“Multum in Parvo”

The Bodger’s Guide to Patio Moonbounce

or

How to get “on the moon” when you don’t own a farm or a US-sized “Backyard”

John Worsnop G4BAO







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The Bodger's Guide to Patio Moonbounce

John Worsnop G4BAO

- Bodger – (noun)
  - A highly skilled itinerant wood-turner, who worked in the beech woods on the chalk hills of the Chilterns, in England
- Bodging (Br. Slang)
  - an inexpertly or roughly done job, typically in the field of DIY.



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EME for Bodgers - some observations

- "Backyard Moonbounce" has been "done to death" at Microwave Round Tables.
  - So what am I doing here?
- My "USP" is that my backyard is not the size of Rutland
  - (Like some of our US colleagues)
- My "buzz" is making things work, not making QSOs!
- Microwave EME is not "easy"

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EME for Bodgers - some observations

- I got sick of going to "Backyard EME" talks where the first slide was:
- "first, find your obsolete 12ft TVRO dish and load it on to the back of your monster jeep and trailer."
- or
- "even a small 2x19 element 144MHz array can give you good results"
  - These people must have no neighbours and very compliant XYLs
- Microwave EME theory and practice are close.
  - It is satisfyingly "predictable"
- There are no short cuts
- You never stop tweaking
- It takes time to make something work
- For me, 2 years from concept to first QSO.

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Which band?

- Determined by:
  - Tolerance threshold of XYL, Patio size, Dish size, HPA availability and cost
  - So how to decide?

SE S SW



The view from my dish site

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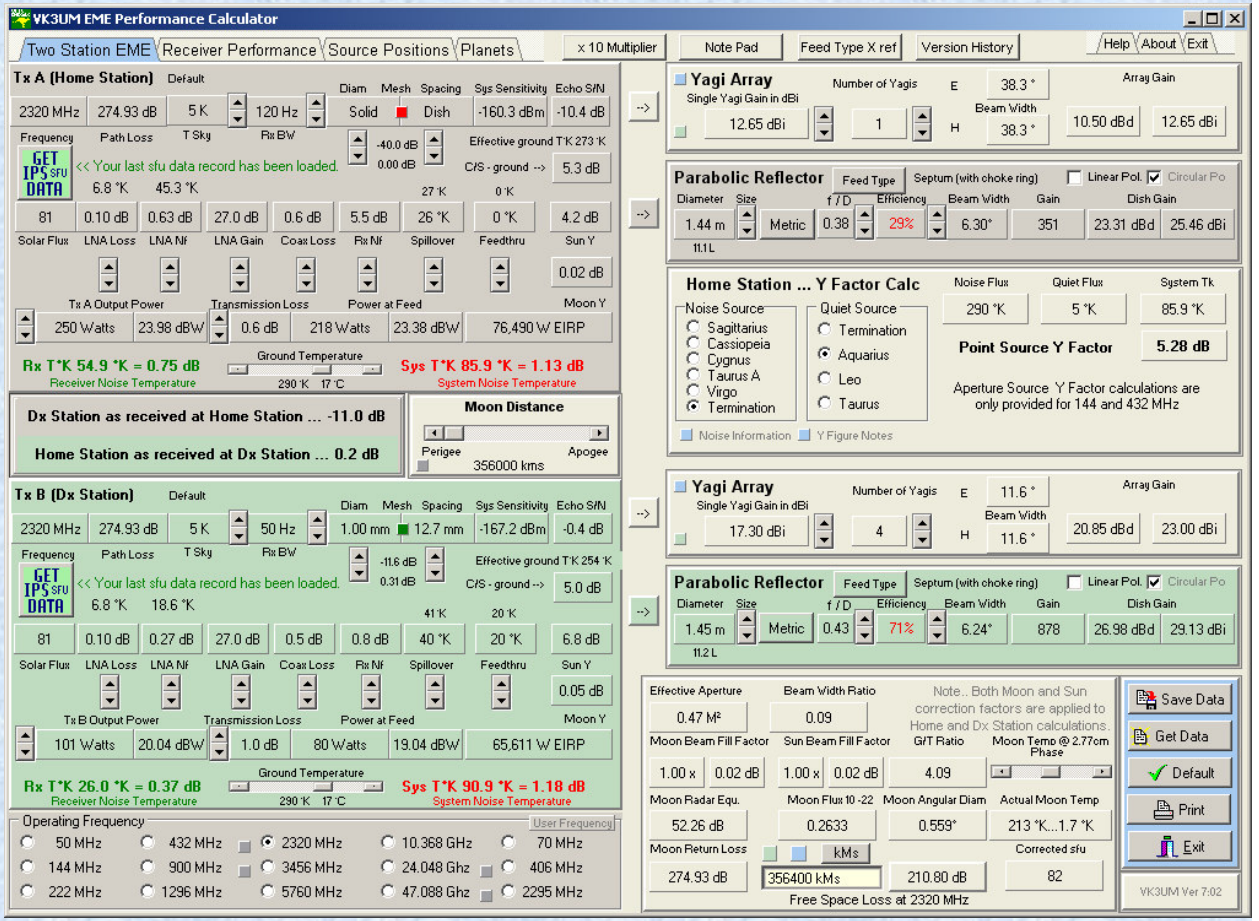
VK3UM EMECalc

- "Must Have"
  - Automates system calculations.
  - Used for "What if" analysis of
    - Band
    - Dish size and shape
    - Feed Type
    - Power
    - Receiver performance
    - Moon distance
    - Sun noise



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Which band? – here's how I decided

- **Starting point** – 1.4m spun aluminium solid dish



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Which band? – here's how I decided



- **Starting point** – 1.4m spun aluminium solid dish
  - Small enough to pick up and carry.
  - It cost me nothing!
  - No argument – anything bigger looks "ugly" and attracts too much attention

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Which band? – here's how I decided



- **Starting point** – 1.4m spun aluminium solid dish
  - Small enough to pick up and carry.
  - It cost me nothing!
  - No argument – anything bigger looks "ugly" and attracts too much attention
  - Can be easily disguised as "garden furniture" when not in use.



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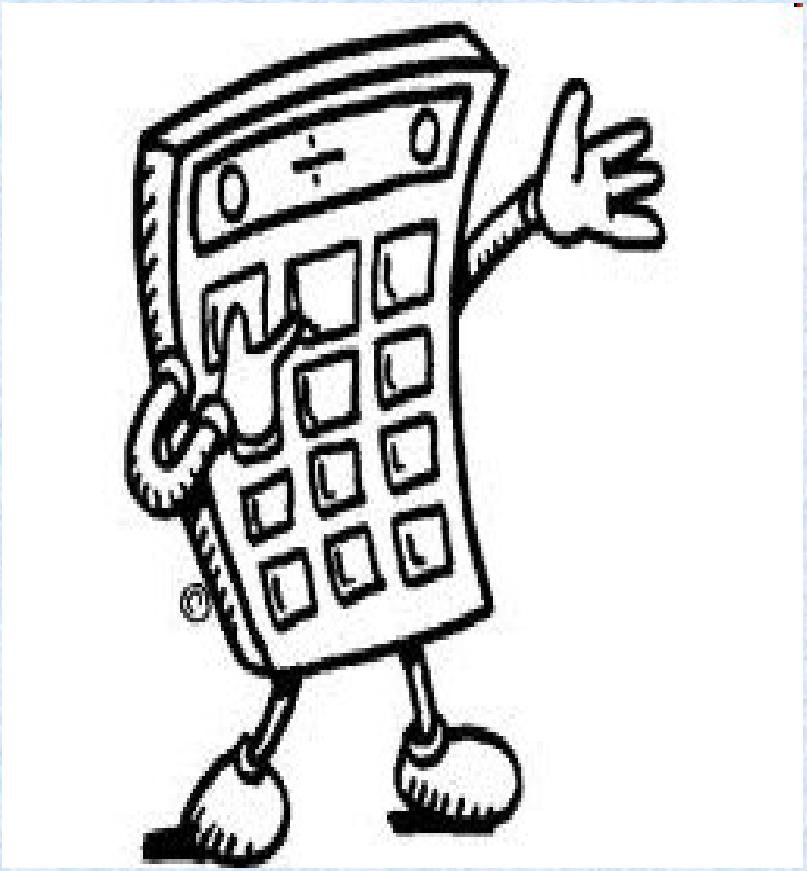
Which band? – here's how I decided

- **Objectives:**
  - **Mainly homebrew**
  - **Polar mount**
  - **No dangerous voltages outdoors**
  - **Good enough to work "big guns" on CW and for JT modes**
  - **"Echoes" > -6dB in 120Hz RX bandwidth**

- **From VK3UM EMECalc**
  - **23cm?**
    - **NF 0.3dB, TX power 700W**
  - **13cm?**
    - **NF 0.35dB, TX power 270W**
  - **9cm?**
    - **NF 0.4dB, TX power 150W**
  - **3cm?**
    - **NF 0.7dB, TX power 45W**



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Which band?



- **23cm? NF 0.3dB, TX power 700W**
  - Too much power + poor dish illumination !!
- **9cm? NF 0.4dB, TX power 150W**
  - **Do-able but PA could be expensive**
- **3cm? NF 0.7dB, TX power 45W**
  - Very expensive SS PA, or outdoor TWT needed.
  - Too many high voltages for my liking!

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The "Goldilocks band"?



- 23cm? NF 0.3dB, TX power 700W
  - Too much power + poor dish illumination !!
- 9cm? NF 0.4dB, TX power 150W
  - Do-able but PA could be expensive
- 3cm? NF 0.7dB, TX power 45W
  - Very expensive SS PA, or outdoor TWT needed.
  - Too many high voltages for my liking!
- **13cm?**
  - **NF 0.35dB, TX power 270W**
  - Surplus PAs and cheap LNAs (G4DDK) available,



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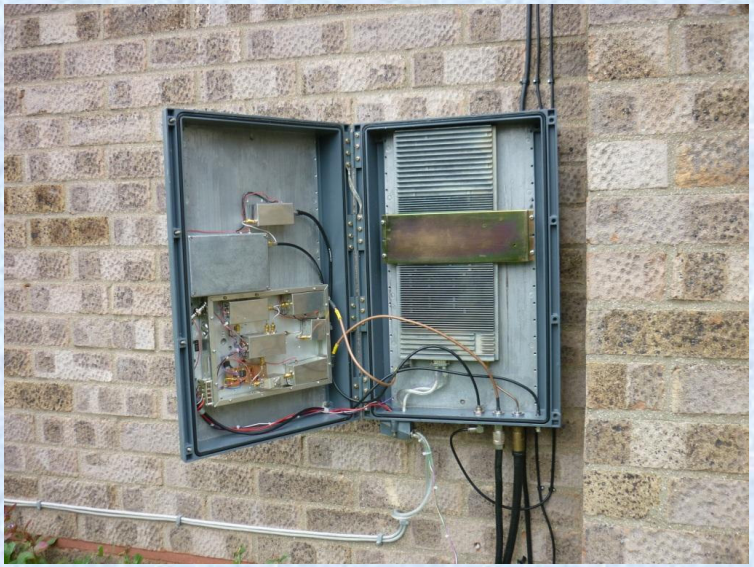
The Hardware

- **Transverter requirements**
  - **Remote from shack**
    - **144MHz IF**
  - **Watertight**
    - **"Storno" base station cabinet**
  - **Close to dish**
    - **Minimise feeder losses**
  - **Locked**
    - **to 10MHz reference in shack**
  - **Low voltage**
    - **28V DC (27Amps!) fed out from house via "Sky feeder" hole**





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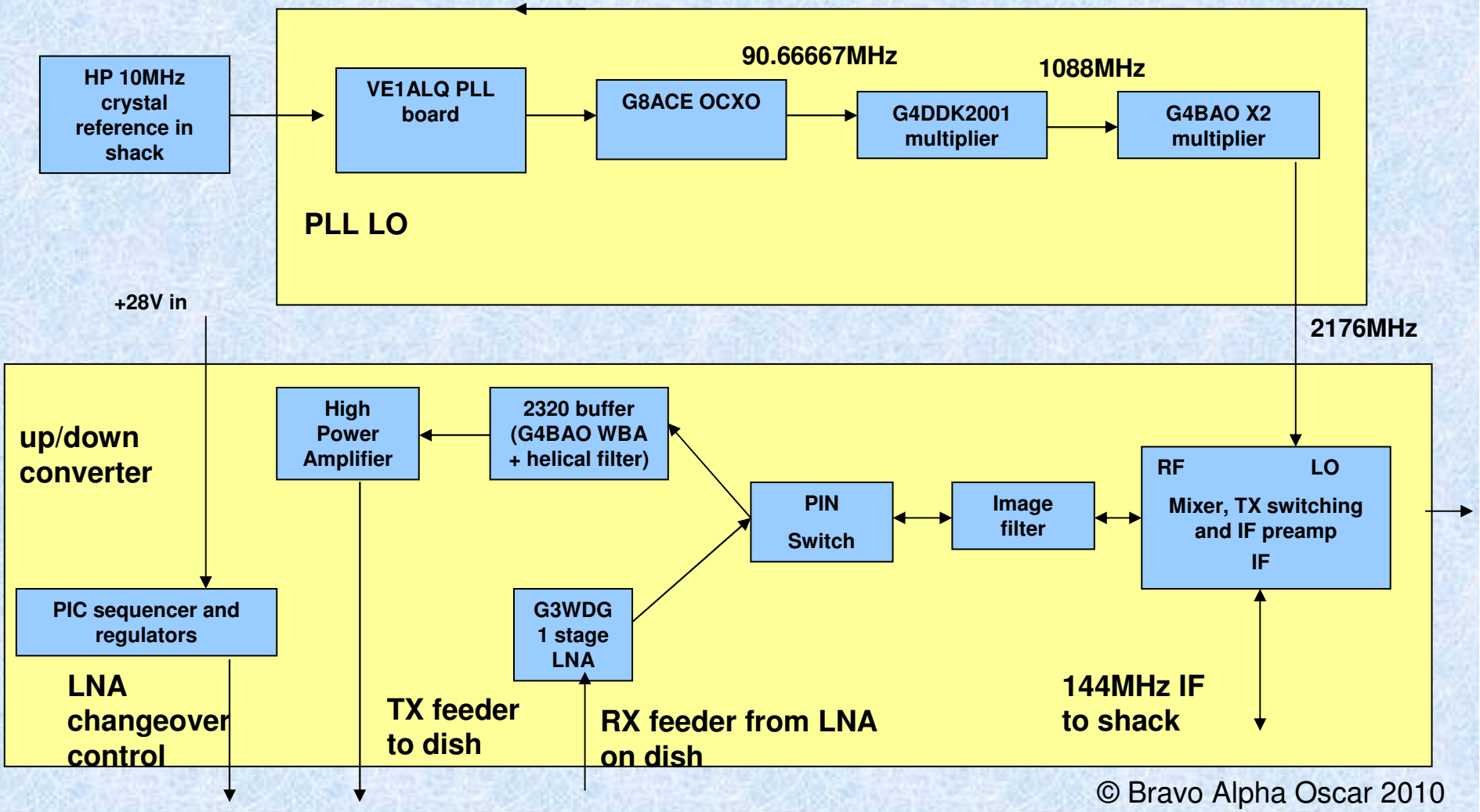
The Transverter



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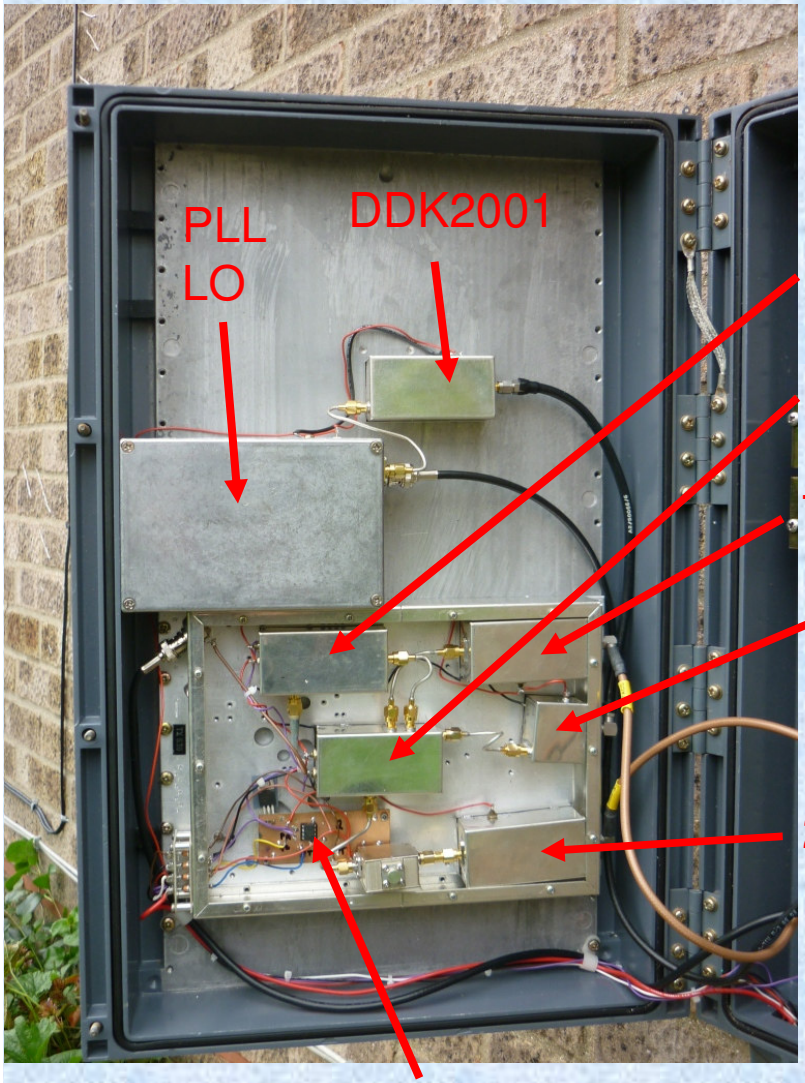
The Transverter





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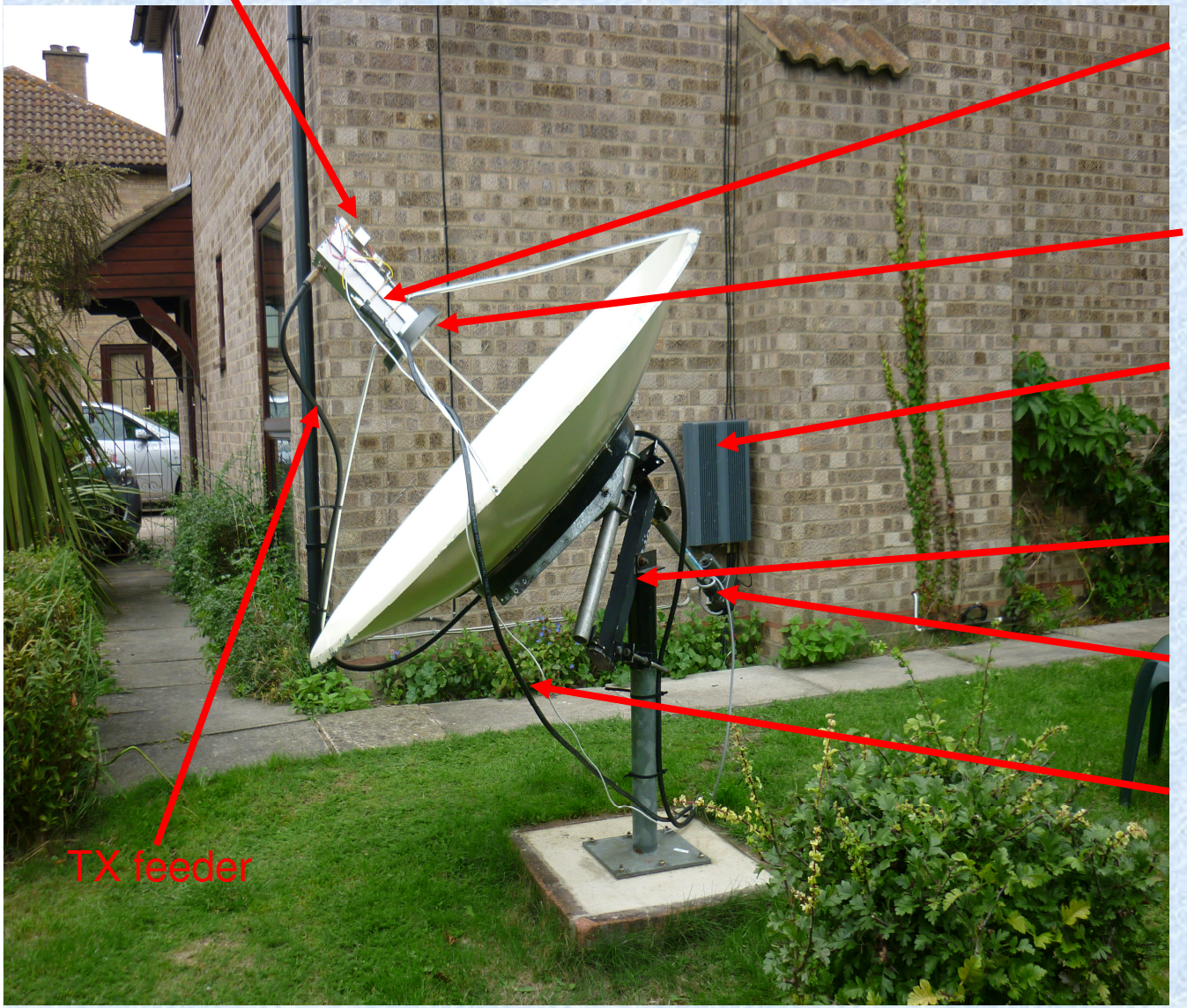
At the dish



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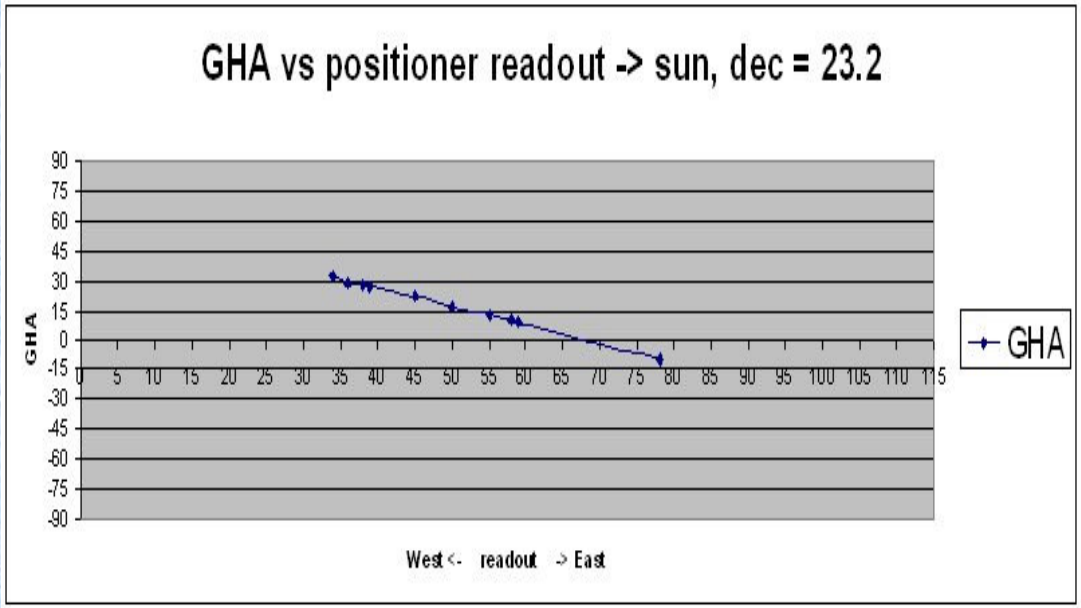
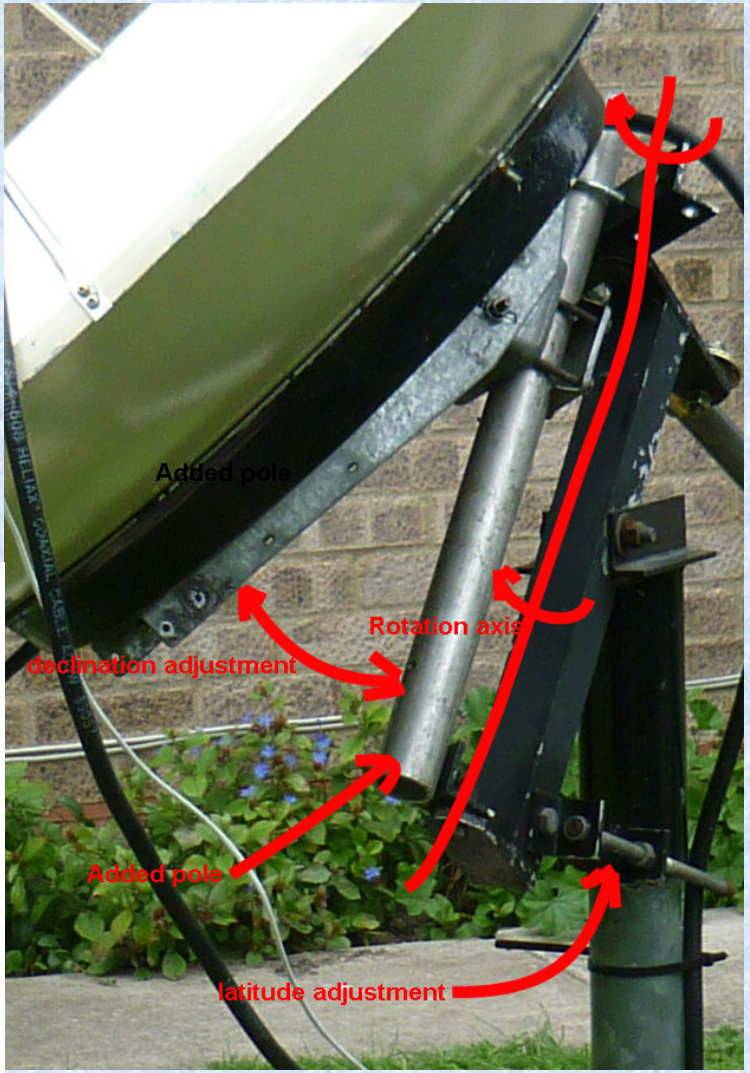
Steering the dish

- Modified TVRO mount
  - TVRO mounts have a fixed declination
- Add declination adjustment
  - Bodged from the latitude adjuster of an old TVRO dish and a short 2 inch pole!
  - Manual setting of declination each moon pass is adequate for such a small dish
- Controlled by Nokia ACU8152
  - Calibrated for GHA by plotting sun noise over a a day





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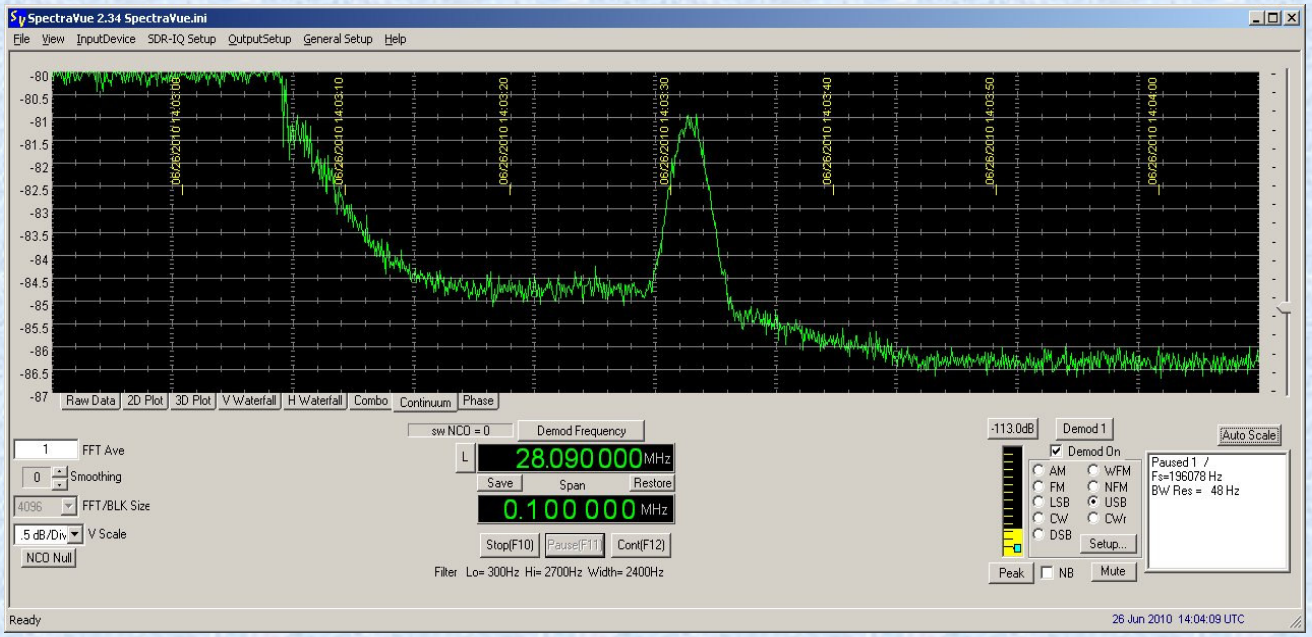
Setting up

- **Tune up the feed for best TX/RX VSWR and TX/RX isolation.**

- **Optimise the dish and feed**
  - **Measure ratio of sun to "cold sky" noise by:**
    - **Finding the position of the feed that gives best sun/cold sky**
    - **Adjusting the choke ring for same**



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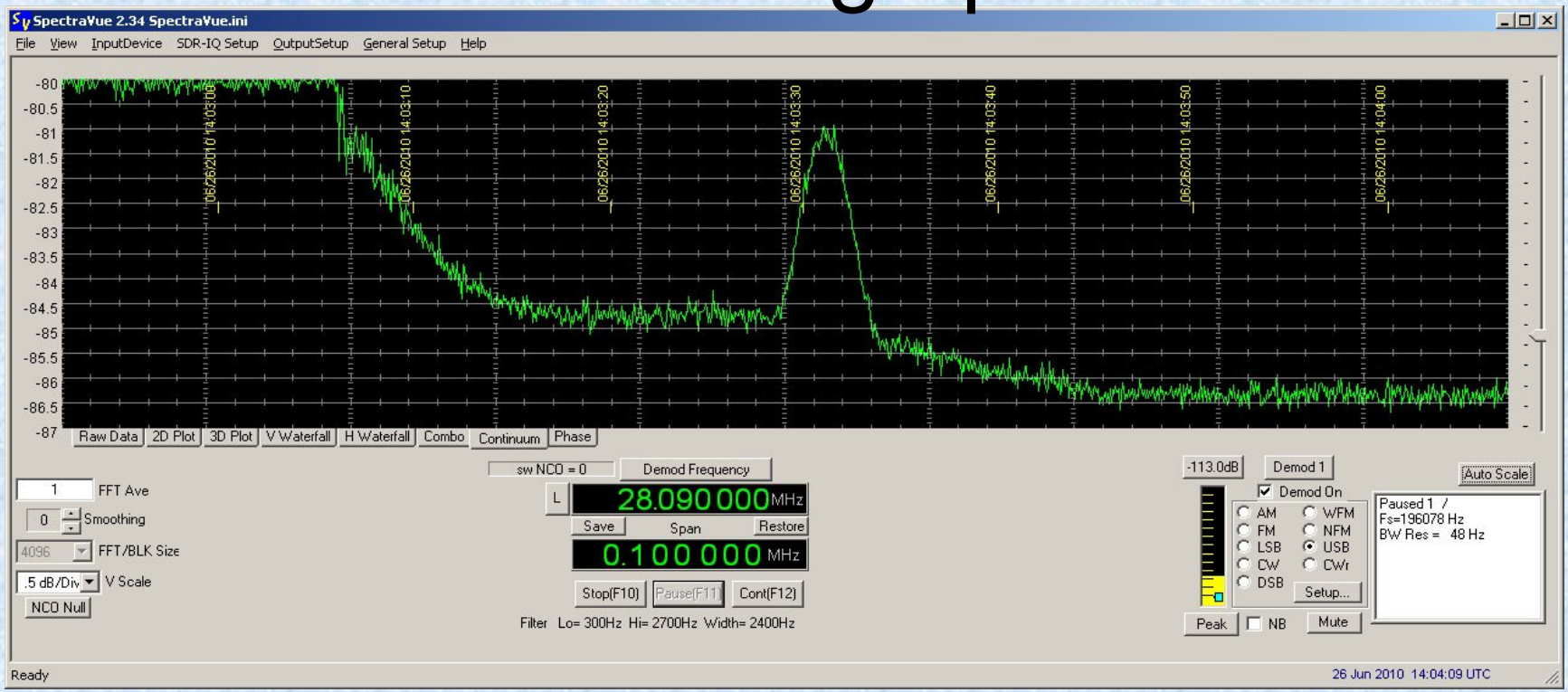
Setting up



- **Note that this is not the same as highest sun noise!**
- **Adjust LNA (in situ) for best sun/cold sky**
- **Check for correct dish illumination on TX (overspill)**
- **Recheck sun/cold sky ratio**
- **This is an "iterative" process**

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Results of first 2 days

ARRL microwave contest 5th and 6th September 2010

Time	Call	Locator	reports sent	received	mode
09:28	F2TU	JN38LG	0	549	CW
09:32	OK1CA	JO7ØGM	0	0	CW
10:27	G4CCH	IO93QL	M	M	CW
10:28	ES5PC	KO38HJ	0	0	CW
09:11	G3LTF	IO91GG	0	0	CW
09:42	OK1DFC	JN79GW	0	0	JT65c

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System Issues and improvement plans

- I got better reports than I sent.
  - QRO and a small dish makes me a bit of an "alligator"
- Finding and keeping on the moon
  - Tracking is currently by "button press"
    - Easy to over compensate/forget/lose track of time&GHA.
    - Need to make a system that automatically "pokes" positioner every minute or so. - "set and forget"
- Further RX improvement
  - Lower dish noise by optimisation of "overspill"
  - Addition of a "rim" to the dish?
  - Improve system NF by improving second stage
- Secondary 128MHz IF RX feed to listen on 2304MHz

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Acknowledgements

- Bernie G4HJW for giving me the dish that kicked the project off
- My XYL Vicki, for not saying anything when aforesaid dish appeared on our lawn one day!
- Sam G4DDK for encouragement, a free 300Watt PA and allowing me to nag him until we got the VLNA performance spot-on!
- Leeds Central High School (now sadly long gone) for introducing a young lad to the wonders of technology and showing me that I could "make things"

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