

CE SAR REPORT

Applicant: Shenzhen Huafurui Technology Co., Ltd.
Address of Applicant: Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen,P.R. China

Equipment Under Test (EUT)

Product Name: Smart phone

Model No.: GT20

Trade mark: HAFURY

Applicable standards: EN 50360:2017, EN 50566:2017
EN 62209-1:2016, EN 62209-2:2010
EN 50663:2017, EN 62479:2010

Date of sample receipt: 22 May., 2020

Date of Test: 18 Jun., 2020 ~ 29 Jun., 2020

Date of report issued: 14 Jul., 2020

Test Result: Maximum 10g SAR(W/kg)
Head: 0.323 Body: 1.117 Hotspot: 1.117
Maximum 10g SAR(W/kg)
Limb: 3.317

Authorized Signature:



Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the CCIS product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	14 Jul., 2020	Original

Remark:
This report was revised by CCISE200507501 report, which was released and tested by Shenzhen Zhongjian Nanfang Testing Co., Ltd. The differences between them as below: Update model, trademark and software version. Update photos. So no needs to be retested.

Tested by:Huheng Cai**Date:**14 Jul., 2020**Test Engineer****Reviewed by:**Tanet Wei**Date:**14 Jul., 2020**Project Engineer**

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4 SAR Results Summary

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

<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 10-g SAR(W/kg)	Equipment Class	Highest Reported 10-g SAR (W/kg)
Head	GSM 900	0.033	PCE	0.323
	DCS1800	0.051		
	WCDMA Band I	0.190		
	WCDMA Band V III	0.030		
	LTE Band 1	0.266		
	LTE Band 3	0.105		
	LTE Band 7	0.323		
	LTE Band 8	0.031		
	LTE Band 20	0.038		
	WLAN 2.4GHz	0.064	DTS	
Body (5 mm Gap)	GSM 900	0.183	PCE	1.117
	DCS1800	0.376		
	WCDMA Band I	0.678		
	WCDMA Band V III	0.171		
	LTE Band 1	0.943		
	LTE Band 3	0.715		
	LTE Band 7	1.117		
	LTE Band 8	0.167		
	LTE Band 20	0.199		
	WLAN 2.4GHz	0.105	DTS	
Hotspot (5 mm Gap)	GSM 900	0.322	PCE	1.117
	DCS1800	0.584		
	WCDMA Band I	0.678		
	WCDMA Band V III	0.171		
	LTE Band 1	0.943		
	LTE Band 3	0.715		
	LTE Band 7	1.117		
	LTE Band 8	0.167		
	LTE Band 20	0.199		
	WLAN 2.4GHz	0.105	DTS	
Limb (0 mm Gap)	GSM 900	0.756	PCE	3.317
	DCS1800	2.042		
	WCDMA Band I	2.671		
	WCDMA Band V III	0.435		
	LTE Band 1	3.317		
	LTE Band 3	2.644		
	LTE Band 7	2.928		
	LTE Band 8	0.431		
	LTE Band 20	0.570		
	WLAN 2.4GHz	0.217	DTS	

<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 10-g SAR (W/kg)	Equipment Class	Highest Reported Simultaneous Transmission 10-g SAR (W/kg)
Bottom	LTE Band 7	1.117	PCE	1.222
	WLAN 2.4GHz	0.105	DTS	
Bottom	LTE Band 1	3.317	PCE	3.534
	WLAN 2.4GHz	0.217	DTS	

Note:

1. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (2.0W/kg for distance 5mm body SAR, 4.0W/kg for distance 0mm extremity SAR) specified in EN 50360:2017 and EN 50566:2017, and had been tested in accordance with the measurement methods and procedures specified in EN 62209-1:2016 and EN 62209-2:2010.

5 General Information

5.1 Client Information

Applicant:	Shenzhen Huafului Technology Co., Ltd.
Address of Applicant:	Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen,P.R. China
Manufacturer:	Shenzhen Huafului Technology Co., Ltd.
Address of Manufacturer:	Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen,P.R. China
Factory:	Shenzhen Huafului Technology Co., Ltd.
Address of Factory:	Unit 1401 &1402, 14/F, Jinqi zhigu mansion (No. 4 building of Chongwen Garden), Crossing of the Liuxian street and Tangling road, Taoyuan street, Nanshan district, Shenzhen,P.R. China

5.2 General Description of EUT

Product Name:	Smart phone		
Model No.:	GT20		
Hardware Version:	V965_MB_V2.0_20200415		
Software Version:	HAFURY_GT20_A031CH_V01_20200715		
Category of device	Portable device		
Operation Frequency:	GSM 900:880 MHz ~ 915 MHz DCS 1800:1710 MHz ~ 1785 MHz WCDMA Band I: 1920 MHz ~1970 MHz WCDMA BandVIII :880MHz~915MHz FDD LTE Band 1 :1920MHz~1980MHz FDD LTE Band 3 :1710MHz~1785MHz FDD LTE Band 7 :2500MHz~2570MHz FDD LTE Band 8 :880MHz~915MHz FDD LTE Band 20 :832MHz~862MHz WLAN: 802.11b/g/n-HT20:2412 MHz ~2472 MHz 802.11n-HT40:2422 MHz ~2462 MHz Bluetooth: 2402 MHz ~2480 MHz NFC: 13.56MHz		
Modulation technology:	GSM/GPRS: GMSK, EGPRS: 8PSK, WCDMA: QPSK LTE:QPSK/16QAM, WLAN: 802.11b: DSSS, 802.11g/n: OFDM Bluetooth: GFSK / π /4DQPSK/8DPSK; BLE: GFSK NFC: ASK		
Antenna Type:	Internal		
(E)GPRS Class:	(E)GPRS: Class 12		
Dimensions (L*W*H):	156 mm (L)× 76 mm (W)× 9 mm (H)		
Accessories information:	Adapter: Model: HJ-0502000W2-EU Input: AC100-240V, 50/60Hz 0.3A Output: DC 5.0V, 2.0A	Battery: 3.85V/4200mAh Rechargeable Li-ion Battery	Headset: Support (shipped without)

5.3 Maximum RF Output Power

Mode	Average Power (dBm)	
	GSM 900	DCS 1800
GSM (Voice)	34.34	31.07
GPRS (1 TX Slot)	34.33	31.05
GPRS (2 TX Slots)	33.47	29.73
GPRS (3 TX Slots)	31.56	28.61
GPRS (4 TX Slots)	30.37	27.14
EGPRS (1 TX Slot)	27.15	26.78
EGPRS (2 TX Slots)	25.72	25.93
EGPRS (3 TX Slots)	22.84	24.73
EGPRS (4 TX Slots)	21.84	23.61

Mode	Average Power (dBm)	
	WCDMA Band I	WCDMA Band VIII
RMC 12.2 kbps	23.93	23.22
HSDPA Sub-test 1	22.77	22.21
HSDPA Sub-test 2	22.67	21.86
HSDPA Sub-test 3	22.01	21.84
HSDPA Sub-test 4	20.99	20.79
HSUPA Sub-test 1	22.80	22.01
HSUPA Sub-test 2	22.87	22.08
HSUPA Sub-test 3	22.79	21.45
HSUPA Sub-test 4	22.84	22.23
HSUPA Sub-test 5	22.69	22.12

Mode	Average Power (dBm)				
	LTE Band 1	LTE Band 3	LTE Band 7	LTE Band 8	LTE Band 20
1.4 MHz	/	24.87	/	24.81	/
5 MHz	24.30	24.73	22.26	24.69	25.00
10 MHz	/	/	/	24.73	/
20 MHz	24.18	24.76	22.32	/	24.99

Mode	RF Output Power(dBm)
2.4GHz WIFI	15.52
Bluetooth	4.45
NFC	-11.84

5.4 Environment of Test Site

Temperature:	18°C~25°C
Humidity:	35%~75% RH
Atmospheric Pressure:	1011 mbar

5.5 Test Location

Shenzhen Zhongjian Nanfang Testing Co., Ltd.
 Address: No.110~116, Building B, Jinyuan Business Building, Xixiang Road, Bao'an District, Shenzhen, Guangdong, China
 Tel: +86-755-23118282, Fax: +86-755-23116366
 Email: info@ccis-cb.com, Website: http://www.ccis-cb.com

6 Introduction

6.1 Introduction

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

6.2 SAR Definition

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

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

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

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

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

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

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 RF Exposure Limits

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

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (10g cube tissue for head and trunk)	2.00W/kg
Spatial Peak SAR (10g cube tissue for limbs)	4.00W/kg
Spatial Peak SAR (10g cube tissue for whole body)	0.08 W/kg

Note:

1. This limit is according to recommendation 1999/519/EC, Annex II (Basic Restrictions)
2. Occupational/Uncontrolled Environments are defined as locations where there is exposure that may be incurred by people who are aware of the potential for exposure, (i.e. as a result of employment or occupation)

8 SAR Measurement System

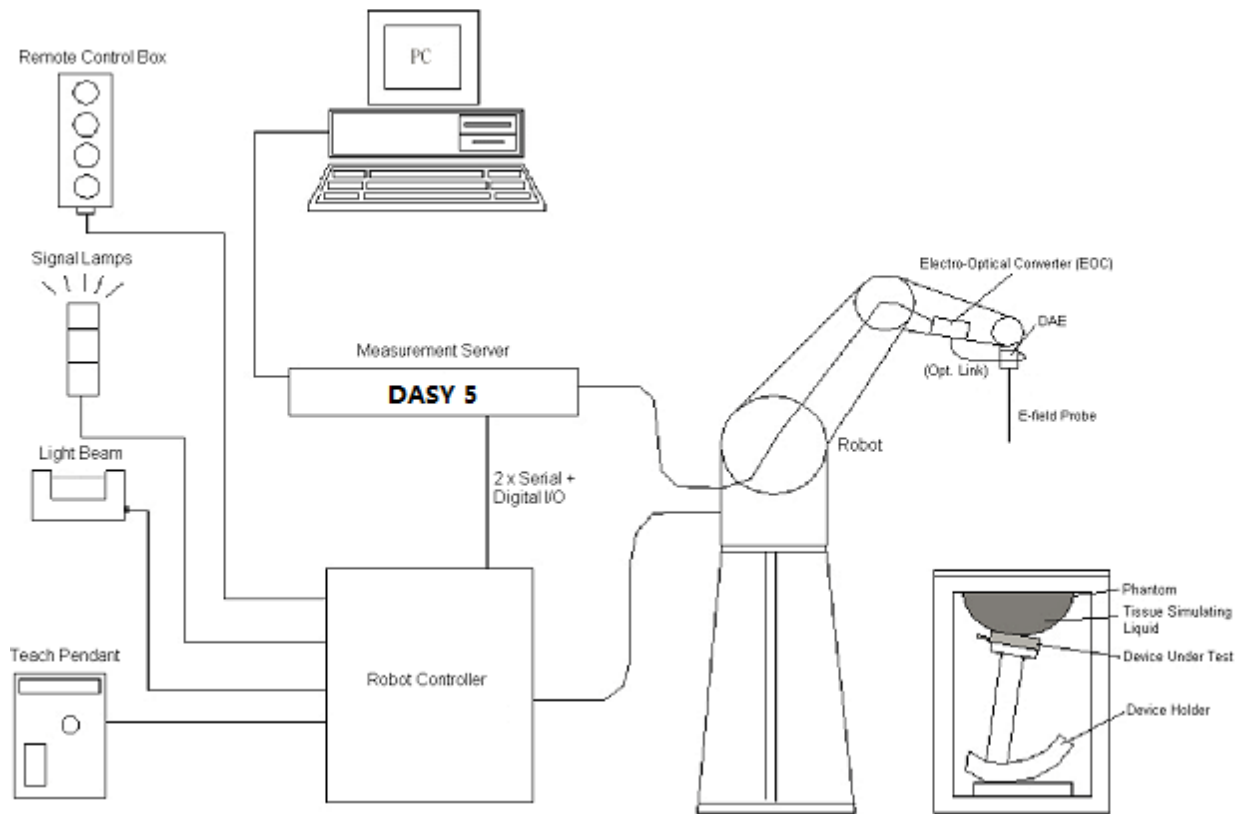


Fig.8.1 SPEAG DASY System Configurations

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

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

Component details are described in the following sub-sections.

8.1 E-Field Probe

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

➤ E-Field Probe Specification <EX3DV4 Probe>


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

Fig.8.2 Photo of E-Field Probe

➤ E-Field Probe Calibration

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

8.2 Data Acquisition Electronics (DAE)

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

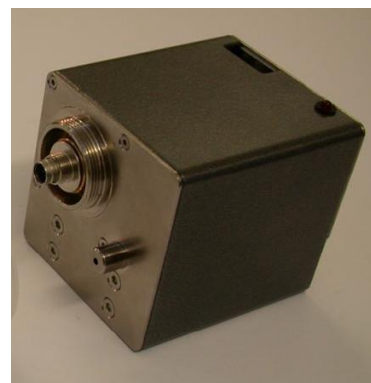


Fig. 8.3 Photo of DAE

8.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; nobelt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)



Fig. 8.4 Photo of Robot

8.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY 5: 400MHz, Intel Celeron), chip-disk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.



Fig. 8.5 Photo of Server for DASY5

8.5 Light Beam Unit

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

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



Fig. 8.6 Photo of Light Beam

8.6 Phantom

<SAM Twin Phantom>

Shell Thickness	2 \pm 0.2 mm; Center ear point: 6 \pm 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000mm; Width: 500mm; Height: adjustable feet
Measurement Areas	Left Head, Right Head, Flat phantom

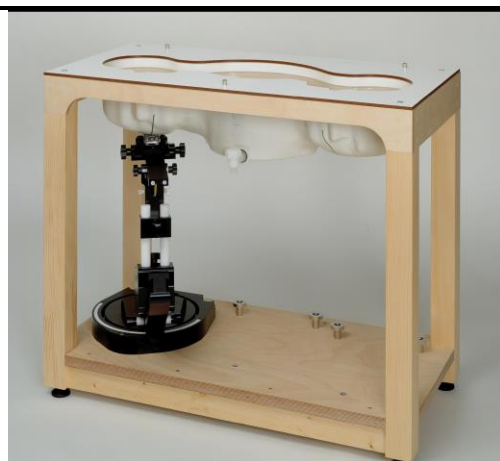


Fig. 8.7 Photo of SAM Phantom

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

<ELI4 Phantom>

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.

ELI4 has been optimized regarding its performance and can be integrated into a SPEAG standard phantom table. 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 can be used with the following tissue simulating liquids:

- Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not in use; otherwise the parameters will change due to water evaporation.
- DGBE based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not in use (desirable at least once a week).
- Do not use other organic solvents without previously testing the phantom resistiveness.



Fig.8.8 Photo of ELI4 Phantom

8.7 Device Holder

<Device Holder for SAM Twin Phantom>

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ± 0.5 mm would produce a SAR uncertainty of ± 20 %. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards. The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP).

Thus the device needs no repositioning when changing the angles.

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



Fig. 8.9 Photo of Device Holder

8.8 Data storage and Evaluation

➤ Data Storage

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

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

➤ Data Evaluation

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

Probe Parameters:	- Sensitivity	Norm _i , a _{i0} , a _{i1} , a _{i2}
	- Conversion	ConvF _i
	- Diode compression point	dcp _i
Device Parameters:	- Frequency	f
	- Crest	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 DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

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

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

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

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

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

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

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

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

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

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

With SAR = local specific absorption rate in mW/g
 E_{tot} = total field strength in V/m
 σ = conductivity in (mho/m) or (Siemens/m)
 ρ = equipment tissue density in g/cm^3

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

8.9 Test Equipment List

Manufacturer	Equipment Description	Model	S/N	Cal. Information	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d154	06.11.2019	06.10.2022
MVG	COMOSAR 1800 MHz REFERENCE DIPOLE	SID1800	SN 09/15 DIP 1G800-360	02.28.2018	02.27.2021
SPEAG	1900MHz System Validation Kit	D1900V2	5d175	06.11.2019	06.10.2022
SPEAG	2450MHz System Validation Kit	D2450V2	910	06.10.2019	06.09.2022
SPEAG	2600MHz System Validation Kit	D2600V2	1114	11.05.2018	11.04.2021
SPEAG	Data Acquisition Electronics	DAE4	1373	08.09.2019	08.08.2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	3924	08.30.2019	08.29.2020
SPEAG	DASY 52 Measurement Software	DASY 52	Version: 52.8.8.1222	N.C.R	N.C.R
SPEAG	DASY 52 File Conversion Software	SEMCAD X	Version: 14.6.10 (7331)	N.C.R	N.C.R
SPEAG	Phantom	Twin Phantom	1765	N.C.R	N.C.R
SPEAG	Phantom	ELI V5.0	1208	N.C.R	N.C.R
SPEAG	Phone Positioner	N/A	N/A	N.C.R	N.C.R
Stäubli	Robot	TX60L	F13/5P6VB1/A/01	N.C.R	N.C.R
Anritsu	Universal Radio Communication Analyzer	MT8820C	6201060814	03.18.2020	03.17.2021
R&S	Universal Radio Communication Tester	CMU200	113097	03.18.2020	03.17.2021
HP	Network Analyzer	8753D	3410A06291	07.22.2019	07.21.2020
Agilent	Spectrum Analyzer	ESRP7	101070	03.18.2020	03.17.2021
R&S	Spectrum Analyzer	FSP30	101454	03.18.2020	03.17.2021
R&S	Signal Generator	N5182A	MY49060014	11.10.2019	11.09.2020
Huber Suhner	RF Cable	SUCOFLEX	12341	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	17268	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	2080	See Note 3	
Weinschel	Attenuator	23-3-34	BL5513	See Note 3	
Weinschel	Attenuator	23-3-34	BL5513	See Note 3	
N/A	Directional Coupler	SHWDGP-050180-10S	281	See Note 3	
SPEAG	Dielectric Assessment Kit	3.5 Probe	1119	See Note 4	
SPEAG	DAK Measurement Software	DAK	Version: DAK 3.5	N.C.R	
ERA	Wideband Amplifier	WDA-00100800-24P26	LNA-00500200-2515	See Note 5	

Note:

- The calibration certificate of DASY can be referred to appendix C of this report.
- Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
- The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
- The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Speag.
- In system check we need to monitor the level on the spectrum analyzer, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1 W input power according to the ratio of 1 W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the spectrum analyzer is critical and we do have calibration for it
- Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
- N.C.R means No Calibration Requirement.

9 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 9.1, for body SAR testing, the liquid height from the center of the flat phantom to liquid top surface is larger than 15 cm, which is shown in Fig. 9.2.

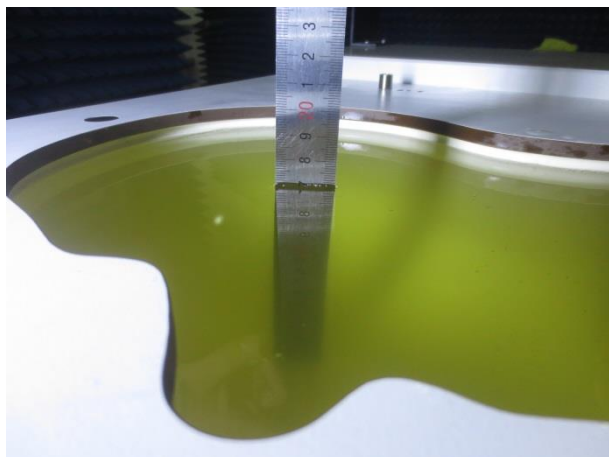


Fig. 9.1 Photo of Liquid Height for Head SAR (700MHz~1000MHz)(depth>15cm)

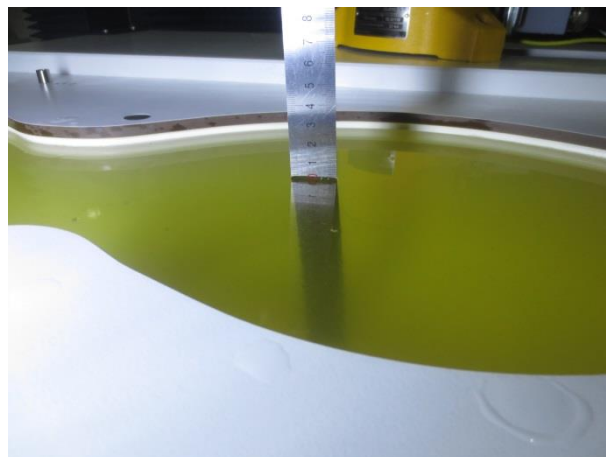


Fig. 9.2 Photo of Liquid Height for Body SAR (700MHz~1000MHz)(depth>15cm)

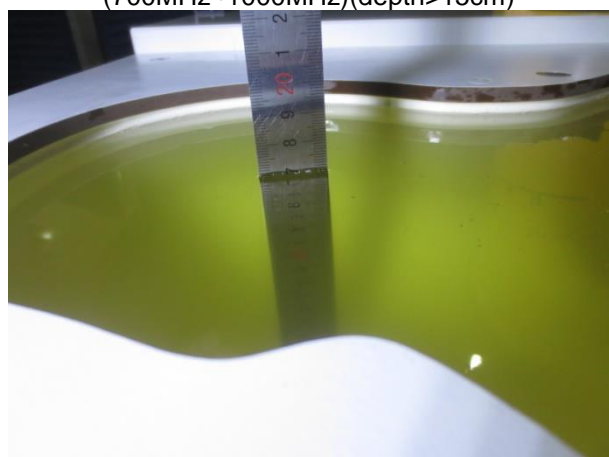


Fig. 9.3 Photo of Liquid Height for Head SAR (1700MHz~2000MHz)(depth>15cm)

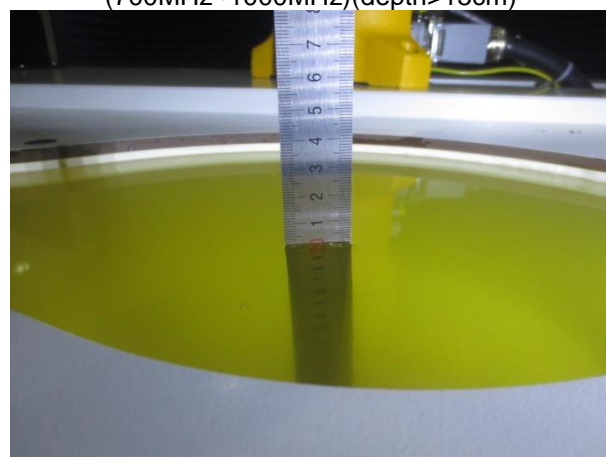


Fig. 9.4 Photo of Liquid Height for Body SAR (1700MHz~2000MHz)(depth>15cm)

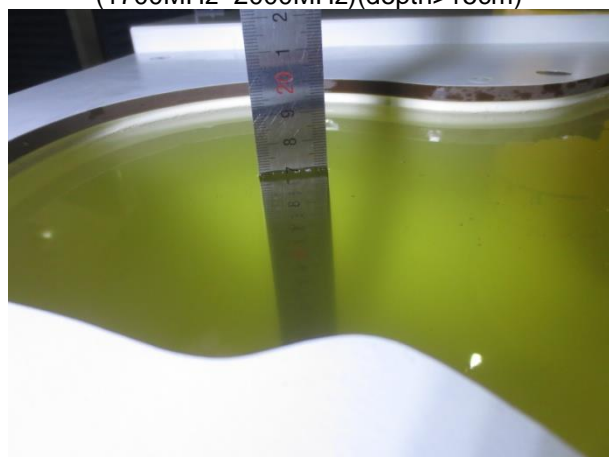


Fig. 9.5 Photo of Liquid Height for Head SAR (2000MHz~2600MHz)(depth>15cm)

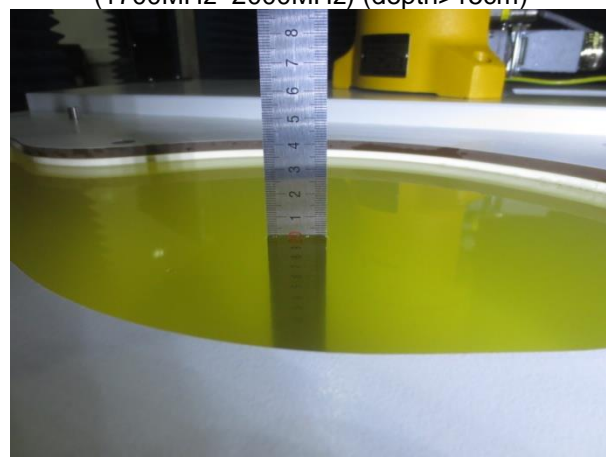


Fig. 9.6 Photo of Liquid Height for Body SAR (2000MHz~2600MHz)(depth>15cm)

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Real part of the complex relative permittivity, ϵ'_r	Conductivity, σ (S/m)
30	55.0	0.75
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
1450	40.5	1.20
1800	40.0	1.40
1900	40.0	1.40
1950	40.0	1.40
2000	40.0	1.40
2100	39.8	1.49
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40
4000	37.4	3.43
5000	36.2	4.45
5200	36.0	4.66
5400	35.8	4.86
5600	35.5	5.07
5800	35.3	5.27
6000	35.1	5.48

Note:

According to EN 62209-2:2010, the liquid parameters for head are the same as body requirements.

The dielectric parameters of liquids were verified prior to the SAR evaluation using a Speag Dielectric Probe Kit and an Agilent Network Analyzer.

The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Temp. (°C)	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity Target(σ)	Permittivity Target(ϵ_r)	Delta (σ)%	Delta (ϵ_r)%	Limit (%)	Date (mm/dd/yy)
835	23.2	0.89	42.14	0.90	41.5	-1.11	1.54	±5	06.18.2020
1800	23.0	1.38	39.75	1.40	40.0	-1.43	-0.63	±5	06.23.2020
1900	23.0	1.41	39.43	1.40	40.0	0.71	-1.43	±5	06.23.2020
2450	23.5	1.78	39.77	1.80	39.2	-1.11	1.45	±5	06.20.2020
2600	23.1	1.99	38.87	1.96	39.0	1.53	-0.33	±5	06.29.2020

10 SAR System Verification

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

➤ Purpose of System Performance check

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

➤ System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The equipment setup is shown below:

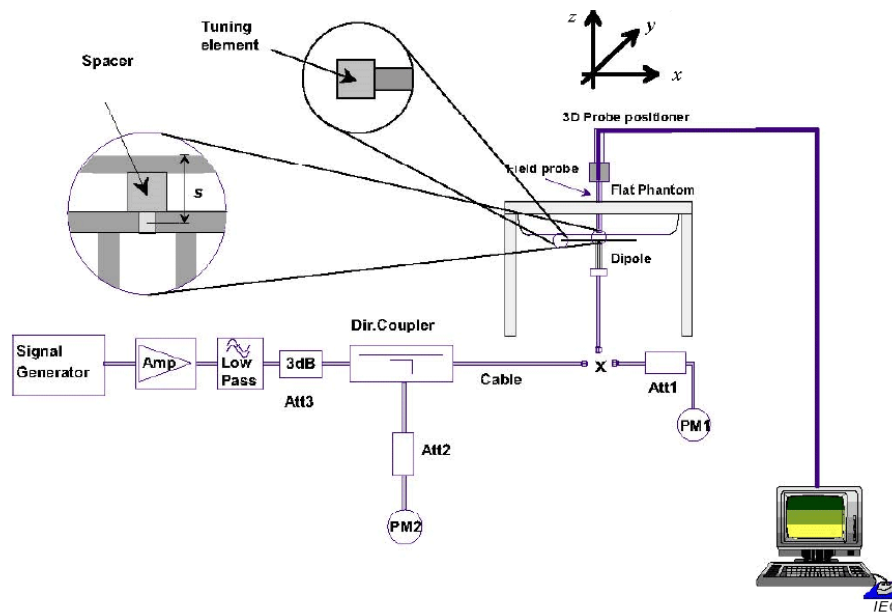


Fig.10.1 System Verification Setup Diagram



Fig.10.2 Photo of Dipole setup

➤ System Verification Results

Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10%. Below table shows the target SAR and measured SAR after normalized to 1W input power. The table as below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix C of this report.

Date (mm/dd/yy)	Frequency (MHz)	Power fed onto dipole (mW)	Measured 10g SAR (W/kg)	Normalized 10g SAR (W/kg)	Target 10g SAR (W/kg)	Deviation (%)
06.18.2020	835	80	0.523	6.54	6.33	3.32
06.23.2020	1800	40	0.821	20.53	20.29	1.18
06.23.2020	1900	40	0.810	20.25	20.4	-0.74
06.20.2020	2450	40	0.964	24.10	24.4	-1.23
06.29.2020	2600	40	0.988	24.70	25.1	-1.59

11 EUT Testing Position

This EUT was tested in six different positions. They are right cheek/right tilted/left cheek/left tilted for head, Front/Back of the EUT with phantom 5 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

11.1 Handset Reference Points

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



Fig.11.1 Illustration for Front, Back and Side of SAM Phantom

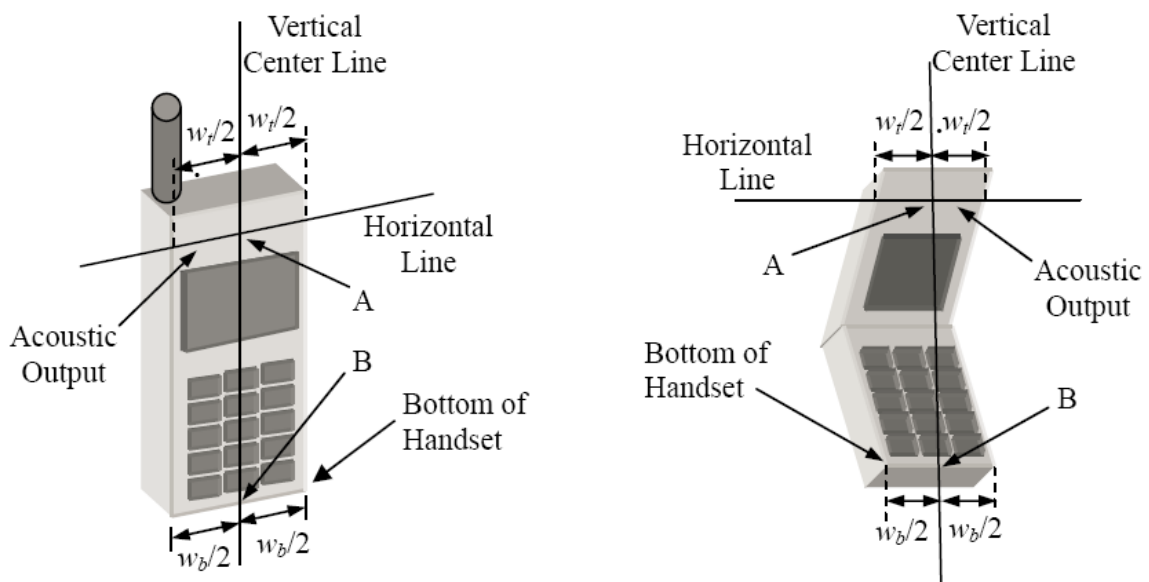


Fig. 11.2 Illustration for Handset Vertical and Horizontal Reference Lines

11.2 Positioning for Cheek / Touch

- To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear and LE: Left Ear) and align the center of the ear piece with the line RE-LE.
- To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below figure)



Fig. 11.3 Illustration for Cheek Position

11.3 Positioning for Ear / 15° Tilt

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



Fig.11.4 Illustration for Tilted Position

11.4 Body Worn Accessory Configurations

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 5 mm or holster surface and the flat phantom to 0 mm.

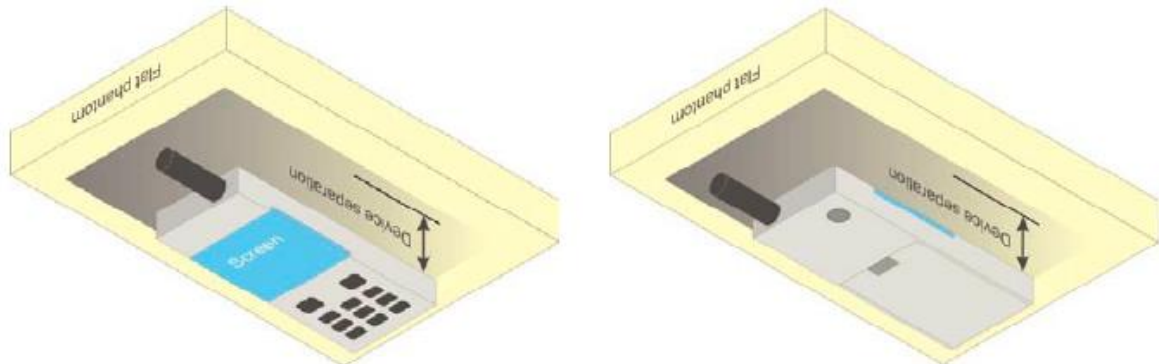


Fig.11.5 Illustration for Body Worn Position

11.5 Hotspot Accessory Configurations

- The SAR evaluation shall be performed for all surfaces of the DUT that are accessible during intended use, as indicated in Figure 11.6. The separation distance in testing shall correspond to the intended use distance as specified in the user instructions provided by the manufacturer.
- If the intended use is not specified, all surfaces of the DUT shall be tested directly against the flat phantom.
- The surface of the generic device (or the surface of the carry accessory holding the DUT) pointing towards the flat phantom shall be parallel to the surface of the phantom.
- For DUTs with multiple antennas, the same principles are applicable, and all the relevant combinations of antenna positions shall be tested. Annex C provides more insight on the way to reduce the number of combinations tested.

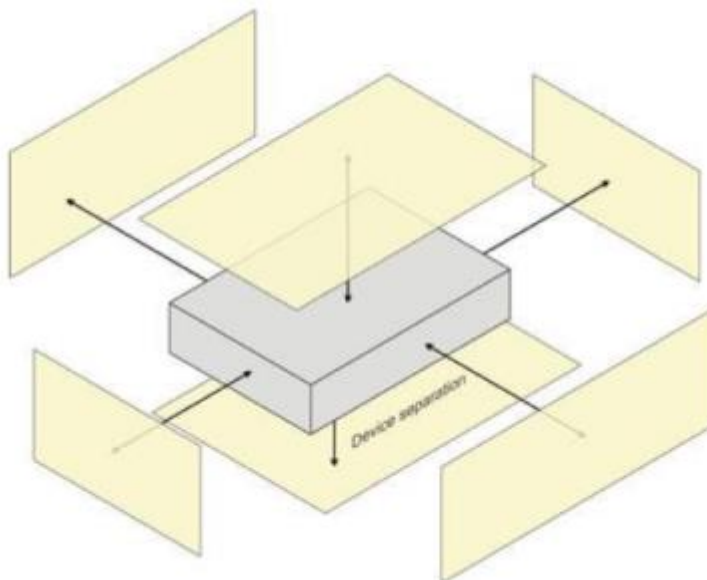


Fig.11.6 Illustration for Hotspot Position

12 Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<Conducted power measurement>

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

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

- Power reference measurement
- Area scan
- Zoom scan
- Power drift measurement

12.1 Spatial Peak SAR Evaluation

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

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

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

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

12.2 Power Reference Measurement

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

12.3 Area Scan Procedures

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

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE1528-2003, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

12.4 Zoom Scan Procedures

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1g cube is 10mm, with the side length of the 10 g cube 21.5mm. The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of $5 \times 5 \times 7$ (8mmx8mmx5mm) providing a volume of 32mm in the X & Y axis, and 30mm in the Z axis.

12.5 SAR Averaged Methods

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

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

12.6 Power Drift Monitoring

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

13 RF Output Power

13.1 GSM Conducted Power

SIM 1:

Band	GSM 900			DCS 1800		
Channel	975	60	124	512	700	885
Frequency	880.2	902	914.8	1710.2	1747.8	1748.8
GSM	34.01	34.34	34.00	30.46	31.07	30.61
GPRS (1 TX Slot)	34.00	34.33	33.98	30.43	31.05	30.58
GPRS (2 TX Slots)	32.91	33.13	33.47	29.59	29.26	29.73
GPRS (3 TX Slots)	31.11	31.02	31.56	28.05	28.12	28.61
GPRS (4 TX Slots)	30.37	29.91	30.30	26.75	26.80	27.14
EGPRS (1 TX Slot)	27.15	26.87	27.10	26.40	26.51	26.78
EGPRS (2 TX Slots)	25.72	25.24	25.64	25.57	25.78	25.93
EGPRS (3 TX Slots)	22.84	22.68	22.75	23.97	24.42	24.73
EGPRS (4 TX Slots)	21.84	20.33	20.34	22.89	23.28	23.61

Note:

1. Cuz the conducted Power of SIM 2 less than SIM 1, we chose SIM 1 to perform a SAR test.

13.2 WCDMA Conducted Power

Band	WCDMA Band I			WCDMA Band VIII		
Channel	9612	9750	9888	2712	2788	2863
Frequency	1922.4	1950	1977.6	882.4	897.6	912.6
WCDMA	23.61	22.73	23.93	23.22	22.58	22.74
HSDPA Sub-test 1	22.53	21.36	22.77	22.21	21.16	21.33
HSDPA Sub-test 2	20.72	21.02	22.67	21.86	19.77	19.64
HSDPA Sub-test 3	22.01	19.95	20.20	21.84	20.20	19.43
HSDPA Sub-test 4	20.40	20.99	19.30	20.79	20.45	20.32
HSUPA Sub-test 1	22.49	21.17	22.80	22.01	21.11	21.15
HSUPA Sub-test 2	22.39	21.48	22.87	22.08	21.05	21.45
HSUPA Sub-test 3	22.39	21.17	22.79	21.45	20.44	20.79
HSUPA Sub-test 4	22.65	21.42	22.84	22.23	21.23	21.44
HSUPA Sub-test 5	22.58	21.33	22.69	22.12	20.98	20.42

13.3 LTE Conducted Power

Band	Modulation	Bandwidth (MHz)	UL Channel	Frequency	RB Size	RB Position	Power (dBm)
1	QPSK	5	18025	1922.5	1	#0	24.13
					1	#Max	24.23
					8	#0	24.23
					8	#Max	24.30
			18300	1950.0	1	#0	23.81
					1	#Max	23.75
					8	#0	23.86
					8	#Max	23.78
			18575	1977.5	1	#0	24.11
					1	#Max	23.92
					8	#0	24.23
					8	#Max	24.07
		20	18100	1930.0	1	#0	24.18
					1	#Max	24.04
					18	#0	24.23
					18	#Max	24.09
			18300	1950.0	1	#0	24.08
					1	#Max	23.83
					18	#0	23.97
					18	#Max	23.73
			18500	1970.0	1	#0	23.91
					1	#Max	23.98
					18	#0	23.98
					18	#Max	23.99

Band	Modulation	Bandwidth (MHz)	UL Channel	Frequency	RB Size	RB Position	Power (dBm)
3	QPSK	1.4	19207	1710.7	1	#0	24.66
					1	#Max	24.64
					5	#0	24.83
					5	#Max	24.87
			19575	1747.5	1	#0	23.45
					1	#Max	23.41
					5	#0	23.45
					5	#Max	23.44
			19943	1784.3	1	#0	24.34
					1	#Max	24.38
					5	#0	24.39
					5	#Max	24.41
		5	19225	1712.5	1	#0	24.60
					1	#Max	24.52
					8	#0	24.73
					8	#Max	24.65
			19575	1747.5	1	#0	23.34
					1	#Max	23.31
					8	#0	23.42
					8	#Max	23.35
			19925	1782.5	1	#0	24.02
					1	#Max	24.14
					8	#0	24.14
					8	#Max	24.24
		20	19300	1720.0	1	#0	24.76
					1	#Max	23.83
					18	#0	24.65
					18	#Max	23.82
			19575	1747.5	1	#0	23.69
					1	#Max	23.53
					18	#0	23.58
					18	#Max	23.49
			19850	1775.0	1	#0	23.32
					1	#Max	24.17
					18	#0	23.41
					18	#Max	24.11

Band	Modulation	Bandwidth (MHz)	UL Channel	Frequency	RB Size	RB Position	Power (dBm)
7	QPSK	5	20775	2502.5	1	#0	22.26
					1	#Max	22.15
					8	#0	22.17
					8	#Max	22.21
			21100	2535.0	1	#0	22.08
					1	#Max	22.07
					8	#0	22.14
					8	#Max	22.11
			21425	2567.5	1	#0	21.77
					1	#Max	21.72
					8	#0	21.83
					8	#Max	21.85
		20	20850	2510.0	1	#0	22.32
					1	#Max	22.14
					18	#0	22.19
					18	#Max	22.16
			21100	2535.0	1	#0	22.15
					1	#Max	21.96
					18	#0	22.11
					18	#Max	22.01
			21350	2560.0	1	#0	21.93
					1	#Max	21.70
					18	#0	21.93
					18	#Max	21.76

Band	Modulation	Bandwidth (MHz)	UL Channel	Frequency	RB Size	RB Position	Power (dBm)
8	QPSK	1.4	21457	880.7	1	#0	24.75
					1	#Max	24.68
					5	#0	24.79
					5	#Max	24.81
			21625	897.5	1	#0	24.06
					1	#Max	24.04
					5	#0	24.10
					5	#Max	24.15
			21793	21793	1	#0	24.53
					1	#Max	24.58
					5	#0	24.63
					5	#Max	24.61
		5	21475	882.5	1	#0	24.55
					1	#Max	24.42
					8	#0	24.69
					8	#Max	24.52
			21625	897.5	1	#0	24.03
					1	#Max	24.00
					8	#0	24.12
					8	#Max	24.07
			21775	912.5	1	#0	24.24
					1	#Max	24.47
					8	#0	24.41
					8	#Max	24.56
		10	21500	885.0	1	#0	24.73
					1	#Max	24.36
					12	#0	24.67
					12	#Max	24.43
			21625	897.5	1	#0	24.11
					1	#Max	24.12
					12	#0	24.17
					12	#Max	24.16
			21750	910.0	1	#0	24.16
					1	#Max	24.55
					12	#0	24.26
					12	#Max	24.55

Band	Modulation	Bandwidth (MHz)	UL Channel	Frequency	RB Size	RB Position	Power (dBm)
20	QPSK	5	24175	834.5	1	#0	24.91
					1	#Max	24.22
					8	#0	25.00
					8	#Max	24.41
			24300	847.0	1	#0	24.91
					1	#Max	24.07
					8	#0	24.86
					8	#Max	24.09
			24425	859.5	1	#0	24.72
					1	#Max	24.20
					8	#0	24.63
					8	#Max	24.09
		20	24250	842.0	1	#0	24.94
					1	#Max	24.26
					18	#0	24.99
					18	#Max	24.42
			24300	847.0	1	#0	24.90
					1	#Max	24.11
					18	#0	24.86
					18	#Max	24.09
			24350	852.0	1	#0	24.74
					1	#Max	24.21
					18	#0	24.65
					18	#Max	24.09

13.4 2.4GHz WLAN EIRP Power

Average Power (dBm)				
Channel	Frequency (MHz)	802.11b	802.11g	802.11n-HT20
CH 01	2412	15.49	13.49	11.56
CH 07	2442	15.52	13.03	11.57
CH 13	2472	14.96	13.05	11.37

Average Power (dBm)		
Channel	Frequency (MHz)	802.11n-HT40
CH 03	2422	9.57
CH 07	2442	9.07
CH 11	2462	9.75

Note:

- When the EUT in continuously transmitting mode, the actual duty cycle is 96.9%, so the duty cycle factor is 1.03

13.5 Bluetooth EIRP Power

Bluetooth Average Power (dBm)			
Modulation	GFSK	$\pi/4$ -DQPSK	8DPSK
Output Power	4.23	2.18	2.15

Average Power (dBm)		
Channel	Frequency (MHz)	BLE
CH 00	2402	4.33
CH 20	2442	4.04
CH 39	2480	4.45

Note:

- According to EN 62479, $C_{\text{uz}} P_{\text{BT, max}} = 4.45\text{dBm} = 2.79\text{ mW} < 20\text{mW}$, stand-alone SAR test for Bluetooth is exclusion.

13.6 NFC Output Power

Average Power (dBm)	
Frequency (MHz)	NFC
13.56	-11.84

Note:

1. According to EN 62479, Cuz $P_{NFC, max} = -11.84\text{dBm} = 0.07\text{ mW} < 20\text{mW}$, stand-alone SAR test for NFC is exclusion.
2. NFC power test procedure: let the NFC antenna be in continuous emission state (fixed frequency), directly contact the NFC antenna with a near-field power probe, and monitor its power value with a spectrum analyzer.

14 EUT Antenna Locations



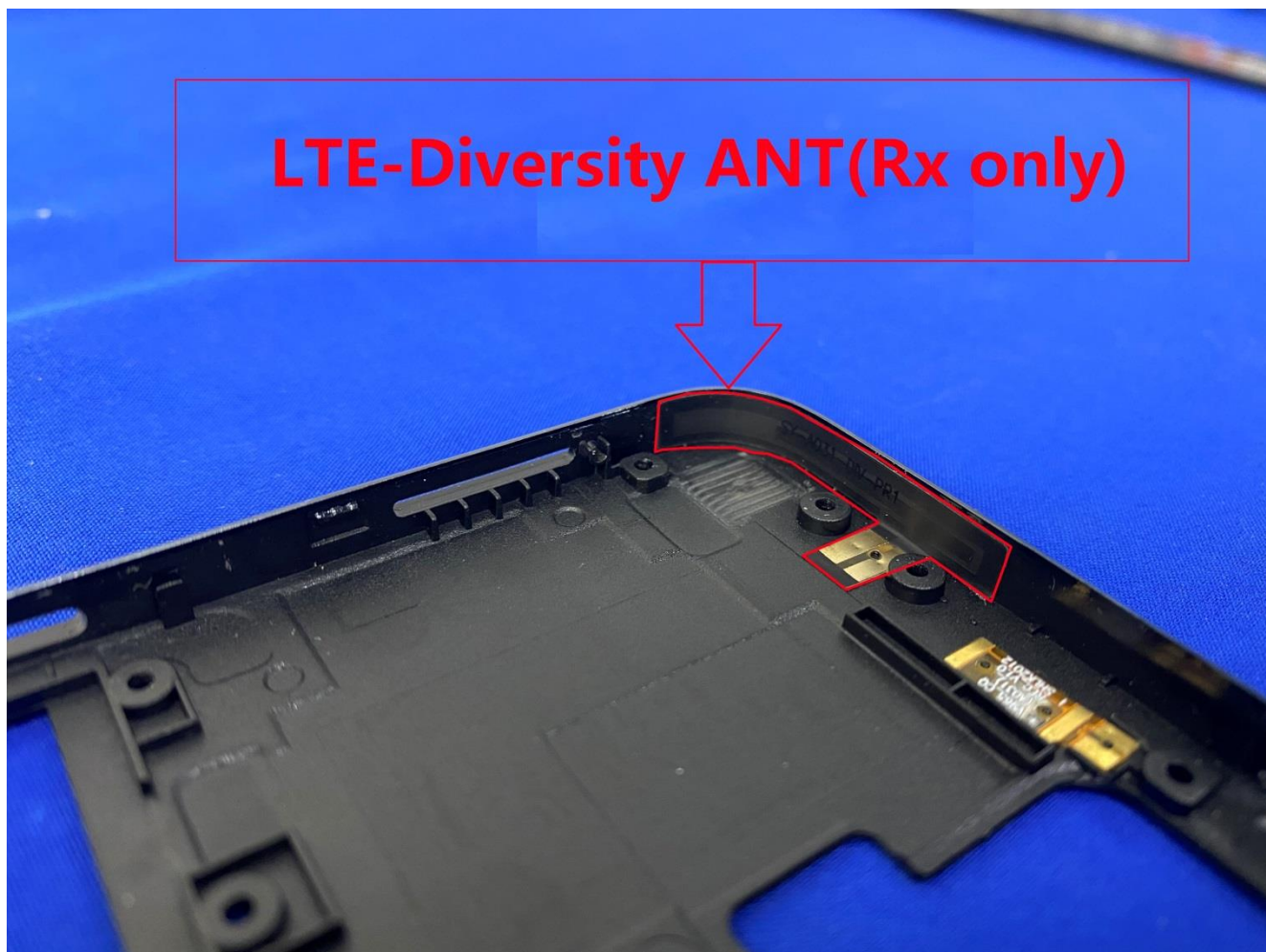




Fig.14.1 EUT Antenna Locations

14.1 Hotspot mode SAR test evaluation

Distance of Antennas to EUT edge/surface Test distance: 5mm						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
2G/3G/4G	<25mm	<25mm	145mm	<25mm	<25mm	<25mm
WLAN & Bluetooth	<25mm	<25mm	<25mm	140mm	<25mm	58mm

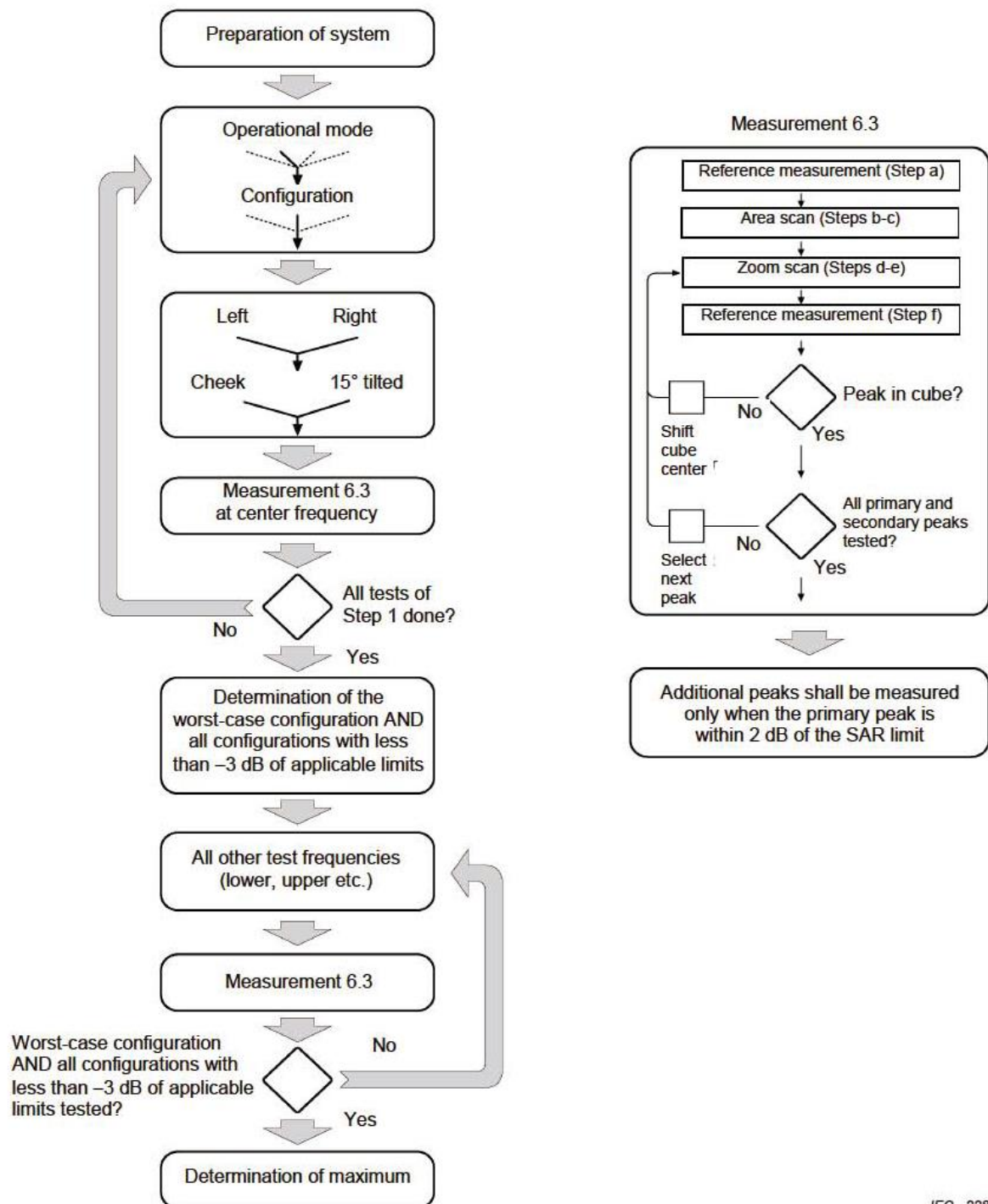
Test Positions Test distance: 5mm						
Antennas	Back	Front	Top Side	Bottom Side	Right Side	Left Side
2G/3G/4G	Yes	Yes	No	Yes	Yes	Yes
WLAN & Bluetooth	Yes	Yes	Yes	No	Yes	No

Note:

1. Because the size of the test distance is inversely proportional to the SAR value. the larger the test distance, the smaller the SAR value, so we only test all surfaces within 25mm from the edge of the antenna to the edge of the EUT.

15 Block diagram of the tests to be Performed

15.1 Head



IEC 228/05

15.2 Body

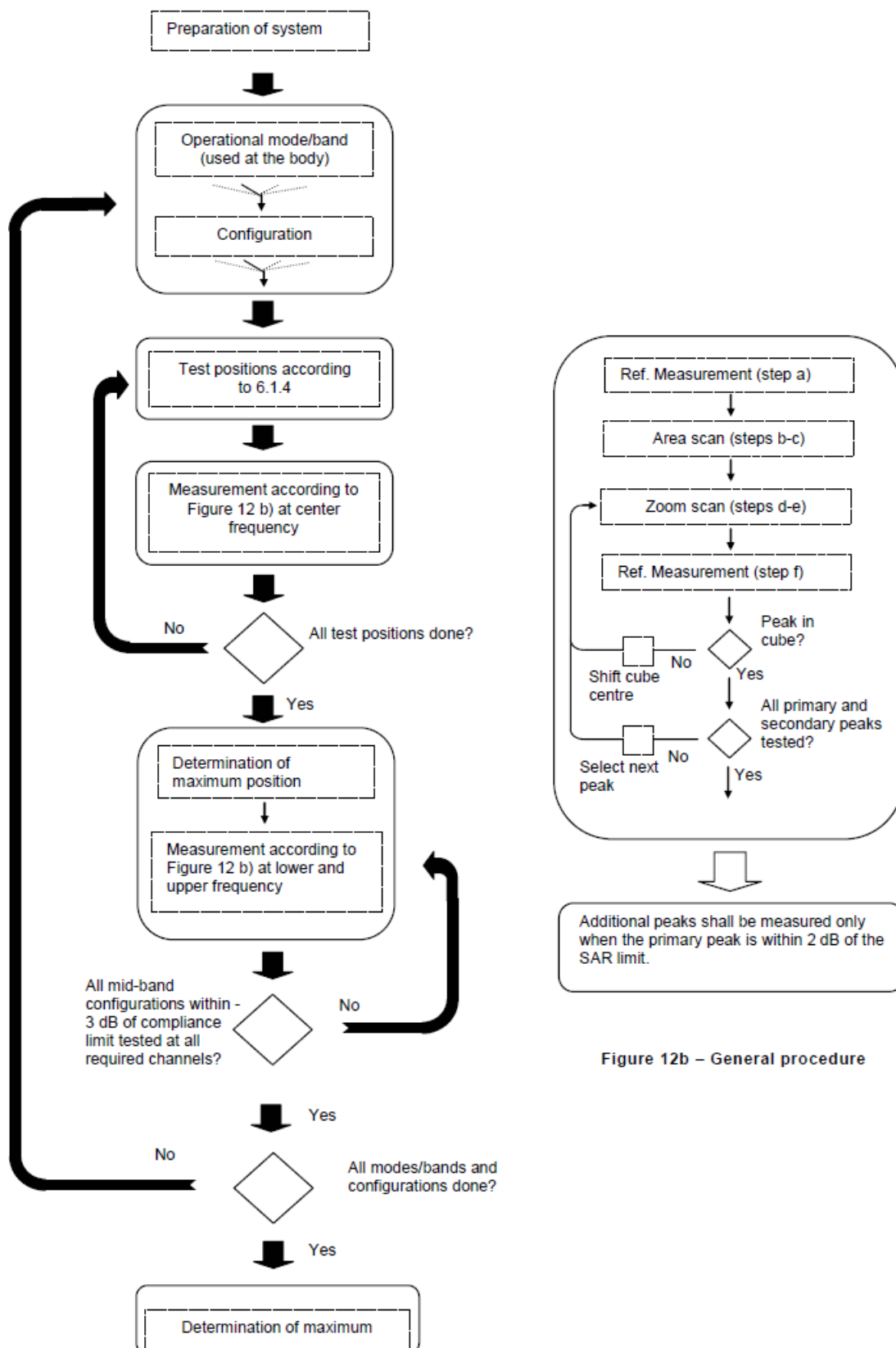


Figure 12b – General procedure

16 SAR Test Results Summary

16.1 Head SAR Data

➤ GSM Head SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
1	GSM900/Voice	Right Cheek	60	902	34.34	-0.04	34.5	0.032	1.038	0.033
	GSM900/Voice	Right Tilted	60	902	34.34	0.04	34.5	0.013	1.038	0.013
	GSM900/Voice	Left Cheek	60	902	34.34	-0.24	34.5	0.019	1.038	0.020
	GSM900/Voice	Left Tilted	60	902	34.34	0.13	34.5	0.008	1.038	0.008
	GSM900/Voice	Right Cheek	975	880.2	34.01	0.02	34.5	0.021	1.118	0.023
	GSM900/Voice	Right Cheek	124	914.8	34.00	-0.23	34.0	0.027	1.000	0.027
2	GSM1800/Voice	Right Cheek	700	1747.8	31.07	0.12	31.5	0.031	1.104	0.034
	GSM1800/Voice	Right Tilted	700	1747.8	31.07	-0.03	31.5	0.011	1.104	0.012
	GSM1800/Voice	Left Cheek	700	1747.8	31.07	-0.11	31.5	0.046	1.104	0.051
	GSM1800/Voice	Left Tilted	700	1747.8	31.07	0.05	31.5	0.019	1.104	0.021
	GSM1800/Voice	Left Cheek	512	1710.2	30.46	-0.22	30.5	0.024	1.009	0.024
	GSM1800/Voice	Left Cheek	885	1784.8	30.61	-0.10	31.0	0.036	1.094	0.039
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ WCDMA Head SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
3	WCDMA Band I	Right Cheek	9750	1950	22.73	-0.21	23.0	0.117	1.064	0.124
	WCDMA Band I	Right Tilted	9750	1950	22.73	-0.04	23.0	0.051	1.064	0.054
	WCDMA Band I	Left Cheek	9750	1950	22.73	-0.15	23.0	0.179	1.064	0.190
	WCDMA Band I	Left Tilted	9750	1950	22.73	0.01	23.0	0.081	1.064	0.086
	WCDMA Band I	Left Cheek	9612	1922.4	23.61	-0.00	24.0	0.134	1.094	0.147
	WCDMA Band I	Left Cheek	9888	1977.6	23.93	0.09	24.0	0.162	1.016	0.165
4	WCDMA Band VIII	Right Cheek	2788	897.6	22.58	-0.17	23.0	0.027	1.102	0.030
	WCDMA Band VIII	Right Tilted	2788	897.6	22.58	-0.02	23.0	0.010	1.102	0.011
	WCDMA Band VIII	Left Cheek	2788	897.6	22.58	-0.14	23.0	0.022	1.102	0.024
	WCDMA Band VIII	Left Tilted	2788	897.6	22.58	-0.22	23.0	0.009	1.102	0.010
	WCDMA Band VIII	Right Cheek	2712	882.4	23.22	0.03	23.5	0.020	1.067	0.021
	WCDMA Band VIII	Right Cheek	2863	912.6	22.74	-0.15	23.0	0.014	1.062	0.015
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ LTE Head SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
5	LTE Band 1 /1RB#0 20M	Right Cheek	18300	1950.0	24.08	-0.06	24.5	0.179	1.102	0.197
	LTE Band 1 /1RB#0 20M	Right Tilted	18300	1950.0	24.08	0.21	24.5	0.080	1.102	0.088
	LTE Band 1 /1RB#0 20M	Left Cheek	18300	1950.0	24.08	0.36	24.5	0.241	1.102	0.266
	LTE Band 1 /1RB#0 20M	Left Tilted	18300	1950.0	24.08	0.27	24.5	0.111	1.102	0.122
	LTE Band 1 /1RB#0 20M	Left Cheek	18100	1930.0	24.23	-0.11	24.5	0.194	1.064	0.206
	LTE Band 1 /1RB#0 20M	Left Cheek	18500	1970.0	23.99	0.04	24.0	0.231	1.002	0.231

	LTE Band 3 /1RB#0 20M	Right Cheek	19575	1747.5	23.69	0.02	24.0	0.073	1.074	0.078
	LTE Band 3 /1RB#0 20M	Right Tilted	19575	1747.5	23.69	-0.17	24.0	0.032	1.074	0.034
6	LTE Band 3 /1RB#0 20M	Left Cheek	19575	1747.5	23.69	-0.25	24.0	0.098	1.074	0.105
	LTE Band 3 /1RB#0 20M	Left Tilted	19575	1747.5	23.69	-0.07	24.0	0.043	1.074	0.046
	LTE Band 3 /1RB#0 20M	Left Cheek	19300	1720.0	24.76	0.04	25.0	0.073	1.057	0.077
	LTE Band 3 /1RB#0 20M	Left Cheek	19850	1775.0	24.17	-0.08	24.5	0.088	1.079	0.095
	LTE Band 7 /1RB#0 20M	Right Cheek	21100	2535.0	22.15	-0.16	22.5	0.160	1.084	0.173
	LTE Band 7 /1RB#0 20M	Right Tilted	21100	2535.0	22.15	-0.10	22.5	0.074	1.084	0.080
7	LTE Band 7 /1RB#0 20M	Left Cheek	21100	2535.0	22.15	-0.35	22.5	0.298	1.084	0.323
	LTE Band 7 /1RB#0 20M	Left Tilted	21100	2535.0	22.15	-0.03	22.5	0.138	1.084	0.150
	LTE Band 7 /1RB#0 20M	Left Cheek	20850	2510.0	22.32	0.02	22.5	0.269	1.042	0.280
	LTE Band 7 /1RB#0 20M	Left Cheek	21350	2560.0	21.93	-0.13	22.0	0.213	1.016	0.216
8	LTE Band 8 /1RB#0 10M	Right Cheek	21625	897.5	24.17	0.28	24.5	0.029	1.079	0.031
	LTE Band 8 /1RB#0 10M	Right Tilted	21625	897.5	24.17	0.01	24.5	0.012	1.079	0.013
	LTE Band 8 /1RB#0 10M	Left Cheek	21625	897.5	24.17	-0.03	24.5	0.018	1.079	0.019
	LTE Band 8 /1RB#0 10M	Left Tilted	21625	897.5	24.17	-0.38	24.5	0.007	1.079	0.008
	LTE Band 8 /1RB#0 10M	Right Cheek	21500	885.0	24.73	-0.09	25.0	0.023	1.064	0.024
	LTE Band 8 /1RB#0 10M	Right Cheek	21750	910.0	24.55	0.01	25.0	0.015	1.109	0.017
9	LTE Band 20 /1RB#0 20M	Right Cheek	24300	847.0	24.90	0.04	25.0	0.037	1.023	0.038
	LTE Band 20 /1RB#0 20M	Right Tilted	24300	847.0	24.90	0.18	25.0	0.015	1.023	0.015
	LTE Band 20 /1RB#0 20M	Left Cheek	24300	847.0	24.90	0.22	25.0	0.028	1.023	0.029
	LTE Band 20 /1RB#0 20M	Left Tilted	24300	847.0	24.90	-0.36	25.0	0.011	1.023	0.011
	LTE Band 20 /1RB#0 20M	Right Cheek	24250	842.0	24.99	-0.04	25.0	0.023	1.002	0.023
	LTE Band 20 /1RB#0 20M	Right Cheek	24350	852.0	24.74	0.29	25.0	0.033	1.062	0.035
SAR LIMIT						2.0 W/kg (mW/g)				
Uncontrolled Exposure/General Population						Averaged over 10g				

➤ WLAN 2.4 GHz Head SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR _{1g} (W/kg)
	802.11b	Right Cheek	07	2442	15.52	0.12	16.0	0.033	1.117	1.03	0.038
	802.11b	Right Tilted	07	2442	15.52	-0.07	16.0	0.022	1.117	1.03	0.025
10	802.11b	Left Cheek	07	2442	15.52	-0.15	16.0	0.056	1.117	1.03	0.064
	802.11b	Left Tilted	07	2442	15.52	-0.04	16.0	0.043	1.117	1.03	0.049
	802.11b	Left Cheek	01	2412	15.49	-0.01	15.5	0.050	1.002	1.03	0.052

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	802.11b	Left Cheek	13	2472	14.96	0.07	15.0	0.041	1.009	1.03	0.043
SAR LIMIT					2.0 W/kg (mW/g)						
Uncontrolled Exposure/General Population					Averaged over 10g						

Note:

1. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
2. When 10g SAR \leq 1.0 W/kg, testing for low and high channel is optional.
3. According to EN62209-1 section 6.3, the drift should be kept within $\pm 5\%$, the units of Power Drift Value measured are V/m, converting to dB should be kept in ± 0.42 dB.

16.2 Body Worn SAR Data

➤ GSM Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	GSM900/Voice	Front	60	902	34.34	-0.10	34.5	0.056	1.038	0.058
11	GSM900/Voice	Back	60	902	34.34	-0.04	34.5	0.176	1.038	0.183
	GSM1800/Voice	Front	700	1747.8	31.07	0.27	31.5	0.165	1.104	0.182
12	GSM1800/Voice	Back	700	1747.8	31.07	0.23	31.5	0.341	1.104	0.376
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ WCDMA Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	WCDMA Band I	Front	9750	1950.0	22.73	-0.01	23.0	0.351	1.064	0.373
13	WCDMA Band I	Back	9750	1950.0	22.73	0.06	23.0	0.637	1.064	0.678
	WCDMA Band VIII	Front	2788	897.6	22.58	-0.09	23.0	0.045	1.102	0.050
14	WCDMA Band VIII	Back	2788	897.6	22.58	-0.04	23.0	0.155	1.102	0.171
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ LTE Body SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	LTE Band 1 /1RB#0 20M	Front	18300	1950.0	24.08	-0.20	24.5	0.434	1.102	0.478
15	LTE Band 1 /1RB#0 20M	Back	18300	1950.0	24.08	0.24	24.5	0.856	1.102	0.943
	LTE Band 3 /1RB#0 20M	Front	19575	1747.5	23.69	-0.00	24.0	0.344	1.074	0.369
16	LTE Band 3 /1RB#0 20M	Back	19575	1747.5	23.69	-0.06	24.0	0.666	1.074	0.715
	LTE Band 7 /1RB#0 20M	Front	21100	2535.0	22.15	-0.09	22.5	0.674	1.084	0.731
	LTE Band 7 /1RB#0 20M	Back	21100	2535.0	22.15	0.14	22.5	1.030	1.084	1.117
17	LTE Band 7 /1RB#0 20M	Back	20850	2510.0	22.32	-0.06	22.5	1.050	1.042	1.094
	LTE Band 7 /1RB#0 20M	Back	21350	2560.0	21.93	-0.12	22.0	0.881	1.016	0.895
	LTE Band 8 /1RB#0 10M	Front	21625	897.5	24.17	0.22	24.5	0.045	1.079	0.049
18	LTE Band 8 /1RB#0 10M	Back	21625	897.5	24.17	-0.07	24.5	0.155	1.079	0.167
	LTE Band 20 /1RB#0 20M	Front	24300	847.0	24.90	-0.14	25.0	0.075	1.023	0.077
19	LTE Band 20 /1RB#0 20M	Back	24300	847.0	24.90	-0.04	25.0	0.195	1.023	0.199
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ **WLAN Body SAR**

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR _{10g} (W/kg)
	802.11b	Front	07	2442	15.52	-0.26	16.0	0.031	1.117	1.03	0.036
20	802.11b	Back	07	2442	15.52	0.12	16.0	0.091	1.117	1.03	0.105
SAR LIMIT Uncontrolled Exposure/General Population					2.0 W/kg (mW/g) Averaged over 10g						

Note:

1. Body-worn SAR testing was performed at 5mm separation, and this distance is determined by the handset manufacturer that there will be body-worn accessories that users may acquire at the time of equipment certification, to enable users to purchase aftermarket body-worn accessories with the required minimum separation.
2. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
3. When 10g SAR ≤ 1.0 W/kg, testing for low and high channel is optional.
4. According to EN62209-1 section 6.3, the drift should be kept within ±5%, the units of Power Drift Value measured are V/m, converting to dB should be kept in ±0.42 dB.

16.3 Hotspot mode SAR Data

➤ GSM Body SAR in Hotspot mode

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	GPRS900/2 slots	Back	60	902	33.13	0.07	33.5	0.292	1.089	0.318
	GPRS900/3 slots	Back	60	902	31.02	0.02	31.5	0.288	1.117	0.322
	GPRS900/2 slots	Front	60	902	29.91	-0.20	30.0	0.115	1.021	0.117
21	GPRS900/4 slots	Back	60	902	29.91	-0.04	30.0	0.300	1.021	0.306
	GPRS900/4 slots	Left	60	902	29.91	0.02	30.0	0.113	1.021	0.115
	GPRS900/4 slots	Right	60	902	29.91	0.17	30.0	0.105	1.021	0.107
	GPRS900/4 slots	Bottom	60	902	29.91	-0.05	30.0	0.187	1.021	0.191
	GPRS900/4 slots	Back	975	880.2	30.37	-0.03	30.5	0.204	1.030	0.210
	GPRS900/4 slots	Back	124	914.8	30.30	0.09	30.5	0.267	1.047	0.280
	GPRS1800/2 slots	Back	700	1747.8	29.26	-0.03	29.5	0.482	1.057	0.509
	GPRS1800/3 slots	Back	700	1747.8	28.12	0.19	28.5	0.449	1.091	0.490
	GPRS1800/4 slots	Front	700	1747.8	26.80	-0.06	27.0	0.367	1.047	0.384
22	GPRS1800/4 slots	Back	700	1747.8	26.80	0.01	27.0	0.558	1.047	0.584
	GPRS1800/4 slots	Left	700	1747.8	26.80	0.02	27.0	0.076	1.047	0.080
	GPRS1800/4 slots	Right	700	1747.8	26.80	-0.00	27.0	0.068	1.047	0.071
	GPRS1800/4 slots	Bottom	700	1747.8	26.80	0.07	27.0	0.113	1.047	0.118
	GPRS1800/4 slots	Back	512	1710.2	26.75	-0.05	27.0	0.411	1.059	0.435
	GPRS1800/4 slots	Back	885	1784.8	27.14	0.11	27.5	0.486	1.086	0.528
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ WCDMA Body SAR in Hotspot mode

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	WCDMA Band I	Front	9750	1950.0	22.73	-0.01	23.0	0.351	1.064	0.373
13	WCDMA Band I	Back	9750	1950.0	22.73	0.06	23.0	0.637	1.064	0.678
	WCDMA Band I	Left	9750	1950.0	22.73	0.14	23.0	0.112	1.064	0.119
	WCDMA Band I	Right	9750	1950.0	22.73	-0.08	23.0	0.103	1.064	0.110
	WCDMA Band I	Bottom	9750	1950.0	22.73	0.09	23.0	0.177	1.064	0.188
	WCDMA Band I	Back	9612	1922.4	23.61	-0.01	24.0	0.522	1.094	0.571
	WCDMA Band I	Back	9888	1977.6	23.93	0.31	24.0	0.615	1.016	0.625
	WCDMA Band VIII	Front	2788	897.6	22.58	-0.09	23.0	0.045	1.102	0.050
14	WCDMA Band VIII	Back	2788	897.6	22.58	-0.04	23.0	0.155	1.102	0.171
	WCDMA Band VIII	Left	2788	897.6	22.58	0.17	23.0	0.051	1.102	0.056
	WCDMA Band VIII	Right	2788	897.6	22.58	-0.08	23.0	0.045	1.102	0.050
	WCDMA Band VIII	Bottom	2788	897.6	22.58	0.01	23.0	0.086	1.102	0.095
	WCDMA Band VIII	Back	2712	882.4	23.22	0.16	23.5	0.131	1.067	0.140
	WCDMA Band VIII	Back	2863	912.6	22.74	-0.05	23.0	0.086	1.062	0.091
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ LTE Body SAR in Hotspot mode

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	LTE Band 1 /1RB#0 20M	Front	18300	1950.0	24.08	-0.20	24.5	0.434	1.102	0.478
15	LTE Band 1 /1RB#0 20M	Back	18300	1950.0	24.08	0.24	24.5	0.856	1.102	0.943
	LTE Band 1 /1RB#0 20M	Left	18300	1950.0	24.08	-0.05	24.5	0.162	1.102	0.179

	LTE Band 1 /1RB#0 20M	Right	18300	1950.0	24.08	0.01	24.5	0.154	1.102	0.170
	LTE Band 1 /1RB#0 20M	Bottom	18300	1950.0	24.08	0.16	24.5	0.243	1.102	0.268
	LTE Band 1 /1RB#0 20M	Back	18100	1930.0	24.23	-0.06	24.5	0.743	1.064	0.791
	LTE Band 1 /1RB#0 20M	Back	18500	1970.0	23.99	0.21	24.0	0.835	1.002	0.837
	LTE Band 3 /1RB#0 20M	Front	19575	1747.5	23.69	-0.00	24.0	0.344	1.074	0.369
16	LTE Band 3 /1RB#0 20M	Back	19575	1747.5	23.69	-0.06	24.0	0.666	1.074	0.715
	LTE Band 3 /1RB#0 20M	Left	19575	1747.5	23.69	0.09	24.0	0.124	1.074	0.133
	LTE Band 3 /1RB#0 20M	Right	19575	1747.5	23.69	-0.01	24.0	0.117	1.074	0.126
	LTE Band 3 /1RB#0 20M	Bottom	19575	1747.5	23.69	-0.22	24.0	0.192	1.074	0.206
	LTE Band 3 /1RB#0 20M	Back	19300	1720.0	24.76	0.11	25.0	0.578	1.057	0.611
	LTE Band 3 /1RB#0 20M	Back	19850	1775.0	24.17	0.34	24.5	0.621	1.079	0.670
	LTE Band 7 /1RB#0 20M	Front	21100	2535.0	22.15	-0.09	22.5	0.674	1.084	0.731
	LTE Band 7 /1RB#0 20M	Back	21100	2535.0	22.15	0.14	22.5	1.030	1.084	1.117
	LTE Band 7 /1RB#0 20M	Left	21100	2535.0	22.15	0.34	22.5	0.175	1.084	0.190
	LTE Band 7 /1RB#0 20M	Right	21100	2535.0	22.15	-0.07	22.5	0.162	1.084	0.176
	LTE Band 7 /1RB#0 20M	Bottom	21100	2535.0	22.15	0.11	22.5	0.324	1.084	0.351
17	LTE Band 7 /1RB#0 20M	Back	20850	2510.0	22.32	-0.06	22.5	1.050	1.042	1.094
	LTE Band 7 /1RB#0 20M	Back	21350	2560.0	21.93	-0.12	22.0	0.881	1.016	0.895
	LTE Band 8 /1RB#0 10M	Front	21625	897.5	24.17	0.22	24.5	0.045	1.079	0.049
18	LTE Band 8 /1RB#0 10M	Back	21625	897.5	24.17	-0.07	24.5	0.155	1.079	0.167
	LTE Band 8 /1RB#0 10M	Left	21625	897.5	24.17	-0.35	24.5	0.049	1.079	0.053
	LTE Band 8 /1RB#0 10M	Right	21625	897.5	24.17	-0.06	24.5	0.043	1.079	0.046
	LTE Band 8 /1RB#0 10M	Bottom	21625	897.5	24.17	0.26	24.5	0.085	1.079	0.092
	LTE Band 8 /1RB#0 10M	Back	21500	885.0	24.73	0.10	25.0	0.132	1.064	0.140
	LTE Band 8 /1RB#0 10M	Back	21750	910.0	24.55	0.06	25.0	0.087	1.109	0.096
	LTE Band 20 /1RB#0 20M	Front	24300	847.0	24.90	-0.14	25.0	0.075	1.023	0.077
19	LTE Band 20 /1RB#0 20M	Back	24300	847.0	24.90	-0.04	25.0	0.195	1.023	0.199
	LTE Band 20 /1RB#0 20M	Left	24300	847.0	24.90	0.13	25.0	0.077	1.023	0.079
	LTE Band 20 /1RB#0 20M	Right	24300	847.0	24.90	0.04	25.0	0.071	1.023	0.073
	LTE Band 20	Bottom	24300	847.0	24.90	-0.03	25.0	0.102	1.023	0.104

	/1RB#0 20M									
	LTE Band 20 /1RB#0 20M	Back	24250	842.0	24.99	0.02	25.0	0.119	1.002	0.119
	LTE Band 20 /1RB#0 20M	Back	24350	852.0	24.74	-0.31	25.0	0.185	1.062	0.196
SAR LIMIT					2.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

➤ WLAN Body SAR in Hotspot mode

WEAR Body SAR in Hotspot mode											
Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR _{10g} (W/kg)
	802.11b	Front	07	2442	15.52	-0.26	16.0	0.031	1.117	1.03	0.036
20	802.11b	Back	07	2442	15.52	0.12	16.0	0.091	1.117	1.03	0.105
	802.11b	Right	07	2442	15.52	-0.15	16.0	0.026	1.117	1.03	0.030
	802.11b	Top	07	2442	15.52	-0.02	16.0	0.043	1.117	1.03	0.049
	802.11b	Back	01	2412	15.49	0.08	15.5	0.084	1.002	1.03	0.087
	802.11b	Back	13	2472	14.96	-0.07	15.0	0.071	1.009	1.03	0.074
SAR LIMIT					2.0 W/kg (mW/g)						
Uncontrolled Exposure/General Population					Averaged over 10g						

Note:

- Hotspot mode SAR testing was performed at 5mm separation, and this distance is determined by the handset manufacture.
- Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
- When 10g SAR ≤ 1.0 W/kg, testing for low and high channel is optional.
- According to EN 62209-1 section 6.3, the drift should be kept within ±5%, the units of Power Drift Value measured are V/m, converting to dB should be kept in ±0.42 dB.

16.4 Limb SAR Data

> GSM Limb SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
23	GPRS900/4 slots	Front	60	902	29.91	0.20	30.0	0.431	1.021	0.440
	GPRS900/4 slots	Back	60	902	29.91	-0.04	30.0	0.740	1.021	0.756
	GPRS900/4 slots	Left	60	902	29.91	-0.08	30.0	0.271	1.021	0.277
	GPRS900/4 slots	Right	60	902	29.91	0.06	30.0	0.256	1.021	0.261
	GPRS900/4 slots	Bottom	60	902	29.91	-0.03	30.0	0.484	1.021	0.494
	GPRS900/4 slots	Back	975	880.2	30.37	-0.15	30.5	0.579	1.030	0.596
	GPRS900/4 slots	Back	124	914.8	30.30	0.13	30.5	0.682	1.047	0.714
SAR LIMIT					4.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					
24	GPRS1800/4 slots	Front	700	1747.8	26.80	0.04	27.0	1.210	1.047	1.267
	GPRS1800/4 slots	Back	700	1747.8	26.80	0.11	27.0	1.950	1.047	2.042
	GPRS1800/4 slots	Left	700	1747.8	26.80	-0.22	27.0	0.286	1.047	0.299
	GPRS1800/4 slots	Right	700	1747.8	26.80	-0.31	27.0	0.271	1.047	0.284
	GPRS1800/4 slots	Bottom	700	1747.8	26.80	-0.10	27.0	0.521	1.047	0.545
	GPRS1800/4 slots	Back	512	1710.2	26.75	-0.18	27.0	1.680	1.059	1.779
	GPRS1800/4 slots	Back	885	1784.8	27.14	0.04	27.5	1.810	1.086	1.966

> WCDMA Limb SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	WCDMA Band I	Front	9750	1950.0	22.73	-0.07	23.0	1.470	1.064	1.564
	WCDMA Band I	Back	9750	1950.0	22.73	0.22	23.0	2.510	1.064	2.671
	WCDMA Band I	Left	9750	1950.0	22.73	0.24	23.0	0.798	1.064	0.849
	WCDMA Band I	Right	9750	1950.0	22.73	-0.15	23.0	0.736	1.064	0.783
	WCDMA Band I	Bottom	9750	1950.0	22.73	-0.29	23.0	1.860	1.064	1.979
	WCDMA Band I	Back	9612	1922.4	23.61	0.33	24.0	2.420	1.094	2.647
25	WCDMA Band I	Back	9888	1977.6	23.93	0.35	24.0	2.580	1.016	2.621
26	WCDMA Band VIII	Front	2788	897.6	22.58	-0.11	23.0	0.137	1.102	0.151
	WCDMA Band VIII	Back	2788	897.6	22.58	0.05	23.0	0.395	1.102	0.435
	WCDMA Band VIII	Left	2788	897.6	22.58	-0.27	23.0	0.138	1.102	0.152
	WCDMA Band VIII	Right	2788	897.6	22.58	0.05	23.0	0.125	1.102	0.138
	WCDMA Band VIII	Bottom	2788	897.6	22.58	-0.26	23.0	0.235	1.102	0.259
	WCDMA Band VIII	Back	2712	882.4	23.22	0.10	23.5	0.321	1.067	0.354
	WCDMA Band VIII	Back	2863	912.6	22.74	-0.22	23.0	0.235	1.062	0.259
SAR LIMIT					4.0 W/kg (mW/g)					
Uncontrolled Exposure/General Population					Averaged over 10g					

> LTE Limb SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	Reported SAR _{10g} (W/kg)
	LTE Band 1 /1RB#0 20M	Front	18300	1950.0	24.08	-0.18	24.5	1.780	1.102	1.962
	LTE Band 1 /1RB#0 20M	Back	18300	1950.0	24.08	0.11	24.5	3.010	1.102	3.317
	LTE Band 1 /1RB#0 20M	Left	18300	1950.0	24.08	0.15	24.5	0.521	1.102	0.574
	LTE Band 1 /1RB#0 20M	Right	18300	1950.0	24.08	0.01	24.5	0.504	1.102	0.555
	LTE Band 1 /1RB#0 20M	Bottom	18300	1950.0	24.08	0.14	24.5	1.250	1.102	1.378
	LTE Band 1 /1RB#0 20M	Back	18100	1930.0	24.23	0.23	24.5	2.920	1.064	3.107

27	LTE Band 1 /1RB#0 20M	Back	18500	1970.0	23.99	0.22	24.0	3.100	1.002	3.126
	LTE Band 3 /1RB#0 20M	Front	19575	1747.5	23.69	0.06	24.0	1.360	1.074	1.461
	LTE Band 3 /1RB#0 20M	Back	19575	1747.5	23.69	0.40	24.0	2.300	1.074	2.470
	LTE Band 3 /1RB#0 20M	Left	19575	1747.5	23.69	-0.21	24.0	0.342	1.074	0.367
	LTE Band 3 /1RB#0 20M	Right	19575	1747.5	23.69	-0.30	24.0	0.315	1.074	0.338
	LTE Band 3 /1RB#0 20M	Bottom	19575	1747.5	23.69	0.02	24.0	0.852	1.074	0.915
	LTE Band 3 /1RB#0 20M	Back	19300	1720.0	24.76	0.19	25.0	2.210	1.057	2.336
28	LTE Band 3 /1RB#0 20M	Back	19850	1775.0	24.17	0.14	24.5	2.450	1.079	2.644
	LTE Band 7 /1RB#0 20M	Front	21100	2535.0	22.15	-0.11	22.5	1.750	1.084	1.897
	LTE Band 7 /1RB#0 20M	Back	21100	2535.0	22.15	0.24	22.5	2.650	1.084	2.873
	LTE Band 7 /1RB#0 20M	Left	21100	2535.0	22.15	-0.37	22.5	0.614	1.084	0.666
	LTE Band 7 /1RB#0 20M	Right	21100	2535.0	22.15	-0.33	22.5	0.589	1.084	0.638
	LTE Band 7 /1RB#0 20M	Bottom	21100	2535.0	22.15	0.12	22.5	1.160	1.084	1.257
29	LTE Band 7 /1RB#0 20M	Back	20850	2510.0	22.32	0.34	22.5	2.810	1.042	2.928
	LTE Band 7 /1RB#0 20M	Back	21350	2560.0	21.93	0.39	22.0	2.320	1.016	2.357
	LTE Band 8 /1RB#0 10M	Front	21625	897.5	24.17	-0.07	24.5	0.175	1.079	0.189
30	LTE Band 8 /1RB#0 10M	Back	21625	897.5	24.17	0.03	24.5	0.399	1.079	0.431
	LTE Band 8 /1RB#0 10M	Left	21625	897.5	24.17	0.21	24.5	0.131	1.079	0.141
	LTE Band 8 /1RB#0 10M	Right	21625	897.5	24.17	-0.26	24.5	0.115	1.079	0.124
	LTE Band 8 /1RB#0 10M	Bottom	21625	897.5	24.17	-0.07	24.5	0.229	1.079	0.247
	LTE Band 8 /1RB#0 10M	Back	21500	885.0	24.73	0.02	25.0	0.325	1.064	0.346
	LTE Band 8 /1RB#0 10M	Back	21750	910.0	24.55	0.14	25.0	0.248	1.109	0.275
	LTE Band 20 /1RB#0 20M	Front	24300	847.0	24.90	-0.31	25.0	0.264	1.023	0.270
31	LTE Band 20 /1RB#0 20M	Back	24300	847.0	24.90	-0.02	25.0	0.555	1.023	0.568
	LTE Band 20 /1RB#0 20M	Left	24300	847.0	24.90	-0.020	25.0	0.154	1.023	0.158
	LTE Band 20 /1RB#0 20M	Right	24300	847.0	24.90	0.15	25.0	0.142	1.023	0.145
	LTE Band 20 /1RB#0 20M	Bottom	24300	847.0	24.90	0.02	25.0	0.312	1.023	0.319
	LTE Band 20 /1RB#0 20M	Back	24250	842.0	24.99	0.01	25.0	0.441	1.002	0.442
	LTE Band 20 /1RB#0 20M	Back	24350	852.0	24.74	-0.19	25.0	0.537	1.062	0.570
SAR LIMIT					4.0 W/kg (mW/g)					

Uncontrolled Exposure/General Population

Averaged over 10g

➤ WLAN Limb SAR

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR _{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR _{10g} (W/kg)
	802.11b	Front	07	2442	15.52	-0.02	16.0	0.064	1.117	1.03	0.074
32	802.11b	Back	07	2442	15.52	0.20	16.0	0.189	1.117	1.03	0.217
	802.11b	Right	07	2442	15.52	0.11	16.0	0.060	1.117	1.03	0.069
	802.11b	Top	07	2442	15.52	0.02	16.0	0.090	1.117	1.03	0.104
	802.11b	Back	01	2412	15.49	0.14	15.5	0.169	1.002	1.03	0.194
	802.11b	Back	13	2472	14.96	0.06	15.0	0.148	1.009	1.03	0.170
SAR LIMIT					4.0 W/kg (mW/g)						
Uncontrolled Exposure/General Population					Averaged over 10g						

Note:

9. Limb SAR testing was performed at 0mm separation, and this distance is determined by the handset manufacturer to enable users to use the device with the required minimum separation.
10. Determination of the worst-case configuration and all configurations with less than 3 dB of applicable limits.
11. When 10g SAR ≤ 2.0 W/kg, testing for low and high channel is optional.
According to EN62209-1 section 6.3, the drift sho

16.5 SAR Simultaneous Transmission Analysis

➤ Head Simultaneous Transmission

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)
GSM900	Right Cheek	0.033	0.038	0.071	GSM 1800	Right Cheek	0.034	0.038	0.072
	Right Tilted	0.013	0.025	0.038		Right Tilted	0.012	0.025	0.037
	Left Cheek	0.020	0.064	0.084		Left Cheek	0.051	0.064	0.115
	Left Tilted	0.008	0.049	0.057		Left Tilted	0.021	0.049	0.070

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)
WCDMA Band I	Right Cheek	0.124	0.038	0.162	WCDMA Band VIII	Right Cheek	0.030	0.038	0.068
	Right Tilted	0.054	0.025	0.079		Right Tilted	0.011	0.025	0.036
	Left Cheek	0.190	0.064	0.254		Left Cheek	0.024	0.064	0.088
	Left Tilted	0.086	0.049	0.135		Left Tilted	0.010	0.049	0.059

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)
LTE Band 1	Right Cheek	0.197	0.038	0.235	LTE Band 3	Right Cheek	0.078	0.038	0.116
	Right Tilted	0.088	0.025	0.113		Right Tilted	0.034	0.025	0.059
	Left Cheek	0.266	0.064	0.330		Left Cheek	0.105	0.064	0.169
	Left Tilted	0.122	0.049	0.171		Left Tilted	0.046	0.049	0.095

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)
LTE Band 7	Right Cheek	0.173	0.038	0.211	LTE Band 8	Right Cheek	0.031	0.038	0.069
	Right Tilted	0.080	0.025	0.105		Right Tilted	0.013	0.025	0.038
	Left Cheek	0.323	0.064	0.387		Left Cheek	0.019	0.064	0.083
	Left Tilted	0.150	0.049	0.199		Left Tilted	0.008	0.049	0.057

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	ΣSAR (W/kg)
LTE Band 20	Right Cheek	0.038	0.038	0.076
	Right Tilted	0.015	0.025	0.040
	Left Cheek	0.029	0.064	0.093
	Left Tilted	0.011	0.049	0.060

➤ Body worn Simultaneous Transmission

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
GSM900	Front	0.058	0.036	0.094	GSM 1800	Front	0.182	0.036	0.218
	Back	0.183	0.105	0.288		Back	0.376	0.105	0.481

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
WCDMA Band I	Front	0.373	0.036	0.409	WCDMA Band VIII	Front	0.050	0.036	0.086
	Back	0.678	0.105	0.783		Back	0.171	0.105	0.276

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 1	Front	0.478	0.036	0.514	LTE Band 3	Front	0.369	0.036	0.405
	Back	0.943	0.105	1.048		Back	0.715	0.105	0.820

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 7	Front	0.731	0.036	0.767	LTE Band 8	Front	0.049	0.036	0.085
	Back	1.117	0.105	1.222		Back	0.167	0.105	0.272

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 20	Front	0.077	0.036	0.113
	Back	0.199	0.105	0.304

Hotspot mode Simultaneous Transmission

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
GSM900	Front	0.117	0.036	0.153	GSM 1800	Front	0.384	0.036	0.420
	Back	0.306	0.105	0.411		Back	0.584	0.105	0.689
	Left	0.115	/	0.115		Left	0.080	/	0.080
	Right	0.107	0.030	0.137		Right	0.071	0.030	0.101
	Top	/	0.049	0.049		Top	/	0.049	0.049
	Bottom	0.191	/	0.191		Bottom	0.118	/	0.118

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
WCDMA Band I	Front	0.373	0.036	0.409	WCDMA Band VIII	Front	0.050	0.036	0.086
	Back	0.678	0.105	0.783		Back	0.171	0.105	0.275
	Left	0.119	/	0.119		Left	0.056	/	0.056
	Right	0.110	0.030	0.140		Right	0.050	0.030	0.080
	Top	/	0.049	0.049		Top	/	0.049	0.049
	Bottom	0.188	/	0.188		Bottom	0.095	/	0.095

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 1	Front	0.478	0.036	0.514	LTE Band 3	Front	0.369	0.036	0.405
	Back	0.943	0.105	1.048		Back	0.715	0.105	0.820
	Left	0.179	/	0.179		Left	0.133	/	0.133
	Right	0.170	0.030	0.200		Right	0.126	0.030	0.156
	Top	/	0.049	0.049		Top	/	0.049	0.049
	Bottom	0.268	/	0.268		Bottom	0.206	/	0.206

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 7	Front	0.731	0.036	0.767	LTE Band 8	Front	0.049	0.036	0.085
	Back	1.117	0.105	1.222		Back	0.167	0.105	0.272
	Left	0.190	/	0.190		Left	0.053	/	0.053
	Right	0.176	0.030	0.206		Right	0.046	0.030	0.076
	Top	/	0.049	0.049		Top	/	0.049	0.049
	Bottom	0.351	/	0.351		Bottom	0.092	/	0.092

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 20	Front	0.077	0.036	0.113
	Back	0.199	0.105	0.304
	Left	0.079	/	0.079
	Right	0.073	0.030	0.103
	Top	/	0.049	0.049
	Bottom	0.104	/	0.104

➤ Limb Simultaneous Transmission

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
GSM 900	Front	0.440	0.074	0.514	GSM 1800	Front	1.267	0.074	1.341
	Back	0.756	0.217	0.973		Back	2.042	0.217	2.259
	Left	0.277	/	0.277		Left	0.299	/	0.299
	Right	0.261	0.069	0.330		Right	0.284	0.069	0.353
	Top	/	0.104	0.104		Top	/	0.104	0.104
	Bottom	0.494	/	0.494		Bottom	0.545	/	0.545

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
WCDMA Band I	Front	1.564	0.074	1.638	WCDMA Band VIII	Front	0.151	0.074	0.225
	Back	2.671	0.217	2.888		Back	0.435	0.217	0.652
	Left	0.849	/	0.849		Left	0.152	/	0.152
	Right	0.783	0.069	0.852		Right	0.138	0.069	0.207
	Top	/	0.104	0.104		Top	/	0.104	0.104
	Bottom	1.979	/	1.979		Bottom	0.259	/	0.259

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 1	Front	1.962	0.074	2.036	LTE Band 3	Front	1.461	0.074	1.535
	Back	3.317	0.217	3.534		Back	2.470	0.217	2.687
	Left	0.574	/	0.574		Left	0.367	/	0.367
	Right	0.555	0.069	0.624		Right	0.338	0.069	0.407
	Top	/	0.104	0.104		Top	/	0.104	0.104
	Bottom	1.378	/	1.378		Bottom	0.915	/	0.915

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)	WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 7	Front	1.897	0.074	1.971	LTE Band 8	Front	0.189	0.074	0.263
	Back	2.873	0.217	3.090		Back	0.431	0.217	0.648
	Left	0.666	/	0.666		Left	0.141	/	0.141
	Right	0.638	0.069	0.707		Right	0.124	0.069	0.193
	Top	/	0.104	0.104		Top	/	0.104	0.104
	Bottom	1.257	/	1.257		Bottom	0.247	/	0.247

WWAN Mode	Position	WWAN SAR _{10g} (W/kg)	WLAN SAR _{10g} (W/kg)	Σ SAR (W/kg)
LTE Band 20	Front	0.270	0.074	0.344
	Back	0.568	0.217	0.785
	Left	0.158	/	0.158
	Right	0.145	0.069	0.214
	Top	/	0.104	0.104
	Bottom	0.319	/	0.319

Note:

1. WLAN 2.4GHz Band and Bluetooth share the same antenna, and cannot transmit simultaneously.
2. GSM/WCDMA/LTE shares the same antenna, and cannot transmit simultaneously.
3. According to EN 62209-2 Annex K, the threshold power level available to the secondary transmitter ($P_{\text{available}}$) is to calculate it from the measured peak spatial-average SAR of the primary transmitter (SAR_1) according to the equation:
$$P_{\text{available}} = P_{\text{th,m}} \times (\text{SAR}_{\text{lim}} - \text{SAR}_1) / \text{SAR}_{\text{lim}}$$

If the output power of the secondary transmitter is less than $P_{\text{available}}$, SAR measurement for the secondary transmitter is not necessary. Therefore, $P_{\text{available}} = 20 \times (2.0 - 1.117) / 2.0 = 8.83\text{mW} = 9.46\text{dBm}$. Cuz $P_{\text{BT, MAX}} = 4.45\text{dBm} < 9.46\text{dBm}$, Cuz $P_{\text{NFC, MAX}} = -11.84\text{dBm} < 9.46\text{dBm}$, the SAR measurement for BT and NFC is not necessary. The consideration of simultaneous transmission of BT and NFC is not necessary.

➤ Simultaneous Transmission Conclusion

The above numerical summed SAR results for all the case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required.

16.6 Measurement Uncertainty

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A Type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience, and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in below Table.

Uncertainty Distributions	Normal	Rectangular	Triangular	U-Shape
Multi-plying Factor	$1/k(b)$	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY uncertainty Budget is shown in the following tables.

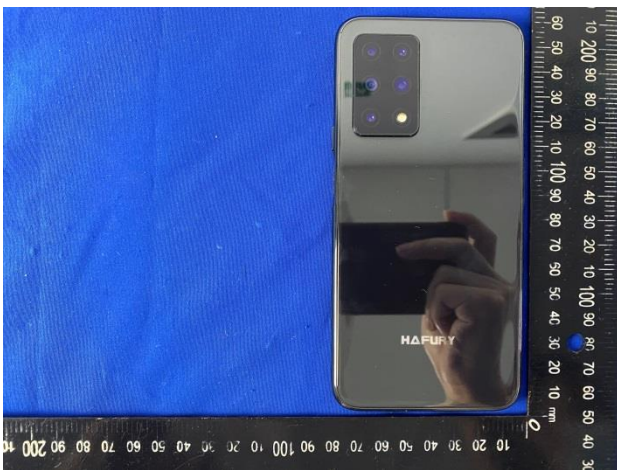
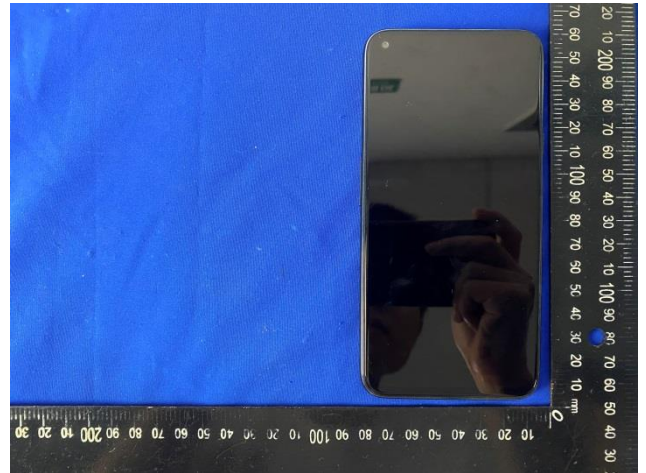
Uncertainty Component	Uncertainty Value	Probability Distribution	Divisor	Ci (1 g)	Ci (10 g)	Standard Uncertainty (1 g)	Standard Uncertainty (10 g)
Measurement System							
Probe Calibration	±7.4%	N	1	1	1	±7.4%	±7.4%
Axial Isotropy	±1.2%	R	$\sqrt{3}$	0.7	0.7	±0.49%	±0.49%
Hemispherical Isotropy	±0.9%	R	$\sqrt{3}$	0.7	0.7	±0.36%	±0.36%
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%
Linearity	±0.9%	R	$\sqrt{3}$	1	1	±0.52%	±0.52%
System Detection Limits	±0.25%	R	$\sqrt{3}$	1	1	±0.14%	±0.14%
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.46%	±0.46%
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.23%	±0.23%
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.68%	±1.68%
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%
Test Sample Related							
Device Positioning	±4.6%	N	1	1	1	±4.6%	±4.6%
Device Holder	±5.2%	N	1	1	1	±5.2%	±5.2%
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.89%	±2.89%
Phantom and Setup							
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.31%	±2.31%
Liquid conductivity (measured value)	±3.33%	N	1	0.78	0.71	±2.6%	±2.6%
Liquid dielectric constant (measured value)	±3.25%	N	1	0.23	0.26	±0.75%	±0.85%
Liquid Conductivity - Temperature Uncertainty	±1.3%	R	$\sqrt{3}$	0.78	0.71	±0.59%	±0.53%
Liquid Dielectric Constant - Temperature Uncertainty	±1.1%	R	$\sqrt{3}$	0.23	0.26	±0.15%	±0.17%
Combined Standard Uncertainty						±11.56%	±11.50%
Expanded Uncertainty (95% Confidence Level, k = 2)						±23.11%	±23.0%

Uncertainty Budget for frequency range 300 MHz to 3 GHz

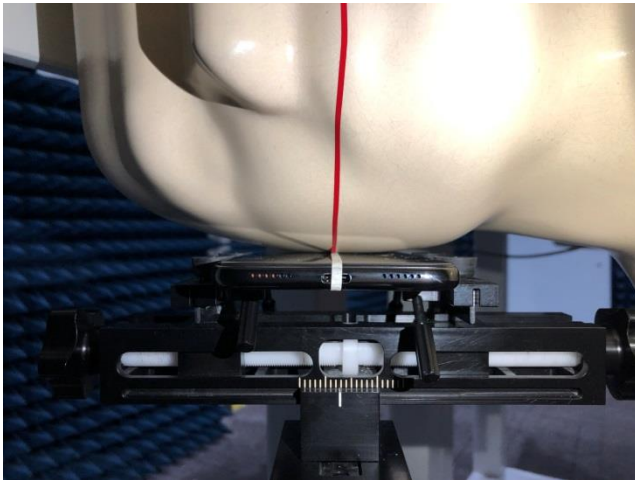
16.7 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the CE, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested. Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

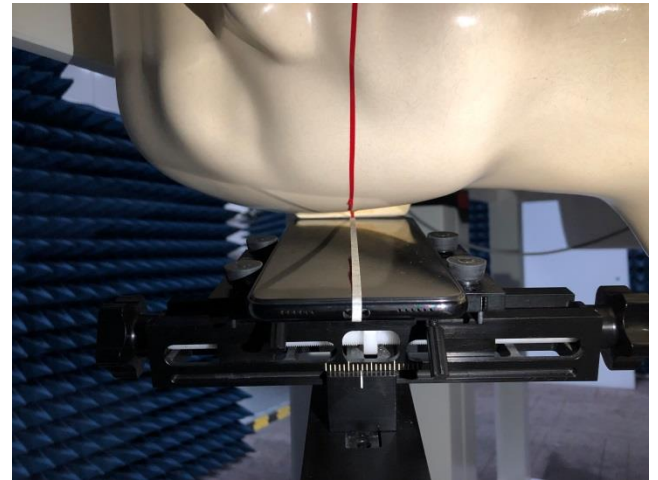
Appendix A: EUT Photos



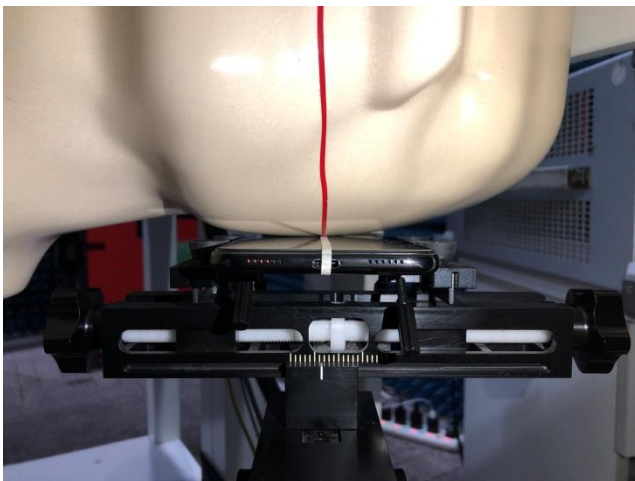
Appendix B: Test Setup Photos



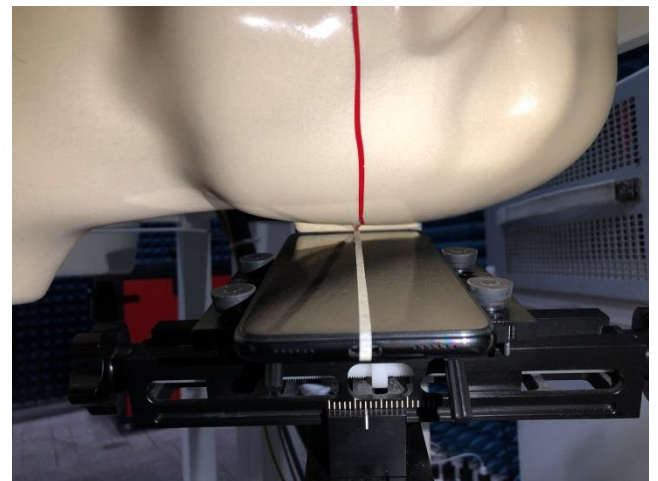
Right Cheek



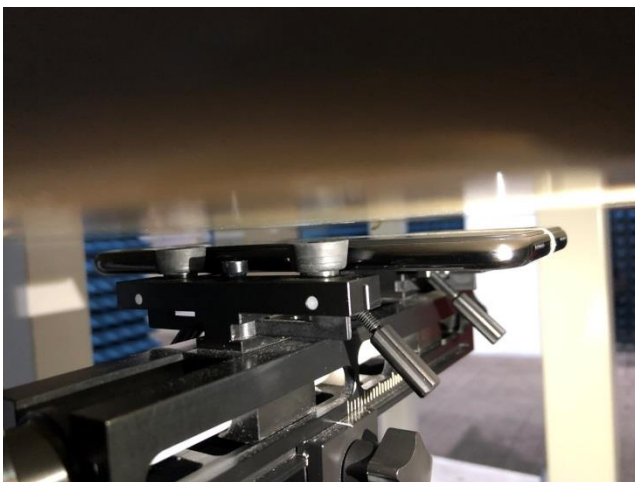
Right Tilted



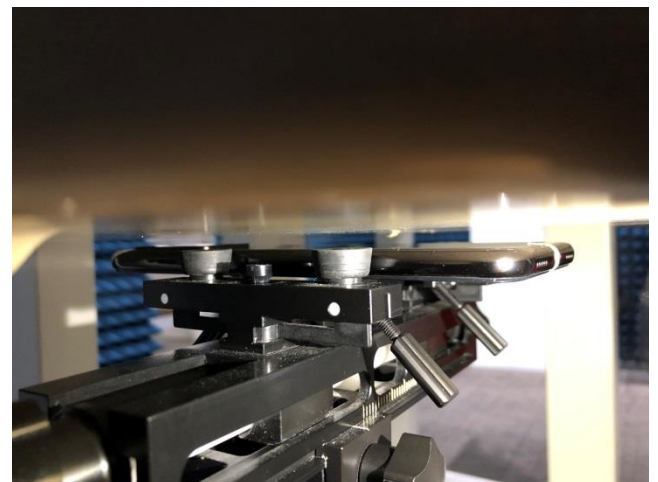
Left Cheek



Left Tilted



Body worn – Front
(Test distance: 5mm, Thickness of DUT: 9mm)



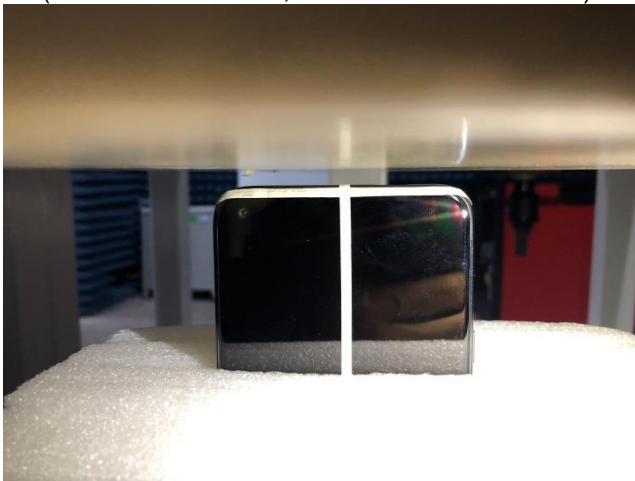
Body worn – Back
(Test distance: 5mm, Thickness of DUT: 9mm)



Body worn – Left
(Test distance: 5mm, Thickness of DUT: 9mm)



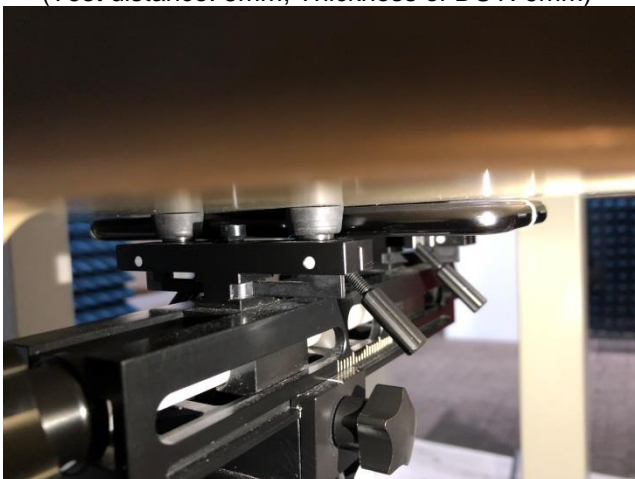
Body worn – Right
(Test distance: 5mm, Thickness of DUT: 9mm)



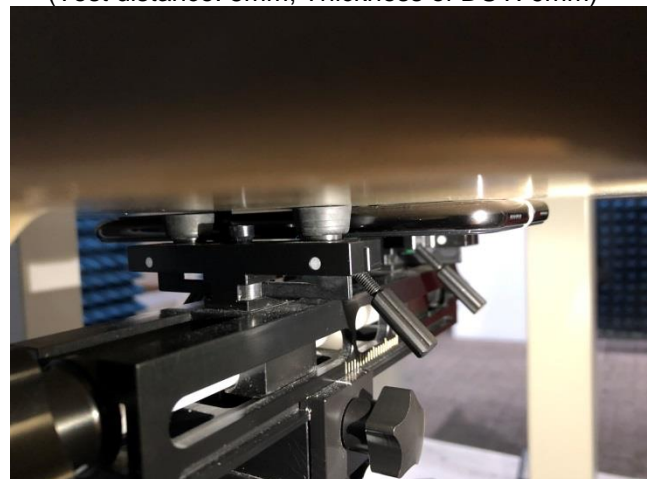
Body worn – Top
(Test distance: 5mm, Thickness of DUT: 9mm)



Body worn – Bottom
(Test distance: 5mm, Thickness of DUT: 9mm)



Limb– Front
(Test distance: 0mm, Thickness of DUT: 9mm)



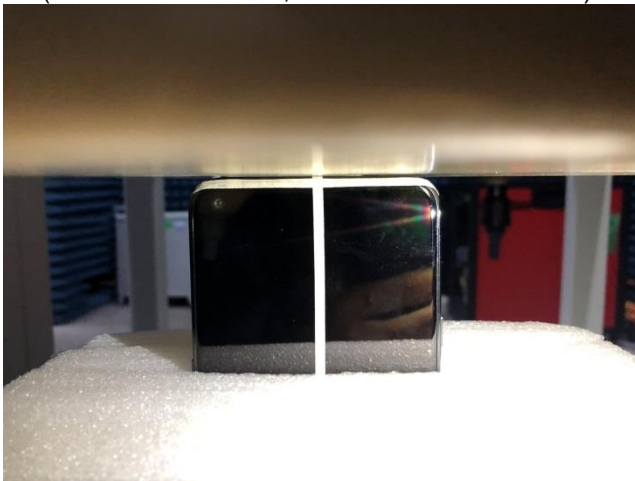
Limb– Back
(Test distance: 0mm, Thickness of DUT: 9mm)



Limb— Left
(Test distance: 0mm, Thickness of DUT: 9mm)



Limb— Right
(Test distance: 0mm, Thickness of DUT: 9mm)



Limb— Top
(Test distance: 0mm, Thickness of DUT: 9mm)



Limb— Bottom
(Test distance: 0mm, Thickness of DUT: 9mm)

Appendix C: Plots of SAR System Check

Test Laboratory: CCIS

Date/Time: 06.18.2020 08:10:58

DUT: Dipole 835 MHz; Type: D835V2; Serial: SN: 4d154

Communication System: UID 0, CW (0); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.886 \text{ S/m}$; $\epsilon_r = 42.138$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.67, 9.67, 9.67); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=2.0mm (EX-Probe)/Area Scan (41x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 1.12 W/kg

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:

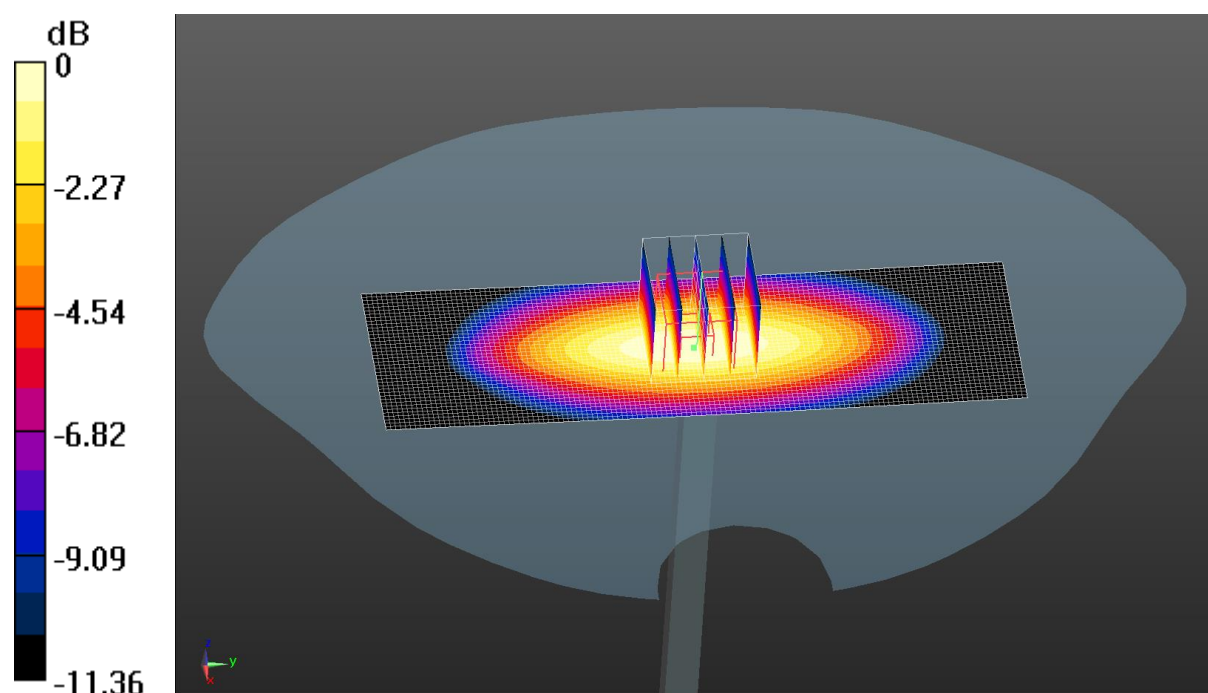
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 32.72 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 1.21 W/kg

SAR(1 g) = 0.781 W/kg; SAR(10 g) = 0.523 W/kg

Maximum value of SAR (measured) = 1.09 W/kg



0 dB = 1.09 W/kg = 0.37 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 08:18:03

DUT: Dipole 1800 MHz; Type: SID1800; Serial: SN:09/15 DIP IG800-360

Communication System: UID 0, CW (0); Frequency: 1800 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1800 \text{ MHz}$; $\sigma = 1.378 \text{ S/m}$; $\epsilon_r = 39.745$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequency 1800MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:

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

Reference Value = 39.84 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 3.17 W/kg

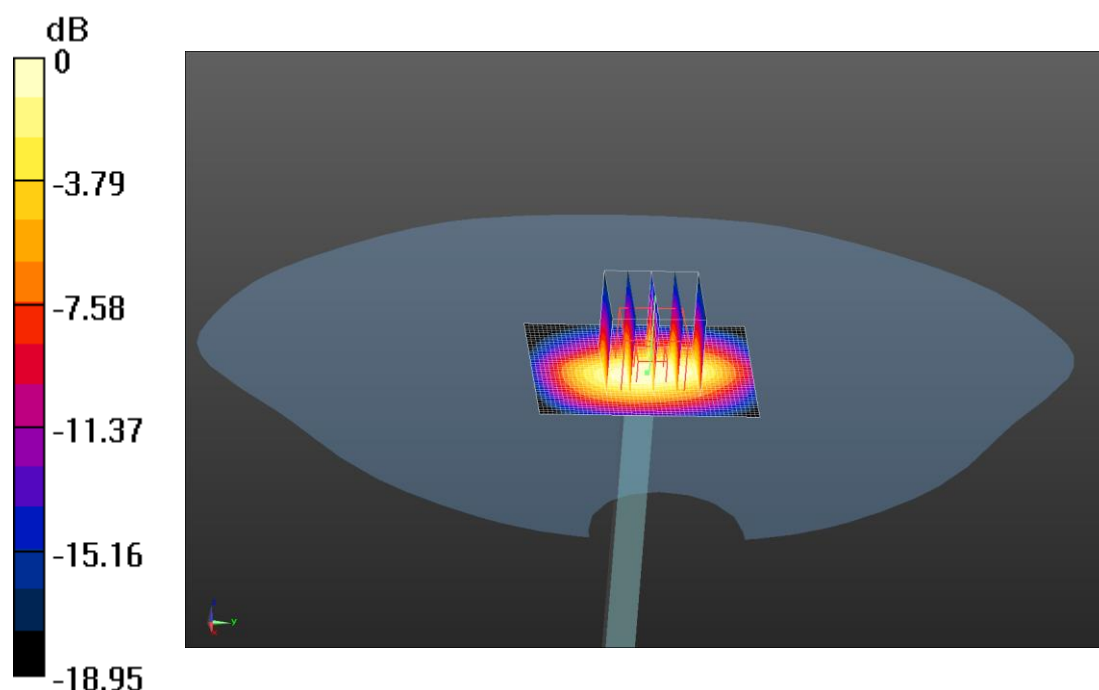
SAR(1 g) = 1.56 W/kg; SAR(10 g) = 0.821 W/kg

Maximum value of SAR (measured) = 2.41 W/kg

System Performance Check at Frequency 1800MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Area Scan (41x51x1): Interpolated grid:

dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.22 W/kg



0 dB = 2.22 W/kg = 3.46 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 08:37:09

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: 5d175

Communication System: UID 0, CW (0); Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.406$ S/m; $\epsilon_r = 39.428$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequency 1900MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 2.45 W/kg

System Performance Check at Frequency 1900MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (5x5x7)/Cube 0:

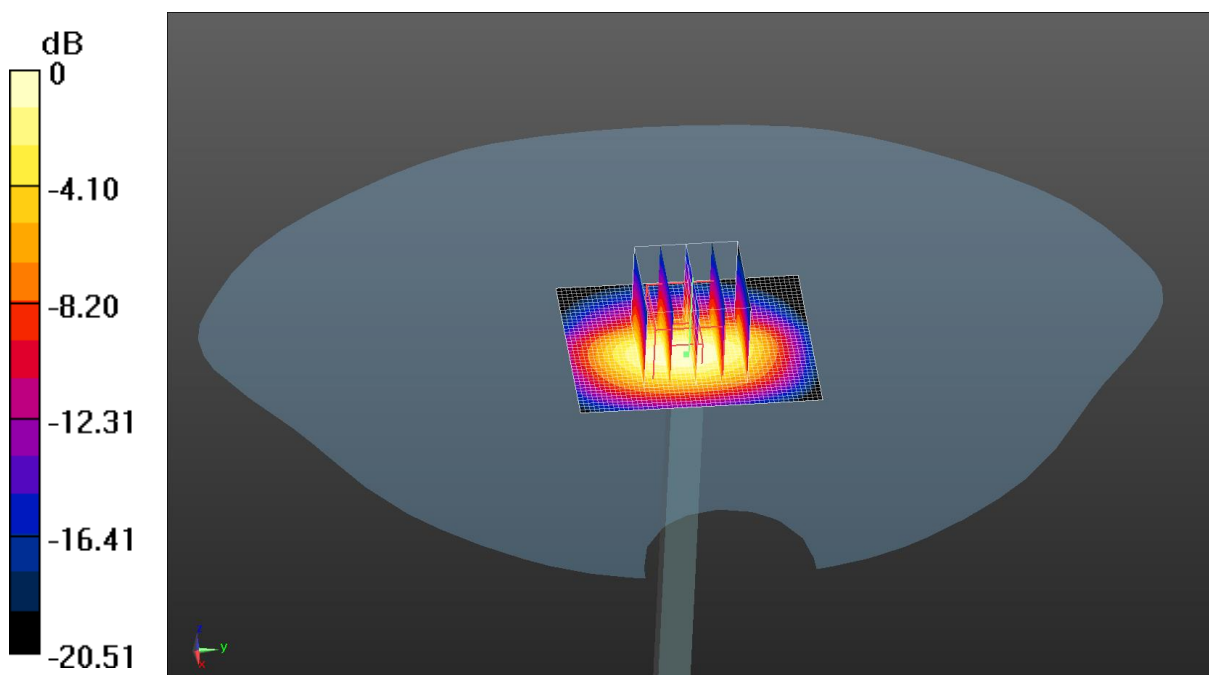
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 39.82 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.18 W/kg

SAR(1 g) = 1.55 W/kg; SAR(10 g) = 0.810 W/kg

Maximum value of SAR (measured) = 2.26 W/kg



0 dB = 2.26 W/kg = 3.54 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.20.2020 08:11:54

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: SN: 910

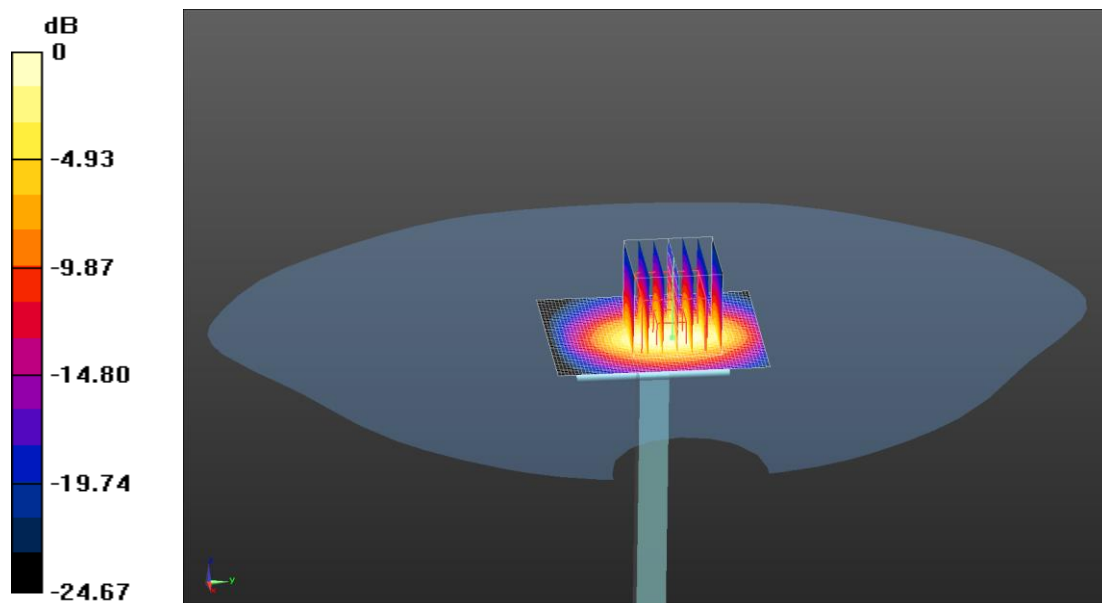
Communication System: UID 0, CW (0); Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2450$ MHz; $\sigma = 1.782$ S/m; $\epsilon_r = 39.765$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequency 2450MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 3.52 W/kg

System Performance Check at Frequency 2450MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 39.78 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 4.32 W/kg
SAR(1 g) = 2.1 W/kg; SAR(10 g) = 0.964 W/kg
Maximum value of SAR (measured) = 3.34 W/kg



0 dB = 3.34 W/kg = 5.24 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.29.2020 08:36:50

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: SN: 1114

Communication System: UID 0, CW (0); Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2600$ MHz; $\sigma = 1.993$ S/m; $\epsilon_r = 38.867$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN3924; ConvF(7.3, 7.3, 7.3); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

System Performance Check at Frequency 2600MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Zoom Scan(7X7X7) (7x7x7)/Cube 0:

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

Reference Value = 43.06 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 4.92 W/kg

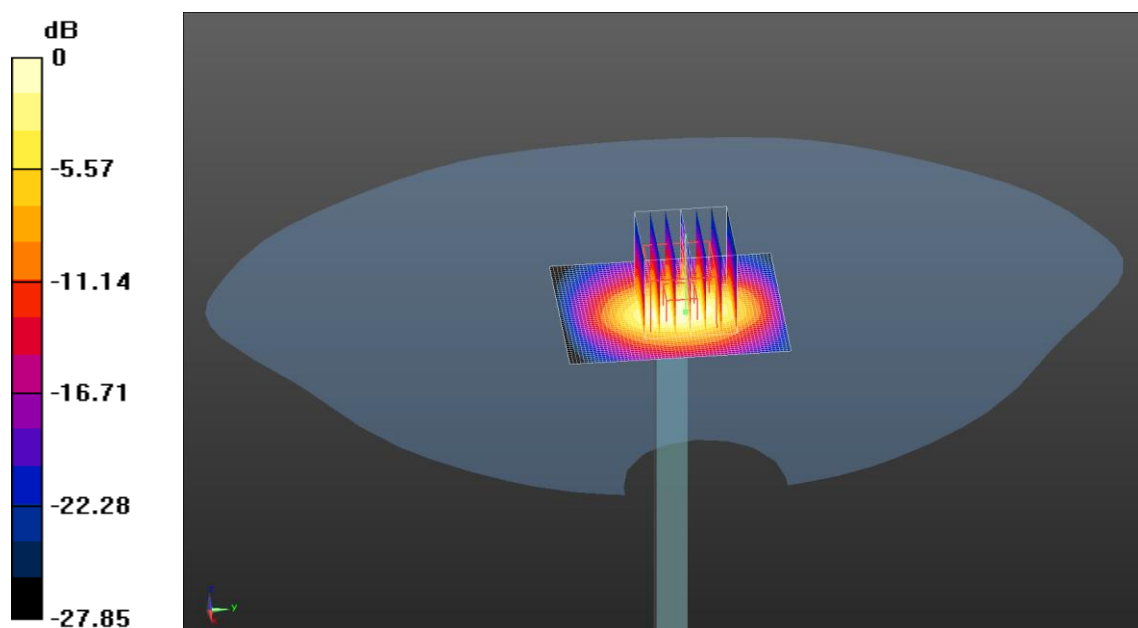
SAR(1 g) = 2.24 W/kg; SAR(10 g) = 0.988 W/kg

Maximum value of SAR (measured) = 3.74 W/kg

System Performance Check at Frequency 2600MHz Head Tissue/d=10mm, Pin=40 mW, dist=2.0mm (EX-Probe)/Area Scan (51x61x1): Interpolated grid:

dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 4.18 W/kg



0 dB = 4.18 W/kg = 6.21 dBW/kg

Appendix D: Plots of SAR Test Data

Test Laboratory: CCIS

Date/Time: 06.18.2020 18:23:40

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GSM (0); Frequency: 902 MHz; Duty Cycle: 1:8.30042
Medium parameters used (interpolated): $f = 902 \text{ MHz}$; $\sigma = 0.978 \text{ S/m}$; $\epsilon_r = 41.674$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Right Section

DASY5 Configuration:

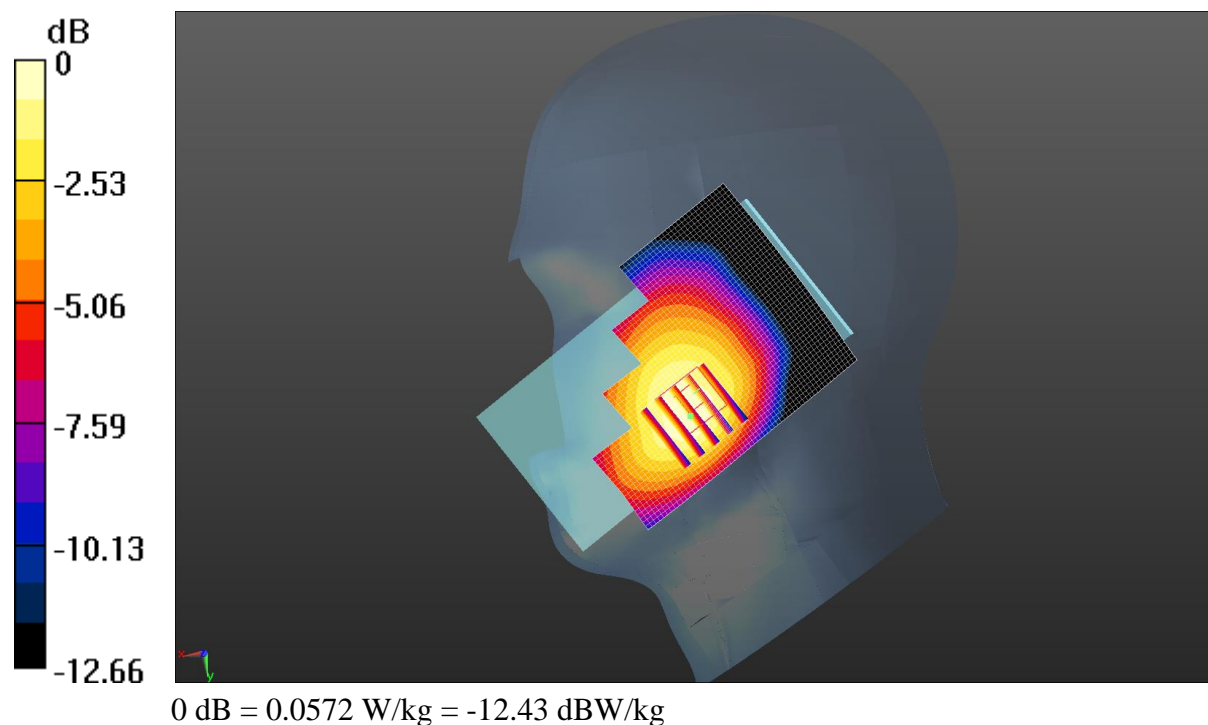
- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GSM 900 Right Cheek/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$
Reference Value = 1.041 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.0640 W/kg
SAR(1 g) = 0.044 W/kg; SAR(10 g) = 0.032 W/kg
Maximum value of SAR (measured) = 0.0561 W/kg

GSM 900 Right Cheek/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$
Maximum value of SAR (interpolated) = 0.0572 W/kg



Test Laboratory: CCIS

Date/Time: 06.23.2020 18:01:42

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GSM (0); Frequency: 1747.8 MHz; Duty Cycle: 1:8.30042

Medium parameters used (interpolated): $f = 1747.8 \text{ MHz}$; $\sigma = 1.344 \text{ S/m}$; $\epsilon_r = 40.286$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GSM 1800 Left Cheek/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.927 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 0.123 W/kg

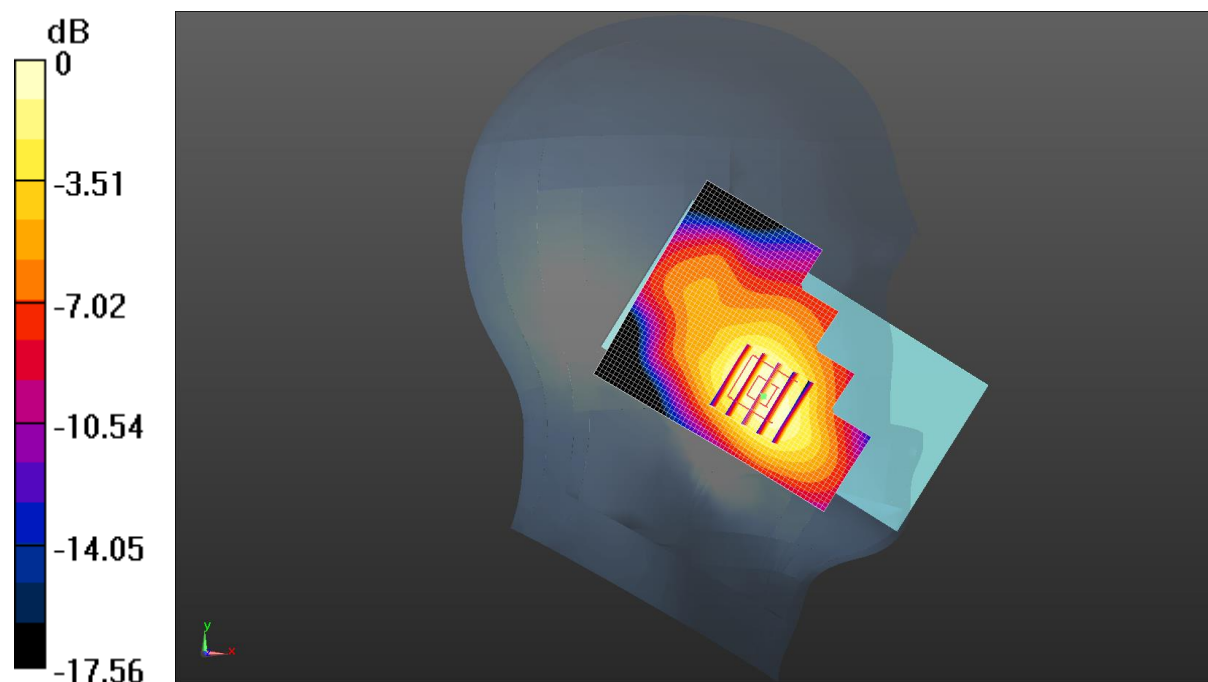
SAR(1 g) = 0.076 W/kg; SAR(10 g) = 0.046 W/kg

Maximum value of SAR (measured) = 0.105 W/kg

GSM 1800 Left Cheek/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.0953 W/kg



0 dB = 0.0953 W/kg = -10.21 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 11:47:57

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1950 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1950 \text{ MHz}$; $\sigma = 1.419 \text{ S/m}$; $\epsilon_r = 39.356$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 2100 Left Cheek/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.759 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.504 W/kg

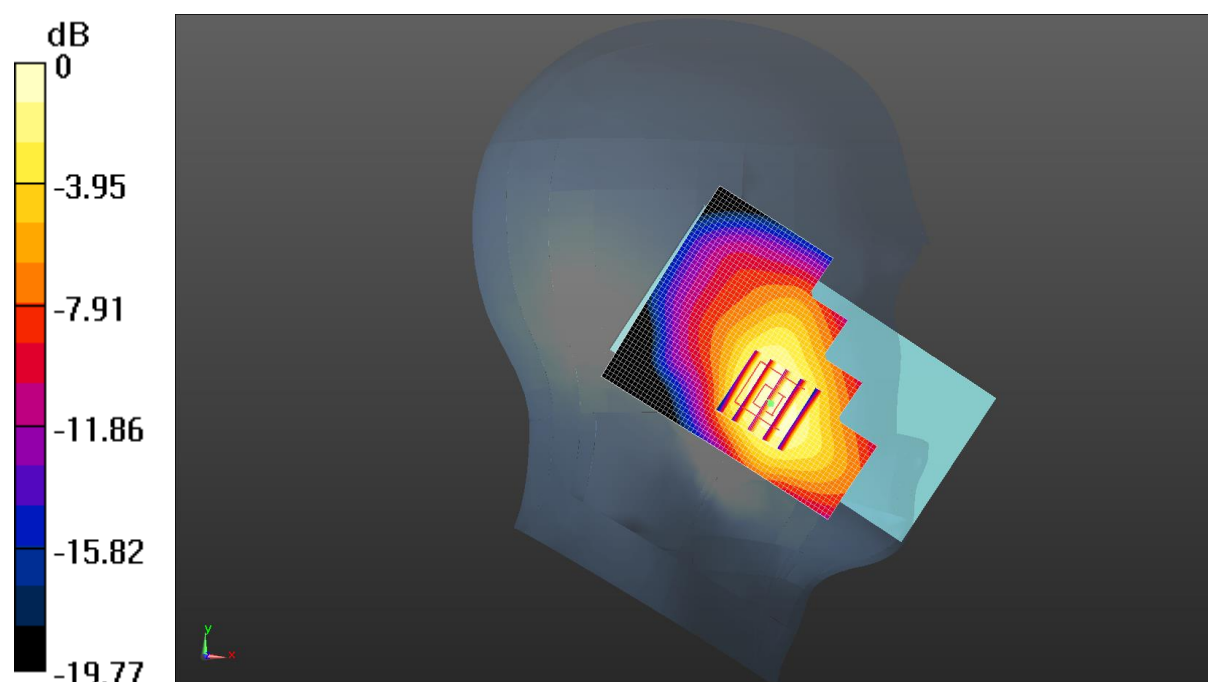
SAR(1 g) = 0.304 W/kg; SAR(10 g) = 0.179 W/kg

Maximum value of SAR (measured) = 0.428 W/kg

WCDMA 2100 Left Cheek/Middle Channel/Area Scan (51x71x1): Interpolated

grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.410 W/kg



0 dB = 0.410 W/kg = -3.87 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 23:31:57

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 897.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 897.6$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 41.716$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 900 Right Cheek/Middle Channel/Area Scan (51x71x1): Interpolated grid: $dx=2.000$ mm, $dy=2.000$ mm

Maximum value of SAR (interpolated) = 0.0461 W/kg

WCDMA 900 Right Cheek/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

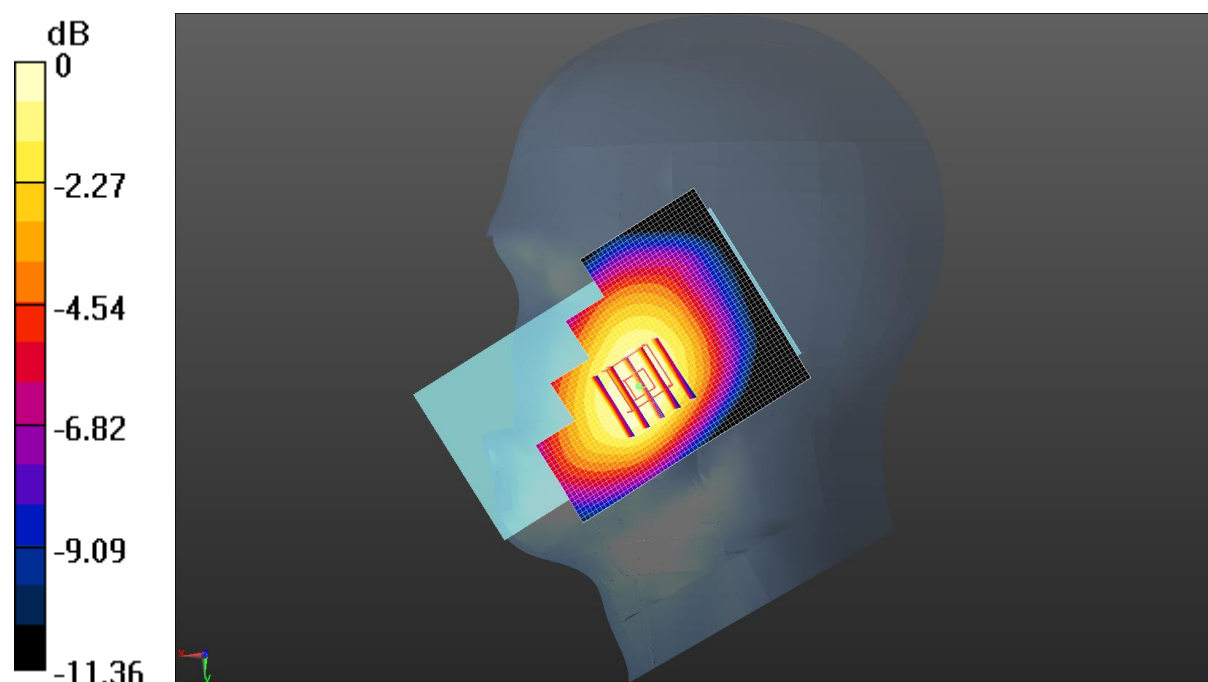
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 1.875 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 0.0510 W/kg

SAR(1 g) = 0.037 W/kg; SAR(10 g) = 0.027 W/kg

Maximum value of SAR (measured) = 0.0457 W/kg



0 dB = 0.0457 W/kg = -13.40 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 23:58:09

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1950 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 1950 \text{ MHz}$; $\sigma = 1.419 \text{ S/m}$; $\epsilon_r = 39.356$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 1 1RB(20MHz) Left Cheek/Middle Channel/Area Scan (51x71x1):

Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.549 W/kg

LTE Band 1 1RB(20MHz) Left Cheek/Middle Channel/Zoom Scan

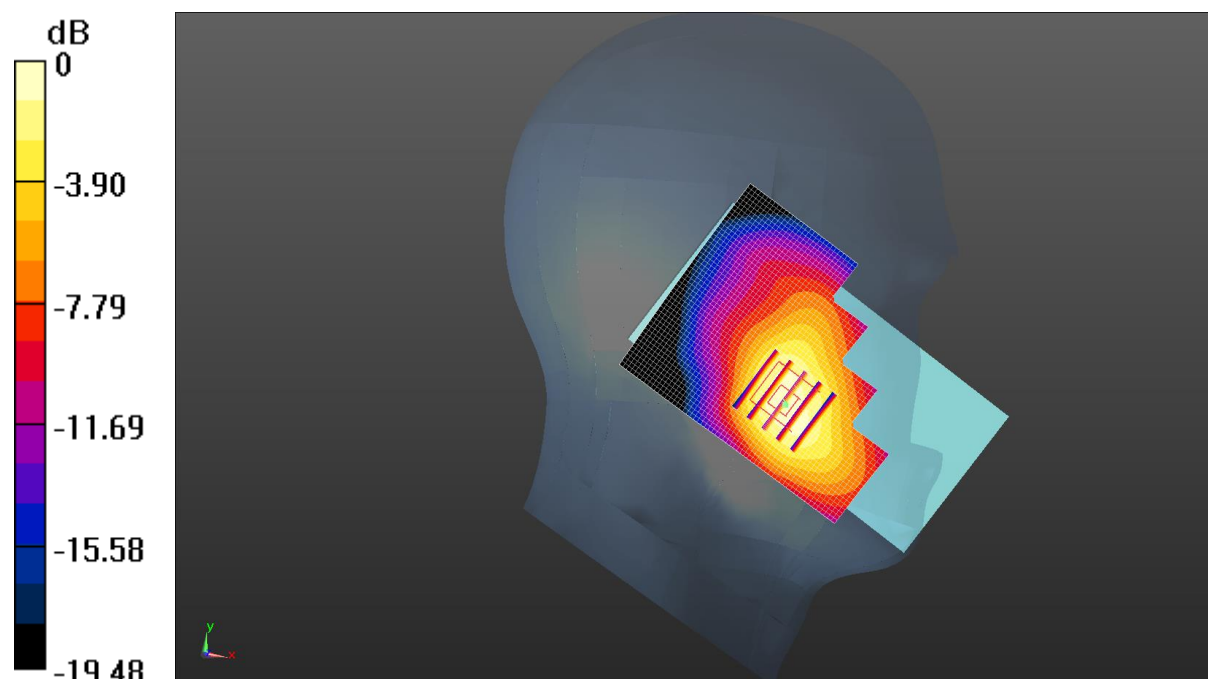
(5x5x7)/Cube 0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 1.988 V/m ; Power Drift = 0.36 dB

Peak SAR (extrapolated) = 0.691 W/kg

SAR(1 g) = 0.411 W/kg ; SAR(10 g) = 0.241 W/kg

Maximum value of SAR (measured) = 0.583 W/kg



0 dB = 0.583 W/kg = -2.34 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 19:02:55

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1747.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1747.5$ MHz; $\sigma = 1.344$ S/m; $\epsilon_r = 40.286$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 3 1RB(20MHz) Left Cheek/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 0.203 W/kg

LTE Band 3 1RB(20MHz) Left Cheek/Middle Channel/Zoom Scan

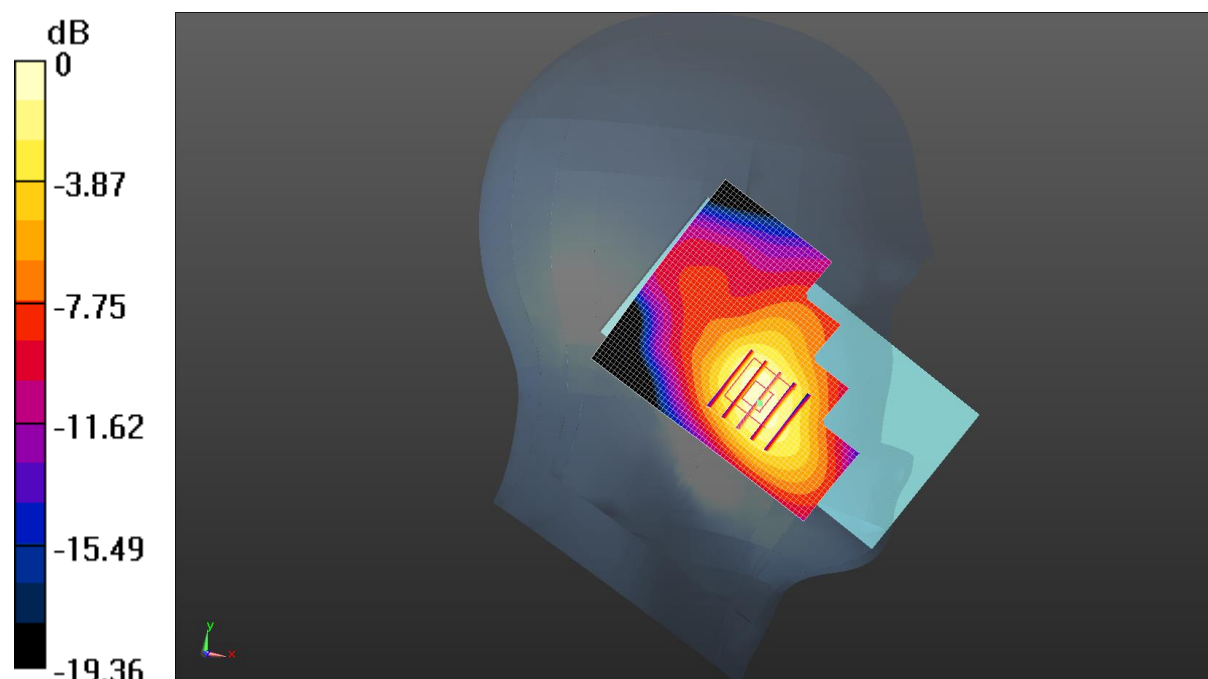
(5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.872 V/m; Power Drift = -0.25 dB

Peak SAR (extrapolated) = 0.271 W/kg

SAR(1 g) = 0.164 W/kg; SAR(10 g) = 0.098 W/kg

Maximum value of SAR (measured) = 0.229 W/kg



0 dB = 0.229 W/kg = -6.40 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.29.2020 16:21:31

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 2535 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 2535$ MHz; $\sigma = 1.913$ S/m; $\epsilon_r = 39.107$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 7 1RB(20MHz) Left Cheek/Middle Channel/Area Scan (51x71x1):

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

Maximum value of SAR (interpolated) = 0.889 W/kg

LTE Band 7 1RB(20MHz) Left Cheek/Middle Channel/Zoom Scan

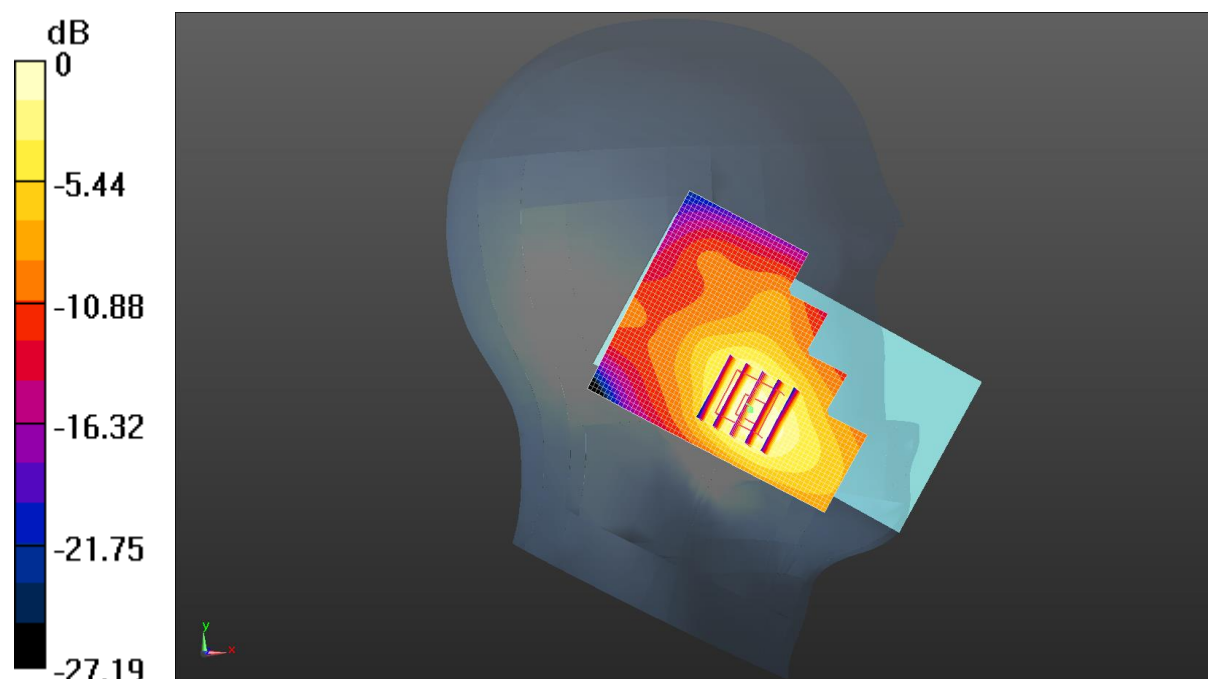
(5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.134 V/m; Power Drift = -0.35 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.574 W/kg; SAR(10 g) = 0.298 W/kg

Maximum value of SAR (measured) = 0.894 W/kg



0 dB = 0.894 W/kg = -0.49 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 13:47:00

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 897.5 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 897.5$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 41.716$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 8 1RB(10MHz) Right Cheek/Middle Channel/Area Scan (51x71x1):

Interpolated grid: $dx=2.000$ mm, $dy=2.000$ mm

Maximum value of SAR (interpolated) = 0.0531 W/kg

LTE Band 8 1RB(10MHz) Right Cheek/Middle Channel/Zoom Scan

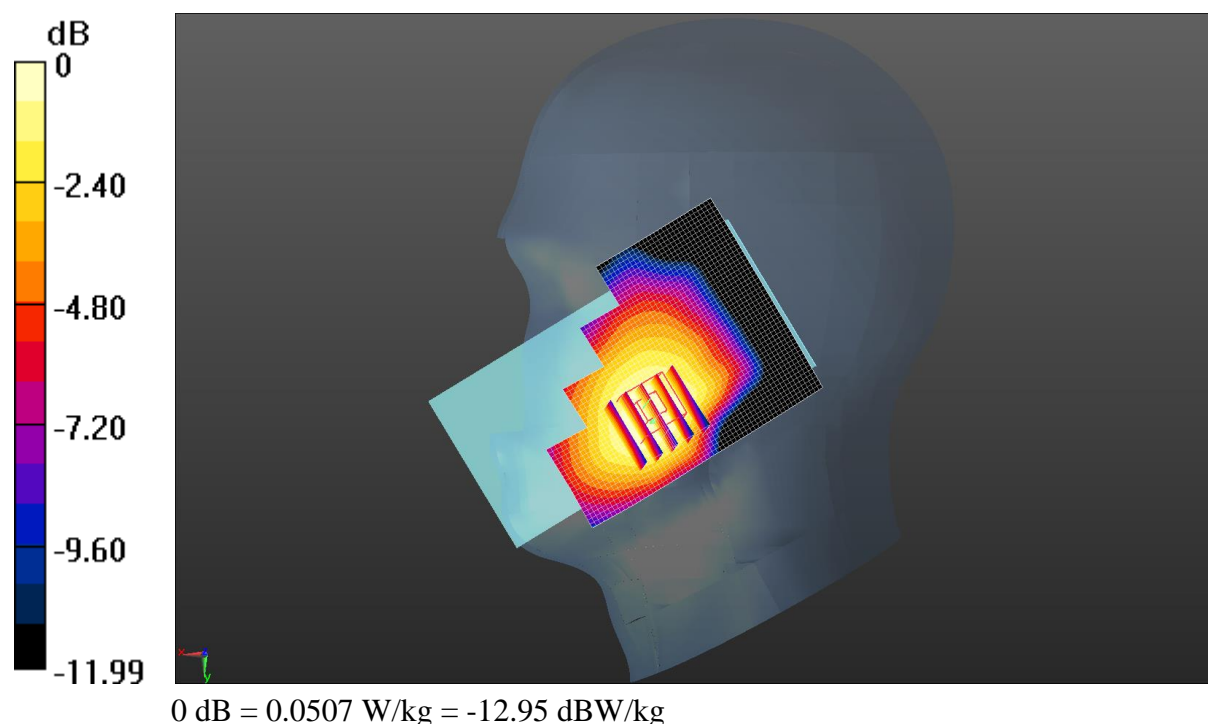
(5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 0.8970 V/m; Power Drift = 0.28 dB

Peak SAR (extrapolated) = 0.0590 W/kg

SAR(1 g) = 0.041 W/kg; SAR(10 g) = 0.029 W/kg

Maximum value of SAR (measured) = 0.0507 W/kg



Test Laboratory: CCIS

Date/Time: 06.18.2020 17:50:02

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 847 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 847$ MHz; $\sigma = 0.897$ S/m; $\epsilon_r = 42.05$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.67, 9.67, 9.67); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 20 1RB(20MHz) Right Cheek/Middle Channel/Area Scan

(51x71x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 0.0649 W/kg

LTE Band 20 1RB(20MHz) Right Cheek/Middle Channel/Zoom Scan

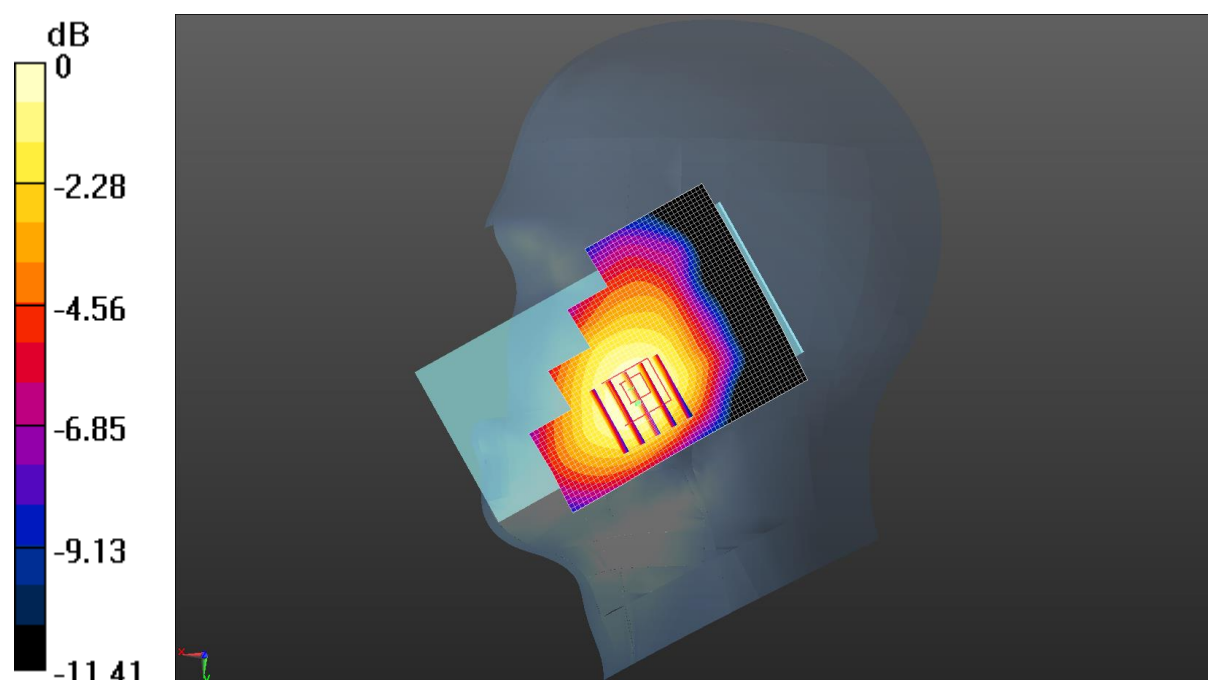
(5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.224 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 0.0720 W/kg

SAR(1 g) = 0.051 W/kg; SAR(10 g) = 0.037 W/kg

Maximum value of SAR (measured) = 0.0635 W/kg



0 dB = 0.0635 W/kg = -11.97 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.20.2020 09:18:44

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);

Frequency: 2442 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2442$ MHz; $\sigma = 1.776$ S/m; $\epsilon_r = 39.784$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WIFI Left Cheek/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.439 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 0.283 W/kg

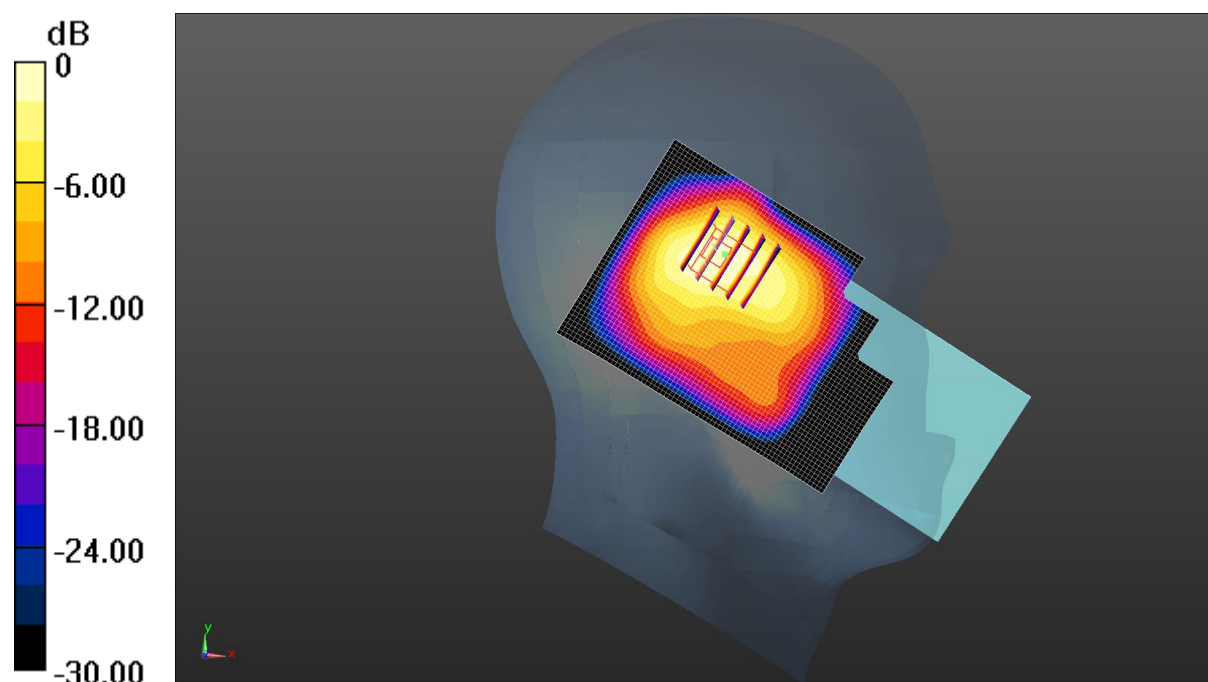
SAR(1 g) = 0.124 W/kg; SAR(10 g) = 0.056 W/kg

Maximum value of SAR (measured) = 0.217 W/kg

WIFI Left Cheek/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.173 W/kg



0 dB = 0.173 W/kg = -7.62 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 19:04:06

DUT: Smart phone; Type: GT20; Serial: 1#

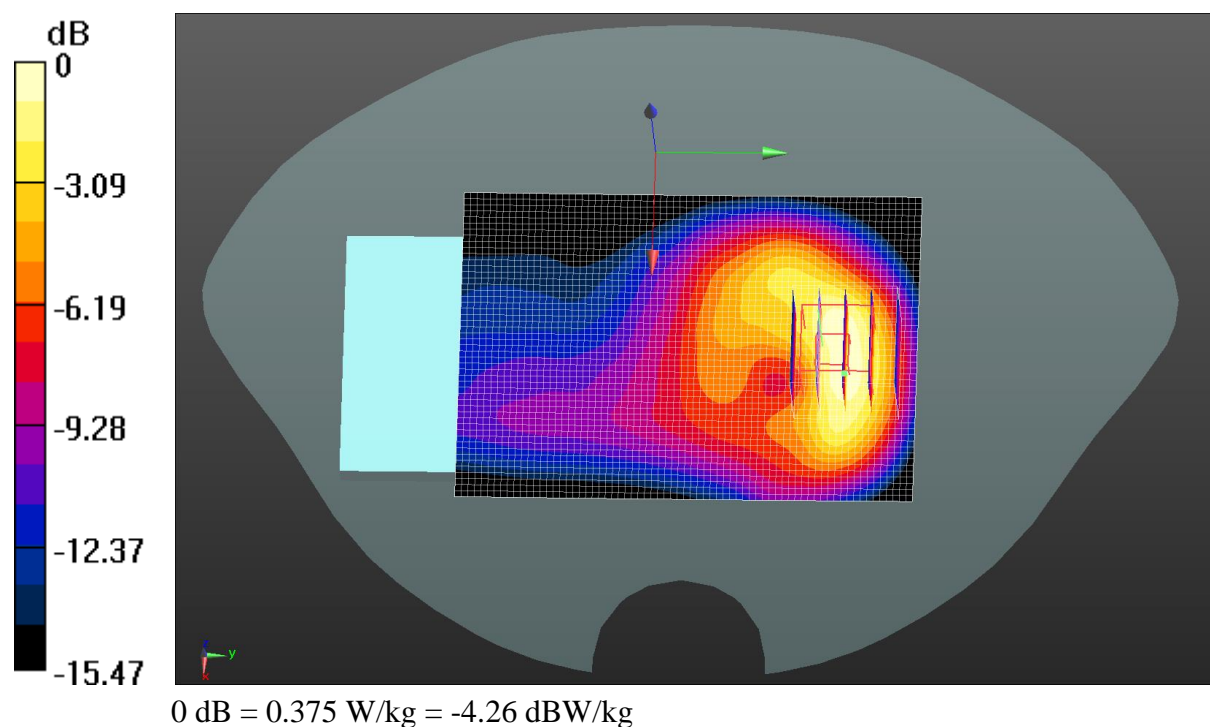
Communication System: UID 0, GSM (0); Frequency: 902 MHz; Duty Cycle: 1:8.30042
Medium parameters used (interpolated): $f = 902$ MHz; $\sigma = 0.978$ S/m; $\epsilon_r = 41.674$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GSM 900 Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.756 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.794 W/kg
SAR(1 g) = 0.356 W/kg; SAR(10 g) = 0.176 W/kg
Maximum value of SAR (measured) = 0.578 W/kg

GSM 900 Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm
Maximum value of SAR (interpolated) = 0.375 W/kg



Test Laboratory: CCIS

Date/Time: 06.23.2020 15:20:40

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GSM (0); Frequency: 1747.8 MHz; Duty Cycle: 1:8.30042

Medium parameters used (interpolated): $f = 1747.8 \text{ MHz}$; $\sigma = 1.344 \text{ S/m}$; $\epsilon_r = 40.286$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GSM 1800 Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 1.43 W/kg

GSM 1800 Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

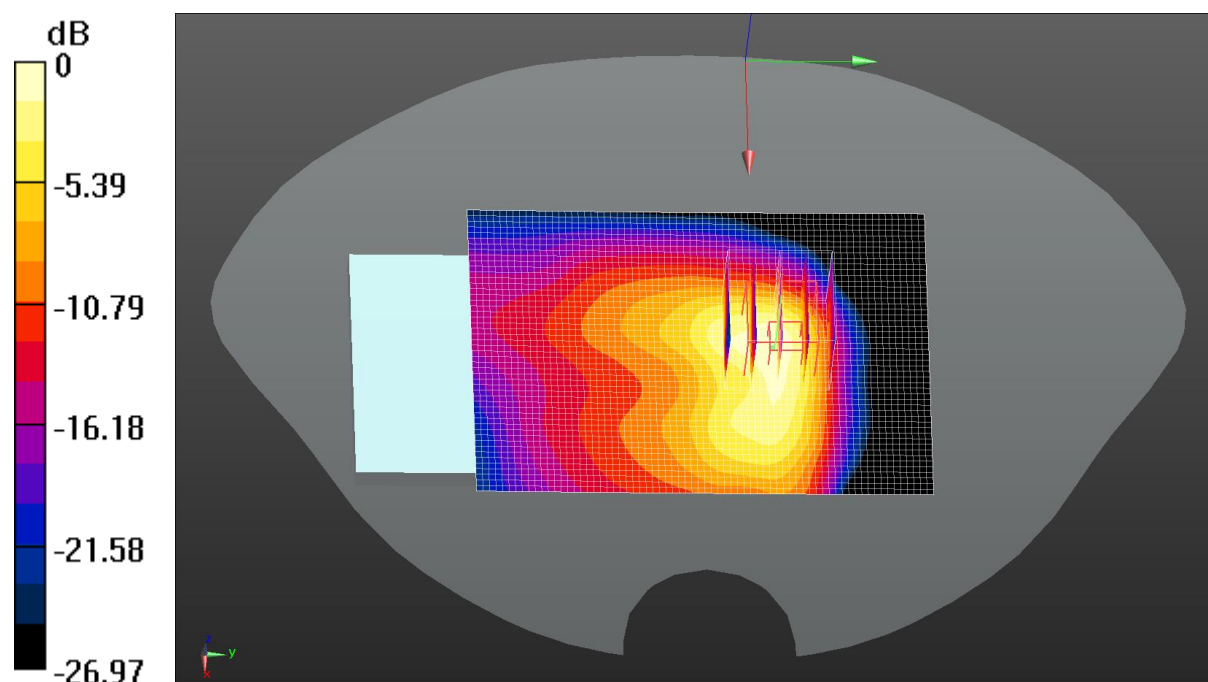
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 17.78 V/m; Power Drift = 0.23 dB

Peak SAR (extrapolated) = 1.70 W/kg

SAR(1 g) = 0.769 W/kg; SAR(10 g) = 0.341 W/kg

Maximum value of SAR (measured) = 1.34 W/kg



0 dB = 1.34 W/kg = 1.27 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 13:58:08

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1950 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1950 \text{ MHz}$; $\sigma = 1.419 \text{ S/m}$; $\epsilon_r = 39.356$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 2100 Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 3.22 W/kg

WCDMA 2100 Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

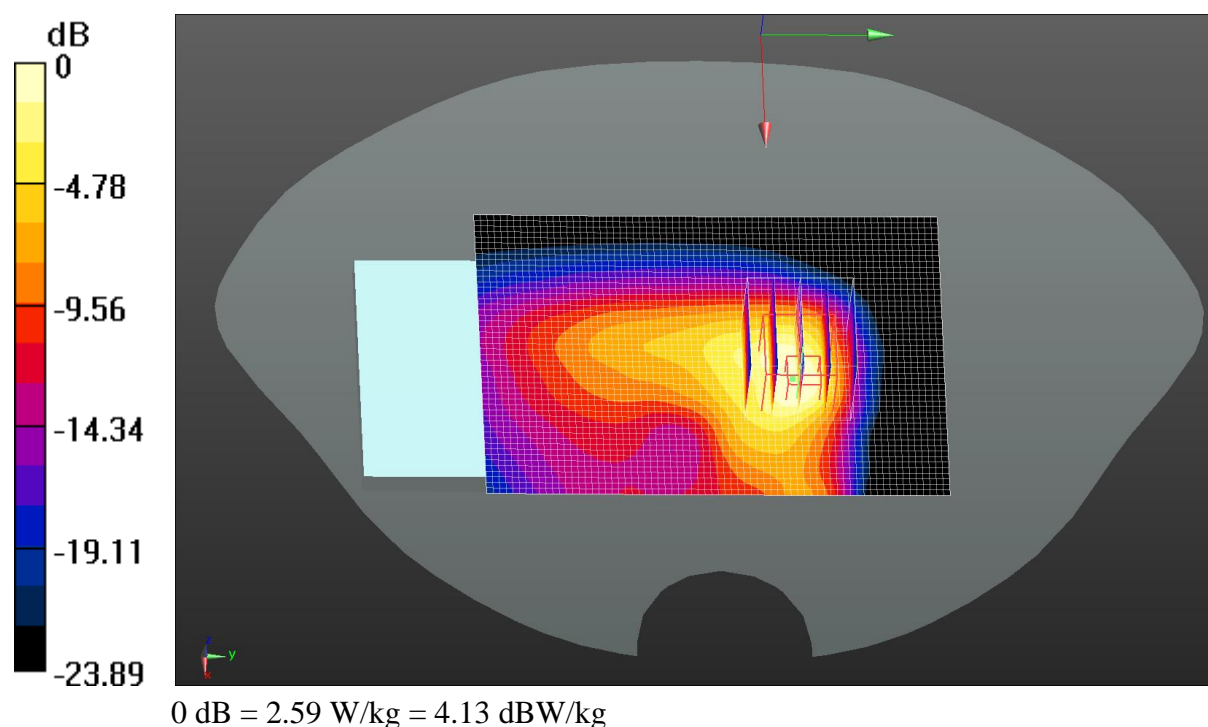
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 27.69 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.34 W/kg

SAR(1 g) = 1.44 W/kg; SAR(10 g) = 0.637 W/kg

Maximum value of SAR (measured) = 2.59 W/kg



Test Laboratory: CCIS

Date/Time: 06.18.2020 21:21:16

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 897.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 897.6$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 41.716$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 900 Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=2.000$ mm, $dy=2.000$ mm

Maximum value of SAR (interpolated) = 0.443 W/kg

WCDMA 900 Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

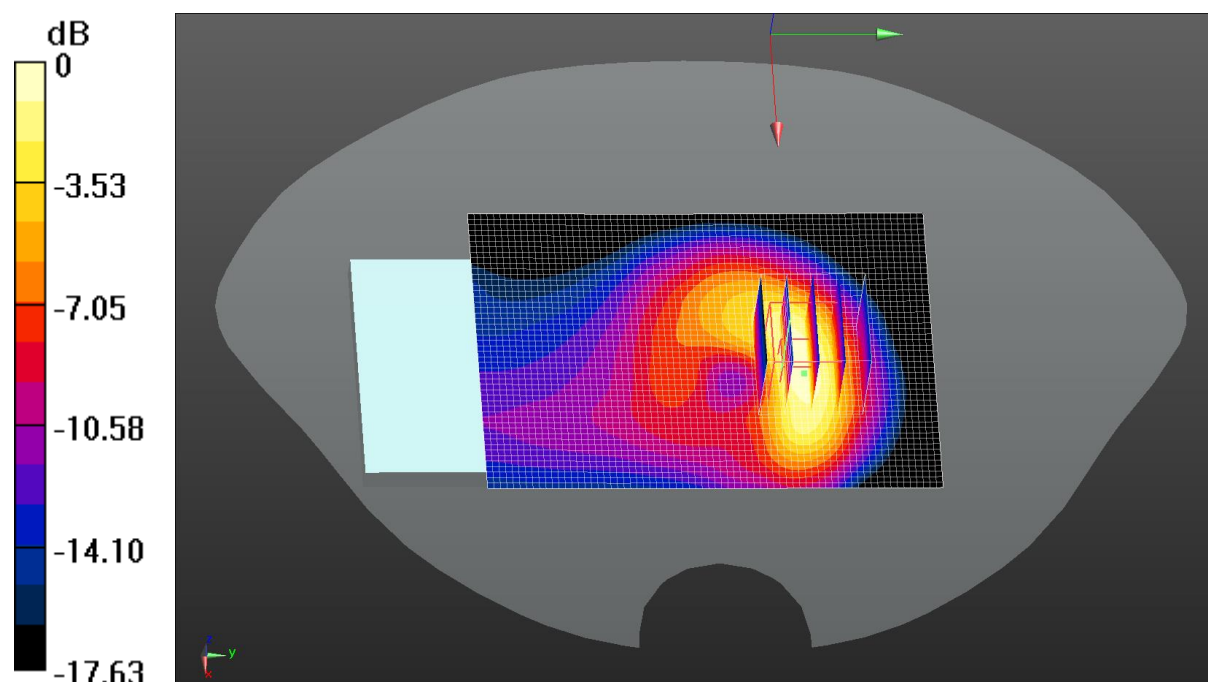
Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 11.49 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.726 W/kg

SAR(1 g) = 0.316 W/kg; SAR(10 g) = 0.155 W/kg

Maximum value of SAR (measured) = 0.463 W/kg



0 dB = 0.463 W/kg = -3.34 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 22:11:18

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1950 MHz; Duty Cycle: 1:1
Medium parameters used (extrapolated): $f = 1950$ MHz; $\sigma = 1.419$ S/m; $\epsilon_r = 39.356$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 1 1RB(20MHz) Body Back/Middle Channel/Zoom Scan

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

Reference Value = 24.43 V/m; Power Drift = 0.24 dB

Peak SAR (extrapolated) = 4.33 W/kg

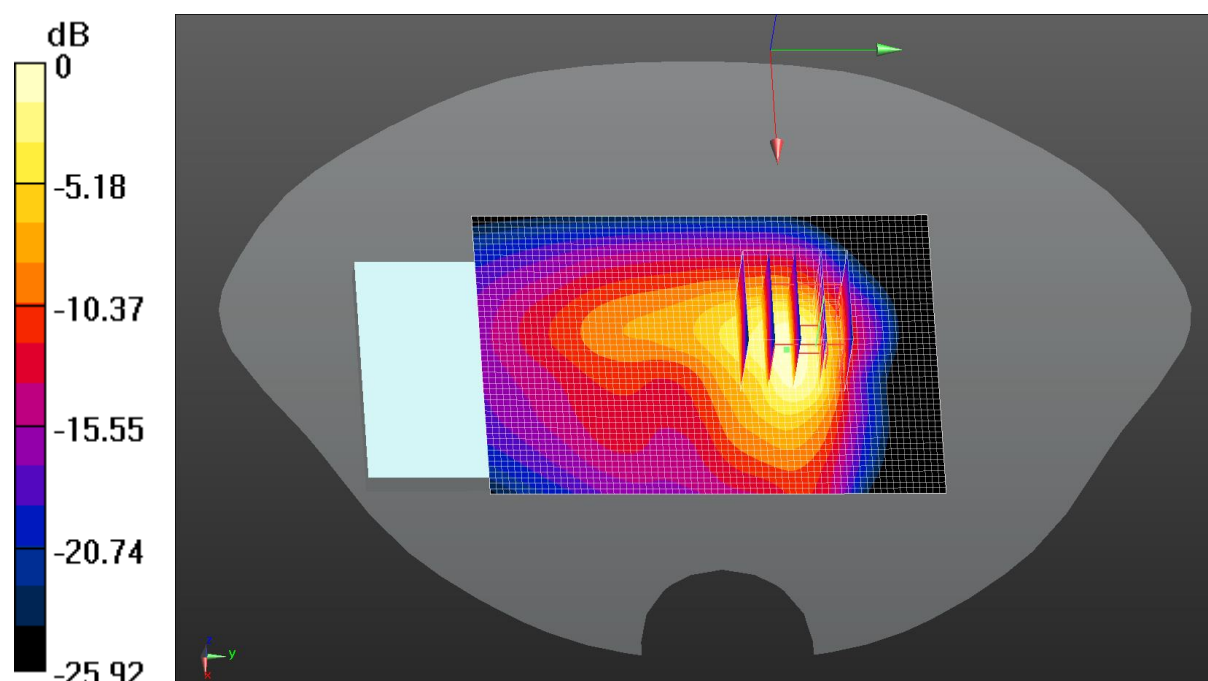
SAR(1 g) = 1.88 W/kg; SAR(10 g) = 0.856 W/kg

Maximum value of SAR (measured) = 3.12 W/kg

LTE Band 1 1RB(20MHz) Body Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 4.43 W/kg



0 dB = 4.43 W/kg = 6.46 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 20:16:47

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1747.5 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1747.5$ MHz; $\sigma = 1.344$ S/m; $\epsilon_r = 40.286$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 3 1RB(20MHz) Body Back/Middle Channel/Zoom Scan

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

Reference Value = 12.77 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 4.75 W/kg

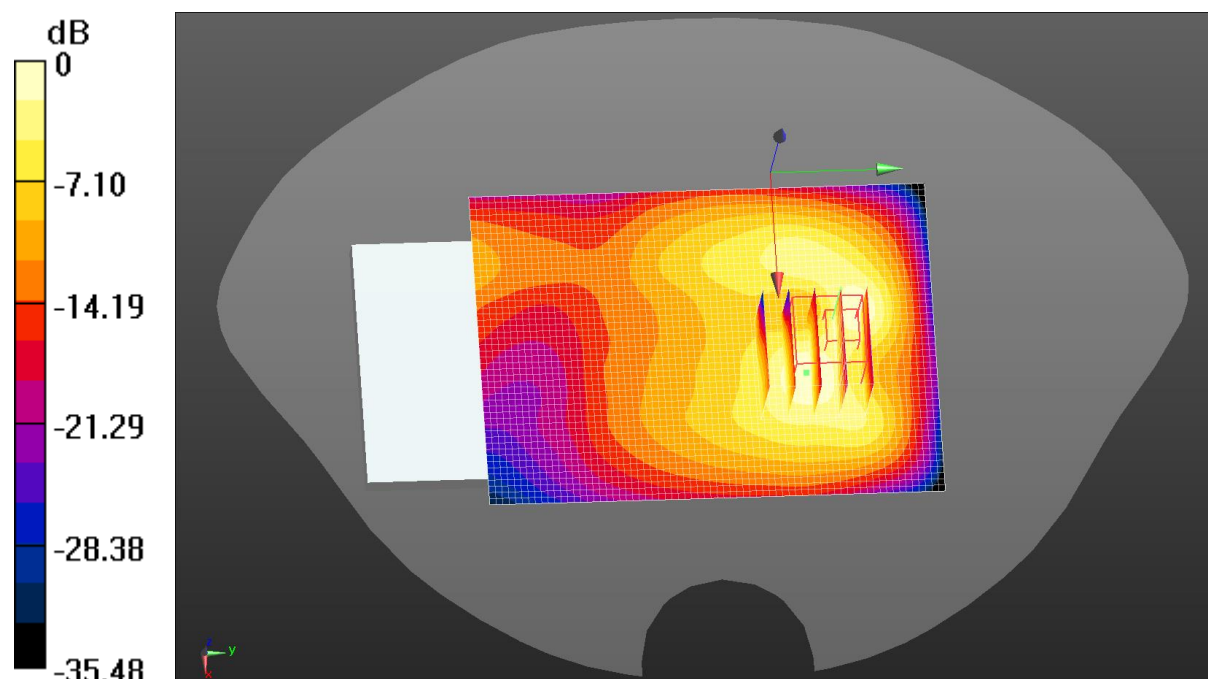
SAR(1 g) = 1.59 W/kg; SAR(10 g) = 0.666 W/kg

Maximum value of SAR (measured) = 3.03 W/kg

LTE Band 3 1RB(20MHz) Body Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 2.08 W/kg



0 dB = 2.08 W/kg = 3.18 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.29.2020 15:40:10

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 2510 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2510 \text{ MHz}$; $\sigma = 1.892 \text{ S/m}$; $\epsilon_r = 39.215$; $\rho = 1000 \text{ kg/m}^3$
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 7 1RB(20MHz) Body Back/Low Channel/Zoom Scan (5x5x7)/Cube

0: Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 38.15 V/m; Power Drift = -0.06 dB

Peak SAR (extrapolated) = 5.55 W/kg

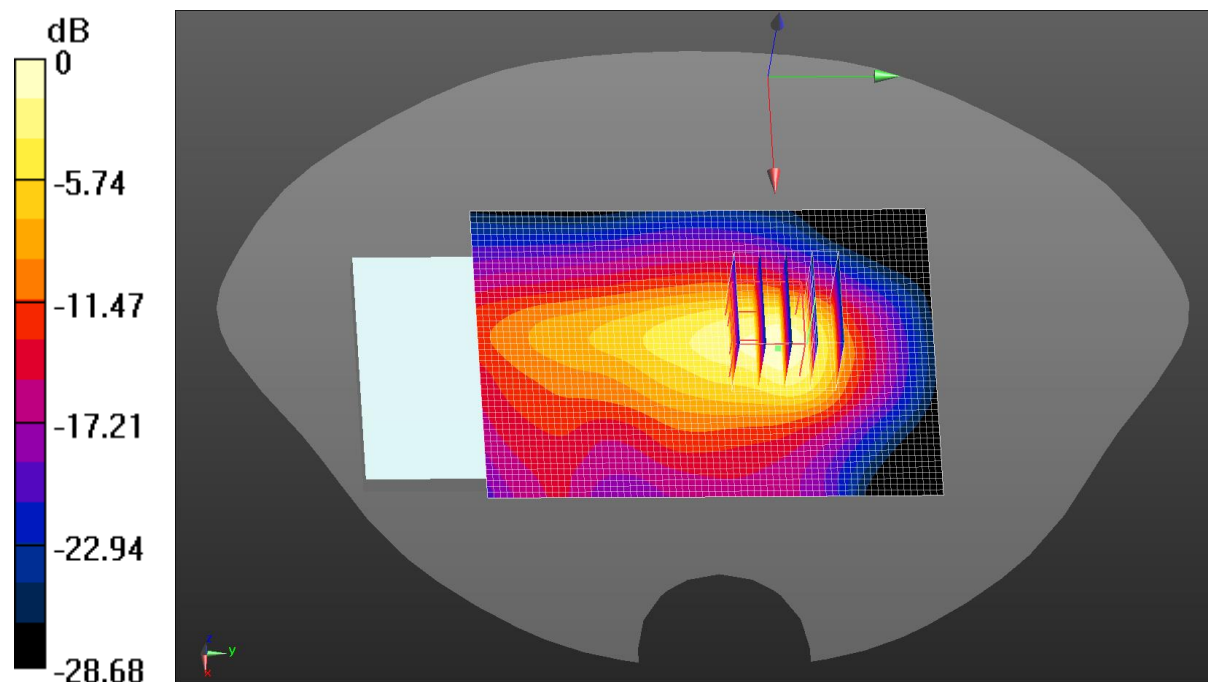
SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.05 W/kg

Maximum value of SAR (measured) = 4.03 W/kg

LTE Band 7 1RB(20MHz) Body Back/Low Channel/Area Scan (51x71x1):

Interpolated grid: $dx=1.500 \text{ mm}$, $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 6.21 W/kg



0 dB = 6.21 W/kg = 7.93 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 14:23:59

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 897.5 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 897.5$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 41.716$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 8 1RB(10MHz) Body Back/Middle Channel/Zoom Scan

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

Reference Value = 11.42 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 0.678 W/kg

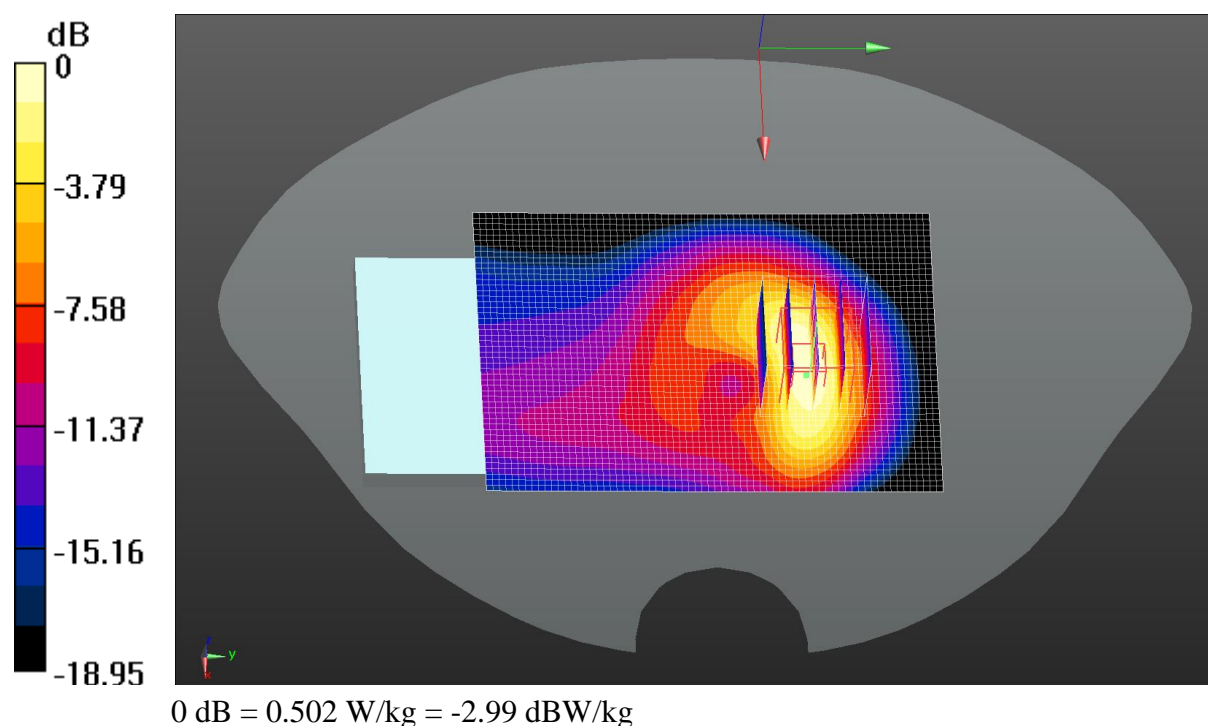
SAR(1 g) = 0.312 W/kg; SAR(10 g) = 0.155 W/kg

Maximum value of SAR (measured) = 0.491 W/kg

LTE Band 8 1RB(10MHz) Body Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 0.502 W/kg



Test Laboratory: CCIS

Date/Time: 06.18.2020 16:12:18

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 847 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 847$ MHz; $\sigma = 0.897$ S/m; $\epsilon_r = 42.05$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.67, 9.67, 9.67); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 20 1RB(20MHz) Body Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: $dx=2.000$ mm, $dy=2.000$ mm

Maximum value of SAR (interpolated) = 0.629 W/kg

LTE Band 20 1RB(20MHz) Body Back/Middle Channel/Zoom Scan

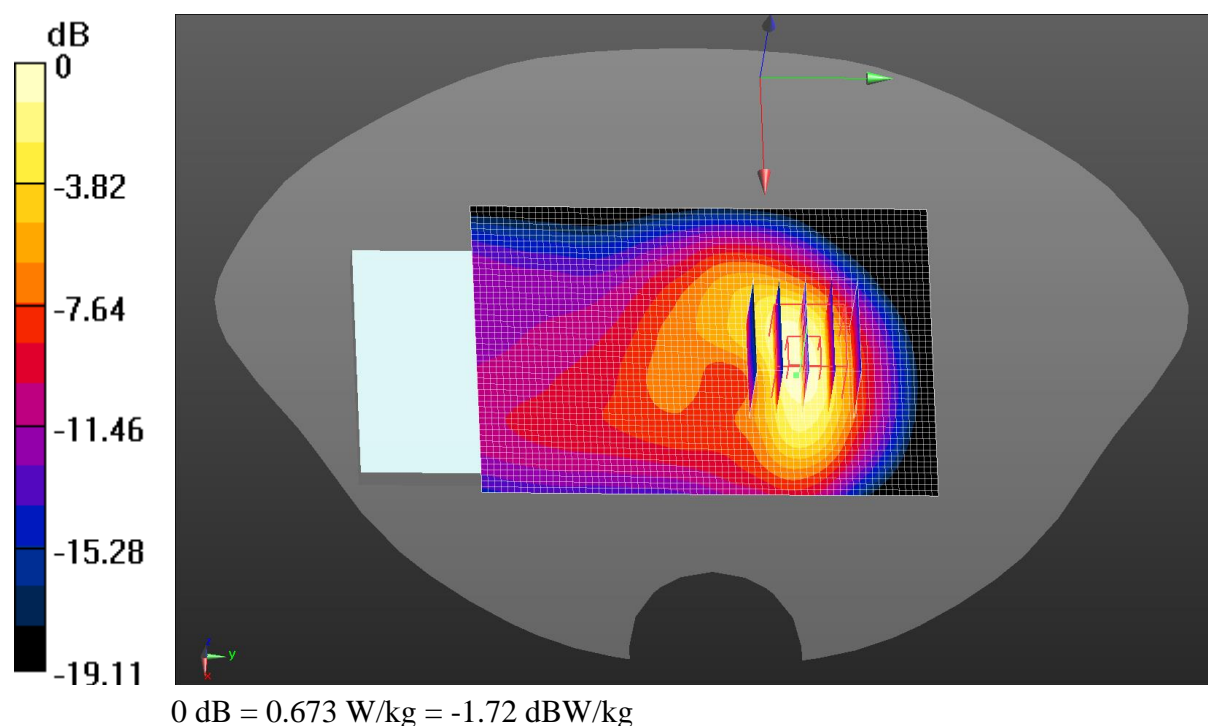
(5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 14.20 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.865 W/kg

SAR(1 g) = 0.391 W/kg; SAR(10 g) = 0.195 W/kg

Maximum value of SAR (measured) = 0.673 W/kg



Test Laboratory: CCIS

Date/Time: 06.20.2020 10:04:16

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);

Frequency: 2442 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2442$ MHz; $\sigma = 1.776$ S/m; $\epsilon_r = 39.784$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WIFI Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 6.787 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.467 W/kg

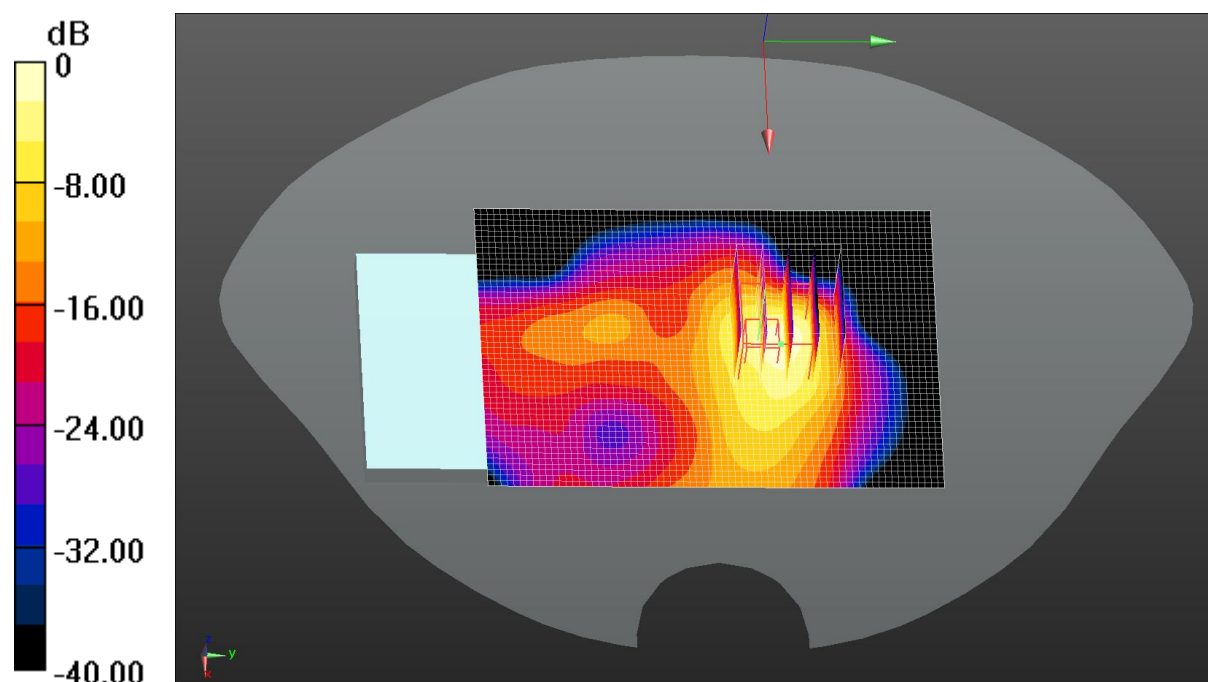
SAR(1 g) = 0.200 W/kg; SAR(10 g) = 0.091 W/kg

Maximum value of SAR (measured) = 0.361 W/kg

WIFI Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 0.655 W/kg



0 dB = 0.655 W/kg = -1.84 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 19:46:31

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GPRS(4 Slots) (0); Frequency: 902 MHz; Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 902 \text{ MHz}$; $\sigma = 0.978 \text{ S/m}$; $\epsilon_r = 41.674$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GPRS 900 4Slots Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 15.09 V/m; Power Drift = -0.04 dB

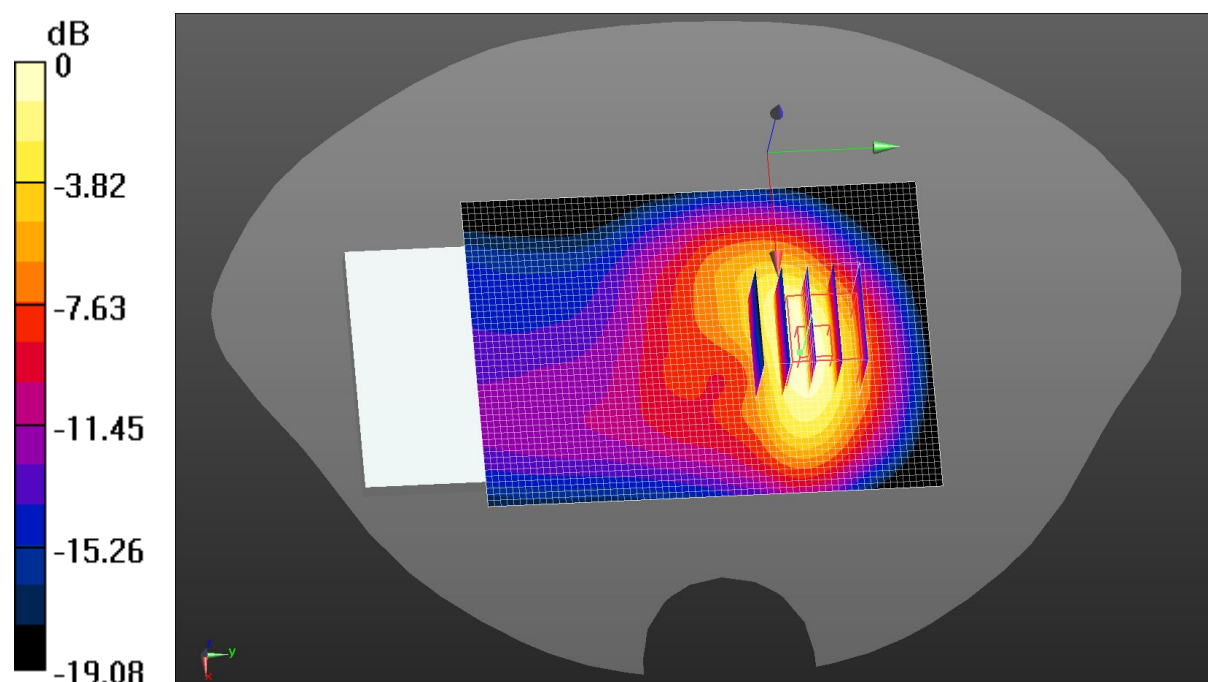
Peak SAR (extrapolated) = 1.37 W/kg

SAR(1 g) = 0.607 W/kg; SAR(10 g) = 0.300 W/kg

Maximum value of SAR (measured) = 1.03 W/kg

GPRS 900 4Slots Body Back/Middle Channel/Area Scan (51x71x1): Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.978 W/kg



0 dB = 0.978 W/kg = -0.10 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 16:15:09

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GPRS(4 Slots) (0); Frequency: 1747.8 MHz; Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 1747.8$ MHz; $\sigma = 1.344$ S/m; $\epsilon_r = 40.286$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GPRS 1800 4Slots Body Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 2.25 W/kg

GPRS 1800 4Slots Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

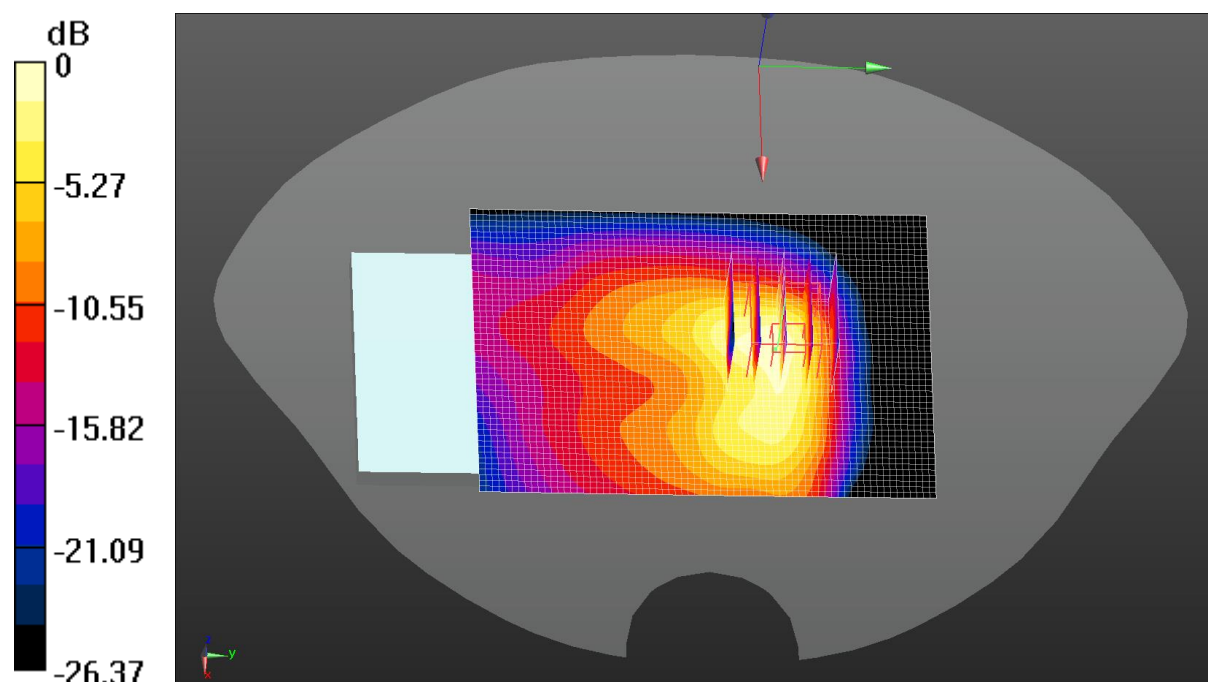
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.80 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 2.83 W/kg

SAR(1 g) = 1.26 W/kg; SAR(10 g) = 0.558 W/kg

Maximum value of SAR (measured) = 2.23 W/kg



0 dB = 2.23 W/kg = 3.48 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 20:52:27

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GPRS(4 Slots) (0); Frequency: 902 MHz; Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 902 \text{ MHz}$; $\sigma = 0.978 \text{ S/m}$; $\epsilon_r = 41.674$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GPRS 900 4Slots Limb Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 16.30 V/m; Power Drift = -0.04 dB

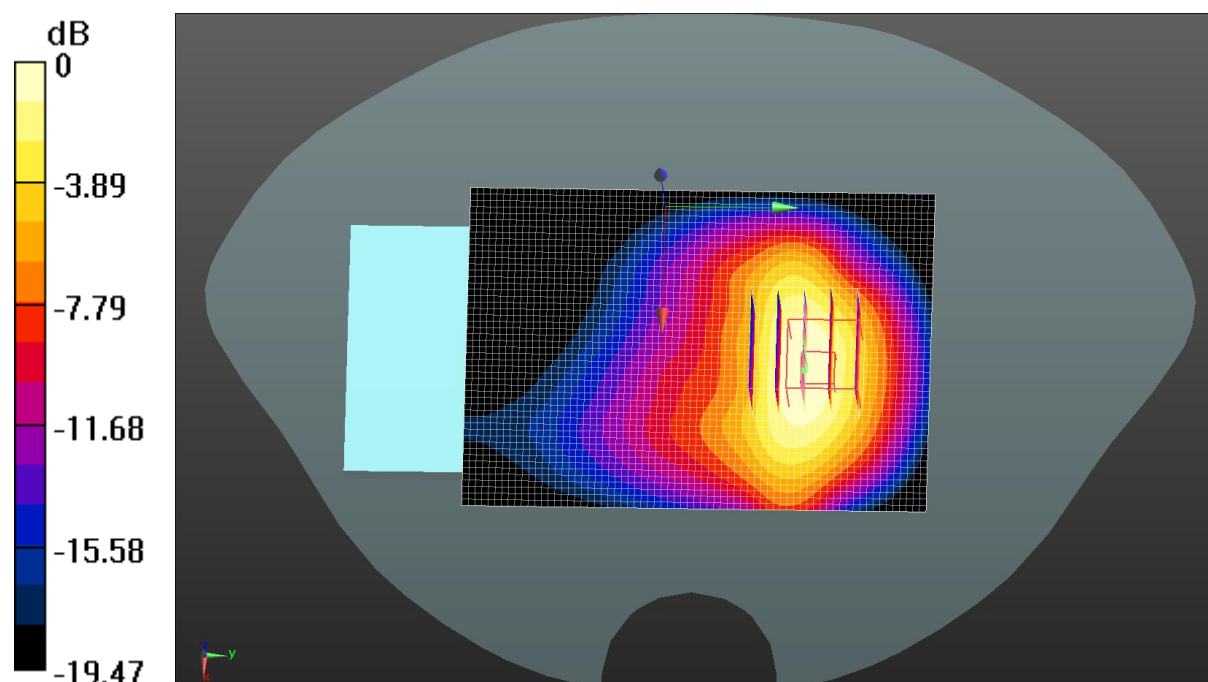
Peak SAR (extrapolated) = 4.22 W/kg

SAR(1 g) = 1.63 W/kg; SAR(10 g) = 0.740 W/kg

Maximum value of SAR (measured) = 2.87 W/kg

GPRS 900 4Slots Limb Back/Middle Channel/Area Scan (51x71x1): Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 1.78 W/kg



0 dB = 1.78 W/kg = 2.50 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 17:24:15

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, GPRS(4 Slots) (0); Frequency: 1747.8 MHz; Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 1747.8 \text{ MHz}$; $\sigma = 1.344 \text{ S/m}$; $\epsilon_r = 40.286$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

GPRS 1800 4Slots Limb Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 7.57 W/kg

GPRS 1800 4Slots Limb Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

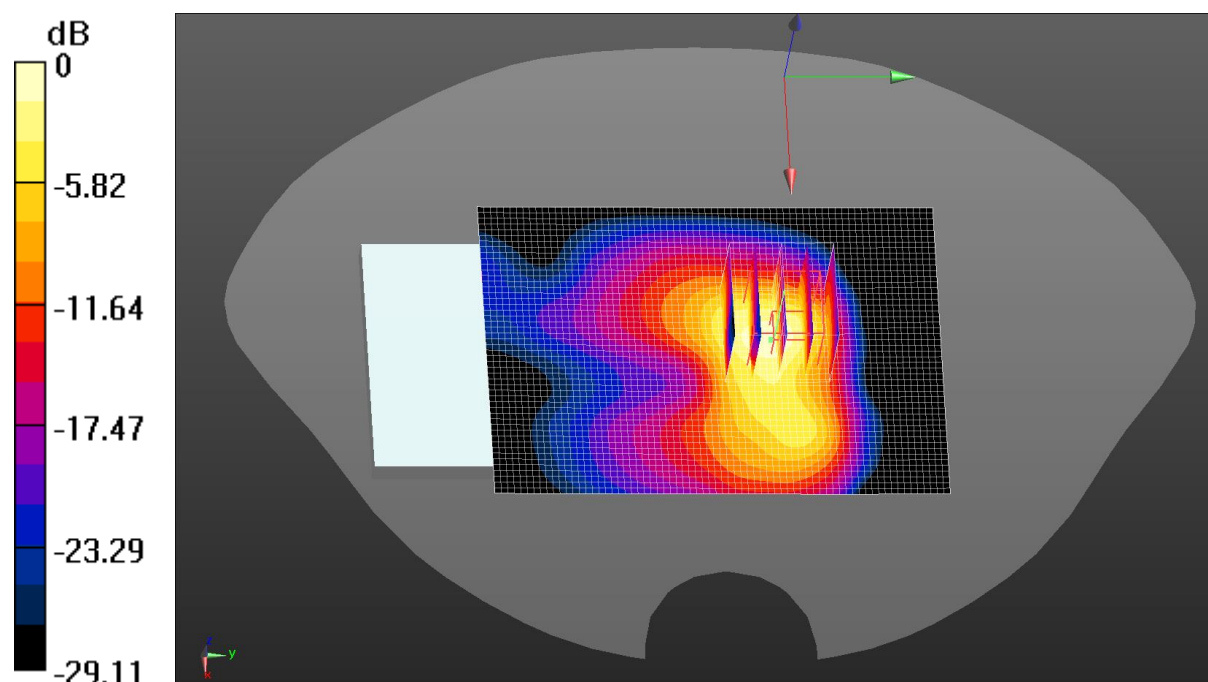
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 30.64 V/m ; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 12.7 W/kg

SAR(1 g) = 4.73 W/kg ; SAR(10 g) = 1.95 W/kg

Maximum value of SAR (measured) = 8.39 W/kg



0 dB = 8.39 W/kg = 9.24 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 14:52:42

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 1977.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1977.6$ MHz; $\sigma = 1.423$ S/m; $\epsilon_r = 39.304$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 2100 Limb Back/High Channel/Area Scan (51x71x1): Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 7.88 W/kg

WCDMA 2100 Limb Back/High Channel/Zoom Scan (5x5x7)/Cube 0:

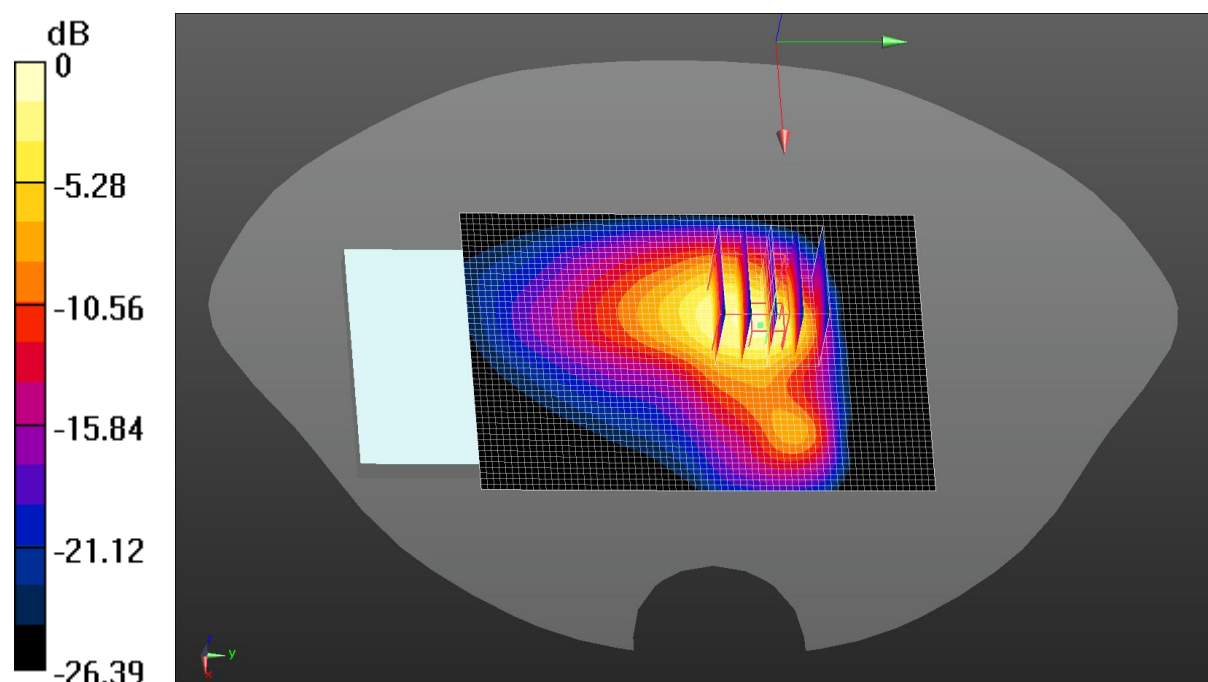
Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 40.54 V/m; Power Drift = 0.35 dB

Peak SAR (extrapolated) = 14.1 W/kg

SAR(1 g) = 5.17 W/kg; SAR(10 g) = 2.58 W/kg

Maximum value of SAR (measured) = 10.2 W/kg



0 dB = 10.2 W/kg = 10.09 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 22:30:08

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, UMTS-FDD(WCDMA) (0); Frequency: 897.6 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 897.6 \text{ MHz}$; $\sigma = 0.974 \text{ S/m}$; $\epsilon_r = 41.716$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WCDMA 900 Limb Back/Middle Channel/Area Scan (51x71x1): Interpolated grid: $dx=2.000 \text{ mm}$, $dy=2.000 \text{ mm}$

Maximum value of SAR (interpolated) = 0.916 W/kg

WCDMA 900 Limb Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:

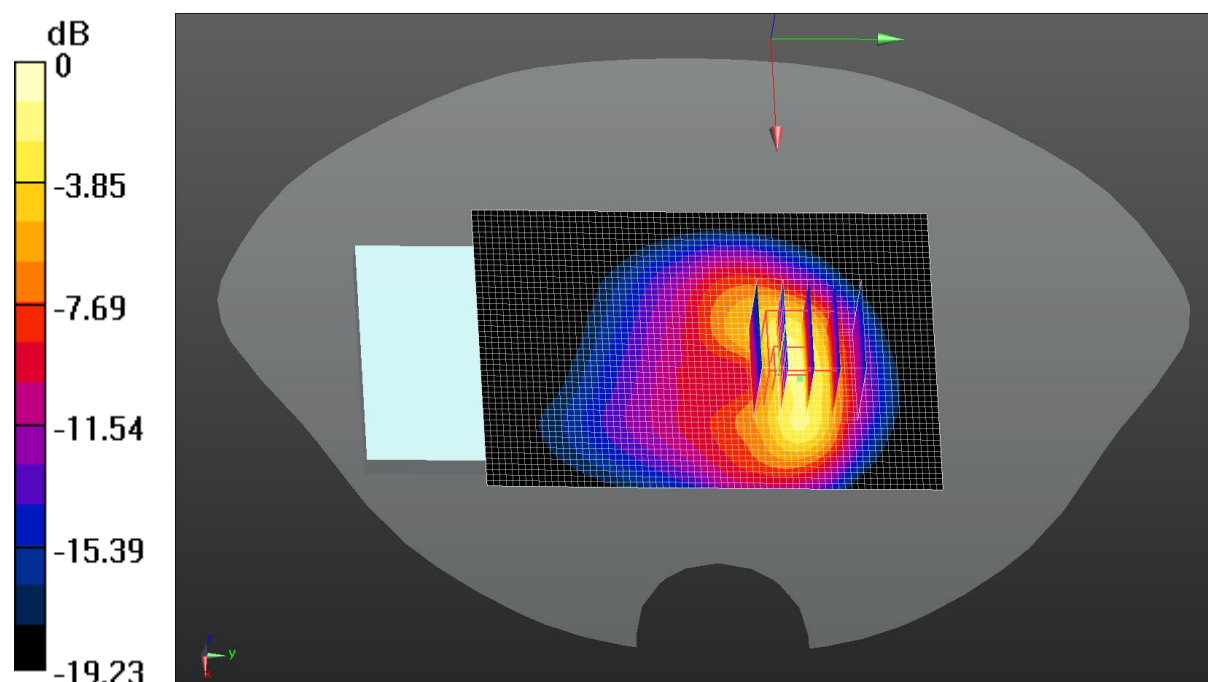
Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$

Reference Value = 14.60 V/m ; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 2.28 W/kg

SAR(1 g) = 0.862 W/kg ; SAR(10 g) = 0.395 W/kg

Maximum value of SAR (measured) = 1.46 W/kg



0 dB = 1.46 W/kg = 1.64 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 23:44:38

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1970 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 1970$ MHz; $\sigma = 1.422$ S/m; $\epsilon_r = 39.31$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.17, 8.17, 8.17); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 1 1RB(20MHz) Limb Back/High Channel/Zoom Scan (5x5x7)/Cube

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

Reference Value = 55.05 V/m; Power Drift = 0.22 dB

Peak SAR (extrapolated) = 16.3 W/kg

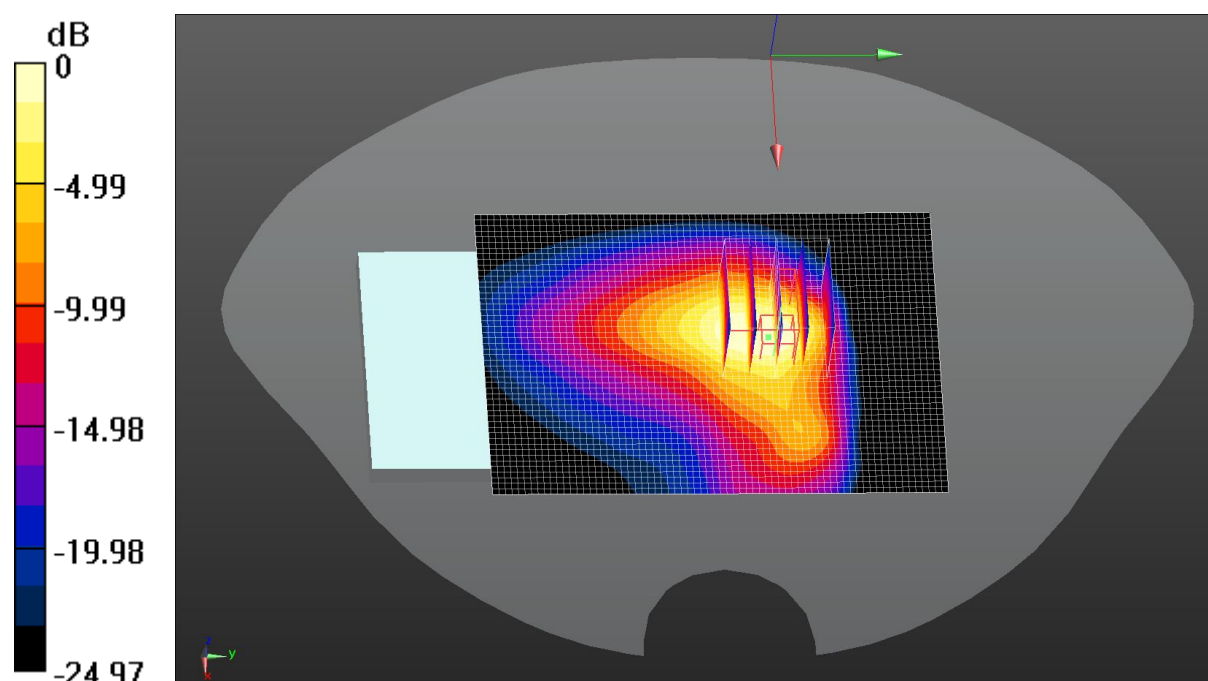
SAR(1 g) = 6.37 W/kg; SAR(10 g) = 3.1 W/kg

Maximum value of SAR (measured) = 11.8 W/kg

LTE Band 1 1RB(20MHz) Limb Back/High Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 9.63 W/kg



0 dB = 9.63 W/kg = 9.84 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.23.2020 21:43:48

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 1775 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 1775$ MHz; $\sigma = 1.356$ S/m; $\epsilon_r = 40.015$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(8.4, 8.4, 8.4); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 3 1RB(20MHz) Limb Back/High Channel/Zoom Scan (5x5x7)/Cube**0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.33 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 17.3 W/kg

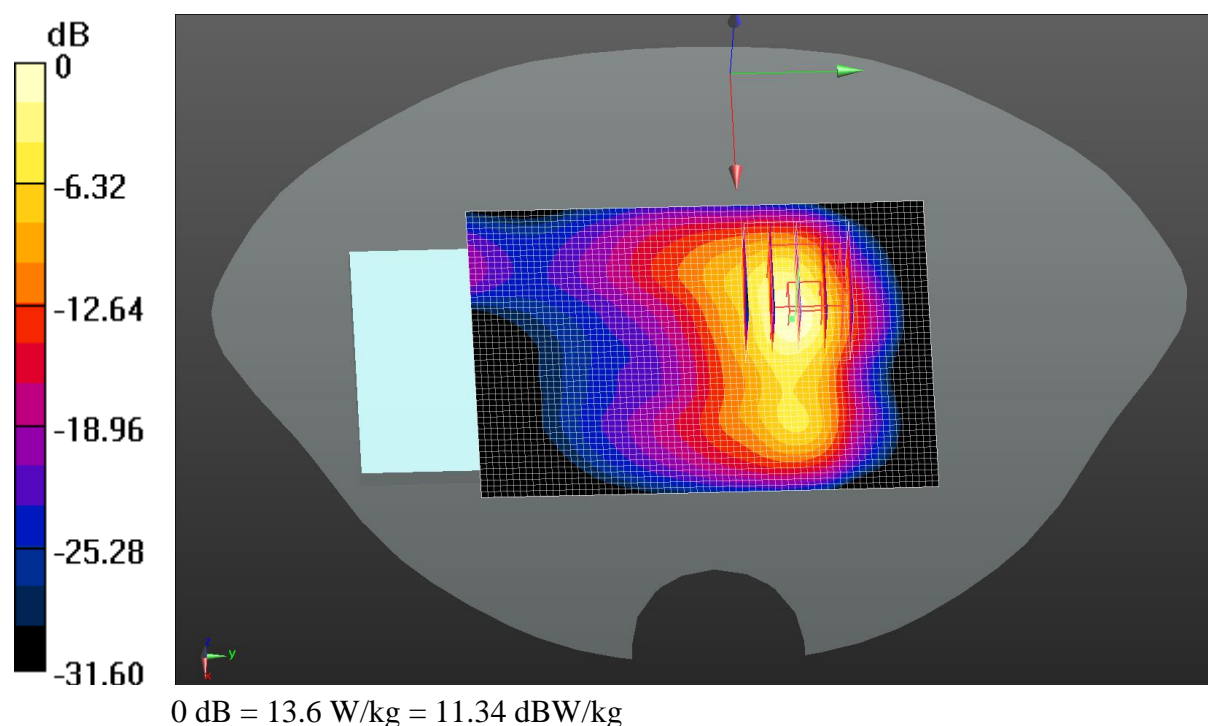
SAR(1 g) = 6.14 W/kg; SAR(10 g) = 2.45 W/kg

Maximum value of SAR (measured) = 11.7 W/kg

LTE Band 3 1RB(20MHz) Limb Back/High Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 13.6 W/kg



Test Laboratory: CCIS

Date/Time: 06.29.2020 14:16:54

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 2510 MHz; Duty Cycle: 1:1
Medium parameters used: $f = 2510$ MHz; $\sigma = 1.892$ S/m; $\epsilon_r = 39.215$; $\rho = 1000$ kg/m³
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 7 1RB(20MHz) Limb Back/Low Channel/Area Scan (51x71x1):

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

Maximum value of SAR (interpolated) = 13.7 W/kg

LTE Band 7 1RB(20MHz) Limb Back/Low Channel/Zoom Scan (5x5x7)/Cube

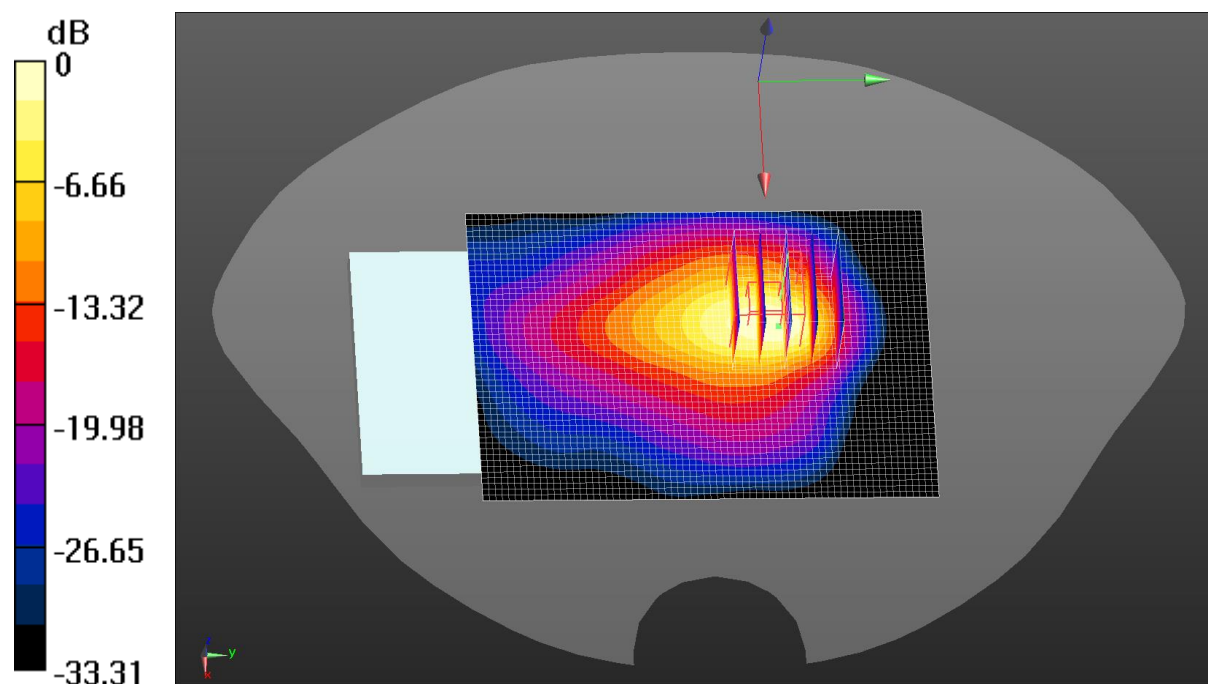
0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 32.16 V/m; Power Drift = 0.34 dB

Peak SAR (extrapolated) = 23.4 W/kg

SAR(1 g) = 6.89 W/kg; SAR(10 g) = 2.81 W/kg

Maximum value of SAR (measured) = 13.9 W/kg



0 dB = 13.9 W/kg = 11.43 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.18.2020 15:31:46

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 897.5 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 897.5$ MHz; $\sigma = 0.974$ S/m; $\epsilon_r = 41.716$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.69, 9.69, 9.69); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 8 1RB(10MHz) Limb Back/Middle Channel/Zoom Scan

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

Reference Value = 14.58 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 2.59 W/kg

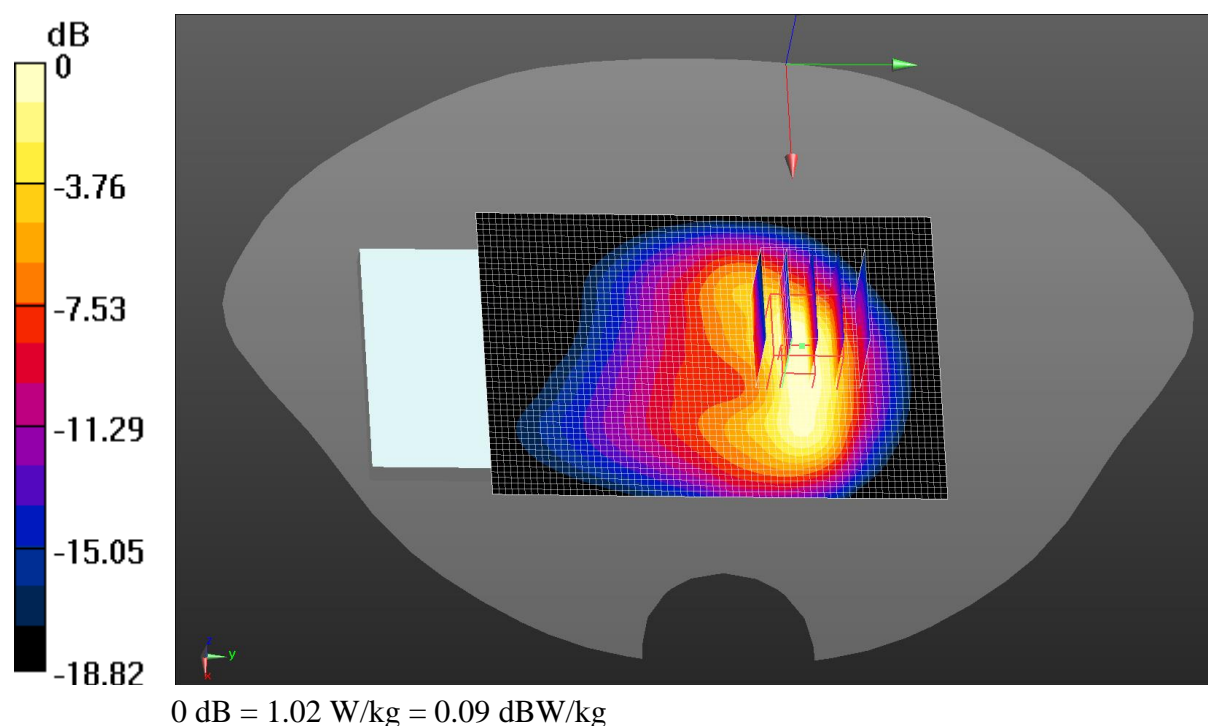
SAR(1 g) = 0.898 W/kg; SAR(10 g) = 0.399 W/kg

Maximum value of SAR (measured) = 1.59 W/kg

LTE Band 8 1RB(10MHz) Limb Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: dx=2.000 mm, dy=2.000 mm

Maximum value of SAR (interpolated) = 1.02 W/kg



Test Laboratory: CCIS

Date/Time: 06.18.2020 16:54:12

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, LTE-FDD(EU) (0); Frequency: 847 MHz; Duty Cycle: 1:1
Medium parameters used (interpolated): $f = 847$ MHz; $\sigma = 0.897$ S/m; $\epsilon_r = 42.05$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(9.67, 9.67, 9.67); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

LTE Band 20 1RB(20MHz) Limb Back/Middle Channel/Area Scan (51x71x1):

Interpolated grid: $dx=2.000$ mm, $dy=2.000$ mm

Maximum value of SAR (interpolated) = 1.61 W/kg

LTE Band 20 1RB(20MHz) Limb Back/Middle Channel/Zoom Scan

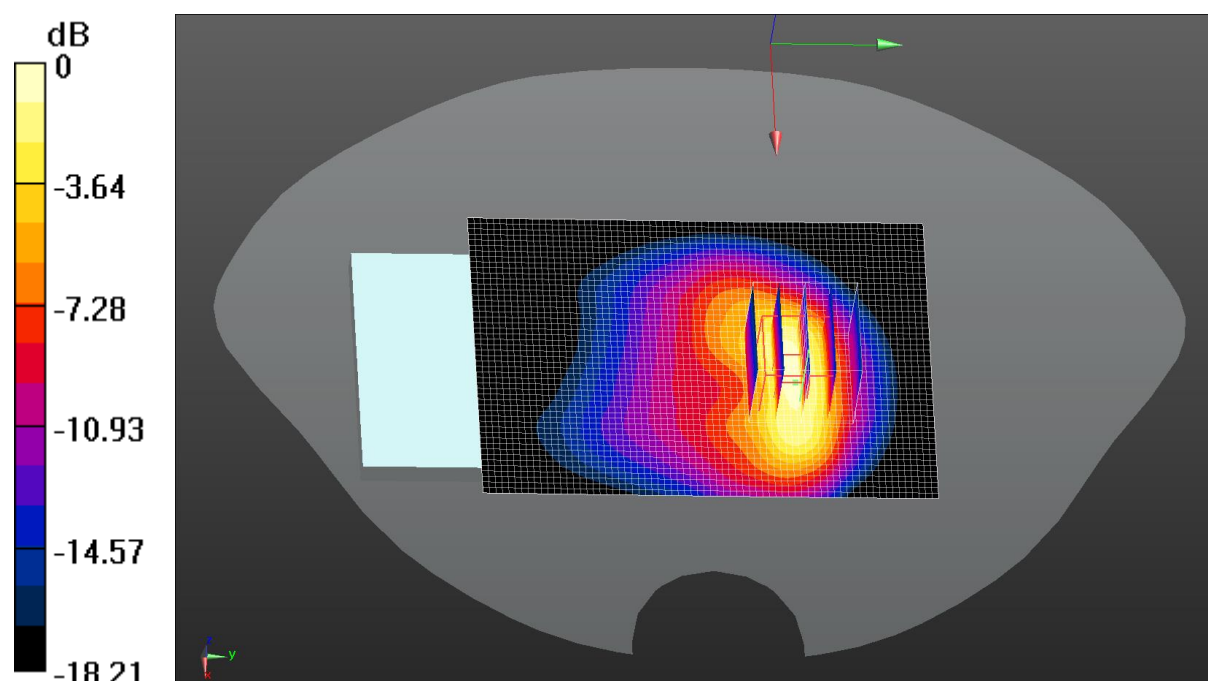
(5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 18.49 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 2.99 W/kg

SAR(1 g) = 1.19 W/kg; SAR(10 g) = 0.555 W/kg

Maximum value of SAR (measured) = 1.92 W/kg



0 dB = 1.92 W/kg = 2.83 dBW/kg

Test Laboratory: CCIS

Date/Time: 06.20.2020 11:05:12

DUT: Smart phone; Type: GT20; Serial: 1#

Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);

Frequency: 2442 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2442$ MHz; $\sigma = 1.776$ S/m; $\epsilon_r = 39.784$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3924; ConvF(7.54, 7.54, 7.54); Calibrated: 08.30.2019;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 08.09.2019
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

WIFI Limb Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid:

$dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 9.261 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 1.24 W/kg

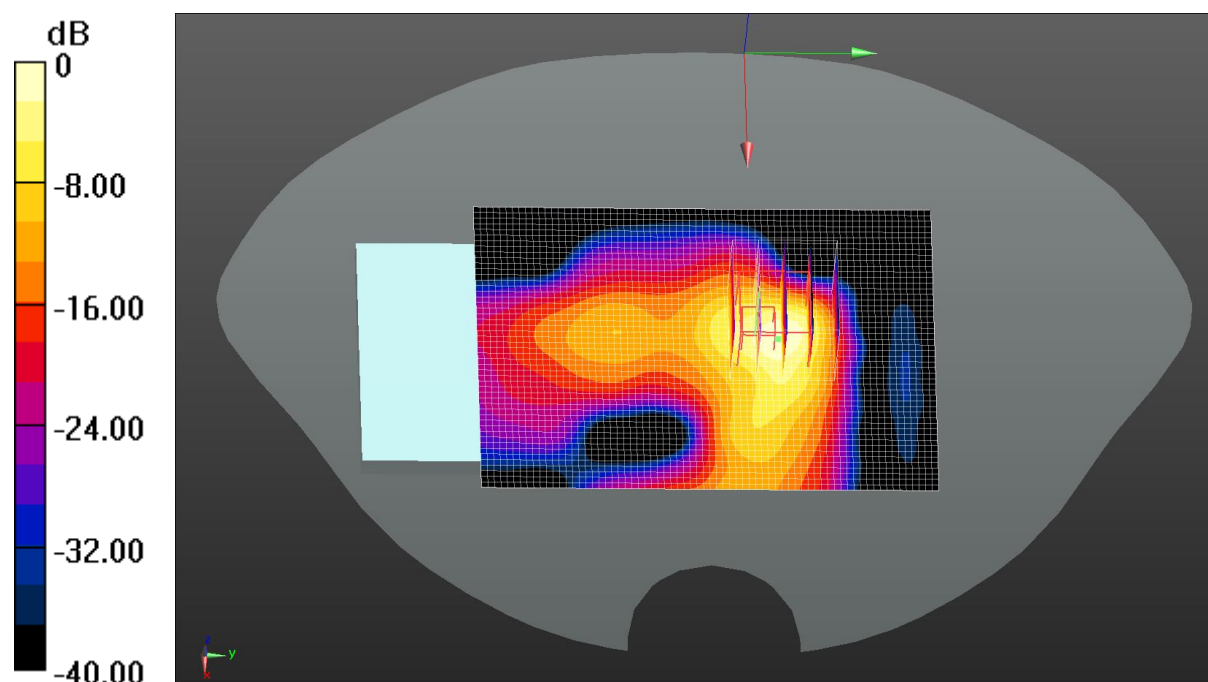
SAR(1 g) = 0.397 W/kg; SAR(10 g) = 0.189 W/kg

Maximum value of SAR (measured) = 0.757 W/kg

WIFI Limb Back/Middle Channel/Area Scan (51x71x1): Interpolated grid:

$dx=1.500$ mm, $dy=1.500$ mm

Maximum value of SAR (interpolated) = 1.38 W/kg



0 dB = 1.38 W/kg = 1.40 dBW/kg

Appendix E: System Calibration Certificate

Calibration information for E-field probes



In Collaboration with
s p e a g
CALIBRATION LABORATORY



中国认可
国际互认
校准
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CNAS L0570

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Client

CCIS

Certificate No: Z19-60260

CALIBRATION CERTIFICATE

Object

EX3DV4 - SN:3924

Calibration Procedure(s)

FF-Z11-004-01

Calibration Procedures for Dosimetric E-field Probes

Calibration date:

August 30, 2019

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101547	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101548	18-Jun-19 (CTTL, No.J19X05125)	Jun-20
Reference10dBAttenuator	18N50W-10dB	09-Feb-18(CTTL, No.J18X01133)	Feb-20
Reference20dBAttenuator	18N50W-20dB	09-Feb-18(CTTL, No.J18X01132)	Feb-20
Reference Probe EX3DV4	SN 7307	24-May-19(SPEAG,No.EX3-7307_May19)	May-20
DAE4	SN 1331	06-Feb-19(SPEAG, No.DAE4-1331_Feb19)	Feb -20
DAE4	SN 917	07-Dec-18(SPEAG, No.DAE4-917_Dec18)	Dec -19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGeneratorMG3700A	6201052605	18-Jun-19 (CTTL, No.J19X05127)	Jun-20
Network Analyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan -20

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: August 31, 2019

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z19-60260

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Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A,B,C,D	modulation dependent linearization parameters
Polarization Φ	Φ rotation around probe axis
Polarization θ	θ rotation around an axis that is in the plane normal to probe axis (at measurement center), i $\theta=0$ is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
- IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\theta=0$ ($f \leq 900\text{MHz}$ in TEM-cell; $f > 1800\text{MHz}$: waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E^2 -field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCP_{x,y,z}**: DCP is numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- PAR**: PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}; A,B,C** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800\text{MHz}$) and inside waveguide using analytical field distributions based on power measurements for $f > 800\text{MHz}$. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty valued are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from $\pm 50\text{MHz}$ to $\pm 100\text{MHz}$.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- Connector Angle**: The angle is assessed using the information gained by determining the NORM_x (no uncertainty required).



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Probe EX3DV4

SN: 3924

Calibrated: August 30, 2019

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3924

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$) ^A	0.50	0.42	0.67	±10.0%
DCP(mV) ^B	101.3	100.5	100.2	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB/ μV	C	D dB	VR mV	Unc ^E (k=2)
0	CW	X	0.0	0.0	1.0	0.00	181.3	±2.3%
		Y	0.0	0.0	1.0		161.5	
		Z	0.0	0.0	1.0		206.8	

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

^A The uncertainties of Norm X, Y, Z do not affect the E²-field uncertainty inside TSL (see Page 5 and Page 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3924

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	41.9	0.89	10.07	10.07	10.07	0.40	0.80	±12.1%
835	41.5	0.90	9.67	9.67	9.67	0.16	1.34	±12.1%
900	41.5	0.97	9.69	9.69	9.69	0.20	1.20	±12.1%
1750	40.1	1.37	8.40	8.40	8.40	0.22	1.07	±12.1%
1900	40.0	1.40	8.17	8.17	8.17	0.28	0.97	±12.1%
2300	39.5	1.67	7.85	7.85	7.85	0.46	0.76	±12.1%
2450	39.2	1.80	7.54	7.54	7.54	0.51	0.75	±12.1%
2600	39.0	1.96	7.30	7.30	7.30	0.60	0.69	±12.1%
5250	35.9	4.71	5.48	5.48	5.48	0.40	1.40	±13.3%
5600	35.5	5.07	4.86	4.86	4.86	0.40	1.40	±13.3%
5750	35.4	5.22	4.98	4.98	4.98	0.45	1.40	±13.3%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3924

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz] ^C	Relative Permittivity ^F	Conductivity (S/m) ^F	ConvF X	ConvF Y	ConvF Z	Alpha ^G	Depth ^G (mm)	Unct. (k=2)
750	55.5	0.96	10.07	10.07	10.07	0.17	1.40	± 12.1%
835	55.2	0.97	9.72	9.72	9.72	0.19	1.34	± 12.1%
900	55.0	1.05	9.75	9.75	9.75	0.24	1.14	± 12.1%
1750	53.4	1.49	8.12	8.12	8.12	0.23	1.06	± 12.1%
1900	53.3	1.52	7.83	7.83	7.83	0.23	1.08	± 12.1%
2300	52.9	1.81	7.66	7.66	7.66	0.49	0.88	± 12.1%
2450	52.7	1.95	7.51	7.51	7.51	0.56	0.80	± 12.1%
2600	52.5	2.16	7.26	7.26	7.26	0.64	0.71	± 12.1%
5250	48.9	5.36	4.90	4.90	4.90	0.40	1.70	± 13.3%
5600	48.5	5.77	4.28	4.28	4.28	0.50	1.30	± 13.3%
5750	48.3	5.94	4.32	4.32	4.32	0.55	1.50	± 13.3%

^C Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

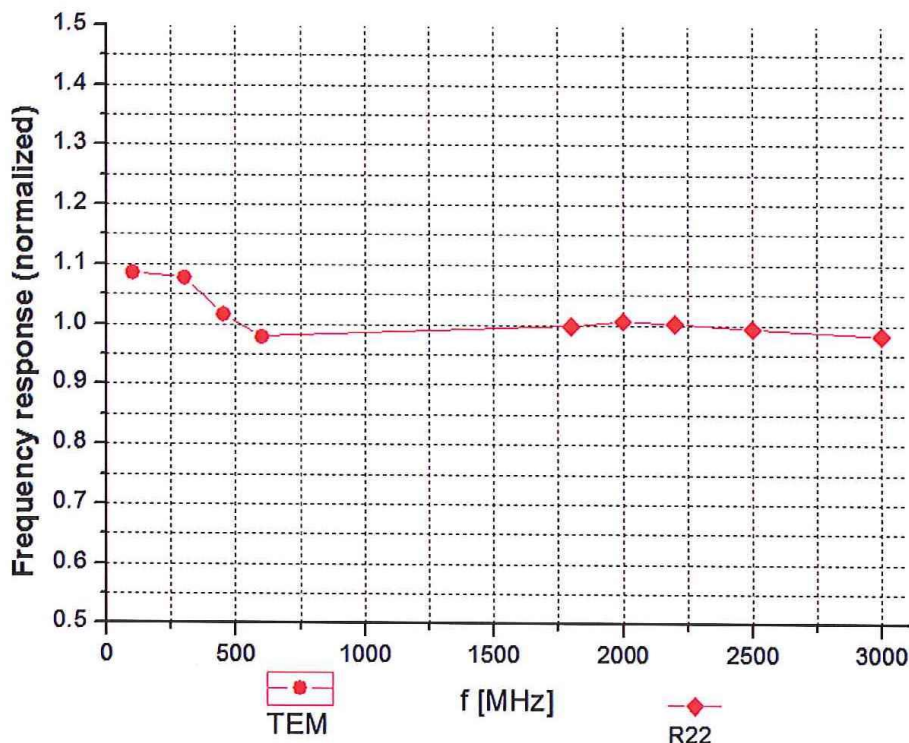
^F At frequency below 3 GHz, the validity of tissue parameters (ϵ and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ϵ and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.



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Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)

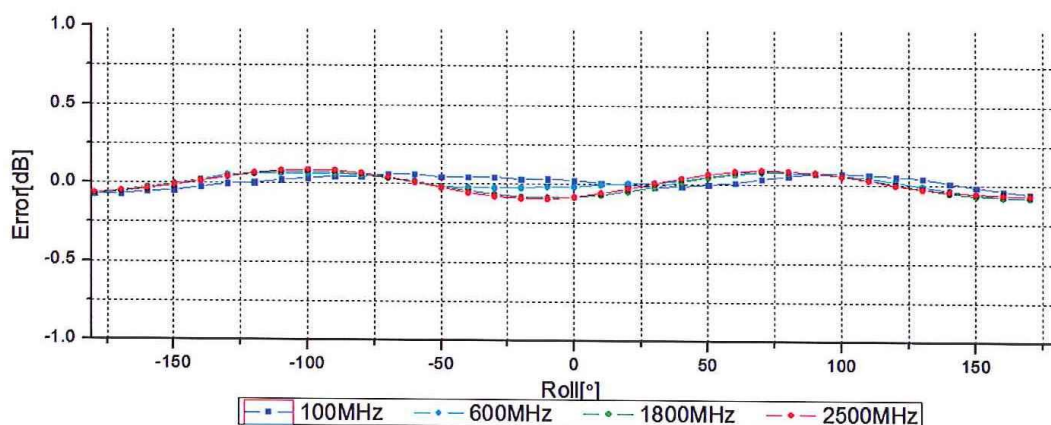
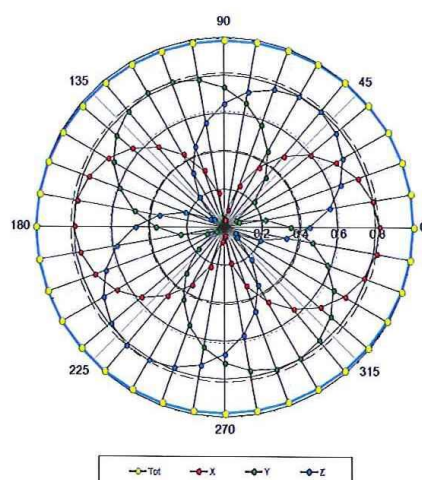
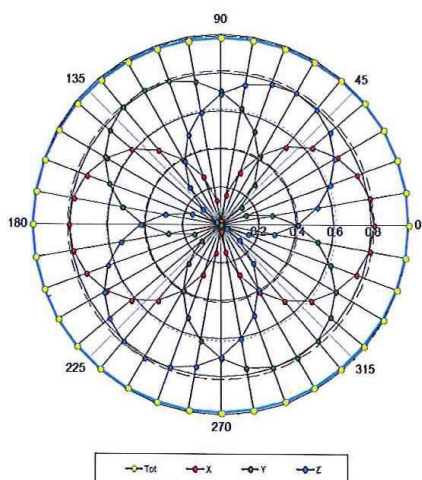


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Receiving Pattern (Φ), $\theta=0^\circ$

f=600 MHz, TEM

f=1800 MHz, R22

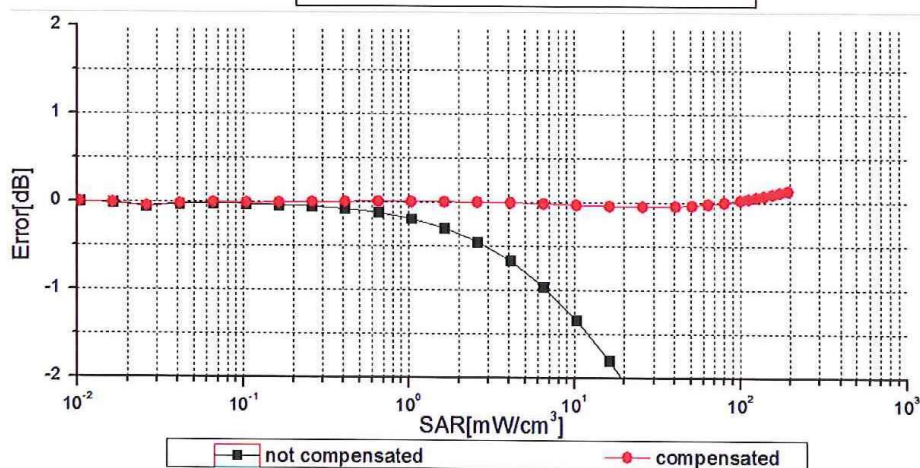
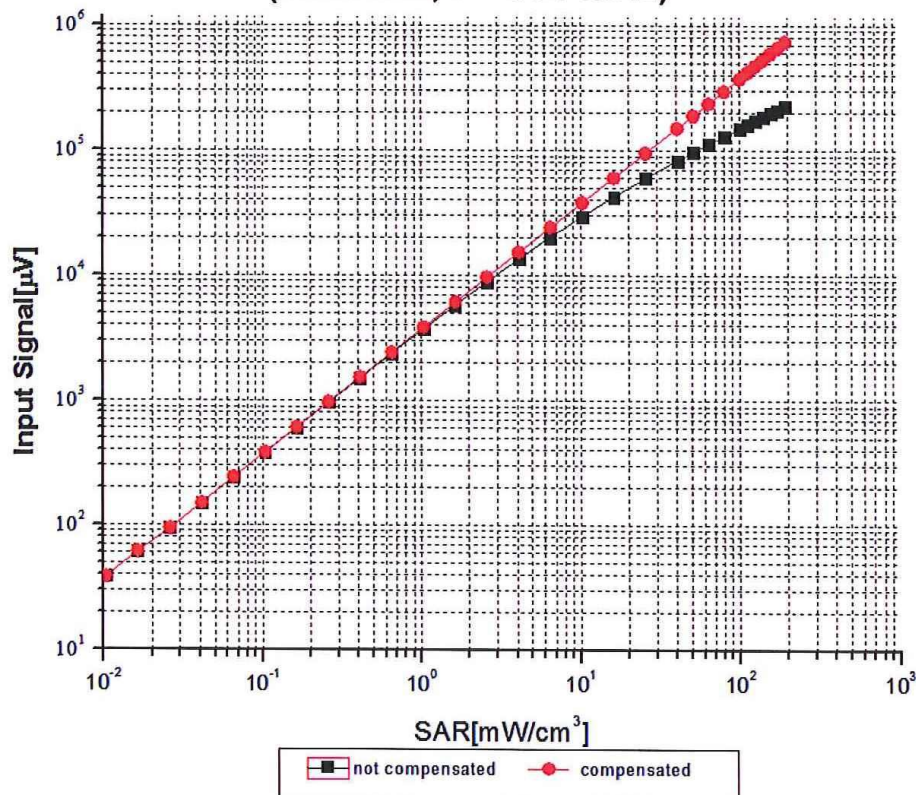


Uncertainty of Axial Isotropy Assessment: $\pm 1.2\%$ ($k=2$)



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Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



Uncertainty of Linearity Assessment: $\pm 0.9\%$ (k=2)

Certificate No: Z19-60260

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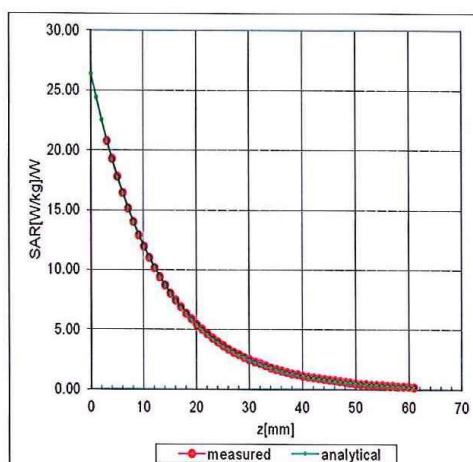
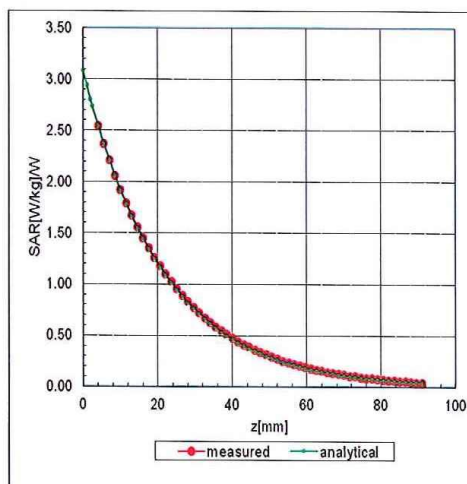


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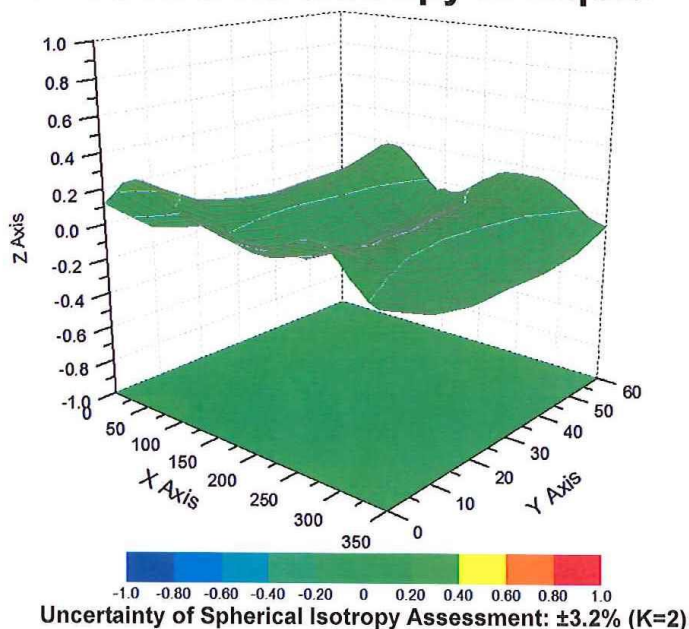
Conversion Factor Assessment

f=750 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid





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 E-mail: cttl@chinattl.com [Http://www.chinattl.cn](http://www.chinattl.cn)

DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3924

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	159.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

Calibration information for Dipole



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中国认可
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CNAS L0570

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Client

CCIS

Certificate No:

Z19-60175

CALIBRATION CERTIFICATE

Object

D835V2 - SN: 4d154

Calibration Procedure(s)

FF-Z11-003-01

Calibration Procedures for dipole validation kits

Calibration date:

June 11, 2019

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1556	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 14, 2019

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Certificate No: Z19-60175

Page 1 of 8



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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.2.1504
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	41.1 \pm 6 %	0.89 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.49 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.57 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.33 W/kg \pm 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	55.0 \pm 6 %	0.97 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.40 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.57 W /kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.31 W/kg \pm 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9Ω- 3.09jΩ
Return Loss	- 29.0dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.3Ω- 4.87jΩ
Return Loss	- 24.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.277 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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DASY5 Validation Report for Head TSL

Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835$ MHz; $\sigma = 0.886$ S/m; $\epsilon_r = 41.12$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.09, 9.09, 9.09) @ 835 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

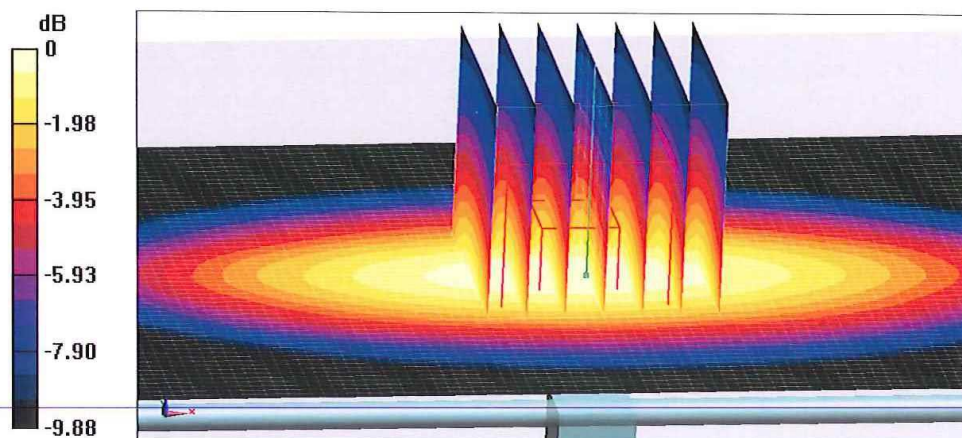
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 58.27 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.45 W/kg

SAR(1 g) = 2.35 W/kg; SAR(10 g) = 1.57 W/kg

Maximum value of SAR (measured) = 3.09 W/kg



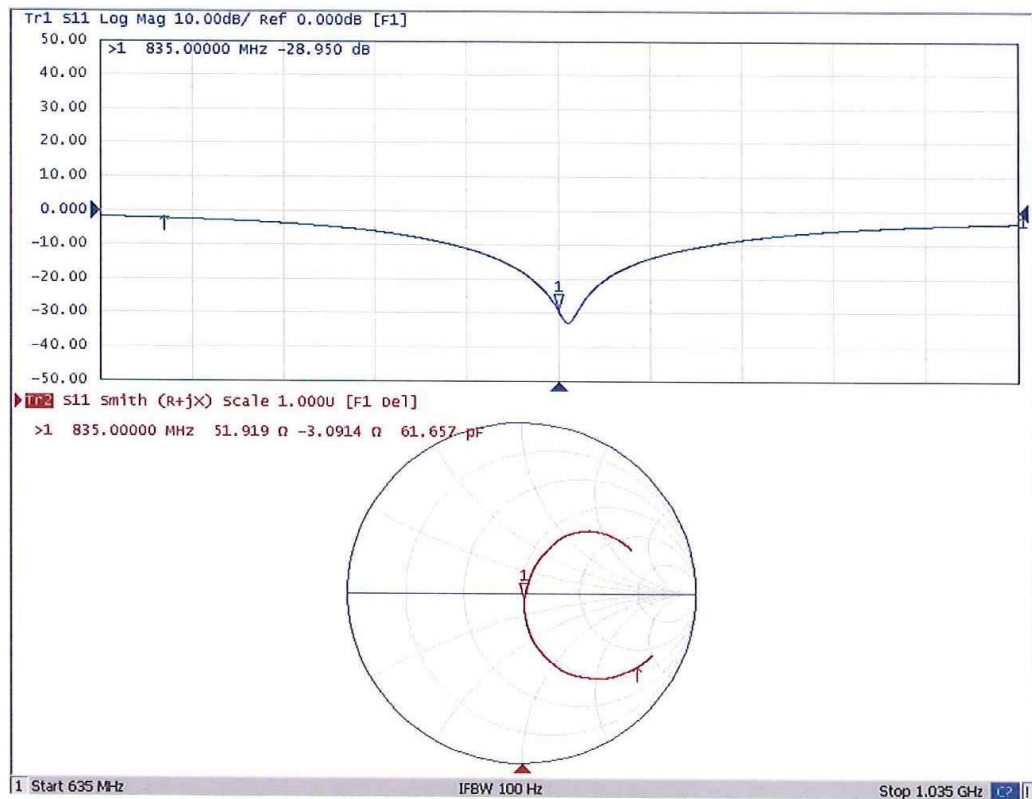
0 dB = 3.09 W/kg = 4.90 dBW/kg



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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 06.11.2019

Test Laboratory: CCTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.973 \text{ S/m}$; $\epsilon_r = 55$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(9.47, 9.47, 9.47) @ 835 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

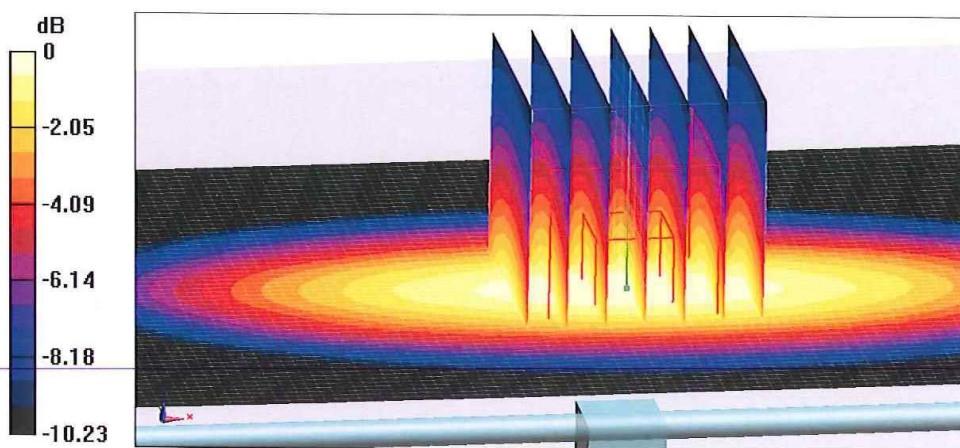
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 53.93 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.67 W/kg

SAR(1 g) = 2.4 W/kg; SAR(10 g) = 1.58 W/kg

Maximum value of SAR (measured) = 3.23 W/kg



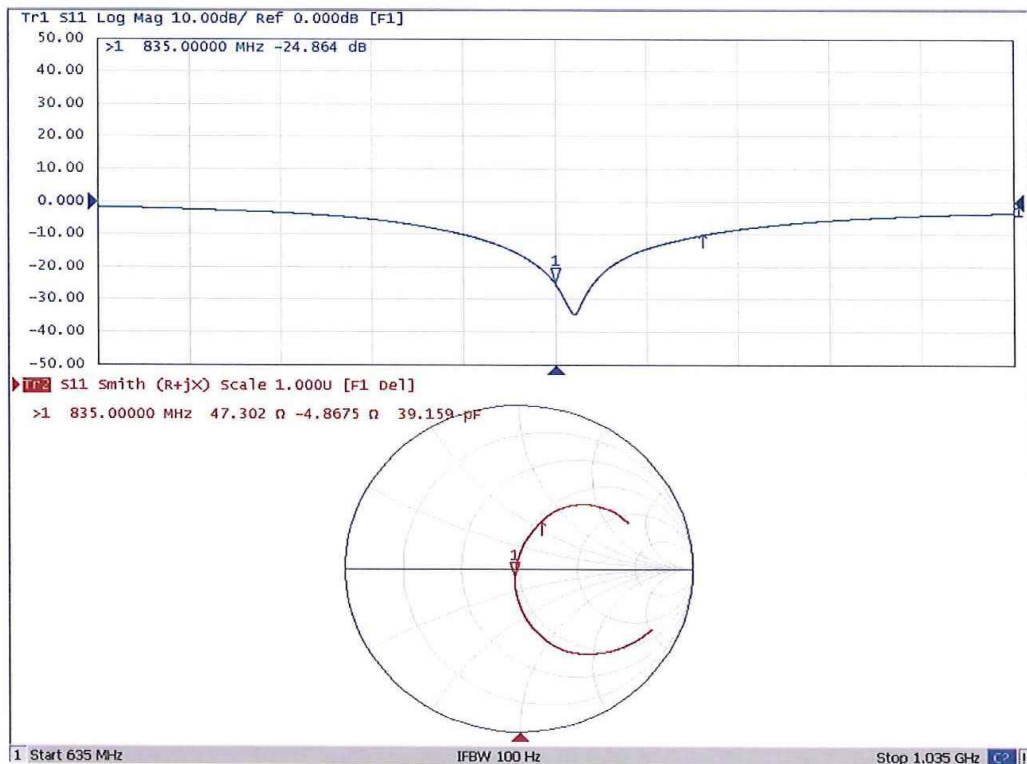
0 dB = 3.23 W/kg = 5.09 dBW/kg



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Impedance Measurement Plot for Body TSL





SAR Reference Dipole Calibration Report

Ref : ACR.93.5.17.SATU.A

WALTEK SERVICES(SHENZHEN) CO.,LTD
1/F., FUKANGTAI BUILDING, WEST BAIMA ROAD,
SONGGANG STREET
BAOAN DISTRICT, SHENZHEN GUANGDONG
518105, CHINA
MVG COMOSAR REFERENCE DIPOLE
FREQUENCY: 1800 MHZ
SERIAL NO.: SN 09/15 DIP 1G800-360

Calibrated at MVG US
2105 Barrett Park Dr. - Kennesaw, GA 30144



Calibration Date: 02/28/2018

Summary:

This document presents the method and results from an accredited SAR reference dipole calibration performed in MVG USA using the COMOSAR test bench. All calibration results are traceable to national metrology institutions.



SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

	<i>Name</i>	<i>Function</i>	<i>Date</i>	<i>Signature</i>
<i>Prepared by :</i>	Jérôme LUC	Product Manager	3/13/2018	<i>JS</i>
<i>Checked by :</i>	Jérôme LUC	Product Manager	3/13/2018	<i>JS</i>
<i>Approved by :</i>	Kim RUTKOWSKI	Quality Manager	3/13/2018	<i>Kim Rutkowski</i>

	<i>Customer Name</i>
<i>Distribution :</i>	Waltek Services (Shenzhen)Co., Ltd

<i>Issue</i>	<i>Date</i>	<i>Modifications</i>
A	3/13/2018	Initial release

Page: 2/11

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

1 INTRODUCTION

This document contains a summary of the requirements set forth by the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards for reference dipoles used for SAR measurement system validations and the measurements that were performed to verify that the product complies with the fore mentioned standards.

2 DEVICE UNDER TEST

Device Under Test	
Device Type	COMOSAR 1800 MHz REFERENCE DIPOLE
Manufacturer	MVG
Model	SID1800
Serial Number	SN 09/15 DIP 1G800-360
Product Condition (new / used)	New

A yearly calibration interval is recommended.

3 PRODUCT DESCRIPTION

3.1 GENERAL INFORMATION

MVG's COMOSAR Validation Dipoles are built in accordance to the IEEE 1528, FCC KDBs and CEI/IEC 62209 standards. The product is designed for use with the COMOSAR test bench only.



Figure 1 – MVG COMOSAR Validation Dipole

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4 MEASUREMENT METHOD

The IEEE 1528, FCC KDBs and CEI/IEC 62209 standards provide requirements for reference dipoles used for system validation measurements. The following measurements were performed to verify that the product complies with the fore mentioned standards.

4.1 RETURN LOSS REQUIREMENTS

The dipole used for SAR system validation measurements and checks must have a return loss of -20 dB or better. The return loss measurement shall be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards.

4.2 MECHANICAL REQUIREMENTS

The IEEE Std. 1528 and CEI/IEC 62209 standards specify the mechanical components and dimensions of the validation dipoles, with the dimensions frequency and phantom shell thickness dependent. The COMOSAR test bench employs a 2 mm phantom shell thickness therefore the dipoles sold for use with the COMOSAR test bench comply with the requirements set forth for a 2 mm phantom shell thickness.

5 MEASUREMENT UNCERTAINTY

All uncertainties listed below represent an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$, traceable to the Internationally Accepted Guides to Measurement Uncertainty.

5.1 RETURN LOSS

The following uncertainties apply to the return loss measurement:

Frequency band	Expanded Uncertainty on Return Loss
400-6000MHz	0.1 dB

5.2 DIMENSION MEASUREMENT

The following uncertainties apply to the dimension measurements:

Length (mm)	Expanded Uncertainty on Length
3 - 300	0.05 mm

5.3 VALIDATION MEASUREMENT

The guidelines outlined in the IEEE 1528, FCC KDBs, CENELEC EN50361 and CEI/IEC 62209 standards were followed to generate the measurement uncertainty for validation measurements.

Scan Volume	Expanded Uncertainty
1 g	20.3 %

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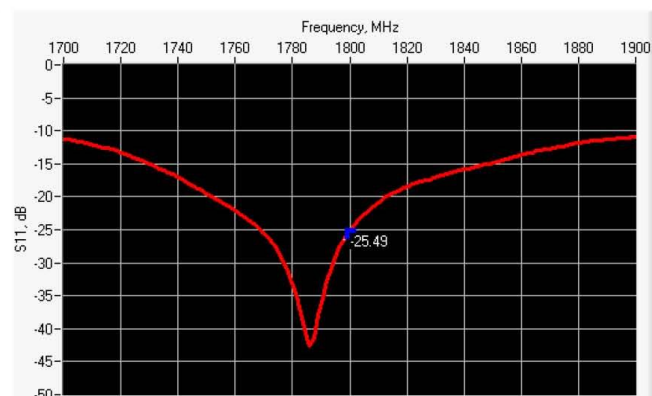
SAR REFERENCE DIPOLE CALIBRATION REPORT

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10 g	20.1 %
------	--------

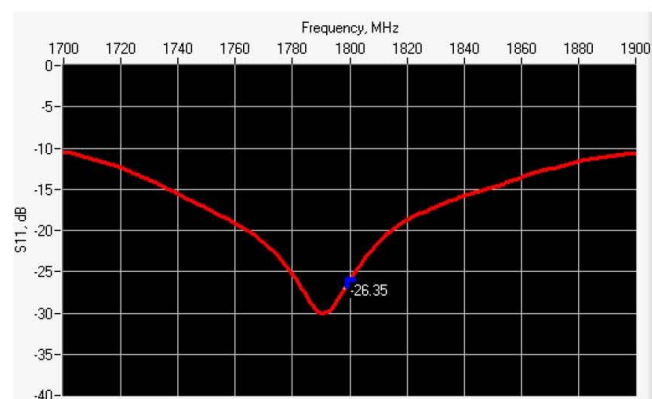
6 CALIBRATION MEASUREMENT RESULTS

6.1 RETURN LOSS AND IMPEDANCE IN HEAD LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-25.49	-20	$45.4 \Omega + 2.6 j\Omega$

6.2 RETURN LOSS AND IMPEDANCE IN BODY LIQUID



Frequency (MHz)	Return Loss (dB)	Requirement (dB)	Impedance
1800	-26.35	-20	$45.4 \Omega - 1.5 j\Omega$

6.3 MECHANICAL DIMENSIONS

Frequency MHz	L mm		h mm		d mm	
	required	measured	required	measured	required	measured
300	$420.0 \pm 1 \%$		$250.0 \pm 1 \%$		$6.35 \pm 1 \%$	

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450	290.0 ±1 %.		166.7 ±1 %.		6.35 ±1 %.	
750	176.0 ±1 %.		100.0 ±1 %.		6.35 ±1 %.	
835	161.0 ±1 %.		89.8 ±1 %.		3.6 ±1 %.	
900	149.0 ±1 %.		83.3 ±1 %.		3.6 ±1 %.	
1450	89.1 ±1 %.		51.7 ±1 %.		3.6 ±1 %.	
1500	80.5 ±1 %.		50.0 ±1 %.		3.6 ±1 %.	
1640	79.0 ±1 %.		45.7 ±1 %.		3.6 ±1 %.	
1750	75.2 ±1 %.		42.9 ±1 %.		3.6 ±1 %.	
1800	72.0 ±1 %.	PASS	41.7 ±1 %.	PASS	3.6 ±1 %.	PASS
1900	68.0 ±1 %.		39.5 ±1 %.		3.6 ±1 %.	
1950	66.3 ±1 %.		38.5 ±1 %.		3.6 ±1 %.	
2000	64.5 ±1 %.		37.5 ±1 %.		3.6 ±1 %.	
2100	61.0 ±1 %.		35.7 ±1 %.		3.6 ±1 %.	
2300	55.5 ±1 %.		32.6 ±1 %.		3.6 ±1 %.	
2450	51.5 ±1 %.		30.4 ±1 %.		3.6 ±1 %.	
2600	48.5 ±1 %.		28.8 ±1 %.		3.6 ±1 %.	
3000	41.5 ±1 %.		25.0 ±1 %.		3.6 ±1 %.	
3500	37.0 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	
3700	34.7 ±1 %.		26.4 ±1 %.		3.6 ±1 %.	

7 VALIDATION MEASUREMENT

The IEEE Std. 1528, FCC KDBs and CEI/IEC 62209 standards state that the system validation measurements must be performed using a reference dipole meeting the fore mentioned return loss and mechanical dimension requirements. The validation measurement must be performed against a liquid filled flat phantom, with the phantom constructed as outlined in the fore mentioned standards. Per the standards, the dipole shall be positioned below the bottom of the phantom, with the dipole length centered and parallel to the longest dimension of the flat phantom, with the top surface of the dipole at the described distance from the bottom surface of the phantom.

7.1 HEAD LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
300	45.3 ±5 %		0.87 ±5 %	
450	43.5 ±5 %		0.87 ±5 %	
750	41.9 ±5 %		0.89 ±5 %	
835	41.5 ±5 %		0.90 ±5 %	
900	41.5 ±5 %		0.97 ±5 %	
1450	40.5 ±5 %		1.20 ±5 %	
1500	40.4 ±5 %		1.23 ±5 %	
1640	40.2 ±5 %		1.31 ±5 %	
1750	40.1 ±5 %		1.37 ±5 %	

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1800	40.0 ±5 %	PASS	1.40 ±5 %	PASS
1900	40.0 ±5 %		1.40 ±5 %	
1950	40.0 ±5 %		1.40 ±5 %	
2000	40.0 ±5 %		1.40 ±5 %	
2100	39.8 ±5 %		1.49 ±5 %	
2300	39.5 ±5 %		1.67 ±5 %	
2450	39.2 ±5 %		1.80 ±5 %	
2600	39.0 ±5 %		1.96 ±5 %	
3000	38.5 ±5 %		2.40 ±5 %	
3500	37.9 ±5 %		2.91 ±5 %	

7.2 SAR MEASUREMENT RESULT WITH HEAD LIQUID

The IEEE Std. 1528 and CEI/IEC 62209 standards state that the system validation measurements should produce the SAR values shown below (for phantom thickness of 2 mm), within the uncertainty for the system validation. All SAR values are normalized to 1 W forward power. In bracket, the measured SAR is given with the used input power.

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Head Liquid Values: eps' : 41.7 sigma : 1.46
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)		10 g SAR (W/kg/W)	
	required	measured	required	measured
300	2.85		1.94	
450	4.58		3.06	
750	8.49		5.55	
835	9.56		6.22	
900	10.9		6.99	
1450	29		16	
1500	30.5		16.8	
1640	34.2		18.4	
1750	36.4		19.3	
1800	38.4	38.76 (3.88)	20.1	20.29 (2.03)

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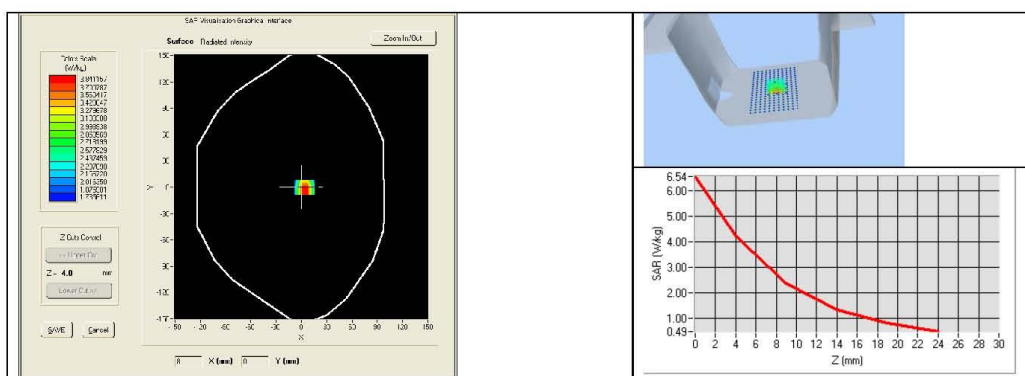
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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

1900	39.7		20.5	
1950	40.5		20.9	
2000	41.1		21.1	
2100	43.6		21.9	
2300	48.7		23.3	
2450	52.4		24	
2600	55.3		24.6	
3000	63.8		25.7	
3500	67.1		25	
3700	67.4		24.2	



7.3 BODY LIQUID MEASUREMENT

Frequency MHz	Relative permittivity (ϵ_r')		Conductivity (σ) S/m	
	required	measured	required	measured
150	61.9 \pm 5 %		0.80 \pm 5 %	
300	58.2 \pm 5 %		0.92 \pm 5 %	
450	56.7 \pm 5 %		0.94 \pm 5 %	
750	55.5 \pm 5 %		0.96 \pm 5 %	
835	55.2 \pm 5 %		0.97 \pm 5 %	
900	55.0 \pm 5 %		1.05 \pm 5 %	
915	55.0 \pm 5 %		1.06 \pm 5 %	
1450	54.0 \pm 5 %		1.30 \pm 5 %	
1610	53.8 \pm 5 %		1.40 \pm 5 %	
1800	53.3 \pm 5 %	PASS	1.52 \pm 5 %	PASS
1900	53.3 \pm 5 %		1.52 \pm 5 %	
2000	53.3 \pm 5 %		1.52 \pm 5 %	
2100	53.2 \pm 5 %		1.62 \pm 5 %	

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SAR REFERENCE DIPOLE CALIBRATION REPORT

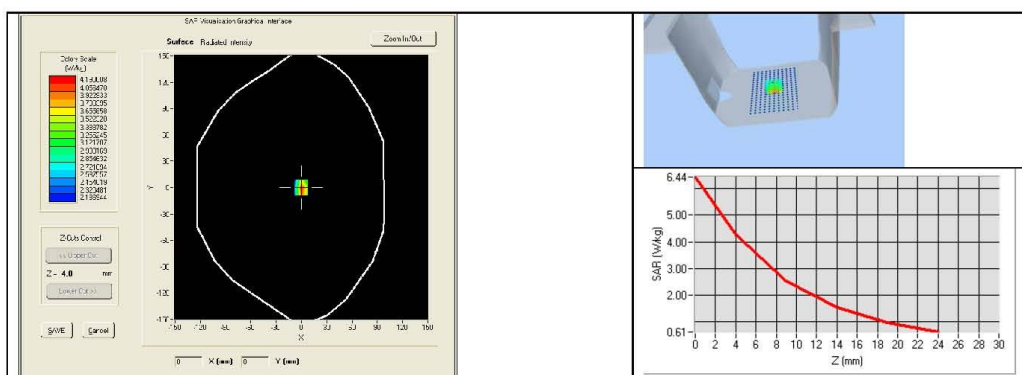
Ref: ACR.93.5.17.SATU.A

2300	52.9 ±5 %		1.81 ±5 %	
2450	52.7 ±5 %		1.95 ±5 %	
2600	52.5 ±5 %		2.16 ±5 %	
3000	52.0 ±5 %		2.73 ±5 %	
3500	51.3 ±5 %		3.31 ±5 %	
3700	51.0 ±5 %		3.55 ±5 %	
5200	49.0 ±10 %		5.30 ±10 %	
5300	48.9 ±10 %		5.42 ±10 %	
5400	48.7 ±10 %		5.53 ±10 %	
5500	48.6 ±10 %		5.65 ±10 %	
5600	48.5 ±10 %		5.77 ±10 %	
5800	48.2 ±10 %		6.00 ±10 %	

7.4 SAR MEASUREMENT RESULT WITH BODY LIQUID

Software	OPENSAR V4
Phantom	SN 20/09 SAM71
Probe	SN 18/11 EPG122
Liquid	Body Liquid Values: eps' : 53.9 sigma : 1.46
Distance between dipole center and liquid	10.0 mm
Area scan resolution	dx=8mm/dy=8mm
Zoon Scan Resolution	dx=8mm/dy=8mm/dz=5mm
Frequency	1800 MHz
Input power	20 dBm
Liquid Temperature	21 °C
Lab Temperature	21 °C
Lab Humidity	45 %

Frequency MHz	1 g SAR (W/kg/W)	10 g SAR (W/kg/W)
	measured	measured
1800	38.90 (3.89)	20.84 (2.08)



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SAR REFERENCE DIPOLE CALIBRATION REPORT

Ref: ACR.93.5.17.SATU.A

8 LIST OF EQUIPMENT

Equipment Summary Sheet				
Equipment Description	Manufacturer / Model	Identification No.	Current Calibration Date	Next Calibration Date
SAM Phantom	MVG	SN-20/09-SAM71	Validated. No cal required.	Validated. No cal required.
COMOSAR Test Bench	Version 3	NA	Validated. No cal required.	Validated. No cal required.
Network Analyzer	Rhode & Schwarz ZVA	SN100132	02/2016	02/2019
Calipers	Carrera	CALIPER-01	01/2017	01/2020
Reference Probe	MVG	EPG122 SN 18/11	10/2017	10/2018
Multimeter	Keithley 2000	1188656	01/2017	01/2020
Signal Generator	Agilent E4438C	MY49070581	01/2017	01/2020
Amplifier	Aethercomm	SN 046	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Power Meter	HP E4418A	US38261498	01/2017	01/2020
Power Sensor	HP ECP-E26A	US37181460	01/2017	01/2020
Directional Coupler	Narda 4216-20	01386	Characterized prior to test. No cal required.	Characterized prior to test. No cal required.
Temperature and Humidity Sensor	Control Company	150798832	10/2017	10/2019

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Certificate No: Z19-60176

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 5d175

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: June 11, 2019

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1556	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

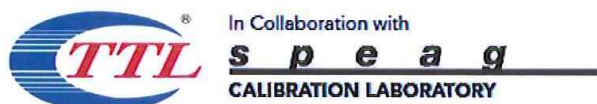
	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 14, 2019

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Certificate No: Z19-60176

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.2.1504
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	40.2 \pm 6 %	1.39 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	39.4 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	20.4 W/kg \pm 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.2 \pm 6 %	1.50 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.5 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.0 W/kg \pm 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.7Ω+ 5.93jΩ
Return Loss	- 24.3dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8Ω+ 5.24jΩ
Return Loss	- 24.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.064 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
-----------------	-------



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DASY5 Validation Report for Head TSL

Date: 06.10.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.387$ S/m; $\epsilon_r = 40.2$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.73, 7.73, 7.73) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

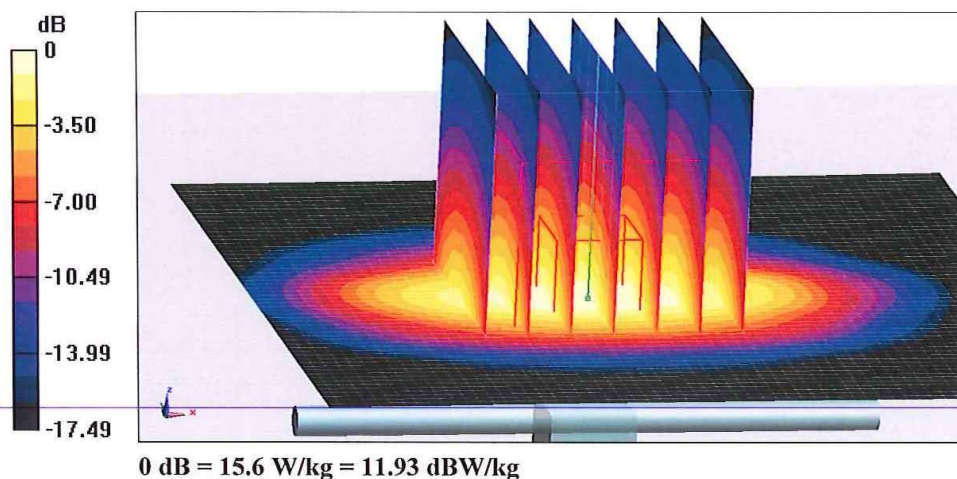
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 98.94 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 9.79 W/kg; SAR(10 g) = 5.07 W/kg

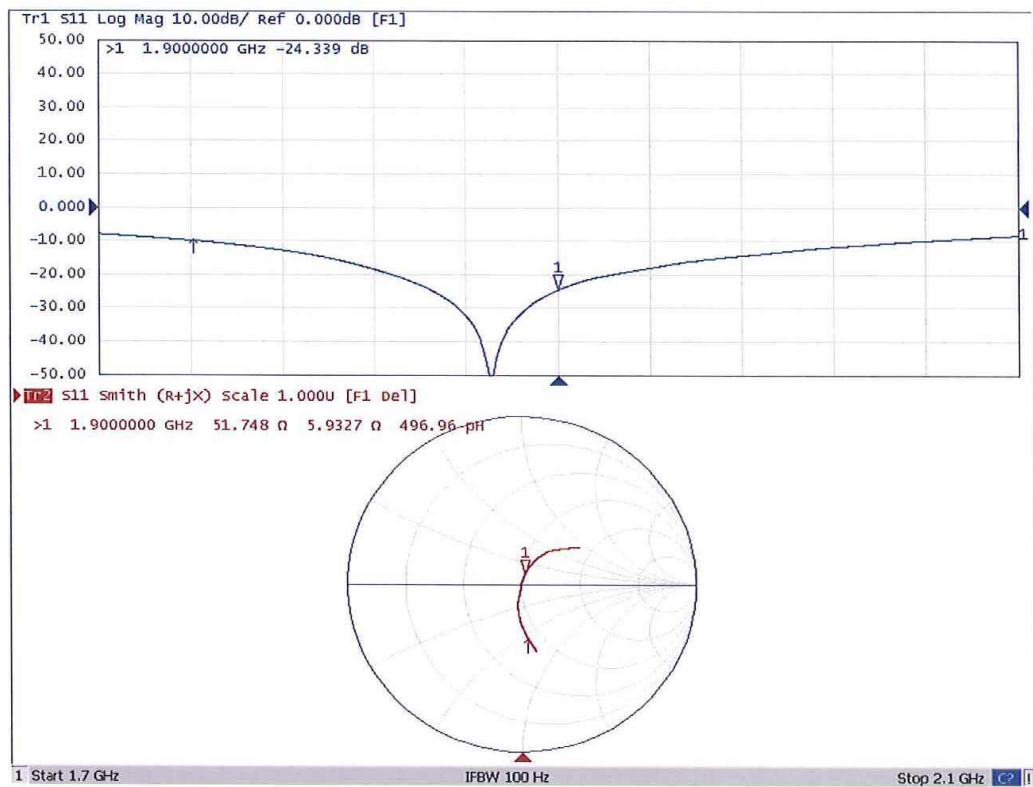
Maximum value of SAR (measured) = 15.6 W/kg

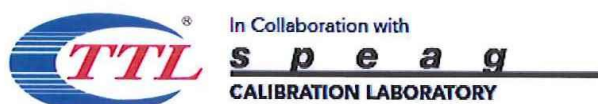




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 06.11.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d175

Communication System: UID 0, CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.499$ S/m; $\epsilon_r = 52.18$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.53, 7.53, 7.53) @ 1900 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7470)

System Performance Check/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid:

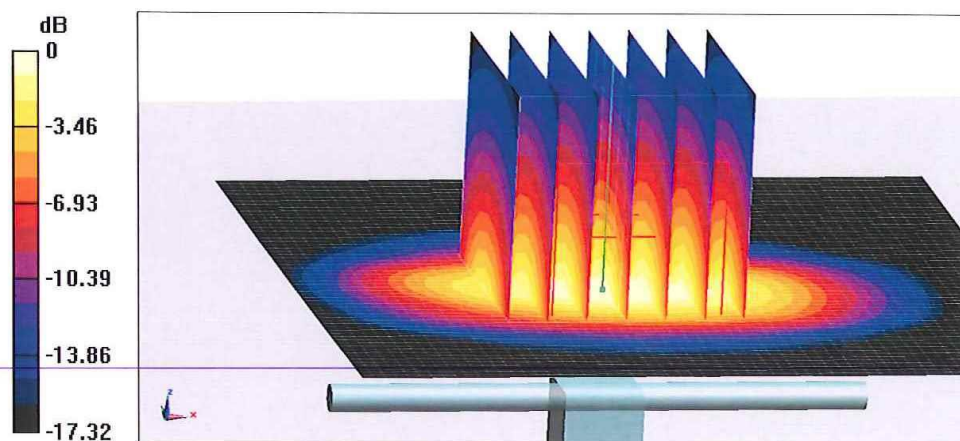
$dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 88.67 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 18.9 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.23 W/kg

Maximum value of SAR (measured) = 15.6 W/kg



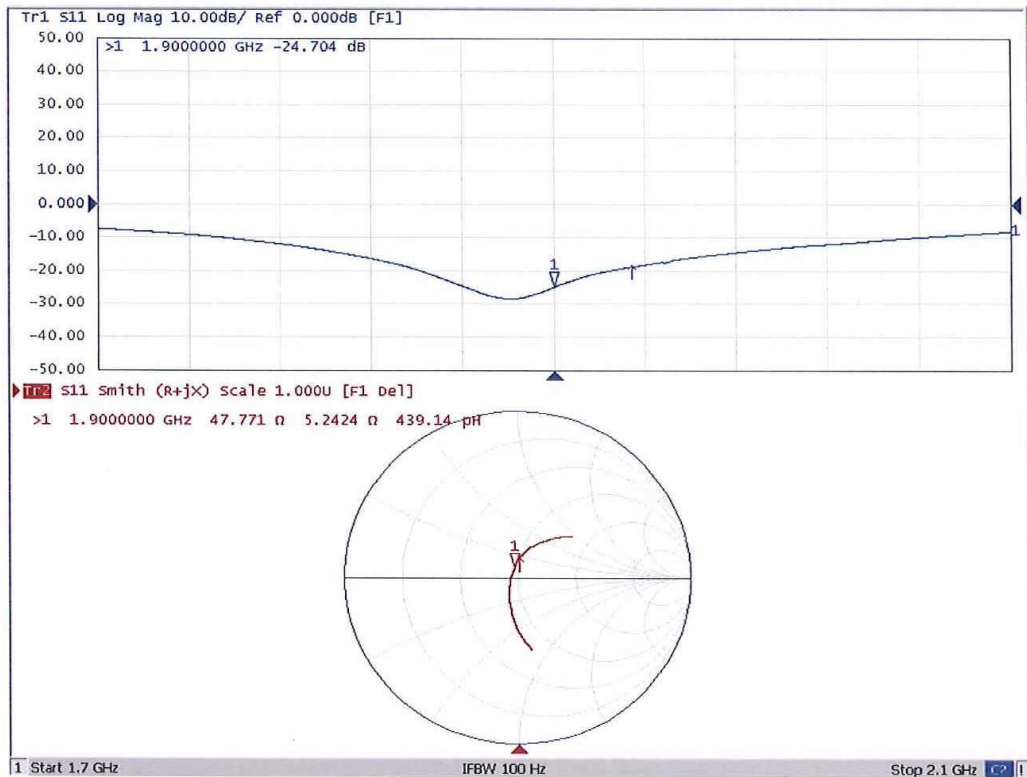
0 dB = 15.6 W/kg = 11.93 dBW/kg



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Impedance Measurement Plot for Body TSL





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Certificate No: Z19-60177

CALIBRATION CERTIFICATE

Object D2450V2 - SN: 910

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: June 10, 2019

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Power sensor NRP8S	104291	20-Aug-18 (CTTL, No.J18X06862)	Aug-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1556	20-Aug-18(SPEAG,No.DAE4-1556_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzer E5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 14, 2019

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Certificate No: Z19-60177

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.8 \pm 6 %	1.83 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.6 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.4 W/kg \pm 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.1 \pm 6 %	1.96 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm ³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.8 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.9 W/kg \pm 18.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.7 W/kg \pm 18.7 % (k=2)



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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1Ω+ 2.51 jΩ
Return Loss	- 26.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	52.3Ω+ 3.40 jΩ
Return Loss	- 27.9dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.020 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
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E-mail: cttl@chinattl.com http://www.chinattl.cn

DASY5 Validation Report for Head TSL

Date: 06.10.2019

Test Laboratory: CCTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.825$ S/m; $\epsilon_r = 39.75$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(6.95, 6.95, 6.95) @ 2450 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

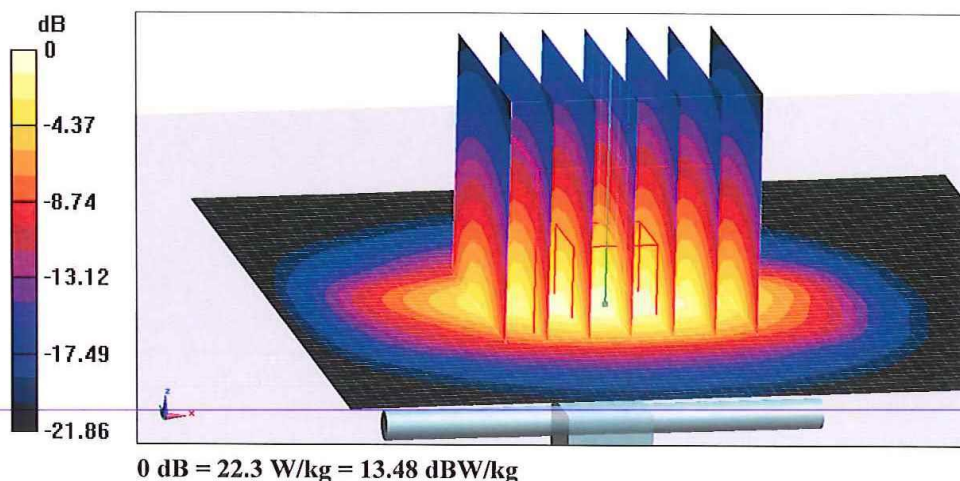
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.66 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.11 W/kg

Maximum value of SAR (measured) = 22.3 W/kg

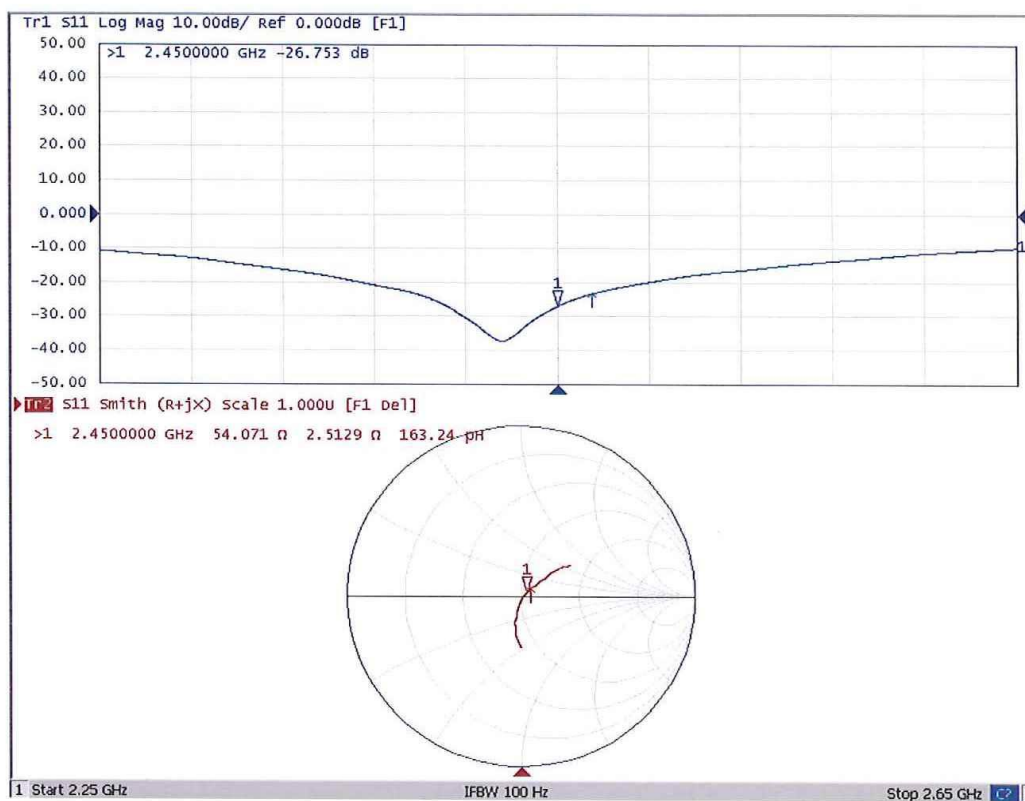




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 06.10.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910

Communication System: UID 0, CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.962$ S/m; $\epsilon_r = 52.06$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.13, 7.13, 7.13) @ 2450 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

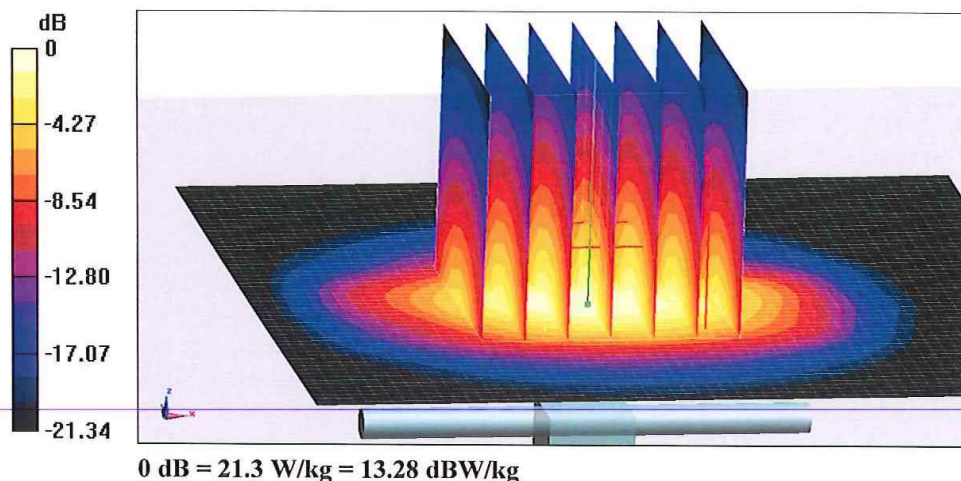
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.63 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 12.8 W/kg; SAR(10 g) = 5.94 W/kg

Maximum value of SAR (measured) = 21.3 W/kg

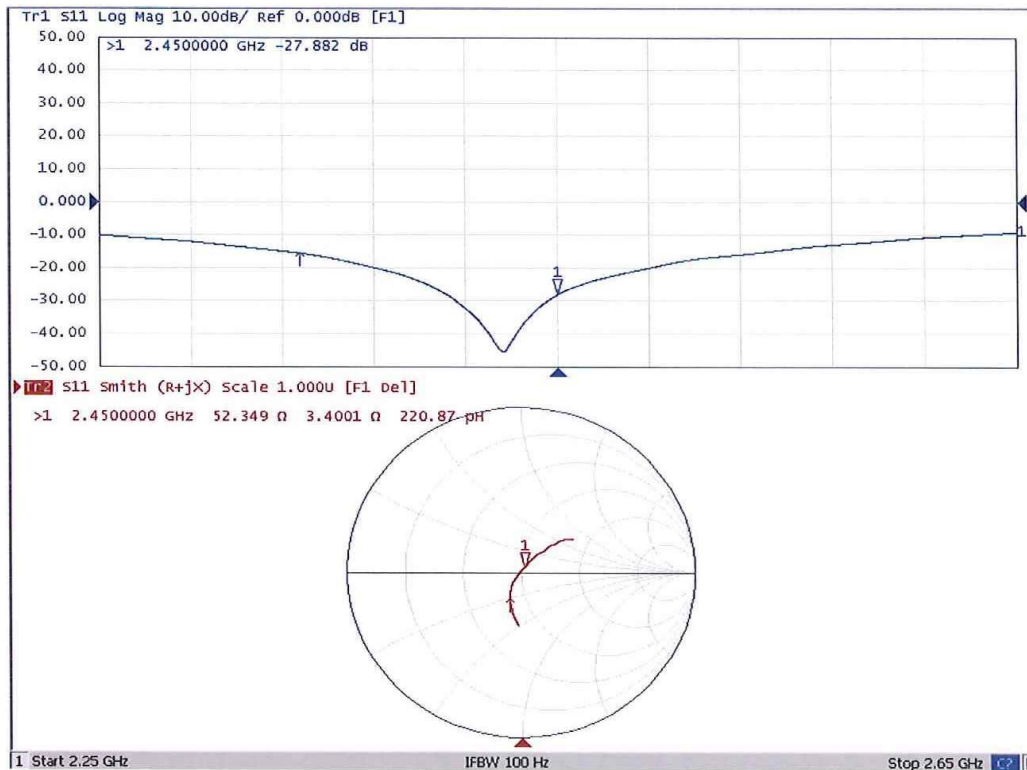




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Impedance Measurement Plot for Body TSL





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Client

CCIS

Certificate No:

Z18-60466

CALIBRATION CERTIFICATE

Object D2600V2 - SN: 1114

Calibration Procedure(s) FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: November 5, 2018

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)°C and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRVD	102196	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Power sensor NRV-Z5	100596	07-Mar-18 (CTTL, No.J18X01510)	Mar-19
Reference Probe EX3DV4	SN 7514	27-Aug-18(SPEAG,No.EX3-7514_Aug18)	Aug-19
DAE4	SN 1555	20-Aug-18(SPEAG,No.DAE4-1555_Aug18)	Aug-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
Network Analyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: November 7, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: Z18-60466

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM _{x,y,z}
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016
- IEC 62209-2, "Procedure to measure the Specific Absorption Rate (SAR) For wireless communication devices used in close proximity to the human body (frequency range of 30MHz to 6GHz)", March 2010
- KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- Measurement Conditions:** Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- Antenna Parameters with TSL:** The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- Feed Point Impedance and Return Loss:** These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- Electrical Delay:** One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- SAR measured:** SAR measured at the stated antenna input power.
- SAR normalized:** SAR as measured, normalized to an input power of 1 W at the antenna connector.
- SAR for nominal TSL parameters:** The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor $k=2$, which for a normal distribution Corresponds to a coverage probability of approximately 95%.



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Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY52	52.10.2.1495
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2600 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.0	1.96 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	39.4 \pm 6 %	1.94 mho/m \pm 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	14.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	56.3 mW / g \pm 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.1 mW / g \pm 18.7 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.5	2.16 mho/m
Measured Body TSL parameters	(22.0 \pm 0.2) °C	52.7 \pm 6 %	2.21 mho/m \pm 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.4 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	53.1 mW / g \pm 18.8 % (k=2)
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	5.92 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	23.6 mW / g \pm 18.7 % (k=2)



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Appendix(Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4Ω- 5.09jΩ
Return Loss	- 25.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7Ω- 5.55jΩ
Return Loss	- 23.5dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.017 ns
----------------------------------	----------

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard. No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

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DASY5 Validation Report for Head TSL

Date: 11.05.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1114

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 1.944$ S/m; $\epsilon_r = 39.41$; $\rho = 1000$ kg/m³

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(6.92, 6.92, 6.92) @ 2600 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

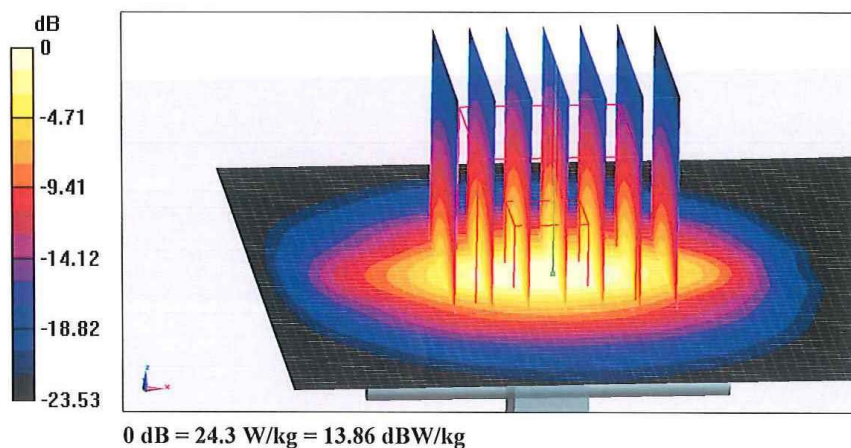
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 107.5 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 30.7 W/kg

SAR(1 g) = 14 W/kg; SAR(10 g) = 6.24 W/kg

Maximum value of SAR (measured) = 24.3 W/kg

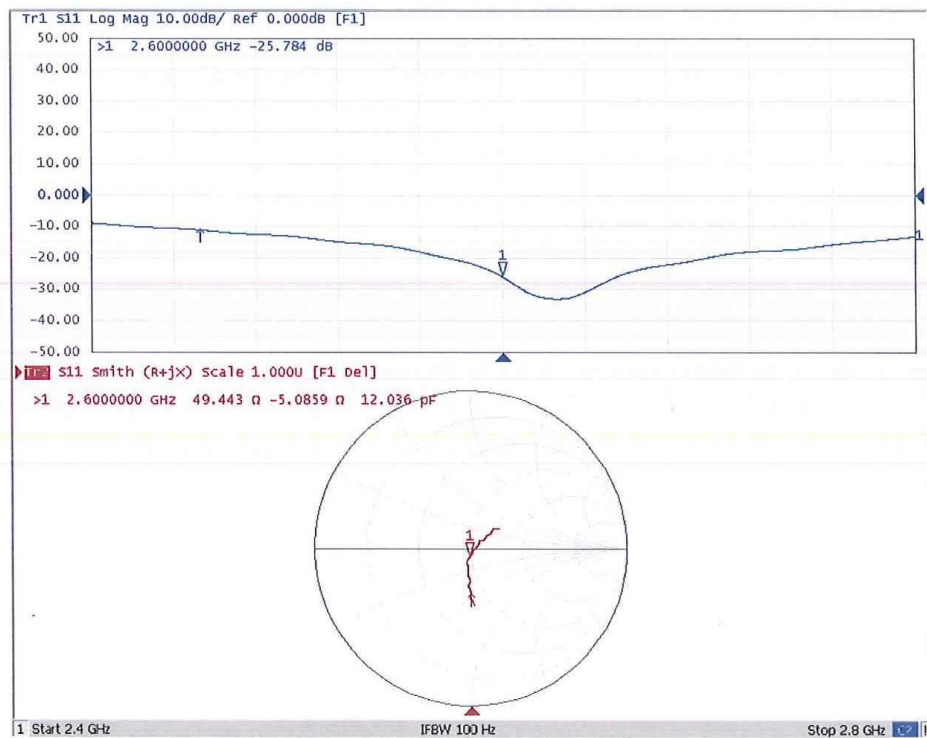




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Impedance Measurement Plot for Head TSL





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DASY5 Validation Report for Body TSL

Date: 11.01.2018

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2600 MHz; Type: D2600V2; Serial: D2600V2 - SN: 1114

Communication System: UID 0, CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2600$ MHz; $\sigma = 2.206$ S/m; $\epsilon_r = 52.65$; $\rho = 1000$ kg/m³

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7514; ConvF(7.06, 7.06, 7.06) @ 2600 MHz; Calibrated: 8/27/2018
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/20/2018
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (2); SEMCAD X Version 14.6.12 (7450)

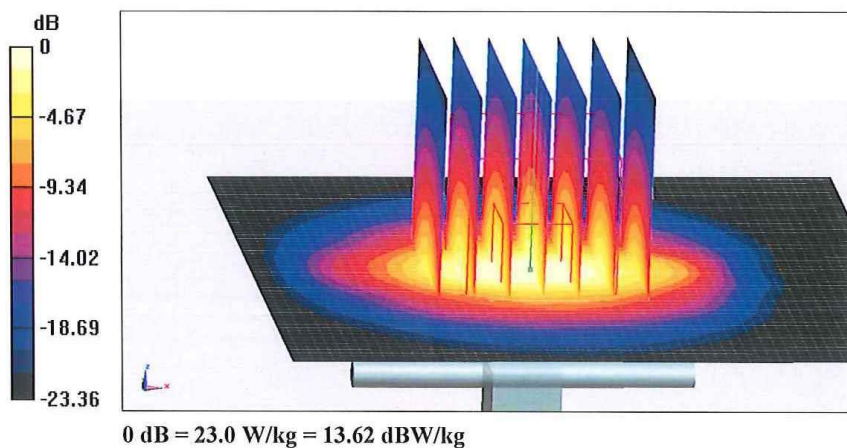
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.22 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 29.3 W/kg

SAR(1 g) = 13.4 W/kg; SAR(10 g) = 5.92 W/kg

Maximum value of SAR (measured) = 23.0 W/kg

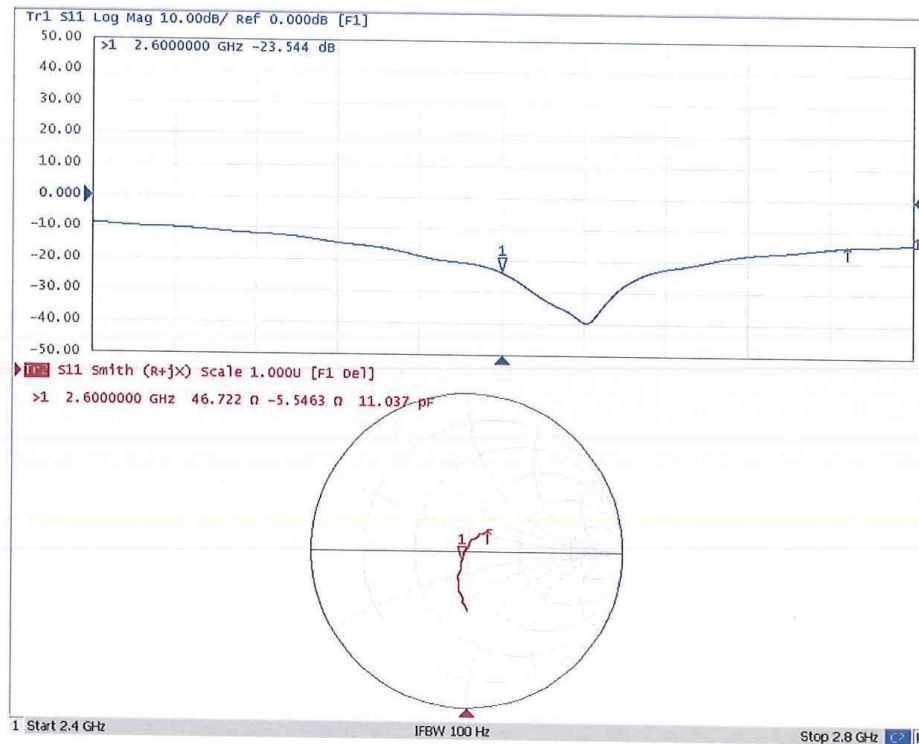




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Impedance Measurement Plot for Body TSL



Dipole Impedance and Return Loss calibration Report

Object: D2600V2 - SN: 1116

Calibration Date: November 07, 2019

Calibration reference: IEEE Std 1528:2013, IEC 62209-1:2016, FCC KDB 865664 D01

Calibrated By: *Janet Wei* (Janet Wei, SAR project engineer)

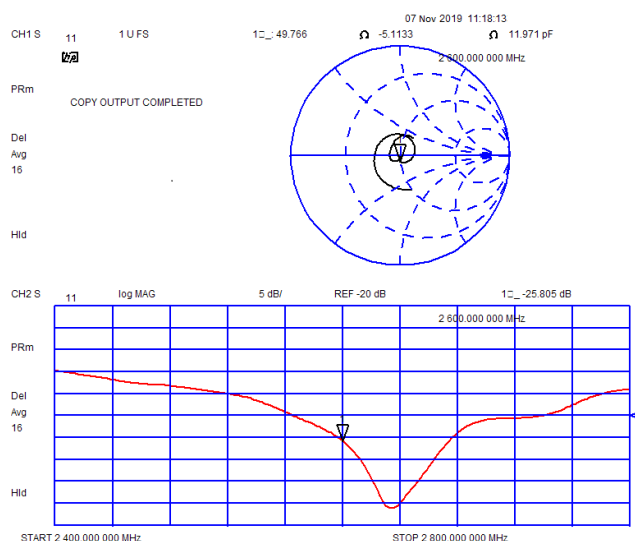
Reviewed By: *Winner Zhang* (Winner Zhang, Technical manager)

Environment of Test Site

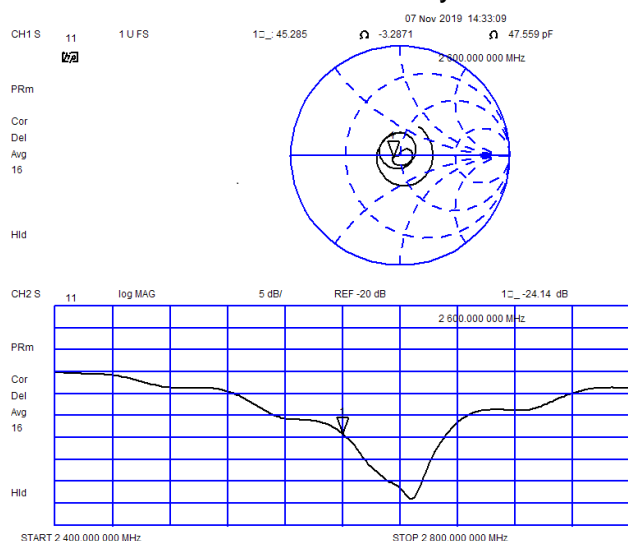
Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

Test Data

Measurement Plot for Head TSL In 2019



Measurement Plot for Body TSL In 2019



Comparison with Original report

Items	TTL	Calibrated By CCIS In 2019	Deviation	Limit
Impedence for Head TSL	49.44Ω-5.08jΩ	49.78Ω-5.11jΩ	0.34Ω-0.03jΩ	±5Ω
Return Loss for Head TSL	-25.78dB	-25.81dB	-0.12%	±20%(No less than 20 dB)
Impedence for Body TSL	46.72Ω-5.55jΩ	45.29Ω-3.29jΩ	-1.43Ω+2.26jΩ	±5Ω
Return Loss for Body TSL	-23.54dB	-24.14dB	-2.55%	±20%(No less than 20 dB)

Result

Compliance

Calibration information for DAE

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1373

IMPORTANT NOTICE

USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:

Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:

Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:

To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

TN_EH190306AE DAE4.docx

07.03.2019

**Calibration Laboratory of
Schmid & Partner
Engineering AG**
Zeughausstrasse 43, 8004 Zurich, Switzerland



S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **CCIS-SZ**

Certificate No: **DAE4-1373_Aug19**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 1373**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **August 09, 2019**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-18 (No:23488)	Sep-19
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	07-Jan-19 (in house check)	In house check: Jan-20
Calibrator Box V2.1	SE UMS 006 AA 1002	07-Jan-19 (in house check)	In house check: Jan-20

Calibrated by:	Name Dominique Steffen	Function Laboratory Technician	Signature
Approved by:	Sven Kühn	Deputy Manager	

Issued: August 9, 2019

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Calibration Laboratory of
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 Zeughausstrasse 43, 8004 Zurich, Switzerland



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Accreditation No.: **SCS 0108**

Glossary

DAE data acquisition electronics
Connector angle information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- **DC Voltage Measurement:** Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- **Connector angle:** The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - **DC Voltage Measurement Linearity:** Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - **Common mode sensitivity:** Influence of a positive or negative common mode voltage on the differential measurement.
 - **Channel separation:** Influence of a voltage on the neighbor channels not subject to an input voltage.
 - **AD Converter Values with inputs shorted:** Values on the internal AD converter corresponding to zero input voltage
 - **Input Offset Measurement:** Output voltage and statistical results over a large number of zero voltage measurements.
 - **Input Offset Current:** Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - **Input resistance:** Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - **Low Battery Alarm Voltage:** Typical value for information. Below this voltage, a battery alarm signal is generated.
 - **Power consumption:** Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V, full range = -100...+300 mV

Low Range: 1LSB = 61nV, full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.900 \pm 0.02% (k=2)	403.865 \pm 0.02% (k=2)	404.160 \pm 0.02% (k=2)
Low Range	3.98780 \pm 1.50% (k=2)	4.00905 \pm 1.50% (k=2)	4.01338 \pm 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	345.5 $^{\circ}$ \pm 1 $^{\circ}$
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Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200036.64	-1.49	-0.00
Channel X + Input	20007.66	1.67	0.01
Channel X - Input	-20003.26	2.58	-0.01
Channel Y + Input	200034.92	-3.47	-0.00
Channel Y + Input	20005.00	-0.97	-0.00
Channel Y - Input	-20006.45	-0.51	0.00
Channel Z + Input	200037.03	-1.49	-0.00
Channel Z + Input	20004.07	-1.80	-0.01
Channel Z - Input	-20007.76	-1.72	0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2001.79	0.32	0.02
Channel X + Input	201.61	0.11	0.05
Channel X - Input	-198.39	0.12	-0.06
Channel Y + Input	2001.55	0.19	0.01
Channel Y + Input	200.46	-0.94	-0.47
Channel Y - Input	-199.08	-0.47	0.24
Channel Z + Input	2001.56	0.26	0.01
Channel Z + Input	199.82	-1.52	-0.76
Channel Z - Input	-200.52	-1.83	0.92

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	8.18	6.30
	- 200	-5.94	-7.46
Channel Y	200	10.49	10.28
	- 200	-12.77	-12.84
Channel Z	200	6.36	6.21
	- 200	-9.67	-10.13

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	0.96	-5.39
Channel Y	200	8.75	-	1.70
Channel Z	200	9.62	5.88	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15936	15515
Channel Y	15863	15901
Channel Z	15893	17897

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	1.11	0.38	2.16	0.31
Channel Y	0.40	-0.61	1.25	0.33
Channel Z	-1.61	-2.89	-0.27	0.46

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9

-----End of report-----