Cryogenic Performance of NGC 35nm InP Low Noise Amplifiers

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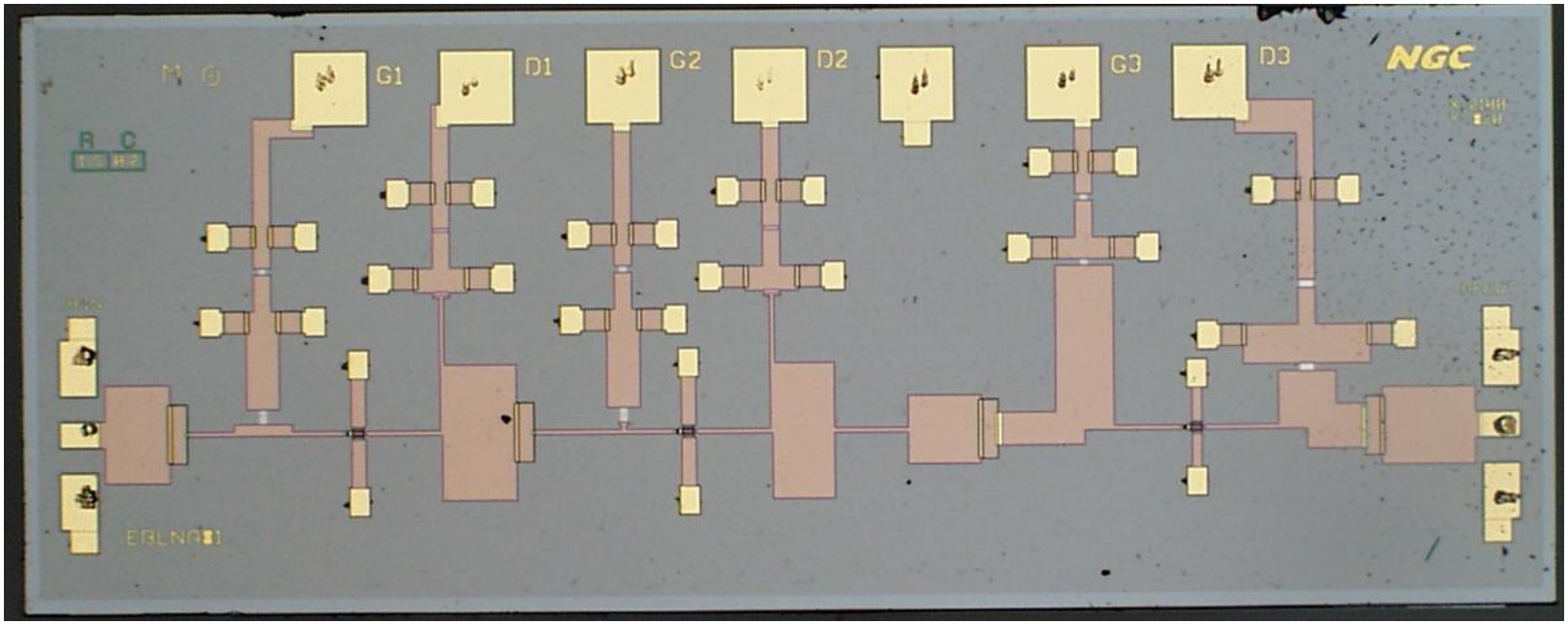
Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

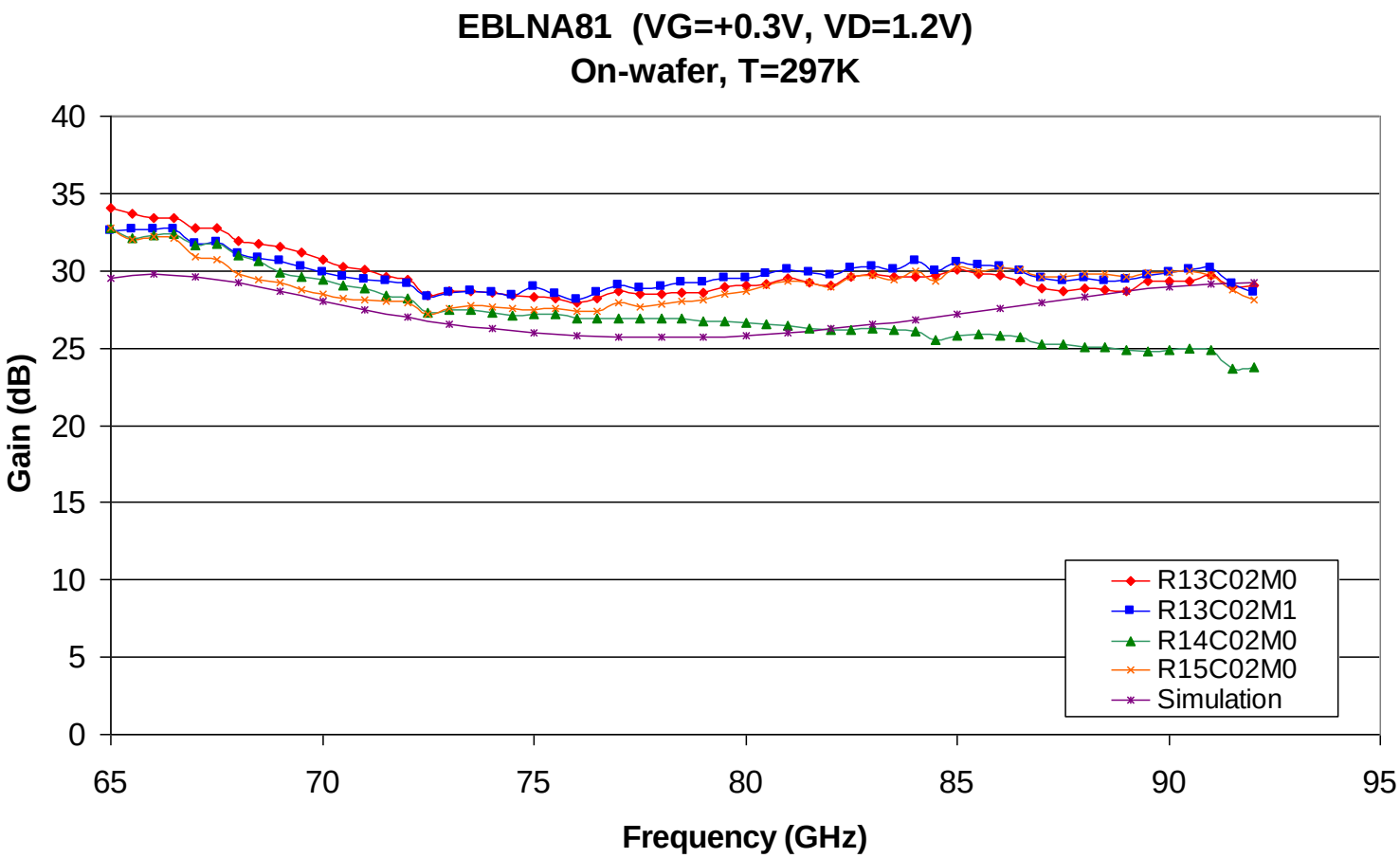
NRAO

EBLNA8I



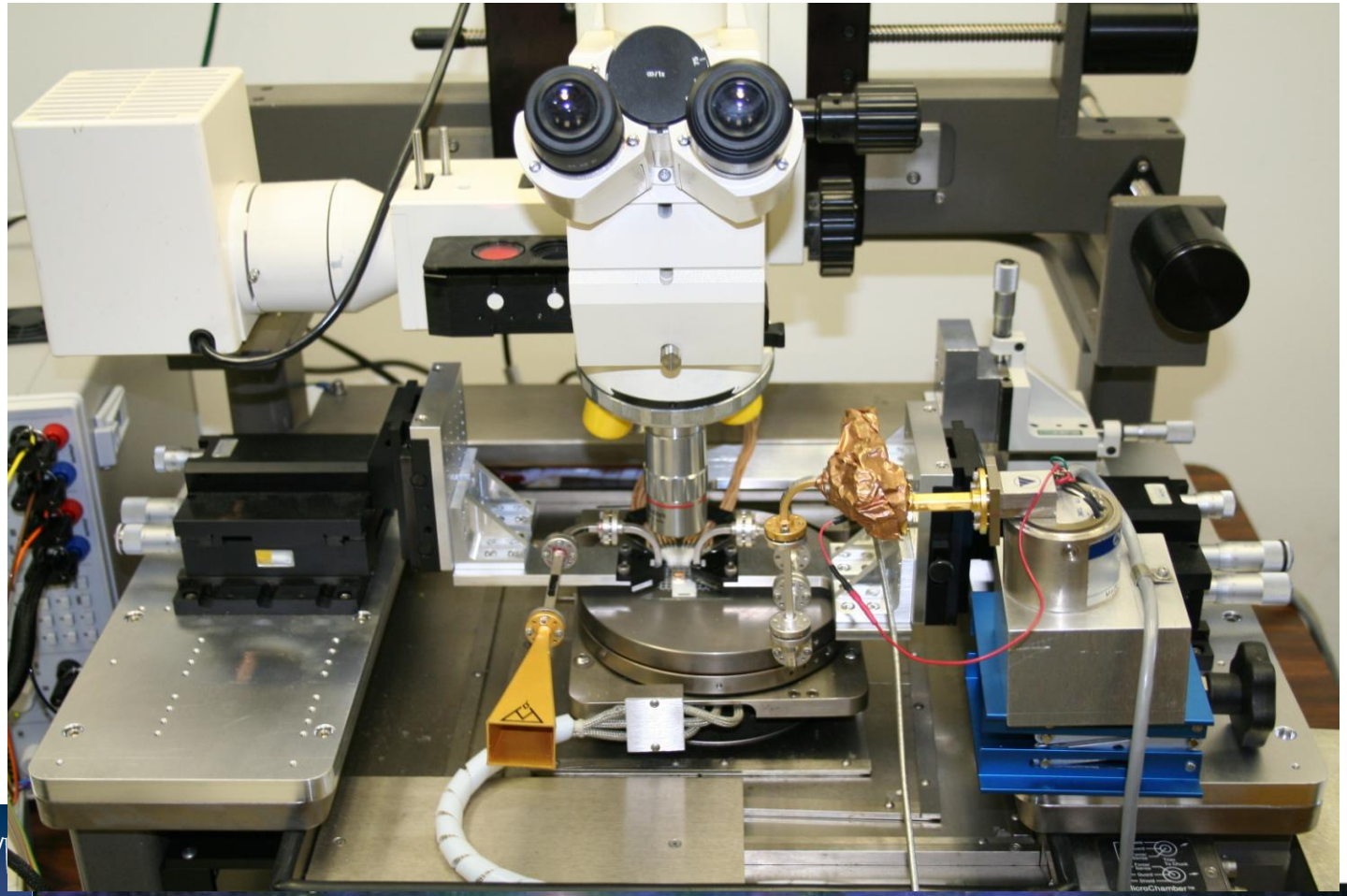
- Wafer run complete 1/15/2008
- Chip Dimension: 2.1mm x 0.8mm

On-chip Measurements

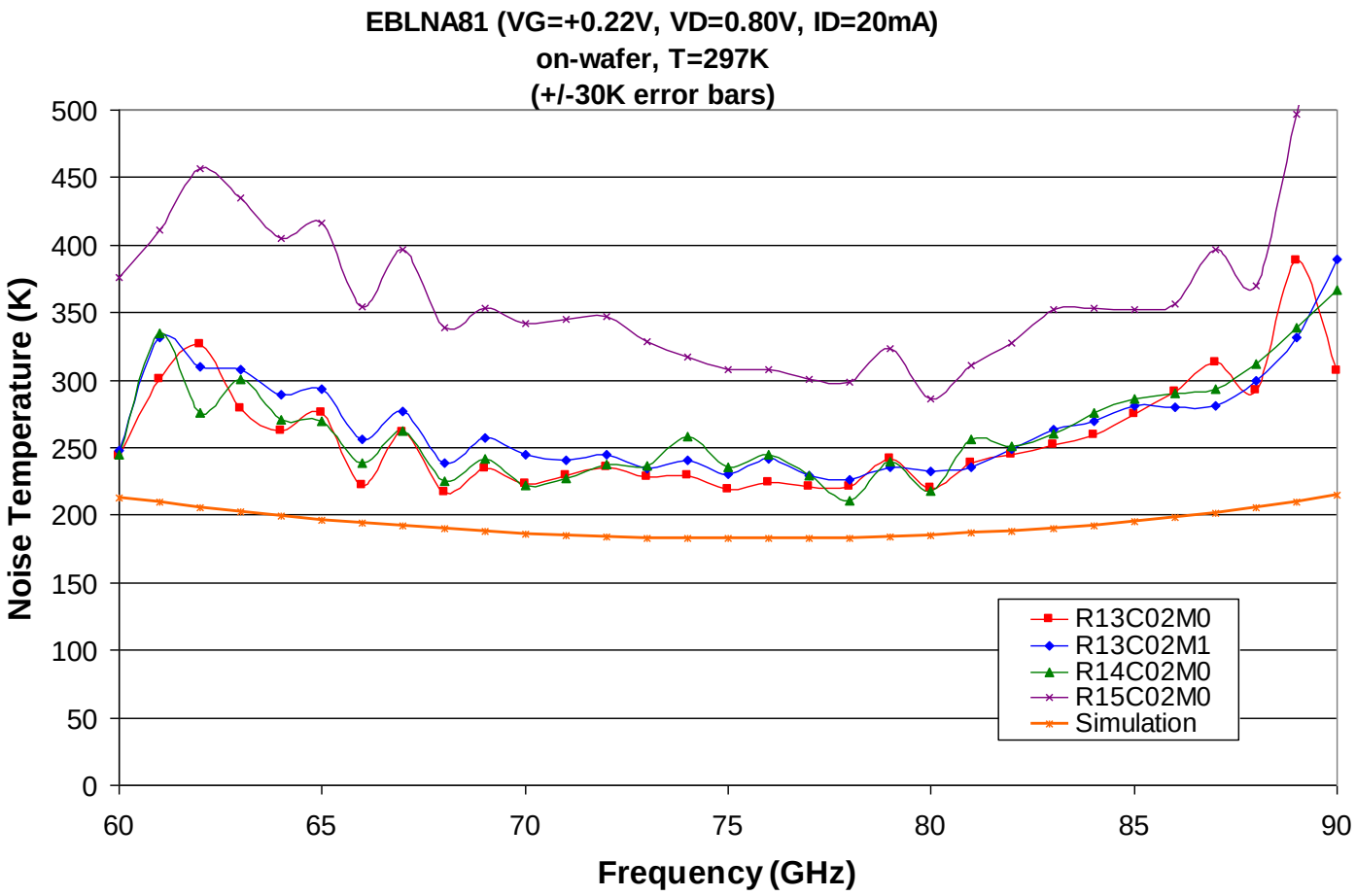


- G_m increased in simulation (from 1950 to 2500 mS/mm) to match measured performance

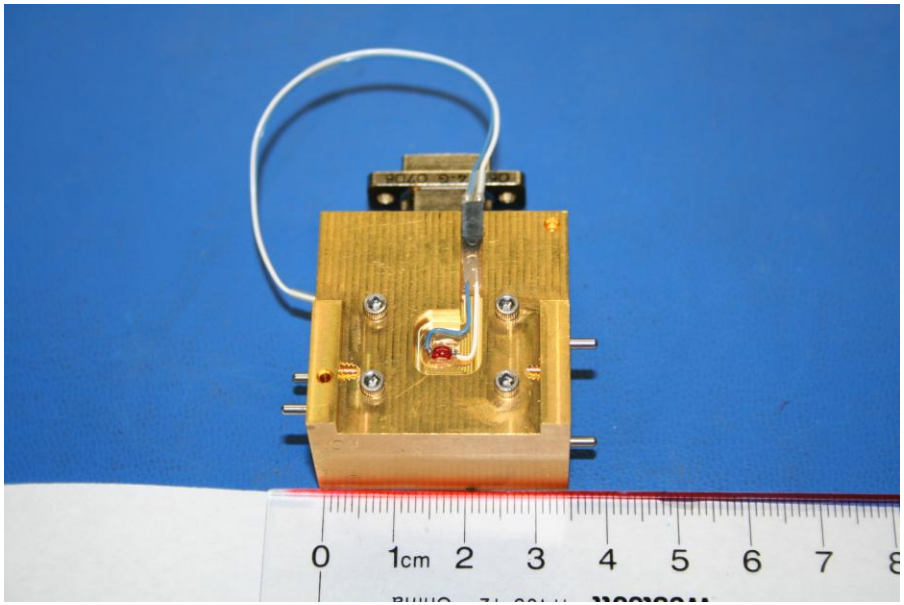
On-Chip Noise Measurement

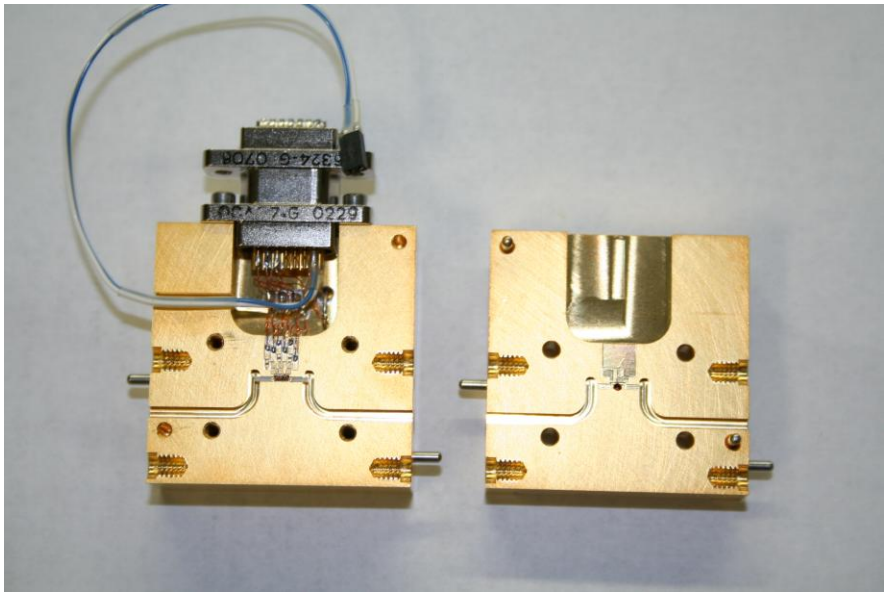


On-chip Noise Measurement



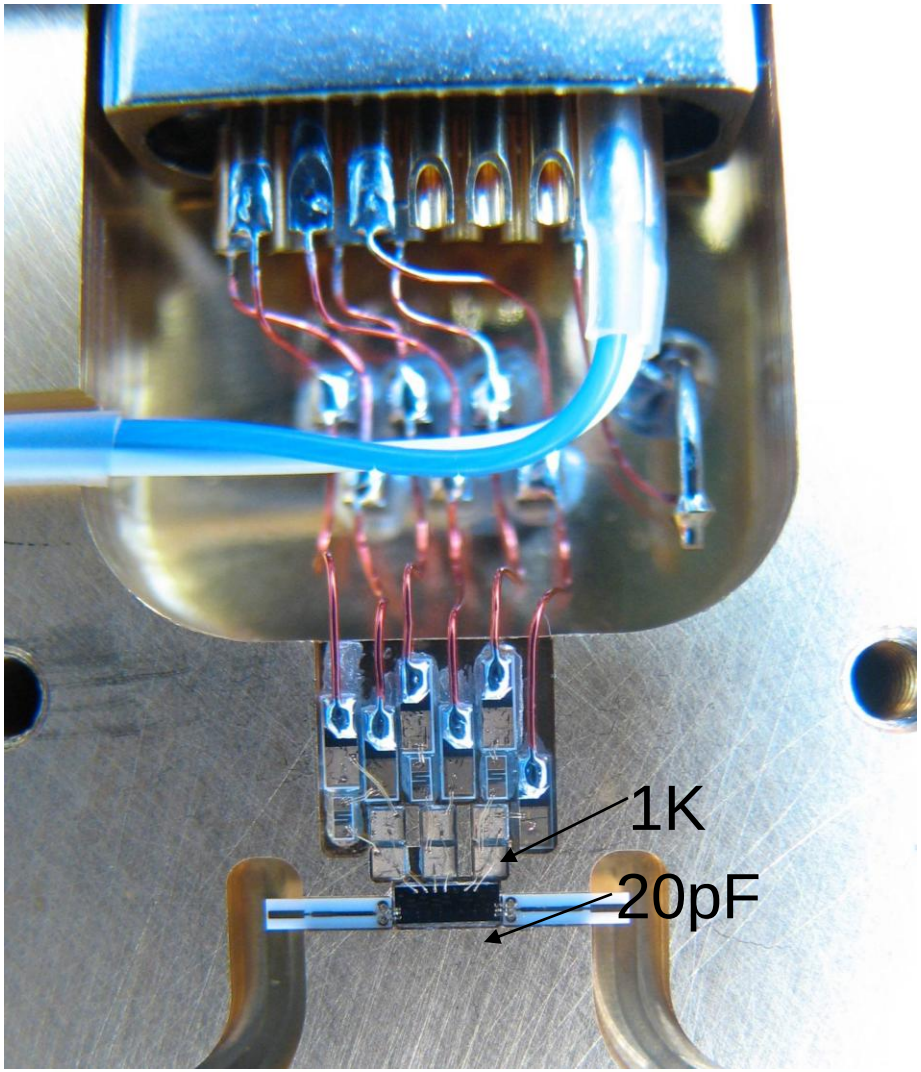
WR-12 LNA Module



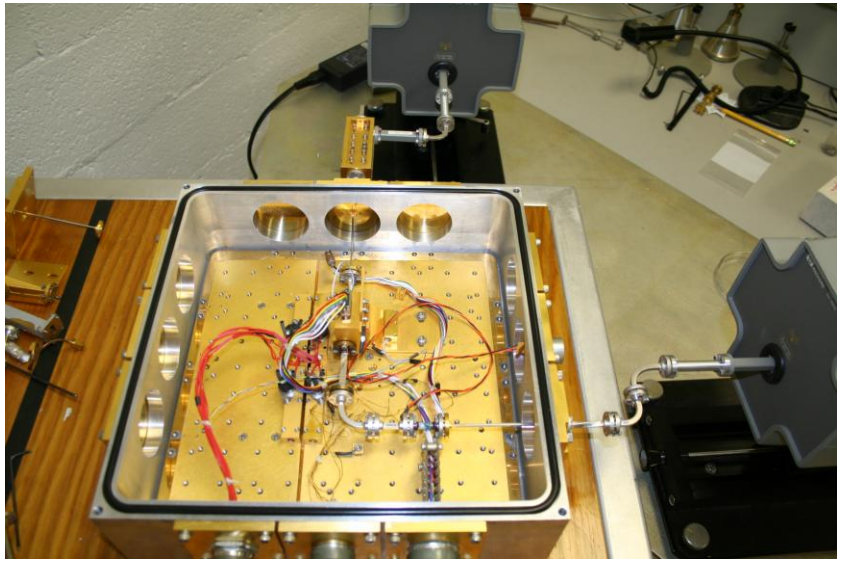


- Same MDM-15 pinout as CDL LNAs

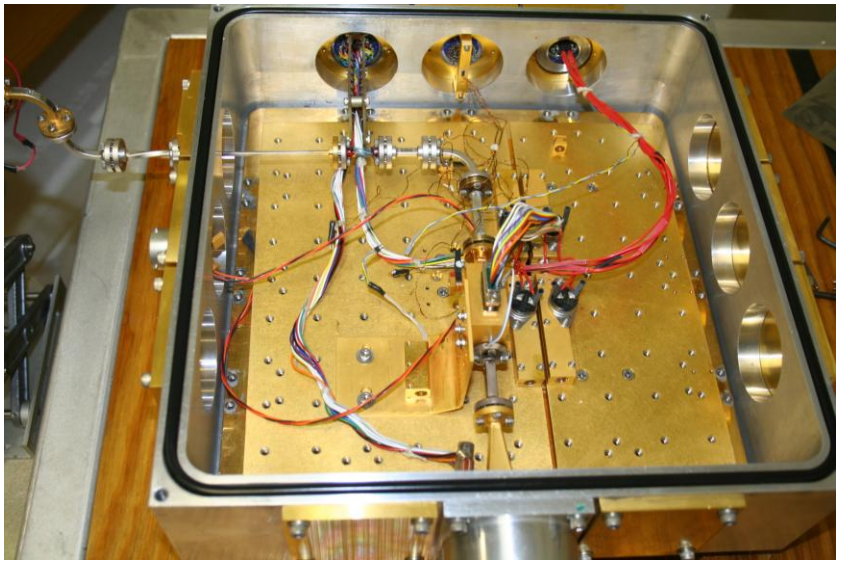
WR-12 LNA Module



LNA Module Measurements

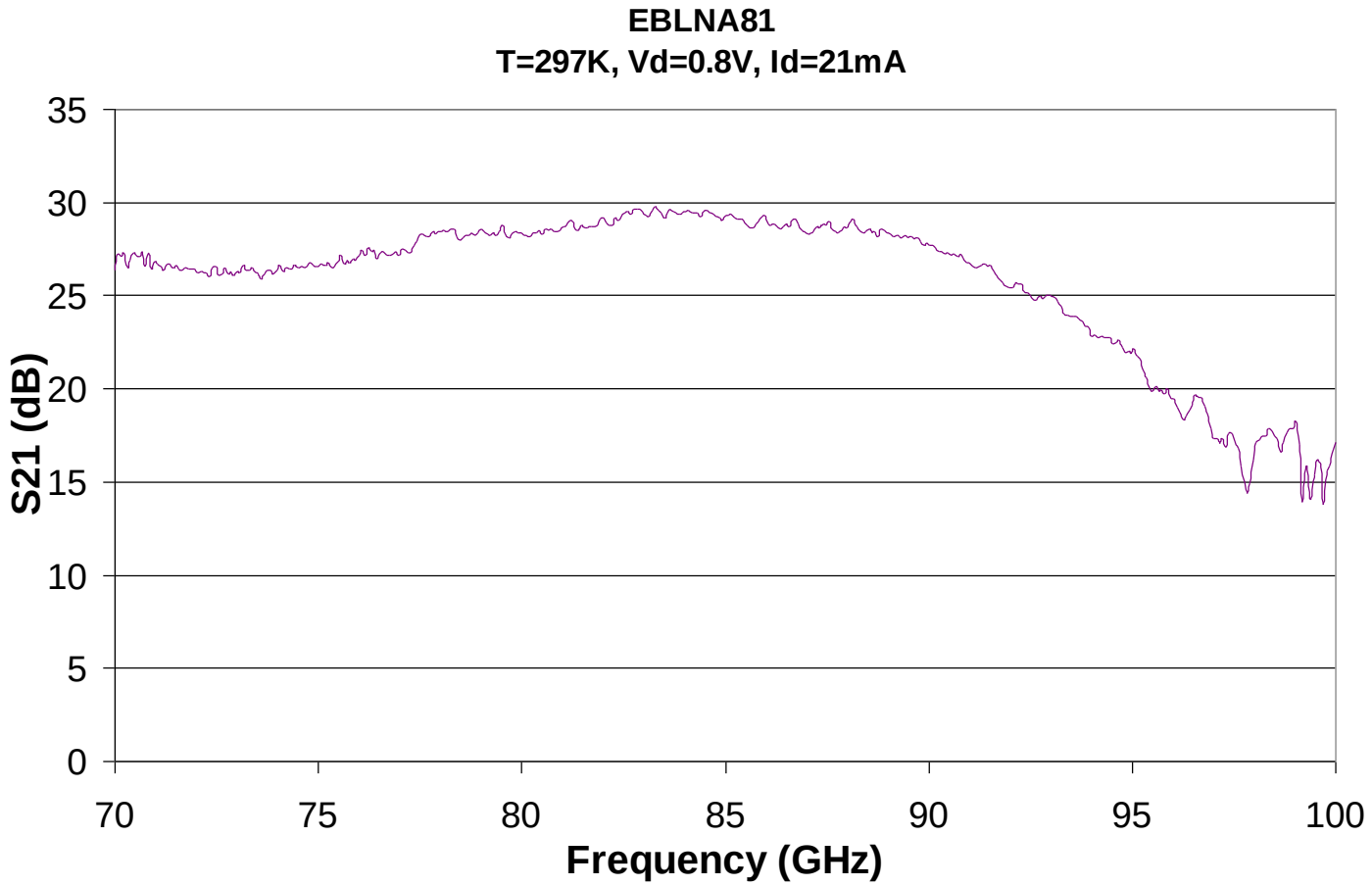


S21

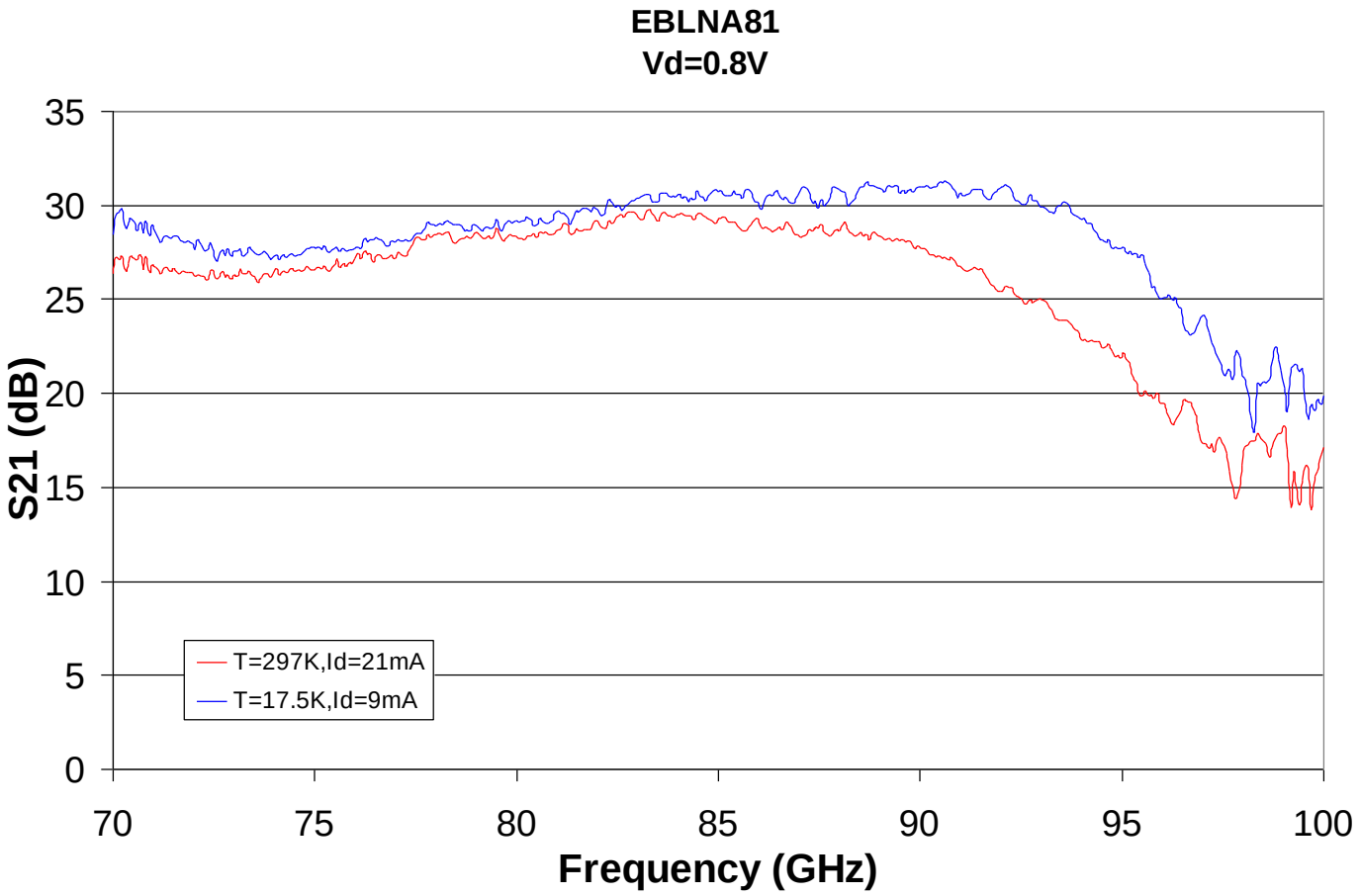


Noise

LNA Module Measurements

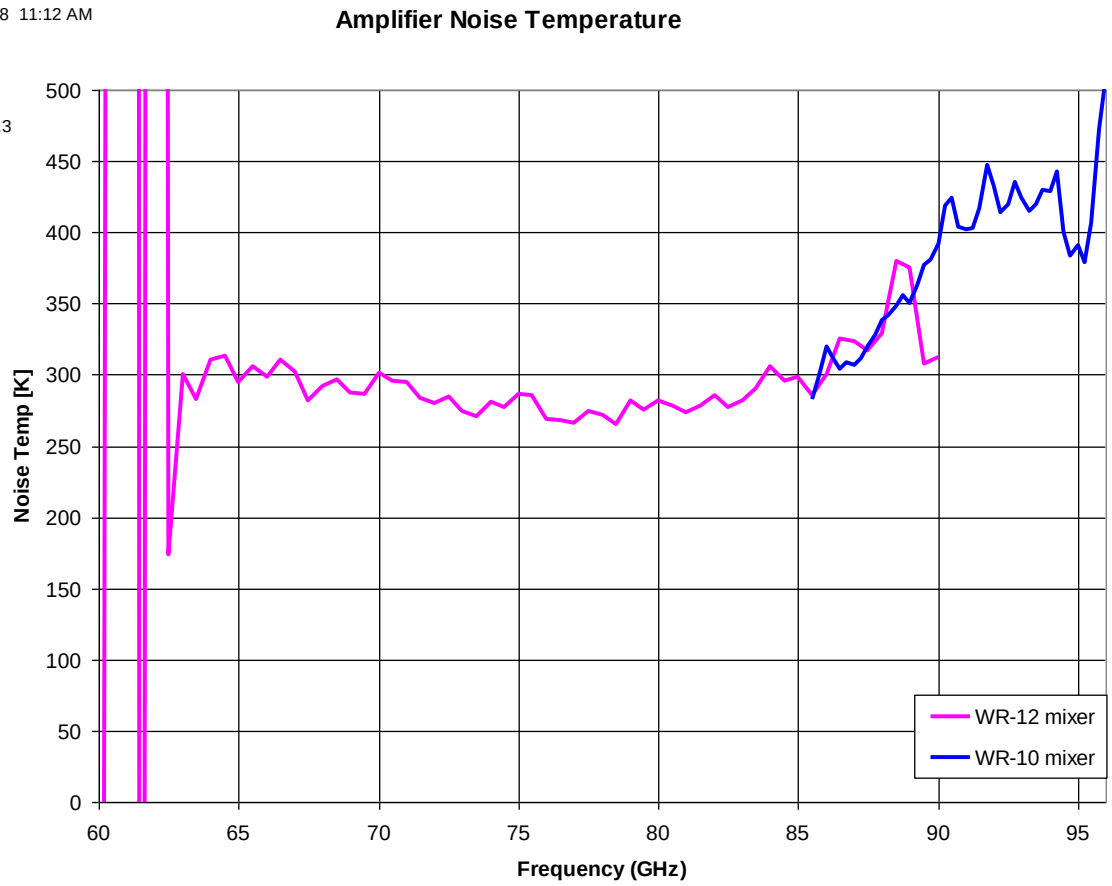


LNA Module Measurements



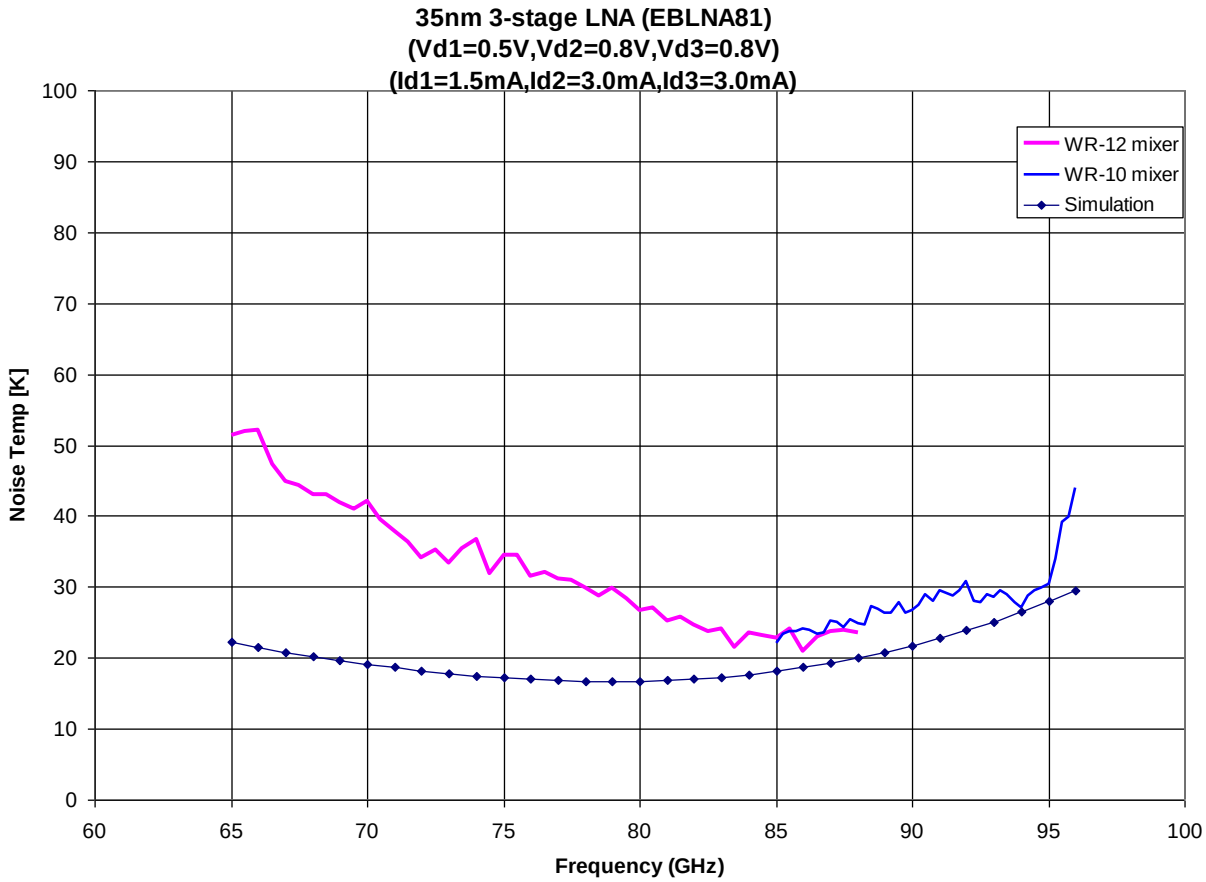
LNA Module Measurements

Amplifier ID: eblna81
Timestamp: 7/9/2008 11:12 AM
Measured by:
Dewar Temp: 327
Ambient Temp: 327
Noise Diode:11833
Software Version: 1.3



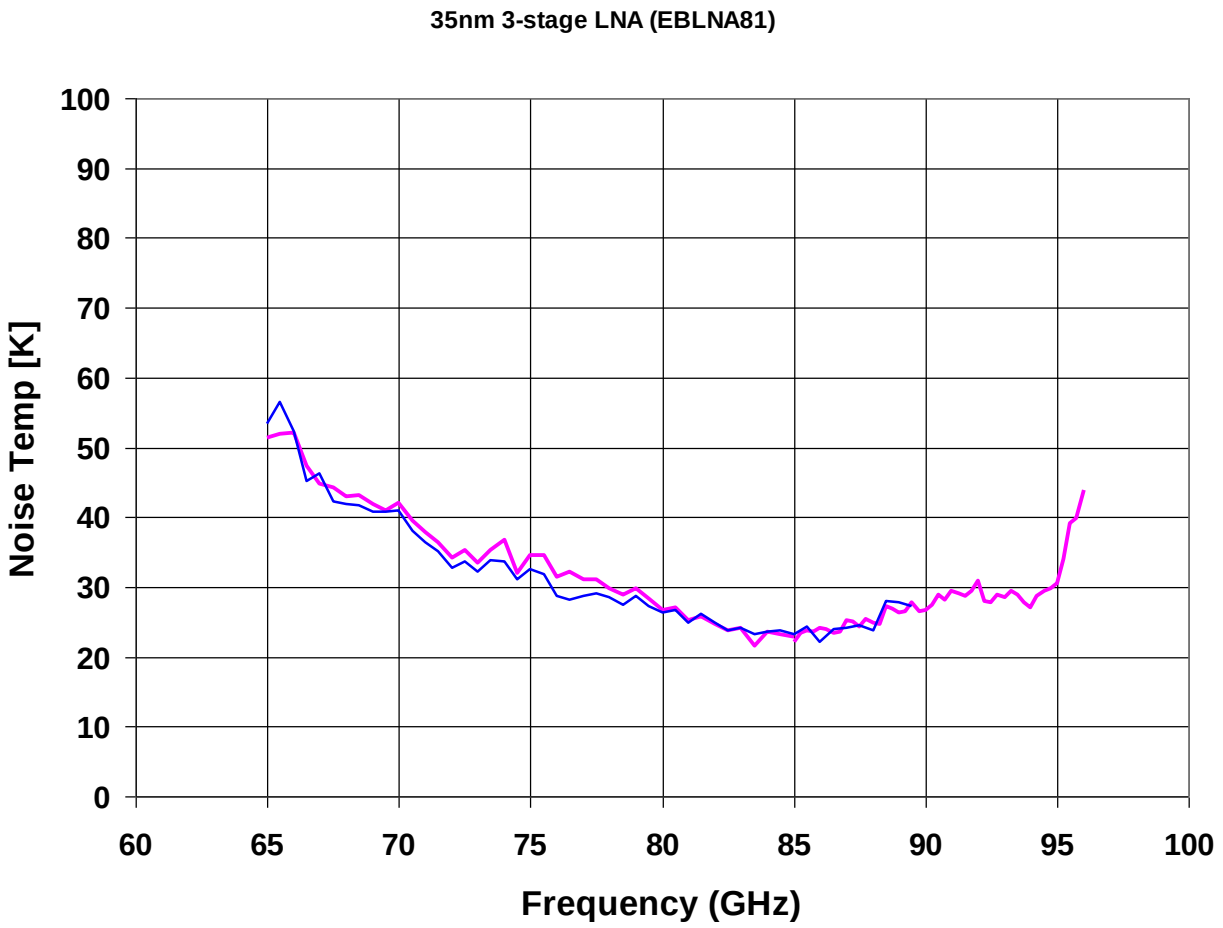
Vd=0.8V, Id=7mA/stage

LNA Module Measurements



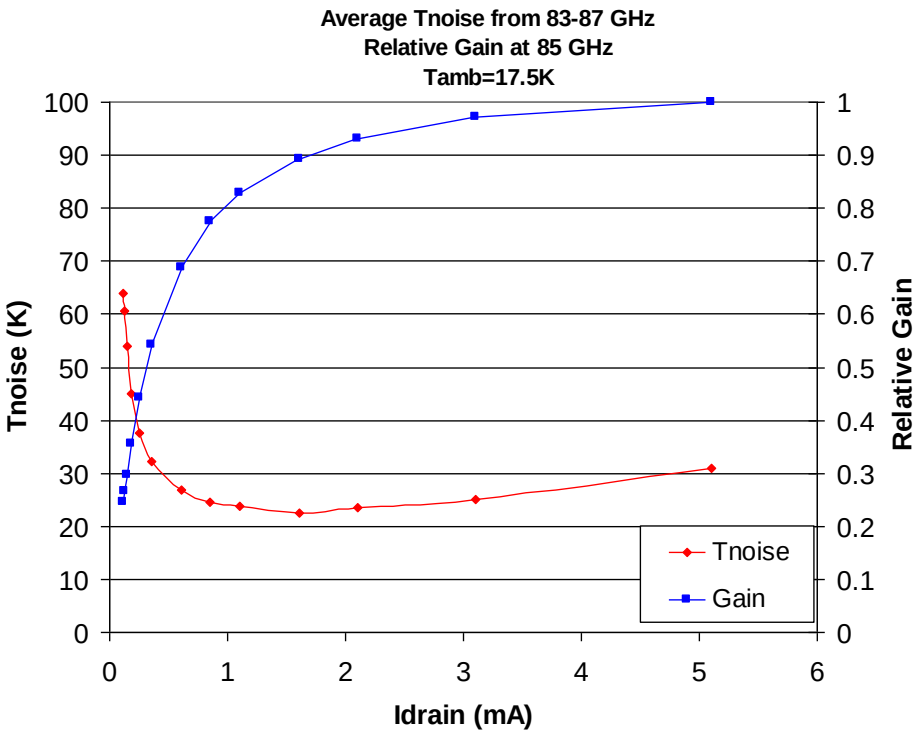
- Simulation: Gm=2500mS/mm, Igs=0, Tdrain=1400
- Pdiss = 5.55mW

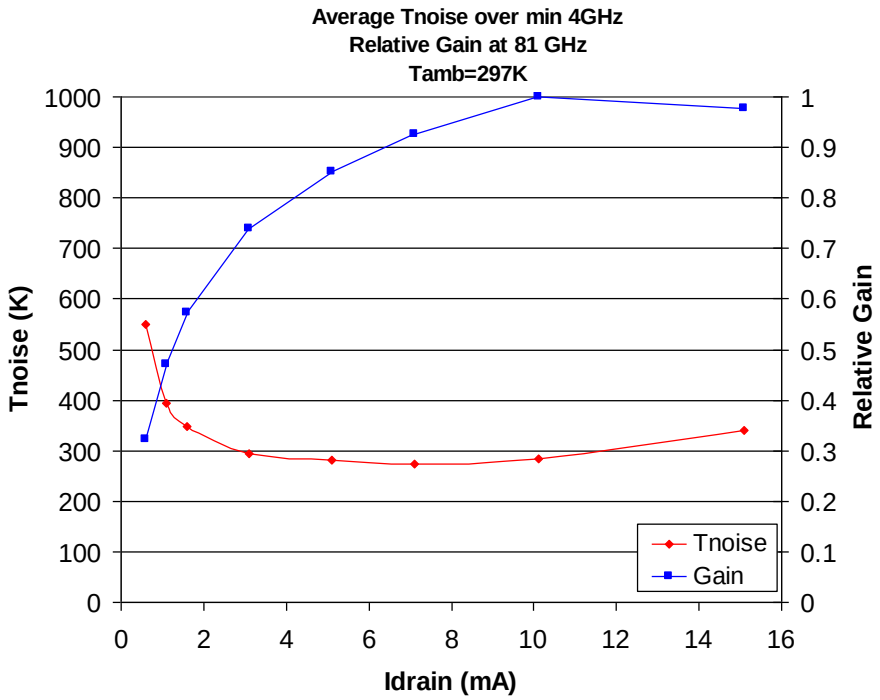
LNA Module Measurements



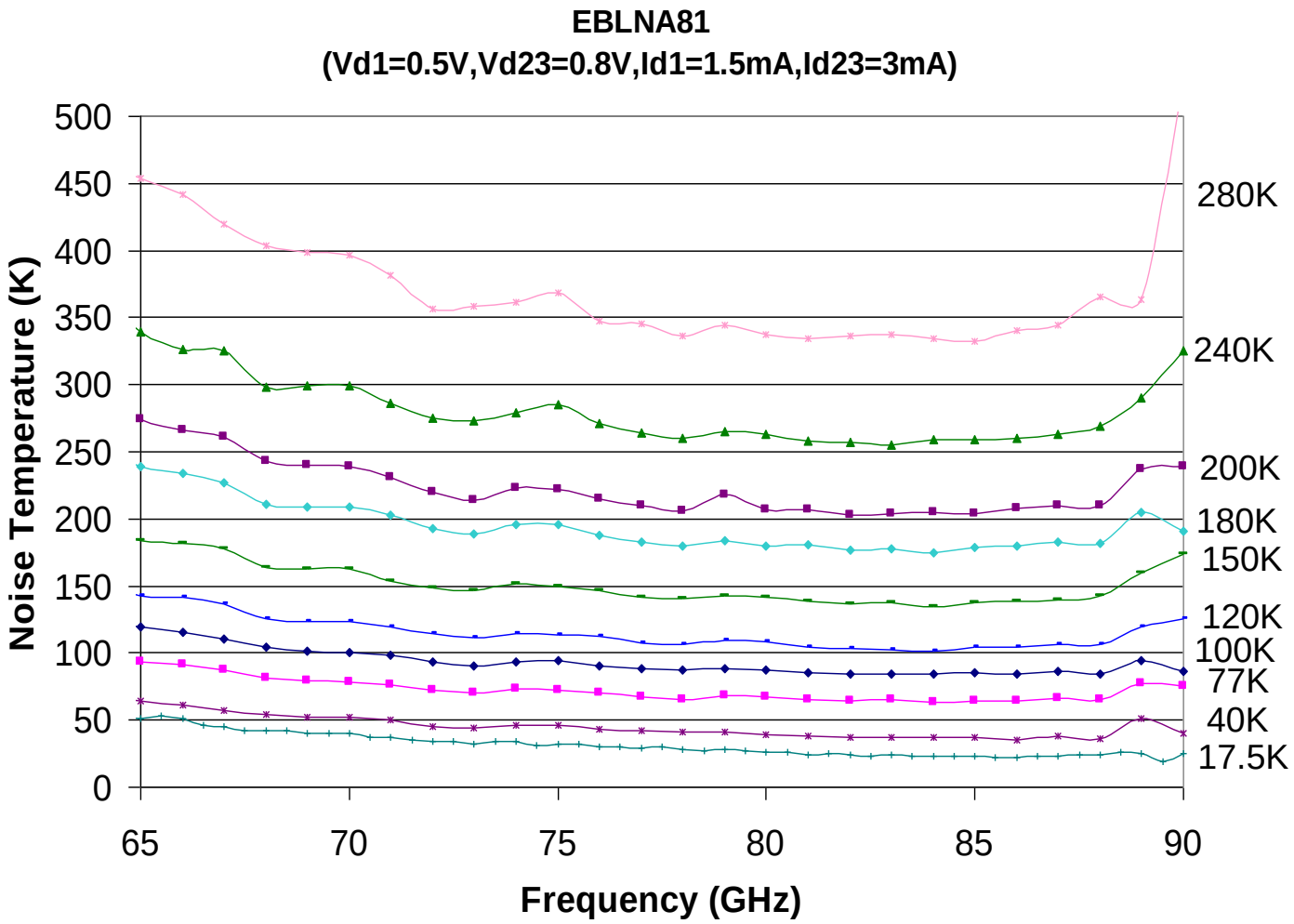
- Blue trace shows noise for minimum power dissipation: Vd1=0.35V, Vd23=0.5V, Id=4.5mA -> Pdiss = 2.06mW

Pinchoff Characteristics

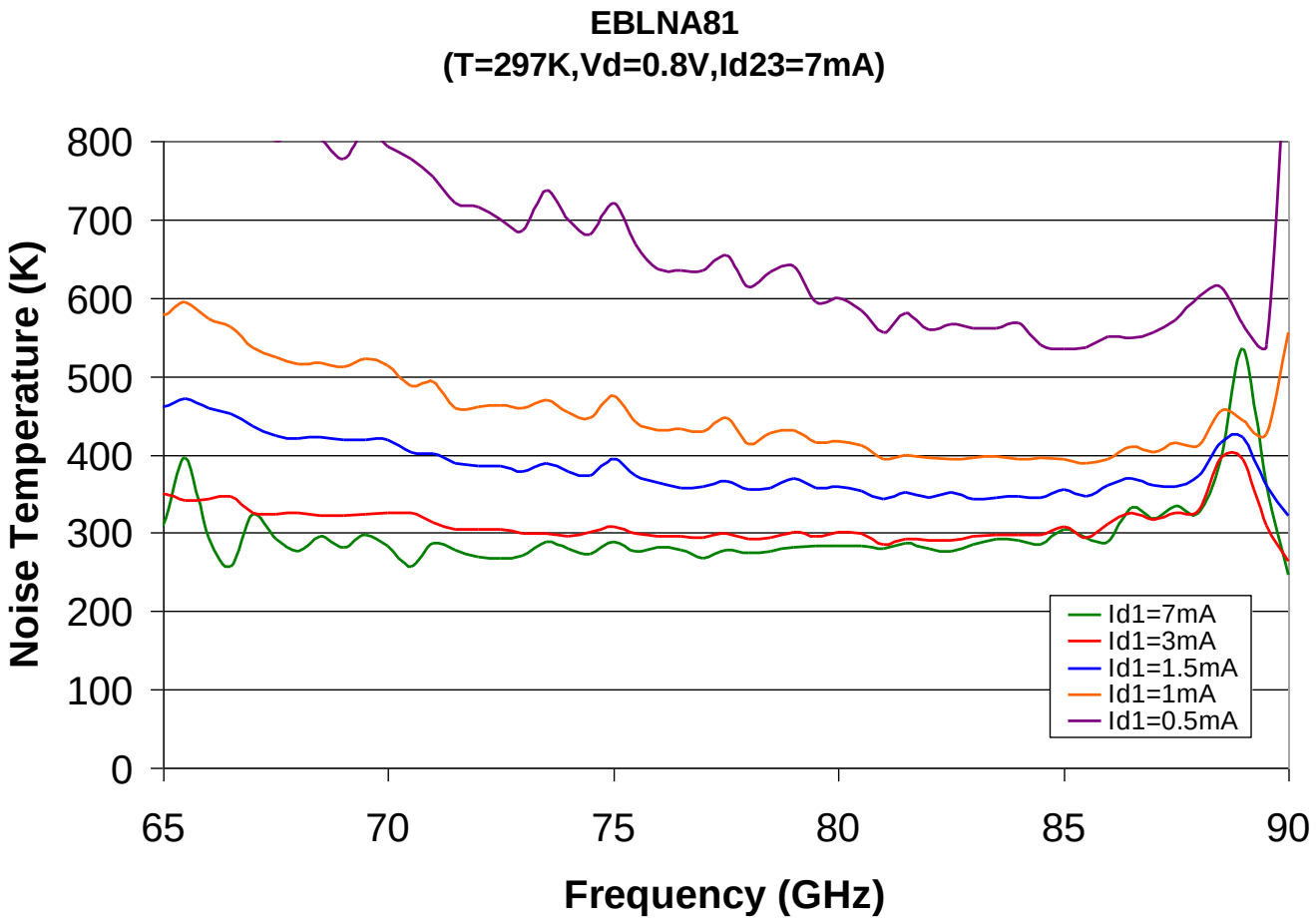




Why the frequency shift cold?

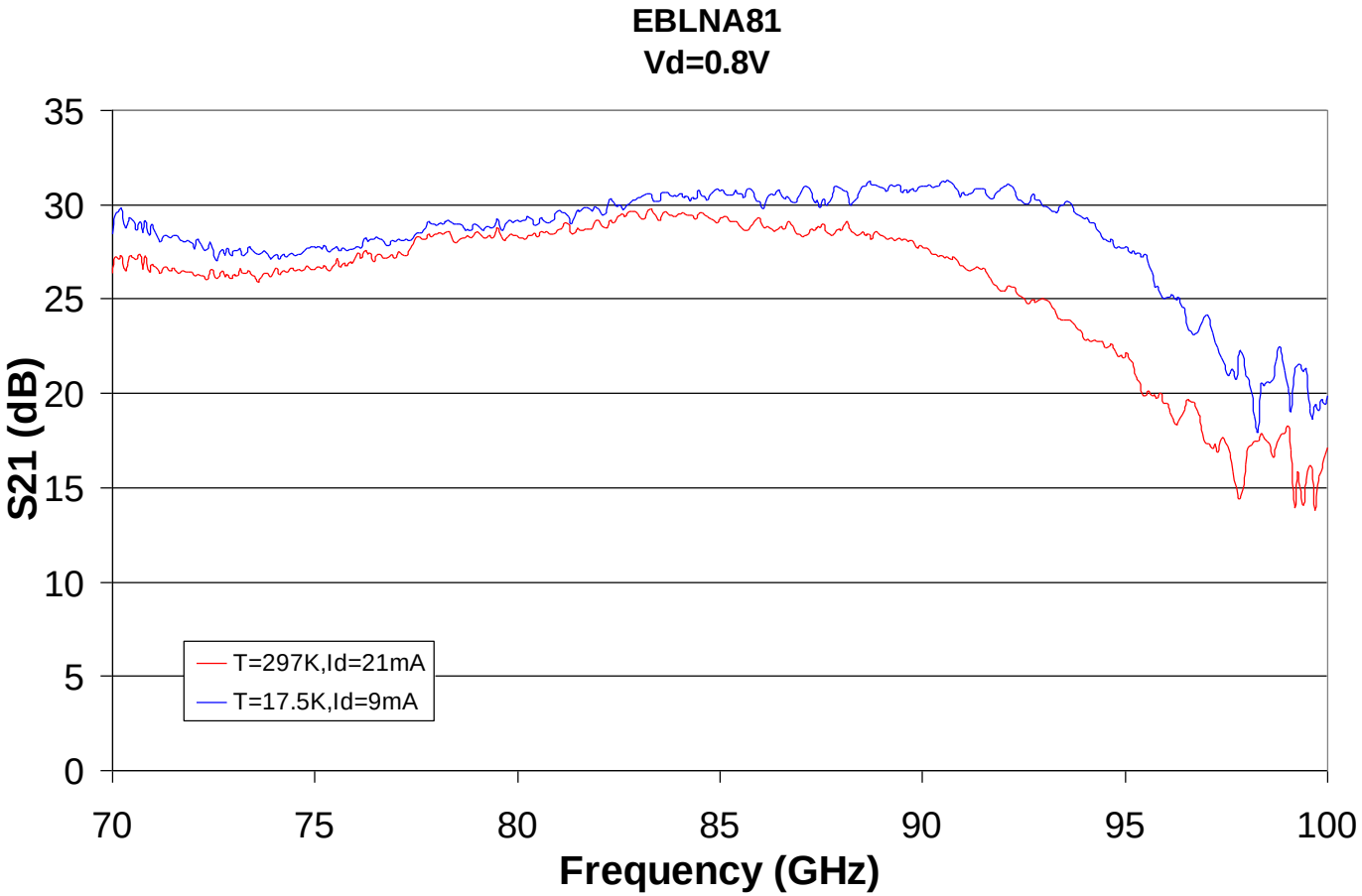


Why the frequency shift cold?



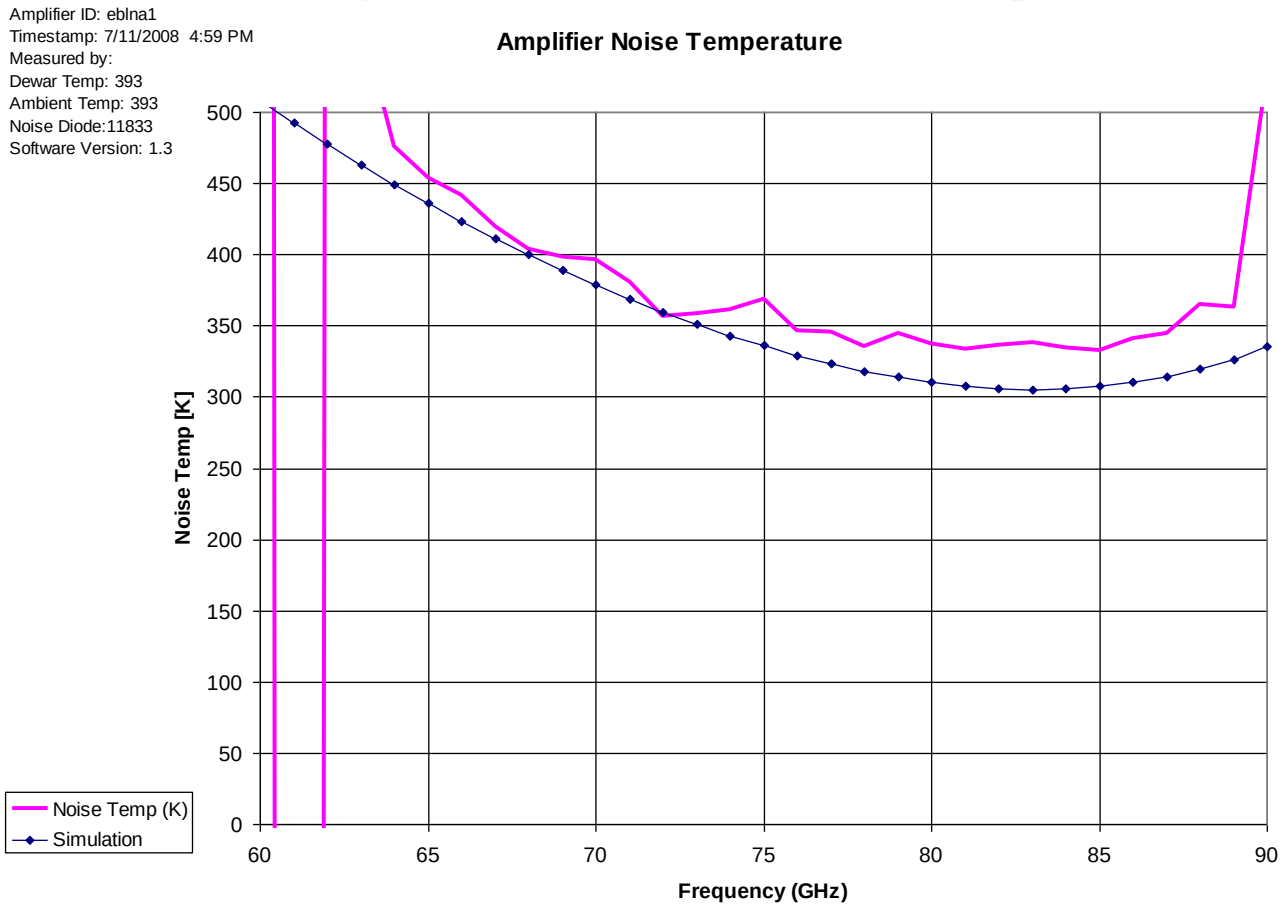
- Hypothesis: Cgs(Vgs) is causing frequency shift

Revised cryogenic model for parasitics



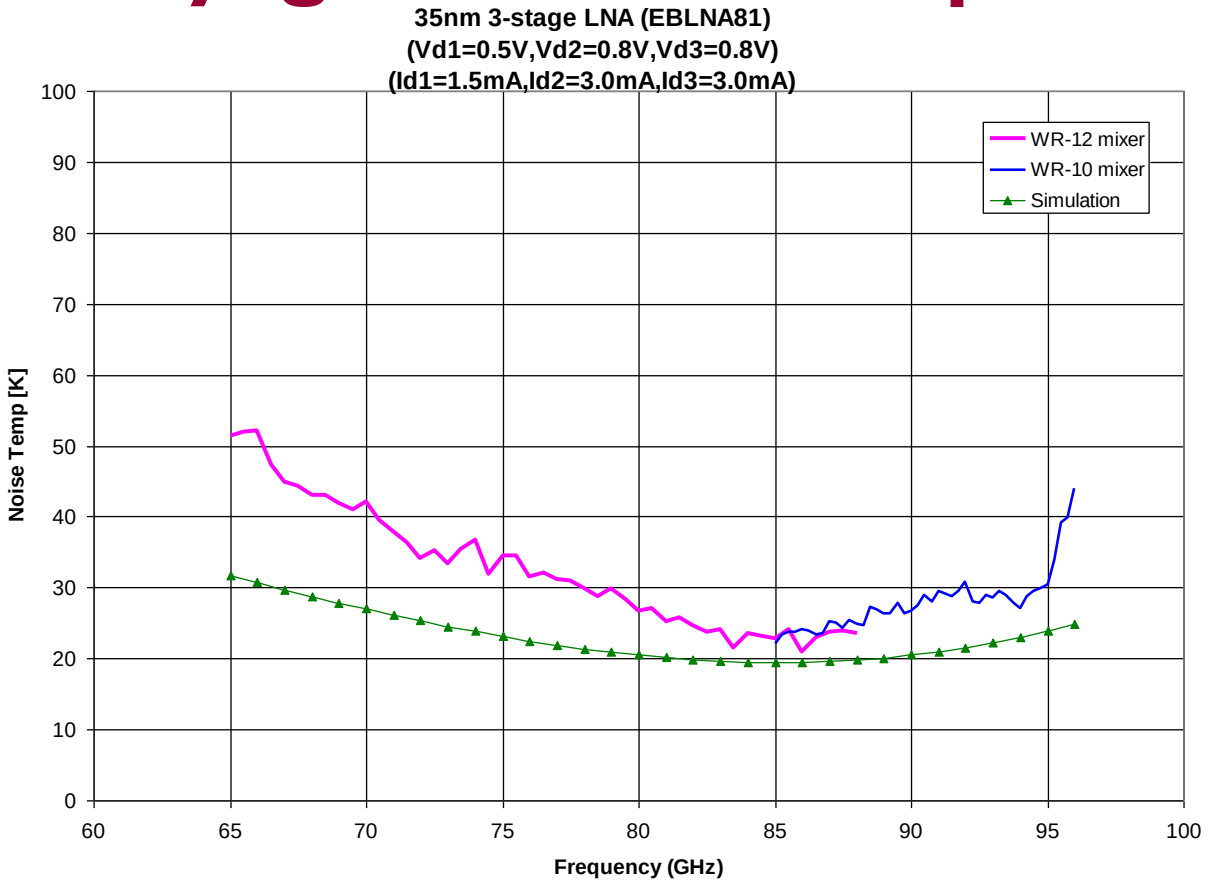
- Change in S21 also modeled well by decrease in Cgs

Revised cryogenic model for parasitics



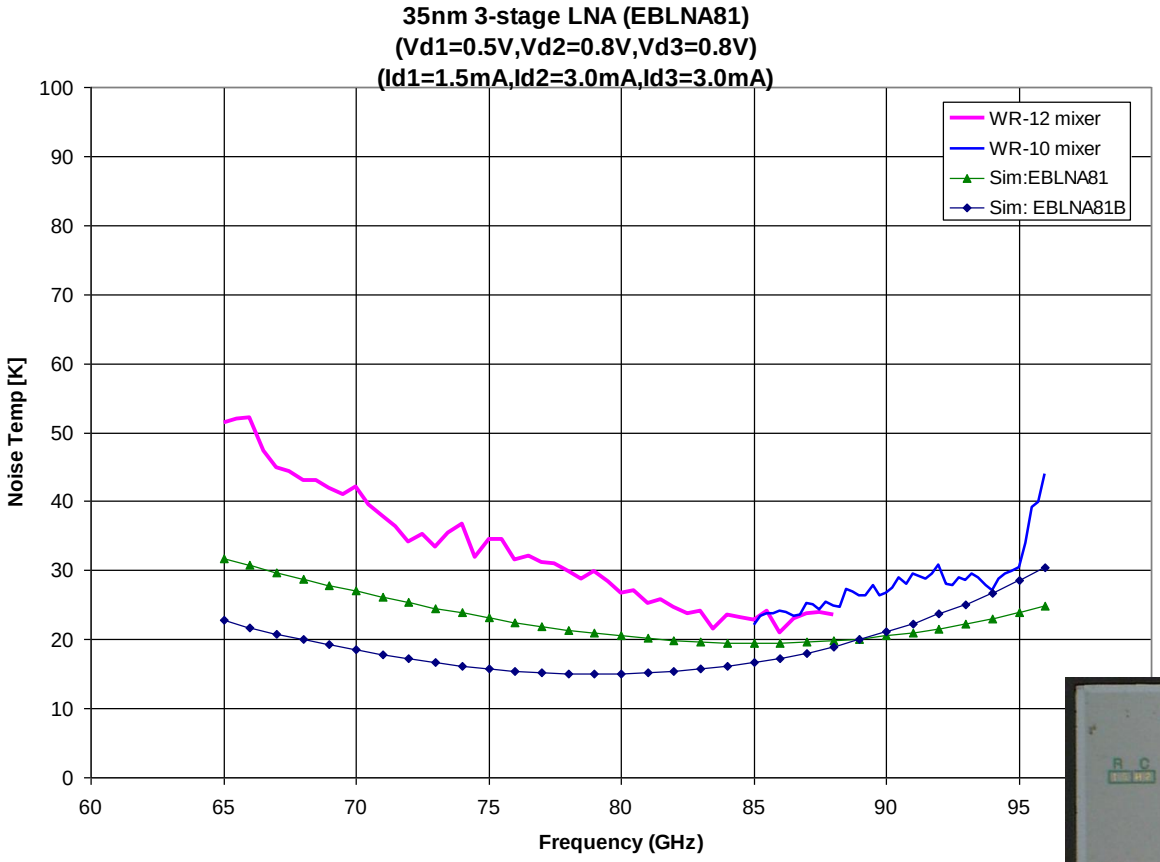
- Id1=1.5mA
- Simulation: gm1=33.6mS, gm23=66.6mS, Cgs1=12.6fF (versus 17.5fF in original model)

Revised cryogenic model for parasitics

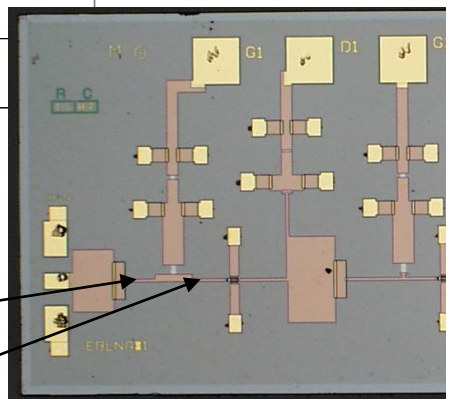


- Simulation: Gm1=64mS, Gm23=90mS, Td1=1400K, Td23=2800K, Cgs1=12.6fF (compared to 17.5fF original)

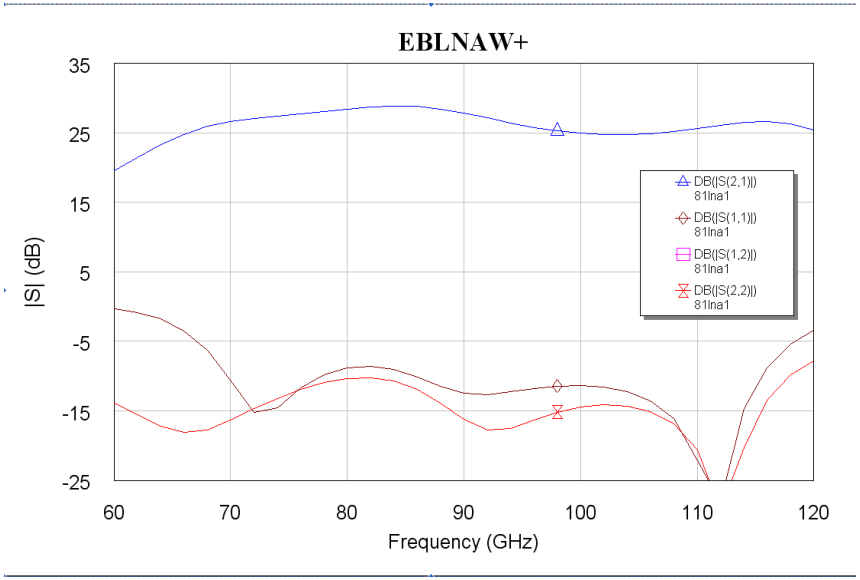
EBLNA81B: Retuned for 67-90 GHz

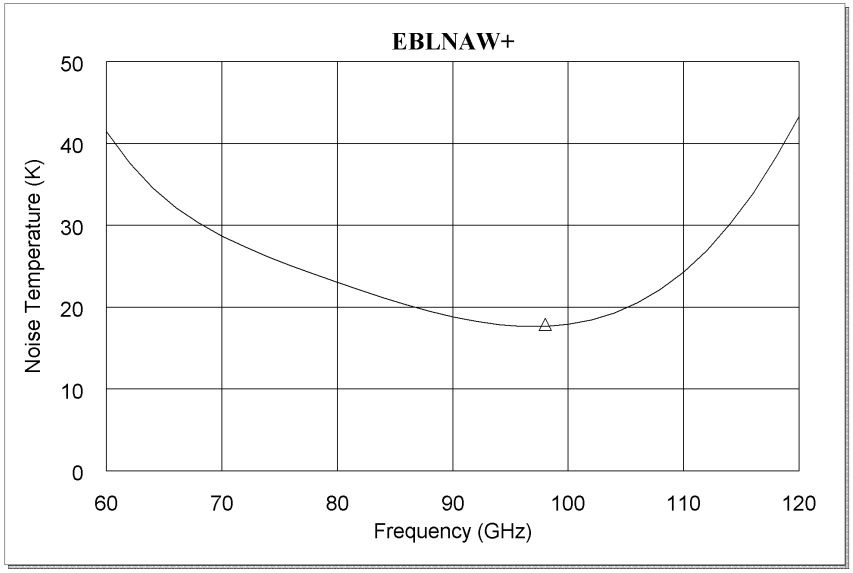


L13: 65 to 34um
L14: 78 to 144um

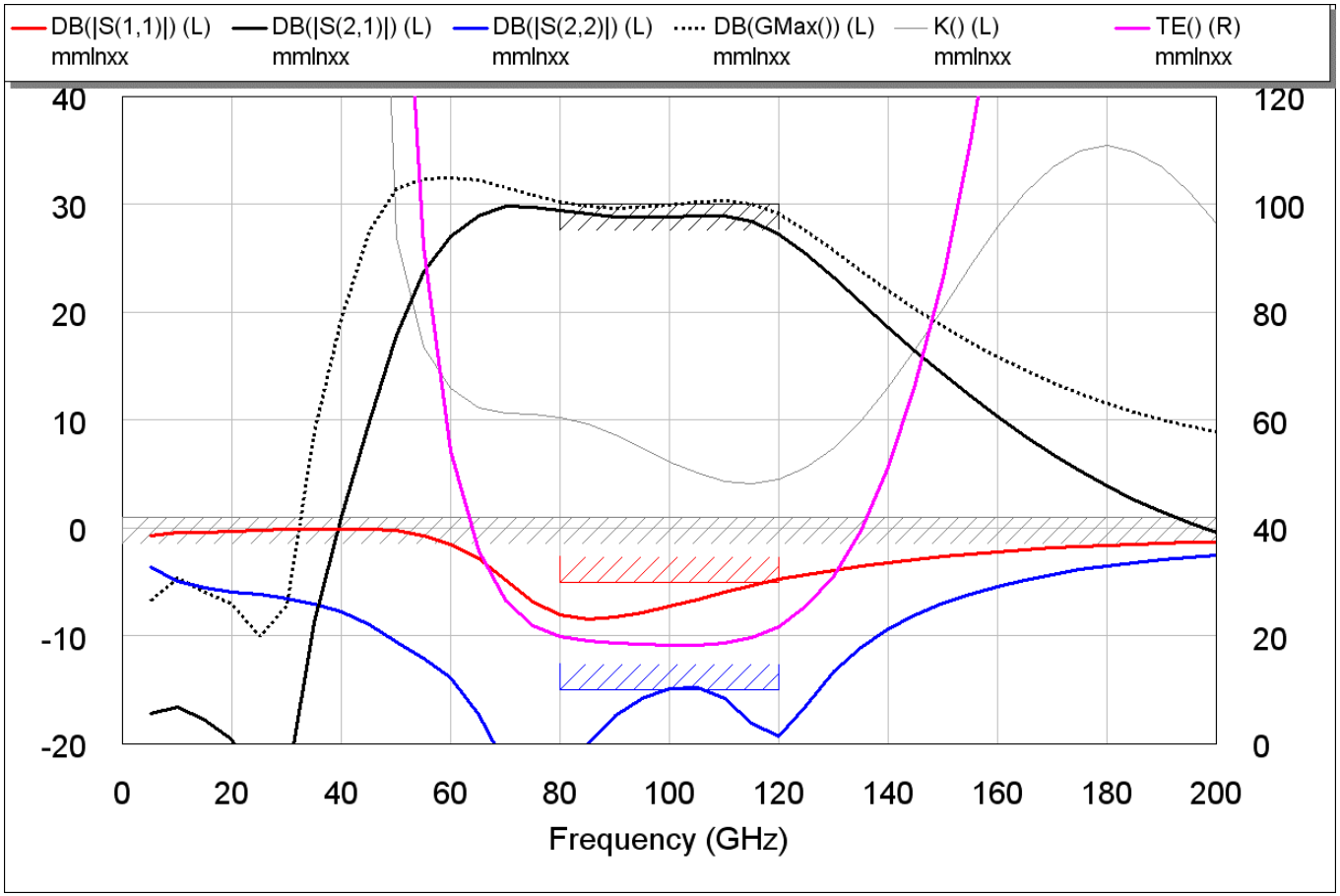


EBLNAW+: Cover full 68-116 GHz band

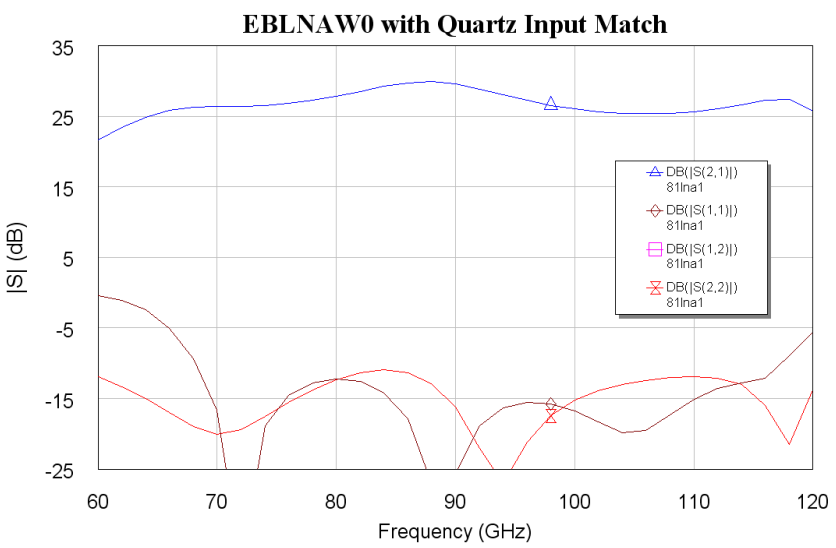


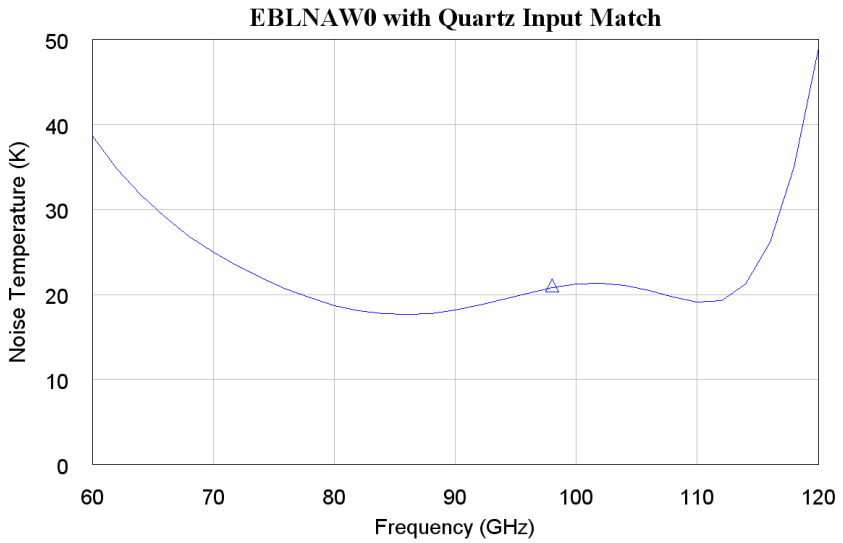


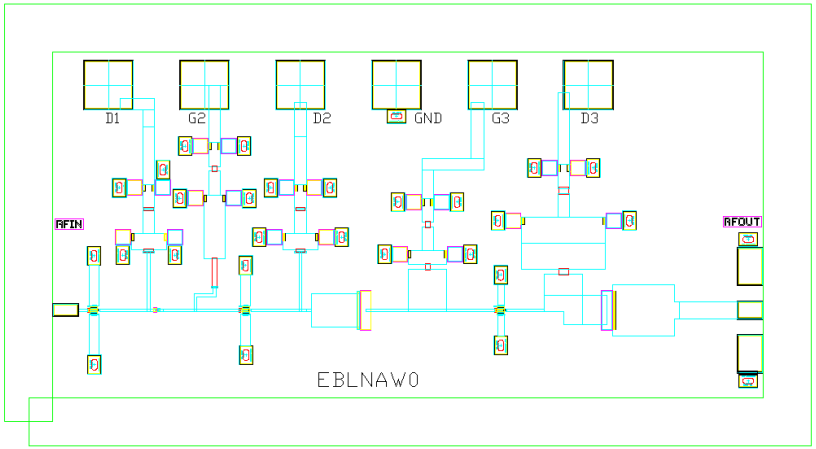
MMLN100: Cover full 68-116 GHz band



EBLNAW0: A "Tunable" MMIC LNA







Questions / Discussion Points

- Is the process repeatable?
- These results are with 70% channel, what do they look like with 100% channel (higher gm)?
- Operation at 4K
- Ultimate limit for W-band LNA noise temperature
- Comparison to SIS development