



REPORT No.: SZ24120064S01

# TEST REPORT

**APPLICANT** : Power Idea Technology (Shenzhen) Co., Ltd.  
**PRODUCT NAME** : POC RADIO  
**MODEL NAME** : PFL01G  
**MARKETING NAME** : RG190  
**BRAND NAME** : RugGear  
**FCC ID** : ZLE-PFL01G  
**STANDARD(S)** : FCC 47 CFR Part 2 (2.1093)  
IEEE 1528-2013  
**RECEIPT DATE** : 2024-12-17  
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Changed History		
Version	Date	Reason for Change
1.0	2025-01-22	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	
		Next to mouth (Gap 25mm)	Body-worn (Gap 0mm)
		1g SAR (W/kg)	10g SAR (W/kg)
GSM	GSM850	0.623	1.422
	GSM1900	0.236	1.335
WCDMA	WCDMA II	0.246	1.429
	WCDMA IV	0.174	1.202
	WCDMA V	0.531	0.694
LTE	LTE Band 2	0.194	1.279
	LTE Band 4	0.119	1.016
	LTE Band 5	0.494	0.963
	LTE Band 7	0.347	1.527
	LTE Band 38	0.145	0.586
	LTE Band 41	0.160	0.655
WLAN	2.4GHz WLAN	0.025	0.220
	5GHz WLAN	0.083	0.325
2.4GHz Band	Bluetooth	0.017	0.055

Highest Simultaneous Transmission SAR <sub>1g</sub> (W/Kg):	0.723	Limit (W/kg): 1.6
Highest Simultaneous Transmission SAR <sub>10g</sub> (W/Kg):	1.634	Limit (W/kg): 4.0

## Note:

1. 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. .
2. 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>	Power Idea Technology (Shenzhen) Co., Ltd.
<b>Applicant Address:</b>	4th Floor, A Section, Languang Science&technology, Xinx RD, Hi-Tech Industrial Park North, Nanshan, ShenZhen, China
<b>Manufacturer:</b>	Power Idea Technology (Shenzhen) Co., Ltd.
<b>Manufacturer Address:</b>	4th Floor, A Section, Languang Science&technology, Xinx RD, Hi-Tech Industrial Park North, Nanshan, ShenZhen, China

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

<b>Product Name:</b>	POC RADIO
<b>EUT No.:</b>	6#
<b>Hardware Version:</b>	V1.0
<b>Software Version:</b>	RG190_00.00_1_20240910
<b>Frequency Bands:</b>	GSM 850: 824 MHz ~ 849 MHz GSM 1900: 1850 MHz ~ 1910 MHz WCDMA II: 1850 MHz ~ 1910 MHz WCDMA IV: 1710 MHz ~ 1755 MHz WCDMA 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 38: 2570 MHz ~ 2620 MHz LTE Band 41: 2496 MHz ~ 2690 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>	GSM/GPRS: GMSK EDGE: 8PSK WCDMA: QPSK, 16QAM LTE: QPSK, 16QAM



	802.11b: DSSS 802.11g/n-HT20/40: OFDM 802.11a/n-HT20/40: OFDM BR+EDR: GFSK (1Mbps), $\pi/4$ -DQPSK (2Mbps), 8-DPSK (3Mbps) Bluetooth LE: GFSK (1Mbps)	
<b>Multi-slot Class:</b>	GPRS: Multi-slot Class 12 EDGE: Multi-slot Class 12	
<b>Operation Class:</b>	Class B	
<b>VoLTE Mode:</b>	Support	
<b>VoWIFI Mode:</b>	Support	
<b>Hotspot Mode:</b>	Support (WLN 5G for B1 & B4)	
<b>Antenna Type:</b>	WWAN: External Antenna WLAN: PIFA Antenna Bluetooth: PIFA Antenna	
<b>SIM Cards Description:</b>	SIM 1	GSM+WCDMA+LTE
	SIM 2	GSM+WCDMA+LTE

**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 %

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. (ρ). The equation description is as below:

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

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

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

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

Where C is the specific head capacity, δT is the temperature rise and δt the exposure duration, or related to the electrical field in the tissue by

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

Where σ is the conductivity of the tissue, ρ 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:**

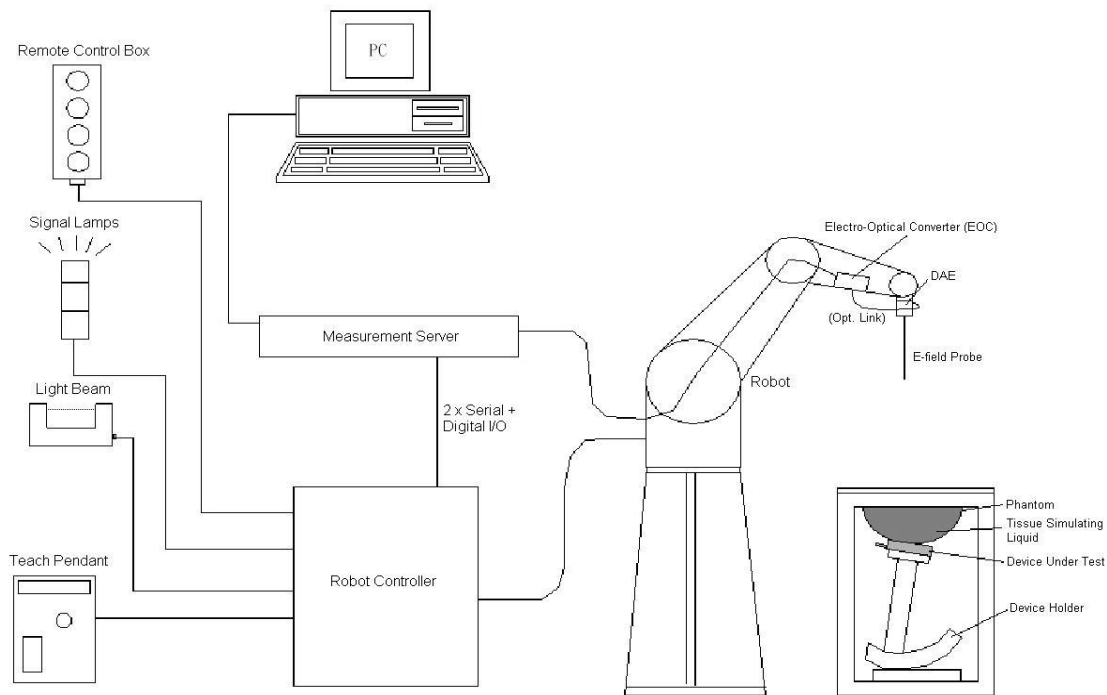
1. Occupational/Uncontrolled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure (i.e. as a result of employment or occupation).
2. Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 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 643646 D01v01r02	SAR Test for PTT Radios	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>

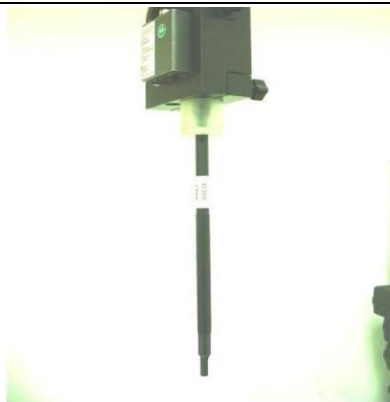
<b>Construction</b>	Symmetrical design with triangular core Built-in optical fiber for surface detection system. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
<b>Frequency</b>	10 MHz to 3 GHz; Linearity: $\pm 0.2$ dB	
<b>Directivity</b>	$\pm 0.2$ 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 bits 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>

Shell Thickness	2 ± 0.2 mm (sagging: <1%) Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	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

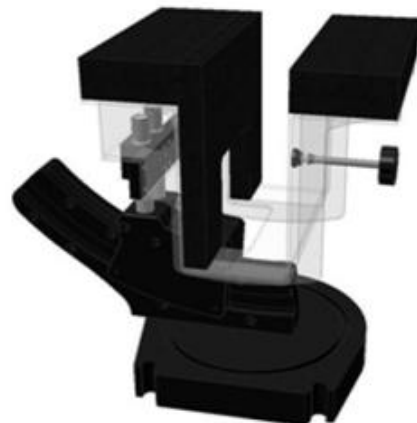


Fig 6.10 Laptop Extension Kit



## 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	$\text{Norm}_i, a_{i0}, a_{i1}, a_{i2}$
	- Conversion factor	$\text{ConvF}_i$
	- Diode compression point	dcpi
<b>Device parameters:</b>	- Frequency	f
	- Crest factor	cf
<b>Media parameters:</b>	- Conductivity	$\sigma$
	- Density	$\rho$

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),  $\text{Mv}/(\text{V/m})^2$  for E-field  
 $\text{Probes ConvF}$  = 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	900MHz System Validation Kit	D900V2	1d064	2024.10.21	2027.10.20
SPEAG	1800MHz System Validation Kit	D1800V2	2d158	2024.10.21	2027.10.20
SPEAG	2000MHz System Validation Kit	D2000V2	1050	2024.10.22	2027.10.21
SPEAG	2450MHz System Validation Kit	D2450V2	805	2024.10.22	2027.10.21
SPEAG	2600MHz System Validation Kit	D2600V2	1198	2024.10.23	2027.10.22
SPEAG	5000MHz System Validation Kit	D5GHzV2	1176	2024.10.22	2027.10.21
SPEAG	DOSIMETRIC ASSESSMENT SYSTEM Software	DASY52	52.10.4.1527	NCR	NCR
SPEAG	Dosimetric E-Field Probe	EX3DV4	3823	2024.11.11	2025.11.10
SPEAG	Dosimetric E-Field Probe	ES3DV3	3295	2024.07.17	2025.07.16
SPEAG	Data Acquisition Electronics	DAE4	480	2024.11.11	2025.11.10
SPEAG	Data Acquisition Electronics	DAE4	1324	2024.07.05	2025.07.04
SPEAG	SAM 2	QD000P40CC	1464	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
Agilent	Network Analyzer	E5071B	MY42404762	2024.01.25	2025.01.24
SPEAG	Dielectric Assessment KIT	DAK-3.5	1279	2024.03.18	2025.03.17
mini-circuits	Amplifier	ZHL-42W+	608501717	NCR	NCR
mini-circuits	Amplifier	ZVE-8G+	754401735	NCR	NCR
Agilent	Signal Generator	N5182B	MY53050509	2024.09.11	2025.09.10
R&S	Power Sensor	NRP8S	103215	2024.01.25	2025.01.24
Agilent	Power Meter	E4416A	MY45102093	2024.09.11	2025.09.10
R&S	Power Sensor	NRP8S	103240	2024.01.25	2025.01.24
Anritsu	Power Meter	E4418B	GB43318055	2024.05.30	2025.05.29
Agilent	Dual Directional Coupler	778D	50422	NA	NA
MCL	Attenuation	351-218-010	N/A	NA	NA
R&S	Spectrum Analyzer	N9030A	MY54170556	2024.09.18	2025.09.17
KTJ	Thermo meter	TA298	N/A	2024.11.20	2025.11.19
SPEAG	Tissue Simulating Liquids	HBBL600-10000V6		24H	



**Note:**

1. The calibration certificate of DASY can be referred to appendix F 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.

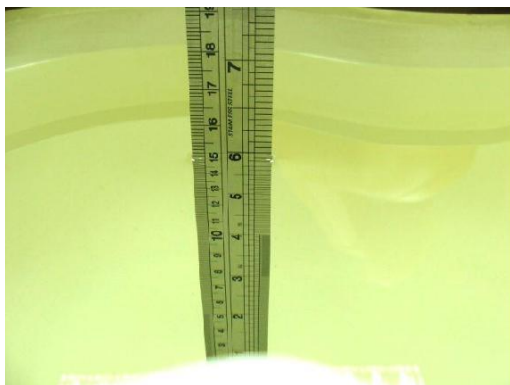


Fig 7.1 Photo of Liquid Height for Head SAR



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
900	HSL	22.3	0.985	0.97	1.55	±5	2024.12.21
1800	HSL	22.2	1.427	1.40	1.93	±5	2024.12.22
2000	HSL	22.1	1.408	1.40	0.57	±5	2024.12.26
2450	HSL	22.2	1.832	1.80	1.78	±5	2024.12.27
2600	HSL	22.3	1.925	1.96	-1.79	±5	2024.12.25
2600	HSL	22.1	1.902	1.96	-2.96	±5	2024.12.29
5250	HSL	22.1	4.620	4.71	-1.91	±5	2024.12.30
5600	HSL	22.3	5.187	5.07	2.31	±5	2024.12.31
5750	HSL	22.2	5.079	5.22	-2.70	±5	2025.01.01
Frequency (MHz)	Tissue Type	Liquid Temp. (°C)	Permittivity ( $\epsilon_r$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Date
900	HSL	22.3	42.857	41.50	3.27	±5	2024.12.21
1800	HSL	22.2	40.627	40.00	1.57	±5	2024.12.22
2000	HSL	22.1	39.173	40.00	-2.07	±5	2024.12.26
2450	HSL	22.2	39.481	39.20	0.72	±5	2024.12.27
2600	HSL	22.3	38.531	39.00	-1.20	±5	2024.12.25
2600	HSL	22.1	38.226	39.00	-1.98	±5	2024.12.29
5250	HSL	22.1	35.317	35.95	-1.76	±5	2024.12.30
5600	HSL	22.3	35.033	35.50	-1.32	±5	2024.12.31
5750	HSL	22.2	36.184	35.35	2.36	±5	2025.01.01

## 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

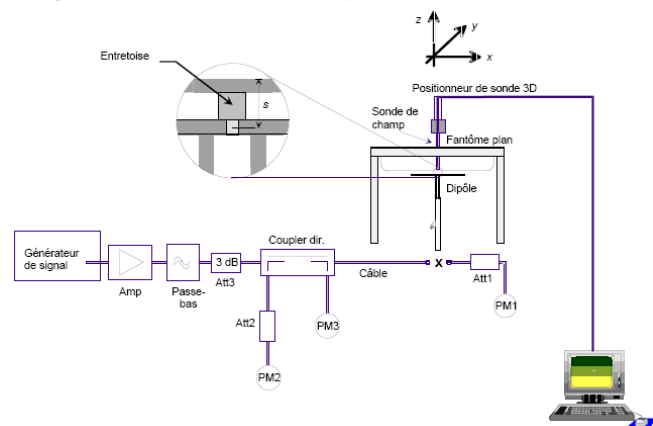


Fig 8.2 System Setup for System Evaluation



### 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
900	HSL	250	D900V2-1d064	3295	1324
1800	HSL	250	D1800V2-2d158	3295	1324
2000	HSL	250	D2000V2-1050	3295	1324
2450	HSL	250	D2450V2-805	3295	1324
2600	HSL	250	D2600V2-1198	3295	1324
2600	HSL	250	D2600V2-1198	3295	1324
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	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2024.12.21	900	HSL	2.82	10.90	11.28	3.49
2024.12.22	1800	HSL	10.16	39.20	40.64	3.67
2024.12.26	2000	HSL	10.29	41.40	41.16	-0.58
2024.12.27	2450	HSL	13.52	52.80	54.08	2.42
2024.12.25	2600	HSL	14.29	55.90	57.16	2.25
2024.12.29	2600	HSL	14.42	55.90	57.68	3.18
2024.12.30	5250	HSL	7.83	77.30	78.3	1.29
2024.12.31	5600	HSL	8.47	82.40	84.7	2.79
2025.01.01	5750	HSL	8.17	77.20	81.7	5.83

Date	Frequency (MHz)	Tissue Type	Measured 10g SAR (W/kg)	Targeted 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Deviation (%)
2024.12.21	900	HSL	1.77	7.00	7.08	1.14
2024.12.22	1800	HSL	5.14	20.70	20.56	-0.68
2024.12.26	2000	HSL	5.25	21.00	21	0.00
2024.12.27	2450	HSL	6.17	24.50	24.68	0.73
2024.12.25	2600	HSL	6.12	24.90	24.48	-1.69
2024.12.29	2600	HSL	6.25	24.90	25	0.40
2024.12.30	5250	HSL	2.21	21.50	22.1	2.79
2024.12.31	5600	HSL	2.33	22.80	23.3	2.19
2025.01.01	5750	HSL	2.06	21.20	20.6	-2.83

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

## 9. EUT Testing Position

### 9.1. Handheld push-to-talk (PTT) Two-way Radios

The operating configurations of handheld PTT two-way radios generally require SAR testing for in-front-of the face and body-worn accessory exposure conditions. A duty factor of 50% should be applied to determine compliance for radios with maximum operating duty factors  $\leq 50\%$ . Radios with higher duty factors must apply the maximum duty factor supported by the device to determine compliance. For example, up to 100% duty factor may be required for certain radios that support operator-assisted PSTN calls. A duty factor of 75% may be applied for PTT radios with Bluetooth or voice activated transmission capabilities to avoid the justification required for using a lower duty factor than what is supported by certain features built-in within the radio.

When a body-worn accessory is not supplied with the PTT radio, a test separation distance  $\leq 10$  mm, applicable to the device form factor, must be applied to determine body-worn accessory SAR test exclusion. A test separation distance of 25 mm must be applied for in-front-of the face SAR test exclusion and SAR measurements. When body-worn accessory SAR testing is required, the body-worn accessory requirements in 4.2.2 should be applied. PTT two-way radios that support held-to-ear operating mode must also be tested according to the exposure configurations required for handsets in KDB Publication 648474 D04.

### 9.2. Body-worn Configurations

According to KDB 648643 body SAR is measured with the radio placed in a body-worn accessory, positioned against a flat phantom, representative of the normal operating conditions expected by users and typically with a standard default audio accessory supplied with the radio. Since audio accessories, including any default audio accessories supplied with a radio, may be designed to operate with a subset of the combinations of antennas, batteries and body-worn accessories, when a default audio accessory does not fully support all the test configurations required in this section for body-worn accessories testing an alternative audio accessory must be selected to be the default audio accessory for body-worn accessories testing. If an alternative audio accessory cannot be identified, body-worn accessories should be tested without any audio accessory. In general, all sides of the radio that may be positioned facing the user when using a body-worn accessory must be considered for SAR compliance.

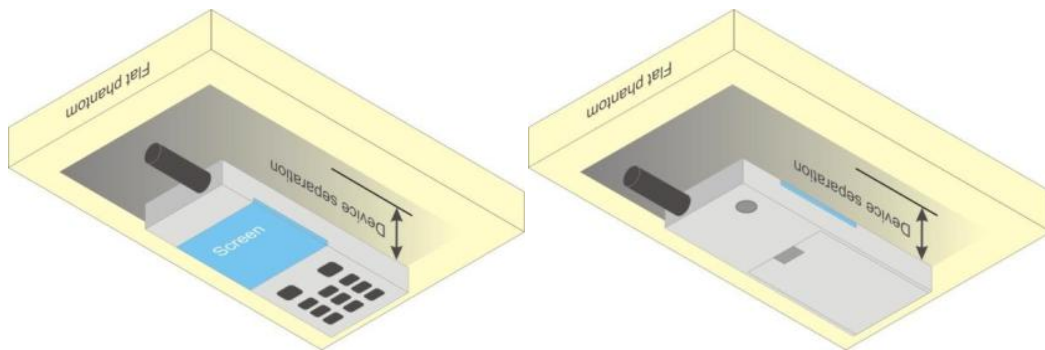


Fig 9.1 Illustration for PTT Test Position

## 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 21.5 mm. 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 5 x 5 x 7 (8 mm x 8 mm x 5 mm) providing a volume of 32 mm in the X & Y axis, and 30 mm in the Z axis.

## 10.5. SAR Averaged Methods

In DASY, 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 DASY 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 dimensionals 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

### <GSM Mode>

A summary of these settings is illustrated below:

For GSM850 frequency band, the power control is set to 5 for GSM/GPRS mode (GSMK-CS1) and set to 8 for EDGE mode (MCS5); For GSM1900 frequency band, the power control is set to 0 for GSM/GPRS mode (GSMK-CS1) and set to 2 for EDGE mode (MCS5).

1. Per KDB 447498 D01v06, the maximum output power channel is used for SAR testing and for further SAR test reduction.
2. Per KDB 941225 D01v03r01, SAR test reduction for GSM / GPRS / EDGE modes is determined by the source-based time-averaged output power including tune-up tolerance. The mode with highest specified time-averaged output power should be tested for SAR compliance in the applicable exposure conditions. For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested. Therefore, the GPRS (4Tx slots) for GSM850/GSM1900 is considered as the primary mode.
3. Other configurations of GSM / GPRS / EDGE are considered as secondary modes.

### Timeslot consignations:

#### Remark:

1. The frame-averaged power is linearly reported the maximum burst averaged power over 8 time slots. The calculated methods are shown as below:  
The duty cycle "x" of different time slots as below:  
1 TX slot is 1/8, 2 TX slots is 2/8, 3 TX slots is 3/8 and 4 TX slots is 4/8  
Based on the calculation formula:  
Frame-averaged power = Burst averaged power + 10 log (x)  
So,  
Frame-averaged power (1 TX slot) = Burst averaged power (1 TX slot) – 9.03  
Frame-averaged power (2 TX slots) = Burst averaged power (2 TX slots) – 6.02  
Frame-averaged power (3 TX slots) = Burst averaged power (3 TX slots) – 4.26  
Frame-averaged power (4 TX slots) = Burst averaged power (4 TX slots) – 3.01
2. CS1 coding scheme was used in GPRS conducted power measurements and SAR testing, MCS5 coding scheme was used in EGPRS conducted power measurements and SAR testing (if necessary).

No. of Slots:	Slot 1	Slot 2	Slot 3	Slot 4
Slot Consignation:	1Up 4Down	2Up 3Down	3Up 2Down	4Up 1Down
Duty Cycle:	1:8.3	1:4.15	1:2.77	1:2.08
Correct Factor:	-9.03dB	-6.02dB	-4.26dB	-3.01dB

## <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, TF1) 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, TF1) 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**

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


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



## &lt;CDMA Mode&gt;

**1xEV-DO Rev. B**

Call box setup procedure

1xEV-DO Release B

1&gt; CMW 500 Signal Generator &gt; 1xEV-DO Taskbar Enable

2&gt; CMW 500 1xEV-DO Signaling Configuration Window &gt;

3&gt; 1xEV-DO Signaling On Window:

Under Access Network Control:

Band Class: BC0: US Cellular

RF Channel: 31

1xEV-DO Power: -70 dBm

4&gt; 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                 | ✓                   | ✓                     |



## &lt;LTE Mode&gt;

**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

**Note:** The measurement result showed some difference from the target MPR level, due to expected 0.5 dB 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	√	√	√	√
38	N/A	N/A	√	√	√	√
41	N/A	N/A	√	√	√	√

**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 ≤ 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/ (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.

## 13. Conducted Power List

Remark: The output power of GSM/WCDMA/LTE/WLAN/Bluetooth was recorded in annex E of this report.

## 14. Exposure Positions Consideration

### ➤ EUT Antenna Locations

The location of antenna was recorded in annex B	
Antenna	Support band
Main ANT	TX&RX: GSM 850/1900, WCDMA Band II/IV/V, LTE B2/B4/B5/B7/B38/B41
DIV ANT	RX: GSM 850/1900, WCDMA Band II/IV/V, LTE B2/B4/B5/B7/B38/B41
GWB ANT	TX&RX: 2.4G/5G/BT/GNSS

### ➤ Test Positions Consideration

1. Per KDB 447498 D01v06, when a body-worn accessory is not supplied with the PTT radio, a test separation distance  $\leq 10$  mm, applicable to the device form factor, must be applied to determine body-worn accessory SAR test exclusion.
2. Per KDB 447498 D01v06, a test separation distance of 25 mm must be applied for in-front-of the face SAR test exclusion and SAR measurements.

## 15. Block Diagram of the Tests to be Performed

### 15.1. Body

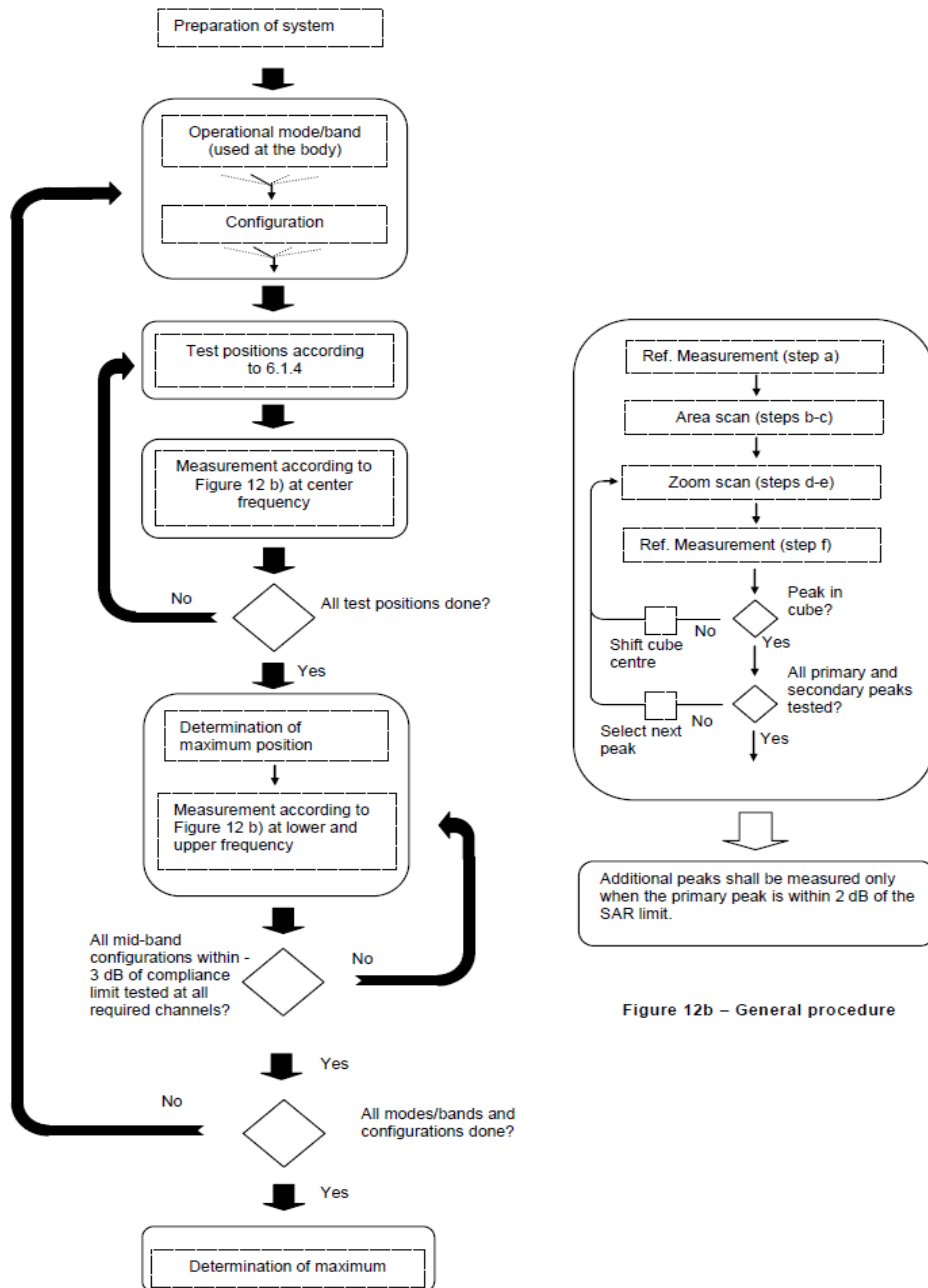


Figure 12b – General procedure

## 16. Test Results List

### 16.1. 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 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.

## 16.2. Next to mouth SAR Data

### ➤ GSM Next to mouth 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)
1#	GSM 850 (4TX slots)	Front Side	189	28.19	29	1.205	0.517	0.623
	GSM 850 (4TX slots)	Front Side	128	28.11	29	1.227	0.310	0.381
	GSM 850 (4TX slots)	Front Side	251	28.15	29	1.216	0.318	0.387
	GSM 1900 (2TX slots)	Front Side	661	28.6	29.5	1.230	0.157	0.193
	GSM 1900 (2TX slots)	Front Side	512	28.55	29.5	1.245	0.170	0.212
2#	GSM 1900 (2TX slots)	Front Side	810	28.58	29.5	1.236	0.191	0.236

### ➤ WCDMA Next to mouth 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)
	Band II/RMC 12.2Kbps	Front Side	9400	23.09	24	1.233	0.185	0.228
	Band II/RMC 12.2Kbps	Front Side	9262	23.05	24	1.245	0.155	0.193
3#	Band II/RMC 12.2Kbps	Front Side	9538	23.02	24	1.253	0.196	0.246
	Band IV/RMC 12.2Kbps	Front Side	1413	23.36	24	1.159	0.124	0.144
	Band IV/RMC 12.2Kbps	Front Side	1312	23.29	24	1.178	0.119	0.140
4#	Band IV/RMC 12.2Kbps	Front Side	1513	23.33	24	1.167	0.149	0.174
5#	Band V/RMC 12.2Kbps	Front Side	4182	23.22	24	1.197	0.444	0.531
	Band V/RMC 12.2Kbps	Front Side	1312	23.19	24	1.205	0.349	0.421
	Band V/RMC 12.2Kbps	Front Side	1513	23.2	24	1.202	0.416	0.500





## ➤ LTE QPSK Next to mouth 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)
6#	LTE Band 2/1RB#0 20M	Front Side	18900	23.09	24	1.233	0.157	0.194
	LTE Band 2/1RB#0 20M	Front Side	18700	23.05	24	1.245	0.135	0.168
	LTE Band 2/1RB#0 20M	Front Side	19100	23.06	24	1.242	0.145	0.180
	LTE Band 2/50RB#0 20M	Front Side	18900	21.96	23	1.271	0.115	0.146
	LTE Band 2/50RB#0 20M	Front Side	18700	21.77	23	1.327	0.118	0.157
	LTE Band 2/50RB#0 20M	Front Side	19100	21.88	23	1.294	0.129	0.167
	LTE Band 4/1RB#0 20M	Front Side	20175	23.11	24.00	1.227	0.088	0.108
	LTE Band 4/1RB#0 20M	Front Side	20050	23.09	24.00	1.233	0.092	0.113
7#	LTE Band 4/1RB#0 20M	Front Side	20300	23.05	24.00	1.245	0.096	0.119
	LTE Band 4/50RB#0 20M	Front Side	20175	22.02	23.00	1.253	0.070	0.088
	LTE Band 4/50RB#0 20M	Front Side	20050	22.00	23.00	1.259	0.084	0.106
	LTE Band 4/50RB#0 20M	Front Side	20300	21.99	23.00	1.262	0.083	0.105
8#	LTE Band 5/1RB#0 10M	Front Side	20525	23.69	24.5	1.205	0.410	0.494
	LTE Band 5/1RB#0 10M	Front Side	20450	23.64	24.5	1.219	0.299	0.364
	LTE Band 5/1RB#0 10M	Front Side	20600	23.66	24.5	1.213	0.370	0.449
	LTE Band 5/25RB#0 10M	Front Side	20525	22.75	23.5	1.189	0.293	0.348
	LTE Band 5/25RB#0 10M	Front Side	20450	22.72	23.5	1.197	0.251	0.300
	LTE Band 5/25RB#0 10M	Front Side	20600	22.58	23.5	1.236	0.309	0.382
9#	LTE Band 7/1RB#0 20M	Front Side	21100	23.25	24	1.189	0.292	0.347
	LTE Band 7/1RB#0 20M	Front Side	20850	23.24	24	1.191	0.190	0.226
	LTE Band 7/1RB#0 20M	Front Side	21350	23.2	24	1.202	0.231	0.278
	LTE Band 7/50RB#0 20M	Front Side	21100	22.36	23	1.159	0.228	0.264
	LTE Band 7/50RB#0 20M	Front Side	20850	22.33	23	1.167	0.183	0.214
	LTE Band 7/50RB#0 20M	Front Side	21350	22.27	23	1.183	0.223	0.264
10#	LTE Band 38/1RB#0 20M	Front Side	38000	22.77	23.5	1.183	0.122	0.145
	LTE Band 38/1RB#0 20M	Front Side	37850	22.73	23.5	1.194	0.115	0.138
	LTE Band 38/1RB#0 20M	Front Side	38150	22.75	23.5	1.189	0.091	0.109
	LTE Band 38/50RB#0 20M	Front Side	38000	21.79	22.5	1.178	0.084	0.100
	LTE Band 38/50RB#0 20M	Front Side	37850	21.72	22.5	1.197	0.080	0.096
	LTE Band 38/50RB#0 20M	Front Side	38150	21.74	22.5	1.191	0.073	0.087





	LTE Band 41/1RB#0 20M	Front Side	40620	22.73	23.5	1.194	0.126	0.151
	LTE Band 41/1RB#0 20M	Front Side	39750	22.61	23.5	1.227	0.084	0.104
11#	LTE Band 41/1RB#0 20M	Front Side	40185	22.66	23.5	1.213	0.131	0.160
	LTE Band 41/1RB#0 20M	Front Side	41055	22.69	23.5	1.205	0.083	0.101
	LTE Band 41/1RB#0 20M	Front Side	41490	22.67	23.5	1.211	0.070	0.085
	LTE Band 41/50RB#0 20M	Front Side	40620	21.67	22.5	1.211	0.088	0.107
	LTE Band 41/50RB#0 20M	Front Side	39750	21.6	22.5	1.230	0.067	0.083
	LTE Band 41/50RB#0 20M	Front Side	40185	21.59	22.5	1.233	0.086	0.107
	LTE Band 41/50RB#0 20M	Front Side	41055	21.61	22.5	1.227	0.070	0.086
	LTE Band 41/50RB#0 20M	Front Side	41490	21.57	22.5	1.239	0.057	0.071

➤ **WLAN/BT Next to mouth 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)
12#	WLAN2.4GHz/802.11b	Front Side	6	15.62	16.5	1.225	0.020	0.025
	WLAN2.4GHz/802.11b	Front Side	1	14.95	15.5	1.135	0.018	0.020
	WLAN2.4GHz/802.11b	Front Side	11	14.85	15.5	1.161	0.015	0.017
13#	WLAN5.2GHz/802.11n-HT40	Front Side	38	13.22	14	1.197	0.062	0.078
	WLAN5.2GHz/802.11n-HT40	Front Side	46	12.61	13.5	1.227	0.055	0.072
14#	WLAN5.3GHz/802.11n-HT20	Front Side	52	12.99	14	1.262	0.057	0.074
	WLAN5.3GHz/802.11n-HT20	Front Side	60	12.5	13.5	1.259	0.051	0.066
	WLAN5.3GHz/802.11n-HT20	Front Side	64	12.47	13.5	1.268	0.047	0.061
15#	WLAN5.5GHz/802.11n-HT40	Front Side	142	13.35	14	1.161	0.051	0.063
	WLAN5.5GHz/802.11n-HT40	Front Side	102	13.18	14	1.208	0.033	0.042
	WLAN5.5GHz/802.11n-HT40	Front Side	110	12.78	13.5	1.180	0.048	0.060
16#	WLAN5.8GHz/802.11a	Front Side	157	12.57	13.5	1.239	0.065	0.083
	WLAN5.8GHz/802.11a	Front Side	149	12.32	13	1.169	0.058	0.070
	WLAN5.8GHz/802.11a	Front Side	165	11.95	13	1.274	0.052	0.068
17#	Bluetooth/DH5	Front Side	39	7.64	8.5	1.219	0.011	0.017
	Bluetooth/DH5	Front Side	0	6.81	7.5	1.172	0.010	0.015
	Bluetooth/DH5	Front Side	78	6.46	7	1.132	0.008	0.012

**Note:**

1. Per KDB 447498 D01v06, for each exposure position, if the highest output power channel Reported SAR  $\leq 0.8$ 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  $\geq 0.8$ 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  $\leq 0.8$  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  $\leq 0.8$  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  $\leq 1.2$  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. The 2.4G WLAN reported 1g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.004/1.003, 1.046/1.062 for WLAN 5.2GHz 802.11n-HT40, 1.023/1.031/1.023 for WLAN 5.3GHz 802.11n-HT20, 1.062 for WLAN 5.5GHz 802.11n-HT40, 1.029 for WLAN 5.8GHz 802.11a, and 1.301 for Bluetooth.

## 16.3. Body-worn SAR Data

### ➤ GSM Body-worn SAR

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)
18#	GSM 850 (4TX slots)	Back Side	189	28.19	29	1.205	1.180	1.422
	GSM 850 (4TX slots)	Left Side	189	28.19	29	1.205	1.040	1.253
	GSM 850 (4TX slots)	Right Side	189	28.19	29	1.205	0.377	0.454
	GSM 850 (4TX slots)	Back Side	128	28.11	29	1.227	1.020	1.252
	GSM 850 (4TX slots)	Back Side	251	28.15	29	1.216	1.060	1.289
	GSM 1900 (2TX slots)	Back Side	661	28.6	29.5	1.230	0.827	1.017
	GSM 1900 (2TX slots)	Left Side	661	28.6	29.5	1.230	0.569	0.700
	GSM 1900 (2TX slots)	Right Side	661	28.6	29.5	1.230	0.246	0.303
	GSM 1900 (2TX slots)	Back Side	512	28.55	29.5	1.245	0.844	1.050
19#	GSM 1900 (2TX slots)	Back Side	810	28.58	29.5	1.236	1.080	1.335

➤ **WCDMA Body-worn SAR**

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)
	Band II/RMC 12.2Kbps	Back Side	9400	23.09	24	1.233	0.879	1.084
	Band II/RMC 12.2Kbps	Left Side	9400	23.09	24	1.233	0.590	0.728
	Band II/RMC 12.2Kbps	Right Side	9400	23.09	24	1.233	0.254	0.313
	Band II/RMC 12.2Kbps	Back Side	9262	23.05	24	1.245	0.838	1.043
20#	Band II/RMC 12.2Kbps	Back Side	9538	23.02	24	1.253	1.140	1.429
	Band IV/RMC 12.2Kbps	Back Side	1413	23.36	24	1.159	0.852	0.987
	Band IV/RMC 12.2Kbps	Left Side	1413	23.36	24	1.159	0.610	0.707
	Band IV/RMC 12.2Kbps	Right Side	1413	23.36	24	1.159	0.153	0.177
	Band IV/RMC 12.2Kbps	Back Side	1312	23.29	24	1.178	0.833	0.981
21#	Band IV/RMC 12.2Kbps	Back Side	1513	23.33	24	1.167	1.030	1.202
	Band V/RMC 12.2Kbps	Back Side	4182	23.22	24	1.197	0.580	0.694
	Band V/RMC 12.2Kbps	Left Side	4182	23.22	24	1.197	0.477	0.571
	Band V/RMC 12.2Kbps	Right Side	4182	23.22	24	1.197	0.443	0.530
	Band V/RMC 12.2Kbps	Back Side	4132	23.19	24	1.205	0.478	0.576
	Band V/RMC 12.2Kbps	Back Side	4233	23.2	24	1.202	0.495	0.595

➤ **LTE QPSK Body-worn SAR**

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)
	LTE Band 2/1RB#0 20M	Back Side	18900	23.09	24	1.233	0.914	1.127
	LTE Band 2/1RB#0 20M	Left Side	18900	23.09	24	1.233	0.526	0.649
	LTE Band 2/1RB#0 20M	Right Side	18900	23.09	24	1.233	0.201	0.248
	LTE Band 2/1RB#0 20M	Back Side	18700	23.05	24	1.245	0.895	1.114
23#	LTE Band 2/1RB#0 20M	Back Side	19100	23.06	24	1.242	1.030	1.279
	LTE Band 2/50RB#0 20M	Back Side	18900	21.96	23	1.271	0.676	0.859
	LTE Band 2/50RB#0 20M	Left Side	18900	21.96	23	1.271	0.450	0.572
	LTE Band 2/50RB#0 20M	Right Side	18900	21.96	23	1.271	0.192	0.244
	LTE Band 2/50RB#0 20M	Back Side	18700	21.77	23	1.327	0.682	0.905
	LTE Band 2/50RB#0 20M	Back Side	19100	21.88	23	1.294	0.715	0.925



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24#	LTE Band 4/1RB#0 20M	Back Side	20175	23.11	24.00	1.227	0.828	1.016
	LTE Band 4/1RB#0 20M	Left Side	20175	23.11	24.00	1.227	0.634	0.778
	LTE Band 4/1RB#0 20M	Right Side	20175	23.11	24.00	1.227	0.142	0.174
	LTE Band 4/1RB#0 20M	Back Side	20050	23.09	24.00	1.233	0.779	0.961
	LTE Band 4/1RB#0 20M	Back Side	20300	23.05	24.00	1.245	0.808	1.006
	LTE Band 4/50RB#0 20M	Back Side	20175	22.02	23.00	1.253	0.703	0.881
	LTE Band 4/50RB#0 20M	Left Side	20175	22.02	23.00	1.253	0.476	0.596
	LTE Band 4/50RB#0 20M	Right Side	20175	22.02	23.00	1.253	0.122	0.153
	LTE Band 4/50RB#0 20M	Back Side	20050	22.00	23.00	1.259	0.711	0.895
	LTE Band 4/50RB#0 20M	Back Side	20300	21.99	23.00	1.262	0.730	0.921
	LTE Band 5/1RB#0 10M	Back Side	20525	23.69	24.5	1.205	0.558	0.672
25#	LTE Band 5/1RB#0 10M	Left Side	20525	23.69	24.5	1.205	0.799	0.963
	LTE Band 5/1RB#0 10M	Right Side	20525	23.69	24.5	1.205	0.427	0.515
	LTE Band 5/1RB#0 10M	Left Side	20450	23.64	24.5	1.219	0.650	0.792
	LTE Band 5/1RB#0 10M	Left Side	20600	23.66	24.5	1.213	0.682	0.828
	LTE Band 5/25RB#0 10M	Back Side	20525	22.75	23.5	1.189	0.428	0.509
	LTE Band 5/25RB#0 10M	Left Side	20525	22.75	23.5	1.189	0.581	0.691
	LTE Band 5/25RB#0 10M	Right Side	20525	22.75	23.5	1.189	0.320	0.380
	LTE Band 5/25RB#0 10M	Left Side	20450	22.72	23.5	1.197	0.516	0.618
	LTE Band 5/25RB#0 10M	Left Side	20600	22.58	23.5	1.236	0.553	0.683
	LTE Band 7/1RB#0 20M	Back Side	21100	23.25	24	1.189	1.070	1.272
	LTE Band 7/1RB#0 20M	Left Side	21100	23.25	24	1.189	0.674	0.801
	LTE Band 7/1RB#0 20M	Right Side	21100	23.25	24	1.189	0.099	0.118
	LTE Band 7/1RB#0 20M	Back Side	20850	23.24	24	1.191	1.020	1.215
26#	LTE Band 7/1RB#0 20M	Back Side	21350	23.2	24	1.202	1.270	1.527
	LTE Band 7/50RB#0 20M	Back Side	21100	22.36	23	1.159	0.983	1.139
	LTE Band 7/50RB#0 20M	Left Side	21100	22.36	23	1.159	0.615	0.713
	LTE Band 7/50RB#0 20M	Right Side	21100	22.36	23	1.159	0.082	0.095
	LTE Band 7/50RB#0 20M	Back Side	20850	22.33	23	1.167	0.919	1.072
	LTE Band 7/50RB#0 20M	Back Side	21350	22.27	23	1.183	0.932	1.103
	LTE Band 38/1RB#0 20M	Back Side	38000	22.77	23.5	1.183	0.346	0.412
	LTE Band 38/1RB#0 20M	Left Side	38000	22.77	23.5	1.183	0.301	0.358
	LTE Band 38/1RB#0 20M	Right Side	38000	22.77	23.5	1.183	0.044	0.052
27#	LTE Band 38/1RB#0 20M	Back Side	37850	22.73	23.5	1.194	0.488	0.586
	LTE Band 38/1RB#0 20M	Back Side	38150	22.75	23.5	1.189	0.351	0.420



	LTE Band 38/50RB#0 20M	Back Side	38000	21.79	22.5	1.178	0.308	0.365
	LTE Band 38/50RB#0 20M	Left Side	38000	21.79	22.5	1.178	0.254	0.301
	LTE Band 38/50RB#0 20M	Right Side	38000	21.79	22.5	1.178	0.037	0.044
	LTE Band 38/50RB#0 20M	Back Side	37850	21.72	22.5	1.197	0.335	0.403
	LTE Band 38/50RB#0 20M	Back Side	38150	21.74	22.5	1.191	0.295	0.354
	LTE Band 41/1RB#0 20M	Back Side	40620	22.73	23.5	1.194	0.387	0.465
	LTE Band 41/1RB#0 20M	Left Side	40620	22.73	23.5	1.194	0.310	0.372
	LTE Band 41/1RB#0 20M	Right Side	40620	22.73	23.5	1.194	0.046	0.055
	LTE Band 41/1RB#0 20M	Back Side	39750	22.61	23.5	1.227	0.402	0.496
28#	LTE Band 41/1RB#0 20M	Back Side	40185	22.66	23.5	1.213	0.537	0.655
	LTE Band 41/1RB#0 20M	Back Side	41055	22.69	23.5	1.205	0.307	0.372
	LTE Band 41/1RB#0 20M	Back Side	41490	22.67	23.5	1.211	0.224	0.273
	LTE Band 41/50RB#0 20M	Back Side	40620	21.67	22.5	1.211	0.317	0.386
	LTE Band 41/50RB#0 20M	Left Side	40620	21.67	22.5	1.211	0.237	0.289
	LTE Band 41/50RB#0 20M	Right Side	40620	21.67	22.5	1.211	0.039	0.047
	LTE Band 41/50RB#0 20M	Back Side	39750	21.6	22.5	1.230	0.345	0.427
	LTE Band 41/50RB#0 20M	Back Side	40185	21.59	22.5	1.233	0.395	0.490
	LTE Band 41/50RB#0 20M	Back Side	41055	21.61	22.5	1.227	0.245	0.303
	LTE Band 41/50RB#0 20M	Back Side	41490	21.57	22.5	1.239	0.176	0.219

➤ **WLAN/BT Body-worn SAR**

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)
	WLAN2.4GHz/802.11b	Back Side	6	15.62	16.5	1.225	0.087	0.107
	WLAN2.4GHz/802.11b	Left Side	6	15.62	16.5	1.225	0.043	0.053
	WLAN2.4GHz/802.11b	Right Side	6	15.62	16.5	1.225	0.151	0.186
29#	WLAN2.4GHz/802.11b	Right Side	1	14.95	15.5	1.135	0.193	0.220
	WLAN2.4GHz/802.11b	Right Side	11	14.85	15.5	1.161	0.147	0.171
	WLAN5.2GHz/802.11n-HT40	Back Side	38	13.22	14	1.197	0.036	0.046
	WLAN5.2GHz/802.11n-HT40	Left Side	38	13.22	14	1.197	0.012	0.015
30#	WLAN5.2GHz/802.11n-HT40	Right Side	38	13.22	14	1.197	0.260	0.325
	WLAN5.2GHz/802.11n-HT40	Right Side	46	12.61	13.5	1.227	0.210	0.274
	WLAN5.3GHz/802.11n-HT20	Back Side	52	12.99	14	1.262	0.035	0.046
	WLAN5.3GHz/802.11n-HT20	Left Side	52	12.99	14	1.262	0.075	0.097



	WLAN5.3GHz/802.11n-HT20	Right Side	52	12.99	14	1.262	0.164	0.212
31#	WLAN5.3GHz/802.11n-HT20	Right Side	60	12.5	13.5	1.259	0.192	0.249
	WLAN5.3GHz/802.11n-HT20	Right Side	64	12.47	13.5	1.268	0.145	0.188
	WLAN5.5GHz/802.11n-HT40	Back Side	142	13.35	14	1.161	0.020	0.025
	WLAN5.5GHz/802.11n-HT40	Left Side	142	13.35	14	1.161	0.012	0.015
	WLAN5.5GHz/802.11n-HT40	Right Side	142	13.35	14	1.161	0.110	0.136
32#	WLAN5.5GHz/802.11n-HT40	Right Side	102	13.18	14	1.208	0.133	0.171
	WLAN5.5GHz/802.11n-HT40	Right Side	110	12.78	13.5	1.180	0.135	0.169
	WLAN5.8GHz/802.11a	Back Side	157	12.57	13.5	1.239	0.030	0.038
	WLAN5.8GHz/802.11a	Left Side	157	12.57	13.5	1.239	0.010	0.013
33#	WLAN5.8GHz/802.11a	Right Side	157	12.57	13.5	1.239	0.092	0.118
	WLAN5.8GHz/802.11a	Right Side	149	12.32	13	1.169	0.081	0.097
	WLAN5.8GHz/802.11a	Right Side	165	11.95	13	1.274	0.079	0.104
	Bluetooth/DH5	Back Side	39	7.64	8.5	1.219	0.021	0.033
	Bluetooth/DH5	Left Side	39	7.64	8.5	1.219	0.006	0.010
34#	Bluetooth/DH5	Right Side	39	7.64	8.5	1.219	0.035	0.055
	Bluetooth/DH5	Right Side	0	6.81	7.5	1.172	0.026	0.040
	Bluetooth/DH5	Right Side	78	6.46	7	1.132	0.030	0.044

**Note:**

The 2.4G WLAN reported 10g SAR (W/kg) should be scaled with the duty cycle scaling factor 1.004/1.003, 1.046/1.062 for WLAN 5.2GHz 802.11n-HT40, 1.023/1.031/1.023 for WLAN 5.3GHz 802.11n-HT20, 1.062 for WLAN 5.5GHz 802.11n-HT40, 1.029 for WLAN 5.8GHz 802.11a, and 1.301 for Bluetooth.

## 17. Simultaneous Transmission Evaluation

### 17.1. Simultaneous Transmission Consideration

No.	Simultaneous Transmission Consideration	Next to mouth	Body-worn
1	WWAN+WLAN 2.4GHz/5GHz	Yes	Yes
2	WWAN+Bluetooth	Yes	Yes
3	WWAN+WLAN 5GHz+Bluetooth	Yes	Yes

**Note:**

1. 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.
2. 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.
3. 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.
4. 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:  $(SAR_1 + SAR_2) ^{1.5} / R_i \leq 0.04$ ,  
 $R_i$  is the separation distance between the peak SAR locations for the antenna pair in mm.





## 17.2. Simultaneous Transmission Analysis

### ➤ Next to mouth Simultaneous Transmission for WWAN + WLAN 2.4GHz/5GHz

WWAN Band	Exposure Position	1	2	3	1+2 Summed 1g SAR (W/kg)	1+3 Summed 1g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
GSM850	Front Side	0.623	0.025	0.083	0.648	0.706
GSM1900	Front Side	0.236	0.025	0.083	0.261	0.319
WCDMA II	Front Side	0.246	0.025	0.083	0.271	0.329
WCDMA IV	Front Side	0.174	0.025	0.083	0.199	0.257
WCDMA V	Front Side	0.531	0.025	0.083	0.556	0.614
LTE Band 2	Front Side	0.194	0.025	0.083	0.219	0.277
LTE Band 4	Front Side	0.119	0.025	0.083	0.144	0.202
LTE Band 5	Front Side	0.494	0.025	0.083	0.519	0.577
LTE Band 7	Front Side	0.347	0.025	0.083	0.372	0.430
LTE Band 38	Front Side	0.145	0.025	0.083	0.170	0.228
LTE Band 41	Front Side	0.183	0.025	0.083	0.208	0.266

### ➤ Next to mouth Simultaneous Transmission for WWAN + Bluetooth

WWAN Band	Exposure Position	1	2	1+2 Summed 1g SAR (W/kg)
		WWAN	Bluetooth	
		1g SAR (W/kg)	1g SAR (W/kg)	
GSM850	Front Side	0.623	0.017	0.640
GSM1900	Front Side	0.236	0.017	0.253
WCDMA II	Front Side	0.246	0.017	0.263
WCDMA IV	Front Side	0.174	0.017	0.191
WCDMA V	Front Side	0.531	0.017	0.548
LTE Band 2	Front Side	0.194	0.017	0.211
LTE Band 4	Front Side	0.119	0.017	0.136
LTE Band 5	Front Side	0.494	0.017	0.511
LTE Band 7	Front Side	0.347	0.017	0.364
LTE Band 38	Front Side	0.145	0.017	0.162
LTE Band 41	Front Side	0.183	0.017	0.200



➤ **Next to mouth Simultaneous Transmission for WWAN + WLAN 5GHz + Bluetooth**

WWAN Band	Exposure Position	1	2	3	1+2+3 Summed 1g SAR (W/kg)
		WWAN	5GHz WLAN	Bluetooth	
		1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	
GSM850	Front Side	0.623	0.083	0.017	0.723
GSM1900	Front Side	0.236	0.083	0.017	0.336
WCDMA II	Front Side	0.246	0.083	0.017	0.346
WCDMA IV	Front Side	0.174	0.083	0.017	0.274
WCDMA V	Front Side	0.531	0.083	0.017	0.631
LTE Band 2	Front Side	0.194	0.083	0.017	0.294
LTE Band 4	Front Side	0.119	0.083	0.017	0.219
LTE Band 5	Front Side	0.494	0.083	0.017	0.594
LTE Band 7	Front Side	0.347	0.083	0.017	0.447
LTE Band 38	Front Side	0.145	0.083	0.017	0.245
LTE Band 41	Front Side	0.183	0.083	0.017	0.283

➤ **Body-worn Simultaneous Transmission for WWAN + WLAN 2.4GHz/5GHz**

WWAN Band	Exposure Position	1	2	3	1+2 Summed 10g SAR (W/kg)	1+3 Summed 10g SAR (W/kg)
		WWAN	2.4GHz WLAN	5GHz WLAN		
		10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)		
GSM850	Back Side	1.422	0.107	0.046	1.529	1.468
	Left Side	1.253	0.053	0.097	1.306	1.350
	Right Side	0.454	0.220	0.325	0.674	0.779
GSM1900	Back Side	1.335	0.107	0.046	1.442	1.381
	Left Side	0.700	0.053	0.097	0.753	0.797
	Right Side	0.303	0.220	0.325	0.523	0.628
WCDMA II	Back Side	1.429	0.107	0.046	1.536	1.475
	Left Side	0.728	0.053	0.097	0.781	0.825
	Right Side	0.313	0.220	0.325	0.533	0.638
WCDMA IV	Back Side	1.202	0.107	0.046	1.309	1.248
	Left Side	0.707	0.053	0.097	0.760	0.804
	Right Side	0.177	0.220	0.325	0.397	0.502
WCDMA V	Back Side	0.694	0.107	0.046	0.801	0.740
	Left Side	0.571	0.053	0.097	0.624	0.668



	Right Side	0.530	0.220	0.325	0.750	0.855
LTE Band 2	Back Side	1.279	0.107	0.046	1.386	1.325
	Left Side	0.649	0.053	0.097	0.702	0.746
	Right Side	0.248	0.220	0.325	0.468	0.573
LTE Band 4	Back Side	1.016	0.107	0.046	1.123	1.062
	Left Side	0.778	0.053	0.097	0.831	0.875
	Right Side	0.174	0.220	0.325	0.394	0.499
LTE Band 5	Back Side	0.672	0.107	0.046	0.779	0.718
	Left Side	0.963	0.053	0.097	1.016	1.060
	Right Side	0.515	0.220	0.325	0.735	0.840
LTE Band 7	Back Side	1.527	0.107	0.046	1.634	1.573
	Left Side	0.801	0.053	0.097	0.854	0.898
	Right Side	0.118	0.220	0.325	0.338	0.443
LTE Band 38	Back Side	0.586	0.107	0.046	0.693	0.632
	Left Side	0.358	0.053	0.097	0.411	0.455
	Right Side	0.052	0.220	0.325	0.272	0.377
LTE Band 41	Back Side	0.702	0.107	0.046	0.809	0.748
	Left Side	0.372	0.053	0.097	0.425	0.469
	Right Side	0.055	0.220	0.325	0.275	0.380

➤ **Body-worn Simultaneous Transmission for WWAN + Bluetooth**

WWAN Band	Exposure Position	1	2	1+2 Summed 10g SAR (W/kg)
		WWAN	Bluetooth	
		10g SAR (W/kg)	10g SAR (W/kg)	
GSM850	Back Side	1.422	0.033	1.455
	Left Side	1.253	0.010	1.263
	Right Side	0.454	0.055	0.509
GSM1900	Back Side	1.335	0.033	1.368
	Left Side	0.700	0.010	0.710
	Right Side	0.303	0.055	0.358
WCDMA II	Back Side	1.429	0.033	1.462
	Left Side	0.728	0.010	0.738
	Right Side	0.313	0.055	0.368
WCDMA IV	Back Side	1.202	0.033	1.235
	Left Side	0.707	0.010	0.717
	Right Side	0.177	0.055	0.232



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WCDMA V	Back Side	0.694	0.033	0.727
	Left Side	0.571	0.010	0.581
	Right Side	0.530	0.055	0.585
LTE Band 2	Back Side	1.279	0.033	1.312
	Left Side	0.649	0.010	0.659
	Right Side	0.248	0.055	0.303
LTE Band 4	Back Side	1.016	0.033	1.049
	Left Side	0.778	0.010	0.788
	Right Side	0.174	0.055	0.229
LTE Band 5	Back Side	0.672	0.033	0.705
	Left Side	0.963	0.010	0.973
	Right Side	0.515	0.055	0.570
LTE Band 7	Back Side	1.527	0.033	1.560
	Left Side	0.801	0.010	0.811
	Right Side	0.118	0.055	0.173
LTE Band 38	Back Side	0.586	0.033	0.619
	Left Side	0.358	0.010	0.368
	Right Side	0.052	0.055	0.107
LTE Band 41	Back Side	0.702	0.033	0.735
	Left Side	0.372	0.010	0.382
	Right Side	0.055	0.055	0.110

➤ **Body-worn Simultaneous Transmission for WWAN + WLAN 5GHz + Bluetooth**

WWAN Band	Exposure Position	1	2	3	1+2+3 Summed 10g SAR (W/kg)
		WWAN	5GHz WLAN	Bluetooth	
		10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	
GSM850	Back Side	1.422	0.046	0.033	1.501
	Left Side	1.253	0.097	0.010	1.360
	Right Side	0.454	0.325	0.055	0.834
GSM1900	Back Side	1.335	0.046	0.033	1.414
	Left Side	0.700	0.097	0.010	0.807
	Right Side	0.303	0.325	0.055	0.683
WCDMA II	Back Side	1.429	0.046	0.033	1.508
	Left Side	0.728	0.097	0.010	0.835
	Right Side	0.313	0.325	0.055	0.693
WCDMA IV	Back Side	1.202	0.046	0.033	1.281



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	Left Side	0.707	0.097	0.010	0.814
	Right Side	0.177	0.325	0.055	0.557
WCDMA V	Back Side	0.694	0.046	0.033	0.773
	Left Side	0.571	0.097	0.010	0.678
	Right Side	0.530	0.325	0.055	0.910
LTE Band 2	Back Side	1.279	0.046	0.033	1.358
	Left Side	0.649	0.097	0.010	0.756
	Right Side	0.248	0.325	0.055	0.628
LTE Band 4	Back Side	1.016	0.046	0.033	1.095
	Left Side	0.778	0.097	0.010	0.885
	Right Side	0.174	0.325	0.055	0.554
LTE Band 5	Back Side	0.672	0.046	0.033	0.751
	Left Side	0.963	0.097	0.010	1.070
	Right Side	0.515	0.325	0.055	0.895
LTE Band 7	Back Side	1.527	0.046	0.033	1.606
	Left Side	0.801	0.097	0.010	0.908
	Right Side	0.118	0.325	0.055	0.498
LTE Band 38	Back Side	0.586	0.046	0.033	0.665
	Left Side	0.358	0.097	0.010	0.465
	Right Side	0.052	0.325	0.055	0.432
LTE Band 41	Back Side	0.702	0.046	0.033	0.781
	Left Side	0.372	0.097	0.010	0.479
	Right Side	0.055	0.325	0.055	0.435

## 18. 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. 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) will be submitted separately.

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