Cryogenic Wideband MMIC-LNA development in SHAO

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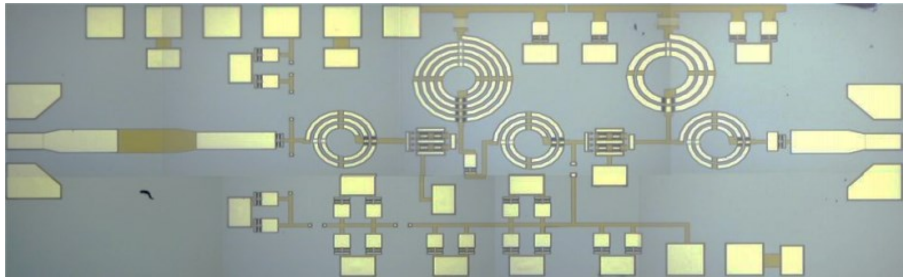
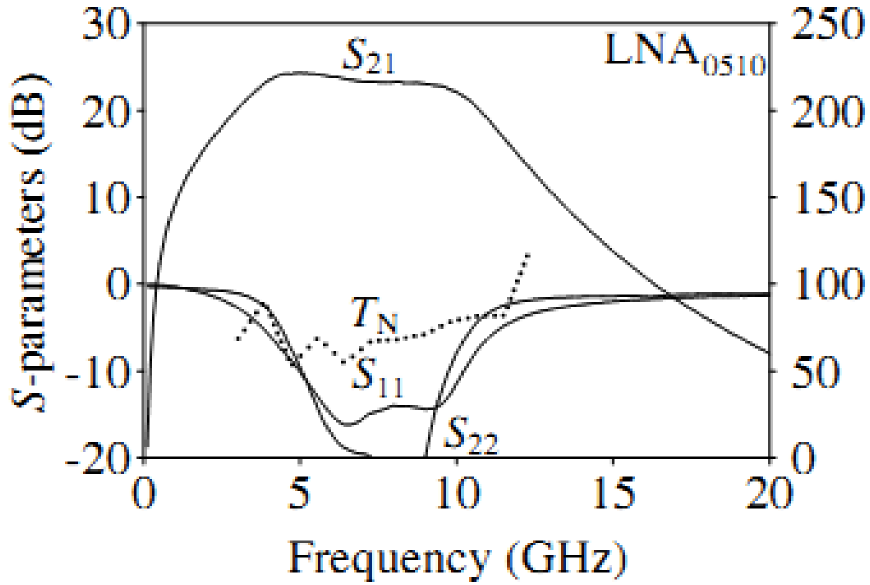
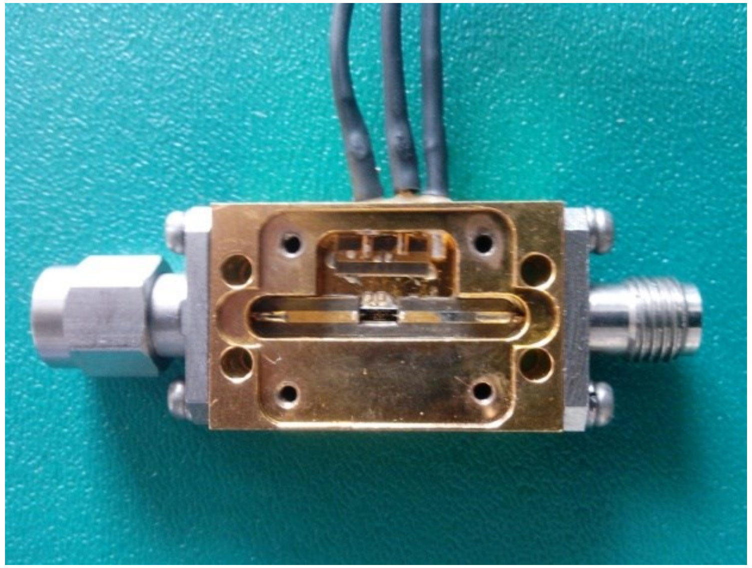
Photographs and Measured Results

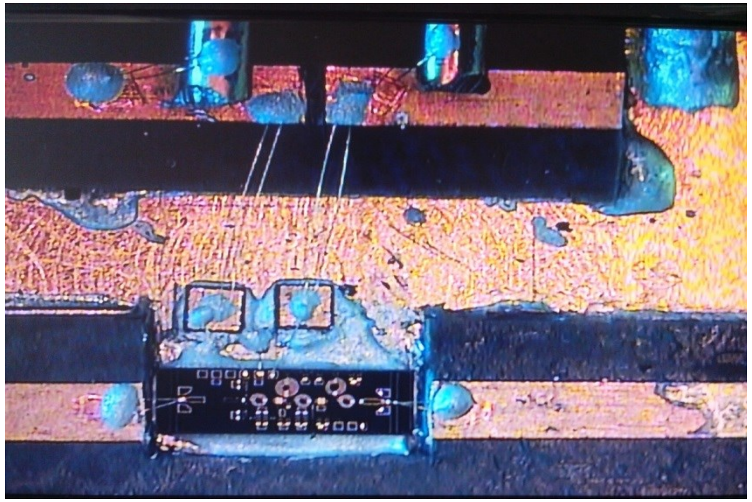
5-10GHz LNA
2300×900um (2 stages)





Average T_N = 80K

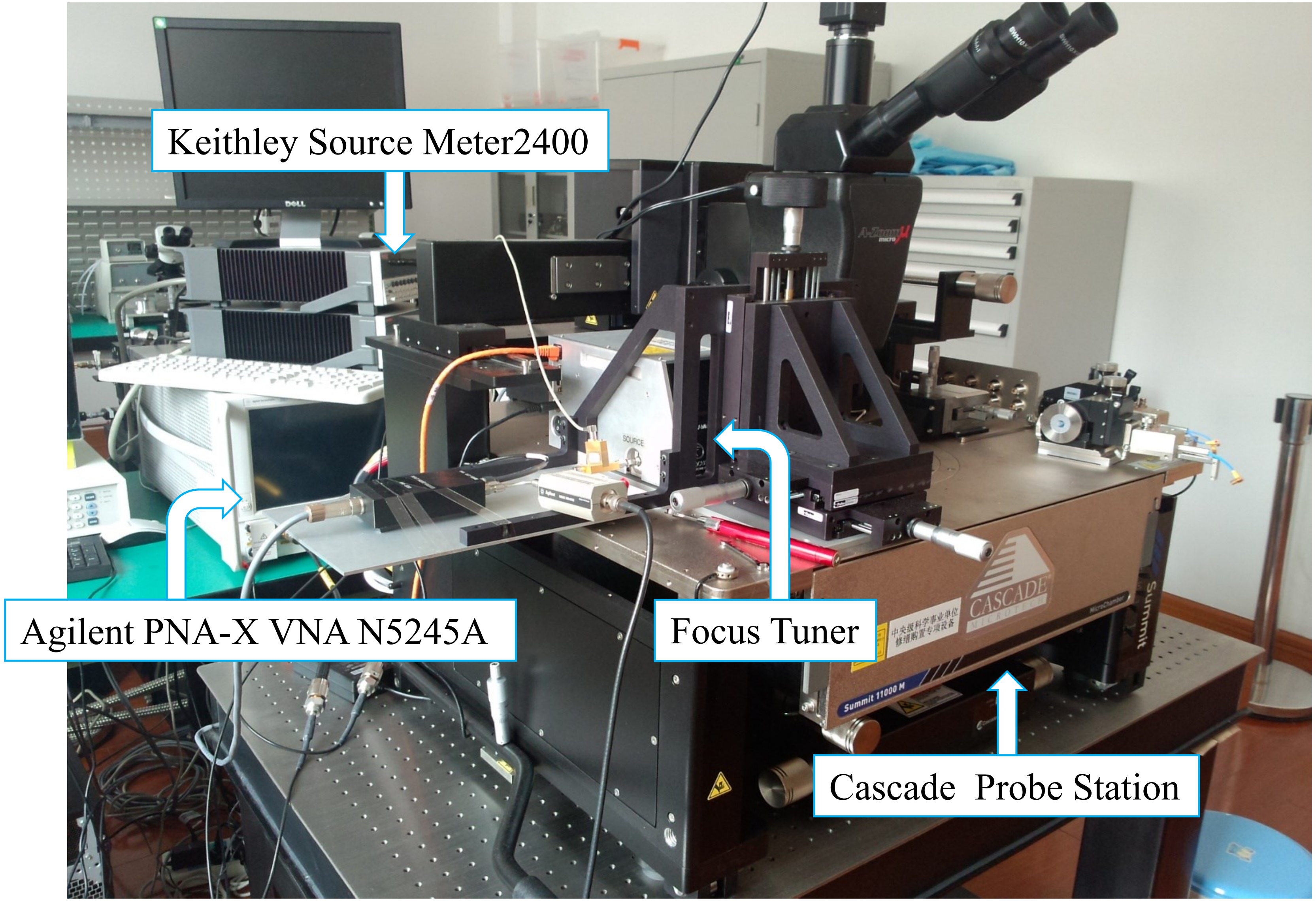




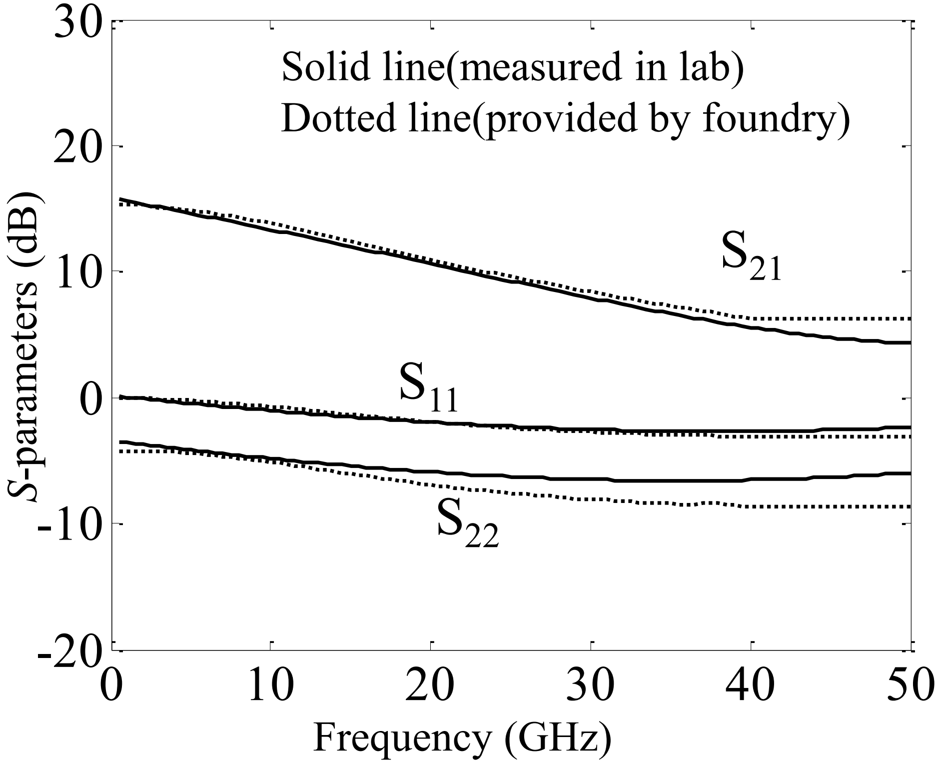
Micro-Packaging Equipments

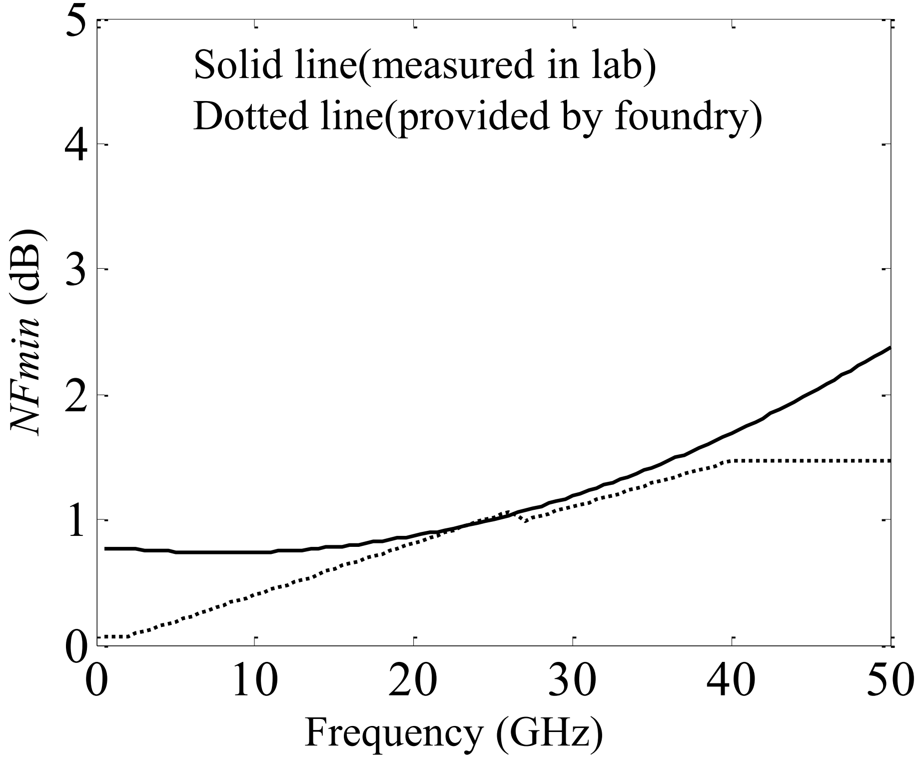
Wire Bonder	Dual Head Epoxy Die Bonder	Single Head Eutectic Die Bonder

MMIC On-Wafer Measurement System

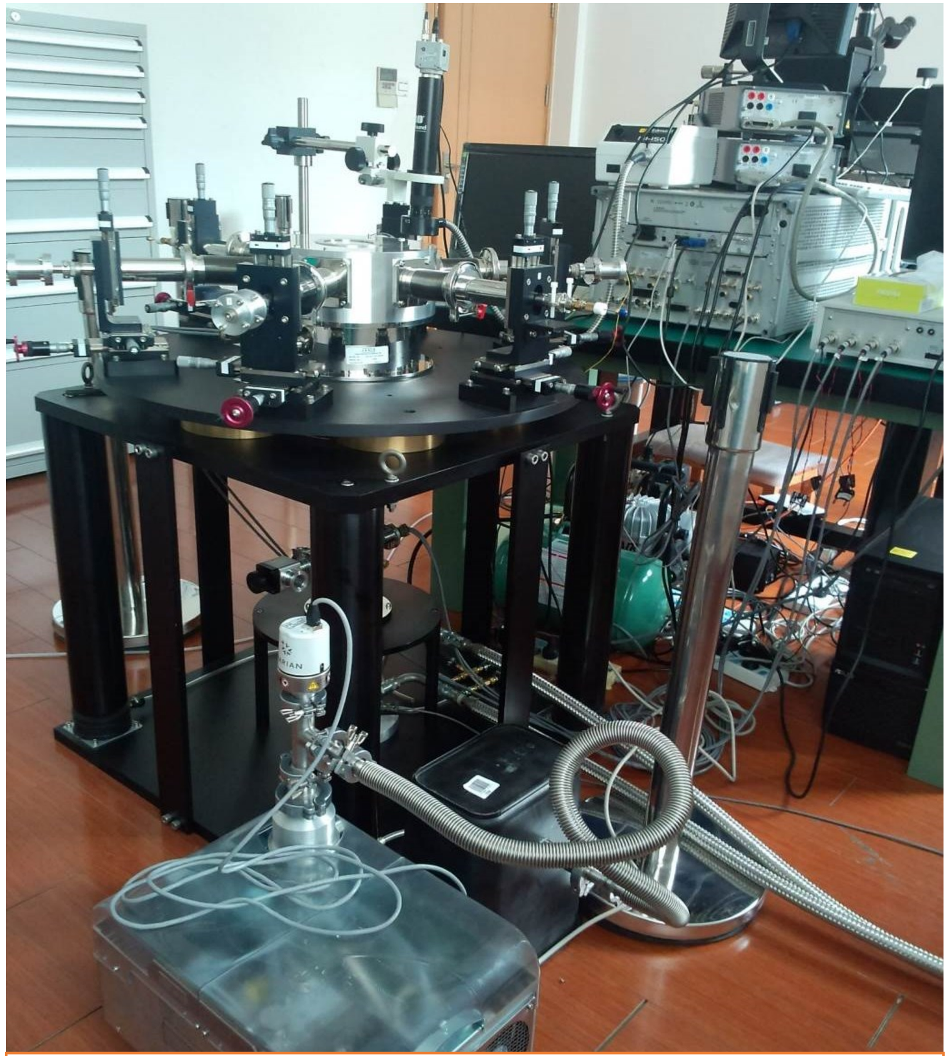


Transistor Parameter Measurement





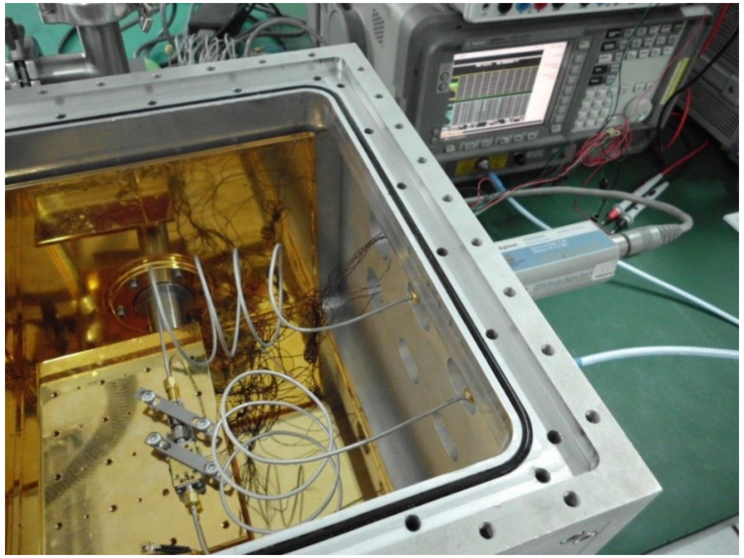
Cryogenic Measurement System

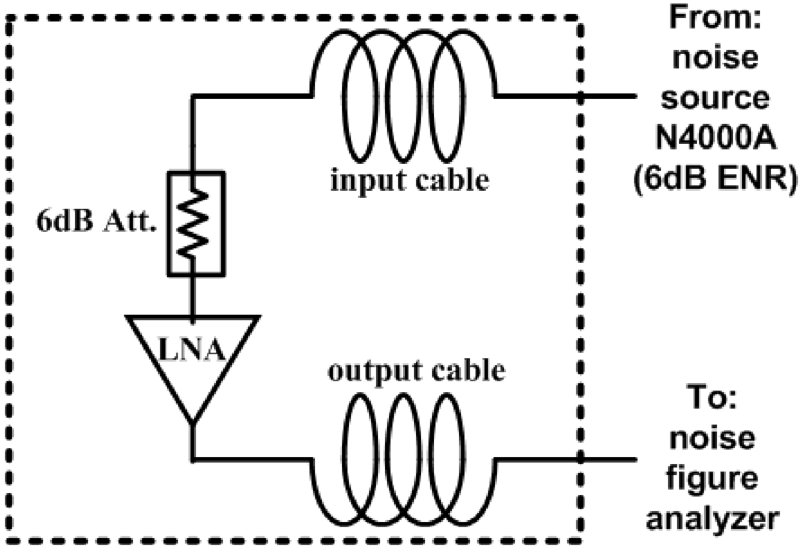


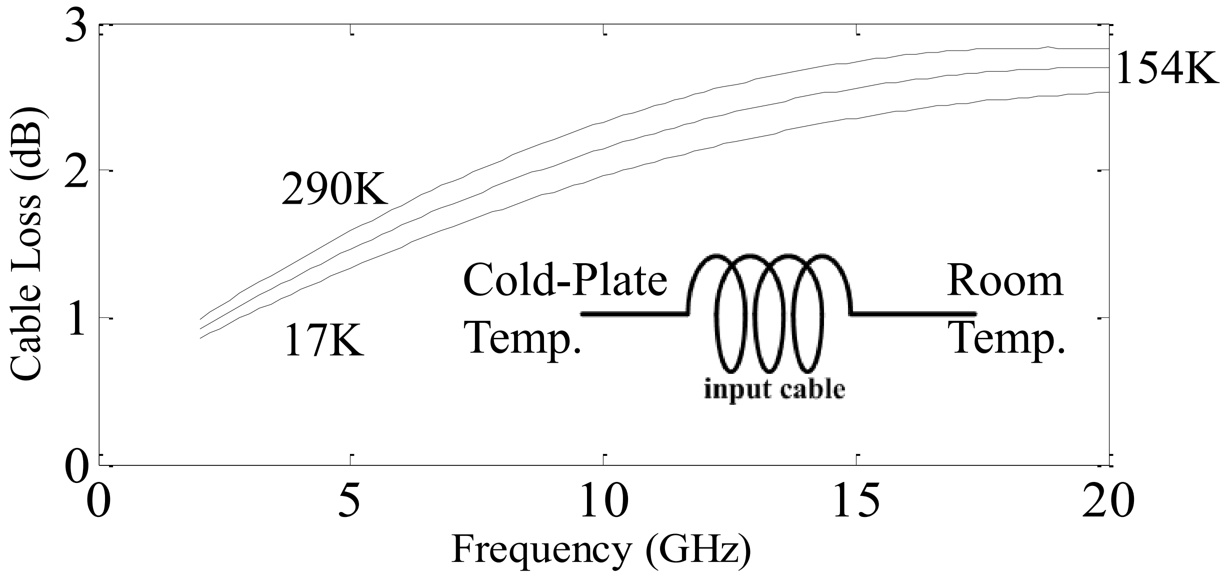
Janis Cryogenic Probe Station

Testing cryostat

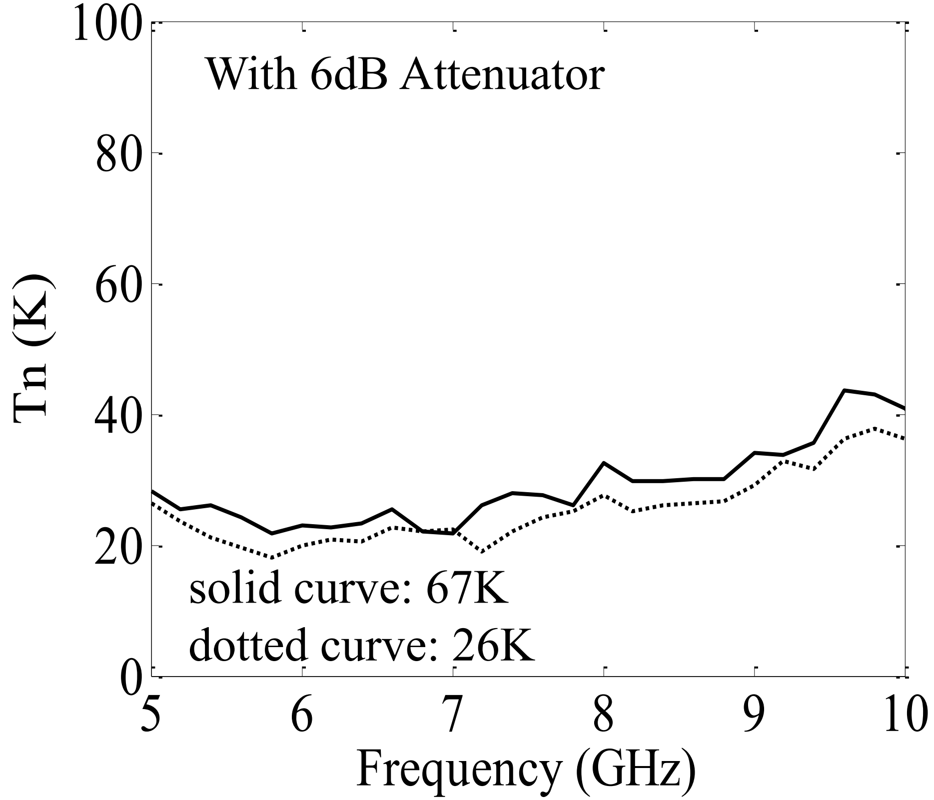
Cryogenic Noise Measurement System

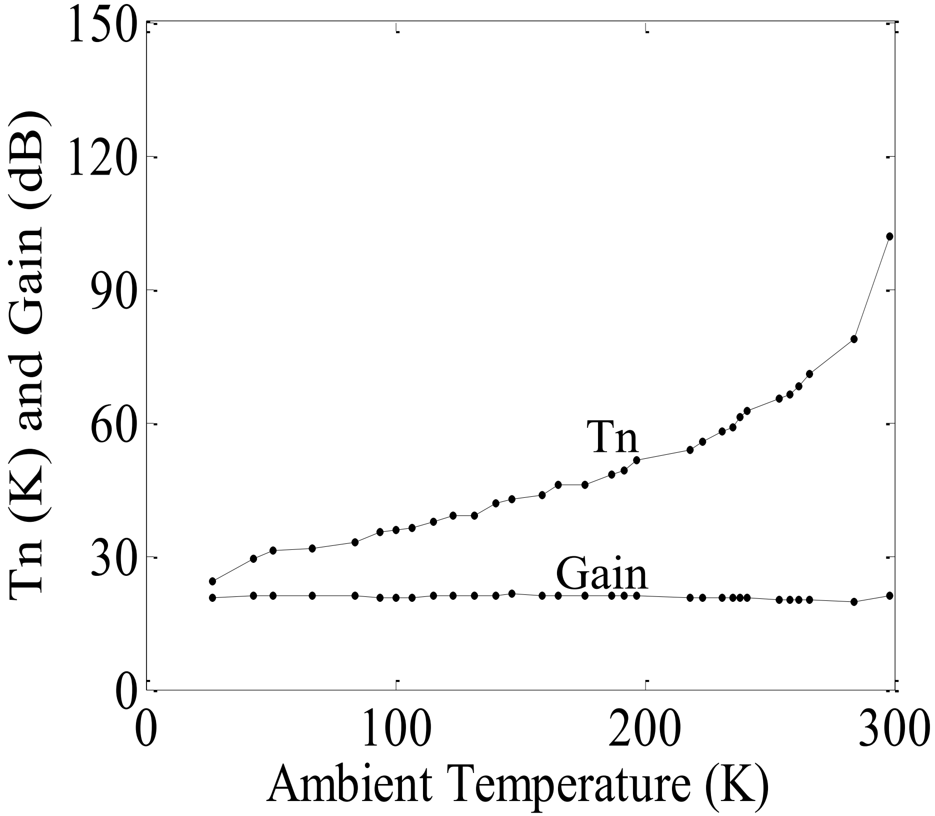






Cryogenic T_N and Gain of 5-10GHz LNA





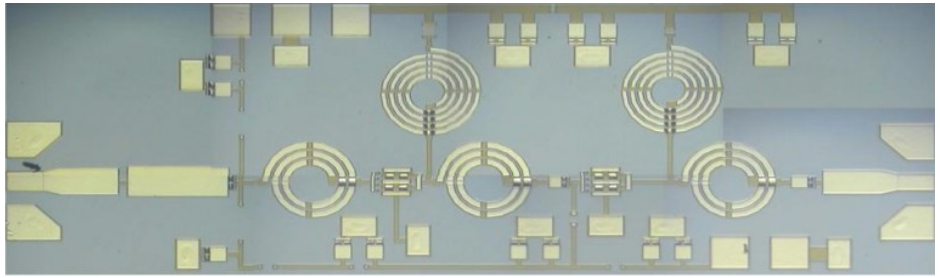
Noise improvement factor ≈ 105/24 =4.4

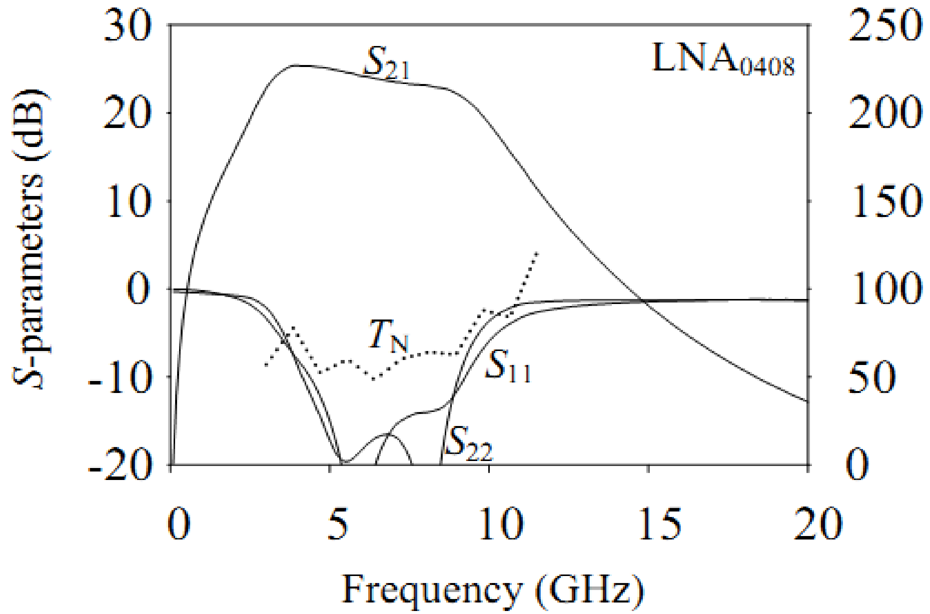
GaAs pHEMT MMIC LNAs

Freq （GHz）	Gain (dB)	Tn (K)	Bias (mA/V)	Area (mm^2)	Process	Status
4-8	23	65	40/2.0	2.3×0.9	150nm GaAs	Completed
5-10	23	80	40/2.5	2.3×0.9	150nm GaAs	Completed
8-20	23	150	40/2.5	2.3×0.9	150nm GaAs	Completed
5-10	26	70	70/2	2.4×0.8	100nm GaAs	Ready for Tape out
20-40	22	220	20/2	2.4×0.7	100nm GaAs	Ready for Tape out
18-26	17/26	140/150	120/2	2.4×0.8	100nm GaAs	Ready for Tape out
30-50	18	300	28/1.5	2.4×0.7	100nm GaAs	Ready for Tape out
1-10	30	63	100/2	2.4×0.8	100nm GaAs	Ready for Tape out
0.4-3	37	48	75/2	2.4×0.9	100nm GaAs	Ready for Tape out
DC-10	16	170-270	500/3.5	2.4×0.7	100nm GaAs	Ready for Tape out

Photographs and Measured Results

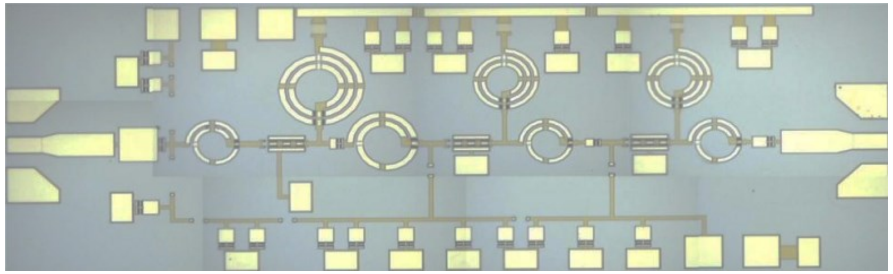
4-8GHz LNA
2300×900um (2 stages)

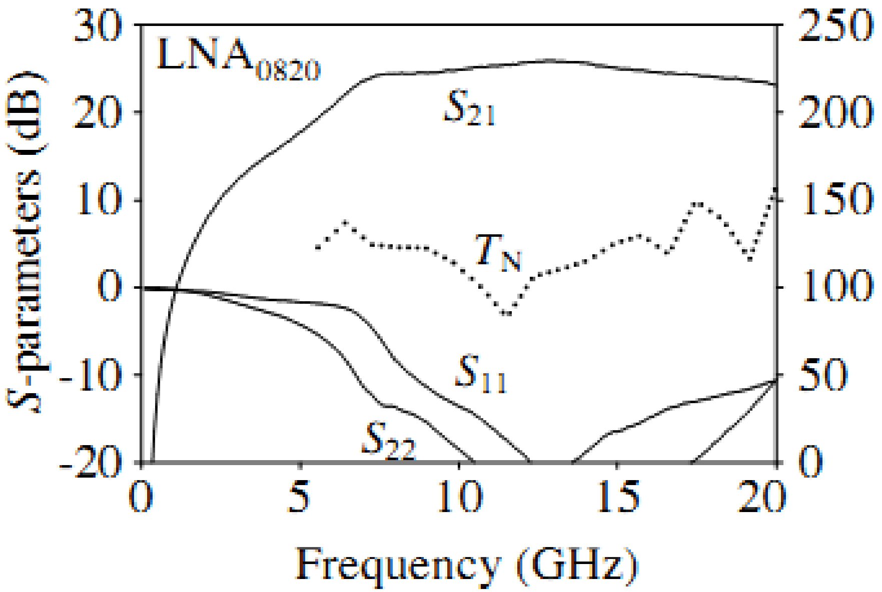




Average T_N = 65K

8-20GHz LNA
2300×900um (3 stages)

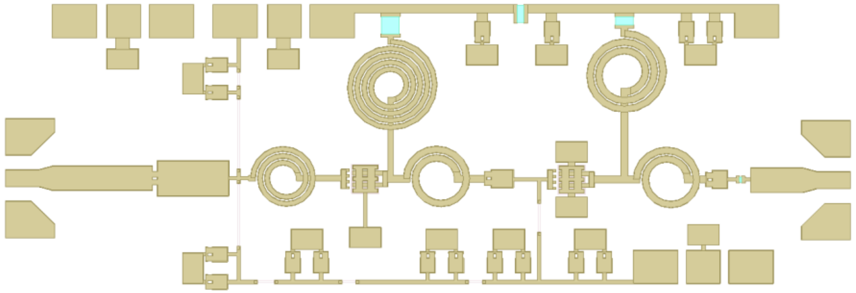




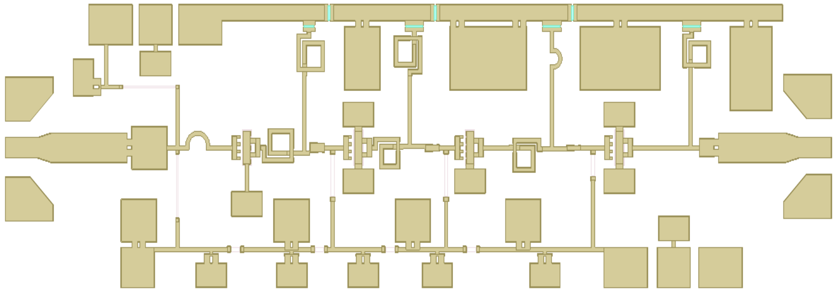
Average T_N = 130K

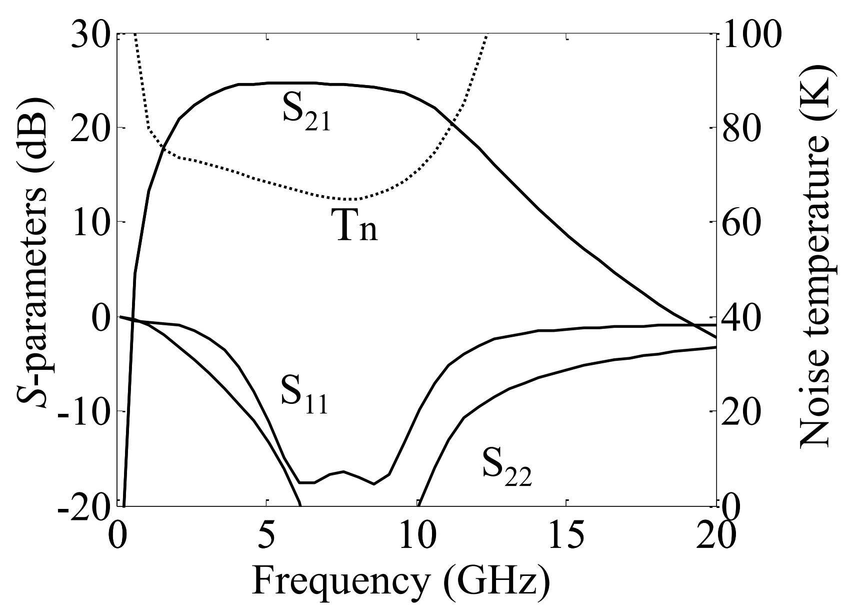
Layouts and Simulation Results

5-10GHz LNA
2400×820um (2 stages)

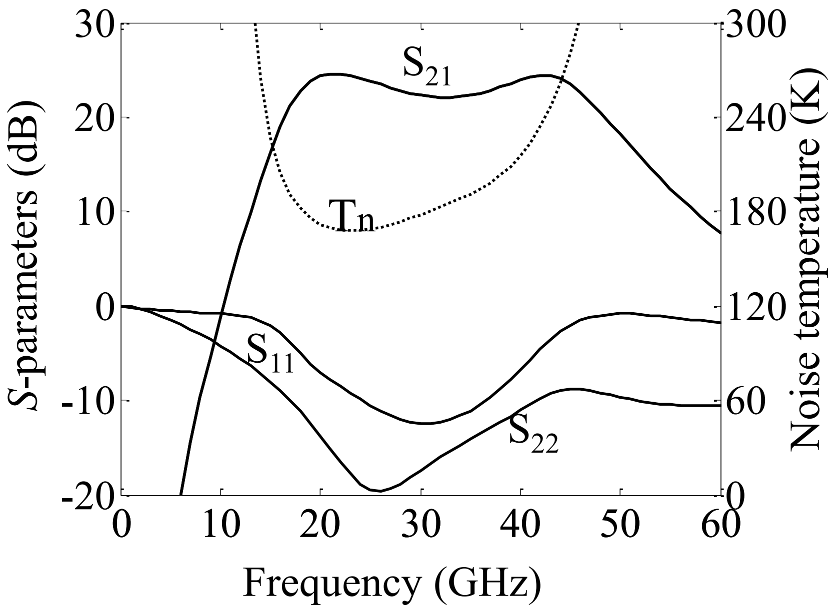


20-40GHz LNA
2400×683um (4 stages)





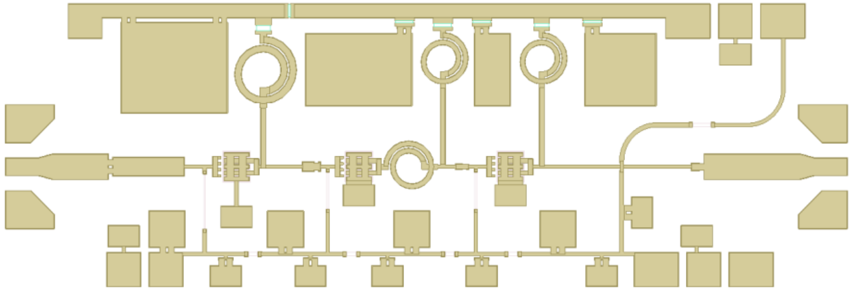
Gain ≈ 26dB and Tn ≈ 70K with 70mA/2V

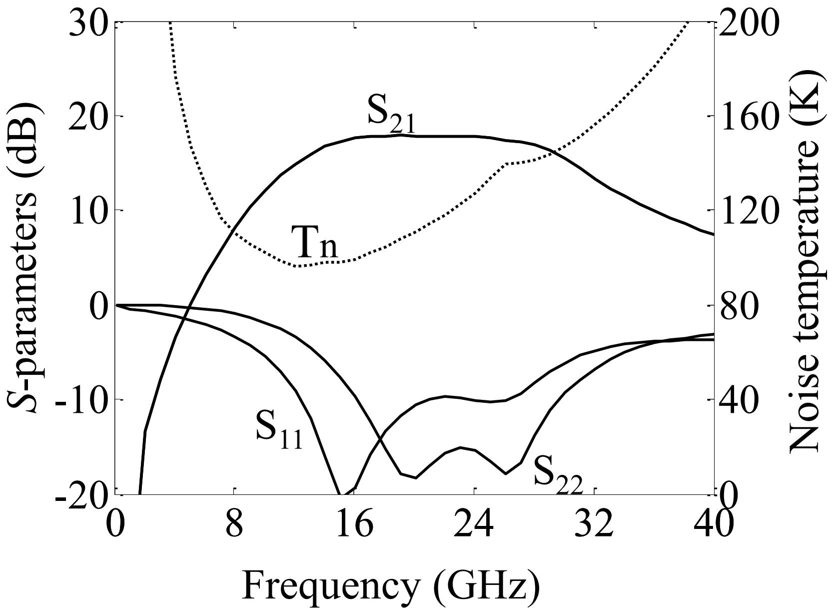


Gain ≈ 22dB and Tn ≈ 220K with 20mA/2V

Layouts and Simulation Results

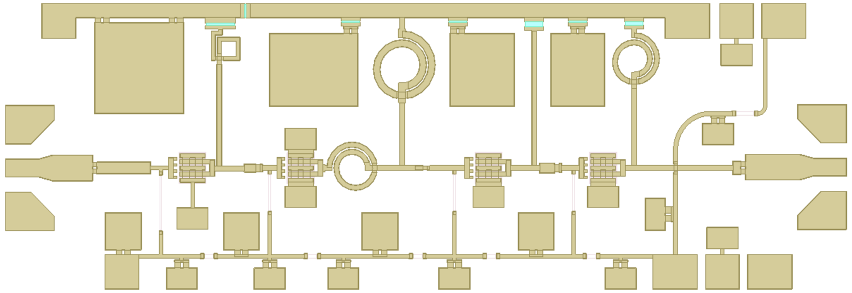
18-26GHz LNA
2400×800um (3 stages)

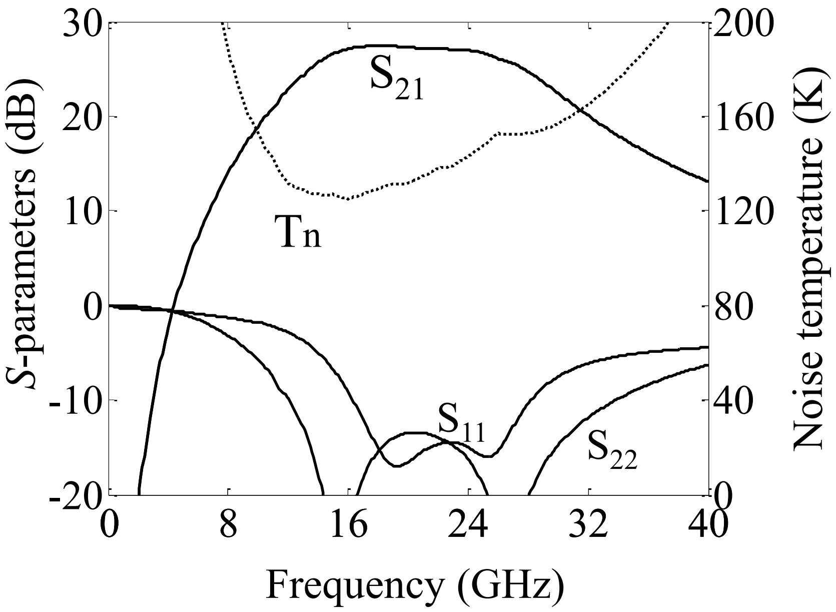




Gain ≈ 17dB and Tn ≈ 140K with 120mA/2V

18-26GHz LNA
2400×800um (4 stages)

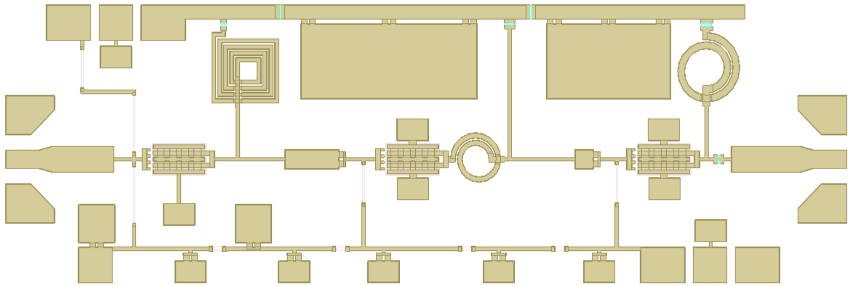


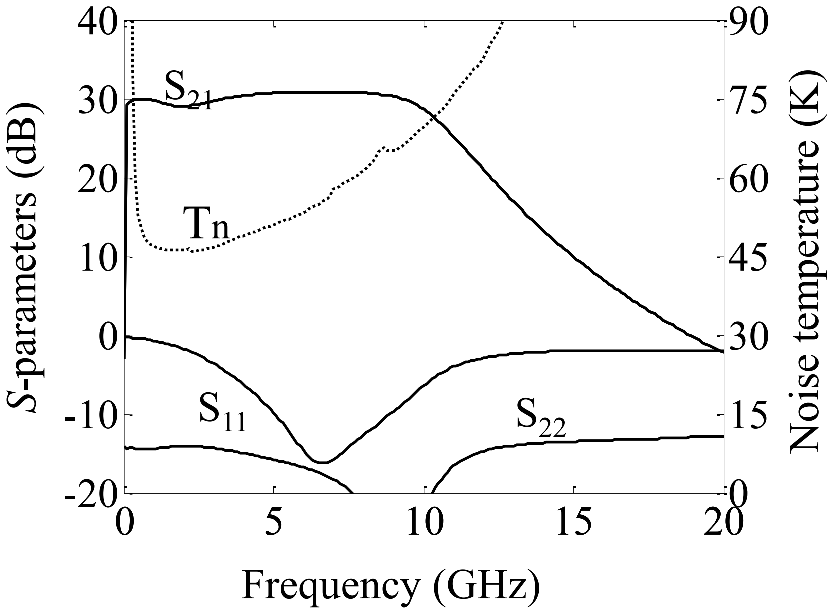


Gain ≈ 26dB and Tn ≈ 150K with 160mA/1.5V

Layouts and Simulation Results

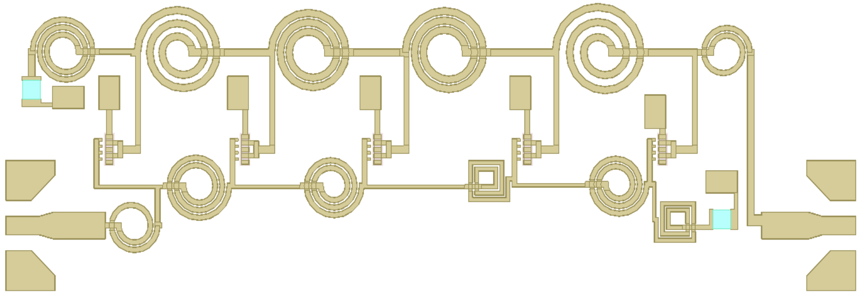
1-10GHz LNA
2400×760um (3 stages)

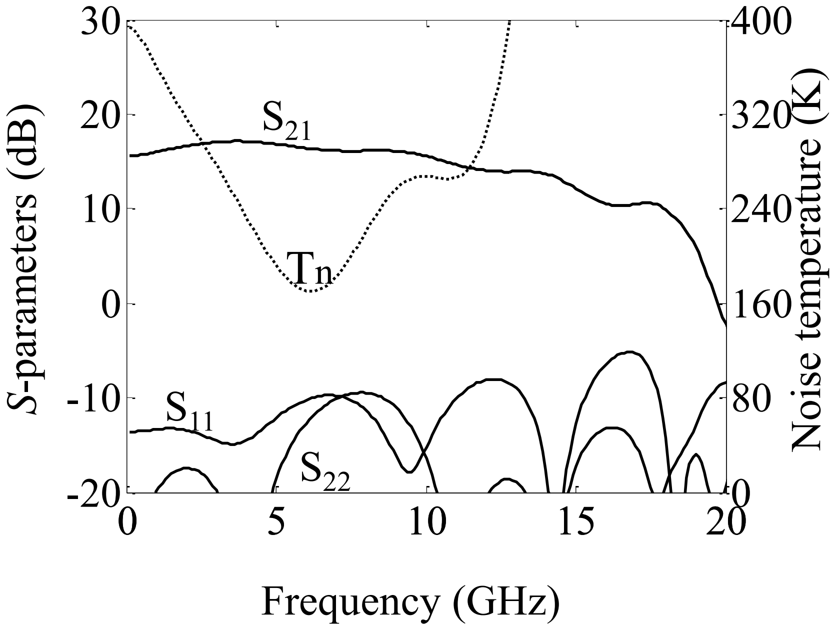




Gain ≈ 30dB and Tn ≈ 63K with 100mA/2V

DC-10GHz DA
2400×760um (5 stages)

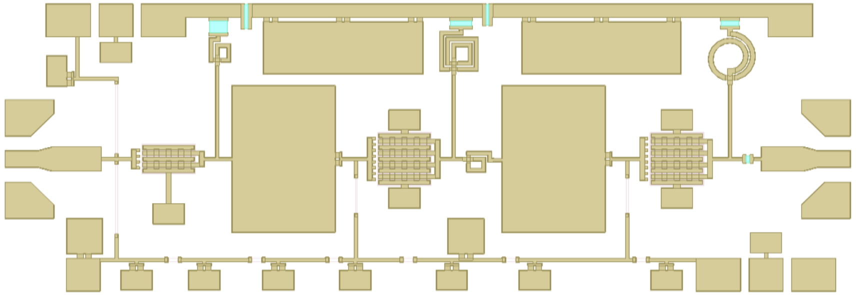


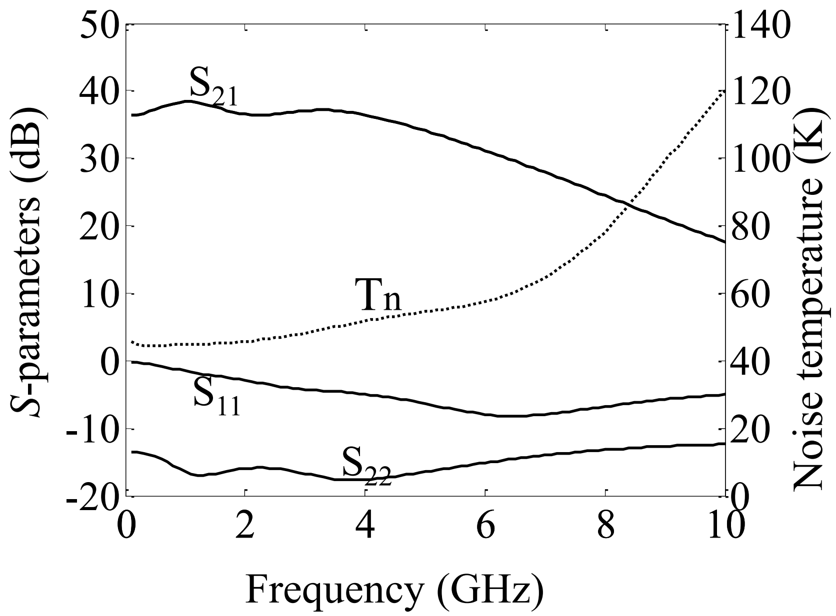


Gain ≈ 16dB and Tn ≈ 170-270K with 500mA/3.5V

Layouts and Simulation Results

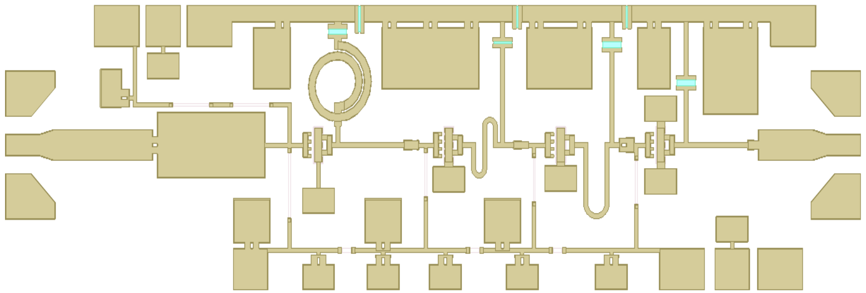
0.4-3GHz LNA
2400×900um (3 stages)

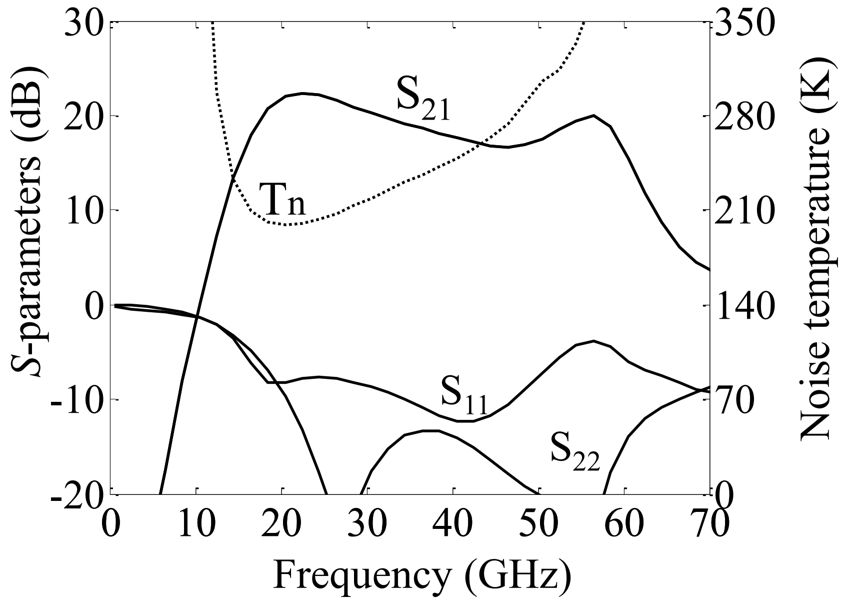




Gain ≈ 37dB and Tn ≈ 48K with 75mA/2V

30-50GHz LNA
2400×670um (4 stages)





Gain ≈ 18dB and Tn ≈ 300K with 50mA/1.5V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