Sony Mobile Communications

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Part 0 SAR and PD Characterization

1. Power Density (PD) Characterization

1.1 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 4 patch antenna arrays (ANT#0, ANT#1, ANT#2, ANT#3).
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

Note: The Patch antenna, located on the back surface, is constructed with its dedicated ground plane behind the entire patch array and can only propagate outward. Therefore, the front surface (S1) is excluded in Table 1 for the Patch antenna.

	Front	Back	Left (Front View)	Right (Front View)	Top	Bottom
	S1	S2	S3	S4	S5	S6
ANT#0 (Left module)	O	O	O	X	O	O
ANT#1 (Right module)	O	O	X	O	O	O
ANT#2 (Top module)	O	O	O	O	O	X
ANT#3 (Bottom module)	O	O	O	O	X	O

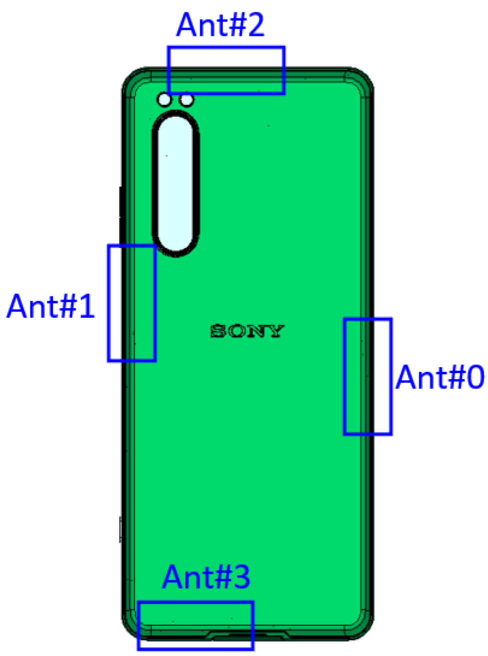
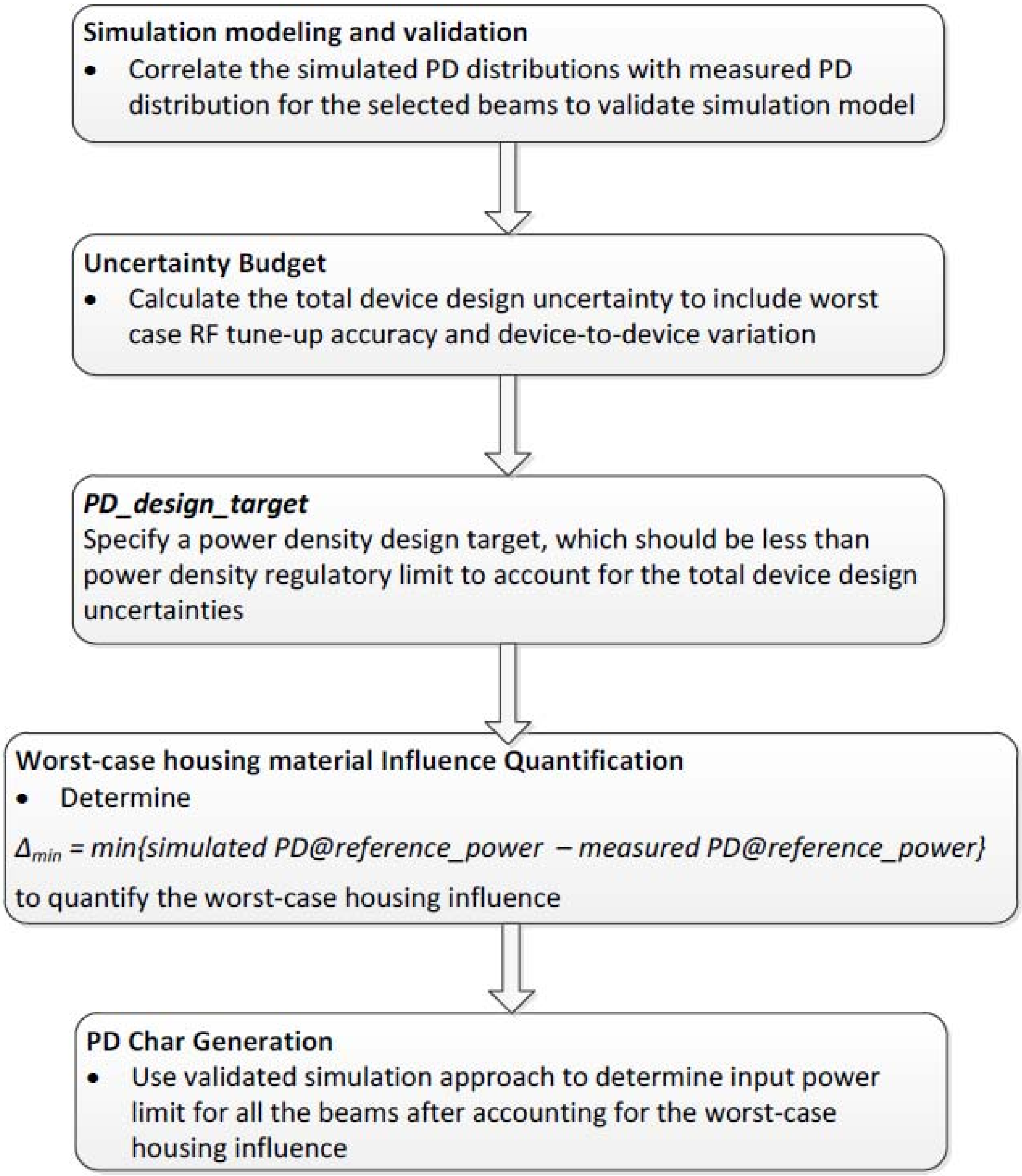


Figure 1: Location of mmWave modules (Back side)

1.2 Power Density Characterization Method



1.3 Codebook for all supported beams

Table 2
5G mmW NR Band n261 ANT#0 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
261	1	0	PATCH	129	1
261	7	0	PATCH	135	2
261	8	0	PATCH	136	2
261	9	0	PATCH	137	2
261	18	0	PATCH	146	2
261	19	0	PATCH	147	2
261	29	0	PATCH	157	4
261	30	0	PATCH	158	4
261	31	0	PATCH	159	4
261	32	0	PATCH	160	4
261	33	0	PATCH	161	4
261	48	0	PATCH	176	4
261	49	0	PATCH	177	4
261	50	0	PATCH	178	4
261	51	0	PATCH	179	4
261	129	0	PATCH	1	1
261	135	0	PATCH	7	2
261	136	0	PATCH	8	2
261	137	0	PATCH	9	2
261	146	0	PATCH	18	2
261	147	0	PATCH	19	2
261	157	0	PATCH	29	4
261	158	0	PATCH	30	4
261	159	0	PATCH	31	4
261	160	0	PATCH	32	4
261	161	0	PATCH	33	4
261	176	0	PATCH	48	4
261	177	0	PATCH	49	4
261	178	0	PATCH	50	4
261	179	0	PATCH	51	4

Table 3
5G mmW NR Band n261 ANT#1 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
261	0	1	PATCH	128	1
261	4	1	PATCH	134	2
261	5	1	PATCH	133	2
261	6	1	PATCH	132	2
261	16	1	PATCH	144	2
261	17	1	PATCH	145	2
261	24	1	PATCH	155	4
261	25	1	PATCH	154	4
261	26	1	PATCH	153	4
261	27	1	PATCH	156	4
261	28	1	PATCH	152	4
261	44	1	PATCH	174	4
261	45	1	PATCH	173	4
261	46	1	PATCH	175	4
261	47	1	PATCH	172	4
261	128	1	PATCH	0	1
261	132	1	PATCH	6	2
261	133	1	PATCH	5	2
261	134	1	PATCH	4	2
261	144	1	PATCH	16	2
261	145	1	PATCH	17	2
261	152	1	PATCH	28	4
261	153	1	PATCH	26	4
261	154	1	PATCH	25	4
261	155	1	PATCH	24	4
261	156	1	PATCH	27	4
261	172	1	PATCH	47	4
261	173	1	PATCH	45	4
261	174	1	PATCH	44	4
261	175	1	PATCH	46	4

Table 4
5G mmW NR Band n261 ANT#2 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
261	3	2	PATCH	131	1
261	13	2	PATCH	141	2
261	14	2	PATCH	142	2
261	15	2	PATCH	143	2
261	22	2	PATCH	150	2
261	23	2	PATCH	151	2
261	39	2	PATCH	168	4
261	40	2	PATCH	169	4
261	41	2	PATCH	167	4
261	42	2	PATCH	170	4
261	43	2	PATCH	171	4
261	56	2	PATCH	185	4
261	57	2	PATCH	186	4
261	58	2	PATCH	184	4
261	59	2	PATCH	187	4
261	131	2	PATCH	3	1
261	141	2	PATCH	13	2
261	142	2	PATCH	14	2
261	143	2	PATCH	15	2
261	150	2	PATCH	22	2
261	151	2	PATCH	23	2
261	167	2	PATCH	41	4
261	168	2	PATCH	39	4
261	169	2	PATCH	40	4
261	170	2	PATCH	42	4
261	171	2	PATCH	43	4
261	184	2	PATCH	58	4
261	185	2	PATCH	56	4
261	186	2	PATCH	57	4
261	187	2	PATCH	59	4

Table 5
5G mmW NR Band n261 ANT#3 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
261	2	3	PATCH	130	1
261	10	3	PATCH	138	2
261	11	3	PATCH	139	2
261	12	3	PATCH	140	2
261	20	3	PATCH	148	2
261	21	3	PATCH	149	2
261	34	3	PATCH	162	4
261	35	3	PATCH	163	4
261	36	3	PATCH	164	4
261	37	3	PATCH	165	4
261	38	3	PATCH	166	4
261	52	3	PATCH	180	4
261	53	3	PATCH	181	4
261	54	3	PATCH	182	4
261	55	3	PATCH	183	4
261	130	3	PATCH	2	1
261	138	3	PATCH	10	2
261	139	3	PATCH	11	2
261	140	3	PATCH	12	2
261	148	3	PATCH	20	2
261	149	3	PATCH	21	2
261	162	3	PATCH	34	4
261	163	3	PATCH	35	4
261	164	3	PATCH	36	4
261	165	3	PATCH	37	4
261	166	3	PATCH	38	4
261	180	3	PATCH	52	4
261	181	3	PATCH	53	4
261	182	3	PATCH	54	4
261	183	3	PATCH	55	4

Table 6
5G mmW NR Band n260 ANT#0 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
260	1	0	PATCH	129	1
260	7	0	PATCH	137	2
260	8	0	PATCH	136	2
260	9	0	PATCH	135	2
260	18	0	PATCH	147	2
260	19	0	PATCH	146	2
260	29	0	PATCH	160	4
260	30	0	PATCH	159	4
260	31	0	PATCH	158	4
260	32	0	PATCH	157	4
260	33	0	PATCH	161	4
260	48	0	PATCH	178	4
260	49	0	PATCH	177	4
260	50	0	PATCH	176	4
260	51	0	PATCH	179	4
260	129	0	PATCH	1	1
260	135	0	PATCH	9	2
260	136	0	PATCH	8	2
260	137	0	PATCH	7	2
260	146	0	PATCH	19	2
260	147	0	PATCH	18	2
260	157	0	PATCH	32	4
260	158	0	PATCH	31	4
260	159	0	PATCH	30	4
260	160	0	PATCH	29	4
260	161	0	PATCH	33	4
260	176	0	PATCH	50	4
260	177	0	PATCH	49	4
260	178	0	PATCH	48	4
260	179	0	PATCH	51	4

Table 7
5G mmW NR Band n260 ANT#1 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
260	0	1	PATCH	128	1
260	4	1	PATCH	132	2
260	5	1	PATCH	133	2
260	6	1	PATCH	134	2
260	16	1	PATCH	145	2
260	17	1	PATCH	144	2
260	24	1	PATCH	152	4
260	25	1	PATCH	153	4
260	26	1	PATCH	154	4
260	27	1	PATCH	155	4
260	28	1	PATCH	156	4
260	44	1	PATCH	172	4
260	45	1	PATCH	173	4
260	46	1	PATCH	174	4
260	47	1	PATCH	175	4
260	128	1	PATCH	0	1
260	132	1	PATCH	4	2
260	133	1	PATCH	5	2
260	134	1	PATCH	6	2
260	144	1	PATCH	17	2
260	145	1	PATCH	16	2
260	152	1	PATCH	24	4
260	153	1	PATCH	25	4
260	154	1	PATCH	26	4
260	155	1	PATCH	27	4
260	156	1	PATCH	28	4
260	172	1	PATCH	44	4
260	173	1	PATCH	45	4
260	174	1	PATCH	46	4
260	175	1	PATCH	47	4

Table 8
5G mmW NR Band n260 ANT#2 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
260	3	2	PATCH	131	1
260	13	2	PATCH	142	2
260	14	2	PATCH	143	2
260	15	2	PATCH	141	2
260	22	2	PATCH	150	2
260	23	2	PATCH	151	2
260	39	2	PATCH	170	4
260	40	2	PATCH	169	4
260	41	2	PATCH	168	4
260	42	2	PATCH	167	4
260	43	2	PATCH	171	4
260	56	2	PATCH	186	4
260	57	2	PATCH	185	4
260	58	2	PATCH	184	4
260	59	2	PATCH	187	4
260	131	2	PATCH	3	1
260	141	2	PATCH	15	2
260	142	2	PATCH	13	2
260	143	2	PATCH	14	2
260	150	2	PATCH	22	2
260	151	2	PATCH	23	2
260	167	2	PATCH	42	4
260	168	2	PATCH	41	4
260	169	2	PATCH	40	4
260	170	2	PATCH	39	4
260	171	2	PATCH	43	4
260	184	2	PATCH	58	4
260	185	2	PATCH	57	4
260	186	2	PATCH	56	4
260	187	2	PATCH	59	4

Table 9
5G mmW NR Band n260 ANT#3 Codebook

Band	Beam ID	Antenna	Ant_Type	Paired_With	# of Ant Feed
260	2	3	PATCH	130	1
260	10	3	PATCH	138	2
260	11	3	PATCH	139	2
260	12	3	PATCH	140	2
260	20	3	PATCH	148	2
260	21	3	PATCH	149	2
260	34	3	PATCH	162	4
260	35	3	PATCH	163	4
260	36	3	PATCH	164	4
260	37	3	PATCH	165	4
260	38	3	PATCH	166	4
260	52	3	PATCH	180	4
260	53	3	PATCH	181	4
260	54	3	PATCH	183	4
260	55	3	PATCH	182	4
260	130	3	PATCH	2	1
260	138	3	PATCH	10	2
260	139	3	PATCH	11	2
260	140	3	PATCH	12	2
260	148	3	PATCH	20	2
260	149	3	PATCH	21	2
260	162	3	PATCH	34	4
260	163	3	PATCH	35	4
260	164	3	PATCH	36	4
260	165	3	PATCH	37	4
260	166	3	PATCH	38	4
260	180	3	PATCH	52	4
260	181	3	PATCH	53	4
260	182	3	PATCH	55	4
260	183	3	PATCH	54	4

1.4 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 n261 band and 6 dBm for n260 band, PD measurements are conducted per antenna module (ANT#0, ANT#1, ANT#2, ANT#3) 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 10

					4cm² ave. PD (W/m²)		
Bnd	Beam ID	Antenna	Surface	Channel	Meas.	Sim.	Delta = Sim-Meas. (dB)
n261	31	ANT#0	Left (S3)	Mid	8.64	18.50	3.31
	158		Left (S3)	Mid	8.66	18.08	3.20
	46	ANT#1	Right (S4)	Mid	7.54	17.90	3.75
	154		Right (S4)	Mid	8.39	17.23	3.13
	41	ANT#2	Top (S5)	Mid	9.27	18.14	2.92
	169		Top (S5)	Mid	9.24	18.33	2.97
	35	ANT#3	Bottom (S6)	Mid	5.95	12.26	3.14
	163		Bottom (S6)	Mid	6.2	14.07	3.56
n260	31	ANT#0	Left (S3)	Mid	10.76	17.76	2.18
	158		Left (S3)	Mid	10.72	17.79	2.20
	26	ANT#1	Right (S4)	Mid	9.84	17.80	2.57
	155		Right (S4)	Mid	8.97	18.17	3.07
	42	ANT#2	Top (S5)	Mid	8.87	18.86	3.28
	184		Top (S5)	Mid	9.57	17.54	2.63
	52	ANT#3	Bottom (S6)	Mid	8.79	12.77	1.62
	163		Bottom (S6)	Mid	7.51	11.02	1.67

1.5 PD_design_target

Table 11

PD_design_target	
$PD\_design\_target < PD\_regulatory\_limit \times 10^{\frac{-Total\ Uncertainty}{10}}$	
psPD over 4 cm² Averaging Area (mW/cm²)	
Total Uncertainty	2.1 dB
PD_regulatory_limit	1.0 mW/cm²
PD_design_target	0.6166 mW/cm²

1.6 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 $4cm^2$ 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 $4cm^2$ PD values to input.power.limit to identify the worst-PD beam per each non-evaluated surface
      ii. Measure $4cm^2$ PD at input.power.limit on identified worst-PD beam per each non-evaluated surface
      iii. Demonstrate all measured $4cm^2$ PD values are below PD_design_target
3. If any of the above surface(s) in Step (2.b.iii) have measured $4cm^2$ 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 Table 2 ~ Table 9 in Sony Mobile PD simulation report, the worst-surface(s) having highest $4cm^2$ PD for all the single beams per each antenna type and each antenna module group in the mid channel of n261 and n260 bands are identified as:

a. for ANT#0 patch: Left (S3)
b. for ANT#1 patch: Right (S4)
c. for ANT#2 patch: Top (S5)

d. for ANT#3 patch: Bottom (S6)

Thus, when comparing a simulated 4cm^2-averaged PD and measured 4 cm^2-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 Table 10. Thus, the worst-case housing influence, denoted as Δmin = Sim. PD − Meas. PD , is determined as

Table 12
$\boldsymbol{\Delta min}$ for ANT#0, ANT#1, ANT#2 and ANT#3

Bnd	Beam ID	Antenna	Surface	Channel	4cm^2 ave. PD (W/m^2) Meas.	Sim.	Delta = Sim-Meas. (dB)
n261	158	ANT#0	Left (S3)	Mid	8.66	18.08	3.20
	154	ANT#1	Right (S4)	Mid	8.39	17.23	3.13
	41	ANT#2	Top (S5)	Mid	9.27	18.14	2.92
	35	ANT#3	Bottom (S6)	Mid	5.95	12.26	3.14
n260	31	ANT#0	Left (S3)	Mid	10.76	17.76	2.18
	26	ANT#1	Right (S4)	Mid	9.84	17.80	2.57
	184	ANT#2	Top (S5)	Mid	9.57	17.54	2.63
	52	ANT#3	Bottom (S6)	Mid	8.79	12.77	1.62

Δmin 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 Δmin 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 1.7.

Simulated 4cm2 PD values in Table 2 ~ Table 9 in Power Density Simulation Report are scaled to input.power.limit and are listed in Tables 13 – 20 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), i.e.,

a. for ANT#0 patch: Front (S1), Back (S2)

b. for ANT#1 patch: Front (S1), Back (S2)

c. for ANT#2 patch: Front (S1), Back (S2)

d. for ANT#3 patch: Front (S1), Back (S2)

Then perform PD measurement for all determined worst-case beams, highlighted in orange in Tables 13 – 20, on the corresponding surface. Measurement is performed in the mid channel of each band with CW modulation. The evaluation distance is at 2 mm. The test results in Table 21 shows that the all measured 4cm2 PD values are less than PD_design_target of 0.6166 mW/cm2, thus, the non-selected surfaces have no influence on the determined Δmin and input.power.limit in Section 1.7.

Table 13
n261/mid channel, ANT#0 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#0	Patch	1	2.20	2.83	6.13	-	0.01	0.03
		7	2.59	2.47	6.17	-	0.01	0.02
		8	2.31	2.35	6.17	-	0.01	0.03
		9	2.64	2.51	6.17	-	0.01	0.01
		18	2.02	2.87	6.17	-	0.01	0.03
		19	2.21	2.83	6.13	-	0.01	0.02
		29	2.43	2.46	6.11	-	0.02	0.02
		30	2.59	2.47	6.17	-	0.01	0.02
		31	2.21	2.83	6.13	-	0.01	0.02
		32	2.32	3.05	5.97	-	0.02	0.09
		33	2.76	2.82	6.17	-	0.09	0.22
		48	2.65	2.51	6.17	-	0.01	0.01
		49	2.31	2.35	6.17	-	0.01	0.02
		50	2.02	2.87	6.17	-	0.01	0.02
		51	2.62	3.03	6.17	-	0.03	0.18
		129	2.11	1.83	6.15	-	0.03	0.07
		135	1.77	1.46	6.12	-	0.06	0.07
		136	1.69	1.57	6.17	-	0.06	0.10
		137	2.73	1.36	6.00	-	0.01	0.04
		146	1.95	1.68	6.17	-	0.02	0.07
		147	1.53	1.65	6.14	-	0.05	0.10
		157	2.82	2.35	6.02	-	0.01	0.02
		158	2.12	1.83	6.16	-	0.02	0.07
		159	1.88	1.75	6.17	-	0.07	0.11
		160	2.75	2.65	5.62	-	0.04	0.03
		161	2.43	2.73	6.13	-	0.01	0.02
		176	2.74	1.36	6.00	-	0.01	0.04
		177	1.53	1.65	6.14	-	0.05	0.10
		178	2.18	1.79	6.11	-	0.07	0.09
		179	2.45	2.72	5.96	-	0.01	0.02

Please note the above scaled simulation values correspond to PD_design_target if the simulation was performed with correct housing material properties.

Table 14
n261/mid channel, ANT#1 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#1	Patch	0	2.36	2.47	-	5.90	0.05	0.03
		4	2.31	2.81	-	6.04	0.18	0.04
		5	2.95	2.67	-	6.07	0.07	0.03
		6	2.94	2.49	-	6.06	0.03	0.03
		16	3.01	2.79	-	6.08	0.09	0.02
		17	2.35	2.46	-	5.89	0.05	0.02
		24	2.53	2.37	-	6.08	0.13	0.12
		25	3.02	2.79	-	6.08	0.09	0.02
		26	2.94	2.50	-	6.06	0.03	0.03
		27	2.31	2.81	-	6.03	0.17	0.03
		28	2.14	3.64	-	6.17	0.57	0.08
		44	3.12	2.73	-	6.10	0.11	0.06
		45	2.96	2.67	-	6.08	0.07	0.03
		46	2.35	2.47	-	5.89	0.05	0.02
		47	2.23	3.04	-	5.73	0.32	0.05
		128	1.85	1.65	-	5.85	0.32	0.07
		132	3.08	2.21	-	5.81	0.09	0.10
		133	1.75	2.07	-	6.00	0.26	0.13
		134	2.47	2.06	-	6.00	0.31	0.08
		144	1.97	2.55	-	6.04	0.18	0.24
		145	1.86	1.65	-	5.85	0.33	0.07
		155	3.08	2.21	-	5.81	0.08	0.10
		154	1.85	1.65	-	5.85	0.33	0.07
		153	1.97	2.54	-	6.04	0.18	0.24
		156	3.12	2.13	-	5.89	0.06	0.03
		152	3.27	2.23	-	6.17	0.06	0.04
		174	2.47	2.06	-	6.00	0.31	0.08
		173	1.75	2.08	-	6.00	0.26	0.13
		175	3.21	2.10	-	5.67	0.03	0.07
		172	2.33	2.75	-	5.39	0.14	0.27

Table 15
n261/mid channel, ANT#2 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#2	Patch	3	2.06	1.61	0.02	0.07	5.73	-
		13	2.96	2.07	0.01	0.05	6.08	-
		14	1.88	1.46	0.02	0.07	6.17	-
		15	3.38	2.18	0.04	0.07	6.00	-
		22	3.27	2.04	0.01	0.07	6.07	-
		23	2.60	2.24	0.05	0.26	6.17	-
		39	3.52	2.50	0.04	0.04	6.17	-
		40	3.27	2.04	0.01	0.08	6.07	-
		41	2.67	2.09	0.03	0.10	6.10	-
		42	2.71	2.44	0.06	0.09	5.88	-
		43	2.12	2.29	0.18	0.78	6.16	-
		56	3.37	2.18	0.03	0.07	6.00	-
		57	2.96	2.08	0.01	0.05	6.08	-
		58	2.60	2.24	0.05	0.26	6.17	-
		59	2.16	2.05	0.17	0.51	6.04	-
		131	2.22	1.70	0.13	0.15	5.76	-
		141	3.79	1.90	0.03	0.19	6.05	-
		142	1.18	0.91	0.11	0.60	5.90	-
		143	1.08	1.11	0.22	0.37	5.95	-
		150	3.13	1.97	0.02	0.09	5.99	-
		151	2.02	1.55	0.11	0.14	5.81	-
		168	3.13	1.97	0.02	0.09	5.99	-
		169	2.22	1.70	0.13	0.15	5.77	-
		167	2.86	2.15	0.02	0.13	6.15	-
		170	1.30	1.00	0.12	0.66	5.88	-
		171	2.87	2.24	0.05	0.10	6.06	-
		185	3.79	1.90	0.03	0.19	6.05	-
		186	1.09	1.11	0.22	0.37	5.95	-
		184	2.98	1.99	0.01	0.12	6.00	-
		187	2.73	2.42	0.04	0.05	5.86	-

Table 16
n261/mid channel, ANT#3 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#3	Patch	2	1.65	1.85	0.02	0.50	-	6.14
		10	1.56	1.74	0.01	0.47	-	5.78
		11	2.45	2.57	0.05	0.86	-	6.16
		12	2.68	3.20	0.15	0.02	-	6.13
		20	2.81	2.88	0.04	0.90	-	6.03
		21	2.53	2.44	0.13	0.45	-	6.17
		34	2.81	2.87	0.04	0.90	-	6.03
		35	2.18	2.44	0.02	0.66	-	6.13
		36	2.67	3.20	0.15	0.02	-	6.13
		37	1.87	3.82	0.21	0.31	-	5.98
		38	2.01	3.68	0.12	0.58	-	5.85
		52	2.44	2.57	0.05	0.87	-	6.16
		53	2.53	2.44	0.13	0.45	-	6.17
		54	2.31	3.70	0.14	0.25	-	6.00
		55	1.33	3.68	0.19	0.64	-	5.95
		130	1.04	0.97	0.07	0.53	-	5.33
		138	2.06	2.24	0.09	0.20	-	5.99
		139	1.94	1.84	0.20	0.70	-	5.99
		140	2.23	2.47	0.01	0.74	-	6.09
		148	1.48	1.38	0.11	0.76	-	5.84
		149	2.23	2.47	0.01	0.74	-	6.09
		162	2.41	2.64	0.01	0.51	-	6.17
		163	2.07	2.24	0.09	0.19	-	5.99
		164	1.48	1.38	0.11	0.76	-	5.84
		165	2.46	2.79	0.04	1.13	-	6.17
		166	2.23	2.47	0.01	0.74	-	6.09
		180	2.48	2.83	0.07	0.22	-	6.08
		181	1.93	1.84	0.20	0.70	-	5.98
		182	3.33	3.29	0.13	1.10	-	6.17
		183	2.36	2.38	0.02	0.91	-	6.17

Table 17
n260/mid channel, ANT#0 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#0	Patch	1	1.95	2.47	6.17	-	0.01	0.02
		7	2.39	3.02	6.17	-	0.01	0.02
		8	2.27	2.91	6.05	-	0.02	0.10
		9	1.55	2.87	6.17	-	0.06	0.04
		18	2.37	2.82	6.17	-	0.04	0.06
		19	2.42	3.06	6.17	-	0.01	0.04
		29	2.22	2.47	6.03	-	0.05	0.02
		30	1.93	2.91	5.70	-	0.02	0.02
		31	2.39	3.02	6.17	-	0.01	0.02
		32	2.26	2.91	6.05	-	0.01	0.10
		33	2.37	2.82	6.17	-	0.03	0.06
		48	1.55	2.87	6.17	-	0.06	0.03
		49	2.08	2.82	5.79	-	0.02	0.02
		50	2.42	3.06	6.17	-	0.01	0.04
		51	2.52	2.93	6.07	-	0.03	0.07
		129	2.73	1.93	6.17	-	0.01	0.06
		135	2.83	2.24	6.17	-	0.01	0.05
		136	2.46	1.74	6.17	-	0.01	0.05
		137	2.61	2.36	6.17	-	0.01	0.03
		146	1.47	2.16	6.17	-	0.02	0.03
		147	2.66	2.02	6.17	-	0.03	0.02
		160	2.68	2.64	6.17	-	0.02	0.02
		159	1.47	2.15	6.17	-	0.02	0.03
		158	2.74	1.94	6.17	-	0.01	0.05
		157	2.98	2.26	6.17	-	0.03	0.02
		161	2.68	2.59	6.17	-	0.04	0.02
		178	1.95	2.67	6.17	-	0.02	0.03
		177	2.61	2.36	6.17	-	0.01	0.03
		176	2.83	2.25	6.17	-	0.01	0.05
		179	2.66	2.64	6.17	-	0.05	0.02

Table 18
n260/mid channel, ANT#1 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#1	Patch	0	2.80	3.05	-	6.17	0.04	0.01
		4	2.52	2.75	-	6.17	0.04	0.01
		5	2.98	2.78	-	6.17	0.06	0.01
		6	2.53	2.72	-	6.17	0.07	0.02
		16	1.67	2.35	-	6.17	0.03	0.06
		17	1.40	2.82	-	6.01	0.02	0.02
		24	1.67	2.35	-	6.17	0.03	0.05
		25	1.40	2.83	-	6.01	0.02	0.02
		26	2.81	3.05	-	6.17	0.05	0.01
		27	2.54	2.73	-	6.17	0.07	0.02
		28	2.19	2.86	-	5.99	0.02	0.02
		44	1.26	3.16	-	6.17	0.03	0.04
		45	2.26	3.31	-	6.17	0.04	0.03
		46	2.98	2.78	-	6.17	0.05	0.01
		47	2.22	2.77	-	6.07	0.03	0.01
		128	3.11	2.38	-	6.17	0.07	0.01
		132	2.37	1.95	-	6.17	0.03	0.03
		133	2.59	1.80	-	6.17	0.08	0.01
		134	2.87	2.03	-	6.17	0.04	0.01
		144	2.80	2.14	-	6.17	0.06	0.01
		145	1.98	1.84	-	6.17	0.03	0.02
		152	3.24	2.34	-	6.17	0.00	0.03
		153	1.75	2.52	-	6.01	0.00	0.02
		154	2.65	2.18	-	6.17	0.03	0.03
		155	3.11	2.38	-	6.17	0.07	0.01
		156	3.33	2.04	-	6.17	0.03	0.02
		172	2.74	2.28	-	6.17	0.04	0.02
		173	2.25	2.08	-	5.78	0.03	0.02
		174	2.88	2.00	-	6.17	0.09	0.01
		175	3.20	2.26	-	6.17	0.04	0.01

Table 19
n260/mid channel, ANT#2 Patch simulated 4cm^2 PD at PD_Design_Target
(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#2	Patch	3	1.40	1.43	0.06	0.09	5.94	-
		13	1.21	1.61	0.02	0.59	5.88	-
		14	1.68	1.71	0.07	0.11	5.89	-
		15	1.68	1.71	0.07	0.11	5.89	-
		22	2.02	2.49	0.05	0.21	6.17	-
		23	1.69	1.91	0.02	0.38	5.99	-
		39	1.35	1.80	0.02	0.66	5.84	-
		40	1.46	2.61	0.07	0.32	6.17	-
		41	2.57	2.28	0.04	0.13	6.17	-
		42	1.67	1.71	0.07	0.11	5.89	-
		43	1.68	1.92	0.02	0.38	5.99	-
		56	1.28	2.41	0.02	0.56	6.17	-
		57	2.02	2.49	0.05	0.21	6.17	-
		58	2.21	1.94	0.06	0.05	6.17	-
		59	2.36	2.40	0.07	0.18	5.68	-
		131	1.44	1.24	0.06	0.10	6.10	-
		141	1.27	1.71	0.04	0.42	6.17	-
		142	2.65	1.56	0.06	0.14	6.17	-
		143	1.65	1.21	0.06	0.11	5.90	-
		150	1.46	1.14	0.03	0.35	6.01	-
		151	1.57	1.36	0.06	0.12	6.09	-
		170	2.99	1.92	0.04	0.28	6.17	-
		169	1.60	2.15	0.05	0.52	6.17	-
		168	2.01	1.48	0.07	0.13	5.84	-
		167	3.33	1.96	0.08	0.17	6.17	-
		171	2.91	2.03	0.06	0.13	6.17	-
		186	2.93	2.16	0.04	0.33	6.17	-
		185	1.86	1.45	0.03	0.44	6.17	-
		184	1.92	1.66	0.08	0.14	6.08	-
		187	2.98	1.85	0.05	0.16	6.17	-

Table 20

n260/mid channel, ANT#3 Patch simulated 4cm^2 PD at PD_Design_Target

(if simulation performed with correct housing material properties) (Δmin)

Module	Type	Beam ID	Simulated 4cm^2 PD(W/m2) Corresponding to PD design target					
			Front(S1)	Back(S2)	Left(S3)	Right(S4)	Top(S5)	Bottom(S6)
Ant#3	Patch	2	2.43	3.59	0.06	0.54	-	5.94
		10	2.08	3.79	0.13	1.16	-	5.59
		11	2.27	2.97	0.04	0.38	-	5.73
		12	2.21	4.41	0.02	0.30	-	5.82
		20	1.82	3.90	0.05	0.37	-	5.61
		21	2.42	3.58	0.06	0.54	-	5.94
		34	2.21	4.40	0.02	0.29	-	5.82
		35	2.28	2.97	0.03	0.38	-	5.74
		36	1.87	3.55	0.05	1.64	-	6.17
		37	1.83	3.90	0.04	0.37	-	5.62
		38	1.79	4.50	0.05	0.44	-	5.97
		52	2.43	3.59	0.05	0.54	-	5.95
		53	1.56	3.16	0.02	1.41	-	6.17
		54	2.08	3.79	0.13	1.16	-	5.59
		55	1.92	4.43	0.03	0.29	-	6.04
		130	2.17	2.15	0.02	0.67	-	5.47
		138	2.91	3.42	0.03	0.86	-	5.84
		139	2.18	2.16	0.03	0.67	-	5.47
		140	2.45	3.37	0.12	0.38	-	5.18
		148	2.06	3.54	0.09	0.94	-	6.17
		149	2.32	3.81	0.08	1.02	-	5.87
		162	2.45	3.37	0.11	0.38	-	5.18
		163	2.18	2.16	0.02	0.68	-	5.47
		164	2.32	3.81	0.08	1.02	-	5.87
		165	3.02	3.64	0.11	0.52	-	5.72
		166	2.72	2.98	0.07	0.30	-	5.58
		180	2.30	3.04	0.07	0.30	-	4.88
		181	2.06	3.54	0.09	0.94	-	6.17
		183	2.71	3.80	0.11	0.52	-	6.00
		182	2.91	3.43	0.03	0.86	-	5.84

Table 21
$4cm^2$ PD of the selected beams measured on the corresponding surfaces that are not selected for Δmin determination

Band	Antenna	Beam ID	Surface	Input Power Limit (dBm)	Meas. $4cm^2$ PD (W/m^2)
n261	Ant#0	157	Front(S1)	3.9	1.77
		32	Back(S2)	4.9	2.12
	Ant#1	152	Front(S1)	4.2	1.40
		28	Back(S2)	5.6	2.66
	Ant#2	185	Front(S1)	4.0	2.51
		39	Back(S2)	4.4	1.93
	Ant#3	182	Front(S1)	6.8	3.33
		37	Back(S2)	7.2	1.16
n260	Ant#0	157	Front(S1)	3.3	3.07
		19	Back(S2)	6.2	3.40
		50	Back(S2)	3.2	2.48
	Ant#1	156	Front(S1)	3.7	2.42
		45	Back(S2)	3.7	2.58
	Ant#2	167	Front(S1)	4.1	2.68
		40	Back(S2)	3.4	1.58
	Ant#3	165	Front(S1)	4.8	1.43
		38	Back(S2)	4.3	2.51

Some of the test cases above were tested at a higher power level than input.power.limit representing a more conservative evaluation.

1. 7 PD Char

1. 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 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:

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

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

$$S(i) = min\{s_{low}(i), s_{mid}(i), s_{higt}(i)\}, i \in single\ beams \qquad (2)$$

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

1.7.2 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:

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

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:

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

1.7.3 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 (Δmin) determined in Table 10, given by:

For n260 and n261

$$input.power.limit(i) = 6dbm + 10 * \log(s(i)) + \Delta_{min}, i \in all\ beams \quad (5)$$

where 6 dBm is the input power used in simulation for n261 and n260, respectively; $s(i)$ is the scaling factor obtained from Eq. (2) or Eq. (4) for beam i; Δmin is the worst-case housing influence factor (determined in Table 10) for beam i.

If simulation overestimates the housing influence, then Δmin (= 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 Δmin 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 Δmin 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,

$$input.power.limit(i) = 6dbm + 10 * \log(s(i)), i \in all\ beams, \text{for n260 and n261} \quad (6)$$

else if Δmin < -TxAGC uncertainty,

$$input.power.limit(i) = 6dbm + 10 * \log(s(i)) + (\Delta_{min} + TxAGC\ uncertainty),$$

$$i \in all\ beams, \text{for n260 and n261} \quad (7)$$

else if Δmin > TxAGC uncertainty,

$$input.power.limit(i) = 6dbm + 10 * \log(s(i)) + (\Delta_{min} - TxAGC\ uncertainty),\ i \in all\ beams, \text{for n260 and n261} \quad (8)$$

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

Table 22
input.power.limit Calculation

Band	Antenna	Δ min (dB)	TxAGC Uncertainty (dB)	input.power.limit = (dBm)	Notes
n261	Ant #0	3.20	0.5	6 dBm + 10*log(s(i)) + 2.70	Using Eq. 8
	Ant #1	3.13	0.5	6 dBm + 10*log(s(i)) + 2.63	Using Eq. 8
	Ant #2	2.92	0.5	6 dBm + 10*log(s(i)) + 2.42	Using Eq. 8
	Ant #3	3.14	0.5	6 dBm + 10*log(s(i)) + 2.64	Using Eq. 8
n260	Ant #0	2.18	0.5	6 dBm + 10*log(s(i)) + 1.68	Using Eq. 8
	Ant #1	2.57	0.5	6 dBm + 10*log(s(i)) + 2.07	Using Eq. 8
	Ant #2	2.63	0.5	6 dBm + 10*log(s(i)) + 2.13	Using Eq. 8
	Ant #3	1.62	0.5	6 dBm + 10*log(s(i)) + 1.12	Using Eq. 8

For some bands/antennas, input.power.limit was reduced to implement a lower time-averaged power.

Table 23
5G NR n261 ANT#0 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
0	1		9.8
	7		7.1
	8		7.0
	9		7.2
	18		7.1
	19		6.8
	29		4.3
	30		4.1
	31		3.8
	32		4.9
	33		5.7
	48		4.2
	49		4.0
	50		4.1
	51		5.4
	129		10.0
	135		6.2
	136		6.6
	137		7.2
	146		6.6
	147		7.0
	157		3.9
	158		4.0
	159		4.0
	160		5.0
	161		4.0
	176		4.2
	177		4.0
	178		4.1
	179		4.4
	1	129	4.8
	7	135	3.2
	8	136	2.1
	9	137	2.2
	18	146	1.8
	19	147	2.2
	29	157	-0.8
	30	158	-1.2
	31	159	-0.8
	32	160	0.4
	33	161	-0.2
	48	176	-0.7
	49	177	-0.9
	50	178	0.2
	51	179	-0.1

Table 24
5G NR n261 ANT#1 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
1	0		9.8
	4		7.4
	5		7.1
	6		6.9
	16		7.1
	17		6.7
	24		5.1
	25		4.1
	26		3.9
	27		4.4
	28		5.6
	44		4.3
	45		4.1
	46		3.7
	47		4.8
	128		9.9
	132		7.2
	133		7.0
	134		7.1
	144		7.4
	145		6.9
	155		4.2
	154		3.9
	153		4.4
	156		4.0
	152		4.2
	174		4.1
	173		4.0
	175		4.1
	172		4.8
	0	128	4.8
	4	134	4.6
	5	133	4.7
	6	132	5.0
	16	144	4.5
	17	145	3.9
	24	155	-0.5
	25	154	-1.2
	26	153	-0.4
	27	156	-0.4
	28	152	0.0
	44	174	-0.8
	45	173	-0.5
	46	175	-0.6
	47	172	0.1

Table 25
5G NR n261 ANT#2 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
2	3		8.5
	13		6.7
	14		5.1
	15		6.8
	22		6.7
	23		6.8
	39		4.4
	40		3.7
	41		3.6
	42		4.4
	43		4.7
	56		3.8
	57		3.7
	58		3.8
	59		4.8
	131		9.3
	141		7.0
	142		6.0
	143		6.6
	150		6.5
	151		5.9
	168		3.5
	169		3.3
	167		3.7
	170		3.5
	171		3.7
	185		4.0
	186		3.6
	184		3.5
	187		3.7
	3	131	5.1
	13	141	4.7
	14	142	3.5
	15	143	4.8
	22	150	4.9
	23	151	2.9
	39	168	-1.6
	40	169	-1.1
	41	167	-0.9
	42	170	-1.4
	43	171	-0.9
	56	185	-1.3
	57	186	-1.8
	58	184	-1.6
	59	187	-0.9

Table 26
5G NR n261 ANT#3 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
3	2		10.4
	10		7.1
	11		8.8
	12		8.9
	20		9.4
	21		8.8
	34		6.4
	35		5.6
	36		5.9
	37		7.2
	38		6.5
	52		5.8
	53		5.8
	54		6.1
	55		7.0
	130		9.5
	138		7.9
	139		8.1
	140		8.5
	148		8.0
	149		8.5
	162		5.3
	163		4.9
	164		5.0
	165		5.7
	166		5.5
	180		5.2
	181		5.1
	182		6.8
	183		5.4
	2	130	5.4
	10	138	2.4
	11	139	2.9
	12	140	3.5
	20	148	3.2
	21	149	3.0
	34	162	0.5
	35	163	-0.6
	36	164	1.1
	37	165	0.8
	38	166	0.2
	52	180	0.0
	53	181	-0.1
	54	182	1.4
	55	183	0.5

Table 27
5G NR n260 ANT#0 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
0	1		8.2
	7		6.0
	8		6.6
	9		6.5
	18		6.4
	19		6.2
	29		3.8
	30		3.5
	31		3.0
	32		3.6
	33		3.4
	48		3.5
	49		3.4
	50		3.2
	51		3.8
	129		9.0
	135		6.1
	136		5.6
	137		6.3
	146		6.2
	147		5.8
	160		3.5
	159		3.2
	158		3.0
	157		3.3
	161		3.4
	178		3.7
	177		3.3
	176		3.1
	179		3.5
	1	129	3.6
	7	137	0.8
	8	136	0.7
	9	135	0.8
	18	147	0.6
	19	146	1.0
	29	160	-1.6
	30	159	-1.8
	31	158	-2.3
	32	157	-2.2
	33	161	-2.2
	48	178	-2.0
	49	177	-2.0
	50	176	-2.4
	51	179	-2.2

Table 28
5G NR n260 ANT#1 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
1	0		9.4
	4		6.0
	5		6.4
	6		6.5
	16		7.0
	17		6.9
	24		4.0
	25		3.9
	26		3.4
	27		3.5
	28		3.7
	44		4.2
	45		3.7
	46		3.4
	47		3.6
	128		9.3
	132		6.1
	133		6.0
	134		5.9
	144		5.9
	145		6.5
	152		3.8
	153		3.9
	154		3.6
	155		3.3
	156		3.7
	172		3.7
	173		4.1
	174		3.4
	175		3.4
	0	128	3.9
	4	132	0.9
	5	133	0.9
	6	134	1.2
	16	145	1.1
	17	144	1.0
	24	152	-1.7
	25	153	-2.0
	26	154	-2.0
	27	155	-1.9
	28	156	-1.8
	44	172	-1.7
	45	173	-1.5
	46	174	-2.1
	47	175	-2.1

Table 29
5G NR n260 ANT#2 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
2	3		8.2
	13		6.3
	14		6.0
	15		6.0
	22		6.3
	23		6.8
	39		3.7
	40		3.4
	41		3.6
	42		3.0
	43		3.8
	56		3.5
	57		3.3
	58		3.3
	59		4.2
	131		8.2
	141		6.1
	142		6.1
	143		5.5
	150		5.8
	151		5.6
	170		4.0
	169		4.1
	168		3.4
	167		4.1
	171		4.0
	186		4.0
	185		3.8
	184		3.5
	187		4.0
	3	131	3.7
	13	142	1.0
	14	143	0.9
	15	141	1.1
	22	150	1.2
	23	151	0.7
	39	170	-1.9
	40	169	-1.9
	41	168	-1.7
	42	167	-2.3
	43	171	-1.8
	56	186	-1.4
	57	185	-2.1
	58	184	-1.9
	59	187	-2.0

Table 30
5G NR n260 ANT#3 Patch input.power.limit

Antenna	Beam ID_1	Beam ID_2	input.power.limit (dBm)
3	2		9.7
	10		7.9
	11		6.7
	12		7.0
	20		6.9
	21		6.8
	34		4.0
	35		3.7
	36		5.3
	37		3.9
	38		4.3
	52		3.8
	53		4.6
	54		4.9
	55		4.1
	130		10.0
	138		7.5
	139		7.0
	140		7.7
	148		7.7
	149		7.9
	162		4.7
	163		4.0
	164		4.9
	165		4.8
	166		4.5
	180		4.3
	181		4.7
	183		4.9
	182		4.5
	2	130	4.6
	10	138	1.8
	11	139	1.6
	12	140	3.3
	20	148	1.7
	21	149	2.4
	34	162	-1.4
	35	163	-1.2
	36	164	-0.5
	37	165	-0.6
	38	166	-0.9
	52	180	-1.3
	53	181	-0.7
	54	183	0.3
	55	182	-0.6

2. SAR Characterization

2.1 DSI and SAR Determination

This device uses different Device State Index (DSI) to configure different time averaged power levels based on certain exposure scenarios. Depending on the detection scheme implemented in the smartphone, the worst-case SAR was determined by measurements for the relevant exposure conditions for that DSI. Detailed descriptions of the detection mechanisms are included in the operational description.

When 1g SAR and 10g SAR exposure comparison is needed, the worst-case was determined from SAR normalized to 1g or 10g SAR limit.

The device state index (DSI) conditions used in Table 31 represent different exposure scenarios.

Table 31
DSI and Corresponding Exposure Scenarios

Scenario	Description	SAR Test Cases
Head (DSI = 5)	･Device positinoned next to head and a sensor is triggerd ･Ear speaker is activated	Head SAR per KDB Publication 648474 D04 and KDB Inquiry
Body worm (DSI = 5)	･Device being used with a body-wom accessary and a sensor is triggerd ･Ear speaker is not activated	Body-worn SAR per KDB Publication 648474 D04 and KDB Inquiry
Phablet Grip (DSI = 5)	･Device being used with a body-wom accessary and a sensor is triggerd ･Ear speaker is not activated	Body-worn SAR per KDB Publication 648474 D04 and KDB Inquiry
Hotspot (DSI = 6)	･Device transmits in hotspot mode near body ･Hotspot Mode Active	Hotspot SAR per KDB Publication 941225 D06

2.2 SAR Design Target

SAR_design_target is determined by ensuring that it is less than FCC SAR limit after accounting for total device designed related uncertainties specified by the manufacturer (see Table 32).

Table 32
SAR_design_target Calculation

SAR_design_target			
$SAR\_design\_target < SAR\_regulatory\_limit \times 10^{\frac{-Total\ Uncertainty}{10}}$			
1g SAR (W/kg)		**10g SAR (W/kg)**	
Total Uncertainty	1.0 dB	*Total Uncertainty*	1.0 dB
SAR_regulatory_limit	1.6 W/kg	*SAR_regulatory_limit*	4.0 W/kg
SAR_design_target	1.0 W/kg	*SAR_design_target*	2.5 W/kg

2.3 SAR Char

SAR test results corresponding to Pmax for each antenna/technology/band/DSI can be found in Part 1 SAR Report.

Plimit is calculated by linearly scaling with the measured SAR at the Pmax to correspond to the SAR_design_target. Plimit determination for each exposure scenario corresponding to SAR_design_target are shown in Table 33.

Table 33
Limit Determination

Device State Index (DSI)	**Plimt Determination Scenarios**
2	Plimt is calculated based on Free Space (Max power)
5	Plimt is calculated based on the following scenarios: 1. 1g Head SAR and 2. 1g Body-worn SAR measured at 10mm and 3. 10g Extremity SAR measured at 0mm for six surfaces
6	Plimt is calculated based on 1g Hotspot SAR measured at 10mm

Table 34
SAR Characterizations

Unit : dBm

Device State Index (DSI)	5	6
Scenario / Band	1g Head SAR 1g Body-worn SAR at 10mm 10g Extremety SAR at 0mm	1g Hotspot SAR at 10mm
GSM850	32.5	32.5
GSM1900	27.5	27.5
UMTS B2	16.0	16.0
UMTS B4	16.0	16.0
UMTS B5	24.0	24.0
LTE B2	16.0	16.0
LTE B4	16.0	16.0
LTE B5	24.0	24.0
LTE B7	16.0	16.0
LTE B12	24.0	24.0
LTE B13	24.0	24.0
LTE B17	24.0	24.0
LTE B25	16.0	16.0
LTE B26	24.2	24.2
LTE B41	16.0	16.0
LTE B48	16.0	16.0
LTE B66	16.0	16.0
FR1 n2	16.0	16.0
FR1 n5	24.0	24.0
FR1 n66	16.0	16.0

Note

P_{limit} for DSI=5 and DSI=6 are the same.