



Beamformer Feeding Board Design and IC Package EM Simulation

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Outline

- Introduction of the Square Kilometer Array (**SKA**) and Octagonal Ring Array (**ORA**);
- Printed Circuit Board (**PCB**) design in Altium;
- Board Electromagnetic (**EM**) Simulation in HyperLynx;
- Integrated Circuit (**IC**) Package **EM** Simulation in ADS and HyperLynx;
- Future Work and Acknowledgement.



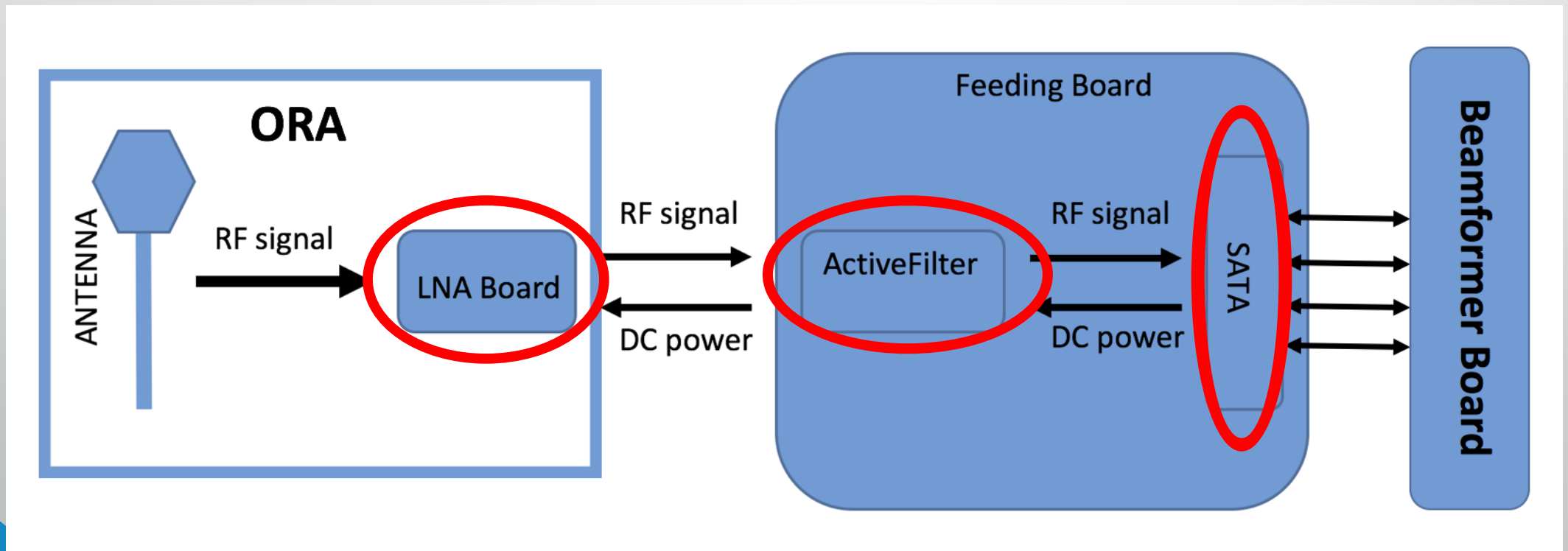
SKA and ORA



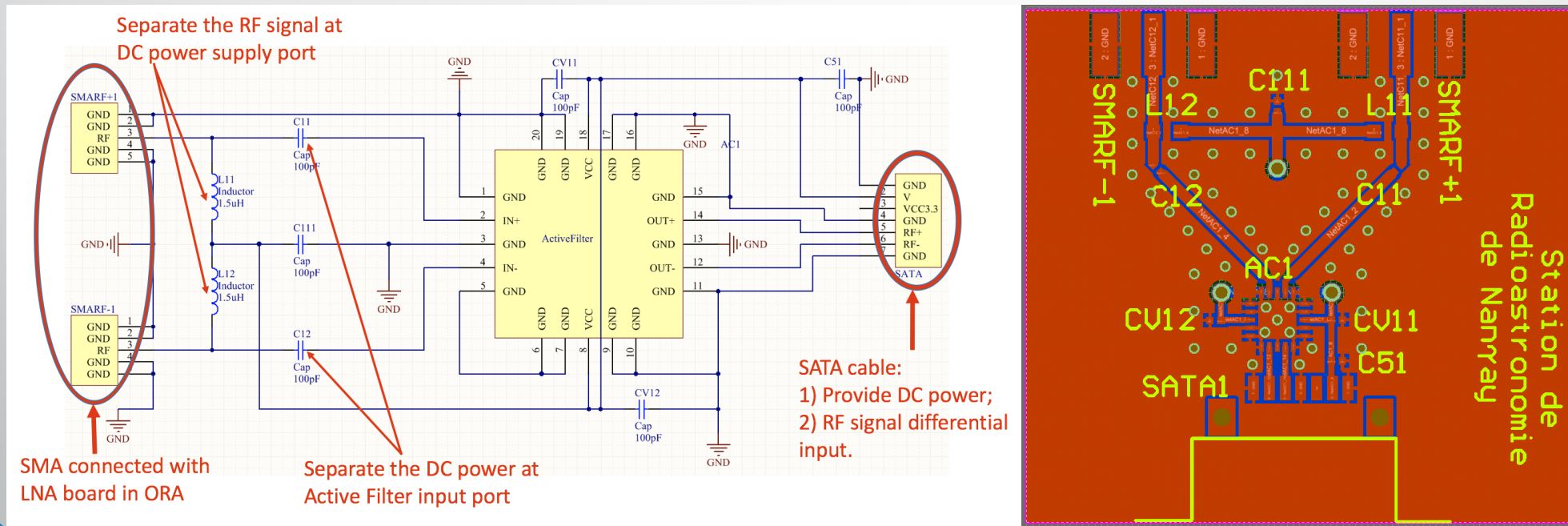
Collecting area: 1 million m²

Spread over thousand kilometers

Introduction of the Board



Step 1: Board Design in Altium



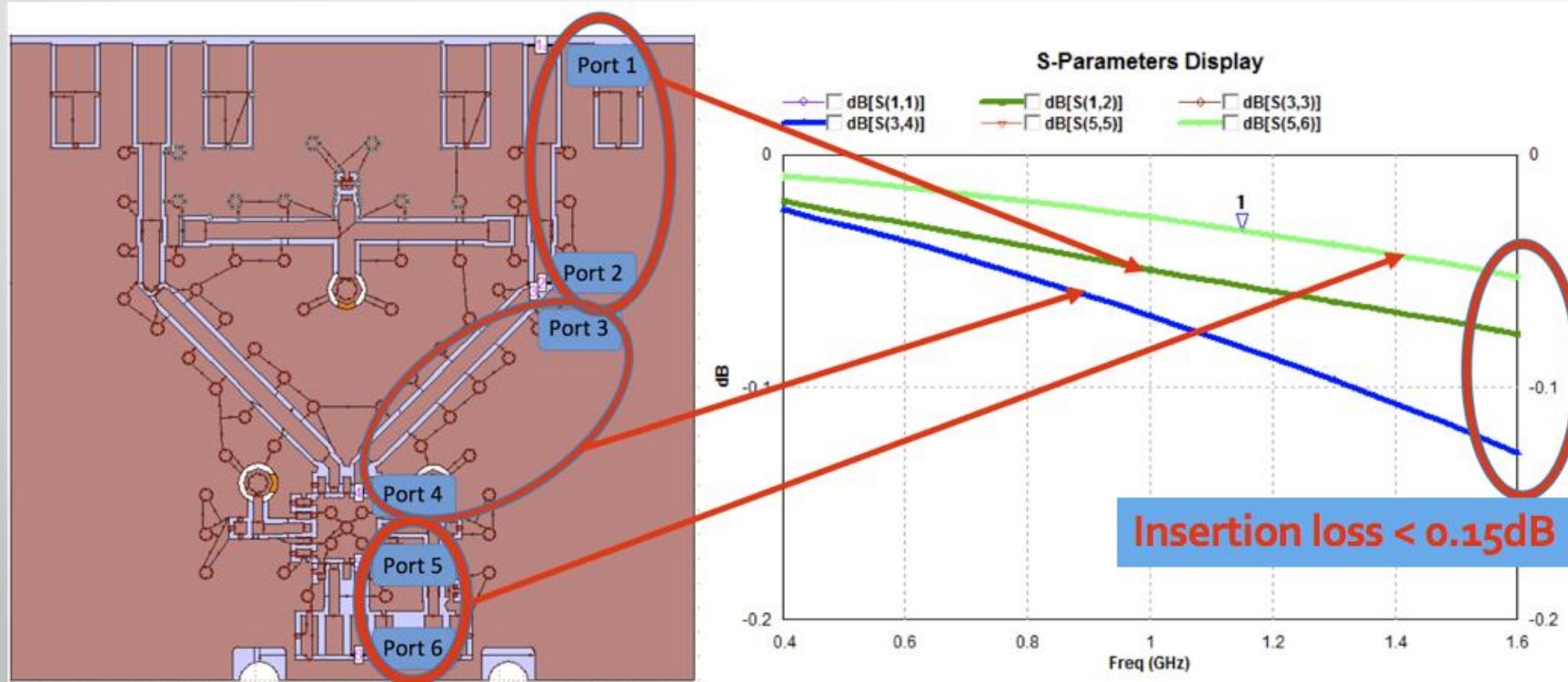
Step 2: Layer Stack of the Board

Layer Name	Type	Material	Thickness (mm)	Dielectric Material	Dielectric Constant	Pullback (mm)
Top Overlay	Overlay					
Top Solder	Solder Mask/Co...	Surface Material	0.01016	Solder Resist	3.5	
Top Layer	Signal	Copper	0.03556			
Dielectric 1	Dielectric	Core	0.36	FR4	4.3	
GROUND	Signal	Copper	0.036			
Dielectric 2	Dielectric	Prepreg	0.71		3.8	
Signal Layer 1	Signal	Copper	0.036			
Dielectric 3	Dielectric	Core	0.36		4.3	
Bottom Layer	Signal	Copper	0.03556			
Bottom Solder	Solder Mask/Co...	Surface Material	0.01016	Solder Resist	3.5	
Bottom Overlay	Overlay					

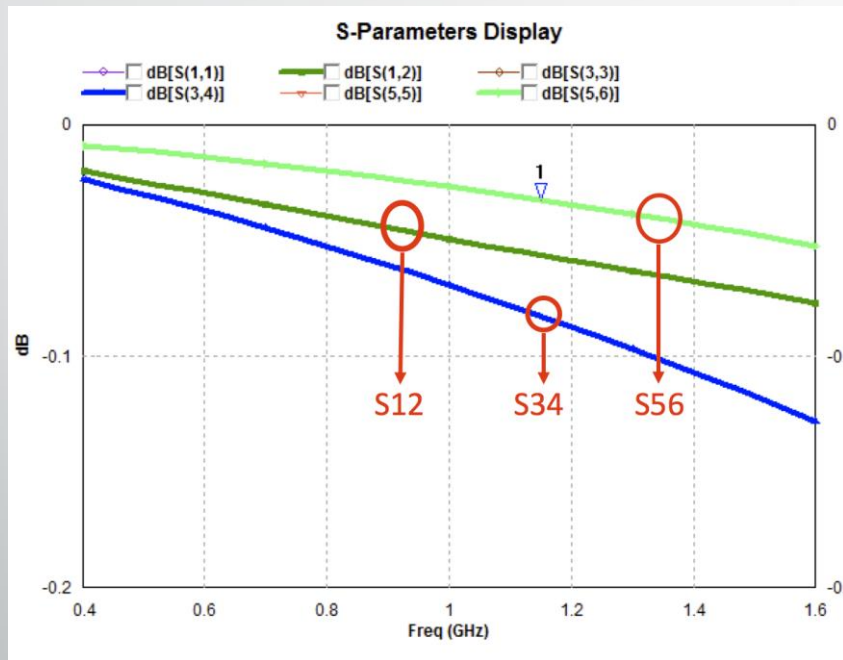
Total Thickness: 1.59344mm

Total Thickness: 1.59mm

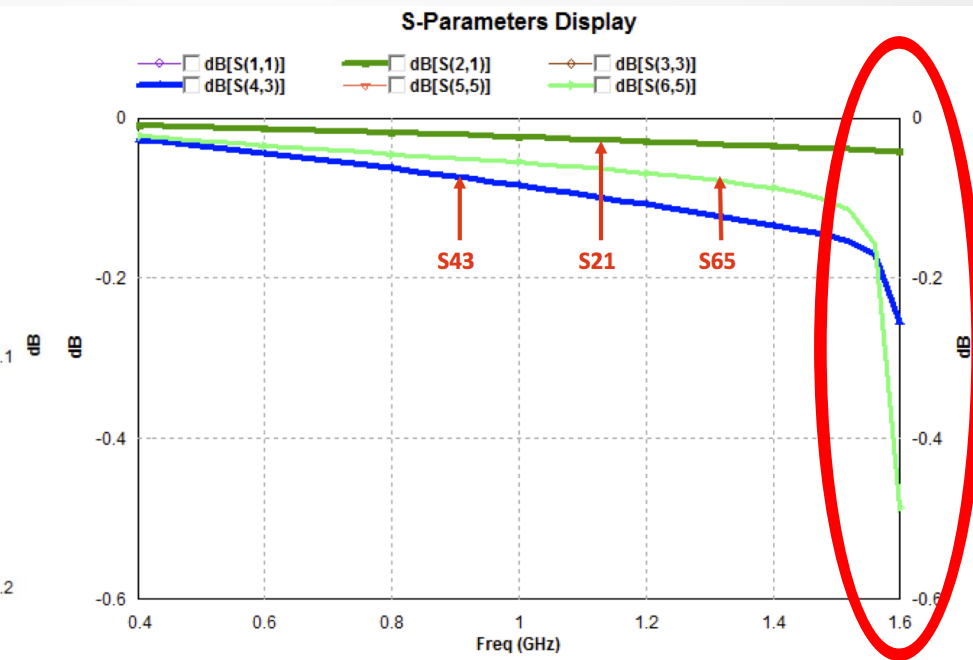
Step 3: EM Simulation with Hyperlynx



The Influence of Metal Via

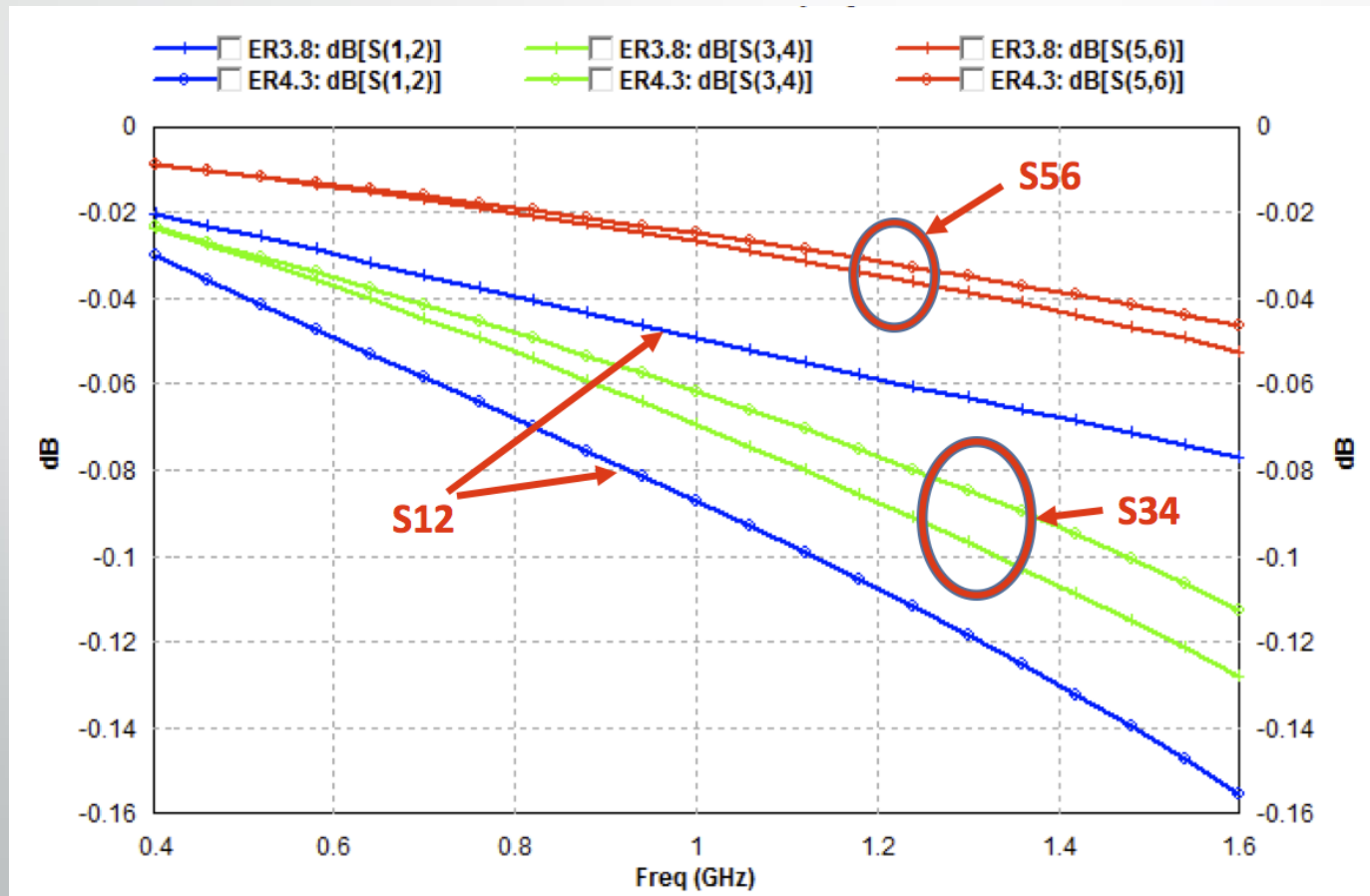


With metal via

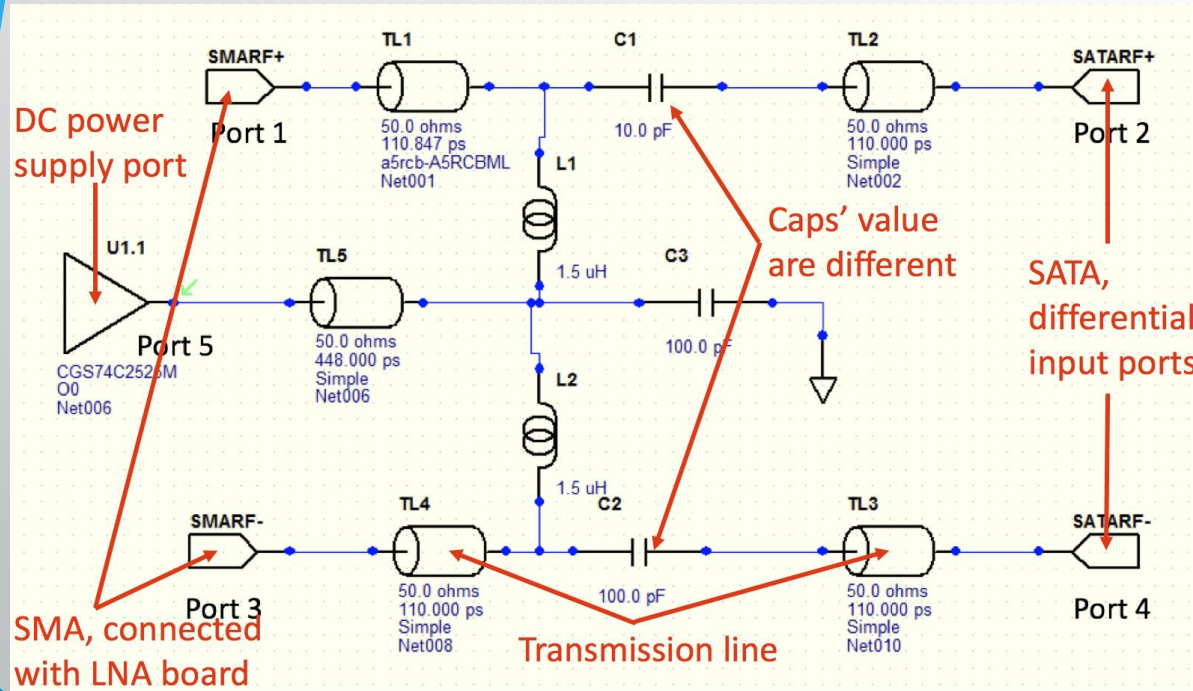


Without metal via

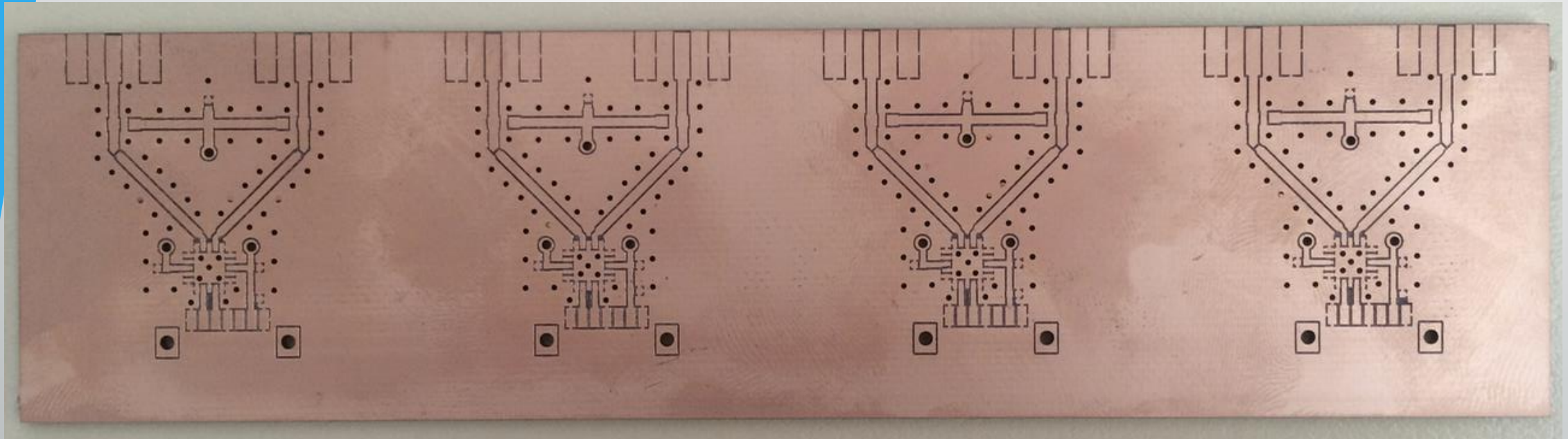
The Influence of Dielectric Constant Variation



Step 4: Line Simulation with Hyperlynx



Step 5: Prototype of the Board



Size: 162mm*41.3mm

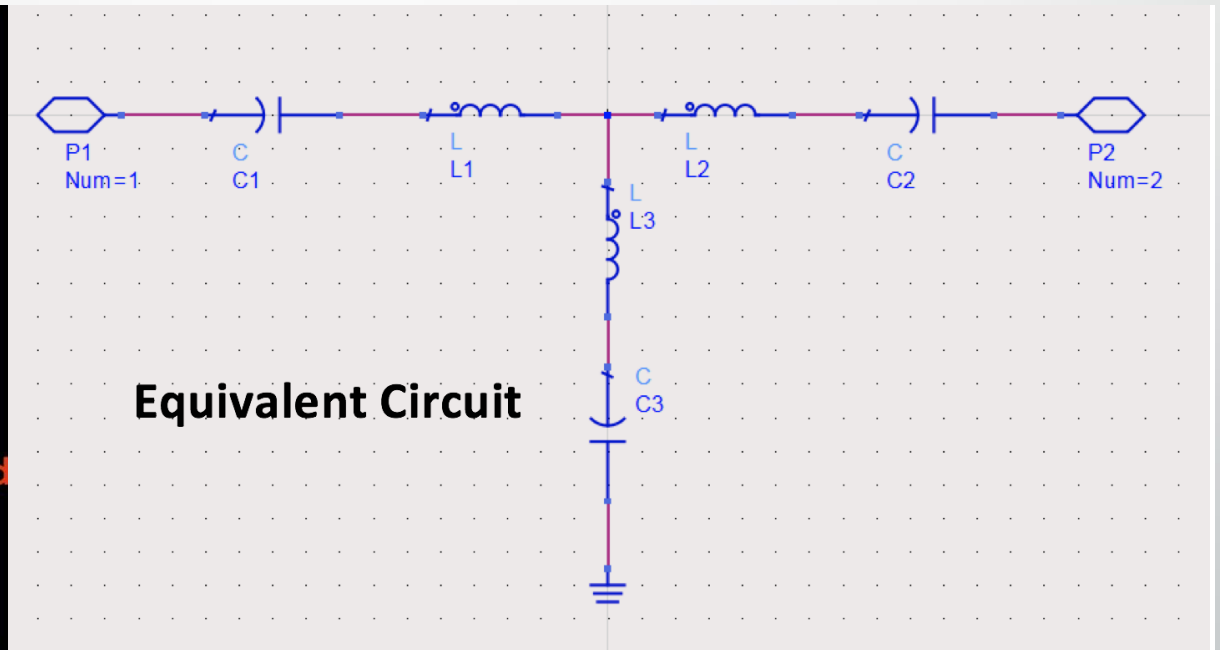
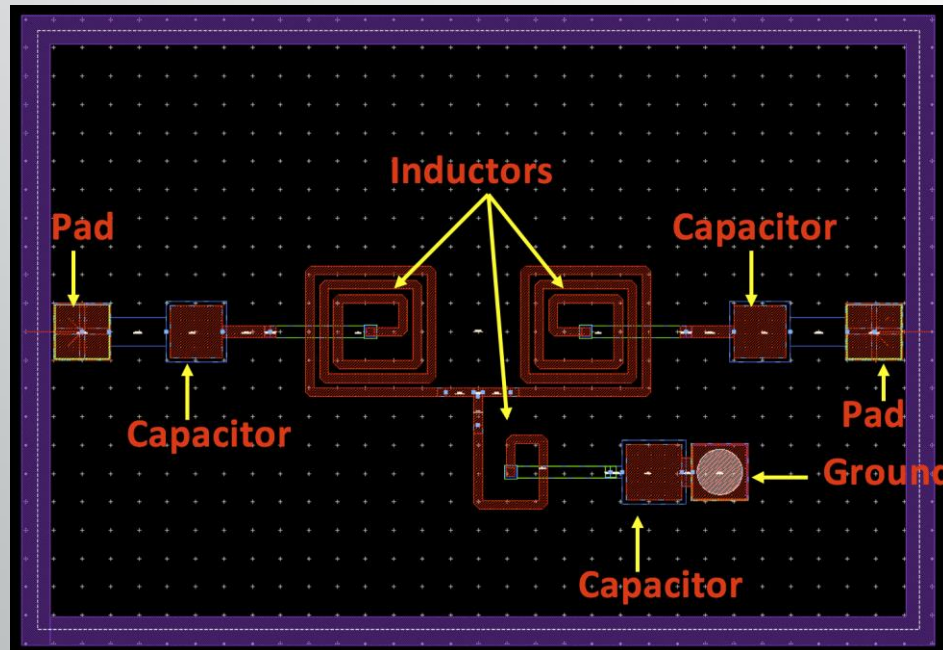


Package EM simulation in ADS

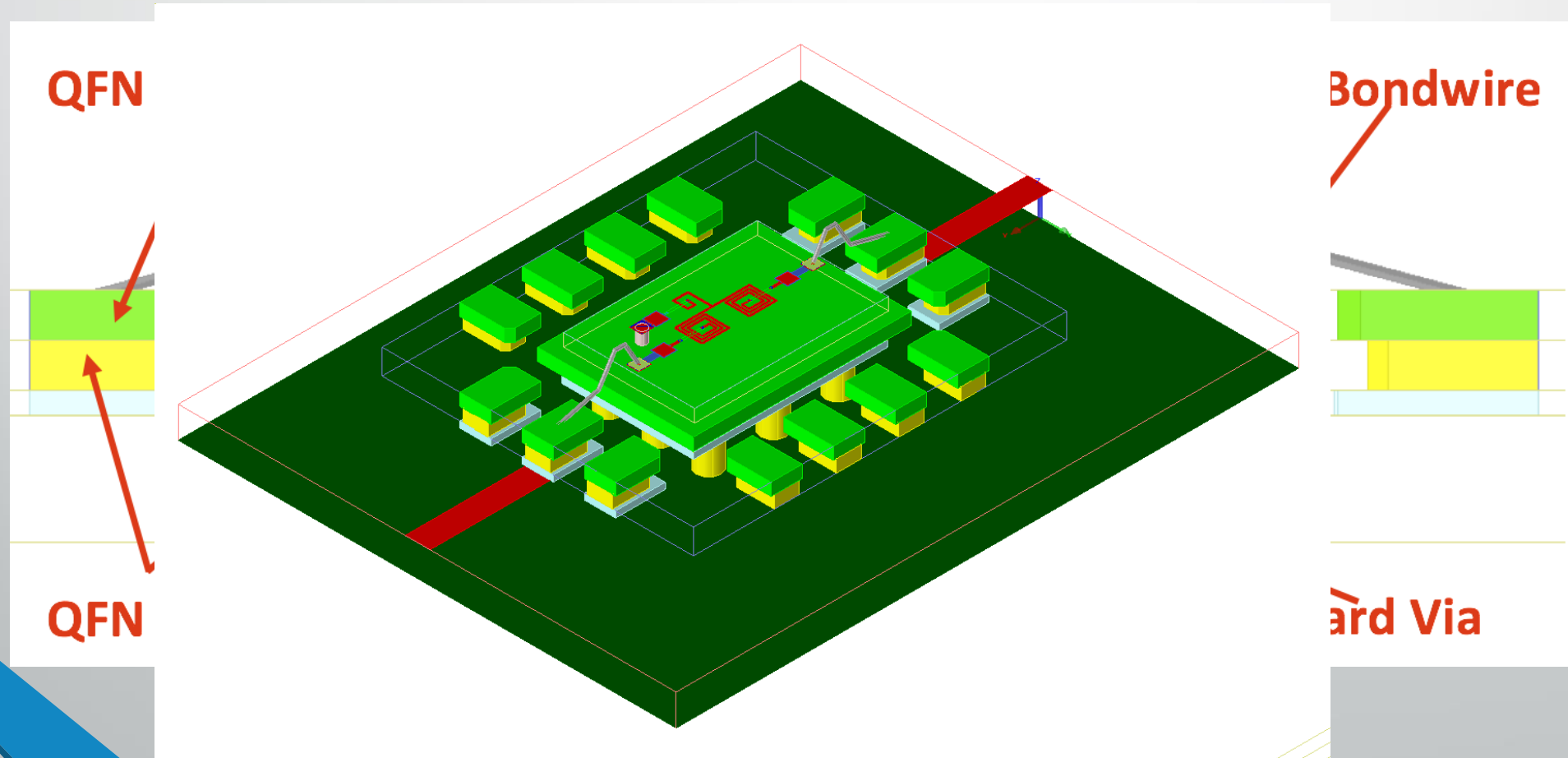
Why do we need to do the simulation?

- IC characterization is no longer limited to the IC itself, as we know, ICs need to be packaged, so the packaging and bondwire will affect the performance.
- Accurate prediction of the affects of package and bondwire at high frequency is increasingly important as ICs continue to shrink and to operate at higher frequencies.

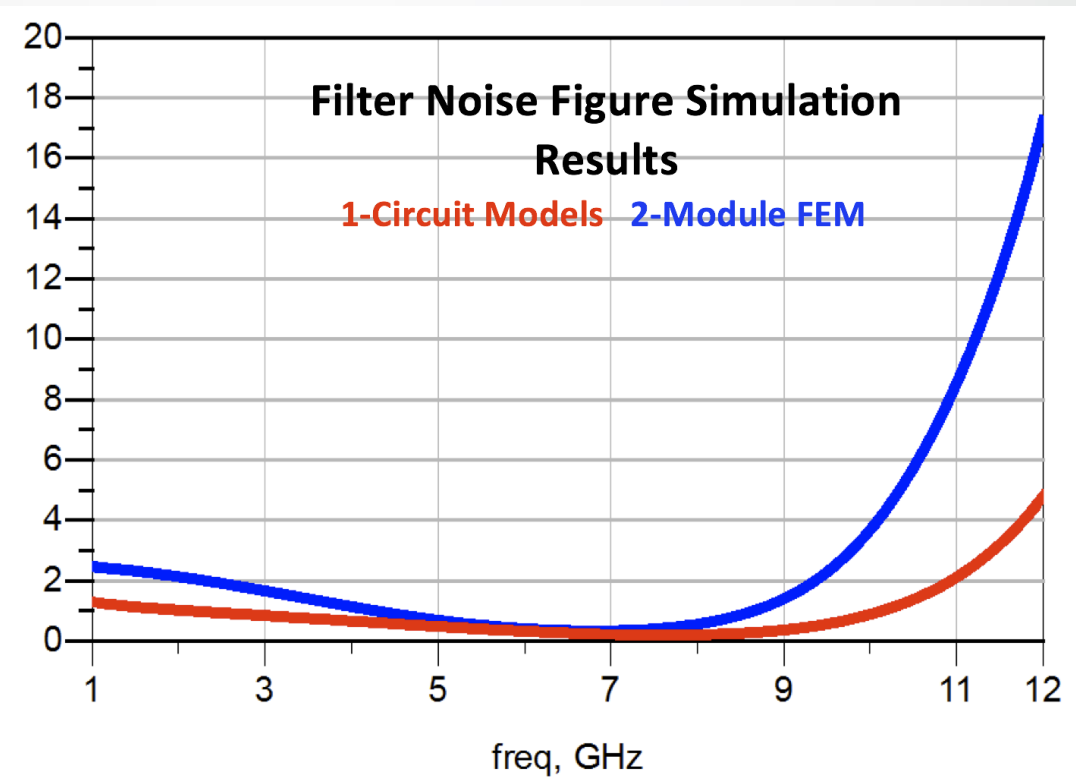
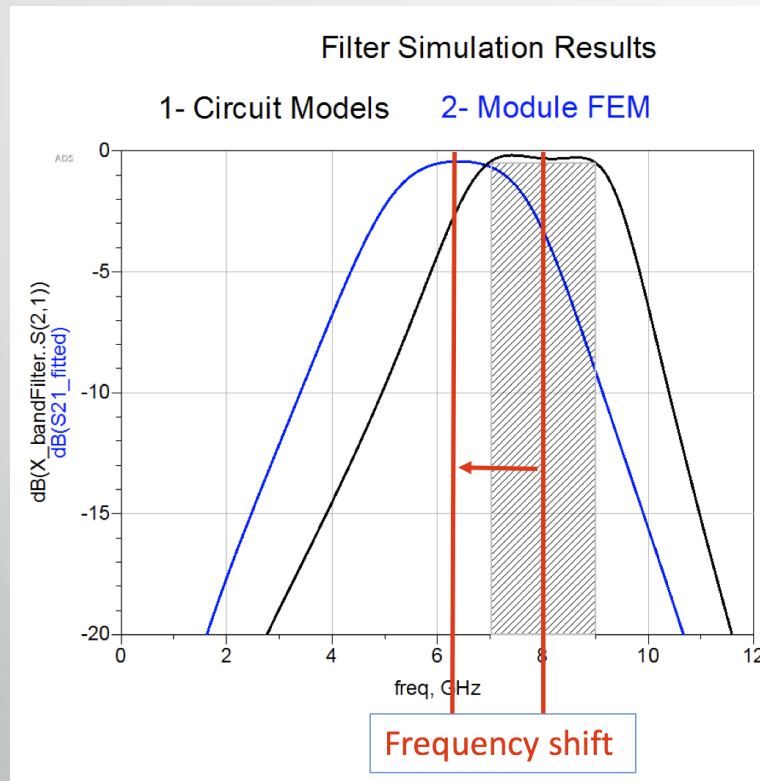
An Example of Filter designed for 7GHz-9GHz



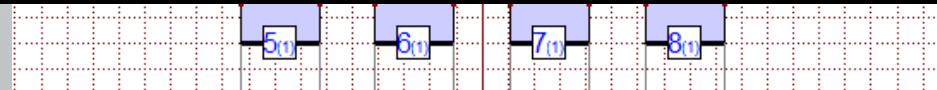
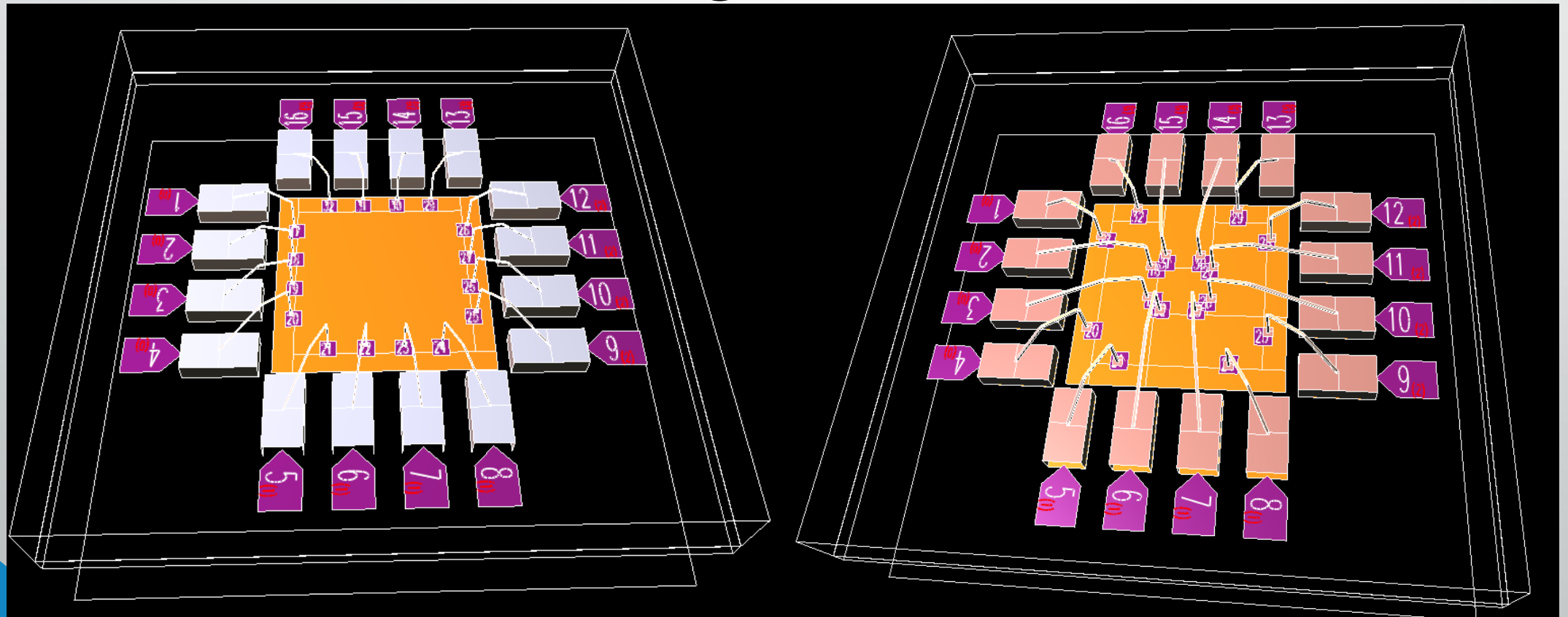
View of the Filter with Package in ADS



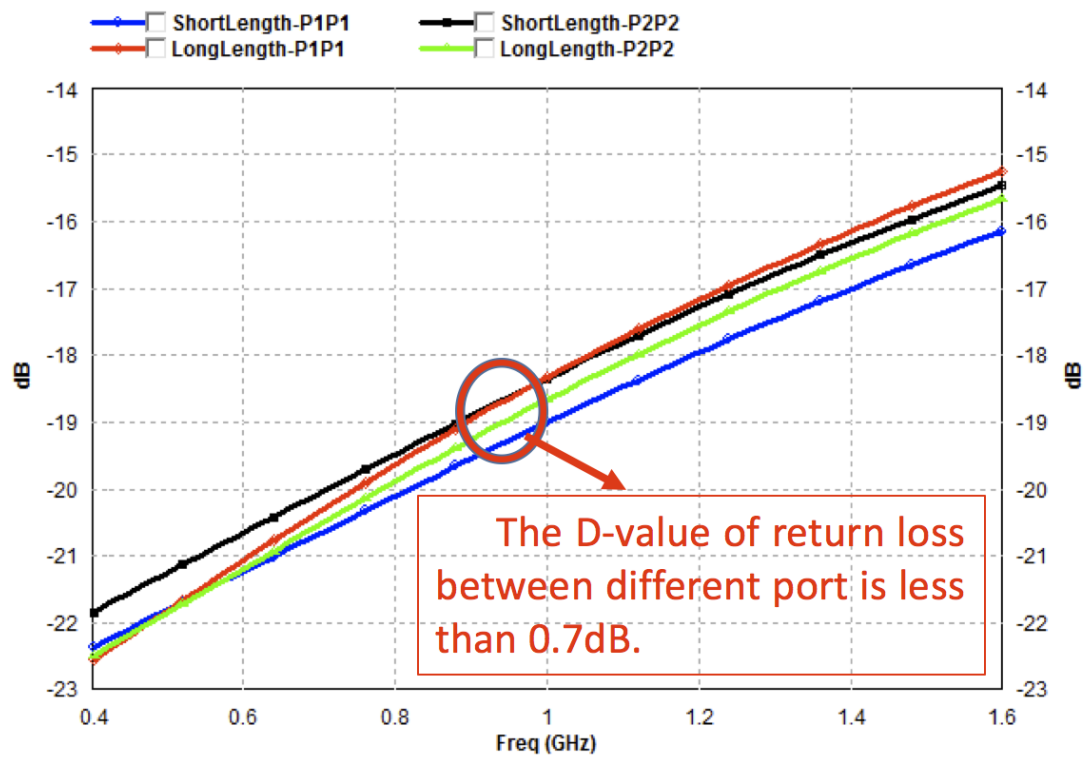
Simulation Results



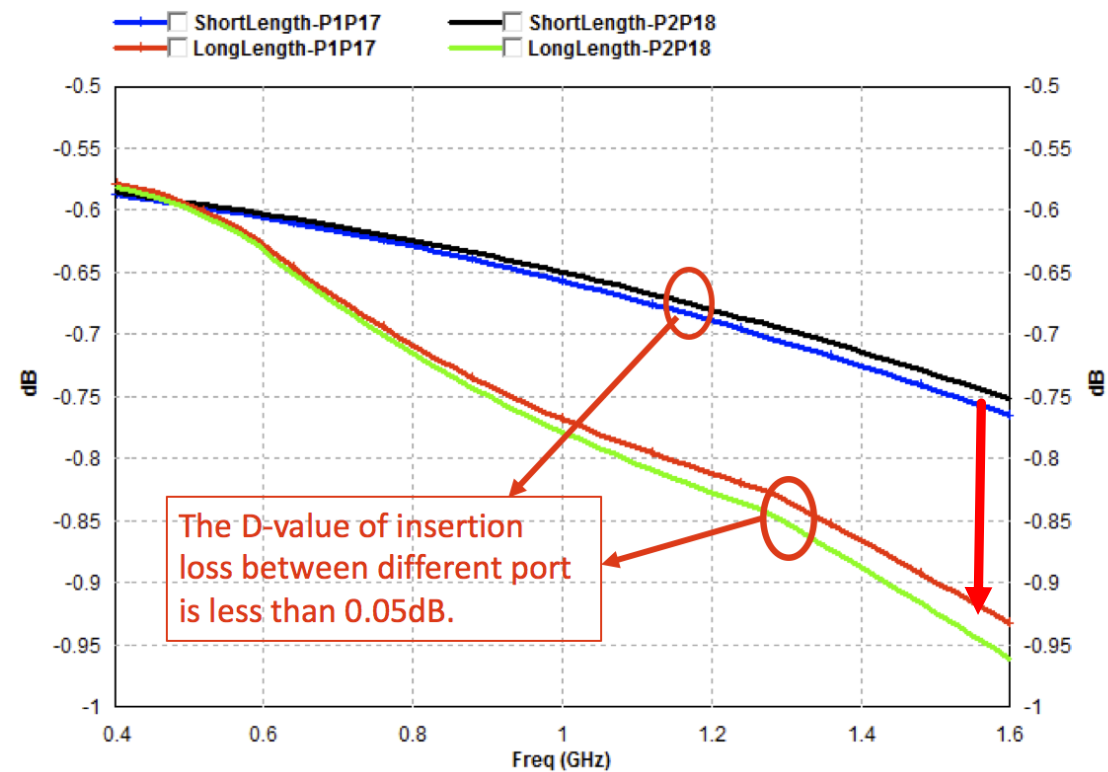
Bondwire Length Influence



S11



S21





Future Work

- Manufacture the board;
- Connect with the beamformer board and Antenna and measurement;
- Further EM simulation about QFN package in HyperLynx, like adding IC and other package types;
- Writing HyperLynx Package EM simulation manual;
- Learn LNA and filter design.



Acknowledgement

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Thank YOU