

FCC ID: A3LSMS926U

Power Density Simulation Report

Revision A

October 18, 2023

SAMSUNG ELECTRONICS

1. Simulation methodology for Power Density (PD)

1.1 Simulation tool

1.1.1 Tool description

For the simulation approach to calculating power density (PD) evaluation for mobile phone with mmWave antenna modules, ANSYS Electromagnetics suite version 2023.R2 (HFSS) is used. ANSYS HFSS is one of several commercial tools for 3D full-wave electromagnetic simulation used for antenna and RF structure design of high frequency component. ANSYS Electromagnetics suite version 2023.R2 (HFSS) is implemented based on Finite Element Method (FEM), which operates in the frequency domain.

1.1.2 Mesh and Convergence criteria

To solve the PD analysis using FEM, volume area containing simulated objects should be subdivided into electrically small parts that are called finite elements as the unknown functions. To subdivide system, the adaptive mesh technique in ANSYS Electromagnetics suite version 2023.R2 (HFSS) is used. ANSYS Electromagnetics suite version 2023.R2 (HFSS) starts to refine the initial mesh based on wavelength and calculate the error to iterative process for adaptive mesh refinement. The determination parameter of the number of iteration in ANSYS Electromagnetics suite version 2023.R2 (HFSS) is defined as convergence criteria, delta S, and the iterative adaptive mesh process repeats until the delta S is met. In ANSYS Electromagnetics suite version 2023.R2 (HFSS), the accuracy of converged results depends on the delta S. Figure 1 is an example of adaptive mesh of the device (cross-section of top view).

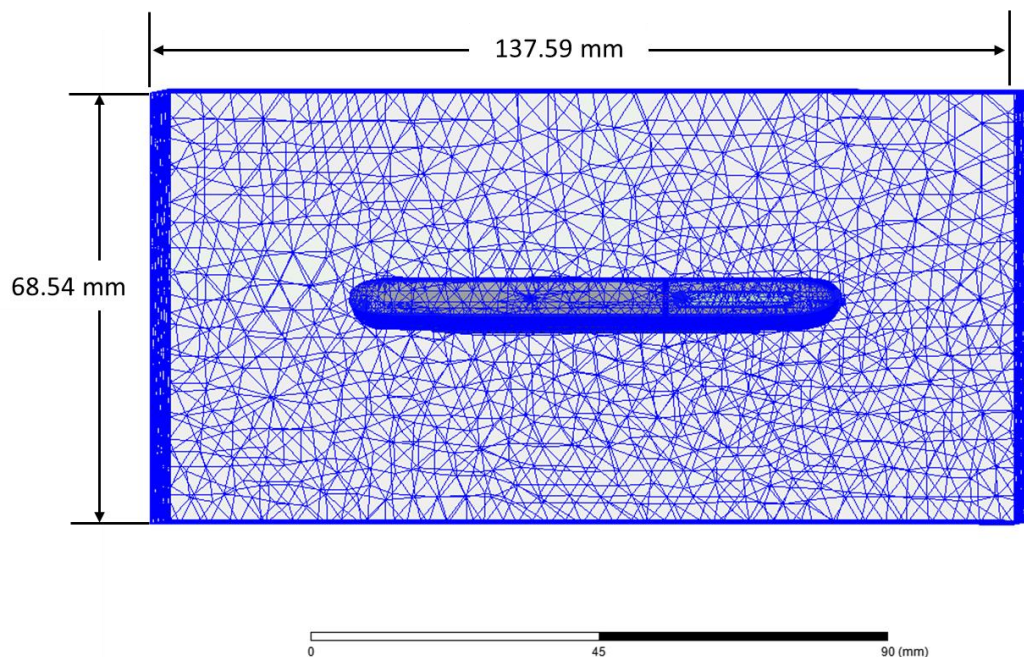


Figure 1 Example of the adaptive mesh technique (Top view)

1.1.3 Power density calculation

After solving 3D full-wave electromagnetic simulation, various kinds of physical quantities can be obtained. To calculate PD evaluation, two physical quantities, an electric field ($\vec{E}$) and a magnetic field ($\vec{H}$) are needed. The actual consumption power can be expressed as the real term of the Poynting vector ($\vec{S}$) from the cross product of $\vec{E}$ and complex conjugation of $\vec{H}$ as shown below:

$$\langle \vec{S} \rangle = \text{Re} \left(\frac{1}{2} \vec{E} \times \vec{H}^* \right)$$

$\langle \vec{S} \rangle$ can be expressed as point power density based on a peak value of each spatial point on mesh grids, and obtained directly from ANSYS Electromagnetics suite version 2023.R2 (HFSS).

From the point power density $\langle \vec{S} \rangle$, the spatial-averaged power density (PD_{av}) on an evaluated area (A) can be derived as shown below:

$$PD_{av} = \frac{1}{A} \int_A \langle \vec{S} \rangle \cdot d\vec{s} = \frac{1}{2A_{av}} \iint_{A_{av}} \| \text{Re}\{E \times H^*\} \| dA$$

, where the spatial-averaged power density (PD_{av}) is total power density value considering on x, y and z components of point power density $\langle \vec{S} \rangle$ and the evaluated area (A) is 4cm^2 .

1.2 Simulation setup

1.2.1 3D modeling

Figure 2 shows the simulation model which is mounted two mmWave antenna modules. The simulation modeling includes most of the entire structure of device itself such as PCB, metal frame, battery, cables, and legacy antennas as well as mmWave antenna modules called as Ant M and Ant N. The modeling contains the entire EUT to enable a Smart transmit GEN2, as well. Ant M is placed on the left side and antennas are facing the back side, and Ant N is placed on the right side and antennas are facing the right side of the device.

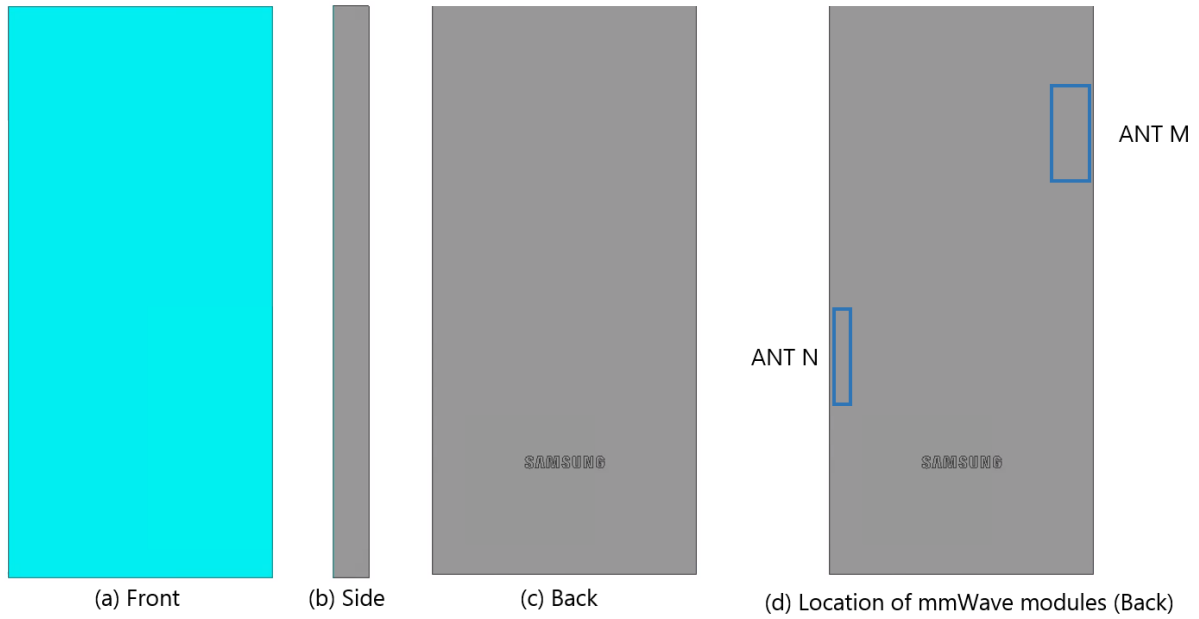


Figure 2 Simulation model which is mounted two mmWave antenna modules

1.2.2 PD evaluation planes

Table 1 shows the PD evaluation planes for each mmWave antenna module and Figure 3 shows the PD evaluation planes and truncation area of the simulation model to find worst case of beamforming cases.

Please note that the “right” and “left” edge of mentioned in this report are defined from the perspective of looking at the device from the front side.

Table 1. PD evaluation planes

Module	Front	Back	Left From Front View	Right From Front View	Top	Bottom
	S1	S2	S3	S4	S5	S6
Ant M	O	O	O	O	O	O
Ant N	O	O	O	O	O	O

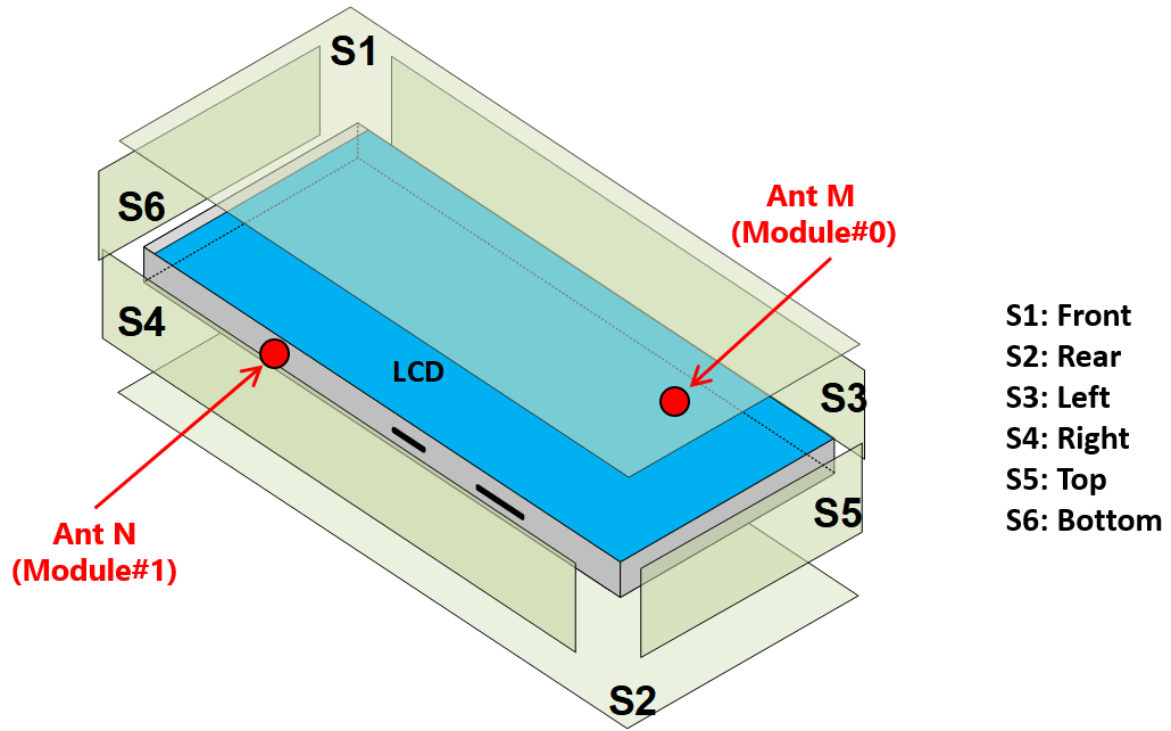


Figure 3. PD evaluation planes

1.2.3 Boundary condition

To simulate electromagnetic tool based on FEM, the boundary condition allows electromagnetic waves to be electrically open at the boundary and radiated far away without reflection. ANSYS Electromagnetics suite version 2023.R2 (HFSS) can support the absorbing boundary condition (ABC) for radiation boundary and make normally a quarter wave length from the radiating structure. In this report, to cover all beamforming cases of mmWave antenna modules, 40 mm spacing from the device for each surfaces were adopted. This distance is sufficiently large enough for “Qualcomm Input Power Limit Generator” to extract valid E- and H-fields from all adjacent exposure surfaces of the EUT.

1.2.4 Source excitation condition

The number of antenna ports of ANT M and ANT N for source excitation are the same. The antenna port of ANT M and N is divided into 10 ports for n261 and n258 1 x 5 patch array antennas, 10 ports for n260 1 x 5 patch array antennas. In the 10 ports included in each patch antenna, 5 ports are divided into vertical polarization feeding, and the other 5 ports are divided into horizontal polarization feeding.

Figure 4 shows the ANT M module structure and surrounding structure. The ANT M module is encrypted in the ANSYS Electromagnetics suite (HFSS) and can only check the feeding position.

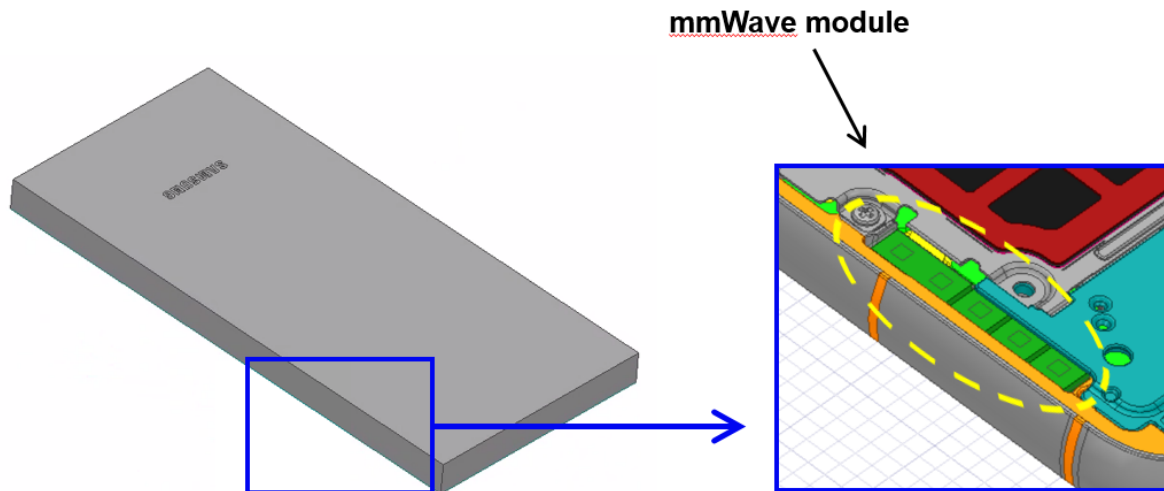


Figure 4. mmWave module (ANT M)

After finishing 3D full wave electromagnetic simulation of modeling structure, the magnitude and phase information can be loaded for each port by using “Edit Sources” function in ANSYS Electromagnetics suite (HFSS). Figure 5 shows an example of antenna port excitations.

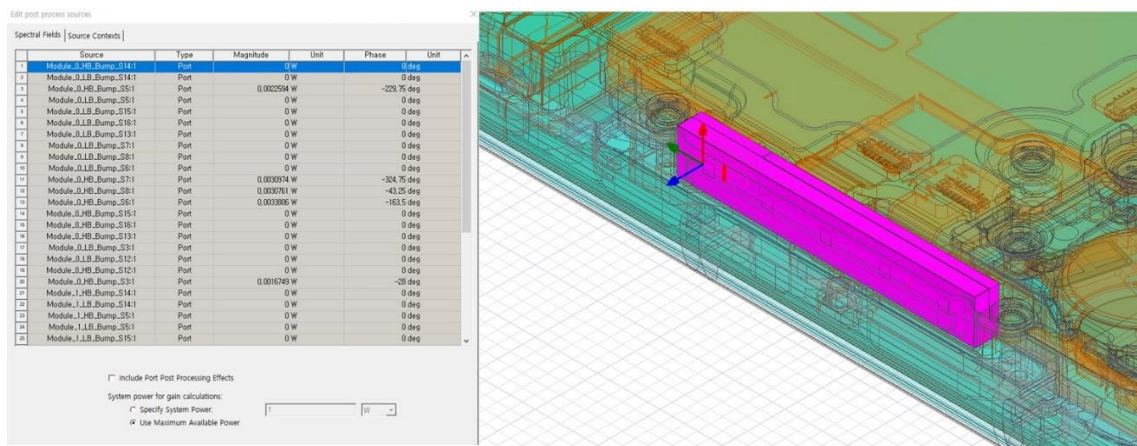


Figure 5. An example of port excitation (ANT N)

Since ANSYS Electromagnetics suite (HFSS) uses FEM solver based on frequency domain analysis method, the input source for the port excitation applies sinusoidal waveform for each frequency.

1.2.5 Condition of simulation completion

The simulation completion condition of ANSYS Electromagnetics suite (HFSS) is defined as delta S. The ANSYS Electromagnetics suite (HFSS) calculates the S-parameter for the mesh conditions of each step and determines whether to proceed with the operation of the next step by comparing the difference

between the S-parameters in the previous step. A difference between the previous step and the current step of S-parameter is expressed as delta S, and the delta S generally sets 0.02. The simulation result of this report is the result of setting delta S to 0.02.

2. Simulation verification

2.1 Spatial-averaged power density and `sim.power_limit`

As mentioned in the previous chapter, the Poynting vector ($\vec{S}$) can be obtained through cross product of an electric field ($\vec{E}$) and complex conjugate of a magnetic field ($\vec{H}$). The real term of the Poynting vector can be described as the point power density or peak power density. Using the point power density, the spatial-averaged power density can be obtained by the integral of 4 cm^2 at 2.5 mm intervals of the point power density result. Figure 6 shows examples of the distribution plot of point power density and the averaged power density.

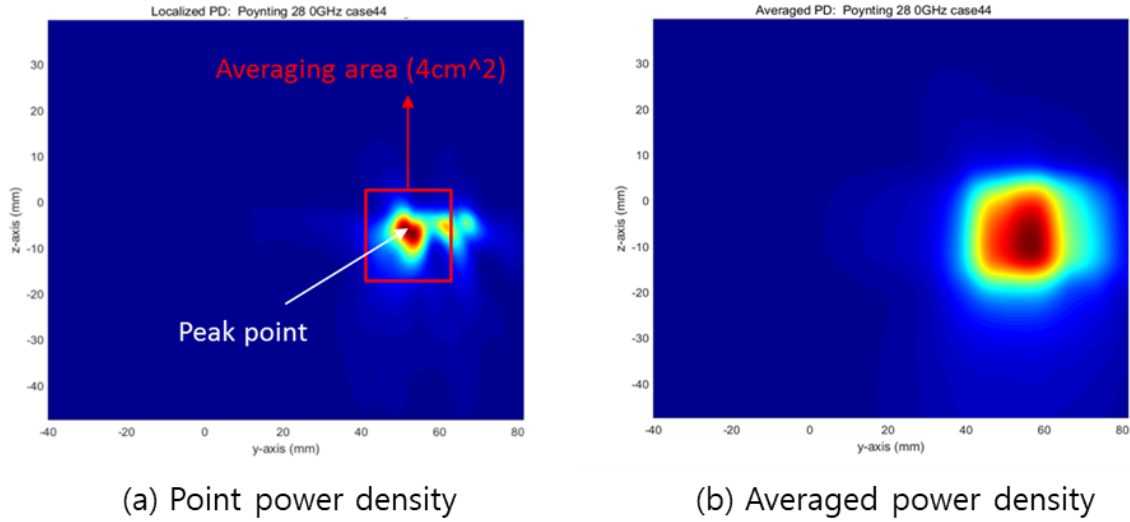


Figure 6. Power density distribution (Example)

For the Smart transmit GEN2, the “Qualcomm Input Power Limit Generator” were used to extract E- and H-fields from the validated simulation and to assess the mutual coupling between all the mmWave antenna modules and all the beams in the codebook to determine the backoff value for each mmWave module. Note the assessment and backoff value derivation are automated with “Qualcomm Input Power Limit Generator”. Once the script is done with assessment, it will provide the `sim.power_limit` (backoff is already included) for all the beams for all three channels for the specified `PD_design_target`. This mode take the minimum `sim.power_limit` out of all three channels (low, mid and high) and use the resulted `sim.power_limit`.

2.2 Comparison between simulation, measurement

In this section, the simulated-power density distributions and measured-power density distributions are compared to each mmWave antenna. Furthermore, to verify the Smart transmit GEN2, the PD distributions printing out from the “Qualcomm Input Power Limit Generator” are added.

Based on comparison of power density distributions, the power densities of simulated, measured and the “Qualcomm Input Power Limit Generator” have a good correlation. The discrepancy in amplitude between the “Qualcomm Input Power Limit Generator” 4cm² averaged power density and measured 4cm² averaged power density is considered as housing influence and used in determining input power limit for each beam for RF exposure compliance.

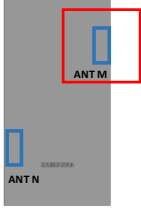
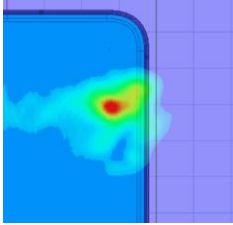
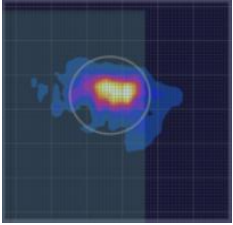
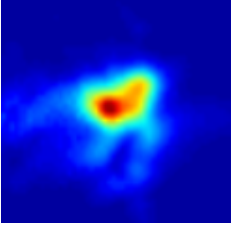
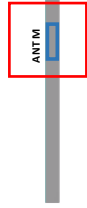
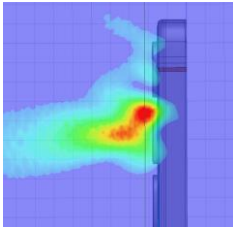
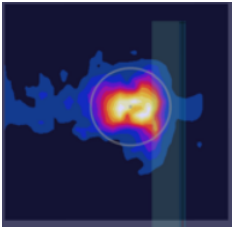
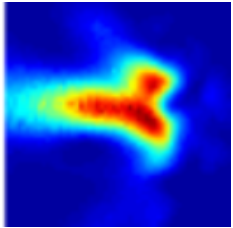
The input powers per each active port are listed below for both Simulation and Measurement validation and power density characterization. For Simulation, these values were entered directly into HFSS model. For measurement, FTM S/W was used to input these values for each active port also.

Mode/Band	Antenna	Input Power (dBm)	Input Power (dBm)
		SISO	MIMO
5G NR n261	M Patch	6.0	6.0
	N Patch	6.0	6.0
5G NR n260	M Patch	6.0	6.0
	N Patch	6.0	6.0
5G NR n258	M Patch	6.0	6.0
	N Patch	6.0	6.0

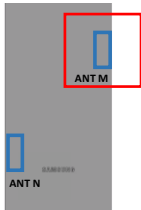
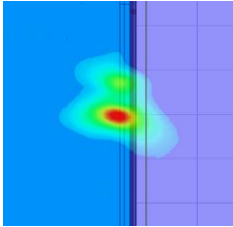
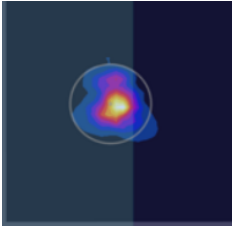
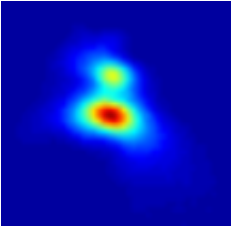
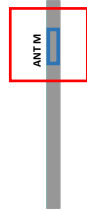
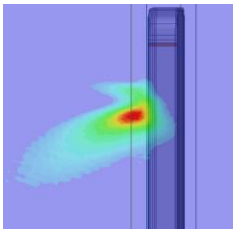
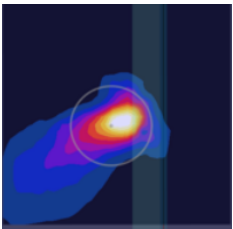
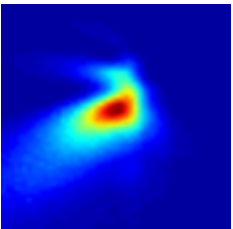
* The below simulation and measurement result were performed at 2mm evaluation distance and 28GHz / 38.5GHz / 24.8 GHz. The *input.power.limit* was determined based on below results.

Band	Channel	Module	Type(P or D)	Side	Beam ID	PLS (10 dBm)	Sim. PD (mW/cm2)	Meas. PD (mW/cm2) * Circle Avg
n261	Mid Ch. 2077891 (27923.5 MHz)	M	Patch	Rear	35	60	1.480	0.775
				Left			0.530	0.272
				Rear	293		2.090	1.39
				Left			1.180	0.724
		N	Patch	Rear	30		0.880	0.309
				Right			1.640	0.73
				Rear	289		0.780	0.344
				Right	286		1.420	1.06
n260	Mid Ch. 2253331 (38449.9 MHz)	M	Patch	Rear	28	60	1.309	0.487
				Left			0.737	0.321
				Rear	291		1.254	0.735
				Left	281		0.598	0.314
		N	Patch	Right	33		2.253	0.989
				Front	39		0.823	0.548
				Right	286		1.835	1.02
				Front			1.339	0.387
n258	Mid Ch. 2025833 (24800.04 MHz)	M	Patch	Rear	35	60	1.199	0.734
				Left	37		0.526	0.197
				Rear	284		2.152	1.41
				Left			1.066	0.602
		N	Patch	Rear	40		1.329	0.618
				Right	30		1.838	0.814
				Rear	288		0.505	0.313
				Right	286		0.889	0.692
Front	0.446	0.287						

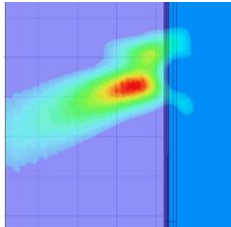
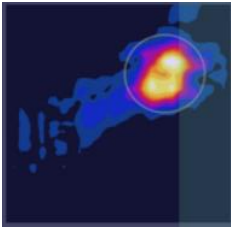
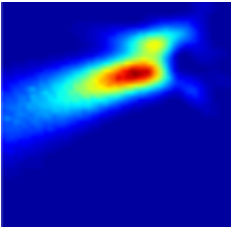
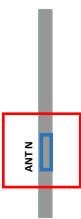
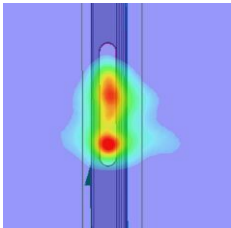
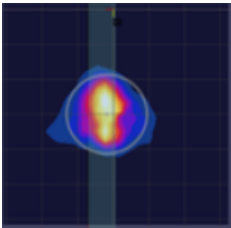
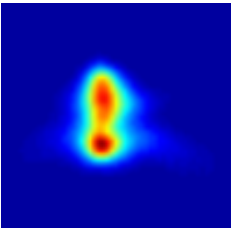
Table 2-1, n261 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
35	S2 (Rear)				
	S3 (Left)				

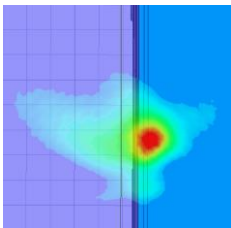
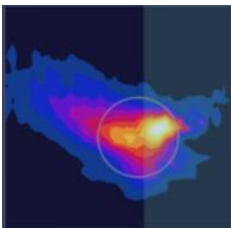
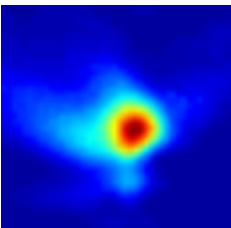
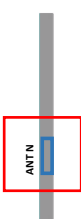
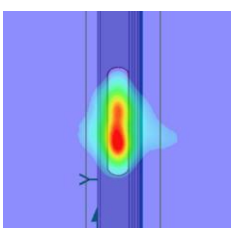
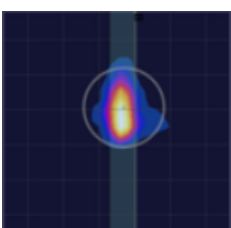
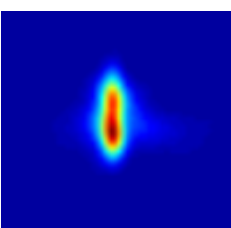
● Table 2-2, n261 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
293	S2 (Rear)				
	S3 (Left)				

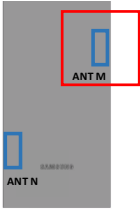
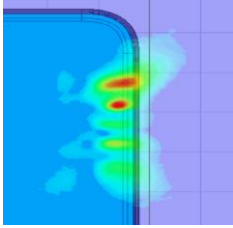
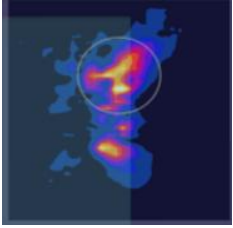
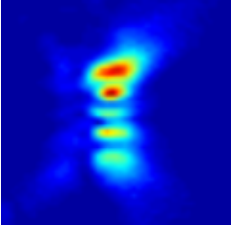
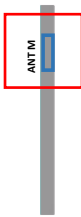
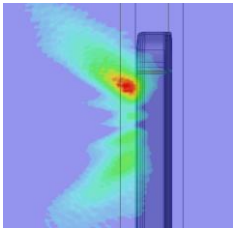
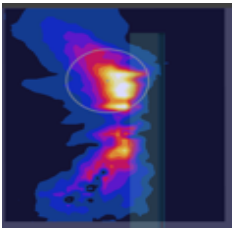
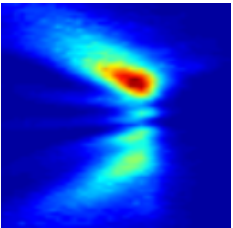
● Table 2-3, n261 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
30	S2 (Rear)				
	S4 (Right)				

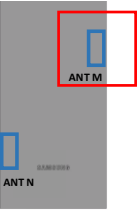
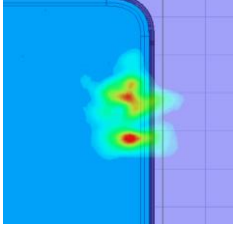
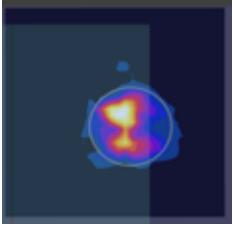
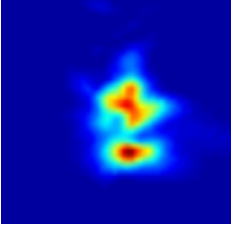
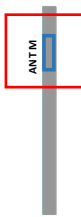
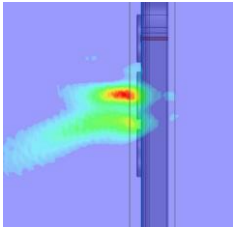
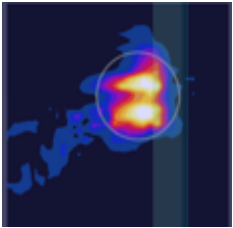
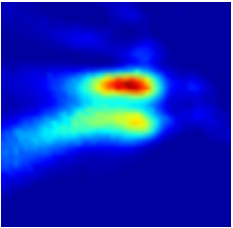
● Table 2-4, n261 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
289	S2 (Rear)				
286	S4 (Right)				

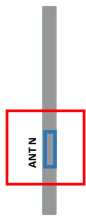
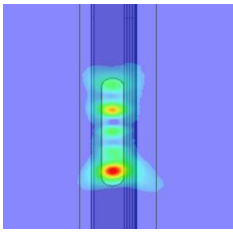
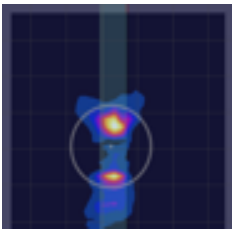
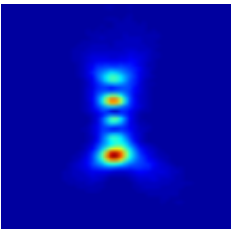
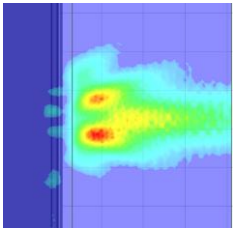
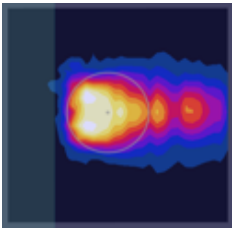
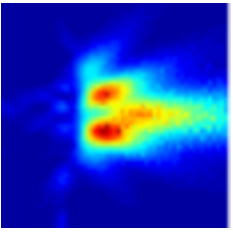
● Table 2-5, n260 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
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	S3 (Left)				

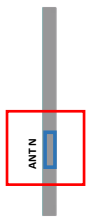
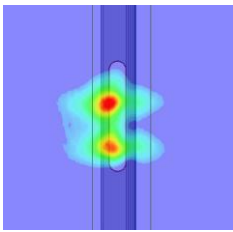
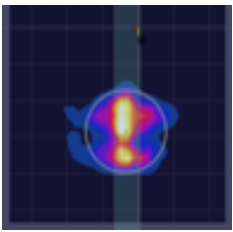
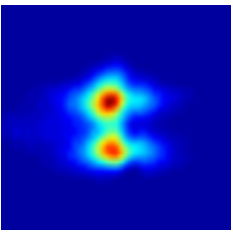
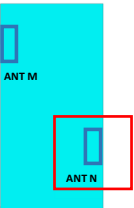
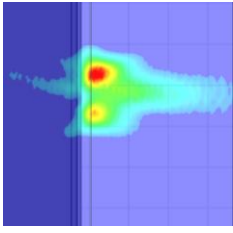
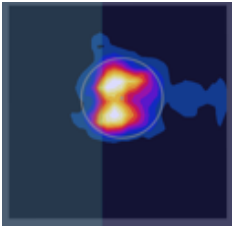
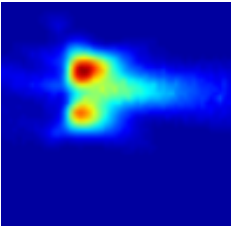
● Table 2-6, n260 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
291	S2 (Rear)				
281	S3 (Left)				

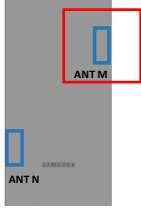
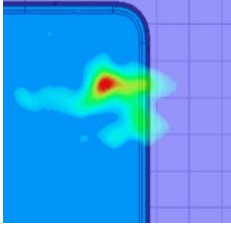
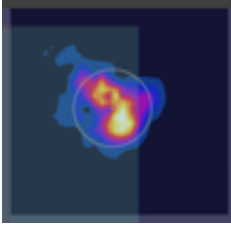
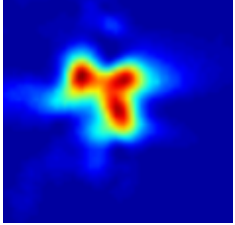
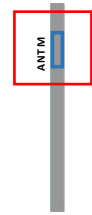
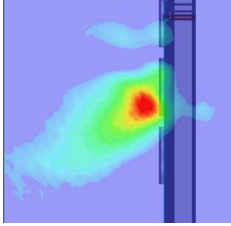
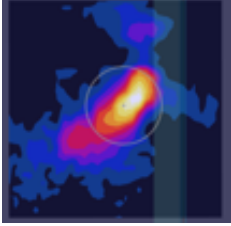
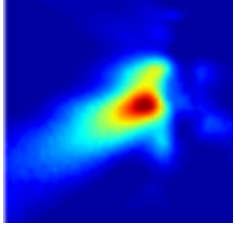
● Table 2-7, n260 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
33	S4 (Right)				
	S1 (Front)				

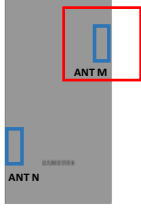
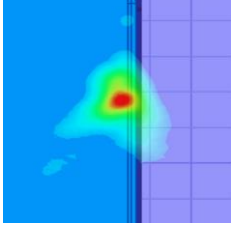
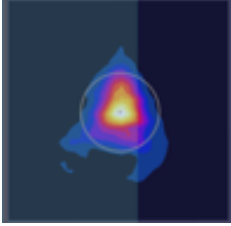
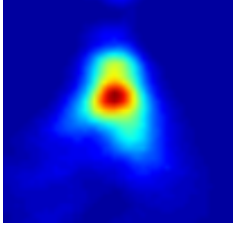
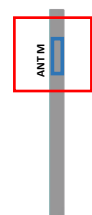
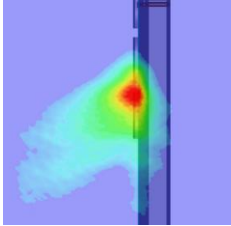
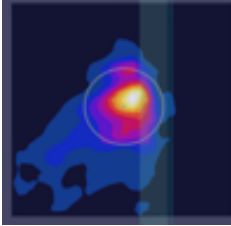
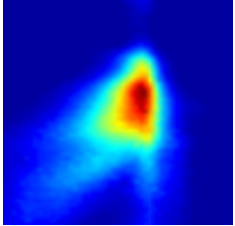
● Table 2-8, n260 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
286	S4 (Right)				
	S1 (Front)				

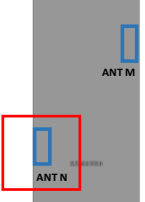
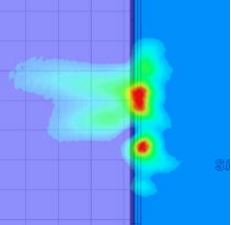
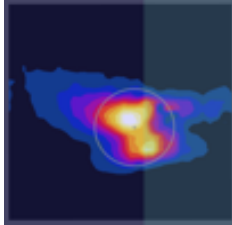
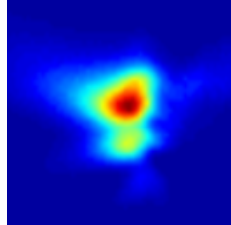
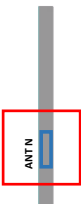
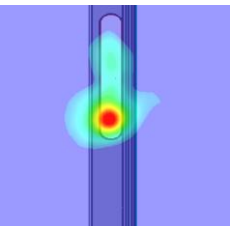
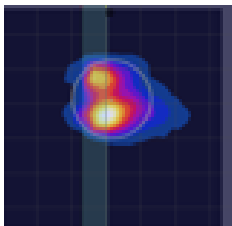
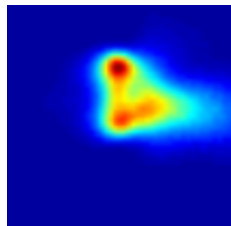
● Table 2-9, n258 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
35	S2 (Rear)				
	S3 (Left)				

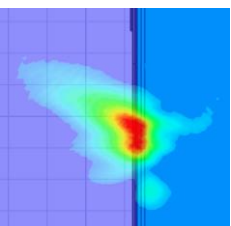
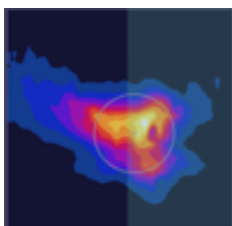
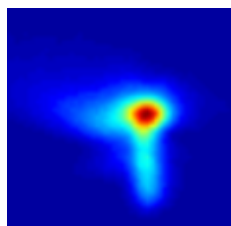
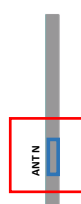
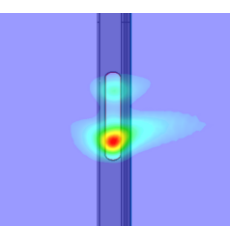
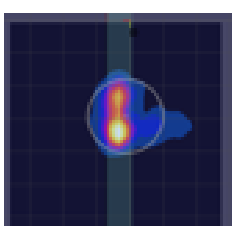
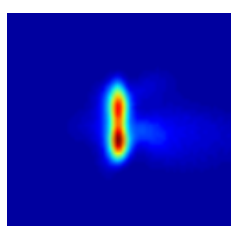
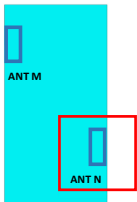
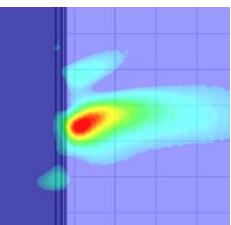
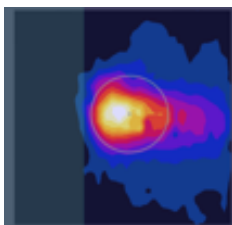
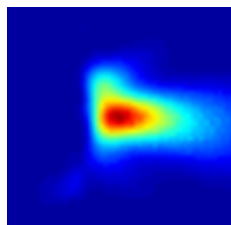
● Table 2-10, n258 ANT M-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
284	S2 (Rear)				
	S3 (Left)				

● Table 2-11, n258 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
40	S2 (Rear)				
30	S4 (Right)				

● Table 2-12, n258 ANT N-Patch

Beam ID	Surface	View	Simulated PD	Measured PD	Print out from Qualcomm IPLG
288	S2 (Rear)				
286	S4 (Right)				
	S1 (Front)				

The Smart transmit GEN2 cannot be finalized until the additional verifications are performed and passed. Follow the below steps for verifications in the mid channel:

VERIFICATION 1: Use “Qualcomm Input Power Limit Generator” to print the PD plots for all the beams selected and evaluated for model validation.

- Throughout above comparisons (Table 2-1 to 2-12), the model validation including Input Power Limit Generator were verified.

3 Simulation results

This section shows the PD simulation results of Ant M and Ant N at 28GHz, 39GHz and 24GHz for each evaluation plane specified in Table 1 at two separation distances of 2mm and 10mm. The ratio of PD exposure from front surface to the worst surface at 2mm, and the ratio of PD exposure from 2mm to 10mm evaluation distance for each beam are also reported in this section to support RF exposure analysis for simultaneous transmission scenarios performed in the Part 1 Near Field PD report.

The relative phase between beam pairs is not controlled in the chipset design. Therefore, the relative phase between each beam pair was considered mathematically to identify the worst case conditions. The below MIMO results represent the highest reported MIMO simulation results after sweeping across the relative phase between beams a 5° step interval from 0° to 360°,

The worst-case simulated PD determined from the tables in this section were used for conservativeness in *input.power.limit* determination in RF Exposure Part 0 Report.

3.1 PD for Low/Mid/High Channel at 28GHz / 39GHz / 24GHz

3.1.1 Ant M– Patch Antenna

Table 3 to 5 show the PD simulation evaluation of Ant M patch antenna at 28GHz / 39GHz / 24GHz for the all surfaces.

Table 3. PD of Ant M – patch antenna (28GHz – n261)

- M-patch Low CH

[illegible]

- M-patch Mid CH

[illegible]

- M-patch High CH

[illegible]

Table 4. PD of Ant M – patch antenna (39GHz – n260)

- M-patch Low CH

[illegible]

- M-patch Mid CH

[illegible]

- M-patch High CH

[illegible]

Table 5. PD of Ant M – patch antenna (24GHz – n258)

- M-patch Low CH

[illegible]

- M-patch Mid CH

No.	Abbr.	Type	Beam ID-1	Beam ID-2	Beam no.	area (square meters)										area ratio out of all beams										area (square meters) at 10mm evaluation distance										area ratio out of all beams																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
						area (square meters)					area ratio out of all beams					area (square meters) at 10mm evaluation distance					area ratio out of all beams					area (square meters)					area ratio out of all beams																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
						category	CL100	CL200	CL300	CL400	CL500	CL600	CL700	CL800	CL900	CL1000	CL1100	CL1200	CL1300	CL1400	CL1500	CL1600	CL1700	CL1800	CL1900	CL2000	CL2100	CL2200	CL2300	CL2400	CL2500	CL2600	CL2700	CL2800	CL2900	CL3000	CL3100	CL3200	CL3300	CL3400	CL3500	CL3600	CL3700	CL3800	CL3900	CL4000	CL4100	CL4200	CL4300	CL4400	CL4500	CL4600	CL4700	CL4800	CL4900	CL5000	CL5100	CL5200	CL5300	CL5400	CL5500	CL5600	CL5700	CL5800	CL5900	CL6000	CL6100	CL6200	CL6300	CL6400	CL6500	CL6600	CL6700	CL6800	CL6900	CL7000	CL7100	CL7200	CL7300	CL7400	CL7500	CL7600	CL7700	CL7800	CL7900	CL8000	CL8100	CL8200	CL8300	CL8400	CL8500	CL8600	CL8700	CL8800	CL8900	CL9000	CL9100	CL9200	CL9300	CL9400	CL9500	CL9600	CL9700	CL9800	CL9900	CL10000	CL10100	CL10200	CL10300	CL10400	CL10500	CL10600	CL10700	CL10800	CL10900	CL11000	CL11100	CL11200	CL11300	CL11400	CL11500	CL11600	CL11700	CL11800	CL11900	CL12000	CL12100	CL12200	CL12300	CL12400	CL12500	CL12600	CL12700	CL12800	CL12900	CL13000	CL13100	CL13200	CL13300	CL13400	CL13500	CL13600	CL13700	CL13800	CL13900	CL14000	CL14100	CL14200	CL14300	CL14400	CL14500	CL14600	CL14700	CL14800	CL14900	CL15000	CL15100	CL15200	CL15300	CL15400	CL15500	CL15600	CL15700	CL15800	CL15900	CL16000	CL16100	CL16200	CL16300	CL16400	CL16500	CL16600	CL16700	CL16800	CL16900	CL17000	CL17100	CL17200	CL17300	CL17400	CL17500	CL17600	CL17700	CL17800	CL17900	CL18000	CL18100	CL18200	CL18300	CL18400	CL18500	CL18600	CL18700	CL18800	CL18900	CL19000	CL19100	CL19200	CL19300	CL19400	CL19500	CL19600	CL19700	CL19800	CL19900	CL20000	CL20100	CL20200	CL20300	CL20400	CL20500	CL20600	CL20700	CL20800	CL20900	CL21000	CL21100	CL21200	CL21300	CL21400	CL21500	CL21600	CL21700	CL21800	CL21900	CL22000	CL22100	CL22200	CL22300	CL22400	CL22500	CL22600	CL22700	CL22800	CL22900	CL23000	CL23100	CL23200	CL23300	CL23400	CL23500	CL23600	CL23700	CL23800	CL23900	CL24000	CL24100	CL24200	CL24300	CL24400	CL24500	CL24600	CL24700	CL24800	CL24900	CL25000	CL25100	CL25200	CL25300	CL25400	CL25500	CL25600	CL25700	CL25800	CL25900	CL26000	CL26100	CL26200	CL26300	CL26400	CL26500	CL26600	CL26700	CL26800	CL26900	CL27000	CL27100	CL27200	CL27300	CL27400	CL27500	CL27600	CL27700	CL27800	CL27900	CL28000	CL28100	CL28200	CL28300	CL28400	CL28500	CL28600	CL28700	CL28800	CL28900	CL29000	CL29100	CL29200	CL29300	CL29400	CL29500	CL29600	CL29700	CL29800	CL29900	CL30000	CL30100	CL30200	CL30300	CL30400	CL30500	CL30600	CL30700	CL30800	CL30900	CL31000	CL31100	CL31200	CL31300	CL31400	CL31500	CL31600	CL31700	CL31800	CL31900	CL32000	CL32100	CL32200	CL32300	CL32400	CL32500	CL32600	CL32700	CL32800	CL32900	CL33000	CL33100	CL33200	CL33300	CL33400	CL33500	CL33600	CL33700	CL33800	CL33900	CL34000	CL34100	CL34200	CL34300	CL34400	CL34500	CL34600	CL34700	CL34800	CL34900	CL35000	CL35100	CL35200	CL35300	CL35400	CL35500	CL35600	CL35700	CL35800	CL35900	CL36000	CL36100	CL36200	CL36300	CL36400	CL36500	CL36600	CL36700	CL36800	CL36900	CL37000	CL37100	CL37200	CL37300	CL37400	CL37500	CL37600	CL37700	CL37800	CL37900	CL38000	CL38100	CL38200	CL38300	CL38400	CL38500	CL38600	CL38700	CL38800	CL38900	CL39000	CL39100	CL39200	CL39300	CL39400	CL39500	CL39600	CL39700	CL39800	CL39900	CL40000	CL40100	CL40200	CL40300	CL40400	CL40500	CL40600	CL40700	CL40800	CL40900	CL41000	CL41100	CL41200	CL41300	CL41400	CL41500	CL41600	CL41700	CL41800	CL41900	CL42000	CL42100	CL42200	CL42300	CL42400	CL42500	CL42600	CL42700	CL42800	CL42900	CL43000	CL43100	CL43200	CL43300	CL43400	CL43500	CL43600	CL43700	CL43800	CL43900	CL44000	CL44100	CL44200	CL44300	CL44400	CL44500	CL44600	CL44700	CL44800	CL44900	CL45000	CL45100	CL45200	CL45300	CL45400	CL45500	CL45600	CL45700	CL45800	CL45900	CL46000	CL46100	CL46200	CL46300	CL46400	CL46500	CL46600	CL46700	CL46800	CL46900	CL47000	CL47100	CL47200	CL47300	CL47400	CL47500	CL47600	CL47700	CL47800	CL47900	CL48000	CL48100	CL48200	CL48300	CL48400	CL48500	CL48600	CL48700	CL48800	CL48900	CL49000	CL49100	CL49200	CL49300	CL49400	CL49500	CL49600	CL49700	CL49800	CL49900	CL50000	CL50100	CL50200	CL50300	CL50400	CL50500	CL50600	CL50700	CL50800	CL50900	CL51000	CL51100	CL51200	CL51300	CL51400	CL51500	CL51600	CL51700	CL51800	CL51900	CL52000	CL52100	CL52200	CL52300	CL52400	CL52500	CL52600	CL52700	CL52800	CL52900	CL53000	CL53100	CL53200	CL53300	CL53400	CL53500	CL53600	CL53700	CL53800	CL53900	CL54000	CL54100	CL54200	CL54300	CL54400	CL54500	CL54600	CL54700	CL54800	CL54900	CL55000	CL55100	CL55200	CL55300	CL55400	CL55500	CL55600	CL55700	CL55800	CL55900	CL56000	CL56100	CL56200	CL56300	CL56400	CL56500	CL56600	CL56700	CL56800	CL56900	CL57000	CL57100	CL57200	CL57300	CL57400	CL57500	CL57600	CL57700	CL57800	CL57900	CL58000	CL58100	CL58200	CL58300	CL58400	CL58500	CL58600	CL58700	CL58800	CL58900	CL59000	CL59100	CL59200	CL59300	CL59400	CL59500	CL59600	CL59700	CL59800	CL59900	CL60000	CL60100	CL60200	CL60300	CL60400	CL60500	CL60600	CL60700	CL60800	CL60900	CL61000	CL61100	CL61200	CL61300	CL61400	CL61500	CL61600	CL61700	CL61800	CL61900	CL62000	CL62100	CL62200	CL62300	CL62400	CL62500	CL62600	CL62700	CL62800	CL62900	CL63000	CL63100	CL63200	CL63300	CL63400	CL63500	CL63600	CL637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- M-patch High CH

[illegible]

3.1.2 Ant N– Patch Antenna

Table 6 to Table 8 show the PD simulation evaluation of Ant N patch antenna at 28GHz / 39GHz / 24GHz for the corresponding evaluation plane specified in Table 1.

Table 6. PD of Ant N – patch antenna (28GHz – n261)

- N-patch Low CH

[illegible]

- N-patch Mid CH

[illegible]

- N-patch High CH

[illegible]

Table 7. PD of Ant N – patch antenna (39GHz – n260)

- N-patch Low CH

[illegible]

- N-patch Mid CH

[illegible]

- N-patch High CH

[illegible]

Table 8. PD of Ant N – patch antenna (24GHz – n258)

- N-patch Low CH

[illegible]

- N-patch Mid CH

[illegible]

- N-patch High CH

[illegible]