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# TEST REPORT

Report No. .... : **CHTEW19030225**

Report verificaiton:



Report No: CHTEW19030225

Project No. .... : **SHT1903006602EW**

FCC ID .... : **QRP-FP-007**

Applicant's name .... : **Azumi S.A**

Address.....: Avenida Aquilino de la Guardia con Calle 47, PH Ocean Plaza, Piso 16 of. 16-01, Marbella, Ciudad de Panama, Panama

Manufacturer.....: AZUMI HK LTD

Address.....: FLAT/RM 18 BLK 1 14/F GOLDEN INDUSTRIAL BUILDING 16-26 KWAI TAK STREET KWAI CHUNG,HK

Test item description .... : **Mobile Phone**

Trade Mark .... : **AZUMI**

Model/Type reference.... : **L3G**

Listed Model(s) .... : **-**

Standard .... : **FCC 47 CFR Part2.1093  
IEEE Std C95.1, 1999 Edition  
IEEE 1528: 2013**

Date of receipt of test sample.....: Mar. 07, 2019

Date of testing.....: Mar. 11, 2019- Mar. 31, 2019

Date of issue.....: Apr. 01, 2019

Result.....: **PASS**

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Testing Laboratory Name .... : **Shenzhen Huatongwei International Inspection Co., Ltd**

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*The test report merely correspond to the test sample.*

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## 1 . **Test Standards and Report version**

### 1.1. **Test Standards**

The tests were performed according to following standards:

[FCC 47 Part 2.1093](#): Radiofrequency Radiation Exposure Evaluation:Portable Devices

[IEEE Std C95.1, 1999 Edition](#): IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

[IEEE Std 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.

FCC published RF exposure KDB procedures:

[KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04](#): SAR Measurement Requirements for 100 MHz to 6 GHz

[KDB 865664 D02 RF Exposure Reporting v01r02](#): RF Exposure Compliance Reporting and Documentation Considerations

[KDB 447498 D01 General RF Exposure Guidance v06](#): Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies

[KDB 648474 D04 Handset SAR v01r03](#): SAR Evaluation Considerations for Wireless Handsets

[KDB 941225 D01 3G SAR Procedures v03r01](#): SAR Measurement Procedures for 3G Devices

### 1.2. **Report version**

Revision No.	Date of issue	Description
N/A	2019-04-01	Original

## 2. Summary

### 2.1. Client Information

Applicant:	Azumi S.A
Address:	Avenida Aquilino de la Guardia con Calle 47, PH Ocean Plaza, Piso 16 of. 16-01, Marbella, Ciudad de Panama, Panama
Manufacturer:	AZUMI HK LTD
Address:	FLAT/RM 18 BLK 1 14/F GOLDEN INDUSTRIAL BUILDING 16-26 KWAI TAK STREET KWAI CHUNG,HK

### 2.2. Product Description

Name of EUT:	Mobile Phone
Trade Mark:	AZUMI
Model No.:	L3G
Listed Model(s):	-
Power supply:	DC 3.7V
Device Category:	Portable
Product stage:	Production unit
RF Exposure Environment:	General Population/Uncontrolled
IMEI:	359442063881099
Hardware version:	AZUMI_L3GA_Lite_II_Hardware_V1.0
Software version:	AZUMI_L3GA_Lite_II_PE_V01
Device Dimension:	Overall (Length x Width x Thickness):110 x 47 x 15mm

#### Maximum SAR Value

Separation Distance:	Head: 0mm
	Body: 15mm
Max Report SAR Value (1g):	Head: 1.433 W/kg
	Body: 0.688 W/kg

#### GSM

Support Network:	GSM,GPRS
Support Band:	GSM850,PCS1900
Modulation Type:	GSM/GPRS:GMSK
GPRS Multislot Class:	12
Antenna type:	FPC

#### WCDMA

Operation Band:	WCDMA Band II,WCDMA Band V
Power Class:	Power Class 3
Modulation Type:	QPSK
DC-HSUPA Release Version:	Not Supported
Antenna type:	FPC

Bluetooth	
Version:	Supported BT2.1+EDR
Modulation:	GFSK, $\pi/4$ DQPSK, 8DPSK
Operation frequency:	2402MHz~2480MHz
Channel number:	79
Channel separation:	1MHz
Antenna type:	FPC

*Remark:*

1. *The EUT battery must be fully charged and checked periodically during the test to ascertain uniform power.*

### **3. Test Environment**

#### **3.1. Test laboratory**

Laboratory: Shenzhen Huatongwei International Inspection Co., Ltd.  
Address: 1/F, Bldg 3, Hongfa Hi-tech Industrial Park, Genyu Road, Tianliao, Gongming, Shenzhen, China

#### **3.2. Test Facility**

**CNAS-Lab Code: L1225**

Shenzhen Huatongwei International Inspection Co., Ltd. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

**A2LA-Lab Cert. No.: 3902.01**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

**FCC-Registration No.: 762235**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the FCC (Federal Communications Commission). The acceptance letter from the FCC is maintained in our files. Registration 762235.

**IC-Registration No.: 5377B-1**

Two 3m Alternate Test Site of Shenzhen Huatongwei International Inspection Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for the performance of radiated measurements with Registration No. 5377B-1.

**ACA**

Shenzhen Huatongwei International Inspection Co., Ltd. EMC Laboratory can also perform testing for the Australian C-Tick mark as a result of our A2LA accreditation.

#### **3.3. Environmental conditions**

During the measurement the environmental conditions were within the listed ranges:

Ambient temperature	18 °C to 25 °C
Ambient humidity	30%RH to 70%RH
Air Pressure	950-1050mbar

#### 4. Equipments Used during the Test

Used	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. date (YY-MM-DD)	Due date (YY-MM-DD)
●	Data Acquisition Electronics DAEEx	SPEAG	DAE4	1315	2018/04/18	2019/04/17
●	E-field Probe	SPEAG	EX3DV4	7375	2018/12/13	2019/12/12
●	Universal Radio Communication Tester	R&S	CMW500	137681	2018/07/11	2019/07/10
● Tissue-equivalent liquids Validation						
●	Dielectric Assessment Kit	SPEAG	DAK-3.5	1267	N/A	N/A
○	Dielectric Assessment Kit	SPEAG	DAK-12	1130	N/A	N/A
●	Network analyzer	Keysight	E5071C	MY46733048	2018/09/19	2019/09/18
● System Validation						
○	System Validation Antenna	SPEAG	CLA-150	4024	2018/02/21	2021/02/20
○	System Validation Dipole	SPEAG	D450V3	1102	2018/02/23	2021/02/22
○	System Validation Dipole	SPEAG	D750V3	1180	2018/02/07	2021/02/06
●	System Validation Dipole	SPEAG	D835V2	4d238	2018/02/19	2021/02/18
○	System Validation Dipole	SPEAG	D1750V2	1164	2018/02/06	2021/02/05
●	System Validation Dipole	SPEAG	D1900V2	5d226	2018/02/22	2021/02/21
○	System Validation Dipole	SPEAG	D2450V2	1009	2018/02/05	2021/02/04
○	System Validation Dipole	SPEAG	D2600V2	1150	2018/02/05	2021/02/04
○	System Validation Dipole	SPEAG	D5GHzV2	1273	2018/02/21	2021/02/20
●	Signal Generator	R&S	SMB100A	114360	2018/08/21	2019/08/20
●	Power Viewer for Windows	R&S	N/A	N/A	N/A	N/A
●	Power sensor	R&S	NRP18A	101010	2018/08/21	2019/08/20
●	Power sensor	R&S	NRP18A	101011	2018/08/21	2019/08/20
●	Power Amplifier	BONN	BLWA 0160-2M	1811887	2018/11/15	2019/11/14
●	Dual Directional Coupler	Mini-Circuits	ZHDC-10-62-S+	F975001814	2018/11/15	2019/11/14
●	Attenuator	Mini-Circuits	VAT-3W2+	1819	2018/11/15	2019/11/14
●	Attenuator	Mini-Circuits	VAT-10W2+	1741	2018/11/15	2019/11/14

Note:

1. The Probe, Dipole and DAE calibration reference to the Appendix B and C.
2. Referring to KDB865664 D01, the dipole calibration interval can be extended to 3 years with justification. The dipole are also not physically damaged or repaired during the interval.

## 5. **Measurement Uncertainty**

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg. The expanded SAR measurement uncertainty must be  $\leq 30\%$ , for a confidence interval of  $k = 2$ . If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

## 6. SAR Measurements System Configuration

## 6.1. SAR Measurement Set-up

The DASY5 system for performing compliance tests consists of the following items:

A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).

A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.

A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

A unit to operate the optical surface detector which is connected to the EOC.

The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.

The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows 2003.

DASY5 software and SEMCAD data evaluation software.

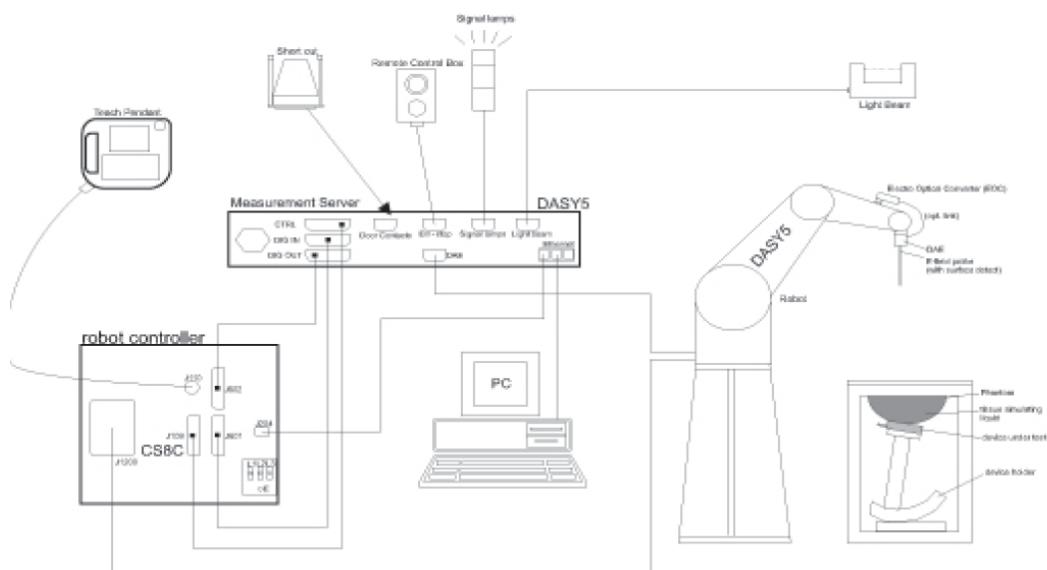
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.

The generic twin phantom enabling the testing of left-hand and right-hand usage.

The device holder for handheld Mobile Phones.

Tissue simulating liquid mixed according to the given recipes.

System validation dipoles allowing to validate the proper functioning of the system.



## 6.2. DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

### ● Probe Specification

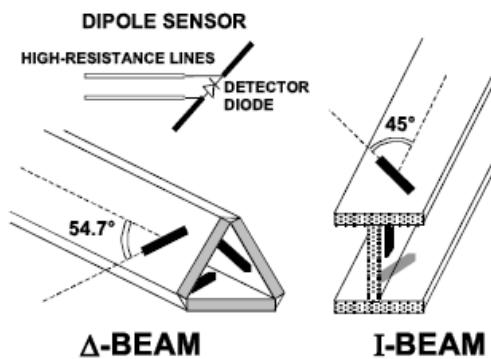
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	4 MHz to 10 GHz; Linearity: $\pm 0.2$ dB (30 MHz to 6 GHz)
Directivity	$\pm 0.3$ dB in HSL (rotation around probe axis) $\pm 0.5$ dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 $\mu$ W/g to > 100 W/kg; Linearity: $\pm 0.2$ dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 6 GHz Dosimetry in strong gradient fields Compliance tests of Mobile Phones
Compatibility	DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI



### ● Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



### 6.3. Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.



SAM-Twin Phantom



ELI Phantom

### 6.4. Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.

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



Device holder supplied by SPEAG

## 7. SAR Test Procedure

### 7.1. Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max.  $\pm 5\%$ .

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above  $\pm 0.1\text{mm}$ ). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within  $\pm 30^\circ$ .)

#### Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of 15 mm x 15 mm is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

#### Zoom Scan

After the maximum interpolated values were calculated between the points in the cube, the SAR was averaged over the spatial volume (1g or 10g) using a 3D-Spline interpolation algorithm. The 3D-spline is composed of three one-dimensional splines with the “Not a knot” condition (in x, y, and z directions). The volume was then integrated with the trapezoidal algorithm.

#### Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as:

- maximum search
- extrapolation
- boundary correction
- peak search for averaged SAR

During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard’s method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

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. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space.

They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard’s method for extrapolation.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

**Table 1: Area and Zoom Scan Resolutions per FCC KDB Publication 865664 D01v04**

		$\leq 3$ GHz	$> 3$ GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		$5 \text{ mm} \pm 1 \text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \text{ mm} \pm 0.5 \text{ mm}$
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: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$		$\leq 2 \text{ GHz: } \leq 15 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 12 \text{ mm}$	$3 - 4 \text{ GHz: } \leq 12 \text{ mm}$ $4 - 6 \text{ GHz: } \leq 10 \text{ mm}$
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$		$\leq 2 \text{ GHz: } \leq 8 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 5 \text{ mm}^*$	$3 - 4 \text{ GHz: } \leq 5 \text{ mm}^*$ $4 - 6 \text{ GHz: } \leq 4 \text{ mm}^*$
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		$\leq 5 \text{ mm}$  $3 - 4 \text{ GHz: } \leq 4 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 3 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$
	graded grid	$\Delta z_{\text{Zoom}}(1):$ between 1 <sup>st</sup> two points closest to phantom surface	$\leq 4 \text{ mm}$  $3 - 4 \text{ GHz: } \leq 3 \text{ mm}$ $4 - 5 \text{ GHz: } \leq 2.5 \text{ mm}$ $5 - 6 \text{ GHz: } \leq 2 \text{ mm}$
		$\Delta z_{\text{Zoom}}(n>1):$ between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1) \text{ mm}$
Minimum zoom scan volume	x, y, z	$\geq 30 \text{ mm}$	$3 - 4 \text{ GHz: } \geq 28 \text{ mm}$ $4 - 5 \text{ GHz: } \geq 25 \text{ mm}$ $5 - 6 \text{ GHz: } \geq 22 \text{ mm}$
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 $\leq 1.4 \text{ W/kg}$ , $\leq 8 \text{ mm}$ , $\leq 7 \text{ mm}$ and $\leq 5 \text{ mm}$ zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

## 7.2. Data Storage and Evaluation

### Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The 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 incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm<sup>2</sup>], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

### Data Evaluation

The SEMCAD software 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:

Probe parameters:	Sensitivity:	Normi, ai0, ai1, ai2
	Conversion factor:	ConvFi
	Diode compression point:	Dcp <i>i</i>
Device parameters:	Frequency:	f
	Crest factor:	cf
Media parameters:	Conductivity:	σ
	Density:	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter 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:

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

*V<sub>i</sub>*: compensated signal of channel ( *i* = x, y, z )

*U<sub>i</sub>*: input signal of channel ( *i* = x, y, z )

*cf*: crest factor of exciting field (DASY parameter)

*dcp<sub>i</sub>*: diode compression point (DASY parameter)

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

$$E - \text{fieldprobes} : \quad E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

$$H - \text{fieldprobes} : \quad H_i = \sqrt{V_i \cdot \frac{a_{i0} + a_{i1}f + a_{i2}f^2}{f}}$$

*V<sub>i</sub>*: compensated signal of channel ( *i* = x, y, z )

*Norm<sub>i</sub>*: sensor sensitivity of channel ( *i* = x, y, z ),  
[mV/(V/m)<sup>2</sup>] for E-field Probes

*ConvF*: sensitivity enhancement in solution

*a<sub>ij</sub>*: sensor sensitivity factors for H-field probes

*f*: carrier frequency [GHz]

*E<sub>i</sub>*: electric field strength of channel *i* in V/m

*H<sub>i</sub>*: magnetic field strength of channel *i* in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

SAR: local specific absorption rate in W/kg

Etot: total field strength in V/m

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

$\rho$ : equivalent tissue density in g/cm<sup>3</sup>

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

## 8. Position of the wireless device in relation to the phantom

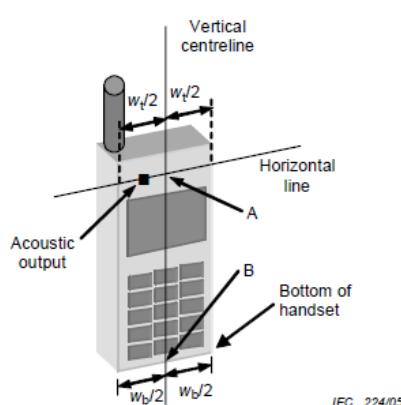
### 8.1. Head Position

The wireless device define two imaginary lines on the handset, the vertical centreline and the horizontal line, for the handset in vertical orientation as shown in Figures 5a and 5b.

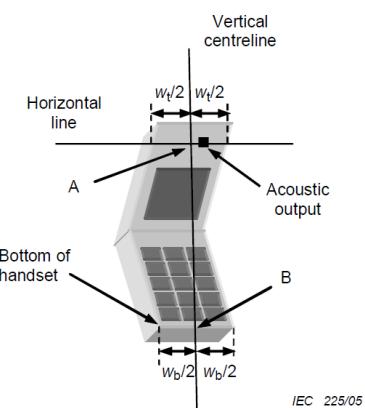
**The vertical centreline** passes through two points on the front side of the handset: the midpoint of the width  $W_t$  of the handset at the level of the acoustic output (point A in Figures 5a and 5b), and the midpoint of the width  $W_b$  of the bottom of the handset (point B).

**The horizontal line** is perpendicular to the vertical centreline and passes through the centre of the acoustic output (see Figures 5a and 5b). The two lines intersect at point A.

Note that for many handsets, point A coincides with the centre of the acoustic output. However, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the handset (see Figure 5b), especially for clam-shell handsets, handsets with flip cover pieces, and other irregularly shaped handsets.



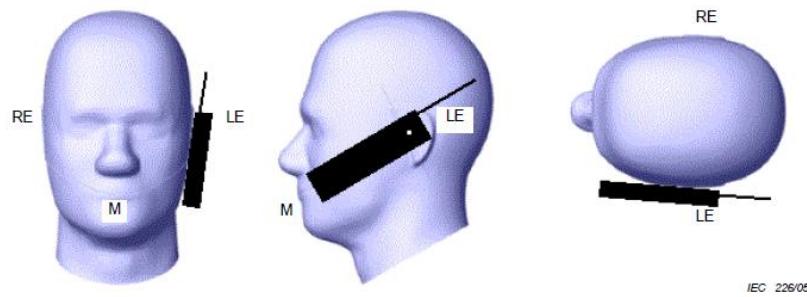
Figures 5a



Figures 5b

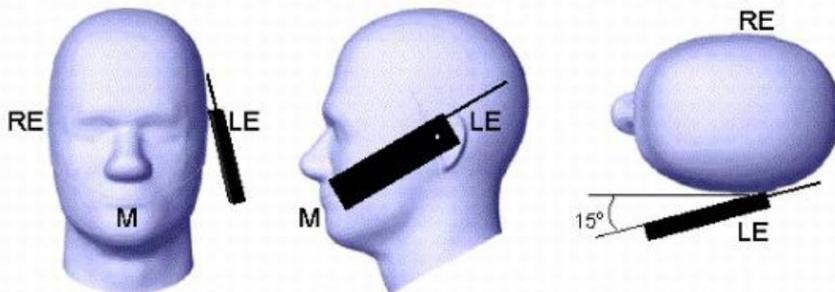
$W_t$  Width of the handset at the level of the acoustic output  
 $W_b$  Width of the bottom of the handset  
 A Midpoint of the width  $W_t$  of the handset at the level of the acoustic output  
 B Midpoint of the width  $W_b$  of the bottom of the handset

#### Cheek position



Picture 2 Cheek position of the wireless device on the left side of SAM

#### Tilt position

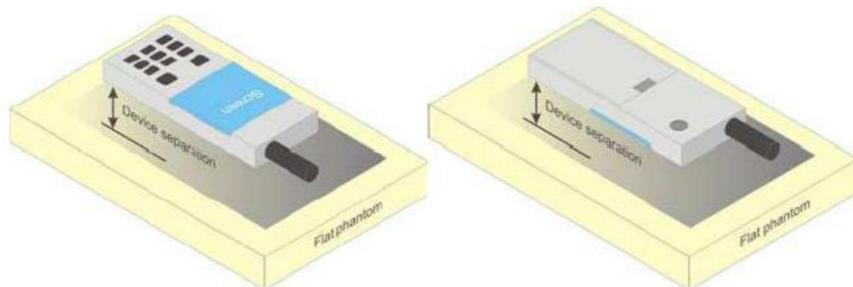


Picture 3 Tilt position of the wireless device on the left side of SAM

## 8.2. Body Position

Devices that support transmission while used with body-worn accessories must be tested for body-worn accessory SAR compliance, typically according to the smallest test separation distance required for the group of body-worn accessories with similar operating and exposure characteristics.

Devices that are designed to operate on the body of users using lanyards and straps or without requiring additional body-worn accessories must be tested for SAR compliance using a conservative minimum test separation distance  $\leq 5 \text{ mm}$  to support compliance.



Picture 4 Test positions for body-worn devices

## 9. System Check

### 9.1. Tissue Dielectric Parameters

The liquid has previously been proven to be suited for worst-case. It's satisfying the latest tissue dielectric parameters requirements proposed by the KDB865664.

Tissue dielectric parameters for head and body phantoms				
Target Frequency		Head		Body
(MHz)	$\epsilon_r$	$\sigma$ (s/m)	$\epsilon_r$	$\sigma$ (s/m)
835	41.5	0.90	55.2	0.97
1800-2000	40.0	1.40	53.3	1.52

#### Check Result:

Dielectric performance of Head tissue simulating liquid									
Frequency (MHz)	$\epsilon_r$		$\sigma$ (s/m)		Delta ( $\epsilon_r$ )	Delta ( $\sigma$ )	Limit	Temp (°C)	Date
	Target	Measured	Target	Measured					
835	41.50	42.50	0.90	0.93	2.41%	3.56%	±5%	22	2019-03-11
1900	40.00	41.67	1.40	1.47	4.16%	4.71%	±5%	22	2019-03-12

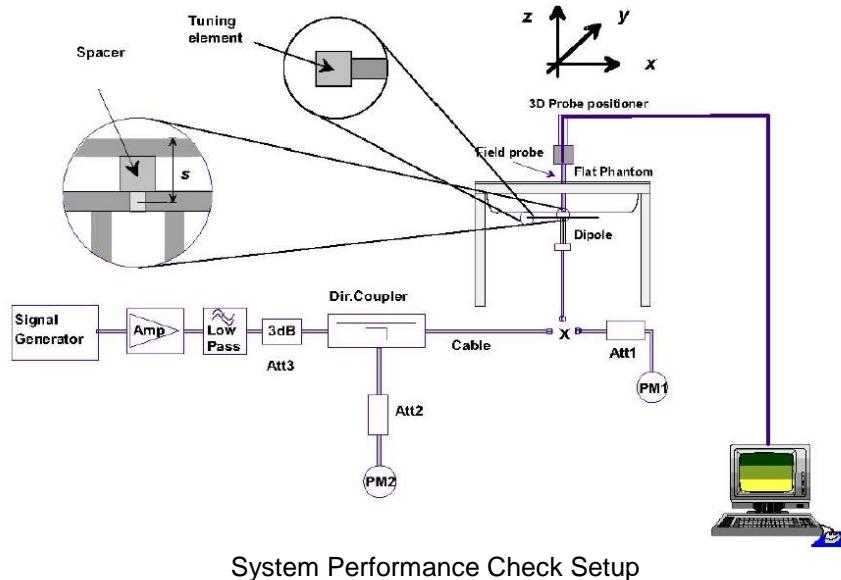
Dielectric performance of Body tissue simulating liquid									
Frequency (MHz)	$\epsilon_r$		$\sigma$ (s/m)		Delta ( $\epsilon_r$ )	Delta ( $\sigma$ )	Limit	Temp (°C)	Date
	Target	Measured	Target	Measured					
835	55.20	55.40	0.97	0.97	0.36%	-0.41%	±5%	22	2019-03-11
1900	53.30	53.72	1.52	1.55	0.79%	1.97%	±5%	22	2019-03-12

## 9.2. SAR System Check

The purpose of the system check is to verify that the system operates within its specifications at the device test frequency. The system check is simple check of repeatability to make sure that the system works correctly at the time of the compliance test;

System check results have to be equal or near the values determined during dipole calibration with the relevant liquids and test system ( $\pm 10\%$ ).

System check is performed regularly on all frequency bands where tests are performed with the DASY5 system.



System Performance Check Setup

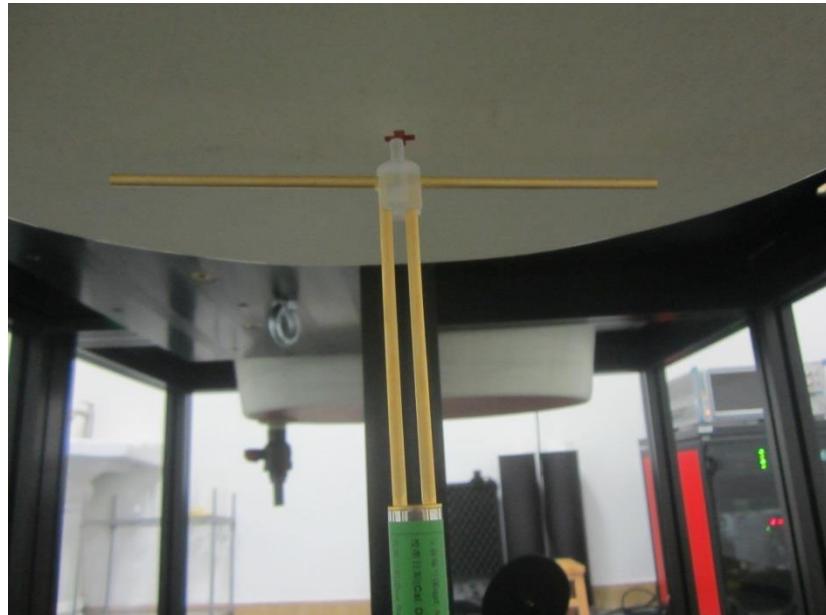


Photo of Dipole Setup

**Check Result:**

Head											
Frequency (MHz)	1g SAR			10g SAR			Delta (1g)	Delta (10g)	Limit	Temp (°C)	Date
	Target 1W	Normalize to 1W	Measured 250mW	Target 1W	Normalize to 1W	Measured 250mW					
835	9.51	9.92	2.48	6.15	6.52	1.63	4.31%	6.02%	±10%	22	2019-03-11
1900	40.30	41.60	10.40	21.10	21.68	5.42	3.23%	2.75%	±10%	22	2019-03-12

Body											
Frequency (MHz)	1g SAR			10g SAR			Delta (1g)	Delta (10g)	Limit	Temp (°C)	Date
	Target 1W	Normalize to 1W	Measured 250mW	Target 1W	Normalize to 1W	Measured 250mW					
835	9.64	10.08	2.52	6.32	6.64	1.66	4.56%	5.06%	±10%	22	2019-03-11
1900	39.80	41.60	10.40	20.90	21.68	5.42	4.52%	3.73%	±10%	22	2019-03-12

## Plots of System Performance Check

### System Performance Check-Head 835MHz

DUT: D835V2; Type: D835V2; Serial: 4d238

Date: 2019-03-11

Communication System: UID 0, CW (0); Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.932$  S/m;  $\epsilon_r = 42.5$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

#### DASY5 Configuration:

- Probe: EX3DV4 - SN7375; ConvF(10.13, 10.13, 10.13); Calibrated: 12/13/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1315; Calibrated: 4/18/2018
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1947
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

### Head/d=15mm, Pin=250mW/Area Scan (41x101x1):

Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 3.51 W/kg

### Head/d=15mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:

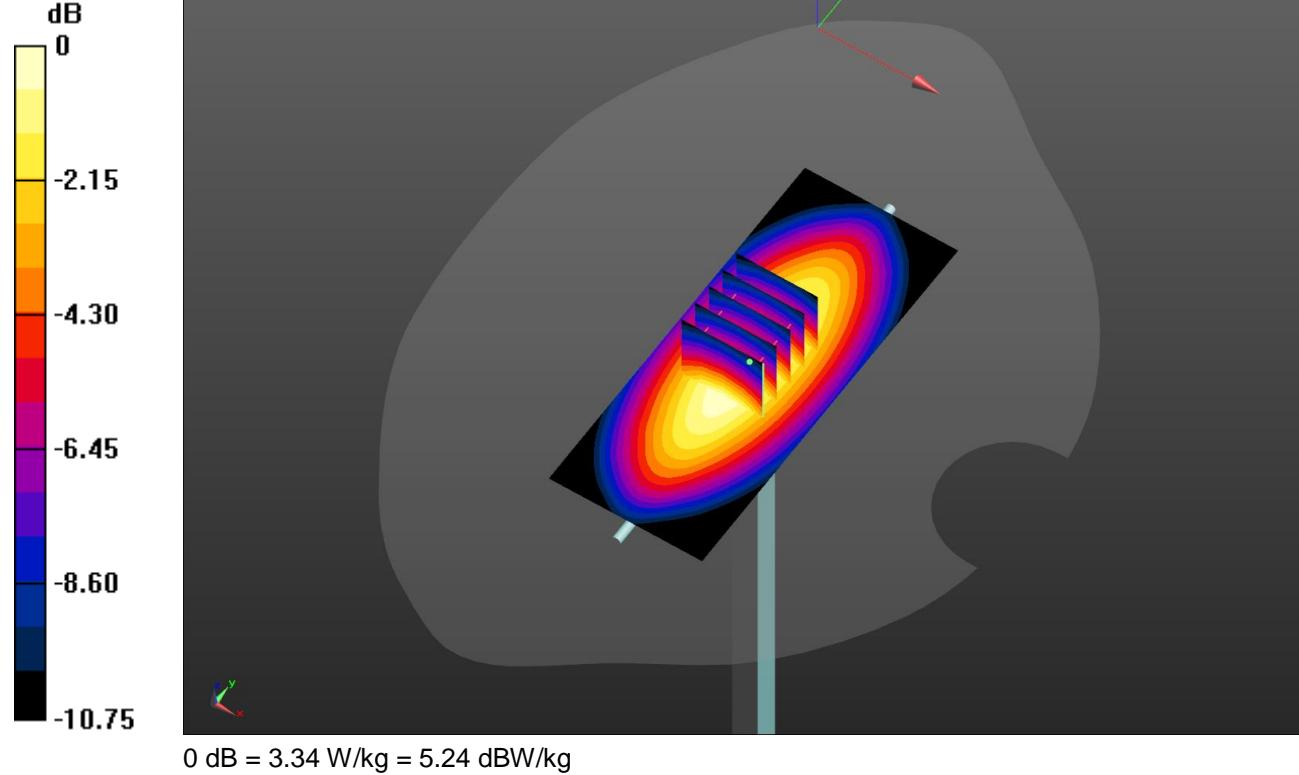
Measurement grid:  $dx=8$  mm,  $dy=8$  mm,  $dz=5$  mm

Reference Value = 66.38 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 3.78 W/kg

**SAR(1 g) = 2.48 W/kg; SAR(10 g) = 1.63 W/kg**

Maximum value of SAR (measured) = 3.34 W/kg



## System Performance Check-Body 835MHz

DUT: D835V2; Type: D835V2; Serial: 4d238

Date: 2019-03-11

Communication System: UID 0, CW (0); Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.966$  S/m;  $\epsilon_r = 55.403$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

### DASY5 Configuration:

- Probe: EX3DV4 - SN7375; ConvF(10.18, 10.18, 10.18); Calibrated: 12/13/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1315; Calibrated: 4/18/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

**Body/d=15mm,Pin=250mW/Area Scan (61x61x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 3.40 W/kg

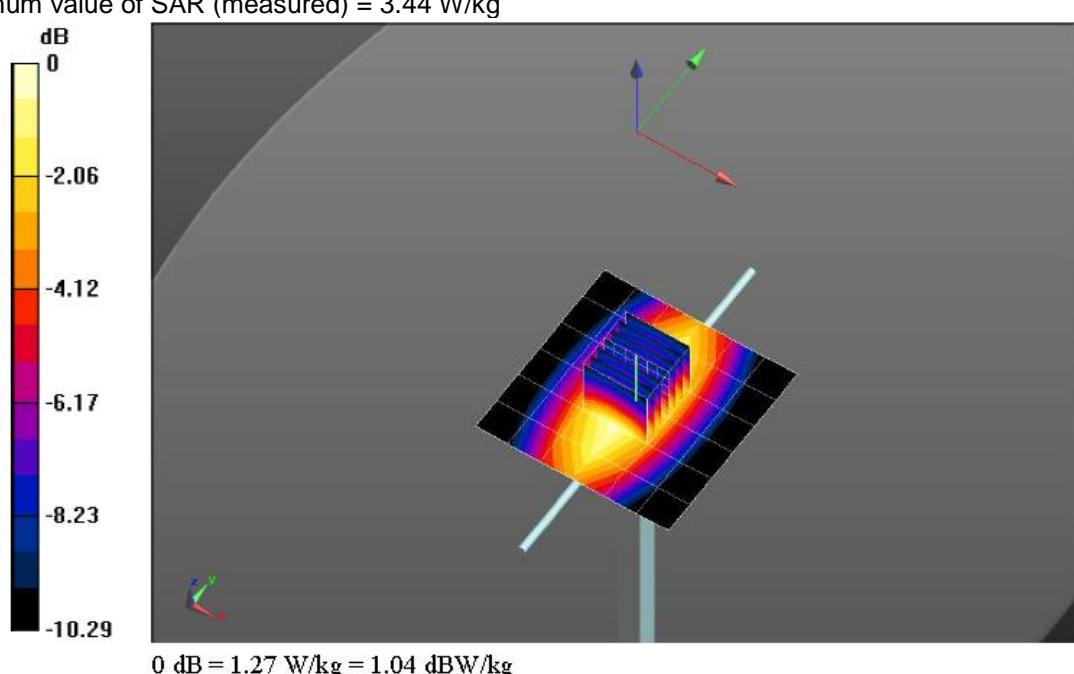
**Body/d=15mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8$  mm,  $dy=8$  mm,  $dz=5$  mm

Reference Value = 61.67 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 3.97 W/kg

**SAR(1 g) = 2.52 W/kg; SAR(10 g) = 1.66 W/kg**

Maximum value of SAR (measured) = 3.44 W/kg



## System Performance Check-Head 1900MHz

DUT: D1900V2; Type: D1900V2; Serial: 5d226

Date: 2019-03-12

Communication System: UID 0, CW (0); Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.466$  S/m;  $\epsilon_r = 41.665$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

### DASY5 Configuration:

- Probe: EX3DV4 - SN7375; ConvF(8.26, 8.26, 8.26); Calibrated: 12/13/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1315; Calibrated: 4/18/2018
- Phantom: Twin-SAM V8.0; Type: QD 000 P41 AA; Serial: 1947
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

**Head/d=10mm,Pin=250mW/Area Scan (41x61x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 17.1 W/kg

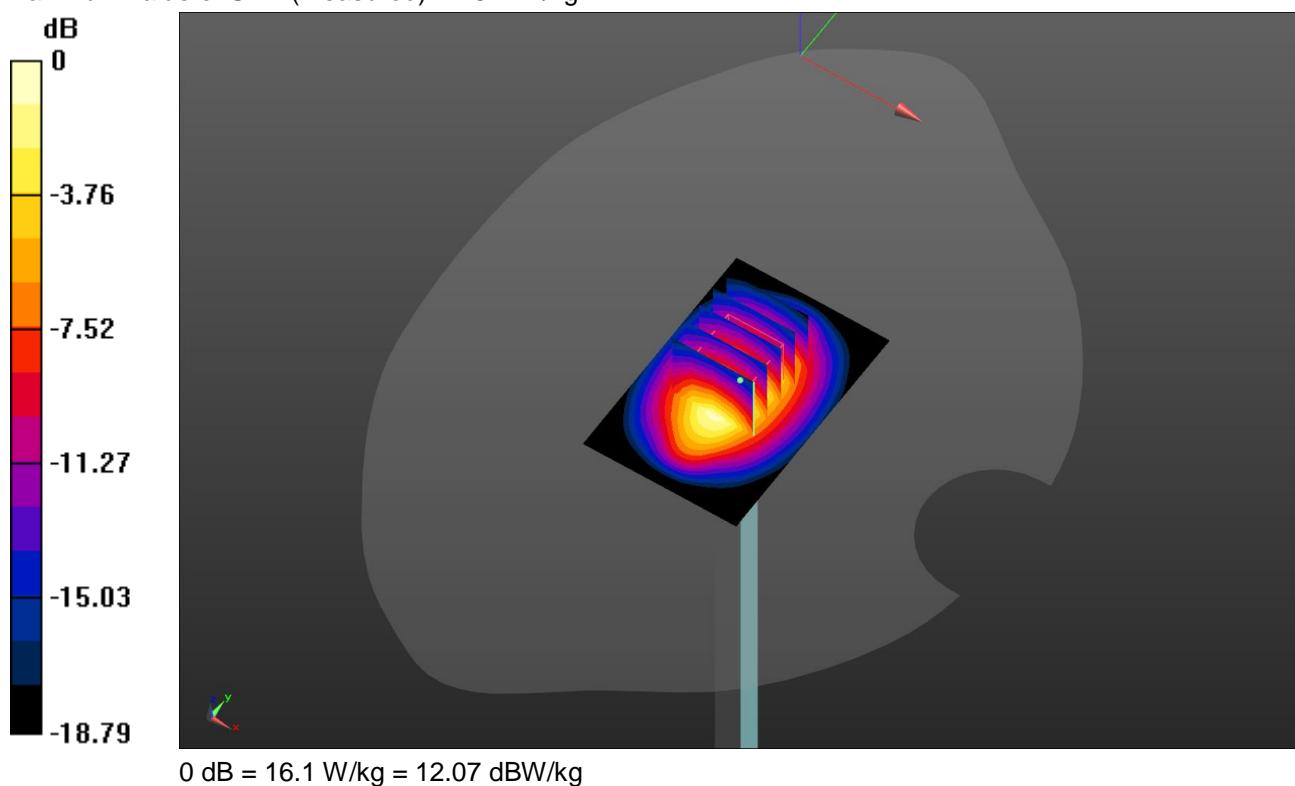
**Head/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8$  mm,  $dy=8$  mm,  $dz=5$  mm

Reference Value = 112.4 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 19.5 W/kg

**SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.42 W/kg**

Maximum value of SAR (measured) = 16.1 W/kg



## System Performance Check-Body 1900MHz

DUT: D1900V2; Type: D1900V2; Serial: 5d226

Date: 2019-03-12

Communication System: UID 0, CW (0); Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.553$  S/m;  $\epsilon_r = 53.719$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

### DASY5 Configuration:

- Probe: EX3DV4 - SN7375; ConvF(8.20, 8.20, 8.20); Calibrated: 12/13/2018;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1315; Calibrated: 4/18/2018
- Phantom: ELI V8.0 ; Type: QD OVA 004 AA ; Serial: 2078
- DASY52 52.10.0(1446); SEMCAD X 14.6.10(7417)

**Body/d=10mm,Pin=250mW/Area Scan (61x61x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 16.4 W/kg

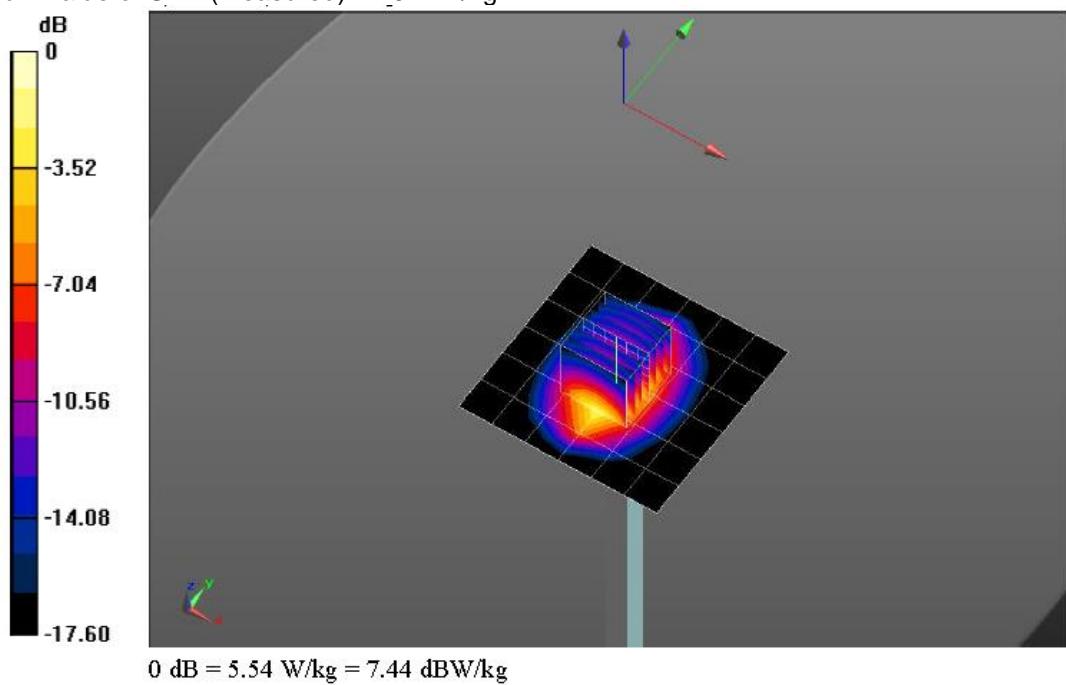
**Body/d=10mm,Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8$  mm,  $dy=8$  mm,  $dz=5$  mm

Reference Value = 105.9 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 18.9 W/kg

**SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.42 W/kg**

Maximum value of SAR (measured) = 15.7 W/kg



## **10. SAR Exposure Limits**

SAR assessments have been made in line with the requirements of FCC 47 CFR § 2.1093.

Type Exposure	Limit (W/kg)	
	General Population / Uncontrolled Exposure Environment	Occupational / Controlled Exposure Environment
Spatial Average SAR (whole body)	0.08	0.4
Spatial Peak SAR (1g cube tissue for head and trunk)	<b>1.6</b>	8.0
Spatial Peak SAR (10g for limb)	4.0	20.0

Population/Uncontrolled Environments: are defined as locations where there is the exposure of individual who have no knowledge or control of their exposure.

Occupational/Controlled 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).

## 11. Conducted Power Measurement Results

### GSM Conducted Power

1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and further SAR test reduction
2. Per KDB 941225 D01, considering the possibility of e.g. 3rd party VoIP operation for Head and Body-worn SAR test reduction for GSM and GPRS modes is determined by the source-base 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.
3. Per KDB941225 D01, for hotspot SAR test reduction for GPRS modes is determined by the source-based time-averaged output power including tune-up tolerance, For modes with the same specified maximum output power and tolerance, the higher number time-slot configuration should be tested.

Mode: GSM850		Burst Average Power (dBm)			Division Factors	Frame-Average Power (dBm)		
		CH128	CH190	CH251		CH128	CH190	CH251
		824.2MHz	836.6MHz	848.8MHz		824.2MHz	836.6MHz	848.8MHz
GSM		34.40	34.51	34.50	-9.03	25.37	25.48	25.47
GPRS (GMSK)	1Tx slot	34.42	34.50	34.48	-9.03	25.39	25.47	25.45
	2Tx slots	33.33	33.62	33.37	-6.02	27.31	27.60	27.35
	3Tx slots	31.90	31.81	31.99	-4.26	27.64	27.55	27.73
	4Tx slots	29.92	29.89	29.77	-3.01	26.91	26.88	26.76
Mode: PCS1900		Burst Average Power (dBm)			Division Factors	Frame-Average Power (dBm)		
		CH512	CH661	CH810		CH512	CH661	CH810
		1850.2MHz	1880.0MHz	1909.8MHz		1850.2MHz	1880.0MHz	1909.8MHz
GSM		30.45	30.90	31.39	-9.03	21.42	21.87	22.36
GPRS (GMSK)	1Tx slot	30.42	30.85	31.33	-9.03	21.39	21.82	22.30
	2Tx slots	28.60	29.65	30.22	-6.02	22.58	23.63	24.20
	3Tx slots	27.15	27.47	28.49	-4.26	22.89	23.21	24.23
	4Tx slots	24.64	25.26	26.04	-3.01	21.63	22.25	23.03

Note:

1) Division Factors

To average the power, the division factor is as follows:

1Tx-slot = 1 transmit time slot out of 8 time slots=> conducted power divided by (8/1) => -9.03dB

2Tx-slots = 2 transmit time slots out of 8 time slots=> conducted power divided by (8/2) => -6.02dB

3Tx-slots = 3 transmit time slots out of 8 time slots=> conducted power divided by (8/3) => -4.26dB

4Tx-slots = 4 transmit time slots out of 8 time slots=> conducted power divided by (8/4) => -3.01dB

## WCDMA Conducted Power

1. The following tests were conducted according to the test requirements outlined in 3GPP TS34.121 specification.
2. The procedures in KDB 941225 D01 are applied for 3GPP Rel. 6 HSPA to configure the device in the required sub-test mode to determine SAR test exclusion

A summary of the test setting are illustrated below:

### HSDPA Setup Configuration:

- a) The EUT was connected to base station RS CMU200 referred to the setup configuration
- b) The RF path losses were compensated into the measurements
- c) A call was established between EUT and base station with following setting:
  - i. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters were set according to each specific sub-test in the following table, C10.1.4, Quoted from the TS 34.121
  - ii. Set RMC 12.2Kbps + HSDPA mode
  - iii. Set Cell Power=-86dBm
  - iv. Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
  - v. Select HSDPA uplink parameters
  - vi. Set Delta ACK, Delta NACK and Delta CQI=8
  - vii. Set Ack-Nack repetition Factor to 3
  - viii. Set CQI Feedback Cycle (K) to 4ms
  - ix. Set CQI repetition factor to 2
  - x. Power ctrl mode= all up bits
- d) The transmitter maximum output power was recorded.

**Table C.10.1.4:  $\beta$  values for transmitter characteristics tests with HS-DPCCH**

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{HS}$ (Note 1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

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

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause 5.13.1AA,  $\Delta_{ACK}$  and  $\Delta_{NACK} = 30/15$  with  $\beta_{hs} = 30/15 * \beta_c$ , and  $\Delta_{CQI} = 24/15$  with  $\beta_{hs} = 24/15 * \beta_c$ .

Note 3: CM = 1 for  $\beta_c/\beta_d = 12/15$ ,  $\beta_{hs}/\beta_c = 24/15$ . For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: 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 signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 11/15$  and  $\beta_d = 15/15$ .

### Setup Configuration

#### HSUPA Setup Configuration:

- a) The EUT was connected to base station RS CMU200 referred to the setup configuration
- b) The RF path losses were compensated into the measurements
- c) A call was established between EUT and base station with following setting:
  - i. Call configs = 5.2b, 5.9b, 5.10b, and 5.13.2B with QPSK
  - ii. Set Gain Factors ( $\beta_c$  and  $\beta_d$ ) and parameters (AG index) were set according to each specific sub-test in the following table, C11.1.3, Quoted from the TS 34.121
  - iii. Set Cell Power=-86dBm
  - iv. Set channel type= 12.2Kbps + HSPA mode
  - v. Set UE Target power
  - vi. Set Ctrl mode=Alternating bits
  - vii. Set and observe the E-TFCI
  - viii. Confirm that E-TFCI is equal the target E-TFCI of 75 for Sub-test 1, and other subtest's E-TFCI
- d) The transmitter maximum output power was recorded.

Table C.11.1.3:  $\beta$  values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	$\beta_c$	$\beta_d$	$\beta_d$ (SF)	$\beta_c/\beta_d$	$\beta_{HS}$ (Note 1)	$\beta_{EC}$	$\beta_{ED}$ (Note 5) (Note 6)	$\beta_{ED}$ (SF)	$\beta_{ED}$ (Codes)	CM (dB) (Note 2)	MPR (dB) (Note 2)	AG Index (Note 6)	E-TFCI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/25	1309/225	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 (Note 4)	15/15 (Note 4)	64	15/15 (Note 4)	30/15	24/15	134/15	4	1	1.0	0.0	21	81

Note 1:  $\Delta_{ACK}, \Delta_{NACK}$  and  $\Delta_{CQI} = 30/15$  with  $\beta_{AG} = 30/15 * \beta_c$ .  
 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 signalled 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 signalled gain factors for the reference TFC (TF1, TF1) to  $\beta_c = 14/15$  and  $\beta_d = 15/15$ .  
 Note 5: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.  
 Note 6:  $\beta_{ED}$  can not be set directly, it is set by Absolute Grant Value.

### Setup Configuration

#### General Note:

1. Per KDB 941225 D01, SAR for Head / Hotsport / Body-worn Exposure is measured using a 12.2Kbps RMC with TPC bit configured to all 1s
2. Per KDB 941225 D01 RMC12.2Kbps setting is used to evaluate SAR. If the maximum output power and Tune-up tolerance specified for production units in HSDPA/HSUPA is  $\leq 1/4$ 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 to RMC 12.2Kbps and the adjusted SAR is  $\leq 1.2$  W/kg, SAR measurement is not required for HSDPA / HSUPA.

Mode		WCDMA Band II			WCDMA Band V		
		Conducted Power (dBm)			Conducted Power (dBm)		
		CH9262	CH9400	CH9538	CH4132	CH4183	CH4233
AMR 12.2K		1852.4	1880.0	1907.6	826.4	836.6	846.6
RMC 12.2K		22.61	22.85	22.60	22.48	22.42	22.31
HSDPA	Subtest-1	21.59	21.81	21.56	22.51	22.48	22.25
	Subtest-2	21.67	21.89	21.64	22.52	22.49	22.26
	Subtest-3	21.80	22.02	21.77	22.56	22.53	22.30
	Subtest-4	21.78	22.00	21.75	22.51	22.48	22.25
HSUPA	Subtest-1	21.02	21.23	20.99	22.20	22.17	21.95
	Subtest-2	21.17	21.38	21.14	22.15	22.12	21.90
	Subtest-3	21.55	21.77	21.52	22.43	22.40	22.17
	Subtest-4	21.52	21.74	21.49	22.48	22.45	22.22
	Subtest-5	21.99	22.21	21.96	22.14	22.11	21.89

**Bluetooth Conducted Power**

Bluetooth			
Mode	Channel	Frequency (MHz)	Conducted power (dBm)
GFSK	0	2402	-6.24
	39	2441	-5.81
	78	2480	-5.18
$\pi/4$ QPSK	0	2402	-4.51
	39	2441	-4.16
	78	2480	-3.54
8DPSK	0	2402	-4.08
	39	2441	-3.73
	78	2480	-3.12

## 12. Maximum Tune-up Limit

GSM		
Mode	Maximum Tune-up (dBm)	
	GSM850	PCS1900
GSM (GMSK, 1Tx Slot)	35.00	31.50
GPRS (GMSK, 1Tx Slot)	34.50	31.50
GPRS (GMSK, 2Tx Slots)	34.00	30.50
GPRS (GMSK, 3Tx Slots)	32.00	28.50
GPRS (GMSK, 4Tx Slots)	30.00	26.50

WCDMA		
Mode	Maximum Tune-up (dBm)	
	WCDMA Band II	WCDMA Band V
AMR 12.2Kbps	23.00	23.00
RMC 12.2Kbps	23.00	23.00
HSDPA Subtest-1	22.50	23.00
HSDPA Subtest-2	22.50	23.00
HSDPA Subtest-3	22.50	23.00
HSDPA Subtest-4	22.50	23.00
HSUPA Subtest-1	22.50	22.50
HSUPA Subtest-2	22.50	22.50
HSUPA Subtest-3	22.50	22.50
HSUPA Subtest-4	22.50	22.50
HSUPA Subtest-5	22.50	22.50

Bluetooth	
Mode	Maximum Tune-up (dBm)
GFSK	-5.00
$\pi/4$ QPSK	-3.00
8DPSK	-3.00

Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100MHz to 6GHz at test separation distances  $\leq$ 50mm are determined by:

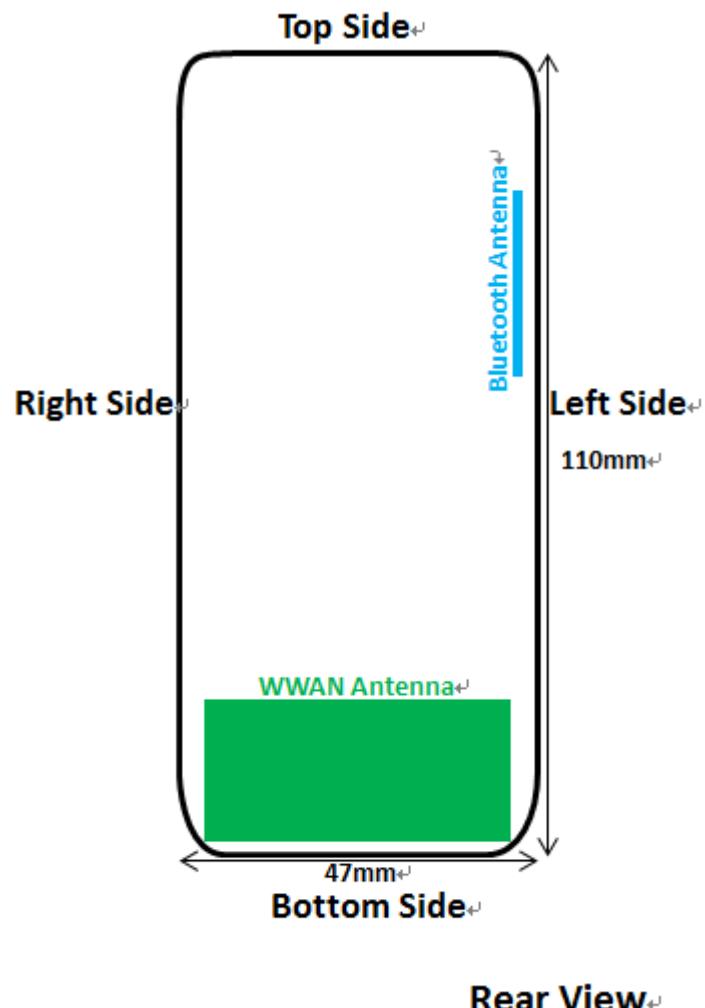
$[(\text{max. Power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})]^*$   
 $[\sqrt{f(\text{GHz})}] \leq 3.0$  for 1-g SAR

Band/Mode	Frequency (GHz)	Position	Tune-up Power		Separation Distance (mm)	Exclusion Thresholds
			dBm	mW		
Bluetooth	2.45	Head	-3.00	0.50	0	0.2
		Body			15	0.1

Per KDB 447498 D01, when the minimum test separation distance is  $<5$ mm, a distance of 5mm is applied to determine SAR test exclusion.

The test exclusion threshold is  $\leq 3$ , SAR testing is not required.

## 13. Antenna Location



## **14. SAR Measurement Results**

### **GENERAL:**

#### **1. Reference from KDB 447498 D01 General RF Exposure Guidance:**

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)  $\leq 0.8 \text{ W/kg}$  or  $2.0 \text{ W/kg}$ , for 1-g or 10-g respectively, when the transmission band is  $\leq 100 \text{ MHz}$
- b)  $\leq 0.6 \text{ W/kg}$  or  $1.5 \text{ W/kg}$ , for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- c)  $\leq 0.4 \text{ W/kg}$  or  $1.0 \text{ W/kg}$ , for 1-g or 10-g respectively, when the transmission band is  $\geq 200 \text{ MHz}$

#### **2. Reference from KDB 648474 D04 Handset SAR:**

With headset attached, when the reported SAR for body-worn accessory, measured without a headset connected to the handset, is  $> 1.2 \text{ W/kg}$ , the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

### **WIRELESS TECHNOLOGY:**

#### **3. Reference KDB 941225 D01 SAR test for 3G devices:**

When the maximum output power and tune-up tolerance specified for production units in a secondary mode is  $\leq 1/4 \text{ dB}$  higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is  $\leq 1.2 \text{ W/kg}$ , SAR measurement is not required for the secondary mode.

## Head SAR

GSM850										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
GPRS (3Tx slots)	Left-Cheek	128	824.2	31.90	32.00	1.02	-0.06	1.400	1.433	1
		190	836.6	31.81	32.00	1.04	0.12	1.020	1.066	-
		251	848.8	31.99	32.00	1.00	0.02	0.857	0.859	-
	Left-Tilt	128	824.2	31.90	32.00	1.02	-	-	-	-
		190	836.6	31.81	32.00	1.04	-0.13	0.678	0.709	-
		251	848.8	31.99	32.00	1.00	-	-	-	-
	Right-Cheek	128	824.2	31.90	32.00	1.02	-	-	-	-
		190	836.6	31.81	32.00	1.04	0.05	0.772	0.806	-
		251	848.8	31.99	32.00	1.00	-	-	-	-
	Right-Tilt	128	824.2	31.90	32.00	1.02	-	-	-	-
		190	836.6	31.81	32.00	1.04	0.07	0.584	0.610	-
		251	848.8	31.99	32.00	1.00	-	-	-	-

PCS1900										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
GPRS (3Tx slots)	Left-Cheek	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	0.06	0.188	0.189	-
	Left-Tilt	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	0.04	0.151	0.152	-
	Right-Cheek	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	0.06	0.249	0.250	3
	Right-Tilt	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	-0.04	0.196	0.196	-

WCDMA Band II										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
RMC 12.2Kb ps	Left-Cheek	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	0.02	0.435	0.447	-
		9538	1907.6	22.63	23.00	1.09	-	-	-	-
	Left-Tilt	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	0.02	0.358	0.368	-
		9538	1907.6	22.63	23.00	1.09	-	-	-	-
	Right-Cheek	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	-0.06	0.447	0.460	5
		9538	1907.6	22.63	23.00	1.09	-	-	-	-
	Right-Tilt	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	-0.01	0.358	0.368	-
		9538	1907.6	22.63	23.00	1.09	-	-	-	-

WCDMA Band V										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
RMC 12.2K bps	Left-Cheek	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	-0.13	0.608	0.690	7
		4233	846.6	22.34	23.00	1.16	-	-	-	-
	Left-Tilt	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	-0.07	0.489	0.555	-
		4233	846.6	22.34	23.00	1.16	-	-	-	-
	Right-Cheek	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	0.09	0.578	0.656	-
		4233	846.6	22.34	23.00	1.16	-	-	-	-
	Right-Tilt	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	0.07	0.455	0.516	-
		4233	846.6	22.34	23.00	1.16	-	-	-	-

Note:

SAR Test Data Plots to the Appendix A.

## Body SAR

GSM850										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
GPRS (3Tx slots)	Front	128	824.2	31.90	32.00	1.02	-	-	-	-
		190	836.6	31.81	32.00	1.04	-0.05	0.435	0.454	-
		251	848.8	31.99	32.00	1.00	-	-	-	-
	Rear	128	824.2	31.90	32.00	1.02	-	-	-	-
		190	836.6	31.81	32.00	1.04	0.10	0.659	0.688	2
		251	848.8	31.99	32.00	1.00	-	-	-	-

PCS1900										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
GPRS (3Tx slots)	Front	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	-0.01	0.140	0.141	-
	Rear	512	1850.2	27.15	28.50	1.36	-	-	-	-
		661	1880.0	27.47	28.50	1.27	-	-	-	-
		810	1909.8	28.49	28.50	1.00	0.02	0.222	0.223	4

WCDMA Band II										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
RMC 12.2Kbps	Front	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	0.00	0.284	0.292	-
		9538	1907.6	22.63	23.00	1.09	-	-	-	-
	Rear	9262	1852.4	22.64	23.00	1.09	-	-	-	-
		9400	1880.0	22.88	23.00	1.03	0.01	0.399	0.410	6
		9538	1907.6	22.63	23.00	1.09	-	-	-	-

WCDMA Band V										
Mode	Test Position	Frequency		Conducted Power (dBm)	Tune up limit (dBm)	Tune up scaling factor	Power Drift(dB)	Measured SAR(1g) (W/kg)	Report SAR(1g) (W/kg)	Plot No.
		CH	MHz							
RMC 12.2Kbps	Front	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	0.05	0.463	0.526	-
		4233	846.6	22.34	23.00	1.16	-	-	-	-
	Rear	4132	826.4	22.51	23.00	1.12	-	-	-	-
		4183	836.6	22.45	23.00	1.14	-0.09	0.541	0.614	8
		4233	846.6	22.34	23.00	1.16	-	-	-	-

Note:

SAR Test Data Plots to the Appendix A.

## 15. SAR Measurement Variability

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

- 1) Repeated measurement is not required when the original highest measured SAR is <0.8 or 2 W/kg (1-g or 10-g respectively); steps 2) through 4) do not apply.
- 2) When the original highest measured SAR is  $\geq 0.8$  or 2 W/kg (1-g or 10-g respectively), repeat that measurement once.
- 3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$  or when the original or repeated measurement is  $\geq 1.45$  or 3.6 W/kg ( $\sim 10\%$  from the 1-g or 10-g respective SAR limit).
- 4) Perform a third repeated measurement only if the original, first, or second repeated measurement is  $\geq 1.5$  or 3.75 W/kg (1-g or 10-g respectively) and the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ .

Band	Test Position	Frequency		Highest Measured SAR (W/kg)	First Repeated		Second Repeated	
		CH	MHz		Measured SAR(W/kg)	Largest to Smallest SAR Ratio	Measured SAR(W/kg)	Largest to Smallest SAR Ratio
GPRS850 3Tx slots	Left-Cheek	128	824.2	1.4	1.37	1.02	N/A	N/A

## 16. Simultaneous Transmission analysis

No.	Simultaneous Transmission Configurations	Head	Body-worn	Note
1	GSM(voice) + Bluetooth (data)	Yes	Yes	
2	WCDMA(voice) + Bluetooth (data)	Yes	Yes	
3	GPRS (data) + Bluetooth (data)	Yes	Yes	
4	WCDMA (data) + Bluetooth (data)	Yes	Yes	

General note:

1. EUT will choose either GSM or WCDMA according to the network signal condition; therefore, they will not operate simultaneously at any moment.
2. The reported SAR summation is calculated based on the same configuration and test position.
3. For simultaneous transmission analysis, Bluetooth SAR is estimated per KDB 447498 D01 based on the formula below
  - a)  $[(\text{max. Power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] * [\sqrt{f(\text{GHz})/x}] \text{W/kg}$  for test separation distances  $\leq 50\text{mm}$ ; when  $x=7.5$  for 1-g SAR, and  $x=18.75$  for 10-g SAR.
  - b) When the minimum separation distance is  $< 5\text{mm}$ , the distance is used 5mm to determine SAR test exclusion
  - c) 0.4 W/kg for 1-g SAR and 1.0W/kg for 10-g SAR, when the test separation distances is  $> 50\text{mm}$ .

Bluetooth Max power	Exposure position	Head	Body-worn
	Test separation	0mm	15mm
-3.00 dBm	Estimated SAR (W/kg)	0.021	0.007

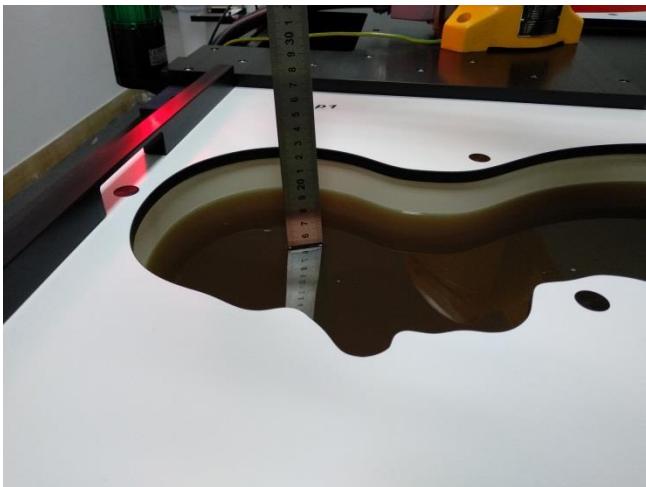
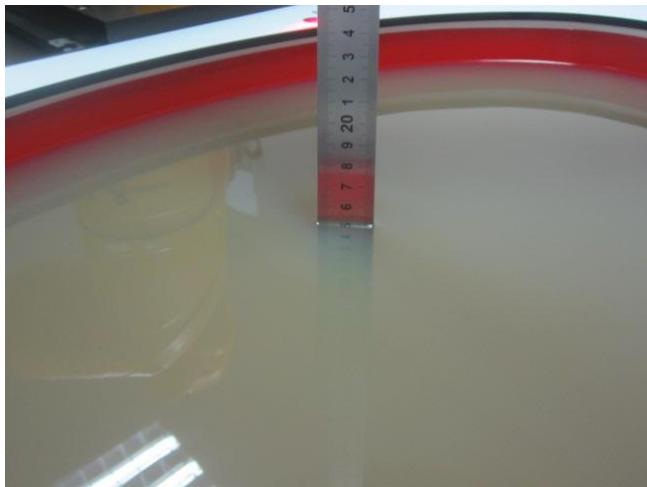
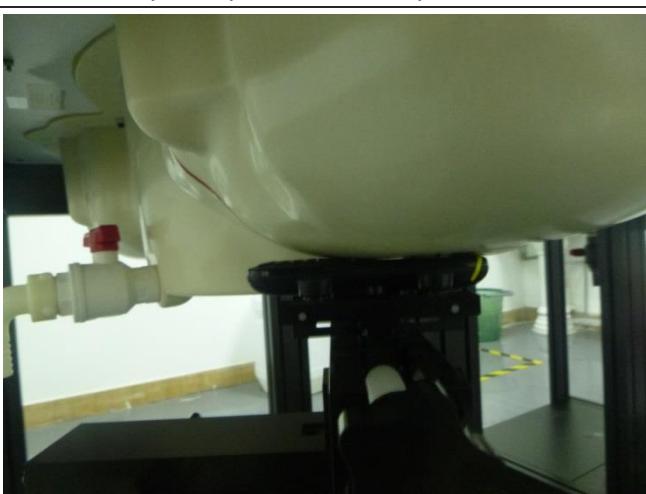
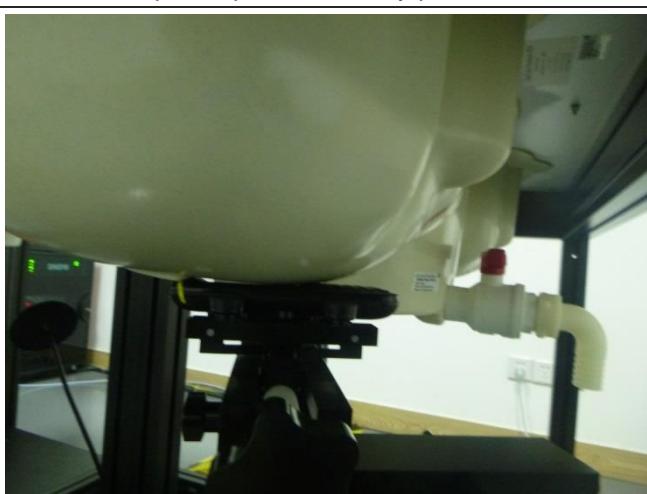
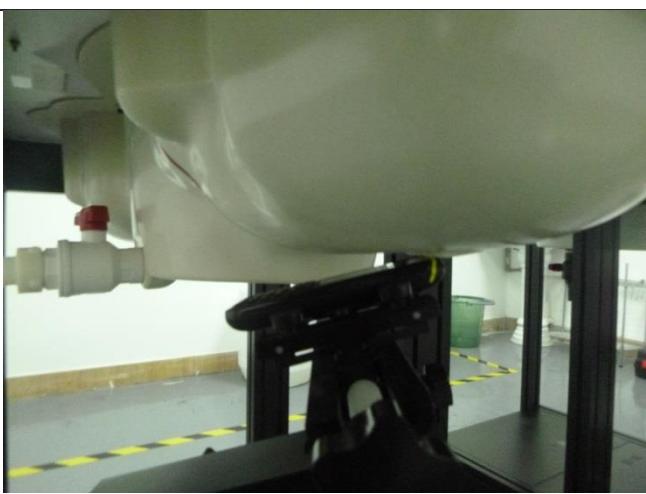
**Maximum reported SAR value for Head**

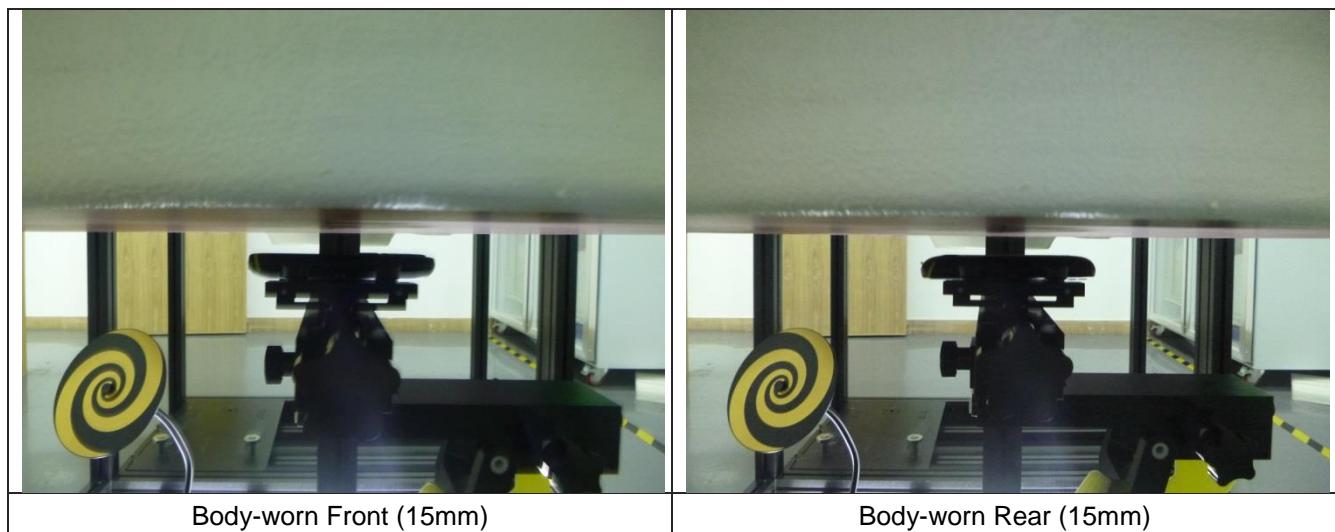
WWAN PCE + Bluetooth					
WWAN Band		Exposure Position	Max SAR (W/kg)		Summed SAR (W/kg)
			WWAN PCE	Bluetooth	
GSM	GSM850	Left Cheek	1.433	0.021	<b>1.454</b>
		Left Tilted	0.709	0.021	0.730
		Right Cheek	0.806	0.021	0.827
		Right Tilted	0.610	0.021	0.631
	PCS1900	Left Cheek	0.189	0.021	0.210
		Left Tilted	0.152	0.021	0.173
		Right Cheek	0.250	0.021	0.271
		Right Tilted	0.196	0.021	0.217
WCDMA	Band II	Left Cheek	0.447	0.021	0.468
		Left Tilted	0.368	0.021	0.389
		Right Cheek	0.460	0.021	0.481
		Right Tilted	0.368	0.021	0.389
	Band V	Left Cheek	0.690	0.021	0.711
		Left Tilted	0.555	0.021	0.576
		Right Cheek	0.656	0.021	0.677
		Right Tilted	0.516	0.021	0.537

**Maximum reported SAR value for Body**

WWAN PCE + Bluetooth					
WWAN Band		Exposure Position	Max SAR (W/kg)		Summed SAR (W/kg)
			WWAN PCE	Bluetooth	
GSM	GSM850	Front	0.454	0.007	0.461
		Rear	0.688	0.007	<b>0.695</b>
	PCS1900	Front	0.141	0.007	0.148
		Rear	0.223	0.007	0.230
WCDMA	Band II	Front	0.292	0.007	0.299
		Rear	0.410	0.007	0.417
	Band V	Front	0.526	0.007	0.533
		Rear	0.614	0.007	0.621

## 17. Test Setup Photos

	
Liquid depth in the Head phantom	Liquid depth in the Body phantom
	
Left Head Touch	Right Head Touch
	
Left Head Tilt (15°)	Right Head Tilt (15°)



## **18. External and Internal Photos of the EUT**

Please reference to the report No.: CHTEW19040037

-----***End of Report***-----