Getting the most from your G4DDK VLNA

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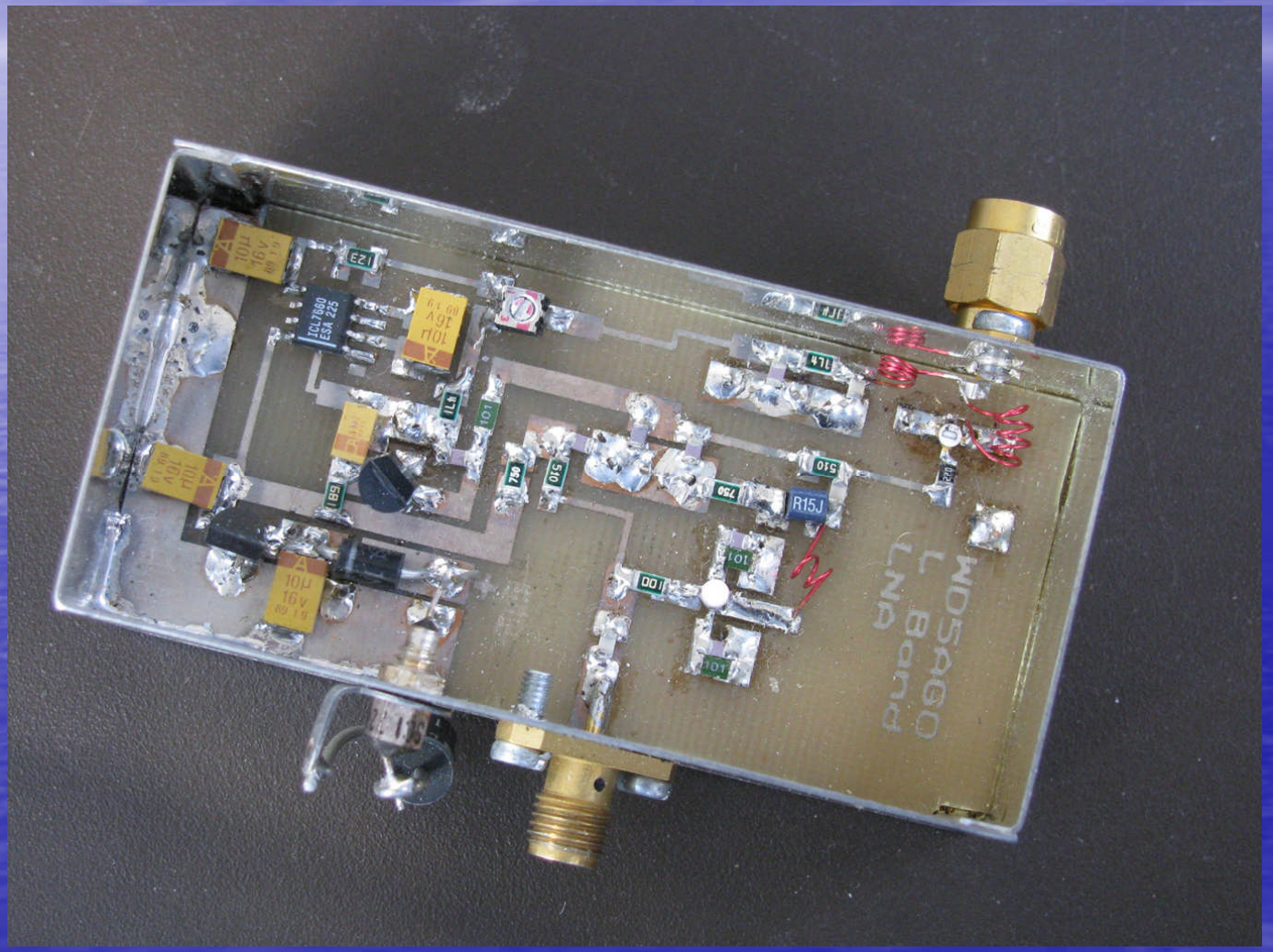
Origins

- WD5AGO 23cm LNA from Microwave Update 1999
  - NE32584C > ATF10136
    - Typically 0.33dB noise figure and 28dB gain
  - Self supporting input inductors and capacitor to reduce loss
  - Stable design with typical input return loss of around 7dB

WD5AGO 23cm pre-amp



Development of the VLNA

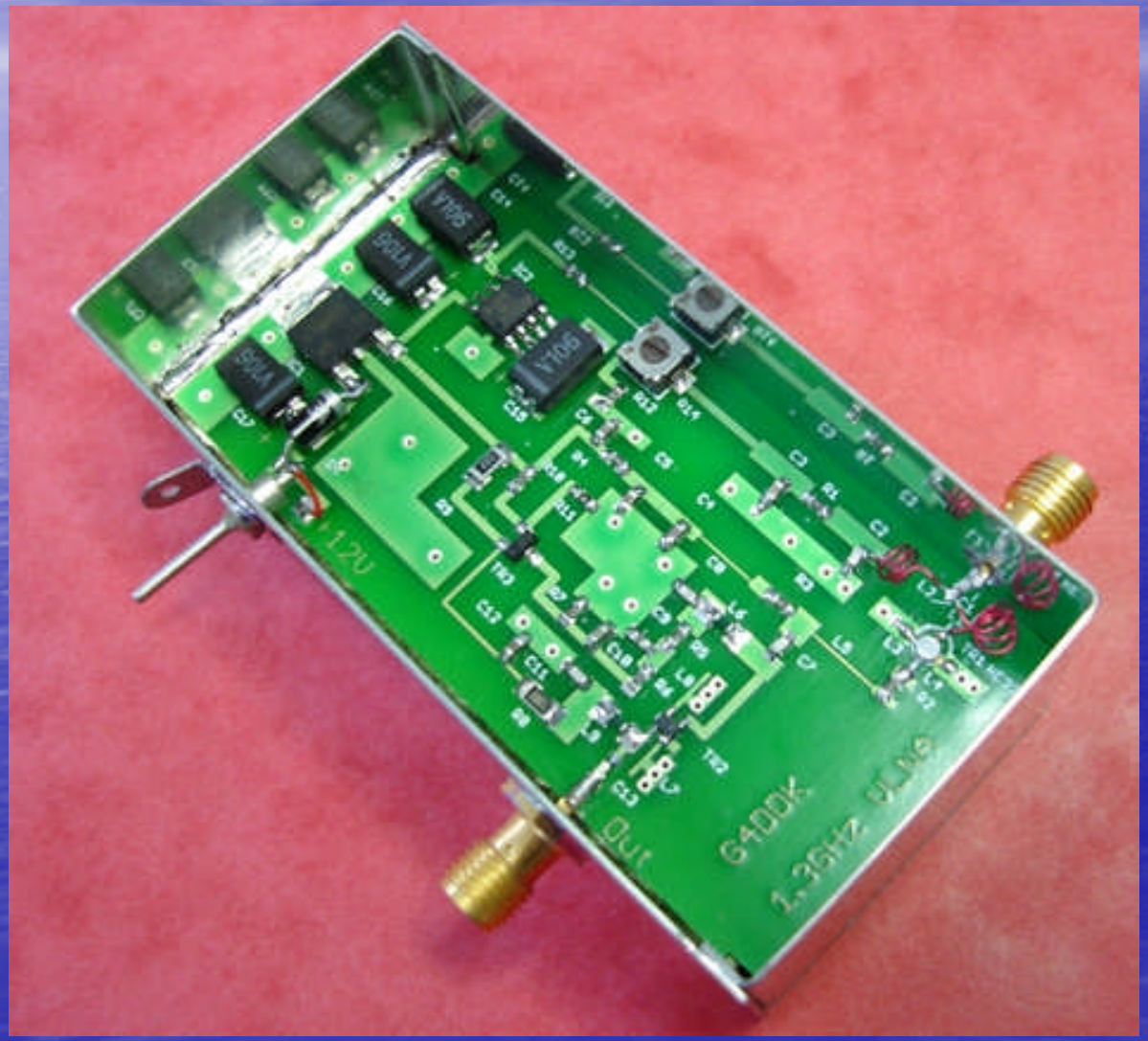
Difficulty obtaining the ATF10135/6 GaAs MESFET 2nd stage device

and

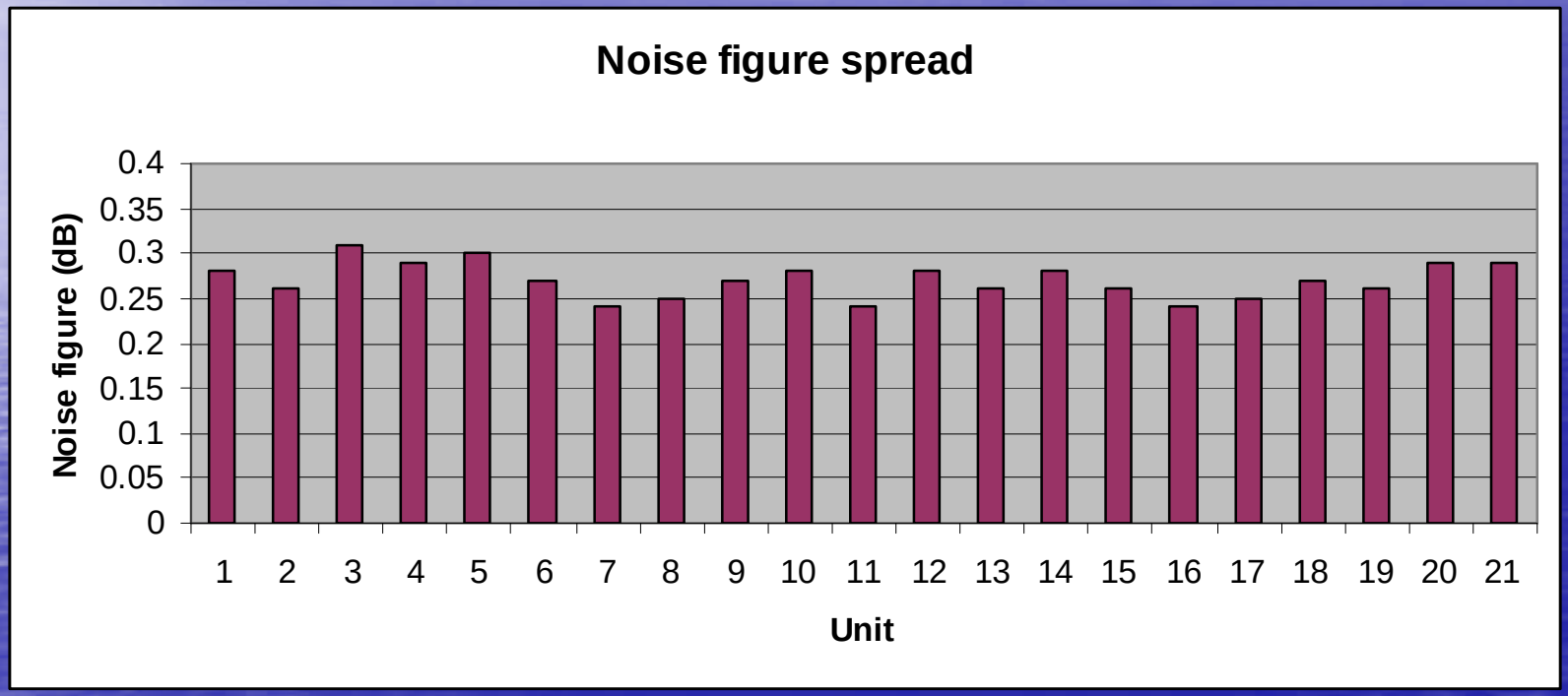
Requirement for a lower noise figure & more gain

Fuelled by the needs for better performance from my small (2.3m) EME dish

23cm VLNA

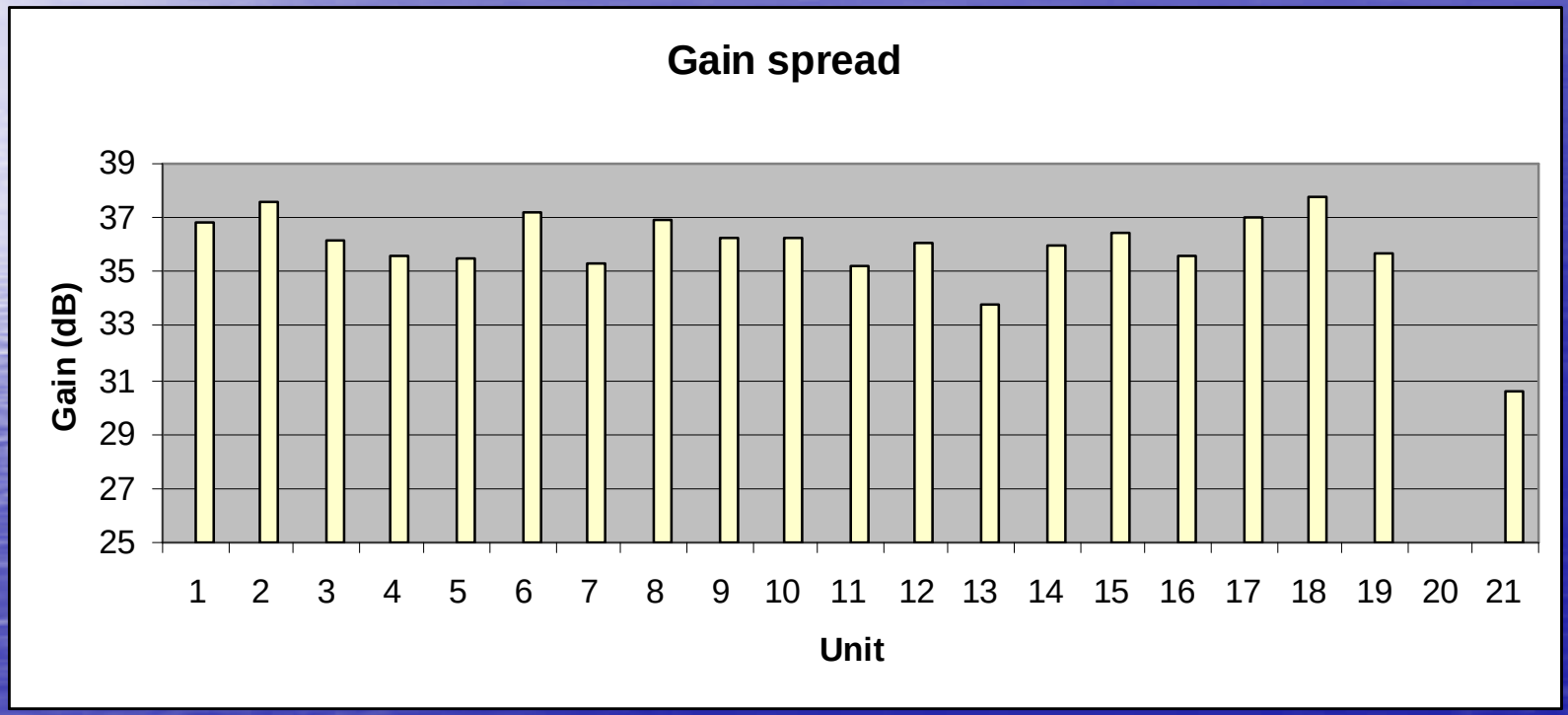


Noise figure results for 23cm VLNA 1



Built by G4DDK
Measured on the same test gear over a three year period

Gain results for 23cm VLNA 1



The same batch of preamplifiers shown in the previous slide
Unit 20 was a single stage pre-amplifier with ~17dB gain
21 uses a different second stage.

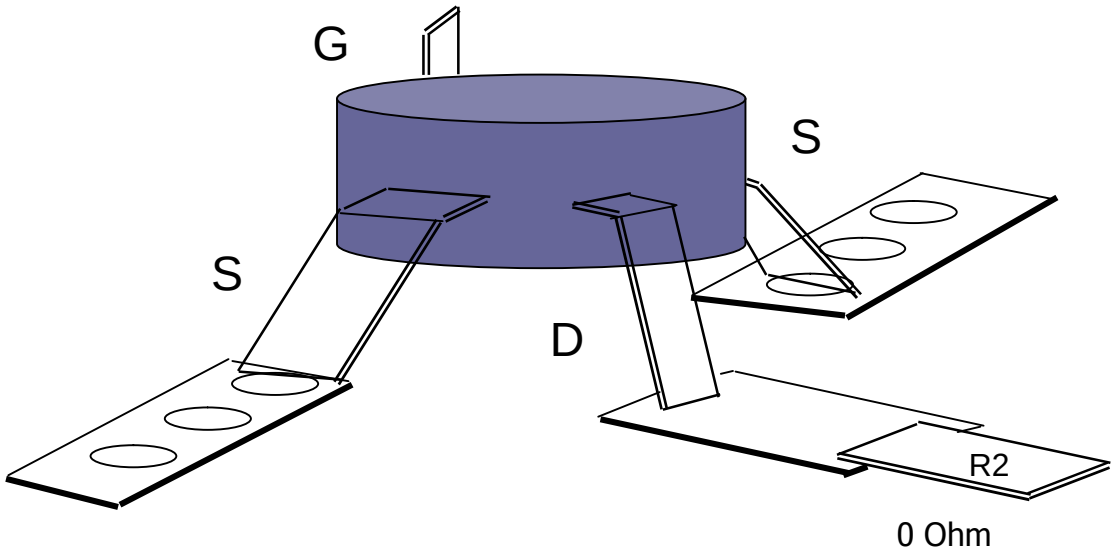
23cm VLNA 2

- Work by Sergie, RW3BP
  - 0.14dB noise figure based on Skobelev feed cold sky source
  - Unconditional stability
  - Good input return loss

Initial attempts to improve performance

- Use MGF4919
- Remove drain resistor
- Increase source lead inductance

More source inductance



MGF4919G ‘raised up’

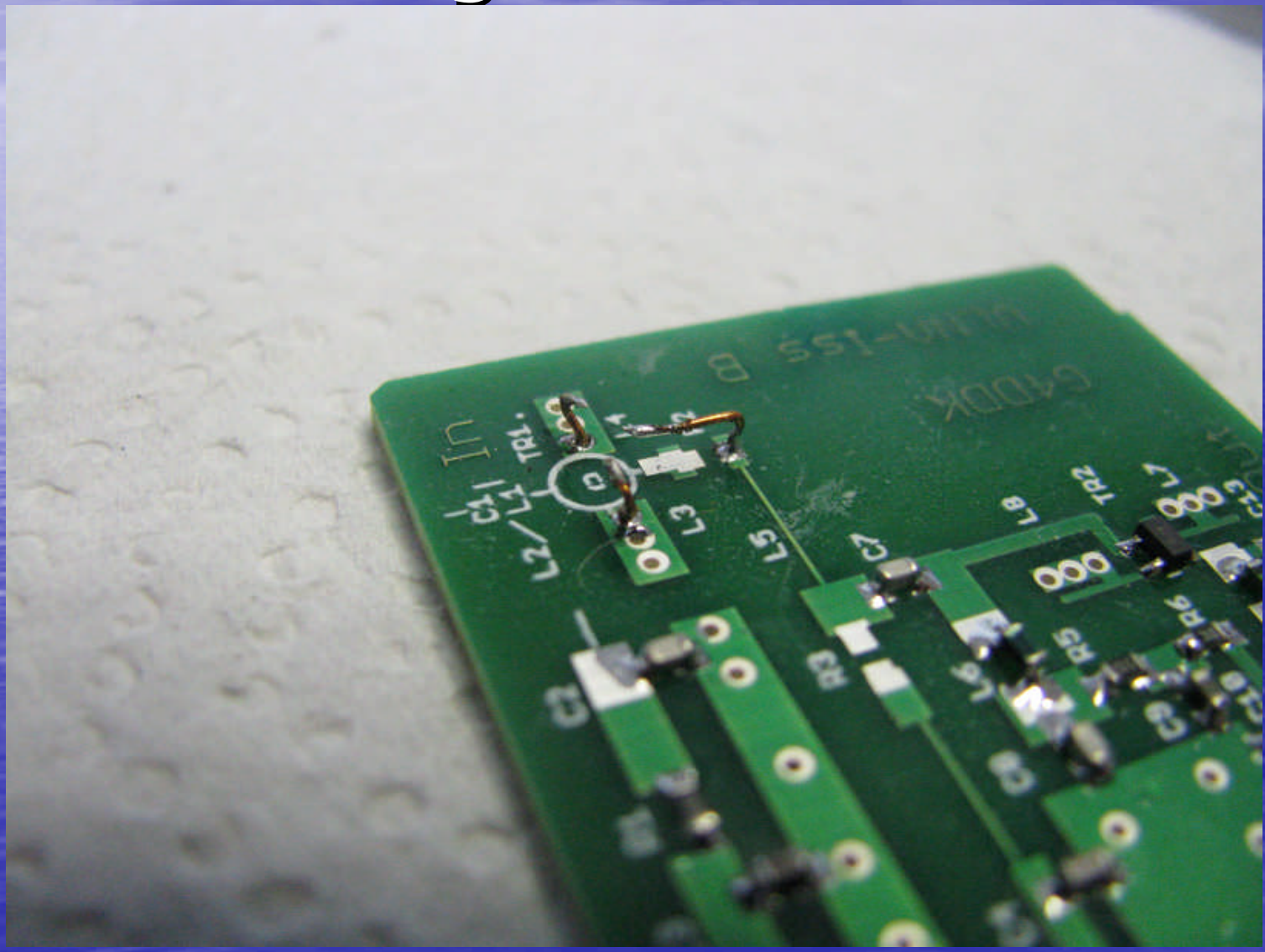
How's that?

Unfortunately, not unconditionally stable

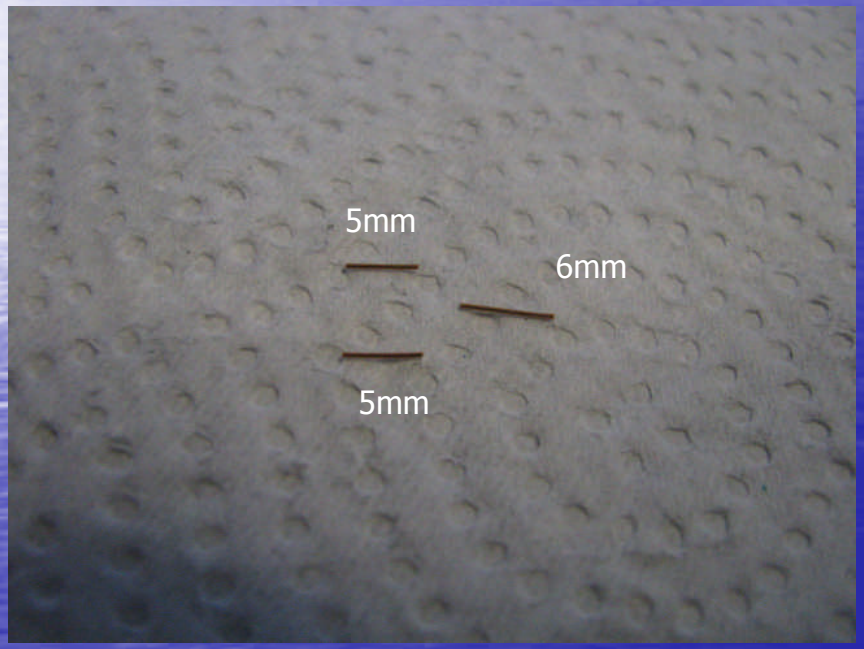
Open circuit input = strong oscillation around 1100MHz

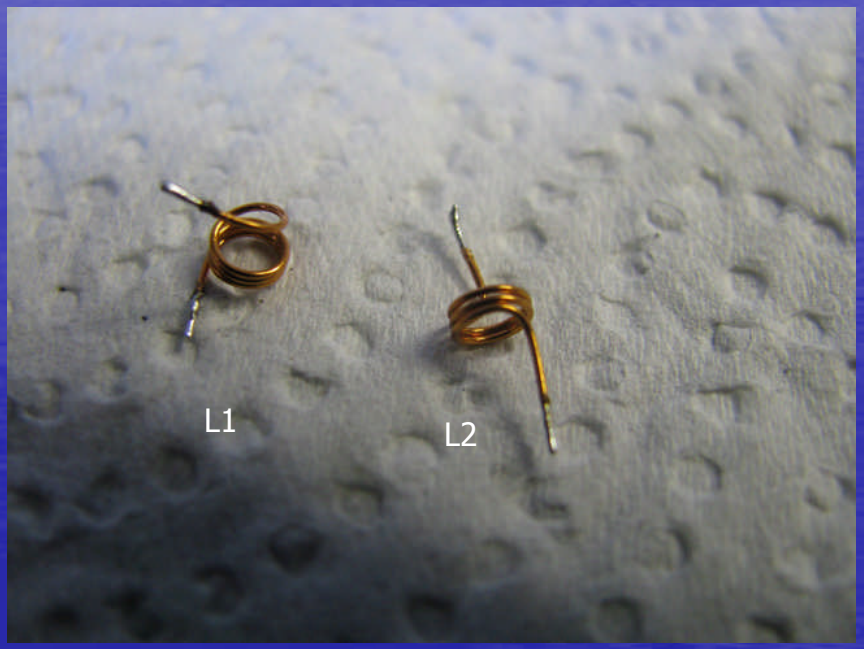
RW3BP suggested more source inductance

Just about right!

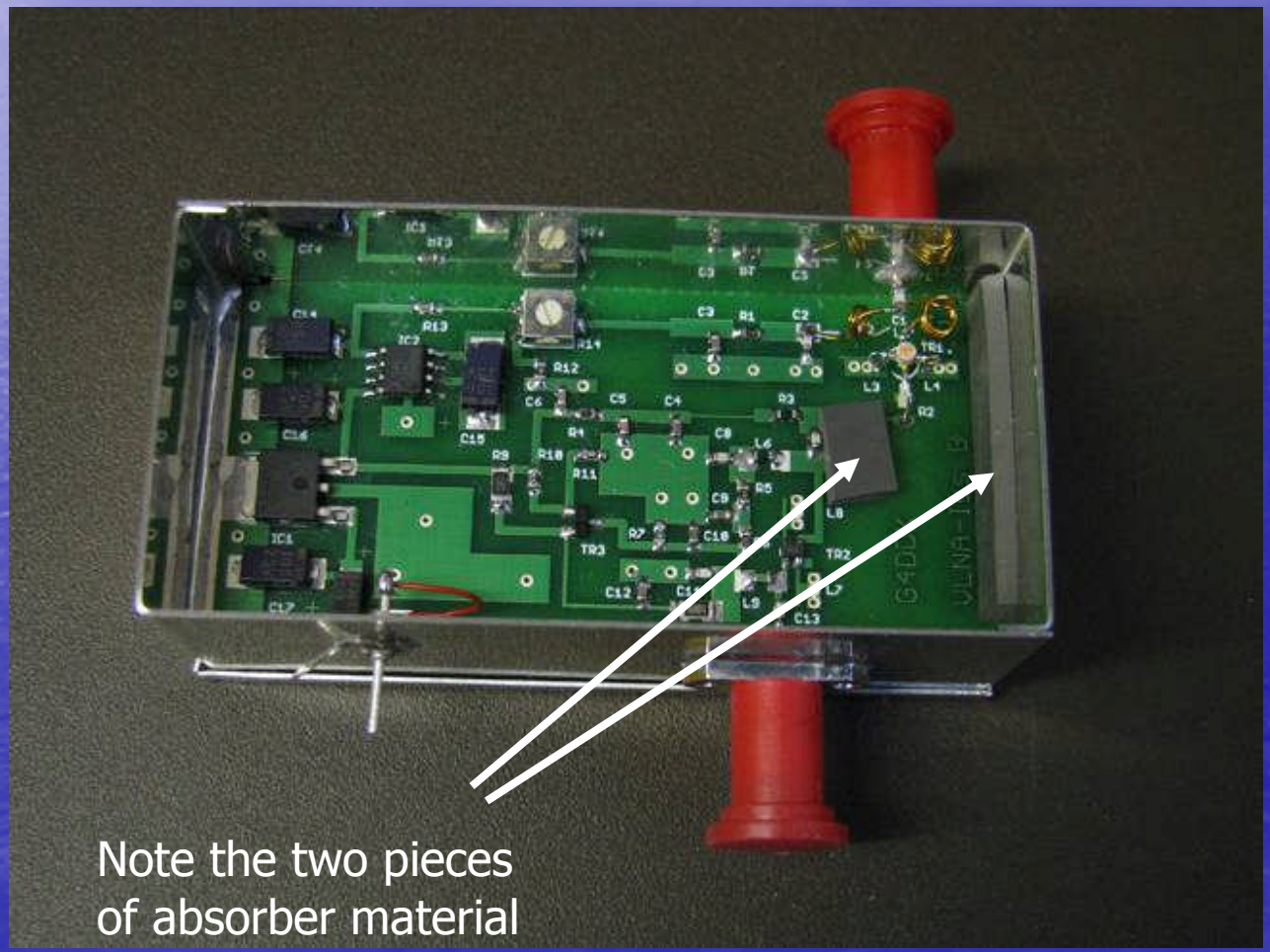


Source, drain and L1/L2 for 23cm VLNA 2





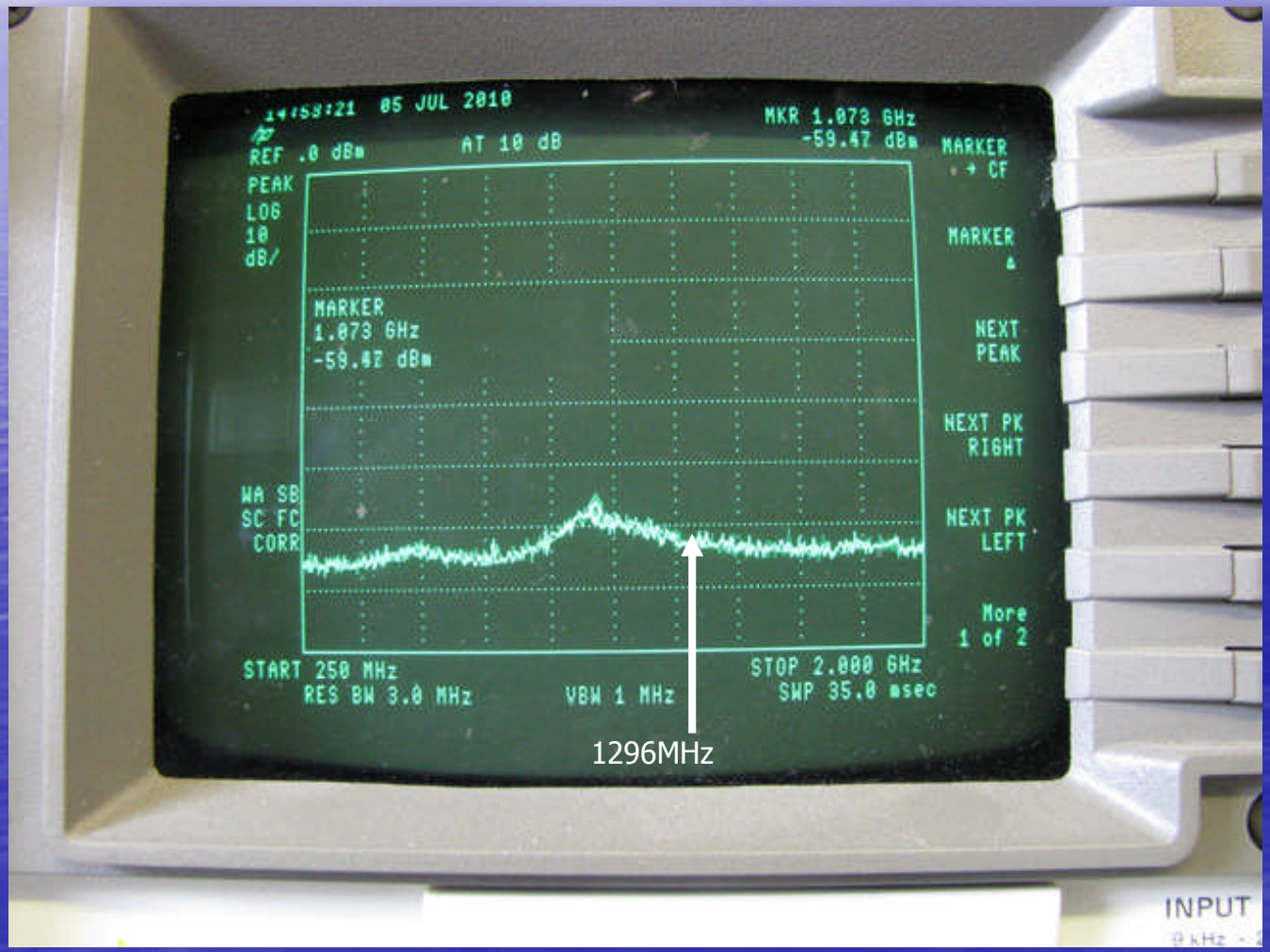
Curing any unwanted oscillation



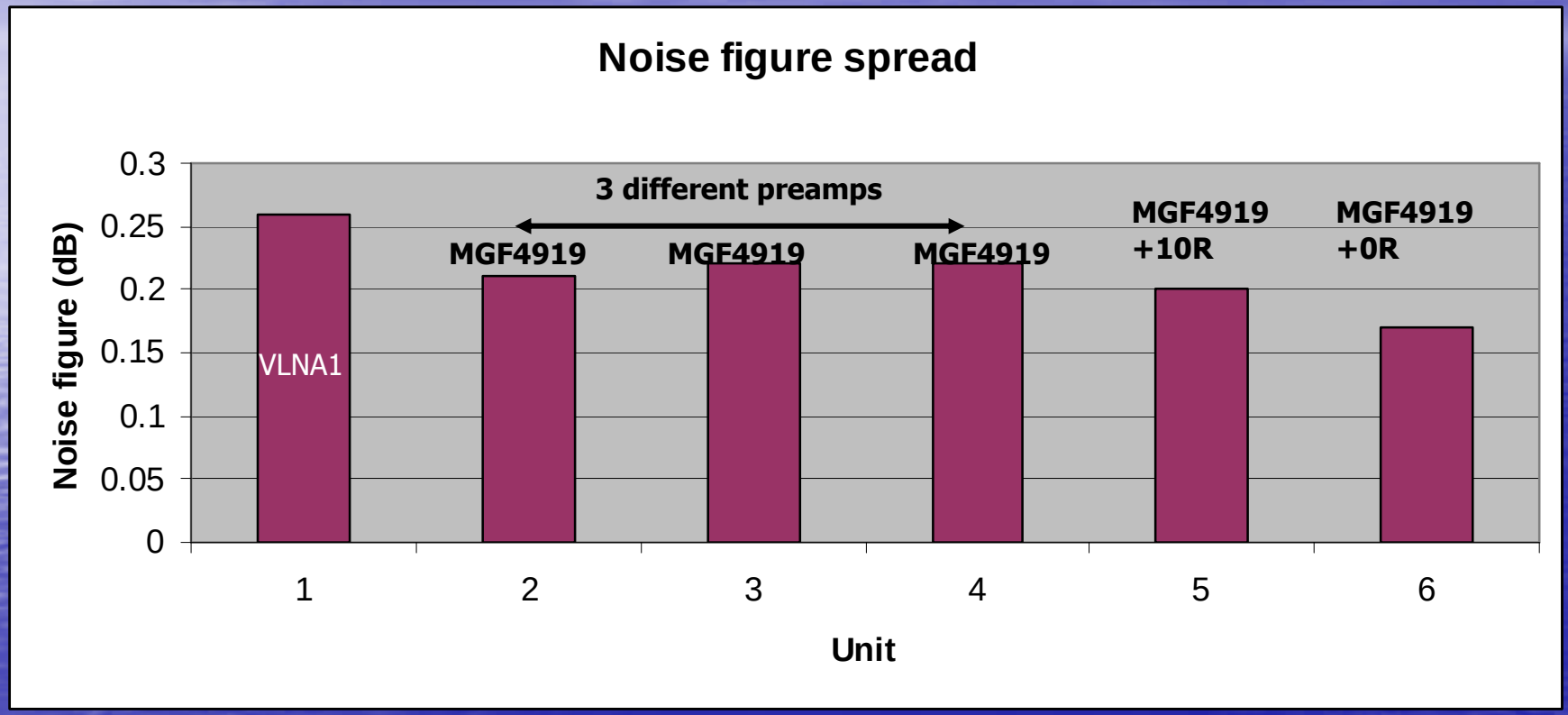
Tune up

- Set bias as described in the VLNA document
- Connect 50 ohm SMA termination to input
- Connect output to a spectrum analyser set to cover 100MHz to 2GHz
- Reference to 0dBm
- Power up the preamp

Tuning without a noise figure meter



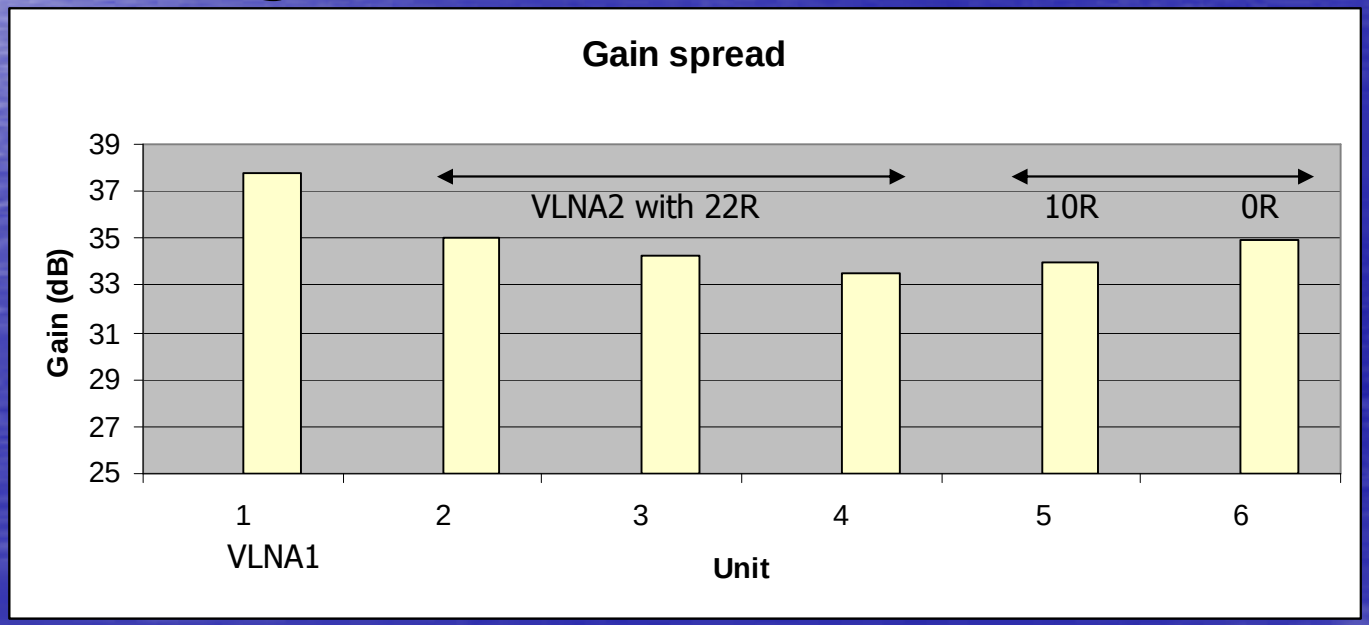
Improvement in performance – Noise figure



1 is the reference 'golden' unit with NE32584C
2, 3 and 4 modified with MGF4919 and 22R drain resistor
5 as 4 but drain resistor = 10R
6 as 4 but drain resistor = 0R

But what about gain?

- Applying negative feedback reduces gain
- Reducing the value of the drain resistor increases gain



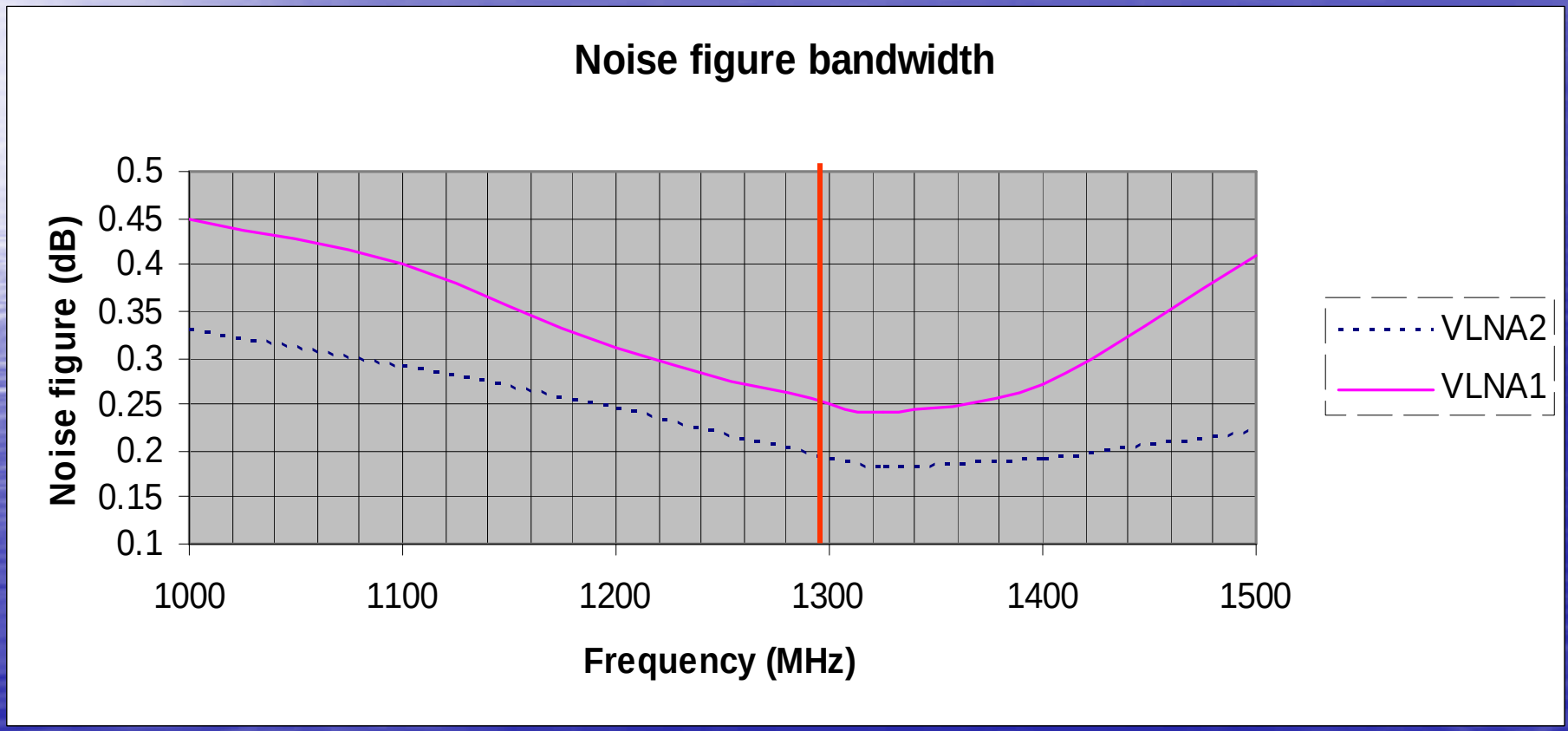
And

- Replacing R3 (51R) with a 3n3H choke also helps increase the gain

And the results

At least for 23cm?

Noise figure bandwidth



23cm VLNA2 After modifications

13cm VLNA2

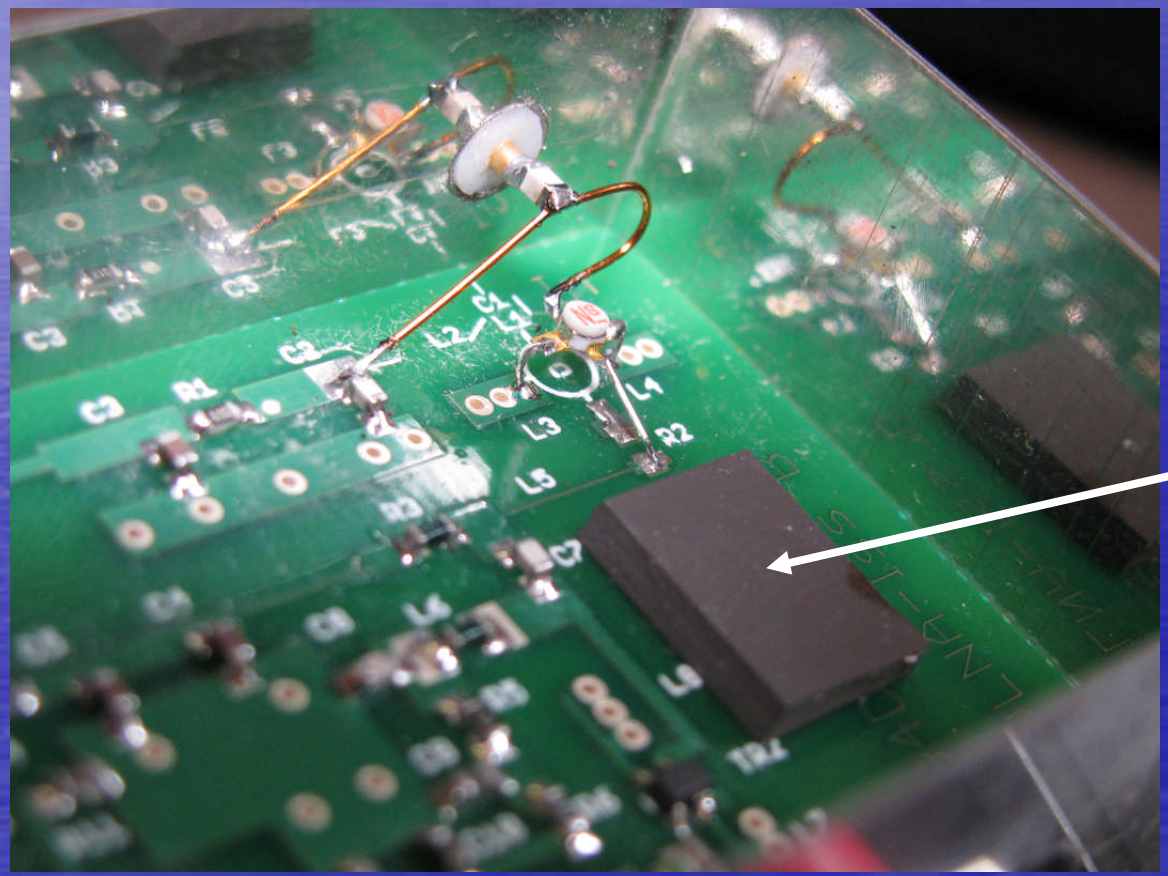
- Improved noise figure
  - Down from average 0.35 to 0.25dB (or better)
- Gain is unchanged
  - Approximately 26 to 27dB

13cm VLNA2

- MGF4919 front end
  - Same length source leads as the 23cm VLNA2
- C1, L1 and L2 as 13cm VLNA1
- T2 absorber strip not required, although T3 is required
- L9 changed to 5.6nH

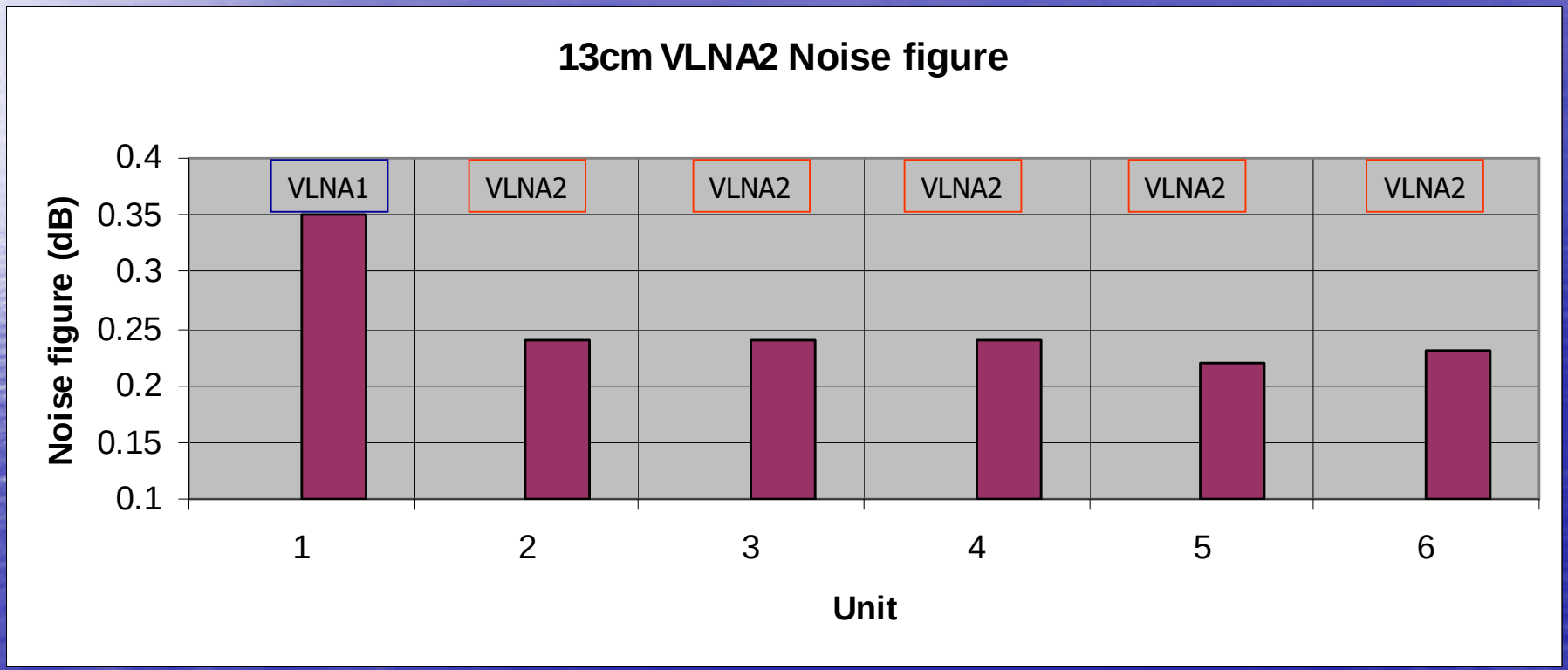
13cm VLNA2

Position of L1 and L2 for lowest noise figure

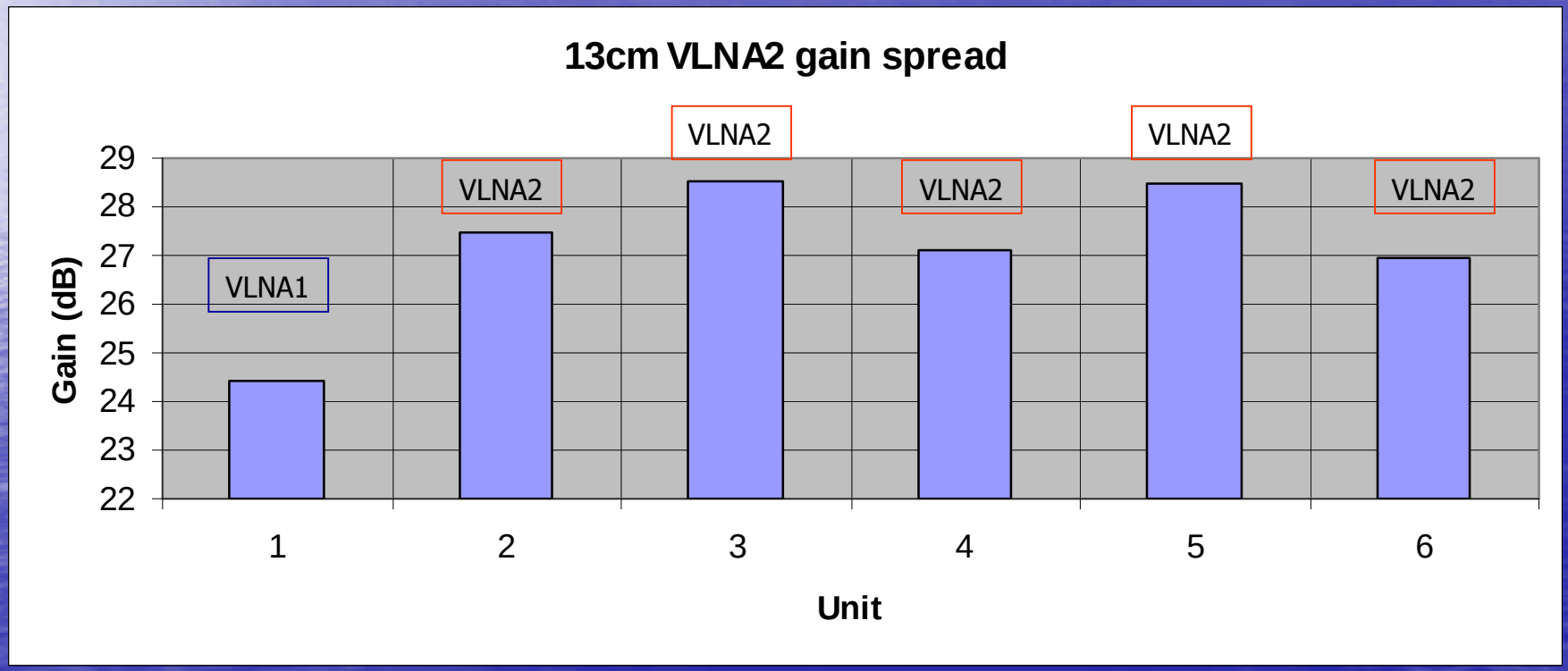


Absorber tile
Too large!

13cm VLNA2 Performance spread



13cm VLNA2 Gain spread



13cm VLNA2


2320
EXT MIX
MHz
INSERTION GAIN
26.88
dB
NOISE FIGURE
0.24
FdB
FIXED FREQ
(MHz)
FREQUENCY
FREQ INCR
DATA
7
8
9
ENTER
4
5
6
STORE
1
2
3
RECALL
0
.
–
SEQ
SPECIAL
FUNCTION
MEASUREMENT
CALIBRATE
UNCORRECTED
CORRECTED
NOISE FIGURE
NOISE FIGURE
AND GAIN
SMOOTHING
DECREASE
INCREASE
HEWLETT·PACKARD

Thank you!

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