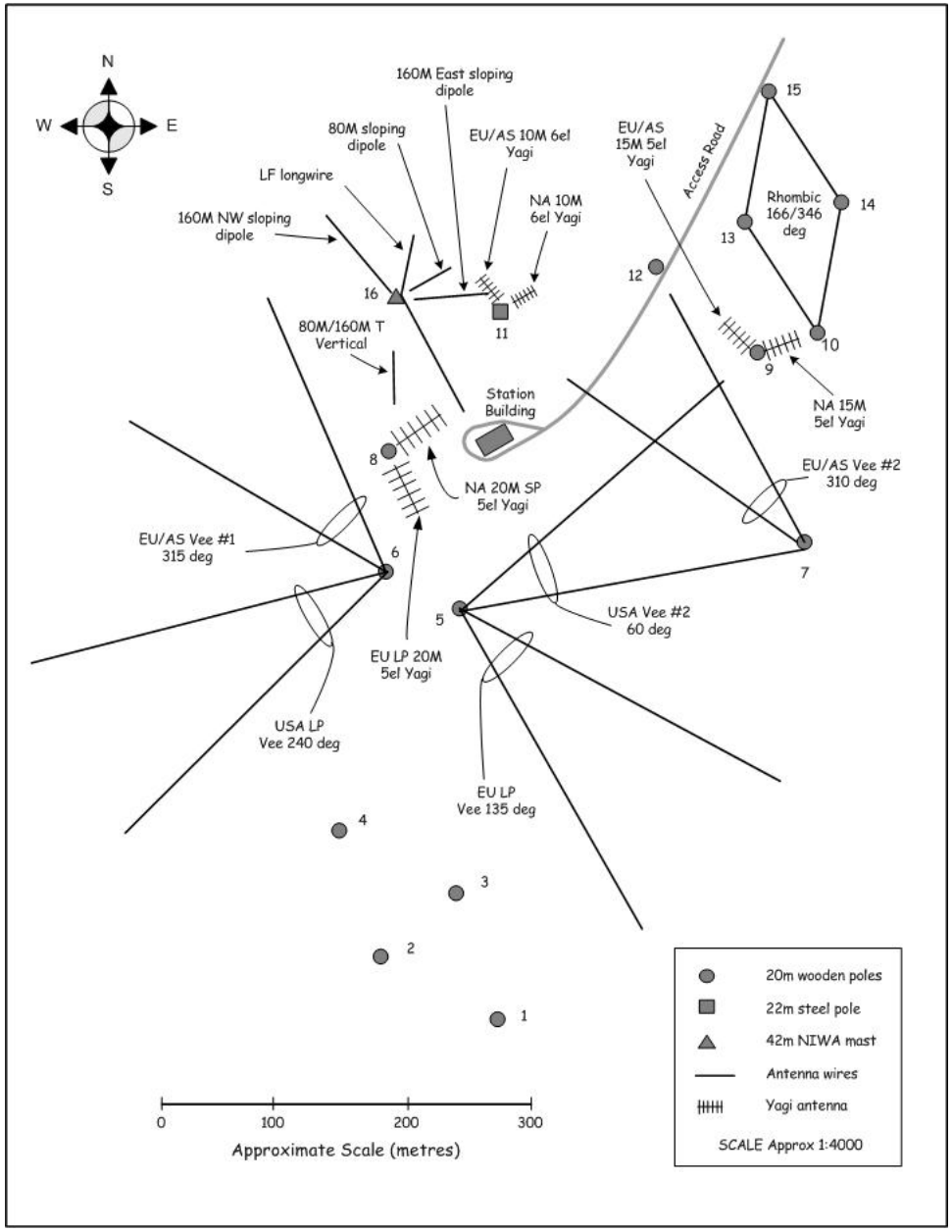
When things go wrong



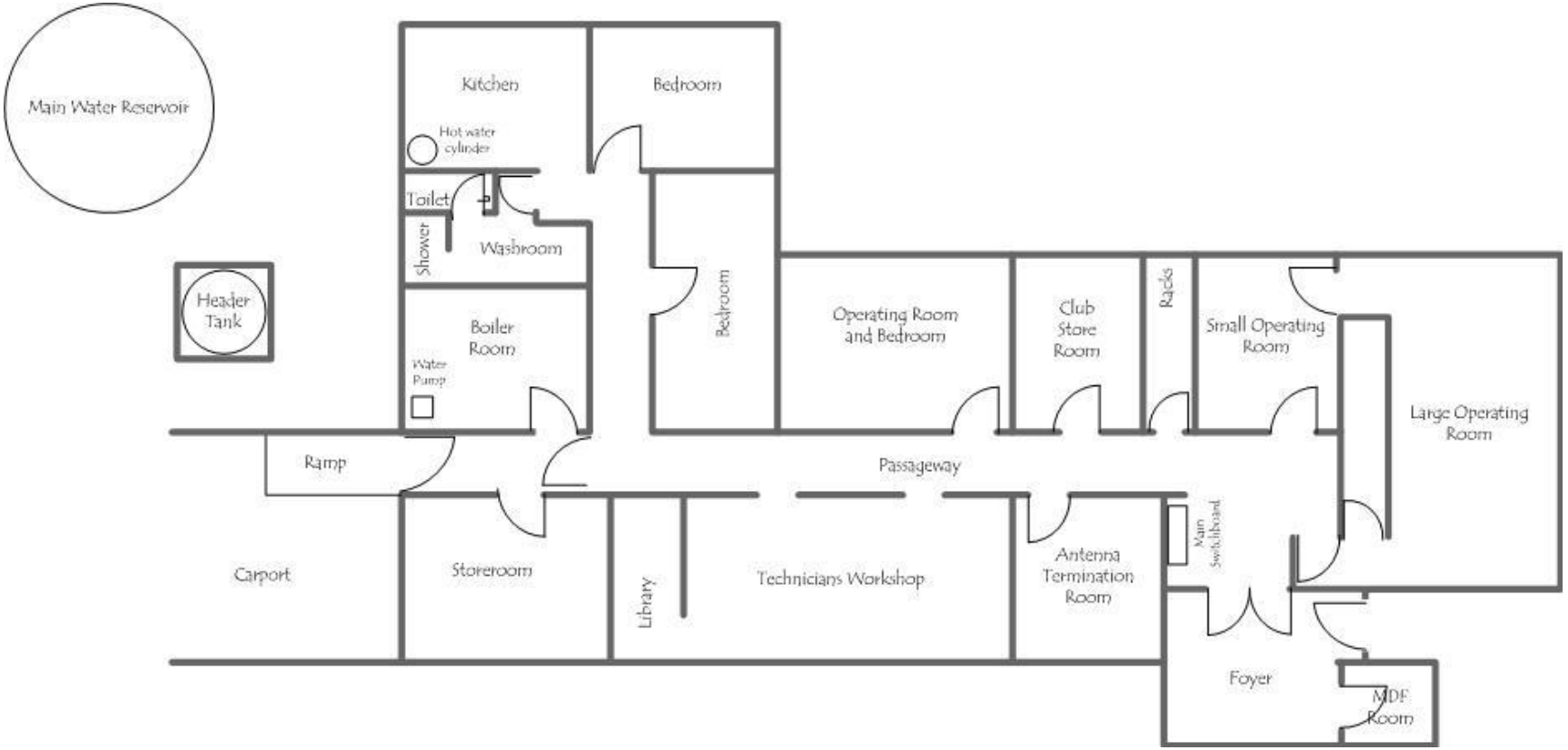
When more things go wrong!

The antenna farm in 2007

- 1 x Rhombic with 200m legs (EU SP and LP)
- 5 x vee beams with 300m legs (NA/EU SP and LP)
- 2 x 20M 5el yagi beams (NA SP and EU LP)
- 2 x 15M 5 el yagi beams (NA SP and EU SP)
- 2 x 10M 6 el yagi beams (NA SP and EU SP)
- Vertical with elevated radials for 80M/160M
- Sloping dipoles for 80M/160M
- Sloping long wire for LF 137/180 kHz


N
W
E
S
160M East sloping dipole
80M sloping dipole
EU/AS 10M 6el Yagi
LF longwire
NA 10M 6el Yagi
160M NW sloping dipole
16
11
80M/160M T Vertical
Station Building
8
NA 20M SP 5el Yagi
EU/AS Vee #1 315 deg
6
EU LP 20M 5el Yagi
USA LP Vee 240 deg
5
EU LP Vee 135 deg
4
3
2
1
EU/AS 15M 5el Yagi
Access Road
15
Rhombic 166/346 deg
14
13
12
10
9
NA 15M 5el Yagi
EU/AS Vee #2 310 deg
7
USA Vee #2 60 deg
0
100
200
300
Approximate Scale (metres)
20m wooden poles
22m steel pole
42m NIWA mast
Antenna wires
Yagi antenna
SCALE Approx 1:4000

Inside the shack



Some of our achievements

- Leading amateur HF station in southern hemisphere
- 171,732 QSOs and 35,638 QSLs
- Many first places and new records in contests
  - CQ WW
  - CQ WPX
- 137 kHz contact with UA0LE – world record
- Hosted visitors from 25 countries

ZL2AMI in a RTTY contest

Setting up LF QSO with UA0LE

2004 CQWPX CW contest

2005 CQWW CW plaque

2005 CQWW CW team

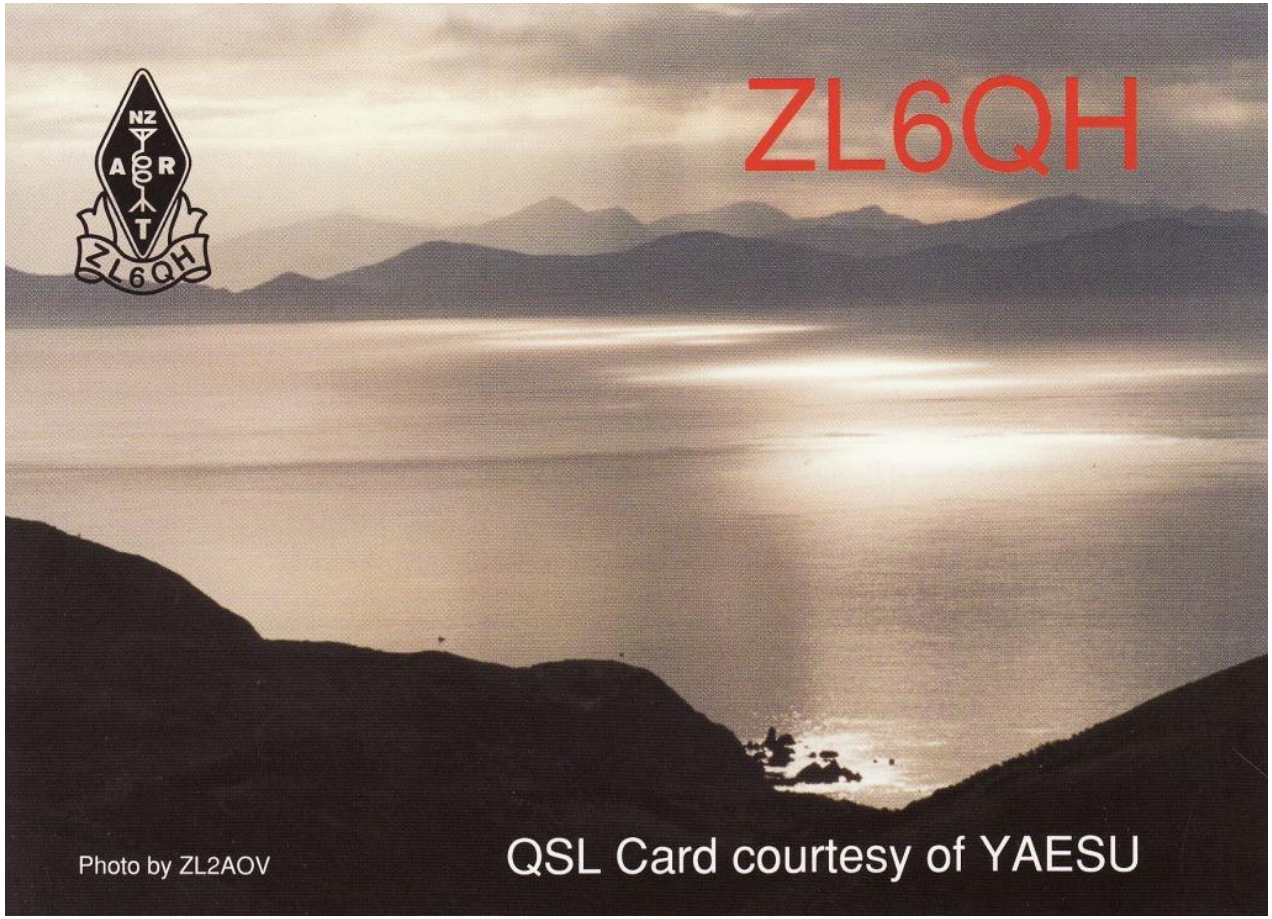
2006 CQWW SSB contest

2006 CQWW SSB team

2007 CQWPCX CW team

Another pile of cards arrives!

ZL6QH QSL card

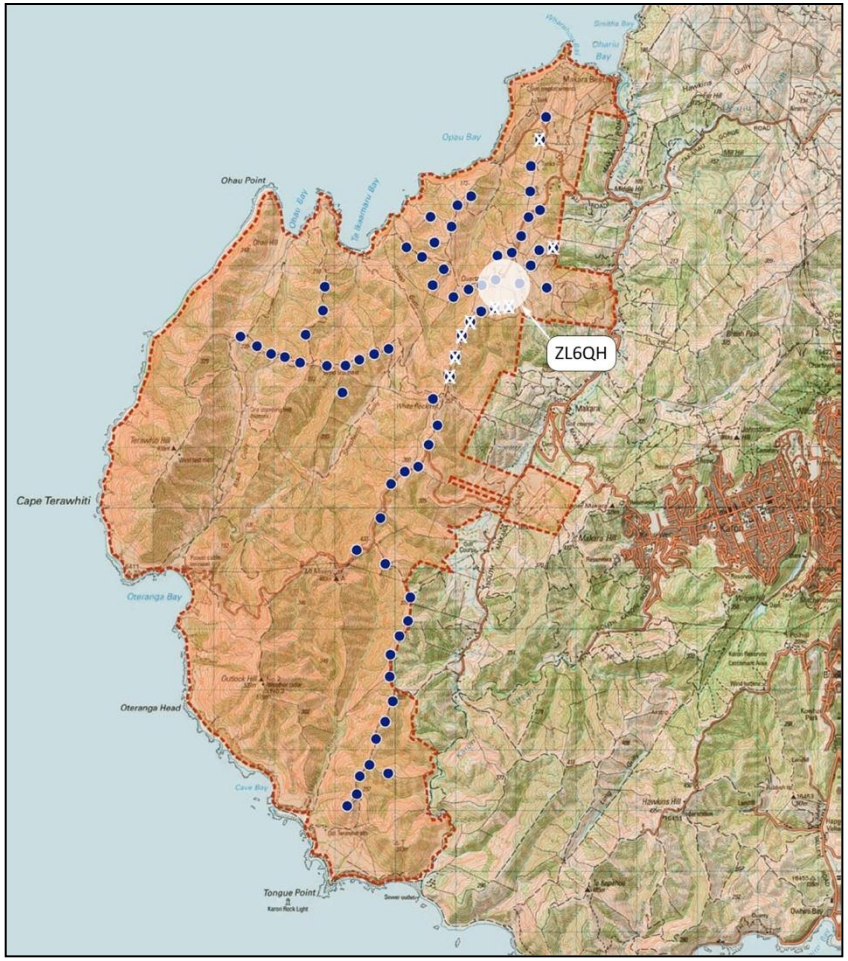


Summer BBQs always popular

2007 wind farm developments

- Meridian Energy gained resource consent in mid 2007 to build a wind farm
- Civil works started 4Q 2007
- Antenna farm dismantled Sep/Oct 2007 to make way for the civil works
- ZL6QH assets stored in building and containers

Wind farm map



Wind farm Turbines

- 62 turbines
- Siemens 2.3 MW
- Maximum height of blade tip = 108 metres
- Weight approx 200 tonnes
- Water-cooled solid state converter to match variable speed generator output to grid
- Transformer to step up 690V AC output to 33kV underground cable to sub-station

Wind farm noise research

- Haunui wind farm (significant noise)
- Te Apiti wind farm (negligible noise)
- Bippen wind farm in Germany using Siemens turbines (some noise)
- Quartz Hill?

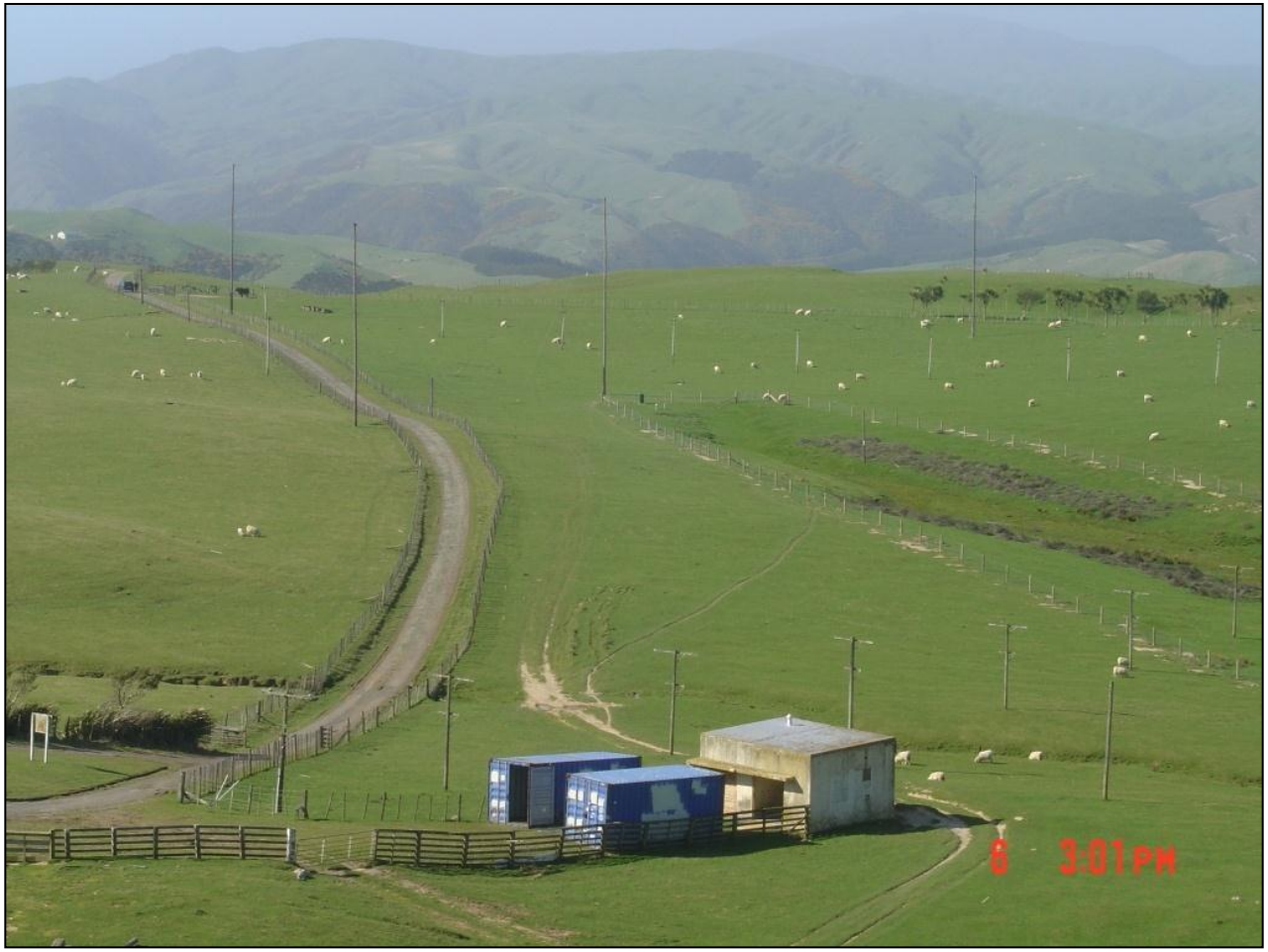
Starting ceremony – Sep 2007

PM helps dig the first sod

The rhombic comes down

ZL2TCU dismantles a feeder pole

Storage containers



ZL6QH - QRT

Road works – March 2008

More road works

The turbines arrive ….

Turbine construction

First Power – 29 April 2009

PM turns on the BIG switch!

Quartz Hill - August 2009

Quartz Hill - August 2009

Quartz Hill – SW view

Quartz Hill noise measurements

- 3.7 MHz
- ½ wave dipole antenna - centre 5 metres AGL
- TS120V receiver
- Battery power
- GPS receiver

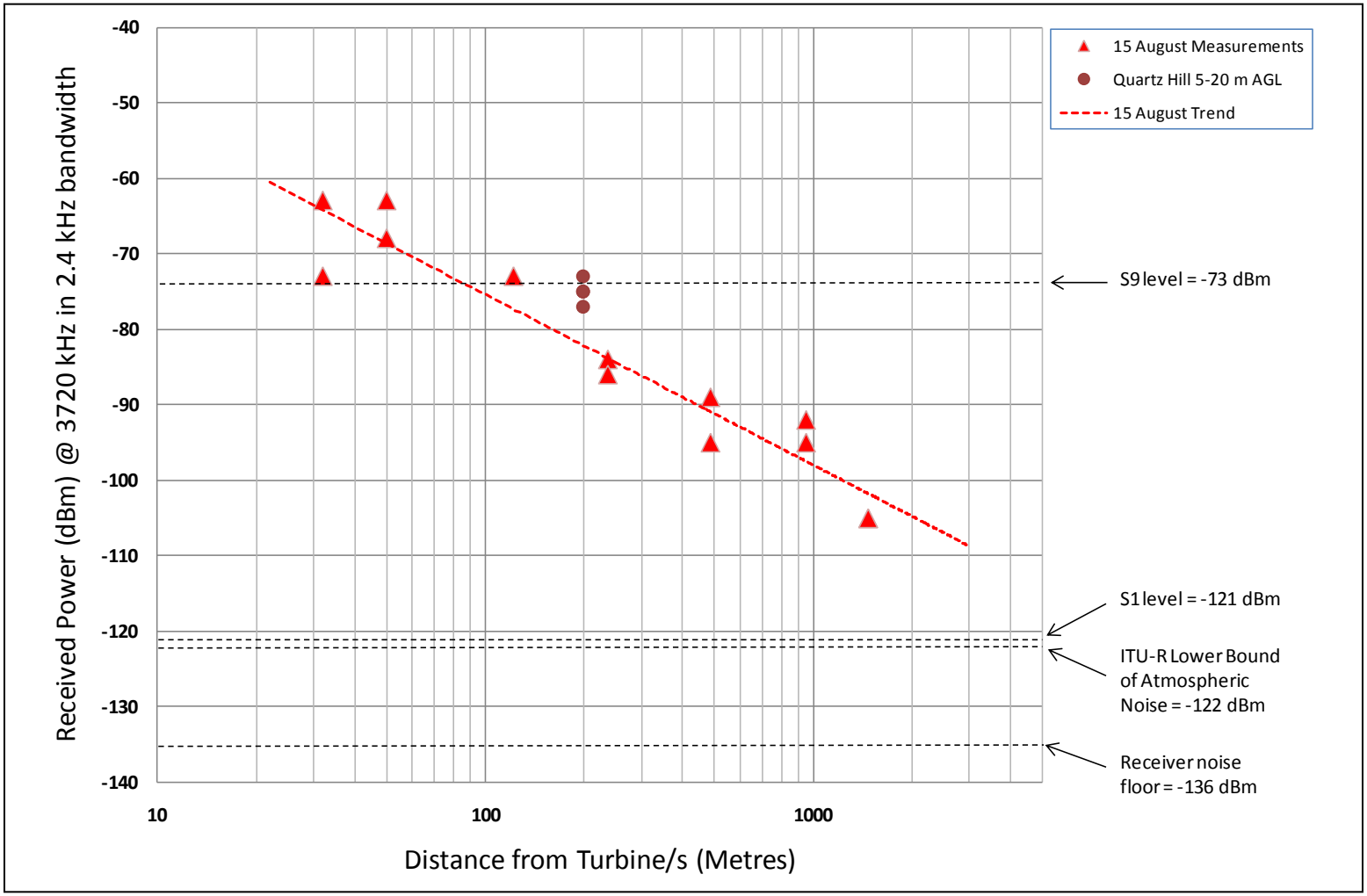
Setting up

Multiple noise sources!

Measurements at 1 km

Height measurements

Results


Received Power (dBm) @ 3720 kHz in 2.4 kHz bandwidth
-40
-50
-60
-70
-80
-90
-100
-110
-120
-130
-140
10
100
1000
Distance from Turbine/s (Metres)
15 August Measurements
Quartz Hill 5-20 m AGL
15 August Trend
S9 level = -73 dBm
S1 level = -121 dBm
ITU-R Lower Bound of Atmospheric Noise = -122 dBm
Receiver noise floor = -136 dBm

Conclusions

- The noise was broadband and emanated from each of the individual turbine systems
- Quartz Hill is too noisy for HF amateur radio operations
- A serious HF amateur radio station would have to be separated from the nearest turbines by a distance of at least several kilometres
- Start planning for a new site and station!

Some things that we have learnt

- It is important to think BIG dreams!
- Look for and take advantage of opportunities
- Location is the most important thing
- Be wary of RF noise from wind farms
- Be patient – building a super station involves a lot of learning and time
- A core group of believers and team work was essential for making this dream a reality

Thankyou

For more information - visit www.zl6qh.com or email brianmiller@xtra.co.nz