Model vs measurements

(Open points & next steps)

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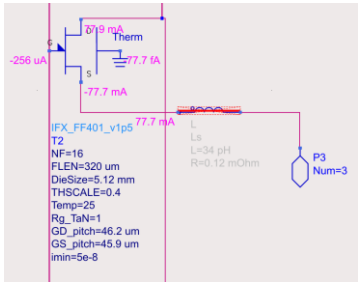
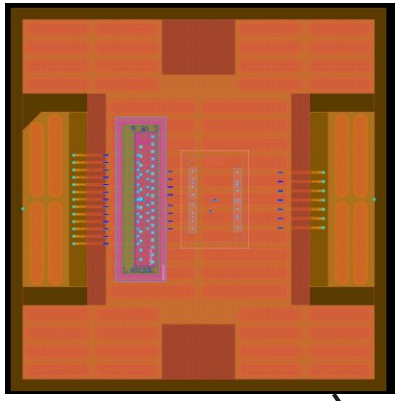
Model ingridents

Compact model

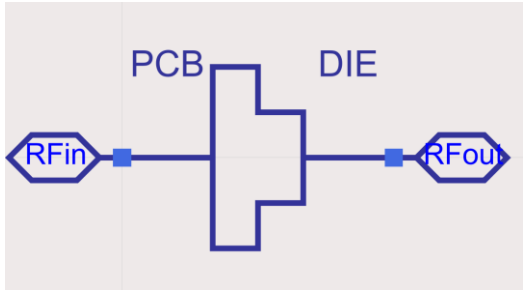


EM_model minipac

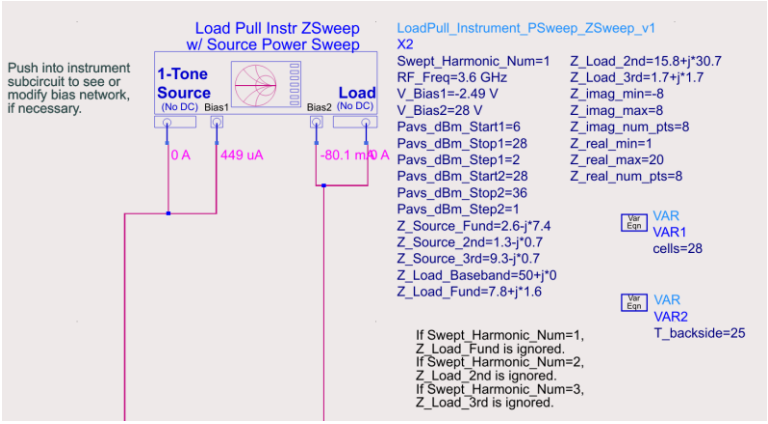


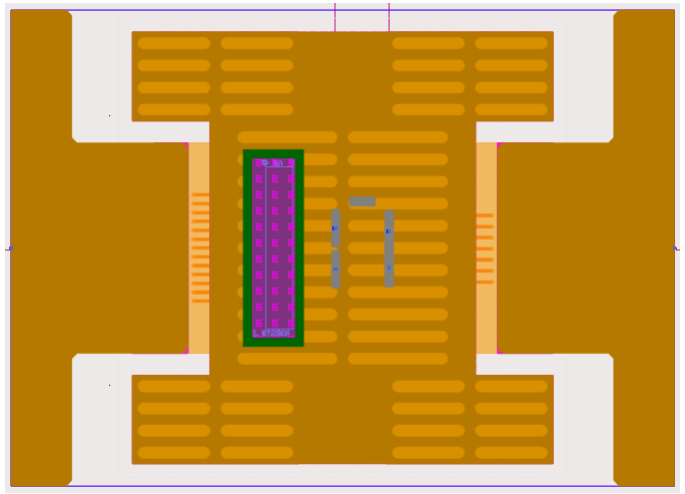
+

EM_model PCB_step

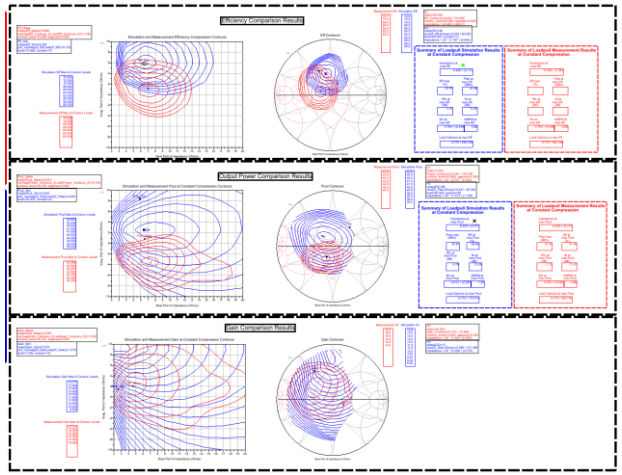


LP template

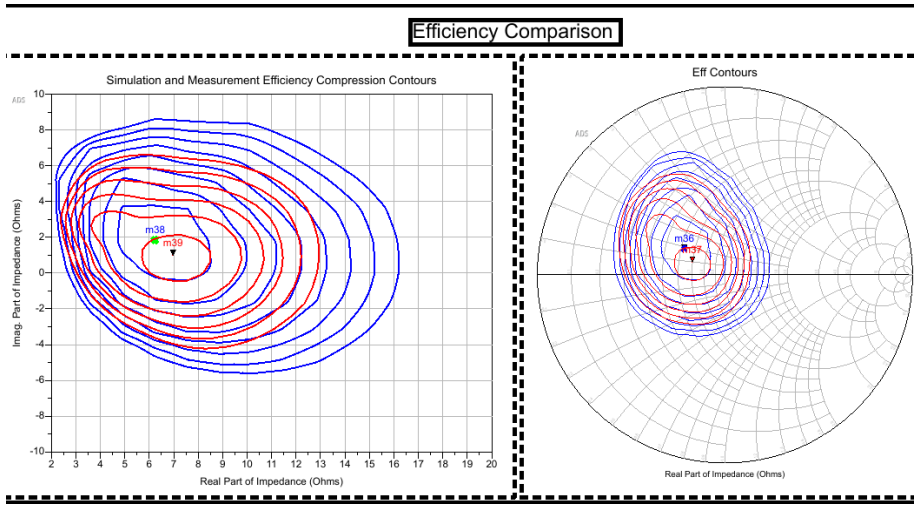




Measurement vs simulation DDS

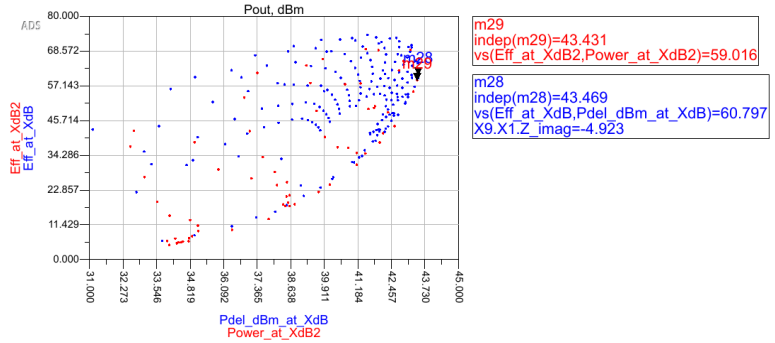


5.12 mm die (Main)



Measurement Eff: 70.7, 70.0, 68.0, 66.0, 64.0, 62.0, 60.0

Simulation Eff: 73.9, 72.0, 70.0, 68.0, 66.0, 64.0, 62.0, 60.0, 58.0



@ 3.6 GHz / P2dB	MXE	MXP	MXG
Measurement	70.7	43.57	16.3
Model	73.9	43.5	15.2

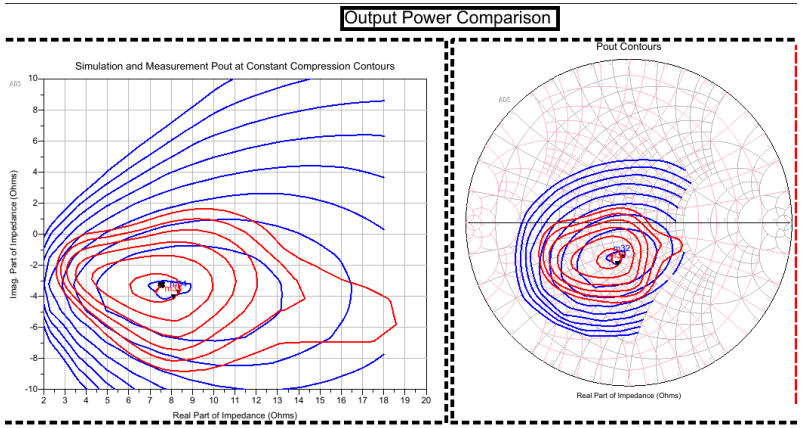
Measurement Gt: 16.3, 16.0, 15.5, 15.0, 14.5, 14.0

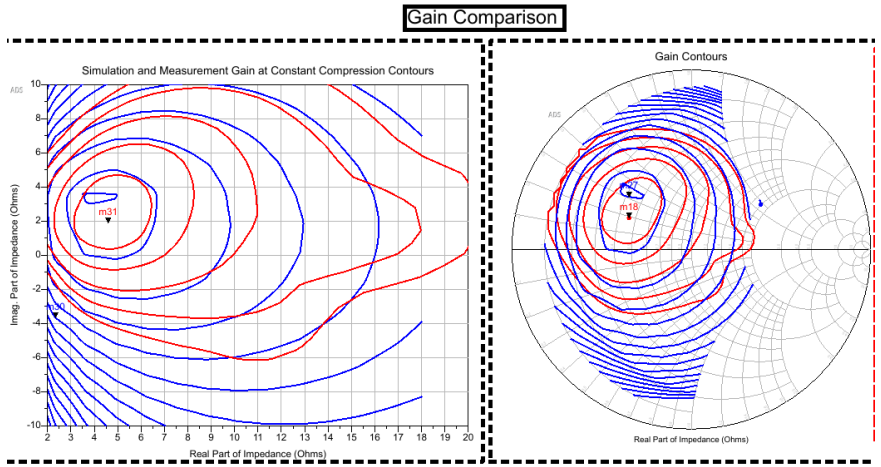
Simulation Gt: 15.2, 15.0, 14.5, 14.0, 13.5, 13.0, 12.5, 12.0, 11.5, 11.0, 10.5, 10.0

- * offset of 0.2dB is applied for measured results to counter calibration error.

Measurement Pout: 43.6, 43.5, 43.3, 43.0, 42.8, 42.5, 42.3

Simulation Pout: 43.5, 43.0, 42.5, 42.0, 41.5, 41.0, 40.5, 40.0, 39.5





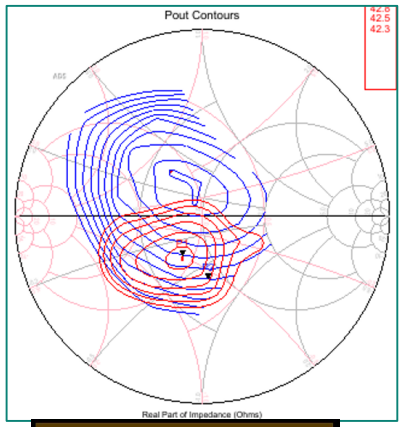
› Model › Meas

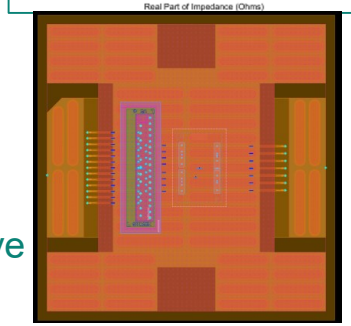
Learnings

- De-embedding has an impact
- Layout discontinuity has an impact
- Additional components needed
  Ls (source inductance)
- BW tuning helps but not very significant

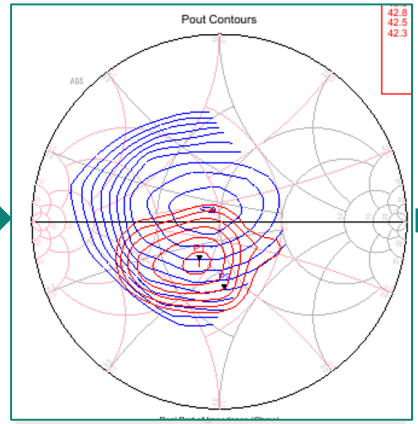
Problem

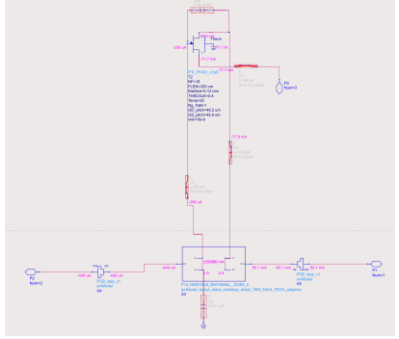
- Discrepancy coming from active or passive modeling ?



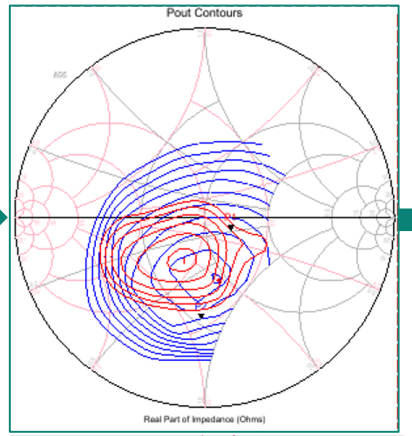


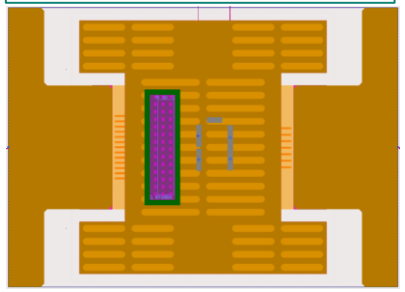
– Minipac



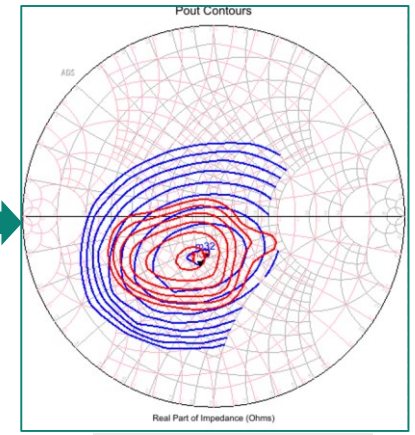


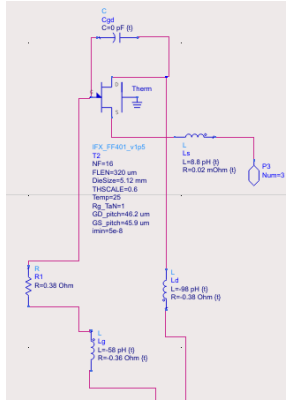
– Minipac + steps (schematic)





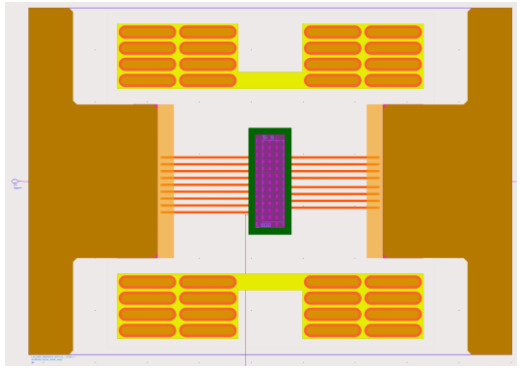
– Minipac + steps (layout)

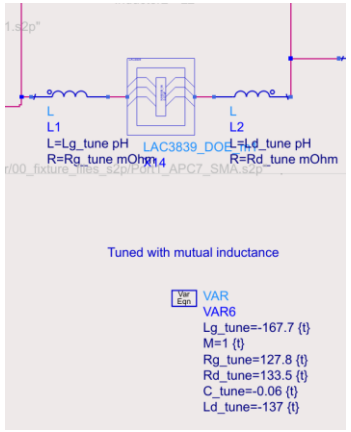




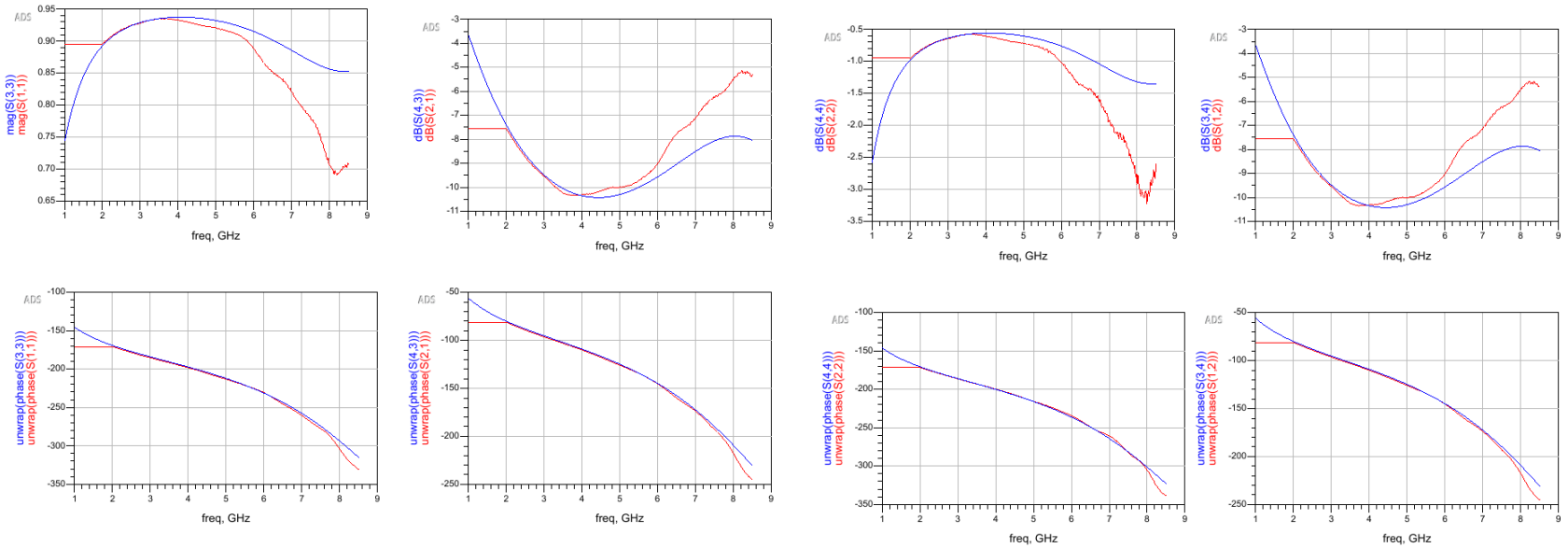
– Minipac + steps (layout) + Ls

Passive only model





› Meas › Model



- Measurements start from 2 GHz
- Good alignment with simulation until 4 GHz
- BW tuning helps but not very significant
- Moscap value (5.5 pF) is in good agreement
- Substrate modeling at HF is an issue ?

Simulation vs Measurement (GSG)

Interstage Matching

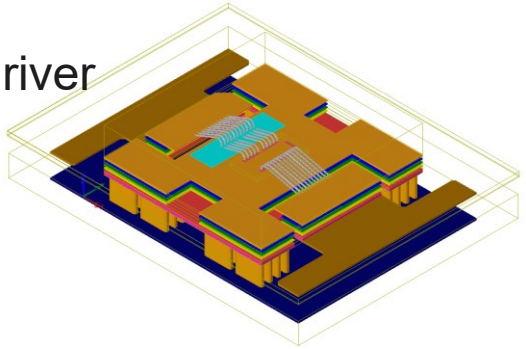
- **Simulation vs measurements of GSG variants show good agreement until 3.5 GHz.**
- **HF fitting needs to be worked upon**

Simulations

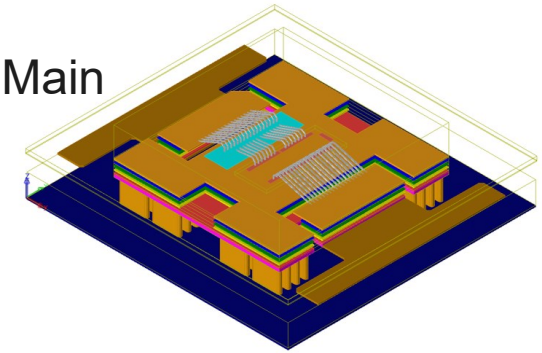
Measurements

PAM-B minipac's

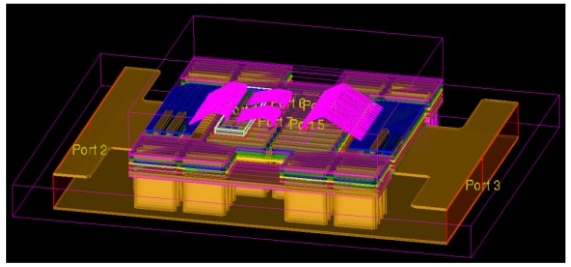
– Driver

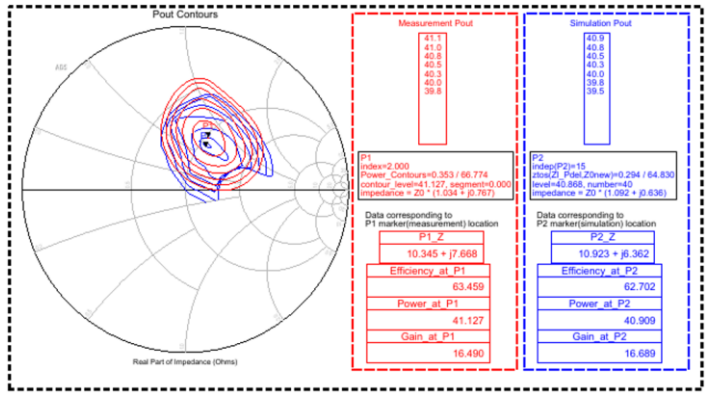


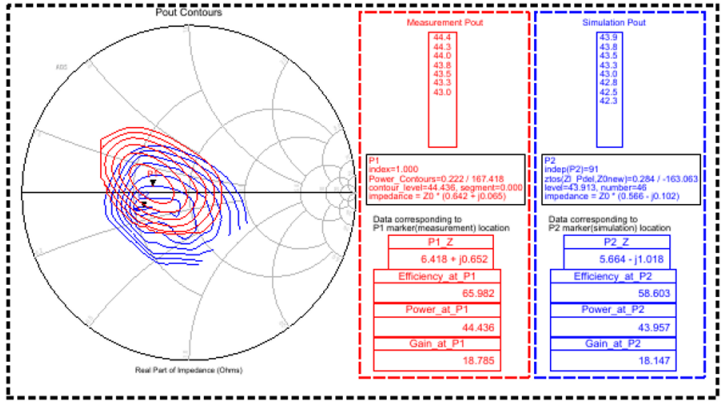
– Main

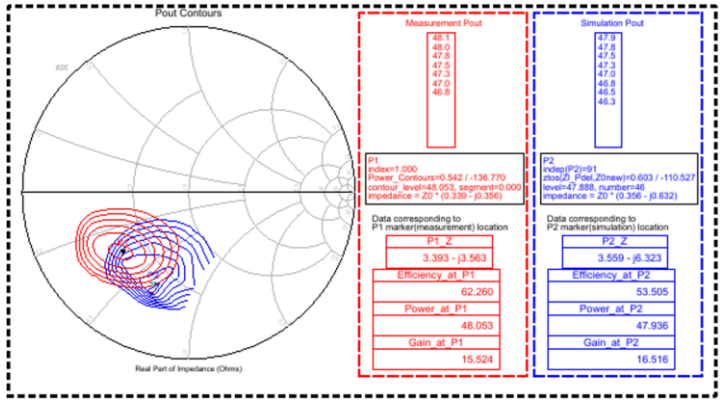


– Peak









Observation

- Initial model
  - Relatively ok for small dies
  - Simultaneous fitting of all parameters not possible
- Additional source inductance needed (Ls)
- Input impedance is quite sensitive
- Scaling issue of the model
- Improvement needed in passive EM accuracy at HF
- Active model needs to be improved
- Current possibilities
  - Minipac approach
  - Fine-tune model
- Next steps
  - Improve compact model
  - Behavior model

Thank you!


infineon