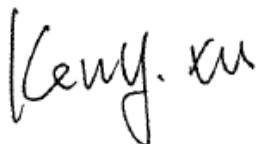


# FCC SAR TEST REPORT

**Application No.:** SZCR2305001453AT  
**Applicant:** Dspread Technology (Beijing) Inc  
**Address of Applicant:** Rm.407, B12C, #10(Universal Business Park), Jiuxianqiao Road,Chaoyang District,Beijing, 100027, China  
**Manufacturer:** Dspread Technology (Beijing) Inc  
**Address of Manufacturer:** Rm.407, B12C, #10(Universal Business Park), Jiuxianqiao Road,Chaoyang District,Beijing, 100027, China  
**Factory:** Shenzhen AXCRT Co., Ltd  
**Address of Factory:** Room 207 Huiju Innovation Park, No. 2 Liuxian Avenue, Xingdong community, Xin'an street, Bao'an District, Shenzhen  
**Product Name:** Mobile POS  
**Model No.(EUT):** QPOS Trio  
**FCC ID:** 2AGQ6-QPOSTRIO  
**Standard(s) :** FCC 47CFR §2.1093  
**Date of Receipt:** 2023-08-01  
**Date of Test:** 2023-08-02 to 2023-08-03  
**Date of Issue:** 2023-08-09

<b>Test Result:</b>	<b>Pass*</b>
---------------------	--------------

\* In the configuration tested, the EUT complied with the standards specified above.



Keny Xu

EMC Laboratory Manager



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# SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

SZSAR-TRF-01-A01 Rev. A/0 May15,2023

Report No.: SZCR230500145306

Page: 2 of 51

Revision Record			
Version	Description	Date	Remark
00	Original	2023-08-09	/

<b>Authorized for issue by:</b>				
		<i>Owen Xiao</i>		
		<b>Owen Xiao / Project Engineer</b>		
		<i>Eric Fu</i>		
		<b>Eric Fu / Reviewer</b>		



SGS-CSTC Standards Technical Services Co., Ltd.  
Shenzhen Branch Inspection & Testing Services Laboratory

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**TEST SUMMARY**

Frequency Band	Test position	Test mode	Max Reported SAR10g (W/kg)	SAR limit (W/kg)	Verdict
GSM850	Limbs	GPRS3TS	1.89	4.0	PASS
GSM1900	Limbs	GPRS3TS	2.99	4.0	PASS
2.4GWIFI	Limbs	802.11b	0.17	4.0	PASS
Maximum Simultaneous SAR for Limbs				3.16	



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# 1 General Information

## 1.1 General Description of EUT

Product Phase:	Production unit		
Device Type :	Portable device		
Exposure Category:	Uncontrolled environment / general population		
SN:	50201022023071400001		
Hardware Version:	001		
Software Version:	1.0.1		
Antenna Gain:	2.4G WIFI: 3.02dBi GSM 900: 1.38dBi; GSM 1800: 1.42dBi		
Antenna Type:	Inner Antenna		
<b>Device Operating Configurations :</b>			
Modulation Mode:	GSM:GMSK; WIFI:DSSS,OFDM;		
GPRS Multi-slots Class:	12	EGPRS Multi-slots Class:	12
Power Class:	1, tested with power level 5(GSM900)		
	2, tested with power level 0(GSM1800)		
Frequency Bands:	Band	Tx (MHz)	Rx (MHz)
	GSM900	880~915	925~960
	DCS 1800	1710~1785	1805~1880
	WIFI(2.4GHz)	2412~2472	2412~2472
Battery Information:	Model:	XHL18650	
	Normal Voltage :	DC3.7V	
	Rated capacity :	2200mAh	
	Battery Type :	Rechargeable Li-ion Battery	
	Manufacturer	ShenZhen New Light Energy Co., Ltd	



### 1.1.1 DUT Antenna Locations

Please see the Appendix D



**1.2 Test Specification**

Identity	Document Title
FCC 47CFR §2.1093	Radio frequency Radiation Exposure Evaluation: Portable Devices
IEEE Std C95.1 – 1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Electric, Magnetic, and Electromagnetic Fields, 0 Hz to 300 GHz
IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB 447498 D04v01	RF Exposure Procedures and Equipment Authorization Policies for Mobile and Portable Devices
KDB 248227 D01 v02r02	SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB 941225 D05 v02r05	SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES
KDB 865664 D01 v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D01 v01r02	RF Exposure Compliance Reporting and Documentation Considerations



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**1.3 RF exposure limits**

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
<b>Spatial Peak SAR*</b> (Brain*Trunk)	1.60 W/kg	8.00 W/kg
<b>Spatial Average SAR**</b> (Whole Body)	0.08 W/kg	0.40 W/kg
<b>Spatial Peak SAR***</b> (Hands/Feet/Ankle/Wrist)	4.00 W/kg	20.00 W/kg

**Notes:**

\* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

\*\* The Spatial Average value of the SAR averaged over the whole body.

\*\*\* The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

**Uncontrolled Environments** are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

**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.)



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### 1.4 Test Location

All tests were performed at:

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Tel: +86 755 2601 2053 Fax: +86 755 2671 0594

No tests were sub-contracted.

### 1.5 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

#### • A2LA (Certificate No. 3816.01)

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 3816.01.

#### • VCCI (Member No. 1937)

The 3m Fully-anechoic chamber for above 1GHz, 10m Semi-anechoic chamber for below 1GHz, Shielded Room for Mains Port Conducted Interference Measurement and Telecommunication Port Conducted Interference Measurement of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen EMC laboratory have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-20026, R-14188, C-12383 and T-11153 respectively.

#### • FCC –Designation Number: CN1336

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized as an accredited testing laboratory.

Designation Number: CN1336. Test Firm Registration Number: 787754.

#### • Innovation, Science and Economic Development Canada

SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

CAB identifier: CN0006.

IC#: 4620C.



## 2 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	



### 3 SAR Measurements System Configuration

#### 3.1 The SAR Measurement System

This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY5 professional system). A E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation  $SAR = \sigma (|E|^2) / \rho$  where  $\sigma$  and  $\rho$  are the conductivity and mass density of the tissue-Simulate.

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

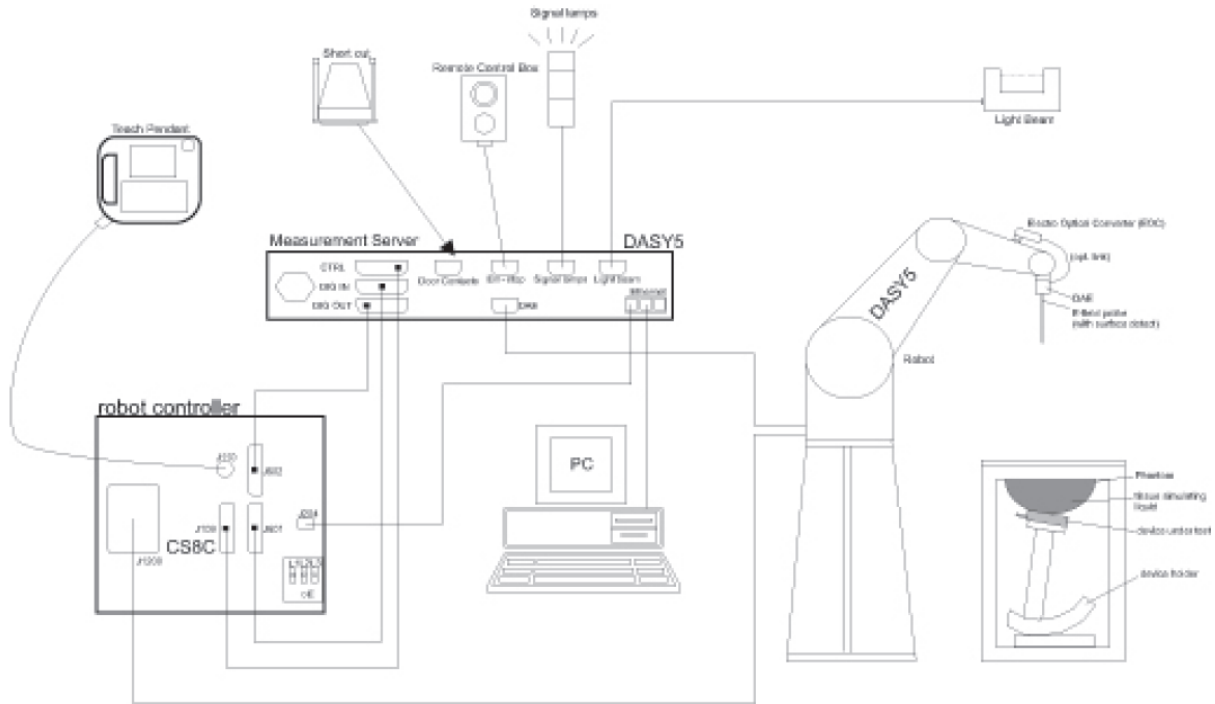
A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software .An arm extension for accommodation the data acquisition electronics (DAE).

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 electronics (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.

The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.





F-1. SAR Measurement System Configuration

- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
- A computer operating Windows 7.
- DASY5 software.
- Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
- The SAM twin phantom enabling testing left-hand, right-hand and Body Worn usage.
- The device holder for handheld mobile phones.
- Tissue simulating liquid mixed according to the given recipes.
- Validation dipole kits allowing to validate the proper functioning of the system.




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### 3.2 Isotropic E-field Probe EX3DV4

	<p>Symmetrical design with triangular core                  Built-in shielding against static charges                  PEEK enclosure material (resistant to organic solvents, e.g., DGBE)</p>
<p><b>Calibration</b></p>	<p>ISO/IEC 17025 <a href="#">calibration service</a> available.</p>
<p><b>Frequency</b></p>	<p>10 MHz to &gt; 6 GHz                  Linearity: ± 0.2 dB (30 MHz to 6 GHz)</p>
<p><b>Directivity</b></p>	<p>± 0.3 dB in TSL (rotation around probe axis)                  ± 0.5 dB in TSL (rotation normal to probe axis)</p>
<p><b>Dynamic Range</b></p>	<p>10 µW/g to &gt; 100 mW/g                  Linearity: ± 0.2 dB (noise: typically &lt; 1 µW/g)</p>
<p><b>Dimensions</b></p>	<p>Overall length: 337 mm (Tip: 20 mm)                  Tip diameter: 2.5 mm (Body: 12 mm)                  Typical distance from probe tip to dipole centers: 1 mm</p>
<p><b>Application</b></p>	<p>High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields); the only probe that enables compliance testing for frequencies up to 6 GHz with precision of better 30%.</p>
<p><b>Compatibility</b></p>	<p>DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI</p>



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### 3.3 Data Acquisition Electronics (DAE)

<b>Model</b>	DAE4
<b>Construction</b>	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY4/5 embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
<b>Measurement Range</b>	-100 to +300 mV (16 bit resolution and two range settings: 4mV,400mV)
<b>Input Offset Voltage</b>	< 5µV (with auto zero)
<b>Input Bias Current</b>	< 50 f A
<b>Dimensions</b>	60 x 60 x 68 mm



### 3.4 SAM Twin Phantom

<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)
<b>Liquid Compatibility</b>	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
<b>Shell Thickness</b>	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
<b>Dimensions (incl. Wooden Support)</b>	Length: 1000 mm Width: 500 mm Height: adjustable feet
<b>Filling Volume</b>	approx. 25 liters
<b>Wooden Support</b>	SPEAG standard phantom table

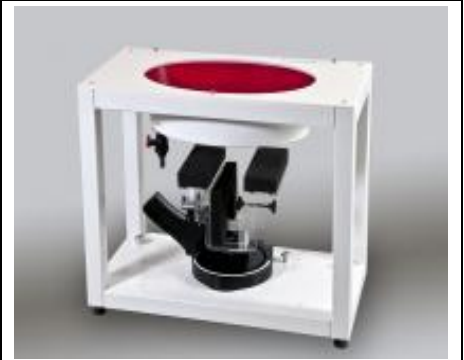


The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.

Twin SAM V5.0 has the same shell geometry and is manufactured from the same material as Twin SAM V4.0, but has reinforced top structure.

**3.5 ELI Phantom**

<b>Material</b>	Vinylester, glass fiber reinforced (VE-GF)
<b>Liquid Compatibility</b>	Compatible with all SPEAG tissue simulating liquids (incl. DGBE type)
<b>Shell Thickness</b>	2.0 ± 0.2 mm (bottom plate)
<b>Dimensions</b>	Major axis: 600 mm Minor axis: 400 mm
<b>Filling Volume</b>	approx. 30 liters
<b>Wooden Support</b>	SPEAG standard phantom table



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 the IEC 62209-2 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.

ELI V5.0 has the same shell geometry and is manufactured from the same material as ELI4, but has reinforced top structure.



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### 3.6 Device Holder for Transmitters



F-2. Device Holder for Transmitters

- 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 centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out 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.



### 3.7 Measurement procedure

#### 3.7.1 Scanning procedure

##### Step 1: Power reference measurement

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.

##### Step 2: Area scan

The SAR distribution at the exposed side of the head was measured at a distance of 4mm from the inner surface of the shell. The area covered the entire dimension of the head and the horizontal grid spacing was 15mm\*15mm or 12mm\*12mm or 10mm\*10mm. Based on the area scan data, the area of the maximum absorption was determined by spline interpolation.

##### Step 3: Zoom scan

Around this point, a volume of 30mm\*30mm\*30mm (fine resolution volume scan, zoom scan) was assessed by measuring 5x5x7 points ( $\leq 2\text{GHz}$ ) and 7x7x7 points ( $\geq 2\text{GHz}$ ). On this basis of this data set, the spatial peak SAR value was evaluated with the following procedure:

The data at the surface was extrapolated, since the centre of the dipoles is 2.0mm away from the tip of the probe and the distance between the surface and the lowest measuring point is 1.2mm. (This can be variable. Refer to the probe specification). The extrapolation was based on a least square algorithm. A polynomial of the fourth order was calculated through the points in z-axis. This polynomial was then used to evaluate the points between the surface and the probe tip. The maximum interpolated value was searched with a straight-forward algorithm. Around this maximum the SAR values averaged over the spatial volumes (1g or 10g) were computed using the 3D-Spline interpolation algorithm. The volume was integrated with the trapezoidal algorithm. One thousand points were interpolated to calculate the average. All neighbouring volumes were evaluated until no neighboring volume with a higher average value was found.

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements. 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.



		≤ 3 GHz	> 3 GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30° ± 1°	20° ± 1°	
Maximum area scan spatial resolution: $\Delta x_{Area}$ , $\Delta y_{Area}$		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 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 ≤ 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: $\Delta x_{Zoom}$ , $\Delta y_{Zoom}$		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm	
	graded grid	$\Delta z_{Zoom}(1)$ : between 1 <sup>st</sup> two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$ : between subsequent points	≤ 1.5 · $\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm	
Note: $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <u>reported</u> SAR from the <u>area scan based 1-g SAR estimation</u> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 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.				

**Step 4: Power reference measurement (drift)**

The Power Drift Measurement job measures the field at the same location as the most recent power reference measurement job within the same procedure, and with the same settings. The indicated drift is mainly the variation of the DUT’s output power and should vary max. ± 5 %



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### 3.7.2 Data Storage

The DASY 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 “.DAE3”. 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], [m W/g], [m W/cm²], [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.

### 3.7.3 Data Evaluation by SEMCAD

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	Dcpi	
Device parameters:	- Frequency	f
- Crest factor	cf	
Media parameters:	- Conductivity	ε
- Density	ρ	

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

$$V_i = U_i + U_i^2 \cdot c f / d c p_i$$

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:

E-field probes:

$$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

H-field probes:

$$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2) / f$$

With  $V_i$  = compensated signal of channel i (i = x, y, z)

$Norm_i$  = sensor sensitivity of channel i (i = x, y, z)

[mV/(V/m)<sup>2</sup>] for E-field Probes

ConvF = sensitivity enhancement in solution

$a_{ij}$  = sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

$E_i$  = electric field strength of channel i in V/m

$H_i$  = magnetic field strength of channel i in A/m

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

$$E_{tot} = (E_x^2 + E_y^2 + E_z^2)^{1/2}$$

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

$$SAR = (E_{tot}^2 \cdot \sigma) / (\epsilon \cdot 1000)$$

With SAR = local specific absorption rate in mW/g

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

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

$\epsilon$  = 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. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with  $P_{pwe}$  = equivalent power density of a plane wave in mW/cm<sup>2</sup>

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

$H_{tot}$  = total magnetic field strength in A/m



## 4 SAR measurement variability and uncertainty

### 4.1 SAR measurement variability

Per KDB865664 D01 SAR measurement 100 MHz to 6 GHz v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

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

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.



### 4.2 SAR measurement uncertainty

Per KDB865664 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 extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.



## 5 Description of Test Position

### 5.1 Extremity exposure conditions

Devices that are designed or intended for use on extremities, or mainly operated in extremity only exposure conditions, i.e., hands, wrists, feet and ankles, may require extremity SAR evaluation. When the device also operates in close proximity to the user's body, SAR compliance for the body is also required. The 1-g body and 10-g extremity SAR Test Exclusion Thresholds in 8.2 should be applied to determine SAR test requirements. When extremity SAR testing is required, a flat phantom must be used if the exposure condition is more conservative than the actual use conditions; otherwise, a KDB inquiry is required to determine the phantom and test requirements. Body SAR compliance is also tested with a flat phantom. For devices with irregular shapes or form factors that do not conform to a flat phantom, and/or unusual operating configurations and exposure conditions, a KDB inquiry is also required to determine the appropriate SAR measurement procedures. Unless it is specified differently in the published RF exposure KDB procedures, when simultaneous transmission applies to extremity exposure, the simultaneous transmission SAR test exclusion provisions should be applied. When simultaneous transmission SAR measurement is required, the enlarged zoom scan and volume scan post-processing procedures in KDB Publication 865664 D01 should be applied.

SAR can test the sides near the antenna, the surface of the device should be tested for SAR compliance with the device touching the phantom. The SAR Exclusion Threshold in KDB 447498 D04 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent device surface is used to determine if SAR testing is required for the adjacent surfaces, with the adjacent surface positioned against the phantom and the surface containing the antenna positioned perpendicular to the phantom.





## 6 SAR System Verification Procedure

### 6.1 Tissue Simulate Liquid

#### 6.1.1 Recipes for Tissue Simulate Liquid

The following tables give the recipes for tissue simulating liquids to be used in different frequency bands:

Ingredients (% by weight)	Frequency (MHz)									
	450		835		915		1900		2450	
Tissue Type	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	38.56	51.16	41.45	52.4	41.05	56.0	54.9	40.4	62.7	73.2
Salt (NaCl)	3.95	1.49	1.45	1.4	1.35	0.76	0.18	0.5	0.5	0.04
Sugar	56.32	46.78	56.0	45.0	56.5	41.76	0.0	58.0	0.0	0.0
HEC	0.98	0.52	1.0	1.0	1.0	1.21	0.0	1.0	0.0	0.0
Bactericide	0.19	0.05	0.1	0.1	0.1	0.27	0.0	0.1	0.0	0.0
Triton X-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0
DGBE	0.0	0.0	0.0	0.0	0.0	0.0	44.92	0.0	0.0	26.7
Dielectric Constant	43.42	58.0	42.54	56.1	42.0	56.8	39.9	54.0	39.8	52.5
Conductivity (S/m)	0.85	0.83	0.91	0.95	1.0	1.07	1.42	1.45	1.88	1.78

HSL5GHz is composed of the following ingredients:

- Water: 50-65%
- Mineral oil: 10-30%
- Emulsifiers: 8-25%
- Sodium salt: 0-1.5%

MSL5GHz is composed of the following ingredients:

- Water: 64-78%
- Mineral oil: 11-18%
- Emulsifiers: 9-15%
- Sodium salt: 2-3%



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**6.1.2 Test Liquids Confirmation**

**Simulated tissue liquid parameter confirmation**

The dielectric parameters were checked prior to assessment using the SPEAG DAK3.5 dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

**IEEE SCC-34/SC-2 P1528 recommended tissue dielectric parameters**

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations and extrapolated according to the head parameters specified in P1528

Target Frequency (MHz)	Head		Body	
	$\epsilon_r$	$\sigma$ (S/m)	$\epsilon_r$	$\sigma$ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800-2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	48.2	6.00

( $\epsilon_r$  = relative permittivity,  $\sigma$  = conductivity and  $\rho = 1000 \text{ kg/m}^3$ )



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**6.1.3 Measurement for Tissue Simulate Liquid**

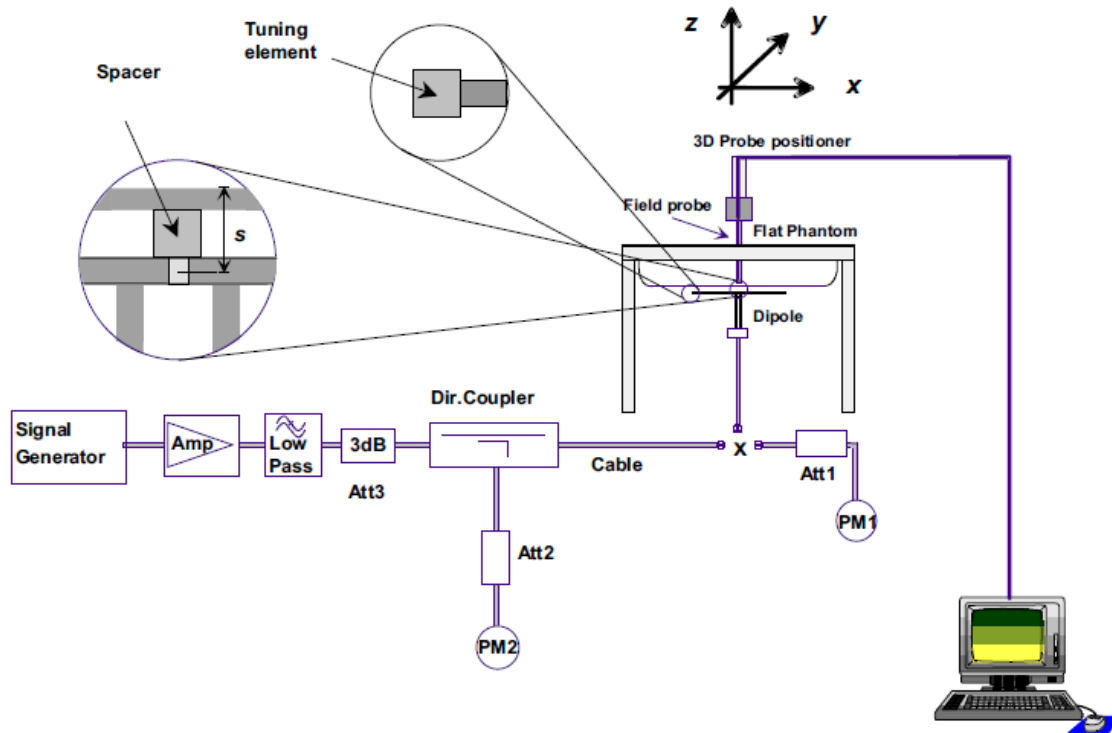
The dielectric properties for this Tissue Simulate Liquids were measured by using the SPEAG DAK3.5 dielectric probe kit in conjunction with Agilent Network Analyzer (300 KHz-8500 MHz). The Conductivity ( $\sigma$ ) and Permittivity ( $\rho$ ) are listed in bellow table. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was  $22\pm 2^{\circ}\text{C}$ .

Measurement for Tissue Simulate Liquid										
Tissue Type	Measured Frequency (MHz)	Conductivity ( $\sigma$ )	Permittivity ( $\epsilon_r$ )	Conductivity Target ( $\sigma$ )	Permittivity Target ( $\epsilon_r$ )	Delta ( $\sigma$ ) (%)	Delta ( $\epsilon_r$ ) (%)	Limit (%)	Liquid Temp. ( $^{\circ}\text{C}$ )	Date
835 Head	835	0.91	41.6	0.90	41.50	1.11	0.24	$\pm 5$	22.1	2023/8/2
1900 Head	1900	1.37	39.14	1.40	40.00	-2.14	-2.15	$\pm 5$	22.3	2023/8/2
2450 Head	2450	1.83	39.8	1.80	39.20	1.67	1.53	$\pm 5$	22	2023/8/3



## 6.2 SAR System Check

The microwave circuit arrangement for system check is sketched in bellow figure. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the following table. During the tests, the ambient temperature of the laboratory was in the range  $22\pm 2^{\circ}\text{C}$ , the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-3. the microwave circuit arrangement used for SAR system verification

### 6.2.1 Justification for Extended SAR Dipole Calibrations

1) Referring to KDB865664 D01 requirements for dipole calibration, instead of the typical annual calibration recommended by measurement standards, longer calibration intervals of up to three years may be considered when it is demonstrated that the SAR target, impedance and return loss of a dipole have remain stable according to the following requirements. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix C.

- a) There is no physical damage on the dipole;
- b) System check with specific dipole is within 10% of calibrated value;
- c) Return-loss is within 10% of calibrated measurement;
- d) Impedance is within 5Ω from the previous measurement.

2) Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.



**6.2.2 Summary System Check Result(s)**

SAR System Validation Result(s)									
Validation Kit		Measured SAR 250mW	Measured SAR 250mW	Measured SAR (normalized to 1w)	Measured SAR (normalized to 1w)	Target SAR (normalized to 1w) (±10%)	Target SAR (normalized to 1w) (±10%)	Liquid Temp. (°C)	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D835V2	Head	2.41	1.59	9.64	6.36	9.41 (8.47~10.35)	6.25 (5.63~6.88)	22.1	2023/8/2
D1950V3	Head	9.82	5.36	39.28	21.44	39.7 (35.73~43.67)	20.5 (18.45~22.55)	22.3	2023/8/2
D2450V2	Head	12.75	6.33	51	25.32	53 (47.70~58.30)	24.6 (22.14~27.60)	22	2023/8/3

**6.2.3 Detailed System Check Results**

Please see the Appendix A



## 7 Test results and Measurement Data

### 7.1 Operation Configurations

#### 7.1.1 GSM Test Configuration

SAR tests for GSM900 and GSM1800, a communication link is set up with a base station by air link. Using CMU200 the power lever is set to "5" and "0" in SAR of GSM900 and GSM1800. The tests in the band of GSM900 and GSM1800 are performed in the mode of GPRS/EGPRS function. Since the GPRS class is 12 for this EUT, it has at most 4 timeslots in uplink and at most 4 timeslots in downlink, the maximum total timeslot is 5. The EGPRS class is 12 for this EUT, it has at most 4 timeslots in uplink, and at most 4 timeslots in downlink, the maximum total timeslot is 5.

SAR test reduction for GPRS and EDGE modes is determined by the source-based time-averaged output power specified for production units. The data 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, the higher number time-slot configuration should be tested.

When SAR tests for EGPRS mode is necessary, GMSK modulation should be used to minimize SAR measurement error due to higher peak-to-average power (PAR) ratios inherent in 8-PSK.

The 3G SAR test reduction procedure is applied to 8-PSK EDGE with GMSK GPRS/EDGE as the primary mode.



### 7.1.2 Wi-Fi Test Configuration

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.

#### 7.1.2.1 Initial Test Position SAR Test Reduction Procedure

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures. The initial test position procedure is described in the following:

- 1) .When the reported SAR of the initial test position is  $\leq 0.4$  W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).
- 2) .When the reported SAR of the initial test position is  $> 0.4$  W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the reported SAR is  $\leq 0.8$  W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.
- 3) .For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is  $> 0.8$  W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is  $\leq 1.2$  W/kg or all required channels are tested. a) Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

#### 7.1.2.2 Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required. SAR test reduction for subsequent highest output test channels is determined according to *reported* SAR of the initial test configuration.

For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.

When the *reported* SAR of the initial test configuration is  $> 0.8$  W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until *reported* SAR is  $\leq 1.2$  W/kg or all required channels are tested.





**7.1.2.3 Subsequent Test Configuration Procedures**

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. The initial test position procedure is applied to next to the ear, UMPC mini-tablet and hotspot mode configurations. When the same maximum output power is specified for multiple transmission modes, additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. The subsequent test configuration and SAR measurement procedures are described in the following.

- 1) . When SAR test exclusion provisions of KDB Publication 447498 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.
- 2) . When the highest *reported* SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is  $\leq 1.2$  W/kg, SAR is not required for that subsequent test configuration.
- 3) . The number of channels in the initial test configuration and subsequent test configuration can be different due to differences in channel bandwidth. When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel. This step requires additional power measurement to identify the highest maximum output power channel in the subsequent test configuration to determine SAR test reduction.
  - a) SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.
  - b) SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the *reported* SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is  $> 1.2$  W/kg or until all required channels are tested. i) For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.
- 4) . SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration (highest maximum output) or subsequent test configuration(s) (subsequent next highest maximum output power) is determined by recursively applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:
  - a) replace “subsequent test configuration” with “next subsequent test configuration” (i.e., subsequent next highest specified maximum output power configuration)
  - b) replace “initial test configuration” with “all tested higher output power configurations”

**7.1.2.4 2.4 GHz Wi-Fi SAR Procedures**

Separate SAR procedures are applied to DSSS and OFDM configurations in the 2.4 GHz band to simplify DSSS test requirements. For 802.11b DSSS SAR measurements, DSSS SAR procedure applies to fixed exposure test position and initial test position procedure applies to multiple exposure test positions. When SAR measurement is required for an OFDM configuration, the initial test configuration, subsequent test configuration and initial test position procedures are applied. The SAR test exclusion requirements for 802.11g/n OFDM configurations are



described in following.

- **802.11b DSSS SAR Test Requirements**

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure. SAR test reduction is determined according to the following:

- 1) . 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.
- 2) . When the reported SAR is  $> 0.8$  W/kg, SAR is required for that exposure configuration 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.

- **2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements**

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3, including sub-sections). SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) . When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) . 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.

## 7.2 Measurement of RF Conducted Power



## 8 Measurement of RF conducted Power

### 8.1.1 Conducted Power Of GSM

GSM 850										
Burst Output Power(dBm)					Tune up	Division Factors	Frame-Average Output Power(dBm)			Tune up
Channel	128	190	251	128			190	251		
GPRS (GMSK)	1 TX Slot	27.93	26.89	26.93	28	-9.03	18.9	17.86	17.9	18.97
	2 TX Slots	27.1	26.84	27.48	27.5	-6.02	21.08	20.82	21.46	21.48
	3 TX Slots	26.07	25.77	26.28	26.5	-4.26	21.81	21.51	<b>22.02</b>	<b>22.24</b>
	4 TX Slots	24.87	24.54	24.93	25	-3.01	21.86	21.53	21.92	21.99
GSM 1900										
Burst Output Power(dBm)					Tune up	Division Factors	Frame-Average Output Power(dBm)			Tune up
Channel	512	661	810	512			661	810		
GPRS (GMSK)	1 TX Slot	26.99	26.5	26.78	27	-9.03	17.96	17.47	17.75	17.97
	2 TX Slots	26.85	26.96	24.25	27	-6.02	20.83	20.94	18.23	20.98
	3 TX Slots	25.88	25.77	26.05	26.5	-4.26	21.62	21.51	21.79	<b>22.24</b>
	4 TX Slots	24.58	24.75	24.86	25	-3.01	21.57	21.74	<b>21.85</b>	21.99



**8.1.2 Conducted Power Of Wi-Fi**

Mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Average Power (dBm)	Tune up
802.11b	1	2412	1	16.12	16.5
	6	2437		15.7	16.5
	11	2462		15.99	16.5
802.11g	1	2412	6	13.05	14
	6	2437		13	14
	11	2462		13.9	14
802.11n HT20 SISO	1	2412	6.5	12.98	14
	6	2437		12.87	14
	11	2462		13.62	14



## 9 Measurement of SAR Data

### 9.1.1 SAR Result Of GSM 850

GSM850 SAR Test Record													
Test position	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg) 1-g	SAR (W/kg) 10-g	Power Drift (dB)	Conducted Power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg) 1-g	Scaled SAR (W/kg) 10-g	Liquid Temp	SAR limit (W/kg)
Limbs Test data(Separate 0mm)													
Front side	GPRS 3TS	190/836.6	1:2.075	0.263	0.177	-0.15	25.77	26.5	1.183	0.311	0.209	22.1	4
Back side	GPRS 3TS	190/836.6	1:2.075	0.182	0.126	-0.06	25.77	26.5	1.183	0.215	0.149	22.1	4
Left side	GPRS 3TS	190/836.6	1:2.075	0.064	0.023	0.08	25.77	26.5	1.183	0.076	0.027	22.1	4
Right side	GPRS 3TS	190/836.6	1:2.075	2.900	1.600	0.04	25.77	26.5	1.183	3.431	<b>1.893</b>	22.1	4
Bottom side	GPRS 3TS	190/836.6	1:2.075	0.131	0.079	-0.07	25.77	26.5	1.183	0.155	0.093	22.1	4
Top side	GPRS 3TS	190/836.6	1:2.075	0.019	0.009	-0.09	25.77	26.5	1.183	0.022	0.011	22.1	4
Right side	GPRS 3TS	128/824.2	1:2.075	2.930	1.640	0.09	26.07	26.5	1.104	3.235	1.811	22.1	4
Right side	GPRS 3TS	251/848.8	1:2.075	2.950	1.680	-0.15	26.28	26.5	1.052	3.103	1.767	22.1	4



**9.1.2 SAR Result Of GSM 1900**

GSM1900 SAR Test Record													
Test position	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg) 1-g	SAR (W/kg) 10-g	Power Drift(dB)	Conducted Power (dBm)	Tune up Limit (dBm)	Scaled factor	Scaled SAR (W/kg) 1-g	Scaled SAR (W/kg) 10-g	Liquid Temp	SAR limit (W/kg)
Limbs Test data(Separate 0mm)													
Front side	GPRS 3TS	661/1880	1:2.075	0.507	0.286	0.11	25.77	26.5	1.183	0.600	0.338	22.3	4
Back side	GPRS 3TS	661/1880	1:2.075	0.200	0.100	-0.14	25.77	26.5	1.183	0.237	0.118	22.3	4
Left side	GPRS 3TS	661/1880	1:2.075	0.152	0.083	-0.05	25.77	26.5	1.183	0.180	0.098	22.3	4
Right side	GPRS 3TS	661/1880	1:2.075	5.510	2.530	-0.09	25.77	26.5	1.183	6.519	<b>2.993</b>	22.3	4
Bottom side	GPRS 3TS	661/1880	1:2.075	0.268	0.139	-0.04	25.77	26.5	1.183	0.317	0.164	22.3	4
Top side	GPRS 3TS	661/1880	1:2.075	0.045	0.018	-0.06	25.77	26.5	1.183	0.053	0.021	22.3	4
Right side	GPRS 3TS	512/1850.2	1:2.075	5.320	2.415	-0.07	25.88	26.5	1.153	6.136	2.786	22.3	4
Right side	GPRS 3TS	810/1909.8	1:2.075	5.620	2.587	-0.13	26.05	26.5	1.109	6.234	2.869	22.3	4



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**9.1.3 SAR Result Of 2.4GHz Wi-Fi**

Wi-Fi 2.4G SAR Test Record													
Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	SAR (W/kg) 10-g	Power drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR (W/kg) 10-g	Liquid Temp.	SAR limit (W/kg)
Limbs Test data (Separate 0mm)													
Front side	802.11b	6/2437	98.23%	1.018	0.251	0.123	-0.12	15.70	16.50	1.202	0.151	22.0	4
Back side	802.11b	6/2437	98.23%	1.018	0.074	0.036	0.05	15.70	16.50	1.202	0.044	22.0	4
Left side	802.11b	6/2437	98.23%	1.018	0.012	0.005	-0.07	15.70	16.50	1.202	0.006	22.0	4
Right side	802.11b	6/2437	98.23%	1.018	0.352	0.133	-0.03	15.70	16.50	1.202	0.163	22.0	4
Bottom side	802.11b	6/2437	98.23%	1.018	0.021	0.009	-0.08	15.70	16.50	1.202	0.011	22.0	4
Top side	802.11b	6/2437	98.23%	1.018	0.008	0.004	-0.15	15.70	16.50	1.202	0.005	22.0	4
Right side	802.11b	1/2412	98.23%	1.018	0.385	0.152	-0.09	16.12	16.50	1.091	<b>0.169</b>	22.0	4
Right side	802.11b	11/2462	98.23%	1.018	0.367	0.147	-0.08	15.99	16.50	1.125	0.168	22.0	4



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## 9.2 Multiple Transmitter Evaluation

### 9.2.1 Simultaneous SAR test evaluation

#### Simultaneous Transmission

NO.	Simultaneous Transmission Configuration	Body
1	WWAN + WIFI 2.4GHz	Yes

#### Simultaneous Transmission SAR Summation Scenario for Body

WWAN Band	Exposure position	①MAX. WWAN SAR (W/kg)	②MAX. WLAN2.4G SAR (W/kg)	Summed SAR ①+②	Volume scan
GSM850	Front	0.209	0.151	0.360	NO
	Back	0.149	0.044	0.193	NO
	Left	0.027	0.006	0.033	NO
	Right	1.893	0.169	2.062	NO
	Top	0.093	0.011	0.104	NO
	Bottom	0.011	0.005	0.016	NO
GSM1900	Front	0.338	0.151	0.489	NO
	Back	0.118	0.044	0.162	NO
	Left	0.098	0.006	0.104	NO
	Right	2.993	0.169	3.162	NO
	Top	0.164	0.011	0.175	NO
	Bottom	0.021	0.005	0.026	NO





## 10 Equipment list

Test Platform		SPEAG DASY5 Professional				
Location		SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch				
Software Reference		DASY52 52.8.4(1052); SEMCAD X 14.6.8(7028)				
Hardware Reference						
Equipment	Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration	
<input checked="" type="checkbox"/>	PC	DELL	Core(TM)i3-6100 3.7GHz	7LLVLG2	N/A	N/A
<input checked="" type="checkbox"/>	Signal Generator	Agilent	N5173B	MY53270267	2023/03/21	2024/03/20
<input checked="" type="checkbox"/>	S-Parameter Network Analyzer	Agilent	E5071C	MY46527453	2023/03/21	2024/03/20
<input checked="" type="checkbox"/>	DAK-3.5 probe	SPEAG	DAK-3.5	1102	N/A	N/A
<input checked="" type="checkbox"/>	Power sensor	KEYSIGHT	U2021XA	MY57110007	2023/03/21	2024/03/20
<input checked="" type="checkbox"/>	universal Radio communication tester	R&S	CMW500	154501	2023/03/20	2024/03/19
<input checked="" type="checkbox"/>	DAE	SPEAG	DAE4	760	2023/06/26	2024/06/25
<input checked="" type="checkbox"/>	E-field PROBE	SPEAG	EX3DV4	7380	2023/06/21	2024/06/20
<input checked="" type="checkbox"/>	Dipole	SPEAG	D835V2	4d042	2022/06/08	2025/06/07
<input checked="" type="checkbox"/>	Dipole	SPEAG	D1950V3	1138	2022/10/31	2025/10/30
<input checked="" type="checkbox"/>	Dipole	SPEAG	D2450V2	955	2022/06/06	2025/06/05
<input checked="" type="checkbox"/>	Electro Thermometer	MITIR	N/A	N/A	2023/03/23	2024/04/22
<input checked="" type="checkbox"/>	Amplifier	Mini-circuits	ZVE-3W-83+	857501833	N/A	N/A
<input checked="" type="checkbox"/>	Amplifier	Mini-circuits	ZHL-42W	A0950002	N/A	N/A
<input checked="" type="checkbox"/>	3db ATTENUATOR	SHX	SMA-3dB-6G	12021302	N/A	N/A
<input checked="" type="checkbox"/>	DUMMY PROBE	SPEAG	DP_2	SPDP2001AA	N/A	N/A
<input checked="" type="checkbox"/>	Dual Directional Coupler	Agilent	772D	MY46151275	N/A	N/A
<input checked="" type="checkbox"/>	SAM PHANTOM (ELI4 v4.0)	SPEAG	QDOVA001BB	1102	N/A	N/A
<input checked="" type="checkbox"/>	Twin SAM Phantom	SPEAG	QD000P40CD	1673	N/A	N/A
<input checked="" type="checkbox"/>	ROBOT KRC	SPEAG	CS8	SP1/D/211/421/00	N/A	N/A
<input checked="" type="checkbox"/>	LIQUID CALIBRATION KIT	ANTENNESSA	41/05 OCP9	00425167	N/A	N/A

Note: All the equipments are within the valid period when the tests are performed.

All measurement facilities used to collect the measurement data are located at

No. 1 Workshop, M-10, Middle Section, Science & Technology Park, Nanshan District, Shenzhen, Guangdong, China. 518057.



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### 11 Calibration certificate

Please see the Appendix C

### 12 Photographs

Please see the Appendix D





## SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

SZSAR-TRF-01-A01 Rev. A/0 May15,2023

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### Appendix A: Detailed System Check Results

The plots of worse case are showing as followings.



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SZSAR-TRF-01-A01 Rev. A/0 May15,2023

Report No.: SZCR230500145306

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Date: 2023/8/2

Test Laboratory: SGS-CSTC Standards Technical Services Co., Ltd., Shenzhen Branch

### SystemPerformanceCheck-D835

**DUT: Dipole 835 MHz; Type: D835V2; Serial:4d042**

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.918 \text{ S/m}$ ;  $\epsilon_r = 42.064$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

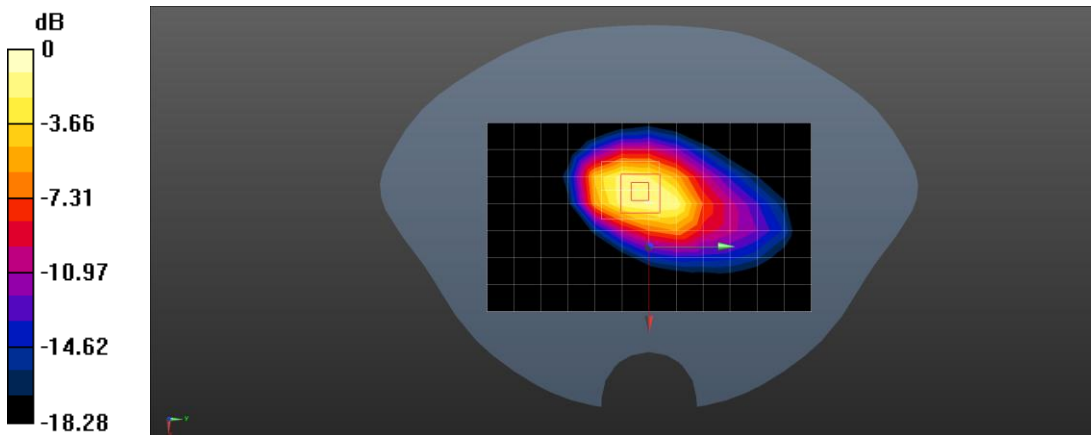
Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(7.5, 7.5, 7.5); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**System Performance Check at Frequencies Low 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Area Scan (7x12x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (measured) = 2.90 W/kg

**System Performance Check at Frequencies Low 1 GHz/d=15mm, Pin=250 mW, dist=3.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm  
Reference Value = 43.376 V/m; Power Drift = 0.04 dB  
Peak SAR (extrapolated) = 5.30 W/kg  
**SAR(1 g) = 2.9 W/kg; SAR(10 g) = 1.6 W/kg**  
Maximum value of SAR (measured) = 3.73 W/kg



0 dB = 3.73 W/kg = 5.72 dBW/kg



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## SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch

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### System Performance Check 1950 MHz

**DUT: Dipole 1950 MHz; Type: D1950V2; Serial: 1138**

Communication System: CW (0); Frequency: 1950 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 1950$  MHz;  $\sigma = 1.432$  S/m;  $\epsilon_r = 39.677$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

### DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(7.5, 7.5, 7.5); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Body/d=10mm, Pin=250mW/Area Scan (5x7x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 6.86 W/kg

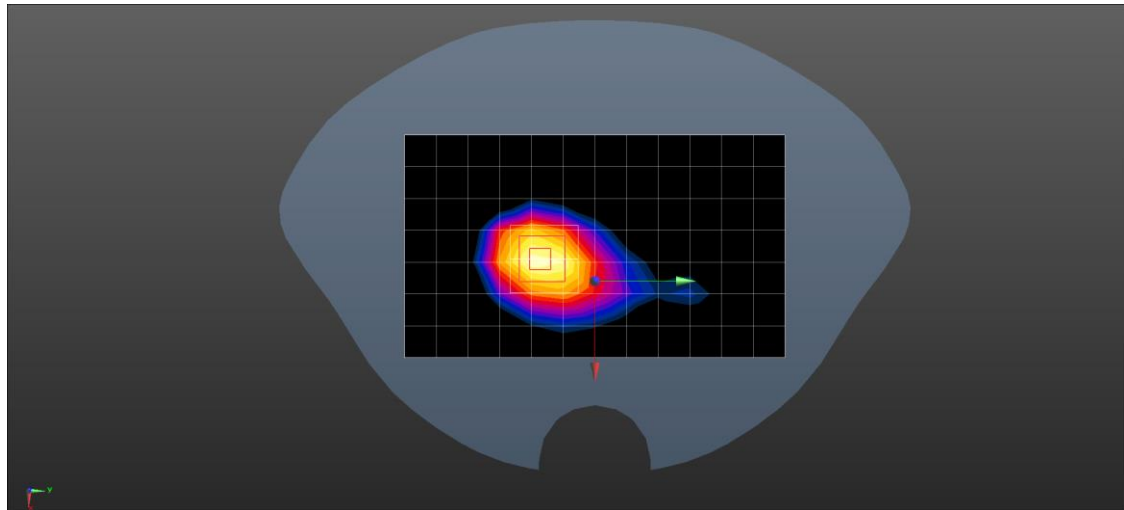
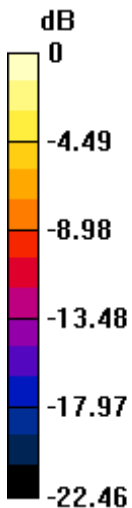
**Body/d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 75.458 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 20.1 W/kg

**SAR(1 g) = 5.51 W/kg; SAR(10 g) = 2.53 W/kg**

Maximum value of SAR (measured) = 7.38 W/kg



0 dB = 7.38 W/kg = 8.68 dBW/kg



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### System Performance Check 2450MHz

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 955**

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.83$  S/m;  $\epsilon_r = 39.51$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

### DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(7.5, 7.5, 7.5); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASYS2, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Body/d=10mm, Pin=250mW/Area Scan (8x8x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 19.9 W/kg

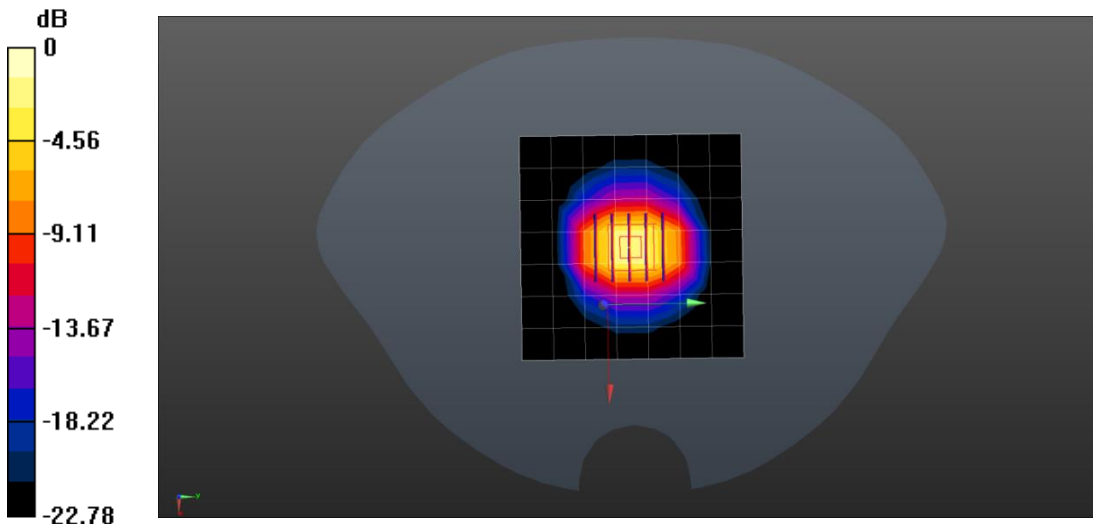
**Body/d=10mm, Pin=250mW/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 118.4 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 45.1 W/kg

**SAR(1 g) = 12.75 W/kg; SAR(10 g) = 6.33 W/kg**

Maximum value of SAR (measured) = 36.9 W/kg



0 dB = 36.9 W/kg = 15.67 dBW/kg



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### Appendix B: Detailed Test Results

The plots of worse case are showing as followings.



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### GSM850 GPRS 3TS Right Side 0mm Ch190

DUT: Mobile POS; Type: QPOS Tiro

Communication System: GPRS-2TX; Frequency: 836.6 MHz; Duty Cycle: 1:4.14954

Medium parameters used (interpolated):  $f = 836.6$  MHz;  $\sigma = 0.933$  S/m;  $\epsilon_r = 42.213$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

#### DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(9.62, 9.62, 9.62); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Body/Area Scan (8x15x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.31 W/kg

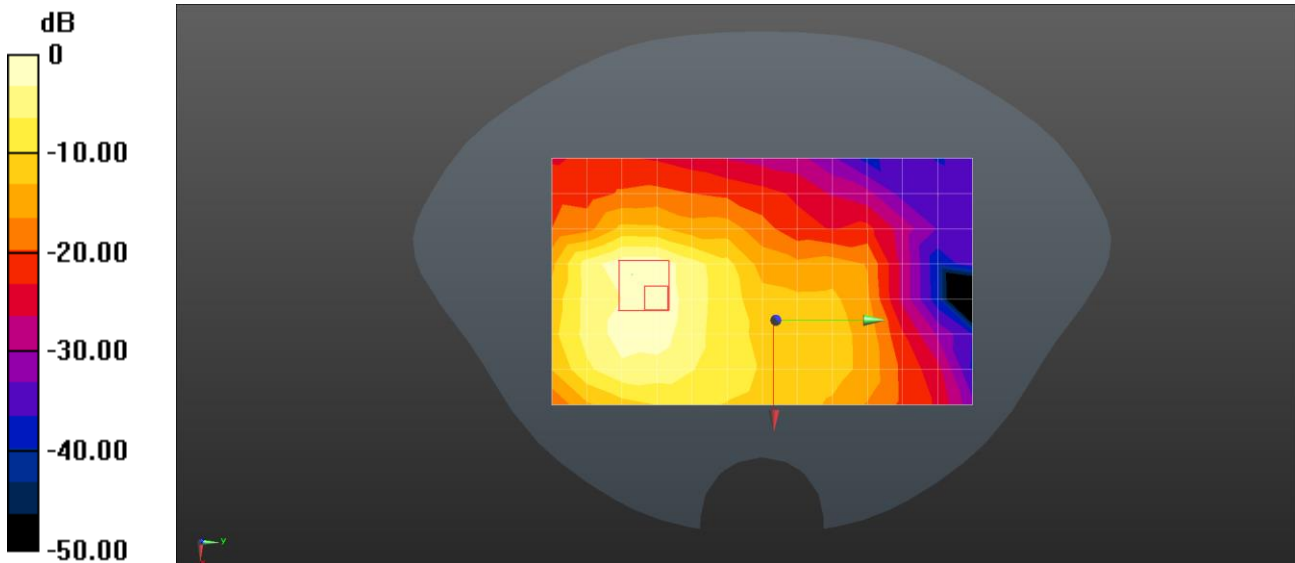
**Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.112 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 2.05 W/kg

**SAR(1 g) = 1.21 W/kg; SAR(10 g) = 0.705 W/kg**

Maximum value of SAR (measured) = 1.79 W/kg



0 dB = 1.79 W/kg = 2.53 dBW/kg



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**GSM1900 GPRS 3TS Right Side 0mm Ch661**

**DUT: Mobile POS; Type: QPOS Tiro**

Communication System: GPRS-2TX; Frequency: 1880 MHz; Duty Cycle: 1:4.14954

Medium parameters used (interpolated):  $f = 1880 \text{ MHz}$ ;  $\sigma = 1.417 \text{ S/m}$ ;  $\epsilon_r = 40.165$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(8.05, 8.05, 8.05); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Body/Area Scan (8x15x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$

Maximum value of SAR (measured) = 1.73 W/kg

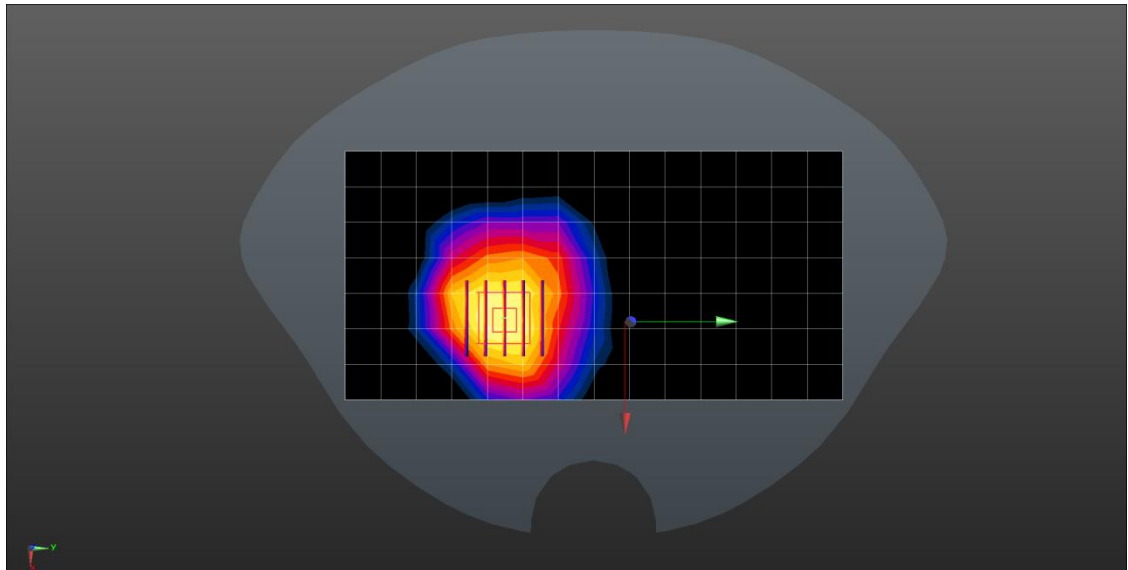
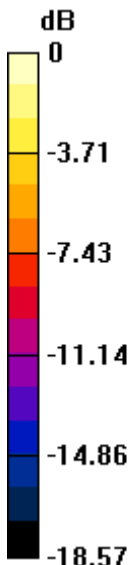
**Body/Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 7.454 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.08 W/kg

**SAR(1 g) = 1.86 W/kg; SAR(10 g) = 1.02 W/kg**

Maximum value of SAR (measured) = 2.27 W/kg



0 dB = 2.27 W/kg = 3.56 dBW/kg



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### WLAN2.4GHz 802.11b Right side 0mm Ch1

DUT: Mobile POS; Type: QPOS Tiro

Communication System: 2.4G WIFI; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.798$  S/m;  $\epsilon_r = 39.35$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(7.5, 7.5, 7.5); Calibrated: 2023/6/21;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn760; Calibrated: 2023/6/26
- Phantom: SAM1; Type: QD00P40CD; Serial: TP:1673
- Measurement SW: DASY52, Version 52.8 (4); SEMCAD X Version 14.6.8 (7028)

**Body/Area Scan (10x18x1):** Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 1.08 W/kg

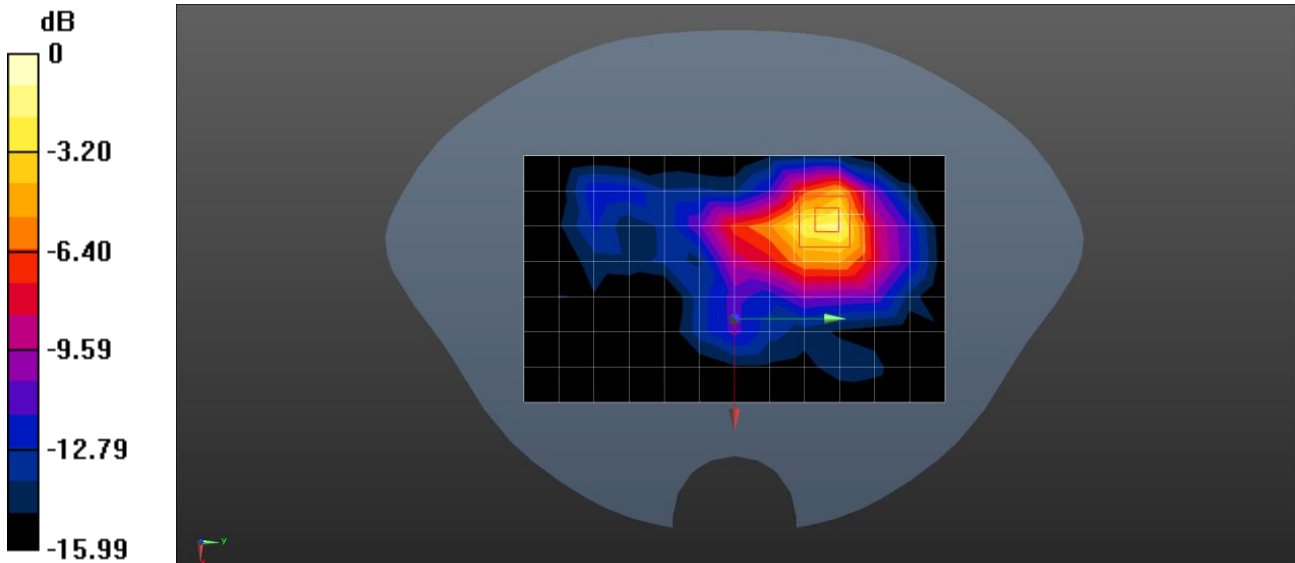
**Body/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 2.348 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 2.51 W/kg

**SAR(1 g) = 0.385 W/kg; SAR(10 g) = 0.152 W/kg**

Maximum value of SAR (measured) = 1.20 W/kg



0 dB = 1.20 W/kg = 0.79 dBW/kg



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### Appendix C: Calibration certificate

### Appendix D: Photographs

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