



# TEST REPORT

**APPLICANT** : Sonim Technologies, Inc.  
**PRODUCT NAME** : 5G smartphone  
**MODEL NAME** : P200  
**BRAND NAME** : Sonim  
**FCC ID** : WYPP200  
**STANDARD(S)** : FCC 47 CFR Part 2(2.1093)  
IEEE 1528-2013  
**RECEIPT DATE** : 2024-01-11  
**TEST DATE** : 2024-02-03 to 2024-02-28  
**ISSUE DATE** : 2024-05-21



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# DIRECTORY

- 1. SAR Results Summary ..... 5
- 2. Technical Information ..... 6
  - 2.1. Applicant and Manufacturer Information ..... 6
  - 2.2. Equipment under Test (EUT) Description ..... 6
  - 2.3. Environment of Test Site/Conditions ..... 8
- 3. Specific Absorption Rate (SAR) ..... 9
  - 3.1. Introduction ..... 9
  - 3.2. SAR Definition ..... 9
- 4. RF Exposure Limits ..... 10
  - 4.1. Uncontrolled Environment ..... 10
  - 4.2. Controlled Environment ..... 10
- 5. Applied Reference Documents ..... 11
- 6. SAR Measurement System ..... 12
  - 6.1. E-Field Probe ..... 13
  - 6.2. Data Acquisition Electronics (DAE) ..... 14
  - 6.3. Robot ..... 14
  - 6.4. Measurement Server ..... 15
  - 6.5. Light Beam Unit ..... 15
  - 6.6. Phantom ..... 15
  - 6.7. Device Holder ..... 16
  - 6.8. Data Storage and Evaluation ..... 17
  - 6.9. Test Equipment List ..... 19
- 7. Tissue Simulating Liquids ..... 21
- 8. SAR System Verification ..... 24
  - 8.1. Purpose of System Performance Check ..... 24
  - 8.2. System Setup ..... 24



8.3. Validation Results ..... 25

9. EUT Testing Position ..... 29

9.1. Handset Reference Points ..... 29

9.2. Positioning for Cheek / Touch ..... 30

9.3. Positioning for Ear / 15° Tilt ..... 30

9.4. SAR Evaluation near the Mouth/Jaw Regions of the Phantom ..... 31

9.5. Body-worn Configurations ..... 31

9.6. Hotspot Mode Exposure Position Conditions ..... 32

10. Measurement Procedures ..... 33

10.1. Spatial Peak SAR Evaluation ..... 33

10.2. Power Reference Measurement ..... 34

10.3. Area Scan Procedures ..... 34

10.4. Zoom Scan Procedures ..... 34

10.5. SAR Averaged Methods ..... 35

10.6. Power Drift Monitoring ..... 35

11. SAR Test Procedure ..... 36

11.1. General Scan Requirements ..... 36

11.2. Test Procedure ..... 37

11.3. Description of Interpolation/Extrapolation Scheme ..... 37

11.4. Wireless Router ..... 37

12. SAR Test Configuration ..... 39

13. Conducted Power List ..... 50

14. Carrier Aggregation ..... 50

14.1. LTE Uplink Carrier Aggregation ..... 50

14.2. LTE Downlink Carrier Aggregation ..... 51

15. 5G NR EN-DC Consideration ..... 53

16. Hotspot Mode Evaluation Procedure ..... 56

17. Block Diagram of the Tests to be Performed ..... 58



**17.1. Head ..... 58**

**17.2. Body ..... 59**

**18. Proximity Sensor Considerations ..... 60**

**18.1. Proximity Sensor Triggering Distances ..... 60**

**18.2. Proximity Sensor Coverage ..... 61**

**19. Test Results List ..... 62**

**19.1. Test Guidance ..... 62**

**19.2. Head SAR Data ..... 65**

**19.3. Body SAR Data ..... 75**

**19.4. Repeated SAR Assessment ..... 86**

**19.5. Extremity SAR Assessment ..... 88**

**20. Simultaneous Transmission Evaluation ..... 89**

**20.1. Simultaneous Transmission Consideration ..... 89**

**20.2. Simultaneous Transmission Analysis ..... 90**

**21. Uncertainty Assessment ..... 90**

**Annex A General Information ..... 91**

**Annex B Test Setup Photos**

**Annex C Plots of System Performance Check**

**Annex D Plots of Maximum SAR Test Results**

**Annex E Conducted Power**

**Annex F Simultaneous Transmission Data**

**Annex G DASY Calibration Certificate**

Changed History		
Version	Date	Reason for Change
1.0	2024-05-21	First edition

# 1. SAR Results Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported SAR Summary>

Frequency Band		Highest SAR Summary			
		Head (Gap 0mm)	Body-worn (Gap 10mm)	Hotspot (Gap 10mm)	Extremity (Gap 0mm)
		1g SAR (W/kg)			10g SAR (W/kg)
WCDMA	WCDMA II	0.708	0.151	0.151	N/A
	WCDMA IV	0.810	0.465	0.465	N/A
	WCDMA V	1.022	0.389	0.389	N/A
LTE	LTE Band 2	0.652	0.535	0.535	N/A
	LTE Band 5	1.053	0.398	0.398	N/A
	LTE Band 7	0.345	0.364	0.364	N/A
	LTE Band 12	0.809	0.249	0.249	N/A
	LTE Band 14	0.962	0.336	0.336	N/A
	LTE Band 26	0.941	0.314	0.314	N/A
	LTE Band 38	0.239	0.095	0.095	N/A
	LTE Band 40	0.270	0.166	0.166	N/A
	LTE Band 41	0.220	0.102	0.102	N/A
	LTE Band 66/4	0.700	0.206	0.215	N/A
5G NR	n2	1.160	0.868	1.030	N/A
	n5	0.985	0.245	0.245	N/A
	n66	1.045	0.233	0.308	N/A
	n77	1.149	1.167	1.167	N/A
WLAN	2.4GHz WLAN	0.441	0.139	0.139	N/A
	5GHz WLAN	0.291	0.435	0.435	0.464
2.4GHz Band	Bluetooth	0.077	0.132	0.132	N/A

Highest Simultaneous Transmission SAR <sub>1g</sub> (W/Kg):	1.490 W/kg	Limit(W/kg): 1.6 W/kg
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**Note:**

- This device is in compliance with Specific Absorption Rate (SAR) for general population or uncontrolled exposure limits (1.6W/kg as averaged over any 1 gram of tissue; specified in FCC 47 CFR Part 1 (1.1310) and ANSI/IEEE C95.1-1992), and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.



- When the test result is a critical value, we will use the measurement uncertainty give the judgment result based on the 95% confidence intervals.

## 2. Technical Information

**Note:** Provide by applicant.

### 2.1. Applicant and Manufacturer Information

<b>Applicant:</b>	Sonim Technologies, Inc.
<b>Applicant Address:</b>	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA
<b>Manufacturer:</b>	Sonim Technologies, Inc.
<b>Manufacturer Address:</b>	4445 Eastgate Mall, Suite 200, San Diego, CA 92121, USA

### 2.2. Equipment under Test (EUT) Description

<b>Product Name:</b>	5G smartphone
<b>EUT IMEI:</b>	01651500000138 01651500000161
<b>Hardware Version:</b>	V1.0
<b>Software Version:</b>	P200.AT01.30D
<b>Frequency Bands:</b>	WCDMA Band II: 1850 MHz ~ 1910 MHz WCDMA Band IV: 1710 MHz ~ 1755 MHz WCDMA Band V: 824 MHz ~ 849 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 7: 2500 MHz ~ 2570 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 14: 788 MHz ~ 798 MHz LTE Band 26: 814 MHz ~ 849 MHz LTE Band 29 (RX): 717 MHz ~ 728 MHz LTE Band 38: 2570 MHz ~ 2620 MHz LTE Band 40: 2300 MHz ~ 2400 MHz LTE Band 41: 2496 MHz ~ 2690 MHz LTE Band 66: 1710 MHz ~ 1780 MHz 5G NR n2: 1850 MHz ~ 1910 MHz 5G NR n5: 824 MHz ~ 849 MHz 5G NR n66: 1710 MHz ~ 1780 MHz



	5G NR n77: 3450 MHz ~ 3550 MHz; 3700 MHz ~3980 MHz WLAN 2.4GHz: 2412 MHz ~ 2462 MHz WLAN 5.2GHz: 5180 MHz ~ 5240 MHz WLAN 5.3GHz: 5260 MHz ~ 5320 MHz WLAN 5.5GHz: 5500 MHz ~ 5720 MHz WLAN 5.8GHz: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
<b>Modulation Mode:</b>	WCDMA: QPSK, 16QAM LTE: QPSK, 16QAM, 64QAM 5G NR: DFT-s-OFDM/CP-OFDM, PI/2 BPSK QPSK, 16QAM, 64QAM, 256QAM 802.11b: DSSS 802.11a/g/n-HT20/HT40/ac-VHT20/40/80: OFDM BR+EDR: GFSK(1Mbps), $\pi/4$ -DQPSK(2Mbps), 8-DPSK(3Mbps) Bluetooth LE: GFSK(1Mbps,2Mbps)
<b>Carrier Aggregation:</b>	Uplink & Downlink
<b>VoLTE Mode:</b>	Support
<b>VoNR Mode:</b>	Support
<b>VoWi-Fi Mode:</b>	Support
<b>VoIP Mode:</b>	Support
<b>Hotspot Mode:</b>	Support (5G WLAN only for B1 & B4)
<b>Antenna Type:</b>	WWAN: PIFA Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna
<b>SIM Cards Description:</b>	WCDMA+LTE+5G NR

**Note:** For more detailed description, please refer to specification or user manual supplied by the applicant and/or manufacturer.



### 2.3. Environment of Test Site/Conditions

Normal Temperature (NT):	20-25 °C
Relative Humidity:	30-75 %

Test Frequency:	WCDMA Band II/IV/V FDD-LTE Band 2/4/5/7/12/14/26/66 TDD-LTE Band 38/40/41 5G NR n2/5/66/77 WLAN 2.4GHz WLAN 5GHz Bluetooth
Operation Mode:	Call established
Power Level:	WCDMA Band II/IV/V (All Up Bits) FDD-LTE Band 2/4/5/7/12/14/26/66 (Maximum output power) TDD-LTE Band 38/40/41 (Maximum output power) 5G NR n2/5/66/77 (Maximum output power) WLAN 2.4GHz /WLAN 5GHz /Bluetooth refer to Annex E

During SAR test, EUT is in Traffic Mode (Channel Allocated) at Normal Voltage Condition. A communication link is set up with a System Simulator (SS) by air link, and a call is established.

The EUT shall use its internal transmitter. The antenna(s), battery and accessories shall be those specified by the Factory. The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power output. If a wireless link is used, the antenna connected to the output of the base station simulator shall be placed at least 50 cm away from the handset.

The signal transmitted by the simulator to the antenna feeding point shall be lower than the output power level of the handset by at least 35 dB.



## 3. Specific Absorption Rate (SAR)

### 3.1. Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational or controlled and general population or uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational or controlled exposure limits are Middle than the limits for general population or uncontrolled.

### 3.2. SAR Definition

The SAR definition is the time derivative (rate) of the incremental energy (dW) absorbed by(dissipated in) an incremental mass (dm) contained in a volume element (dv) of a given density. ( $\rho$ ). The equation description is as below:

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

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

SAR measurement can be either related to the temperature elevation in tissue by,

$$\text{SAR} = C \left( \frac{\delta T}{\delta t} \right)$$

Where C is the specific head capacity,  $\delta T$  is the temperature rise and  $\delta t$  the exposure duration, or related to the electrical field in the tissue by

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

Where  $\sigma$  is the conductivity of the tissue,  $\rho$  is the mass density of the tissue and  $|E|$  is the rmselectrical field strength.

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.



## 4. RF Exposure Limits

### 4.1. Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

### 4.2. Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

**Limits for General Population/Uncontrolled Exposure (W/kg)**

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for head and trunk)	1.6 W/kg
Spatial Peak SAR (10g cube tissue for limbs)	4.0 W/kg
Spatial Peak SAR (1g cube tissue for whole body)	0.08 W/kg

**Note:**

- Occupational/Uncontrolled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).
- Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

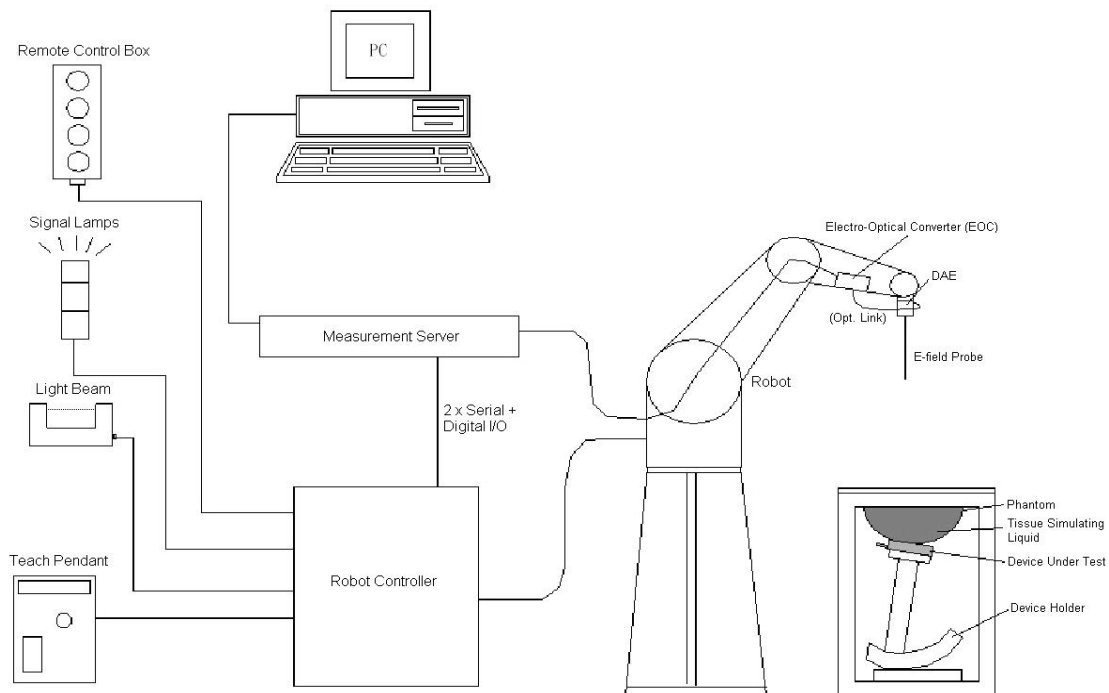


## 5. Applied Reference Documents

Leading reference documents for testing:

Identity	Document Title	Method Determination /Remark
FCC 47 CFR Part 2(2.1093)	Radio Frequency Radiation Exposure Evaluation: Portable Devices	No deviation
IEEE 1528-2013	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	No deviation
KDB 447498 D01v06	General RF Exposure Guidance	No deviation
KDB 248227 D01v02r02	SAR Measurement Procedures for 802.11 Transmitters	No deviation
KDB 865664 D01v01r04	SAR Measurement 100 MHz to 6 GHz	No deviation
KDB 865664 D02v01r02	RF Exposure Reporting	No deviation
KDB 648474 D04v01r03	Handset SAR	No deviation
KDB 941225 D01v03r01	3G SAR MEAUREMENT PROCEDURES	No deviation
KDB 941225 D05v02r05	SAR Evaluation Consideration for LTE Devices	No deviation
KDB 941225 D06v02r01	SAR Evaluation Procedures For Portable Devices With Wireless Router Capabilities	No deviation
<b>Note 1:</b> Additions to, deviation, or exclusions from the method shall be judged in the "method determination" column of add, deviate or exclude from the specific method shall be explained in the "Remark" of the above table.		

## 6. SAR Measurement System



**Fig 6.1 SPEAG DASY System Configurations**

The DASY system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software.
- A data acquisition electronic (DAE) attached to the robot arm extension.
- A dosimetric probe equipped with an optical surface detector system.
- The electro-optical converter (ECO) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning.
- A computer operating Windows XP.
- DASY software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom.
- A device holder.
- Tissue simulating liquid.
- Dipole for evaluating the proper functioning of the system.
- Some of the components are described in details in the following sub-sections.

## 6.1. E-Field Probe

The SAR measurement is conducted with the dosimetric probe (manufactured by SPEAG). The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency. This probe has a built in optical surface detection system to prevent from collision with phantom.

### ➤ E-Field Probe Specification

#### <ES3DV3 Probe>


<b>Construction</b>	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
<b>Frequency</b>	10 MHz to 3 GHz; Linearity: $\pm 0.2$ dB	
<b>Directivity</b>	$\pm 0.2$ dB in HSL (rotation around probe axis) $\pm 0.4$ dB in HSL (rotation normal to probe axis)	
<b>Dynamic Range</b>	5 $\mu$ W/g to 100 mW/g; Linearity: $\pm 0.2$ dB	
<b>Dimensions</b>	Overall length: 330 mm (Tip: 16 mm) Tip diameter: 6.8 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.7 mm	

Fig 6.2 Photo of ES3DV3

#### <EX3DV4 Probe>


<b>Construction</b>	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
<b>Frequency</b>	10 MHz to 6 GHz; Linearity: $\pm 0.2$ dB	
<b>Directivity</b>	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)	
<b>Dynamic Range</b>	10 $\mu$ W/g to 100 mW/g; Linearity: $\pm 0.2$ dB	
<b>Dimensions</b>	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Fig 6.3 Photo of EX3DV4

### ➤ E-Field Probe Calibration

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than  $\pm 10\%$ . The spherical isotropy shall be evaluated and within  $\pm 0.25$  dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

## 6.2. Data Acquisition Electronics (DAE)

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock. The input impedance of the DAE is 200M $\Omega$ ; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.



Fig 6.4 Photo of DAE

## 6.3. Robot

The SPEAG DASY system uses the high precision robots (DASY4: RX90BL; DASY5: TX90XL) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB; DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

High precision (repeatability  $\pm 0.035$  mm)

High reliability (industrial design)

Jerk-free straight movements

Low ELF interference (the closed metallic construction shields against motor control fields)



Fig 6.5 Photo of DASY5



### 6.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY4: 166 MHz, Intel Pentium; DASY5: 400 MHz, Intel Celeron), chip disk (DASY4: 32 MB; DASY5: 128 MB), RAM (DASY4: 64 MB, DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board. The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.



Fig 6.6 Photo of Server for DASY5

### 6.5. Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.

The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.



Fig. 6.7 Photo of Light Beam

### 6.6. Phantom

<SAM Twin Phantom>

<b>Shell Thickness</b>	2 ± 0.2 mm (sagging: <1%) Center ear point: 6 ± 0.2 mm
<b>Filling Volume</b>	Approx. 25 liters
<b>Dimensions</b>	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
<b>Measurement Areas</b>	Left Head, Right Head, Flat Phantom



Fig. 6.8 Photo of SAM Phantom

The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

## 6.7. Device Holder

### <Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of  $\pm 0.5$  mm would produce a SAR uncertainty of  $\pm 20$  %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity  $\epsilon = 3$  and loss tangent  $\delta = 0.02$ . The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

### <Laptop Extension Kit>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.



Fig 6.9 Device Holder

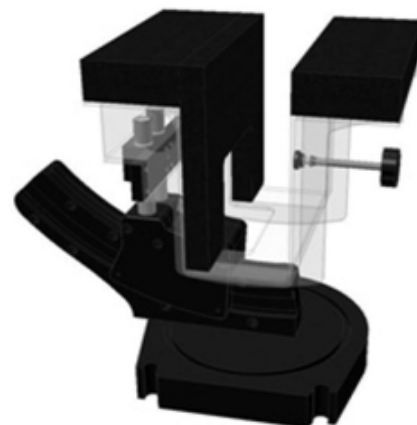


Fig 6.10 Laptop Extension Kit





## 6.8. Data Storage and Evaluation

### ➤ Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### ➤ Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software.

<b>Probe parameters:</b>	- Sensitivity	Norm <sub>i</sub> , a <sub>i0</sub> , a <sub>i1</sub> , a <sub>i2</sub>
	- Conversion factor	ConvF <sub>i</sub>
	- Diode compression point	dcpi
<b>Device parameters:</b>	- Frequency	f
	- Crest factor	cf
<b>Media parameters:</b>	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the



exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \times \frac{cf}{dcp_i}$$

With  $V_i$  = compensated signal of channel  $i$ , ( $i = x, y, z$ )  
 $U_i$  = input signal of channel  $i$ , ( $i = x, y, z$ )  
 $cf$  = crest factor of exciting field (DASY parameter)  
 $dcp_i$  = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated:

$$\text{E-field Probes: } E_i = \sqrt{\frac{V_i}{\text{Norm}_i \times \text{ConvF}}}$$

$$\text{H-field Probes: } H_i = \sqrt{V_i} \times \frac{a_{i0} + a_{i1} + a_{i2} f^2}{f}$$

With  $V_i$  = compensated signal of channel  $i$ , ( $i = x, y, z$ )  
 $\text{Norm}_i$  = sensor sensitivity of channel  $i$ , ( $i = x, y, z$ ),  $\mu\text{V}/(\text{V}/\text{m})^2$  for E-field  
 Probes ConvF = sensitivity enhancement in solution  
 $a_{ij}$  = sensor sensitivity factors for H-field probes  
 $f$  = carrier frequency [GHz]  
 $E_i$  = electric field strength of channel  $i$  in V/m  
 $H_i$  = magnetic field strength of channel  $i$  in A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{\text{tot}} = \sqrt{E_x^2 + E_y^2 + E_z^2}$$

The primary field data are used to calculate the derived field units.

$$\text{SAR} = E_{\text{tot}}^2 \times \frac{\sigma}{\rho \times 1000}$$

with SAR = local specific absorption rate in mW/g

$E_{\text{tot}}$  = total field strength in V/m

$\sigma$  = conductivity in [mho/m] or [Siemens/m]

$\rho$  = equivalent tissue density in  $\text{g}/\text{cm}^3$

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.



## 6.9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial No./ SW Version	Calibration	
				Last Cal.	Due Date
SPEAG	750MHz System Validation Kit	D750V3	1223	2022.08.22	2025.08.21
SPEAG	900MHz System Validation Kit	D900V2	1d064	2021.12.17	2024.12.16
SPEAG	1800MHz System Validation Kit	D1800V2	2d158	2021.12.17	2024.12.16
SPEAG	2000MHz System Validation Kit	D2000V2	1050	2021.12.18	2024.12.17
SPEAG	2300MHz System Validation Kit	D2300V2	1107	2023.06.03	2026.06.02
SPEAG	2450MHz System Validation Kit	D2450V2	805	2021.12.17	2024.12.16
SPEAG	2600MHz System Validation Kit	D2600V2	1198	2022.08.17	2025.08.16
SPEAG	3500MHz System Validation Kit	D3500V2	1104	2023.06.03	2026.06.02
SPEAG	3700MHz System Validation Kit	D3700V2	1076	2023.06.03	2026.06.02
SPEAG	3900MHz System Validation Kit	D3900V2	1046	2023.06.02	2026.06.01
SPEAG	5000MHz System Validation Kit	D5GHZV2	1176	2021.12.19	2024.12.18
SPEAG	Dosimetric E-Field Probe	EX3DV4	3823	2023.09.14	2024.09.13
SPEAG	Dosimetric E-Field Probe	EX3DV4	7608	2023.03.15	2024.03.14
SPEAG	Data Acquisition Electronics	DAE4	480	2023.09.19	2024.09.18
SPEAG	Data Acquisition Electronics	DAE4	1643	2023.02.22	2024.02.21
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM Software	DASY52	52.10.4.1527	NCR	NCR
SPEAG	SAM Twin Phantom 2	QD000P40CC	TP-1464	NCR	NCR
SPEAG	Twin-SAM	QD 000 P41 Ax	2020	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
R&S	Network Emulator	CMW500	165755	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8820C	6201274521	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8821C	6261830572	2024.01.25	2025.01.24
Anritsu	Network Emulator	MT8000A	6262148249	2023.06.27	2024.06.24
Agilent	Network Analyzer	E5071B	MY42404762	2024.01.25	2025.01.24
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2023.08.03	2024.08.02
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
mini-circuits	Amplifier	ZVE-8G+	754401735	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2023.09.19	2024.09.18
R&S	Power Sensor	NRP8S	103215	2024.01.25	2025.01.24
Agilent	Power Meter	E4416A	MY45102093	2023.09.19	2024.09.18



R&S	Power Sensor	NRP8S	103240	2024.01.25	2025.01.24
Anritsu	Power Meter	E4418B	GB43318055	2023.06.21	2024.06.20
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation	351-218-010	N/A	NA	NA
R&S	Spectrum Analyzer	N9030A	MY54170556	2023.10.07	2024.10.06
KTJ	Thermo meter	TA298	N/A	2023.11.22	2024.11.21
SPEAG	Tissue Simulating Liquids	HBBL600-10000V6			24H

**Note:**

1. The calibration certificate of DASY can be referred to appendix G of this report.
2. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
3. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.
4. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it.
5. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
6. N.C.R means No Calibration Requirement.

## 7. Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm, which is shown in Fig. 7.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 7.2. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in below table.

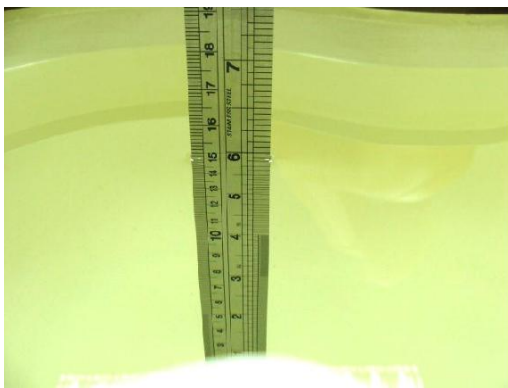


Fig 7.1 Photo of Liquid Height for Head SAR



Fig 7.2 Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquids

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )
Head								
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800,1900,2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
Body								
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800,1900,2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	68.1	0	0	0.1	0	31.8	2.16	52.5

Simulating Liquid for 5GHz, Manufactured by SPEAG.

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%



**Note:** Please refer to the validation results for dielectric parameters of each frequency band. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a SPEAG Dielectric Assessment KIT and an Agilent Network Analyzer.

**Table 1: Dielectric Performance of Tissue Simulating Liquid**

Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Conductivity ( $\sigma$ )	Conductivity Target ( $\sigma$ )	Delta ( $\sigma$ ) (%)	Limit (%)	Date
750	HSL	22.1	0.913	0.89	2.58	±5	2024.02.04
900	HSL	22.1	0.971	0.97	0.10	±5	2024.02.08
900	HSL	22.6	0.983	0.97	1.34	±5	2024.02.24
1800	HSL	22.3	1.388	1.40	-0.86	±5	2024.02.19
1800	HSL	22.3	1.391	1.40	-0.64	±5	2024.02.20
1800	HSL	22.5	1.406	1.40	0.43	±5	2024.02.21
1800	HSL	22.4	1.397	1.40	-0.21	±5	2024.02.27
2000	HSL	22.5	1.458	1.40	4.14	±5	2024.02.21
2000	HSL	22.4	1.449	1.40	3.50	±5	2024.02.27
2300	HSL	22.4	1.633	1.67	-2.22	±5	2024.02.22
2450	HSL	22.5	1.841	1.80	2.28	±5	2024.02.26
2600	HSL	22.2	1.942	1.96	-0.92	±5	2024.02.28
3500	HSL	22.3	2.869	2.91	-1.41	±5	2024.02.06
3500	HSL	22.3	2.904	2.91	-0.21	±5	2024.02.16
3700	HSL	22.3	3.116	3.05	2.16	±5	2024.02.18
3900	HSL	22.1	3.134	3.15	-0.51	±5	2024.02.07
3900	HSL	22.3	3.176	3.15	0.83	±5	2024.02.17
5250	HSL	22.4	4.629	4.71	-1.72	±5	2024.02.25
5600	HSL	22.4	5.322	5.07	4.97	±5	2024.02.23
5750	HSL	22.4	5.286	5.22	1.26	±5	2024.02.23
Frequency (MHz)	Tissue Type	Liquid Temp.(°C)	Permittivity ( $\epsilon_r$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
750	HSL	22.1	41.449	41.90	-1.08	±5	2024.02.04
900	HSL	22.1	41.295	41.50	-0.49	±5	2024.02.08
900	HSL	22.6	41.303	41.50	-0.47	±5	2024.02.24
1800	HSL	22.3	38.494	40.00	-3.77	±5	2024.02.19
1800	HSL	22.3	38.498	40.00	-3.76	±5	2024.02.20
1800	HSL	22.5	38.763	40.00	-3.09	±5	2024.02.21
1800	HSL	22.4	38.596	40.00	-3.51	±5	2024.02.27
2000	HSL	22.5	39.036	40.00	-2.41	±5	2024.02.21



2000	HSL	22.4	38.874	40.00	-2.81	±5	2024.02.27
2300	HSL	22.4	37.763	39.50	-4.40	±5	2024.02.22
2450	HSL	22.5	38.742	39.20	-1.17	±5	2024.02.26
2600	HSL	22.2	39.074	39.00	0.19	±5	2024.02.28
3500	HSL	22.3	37.541	37.90	-0.95	±5	2024.02.06
3500	HSL	22.3	37.298	37.90	-1.59	±5	2024.02.16
3700	HSL	22.3	38.154	37.70	1.20	±5	2024.02.18
3900	HSL	22.1	37.861	37.50	0.96	±5	2024.02.07
3900	HSL	22.3	38.053	37.50	1.47	±5	2024.02.17
5250	HSL	22.4	36.208	35.95	0.72	±5	2024.02.25
5600	HSL	22.4	35.813	35.50	0.88	±5	2024.02.23
5750	HSL	22.4	36.411	35.35	3.00	±5	2024.02.23

## 8. SAR System Verification

Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

### 8.1. Purpose of System Performance Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

### 8.2. System Setup

The output power on dipole port must be calibrated to 24 dBm (250 mW) before dipole is connected. In the simplified setup for system evaluation, the DUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.



Fig 8.1 Photo of Dipole Setup

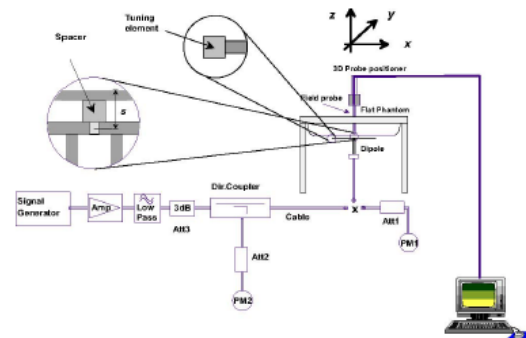


Fig 8.2 System Setup for System Evaluation





### 8.3. Validation Results

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10%.

#### <Validation Setup>

Frequency (MHz)	Tissue Type	Input Power(mW)	Dipole S/N	Probe S/N	DAE S/N
750	HSL	250	D750V3-1223	3823	480
900	HSL	250	D900V2-1d064	3823	480
1800	HSL	250	D1800V2-2d158	3823	480
2000	HSL	250	D2000V2-1050	3823	480
2300	HSL	250	D2300V2-1107	3823	480
2450	HSL	250	D2450V2-805	3823	480
2600	HSL	250	D2600V2-1198	3823	480
3500	HSL	100	D3500V2-1104	7608	1643
3700	HSL	100	D3700V2-1076	7608	1643
3900	HSL	100	D3900V2-1176	7608	1643
5250	HSL	100	D5GHzV2-1176-5250	3823	480
5600	HSL	100	D5GHzV2-1176-5600	3823	480
5750	HSL	100	D5GHzV2-1176-5750	3823	480

#### <System Validation>

Frequency (MHz)	Tissue Type	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	CW Signal Validation		
				Sensitivity	Probe Linearity	Probe Isotropy
750	HSL	0.851	42.43	PASS	PASS	PASS
835	HSL	0.898	41.88	PASS	PASS	PASS
1750	HSL	1.386	39.91	PASS	PASS	PASS
1800	HSL	1.449	41.26	PASS	PASS	PASS
1900	HSL	1.435	39.65	PASS	PASS	PASS
2000	HSL	1.451	39.42	PASS	PASS	PASS
2300	HSL	1.764	38.99	PASS	PASS	PASS
2450	HSL	1.863	38.85	PASS	PASS	PASS
2600	HSL	1.973	38.58	PASS	PASS	PASS
3400	HSL	2.88	38.10	PASS	PASS	PASS
3500	HSL	2.91	37.90	PASS	PASS	PASS
3700	HSL	3.05	37.70	PASS	PASS	PASS



3900	HSL	3.15	37.50	PASS	PASS	PASS
4100	HSL	3.25	37.20	PASS	PASS	PASS
4200	HSL	3.34	37.00	PASS	PASS	PASS
4400	HSL	3.58	36.70	PASS	PASS	PASS
4600	HSL	3.70	36.60	PASS	PASS	PASS
4800	HSL	3.82	36.40	PASS	PASS	PASS
4900	HSL	3.96	36.20	PASS	PASS	PASS
5250	HSL	4.528	35.32	PASS	PASS	PASS
5600	HSL	4.905	34.89	PASS	PASS	PASS
5750	HSL	5.077	34.28	PASS	PASS	PASS

Frequency (MHz)	Tissue Type	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Modulation Signal Validation		
				Mod. Type	Duty Factor	PAR
750	HSL	0.851	42.43	N/A	N/A	N/A
835	HSL	0.898	41.88	GMSK	PASS	N/A
1750	HSL	1.386	39.91	N/A	N/A	N/A
1800	HSL	1.449	41.26	N/A	N/A	N/A
1900	HSL	1.435	39.65	GMSK	PASS	N/A
2000	HSL	1.451	39.42	GMSK	PASS	N/A
2300	HSL	1.764	38.99	OFDM	PASS	PASS
2450	HSL	1.863	38.85	OFDM	PASS	PASS
2600	HSL	1.973	38.58	TDD	PASS	N/A
3400	HSL	2.88	38.10	OFDM	PASS	PASS
3500	HSL	2.91	37.90	OFDM	PASS	PASS
3700	HSL	3.05	37.70	OFDM	PASS	PASS
3900	HSL	3.15	37.50	OFDM	PASS	PASS
4100	HSL	3.25	37.20	OFDM	PASS	PASS
4200	HSL	3.34	37.00	OFDM	PASS	PASS
4400	HSL	3.58	36.70	OFDM	PASS	PASS
4600	HSL	3.70	36.60	OFDM	PASS	PASS
4800	HSL	3.82	36.40	OFDM	PASS	PASS
4900	HSL	3.96	36.20	OFDM	PASS	PASS
5250	HSL	4.528	35.32	OFDM	N/A	PASS
5600	HSL	4.905	34.89	OFDM	N/A	PASS
5750	HSL	5.077	34.28	OFDM	N/A	PASS



## &lt;Validation Results&gt;

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2024.02.04	750	HSL	250	2.09	8.54	8.36	-2.11
2024.02.08	900	HSL	250	2.87	11.20	11.48	2.50
2024.02.24	900	HSL	250	2.69	11.20	10.76	-3.93
2024.02.19	1800	HSL	250	9.48	39.20	37.92	-3.27
2024.02.20	1800	HSL	250	9.58	39.20	38.32	-2.24
2024.02.21	1800	HSL	250	9.63	39.20	38.52	-1.73
2024.02.27	1800	HSL	250	9.51	39.20	38.04	-2.96
2024.02.21	2000	HSL	250	9.46	41.60	37.84	-9.04
2024.02.27	2000	HSL	250	9.39	41.60	37.56	-9.71
2024.02.22	2300	HSL	250	12.46	48.40	49.84	2.98
2024.02.26	2450	HSL	250	12.66	52.30	50.64	-3.17
2024.02.28	2600	HSL	250	14.11	57.00	56.44	-0.98
2024.02.06	3500	HSL	100	7.15	67.20	71.5	6.40
2024.02.16	3500	HSL	100	7.03	67.20	70.3	4.61
2024.02.18	3700	HSL	100	7.11	67.50	71.1	5.33
2024.02.07	3900	HSL	100	7.51	69.90	75.1	7.44
2024.02.17	3900	HSL	100	7.45	69.90	74.5	6.58
2024.02.25	5250	HSL	100	8.09	76.70	80.9	5.48
2024.02.23	5600	HSL	100	8.35	80.80	83.5	3.34
2024.02.23	5750	HSL	100	8.29	78.70	82.9	5.34

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2024.02.04	750	HSL	250	1.44	5.57	5.76	3.41
2024.02.08	900	HSL	250	1.85	7.19	7.4	2.92
2024.02.24	900	HSL	250	1.79	7.19	7.16	-0.42
2024.02.19	1800	HSL	250	5.29	20.10	21.16	5.27
2024.02.20	1800	HSL	250	5.37	20.10	21.48	6.87
2024.02.21	1800	HSL	250	5.41	20.10	21.64	7.66
2024.02.27	1800	HSL	250	5.32	20.10	21.28	5.87
2024.02.21	2000	HSL	250	4.83	20.70	19.32	-6.67
2024.02.27	2000	HSL	250	4.74	20.70	18.96	-8.41
2024.02.22	2300	HSL	250	6.11	23.00	24.44	6.26
2024.02.26	2450	HSL	250	6.29	23.90	25.16	5.27



2024.02.28	2600	HSL	250	6.54	25.70	26.16	1.79
2024.02.06	3500	HSL	100	2.68	25.10	26.8	6.77
2024.02.16	3500	HSL	100	2.67	25.10	26.7	6.37
2024.02.18	3700	HSL	100	2.47	24.20	24.7	2.07
2024.02.07	3900	HSL	100	2.59	24.10	25.9	7.47
2024.02.17	3900	HSL	100	2.56	24.10	25.6	6.22
2024.02.25	5250	HSL	100	2.13	22.10	21.3	-3.62
2024.02.23	5600	HSL	100	2.41	23.30	24.1	3.43
2024.02.23	5750	HSL	100	2.23	22.50	22.3	-0.89

**Note:** System checks the specific test data please see Annex C.

## 9. EUT Testing Position

This EUT was tested in ten different positions. They are right cheek/right tilted/left cheek/left tilted for head, Front/Back/Left/Right/Top/Bottom of the EUT with phantom 10 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

### 9.1. Handset Reference Points

The vertical centre line passes through two points on the front side of the handset – the midpoint of the width  $w_t$  of the handset at the level of the acoustic output, and the midpoint of the width  $w_b$  of the bottom of the handset.

The horizontal line is perpendicular to the vertical centre line and passes the center of the acoustic output. The horizontal line is also tangential to the handset at point A.

The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centre line is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



Fig. 9.1 Illustration for Cheek Position

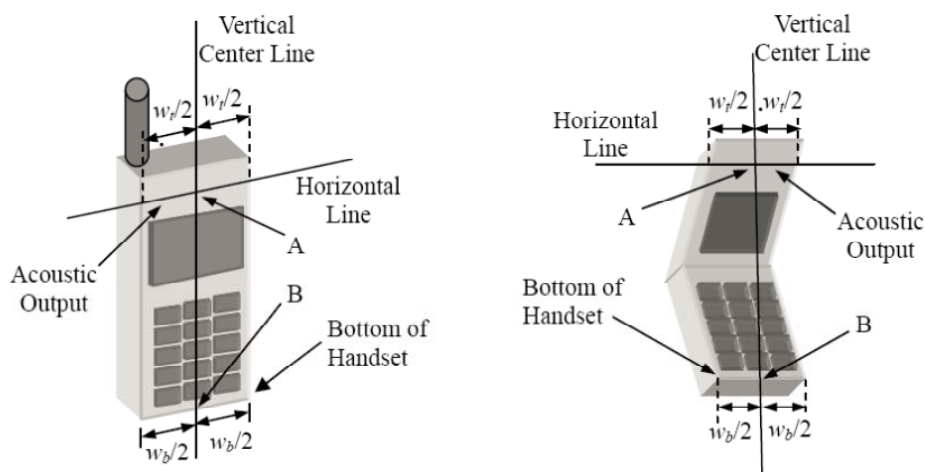


Fig. 9.2 Illustration for Handset Vertical and Horizontal Reference Lines

## 9.2. Positioning for Cheek / Touch

To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear and LE: Left Ear) and align the center of the ear piece with the line RE-LE.

To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below figure)

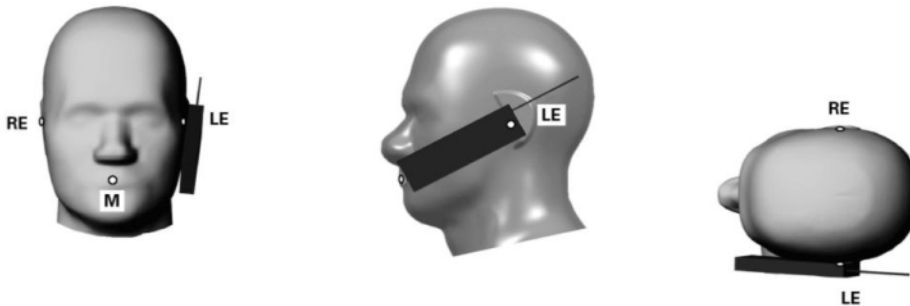


Fig 9.3 Illustration for Cheek Position

## 9.3. Positioning for Ear / 15° Tilt

To position the device in the “cheek” position described above. While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see figure below).

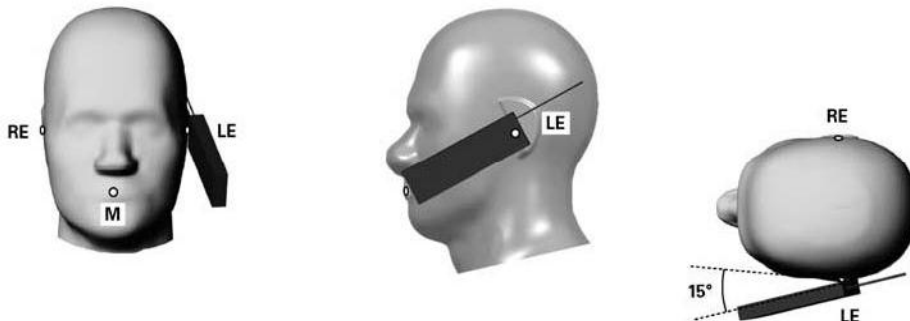


Fig 9.4 Illustration for Tilted Position

## 9.4. SAR Evaluation near the Mouth/Jaw Regions of the Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jaw regions of the SAM head phantom. This typically applies to clam-shell style phones that are generally longer in the unfolded normal use positions or to certain older style long rectangular phones.

Under these circumstances, the following procedures apply, adopted from the FCC guidance on SAR handsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAM should be measured using a flat phantom. The phone should be positioned with a separation distance of 4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. While maintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered from the phantom to establish the same separation distance between the peak SAR locations identified by the truncated partial SAR distribution measured with the SAM phantom. The distance from the peak SAR location to the phone is determined by the straight line passing perpendicularly through the phantom surface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing the required separation at the peak SAR location, the top edge of the phone will be allowed to touch the phantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right while placed in this inclined position to the flat phantom.

## 9.5. Body-worn Configurations

The body-worn configurations shall be tested with the supplied accessories (belt-clips, holsters, etc.) attached to the device in normal use configuration.

For body-worn and other configurations a flat phantom shall be used which is comprised of material with electrical properties similar to the corresponding tissues.

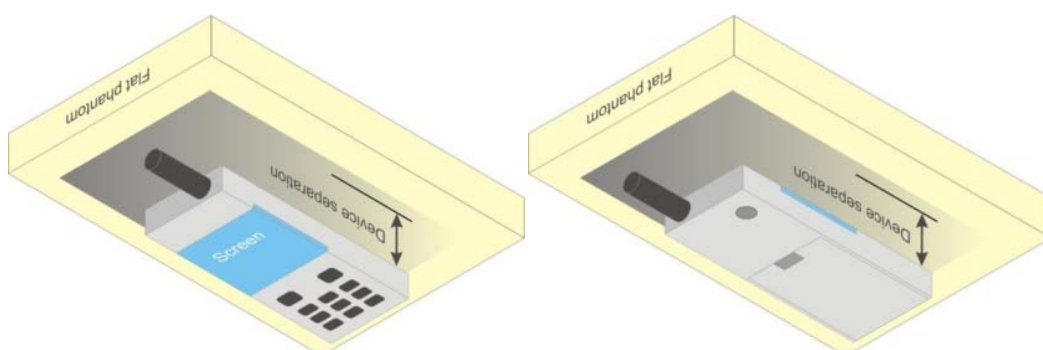
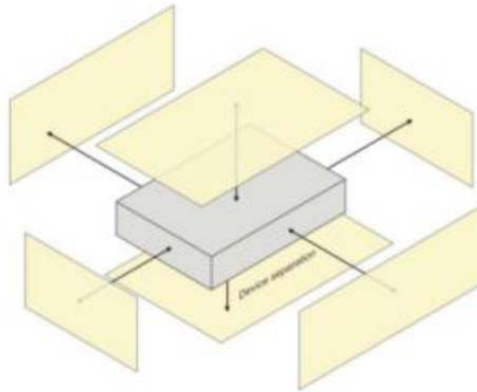


Fig 9.5 Illustration for Body Worn Position

## 9.6. Hotspot Mode Exposure Position Conditions

For handsets that support hotspot mode operations, with wireless router capabilities and various web browsing functions, the relevant hand and body exposure conditions are tested according to the hotspot SAR procedures in KDB 941225. A test separation distance of 10 mm is required between the phantom and all surfaces and edges with a transmitting antenna located within 25 mm from that surface or edge. When the form factor of a handset is smaller than 9 cm x 5 cm, a test separation distance of 5 mm (instead of 10 mm) is required for testing hotspot mode. When the separation distance required for body-worn accessory testing is larger than or equal to that tested for hotspot mode, in the same wireless mode and for the same surface of the phone, the hotspot mode SAR data may be used to support body-worn accessory SAR compliance for that particular configuration (surface).



**Fig 9.6 Illustration for Hotspot Position**



## 10. Measurement Procedures

The measurement procedures are as follows:

### <Conducted power measurement>

- (a) For WWAN power measurement, use base station simulator to configure EUT WWAN transmission in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- (b) Read the WWAN RF power level from the base station simulator.
- (c) For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- (d) Connect EUT RF port through RF cable to the power meter, and measure WLAN/BT output power.

### <SAR measurement>

- (a) Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- (b) Place the EUT in the positions as Appendix D demonstrates.
- (c) Set scan area, grid size and other setting on the DASY software.
- (d) Measure SAR results for the highest power channel on each testing position.
- (e) Find out the largest SAR result on these testing positions of each band.
- (f) Measure SAR results for other channels in worst SAR testing position if the reported SAR of highest power channel is larger than 0.8 W/kg.

According to the test standard, the recommended procedure for assessing the peak spatial-average SAR value consists of the following steps:

- (a) Power reference measurement.
- (b) Area scan.
- (c) Zoom scan.
- (d) Power drift measurement.

### 10.1. Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.



The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

- (a) Extraction of the measured data (grid and values) from the Zoom Scan.
- (b) Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters).
- (c) Generation of a high-resolution mesh within the measured volume.
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid.
- (e) Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface.
- (f) Calculation of the averaged SAR within masses of 1g and 10g.

## 10.2. Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

## 10.3. Area Scan Procedures

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm<sup>2</sup> step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima founding the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE1528-2003.

## 10.4. Zoom Scan Procedures

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m<sup>3</sup> is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side



length of the 10 g cube 21,5mm. The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 5x5x7 (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

## 10.5. SAR Averaged Methods

In DASYS, the interpolation and extrapolation are both based on the modified Quadratic Sheppard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

## 10.6. Power Drift Monitoring

All SAR testing is under the DUT install full charged battery and transmit maximum output power. In DASYS measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of DUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drift more than 5%, the SAR will be retested.

# 11. SAR Test Procedure

## 11.1. General Scan Requirements

Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std. 1528-2013.

		$\leq 3$ GHz	$> 3$ GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 mm $\pm$ 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2)$ mm $\pm$ 0.5 mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$	
Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$		$\leq 2$ GHz: $\leq 15$ mm 2 – 3 GHz: $\leq 12$ mm	3 – 4 GHz: $\leq 12$ mm 4 – 6 GHz: $\leq 10$ mm	
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.		
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$		$\leq 2$ GHz: $\leq 8$ mm 2 – 3 GHz: $\leq 5$ mm*	3 – 4 GHz: $\leq 5$ mm* 4 – 6 GHz: $\leq 4$ mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	$\leq 5$ mm	3 – 4 GHz: $\leq 4$ mm 4 – 5 GHz: $\leq 3$ mm 5 – 6 GHz: $\leq 2$ mm	
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4$ mm	3 – 4 GHz: $\leq 3$ mm 4 – 5 GHz: $\leq 2.5$ mm 5 – 6 GHz: $\leq 2$ mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$ mm	
Minimum zoom scan volume	x, y, z	$\geq 30$ mm	3 – 4 GHz: $\geq 28$ mm 4 – 5 GHz: $\geq 25$ mm 5 – 6 GHz: $\geq 22$ mm	
Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the <i>reported</i> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB Publication 447498 is $\leq 1.4$ W/kg, $\leq 8$ mm, $\leq 7$ mm and $\leq 5$ mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				



## 11.2. Test Procedure

The Following steps are used for each test position

1. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface.
2. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
3. Measurement of the SAR distribution with a grid of 8 to 16mm \* 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
4. Around this point, a cube of 30 \* 30 \* 30 mm or 32 \* 32 \* 32 mm is assessed by measuring 5 or 8 \* 5 or 8\*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

## 11.3. Description of Interpolation/Extrapolation Scheme

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10 grams and 1 gram requires a very fine resolution in the three dimensional scanned data array.

## 11.4. Wireless Router

Some battery-operated handsets have the capability to transmit and receive user through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 v02r01 where SAR test considerations for handsets ( $L \times W \geq 9 \text{ cm} \times 5 \text{ cm}$ ) are based on a composite test separation distance of 10 from the front, back and edges of the device containing transmitting antennas within 2.5cm of their edges,



determined from general mixed use conditions for this type of devices. Since the hotspot SAR results may overlap with the body-worn accessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of both the WIFI transmitter and another licensed transmitter. Both transmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated for SAR under actual use conditions due to the limitations of the SAR assessment probes. Therefore, SAR must be evaluated for each frequency transmission and mode separately and spatially summed with the WIFI transmitter according to FCC KDB Publication 447498 D01v06 publication procedures. The "Portable Hotspot" feature on the handset was NOT activated during SAR assessments, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal at a time.

## 12. SAR Test Configuration

### <WCDMA Mode>

Summary of UMTS conducted power measurement:

1. The 3G SAR test reduction procedure is applied, when the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq \frac{1}{4}$  dB higher than the primary mode, SAR measurement is not required for the secondary mode.
2. The following tests were conducted according to the test requirements outlines in 3GPP TS 34.121 specification.
3. The procedures in KDB 941225 D01v03r01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode(s) to determine SAR test exclusion.
4. For HSPA+ devices supporting 16 QAM in the uplink, power measurements procedure is according to the configurations in Table C.11.1.4 of 3GPP TS 34.121-1.
5. Per KDB 941225 D01v03r01, RMC 12.2kbps setting is used to evaluate SAR. The maximum output power and tune-up tolerance specified for production units in HSDPA / HSUPA / DC-HSDPA / HSPA+ is  $\leq \frac{1}{4}$  dB higher than RMC 12.2Kbps or when the highest reported SAR of the RMC12.2Kbps is scaled by the ratio of specified maximum output power and tune-up tolerance of HSDPA / HSUPA / DC-HSDPA / HSPA+ to RMC12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+, and according to the following RF output power, the output power results of the secondary modes (HSDPA / HSUPA / DC-HSDPA / HSPA+) are less than  $\frac{1}{4}$  dB higher than the primary modes; therefore, SAR measurement is not required for HSDPA / HSUPA / DC-HSDPA / HSPA+.
6. A fixed level power reduction is applied for WCDMA Band II when handset open Hotspot mode, the power reduction triggered.

### HSDPA Setup Configuration

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{hs}^{(1)}$	CM (dB) <sup>(2)</sup>
1	2/15	15/15	64	2/15	4/15	0.0
2	12/15 <sup>(3)</sup>	15/15 <sup>(3)</sup>	64	12/15 <sup>(3)</sup>	24/15	1.0
3	15/15	8/15	64	15/8	30/15	1.5
4	15/15	4/15	64	15/4	30/15	1.5

Note 1:  $\Delta_{ACK}, \Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$   
 Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15, \beta_{hs}/\beta_c = 24/15$ .  
 Note 3: For subtest 2 the  $\beta_c/\beta_d$  ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .



**HSUPA Setup Configuration**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{hs}^{(1)}$	$\beta_{ec}$	$\beta_{ed}$	$\beta_{ed}$ (SF)	$\beta_{ed}$ (codes)	CM <sup>(2)</sup> (dB)	MPR (dB)	AG <sup>(4)</sup> Index	E-TFCI
1	11/15 <sup>(3)</sup>	15/15 <sup>(3)</sup>	64	11/15 <sup>(3)</sup>	22/15	209/225	1039/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	$\beta_{ed1}$ : 47/15 $\beta_{ed2}$ : 47/15	4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15 <sup>(4)</sup>	15/15 <sup>(4)</sup>	64	15/15 <sup>(4)</sup>	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 8 \Leftrightarrow A_{hs} = \beta_{hs}/\beta_c = 30/15 \Leftrightarrow \beta_{hs} = 30/15 * \beta_c$ .

Note 2: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the  $\beta_c/\beta_d$  ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF0) to  $\beta_c = 10/15$  and  $\beta_d = 15/15$ .

Note 4: For subtest 5 the  $\beta_c/\beta_d$  ratio of 15/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF0) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .

Note 5: Testing UE using E-DPDCH Physical Layer category 1 Sub-test 3 is not required according to TS 25.306 Table 5.1g.

Note 6:  $\beta_{ed}$  cannot be set directly; it is set by Absolute Grant Value.

**HSPA+ 3GPP release 7 (uplink category 7) 16QAM, Setup Configuration:**
**Table C.11.1.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH and E-DCH with 16QAM**

Sub-test	$\beta_c$ (Note 3)	$\beta_d$	$\beta_{hs}$ (Note 1)	$\beta_{ec}$	$\beta_{ed}$ (2xSF2) (Note 4)	$\beta_{ed}$ (2xSF4) (Note 4)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 4)	E-TFCI (Note 5)	E-TFCI (boost)
1	1	0	30/15	30/15	$\beta_{ed1}$ : 30/15 $\beta_{ed2}$ : 30/15	$\beta_{ed3}$ : 24/15 $\beta_{ed4}$ : 24/15	3.5	2.5	14	105	105

Note 1:  $\Delta_{ACK}$ ,  $\Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{hs} = 30/15 * \beta_c$ .

Note 2: CM = 3.5 and the MPR is based on the relative CM difference, MPR = MAX(CM-1,0).

Note 3: DPDCH is not configured, therefore the  $\beta_c$  is set to 1 and  $\beta_d = 0$  by default.

Note 4:  $\beta_{ed}$  can not be set directly; it is set by Absolute Grant Value.

Note 5: All the sub-tests require the UE to transmit 2SF2+2SF4 16QAM EDCH and they apply for UE using E-DPDCH category 7. E-DCH TTI is set to 2ms TTI and E-DCH table index = 2. To support these E-DCH configurations DPDCH is not allocated. The UE is signaled to use the extrapolation algorithm.



**DC-HSDPA Setup Configuration**

The following tests were completed according to procedures in section 7.3.13 of 3GPP TS34.108 v9.5.0. A summary of these settings are illustrated below:

Downlink Physical Channels are set as per 3GPP TS34.121-1 v9.0.0 E.5.

**Table E.5.0: Levels for HSDPA connection setup**

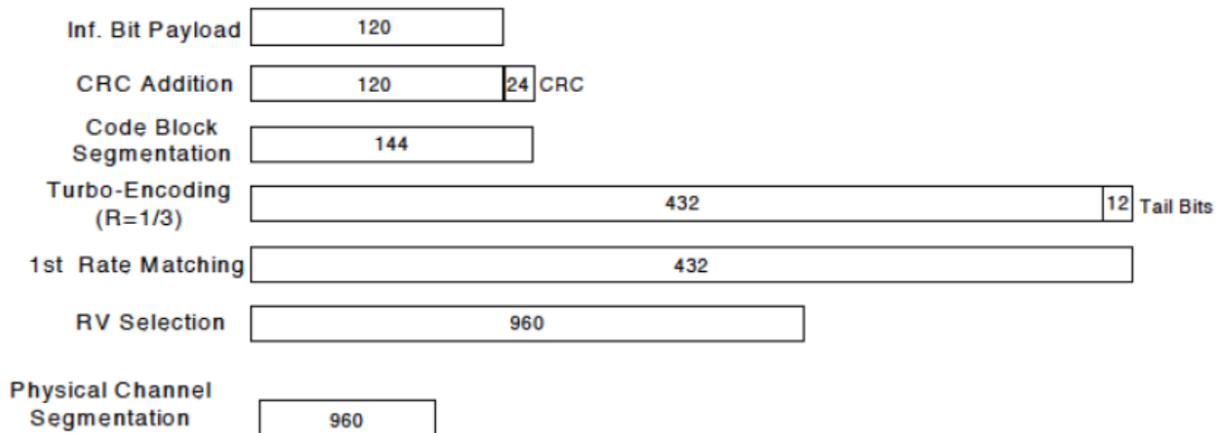
<b>Parameter During Connection setup</b>	<b>Unit</b>	<b>Value</b>
P-CPICH_Ec/lor	dB	-10
P-CCPCH and SCH_Ec/lor	dB	-12
PICH_Ec/lor	dB	-15
HS-PDSCH	dB	off
HS-SCCH_1	dB	off
DPCH_Ec/lor	dB	-5
OCNS_Ec/lor	dB	-3.1

Call is set up as per 3GPP TS34.108 v9.5.0 sub clause 7.3.13

The configurations of the fixed reference channels for HSDPA RF tests are described in 3GPP TS 34.121, annex C for FDD and 3GPP TS 34.122.

**Table C.8.1.12: Fixed Reference Channel H-Set 12**

Parameter	Unit	Value
Nominal Avg. Inf. Bit Rate	kbps	60
inter-TTI Distance	TTI's	1
Number of HARQ Processes	Processes	6
Information Bit Payload ( $N_{INF}$ )	Bits	120
Number Code Blocks	Blocks	1
Binary Channel Bits Per TTI	Bits	960
Total Available SML's in UE	SML's	19200
Number of SML's per HARQ Proc.	SML's	3200
Coding Rate		0.15
Number of Physical Channel Codes	Codes	1
Modulation		QPSK
Note 1: The RMC is intended to be used for DC-HSDPA mode and both cells shall transmit with identical parameters as listed in the table. Note 2: Maximum number of transmission is limited to 1, i.e., retransmission is not allowed. The redundancy and constellation version 0 shall be used.		


**Figure C.8.19: Coding rate for Fixed reference Channel H-Set 12 (QPSK)**



<CDMA Mode>

**1xEV-DO Rev. B**

Call box setup procedure

1xEV-DO Release B

1> CMW 500 Signal Generator > 1xEV-DO Taskbar Enable

2> CMW 500 1xEV-DO Signaling Configuration Window >

3> 1xEV-DO Signaling On Window:

Under Access Network Control:

Band Class: BC0: US Cellular

RF Channel: 31

1xEV-DO Power: -70 dBm

4> 1xEV-DO Signaling Configuration Window

Under RF Frequency Band / Channel: Enter Ch. Frequency

- Under Carrier Configuration: RF Frequency  
For Two Carriers: Low Channel (1013)

	<u>RF Channel</u>	<u>RF Channel Offset</u>
Carrier [0]	31	0
Carrier [1]	1013	982

- Under Carrier Configuration: RF Pilot
- |           | <u>Carrier Sector</u> | <u>Active on AN</u> | <u>Assigned to AT</u> |
|-----------|-----------------------|---------------------|-----------------------|
| Pilot [0] | C0/S0                 | ✓                   | ✓                     |
|           | CA/S1                 | ✓                   | ✓                     |

For Three Carriers: Low Channel (1013)

	<u>RF Channel</u>	<u>RF Channel Offset</u>
Carrier [0]	72	0
Carrier [1]	31	-41
Carrier [2]	1013	941

- Under Carrier Configuration: RF Pilot
- |           | <u>Carrier Sector</u> | <u>Active on AN</u> | <u>Assigned to AT</u> |
|-----------|-----------------------|---------------------|-----------------------|
| Pilot [0] | C0/S0                 | ✓                   | ✓                     |
| Pilot [1] | C1/S1                 | ✓                   | ✓                     |
| Pilot [2] | C2/S2                 | ✓                   | ✓                     |

**<LTE Mode>****LTE Target MPR level**

The device implements maximum power reduction per 3GPP 36.101 requirements where the MPR target is as below table. The MPR settings are implemented configured into firmware and cannot be disabled by the end user or LTE carrier network.

Modulation	Channel bandwidth / Transmission bandwidth configuration [RB]						MPR	3GPP
	1.4	3.0	5	10	15	20	Target	MPR
	MHz	MHz	MHz	MHz	MHz	MHz	(dB)	(dB)
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	1	≤ 1
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	2	≤ 2

**Note:** The measurement result showed some difference from the target MPR level, due to expected 0.5dB measurement tolerance

**LTE Bands**

LTE Bands	Channel bandwidth / Transmission bandwidth configuration [RB]					
	1.4	3.0	5	10	15	20
	MHz	MHz	MHz	MHz	MHz	MHz
2	√	√	√	√	√	√
4	√	√	√	√	√	√
5	√	√	√	√	N/A	N/A
7	N/A	N/A	√	√	√	√
12	√	√	√	√	N/A	N/A
14	N/A	N/A	√	√	N/A	N/A
26	√	√	√	√	√	N/A
38	N/A	N/A	√	√	√	√
40	N/A	N/A	√	√	N/A	N/A
41	N/A	N/A	√	√	√	√
66	√	√	√	√	√	√

**Note:**

1. Per KDB 941225 D05v02r05, when a properly configured base station simulator is used for the SAR and power measurements, spectrum plots for each RB allocation and offset configuration is not required.
2. Per KDB 941225 D05v02r05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
3. Per KDB 941225 D05v02r05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.



4. Per KDB 941225 D05v02r05, for QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8$  W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is  $> 1.45$  W/kg, the remaining required test channels must also be tested.
5. Per KDB 941225 D05v02r05, 16QAM/64QAM output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is  $\leq 1.45$  W/kg; Per KDB941225 D05v02r05, 16QAM/64QAM SAR testing is not required.
6. Per KDB 941225 D05v02r05, smaller bandwidth output power for each RB allocation configuration is  $>$  not  $\frac{1}{2}$  Db higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported band width is  $\leq 1.45$  W/kg; Per KDB 941225 D05v02r05, smaller bandwidth SAR testing is not required.
7. For LTE B4 / B5 / B7 / B17 the maximum bandwidth does not support three non-overlapping channels, per KDB941225 D05v02r05, when a device supports overlapping channel assignment in a channel bandwidth configuration, the middle channel of the group of overlapping channels should be selected for testing.
8. LTE band 2 / 12 SAR test was covered by Band 25 / 17; according to April 2015 TCB workshop, SAR test for overlapping LTE bands can be reduced if
  - a. The maximum output power, including tolerance, for the smaller band is  $\leq$  the larger band to qualify for the SAR test exclusion.
  - b. The channel bandwidth and other operating parameters for the smaller band are fully supported by the larger band.
9. According to 2017 TCB workshop, for 64 QAM and 16 QAM should be verified by checking the signal constellation with a call box to avoid incorrect maximum power levels due to MPR and other requirements associated with signal modulation, and the following figure is taken from the "Fundamental Measurement >> Modulation Analysis >> constellation" mode of the device connect to the CMW500 base station, therefore, the device 64QAM and 16QAM signal modulation are correct. Identify if Maximum Power Reduction (MPR) is optional or mandatory, i.e. built-in by design: only mandatory MPR may be considered during SAR testing, when the maximum output power is permanently limited by the MPR implemented within the UE; and only for the applicable RB (resource block) configurations specified in LTE standards: b) A-MPR (additional MPR) must be disabled.
10. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to " $1/(\text{duty cycle})$ "





- c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor
  - d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor
  - e. For TDD LTE SAR measurement, the duty cycle 1:1.59 (62.9 %) was used perform testing and considering the theoretical duty cycle of 63.3% for extended cyclic prefix in the uplink, and the theoretical duty cycle of 62.9% for normal cyclic prefix in uplink, a scaling factor of extended cyclic prefix  $63.3\%/62.9\% = 1.006$  is applied to scale-up the measured SAR result. The Reported TDD LTE SAR = measured SAR (W/kg)\* Tune-up Scaling Factor\* scaling factor for extended cyclic prefix.
11. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:  $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz  $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz  $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
  12. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$ W/kg.
  13. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is  $\leq 1.2$  W/kg, SAR testing with a headset connected to the handset is not required.

#### <WLAN 2.4GHz>

1. SAR is measured for 2.4 GHz 802.11b DSSS using either the fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:
  - a. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8$  W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.
  - b. When the reported SAR is  $> 0.8$  W/kg, SAR is required for that position using the next highest measured output power channel. When any reported SAR is  $> 1.2$  W/kg, SAR is required for the third channel; i.e., all channels require testing.
2. 2.4 GHz 802.11 g/n OFDM are additionally evaluated for SAR if the highest reported SAR for 802.11b, adjusted by the ratio of the OFDM to DSSS specified maximum output power, is  $> 1.2$  W/kg. When SAR is required for OFDM modes in 2.4 GHz band, the Initial Test configuration Procedures should be followed.
3. For held-to-ear and hotspot operations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When reported SAR for the initial test position is  $\leq 0.4$  W/kg, no additional testing for the remaining test positions was required. Otherwise, SAR is evaluated at the subsequent highest peak SAR



positions until the reported SAR result is  $\leq 0.8$  W/kg or all test positions are measured.

4. Justification for test configurations for WLAN per KDB Publication 248227 D02DR02-41929 for 2.4 GHz WI-FI single transmission chain operations, the highest measured maximum output power channel for DSSS was selected for SAR measurement. SAR for OFDM modes (2.4 GHz 802.11g/n) was not required due to the maximum allowed powers and the highest reported DSSS SAR.
5. A fixed level power reduction is applied for WiFi when handset operates "held to the body" condition or "held to the ear" condition, the power reduction triggered by audio receiver detection and call establish status.
6. Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:
  - a. When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
  - b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg.

## <WLAN 5GHz>

### A) U-NII-1 and U-NII-2A Bands

For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following:

1. When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is  $\leq 1.2$  W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.
2. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.
3. The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50.
4. Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is  $> 1.2$  W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not



required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

#### **B) U-NII-2C and U-NII-3 Bands**

The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. when Terminal Doppler Weather Radar (TDWR) restriction applies, all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures. When the same transmitter and antenna(s) are used for U-NII-2C band and U-NII-3 band or 5.8 GHz band of §15.247, the bands may be aggregated to enable additional channels with 20, 40 or 80 MHz bandwidth to span across the band gap, as illustrated in Appendix B. The maximum output power for the additional band gap channels is limited to the lower of those certified for the bands. Unless band gap channels are permanently disabled, they must be considered for SAR testing. The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

#### **C) OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements**

The initial test configuration for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.

1. The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
2. If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
3. If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.





4. When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n. After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.
5. The channel closest to mid-band frequency is selected for SAR measurement.
6. For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

#### **D) SAR Test Requirements for OFDM configurations**

When SAR measurement is required for 802.11 a/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 bands are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

## 13. Conducted Power List

Remark: The output power of WWAN/WLAN was recorded in annex E of this report.

## 14. Carrier Aggregation

### 14.1. LTE Uplink Carrier Aggregation

➤ **Carrier Aggregation Configuration**

<Inter-band>

2CC Uplink Carrier Aggregation				
No.	Combination	MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_12A-66A	-	-	No
2	CA_14A-66A	-	-	No
3	CA_2A-12A	-	-	No
4	CA_2A-14A	-	-	No
5	CA_2A-5A	-	-	No
6	CA_5A-66A	-	-	No
7	CA_2A-66A	-	-	No

**Note:**

According to October 2018 TCB Workshop publication, LTE uplink CA SAR assessment should follow:

- a. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
- b. If one or the signal uplink 1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
- c. If the algebraic sum of the 1-g SAR values is > 1.45 W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance. And PAG is required for this case.



## 14.2. LTE Downlink Carrier Aggregation

### ➤ Carrier Aggregation Configuration

For the device supports bands and bandwidths and configurations are provided as follow table was according to 3GPP.

2CC Downlink Carrier Aggregation				
No.	Combination	4G 4 X4 DL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_12A-66A	-	-	3CC-1
2	CA_14A-66A	-	-	3CC-2
3	CA_29A-66A	-	-	No
4	CA_2A-12A	-	-	3CC-3
5	CA_2A-14A	-	-	3CC-4
6	CA_2A-29A	-	-	3CC-11
7	CA_2A-2A	-	-	3CC-7
8	CA_2A-5A	-	-	3CC-8
9	CA_2A-66A	-	-	3CC-9
10	CA_5A-66A	-	-	3CC-10
11	CA_5B	-	-	No
12	CA_66A-66A	-	-	No
13	CA_7A-29A	-	-	No
14	CA_7A-7A	-	-	No
15	CA_7C	-	-	No
16	CA_5A-7A	-	-	3CC-14
17	CA_7A-12A	-	-	No

3CC Downlink Carrier Aggregation				
No.	Combination	4G 4 X4 DL MIMO	Restriction	Completely Covered by Measurement Superset
1	CA_12A-66A-66A	-	-	No
2	CA_14A-66A-66A	-	-	No
3	CA_2A-12A-66A	-	-	No
4	CA_2A-14A-66A	-	-	No
5	CA_2A-2A-12A	-	-	No
6	CA_2A-2A-14A	-	-	No
7	CA_2A-2A-66A	-	-	No
8	CA_2A-5A-66A	-	-	No
9	CA_2A-66A-66A	-	-	No



10	CA_5A-66A-66A	-	-	No
11	CA_2A-29A-66A	-	-	No
12	CA_2A-2A-4A	-	-	No
13	CA_2A-2A-5A	-	-	No
14	CA_5A-7A-7A	-	-	No

➤ **LTE Downlink Carrier Aggregation Conducted Power**

1. According to KDB941225 D05A v01r02, Uplink maximum output power measurement with downlink carrier aggregation active should be measured, using the highest output channel measured without downlink carrier aggregation, to confirm that uplink maximum output power with downlink carrier aggregation active remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output measured without downlink carrier aggregation active.
2. Uplink maximum output power with downlink carrier aggregation active does not show more than ¼ dB higher than the maximum output power without downlink carrier aggregation active, therefore SAR evaluation with downlink carrier aggregation active can be excluded.
3. For power measurement were control and acknowledge data is sent on uplink channels that operate identical to specifications when downlink carrier aggregation is inactive.
4. Selected highest measured power when downlink carrier aggregation is inactive for conducted power comparison with downlink carrier aggregation is active, to confirm that when downlink carrier aggregation is active uplink maximum output power remains within the specified tune-up tolerance limits and not more than ¼ dB higher than the maximum output power measured when downlink carrier aggregation inactive.
5. For non-contiguous intra-band CA, the SCC selected to provide maximum separation from the PCC and must remain fully within the downlink transmission band.
6. For Intra-band, contiguous CA, the downlink channels selected to perform the uplink power measurement must satisfy
7. 3GPP channel spacing (5.4.1A of 3GPP TS 36.521 or equivalent) and channel bandwidth (5.4.2A) requirements.

$$\text{Nominal channel spacing} = \left\lceil \frac{BW_{\text{Channel}(1)} + BW_{\text{Channel}(2)} - 0.1|BW_{\text{Channel}(1)} - BW_{\text{Channel}(2)}|}{0.6} \right\rceil 0.3 \text{ [MHz]}$$

8. The output power of CA uplink & downlink was recorded in annex E of this report.

## 15. 5G NR EN-DC Consideration

### ➤ General Guidance

1. It is limited to operate at EN-DC (NSA)/SA for 5G NR implementation according to the character of the device. SAR measurement should be performed separately for the limitations of the probe calculation factors.
2. When the EN-DC is active the output power of the LTE anchors is equal or less than the standalone carrier, therefore the LTE output power and SAR were estimated based on the standalone carrier to performed sim-TX analysis with 5G NR, WLAN and Bluetooth.
3. According to October 2020 TCB Workshop publication, EN-DC SAR assessment should follow:
  - a. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
  - b. If one or the signal uplink 1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
  - c. If the algebraic sum of the 1-g SAR values is  $> 1.45$  W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance and PAG is required for this case.
  - d. When the algebraic sum of the 1-g SAR values is  $> 1.6$  W/kg, SPLSR analysis procedure should be applied.

### ➤ 5G NR Anchor Combination

5G-NR	EN-DC Combination	LTE Uplink	5G-NR Uplink	SCS (kHz)	Maximum Bandwidth (MHz)
FDD	DC_12A_n2A	12A	n2A	15	20
FDD	DC_12A_n66A	12A	n66A	15	20
TDD	DC_12A_n77A	12A	n77A	30	100
FDD	DC_12A-66A_n2A	12A/66A	n2A	15	20
FDD	DC_12A-66A_n66A	12A/66A	n66A	15	20
FDD	DC_14A_n2A	14A	n2A	15	20
FDD	DC_14A_n66A	14A	n66A	15	20
TDD	DC_14A_n77A	14A	n77A	30	100
FDD	DC_14A-66A_n2A	14A/66A	n2A	15	20
FDD	DC_14A-66A_n66A	14A/66A	n66A	15	20
FDD	DC_29A-66A_n2A	66A	n2A	15	20
FDD	DC_2A_n5A	2A	n5A	15	20
FDD	DC_2A_n66A	2A	n66A	15	20



TDD	DC_2A_n77A	2A	n77A	30	100
FDD	DC_2A-12A_n2A	2A/12A	n2A	15	20
FDD	DC_2A-12A_n66A	2A/12A	n66A	15	20
FDD	DC_2A-14A_n2A	2A/14A	n2A	15	20
FDD	DC_2A-14A_n66A	2A/14A	n66A	15	20
FDD	DC_2A-29A_n66A	2A	n66A	15	20
FDD	DC_2A-2A_n5A	2A	n5A	15	20
FDD	DC_2A-2A_n66A	2A	n66A	15	20
TDD	DC_2A-2A_n77A	2A	n77A	30	100
FDD	DC_2A-5A_n2A	2A/5A	n2A	15	20
FDD	DC_2A-5A_n66A	2A/5A	n66A	15	20
FDD	DC_2A-66A_n2A	2A/66A	n2A	15	20
FDD	DC_2A-66A_n5A	2A/66A	n5A	15	20
FDD	DC_2A-66A_n66A	2A/66A	n66A	15	20
FDD	DC_5A_n2A	5A	n2A	15	20
FDD	DC_5A_n66A	5A	n66A	15	20
TDD	DC_5A_n77A	5A	n77A	30	100
FDD	DC_5A-66A_n2A	5A/66A	n2A	15	20
FDD	DC_5A-66A_n66A	5A/66A	n66A	15	20
FDD	DC_66A_n2A	66A	n2A	15	20
FDD	DC_66A_n5A	66A	n5A	15	20
TDD	DC_66A_n77A	66A	n77A	30	100
FDD	DC_66A-66A_n5A	66A	n5A	15	20
TDD	DC_66A-66A_n77A	66A	n77A	30	100
TDD	DC_7A_n77A	7A	n77A	30	100
TDD	DC_7A-7A_n77A	7A	n77A	30	100
TDD	DC_7C_n77A	7A	n77A	30	100
FDD	DC_66A-66A_n2A	66A	n2A	15	20

➤ **Maximum Power for EN-DC**

EN-DC Configuration	LTE Signal Carrier				5G NR			
	Band	BW (MHz)	Maximum Power(dBm)		Band	BW (MHz)	Maximum Power(dBm)	
			Standalone	EN-DC Active			Standalone	EN-DC Active
DC_12A_n2A	12	10	24.5	24.5	n2	20	/	24
DC_12A_n66A	12	10	24.5	24.5	n66	20	/	24
DC_12A_n77A	12	10	24.5	24.5	n77	100	28.5	17



DC_14A_n2A	14	10	22	22	n2	20	/	24
DC_14A_n66A	14	10	22	22	n66	20	/	24
DC_14A_n77A	14	10	22	22	n77	100	28.5	17
DC_2A_n5A	2	20	/	24	n5	20	20	20
DC_2A_n66A	2	20	/	24	n66	20	19	19
DC_2A_n77A	2	20	17	17	n77	100	28.5	17
DC_5A_n2A	5	10	22	22	n2	20	/	24
DC_5A_n66A	5	10	22	22	n66	20	/	24
DC_5A_n77A	5	10	22	22	n77	100	28.5	17
DC_66A_n2A	66	20	/	24	n2	20	19	19
DC_66A_n5A	66	20	/	24	n5	20	20	20
DC_66A_n77A	66	20	20	20	n77	100	28.5	17
DC_7A_n77A	7	20	24	24	n77	100	28.5	17



## 16. Hotspot Mode Evaluation Procedure

### ➤ EUT Antenna Location

The location of antenna was recorded in annex B

ANT1:

TRX: WCDMA Band II/IV, LTE Band 2/4/66, 5G NR n2/66

PRX MIMO: LTE Band 7/38/40/41

ANT2:

TRX: WCDMA Band V, LTE Band 5/12/14/26/29(RX), 5G NR n5

ANT3:

PRX MIMO: WCDMA Band II/IV, LTE Band 2/4/66, 5G NR n2/66

DRX MIMO: 5G NR n77

ANT 4:

DRX MIMO: WCDMA Band II/IV, LTE Band 2/4/7/38/40/41/66, 5G NR n2/66

PRX MIMO: 5G NR n77

ANT 5:

TX1/DRX(only CA/NSA support UL TX): LTE Band 2/4/66, 5G NR n2/66

RX: LTE Band 5/12/14/26/29, 5G NR n5

ANT 6: GPS L1

ANT 7: WLAN 2.4GHz/5GHz; Bluetooth

ANT 8: TRX: LTE Band 7/38/40/41

RX: 5G NR n77

ANT 9: GPS L5

ANT 10: TX: 5G NR n77



**➤ EUT Antenna Distance**

Antenna Location	Front	Back	Left	Right	Top	Bottom
ANT 1	<5mm	<5mm	<5mm	>25mm	<5mm	>25mm
ANT 2	<5mm	<5mm	<25mm	<25mm	<5mm	>25mm
ANT 5	<5mm	<5mm	<5mm	<25mm	>25mm	<5mm
ANT 7	<5mm	<5mm	>25mm	<5mm	<25mm	>25mm
ANT 8	<5mm	<5mm	<5mm	>25mm	>25mm	>25mm
ANT 10	<5mm	<5mm	<5mm	>25mm	>25mm	>25mm

**➤ Hotspot Evaluation**

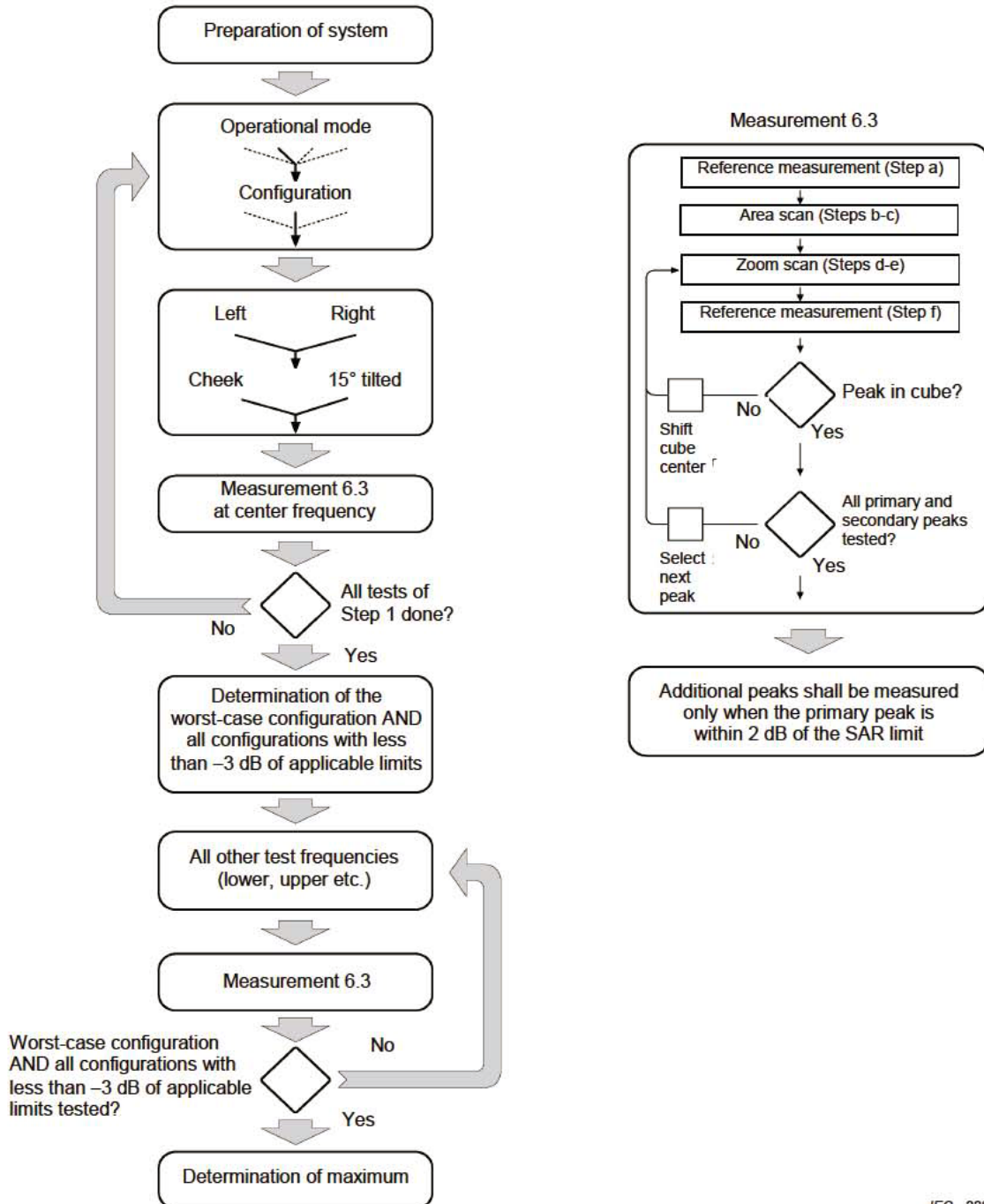
Assessment	Hotspot Side for SAR Test Distance: 10mm					
Antennas	Front	Back	Left	Right	Top	Bottom
ANT 1	Yes	Yes	Yes	No	Yes	No
ANT 2	Yes	Yes	Yes	Yes	Yes	No
ANT 5	Yes	Yes	Yes	Yes	No	Yes
ANT 7	Yes	Yes	No	Yes	Yes	No
ANT 8	Yes	Yes	Yes	No	No	No
ANT 10	Yes	Yes	Yes	No	No	No

**Note :**

1. The SAR evaluation procedures for Portable Devices with Wireless Router function is according to KDB 941225 D06 Hotspot SAR v02r01.
2. Head/Body-worn/Hotspot mode SAR assessments are required.
3. Referring to KDB 941225 D06, when the overall device length and width are  $\geq 9\text{cm} \times 5\text{cm}$ , the test distance is 10 mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.
4. For WWAN bands, all of surface or edges would be tested except the bottom side of ANT 1 & 2 & 8 & 10 and top side of ANT 5 in this report.
5. For WLAN bands, all of surface or edges would be tested except the bottom side in this report.

# 17. Block Diagram of the Tests to be Performed

## 17.1. Head



IEC 228/05

## 17.2. Body

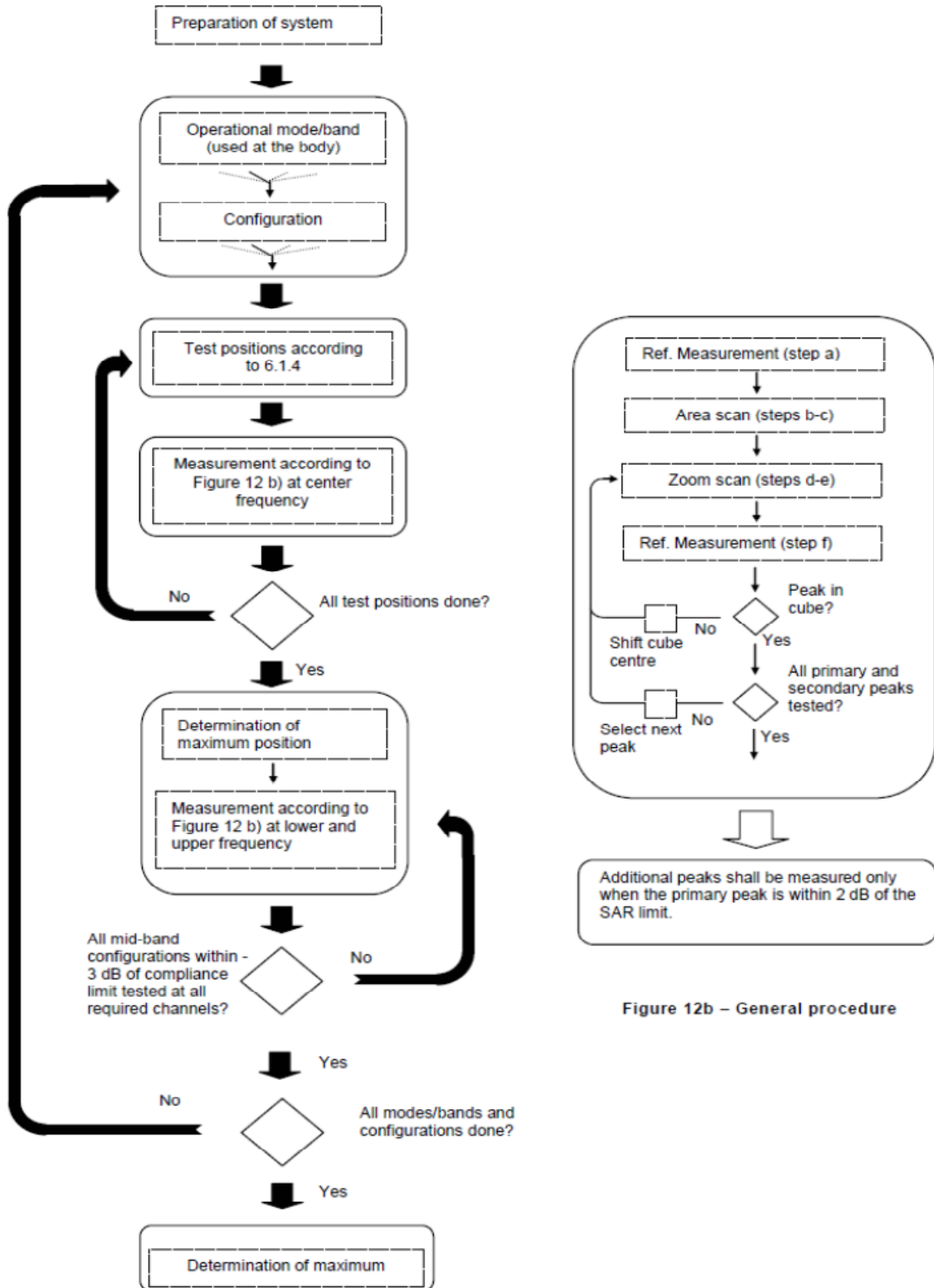


Figure 12b – General procedure

## 18. Proximity Sensor Considerations

### 18.1. Proximity Sensor Triggering Distances

#### ➤ P-sensor Triggering Distance Testing

The EUT should be moved further away from and toward the flat phantom that fill with the tissue simulating liquid to determine the proximity sensor triggering distances. Conducted power is monitored qualitatively to identify the general triggering characteristics and recorded quantitatively, versus spacing, as required by the procedures.

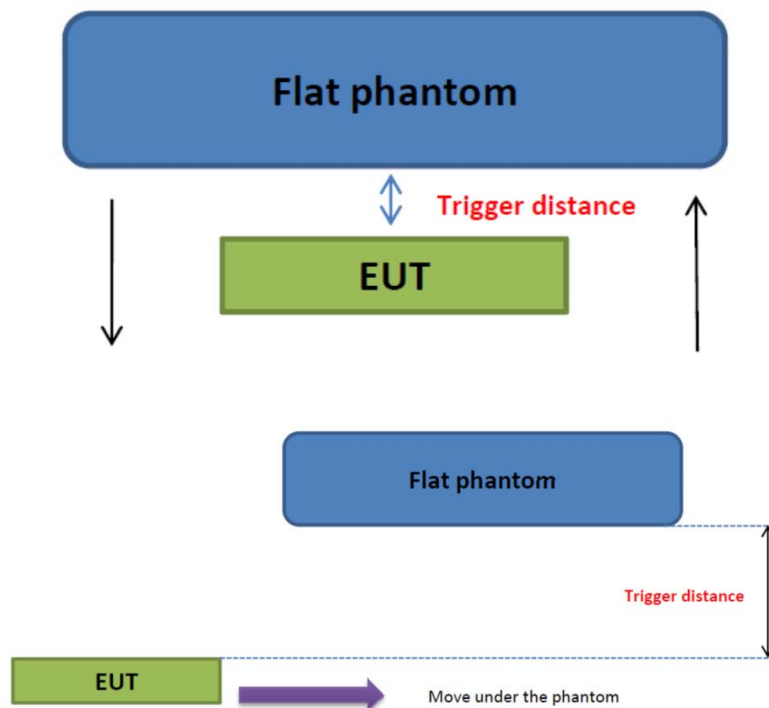


Fig.19.1 Illustration for proximity sensor trigger

#### ➤ P-sensor Triggering Distance

##### <Top Antenna>

Proximity Sensor Trigger Distance (mm)						
Exposure Position	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Minimum	16	16	11	11	11	/

##### <Bottom Antenna>

Proximity Sensor Trigger Distance (mm)						
Exposure Position	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Minimum	16	16	11	/	/	17



## 18.2. Proximity Sensor Coverage

Proximity sensors are not normally designed to cover the entire back surface or edges of the 5G smart phone. The sensing regions are usually limited to areas near the sensor element. If a sensor is spatially offset from the antenna(s), it is necessary to verify sensor triggering for conditions where the antenna is next to the user but the sensor is laterally further away to ensure sensor coverage is sufficient for reducing the power to maintain compliance. For P-sensor coverage testing, the device is moved and “along the direction of maximum antenna and sensor offset”. Illustrating in the internal photo exhibit, although the sensor spatially offset, there is no trigger condition where the antenna is next to the user, the sensor is laterally further away, therefore proximity sensor coverage testing is not required. This procedure is not required since the antenna, sensor and peak SAR location is overlapped with the sensor.



## 19. Test Results List

### 19.1. Test Guidance

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
  - a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
  - b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)".
  - c. For WWAN: Reported SAR(W/kg)= Measured SAR(W/kg)\*Tune-up Scaling Factor.
  - d. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)\* Duty Cycle scaling factor \* Tune-up scaling factor.
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - a.  $\leq 0.8$  W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\leq 100$  MHz
  - b.  $\leq 0.6$  W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - c.  $\leq 0.4$  W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is  $\geq 200$  MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is  $\geq 0.8$ W/kg.
4. Per KDB 648474 D04v01r03, when the reported SAR for a body-worn accessory measured without a headset connected to the handset is  $\leq 1.2$  W/kg, SAR testing with a headset connected to the handset is not required.
5. Per KDB648474 D04v01r03, for smart phones with a display diagonal dimension  $> 15.0$  cm or an overall diagonal dimension  $> 16.0$  cm, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR  $> 1.2$  W/kg, however, when power reduction applies to hotspot mode the measured SAR must be scaled to the maximum output power, including tolerance, allowed for tablet modes to compare with the 1.2 W/kg SAR test reduction threshold.
6. Per KDB248227 D01v02r02, a Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies required for operations in the U.S. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic



transmission duty factor is required for current generation SAR systems to measure SAR correctly. Unless it is permitted by specific KDB procedures or continuous transmission is specifically restricted by the device, the reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit. When a device is not capable of sustaining continuous transmission or the output can become nonlinear, and it is limited by hardware design and unable to transmit at higher than 85% duty factor, a periodic duty factor within 15% of the maximum duty factor the device is capable of transmitting should be used. The reported SAR must be scaled to the maximum transmission duty factor to determine compliance. Descriptions of the procedures applied to establish the specific duty factor used for SAR testing are required in SAR reports to support the test results.

7. The LTE Band 2/4/66 and 5G NR n2/66 in antenna 5 are TX only when CA or ENDC is in use and do not support independent transmission.
8. When this device is proximity to human the sensor will be active automatically and the reduced power level 1&2 of WWAN applied.
9. The reduced power level 2 of WWAN will be applied to CA /EN-DC /simultaneous transmission.
10. The Power level condition applied should be follow:

Transmission Condition	Wireless System	Antenna	Head & Body
Standalone	WCDMA II	ANT 1	Reduced Power Level 1
	WCDMA IV	ANT 1	Reduced Power Level 1
	WCDMA V	ANT 2	Reduced Power Level 1
	LTE Band 2	ANT 1	Reduced Power Level 1
	LTE Band 5	ANT 2	Reduced Power Level 1
	LTE Band 7	ANT 8	Full Power
	LTE Band 12	ANT 2	Full Power
	LTE Band 14	ANT 2	Reduced Power Level 1
	LTE Band 26	ANT 2	Reduced Power Level 1
	LTE Band 38	ANT 8	Full Power
	LTE Band 40	ANT 8	Full Power
	LTE Band 41	ANT 8	Full Power
	LTE Band 66/4	ANT 1	Reduced Power Level 1
	n2	ANT 1	Reduced Power Level 1
	n5	ANT 2	Reduced Power Level 1
	n66	ANT 1	Reduced Power Level 1
	n77A (PC2)	ANT 10	Reduced Power Level 1
	n77A (PC3)	ANT 10	Full Power
	n77B (PC2)	ANT 10	Full Power



	n77B (PC3)	ANT 10	Full Power
	WLAN	ANT 7	Full Power
	Bluetooth	ANT 7	Full Power

Transmission Condition	Wireless System	Antenna	Head & Body
CA/EN-DC/ Simultaneous	WCDMA II	ANT 1	Reduced Power Level 1
	WCDMA IV	ANT 1	Reduced Power Level 1
	WCDMA V	ANT 2	Reduced Power Level 1
	LTE Band 2	ANT 1	Reduced Power Level 1
		ANT 5	Full Power
	LTE Band 5	ANT 2	Reduced Power Level 1
	LTE Band 7	ANT 8	Full Power
	LTE Band 12	ANT 2	Full Power
	LTE Band 14	ANT 2	Reduced Power Level 1
	LTE Band 26	ANT 2	Reduced Power Level 1
	LTE Band 38	ANT 8	Full Power
	LTE Band 40	ANT 8	Full Power
	LTE Band 41	ANT 8	Full Power
	LTE Band 66/4	ANT 1	Reduced Power Level 1
		ANT 5	Full Power
	n2	ANT 1	Reduced Power Level 1
		ANT 5	Full Power
	n5	ANT 2	Reduced Power Level 1
	n66	ANT 1	Reduced Power Level 1
		ANT 5	Reduced Power Level 2
	n77A (PC2)	ANT 10	Reduced Power Level 2
	n77A (PC3)	ANT 10	Reduced Power Level 2
	n77B (PC2)	ANT 10	Reduced Power Level 2
	n77B (PC3)	ANT 10	Reduced Power Level 2
WLAN	ANT 7	Full Power	
Bluetooth	ANT 7	Full Power	





11. The 5G NR (NSA) SAR measurement procedure should be followed the TCB workshop publication in October 2020:
  - a. If the signal uplink 1-g SAR values for each band are both less than 0.8 W/kg and the algebraic summation of the 1-g SAR values are less than 1.45 W/kg no additional measurements need to be performed.
  - b. If one or the signal uplink 1-g SAR values is greater than 0.8 W/kg, instead of algebraically summing the 1-g SAR values, sum up the SAR distributions, similar to the enlarged zoom scan (volume scan) procedures found in FCC KDB Publication 865664 D01. And PAG is required for this case.
  - c. If the algebraic sum of the 1-g SAR values is > 1.45 W/kg additional measurements may have to be made. Submit a KDB inquiry for additional guidance and PAG is required for this case.
  - d. When the algebraic sum of the 1-g SAR values is > 1.6 W/kg, SPLSR analysis procedure should be applied.

## 19.2. Head SAR Data

### ➤ WCDMA Head SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
1#	Band II/RMC 12.2Kbps	Right Cheek	9400	16.32	17.00	1.169	0.605	0.708
	Band II/RMC 12.2Kbps	Right Tilt	9400	16.32	17.00	1.169	0.245	0.287
	Band II/RMC 12.2Kbps	Left Cheek	9400	16.32	17.00	1.169	0.203	0.238
	Band II/RMC 12.2Kbps	Left Tilt	9400	16.32	17.00	1.169	0.322	0.377
Sensor on/Reduced Power Level 1 (ANT 1)								
2#	Band IV/RMC 12.2Kbps	Right Cheek	1413	19.44	20.00	1.138	0.712	0.810
	Band IV/RMC 12.2Kbps	Right Tilt	1413	19.44	20.00	1.138	0.381	0.433
	Band IV/RMC 12.2Kbps	Left Cheek	1413	19.44	20.00	1.138	0.320	0.364
	Band IV/RMC 12.2Kbps	Left Tilt	1413	19.44	20.00	1.138	0.305	0.347
	Band IV/RMC 12.2Kbps	Right Cheek	1312	19.42	20.00	1.143	0.681	0.778
	Band IV/RMC 12.2Kbps	Right Cheek	1513	19.36	20.00	1.159	0.675	0.782
Sensor on/Reduced Power Level 1 (ANT 2)								
	Band V/RMC 12.2Kbps	Right Cheek	4182	21.47	22.00	1.130	0.891	1.007
	Band V/RMC 12.2Kbps	Right Tilt	4182	21.47	22.00	1.130	0.733	0.829
	Band V/RMC 12.2Kbps	Left Cheek	4182	21.47	22.00	1.130	0.827	0.934
	Band V/RMC 12.2Kbps	Left Tilt	4182	21.47	22.00	1.130	0.751	0.848



	Band V/RMC 12.2Kbps	Right Cheek	4132	21.29	22.00	1.178	0.830	0.977
3#	Band V/RMC 12.2Kbps	Right Cheek	4233	21.45	22.00	1.135	0.900	1.022
	Band V/RMC 12.2Kbps	Right Tilt	4132	21.29	22.00	1.178	0.718	0.846
	Band V/RMC 12.2Kbps	Right Tilt	4233	21.45	22.00	1.135	0.682	0.774
	Band V/RMC 12.2Kbps	Left Cheek	4132	21.29	22.00	1.178	0.674	0.794
	Band V/RMC 12.2Kbps	Left Cheek	4233	21.45	22.00	1.135	0.800	0.908
	Band V/RMC 12.2Kbps	Left Tilt	4132	21.29	22.00	1.178	0.662	0.780
	Band V/RMC 12.2Kbps	Left Tilt	4233	21.45	22.00	1.135	0.638	0.724

➤ **LTE QPSK Head SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
4#	LTE Band 2/1RB#0 20M	Right Cheek	18900	15.91	17.00	1.285	0.507	0.652
	LTE Band 2/1RB#0 20M	Right Tilt	18900	15.91	17.00	1.285	0.176	0.226
	LTE Band 2/1RB#0 20M	Left Cheek	18900	15.91	17.00	1.285	0.159	0.204
	LTE Band 2/1RB#0 20M	Left Tilt	18900	15.91	17.00	1.285	0.235	0.302
	LTE Band 2/50RB#0 20M	Right Cheek	18900	14.90	16.00	1.288	0.473	0.609
	LTE Band 2/50RB#0 20M	Right Tilt	18900	14.90	16.00	1.288	0.160	0.206
	LTE Band 2/50RB#0 20M	Left Cheek	18900	14.90	16.00	1.288	0.145	0.187
	LTE Band 2/50RB#0 20M	Left Tilt	18900	14.90	16.00	1.288	0.214	0.275
Sensor off/Full Power for CA/ENDC (ANT 5)								
	LTE Band 2/1RB#0 20M	Right Cheek	18900	22.91	24.00	1.285	0.026	0.033
	LTE Band 2/1RB#0 20M	Right Tilt	18900	22.91	24.00	1.285	0.006	0.008
	LTE Band 2/1RB#0 20M	Left Cheek	18900	22.91	24.00	1.285	0.013	0.017
	LTE Band 2/1RB#0 20M	Left Tilt	18900	22.91	24.00	1.285	0.004	0.005
	LTE Band 2/50RB#0 20M	Right Cheek	18900	21.90	23.00	1.288	0.018	0.023
	LTE Band 2/50RB#0 20M	Right Tilt	18900	21.90	23.00	1.288	0.004	0.005
	LTE Band 2/50RB#0 20M	Left Cheek	18900	21.90	23.00	1.288	0.009	0.012
	LTE Band 2/50RB#0 20M	Left Tilt	18900	21.90	23.00	1.288	0.003	0.004
Sensor on/Reduced Power Level 1 (ANT 2)								
	LTE Band 5/1RB#0 10M	Right Cheek	20525	21.32	22.00	1.169	0.859	1.005
	LTE Band 5/1RB#0 10M	Right Tilt	20525	21.32	22.00	1.169	0.694	0.812
	LTE Band 5/1RB#0 10M	Left Cheek	20525	21.32	22.00	1.169	0.775	0.906
	LTE Band 5/1RB#0 10M	Left Tilt	20525	21.32	22.00	1.169	0.709	0.829
	LTE Band 5/1RB#0 10M	Right Cheek	20450	21.04	22.00	1.247	0.803	1.001
5#	LTE Band 5/1RB#0 10M	Right Cheek	20600	21.28	22.00	1.180	0.892	1.053
	LTE Band 5/1RB#0 10M	Right Tilt	20450	21.04	22.00	1.247	0.641	0.800



	LTE Band 5/1RB#0 10M	Right Tilt	20600	21.28	22.00	1.180	0.598	0.706
	LTE Band 5/1RB#0 10M	Left Cheek	20450	21.04	22.00	1.247	0.716	0.893
	LTE Band 5/1RB#0 10M	Left Cheek	20600	21.28	22.00	1.180	0.783	0.924
	LTE Band 5/1RB#0 10M	Left Tilt	20450	21.04	22.00	1.247	0.597	0.745
	LTE Band 5/1RB#0 10M	Left Tilt	20600	21.28	22.00	1.180	0.669	0.790
	LTE Band 5/25RB#0 10M	Right Cheek	20525	20.04	21.00	1.247	0.751	0.937
	LTE Band 5/25RB#0 10M	Right Tilt	20525	20.04	21.00	1.247	0.631	0.787
	LTE Band 5/25RB#0 10M	Left Cheek	20525	20.04	21.00	1.247	0.704	0.878
	LTE Band 5/25RB#0 10M	Left Tilt	20525	20.04	21.00	1.247	0.645	0.805
	LTE Band 5/25RB#0 10M	Right Cheek	20450	19.91	21.00	1.285	0.711	0.914
	LTE Band 5/25RB#0 10M	Right Cheek	20600	19.84	21.00	1.306	0.685	0.895
	LTE Band 5/25RB#0 10M	Left Cheek	20450	19.91	21.00	1.285	0.650	0.835
	LTE Band 5/25RB#0 10M	Left Cheek	20600	19.84	21.00	1.306	0.594	0.776
	LTE Band 5/25RB#0 10M	Left Tilt	20450	19.91	21.00	1.285	0.672	0.864
	LTE Band 5/25RB#0 10M	Left Tilt	20600	19.84	21.00	1.306	0.680	0.888
	<b>LTE Band 5/50RB#0 10M</b>	Right Cheek	20600	21.28	22.00	1.180	0.826	0.975
Sensor off/Full Power (ANT 8)								
	LTE Band 7/1RB#0 20M	Right Cheek	21350	22.94	24.00	1.276	0.227	0.290
	LTE Band 7/1RB#0 20M	Right Tilt	21350	22.94	24.00	1.276	0.042	0.054
6#	LTE Band 7/1RB#0 20M	Left Cheek	21350	22.94	24.00	1.276	0.270	0.345
	LTE Band 7/1RB#0 20M	Left Tilt	21350	22.94	24.00	1.276	0.032	0.040
	LTE Band 7/50RB#0 20M	Right Cheek	21350	21.89	23.00	1.291	0.212	0.274
	LTE Band 7/50RB#0 20M	Right Tilt	21350	21.89	23.00	1.291	0.036	0.046
	LTE Band 7/50RB#0 20M	Left Cheek	21350	21.89	23.00	1.291	0.224	0.289
	LTE Band 7/50RB#0 20M	Left Tilt	21350	21.89	23.00	1.291	0.027	0.035
Sensor off/Full Power (ANT 2)								
7#	LTE Band 12/1RB#0 10M	Right Cheek	23095	23.91	24.50	1.146	0.706	0.809
	LTE Band 12/1RB#0 10M	Right Tilt	23095	23.91	24.50	1.146	0.655	0.750
	LTE Band 12/1RB#0 10M	Left Cheek	23095	23.91	24.50	1.146	0.600	0.687
	LTE Band 12/1RB#0 10M	Left Tilt	23095	23.91	24.50	1.146	0.553	0.633
	LTE Band 12/1RB#0 10M	Right Cheek	23060	23.88	24.50	1.153	0.698	0.805
	LTE Band 12/1RB#0 10M	Right Cheek	23130	23.82	24.50	1.169	0.609	0.712
	LTE Band 12/25RB#0 10M	Right Cheek	23095	22.88	23.50	1.153	0.608	0.701
	LTE Band 12/25RB#0 10M	Right Tilt	23095	22.88	23.50	1.153	0.579	0.668
	LTE Band 12/25RB#0 10M	Left Cheek	23095	22.88	23.50	1.153	0.545	0.629
	LTE Band 12/25RB#0 10M	Left Tilt	23095	22.88	23.50	1.153	0.503	0.580
	<b>LTE Band 12/50RB#0 10M</b>	Right Cheek	23060	22.77	23.50	1.183	0.574	0.679
Sensor on/Reduced Power Level 1 (ANT 2)								



8#	LTE Band 14/1RB#0 10M	Right Cheek	23330	20.79	21.50	1.178	0.817	0.962
	LTE Band 14/1RB#0 10M	Right Tilt	23330	20.79	21.50	1.178	0.572	0.674
	LTE Band 14/1RB#0 10M	Left Cheek	23330	20.79	21.50	1.178	0.724	0.853
	LTE Band 14/1RB#0 10M	Left Tilt	23330	20.79	21.50	1.178	0.631	0.743
	LTE Band 14/25RB#0 10M	Right Cheek	23330	19.78	20.50	1.180	0.706	0.833
	LTE Band 14/25RB#0 10M	Right Tilt	23330	19.78	20.50	1.180	0.520	0.614
	LTE Band 14/25RB#0 10M	Left Cheek	23330	19.78	20.50	1.180	0.658	0.777
	LTE Band 14/25RB#0 10M	Left Tilt	23330	19.78	20.50	1.180	0.574	0.678
	<b>LTE Band 14/50RB#0 10M</b>	Right Cheek	23330	19.75	20.50	1.189	0.648	0.770
Sensor on/Reduced Power Level 1 (ANT 2)								
9#	LTE Band 26/1RB#0 15M	Right Cheek	26965	20.96	22.00	1.271	0.741	0.941
	LTE Band 26/1RB#0 15M	Right Tilt	26965	20.96	22.00	1.271	0.543	0.690
	LTE Band 26/1RB#0 15M	Left Cheek	26965	20.96	22.00	1.271	0.614	0.780
	LTE Band 26/1RB#0 15M	Left Tilt	26965	20.96	22.00	1.271	0.591	0.751
	LTE Band 26/1RB#0 15M	Right Cheek	26765	20.66	22.00	1.361	0.647	0.881
	LTE Band 26/1RB#0 15M	Right Cheek	26865	20.75	22.00	1.334	0.685	0.913
	LTE Band 26/36RB#0 15M	Right Cheek	26965	19.86	21.00	1.300	0.658	0.856
	LTE Band 26/36RB#0 15M	Right Tilt	26965	19.86	21.00	1.300	0.494	0.642
	LTE Band 26/36RB#0 15M	Left Cheek	26965	19.86	21.00	1.300	0.542	0.705
	LTE Band 26/36RB#0 15M	Left Tilt	26965	19.86	21.00	1.300	0.519	0.675
	LTE Band 26/36RB#0 15M	Right Cheek	26765	19.63	21.00	1.371	0.579	0.794
	LTE Band 26/36RB#0 15M	Right Cheek	26865	19.71	21.00	1.346	0.591	0.795
	<b>LTE Band 26/75RB#0 15M</b>	Right Cheek	26965	19.85	21.00	1.303	0.583	0.760
Sensor off/Full Power (ANT 8)								
10#	LTE Band 38/1RB#0 20M	Right Cheek	38000	23.07	24.00	1.239	0.192	0.239
	LTE Band 38/1RB#0 20M	Right Tilt	38000	23.07	24.00	1.239	0.036	0.045
	LTE Band 38/1RB#0 20M	Left Cheek	38000	23.07	24.00	1.239	0.176	0.219
	LTE Band 38/1RB#0 20M	Left Tilt	38000	23.07	24.00	1.239	0.020	0.025
	LTE Band 38/50RB#0 20M	Right Cheek	38000	21.92	23.00	1.282	0.184	0.237
	LTE Band 38/50RB#0 20M	Right Tilt	38000	21.92	23.00	1.282	0.034	0.044
	LTE Band 38/50RB#0 20M	Left Cheek	38000	21.92	23.00	1.282	0.157	0.203
	LTE Band 38/50RB#0 20M	Left Tilt	38000	21.92	23.00	1.282	0.019	0.025
Sensor off/Full Power (ANT 8)								
11#	LTE Band 40/1RB#0 10M	Right Cheek	38750	23.20	24.00	1.202	0.223	0.270
	LTE Band 40/1RB#0 10M	Right Tilt	38750	23.20	24.00	1.202	0.106	0.128
	LTE Band 40/1RB#0 10M	Left Cheek	38750	23.20	24.00	1.202	0.152	0.184
	LTE Band 40/1RB#0 10M	Left Tilt	38750	23.20	24.00	1.202	0.075	0.091
	LTE Band 40/25RB#0 10M	Right Cheek	38750	22.11	23.00	1.227	0.201	0.248



	LTE Band 40/25RB#0 10M	Right Tilt	38750	22.11	23.00	1.227	0.087	0.107
	LTE Band 40/25RB#0 10M	Left Cheek	38750	22.11	23.00	1.227	0.125	0.154
	LTE Band 40/25RB#0 10M	Left Tilt	38750	22.11	23.00	1.227	0.069	0.085
Sensor off/Full Power (ANT 8)								
	LTE Band 40/1RB#0 10M	Right Cheek	39200	23.42	24.00	1.143	0.144	0.166
	LTE Band 40/1RB#0 10M	Right Tilt	39200	23.42	24.00	1.143	0.074	0.085
	LTE Band 40/1RB#0 10M	Left Cheek	39200	23.42	24.00	1.143	0.100	0.115
	LTE Band 40/1RB#0 10M	Left Tilt	39200	23.42	24.00	1.143	0.050	0.057
	LTE Band 40/25RB#0 10M	Right Cheek	39200	22.34	23.00	1.164	0.121	0.142
	LTE Band 40/25RB#0 10M	Right Tilt	39200	22.34	23.00	1.164	0.057	0.067
	LTE Band 40/25RB#0 10M	Left Cheek	39200	22.34	23.00	1.164	0.083	0.097
	LTE Band 40/25RB#0 10M	Left Tilt	39200	22.34	23.00	1.164	0.037	0.044
Sensor off/Full Power (ANT 8)								
12#	LTE Band 41/1RB#0 20M	Right Cheek	40620	23.29	24.00	1.178	0.186	0.220
	LTE Band 41/1RB#0 20M	Right Tilt	40620	23.29	24.00	1.178	0.033	0.039
	LTE Band 41/1RB#0 20M	Left Cheek	40620	23.29	24.00	1.178	0.161	0.191
	LTE Band 41/1RB#0 20M	Left Tilt	40620	23.29	24.00	1.178	0.023	0.027
	LTE Band 41/50RB#0 20M	Right Cheek	40620	22.27	23.00	1.183	0.103	0.123
	LTE Band 41/50RB#0 20M	Right Tilt	40620	22.27	23.00	1.183	0.035	0.041
	LTE Band 41/50RB#0 20M	Left Cheek	40620	22.27	23.00	1.183	0.091	0.108
	LTE Band 41/50RB#0 20M	Left Tilt	40620	22.27	23.00	1.183	0.028	0.033
Sensor on/Reduced Power Level 1 (ANT 1)								
13#	LTE Band 66/1RB#0 20M	Right Cheek	132322	19.46	20.00	1.132	0.618	0.700
	LTE Band 66/1RB#0 20M	Right Tilt	132322	19.46	20.00	1.132	0.326	0.369
	LTE Band 66/1RB#0 20M	Left Cheek	132322	19.46	20.00	1.132	0.403	0.456
	LTE Band 66/1RB#0 20M	Left Tilt	132322	19.46	20.00	1.132	0.276	0.313
	LTE Band 66/50RB#0 20M	Right Cheek	132322	18.41	19.00	1.146	0.585	0.670
	LTE Band 66/50RB#0 20M	Right Tilt	132322	18.41	19.00	1.146	0.295	0.338
	LTE Band 66/50RB#0 20M	Left Cheek	132322	18.41	19.00	1.146	0.367	0.420
	LTE Band 66/50RB#0 20M	Left Tilt	132322	18.41	19.00	1.146	0.249	0.285
Sensor off/Full Power for CA/ENDC (ANT 5)								
	LTE Band 66/1RB#0 20M	Right Cheek	132322	23.46	24.00	1.132	0.031	0.035
	LTE Band 66/1RB#0 20M	Right Tilt	132322	23.46	24.00	1.132	0.011	0.012
	LTE Band 66/1RB#0 20M	Left Cheek	132322	23.46	24.00	1.132	0.018	0.020
	LTE Band 66/1RB#0 20M	Left Tilt	132322	23.46	24.00	1.132	0.009	0.010
	LTE Band 66/50RB#0 20M	Right Cheek	132322	22.41	23.00	1.146	0.022	0.025
	LTE Band 66/50RB#0 20M	Right Tilt	132322	22.41	23.00	1.146	0.008	0.009
	LTE Band 66/50RB#0 20M	Left Cheek	132322	22.41	23.00	1.146	0.013	0.014



LTE Band 66/50RB#0 20M	Left Tilt	132322	22.41	23.00	1.146	0.006	0.007
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➤ **5G NR DFT-s-QPSK Head SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
	5G NR n2/1RB#1 20M	Right Cheek	376000	18.17	19.00	1.211	0.725	0.878
	5G NR n2/1RB#1 20M	Right Tilt	376000	18.17	19.00	1.211	0.458	0.554
	5G NR n2/1RB#1 20M	Left Cheek	376000	18.17	19.00	1.211	0.402	0.487
	5G NR n2/1RB#1 20M	Left Tilt	376000	18.17	19.00	1.211	0.511	0.619
14#	5G NR n2/1RB#1 20M	Right Cheek	372000	17.97	19.00	1.268	0.915	1.160
	5G NR n2/1RB#1 20M	Right Cheek	380000	18.10	19.00	1.230	0.845	1.040
	5G NR n2/50RB#1 20M	Right Cheek	376000	17.96	19.00	1.271	0.659	0.837
	5G NR n2/50RB#1 20M	Right Tilt	376000	17.96	19.00	1.271	0.416	0.529
	5G NR n2/50RB#1 20M	Left Cheek	376000	17.96	19.00	1.271	0.365	0.464
	5G NR n2/50RB#1 20M	Left Tilt	376000	17.96	19.00	1.271	0.466	0.592
	5G NR n2/50RB#1 20M	Right Cheek	372000	17.81	19.00	1.315	0.842	1.107
	5G NR n2/50RB#1 20M	Right Cheek	380000	17.78	19.00	1.324	0.795	1.053
	<b>5G NR n2/100RB#0 20M</b>	Right Cheek	372000	17.82	19.00	1.312	0.617	0.810
Sensor off/Full Power for ENDC (ANT 5)								
	5G NR n2/1RB#1 20M	Right Cheek	376000	23.17	24.00	1.211	0.089	0.108
	5G NR n2/1RB#1 20M	Right Tilt	376000	23.17	24.00	1.211	0.045	0.055
	5G NR n2/1RB#1 20M	Left Cheek	376000	23.17	24.00	1.211	0.058	0.070
	5G NR n2/1RB#1 20M	Left Tilt	376000	23.17	24.00	1.211	0.048	0.058
	5G NR n2/50RB#1 20M	Right Cheek	376000	22.96	24.00	1.271	0.081	0.103
	5G NR n2/50RB#1 20M	Right Tilt	376000	22.96	24.00	1.271	0.041	0.052
	5G NR n2/50RB#1 20M	Left Cheek	376000	22.96	24.00	1.271	0.053	0.067
	5G NR n2/50RB#1 20M	Left Tilt	376000	22.96	24.00	1.271	0.044	0.056
Sensor on/Reduced Power Level 1 (ANT 2)								
15#	5G NR n5/1RB#1 20M	Right Cheek	167300	19.03	20.00	1.250	0.788	0.985
	5G NR n5/1RB#1 20M	Right Tilt	167300	19.03	20.00	1.250	0.429	0.536
	5G NR n5/1RB#1 20M	Left Cheek	167300	19.03	20.00	1.250	0.627	0.784
	5G NR n5/1RB#1 20M	Left Tilt	167300	19.03	20.00	1.250	0.470	0.588
	5G NR n5/1RB#1 20M	Right Cheek	166800	18.84	20.00	1.306	0.612	0.799
	5G NR n5/1RB#1 20M	Right Cheek	167800	18.92	20.00	1.282	0.641	0.822
	5G NR n5/50RB#1 20M	Right Cheek	167300	18.99	20.00	1.262	0.716	0.903
	5G NR n5/50RB#1 20M	Right Tilt	167300	18.99	20.00	1.262	0.390	0.492
	5G NR n5/50RB#1 20M	Left Cheek	167300	18.99	20.00	1.262	0.570	0.719





	5G NR n5/50RB#1 20M	Left Tilt	167300	18.99	20.00	1.262	0.427	0.539
	5G NR n5/50RB#1 20M	Right Cheek	166800	18.88	20.00	1.294	0.501	0.648
	5G NR n5/50RB#1 20M	Right Cheek	167800	18.95	20.00	1.274	0.532	0.678
	<b>5G NR n5/100RB#0 20M</b>	Right Cheek	167800	18.98	20.00	1.265	0.732	0.926
Sensor on/Reduced Power Level 1 (ANT 1)								
16#	5G NR n66/1RB#1 20M	Right Cheek	349000	18.02	19.00	1.253	0.834	1.045
	5G NR n66/1RB#1 20M	Right Tilt	349000	18.02	19.00	1.253	0.463	0.580
	5G NR n66/1RB#1 20M	Left Cheek	349000	18.02	19.00	1.253	0.526	0.659
	5G NR n66/1RB#1 20M	Left Tilt	349000	18.02	19.00	1.253	0.393	0.492
	5G NR n66/1RB#1 20M	Right Cheek	344000	17.87	19.00	1.297	0.801	1.039
	5G NR n66/1RB#1 20M	Right Cheek	354000	17.83	19.00	1.309	0.741	0.970
	5G NR n66/50RB#1 20M	Right Cheek	349000	17.94	19.00	1.276	0.712	0.909
	5G NR n66/50RB#1 20M	Right Tilt	349000	17.94	19.00	1.276	0.421	0.537
	5G NR n66/50RB#1 20M	Left Cheek	349000	17.94	19.00	1.276	0.478	0.610
	5G NR n66/50RB#1 20M	Left Tilt	349000	17.94	19.00	1.276	0.351	0.448
	5G NR n66/50RB#1 20M	Right Cheek	344000	17.70	19.00	1.349	0.719	0.970
	5G NR n66/50RB#1 20M	Right Cheek	354000	17.81	19.00	1.315	0.678	0.892
	<b>5G NR n66/100RB#1 20M</b>	Right Cheek	349000	17.85	19.00	1.303	0.733	0.955
Sensor on/Reduced Power Level 2 for ENDC (ANT 5)								
	5G NR n66/1RB#1 20M	Right Cheek	349000	23.02	24.00	1.253	0.061	0.076
	5G NR n66/1RB#1 20M	Right Tilt	349000	23.02	24.00	1.253	0.035	0.043
	5G NR n66/1RB#1 20M	Left Cheek	349000	23.02	24.00	1.253	0.048	0.060
	5G NR n66/1RB#1 20M	Left Tilt	349000	23.02	24.00	1.253	0.041	0.051
	5G NR n66/50RB#1 20M	Right Cheek	349000	22.94	24.00	1.276	0.054	0.069
	5G NR n66/50RB#1 20M	Right Tilt	349000	22.94	24.00	1.276	0.029	0.036
	5G NR n66/50RB#1 20M	Left Cheek	349000	22.94	24.00	1.276	0.042	0.054
	5G NR n66/50RB#1 20M	Left Tilt	349000	22.94	24.00	1.276	0.033	0.042
Sensor on/Reduced Power Level 1 (ANT 10) (HPUE)								
17#	5G NR n77/1RB#1 100M	Right Cheek	633334	23.16	24.00	1.213	0.947	1.149
	5G NR n77/1RB#1 100M	Right Tilt	633334	23.16	24.00	1.213	0.451	0.547
	5G NR n77/1RB#1 100M	Left Cheek	633334	23.16	24.00	1.213	0.596	0.723
	5G NR n77/1RB#1 100M	Left Tilt	633334	23.16	24.00	1.213	0.345	0.419
	5G NR n77/135RB#1 100M	Right Cheek	633334	22.91	24.00	1.285	0.861	1.107
	5G NR n77/135RB#1 100M	Right Tilt	633334	22.91	24.00	1.285	0.410	0.527
	5G NR n77/135RB#1 100M	Left Cheek	633334	22.91	24.00	1.285	0.542	0.697
	5G NR n77/135RB#1 100M	Left Tilt	633334	22.91	24.00	1.285	0.314	0.404
	<b>5G NR n77/270RB#1 100M</b>	Right Cheek	633334	21.39	23.00	1.449	0.705	1.021





Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission (ANT 10)								
(HPUE)								
	5G NR n77/1RB#1 100M	Right Cheek	633334	15.30	16.00	1.175	0.164	0.193
	5G NR n77/1RB#1 100M	Right Tilt	633334	15.30	16.00	1.175	0.079	0.093
	5G NR n77/1RB#1 100M	Left Cheek	633334	15.30	16.00	1.175	0.104	0.122
	5G NR n77/1RB#1 100M	Left Tilt	633334	15.30	16.00	1.175	0.051	0.060
	5G NR n77/135RB#1 100M	Right Cheek	633334	14.91	16.00	1.285	0.141	0.181
	5G NR n77/135RB#1 100M	Right Tilt	633334	14.91	16.00	1.285	0.067	0.086
	5G NR n77/135RB#1 100M	Left Cheek	633334	14.91	16.00	1.285	0.089	0.114
	5G NR n77/135RB#1 100M	Left Tilt	633334	14.91	16.00	1.285	0.042	0.054
Sensor off/Full Power (ANT 10)								
(HPUE)								
	5G NR n77/1RB#1 100M	Right Cheek	656000	27.60	28.50	1.230	0.580	0.714
	5G NR n77/1RB#1 100M	Right Tilt	656000	27.60	28.50	1.230	0.184	0.226
	5G NR n77/1RB#1 100M	Left Cheek	656000	27.60	28.50	1.230	0.318	0.391
	5G NR n77/1RB#1 100M	Left Tilt	656000	27.60	28.50	1.230	0.109	0.134
	5G NR n77/135RB#1 100M	Right Cheek	656000	27.32	28.50	1.312	0.406	0.533
	5G NR n77/135RB#1 100M	Right Tilt	656000	27.32	28.50	1.312	0.129	0.169
	5G NR n77/135RB#1 100M	Left Cheek	656000	27.32	28.50	1.312	0.223	0.292
	5G NR n77/135RB#1 100M	Left Tilt	656000	27.32	28.50	1.312	0.076	0.100
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission (ANT 10)								
(HPUE)								
	5G NR n77/1RB#1 100M	Right Cheek	656000	16.10	17.00	1.230	0.129	0.159
	5G NR n77/1RB#1 100M	Right Tilt	656000	16.10	17.00	1.230	0.041	0.050
	5G NR n77/1RB#1 100M	Left Cheek	656000	16.10	17.00	1.230	0.070	0.086
	5G NR n77/1RB#1 100M	Left Tilt	656000	16.10	17.00	1.230	0.024	0.030
	5G NR n77/135RB#1 100M	Right Cheek	656000	15.82	17.00	1.312	0.097	0.127
	5G NR n77/135RB#1 100M	Right Tilt	656000	15.82	17.00	1.312	0.031	0.041
	5G NR n77/135RB#1 100M	Left Cheek	656000	15.82	17.00	1.312	0.053	0.070
	5G NR n77/135RB#1 100M	Left Tilt	656000	15.82	17.00	1.312	0.018	0.024
Sensor off/Full Power (ANT 10)								
	5G NR n77/1RB#1 100M	Right Cheek	633334	22.54	24.00	1.400	0.776	1.086
	5G NR n77/1RB#1 100M	Right Tilt	633334	22.54	24.00	1.400	0.474	0.663
	5G NR n77/1RB#1 100M	Left Cheek	633334	22.54	24.00	1.400	0.606	0.848
	5G NR n77/1RB#1 100M	Left Tilt	633334	22.54	24.00	1.400	0.212	0.297
	5G NR n77/135RB#1 100M	Right Cheek	633334	22.49	24.00	1.416	0.543	0.769
	5G NR n77/135RB#1 100M	Right Tilt	633334	22.49	24.00	1.416	0.332	0.470
	5G NR n77/135RB#1 100M	Left Cheek	633334	22.49	24.00	1.416	0.424	0.601



	5G NR n77/135RB#1 100M	Left Tilt	633334	22.49	24.00	1.416	0.148	0.210
	<b>5G NR n77/270RB#1 100M</b>	Right Cheek	633334	22.47	24.00	1.422	0.712	1.013
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission (ANT 10)								
	5G NR n77/1RB#1 100M	Right Cheek	633334	15.30	16.00	1.175	0.164	0.193
	5G NR n77/1RB#1 100M	Right Tilt	633334	15.30	16.00	1.175	0.079	0.093
	5G NR n77/1RB#1 100M	Left Cheek	633334	15.30	16.00	1.175	0.104	0.122
	5G NR n77/1RB#1 100M	Left Tilt	633334	15.30	16.00	1.175	0.051	0.060
	5G NR n77/135RB#1 100M	Right Cheek	633334	14.99	16.00	1.262	0.141	0.178
	5G NR n77/135RB#1 100M	Right Tilt	633334	14.99	16.00	1.262	0.067	0.085
	5G NR n77/135RB#1 100M	Left Cheek	633334	14.99	16.00	1.262	0.089	0.112
	5G NR n77/135RB#1 100M	Left Tilt	633334	14.99	16.00	1.262	0.042	0.053
Sensor off/Full Power (ANT 10)								
	5G NR n77/1RB#1 100M	Right Cheek	656000	22.56	24.00	1.393	0.396	0.552
	5G NR n77/1RB#1 100M	Right Tilt	656000	22.56	24.00	1.393	0.110	0.153
	5G NR n77/1RB#1 100M	Left Cheek	656000	22.56	24.00	1.393	0.309	0.430
	5G NR n77/1RB#1 100M	Left Tilt	656000	22.56	24.00	1.393	0.064	0.089
	5G NR n77/135RB#1 100M	Right Cheek	656000	22.52	24.00	1.406	0.277	0.390
	5G NR n77/135RB#1 100M	Right Tilt	656000	22.52	24.00	1.406	0.077	0.108
	5G NR n77/135RB#1 100M	Left Cheek	656000	22.52	24.00	1.406	0.216	0.304
	5G NR n77/135RB#1 100M	Left Tilt	656000	22.52	24.00	1.406	0.045	0.063
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission (ANT 10)								
	5G NR n77/1RB#1 100M	Right Cheek	656000	16.06	17.00	1.242	0.129	0.160
	5G NR n77/1RB#1 100M	Right Tilt	656000	16.06	17.00	1.242	0.041	0.051
	5G NR n77/1RB#1 100M	Left Cheek	656000	16.06	17.00	1.242	0.070	0.087
	5G NR n77/1RB#1 100M	Left Tilt	656000	16.06	17.00	1.242	0.024	0.030
	5G NR n77/135RB#1 100M	Right Cheek	656000	16.02	17.00	1.253	0.097	0.122
	5G NR n77/135RB#1 100M	Right Tilt	656000	16.02	17.00	1.253	0.031	0.039
	5G NR n77/135RB#1 100M	Left Cheek	656000	16.02	17.00	1.253	0.053	0.066
	5G NR n77/135RB#1 100M	Left Tilt	656000	16.02	17.00	1.253	0.018	0.023

➤ **WLAN Head SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Full Power (ANT 7)								
	WLAN2.4GHz/802.11b	Right Cheek	11	16.38	17.00	1.153	0.192	0.223
	WLAN2.4GHz/802.11b	Right Tilt	11	16.38	17.00	1.153	0.078	0.091
18#	WLAN2.4GHz/802.11b	Left Cheek	11	16.38	17.00	1.153	0.380	0.441
	WLAN2.4GHz/802.11b	Left Tilt	11	16.38	17.00	1.153	0.107	0.124



Full Power (ANT 7)								
	WLAN5.2GHz/802.11a	Right Cheek	44	16.46	17.00	1.132	0.049	0.056
	WLAN5.2GHz/802.11a	Right Tilt	44	16.46	17.00	1.132	0.024	0.028
19#	WLAN5.2GHz/802.11a	Left Cheek	44	16.46	17.00	1.132	0.238	0.274
	WLAN5.2GHz/802.11a	Left Tilt	44	16.46	17.00	1.132	0.085	0.098
Full Power (ANT 7)								
	WLAN5.3GHz/802.11a	Right Cheek	52	16.42	17.00	1.143	0.057	0.066
	WLAN5.3GHz/802.11a	Right Tilt	52	16.42	17.00	1.143	0.031	0.036
20#	WLAN5.3GHz/802.11a	Left Cheek	52	16.42	17.00	1.143	0.251	0.291
	WLAN5.3GHz/802.11a	Left Tilt	52	16.42	17.00	1.143	0.087	0.101
Full Power (ANT 7)								
	WLAN5.5GHz/802.11ac40	Right Cheek	126	16.59	17.00	1.099	0.097	0.110
	WLAN5.5GHz/802.11ac40	Right Tilt	126	16.59	17.00	1.099	0.058	0.066
21#	WLAN5.5GHz/802.11ac40	Left Cheek	126	16.59	17.00	1.099	0.196	0.222
	WLAN5.5GHz/802.11ac40	Left Tilt	126	16.59	17.00	1.099	0.042	0.048
Full Power (ANT 7)								
	WLAN5.8GHz/802.11a	Right Cheek	165	16.76	17.00	1.057	0.108	0.116
	WLAN5.8GHz/802.11a	Right Tilt	165	16.76	17.00	1.057	0.038	0.041
22#	WLAN5.8GHz/802.11a	Left Cheek	165	16.76	17.00	1.057	0.211	0.226
	WLAN5.8GHz/802.11a	Left Tilt	165	16.76	17.00	1.057	0.040	0.043
Full Power (ANT 7)								
	Bluetooth/DH5	Right Cheek	78	10.38	10.50	1.028	0.046	0.051
	Bluetooth/DH5	Right Tilt	78	10.38	10.50	1.028	0.042	0.047
23#	Bluetooth/DH5	Left Cheek	78	10.38	10.50	1.028	0.069	0.077
	Bluetooth/DH5	Left Tilt	78	10.38	10.50	1.028	0.045	0.050

**Note:**

1. Per KDB 447498 D01v06, for each exposure position, if the highest output power channel Reported SAR  $\leq 0.8\text{W/kg}$ , other channels SAR testing is not necessary.
2. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is  $\geq 0.8\text{W/kg}$ .
3. Per KDB 941225 D05v02r05, 100% RB allocation SAR measurement is not required when the highest reported SAR for 1 RB and 50% RB allocation are  $\leq 0.8\text{W/kg}$ .
4. Per KDB 248227 D01v02r02, for 802.11b DSSS, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is  $\leq 0.8\text{W/kg}$ , no further SAR testing is required in that exposure configuration.
5. Per KDB 248227 D01v02r02, OFDM SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2\text{W/kg}$ .



6. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.
7. Per 248227 D01v02r02, if the highest reported SAR in a 802.11b mode and exposure condition is 0.441 W/kg and the specified maximum output power for 802.11b and 802.11g bands are 43.45 mW and 43.85 mW respectively, the adjusted SAR is  $0.441 \times 43.85 / 43.45 = 0.445$  W/kg. The adjusted SAR is  $\leq 1.2$  W/kg, therefore SAR is not required for that 802.11g mode configuration.
8. For TDD-LTE, the reported SAR should be scaled with the duty cycle scaling factor 1.006.
9. The 2.4G WLAN reported 1g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.007, 5G WLAN 802.11a with 1.015, 802.11ac40 with 1.032 and Bluetooth with 1.082.

### 19.3. Body SAR Data

➤ **WCDMA Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
	Band II/RMC 12.2Kbps	Front Side	9400	16.32	17.00	1.169	0.123	0.144
24#	Band II/RMC 12.2Kbps	Back Side	9400	16.32	17.00	1.169	0.129	0.151
	Band II/RMC 12.2Kbps	Left Side	9400	16.32	17.00	1.169	0.077	0.090
	Band II/RMC 12.2Kbps	Right Side	9400	16.32	17.00	1.169	0.020	0.023
	Band II/RMC 12.2Kbps	Top Side	9400	16.32	17.00	1.169	0.127	0.149
Sensor on/Reduced Power Level 1 (ANT 1)								
	Band IV/RMC 12.2Kbps	Front Side	1413	19.44	20.00	1.138	0.358	0.407
25#	Band IV/RMC 12.2Kbps	Back Side	1413	19.44	20.00	1.138	0.409	0.465
	Band IV/RMC 12.2Kbps	Left Side	1413	19.44	20.00	1.138	0.100	0.114
	Band IV/RMC 12.2Kbps	Right Side	1413	19.44	20.00	1.138	0.030	0.034
	Band IV/RMC 12.2Kbps	Top Side	1413	19.44	20.00	1.138	0.407	0.463
Sensor on/Reduced Power Level 1 (ANT 2)								
	Band V/RMC 12.2Kbps	Front Side	4182	21.47	22.00	1.130	0.314	0.355
26#	Band V/RMC 12.2Kbps	Back Side	4182	21.47	22.00	1.130	0.344	0.389
	Band V/RMC 12.2Kbps	Left Side	4182	21.47	22.00	1.130	0.075	0.085
	Band V/RMC 12.2Kbps	Right Side	4182	21.47	22.00	1.130	0.142	0.160
	Band V/RMC 12.2Kbps	Top Side	4182	21.47	22.00	1.130	0.236	0.267



➤ LTE QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
	LTE Band 2/1RB#0 20M	Front Side	18900	15.91	17.00	1.285	0.160	0.206
27#	LTE Band 2/1RB#0 20M	Back Side	18900	15.91	17.00	1.285	0.416	0.535
	LTE Band 2/1RB#0 20M	Left Side	18900	15.91	17.00	1.285	0.120	0.154
	LTE Band 2/1RB#0 20M	Right Side	18900	15.91	17.00	1.285	0.053	0.068
	LTE Band 2/1RB#0 20M	Top Side	18900	15.91	17.00	1.285	0.123	0.158
	LTE Band 2/50RB#0 20M	Front Side	18900	14.90	16.00	1.288	0.112	0.144
	LTE Band 2/50RB#0 20M	Back Side	18900	14.90	16.00	1.288	0.291	0.375
	LTE Band 2/50RB#0 20M	Left Side	18900	14.90	16.00	1.288	0.084	0.108
	LTE Band 2/50RB#0 20M	Right Side	18900	14.90	16.00	1.288	0.037	0.048
	LTE Band 2/50RB#0 20M	Top Side	18900	14.90	16.00	1.288	0.086	0.111
Sensor off/Full Power for CA/ENDC (ANT 5)								
	LTE Band 2/1RB#0 20M	Front Side	18900	22.91	24.00	1.285	0.077	0.099
	LTE Band 2/1RB#0 20M	Back Side	18900	22.91	24.00	1.285	0.080	0.103
	LTE Band 2/1RB#0 20M	Left Side	18900	22.91	24.00	1.285	0.025	0.032
	LTE Band 2/1RB#0 20M	Right Side	18900	22.91	24.00	1.285	0.014	0.018
	LTE Band 2/1RB#0 20M	Bottom Side	18900	22.91	24.00	1.285	0.095	0.122
	LTE Band 2/50RB#0 20M	Front Side	18900	21.90	23.00	1.288	0.054	0.069
	LTE Band 2/50RB#0 20M	Back Side	18900	21.90	23.00	1.288	0.056	0.072
	LTE Band 2/50RB#0 20M	Left Side	18900	21.90	23.00	1.288	0.018	0.023
	LTE Band 2/50RB#0 20M	Right Side	18900	21.90	23.00	1.288	0.010	0.013
	LTE Band 2/50RB#0 20M	Bottom Side	18900	21.90	23.00	1.288	0.067	0.086
Sensor on/Reduced Power Level 1 (ANT 2)								
	LTE Band 5/1RB#0 10M	Front Side	20525	21.32	22.00	1.169	0.272	0.318
28#	LTE Band 5/1RB#0 10M	Back Side	20525	21.32	22.00	1.169	0.340	0.398
	LTE Band 5/1RB#0 10M	Left Side	20525	21.32	22.00	1.169	0.033	0.039
	LTE Band 5/1RB#0 10M	Right Side	20525	21.32	22.00	1.169	0.105	0.123
	LTE Band 5/1RB#0 10M	Top Side	20525	21.32	22.00	1.169	0.230	0.269
	LTE Band 5/25RB#0 10M	Front Side	20525	20.04	21.00	1.247	0.190	0.238
	LTE Band 5/25RB#0 10M	Back Side	20525	20.04	21.00	1.247	0.238	0.297
	LTE Band 5/25RB#0 10M	Left Side	20525	20.04	21.00	1.247	0.023	0.029
	LTE Band 5/25RB#0 10M	Right Side	20525	20.04	21.00	1.247	0.074	0.092
	LTE Band 5/25RB#0 10M	Top Side	20525	20.04	21.00	1.247	0.161	0.201
Sensor off/Full Power (ANT 8)								
	LTE Band 7/1RB#0 20M	Front Side	21350	22.94	24.00	1.276	0.073	0.093



29#	LTE Band 7/1RB#0 20M	Back Side	21350	22.94	24.00	1.276	0.285	0.364
	LTE Band 7/1RB#0 20M	Left Side	21350	22.94	24.00	1.276	0.105	0.134
	LTE Band 7/1RB#0 20M	Right Side	21350	22.94	24.00	1.276	0.019	0.024
	LTE Band 7/1RB#0 20M	Top Side	21350	22.94	24.00	1.276	0.005	0.006
	LTE Band 7/50RB#0 20M	Front Side	21350	21.89	23.00	1.291	0.051	0.066
	LTE Band 7/50RB#0 20M	Back Side	21350	21.89	23.00	1.291	0.200	0.258
	LTE Band 7/50RB#0 20M	Left Side	21350	21.89	23.00	1.291	0.074	0.095
	LTE Band 7/50RB#0 20M	Right Side	21350	21.89	23.00	1.291	0.013	0.017
	LTE Band 7/50RB#0 20M	Top Side	21350	21.89	23.00	1.291	0.004	0.005
Sensor off/Full Power (ANT 2)								
	LTE Band 12/1RB#0 10M	Front Side	23095	23.91	24.50	1.146	0.201	0.230
30#	LTE Band 12/1RB#0 10M	Back Side	23095	23.91	24.50	1.146	0.217	0.249
	LTE Band 12/1RB#0 10M	Left Side	23095	23.91	24.50	1.146	0.056	0.064
	LTE Band 12/1RB#0 10M	Right Side	23095	23.91	24.50	1.146	0.103	0.118
	LTE Band 12/1RB#0 10M	Top Side	23095	23.91	24.50	1.146	0.150	0.172
	LTE Band 12/25RB#0 10M	Front Side	23095	22.88	23.50	1.153	0.141	0.162
	LTE Band 12/25RB#0 10M	Back Side	23095	22.88	23.50	1.153	0.152	0.175
	LTE Band 12/25RB#0 10M	Left Side	23095	22.88	23.50	1.153	0.039	0.045
	LTE Band 12/25RB#0 10M	Right Side	23095	22.88	23.50	1.153	0.072	0.083
	LTE Band 12/25RB#0 10M	Top Side	23095	22.88	23.50	1.153	0.105	0.121
Sensor on/Reduced Power Level 1 (ANT 2)								
	LTE Band 14/1RB#0 10M	Front Side	23330	20.79	21.50	1.178	0.246	0.290
31#	LTE Band 14/1RB#0 10M	Back Side	23330	20.79	21.50	1.178	0.285	0.336
	LTE Band 14/1RB#0 10M	Left Side	23330	20.79	21.50	1.178	0.023	0.027
	LTE Band 14/1RB#0 10M	Right Side	23330	20.79	21.50	1.178	0.109	0.128
	LTE Band 14/1RB#0 10M	Top Side	23330	20.79	21.50	1.178	0.195	0.230
	LTE Band 14/25RB#0 10M	Front Side	23330	19.78	20.50	1.180	0.172	0.203
	LTE Band 14/25RB#0 10M	Back Side	23330	19.78	20.50	1.180	0.200	0.235
	LTE Band 14/25RB#0 10M	Left Side	23330	19.78	20.50	1.180	0.016	0.019
	LTE Band 14/25RB#0 10M	Right Side	23330	19.78	20.50	1.180	0.076	0.090
	LTE Band 14/25RB#0 10M	Top Side	23330	19.78	20.50	1.180	0.137	0.161
Sensor on/Reduced Power Level 1 (ANT 2)								
	LTE Band 26/1RB#0 10M	Front Side	26965	20.96	22.00	1.271	0.206	0.262
32#	LTE Band 26/1RB#0 10M	Back Side	26965	20.96	22.00	1.271	0.247	0.314
	LTE Band 26/1RB#0 10M	Left Side	26965	20.96	22.00	1.271	0.021	0.027
	LTE Band 26/1RB#0 10M	Right Side	26965	20.96	22.00	1.271	0.077	0.098
	LTE Band 26/1RB#0 10M	Top Side	26965	20.96	22.00	1.271	0.173	0.220
	LTE Band 26/25RB#0 10M	Front Side	26965	19.86	21.00	1.300	0.144	0.187





	LTE Band 26/25RB#0 10M	Back Side	26965	19.86	21.00	1.300	0.173	0.225
	LTE Band 26/25RB#0 10M	Left Side	26965	19.86	21.00	1.300	0.015	0.019
	LTE Band 26/25RB#0 10M	Right Side	26965	19.86	21.00	1.300	0.054	0.070
	LTE Band 26/25RB#0 10M	Top Side	26965	19.86	21.00	1.300	0.121	0.157
Sensor off/Full Power (ANT 8)								
	LTE Band 38/1RB#0 20M	Front Side	38000	23.07	24.00	1.239	0.050	0.062
33#	LTE Band 38/1RB#0 20M	Back Side	38000	23.07	24.00	1.239	0.076	0.095
	LTE Band 38/1RB#0 20M	Left Side	38000	23.07	24.00	1.239	0.054	0.068
	LTE Band 38/1RB#0 20M	Right Side	38000	23.07	24.00	1.239	0.017	0.021
	LTE Band 38/1RB#0 20M	Top Side	38000	23.07	24.00	1.239	0.006	0.007
	LTE Band 38/50RB#0 20M	Front Side	38000	21.92	23.00	1.282	0.044	0.057
	LTE Band 38/50RB#0 20M	Back Side	38000	21.92	23.00	1.282	0.072	0.093
	LTE Band 38/50RB#0 20M	Left Side	38000	21.92	23.00	1.282	0.051	0.066
	LTE Band 38/50RB#0 20M	Right Side	38000	21.92	23.00	1.282	0.012	0.015
	LTE Band 38/50RB#0 20M	Top Side	38000	21.92	23.00	1.282	0.004	0.005
Sensor off/Full Power (ANT 8)								
	LTE Band 40/1RB#0 10M	Front Side	38750	23.20	24.00	1.202	0.086	0.104
34#	LTE Band 40/1RB#0 10M	Back Side	38750	23.20	24.00	1.202	0.137	0.166
	LTE Band 40/1RB#0 10M	Left Side	38750	23.20	24.00	1.202	0.094	0.114
	LTE Band 40/1RB#0 10M	Right Side	38750	23.20	24.00	1.202	0.017	0.021
	LTE Band 40/1RB#0 10M	Top Side	38750	23.20	24.00	1.202	0.006	0.007
	LTE Band 40/25RB#0 10M	Front Side	38750	22.11	23.00	1.227	0.068	0.084
	LTE Band 40/25RB#0 10M	Back Side	38750	22.11	23.00	1.227	0.123	0.152
	LTE Band 40/25RB#0 10M	Left Side	38750	22.11	23.00	1.227	0.082	0.101
	LTE Band 40/25RB#0 10M	Right Side	38750	22.11	23.00	1.227	0.012	0.015
	LTE Band 40/25RB#0 10M	Top Side	38750	22.11	23.00	1.227	0.004	0.005
Sensor off/Full Power (ANT 8)								
	LTE Band 40/1RB#0 10M	Front Side	39200	23.42	24.00	1.143	0.057	0.066
	LTE Band 40/1RB#0 10M	Back Side	39200	23.42	24.00	1.143	0.129	0.148
	LTE Band 40/1RB#0 10M	Left Side	39200	23.42	24.00	1.143	0.099	0.114
	LTE Band 40/1RB#0 10M	Right Side	39200	23.42	24.00	1.143	0.013	0.015
	LTE Band 40/1RB#0 10M	Top Side	39200	23.42	24.00	1.143	0.007	0.008
	LTE Band 40/25RB#0 10M	Front Side	39200	22.34	23.00	1.164	0.041	0.048
	LTE Band 40/25RB#0 10M	Back Side	39200	22.34	23.00	1.164	0.109	0.128
	LTE Band 40/25RB#0 10M	Left Side	39200	22.34	23.00	1.164	0.079	0.093
	LTE Band 40/25RB#0 10M	Right Side	39200	22.34	23.00	1.164	0.009	0.011
	LTE Band 40/25RB#0 10M	Top Side	39200	22.34	23.00	1.164	0.005	0.006
Sensor off/Full Power (ANT 8)								



	LTE Band 41/1RB#0 20M	Front Side	40620	23.29	24.00	1.178	0.045	0.053
35#	LTE Band 41/1RB#0 20M	Back Side	40620	23.29	24.00	1.178	0.086	0.102
	LTE Band 41/1RB#0 20M	Left Side	40620	23.29	24.00	1.178	0.081	0.096
	LTE Band 41/1RB#0 20M	Right Side	40620	23.29	24.00	1.178	0.017	0.020
	LTE Band 41/1RB#0 20M	Top Side	40620	23.29	24.00	1.178	0.009	0.011
	LTE Band 41/25RB#0 20M	Front Side	40620	22.27	23.00	1.183	0.033	0.039
	LTE Band 41/25RB#0 20M	Back Side	40620	22.27	23.00	1.183	0.074	0.088
	LTE Band 41/25RB#0 20M	Left Side	40620	22.27	23.00	1.183	0.067	0.080
	LTE Band 41/25RB#0 20M	Right Side	40620	22.27	23.00	1.183	0.012	0.014
	LTE Band 41/25RB#0 20M	Top Side	40620	22.27	23.00	1.183	0.006	0.007
Sensor on/Reduced Power Level 1 (ANT 1)								
	LTE Band 66/1RB#0 20M	Front Side	132322	19.46	20.00	1.132	0.130	0.147
36#	LTE Band 66/1RB#0 20M	Back Side	132322	19.46	20.00	1.132	0.182	0.206
	LTE Band 66/1RB#0 20M	Left Side	132322	19.46	20.00	1.132	0.115	0.130
	LTE Band 66/1RB#0 20M	Right Side	132322	19.46	20.00	1.132	0.027	0.031
37#	LTE Band 66/1RB#0 20M	Top Side	132322	19.46	20.00	1.132	0.190	0.215
	LTE Band 66/50RB#0 20M	Front Side	132322	18.41	19.00	1.146	0.091	0.104
	LTE Band 66/50RB#0 20M	Back Side	132322	18.41	19.00	1.146	0.127	0.146
	LTE Band 66/50RB#0 20M	Left Side	132322	18.41	19.00	1.146	0.081	0.092
	LTE Band 66/50RB#0 20M	Right Side	132322	18.41	19.00	1.146	0.019	0.022
	LTE Band 66/50RB#0 20M	Top Side	132322	18.41	19.00	1.146	0.133	0.152
Sensor off/Full Power for CA/ENDC (ANT 5)								
	LTE Band 66/1RB#0 20M	Front Side	132322	23.46	24.00	1.132	0.039	0.044
	LTE Band 66/1RB#0 20M	Back Side	132322	23.46	24.00	1.132	0.042	0.048
	LTE Band 66/1RB#0 20M	Left Side	132322	23.46	24.00	1.132	0.018	0.020
	LTE Band 66/1RB#0 20M	Right Side	132322	23.46	24.00	1.132	0.010	0.011
	LTE Band 66/1RB#0 20M	Bottom Side	132322	23.46	24.00	1.132	0.097	0.110
	LTE Band 66/50RB#0 20M	Front Side	132322	22.41	23.00	1.146	0.027	0.031
	LTE Band 66/50RB#0 20M	Back Side	132322	22.41	23.00	1.146	0.029	0.034
	LTE Band 66/50RB#0 20M	Left Side	132322	22.41	23.00	1.146	0.012	0.014
	LTE Band 66/50RB#0 20M	Right Side	132322	22.41	23.00	1.146	0.007	0.008
	LTE Band 66/50RB#0 20M	Bottom Side	132322	22.41	23.00	1.146	0.068	0.078





➤ 5G NR DFT-s-QPSK Body SAR

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 1)								
	5G NR n2/1RB#1 20M	Front Side	376000	18.17	19.00	1.211	0.594	0.719
38#	5G NR n2/1RB#1 20M	Back Side	376000	18.17	19.00	1.211	0.717	0.868
	5G NR n2/1RB#1 20M	Left Side	376000	18.17	19.00	1.211	0.493	0.597
	5G NR n2/1RB#1 20M	Right Side	376000	18.17	19.00	1.211	0.084	0.102
	5G NR n2/1RB#1 20M	Top Side	376000	18.17	19.00	1.211	0.601	0.728
	5G NR n2/1RB#1 20M	Back Side	372000	17.97	19.00	1.268	0.600	0.761
	5G NR n2/1RB#1 20M	Back Side	380000	18.10	19.00	1.230	0.702	0.864
	5G NR n2/50RB#1 20M	Front Side	376000	17.96	19.00	1.271	0.416	0.528
	5G NR n2/50RB#1 20M	Back Side	376000	17.96	19.00	1.271	0.502	0.638
	5G NR n2/50RB#1 20M	Left Side	376000	17.96	19.00	1.271	0.345	0.438
	5G NR n2/50RB#1 20M	Right Side	376000	17.96	19.00	1.271	0.059	0.075
	5G NR n2/50RB#1 20M	Top Side	376000	17.96	19.00	1.271	0.421	0.535
	<b>5G NR n2/100RB#0 20M</b>	Back Side	372000	17.82	19.00	1.312	0.584	0.766
Sensor off/Full Power for ENDC (ANT 5)								
	5G NR n2/1RB#1 20M	Front Side	376000	23.17	24.00	1.211	0.408	0.494
	5G NR n2/1RB#1 20M	Back Side	376000	23.17	24.00	1.211	0.434	0.525
	5G NR n2/1RB#1 20M	Left Side	376000	23.17	24.00	1.211	0.078	0.094
	5G NR n2/1RB#1 20M	Right Side	376000	23.17	24.00	1.211	0.123	0.149
39#	5G NR n2/1RB#1 20M	Bottom Side	376000	23.17	24.00	1.211	0.851	1.030
	5G NR n2/1RB#1 20M	Bottom Side	372000	22.97	24.00	1.268	0.792	1.004
	5G NR n2/1RB#1 20M	Bottom Side	380000	23.10	24.00	1.230	0.784	0.965
	5G NR n2/50RB#1 20M	Front Side	376000	22.96	24.00	1.271	0.286	0.363
	5G NR n2/50RB#1 20M	Back Side	376000	22.96	24.00	1.271	0.304	0.386
	5G NR n2/50RB#1 20M	Left Side	376000	22.96	24.00	1.271	0.055	0.069
	5G NR n2/50RB#1 20M	Right Side	376000	22.96	24.00	1.271	0.086	0.109
	5G NR n2/50RB#1 20M	Bottom Side	376000	22.96	24.00	1.271	0.596	0.757
	<b>5G NR n2/100RB#0 20M</b>	Bottom Side	372000	22.82	24.00	1.312	0.705	0.925
Sensor on/Reduced Power Level 1 (ANT 2)								
	5G NR n5/1RB#1 20M	Front Side	167300	19.03	20.00	1.250	0.181	0.226
40#	5G NR n5/1RB#1 20M	Back Side	167300	19.03	20.00	1.250	0.196	0.245
	5G NR n5/1RB#1 20M	Left Side	167300	19.03	20.00	1.250	0.027	0.034
	5G NR n5/1RB#1 20M	Right Side	167300	19.03	20.00	1.250	0.074	0.093
	5G NR n5/1RB#1 20M	Top Side	167300	19.03	20.00	1.250	0.142	0.178
	5G NR n5/50RB#1 20M	Front Side	167300	18.99	20.00	1.262	0.127	0.160



	5G NR n5/50RB#1 20M	Back Side	167300	18.99	20.00	1.262	0.137	0.173
	5G NR n5/50RB#1 20M	Left Side	167300	18.99	20.00	1.262	0.019	0.024
	5G NR n5/50RB#1 20M	Right Side	167300	18.99	20.00	1.262	0.052	0.066
	5G NR n5/50RB#1 20M	Top Side	167300	18.99	20.00	1.262	0.099	0.125
Sensor on/Reduced Power Level 1 (ANT 1)								
	5G NR n66/1RB#1 20M	Front Side	349000	18.02	19.00	1.253	0.175	0.219
41#	5G NR n66/1RB#1 20M	Back Side	349000	18.02	19.00	1.253	0.186	0.233
	5G NR n66/1RB#1 20M	Left Side	349000	18.02	19.00	1.253	0.164	0.206
	5G NR n66/1RB#1 20M	Right Side	349000	18.02	19.00	1.253	0.022	0.028
42#	5G NR n66/1RB#1 20M	Top Side	349000	18.02	19.00	1.253	0.246	0.308
	5G NR n66/50RB#1 20M	Front Side	349000	17.94	19.00	1.276	0.126	0.161
	5G NR n66/50RB#1 20M	Back Side	349000	17.94	19.00	1.276	0.133	0.170
	5G NR n66/50RB#1 20M	Left Side	349000	17.94	19.00	1.276	0.115	0.147
	5G NR n66/50RB#1 20M	Right Side	349000	17.94	19.00	1.276	0.015	0.019
	5G NR n66/50RB#1 20M	Top Side	349000	17.94	19.00	1.276	0.172	0.220
Sensor on/Reduced Power Level 2 for ENDC (ANT 5)								
	5G NR n66/1RB#1 20M	Front Side	349000	23.02	24.00	1.253	0.141	0.177
	5G NR n66/1RB#1 20M	Back Side	349000	23.02	24.00	1.253	0.078	0.098
	5G NR n66/1RB#1 20M	Left Side	349000	23.02	24.00	1.253	0.054	0.068
	5G NR n66/1RB#1 20M	Right Side	349000	23.02	24.00	1.253	0.062	0.077
	5G NR n66/1RB#1 20M	Bottom Side	349000	23.02	24.00	1.253	0.192	0.241
	5G NR n66/50RB#1 20M	Front Side	349000	22.94	24.00	1.276	0.099	0.126
	5G NR n66/50RB#1 20M	Back Side	349000	22.94	24.00	1.276	0.055	0.070
	5G NR n66/50RB#1 20M	Left Side	349000	22.94	24.00	1.276	0.038	0.048
	5G NR n66/50RB#1 20M	Right Side	349000	22.94	24.00	1.276	0.043	0.055
	5G NR n66/50RB#1 20M	Bottom Side	349000	22.94	24.00	1.276	0.134	0.172
Sensor on/Reduced Power Level 1 (ANT 10) (HPUE)								
	5G NR n77/1RB#1 100M	Front Side	633334	23.16	24.00	1.213	0.152	0.184
	5G NR n77/1RB#1 100M	Back Side	633334	23.16	24.00	1.213	0.900	1.092
	5G NR n77/1RB#1 100M	Left Side	633334	23.16	24.00	1.213	0.806	0.978
	5G NR n77/1RB#1 100M	Right Side	633334	23.16	24.00	1.213	0.050	0.061
	5G NR n77/1RB#1 100M	Top Side	633334	23.16	24.00	1.213	0.101	0.123
	5G NR n77/135RB#1 100M	Front Side	633334	22.91	24.00	1.285	0.121	0.156
	5G NR n77/135RB#1 100M	Back Side	633334	22.91	24.00	1.285	0.716	0.920
	5G NR n77/135RB#1 100M	Left Side	633334	22.91	24.00	1.285	0.644	0.828
	5G NR n77/135RB#1 100M	Right Side	633334	22.91	24.00	1.285	0.041	0.053
	5G NR n77/135RB#1 100M	Top Side	633334	22.91	24.00	1.285	0.080	0.103



	<b>5G NR n77/270RB#0 100M</b>	Back Side	633334	21.39	23.00	1.449	0.482	0.698
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission(ANT 10) (HPUE)								
	5G NR n77/1RB#1 100M	Front Side	633334	15.30	16.00	1.175	0.027	0.032
	5G NR n77/1RB#1 100M	Back Side	633334	15.30	16.00	1.175	0.150	0.176
	5G NR n77/1RB#1 100M	Left Side	633334	15.30	16.00	1.175	0.145	0.170
	5G NR n77/1RB#1 100M	Right Side	633334	15.30	16.00	1.175	0.009	0.011
	5G NR n77/1RB#1 100M	Top Side	633334	15.30	16.00	1.175	0.018	0.021
	5G NR n77/135RB#1 100M	Front Side	633334	14.91	16.00	1.285	0.021	0.027
	5G NR n77/135RB#1 100M	Back Side	633334	14.91	16.00	1.285	0.126	0.162
	5G NR n77/135RB#1 100M	Left Side	633334	14.91	16.00	1.285	0.113	0.145
	5G NR n77/135RB#1 100M	Right Side	633334	14.91	16.00	1.285	0.007	0.009
	5G NR n77/135RB#1 100M	Top Side	633334	14.91	16.00	1.285	0.014	0.018
Sensor off/Full Power (ANT 10)								
	5G NR n77/1RB#1 100M	Front Side	633334	22.54	24.00	1.400	0.145	0.203
	5G NR n77/1RB#1 100M	Back Side	633334	22.54	24.00	1.400	0.771	1.079
	5G NR n77/1RB#1 100M	Left Side	633334	22.54	24.00	1.400	0.643	0.900
	5G NR n77/1RB#1 100M	Right Side	633334	22.54	24.00	1.400	0.038	0.053
	5G NR n77/1RB#1 100M	Top Side	633334	22.54	24.00	1.400	0.074	0.104
	5G NR n77/135RB#1 100M	Front Side	633334	22.49	24.00	1.416	0.102	0.144
	5G NR n77/135RB#1 100M	Back Side	633334	22.49	24.00	1.416	0.540	0.764
	5G NR n77/135RB#1 100M	Left Side	633334	22.49	24.00	1.416	0.450	0.637
	5G NR n77/135RB#1 100M	Right Side	633334	22.49	24.00	1.416	0.027	0.038
	5G NR n77/135RB#1 100M	Top Side	633334	22.49	24.00	1.416	0.052	0.073
	<b>5G NR n77/270RB#1 100M</b>	Back Side	633334	22.47	24.00	1.422	0.706	1.004
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission(ANT 10)								
	5G NR n77/1RB#1 100M	Front Side	633334	15.30	16.00	1.175	0.045	0.053
	5G NR n77/1RB#1 100M	Back Side	633334	15.30	16.00	1.175	0.238	0.280
	5G NR n77/1RB#1 100M	Left Side	633334	15.30	16.00	1.175	0.198	0.233
	5G NR n77/1RB#1 100M	Right Side	633334	15.30	16.00	1.175	0.012	0.014
	5G NR n77/1RB#1 100M	Top Side	633334	15.30	16.00	1.175	0.023	0.027
	5G NR n77/135RB#1 100M	Front Side	633334	14.99	16.00	1.262	0.031	0.039
	5G NR n77/135RB#1 100M	Back Side	633334	14.99	16.00	1.262	0.166	0.209
	5G NR n77/135RB#1 100M	Left Side	633334	14.99	16.00	1.262	0.138	0.174
	5G NR n77/135RB#1 100M	Right Side	633334	14.99	16.00	1.262	0.008	0.010
	5G NR n77/135RB#1 100M	Top Side	633334	14.99	16.00	1.262	0.015	0.019
Sensor off/Full Power (ANT 10) (HPUE)								



	5G NR n77/1RB#1 100M	Front Side	656000	27.60	28.50	1.230	0.143	0.176
	5G NR n77/1RB#1 100M	Back Side	656000	27.60	28.50	1.230	0.930	1.144
	5G NR n77/1RB#1 100M	Left Side	656000	27.60	28.50	1.230	0.858	1.056
	5G NR n77/1RB#1 100M	Right Side	656000	27.60	28.50	1.230	0.074	0.091
	5G NR n77/1RB#1 100M	Top Side	656000	27.60	28.50	1.230	0.072	0.089
	5G NR n77/1RB#1 100M	Back Side	650000	27.39	28.50	1.291	0.694	0.896
	5G NR n77/1RB#1 100M	Back Side	653000	27.44	28.50	1.276	0.752	0.960
43#	5G NR n77/1RB#1 100M	Back Side	659000	27.43	28.50	1.279	0.912	1.167
	5G NR n77/1RB#1 100M	Back Side	662000	27.56	28.50	1.242	0.898	1.115
	5G NR n77/1RB#1 100M	Left Side	650000	27.39	28.50	1.291	0.686	0.886
	5G NR n77/1RB#1 100M	Left Side	653000	27.44	28.50	1.276	0.700	0.894
	5G NR n77/1RB#1 100M	Left Side	659000	27.43	28.50	1.279	0.841	1.076
	5G NR n77/1RB#1 100M	Left Side	662000	27.56	28.50	1.242	0.900	1.117
	5G NR n77/135RB#1 100M	Front Side	656000	27.32	28.50	1.312	0.100	0.131
	5G NR n77/135RB#1 100M	Back Side	656000	27.32	28.50	1.312	0.651	0.854
	5G NR n77/135RB#1 100M	Left Side	656000	27.32	28.50	1.312	0.601	0.788
	5G NR n77/135RB#1 100M	Right Side	656000	27.32	28.50	1.312	0.052	0.068
	5G NR n77/135RB#1 100M	Top Side	656000	27.32	28.50	1.312	0.050	0.066
	5G NR n77/135RB#1 100M	Back Side	650000	27.05	28.50	1.396	0.484	0.676
	5G NR n77/135RB#1 100M	Back Side	653000	27.20	28.50	1.349	0.486	0.655
	5G NR n77/135RB#1 100M	Back Side	659000	27.23	28.50	1.340	0.526	0.705
	5G NR n77/135RB#1 100M	Back Side	662000	27.26	28.50	1.330	0.638	0.849
	<b>5G NR n77/270RB#0 100M</b>	Back Side	662000	26.18	27.50	1.355	0.600	0.813
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission(ANT 10) (HPUE)								
	5G NR n77/1RB#1 100M	Front Side	656000	16.10	17.00	1.230	0.039	0.048
	5G NR n77/1RB#1 100M	Back Side	656000	16.10	17.00	1.230	0.243	0.299
	5G NR n77/1RB#1 100M	Left Side	656000	16.10	17.00	1.230	0.224	0.276
	5G NR n77/1RB#1 100M	Right Side	656000	16.10	17.00	1.230	0.021	0.026
	5G NR n77/1RB#1 100M	Top Side	656000	16.10	17.00	1.230	0.018	0.022
	5G NR n77/135RB#1 100M	Front Side	656000	15.82	17.00	1.312	0.031	0.041
	5G NR n77/135RB#1 100M	Back Side	656000	15.82	17.00	1.312	0.208	0.273
	5G NR n77/135RB#1 100M	Left Side	656000	15.82	17.00	1.312	0.191	0.251
	5G NR n77/135RB#1 100M	Right Side	656000	15.82	17.00	1.312	0.016	0.021
	5G NR n77/135RB#1 100M	Top Side	656000	15.82	17.00	1.312	0.012	0.016
Sensor off/Full Power (ANT 10)								
	5G NR n77/1RB#1 100M	Front Side	656000	22.56	24.00	1.393	0.079	0.110
	5G NR n77/1RB#1 100M	Back Side	656000	22.56	24.00	1.393	0.517	0.720



	5G NR n77/1RB#1 100M	Left Side	656000	22.56	24.00	1.393	0.477	0.665
	5G NR n77/1RB#1 100M	Right Side	656000	22.56	24.00	1.393	0.040	0.056
	5G NR n77/1RB#1 100M	Top Side	656000	22.56	24.00	1.393	0.041	0.057
	5G NR n77/135RB#1 100M	Front Side	656000	22.52	24.00	1.406	0.056	0.079
	5G NR n77/135RB#1 100M	Back Side	656000	22.52	24.00	1.406	0.362	0.509
	5G NR n77/135RB#1 100M	Left Side	656000	22.52	24.00	1.406	0.334	0.470
	5G NR n77/135RB#1 100M	Right Side	656000	22.52	24.00	1.406	0.029	0.041
	5G NR n77/135RB#1 100M	Top Side	656000	22.52	24.00	1.406	0.028	0.039
Sensor on/Reduced Power Level 2 for ENDC/simultaneous transmission(ANT 10)								
	5G NR n77/1RB#1 100M	Front Side	656000	16.06	17.00	1.242	0.039	0.048
	5G NR n77/1RB#1 100M	Back Side	656000	16.06	17.00	1.242	0.243	0.302
	5G NR n77/1RB#1 100M	Left Side	656000	16.06	17.00	1.242	0.224	0.278
	5G NR n77/1RB#1 100M	Right Side	656000	16.06	17.00	1.242	0.018	0.022
	5G NR n77/1RB#1 100M	Top Side	656000	16.06	17.00	1.242	0.021	0.026
	5G NR n77/135RB#1 100M	Front Side	656000	16.02	17.00	1.253	0.031	0.039
	5G NR n77/135RB#1 100M	Back Side	656000	16.02	17.00	1.253	0.208	0.261
	5G NR n77/135RB#1 100M	Left Side	656000	16.02	17.00	1.253	0.191	0.239
	5G NR n77/135RB#1 100M	Right Side	656000	16.02	17.00	1.253	0.016	0.020
	5G NR n77/135RB#1 100M	Top Side	656000	16.02	17.00	1.253	0.012	0.015

➤ **WLAN Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Full Power (ANT 7)								
	WLAN2.4GHz/802.11b	Front Side	11	16.38	17.00	1.153	0.083	0.096
44#	WLAN2.4GHz/802.11b	Back Side	11	16.38	17.00	1.153	0.120	0.139
	WLAN2.4GHz/802.11b	Left Side	11	16.38	17.00	1.153	0.076	0.088
	WLAN2.4GHz/802.11b	Right Side	11	16.38	17.00	1.153	0.026	0.030
	WLAN2.4GHz/802.11b	Top Side	11	16.38	17.00	1.153	0.112	0.130
Full Power (ANT 7)								
	WLAN5.2GHz/802.11a	Front Side	44	16.46	17.00	1.132	0.074	0.085
45#	WLAN5.2GHz/802.11a	Back Side	44	16.46	17.00	1.132	0.368	0.423
	WLAN5.2GHz/802.11a	Left Side	44	16.46	17.00	1.132	0.313	0.360
	WLAN5.2GHz/802.11a	Right Side	44	16.46	17.00	1.132	0.086	0.099
	WLAN5.2GHz/802.11a	Top Side	44	16.46	17.00	1.132	0.114	0.131
Full Power (ANT 7)								
	WLAN5.3GHz/802.11a	Front Side	52	16.42	17.00	1.143	0.060	0.070
46#	WLAN5.3GHz/802.11a	Back Side	52	16.42	17.00	1.143	0.375	0.435



Full Power (ANT 7)								
	WLAN5.5GHz/802.11ac40	Front Side	126	16.59	17.00	1.099	0.039	0.045
47#	WLAN5.5GHz/802.11ac40	Back Side	126	16.59	17.00	1.099	0.209	0.237
Full Power (ANT 7)								
	WLAN5.8GHz/802.11a	Front Side	165	16.76	17.00	1.057	0.014	0.015
48#	WLAN5.8GHz/802.11a	Back Side	165	16.76	17.00	1.057	0.164	0.176
	WLAN5.8GHz/802.11a	Left Side	165	16.76	17.00	1.057	0.110	0.118
	WLAN5.8GHz/802.11a	Right Side	165	16.76	17.00	1.057	0.013	0.014
	WLAN5.8GHz/802.11a	Top Side	165	16.76	17.00	1.057	0.014	0.015
Full Power (ANT 7)								
	Bluetooth/DH5	Front Side	78	10.38	10.50	1.028	0.080	0.089
49#	Bluetooth/DH5	Back Side	78	10.38	10.50	1.028	0.119	0.132
	Bluetooth/DH5	Left Side	78	10.38	10.50	1.028	0.069	0.077
	Bluetooth/DH5	Right Side	78	10.38	10.50	1.028	0.020	0.022
	Bluetooth/DH5	Top Side	78	10.38	10.50	1.028	0.107	0.119

**Note:**

1. For TDD-LTE, the reported SAR should be scaled with the duty cycle scaling factor 1.006.
2. The 2.4G WLAN reported 1g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.007, 5G WLAN 802.11a with 1.015, 802.11ac40 with 1.032 and Bluetooth with 1.082.



## 19.4. Repeated SAR Assessment

### ➤ General Note

In accordance with published RF Exposure KDB procedure 865664 D01 SAR measurement 100 MHz to 6 GHz. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1. Repeated measurement is not required when the original highest measured SAR is  $< 0.80$  W/kg;
2. When the original highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  W/kg ( $\sim 10\%$  from the 1-g SAR limit).
4. Perform a third repeated measurement only if the original, first or second repeated measurement is  $\geq 1.5$  W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

### ➤ Test Results

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>1g</sub> (W/kg)	Reported SAR <sub>1g</sub> (W/kg)
Sensor on/Reduced Power Level 1 (ANT 2)								
OR.	Band V/RMC 12.2Kbps	Right Cheek	4233	21.45	22.00	1.135	0.900	1.022
1 <sup>st</sup>	Band V/RMC 12.2Kbps	Right Cheek	4182	21.47	22.00	1.130	0.843	0.952
Sensor on/Reduced Power Level 1 (ANT 2)								
OR.	LTE Band 5/1RB#0 10M	Right Cheek	20600	21.28	22.00	1.180	0.892	1.053
1 <sup>st</sup>	LTE Band 5/1RB#0 10M	Right Cheek	20600	21.28	22.00	1.180	0.826	0.975
Sensor on/Reduced Power Level 1 (ANT 2)								
OR.	LTE Band 14/1RB#0 10M	Right Cheek	23330	20.79	21.50	1.178	0.817	0.962
1 <sup>st</sup>	LTE Band 14/1RB#0 10M	Right Cheek	23330	20.79	21.50	1.178	0.769	0.906
Sensor on/Reduced Power Level 1 (ANT 1)								
OR.	5G NR n2/1RB#1 20M	Right Cheek	372000	17.97	19.00	1.268	0.915	1.160
1 <sup>st</sup>	5G NR n2/1RB#1 20M	Right Cheek	372000	17.97	19.00	1.268	0.889	1.127
Sensor on/Reduced Power Level 1 (ANT 1)								
OR.	5G NR n66/1RB#1 20M	Right Cheek	349000	18.02	19.00	1.253	0.834	1.045
1 <sup>st</sup>	5G NR n66/1RB#1 20M	Right Cheek	349000	18.02	19.00	1.253	0.811	1.016
Sensor on/Reduced Power Level 1 (ANT 10) (HPUE)								





OR.	5G NR n77/1RB#1 100M	Right Cheek	633334	23.16	24.00	1.213	0.947	1.149
1 <sup>st</sup>	5G NR n77/1RB#1 100M	Right Cheek	633334	23.16	24.00	1.213	0.919	1.115
Sensor on/Reduced Power Level 1 (ANT 1)								
OR.	5G NR n2/1RB#1 20M	Bottom Side	376000	23.17	24.00	1.211	0.851	1.030
1 <sup>st</sup>	5G NR n2/1RB#1 20M	Bottom Side	376000	23.17	24.00	1.211	0.813	0.984
Sensor on/Reduced Power Level 1 (ANT 10) (HPUE)								
OR.	5G NR n77/1RB#1 100M	Back Side	633334	23.16	24.00	1.213	0.900	1.092
1 <sup>st</sup>	5G NR n77/1RB#1 100M	Back Side	633334	23.16	24.00	1.213	0.869	1.054
Sensor off/Full Power (ANT 10)								
OR.	5G NR n77/1RB#1 100M	Back Side	659000	27.43	28.50	1.279	0.912	1.167
1 <sup>st</sup>	5G NR n77/1RB#1 100M	Back Side	659000	27.43	28.50	1.279	0.892	1.141



## 19.5. Extremity SAR Assessment

➤ **General Guidance**

1. According to KDB 648747 D04v01r03 The UMPC mini-tablet procedures must also be applied to test the SAR of all surfaces and edges with an antenna located at  $\leq 25$  mm from that surface or edge, in direct contact with a flat phantom, for 10-g extremity SAR according to the body-equivalent tissue dielectric parameters in KDB Publication 865664 D01 to address interactive hand use exposure conditions.
2. When hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR  $> 1.2$  W/kg.
3. According to the user manual, the EUT diagonal size is greater than 16cm, therefore the 0mm extremity SAR of WLAN 5GHz is required.

➤ **Test Results**

Plot No.	Band/Mode	Test Position	CH.	Ave. Power (dBm)	Tune-up Limit (dBm)	Tune-up Scaling Factor	Meas. SAR <sub>10g</sub> (W/kg)	Reported SAR <sub>10g</sub> (W/kg)
Full Power (ANT 7)								
	WLAN5.3GHz/802.11a	Front Side	52	16.42	17.00	1.143	0.044	0.051
50#	WLAN5.3GHz/802.11a	Back Side	52	16.42	17.00	1.143	0.225	0.261
Full Power (ANT 7)								
	WLAN5.5GHz/802.11ac40	Front Side	126	16.59	17.00	1.099	0.029	0.033
51#	WLAN5.5GHz/802.11ac40	Back Side	126	16.59	17.00	1.099	0.409	0.464

**Note:** The 5G WLAN 802.11a reported 1g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.015, 802.11ac40 with 1.032.



## 20. Simultaneous Transmission Evaluation

### 20.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Head	Body-Worn	Hotspot
1	WWAN+WLAN 2.4GHz	Yes	Yes	Yes
3	WWAN+WLAN 5.2/5.8GHz	Yes	Yes	Yes
4	WWAN+WLAN 5.3/5.5GHz	Yes	Yes	No
5	WWAN+Bluetooth	Yes	Yes	Yes
6	WLAN 5.2/5.8GHz+Bluetooth	Yes	Yes	Yes
7	WLAN 5.3/5.5GHz+Bluetooth	Yes	Yes	No
8	WWAN+WLAN 5.2/5.8GHz+Bluetooth	Yes	Yes	Yes
9	WWAN+WLAN 5.3/5.5GHz+Bluetooth	Yes	Yes	No

**Note:**

- When the user enables the personal wireless router functions for the handset, actual operations include simultaneous transmission of the WWAN and WLAN transmitters. The "Portable Hotspot" feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.
- The hotspot SAR result may overlap with the body-worn accessory SAR requirements, per KDB 941225 D06, the more conservative configurations can be considered, thus excluding some unnecessary body-worn accessory SAR tests.
- Simultaneous Transmission SAR evaluation is not required for BT and WLAN 2.4GHz, because the software mechanism have been incorporated to guarantee that the WLAN 2.4GHz and Bluetooth transmitters would not simultaneously operate.
- Per KDB 447498D01v06, simultaneous transmission SAR evaluation procedures is as followed:  
 Step 1: If sum of 1 g SAR < 1.6 W/kg, Simultaneous SAR measurement is not required.  
 Step 2: If sum of 1 g SAR > 1.6 W/kg, ratio of SAR to peak separation distance for pair of transmitters calculated.  
 Step 3: If the ratio of SAR to peak separation distance is  $\leq 0.04$ , Simultaneous SAR measurement is not required.  
 Step 4: If the ratio of SAR to peak separation distance is  $> 0.04$ , Simultaneous SAR measurement is required and simultaneous transmission SAR value is calculated.  
 (The ratio is determined by:  $(SAR1 + SAR2) \wedge 1.5/Ri \leq 0.04$ ,  
 Ri is the separation distance between the peak SAR locations for the antenna pair in mm.
- The co-location of WWAN+Bluetooth, WLAN 5GHz+Bluetooth and WWAN+WLAN 5GHz would not be recorded since it is less than the combination of WWAN+WLAN 5GHz+Bluetooth.



## 20.2. Simultaneous Transmission Analysis

Remark: The Inter-band ULCA data, 5G EN-DC data and simultaneous transmission data were recorded in annex F.

## 21. Uncertainty Assessment

According to KDB 865664 D01 SAR measurement 100 MHz to 6GHz, when the highest measured 1-g SAR is less than 1.5 W/kg and 10-g extremity SAR less than 3.75 W/kg, the expanded SAR measurement uncertainty must be less than 30% with a confidence interval of  $k=2$ . When these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE 1528-2013 is not required in the SAR report and submitted for equipment approval. For this device, both the 1-g SAR is less than 1.5 W/kg and 10-g extremity SAR less than 3.75 W/kg. Therefore the measurement uncertainty table is not required in this report.



## Annex A General Information

### 1. Identification of the Responsible Testing Laboratory

Laboratory Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Laboratory Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China
Telephone:	+86 755 36698555
Facsimile:	+86 755 36698525

### 2. Identification of the Responsible Testing Location

Name:	Shenzhen Morlab Communications Technology Co., Ltd.
Address:	FL.3, Building A, FeiYang Science Park, No.8 LongChang Road, Block 67, BaoAn District, ShenZhen, Guangdong Province, P. R. China

### 3. Facilities and Accreditations

The FCC designation number is CN1192, the test firm registration number is 226174.

#### Note:

The main report is end here and the other Annex (B,C,D,E,F,G) will be submitted separately.

\*\*\*\*\* END OF MAIN REPORT \*\*\*\*\*