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Shenzhen Branch

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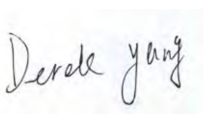
FCC SAR TEST REPORT

Application No:	HR201880005
Applicant:	Orion Labs, Inc
Manufacturer:	Orion Labs, Inc
Product Name:	Orion Sync
Model No.(EUT):	ROS-001-TM
Trade Mark:	Orion Labs
FCC ID:	2APONROS001US
Standards:	FCC 47CFR §2.1093
Date of Receipt:	2018-10-22
Date of Test:	2018-10-29 to 2018-11-06
Date of Issue:	2018-11-23
Test Result:	**PASS ***

* In the configuration tested, the EUT detailed in this report complied with the standards specified above.

Authorized Signature:



Derek Yang

Wireless Laboratory Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.
If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.

REVISION HISTORY

Revision Record				
Version	Chapter	Date	Modifier	Remark
01		2018-11-23		Original

TEST SUMMARY

Frequency Band	Maximum Reported SAR(W/kg)		
	Head 25mm	Body worn 10mm	Hotspot 10mm
LTE Band 2	0.08	0.62	0.62
LTE Band 4	**0.14**	**0.63**	**0.63**
LTE Band 12	0.12	0.32	0.32
WI-FI (2.4GHz)	0.01	0.22	0.22
WI-FI (5GHz)	0.02	0.20	0.20
SAR Limited(W/kg)	1.6		
Maximum Simultaneous Transmission SAR (W/kg)			
Scenario	Head 25mm	Body worn 10mm	Hotspot 10mm
Sum SAR	0.17	0.71	0.71
SPLSR	N/A	N/A	N/A
SPLSR Limited	0.04		

Approved & Released by

Simon Ling

SAR Manager

Tested by

Jackson Li

SAR Engineer

CONTENTS

1 General Information

1.1 Details of Client

Applicant:	Orion Labs, Inc
Address:	208 Utah Street Suite 350 San Francisco California United States
Manufacturer:	Orion Labs, Inc
Address:	208 Utah Street Suite 350 San Francisco California United States

1.2 Test Location

Company: SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch E&E Lab

Address: No. 1 Workshop, M-10, Middle section, Science & Technology Park, Shenzhen, Guangdong, China

Post code: 518057

Telephone: +86 (0) 755 2601 2053

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E-mail: ee.shenzhen@sgs.com

1.3 Test Facility

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

• CNAS (No. CNAS L2929)

CNAS has accredited SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• A2LA (Certificate No. 3816.01)

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

• VCCI

The 10m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services Co., Ltd. have been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: G-823, R-4188, T-1153 and C-2383 respectively.

• FCC –Designation Number: CN1178

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

Designation Number: CN1178. Test Firm Registration Number: 406779.

• Industry Canada (IC)

Two 3m Semi-anechoic chambers and the 10m Semi-anechoic chamber of SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch EMC Lab have been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 4620C-1, 4620C-2, 4620C-3.

1.4 General Description of EUT

<table>
<tr><td>Product Name:</td><td colspan="3">Orion Sync</td></tr>
<tr><td>Model No.(EUT):</td><td colspan="3">ROS-001-TM</td></tr>
<tr><td>Trade Mark:</td><td colspan="3">Orion Labs</td></tr>
<tr><td>Product Phase:</td><td colspan="3">production unit</td></tr>
<tr><td>Device Type :</td><td colspan="3">portable device</td></tr>
<tr><td>Exposure Category:</td><td colspan="3">uncontrolled environment / general population</td></tr>
<tr><td>SN:</td><td colspan="3">353586083398355/353586083408519</td></tr>
<tr><td>FCC ID:</td><td colspan="3">2APONROS001US</td></tr>
<tr><td>Hardware Version:</td><td colspan="3">RA15_MB P4</td></tr>
<tr><td>Software Version:</td><td colspan="3">7.1.2</td></tr>
<tr><td>Antenna Type:</td><td colspan="3">Inner Antenna</td></tr>
<tr><td colspan="4">Device Operating Configurations :</td></tr>
<tr><td>Modulation Mode:</td><td colspan="3">LTE: QPSK,16QAM; WIFI: DSSS; OFDM; BT: GFSK, π/4DQPSK,8DPSK</td></tr>
<tr><td>Power Class</td><td colspan="3">3, tested with power control Max Power(LTE Band 2/4/12)</td></tr>
<tr><td rowspan="7">Frequency Bands:</td><td>Band</td><td>Tx (MHz)</td><td>Rx (MHz)</td></tr>
<tr><td>LTE Band 2</td><td>1850~1910</td><td>1930~1990</td></tr>
<tr><td>LTE Band 4</td><td>1710~1755</td><td>2110~2155</td></tr>
<tr><td>LTE Band 12</td><td>699~716</td><td>729~746</td></tr>
<tr><td>WIFI(2.4GHz)</td><td>2412~2462</td><td>2412~2462</td></tr>
<tr><td>WIFI(5GHz)</td><td>5150~5350
5470~5850</td><td>5150~5350
5470~5850</td></tr>
<tr><td>BT</td><td>2402~2480</td><td>2402~2480</td></tr>
<tr><td rowspan="4">Battery Information:</td><td>Model:</td><td colspan="2">U784143PG</td></tr>
<tr><td>Normal Voltage:</td><td colspan="2">3.7V</td></tr>
<tr><td>Rated capacity:</td><td colspan="2">1600mAh</td></tr>
<tr><td>Manufacturer:</td><td colspan="2">SHENZHEN UTILITY POWER SOURCE CO.,LTD</td></tr>
</table>

1.5 Test Specification

Identity	Document Title
FCC 47CFR §2.1093	Radiofrequency Radiation Exposure Evaluation: Portable Devices
ANSI/IEEE Std C95.1 – 1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz – 300 GHz.
IEEE 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
KDB 941225 D01 3G SAR Procedures v03r01	3G SAR Measurement Procedures
KDB 941225 D05 SAR for LTE Devices v02r05	SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES
KDB 248227 D01 802.11 Wi-Fi SAR v02r02	SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS
KDB 941225 D06 Hotspot Mode SAR v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
KDB447498 D01 General RF Exposure Guidance v06	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB447498 D03 Supplement C Cross-Reference v01	OET Bulletin 65, Supplement C Cross-Reference
KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02	RF Exposure Compliance Reporting and Documentation Considerations

1.6 RF exposure limits

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

Notes:

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

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

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

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

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation.)

2 SAR Measurements System Configuration

2.1 The SAR Measurement System

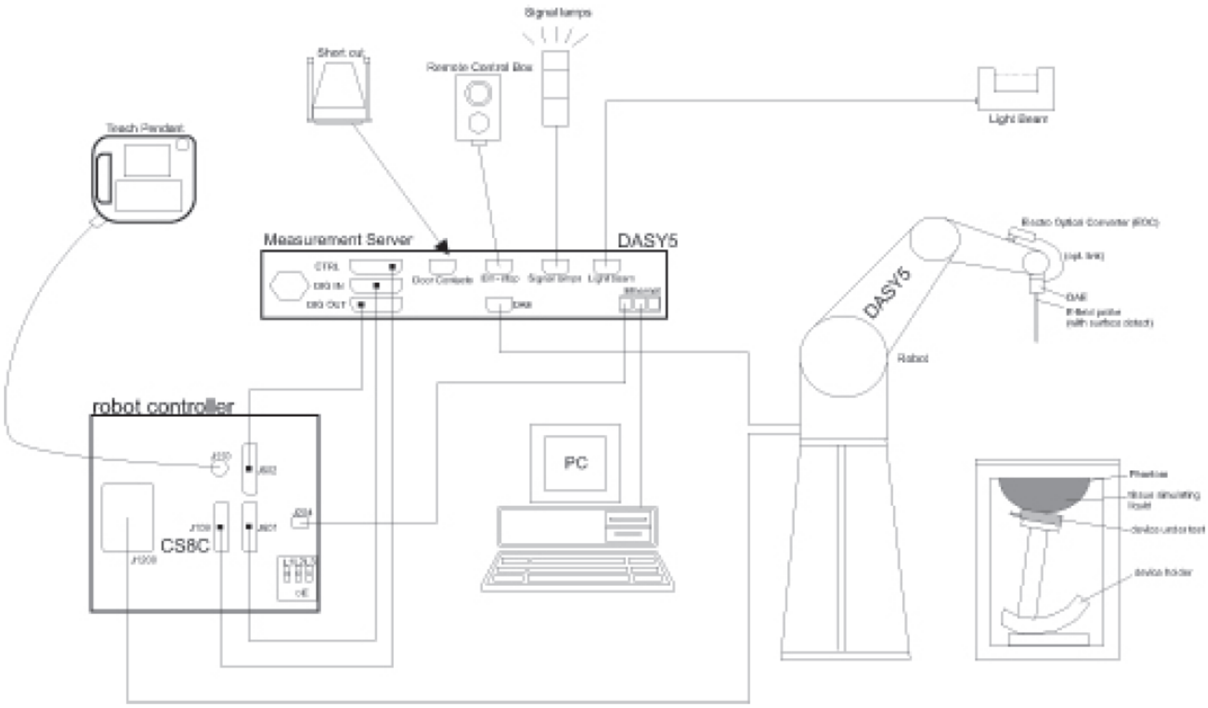
This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY5 professional system). A E-field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ (|Ei|2)/ ρ where σ and ρ are the conductivity and mass density of the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

The DASY5 system for performing compliance tests consists of the following items:
A standard high precision 6-axis robot (Stabile RX family) with controller, teach pendant and software .An arm extension for accommodation the data acquisition electronics (DAE).

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

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

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



F-1. SAR Measurement System Configuration

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

2.2 Isotropic E-field Probe EX3DV4

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

2.3 Data Acquisition Electronics (DAE)

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

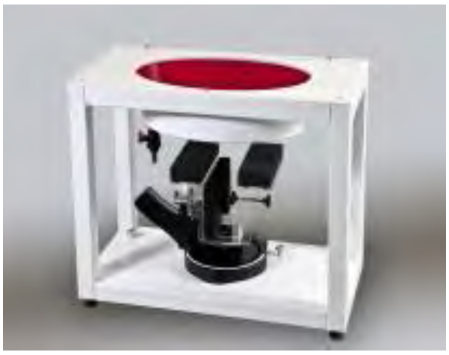
2.4 SAM Twin Phantom

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

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

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

2.5 ELI Phantom

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

Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.

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

2.6 Device Holder for Transmitters

F-2. Device Holder for Transmitters

- The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation centres for both scales are the ear reference point (ERP). Thus the device needs no repositioning when changing the angles.
- The DASY device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity ε=3 and loss tangent δ=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.

2.7 Measurement procedure

2.7.1 Scanning procedure

Step 1: Power reference measurement

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure.

Step 2: *Area scan*

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

Step 3: *Zoom scan*

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

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

The area and zoom scan resolutions specified in the table below must be applied to the SAR measurements Probe boundary effect error compensation is required for measurements with the probe tip closer than half a probe tip diameter to the phantom surface. Both the probe tip diameter and sensor offset distance must satisfy measurement protocols; to ensure probe boundary effect errors are minimized and the higher fields closest to the phantom surface can be correctly measured and extrapolated to the phantom surface for computing 1-g SAR. Tolerances of the post-processing algorithms must be verified by the test laboratory for the scan resolutions used in the SAR measurements, according to the reference distribution functions specified in IEEE Std. 1528-2013.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">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 reported SAR from the area scan based 1-g SAR estimation 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.</td></tr>
</table>

Step 4: Power reference measurement (drift)

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

2.7.2 Data Storage

The DASY software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension "DAE". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated. The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [m W/g], [m W/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

2.7.3 Data Evaluation by SEMCAD

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

Probe parameters: - Sensitivity Normi, ai0, ai1, ai2
- Conversion factor ConvFi
- Diode compression point Dcpi
Device parameters: - Frequency f
- Crest factor cf
Media parameters: - Conductivity ε
- Density ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf / dcp_i$$

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

Ui = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcp i = diode compression point (DASY parameter)

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

E-field probes:

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

H-field probes:

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

With Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel I (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m

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

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

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

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

$$SAR = (Etot^2 \cdot \sigma) / (\varepsilon \cdot 1000)$$

with SAR = local specific absorption rate in mW/g

Etot = total field strength in V/m

σ= conductivity in [mho/m] or [Siemens/m]

ε= equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

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

with Ppwe = equivalent power density of a plane wave in mW/cm2
Etot = total electric field strength in V/m

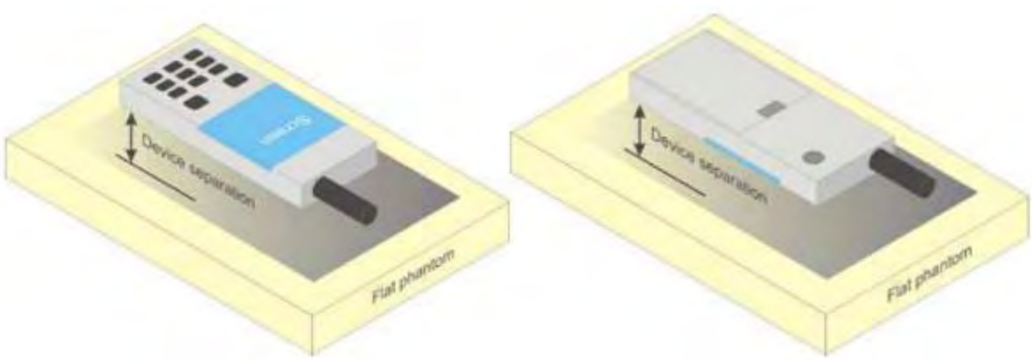
Htot = total magnetic field strength in A/m

3 Description of Test Position

3.1 Body-worn accessory Exposure Condition

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Transmitters that are built-in within devices typically operate in speaker mode for voice communication, with the device positioned next to the mouth. When SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 25 mm from a flat phantom filled with head tissue-equivalent medium.



F-3. Test positions for body-worn devices

3.2 3.2.1 Wireless Router exposure conditions

Some battery-operated handsets have the capability to transmit and receive user data through simultaneous transmission of WIFI simultaneously with a separate licensed transmitter. The FCC has provided guidance in FCC KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edges of the device containing transmitting antennas within 2.5 cm of their edges, determined from general mixed use conditions for this type of devices. For devices with form factors smaller than 9 cm x 5 cm, a test separation distance of 5 mm is required.

4 SAR System Verification Procedure

4.1 Tissue Simulate Liquid

4.1.1 Recipes for Tissue Simulate Liquid

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

Ingredients (% by weight)	Frequency (MHz)							
	450		700-950		1700-2000		2300-2700	
Tissue Type	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**	**Head**	**Body**
Water	38.56	51.16	40.30	50.75	55.24	70.17	55.00	68.53
Salt (NaCl)	3.95	1.49	1.38	0.94	0.31	0.39	0.2	0.1
Sucrose	56.32	46.78	57.90	48.21	0	0	0	0
HEC	0.98	0.52	0.24	0	0	0	0	0
Bactericide	0.19	0.05	0.18	0.10	0	0	0	0
Tween	0	0	0	0	44.45	29.44	44.80	31.37

Salt: 99^{+}% Pure Sodium Chloride
Sucrose: 98^{+}% Pure Sucrose
Water: De-ionized, 16 $M\Omega^{+}$ resistivity
HEC: Hydroxyethyl Cellulose
Tween: Polyoxyethylene (20) sorbitan monolaurate

HSL5GHz is composed of the following ingredients:
Water: 50-65%
Mineral oil: 10-30%
Emulsifiers: 8-25%
Sodium salt: 0-1.5%

MSL5GHz is composed of the following ingredients:
Water: 64-78%
Mineral oil: 11-18%
Emulsifiers: 9-15%
Sodium salt: 2-3%

Table 1： Recipe of Tissue Simulate Liquid

4.1.2 Measurement for Tissue Simulate Liquid

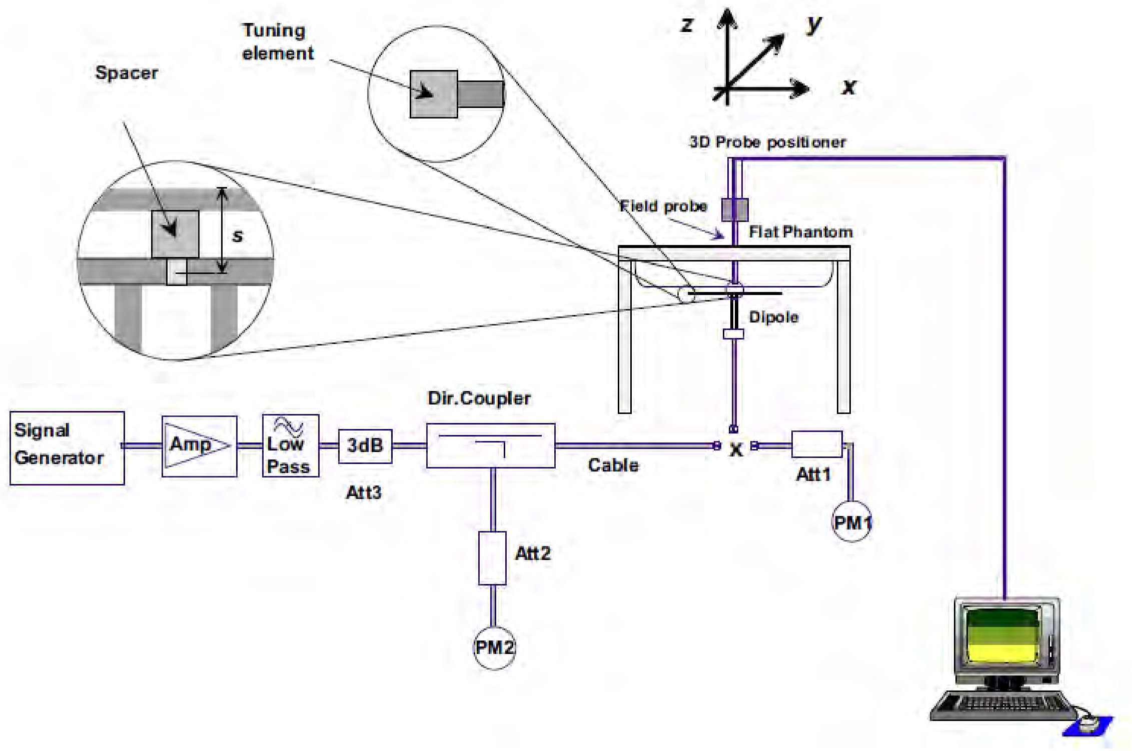
The dielectric properties for this Tissue Simulate Liquids were measured by using the Agilent Model 85070E Dielectric Probe in conjunction with Agilent E5071C Network Analyzer (300 KHz-8500 MHz). The Conductivity (σ) and Permittivity (ρ) are listed in Table 2. For the SAR measurement given in this report. The temperature variation of the Tissue Simulate Liquids was 22±2°C.

Tissue Type	Measured Frequency (MHz)	Target Tissue (±5%)		Measured Tissue		Liquid Temp.	Measured Date
		ε_r	σ(S/m)	ε_r	σ(S/m)	(℃)	
750 Head	750	41.9 (39.81~44)	0.89 (0.85~0.94)	43.089	0.878	22.1	2018/10/30
750 Body	750	55.5 (52.73~58.28)	0.96 (0.91~1.00)	56.279	0.956	22.1	2018/11/2
1750 Head	1750	40.1 (38.10~42.11)	1.37 (1.30~1.44)	40.679	1.336	22.2	2018/10/31
1750 Body	1750	53.4 (50.73~56.07)	1.49 (1.42~1.56)	53.203	1.481	22.2	2018/10/31
1900 Head	1900	40.0 (38.00~42.00)	1.40 (1.33~1.47)	40.284	1.389	22.3	2018/10/29
1900 Body	1900	53.3 (50.64~55.97)	1.52 (1.44~1.60)	53.025	1.524	22.3	2018/10/29
2450 Head	2450	39.20 (37.24~41.16)	1.80 (1.71~1.89)	39.924	1.819	22.0	2018/11/2
2450 Body	2450	52.70 (50.07~55.34)	1.95 (1.85~2.05)	52.667	1.969	22.0	2018/11/2
5250 Head	5250	35.9 (34.11~37.70)	4.71 (4.47~4.95)	36.011	4.767	22.2	2018/11/6
5250 Body	5250	48.9 (46.46~51.35)	5.36 (5.09~5.63)	48.368	5.382	22.2	2018/11/6
5600 Head	5600	35.5 (33.73~37.28)	5.07 (4.82~5.32)	35.059	5.157	22.2	2018/11/6
5600 Body	5600	48.5 (46.08~50.93)	5.77 (5.48~6.06)	47.435	5.803	22.2	2018/11/6
5750 Head	5750	35.4 (33.63~37.17)	5.22 (4.96~5.48)	34.695	5.329	22.2	2018/11/6
5750 Body	5750	48.3 (45.89~50.72)	5.94 (5.64~6.24)	47.096	5.969	22.2	2018/11/6

Table 2: Measurement result of Tissue electric parameters

4.2 SAR System Check

The microwave circuit arrangement for system Check is sketched in F-12. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. The tests were conducted on the same days as the measurement of the EUT. The obtained results from the system accuracy verification are displayed in the following table 3(A power level of 250mw (below 3GHz) or 100mw (3-6GHz) was input to the dipole antenna). During the tests, the ambient temperature of the laboratory was in the range 22±2°C, the relative humidity was in the range 60% and the liquid depth above the ear reference points was above 15±0.5 cm in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.



F-4. the microwave circuit arrangement used for SAR system check

4.2.1 Justification for Extended SAR Dipole Calibrations

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

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

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

4.2.2 Summary System Check Result(s)

SAR System Validation Result(s)										
Validation Kit		Measured SAR 250mW	Measured SAR 250mW	Measured SAR (normalized to 1W)	Measured SAR (normalized to 1W)	Target SAR (normalized to 1W) (±10%)	Target SAR (normalized to 1W) (±10%)	Liquid Temp. (℃)	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D750V2	Head	2.01	1.33	8.04	5.32	8.17 (7.35~8.99)	5.36 (4.82~5.9)	22.1	2018/10/30
	Body	2.12	1.41	8.48	5.64	8.57 (7.71~9.43)	5.66 (5.09~6.23)	22.1	2018/11/2
D1750V2	Head	8.88	4.76	35.52	19.04	36.7 (33.03~40.37)	19.5 (17.55~21.45)	22.2	2018/10/31
	Body	9.41	4.97	37.64	19.88	37 (33.30~40.70)	19.7 (17.73~21.67)	22.2	2018/10/31
D1900V2	Head	10.3	5.34	41.2	21.36	40.7 (36.63~44.77)	21.1 (18.99~23.21)	22.3	2018/10/29
	Body	10.4	5.49	41.6	21.96	41.6 (37.44~45.76)	21.4 (19.26~23.54)	22.3	2018/10/29
D2450V2	Head	13.3	6.15	53.2	24.6	53.1 (47.79~58.41)	24.9 (22.41~27.39)	22.0	2018/11/2
	Body	12.7	5.86	50.8	23.44	51.0 (45.9~56.1)	23.5 (21.15~25.85)	22.0	2018/11/2
Validation Kit		Measured SAR 100mW	Measured SAR 100mW	Measured SAR (normalized to 1w)	Measured SAR (normalized to 1w)	Target SAR (normalized to 1w) (±10%)	Target SAR (normalized to 1w) (±10%)	Liquid Temp. (℃)	Measured Date
		1g (W/kg)	10g (W/kg)	1g (W/kg)	10g (W/kg)	1-g(W/kg)	10-g(W/kg)		
D5GHzV2	Head(5.25GHz)	7.10	2.02	71.00	20.20	76.6 (68.94~84.26)	21.9 (19.71~24.09)	22.2	2018/11/6
	Body(5.25GHz)	7.57	2.10	75.70	21.00	75.6 (68.04~83.16)	21.3 (19.17~23.43)	22.2	2018/11/6
	Head(5.6GHz)	7.92	2.23	79.20	22.30	80.4 (72.36~88.44)	22.8 (20.52~25.08)	22.2	2018/11/6
	Body(5.6GHz)	8.00	2.21	80.00	22.10	81.1 (72.99~89.21)	22.9 (20.61~25.19)	22.2	2018/11/6
	Head(5.75GHz)	8.14	2.32	81.40	23.20	80 (72~88)	22.7 (20.43~24.97)	22.2	2018/11/6
	Body(5.75GHz)	7.65	2.11	76.50	21.10	74.8 (67.32~82.28)	21 (18.9~23.1)	22.2	2018/11/6

Table 3： SAR System Check Result

4.2.3 Detailed System Check Results

Please see the Appendix A

5 Test results and Measurement Data

5.1 3G SAR Test Reduction Procedure

According to KDB 941225D01, in the following procedures, the mode tested for SAR is referred to as the primary mode. The equivalent modes considered for SAR test reduction are denoted as secondary modes. Both primary and secondary modes must be in the same frequency band. When the maximum output power and tune-up tolerance specified for production units in a secondary mode is ≤ ¼ dB higher than the primary mode or when the highest reported SAR of the primary mode is scaled by the ratio of specified maximum output power and tune-up tolerance of secondary to primary mode and the adjusted SAR is ≤ 1.2 W/kg, SAR measurement is not required for the secondary mode. This is referred to as the 3G SAR test reduction procedure in the following SAR test guidance, where the primary mode is identified in the applicable wireless mode test procedures and the secondary mode is wireless mode being considered for SAR test reduction by that procedure. When the 3G SAR test reduction procedure is not satisfied, it is identified as "otherwise" in the applicable procedures; SAR measurement is required for the secondary mode.

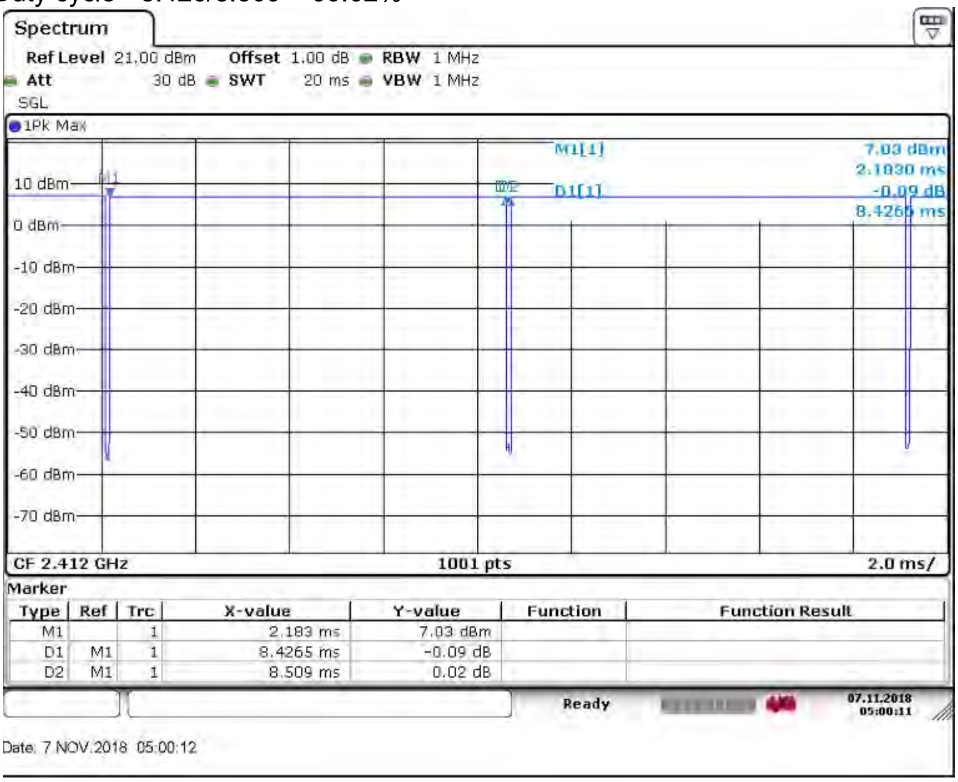
5.2 Operation Configurations

5.2.1 WiFi Test Configuration

A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement.

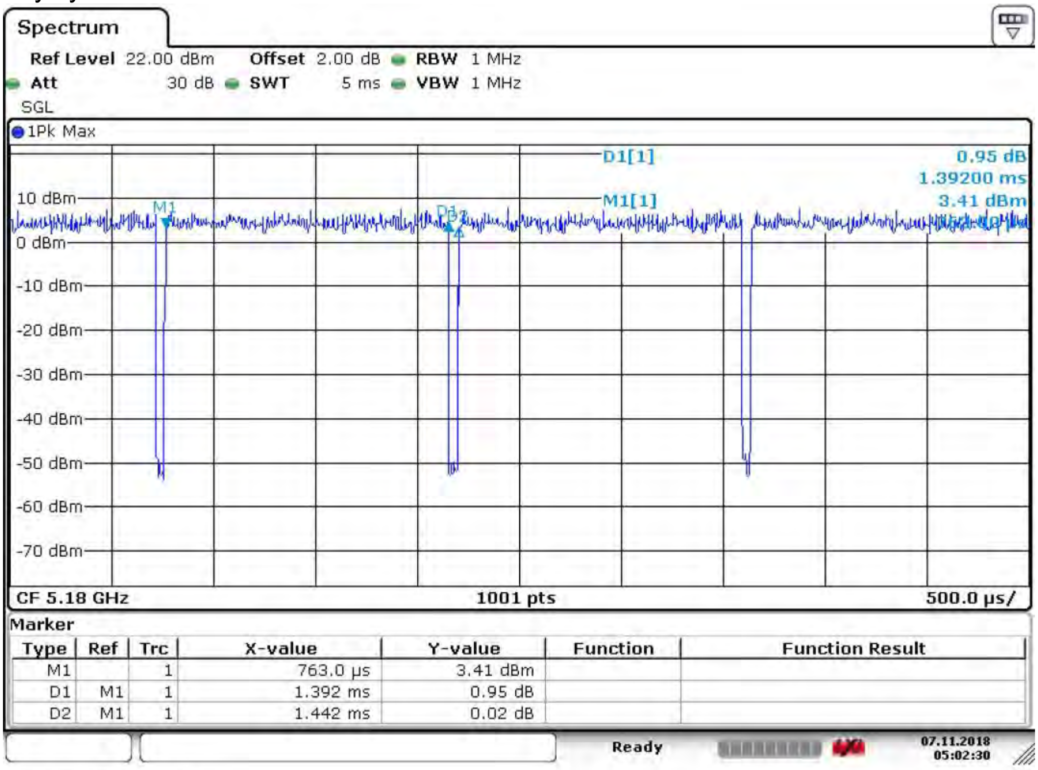
- WIFI 2.4G 802.11b

  Duty cycle= 8.426/8.509 = 99.02%



- WIFI 5G 802.11a

Duty cycle= 1.392/1.442 = 96.53%



Type	Ref	Trc	X-value	Y-value	Function	Function Result
M1		1	763.0 µs	3.41 dBm		
D1	M1	1	1.392 ms	0.95 dB		
D2	M1	1	1.442 ms	0.02 dB		

Date: 7.NOV.2018 05:02:30

5.2.1.1 Initial Test Position SAR Test Reduction Procedure

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

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

5.2.1.2 Initial Test Configuration Procedures

An initial test configuration is determined for OFDM transmission modes according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. SAR is measured using the highest measured maximum output power channel. For configurations with the same specified or measured maximum output power, additional transmission mode and test channel selection procedures are required. SAR test reduction for subsequent highest output test channels is determined according to *reported* SAR of the initial test configuration.
For next to the ear, hotspot mode and UMC mini-tablet exposure configurations where multiple test positions are required, the initial test position procedure is applied to minimize the number of test positions required for SAR measurement using the initial test configuration transmission mode. For fixed exposure conditions that do not have multiple SAR test positions, SAR is measured in the transmission mode determined by the initial test configuration.
When the *reported* SAR of the initial test configuration is > 0.8 W/kg, SAR measurement is required for subsequent next highest measured output power channel(s) in the initial test configuration until *reported* SAR is ≤ 1.2 W/kg or all required channels are tested.

5.2.1.3 Subsequent Test Configuration Procedures

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

1）. When SAR test exclusion provisions of KDB Publication 447498 are applicable and SAR measurement is not required for the initial test configuration, SAR is also not required for the next highest maximum output power transmission mode subsequent test configuration(s) in that frequency band or aggregated band and exposure configuration.
2）. When the highest *reported* SAR for the initial test configuration (when applicable, include subsequent highest output channels), according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

3）. The number of channels in the initial test configuration and subsequent test configuration can be different due to differences in channel bandwidth. When SAR measurement is required for a subsequent test configuration and the channel bandwidth is smaller than that in the initial test configuration, all channels in the subsequent test configuration that overlap with the larger bandwidth channel tested in the initial test configuration should be used to determine the highest maximum output power channel. This step requires additional power measurement to identify the highest maximum output power channel in the subsequent test configuration to determine SAR test reduction.

a)SAR should first be measured for the channel with highest measured output power in the subsequent test configuration.

b) SAR for subsequent highest measured maximum output power channels in the subsequent test configuration is required only when the *reported* SAR of the preceding higher maximum output power channel(s) in the subsequent test configuration is > 1.2 W/kg or until all required channels are tested. i) For channels with the same measured maximum output power, SAR should be measured using the channel closest to the center frequency of the larger channel bandwidth channel in the initial test configuration.

4）. SAR measurements for the remaining highest specified maximum output power OFDM transmission mode configurations that have not been tested in the initial test configuration (highest maximum output) or subsequent test configuration(s) (subsequent next highest maximum output power) is determined by recursively applying the subsequent test configuration procedures in this section to the remaining configurations according to the following:

a)replace “subsequent test configuration” with “next subsequent test configuration” (i.e., subsequent next highest specified maximum output power configuration)

b) replace “initial test configuration” with “all tested higher output power configurations”

5.2.1.4 2.4 GHz SAR Procedures

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

- **802.11b DSSS SAR Test Requirements**

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

1）. When the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no further SAR testing is required for 802.11b DSSS in that exposure configuration.

2）. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

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

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

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

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

- **SAR Test Requirements for OFDM configurations**

When SAR measurement is required for 802.11 g/n OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

5.2.1.5 5 GHz SAR Procedures

- **U-NII-1 and U-NII-2A Bands**
  For devices that operate in only one of the U-NII-1 and U-NII-2A bands, the normally required SAR procedures for OFDM configurations are applied. For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following：

1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, both bands are tested independently for SAR.
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration; otherwise, both bands are tested independently for SAR.
3) The two U-NII bands may be aggregated to support a 160 MHz channel on channel number 50. Without additional testing, the maximum output power for this is limited to the lower of the maximum output power certified for the two bands. When SAR measurement is required for at least one of the bands and the highest reported SAR adjusted by the ratio of specified maximum output power of aggregated to standalone band is > 1.2 W/kg, SAR is required for the 160 MHz channel. This procedure does not apply to an aggregated band with maximum output higher than the standalone band(s); the aggregated band must be tested independently for SAR. SAR is not required when the 160 MHz channel is operating at a reduced maximum power and also qualifies for SAR test exclusion.

- **U-NII-2C and U-NII-3 Bands**
  The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. when Terminal Doppler Weather Radar (TDWR) restriction applies, all channels that operate at 5.60 – 5.65 GHz must be included to apply the SAR test reduction and measurement procedures.

  When the same transmitter and antenna(s) are used for U-NII-2C band and U-NII-3 band or 5.8 GHz band of §15.247, the bands may be aggregated to enable additional channels with 20, 40 or 80 MHz bandwidth to span across the band gap, as illustrated in Appendix B. The maximum output power for the additional band gap channels is limited to the lower of those certified for the bands. Unless band gap channels are permanently disabled, they must be considered for SAR testing. The frequency range covered by these bands is 380 MHz (5.47 – 5.85 GHz), which requires a minimum of at least two SAR probe calibration frequency points to support SAR measurements. To maintain SAR measurement accuracy and to facilitate test reduction, the channels in U-NII-2C band above 5.65 GHz may be grouped with the 5.8 GHz channels in U-NII-3 or §15.247 band to enable two SAR probe calibration frequency points to cover the bands, including the band gap channels. When band gap channels are supported and the bands are not aggregated for SAR testing, band gap channels must be considered independently in each band according to the normally required OFDM SAR measurement and probe calibration frequency points requirements.

- **OFDM Transmission Mode SAR Test Configuration and Channel Selection Requirements**
  The initial test configuration for 5 GHz OFDM transmission modes is determined by the 802.11 configuration with the highest maximum output power specified for production units, including tune-up tolerance, in each standalone and aggregated frequency band. SAR for the initial test configuration is measured using the highest maximum output power channel determined by the default power measurement procedures. When multiple configurations in a frequency band have the same specified maximum output power, the initial test configuration is determined according to the following steps applied sequentially.
  1) The largest channel bandwidth configuration is selected among the multiple configurations with the same specified maximum output power.
  2) If multiple configurations have the same specified maximum output power and largest channel bandwidth, the lowest order modulation among the largest channel bandwidth configurations is selected.
  3) If multiple configurations have the same specified maximum output power, largest channel bandwidth and lowest order modulation, the lowest data rate configuration among these configurations is selected.
  4) When multiple transmission modes (802.11a/g/n/ac) have the same specified maximum output power, largest channel bandwidth, lowest order modulation and lowest data rate, the lowest order 802.11 mode is selected; i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over 802.11n. After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following. These channel selection procedures apply to both the initial test configuration and subsequent test configuration(s), with respect to the default power measurement procedures or additional power measurements required for further SAR test reduction. The same procedures also apply to subsequent highest output power channel(s) selection.
     a) The channel closest to mid-band frequency is selected for SAR measurement.
     b) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

- **SAR Test Requirements for OFDM configurations**

When SAR measurement is required for 802.11 a/n/ac OFDM configurations, each standalone and frequency aggregated band is considered separately for SAR test reduction. When the same transmitter and antenna(s) are used for U-NII-1 and U-NII-2A bands, additional SAR test reduction applies. When band gap channels between U-NII-2C band and 5.8 GHz U-NII-3 or §15.247 band are supported, the highest maximum output power transmission mode configuration and maximum output power channel across the bands must be used to determine SAR test reduction, according to the initial test configuration and subsequent test configuration requirements. In applying the initial test configuration and subsequent test configuration procedures, the 802.11 transmission configuration with the highest specified maximum output power and the channel within a test configuration with the highest measured maximum output power should be clearly distinguished to apply the procedures.

5.2.2 LTE Test Configuration

LTE modes were tested according to FCC KDB 941225 D05 publication. Please see notes after the tabulated SAR data for required test configurations. Establishing connections with base station simulators ensure a consistent means for testing SAR and are recommended for evaluating SAR [4]. The Anritsu MT8821C was used for LTE output power measurements and SAR testing. Max power control was used so the UE transmits with maximum output power during SAR testing. SAR must be measured with the maximum TTI (transmit time interval) supported by the device in each LTE configuration.

A) Spectrum Plots for RB Configurations
A properly configured base station simulator was used for SAR tests and power measurements. Therefore, spectrum plots for RB configurations were not required to be included in this report.

B) MPR
MPR is permanently implemented for this device by the manufacturer. The specific manufacturer target MPR is indicated alongside the SAR results. MPR is enabled for this device, according to 3GPP TS36.101 Section 6.2.3 – 6.2.5 under Table 6.2.3-1.

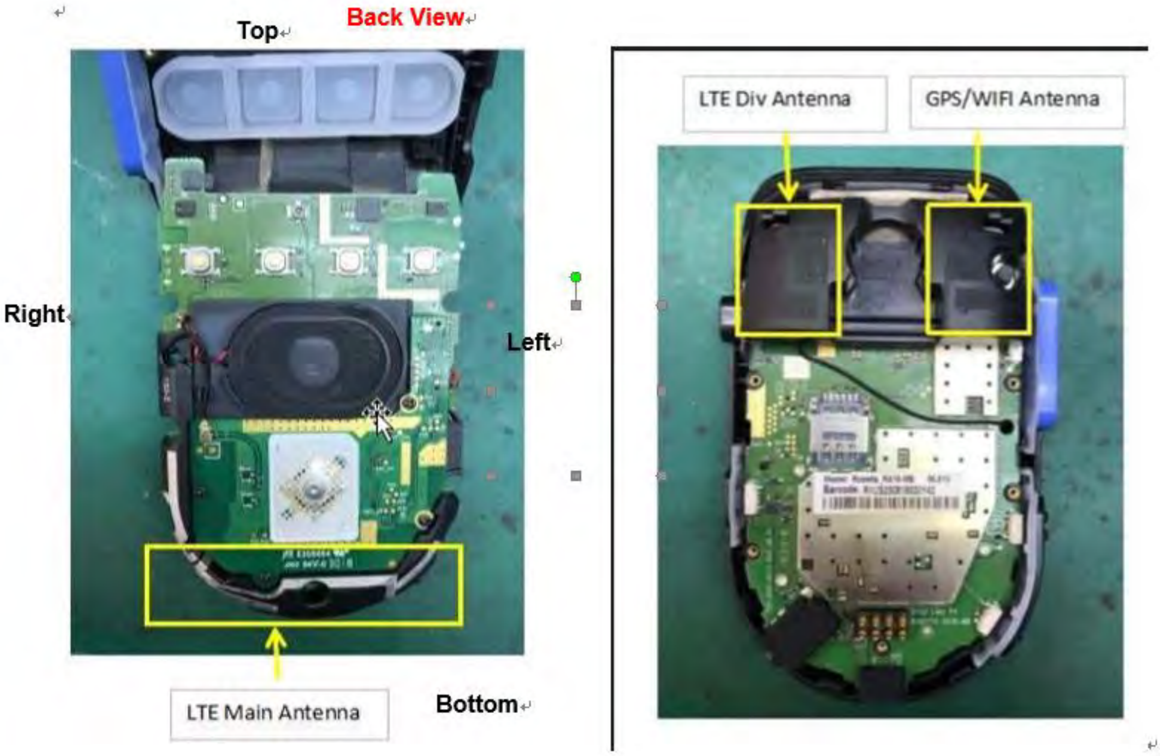
Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	≤ 1
16 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 1
16 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 2
64 QAM	≤ 5	≤ 4	≤ 8	≤ 12	≤ 16	≤ 18	≤ 2
64 QAM	> 5	> 4	> 8	> 12	> 16	> 18	≤ 3

C) A-MPR
A-MPR (Additional MPR) has been disabled for all SAR tests by setting NS=01 on the base station simulator.

D) Largest channel bandwidth standalone SAR test requirements
1) QPSK with 1 RB allocation
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. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required for 1 RB allocation; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.
2) QPSK with 50% RB allocation
The procedures required for 1 RB allocation in 1) are applied to measure the SAR for QPSK with 50% RB allocation.
3) QPSK with 100% RB allocation
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 in 1) and 2) 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.
4) Higher order modulations
For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in above sections to determine the QAM configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

E) Other channel bandwidth standalone SAR test requirements
For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in section A) to determine the channels and RB configurations that need SAR testing and only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

5.2.3 DUT Antenna Locations



Note:

1) The diversity Antenna does not support transmitter function.

5.2.4 EUT side for SAR Testing

According to the distance between LTE/ WIFI antennas and the sides of the EUT we can draw the conclusion that:

EUT Sides for SAR Testing						
Mode	Front	Back	Left	Right	Top	Bottom
LTE	Yes	Yes	Yes	Yes	Yes	Yes
Wi-Fi	Yes	Yes	Yes	Yes	Yes	Yes

Table 4： EUT Sides for SAR Testing

5.2.5 Stand-alone SAR test evaluation

Unless specifically required by the published RF exposure KDB procedures, standalone 1-g head or body and 10-g extremity SAR evaluation for general population exposure conditions, by measurement or numerical simulation, is not required when the corresponding SAR Test Exclusion Threshold condition is satisfied. These test exclusion conditions are based on source-based time-averaged maximum conducted output power of the RF channel requiring evaluation, adjusted for tune-up tolerance, and the minimum test separation distance required for the exposure conditions.

Freq. Band	Frequency (GHz)	Position	Average Power		Test Separation (mm)	Calculate Value	Exclusion Threshold	Exclusion (Y/N)
			dBm	mW				
Bluetooth	2.48	Head	5.5	3.5	25	0.2	3	Y
		hotspot	5.5	3.5	10	0.6	3	Y

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:
[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] · [√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, where
• f(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

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

5.3 Measurement of RF conducted Power

5.3.1 Conducted Power Of LTE

LTE Band 2				Conducted Power(dBm)			
Bandwidth	Modulation	RB size	RB offset	Channel 18625	Channel 18900	Channel 19175	Tune up
5MHz	QPSK	1	0	22.72	23.57	23.50	24.50
		1	13	22.94	23.72	23.68	24.50
		1	24	22.64	23.41	23.21	24.50
		12	0	21.77	22.67	22.59	23.50
		12	6	21.87	22.78	22.66	23.50
		12	13	21.76	22.67	22.50	23.50
		25	0	21.78	22.68	22.58	23.50
	16QAM	1	0	21.58	22.40	22.49	23.50
		1	13	21.80	22.64	22.54	23.50
		1	24	21.59	22.29	22.16	23.50
		12	0	22.01	22.41	22.41	22.50
		12	6	22.44	20.81	21.40	22.50
		12	13	22.34	20.68	21.21	22.50
		25	0	22.37	22.06	22.02	22.50
Bandwidth	Modulation	RB size	RB offset	Channel 18650	Channel 18900	Channel 19150	Tune up
10MHz	QPSK	1	0	22.60	23.14	22.76	24.50
		1	25	22.80	23.65	23.56	24.50
		1	49	22.62	22.95	22.96	24.50
		25	0	21.56	22.42	22.14	23.50
		25	13	21.71	22.57	22.50	23.50
		25	25	21.59	22.41	22.39	23.50
		50	0	21.54	22.39	22.31	23.50
	16QAM	1	0	21.58	22.07	21.86	23.50
		1	25	21.72	22.54	22.59	23.50
		1	49	21.62	21.88	21.90	23.50
		25	0	21.92	22.43	21.69	22.50
		25	13	22.22	21.91	21.57	22.50
		25	25	22.09	21.89	21.56	22.50
		50	0	22.04	21.87	21.53	22.50
Bandwidth	Modulation	RB size	RB offset	Channel 18675	Channel 18900	Channel 19125	Tune up
15MHz	QPSK	1	0	22.63	23.07	22.69	24.50
		1	38	23.31	23.96	23.76	24.50
		1	74	22.50	23.01	22.98	24.50
		36	0	21.76	22.63	22.13	23.50
		36	18	22.09	22.90	22.76	23.50
		36	39	21.89	22.54	22.65	23.50
		75	0	22.11	22.56	21.73	23.50
	16QAM	1	0	21.75	22.06	21.68	23.50
		1	38	22.28	22.87	22.75	23.50
		1	74	21.56	21.94	21.98	23.50
		36	0	21.92	22.34	21.58	22.50
		36	18	22.35	21.80	21.33	22.50

		36	39	22.21	21.77	21.32	22.50
		75	0	22.14	21.80	21.26	22.50
Bandwidth	Modulation	RB size	RB offset	Channel	Channel	Channel	Tune up
				18700	18900	19100	
20MHz	QPSK	1	0	23.89	**24.06**	23.96	24.50
		1	50	22.95	23.52	23.08	24.50
		1	99	23.39	23.95	23.90	24.50
		50	0	21.98	**22.73**	22.34	23.50
		50	25	21.94	22.61	22.16	23.50
		50	50	22.25	22.67	22.69	23.50
		100	0	23.09	23.29	22.72	23.50
	16QAM	1	0	22.34	23.08	23.03	23.50
		1	50	21.81	22.59	22.20	23.50
		1	99	22.87	22.98	23.05	23.50
		50	0	22.90	22.47	22.61	22.50
		50	25	22.23	22.35	22.18	22.50
		50	50	22.30	22.45	22.19	22.50
		100	0	22.23	22.38	22.14	22.50

LTE Band 4				**Conducted Power(dBm)**			
Bandwidth	Modulation	RB size	RB offset	Channel	Channel	Channel	Tune up
				19975	20175	20375	
5MHz	QPSK	1	0	23.38	23.01	23.63	24.50
		1	13	23.65	23.32	23.89	24.50
		1	24	23.28	23.03	23.35	24.50
		12	0	22.59	22.16	22.82	23.50
		12	6	22.68	22.26	22.87	23.50
		12	13	22.56	22.16	22.70	23.50
		25	0	22.61	22.14	22.78	23.50
	16QAM	1	0	22.48	22.14	22.73	23.50
		1	13	22.74	22.44	22.90	23.50
		1	24	22.38	22.21	22.48	23.50
		12	0	22.38	22.46	22.43	22.50
		12	6	22.44	21.91	22.09	22.50
		12	13	22.34	21.83	21.87	22.50
		25	0	22.36	22.17	22.06	22.50
Bandwidth	Modulation	RB size	RB offset	Channel	Channel	Channel	Tune up
				20000	20175	20350	
10MHz	QPSK	1	0	23.14	22.71	23.26	24.50
		1	25	23.60	23.30	23.81	24.50
		1	49	22.72	22.79	23.07	24.50
		25	0	22.46	21.98	22.62	23.50
		25	13	22.52	22.16	22.81	23.50
		25	25	22.17	22.08	22.66	23.50
		50	0	22.27	22.01	22.61	23.50
	16QAM	1	0	22.31	21.72	22.37	23.50
		1	25	22.60	22.34	22.79	23.50
		1	49	21.83	21.96	22.19	23.50
		25	0	22.42	22.33	22.46	22.50

		25	13	21.79	22.28	22.23	22.50
		25	25	21.67	22.33	22.20	22.50
		50	0	21.64	22.27	22.21	22.50
Bandwidth	Modulation	RB size	RB offset	Channel	Channel	Channel	Tune up
				20025	20175	20325	
15MHz	QPSK	1	0	23.14	22.69	23.06	24.50
		1	38	23.70	23.61	24.08	24.50
		1	74	22.60	22.98	23.07	24.50
		36	0	22.54	22.17	22.63	23.50
		36	18	22.69	22.49	23.05	23.50
		36	39	22.20	22.32	22.81	23.50
		75	0	22.24	22.58	22.32	23.50
	16QAM	1	0	22.28	21.98	22.21	23.50
		1	38	22.95	22.83	23.14	23.50
		1	74	21.86	22.21	22.24	23.50
		36	0	22.35	22.36	22.31	22.50
		36	18	22.19	22.06	21.95	22.50
		36	39	21.99	22.04	21.94	22.50
		75	0	22.32	22.05	21.91	22.50
Bandwidth	Modulation	RB size	RB offset	Channel	Channel	Channel	Tune up
				20050	20175	20300	
20MHz	QPSK	1	0	23.84	**24.19**	24.13	24.50
		1	50	23.17	23.08	23.56	24.50
		1	99	23.78	23.99	23.89	24.50
		50	0	22.62	22.33	22.70	23.50
		50	25	22.29	22.26	22.71	23.50
		50	50	22.32	**23.03**	22.61	23.50
		100	0	23.21	23.47	23.41	23.50
	16QAM	1	0	23.34	22.96	23.00	23.50
		1	50	22.39	22.27	22.78	23.50
		1	99	22.98	23.16	23.39	23.50
		50	0	22.46	22.48	22.29	22.50
		50	25	21.97	22.28	22.25	22.50
		50	50	22.23	22.24	22.32	22.50
		100	0	22.18	22.19	22.12	22.50

LTE FDD Band 12				Conducted Power(dBm)			
Bandwidth	Modulation	RB size	RB offset	Channel 23035	Channel 23095	Channel 23155	Tune up
5MHz	QPSK	1	0	23.52	23.41	23.25	24.00
		1	13	23.32	23.04	23.33	24.00
		1	24	23.21	23.17	23.59	24.00
		12	0	22.40	22.10	22.12	23.00
		12	6	22.21	21.95	22.26	23.00
		12	13	22.19	21.99	22.62	23.00
		25	0	22.26	21.98	22.43	23.00
	16QAM	1	0	22.68	22.52	22.25	23.00
		1	13	22.40	21.99	22.51	23.00
		1	24	22.20	22.22	22.90	23.00
		12	0	21.84	21.28	21.87	22.00
		12	6	21.16	20.65	20.75	22.00
		12	13	21.26	20.59	21.04	22.00
		25	0	21.09	21.49	21.95	22.00
Bandwidth	Modulation	RB size	RB offset	Channel 23060	Channel 23095	Channel 23130	Tune up
10MHz	QPSK	1	0	23.17	23.03	22.87	24.00
		1	25	22.96	23.06	23.12	24.00
		1	49	22.70	22.82	**23.39**	24.00
		25	0	22.26	**22.34**	21.99	23.00
		25	13	22.18	21.98	22.10	23.00
		25	25	22.07	22.09	22.14	23.00
		50	0	22.25	21.84	22.01	23.00
	16QAM	1	0	22.27	22.11	22.07	23.00
		1	25	22.13	22.07	22.16	23.00
		1	49	21.78	21.91	22.43	23.00
		25	0	21.98	21.84	21.88	22.00
		25	13	21.12	21.68	21.62	22.00
		25	25	21.30	21.64	21.62	22.00
		50	0	20.98	21.59	21.63	22.00

Table 5： Conducted Power Of LTE.

5.3.2 Conducted Power Of WIFI and BT

WiFi 2.4G						
Mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11b	1	2412	1	15.00	13.65	No
	6	2437		15.00	13.97	No
	11	2462		15.00	**14.22**	Yes
802.11g	1	2412	6	13.50	11.96	No
	6	2437		13.50	12.37	No
	11	2462		13.50	12.72	No
802.11n 20M	1	2412	6.5	12.00	10.35	No
	6	2437		12.00	10.85	No
	11	2462		12.00	11.12	No

Table 6： Conducted Power Of WIFI 2.4G.

WiFi 5G							
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11a	U-NII-1	36	5180	6	12.50	10.21	No
		44	5220		12.50	10.46	No
		48	5240		12.50	**10.71**	Yes
	U-NII-2A	52	5260		12.50	11.28	No
		60	5300		12.50	**11.58**	Yes
	U-NII-2C	100	5500		12.50	12.01	No
		116	5580		12.50	**12.24**	Yes
		140	5700		12.50	12.04	No
	U-NII-3	149	5745		12.50	12.21	No
		157	5785		12.50	12.18	No
		165	5825		12.50	**12.23**	Yes
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11n-HT20	U-NII-1	36	5180	MCS0	10.00	9.04	No
		44	5220		10.00	9.26	No
		48	**5240**		10.00	9.45	No
	U-NII-2A	52	5260		8.00	6.34	No
		60	5300		8.00	6.96	No
		64	5320		8.00	7.03	No
	U-NII-2C	100	5500		11.00	10.21	No
		116	5580		11.00	10.43	No
		140	5700		11.00	10.11	No
	U-NII-3	149	5745		11.00	10.46	No
		157	5785		11.00	10.37	No
		165	5825		11.00	10.54	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test

5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11n-HT40	U-NII-1	38	5190	MCS0	10.00	9.12	No
		46	5230		10.00	9.46	No
	U-NII-2A	54	5270		10.00	8.42	No
		62	5310		10.00	8.93	No
	U-NII-2C	102	5510		11.00	10.18	No
		110	5550		11.00	10.25	No
		134	5670		11.00	10.07	No
	U-NII-3	151	5755		11.00	10.43	No
		159	5795		11.00	10.51	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 20M	U-NII-1	36	5180	MCS0	10.00	9.02	No
		44	5220		10.00	9.25	No
		48	**5240**		10.00	9.51	No
	U-NII-2A	52	5260		8.00	6.56	No
		60	5300		8.00	6.94	No
		64	5320		8.00	7.01	No
	U-NII-2C	100	5500		11.00	10.16	No
		116	5580		11.00	10.28	No
		140	5700		11.00	10.13	No
	U-NII-3	149	5745		11.00	10.46	No
		157	5785		11.00	10.37	No
		165	5825		11.00	10.56	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 40M	U-NII-1	38	5190	MCS0	9.00	7.71	No
		46	5230		9.00	8.16	No
	U-NII-2A	54	5270		9.00	6.73	No
		62	5310		9.00	7.18	No
	U-NII-2C	102	5510		10.00	9.09	No
		110	5550		10.00	9.32	No
		134	5670		10.00	9.15	No
	U-NII-3	151	5755		10.00	9.36	No
		159	5795		10.00	9.39	No
5GHz	mode	Channel	Frequency(MHz)	Data Rate(Mbps)	Tune up	Average Power (dBm)	SAR Test
802.11ac 80M	U-NII-1	42	5210	MCS0	7.00	5.41	No
	U-NII-2A	58	5290		7.00	5.72	No
	U-NII-2C	106	5530		7.00	6.51	No
		122	5610		7.00	6.44	No
	U-NII-3	155	5775		7.00	6.68	No

Table 7： Conducted Power Of WIFI 5G.

Note:
a) Power must be measured at each transmit antenna port according to the DSSS and OFDM transmission configurations in each standalone and aggregated frequency band.
b) Power measurement is required for the transmission mode configuration with the highest maximum output power specified for production units.

1) When the same highest maximum output power specification applies to multiple transmission modes, the largest channel bandwidth configuration with the lowest order modulation and lowest data rate is measured.

2) When the same highest maximum output power is specified for multiple largest channel bandwidth configurations with the same lowest order modulation or lowest order modulation and lowest data rate, power measurement is required for all equivalent 802.11 configurations with the same maximum output power.

c) For each transmission mode configuration, power must be measured for the highest and lowest channels; and at the mid-band channel(s) when there are at least 3 channels. For configurations with multiple mid-band channels, due to an even number of channels, both channels should be measured.

BT			Tune up (dBm)	Average Conducted Power(dBm)
Modulation	Channel	Frequency(MHz)		
GFSK	0	2402	5.5	**5.38**
	39	2441	5.5	5.33
	78	2480	5.5	4.56
π/4DQPSK	0	2402	1	-0.56
	39	2441	1	-0.47
	78	2480	1	-0.98
8DPSK	0	2402	1	-0.58
	39	2441	1	-0.55
	78	2480	1	-0.98
BLE			Tune up (dBm)	Average Conducted Power(dBm)
Modulation	Channel	Frequency(MHz)		
GFSK	0	2402	5.5	**5.0**
	19	2440	5.5	4.96
	39	2480	5.5	3.86

Table 8： Conducted Power Of BT.

5.4 Measurement of SAR Data

5.4.1 SAR Result of LTE Band 2

Test position	BW.	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg)1-g	Power Drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR(W/kg)	Liquid Temp.
Head Test data(Separate 25mm with Head Liquid 1RB)											
Front side with mouth	20	QPSK 1RB_0	18900/1880	1:1	0.068	-0.09	24.06	24.50	1.107	**0.076**	22.3
Head Test data(Separate 25mm with Head Liquid 50%RB)											
Front side with mouth	20	QPSK 50RB_0	18900/1880	1:1	0.053	0.05	22.73	23.50	1.194	0.063	22.3
Body worn Test data(Separate 10mm 1RB)											
Front side	20	QPSK 1RB_0	18900/1880	1:1	0.560	-0.02	24.06	24.50	1.107	**0.620**	22.3
Back side	20	QPSK 1RB_0	18900/1880	1:1	0.088	0.08	24.06	24.50	1.107	0.097	22.3
Body worn Test data(Separate 10mm 50%RB)											
Front side	20	QPSK 50RB_0	18900/1880	1:1	0.452	0.10	22.73	23.50	1.194	0.540	22.3
Back side	20	QPSK 50RB_0	18900/1880	1:1	0.067	-0.01	22.73	23.50	1.194	0.080	22.3
Hotspot Test data(Separate 10mm 1RB)											
Front side	20	QPSK 1RB_0	18900/1880	1:1	0.560	-0.02	24.06	24.50	1.107	**0.620**	22.3
Back side	20	QPSK 1RB_0	18900/1880	1:1	0.088	0.08	24.06	24.50	1.107	0.097	22.3
Left side	20	QPSK 1RB_0	18900/1880	1:1	0.193	0.01	24.06	24.50	1.107	0.214	22.3
Right side	20	QPSK 1RB_0	18900/1880	1:1	0.041	-0.08	24.06	24.50	1.107	0.045	22.3
Top side	20	QPSK 1RB_0	18900/1880	1:1	0.028	0.05	24.06	24.50	1.107	0.031	22.3
Bottom side	20	QPSK 1RB_0	18900/1880	1:1	0.104	-0.06	24.06	24.50	1.107	0.115	22.3
Hotspot Test data (Separate 10mm 50%RB)											
Front side	20	QPSK 50RB_0	18900/1880	1:1	0.452	0.10	22.73	23.50	1.194	0.540	22.3
Back side	20	QPSK 50RB_0	18900/1880	1:1	0.067	-0.01	22.73	23.50	1.194	0.080	22.3
Left side	20	QPSK 50RB_0	18900/1880	1:1	0.164	-0.08	22.73	23.50	1.194	0.196	22.3
Right side	20	QPSK 50RB_0	18900/1880	1:1	0.034	0.01	22.73	23.50	1.194	0.040	22.3
Top side	20	QPSK 1RB_0	18900/1880	1:1	0.024	-0.05	22.73	23.50	1.194	0.029	22.3
Bottom side	20	QPSK 50RB_0	18900/1880	1:1	0.081	0.08	22.73	23.50	1.194	0.097	22.3
Hotspot Test data at the worst case with Back Splint(Separate 0mm 1RB)											
Back side	20	QPSK 1RB_0	18900/1880	1:1	0.061	-0.17	24.06	24.50	1.107	0.068	22.3

Table 9： SAR of LTE Band 2.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

5.4.2 SAR Result of LTE Band 4

Test position	BW.	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg)1-g	Power Drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR(W/kg)	Liquid Temp.
Head Test data(Separate 25mm with Head Liquid 1RB)											
Front side with mouth	20	QPSK 1RB_0	20175/1732.5	1:1	0.133	-0.07	24.19	24.50	1.074	**0.143**	22.2
Head Test data(Separate 25mm with Head Liquid 50%RB)											
Front side with mouth	20	QPSK 50RB_50	20175/1732.5	1:1	0.091	0.02	23.03	23.50	1.114	0.101	22.2
Body worn Test data(Separate 10mm 1RB)											
Front side	20	QPSK 1RB_0	20175/1732.5	1:1	0.590	-0.16	24.19	24.50	1.074	**0.634**	22.2
Back side	20	QPSK 1RB_0	20175/1732.5	1:1	0.102	0.11	24.19	24.50	1.074	0.110	22.2
Body worn Test data(Separate 10mm 50%RB)											
Front side	20	QPSK 50RB_50	20175/1732.5	1:1	0.483	-0.07	23.03	23.50	1.114	0.538	22.2
Back side	20	QPSK 50RB_50	20175/1732.5	1:1	0.081	-0.08	23.03	23.50	1.114	0.090	22.2
Hotspot Test data(Separate 10mm 1RB)											
Front side	20	QPSK 1RB_0	20175/1732.5	1:1	0.590	-0.16	24.19	24.50	1.074	**0.634**	22.2
Back side	20	QPSK 1RB_0	20175/1732.5	1:1	0.102	0.11	24.19	24.50	1.074	0.110	22.2
Left side	20	QPSK 1RB_0	20175/1732.5	1:1	0.165	0.07	24.19	24.50	1.074	0.177	22.2
Right side	20	QPSK 1RB_0	20175/1732.5	1:1	0.022	-0.03	24.19	24.50	1.074	0.024	22.2
Top side	20	QPSK 1RB_0	20175/1732.5	1:1	0.035	-0.05	24.19	24.50	1.074	0.038	22.2
Bottom side	20	QPSK 1RB_0	20175/1732.5	1:1	0.268	-0.01	24.19	24.50	1.074	0.288	22.2
Hotspot Test data (Separate 10mm 50%RB)											
Front side	20	QPSK 50RB_50	20175/1732.5	1:1	0.483	-0.07	23.03	23.50	1.114	0.538	22.2
Back side	20	QPSK 50RB_50	20175/1732.5	1:1	0.081	-0.08	23.03	23.50	1.114	0.090	22.2
Left side	20	QPSK 50RB_50	20175/1732.5	1:1	0.116	-0.07	23.03	23.50	1.114	0.129	22.2
Right side	20	QPSK 50RB_50	20175/1732.5	1:1	0.020	-0.09	23.03	23.50	1.114	0.022	22.2
Top side	20	QPSK 50RB_50	20175/1732.5	1:1	0.022	-0.05	23.03	23.50	1.114	0.025	22.2
Bottom side	20	QPSK 50RB_50	20175/1732.5	1:1	0.224	-0.04	23.03	23.50	1.114	0.250	22.2
Hotspot Test data at the worst case with Back Splint(Separate 0mm 1RB)											
Back side	20	QPSK 1RB_0	20175/1732.5	1:1	0.087	-0.01	24.19	24.50	1.074	0.093	22.2

Table 10：SAR of LTE Band 4.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s)

5.4.3 SAR Result of LTE Band 12

Test position	BW.	Test mode	Test Ch./Freq.	Duty Cycle	SAR (W/kg)1-g	Power Drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR(W/kg)	Liquid Temp.
Head Test data(Separate 25mm with Head Liquid 1RB)											
Front side with mouth	10	QPSK 1RB_49	23130/711	1:1	0.099	-0.06	23.39	24.00	1.151	0.113	22.1
Head Test data(Separate 25mm with Head Liquid 50%RB)											
Front side with mouth	10	QPSK 25RB_0	23095/707.5	1:1	0.099	-0.08	22.34	23.00	1.164	**0.115**	22.1
Body worn Test data(Separate 10mm 1RB)											
Front side	10	QPSK 1RB_49	23130/711	1:1	0.275	0.02	23.39	24.00	1.151	**0.316**	22.1
Back side	10	QPSK 1RB_49	23130/711	1:1	0.144	-0.15	23.39	24.00	1.151	0.166	22.1
Body worn Test data(Separate 10mm 50%RB)											
Front side	10	QPSK 25RB_0	23095/707.5	1:1	0.221	-0.02	22.34	23.00	1.164	0.257	22.1
Back side	10	QPSK 25RB_0	23095/707.5	1:1	0.118	-0.01	22.34	23.00	1.164	0.137	22.1
Hotspot Test data(Separate 10mm 1RB)											
Front side	10	QPSK 1RB_49	23130/711	1:1	0.275	0.02	23.39	24.00	1.151	**0.316**	22.1
Back side	10	QPSK 1RB_49	23130/711	1:1	0.144	-0.15	23.39	24.00	1.151	0.166	22.1
Left side	10	QPSK 1RB_49	23130/711	1:1	0.135	0.07	23.39	24.00	1.151	0.155	22.1
Right side	10	QPSK 1RB_49	23130/711	1:1	0.060	-0.04	23.39	24.00	1.151	0.070	22.1
Top side	10	QPSK 1RB_49	23130/711	1:1	0.009	0.09	23.39	24.00	1.151	0.011	22.1
Bottom side	10	QPSK 1RB_49	23130/711	1:1	0.043	-0.02	23.39	24.00	1.151	0.050	22.1
Hotspot Test data (Separate 10mm 50%RB)											
Front side	10	QPSK 25RB_0	23095/707.5	1:1	0.221	-0.02	22.34	23.00	1.164	0.257	22.1
Back side	10	QPSK 25RB_0	23095/707.5	1:1	0.118	-0.01	22.34	23.00	1.164	0.137	22.1
Left side	10	QPSK 25RB_0	23095/707.5	1:1	0.106	-0.04	22.34	23.00	1.164	0.123	22.1
Right side	10	QPSK 25RB_0	23095/707.5	1:1	0.048	-0.01	22.34	23.00	1.164	0.056	22.1
Top side	10	QPSK 25RB_0	23095/707.5	1:1	0.009	0.05	22.34	23.00	1.164	0.010	22.1
Bottom side	10	QPSK 25RB_0	23095/707.5	1:1	0.040	-0.05	22.34	23.00	1.164	0.046	22.1
Hotspot Test data at the worst case with Back Splint(Separate 0mm 1RB)											
Back side	10	QPSK 25RB_0	23130/711	1:1	0.077	-0.02	23.39	24.00	1.151	0.089	22.1

Table 11：SAR of LTE Band 12.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B.

2) Per FCC KDB Publication 447498 D01, if the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s)

5.4.4 SAR Result of WiFi 2.4G

Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg) 1-g	SAR (W/kg) 10-g	Power drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR(W/kg)	Liquid Temp.
Head Test data (Separate 25mm with Head Liquid)												
Front	802.11b	11/2462	99.02%	1.010	0.00636	0.00253	0.09	14.22	15.00	1.197	**0.008**	22.0
Body worn Test data(Separate 10mm 1RB)												
Front side	802.11b	11/2462	99.02%	1.010	0.026	0.013	-0.12	14.22	15.00	1.197	0.031	22.0
Back side	802.11b	11/2462	99.02%	1.010	**0.185**	0.086	-0.09	14.22	15.00	1.197	**0.224**	22.0
Hotspot Test data (Separate 10mm)												
Front side	802.11b	11/2462	99.02%	1.010	0.026	0.013	-0.12	14.22	15.00	1.197	0.031	22.0
Back side	802.11b	11/2462	99.02%	1.010	**0.185**	0.086	-0.09	14.22	15.00	1.197	**0.224**	22.0
Left side	802.11b	11/2462	99.02%	1.010	0.100	0.051	0.10	14.22	15.00	1.197	0.121	22.0
Right side	802.11b	11/2462	99.02%	1.010	0.005	0.002	0.02	14.22	15.00	1.197	0.006	22.0
Top side	802.11b	11/2462	99.02%	1.010	0.018	0.008	-0.01	14.22	15.00	1.197	0.022	22.0
Bottom side	802.11b	11/2462	99.02%	1.010	0.009	0.004	-0.01	14.22	15.00	1.197	0.011	22.0
Hotspot Test data at the worst case with Back Splint(Separate 0mm)												
Back side	802.11b	11/2462	99.02%	1.010	0.054	0.029	-0.03	14.22	15.00	1.197	0.065	22.0

Table 12：SAR of WiFi 2.4G.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph Results refer to Appendix B

2) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) Per KDB248227D01, for Body SAR test of WiFi 2.4G, SAR is measured for 2.4 GHz 802.11b DSSS using the initial test position procedure.The highest reported SAR for DSSS is adjusted by the ratio of OFDM 802.11g/n to DSSS specified maximum output power and the adjusted SAR is < 1.2 W/kg, so SAR for 802.11g/n is not required.

Mode	Tune-up (dBm)	Tune-up (mw)	Max Reported SAR1-g(W/kg)	Adjusted SAR1-g(W/kg)	SAR test
Head Test data 25mm					
802.11b	15.00	31.62	0.008	/	Yes
802.11g	13.50	22.39	/	0.006	No
802.1n 20M	12.00	15.85	/	0.004	No
Hotspot 10mm					
802.11b	15.00	31.62	0.224	/	Yes
802.11g	13.50	22.39	/	0.159	No
802.1n 20M	12.00	15.85	/	0.112	No

5.4.5 SAR Result of WiFi 5G

Test position	Test mode	Test Ch./Freq.	Duty Cycle	Duty Cycle Scaled factor	SAR (W/kg)1-g	Power drift(dB)	Conducted power(dBm)	Tune up Limit(dBm)	Scaled factor	Scaled SAR(W/kg)	Liquid Temp.
Head Test data of U-NII-2A(Separate 25mm with Head Liquid)											
Front side with mouth	802.11a	60/5300	96.53%	1.036	0.019	-0.04	11.58	12.50	1.236	**0.024**	22.2
Head Test data of U-NII-2C(Separate 25mm with Head Liquid)											
Front side with mouth	802.11a	116/5580	96.53%	1.036	0.021	0.01	12.24	12.50	1.062	0.023	22.2
Head Test data of U-NII-3(Separate 25mm with Head Liquid)											
Front side with mouth	802.11a	165/5825	96.53%	1.036	0.018	0.13	12.23	12.50	1.064	0.020	22.2
Body worn Test data U-NII-2A(Separate 10mm)											
Front side	802.11a	60/5300	96.53%	1.036	0.001	0.01	11.58	12.50	1.236	0.001	22.2
Back side	802.11a	60/5300	96.53%	1.036	0.014	0.08	11.58	12.50	1.236	0.018	22.2
Body worn Test data U-NII-2C(Separate 10mm)											
Front side	802.11a	116/5580	96.53%	1.036	0.016	0.00	12.24	12.50	1.062	0.017	22.2
Back side	802.11a	116/5580	96.53%	1.036	0.174	0.01	12.24	12.50	1.062	0.191	22.2
Body worn Test data U-NII-3(Separate 10mm)											
Front side	802.11a	165/5825	96.53%	1.036	0.016	0.00	12.23	12.50	1.064	0.018	22.2
Back side	802.11a	165/5825	96.53%	1.036	0.185	0.06	12.23	12.50	1.064	**0.204**	22.2
Hotspot Test data of U-NII-1(Separate 10mm)											
Front side	802.11a	48/5240	96.53%	1.036	0.001	0.00	10.71	12.50	1.510	0.001	22.2
Back side	802.11a	48/5240	96.53%	1.036	0.013	0.08	10.71	12.50	1.510	0.021	22.2
Left side	802.11a	48/5240	96.53%	1.036	0.102	0.07	10.71	12.50	1.510	0.160	22.2
Right side	802.11a	48/5240	96.53%	1.036	0.004	0.00	10.71	12.50	1.510	0.007	22.2
Top side	802.11a	48/5240	96.53%	1.036	0.042	-0.09	10.71	12.50	1.510	0.065	22.2
Bottom side	802.11a	48/5240	96.53%	1.036	0.012	0.00	10.71	12.50	1.510	0.018	22.2
Hotspot Test data of U-NII-3 (Separate 10mm)											
Front side	802.11a	165/5825	96.53%	1.036	0.016	0.00	12.23	12.50	1.064	0.018	22.2
Back side	802.11a	165/5825	96.53%	1.036	0.185	0.06	12.23	12.50	1.064	**0.204**	22.2
Left side	802.11a	165/5825	96.53%	1.036	0.065	-0.03	12.23	12.50	1.064	0.072	22.2
Right side	802.11a	165/5825	96.53%	1.036	0.005	0.00	12.23	12.50	1.064	0.006	22.2
Top side	802.11a	165/5825	96.53%	1.036	0.011	0.00	12.23	12.50	1.064	0.012	22.2

Bottom side	802.11a	165/5825	96.53%	1.036	0.005	-0.03	12.23	12.50	1.064	0.005	22.2
Hotspot Test data at the worst case with Back Splint(Separate 0mm)											
Back side	802.11a	165/5825	96.53%	1.036	0.003	-0.06	12.23	12.50	1.064	0.004	22.2

Table 13：SAR of WiFi 5G.

Note:

1) The maximum Scaled SAR value is marked in bold. Graph results refer to Appendix B

2) If the reported (scaled) SAR measured at the middle channel or highest output power channel for each test configuration is ≤ 0.8 W/kg then testing at the other channels is not required for such test configuration(s).

3) Each channel was tested at the lowest data rate.

4) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. As the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration;

5) When the highest reported SAR for the initial test configuration is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR test for the other 802.11 modes are not required.

Mode	Tune-up (dBm)	Tune-up (mw)	Max Reported SAR1-g(W/kg)	Adjusted SAR1-g(W/kg)	SAR test
Head Test data 25mm					
802.11a	12.5	17.78	0.024	/	Yes
802.11n 20M	11.0	12.59	/	0.017	No
802.1n 40M	11.0	12.59	/	0.017	No
802.11ac 20M	11.0	12.59	/	0.017	No
802.11ac 40M	10.0	10.00	/	0.013	No
802.11ac 80M	7.0	5.01	/	0.007	No
Hotspot/Body worn 10mm					
802.11a	12.5	17.78	0.204	/	Yes
802.11n 20M	11.0	12.59	/	0.144	No
802.1n 40M	11.0	12.59	/	0.144	No
802.11ac 20M	11.0	12.59	/	0.144	No
802.11ac 40M	10.0	10.00	/	0.115	No
802.11ac 80M	7.0	5.01	/	0.057	No

5.5 Multiple Transmitter Evaluation

5.5.1 Simultaneous SAR SAR test evaluation

1) Simultaneous Transmission

NO.	Simultaneous Transmission Configuration	Head 25mm	Hotspot 10mm
1	LTE + WiFi	Yes	Yes
2	LTE + BT	Yes	Yes
3	BT+WIFI (They share the same antenna and cannot transmit at the same time by design.)	No	No

Note:
1) Wi-Fi can transmit simultaneously with Bluetooth.

5.5.2 Estimated SAR

When the standalone SAR test exclusion is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion:

• (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)]·[√f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

Where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

• 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm.

Estimated SAR Result

Freq. Band	**Frequency (GHz)**	**Test Position**	**max. power(dBm)**	**Test Separation (mm)**	**Estimated**
					1g SAR (W/kg)
Bluetooth	2.48	Head	5.50	25	0.030
		Hotspot/ Body worn	5.50	10	0.075

2) Simultaneous Transmission SAR Summation Scenario for head

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN2.4GHz SAR(W/kg)	③ MAX.WLAN5GHz SAR(W/kg)	④ MAX.BT SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
LTE Band 2	Front side with mouth	0.076	0.008	0.024	0.030	0.084	0.100	0.106	No
LTE Band 4	Front side with mouth	0.143	0.008	0.024	0.030	0.151	0.167	**0.173**	No
LTE Band 12	Front side with mouth	0.115	0.008	0.024	0.030	0.123	0.139	0.145	No

3) Simultaneous Transmission SAR Summation Scenario for Body worn 10mm

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN2.4GHz SAR(W/kg)	③ MAX.WLAN5GHz SAR(W/kg)	④MAX.BT SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
LTE Band 2	Front	0.620	0.031	0.018	0.075	0.651	0.638	0.695	No
	Back	0.097	0.224	0.204	0.075	0.321	0.301	0.172	No
LTE Band 4	Front	0.634	0.031	0.018	0.075	0.665	0.652	**0.709**	No
	Back	0.110	0.224	0.204	0.075	0.334	0.314	0.185	No
LTE Band 12	Front	0.316	0.031	0.018	0.075	0.347	0.334	0.391	No
	Back	0.166	0.224	0.204	0.075	0.390	0.370	0.241	No

4) Simultaneous Transmission SAR Summation Scenario for hotspot 10mm

WWAN Band	Exposure position	① MAX.WWAN SAR(W/kg)	② MAX.WLAN2.4GHz SAR(W/kg)	③ MAX.WLAN5GHz SAR(W/kg)	④MAX.BT SAR(W/kg)	Summed SAR①+②	Summed SAR①+③	Summed SAR①+④	Case NO.
LTE Band 2	Front	0.620	0.031	0.018	0.075	0.651	0.638	0.695	No
	Back	0.097	0.224	0.204	0.075	0.321	0.301	0.172	No
	Left	0.214	0.121	0.160	0.075	0.335	0.374	0.289	No
	Right	0.045	0.006	0.007	0.075	0.051	0.052	0.12	No
	Top	0.031	0.022	0.065	0.075	0.053	0.096	0.106	No
	Bottom	0.115	0.011	0.018	0.075	0.126	0.133	0.19	No
LTE Band 4	Front	0.634	0.031	0.018	0.075	0.665	0.652	**0.709**	No
	Back	0.110	0.224	0.204	0.075	0.334	0.314	0.185	No
	Left	0.177	0.121	0.160	0.075	0.298	0.337	0.252	No
	Right	0.024	0.006	0.007	0.075	0.030	0.031	0.099	No
	Top	0.038	0.022	0.065	0.075	0.060	0.103	0.113	No
	Bottom	0.288	0.011	0.018	0.075	0.299	0.306	0.363	No
LTE Band 12	Front	0.316	0.031	0.018	0.075	0.347	0.334	0.391	No
	Back	0.166	0.224	0.204	0.075	0.390	0.370	0.241	No
	Left	0.155	0.121	0.160	0.075	0.276	0.315	0.23	No
	Right	0.070	0.006	0.007	0.075	0.076	0.077	0.145	No
	Top	0.011	0.022	0.065	0.075	0.033	0.076	0.086	No
	Bottom	0.050	0.011	0.018	0.075	0.061	0.068	0.125	No

6 Equipment list

Test Platform	SPEAG DASY5 Professional
Location	SGS-CSTC Standards Technical Services Co., Ltd. Shenzhen Branch
Description	SAR Test System (Frequency range 300MHz-6GHz)
Software Reference	DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Hardware Reference

	Equipment	Manufacturer	Model	Serial Number	Calibration Date	Due date of calibration
☒	Twin Phantom	SPEAG	SAM 1	1824	NCR	NCR
☒	Twin Phantom	SPEAG	SAM 1	1141	NCR	NCR
☒	Twin Phantom	SPEAG	SAM 2	1640	NCR	NCR
☒	ELI	SPEAG	ELI V5.0	1143	NCR	NCR
☒	ELI	SPEAG	ELI V5.0	1123	NCR	NCR
☒	DAE	SPEAG	DAE4	1267	2017-11-28	2018-11-27
☒	DAE	SPEAG	DAE4	1428	2018-01-17	2019-01-16
☒	E-Field Probe	SPEAG	EX3DV4	3962	2018-01-11	2019-01-10
☒	E-Field Probe	SPEAG	EX3DV4	3982	2018-04-10	2019-04-09
☒	Validation Kits	SPEAG	D750V3	1160	2016-06-22	2019-06-21
☒	Validation Kits	SPEAG	D1750V2	1149	2016-06-23	2019-06-22
☒	Validation Kits	SPEAG	D1900V2	5d028	2016-12-07	2019-12-06
☒	Validation Kits	SPEAG	D2450V2	733	2016-12-07	2019-12-06
☒	Validation Kits	SPEAG	D5GHzV2	1165	2016-12-13	2019-12-12
☒	Agilent Network Analyzer	Agilent	E5071C	MY46523590	2018-03-13	2019-03-12
☒	Dielectric Probe Kit	Agilent	85070E	US01440210	NCR	NCR
☒	Radio Communication Analyzer	Anritsu Corporation	MT8821C	6201502984	2018-05-02	2019-05-01
☒	RF Bi-Directional Coupler	Agilent	86205-60001	MY31400031	NCR	NCR
☒	Signal Generator	Agilent	N5171B	MY53050736	2018-03-13	2019-03-12
☒	Preamplifier	Mini-Circuits	ZHL-42W	15542	NCR	NCR
☒	Preamplifier	Compliance Directions Systems Inc.	AMP28-3W	073501433	NCR	NCR
☒	Power Meter	Agilent	E4416A	GB41292095	2018-03-13	2019-03-12
☒	Power Sensor	Agilent	8481H	MY41091234	2018-03-13	2019-03-12
☒	Power Sensor	R&S	NRP-Z92	100025	2018-03-13	2019-03-12
☒	Attenuator	SHX	TS2-3dB	30704	NCR	NCR
☒	Coaxial low pass filter	Mini-Circuits	VLF-2500(+)	NA	NCR	NCR
☒	Coaxial low pass filter	Microlab Fxr	LA-F13	NA	NCR	NCR
☒	50 Ω coaxial load	Mini-Circuits	KARN-50+	00850	NCR	NCR
☒	DC POWER SUPPLY	SAKO	SK1730SL5A	NA	NCR	NCR

☒	Speed reading thermometer	MingGao	T809	NA	2018-03-19	2019-03-18
☒	Humidity and Temperature Indicator	KIMTOKA	KIMTOKA	NA	2018-03-19	2019-03-18

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

7 Measurement Uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

8 Calibration certificate

Please see the Appendix C

9 Photographs

Please see the Appendix D

Appendix A: Detailed System Check Results

Appendix B: Detailed Test Results

Appendix C: Calibration certificate

Appendix D: Photographs

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Appendix A

Detailed System Check Results

1. System Performance Check for Head
System Performance Check 750 MHz Head
System Performance Check 750 MHz Body
System Performance Check 1750 MHz Head
System Performance Check 1750 MHz Body
System Performance Check 1900 MHz Head
System Performance Check 1900 MHz Body
System Performance Check 2450 MHz Head
System Performance Check 2450 MHz Body
System Performance Check 5250 MHz Head
System Performance Check 5250 MHz Body
System Performance Check 5600 MHz Head
System Performance Check 5600 MHz Body
System Performance Check 5750 MHz Head
System Performance Check 5750 MHz Body

Date: 2018/10/30

Test Laboratory: SGS-SAR Lab

System Performance Check 750 MHz Head

DUT: D750V3; Type: D750V3; Serial: 1160

Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1

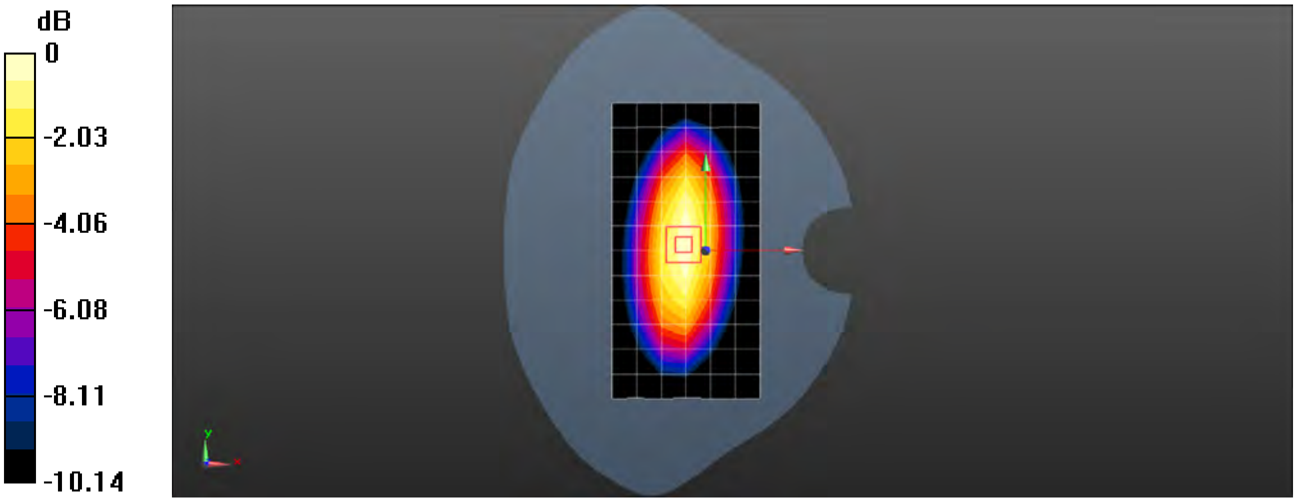
Medium: HSL750;Medium parameters used: f = 750 MHz; σ = 0.878 S/m; ε_r = 43.089; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(10.67, 10.67, 10.67); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1824
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=15mm, Pin=250mW/Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.25 W/kg

Body/d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 44.98 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 2.90 W/kg
SAR(1 g) = 2.01 W/kg; SAR(10 g) = 1.33 W/kg
Maximum value of SAR (measured) = 2.10 W/kg



0 dB = 2.10 W/kg = 3.22 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

System Performance Check 750 MHz Body

DUT: D750V3; Type: D750V3; Serial: 1160

Communication System: UID 0, CW (0); Frequency: 750 MHz;Duty Cycle: 1:1

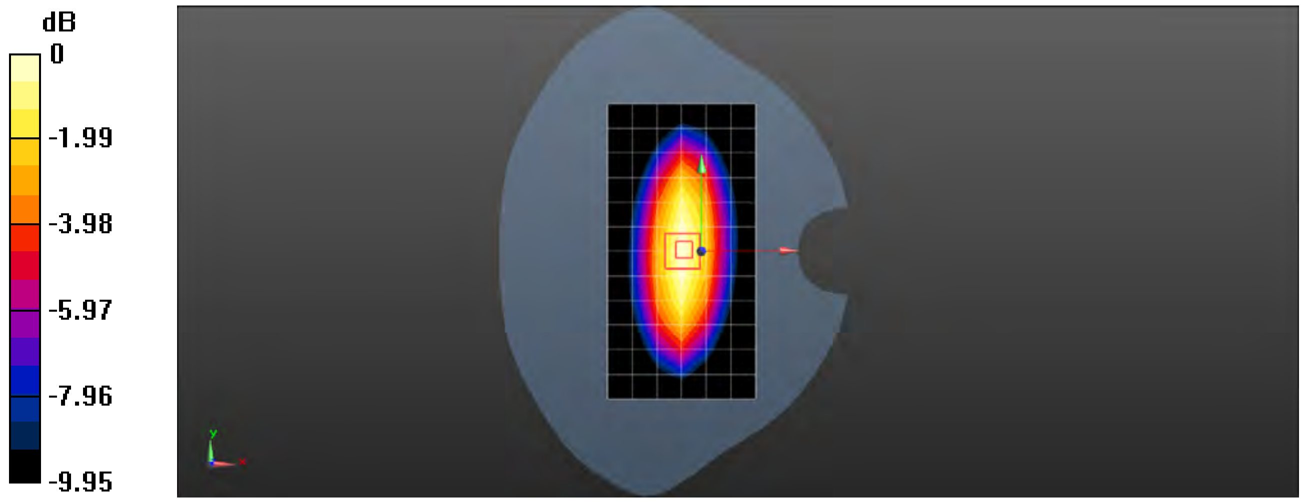
Medium: MSL750;Medium parameters used: f = 750 MHz; σ = 0.956 S/m; ε_r = 56.279; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(10.69, 10.69, 10.69); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=15mm, Pin=250mW/Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 2.66 W/kg

Body/d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 47.02 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 3.14 W/kg
SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.41 W/kg
Maximum value of SAR (measured) = 2.66 W/kg



0 dB = 2.66 W/kg = 4.25 dBW/kg

Date: 2018/10/31

Test Laboratory: SGS-SAR Lab

System Performance Check 1750 MHz Head

DUT: D1750V2; Type: D1750V2; Serial: 1149

Communication System: UID 0, CW (0); Frequency: 1750 MHz;Duty Cycle: 1:1

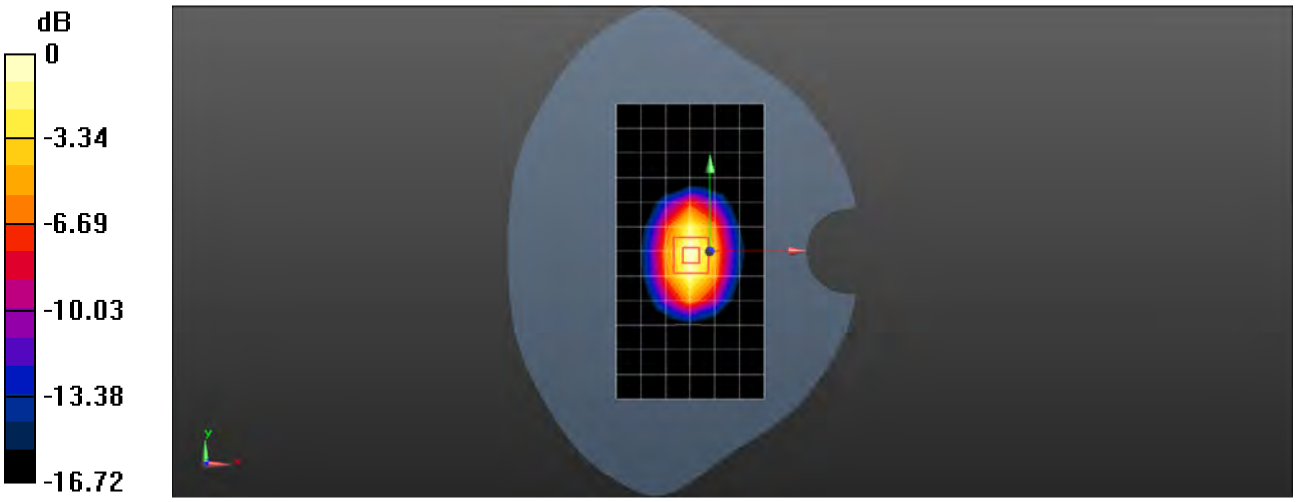
Medium: HSL1750;Medium parameters used: f = 1750 MHz; σ = 1.336 S/m; ε_r = 40.679; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.8, 8.8, 8.8); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (7x13x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 9.90 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 77.71 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 8.88 W/kg; SAR(10 g) = 4.76 W/kg
Maximum value of SAR (measured) = 9.94 W/kg



0 dB = 9.94 W/kg = 9.97 dBW/kg

Date: 2018/10/31

Test Laboratory: SGS-SAR Lab

System Performance Check 1750 MHz Body

DUT: D1750V2; Type: D1750V2; Serial: 1149

Communication System: UID 0, CW (0); Frequency: 1750 MHz;Duty Cycle: 1:1

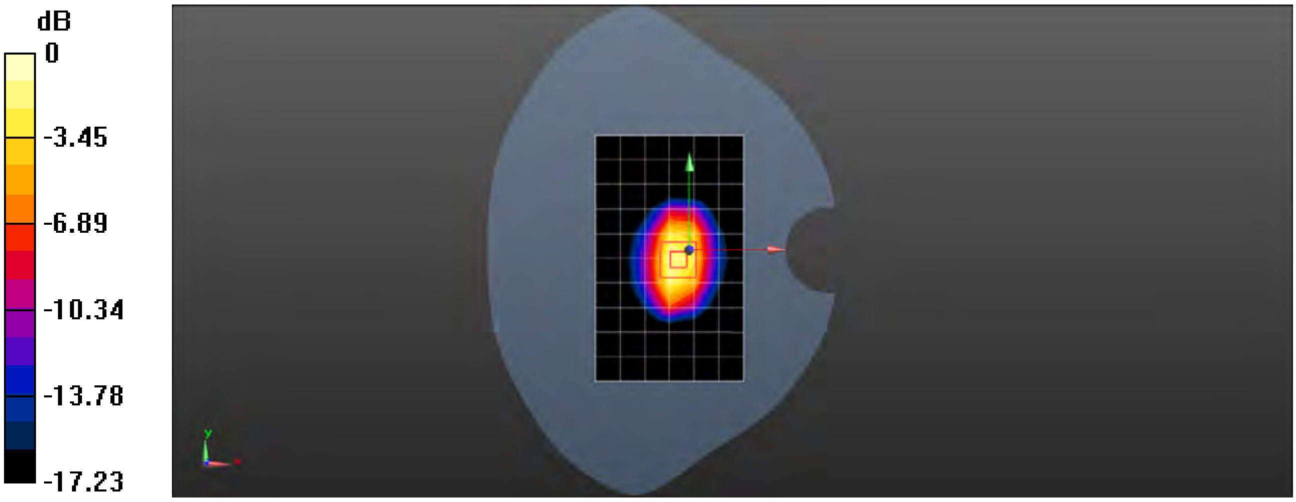
Medium: MSL1750;Medium parameters used: f = 1750 MHz; σ = 1.481 S/m; ε_r = 53.203; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.48, 8.48, 8.48); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 10.6 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 58.01 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 16.8 W/kg
SAR(1 g) = 9.41 W/kg; SAR(10 g) = 4.97 W/kg
Maximum value of SAR (measured) = 13.2 W/kg



0 dB = 13.2 W/kg = 11.21 dBW/kg

Date: 2018/10/29

Test Laboratory: SGS-SAR Lab

System Performance Check 1900 MHz Head

DUT: D1900V2; Type: D1900V2; Serial: 5d028

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

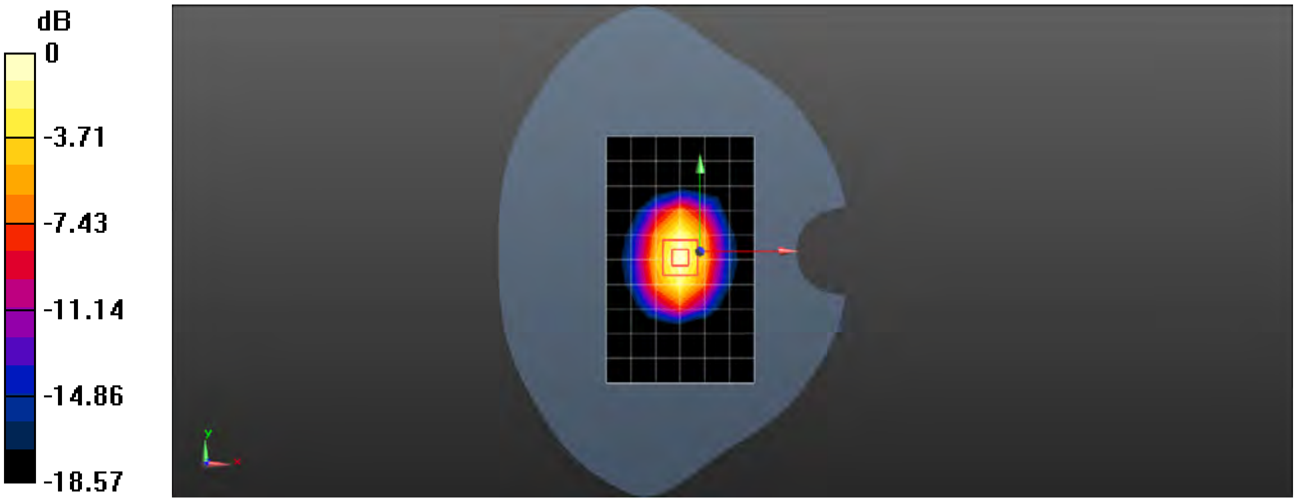
Medium: HSL1900;Medium parameters used: f = 1900 MHz; σ = 1.389 S/m; ε_r = 40.284; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.5, 8.5, 8.5); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.5 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 84.30 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 19.6 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.34 W/kg
Maximum value of SAR (measured) = 11.5 W/kg



0 dB = 11.5 W/kg = 10.61 dBW/kg

Date: 2018/10/29

Test Laboratory: SGS-SAR Lab

System Performance Check 1900 MHz Body

DUT: D1900V2; Type: D1900V2; Serial: 5d028

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

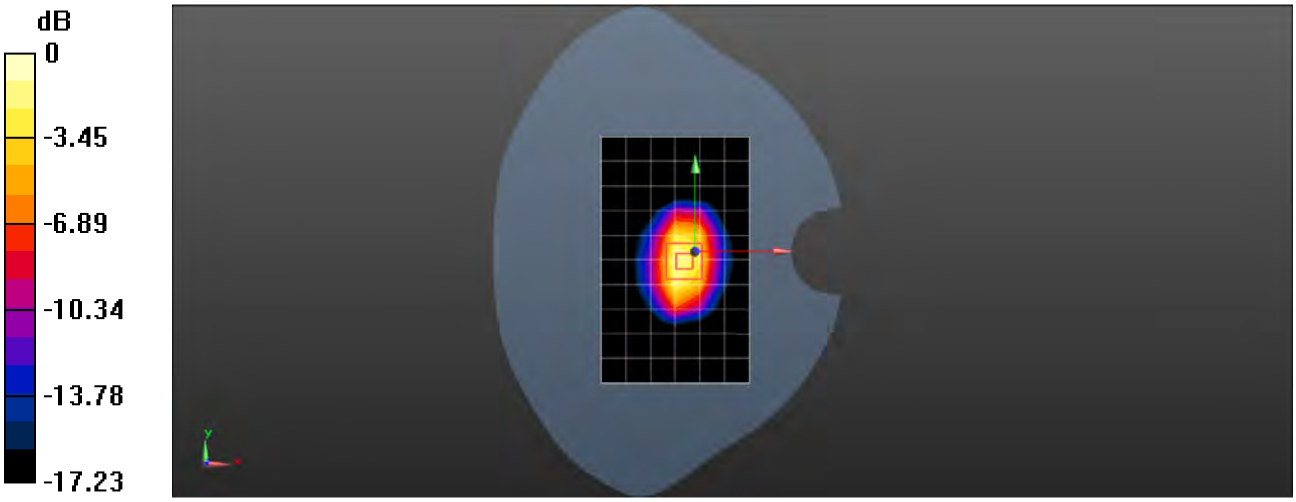
Medium: MSL1900;Medium parameters used: f = 1900 MHz; σ = 1.524 S/m; ε_r = 53.025; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.13, 8.13, 8.13); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 11.7 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 60.16 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 18.5 W/kg
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.49 W/kg
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.6 W/kg = 11.64 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

System Performance Check 2450MHz Head

DUT: D2450V2; Type: D2450V2; Serial: 733

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

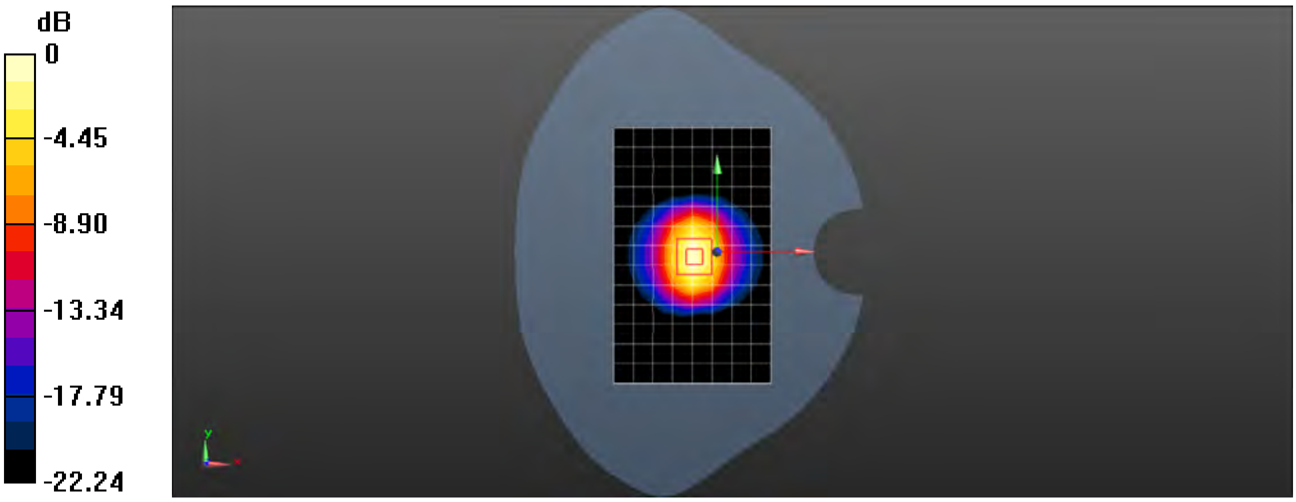
Medium: HSL2450;Medium parameters used: f = 2450 MHz; σ = 1.819 S/m; ε_r = 39.924; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(7.94, 7.94, 7.94); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (9x14x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 13.9 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.68 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.15 W/kg
Maximum value of SAR (measured) = 15.2 W/kg



0 dB = 15.2 W/kg = 11.82 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

System Performance Check 2450MHz Body

DUT: D2450V2; Type: D2450V2; Serial: 733

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

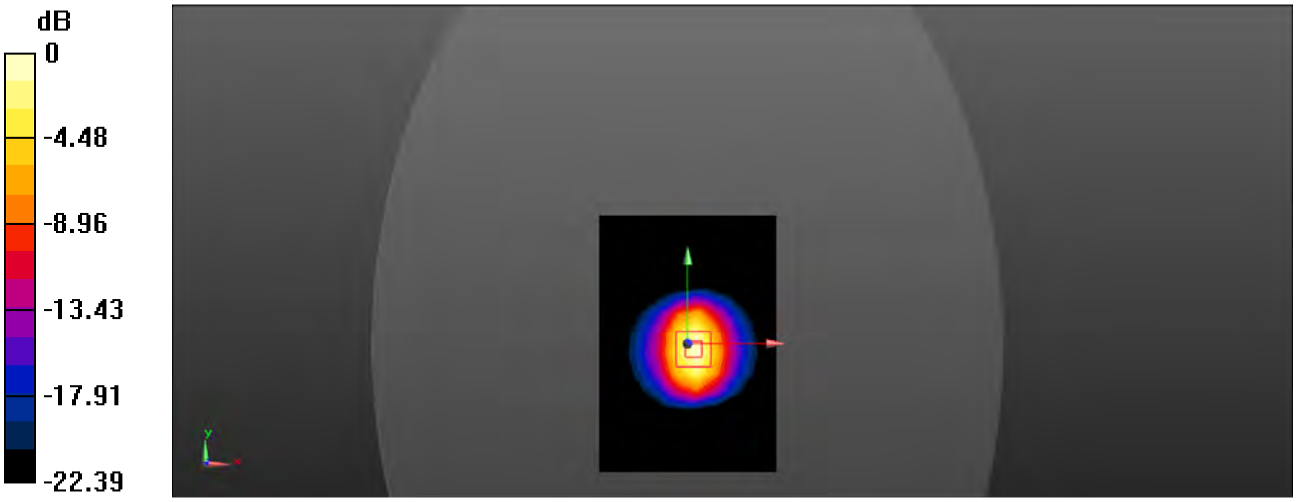
Medium: MSL2450;Medium parameters used: f = 2450 MHz; σ = 1.969 S/m; ε_r = 52.667; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(7.82, 7.82, 7.82); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI5; Type: ELI5; Serial: 1143
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=250mW/Area Scan (10x14x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 14.1 W/kg

Body/d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 80.45 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 12.7 W/kg; SAR(10 g) = 5.86 W/kg
Maximum value of SAR (measured) = 14.6 W/kg



0 dB = 14.6 W/kg = 11.64 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.25GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1

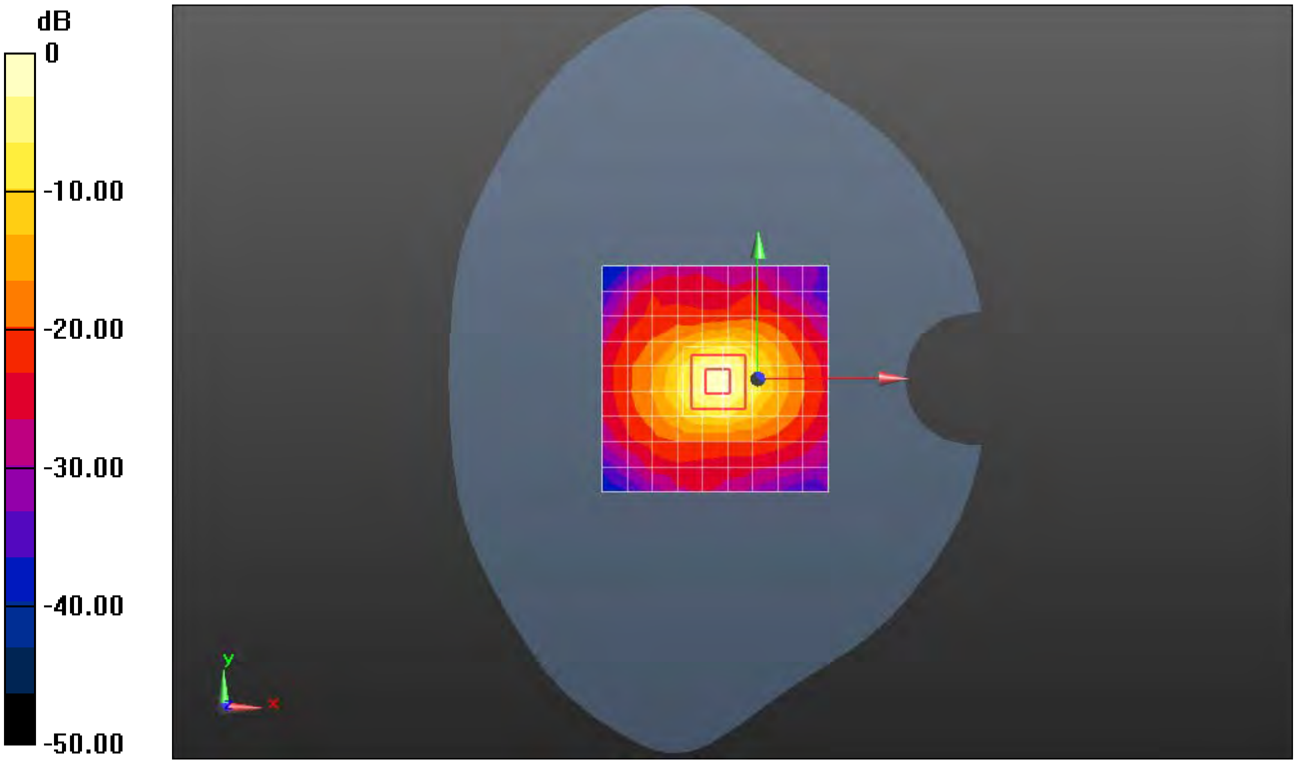
Medium: HSL5GHz;Medium parameters used: f = 5250 MHz; σ = 4.767 S/m; ε_r = 36.011; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(5.68, 5.68, 5.68); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: SAM 2; Type: SAM V4.0; Serial: 1640
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 12.2 W/kg

Body/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.27 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 30.1 W/kg
SAR(1 g) = 7.1 W/kg; SAR(10 g) = 2.02 W/kg
Maximum value of SAR (measured) = 16.7 W/kg



0 dB = 16.7 W/kg = 12.23 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.25GHz Body

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1

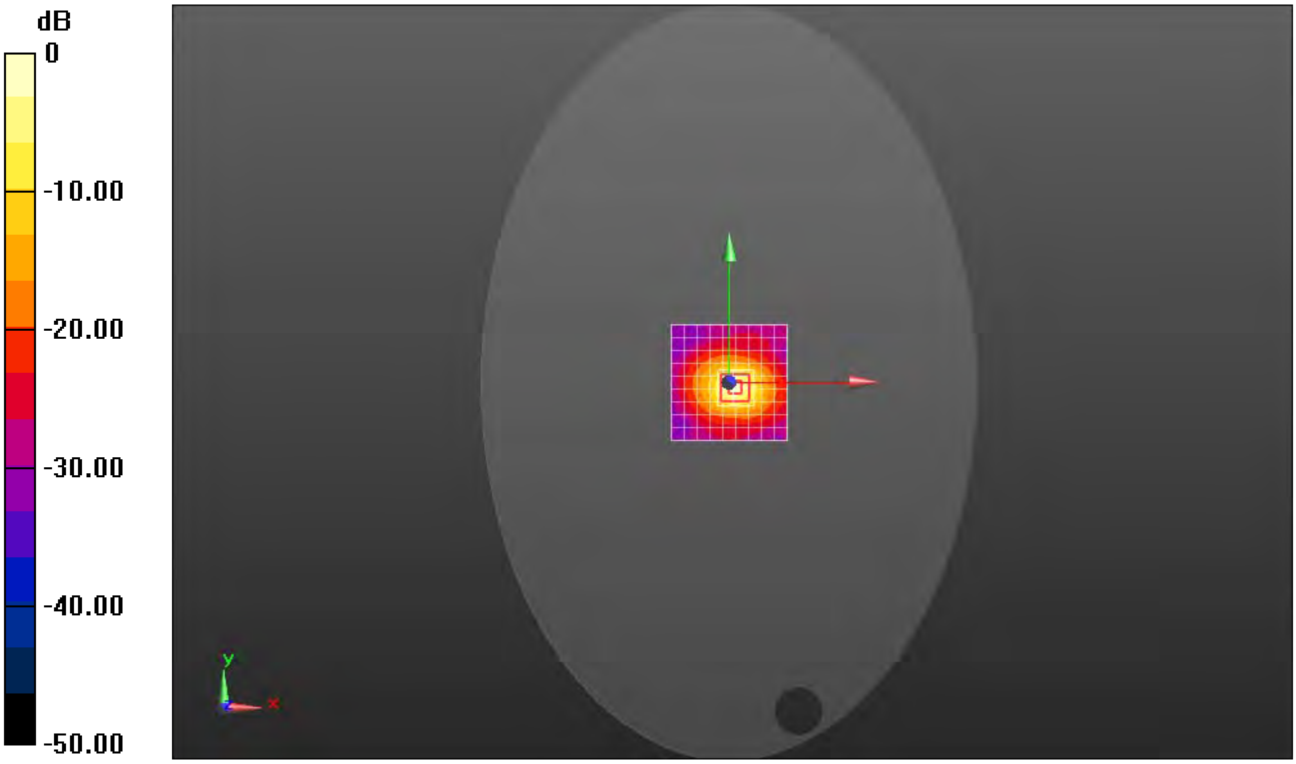
Medium: MSL5G;Medium parameters used: f = 5250 MHz; σ = 5.382 S/m; ε_r = 48.368; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(5.22, 5.22, 5.22); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI V5.0; Type: ELI; Serial: 1123
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5250 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 20.3 W/kg

Body/d=10mm, Pin=100mW, f=5250 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 51.93 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 34.2 W/kg
SAR(1 g) = 7.57 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 18.7 W/kg



0 dB = 18.7 W/kg = 12.71 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.6GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1

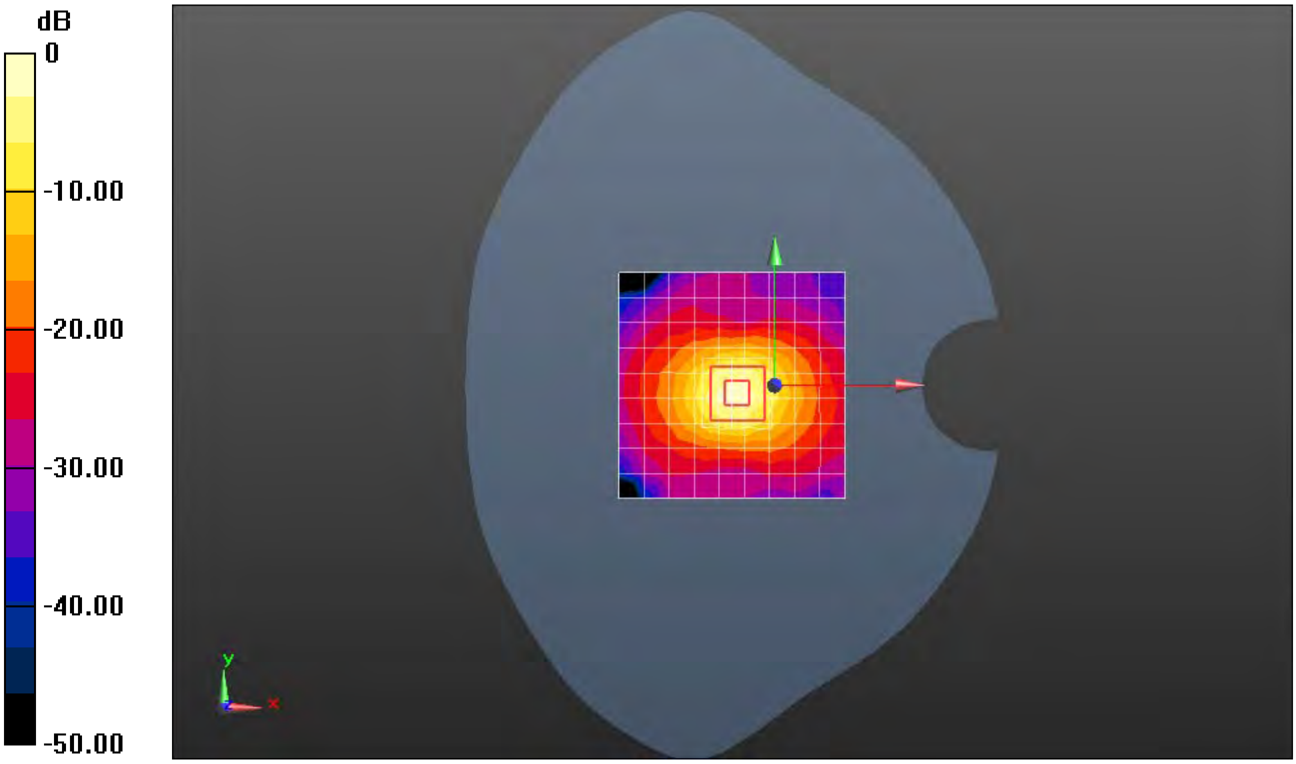
Medium: HSL5GHz;Medium parameters used: f = 5600 MHz; σ = 5.157 S/m; ε_r = 35.059; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(4.89, 4.89, 4.89); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: SAM 2; Type: SAM V4.0; Serial: 1640
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 17.0 W/kg

Body/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.97 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 36.3 W/kg
SAR(1 g) = 7.92 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.9 W/kg



0 dB = 19.9 W/kg = 12.99 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.6GHz Body

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1

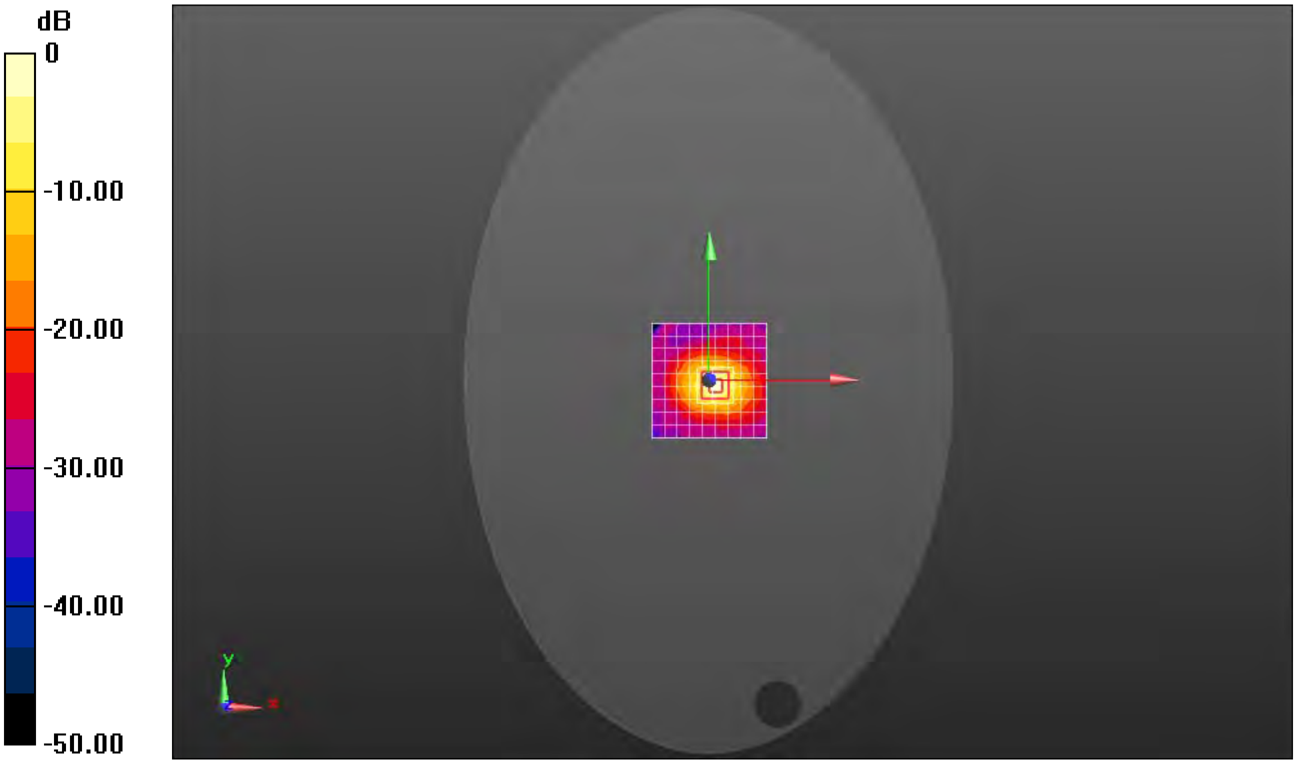
Medium: MSL5G;Medium parameters used: f = 5600 MHz; σ = 5.803 S/m; ε_r = 47.435; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(4.45, 4.45, 4.45); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI V5.0; Type: ELI; Serial: 1123
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5600 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 21.9 W/kg

Body/d=10mm, Pin=100mW, f=5600 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 52.72 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 37.8 W/kg
SAR(1 g) = 8 W/kg; SAR(10 g) = 2.21 W/kg
Maximum value of SAR (measured) = 20.1 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.75GHz Head

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1

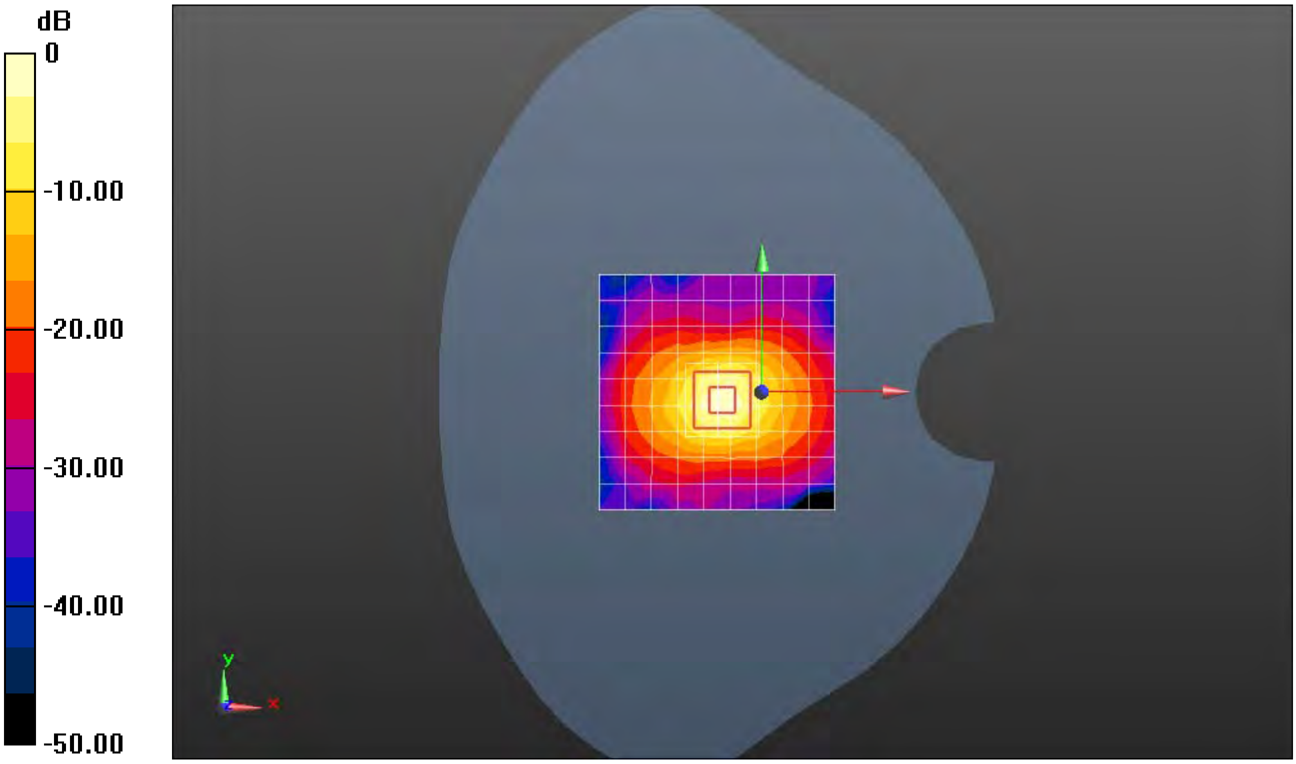
Medium: HSL5GHz;Medium parameters used: f = 5750 MHz; σ = 5.329 S/m; ε_r = 34.695; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(5.05, 5.05, 5.05); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: SAM 2; Type: SAM V4.0; Serial: 1640
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 18.6 W/kg

Body/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.50 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 37.6 W/kg
SAR(1 g) = 8.14 W/kg; SAR(10 g) = 2.32 W/kg
Maximum value of SAR (measured) = 20.0 W/kg



0 dB = 20.0 W/kg = 13.01 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

System Performance Check 5.75GHz Body

DUT: D5GHzV2; Type: D5GHzV2; Serial: 1165

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1

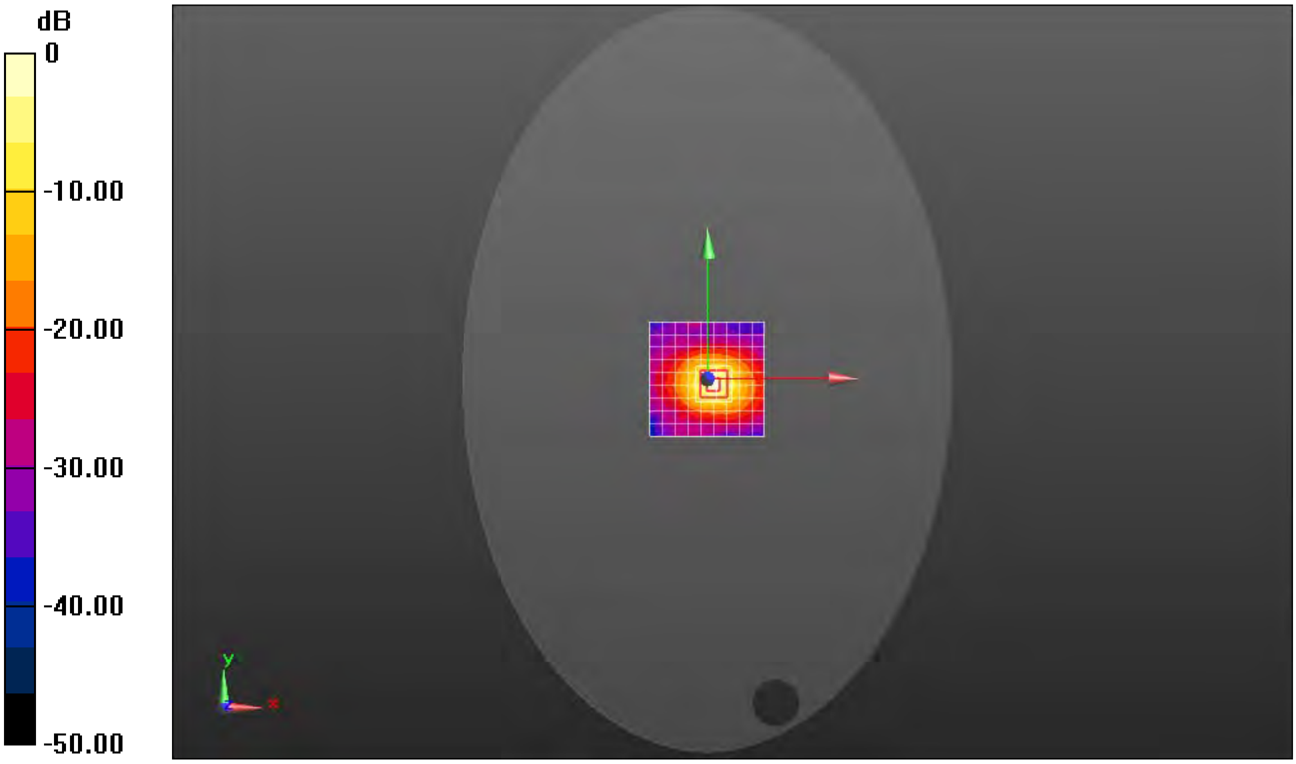
Medium: MSL5G;Medium parameters used: f = 5750 MHz; σ = 5.969 S/m; ε_r = 47.096; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(4.59, 4.59, 4.59); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = 1.0, 25.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI V5.0; Type: ELI; Serial: 1123
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Body/d=10mm, Pin=100mW, f=5750 MHz/Area Scan (10x10x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 21.0 W/kg

Body/d=10mm, Pin=100mW, f=5750 MHz/Zoom Scan (4x4x1.4mm, graded), dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 51.21 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 38.6 W/kg
SAR(1 g) = 7.65 W/kg; SAR(10 g) = 2.11 W/kg
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg = 12.88 dBW/kg

Appendix B

Detailed Test Results

1. LTE
LTE Band 2
LTE Band 4
LTE Band 12
2. WIFI
WIFI 2.4GHz
WIFI 5GHz

Date: 2018/10/29

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 2 20M Bandwidth QPSK 1RB0 18900CH Front side with mouth 25mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1880 MHz;Duty Cycle: 1:1

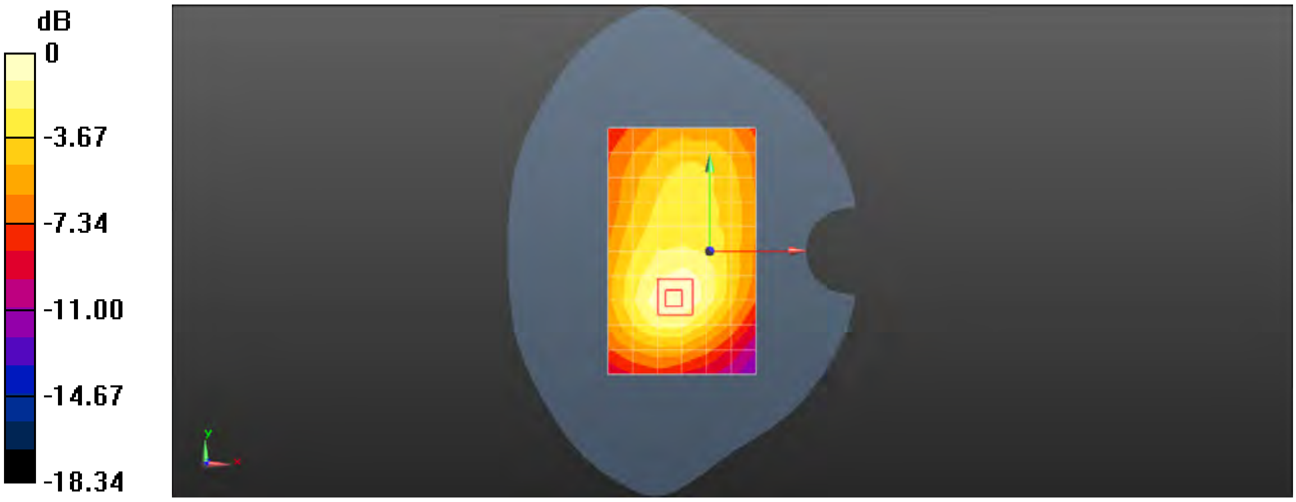
Medium: HSL1900;Medium parameters used: f = 1880 MHz; σ = 1.368 S/m; ε_r = 40.278; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.5, 8.5, 8.5); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0944 W/kg

Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.023 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.117 W/kg
SAR(1 g) = 0.068 W/kg; SAR(10 g) = 0.040 W/kg
Maximum value of SAR (measured) = 0.0933 W/kg



0 dB = 0.0933 W/kg = -10.30 dBW/kg

Date: 2018/10/29

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 2 20M Bandwidth QPSK 1RB0 18900CH Front side 10mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: MSL1900;Medium parameters used: f = 1880 MHz; σ = 1.522 S/m; ε_r = 53.099; ρ = 1000 kg/m^3

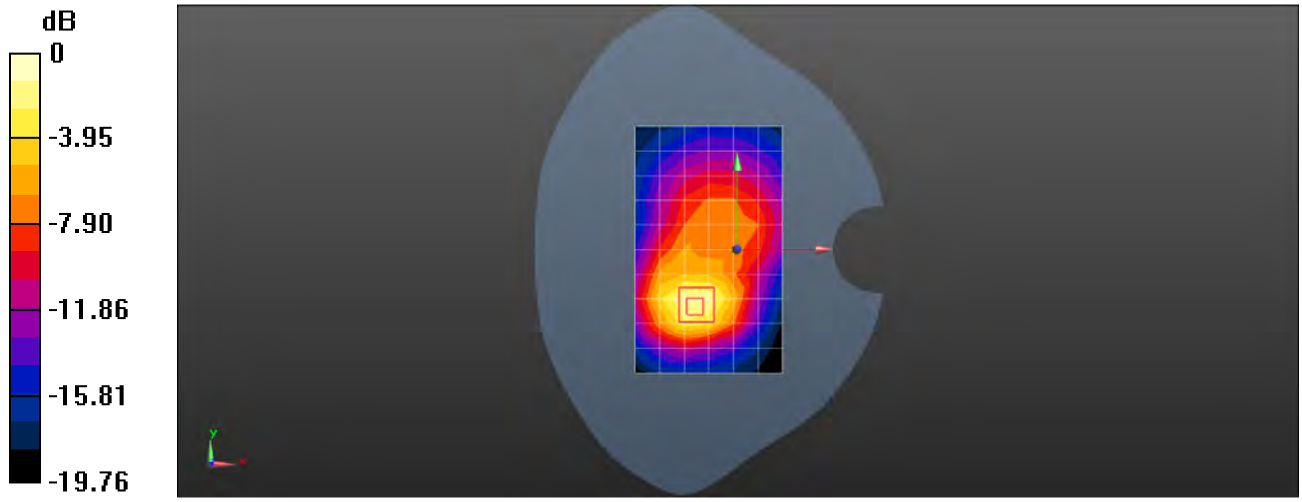
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.13, 8.13, 8.13); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.626 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 9.419 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.560 W/kg; SAR(10 g) = 0.289 W/kg
Maximum value of SAR (measured) = 0.793 W/kg



0 dB = 0.793 W/kg = -1.01 dBW/kg

Date: 2018/10/29

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 2 20M Bandwidth QPSK 1RB0 18900CH Back side 0mm with Back Splint

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1880 MHz;Duty Cycle: 1:1

Medium: MSL1900;Medium parameters used: f = 1880 MHz; σ = 1.522 S/m; ε_r = 53.099; ρ = 1000 kg/m^3

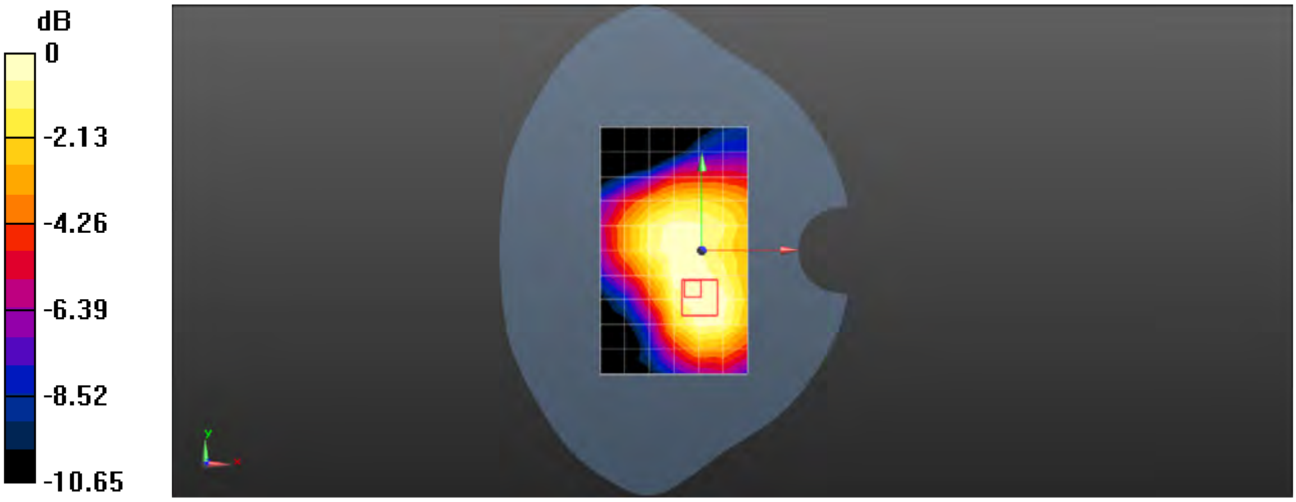
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.13, 8.13, 8.13); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0849 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.733 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.100 W/kg
SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.038 W/kg
Maximum value of SAR (measured) = 0.0808 W/kg



0 dB = 0.0808 W/kg = -10.93 dBW/kg

Date: 2018/10/31

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 4 20M Bandwidth QPSK 1RB0 20175CH Front side with mouth 25mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1

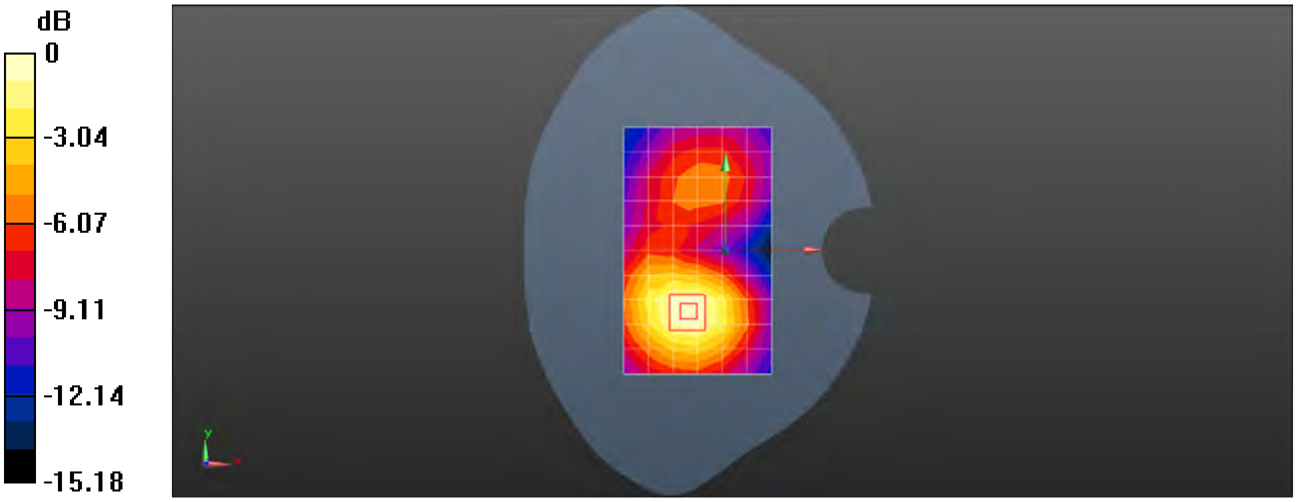
Medium: HSL1750;Medium parameters used: f = 1732.5 MHz; σ = 1.322 S/m; ε_r = 40.586; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.8, 8.8, 8.8); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.156 W/kg

Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 4.306 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 0.209 W/kg
SAR(1 g) = 0.133 W/kg; SAR(10 g) = 0.081 W/kg
Maximum value of SAR (measured) = 0.174 W/kg



0 dB = 0.174 W/kg = -7.59 dBW/kg

Date: 2018/10/31

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 4 20M Bandwidth QPSK 1RB0 20175CH Front side 10mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1

Medium: MSL1750;Medium parameters used: f = 1732.5 MHz; σ = 1.466 S/m; ε_r = 53.297; ρ = 1000 kg/m^3

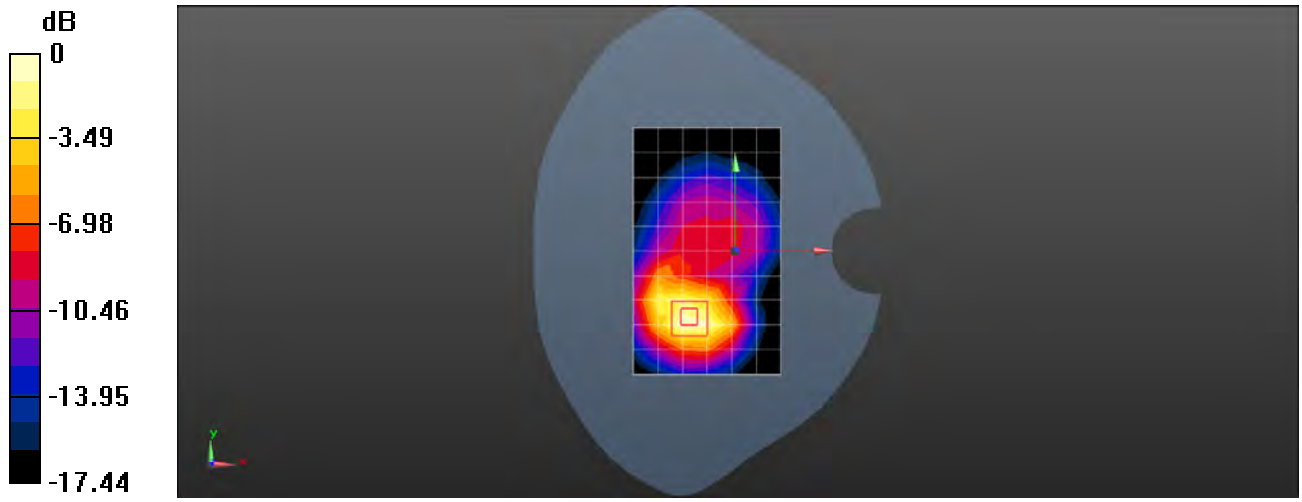
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.48, 8.48, 8.48); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.783 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.217 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 1.01 W/kg
SAR(1 g) = 0.590 W/kg; SAR(10 g) = 0.319 W/kg
Maximum value of SAR (measured) = 0.803 W/kg



0 dB = 0.803 W/kg = -0.95 dBW/kg

Date: 2018/10/31

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 4 20M Bandwidth QPSK 1RB99 20175CH Back side 0mm with Back Splint

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 20MHz (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1

Medium: MSL1750;Medium parameters used: f = 1732.5 MHz; σ = 1.466 S/m; ε_r = 53.297; ρ = 1000 kg/m^3

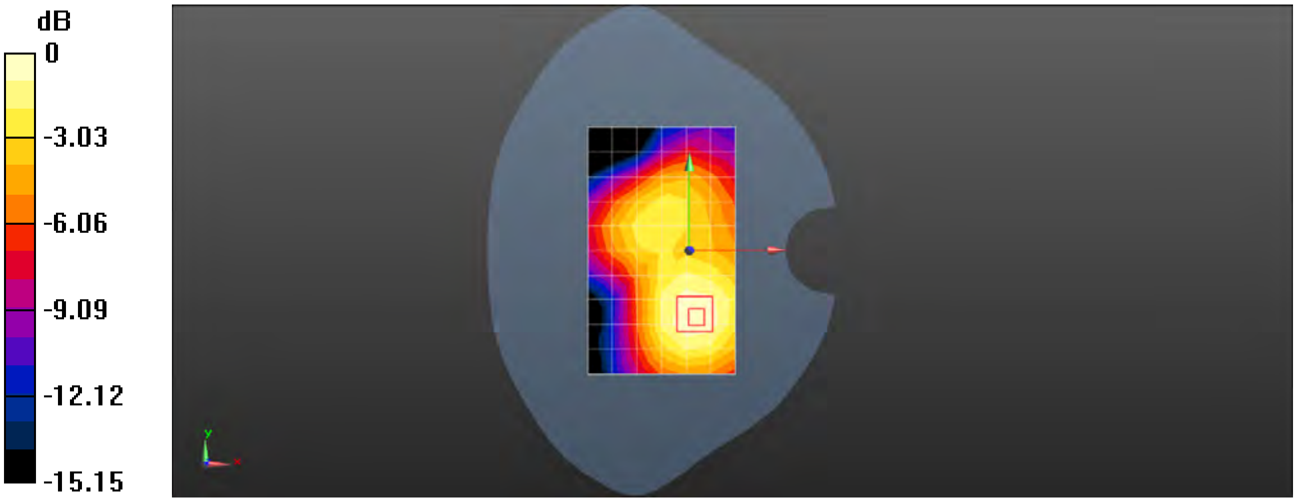
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(8.48, 8.48, 8.48); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.111 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 5.957 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 0.138 W/kg
SAR(1 g) = 0.087 W/kg; SAR(10 g) = 0.055 W/kg
Maximum value of SAR (measured) = 0.114 W/kg



0 dB = 0.114 W/kg = -9.43 dBW/kg

Date: 2018/10/30

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 12 10M Bandwidth QPSK 25RB0 23130CH Front side with mouth 25mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 10MHZ (0); Frequency: 707.5 MHz;Duty Cycle: 1:1

Medium: HSL750;Medium parameters used: f = 707.5 MHz; σ = 0.852 S/m; ε_r = 43.367; ρ = 1000 kg/m^3

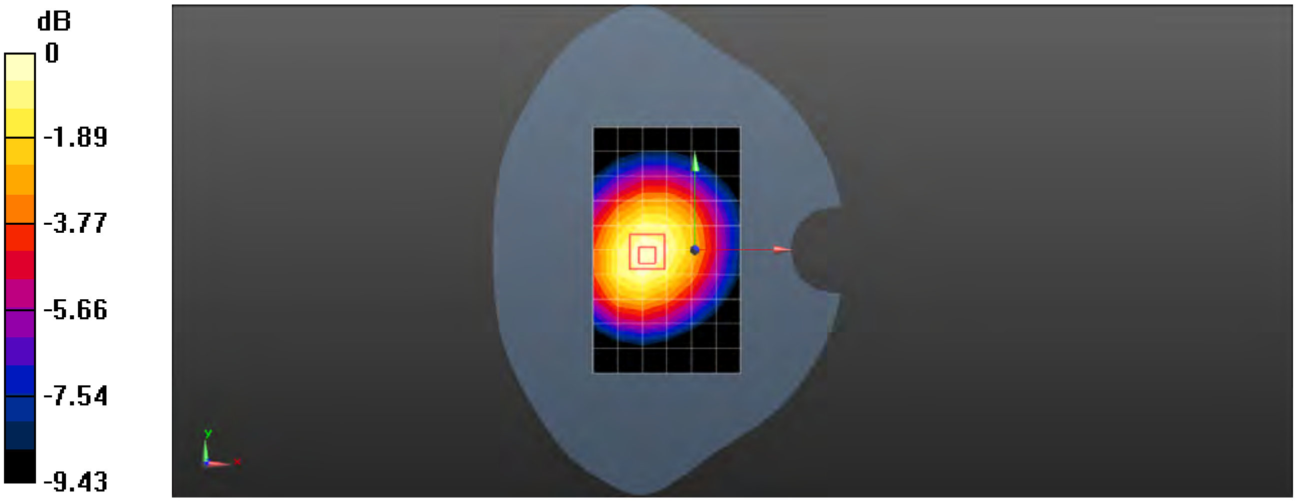
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(10.67, 10.67, 10.67); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin Phantom; Type: SAM1; Serial: 1824
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.118 W/kg

Configuration/Head/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 10.64 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 0.138 W/kg
SAR(1 g) = 0.099 W/kg; SAR(10 g) = 0.071 W/kg
Maximum value of SAR (measured) = 0.121 W/kg



0 dB = 0.121 W/kg = -9.17 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 12 10M Bandwidth QPSK 1RB49 23130CH Front side 10mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 10MHZ (0); Frequency: 711 MHz;Duty Cycle: 1:1

Medium: MSL750;Medium parameters used: f = 711 MHz; $\sigma = 0.939$ S/m; $\varepsilon_r = 56.771$; $\rho = 1000$ kg/m^3

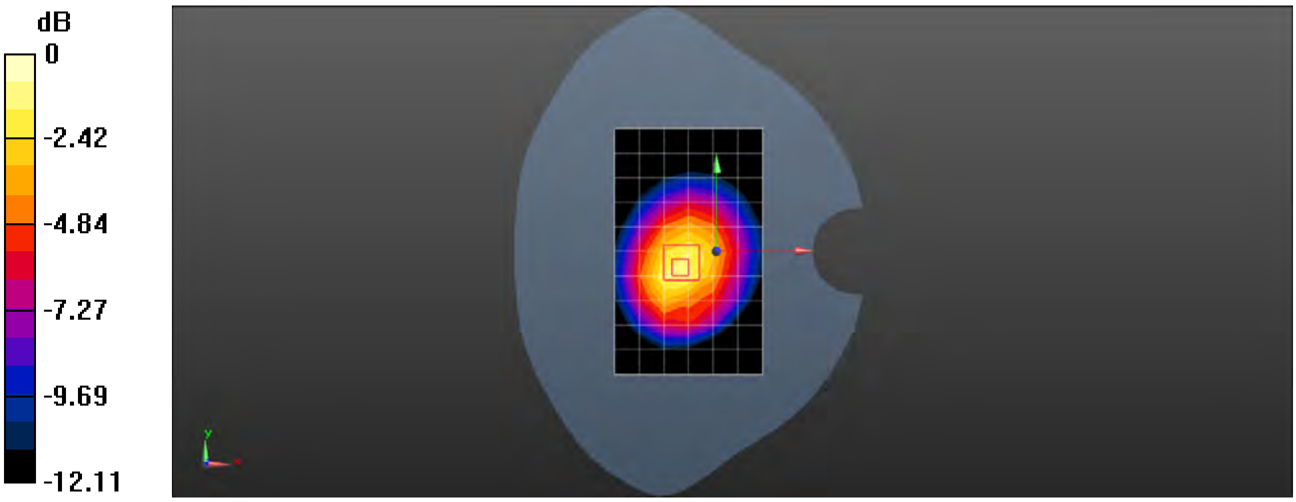
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(10.69, 10.69, 10.69); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.255 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 15.36 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 0.411 W/kg
SAR(1 g) = 0.275 W/kg; SAR(10 g) = 0.183 W/kg
Maximum value of SAR (measured) = 0.347 W/kg



0 dB = 0.347 W/kg = -4.60 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

ROS-001-TM LTE Band 12 10M Bandwidth QPSK 1RB49 23130CH Back side 0mm with Back Splint

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, LTE-FDD BW 10MHZ (0); Frequency: 711 MHz;Duty Cycle: 1:1

Medium: MSL750;Medium parameters used: f = 711 MHz; σ = 0.939 S/m; ε_r = 56.771; ρ = 1000 kg/m^3

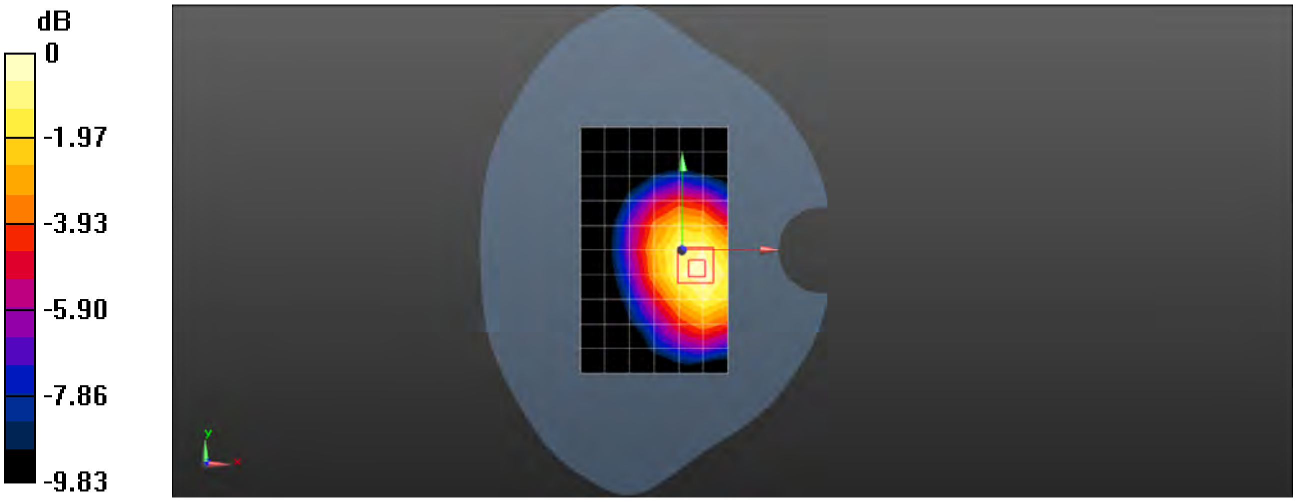
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(10.69, 10.69, 10.69); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (7x11x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (measured) = 0.0928 W/kg

Configuration/Body/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.068 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 0.107 W/kg
SAR(1 g) = 0.077 W/kg; SAR(10 g) = 0.055 W/kg
Maximum value of SAR (measured) = 0.0931 W/kg



0 dB = 0.0931 W/kg = -10.31 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

ROS-001-TM Wifi2.4GHz 802.11b 11CH Front side with mouth 25mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2462 MHz;Duty Cycle: 1:1

Medium: HSL2450;Medium parameters used: f = 2462 MHz; σ = 1.836 S/m; ε_r = 39.903; ρ = 1000 kg/m^3

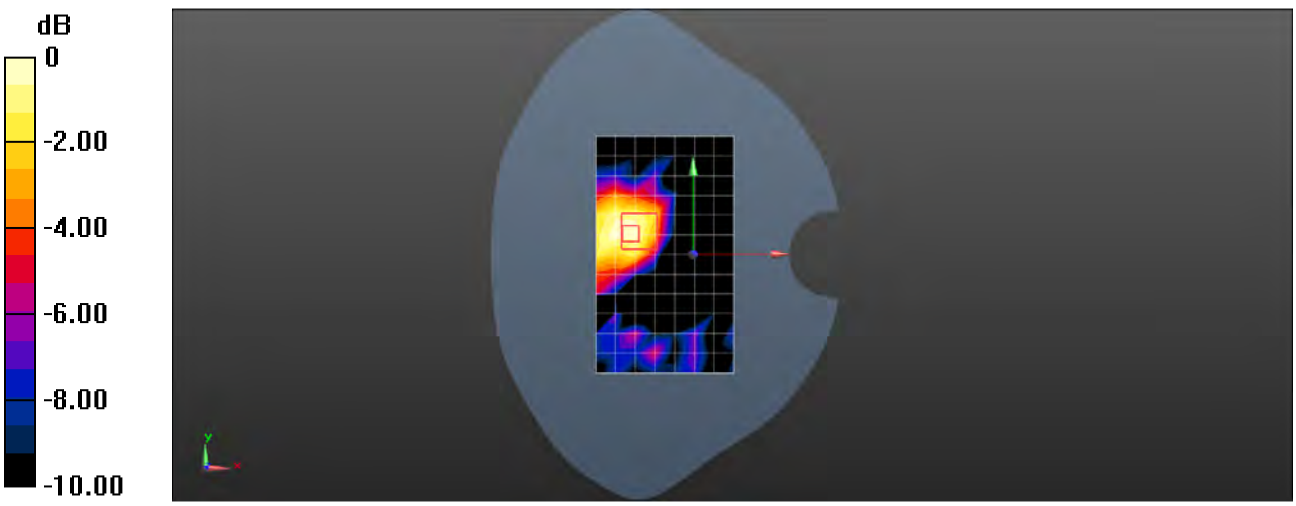
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(7.94, 7.94, 7.94); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: Twin phantom; Type: SAM1; Serial: 1141
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (8x13x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.00981 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.6520 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.0150 W/kg
SAR(1 g) = 0.00636 W/kg; SAR(10 g) = 0.00253 W/kg
Maximum value of SAR (measured) = 0.0102 W/kg



0 dB = 0.0102 W/kg = -19.91 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

ROS-001-TM Wifi2.4GHz 802.11b 11CH Back side 10mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2462 MHz;Duty Cycle: 1:1

Medium: MSL2450;Medium parameters used: f = 2462 MHz; σ = 1.986 S/m; ε_r = 52.649; ρ = 1000 kg/m^3

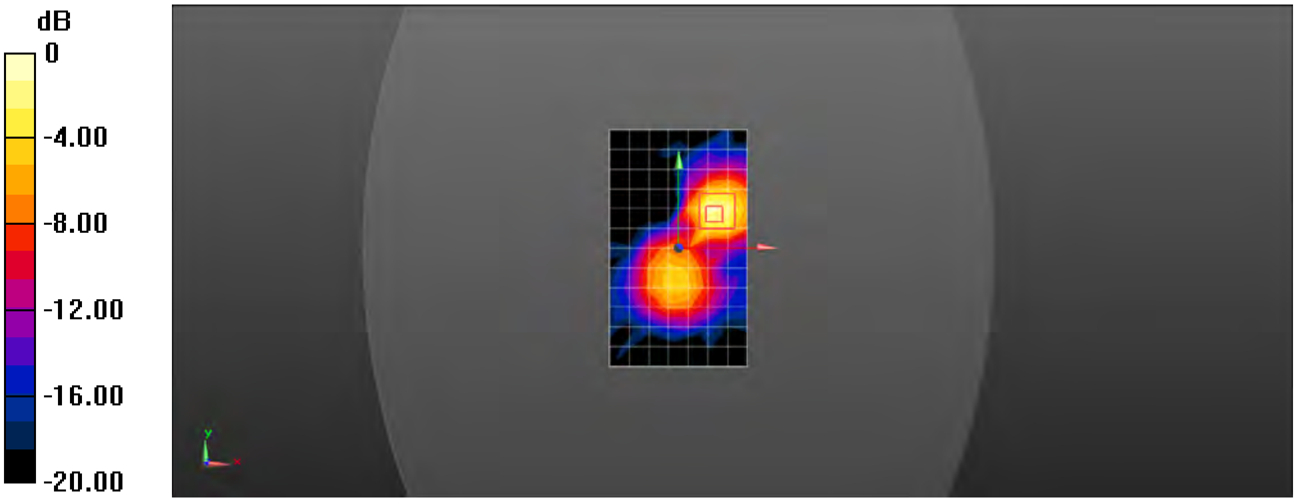
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(7.82, 7.82, 7.82); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI5; Type: ELI5; Serial: 1143
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (8x13x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.240 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.672 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.364 W/kg
SAR(1 g) = 0.185 W/kg; SAR(10 g) = 0.086 W/kg
Maximum value of SAR (measured) = 0.280 W/kg



0 dB = 0.280 W/kg = -5.53 dBW/kg

Date: 2018/11/2

Test Laboratory: SGS-SAR Lab

ROS-001-TM Wifi2.4GHz 802.11b 11CH Back side 0mm with Back Splint

DUT: ROS-001-TM; Type: Orion Sync; Serial: 872HADT4RPLGE

Communication System: UID 0, WI-FI(2.4GHz) (0); Frequency: 2462 MHz;Duty Cycle: 1:1

Medium: MSL2450;Medium parameters used: f = 2462 MHz; σ = 1.986 S/m; ε_r = 52.649; ρ = 1000 kg/m^3

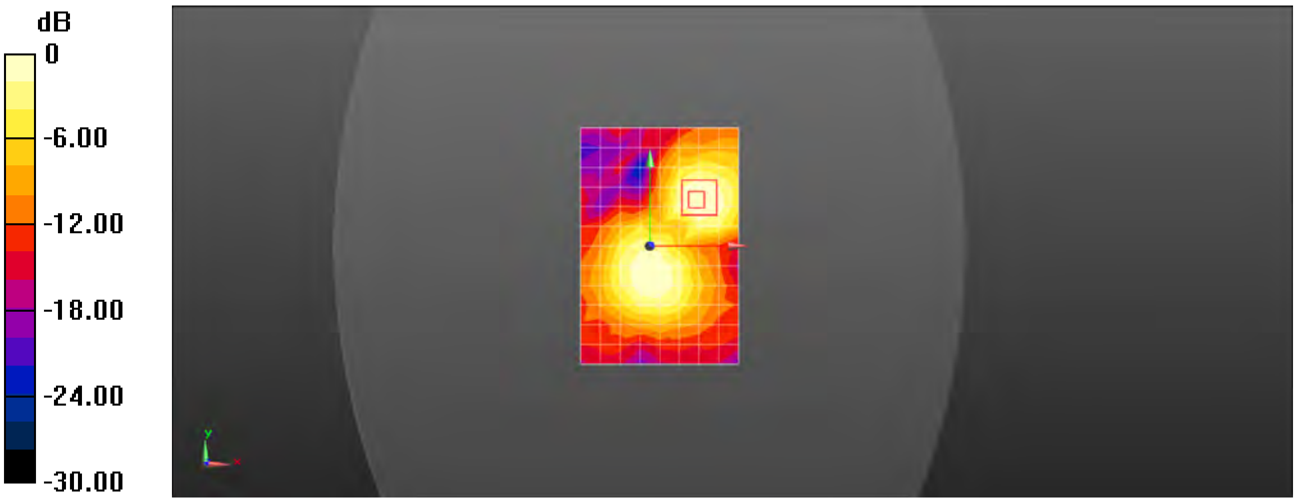
Phantom section: Flat Section

DASY 5 Configuration:

- Probe: EX3DV4 - SN3982; ConvF(7.82, 7.82, 7.82); Calibrated: 2018/4/10;
- Sensor-Surface: 2mm (Mechanical Surface Detection), z = -2.0, 31.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI5; Type: ELI5; Serial: 1143
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (9x13x1): Measurement grid: dx=12mm, dy=12mm
Maximum value of SAR (measured) = 0.100 W/kg

Configuration/Body/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 4.991 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.0990 W/kg
SAR(1 g) = 0.054 W/kg; SAR(10 g) = 0.028 W/kg
Maximum value of SAR (measured) = 0.0764 W/kg



0 dB = 0.0764 W/kg = -11.17 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

ROS-001-TM WIFI 802.11a 60CH Front side with mouth 25mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: N/A

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5300 MHz;Duty Cycle: 1:1

Medium: HSL5G;Medium parameters used: f = 5300 MHz; σ = 4.811 S/m; ε_r = 36.412; ρ = 1000 kg/m^3

Phantom section: Flat Section

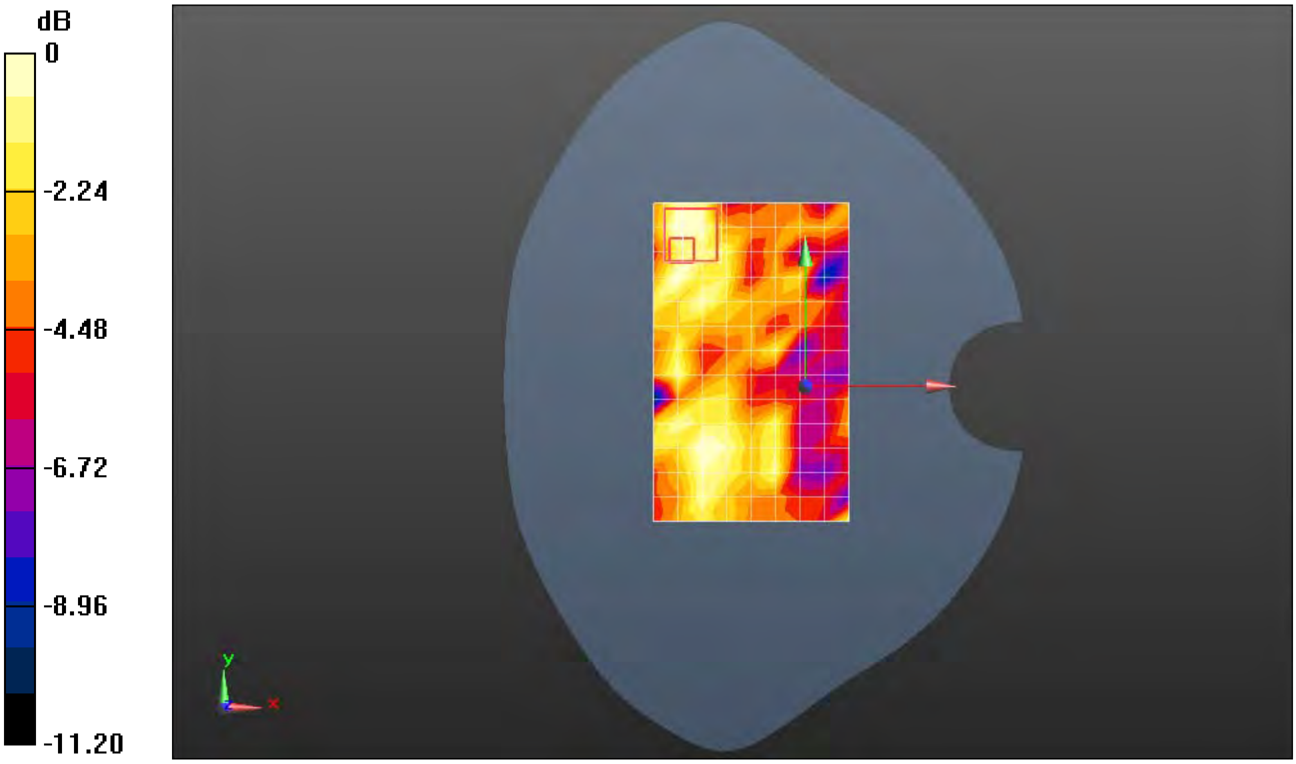
DASY 5 Configuration:

- Probe: EX3DV4 - SN3962; ConvF(5.68, 5.68, 5.68); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -2.0, 23.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: SAM 2; Type: SAM V4.0; Serial: 1640
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Head/Area Scan (9x14x1): Measurement grid: dx=10mm, dy=10mm
Maximum value of SAR (measured) = 0.0505 W/kg

Configuration/Head/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.351 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.0650 W/kg
SAR(1 g) = 0.019 W/kg; SAR(10 g) = 0.014 W/kg

Maximum value of SAR (measured) = 0.0458 W/kg



0 dB = 0.0458 W/kg = -13.39 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

ROS-001-TM WIFI 802.11a 165CH Back side 10mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: N/A

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5825 MHz;Duty Cycle: 1:1

Medium: MSL5G;Medium parameters used: f = 5825 MHz; σ = 6.043 S/m; ε_r = 46.769; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY 5 Configuration:

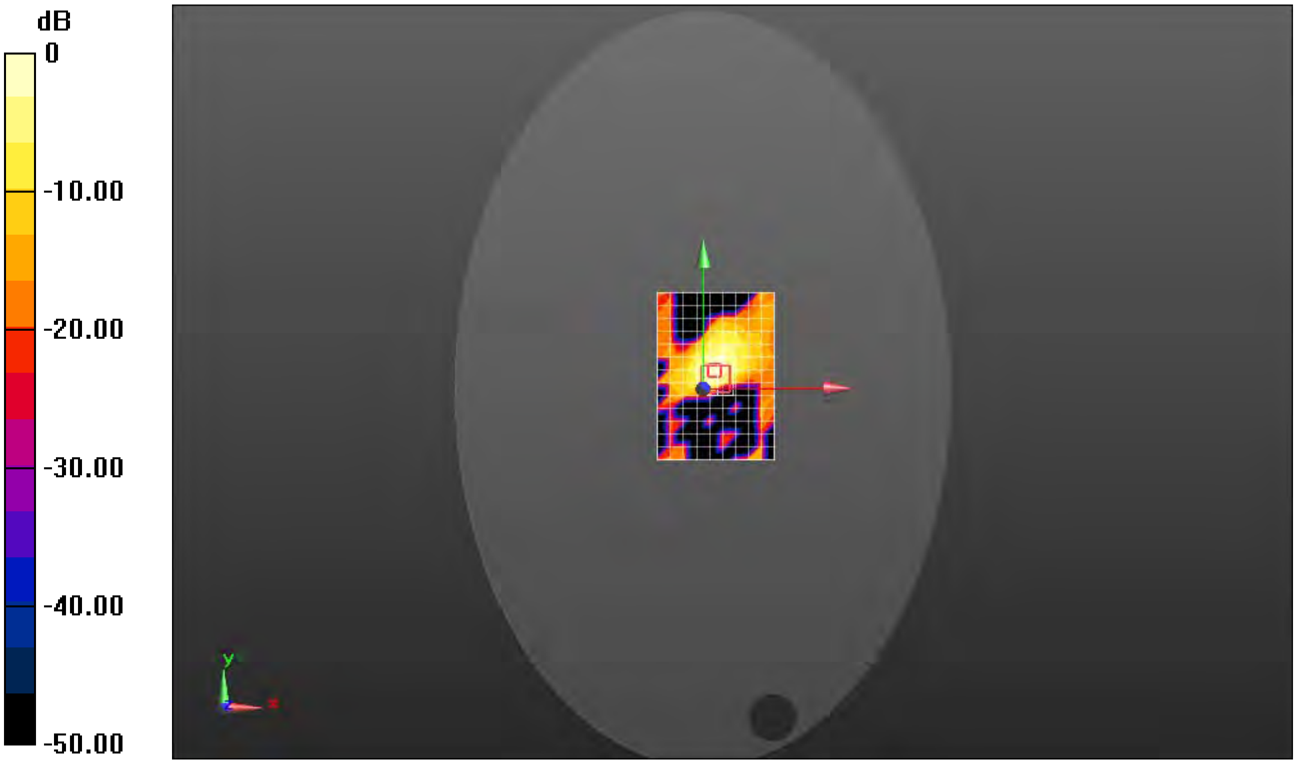
- Probe: EX3DV4 - SN3962; ConvF(4.59, 4.59, 4.59); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -2.0, 23.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI V5.0; Type: ELI; Serial: 1123
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x14x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.456 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.961 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.13 W/kg
SAR(1 g) = 0.185 W/kg; SAR(10 g) = 0.047 W/kg

Maximum value of SAR (measured) = 0.538 W/kg



0 dB = 0.538 W/kg = -2.69 dBW/kg

Date: 2018/11/6

Test Laboratory: SGS-SAR Lab

ROS-001-TM WIFI 802.11a 165CH Back side with Back Splint 0mm

DUT: ROS-001-TM; Type: Orion Sync; Serial: N/A

Communication System: UID 0, WI-FI(5GHz) (0); Frequency: 5825 MHz;Duty Cycle: 1:1

Medium: MSL5G;Medium parameters used: f = 5825 MHz; σ = 6.043 S/m; ε_r = 46.769; ρ = 1000 kg/m^3

Phantom section: Flat Section

DASY 5 Configuration:

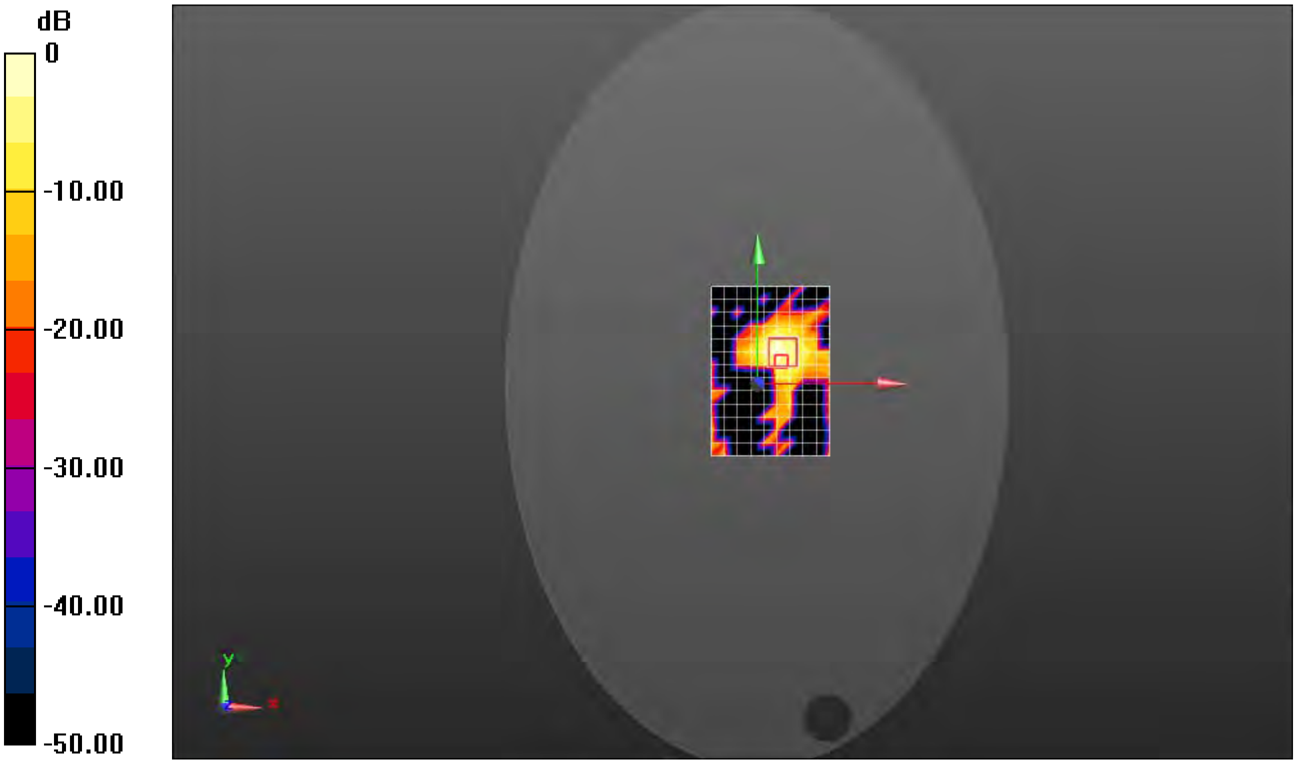
- Probe: EX3DV4 - SN3962; ConvF(4.59, 4.59, 4.59); Calibrated: 2018/1/11;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection), z = -2.0, 23.0
- Electronics: DAE4 Sn1428; Calibrated: 2018/1/17
- Phantom: ELI V5.0; Type: ELI; Serial: 1123
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Body/Area Scan (10x14x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.235 W/kg

Configuration/Body/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 3.492 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.116 W/kg
SAR(1 g) = 0.00349 W/kg; SAR(10 g) = 0.000439 W/kg

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



0 dB = 0.105 W/kg = -9.79 dBW/kg

Appendix C

Calibration certificate

1. Dipole
D750V3 - SN 1160(2016-06-22)
D1750V2 - SN 1149(2016-06-23)
D1900V2 - SN 5d028(2016-12-07)
D2450V2 - SN 733(2016-12-07)
D5GHzV2 - SN 1165(2016-12-13)
2. DAE
DAE4 - SN 1428(2018-01-17)
3. Probe
EX3DV4 - SN 3962(2018-01-11)
EX3DV4 - SN 3982(2018-04-10)

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S **Schweizerischer Kalibrierdienst**
C **Service suisse d'étalonnage**
S **Servizio svizzero di taratura**
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **SGS-SZ (Auden)**

Certificate No: D750V3-1160_Jun16

CALIBRATION CERTIFICATE

Object	D750V3 - SN:1160
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 22, 2016

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
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 27, 2016

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:

a) 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
b) 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 300 MHz to 3 GHz)", February 2005
c) 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
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) 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%.

Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.6 ± 6 %	0.91 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.08 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.17 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.36 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.4 ± 6 %	1.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.21 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.57 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.66 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.8 Ω - 1.6 jΩ
Return Loss	- 26.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω - 3.8 jΩ
Return Loss	- 28.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.040 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	November 19, 2015

DASY5 Validation Report for Head TSL

Date: 22.06.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1160

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.91 S/m; ε_r = 41.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

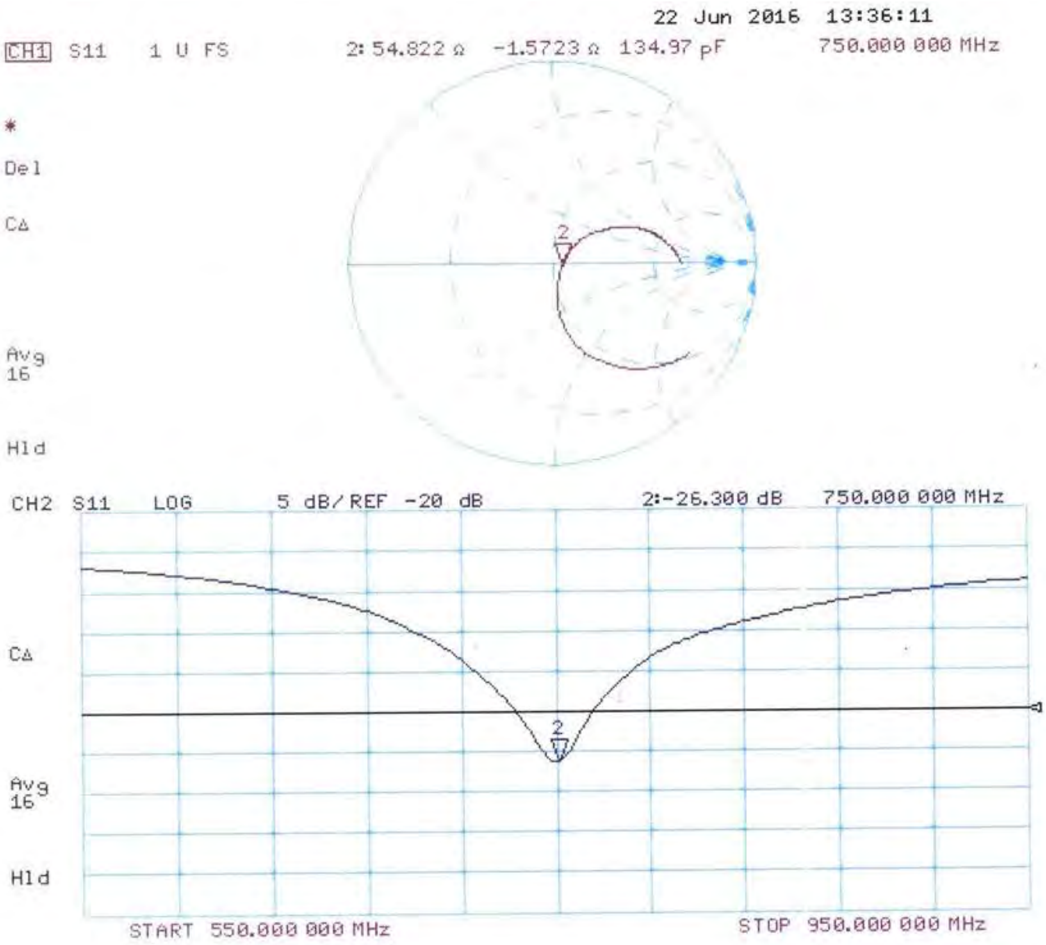
DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(10.17, 10.17, 10.17); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.89 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 3.12 W/kg
SAR(1 g) = 2.08 W/kg; SAR(10 g) = 1.36 W/kg
Maximum value of SAR (measured) = 2.76 W/kg

0 dB = 2.76 W/kg = 4.41 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 22.06.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN:1160

Communication System: UID 0 - CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 1 S/m; ε_r = 55.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

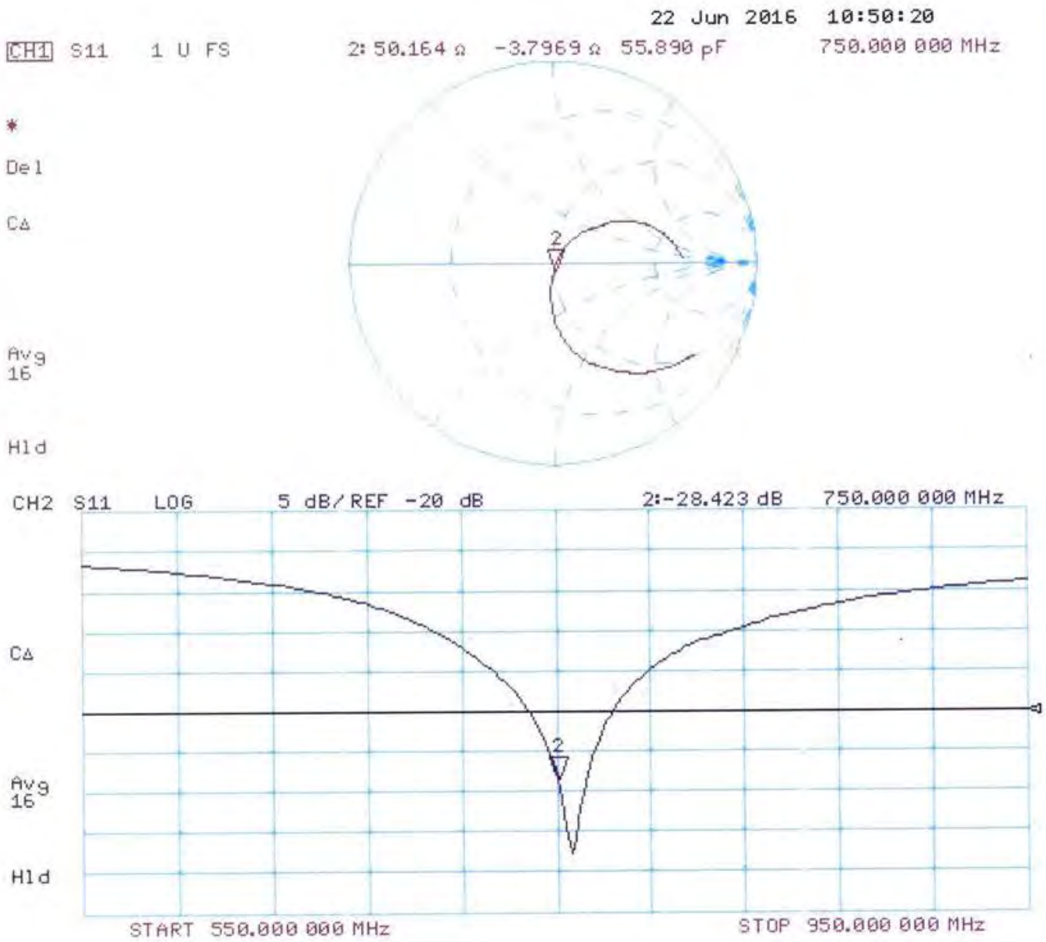
DASY52 Configuration:

- Probe: EX3DV4 - SN7349; ConvF(9.99, 9.99, 9.99); Calibrated: 15.06.2016;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 56.66 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.29 W/kg
SAR(1 g) = 2.21 W/kg; SAR(10 g) = 1.45 W/kg
Maximum value of SAR (measured) = 2.93 W/kg

0 dB = 2.93 W/kg = 4.67 dBW/kg

Impedance Measurement Plot for Body TSL



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Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **SGS-SZ (Auden)**

Certificate No: **D1750V2-1149_Jun16**

CALIBRATION CERTIFICATE

Object	D1750V2 - SN:1149
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	June 23, 2016

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
Power meter NRP	SN: 104778	06-Apr-16 (No. 217-02288/02289)	Apr-17
Power sensor NRP-Z91	SN: 103244	06-Apr-16 (No. 217-02288)	Apr-17
Power sensor NRP-Z91	SN: 103245	06-Apr-16 (No. 217-02289)	Apr-17
Reference 20 dB Attenuator	SN: 5058 (20k)	05-Apr-16 (No. 217-02292)	Apr-17
Type-N mismatch combination	SN: 5047.2 / 06327	05-Apr-16 (No. 217-02295)	Apr-17
Reference Probe EX3DV4	SN: 7349	15-Jun-16 (No. EX3-7349_Jun16)	Jun-17
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-442A	SN: GB37480704	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (No. 217-02222)	In house check: Oct-16
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (No. 217-02223)	In house check: Oct-16
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Jun-15)	In house check: Oct-16
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: June 28, 2016