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PART 0 SAR AND POWER DENSITY CHAR REPORT

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Date of Testing:
05/15/19 – 06/10/19
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Document Serial No.:
1M1905130071-20-R2.A3L

FCC ID:	**A3LSMN976V**
APPLICANT:	**SAMSUNG ELECTRONICS CO., LTD**

Report Type:	Part 0 SAR and Power Density Characterization
DUT Type:	Portable Handset
Model:	SM-N976V
Additional Model:	SM-N976XU

Note: This revised test report (S/N: 1M1905130071-20-R2.A3L) supersedes and replaces the previously issued test report on the same subject device for the same type of testing as indicated. Please discard or destroy the previously issued test report(s) and dispose of it accordingly.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

Test results reported herein relate only to the item(s) tested.

Randy Ortanez
President

ACCREDITED
TESTING CERT#2041.01

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1 DEVICE UNDER TEST

1.1 Device Overview

Band & Mode	Operating Modes	Tx Frequency
Cell. CDMA/EVDO	Voice/Data	824.70 - 848.31 MHz
PCS CDMA/EVDO	Voice/Data	1851.25 - 1908.75 MHz
GSM/GPRS/EDGE 850	Voice/Data	824.20 - 848.80 MHz
GSM/GPRS/EDGE 1900	Voice/Data	1850.20 - 1909.80 MHz
UMTS 850	Voice/Data	826.40 - 846.60 MHz
UMTS 1900	Voice/Data	1852.4 - 1907.6 MHz
LTE Band 12	Voice/Data	699.7 - 715.3 MHz
LTE Band 13	Voice/Data	779.5 - 784.5 MHz
LTE Band 26 (Cell)	Voice/Data	814.7 - 848.3 MHz
LTE Band 5 (Cell)	Voice/Data	824.7 - 848.3 MHz
LTE Band 66 (AWS)	Voice/Data	1710.7 - 1779.3 MHz
LTE Band 4 (AWS)	Voice/Data	1710.7 - 1754.3 MHz
LTE Band 2 (PCS)	Voice/Data	1850.7 - 1909.3 MHz
LTE Band 7	Voice/Data	2502.5 - 2567.5 MHz
LTE Band 48	Voice/Data	3552.5 - 3697.5 MHz
LTE Band 41	Voice/Data	2498.5 - 2687.5 MHz
LTE Band 38	Voice/Data	2572.5 - 2617.5 MHz
2.4 GHz WLAN	Voice/Data	2412 - 2462 MHz
U-NII-1	Voice/Data	5180 - 5240 MHz
U-NII-2A	Voice/Data	5260 - 5320 MHz
U-NII-2C	Voice/Data	5500 - 5720 MHz
U-NII-3	Voice/Data	5745 - 5825 MHz
Bluetooth	Data	2402 - 2480 MHz
NFC	Data	13.56 MHz
ANT+	Data	2402 - 2480 MHz
MST	Data	555 Hz - 8.33 kHz
NR Band n260	Data	37000 - 40000 MHz
NR Band n261	Data	27500 - 28350 MHz

This device uses the Qualcomm® Smart Transmit feature to control and manage transmitting power in real time and to ensure the time-averaged RF exposure is in compliance with the FCC requirement at all times for 2G/3G/4G/5G WWAN operations. Additionally, this device supports WLAN/BT/NFC/ANT+/MST technologies but the output power of these modems is not controlled by the Smart Transmit algorithm.

1.2 Time-Averaging for SAR and Power Density

This device is enabled with Qualcomm® Smart Transmit algorithm to control and manage transmitting power in real time and to ensure that the time-averaged RF exposure from 2G/3G/4G/5G mmW NR WWAN is in compliance with FCC requirements. This Part 0 report shows SAR and Power Density characterization of WWAN radios for 2G/3G/4G and 5G mmW NR respectively. Characterization is achieved by determining *PLimit* for 2G/3G/4G and *input.power.limit* for 5G mmW NR that correspond to the exposure design targets after accounting for all device design related uncertainties, i.e., *SAR_design_target* (< FCC SAR limit) for sub-6 radio and *PD_design_target* (< FCC PD limit) for mmW radio. The SAR characterization and PD characterization are denoted as SAR Char and PD Char in this report. Section 1.3 includes a nomenclature of the specific terms used in this report.

The compliance test under the static transmission scenario and simultaneous transmission analysis are reported in Part 1 report. The validation of the time-averaging algorithm and compliance under the dynamic (time- varying) transmission scenario for WWAN technologies are reported in Part 2 report (report SN could be found in Section 1.4 – Bibliography).

1.3 Nomenclature for Part 0 Report

Technology	Term	Description
2G/3G/4G	*Plimit*	Power level that corresponds to the exposure design target (*SAR_design_target)* after accounting for all device design related uncertainties
	Pmax	Maximum tune up output power
	SAR_design_target	Target SAR level < FCC SAR limit after accounting for all device design related uncertainties
	SAR Char	Table containing *Plimit* for all technologies and bands
5G mmW NR	*input.power.limit*	Power level at antenna element for each beam corresponding to the exposure design target (*PD_design_target)*
	PD_design_target	Target PD level < FCC SAR limit after accounting for all device design related uncertainties
	Δmin	Housing material influence
	PD Char	Table containing *input.power.limit* for all beams and bands

1.4 Bibliography

Report Type	Report Serial Number
FCC SAR Evaluation Report (Part 1)	1M1905130071-01-R2.A3L
FCC PD Evaluation Report (Part 1)	1M1905130071-21-R2.A3L
RF Exposure Part 2 Test Report	80-W5681-2 Rev.F
Power Density Simulation Report	RevB

2 SAR AND POWER DENSITY MEASUREMENTS

2.1 SAR Definition

Specific Absorption Rate is defined as the time derivative (rate) of the incremental energy (dU) absorbed by (dissipated in) an incremental mass (dm) contained in a volume element (dV) of a given density (ρ). It is also defined as the rate of RF energy absorption per unit mass at a point in an absorbing body (see Equation 2-1).

Equation 2-1
SAR Mathematical Equation

$$SAR = \frac{d}{dt}\left(\frac{dU}{dm}\right) = \frac{d}{dt}\left(\frac{dU}{\rho dv}\right)$$

SAR is expressed in units of Watts per Kilogram (W/kg).

$$SAR = \frac{\sigma \cdot E^2}{\rho}$$

where:

σ	=	conductivity of the tissue-simulating material (S/m)
ρ	=	mass density of the tissue-simulating material (kg/m^3)
E	=	Total RMS electric field strength (V/m)

NOTE: The primary factors that control rate of energy absorption were found to be the wavelength of the incident field in relation to the dimensions and geometry of the irradiated organism, the orientation of the organism in relation to the polarity of field vectors, the presence of reflecting surfaces, and whether conductive contact is made by the organism with a ground plane.[6]

2.2 SAR Measurement Procedure

The evaluation was performed using the following procedure compliant to FCC KDB Publication 865664 D01v01r04 and IEEE 1528-2013:

1. The SAR distribution at the exposed side of the head or body was measured at a distance no greater than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the device-head and body interface and the horizontal grid resolution was determined per FCC KDB Publication 865664 D01v01r04 (See
2. Table 2-1) and IEEE 1528-2013.
3. The point SAR measurement was taken at the maximum SAR region determined from Step 1 to enable the monitoring of SAR fluctuations/drifts during the 1g/10g cube evaluation. SAR at this fixed point was measured and used as a reference value.

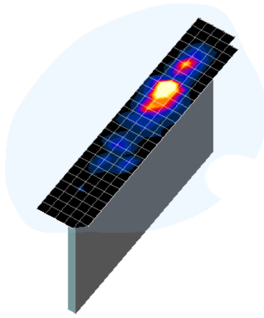


Figure 2-1
Sample SAR Area Scan

4. Based on the area scan data, the peak of the region with maximum SAR was determined by spline interpolation. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB Publication 865664 D01v01r04 (See
5. Table 2-1) and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (see references or the DASY manual online for more details):
   a. SAR values at the inner surface of the phantom are extrapolated from the measured values along the line away from the surface with spacing no greater than that in
   b. Table 2-1. The extrapolation was based on a least-squares algorithm. A polynomial of the fourth order was calculated through the points in the z-axis (normal to the phantom shell).
   c. After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the "Not a knot" condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were obtained through interpolation, in order to calculate the averaged SAR.
   d. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
6. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan was complete to calculate the SAR drift. If the drift deviated by more than 5%, the SAR test and drift measurements were repeated.

Table 2-1
Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

Frequency	Maximum Area Scan Resolution (mm) (Δx_{area}, Δy_{area})	Maximum Zoom Scan Resolution (mm) (Δx_{zoom}, Δy_{zoom})	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			$\Delta z_{zoom}(n)$	$\Delta z_{zoom}(1)$*	$\Delta z_{zoom}(n>1)$*	
≤ 2 GHz	≤ 15	≤ 8	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
2-3 GHz	≤ 12	≤ 5	≤ 5	≤ 4	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 30
3-4 GHz	≤ 12	≤ 5	≤ 4	≤ 3	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 28
4-5 GHz	≤ 10	≤ 4	≤ 3	≤ 2.5	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 25
5-6 GHz	≤ 10	≤ 4	≤ 2	≤ 2	≤ 1.5*$\Delta z_{zoom}(n-1)$	≥ 22

*Also compliant to IEEE 1528-2013 Table 6

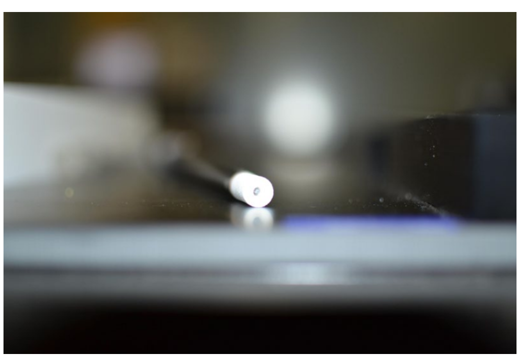
2.3 Power Density Measurement Setup

Power Density measurements for mmWave frequencies were performed using the DASY6 with cDASY6 5G module. The DASY6 is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland and consists of a high precision robotics system (Staubli), robot controller, desktop computer, near-field probe, probe alignment sensor, and the 5G phantom. The robot is a six-axis industrial robot, performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF).

2.4 SPEAG EUmmWV3 Probe / E-Field 5G Probe

The EUmmWV3 probe consists of two dipoles optimally arranged to obtain pseudo-vector information.

Frequency Range	750 MHz – 110 GHz
Dynamic Range	< 20 V/m – 10,000 V/m with PRE-10 (min < 50 V/m – 3,000 V/m)
Position Precision	< 0.2 mm (cDASY6)
Dimensions	Probe Overall Length: 320 mm Probe Body Diameter: 8 mm Probe Tip Length: 23 mm Probe Tip Diameter: Encapsulation 8 mm Distance from Probe Tip to Sensor X Calibration Point: 1.5 mm Distance from Probe Tip to Sensor Y Calibration Point: 1.5 mm
Applications	E-field measurements of 5G devices and other mm-wave transmitters operating above 10 GHz in < 2 mm distance from device (free-space) Power density, H-field and far-field analysis using total field reconstruction
Compatibility	cDASY6 + 5G-Module SW1.6.2.6



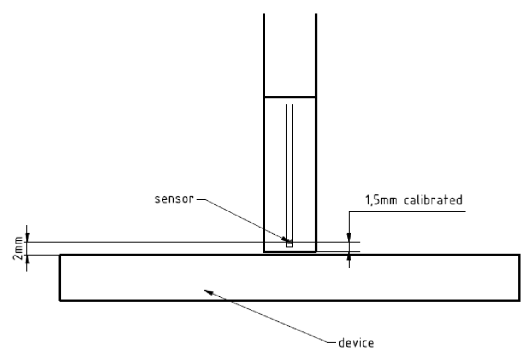


Figure 2-2
EUmmWV3 Probe

2.5 Power Density Assessment Based on E-field Measurements

Within a short distance from the transmitting source, power density was determined based on both electric and magnetic fields. Generally, the magnitude and phase of two components of either the E-field or H-field were needed on a sufficiently large surface to fully characterize the total E-field and H-field distributions. Nevertheless, solutions based on direct measurement of E-field and H-field can be used to compute power density. The general measurement approach used for this device was:

a) The local E field on the measurement surface was measured at a reference location where the field is well above the noise level. This reference level was used at the end of this procedure to assess output power drift of the DUT during the measurement.

b) The electric field on the measurement surface was scanned. Measurements are conducted according to the instructions provided by the measurement system manufacturer. Measurement spatial resolution can depend on the measured field characteristic and measurement methodology used by the system. The planar scan step size was configured at λ/4.

c) For cDASY6, H-field was calculated from the measured E-field using a reconstruction algorithm. As the power density calculation requires knowledge of both amplitude and phase, reconstruction algorithms can also be used to obtain field information from the measured E-field data (e.g. the phase from the amplitude if only the amplitude is measured). H-field and phase data was reconstructed from repeated measurements (three per measurement point) on two measurement planes separated by λ/4.

d) The total spatial-average power density (SAPD) distribution on the evaluation surface is determined per the below equation. The spatial averaging area, *A*, is specified by the applicable exposure limits or regulatory requirements. A circular shape was used.

Equation 2-2
SAPD Mathematical Equation

$$SAPD = \frac{1}{2A}\int_A |Re(ExH)| \cdot ds$$

e) The maximum spatial-average on the evaluation surface is the final quantity to determine compliance against applicable limits.

f) The local E field reference value, at the same location as step 2, was re-measured after the scan was complete to calculate the power drift. If the drift deviated by more than 5%, the power density test and drift measurements were repeated.

2.6 Reconstruction Algorithm

Computation of the power density in general requires measurement information from the both E-field and H-field amplitudes and phases in the plane of incidence. Reconstruction of these quantities from pseudo-vector E-field measurements is feasible according to the manufacturer, as they are determined via Maxwell's equations. As such, the SPEAG reconstruction approach was based on the Gerchberg-Saxton algorithm, which benefits from the availability of the E-field polarization ellipse information obtained with the EUmmWV3 probe.

3 SAR CHARACTERIZATION

3.1 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 3-1 represent different exposure scenarios.

Table 3-1
DSI and Corresponding Exposure Scenarios

Scenario	Description	SAR Test Cases
Head (DSI = 2)	▪ Device positioned next to head ▪ Receiver Active	*Head SAR per KDB Publication 648474 D04*
Hotspot mode (DSI = 3)	▪ Device transmits in hotspot mode near body ▪ Hotspot Mode Active	*Hotspot SAR per KDB Publication 941225 D06*
Phablet Grip (DSI=1 or 4)	▪ Device is held with hand and grip sensor is triggered ▪ Grip sensor triggered or earjack is active	*Phablet SAR per KDB Publication 648474 D04 & KDB Publication 616217 D04*
Phablet (DSI = 0)	▪ Device is held with hand and grip sensor is not triggered ▪ Distance grip sensor not triggered	*Phablet SAR per KDB Publication 648474 D04 & KDB Publication 616217 D04*
Body-worn (DSI = 0)	▪ Device being used with a body-worn accessory	*Body-worn SAR per KDB Publication 648474 D04*

3.2 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 3-2).

Table 3-2
***SAR_design_target* Calculations**

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

3.3 SAR Char

SAR test results corresponding to *Pmax* for each antenna/technology/band/DSI can be found in Appendix A.

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 3-3.

Table 3-3
***PLimit* Determination**

Device State Index (DSI)	*PLimit* Determination Scenarios
0	The worst-case SAR exposure is determined as maximum SAR normalized to the limit among: 1. Body Worn SAR and 2. Extremity SAR measured at 8, 6 and 11 mm spacing for back, front, bottom respectively 3. Extremity SAR measured at 0 mm for left and right surfaces
1 or 4	P_{limit} is calculated based on 10g Extremity SAR at 0 mm for back, bottom, and front surfaces
2	P_{limit} is calculated based on 1g Head SAR
3	P_{limit} is calculated based on 1g Hotspot SAR at 10 mm

Note:

For DSI = 0, P_{limit} is calculated by:

$$P_{limit} = \min\{\, P_{limit} \text{ corresponding to 1g Body Worn SAR evaluation at 15 mm spacing,}$$
$$P_{limit} \text{ corresponding to 10g Extremity SAR evaluation at 7~12 mm spacing,}$$
$$P_{limit} \text{ correponding to 10g Extremity SAR evalution at 0 mm for left and right surfaces}\}$$

Table 3-4
SAR Characterizations

Device State Index (DSI)	0	1	2	3	4
Exposure Scenario	Body-Worn 1g SAR at 15 mm Phablet 10g SAR at Max Power	Phablet 10g SAR at Red Power	Head 1g SAR	Hotspot 1g SAR	Phablet 10g SAR at Red Power
Mode/Band	PLimit (dBm)	PLimit (dBm)	PLimit (dBm)	PLimit (dBm)	PLimit (dBm)
GSM/GPRS/EDGE 850 MHz	31.5	27.2	33.9	27.4	27.2
GSM/GPRS/EDGE 1900 MHz	25.7	22.1	33.2	17.7	22.1
UMTS B5	30.5	26.9	32.8	27.2	26.9
UMTS B2	24.7	19.7	32.9	17.4	19.7
CDMA/EVDO BC0	32.4	26.1	33.7	27.6	26.1
CDMA/EVDO BC1	25.5	19.8	33.3	18.0	19.8
LTE FDD B12	32.9	27.6	34.7	30.6	27.6
LTE FDD B13	32.3	25.5	33.5	28.4	25.5
LTE FDD B26	31.9	27.3	34.3	27.8	27.3
LTE FDD B5	32.6	25.3	31.7	27.3	25.3
LTE FDD B66/4	24.6	20.6	33.2	19.8	20.6
LTE FDD B2	26.2	20.2	33.9	18.0	20.2
LTE FDD B7	27.4	20.8	33.8	20.8	20.8
LTE TDD B48	27.9	20.1	37.2	23.1	20.1
LTE TDD B38	26.6	20.0	33.2	20.0	20.0
LTE TDD B41 (PC3)	26.6	20.0	33.2	20.0	20.0

Notes:

1. When Hotspot Mode (DSI=3) and Extremity sensor (DSI=1) are trigged at the same time, DSI=1 takes priority, thus the P_{limit} for DSI=3 is set to be less or equal to P_{limit} for DSI=1.
2. When $P_{max} < P_{limit}$, the DUT will operate at a power level up to P_{max}.
3. P_{limit} for DSI=1 and DSI =4 are the same.

4 POWER DENSITY CHARACTERIZATION

4.1 Exposure Scenarios in Power Density Evaluation

At frequencies > 6 GHz, the total spatial-average power density (SAPD) is required to be assessed for all antenna configurations (beams) from all mmW antenna modules installed inside the device. This device has 3 patch antenna arrays (J Patch, K Patch, L Patch) and 1 dipole antenna array (J Dipole). Per each supported band, there are a total of 153 beams: 102 SISO beams and 51 MIMO beam pairs.

As showed in Figure 4-1, the surfaces near-by each mmW antenna module for PD characterization are identified and listed in Table 4-1.

Table 4-1
Evaluation Surfaces for PD Characterization

Band & Mode	Antenna	Back S2	Front S1	Top S5	Bottom S6	Right S4	Left S3
5G NR Band n261/n260	J Patch	Yes	No	Yes	No	No	Yes
	K Patch	Yes	Yes	No	No	Yes	No
	L Patch	Yes	Yes	No	No	No	Yes
	J Dipole	Yes	Yes	Yes	No	No	Yes

Note: For J Patch located on back surface, the patch antenna is constructed with its dedicated ground plane behind entire patch array and can only propagates outward, therefore, the front surface (S1) is excluded in Table 4-1 for J Patch.

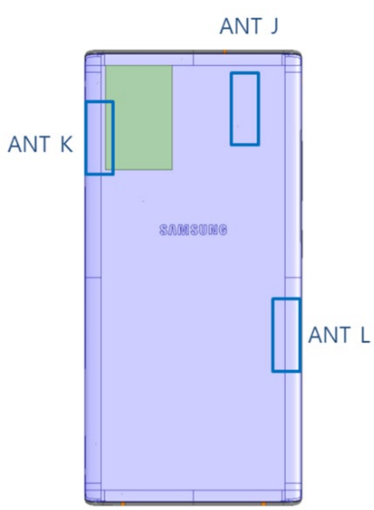


Figure 4-1: Location of mmW antenna modules looking from back of the DUT

4.2 Power Density Characterization Method

An overview of power density characterization method could be found in Figure 4-1 below.

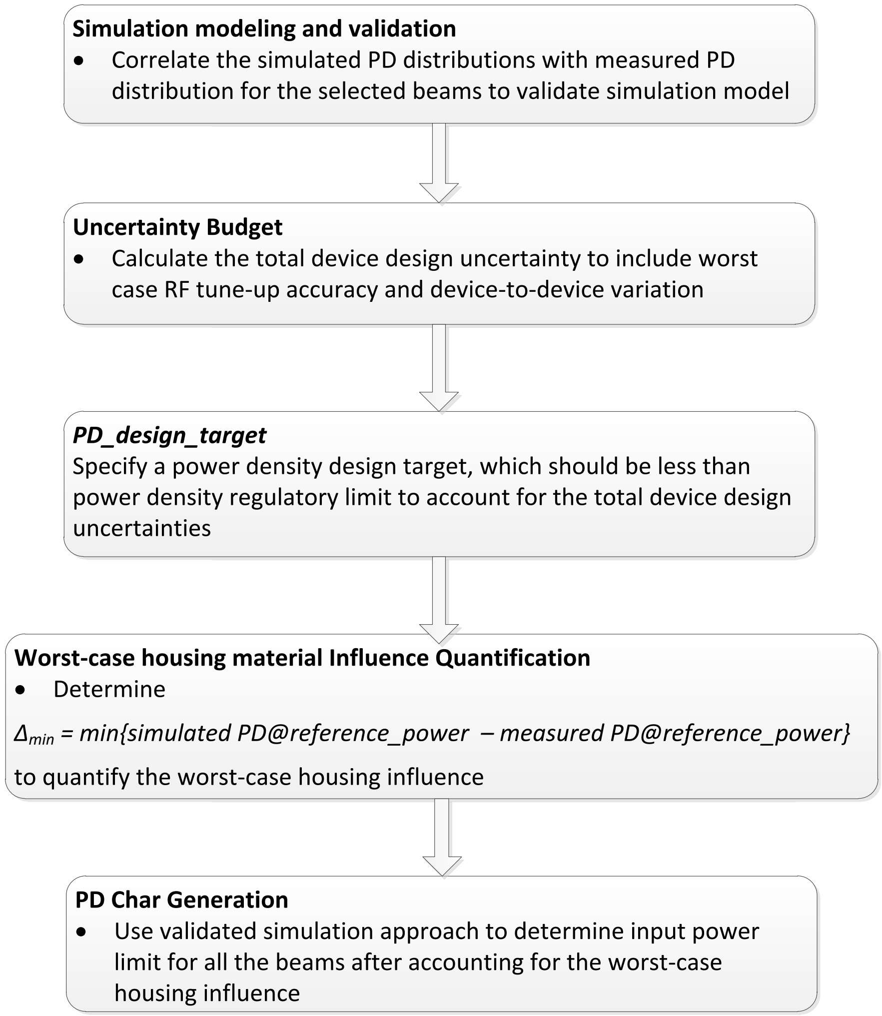


Figure 4-2
Flow Chart for Power Density Characterization

4.3 Codebook for all supported beams

All the beams that the DUT supports are specified in the pre-defined codebook. The codebook for this device is specified as below.

Table 4-2
5G mmW NR Band n261 Ant J Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
261	0	J	DIPOLE	128	2
261	1	J	PATCH	129	1
261	4	J	DIPOLE	133	4
261	5	J	DIPOLE	132	4
261	6	J	DIPOLE	134	4
261	7	J	PATCH	137	2
261	8	J	PATCH	136	2
261	9	J	PATCH	135	2
261	16	J	DIPOLE	144	4
261	17	J	DIPOLE	145	4
261	18	J	PATCH	147	2
261	19	J	PATCH	146	2
261	24	J	PATCH	155	4
261	25	J	PATCH	156	4
261	26	J	PATCH	153	4
261	27	J	PATCH	152	4
261	28	J	PATCH	154	4
261	39	J	PATCH	170	4
261	40	J	PATCH	169	4
261	41	J	PATCH	167	4
261	42	J	PATCH	168	4
261	128	J	DIPOLE	0	2
261	129	J	PATCH	1	1
261	132	J	DIPOLE	5	4
261	133	J	DIPOLE	4	4
261	134	J	DIPOLE	6	4
261	135	J	PATCH	9	2
261	136	J	PATCH	8	2
261	137	J	PATCH	7	2
261	144	J	DIPOLE	16	4
261	145	J	DIPOLE	17	4
261	146	J	PATCH	19	2
261	147	J	PATCH	18	2
261	152	J	PATCH	27	4
261	153	J	PATCH	26	4
261	154	J	PATCH	28	4
261	155	J	PATCH	24	4
261	156	J	PATCH	25	4
261	167	J	PATCH	41	4
261	168	J	PATCH	42	4
261	169	J	PATCH	40	4
261	170	J	PATCH	39	4

Table 4-3
5G mmW NR Band n260 Ant J Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
260	0	J	DIPOLE	128	2
260	1	J	PATCH	129	1
260	4	J	DIPOLE	132	4
260	5	J	DIPOLE	134	4
260	6	J	DIPOLE	133	4
260	7	J	PATCH	136	2
260	8	J	PATCH	137	2
260	9	J	PATCH	135	2
260	16	J	DIPOLE	144	4
260	17	J	DIPOLE	145	4
260	18	J	PATCH	147	2
260	19	J	PATCH	146	2
260	24	J	PATCH	153	4
260	25	J	PATCH	154	4
260	26	J	PATCH	152	4
260	27	J	PATCH	155	4
260	28	J	PATCH	156	4
260	39	J	PATCH	167	4
260	40	J	PATCH	169	4
260	41	J	PATCH	168	4
260	42	J	PATCH	170	4
260	128	J	DIPOLE	0	2
260	129	J	PATCH	1	1
260	132	J	DIPOLE	4	4
260	133	J	DIPOLE	6	4
260	134	J	DIPOLE	5	4
260	135	J	PATCH	9	2
260	136	J	PATCH	7	2
260	137	J	PATCH	8	2
260	144	J	DIPOLE	16	4
260	145	J	DIPOLE	17	4
260	146	J	PATCH	19	2
260	147	J	PATCH	18	2
260	152	J	PATCH	26	4
260	153	J	PATCH	24	4
260	154	J	PATCH	25	4
260	155	J	PATCH	27	4
260	156	J	PATCH	28	4
260	167	J	PATCH	39	4
260	168	J	PATCH	41	4
260	169	J	PATCH	40	4
260	170	J	PATCH	42	4

Table 4-4
5G mmW NR Band n261 Ant K Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
261	2	K	PATCH	130	1
261	10	K	PATCH	138	2
261	11	K	PATCH	139	2
261	12	K	PATCH	140	2
261	20	K	PATCH	148	2
261	21	K	PATCH	149	2
261	29	K	PATCH	158	4
261	30	K	PATCH	157	4
261	31	K	PATCH	160	4
261	32	K	PATCH	161	4
261	33	K	PATCH	159	4
261	43	K	PATCH	172	4
261	44	K	PATCH	171	4
261	45	K	PATCH	173	4
261	46	K	PATCH	174	4
261	130	K	PATCH	2	1
261	138	K	PATCH	10	2
261	139	K	PATCH	11	2
261	140	K	PATCH	12	2
261	148	K	PATCH	20	2
261	149	K	PATCH	21	2
261	157	K	PATCH	30	4
261	158	K	PATCH	29	4
261	159	K	PATCH	33	4
261	160	K	PATCH	31	4
261	161	K	PATCH	32	4
261	171	K	PATCH	44	4
261	172	K	PATCH	43	4
261	173	K	PATCH	45	4
261	174	K	PATCH	46	4

Table 4-5
5G mmW NR Band n260 Ant K Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
260	2	K	PATCH	130	1
260	10	K	PATCH	139	2
260	11	K	PATCH	140	2
260	12	K	PATCH	138	2
260	20	K	PATCH	148	2
260	21	K	PATCH	149	2
260	29	K	PATCH	157	4
260	30	K	PATCH	158	4
260	31	K	PATCH	159	4
260	32	K	PATCH	160	4
260	33	K	PATCH	161	4
260	43	K	PATCH	173	4
260	44	K	PATCH	172	4
260	45	K	PATCH	174	4
260	46	K	PATCH	171	4
260	130	K	PATCH	2	1
260	138	K	PATCH	12	2
260	139	K	PATCH	10	2
260	140	K	PATCH	11	2
260	148	K	PATCH	20	2
260	149	K	PATCH	21	2
260	157	K	PATCH	29	4
260	158	K	PATCH	30	4
260	159	K	PATCH	31	4
260	160	K	PATCH	32	4
260	161	K	PATCH	33	4
260	171	K	PATCH	46	4
260	172	K	PATCH	44	4
260	173	K	PATCH	43	4
260	174	K	PATCH	45	4

Table 4-6
5G mmW NR Band n261 Ant L Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
261	3	L	PATCH	131	1
261	13	L	PATCH	141	2
261	14	L	PATCH	142	2
261	15	L	PATCH	143	2
261	22	L	PATCH	150	2
261	23	L	PATCH	151	2
261	34	L	PATCH	163	4
261	35	L	PATCH	162	4
261	36	L	PATCH	164	4
261	37	L	PATCH	166	4
261	38	L	PATCH	165	4
261	47	L	PATCH	176	4
261	48	L	PATCH	175	4
261	49	L	PATCH	177	4
261	50	L	PATCH	178	4
261	131	L	PATCH	3	1
261	141	L	PATCH	13	2
261	142	L	PATCH	14	2
261	143	L	PATCH	15	2
261	150	L	PATCH	22	2
261	151	L	PATCH	23	2
261	162	L	PATCH	35	4
261	163	L	PATCH	34	4
261	164	L	PATCH	36	4
261	165	L	PATCH	38	4
261	166	L	PATCH	37	4
261	175	L	PATCH	48	4
261	176	L	PATCH	47	4
261	177	L	PATCH	49	4
261	178	L	PATCH	50	4

Table 4-7
5G mmW NR Band n260 Ant L Codebook

Band	Beam ID	Antenna	Antenna Type	Paired With	# of Antenna Feed
260	3	L	PATCH	131	1
260	13	L	PATCH	141	2
260	14	L	PATCH	142	2
260	15	L	PATCH	143	2
260	22	L	PATCH	150	2
260	23	L	PATCH	151	2
260	34	L	PATCH	166	4
260	35	L	PATCH	163	4
260	36	L	PATCH	162	4
260	37	L	PATCH	165	4
260	38	L	PATCH	164	4
260	47	L	PATCH	175	4
260	48	L	PATCH	176	4
260	49	L	PATCH	177	4
260	50	L	PATCH	178	4
260	131	L	PATCH	3	4
260	141	L	PATCH	13	2
260	142	L	PATCH	14	2
260	143	L	PATCH	15	2
260	150	L	PATCH	22	2
260	151	L	PATCH	23	2
260	162	L	PATCH	36	4
260	163	L	PATCH	35	4
260	164	L	PATCH	38	4
260	165	L	PATCH	37	4
260	166	L	PATCH	34	4
260	175	L	PATCH	47	4
260	176	L	PATCH	48	4
260	177	L	PATCH	49	4
260	178	L	PATCH	50	4

4.4 Simulation and modeling validation

Power density simulations of all beams and surfaces were performed by the manufacturer. Details of these simulations and modeling validation can be found in the Power Density Simulation Report (report SN could be found in Section 1-4 – Bibliography). Table 4-8 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 8 dBm for n261 band and 6.5 dBm for n260 band, PD measurements are conducted for at least one single beam per antenna type (dipole vs. patch) and per antenna module (J, K, L) on worst-surface(s) listed in Section 4.6. PD measurements are performed at mid channel of each mmW band and with CW modulation. All measured PD values are listed in Table 4-8 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 4-8
Measured and Simulated 4cm^2 SAPD for Selected Beams
with 8 dBm Input Power for n261 and 6.5 dBm Input Power for n260

				4cm2 SAPD (W/m2)		
Band	**Beam ID**	**Antenna**	**Surface**	**Meas.**	**Sim**	**Delta = Sim. - Meas. (dB)**
n261	16	J (Dipole)	Back	15.2	30.5	**3.00**
	133		Back	8.02	21.9	4.36
	24	J (Patch)	Back	17.10	39.76	3.66
	154		Back	17.00	39.40	**3.65**
	30	K (Patch)	Back	11.10	32.00	4.30
			Right	11.40	33.13	4.60
	173		Back	6.99	18.06	4.12
			Right	13.00	31.24	**3.81**
	37	L (Patch)	Back	10.30	35.25	5.34
			Left	9.92	30.59	4.89
	177		Back	5.70	17.54	4.88
			Left	9.37	27.96	**4.75**
n260	6	J (Dipole)	Back	7.28	14.16	**2.89**
	134		Back	4.94	9.93	3.03
	39	J (Patch)	Back	5.09	17.89	**5.46**
	153		Back	5.03	19.55	5.90
	44	K (Patch)	Back	6.44	18.09	4.48
			Right	7.31	19.94	4.36
	157		Back	3.32	6.90	3.18
			Right	10.70	14.21	**1.23**
	36	L (Patch)	Back	8.09	22.11	4.37
			Left	7.51	20.89	4.44
	175		Back	4.00	5.38	**1.28**
			Left	8.48	12.72	1.76

4.5 *PD_design_target*

PD_design_target is determined by ensuring that it is less than FCC PD limit after accounting for total device design uncertainties including TxAGC and device-to-device variation, specified by the manufacturer (see Table 4-9).

Table 4-9
***PD_design_target* Calculations**

PD_design_target	
$PD\_design\_target < PD\_regulatory\_limit \times 10^{\frac{-Total\ Uncertainty}{10}}$	
SAPD over 4 cm^2 Averaging Area (mW/cm^2)	
Total Uncertainty	2.4 dB
PD_regulatory_limit	1.0 mW/cm^2
PD_design_target	0.5754 mW/cm^2

4.6 Worst-case Housing Influence Determination: *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 location as shown in Figure 3-1, 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 Δ_{min} 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 Δ_{min} determination in Step (2.a), and re-evaluate *input.power.limit* with these added surfaces.

Following above procedure, based on Table 2 ~ Table 7 in Samsung 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 J dipole: Back (S2)

b. for J patch: Back (S2)

c. for K patch: Back (S2) & Right (S4)

d. for L patch: Back (S2) & Left (S3)

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 4-8. Thus, the worst-case housing influence, denoted as $\Delta_{min} = \mathrm{Sim.PD} - \mathrm{Meas.PD}$, is determined as

Table 4-8
Δ_{min} for Ant J, Ant K and Ant L

Band	Ant	Δ_{min} (dB)
n261	J (Dipole Beam)	3.00
	J (Patch Beam)	3.65
	K (Patch Beam)	3.81
	L (Patch Beam)	4.75
n260	J (Dipole Beam)	2.89
	J (Patch Beam)	5.46
	K (Patch Beam)	1.23
	L (Patch Beam)	1.28

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 4.7.

Simulated 4cm^{2}PD values in Table 2 ~ Table 7 in Power Density Simulation Report are scaled to *input.power.limit* and are listed in Tables 4-11 –4-18 for all single beams for all identified surfaces (shown in Table 4-1), 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 J dipole: Left (S3), Top (S5), Front (S1)

b. for J patch: Left (S3), Top (S5)

c. for K patch: Front (S1)

b. for L patch: Front (S1)

Then perform PD measurement for all determined worst-case beams, highlighted in orange in Tables 4-11 – 4-18, 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 4-19 shows that the all measured 4cm2PD values are less than *PD_design_target* of 0.5754 mW/cm^2, thus, the non-selected surfaces have no influence on the determined Δ_{min} and *input.power.limit* in Section 4.7.

Table 4-9: n261/mid channel, J Dipole simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties			
				S3(Left)	S5(Top)	S1(Front)	S2(Back)
J	DIPOLE	0	1	1.26	0.20	0.12	5.67
		4	2	0.56	0.09	0.07	5.62
		5	2	0.74	0.19	0.05	5.63
		6	2	0.96	0.48	0.05	5.63
		16	2	0.55	0.07	0.07	5.63
		17	2	0.89	0.35	0.05	5.66
		128	1	1.23	0.10	0.01	5.67
		132	2	1.11	0.23	0.03	5.68
		133	2	0.83	0.06	0.01	5.59
		134	2	0.68	0.23	0.02	5.75
		144	2	0.94	0.05	0.01	5.45
		145	2	0.66	0.18	0.02	5.75

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

Table 4-10: n261/mid channel J Patch simulated 4cm²PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S3(Left)	S5(Top)	S2(Back)
J	PATCH	1	1	0.26	0.16	5.48
		7	2	0.10	0.12	5.56
		8	2	0.24	0.07	5.52
		9	2	0.21	0.30	5.53
		18	2	0.09	0.09	5.56
		19	2	0.32	0.27	5.44
		24	4	0.24	0.04	5.46
		25	4	0.21	0.03	5.51
		26	4	0.19	0.22	5.33
		27	4	0.29	0.28	5.53
		28	4	0.37	0.66	5.67
		39	4	0.17	0.04	5.43
		40	4	0.16	0.03	5.47
		41	4	0.19	0.13	5.47
		42	4	0.35	0.52	5.59
		129	1	0.13	0.76	5.46
		135	2	0.09	0.14	5.55
		136	2	0.25	0.05	5.70
		137	2	0.22	0.11	5.71
		146	2	0.21	0.44	5.57
		147	2	0.23	0.05	5.68
		152	4	0.17	0.35	5.75
		153	4	0.24	0.15	5.66
		154	4	0.24	0.08	5.69
		155	4	0.25	0.16	5.48
		156	4	0.28	0.11	5.49
		167	4	0.20	0.31	5.70
		168	4	0.23	0.19	5.72
		169	4	0.28	0.11	5.63
		170	4	0.28	0.18	***5.53***

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

Table 4-11: n261/mid channel, K Patch simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S4(Right)	S1(Front)	S2(Back)
K	Patch	2	1	5.29	0.11	5.35
		10	2	5.19	0.16	5.51
		11	2	5.46	0.22	5.51
		12	2	5.24	0.24	5.59
		20	2	5.29	0.23	5.55
		21	2	5.29	0.28	5.47
		29	4	5.47	0.34	5.55
		30	4	5.75	0.23	***5.56***
		31	4	5.48	0.24	5.41
		32	4	5.32	0.19	5.42
		33	4	5.10	0.19	5.51
		43	4	5.66	0.24	5.61
		44	4	5.47	0.25	5.31
		45	4	5.49	0.25	5.52
		46	4	5.25	0.21	5.52
		130	1	5.04	0.64	2.29
		138	2	5.11	1.09	2.83
		139	2	5.55	1.18	3.11
		140	2	5.50	0.67	3.53
		148	2	5.29	1.11	2.97
		149	2	5.75	1.23	3.19
		157	4	5.45	1.15	3.00
		158	4	3.88	1.36	2.05
		159	4	5.05	1.17	2.99
		160	4	5.75	1.07	3.16
		161	4	4.66	0.72	3.08
		171	4	5.03	1.26	3.05
		172	4	4.86	1.29	2.01
		173	4	5.50	1.16	3.18
		174	4	5.75	0.58	3.13

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

Table 4-12: n261/mid channel, L Patch simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S3(Left)	S1(Front)	S2(Back)
L	Patch	3	1	5.20	0.09	5.59
		13	2	4.91	0.25	5.54
		14	2	4.72	0.18	5.50
		15	2	5.33	0.31	5.75
		22	2	4.88	0.10	5.75
		23	2	5.13	0.22	5.75
		34	4	5.09	0.38	5.75
		35	4	5.06	0.19	5.60
		36	4	5.08	0.18	5.61
		37	4	4.99	0.28	5.75
		38	4	4.49	0.39	5.75
		47	4	4.99	0.25	5.75
		48	4	5.22	0.20	5.56
		49	4	4.81	0.20	5.58
		50	4	4.81	0.29	5.75
		131	1	5.75	1.08	3.34
		141	2	5.75	1.51	3.68
		142	2	5.75	1.67	3.86
		143	2	5.59	0.88	3.05
		150	2	5.75	1.73	3.75
		151	2	5.69	0.83	4.20
		162	4	5.75	1.86	3.82
		163	4	5.61	1.40	3.85
		164	4	5.69	1.48	3.98
		165	4	5.75	1.25	4.18
		166	4	5.46	1.57	3.14
		175	4	5.75	1.80	3.88
		176	4	5.37	1.27	3.70
		177	4	5.75	1.24	3.61
		178	4	5.75	0.76	3.13

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

Table 4-13: n260/mid channel, J Dipole simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties			
				S3(Left)	S5(Top)	S1(Front)	S2(Back)
J	DIPOLE	0	2	1.30	0.49	0.02	5.52
		4	4	0.76	0.78	0.02	5.43
		5	4	1.34	0.47	0.02	5.69
		6	4	0.76	0.71	0.02	5.33
		16	4	0.94	0.45	0.02	5.46
		17	4	0.80	0.80	0.02	5.52
		128	2	0.82	0.19	0.02	5.00
		132	4	0.98	0.28	0.01	5.39
		133	4	0.99	0.27	0.01	5.50
		134	4	0.48	0.23	0.02	5.39
		144	4	0.83	0.36	0.02	5.61
		145	4	0.07	0.04	0.01	5.26
		0	2	1.26	0.20	0.12	5.67
		4	4	1.26	0.20	0.12	5.67
		5	4	1.26	0.20	0.12	5.67
		6	4	1.26	0.20	0.12	5.67
		16	4	1.26	0.20	0.12	5.67
		17	4	1.26	0.20	0.12	5.67

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

Table 4-14: n260/mid channel, J Patch simulated 4cm²PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm² SAPD (W/m²) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S3(Left)	S5(Top)	S2(Back)
J	PATCH	1	1	0.19	0.70	5.75
		7	2	0.13	0.20	5.75
		8	2	0.19	0.12	5.75
		9	2	0.20	0.83	5.75
		18	2	0.18	0.32	5.75
		19	2	0.11	0.58	5.75
		24	4	0.11	0.09	5.75
		25	4	0.07	0.89	5.75
		26	4	0.16	0.10	5.74
		27	4	0.27	0.68	5.75
		28	4	0.16	1.31	4.82
		39	4	0.24	0.57	5.75
		40	4	0.18	1.05	5.75
		41	4	0.26	0.20	5.72
		42	4	0.20	1.28	5.75
		129	1	0.14	0.08	5.75
		135	2	0.13	0.09	5.75
		136	2	0.11	0.05	5.75
		137	2	0.08	0.03	5.75
		146	2	0.10	0.03	5.75
		147	2	0.18	0.12	5.75
		152	4	0.22	0.18	5.75
		153	4	0.03	0.06	5.75
		154	4	0.06	0.17	5.75
		155	4	0.19	0.23	5.75
		156	**4**	0.05	0.10	5.75
		167	4	0.27	0.21	5.75
		168	4	0.07	0.13	5.73
		169	4	0.28	0.24	5.75
		170	4	0.06	0.14	5.75

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

Table 4-15: n260/mid channel, K Patch simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S4(Right)	S1(Front)	S2(Back)
K	Patch	2	1	5.16	0.21	4.57
		10	2	5.75	0.28	4.80
		11	2	5.45	0.22	**5.08**
		12	2	5.75	0.28	4.80
		20	2	5.37	0.25	4.78
		21	2	5.58	0.18	4.76
		29	4	5.75	0.58	**5.12**
		30	4	5.69	0.23	4.82
		31	4	4.90	0.24	4.58
		32	4	5.75	0.41	4.44
		33	4	5.59	0.44	**5.21**
		43	4	5.64	0.31	4.81
		44	4	5.68	0.11	**5.16**
		45	4	4.69	0.33	4.57
		46	4	5.75	0.51	4.65
		130	1	5.07	0.80	2.72
		138	2	5.75	1.06	1.69
		139	2	5.75	1.02	4.05
		140	2	5.75	0.98	2.15
		148	2	5.75	1.55	3.13
		149	2	5.69	0.98	2.10
		157	4	5.75	1.19	2.79
		158	4	5.69	1.57	3.73
		159	4	5.75	1.18	3.45
		160	4	5.60	1.42	3.56
		161	4	5.14	1.19	2.35
		171	4	5.75	1.51	3.54
		172	4	5.47	0.99	3.60
		173	4	5.75	1.49	3.55
		174	4	5.09	1.37	2.83

Note: Even though the worst surface having the highest 4cm^{2}PD values is right surface (S4), as shown in Table 4-8, the back surface (S2) was also selected for Δ_{min} determination. Therefore, the worst-case beam for remaining non-selected surfaces (identified in Table 4-1) is from front surface (S1) only.

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

Table 4-16: n260/mid channel, L Patch simulated 4cm^{2}PD at *PD_Design_Target* (if simulation performed with correct housing material properties) (Δ_{min})

Module	Type(P or D)	Beam ID_1	Feed no.	Simulated 4cm^2 SAPD (W/m^2) corresponding to PD_design_target if the simulation was performed with correct housing material properties		
				S3(Left)	S1(Front)	S2(Back)
L	Patch	3	1	5.75	0.24	5.75
		13	2	5.75	0.29	5.41
		14	2	5.41	0.06	5.37
		15	2	5.75	0.29	5.38
		22	2	5.75	0.25	5.50
		23	2	5.75	0.11	5.44
		34	4	5.75	0.32	5.59
		35	4	5.75	0.27	5.56
		36	4	5.44	0.24	5.75
		37	4	5.75	0.30	5.56
		38	4	5.75	0.43	5.45
		47	4	5.72	0.32	5.75
		48	4	5.01	0.03	4.95
		49	4	5.67	0.29	5.75
		50	4	5.75	0.53	4.43
		131	1	5.75	0.82	2.87
		141	2	5.74	1.36	2.99
		142	2	5.75	1.68	4.04
		143	2	5.75	1.23	3.48
		150	2	5.75	1.77	2.85
		151	2	5.75	1.72	3.73
		162	4	4.87	1.61	2.81
		163	4	5.75	2.24	2.73
		164	4	5.75	1.33	3.96
		165	4	5.75	1.56	3.83
		166	4	5.47	1.65	2.96
		175	4	5.75	1.72	2.43
		176	4	5.75	2.02	3.72
		177	4	5.75	1.63	3.84
		178	4	5.71	1.72	3.18

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

Table 4-17: 4cm² PD of the selected beams measured on the corresponding surfaces that are not selected for Δmin determination

Band	Beam ID	Antenna	Surface	input.power.limit (dBm)	Meas. 4cm² PD (W/m²)
n261	0	J (Dipole)	Left (S3)	6.6	0.792
	0		Front (S1)	6.6	0.141
	6		Top (S5)	3.1	0.356
	28	J (Patch)	Left (S3)	1.4	0.149
	129		Top (S5)	7.2	0.657
	158	K (Patch)	Front (S1)	2.8	1.31
	162	L (Patch)	Front (S1)	4.5	1.47
n260	0	J (Dipole)	Front (S1)	6.4	0.582
	5		Left (S3)	3.7	0.837
	17		Top (S5)	3.1	0.431
	169	J (Patch)	Left (S3)	5.8	0.276
	28		Top (S5)	5.2	1.06
	158	K (Patch)	Front (S1)	3.2	1.35
	163	L (Patch)	Front (S1)	3.8	1.13

4.7 PD Char

4.7.1 Scaling Factor for 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 8dBm input power per active port for n261 band and 6.5dBm input power per active port for n260 band:

1. Obtained $PD_{surface}$ value (the worst PD among all identified surfaces of the DUT) at all three channels for all single beams specified in the codebook of Table 3-1.
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:

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

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

4.7.2 Scaling Factor for 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:

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

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*:

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

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}) determined in Table 4-10, given by:

- For n261

$$input.power.limit(i) = 8\ dBm + 10 * \log(s(i)) + \Delta_{min},\ i \in all\ beams \quad (5a)$$

- For n260

$$input.power.limit(i) = 6.5\ dBm + 10 * \log(s(i)) + \Delta_{min},\ i \in all\ beams \quad (5b)$$

where $8\ dBm$ and $6.5\ dBm$ are the input powers used in simulation for 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 (determined in Table 4-10) 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 5a and 5b is modified to:

If -TxAGC uncertainty < Δ_{min} < TxAGC uncertainty,

$$input.power.limit(i) = 8\ dBm + 10 * \log\big(s(i)\big)\ ,\ i \in all\ beams, \text{ for n261} \quad (6a)$$

$$input.power.limit(i) = 6.5\ dBm + 10 * \log\big(s(i)\big)\ ,\ i \in all\ beams, \text{ for n260} \quad (6b)$$

else if Δ_{min} < -TxAGC uncertainty,

$$input.power.limit(i) = 8\ dBm + 10 * \log\big(s(i)\big) + \ (\Delta_{min} + \text{TxAGC uncertainty}),$$
$$i \in all\ beams, \text{ for n261} \quad (7a)$$

$$input.power.limit(i) = 6.5\ dBm + 10 * \log\big(s(i)\big) + \ (\Delta_{min} + \text{TxAGC uncertainty}),$$
$$i \in all\ beams, \text{ for n260} \quad (7b)$$

else if Δ_{min} > TxAGC uncertainty,

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

$$input.power.limit(i) = 6.5\ dBm + 10 * \log\big(s(i)\big) + (\Delta_{min} - \text{TxAGC uncertainty}),$$
$$i \in all\ beams, \text{ for n260} \quad (8b)$$

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

Table 4-18
***input.power.limit* Calculation**

Band	Ant	Δ_{min} (dB)	Device Uncertainty (dB)	*input.power.limit* (dBm) =	Notes
n261	J (dipole beam)	3.00	2.4	$8\ dBm + 10 * \log\big(s(i)\big) + 0.6$	Using Eq. 8a
	J (patch beam)	3.65	2.4	$8\ dBm + 10 * \log\big(s(i)\big) + 1.25$	Using Eq. 8a
	K (patch beam)	3.81	2.4	$8\ dBm + 10 * \log\big(s(i)\big) + 1.41$	Using Eq. 8a
	L (patch beam)	4.75	2.4	$8\ dBm + 10 * \log\big(s(i)\big) + 2.35$	Using Eq. 8a
n260	J (dipole beam)	2.89	2.4	$6.5\ dBm + 10 * \log\big(s(i)\big) + 0.49$	Using Eq. 8b
	J (patch beam)	5.46	2.4	$6.5\ dBm + 10 * \log\big(s(i)\big) + 3.06$	Using Eq. 8b
	K (patch beam)	1.23	2.4	$6.5\ dBm + 10 * \log\big(s(i)\big)$	Using Eq. 6b
	L (patch beam)	1.28	2.4	$6.5\ dBm + 10 * \log\big(s(i)\big)$	Using Eq. 6b

Thus, the DUT PD Char for n261 and n260 bands is as shown in the tables 4-21 – 4-28 below. The full simulation results used to support this calculation can be found in the Power Density Simulation Report.

Table 4-19
5G NR n261 J Dipole *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
J Dipole	0		6.60
	4		1.50
	5		1.94
	6		3.07
	16		1.28
	17		2.62
	128		6.24
	132		3.51
	133		2.67
	134		3.11
	144		2.64
	145		2.92
	0	128	4.96
	4	133	1.77
	5	132	1.84
	6	134	1.11
	16	144	1.68
	17	145	0.33

Table 4-20
5G NR n261 J Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
J Patch	1		6.14
	7		3.54
	8		3.57
	9		4.29
	18		3.48
	19		3.47
	24		0.63
	25		1.06
	26		1.15
	27		0.69
	28		1.37
	39		0.70
	40		1.24
	41		0.72
	42		0.98
	129		7.22
	135		4.08
	136		3.81
	137		3.71
	146		3.72
	147		3.69
	152		0.95
	153		1.02
	154		0.85
	155		0.81
	156		1.15
	167		0.96
	168		1.15
	169		0.83
	170		0.92
	1	129	4.14
	7	137	1.59
	8	136	0.22
	9	135	1.28
	18	147	1.03
	19	146	1.09
	24	155	-1.77
	25	156	-1.26
	26	153	-1.83
	27	152	-2.74
	28	154	-2.03
	39	170	-1.39
	40	169	-2.04
	41	167	-3.13
	42	168	-1.92

Table 4-21
5G NR n261 K Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
K Patch	2		7.72
	10		5.21
	11		4.64
	12		5.71
	20		4.95
	21		4.90
	29		2.75
	30		1.80
	31		1.90
	32		2.14
	33		2.29
	43		2.17
	44		1.97
	45		2.11
	46		2.21
	130		8.49
	138		4.88
	139		4.96
	140		6.88
	148		4.66
	149		5.34
	157		3.90
	158		2.84
	159		1.70
	160		2.49
	161		3.64
	171		3.40
	172		2.18
	173		1.86
	174		3.09
	2	130	6.44
	10	138	3.02
	11	139	3.04
	12	140	2.68
	20	148	3.33
	21	149	3.19
	29	158	-0.73
	30	157	0.54
	31	160	-0.43
	32	161	1.01
	33	159	0.34
	43	172	-0.74
	44	171	-0.08
	45	173	-0.85
	46	174	1.14

Table 4-22
5G NR n261 L Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
L Patch	3		8.22
	13		5.32
	14		5.09
	15		6.59
	22		5.25
	23		5.48
	34		2.77
	35		2.38
	36		2.57
	37		2.48
	38		3.42
	47		2.65
	48		2.51
	49		2.40
	50		2.67
	131		10.20
	141		6.76
	142		7.04
	143		7.44
	150		6.68
	151		8.26
	162		4.47
	163		3.59
	164		3.47
	165		4.66
	166		6.65
	175		4.00
	176		3.12
	177		3.48
	178		5.74
	3	131	6.53
	13	141	0.99
	14	142	2.39
	15	143	3.52
	22	150	1.38
	23	151	2.82
	34	163	-0.39
	35	162	0.32
	36	164	0.26
	37	166	1.32
	38	165	2.12
	47	176	-0.14
	48	175	-0.45
	49	177	1.76
	50	178	1.49

Table 4-23
5G NR n260 J Dipole *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
J Dipole	0		6.44
	4		2.94
	5		3.71
	6		2.74
	16		3.07
	17		3.14
	128		7.78
	132		5.39
	133		5.44
	134		4.33
	144		5.26
	145		4.43
	0	128	6.34
	4	132	3.46
	5	134	2.51
	6	133	1.16
	16	144	2.56
	17	145	3.33

Table 4-24
5G NR n260 J Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
J Patch	1		9.25
	7		7.17
	8		7.19
	9		6.53
	18		7.16
	19		8.56
	24		4.72
	25		5.34
	26		4.79
	27		4.98
	28		5.18
	39		4.63
	40		5.56
	41		5.32
	42		4.87
	129		9.56
	135		7.03
	136		7.25
	137		6.99
	146		6.91
	147		7.36
	152		5.18
	153		4.25
	154		5.75
	155		5.73
	156		4.38
	167		5.49
	168		4.72
	169		5.80
	170		4.41
	1	129	6.74
	7	136	5.14
	8	137	5.05
	9	135	5.03
	18	147	5.47
	19	146	4.13
	24	153	1.78
	25	154	1.41
	26	152	1.67
	27	155	1.67
	28	156	2.08
	39	167	2.05
	40	169	1.93
	41	168	1.47
	42	170	2.11

Table 4-25
5G NR n260 K Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
K Patch	2		6.74
	10		3.90
	11		3.14
	12		3.90
	20		3.40
	21		3.39
	29		1.80
	30		1.11
	31		0.52
	32		1.57
	33		1.64
	43		1.58
	44		1.05
	45		1.40
	46		1.31
	130		7.58
	138		4.70
	139		5.30
	140		4.61
	148		5.39
	149		4.83
	157		2.57
	158		3.18
	159		2.89
	160		3.14
	161		2.15
	171		3.87
	172		3.14
	173		3.17
	174		2.35
	2	130	3.92
	10	139	1.21
	11	140	1.21
	12	138	0.08
	20	148	1.58
	21	149	1.34
	29	157	-1.90
	30	158	-1.45
	31	159	-0.77
	32	160	-1.92
	33	161	-1.44
	43	173	-1.19
	44	172	-1.30
	45	174	-1.65
	46	171	-1.10

Table 4-26
5G NR n260 L Patch *input.power.limit*

Antenna	Beam ID_1	Beam ID_2	Input.Power.Limit (in dBm)
L Patch	3		6.05
	13		3.29
	14		3.46
	15		3.86
	22		3.23
	23		3.59
	34		1.31
	35		0.93
	36		0.65
	37		1.68
	38		1.45
	47		1.00
	48		0.81
	49		0.79
	50		1.42
	131		8.01
	141		5.56
	142		5.31
	143		4.92
	150		5.52
	151		4.98
	162		2.93
	163		3.75
	164		2.85
	165		3.37
	166		2.93
	175		3.05
	176		3.10
	177		3.04
	178		3.17
	3	131	3.65
	13	141	1.81
	14	142	0.92
	15	143	2.24
	22	150	1.09
	23	151	0.53
	34	166	-1.50
	35	163	-1.51
	36	162	-1.75
	37	165	-1.16
	38	164	-1.38
	47	175	-0.74
	48	176	-1.34
	49	177	-1.43
	50	178	-1.38

5 EQUIPMENT LIST

For SAR measurements

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
Agilent	8648D	(9kHz-4GHz) Signal Generator	4/29/2019	Annual	4/29/2020	3613A00315
Agilent	N9020A	MXA Signal Analyzer	4/20/2019	Annual	4/20/2020	US46470561
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB44450273
Agilent	E5515C	Wireless Communications Test Set	2/7/2018	Triennial	2/7/2021	GB43304447
Agilent	E5515C	Wireless Communications Test Set	5/22/2018	Biennial	5/22/2020	GB43193563
Agilent	8753ES	S-Parameter Network Analyzer	3/11/2019	Annual	3/11/2020	US39170122
Agilent	E4438C	ESG Vector Signal Generator	3/11/2019	Biennial	3/11/2021	MY42082659
Agilent	8753ES	S-Parameter Network Analyzer	7/30/2018	Annual	7/30/2019	MY40000670
Agilent	N4010A	Wireless Connectivity Test Set	N/A	N/A	N/A	GB46170464
Agilent	N5182A-506	MXG Vector Signal Generator	6/19/2018	Annual	6/19/2019	MY48180366
Agilent	34405A	Digital Multimeter	6/21/2017	Biennial	6/21/2019	TW46220115
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433972
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433974
Amplifier Research	15S1G6	Amplifier	CBT	N/A	CBT	433976
Amplifier Research	150A100C	DC Amplifier	CBT	N/A	CBT	348812
Anritsu	MT8821C	Radio Communication Analyzer	11/6/2018	Annual	11/6/2019	6200901190
Anritsu	MT8820C	Radio Communication Analyzer	3/29/2019	Annual	3/29/2020	6201300731
Anritsu	ML2496A	Power Meter	6/19/2018	Annual	6/19/2019	1306009
Anritsu	MT8821C	Radio Communication Analyzer	7/24/2018	Annual	7/24/2019	6201664756
Anritsu	MA24106A	USB Power Sensor	9/20/2018	Annual	9/20/2019	1344545
Anritsu	MA24106A	USB Power Sensor	9/20/2018	Annual	9/20/2019	1344559
Anritsu	MA2411B	Pulse Power Sensor	11/20/2018	Annual	11/20/2019	1339008
Anritsu	MT8862A	Wireless Connectivity Test Set	7/3/2018	Annual	7/3/2019	6261782395
Anritsu	MG3692C	Signal Generator	10/5/2018	Annual	10/5/2019	163005
Anritsu	MT8000A	Radio Communication Test Station	11/14/2018	Annual	11/14/2019	6261914237
Control Company	4040	Therm./ Clock/ Humidity Monitor	10/9/2018	Biennial	10/9/2020	181647811
Control Company	4352	Ultra Long Stem Thermometer	11/29/2018	Biennial	11/29/2020	181766816
Keysight	772D	Dual Directional Coupler	CBT	N/A	CBT	MY52180215
MCL	BW-N6W5+	6dB Attenuator	CBT	N/A	CBT	1139
MiniCircuits	VLF-6000+	Low Pass Filter	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5+	DC to 18 GHz Precision Fixed 20 dB Attenuator	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-1200+	Low Pass Filter DC to 1000 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	NLP-2950+	Low Pass Filter DC to 2700 MHz	CBT	N/A	CBT	N/A
Mini-Circuits	BW-N20W5	Power Attenuator	CBT	N/A	CBT	1226
Narda	4014C-6	4 - 8 GHz SMA 6 dB Directional Coupler	CBT	N/A	CBT	N/A
Narda	4772-3	Attenuator (3dB)	CBT	N/A	CBT	9406
Narda	BW-S3W2	Attenuator (3dB)	CBT	N/A	CBT	120
Pasternack	PE2208-6	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE2209-10	Bidirectional Coupler	CBT	N/A	CBT	N/A
Pasternack	PE5011-1	Torque Wrench	7/19/2017	Biennial	7/19/2019	N/A
Rohde & Schwarz	CMW500	Radio Communication Tester	6/9/2018	Annual	6/9/2019	108843
Rohde & Schwarz	CMW500	Radio Communication Tester	11/5/2018	Annual	11/5/2019	140148
Rohde & Schwarz	CMW500	Wideband Radio Communication Tester	5/29/2018	Annual	5/29/2019	161662
SPEAG	DAK-12	Dielectric Assessment Kit (10MHz - 3GHz)	3/13/2019	Annual	3/13/2020	1102
SPEAG	D750V3	750 MHz SAR Dipole	1/15/2018	Biennial	1/15/2020	1003
SPEAG	D835V2	835 MHz SAR Dipole	1/22/2019	Annual	1/22/2020	4d132
SPEAG	D1765V2	1765 MHz SAR Dipole	5/23/2018	Biennial	5/23/2020	1008
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	5d080
SPEAG	D2450V2	2450 MHz SAR Dipole	9/11/2017	Biennial	9/11/2019	797
SPEAG	D2600V2	2600 MHz SAR Dipole	9/13/2016	Triennial	9/13/2019	1071
SPEAG	D3500V2	3500 MHz SAR Dipole	8/15/2018	Annual	8/15/2019	1055
SPEAG	D3700V2	3700 MHz SAR Dipole	9/13/2018	Annual	9/13/2019	1002
SPEAG	D5GHzV2	5 GHz SAR Dipole	9/21/2016	Triennial	9/21/2019	1191
SPEAG	D835V2	835 MHz SAR Dipole	10/19/2018	Annual	10/19/2019	4d133
SPEAG	D1750V2	1750 MHz SAR Dipole	10/22/2018	Annual	10/22/2019	1150
SPEAG	D1900V2	1900 MHz SAR Dipole	10/23/2018	Annual	10/23/2019	5d149
SPEAG	D1900V2	1900 MHz SAR Dipole	2/21/2019	Annual	2/21/2020	5d148
SPEAG	D2450V2	2450 MHz SAR Dipole	8/17/2017	Biennial	8/17/2019	719
SPEAG	D2600V2	2600 MHz SAR Dipole	4/11/2018	Biennial	4/11/2020	1004
SPEAG	D5GHzV2	5 GHz SAR Dipole	8/10/2018	Annual	8/10/2019	1237
SPEAG	D5GHzV2	5 GHz SAR Dipole	1/16/2018	Biennial	1/16/2020	1057
SPEAG	EX3DV4	SAR Probe	6/25/2018	Annual	6/25/2019	7409
SPEAG	EX3DV4	SAR Probe	5/16/2019	Annual	5/16/2020	7406
SPEAG	EX3DV4	SAR Probe	8/23/2018	Annual	8/23/2019	7308
SPEAG	EX3DV4	SAR Probe	1/25/2019	Annual	1/25/2020	3589
SPEAG	EX3DV4	SAR Probe	4/24/2019	Annual	4/24/2020	7357
SPEAG	EX3DV4	SAR Probe	1/24/2019	Annual	1/24/2020	7488
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	3914
SPEAG	EX3DV4	SAR Probe	7/20/2018	Annual	7/20/2019	7410
SPEAG	EX3DV4	SAR Probe	2/19/2019	Annual	2/19/2020	7417
SPEAG	DAE4	Dasy Data Acquisition Electronics	6/18/2018	Annual	6/18/2019	1334
SPEAG	DAE4	Dasy Data Acquisition Electronics	5/8/2019	Annual	5/8/2020	859
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/3/2018	Annual	10/3/2019	1558
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/22/2018	Annual	8/22/2019	1450
SPEAG	DAE4	Dasy Data Acquisition Electronics	4/18/2019	Annual	4/18/2020	1407
SPEAG	DAE4	Dasy Data Acquisition Electronics	1/15/2019	Annual	1/15/2020	1530
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/14/2019	Annual	2/14/2020	1272
SPEAG	DAE4	Dasy Data Acquisition Electronics	7/11/2018	Annual	7/11/2019	1322
SPEAG	DAE4	Dasy Data Acquisition Electronics	2/13/2019	Annual	2/13/2020	665

Note:

1. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.
2. Each equipment item was used solely within its respective calibration period.

For PD measurements

Manufacturer	Model	Description	Cal Date	Cal Interval	Cal Due	Serial Number
-	WL25-1	Conducted Cable Set (25GHz)	10/31/2018	Annual	10/31/2019	WL25-1
Emco	3116	Horn Antenna (18 - 40GHz)	6/7/2018	Triennial	6/7/2021	9203-2178
Huber+Suhner	Sucoflex 102A	40GHz Radiated Cable	8/23/2018	Annual	8/23/2019	251425001
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	6/25/2018	Annual	6/25/2019	102133
Rohde & Schwarz	TS-PR40	26.5-40 GHz Pre-Amplifier	9/19/2018	Annual	9/19/2019	100037
Rohde & Schwarz	FSW67	Signal / Spectrum Analyzer	8/17/2018	Annual	8/17/2019	103200
SPEAG	EUmmWV3	EUmmWV3 Probe	3/6/2019	Annual	3/6/2020	9416
SPEAG	EUmmWV3	EUmmWV3 Probe	11/6/2018	Annual	11/6/2019	9389
SPEAG	EUmmWV3	EUmmWV3 Probe	12/7/2018	Annual	12/7/2019	9407
SPEAG	SM 003 100 AA	30GHz System Verification Ka- Band Source Antenna	3/19/2019	Annual	3/19/2020	1002
SPEAG	SM 003 100 AA	30GHz System Verification Ka- Band Source Antenna	10/1/2018	Annual	10/1/2019	1015
SPEAG	SM 003 100 AA	30GHz System Verification Ka- Band Source Antenna	4/3/2019	Annual	4/3/2020	1045
SPEAG	DAE4	Dasy Data Acquisition Electronics	10/18/2018	Annual	10/18/2019	1333
SPEAG	DAE4	Dasy Data Acquisition Electronics	8/14/2018	Annual	8/14/2019	1323
HP	8564E	Spectrum Analyzer (9 kHz - 40 GHz)	7/23/2018	Annual	7/23/2019	3846A01599
Agilent	N9030A	PXA Signal Analyzer (44GHz)	6/12/2019	Annual	6/12/2020	MY52350166
Com-Power	AL-130	9kHz - 30MHz Loop Antenna	10/10/2017	Biennial	10/10/2019	121034
Com-Power	PAM-103	Pre-Amplifier (1-1000MHz)	9/17/2018	Annual	9/17/2019	441119
Emco	3115	Horn Antenna (1-18GHz)	3/28/2018	Biennial	3/28/2020	9704-5182
Keysight Technologies	N9030A	3Hz-44GHz PXA Signal Analyzer	5/2/2019	Annual	5/2/2020	MY49430494
Keysight Technologies	N9030A	PXA Signal Analyzer	8/6/2018	Annual	8/6/2019	MY54490576
Rohde & Schwarz	180-442-KF	Horn (Small)	8/21/2018	Annual	8/21/2019	U157403-01
Rohde & Schwarz	ESU26	EMI Test Receiver (26.5GHz)	6/5/2019	Annual	6/5/2020	100342
Rohde & Schwarz	SFUNIT-Rx	Shielded Filter Unit	7/18/2018	Annual	7/18/2019	102134
Sunol	JB5	Bi-Log Antenna (30M - 5GHz)	4/19/2018	Biennial	4/19/2020	A051107
Virginia Diodes Inc	SAX252	Spectrum Analyzer Extension Module	8/14/2018	Annual	8/14/2019	SAX252
Virginia Diodes Inc	SAX253	Spectrum Analyzer Extension Module	8/8/2018	Annual	8/8/2019	SAX253
Virginia Diodes Inc	SAX254	Spectrum Analyzer Extension Module	8/22/2018	Annual	8/22/2019	SAX254

Note:
1. Each equipment item was used solely within its respective calibration period.
2. CBT (Calibrated Before Testing). Prior to testing, the measurement paths containing a cable, amplifier, attenuator, coupler or filter were connected to a calibrated source (i.e. a signal generator) to determine the losses of the measurement path. The power meter offset was then adjusted to compensate for the measurement system losses. This level offset is stored within the power meter before measurements are made. This calibration verification procedure applies to the system verification and output power measurements. The calibrated reading is then taken directly from the power meter after compensation of the losses for all final power measurements.

6 MEASUREMENT UNCERTAINTIES

For SAR Measurements

a	c	d	e= f(d,k)	f	g	h = c x f/e	i = c x g/e	k
Uncertainty Component	Tol. (± %)	Prob. Dist.	Div.	c_i 1gm	c_i 10 gms	1gm u_i (± %)	10gms u_i (± %)	v_i
Measurement System								
Probe Calibration	6.55	N	1	1.0	1.0	6.6	6.6	∞
Axial Isotropy	0.25	N	1	0.7	0.7	0.2	0.2	∞
Hemishperical Isotropy	1.3	N	1	0.7	0.7	0.9	0.9	∞
Boundary Effect	2.0	R	1.73	1.0	1.0	1.2	1.2	∞
Linearity	0.3	N	1	1.0	1.0	0.3	0.3	∞
System Detection Limits	0.25	R	1.73	1.0	1.0	0.1	0.1	∞
Readout Electronics	0.3	N	1	1.0	1.0	0.3	0.3	∞
Response Time	0.8	R	1.73	1.0	1.0	0.5	0.5	∞
Integration Time	2.6	R	1.73	1.0	1.0	1.5	1.5	∞
RF Ambient Conditions - Noise	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
RF Ambient Conditions - Reflections	3.0	R	1.73	1.0	1.0	1.7	1.7	∞
Probe Positioner Mechanical Tolerance	0.4	R	1.73	1.0	1.0	0.2	0.2	∞
Probe Positioning w/ respect to Phantom	6.7	R	1.73	1.0	1.0	3.9	3.9	∞
Extrapolation, Interpolation & Integration algorithms for Max. SAR Evaluation	4.0	R	1.73	1.0	1.0	2.3	2.3	∞
Test Sample Related								
Test Sample Positioning	2.7	N	1	1.0	1.0	2.7	2.7	35
Device Holder Uncertainty	1.67	N	1	1.0	1.0	1.7	1.7	5
Output Power Variation - SAR drift measurement	5.0	R	1.73	1.0	1.0	2.9	2.9	∞
SAR Scaling	0.0	R	1.73	1.0	1.0	0.0	0.0	∞
Phantom & Tissue Parameters								
Phantom Uncertainty (Shape & Thickness tolerances)	7.6	R	1.73	1.0	1.0	4.4	4.4	∞
Liquid Conductivity - measurement uncertainty	4.2	N	1	0.78	0.71	3.3	3.0	10
Liquid Permittivity - measurement uncertainty	4.1	N	1	0.23	0.26	1.0	1.1	10
Liquid Conductivity - Temperature Uncertainty	3.4	R	1.73	0.78	0.71	1.5	1.4	∞
Liquid Permittivity - Temperature Unceritainty	0.6	R	1.73	0.23	0.26	0.1	0.1	∞
Liquid Conductivity - deviation from target values	5.0	R	1.73	0.64	0.43	1.8	1.2	∞
Liquid Permittivity - deviation from target values	5.0	R	1.73	0.60	0.49	1.7	1.4	∞
Combined Standard Uncertainty (k=1)		RSS				11.5	11.3	60
Expanded Uncertainty (95% CONFIDENCE LEVEL)		k=2				23.0	22.6	

For PD Measurements

a	b	c	d	e	f = b x e/d	g
Uncertainty Component	Unc. (± dB)	Prob. Dist.	Div.	ci	ui (± dB)	vi
Measurement System						
Probe Calibration	0.49	N	1	1.0	0.49	∞
Hemispherical Isotropy	0.5	R	1.73	1.0	0.29	∞
Linearity	0.2	R	1.73	0.0	0.00	∞
Detection Limits	0.04	R	1.73	1.0	0.02	∞
Modulation Response	0.4	R	1.73	1.0	0.23	∞
Resource Block Offset	0.1	R	1.73	1.0	0.06	∞
Readout Electronics	0.03	N	1	1.0	0.03	∞
Response Time	0	R	1.73	1.0	0.00	∞
Integration Time	0	R	1.73	1.0	0.00	∞
RF Ambient Conditions - Noise	0.04	R	1.73	1.0	0.02	∞
RF Ambient Conditions - Reflections	0.21	R	1.73	1.0	0.12	∞
Probe Positioner	0.04	R	1.73	1.0	0.02	∞
Probe Positioning	0.3	R	1.73	1.0	0.17	∞
Post-processing	0.6	R	1.73	1.0	0.35	∞
Test Sample Related						
Power Drift	0.22	R	1.73	1.0	0.13	∞
Input Power	0.0	N	1	0.0	0.00	∞
Combined Standard Uncertainty (k=1)		RSS			0.75	∞
Expanded Uncertainty (95% CONFIDENCE LEVEL)	k=2				1.5	

APPENDIX A: SAR TEST RESULTS FOR *PLIMIT* CALCULATIONS

Table A-1
DSI = 2 P_{Limit} Calculations – 2G/3G Head SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode/Band	Service	Conducted Power [dBm]	Side	Test Position	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.							(W/kg)	[dBm]	[dBm]
836.60	190	GSM 850	GSM	33.50	Right	Cheek	1:8.3	0.109	33.92	33.92
836.60	190	GSM 850	GSM	33.50	Right	Tilt	1:8.3	0.056	36.81	
836.60	190	GSM 850	GSM	33.50	Left	Cheek	1:8.3	0.089	34.80	
836.60	190	GSM 850	GSM	33.50	Left	Tilt	1:8.3	0.044	37.86	
1880.00	661	GSM 1900	GSM	30.00	Right	Cheek	1:8.3	0.045	34.26	33.23
1880.00	661	GSM 1900	GSM	30.00	Right	Tilt	1:8.3	0.040	34.77	
1880.00	661	GSM 1900	GSM	30.00	Left	Cheek	1:8.3	0.057	33.23	
1880.00	661	GSM 1900	GSM	30.00	Left	Tilt	1:8.3	0.027	36.48	
836.60	4183	UMTS 850	RMC	25.50	Right	Cheek	1:1	0.188	32.76	32.76
836.60	4183	UMTS 850	RMC	25.50	Right	Tilt	1:1	0.081	36.42	
836.60	4183	UMTS 850	RMC	25.50	Left	Cheek	1:1	0.138	34.10	
836.60	4183	UMTS 850	RMC	25.50	Left	Tilt	1:1	0.067	37.24	
1880.00	9400	UMTS 1900	RMC	25.00	Right	Cheek	1:1	0.138	33.60	32.85
1880.00	9400	UMTS 1900	RMC	25.00	Right	Tilt	1:1	0.105	34.79	
1880.00	9400	UMTS 1900	RMC	25.00	Left	Cheek	1:1	0.164	32.85	
1880.00	9400	UMTS 1900	RMC	25.00	Left	Tilt	1:1	0.070	36.55	
836.52	384	Cell. CDMA	RC3 / SO55	26.30	Right	Cheek	1:1	0.183	33.68	33.68
836.52	384	Cell. CDMA	RC3 / SO55	26.30	Right	Tilt	1:1	0.073	37.67	
836.52	384	Cell. CDMA	RC3 / SO55	26.30	Left	Cheek	1:1	0.112	35.81	
836.52	384	Cell. CDMA	RC3 / SO55	26.30	Left	Tilt	1:1	0.060	38.52	
836.52	384	Cell. CDMA	EVDO Rev. A	26.30	Right	Cheek	1:1	0.172	33.94	
836.52	384	Cell. CDMA	EVDO Rev. A	26.30	Right	Tilt	1:1	0.071	37.79	
836.52	384	Cell. CDMA	EVDO Rev. A	26.30	Left	Cheek	1:1	0.115	35.69	
836.52	384	Cell. CDMA	EVDO Rev. A	26.30	Left	Tilt	1:1	0.061	38.45	
1880.00	600	PCS CDMA	RC3 / SO55	25.00	Right	Cheek	1:1	0.104	34.83	33.30
1880.00	600	PCS CDMA	RC3 / SO55	25.00	Right	Tilt	1:1	0.080	35.97	
1880.00	600	PCS CDMA	RC3 / SO55	25.00	Left	Cheek	1:1	0.148	33.30	
1880.00	600	PCS CDMA	RC3 / SO55	25.00	Left	Tilt	1:1	0.073	36.37	
1880.00	600	PCS CDMA	EVDO Rev. A	25.00	Right	Cheek	1:1	0.113	34.47	
1880.00	600	PCS CDMA	EVDO Rev. A	25.00	Right	Tilt	1:1	0.078	36.08	
1880.00	600	PCS CDMA	EVDO Rev. A	25.00	Left	Cheek	1:1	0.138	33.60	
1880.00	600	PCS CDMA	EVDO Rev. A	25.00	Left	Tilt	1:1	0.075	36.25	

Table A-2
DSI = 2 P_{Limit} Calculations – LTE B12/13/26/5 Head SAR

MEASUREMENT RESULTS

FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
707.50	23095	Mid	LTE Band 12	10	25.80	0	Right	Cheek	QPSK	1	25	1:1	0.129	34.69	34.69
707.50	23095	Mid	LTE Band 12	10	24.80	1	Right	Cheek	QPSK	25	0	1:1	0.096	34.98	
707.50	23095	Mid	LTE Band 12	10	25.80	0	Right	Tilt	QPSK	1	25	1:1	0.061	37.95	
707.50	23095	Mid	LTE Band 12	10	24.80	1	Right	Tilt	QPSK	25	0	1:1	0.050	37.81	
707.50	23095	Mid	LTE Band 12	10	25.80	0	Left	Cheek	QPSK	1	25	1:1	0.104	35.63	
707.50	23095	Mid	LTE Band 12	10	24.80	1	Left	Cheek	QPSK	25	0	1:1	0.073	36.17	
707.50	23095	Mid	LTE Band 12	10	25.80	0	Left	Tilt	QPSK	1	25	1:1	0.058	38.17	
707.50	23095	Mid	LTE Band 12	10	24.80	1	Left	Tilt	QPSK	25	0	1:1	0.036	39.24	
782.00	23230	Mid	LTE Band 13	10	25.80	0	Right	Cheek	QPSK	1	25	1:1	0.145	34.19	33.53
782.00	23230	Mid	LTE Band 13	10	24.80	1	Right	Cheek	QPSK	25	0	1:1	0.134	33.53	
782.00	23230	Mid	LTE Band 13	10	25.80	0	Right	Tilt	QPSK	1	25	1:1	0.086	36.46	
782.00	23230	Mid	LTE Band 13	10	24.80	1	Right	Tilt	QPSK	25	0	1:1	0.067	36.54	
782.00	23230	Mid	LTE Band 13	10	25.80	0	Left	Cheek	QPSK	1	25	1:1	0.114	35.23	
782.00	23230	Mid	LTE Band 13	10	24.80	1	Left	Cheek	QPSK	25	0	1:1	0.093	35.12	
782.00	23230	Mid	LTE Band 13	10	25.80	0	Left	Tilt	QPSK	1	25	1:1	0.077	36.94	
782.00	23230	Mid	LTE Band 13	10	24.80	1	Left	Tilt	QPSK	25	0	1:1	0.062	36.88	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	Right	Cheek	QPSK	1	0	1:1	0.120	35.01	34.31
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	Right	Cheek	QPSK	36	18	1:1	0.112	34.31	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	Right	Tilt	QPSK	1	0	1:1	0.069	37.41	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	Right	Tilt	QPSK	36	18	1:1	0.061	36.95	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	Left	Cheek	QPSK	1	0	1:1	0.092	36.16	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	Left	Cheek	QPSK	36	18	1:1	0.089	35.31	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	Left	Tilt	QPSK	1	0	1:1	0.065	37.67	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	Left	Tilt	QPSK	36	18	1:1	0.056	37.32	
836.50	20525	Mid	LTE Band 5 (Cell) - 2CC Uplink	10	25.80	0	Right	Cheek	QPSK	1	0	1:1	0.260	31.65	31.65
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	Right	Cheek	QPSK	25	25	1:1	0.204	31.70	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	Right	Tilt	QPSK	1	0	1:1	0.123	34.90	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	Right	Tilt	QPSK	25	25	1:1	0.092	35.16	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	Left	Cheek	QPSK	1	0	1:1	0.226	32.26	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	Left	Cheek	QPSK	25	25	1:1	0.156	32.87	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	Left	Tilt	QPSK	1	0	1:1	0.132	34.59	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	Left	Tilt	QPSK	25	25	1:1	0.087	35.40	

Table A-3
DSI = 2 P_{Limit} Calculations – LTE B66/2/7/48/41 Head SAR

MEASUREMENT RESULTS															
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Side	Test Position	Modulation	RB Size	RB Offset	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	Right	Cheek	QPSK	1	0	1:1	0.088	35.56	33.15
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	Right	Cheek	QPSK	50	25	1:1	0.071	35.49	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	Right	Tilt	QPSK	1	0	1:1	0.091	35.41	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	Right	Tilt	QPSK	50	25	1:1	0.087	34.60	
1775.00	132622	High	LTE Band 66 (AWS)	10	25.00	0	Left	Cheek	QPSK	1	0	1:1	0.153	33.15	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	Left	Cheek	QPSK	50	25	1:1	0.102	33.91	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	Left	Tilt	QPSK	1	0	1:1	0.091	35.41	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	Left	Tilt	QPSK	50	25	1:1	0.073	35.37	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	Right	Cheek	QPSK	1	99	1:1	0.078	36.08	33.86
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	Right	Cheek	QPSK	50	50	1:1	0.057	36.44	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	Right	Tilt	QPSK	1	99	1:1	0.083	35.81	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	Right	Tilt	QPSK	50	50	1:1	0.062	36.08	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	Left	Cheek	QPSK	1	99	1:1	0.130	33.86	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	Left	Cheek	QPSK	50	50	1:1	0.100	34.00	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	Left	Tilt	QPSK	1	99	1:1	0.054	37.68	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	Left	Tilt	QPSK	50	50	1:1	0.044	37.57	
2560.00	21350	High	LTE Band 7	20	24.00	0	Right	Cheek	QPSK	1	50	1:1	0.085	34.71	33.76
2560.00	21350	High	LTE Band 7	20	23.00	1	Right	Cheek	QPSK	50	25	1:1	0.069	34.61	
2560.00	21350	High	LTE Band 7	20	24.00	0	Right	Tilt	QPSK	1	50	1:1	0.088	34.56	
2560.00	21350	High	LTE Band 7	20	23.00	1	Right	Tilt	QPSK	50	25	1:1	0.063	35.01	
2560.00	21350	High	LTE Band 7	20	24.00	0	Left	Cheek	QPSK	1	50	1:1	0.105	33.79	
2560.00	21350	High	LTE Band 7	20	23.00	1	Left	Cheek	QPSK	50	25	1:1	0.084	33.76	
2560.00	21350	High	LTE Band 7	20	24.00	0	Left	Tilt	QPSK	1	50	1:1	0.059	36.29	
2560.00	21350	High	LTE Band 7	20	23.00	1	Left	Tilt	QPSK	50	25	1:1	0.050	36.01	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	Right	Cheek	QPSK	1	0	1:1.58	0.015	39.25	37.21
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	Right	Cheek	QPSK	50	25	1:1.58	0.011	39.60	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	Right	Tilt	QPSK	1	0	1:1.58	0.024	37.21	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	Right	Tilt	QPSK	50	25	1:1.58	0.008	40.98	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	Left	Cheek	QPSK	1	0	1:1.58	0.014	39.55	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	Left	Cheek	QPSK	50	25	1:1.58	0.014	38.55	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	Left	Tilt	QPSK	1	0	1:1.58	0.006	43.23	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	Left	Tilt	QPSK	50	25	1:1.58	0.006	42.23	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	Right	Cheek	QPSK	1	50	1:1.58	0.082	33.38	33.19
2593.00	40620	Mid	LTE Band 41	20	23.50	1	Right	Cheek	QPSK	50	25	1:1.58	0.056	34.03	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	Right	Tilt	QPSK	1	50	1:1.58	0.072	33.94	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	Right	Tilt	QPSK	50	25	1:1.58	0.055	34.11	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	Left	Cheek	QPSK	1	50	1:1.58	0.078	33.59	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	Left	Cheek	QPSK	50	25	1:1.58	0.068	33.19	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	Left	Tilt	QPSK	1	50	1:1.58	0.051	35.44	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	Left	Tilt	QPSK	50	25	1:1.58	0.041	35.39	

Table A-4
DSI = 0 P_{Limit} Calculations – 2G/3G Body-Worn SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode/Band	Service	Conducted Power [dBm]	Spacing	Side	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.							(W/kg)	[dBm]	[dBm]
836.60	190	GSM 850	GSM	33.50	15 mm	Back	1:8.3	0.189	31.53	31.53
1880.00	661	GSM 1900	GSM	30.00	15 mm	Back	1:8.3	0.323	25.70	25.70
836.60	4183	UMTS 850	RMC	25.50	15 mm	Back	1:1	0.320	30.45	30.45
1852.40	9262	UMTS 1900	RMC	25.00	15 mm	Back	1:1	1.067	24.72	24.72
836.52	384	Cell. CDMA	TDSO / SO32	26.30	15 mm	Back	1:1	0.244	32.43	32.43
1851.25	25	PCS CDMA	TDSO / SO32	25.00	15 mm	Back	1:1	0.894	25.49	25.49

Table A-5
DSI = 0 P_{Limit} Calculations – 4G Body-Worn SAR

MEASUREMENT RESULTS																
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	15 mm	Back	1:1	0.187	33.08	32.90
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	15 mm	Back	1:1	0.155	32.90	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	15 mm	Back	1:1	0.224	32.30	32.30
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	15 mm	Back	1:1	0.172	32.44	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	15 mm	Back	1:1	0.213	32.52	31.90
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	15 mm	Back	1:1	0.195	31.90	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	QPSK	1	0	15 mm	Back	1:1	0.186	33.10	32.60
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	15 mm	Back	1:1	0.166	32.60	
1775.00	132622	High	LTE Band 66 (AWS) - CA_66C - 2CC Uplink	10	25.00	0	QPSK	1	0	15 mm	Back	1:1	1.025	24.89	24.57
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	15 mm	Back	1:1	0.876	24.57	
1900.00	19100	High	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	0	15 mm	Back	1:1	0.762	26.18	26.18
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	15 mm	Back	1:1	0.564	26.49	
2560.00	21350	High	LTE Band 7	20	24.00	0	QPSK	1	50	15 mm	Back	1:1	0.292	29.35	29.35
2560.00	21350	High	LTE Band 7	20	23.00	1	QPSK	50	25	15 mm	Back	1:1	0.221	29.56	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	QPSK	1	0	15 mm	Back	1:1.58	0.112	30.52	30.33
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	QPSK	50	25	15 mm	Back	1:1.58	0.093	30.33	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	QPSK	1	50	15 mm	Back	1:1.58	0.389	26.61	26.61
2593.00	40620	Mid	LTE Band 41	20	23.50	0	QPSK	50	25	15 mm	Back	1:1.58	0.304	26.69	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-6
DSI = 3 P_{Limit} Calculations – 2G/3G Hotspot SAR

MEASUREMENT RESULTS											
FREQUENCY		Mode/Band	Service	Conducted Power [dBm]	Spacing	Side	# of GPRS Slots	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.								(W/kg)	[dBm]	[dBm]
848.80	251	GSM 850	GPRS	30.50	10 mm	Back	3	1:2.76	0.745	27.37	27.37
836.60	190	GSM 850	GPRS	30.50	10 mm	Front	3	1:2.76	0.342	30.75	
836.60	190	GSM 850	GPRS	30.50	10 mm	Bottom	3	1:2.76	0.355	30.56	
836.60	190	GSM 850	GPRS	30.50	10 mm	Right	3	1:2.76	0.213	32.78	
836.60	190	GSM 850	GPRS	30.50	10 mm	Left	3	1:2.76	0.074	37.37	
1880.00	661	GSM 1900	GPRS	26.19	10 mm	Back	3	1:2.76	0.733	23.13	19.79
1880.00	661	GSM 1900	GPRS	26.19	10 mm	Front	3	1:2.76	0.531	24.53	
1880.00	661	GSM 1900	GPRS	26.19	10 mm	Bottom	3	1:2.76	1.580	19.79	
1880.00	661	GSM 1900	GPRS	26.19	10 mm	Right	3	1:2.76	0.107	31.49	
1880.00	661	GSM 1900	GPRS	26.19	10 mm	Left	3	1:2.76	0.125	30.81	
846.60	4233	UMTS 850	RMC	25.50	10 mm	Back	N/A	1:1	0.676	27.20	27.20
836.60	4183	UMTS 850	RMC	25.50	10 mm	Front	N/A	1:1	0.379	29.71	
836.60	4183	UMTS 850	RMC	25.50	10 mm	Bottom	N/A	1:1	0.363	29.90	
836.60	4183	UMTS 850	RMC	25.50	10 mm	Right	N/A	1:1	0.228	31.92	
836.60	4183	UMTS 850	RMC	25.50	10 mm	Left	N/A	1:1	0.079	36.52	
1880.00	9400	UMTS 1900	RMC	23.56	10 mm	Back	N/A	1:1	1.500	21.80	18.26
1880.00	9400	UMTS 1900	RMC	23.56	10 mm	Front	N/A	1:1	0.864	24.19	
1852.40	9262	UMTS 1900	RMC	23.56	10 mm	Bottom	N/A	1:1	3.390	18.26	
1880.00	9400	UMTS 1900	RMC	23.56	10 mm	Right	N/A	1:1	0.162	31.46	
1880.00	9400	UMTS 1900	RMC	23.56	10 mm	Left	N/A	1:1	0.193	30.70	
848.31	777	Cell. CDMA	EVDO Rev. 0	26.30	10 mm	Back	N/A	1:1	0.740	27.61	27.61
836.52	384	Cell. CDMA	EVDO Rev. 0	26.30	10 mm	Front	N/A	1:1	0.291	31.66	
836.52	384	Cell. CDMA	EVDO Rev. 0	26.30	10 mm	Bottom	N/A	1:1	0.360	30.74	
836.52	384	Cell. CDMA	EVDO Rev. 0	26.30	10 mm	Right	N/A	1:1	0.160	34.26	
836.52	384	Cell. CDMA	EVDO Rev. 0	26.30	10 mm	Left	N/A	1:1	0.066	38.10	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	10 mm	Back	N/A	1:1	1.220	21.84	18.35
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	10 mm	Front	N/A	1:1	0.915	23.09	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	10 mm	Bottom	N/A	1:1	2.720	18.35	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	10 mm	Right	N/A	1:1	0.150	30.94	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	10 mm	Left	N/A	1:1	0.207	29.54	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-7
DSI = 3 P_{Limit} Calculations – LTE B12/13/26/5 Hotspot SAR

MEASUREMENT RESULTS																
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	10 mm	Back	1:1	0.333	30.58	30.58
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	10 mm	Back	1:1	0.253	30.77	
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	10 mm	Front	1:1	0.199	32.81	
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	10 mm	Front	1:1	0.152	32.98	
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	10 mm	Bottom	1:1	0.194	32.92	
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	10 mm	Bottom	1:1	0.143	33.25	
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	10 mm	Right	1:1	0.188	33.06	
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	10 mm	Right	1:1	0.160	32.76	
707.50	23095	Mid	LTE Band 12	10	25.80	0	QPSK	1	25	10 mm	Left	1:1	0.116	35.16	
707.50	23095	Mid	LTE Band 12	10	24.80	1	QPSK	25	0	10 mm	Left	1:1	0.099	34.84	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	10 mm	Back	1:1	0.556	28.35	28.35
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	10 mm	Back	1:1	0.430	28.47	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	10 mm	Front	1:1	0.323	30.71	
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	10 mm	Front	1:1	0.257	30.70	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	10 mm	Bottom	1:1	0.312	30.86	
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	10 mm	Bottom	1:1	0.254	30.75	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	10 mm	Right	1:1	0.170	33.50	
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	10 mm	Right	1:1	0.145	33.19	
782.00	23230	Mid	LTE Band 13	10	25.80	0	QPSK	1	25	10 mm	Left	1:1	0.089	36.31	
782.00	23230	Mid	LTE Band 13	10	24.80	1	QPSK	25	0	10 mm	Left	1:1	0.068	36.47	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	10 mm	Back	1:1	0.622	27.86	27.77
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	10 mm	Back	1:1	0.505	27.77	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	10 mm	Front	1:1	0.235	32.09	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	10 mm	Front	1:1	0.220	31.38	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	10 mm	Bottom	1:1	0.211	32.56	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	10 mm	Bottom	1:1	0.182	32.20	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	10 mm	Right	1:1	0.114	35.23	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	10 mm	Right	1:1	0.095	35.02	
831.50	26865	Mid	LTE Band 26 (Cell)	15	25.80	0	QPSK	1	0	10 mm	Left	1:1	0.052	38.64	
831.50	26865	Mid	LTE Band 26 (Cell)	15	24.80	1	QPSK	36	18	10 mm	Left	1:1	0.041	38.67	
836.50	20525	Mid	LTE Band 5 (Cell) - 2CC Uplink	10	25.80	0	QPSK	1	0	10 mm	Back	1:1	0.668	27.55	27.32
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	10 mm	Back	1:1	0.560	27.32	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	QPSK	1	0	10 mm	Front	1:1	0.384	29.96	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	10 mm	Front	1:1	0.351	29.35	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	QPSK	1	0	10 mm	Bottom	1:1	0.331	30.60	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	10 mm	Bottom	1:1	0.295	30.10	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	QPSK	1	0	10 mm	Right	1:1	0.132	34.59	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	10 mm	Right	1:1	0.128	33.73	
836.50	20525	Mid	LTE Band 5 (Cell)	10	25.80	0	QPSK	1	0	10 mm	Left	1:1	0.067	37.54	
836.50	20525	Mid	LTE Band 5 (Cell)	10	24.80	1	QPSK	25	25	10 mm	Left	1:1	0.052	37.64	

Table A-8
DSI = 3 P_{Limit} Calculations – LTE B66/2/7/48/41 Hotspot SAR

MEASUREMENT RESULTS															
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (1g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	10 mm	Back	1:1	1.610	21.99	19.78
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	10 mm	Front	1:1	1.200	23.27	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	10 mm	Bottom	1:1	2.680	19.78	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	10 mm	Right	1:1	0.221	30.62	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	10 mm	Left	1:1	0.272	29.71	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	10 mm	Back	1:1	1.420	22.41	18.72
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	10 mm	Front	1:1	1.100	23.52	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	10 mm	Bottom	1:1	3.320	18.72	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	10 mm	Right	1:1	0.165	31.76	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	10 mm	Left	1:1	0.284	29.40	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	10 mm	Back	1:1	0.685	24.80	22.05
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	10 mm	Front	1:1	0.596	25.41	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	10 mm	Bottom	1:1	1.290	22.05	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	10 mm	Right	1:1	0.156	31.23	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	10 mm	Left	1:1	0.138	31.76	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	QPSK	1	0	10 mm	back	1:1.58	0.234	27.32	23.10
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	QPSK	50	25	10 mm	back	1:1.58	0.208	26.83	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	QPSK	1	0	10 mm	front	1:1.58	0.184	28.37	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	QPSK	50	25	10 mm	front	1:1.58	0.172	27.66	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	QPSK	1	0	10 mm	bottom	1:1.58	0.557	23.56	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	QPSK	50	25	10 mm	bottom	1:1.58	0.491	23.10	
3603.30	55773	Low-Mid	LTE Band 48	20	23.00	0	QPSK	1	0	10 mm	left	1:1.58	0.105	30.80	
3646.70	56207	Mid-High	LTE Band 48	20	22.00	1	QPSK	50	25	10 mm	left	1:1.58	0.082	30.88	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	10 mm	Back	1:1.58	0.582	25.66	23.10
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	10 mm	Front	1:1.58	0.460	26.69	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	10 mm	Bottom	1:1.58	1.050	23.10	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	10 mm	Right	1:1.58	0.103	33.19	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	10 mm	Left	1:1.58	0.225	29.79	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-9
DSI = 0 P_{Limit} Calculations – 2G/3G Phablet SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode/Band	Service	Conducted Power [dBm]	Spacing	Side	Duty Cycle	SAR (10g)	PLimit	Minimum PLimit
MHz	Ch.							(W/kg)	[dBm]	[dBm]
1880.00	9400	UMTS 1900	RMC	25.00	8 mm	Back	1:1	1.256	27.99	25.26
1880.00	9400	UMTS 1900	RMC	25.00	6 mm	Front	1:1	1.543	27.10	
1907.60	9538	UMTS 1900	RMC	25.00	11 mm	Bottom	1:1	2.355	25.26	
1880.00	9400	UMTS 1900	RMC	25.00	0 mm	Right	1:1	0.443	32.52	
1880.00	9400	UMTS 1900	RMC	25.00	0 mm	Left	1:1	0.866	29.60	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.00	8 mm	Back	1:1	1.219	28.12	26.38
1880.00	600	PCS CDMA	EVDO Rev. 0	25.00	6 mm	Front	1:1	1.142	28.40	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.00	11 mm	Bottom	1:1	1.820	26.38	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.00	0 mm	Right	1:1	0.395	33.01	
1880.00	600	PCS CDMA	EVDO Rev. 0	25.00	0 mm	Left	1:1	0.739	30.29	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-10
DSI = 1 P_{Limit} Calculations – 2G/3G Phablet SAR

MEASUREMENT RESULTS										
FREQUENCY		Mode/Band	Service	Conducted Power [dBm]	Spacing	Side	Duty Cycle	SAR (10g)	PLimit	Minimum PLimit
MHz	Ch.							(W/kg)	[dBm]	[dBm]
1880.00	9400	UMTS 1900	RMC	23.56	0 mm	Back	1:1	4.500	21.01	20.27
1880.00	9400	UMTS 1900	RMC	23.56	0 mm	Front	1:1	3.760	21.79	
1880.00	9400	UMTS 1900	RMC	23.56	0 mm	Bottom	1:1	5.330	20.27	
1880.00	9400	UMTS 1900	RMC	23.56	0 mm	Right	1:1	0.333	32.31	
1880.00	9400	UMTS 1900	RMC	23.56	0 mm	Left	1:1	0.651	29.40	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	0 mm	Back	1:1	4.010	20.65	19.82
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	0 mm	Front	1:1	3.040	21.85	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	0 mm	Bottom	1:1	4.850	19.82	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	0 mm	Right	1:1	0.278	32.24	
1880.00	600	PCS CDMA	EVDO Rev. 0	22.70	0 mm	Left	1:1	0.520	29.52	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-11
DSI = 0 P_{Limit} Calculations – 4G Phablet SAR

MEASUREMENT RESULTS															
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (10g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	QPSK	1	0	8 mm	back	1:1	1.378	27.59	27.05
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	8 mm	back	1:1	1.019	27.90	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	QPSK	1	0	6 mm	front	1:1	1.343	27.70	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	6 mm	front	1:1	1.240	27.05	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	QPSK	1	0	11 mm	bottom	1:1	1.496	27.23	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	11 mm	bottom	1:1	1.171	27.29	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	QPSK	1	0	0 mm	right	1:1	0.335	33.73	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	0 mm	right	1:1	0.272	33.63	
1770.00	132572	High	LTE Band 66 (AWS)	20	25.00	0	QPSK	1	0	0 mm	left	1:1	0.497	32.02	
1770.00	132572	High	LTE Band 66 (AWS)	20	24.00	1	QPSK	50	25	0 mm	left	1:1	0.409	31.86	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	99	8 mm	back	1:1	1.210	28.15	26.42
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	8 mm	back	1:1	0.857	28.65	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	99	6 mm	front	1:1	1.303	27.83	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	6 mm	front	1:1	0.989	28.03	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	0	11 mm	bottom	1:1	1.803	26.42	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	11 mm	bottom	1:1	1.349	26.68	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	99	0 mm	right	1:1	0.392	33.05	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	0 mm	right	1:1	0.319	32.94	
1860.00	18700	Low	LTE Band 2 (PCS)	20	25.00	0	QPSK	1	99	0 mm	left	1:1	0.783	30.04	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	24.00	1	QPSK	50	50	0 mm	left	1:1	0.597	30.22	
2560.00	21350	High	LTE Band 7	20	24.00	0	QPSK	1	50	8 mm	back	1:1	0.563	30.47	27.38
2560.00	21350	High	LTE Band 7	20	23.00	1	QPSK	50	25	8 mm	back	1:1	0.427	30.68	
2560.00	21350	High	LTE Band 7	20	24.00	0	QPSK	1	50	6 mm	front	1:1	0.520	30.82	
2560.00	21350	High	LTE Band 7	20	23.00	1	QPSK	50	25	6 mm	front	1:1	0.392	31.05	
2560.00	21350	High	LTE Band 7	20	24.00	0	QPSK	1	50	11 mm	bottom	1:1	0.540	30.66	
2560.00	21350	High	LTE Band 7	20	23.00	1	QPSK	50	25	11 mm	bottom	1:1	0.236	33.25	
2560.00	21350	High	LTE Band 7	20	24.00	0	QPSK	1	50	0 mm	left	1:1	1.149	27.38	
2560.00	21350	High	LTE Band 7	20	23.00	1	QPSK	50	25	0 mm	left	1:1	0.870	27.58	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	QPSK	1	50	8 mm	back	1:1.58	0.454	29.92	28.34
2593.00	40620	Mid	LTE Band 41	20	23.50	1	QPSK	50	25	8 mm	back	1:1.58	0.351	30.04	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	QPSK	1	50	6 mm	front	1:1.58	0.401	30.46	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	QPSK	50	25	6 mm	front	1:1.58	0.315	30.51	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	QPSK	1	50	11 mm	bottom	1:1.58	0.569	28.94	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	QPSK	50	25	11 mm	bottom	1:1.58	0.449	28.97	
2593.00	40620	Mid	LTE Band 41	20	24.50	0	QPSK	1	50	0 mm	left	1:1.58	0.653	28.34	
2593.00	40620	Mid	LTE Band 41	20	23.50	1	QPSK	50	25	0 mm	left	1:1.58	0.514	28.38	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.

Table A-12
DSI = 1 P_{Limit} Calculations – 4G Phablet SAR

MEASUREMENT RESULTS															
FREQUENCY			Mode	Bandwidth [MHz]	Conducted Power [dBm]	MPR [dB]	Modulation	RB Size	RB Offset	Spacing	Side	Duty Cycle	SAR (10g)	PLimit	Minimum PLimit
MHz	Ch.												(W/kg)	[dBm]	[dBm]
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	0 mm	Back	1:1	4.500	21.51	20.64
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	0 mm	Front	1:1	4.140	21.87	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	0 mm	Bottom	1:1	5.490	20.64	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	0 mm	Right	1:1	0.346	32.65	
1745.00	132322	Mid	LTE Band 66 (AWS)	20	24.06	0	QPSK	1	0	0 mm	Left	1:1	0.517	30.90	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	0 mm	Back	1:1	4.470	21.41	20.19
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	0 mm	Front	1:1	3.480	22.49	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	0 mm	Bottom	1:1	5.920	20.19	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	0 mm	Right	1:1	0.339	32.61	
1880.00	18900	Mid	LTE Band 2 (PCS)	20	23.93	0	QPSK	1	0	0 mm	Left	1:1	0.730	29.28	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	0 mm	Back	1:1	3.670	21.49	21.49
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	0 mm	Front	1:1	2.520	23.13	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	0 mm	Bottom	1:1	3.640	21.53	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	0 mm	Right	1:1	0.390	31.23	
2535.00	21100	Mid	LTE Band 7	20	23.16	0	QPSK	1	0	0 mm	Left	1:1	1.000	27.14	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	0 mm	Back	1:1.58	2.540	23.25	22.39
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	0 mm	Front	1:1.58	2.330	23.62	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	0 mm	Bottom	1:1.58	3.090	22.39	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	0 mm	Right	1:1.58	0.283	32.78	
2593.00	40620	Mid	LTE Band 41	20	25.30	0	QPSK	1	0	0 mm	Left	1:1.58	0.873	27.88	

For some bands/modes, a lower P_{Limit} was selected as a more conservative evaluation.