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# Power Density Simulation Report

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# 1. Electromagnetic simulation method for power density

## 1.1 EM simulation tool

### 1.1.1 EM simulation tool description

The mmWave power density (PD) simulation method for calculating PD for mobile phones with mmWave antenna modules is available in ANSYS Electromagnetics suite HFSS ver. 20.2(2020 R2) 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 HFSS ver. 20.2(2020 R2) 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. 20.2(2020 R2) uses the 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. 20.2(2020 R2) is used. ANSYS Electromagnetics suite HFSS ver. 20.2(2020 R2) 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 HFSS ver. 20.2(2020 R2) 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. 20.2(2020 R2), the accuracy of converged results depends on the delta S.

### 1.1.3 Time-averaged power density calculation

It is possible to get various kinds of physical quantities can be obtained after finishing 3D full-wave electromagnetic simulation. 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 time-averaged Poynting vector ( $\vec{S}$ ) from the cross product of  $\vec{E}$  and complex conjugation of  $\vec{H}$  as shown below:

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

( $\vec{S}$ ) 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. 20.2(2020 R2) .

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

$$PD_{av} = \frac{1}{A} \int_A (\vec{S}) \cdot d\vec{s} = \frac{1}{2A} \int_A |Re(\vec{E} \times \vec{H})| \cdot d\vec{s} ,$$

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

## 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 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, large components and legacy antennas as well as mmWave antenna modules QTM#0 and QTM#1. On the back front view, QTM#0 is placed on the left side and antennas are facing the left side of the device. QTM#1 is placed on the top side and antennas are facing the back side of the device.



Figure 1. HFSS simulation model which is mounted two mmWave antenna modules.

### 1.2.2 PD evaluation surfaces

Table 1 shows the PD evaluation surfaces for each mmWave antenna module and Figure 2 shows the PD evaluation planes and truncation area of the simulation model to find worst case of beam forming cases. In these cases, 5 PD evaluation surfaces except bottom side are set up. QTM#0 and QTM#1 are placed at the top of the device and the bottom side is excluded from the worst case because the distance from the bottom side is more than  $10\lambda$  at 28GHz and 39GHz.

Table 1. PD evaluation surfaces

| MODULE | Front | Back | Right | Left | Top | Bottom |
|--------|-------|------|-------|------|-----|--------|
| QTM#0  | ○     | ○    | ○     | ○    | ○   | ×      |
| QTM#1  | ○     | ○    | ○     | ○    | ○   | ×      |

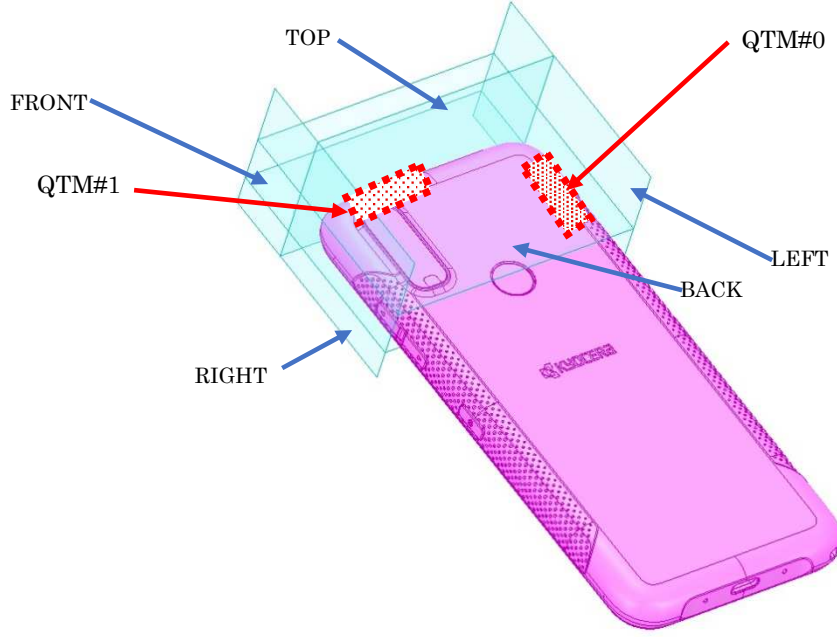


Figure 2. PD evaluation Surfaces

### 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 3 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  $< 0.04\text{dB}$  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  $1 \times 4$  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 are 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.

Figure 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.

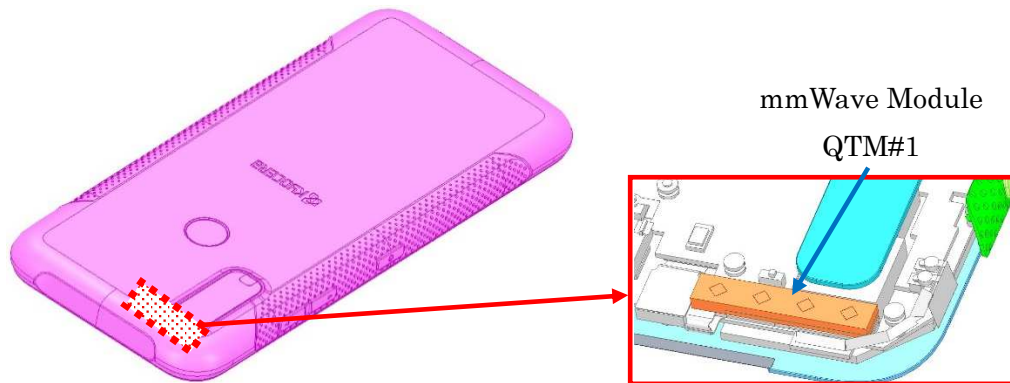


Figure 3. mmWave module

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). Figure4 shows an example of antenna port excitations.

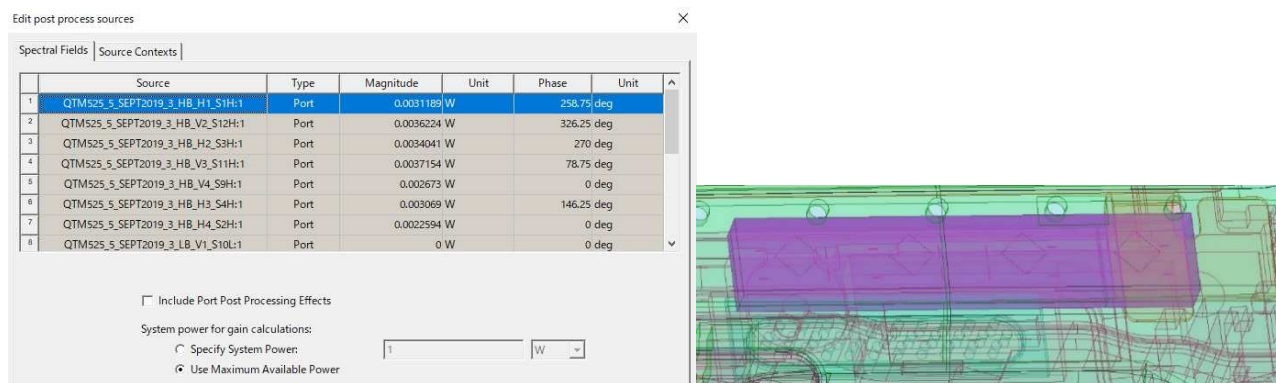


Figure 4. An example of port excitation (QTM#1)

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 set 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  $4\text{cm}^2$  at 2.5 mm intervals of the point power density result. Figure 5 shows examples of the distribution plot of point power density and the averaged power density.

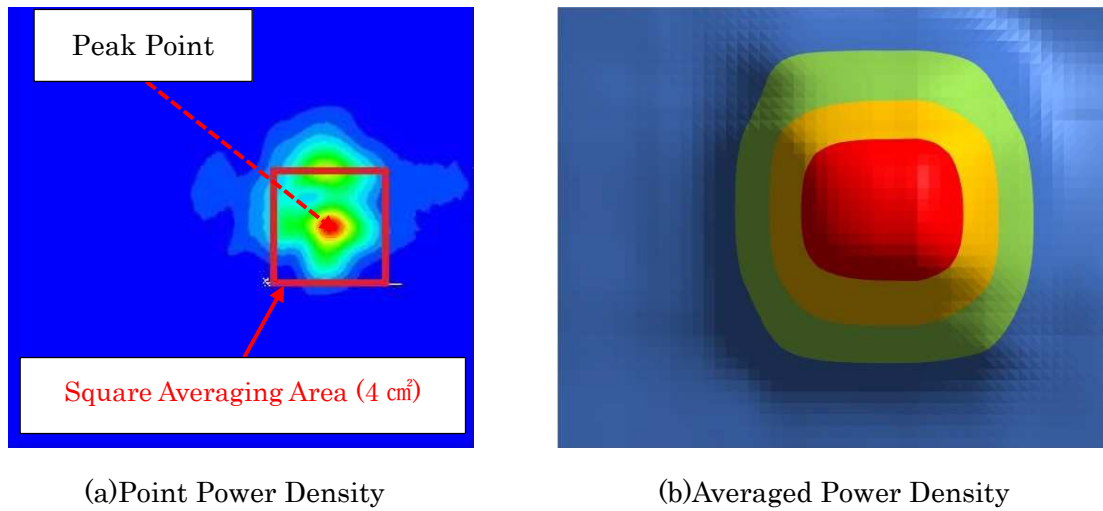


Figure 5. Power density distribution (Example)

## 2.2 Comparison between simulation and measurement

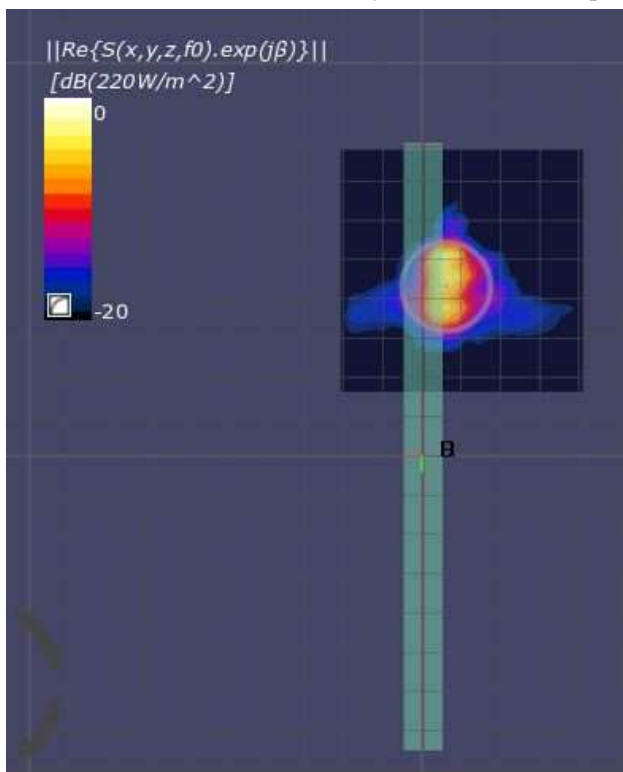
In this section, the simulated and measured power density distributions are compared with each mmWave antenna. Based on the comparison of the power density distribution, the simulated power density and the measured power density have a good correlation. The amplitude mismatch between the simulated  $4\text{cm}^2$  average power density and the measured  $4\text{cm}^2$  average power density is considered a housing influence. Input power per each active port is listed below for both simulation and measurement verification and power density characterization. For simulation, these values were entered directly into the HFSS model. For measurement, it was used to input these values for each active port using Factory Test Mode S/W.

| Mode/Band             | Antenna     | Input Power (dBm)<br>SISO | Input Power (dBm)<br>MIMO |
|-----------------------|-------------|---------------------------|---------------------------|
| 5G NR n261<br>(28GHz) | QTM#0 Patch | 6.0                       | 6.0                       |
|                       | QTM#1 Patch | 6.0                       | 6.0                       |
| 5G NR n260<br>(39GHz) | QTM#0 Patch | 6.0                       | 6.0                       |
|                       | QTM#1 Patch | 6.0                       | 6.0                       |

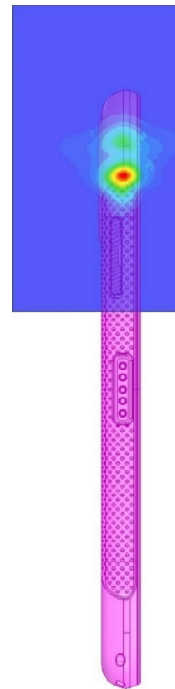
The simulation and measurement results below were performed at 2mm evaluation distance and 28 GHz / 39GHz.

| 6dBm input measurement/ simulation |          |        |                                 |         |         |         | 4cm <sup>2</sup> avg.PD<br>(mW/cm <sup>2</sup> ) |           | $\Delta$<br>(dB) | $\Delta_{\min}$<br>(dB) |
|------------------------------------|----------|--------|---------------------------------|---------|---------|---------|--------------------------------------------------|-----------|------------------|-------------------------|
| Band                               | Ant Type | Module | Ant Group<br>(Ant Polarization) | beam ID | Surface | Channel | Measured                                         | Simulated |                  |                         |
| n261                               | Patch    | QTM#0  | AG0(V)                          | 17      | Left    | Mid     | 0.86                                             | 1.25      | 1.63             | -1.18                   |
|                                    |          |        | AG1(H)                          | 149     | Left    | Mid     | 1.60                                             | 1.22      | -1.18            |                         |
|                                    |          | QTM#1  | AG0(V)                          | 13      | Back    | Mid     | 0.81                                             | 1.17      | 1.60             | 0.84                    |
|                                    |          |        | AG1(H)                          | 141     | Back    | Mid     | 0.89                                             | 1.08      | 0.84             |                         |
| n260                               | Patch    | QTM#0  | AG0(V)                          | 22      | Left    | Mid     | 0.84                                             | 2.52      | 4.79             | 2.23                    |
|                                    |          |        | AG1(H)                          | 150     | Left    | Mid     | 1.09                                             | 1.81      | 2.23             |                         |
|                                    |          | QTM#1  | AG0(V)                          | 12      | Back    | Mch     | 0.62                                             | 2.43      | 5.96             | 4.31                    |
|                                    |          |        | AG1(H)                          | 140     | Back    | Mch     | 0.63                                             | 1.69      | 4.31             |                         |

n261 Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 17 Left-side Mid ch.

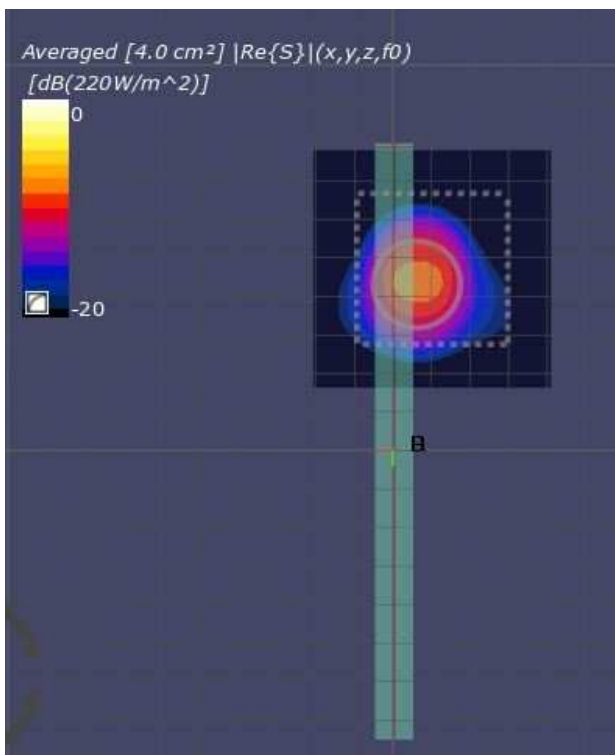


(a)Measurement

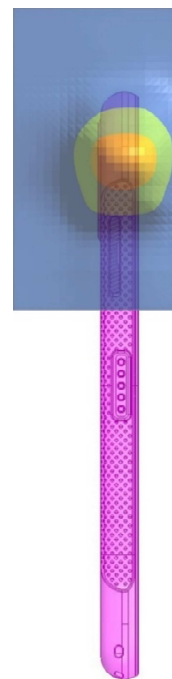


(b)Simulation

Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 17, Point power density



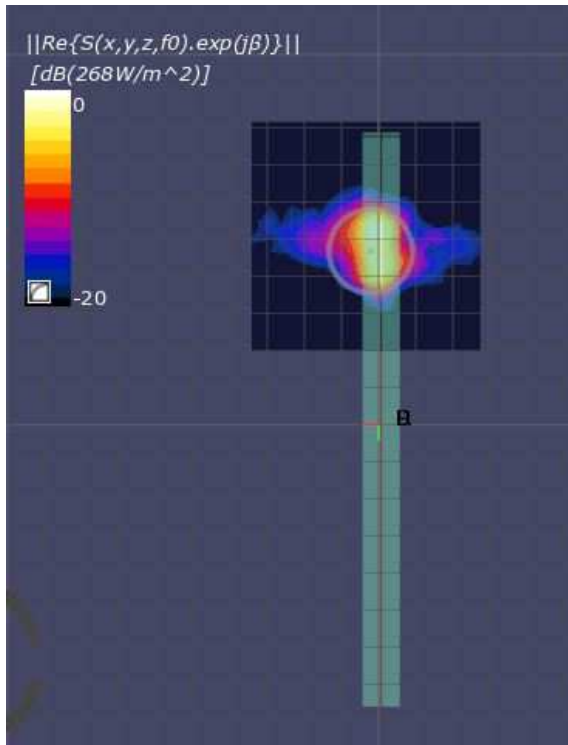
(a)Measurement



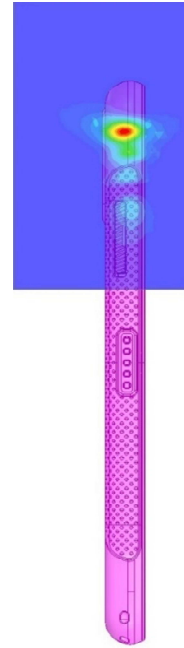
(b)Simulation

Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 17, 4cm<sup>2</sup> Averaged power density

n261 Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 149 Left-side Mid ch

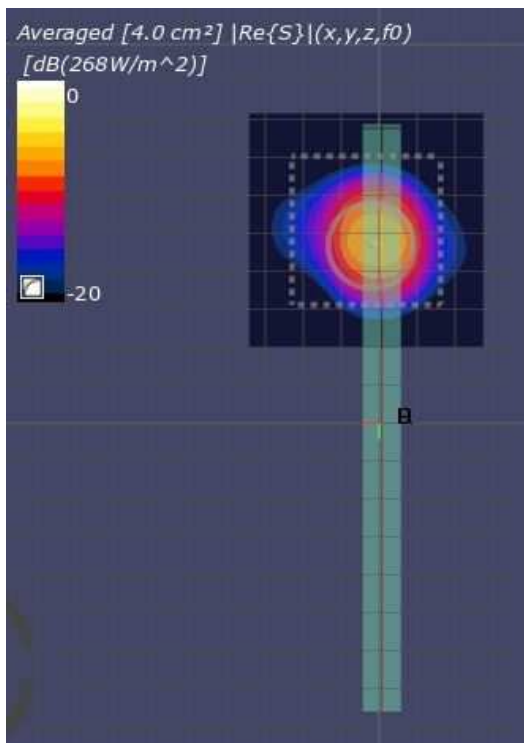


(a)Measurement

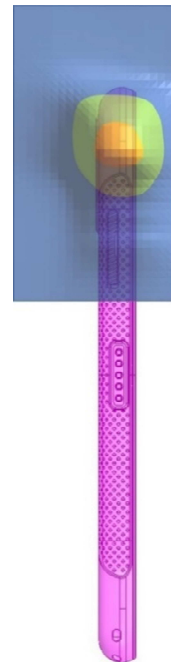


(b)Simulation

Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 149, Point power density



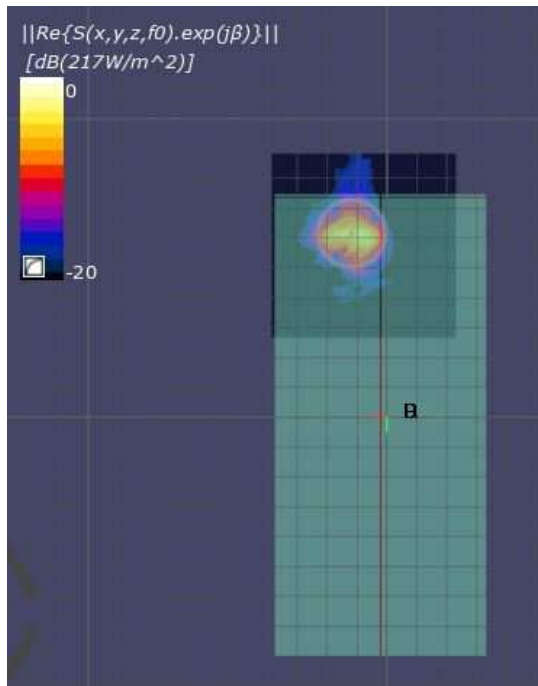
(a)Measurement



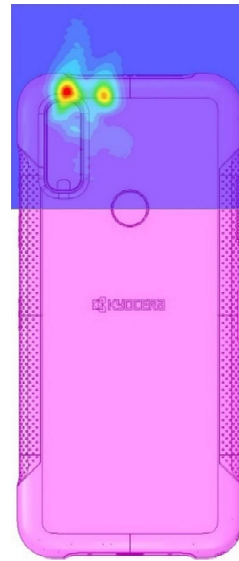
(b)Simulation

Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 149, 4cm<sup>2</sup> Averaged power density

n261 Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 13 Back-side Mid ch.



(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 13, Point power density



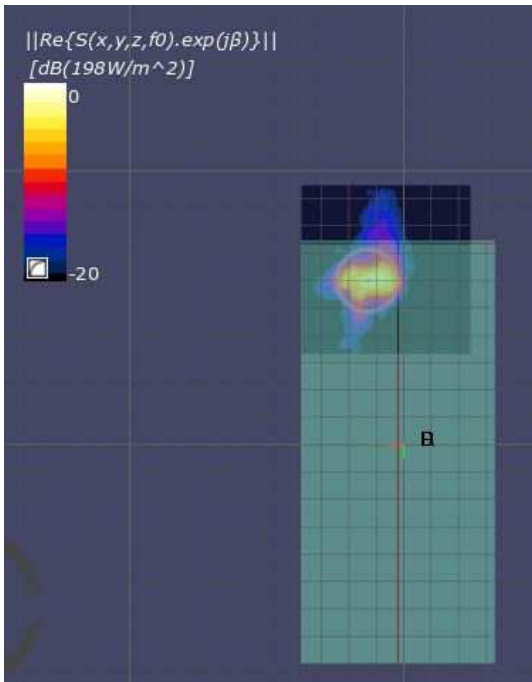
(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 13, 4cm<sup>2</sup> Averaged power density

n261 Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 141 Back-side Mid ch.

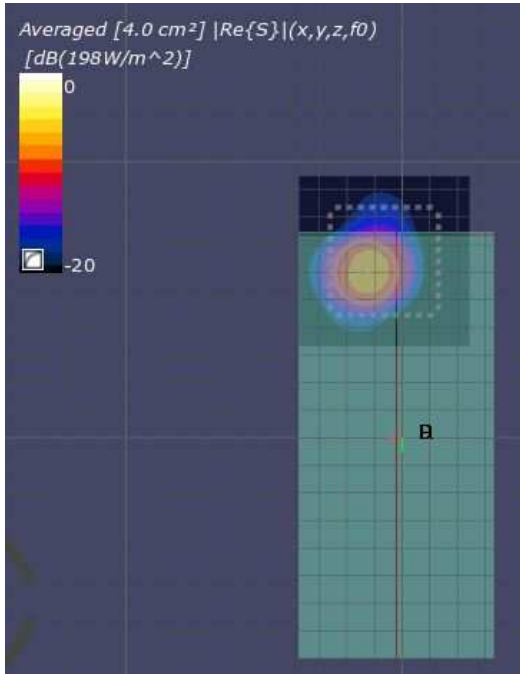


(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 141, Point power density



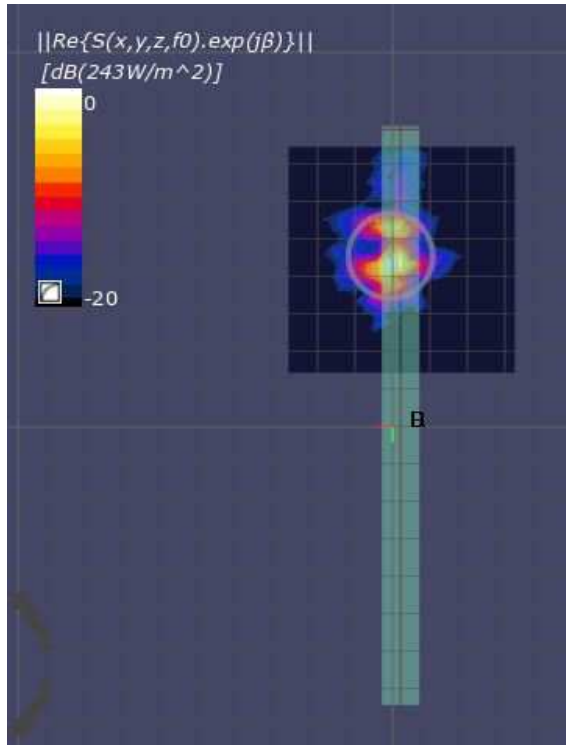
(a)Measurement



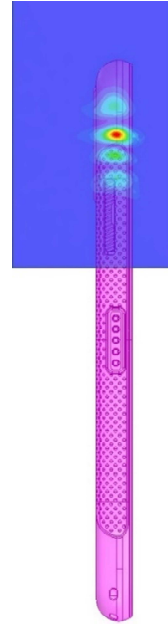
(b)Simulation

Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 141, 4cm<sup>2</sup> Averaged power density

n260 Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 22 Left-side Mid ch.

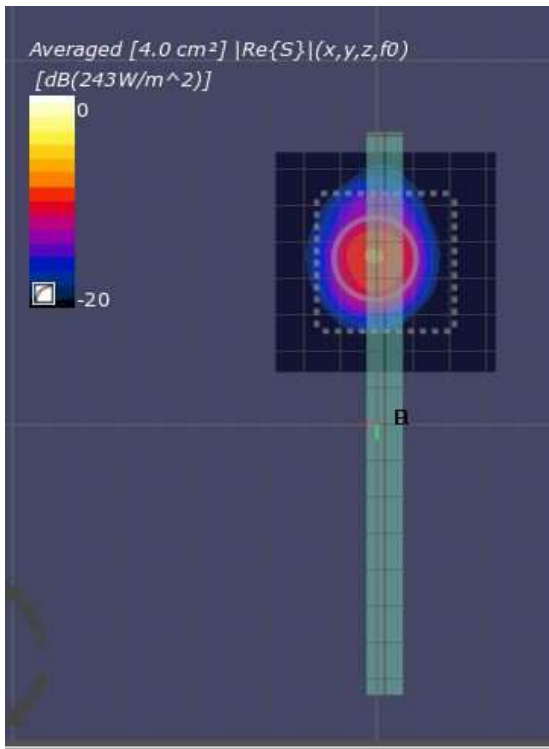


(a) Measurement

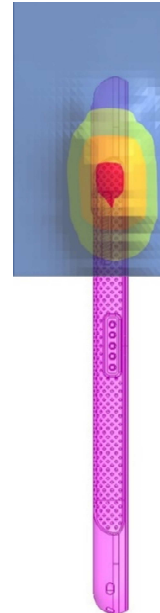


(b) Simulation

Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 22, Point power density



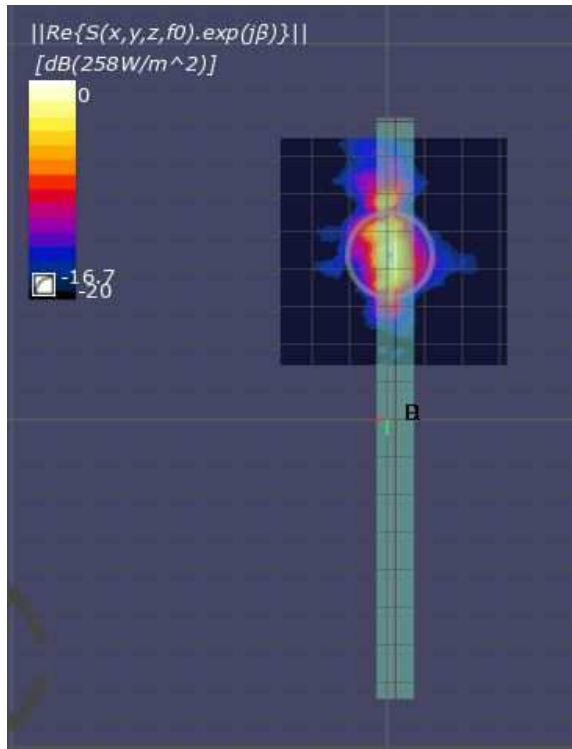
(a) Measurement



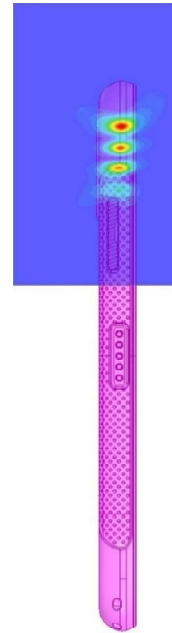
(b) Simulation

Patch antenna QTM#0 Ant\_Group0(V-polarization) beam ID 22, 4cm<sup>2</sup> Averaged power density

n260 Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 150 Left-side Mid ch.

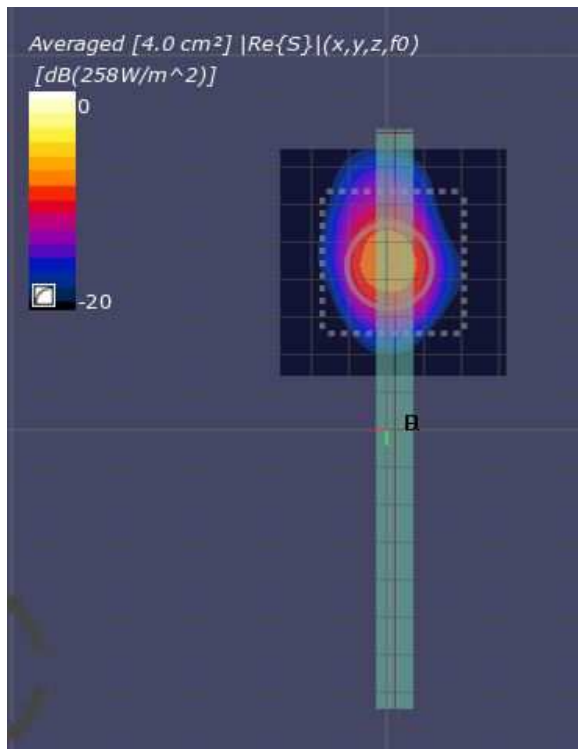


(a)Measurement

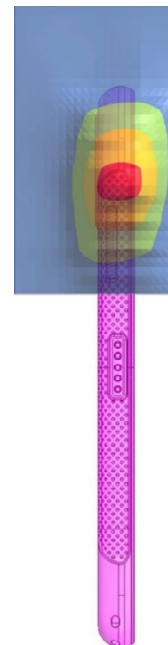


(b)Simulation

Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 150, Point power density



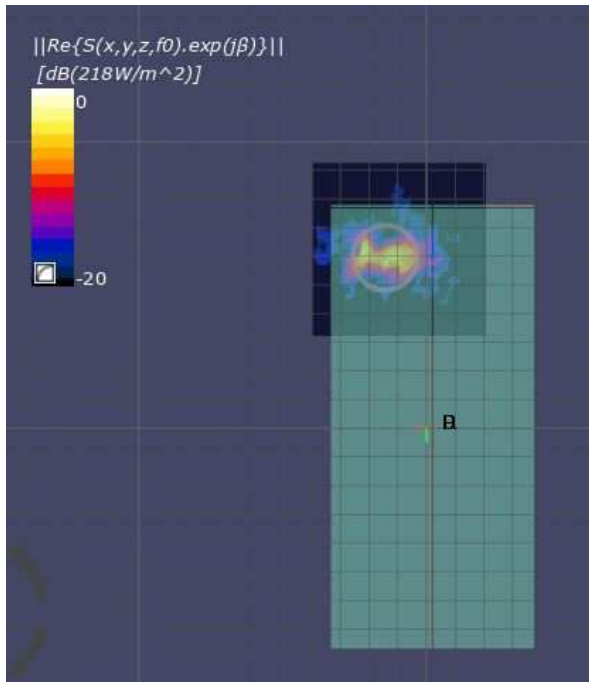
(a)Measurement



(b)Simulation

Patch antenna QTM#0 Ant\_Group1(H-polarization) beam ID 150, 4cm<sup>2</sup> Averaged power density

n260 Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 12 Back-side Mid ch.

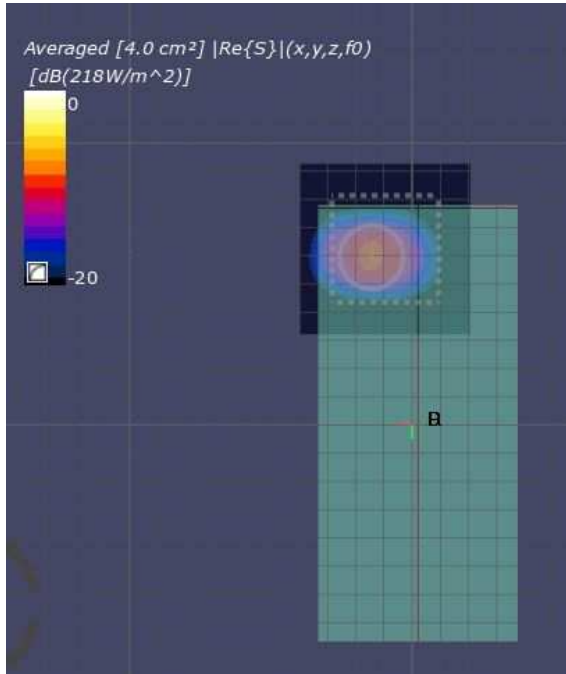


(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 12, Point power density



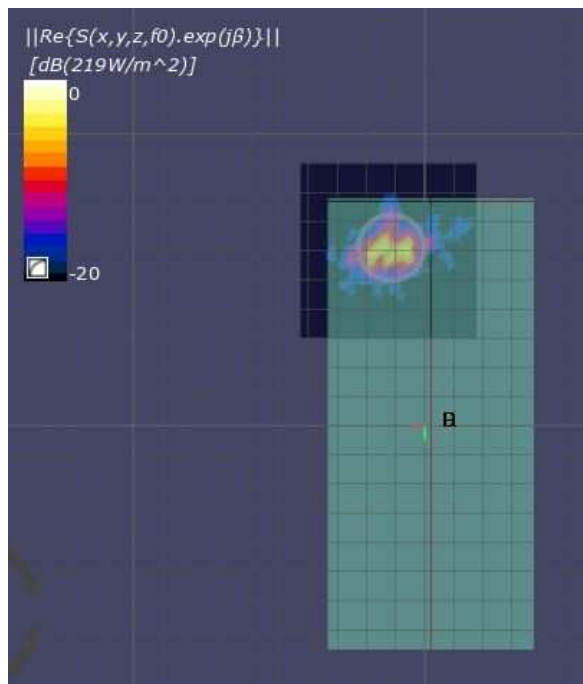
(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group0(V-polarization) beam ID 12, 4cm<sup>2</sup> Averaged power density

n260 Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 140 Back-side Mid ch.



(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 140, Point power density



(a)Measurement



(b)Simulation

Patch antenna QTM#1 Ant\_Group1(H-polarization) beam ID 140, 4cm<sup>2</sup> Averaged power density

## Simulation results

This section shows the PD simulation results of QTM#0 and QTM#1 at 28GHz and 39GHz for each evaluation surface specified in Table 1 at 2mm distance.

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 tables MIMO results represent worst case of MIMO. After sweeping the relative phase between beams at  $5^\circ$  intervals from  $0^\circ$  to  $360^\circ$ , the highest value is attached to the MIMO simulation results.

## 2.3 PD for Low/Mid/High Channel at 28GHz / 39GHz

### 2.3.1 QTM#0 – Patch Antenna

Table 2 & Table 3 show the PD simulation evaluation of QTM#0 patch antenna at 28GHz / 39GHz for the corresponding evaluation surface specified in Table 1.

Table 2. PD of QTM#0 – patch antenna (28GHz)

QTM#0 Low Ch.

| n261 Low Ch (27.56 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|-------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                    | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                         | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                    | 1      |       | QTM#0         | Patch       | 1              | 0.382                                                                   | 0.001 | 0.012 | -      | 0.007 | 0.075 |
| n261                    | 5      |       | QTM#0         | Patch       | 2              | 0.905                                                                   | 0.001 | 0.034 | -      | 0.032 | 0.217 |
| n261                    | 6      |       | QTM#0         | Patch       | 2              | 0.876                                                                   | 0.001 | 0.012 | -      | 0.032 | 0.226 |
| n261                    | 7      |       | QTM#0         | Patch       | 2              | 0.622                                                                   | 0.001 | 0.025 | -      | 0.025 | 0.129 |
| n261                    | 10     |       | QTM#0         | Patch       | 2              | 0.930                                                                   | 0.001 | 0.026 | -      | 0.024 | 0.244 |
| n261                    | 11     |       | QTM#0         | Patch       | 2              | 0.795                                                                   | 0.001 | 0.011 | -      | 0.029 | 0.185 |
| n261                    | 14     |       | QTM#0         | Patch       | 4              | 0.882                                                                   | 0.002 | 0.078 | -      | 0.041 | 0.309 |
| n261                    | 15     |       | QTM#0         | Patch       | 4              | 0.962                                                                   | 0.002 | 0.034 | -      | 0.069 | 0.287 |
| n261                    | 16     |       | QTM#0         | Patch       | 4              | 1.179                                                                   | 0.002 | 0.008 | -      | 0.068 | 0.259 |
| n261                    | 17     |       | QTM#0         | Patch       | 4              | 1.228                                                                   | 0.002 | 0.018 | -      | 0.063 | 0.216 |
| n261                    | 18     |       | QTM#0         | Patch       | 4              | 0.958                                                                   | 0.003 | 0.048 | -      | 0.029 | 0.194 |
| n261                    | 20     |       | QTM#0         | Patch       | 4              | 0.945                                                                   | 0.002 | 0.048 | -      | 0.064 | 0.322 |
| n261                    | 21     |       | QTM#0         | Patch       | 4              | 1.014                                                                   | 0.002 | 0.018 | -      | 0.071 | 0.268 |
| n261                    | 22     |       | QTM#0         | Patch       | 4              | 1.250                                                                   | 0.003 | 0.023 | -      | 0.067 | 0.229 |
| n261                    | 23     |       | QTM#0         | Patch       | 4              | 1.221                                                                   | 0.003 | 0.022 | -      | 0.042 | 0.212 |
| n261                    |        | 129   | QTM#0         | Patch       | 1              | 0.339                                                                   | 0.001 | 0.009 | -      | 0.013 | 0.057 |
| n261                    |        | 133   | QTM#0         | Patch       | 2              | 1.105                                                                   | 0.001 | 0.010 | -      | 0.019 | 0.248 |
| n261                    |        | 134   | QTM#0         | Patch       | 2              | 0.808                                                                   | 0.001 | 0.051 | -      | 0.012 | 0.192 |
| n261                    |        | 135   | QTM#0         | Patch       | 2              | 0.899                                                                   | 0.001 | 0.025 | -      | 0.031 | 0.204 |
| n261                    |        | 138   | QTM#0         | Patch       | 2              | 0.995                                                                   | 0.001 | 0.028 | -      | 0.016 | 0.206 |
| n261                    |        | 139   | QTM#0         | Patch       | 2              | 0.742                                                                   | 0.001 | 0.064 | -      | 0.014 | 0.158 |
| n261                    |        | 142   | QTM#0         | Patch       | 4              | 1.021                                                                   | 0.002 | 0.019 | -      | 0.074 | 0.320 |
| n261                    |        | 143   | QTM#0         | Patch       | 4              | 1.108                                                                   | 0.001 | 0.019 | -      | 0.057 | 0.323 |
| n261                    |        | 144   | QTM#0         | Patch       | 4              | 1.215                                                                   | 0.001 | 0.039 | -      | 0.040 | 0.276 |
| n261                    |        | 145   | QTM#0         | Patch       | 4              | 0.636                                                                   | 0.004 | 0.144 | -      | 0.037 | 0.298 |
| n261                    |        | 146   | QTM#0         | Patch       | 4              | 1.072                                                                   | 0.001 | 0.020 | -      | 0.082 | 0.366 |
| n261                    |        | 148   | QTM#0         | Patch       | 4              | 0.990                                                                   | 0.002 | 0.015 | -      | 0.068 | 0.306 |
| n261                    |        | 149   | QTM#0         | Patch       | 4              | 1.272                                                                   | 0.001 | 0.018 | -      | 0.051 | 0.327 |
| n261                    |        | 150   | QTM#0         | Patch       | 4              | 0.931                                                                   | 0.003 | 0.108 | -      | 0.033 | 0.206 |
| n261                    |        | 151   | QTM#0         | Patch       | 4              | 0.848                                                                   | 0.002 | 0.073 | -      | 0.060 | 0.339 |
| n261                    | 1      | 129   | QTM#0         | Patch       | 1              | 0.404                                                                   | 0.002 | 0.029 | -      | 0.016 | 0.091 |
| n261                    | 5      | 133   | QTM#0         | Patch       | 2              | 1.521                                                                   | 0.003 | 0.021 | -      | 0.049 | 0.326 |
| n261                    | 6      | 134   | QTM#0         | Patch       | 2              | 1.493                                                                   | 0.002 | 0.047 | -      | 0.044 | 0.229 |
| n261                    | 7      | 135   | QTM#0         | Patch       | 2              | 1.275                                                                   | 0.001 | 0.050 | -      | 0.031 | 0.333 |
| n261                    | 10     | 138   | QTM#0         | Patch       | 2              | 1.722                                                                   | 0.002 | 0.068 | -      | 0.043 | 0.533 |
| n261                    | 11     | 139   | QTM#0         | Patch       | 2              | 1.722                                                                   | 0.002 | 0.068 | -      | 0.043 | 0.533 |
| n261                    | 14     | 142   | QTM#0         | Patch       | 4              | 1.553                                                                   | 0.005 | 0.095 | -      | 0.070 | 0.652 |
| n261                    | 15     | 143   | QTM#0         | Patch       | 4              | 1.981                                                                   | 0.004 | 0.052 | -      | 0.087 | 0.740 |
| n261                    | 16     | 144   | QTM#0         | Patch       | 4              | 1.940                                                                   | 0.004 | 0.058 | -      | 0.080 | 0.593 |
| n261                    | 17     | 145   | QTM#0         | Patch       | 4              | 1.840                                                                   | 0.005 | 0.161 | -      | 0.079 | 0.406 |
| n261                    | 18     | 146   | QTM#0         | Patch       | 4              | 1.978                                                                   | 0.004 | 0.071 | -      | 0.063 | 0.562 |
| n261                    | 20     | 148   | QTM#0         | Patch       | 4              | 1.540                                                                   | 0.005 | 0.103 | -      | 0.088 | 0.648 |
| n261                    | 21     | 149   | QTM#0         | Patch       | 4              | 2.203                                                                   | 0.003 | 0.027 | -      | 0.082 | 0.662 |
| n261                    | 22     | 150   | QTM#0         | Patch       | 4              | 1.685                                                                   | 0.006 | 0.102 | -      | 0.078 | 0.451 |
| n261                    | 23     | 151   | QTM#0         | Patch       | 4              | 1.893                                                                   | 0.004 | 0.133 | -      | 0.056 | 0.493 |

QTM#0 Mid Ch.

| n261 Mid Ch (27.925 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                     | 1      |       | QTM#0         | Patch       | 1              | 0.358                                                                   | 0.001 | 0.011 | -      | 0.009 | 0.079 |
| n261                     | 5      |       | QTM#0         | Patch       | 2              | 0.854                                                                   | 0.002 | 0.026 | -      | 0.032 | 0.214 |
| n261                     | 6      |       | QTM#0         | Patch       | 2              | 0.837                                                                   | 0.001 | 0.010 | -      | 0.036 | 0.210 |
| n261                     | 7      |       | QTM#0         | Patch       | 2              | 0.614                                                                   | 0.001 | 0.036 | -      | 0.028 | 0.116 |
| n261                     | 10     |       | QTM#0         | Patch       | 2              | 0.917                                                                   | 0.001 | 0.022 | -      | 0.028 | 0.239 |
| n261                     | 11     |       | QTM#0         | Patch       | 2              | 0.744                                                                   | 0.001 | 0.018 | -      | 0.033 | 0.162 |
| n261                     | 14     |       | QTM#0         | Patch       | 4              | 0.866                                                                   | 0.002 | 0.082 | -      | 0.049 | 0.280 |
| n261                     | 15     |       | QTM#0         | Patch       | 4              | 0.896                                                                   | 0.002 | 0.039 | -      | 0.064 | 0.321 |
| n261                     | 16     |       | QTM#0         | Patch       | 4              | 1.020                                                                   | 0.001 | 0.011 | -      | 0.069 | 0.297 |
| n261                     | 17     |       | QTM#0         | Patch       | 4              | 1.248                                                                   | 0.002 | 0.028 | -      | 0.068 | 0.194 |
| n261                     | 18     |       | QTM#0         | Patch       | 4              | 0.895                                                                   | 0.003 | 0.040 | -      | 0.034 | 0.199 |
| n261                     | 20     |       | QTM#0         | Patch       | 4              | 0.886                                                                   | 0.003 | 0.054 | -      | 0.070 | 0.295 |
| n261                     | 21     |       | QTM#0         | Patch       | 4              | 0.925                                                                   | 0.002 | 0.026 | -      | 0.064 | 0.334 |
| n261                     | 22     |       | QTM#0         | Patch       | 4              | 1.178                                                                   | 0.002 | 0.021 | -      | 0.067 | 0.232 |
| n261                     | 23     |       | QTM#0         | Patch       | 4              | 1.161                                                                   | 0.003 | 0.021 | -      | 0.033 | 0.209 |
| n261                     |        | 129   | QTM#0         | Patch       | 1              | 0.310                                                                   | 0.001 | 0.010 | -      | 0.015 | 0.051 |
| n261                     |        | 133   | QTM#0         | Patch       | 2              | 1.088                                                                   | 0.001 | 0.005 | -      | 0.016 | 0.260 |
| n261                     |        | 134   | QTM#0         | Patch       | 2              | 0.783                                                                   | 0.001 | 0.047 | -      | 0.011 | 0.222 |
| n261                     |        | 135   | QTM#0         | Patch       | 2              | 0.811                                                                   | 0.002 | 0.033 | -      | 0.025 | 0.199 |
| n261                     |        | 138   | QTM#0         | Patch       | 2              | 0.988                                                                   | 0.001 | 0.021 | -      | 0.015 | 0.218 |
| n261                     |        | 139   | QTM#0         | Patch       | 2              | 0.747                                                                   | 0.001 | 0.070 | -      | 0.014 | 0.185 |
| n261                     |        | 142   | QTM#0         | Patch       | 4              | 0.883                                                                   | 0.003 | 0.012 | -      | 0.076 | 0.352 |
| n261                     |        | 143   | QTM#0         | Patch       | 4              | 1.037                                                                   | 0.002 | 0.014 | -      | 0.058 | 0.300 |
| n261                     |        | 144   | QTM#0         | Patch       | 4              | 1.187                                                                   | 0.002 | 0.033 | -      | 0.045 | 0.274 |
| n261                     |        | 145   | QTM#0         | Patch       | 4              | 0.566                                                                   | 0.004 | 0.166 | -      | 0.045 | 0.213 |
| n261                     |        | 146   | QTM#0         | Patch       | 4              | 1.054                                                                   | 0.002 | 0.033 | -      | 0.072 | 0.372 |
| n261                     |        | 148   | QTM#0         | Patch       | 4              | 0.930                                                                   | 0.003 | 0.012 | -      | 0.071 | 0.329 |
| n261                     |        | 149   | QTM#0         | Patch       | 4              | 1.221                                                                   | 0.001 | 0.012 | -      | 0.057 | 0.301 |
| n261                     |        | 150   | QTM#0         | Patch       | 4              | 0.912                                                                   | 0.004 | 0.093 | -      | 0.035 | 0.235 |
| n261                     |        | 151   | QTM#0         | Patch       | 4              | 0.794                                                                   | 0.003 | 0.105 | -      | 0.066 | 0.294 |
| n261                     | 1      | 129   | QTM#0         | Patch       | 1              | 0.380                                                                   | 0.002 | 0.030 | -      | 0.024 | 0.090 |
| n261                     | 5      | 133   | QTM#0         | Patch       | 2              | 1.428                                                                   | 0.003 | 0.018 | -      | 0.057 | 0.292 |
| n261                     | 6      | 134   | QTM#0         | Patch       | 2              | 1.530                                                                   | 0.002 | 0.052 | -      | 0.045 | 0.197 |
| n261                     | 7      | 135   | QTM#0         | Patch       | 2              | 1.177                                                                   | 0.002 | 0.057 | -      | 0.034 | 0.322 |
| n261                     | 10     | 138   | QTM#0         | Patch       | 2              | 1.641                                                                   | 0.004 | 0.042 | -      | 0.048 | 0.569 |
| n261                     | 11     | 139   | QTM#0         | Patch       | 2              | 1.241                                                                   | 0.002 | 0.067 | -      | 0.043 | 0.392 |
| n261                     | 14     | 142   | QTM#0         | Patch       | 4              | 1.652                                                                   | 0.006 | 0.095 | -      | 0.092 | 0.716 |
| n261                     | 15     | 143   | QTM#0         | Patch       | 4              | 1.885                                                                   | 0.004 | 0.060 | -      | 0.088 | 0.697 |
| n261                     | 16     | 144   | QTM#0         | Patch       | 4              | 1.842                                                                   | 0.005 | 0.048 | -      | 0.103 | 0.584 |
| n261                     | 17     | 145   | QTM#0         | Patch       | 4              | 1.821                                                                   | 0.006 | 0.151 | -      | 0.085 | 0.368 |
| n261                     | 18     | 146   | QTM#0         | Patch       | 4              | 1.694                                                                   | 0.004 | 0.108 | -      | 0.066 | 0.615 |
| n261                     | 20     | 148   | QTM#0         | Patch       | 4              | 1.468                                                                   | 0.007 | 0.111 | -      | 0.110 | 0.676 |
| n261                     | 21     | 149   | QTM#0         | Patch       | 4              | 2.140                                                                   | 0.003 | 0.039 | -      | 0.077 | 0.615 |
| n261                     | 22     | 150   | QTM#0         | Patch       | 4              | 1.435                                                                   | 0.009 | 0.085 | -      | 0.105 | 0.481 |
| n261                     | 23     | 151   | QTM#0         | Patch       | 4              | 1.717                                                                   | 0.006 | 0.191 | -      | 0.067 | 0.490 |

# QTM#0 High Ch

| n261 High Ch (28.29 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                     | 1      |       | QTM#0         | Patch       | 1              | 0.353                                                                   | 0.001 | 0.011 | -      | 0.008 | 0.070 |
| n261                     | 5      |       | QTM#0         | Patch       | 2              | 0.837                                                                   | 0.001 | 0.025 | -      | 0.044 | 0.198 |
| n261                     | 6      |       | QTM#0         | Patch       | 2              | 0.823                                                                   | 0.001 | 0.016 | -      | 0.034 | 0.178 |
| n261                     | 7      |       | QTM#0         | Patch       | 2              | 0.577                                                                   | 0.001 | 0.024 | -      | 0.020 | 0.089 |
| n261                     | 10     |       | QTM#0         | Patch       | 2              | 0.882                                                                   | 0.001 | 0.026 | -      | 0.035 | 0.222 |
| n261                     | 11     |       | QTM#0         | Patch       | 2              | 0.728                                                                   | 0.001 | 0.014 | -      | 0.034 | 0.128 |
| n261                     | 14     |       | QTM#0         | Patch       | 4              | 0.867                                                                   | 0.003 | 0.076 | -      | 0.049 | 0.250 |
| n261                     | 15     |       | QTM#0         | Patch       | 4              | 0.854                                                                   | 0.002 | 0.042 | -      | 0.052 | 0.313 |
| n261                     | 16     |       | QTM#0         | Patch       | 4              | 0.930                                                                   | 0.001 | 0.011 | -      | 0.065 | 0.321 |
| n261                     | 17     |       | QTM#0         | Patch       | 4              | 1.144                                                                   | 0.002 | 0.025 | -      | 0.057 | 0.216 |
| n261                     | 18     |       | QTM#0         | Patch       | 4              | 0.809                                                                   | 0.003 | 0.045 | -      | 0.022 | 0.174 |
| n261                     | 20     |       | QTM#0         | Patch       | 4              | 0.855                                                                   | 0.002 | 0.054 | -      | 0.053 | 0.278 |
| n261                     | 21     |       | QTM#0         | Patch       | 4              | 0.848                                                                   | 0.002 | 0.028 | -      | 0.055 | 0.335 |
| n261                     | 22     |       | QTM#0         | Patch       | 4              | 1.099                                                                   | 0.002 | 0.019 | -      | 0.063 | 0.285 |
| n261                     | 23     |       | QTM#0         | Patch       | 4              | 1.076                                                                   | 0.003 | 0.030 | -      | 0.036 | 0.195 |
| n261                     |        | 129   | QTM#0         | Patch       | 1              | 0.286                                                                   | 0.001 | 0.009 | -      | 0.015 | 0.034 |
| n261                     |        | 133   | QTM#0         | Patch       | 2              | 1.034                                                                   | 0.001 | 0.008 | -      | 0.017 | 0.246 |
| n261                     |        | 134   | QTM#0         | Patch       | 2              | 0.778                                                                   | 0.002 | 0.047 | -      | 0.015 | 0.206 |
| n261                     |        | 135   | QTM#0         | Patch       | 2              | 0.749                                                                   | 0.002 | 0.033 | -      | 0.023 | 0.172 |
| n261                     |        | 138   | QTM#0         | Patch       | 2              | 0.966                                                                   | 0.001 | 0.023 | -      | 0.018 | 0.206 |
| n261                     |        | 139   | QTM#0         | Patch       | 2              | 0.772                                                                   | 0.002 | 0.068 | -      | 0.010 | 0.171 |
| n261                     |        | 142   | QTM#0         | Patch       | 4              | 0.855                                                                   | 0.002 | 0.015 | -      | 0.071 | 0.323 |
| n261                     |        | 143   | QTM#0         | Patch       | 4              | 0.984                                                                   | 0.001 | 0.017 | -      | 0.050 | 0.300 |
| n261                     |        | 144   | QTM#0         | Patch       | 4              | 1.105                                                                   | 0.002 | 0.046 | -      | 0.047 | 0.259 |
| n261                     |        | 145   | QTM#0         | Patch       | 4              | 0.540                                                                   | 0.004 | 0.142 | -      | 0.036 | 0.214 |
| n261                     |        | 146   | QTM#0         | Patch       | 4              | 1.029                                                                   | 0.002 | 0.043 | -      | 0.073 | 0.305 |
| n261                     |        | 148   | QTM#0         | Patch       | 4              | 0.902                                                                   | 0.002 | 0.015 | -      | 0.065 | 0.323 |
| n261                     |        | 149   | QTM#0         | Patch       | 4              | 1.103                                                                   | 0.001 | 0.020 | -      | 0.054 | 0.285 |
| n261                     |        | 150   | QTM#0         | Patch       | 4              | 0.907                                                                   | 0.004 | 0.096 | -      | 0.030 | 0.226 |
| n261                     |        | 151   | QTM#0         | Patch       | 4              | 0.760                                                                   | 0.003 | 0.108 | -      | 0.054 | 0.249 |
| n261                     | 1      | 129   | QTM#0         | Patch       | 1              | 0.382                                                                   | 0.001 | 0.025 | -      | 0.028 | 0.078 |
| n261                     | 5      | 133   | QTM#0         | Patch       | 2              | 1.338                                                                   | 0.003 | 0.029 | -      | 0.068 | 0.228 |
| n261                     | 6      | 134   | QTM#0         | Patch       | 2              | 1.491                                                                   | 0.002 | 0.055 | -      | 0.041 | 0.166 |
| n261                     | 7      | 135   | QTM#0         | Patch       | 2              | 1.130                                                                   | 0.004 | 0.062 | -      | 0.038 | 0.307 |
| n261                     | 10     | 138   | QTM#0         | Patch       | 2              | 1.604                                                                   | 0.003 | 0.047 | -      | 0.055 | 0.534 |
| n261                     | 11     | 139   | QTM#0         | Patch       | 2              | 1.319                                                                   | 0.004 | 0.080 | -      | 0.057 | 0.348 |
| n261                     | 14     | 142   | QTM#0         | Patch       | 4              | 1.679                                                                   | 0.005 | 0.100 | -      | 0.084 | 0.772 |
| n261                     | 15     | 143   | QTM#0         | Patch       | 4              | 1.699                                                                   | 0.003 | 0.071 | -      | 0.080 | 0.732 |
| n261                     | 16     | 144   | QTM#0         | Patch       | 4              | 1.847                                                                   | 0.004 | 0.065 | -      | 0.118 | 0.537 |
| n261                     | 17     | 145   | QTM#0         | Patch       | 4              | 1.744                                                                   | 0.007 | 0.151 | -      | 0.087 | 0.384 |
| n261                     | 18     | 146   | QTM#0         | Patch       | 4              | 1.660                                                                   | 0.007 | 0.133 | -      | 0.062 | 0.542 |
| n261                     | 20     | 148   | QTM#0         | Patch       | 4              | 1.410                                                                   | 0.005 | 0.118 | -      | 0.098 | 0.686 |
| n261                     | 21     | 149   | QTM#0         | Patch       | 4              | 2.033                                                                   | 0.003 | 0.038 | -      | 0.084 | 0.605 |
| n261                     | 22     | 150   | QTM#0         | Patch       | 4              | 1.416                                                                   | 0.006 | 0.093 | -      | 0.115 | 0.514 |
| n261                     | 23     | 151   | QTM#0         | Patch       | 4              | 1.667                                                                   | 0.009 | 0.212 | -      | 0.054 | 0.474 |

Table 3. PD of QTM#0 – patch antenna (39GHz)

QTM#0 Low Ch

| n260 Low Ch (37.05 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|-------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                    | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                         | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                    | 1      |       | QTM#0         | Patch       | 1              | 0.493                                                                   | 0.001 | 0.009 | -      | 0.004 | 0.051 |
| n260                    | 5      |       | QTM#0         | Patch       | 2              | 0.958                                                                   | 0.001 | 0.037 | -      | 0.011 | 0.101 |
| n260                    | 6      |       | QTM#0         | Patch       | 2              | 1.115                                                                   | 0.002 | 0.024 | -      | 0.026 | 0.085 |
| n260                    | 7      |       | QTM#0         | Patch       | 2              | 1.107                                                                   | 0.002 | 0.044 | -      | 0.012 | 0.100 |
| n260                    | 10     |       | QTM#0         | Patch       | 2              | 1.550                                                                   | 0.002 | 0.047 | -      | 0.021 | 0.082 |
| n260                    | 11     |       | QTM#0         | Patch       | 2              | 1.097                                                                   | 0.002 | 0.038 | -      | 0.022 | 0.108 |
| n260                    | 14     |       | QTM#0         | Patch       | 4              | 1.451                                                                   | 0.003 | 0.069 | -      | 0.037 | 0.250 |
| n260                    | 15     |       | QTM#0         | Patch       | 4              | 1.295                                                                   | 0.003 | 0.061 | -      | 0.024 | 0.137 |
| n260                    | 16     |       | QTM#0         | Patch       | 4              | 2.054                                                                   | 0.002 | 0.052 | -      | 0.027 | 0.186 |
| n260                    | 17     |       | QTM#0         | Patch       | 4              | 2.103                                                                   | 0.004 | 0.085 | -      | 0.037 | 0.262 |
| n260                    | 18     |       | QTM#0         | Patch       | 4              | 1.579                                                                   | 0.002 | 0.073 | -      | 0.033 | 0.279 |
| n260                    | 20     |       | QTM#0         | Patch       | 4              | 1.356                                                                   | 0.002 | 0.059 | -      | 0.033 | 0.194 |
| n260                    | 21     |       | QTM#0         | Patch       | 4              | 1.653                                                                   | 0.004 | 0.084 | -      | 0.019 | 0.163 |
| n260                    | 22     |       | QTM#0         | Patch       | 4              | 2.346                                                                   | 0.005 | 0.026 | -      | 0.027 | 0.251 |
| n260                    | 23     |       | QTM#0         | Patch       | 4              | 1.824                                                                   | 0.003 | 0.089 | -      | 0.037 | 0.345 |
| n260                    |        | 129   | QTM#0         | Patch       | 1              | 0.572                                                                   | 0.001 | 0.005 | -      | 0.006 | 0.076 |
| n260                    |        | 133   | QTM#0         | Patch       | 2              | 0.997                                                                   | 0.001 | 0.031 | -      | 0.018 | 0.072 |
| n260                    |        | 134   | QTM#0         | Patch       | 2              | 1.242                                                                   | 0.002 | 0.028 | -      | 0.009 | 0.177 |
| n260                    |        | 135   | QTM#0         | Patch       | 2              | 1.464                                                                   | 0.001 | 0.033 | -      | 0.019 | 0.166 |
| n260                    |        | 138   | QTM#0         | Patch       | 2              | 1.384                                                                   | 0.001 | 0.018 | -      | 0.011 | 0.142 |
| n260                    |        | 139   | QTM#0         | Patch       | 2              | 1.227                                                                   | 0.002 | 0.046 | -      | 0.014 | 0.179 |
| n260                    |        | 142   | QTM#0         | Patch       | 4              | 1.116                                                                   | 0.002 | 0.108 | -      | 0.044 | 0.178 |
| n260                    |        | 143   | QTM#0         | Patch       | 4              | 1.134                                                                   | 0.002 | 0.064 | -      | 0.027 | 0.172 |
| n260                    |        | 144   | QTM#0         | Patch       | 4              | 1.444                                                                   | 0.002 | 0.020 | -      | 0.050 | 0.218 |
| n260                    |        | 145   | QTM#0         | Patch       | 4              | 1.320                                                                   | 0.004 | 0.119 | -      | 0.038 | 0.242 |
| n260                    |        | 146   | QTM#0         | Patch       | 4              | 1.197                                                                   | 0.002 | 0.090 | -      | 0.040 | 0.171 |
| n260                    |        | 148   | QTM#0         | Patch       | 4              | 1.223                                                                   | 0.002 | 0.088 | -      | 0.045 | 0.158 |
| n260                    |        | 149   | QTM#0         | Patch       | 4              | 1.292                                                                   | 0.002 | 0.016 | -      | 0.044 | 0.173 |
| n260                    |        | 150   | QTM#0         | Patch       | 4              | 1.845                                                                   | 0.003 | 0.086 | -      | 0.061 | 0.295 |
| n260                    |        | 151   | QTM#0         | Patch       | 4              | 1.308                                                                   | 0.003 | 0.112 | -      | 0.043 | 0.171 |
| n260                    | 1      | 129   | QTM#0         | Patch       | 1              | 1.308                                                                   | 0.003 | 0.112 | -      | 0.043 | 0.171 |
| n260                    | 5      | 133   | QTM#0         | Patch       | 2              | 1.652                                                                   | 0.003 | 0.082 | -      | 0.029 | 0.146 |
| n260                    | 6      | 134   | QTM#0         | Patch       | 2              | 2.239                                                                   | 0.003 | 0.046 | -      | 0.042 | 0.180 |
| n260                    | 7      | 135   | QTM#0         | Patch       | 2              | 2.251                                                                   | 0.002 | 0.115 | -      | 0.026 | 0.319 |
| n260                    | 10     | 138   | QTM#0         | Patch       | 2              | 2.008                                                                   | 0.003 | 0.040 | -      | 0.028 | 0.230 |
| n260                    | 11     | 139   | QTM#0         | Patch       | 2              | 2.151                                                                   | 0.003 | 0.061 | -      | 0.041 | 0.201 |
| n260                    | 14     | 142   | QTM#0         | Patch       | 4              | 2.836                                                                   | 0.005 | 0.261 | -      | 0.080 | 0.569 |
| n260                    | 15     | 143   | QTM#0         | Patch       | 4              | 2.320                                                                   | 0.005 | 0.151 | -      | 0.044 | 0.278 |
| n260                    | 16     | 144   | QTM#0         | Patch       | 4              | 2.844                                                                   | 0.004 | 0.070 | -      | 0.083 | 0.489 |
| n260                    | 17     | 145   | QTM#0         | Patch       | 4              | 3.454                                                                   | 0.010 | 0.335 | -      | 0.099 | 0.539 |
| n260                    | 18     | 146   | QTM#0         | Patch       | 4              | 2.442                                                                   | 0.006 | 0.220 | -      | 0.059 | 0.464 |
| n260                    | 20     | 148   | QTM#0         | Patch       | 4              | 2.253                                                                   | 0.006 | 0.183 | -      | 0.072 | 0.407 |
| n260                    | 21     | 149   | QTM#0         | Patch       | 4              | 2.513                                                                   | 0.006 | 0.095 | -      | 0.060 | 0.346 |
| n260                    | 22     | 150   | QTM#0         | Patch       | 4              | 3.846                                                                   | 0.005 | 0.180 | -      | 0.118 | 0.346 |
| n260                    | 23     | 151   | QTM#0         | Patch       | 4              | 2.782                                                                   | 0.006 | 0.313 | -      | 0.062 | 0.623 |

# QTM#0 Mid Ch

| n260 Mid Ch (38.5 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                   | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                        | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                   | 1      |       | QTM#0         | Patch       | 1              | 0.598                                                                   | 0.001 | 0.006 | -      | 0.005 | 0.052 |
| n260                   | 5      |       | QTM#0         | Patch       | 2              | 0.957                                                                   | 0.001 | 0.040 | -      | 0.017 | 0.121 |
| n260                   | 6      |       | QTM#0         | Patch       | 2              | 1.158                                                                   | 0.002 | 0.029 | -      | 0.012 | 0.130 |
| n260                   | 7      |       | QTM#0         | Patch       | 2              | 1.049                                                                   | 0.002 | 0.044 | -      | 0.014 | 0.117 |
| n260                   | 10     |       | QTM#0         | Patch       | 2              | 1.650                                                                   | 0.002 | 0.059 | -      | 0.012 | 0.080 |
| n260                   | 11     |       | QTM#0         | Patch       | 2              | 1.153                                                                   | 0.002 | 0.036 | -      | 0.015 | 0.167 |
| n260                   | 14     |       | QTM#0         | Patch       | 4              | 1.728                                                                   | 0.004 | 0.092 | -      | 0.033 | 0.397 |
| n260                   | 15     |       | QTM#0         | Patch       | 4              | 1.374                                                                   | 0.004 | 0.067 | -      | 0.018 | 0.165 |
| n260                   | 16     |       | QTM#0         | Patch       | 4              | 1.965                                                                   | 0.003 | 0.070 | -      | 0.025 | 0.193 |
| n260                   | 17     |       | QTM#0         | Patch       | 4              | 2.291                                                                   | 0.003 | 0.075 | -      | 0.038 | 0.306 |
| n260                   | 18     |       | QTM#0         | Patch       | 4              | 1.660                                                                   | 0.003 | 0.099 | -      | 0.026 | 0.348 |
| n260                   | 20     |       | QTM#0         | Patch       | 4              | 1.489                                                                   | 0.003 | 0.091 | -      | 0.023 | 0.331 |
| n260                   | 21     |       | QTM#0         | Patch       | 4              | 1.511                                                                   | 0.004 | 0.104 | -      | 0.023 | 0.153 |
| n260                   | 22     |       | QTM#0         | Patch       | 4              | 2.518                                                                   | 0.002 | 0.034 | -      | 0.023 | 0.262 |
| n260                   | 23     |       | QTM#0         | Patch       | 4              | 2.026                                                                   | 0.003 | 0.089 | -      | 0.038 | 0.355 |
| n260                   |        | 129   | QTM#0         | Patch       | 1              | 0.690                                                                   | 0.001 | 0.008 | -      | 0.006 | 0.105 |
| n260                   |        | 133   | QTM#0         | Patch       | 2              | 1.033                                                                   | 0.001 | 0.051 | -      | 0.015 | 0.062 |
| n260                   |        | 134   | QTM#0         | Patch       | 2              | 1.367                                                                   | 0.002 | 0.045 | -      | 0.018 | 0.244 |
| n260                   |        | 135   | QTM#0         | Patch       | 2              | 1.237                                                                   | 0.002 | 0.036 | -      | 0.015 | 0.196 |
| n260                   |        | 138   | QTM#0         | Patch       | 2              | 1.274                                                                   | 0.001 | 0.035 | -      | 0.012 | 0.184 |
| n260                   |        | 139   | QTM#0         | Patch       | 2              | 1.125                                                                   | 0.001 | 0.045 | -      | 0.015 | 0.280 |
| n260                   |        | 142   | QTM#0         | Patch       | 4              | 1.198                                                                   | 0.003 | 0.136 | -      | 0.029 | 0.320 |
| n260                   |        | 143   | QTM#0         | Patch       | 4              | 1.015                                                                   | 0.003 | 0.085 | -      | 0.042 | 0.181 |
| n260                   |        | 144   | QTM#0         | Patch       | 4              | 1.352                                                                   | 0.002 | 0.031 | -      | 0.058 | 0.250 |
| n260                   |        | 145   | QTM#0         | Patch       | 4              | 1.712                                                                   | 0.003 | 0.146 | -      | 0.045 | 0.275 |
| n260                   |        | 146   | QTM#0         | Patch       | 4              | 1.274                                                                   | 0.002 | 0.118 | -      | 0.028 | 0.262 |
| n260                   |        | 148   | QTM#0         | Patch       | 4              | 1.184                                                                   | 0.002 | 0.104 | -      | 0.037 | 0.246 |
| n260                   |        | 149   | QTM#0         | Patch       | 4              | 1.329                                                                   | 0.002 | 0.042 | -      | 0.031 | 0.274 |
| n260                   |        | 150   | QTM#0         | Patch       | 4              | 1.811                                                                   | 0.004 | 0.094 | -      | 0.074 | 0.231 |
| n260                   |        | 151   | QTM#0         | Patch       | 4              | 1.224                                                                   | 0.002 | 0.138 | -      | 0.029 | 0.302 |
| n260                   | 1      | 129   | QTM#0         | Patch       | 1              | 0.927                                                                   | 0.002 | 0.015 | -      | 0.020 | 0.156 |
| n260                   | 5      | 133   | QTM#0         | Patch       | 2              | 1.533                                                                   | 0.004 | 0.136 | -      | 0.033 | 0.177 |
| n260                   | 6      | 134   | QTM#0         | Patch       | 2              | 2.814                                                                   | 0.004 | 0.063 | -      | 0.036 | 0.131 |
| n260                   | 7      | 135   | QTM#0         | Patch       | 2              | 2.523                                                                   | 0.004 | 0.124 | -      | 0.028 | 0.502 |
| n260                   | 10     | 138   | QTM#0         | Patch       | 2              | 2.208                                                                   | 0.003 | 0.030 | -      | 0.026 | 0.184 |
| n260                   | 11     | 139   | QTM#0         | Patch       | 2              | 2.453                                                                   | 0.004 | 0.076 | -      | 0.030 | 0.208 |
| n260                   | 14     | 142   | QTM#0         | Patch       | 4              | 3.296                                                                   | 0.007 | 0.384 | -      | 0.053 | 0.968 |
| n260                   | 15     | 143   | QTM#0         | Patch       | 4              | 2.899                                                                   | 0.010 | 0.261 | -      | 0.042 | 0.571 |
| n260                   | 16     | 144   | QTM#0         | Patch       | 4              | 3.157                                                                   | 0.004 | 0.143 | -      | 0.053 | 0.461 |
| n260                   | 17     | 145   | QTM#0         | Patch       | 4              | 4.076                                                                   | 0.006 | 0.329 | -      | 0.103 | 0.697 |
| n260                   | 18     | 146   | QTM#0         | Patch       | 4              | 2.830                                                                   | 0.007 | 0.358 | -      | 0.046 | 0.877 |
| n260                   | 20     | 148   | QTM#0         | Patch       | 4              | 2.994                                                                   | 0.008 | 0.306 | -      | 0.048 | 0.836 |
| n260                   | 21     | 149   | QTM#0         | Patch       | 4              | 2.374                                                                   | 0.006 | 0.179 | -      | 0.051 | 0.380 |
| n260                   | 22     | 150   | QTM#0         | Patch       | 4              | 3.836                                                                   | 0.005 | 0.153 | -      | 0.095 | 0.582 |
| n260                   | 23     | 151   | QTM#0         | Patch       | 4              | 3.222                                                                   | 0.007 | 0.368 | -      | 0.079 | 0.949 |

# QTM#0 High Ch

| n260 High Ch (39.95 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                     | 1      |       | QTM#0         | Patch       | 1              | 0.600                                                                   | 0.001 | 0.006 | -      | 0.004 | 0.087 |
| n260                     | 5      |       | QTM#0         | Patch       | 2              | 0.952                                                                   | 0.002 | 0.027 | -      | 0.014 | 0.097 |
| n260                     | 6      |       | QTM#0         | Patch       | 2              | 1.243                                                                   | 0.001 | 0.046 | -      | 0.007 | 0.150 |
| n260                     | 7      |       | QTM#0         | Patch       | 2              | 1.129                                                                   | 0.002 | 0.037 | -      | 0.010 | 0.097 |
| n260                     | 10     |       | QTM#0         | Patch       | 2              | 1.673                                                                   | 0.001 | 0.051 | -      | 0.010 | 0.076 |
| n260                     | 11     |       | QTM#0         | Patch       | 2              | 1.179                                                                   | 0.003 | 0.037 | -      | 0.011 | 0.089 |
| n260                     | 14     |       | QTM#0         | Patch       | 4              | 1.735                                                                   | 0.006 | 0.080 | -      | 0.038 | 0.216 |
| n260                     | 15     |       | QTM#0         | Patch       | 4              | 1.062                                                                   | 0.004 | 0.082 | -      | 0.027 | 0.175 |
| n260                     | 16     |       | QTM#0         | Patch       | 4              | 1.708                                                                   | 0.002 | 0.105 | -      | 0.015 | 0.183 |
| n260                     | 17     |       | QTM#0         | Patch       | 4              | 2.460                                                                   | 0.004 | 0.045 | -      | 0.040 | 0.264 |
| n260                     | 18     |       | QTM#0         | Patch       | 4              | 1.420                                                                   | 0.005 | 0.087 | -      | 0.032 | 0.245 |
| n260                     | 20     |       | QTM#0         | Patch       | 4              | 1.214                                                                   | 0.005 | 0.090 | -      | 0.027 | 0.233 |
| n260                     | 21     |       | QTM#0         | Patch       | 4              | 1.202                                                                   | 0.004 | 0.086 | -      | 0.014 | 0.166 |
| n260                     | 22     |       | QTM#0         | Patch       | 4              | 2.277                                                                   | 0.002 | 0.064 | -      | 0.024 | 0.227 |
| n260                     | 23     |       | QTM#0         | Patch       | 4              | 2.113                                                                   | 0.005 | 0.058 | -      | 0.044 | 0.226 |
| n260                     |        | 129   | QTM#0         | Patch       | 1              | 0.755                                                                   | 0.000 | 0.008 | -      | 0.005 | 0.083 |
| n260                     |        | 133   | QTM#0         | Patch       | 2              | 1.014                                                                   | 0.001 | 0.044 | -      | 0.014 | 0.096 |
| n260                     |        | 134   | QTM#0         | Patch       | 2              | 1.306                                                                   | 0.002 | 0.034 | -      | 0.012 | 0.215 |
| n260                     |        | 135   | QTM#0         | Patch       | 2              | 1.049                                                                   | 0.001 | 0.043 | -      | 0.013 | 0.154 |
| n260                     |        | 138   | QTM#0         | Patch       | 2              | 1.017                                                                   | 0.002 | 0.047 | -      | 0.013 | 0.188 |
| n260                     |        | 139   | QTM#0         | Patch       | 2              | 1.200                                                                   | 0.001 | 0.040 | -      | 0.013 | 0.184 |
| n260                     |        | 142   | QTM#0         | Patch       | 4              | 1.205                                                                   | 0.002 | 0.130 | -      | 0.026 | 0.156 |
| n260                     |        | 143   | QTM#0         | Patch       | 4              | 1.058                                                                   | 0.002 | 0.100 | -      | 0.024 | 0.153 |
| n260                     |        | 144   | QTM#0         | Patch       | 4              | 1.390                                                                   | 0.002 | 0.039 | -      | 0.044 | 0.226 |
| n260                     |        | 145   | QTM#0         | Patch       | 4              | 1.610                                                                   | 0.002 | 0.115 | -      | 0.048 | 0.186 |
| n260                     |        | 146   | QTM#0         | Patch       | 4              | 1.089                                                                   | 0.002 | 0.129 | -      | 0.023 | 0.140 |
| n260                     |        | 148   | QTM#0         | Patch       | 4              | 0.905                                                                   | 0.002 | 0.123 | -      | 0.019 | 0.140 |
| n260                     |        | 149   | QTM#0         | Patch       | 4              | 1.044                                                                   | 0.003 | 0.053 | -      | 0.019 | 0.216 |
| n260                     |        | 150   | QTM#0         | Patch       | 4              | 1.697                                                                   | 0.002 | 0.063 | -      | 0.057 | 0.219 |
| n260                     |        | 151   | QTM#0         | Patch       | 4              | 1.262                                                                   | 0.002 | 0.112 | -      | 0.033 | 0.159 |
| n260                     | 1      | 129   | QTM#0         | Patch       | 1              | 1.051                                                                   | 0.002 | 0.011 | -      | 0.011 | 0.134 |
| n260                     | 5      | 133   | QTM#0         | Patch       | 2              | 1.424                                                                   | 0.004 | 0.065 | -      | 0.022 | 0.208 |
| n260                     | 6      | 134   | QTM#0         | Patch       | 2              | 2.749                                                                   | 0.003 | 0.066 | -      | 0.026 | 0.178 |
| n260                     | 7      | 135   | QTM#0         | Patch       | 2              | 3.076                                                                   | 0.003 | 0.136 | -      | 0.026 | 0.412 |
| n260                     | 10     | 138   | QTM#0         | Patch       | 2              | 2.317                                                                   | 0.003 | 0.021 | -      | 0.026 | 0.127 |
| n260                     | 11     | 139   | QTM#0         | Patch       | 2              | 2.811                                                                   | 0.004 | 0.065 | -      | 0.040 | 0.149 |
| n260                     | 14     | 142   | QTM#0         | Patch       | 4              | 3.578                                                                   | 0.009 | 0.251 | -      | 0.059 | 0.447 |
| n260                     | 15     | 143   | QTM#0         | Patch       | 4              | 3.345                                                                   | 0.007 | 0.224 | -      | 0.050 | 0.535 |
| n260                     | 16     | 144   | QTM#0         | Patch       | 4              | 2.623                                                                   | 0.005 | 0.208 | -      | 0.035 | 0.517 |
| n260                     | 17     | 145   | QTM#0         | Patch       | 4              | 3.658                                                                   | 0.006 | 0.166 | -      | 0.065 | 0.590 |
| n260                     | 18     | 146   | QTM#0         | Patch       | 4              | 3.500                                                                   | 0.011 | 0.265 | -      | 0.052 | 0.445 |
| n260                     | 20     | 148   | QTM#0         | Patch       | 4              | 3.524                                                                   | 0.012 | 0.256 | -      | 0.046 | 0.421 |
| n260                     | 21     | 149   | QTM#0         | Patch       | 4              | 2.035                                                                   | 0.007 | 0.208 | -      | 0.039 | 0.493 |
| n260                     | 22     | 150   | QTM#0         | Patch       | 4              | 3.394                                                                   | 0.005 | 0.132 | -      | 0.071 | 0.456 |
| n260                     | 23     | 151   | QTM#0         | Patch       | 4              | 3.502                                                                   | 0.007 | 0.183 | -      | 0.063 | 0.501 |

### 2.3.2 QTM#1 – Patch Antenna

Table 4 & Table 5 show the PD simulation evaluation of QTM#1 patch antenna at 28GHz / 39GHz for the corresponding evaluation surface specified in Table 1.

Table 4. PD of QTM#1 – patch antenna (28GHz)

QTM#1 Low Ch

| n261 Low Ch (27.56 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|-------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                    | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                         | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                    | 0      |       | QTM#1         | Patch       | 1              | 0.004                                                                   | 0.044 | 0.088 | -      | 0.004 | 0.536 |
| n261                    | 2      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.032 | 0.284 | -      | 0.011 | 1.210 |
| n261                    | 3      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.014 | 0.306 | -      | 0.014 | 0.995 |
| n261                    | 4      |       | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.028 | 0.203 | -      | 0.014 | 1.153 |
| n261                    | 8      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.015 | 0.296 | -      | 0.012 | 0.962 |
| n261                    | 9      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.014 | 0.315 | -      | 0.016 | 1.011 |
| n261                    | 12     |       | QTM#1         | Patch       | 4              | 0.006                                                                   | 0.027 | 0.281 | -      | 0.029 | 1.078 |
| n261                    | 13     |       | QTM#1         | Patch       | 4              | 0.006                                                                   | 0.039 | 0.323 | -      | 0.036 | 1.291 |
| n261                    | 19     |       | QTM#1         | Patch       | 4              | 0.007                                                                   | 0.024 | 0.303 | -      | 0.031 | 1.180 |
| n261                    |        | 128   | QTM#1         | Patch       | 1              | 0.004                                                                   | 0.014 | 0.087 | -      | 0.003 | 0.520 |
| n261                    |        | 130   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.055 | 0.068 | -      | 0.009 | 0.625 |
| n261                    |        | 131   | QTM#1         | Patch       | 2              | 0.010                                                                   | 0.049 | 0.242 | -      | 0.009 | 0.631 |
| n261                    |        | 132   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.042 | 0.257 | -      | 0.013 | 0.876 |
| n261                    |        | 136   | QTM#1         | Patch       | 2              | 0.009                                                                   | 0.048 | 0.251 | -      | 0.010 | 0.684 |
| n261                    |        | 137   | QTM#1         | Patch       | 2              | 0.009                                                                   | 0.048 | 0.251 | -      | 0.010 | 0.684 |
| n261                    |        | 140   | QTM#1         | Patch       | 4              | 0.016                                                                   | 0.093 | 0.309 | -      | 0.027 | 0.938 |
| n261                    |        | 141   | QTM#1         | Patch       | 4              | 0.013                                                                   | 0.089 | 0.304 | -      | 0.025 | 1.198 |
| n261                    |        | 147   | QTM#1         | Patch       | 4              | 0.017                                                                   | 0.094 | 0.282 | -      | 0.025 | 0.891 |
| n261                    | 0      | 128   | QTM#1         | Patch       | 1              | 0.006                                                                   | 0.071 | 0.116 | -      | 0.009 | 0.582 |
| n261                    | 2      | 130   | QTM#1         | Patch       | 2              | 0.013                                                                   | 0.049 | 0.325 | -      | 0.015 | 1.160 |
| n261                    | 3      | 131   | QTM#1         | Patch       | 2              | 0.013                                                                   | 0.080 | 0.493 | -      | 0.018 | 1.605 |
| n261                    | 4      | 132   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.072 | 0.264 | -      | 0.016 | 1.393 |
| n261                    | 8      | 136   | QTM#1         | Patch       | 2              | 0.018                                                                   | 0.033 | 0.588 | -      | 0.024 | 1.497 |
| n261                    | 9      | 137   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.089 | 0.532 | -      | 0.017 | 1.543 |
| n261                    | 12     | 140   | QTM#1         | Patch       | 4              | 0.029                                                                   | 0.099 | 0.490 | -      | 0.040 | 2.133 |
| n261                    | 13     | 141   | QTM#1         | Patch       | 4              | 0.021                                                                   | 0.126 | 0.571 | -      | 0.042 | 2.187 |
| n261                    | 19     | 147   | QTM#1         | Patch       | 4              | 0.027                                                                   | 0.103 | 0.489 | -      | 0.038 | 1.790 |

QTM#1 Mid Ch

| n261 Mid Ch (27.925 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                     | 0      |       | QTM#1         | Patch       | 1              | 0.004                                                                   | 0.039 | 0.092 | -      | 0.004 | 0.500 |
| n261                     | 2      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.034 | 0.281 | -      | 0.010 | 1.123 |
| n261                     | 3      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.011 | 0.275 | -      | 0.011 | 1.033 |
| n261                     | 4      |       | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.027 | 0.199 | -      | 0.013 | 1.113 |
| n261                     | 8      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.012 | 0.268 | -      | 0.010 | 0.990 |
| n261                     | 9      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.011 | 0.284 | -      | 0.012 | 1.087 |
| n261                     | 12     |       | QTM#1         | Patch       | 4              | 0.007                                                                   | 0.019 | 0.291 | -      | 0.025 | 0.998 |
| n261                     | 13     |       | QTM#1         | Patch       | 4              | 0.007                                                                   | 0.044 | 0.316 | -      | 0.028 | 1.171 |
| n261                     | 19     |       | QTM#1         | Patch       | 4              | 0.008                                                                   | 0.023 | 0.299 | -      | 0.024 | 1.080 |
| n261                     |        | 128   | QTM#1         | Patch       | 1              | 0.003                                                                   | 0.015 | 0.092 | -      | 0.003 | 0.501 |
| n261                     |        | 130   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.060 | 0.065 | -      | 0.008 | 0.617 |
| n261                     |        | 131   | QTM#1         | Patch       | 2              | 0.009                                                                   | 0.045 | 0.282 | -      | 0.014 | 0.608 |
| n261                     |        | 132   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.041 | 0.295 | -      | 0.018 | 0.834 |
| n261                     |        | 136   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.045 | 0.292 | -      | 0.015 | 0.660 |
| n261                     |        | 137   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.045 | 0.292 | -      | 0.015 | 0.660 |
| n261                     |        | 140   | QTM#1         | Patch       | 4              | 0.016                                                                   | 0.088 | 0.380 | -      | 0.030 | 0.840 |
| n261                     |        | 141   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.090 | 0.373 | -      | 0.028 | 1.080 |
| n261                     |        | 147   | QTM#1         | Patch       | 4              | 0.016                                                                   | 0.091 | 0.346 | -      | 0.027 | 0.802 |
| n261                     | 0      | 128   | QTM#1         | Patch       | 1              | 0.005                                                                   | 0.062 | 0.141 | -      | 0.008 | 0.551 |
| n261                     | 2      | 130   | QTM#1         | Patch       | 2              | 0.014                                                                   | 0.065 | 0.308 | -      | 0.014 | 1.059 |
| n261                     | 3      | 131   | QTM#1         | Patch       | 2              | 0.015                                                                   | 0.079 | 0.499 | -      | 0.020 | 1.664 |
| n261                     | 4      | 132   | QTM#1         | Patch       | 2              | 0.009                                                                   | 0.066 | 0.296 | -      | 0.021 | 1.423 |
| n261                     | 8      | 136   | QTM#1         | Patch       | 2              | 0.016                                                                   | 0.034 | 0.608 | -      | 0.034 | 1.504 |
| n261                     | 9      | 137   | QTM#1         | Patch       | 2              | 0.010                                                                   | 0.082 | 0.510 | -      | 0.016 | 1.572 |
| n261                     | 12     | 140   | QTM#1         | Patch       | 4              | 0.023                                                                   | 0.103 | 0.572 | -      | 0.046 | 2.170 |
| n261                     | 13     | 141   | QTM#1         | Patch       | 4              | 0.022                                                                   | 0.151 | 0.643 | -      | 0.053 | 2.194 |
| n261                     | 19     | 147   | QTM#1         | Patch       | 4              | 0.026                                                                   | 0.116 | 0.572 | -      | 0.047 | 1.795 |

QTM#1 High Ch

| n261 High Ch (28.29 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n261                     | 0      |       | QTM#1         | Patch       | 1              | 0.004                                                                   | 0.033 | 0.087 | -      | 0.005 | 0.448 |
| n261                     | 2      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.032 | 0.269 | -      | 0.012 | 1.003 |
| n261                     | 3      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.012 | 0.228 | -      | 0.010 | 1.024 |
| n261                     | 4      |       | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.025 | 0.184 | -      | 0.014 | 1.014 |
| n261                     | 8      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.015 | 0.219 | -      | 0.009 | 0.969 |
| n261                     | 9      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.011 | 0.238 | -      | 0.011 | 1.073 |
| n261                     | 12     |       | QTM#1         | Patch       | 4              | 0.007                                                                   | 0.017 | 0.293 | -      | 0.023 | 0.931 |
| n261                     | 13     |       | QTM#1         | Patch       | 4              | 0.006                                                                   | 0.041 | 0.290 | -      | 0.027 | 1.045 |
| n261                     | 19     |       | QTM#1         | Patch       | 4              | 0.008                                                                   | 0.021 | 0.293 | -      | 0.024 | 0.958 |
| n261                     |        | 128   | QTM#1         | Patch       | 1              | 0.003                                                                   | 0.013 | 0.096 | -      | 0.004 | 0.484 |
| n261                     |        | 130   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.061 | 0.052 | -      | 0.007 | 0.611 |
| n261                     |        | 131   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.043 | 0.296 | -      | 0.015 | 0.605 |
| n261                     |        | 132   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.043 | 0.302 | -      | 0.019 | 0.810 |
| n261                     |        | 136   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.044 | 0.304 | -      | 0.017 | 0.656 |
| n261                     |        | 137   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.044 | 0.304 | -      | 0.017 | 0.656 |
| n261                     |        | 140   | QTM#1         | Patch       | 4              | 0.015                                                                   | 0.094 | 0.405 | -      | 0.031 | 0.799 |
| n261                     |        | 141   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.093 | 0.395 | -      | 0.030 | 1.023 |
| n261                     |        | 147   | QTM#1         | Patch       | 4              | 0.015                                                                   | 0.097 | 0.381 | -      | 0.029 | 0.765 |
| n261                     | 0      | 128   | QTM#1         | Patch       | 1              | 0.005                                                                   | 0.048 | 0.150 | -      | 0.010 | 0.525 |
| n261                     | 2      | 130   | QTM#1         | Patch       | 2              | 0.014                                                                   | 0.075 | 0.283 | -      | 0.015 | 0.975 |
| n261                     | 3      | 131   | QTM#1         | Patch       | 2              | 0.015                                                                   | 0.078 | 0.447 | -      | 0.019 | 1.637 |
| n261                     | 4      | 132   | QTM#1         | Patch       | 2              | 0.010                                                                   | 0.063 | 0.304 | -      | 0.024 | 1.393 |
| n261                     | 8      | 136   | QTM#1         | Patch       | 2              | 0.011                                                                   | 0.035 | 0.626 | -      | 0.031 | 1.548 |
| n261                     | 9      | 137   | QTM#1         | Patch       | 2              | 0.011                                                                   | 0.082 | 0.406 | -      | 0.017 | 1.480 |
| n261                     | 12     | 140   | QTM#1         | Patch       | 4              | 0.019                                                                   | 0.120 | 0.631 | -      | 0.051 | 2.024 |
| n261                     | 13     | 141   | QTM#1         | Patch       | 4              | 0.019                                                                   | 0.168 | 0.703 | -      | 0.057 | 2.176 |
| n261                     | 19     | 147   | QTM#1         | Patch       | 4              | 0.022                                                                   | 0.128 | 0.643 | -      | 0.051 | 1.698 |

Table 5. PD of QTM#1 – patch antenna (39GHz)

QTM#1 Low Ch

| n260 Low Ch (37.05 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|-------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                    | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                         | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                    | 0      |       | QTM#1         | Patch       | 1              | 0.003                                                                   | 0.016 | 0.093 | -      | 0.005 | 0.571 |
| n260                    | 2      |       | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.060 | 0.241 | -      | 0.010 | 1.016 |
| n260                    | 3      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.034 | 0.122 | -      | 0.009 | 0.826 |
| n260                    | 4      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.034 | 0.122 | -      | 0.009 | 0.826 |
| n260                    | 8      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.034 | 0.122 | -      | 0.009 | 0.826 |
| n260                    | 9      |       | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.034 | 0.122 | -      | 0.009 | 0.826 |
| n260                    | 12     |       | QTM#1         | Patch       | 4              | 0.008                                                                   | 0.095 | 0.340 | -      | 0.016 | 1.733 |
| n260                    | 13     |       | QTM#1         | Patch       | 4              | 0.009                                                                   | 0.087 | 0.350 | -      | 0.017 | 1.767 |
| n260                    | 19     |       | QTM#1         | Patch       | 4              | 0.009                                                                   | 0.095 | 0.353 | -      | 0.016 | 1.737 |
| n260                    |        | 128   | QTM#1         | Patch       | 1              | 0.002                                                                   | 0.011 | 0.037 | -      | 0.002 | 0.365 |
| n260                    |        | 130   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.040 | 0.143 | -      | 0.011 | 0.876 |
| n260                    |        | 131   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.042 | 0.136 | -      | 0.011 | 0.894 |
| n260                    |        | 132   | QTM#1         | Patch       | 2              | 0.012                                                                   | 0.043 | 0.143 | -      | 0.008 | 0.926 |
| n260                    |        | 136   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.042 | 0.136 | -      | 0.011 | 0.894 |
| n260                    |        | 137   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.040 | 0.143 | -      | 0.011 | 0.876 |
| n260                    |        | 140   | QTM#1         | Patch       | 4              | 0.010                                                                   | 0.115 | 0.245 | -      | 0.020 | 1.257 |
| n260                    |        | 141   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.122 | 0.284 | -      | 0.014 | 1.139 |
| n260                    |        | 147   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.124 | 0.280 | -      | 0.014 | 1.104 |
| n260                    | 0      | 128   | QTM#1         | Patch       | 1              | 0.006                                                                   | 0.023 | 0.129 | -      | 0.006 | 0.683 |
| n260                    | 2      | 130   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.073 | 0.538 | -      | 0.016 | 1.354 |
| n260                    | 3      | 131   | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.089 | 0.288 | -      | 0.022 | 1.680 |
| n260                    | 4      | 132   | QTM#1         | Patch       | 2              | 0.014                                                                   | 0.098 | 0.280 | -      | 0.023 | 1.293 |
| n260                    | 8      | 136   | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.088 | 0.265 | -      | 0.016 | 1.662 |
| n260                    | 9      | 137   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.075 | 0.217 | -      | 0.012 | 1.644 |
| n260                    | 12     | 140   | QTM#1         | Patch       | 4              | 0.019                                                                   | 0.105 | 0.607 | -      | 0.028 | 2.805 |
| n260                    | 13     | 141   | QTM#1         | Patch       | 4              | 0.025                                                                   | 0.126 | 0.626 | -      | 0.030 | 2.564 |
| n260                    | 19     | 147   | QTM#1         | Patch       | 4              | 0.020                                                                   | 0.137 | 0.636 | -      | 0.030 | 2.634 |

QTM#1 Mid Ch

| n260 Mid Ch (38.5 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                   | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                        | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                   | 0      |       | QTM#1         | Patch       | 1              | 0.007                                                                   | 0.024 | 0.093 | -      | 0.006 | 0.663 |
| n260                   | 2      |       | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.065 | 0.247 | -      | 0.010 | 1.326 |
| n260                   | 3      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.037 | 0.177 | -      | 0.017 | 1.083 |
| n260                   | 4      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.037 | 0.177 | -      | 0.017 | 1.083 |
| n260                   | 8      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.037 | 0.177 | -      | 0.017 | 1.083 |
| n260                   | 9      |       | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.037 | 0.177 | -      | 0.017 | 1.083 |
| n260                   | 12     |       | QTM#1         | Patch       | 4              | 0.010                                                                   | 0.100 | 0.350 | -      | 0.018 | 2.425 |
| n260                   | 13     |       | QTM#1         | Patch       | 4              | 0.013                                                                   | 0.098 | 0.368 | -      | 0.018 | 2.424 |
| n260                   | 19     |       | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.115 | 0.377 | -      | 0.018 | 2.296 |
| n260                   |        | 128   | QTM#1         | Patch       | 1              | 0.002                                                                   | 0.020 | 0.045 | -      | 0.002 | 0.401 |
| n260                   |        | 130   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.038 | 0.189 | -      | 0.011 | 1.101 |
| n260                   |        | 131   | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.040 | 0.176 | -      | 0.011 | 1.086 |
| n260                   |        | 132   | QTM#1         | Patch       | 2              | 0.011                                                                   | 0.048 | 0.152 | -      | 0.013 | 1.150 |
| n260                   |        | 136   | QTM#1         | Patch       | 2              | 0.002                                                                   | 0.040 | 0.176 | -      | 0.011 | 1.086 |
| n260                   |        | 137   | QTM#1         | Patch       | 2              | 0.003                                                                   | 0.038 | 0.189 | -      | 0.011 | 1.101 |
| n260                   |        | 140   | QTM#1         | Patch       | 4              | 0.009                                                                   | 0.108 | 0.279 | -      | 0.024 | 1.692 |
| n260                   |        | 141   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.116 | 0.262 | -      | 0.023 | 1.466 |
| n260                   |        | 147   | QTM#1         | Patch       | 4              | 0.012                                                                   | 0.115 | 0.257 | -      | 0.021 | 1.373 |
| n260                   | 0      | 128   | QTM#1         | Patch       | 1              | 0.009                                                                   | 0.041 | 0.202 | -      | 0.006 | 0.914 |
| n260                   | 2      | 130   | QTM#1         | Patch       | 2              | 0.013                                                                   | 0.091 | 0.580 | -      | 0.021 | 1.704 |
| n260                   | 3      | 131   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.094 | 0.297 | -      | 0.027 | 2.372 |
| n260                   | 4      | 132   | QTM#1         | Patch       | 2              | 0.010                                                                   | 0.114 | 0.345 | -      | 0.025 | 1.858 |
| n260                   | 8      | 136   | QTM#1         | Patch       | 2              | 0.007                                                                   | 0.080 | 0.252 | -      | 0.017 | 2.210 |
| n260                   | 9      | 137   | QTM#1         | Patch       | 2              | 0.006                                                                   | 0.053 | 0.226 | -      | 0.009 | 2.194 |
| n260                   | 12     | 140   | QTM#1         | Patch       | 4              | 0.029                                                                   | 0.089 | 0.872 | -      | 0.041 | 3.327 |
| n260                   | 13     | 141   | QTM#1         | Patch       | 4              | 0.042                                                                   | 0.106 | 0.860 | -      | 0.041 | 2.982 |
| n260                   | 19     | 147   | QTM#1         | Patch       | 4              | 0.034                                                                   | 0.111 | 0.905 | -      | 0.040 | 3.036 |

QTM#1 High Ch

| n260 High Ch (39.95 GHz) |        |       |               |             |                | Power Density [mW/cm <sup>2</sup> ]<br>at 2mm evaluation surface @ 6dBm |       |       |        |       |       |
|--------------------------|--------|-------|---------------|-------------|----------------|-------------------------------------------------------------------------|-------|-------|--------|-------|-------|
| Band                     | BeamID |       | ANT<br>Module | ANT<br>Type | Num of<br>Feed | Relative phase worst PD for MIMO                                        |       |       |        |       |       |
|                          | Vpol.  | Hpol. |               |             |                | Left                                                                    | Right | Top   | Bottom | Front | Back  |
| n260                     | 0      |       | QTM#1         | Patch       | 1              | 0.006                                                                   | 0.022 | 0.066 | -      | 0.005 | 0.760 |
| n260                     | 2      |       | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.051 | 0.213 | -      | 0.008 | 1.422 |
| n260                     | 3      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.031 | 0.190 | -      | 0.017 | 1.078 |
| n260                     | 4      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.031 | 0.190 | -      | 0.017 | 1.078 |
| n260                     | 8      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.031 | 0.190 | -      | 0.017 | 1.078 |
| n260                     | 9      |       | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.031 | 0.190 | -      | 0.017 | 1.078 |
| n260                     | 12     |       | QTM#1         | Patch       | 4              | 0.011                                                                   | 0.115 | 0.375 | -      | 0.024 | 2.484 |
| n260                     | 13     |       | QTM#1         | Patch       | 4              | 0.011                                                                   | 0.106 | 0.361 | -      | 0.025 | 2.587 |
| n260                     | 19     |       | QTM#1         | Patch       | 4              | 0.011                                                                   | 0.125 | 0.345 | -      | 0.022 | 2.379 |
| n260                     |        | 128   | QTM#1         | Patch       | 1              | 0.003                                                                   | 0.024 | 0.061 | -      | 0.002 | 0.521 |
| n260                     |        | 130   | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.032 | 0.220 | -      | 0.007 | 1.055 |
| n260                     |        | 131   | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.032 | 0.236 | -      | 0.007 | 1.064 |
| n260                     |        | 132   | QTM#1         | Patch       | 2              | 0.008                                                                   | 0.041 | 0.147 | -      | 0.013 | 1.010 |
| n260                     |        | 136   | QTM#1         | Patch       | 2              | 0.005                                                                   | 0.032 | 0.236 | -      | 0.007 | 1.064 |
| n260                     |        | 137   | QTM#1         | Patch       | 2              | 0.004                                                                   | 0.032 | 0.220 | -      | 0.007 | 1.055 |
| n260                     |        | 140   | QTM#1         | Patch       | 4              | 0.008                                                                   | 0.103 | 0.302 | -      | 0.020 | 1.678 |
| n260                     |        | 141   | QTM#1         | Patch       | 4              | 0.011                                                                   | 0.108 | 0.311 | -      | 0.018 | 1.349 |
| n260                     |        | 147   | QTM#1         | Patch       | 4              | 0.011                                                                   | 0.106 | 0.336 | -      | 0.020 | 1.301 |
| n260                     | 0      | 128   | QTM#1         | Patch       | 1              | 0.007                                                                   | 0.060 | 0.176 | -      | 0.007 | 1.055 |
| n260                     | 2      | 130   | QTM#1         | Patch       | 2              | 0.009                                                                   | 0.092 | 0.451 | -      | 0.021 | 1.734 |
| n260                     | 3      | 131   | QTM#1         | Patch       | 2              | 0.015                                                                   | 0.083 | 0.286 | -      | 0.029 | 2.540 |
| n260                     | 4      | 132   | QTM#1         | Patch       | 2              | 0.012                                                                   | 0.091 | 0.345 | -      | 0.028 | 1.615 |
| n260                     | 8      | 136   | QTM#1         | Patch       | 2              | 0.016                                                                   | 0.074 | 0.191 | -      | 0.023 | 2.356 |
| n260                     | 9      | 137   | QTM#1         | Patch       | 2              | 0.014                                                                   | 0.055 | 0.218 | -      | 0.016 | 2.115 |
| n260                     | 12     | 140   | QTM#1         | Patch       | 4              | 0.020                                                                   | 0.108 | 0.899 | -      | 0.036 | 3.361 |
| n260                     | 13     | 141   | QTM#1         | Patch       | 4              | 0.029                                                                   | 0.112 | 0.864 | -      | 0.033 | 2.935 |
| n260                     | 19     | 147   | QTM#1         | Patch       | 4              | 0.025                                                                   | 0.132 | 0.854 | -      | 0.036 | 2.917 |