R10L5TR Sub6_MMW Power Density Simulation PART0 Report

1 .Electromagnetic simulation method for power density

1.1 EM simulation

1.1.1 EM simulation tool description

The mmWave power density (PD) simulation method for calculating PD (Power Density) for mobile phones with mmWave antenna modules is available in ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1) is used. ANSYS HFSS is one of several commercial tools for 3D fullwave electromagnetic simulation used for antenna and RF structure design of high frequency component. ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1) is implemented based on Finite Element Method (FEM), which operates in the frequency domain.

1.1.2 Mesh and convergence criteria

ANSYS Electromagnetic suite HFSS ver. 21.1 (2021 R1) uses the Finite Element Method (FEM) to solve the structure for 3D EM simulations to analyze power density. The volume area containing the simulated object should be subdivided into electrically small parts called finite elements with unknown functions. To subdivide system, the adaptive mesh technique in ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1) is used. ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1) 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 iterations in ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1) is defined as convergence criteria, delta S, and the iterative adaptive mesh process repeats until the delta S is met. In ANSYS Electromagnetics suite HFSS ver. 21.1 (2021 R1), 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).

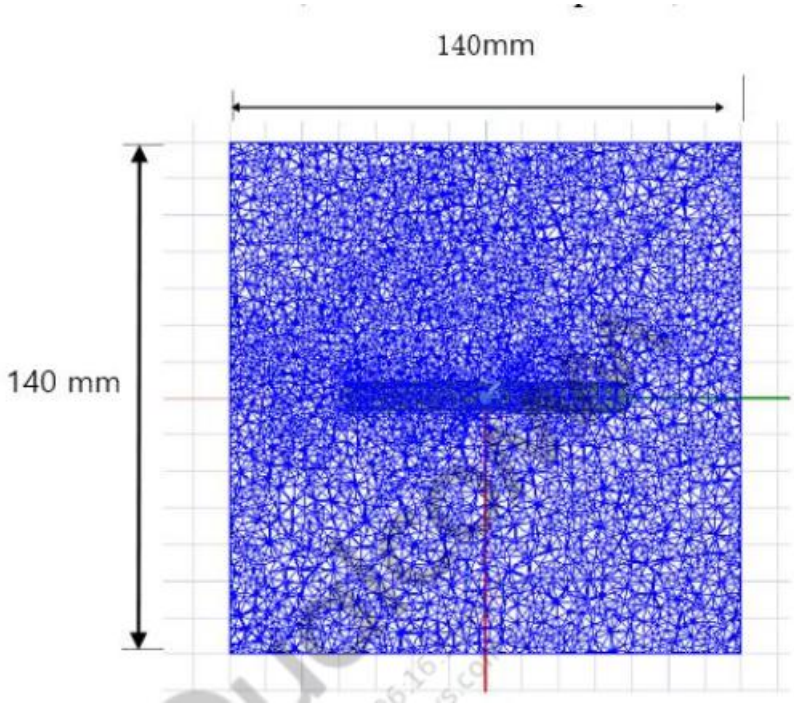


Figure 1-1: Example of HFSS mesh in a model of the device (Top view)

1.1.3 Time-averaged power density calculation

It is possible to get various kinds of physical quantities can be obtained after finishing 3D fullwave electromagnetic simulation. To calculate PD evaluation, two physical quantities, an electric field () and a magnetic field () are needed. The actual consumption power can be expressed as the real term of the time-averaged Poynting vector () from the cross product of and complex conjugation of as shown below:

$$(\vec{S}) = \mathrm{Re}\left(\frac{1}{2}\vec{E} \times \vec{H}*\right)$$

(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 HFSS ver. 21.1 (2021 R1).
From the point power density(, the spatial-averaged power density () on an evaluated area (A) can be derived as shown below:

$$PD_{av} = \frac{1}{A}\int_A (\vec{S}).ds = \frac{1}{2A}\int_A |Re(\vec{E} \times \vec{H}\ *)|.ds$$

1.2 Simulation setup

1.2.1 Modeling for simulation

The simulation approach to perform PD assessment for a smartphone requires accurate modeling for mmWave antenna module as well as the smartphone itself. Figure 1-2 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 QMT0# and QMT1#. On the front side view, QMT0# is placed at the left side and antennas are facing the left side of the device. QMT1# is placed on the right side and antennas are facing the right side.

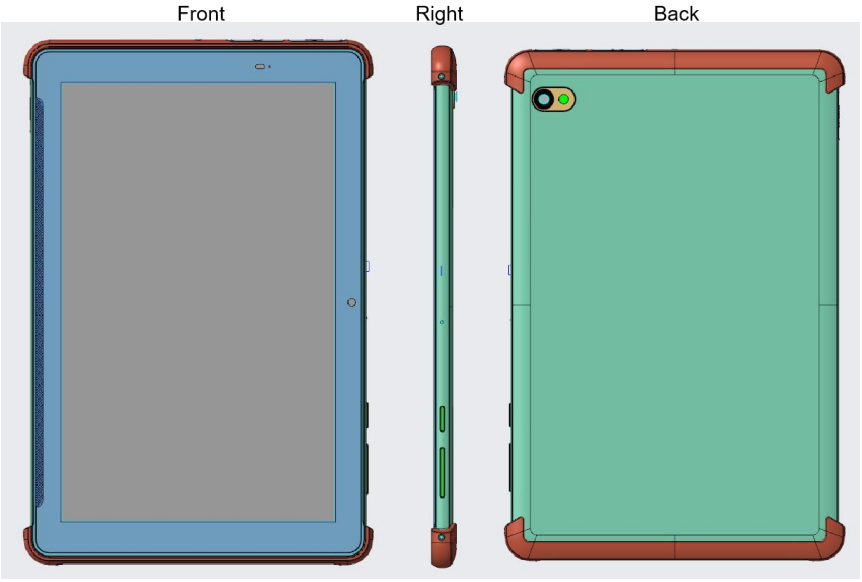


Figure 1-2: HFSS simulation model which is mounted two mmWave antenna modules

1.2.2 PD evaluation surfaces

Figure 1-3 shows the PD evaluation planes and truncation area of the simulation model to find worst case surfaces for evaluation.

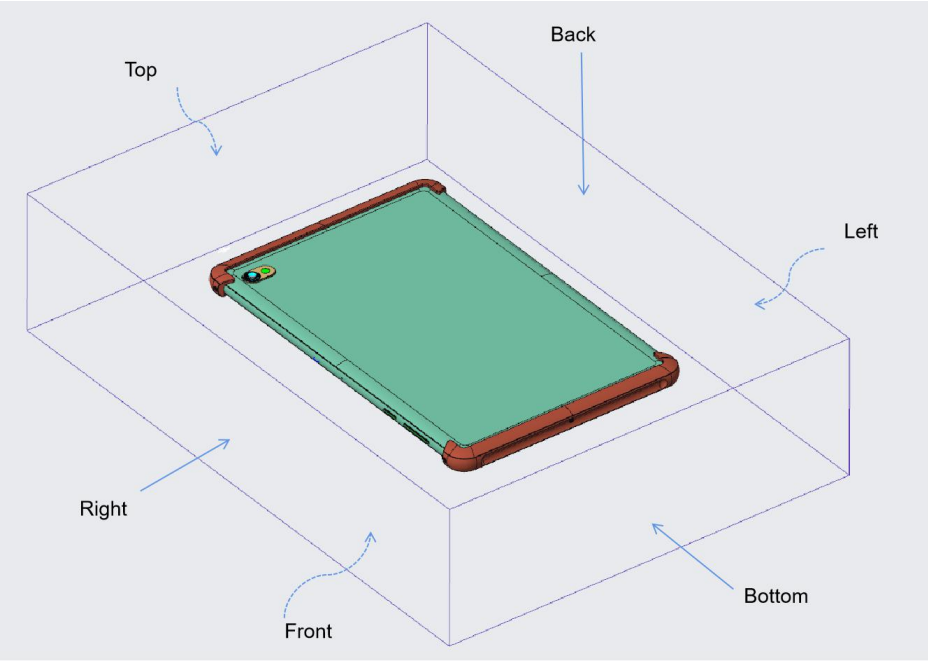


Figure 1-3: EUT simulation model

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 1-1 shows the surfaces selected for PD evaluation planes for QTM#0 and QTM#1.

Table 1-1: PD evaluation surfaces

	Front	Back	Left From Front View	Right From Front View	Top	Bottom
QTM#0	√	√	√			
QTM#1	√	√		√		

1.2.3 Radiation boundary condition

For radiation boundary, the 2nd order absorbing boundary condition (ABC) is used for all simulations in this report. This radiation boundary simulates an electrically open surface that allows waves to radiate infinitely far into space. The system absorbs the wave via the 2nd order radiation boundary, essentially ballooning the boundary infinitely far away from the structure and into space. The radiation boundaries may also be placed relatively close to a structure and can be of arbitrary shape.

Per ANSYS recommendations for their simulation tool, the radiation boundary plane must be located at least a quarter wavelength from strongly radiating structure, or at least a tenth of a wavelength from a weakly radiating structure. In this simulation report, about two or three

wavelengths spacing from the device surfaces in all main beam directions are applied to ensure convergence.
By changing convergence error (i.e., maximum magnitude delta S) from 2% to 4% and moving the radiation boundary closer towards the device by 20%, the combined influence in PD value is < 0.04 dB which confirms that the simulation model is reliable using this setup.

1.2.4 Source excitation condition

Each of the two 5G mmWave array modules is the same part containing a 1x4 element array of dual-polarization patch antennas. The number of antenna ports of QTM#0 and QTM#1 for source excitation is equal to 16. The port of each patch antenna is separated in frequency and polarization. That is, the ports of each patch antenna are divided into a feed for 28 GHz and a feed for 39 GHz, and a vertical polarity feed and a horizontal polarity feed are divided.
Above figure 1-3 shows the QTM#1 module structure and surrounding structure. The QTM#1 module is encrypted in the ANSYS Electromagnetics suite (HFSS) and can only check the feeding position is encrypted in the ANSYS Electromagnetics suite (HFSS) and can only check the feeding position.

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 4 shows an example of antenna port excitations.

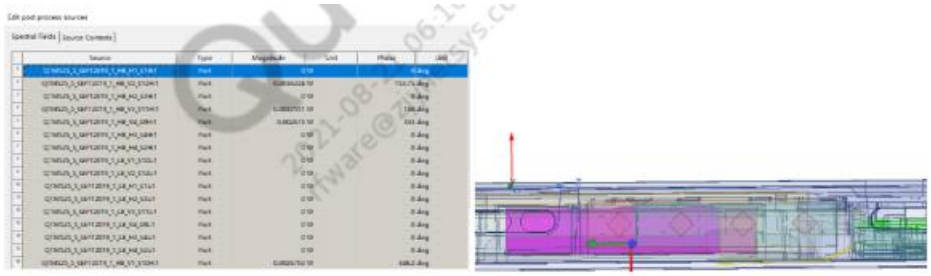


Figure 1-4: An example of port excitation (QTM#1)

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 .Codebook

The codebook supported by this EUT is shown in Table 2-1 below.

- **N261 codebook**

Band	Beam ID	Module	Ant Group	Ant Type	Ant Feed	Paired With
261	0	1	0	PATCH	12	128
261	1	0	0	PATCH	12	129
261	2	0	0	PATCH	11	130
261	3	1	0	PATCH	12;11	131
261	4	1	0	PATCH	12;11	132
261	5	1	0	PATCH	12;11	133
261	6	1	0	PATCH	10;12	134
261	7	0	0	PATCH	11;9	135
261	8	0	0	PATCH	10;12	136
261	9	0	0	PATCH	12;11	137
261	10	0	0	PATCH	12;11	138
261	11	1	0	PATCH	12;11	139
261	12	1	0	PATCH	11;9	140
261	13	1	0	PATCH	12;11	141
261	14	0	0	PATCH	12;11	142
261	15	0	0	PATCH	12;11	143
261	16	0	0	PATCH	12;11	144
261	17	1	0	PATCH	10;12;11;9	145
261	18	1	0	PATCH	10;12;11;9	146
261	19	1	0	PATCH	10;12;11;9	147
261	20	1	0	PATCH	10;12;11;9	148
261	21	1	0	PATCH	10;12;11;9	149
261	22	0	0	PATCH	10;12;11;9	150
261	23	0	0	PATCH	10;12;11;9	151
261	24	0	0	PATCH	10;12;11;9	152
261	25	0	0	PATCH	10;12;11;9	153
261	26	0	0	PATCH	10;12;11;9	154
261	27	1	0	PATCH	10;12;11;9	155
261	28	1	0	PATCH	10;12;11;9	156
261	29	1	0	PATCH	10;12;11;9	157
261	30	1	0	PATCH	10;12;11;9	158
261	31	0	0	PATCH	10;12;11;9	159
261	32	0	0	PATCH	10;12;11;9	160
261	33	0	0	PATCH	10;12;11;9	161
261	34	0	0	PATCH	10;12;11;9	162
261	128	1	1	PATCH	3	0
261	129	0	1	PATCH	3	1
261	130	0	1	PATCH	4	2
261	131	1	1	PATCH	3;4	3
261	132	1	1	PATCH	3;4	4
261	133	1	1	PATCH	3;4	5
261	134	1	1	PATCH	1;3	6
261	135	0	1	PATCH	3;4	7
261	136	0	1	PATCH	3;4	8
261	137	0	1	PATCH	1;3	9
261	138	0	1	PATCH	3;4	10
261	139	1	1	PATCH	1;3	11
261	140	1	1	PATCH	3;4	12

261	141	1	1	PATCH	4;2	13
261	142	0	1	PATCH	1;3	14
261	143	0	1	PATCH	1;3	15
261	144	0	1	PATCH	1;3	16
261	145	1	1	PATCH	1;3;4;2	17
261	146	1	1	PATCH	1;3;4;2	18
261	147	1	1	PATCH	1;3;4;2	19
261	148	1	1	PATCH	1;3;4;2	20
261	149	1	1	PATCH	1;3;4;2	21
261	150	0	1	PATCH	1;3;4;2	22
261	151	0	1	PATCH	1;3;4;2	23
261	152	0	1	PATCH	1;3;4;2	24
261	153	0	1	PATCH	1;3;4;2	25
261	154	0	1	PATCH	1;3;4;2	26
261	155	1	1	PATCH	1;3;4;2	27
261	156	1	1	PATCH	1;3;4;2	28
261	157	1	1	PATCH	1;3;4;2	29
261	158	1	1	PATCH	1;3;4;2	30
261	159	0	1	PATCH	1;3;4;2	31
261	160	0	1	PATCH	1;3;4;2	32
261	161	0	1	PATCH	1;3;4;2	33
261	162	0	1	PATCH	1;3;4;2	34

- N260 codebook

Band	Beam ID	Module	Ant Group	Ant Type	Ant Feed	Paired With
260	0	1	0	PATCH	12	128
260	1	0	0	PATCH	12	129
260	2	1	0	PATCH	11	130
260	3	0	0	PATCH	11	131
260	4	1	0	PATCH	9	132
260	5	1	0	PATCH	10;12	133
260	6	1	0	PATCH	11;9	134
260	7	1	0	PATCH	10;12	135
260	8	1	0	PATCH	10;12	136
260	9	0	0	PATCH	12;11	137
260	10	0	0	PATCH	11;9	138
260	11	0	0	PATCH	10;12	139
260	12	0	0	PATCH	10;12	140
260	13	1	0	PATCH	12;11	141
260	14	1	0	PATCH	12;11	142
260	15	1	0	PATCH	12;11	143
260	16	0	0	PATCH	11;9	144
260	17	0	0	PATCH	10;12	145
260	18	0	0	PATCH	10;12	146
260	19	1	0	PATCH	10;12;11;9	147
260	20	1	0	PATCH	10;12;11;9	148
260	21	1	0	PATCH	10;12;11;9	149
260	22	1	0	PATCH	10;12;11;9	150
260	23	1	0	PATCH	10;12;11;9	151
260	24	0	0	PATCH	10;12;11;9	152
260	25	0	0	PATCH	10;12;11;9	153
260	26	0	0	PATCH	10;12;11;9	154
260	27	0	0	PATCH	10;12;11;9	155
260	28	0	0	PATCH	10;12;11;9	156
260	29	1	0	PATCH	10;12;11;9	157
260	30	1	0	PATCH	10;12;11;9	158
260	31	1	0	PATCH	10;12;11;9	159
260	32	1	0	PATCH	10;12;11;9	160

260	33	0	0	PATCH	10;12;11;9	161
260	34	0	0	PATCH	10;12;11;9	162
260	35	0	0	PATCH	10;12;11;9	163
260	36	0	0	PATCH	10;12;11;9	164
260	128	1	1	PATCH	3	0
260	129	0	1	PATCH	3	1
260	130	1	1	PATCH	4	2
260	131	0	1	PATCH	4	3
260	132	1	1	PATCH	2	4
260	133	1	1	PATCH	3;4	5
260	134	1	1	PATCH	3;4	6
260	135	1	1	PATCH	1;3	7
260	136	1	1	PATCH	4;2	8
260	137	0	1	PATCH	4;2	9
260	138	0	1	PATCH	3;4	10
260	139	0	1	PATCH	1;3	11
260	140	0	1	PATCH	4;2	12
260	141	1	1	PATCH	3;4	13
260	142	1	1	PATCH	1;3	14
260	143	1	1	PATCH	1;3	15
260	144	0	1	PATCH	3;4	16
260	145	0	1	PATCH	1;3	17
260	146	0	1	PATCH	1;3	18
260	147	1	1	PATCH	1;3;4;2	19
260	148	1	1	PATCH	1;3;4;2	20
260	149	1	1	PATCH	1;3;4;2	21
260	150	1	1	PATCH	1;3;4;2	22
260	151	1	1	PATCH	1;3;4;2	23
260	152	0	1	PATCH	1;3;4;2	24
260	153	0	1	PATCH	1;3;4;2	25
260	154	0	1	PATCH	1;3;4;2	26
260	155	0	1	PATCH	1;3;4;2	27
260	156	0	1	PATCH	1;3;4;2	28
260	157	1	1	PATCH	1;3;4;2	29
260	158	1	1	PATCH	1;3;4;2	30
260	159	1	1	PATCH	1;3;4;2	31
260	160	1	1	PATCH	1;3;4;2	32
260	161	0	1	PATCH	1;3;4;2	33
260	162	0	1	PATCH	1;3;4;2	34
260	163	0	1	PATCH	1;3;4;2	35
260	164	0	1	PATCH	1;3;4;2	36

Table 2-1: EUT codebook

3 .Simulation verification

The beams selected for simulation verification are highlighted in yellow in Table 2-1. Input power level used for comparison is listed in Table 3-1

Mode/Band	Antenna	Input Power (dBm)SISO	Input Power (dBm)MIMO
5G NR n261 (28 GHz)	QTM#0 Patch	6	6
	QTM#1 Patch	6	6
5G NR n260 (39 GHz)	QTM#0 Patch	6	6
	QTM#1 Patch	6	6

Table 3-1: Input power used in simulation validation

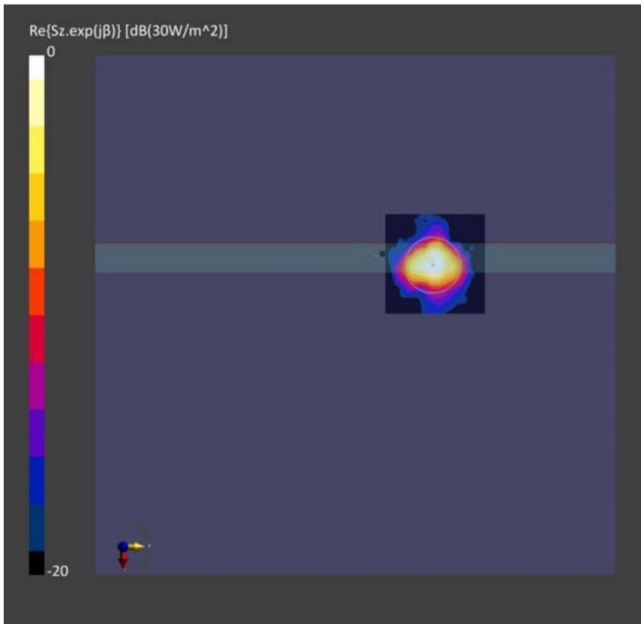
The simulation and measurement were performed at 2mm evaluation distance. The simulated and measured 4cm2 averaged PD results are shown in Table 3-2.

6dBm input measurement / simulation									
Band	Ant Type	Module	Ant Group (Ant Polarization)	beam ID	Surface	Channel	Measured	Simulated(Middle)	Delta (Simulated/Measured)
n260	Patch	QTM0	AG0(V)	36	Leftface	Mid	5.81	16.32	4.49
					Frontface	Mid	3.48	7.44	3.30
					Backface	Mid	2.67	5.29	2.97
			AG1(H)	161	Leftface	Mid	6.95	14.96	3.33
					Frontface	Mid	4.24	8.11	2.82
					Backface	Mid	2.14	4.03	2.75
		QTM1	AG0(V)	32	Right	Mid	6.53	14.83	3.56
					Frontface	Mid	3.81	6.49	2.31
					Backface	Mid	2.47	5.73	3.65
			AG1(H)	160	Right	Mid	6.68	14.03	3.22
					Frontface	Mid	2.93	6.17	3.23
					Backface	Mid	2.93	5.25	2.53
n261	Patch	QTM0	AG0(V)	24	Leftface	Mid	10.4	16.5	2.00
					Frontface	Mid	4.9	9.33	2.80
					Backface	Mid	4.09	8.46	3.16
			AG1(H)	152	Leftface	Mid	8.8	15.76	2.53
					Frontface	Mid	3.31	9.16	4.42
					Backface	Mid	3.9	7.87	3.05
		QTM1	AG0(V)	28	Rightface	Mid	7.85	16.4	3.20
					Frontface	Mid	4.63	9.46	3.10
					Backface	Mid	4.17	8.75	3.22
			AG1(H)	157	Rightface	Mid	7.78	15.19	2.91
					Frontface	Mid	3.71	8.94	3.82
					Backface	Mid	3.35	7.2	3.32

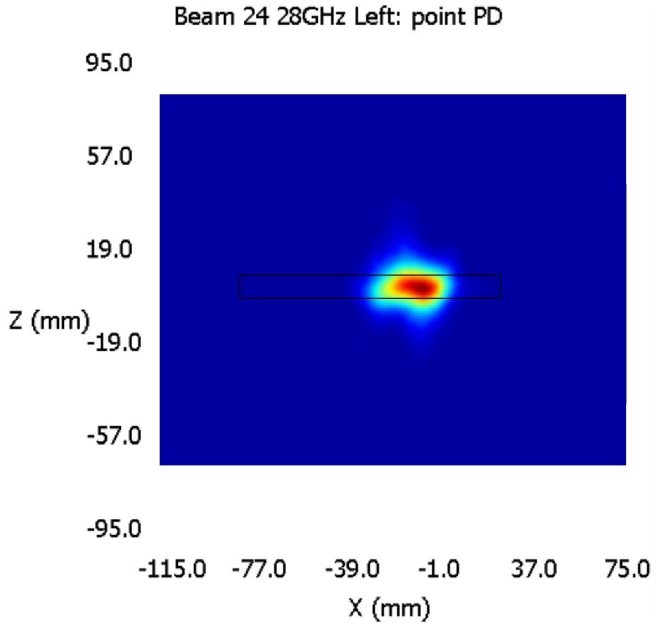
Table 3-2: Simulated and measured 4cm2 averaged PD comparison

Below Figures show Measured and simulated PD distributions for selected beams. As can be seen, the Simulated point PD distribution and Measured point PD distribution have good correlation on all surfaces evaluated.

• N261 QTM0: mid channel, Beam24, Left face, Point PD

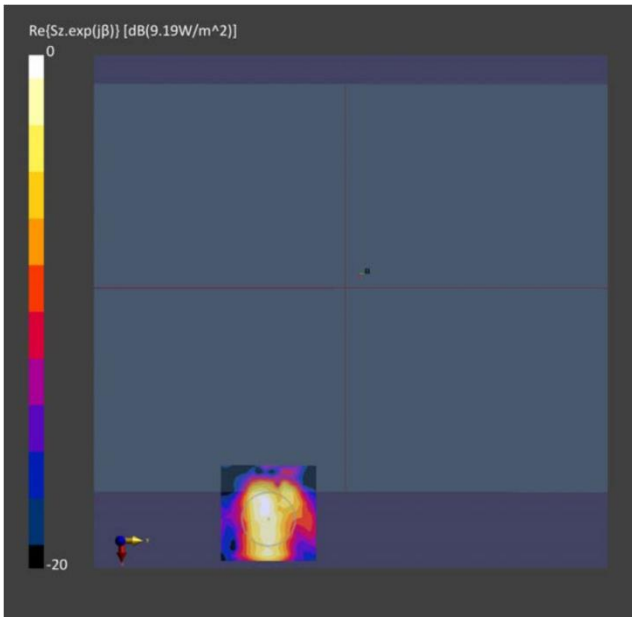


(a) Measurement

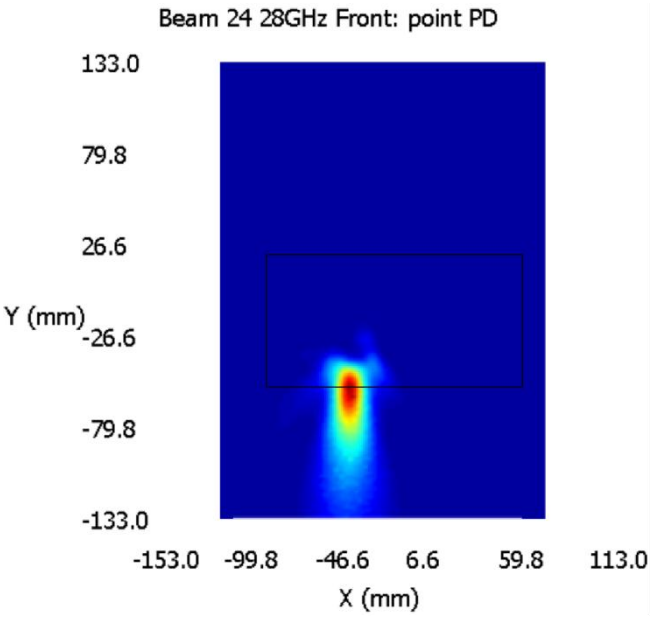


(b) Simulation

• N261 QTM0: mid channel, Beam24, Front face, Point PD

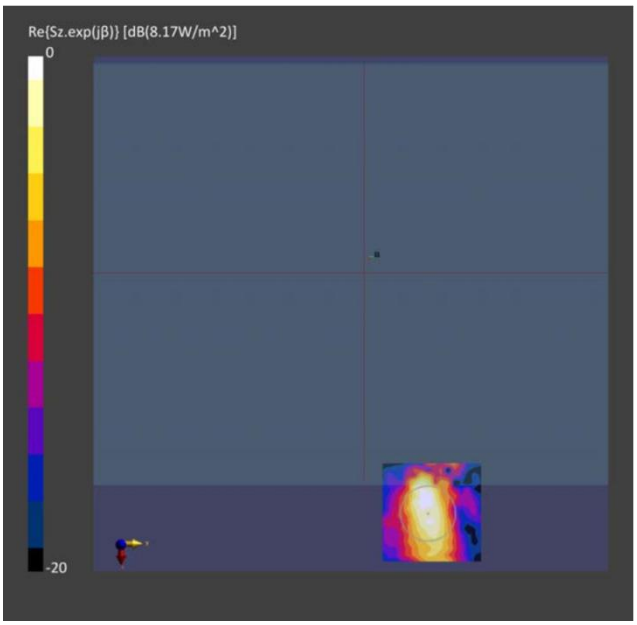


(a) Measurement

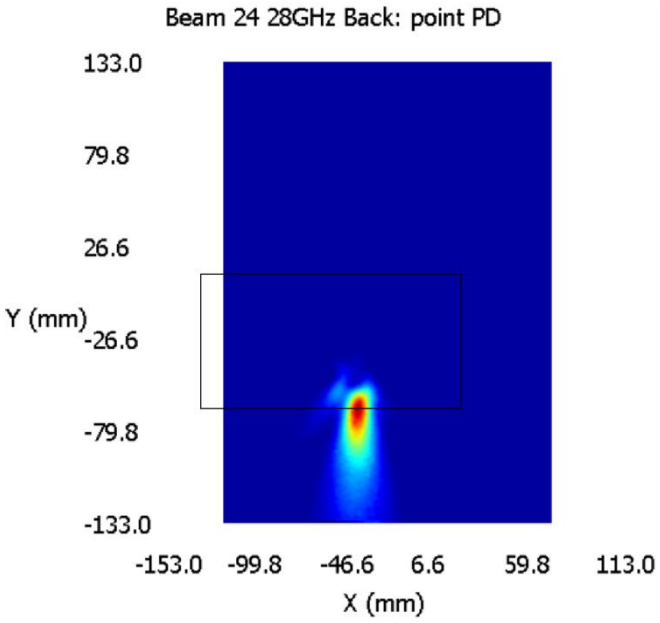


(b) Simulation

N261 QTM0: mid channel, Beam24, Back face, Point PD

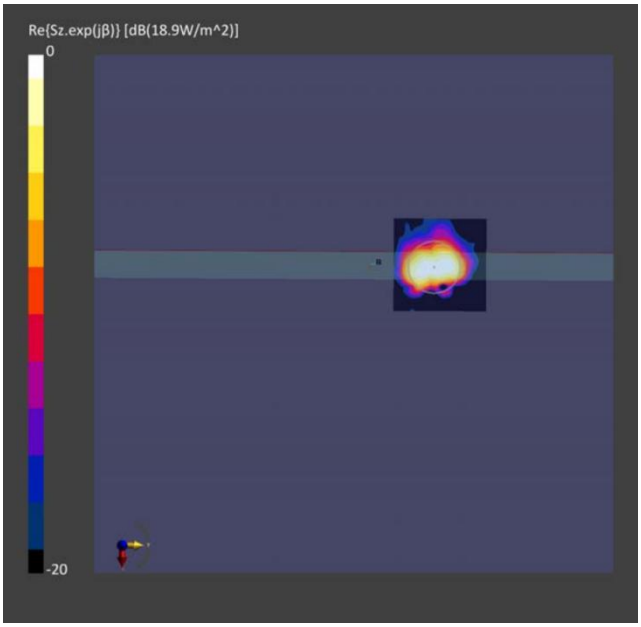


(a) Measurement

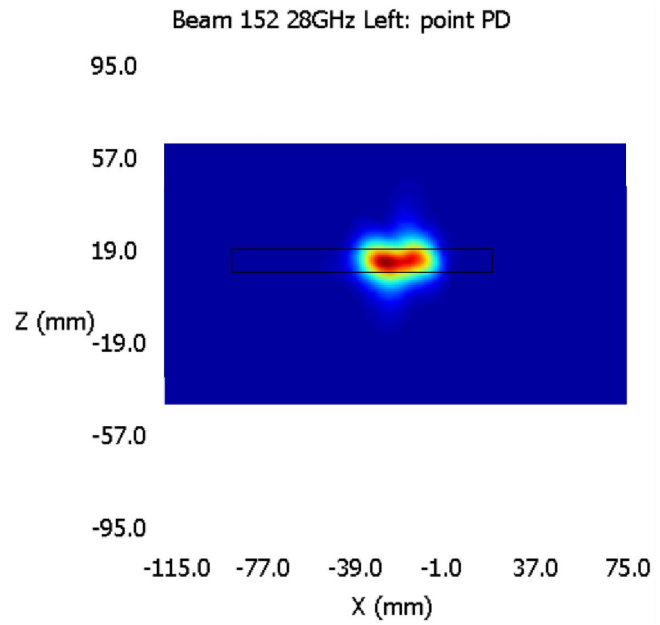


(b) Simulation

• N261 QTM0: Middle channel, Beam152, Left face, Point PD

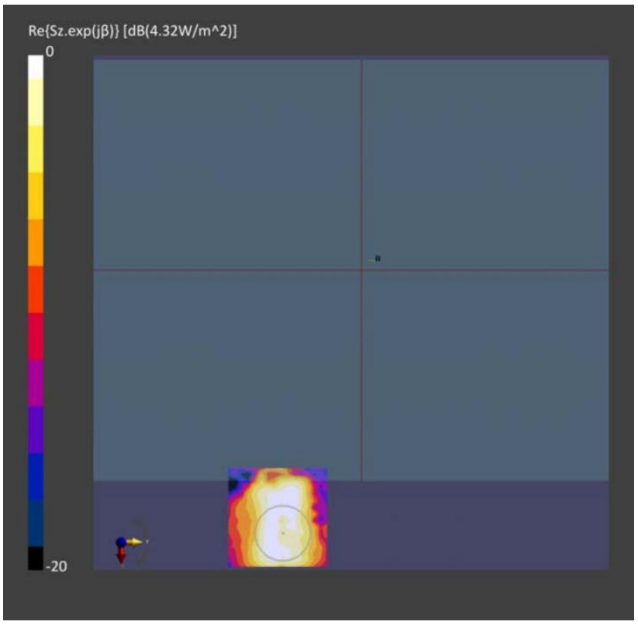


(a) Measurement

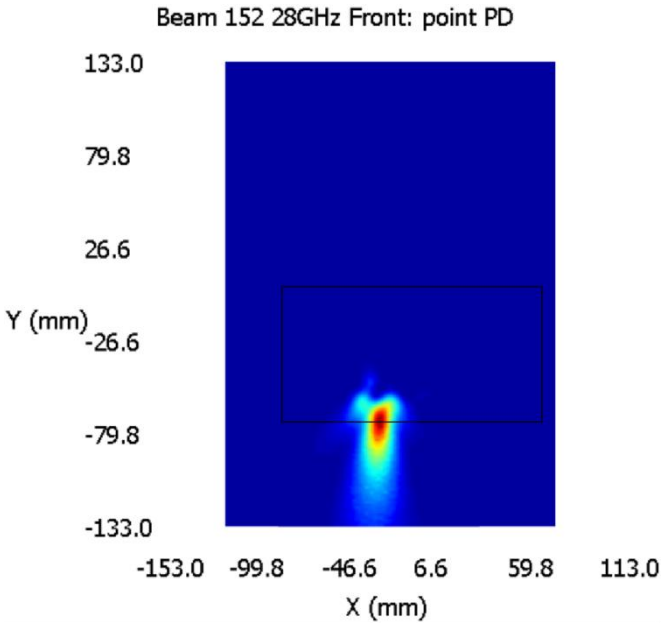


(b) Simulation

• N261 QTM0: Middle channel, Beam152, Front face, Point PD

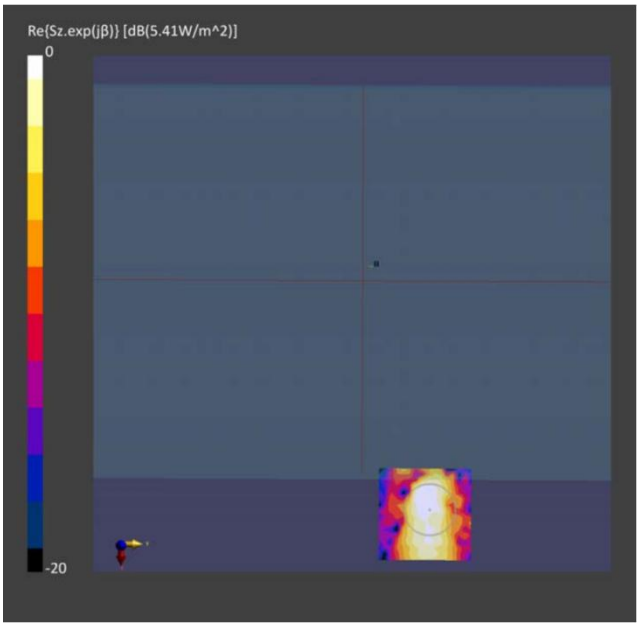


(a) Measurement

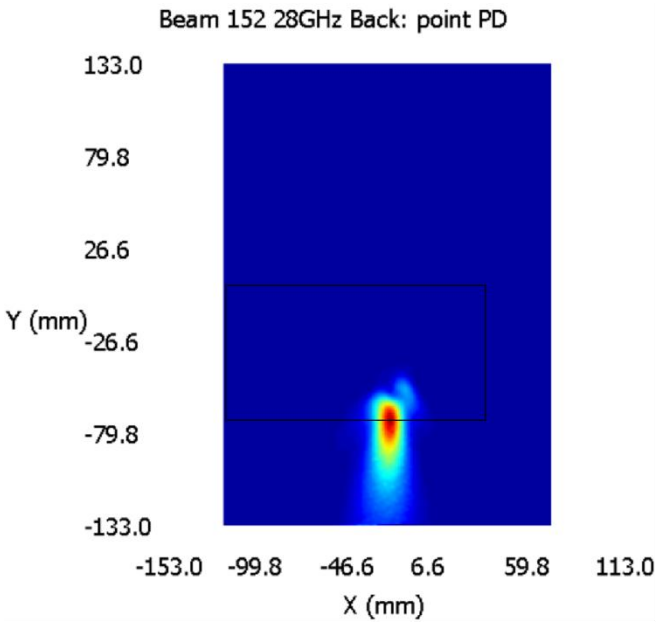


(b) Simulation

• N261 QTM0: Middle channel, Beam152, Back face, Point PD

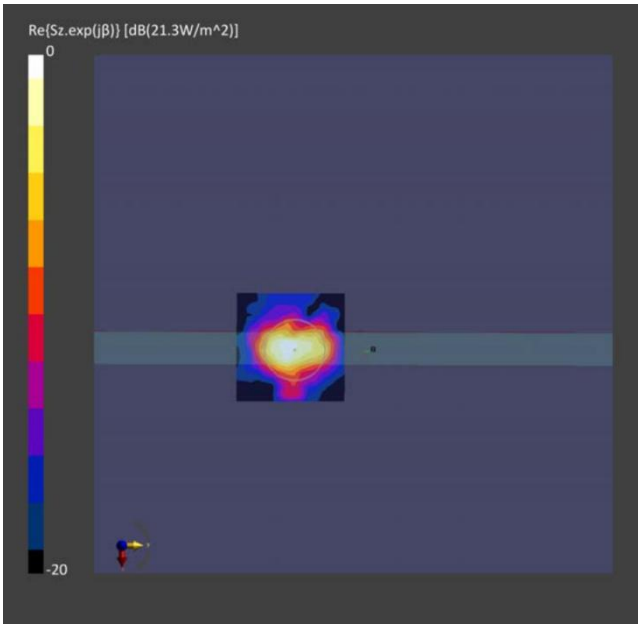


(a) Measurement

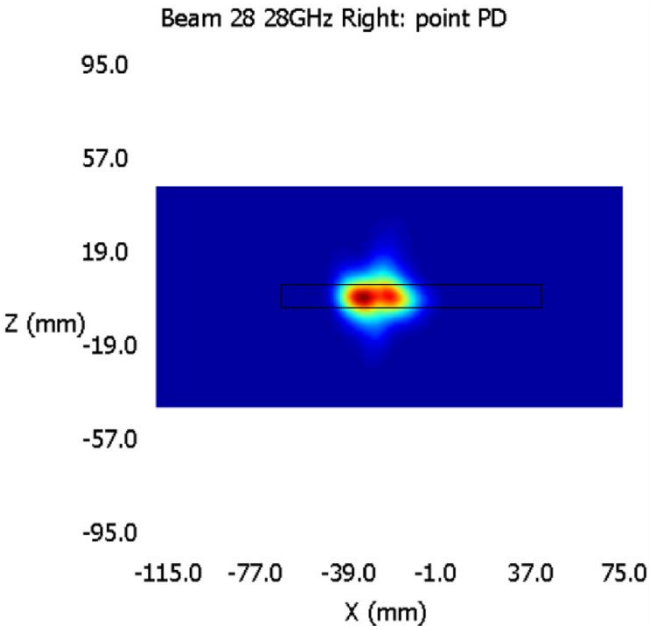


(b) Simulation

• N261 QTM1: mid channel, Beam28, right face, Point PD

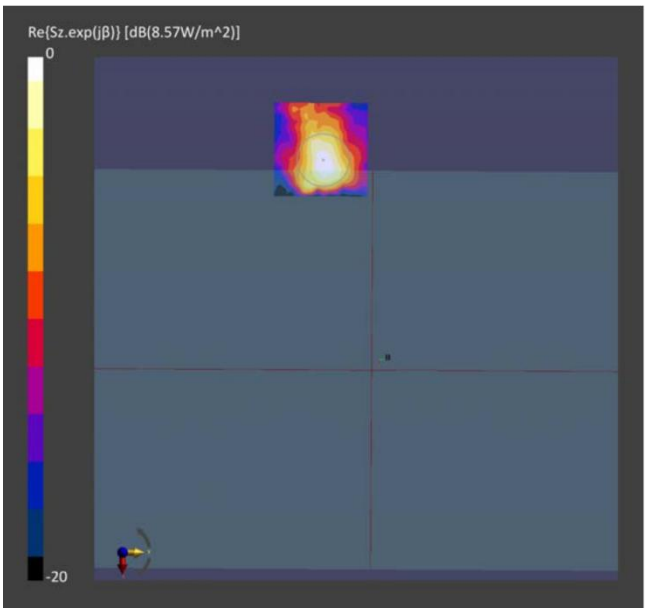


(a) Measurement

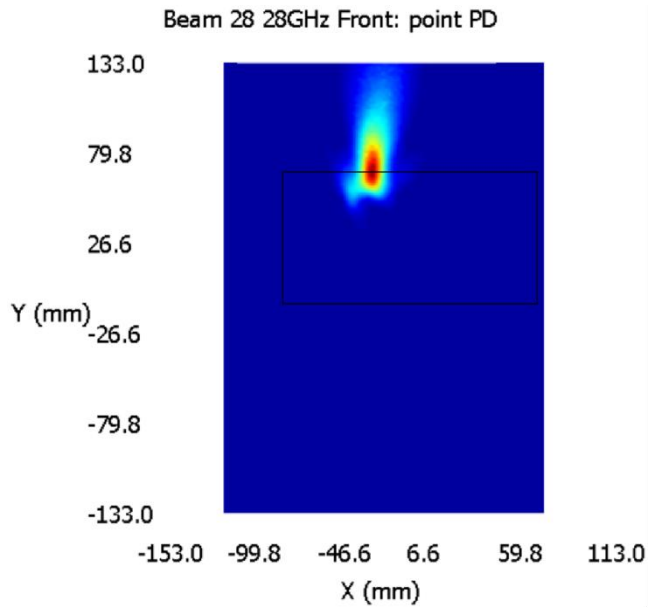


(b) Simulation

• N261 QTM1: mid channel, Beam28, Front face, Point PD

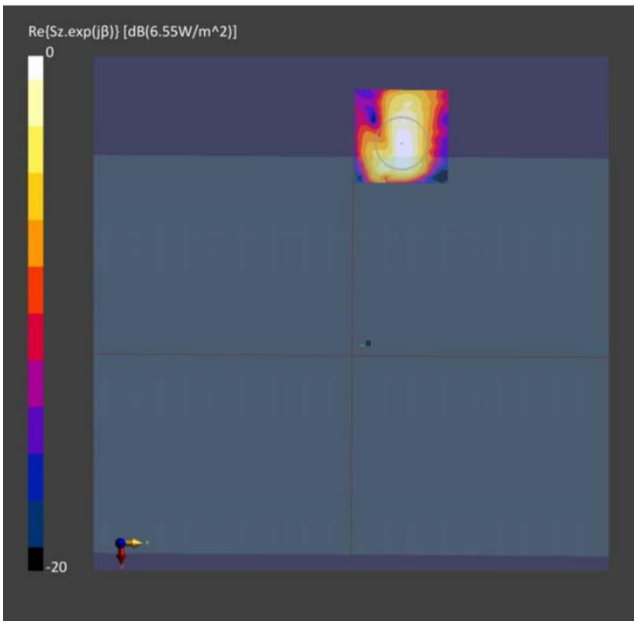


(a) Measurement

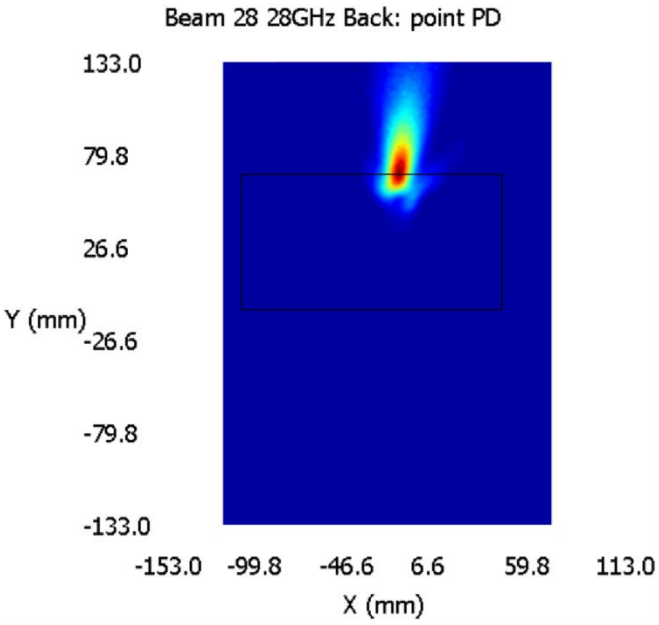


(b) Simulation

• N261 QTM1: mid channel, Beam28, Back face, Point PD

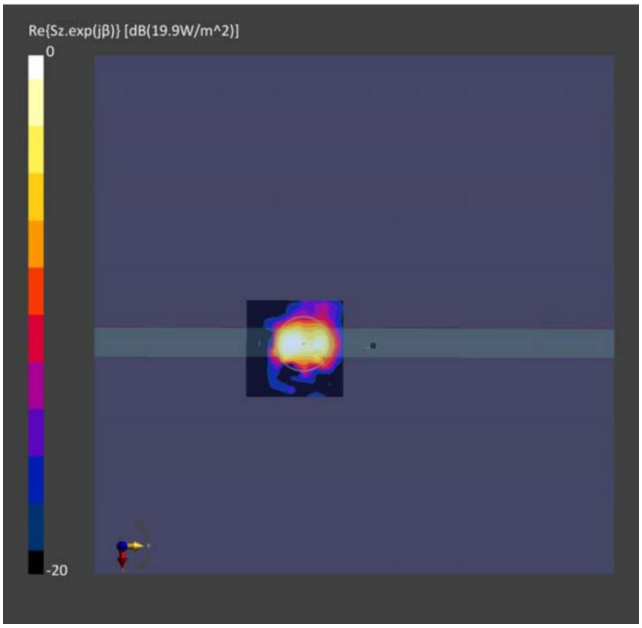


(a) Measurement

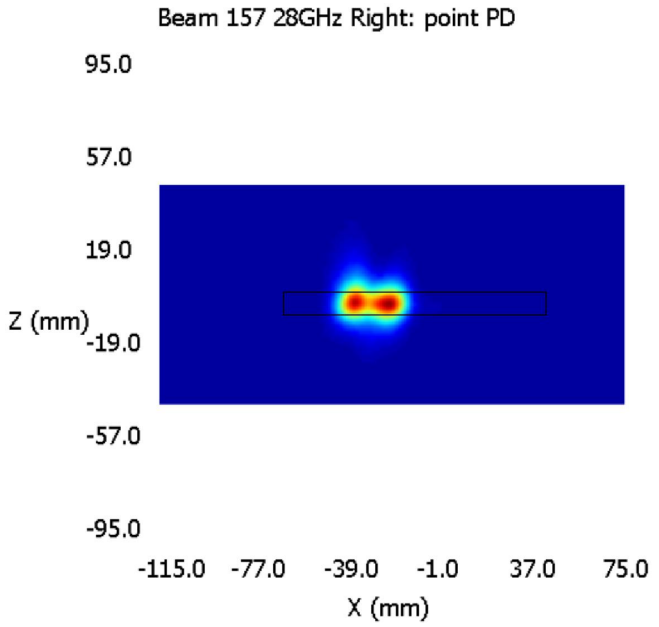


(b) Simulation

• N261 QTM1: Middle channel, Beam157, Right face, Point PD

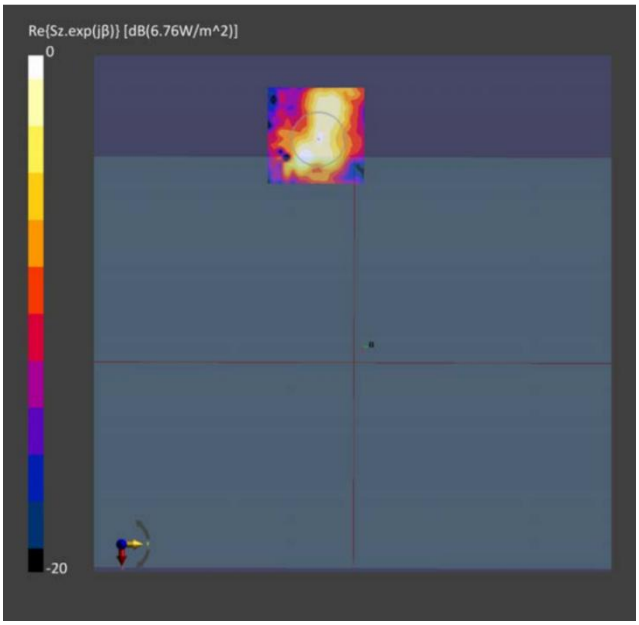


(a) Measurement

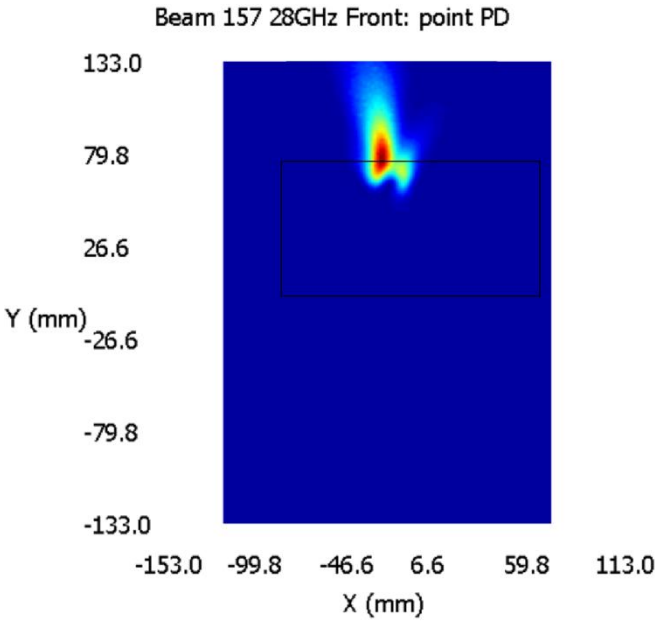


(b) Simulation

• N261 QTM1: Middle channel, Beam157, Front face, Point PD

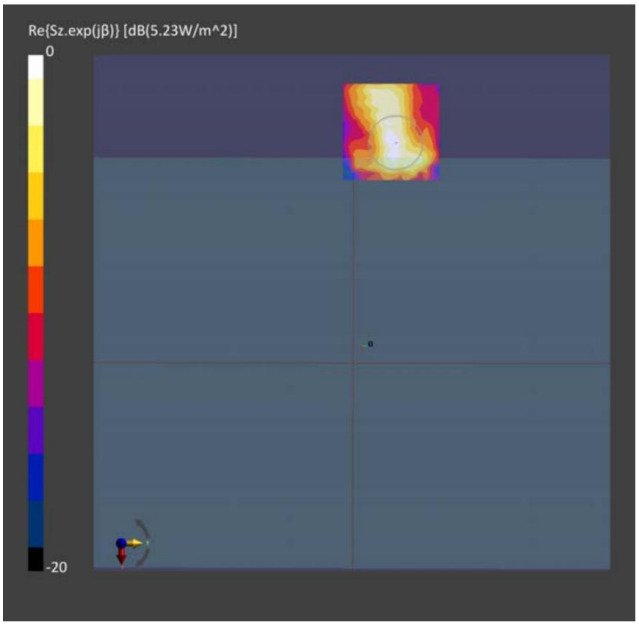


(a) Measurement

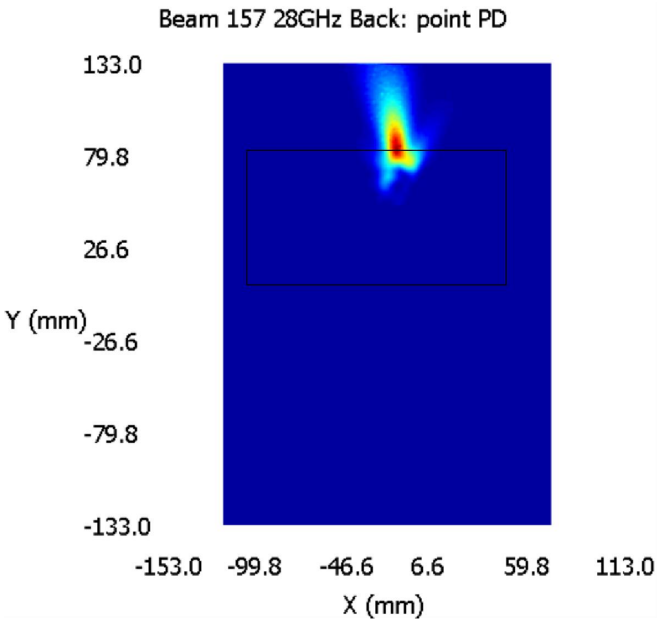


(b) Simulation

• N261 QTM1: Middle channel, Beam157, Back face, Point PD

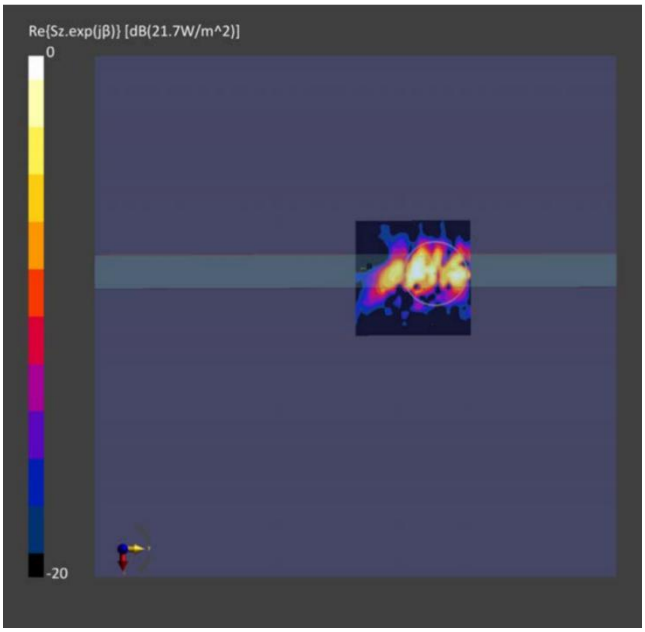


(a) Measurement

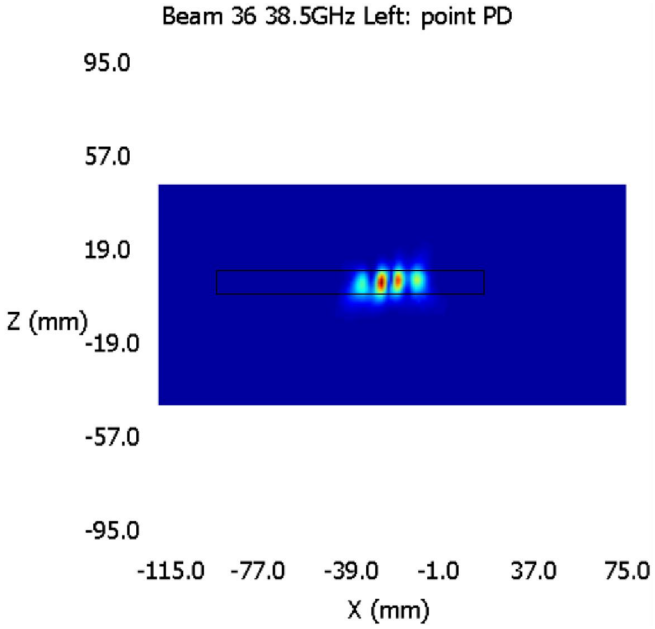


(b) Simulation

• N260 QTM0: Middle channel, Beam36, Left face, Point PD

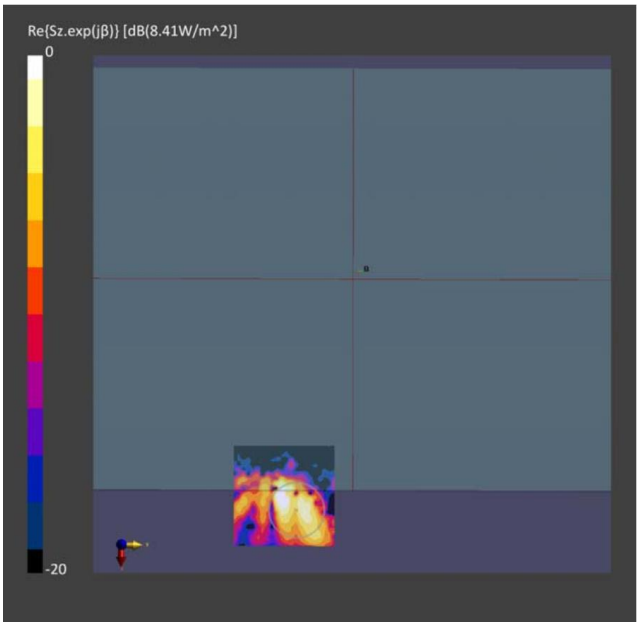


(a) Measurement

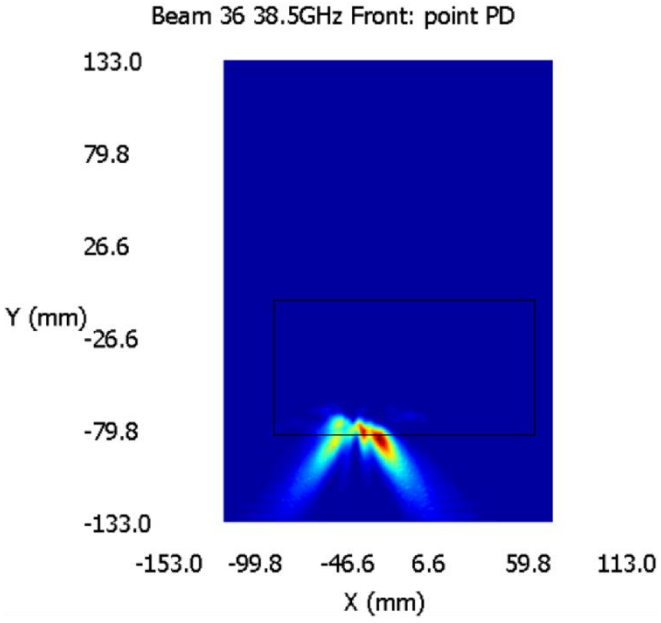


(b) Simulation

• N260 QTM0: Middle channel, Beam36, Front face, Point PD

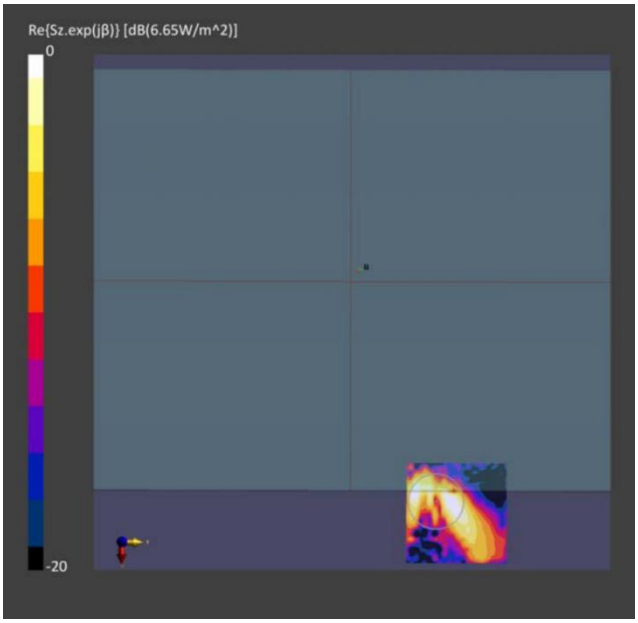


(a) Measurement

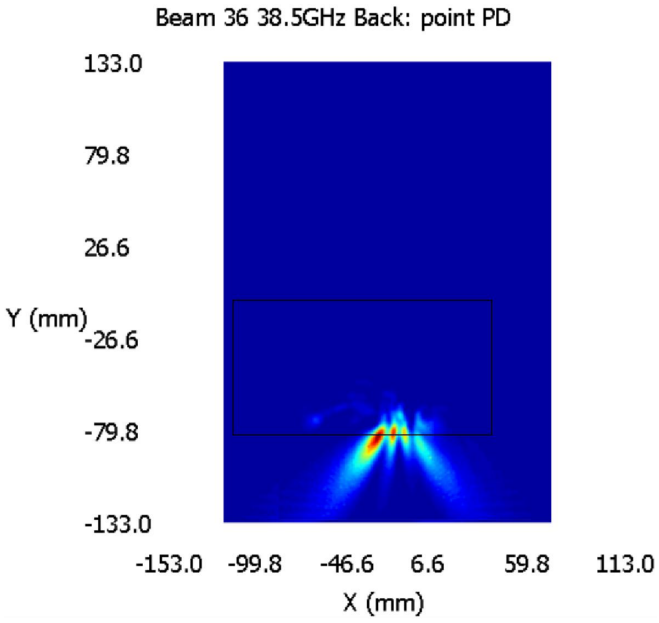


(b) Simulation

• N260 QTM0: Middle channel, Beam36, Back face, Point PD

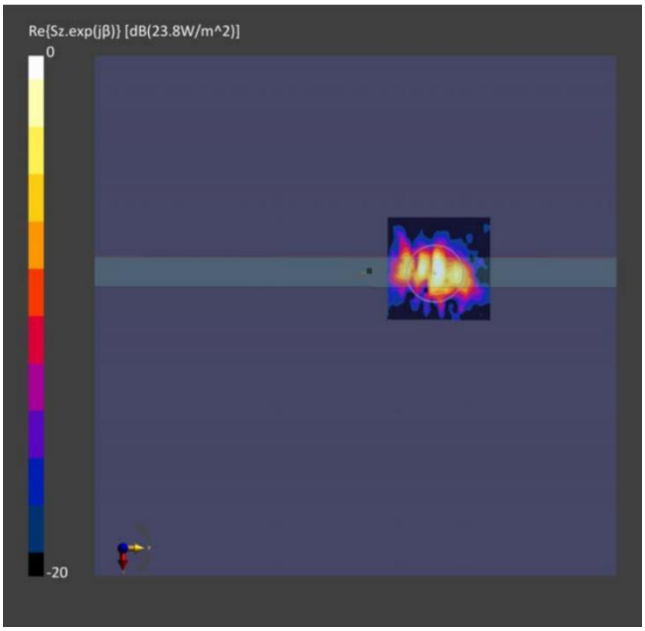


(a) Measurement

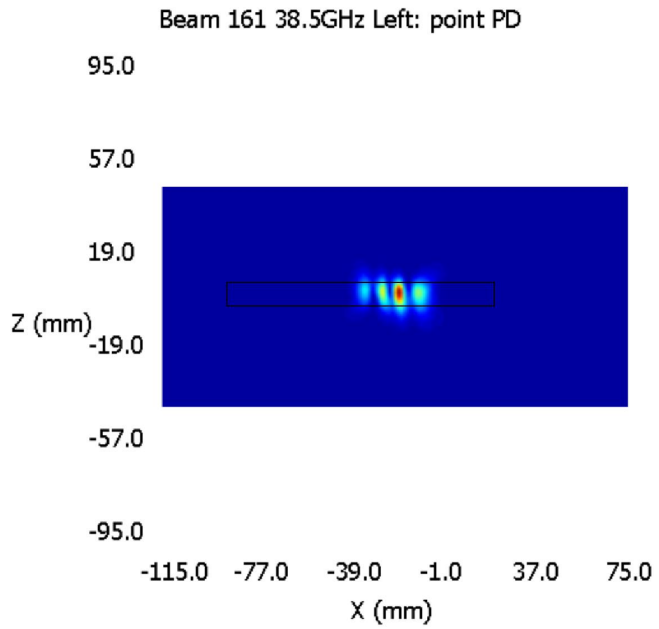


(b) Simulation

• N260 QTM0: Middle channel, Beam161, Left face, Point PD

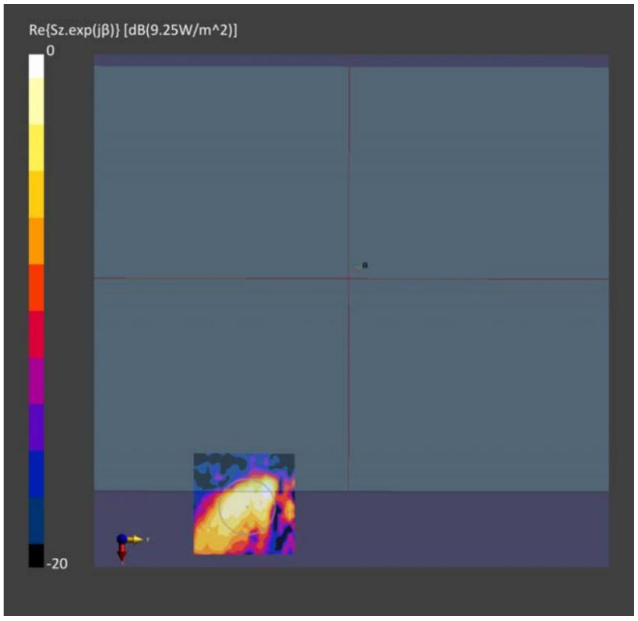


(a) Measurement

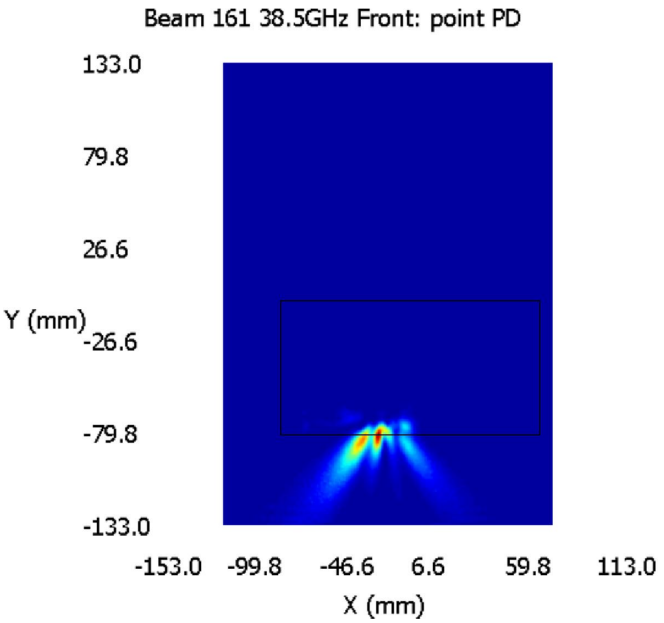


(b) Simulation

• N260 QTM0: Middle channel, Beam161, Front face, Point PD

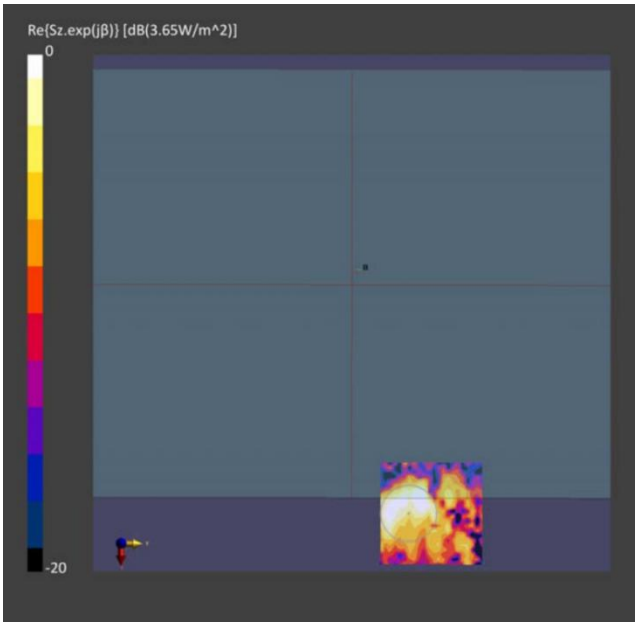


(a) Measurement

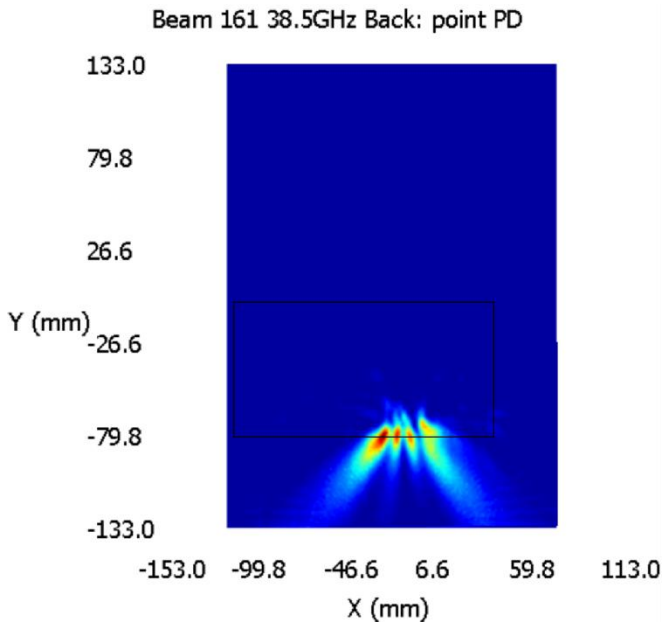


(b) Simulation

• N260 QTM0: Middle channel, Beam161, Back face, Point PD

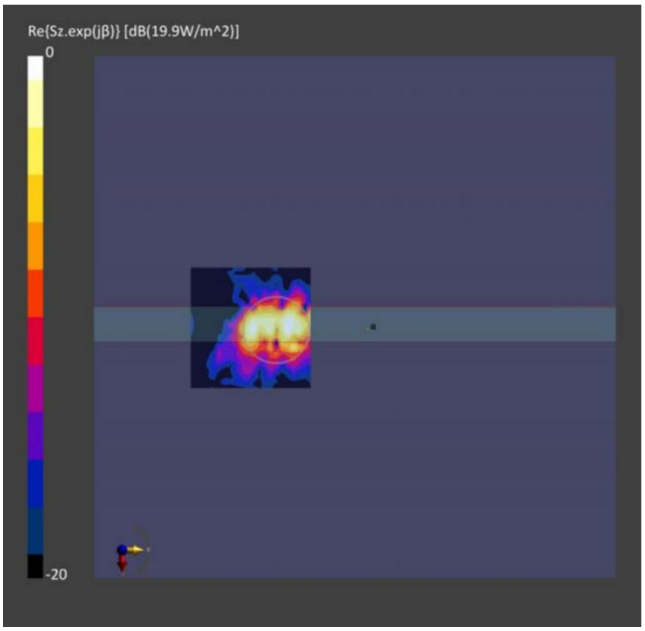


(a) Measurement

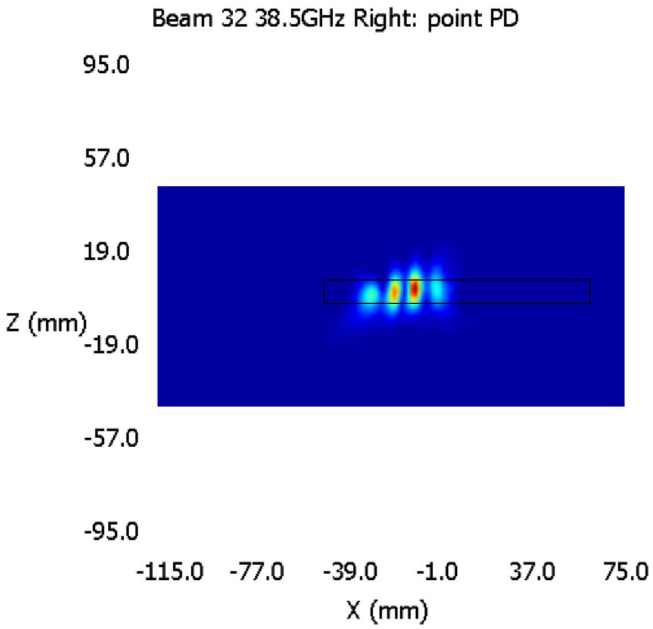


(b) Simulation

• N260 QTM1: Middle channel, Beam32, Right face, Point PD

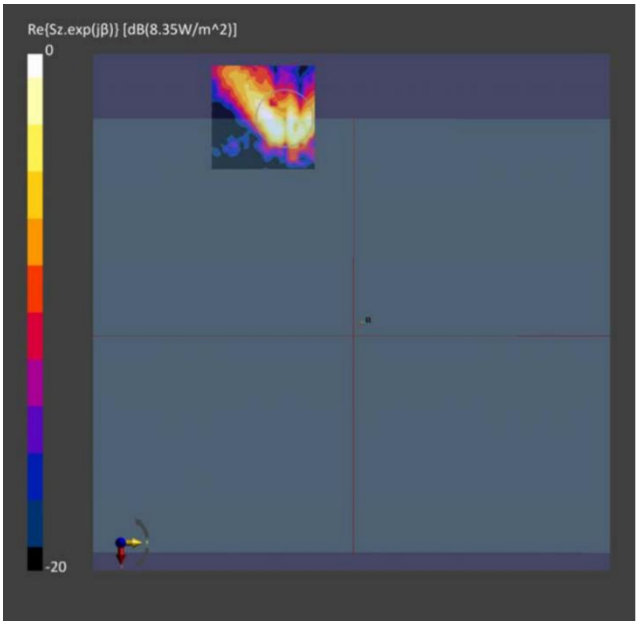


(a) Measurement

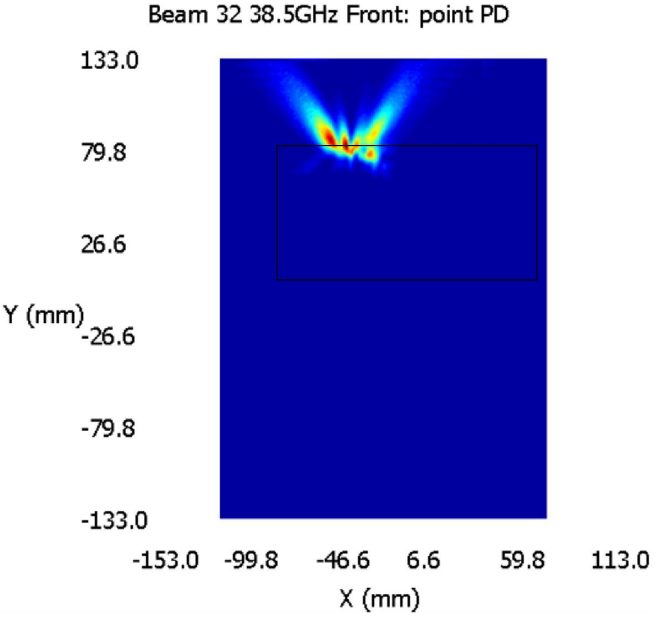


(b) Simulation

• N260 QTM1: Middle channel, Beam32, Front face, Point PD

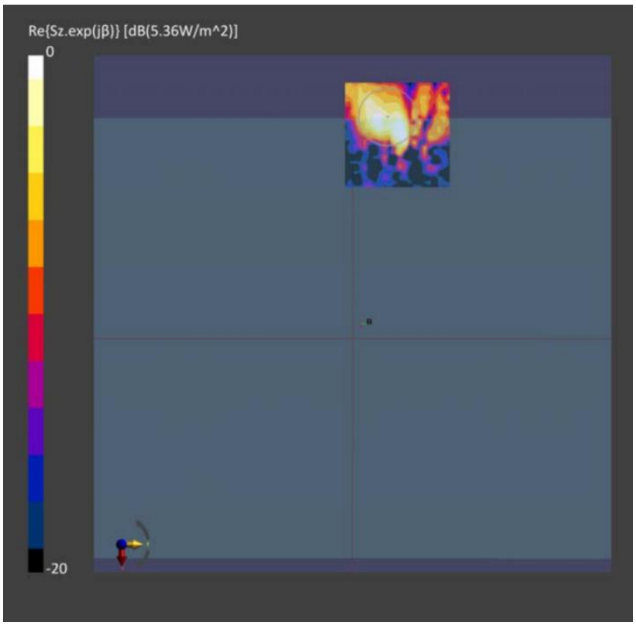


(a) Measurement

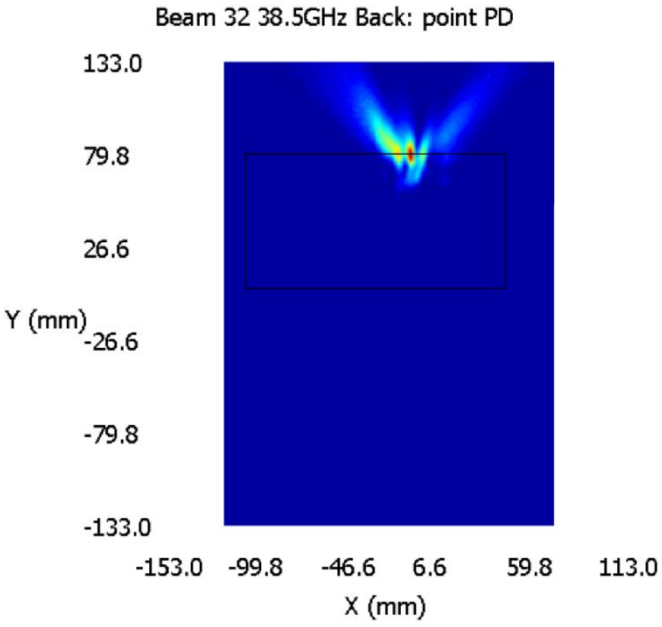


(b) Simulation

• N260 QTM1: Middle channel, Beam32, Back face, Point PD

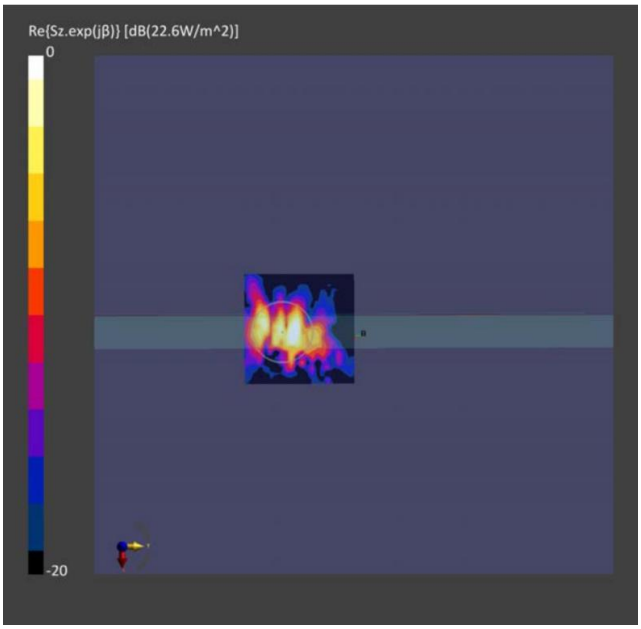


(a) Measurement

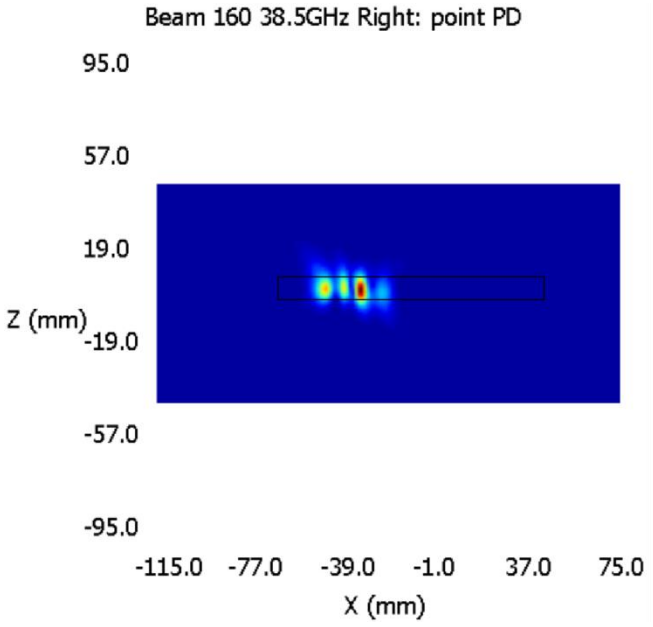


(b) Simulation

• N260 QTM1: Middle channel, Beam160, Right face, Point PD

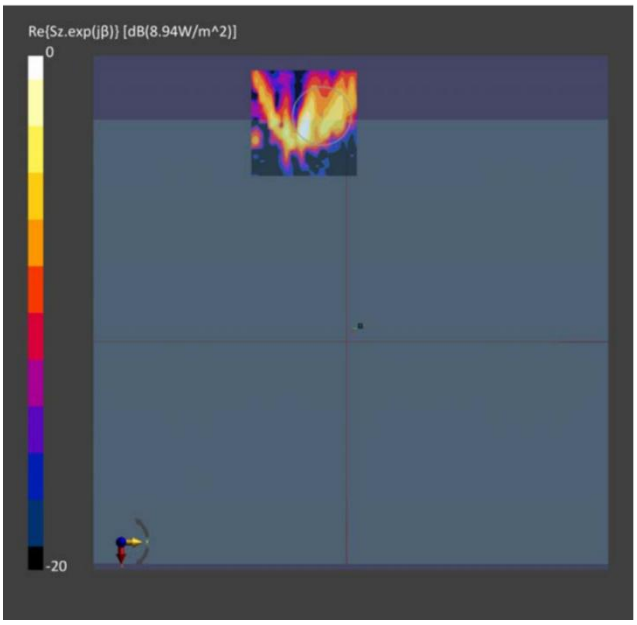


(a) Measurement

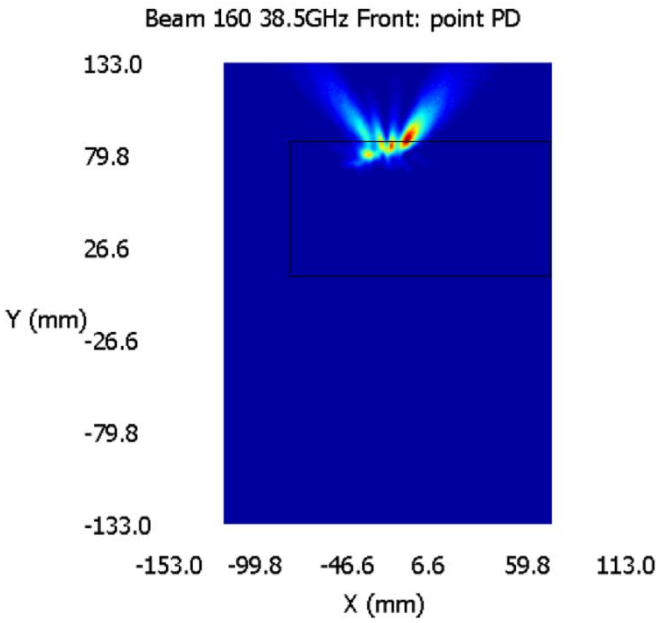


(b) Simulation

• N260 QTM1: Middle channel, Beam160, Front face, Point PD

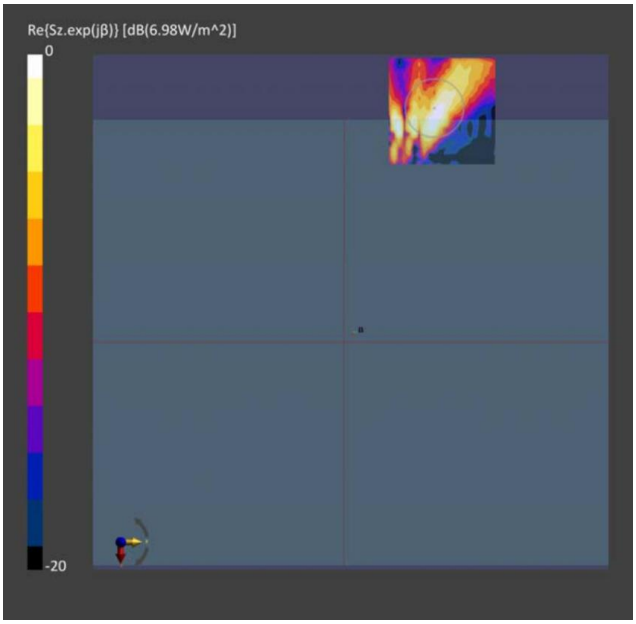


(a) Measurement

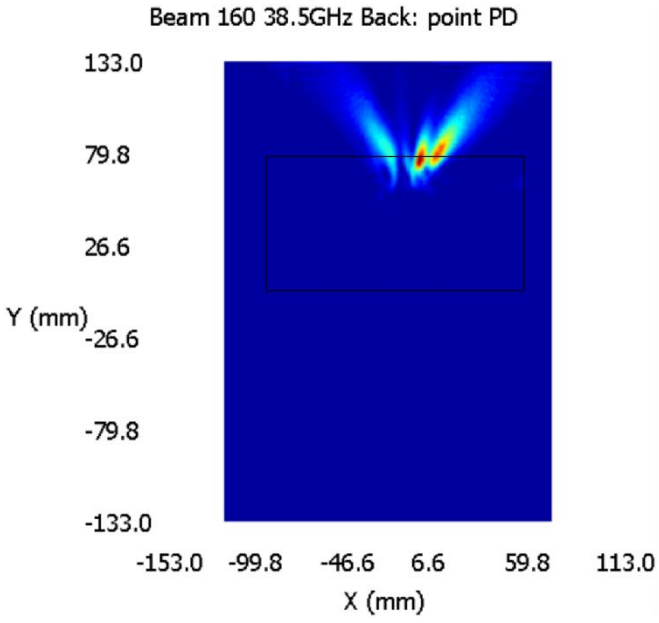


(b) Simulation

N260 QTM1: Middle channel, Beam160, Back face, Point PD



(a) Measurement



(b) Simulation

4 .Simulation Result

The model is validated in Section 3, the PD exposure of EUT can be reliably assessed using the validated simulation approach. The PD simulation was performed at n261 and n260. The simulated PD results are reported in this section. The Ratio of PD exposure from front surface to the worst surface at 2mm, and the ratio of PD exposure for 2mm evaluation distance for each beam are also reported for simultaneous transmission analysis in Part 1.
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 PD result for each MIMO beam represents the highest PD value after sweeping the relative phase between two SISO beams with a ‘5 degree’ step interval from 0 degree to 360 degree.

4.1 PD for Low/Mid/High Channel at n261 and n260

Below Tables show the PD simulation evaluation of QTM0 at N261 and N260 for those surface which need to take it into consideration as shown in Figure 1-3.

▪ QTM0 N261 Low channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.58	0.53	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
27.5	0	Patch		1	2.11	1.6	4.78	0	4.78	0.44	0.33	0.00
27.5	0	Patch		2	1.72	1.92	4.9	0	4.9	0.35	0.39	0.00
27.5	0	Patch		7	2.76	3.46	8.15	0	8.15	0.34	0.42	0.00
27.5	0	Patch		8	4.07	3.5	7.87	0	7.87	0.52	0.44	0.00
27.5	0	Patch		9	4.78	4.52	9.04	0	9.04	0.53	0.50	0.00
27.5	0	Patch		10	2.94	3.17	8.45	0	8.45	0.35	0.38	0.00
27.5	0	Patch		14	4.33	3.73	9.03	0	9.03	0.48	0.41	0.00
27.5	0	Patch		15	5.09	4.62	9.25	0	9.25	0.55	0.50	0.00
27.5	0	Patch		16	4	4.01	8.73	0	8.73	0.46	0.46	0.00
27.5	0	Patch		22	5.79	5.22	13.49	0.01	13.49	0.43	0.39	0.00
27.5	0	Patch		23	8.01	8	15.39	0.01	15.39	0.52	0.52	0.00
27.5	0	Patch		24	9.38	8.47	16.58	0.01	16.58	0.57	0.51	0.00
27.5	0	Patch		25	8.02	8.14	15.61	0	15.61	0.51	0.52	0.00
27.5	0	Patch		26	6.36	6.68	14.18	0	14.18	0.45	0.47	0.00
27.5	0	Patch		31	7.49	7.49	14.9	0	14.9	0.50	0.50	0.00
27.5	0	Patch		32	8.78	8.27	15.95	0.01	15.95	0.55	0.52	0.00
27.5	0	Patch		33	8.96	8.61	16.37	0	16.37	0.55	0.53	0.00
27.5	0	Patch		34	7.47	7.77	15.42	0	15.42	0.48	0.50	0.00
27.5	0	Patch		129	1.71	2.01	4.92	0	4.92	0.35	0.41	0.00
27.5	0	Patch		130	1.95	1.46	4.32	0	4.32	0.45	0.34	0.00
27.5	0	Patch		135	2.66	2.79	8.07	0	8.07	0.33	0.35	0.00

27.5	0	Patch		136	4.5	4.38	8.67	0	8.67	0.52	0.51	0.00
27.5	0	Patch		137	4.23	4.11	8.63	0	8.63	0.49	0.48	0.00
27.5	0	Patch		138	2.82	2.29	8.08	0	8.08	0.35	0.28	0.00
27.5	0	Patch		142	3.71	3.72	8.55	0	8.55	0.43	0.44	0.00
27.5	0	Patch		143	4.59	4.25	8.71	0	8.71	0.53	0.49	0.00
27.5	0	Patch		144	3.71	3.8	8.53	0	8.53	0.43	0.45	0.00
27.5	0	Patch		150	5.74	5.05	12.68	0	12.68	0.45	0.40	0.00
27.5	0	Patch		151	8.42	6.49	14.6	0	14.6	0.58	0.44	0.00
27.5	0	Patch		152	8.86	8.16	15.71	0	15.71	0.56	0.52	0.00
27.5	0	Patch		153	8.07	7.33	14.69	0	14.69	0.55	0.50	0.00
27.5	0	Patch		154	6.18	4.62	13.4	0	13.4	0.46	0.34	0.00
27.5	0	Patch		159	7.19	5.81	13.5	0	13.5	0.53	0.43	0.00
27.5	0	Patch		160	8.71	7.8	15.56	0	15.56	0.56	0.50	0.00
27.5	0	Patch		161	9	7.89	15.68	0	15.68	0.57	0.50	0.00
27.5	0	Patch		162	7.45	6.42	14.15	0	14.15	0.53	0.45	0.00

▪ QTM0 N261 Low channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.63	0.55	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
27.5	0	Patch	129	1	4.87	4.71	10.19	0	10.19	0.48	0.46	0.00
27.5	0	Patch	130	2	4.79	4.41	9.64	0	9.64	0.50	0.46	0.00
27.5	0	Patch	135	7	6.07	7.68	15.73	0.01	15.73	0.39	0.49	0.00
27.5	0	Patch	136	8	8.88	9.29	17	0.01	17	0.52	0.55	0.00
27.5	0	Patch	137	9	10.08	9.16	17.41	0	17.41	0.58	0.53	0.00
27.5	0	Patch	138	10	6.77	6.8	17.79	0.01	17.79	0.38	0.38	0.00
27.5	0	Patch	142	14	9.37	7.85	17.84	0.01	17.84	0.53	0.44	0.00
27.5	0	Patch	143	15	11.07	8.85	18.5	0	18.5	0.60	0.48	0.00
27.5	0	Patch	144	16	8.79	8.75	16.72	0	16.72	0.53	0.52	0.00
27.5	0	Patch	150	22	12.82	12.3	27.83	0.01	27.83	0.46	0.44	0.00
27.5	0	Patch	151	23	17.59	15.99	31.14	0.01	31.14	0.56	0.51	0.00
27.5	0	Patch	152	24	20.72	17.24	33.08	0.01	33.08	0.63	0.52	0.00
27.5	0	Patch	153	25	18.02	16.65	31.42	0.01	31.42	0.57	0.53	0.00
27.5	0	Patch	154	26	13.99	12.37	28.58	0.01	28.58	0.49	0.43	0.00
27.5	0	Patch	159	31	15.97	14.95	29.85	0.01	29.85	0.54	0.50	0.00
27.5	0	Patch	160	32	19.14	16.75	32.16	0.01	32.16	0.60	0.52	0.00
27.5	0	Patch	161	33	19.44	16.77	32.75	0.01	32.75	0.59	0.51	0.00
27.5	0	Patch	162	34	17.12	15.53	30.61	0.01	30.61	0.56	0.51	0.00

▪ QTM1 N261 Low channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.59	0.56	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
27.5	1	Patch		0	2.11	1.73	0	4.53	4.53	0.47	0.38	0.00
27.5	1	Patch		3	2.91	2.89	0	7.65	7.65	0.38	0.38	0.00

27.5	1	Patch		4	4.94	4.39	0	8.69	8.69	0.57	0.51	0.00
27.5	1	Patch		5	4.79	4.12	0	8.86	8.86	0.54	0.47	0.00
27.5	1	Patch		6	3.04	2.37	0	7.19	7.19	0.42	0.33	0.00
27.5	1	Patch		11	3.91	3.69	0	8.06	8.06	0.49	0.46	0.00
27.5	1	Patch		12	4.46	4.33	0	8.46	8.46	0.53	0.51	0.00
27.5	1	Patch		13	3.71	2.95	0	8.18	8.18	0.45	0.36	0.00
27.5	1	Patch		17	5.49	5.66	0.01	12	12	0.46	0.47	0.00
27.5	1	Patch		18	9.05	8.22	0.01	15.75	15.75	0.57	0.52	0.00
27.5	1	Patch		19	8.8	8.99	0.01	16.09	16.09	0.55	0.56	0.00
27.5	1	Patch		20	7.81	6.91	0.01	15.01	15.01	0.52	0.46	0.00
27.5	1	Patch		21	6.01	4.9	0	13.11	13.11	0.46	0.37	0.00
27.5	1	Patch		27	7.69	7.23	0.01	14.44	14.44	0.53	0.50	0.00
27.5	1	Patch		28	9.41	9.11	0.01	16.5	16.5	0.57	0.55	0.00
27.5	1	Patch		29	8.52	8.24	0	15.35	15.35	0.56	0.54	0.00
27.5	1	Patch		30	7.44	6.11	0	15.02	15.02	0.50	0.41	0.00
27.5	1	Patch		128	1.96	1.81	0	4.74	4.74	0.41	0.38	0.00
27.5	1	Patch		131	3.1	2.34	0	7.59	7.59	0.41	0.31	0.00
27.5	1	Patch		132	4.77	4	0	8.52	8.52	0.56	0.47	0.00
27.5	1	Patch		133	4.6	4.06	0	8.25	8.25	0.56	0.49	0.00
27.5	1	Patch		134	3.07	3.09	0	8.09	8.09	0.38	0.38	0.00
27.5	1	Patch		139	4.19	3.94	0	8.58	8.58	0.49	0.46	0.00
27.5	1	Patch		140	4.89	4.25	0	8.48	8.48	0.58	0.50	0.00
27.5	1	Patch		141	3.25	2.37	0	5.97	5.97	0.54	0.40	0.00
27.5	1	Patch		145	5.77	3.91	0.01	11.66	11.66	0.49	0.34	0.00
27.5	1	Patch		146	8.16	7	0	14.7	14.7	0.56	0.48	0.00
27.5	1	Patch		147	9.1	7.67	0.01	15.49	15.49	0.59	0.50	0.00
27.5	1	Patch		148	8.03	6.82	0.01	14.38	14.38	0.56	0.47	0.00
27.5	1	Patch		149	5.04	5.03	0	12	12	0.42	0.42	0.00
27.5	1	Patch		155	7.48	5.74	0	14.26	14.26	0.52	0.40	0.00
27.5	1	Patch		156	8.92	7.93	0	15.3	15.3	0.58	0.52	0.00
27.5	1	Patch		157	9.05	7.59	0	15.66	15.66	0.58	0.48	0.00
27.5	1	Patch		158	6.51	5.7	0.01	13.11	13.11	0.50	0.43	0.00

▪ QTM1 N261 Low channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.68	0.61	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
27.5	1	Patch	128	0	5.14	4.77	0	9.68	9.68	0.53	0.49	0.00
27.5	1	Patch	131	3	6.9	6.62	0.01	16.1	16.1	0.43	0.41	0.00
27.5	1	Patch	132	4	11.34	9.52	0.01	18.25	18.25	0.62	0.52	0.00
27.5	1	Patch	133	5	11.1	9.48	0.01	18.16	18.16	0.61	0.52	0.00
27.5	1	Patch	134	6	7.21	7.38	0.01	16.72	16.72	0.43	0.44	0.00
27.5	1	Patch	139	11	9.41	8.8	0.01	15.87	15.87	0.59	0.55	0.00
27.5	1	Patch	140	12	10.32	9.27	0.01	16.86	16.86	0.61	0.55	0.00
27.5	1	Patch	141	13	8.94	6.7	0.01	14.1	14.1	0.63	0.48	0.00
27.5	1	Patch	145	17	13.18	11.77	0.01	25.85	25.85	0.51	0.46	0.00
27.5	1	Patch	146	18	20.62	17.96	0.01	31.4	31.4	0.66	0.57	0.00
27.5	1	Patch	147	19	21.79	18.69	0.03	32.26	32.26	0.68	0.58	0.00
27.5	1	Patch	148	20	18.55	16.96	0.01	30.51	30.51	0.61	0.56	0.00
27.5	1	Patch	149	21	12.73	12.42	0.01	26.54	26.54	0.48	0.47	0.00
27.5	1	Patch	155	27	18.97	15.24	0.01	30.88	30.88	0.61	0.49	0.00
27.5	1	Patch	156	28	22.07	19.86	0.02	32.6	32.6	0.68	0.61	0.00
27.5	1	Patch	157	29	21.05	18.33	0.01	31.97	31.97	0.66	0.57	0.00
27.5	1	Patch	158	30	16.67	14.87	0.01	29.16	29.16	0.57	0.51	0.00

▪ QTM0 N261 Middle channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.59	0.54	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
28	0	Patch		1	2.15	1.51	4.59	0	4.59	0.47	0.33	0.00
28	0	Patch		2	1.71	1.96	4.78	0	4.78	0.36	0.41	0.00
28	0	Patch		7	2.48	3.6	7.79	0	7.79	0.32	0.46	0.00
28	0	Patch		8	4.09	3.71	7.95	0	7.95	0.51	0.47	0.00
28	0	Patch		9	4.71	4.31	8.75	0	8.75	0.54	0.49	0.00
28	0	Patch		10	2.99	3.04	8.2	0	8.2	0.36	0.37	0.00
28	0	Patch		14	4.24	3.72	8.72	0	8.72	0.49	0.43	0.00
28	0	Patch		15	4.98	4.52	8.95	0	8.95	0.56	0.51	0.00
28	0	Patch		16	3.98	3.78	8.48	0	8.48	0.47	0.45	0.00
28	0	Patch		22	5.57	5.33	13.11	0	13.11	0.42	0.41	0.00
28	0	Patch		23	7.71	8.07	15.08	0	15.08	0.51	0.54	0.00
28	0	Patch		24	9.33	8.46	16.5	0	16.5	0.57	0.51	0.00
28	0	Patch		25	7.73	7.71	15.12	0	15.12	0.51	0.51	0.00
28	0	Patch		26	6.43	6.51	13.8	0	13.8	0.47	0.47	0.00
28	0	Patch		31	7.21	7.56	14.61	0	14.61	0.49	0.52	0.00
28	0	Patch		32	8.5	8.39	15.64	0	15.64	0.54	0.54	0.00
28	0	Patch		33	8.99	8.39	16.24	0	16.24	0.55	0.52	0.00
28	0	Patch		34	7.25	7.4	14.9	0	14.9	0.49	0.50	0.00
28	0	Patch		129	1.65	2.04	4.75	0	4.75	0.35	0.43	0.00
28	0	Patch		130	2.03	1.35	4.09	0	4.09	0.50	0.33	0.00
28	0	Patch		135	2.56	2.73	7.62	0	7.62	0.34	0.36	0.00
28	0	Patch		136	4.38	4.12	8.28	0	8.28	0.53	0.50	0.00
28	0	Patch		137	4.36	4.18	8.74	0	8.74	0.50	0.48	0.00
28	0	Patch		138	2.83	2.34	7.71	0	7.71	0.37	0.30	0.00
28	0	Patch		142	3.95	3.73	8.7	0	8.7	0.45	0.43	0.00
28	0	Patch		143	4.85	4.28	8.85	0	8.85	0.55	0.48	0.00
28	0	Patch		144	3.76	3.93	8.62	0	8.62	0.44	0.46	0.00
28	0	Patch		150	5.58	4.83	12.15	0	12.15	0.46	0.40	0.00
28	0	Patch		151	8.43	6.17	14.28	0	14.28	0.59	0.43	0.00
28	0	Patch		152	9.16	7.87	15.76	0	15.76	0.58	0.50	0.00
28	0	Patch		153	7.88	6.83	14.06	0	14.06	0.56	0.49	0.00
28	0	Patch		154	6.05	4.85	12.99	0	12.99	0.47	0.37	0.00
28	0	Patch		159	7.04	5.46	12.95	0	12.95	0.54	0.42	0.00
28	0	Patch		160	9	7.33	15.45	0	15.45	0.58	0.47	0.00
28	0	Patch		161	9.13	7.6	15.56	0	15.56	0.59	0.49	0.00
28	0	Patch		162	7.2	6.27	13.61	0	13.61	0.53	0.46	0.00

▪ QTM0 N261 Middle channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.64	0.58	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
28	0	Patch	129	1	5.06	4.95	10.29	0	10.29	0.49	0.48	0.00
28	0	Patch	130	2	4.98	4.47	9.4	0	9.4	0.53	0.48	0.00
28	0	Patch	135	7	5.83	7.73	14.91	0	14.91	0.39	0.52	0.00
28	0	Patch	136	8	8.98	9.64	16.64	0.01	16.64	0.54	0.58	0.00

28	0	Patch	137	9	10.4	9.06	17.53	0	17.53	0.59	0.52	0.00
28	0	Patch	138	10	7.11	7.14	17.14	0.01	17.14	0.41	0.42	0.00
28	0	Patch	142	14	9.77	8.12	18	0.01	18	0.54	0.45	0.00
28	0	Patch	143	15	11.34	9.02	18.36	0	18.36	0.62	0.49	0.00
28	0	Patch	144	16	9.07	8.87	16.48	0.01	16.48	0.55	0.54	0.00
28	0	Patch	150	22	13.02	12.26	26.33	0.01	26.33	0.49	0.47	0.00
28	0	Patch	151	23	17.08	15.72	31.08	0.01	31.08	0.55	0.51	0.00
28	0	Patch	152	24	21.19	17.2	33.12	0.01	33.12	0.64	0.52	0.00
28	0	Patch	153	25	17.45	15.85	30.21	0.01	30.21	0.58	0.52	0.00
28	0	Patch	154	26	14.75	12.48	28.58	0.01	28.58	0.52	0.44	0.00
28	0	Patch	159	31	15.52	14.74	28.81	0.01	28.81	0.54	0.51	0.00
28	0	Patch	160	32	18.98	16.76	31.71	0.01	31.71	0.60	0.53	0.00
28	0	Patch	161	33	19.58	16.68	32.58	0.01	32.58	0.60	0.51	0.00
28	0	Patch	162	34	16.72	15.24	29.16	0.01	29.16	0.57	0.52	0.00

▪ QTM1 N261 Middle channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.60	0.54	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
28	1	Patch		0	2.2	1.6	0	4.38	4.38	0.50	0.37	0.00
28	1	Patch		3	2.91	2.73	0	7.33	7.33	0.40	0.37	0.00
28	1	Patch		4	4.86	4.1	0	8.36	8.36	0.58	0.49	0.00
28	1	Patch		5	4.67	3.95	0	8.57	8.57	0.54	0.46	0.00
28	1	Patch		6	2.93	2.35	0	7.15	7.15	0.41	0.33	0.00
28	1	Patch		11	3.82	3.43	0.01	7.72	7.72	0.49	0.44	0.00
28	1	Patch		12	4.32	4.21	0	8.1	8.1	0.53	0.52	0.00
28	1	Patch		13	3.49	2.84	0	7.86	7.86	0.44	0.36	0.00
28	1	Patch		17	5.65	5.26	0.01	11.5	11.5	0.49	0.46	0.00
28	1	Patch		18	8.95	7.89	0.01	15.33	15.33	0.58	0.51	0.00
28	1	Patch		19	8.86	8.63	0	15.98	15.98	0.55	0.54	0.00
28	1	Patch		20	7.53	6.96	0	14.6	14.6	0.52	0.48	0.00
28	1	Patch		21	5.62	4.7	0	12.5	12.5	0.45	0.38	0.00
28	1	Patch		27	7.65	6.77	0.01	13.86	13.86	0.55	0.49	0.00
28	1	Patch		28	9.46	8.75	0	16.4	16.4	0.58	0.53	0.00
28	1	Patch		29	8.19	7.74	0	14.74	14.74	0.56	0.53	0.00
28	1	Patch		30	7.12	6.18	0	14.68	14.68	0.49	0.42	0.00
28	1	Patch		128	1.86	1.87	0	4.65	4.65	0.40	0.40	0.00
28	1	Patch		131	2.9	2.27	0	7.24	7.24	0.40	0.31	0.00
28	1	Patch		132	4.62	3.92	0	8.2	8.2	0.56	0.48	0.00
28	1	Patch		133	4.51	3.98	0	8.03	8.03	0.56	0.50	0.00
28	1	Patch		134	3.1	3.31	0	8.1	8.1	0.38	0.41	0.00
28	1	Patch		139	3.97	3.98	0	8.37	8.37	0.47	0.48	0.00
28	1	Patch		140	4.79	4.15	0	8.24	8.24	0.58	0.50	0.00
28	1	Patch		141	3.31	2.18	0	5.74	5.74	0.58	0.38	0.00
28	1	Patch		145	5.27	3.89	0.01	11.03	11.03	0.48	0.35	0.00
28	1	Patch		146	7.59	6.79	0	13.85	13.85	0.55	0.49	0.00
28	1	Patch		147	9.14	7.17	0.01	15.13	15.13	0.60	0.47	0.00
28	1	Patch		148	7.86	6.65	0.01	13.88	13.88	0.57	0.48	0.00
28	1	Patch		149	5.34	4.92	0	11.7	11.7	0.46	0.42	0.00
28	1	Patch		155	6.89	5.58	0	13.32	13.32	0.52	0.42	0.00
28	1	Patch		156	8.61	7.64	0	14.64	14.64	0.59	0.52	0.00
28	1	Patch		157	8.94	7.2	0.01	15.19	15.19	0.59	0.47	0.00
28	1	Patch		158	6.69	5.49	0	12.77	12.77	0.52	0.43	0.00

▪ QTM1 N261 Middle channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.69	0.61	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
28	1	Patch	128	0	5.3	4.8	0.01	9.72	9.72	0.55	0.49	0.00
28	1	Patch	131	3	6.95	6.76	0.01	15.92	15.92	0.44	0.42	0.00
28	1	Patch	132	4	10.93	9.23	0.01	17.38	17.38	0.63	0.53	0.00
28	1	Patch	133	5	10.65	9.23	0.01	17.41	17.41	0.61	0.53	0.00
28	1	Patch	134	6	7.25	7.55	0.01	16.42	16.42	0.44	0.46	0.00
28	1	Patch	139	11	9.23	8.67	0.01	15.3	15.3	0.60	0.57	0.00
28	1	Patch	140	12	10.18	9.15	0	16.33	16.33	0.62	0.56	0.00
28	1	Patch	141	13	8.81	6.38	0.01	13.82	13.82	0.64	0.46	0.00
28	1	Patch	145	17	13.39	11.44	0.02	23.79	23.79	0.56	0.48	0.00
28	1	Patch	146	18	19.92	17.41	0.02	30.32	30.32	0.66	0.57	0.00
28	1	Patch	147	19	21.85	17.68	0.02	31.72	31.72	0.69	0.56	0.00
28	1	Patch	148	20	17.74	16.82	0.01	30.03	30.03	0.59	0.56	0.00
28	1	Patch	149	21	12.83	11.89	0.01	25.05	25.05	0.51	0.47	0.00
28	1	Patch	155	27	18.65	14.55	0.02	29.38	29.38	0.63	0.50	0.00
28	1	Patch	156	28	21.85	19.48	0.01	31.95	31.95	0.68	0.61	0.00
28	1	Patch	157	29	20.28	17.31	0.01	30.76	30.76	0.66	0.56	0.00
28	1	Patch	158	30	16.33	14.51	0.01	28.05	28.05	0.58	0.52	0.00

▪ QTM0 N261 High channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.60	0.53	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
28.35	0	Patch		1	2.17	1.41	4.39	0	4.39	0.49	0.32	0.00
28.35	0	Patch		2	1.66	1.93	4.54	0	4.54	0.37	0.43	0.00
28.35	0	Patch		7	2.29	3.57	7.34	0	7.34	0.31	0.49	0.00
28.35	0	Patch		8	4.06	3.6	7.72	0	7.72	0.53	0.47	0.00
28.35	0	Patch		9	4.53	4.04	8.37	0	8.37	0.54	0.48	0.00
28.35	0	Patch		10	2.9	2.85	7.82	0	7.82	0.37	0.36	0.00
28.35	0	Patch		14	4.09	3.51	8.26	0	8.26	0.50	0.42	0.00
28.35	0	Patch		15	4.82	4.29	8.54	0	8.54	0.56	0.50	0.00
28.35	0	Patch		16	3.82	3.52	8.11	0	8.11	0.47	0.43	0.00
28.35	0	Patch		22	5.07	5.2	12.19	0	12.19	0.42	0.43	0.00
28.35	0	Patch		23	7.44	7.7	14.56	0	14.56	0.51	0.53	0.00
28.35	0	Patch		24	9.23	8.04	16.07	0	16.07	0.57	0.50	0.00
28.35	0	Patch		25	7.49	7.1	14.4	0	14.4	0.52	0.49	0.00
28.35	0	Patch		26	6.21	5.98	12.97	0	12.97	0.48	0.46	0.00
28.35	0	Patch		31	6.77	7.27	13.81	0	13.81	0.49	0.53	0.00
28.35	0	Patch		32	8.3	8.04	15.24	0	15.24	0.54	0.53	0.00
28.35	0	Patch		33	8.9	7.9	15.74	0	15.74	0.57	0.50	0.00
28.35	0	Patch		34	7.02	6.79	14.11	0	14.11	0.50	0.48	0.00
28.35	0	Patch		129	1.62	1.98	4.56	0	4.56	0.36	0.43	0.00
28.35	0	Patch		130	2.02	1.25	3.84	0	3.84	0.53	0.33	0.00
28.35	0	Patch		135	2.52	2.54	7.2	0	7.2	0.35	0.35	0.00
28.35	0	Patch		136	4.25	3.75	7.85	0	7.85	0.54	0.48	0.00
28.35	0	Patch		137	4.3	4.11	8.53	0	8.53	0.50	0.48	0.00

28.35	0	Patch		138	2.76	2.32	7.3	0	7.3	0.38	0.32	0.00
28.35	0	Patch		142	3.98	3.58	8.5	0	8.5	0.47	0.42	0.00
28.35	0	Patch		143	4.84	4.18	8.64	0	8.64	0.56	0.48	0.00
28.35	0	Patch		144	3.69	3.91	8.42	0	8.42	0.44	0.46	0.00
28.35	0	Patch		150	5.39	4.47	11.57	0	11.57	0.47	0.39	0.00
28.35	0	Patch		151	8.15	5.73	13.65	0	13.65	0.60	0.42	0.00
28.35	0	Patch		152	9.16	7.43	15.36	0	15.36	0.60	0.48	0.00
28.35	0	Patch		153	7.47	6.41	13.27	0	13.27	0.56	0.48	0.00
28.35	0	Patch		154	5.8	4.76	12.3	0	12.3	0.47	0.39	0.00
28.35	0	Patch		159	6.78	5.01	12.35	0	12.35	0.55	0.41	0.00
28.35	0	Patch		160	8.91	6.84	14.86	0	14.86	0.60	0.46	0.00
28.35	0	Patch		161	8.97	7.19	15.03	0.01	15.03	0.60	0.48	0.00
28.35	0	Patch		162	6.82	5.99	12.79	0	12.79	0.53	0.47	0.00

▪ QTM0 N261 High channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.65	0.58	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
28.35	0	Patch	129	1	5.12	4.9	10.13	0	10.13	0.51	0.48	0.00
28.35	0	Patch	130	2	5.01	4.39	9.09	0	9.09	0.55	0.48	0.00
28.35	0	Patch	135	7	5.61	7.6	14.19	0.01	14.19	0.40	0.54	0.00
28.35	0	Patch	136	8	8.87	9.23	16.01	0.01	16.01	0.55	0.58	0.00
28.35	0	Patch	137	9	10.11	8.7	17.12	0.01	17.12	0.59	0.51	0.00
28.35	0	Patch	138	10	7.09	7.18	16.65	0.01	16.65	0.43	0.43	0.00
28.35	0	Patch	142	14	9.78	8	17.46	0.01	17.46	0.56	0.46	0.00
28.35	0	Patch	143	15	11.13	8.94	17.77	0	17.77	0.63	0.50	0.00
28.35	0	Patch	144	16	8.85	8.51	16.04	0.01	16.04	0.55	0.53	0.00
28.35	0	Patch	150	22	12.49	11.82	24.58	0.01	24.58	0.51	0.48	0.00
28.35	0	Patch	151	23	16.75	14.98	30.29	0.01	30.29	0.55	0.49	0.00
28.35	0	Patch	152	24	21.07	16.65	32.26	0.01	32.26	0.65	0.52	0.00
28.35	0	Patch	153	25	16.58	14.86	28.89	0.01	28.89	0.57	0.51	0.00
28.35	0	Patch	154	26	14.46	11.88	26.93	0.01	26.93	0.54	0.44	0.00
28.35	0	Patch	159	31	15.01	14.02	27.41	0.01	27.41	0.55	0.51	0.00
28.35	0	Patch	160	32	18.54	16.42	31.03	0.01	31.03	0.60	0.53	0.00
28.35	0	Patch	161	33	19.14	16.12	31.8	0.01	31.8	0.60	0.51	0.00
28.35	0	Patch	162	34	15.95	14.31	27.28	0.01	27.28	0.58	0.52	0.00

▪ QTM1 N261 High channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.62	0.52	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
28.35	1	Patch		0	2.18	1.47	0	4.15	4.15	0.53	0.35	0.00
28.35	1	Patch		3	2.81	2.57	0	6.98	6.98	0.40	0.37	0.00
28.35	1	Patch		4	4.66	3.79	0	7.96	7.96	0.59	0.48	0.00
28.35	1	Patch		5	4.49	3.65	0	8.11	8.11	0.55	0.45	0.00

28.35	1	Patch		6	2.8	2.13	0	6.82	6.82	0.41	0.31	0.00
28.35	1	Patch		11	3.61	3.19	0	7.35	7.35	0.49	0.43	0.00
28.35	1	Patch		12	4.17	3.97	0	7.71	7.71	0.54	0.51	0.00
28.35	1	Patch		13	3.34	2.65	0	7.44	7.44	0.45	0.36	0.00
28.35	1	Patch		17	5.57	4.89	0.01	10.96	10.96	0.51	0.45	0.00
28.35	1	Patch		18	8.49	7.31	0.01	14.5	14.5	0.59	0.50	0.00
28.35	1	Patch		19	8.72	8.01	0.01	15.34	15.34	0.57	0.52	0.00
28.35	1	Patch		20	7.14	6.5	0	13.77	13.77	0.52	0.47	0.00
28.35	1	Patch		21	5.12	4.36	0	11.37	11.37	0.45	0.38	0.00
28.35	1	Patch		27	7.26	6.3	0.01	13.05	13.05	0.56	0.48	0.00
28.35	1	Patch		28	9.36	8.15	0	15.84	15.84	0.59	0.51	0.00
28.35	1	Patch		29	7.81	7.14	0.01	13.9	13.9	0.56	0.51	0.00
28.35	1	Patch		30	6.59	5.8	0	13.61	13.61	0.48	0.43	0.00
28.35	1	Patch		128	1.79	1.8	0	4.42	4.42	0.40	0.41	0.00
28.35	1	Patch		131	2.73	2.19	0	6.86	6.86	0.40	0.32	0.00
28.35	1	Patch		132	4.45	3.64	0	7.82	7.82	0.57	0.47	0.00
28.35	1	Patch		133	4.39	3.64	0	7.65	7.65	0.57	0.48	0.00
28.35	1	Patch		134	3.14	3.04	0	7.77	7.77	0.40	0.39	0.00
28.35	1	Patch		139	3.72	3.87	0	7.92	7.92	0.47	0.49	0.00
28.35	1	Patch		140	4.67	3.81	0	7.87	7.87	0.59	0.48	0.00
28.35	1	Patch		141	3.34	1.99	0	5.51	5.51	0.61	0.36	0.00
28.35	1	Patch		145	4.89	3.89	0	10.39	10.39	0.47	0.37	0.00
28.35	1	Patch		146	7.08	6.3	0	12.92	12.92	0.55	0.49	0.00
28.35	1	Patch		147	9.07	6.64	0	14.63	14.63	0.62	0.45	0.00
28.35	1	Patch		148	7.79	6.06	0.01	13.29	13.29	0.59	0.46	0.00
28.35	1	Patch		149	5.39	4.48	0	11.05	11.05	0.49	0.41	0.00
28.35	1	Patch		155	6.42	5.34	0	12.46	12.46	0.52	0.43	0.00
28.35	1	Patch		156	8.23	7.03	0	13.8	13.8	0.60	0.51	0.00
28.35	1	Patch		157	8.76	6.56	0	14.45	14.45	0.61	0.45	0.00
28.35	1	Patch		158	6.82	5.07	0.01	12.31	12.31	0.55	0.41	0.00

▪ QTM1 N261 High channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.70	0.59	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
28.35	1	Patch	128	0	5.26	4.62	0.01	9.45	9.45	0.56	0.49	0.00
28.35	1	Patch	131	3	6.75	6.63	0.01	15.56	15.56	0.43	0.43	0.00
28.35	1	Patch	132	4	10.38	8.71	0.01	16.47	16.47	0.63	0.53	0.00
28.35	1	Patch	133	5	10.28	8.59	0.01	16.52	16.52	0.62	0.52	0.00
28.35	1	Patch	134	6	7.44	6.93	0.01	15.99	15.99	0.47	0.43	0.00
28.35	1	Patch	139	11	8.69	8.4	0.01	14.7	14.7	0.59	0.57	0.00
28.35	1	Patch	140	12	10.03	8.59	0.01	15.82	15.82	0.63	0.54	0.00
28.35	1	Patch	141	13	8.75	5.92	0.01	13.22	13.22	0.66	0.45	0.00
28.35	1	Patch	145	17	13.26	11.2	0.02	22.26	22.26	0.60	0.50	0.00
28.35	1	Patch	146	18	18.57	16.35	0.01	28.71	28.71	0.65	0.57	0.00
28.35	1	Patch	147	19	21.52	16.69	0.01	30.7	30.7	0.70	0.54	0.00
28.35	1	Patch	148	20	16.86	15.62	0.01	28.8	28.8	0.59	0.54	0.00
28.35	1	Patch	149	21	12.61	10.75	0.01	23.24	23.24	0.54	0.46	0.00
28.35	1	Patch	155	27	17.73	13.85	0.02	27.6	27.6	0.64	0.50	0.00
28.35	1	Patch	156	28	21.03	18.3	0.01	30.82	30.82	0.68	0.59	0.00
28.35	1	Patch	157	29	19.49	16.36	0.01	29.35	29.35	0.66	0.56	0.00
28.35	1	Patch	158	30	15.86	13.25	0.01	26.34	26.34	0.60	0.50	0.00

▪ QTM0 N260 LOW channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.67	0.52	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
37	0	Patch		1	2.03	0.95	4	0	4	0.51	0.24	0.00
37	0	Patch		3	1.37	1.38	3.84	0	3.84	0.36	0.36	0.00
37	0	Patch		9	3.48	2.32	8.65	0	8.65	0.40	0.27	0.00
37	0	Patch		10	2.55	2.8	5.97	0	5.97	0.43	0.47	0.00
37	0	Patch		11	3.21	2.02	6.94	0	6.94	0.46	0.29	0.00
37	0	Patch		12	3.14	1.5	7.27	0	7.27	0.43	0.21	0.00
37	0	Patch		16	2.63	2.65	7.13	0	7.13	0.37	0.37	0.00
37	0	Patch		17	2.84	2.24	5.08	0	5.08	0.56	0.44	0.00
37	0	Patch		18	3.1	1.69	7.68	0	7.68	0.40	0.22	0.00
37	0	Patch		24	5.39	3.82	12.19	0	12.19	0.44	0.31	0.00
37	0	Patch		25	6.09	4.31	10.49	0	10.49	0.58	0.41	0.00
37	0	Patch		26	4.77	4.58	8.81	0	8.81	0.54	0.52	0.00
37	0	Patch		27	6.04	3.77	12.45	0	12.45	0.49	0.30	0.00
37	0	Patch		28	5.32	4.53	12.59	0	12.59	0.42	0.36	0.00
37	0	Patch		33	5.58	4.1	12.96	0	12.96	0.43	0.32	0.00
37	0	Patch		34	5.63	4.41	9.38	0	9.38	0.60	0.47	0.00
37	0	Patch		35	5.04	4.32	9.84	0.01	9.84	0.51	0.44	0.00
37	0	Patch		36	5.57	3.86	13.65	0	13.65	0.41	0.28	0.00
37	0	Patch		129	1.25	1.27	3.55	0	3.55	0.35	0.36	0.00
37	0	Patch		131	1.87	0.87	3.51	0	3.51	0.53	0.25	0.00
37	0	Patch		137	3.1	1.35	6.5	0	6.5	0.48	0.21	0.00
37	0	Patch		138	3.11	2.28	6.17	0	6.17	0.50	0.37	0.00
37	0	Patch		139	2.61	2.38	6.73	0	6.73	0.39	0.35	0.00
37	0	Patch		140	3.43	1.75	6.08	0	6.08	0.56	0.29	0.00
37	0	Patch		144	3.44	2.14	7.69	0	7.69	0.45	0.28	0.00
37	0	Patch		145	2.76	2.37	5.55	0	5.55	0.50	0.43	0.00
37	0	Patch		146	2.56	2.14	7.29	0	7.29	0.35	0.29	0.00
37	0	Patch		152	5.43	3.67	11.66	0.01	11.66	0.47	0.31	0.00
37	0	Patch		153	7.02	3.79	11.36	0	11.36	0.62	0.33	0.00
37	0	Patch		154	5.68	3.64	8.43	0	8.43	0.67	0.43	0.00
37	0	Patch		155	5.55	3.74	11.65	0.01	11.65	0.48	0.32	0.00
37	0	Patch		156	7.02	3.42	11.77	0	11.77	0.60	0.29	0.00
37	0	Patch		161	6.51	3.64	12.16	0	12.16	0.54	0.30	0.00
37	0	Patch		162	4.77	4.43	8.94	0.01	8.94	0.53	0.50	0.00
37	0	Patch		163	5.75	3.6	9.02	0	9.02	0.64	0.40	0.00
37	0	Patch		164	5.98	3.56	12.33	0	12.33	0.48	0.29	0.00

▪ QTM0 N260 LOW channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.68	0.55	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
37	0	Patch	129	1	3.99	2.83	8.19	0	8.19	0.49	0.35	0.00
37	0	Patch	131	3	3.83	2.82	7.72	0	7.72	0.50	0.37	0.00
37	0	Patch	137	9	7.27	5.05	15.72	0.01	15.72	0.46	0.32	0.00
37	0	Patch	138	10	6.17	5.88	12.5	0.01	12.5	0.49	0.47	0.00

37	0	Patch	139	11	7.12	6.26	14.76	0	14.76	0.48	0.42	0.00
37	0	Patch	140	12	6.61	3.21	11.36	0	11.36	0.58	0.28	0.00
37	0	Patch	144	16	8.02	5.49	15.31	0.01	15.31	0.52	0.36	0.00
37	0	Patch	145	17	6.92	6.08	11.26	0.01	11.26	0.61	0.54	0.00
37	0	Patch	146	18	7.65	5.24	16.05	0	16.05	0.48	0.33	0.00
37	0	Patch	152	24	13.81	9.78	27.83	0.01	27.83	0.50	0.35	0.00
37	0	Patch	153	25	16.22	9.82	25.5	0.01	25.5	0.64	0.39	0.00
37	0	Patch	154	26	12.41	10.06	18.2	0.01	18.2	0.68	0.55	0.00
37	0	Patch	155	27	13.55	9.74	27.07	0.01	27.07	0.50	0.36	0.00
37	0	Patch	156	28	14.16	9.85	27.62	0.01	27.62	0.51	0.36	0.00
37	0	Patch	161	33	15.37	10.35	29.77	0.01	29.77	0.52	0.35	0.00
37	0	Patch	162	34	11.84	11.41	20.72	0.01	20.72	0.57	0.55	0.00
37	0	Patch	163	35	11.8	10.5	20.9	0.02	20.9	0.56	0.50	0.00
37	0	Patch	164	36	14.69	9.57	30.59	0.01	30.59	0.48	0.31	0.00

▪ QTM1 N260 LOW channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.64	0.52	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
37	1	Patch		0	1.93	1.04	0	3.56	3.56	0.54	0.29	0.00
37	1	Patch		2	1.38	1.44	0	3.56	3.56	0.39	0.40	0.00
37	1	Patch		4	1.09	1.02	0	2.55	2.55	0.43	0.40	0.00
37	1	Patch		5	2.8	2.25	0	6.1	6.1	0.46	0.37	0.00
37	1	Patch		6	2.63	2.67	0	5.66	5.66	0.46	0.47	0.00
37	1	Patch		7	2.72	2.33	0	5.77	5.77	0.47	0.40	0.00
37	1	Patch		8	3.17	1.44	0	6.39	6.39	0.50	0.23	0.00
37	1	Patch		13	3.37	2.46	0	6.95	6.95	0.48	0.35	0.00
37	1	Patch		14	3.18	2.73	0	6.31	6.31	0.50	0.43	0.00
37	1	Patch		15	3.56	2.44	0	7.95	7.95	0.45	0.31	0.00
37	1	Patch		19	5.27	3.84	0	11.03	11.03	0.48	0.35	0.00
37	1	Patch		20	5.97	3.54	0.01	9.39	9.39	0.64	0.38	0.00
37	1	Patch		21	4.52	4.68	0.01	8.95	8.95	0.51	0.52	0.00
37	1	Patch		22	5.38	4.01	0	11.38	11.38	0.47	0.35	0.00
37	1	Patch		23	5.42	4.45	0.01	10.83	10.83	0.50	0.41	0.00
37	1	Patch		29	5.39	4.47	0	11.29	11.29	0.48	0.40	0.00
37	1	Patch		30	5.12	4.46	0	9.11	9.11	0.56	0.49	0.00
37	1	Patch		31	4.86	4.85	0.01	10.26	10.26	0.47	0.47	0.00
37	1	Patch		32	5.65	4.52	0	11.97	11.97	0.47	0.38	0.00
37	1	Patch		128	1.19	1.35	0	3.11	3.11	0.38	0.43	0.00
37	1	Patch		130	1.75	0.86	0	3.17	3.17	0.55	0.27	0.00
37	1	Patch		132	1.26	0.82	0	2.4	2.4	0.53	0.34	0.00
37	1	Patch		133	3.24	2.11	0	7.05	7.05	0.46	0.30	0.00
37	1	Patch		134	2.8	2.45	0	5.78	5.78	0.48	0.42	0.00
37	1	Patch		135	2.46	2.42	0	6.42	6.42	0.38	0.38	0.00
37	1	Patch		136	3.03	1.83	0	5.56	5.56	0.54	0.33	0.00
37	1	Patch		141	3.12	2.18	0	6.88	6.88	0.45	0.32	0.00
37	1	Patch		142	2.49	2.43	0	5.17	5.17	0.48	0.47	0.00
37	1	Patch		143	2.26	2.12	0	6.45	6.45	0.35	0.33	0.00
37	1	Patch		147	5.52	3.95	0.01	10.52	10.52	0.52	0.38	0.00
37	1	Patch		148	5.67	3.97	0.01	10.01	10.01	0.57	0.40	0.00
37	1	Patch		149	5.07	4.08	0	7.98	7.98	0.64	0.51	0.00
37	1	Patch		150	5.51	3.83	0.01	10.18	10.18	0.54	0.38	0.00
37	1	Patch		151	5.83	3.31	0.01	10.78	10.78	0.54	0.31	0.00
37	1	Patch		157	5.68	3.75	0	11.04	11.04	0.51	0.34	0.00
37	1	Patch		158	4.74	4.16	0.01	8.17	8.17	0.58	0.51	0.00

37	1	Patch		159	5.47	3.83	0.01	8.41	8.41	0.65	0.46	0.00
37	1	Patch		160	5.52	3.64	0	11.16	11.16	0.49	0.33	0.00

▪ QTM1 N260 LOW channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.63	0.56	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
37	1	Patch	128	0	3.77	2.93	0	7.16	7.16	0.53	0.41	0.00
37	1	Patch	130	2	3.85	2.77	0	7.16	7.16	0.54	0.39	0.00
37	1	Patch	132	4	2.87	2.15	0	5.36	5.36	0.54	0.40	0.00
37	1	Patch	133	5	6.74	5.1	0.01	13.12	13.12	0.51	0.39	0.00
37	1	Patch	134	6	5.99	6	0.01	11.57	11.57	0.52	0.52	0.00
37	1	Patch	135	7	6.14	6.28	0.01	12.74	12.74	0.48	0.49	0.00
37	1	Patch	136	8	5.98	3.2	0.01	10.31	10.31	0.58	0.31	0.00
37	1	Patch	141	13	7.83	5.34	0.01	14.77	14.77	0.53	0.36	0.00
37	1	Patch	142	14	5.83	5.82	0.01	11.18	11.18	0.52	0.52	0.00
37	1	Patch	143	15	6.78	4.79	0.01	14.21	14.21	0.48	0.34	0.00
37	1	Patch	147	19	13.19	9.66	0.01	25.09	25.09	0.53	0.39	0.00
37	1	Patch	148	20	14.01	9.21	0.03	22.12	22.12	0.63	0.42	0.00
37	1	Patch	149	21	10.07	9.54	0.01	18.11	18.11	0.56	0.53	0.00
37	1	Patch	150	22	12.78	9.36	0.01	24.34	24.34	0.53	0.38	0.00
37	1	Patch	151	23	13.53	9.77	0.02	24.41	24.41	0.55	0.40	0.00
37	1	Patch	157	29	14.1	9.9	0.01	26.15	26.15	0.54	0.38	0.00
37	1	Patch	158	30	11.06	10.25	0.01	18.38	18.38	0.60	0.56	0.00
37	1	Patch	159	31	12.29	10.06	0.01	21.61	21.61	0.57	0.47	0.00
37	1	Patch	160	32	13.98	9.59	0.01	26.8	26.8	0.52	0.36	0.00

▪ QTM0 N260 Middle channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.60	0.50	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
38.5	0	Patch		1	2.53	1.33	4.99	0	4.99	0.51	0.27	0.00
38.5	0	Patch		3	1.75	1.93	4.93	0	4.93	0.35	0.39	0.00
38.5	0	Patch		9	3.97	3.34	10	0	10	0.40	0.33	0.00
38.5	0	Patch		10	3.18	3.85	7.75	0	7.75	0.41	0.50	0.00
38.5	0	Patch		11	3.86	2.8	8.29	0	8.29	0.47	0.34	0.00
38.5	0	Patch		12	3.63	2.45	8.96	0	8.96	0.41	0.27	0.00
38.5	0	Patch		16	3.25	3.78	9.35	0	9.35	0.35	0.40	0.00
38.5	0	Patch		17	3.88	2.8	6.94	0	6.94	0.56	0.40	0.00
38.5	0	Patch		18	3.51	2.46	9.06	0	9.06	0.39	0.27	0.00
38.5	0	Patch		24	6.16	5.16	14.5	0	14.5	0.42	0.36	0.00
38.5	0	Patch		25	7.54	7.2	14.57	0.01	14.57	0.52	0.49	0.00
38.5	0	Patch		26	6.06	5.75	11.96	0	11.96	0.51	0.48	0.00
38.5	0	Patch		27	7.59	5.16	14.61	0	14.61	0.52	0.35	0.00
38.5	0	Patch		28	6.12	6.67	15.13	0	15.13	0.40	0.44	0.00

38.5	0	Patch		33	6.06	6.36	15.67	0	15.67	0.39	0.41	0.00
38.5	0	Patch		34	7.04	6.02	13.19	0.01	13.19	0.53	0.46	0.00
38.5	0	Patch		35	7.52	6.22	13.68	0	13.68	0.55	0.45	0.00
38.5	0	Patch		36	7.44	5.29	16.32	0	16.32	0.46	0.32	0.00
38.5	0	Patch		129	1.52	1.81	4.53	0	4.53	0.34	0.40	0.00
38.5	0	Patch		131	2.33	1.13	4.23	0	4.23	0.55	0.27	0.00
38.5	0	Patch		137	3.74	1.69	7.94	0	7.94	0.47	0.21	0.00
38.5	0	Patch		138	4.27	3.08	8.34	0	8.34	0.51	0.37	0.00
38.5	0	Patch		139	3.14	3.33	8.56	0	8.56	0.37	0.39	0.00
38.5	0	Patch		140	4.33	2.22	7.56	0	7.56	0.57	0.29	0.00
38.5	0	Patch		144	4.26	2.46	8.91	0	8.91	0.48	0.28	0.00
38.5	0	Patch		145	3.2	3.54	7.25	0	7.25	0.44	0.49	0.00
38.5	0	Patch		146	3.06	2.79	9.33	0	9.33	0.33	0.30	0.00
38.5	0	Patch		152	6.27	4.92	13.19	0	13.19	0.48	0.37	0.00
38.5	0	Patch		153	8.57	5.47	14.26	0	14.26	0.60	0.38	0.00
38.5	0	Patch		154	6.99	5.08	11.82	0.01	11.82	0.59	0.43	0.00
38.5	0	Patch		155	6.45	5.6	13.23	0	13.23	0.49	0.42	0.00
38.5	0	Patch		156	8.27	4.71	14.51	0	14.51	0.57	0.32	0.00
38.5	0	Patch		161	8.11	4.03	14.96	0	14.96	0.54	0.27	0.00
38.5	0	Patch		162	6.56	5.89	12.31	0.01	12.31	0.53	0.48	0.00
38.5	0	Patch		163	6.95	5.57	12.16	0	12.16	0.57	0.46	0.00
38.5	0	Patch		164	6.92	4.85	14.89	0	14.89	0.46	0.33	0.00

▪ QTM0 N260 Middle channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.68	0.63	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
38.5	0	Patch	129	1	5.2	4.4	10.15	0	10.15	0.51	0.43	0.00
38.5	0	Patch	131	3	5.17	4.14	9.62	0	9.62	0.54	0.43	0.00
38.5	0	Patch	137	9	8.97	6.81	18.21	0	18.21	0.49	0.37	0.00
38.5	0	Patch	138	10	8.91	8.53	16.23	0.01	16.23	0.55	0.53	0.00
38.5	0	Patch	139	11	9.27	9.49	17.56	0	17.56	0.53	0.54	0.00
38.5	0	Patch	140	12	7.94	4.97	14.22	0.01	14.22	0.56	0.35	0.00
38.5	0	Patch	144	16	9.32	8.05	18.27	0.01	18.27	0.51	0.44	0.00
38.5	0	Patch	145	17	10.05	9.37	14.85	0	14.85	0.68	0.63	0.00
38.5	0	Patch	146	18	9.01	7.49	19.92	0.01	19.92	0.45	0.38	0.00
38.5	0	Patch	152	24	14.22	12.12	30.81	0.01	30.81	0.46	0.39	0.00
38.5	0	Patch	153	25	18.44	14.33	32.15	0.02	32.15	0.57	0.45	0.00
38.5	0	Patch	154	26	15.65	14.66	26.89	0.01	26.89	0.58	0.55	0.00
38.5	0	Patch	155	27	16.7	13.51	30.08	0.01	30.08	0.56	0.45	0.00
38.5	0	Patch	156	28	15.87	13.99	32.26	0.01	32.26	0.49	0.43	0.00
38.5	0	Patch	161	33	16.6	13.57	35.48	0.01	35.48	0.47	0.38	0.00
38.5	0	Patch	162	34	15.17	15.23	29.66	0.02	29.66	0.51	0.51	0.00
38.5	0	Patch	163	35	16.52	15.61	28.49	0.01	28.49	0.58	0.55	0.00
38.5	0	Patch	164	36	15.34	11.88	35.78	0.01	35.78	0.43	0.33	0.00

▪ QTM1 N260 Middle channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm	MAX PD	Max Ratio		
							0.59	0.55	0.00
							Ratio		

					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
38.5	1	Patch		0	2.46	1.45	0	4.55	4.55	0.54	0.32	0.00
38.5	1	Patch		2	1.69	2.09	0	4.75	4.75	0.36	0.44	0.00
38.5	1	Patch		4	1.45	1.27	0	3.35	3.35	0.43	0.38	0.00
38.5	1	Patch		5	4.03	2.99	0	7.57	7.57	0.53	0.39	0.00
38.5	1	Patch		6	3.12	3.89	0	7.4	7.4	0.42	0.53	0.00
38.5	1	Patch		7	4.07	3.03	0	7.21	7.21	0.56	0.42	0.00
38.5	1	Patch		8	3.76	2.41	0	8.22	8.22	0.46	0.29	0.00
38.5	1	Patch		13	4.04	4.14	0	9.2	9.2	0.44	0.45	0.00
38.5	1	Patch		14	4.4	3.65	0	8.53	8.53	0.52	0.43	0.00
38.5	1	Patch		15	4.05	3.32	0	9.67	9.67	0.42	0.34	0.00
38.5	1	Patch		19	6.68	5.27	0.01	14.24	14.24	0.47	0.37	0.00
38.5	1	Patch		20	7.29	7.02	0.01	13.82	13.82	0.53	0.51	0.00
38.5	1	Patch		21	6.08	6.59	0.01	12.13	12.13	0.50	0.54	0.00
38.5	1	Patch		22	7.71	4.93	0	14.19	14.19	0.54	0.35	0.00
38.5	1	Patch		23	6.27	6.79	0.01	14.32	14.32	0.44	0.47	0.00
38.5	1	Patch		29	6.4	6.21	0.01	14.27	14.27	0.45	0.44	0.00
38.5	1	Patch		30	6.52	5.83	0.01	12.17	12.17	0.54	0.48	0.00
38.5	1	Patch		31	7.45	5.93	0	13.42	13.42	0.56	0.44	0.00
38.5	1	Patch		32	6.49	5.73	0.01	14.83	14.83	0.44	0.39	0.00
38.5	1	Patch		128	1.57	1.89	0	4.3	4.3	0.37	0.44	0.00
38.5	1	Patch		130	2.14	1.19	0	3.86	3.86	0.55	0.31	0.00
38.5	1	Patch		132	1.56	1	0	2.91	2.91	0.54	0.34	0.00
38.5	1	Patch		133	3.64	3.13	0	8.47	8.47	0.43	0.37	0.00
38.5	1	Patch		134	4.03	3.14	0	7.67	7.67	0.53	0.41	0.00
38.5	1	Patch		135	3.11	3.83	0	8.46	8.46	0.37	0.45	0.00
38.5	1	Patch		136	3.92	2.23	0	6.8	6.8	0.58	0.33	0.00
38.5	1	Patch		141	4.02	2.58	0	8.32	8.32	0.48	0.31	0.00
38.5	1	Patch		142	3.2	3.79	0	6.94	6.94	0.46	0.55	0.00
38.5	1	Patch		143	2.96	2.98	0	8.83	8.83	0.34	0.34	0.00
38.5	1	Patch		147	5.74	6.09	0.01	12.7	12.7	0.45	0.48	0.00
38.5	1	Patch		148	7.82	5.06	0	13.31	13.31	0.59	0.38	0.00
38.5	1	Patch		149	6.5	5.51	0.01	10.97	10.97	0.59	0.50	0.00
38.5	1	Patch		150	5.81	6.78	0.01	12.91	12.91	0.45	0.53	0.00
38.5	1	Patch		151	7.27	4.14	0.01	13.91	13.91	0.52	0.30	0.00
38.5	1	Patch		157	6.81	4.82	0	13.88	13.88	0.49	0.35	0.00
38.5	1	Patch		158	6.42	6.19	0.01	11.61	11.61	0.55	0.53	0.00
38.5	1	Patch		159	7.39	5.94	0.01	12.05	12.05	0.61	0.49	0.00
38.5	1	Patch		160	6.17	5.25	0.01	14.03	14.03	0.44	0.37	0.00

▪ QTM1 N260 Middle channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.60	0.61	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
38.5	1	Patch	128	0	5.24	4.44	0	9.45	9.45	0.55	0.47	0.00
38.5	1	Patch	130	2	4.9	4.27	0	9.06	9.06	0.54	0.47	0.00
38.5	1	Patch	132	4	3.99	3	0	6.78	6.78	0.59	0.44	0.00
38.5	1	Patch	133	5	9.4	7.61	0.01	15.65	15.65	0.60	0.49	0.00
38.5	1	Patch	134	6	8.75	8.78	0.01	15.36	15.36	0.57	0.57	0.00
38.5	1	Patch	135	7	9.75	10.03	0.01	16.35	16.35	0.60	0.61	0.00
38.5	1	Patch	136	8	7.64	5.02	0.01	13.01	13.01	0.59	0.39	0.00
38.5	1	Patch	141	13	9.46	7.62	0.01	18.54	18.54	0.51	0.41	0.00

38.5	1	Patch	142	14	9.32	8.95	0.01	16.28	16.28	0.57	0.55	0.00
38.5	1	Patch	143	15	8.08	7.14	0.01	18.04	18.04	0.45	0.40	0.00
38.5	1	Patch	147	19	15.45	12.97	0.01	29.54	29.54	0.52	0.44	0.00
38.5	1	Patch	148	20	16.84	14.5	0.01	29.75	29.75	0.57	0.49	0.00
38.5	1	Patch	149	21	15.69	13.55	0.02	25.98	25.98	0.60	0.52	0.00
38.5	1	Patch	150	22	16.11	14.65	0.02	28.98	28.98	0.56	0.51	0.00
38.5	1	Patch	151	23	14.86	13.27	0.02	30.45	30.45	0.49	0.44	0.00
38.5	1	Patch	157	29	15.76	12.76	0.01	32.46	32.46	0.49	0.39	0.00
38.5	1	Patch	158	30	14.21	13.64	0.02	26.1	26.1	0.54	0.52	0.00
38.5	1	Patch	159	31	17.28	14.93	0.01	26.81	26.81	0.64	0.56	0.00
38.5	1	Patch	160	32	14.97	11.66	0.01	32.44	32.44	0.46	0.36	0.00

▪ QTM0 N260 High channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.59	0.54	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
40	0	Patch		1	2.42	1.57	5.22	0	5.22	0.46	0.30	0.00
40	0	Patch		3	2.02	1.96	5.3	0	5.3	0.38	0.37	0.00
40	0	Patch		9	3.59	3.37	10.21	0	10.21	0.35	0.33	0.00
40	0	Patch		10	3.08	4.25	8.15	0	8.15	0.38	0.52	0.00
40	0	Patch		11	3.68	3.17	8.74	0	8.74	0.42	0.36	0.00
40	0	Patch		12	3.57	2.91	9.24	0	9.24	0.39	0.31	0.00
40	0	Patch		16	3.49	3.86	9.95	0	9.95	0.35	0.39	0.00
40	0	Patch		17	4.2	3.01	7.42	0	7.42	0.57	0.41	0.00
40	0	Patch		18	3.23	2.96	9.38	0	9.38	0.34	0.32	0.00
40	0	Patch		24	6.53	5.11	14.88	0	14.88	0.44	0.34	0.00
40	0	Patch		25	6.92	8.09	15.1	0.01	15.1	0.46	0.54	0.00
40	0	Patch		26	6.74	6.55	13.76	0.01	13.76	0.49	0.48	0.00
40	0	Patch		27	7.76	5.15	14.84	0	14.84	0.52	0.35	0.00
40	0	Patch		28	5.84	6.83	14.89	0.01	14.89	0.39	0.46	0.00
40	0	Patch		33	5.75	6.49	15.39	0	15.39	0.37	0.42	0.00
40	0	Patch		34	6.48	7.34	14.11	0.01	14.11	0.46	0.52	0.00
40	0	Patch		35	7.99	6.22	14.22	0.01	14.22	0.56	0.44	0.00
40	0	Patch		36	6.76	5.67	15.97	0	15.97	0.42	0.36	0.00
40	0	Patch		129	1.7	1.91	4.81	0	4.81	0.35	0.40	0.00
40	0	Patch		131	2.07	1.43	4.48	0	4.48	0.46	0.32	0.00
40	0	Patch		137	3.38	2.35	8.55	0	8.55	0.40	0.27	0.00
40	0	Patch		138	4.53	3.24	8.88	0	8.88	0.51	0.36	0.00
40	0	Patch		139	3.56	3.7	9.01	0	9.01	0.40	0.41	0.00
40	0	Patch		140	3.92	2.6	7.91	0	7.91	0.50	0.33	0.00
40	0	Patch		144	4.04	2.52	8.96	0	8.96	0.45	0.28	0.00
40	0	Patch		145	3.44	4.15	7.71	0	7.71	0.45	0.54	0.00
40	0	Patch		146	3.92	2.47	9.74	0	9.74	0.40	0.25	0.00
40	0	Patch		152	6.12	5.55	13.44	0	13.44	0.46	0.41	0.00
40	0	Patch		153	8.37	5.22	14.19	0.01	14.19	0.59	0.37	0.00
40	0	Patch		154	6.71	6.13	12.58	0	12.58	0.53	0.49	0.00
40	0	Patch		155	5.23	6.17	13.76	0	13.76	0.38	0.45	0.00
40	0	Patch		156	7.86	4.28	14.04	0.01	14.04	0.56	0.30	0.00
40	0	Patch		161	7.85	4.32	14.78	0	14.78	0.53	0.29	0.00
40	0	Patch		162	7.8	5.75	13.52	0.01	13.52	0.58	0.43	0.00
40	0	Patch		163	6.59	6.87	13.36	0	13.36	0.49	0.51	0.00
40	0	Patch		164	7.07	4.84	14.89	0	14.89	0.47	0.33	0.00

▪ QTM0 N260 High channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.70	0.64	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Right/ worse surface
40	0	Patch	129	1	6.09	5.23	10.31	0	10.31	0.59	0.51	0.00
40	0	Patch	131	3	5.97	5.01	10.11	0	10.11	0.59	0.50	0.00
40	0	Patch	137	9	8.79	7.74	18.46	0	18.46	0.48	0.42	0.00
40	0	Patch	138	10	9.86	9.63	16.86	0.01	16.86	0.58	0.57	0.00
40	0	Patch	139	11	10.61	10.4	18.75	0.01	18.75	0.57	0.55	0.00
40	0	Patch	140	12	7.43	6.17	14.73	0	14.73	0.50	0.42	0.00
40	0	Patch	144	16	9.51	8.52	18.63	0.01	18.63	0.51	0.46	0.00
40	0	Patch	145	17	11.05	10.07	15.75	0.01	15.75	0.70	0.64	0.00
40	0	Patch	146	18	10.97	8.26	20.15	0.01	20.15	0.54	0.41	0.00
40	0	Patch	152	24	13.61	11.43	30.2	0.01	30.2	0.45	0.38	0.00
40	0	Patch	153	25	16.34	15.56	31.07	0.01	31.07	0.53	0.50	0.00
40	0	Patch	154	26	15.93	15.67	29.38	0.01	29.38	0.54	0.53	0.00
40	0	Patch	155	27	15.1	12.88	29.98	0.01	29.98	0.50	0.43	0.00
40	0	Patch	156	28	16.76	13.19	30.53	0.01	30.53	0.55	0.43	0.00
40	0	Patch	161	33	15.03	11.24	31.97	0.01	31.97	0.47	0.35	0.00
40	0	Patch	162	34	15.6	15.28	30.59	0.01	30.59	0.51	0.50	0.00
40	0	Patch	163	35	17.09	16.24	28.9	0.01	28.9	0.59	0.56	0.00
40	0	Patch	164	36	15.09	10.52	32.5	0.01	32.5	0.46	0.32	0.00

▪ QTM1 N260 High channel SISO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.62	0.57	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
40	1	Patch		0	2.45	1.66	0	4.81	4.81	0.51	0.35	0.00
40	1	Patch		2	1.86	1.99	0	4.87	4.87	0.38	0.41	0.00
40	1	Patch		4	1.72	1.32	0	3.69	3.69	0.47	0.36	0.00
40	1	Patch		5	3.95	3.3	0	7.97	7.97	0.50	0.41	0.00
40	1	Patch		6	3.02	3.74	0	7.42	7.42	0.41	0.50	0.00
40	1	Patch		7	4.09	3.25	0	7.54	7.54	0.54	0.43	0.00
40	1	Patch		8	3.52	3.09	0	8.65	8.65	0.41	0.36	0.00
40	1	Patch		13	3.85	4.25	0	9.47	9.47	0.41	0.45	0.00
40	1	Patch		14	4.83	3.66	0.01	9.04	9.04	0.53	0.40	0.00
40	1	Patch		15	3.69	3.21	0	9.53	9.53	0.39	0.34	0.00
40	1	Patch		19	6.78	5.76	0	14.88	14.88	0.46	0.39	0.00
40	1	Patch		20	6.47	8.03	0	14.12	14.12	0.46	0.57	0.00
40	1	Patch		21	7.29	5.88	0.01	13.02	13.02	0.56	0.45	0.00
40	1	Patch		22	7.85	5.34	0	14.31	14.31	0.55	0.37	0.00
40	1	Patch		23	5.78	6.85	0.01	13.98	13.98	0.41	0.49	0.00
40	1	Patch		29	6.18	6.52	0.01	14.97	14.97	0.41	0.44	0.00
40	1	Patch		30	6.42	6.06	0.01	12.74	12.74	0.50	0.48	0.00
40	1	Patch		31	7.77	5.77	0	13.9	13.9	0.56	0.42	0.00
40	1	Patch		32	6.22	5.91	0.01	15.06	15.06	0.41	0.39	0.00
40	1	Patch		128	1.74	1.87	0	4.5	4.5	0.39	0.42	0.00

40	1	Patch		130	1.98	1.42	0	4.02	4.02	0.49	0.35	0.00
40	1	Patch		132	1.44	1	0	3.02	3.02	0.48	0.33	0.00
40	1	Patch		133	2.99	3.22	0	8.37	8.37	0.36	0.38	0.00
40	1	Patch		134	4.44	3.05	0	8.25	8.25	0.54	0.37	0.00
40	1	Patch		135	3.48	4.11	0	9	9	0.39	0.46	0.00
40	1	Patch		136	3.7	2.37	0	7.09	7.09	0.52	0.33	0.00
40	1	Patch		141	3.88	2.56	0	8.43	8.43	0.46	0.30	0.00
40	1	Patch		142	3.8	4.31	0	7.73	7.73	0.49	0.56	0.00
40	1	Patch		143	3.77	2.78	0	9.13	9.13	0.41	0.30	0.00
40	1	Patch		147	5.83	6.02	0.01	13.04	13.04	0.45	0.46	0.00
40	1	Patch		148	8.27	4.38	0.01	13.42	13.42	0.62	0.33	0.00
40	1	Patch		149	6.49	5.95	0.01	11.91	11.91	0.54	0.50	0.00
40	1	Patch		150	5.39	6.79	0	13.32	13.32	0.40	0.51	0.00
40	1	Patch		151	7.25	3.7	0.01	13.19	13.19	0.55	0.28	0.00
40	1	Patch		157	6.55	5.07	0.01	13.6	13.6	0.48	0.37	0.00
40	1	Patch		158	7.89	5.86	0	13.23	13.23	0.60	0.44	0.00
40	1	Patch		159	6.24	7.37	0.01	12.84	12.84	0.49	0.57	0.00
40	1	Patch		160	6.17	5.15	0.01	13.96	13.96	0.44	0.37	0.00

▪ QTM1 N260 High channel MIMO

Frequency (GHz)	Module	Antenna type	Beam 2	Beam 1	4cm2 PD(W/m2) at 2mm evaluation surfaces @6dBm				MAX PD	Max Ratio		
										0.65	0.62	0.00
										Ratio		
					Front	Back	Left	Right		Front/ worse surface	back/ worse surface	Left/ worse surface
40	1	Patch	128	0	6.09	5.2	0	9.58	9.58	0.64	0.54	0.00
40	1	Patch	130	2	5.48	4.87	0	9.3	9.3	0.59	0.52	0.00
40	1	Patch	132	4	4.49	3.21	0	6.94	6.94	0.65	0.46	0.00
40	1	Patch	133	5	8.75	8.75	0.01	16.2	16.2	0.54	0.54	0.00
40	1	Patch	134	6	9.23	8.88	0.01	15.18	15.18	0.61	0.58	0.00
40	1	Patch	135	7	10.95	10.73	0.01	17.2	17.2	0.64	0.62	0.00
40	1	Patch	136	8	7.2	6.22	0.01	14.25	14.25	0.51	0.44	0.00
40	1	Patch	141	13	8.62	7.57	0.01	18.6	18.6	0.46	0.41	0.00
40	1	Patch	142	14	10.38	9.75	0.01	16.99	16.99	0.61	0.57	0.00
40	1	Patch	143	15	9.66	7.31	0.01	18.32	18.32	0.53	0.40	0.00
40	1	Patch	147	19	14.62	11.75	0.01	29.32	29.32	0.50	0.40	0.00
40	1	Patch	148	20	16.41	14.54	0.01	29.54	29.54	0.56	0.49	0.00
40	1	Patch	149	21	16.28	14.39	0.02	25.58	25.58	0.64	0.56	0.00
40	1	Patch	150	22	15.54	14.47	0.01	28.53	28.53	0.54	0.51	0.00
40	1	Patch	151	23	15.83	11.84	0.02	28.65	28.65	0.55	0.41	0.00
40	1	Patch	157	29	14.13	11.83	0.02	30.08	30.08	0.47	0.39	0.00
40	1	Patch	158	30	15.13	13.27	0.01	27.23	27.23	0.56	0.49	0.00
40	1	Patch	159	31	16.87	17.32	0.01	27.93	27.93	0.60	0.62	0.00
40	1	Patch	160	32	14.02	10.89	0.02	30.75	30.75	0.46	0.35	0.00

Table 4-1: Max Ratio for SISO and MIMO per band per module

Band	module	Distance	Max Ratio for SISO	Max Ratio for MIMO
N261	0	2mm	0.60	0.65
	1	2mm	0.62	0.70
N260	0	2mm	0.67	0.70
	1	2mm	0.64	0.65

5 .Power Density Characterization

5.1 PD design target

For Qualcomm SDX55/QTM525, the total device uncertainty for mmW radio is 2.1dB.

To account for the total design related uncertainty, PD_design_target needs to be:

$$PD\_design\_target < PD_{regulatory\_limit} \times 10^{\frac{-total\ uncertainty}{10}}$$

With FCC 4cm2-averaged PD requirement of 10 W/m2 and the declared 2.1 dB device design related uncertainty, the PD_design_target for the EUT is determined as:

$$PD\_design\_target = 6\ W/m^2$$

5.2 Worst-case housing influence determination

For non-metal material, the material property cannot be accurately characterized at mmW frequencies to date. The estimated material property for the device housing is used in the simulation model, which could influence the accuracy in simulation for PD amplitude quantification. Since the housing influence on PD could vary from surface to surface where the EM field propagates through, the most underestimated surface is used to quantify the worst-case housing influence for conservative assessment.

Since the mmW antenna modules are placed at different location as shown in Figure 1-3, only material/housing surrounded has impact on EM field propagation, in turn impact on power density. Therefore, only adjacent surfaces for each QTM (as listed in Table 3-2) were used to evaluate the worst-case housing influence for each frequency band. For this EUT, when comparing a simulated 4cm2-avgeraged PD and measured 4 cm2-avgerated PD, the worst error introduced for each antenna module operating at each band when using the estimated material property in the simulation is highlighted red in Table 3-2. Thus, the worst-case housing influence, denoted as $\Delta min=Sim.PD-Meas.PD$, is determined as:

Table 5-1: Δmin for QTM0 and QTM1

Band	QTM	Δmin(db)
N260	0	2.75
	1	2.31
N261	0	2
	1	2.91

Δmin represents the worst case where RF exposure is underestimated the most in simulation when using the estimated material property for glass/plastics of the housing. For conservative assessment, the is used as the worst-case factor and applied to all the beams in the corresponding beam group to determine input power limits in PD char for compliance.

5.3 PD Char of the EUT

This section describes the PD Char generation that complies with the PD_design_target determined in Section 5.1 and is in compliance with the regulatory power density limit.

5.3.1 Scaling factor for SISO beams

Determine scaling factor for low, mid, high channel, S(i)low_or_mid_high by:

$$S(i)_{low\ or\ mid\ or\ high} = \frac{PD\ design\ target}{sim.PD_{surface(i)}} \quad , i \in SISO\ beams$$

Then finalize scaling factor, **S(i)**, by using equation below:

$$S(i) = min\{s_{low}(i), s_{mid}(i), s_{high}(i)\} \ , i \in SISO\ beams$$

and this scaling factor **S(i)**, is applied to the input power at each antenna port to determine *input.power.limit* for SISO beams.

5.3.2 Scaling factor for MIMO beams

The relative phase between beam pair is not controlled in the EUT and could vary from run to run. Therefore, for beam pair, based on the simulation results, the worst-case scaling factor needs to be determined mathematically to ensure the compliance.

For beam pair, extract the E-fields and H-fields from the corresponding single beams at low, mid and high channel for each supported band and for all identified surfaces of the EUT.

For a given beam pair containing *beam_a* and *beam_b*, and for a given channel, let relative phase between *beam_a* and *beam_b* = Ø , and the total PD of the beam pair can be expressed as:

$$\text{total } PD(\phi) = \frac{1}{2}\sqrt{\{PD_x(\phi)^2 + \text{Re}\{PD_y(\phi)^2 + \text{Re}\{PD_z(\phi)^2}}$$

$$= \frac{1}{2} Re\left\{\left(\vec{E}_a + \vec{E}_b e^{j\omega\phi}\right) \times \left(\vec{H}_a + \vec{H}_b e^{j\omega\phi}\right)^*\right\} \quad (4)$$

where, PDx(Ø), PDy(Ø) and PDz(Ø) ar e the three components of the total PD (Ø); and are the extracted E-fields and H-fields of *beam_a*, while and are the extracted E-fields and H-fields of *beam_b*. Sweep Ø with a 5° step from 0° to 360° to determine the worst-case, Ø , which results in the highest total PD (Ø) among all identified surfaces for this MIMO beam at this channel.

Follow the above procedure to determine Ø for all three channels of all bands supported, and obtain the scaling factor given by the below equation for low, mid and high channels:

$$S(i)_{low\ or\ mid\ or\ high} = \frac{PD\ design\ target}{sim.PD(\emptyset)_{worstcase}} \quad ,i \in MIMO\ beams$$

Similar to SISO beam, the worst-case scaling factor, **S(i)**, for MIMO beam ***i*** is determined as:

$$S(i)=min\{s_{low}(i), s_{mid}(i), s_{high}(i)\} \ ,i \in MIMO\ beams$$

and this scaling factor **S(i)**, is applied to the input power at each antenna port to determine *input.power.limit* for MIMO beams.

5.3.3 Input power limit when only mmW radio is ON

When only mmW radio is on, the power limit specifies the power level (denoted as *input.power.limit*) at antenna port that corresponds to PD_design_target for all the beams. The reference power used in simulation is 6dBm and denoted as ***Pref.***

*Sim power.limit=10*Log(S(i))+Pref I ∈ all beams*

We can get this *Sim power.limit* from PD simulation output results since the QMG tool can generate the sim.power.limit automatically with it' s own mathematics

The logic to determine *input.power.limit* is as shown below:

If -TxAGC uncertainty at reference power level < Δ *min* < TxAGC uncertainty at reference power level, then

input.power.limit(i)=Sim power.limit,i ∈ all beams (1)

else if Δ *min* < -TxAGC uncertainty at reference power level,

*input.power.limit(i)=Sim power.limit+(*Δmin*+TxAGC uncertanity at reference power level)* (2)
I ∈ all beams

else if Δ *min* > TxAGC uncertainty at reference power level,

*input.power.limit(i)=Sim power.limit+(*Δmin*-TxAGC uncertanity at reference power level)* (3)
I ∈ all beam

Following above logic, the *input.power.limit* for this EUT can be calculated as:

Table 5-2: power.limit calculation

Band	Module	Δmin(db)	Input.power.limit(dbm)	Notes
N261	0	**2.75**	Sim power.limit+(2.75-0.5)	Using Eq.3
	1	**2.31**	Sim power.limit+(2.31-0.5)	Using Eq.3

N260	0	**2**	Sim power.limit+(2-0.5)	Using Eq.3
	1	**2.91**	Sim power.limit+(2.91-0.5)	Using Eq.3

Note the **Δmin (dB)** used is the minimum of Hpol and Vpol per QTM per band (see Table 3-2).
Resulted *input.power.limit* for all beams is listed in Table below:

Frequency (GHz)	Module	Beam 2	Beam 1	sim. power. limit (dBm)	Delta min-TXAGC	input power limit
38.5	1		0	7.1	1.81	8.91
38.5	0		1	6.7	2.25	8.95
38.5	1		2	6.91	1.81	8.72
38.5	0		3	6.76	2.25	9.01
38.5	1		4	8.44	1.81	10.25
38.5	1		5	4.89	1.81	6.7
38.5	1		6	4.99	1.81	6.8
38.5	1		7	5.1	1.81	6.91
38.5	1		8	4.53	1.81	6.34
38.5	0		9	3.68	2.25	5.93
38.5	0		10	4.79	2.25	7.04
38.5	0		11	4.5	2.25	6.75
38.5	0		12	4.16	2.25	6.41
38.5	1		13	4.04	1.81	5.85
38.5	1		14	4.37	1.81	6.18
38.5	1		15	3.83	1.81	5.64
38.5	0		16	3.97	2.25	6.22
38.5	0		17	5.27	2.25	7.52
38.5	0		18	4.11	2.25	6.36
38.5	1		19	2.15	1.81	3.96
38.5	1		20	2.28	1.81	4.09
38.5	1		21	2.84	1.81	4.65
38.5	1		22	2.16	1.81	3.97
38.5	1		23	2.12	1.81	3.93
38.5	0		24	2.07	2.25	4.32
38.5	0		25	2.05	2.25	4.3
38.5	0		26	2.9	2.25	5.15
38.5	0		27	2.03	2.25	4.28
38.5	0		28	1.88	2.25	4.13
38.5	1		29	2.14	1.81	3.95
38.5	1		30	2.83	1.81	4.64
38.5	1		31	2.41	1.81	4.22
38.5	1		32	1.97	1.81	3.78
38.5	0		33	1.73	2.25	3.98
38.5	0		34	2.48	2.25	4.73
38.5	0		35	2.32	2.25	4.57
38.5	0		36	1.55	2.25	3.8
38.5	1		128	7.34	1.81	9.15
38.5	0		129	7.12	2.25	9.37
38.5	1		130	7.81	1.81	9.62
38.5	0		131	7.42	2.25	9.67
38.5	1		132	9.04	1.81	10.85
38.5	1		133	4.4	1.81	6.21
38.5	1		134	4.84	1.81	6.65
38.5	1		135	4.41	1.81	6.22

Frequency (GHz)	Module	Beam 2	Beam 1	sim. power. limit (dBm)	Delta min-TXAGC	Input power limit
28	1		0	7.26	2.41	9.67
28	0		1	7.07	1.5	8.57
28	0		2	6.89	1.5	8.39
28	1		3	5.03	2.41	7.44
28	1		4	4.46	2.41	6.87
28	1		5	4.35	2.41	6.76
28	1		6	5.14	2.41	7.55
28	0		7	4.76	1.5	6.26
28	0		8	4.68	1.5	6.18
28	0		9	4.26	1.5	5.76
28	0		10	4.54	1.5	6.04
28	1		11	4.81	2.41	7.22
28	1		12	4.59	2.41	7
28	1		13	4.73	2.41	7.14
28	0		14	4.28	1.5	5.78
28	0		15	4.17	1.5	5.67
28	0		16	4.4	1.5	5.9
28	1		17	3.07	2.41	5.48
28	1		18	1.83	2.41	4.24
28	1		19	1.64	2.41	4.05
28	1		20	2.04	2.41	4.45
28	1		21	2.71	2.41	5.12
28	0		22	2.51	1.5	4.01
28	0		23	1.9	1.5	3.4
28	0		24	1.51	1.5	3.01
28	0		25	1.89	1.5	3.39
28	0		26	2.28	1.5	3.78
28	1		27	2.26	2.41	4.67
28	1		28	1.53	2.41	3.94
28	1		29	2	2.41	4.41
28	1		30	2.01	2.41	4.42
28	0		31	2.03	1.5	3.53
28	0		32	1.74	1.5	3.24
28	0		33	1.58	1.5	3.08
28	0		34	1.95	1.5	3.45
28	1		128	7.01	2.41	9.42
28	0		129	6.91	1.5	8.41
28	0		130	7.56	1.5	9.06
28	1		131	5.08	2.41	7.49
28	1		132	4.55	2.41	6.96
28	1		133	4.63	2.41	7.04
28	1		134	4.6	2.41	7.01
28	0		135	4.86	1.5	6.36
28	0		136	4.5	1.5	6
28	0		137	4.27	1.5	5.77

38.5	1		136	5.36	1.81	7.17
38.5	0		137	4.68	2.25	6.93
38.5	0		138	4.47	2.25	6.72
38.5	0		139	4.36	2.25	6.61
38.5	0		140	4.9	2.25	7.15
38.5	1		141	4.48	1.81	6.29
38.5	1		142	5.27	1.81	7.08
38.5	1		143	4.22	1.81	6.03
38.5	0		144	4.18	2.25	6.43
38.5	0		145	5.08	2.25	7.33
38.5	0		146	3.98	2.25	6.23
38.5	1		147	2.64	1.81	4.45
38.5	1		148	2.44	1.81	4.25
38.5	1		149	3.28	1.81	5.09
38.5	1		150	2.57	1.81	4.38
38.5	1		151	2.25	1.81	4.06
38.5	0		152	2.48	2.25	4.73
38.5	0		153	2.14	2.25	4.39
38.5	0		154	2.95	2.25	5.2
38.5	0		155	2.47	2.25	4.72
38.5	0		156	2.06	2.25	4.31
38.5	1		157	2.26	1.81	4.07
38.5	1		158	3.03	1.81	4.84
38.5	1		159	2.87	1.81	4.68
38.5	1		160	2.21	1.81	4.02
38.5	0		161	1.93	2.25	4.18
38.5	0		162	2.78	2.25	5.03
38.5	0		163	2.83	2.25	5.08
38.5	0		164	1.95	2.25	4.2
38.5	1	128	0	3.93	1.81	5.74
38.5	0	129	1	3.62	2.25	5.87
38.5	1	130	2	4.11	1.81	5.92
38.5	0	131	3	3.85	2.25	6.1
38.5	1	132	4	5.37	1.81	7.18
38.5	1	133	5	1.74	1.81	3.55
38.5	1	134	6	1.82	1.81	3.63
38.5	1	135	7	1.55	1.81	3.36
38.5	1	136	8	2.54	1.81	4.35
38.5	0	137	9	1.08	2.25	3.33
38.5	0	138	10	1.58	2.25	3.83
38.5	0	139	11	1.24	2.25	3.49
38.5	0	140	12	2.15	2.25	4.4
38.5	1	141	13	1	1.81	2.81
38.5	1	142	14	1.56	1.81	3.37
38.5	1	143	15	1.12	1.81	2.93
38.5	0	144	16	1.06	2.25	3.31
38.5	0	145	17	1.96	2.25	4.21
38.5	0	146	18	0.69	2.25	2.94
38.5	1	147	19	-1.02	1.81	0.79
38.5	1	148	20	-1.05	1.81	0.76
38.5	1	149	21	-0.47	1.81	1.34
38.5	1	150	22	-0.94	1.81	0.87
38.5	1	151	23	-1.15	1.81	0.66
38.5	0	152	24	-1.21	2.25	1.04
38.5	0	153	25	-1.39	2.25	0.86
38.5	0	154	26	-0.61	2.25	1.64
38.5	0	155	27	-1.1	2.25	1.15
38.5	0	156	28	-1.41	2.25	0.84
38.5	1	157	29	-1.43	1.81	0.38
38.5	1	158	30	-0.48	1.81	1.33
38.5	1	159	31	-0.6	1.81	1.21

28	0		138	4.81	1.5	6.31
28	1		139	4.45	2.41	6.86
28	1		140	4.52	2.41	6.93
28	1		141	6.09	2.41	8.5
28	0		142	4.29	1.5	5.79
28	0		143	4.21	1.5	5.71
28	0		144	4.33	1.5	5.83
28	1		145	3.26	2.41	5.67
28	1		146	2.27	2.41	4.68
28	1		147	1.88	2.41	4.29
28	1		148	2.26	2.41	4.67
28	1		149	3	2.41	5.41
28	0		150	2.84	1.5	4.34
28	0		151	2.13	1.5	3.63
28	0		152	1.71	1.5	3.21
28	0		153	2.2	1.5	3.7
28	0		154	2.54	1.5	4.04
28	1		155	2.44	2.41	4.85
28	1		156	2.03	2.41	4.44
28	1		157	1.87	2.41	4.28
28	1		158	2.62	2.41	5.03
28	0		159	2.56	1.5	4.06
28	0		160	1.79	1.5	3.29
28	0		161	1.76	1.5	3.26
28	0		162	2.34	1.5	3.84
28	1	128	0	3.8	2.41	6.21
28	0	129	1	3.56	1.5	5.06
28	0	130	2	3.95	1.5	5.45
28	1	131	3	1.66	2.41	4.07
28	1	132	4	1.28	2.41	3.69
28	1	133	5	1.27	2.41	3.68
28	1	134	6	1.53	2.41	3.94
28	0	135	7	1.95	1.5	3.45
28	0	136	8	1.47	1.5	2.97
28	0	137	9	1.24	1.5	2.74
28	0	138	10	1.34	1.5	2.84
28	1	139	11	1.83	2.41	4.24
28	1	140	12	1.55	2.41	3.96
28	1	141	13	2.28	2.41	4.69
28	0	142	14	1.13	1.5	2.63
28	0	143	15	1.04	1.5	2.54
28	0	144	16	1.51	1.5	3.01
28	1	145	17	-0.08	2.41	2.33
28	1	146	18	-1.14	2.41	1.27
28	1	147	19	-1.33	2.41	1.08
28	1	148	20	-1.09	2.41	1.32
28	1	149	21	-0.31	2.41	2.1
28	0	150	22	-0.52	1.5	0.98
28	0	151	23	-1.24	1.5	0.26
28	0	152	24	-1.52	1.5	-0.02
28	0	153	25	-1.12	1.5	0.38
28	0	154	26	-0.88	1.5	0.62
28	1	155	27	-1	2.41	1.41
28	1	156	28	-1.36	2.41	1.05
28	1	157	29	-1.2	2.41	1.21
28	1	158	30	-0.8	2.41	1.61
28	0	159	31	-0.91	1.5	0.59
28	0	160	32	-1.33	1.5	0.17
28	0	161	33	-1.45	1.5	0.05
28	0	162	34	-0.97	1.5	0.53

38.5	1	160	32	-1.43	1.81	0.38
38.5	0	161	33	-1.82	2.25	0.43
38.5	0	162	34	-1.04	2.25	1.21
38.5	0	163	35	-0.87	2.25	1.38
38.5	0	164	36	-1.85	2.25	0.4

Table 5-3: input.power.limit for n260/n261

5.3.4 Further limitation and power backoff consideration

This EUT will use the Legacy power backoff solution to limit mmW transmit power from all of the beams. The mechanism in legacy power backoff solution can only control the transmit power per QTM per band per SISO or MIMO beam, therefore, in order to ensure compliance all times, for each band, the minimum of input.power.limit out of all SISO beams and minimum of input.power.limit out of all MIMO beams needs to be determined and applied via legacy backoff solution accordingly.

The minimum power limit, min.power.limit, is determined based on Table 5-3 and listed in Table 5-4. Note the min.power.limit data rounded to one decimal place.

Table 5-4: SISO and MIMO min.power.limit for each band

N261	min.power.limit
min input.power.limit out of all SISO beams from QTM0 (dBm)	3.01
min input.power.limit out of all MIMO beams from QTM0 (dBm)	-0.02
min input.power.limit out of all SISO beams from QTM1 (dBm)	3.94
min input.power.limit out of all MIMO beams from QTM1 (dBm)	1.05
N260	min.power.limit
min input.power.limit out of all SISO beams from QTM0 (dBm)	3.8
min input.power.limit out of all MIMO beams from QTM0 (dBm)	0.4
min input.power.limit out of all SISO beams from QTM1 (dBm)	3.78
min input.power.limit out of all MIMO beams from QTM1 (dBm)	0.38

Furthermore, the additional power backoff needs to be added in order to comply with TER requirement when mmW NR, LTE and WLAN MIMO transmit simultaneously. The maximum allowed PD budget is provided based on simultaneous transmission *reported* SAR in Part 1 report. For a given exposure scenario, if the maximum PD contribution ratio is higher than the corresponding maximum allowed PD budget, then the additional power backoff for TER requirement is determined using equation:

$$additional\ power\ backoff\ (dB) = 10 * \log\left(\frac{maximum\ PD\ contribution\ ratio\ (in\ linear)}{maximum\ allowed\ PD\ budget\ (in\ linear)}\right)$$

For tablet device,regulatory requirement is only applied with 0mm , just need to calculate the 0mm additional power backoff for TER

Examples for n261:

1. For head exposure, the maximum allowed PD budget is 0.25, the maximum PD contribution from left surface (QTM0) at 2mm to front surface at 2mm out of all SISO beams of QTM0 is 0.6, then the additional power backoff is 3.8dB =10*log(0.6/0.25) for all SISO beams of QTM0.

Following the similar steps described in the above examples, all additional power backoff required for TER requirement is listed in Table 5-5.

Table 5-5: Additional power backoff required for TER requirement

				Max PD contribution Ratio				Additional power backoff			
Band	Exposure position	SAR test Distance	mmw PD budget	SISO beams for QTM0	MIMO beams for QTM0	SISO beams for QTM1	MIMO beams for QTM1	SISO for QTM0(db)	MIMO for QTM0(db)	SISO for QTM1(db)	MIMO for QTM1(db)
n260	Head worst -case(Front)	0mm	0.25	0.67	0.7	0.64	0.65	**4.28**	**4.47**	**4.08**	**4.15**
n261	Head worst -case(Front)	0mm	0.25	0.6	0.65	0.62	0.7	**3.8**	**4.15**	**3.94**	**4.47**

5.3.5 PD char

Based on Table 5-4 and Table 5-5, the PD char for compliance via smart transmit backoff solution can be finalized listed as Table 5-6 and will be implemented in production units.

Table 5-6: Final PD Char

N261	min.power.limit
min input.power.limit out of all SISO beams from QTM0 (dBm)	-0.79
min input.power.limit out of all MIMO beams from QTM0 (dBm)	-4.17
min input.power.limit out of all SISO beams from QTM1 (dBm)	0
min input.power.limit out of all MIMO beams from QTM1 (dBm)	-3.42
N260	min.power.limit
min input.power.limit out of all SISO beams from QTM0 (dBm)	-0.48
min input.power.limit out of all MIMO beams from QTM0 (dBm)	-4.07
min input.power.limit out of all SISO beams from QTM1 (dBm)	-0.3
min input.power.limit out of all MIMO beams from QTM1 (dBm)	-3.77