Power Density Simulation Report

FCC ID : A3LSMA546V

Revision : B

Date : Jan 10th, 2023

Innovative Product R&D Group 1

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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 2022.R1 (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 2022.R1 (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 2022.R1 (HFSS) is used. ANSYS Electromagnetics suite version 2022.R1 (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 2022.R1 (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 2022.R1 (HFSS), the accuracy of converged results depends on the delta S. Figure 1 is an example of final adaptive mesh of the device (cross-section of top view).
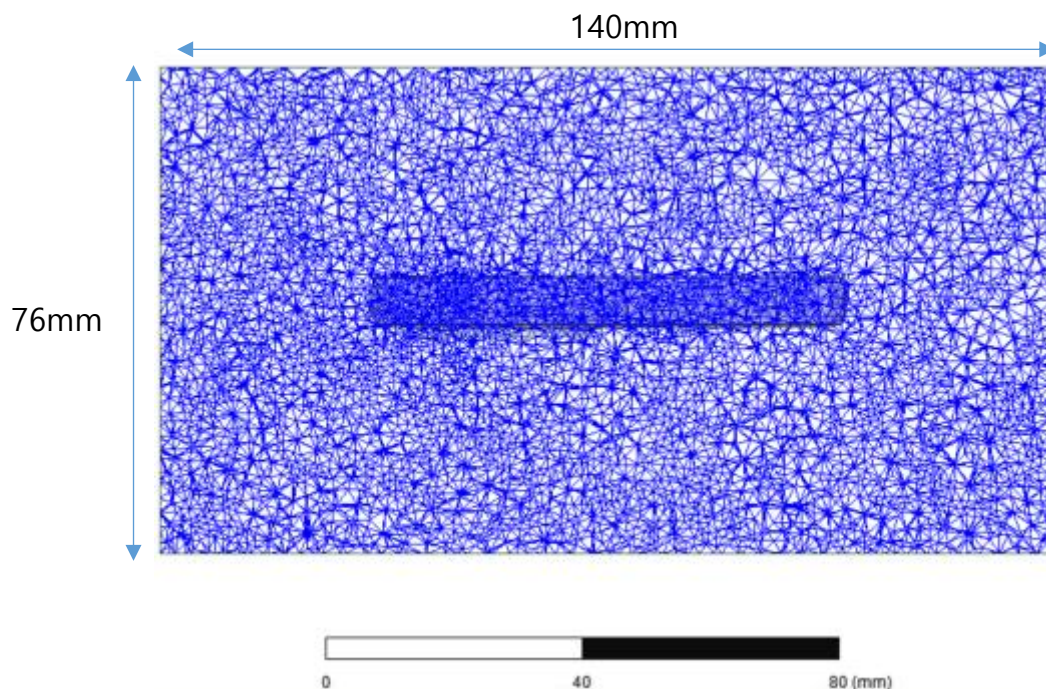

Figure 1 Example of the adaptive mesh technique (Top view)

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 2022.R1 (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:

$$PD_{av} = \frac{1}{A} \int_A \langle \vec{S} \rangle \cdot ds = \frac{1}{2A_{av}} \iint_{A_{av}} \|Re\{ExH^*\}\| \, dA$$

, 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 one mmWave antenna module. 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 module called as Ant L. Ant L is placed on the right side and antennas are facing the right side of the device.
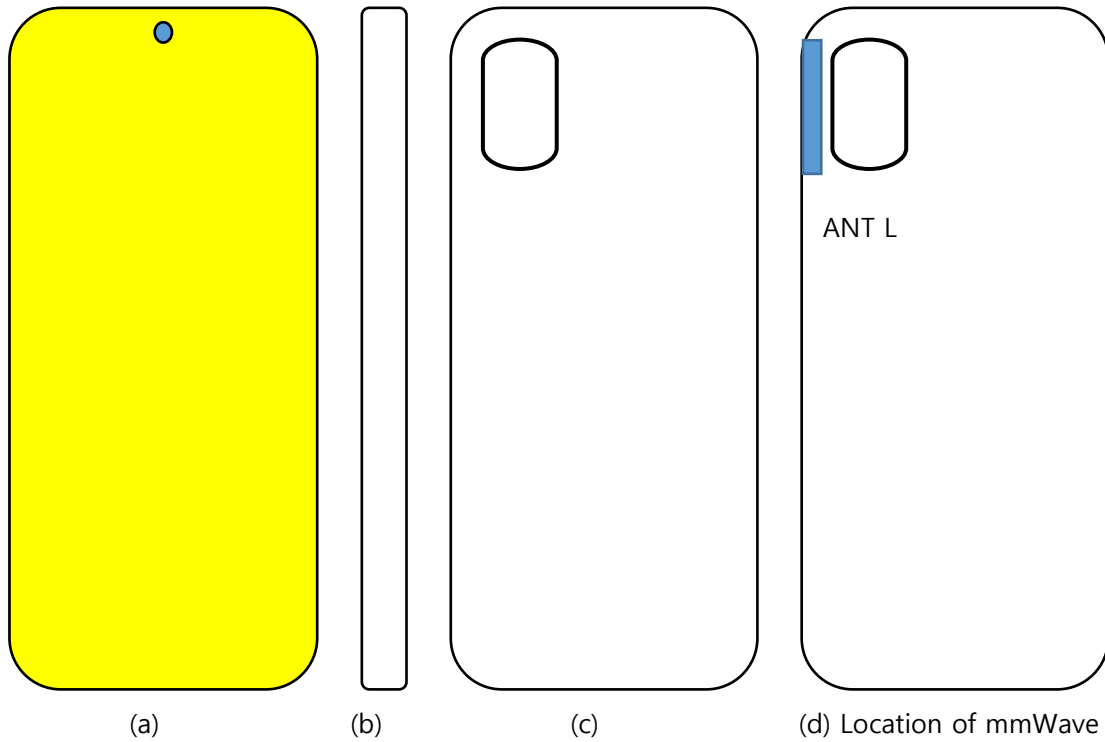
(a)	(b)	(c)	(d) Location of mmWave

Figure 2 Simulation model which is mounted three mmWave antenna modules

1.2.2 PD evaluation planes

Table 1 shows the PD evaluation planes for 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. In Ant L case, six PD evaluation planes are set up.

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 back side.

Table 1. PD evaluation planes

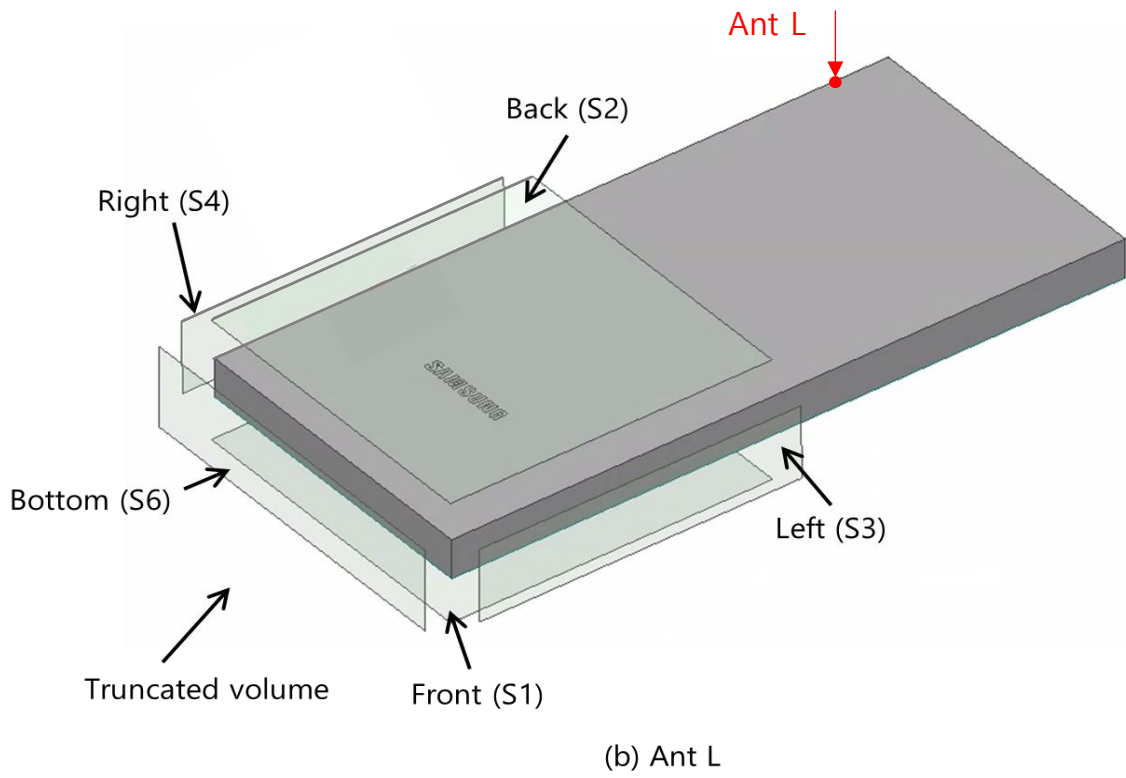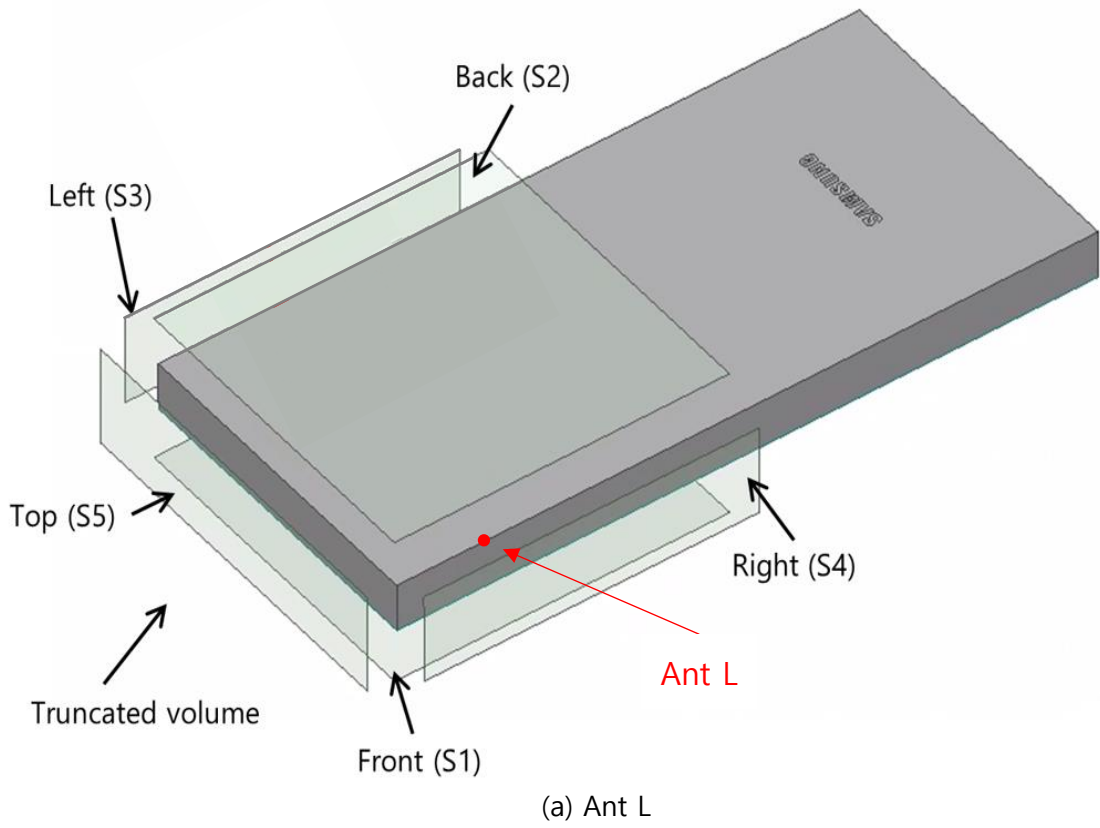|	Front	Back	Left From Front View	Right From Front View	Top	Bottom
	S1	S2	S3	S4	S5	S6
Ant L	O	O	O	O	O	O

(a) Ant L

(b) Ant L

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 2022.R1 (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 module, the three wavelength spacing from the device is used.

1.2.4 Source excitation condition

The dipole array antennas consist of 5 antenna elements and each element uses two ports as a source excitation. All antenna ports of ANT L are for patch array antennas.

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). 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

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 4 shows examples of the distribution plot of point power density and the averaged power density.

(a) Point power density   (b) Averaged power density
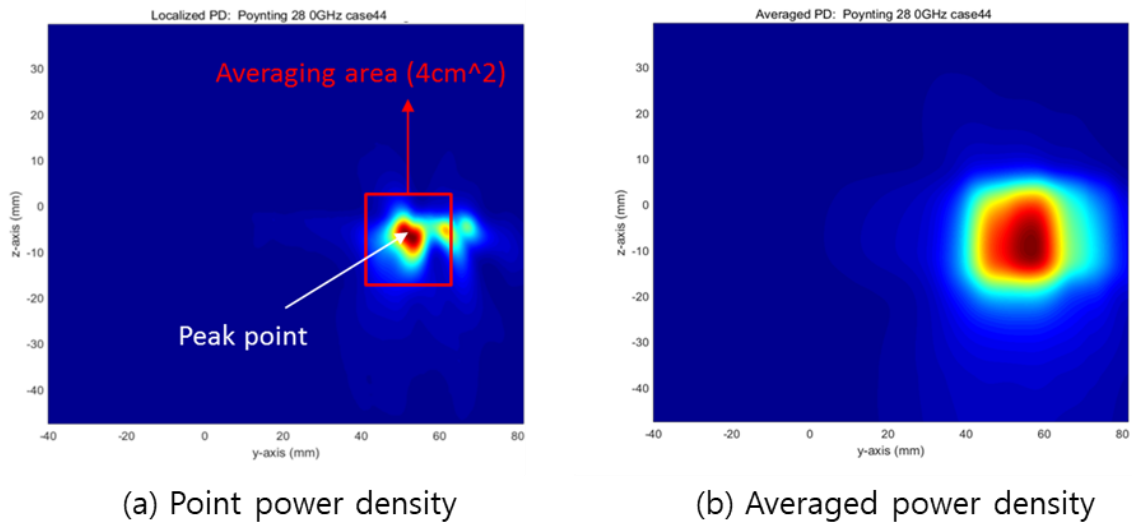
Figure 4. Power density distribution (Example)

2.2 Comparison between simulation and measurement

In this section, the simulated-power density distributions and measured-power density distributions are compared to each mmWave antenna.

Based on comparison of power density distributions, simulated power density and measured power density have a good correlation. The discrepancy in amplitude between simulated 4cm^2 averaged power density and measured 4cm^2 averaged power density is considered as housing influence and used in determining input power limit for each beam for RF exposure compliance (see RF Exposure Part 0 Report).

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.

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* The below simulation and measurement result were performed at 2mm evaluation distance and 28GHz / 38.5GHz.

Table 2.

Band	Beam ID	Polarization	Antenna	Surface	Channel	Sim. PD (mW/cm2)	Meas.PD (mW/cm2)
n261	0	H	L(patch)	Rear	Mid	0.124	0.237
	7	V			Mid	0.632	0.666
	2	H		Front	Mid	0.45	0.879
	11	V			Mid	0.166	0.151
	6	H		Right	Mid	0.479	0.938
	7	V			Mid	0.749	0.562
n260	0	H	L(patch)	Rear	Mid	0.332	0.324
	8	V			Mid	0.579	0.419
	2	H		Front	Mid	0.343	0.176
	8	V			Mid	0.157	0.086
	2	H		Right	Mid	0.618	0.678
	8	V			Mid	0.723	0.484

- n261 Ant L-Patch: Mid Channel, Beam ID 0 Back
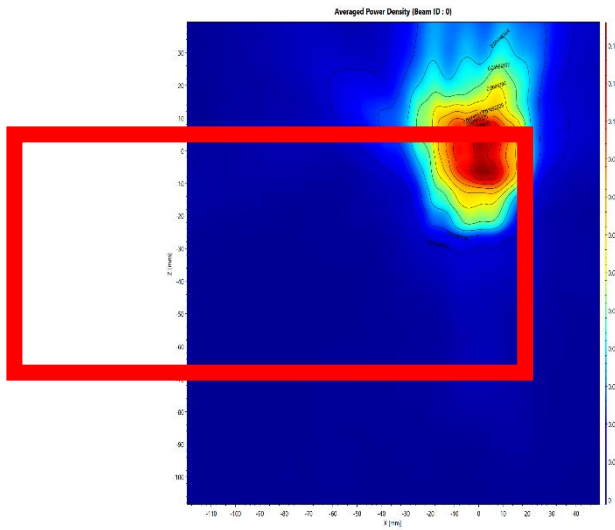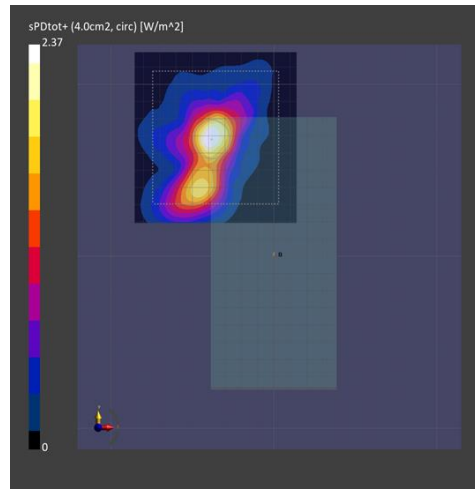
(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Rear view***)

- n261 Ant L-Patch: Mid Channel, Beam ID 7 Back

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Rear view***)

- n261 Ant L-Patch: Mid Channel, Beam ID 2, Front

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Front view***)

- n261 Ant L-Patch: Mid Channel, Beam ID 11, Front

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Front view***)

- n261 Ant L-Patch: Mid Channel, Beam ID 6, Right

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Right view***)

- n261 Ant L-Patch: Mid Channel, Beam ID 7, Right

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Right view***)

- n260 Ant L-Patch: Mid Channel, Beam ID 0, Back

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (**Rear view**)

- n260 Ant L-Patch: Mid Channel, Beam ID 8, Back

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (**Rear view**)

- n260 Ant L-Patch: Mid Channel, Beam ID 2, Front

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (**_Front view_**)

- n260 Ant L-Patch: Mid Channel, Beam ID 8, Front

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (**_Front view_**)

- n260 Ant L-Patch: Mid Channel, Beam ID 2, Right

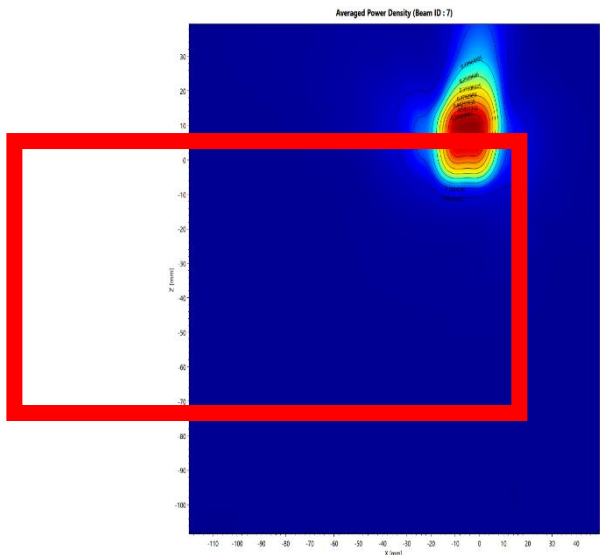

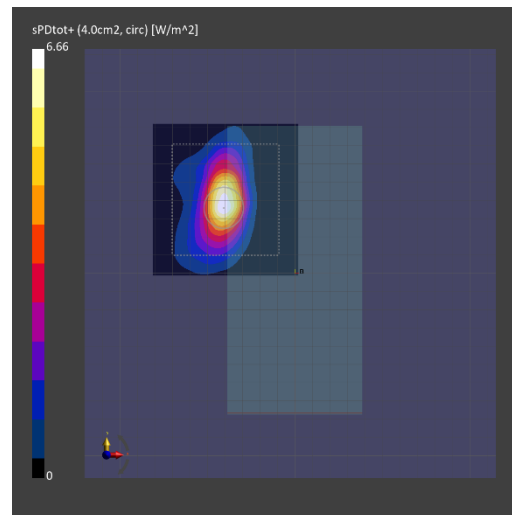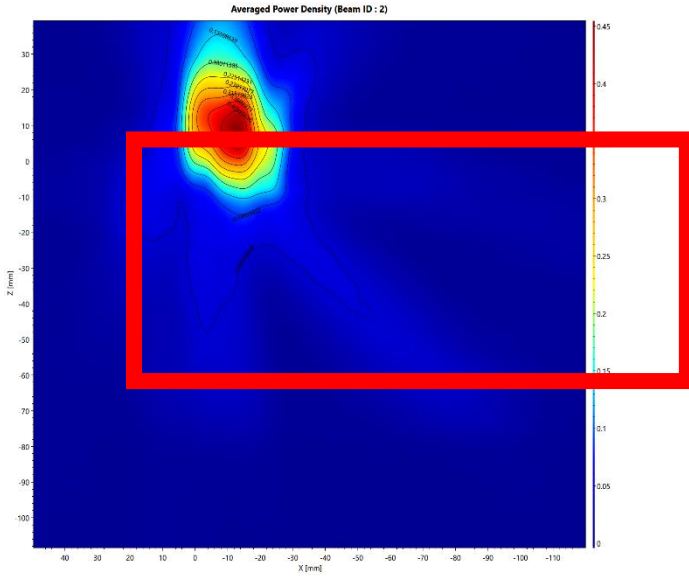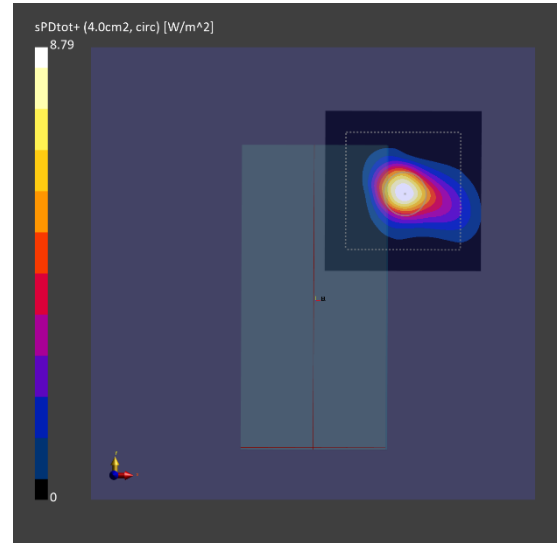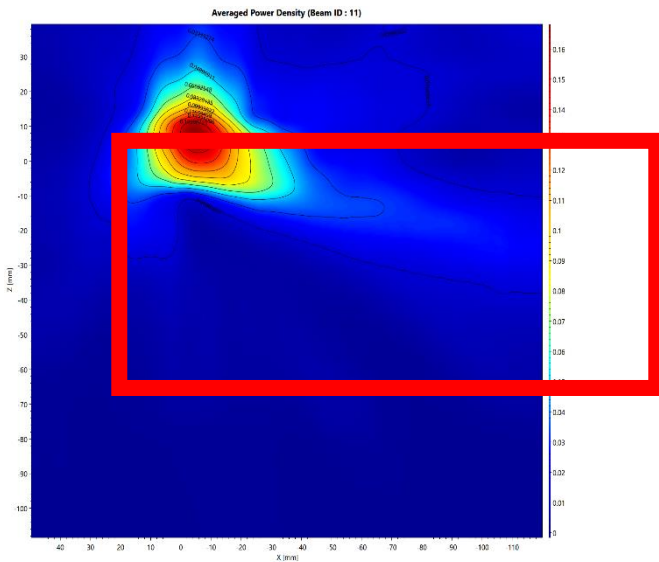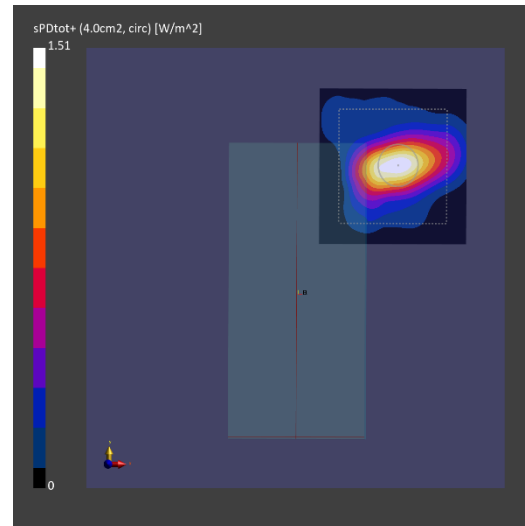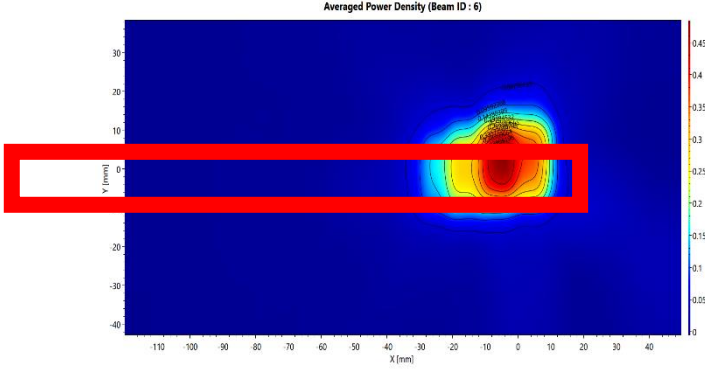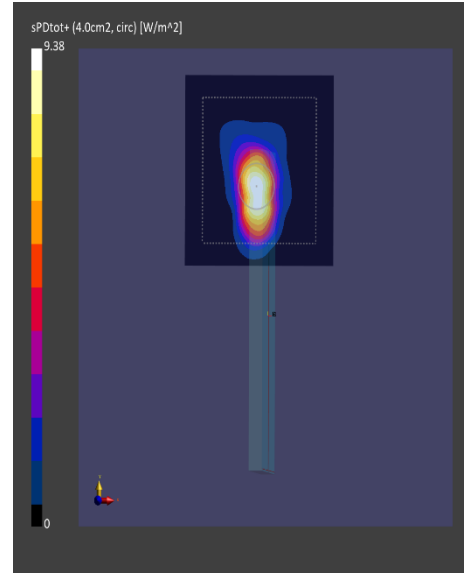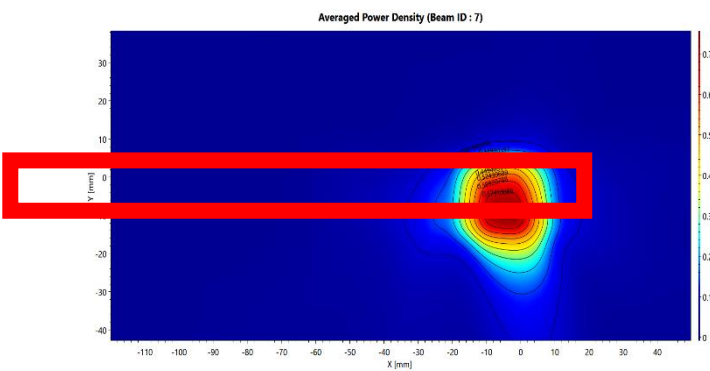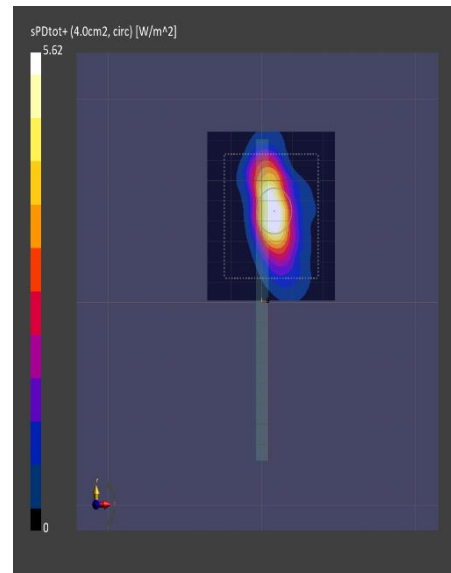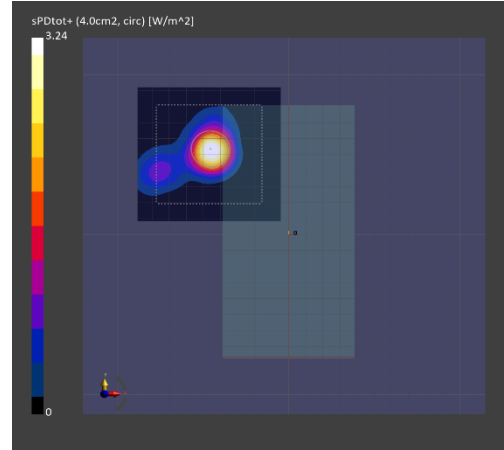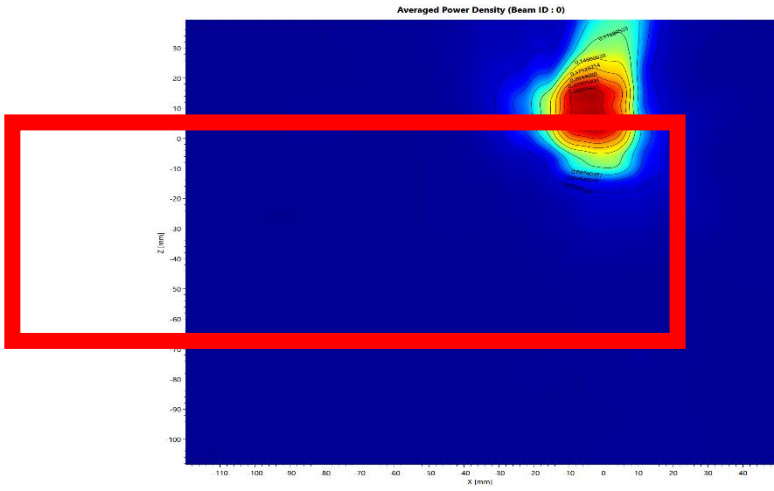(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Right view***)
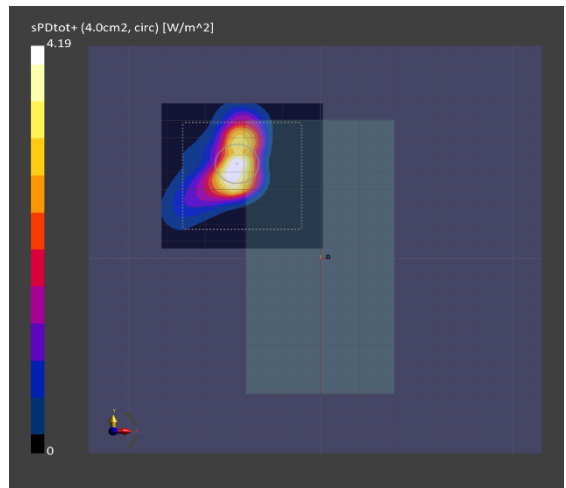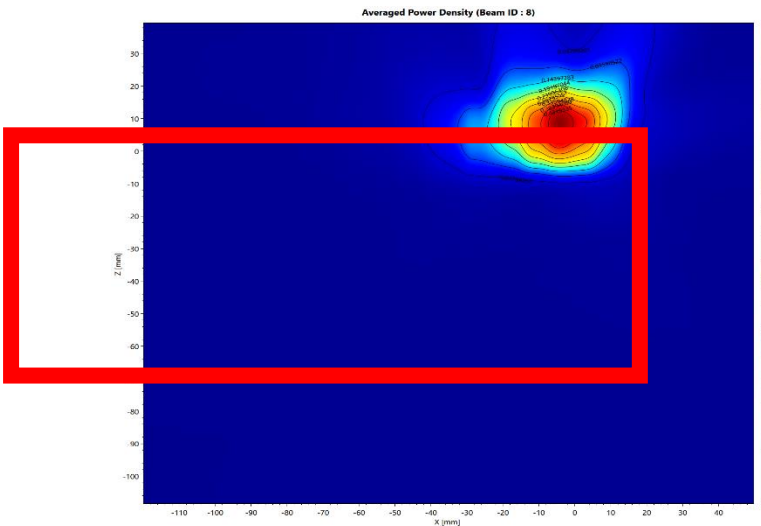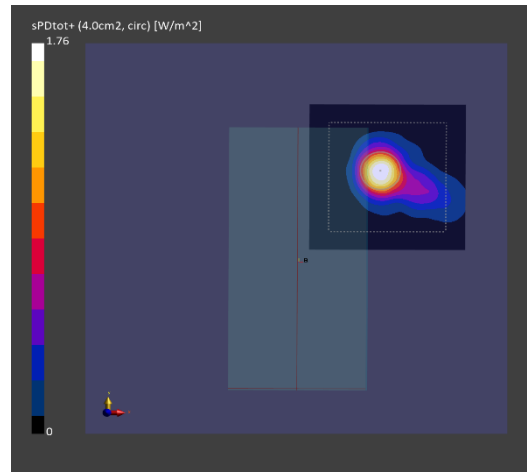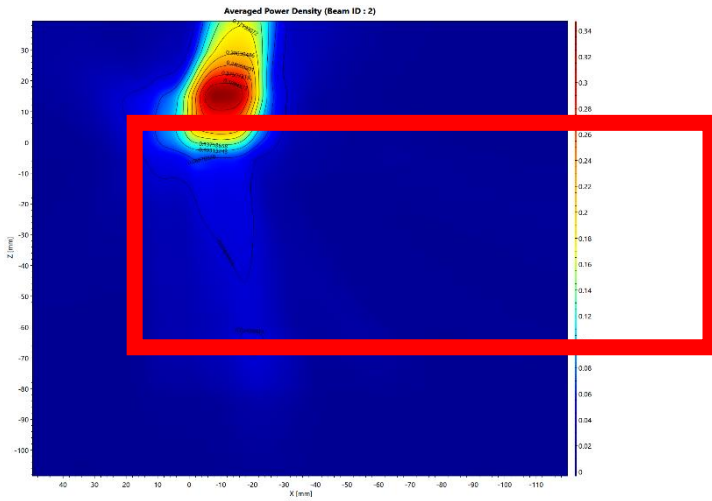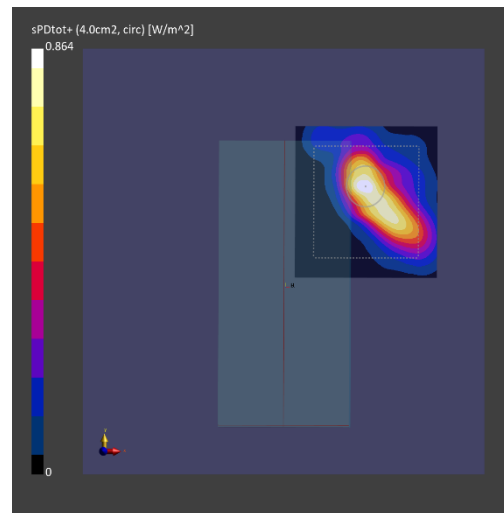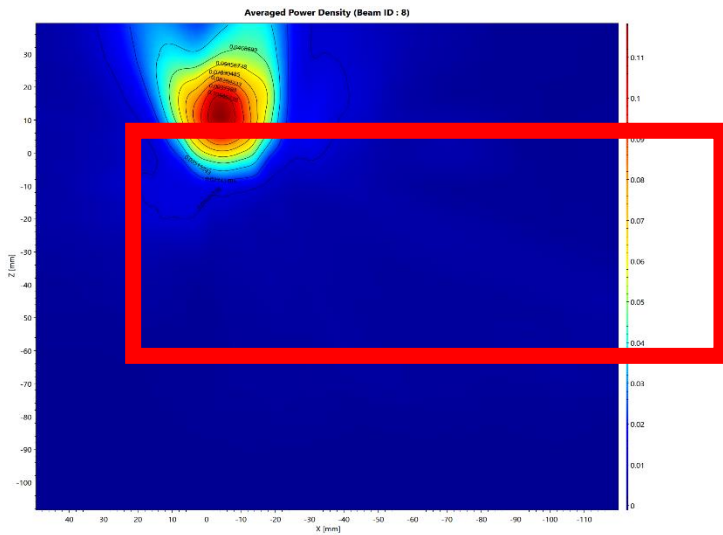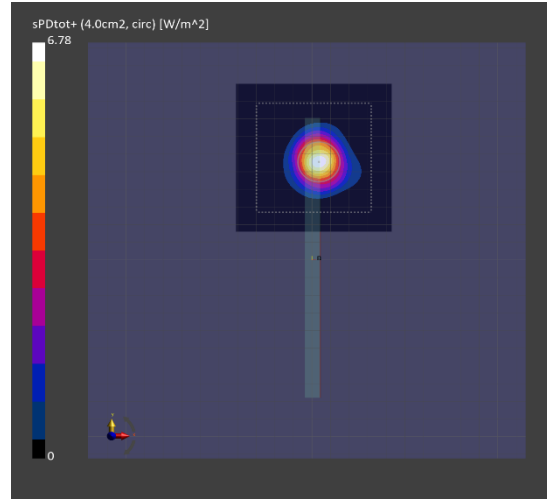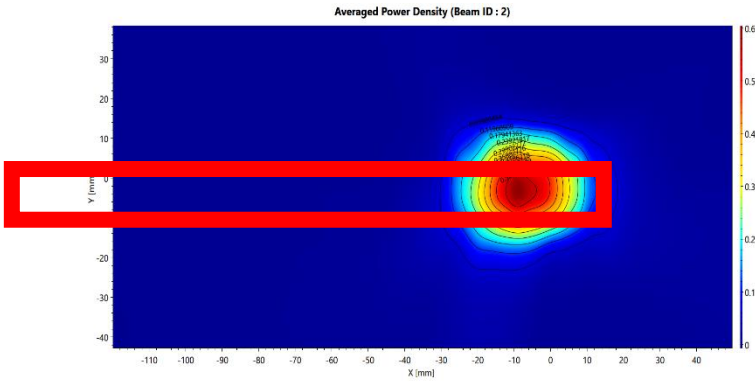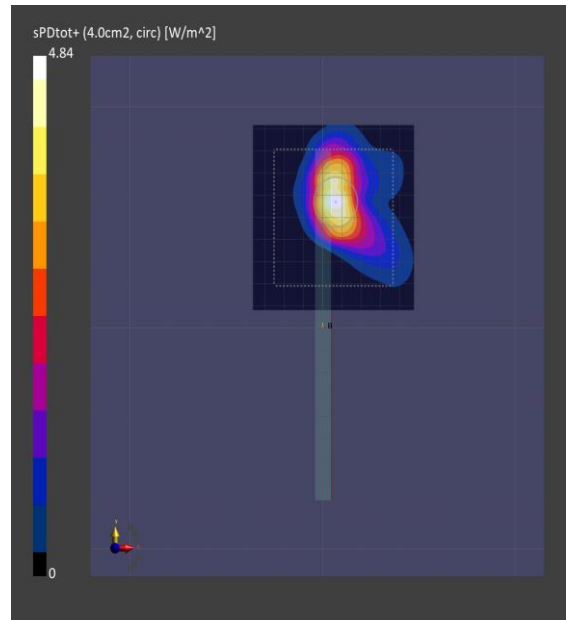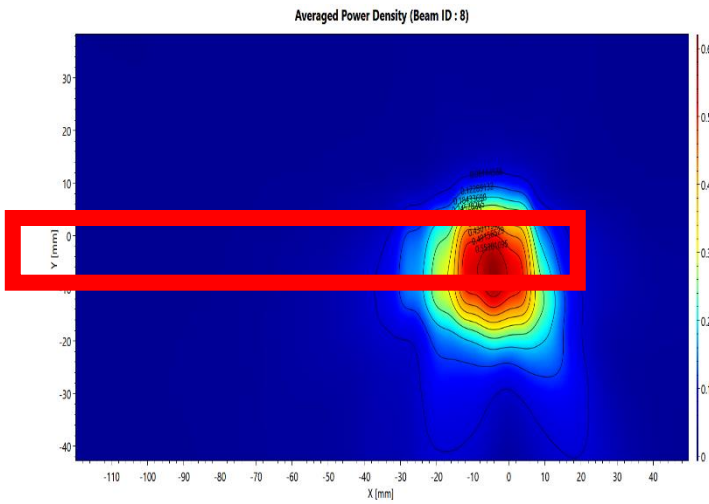
- n260 Ant L-Patch: Mid Channel, Beam ID 8, Right

(a) simulation   (b) measurement

Ant L-Patch: Mid Channel, 4cm^2 averaged power density (***Right view***)

3 Simulation results

This section shows the PD simulation results of Ant L at 28GHz and 39GHz 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 Appendix D of 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°,

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

3.1.1 Ant L – Patch Antenna

Table 3 & Table 4 show the PD simulation evaluation of Ant L patch antenna at 28GHz / 39GHz for the corresponding evaluation plane specified in Table 1.

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

- L–patch Low CH

PD Simulation (2mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 3.3%	ratio (Top 2mm)/(worst-surface 2mm) 27.5%	ratio (Bottom 2mm)/(worst-surface 2mm) 4.3%	ratio (Front 2mm)/(worst-surface 2mm) 90.2%	ratio (Rear 2mm)/(worst-surface 2mm) 100.0%
1			0		5	0.46	0.00	0.06	0.00	0.34	0.12	0.46	0.46	0.96		100.0%	0.0%	13.0%	0.0%	73.9%	26.1%
2			1		5	0.41	0.01	0.05	0.00	0.37	0.09	0.41	0.41	1.08		100.0%	2.4%	12.2%	0.0%	90.2%	22.0%
3			2		5	0.45	0.01	0.10	0.00	0.39	0.05	0.45	0.45	0.98		100.0%	2.2%	22.2%	0.0%	86.7%	10.4%
4			3		5	0.37	0.01	0.03	0.01	0.23	0.08	0.37	0.37	1.19		100.0%	2.7%	8.1%	2.7%	62.2%	21.6%
5			4		5	0.32	0.01	0.06	0.00	0.24	0.14	0.32	0.32	1.38		100.0%	3.1%	18.8%	0.0%	75.0%	43.8%
6			5		5	0.30	0.01	0.07	0.00	0.24	0.15	0.30	0.30	1.47		100.0%	3.3%	23.3%	0.0%	80.0%	50.0%
7			6		5	0.45	0.01	0.04	0.00	0.39	0.09	0.45	0.45	0.98		100.0%	2.2%	8.9%	0.0%	86.7%	20.0%
8				7	5	0.73	0.00	0.07	0.00	0.07	0.63	0.73	0.73	0.61		100.0%	0.0%	9.6%	0.0%	9.6%	86.3%
9				8	5	0.51	0.00	0.11	0.01	0.05	0.44	0.51	0.51	0.87		100.0%	0.0%	21.6%	2.0%	9.8%	86.3%
10				9	5	0.53	0.00	0.11	0.00	0.07	0.47	0.53	0.53	0.83		100.0%	0.0%	20.8%	0.0%	13.2%	88.7%
11	L	Patch		10	5	0.64	0.00	0.11	0.00	0.10	0.57	0.64	0.64	0.69		100.0%	0.0%	17.2%	0.0%	15.6%	89.1%
12				11	5	0.47	0.00	0.09	0.02	0.15	0.47	0.47	0.47	0.94		100.0%	0.0%	19.1%	4.3%	31.9%	100.0%
13				12	5	0.52	0.00	0.13	0.01	0.16	0.32	0.52	0.52	0.85		100.0%	0.0%	25.0%	1.9%	30.8%	61.5%
14				13	5	0.63	0.00	0.13	0.00	0.10	0.53	0.63	0.63	0.70		100.0%	0.0%	20.6%	0.0%	15.9%	84.1%
15			0	7	10	1.04	0.01	0.13	0.01	0.39	0.76	1.04	1.04	0.43		100.0%	1.0%	12.5%	1.0%	37.5%	73.1%
16			1	8	10	0.82	0.01	0.21	0.01	0.40	0.44	0.82	0.82	0.54		100.0%	1.2%	25.6%	1.2%	48.8%	53.7%
17			2	9	10	0.90	0.02	0.14	0.01	0.55	0.55	0.90	0.90	0.49		100.0%	2.2%	15.6%	1.1%	61.1%	61.1%
18			3	10	10	1.00	0.01	0.16	0.02	0.38	0.72	1.00	1.00	0.44		100.0%	1.0%	16.0%	2.0%	38.0%	72.0%
19			4	11	10	0.86	0.02	0.18	0.03	0.40	0.60	0.86	0.86	0.51		100.0%	2.3%	20.9%	3.5%	46.5%	69.8%
20			5	12	10	0.69	0.02	0.19	0.02	0.36	0.40	0.69	0.69	0.64		100.0%	2.9%	27.5%	2.9%	52.2%	58.0%
21			6	13	10	1.00	0.01	0.18	0.01	0.45	0.58	1.00	1.00	0.44		100.0%	1.0%	18.0%	1.0%	45.0%	58.0%

PD Simulation (10mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 70.7%	ratio (Left 2mm)/(worst-surface 2mm) 3.3%	ratio (Top 2mm)/(worst-surface 2mm) 13.5%	ratio (Bottom 2mm)/(worst-surface 2mm) 0.0%	ratio (Front 2mm)/(worst-surface 2mm) 40.0%	ratio (Rear 2mm)/(worst-surface 2mm) 46.6%
1			0		5	0.25	0.00	0.03	0.00	0.13	0.06	0.25	0.25	1.77		54.3%	0.0%	6.5%	0.0%	28.3%	13.0%
2			1		5	0.29	0.01	0.03	0.00	0.16	0.05	0.29	0.29	1.52		70.7%	2.4%	7.3%	0.0%	39.0%	12.2%
3			2		5	0.26	0.01	0.04	0.00	0.16	0.03	0.26	0.26	1.70		57.8%	2.2%	8.9%	0.0%	35.6%	6.7%
4			3		5	0.18	0.01	0.01	0.00	0.10	0.03	0.18	0.18	2.46		48.6%	2.7%	2.7%	0.0%	27.0%	8.1%
5			4		5	0.16	0.01	0.04	0.00	0.10	0.05	0.16	0.16	2.76		50.0%	3.1%	12.5%	0.0%	31.3%	15.6%
6			5		5	0.16	0.01	0.03	0.00	0.09	0.05	0.16	0.16	2.76		53.3%	3.3%	10.0%	0.0%	30.0%	16.7%
7			6		5	0.28	0.01	0.02	0.00	0.18	0.05	0.28	0.28	1.58		62.2%	2.2%	4.4%	0.0%	40.0%	11.1%
8				7	5	0.37	0.00	0.03	0.00	0.03	0.34	0.37	0.37	1.19		50.7%	0.0%	4.1%	0.0%	4.1%	46.6%
9				8	5	0.22	0.00	0.05	0.00	0.01	0.19	0.22	0.22	2.01		43.1%	0.0%	9.8%	0.0%	2.0%	37.3%
10				9	5	0.25	0.00	0.04	0.00	0.03	0.23	0.25	0.25	1.77		47.2%	0.0%	7.5%	0.0%	5.7%	43.4%
11	L	Patch		10	5	0.29	0.00	0.05	0.00	0.02	0.29	0.29	0.29	1.52		45.3%	0.0%	7.8%	0.0%	3.1%	45.3%
12				11	5	0.15	0.00	0.03	0.00	0.04	0.18	0.18	0.18	2.46		31.9%	0.0%	6.4%	0.0%	8.5%	38.3%
13				12	5	0.15	0.00	0.07	0.00	0.03	0.09	0.15	0.15	2.95		28.8%	0.0%	13.5%	0.0%	5.8%	17.3%
14				13	5	0.23	0.00	0.07	0.00	0.03	0.20	0.23	0.23	1.92		36.5%	0.0%	11.1%	0.0%	4.8%	31.7%
15			0	7	10	0.45	0.01	0.06	0.00	0.14	0.41	0.45	0.45	0.98		43.3%	1.0%	5.8%	0.0%	13.5%	39.4%
16			1	8	10	0.41	0.01	0.10	0.00	0.17	0.19	0.41	0.41	1.08		50.0%	1.2%	12.2%	0.0%	20.7%	23.2%
17			2	9	10	0.40	0.01	0.05	0.00	0.22	0.25	0.40	0.40	1.11		44.4%	1.1%	5.6%	0.0%	24.4%	27.8%
18			3	10	10	0.41	0.01	0.06	0.00	0.13	0.37	0.41	0.41	1.08		41.0%	1.0%	6.0%	0.0%	13.0%	37.0%
19			4	11	10	0.28	0.01	0.06	0.00	0.12	0.26	0.28	0.28	1.58		32.6%	1.2%	7.0%	0.0%	14.0%	30.2%
20			5	12	10	0.21	0.01	0.08	0.00	0.11	0.12	0.21	0.21	2.10		30.4%	1.4%	11.6%	0.0%	15.9%	17.4%
21			6	13	10	0.40	0.01	0.10	0.00	0.20	0.19	0.40	0.40	1.11		40.0%	1.0%	10.0%	0.0%	20.0%	19.0%

- **L–patch Mid CH**

PD Simulation (2mm)

No.	Module	Type(P or D)	Beam ID_1 (H pole)	Bema ID_2 (V pole)	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 4.7%	ratio (Top 2mm)/(worst-surface 2mm) 27.3%	ratio (Bottom 2mm)/(worst-surface 2mm) 5.4%	ratio (Front 2mm)/(worst-surface 2mm) 95.9%	ratio (Rear 2mm)/(worst-surface 2mm) 99.6%
1			0		5	0.466	0.007	0.058	0.006	0.353	0.124	0.47	0.47	0.95		100.0%	1.5%	12.4%	1.3%	75.8%	26.6%
2			1		5	0.414	0.011	0.061	0.004	0.385	0.099	0.41	0.41	1.07		100.0%	2.7%	14.7%	1.0%	93.0%	23.9%
3			2		5	0.469	0.010	0.092	0.005	0.450	0.083	0.47	0.47	0.94		100.0%	2.1%	19.6%	1.1%	95.9%	17.7%
4			3		5	0.355	0.009	0.037	0.006	0.241	0.082	0.36	0.36	1.25		100.0%	2.5%	10.4%	1.7%	67.9%	23.1%
5			4		5	0.326	0.011	0.078	0.004	0.251	0.117	0.33	0.33	1.36		100.0%	3.4%	23.9%	1.2%	77.0%	35.9%
6			5		5	0.296	0.014	0.069	0.003	0.244	0.114	0.30	0.30	1.49		100.0%	4.7%	23.3%	1.0%	82.4%	38.5%
7	L	Patch	6		5	0.479	0.007	0.048	0.003	0.404	0.083	0.48	0.48	0.92		100.0%	1.5%	10.0%	0.6%	84.3%	17.3%
8				7	5	0.749	0.003	0.070	0.005	0.083	0.632	0.75	0.75	0.59		100.0%	0.4%	9.3%	0.7%	11.1%	84.4%
9				8	5	0.517	0.003	0.110	0.009	0.054	0.459	0.52	0.52	0.85		100.0%	0.6%	21.3%	1.7%	10.4%	88.8%
10				9	5	0.541	0.003	0.098	0.007	0.087	0.462	0.54	0.54	0.82		100.0%	0.6%	18.1%	1.3%	16.1%	85.4%
11				10	5	0.685	0.003	0.088	0.006	0.116	0.605	0.69	0.69	0.65		100.0%	0.4%	12.8%	0.9%	16.9%	88.3%
12				11	5	0.496	0.003	0.058	0.027	0.166	0.494	0.50	0.50	0.89		100.0%	0.6%	11.7%	5.4%	33.5%	99.6%
13				12	5	0.476	0.003	0.130	0.015	0.150	0.312	0.48	0.48	0.93		100.0%	0.6%	27.3%	3.2%	31.5%	65.5%
14				13	5	0.594	0.003	0.133	0.008	0.098	0.489	0.59	0.59	0.74		100.0%	0.5%	22.4%	1.3%	16.5%	82.3%
15			0	7	10	1.026	0.011	0.100	0.008	0.380	0.759	1.03	1.03	0.43		100.0%	1.1%	9.7%	0.8%	37.0%	74.0%
16			1	8	10	0.812	0.015	0.218	0.007	0.421	0.469	0.81	0.81	0.54		100.0%	1.8%	26.8%	0.9%	51.8%	57.8%
17			2	9	10	0.943	0.019	0.143	0.013	0.576	0.616	0.94	0.94	0.47		100.0%	2.0%	15.2%	1.4%	61.1%	65.3%
18			3	10	10	1.022	0.011	0.155	0.016	0.374	0.763	1.02	1.02	0.43		100.0%	1.1%	15.2%	1.6%	36.6%	74.7%
19			4	11	10	0.863	0.018	0.148	0.030	0.403	0.658	0.86	0.86	0.51		100.0%	2.1%	17.1%	3.5%	46.7%	76.2%
20			5	12	10	0.632	0.022	0.143	0.021	0.337	0.307	0.63	0.63	0.70		100.0%	3.5%	22.6%	3.3%	53.3%	48.6%
21			6	13	10	0.984	0.009	0.200	0.013	0.474	0.532	0.98	0.98	0.45		100.0%	0.9%	20.3%	1.3%	48.2%	54.1%

PD Simulation (10mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 10mm)/(worst-surface 2mm) 71.0%	ratio (Left 10mm)/(worst-surface 2mm) 2.0%	ratio (Top 10mm)/(worst-surface 2mm) 15.3%	ratio (Bottom 10mm)/(worst-surface 2mm) 0.0%	ratio (Front 10mm)/(worst-surface 2mm) 39.9%	ratio (Rear 10mm)/(worst-surface 2mm) 45.3%
1			0		5	0.265	0.005	0.036	0.000	0.140	0.058	0.27	0.27	1.67		56.9%	1.1%	7.7%	0.0%	30.0%	12.4%
2			1		5	0.294	0.008	0.029	0.000	0.140	0.050	0.29	0.29	1.50		71.0%	1.9%	7.0%	0.0%	33.8%	12.1%
3			2		5	0.310	0.006	0.039	0.000	0.178	0.037	0.31	0.31	1.43		66.1%	1.3%	8.3%	0.0%	38.0%	7.9%
4			3		5	0.200	0.006	0.020	0.000	0.113	0.034	0.20	0.20	2.21		56.3%	1.7%	5.6%	0.0%	31.8%	9.6%
5			4		5	0.161	0.005	0.048	0.000	0.102	0.049	0.16	0.16	2.75		49.4%	1.5%	14.7%	0.0%	31.3%	15.0%
6			5		5	0.133	0.006	0.041	0.000	0.074	0.045	0.13	0.13	3.32		44.9%	2.0%	13.9%	0.0%	25.0%	15.2%
7			6		5	0.299	0.004	0.032	0.000	0.191	0.038	0.30	0.30	1.48		62.4%	0.8%	6.7%	0.0%	39.9%	7.9%
8				7	5	0.383	0.002	0.035	0.000	0.031	0.339	0.38	0.38	1.15		51.1%	0.3%	4.7%	0.0%	4.1%	45.3%
9				8	5	0.229	0.002	0.051	0.000	0.018	0.197	0.23	0.23	1.93		44.3%	0.4%	9.9%	0.0%	3.5%	38.1%
10				9	5	0.249	0.002	0.037	0.000	0.034	0.242	0.25	0.25	1.78		46.0%	0.4%	6.8%	0.0%	6.3%	44.7%
11	L	Patch		10	5	0.320	0.003	0.052	0.000	0.040	0.309	0.32	0.32	1.38		46.7%	0.4%	7.6%	0.0%	5.8%	45.1%
12				11	5	0.161	0.002	0.020	0.000	0.049	0.206	0.21	0.21	2.15		32.5%	0.4%	4.0%	0.0%	9.9%	41.5%
13				12	5	0.152	0.002	0.073	0.000	0.031	0.098	0.15	0.15	2.91		31.9%	0.4%	15.3%	0.0%	6.5%	20.6%
14				13	5	0.207	0.002	0.072	0.000	0.023	0.185	0.21	0.21	2.14		34.8%	0.3%	12.1%	0.0%	3.9%	31.1%
15			0	7	10	0.478	0.008	0.050	0.000	0.154	0.418	0.48	0.48	0.92		46.6%	0.8%	4.9%	0.0%	15.0%	40.7%
16			1	8	10	0.397	0.010	0.095	0.000	0.139	0.202	0.40	0.40	1.11		48.9%	1.2%	11.7%	0.0%	17.1%	24.9%
17			2	9	10	0.422	0.011	0.058	0.000	0.244	0.301	0.42	0.42	1.05		44.8%	1.2%	6.2%	0.0%	25.9%	31.9%
18			3	10	10	0.441	0.008	0.054	0.000	0.136	0.365	0.44	0.44	1.00		43.2%	0.8%	5.3%	0.0%	13.3%	35.7%
19			4	11	10	0.279	0.009	0.074	0.000	0.152	0.302	0.30	0.30	1.46		32.3%	1.0%	8.6%	0.0%	17.6%	35.0%
20			5	12	10	0.199	0.009	0.072	0.000	0.132	0.125	0.20	0.20	2.22		31.5%	1.4%	11.4%	0.0%	20.9%	19.8%
21			6	13	10	0.405	0.005	0.117	0.000	0.219	0.201	0.41	0.41	1.09		41.2%	0.5%	11.9%	0.0%	22.3%	20.4%

- L–patch High CH

PD Simulation (2mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 2.9%	ratio (Top 2mm)/(worst-surface 2mm) 29.4%	ratio (Bottom 2mm)/(worst-surface 2mm) 4.0%	ratio (Front 2mm)/(worst-surface 2mm) 97.9%	ratio (Rear 2mm)/(worst-surface 2mm) 96.0%
1			0		5	0.45	0.01	0.05	0.00	0.37	0.12	0.45	0.45	0.98		100.0%	2.2%	11.1%	0.0%	82.2%	26.7%
2			1		5	0.41	0.01	0.06	0.01	0.40	0.12	0.41	0.41	1.08		100.0%	2.4%	14.6%	2.4%	97.6%	29.3%
3			2		5	0.48	0.01	0.08	0.01	0.47	0.10	0.48	0.48	0.92		100.0%	2.1%	16.7%	2.1%	97.9%	20.8%
4			3		5	0.38	0.01	0.05	0.01	0.25	0.10	0.38	0.38	1.16		100.0%	2.6%	13.2%	2.6%	65.8%	26.3%
5			4		5	0.34	0.01	0.10	0.01	0.25	0.10	0.34	0.34	1.30		100.0%	2.9%	29.4%	2.9%	73.5%	29.4%
6			5		5	0.35	0.01	0.10	0.01	0.27	0.08	0.35	0.35	1.26		100.0%	2.9%	28.6%	2.9%	77.1%	22.9%
7			6		5	0.50	0.01	0.06	0.00	0.40	0.10	0.50	0.50	0.88		100.0%	2.0%	12.0%	0.0%	80.0%	20.0%
8				7	5	0.72	0.00	0.08	0.01	0.09	0.62	0.72	0.72	0.61		100.0%	0.0%	11.1%	1.4%	12.5%	86.1%
9				8	5	0.52	0.00	0.12	0.01	0.05	0.48	0.52	0.52	0.85		100.0%	0.0%	23.1%	1.9%	9.6%	92.3%
10				9	5	0.53	0.00	0.09	0.01	0.09	0.45	0.53	0.53	0.83		100.0%	0.0%	17.0%	1.9%	17.0%	84.9%
11	L	Patch		10	5	0.71	0.00	0.08	0.01	0.11	0.60	0.71	0.71	0.62		100.0%	0.0%	11.3%	1.4%	15.5%	84.5%
12				11	5	0.50	0.00	0.07	0.02	0.16	0.48	0.50	0.50	0.88		100.0%	0.0%	14.0%	4.0%	32.0%	96.0%
13				12	5	0.45	0.00	0.11	0.01	0.14	0.32	0.45	0.45	0.98		100.0%	0.0%	24.4%	2.2%	31.1%	71.1%
14				13	5	0.58	0.00	0.12	0.01	0.10	0.47	0.58	0.58	0.76		100.0%	0.0%	20.7%	1.7%	17.2%	81.0%
15			0	7	10	1.01	0.01	0.10	0.01	0.43	0.76	1.01	1.01	0.44		100.0%	1.0%	9.9%	1.0%	42.6%	75.2%
16			1	8	10	0.78	0.02	0.22	0.01	0.46	0.47	0.78	0.78	0.57		100.0%	2.6%	28.2%	1.3%	59.0%	60.3%
17			2	9	10	0.97	0.01	0.17	0.02	0.63	0.62	0.97	0.97	0.46		100.0%	1.0%	17.5%	2.1%	64.9%	63.9%
18			3	10	10	1.06	0.01	0.18	0.01	0.36	0.76	1.06	1.06	0.42		100.0%	0.9%	17.0%	0.9%	34.0%	71.7%
19			4	11	10	0.85	0.02	0.16	0.03	0.41	0.66	0.85	0.85	0.52		100.0%	2.4%	18.8%	3.5%	48.2%	77.6%
20			5	12	10	0.68	0.02	0.14	0.02	0.38	0.30	0.68	0.68	0.65		100.0%	2.9%	20.6%	2.9%	55.9%	44.1%
21			6	13	10	1.02	0.01	0.19	0.02	0.52	0.53	1.02	1.02	0.43		100.0%	1.0%	18.6%	2.0%	51.0%	52.0%

PD Simulation (10mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 66.7%	ratio (Left 2mm)/(worst-surface 2mm) 2.9%	ratio (Top 2mm)/(worst-surface 2mm) 17.6%	ratio (Bottom 2mm)/(worst-surface 2mm) 0.0%	ratio (Front 2mm)/(worst-surface 2mm) 38.0%	ratio (Rear 2mm)/(worst-surface 2mm) 44.4%
1			0		5	0.25	0.01	0.03	0.00	0.14	0.05	0.25	0.25	1.77		55.6%	2.2%	6.7%	0.0%	31.1%	11.1%
2			1		5	0.27	0.01	0.02	0.00	0.13	0.05	0.27	0.27	1.64		65.9%	2.4%	4.9%	0.0%	31.7%	12.2%
3			2		5	0.32	0.01	0.03	0.00	0.18	0.04	0.32	0.32	1.38		66.7%	2.1%	6.3%	0.0%	37.5%	8.3%
4			3		5	0.21	0.01	0.02	0.00	0.11	0.03	0.21	0.21	2.10		55.3%	2.6%	5.3%	0.0%	28.9%	7.9%
5			4		5	0.16	0.01	0.06	0.00	0.10	0.05	0.16	0.16	2.76		47.1%	2.9%	17.6%	0.0%	29.4%	14.7%
6			5		5	0.17	0.01	0.06	0.00	0.09	0.03	0.17	0.17	2.60		48.6%	2.9%	17.1%	0.0%	25.7%	8.6%
7			6		5	0.30	0.00	0.03	0.00	0.19	0.03	0.30	0.30	1.47		60.0%	0.0%	6.0%	0.0%	38.0%	6.0%
8				7	5	0.37	0.00	0.04	0.00	0.03	0.32	0.37	0.37	1.19		51.4%	0.0%	5.6%	0.0%	4.2%	44.4%
9				8	5	0.22	0.00	0.05	0.00	0.02	0.20	0.22	0.22	2.01		42.3%	0.0%	9.6%	0.0%	3.8%	38.5%
10				9	5	0.24	0.00	0.03	0.00	0.03	0.23	0.24	0.24	1.84		45.3%	0.0%	5.7%	0.0%	5.7%	43.4%
11	L	Patch		10	5	0.33	0.00	0.05	0.00	0.04	0.31	0.33	0.33	1.34		46.5%	0.0%	7.0%	0.0%	5.6%	43.7%
12				11	5	0.16	0.00	0.02	0.00	0.04	0.20	0.20	0.20	2.21		32.0%	0.0%	4.0%	0.0%	8.0%	40.0%
13				12	5	0.13	0.00	0.06	0.00	0.03	0.10	0.13	0.13	3.40		28.9%	0.0%	13.3%	0.0%	6.7%	22.2%
14				13	5	0.21	0.00	0.06	0.00	0.03	0.18	0.21	0.21	2.10		36.2%	0.0%	10.3%	0.0%	5.2%	31.0%
15			0	7	10	0.48	0.01	0.05	0.00	0.16	0.38	0.48	0.48	0.92		47.5%	1.0%	5.0%	0.0%	15.8%	37.6%
16			1	8	10	0.37	0.01	0.09	0.00	0.13	0.21	0.37	0.37	1.19		47.4%	1.3%	11.5%	0.0%	16.7%	26.9%
17			2	9	10	0.43	0.01	0.06	0.00	0.26	0.31	0.43	0.43	1.03		44.3%	1.0%	6.2%	0.0%	26.8%	32.0%
18			3	10	10	0.45	0.01	0.05	0.00	0.13	0.39	0.45	0.45	0.98		42.5%	0.9%	4.7%	0.0%	12.3%	36.8%
19			4	11	10	0.27	0.01	0.08	0.00	0.14	0.30	0.30	0.30	1.47		31.8%	1.2%	9.4%	0.0%	16.5%	35.3%
20			5	12	10	0.23	0.01	0.08	0.00	0.15	0.13	0.23	0.23	1.92		33.8%	1.5%	11.8%	0.0%	22.1%	19.1%
21			6	13	10	0.42	0.01	0.11	0.00	0.24	0.19	0.42	0.42	1.05		41.2%	1.0%	10.8%	0.0%	23.5%	18.6%

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

- L–patch Low CH

PD Simulation (2mm) — 4cm2 PD(mW/cm2) / max ratio out of all beams

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 1.8%	ratio (Top 2mm)/(worst-surface 2mm) 33.3%	ratio (Bottom 2mm)/(worst-surface 2mm) 2.0%	ratio (Front 2mm)/(worst-surface 2mm) 50.0%	ratio (Rear 2mm)/(worst-surface 2mm) 80.6%
1			0		5	0.64	0.01	0.03	0.01	0.31	0.36	0.64	0.64	0.69		100.0%	1.6%	4.7%	1.6%	48.4%	56.3%
2			1		5	0.56	0.01	0.03	0.00	0.23	0.35	0.56	0.56	0.79		100.0%	1.8%	5.4%	0.0%	41.1%	62.5%
3			2		5	0.68	0.01	0.04	0.00	0.34	0.34	0.68	0.68	0.65		100.0%	1.5%	5.9%	0.0%	50.0%	50.0%
4			3		5	0.63	0.01	0.11	0.00	0.22	0.31	0.63	0.63	0.70		100.0%	1.6%	17.5%	0.0%	34.9%	49.2%
5			4		5	0.51	0.00	0.17	0.01	0.19	0.22	0.51	0.51	0.87		100.0%	0.0%	33.3%	2.0%	37.3%	43.1%
6			5		5	0.62	0.01	0.10	0.00	0.27	0.33	0.62	0.62	0.71		100.0%	1.6%	16.1%	0.0%	43.5%	53.2%
7			6		5	0.60	0.01	0.04	0.00	0.27	0.36	0.60	0.60	0.74		100.0%	1.7%	6.7%	0.0%	45.0%	60.0%
8				7	5	0.68	0.00	0.10	0.00	0.11	0.53	0.68	0.68	0.65		100.0%	0.0%	14.7%	0.0%	16.2%	77.9%
9				8	5	0.73	0.00	0.14	0.00	0.09	0.58	0.73	0.73	0.61		100.0%	0.0%	19.2%	0.0%	12.3%	79.5%
10				9	5	0.80	0.00	0.09	0.00	0.09	0.64	0.80	0.80	0.55		100.0%	0.0%	11.3%	0.0%	11.3%	80.0%
11	L	Patch		10	5	0.67	0.00	0.06	0.00	0.10	0.54	0.67	0.67	0.66		100.0%	0.0%	9.0%	0.0%	14.9%	80.6%
12				11	5	0.76	0.00	0.05	0.00	0.09	0.60	0.76	0.76	0.58		100.0%	0.0%	6.6%	0.0%	11.8%	78.9%
13				12	5	0.67	0.00	0.10	0.00	0.11	0.54	0.67	0.67	0.66		100.0%	0.0%	14.9%	0.0%	16.4%	80.6%
14				13	5	0.65	0.00	0.13	0.01	0.10	0.49	0.65	0.65	0.68		100.0%	0.0%	20.0%	1.5%	15.4%	75.4%
15			0	7	10	1.25	0.01	0.10	0.01	0.42	0.81	1.25	1.25	0.35		100.0%	0.8%	8.0%	0.8%	33.6%	64.8%
16			1	8	10	1.22	0.01	0.15	0.01	0.28	0.88	1.22	1.22	0.36		100.0%	0.8%	12.3%	0.8%	23.0%	72.1%
17			2	9	10	1.39	0.01	0.11	0.01	0.46	0.95	1.39	1.39	0.32		100.0%	0.7%	7.9%	0.7%	33.1%	68.3%
18			3	10	10	1.22	0.01	0.10	0.01	0.21	0.81	1.22	1.22	0.36		100.0%	0.8%	8.2%	0.8%	17.2%	66.4%
19			4	11	10	1.22	0.01	0.17	0.01	0.23	0.75	1.22	1.22	0.36		100.0%	0.8%	13.9%	0.8%	18.9%	61.5%
20			5	12	10	1.24	0.01	0.18	0.01	0.38	0.75	1.24	1.24	0.36		100.0%	0.8%	14.5%	0.8%	30.6%	60.5%
21			6	13	10	1.31	0.01	0.18	0.01	0.34	0.91	1.31	1.31	0.34		100.0%	0.8%	13.7%	0.8%	26.0%	69.5%

PD Simulation (10mm) — 4cm2 PD(mW/cm2) / max ratio out of all beams

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 66.1%	ratio (Left 2mm)/(worst-surface 2mm) 1.8%	ratio (Top 2mm)/(worst-surface 2mm) 21.6%	ratio (Bottom 2mm)/(worst-surface 2mm) 0.0%	ratio (Front 2mm)/(worst-surface 2mm) 22.1%	ratio (Rear 2mm)/(worst-surface 2mm) 41.8%
1			0		5	0.40	0.01	0.01	0.00	0.14	0.17	0.40	0.40	1.11		62.5%	1.6%	1.6%	0.0%	21.9%	26.6%
2			1		5	0.32	0.01	0.02	0.00	0.10	0.17	0.32	0.32	1.38		57.1%	1.8%	3.6%	0.0%	17.9%	30.4%
3			2		5	0.37	0.00	0.02	0.00	0.15	0.17	0.37	0.37	1.19		54.4%	0.0%	2.9%	0.0%	22.1%	25.0%
4			3		5	0.36	0.00	0.06	0.00	0.09	0.15	0.36	0.36	1.23		57.1%	0.0%	9.5%	0.0%	14.3%	23.8%
5			4		5	0.31	0.00	0.11	0.00	0.07	0.08	0.31	0.31	1.43		60.8%	0.0%	21.6%	0.0%	13.7%	15.7%
6			5		5	0.41	0.00	0.02	0.00	0.12	0.13	0.41	0.41	1.08		66.1%	0.0%	3.2%	0.0%	19.4%	21.0%
7			6		5	0.34	0.00	0.02	0.00	0.11	0.18	0.34	0.34	1.30		56.7%	0.0%	3.3%	0.0%	18.3%	30.0%
8				7	5	0.29	0.00	0.06	0.00	0.03	0.26	0.29	0.29	1.52		42.6%	0.0%	8.8%	0.0%	4.4%	38.2%
9				8	5	0.30	0.00	0.09	0.00	0.02	0.24	0.30	0.30	1.47		41.1%	0.0%	12.3%	0.0%	2.7%	32.9%
10				9	5	0.38	0.00	0.06	0.00	0.03	0.31	0.38	0.38	1.16		47.5%	0.0%	6.3%	0.0%	3.8%	38.8%
11	L	Patch		10	5	0.34	0.00	0.03	0.00	0.03	0.28	0.34	0.34	1.30		50.7%	0.0%	4.5%	0.0%	4.5%	41.8%
12				11	5	0.33	0.00	0.01	0.00	0.02	0.28	0.33	0.33	1.34		43.4%	0.0%	1.3%	0.0%	2.6%	36.8%
13				12	5	0.27	0.00	0.06	0.00	0.02	0.23	0.27	0.27	1.64		40.3%	0.0%	9.0%	0.0%	3.0%	34.3%
14				13	5	0.23	0.00	0.08	0.00	0.02	0.20	0.23	0.23	1.92		35.4%	0.0%	12.3%	0.0%	3.1%	30.8%
15			0	7	10	0.64	0.00	0.06	0.00	0.19	0.37	0.64	0.64	0.69		51.2%	0.0%	4.8%	0.0%	15.2%	29.6%
16			1	8	10	0.61	0.00	0.09	0.00	0.10	0.42	0.61	0.61	0.72		50.0%	0.0%	7.4%	0.0%	8.2%	34.4%
17			2	9	10	0.68	0.00	0.07	0.00	0.18	0.41	0.68	0.68	0.65		48.9%	0.0%	5.0%	0.0%	12.9%	29.5%
18			3	10	10	0.60	0.00	0.06	0.00	0.06	0.39	0.60	0.60	0.74		49.2%	0.0%	4.9%	0.0%	4.9%	32.0%
19			4	11	10	0.46	0.00	0.11	0.00	0.07	0.33	0.46	0.46	0.96		37.7%	0.0%	9.0%	0.0%	5.7%	27.0%
20			5	12	10	0.62	0.00	0.12	0.00	0.16	0.33	0.62	0.62	0.71		50.0%	0.0%	9.7%	0.0%	12.9%	26.6%
21			6	13	10	0.62	0.00	0.11	0.00	0.13	0.38	0.62	0.62	0.71		47.3%	0.0%	8.4%	0.0%	9.9%	29.0%

ELECTRONICS

- L–patch Mid CH

No.	Module	Type(P or D)	Beam ID_1 (H pole)	Bema ID_2 (V pole)	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 2.3%	ratio (Top 2mm)/(worst-surface 2mm) 31.8%	ratio (Bottom 2mm)/(worst-surface 2mm) 3.1%	ratio (Fornt 2mm)/(worst-surface 2mm) 57.1%	ratio (Rear 2mm)/(worst-surface 2mm) 80.1%
1			0		5	0.538	0.008	0.031	0.005	0.307	0.332	0.54	0.54	0.82	100.0%	1.5%	5.8%	0.9%	57.1%	61.7%
2			1		5	0.604	0.011	0.034	0.004	0.271	0.310	0.60	0.60	0.73	100.0%	1.8%	5.6%	0.7%	44.9%	51.3%
3			2		5	0.618	0.014	0.043	0.002	0.343	0.290	0.62	0.62	0.72	100.0%	2.3%	7.0%	0.3%	55.5%	46.9%
4			3		5	0.518	0.007	0.113	0.008	0.253	0.204	0.52	0.52	0.85	100.0%	1.4%	21.8%	1.5%	48.8%	39.4%
5			4		5	0.488	0.009	0.155	0.015	0.200	0.204	0.49	0.49	0.91	100.0%	1.8%	31.8%	3.1%	41.0%	41.8%
6			5		5	0.475	0.006	0.065	0.009	0.266	0.234	0.48	0.48	0.93	100.0%	1.3%	13.7%	1.9%	56.0%	49.3%
7			6		5	0.591	0.010	0.029	0.004	0.255	0.320	0.59	0.59	0.75	100.0%	1.7%	4.9%	0.7%	43.1%	54.1%
8				7	5	0.713	0.002	0.067	0.003	0.133	0.543	0.71	0.71	0.62	100.0%	0.3%	9.4%	0.4%	18.7%	76.2%
9				8	5	0.723	0.002	0.114	0.005	0.157	0.579	0.72	0.72	0.61	100.0%	0.3%	15.8%	0.7%	21.7%	80.1%
10				9	5	0.677	0.003	0.066	0.003	0.118	0.528	0.68	0.68	0.65	100.0%	0.4%	9.7%	0.4%	17.4%	78.0%
11	L	Patch		10	5	0.674	0.003	0.062	0.004	0.149	0.497	0.67	0.67	0.66	100.0%	0.4%	9.2%	0.6%	22.1%	73.7%
12				11	5	0.713	0.006	0.032	0.003	0.149	0.543	0.71	0.71	0.62	100.0%	0.8%	4.5%	0.4%	20.9%	76.2%
13				12	5	0.676	0.005	0.065	0.003	0.141	0.511	0.68	0.68	0.65	100.0%	0.7%	9.6%	0.4%	20.9%	75.6%
14				13	5	0.657	0.002	0.152	0.007	0.129	0.500	0.66	0.66	0.67	100.0%	0.3%	23.1%	1.1%	19.6%	76.1%
15			0	7	10	1.198	0.009	0.096	0.006	0.393	0.811	1.20	1.20	0.37	100.0%	0.8%	8.0%	0.5%	32.8%	67.7%
16			1	8	10	1.162	0.010	0.142	0.011	0.449	0.763	1.16	1.16	0.38	100.0%	0.9%	12.2%	0.9%	38.6%	65.7%
17			2	9	10	1.096	0.017	0.119	0.007	0.438	0.687	1.10	1.10	0.40	100.0%	1.6%	10.9%	0.6%	40.0%	62.7%
18			3	10	10	1.223	0.010	0.120	0.014	0.299	0.697	1.22	1.22	0.36	100.0%	0.8%	9.8%	1.1%	24.4%	57.0%
19			4	11	10	1.219	0.008	0.192	0.011	0.241	0.759	1.22	1.22	0.36	100.0%	0.7%	15.8%	0.9%	19.8%	62.3%
20			5	12	10	0.949	0.010	0.105	0.011	0.350	0.615	0.95	0.95	0.47	100.0%	1.1%	11.1%	1.2%	36.9%	64.8%
21			6	13	10	1.175	0.014	0.150	0.009	0.403	0.786	1.18	1.18	0.38	100.0%	1.2%	12.8%	0.8%	34.3%	66.9%

PD Simulation (2mm), 4cm2 PD(mW/cm2), max ratio out of all beams

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	ratio (Right 10mm)/(worst-surface 2mm) 61.3%	ratio (Left 10mm)/(worst-surface 2mm) 1.5%	ratio (Top 10mm)/(worst-surface 2mm) 20.7%	ratio (Bottom 10mm)/(worst-surface 2mm) 0.0%	ratio (Front 10mm)/(worst-surface 2mm) 27.8%	ratio (Rear 10mm)/(worst-surface 2mm) 40.3%
1			0		5	0.306	0.007	0.021	0.000	0.137	0.154	0.31	0.31	1.44	56.9%	1.3%	3.9%	0.0%	25.5%	28.6%
2			1		5	0.287	0.006	0.011	0.000	0.133	0.178	0.29	0.29	1.54	47.5%	1.0%	1.8%	0.0%	22.0%	29.5%
3			2		5	0.316	0.008	0.022	0.000	0.172	0.170	0.32	0.32	1.40	51.1%	1.3%	3.6%	0.0%	27.8%	27.5%
4			3		5	0.289	0.003	0.065	0.000	0.108	0.090	0.29	0.29	1.53	55.8%	0.6%	12.5%	0.0%	20.8%	17.4%
5			4		5	0.270	0.004	0.101	0.000	0.077	0.094	0.27	0.27	1.64	55.3%	0.8%	20.7%	0.0%	15.8%	19.3%
6			5		5	0.291	0.003	0.022	0.000	0.119	0.113	0.29	0.29	1.52	61.3%	0.6%	4.6%	0.0%	25.1%	23.8%
7			6		5	0.298	0.009	0.015	0.000	0.119	0.201	0.30	0.30	1.48	50.4%	1.5%	2.5%	0.0%	20.1%	34.0%
8				7	5	0.299	0.001	0.043	0.000	0.049	0.260	0.30	0.30	1.48	41.9%	0.1%	6.0%	0.0%	6.9%	36.5%
9				8	5	0.249	0.001	0.071	0.000	0.036	0.202	0.25	0.25	1.78	34.4%	0.1%	9.8%	0.0%	5.0%	27.9%
10				9	5	0.320	0.001	0.038	0.000	0.043	0.273	0.32	0.32	1.38	47.3%	0.1%	5.6%	0.0%	6.4%	40.3%
11	L	Patch		10	5	0.309	0.002	0.036	0.000	0.061	0.250	0.31	0.31	1.43	45.8%	0.3%	5.3%	0.0%	9.1%	37.1%
12				11	5	0.305	0.002	0.015	0.000	0.049	0.243	0.31	0.31	1.45	42.8%	0.3%	2.1%	0.0%	6.9%	34.1%
13				12	5	0.259	0.002	0.039	0.000	0.049	0.221	0.26	0.26	1.71	38.3%	0.3%	5.8%	0.0%	7.2%	32.7%
14				13	5	0.247	0.001	0.097	0.000	0.040	0.202	0.25	0.25	1.79	37.6%	0.2%	14.8%	0.0%	6.1%	30.7%
15			0	7	10	0.547	0.005	0.059	0.000	0.177	0.403	0.55	0.55	0.81	45.7%	0.4%	4.9%	0.0%	14.8%	33.6%
16			1	8	10	0.535	0.005	0.085	0.000	0.162	0.359	0.54	0.54	0.83	46.0%	0.4%	7.3%	0.0%	13.9%	30.9%
17			2	9	10	0.524	0.009	0.061	0.000	0.206	0.331	0.52	0.52	0.84	47.8%	0.8%	5.6%	0.0%	18.8%	30.2%
18			3	10	10	0.531	0.006	0.074	0.000	0.096	0.352	0.53	0.53	0.83	43.4%	0.5%	6.1%	0.0%	7.8%	28.8%
19			4	11	10	0.513	0.004	0.126	0.000	0.079	0.320	0.51	0.51	0.86	42.1%	0.3%	10.3%	0.0%	6.5%	26.3%
20			5	12	10	0.447	0.006	0.062	0.000	0.149	0.294	0.45	0.45	0.99	47.1%	0.6%	6.5%	0.0%	15.7%	31.0%
21			6	13	10	0.530	0.011	0.092	0.000	0.173	0.359	0.53	0.53	0.83	45.1%	0.9%	7.8%	0.0%	14.7%	30.6%

PD Simulation (10mm), 4cm2 PD(mW/cm2)

ELECTRONICS

- L–patch High CH

PD Simulation (2mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 100.0%	ratio (Left 2mm)/(worst-surface 2mm) 3.1%	ratio (Top 2mm)/(worst-surface 2mm) 28.2%	ratio (Bottom 2mm)/(worst-surface 2mm) 3.1%	ratio (Front 2mm)/(worst-surface 2mm) 74.3%	ratio (Rear 2mm)/(worst-surface 2mm) 76.6%
1			0		5	0.37	0.01	0.03	0.00	0.25	0.23	0.37	0.37	1.19		100.0%	2.7%	8.1%	0.0%	67.6%	62.2%
2			1		5	0.35	0.01	0.06	0.01	0.24	0.18	0.35	0.35	1.26		100.0%	2.9%	17.1%	2.9%	68.6%	51.4%
3			2		5	0.45	0.01	0.05	0.00	0.31	0.17	0.45	0.45	0.98		100.0%	2.2%	11.1%	0.0%	68.9%	37.8%
4			3		5	0.39	0.01	0.11	0.00	0.19	0.13	0.39	0.39	1.13		100.0%	2.6%	28.2%	0.0%	48.7%	33.3%
5			4		5	0.37	0.01	0.10	0.01	0.15	0.15	0.37	0.37	1.19		100.0%	2.7%	27.0%	2.7%	40.5%	40.5%
6			5		5	0.32	0.01	0.04	0.01	0.17	0.19	0.32	0.32	1.38		100.0%	3.1%	12.5%	3.1%	53.1%	59.4%
7			6		5	0.35	0.01	0.04	0.00	0.26	0.19	0.35	0.35	1.26		100.0%	2.9%	11.4%	0.0%	74.3%	54.3%
8				7	5	0.55	0.00	0.07	0.00	0.11	0.37	0.55	0.55	0.80		100.0%	0.0%	12.7%	0.0%	20.0%	67.3%
9				8	5	0.64	0.00	0.11	0.01	0.13	0.49	0.64	0.64	0.69		100.0%	0.0%	17.2%	1.6%	20.3%	76.6%
10				9	5	0.57	0.00	0.05	0.00	0.12	0.42	0.57	0.57	0.78		100.0%	0.0%	8.8%	0.0%	21.1%	73.7%
11	L	Patch		10	5	0.56	0.00	0.07	0.00	0.13	0.41	0.56	0.56	0.79		100.0%	0.0%	12.5%	0.0%	23.2%	73.2%
12				11	5	0.56	0.00	0.04	0.00	0.12	0.39	0.56	0.56	0.79		100.0%	0.0%	7.1%	0.0%	21.4%	69.6%
13				12	5	0.61	0.00	0.08	0.00	0.08	0.44	0.61	0.61	0.72		100.0%	0.0%	13.1%	0.0%	13.1%	72.1%
14				13	5	0.60	0.00	0.13	0.01	0.12	0.45	0.60	0.60	0.74		100.0%	0.0%	21.7%	1.7%	20.0%	75.0%
15			0	7	10	0.92	0.01	0.09	0.01	0.35	0.66	0.92	0.92	0.48		100.0%	1.1%	9.8%	1.1%	38.0%	71.7%
16			1	8	10	1.03	0.01	0.14	0.02	0.41	0.64	1.03	1.03	0.43		100.0%	1.0%	13.6%	1.9%	39.8%	62.1%
17			2	9	10	0.92	0.01	0.12	0.01	0.39	0.54	0.92	0.92	0.48		100.0%	1.1%	13.0%	1.1%	42.4%	58.7%
18			3	10	10	1.05	0.01	0.14	0.01	0.32	0.54	1.05	1.05	0.42		100.0%	1.0%	13.3%	1.0%	30.5%	51.4%
19			4	11	10	0.95	0.01	0.11	0.01	0.26	0.55	0.95	0.95	0.47		100.0%	1.1%	11.6%	1.1%	27.4%	57.9%
20			5	12	10	0.79	0.01	0.10	0.01	0.28	0.49	0.79	0.79	0.56		100.0%	1.3%	12.7%	1.3%	35.4%	62.0%
21			6	13	10	0.89	0.01	0.14	0.01	0.37	0.60	0.89	0.89	0.50		100.0%	1.1%	15.7%	1.1%	41.6%	67.4%

PD Simulation (10mm)

No.	Module	Type(P or D)	Beam ID_1	Bema ID_2	Feed no.	S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Rear)	Max	Max. PD w MIMO rate	Scaling Factor	Note	ratio (Right 2mm)/(worst-surface 2mm) 51.4%	ratio (Left 2mm)/(worst-surface 2mm) 0.0%	ratio (Top 2mm)/(worst-surface 2mm) 18.9%	ratio (Bottom 2mm)/(worst-surface 2mm) 0.0%	ratio (Front 2mm)/(worst-surface 2mm) 37.1%	ratio (Rear 2mm)/(worst-surface 2mm) 35.7%
1			0		5	0.19	0.00	0.01	0.00	0.13	0.11	0.19	0.19	2.33		51.4%	0.0%	2.7%	0.0%	35.1%	29.7%
2			1		5	0.18	0.00	0.02	0.00	0.11	0.08	0.18	0.18	2.46		51.4%	0.0%	5.7%	0.0%	31.4%	22.9%
3			2		5	0.23	0.00	0.02	0.00	0.15	0.09	0.23	0.23	1.92		51.1%	0.0%	4.4%	0.0%	33.3%	20.0%
4			3		5	0.19	0.00	0.07	0.00	0.08	0.06	0.19	0.19	2.33		48.7%	0.0%	17.9%	0.0%	20.5%	15.4%
5			4		5	0.17	0.00	0.07	0.00	0.05	0.06	0.17	0.17	2.60		45.9%	0.0%	18.9%	0.0%	13.5%	16.2%
6			5		5	0.15	0.00	0.01	0.00	0.07	0.08	0.15	0.15	2.95		46.9%	0.0%	3.1%	0.0%	21.9%	25.0%
7			6		5	0.18	0.00	0.02	0.00	0.13	0.09	0.18	0.18	2.46		51.4%	0.0%	5.7%	0.0%	37.1%	25.7%
8				7	5	0.18	0.00	0.04	0.00	0.04	0.18	0.18	0.18	2.46		32.7%	0.0%	7.3%	0.0%	7.3%	32.7%
9				8	5	0.25	0.00	0.07	0.00	0.04	0.19	0.25	0.25	1.77		39.1%	0.0%	10.9%	0.0%	6.3%	29.7%
10				9	5	0.23	0.00	0.03	0.00	0.05	0.19	0.23	0.23	1.92		40.4%	0.0%	5.3%	0.0%	8.8%	33.3%
11	L	Patch		10	5	0.21	0.00	0.04	0.00	0.05	0.20	0.21	0.21	2.10		37.5%	0.0%	7.1%	0.0%	8.9%	35.7%
12				11	5	0.23	0.00	0.02	0.00	0.03	0.16	0.23	0.23	1.92		41.1%	0.0%	3.6%	0.0%	5.4%	28.6%
13				12	5	0.24	0.00	0.05	0.00	0.03	0.18	0.24	0.24	1.84		39.3%	0.0%	8.2%	0.0%	4.9%	29.5%
14				13	5	0.23	0.00	0.08	0.00	0.03	0.21	0.23	0.23	1.92		38.3%	0.0%	13.3%	0.0%	5.0%	35.0%
15			0	7	10	0.38	0.00	0.06	0.00	0.17	0.31	0.38	0.38	1.16		41.3%	0.0%	6.0%	0.0%	18.5%	33.7%
16			1	8	10	0.39	0.00	0.09	0.00	0.16	0.27	0.39	0.39	1.13		37.9%	0.0%	8.7%	0.0%	15.5%	26.2%
17			2	9	10	0.38	0.00	0.07	0.00	0.17	0.26	0.38	0.38	1.16		41.3%	0.0%	7.6%	0.0%	18.5%	28.3%
18			3	10	10	0.40	0.00	0.09	0.00	0.10	0.27	0.40	0.40	1.11		38.1%	0.0%	8.6%	0.0%	9.5%	25.7%
19			4	11	10	0.35	0.00	0.08	0.00	0.09	0.25	0.35	0.35	1.26		36.8%	0.0%	8.4%	0.0%	9.5%	26.3%
20			5	12	10	0.29	0.00	0.06	0.00	0.11	0.21	0.29	0.29	1.52		36.7%	0.0%	7.6%	0.0%	13.9%	26.6%
21			6	13	10	0.36	0.00	0.09	0.00	0.16	0.29	0.36	0.36	1.23		40.4%	0.0%	10.1%	0.0%	18.0%	32.6%