FCC SAR TEST REPORT

APPLICANT	**:**	**Amazon.com Services LLC**
EQUIPMENT	**:**	**Electronic Display Device**
Model Name	**:**	**C4A6T4**
FCC ID	**:**	**2A4DH-3426**
STANDARD	**:**	**FCC 47 CFR Part 2 (2.1093)**

We, Sporton International Inc. (Shenzhen), would like to declare that the tested sample has been evaluated in accordance with the test procedures given in 47 CFR Part 2.1093 and FCC KDB and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. (Shenzhen), the test report shall not be reproduced except in full.

Si Zhang

Approved by: Si Zhang

ilac-MRA

ACCREDITED
Cert #5145.01

Sporton International Inc. (Shenzhen)

1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China

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History of this test report

Report No.	Version	Description	Issued Date
FA211916-01	Rev. 01	Initial issue of report	Jun. 27, 2022
FA211916-01	Rev. 02	Updated the WLAN2.4GHz/5GHz tune up limit and relevant data	Jul. 05, 2022

1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for **Amazon.com Services LLC, Electronic Display Device, C4A6T4,** are as follows.

Highest Standalone 1g SAR Summary				
Equipment Class	Frequency Band		Body (Separation 0mm) 1g SAR (W/kg)	Highest Simultaneous Transmission 1g SAR (W/kg)
DTS	WLAN	2.4GHz WLAN	**0.61**	
NII		5GHz WLAN	0.56	0.66
DSS	Bluetooth	Bluetooth	0.10	0.66
Date of Testing:		2022/5/30 ~ 2022/6/2		

Declaration of Conformity:
The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.
Comments and Explanations:
The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

This device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg for Partial-Body 1g SAR) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 and FCC KDB publications.

2. Administration Data

Sporton International Inc. (Shenzhen) is accredited to ISO/IEC 17025:2017 by American Association for Laboratory Accreditation with Certificate Number 5145.01.

Testing Laboratory			
Test Firm	Sporton International Inc. (Shenzhen)		
Test Site Location	1/F, 2/F, Bldg 5, Shiling Industrial Zone, Xinwei Village, Xili, Nanshan, Shenzhen, 518055 People's Republic of China TEL: +86-755-86379589 FAX: +86-755-86379595		
Test Site No.	Sporton Site No.	FCC Designation No.	FCC Test Firm Registration No.
	SAR04-SZ	CN1256	421272

Applicant	
Company Name	Amazon.com Services LLC
Address	410 Terry Avenue N Seattle, WA 98109-5210 United States

3. Guidance Applied

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1-1992
- IEEE 1528-2013
- FCC KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04
- FCC KDB 865664 D02 SAR Reporting v01r02
- FCC KDB 447498 D01 General RF Exposure Guidance v06
- FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02
- FCC KDB 616217 D04 SAR for laptop and tablets v01r02

4. Equipment Under Test (EUT) Information

4.1 General Information

Product Feature & Specification	
Equipment Name	Electronic Display Device
Model Name	C4A6T4
FCC ID	2A4DH-3426
S/N Code	G0B22701219400R
Wireless Technology and Frequency Range	WLAN 2.4GHz Band: 2412 MHz ~ 2472 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.3GHz Band: 5260 MHz ~ 5320 MHz WLAN 5.5GHz Band: 5500 MHz ~ 5720 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz Bluetooth: 2402 MHz ~ 2480 MHz
Mode	WLAN 2.4GHz 802.11b/g/n HT20 WLAN 5GHz 802.11a/n HT20/HT40 WLAN 5GHz 802.11ac VHT20/VHT40/VHT80 Bluetooth BR/EDR/LE

Remark:
1. This device has no voice function.
2. 802.11n-HT40 is not supported in 2.4GHz WLAN.
3. The 2.4GHz/5GHz WLAN can transmit in SISO antenna mode only and it has no MIMO antenna mode.
4. This device has a rear cover as a tablet protective cover, and the rear cover was used as an accessory, so tablet mode with rear cover verified the worst case of each band in tablet mode to satisfy SAR compliance

5. RF Exposure Limits

5.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

5.2 Controlled Environment

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). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. The exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Limits for Occupational/Controlled Exposure (W/kg)

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.4	8.0	20.0

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

Whole-Body	Partial-Body	Hands, Wrists, Feet and Ankles
0.08	1.6	4.0

Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.

6. Specific Absorption Rate (SAR)

6.1 Introduction

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

6.2 SAR Definition

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

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

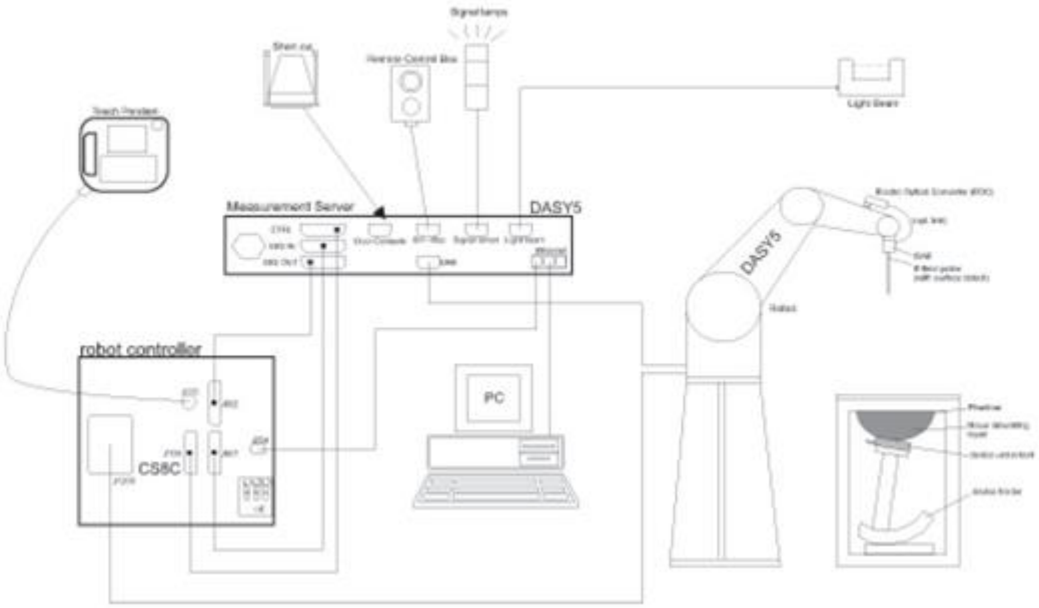
SAR is expressed in units of Watts per kilogram (W/kg)

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

7. System Description and Setup

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- 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 from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- 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.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

7.1 E-Field Probe

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

<EX3DV4 Probe>

Construction	Symmetric design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Frequency	10 MHz – >6 GHz Linearity: ±0.2 dB (30 MHz – 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 – >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	

7.2 Data Acquisition Electronics (DAE)

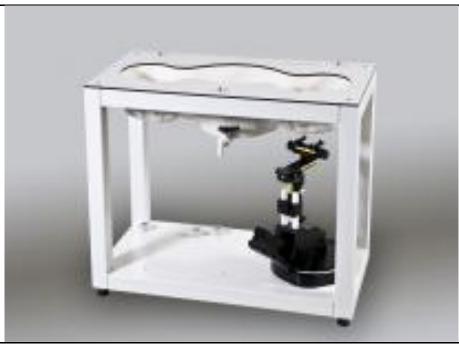
The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an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

Photo of DAE

7.3 Phantom

<SAM Twin Phantom>

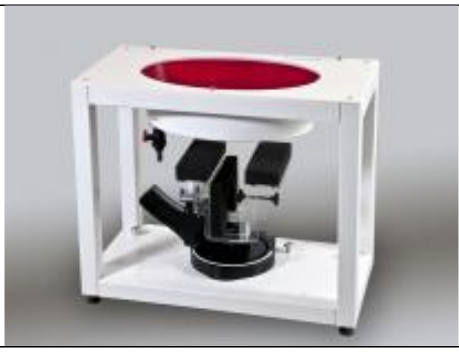
Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume	Approx. 25 liters
Dimensions	Length: 1000 mm; Width: 500 mm; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom



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

<ELI Phantom>

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



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

7.4 Device Holder

<Mounting Device for Hand-Held Transmitter>

In combination with the Twin SAM V5.0/V5.0c or ELI phantoms, the Mounting Device for Hand-Held Transmitters enables rotation of the mounted transmitter device to specified spherical coordinates. At the heads, the rotation axis is at the ear opening. Transmitter devices can be easily and accurately positioned according to IEC 62209-1, IEEE 1528, FCC, or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat). And upgrade kit to Mounting Device to enable easy mounting of wider devices like big smart-phones, e-books, small tablets, etc. It holds devices with width up to 140 mm.

Mounting Device for Hand-Held Transmitters

Mounting Device Adaptor for Wide-Phones

<Mounting Device for Laptops and other Body-Worn Transmitters>

The extension is lightweight and made of POM, acrylic glass and foam. It fits easily on the upper part of the mounting device in place of the phone positioned. The extension is fully compatible with the SAM Twin and ELI phantoms.

Mounting Device for Laptops

8. Measurement Procedures

The measurement procedures are as follows:

<Conducted power measurement>

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

<SAR measurement>

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

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

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

8.1 Spatial Peak SAR Evaluation

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

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

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

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

8.2 Power Reference Measurement

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

8.3 Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB0 is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.

Area scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

	≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

8.4 Zoom Scan

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

Zoom scan parameters extracted from FCC KDB 865664 D01v01r04 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><th colspan="3"></th><th>$\leq$ 3 GHz</th><th>> 3 GHz</th></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>$\leq$ 2 GHz: $\leq$ 8 mm
2 – 3 GHz: $\leq$ 5 mm*</td><td>3 – 4 GHz: $\leq$ 5 mm*
4 – 6 GHz: $\leq$ 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>$\leq$ 5 mm</td><td>3 – 4 GHz: $\leq$ 4 mm
4 – 5 GHz: $\leq$ 3 mm
5 – 6 GHz: $\leq$ 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>$\leq$ 4 mm</td><td>3 – 4 GHz: $\leq$ 3 mm
4 – 5 GHz: $\leq$ 2.5 mm
5 – 6 GHz: $\leq$ 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>$\geq$ 30 mm</td><td>3 – 4 GHz: $\geq$ 28 mm
4 – 5 GHz: $\geq$ 25 mm
5 – 6 GHz: $\geq$ 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 <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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>

8.5 Volume Scan Procedures

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

8.6 Power Drift Monitoring

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

9. Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	924	Sep. 02, 2020	Sep. 01, 2023
SPEAG	5000MHz System Validation Kit	D5GHzV2	1113	Sep. 24, 2019	Sep. 22, 2022
SPEAG	Data Acquisition Electronics	DAE4	715	Dec. 29, 2021	Dec. 28, 2022
SPEAG	Dosimetric E-Field Probe	EX3DV4	7641	Apr. 11, 2022	Apr. 10, 2023
SPEAG	ELI Phantom	QD OVA 001 BB	1113	NCR	NCR
SPEAG	Phone Positioner	N/A	N/A	NCR	NCR
Keysight	Network Analyzer	E5071C	MY46523671	Oct. 25, 2021	Oct. 24, 2022
Speag	Dielectric Assessment KIT	DAK-3.5	1071	Jan. 24, 2022	Jan. 23, 2023
Agilent	Signal Generator	N5181A	MY50145381	Dec. 28, 2021	Dec. 27, 2022
Anritsu	Power Senor	MA2411B	1306099	Sep. 29, 2021	Sep. 28, 2022
Anritsu	Power Meter	ML2495A	1349001	Sep. 29, 2021	Sep. 28, 2022
Anritsu	Power Sensor	MA2411B	1542004	Dec. 28, 2021	Dec. 27, 2022
Anritsu	Power Meter	ML2495A	1339473	Dec. 28, 2021	Dec. 27, 2022
R&S	CBT BLUETOOTH TESTER	CBT	100963	Dec. 28, 2021	Dec. 27, 2022
R&S	Spectrum Analyzer	FSP7	100818	Jul. 14, 2021	Jul. 13, 2022
TES	Hygrometer	1310	200505600	Jul. 17, 2021	Jul. 16, 2022
Anymetre	Thermo-Hygrometer	JR593	2018100802	Oct. 29, 2021	Oct. 28, 2022
SPEAG	Device Holder	N/A	N/A	N/A	N/A
AR	Amplifier	5S1G4	0333096	Note 1	
mini-circuits	Amplifier	ZVE-3W-83+	599201528	Note 1	
ARRA	Power Divider	A3200-2	N/A	Note 1	
ET Industries	Dual Directional Coupler	C-058-10	N/A	Note 1	
Weinschel	Attenuator 1	3M-10	N/A	Note 1	
Weinschel	Attenuator 2	3M-20	N/A	Note 1	

Note:

1. Prior to system verification and validation, the path loss from the signal generator to the system check source and the power meter, which includes the amplifier, cable, attenuator and directional coupler, was measured by the network analyzer. The reading of the power meter was offset by the path loss difference between the path to the power meter and the path to the system check source to monitor the actual power level fed to the system check source.
2. Referring to KDB 865664 D01v01r04, the dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The justification data of dipole can be found in appendix C. The return loss is < -20dB, within 20% of prior calibration, the impedance is within 5 ohm of prior calibration.

10. System Verification

10.1 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 11.1.

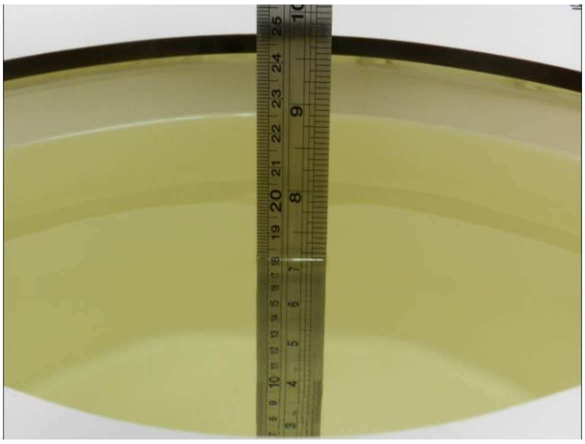


Fig 11.1 Photo of Liquid Height for Body SAR

10.2 Tissue Verification

The following tissue formulations are provided for reference only as some of the parameters have not been thoroughly verified. The composition of ingredients may be modified accordingly to achieve the desired target tissue parameters required for routine SAR evaluation.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
2450	55.0	0	0	0	0	45.0	1.80	39.2

Simulating Liquid for 5GHz, Manufactured by SPEAG

Ingredients	(% by weight)
Water	64~78%
Mineral oil	11~18%
Emulsifiers	9~15%
Additives and Salt	2~3%

<Tissue Dielectric Parameter Check Results>

Frequency (MHz)	Tissue Type	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (ε_r)	Conductivity Target (σ)	Permittivity Target (ε_r)	Delta (σ) (%)	Delta (ε_r) (%)	Limit (%)	Date
2450	Head	22.7	1.856	37.685	1.80	39.20	3.11	-3.86	±5	2022/5/30
5250	Head	22.6	4.713	36.255	4.71	35.95	0.06	0.85	±5	2022/6/2
5600	Head	22.5	4.986	36.112	5.07	35.50	-1.66	1.72	±5	2022/5/31
5750	Head	22.4	5.315	35.552	5.22	35.35	1.82	0.57	±5	2022/6/1

10.3 System Performance Check Results

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

Date	Frequency (MHz)	Tissue Type	Input Power (mW)	Dipole S/N	Probe S/N	DAE S/N	Measured 1g SAR (W/kg)	Targeted 1g SAR (W/kg)	Normalized 1g SAR (W/kg)	Deviation (%)
2022/5/30	2450	Head	250	924	7641	715	13.400	51.40	53.6	4.28
2022/6/2	5250	Head	100	1113	7641	715	8.100	80.50	81	0.62
2022/5/31	5600	Head	100	1113	7641	715	8.610	83.40	86.1	3.24
2022/6/1	5750	Head	100	1113	7641	715	8.320	80.00	83.2	4.00

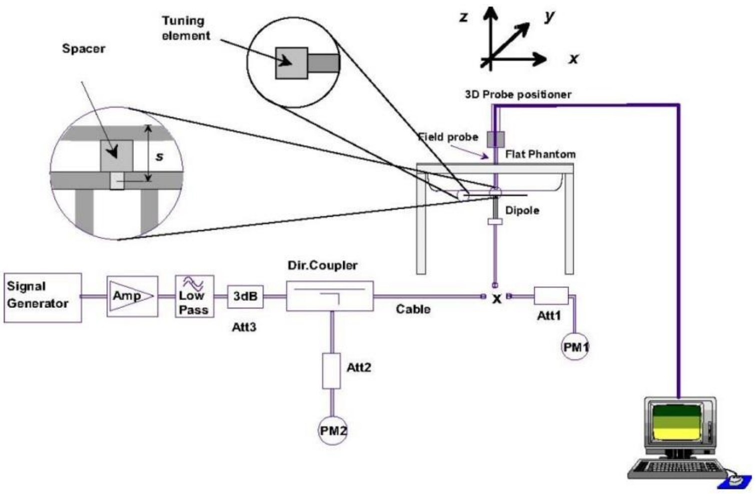


Fig 8.3.1 System Performance Check Setup

Fig 8.3.2 Setup Photo

11. RF Exposure Positions

11.1 SAR Testing for Tablet

This device can be used also in full sized tablet exposure conditions, due to its size. Per FCC KDB 616217, the back surface and edges of the tablet should be tested for SAR compliance with the tablet touching the phantom. The SAR exclusion threshold in KDB 447498 D01v06 can be applied to determine SAR test exclusion for adjacent edge configurations. The closest distance from the antenna to an adjacent tablet edge is used to determine if SAR testing is required for the adjacent edges, with the adjacent edge positioned against the phantom and the edge containing the antenna positioned perpendicular to the phantom.

<EUT Setup Photos>

Please refer to the test setup photos.

12. Conducted RF Output Power (Unit: dBm)

The detailed conducted power table can refer to Appendix D.

<WLAN Conducted Power>

General Note:

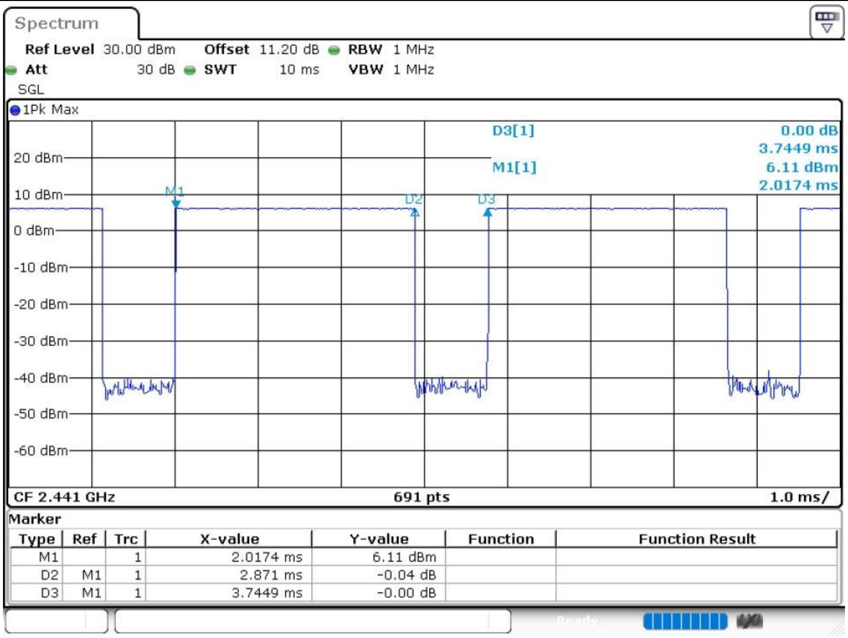
1. Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.
2. For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).
3. For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.
4. 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.18 The initial test position procedure is described in the following:
   a. When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.
   b. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
   c. For all positions/configurations, 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.
5. The 2.4GHz/5GHz WLAN can transmit in SISO antenna mode only and it has no MIMO antenna mode.

<2.4GHz Bluetooth>

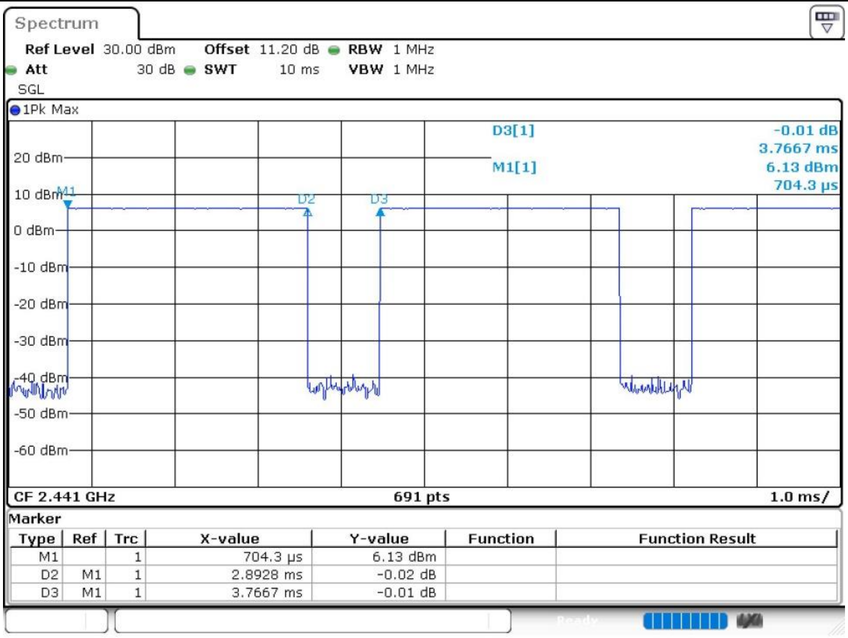
General Note:

1. For 2.4GHz Bluetooth SAR testing was selected 1Mbps, due to its highest average power.
2. The Bluetooth duty cycle are 76.7 % for ANT1, 76.8 % for ANT2 as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%, therefore the actual duty cycle will be scaled up to100% for Bluetooth reported SAR calculation.

Bluetooth time-domain plot for ANT1



Bluetooth time-domain plot for ANT2



13. Antenna Location

The detailed antenna location information can refer to SAR Test Setup Photos.

<SAR test exclusion table>

General Note:

1. The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"
2. Maximum power is the source-based time-average power and represents the maximum RF output power among production units
3. Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
4. Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.
5. Per KDB 447498 D01v06, 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
   - 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
6. Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for *test separation distances* > 50 mm, the SAR test exclusion threshold is determined according to the following
   a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz
   b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

Exposure Position	Wireless Interface	BT ANT 1	BT ANT 2	2.4GHz WLAN ANT 1	2.4GHz WLAN ANT 2	5GHz WLAN ANT 1	5GHz WLAN ANT 2
	Calculated Frequency (MHz)	2480	2480	2472	2472	5825	5825
	Maximum power (dBm)	6.5	6.5	16.0	16.0	15.0	15.0
	Maximum rated power(mW)	4.47	4.47	39.81	39.81	31.62	31.62
Bottom Face	Separation distance(mm)	0.0	0.0	0.0	0.0	0.0	0.0
	exclusion threshold	1.4	1.4	12.5	12.5	15.3	15.3
	Testing required?	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**
Edge 1	Separation distance(mm)	5.0	192.0	5.0	192.0	5.0	192.0
	exclusion threshold	1.4	1515.0	12.5	1515.0	15.3	1482.0
	Testing required?	**No**	**No**	**Yes**	**No**	**Yes**	**No**
Edge 2	Separation distance(mm)	180.0	180.0	180.0	180.0	180.0	180.0
	exclusion threshold	1395.0	1395.0	1395.0	1395.0	1362.0	1362.0
	Testing required?	**No**	**No**	**No**	**No**	**No**	**No**
Edge 3	Separation distance(mm)	192.0	5.0	192.0	5.0	192.0	5.0
	exclusion threshold	1515.0	1.4	1515.0	12.5	1482.0	15.3
	Testing required?	**No**	**No**	**No**	**Yes**	**No**	**Yes**
Edge 4	Separation distance(mm)	5.0	5.0	5.0	5.0	5.0	5.0
	exclusion threshold	1.4	1.4	12.5	12.5	15.3	15.3
	Testing required?	**No**	**No**	**Yes**	**Yes**	**Yes**	**Yes**

14. SAR Test Results

General Note:

1. Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   a. Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.
   b. For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"
   c. For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor
2. Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the *reported* 1-g or 10-g SAR for the mid-band or highest output power channel is:
   · ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   · ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   · ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
3. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
4. The following table“n/a”means the measured SAR is too small to find the 1g cube SAR.

WLAN Note:

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required 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.
2. Per KDB 248227 D01v02r02, U-NII-1 SAR testing is not required when the U-NII-2A band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band.
3. When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.
4. For all positions / configurations, 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.
5. During SAR testing the WLAN transmission was verified using a spectrum analyzer.
6. The 2.4GHz/5GHz WLAN can transmit in SISO antenna mode only and it has no MIMO antenna mode.

14.1 Body SAR

<Bluetooth SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	Bluetooth	DH5	Bottom Face	0mm	Ant 1	39	2441	5.90	6.50	1.148	76.7	1.304	-	n/a	n/a
	Bluetooth	DH5	Edge 1	0mm	Ant 1	39	2441	5.90	6.50	1.148	76.7	1.304	-	n/a	n/a
	Bluetooth	DH5	Edge 4	0mm	Ant 1	39	2441	5.90	6.50	1.148	76.7	1.304	-	n/a	n/a
	Bluetooth with rear cover	DH5	Edge 4	0mm	Ant 1	39	2441	5.90	6.50	1.148	76.7	1.304	-	n/a	n/a
	Bluetooth	DH5	Edge 4	0mm	Ant 1	0	2402	5.90	6.50	1.148	76.7	1.304	-	n/a	n/a
	Bluetooth	DH5	Edge 4	0mm	Ant 1	78	2480	5.80	6.50	1.175	76.7	1.304	-	n/a	n/a
	Bluetooth	DH5	Bottom Face	0mm	Ant 2	39	2441	6.00	6.50	1.122	76.8	1.302	-	n/a	n/a
	Bluetooth	DH5	Edge 3	0mm	Ant 2	39	2441	6.00	6.50	1.122	76.8	1.302	-0.1	0.010	0.015
01	Bluetooth	DH5	Edge 4	0mm	Ant 2	39	2441	6.00	6.50	1.122	76.8	1.302	-0.16	0.070	**0.102**
	Bluetooth with rear cover	DH5	Edge 4	0mm	Ant 2	39	2441	6.00	6.50	1.122	76.8	1.302	-0.09	0.041	0.060
	Bluetooth	DH5	Edge 4	0mm	Ant 2	0	2402	5.90	6.50	1.148	76.8	1.302	-0.04	0.056	0.084
	Bluetooth	DH5	Edge 4	0mm	Ant 2	78	2480	5.90	6.50	1.148	76.8	1.302	0.07	0.062	0.093

<WLAN2.4GHz SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 1	1	2412	15.50	16.00	1.122	99.14	1.009	0.01	0.021	0.024
	WLAN2.4GHz	802.11b 1Mbps	Edge 1	0mm	Ant 1	1	2412	15.50	16.00	1.122	99.14	1.009	0.09	0.063	0.071
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 1	1	2412	15.50	16.00	1.122	99.14	1.009	-0.06	0.140	0.158
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 1	6	2437	15.30	16.00	1.175	99.14	1.009	-0.09	0.171	0.203
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 1	11	2462	15.10	16.00	1.230	99.14	1.009	-0.02	0.371	0.461
	WLAN2.4GHz with rear cover	802.11b 1Mbps	Edge 4	0mm	Ant 1	11	2462	15.10	16.00	1.230	99.14	1.009	0.05	0.107	0.133
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 1	12	2467	15.00	16.00	1.259	99.14	1.009	-0.09	0.196	0.249
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 1	13	2472	14.90	16.00	1.288	99.14	1.009	-0.01	0.207	0.269
	WLAN2.4GHz	802.11b 1Mbps	Bottom Face	0mm	Ant 2	1	2412	15.30	16.00	1.175	99.14	1.009	-0.06	0.046	0.055
	WLAN2.4GHz	802.11b 1Mbps	Edge 3	0mm	Ant 2	1	2412	15.30	16.00	1.175	99.14	1.009	-0.03	0.130	0.154
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 2	1	2412	15.30	16.00	1.175	99.14	1.009	-0.01	0.355	0.421
02	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 2	6	2437	15.10	16.00	1.230	99.14	1.009	-0.03	0.495	**0.614**
	WLAN2.4GHz with rear cover	802.11b 1Mbps	Edge 4	0mm	Ant 2	6	2437	15.10	16.00	1.230	99.14	1.009	-0.03	0.199	0.247
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 2	11	2462	14.90	16.00	1.288	99.14	1.009	-0.09	0.295	0.383
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 2	12	2467	14.80	16.00	1.318	99.14	1.009	0.02	0.304	0.404
	WLAN2.4GHz	802.11b 1Mbps	Edge 4	0mm	Ant 2	13	2472	14.70	16.00	1.349	99.14	1.009	-0.01	0.280	0.381

<WLAN5G SAR>

Plot No.	Band	Mode	Test Position	Gap (mm)	Antenna	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Tune-up Scaling Factor	Duty Cycle %	Duty Cycle Scaling Factor	Power Drift (dB)	Measured 1g SAR (W/kg)	Reported 1g SAR (W/kg)
	WLAN5.3GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 1	64	5320	14.31	15.00	1.173	96.48	1.036	0.09	0.022	0.027
	WLAN5.3GHz	802.11a 6Mbps	Edge 1	0mm	Ant 1	64	5320	14.31	15.00	1.173	96.48	1.036	0.03	0.098	0.119
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	64	5320	14.31	15.00	1.173	96.48	1.036	-0.07	0.168	0.204
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	52	5260	14.24	15.00	1.192	96.48	1.036	0.09	0.257	0.317
	WLAN5.3GHz with rear cover	802.11a 6Mbps	Edge 4	0mm	Ant 1	52	5260	14.24	15.00	1.192	96.48	1.036	0.08	0.180	0.222
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	56	5280	14.11	15.00	1.227	96.48	1.036	-0.07	0.160	0.203
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	60	5300	14.14	15.00	1.220	96.48	1.036	0.01	0.165	0.209
	WLAN5.3GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 2	64	5320	14.25	15.00	1.189	96.87	1.032	0.03	0.027	0.033
	WLAN5.3GHz	802.11a 6Mbps	Edge 3	0mm	Ant 2	64	5320	14.25	15.00	1.189	96.87	1.032	0.01	0.200	0.245
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	64	5320	14.25	15.00	1.189	96.87	1.032	0.06	0.368	0.452
03	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	52	5260	14.21	15.00	1.200	96.87	1.032	0.05	0.444	**0.550**
	WLAN5.3GHz with rear cover	802.11a 6Mbps	Edge 4	0mm	Ant 2	52	5260	14.21	15.00	1.200	96.87	1.032	0.04	0.248	0.307
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	56	5280	14.12	15.00	1.225	96.87	1.032	0.06	0.353	0.446
	WLAN5.3GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	60	5300	14.14	15.00	1.220	96.87	1.032	-0.1	0.346	0.435
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 1	100	5500	14.21	15.00	1.201	96.48	1.036	0.07	0.019	0.024
	WLAN5.5GHz	802.11a 6Mbps	Edge 1	0mm	Ant 1	100	5500	14.21	15.00	1.201	96.48	1.036	0.08	0.119	0.148
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	100	5500	14.21	15.00	1.201	96.48	1.036	0.04	0.186	0.231
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	116	5580	14.12	15.00	1.226	96.48	1.036	0.04	0.182	0.231
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	124	5620	14.08	15.00	1.236	96.48	1.036	-0.04	0.180	0.230
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	132	5660	14.03	15.00	1.250	96.48	1.036	0.07	0.203	0.263
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	140	5700	14.11	15.00	1.229	96.48	1.036	0.05	0.219	0.279
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	144	5720	14.04	15.00	1.249	96.48	1.036	0.01	0.353	0.457
	WLAN5.5GHz with rear cover r	802.11a 6Mbps	Edge 4	0mm	Ant 1	144	5720	14.04	15.00	1.249	96.48	1.036	-0.03	0.183	0.237
	WLAN5.5GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 2	116	5580	14.17	15.00	1.211	96.87	1.032	0.05	0.020	0.025
	WLAN5.5GHz	802.11a 6Mbps	Edge 3	0mm	Ant 2	116	5580	14.17	15.00	1.211	96.87	1.032	-0.04	0.127	0.159
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	116	5580	14.17	15.00	1.211	96.87	1.032	-0.08	0.197	0.246
04	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	100	5500	14.09	15.00	1.234	96.87	1.032	-0.1	0.437	**0.556**
	WLAN5.5GHz with rear cover	802.11a 6Mbps	Edge 4	0mm	Ant 2	100	5500	14.09	15.00	1.234	96.87	1.032	0.02	0.251	0.320
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	124	5620	14.11	15.00	1.227	96.87	1.032	-0.03	0.211	0.267
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	132	5660	14.06	15.00	1.242	96.87	1.032	-0.08	0.218	0.279
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	140	5700	13.91	15.00	1.286	96.87	1.032	-0.1	0.211	0.280
	WLAN5.5GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	144	5720	13.98	15.00	1.265	96.87	1.032	-0.07	0.240	0.313
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 1	149	5745	13.68	15.00	1.355	96.48	1.036	0.04	0.031	0.044
	WLAN5.8GHz	802.11a 6Mbps	Edge 1	0mm	Ant 1	149	5745	13.68	15.00	1.355	96.48	1.036	0.06	0.106	0.149
05	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	149	5745	13.68	15.00	1.355	96.48	1.036	0.06	0.371	**0.521**
	WLAN5.8GHz with rear cover	802.11a 6Mbps	Edge 4	0mm	Ant 1	149	5745	13.68	15.00	1.355	96.48	1.036	-0.02	0.179	0.251
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	157	5785	13.65	15.00	1.365	96.48	1.036	-0.06	0.195	0.276
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 1	165	5825	13.66	15.00	1.361	96.48	1.036	0.07	0.278	0.392
	WLAN5.8GHz	802.11a 6Mbps	Bottom Face	0mm	Ant 2	165	5825	13.65	15.00	1.365	96.87	1.032	0.18	0.033	0.046
	WLAN5.8GHz	802.11a 6Mbps	Edge 3	0mm	Ant 2	165	5825	13.65	15.00	1.365	96.87	1.032	-0.03	0.098	0.138
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	165	5825	13.65	15.00	1.365	96.87	1.032	0.06	0.234	0.330
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	149	5745	13.62	15.00	1.374	96.87	1.032	-0.05	0.217	0.308
	WLAN5.8GHz	802.11a 6Mbps	Edge 4	0mm	Ant 2	157	5785	13.64	15.00	1.368	96.87	1.032	0.02	0.357	0.504
	WLAN5.8GHz with rear cover	802.11a 6Mbps	Edge 4	0mm	Ant 2	157	5785	13.64	15.00	1.368	96.87	1.032	0.11	0.279	0.394

15. Simultaneous Transmission Analysis

NO.	Simultaneous Transmission Configurations	Wireless Tablet
		Body
1.	WLAN5GHz ANT1 + Bluetooth ANT1	Yes
2.	WLAN5GHz ANT2 + Bluetooth ANT2	Yes

General Note:

1. The 2.4GHz/5GHz WLAN can transmit in SISO antenna mode only and it has no MIMO antenna mode.
2. EUT will choose either 2.4GHz WLAN or 5GHz WLAN according to the network signal condition; therefore, 2.4GHz WLAN and 5GHz WLAN will not operate simultaneously at any moment.
3. 2.4GHz WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.
4. Above table listed transmitting simultaneous state is supported only for this device.
5. According to the EUT characteristic, WLAN 5GHz and Bluetooth can transmit simultaneously.
6. Per KDB 447498 D01v06, simultaneous transmission SAR is compliant if,
   i) 1g Scalar SAR summation < 1.6W/kg.
   ii) SPLSR = (SAR1 + SAR2)^1.5 / (min. separation distance, mm), and the peak separation distance is determined from the square root of [(x1-x2)2 + (y1-y2)2 + (z1-z2)2], where (x1, y1, z1) and (x2, y2, z2) are the coordinates of the extrapolated peak SAR locations in the zoom scan.
   iii) If SPLSR ≤ 0.04 for 1g SAR, simultaneously transmission SAR measurement is not necessary.
   iv) Simultaneously transmission SAR measurement, and the reported multi-band 1g SAR < 1.6W/kg.

15.1 Body Exposure Conditions

Exposure Position	6	7	9	10	6+9	7+10
	WLAN5GHz Ant 1	WLAN5GHz Ant 2	Bluetooth Ant 1	Bluetooth Ant 2	Summed	Summed
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)
Bottom Face	0.044	0.046			0.04	0.05
Edge 1	0.149				0.15	0.00
Edge 3		0.245		0.015	0.00	0.26
Edge 4	0.521	0.556		0.102	0.52	**0.66**

Test Engineer : Hank Huang, Kevin Xu, David Dai, Bin He

16. Uncertainty Assessment

Per KDB 865664 D01 SAR measurement 100MHz to 6GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg and the measured 10-g SAR within a frequency band is < 3.75 W/kg. The expanded SAR measurement uncertainty must be ≤ 30%, for a confidence interval of k = 2. If these conditions are met, extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. For this device, the highest measured 1-g SAR is less 1.5W/kg. Therefore, the measurement uncertainty table is not required in this report.

17. References

[1] FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”

[2] ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3] IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, Sep 2013

[4] SPEAG DASY System Handbook

[5] FCC KDB 865664 D01 v01r04, "SAR Measurement Requirements for 100 MHz to 6 GHz", Aug 2015.

[6] FCC KDB 865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations” Oct 2015.

[7] FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 2015

[8] FCC KDB 248227 D01 v02r02, “SAR Guidance for IEEE 802.11 (WiFi) Transmitters”, Oct 2015.

[9] FCC KDB 616217 D04 v01r02, “SAR Evaluation Considerations for Laptop, Notebook, Netbook and Tablet Computers”, Oct 2015

------THE END------

Appendix A. Plots of System Performance Check

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2022/5/30

System Check_Head_2450MHz

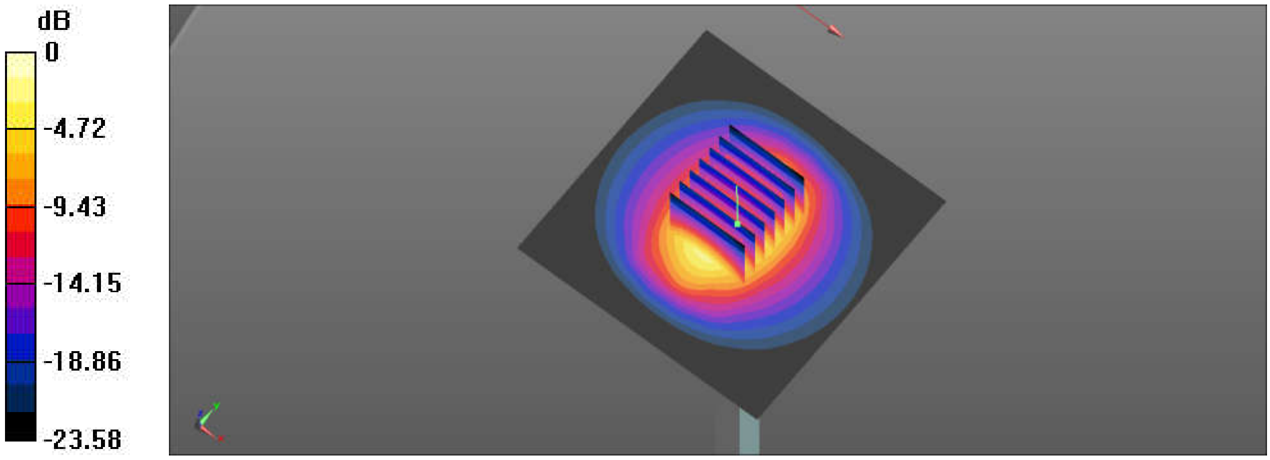
DUT: D2450V2-SN:924

Communication System: UID 0, CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL_2450_220530 Medium parameters used: f = 2450 MHz; σ = 1.856 S/m; ε_r = 37.685; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(8.24, 8.24, 8.24); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=250mW/Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 23.8 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 102.9 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 30.1 W/kg
SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.16 W/kg
Maximum value of SAR (measured) = 23.8 W/kg



0 dB = 23.8 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2022/6/2

System Check_Head_5250MHz

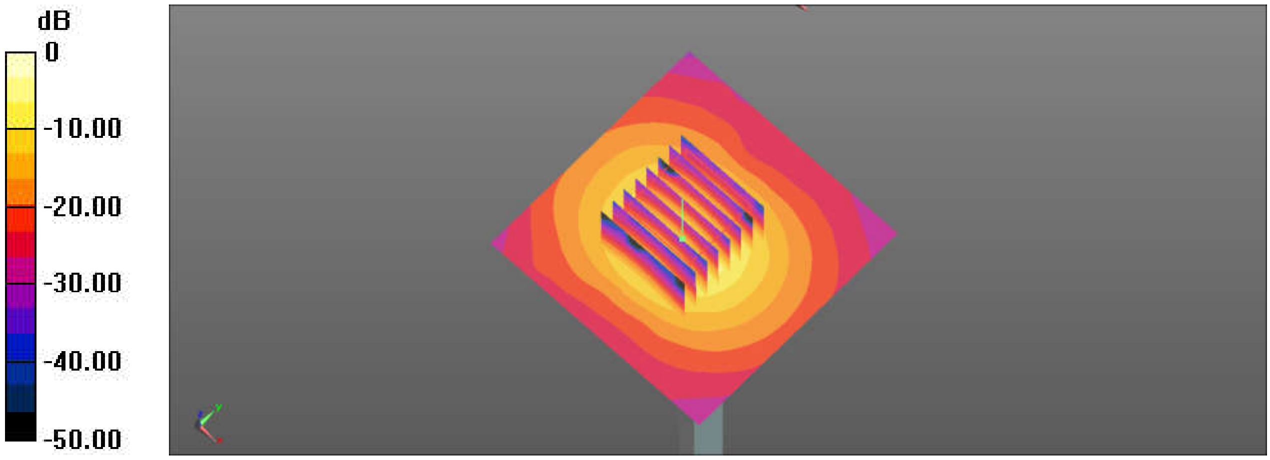
DUT: D5GHzV2-SN:1113

Communication System: UID 0, CW (0); Frequency: 5250 MHz;Duty Cycle: 1:1
Medium: HSL_5250_220602 Medium parameters used: f = 5250 MHz; σ = 4.713 S/m; ε_r = 36.255; ρ = 1000 kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.71, 5.71, 5.71); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 22.0 W/kg

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.88 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 35.8 W/kg
SAR(1 g) = 8.1 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 21.8 W/kg



0 dB = 21.8 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2022/5/31

System Check_Head_5600MHz

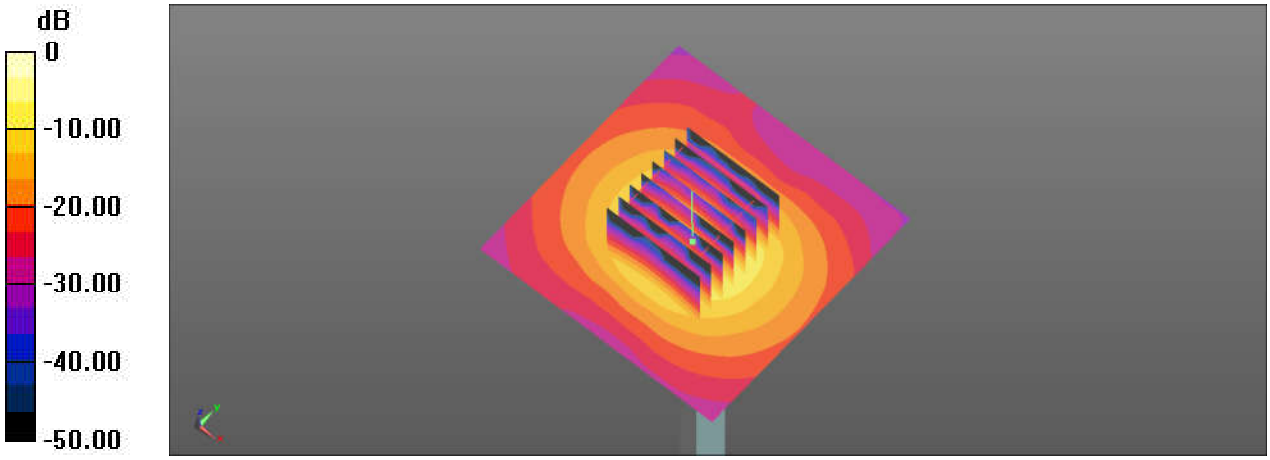
DUT: D5GHzV2-SN:1113

Communication System: UID 0, CW (0); Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: HSL_5600_220531 Medium parameters used: f = 5600 MHz; σ = 4.986 S/m; ε_r = 36.112; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.08, 5.08, 5.08); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 21.9 W/kg

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 74.01 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 39.2 W/kg
SAR(1 g) = 8.61 W/kg; SAR(10 g) = 2.42 W/kg
Maximum value of SAR (measured) = 22.8 W/kg



0 dB = 22.8 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2022/6/1

System Check_Head_5750MHz

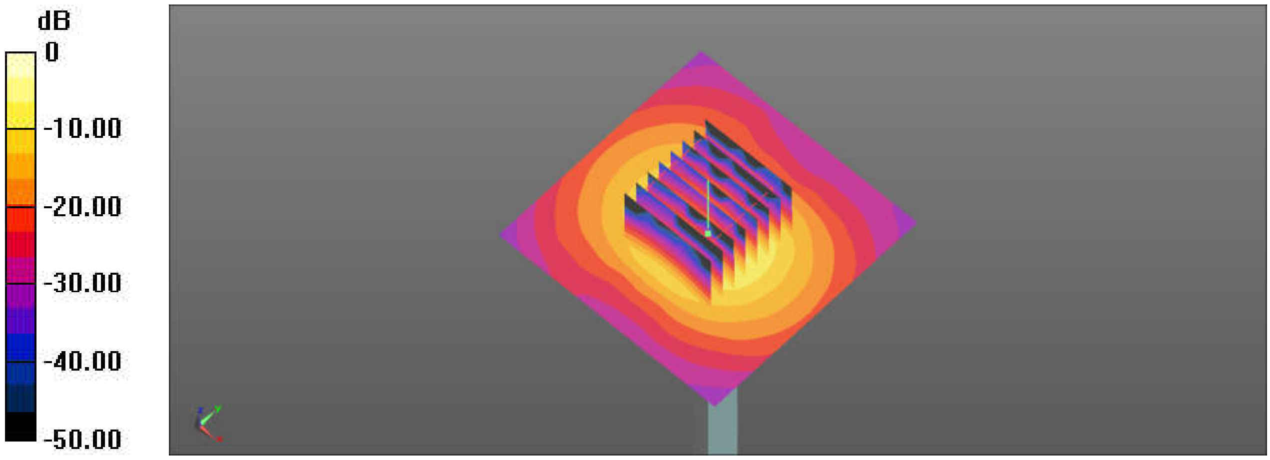
DUT: D5GHzV2-SN:1113

Communication System: UID 0, CW (0); Frequency: 5750 MHz;Duty Cycle: 1:1
Medium: HSL_5750_220601 Medium parameters used: f = 5750 MHz; σ = 5.315 S/m; ε_r = 35.552; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.25, 5.25, 5.25); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Pin=100mW/Area Scan (71x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 23.1 W/kg

Pin=100mW/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.91 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 42.7 W/kg
SAR(1 g) = 8.32 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 23.9 W/kg



0 dB = 23.9 W/kg

Appendix B. Plots of SAR Measurement

The plots are shown as follows.

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2022/5/30

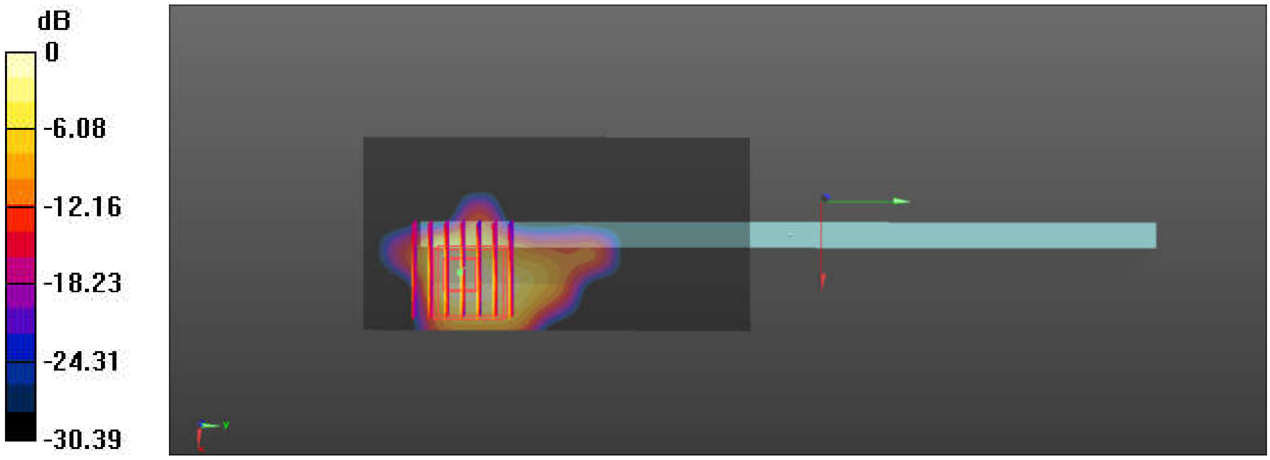
01_Bluetooth_DH5_Edge 4_0mm_Ch39

Communication System: UID 0, BT (0); Frequency: 2441 MHz;Duty Cycle: 1:1.302
Medium: HSL_2450_220530 Medium parameters used: f = 2441 MHz; σ = 1.846 S/m; ε_r = 37.718; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(8.24, 8.24, 8.24); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch39/Area Scan (51x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.132 W/kg

Ch39/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = -0.16 dB
Peak SAR (extrapolated) = 0.143 W/kg
SAR(1 g) = 0.070 W/kg; SAR(10 g) = 0.030 W/kg
Maximum value of SAR (measured) = 0.0933 W/kg



0 dB = 0.0933 W/kg

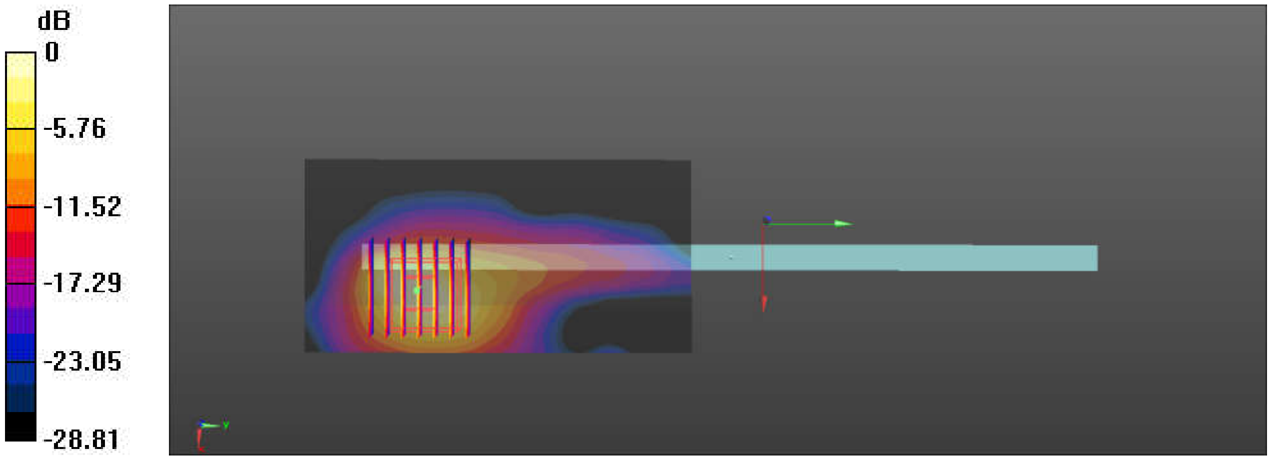
02_WLAN2.4GHz_802.11b 1Mbps_Edge 4_0mm_Ch6

Communication System: UID 0, WIFI (0); Frequency: 2437 MHz;Duty Cycle: 1:1.009
Medium: HSL_2450_220530 Medium parameters used: f = 2437 MHz; σ = 1.842 S/m; ε_r = 37.736; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.7 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(8.24, 8.24, 8.24); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch6/Area Scan (51x101x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.989 W/kg

Ch6/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.157 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.495 W/kg; SAR(10 g) = 0.196 W/kg
Maximum value of SAR (measured) = 0.923 W/kg



0 dB = 0.923 W/kg

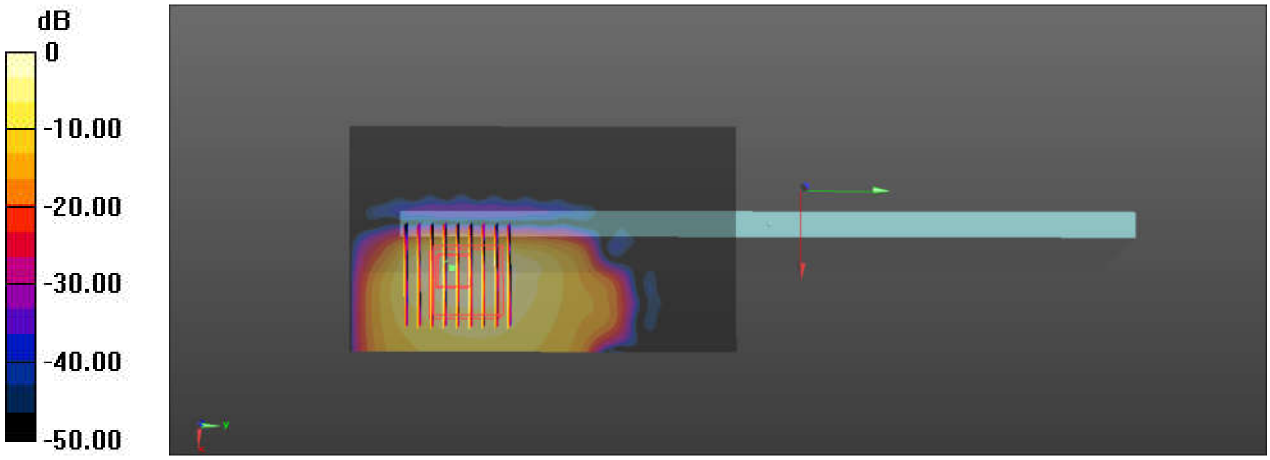
03_WLAN5GHz_802.11a_6Mbps_Edge 4_0mm_Ch52

Communication System: UID 0, WIFI (0); Frequency: 5260 MHz;Duty Cycle: 1:1.032
Medium: HSL_5250_220602 Medium parameters used: f = 5260 MHz; $\sigma = 4.728$ S/m; $\varepsilon_r = 36.24$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.4 ℃; Liquid Temperature：22.6 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.71, 5.71, 5.71); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch52/Area Scan (71x121x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.70 W/kg

Ch52/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.75 W/kg
SAR(1 g) = 0.444 W/kg; SAR(10 g) = 0.159 W/kg
Maximum value of SAR (measured) = 1.04 W/kg



0 dB = 1.04 W/kg

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2022/5/31

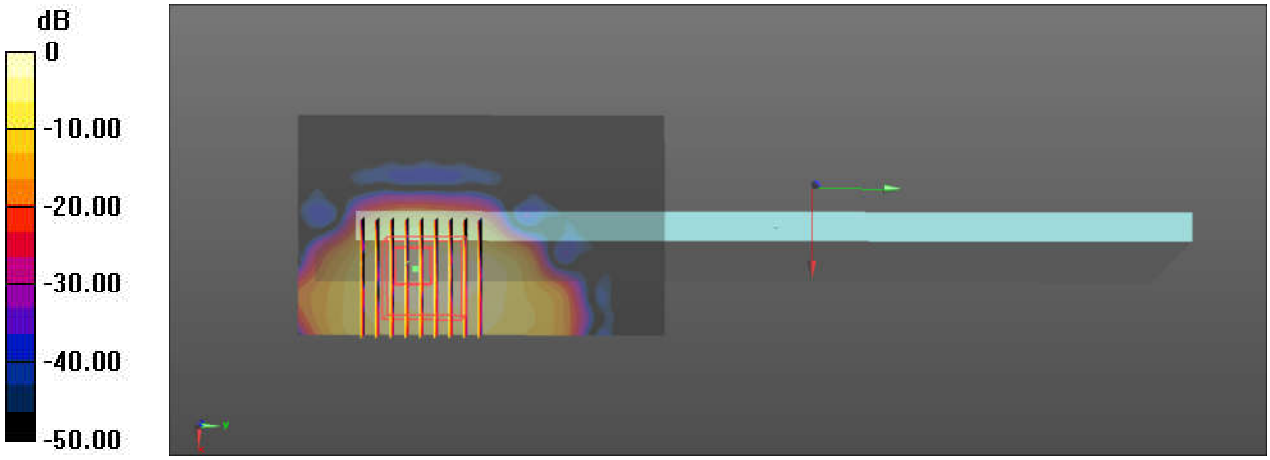
04_WLAN5GHz_802.11a_6Mbps_Edge 4_0mm_Ch100

Communication System: UID 0, WIFI (0); Frequency: 5500 MHz;Duty Cycle: 1:1.032
Medium: HSL_5600_220531 Medium parameters used: f = 5500 MHz; σ = 4.872 S/m; ε_r = 36.29; ρ = 1000 kg/m^3
Ambient Temperature：23.5 ℃; Liquid Temperature：22.5 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.08, 5.08, 5.08); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch100/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.30 W/kg

Ch100/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.89 W/kg
SAR(1 g) = 0.437 W/kg; SAR(10 g) = 0.152 W/kg
Maximum value of SAR (measured) = 1.04 W/kg



0 dB = 1.04 W/kg

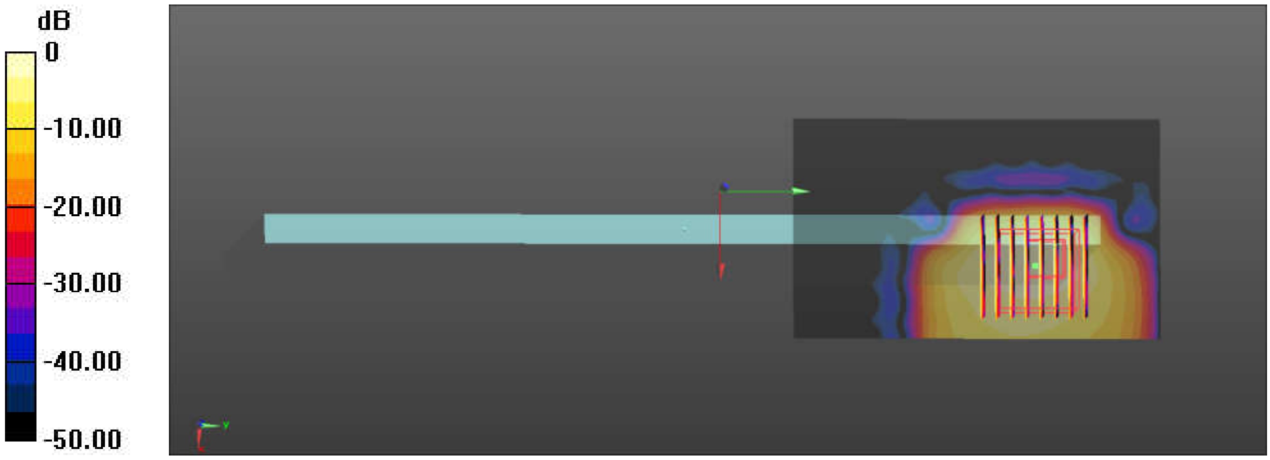
05_WLAN5GHz_802.11a_6Mbps_Edge 4_0mm_Ch149

Communication System: UID 0, WIFI (0); Frequency: 5745 MHz;Duty Cycle: 1:1.036
Medium: HSL_5750_220601 Medium parameters used: f = 5745 MHz; σ = 5.308 S/m; ε_r = 35.56; ρ = 1000 kg/m^3
Ambient Temperature：23.3 ℃; Liquid Temperature：22.4 ℃

DASY5 Configuration:
- Probe: EX3DV4 - SN7641; ConvF(5.25, 5.25, 5.25); Calibrated: 2022/4/11
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn715; Calibrated: 2021/12/29
- Phantom: ELI v4.0; Type: QDOVA001BB; Serial: TP: 1113
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Ch149/Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.916 W/kg

Ch149/Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 0 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 1.68 W/kg
SAR(1 g) = 0.371 W/kg; SAR(10 g) = 0.122 W/kg
Maximum value of SAR (measured) = 0.886 W/kg



0 dB = 0.886 W/kg

Appendix C. DASY Calibration Certificate

The DASY calibration certificates are shown as follows.

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 **Sporton**

Certificate No: **D2450V2-924_Sep20**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN:924
Calibration procedure(s)	QA CAL-05.v11 Calibration Procedure for SAR Validation Sources between 0.7-3 GHz
Calibration date:	September 02, 2020

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°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	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 7349	29-Jun-20 (No. EX3-7349_Jun20)	Jun-21
DAE4	SN: 601	27-Dec-19 (No. DAE4-601_Dec19)	Dec-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-19)	In house check: Oct-20

	Name	Function	Signature
Calibrated by:	Jeffrey Katzman	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: September 2, 2020

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.9 ± 6 %	1.84 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	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.4 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.0 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	53.9 Ω + 7.2 jΩ
Return Loss	- 22.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.155 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

DASY5 Validation Report for Head TSL

Date: 02.09.2020

Test Laboratory: SPEAG, Zurich, Switzerland

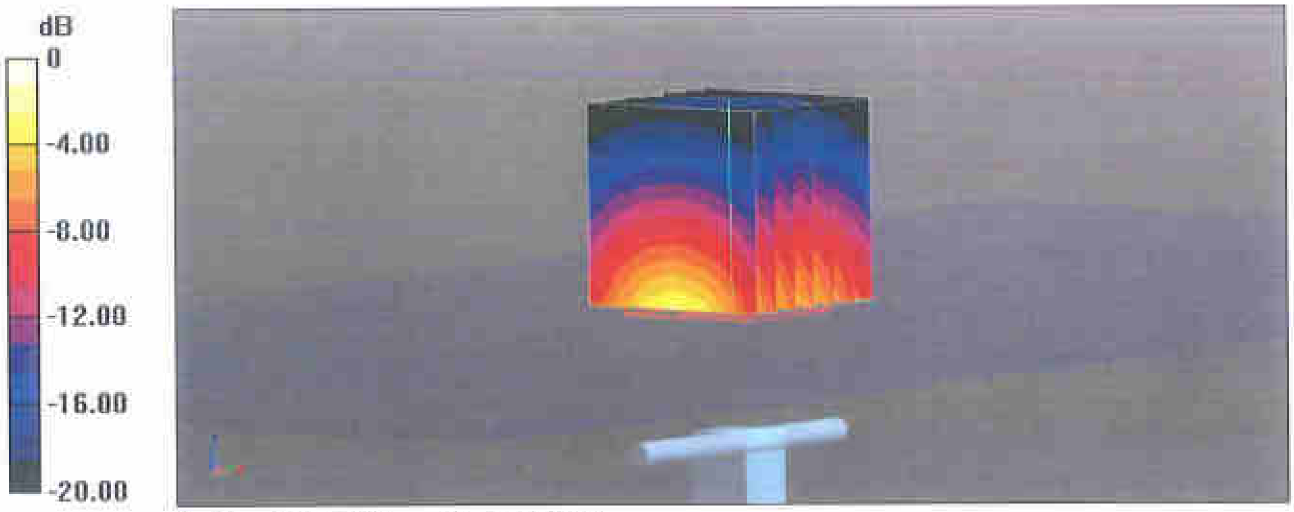
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:924

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

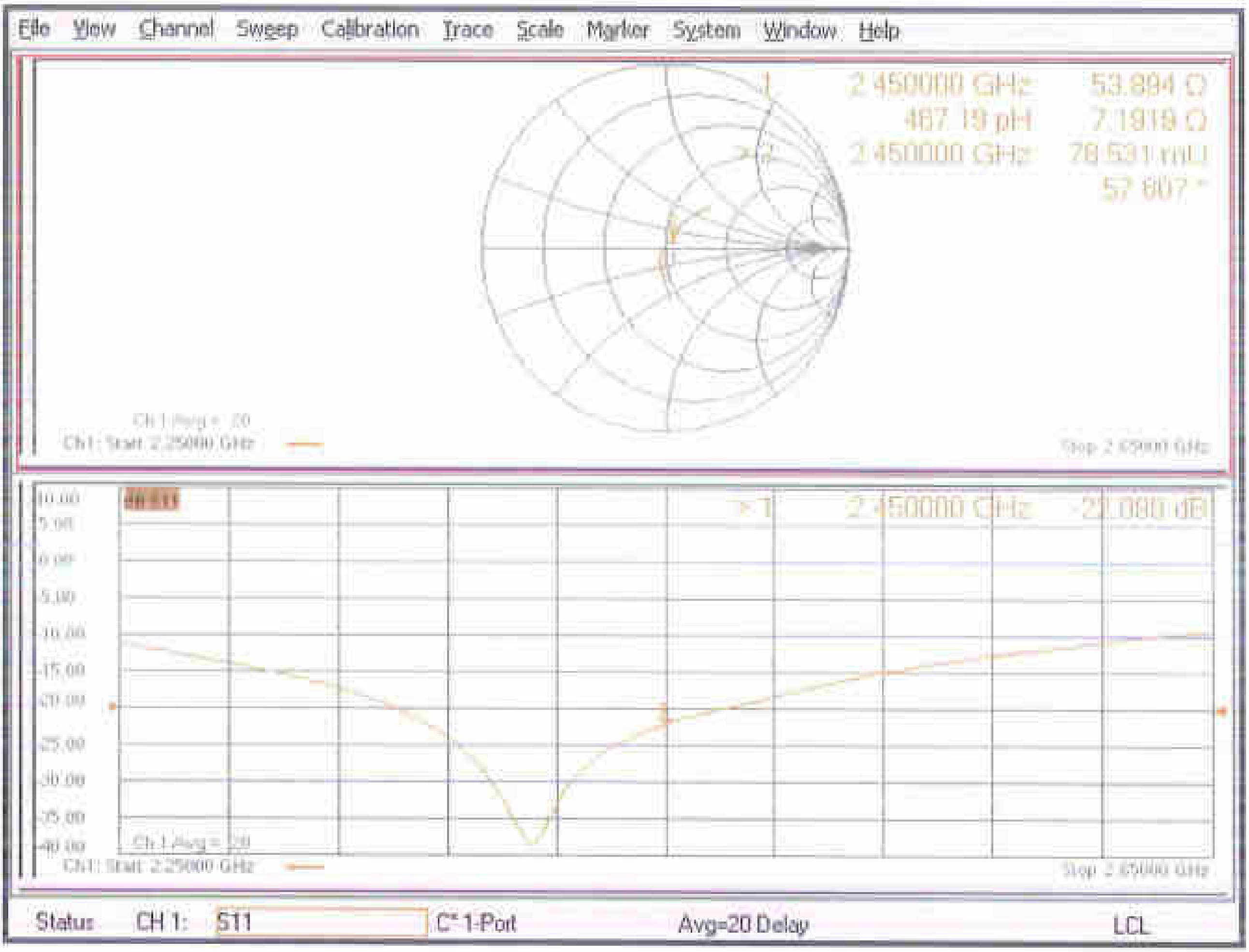
- Probe: EX3DV4 - SN7349; ConvF(7.74, 7.74, 7.74) @ 2450 MHz; Calibrated: 29.06.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.12.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 115.2 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 25.4 W/kg
SAR(1 g) = 13.0 W/kg; SAR(10 g) = 6.04 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 51%
Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

Impedance Measurement Plot for Head TSL



D2450V2, Serial No. 924 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of prior calibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary and the calibration interval can be extended.

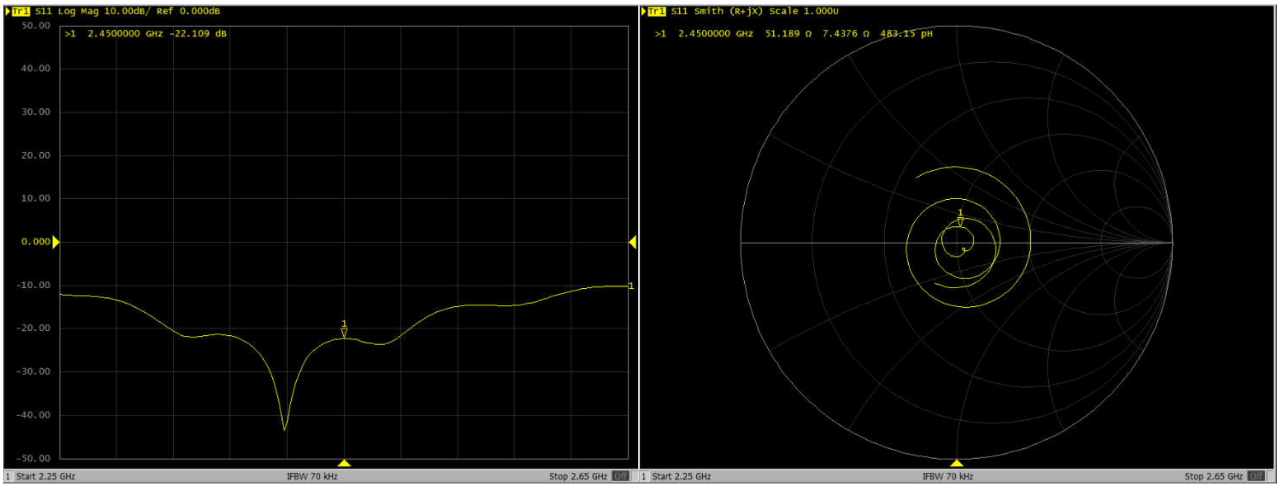
D2450V2 – serial no. 924												
	2450 Head											
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)						
2020.9.2	-22.1		53.9		7.2							
2021.9.1	-22.1	0.0	51.2	2.7	7.4	-0.2						

<Justification of the extended calibration>

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

Dipole Verification Data> D2450V2, serial no. 924

2450MHz – Head----2021.9.1



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

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

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

Accreditation No.: **SCS 0108**

Client **Sporton**

Certificate No: **D5GHzV2-1113_Sep19**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1113
Calibration procedure(s)	QA CAL-22.v4 Calibration Procedure for SAR Validation Sources between 3-6 GHz
Calibration date:	September 24, 2019

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	03-Apr-19 (No. 217-02892/02893)	Apr-20
Power sensor NRP-Z91	SN: 103244	03-Apr-19 (No. 217-02892)	Apr-20
Power sensor NRP-Z91	SN: 103245	03-Apr-19 (No. 217-02893)	Apr-20
Reference 20 dB Attenuator	SN: 5058 (20k)	04-Apr-19 (No. 217-02894)	Apr-20
Type-N mismatch combination	SN: 5047.2 / 06327	04-Apr-19 (No. 217-02895)	Apr-20
Reference Probe EX3DV4	SN: 3503	25-Mar-19 (No. EX3-3503_Mar19)	Mar-20
DAE4	SN: 601	30-Apr-19 (No. DAE4-601_Apr19)	Apr-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Feb-19)	In house check: Oct-20
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-18)	In house check: Oct-20
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-18)	In house check: Oct-20
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-18)	In house check: Oct-19

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

Issued: September 25, 2019

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, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
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	V52.10.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	4.53 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.09 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.33 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.06 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.0 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.30 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	51.7 Ω - 6.2 jΩ
Return Loss	- 24.0 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.0 Ω - 2.7 jΩ
Return Loss	- 24.1 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	56.7 Ω - 1.0 jΩ
Return Loss	- 23.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.195 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

DASY5 Validation Report for Head TSL

Date: 24.09.2019

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1113

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz,
Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; $\sigma = 4.53$ S/m; $\varepsilon_r = 35.1$; $\rho = 1000$ kg/m^3 ,
Medium parameters used: f = 5600 MHz; $\sigma = 4.88$ S/m; $\varepsilon_r = 34.6$; $\rho = 1000$ kg/m^3 ,
Medium parameters used: f = 5750 MHz; $\sigma = 5.03$ S/m; $\varepsilon_r = 34.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.4, 5.4, 5.4) @ 5250 MHz, ConvF(4.95, 4.95, 4.95) @ 5600 MHz, ConvF(4.98, 4.98, 4.98) @ 5750 MHz; Calibrated: 25.03.2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2019
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.2(1504); SEMCAD X 14.6.12(7470)

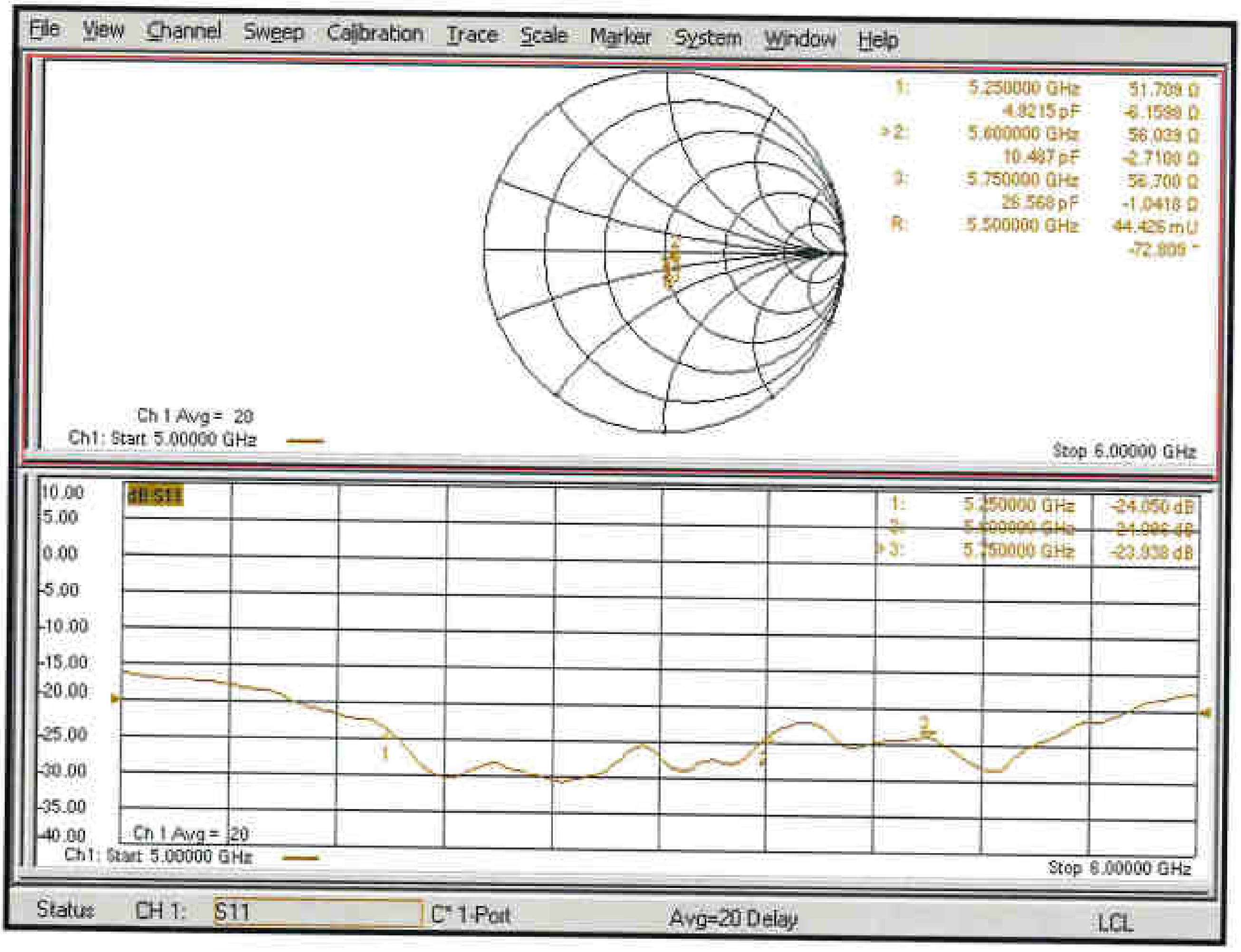
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.54 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.9 W/kg
SAR(1 g) = 8.09 W/kg; SAR(10 g) = 2.33 W/kg
Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 78.00 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.1 W/kg
SAR(1 g) = 8.40 W/kg; SAR(10 g) = 2.40 W/kg
Maximum value of SAR (measured) = 19.4 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.13 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 31.8 W/kg
SAR(1 g) = 8.06 W/kg; SAR(10 g) = 2.30 W/kg
Maximum value of SAR (measured) = 19.0 W/kg

0 dB = 18.1 W/kg = 12.58 dBW/kg

Impedance Measurement Plot for Head TSL



D5GHzV2, Serial No. 1113 Extended Dipole Calibrations

Referring to KDB 865664 D01, if dipoles are verified in return loss (<-20dB, within 20% of priorcalibration), and in impedance (within 5 ohm of prior calibration), the annual calibration is not necessary andthe calibration interval can be extended.

D5GHzV2 – serial no. 1113						
5250 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.9.24	-24.05		51.71		-6.16	
2020.9.23	-24.80	-0.03	50.56	1.15	-5.94	-0.22
2021.9.23	-23.93	0.01	51.89	-0.18	-6.28	0.12

D5GHzV2 – serial no. 1113						
5600 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.9.24	-24.09		56.04		-2.71	
2020.9.23	-23.95	0.01	57.70	-1.66	-2.85	0.14
2021.9.23	-24.99	-0.04	56.04	0.01	-2.69	-0.02

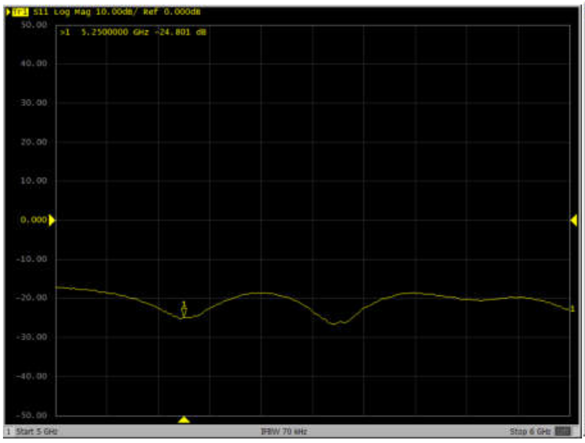
D5GHzV2 – serial no. 1113						
5750 Head						
Date of Measurement	Return-Loss (dB)	Delta (%)	Real Impedance (ohm)	Delta (ohm)	Imaginary Impedance (ohm)	Delta (ohm)
2019.9.24	-23.94		56.70		-1.04	
2020.9.23	-21.92	0.08	58.56	-1.86	-1.58	0.54
2021.9.23	-22.90	0.04	57.64	-0.94	-1.04	0.00

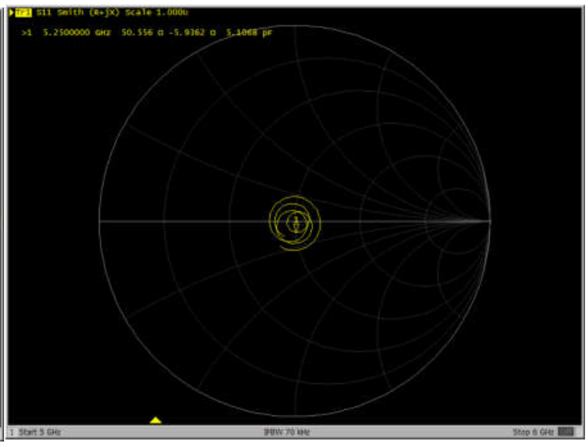
<Justification of the extended calibration>

The return loss is < -20dB, within 20% of prior calibration; the impedance is within 5 ohm of prior calibration. Therefore the verification result should support extended calibration.

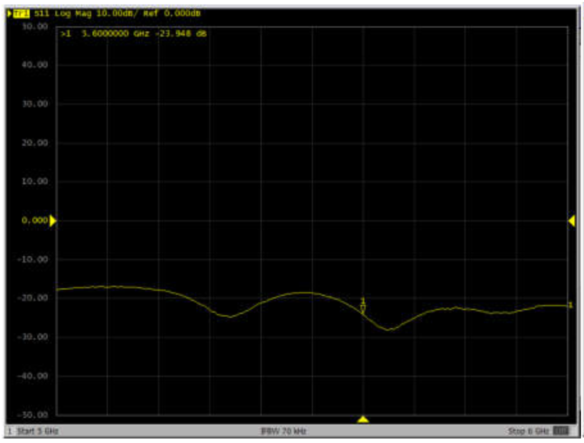
Dipole Verification Data> D5GHzV2, Serial No. 1113

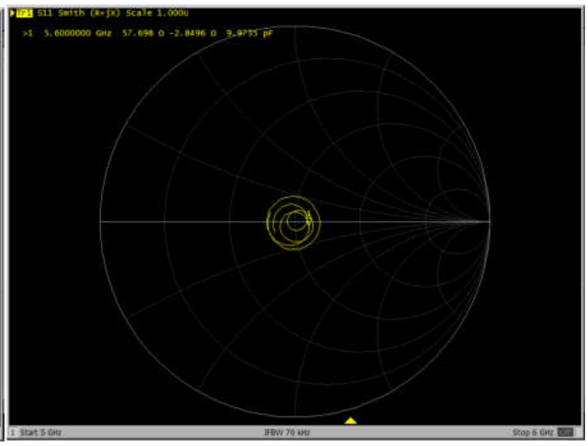
5250MHz – Head----2020. 9. 23



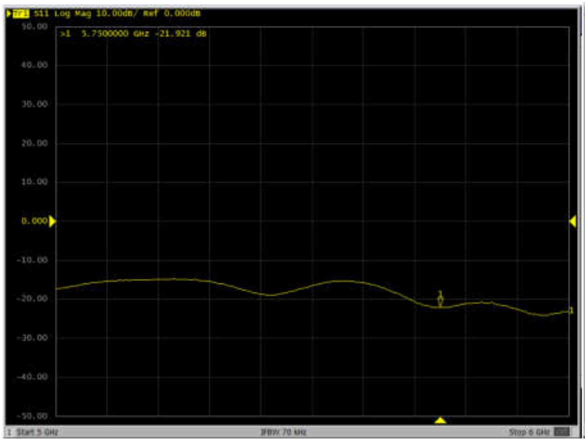


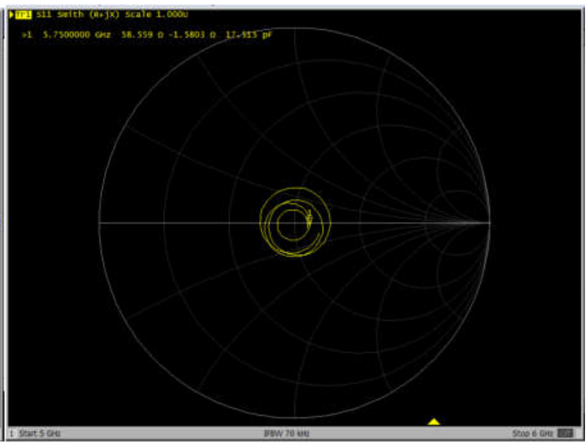
5600MHz – Head----2020. 9. 23





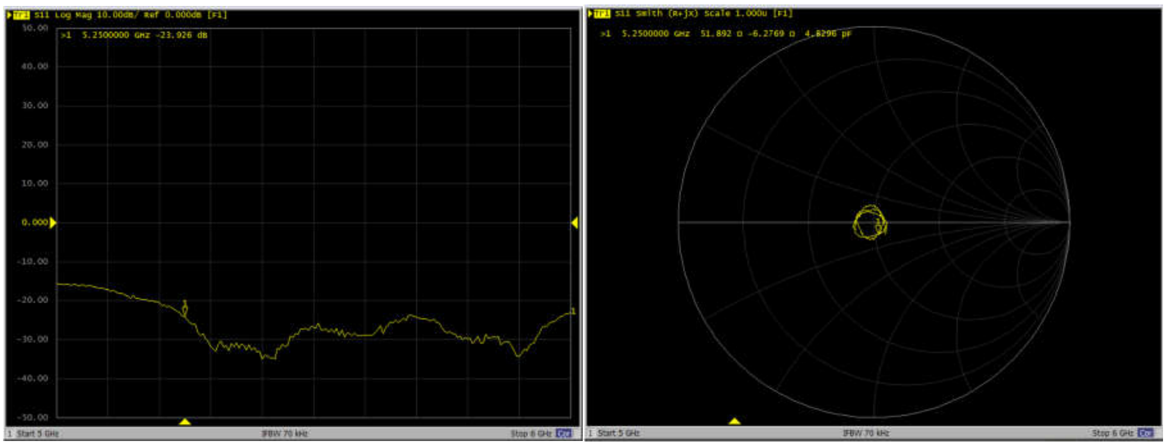
5750MHz – Head----2020. 9. 23



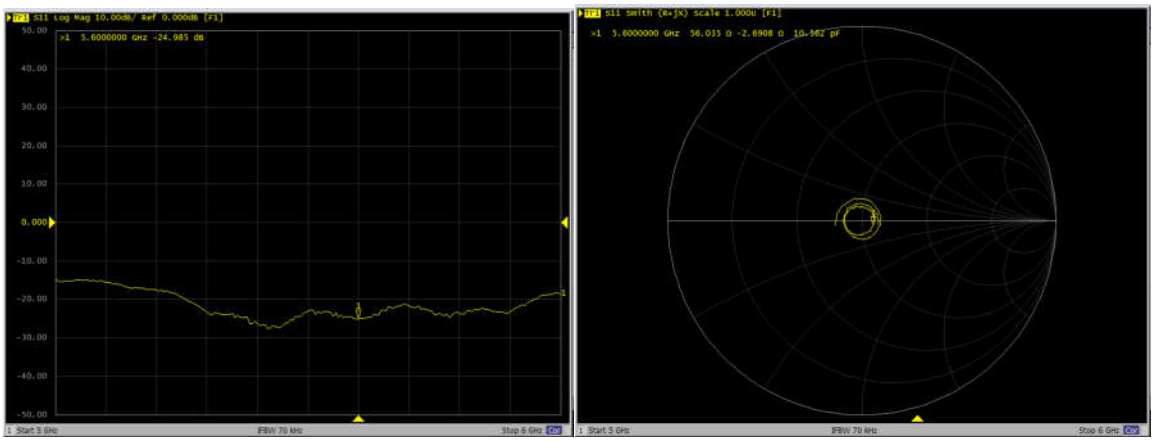


SPORTON INTERNATIONAL (KUNSHAN) INC.
TEL : 86-0512-5790-0158
FAX : 86-0512-5790-0958

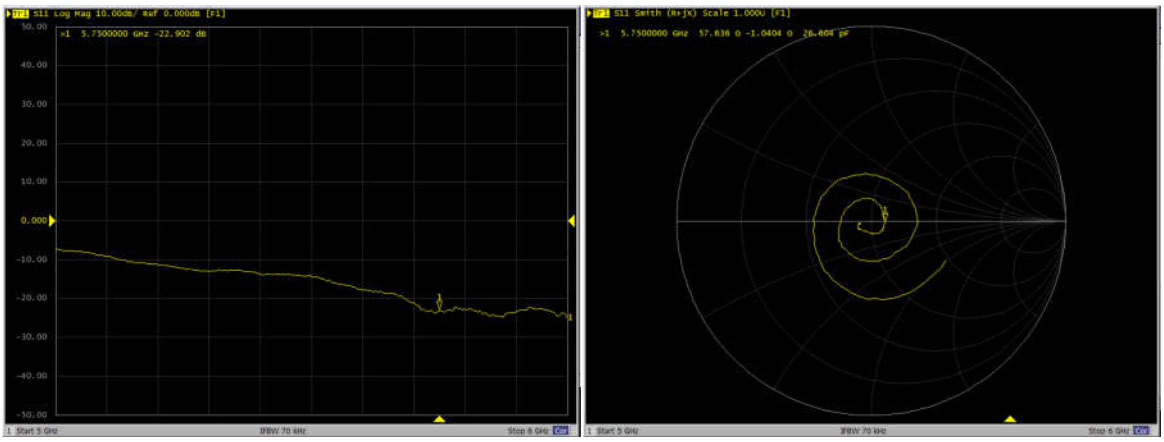
5250MHz – Head----2021. 9. 23



5600MHz – Head----2021. 9. 23



5750MHz – Head----2021. 9. 23



In Collaboration with
s p e a g
CALIBRATION LABORATORY
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

中国认可
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校准
CALIBRATION
CNAS L0570

Client : Sporton

Certificate No: Z21-60491

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 715
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	December 29, 2021

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	15-Jun-21 (CTTL, No.J21X04465)	Jun-22

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

Issued: December 31, 2021

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

Glossary:

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters:

- *DC Voltage Measurement*: Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The report provide only calibration results for DAE, it does not contain other performance test results.

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CALIBRATION LABORATORY
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E-mail: cttl@chinattl.com Http://www.chinattl.cn

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.122 ± 0.15% (k=2)	404.671 ± 0.15% (k=2)	404.495 ± 0.15% (k=2)
Low Range	3.99094 ± 0.7% (k=2)	3.97897 ± 0.7% (k=2)	3.97797 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	330.5° ± 1 °

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 **Sporton**

Certificate No: EX3-7641_Apr22

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:7641
Calibration procedure(s)	QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v6, QA CAL-23.v5, QA CAL-25.v7 Calibration procedure for dosimetric E-field probes
Calibration date:	April 11, 2022

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	04-Apr-22 (No. 217-03525/03524)	Apr-23
Power sensor NRP-Z91	SN: 103244	04-Apr-22 (No. 217-03524)	Apr-23
Power sensor NRP-Z91	SN: 103245	04-Apr-22 (No. 217-03525)	Apr-23
Reference 20 dB Attenuator	SN: CC2552 (20x)	04-Apr-22 (No. 217-03527)	Apr-23
DAE4	SN: 660	13-Oct-21 (No. DAE4-660_Oct21)	Oct-22
Reference Probe ES3DV2	SN: 3013	27-Dec-21 (No. ES3-3013_Dec21)	Dec-22
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-20)	In house check: Jun-22
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-20)	In house check: Jun-22
Network Analyzer E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-22

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Sven Kühn	Deputy Manager	S.K

Issued: April 11, 2022

Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure For The Assessment Of Specific Absorption Rate Of Human Exposure To Radio Frequency Fields From Hand-Held And Body-Worn Wireless Communication Devices - Part 1528: Human Models, Instrumentation And Procedures (Frequency Range of 4 MHz to 10 GHz)", October 2020.
b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).