

FCC SAR Test Report

Client Name : LAVA International Limited

Address : A-56, Sector 64, Noida 201301, U.P., India

Product Name : Mobile Phone

Date : Aug. 31, 2020

Shenzhen Anbotek Compliance Laboratory Limited



Shenzhen Anbotek Compliance Laboratory Limited

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TEST REPORT

Applicant : LAVA International Limited
Manufacturer : LAVA International Limited
Product Name : Mobile Phone
Model No. : LE000Z93P
Trade Mark : LAVA
Rating(s) : DC 3.85V from battery or DC 5V from adapter

**Test Standard(s) : IEEE 1528-2013;
ANSI/IEEE C95.1:2005; FCC 47 CFR Part 2 (2.1093);**

The device described above is tested by Shenzhen Anbotek Compliance Laboratory Limited to determine the maximum emission levels emanating from the device and the severe levels of the device can endure and its performance criterion. The measurement results are contained in this test report and Shenzhen Anbotek Compliance Laboratory Limited is assumed full of responsibility for the accuracy and completeness of these measurements. Also, this report shows that the EUT (Equipment Under Test) is technically compliant with the IEEE 1528-2013, FCC 47 CFR Part 2 (2.1093), ANSI/IEEE C95.1:2005 requirements.

This report applies to above tested sample only and shall not be reproduced in part without written approval of Shenzhen Anbotek Compliance Laboratory Limited.

Date of Test

Aug. 03, 2020~ Aug. 31, 2020

Prepared By

King Kong Jin

(Engineer / Kingkong Jin)

Reviewer

Bibo Zhang

(Supervisor / Bibo Zhang)

Approved & Authorized Signer

Tom Chen

(Manager / Tom Chen)

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Version

Version No.	Date	Description
01	Aug. 31, 2020	Original

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1. Statement of Compliance

<Highest SAR Summary>

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013

The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

<Highest SAR Summary>

FrequencyBand	Highest Reported 1g-SAR(W/Kg)		SAR Test Limit (W/Kg)
	Head	Body Worn and Hotspot(10mm)	
GSM 850	0.241	0.769	1.6
GSM1900	0.165	0.690	
LTE Band 5	0.178	0.535	
LTE Band 41	0.124	0.463	
WLAN2.4G	0.110	0.136	
WLAN5.2G	0.091	0.107	
WLAN5.8G	0.079	0.092	
Simultaneous Reported SAR	0.351	0.905	
Test Result	PASS		

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013

2. General Information

2.1. Client Information

Applicant	:	LAVA International Limited
Address	:	A-56, Sector 64, Noida 201301, U.P., India
Manufacturer	:	LAVA International Limited
Address	:	A-56, Sector 64, Noida 201301, U.P., India
Factory	:	LAVA International Limited
Address	:	A-56, Sector 64, Noida 201301, U.P., India

2.2. Testing Laboratory Information

Test Site:	:	Shenzhen Anbotek Compliance Laboratory Limited
Address:	:	1/F, Building D, Sogood Science and Technology Park, Sanwei community, Hangcheng Street, Bao'an District, Shenzhen, Guangdong, China.518102

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2.3. Description of Equipment Under Test (EUT)

Product Name	:	Mobile Phone
Model No.	:	LE000Z93P
Trade Mark	:	LAVA
Test Power Supply	:	DC 3.85V from battery or DC 5V from adapter
Test Sample No.	:	S1(Normal Sample), S2(Engineering Sample)
Tx Frequency	:	GSM850: 824.2 MHz ~ 848.6 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz LTE BAND 5: 824MHz~849MHz LTE BAND 41: 2555MHz~2655MHz BT: 2402 MHz ~ 2480 MHz BLE: 2402MHz~2480MHz 802.11b/ g/ n: 2412 MHz -2462MHz WIFI 5G: 5180 MHz-5240 MHz, 5745 MHz-5825MHz
Type of Modulation	:	2G: GSM,GPRS, EGPRS LTE: QPSK,16QAM BT: GFSK,8DPSK, $\pi/4$ DQPSK WIFI: BPSK,QPSK,16QAM,64QAM
Hardware version	:	V2.0
Software version	:	V2.0
Category of device	:	Portable device
Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.		

2.4. Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

2.5. Applied Standard

The Specific Absorption Rate (SAR) testing specification, method, and procedure for this device is in accordance with the following standards:

- FCC 47 CFR Part 2 (2.1093:2013)
- ANSI/IEEE C95.1:2005
- IEEE Std 1528:2013
- KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- KDB 865664 D02 RF Exposure Reporting v01r02
- KDB 447498 D01 General RF Exposure Guidance v06
- KDB248227 D01 802.11 Wi-Fi SAR v02r02
- KDB941225 D01 3G SAR Procedures v03r01
- KDB 941225 D05 SAR for LTE Devices v02r05
- KDB 941225 D06 Hotspot SAR v02r01
- KDB648474 D04 Handset SAR v01r03

2.6. Environment of Test Site

Items	Required	Actual
Temperature (°C)	18-25	22~23
Humidity (%RH)	30-70	55~65

2.7. Test Configuration

The device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during all tests. For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

3. Specific Absorption Rate (SAR)

3.1. Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/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.

3.2. SAR Definition

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

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

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

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

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

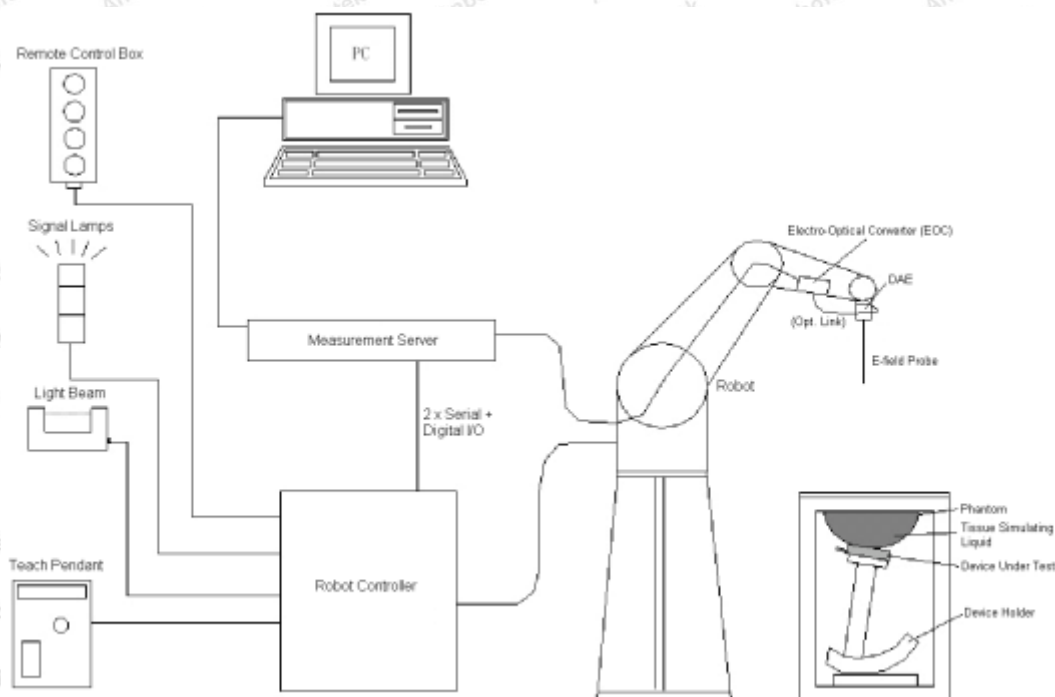
Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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.

4. SAR Measurement System



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

components are described in details in the following sub-sections.

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4.1. 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	10 MHz to 6 GHz; Linearity: ± 0.2 dB	
Directivity	± 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: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm	

Photo of EX3DV4

➤ E-Field Probe Calibration

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

4.2. 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 200M Ω ; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

**Photo of DAE**

4.3. Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controllersystem, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäublirobot series have many features that are important for our application:

- High precision (repeatability ± 0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

**Photo of DASY5**

4.4. Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (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.

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



Photo of Server for DASY5

4.5. Phantom

<SAM Twin Phantom>

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

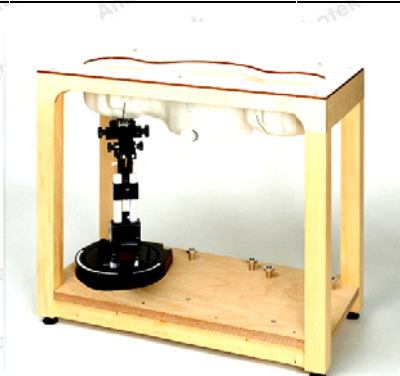


Photo of SAM Phantom

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>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis:400 mm



Photo of ELI4 Phantom

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the **Shenzhen Anbotek Compliance Laboratory Limited**

frequency range of 30 MHz to 6 GHz. ELI4 is fully compatible with standard and all known tissue simulating liquids.

4.6. Device Holder

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

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (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.



Device Holder

4.7. Data Storage and Evaluation

➤ Data Storage

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

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [mW/g]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-loss 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	$\text{Norm}_i, a_{i0}, a_{i1}, a_{i2}$
	- Conversion factor	ConvF_i
	- Diode compression point	dcp_i
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the 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 , ($i = x, y, z$), $\mu\text{V}/(\text{V/m})^2$ for E-field Probes

ConvF = sensitivity enhancement in solution

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

f = carrier frequency [GHz]

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

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

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

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

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

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

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 = equivalent tissue density in g/cm³

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

5. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	4d154	Jun 16,2018	Jun 15,2021
SPEAG	1900MHz System Validation Kit	D1900V2	5d175	Jun 15,2018	Jun 14,2021
SPEAG	2450MHz System Validation Kit	D2450V2	910	Jun 15,2018	Jun 14,2021
SPEAG	2600MHz System Validation Kit	D2600V2	1058	Jun. 19, 2018	Jun. 18, 2021
SPEAG	5GHz System Validation Kit	D5GHzV2	1160	Oct. 02, 2018	Oct. 01, 2021
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMU 200	117888	Nov.04, 2019	Nov.03, 2020
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMW500	1201.0002K50-104 209-JC	Nov.04, 2019	Nov.03, 2020
SPEAG	Data Acquisition Electronics	DAE4	387	Sept.03,2019	Sept.02,2020
SPEAG	Dosimetric E-Field Probe	EX3DV4	7396	May 06,2020	May 05,2021
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	Nov.04, 2019	Nov.03, 2020
SPEAG	DAK	DAK-3.5	1226	NCR	NCR
SPEAG	SAM Twin Phantom	QD000P40CD	1802	NCR	NCR
SPEAG	ELI Phantom	QDOVA004AA	2058	NCR	NCR
AR	Amplifier	ZHL-42W	QA1118004	NCR	NCR
Agilent	Power Meter	N1914A	MY50001102	Nov.04, 2019	Nov.03, 2020
Agilent	Power Sensor	N8481H	MY51240001	Nov.04, 2019	Nov.03, 2020
R&S	Spectrum Analyzer	N9020A	MY51170037	Nov.04, 2019	Nov.03, 2020
Agilent	Signal Generation	N5182A	MY48180656	Nov.04, 2019	Nov.03, 2020
Worken	Directional Coupler	0110A05601O-10	COM5BNW1A2	Nov.04, 2019	Nov.03, 2020

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. The dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. 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 Agilent.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it

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6. 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. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown as followed:



Photo of Liquid Height for Head SAR

Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (ϵ_r)
For Head								
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1750	55.2	0	0	0.3	0	44.5	1.37	40.1
1800,1900,2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
900	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1750	70.2	0	0	0.4	0	29.4	1.49	53.4
1800,1900,2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	65.5	0	0	0	0	31.5	2.16	52.5

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The following table shows the measuring results for simulating liquid.

Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
	ϵ_r	σ	ϵ_r	Dev. (%)	σ	Dev. (%)		
850	55.2	0.97	55.04	-0.29	0.99	2.06	22.2℃	08/30/2020
1900	53.3	1.52	53.83	0.99	1.5	-1.32	22.1℃	08/28/2020
2450	52.7	1.95	52.1	-1.14	1.93	-1.03	22.3℃	08/29/2020
2600	52.2	2.16	52.62	0.80	2.08	-3.70	22.1℃	08/27/2020
5200	49.0	5.30	48.27	-1.49	5.53	4.34	21.9℃	08/31/2020
5800	48.20	6.00	47.45	-1.56	6.11	1.83	21.8℃	08/31/2020

7. System Verification Procedures

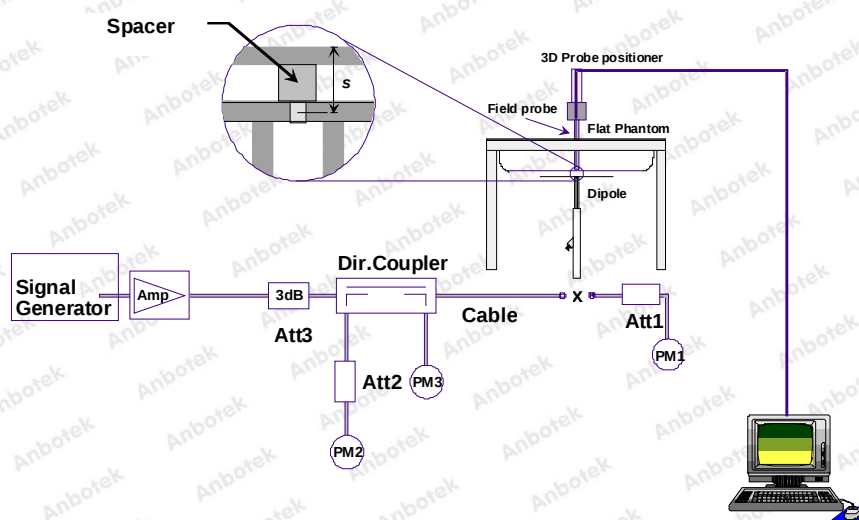
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix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



System Setup for System Evaluation



Photo of Dipole Setup

► Validation Results

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

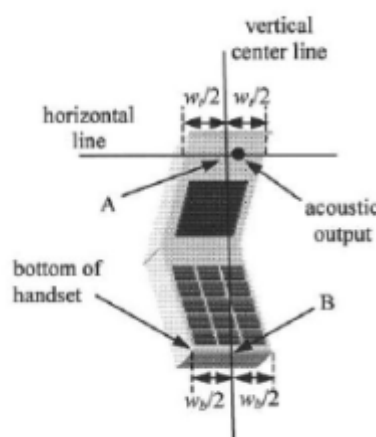
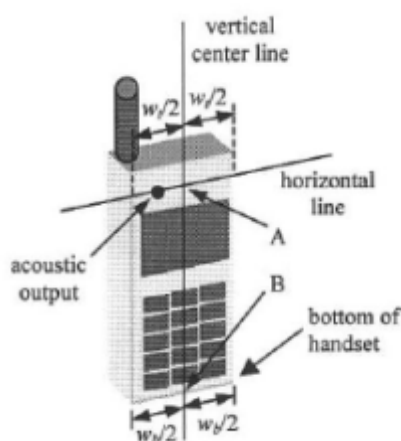
Date	Frequency (MHz)	Power fed onto reference dipole (mW)	Targeted SAR (W/kg)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Deviation (%)
08/30/2020	850	250	9.57	2.34	9.36	-2.19
08/28/2020	1900	250	40.1	10.14	40.56	1.15
08/29/2020	2450	250	51.8	12.96	51.84	0.08
08/27/2020	2600	250	55.3	13.42	53.68	-2.93
08/31/2020	5200	100	77.8	7.68	76.80	-1.29
08/31/2020	5800	100	78.3	7.72	77.20	-1.40

Target and Measurement SAR after Normalized

8. EUT Testing Position

8.1. Define two imaginary lines on the handset

- The vertical centerline 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 centerline and passes through the center of the acoustic output. The horizontal line is also tangential to the face of 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 centerline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.



Handset Vertical and Horizontal Reference Lines

8.2. Position 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.



Cheek Position

8.3. Position 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.

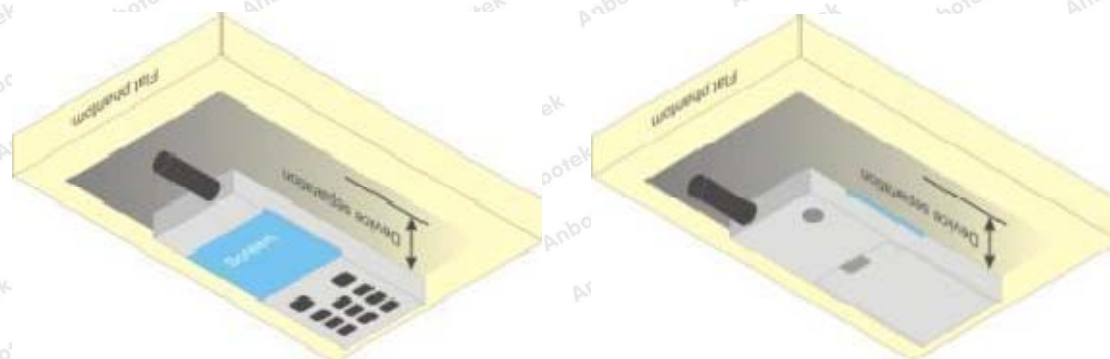


Tilt Position

8.4. Body Worn Position

Body-worn operating configurations are tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in a normal use configuration. Per KDB 648474 D04, body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for body-worn accessory, measured without a headset connected to the handset is $< 1.2 \text{ W/kg}$, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a handset attached to the handset.

Accessories for body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.



Body Worn Position

9. Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
- (b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as setup photos demonstrates.
- (e) Set scan area, grid size and other setting on the DASY software.
- (f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
- (g) Identify the exposure position and device configuration resulting the highest SAR
- (h) Measure SAR at the lowest and highest channels at the worst exposure position and device configuration if applicable.

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

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

9.1. Spatial Peak SAR Evaluation

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

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

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

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

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9.2. Power Reference Measurement

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

9.3. Area Scan Procedures

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum 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 IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area} , Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

9.4. Zoom Scan Procedures

Zoom scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube whose base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{\text{Zoom}}, \Delta y_{\text{Zoom}}$			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{\text{Zoom}}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{\text{Zoom}}(1)$: between 1 st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: < 2 mm
		$\Delta z_{\text{Zoom}}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{\text{Zoom}}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.				
* When zoom scan is required and the <u>reported</u> SAR from the <i>area scan based 1-g SAR estimation</i> procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

9.5. Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing. When all volume scan were completed, the software, SEMCAD postprocessor can combine and subsequently superpose these measurement data to calculating the multiband SAR.

9.6. 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 drift more than 5%, the SAR will be retested.

10. Conducted Power

<GSM Conducted power>

Band GSM850	Burst Average Power (dBm)				Frame-Average Power (dBm)		
TX Channel	Tune-up	128	190	251	128	190	251
Frequency (MHz)	power	824.2	836.6	848.6	824.2	836.6	848.6
GSM (GMSK, 1 Tx slot)	30.5	30.42	30.45	30.32	21.39	21.42	21.29
GPRS (GMSK, 1 Tx slot)	30.7	30.62	30.60	30.44	21.59	21.57	21.41
GPRS (GMSK, 2 Tx slots)	30.0	29.83	29.81	29.61	23.81	23.79	23.59
GPRS (GMSK, 3 Tx slots)	28.1	28.03	27.99	27.80	23.77	23.73	23.54
GPRS (GMSK, 4 Tx slots)	27.0	26.87	26.86	26.65	23.86	23.85	23.64
EGPRS (GMSK, 1 Tx slot)	28.5	28.41	28.09	27.82	19.38	19.06	18.79
EGPRS (GMSK, 2 Tx slots)	27.0	26.81	26.54	26.37	20.79	20.52	20.35
EGPRS (GMSK, 3 Tx slots)	24.5	24.40	24.20	23.93	20.14	19.94	19.67
EGPRS (GMSK, 4 Tx slots)	23.1	23.10	22.99	22.56	20.09	19.98	19.55
Band GSM1900	Burst Average Power (dBm)				Frame-Average Power (dBm)		
TX Channel	Tune-up	512	661	810	512	661	810
Frequency (MHz)	power	1850.2	1880.0	1909.8	1850.2	1880.0	1909.8
GSM (GMSK, 1 Tx slot)	32.1	32.04	31.95	31.88	23.01	22.92	22.85
GPRS (GMSK, 1 Tx slot)	32.3	32.24	32.05	31.44	23.21	23.02	22.41
GPRS (GMSK, 2 Tx slots)	30.3	30.10	29.99	30.30	24.08	23.97	24.28
GPRS (GMSK, 3 Tx slots)	29.0	28.98	28.86	28.97	24.72	24.60	24.71
GPRS (GMSK, 4 Tx slots)	28.0	27.84	27.77	27.86	24.83	24.76	24.85
EGPRS (GMSK, 1 Tx slot)	31.1	31.03	30.69	30.48	22.00	21.66	21.45
EGPRS (GMSK, 2 Tx slots)	30.0	29.92	29.59	29.63	23.90	23.57	23.61
EGPRS (GMSK, 3 Tx slots)	28.0	27.95	27.77	27.71	23.69	23.51	23.45
EGPRS (GMSK, 4 Tx slots)	27.0	26.87	26.53	26.65	23.86	23.52	23.64

Remark: The frame-averaged power is linearly scaled the maximum burst averaged power over 8 time slots.

The calculated method are shown as below:

Frame-averaged power = Maximum burst averaged power (1 Tx Slot) – 9.03 dB

Frame-averaged power = Maximum burst averaged power (2 Tx Slots) – 6.02 dB

Frame-averaged power = Maximum burst averaged power (3 Tx Slots) - 4.26 dB

Frame-averaged power = Maximum burst averaged power (4 Tx Slots) – 3.01 dB

Note:

1. Per KDB 447498 D01, the maximum output power channel is used for SAR testing and for further SAR test reduction
2. For Head SAR testing, GSM should be evaluated, therefore the EUT was set in GSM Voice for GSM850 and GSM1900 due to its highest frame-average power.
3. For Hotspot mode SAR testing, GPRS should be evaluated, therefore the EUT was set in GPRS 4 Tx slots for GSM850 and GSM1900 due to its highest frame-average power.

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LTE FDD Band 5				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	Burst Average Power [dBm]	
			QPSK	16QAM
1.4 MHz	824.7	1 RB low	22.62	21.51
		1 RB high	22.77	21.61
		50% RB mid	22.64	21.48
		100% RB	22.63	21.45
	836.5	1 RB low	22.76	21.64
		1 RB high	22.77	21.81
		50% RB mid	22.89	21.68
		100% RB	22.78	21.59
	848.3	1 RB low	22.97	21.80
		1 RB high	22.94	21.67
		50% RB mid	23.07	21.67
		100% RB	22.88	21.69
3 MHz	825.5	1 RB low	22.65	21.68
		1 RB high	22.68	21.69
		50% RB mid	22.68	21.72
		100% RB	21.78	20.71
	836.5	1 RB low	22.86	21.87
		1 RB high	22.83	21.85
		50% RB mid	22.84	21.86
		100% RB	21.93	20.90
	847.5	1 RB low	23.13	21.76
		1 RB high	23.02	21.77
		50% RB mid	23.02	21.80
		100% RB	22.00	20.91
5 MHz	826.5	1 RB low	22.79	21.68
		1 RB high	22.68	21.62
		50% RB mid	22.68	21.61
		100% RB	21.68	20.63
	836.5	1 RB low	22.85	21.80
		1 RB high	22.95	21.90
		50% RB mid	22.86	21.76
		100% RB	21.91	20.84
	846.5	1 RB low	22.98	21.94
		1 RB high	22.97	22.01
		50% RB mid	22.90	21.94

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10 MHz	829.0	100% RB	22.00	20.98
		1 RB low	22.79	21.84
		1 RB high	22.83	21.81
		50% RB mid	22.92	21.85
		100% RB	21.82	20.80
	836.5	1 RB low	22.92	21.84
		1 RB high	23.21	21.66
		50% RB mid	23.05	21.85
		100% RB	22.02	20.99
	844.0	1 RB low	23.03	21.86
		1 RB high	22.89	21.71
		50% RB mid	22.96	21.78
		100% RB	22.05	21.07

LTE Band 41				
TX Channel Bandwidth	Frequency (MHz)	RB Size/Offset	Burst Average Power [dBm]	
			QPSK	16QAM
5 MHz	2557.5	1 RB low	22.92	21.80
		1 RB mid	23.02	21.94
		1 RB high	22.93	21.84
		50% RB low	21.88	20.85
		50% RB mid	21.89	20.86
		50% RB high	21.98	20.91
		100% RB	21.94	20.92
	2600.0	1 RB low	23.10	22.16
		1 RB mid	23.07	22.24
		1 RB high	23.19	22.13
		50% RB low	22.11	21.10
		50% RB mid	22.10	21.08
		50% RB high	22.13	21.11
		100% RB	22.13	21.06
	2652.5	1 RB low	23.30	22.31
		1 RB mid	23.29	22.23
		1 RB high	23.43	22.19
		50% RB low	22.31	21.27
		50% RB mid	22.29	21.26
		50% RB high	22.29	21.25
		100% RB	22.30	21.28

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10 MHz	2560.0	1 RB low	22.96	22.15
		1 RB mid	23.00	21.93
		1 RB high	23.36	21.70
		50% RB low	22.06	21.03
		50% RB mid	22.02	21.01
		50% RB high	22.04	21.04
		100% RB	22.05	21.03
	2600.0	1 RB low	23.16	21.95
		1 RB mid	23.44	22.23
		1 RB high	23.21	21.99
		50% RB low	22.21	21.15
		50% RB mid	22.21	21.18
		50% RB high	22.23	21.17
		100% RB	22.15	21.19
	2650.0	1 RB low	23.37	22.38
		1 RB mid	23.63	22.63
		1 RB high	23.32	22.36
		50% RB low	22.41	21.35
		50% RB mid	22.33	21.35
		50% RB high	22.39	21.28
		100% RB	22.34	21.31
15 MHz	2562.5	1 RB low	22.84	22.08
		1 RB mid	22.94	22.02
		1 RB high	22.87	22.03
		50% RB low	22.03	22.03
		50% RB mid	22.08	22.10
		50% RB high	22.01	21.99
		100% RB	22.03	21.01
	2600.0	1 RB low	23.04	21.80
		1 RB mid	23.18	21.94
		1 RB high	23.18	21.93
		50% RB low	21.98	21.94
		50% RB mid	21.79	21.79
		50% RB high	21.94	21.99
		100% RB	22.25	21.17
	2647.5	1 RB low	23.29	22.29
		1 RB mid	23.36	22.35
		1 RB high	23.12	22.11
		50% RB low	22.35	22.20
		50% RB mid	22.26	22.35

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20 MHz	2570.0	50% RB high	22.16	22.29
		100% RB	22.37	21.29
		1 RB low	22.87	21.95
		1 RB mid	22.82	21.94
		1 RB high	23.33	22.43
		50% RB low	22.00	21.10
		50% RB mid	22.00	21.01
		50% RB high	22.11	21.00
	2600.0	100% RB	22.06	21.00
		1 RB low	22.99	21.67
		1 RB mid	22.82	21.84
		1 RB high	23.38	22.23
		50% RB low	22.12	21.16
		50% RB mid	22.24	21.27
		50% RB high	22.22	21.28
		100% RB	22.18	21.16
	2640.0	1 RB low	23.68	22.48
		1 RB mid	22.94	21.85
		1 RB high	23.16	22.05
		50% RB low	22.25	21.24
		50% RB mid	22.26	21.27
		50% RB high	22.25	21.26
		100% RB	22.28	21.26

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<WLAN 2.4GHz Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Output Power(Average, dBm)	Tune-up Power (dBm)
802.11b	1	2412	17.25	17.5
	6	2437	15.10	15.2
	11	2462	14.86	15.0
802.11g	1	2412	15.93	16.0
	6	2437	15.82	16.0
	11	2462	15.94	16.0
802.11n(20MHz)	1	2412	16.52	16.6
	6	2437	15.74	16.0
	11	2462	15.92	16.0
802.11n(40MHz)	3	2422	15.86	16.0
	6	2437	15.05	15.1
	9	2452	13.76	14.0

<WLAN 5.2GHz Conducted Power>

Mode	Test channel	Maximum Conducted Output Power (dBm)
11a	CH36	16.32
11a	CH40	16.72
11a	CH48	15.7
11n(HT20)	CH36	16.04
11n(HT20)	CH40	16.63
11n(HT20)	CH48	16.66
11n(HT40)	CH38	16.42
11n(HT40)	CH46	16.55
11ac(HT20)	CH36	16.24
11ac(HT20)	CH40	16.39
11ac(HT20)	CH48	15.62
11ac(HT40)	CH38	15.47
11ac(HT40)	CH46	15.61
11ac(HT80)	CH42	14.77

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<WLAN 5.8GHz Conducted Power>

Mode	Test channel	Maximum Conducted Output Power (dBm)
11a	CH149	12.00
11a	CH157	10.67
11a	CH165	12.00
11n HT20	CH149	10.03
11n HT20	CH157	10.62
11n HT20	CH165	11.66
11n HT40	CH151	11.21
11n HT40	CH159	11.71
11ac HT20	CH149	10.05
11ac HT20	CH157	10.59
11ac HT20	CH165	11.64
11ac HT40	CH151	11.18
11ac HT40	CH159	11.59
11ac HT80	CH155	9.83

Note:

1. Per KDB 447498 D01, the 1-g SAR test exclusion thresholds for 100 MHz to 6 GHz at *test separation distances* ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$

for 1-g SAR, where

$f(\text{GHz})$ is the RF channel transmit frequency in GHz

Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

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Mode	Frequency (GHz)	Tune-up Power (dBm)	Max. Power (mW)	Test distance (mm)	Result	exclusion thresholds for 1-g SAR
802.11b	2412	17.5	56.23	5	17.466	3.0
802.11b	2412	17.5	56.23	10	8.733	3.0
802.11a	5200	16.8	47.86	5	21.828	3.0
802.11a	5200	16.8	47.86	10	10.914	3.0
802.11a	5745	12.0	15.85	5	7.598	3.0
802.11a	5745	12.0	15.85	10	3.799	3.0

2. Base on the result of note1, RF exposure evaluation of 2.4G/5G WIFI mode is required..

3. Per KDB 248227 D01, choose the highest output power channel to test SAR and determine further SAR exclusion.

4. Per KDB 248227 D01, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. SAR is not required for the following 2.4 GHz OFDM conditions:

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

2) When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

<Bluetooth Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Power (dBm)	Tune-up power(dBm)
BLE-GFSK	00	2402	-7.882	-7
	19	2440	-5.501	-5
	39	2480	-5.894	-5
GFSK	00	2402	-5.726	-5
	39	2441	-3.567	-3
	78	2480	-1.655	-1
$\pi/4$ DQPSK	00	2402	-6.528	-6
	39	2441	-2.111	-2
	78	2480	-6.172	-6
8DPSK	00	2402	-2.114	-2
	39	2441	-5.726	-5
	78	2480	-3.567	-3

Note:

Per KDB 447498 D01v05r02, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$

for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

$f(\text{GHz})$ is the RF channel transmit frequency in GHz

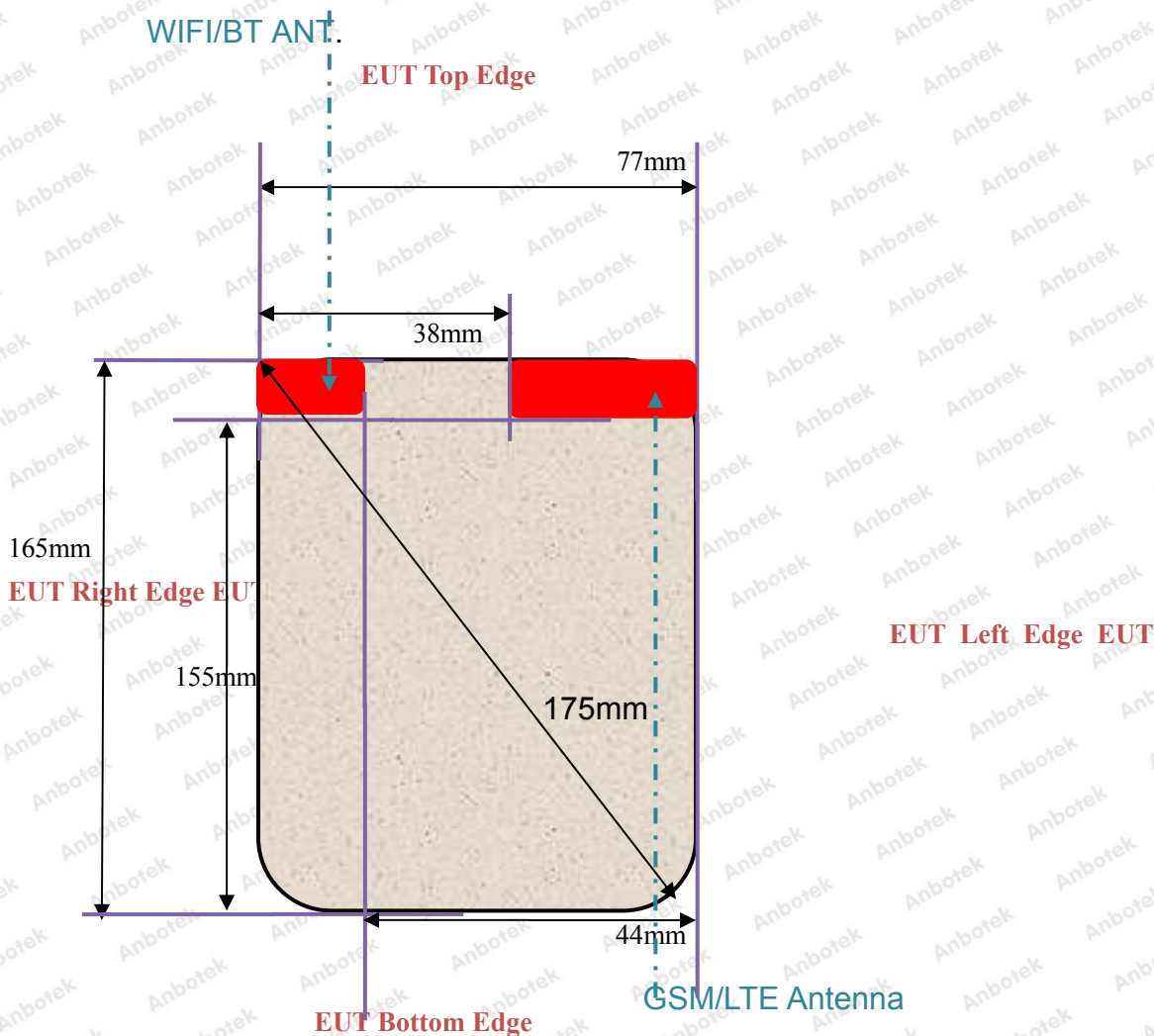
Power and distance are rounded to the nearest mW and mm before calculation

The result is rounded to one decimal place for comparison

Bluetooth Max Power (dBm)	Separation Distance (mm)	Frequency (GHz)	exclusion thresholds
-1	5	2.48	0.249

Per KDB 447498 D01, when the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion. The test exclusion threshold is 0.249 which is ≤ 3 , SAR testing is not required.

11. Antenna Location



EUT BACK VIEW

Distance of The Antenna to the EUT surface and edge						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	<25mm	<25mm	<25mm	>25mm	>25mm	<25mm
BT&WLAN	<25mm	<25mm	<25mm	>25mm	<25mm	>25mm

Positions for SAR tests; Hotspot mode						
Antennas	Front	Back	Top Side	Bottom Side	Left Side	Right Side
WWAN	Yes	Yes	Yes	No	No	Yes
BT&WLAN	Yes	Yes	Yes	No	Yes	No

General Note: According with FCC KDB 447498 D01, appendix A, <SAR test exclusion thresholds for 100MHz~6GHz and≤50mm> table, this device SAR test configurations considerations are shown in the table above.

Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.

12.SAR Test Results Summary

General Note:

1.Per KDB 447498 D01v05r01, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

Scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.

Reported SAR(W/kg)= Measured SAR(W/kg) Scaling Factor*

2.Per KDB 447498 D01v05r01, for each exposure position, if the highest output channel reported SAR≤0.8W/kg, other channels SAR testing are not necessary

3.Per KDB 941225 D05, start with the largest channel bandwidth and measure SAR for QPSK with 1 RB allocation, using the RB offset and required test channel combination with the highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.

4.Per KDB 941225 D05, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.

5.Per KDB 941225 D05, For QPSK with 100% RB allocation, SAR is not required when the highest maximum output power for 100 % RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

6.Per KDB 941225 D05, 16QAM output power for each RB allocation configuration is > not ½ dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/kg; Per KDB 941225 D05, 16QAM SAR testing is not required.

7.Per KDB 941225 D05, Smaller bandwidth output power for each RB allocation configuration is > not ½ dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/kg; Per KDB 941225 D05, smaller bandwidth SAR testing is not required.

8.Per KDB865664 D01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/Kg; if the deviation among the repeated measurement is ≤20%,and the measured SAR <1.45W/Kg, only one repeated measurement is required.

9.When the user enables the personal Wireless router functions for the handsets, actual operations include simultaneous transmission of both the Wi-Fi transmitting frequency and thus cannot be evaluated for SAR under actual use conditions. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SAR measurements were evaluated for a single transmission frequency RF signal.

12.1. Head SAR Results

<GSM>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
#1	GSM850	GSM Voice	Right Cheek	190	836.6	30.45	30.5	1.002	0.16	0.241	0.241
	GSM850	GSM Voice	Right Tilted	190	836.6	30.45	30.5	1.002	-0.08	0.175	0.175
	GSM850	GSM Voice	Left Cheek	190	836.6	30.45	30.5	1.002	-0.11	0.210	0.210
	GSM850	GSM Voice	Left Tilted	190	836.6	30.45	30.5	1.002	0.10	0.166	0.166
#2	GSM1900	GSM Voice	Right Cheek	512	1850.2	32.04	32.1	1.002	0.10	0.165	0.165
	GSM1900	GSM Voice	Right Tilted	512	1850.2	32.04	32.1	1.002	-0.09	0.124	0.124
	GSM1900	GSM Voice	Left Cheek	512	1850.2	32.04	32.1	1.002	0.15	0.145	0.145
	GSM1900	GSM Voice	Left Tilted	512	1850.2	32.04	32.1	1.002	0.16	0.102	0.102

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<LTE>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 5	10MHz/1RB	Right Cheek	20525	836.5	23.21	23.3	1.004	0.07	0.165	0.166
	LTE Band 5	10MHz/50RB	Right Cheek	20525	836.5	23.21	23.3	1.004	0.07	0.152	0.153
	LTE Band 5	10MHz/1RB	Right Tilted	20525	836.5	23.21	23.3	1.004	0.06	0.117	0.117
	LTE Band 5	10MHz/50RB	Right Tilted	20525	836.5	23.21	23.3	1.004	0.09	0.110	0.110
#3	LTE Band 5	10MHz/1RB	Left Cheek	20525	836.5	23.21	23.3	1.004	-0.12	0.177	0.178
	LTE Band 5	10MHz/50RB	Left Cheek	20525	836.5	23.21	23.3	1.004	-0.07	0.164	0.165
	LTE Band 5	10MHz/1RB	Left Tilted	20525	836.5	23.21	23.3	1.004	0.08	0.126	0.126
	LTE Band 5	10MHz/50RB	Left Tilted	20525	836.5	23.21	23.3	1.004	0.07	0.125	0.125
	LTE Band 41	20MHz/1RB	Right Cheek	41140	2640	23.68	23.7	1.001	0.16	0.114	0.114
	LTE Band 41	20MHz/50RB	Right Cheek	41140	2640	23.68	23.7	1.001	-0.15	0.112	0.112
	LTE Band 41	20MHz/1RB	Right Tilted	41140	2640	23.68	23.7	1.001	0.09	0.072	0.072
	LTE Band 41	20MHz/50RB	Right Tilted	41140	2640	23.68	23.7	1.001	0.11	0.066	0.066
#4	LTE Band 41	20MHz/1RB	Left Cheek	41140	2640	23.68	23.7	1.001	0.08	0.124	0.124
	LTE Band 41	20MHz/50RB	Left Cheek	41140	2640	23.68	23.7	1.001	0.09	0.114	0.114
	LTE Band 41	20MHz/1RB	Left Tilted	41140	2640	23.68	23.7	1.001	-0.11	0.068	0.068
	LTE Band 41	20MHz/50RB	Left Tilted	41140	2640	23.68	23.7	1.001	0.08	0.066	0.066

<WIFI 2.4GHz>

Plot No.	Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
#5	WIFI2.4GHz	802.11b	Right Cheek	1	2412	17.25	17.5	1.014	-0.08	0.108	0.110
	WIFI2.4GHz	802.11b	Right Tilted	1	2412	17.25	17.5	1.014	0.06	0.087	0.088
	WIFI2.4GHz	802.11b	Left Cheek	1	2412	17.25	17.5	1.014	0.07	0.096	0.097
	WIFI2.4GHz	802.11b	Left Tilted	1	2412	17.25	17.5	1.014	0.10	0.075	0.076
	WIFI5.2GHz	802.11a	Right Cheek	40	5200	16.72	16.8	1.005	0.06	0.082	0.082
	WIFI5.2GHz	802.11a	Right Tilted	40	5200	16.72	16.8	1.005	0.11	0.056	0.056
#6	WIFI5.2GHz	802.11a	Left Cheek	40	5200	16.72	16.8	1.005	0.08	0.091	0.091
	WIFI5.2GHz	802.11a	Left Tilted	40	5200	16.72	16.8	1.005	-0.12	0.067	0.067
#7	WIFI5.8GHz	802.11a	Right Cheek	149	5745	12.0	12.0	1.000	0.09	0.079	0.079
	WIFI5.8GHz	802.11a	Right Tilted	149	5745	12.0	12.0	1.000	0.12	0.044	0.044
	WIFI5.8GHz	802.11a	Left Cheek	149	5745	12.0	12.0	1.000	0.08	0.066	0.066
	WIFI5.8GHz	802.11a	Left Tilted	149	5745	12.0	12.0	1.000	0.13	0.043	0.043

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12.2. Body –worn and Hotspot SAR Results

<GSM>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	GSM850	GPRS(4 Tx slots)	Front	10	128	824.2	26.87	27.0	1.005	0.06	0.452	0.454
#8	GSM850	GPRS(4 Tx slots)	Back	10	128	824.2	26.87	27.0	1.005	0.08	0.765	0.769
	GSM850	GPRS(4 Tx slots)	Left Side	10	128	824.2	N/A	N/A	N/A	N/A	N/A	N/A
	GSM850	GPRS(4 Tx slots)	Right Side	10	128	824.2	26.87	27.0	1.005	-0.12	0.212	0.213
	GSM850	GPRS(4 Tx slots)	Top Side	10	128	824.2	26.87	27.0	1.005	-0.11	0.315	0.317
	GSM850	GPRS(4 Tx slots)	Bottom Side	10	128	824.2	N/A	N/A	N/A	N/A	N/A	N/A
	GSM1900	GPRS(4 Tx slots)	Front	10	810	1909.8	27.86	28.0	1.005	0.05	0.452	0.454
#9	GSM1900	GPRS(4 Tx slots)	Back	10	810	1909.8	27.86	28.0	1.005	0.11	0.687	0.690
	GSM1900	GPRS(4 Tx slots)	Left Side	10	810	1909.8	N/A	N/A	N/A	N/A	N/A	N/A
	GSM1900	GPRS(4 Tx slots)	Right Side	10	810	1909.8	27.86	28.0	1.005	-0.06	0.204	0.205
	GSM1900	GPRS(4 Tx slots)	Top Side	10	810	1909.8	27.86	28.0	1.005	0.08	0.289	0.290
	GSM1900	GPRS(4 Tx slots)	Bottom Side	10	810	1909.8	N/A	N/A	N/A	N/A	N/A	N/A

<LTE>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	LTE Band 5	10MHz/1RB	Front	10	20525	836.5	23.21	23.3	1.000	0.08	0.265	0.266
	LTE Band 5	10MHz/50RB	Front	10	20525	836.5	23.21	23.3	1.000	0.16	0.252	0.253
#10	LTE Band 5	10MHz/1RB	Back	10	20525	836.5	23.21	23.3	1.000	0.09	0.533	0.535
	LTE Band 5	10MHz/50RB	Back	10	20525	836.5	23.21	23.3	1.000	0.10	0.424	0.426
	LTE Band 5	10MHz/1RB	Left Side	10	20525	836.5	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 5	10MHz/50RB	Left Side	10	20525	836.5	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 5	10MHz/1RB	Right Side	10	20525	836.5	23.21	23.3	1.000	-0.11	0.186	0.187
	LTE Band 5	10MHz/50RB	Right Side	10	20525	836.5	23.21	23.3	1.000	0.05	0.105	0.105
	LTE Band 5	10MHz/1RB	Top Side	10	20525	836.5	23.21	23.3	1.000	0.08	0.207	0.208
	LTE Band 5	10MHz/50RB	Top Side	10	20525	836.5	23.21	23.3	1.000	0.12	0.130	0.131
	LTE Band 5	10MHz/1RB	Bottom Side	10	20525	836.5	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 5	10MHz/50RB	Bottom Side	10	20525	836.5	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 41	20MHz/1RB	Front	10	41140	2640	23.68	23.7	1.011	0.01	0.257	0.257
	LTE Band 41	20MHz/50RB	Front	10	41140	2640	23.68	23.7	1.011	0.08	0.251	0.251
#11	LTE Band 41	20MHz/1RB	Back	10	41140	2640	23.68	23.7	1.011	0.12	0.463	0.463
	LTE Band 41	20MHz/50RB	Back	10	41140	2640	23.68	23.7	1.011	0.09	0.435	0.435
	LTE Band 41	20MHz/1RB	Left Side	10	41140	2640	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 41	20MHz/50RB	Left Side	10	41140	2640	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 41	20MHz/1RB	Right Side	10	41140	2640	23.68	23.7	1.011	0.11	0.129	0.129
	LTE Band 41	20MHz/50RB	Right Side	10	41140	2640	23.68	23.7	1.011	0.03	0.126	0.126
	LTE Band 41	20MHz/1RB	Top Side	10	41140	2640	23.68	23.7	1.011	0.07	0.169	0.169
	LTE Band 41	20MHz/50RB	Top Side	10	41140	2640	23.68	23.7	1.011	0.08	0.155	0.155
	LTE Band 41	20MHz/1RB	Bottom Side	10	41140	2640	N/A	N/A	N/A	N/A	N/A	N/A
	LTE Band 41	20MHz/50RB	Bottom Side	10	41140	2640	N/A	N/A	N/A	N/A	N/A	N/A

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<WIFI 2.4GHz>

Plot No.	Band	Mode	Test Position	Gap (cm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR _{1g} (W/kg)	Reported SAR _{1g} (W/kg)
	WIFI2.4GHz	802.11b	Front	10	1	2412	17.25	17.5	1.014	0.07	0.087	0.088
#12	WIFI2.4GHz	802.11b	Back	10	1	2412	17.25	17.5	1.014	0.08	0.134	0.136
	WIFI2.4GHz	802.11b	Left Side	10	1	2412	17.25	17.5	1.014	0.07	0.085	0.086
	WIFI2.4GHz	802.11b	Right Side	10	1	2412	N/A	N/A	N/A	N/A	N/A	N/A
	WIFI2.4GHz	802.11b	Top Side	10	1	2412	17.25	17.5	1.014	0.15	0.083	0.084
	WIFI2.4GHz	802.11b	Bottom Side	10	1	2412	N/A	N/A	N/A	N/A	N/A	N/A
	WIFI5.2GHz	802.11a	Front	10	40	5200	16.72	16.8	1.005	0.06	0.096	0.096
#13	WIFI5.2GHz	802.11a	Back	10	40	5200	16.72	16.8	1.005	-0.10	0.106	0.107
	WIFI5.2GHz	802.11a	Left Side	10	40	5200	16.72	16.8	1.005	0.06	0.065	0.065
	WIFI5.2GHz	802.11a	Right Side	10	40	5200	N/A	N/A	N/A	N/A	N/A	N/A
	WIFI5.2GHz	802.11a	Top Side	10	40	5200	16.72	16.8	1.005	0.06	0.073	0.073
	WIFI5.2GHz	802.11a	Bottom Side	10	40	5200	N/A	N/A	N/A	N/A	N/A	N/A
	WIFI5.8GHz	802.11a	Front	10	149	5745	12.0	12.0	1.000	0.12	0.065	0.065
#14	WIFI5.8GHz	802.11a	Back	10	149	5745	12.0	12.0	1.000	0.08	0.092	0.092
	WIFI5.8GHz	802.11a	Left Side	10	149	5745	12.0	12.0	1.000	0.11	0.047	0.047
	WIFI5.8GHz	802.11a	Right Side	10	149	5745	N/A	N/A	N/A	N/A	N/A	N/A
	WIFI5.8GHz	802.11a	Top Side	10	149	5745	12.0	12.0	1.000	-0.08	0.056	0.056
	WIFI5.8GHz	802.11a	Bottom Side	10	149	5745	N/A	N/A	N/A	N/A	N/A	N/A

Note:

1. Per KDB 865664 D01V01, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥ 0.8 W/Kg.
2. Per KDB 865664 D01V01, if the ratio of largest to smallest SAR for the original and first repeated measurement is ≤ 1.2 and the measured SAR < 1.45 W/Kg, only one repeated measurement is required.
3. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/Kg.
4. The ratio is the difference in percentage between original and repeated measured SAR.

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13.Simultaneous Transmission Analysis

Simultaneous TX SAR Considerations

No.	Applicable Simultaneous Transmission
1.	GSM+WIFI 2.4G
2.	LTE+WIFI2.4G
3.	GSM+BT
4.	LTE+BT
5.	GSM+WIFI 5.2G
6.	LTE+WIFI 5.2G
7.	GSM+WIFI 5.8G
8.	LTE+WIFI 5.8G

Note:

1. WIFI 2.4GHz, WIFI 5GHz and Bluetooth share the same antenna, and can not transmit simultaneously.
2. EUT will choose either GSM/ LTE according to the network signal condition; therefore, GSM/ LTE cannot transmit simultaneously.
3. Bluetooth stand-alone SAR tests are not required and are considered zero in the SAR summation.

Evaluation of Simultaneous SAR

<GSM>

Test Position	WiFi SAR _{1-g} (W/Kg)	GSM 850 _{1-g} (W/Kg)	PCS 1900 _{1-g} (W/Kg)	MAX. ΣSAR _{1-g} (W/Kg)	SAR _{1-g} Limit (W/Kg)	Simut. Meas. Required
Right Cheek	0.110	0.241	0.165	0.351	1.6	N/A
Right Tilted	0.088	0.175	0.124	0.263	1.6	N/A
Left Cheek	0.097	0.210	0.145	0.307	1.6	N/A
Left Tilted	0.076	0.166	0.102	0.242	1.6	N/A
Front	0.088	0.454	0.454	0.542	1.6	N/A
Back	0.136	0.769	0.690	0.905	1.6	N/A
Left Side	0.086	N/A	N/A	N/A	1.6	N/A
Right Side	N/A	0.213	0.205	N/A	1.6	N/A
Top side	0.084	0.317	0.290	0.401	1.6	N/A
Bottom Side	N/A	N/A	N/A	N/A	1.6	N/A

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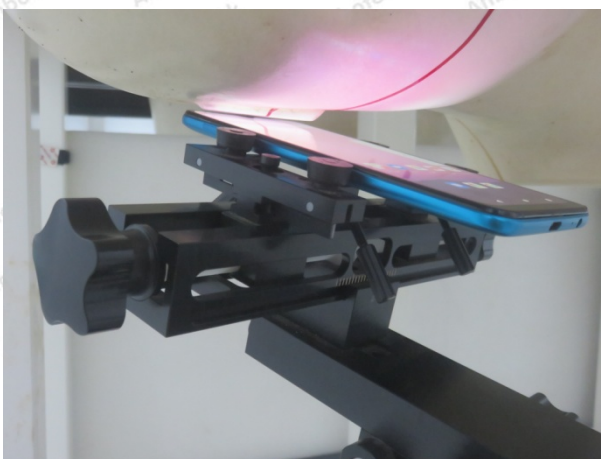
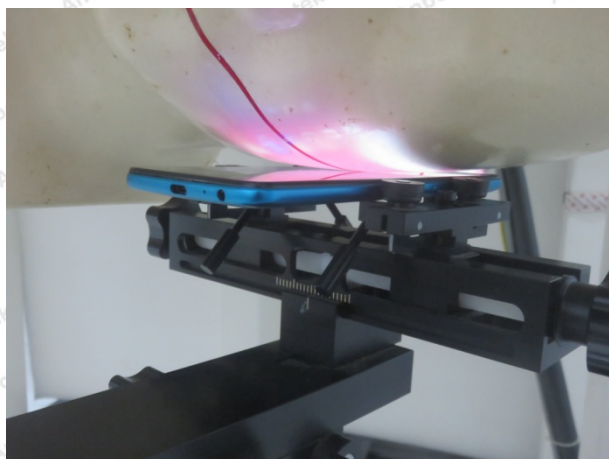
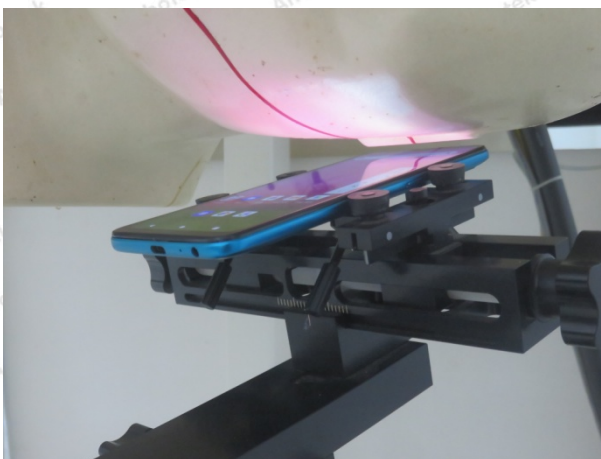
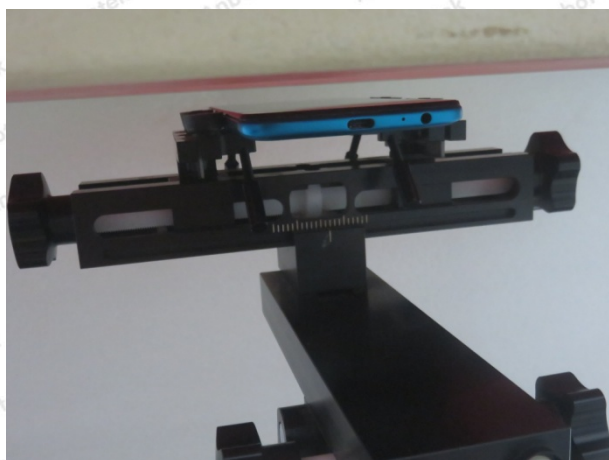
<LTE>

Test Position	WiFi SAR _{1-g} (W/Kg)	LTE BAND 5 _{1-g} (W/Kg)	LTE BAND 41 _{1-g} (W/Kg)	MAX. ΣSAR _{1-g} (W/Kg)	SAR _{1-g} Limit (W/Kg)	Simut. Meas. Required
Right Cheek	0.110	0.166	0.114	0.276	1.6	N/A
Right Tilted	0.088	0.117	0.072	0.205	1.6	N/A
Left Cheek	0.097	0.178	0.124	0.275	1.6	N/A
Left Tilted	0.076	0.126	0.068	0.202	1.6	N/A
Front	0.088	0.266	0.257	0.354	1.6	N/A
Back	0.136	0.535	0.463	0.671	1.6	N/A
Left Side	0.086	N/A	N/A	N/A	1.6	N/A
Right Side	N/A	0.187	0.129	N/A	1.6	N/A
Top side	0.084	0.208	0.169	0.292	1.6	N/A
Bottom Side	N/A	N/A	N/A	N/A	1.6	N/A

14.Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/Kg, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval.

Appendix A. EUT Photos and Test Setup Photos

**Right Check****Right Tilt 15°****Left Check****Left Tilt 15°****Front with Phantom 10 mm****Back with Phantom 10 mm**

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Bottom with Phantom (10mm)



Left with Phantom (10mm)



Right with Phantom (10mm)

Appendix B. Plots of SAR System Check

System Performance Check at 835 MHz Body

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

Date: 08/30/2020

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

Medium parameters used (interpolated): $f = 835$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.04$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(9.88, 9.88, 9.88); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x91x1): Measurement grid: $dx=15.00$ mm, $dy=15.00$ mm

Maximum value of SAR (interpolated) = 2.892 mW/g

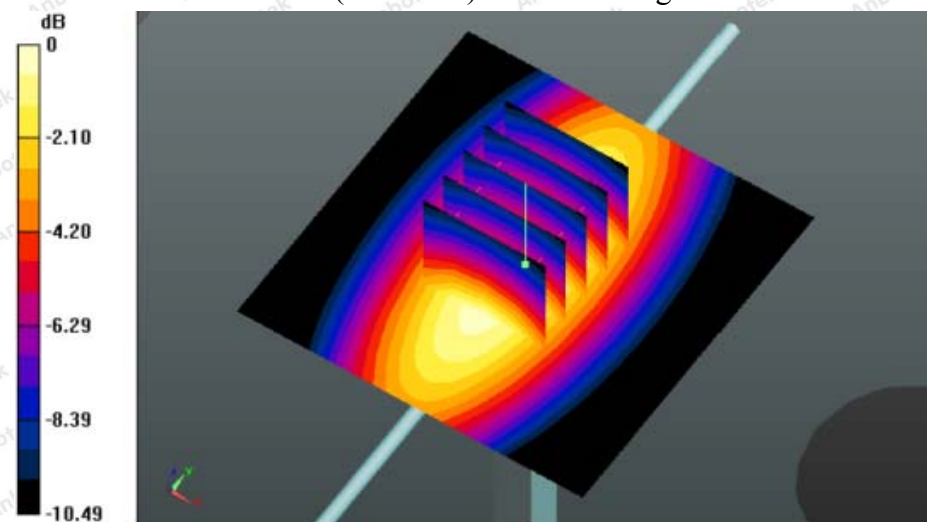
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 50.236 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 3.251 W/kg

SAR(1 g) = 2.34 mW/g; SAR(10 g) = 1.56 mW/g

Maximum value of SAR (measured) = 2.879 mW/g



System Performance Check 835MHz Body 250mW

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System Performance Check at 1900 MHz Body

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

Date: 08/28/2020

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 1900$ MHz; $\sigma = 1.50$ S/m; $\epsilon_r = 53.83$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN7396; ConvF(7.97, 7.97, 7.97); Calibrated: 05.06.2020;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn387; Calibrated: 03.09.2019

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1): Measurement grid: $dx=15.00$ mm, $dy=15.00$ mm

Maximum value of SAR (interpolated) = 16.365 mW/g

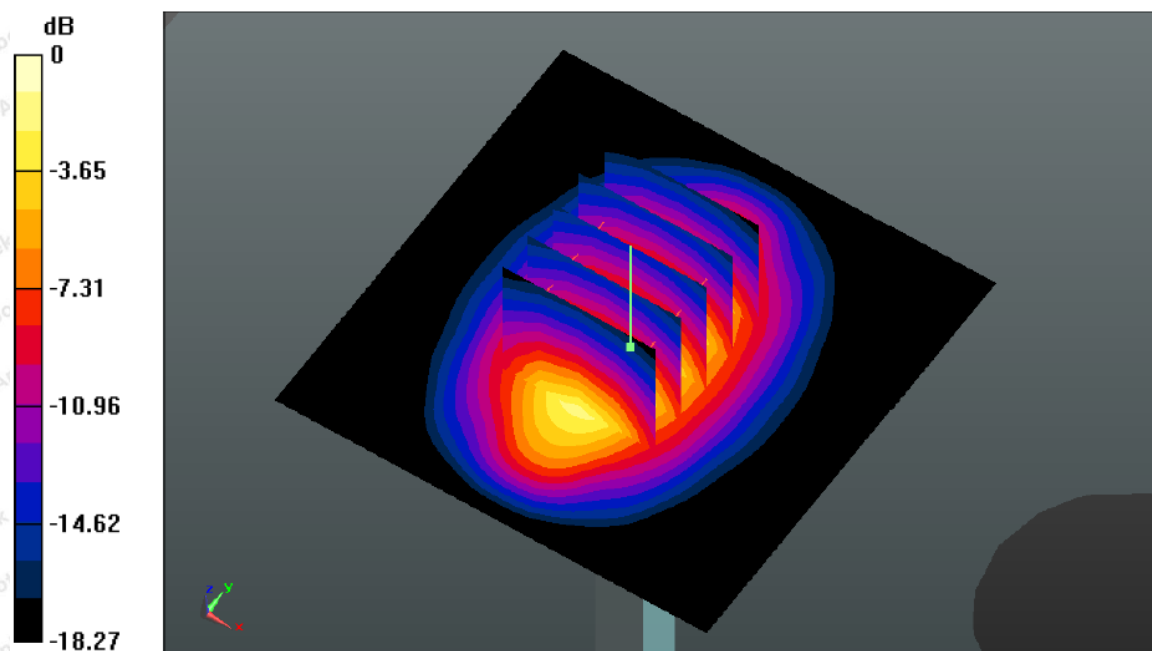
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=8$ mm, $dy=8$ mm, $dz=5$ mm

Reference Value = 87.414 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 19.622 W/kg

SAR(1 g) = 10.14 mW/g; SAR(10 g) = 5.32 mW/g

Maximum value of SAR (measured) = 15.11 mW/g



System Performance Check 1900MHz Body250mW

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System Performance Check at 2450 MHz Body

Date:08/29/2020

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

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

Medium parameters used (interpolated): $f = 2450$ MHz; $\sigma = 1.93$ S/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

Probe: EX3DV4 - SN7396; ConvF(7.53, 7.53, 7.53); Calibrated: 05.06.2020;

Sensor-Surface: 3mm (Mechanical Surface Detection)

Electronics: DAE4 Sn387; Calibrated: 03.09.2019

Phantom: SAM 1; Type: SAM;

Measurement SW: DASY52, Version 52.8 (1); SEMCAD X Version 14.6.5 (6469)

Area Scan (61x91x1):Measurement grid: dx=10.00 mm, dy=10.00 mm

Maximum value of SAR (interpolated) = 19.225 mW/g

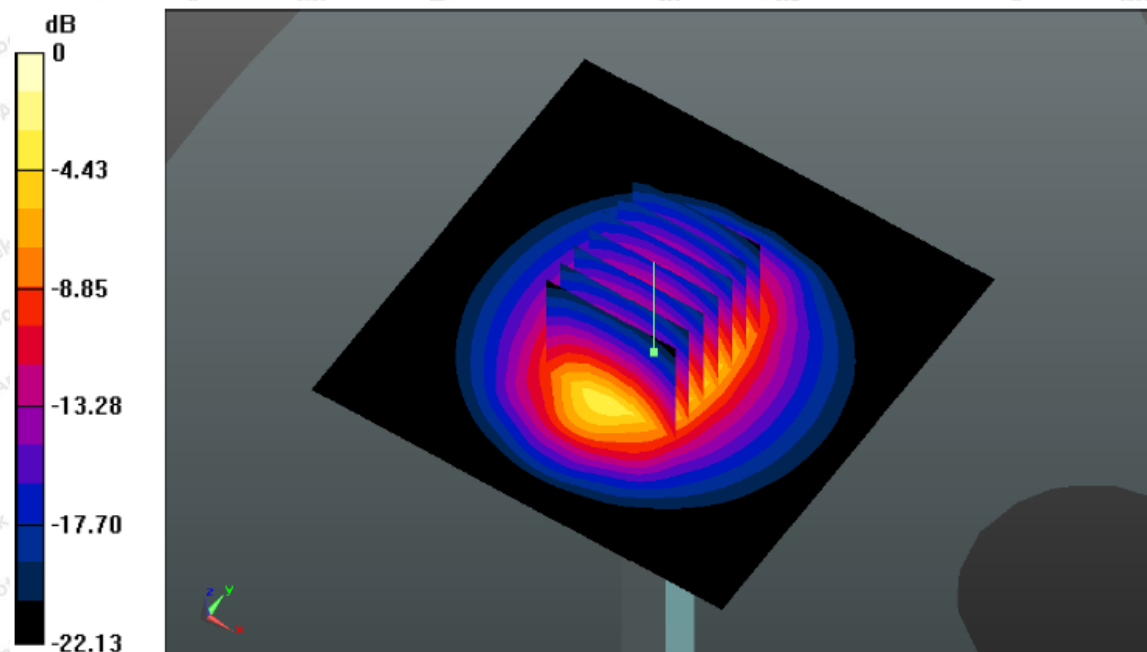
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 84.153 V/m; Power Drift = 0.05dB

Peak SAR (extrapolated) = 26.125 W/kg

SAR(1 g) = 12.96 mW/g; SAR(10 g) = 5.69 mW/g

Maximum value of SAR (measured) = 19.18mW/g



System Performance Check 2450MHz Body250mW

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2600MHz Head System Check at Body**DUT: Dipole 2600 MHz; Type: D2600V2;**

Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2600$ MHz; $\sigma = 2.08$ S/m; $\epsilon_r = 52.62$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(7.38, 7.38, 7.38); Calibrated: 05.06.2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=250mW/Area Scan (81x81x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm

Maximum value of SAR (interpolated) = 24.8 W/kg

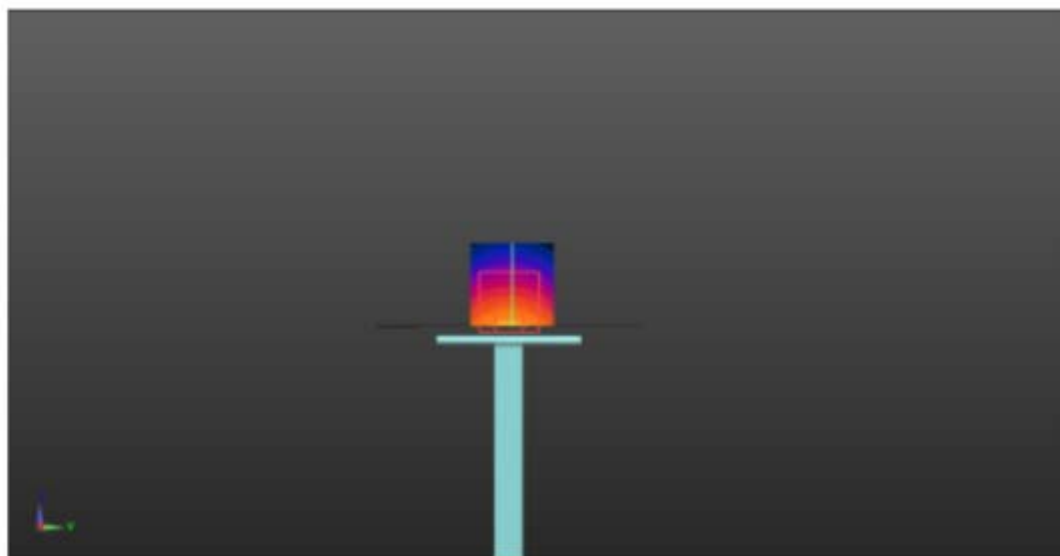
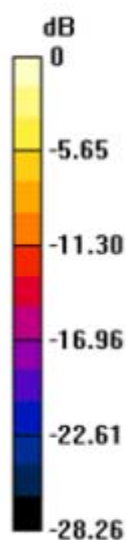
Configuration/Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 110.2 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 33.1 W/kg

SAR(1 g) = 13.42 W/kg; SAR(10 g) = 6.47 W/kg

Maximum value of SAR (measured) = 25.6 W/kg



5200MHz System Check**DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160**

Communication System: UID 0, CW; Frequency: 5200 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5200$ MHz; $\sigma = 5.53$ S/m; $\epsilon_r = 48.27$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(4.93, 4.93, 4.93); Calibrated: May,06.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: Sep 3,2019
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 49.005 V/m; Power Drift = 0.08 dB

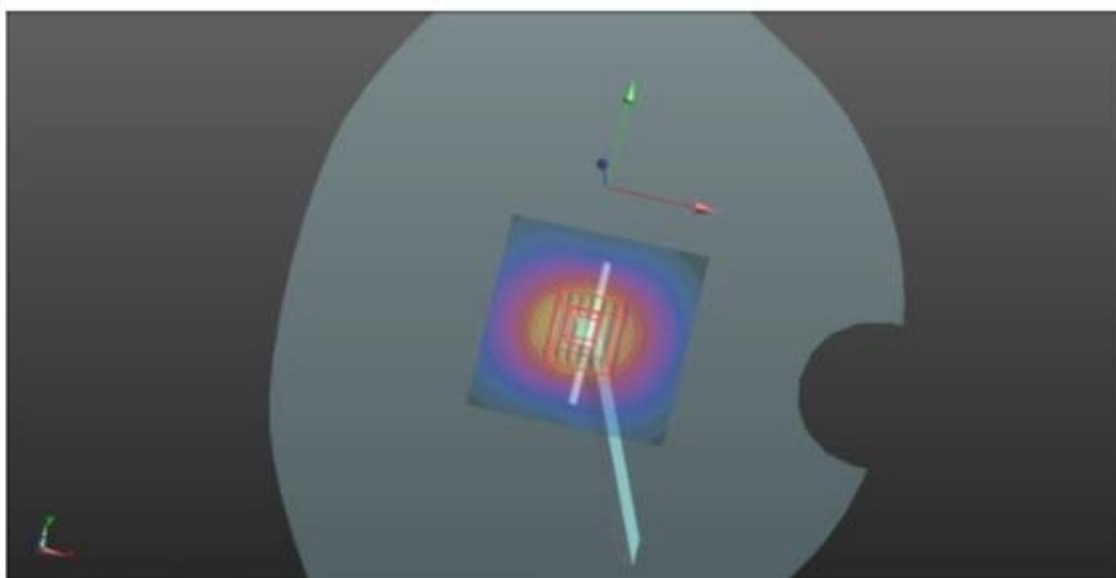
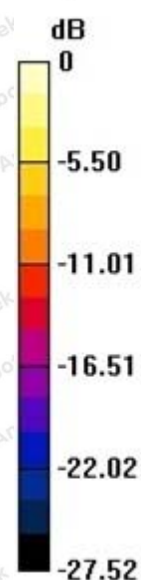
Peak SAR (extrapolated) = 31.8 W/kg

SAR(1 g) = 7.68 W/kg; SAR(10 g) = 2.17 W/kg

Maximum value of SAR (measured) = 19.4 W/kg

Configuration/Pin=100mW/Area Scan (71x71x1):Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.9 W/kg



5800MHz System Check

DUT: Dipole 5 GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1160

Communication System: UID 0, CW; Frequency: 5800 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 5800 \text{ MHz}$; $\sigma = 6.11 \text{ S/m}$; $\epsilon_r = 47.45$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(4.93, 4.93, 4.93); Calibrated: May,06.2020;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: Sep 3,2019
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

Configuration/Pin=100mW/Zoom Scan (7x7x7)/Cube 0:Measurement grid: $dx=4\text{mm}$, $dy=4\text{mm}$, $dz=1.4\text{mm}$

Reference Value = 49.012 V/m; Power Drift = 0.08 dB

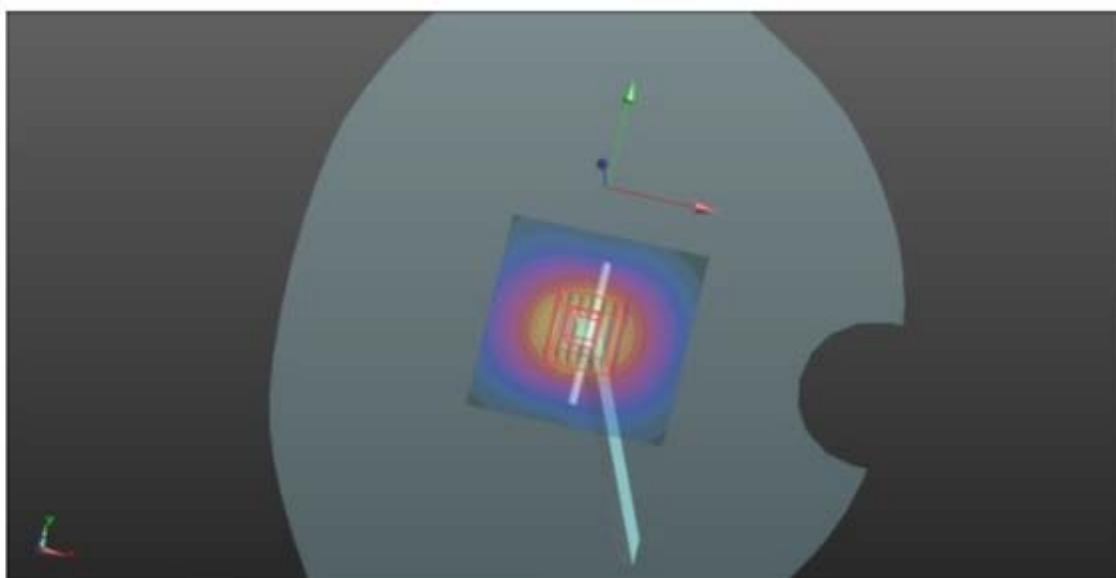
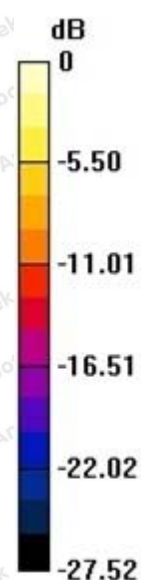
Peak SAR (extrapolated) = 32.6 W/kg

SAR(1 g) = 7.72 W/kg; SAR(10 g) = 2.35 W/kg

Maximum value of SAR (measured) = 18.8 W/kg

Configuration/Pin=100mW/Area Scan (71x71x1):Interpolated grid: $dx=1.000 \text{ mm}$, $dy=1.000 \text{ mm}$

Maximum value of SAR (interpolated) = 18.8 W/kg



Appendix C. Plots of SAR Test Data

#1Date: 08/30/2020

GSM850_GSM Voice_Right Cheek_Ch190

Communication System: UID 0, Generic GSM (0); Frequency: 836.6 MHz;Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.04$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(9.71, 9.71, 9.71); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Right HEAD/L-C/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.323 W/kg

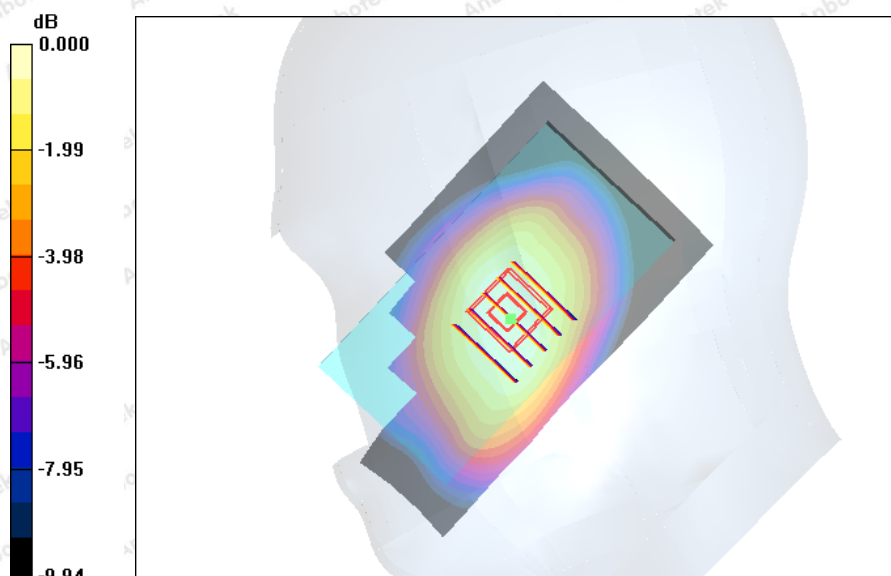
Right HEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.41 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 0.315 W/kg

SAR(1 g) = 0.241 W/kg; SAR(10 g) = 0.175 W/kg

Maximum value of SAR (measured) = 0.312 W/kg



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#2 Date: 08/28/2020

GSM1900_GSM Voice_Right Cheek_Ch512

Communication System: UID 0, Generic GSM (0); Frequency: 1850.2 MHz; Duty Cycle: 1:1.99986

Medium parameters used: $f = 1850.2$ MHz; $\sigma = 1.50$ S/m; $\epsilon_r = 53.83$; $\rho = 1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(8.13, 8.13, 8.13); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Right HEAD/L-C/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.188 W/kg

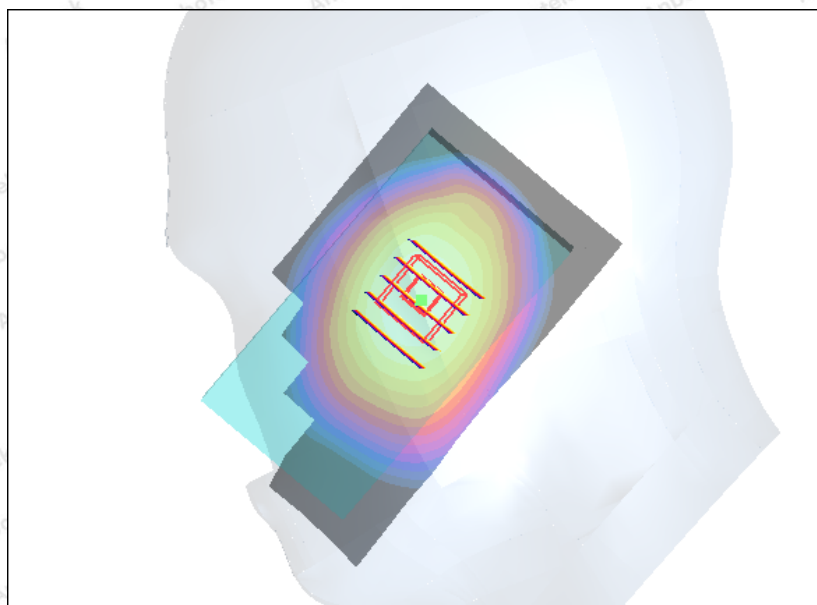
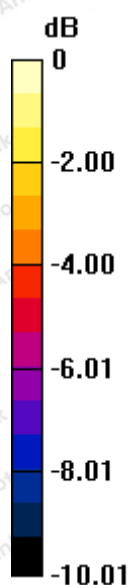
Right HEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.52 V/m; Power Drift = 0.10 dB

Peak SAR (extrapolated) = 0.174 W/kg

SAR(1 g) = 0.165 W/kg; SAR(10 g) = 0.102 W/kg

Maximum value of SAR (measured) = 0.182 W/kg

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Date: 08/30/2020

LTE Band 5_Left Cheek_Ch20600

Communication System: UID 0, Generic LTE (0); Frequency: 844.0 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 844.0$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.04$; $\rho = 1000$ kg/m³

Phantom section: left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(9.87, 9.87, 9.87); Calibrated: 05. 06,2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (7x11x1):Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.184 mW/g

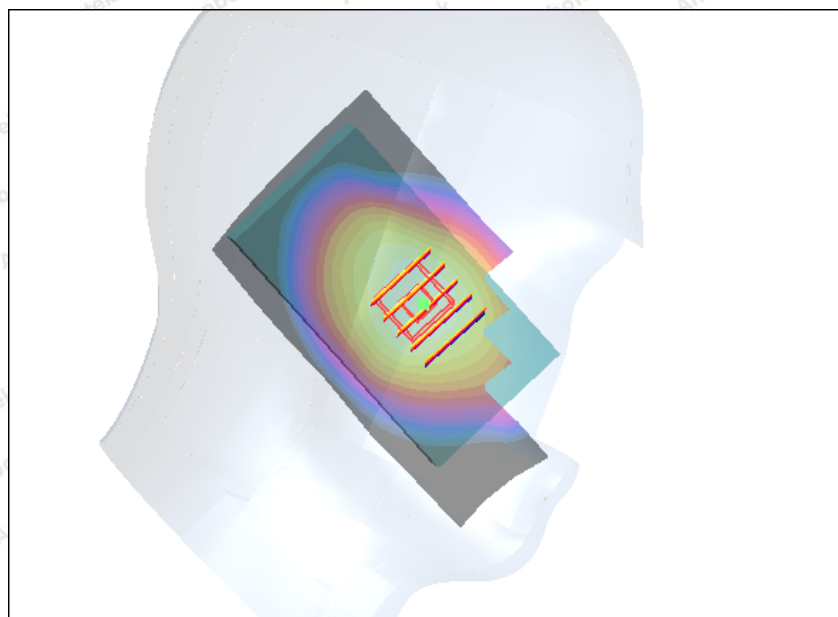
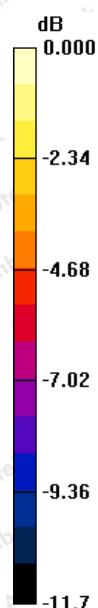
Zoom Scan (5x5x7)/Cube 0:Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.54 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 0.182 W/kg

SAR(1 g) = 0.1 77 mW/g; SAR(10 g) = 0.086 mW/g

Maximum value of SAR (measured) = 0.177 mW/g



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#4

Date: 08/27/2020

LTE Band 41_Left Cheek_Ch41140

Communication System: UID 0, Generic LTE (0); Frequency: 2640MHz;

Medium parameters used (interpolated): $f=2640$ MHz; $\sigma=2.08$ S/m; $\epsilon_r=52.62$; $\rho=1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(7.38, 7.38, 7.38); Calibrated: 05. 06,2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (8x13x1):Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.145 mW/g

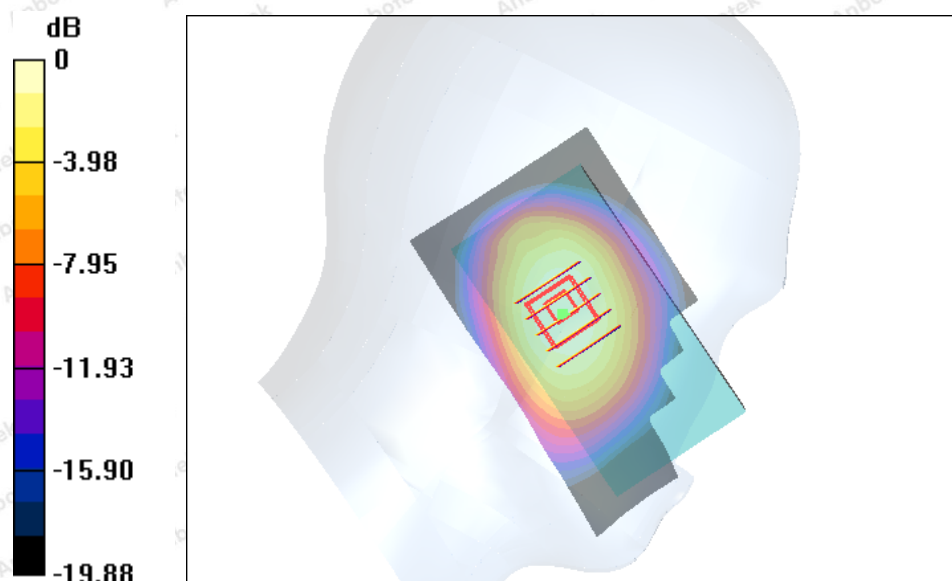
Zoom Scan (5x5x7)/Cube 0:Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.32 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.124 mW/g; SAR(10 g) = 0.062 mW/g

Maximum value of SAR (measured) = 0.136 mW/g

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#5

Date: 08/29/2020

WIFI 2.4G_802.11b_RIGHTCheek_Ch6

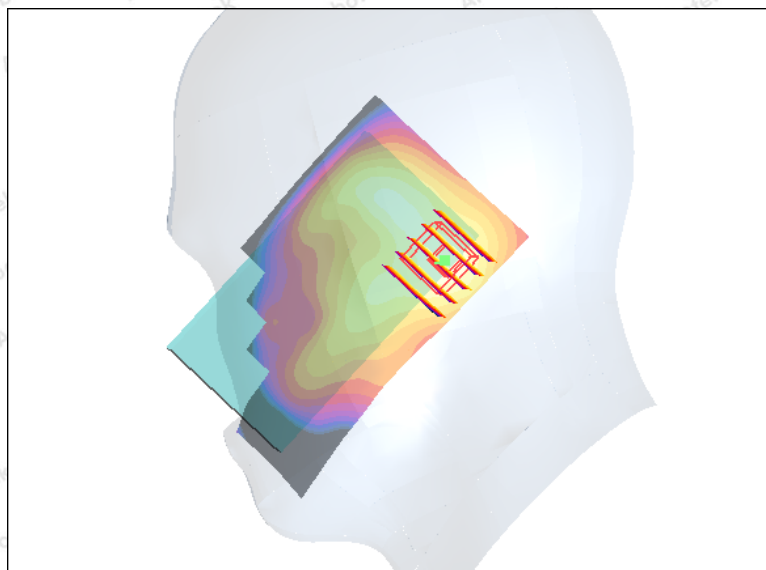
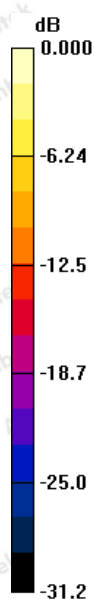
Communication System: UID 0, wifi (0); Frequency: 2437MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2437\text{MHz}$; $\sigma = 1.93\text{ S/m}$; $\epsilon_r = 52.1$; $\rho = 1000\text{ kg/m}^3$

Phantom section: LEFT Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(7.57, 7.57, 7.57); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

RIGHTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$ Maximum value of SAR (measured) = 0.112 W/kg RIGHTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$ Reference Value = 12.63 V/m ; Power Drift = -0.08 dB Peak SAR (extrapolated) = 0.125 W/kg SAR(1 g) = 0.108 W/kg ; SAR(10 g) = 0.062 W/kg Maximum value of SAR (measured) = 0.120 W/kg **Shenzhen Anbotek Compliance Laboratory Limited**

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#6Date: 08/31/2020

WIFI 5.2G_802.11a_LEFTCheek_Ch40

Communication System: UID 0, wifi (0); Frequency: 5200MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5200 \text{ MHz}$; $\sigma = 5.53 \text{ S/m}$; $\epsilon_r = 48.27$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: LEFT Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConyF(7.57, 7.57, 7.57); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

LEFTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$

Maximum value of SAR (measured) = 0.094 W/kg

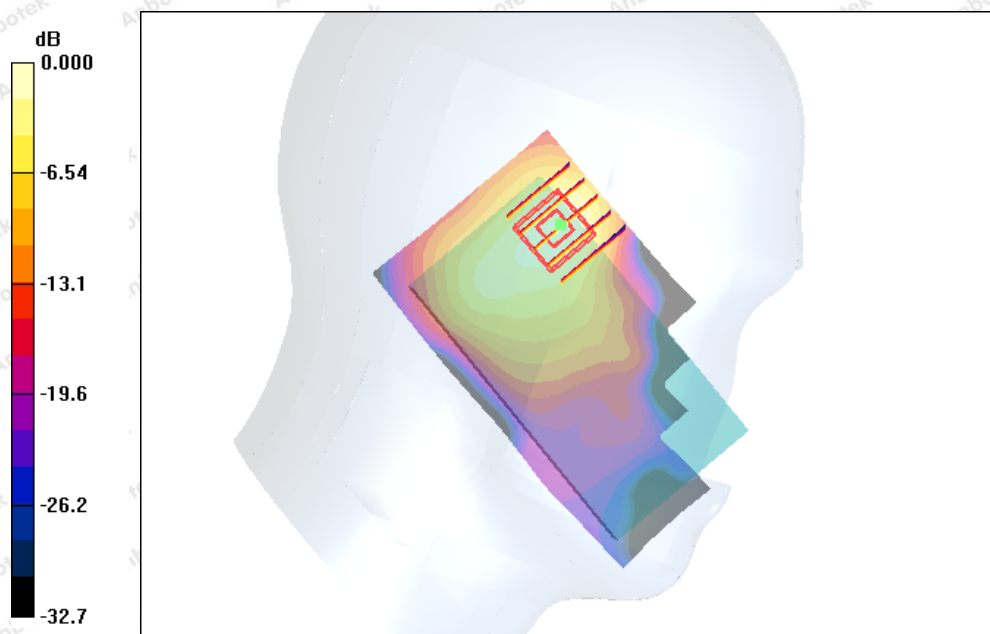
RIGHTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$

Reference Value = 12.12 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.096 W/kg

SAR(1 g) = 0.091 W/kg; SAR(10 g) = 0.055 W/kg

Maximum value of SAR (measured) = 0.094 W/kg

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#7Date: 08/31/2020

WIFI 5.8G_802.11a_RIGHTCheek_Ch149

Communication System: UID 0, wifi (0); Frequency: 5745MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5745 \text{ MHz}$; $\sigma = 6.11 \text{ S/m}$; $\epsilon_r = 47.45$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: LEFT Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConyF(7.57, 7.57, 7.57); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

RIGHTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$

Maximum value of SAR (measured) = 0.084 W/kg

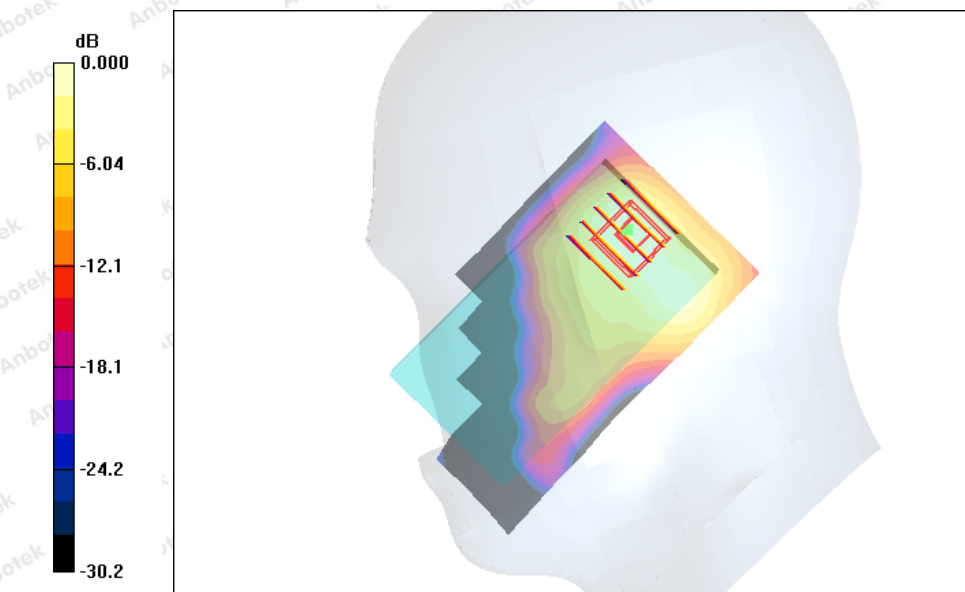
RIGHTHEAD/L-C/Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7\text{mm}$, $dy=7\text{mm}$, $dz=5\text{mm}$

Reference Value = 13.6 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.080 W/kg

SAR(1 g) = 0.079 W/kg; SAR(10 g) = 0.044 W/kg

Maximum value of SAR (measured) = 0.088 W/kg

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#8 Date: 08/30/2020

GSM850_GPRS_4TX_Body Back_Ch190

Communication System: UID 0, GPRS(4 Tx slots) (0); Frequency: 836.6MHz; Duty Cycle: 1:1.99986

Medium parameters used (interpolated): $f = 836.6$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.04$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(9.88, 9.88, 9.88); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/Unnamed procedure/Area Scan (161x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.780 W/kg

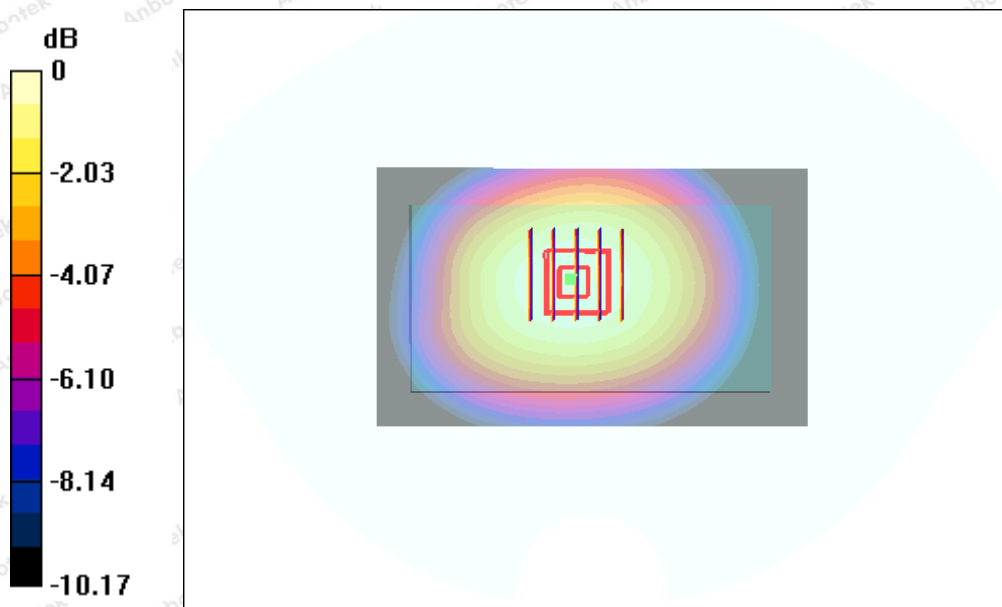
Configuration/Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 7.10 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.794 W/kg

SAR(1 g) = 0.765 W/kg; SAR(10 g) = 0.425 W/kg

Maximum value of SAR (measured) = 0.772 W/kg



#9Date: 08/28/2020

GSM1900_GPRS_4TX_Body Back_Ch512

Communication System: UID 0, GPRS(4 Tx slots) (0); Frequency: 1850.2MHz;Duty Cycle: 1:1.99986

Medium parameters used: $f = 1850.2 \text{ MHz}$; $\sigma = 1.50 \text{ S/m}$; $\epsilon_r = 53.83$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(7.97, 7.97, 7.97); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

BODY/4ST-BACK/Area Scan (9x15x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) =0.702 W/kg

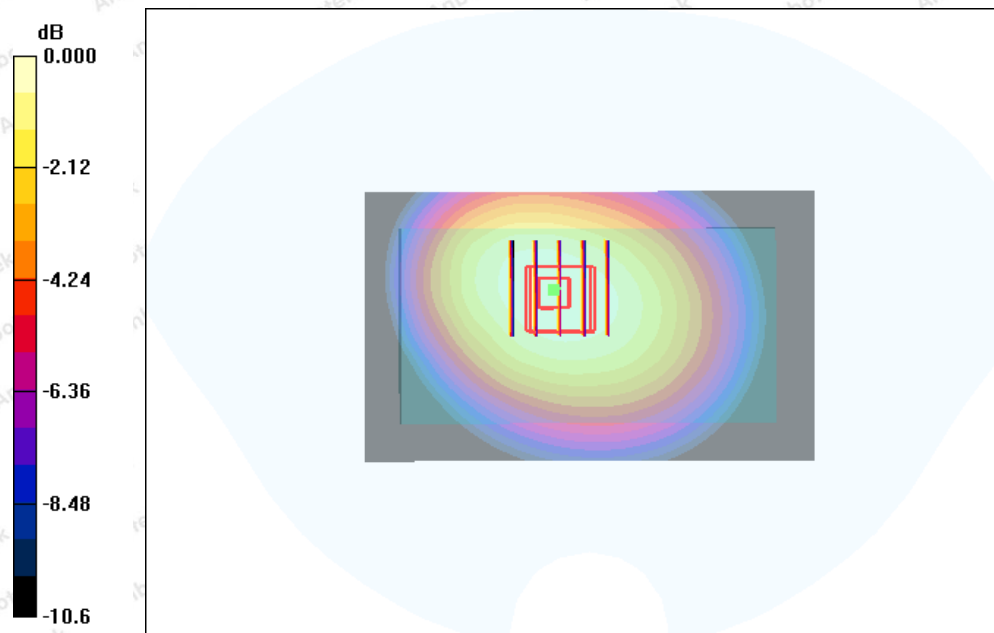
BODY/4ST-BACK/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 22.65 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 0.714 W/kg

SAR(1 g) = 0.687 W/kg; SAR(10 g) = 0.457 W/kg

Maximum value of SAR (measured) = 0.706 W/kg

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LTE Band 5_ Body Back_1RB_Ch20600

Communication System: UID 0, Generic LTE (0); Frequency: 844.0 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 844.0$ MHz; $\sigma = 0.99$ S/m; $\epsilon_r = 55.04$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(9.87, 9.87, 9.87); Calibrated: 05. 06,2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

BODY/BACK-L/Area Scan (8x13x1):Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.582 mW/g

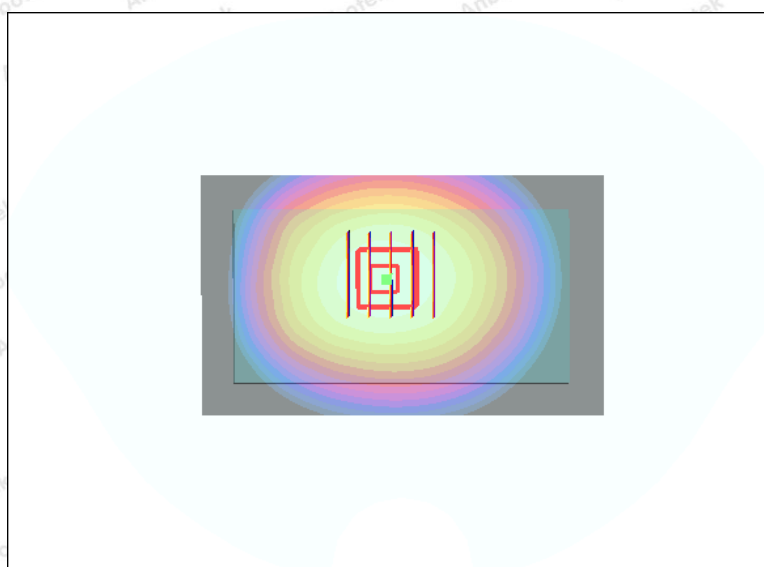
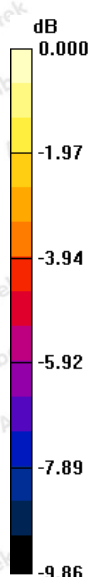
BODY/BACK-L/Zoom Scan (5x5x7)/Cube 0:Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 17.36 V/m; Power Drift = 0.09 dB

Peak SAR (extrapolated) = 0.565 W/kg

SAR(1 g) = 0.533 mW/g; SAR(10 g) = 0.285 mW/g

Maximum value of SAR (measured) = 0.554 mW/g



Date: 08/27/2020

LTE Band 41_ Body Back_1RB_ Ch41140

Communication System: UID 0, Generic LTE (0); Frequency: 2640 MHz;

Medium parameters used (interpolated): $f=2640$ MHz; $\sigma=2.08$ S/m; $\epsilon_r=52.62$; $\rho=1000$ kg/m³

Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(7.38, 7.38, 7.38); Calibrated: 05. 06,2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/Unnamed procedure/Area Scan (161x101x1): Interpolated grid: $dx=1.000$ mm, $dy=1.000$ mm

Maximum value of SAR (interpolated) = 0.475 W/kg

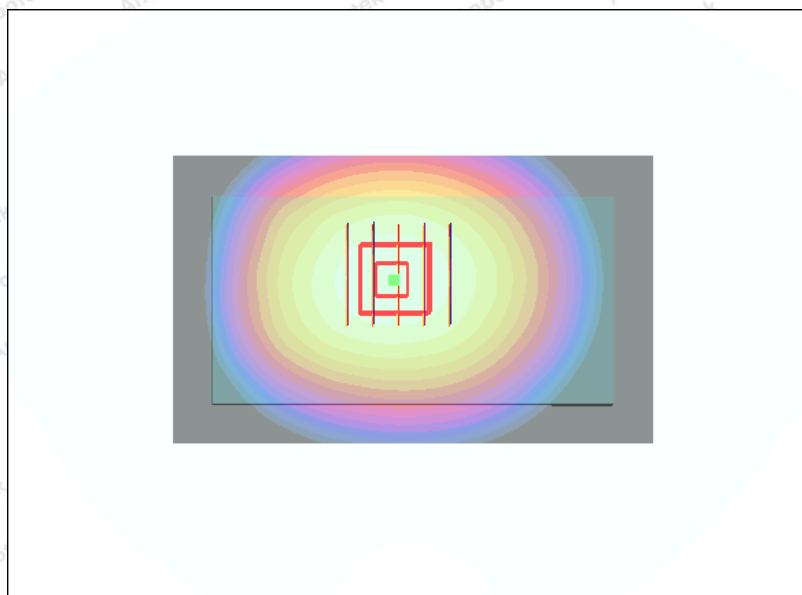
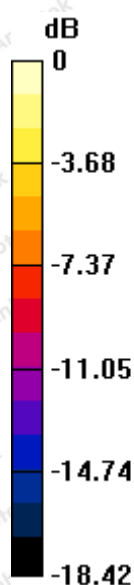
Configuration/Unnamed procedure/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 24.35 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.487 W/kg

SAR(1 g) = 0.463 W/kg; SAR(10 g) = 0.241 W/kg

Maximum value of SAR (measured) = 0.484 W/kg



#12 Date:08/29/2020

WIFI 2.4G_802.11b_Body Back_Ch6

Communication System: UID 0, wifi (fcc) (0); Frequency: 2437 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.93$ S/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7396; ConvF(7.53, 7.53, 7.53); Calibrated: 05.06.2020;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM 1; Type: SAM;
- Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Configuration/BACK/Area Scan (33x17x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.147 W/kg

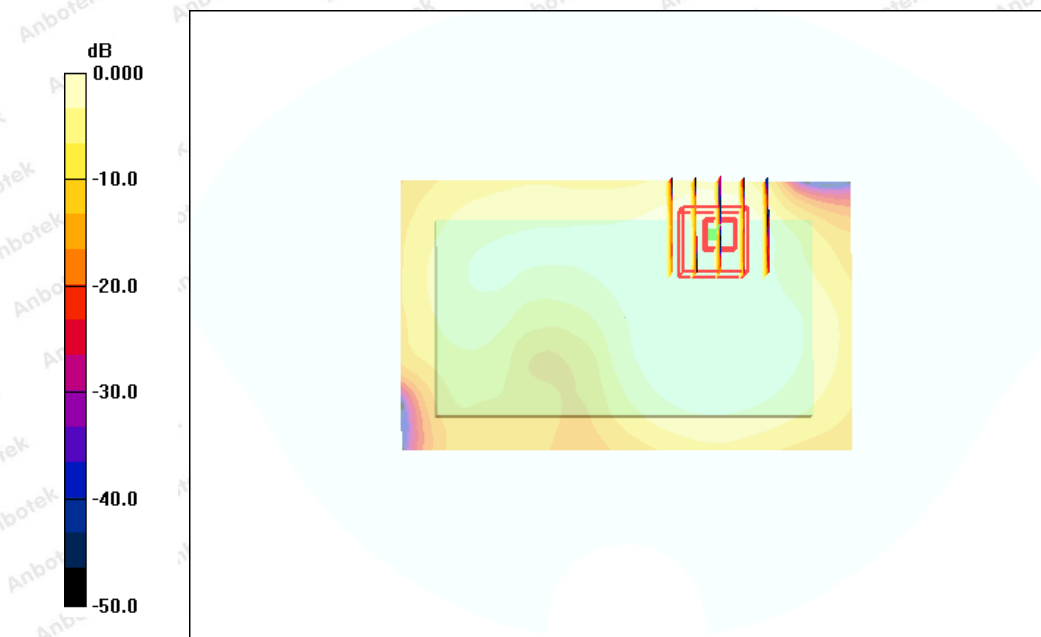
Configuration/BACK/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.13 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 0.155 W/kg

SAR(1 g) = 0.134 W/kg; SAR(10 g) = 0.078 W/kg

Maximum value of SAR (measured) = 0.155 W/kg

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#13 Date: 08/31/2020

WIFI 5.2G_Body back_Ch40

Communication System: UID 0, 802.11a (0); Frequency: 5200MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5200$ MHz; $\sigma = 5.53$ S/m; $\epsilon_r = 48.27$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(4.93, 4.93, 4.93); Calibrated: May,06.2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: Sep 3,2019

Phantom: SAM2; Type: QD000P40

- CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

BODY back /Area Scan (9x13x1):Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.116W/kg

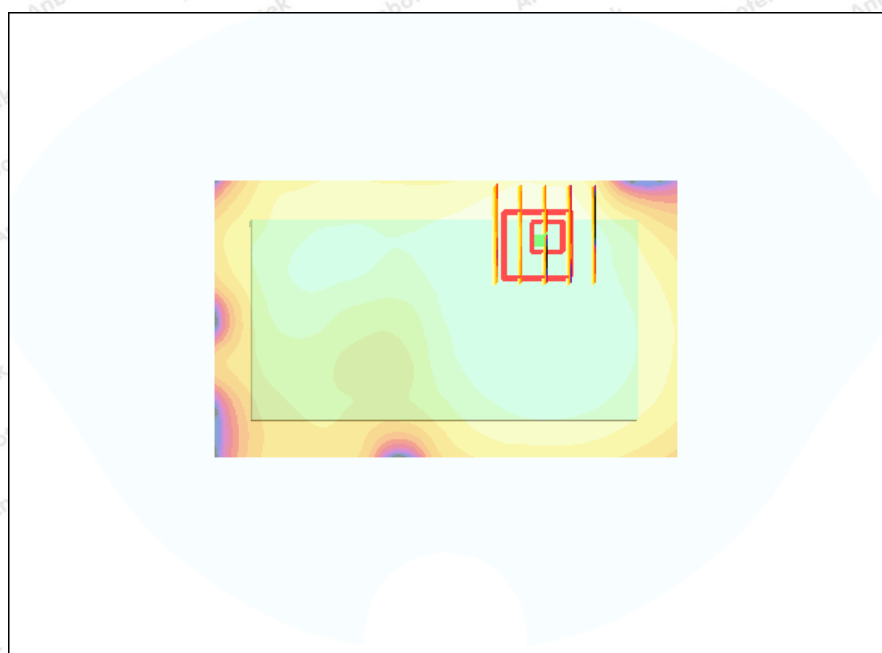
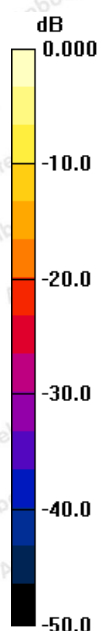
BODY back /Zoom Scan (8x8x12)/Cube 0:Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 22.20 V/m; Power Drift = -0.10 dB

Peak SAR (extrapolated) = 0.114 W/kg

SAR(1 g) = 0.106 W/kg; SAR(10 g) = 0.065 W/kg

Maximum value of SAR (measured) = 0.108 W/kg

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Date: 08/31/2020

WIFI 5.8G_Body back _Ch149

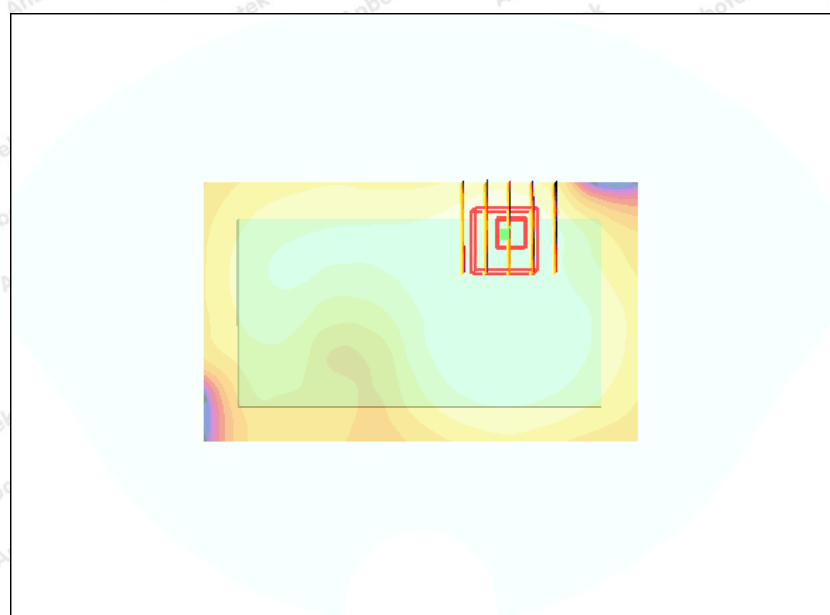
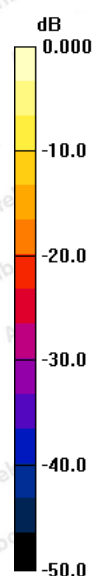
Communication System: UID 0, 802.11ac80 (0); Frequency: 5745MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): $f = 5745 \text{ MHz}$; $\sigma = 6.11 \text{ S/m}$; $\epsilon_r = 47.45$; $\rho = 1000 \text{ kg/m}^3$

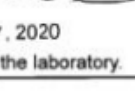
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7396; ConvF(4.93, 4.93, 4.93); Calibrated: 06.05.2020;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn387; Calibrated: 03.09.2019
- Phantom: SAM2; Type: QD000P40CD; Serial: TP:1670
- Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

BODY back /Area Scan (9x13x1):Measurement grid: $dx=10\text{mm}$, $dy=10\text{mm}$ Maximum value of SAR (measured) = 0.107 W/kg **BODY back /Zoom Scan (5x5x7)/Cube 0:** Measurement grid: $dx=8\text{mm}$, $dy=8\text{mm}$, $dz=5\text{mm}$ Reference Value = 11.36 V/m ; Power Drift = 0.08 dB Peak SAR (extrapolated) = 0.109 W/kg **SAR(1 g) = 0.092 W/kg ; SAR(10 g) = 0.060 W/kg** Maximum value of SAR (measured) = 0.105 W/kg 

Appendix D. DASY System Calibration Certificate

		In Collaboration with s p e a g CALIBRATION LABORATORY				中国认可 国际互认 校准 CALIBRATION CNAS L0570
Add: No.51 Xueyuan Road, Haidian District, Beijing, 100191, China Tel: +86-10-62304633-2218 Fax: +86-10-62304633-2209 E-mail: cttl@chinattl.com Http://www.chinattl.cn						
Client		Anbotek (Auden)		Certificate No: Z20-68716		
CALIBRATION CERTIFICATE						
Object		EX3DV4 - SN:7396				
Calibration Procedure(s)		FF-Z11-007-03 Calibration Procedures for Dosimetric E-field Probes				
Calibration date:		May06, 2020				
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)℃ 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	20-Jun-19 (CTTL, No.J18X07447)		Jun-20	
Power sensor	NRP-Z91	101547	20-Jun-19 (CTTL, No.J18X07447)		Jun-20	
Power sensor	NRP-Z91	101548	20-Jun-19 (CTTL, No.J18X07447)		Jun-20	
Reference10dBAttenuator		18N50W-10dB	13-Mar-20(CTTL, No.J19X01547)		Mar-21	
Reference20dBAttenuator		18N50W-20dB	13-Mar-20(CTTL, No.J19X01548)		Mar-21	
Reference Probe	EX3DV4	SN 7433	26-Sep-19(SPEAG, No.EX3-7433_Sep18)		Sep-20	
DAE4		SN 549	13-Dec-19(SPEAG, No.DAE4-549_Dec18)		Dec -20	
Secondary Standards		ID #	Cal Date(Calibrated by, Certificate No.)		Scheduled Calibration	
SignalGenerator	MG3700A	6201052605	27-Jun-19 (CTTL, No.J18X04776)		Jun-20	
Network Analyzer	E5071C	MY46110673	13-Jan-20 (CTTL, No.J19X00285)		Jan -21	
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: May07, 2020 This calibration certificate shall not be reproduced except in full without written approval of the laboratory.						

Certificate No: Z20-68716

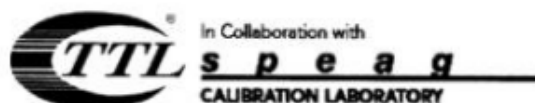
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Glossary:

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, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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 are 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: 7396

Calibrated: May 06, 2020

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: Z20-68716

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.54	0.53	0.50	±10.0%
DCP(mV) ^B	97.8	104.5	102.5	

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	199.9	±2.4%
		Y	0.0	0.0	1.0		203.3	
		Z	0.0	0.0	1.0		195.0	

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: 7396

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	9.82	9.82	9.82	0.30	0.85	± 12.1%
835	41.5	0.90	9.71	9.71	9.71	0.15	1.36	± 12.1%
900	41.5	0.97	9.87	9.87	9.87	0.16	1.37	± 12.1%
1750	40.1	1.37	8.61	8.61	8.61	0.25	1.04	± 12.1%
1900	40.0	1.40	8.13	8.13	8.13	0.24	1.01	± 12.1%
2100	39.8	1.49	8.14	8.14	8.14	0.24	1.04	± 12.1%
2300	39.5	1.67	7.85	7.85	7.85	0.40	0.75	± 12.1%
2450	39.2	1.80	7.57	7.57	7.57	0.50	0.75	± 12.1%
2600	39.0	1.96	7.38	7.38	7.38	0.64	0.68	± 12.1%
5250	35.9	4.71	5.33	5.33	5.33	0.45	1.30	± 13.3%
5600	35.5	5.07	4.89	4.89	4.89	0.45	1.35	± 13.3%
5750	35.4	5.22	4.92	4.92	4.92	0.45	1.45	± 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: 7396

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)	Unc. (k=2)
750	55.5	0.96	10.09	10.09	10.09	0.30	0.90	±12.1%
835	55.2	0.97	9.88	9.88	9.88	0.19	1.32	±12.1%
900	55.0	1.05	9.82	9.82	9.82	0.23	1.15	±12.1%
1750	53.4	1.49	8.24	8.24	8.24	0.24	1.06	±12.1%
1900	53.3	1.52	7.97	7.97	7.97	0.19	1.24	±12.1%
2100	53.2	1.62	8.18	8.18	8.18	0.19	1.39	±12.1%
2300	52.9	1.81	7.88	7.88	7.88	0.55	0.80	±12.1%
2450	52.7	1.95	7.53	7.53	7.53	0.46	0.89	±12.1%
2600	52.5	2.16	7.38	7.38	7.38	0.52	0.80	±12.1%
5250	48.9	5.36	4.93	4.93	4.93	0.45	1.80	±13.3%
5600	48.5	5.77	4.19	4.19	4.19	0.48	1.90	±13.3%
5750	48.3	5.94	4.52	4.52	4.52	0.48	1.95	±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.

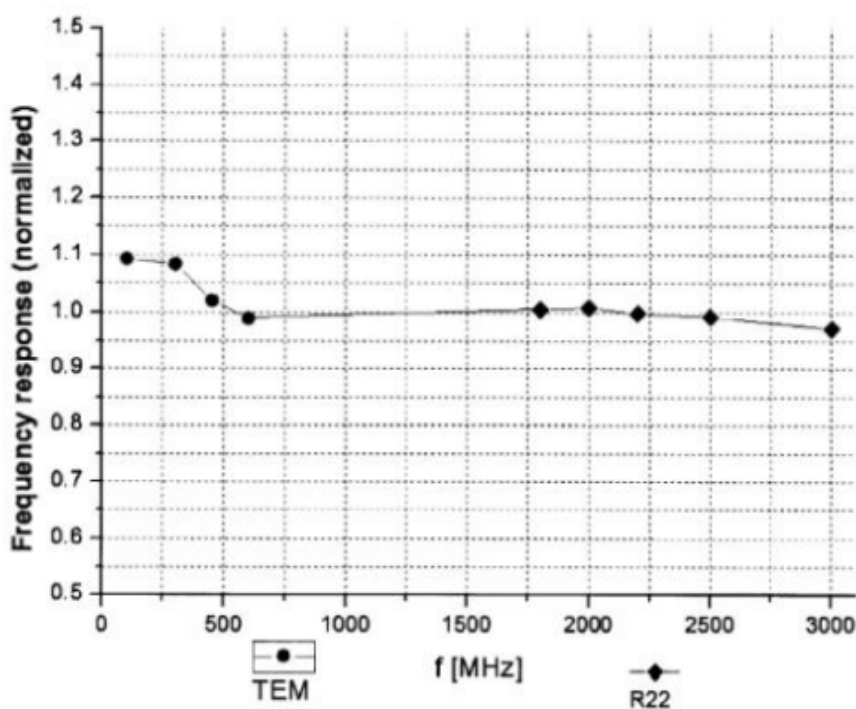
^G Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from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





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

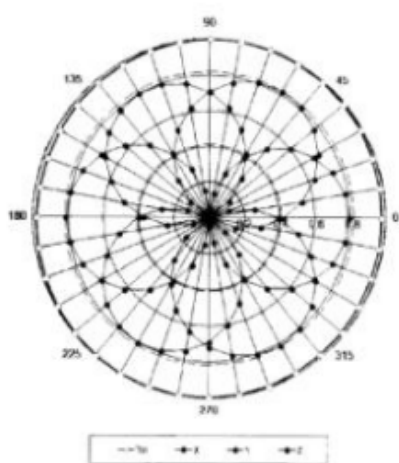
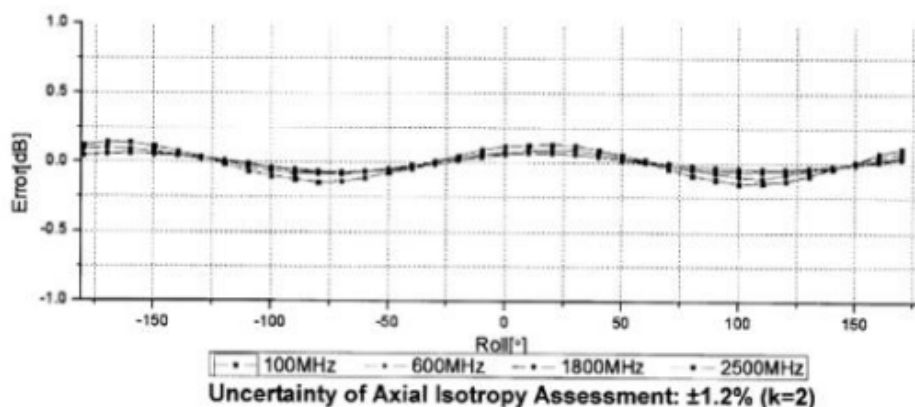
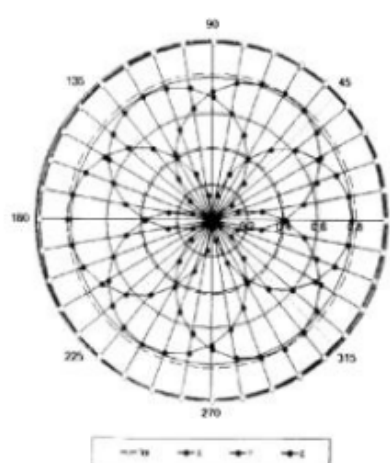


Uncertainty of Frequency Response of E-field: $\pm 7.4\%$ ($k=2$)



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

f=600 MHz, TEM**f=1800 MHz, R22**

Certificate No: Z20-68716

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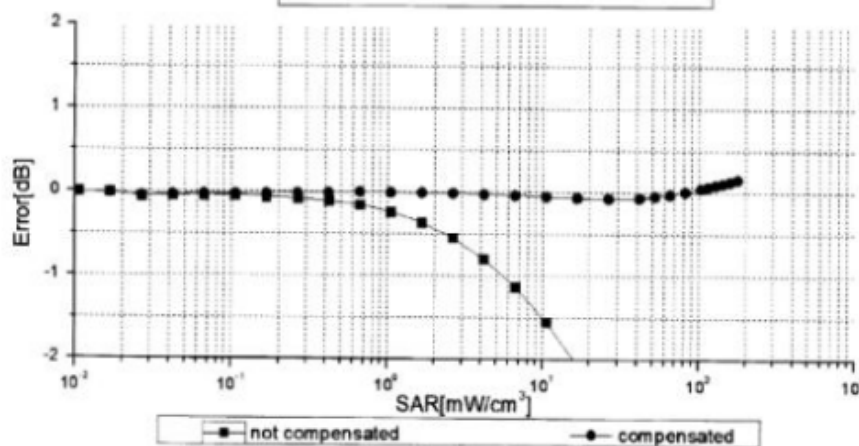
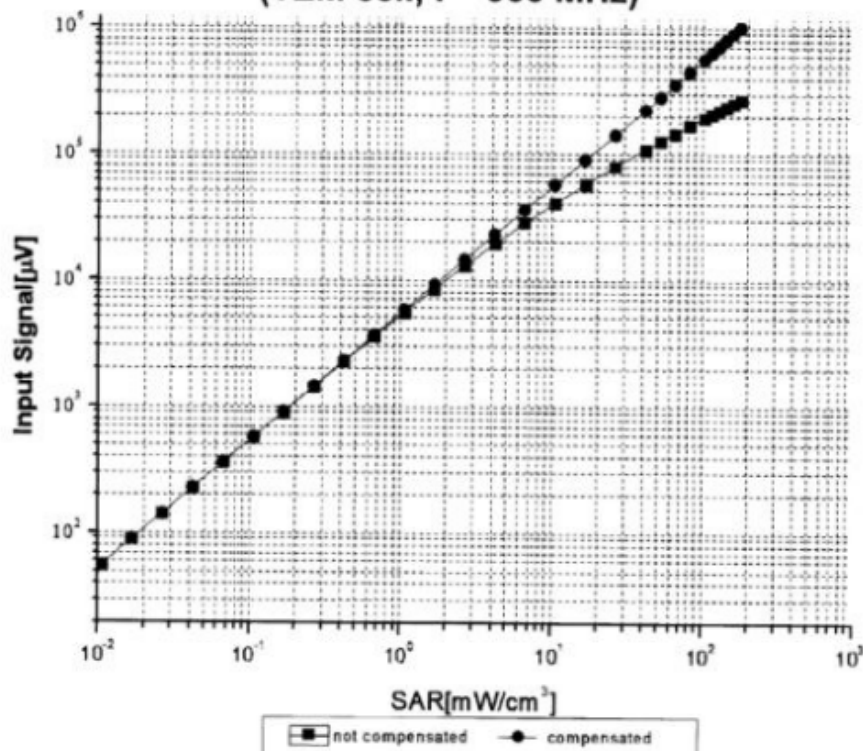
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Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



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

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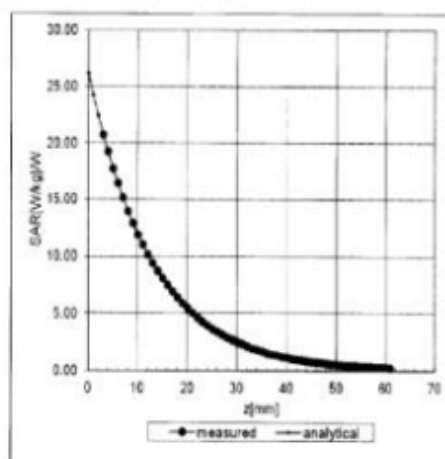
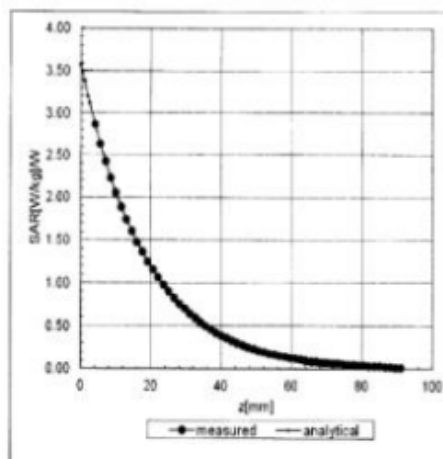


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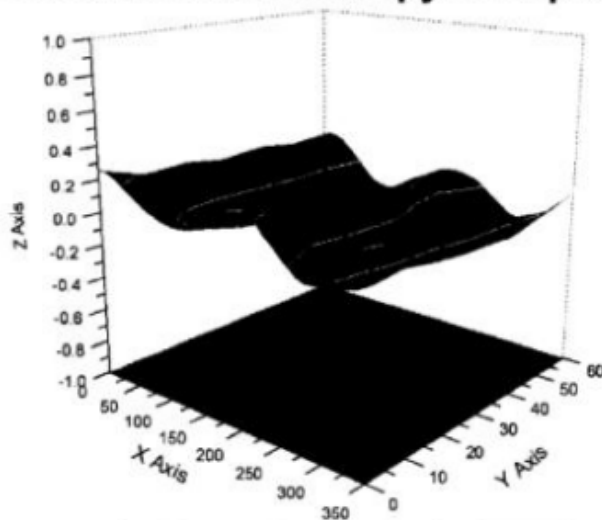
Conversion Factor Assessment

f=900 MHz, WGLS R9(H_convF)

f=1750 MHz, WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: $\pm 3.2\%$ (K=2)

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 7396

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	156.9
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



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IMPORTANT NOTICE

USAGE OF THE DAE 4

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 closed 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.

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TN_BR040315AD DAE4.doc

11.12.2009

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **Anbotek (Auden)**

Certificate No: **DAE4-387_Sep03**

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BM - SN: 387**

Calibration procedure(s) **QA CAL-06.v29
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **September 03, 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	11-Aug-19 (No:21092)	Aug-20
Secondary Standards	ID #	Check Date (In house)	Scheduled Check
Auto DAE Calibration Unit Calibrator Box V2.1	SE UWS 053 AA 1001	05-Jan-19 (in house check)	In house check: Jan-20
	SE UMS 006 AA 1002	05-Jan-19 (in house check)	In house check: Jan-20

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: September 03, 2019

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

Certificate No: DAE4-387_Sep03

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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.

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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	404.489 $\pm$ 0.02% (k=2)	404.852 $\pm$ 0.02% (k=2)	404.862 $\pm$ 0.02% (k=2)
Low Range	3.97827 $\pm$ 1.50% (k=2)	3.95875 $\pm$ 1.50% (k=2)	3.97982 $\pm$ 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	53.0 ° $\pm$ 1 °
---	------------------



Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	200032.85	-3.31	-0.00
Channel X + Input	20007.64	1.88	0.01
Channel X - Input	-20003.48	1.18	-0.01
Channel Y + Input	200034.23	-1.43	-0.00
Channel Y + Input	20006.60	0.91	0.00
Channel Y - Input	-20004.04	0.72	-0.00
Channel Z + Input	200035.38	-0.83	-0.00
Channel Z + Input	20003.69	-2.11	-0.01
Channel Z - Input	-20006.38	-1.59	0.01

Low Range	Reading (μV)	Difference (μV)	Error (%)
Channel X + Input	2001.63	0.08	0.00
Channel X + Input	202.29	0.70	0.35
Channel X - Input	-197.90	0.60	-0.30
Channel Y + Input	2001.33	-0.07	-0.00
Channel Y + Input	200.86	-0.60	-0.30
Channel Y - Input	-199.87	-1.23	0.62
Channel Z + Input	2001.61	0.27	0.01
Channel Z + Input	200.60	-0.70	-0.35
Channel Z - Input	-199.51	-0.85	0.43

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	13.50	11.56
	- 200	-8.64	-11.18
Channel Y	200	-0.81	-1.28
	- 200	1.05	0.09
Channel Z	200	7.17	6.91
	- 200	-9.46	-9.01

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	-	-1.70	0.33
Channel Y	200	10.70	-	-0.38
Channel Z	200	7.11	7.89	-

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	15969	17466
Channel Y	15661	16162
Channel Z	15990	16190

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	0.73	-2.58	3.29	0.62
Channel Y	0.41	-0.49	1.23	0.40
Channel Z	-0.80	-1.88	0.30	0.42

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



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CALIBRATION
CNAS L0570

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Client

Anbotek (Auden)

Certificate No: Z18-97089

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d154

Calibration Procedure(s)
FD-Z11-2-003-01
Calibration Procedures for dipole validation kits

Calibration date: Jun 16, 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)℃ 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	01-Jul-17 (CTTL, No.J17X04256)	Jun-18
Power sensor NRP-Z91	101547	01-Jul-17 (CTTL, No.J17X04256)	Jun-18
Reference Probe EX3DV4	SN 7307	19-Feb-18(SPEAG, No.EX3-7307_Feb18)	Feb-19
DAE4	SN 771	02-Feb-18(CTTL-SPEAG, No.Z18-97011)	Feb-19
Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	01-Feb-18 (CTTL, No.J18X00893)	Jan-19
Network Analyzer E5071C	MY46110673	26-Jan-18 (CTTL, No.J18X00894)	Jan-19

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: Jun 17, 2018

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

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Shenzhen Anbotek Compliance Laboratory Limited

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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, "Procedure to measure the Specific Absorption Rate (SAR) For hand-held devices used in close proximity to the ear (frequency range of 300MHz to 3GHz)", February 2005
- 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	52.8.8.1258
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	41.0 $\pm$ 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	2.30 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.24 mW / g $\pm$ 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.50 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.02 mW / g $\pm$ 20.4 % (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	55.4 $\pm$ 6 %	0.99 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	2.43 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	9.57 mW / g $\pm$ 20.8 % (k=2)
SAR averaged over 10 cm ³ (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.61 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	6.36 mW / g $\pm$ 20.4 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.2Ω- 3.11jΩ
Return Loss	- 29.8dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.6Ω- 2.33jΩ
Return Loss	- 27.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.508 ns
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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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