FCC ID: A3LSMS928U

Part 0 Power Density Report
Power Density Characterization

Revision A

October 15, 2023

SAMSUNG ELECTRONICS

Power Density Characterization

1 Exposure Scenarios

At frequencies > 6 GHz, the total peak spatial averaged power density (psPD) is required to be assessed for all antenna configurations (beams) from all mmW antenna modules installed inside the device. This device has 2 patch antenna arrays.

As showed in Figure 1, the surfaces near-by each mmW antenna module for PD characterization are identified and listed in Table 1.

Table 1
Evaluation Surfaces for PD Characterization

Band/Mode	Antenna Module	Back	Front	Top	Bottom	Right	Left
NR n258	**M**	Yes	Yes	Yes	No	No	Yes
NR n261	**M**	Yes	Yes	Yes	No	No	Yes
NR n260	**M**	Yes	Yes	Yes	No	No	Yes
NR n258	**N**	Yes	Yes	No	No	Yes	No
NR n261	**N**	Yes	Yes	No	No	Yes	No
NR n260	**N**	Yes	Yes	No	No	Yes	No

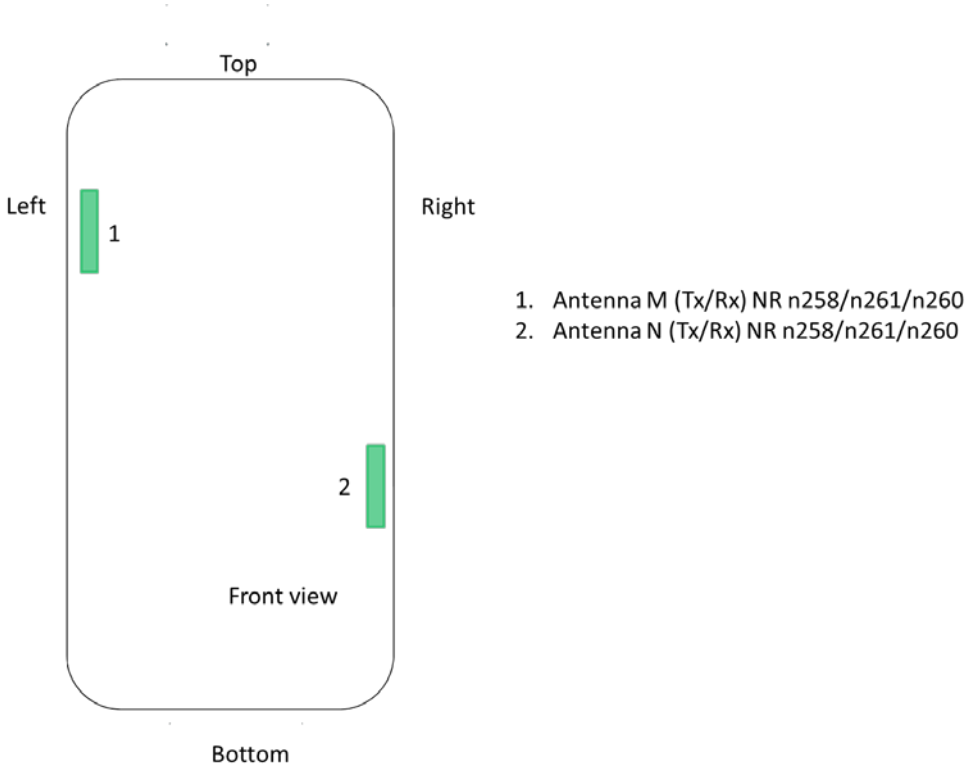
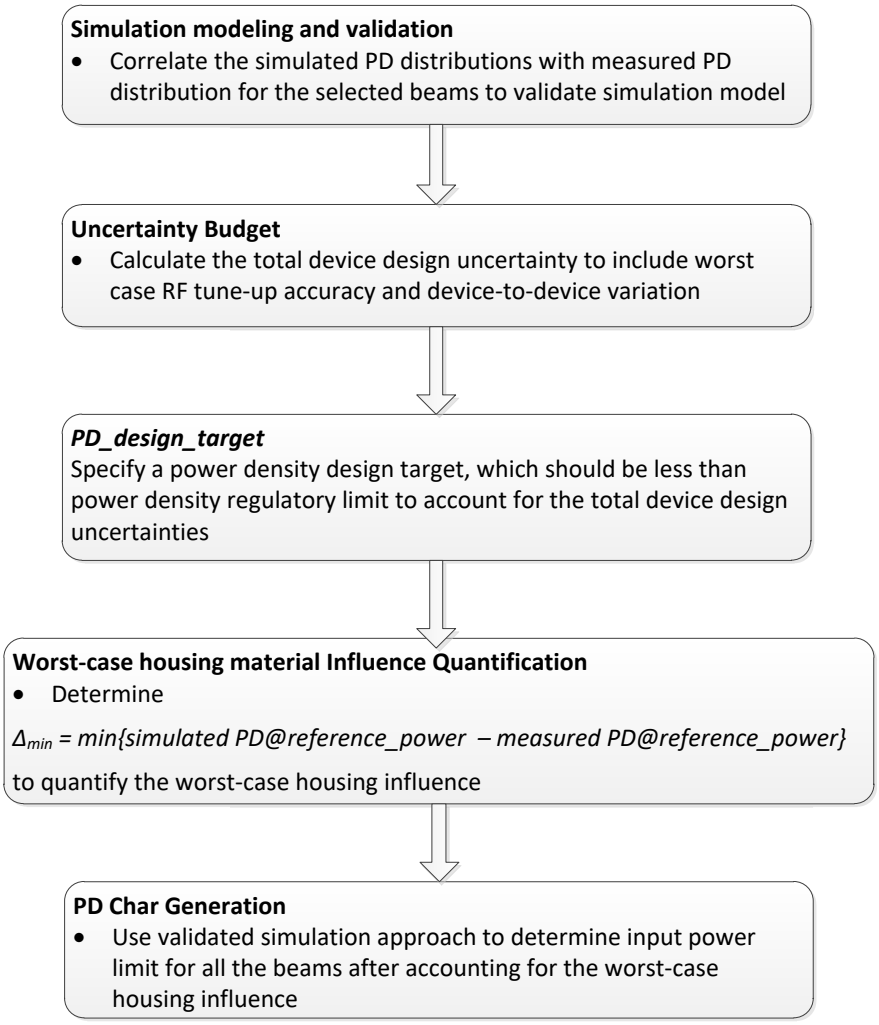


Figure 1: Location of mmW antenna modules looking from front of the DUT

2 Power Density Characterization Method



3 Codebook for all supported beams

Table 2
5G mmW NR Band n258 Ant M Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n258	M	Patch	0	1	256
n258	M	Patch	2	1	258
n258	M	Patch	4	1	260
n258	M	Patch	6	1	262
n258	M	Patch	8	1	264
n258	M	Patch	10	2	266
n258	M	Patch	11	2	267
n258	M	Patch	12	2	268
n258	M	Patch	13	2	269
n258	M	Patch	18	2	274
n258	M	Patch	19	2	275
n258	M	Patch	20	2	276
n258	M	Patch	24	5	280
n258	M	Patch	25	5	281
n258	M	Patch	26	5	282
n258	M	Patch	27	5	283
n258	M	Patch	28	5	284
n258	M	Patch	34	5	290
n258	M	Patch	35	5	291
n258	M	Patch	36	5	292
n258	M	Patch	37	5	293
n258	M	Patch	256	1	0
n258	M	Patch	258	1	2
n258	M	Patch	260	1	4
n258	M	Patch	262	1	6
n258	M	Patch	264	1	8
n258	M	Patch	266	2	10
n258	M	Patch	267	2	11
n258	M	Patch	268	2	12
n258	M	Patch	269	2	13
n258	M	Patch	274	2	18
n258	M	Patch	275	2	19
n258	M	Patch	276	2	20
n258	M	Patch	280	5	24
n258	M	Patch	281	5	25
n258	M	Patch	282	5	26
n258	M	Patch	283	5	27
n258	M	Patch	284	5	28
n258	M	Patch	290	5	34
n258	M	Patch	291	5	35
n258	M	Patch	292	5	36
n258	M	Patch	293	5	37

Table 3
5G mmW NR Band n261 Ant M Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n261	M	Patch	0	1	256
n261	M	Patch	2	1	258
n261	M	Patch	4	1	260
n261	M	Patch	6	1	262
n261	M	Patch	8	1	264
n261	M	Patch	10	2	266
n261	M	Patch	11	2	267
n261	M	Patch	12	2	268
n261	M	Patch	13	2	269
n261	M	Patch	18	2	274
n261	M	Patch	19	2	275
n261	M	Patch	20	2	276
n261	M	Patch	24	5	280
n261	M	Patch	25	5	281
n261	M	Patch	26	5	282
n261	M	Patch	27	5	283
n261	M	Patch	28	5	284
n261	M	Patch	34	5	290
n261	M	Patch	35	5	291
n261	M	Patch	36	5	292
n261	M	Patch	37	5	293
n261	M	Patch	256	1	0
n261	M	Patch	258	1	2
n261	M	Patch	260	1	4
n261	M	Patch	262	1	6
n261	M	Patch	264	1	8
n261	M	Patch	266	2	10
n261	M	Patch	267	2	11
n261	M	Patch	268	2	12
n261	M	Patch	269	2	13
n261	M	Patch	274	2	18
n261	M	Patch	275	2	19
n261	M	Patch	276	2	20
n261	M	Patch	280	5	24
n261	M	Patch	281	5	25
n261	M	Patch	282	5	26
n261	M	Patch	283	5	27
n261	M	Patch	284	5	28
n261	M	Patch	290	5	34
n261	M	Patch	291	5	35
n261	M	Patch	292	5	36
n261	M	Patch	293	5	37

Table 4
5G mmW NR Band n260 Ant M Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n260	M	Patch	0	1	256
n260	M	Patch	2	1	258
n260	M	Patch	4	1	260
n260	M	Patch	6	1	262
n260	M	Patch	8	1	264
n260	M	Patch	10	2	266
n260	M	Patch	11	2	267
n260	M	Patch	12	2	268
n260	M	Patch	13	2	269
n260	M	Patch	18	2	274
n260	M	Patch	19	2	275
n260	M	Patch	20	2	276
n260	M	Patch	24	5	280
n260	M	Patch	25	5	281
n260	M	Patch	26	5	282
n260	M	Patch	27	5	283
n260	M	Patch	28	5	284
n260	M	Patch	34	5	290
n260	M	Patch	35	5	291
n260	M	Patch	36	5	292
n260	M	Patch	37	5	293
n260	M	Patch	256	1	0
n260	M	Patch	258	1	2
n260	M	Patch	260	1	4
n260	M	Patch	262	1	6
n260	M	Patch	264	1	8
n260	M	Patch	266	2	10
n260	M	Patch	267	2	11
n260	M	Patch	268	2	12
n260	M	Patch	269	2	13
n260	M	Patch	274	2	18
n260	M	Patch	275	2	19
n260	M	Patch	276	2	20
n260	M	Patch	280	5	24
n260	M	Patch	281	5	25
n260	M	Patch	282	5	26
n260	M	Patch	283	5	27
n260	M	Patch	284	5	28
n260	M	Patch	290	5	34
n260	M	Patch	291	5	35
n260	M	Patch	292	5	36
n260	M	Patch	293	5	37

Table 5
5G mmW NR Band n258 Ant N Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n258	N	Patch	1	1	257
n258	N	Patch	3	1	259
n258	N	Patch	5	1	261
n258	N	Patch	7	1	263
n258	N	Patch	9	1	265
n258	N	Patch	14	2	270
n258	N	Patch	15	2	271
n258	N	Patch	16	2	272
n258	N	Patch	17	2	273
n258	N	Patch	21	2	277
n258	N	Patch	22	2	278
n258	N	Patch	23	2	279
n258	N	Patch	29	5	285
n258	N	Patch	30	5	286
n258	N	Patch	31	5	287
n258	N	Patch	32	5	288
n258	N	Patch	33	5	289
n258	N	Patch	38	5	294
n258	N	Patch	39	5	295
n258	N	Patch	40	5	296
n258	N	Patch	41	5	297
n258	N	Patch	257	1	1
n258	N	Patch	259	1	3
n258	N	Patch	261	1	5
n258	N	Patch	263	1	7
n258	N	Patch	265	1	9
n258	N	Patch	270	2	14
n258	N	Patch	271	2	15
n258	N	Patch	272	2	16
n258	N	Patch	273	2	17
n258	N	Patch	277	2	21
n258	N	Patch	278	2	22
n258	N	Patch	279	2	23
n258	N	Patch	285	5	29
n258	N	Patch	286	5	30
n258	N	Patch	287	5	31
n258	N	Patch	288	5	32
n258	N	Patch	289	5	33
n258	N	Patch	294	5	38
n258	N	Patch	295	5	39
n258	N	Patch	296	5	40
n258	N	Patch	297	5	41

Table 6
5G mmW NR Band n261 Ant N Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n261	N	Patch	1	1	257
n261	N	Patch	3	1	259
n261	N	Patch	5	1	261
n261	N	Patch	7	1	263
n261	N	Patch	9	1	265
n261	N	Patch	14	2	270
n261	N	Patch	15	2	271
n261	N	Patch	16	2	272
n261	N	Patch	17	2	273
n261	N	Patch	21	2	277
n261	N	Patch	22	2	278
n261	N	Patch	23	2	279
n261	N	Patch	29	5	285
n261	N	Patch	30	5	286
n261	N	Patch	31	5	287
n261	N	Patch	32	5	288
n261	N	Patch	33	5	289
n261	N	Patch	38	5	294
n261	N	Patch	39	5	295
n261	N	Patch	40	5	296
n261	N	Patch	41	5	297
n261	N	Patch	257	1	1
n261	N	Patch	259	1	3
n261	N	Patch	261	1	5
n261	N	Patch	263	1	7
n261	N	Patch	265	1	9
n261	N	Patch	270	2	14
n261	N	Patch	271	2	15
n261	N	Patch	272	2	16
n261	N	Patch	273	2	17
n261	N	Patch	277	2	21
n261	N	Patch	278	2	22
n261	N	Patch	279	2	23
n261	N	Patch	285	5	29
n261	N	Patch	286	5	30
n261	N	Patch	287	5	31
n261	N	Patch	288	5	32
n261	N	Patch	289	5	33
n261	N	Patch	294	5	38
n261	N	Patch	295	5	39
n261	N	Patch	296	5	40
n261	N	Patch	297	5	41

Table 7
5G mmW NR Band n260 Ant N Codebook

Band	Antenna Module	Antenna Type	Beam ID	Feed no.	Paired With
n260	N	Patch	1	1	257
n260	N	Patch	3	1	259
n260	N	Patch	5	1	261
n260	N	Patch	7	1	263
n260	N	Patch	9	1	265
n260	N	Patch	14	2	270
n260	N	Patch	15	2	271
n260	N	Patch	16	2	272
n260	N	Patch	17	2	273
n260	N	Patch	21	2	277
n260	N	Patch	22	2	278
n260	N	Patch	23	2	279
n260	N	Patch	29	5	285
n260	N	Patch	30	5	286
n260	N	Patch	31	5	287
n260	N	Patch	32	5	288
n260	N	Patch	33	5	289
n260	N	Patch	38	5	294
n260	N	Patch	39	5	295
n260	N	Patch	40	5	296
n260	N	Patch	41	5	297
n260	N	Patch	257	1	1
n260	N	Patch	259	1	3
n260	N	Patch	261	1	5
n260	N	Patch	263	1	7
n260	N	Patch	265	1	9
n260	N	Patch	270	2	14
n260	N	Patch	271	2	15
n260	N	Patch	272	2	16
n260	N	Patch	273	2	17
n260	N	Patch	277	2	21
n260	N	Patch	278	2	22
n260	N	Patch	279	2	23
n260	N	Patch	285	5	29
n260	N	Patch	286	5	30
n260	N	Patch	287	5	31
n260	N	Patch	288	5	32
n260	N	Patch	289	5	33
n260	N	Patch	294	5	38
n260	N	Patch	295	5	39
n260	N	Patch	296	5	40
n260	N	Patch	297	5	41

4 Simulation and Modeling Validation

Power density simulations of all beams and surfaces were performed. Details of these simulations and modeling validation can be found in the Power Density Simulation Report. Table below includes a summary of the validation results to support worst-case housing influence quantification in power density characterization for this model.

With an input power of 6 dBm for n258 band, 6 dBm for n261 band, and 6 dBm for n260 band, PD measurements are conducted for at least one single beam per antenna module on worst-surface(s). PD measurements are performed at mid channel of each mmW band and with CW modulation. All measured PD values are listed in table below along with corresponding simulated PD values for the same configuration.

PD value will be used to determine worst-case housing influence for conservative assessment.

Table 8

Band	Antenna	Beam ID	Surface	4cm^2 psPD		Delta = Simulated - Measured
				Measured	Simulated	
				(mW/cm^2)		(dB)
n258	M	36	Rear	0.478	1.188	3.95
		284	Rear	1.380	1.934	**1.47**
		284	Left	0.657	1.061	2.08
	N	40	Right	0.823	1.811	3.43
		295	Right	0.645	0.909	**1.49**
n261	M	26	Rear	0.826	1.459	2.47
		26	Left	0.346	0.929	4.29
		284	Rear	1.380	2.3	**2.22**
		284	Left	0.771	1.38	2.53
	N	30	Right	0.796	1.571	2.95
		288	Right	1.360	1.833	**1.30**
n260	M	26	Rear	0.691	1.032	1.74
		26	Left	0.411	0.586	**1.54**
		282	Rear	0.790	1.306	2.18
	N	33	Right	1.150	2.163	**2.74**
		288	Rear	0.292	0.731	3.99
		287	Right	0.697	1.400	3.03
		295	Front	0.332	0.777	3.69

5 *PD_design_target*

Table 9

PD_design_target	
$PD\_design\_target < PD\_regulatory\_limit\ x\ 10^{\frac{-\ Total\ Uncertainty}{10}}$	
psPD over 4 cm2 Averaging Area (mW/cm^2)	
Total Uncertainty	1.4 dB
PD_regulatory_limit	1.0 mW/cm^2
PD_design_target	0.631 mW/cm^2

6 Δmin

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

Since the mmW antenna modules are placed at different locations, only surrounding material/housing has impact on EM field propagation, and in turn power density. Furthermore, depending on the type of antenna array, i.e., dipole antenna array or patch antenna array, the nature of EM field propagation in the near field is different. Therefore, the worst-case housing influence is determined per antenna module and per antenna type.

For this DUT, the below procedure was used to determine worst-case housing influence, Δmin:

1. Based on PD simulation, for each module and antenna type, determine one or more worst-surface(s) that has highest 4cm2 PD for all the single beams per antenna module and per antenna type in the mid channel of each band.
2. For identified worst surface(s) per antenna module and per antenna type group,
    a. First determine Δmin based on identified worst surface(s), and derive input.power.limit
    b. Then prove all other near-by surface(s), i.e., non-selected surface(s), is not required for housing material loss quantification (in other words, these non-evaluated surfaces have no influence on the determined input.power.limit) by:
        i. re-scale all simulated 4cm2 PD values to input.power.limit to identify the worst-PD beam per each non-evaluated surface
        ii. Measure 4cm2 PD at input.power.limit on identified worst-PD beam per each non-evaluated surface
        iii. Demonstrate all measured 4cm2 PD values are below PD_design_target

3. If any of the above surface(s) in Step (2.b.iii) have measured 4cm2 PD ≥ PD_design_target, then those surfaces must be included in the Δmin determination in Step (2.a), and re-evaluate input.power.limit with these added surfaces.

Following above procedure, based on the Samsung PD simulation report, the worst-surface(s) having highest 4cm2 PD for all the single beams per each antenna type and each antenna module group in the mid channel of n258, n261, and n260 bands are identified in the following table:

Table 10

Worst-surface(s)

Band/Mode	Antenna Module	Back	Front	Top	Bottom	Right	Left
NR n258	**M**	Yes	No	No	No	No	Yes
NR n258	**N**	No	No	No	No	Yes	No
NR n261	**M**	Yes	No	No	No	No	Yes
NR n261	**N**	No	No	No	No	Yes	No
NR n260	**M**	Yes	No	No	No	No	Yes
NR n260	**N**	Yes	Yes	No	No	Yes	No

Thus, when comparing a simulated 4cm2-averaged PD and measured 4 cm2-averaged PD for the identified worst surface(s), the worst error introduced for each antenna type and each antenna module group when using the estimated material property in the simulation is highlighted in bold numbers in the table below. Thus, the worst-case housing influence, denoted as $\Delta_{min} = \mathrm{Sim.PD} - \mathrm{Meas.PD}$, is determined as

Table 11

Δ_{min}

Band	Antenna	Δmin (dB)
n258	M	**1.47**
n258	N	**1.49**
n261	M	**2.22**
n261	N	**1.30**
n260	M	**1.54**
n260	N	**2.74**

Δ_{min} represents the worst case where RF exposure is underestimated the most in simulation when using the estimated material property of the housing. For conservative assessment, the Δ_{min} is used as the worst-case factor and applied to all the beams in the corresponding antenna type and antenna module group to determine input power limits in PD char for compliance.

The detail input.power.limit derivation is described in Section 7.

Simulated 4cm2 PD values in the Power Density Simulation Report are scaled to input.power.limit and are listed in the tables below for all single beams for all identified surfaces, when assuming the simulation is performed with correct housing influence.

Determine the worst beam for each of non-selected surface(s), identified in the table below:

Table 12

Non-Selected Surface(s)

Band/Mode	Antenna Module	Back	Front	Top	Bottom	Right	Left
NR n258	**M**	No	Yes	Yes	No	No	Yes
NR n258	**N**	Yes	Yes	No	No	No	No
NR n261	**M**	No	Yes	Yes	No	No	No
NR n261	**N**	Yes	Yes	No	No	No	No
NR n260	**M**	No	Yes	Yes	No	No	Yes
NR n260	**N**	Yes	Yes	No	No	No	No

Then perform PD measurement for all determined worst-case beams, highlighted in orange in the tables below, on the corresponding surface. Measurement is performed in the mid channel of each band with CW modulation. The evaluation distance is at 2 mm.

Table 13
n258/mid channel, Antenna M Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
M	0	0.02490621	0.24076004	0.07471863	0.00830207	0.10792691	0.60605113
M	2	0.01331134	0.19967005	0.02396041	0.0079868	0.03460947	0.57504973
M	4	0.01631786	0.19581435	0.02991608	0.00815893	0.02447679	0.54664839
M	6	0.01587314	0.20635083	0.05952428	0.00396829	0.09523884	0.60714763
M	8	0.01282434	0.17697584	0.11798389	0.00256487	0.03077841	0.56683566
M	10	0.02175715	0.25606492	0.16401544	0.00334725	0.05020881	0.62091558
M	11	0.0141391	0.24920164	0.02297604	0.00530216	0.03181298	0.62742257
M	12	0.00979313	0.20005965	0.04476859	0.00279804	0.06155681	0.54841525
M	13	0.01843707	0.1433994	0.04301982	0.01843707	0.05940832	0.55720908
M	18	0.0124942	0.2045926	0.0577857	0.00312355	0.05622392	0.5887894
M	19	0.01364232	0.25238294	0.02216877	0.00511587	0.02728464	0.63095734
M	20	0.0112671	0.19154062	0.05633548	0.00563355	0.10328171	0.55208768
M	24	0.01271697	0.28368625	0.12619147	0.00391291	0.06749776	0.59378466
M	25	0.02075012	0.18367699	0.10298208	0.00384261	0.03996319	0.57331812
M	26	0.02143062	0.18839011	0.03438867	0.00299032	0.03987092	0.58012192
M	27	0.01897209	0.23091738	0.01951414	0.00379442	0.03035534	0.54910635
M	28	0.02188841	0.14275053	0.0352118	0.0095167	0.06852025	0.63095734
M	34	0.01520379	0.25276303	0.13303318	0.00285071	0.04086019	0.58534597
M	35	0.02477581	0.17343068	0.06386654	0.00220229	0.02973097	0.54286557
M	36	0.02189135	0.27583101	0.0248102	0.00291885	0.04135033	0.57793163
M	37	0.01945683	0.16260354	0.02710059	0.00625398	0.03821878	0.63026246
M	256	0.00201584	0.24794809	0.02419006	0.00604751	0.01814254	0.5866089
M	258	0.00376691	0.22413112	0.02825182	0.00753382	0.01130073	0.57633716
M	260	0.00374455	0.24526829	0.03744554	0.00561683	0.01310594	0.5448326
M	262	0.00439692	0.24842571	0.04836607	0.00659537	0.02418303	0.62875889
M	264	0.00618586	0.2453723	0.07629223	0.00618586	0.02268147	0.59590416
M	266	0.00701064	0.28509924	0.07244325	0.00701064	0.02453723	0.57019849
M	267	0.00418407	0.29121108	0.04016705	0.00083681	0.01506264	0.54978644
M	268	0.0033252	0.26767887	0.00498781	0.00581911	0.01496342	0.5827419
M	269	0.00967396	0.28591934	0.05051958	0.01182373	0.03869585	0.61590896
M	274	0.00457215	0.32005083	0.05760915	0.00548659	0.02011748	0.56054616
M	275	0.00242365	0.27306477	0.02666017	0.00080788	0.01373403	0.58329219
M	276	0.00422894	0.28164718	0.00507472	0.0067663	0.01522417	0.56921487
M	280	0.00571002	0.28876393	0.12154188	0.00122358	0.02773439	0.56569996
M	281	0.00592139	0.30593865	0.06480636	0.00131587	0.01579038	0.56516409
M	282	0.00375794	0.31040546	0.01916547	0.00075159	0.00939484	0.5693272
M	283	0.00645297	0.28966678	0.01039646	0.00143399	0.01720793	0.58005056
M	284	0.00747934	0.3174233	0.0113686	0.00927438	0.02752398	0.57860195
M	290	0.0055063	0.30252267	0.10688702	0.0012956	0.02558811	0.56423393
M	291	0.00427285	0.29696299	0.01317462	0.00106821	0.00818963	0.55796284
M	292	0.00361373	0.29777139	0.01626179	0.00072275	0.00975707	0.56554882
M	293	0.00870748	0.31246454	0.01540554	0.00200942	0.02411302	0.58909446

Note: For left edge, only V beams were considered for non-selected surface testing.

Table 14
n261/mid channel, Antenna M Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
M	0	0.01971742	0.35491351	0.03943483	0.00492935	0.07394031	0.56194638
M	2	0.00966984	0.22240642	0.02175715	0.00483492	0.01933969	0.56085097
M	4	0.00698477	0.30732978	0.02328256	0.00232826	0.03492384	0.57275095
M	6	0.00714291	0.32857401	0.05476234	0.00476194	0.06428622	0.62381443
M	8	0.01142004	0.15131556	0.0799403	0.00285501	0.02855011	0.58527717
M	10	0.00565881	0.26313468	0.07073513	0.00565881	0.04244108	0.58285746
M	11	0.01170607	0.2715809	0.08194251	0.00234121	0.03394761	0.61222763
M	12	0.0083334	0.36071712	0.01904777	0.00357146	0.05357185	0.60476666
M	13	0.00972842	0.28907297	0.03891367	0.00694887	0.03613412	0.58370503
M	18	0.00979313	0.30358701	0.02937939	0.00279804	0.04336957	0.5596074
M	19	0.00784339	0.31460718	0.01132934	0.00174298	0.01742976	0.59174038
M	20	0.01628277	0.26459502	0.02442416	0.00814139	0.06106039	0.57803834
M	24	0.01485634	0.21235822	0.14943727	0.00699122	0.06117315	0.57764931
M	25	0.01533761	0.24593057	0.04918611	0.00211553	0.03913734	0.55268267
M	26	0.01513606	0.4017542	0.02248786	0.00172984	0.02810982	0.63095734
M	27	0.01541513	0.28650885	0.02285692	0.00265778	0.03827205	0.54165588
M	28	0.01250796	0.26405704	0.04447276	0.00486421	0.05976028	0.61497494
M	34	0.0159979	0.19645426	0.11710466	0.00319958	0.04863363	0.57720439
M	35	0.02223638	0.34420067	0.02408941	0.00185303	0.02825874	0.57675616
M	36	0.01074169	0.37502498	0.01214278	0.00233515	0.03782942	0.5926609
M	37	0.01719715	0.26032921	0.0231272	0.00415104	0.05396346	0.57936591
M	256	0.00167363	0.22259238	0.02677803	0.00502088	0.00669451	0.61087382
M	258	0.00170069	0.33503665	0.02210902	0.00510208	0.01360555	0.62925665
M	260	0.00367905	0.33295417	0.03679052	0.00367905	0.01103715	0.61440161
M	262	0.00164312	0.2546833	0.05915225	0.00492935	0.00985871	0.62767111
M	264	0.00183953	0.31455891	0.04230909	0.00367905	0.02023478	0.61992019
M	266	0.00262534	0.28441212	0.04813128	0.0061258	0.01312671	0.60557903
M	267	0.00144054	0.31619894	0.03097165	0.00144054	0.00936352	0.61655193
M	268	0.00071375	0.35259381	0.00642377	0.00214126	0.00713753	0.62025105
M	269	0.00157346	0.34930806	0.01101422	0.00708057	0.0157346	0.61364929
M	274	0.00164526	0.34221415	0.0871988	0.00329052	0.01727523	0.62190841
M	275	0.00071618	0.35451065	0.01217511	0.00071618	0.00572947	0.62307933
M	276	0.00342446	0.35100748	0.02397124	0.00770504	0.02140289	0.62410842
M	280	0.00293841	0.34058874	0.12368046	0.00106851	0.02591146	0.61332687
M	281	0.00249672	0.39091535	0.0420876	0.00071335	0.00998689	0.63095734
M	282	0.00143644	0.43452384	0.01436442	0.00143644	0.00718221	0.61802936
M	283	0.0016578	0.39820272	0.00563651	0.00099468	0.01425705	0.62896799
M	284	0.00460158	0.37353974	0.00784975	0.00866179	0.03058695	0.62256623
M	290	0.00229335	0.34858888	0.10377399	0.00086001	0.02035346	0.63038401
M	291	0.00252239	0.42051812	0.0140533	0.00072068	0.00756716	0.63095734
M	292	0.00248828	0.40807833	0.0056875	0.00071094	0.00888672	0.63095734
M	293	0.00421012	0.35196642	0.00533282	0.00280675	0.02385737	0.6135555

Table 15
n260/mid channel, Antenna M Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
M	0	0.00830207	0.23245797	0.02490621	0.00276736	0.01660414	0.63095734
M	2	0.01414703	0.21220538	0.02829405	0.00282941	0.02263524	0.6054927
M	4	0.00785424	0.25657187	0.03403504	0.00261808	0.05497969	0.5445607
M	6	0.0079868	0.19434551	0.04792081	0.00266227	0.04259628	0.60699694
M	8	0.01349641	0.24968366	0.06410797	0.01012231	0.05061155	0.61746093
M	10	0.00962244	0.21306838	0.04536295	0.0041239	0.04948685	0.62408417
M	11	0.01630705	0.2483689	0.0213246	0.00376317	0.01379827	0.63095734
M	12	0.01568678	0.24924558	0.01742976	0.00174298	0.02614464	0.59261187
M	13	0.01606604	0.21324021	0.03213209	0.0029211	0.04527703	0.56669317
M	18	0.01307068	0.2317075	0.03208258	0.00356473	0.01188244	0.63095734
M	19	0.02126823	0.32079573	0.02658528	0.00708941	0.06380468	0.63095734
M	20	0.01187684	0.17815266	0.03711514	0.00148461	0.02523829	0.54188101
M	24	0.00448681	0.26247826	0.09646637	0.00504766	0.04823318	0.52607821
M	25	0.01699364	0.20502002	0.04275819	0.00219273	0.03727637	0.53995915
M	26	0.02812407	0.35827617	0.02017596	0.00489114	0.01956457	0.63095734
M	27	0.02783635	0.18712215	0.02551666	0.01082525	0.10515956	0.54590182
M	28	0.02300728	0.17987513	0.06902185	0.00418314	0.043923	0.63095734
M	34	0.00939253	0.23591838	0.06740525	0.00497252	0.04530517	0.538137
M	35	0.02027419	0.2869105	0.03071847	0.00184311	0.02088856	0.62297054
M	36	0.02320246	0.37797563	0.02619633	0.00374233	0.04790186	0.61598801
M	37	0.03004559	0.17383519	0.02289188	0.00929982	0.08870602	0.51077499
M	256	0.0026964	0.19414072	0.01617839	0.0026964	0.01617839	0.53927978
M	258	0.00502755	0.20110194	0.02011019	0.00251377	0.01508265	0.63095734
M	260	0.00646031	0.19165599	0.01938094	0.00215344	0.01292063	0.63095734
M	262	0.00827485	0.11998533	0.06206138	0.00206871	0.02068713	0.63095734
M	264	0.00536985	0.20136937	0.04564372	0.00268492	0.01879447	0.63095734
M	266	0.00335022	0.18091166	0.06700432	0.00223348	0.01675108	0.57288693
M	267	0.0096884	0.15259237	0.05207517	0.00121105	0.01453261	0.63095734
M	268	0.0070367	0.22165602	0.01055505	0.00117278	0.01759175	0.63095734
M	269	0.00464794	0.16848769	0.03137357	0.00232397	0.01626778	0.63095734
M	274	0.00559607	0.20705474	0.02798037	0.00279804	0.01958626	0.55820838
M	275	0.00614968	0.23614778	0.00737962	0.00122994	0.01721911	0.63095734
M	276	0.01041184	0.17700124	0.03123551	0.00104118	0.01874131	0.63095734
M	280	0.00461998	0.23429901	0.13265944	0.00461998	0.03233986	0.59729749
M	281	0.00746401	0.20003537	0.04428644	0.0014928	0.01492801	0.54586767
M	282	0.01401054	0.20049563	0.01497678	0.00096624	0.01014556	0.63095734
M	283	0.0145951	0.23183753	0.01515645	0.0011227	0.02975155	0.63095734
M	284	0.00969134	0.18515563	0.0346848	0.00153021	0.01887261	0.63095734
M	290	0.00508017	0.20219084	0.10261947	0.0030481	0.02336879	0.55221468
M	291	0.01232568	0.20836266	0.01643424	0.00176081	0.01408649	0.59750193
M	292	0.01418431	0.20249329	0.0102714	0.00048911	0.01418431	0.63095734
M	293	0.00949936	0.22348489	0.01799878	0.00099993	0.02949801	0.61145866

Note: For left edge, only H beams were considered for non-selected surface testing.

Table 16
n258/mid channel, Antenna N Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
N	1	0.59818034	0.00546283	0	0.01365709	0.22670762	0.3031873
N	3	0.56976081	0.00422045	0.00211023	0.01266135	0.20258162	0.25533725
N	5	0.61053067	0.00680889	0.00226963	0.02042668	0.17249194	0.28143421
N	7	0.61672522	0.00474404	0.00237202	0.0237202	0.22534191	0.23008595
N	9	0.60002806	0.00618586	0.00309293	0.00618586	0.22887668	0.27836353
N	14	0.61225308	0.00498781	0.00124695	0.02119817	0.20325306	0.36410977
N	15	0.61946798	0.00191489	0	0.00670213	0.26234038	0.26234038
N	16	0.60927496	0.00325236	0.00216824	0.00325236	0.27645038	0.29379629
N	17	0.59029565	0.00560851	0.00280425	0.01261915	0.25799145	0.35894462
N	21	0.61561802	0.00306786	0	0.01227146	0.24236125	0.29042445
N	22	0.61900416	0.0025614	0.0008538	0.00426899	0.22967189	0.28858401
N	23	0.63095734	0.00575691	0.00345415	0.01151382	0.22797364	0.3327494
N	29	0.5603079	0.00266602	0.00088867	0.02532716	0.19062021	0.30659195
N	30	0.6148939	0.00298855	0.00037357	0.00261498	0.25514735	0.28017644
N	31	0.63024197	0.00464991	0.00035769	0.00143074	0.28972531	0.28936763
N	32	0.62268989	0.00300635	0.00037579	0.00150317	0.26117651	0.29687689
N	33	0.59093186	0.01223001	0.0055591	0.00277955	0.16121377	0.45751356
N	38	0.5766859	0.00207143	0.00082857	0.0145	0.20590007	0.28958581
N	39	0.62954264	0.00282941	0.00035368	0.00176838	0.28824565	0.2744523
N	40	0.63095734	0.00418083	0.0003484	0.00209042	0.28255461	0.29509711
N	41	0.57826201	0.00878256	0.0023112	0.00184896	0.20615896	0.37348977
N	257	0.59284583	0.00846923	0.00423461	0.00846923	0.20749604	0.35147288
N	259	0.54392875	0.00870286	0.00435143	0.01305429	0.16970577	0.26543723
N	261	0.5537899	0.00907852	0.00453926	0.01361778	0.19064898	0.22242381
N	263	0.5537899	0.00453926	0.00453926	0.01361778	0.18610972	0.295052
N	265	0.54140211	0.00407069	0.00407069	0.00814139	0.19539324	0.22388809
N	270	0.55823684	0.00855535	0.00213884	0.01711071	0.22030036	0.26521597
N	271	0.55483649	0.0067663	0	0.00507472	0.2199047	0.226671
N	272	0.55165669	0.00344785	0.00344785	0.00344785	0.19825162	0.24307373
N	273	0.54250538	0.009828	0.0058968	0.0078624	0.20245672	0.39705104
N	277	0.58615564	0.00373348	0.00186674	0.00746695	0.2128081	0.24454264
N	278	0.5577793	0.00650471	0.00162618	0.00162618	0.21628177	0.23904827
N	279	0.53244356	0.0070367	0.00469113	0.00938227	0.17826304	0.30961476
N	285	0.58459538	0.00434643	0.00072441	0.01593692	0.25643961	0.25716402
N	286	0.55596143	0.00681781	0.0006198	0.003099	0.2640352	0.21816993
N	287	0.54874367	0.00587241	0.00065249	0.00130498	0.25642837	0.22445639
N	288	0.56353221	0.00425843	0.00141948	0.00283895	0.21647018	0.31157511
N	289	0.55722121	0.01026706	0.01120043	0.00560021	0.15120575	0.38641471
N	294	0.56244595	0.00587241	0.00065249	0.00521992	0.2668682	0.2296763
N	295	0.56284615	0.0080495	0.00061919	0.00123839	0.2712064	0.22662452
N	296	0.55208768	0.00548659	0.00068582	0.00274329	0.22632166	0.27364346
N	297	0.57213246	0.00564074	0.00483492	0.0040291	0.19581435	0.35375514

Table 17
n261/mid channel, Antenna N Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
N	1	0.59445568	0.00260726	0.00260726	0.00521452	0.25811891	0.18511558
N	3	0.63095734	0.00997561	0.0024939	0.00498781	0.21198172	0.20450001
N	5	0.63095734	0.00711606	0.00237202	0.00711606	0.22771393	0.21585383
N	7	0.58558028	0.00648244	0.00216081	0.01296488	0.20311641	0.16422177
N	9	0.55805789	0.00251377	0.00251377	0.00754132	0.22121214	0.19356062
N	14	0.63095734	0.00878072	0.00250878	0.00627194	0.26342156	0.25464084
N	15	0.6220287	0.00595243	0.00099207	0.00297621	0.27083546	0.26984339
N	16	0.60222522	0.00689571	0.00114928	0.00459714	0.28502263	0.25169337
N	17	0.61946217	0.00638621	0.00255448	0.00894069	0.27971591	0.21968555
N	21	0.6191195	0.00591892	0.00236757	0.01065406	0.27582188	0.24030833
N	22	0.60737015	0.00707616	0	0.00353808	0.28068757	0.26417653
N	23	0.60928324	0.0072247	0.00120412	0.0072247	0.28657986	0.23600695
N	29	0.62541379	0.00453564	0.00151188	0.00907127	0.28171338	0.24794809
N	30	0.63095734	0.00682767	0.00040163	0.00120488	0.30523716	0.29680298
N	31	0.59968417	0.01141048	0.00042261	0.00126783	0.28991074	0.31188648
N	32	0.60958345	0.0076946	0.00042748	0.00299235	0.29239487	0.30692911
N	33	0.62253798	0.00445731	0.00099051	0.01337194	0.29467788	0.23128499
N	38	0.63095734	0.00529845	0.00176615	0.00309076	0.29936255	0.25874108
N	39	0.63009656	0.00946866	0.00043039	0.00258236	0.29998449	0.32968167
N	40	0.59478246	0.00967468	0.00042064	0.00210319	0.28897846	0.3091691
N	41	0.62478014	0.00529475	0.00044123	0.00352983	0.30135935	0.27753299
N	257	0.63095734	0.00510897	0.00255448	0.00766345	0.21968555	0.18647727
N	259	0.60121525	0.00424887	0.00212444	0.00849774	0.1975725	0.1614571
N	261	0.6160863	0.00212444	0.00212444	0.00637331	0.19969694	0.1614571
N	263	0.60484876	0.00217571	0.00435143	0.00435143	0.20451721	0.16753005
N	265	0.59774906	0.00510897	0.00510897	0.00255448	0.20691314	0.18647727
N	270	0.61078976	0.00384145	0.00384145	0.00288108	0.22376417	0.20263622
N	271	0.61193766	0.00165389	0.00165389	0.00082694	0.24477506	0.2009471
N	272	0.62738757	0.00178489	0.00089244	0.00446222	0.23738989	0.19812239
N	273	0.63095734	0.00355135	0.00118378	0.01065406	0.24741104	0.20716236
N	277	0.59991024	0.00300456	0.00400608	0.0050076	0.22934799	0.19830088
N	278	0.61087382	0.00167363	0.00083681	0.00167363	0.24434953	0.20167204
N	279	0.62414145	0.0029211	0.0009737	0.0068159	0.246346	0.20642432
N	285	0.6122462	0.009138	0.00826772	0.00261086	0.21409035	0.29328638
N	286	0.59893861	0.00452029	0.00075338	0.00113007	0.2497461	0.21132362
N	287	0.61273351	0.00171923	0.00103154	0.00068769	0.28195369	0.22728218
N	288	0.62013127	0.00135326	0.00067663	0.00101494	0.28452286	0.24494001
N	289	0.63095734	0.00199796	0.00039959	0.00879105	0.26852649	0.2337619
N	294	0.59970249	0.00468823	0.00156274	0.00078137	0.24222511	0.23128591
N	295	0.6098778	0.0035728	0.00107184	0.00142912	0.27046133	0.22079934
N	296	0.60938615	0.0013482	0.00033705	0.0006741	0.28177369	0.22885686
N	297	0.63095734	0.00141788	0.00035447	0.00248129	0.27400563	0.24458459

Table 18
n260/mid channel, Antenna N Patch simulated 4cm2 PD at PD_Design_Target (if simulation performed with correct housing material properties) (Δmin)

Antenna	Beam ID_1	Simulated 4cm^2 PD (mW/cm^2) Corresponding to PD_design_target if the simulation was performed with correct No. Module Type housing material properties					
		S4(Right)	S3(Left)	S5(Top)	S6(Bottom)	S1(Front)	S2(Back)
N	1	0.62530698	0.00376691	0.00188345	0.00941727	0.1996462	0.19022893
N	3	0.63095734	0.00504766	0.00336511	0.01850808	0.18171572	0.15815997
N	5	0.63095734	0.00448548	0.00897096	0.02541771	0.17941915	0.15998208
N	7	0.63095734	0.00975707	0.00162618	0.01463561	0.18863673	0.15773934
N	9	0.55849446	0.00353478	0.00176739	0.00883694	0.18557569	0.17850614
N	14	0.63095734	0.00426803	0.0092474	0.02418551	0.20842221	0.2027315
N	15	0.63095734	0.00342446	0.00171223	0.0162662	0.18748936	0.18834548
N	16	0.63095734	0.00856503	0.00380668	0.00475835	0.2969211	0.268371
N	17	0.63095734	0.0031313	0.00391413	0.01800499	0.18239834	0.18631247
N	21	0.63095734	0.0034592	0.00968575	0.0318246	0.17226796	0.15428014
N	22	0.63095734	0.00582422	0.00194141	0.00776563	0.26014857	0.25529505
N	23	0.63095734	0.00620105	0.00310053	0.00852645	0.24106601	0.22556337
N	29	0.63095734	0.00283647	0.00850941	0.03908028	0.22313576	0.22534191
N	30	0.59265144	0.00249144	0.00529431	0.04422307	0.18685805	0.17626943
N	31	0.63095734	0.01104415	0.00336126	0.01392524	0.27082187	0.26842097
N	32	0.56445103	0.0146655	0.00102317	0.00306952	0.28103181	0.25818092
N	33	0.63095734	0.00379216	0.01137648	0.02917047	0.22607117	0.22723799
N	38	0.63095734	0.00345128	0.0100401	0.03514034	0.22652969	0.23186349
N	39	0.608865	0.00441847	0.00176739	0.06450964	0.21517943	0.23638808
N	40	0.62279656	0.0085903	0.00214757	0.00429515	0.31010974	0.28133224
N	41	0.62670131	0.00567471	0.00851207	0.00461071	0.25997287	0.26458357
N	257	0.61396186	0.00424887	0.00424887	0.00212444	0.28467436	0.20819468
N	259	0.63095734	0.00622655	0.00415104	0.00622655	0.25113763	0.22208038
N	261	0.62122035	0.0116844	0.0058422	0.0116844	0.29016248	0.22979311
N	263	0.62912317	0.01100507	0.00550253	0.01100507	0.26962421	0.18525201
N	265	0.63095734	0.01034356	0.00206871	0.00413743	0.29375719	0.20066512
N	270	0.63095734	0.0079868	0.0079868	0.01896865	0.25457931	0.12179873
N	271	0.61364713	0.01125164	0.00519306	0.00865511	0.25099812	0.18695032
N	272	0.59986088	0.01304045	0.00802489	0.00902801	0.30293977	0.31196778
N	273	0.59175046	0.0072943	0.0072943	0.00455894	0.23980026	0.16138649
N	277	0.59992666	0.00724049	0.00827485	0.01551534	0.21928354	0.11791662
N	278	0.61337649	0.01855757	0.00293014	0.01269728	0.28715396	0.31450196
N	279	0.57091155	0.00571865	0.00571865	0.00381243	0.22207411	0.24113627
N	285	0.56934871	0.01274661	0.01327772	0.02549323	0.27192774	0.13224611
N	286	0.56960771	0.01085417	0.00660688	0.02501177	0.28268022	0.14629527
N	287	0.63095734	0.02073146	0.00225342	0.01352051	0.32719645	0.30240884
N	288	0.57315973	0.01782093	0.00626141	0.00337153	0.2663507	0.35208383
N	289	0.55864983	0.0104004	0.00940988	0.02674387	0.25604784	0.1391672
N	294	0.56596603	0.01299826	0.01353986	0.02653812	0.26917236	0.13106582
N	295	0.62188912	0.01479552	0.00620457	0.01384097	0.37084255	0.21572823
N	296	0.63095734	0.02765712	0.00234382	0.00281259	0.3084472	0.33094791
N	297	0.5968369	0.01353986	0.00812391	0.00866551	0.33362208	0.25292453

Note: For Back side and front side, only V beams were considered for non-selected surface testing.

The test results in the table below shows that the all measured 4cm2 PD values are less than PD_design_target of 0.631 mW/cm2, thus, the non-selected surfaces have no influence on the determined Δ_{min} and input.power.limit in Section 7.

Table 19
4cm2 PD of the selected beams measured on the corresponding surfaces that are not selected for Δmin determination

Band	Antenna	Beam ID	Surface	Tested Power Level (dBm)	input.power.limit (dBm)	Meas. 4cm^2 PD (mW/cm^2)
n258	M	0	Front	16.2	16.2	0.050
		10	Top	9.2	9.2	0.154
		24	Left	6.9	6.9	0.170
n261	M	0	Front	14.7	14.7	0.066
		24	Top	7.2	7.2	0.182
n260	M	27	Front	6.0	6.0	0.036
		280	Top	5.3	5.3	0.100
		275	Left	8.0	8.0	0.139
n258	N	33	Rear	4.5	4.5	0.264
		31	Front	2.8	2.8	0.149
n261	N	39	Rear	3.2	3.2	0.219
		30	Front	2.9	2.9	0.128
n260	N	40	Rear	4.6	4.6	0.215
		40	Front	4.6	4.6	0.231

7 PD Char

7.1 Single Beams

To determine the input power limit at each antenna port, simulation was performed at low, mid, and high channel for each mmW band supported, with 6 dBm input power per active port for n258 band, 6 dBm input power per active port for n261 band, and 6 dBm input power per active port for n260 band:

1. Obtained PDsurface value (the worst PD among all identified surfaces of the DUT) at all three channels for all single beams specified in the codebook.
2. Derived a scaling factor at low, mid and high channel, $s(i)_{low\_or\_mid\_or\_high}$, by:

$$s(i)_{low\_or\_mid\_or\_high} = \frac{PD\ design\ target}{sim.PD_{surface}(i)},\ i \in single\ beams \quad (1)$$

3. Determined the worst-case scaling factor, $\boldsymbol{s(i)}$, among low, mid and high channels:

$$\boldsymbol{s(i)} = min\{s_{low}(i), s_{mid}(i), s_{high}(i)\},\ i \in single\ beams \quad (2)$$

and this scaling factor applies to the input power at each antenna port.

7.2 Beam Pairs

Per the manufacturer, the relative phase between beam pair is not controlled in the chipset design and could vary from run to run. Therefore, for each beam pair, based on the simulation results, the worst-case scaling factor was determined mathematically to ensure the compliance. The worst-case PD for MIMO operations was found by sweeping the relative phase for all possible angles to ensure a conservative assessment. The power density simulation report contains the worst-case power density for each surface after sweeping through all relative phases between beams.

Once the power density was determined for the worst-case ∅, the scaling factor was obtained by the below equation for low, mid and high channels:

$$s(i)_{low\_or\_mid\_or\_high} = \frac{PD\ design\ target}{total\ PD\ (\emptyset(i)_{worstcase})}, i \in beam\ pairs \qquad (3)$$

The $total\ PD\ (\emptyset_{worstcase})$ varies with channel and beam pair, the lowest scaling factor among all three channels, $s(i)$, is determined for the beam pair i:

$$\boldsymbol{s(i)} = min\{s_{low}(i), s_{mid}(i), s_{high}(i)\},\ i \in beam\ pairs \qquad (4)$$

7.3 *Input.Power.Limit* Calculations

The PD Char specifies the limit of input power at antenna port that corresponds to PD_design_target for all the beams.

Ideally, if there is no uncertainty associated with hardware design, the input power limit, denoted as $input.power.limit(i)$, for beam i can be obtained after accounting for the housing influence (Δ_{min}), given by:

- For n258, n261, and n260

$$input.power.limit(i) = sim.power_{limit} + 10 * \log\big(s(i)\big) + \Delta_{min},\ i \in all\ beams \quad (5)$$

where 6 dBm is the input power used in simulation for n258, n261 and n260, respectively; $s(i)$ is the scaling factor obtained from Eq. (2) or Eq. (4) for beam i; Δ_{min} is the worst-case housing influence factor for beam i.

If simulation overestimates the housing influence, then Δ_{min} (= simulated PD – measured PD) is negative, which means that the measured PD would be higher than the simulated PD. The input power to antenna elements determined via simulation must be decreased for compliance.

Similarly, if simulation underestimates the loss, then Δ_{min} is positive (measured PD would be lower than the simulated value). Input power to antenna elements determined via simulation can be increased and still be PD compliant.

In reality the hardware design has uncertainty which must be properly considered. The device design related uncertainty is embedded in the process of Δ_{min} determination. Since the device uncertainty is already accounted for in PD_design_target, it needs to be removed to avoid double counting this uncertainty.

Thus, Equation 5 is modified to:

If -TxAGC uncertainty < Δmin < TxAGC uncertainty,

$$input.power.limit(i) = sim.power_{limit}(\mathrm{i}),\ i \in all\ beams, \text{ for n258, n261, and n260} \quad (6)$$

else if Δmin < -TxAGC uncertainty,

$$input.power.limit(i) = sim.power_{limit}(\mathrm{i}) + (\Delta_{min} + \mathrm{TxAGC\ uncertainty}),$$
$$i \in all\ beams, \text{ for n258, n261, and n260} \quad (7)$$

else if Δmin > TxAGC uncertainty,

$$input.power.limit(i) = sim.power_{limit}(\mathrm{i}) + (\Delta_{min} - \mathrm{TxAGC\ uncertainty}),$$
$$i \in all\ beams, \text{ for n258, n261, and n260} \quad (8)$$

Following above logic, the input.power.limit for this DUT can be calculated using Equations (6), (7), and (8), i.e.,

Table 20
***input.power.limit* Calculation**

Band	Antenna	Δmin	TxAGC Uncertainty	*input.power.limit*	Notes
n258	M	1.47	0.47	*input.power.limit(i) = sim.power_limit + 1*	Using Eq.8
n258	N	1.49	0.47	*input.power.limit(i) = sim.power_limit + 1.02*	Using Eq.8
n261	M	2.22	0.47	*input.power.limit(i) = sim.power_limit + 1.75*	Using Eq.8
n261	N	1.30	0.47	*input.power.limit(i) = sim.power_limit + 0.83*	Using Eq.8
n260	M	1.54	0.47	*input.power.limit(i) = sim.power_limit + 1.07*	Using Eq.8
n260	N	2.74	0.47	*input.power.limit(i) = sim.power_limit + 2.27*	Using Eq.8

Table 21
Permanent backoff applied to calculated input.power.limit

Band	Antenna	backoff (dB)
n258	M	0.1
n261	M	0.1
n260	M	0.1
n258	N	0.2
n261	N	0.1
n260	N	0.2

Note: The above backoff values have been permanently applied to the input.power.limits calculated from the equations above. The final input.power.limits implemented in the EFS are in the tables below.

Table 22

5G mmWave NR n258 M Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n258	0		16.2
n258	2		11.2
n258	4		11.3
n258	6		12.9
n258	8		11.0
n258	10		9.2
n258	11		9.4
n258	12		8.4
n258	13		10.1
n258	18		8.9
n258	19		9.3
n258	20		9.7
n258	24		6.8
n258	25		5.8
n258	26		3.9
n258	27		4.3
n258	28		6.7
n258	34		6.7
n258	35		4.4
n258	36		3.8
n258	37		5.4
n258		256	10.0
n258		258	9.7
n258		260	9.7
n258		262	10.4
n258		264	10.1
n258		266	7.6
n258		267	6.2
n258		268	6.1
n258		269	7.3
n258		274	6.6
n258		275	6.0
n258		276	6.2
n258		280	3.0
n258		281	2.1
n258		282	2.7
n258		283	2.5
n258		284	1.7
n258		290	2.0
n258		291	2.5
n258		292	2.5
n258		293	2.2
n258	0	256	8.0
n258	2	258	7.1
n258	4	260	7.1
n258	6	262	7.8
n258	8	264	7.3
n258	10	266	4.4
n258	11	267	3.9
n258	12	268	4.3
n258	13	269	5.3
n258	18	274	3.8
n258	19	275	3.8
n258	20	276	5.4
n258	24	280	-0.1
n258	25	281	0.2
n258	26	282	-0.1
n258	27	283	0.1
n258	28	284	0.2
n258	34	290	-0.4
n258	35	291	0.1
n258	36	292	-0.1
n258	37	293	0.5

Table 23

5G mmWave NR n261 M Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n261	0		14.6
n261	2		11.5
n261	4		11.4
n261	6		11.5
n261	8		12.2
n261	10		9.2
n261	11		8.4
n261	12		8.5
n261	13		9.1
n261	18		9.2
n261	19		7.1
n261	20		10.8
n261	24		7.1
n261	25		4.9
n261	26		4.1
n261	27		5.0
n261	28		6.1
n261	34		5.8
n261	35		4.4
n261	36		4.4
n261	37		5.4
n261		256	9.9
n261		258	10.0
n261		260	10.3
n261		262	9.8
n261		264	10.3
n261		266	7.1
n261		267	6.3
n261		268	6.2
n261		269	6.7
n261		274	6.8
n261		275	6.2
n261		276	7.0
n261		280	2.0
n261		281	3.2
n261		282	3.2
n261		283	2.9
n261		284	2.0
n261		290	2.3
n261		291	3.3
n261		292	3.2
n261		293	2.2
n261	0	256	7.8
n261	2	258	7.4
n261	4	260	7.7
n261	6	262	7.1
n261	8	264	8.0
n261	10	266	4.8
n261	11	267	4.7
n261	12	268	4.3
n261	13	269	5.1
n261	18	274	4.6
n261	19	275	3.5
n261	20	276	4.9
n261	24	280	0.1
n261	25	281	0.6
n261	26	282	0.4
n261	27	283	0.3
n261	28	284	0.0
n261	34	290	0.0
n261	35	291	0.5
n261	36	292	0.5
n261	37	293	0.3

Table 24

5G mmWave NR n260 M Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n260	0		11.4
n260	2		11.5
n260	4		11.2
n260	6		11.3
n260	8		12.3
n260	10		8.4
n260	11		8.0
n260	12		9.4
n260	13		8.7
n260	18		7.8
n260	19		9.5
n260	20		8.7
n260	24		4.5
n260	25		4.4
n260	26		4.9
n260	27		5.9
n260	28		5.5
n260	34		4.4
n260	35		4.9
n260	36		5.8
n260	37		5.6
n260		256	11.3
n260		258	11.0
n260		260	10.4
n260		262	10.2
n260		264	11.3
n260		266	7.5
n260		267	7.9
n260		268	7.7
n260		269	7.7
n260		274	8.5
n260		275	7.9
n260		276	7.2
n260		280	5.2
n260		281	4.0
n260		282	3.9
n260		283	4.5
n260		284	4.1
n260		290	4.1
n260		291	4.7
n260		292	3.9
n260		293	4.0
n260	0	256	8.2
n260	2	258	7.9
n260	4	260	7.6
n260	6	262	7.0
n260	8	264	8.4
n260	10	266	4.0
n260	11	267	5.4
n260	12	268	5.2
n260	13	269	4.6
n260	18	274	4.7
n260	19	275	5.5
n260	20	276	4.8
n260	24	280	1.0
n260	25	281	0.6
n260	26	282	0.9
n260	27	283	1.3
n260	28	284	1.1
n260	34	290	0.4
n260	35	291	0.9
n260	36	292	1.1
n260	37	293	1.0

Table 25

5G mmWave NR n258 N Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n258	1		11.2
n258	3		10.1
n258	5		10.4
n258	7		10.6
n258	9		11.8
n258	14		7.8
n258	15		6.7
n258	16		7.2
n258	17		8.3
n258	21		7.0
n258	22		6.2
n258	23		7.5
n258	29		3.4
n258	30		2.6
n258	31		2.4
n258	32		2.6
n258	33		4.3
n258	38		3.0
n258	39		2.4
n258	40		2.3
n258	41		3.5
n258		257	13.1
n258		259	13.3
n258		261	13.5
n258		263	13.4
n258		265	13.0
n258		270	10.2
n258		271	9.2
n258		272	9.2
n258		273	9.8
n258		277	9.6
n258		278	9.0
n258		279	10.6
n258		285	5.5
n258		286	4.8
n258		287	5.0
n258		288	5.4
n258		289	6.6
n258		294	5.0
n258		295	4.8
n258		296	5.2
n258		297	5.9
n258	1	257	8.5
n258	3	259	7.6
n258	5	261	7.7
n258	7	263	8.0
n258	9	265	8.2
n258	14	270	5.7
n258	15	271	4.0
n258	16	272	4.5
n258	17	273	5.2
n258	21	277	4.3
n258	22	278	3.6
n258	23	279	5.5
n258	29	285	0.6
n258	30	286	-0.3
n258	31	287	-0.3
n258	32	288	0.2
n258	33	289	1.6
n258	38	294	0.2
n258	39	295	-0.4
n258	40	296	-0.1
n258	41	297	1.1

Table 26

5G mmWave NR n261 N Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n261	1		10.9
n261	3		10.8
n261	5		10.5
n261	7		10.1
n261	9		10.8
n261	14		7.8
n261	15		6.7
n261	16		7.4
n261	17		7.8
n261	21		7.5
n261	22		7.5
n261	23		7.6
n261	29		3.8
n261	30		2.8
n261	31		3.0
n261	32		3.1
n261	33		3.7
n261	38		3.2
n261	39		3.1
n261	40		3.0
n261	41		3.2
n261		257	10.8
n261		259	10.1
n261		261	10.0
n261		263	10.2
n261		265	10.8
n261		270	6.6
n261		271	5.9
n261		272	6.3
n261		273	7.5
n261		277	6.8
n261		278	6.0
n261		279	6.7
n261		285	3.2
n261		286	2.5
n261		287	2.1
n261		288	2.1
n261		289	2.8
n261		294	2.7
n261		295	2.3
n261		296	2.1
n261		297	2.3
n261	1	257	7.4
n261	3	259	6.9
n261	5	261	6.8
n261	7	263	6.9
n261	9	265	7.2
n261	14	270	3.8
n261	15	271	3.1
n261	16	272	3.4
n261	17	273	4.3
n261	21	277	4.2
n261	22	278	3.2
n261	23	279	3.9
n261	29	285	-0.2
n261	30	286	-0.9
n261	31	287	-0.8
n261	32	288	-0.8
n261	33	289	-0.2
n261	38	294	-0.7
n261	39	295	-0.8
n261	40	296	-0.8
n261	41	297	-0.7

Table 27

5G mmWave NR n260 N Patch *input.power.limit*

Band	Beam ID 1	Beam ID 2	input.power.limit
n260	1		10.9
n260	3		10.4
n260	5		9.9
n260	7		10.2
n260	9		10.6
n260	14		6.6
n260	15		7.5
n260	16		7.9
n260	17		7.1
n260	21		6.5
n260	22		8.0
n260	23		7.0
n260	29		3.1
n260	30		3.1
n260	31		4.9
n260	32		3.5
n260	33		2.8
n260	38		3.1
n260	39		4.6
n260	40		4.5
n260	41		3.6
n260		257	11.4
n260		259	11.3
n260		261	11.0
n260		263	10.8
n260		265	11.3
n260		270	8.1
n260		271	7.5
n260		272	8.1
n260		273	7.7
n260		277	8.3
n260		278	8.0
n260		279	7.9
n260		285	5.4
n260		286	4.9
n260		287	4.7
n260		288	5.0
n260		289	5.1
n260		294	5.5
n260		295	4.9
n260		296	4.8
n260		297	5.5
n260	1	257	7.7
n260	3	259	7.2
n260	5	261	7.2
n260	7	263	6.9
n260	9	265	7.3
n260	14	270	3.9
n260	15	271	4.0
n260	16	272	4.4
n260	17	273	4.0
n260	21	277	4.0
n260	22	278	4.9
n260	23	279	3.9
n260	29	285	0.8
n260	30	286	0.4
n260	31	287	1.2
n260	32	288	0.8
n260	33	289	0.5
n260	38	294	0.6
n260	39	295	0.6
n260	40	296	1.0
n260	41	297	0.4