



Cairo University



Faculty of Engineering

Advanced Topics in Electronics-1

Under supervision of:

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Eng. Ahmed Atef

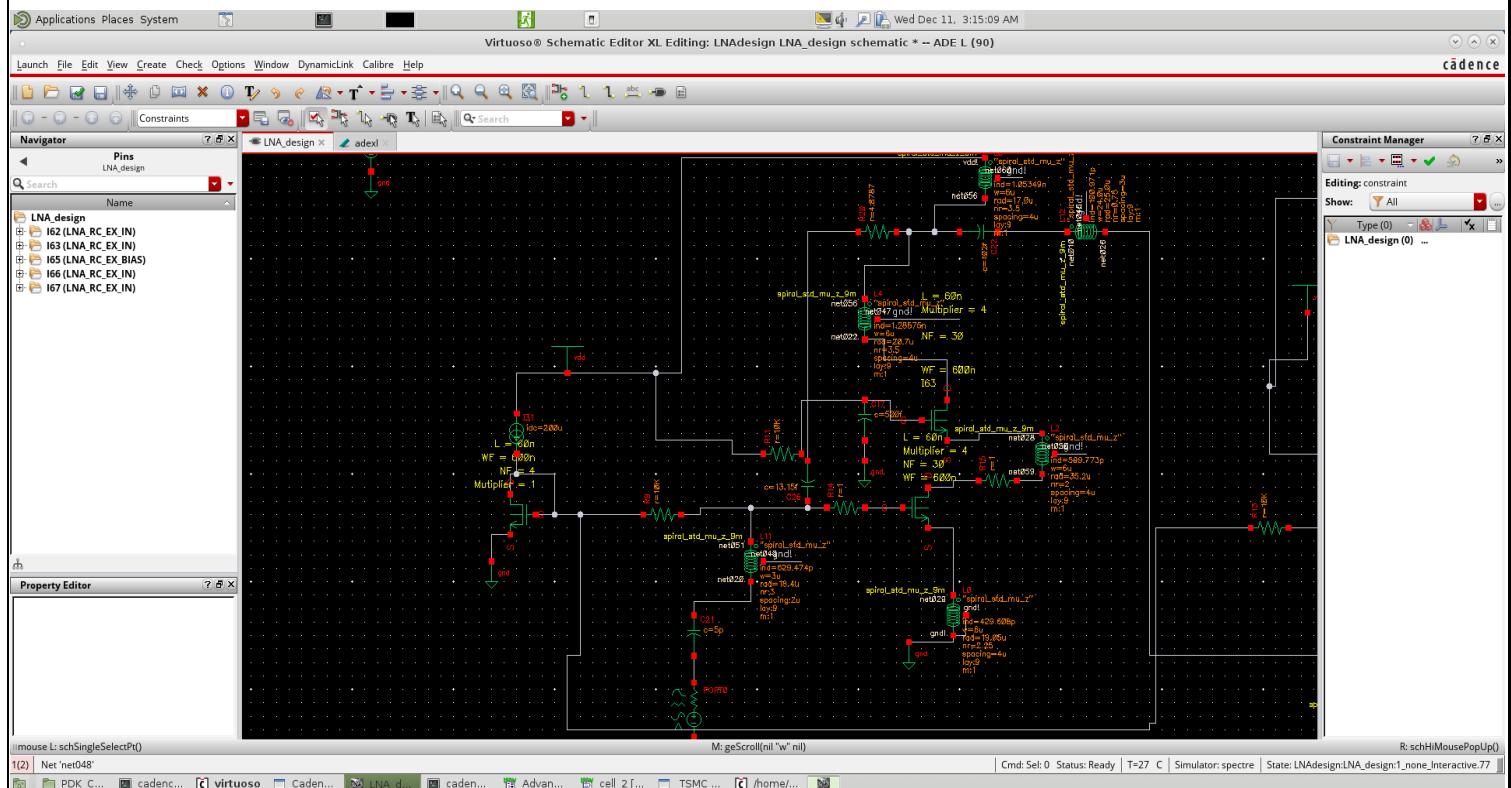
Students Names:

Kerolos Hanna Fayed 1200049

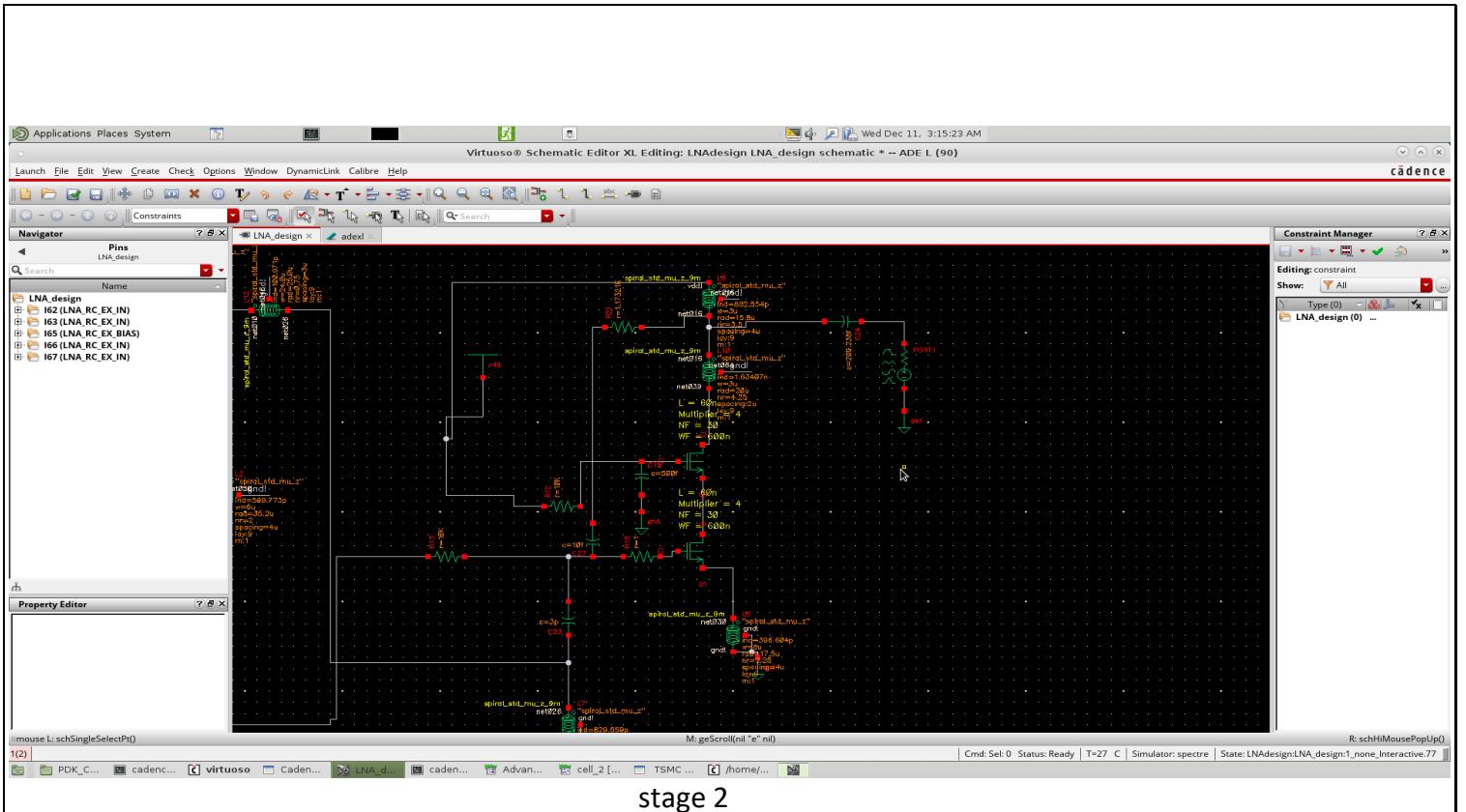
Show the LNA schematics including device sizes, and indicate the bias point of the devices on the LNA schematic.

I designed two stage cascode Low noise amplifier with a source of VDD using for the input transistor 4 multiplier and 30 fingers , the bias transistor uses 1 multiplier and 4 fingers , I used nmos_rf_lvt.

My design is more power hungry but less area consumption .

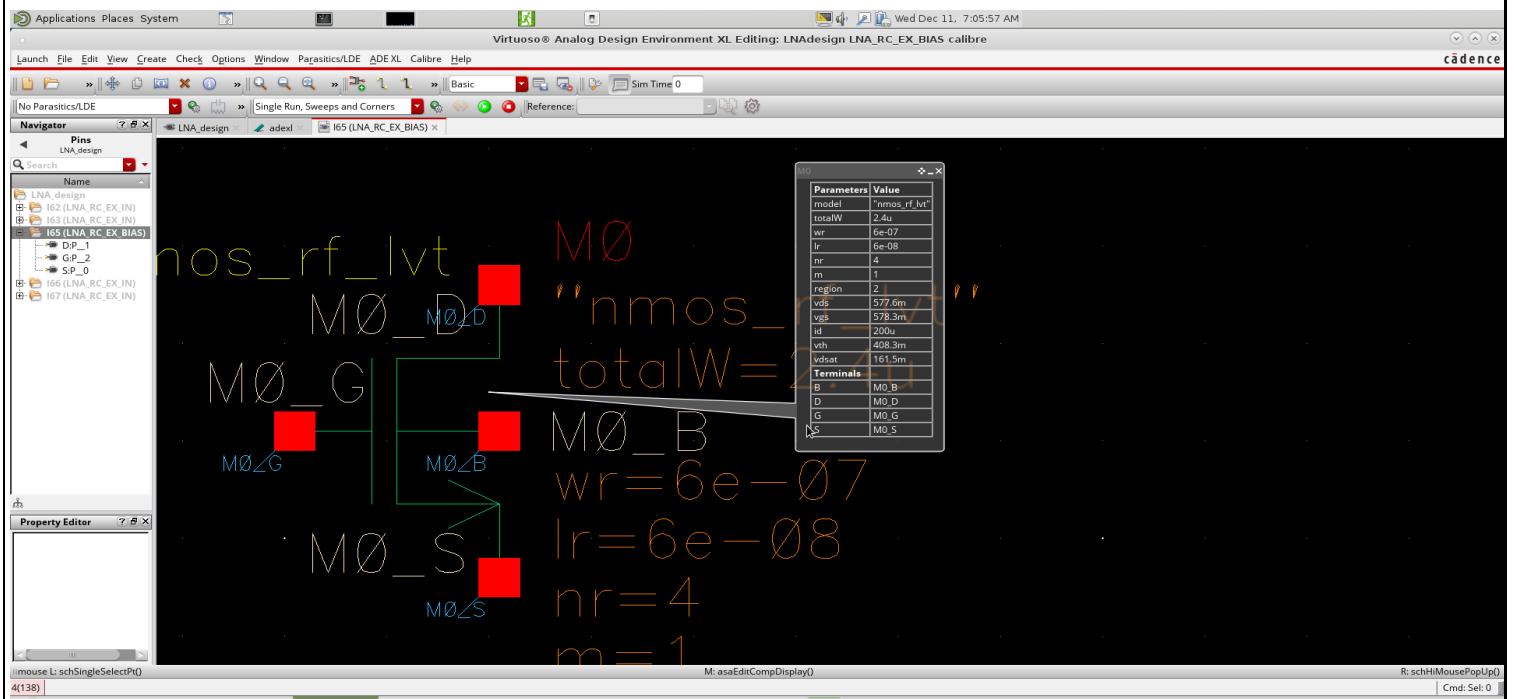


stage 1

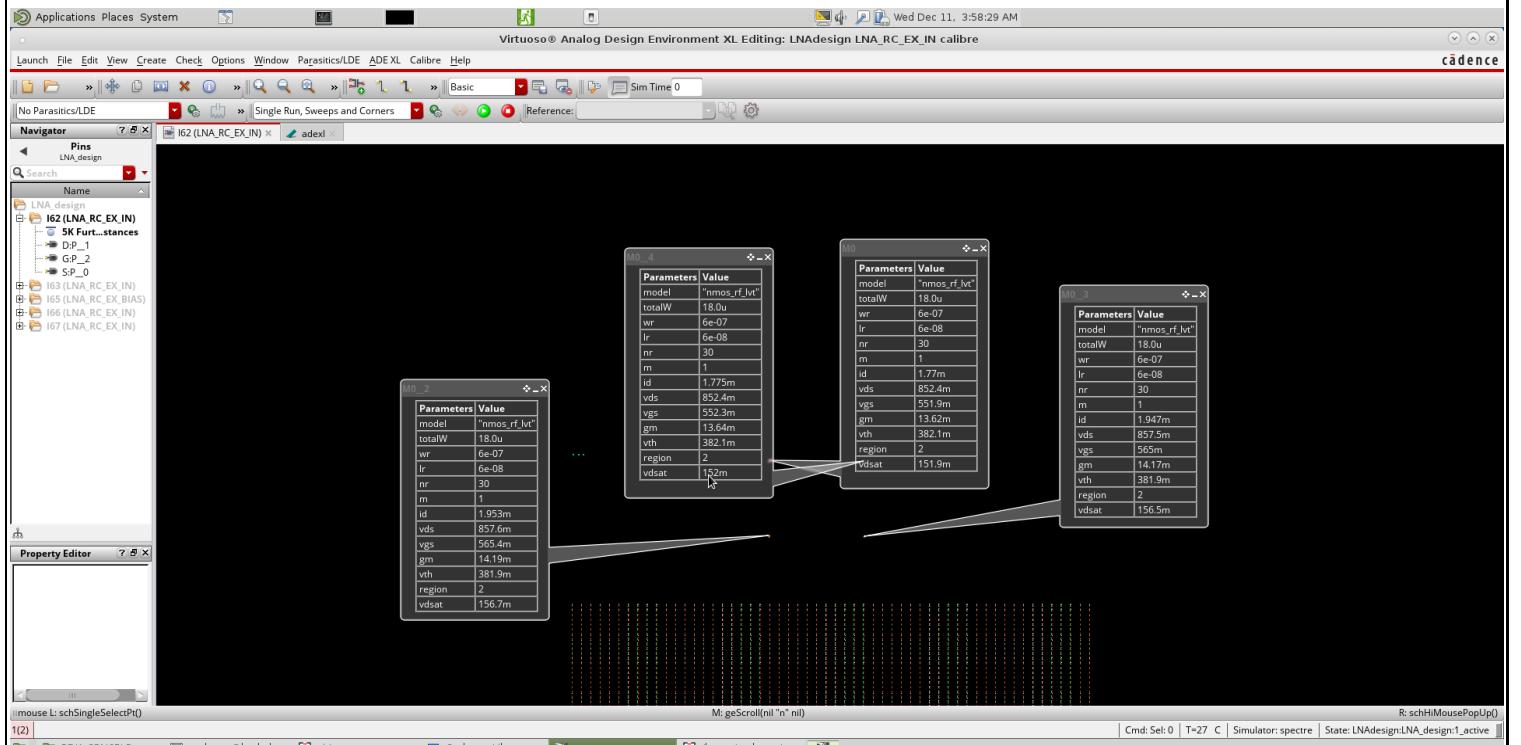


Operating point for the devices @ nominal:

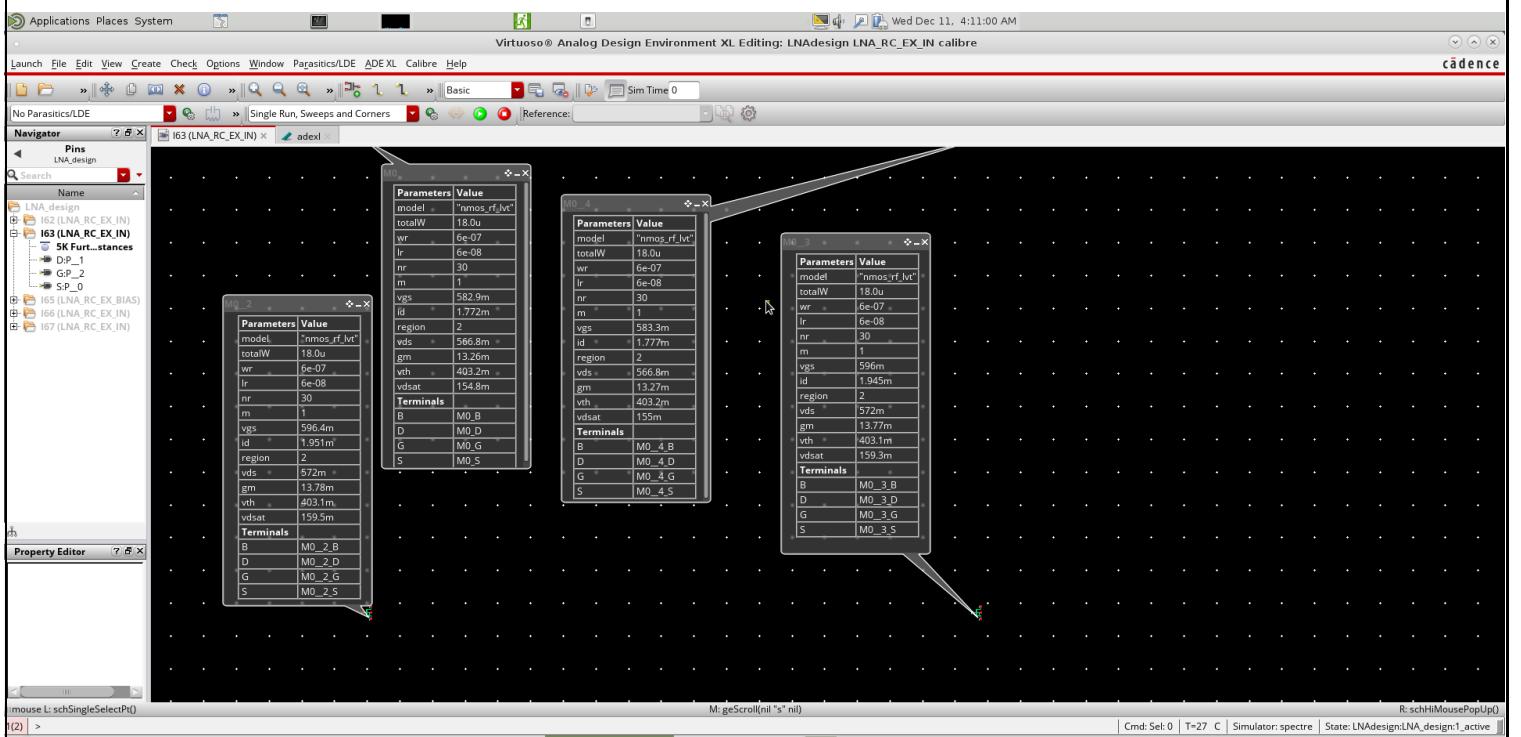
For the bias device :



For the input devices :

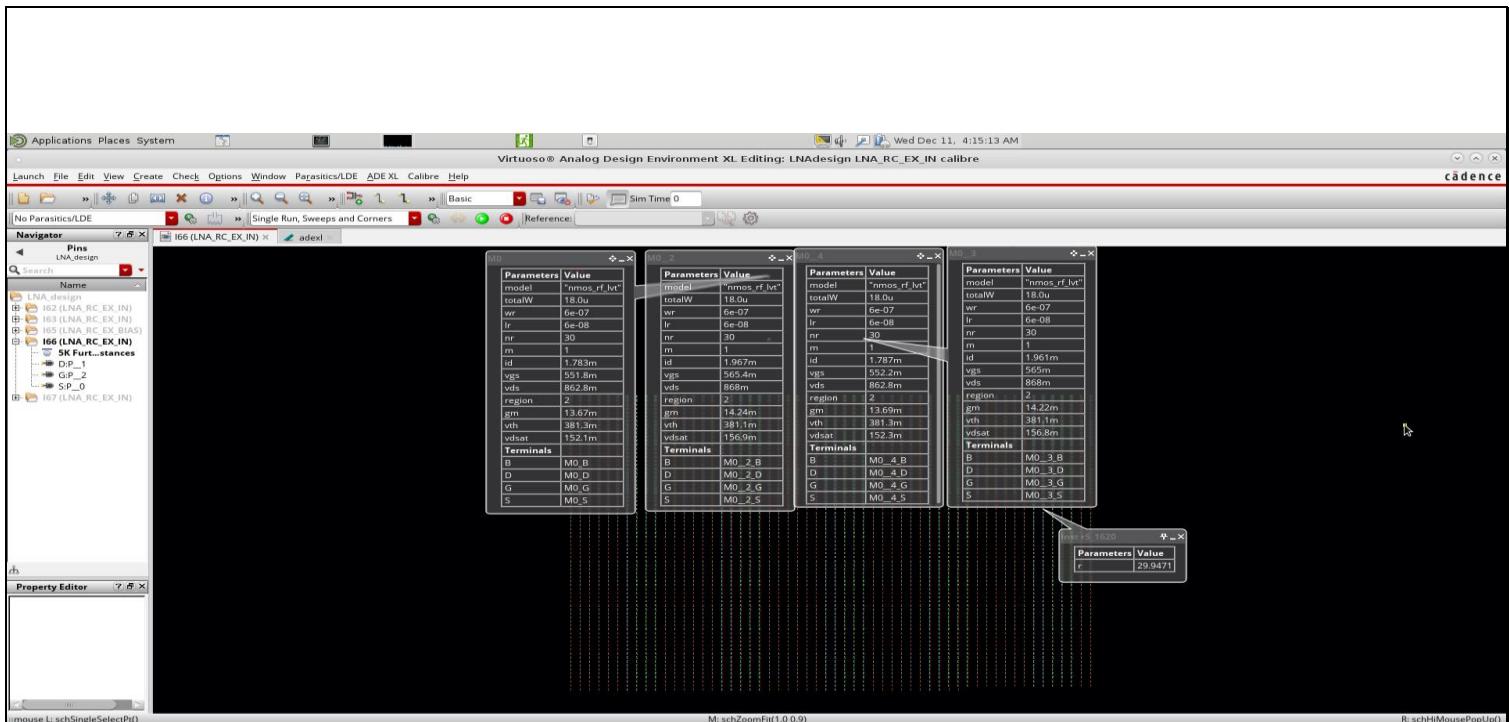


Operating point for the input transistor first stage.

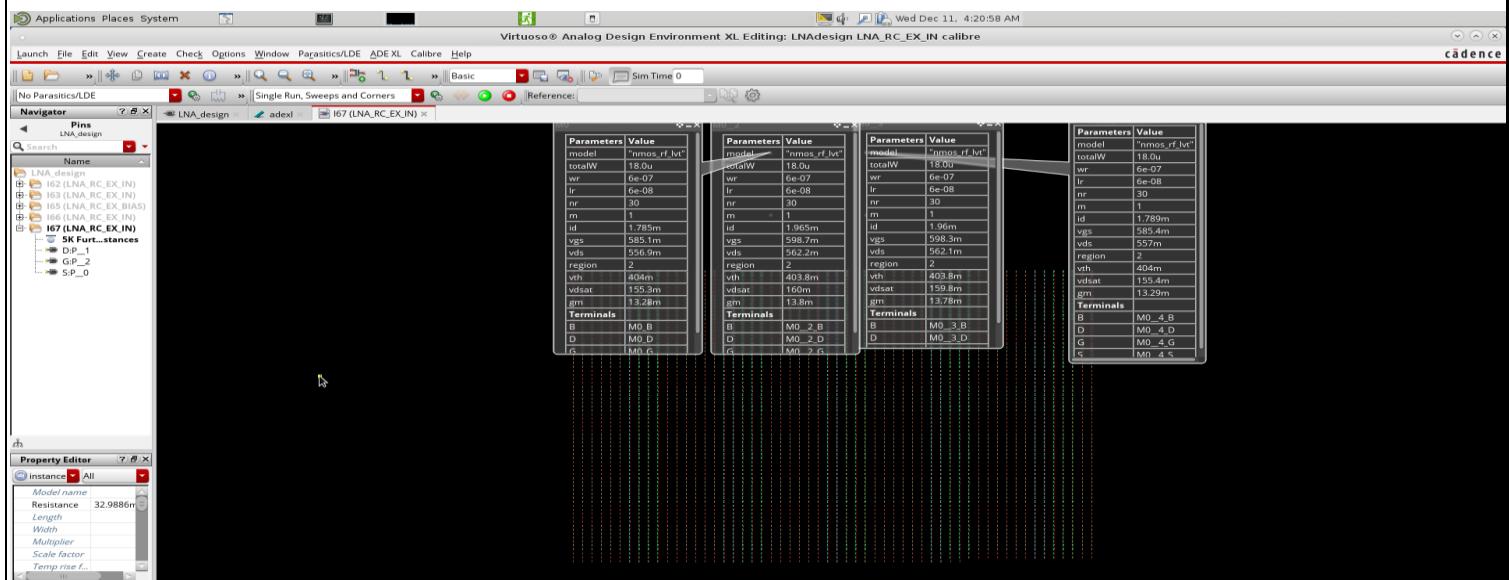


Operating point for the cascode transistor first stage.

$$\text{Current in the first stage} = 1.951 + 1.772 + 1.777 + 1.945 = 7.44 \text{mA}$$



Operating point for the input transistor second stage



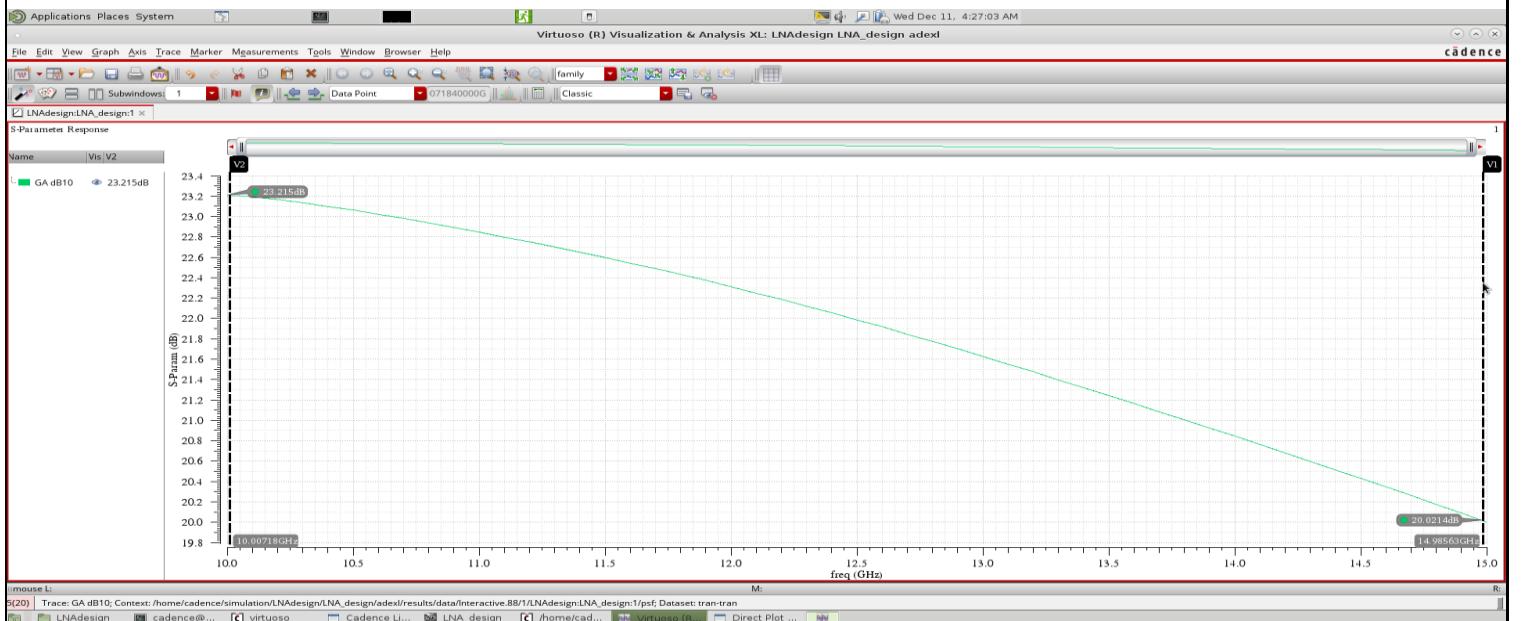
Operating point for the cascode transistor second stage

Current in the first stage = $1.965 + 1.785 + 1.789 + 1.96 = 7.499\text{mA}$

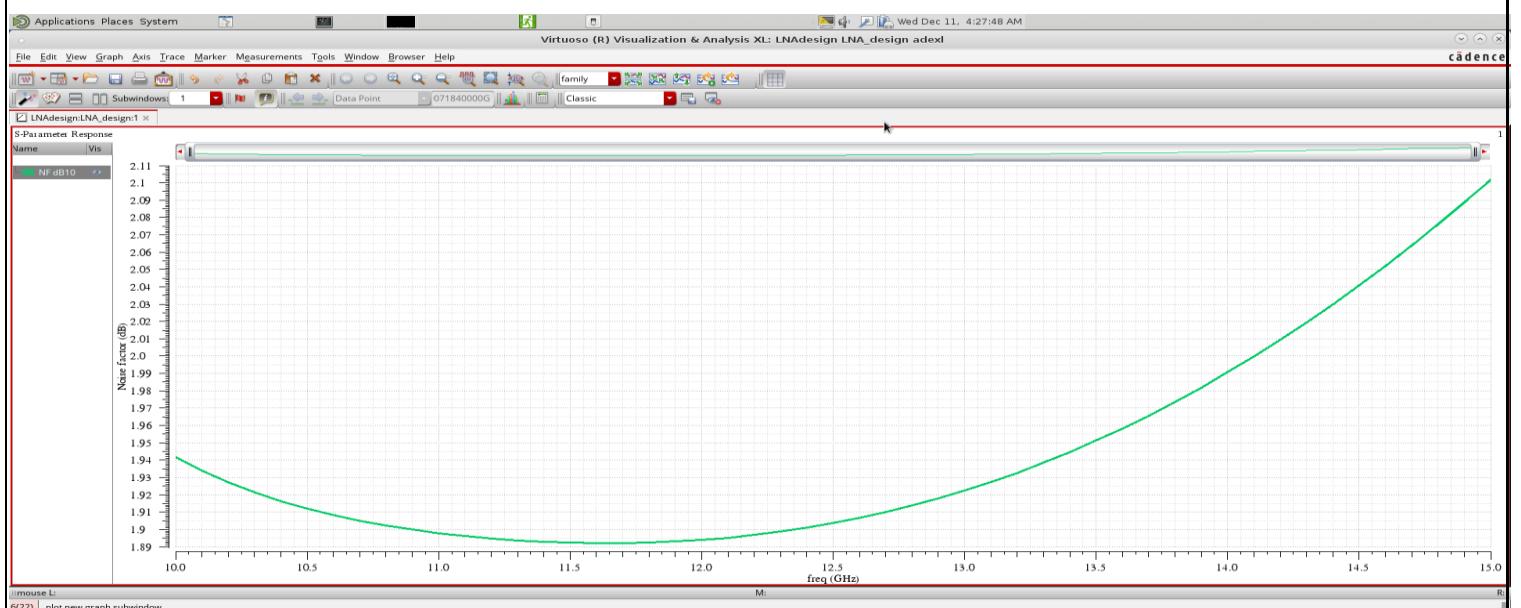
Total power consumption = $1.5 * (7.44 \text{ mA} + 7.499 \text{ mA} + 0.2\text{mA}) = 22.7085\text{mWatt}$

Show plots for the LNA gain, NF, NFmin, S11, S22, IIP3, and IP1dB versus Frequency

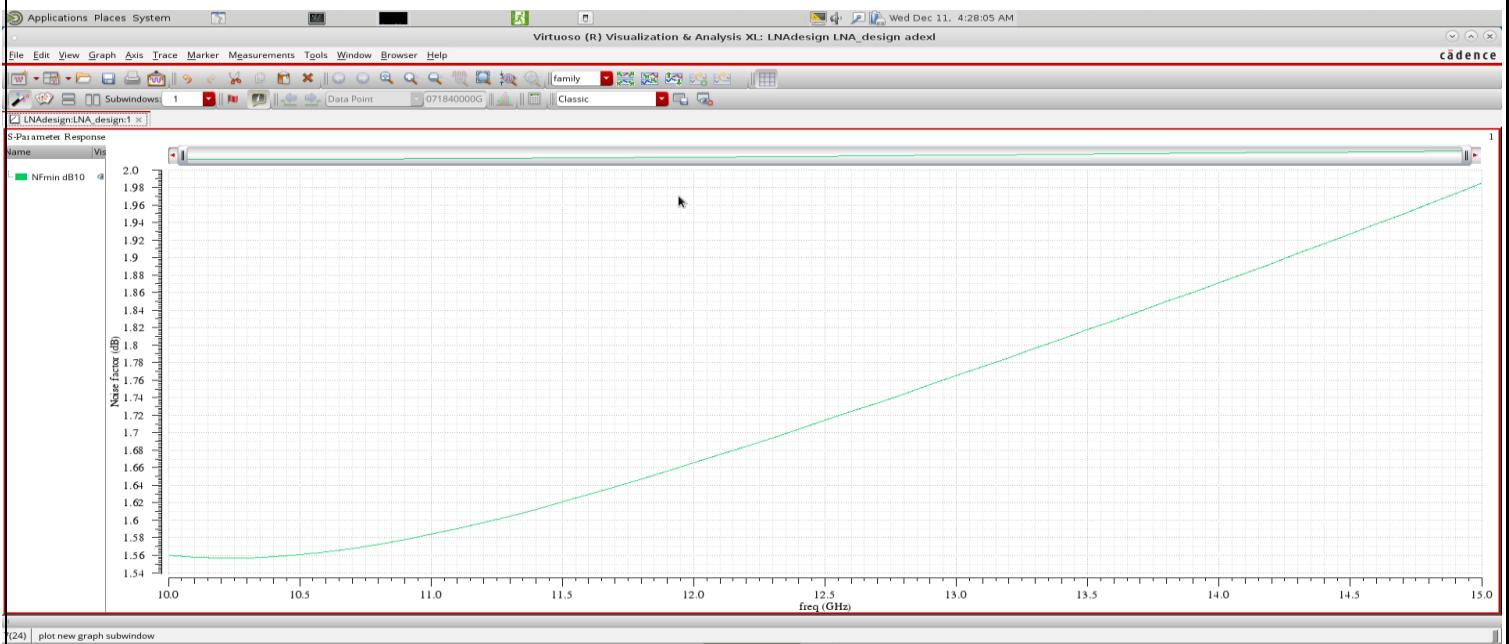
LNA gain:



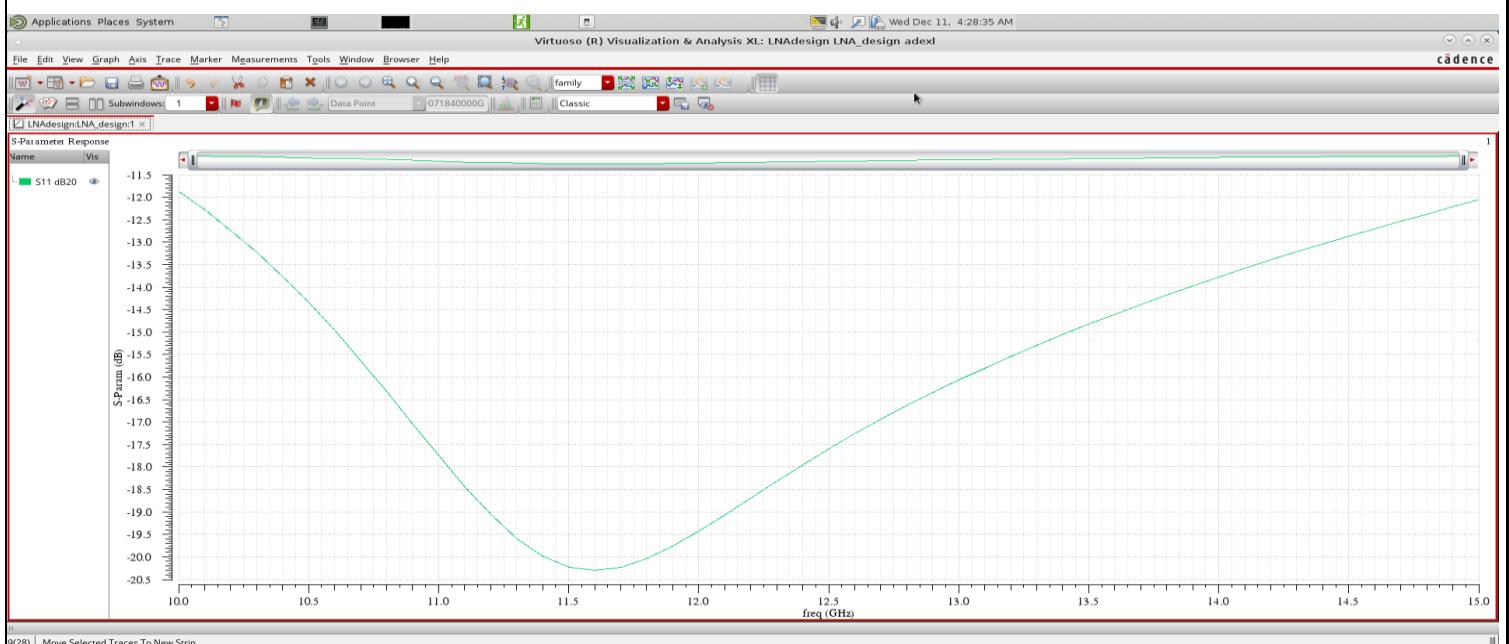
NF



NFmin



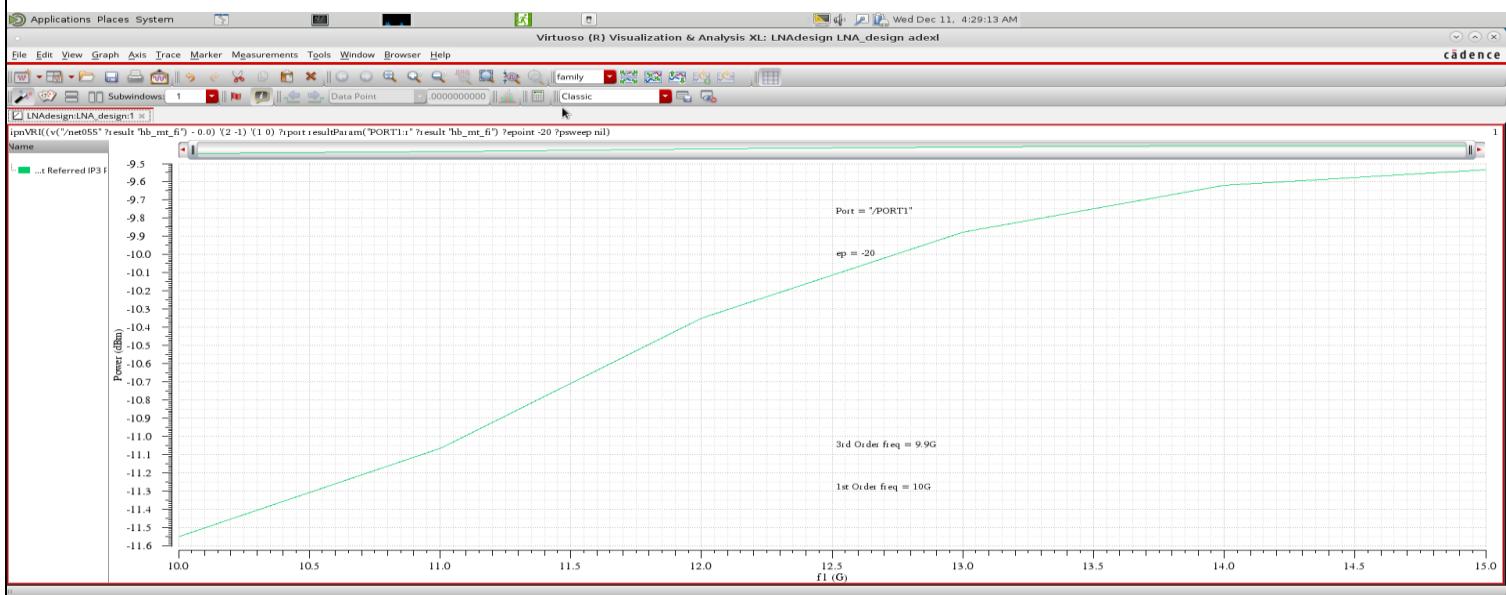
S11



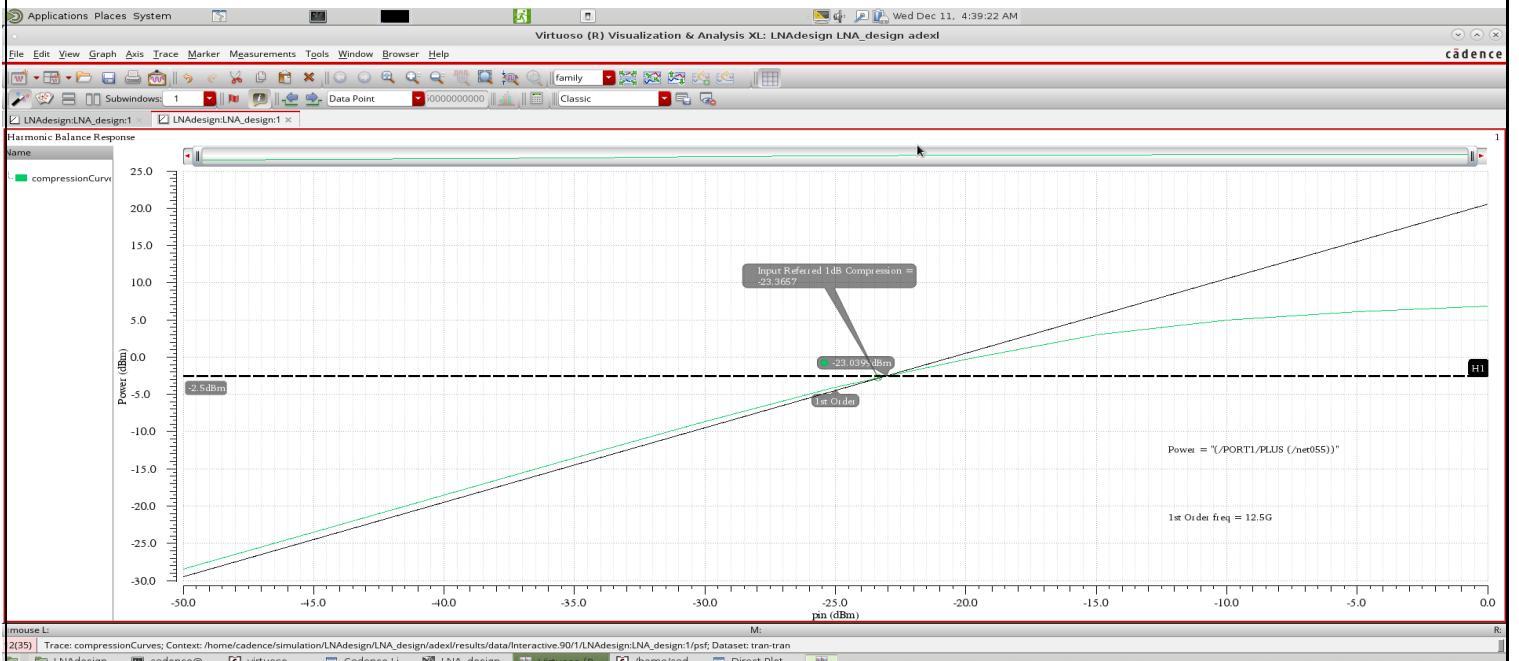
S22



IIP3



IP1dB



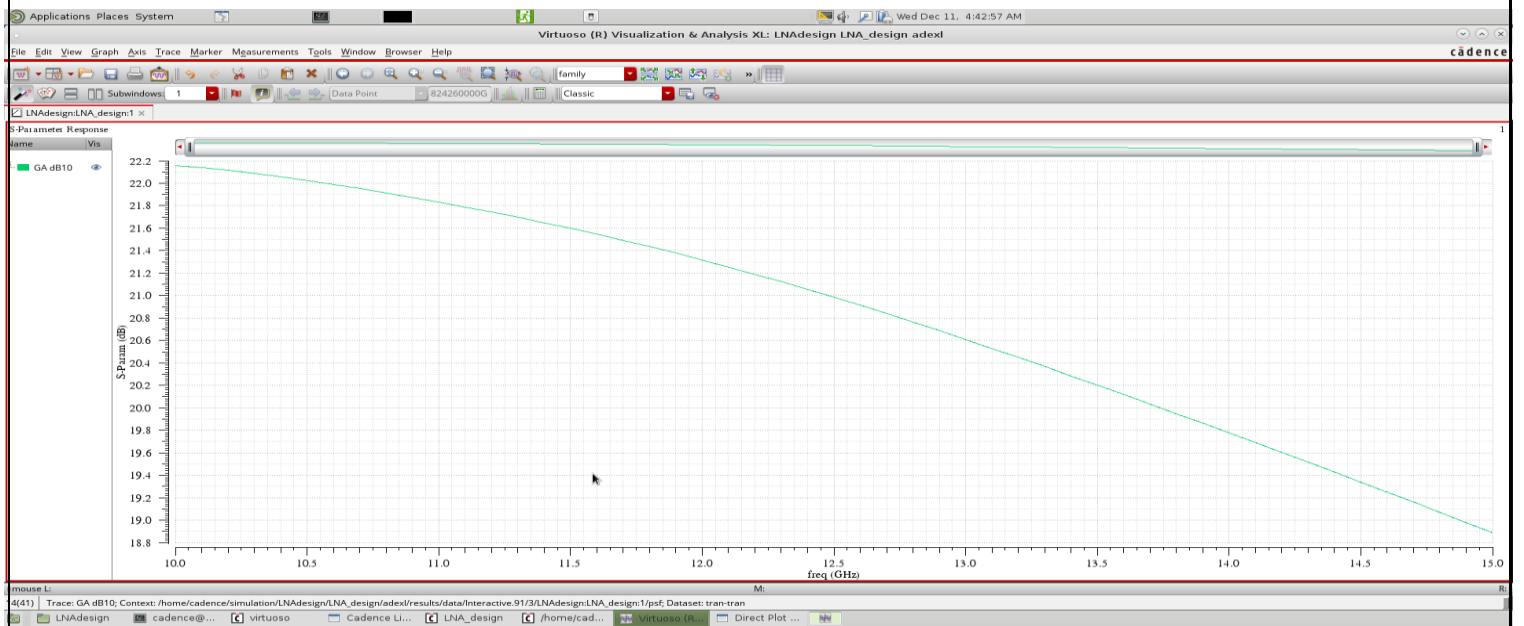
5. Repeat 4 across PVT corners (typical, slow hot low supply, fast cold high supply)

o Cold =-40°C, Hot =85°C

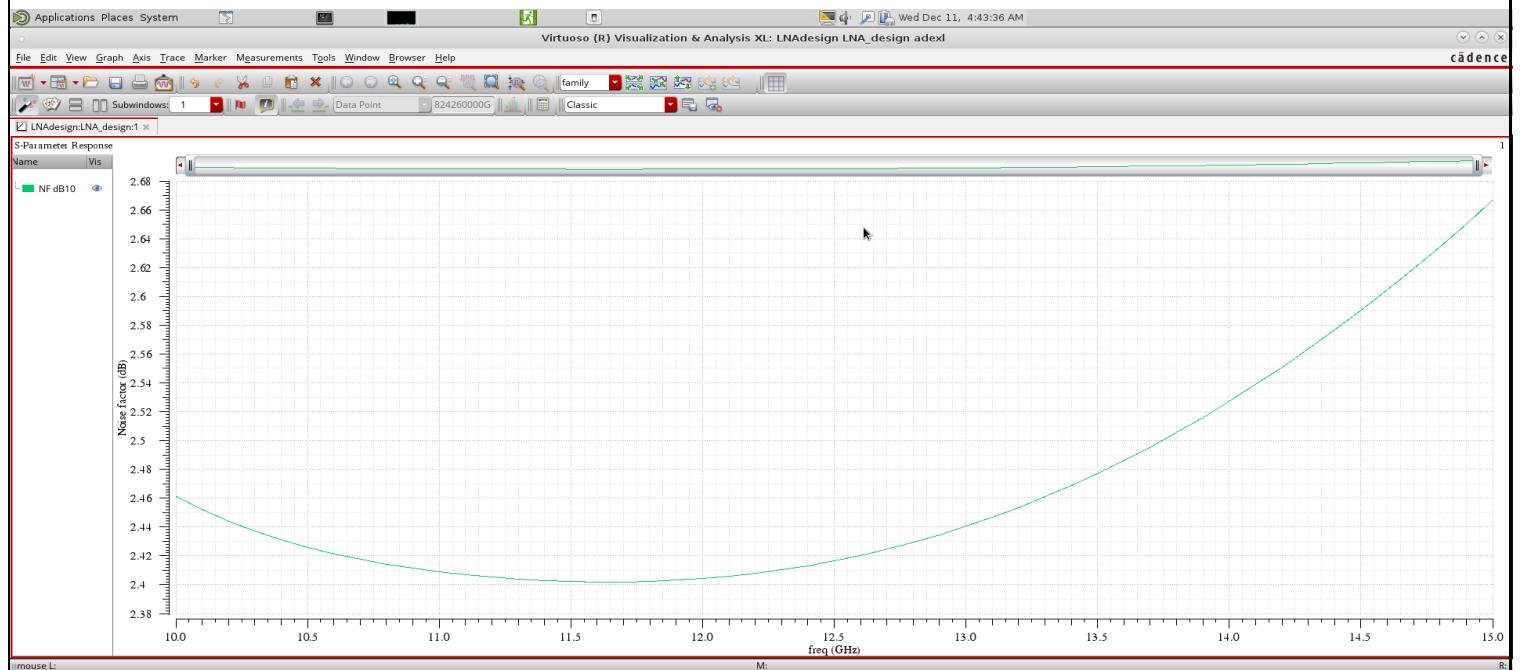
o High/low supply = +/- 10%

slow hot low supply

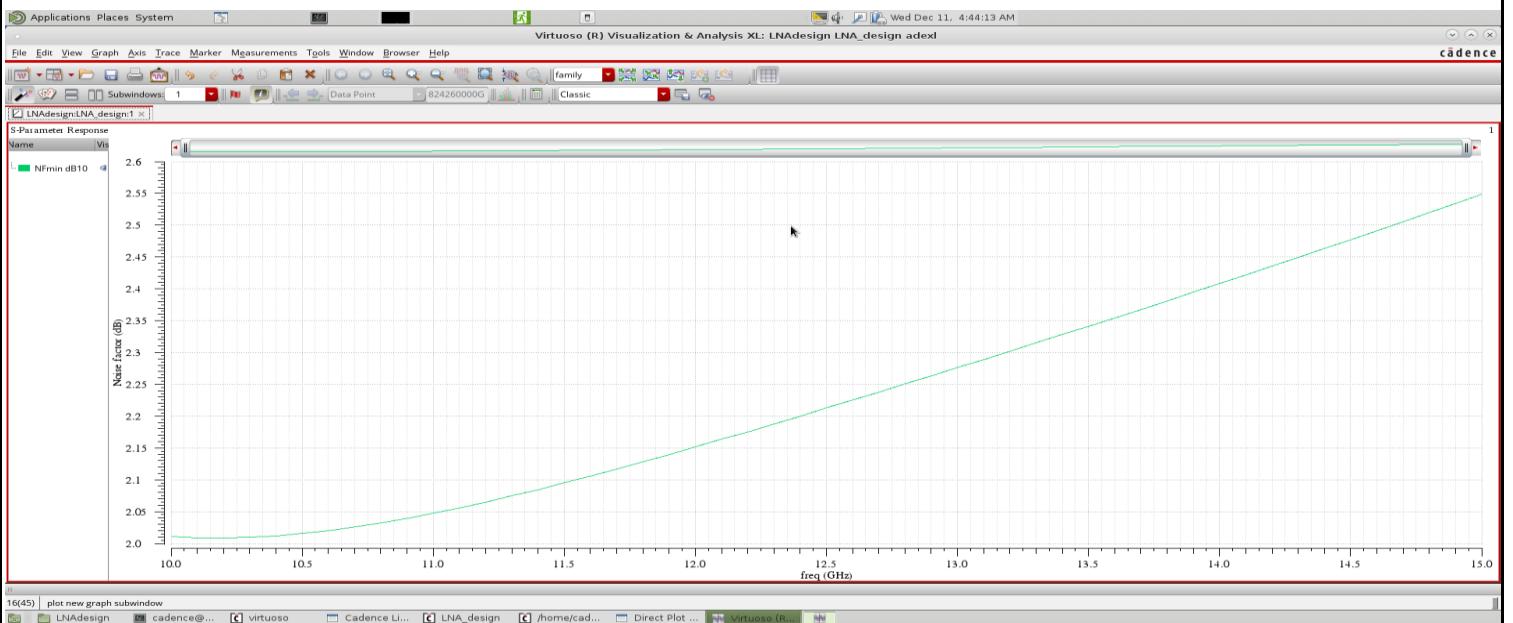
LNA gain:



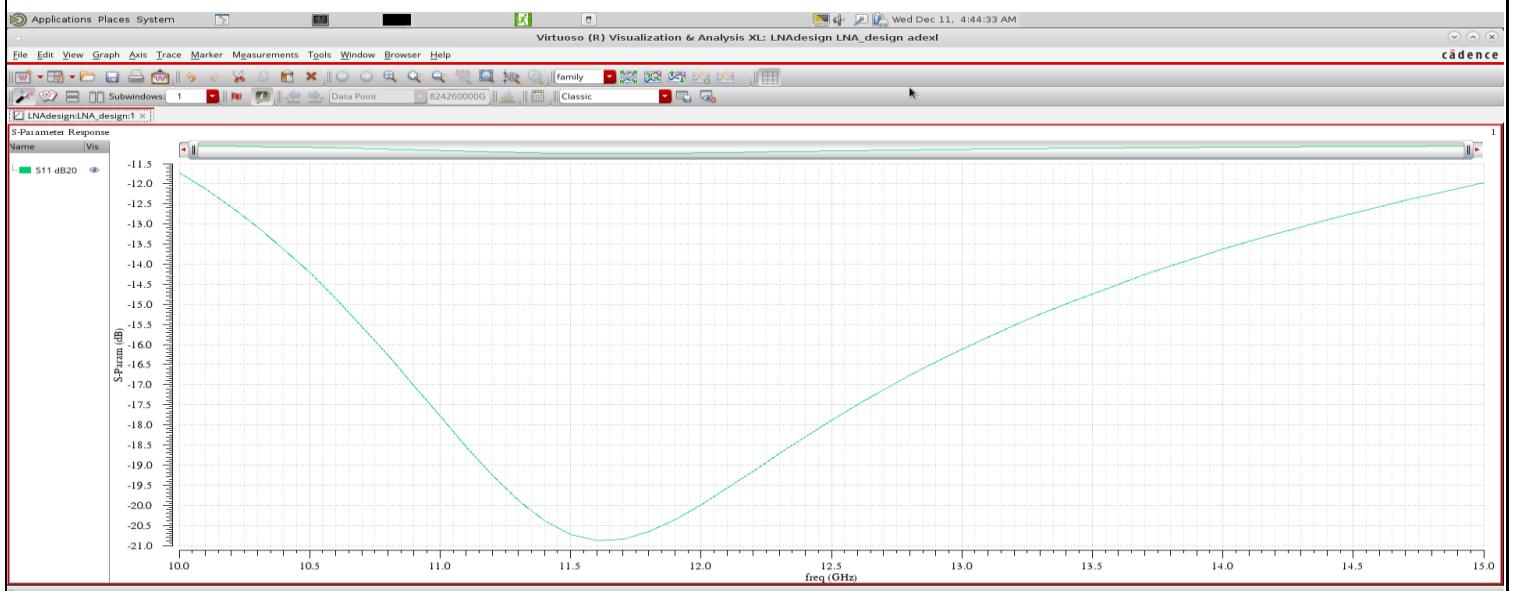
NF



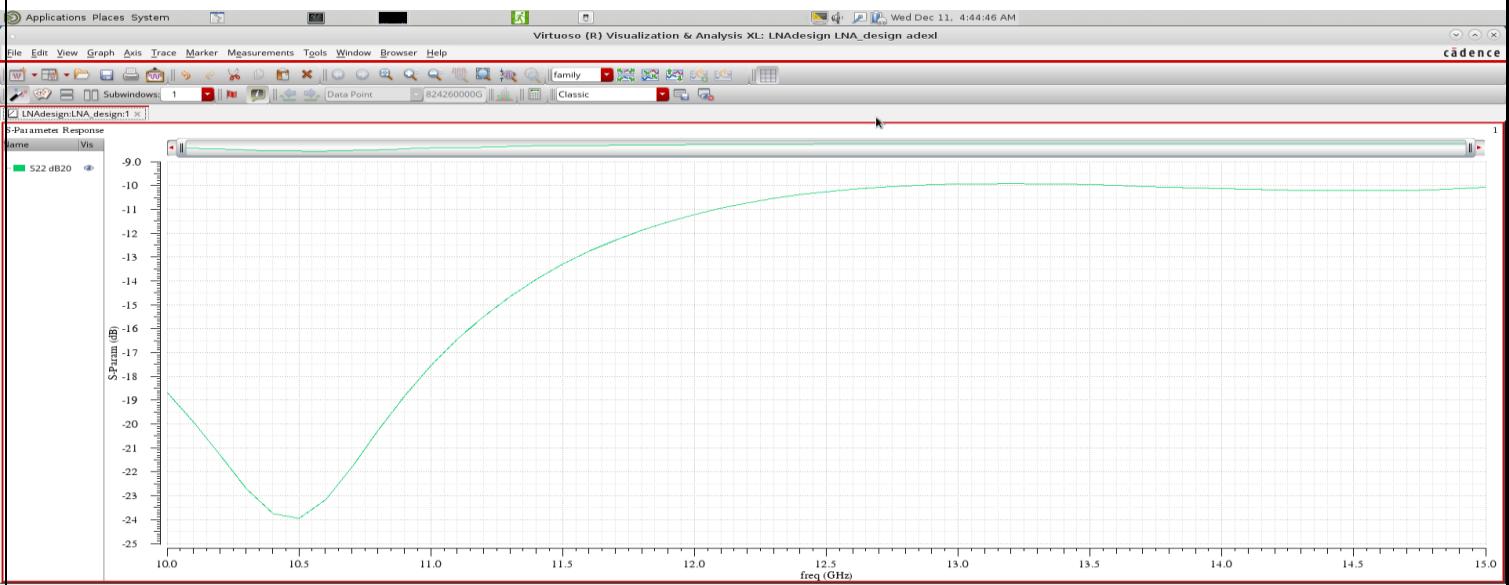
NFmin



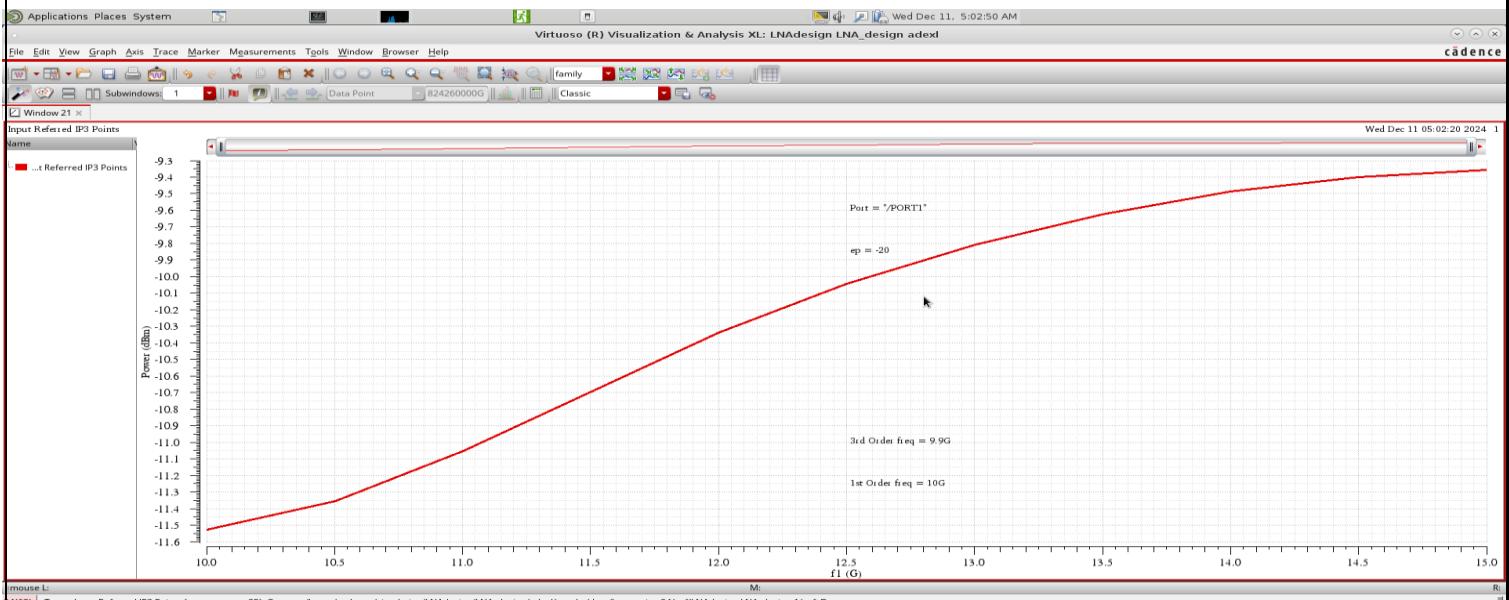
S11



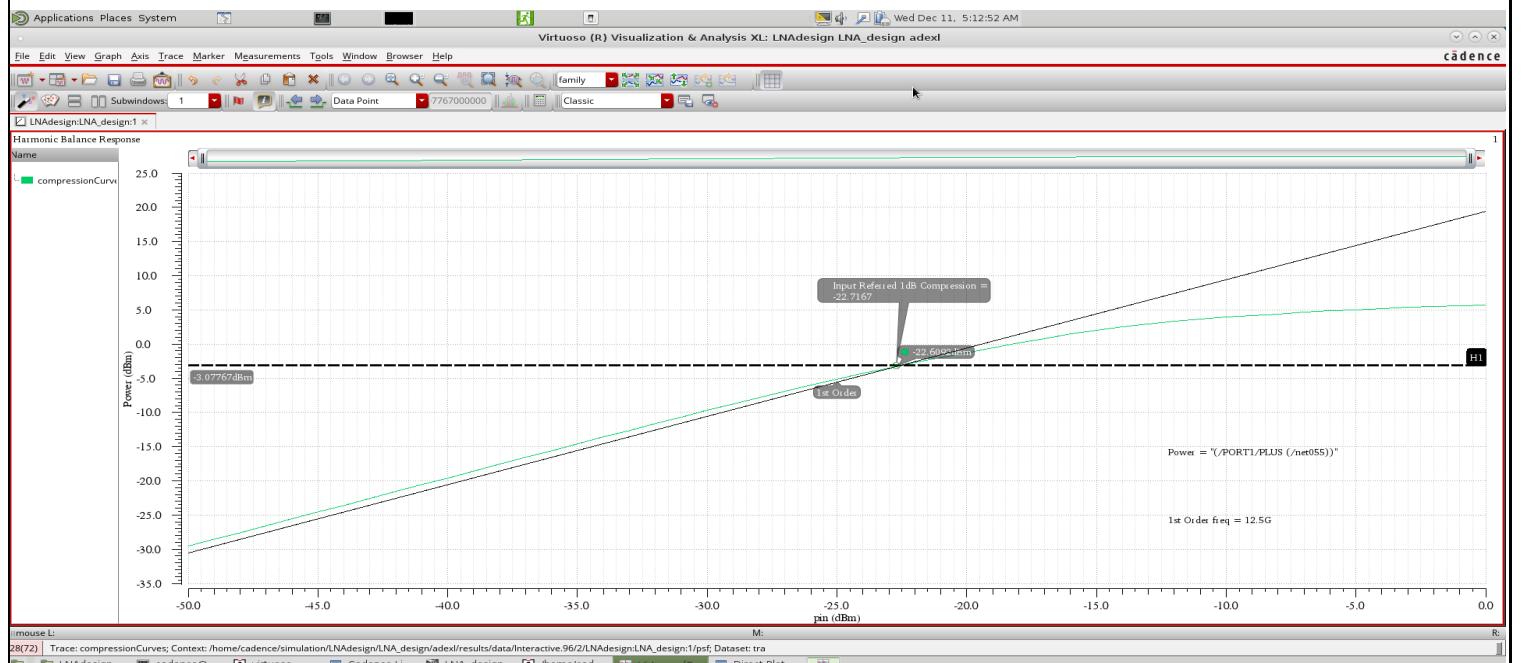
S22



IIP3

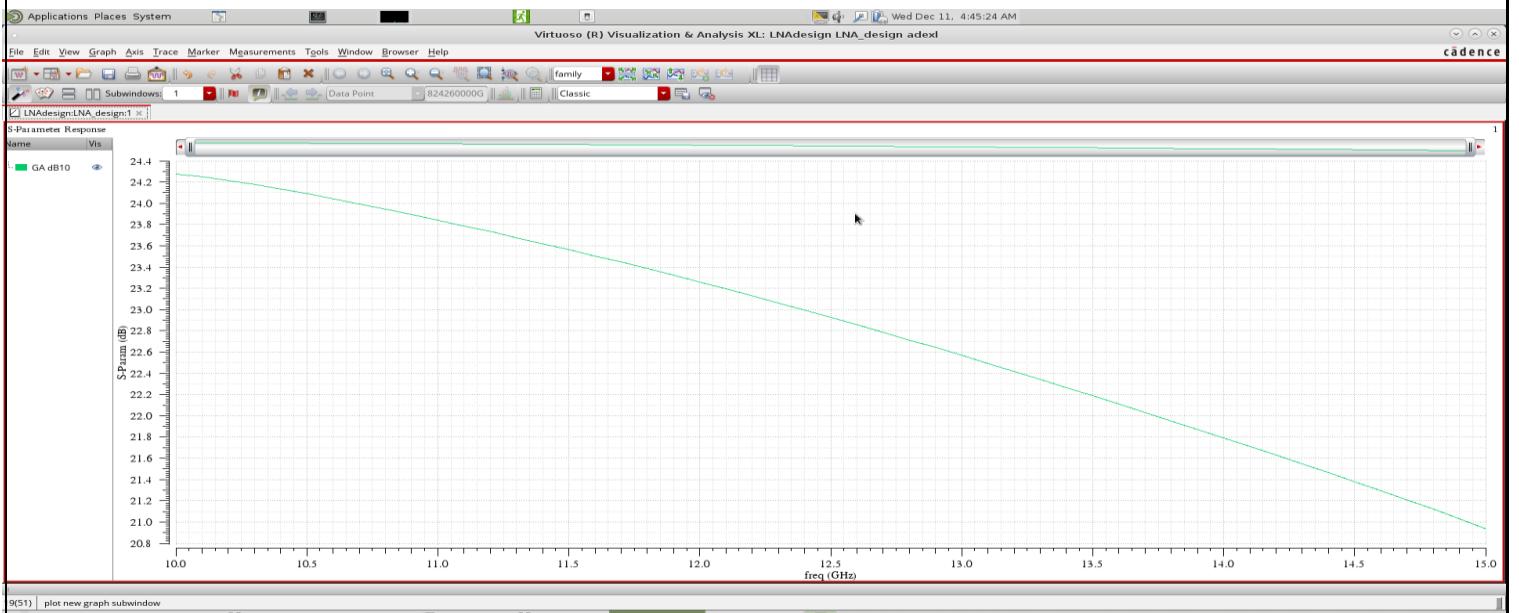


IP1dB



Cold high supply

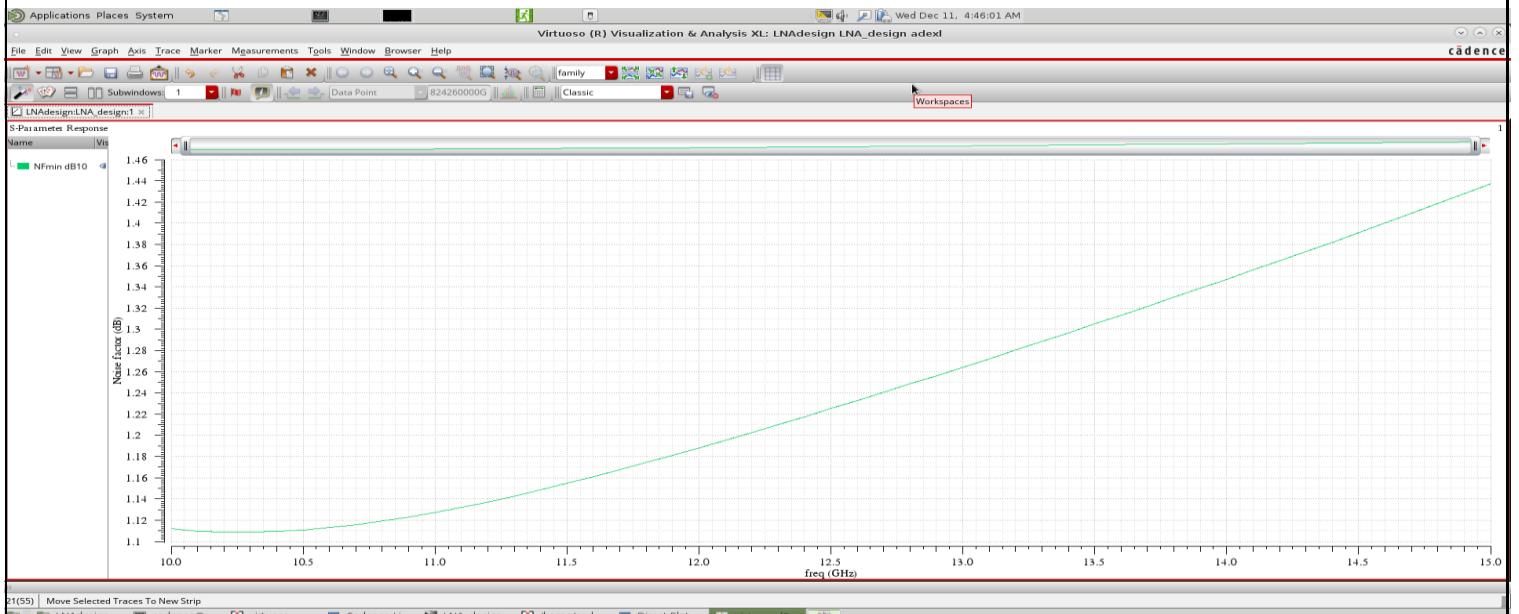
LNA gain:



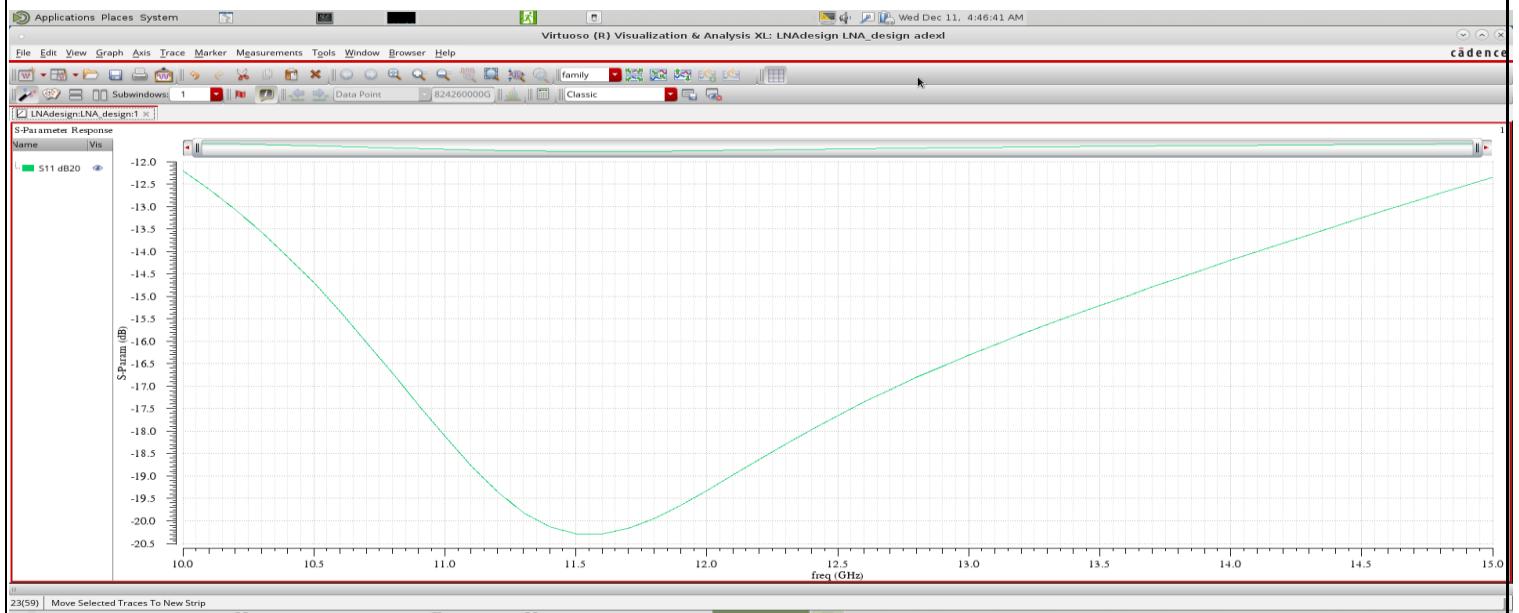
NF



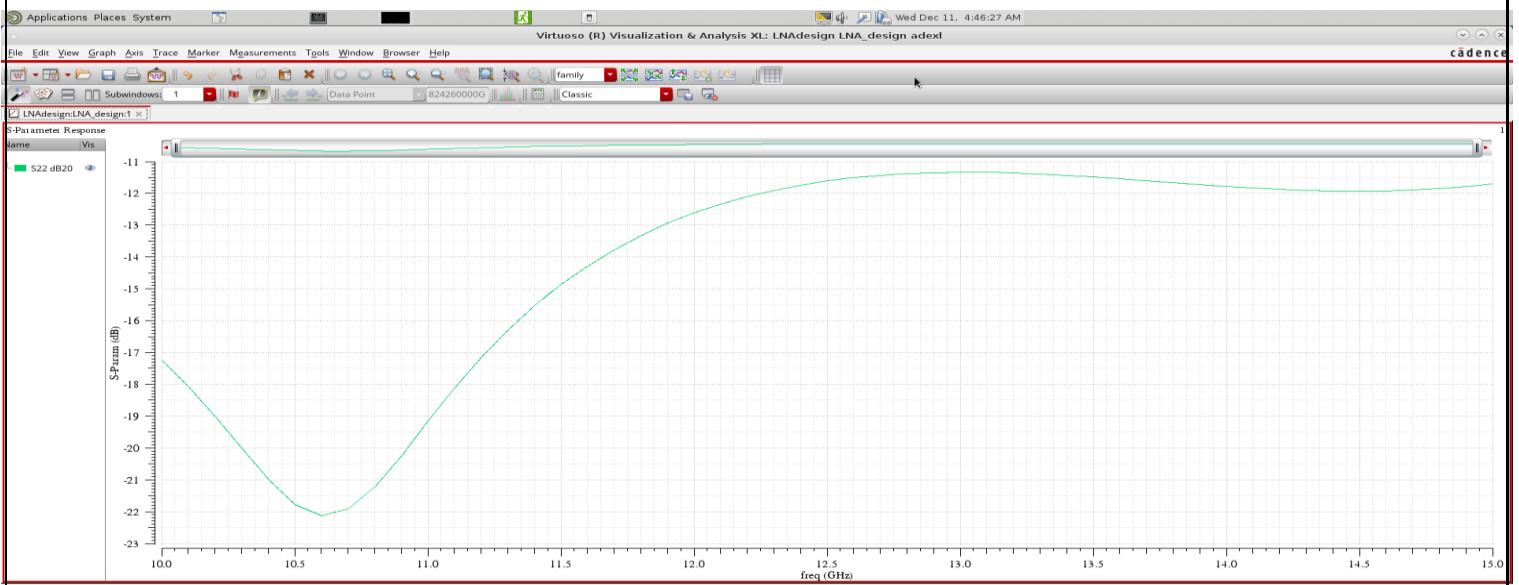
NFmin



S11



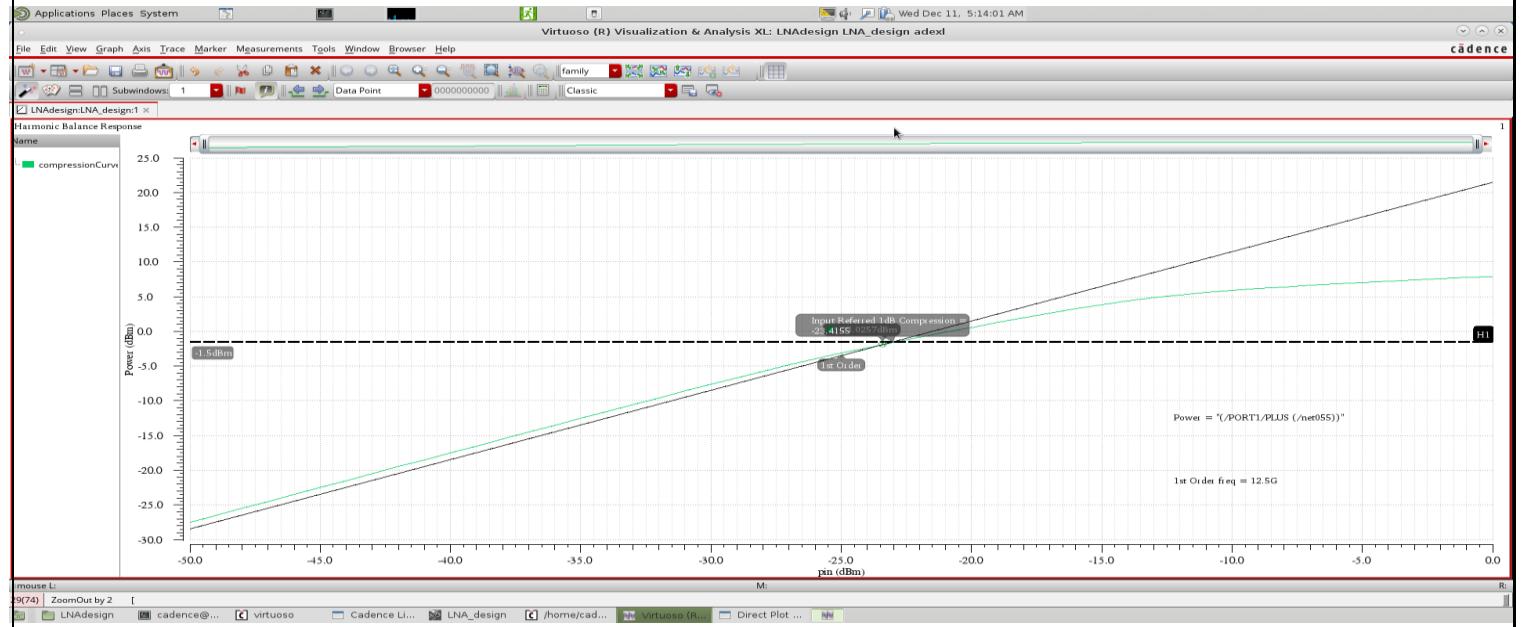
S22



IIP3

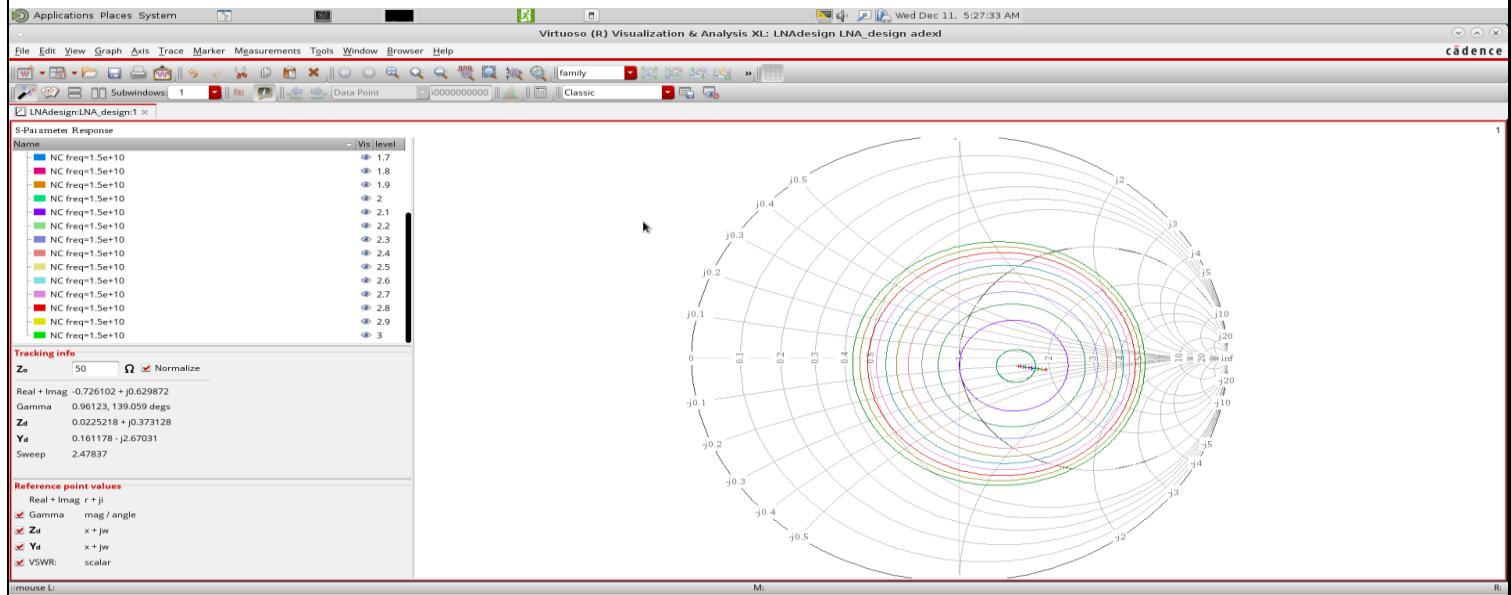


IP1dB

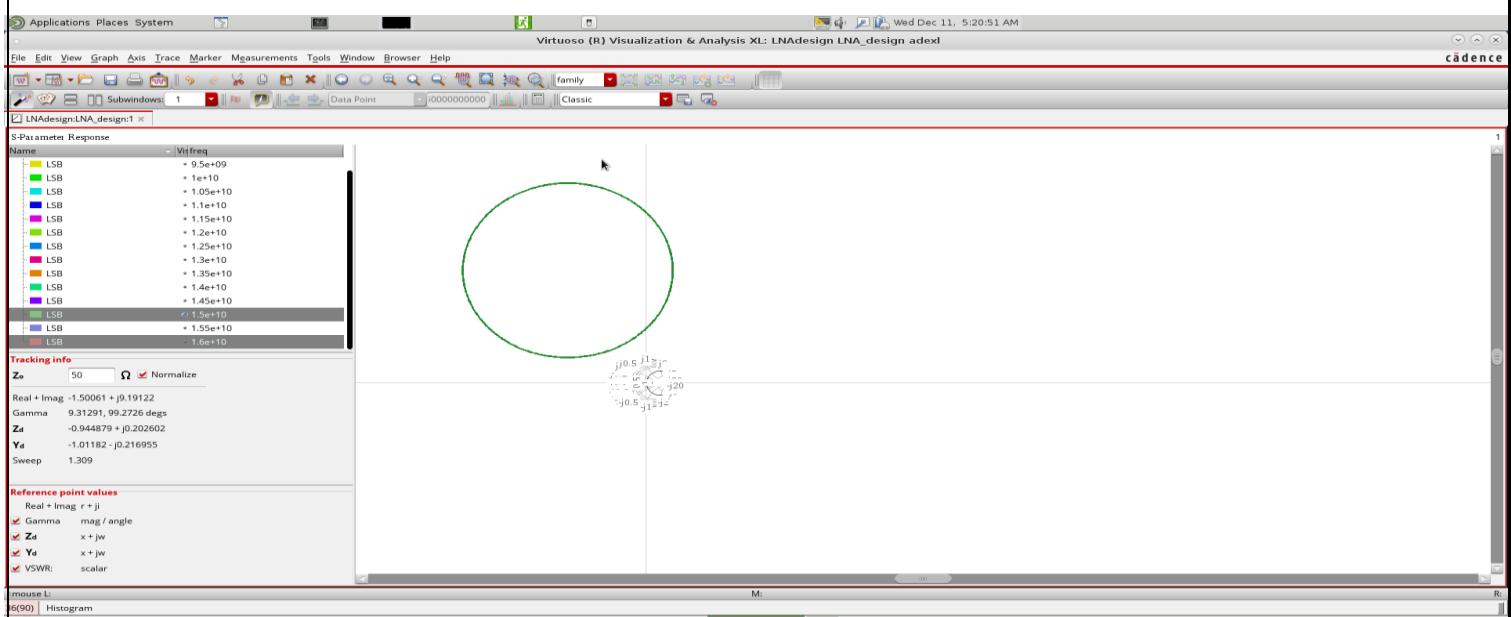


Show plots for the LNA noise, load, & source stability circles for the typical corner at 15GHz

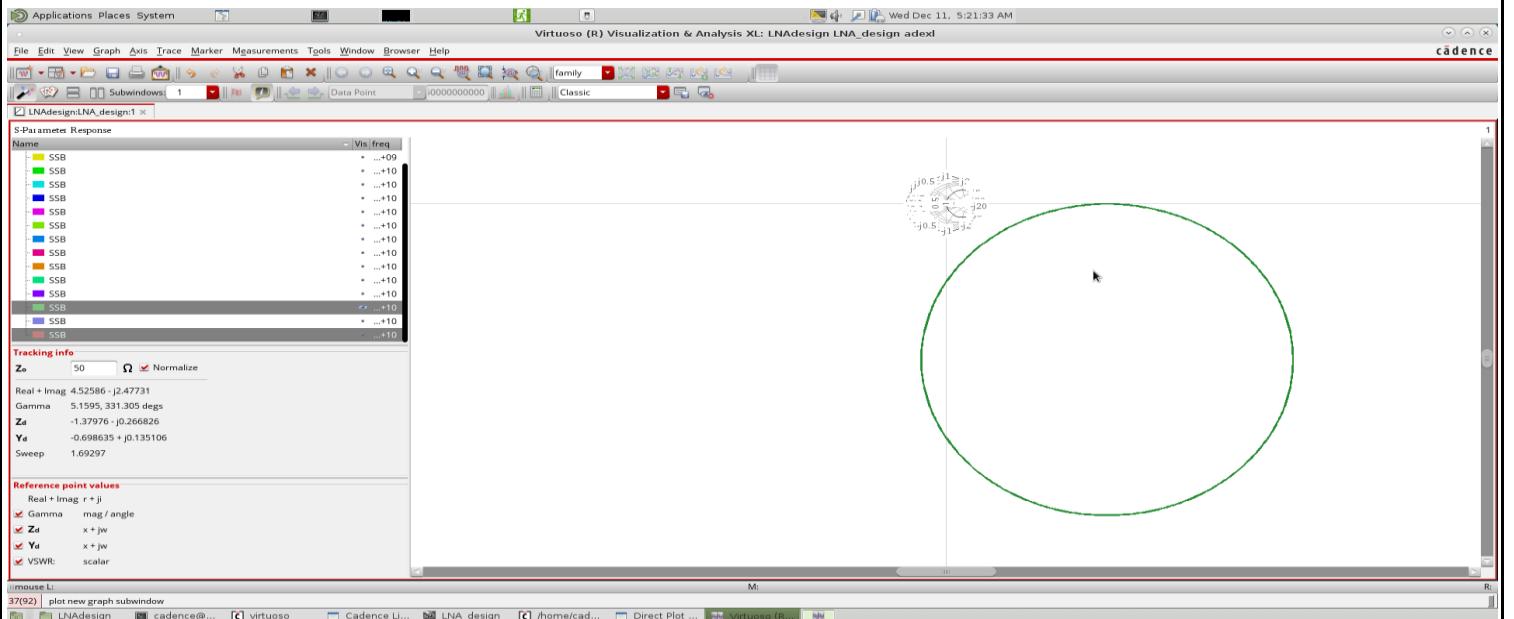
LNA noise



Load

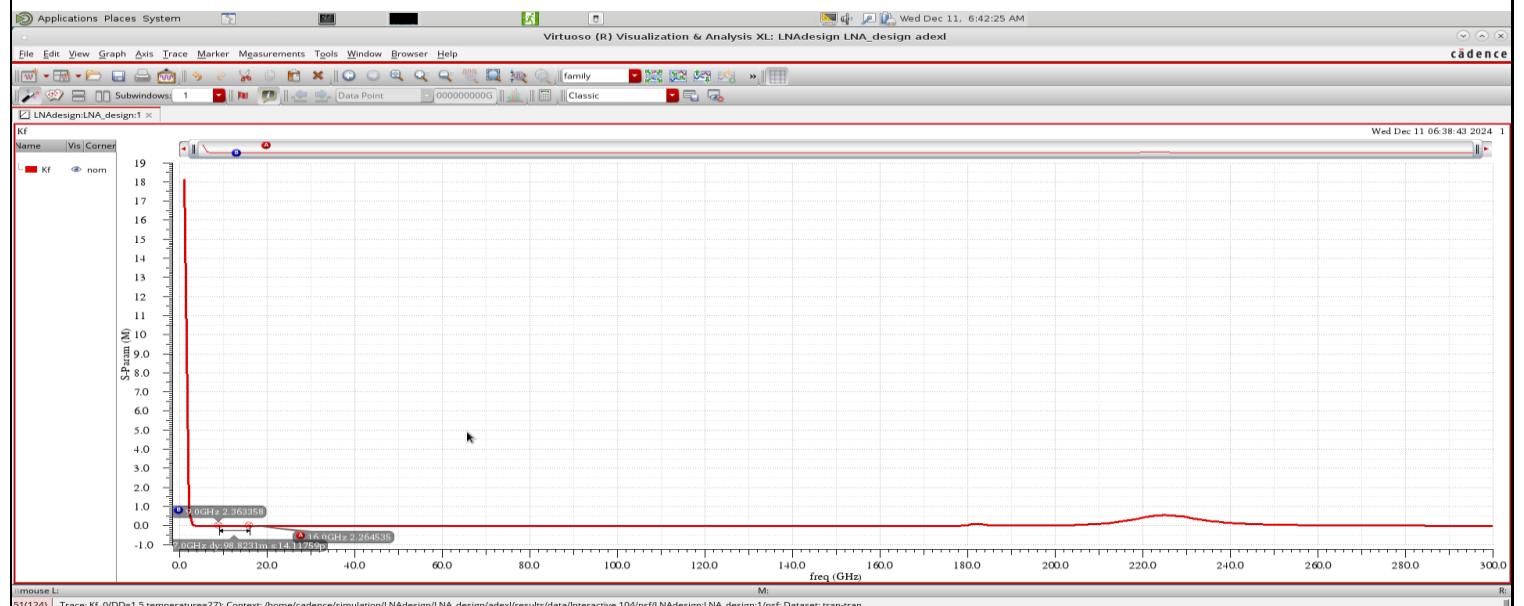


Source



Show plots for the K-stability factor across corners

Nominal



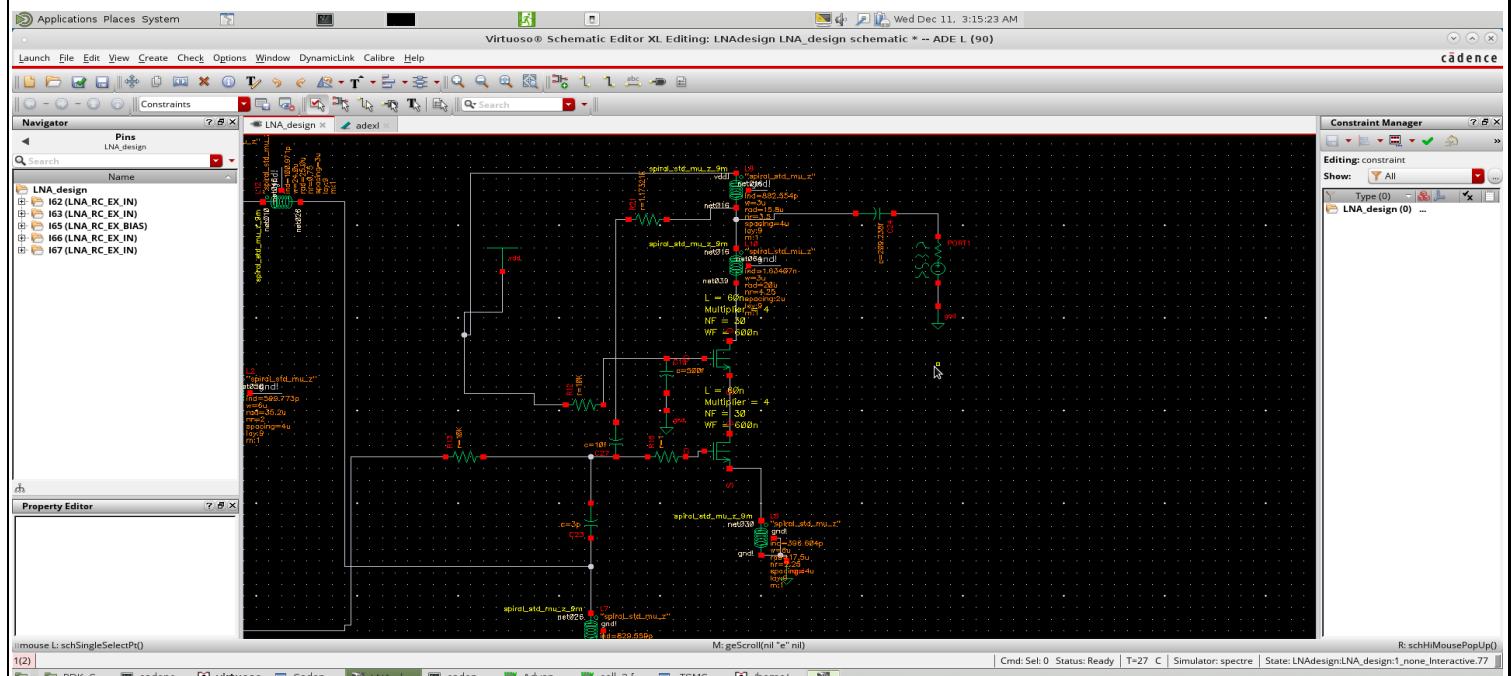
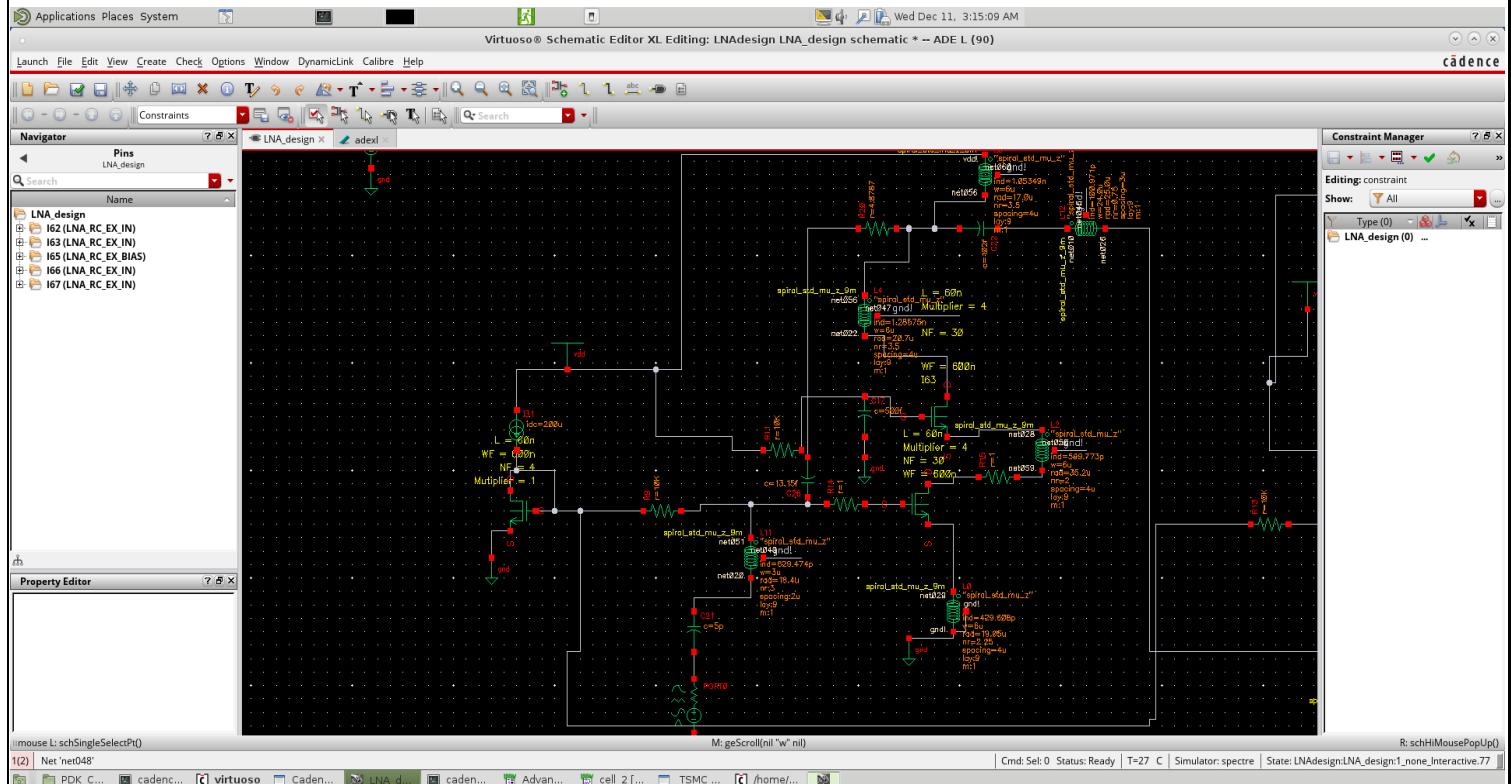
Corner Hot low



Corner cold high

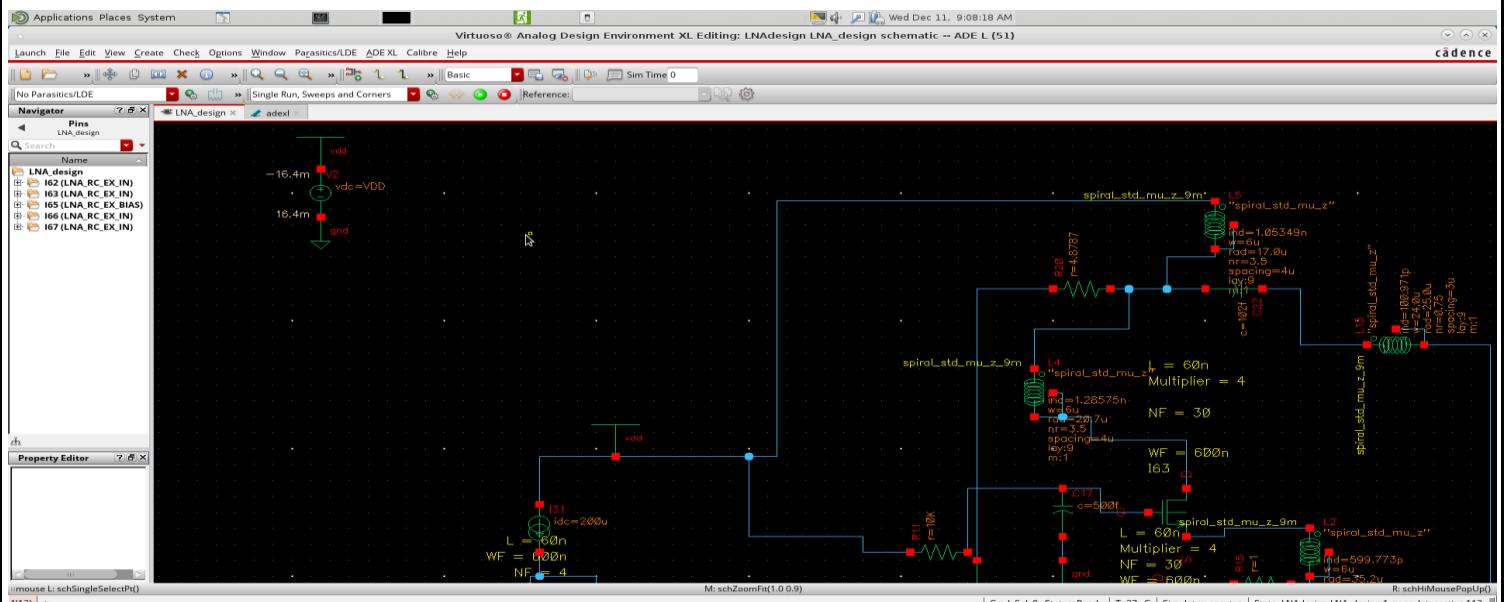


Include the testbench used to generate the results



	spec	slow	typical	fast	unit
Gain	20	18.8	20.08	21	dB
1dB BW(F_{low} & F_{high})		3.21667G	3.05G	3G	GHz
NF	2.5	2.66	2.1	1.54	dB
IIP3	-15	-11.5	-11.4	-11.6	dBm
IP _{1dB}	-25	-22.6	-23	-23.4	dBm

S ₁₁	-10	-11.5	-12	-12	dB
S ₂₂	-10	-10	-11	-12	dB
Power consumption		19	22.7	27.06	mW



power consumption = $16.4 * 1.65$ (cold high supply corner) = 27mwatt

