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PART 0 SAR CHAR REPORT

Applicant Name:

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Date of Issue: Dec. 06, 2021

Test Report No.: HCT-SR-2111-FC011-R1

Test Site: HCT CO., LTD.

FCC ID:

A3LSMX706B

Report Type:

Part 0 SAR Characterization

Equipment Type:

Mobile Phone

Model Name:

SM-X706B

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.

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REVISION HISTORY

The revision history for this test report is shown in table.

Revision No.	Date of Issue	Description
0	Dec. 01, 2021	Initial Release
1	Dec. 06, 2021	Revised Sec.4 and Appendix A

This test results were applied only to the test methods required by the standard.

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1. Test Location

1.1 Test Laboratory

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1.2 Test Facilities

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

Korea	National Radio Research Agency (Designation No. KR0032)
	KOLAS (Testing No. KT197)

2. DEVICE UNDER TEST

2.1 General Information of the EUT

Device Wireless specification overview		
Band & Mode	Operating Mode	Tx Frequency
GSM850	Data	824.2 MHz~ 848.8 MHz
GSM1900	Data	1 850.2 MHz~ 1 909.8 MHz
UMTS 850	Data	826.4 MHz ~ 846.6 MHz
UMTS 1700	Data	1 712.4 MHz ~ 1 752.6 MHz
UMTS 1900	Data	1 852.4 MHz ~ 1 907.6 MHz
LTE Band 2	Data	1 850.7 MHz ~ 1 909.3 MHz
LTE Band 4	Data	1 710.7 MHz ~ 1 754.3 MHz
LTE Band 5 (Cell)	Data	824.7 MHz ~ 848.3 MHz
LTE Band 12	Data	699.7 MHz ~ 715.3 MHz
LTE Band 13	Data	779.5 MHz ~ 784.5 MHz
LTE Band 17	Data	706.5 MHz ~ 713.5 MHz
LTE Band 25	Data	1 850.7 MHz ~ 1 914.3 MHz
LTE Band 26	Data	814.7 MHz ~ 848.3 MHz
LTE TDD Band 41	Data	2 498.5 MHz ~ 2 687.5 MHz
LTE Band 66 (AWS)	Data	1 710.7 MHz ~ 1 779.3 MHz
NR Band 5	Data	826.5 MHz ~ 846.5 MHz
NR Band 66	Data	1 712.5 MHz ~ 1 777.5 MHz
WLAN 2.4 GHz	Data	2 412 MHz ~ 2 462 MHz
U-NII-1	Data	5 180 MHz ~ 5 240 MHz
U-NII-2A	Data	5 260 MHz ~ 5 320 MHz
U-NII-2C	Data	5 500 MHz ~ 5 720 MHz
U-NII-3	Data	5 745 MHz ~ 5 825 MHz
U-NII-4	Data	5 845 MHz ~ 5 885 MHz
U-NII-5	Data	5 935 MHz ~ 6 415 MHz
U-NII-6	Data	6 435 MHz ~ 6 525 MHz
U-NII-7	Data	6 535 MHz ~ 6 875 MHz
U-NII-8	Data	6 895 MHz ~ 7 115 MHz
Bluetooth	Data	2 402 MHz ~ 2 480 MHz
S-PEN	Data	530 kHz

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 technologies, but the output power of these technologies is not controlled by the Smart Transmit algorithm.

2.2 Time-Averaging for SAR

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 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 Sub-6 NR respectively. Characterization is achieved by determining *Plimit* for 2G/3G/4G and 5G Sub-6 NR 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.

The SAR characterization is denoted as SAR Char in this report. Section 2.3 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 RF Exposure report

Technology	Term	Description
2G/3G/4G/5G Sub 6 NR	<i>Plimit</i>	Power level that corresponds to the exposure design target (<i>SAR_design_target</i>) after accounting for all device design related uncertainties
	<i>Pmax</i>	Maximum tune up output power
	<i>SAR_design_target</i>	Target SAR level < FCC SAR limit after accounting for all device design related uncertainties.
	SAR Char	Table containing <i>Plimit</i> for all technologies and bands

3. SAR MEASUREMENTS

3.1 SAR Definition

Specific Absorption Rate (SAR) is defined as the time derivative of the incremental electromagnetic energy (dW) 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

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

SAR Mathematical Equation

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

$$SAR = \sigma E^2 / \rho$$

Where:

σ = conductivity of the tissue-simulant material (S/m)
 ρ = mass density of the tissue-simulant material (kg/m³)
 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 relations 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.

3.2 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 more than 5.0 mm from the inner surface of the shell. The area covered the entire dimension of the DUT's head and body area and the horizontal grid resolution was depending on the FCC KDB 865664 D01v01r04 (see table 3-1) & IEEE 1528-2013.
2. Based on step, the area of the maximum absorption was determined by sophisticated interpolations routines implemented in DASY software. When an Area Scan has measured all reachable point. DASY system computes the field maximal found in the scanned are, within a range of the maximum. SAR at this fixed point was measured and used as a reference value.
3. Around this point, a volume was assessed according to the measurement resolution and volume size requirements of FCC KDB 865664 D01v01r04 table 4-1 and IEEE 1528-2013. On the basis of this data set, the spatial peak SAR value was evaluated with the following procedure (reference from the DASY manual.)
 - a. The data at the surface were extrapolated, since the center of the dipoles is no more than 2.7 mm away from the tip of the probe (it is different from the probe type) and the distance between the surface and the lowest measuring point is 1.2 mm. The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axes. This polynomial was then used to evaluate the points between the surface and the probe tip.
 - b. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1 g or 10 g) were computed using the 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 integrated with the trapezoidal algorithm. One thousand points (10 x 10 x 10) were interpolated to calculate the average.
 - c. All neighboring volumes were evaluated until no neighboring volume with a higher average value was found.
4. The SAR reference value, at the same location as step 2, was re-measured after the zoom scan. If the value changed by more than 5 %, the SAR evaluation and drift measurements were repeated.

Table 3-1

Frequency	Maximum Area Scan Resolution(mm) (Δxarea, Δyarea)	Maximum Zoom Scan Resolution (mm) (Δxzoom, Δyzoom)	Maximum Zoom Scan Spatial Resolution (mm)			Minimum Zoom Scan Volume (mm) (x,y,z)
			Uniform Grid	Graded Grid		
			Δzzoom(n)	Δzzoom(1)*	Δzzoom(n>1)*	
≤2 GHz	≤15	≤8	≤5	≤4	≤1.5*Δzzoom(n-1)	≥30
2-3 GHz	≤12	≤5	≤5	≤4	≤1.5*Δzzoom(n-1)	≥30
3-4 GHz	≤12	≤5	≤4	≤3	≤1.5*Δzzoom(n-1)	≥28
4-5 GHz	≤10	≤4	≤3	≤2.5	≤1.5*Δzzoom(n-1)	≥25
5-6 GHz	≤10	≤4	≤2	≤2	≤1.5*Δzzoom(n-1)	≥22

Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v01r04*

4. SAR CHARACTERIZATION

4.1 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 exposure comparison is needed, the worst-case was determined from SAR normalized to 1g SAR limit.

The device state index (DSI) conditions used in Table 4-1 represent different exposure scenarios.

Scenario	Description	SAR Test Cases
Max Power (DSI = 0)	▪ Grip sensor is not triggered Max Power Condition	<i>KDB Publication 616217 D04</i>
Grip on (DSI=1)	▪ Grip sensor is triggered Reduced Power condition	<i>KDB Publication 616217 D04</i>

Table 4-1 DSI and Corresponding Exposure Scenarios

4.2 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 4-2).

SAR_{design_target}	
$SAR_{design_target} < SAR_{regulatory_limit} \times 10^{-Total\ Uncertainty/10}$	
1g SAR (W/kg)	
<i>Total Uncertainty</i>	1.0 dB
<i>SAR_regulatory_limit</i>	1.6 W/kg
<i>SAR_design_target</i>	1.0 W/kg

Table 4-2 SAR_{design_target} Calculations

4.3 SAR Characterization

SAR test results corresponding to P_{max} for each antenna/technology/band/DSI can be found in Appendix A. P_{limit} is calculated by linearly scaling with the measured SAR at the P_{max} to correspond to the SAR_{design_target} . P_{limit} determination for each exposure scenario corresponding to SAR_{design_target} are shown in Table 4-3.

Table 4-3 P_{limit} Determination

Device State Index (DSI)	P_{limit} Determination Scenarios
0	The worst-case SAR exposure is determined as maximum SAR normalized to the limit among: - Body SAR measured at 15, 9, 14 and 22mm spacing for Rear, Right, Right Corner and Top surface respectively for Main 1 Ant - Body SAR measured at 9 and 17 mm spacing for Rear and Bottom surface respectively for Sub Ant 1 0mm for Left and Bottom surface for Main 1 Ant, Left, Right and Top surface for Sub 1 Ant.
1	P_{limit} is calculated based on 1g Body SAR at 0 mm for Rear, Right Right corner and Top surfaces for Main Ant 1 P_{limit} is calculated based on 1g Body SAR at 0 mm for Rear and Bottom surface respectively for Sub Ant 1

Note:

Main 1 Ant) For DSI=0, P_{limit} is calculated by :

$P_{limit} = \min\{ P_{limit} \text{ cooresponding to } 1g \text{ Body SAR evaluation at } 15 \text{ (Rear), } 9 \text{ (Right), } 14 \text{ (Right corner), } 22 \text{ (Top) spacing } P_{limit} \text{ cooresponding to } 1g \text{ Body SAR evaluation at } 0mm \text{ for Left surfaces} \}$

Sub 1 Ant) For DSI=0, P_{limit} is calculated by :

$P_{limit} = \min\{ P_{limit} \text{ cooresponding to } 1g \text{ Body SAR evaluation at } 9 \text{ (Rear), } 17 \text{ (Bottom) spacing, } P_{limit} \text{ cooresponding to } 1g \text{ Body SAR evaluation at } 0mm \text{ for Left and Right surfaces} \}$

Table 4-4 SAR Characterization

SAR Exposure Configurations			Plimit (all values are time averaged)		Pmax			Max reduction [dBm]
			Body SAR Grip Off	Body SAR Grip ON	Burst Average Power [dBm]	Frame Averaged Power [dBm]	UL:DL Ratio	
Test Configuration			Max Power	Reduced Power				
Averaging volume			1g	1g				
DSI			0	1				
Mode	Band	Antenna	Plimt		Pmax			
GSM/GPRS	850	Main 1	25.0	15.5	32.5	23.5	12.5%	9.5
					31.0	25.0	25.0%	
					29.0	24.7	37.5%	
					26.5	23.5	50%	
GSM/GPRS	1900	Main 1	22.5	12.5	29.5	20.5	12.5%	10.0
					28.5	22.5	25.0%	
					26.0	21.7	37.5%	
					24.0	21.0	50%	
UMTS	5	Main 1	24.0	15.5	24.0	FDD	100%	8.5
UMTS	4	Main 1	22.0	12.0	23.5	FDD	100%	11.5
UMTS	2	Main 1	22.0	12.0	22.0	FDD	100%	10.0
LTE FDD	2	Main 1	22.1	12.1	22.1	FDD	100%	10.0
LTE FDD	4	Main 1	22.7	12.7	22.7	FDD	100%	10.0
LTE FDD	5	Main 1	24.0	15.0	24.0	FDD	100%	9.0
LTE FDD	12	Main 1	24.0	16.0	24.0	FDD	100%	8.0
LTE FDD	13	Main 1	24.0	16.0	24.0	FDD	100%	8.0
LTE FDD	17	Main 1	24.0	16.0	24.0	FDD	100%	8.0
LTE FDD	25	Main 1	22.1	12.1	22.1	FDD	100%	10.0
LTE FDD	26	Main 1	24.0	15.0	24.0	FDD	100%	9.0
LTE FDD	66	Main 1	22.7	12.7	22.7	FDD	100%	10.0
LTE TDD PC3	41	Main 1	22.0	12.0	24.0	22.0	63.3%	10.0
LTE TDD PC2	41	Main 1	22.4	12.0	26.0	22.4	43.3%	10.4
LTE FDD With FR1 ENDC	2	Sub 1	22.3	12.6	22.3	FDD	100%	9.7
LTE FDD With FR1 ENDC	66	Sub 1	22.9	12.9	22.9	FDD	100%	10.0
NR FDD	5	Main 1	24.0	16.0	24.0	FDD	100%	8.0
NR FDD	66	Main 1	22.0	12.0	22.0	FDD	100%	10.0

Note:

1. When the Proximity sensor is triggered ,the *Plimit* for DSI=1 is set
2. When $P_{max} < Plimit$, the DUT will operate at a power level up to P_{max} .
3. When DSI=1, $Plimit((Tune-up)) < Plimit(cal)$, the DUT will operate at a power level to *Plimit as tune-up document*
4. Maximum Tune up Power, P_{max} . is configured in NV settings in EUT to limit maximum transmitting power

5. Equipment List

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
SPEAG	ELI4.0 flat phantom	-	N/A	N/A	N/A
SPEAG	SAM Phantom	-	N/A	N/A	N/A
HP	SAR System Control PC	-	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F11/ 5K3RA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F12/ 5K9GA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F17/ 59CHA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F17/ 59RAA1/ C/ 01	N/A	N/A	N/A
Staubli	CS8Cspeag-TX90	F13/ 5R4XF1/ C/ 01	N/A	N/A	N/A
Staubli	CS9spe-TX2-60	F21/0029002/C/001	N/A	N/A	N/A
Staubli	CS9spe-TX2-60	F21/0029145/C/001	N/A	N/A	N/A
Staubli	TX90 XLspeag	F11/ 5K3RA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F12/ 5K9GA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F17/ 59CHA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F17/ 59RAA1/ A/ 01	N/A	N/A	N/A
Staubli	TX90 XLspeag	F13/ 5R4XF1/ A/ 01	N/A	N/A	N/A
Staubli	TX2-60 Lspe	F21/0029002/A/001	N/A	N/A	N/A
Staubli	TX2-60 Lspe	F21/0029145/A/001	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1203 0309	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1206 0513	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	010963	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	011578	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	S-1338 1332	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	D21144507C	N/A	N/A	N/A
Staubli	Teach Pendant (Joystick)	2008	N/A	N/A	N/A
TESTO	175-H1/Thermometer	40331936309	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	40331939309	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	40331915309	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	40331922309	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	40332651310	01/26/2021	Annual	01/26/2022
TESTO	175-H1/Thermometer	83239085	11/15/2021	Annual	11/15/2022
SPEAG	DAE4	648	06/02/2021	Annual	06/02/2022
SPEAG	DAE4	446	09/30/2021	Annual	09/30/2022
SPEAG	DAE4	869	03/29/2021	Annual	03/29/2022
SPEAG	DAE4	1686	06/21/2021	Annual	06/21/2022
SPEAG	DAE4	466	04/23/2021	Annual	04/23/2022
SPEAG	DAE4	504	02/19/2021	Annual	02/19/2022
SPEAG	DAE4	868	09/27/2021	Annual	09/27/2022
SPEAG	E-Field Probe EX3DV4	7654	05/21/2021	Annual	05/21/2022
SPEAG	E-Field Probe EX3DV4	3797	11/25/2020	Annual	11/25/2021
SPEAG	E-Field Probe EX3DV4	3972	05/21/2021	Annual	05/21/2022
SPEAG	E-Field Probe ES3DV3	3076	07/28/2021	Annual	07/28/2022
SPEAG	E-Field Probe EX3DV4	7655	05/21/2021	Annual	05/21/2022
SPEAG	E-Field Probe EX3DV4	7309	04/20/2021	Annual	04/20/2022
SPEAG	E-Field Probe EX3DV4	3968	09/29/2021	Annual	09/29/2022
SPEAG	Dipole D750V3	1014	06/01/2021	Annual	06/01/2022
SPEAG	Dipole D835V2	4d165	08/03/2021	Annual	08/03/2022
SPEAG	Dipole D1800V2	2d015	07/30/2021	Annual	07/30/2022
SPEAG	Dipole D1900V2	5d032	01/28/2021	Annual	01/28/2022
SPEAG	Dipole D2450V2	965	06/15/2021	Annual	06/15/2022
SPEAG	Dipole D2600V2	1106	07/30/2021	Annual	07/30/2022
SPEAG	Dipole D6.5GHzV2	1012	09/24/2021	Annual	09/24/2022
SPEAG	Dipole D5GHzV2	1107	07/22/2021	Annual	07/22/2022
SPEAG	Dipole D5GHzV2	1317	08/28/2020	Biannual	08/28/2022

Manufacturer	Type / Model	S/N	Calib. Date	Calib.Interval	Calib.Due
Agilent	Power Meter E4419B	MY41291386	10/06/2021	Annual	10/06/2022
Agilent	Power Meter N1911A	MY45101406	07/08/2021	Annual	07/08/2022
Agilent	Power Sensor 8481A	SG1091286	10/06/2021	Annual	10/06/2022
Agilent	Power Sensor 8481A	MY41090675	10/06/2021	Annual	10/06/2022
Agilent	Power Sensor N1921A	MY55220026	08/05/2021	Annual	08/05/2022
SPEAG	DAKS 3.5	1038	03/17/2021	Annual	03/17/2022
ROHDE&SC HWAZ	Signal Generator SMB100A	177633	07/05/2021	Annual	07/05/2022
H.P	Network Analyzer /8753ES	JP39240221	01/11/2021	Annual	01/11/2022
Agilent	WIRELESS COMMUNICATION E5515C	GB44051865	05/28/2021	Annual	05/28/2022
Agilent	WIRELESS COMMUNICATION E5515C	MY48360252	07/23/2021	Annual	07/23/2022
R&S	Wireless Communication Test Set CMW500	115733	04/15/2021	Annual	04/15/2022
Agilent	Signal Generator N5182A	MY47070230	01/26/2021	Annual	01/26/2022
Agilent	11636B/Power Divider	58698	02/26/2021	Annual	02/26/2022
OSI	Power Divider	#1	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#2	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#3	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#4	06/24/2021	Annual	06/24/2022
OSI	Power Divider	#5	06/24/2021	Annual	06/24/2022
EMPOWER	RF Power Amplifier	1084	06/25/2021	Annual	06/25/2022
EMPOWER	RF Power Amplifier	1041D/C0508	06/24/2021	Annual	06/24/2022
MICRO LAB	LP Filter / LA-15N	10453	10/06/2021	Annual	10/06/2022
MICRO LAB	LP Filter / LA-30N	-	10/06/2021	Annual	10/06/2022
MICRO LAB	LP Filter / LA-60N	32011	10/06/2021	Annual	10/06/2022
HP	Attenuator (3dB) 333340A	02427	09/06/2021	Annual	09/06/2022
HP	Attenuator (20dB) 8493C	09271	09/06/2021	Annual	09/17/2022
Agilent	Directional Bridge 86205A	3140A03878	05/28/2021	Annual	05/28/2022
Agilent	MXA Signal Analyzer N9020A	MY50510407	10/23/2020	Annual	10/23/2021
Agilent	MXA Signal Analyzer N9020A	MY50510407	10/22/2021	Annual	10/22/2022
HP	Dual Directional Coupler	16072	10/05/2021	Annual	10/05/2022
Anritsu	Radio Communication Tester MT8820C	6201074225	02/26/2021	Annual	02/26/2022
Anritsu	Radio Communication Tester MT8820C	6200695605	04/15/2021	Annual	04/15/2022
Anritsu	Radio Communication Tester MT8821C	6201502997	07/08/2021	Annual	07/08/2022
Anritsu	Radio Communication Tester MT8821C	6262044720	12/22/2020	Annual	12/22/2021
Anritsu	Radio Communication Test Station MT8000A	6262036812	12/22/2020	Annual	12/22/2021
ROHDE&SCH WARZ	BLUETOOTH TESTER CBT	100272	02/26/2021	Annual	02/26/2022

* The E-field probe was calibrated by SPEAG, by the waveguide technique procedure. Dipole Verification measurement is performed by HCT Lab. before each test. The brain/body simulating material is calibrated by HCT using the DAKS 3.5 to determine the conductivity and permittivity (dielectric constant) of the brain/body-equivalent material.

6. Measurement Uncertainty

The measured SAR was <1.5 W/Kg for 1g SAR and <3.75 W/Kg For 10g SAR for all frequency bands. Therefore, per KDB Publication 865664 D01v01r04, the extended measurement uncertainty analysis per IEEE1528-2013 was not required.

Appendix A: SAR Test Results For P limit CALCULATIONS

Table A-10 DSI = 0 PLimit Calculations - - 2G/3G Body SAR

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

MEASUREMENT RESULTS (Main 1 Ant)										
Frequency		Mode		Conducted Power	Test Position	Distance	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(dBm)		(mm)		(W/kg)	(dBm)	(dBm)
836.6	190	GSM 850	GRPS 2Tx	25.13	Rear	15	1:4.15	0.608	27.3	27.3
836.6	190	GSM 850	GRPS 2Tx	25.13	Top	22	1:4.15	0.494	28.2	
836.6	190	GSM 850	GRPS 2Tx	25.13	Right	9	1:4.15	0.089	35.6	
836.6	190	GSM 850	GRPS 2Tx	25.13	Left	0	1:4.15	0.136	33.8	
836.6	190	GSM 850	GRPS 2Tx	25.13	Right Corner	14	1:4.15	0.067	36.9	
1 880	661	GSM 1900	GPRS 2Tx	22.82	Rear	15	1:4.15	0.369	27.1	25.3
1 880	661	GSM 1900	GPRS 2Tx	22.82	Top	22	1:4.15	0.570	25.3	
1 880	661	GSM 1900	GPRS 2Tx	22.82	Right	9	1:4.15	0.006	45.0	
1 880	661	GSM 1900	GPRS 2Tx	22.82	Left	0	1:4.15	0.165	30.6	
1 880	661	GSM 1900	GPRS 2Tx	22.82	Right Corner	14	1:4.15	0.042	36.6	
836.6	4183	UMTS 850	RMC	23.99	Rear	15	1:1	0.514	26.9	26.9
836.6	4183	UMTS 850	RMC	23.99	Top	22	1:1	0.483	27.2	
836.6	4183	UMTS 850	RMC	23.99	Right	9	1:1	0.146	32.3	
836.6	4183	UMTS 850	RMC	23.99	Left	0	1:1	0.121	33.2	
836.6	4183	UMTS 850	RMC	23.99	Right Corner	14	1:1	0.082	34.9	
1 732.4	1412	UMTS 1700	RMC	22.55	Rear	15	1:1	0.760	23.7	23.7
1 732.4	1412	UMTS 1700	RMC	22.55	Top	22	1:1	0.618	24.6	
1 732.4	1412	UMTS 1700	RMC	22.55	Right	9	1:1	0.006	44.8	
1 732.4	1412	UMTS 1700	RMC	22.55	Left	0	1:1	0.048	35.7	
1 732.4	1412	UMTS 1700	RMC	22.55	Right Corner	14	1:1	0.079	33.6	
1 880.0	9400	UMTS 1900	RMC	22.61	Rear	15	1:1	0.811	23.5	23.2
1 880.0	9400	UMTS 1900	RMC	22.61	Top	22	1:1	0.878	23.2	
1 880.0	9400	UMTS 1900	RMC	22.61	Right	9	1:1	0.045	36.1	
1 880.0	9400	UMTS 1900	RMC	22.61	Left	0	1:1	0.075	33.9	
1 880.0	9400	UMTS 1900	RMC	22.61	Right Corner	14	1:1	0.103	32.5	

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

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

MEASUREMENT RESULTS (Main 1 Ant)														
Frequency		Mode		Band width	Conducted Power	Test Position	Distance	MPR	RB	RB	Duty	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHz)	(dBm)		(mm)	(dBm)	Size	offset	Cycle	(W/kg)	(dBm)	(dBm)
836.5	20525	LTE Band 5	Mid	10	23.86	Rear	15	0	1	24	1:1	0.583	26.2	26.2
836.5	20525	LTE Band 5	Mid	10	23.86	Top	22	0	1	24	1:1	0.419	27.6	
836.5	20525	LTE Band 5	Mid	10	23.86	Right	9	0	1	24	1:1	0.096	34.0	
836.5	20525	LTE Band 5	Mid	10	23.86	Left	0	0	1	24	1:1	0.101	33.8	
836.5	20525	LTE Band 5	Mid	10	23.86	Right Corner	14	0	1	24	1:1	0.061	36.0	
707.5	23095	LTE Band 12	Mid	10	24.57	Rear	15	0	1	24	1:1	0.411	28.4	28.4
707.5	23095	LTE Band 12	Mid	10	24.57	Top	22	0	1	24	1:1	0.258	30.5	
707.5	23095	LTE Band 12	Mid	10	24.57	Right	9	0	1	24	1:1	0.147	32.9	
707.5	23095	LTE Band 12	Mid	10	24.57	Left	0	0	1	24	1:1	0.084	35.3	
707.5	23095	LTE Band 12	Mid	10	24.57	Right Corner	14	0	1	24	1:1	0.057	37.0	
782	23230	LTE Band 13	Mid	10	24.37	Rear	15	0	1	0	1:1	0.456	27.8	27.8
782	23230	LTE Band 13	Mid	10	24.37	Top	22	0	1	0	1:1	0.354	28.9	
782	23230	LTE Band 13	Mid	10	24.37	Right	9	0	1	0	1:1	0.152	32.6	
782	23230	LTE Band 13	Mid	10	24.37	Left	0	0	1	0	1:1	0.062	36.4	
782	23230	LTE Band 13	Mid	10	24.37	Right Corner	14	0	1	0	1:1	0.080	35.3	
1 860.0	26140	LTE Band 25	Low	20	22.49	Rear	15	0	1	49	1:1	0.614	24.6	24.2
1 860.0	26140	LTE Band 25	Low	20	22.49	Top	22	0	1	49	1:1	0.678	24.2	
1 860.0	26140	LTE Band 25	Low	20	22.49	Right	9	0	1	49	1:1	0.067	34.2	
1 860.0	26140	LTE Band 25	Low	20	22.49	Left	0	0	1	49	1:1	0.051	35.4	
1 860.0	26140	LTE Band 25	Low	20	22.49	Right Corner	14	0	1	49	1:1	0.067	34.2	
831.5	26865	LTE Band 26	Mid	15	23.56	Rear	15	0	1	74	1:1	0.365	27.9	27.9
831.5	26865	LTE Band 26	Mid	15	23.56	Top	22	0	1	74	1:1	0.227	30.0	
831.5	26865	LTE Band 26	Mid	15	23.56	Right	9	0	1	74	1:1	0.113	33.0	
831.5	26865	LTE Band 26	Mid	15	23.56	Left	0	0	1	74	1:1	0.051	36.5	
831.5	26865	LTE Band 26	Mid	15	23.56	Right Corner	14	0	1	74	1:1	0.063	35.6	
1 770	132572	LTE Band 66	High	20	22.87	Rear	15	0	1	99	1:1	0.907	23.3	23.3
1 770	132572	LTE Band 66	High	20	22.87	Top	22	0	1	99	1:1	0.766	24.0	
1 770	132572	LTE Band 66	High	20	22.87	Right	9	0	1	99	1:1	0.024	39.1	
1 770	132572	LTE Band 66	High	20	22.87	Left	0	0	1	99	1:1	0.079	33.9	
1 770	132572	LTE Band 66	High	20	22.87	Right Corner	14	0	1	99	1:1	0.092	33.2	
2 593	40620	LTE Band 41(PC3)	Mid	20	22.47	Rear	15	0	1	49	1:1.58	0.234	28.8	27.2
2 593	40620	LTE Band 41(PC3)	Mid	20	22.47	Top	22	0	1	49	1:1.58	0.320	27.4	
2 593	40620	LTE Band 41(PC3)	Mid	20	22.47	Right	9	0	1	49	1:1.58	0.105	32.3	
2 593	40620	LTE Band 41(PC3)	Mid	20	22.47	Left	0	0	1	49	1:1.58	0.290	27.9	
2 593	40620	LTE Band 41(PC3)	Mid	20	22.47	Right Corner	14	0	1	49	1:1.58	0.219	29.1	
2 593	40620	LTE Band 41(PC2)	Mid	20	22.45	Top	22	0	1	49	1:1.58	0.337	27.2	

MEASUREMENT RESULTS (Sub 1 Ant)														
Frequency		Mode		Band width	Conducted Power	Test Position	Distance	MPR	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHz)	(dBm)		(mm)	(dBm)				(W/kg)	(dBm)	(dBm)
1 900	19100	LTE Band 2 (Sub 1)	High	20	23.12	Rear	9	0	1	49	1:1	0.460	26.5	26.5
1 900	19100	LTE Band 2 (Sub 1)	High	20	23.12	Bottom	17	0	1	49	1:1	0.273	28.8	
1 900	19100	LTE Band 2 (Sub 1)	High	20	23.12	Right	0	0	1	49	1:1	0.095	33.3	
1 900	19100	LTE Band 2 (Sub 1)	High	20	23.12	Left	0	0	1	49	1:1	0.012	42.3	
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	23.22	Rear	9	0	1	49	1:1	0.470	26.5	26.5
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	23.22	Bottom	17	0	1	49	1:1	0.273	28.9	
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	23.22	Right	0	0	1	49	1:1	0.047	36.5	
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	23.22	Left	0	0	1	49	1:1	0.050	36.2	

Table A-11 DSI = 0 P_{Limit} Calculations - – NR Body SAR

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

MEASUREMENT RESULTS(Main 1 Ant)															
Frequency		Mode		Band width	Conducted Power	Test Position		MPR	Spacing (mm)	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHz)	(dBm)			(dBm)					(W/kg)	(dBm)	(dBm)
836.5	167300	NR Band n5	Mid	20	24.23	Rear	DFT-s-OFDM QPSK	0	15	1	104	1:1	0.544	26.9	26.9
836.5	167300	NR Band n5	Mid	20	24.23	Top	DFT-s-OFDM QPSK	0	22	1	104	1:1	0.355	28.7	
836.5	167300	NR Band n5	Mid	20	24.23	Right	DFT-s-OFDM QPSK	0	9	1	104	1:1	0.070	35.8	
836.5	167300	NR Band n5	Mid	20	24.23	Left	DFT-s-OFDM QPSK	0	0	1	104	1:1	0.091	34.6	
836.5	167300	NR Band n5	Mid	20	24.23	Right Corner	DFT-s-OFDM QPSK	0	14	1	104	1:1	0.060	36.4	
1 770	354000	NR Band n66	High	40	21.95	Rear	DFT-s-OFDM QPSK	0	15	1	104	1:1	0.857	22.6	22.6
1 770	354000	NR Band n66	High	40	21.95	Top	DFT-s-OFDM QPSK	0	22	1	104	1:1	0.661	23.7	
1 770	354000	NR Band n66	High	40	21.95	Right	DFT-s-OFDM QPSK	0	9	1	104	1:1	0.017	39.6	
1 770	354000	NR Band n66	High	40	21.95	Left	DFT-s-OFDM QPSK	0	0	1	104	1:1	0.069	33.6	
1 770	354000	NR Band n66	High	40	21.95	Right Corner	DFT-s-OFDM QPSK	0	14	1	104	1:1	0.066	33.8	

Table A-11 DSI = 1 P_{Limit} Calculations - - 2G/3G Body SAR

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

MEASUREMENT RESULTS (Main 1 Ant)										
Frequency		Mode		Conducted Power	Test Position	Distance	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(dBm)		(mm)		(W/kg)	(dBm)	(dBm)
836.6	190	GSM 850	GRPS 1Tx	15.39	Rear	0	1:8.3	0.199	22.4	20.7
836.6	190	GSM 850	GRPS 1Tx	15.39	Top	0	1:8.3	0.179	22.9	
836.6	190	GSM 850	GRPS 1Tx	15.39	Right	0	1:8.3	0.021	32.2	
836.6	190	GSM 850	GRPS 1Tx	15.39	Right Corner	0	1:8.3	0.296	20.7	
1 880	661	GSM 1900	GPRS 2Tx	12.38	Rear	0	1:4.15	0.357	15.8	15.8
1 880	661	GSM 1900	GPRS 2Tx	12.38	Top	0	1:4.15	0.205	18.2	
1 880	661	GSM 1900	GPRS 2Tx	12.38	Right	0	1:4.15	0	0	
1 880	661	GSM 1900	GPRS 2Tx	12.38	Right Corner	0	1:4.15	0.00342	36.4	
836.6	4183	UMTS 850	RMC	15.43	Rear	0	1:1	0.479	18.6	16.8
836.6	4183	UMTS 850	RMC	15.43	Top	0	1:1	0.724	16.8	
836.6	4183	UMTS 850	RMC	15.43	Right	0	1:1	0.043	29.1	
836.6	4183	UMTS 850	RMC	15.43	Right Corner	0	1:1	0.045	28.9	
1 732.4	1412	UMTS 1700	RMC	12.76	Rear	0	1:1	0.857	13.4	13.4
1 732.4	1412	UMTS 1700	RMC	12.76	Top	0	1:1	0.451	16.2	
1 732.4	1412	UMTS 1700	RMC	12.76	Right	0	1:1	0	0	
1 732.4	1412	UMTS 1700	RMC	12.76	Right Corner	0	1:1	0.009	33.2	
1 880.0	9400	UMTS 1900	RMC	12.84	Rear	0	1:1	0.460	16.2	14.1
1 880.0	9400	UMTS 1900	RMC	12.84	Top	0	1:1	0.743	14.1	
1 880.0	9400	UMTS 1900	RMC	12.84	Right	0	1:1	0.021	29.6	
1 880.0	9400	UMTS 1900	RMC	12.84	Right Corner	0	1:1	0.029	28.2	

Table A-13 DSI = 1 P_{Limit} Calculations - – 4G Body SAR

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

MEASUREMENT RESULTS(Main 1 Ant)														
Frequency		Mode		Band width	Conducted Power	Test Position	Distance	MPR	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHz)	(dBm)		(mm)	(dBm)				(W/kg)	(dBm)	(dBm)
836.5	20525	LTE Band 5	Mid	10	14.42	Rear	0	0	1	24	1:1	0.344	19.1	17.6
836.5	20525	LTE Band 5	Mid	10	14.42	Top	0	0	1	24	1:1	0.477	17.6	
836.5	20525	LTE Band 5	Mid	10	14.42	Right	0	0	1	24	1:1	0.028	29.9	
836.5	20525	LTE Band 5	Mid	10	14.42	Right Corner	0	0	1	24	1:1	0.051	27.3	
707.5	23095	LTE Band 12	Mid	10	15.25	Rear	0	0	1	49	1:1	0.307	20.4	18.5
707.5	23095	LTE Band 12	Mid	10	15.25	Top	0	0	1	49	1:1	0.476	18.5	
707.5	23095	LTE Band 12	Mid	10	15.25	Right	0	0	1	49	1:1	0.030	30.5	
707.5	23095	LTE Band 12	Mid	10	15.25	Right Corner	0	0	1	49	1:1	0.055	27.8	
782	23230	LTE Band 13	Mid	10	15.43	Rear	0	0	1	49	1:1	0.385	19.6	18.2
782	23230	LTE Band 13	Mid	10	15.43	Top	0	0	1	49	1:1	0.534	18.2	
782	23230	LTE Band 13	Mid	10	15.43	Right	0	0	1	49	1:1	0.033	30.2	
782	23230	LTE Band 13	Mid	10	15.43	Right Corner	0	0	1	49	1:1	0.050	28.4	
1 860.0	26140	LTE Band 25	Low	20	12.57	Rear	0	0	1	0	1:1	0.636	14.5	14.5
1 860.0	26140	LTE Band 25	Low	20	12.57	Top	0	0	1	0	1:1	0.515	15.5	
1 860.0	26140	LTE Band 25	Low	20	12.57	Right	0	0	1	0	1:1	0.021	29.3	
1 860.0	26140	LTE Band 25	Low	20	12.57	Right Corner	0	0	1	0	1:1	0.023	29.0	
831.5	26865	LTE Band 26	Mid	15	14.27	Rear	0	0	1	36	1:1	0.336	19.0	17.7
831.5	26865	LTE Band 26	Mid	15	14.27	Top	0	0	1	36	1:1	0.455	17.7	
831.5	26865	LTE Band 26	Mid	15	14.27	Right	0	0	1	36	1:1	0.034	29.0	
831.5	26865	LTE Band 26	Mid	15	14.27	Right Corner	0	0	1	36	1:1	0.053	27.0	
2 593	40620	LTE Band 41(PC3)	Mid	20	12.32	Rear	0	0	1	49	1:1.58	0.768	13.5	13.5
2 593	40620	LTE Band 41(PC3)	Mid	20	12.32	Top	0	0	1	49	1:1.58	0.707	13.8	
2 593	40620	LTE Band 41(PC3)	Mid	20	12.32	Right	0	0	1	49	1:1.58	0.132	21.1	
2 593	40620	LTE Band 41(PC3)	Mid	20	12.32	Right Corner	0	0	1	49	1:1.58	0.271	18.0	
1 770.0	132572	LTE Band 66	High	20	12.87	Rear	0	0	1	49	1:1	0.850	13.6	13.6
1 770.0	132572	LTE Band 66	High	20	12.87	Top	0	0	1	49	1:1	0.379	17.1	
1 770.0	132572	LTE Band 66	High	20	12.87	Right	0	0	1	49	1:1	0.006	35.1	
1 770.0	132572	LTE Band 66	High	20	12.87	Right Corner	0	0	1	49	1:1	0.011	32.5	

MEASUREMENT RESULTS(Sub 1 Ant)														
Frequency		Mode		Band width	Conducted Power	Test Position	Distance	MPR	RB	RB	Duty	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHZ)	(dBm)		(mm)	(dBm)	Size	offset	Cycle	(W/kg)	(dBm)	(dBm)
1 900	19100	LTE Band 2 (Sub 1)	High	20	13.36	Rear	0	0	1	49	1:1	0.330	18.2	17.9
1 900	19100	LTE Band 2 (Sub 1)	High	20	13.36	Bottom	0	0	1	49	1:1	0.353	17.9	
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	13.14	Rear	0	0	1	49	1:1	0.161	21.1	17.4
1 745.0	132322	LTE Band 66 (Sub 1)	Mid	20	13.14	Bottom	0	0	1	49	1:1	0.379	17.4	

Table A-15 DSI = 1 P_{Limit} Calculations - - NR Body SAR

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

MEASUREMENT RESULTS (Main 1 Ant)															
Frequency		Mode		Band width	Conducted Power	Test Position		MPR	Spacing (mm)	RB Size	RB offset	Duty Cycle	Meas. SAR(1g)	Plimit	Minimum Plimit
Mhz	Ch.			(MHz)	(dBm)			(dBm)					(dBm)	(W/kg)	(dBm)
836.5	167300	NR Band n5	Mid	20	15.21	Rear	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.534	17.9	17.9
836.5	167300	NR Band n5	Mid	20	15.21	Top	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.481	18.4	
836.5	167300	NR Band n5	Mid	20	15.21	Right	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.051	28.1	
836.5	167300	NR Band n5	Mid	20	15.21	Right Corner	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.066	27.0	
1 770	354000	NR Band n66	High	40	11.60	Rear	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.560	14.1	14.1
1 770	354000	NR Band n66	High	40	11.60	Top	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.232	17.9	
1 770	354000	NR Band n66	High	40	11.60	Right	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.007	33.1	
1 770	354000	NR Band n66	High	40	11.60	Right Corner	DFT-s-OFDM QPSK	0	0	1	1	1:1	0.003	36.8	