

AUTOMOBILE RADAR LAYOUT DESIGN

Scope: PCB Layout Design

Application: Advanced Driver Assistance System (ADAS)

Automobile radar is a technology that uses radio waves to detect the distance, speed and direction of other vehicles on the road. It helps drivers avoid collisions, maintain a safe distance and optimize their driving performance. Automobile radar systems typically consist of a transmitter, a receiver and a processor that analyze the signals and provide feedback to the driver or the vehicle's control system.



Layout Design – Challenge

We have been assigned the responsibility of designing an automobile radar system's PCB from the ground up, as specified by our client. The Layout design of the radar must meet the following key requirements:

Requirement:

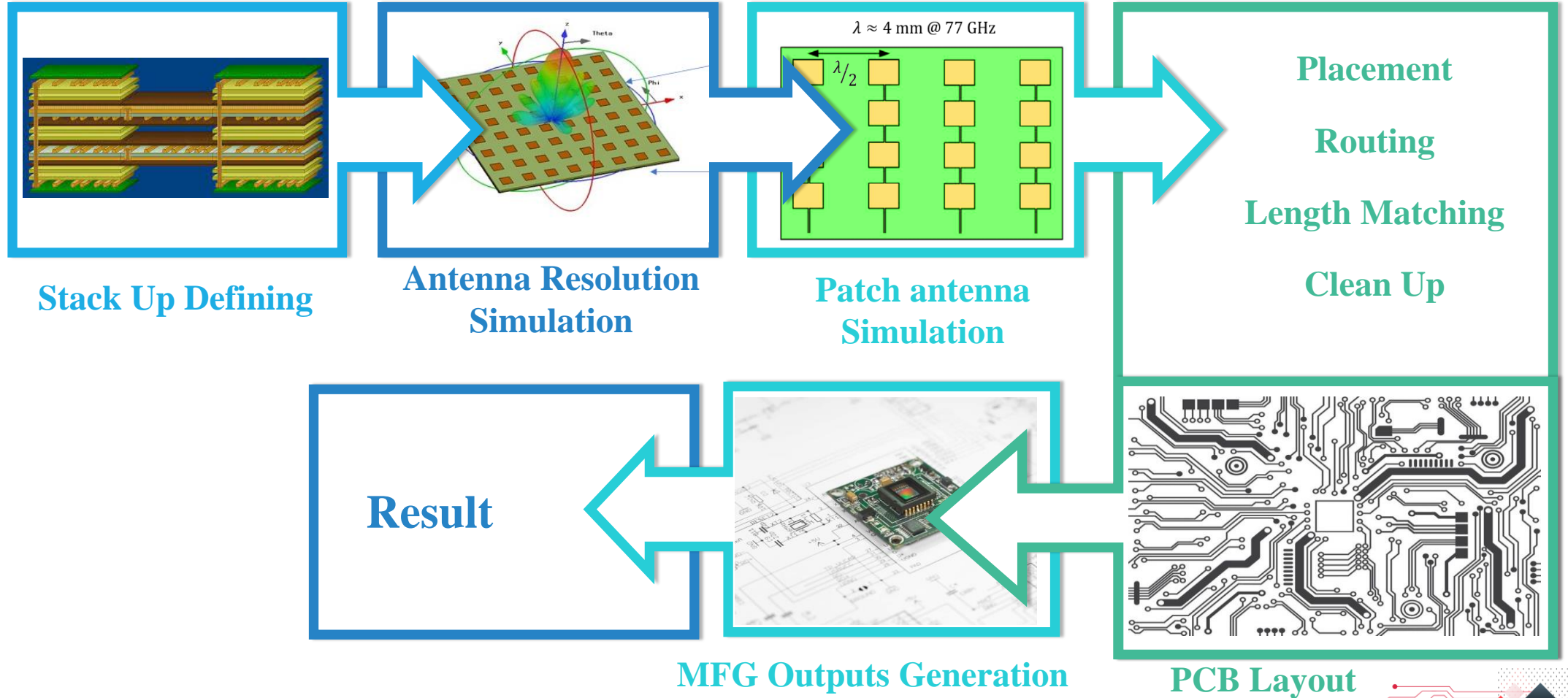
- Small Form Factor.
- Power supply – 12V Battery.
- Low Iq and High Efficient power supply.
- Longer-range TX beamforming and beamsteering.
- High angular resolution MIMO.
- Need to provide Data over CAN-FD, Ethernet or LVDS.

Challenge:

- Layer Stack up Creation
- Antenna Resolution Calculation & Simulation
- Antenna PCB design, Calculation & Simulation
- Length Matching



Layout Design –SoW



How We Executed? (Cont.)

Stack Up Defining

To create an efficient radar PCB, we Converted to manufacturer for the best stack up for 10 Layer based on the following factors,

- Substrate thickness
- Metal thickness
- Metal roughness
- Plating
- Etch tolerances (LDI vs. LPI masks)
- Air gap tolerances
- Solder-mask tolerance (LDI vs. LPI accuracy)
- Sequential stack-up layer registration
- Peel strength vs plating height

	Material	Thickness (mils)
Top Overlay		
Top Solder	Solder Resist	0.4
Layer1	Copper	1.6
Dielectric1	RO3003 core	5
Layer2	Copper	1.4
Dielectric2	RO4450F Prepreg	5
Layer3	Copper	0.7
Dielectric3	RO4835 core	9
Layer4	Copper	0.7
Dielectric4	370HR Prepreg	5
Layer5	Copper	0.7
Dielectric5	370HR core	5
Layer6	Copper	0.7
Dielectric6	370HR Prepreg	5
Layer7	Copper	0.7
Dielectric7	370HR core	9
Layer8	Copper	0.7
Dielectric8	370HR Prepreg	5
Layer9	Copper	1.4
Dielectric9	370HR core	5
Layer10	Copper	0.6
Bottom Solder	Solder Resist	0.4
Bottom Overlay		

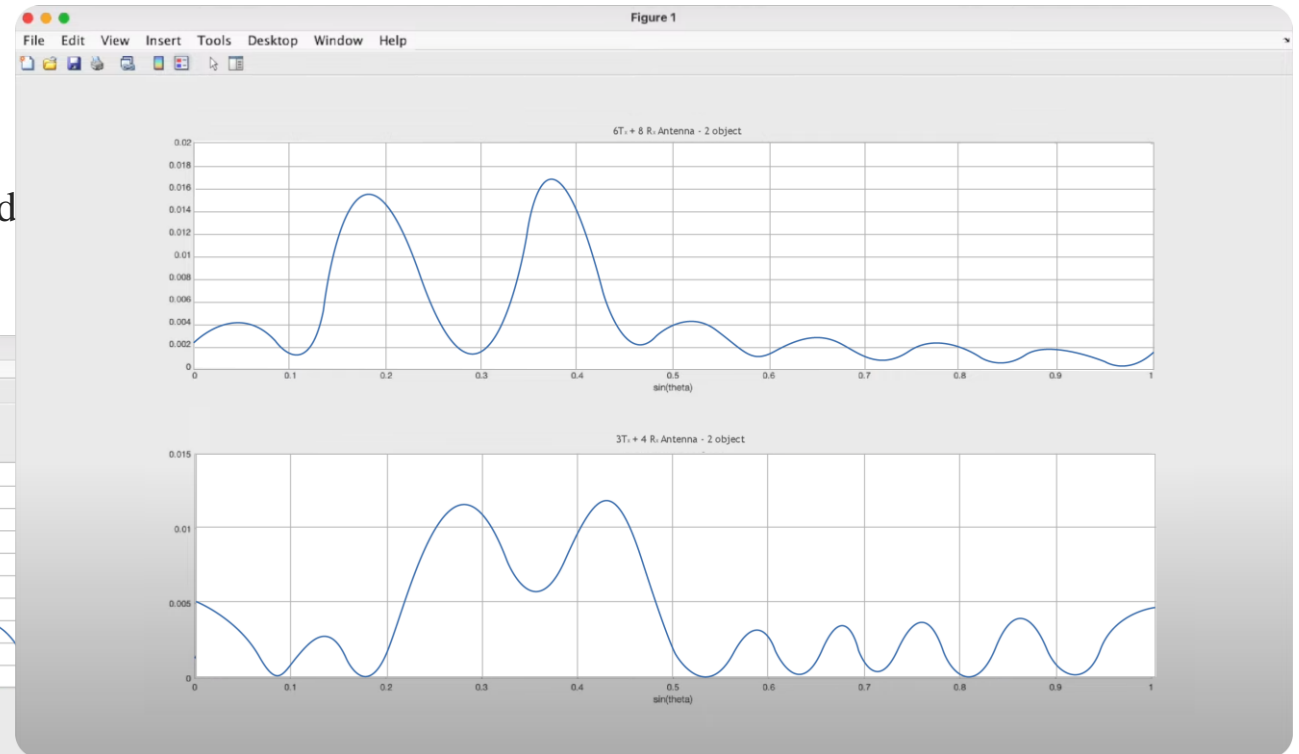
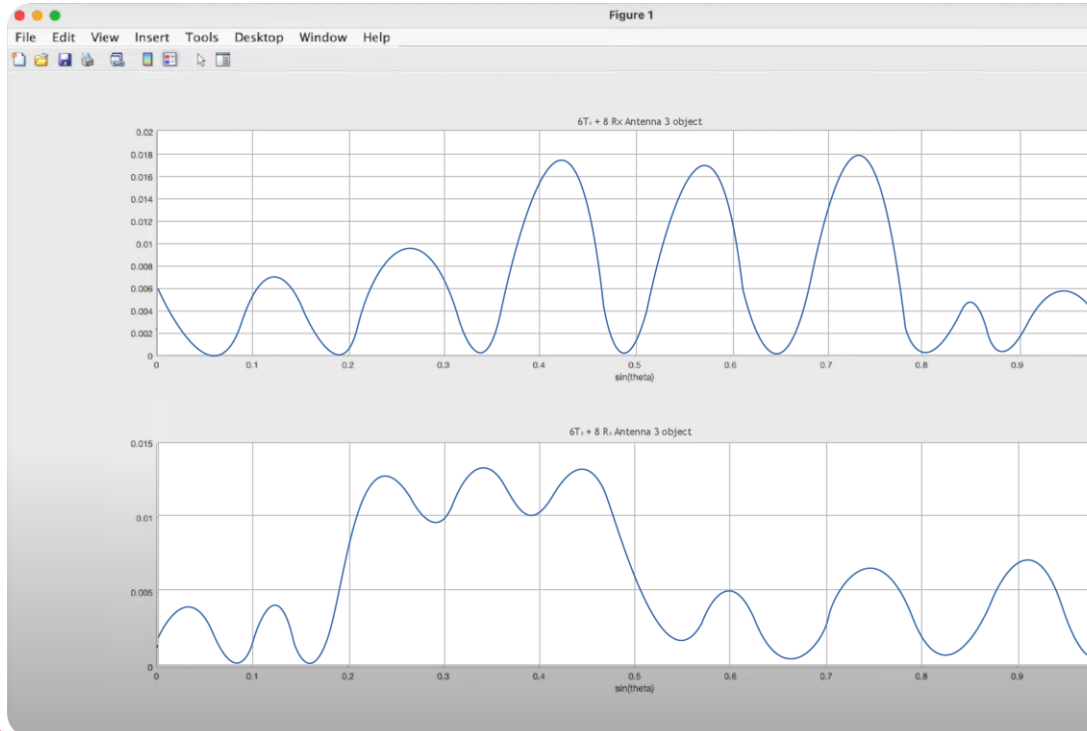
Total Thickness	1.6 +/- 0.1 mm
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How We Executed? (Cont.)

Antenna Resolution Simulation

The simulation of antenna is done in MATLAB tool to find high resolution Tx and Rx configuration.



The result shows that the resolution is higher than the 3Tx+4Rx configuration.

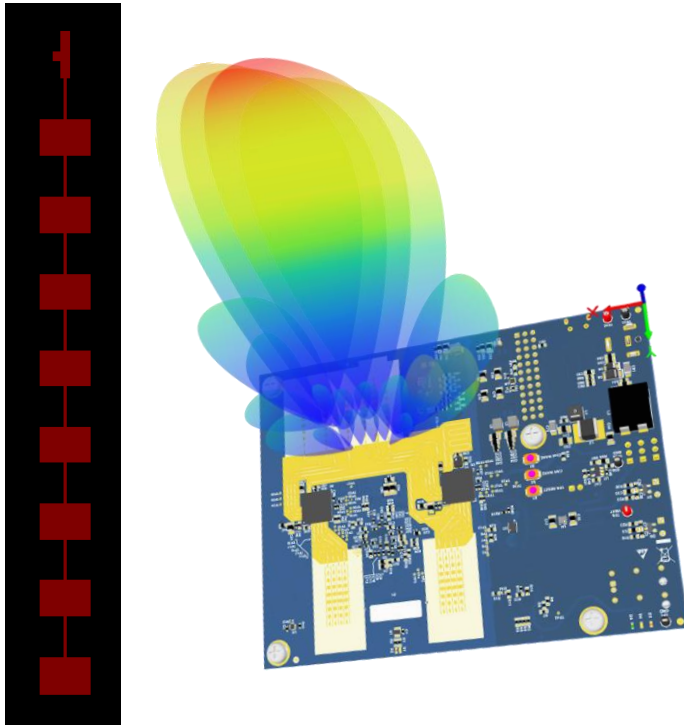


How We Executed? (Cont.)

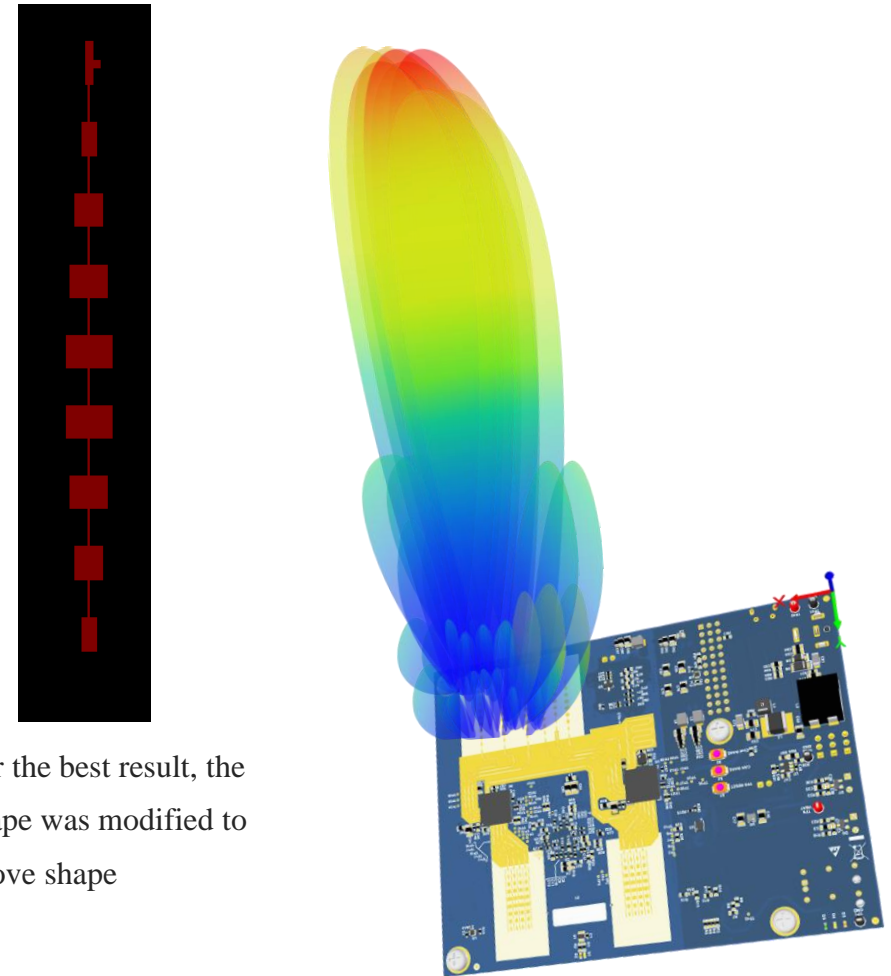
Patch antenna Simulation

The simulation of antenna is done in MATLAB tool to find how effective beamforming will occur in the shape.

Before



After



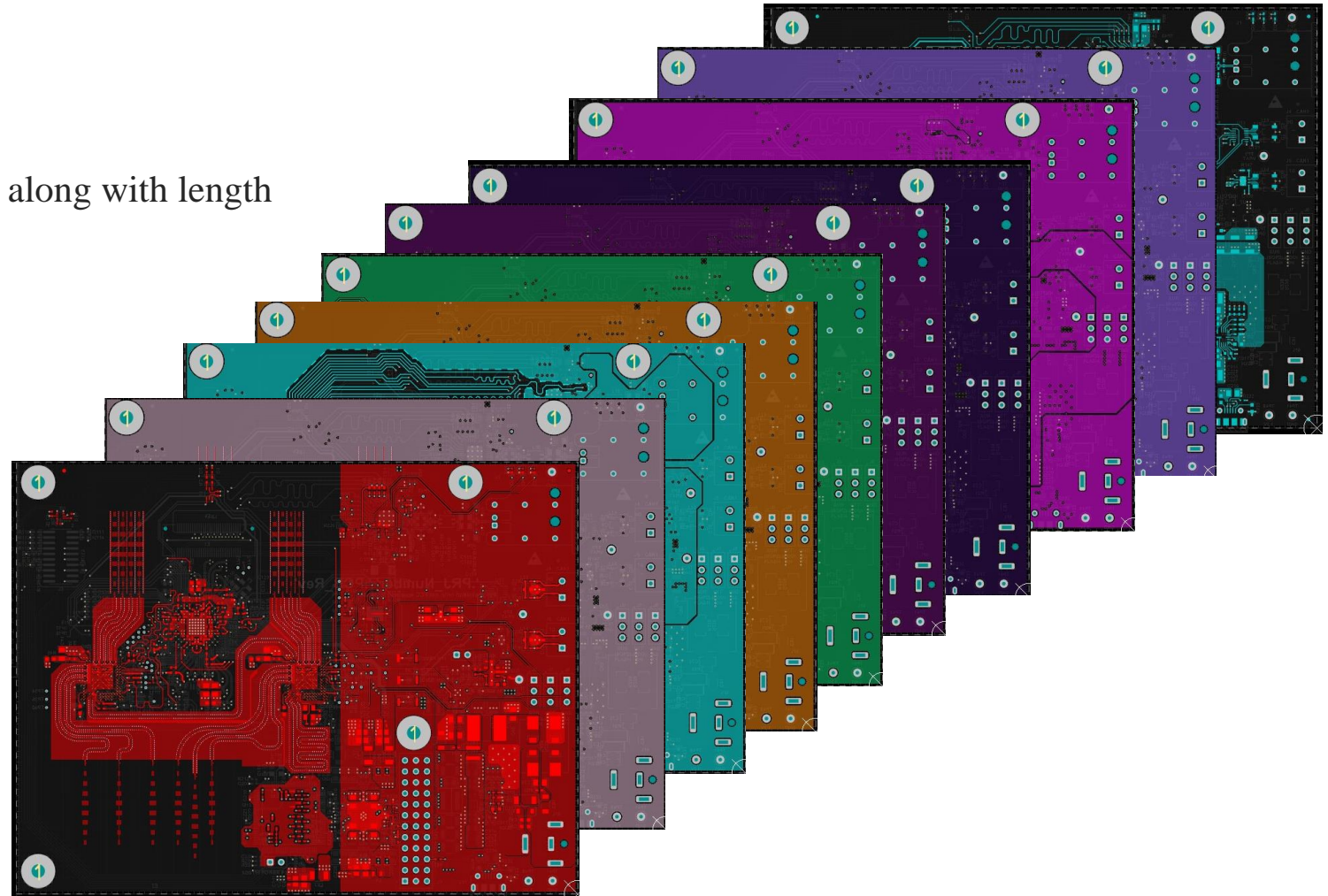
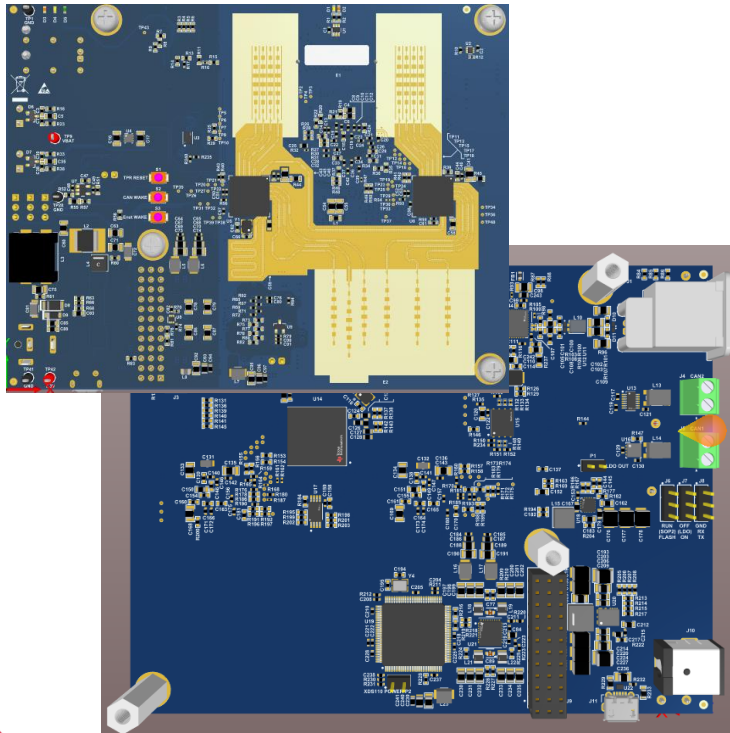
For the best result, the shape was modified to above shape



How We Executed? (Cont.)

PCB Layout

The complete PCB Layout was formed, along with length matching of high speed signal.

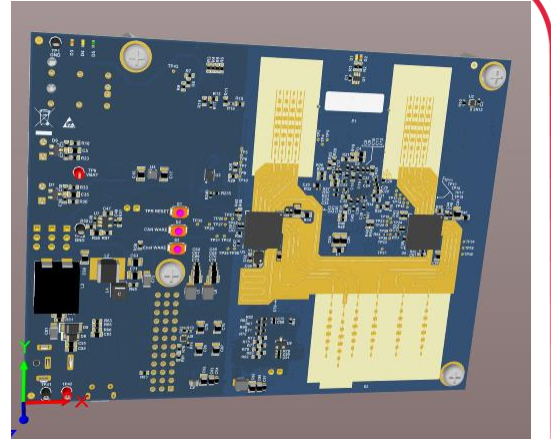
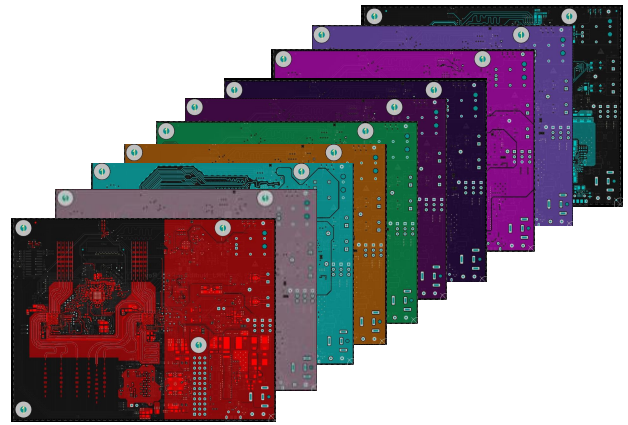


How We Executed?

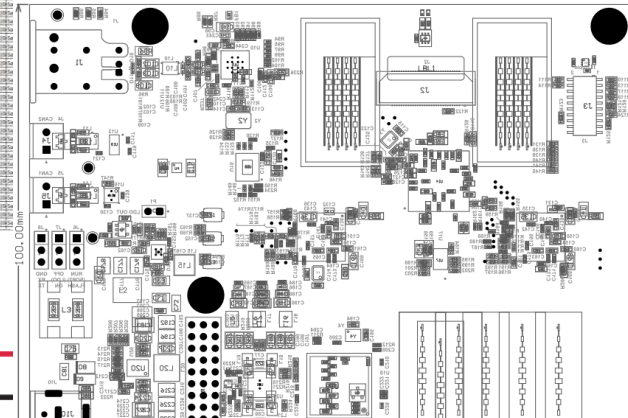
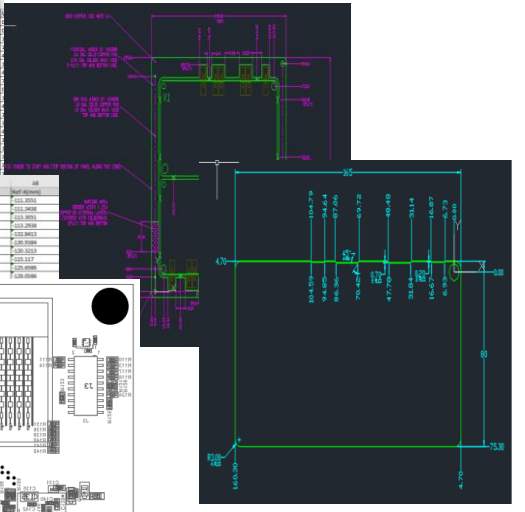
MFG Outputs Generation

The following files are sent to manufacturer to fabricate the PCB and assemble the components.

- Gerber Files
- NC Drill Files.
- ODB++ files
- Hyper Lynx File
- Fab and Array Drawing Files
- BOM (Bill Of Materials) and PNP (Pick and Place) file
- Assembly Drawings (PDF file)
- 3D STEP File



Part No.	Quantity	Designator	Dimension	Library Name	Part 1	Part 2	Type	Unit	Type
500019	1	U10	1.27x1.27x0.4	U10	U10	U10	U10	U10	U10
500020	1	R10	0.4x0.4	R10	R10	R10	R10	R10	R10
500021	1	C10	0.6x0.6	C10	C10	C10	C10	C10	C10



A Heartfelt Customer's Voice

I am deeply impressed by the remarkable dedication and exceptional work exhibited by the team in overcoming challenges during the development of our Radar layout design project. The team's efficiency and commitment are evident in the quick turnaround time for completing the Layout. This design not only aligns seamlessly with our specified requirements but also ensures the Antenna functions at optimal efficiency for low cost. It marks a significant milestone in our project journey, and we eagerly anticipate further collaboration with such a talented and dependable team.



Conclusion

- Our commitment to excellence and technical expertise were demonstrated through the successful delivery of complete Automobile Radar Layout Design that precisely met the client's requirements.
- In addition to the PCB development, we also provide support for the programming of the device.
- Our commitment lies in delivering top-tier Layout services, serving as a testament to our capacity and dependability in achieving outstanding outcomes.

