Using your 2300MHz NoV

- Options and ideas

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Using your 2300MHz NoV

What is this NoV and why is it important we use it?

- The threat to 13cm from commercial interests is real
- "Slowly and Surely, they drew their plans against us" 

- Worst case outcome?
  - Low activity on 2320 + poor uptake of 2300 NoVs
  = no interest in 13cm by UK Amateurs
- Both bands lost!

- We must not be paralysed by uncertainty.

Using your 2300MHz NoV

What is this NoV and why is it important we use it?

- Condx of NoV
  - Full, Reciprocal and Club licensees
  - To operate between 2300 and 2302MHz
  - Full 400Watts RF power
  - No antenna or EIRP restrictions
    - perfect for EME
  - /A, /P or /M allowed
  - Not Jersey, Guernsey or IoM

Using your 2300MHz NoV

What is this NoV and why is it important we use it?

- **Condx of NoV**
  - **No other geographic or time restrictions (unlike 2320 band)**
  - **Valid until November 2017**
  - **Full 2MHz all modes allows experimentation with RBDATV with careful band planning**

Using your 2300MHz NoV

Current RSGB band plan

2300-2302 MHz	Necessary Bandwidth	UK Usage
2300.000-2300.400	2.7 kHz	**Narrowband Modes (including CW SSB, MGM)** 2300.350-2300.400 Attended Beacons
2300.400-2301.800	500 kHz	**Wideband Modes (NBFM, DV, Data , DATV etc) - Note-1** Note-2 for centre frequency recommendations
2301.800-2302.000	2.7kHz	**Narrowband Modes (including CW SSB, MGM)** EME Usage

Note-1: Users of wideband modes must ensure their spectral emissions are contained with the band limits
Note-2: Recommended centre frequencies: DV/NBFM Voice etc 2300.500 MHz, Wideband Data/DATV - 2301.100 MHz

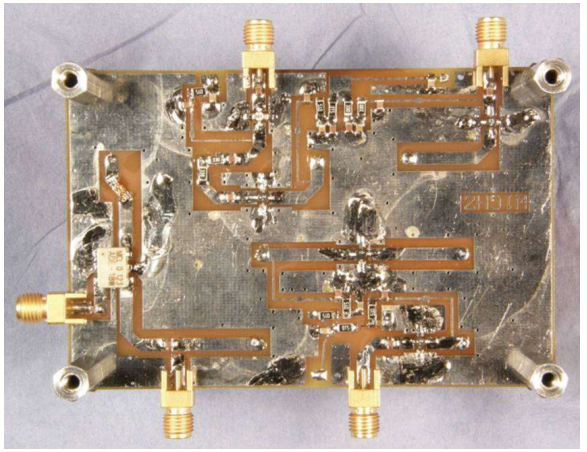
LICENCE NOTES: Full Licensees only, with NoV, 400W max - not available in the Isle of Man or Channel Isles
Note that additional restrictions on usage are specified by the NoV terms

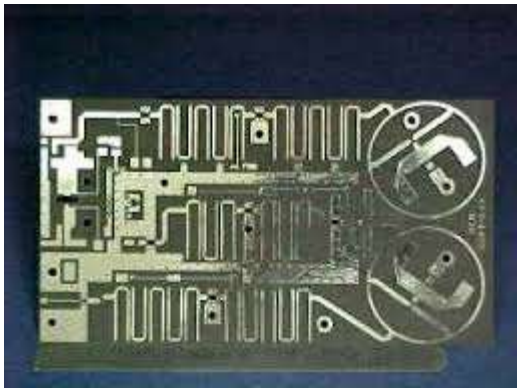
It should be emphasised that this is UK-specific and is available on a non-interference basis to existing services.

Using your 2300MHz NoV

What equipment options are available?

- Separate Homebrew 2300-144MHz transverter
- Modify existing 2320 unit for dual band
- DB6NT new multiband transverter
- Down East Microwave kits ?
  - KK7B 2304 design
- SG – Lab 2300 transverter
  - 432 MHz IF with all band coverage





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Existing 2320/2304 equipment

- **DB6NT G2 version**
  - 144 IF version uses 2176MHz LO and 90.667MHz crystal
  - To operate on 2300 it requires

  (2300-144) / 24 = 89.83333MHz crystal
  - Switchable external LOs? – not tried
- **DB6NT G3 version**
  - PLL locked transverter so simply switching in a different crystal to put the LO at 2156 instead of 2176 is not an option as it would require a firmware change
  - Drive at 124MHz instead of 144MHz giving an output 20MHz lower?
  - More about this later

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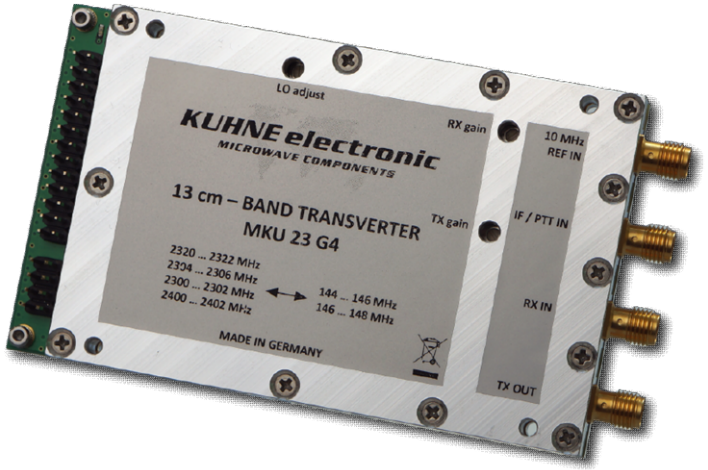
Existing 2320 / 2304 equipment

- **DB6NT Multiband 13cm**
  - **“Chequebook solution”**
  - **2300-2302**
  - **2304-2306**
  - **2320-2322**
  - **2400-2402**



Using your 2300MHz NoV

Existing 2320/2304 equipment

- **DEMI / KK7B board?**
  - Solid, simple no – tune design
  - Easy – originally designed for 2304
  - Options:
    - Use IF drive at 140-142MHz
    - Change LO freq to 1078MHz
    - Switchable crystals?
    - Switchable Apollo synthesiser?

Photo W6PQL

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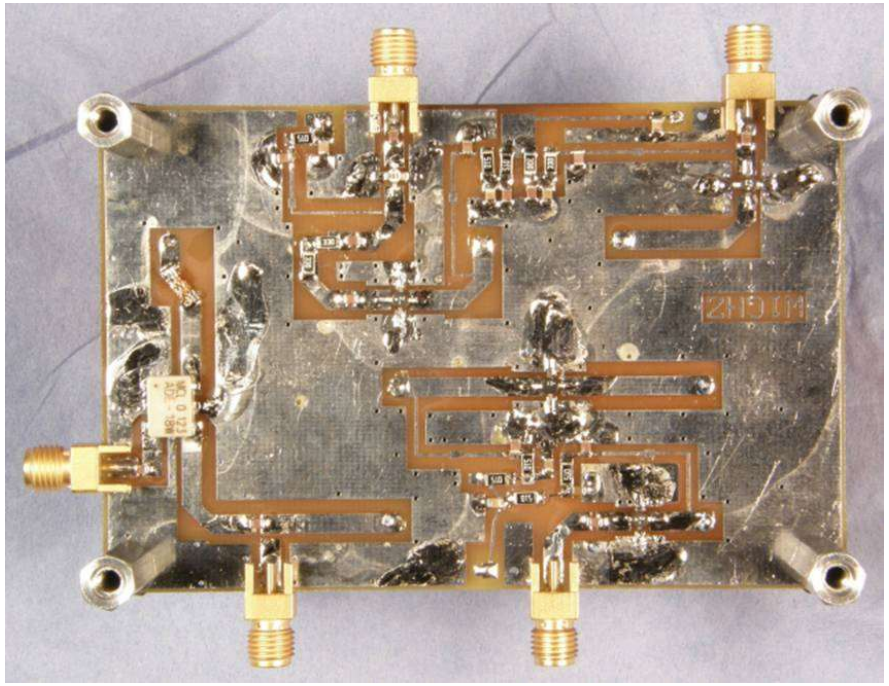
Existing 2320 / 2304 equipment

- **W1GHZ designs**
  - **Simple, solid, reliable and flexible**
  - **Designed for 2304MHz**



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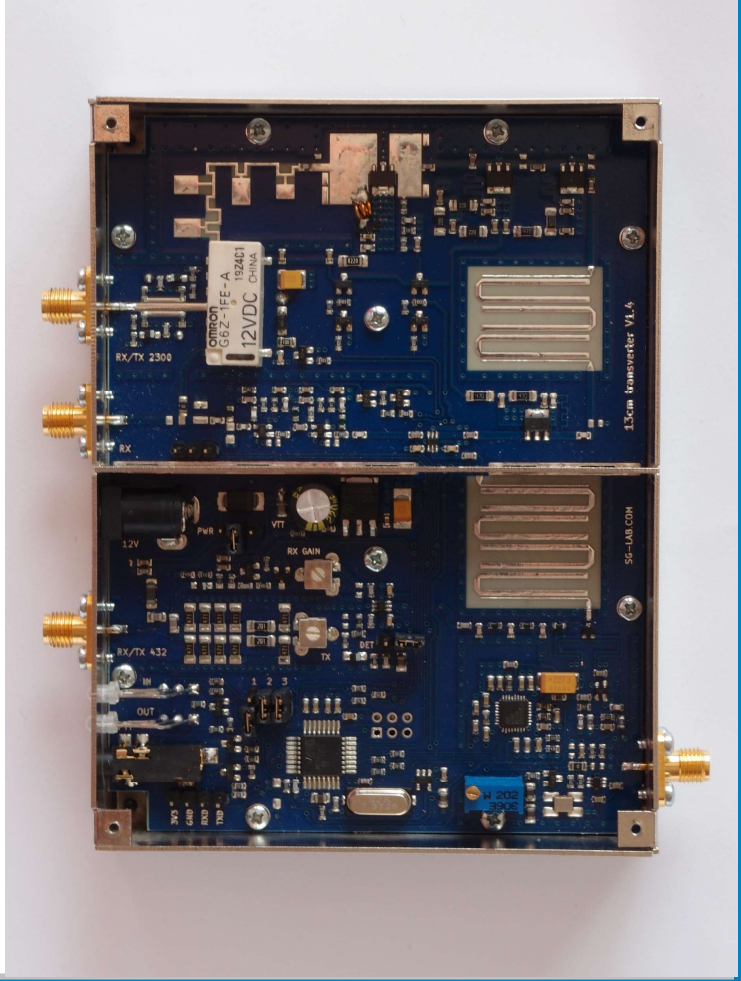
Existing 2320 / 2304 equipment

- SG-Lab SG2300
  - 2300- 2345MHz band switched
  - 430-440MHz IF
  - 2 watts output, 1.2dB noise figure
  - Can be locked to 10MHz ref.
  - Budget solution. Approx. €200
    - Great low cost entry to 13cm
  - Small enough for masthead/dish feed mounting
  - www.sg-lab.com
  - email info@sg-lab.com for details.



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2300 MHz transverter from the ground up?

- Not necessary if you already have a homebrew 2320 transverter
- Options
  - I modified my homebrew transverter by adding a synthesised LO
  - Switchable between 2176 for 2320 and 2156 for 2300,
    - Down East Microwave Apollo allows this
    - G4JNT LMX2541 (or similar) board is an option
    - Even two separate crystal LO chains
- Many 13cm transverter designs are wide enough to cover both bands
  - Many were designed for 2304 anyway

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Using 2320MHz equipment

- **Using the DB6NT G3 at 124MHz IF**
- **RX side**
  - **I'd already confirmed that the RX side works at 2304, (the US EME band) with a separate receive converter at 128MHz**
  - **I wrote about it in RadCom "GHz bands" last year**
  - **RX filters are wideband enough to extend down to 2300**

Using your 2300MHz NoV

Using 2320MHz equipment

- **Using the DB6NT G3 at 124MHz IF**
- **TX side?**
  - **I measured the 13cm output from the transverter using equal drive at 144MHz, then 124MHz.**
  - **Output at 2300MHz dropped by just 4dB**
  - **Many ex cellular 2320MHz PAs should have more gain at 2300 so that is not going to be an issue.**
  - **Increasing the 124MHz drive by the same 4dB and the 2300MHz output level came back to the 2320MHz level.**
  - **Transverter's LO leakage and TX image are unchanged**
  - **No significant difference in harmonic levels between 2300 and 2320MHz output.**

Using your 2300MHz NoV

Generating 124 - 126MHz drive

- I've found no 144MHz rigs that can be made to TX on 124MHz
  - Please tell me if I'm wrong!
- Options ?
  - Build a 124MHz version of the excellent G4DDK Anglian 144MHz transverter kit
- I use my Elecraft K3 with IF switching for 2300 and 2320MHz TX and RX
  - Switching includes cross band combinations to receive on 2304 by tuning the K3 to 32MHz.
- I've verified that the K3 will receive at 32MHz via it's transverter ports with little drop off in performance.

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Generating 124 - 126MHz drive

- Using QUCs I redesigned the filters in G4DDK's Anglian 28 - 144MHz transverter
- Tweaked to centre them on 126MHz
  - To best cover the proposed EME section above 2301.900.
- Results are just perfect
  - Just a few minor component changes it now performs centred on 126MHz
- Produces up to +22dBm TX output
- 20 dB of RX gain at 2.4dB noise figure
  - without any changes to the RX front end noise matching.
- More than adequate as an IF system.

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Generating 124 - 126MHz drive

- **Changes to Anglian transverter for 124-126MHz**
  - **Change the crystal oscillator from 116 to 96MHz**
    - **Easy, as there's already a 96MHz version of the G4DDK Butler Oscillator in Sam's G4DDK2001 multiplier design to copy.**
    - **Just need to change the second stage values so that it buffers at 96MHz instead of multiplying.**
- **Main and TX 145Mhz Band pass filters**
  - **Change shunt Cs from 4.7 to 6.8pf to drop centre frequency to 126MHz.**
- **LO diplexer**
  - **Add 5dB pad to soak up excess drive and change C16 to 47pF**
- **IF diplexer**
  - **No change**
- **TX LPF**
  - **Change L19 to 56pF**

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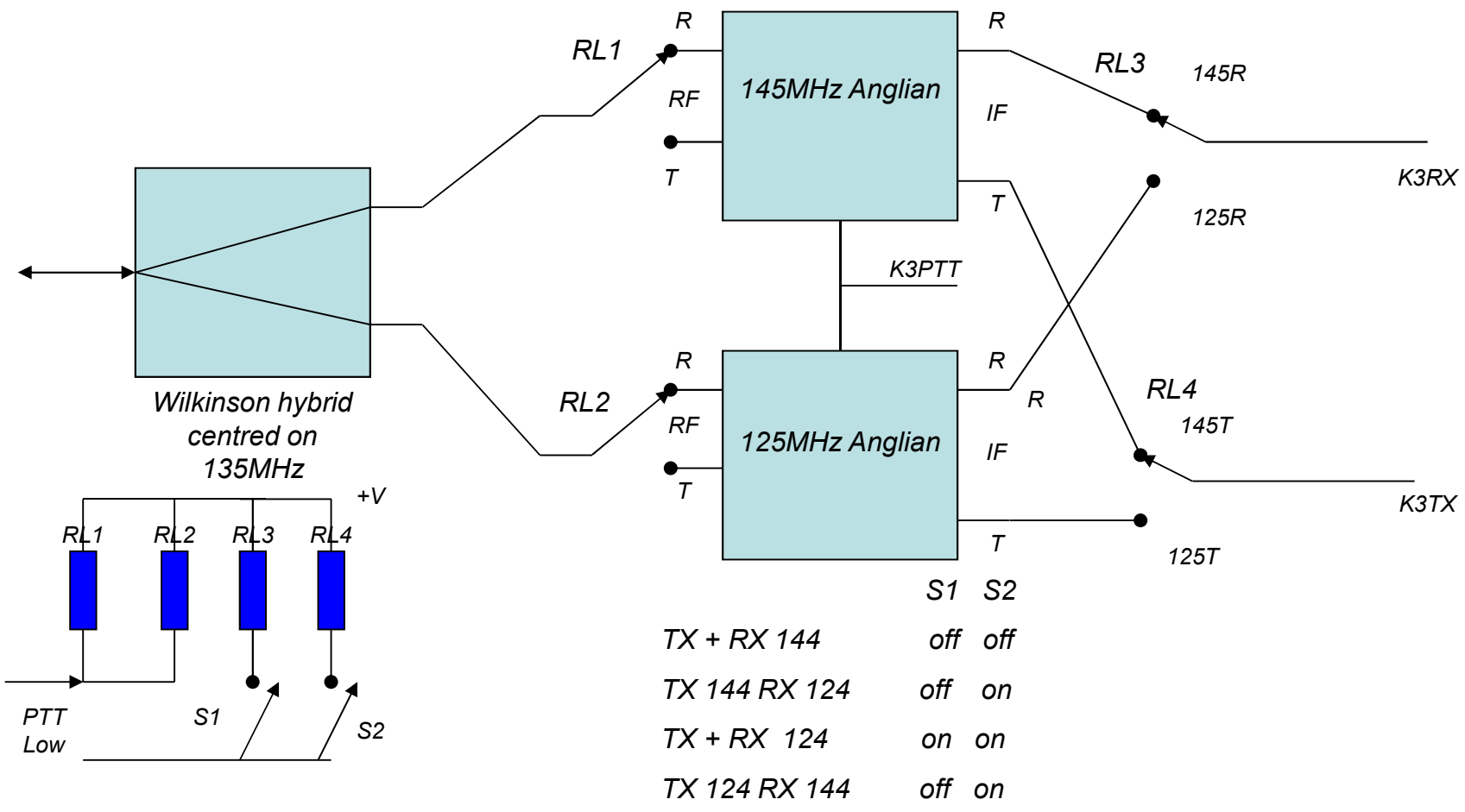
Band Switching



	S1	S2
TX + RX 144	off	off
TX 144 RX 124	off	on
TX + RX 124	on	on
TX 124 RX 144	off	on

Using your 2300MHz NoV

Take care with the 124 - 126MHz drive!

- A word
- to a age
- Why

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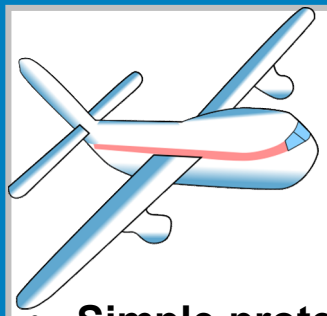
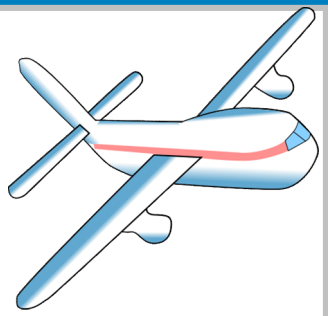


Take care with 124 - 126MHz drive!



- Simple protection calculations for G4BAO JO02cg
  - Closest airfields are Cambridge, Stansted and Coltishall
- Assumptions
  - +16dBm 125MHz drive power
  - 60 dB leakage from IF feed
  - Ground to air EIRP = 10W omni
  - Aircraft antenna omni
- Approx leakage LOS signal strength 100m above my house = -106dBm
- Approx LOS signal from these airfields at 100m above my house = -46, -62 and -64dBm
- Approx protection for aircraft receiver = 60dB, 44dB and 42dB resp.

- And I hope aircraft won't be flying 100m above my house!

Using your 2300MHz NoV

Why Bother?

.The threat to our 13cm band from commercial interests is real.

- It really is “Use it or loose it”
- If you don’t care about the band, don’t waste time and effort and let’s give it back to Ofcom.
- Because. let’s face it…….
- The public need more bandwidth for “skateboarding cat videos”

Acknowledgements and References

- **Sam, G4DDK for advice on modifying the Anglian**
- **DB6NT's tech staff for telling me not to bother trying to modify the G3 synth.**
- **Those nice people at Ofcom for letting us have such a generous 2300 NoV**
- **Murray G6JYB and his RSGB team for tireless and apparently unsung efforts to hang on to our GHz bands**

This presentation will be available on www.g4bao.com in due course