

# SAR TEST REPORT

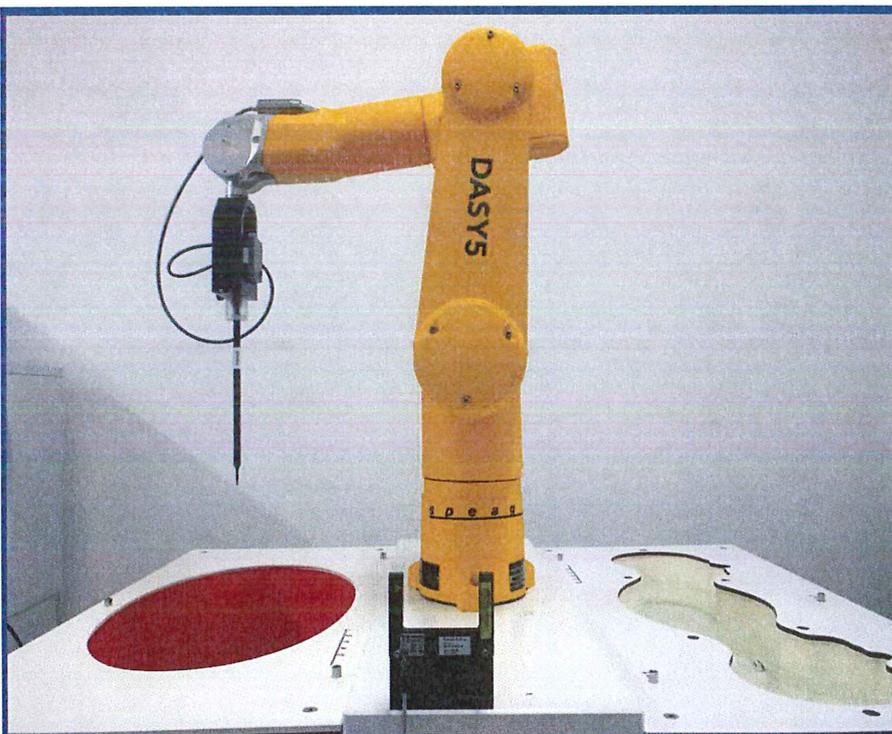
ISSUED BY  
Shenzhen BALUN Technology Co., Ltd.



FOR  
**UHF Mobile RFID Reader**

ISSUED TO  
Megabyte Limited

Units 507, 5/F, Building 12W, No. 12 Science Park West Avenue, Hong Kong Science Park, Shatin, NT Hong Kong



Tested by: Xu Rui  
Xu Rui  
Date Aug. 18, 2021

Approved by: Wei Yanquan  
Wei Yanquan  
(Chief Engineer)  
Date Aug. 18, 2021

Report No.: BL-SZ20C0502-701  
EUT Name: UHF Mobile RFID Reader  
Model Name: MTRAY-F1-MB-BW  
Brand Name: Myndar  
FCC ID: XEK-MTRAYF1MB  
Test Standard: 47 CFR Part 2.1093  
(refer section 3.1)  
Maximum SAR: Body (1 g): 0.399 W/kg  
Extremity (10 g): 0.797 W/kg

Test Conclusion: Pass  
Test Date: Jun. 14, 2021 ~ Jun. 16, 2021  
Date of Issue: Aug. 18, 2021

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### Revision History

<u>Version</u>	<u>Issue Date</u>	<u>Revisions Content</u>
<u>Rev. 01</u>	<u>Aug. 09, 2021</u>	<u>Initial Issue</u>
<u>Rev. 02</u>	<u>Aug. 18, 2021</u>	<u>Added the Extremity (10 g) information on the home page</u> <u>Updated the applicant address</u>

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# 1 GENERAL INFORMATION

## 1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Phone Number	+86 755 6685 0100
Fax Number	+86 755 6182 4271

## 1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1st FL, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.
Description	All measurement facilities used to collect the measurement data are located at Block B, FL 1, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China 518055

## 1.3 Test Environment Condition

Ambient Temperature	21°C to 23°C
Ambient Relative Humidity	36% to 48%
Ambient Pressure	100 KPa to 102 KPa

## 1.4 Announce

- (1) The test report reference to the report template version v2.2.
- (2) The test report is invalid if not marked with the signatures of the persons responsible for preparing and approving the test report.
- (3) The test report is invalid if there is any evidence and/or falsification.
- (4) The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein.
- (5) This document may not be altered or revised in any way unless done so by BALUN and all revisions are duly noted in the revisions section.
- (6) Content of the test report, in part or in full, cannot be used for publicity and/or promotional purposes without prior written approval from the laboratory.
- (7) The laboratory is only responsible for the data released by the laboratory, except for the part provided by the applicant.

## 2 PRODUCT INFORMATION

### 2.1 Applicant Information

Applicant	Megabyte Limited
Address	Units 507, 5/F, Building 12W, No. 12 Science Park West Avenue, Hong Kong Science Park, Shatin, NT Hong Kong

### 2.2 Manufacturer Information

Manufacturer	N/A
Address	N/A

### 2.3 Factory Information

Factory	N/A
Address	N/A

### 2.4 General Description for Equipment under Test (EUT)

EUT Name	UHF Mobile RFID Reader
Model Name Under Test	MTRAY-F1-MB-BW
Series Model Name	N/A
Description of Model Name Differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

### 2.5 Ancillary Equipment

Ancillary Equipment 1	Battery	
	Brand Name	N/A
	Model No.	7847100
	Serial No.	N/A
	Capacitance	5000mAh
	Rated Voltage	3.7 V
	Limit Charge Voltage	5.0 V

## 2.6 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 802.11a, 802.11b, 802.11g, 802.11n U-NII-1/3 RFID
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The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	RFID, WLAN, Bluetooth	
Frequency Range	RFID	902 ~ 928 MHz
	802.11b/g/n(HT20)	2412 ~ 2462 MHz
	802.11a/ n(HT20/HT40)	5150 ~ 5250 MHz
		5725 ~ 5850 MHz
Bluetooth	2402 ~ 2480 MHz	
Antenna Type	RFID	PCB Antenna
	WLAN	PIFA Antenna
	Bluetooth	Chip Antenna
DTM	N/A	
Hotspot Function	N/A	
Power Reduction	N/A	
Exposure Category	General Population/Uncontrolled exposure	
EUT Stage	Portable Device	
Product	Type	
	<input checked="" type="checkbox"/> Production unit	<input type="checkbox"/> Identical prototype

### 3 SUMMARY OF TEST RESULT

#### 3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	ANSI C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
3	IEEE Std. 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
4	FCC KDB 447498 D01 v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
5	FCC KDB 941225 D06 v02r01	SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities
6	FCC KDB 865664 D01 v01r04	SAR Measurement 100 MHz to 6 GHz
7	FCC KDB 865664 D02 v01r02	RF Exposure Reporting
8	KDB 248227 D01 v02r02	SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters

### 3.2 Device Category and SAR Limit

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user.

Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

Table of Exposure Limits:

Body Position	SAR Value (W/Kg)	
	General Population/ Uncontrolled Exposure	Occupational/ Controlled Exposure
Whole-Body SAR (averaged over the entire body)	0.08	0.4
Partial-Body SAR (averaged over any 1 gram of tissue)	1.60	8.0
SAR for hands, wrists, feet and ankles (averaged over any 10 grams of tissue)	4.0	20.0

NOTE:

**General Population/Uncontrolled Exposure:** Locations where there is the exposure of individuals who have no knowledge or control of their exposure. 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.

**Occupational/Controlled Exposure:** Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, 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. This 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.

### 3.3 Test Result Summary

#### 3.3.1 Highest SAR (1 g Value)

Band	Maximum Scaled SAR (W/kg)	Maximum Report SAR (W/kg)
	Body	Body
RFID	0.265	<b>0.399</b>
WIFI 2.4G	<b>0.399</b>	
WIFI 5.2G	0.389	
WIFI 5.8G	0.253	
Limit (W/kg)	1.60	
Verdict	Pass	

#### 3.3.2 Highest Extremity SAR (10 g Value)

Band	Maximum Scaled SAR (W/kg)	Maximum Report SAR (W/kg)
	Extremity 10g	Extremity 10g
RFID	0.285	<b>0.797</b>
WIFI 2.4G	<b>0.797</b>	
WIFI 5.2G	0.411	
WIFI 5.8G	0.269	
Limit (W/kg)	4.0	
Verdict	Pass	

#### 3.3.3 Highest Simultaneous SAR

Position	Simultaneous Configuration	Simultaneous SAR (W/kg)	Limit (W/kg)	Verdict
Body (1g)	RFID + 2.4GWIFI	0.664	1.6	Pass
Extremity (10g)	RFID + 2.4GWIFI	1.082	4.0	Pass

### 3.4 Test Uncertainty

According to KDB 865664 D01, When the highest measured 1 g SAR within a frequency band is  $< 1.5$  W/kg, the extensive SAR measurement uncertainty analysis is not required in SAR reports submitted for equipment approval.

The maximum 1 g SAR for the EUT in this report is 0.399 W/kg, which is lower than 1.5 W/kg, so the extensive SAR measurement uncertainty analysis is not required in this report.

The maximum 10 g SAR for the EUT in this report is 0.797 W/kg, which is lower than 3.75 W/kg, so the extensive SAR measurement uncertainty analysis is not required in this report.

## 4 MEASUREMENT SYSTEM

### 4.1 Specific Absorption Rate (SAR) Definition

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.

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 ( $\rho$ ). The equation description is as below:

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

SAR is expressed in units of Watts per kilogram (W/kg) SAR measurement can be related to the electrical field in the tissue by

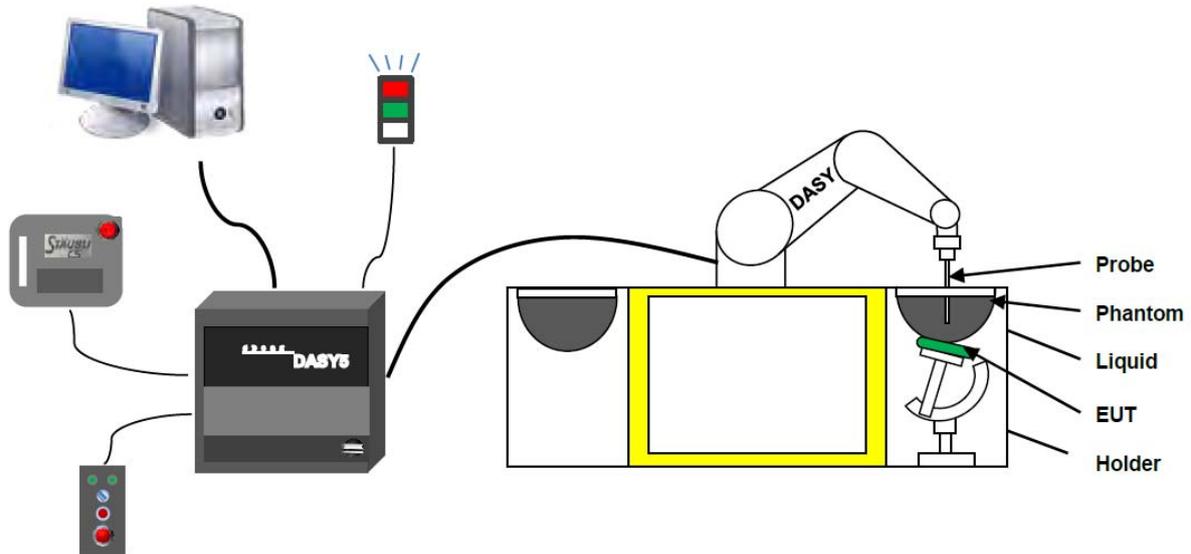
$$\mathbf{SAR} = \frac{\sigma E^2}{\rho}$$

Where:  $\sigma$  is the conductivity of the tissue,

$\rho$  is the mass density of the tissue and  $E$  is the RMS electrical field strength.

## 4.2 DASY SAR System

### 4.2.1 DASY SAR System Diagram



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

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronic (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.
4. A unit to operate the optical surface detector which is connected to the EOC.
5. The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASYS measurement server.
6. The DASYS measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
7. DASYS software and SEMCAD data evaluation software.
8. Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
9. The generic twin phantom enabling the testing of left-hand and right-hand usage.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
12. System validation dipoles allowing to validate the proper functioning of the system.

#### 4.2.2 Robot

The Dasy SAR system uses the high precision robots. Symmetrical design with triangular core Built-in optical fiber for surface detection system For the 6-axis controller system, Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents). The robot series have many features that are important for our application:



- High precision  
(repeatability  $\pm 0.02$  mm)
- High reliability  
(industrial design)
- Low maintenance costs  
(virtually maintenance free due to direct drive gears; no belt drives)
- Jerk-free straight movements  
(brush less synchron motors; no stepper motors)
- Low ELF interference  
(motor control fields shielded via the closed metallic construction shields)

### 4.2.3 E-Field Probe

The probe is specially designed and calibrated for use in liquids with high permittivities for the measurements the Specific Dosimetric E-Field Probe EX3DV4-SN:7510 with following specifications is used.

- Construction Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycoether)
- Calibration ISO/IEC 17025 calibration service available
- Frequency 10 MHz to 6 GHz; Linearity:  $\pm 0.2$  dB (30 MHz to 6 GHz)
- Directivity  $\pm 0.2$  dB in HSL (rotation around probe axis) ;  $\pm 0.4$  dB in HSL (rotation normal to probe axis)
- Dynamic range 5  $\mu$ W/g to > 100 mW/g; Linearity:  $\pm 0.2$  dB
- Dimensions Overall length: 337 mm (Tip: 9 mm) Tip diameter: 2.5 mm (Body: 10 mm) Distance from probe tip to dipole centers: 1.0 mm
- Application General dosimetry up to 3 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms (EX3DV4)



#### E-Field Probe Calibration Process

Probe calibration is realized, in compliance with CENELEC EN 62209-1/-2 and IEEE 1528 std, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the EN 62209-1/2 annexe technique using reference guide at the five frequencies.

#### 4.2.4 Data Acquisition Electronics

The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a 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.



- Input Impedance: 200M Ohm
- The Inputs: Symmetrical and Floating
- Common Mode Rejection: Above 80dB

#### 4.2.5 Phantoms

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.



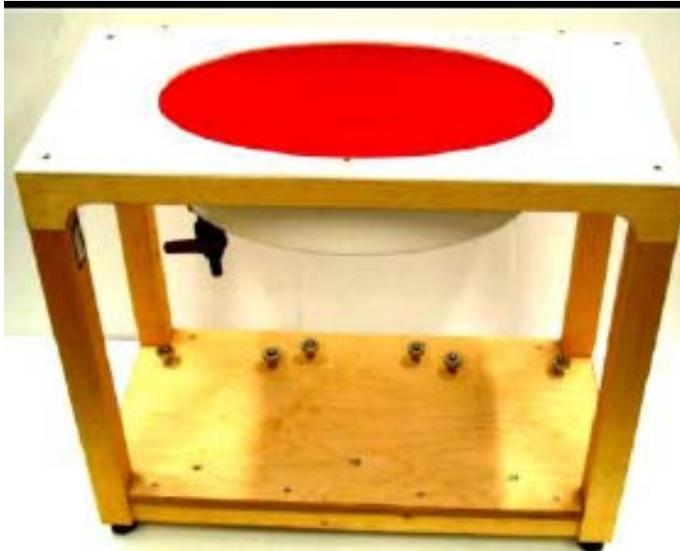
- Left hand
- Right hand
- Flat phantom

Photo of Phantom SN1857



Serial Number	Material	Length	Height
SN 1857 SAM	Vinylester, glass fiber reinforced	1000	500

Phantom 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 the latest draft of the standard IEC 62209 Part II and all known tissue simulating liquids. ELI4 has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points.



·Flat phantom

Photo of Phantom SN1012



Serial Number	Shell Thickness (mm)	Major ellipse axis (mm)	Minor axis ( mm )
SN 1012 ELI4	2.0 ± 0.2	600	500

#### 4.2.6 Device Holder

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of  $65^\circ$ . 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. This device holder is used for standard mobile phones or PDA"s only. If necessary an additional support of polystyrene material is used. Larger DUT"s (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values. Therefore those devices are normally only tested at the flat part of the SAM.



The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than  $1^\circ$ .

### 4.2.7 Simulating Liquid

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5%.



The following table gives the recipes for tissue simulating liquid and the theoretical Conductivity/Permittivity.

Head (Reference IEEE1528)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity $\sigma$ (S/m)	Permittivity $\epsilon$
750	41.1	57.0	0.2	1.4	0.2	0	0.89	41.9
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
900	40.3	57.9	0.2	1.4	0.2	0	0.97	41.5
1800, 1900, 2000	55.2	0	0	0.3	0	44.5	1.4	40.0
2450	55.0	0	0	0.1	0	44.9	1.80	39.2
2600	54.9	0	0	0.1	0	45.0	1.96	39.0
Frequency (MHz)	Water (%)	Hexyl Carbitol (%)			Triton X-100 (%)		Conductivity $\sigma$ (S/m)	Permittivity $\epsilon$
5200	62.52	17.24			17.24		4.66	36.0
5800	62.52	17.24			17.24		5.27	35.3
Body (From instrument manufacturer)								
Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity $\sigma$ (S/m)	Permittivity $\epsilon$
750	51.7	47.2	0	0.9	0.1	0	0.96	55.5
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
900	50.8	48.2	0	0.9	0.1	0	1.05	55.0
1800, 1900, 2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0.1	0	31.3	1.95	52.7
2600	68.2	0	0	0.1	0	31.7	2.16	52.5
Frequency(MHz)	Water	DGBE (%)			Salt (%)		Conductivity $\sigma$ (S/m)	Permittivity $\epsilon$
5200	78.60	21.40			/		5.54	47.86
5800	78.50	21.40			0.1		6.0	48.20

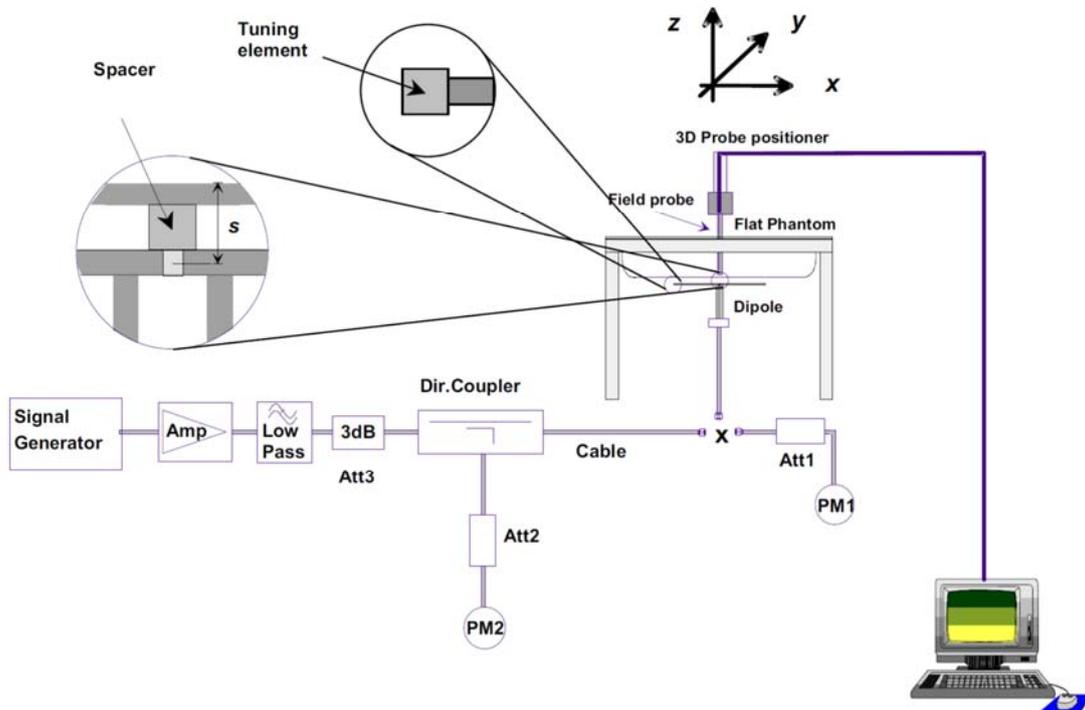
## 5 SYSTEM VERIFICATION

### 5.1 Purpose of System Check

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

### 5.2 System Check Setup

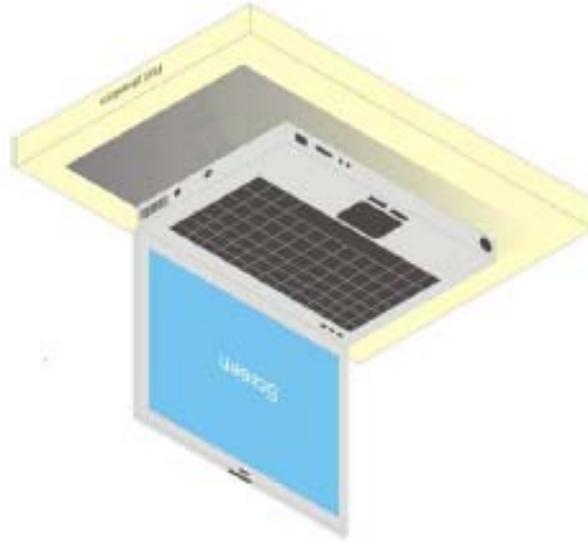
In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave that comes from a signal generator. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder.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



## 6 TEST POSITION CONFIGURATIONS

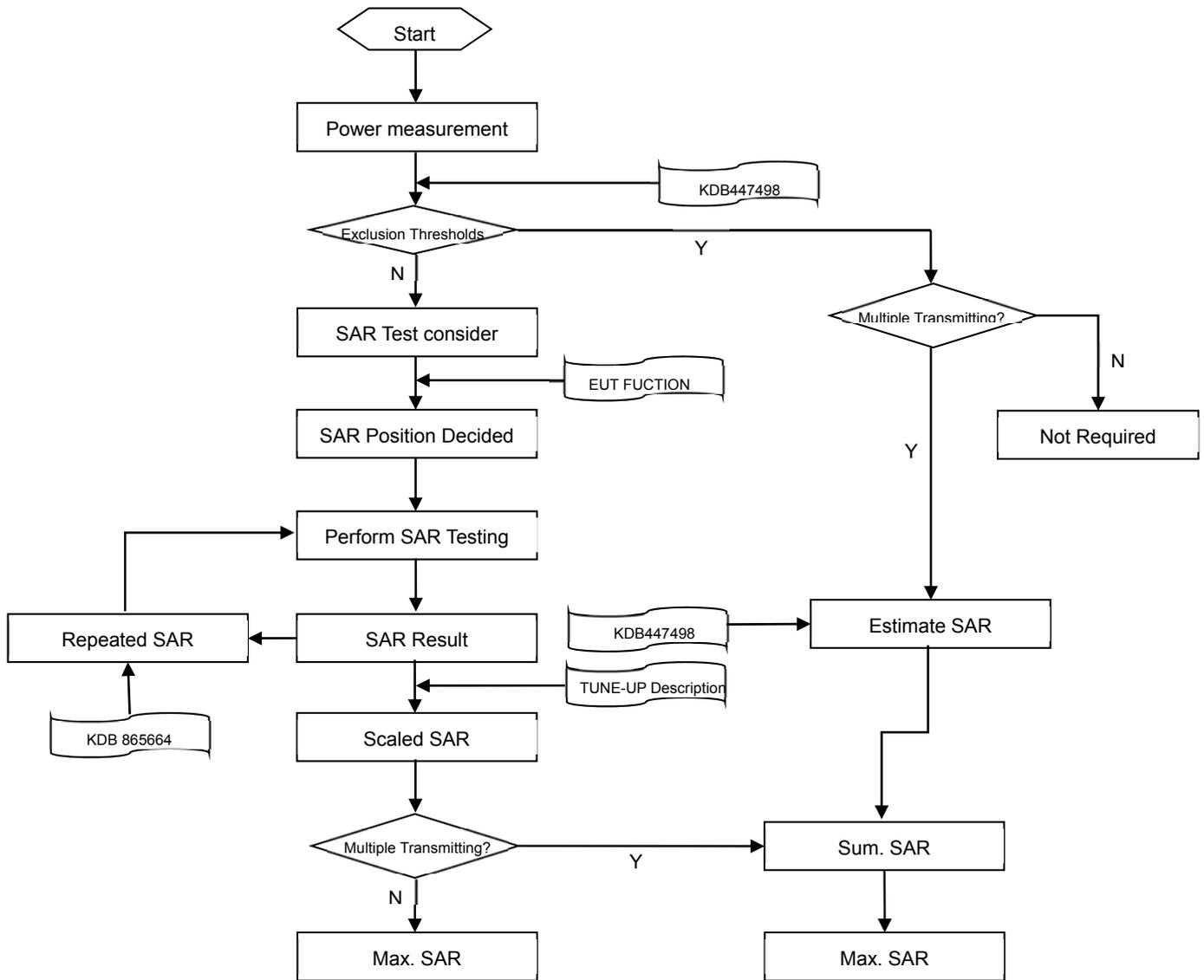
This DUT was tested in one position which is bottom of laptop touching with phantom 0 mm air gap.

### 6.1 Body Supported Exposure Condition



## 7 MEASUREMENT PROCEDURE

### 7.1 Measurement Process Diagram



## 7.2 SAR Scan General Requirement

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

		≤3GHz	>3GHz	
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface		5±1 mm	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5$ mm	
Maximum probe angle from probe axis to phantom surface normal at the measurement location		30°±1°	20°±1°	
Maximum area scan spatial resolution: $\Delta x$ Area , $\Delta y$ Area		≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3–4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm	
		When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.		
Maximum zoom scan spatial resolution: $\Delta x$ Zoom , $\Delta y$ Zoom		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3–4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*	
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z$ Zoom (n)	≤ 5 mm	3–4 GHz: ≤ 4 mm	
			4–5 GHz: ≤ 3 mm	
	graded grid	$\Delta z$ Zoom (1): between 1st two points closest to phantom surface  $\Delta z$ Zoom (n>1): between subsequent points	≤ 4 mm	3–4 GHz: ≤ 3 mm 4–5 GHz: ≤ 2.5 mm 5–6 GHz: ≤ 2 mm
			≤ 1.5· $\Delta z$ Zoom (n-1)	
Minimum zoom scan volume	x, y, z	≥30 mm	3–4 GHz: ≥ 28 mm	
			4–5 GHz: ≥ 25 mm	
			5–6 GHz: ≥ 22 mm	
<b>Note:</b> 1. $\delta$ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. 2. * When zoom scan is required and the reported SAR from the area scan based 1 g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.				

### 7.3 Measurement Procedure

The following steps are used for each test position

- a. Establish a call with the maximum output power with a base station simulator. The connection between the mobile and the base station simulator is established via air interface
- b. Measurement of the local E-field value at a fixed location. This value serves as a reference value for calculating a possible power drift.
- c. Measurement of the SAR distribution with a grid of 8 to 16mm \* 8 to 16 mm and a constant distance to the inner surface of the phantom. Since the sensors cannot directly measure at the inner phantom surface, the values between the sensors and the inner phantom surface are extrapolated. With these values the area of the maximum SAR is calculated by an interpolation scheme.
- d. Around this point, a cube of 30 \* 30 \* 30 mm or 32 \* 32 \* 32 mm is assessed by measuring 5 or 8 \* 5 or 8\*4 or 5 mm. With these data, the peak spatial-average SAR value can be calculated.

### 7.4 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

When the 1 g SAR of the highest peak is within 2 dB of the SAR limit, additional zoom scans are required for other peaks within 2 dB of the highest peak that have not been included in any zoom scan to ensure there is no increase in SAR.

## 8 CONDUCTED RF OUTPUT POWER

### 8.1 RFID

Mode	RFID		
Channel	Low	Middle	High
Frequency (MHz)	902.0	915.0	927.5
Conducted Power (dBm)	19.59	<b>19.60</b>	19.56
Tune-Up Limit (dBm)	20.00		

## 8.2 WIFI

### 8.2.1 2.4G WIFI

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
2.4 (2.4~2.4835)	802.11b	1	2412	<b>14.68</b>	15.00	Yes
		6	2437	14.63	15.00	No
		11	2462	14.53	15.00	No
	802.11g	1	2412	12.06	13.00	No
		6	2437	11.95	13.00	No
		11	2462	11.87	13.00	No
	802.11n(HT20)	1	2412	12.71	13.00	No
		6	2437	12.65	13.00	No
		11	2462	11.55	13.00	No

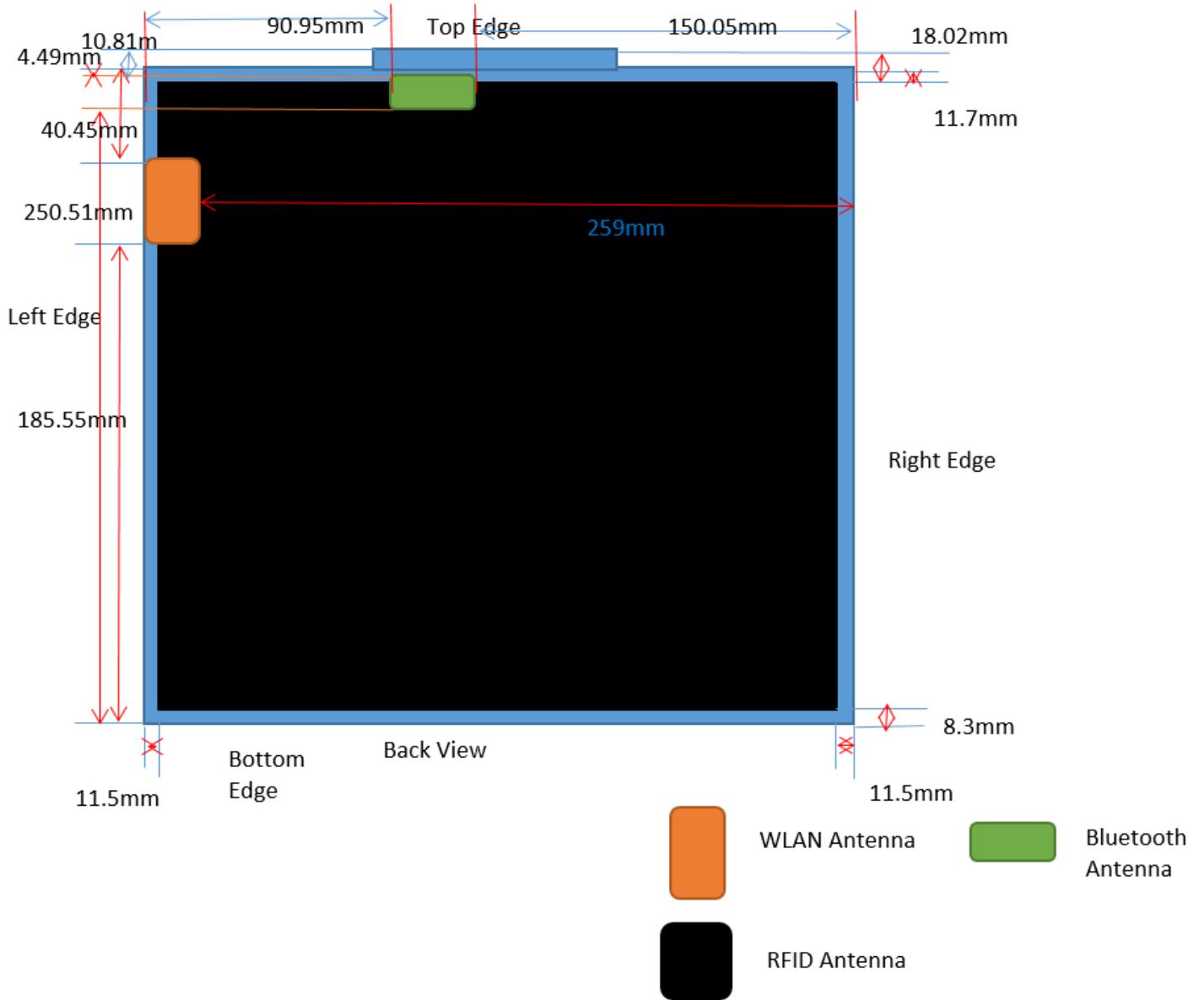
### 8.2.2 5G WIFI

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	12.39	13.00	No
		44	5220	<b>12.45</b>	13.00	Yes
		48	5240	12.39	13.00	No
	802.11n(HT20)	36	5180	12.63	13.00	No
		44	5220	12.57	13.00	No
		48	5240	12.42	13.00	No
	802.11n(HT40)	38	5190	11.13	12.00	No
46		5230	11.09	12.00	No	
5.8 (5.725~5.850)	802.11a	149	5745	12.74	13.00	No
		157	5785	12.48	13.00	No
		165	5825	12.12	13.00	No
	802.11n(HT20)	149	5745	12.39	13.00	No
		157	5785	12.07	13.00	No
		165	5825	11.88	13.00	No
	802.11n(HT40)	151	5755	<b>12.35</b>	13.00	Yes
159		5795	12.11	13.00	No	

### 8.3 Bluetooth

Mode	GFSK			$\pi/4$ -DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Conducted Power (dBm)	3.88	6.89	8.30	1.99	5.34	7.08
Tune-Up Limit (dBm)	4.00	7.00	8.50	2.50	5.50	7.50
Mode	8-DPSK			BLE		
Channel	0	39	78	0	19	39
Frequency (MHz)	2402	2441	2480	2402	2440	2480
Conducted Power (dBm)	2.40	5.73	7.32	4.59	7.87	<b>9.32</b>
Tune-Up Limit (dBm)	2.50	6.00	7.50	5.00	8.00	9.50

## 9 TEST EXCLUSION CONSIDERATION



## 9.1 SAR Test Exclusion Consideration Table

According with FCC KDB 447498 D01, Appendix A, <SAR Test Exclusion Thresholds for 100 MHz - 6 GHz and ≤ 50 mm> Table, this Device SAR test configurations consider as following :

Band	Mode	Max. Peak Power		Test Position Configurations					
		dBm	mW	Head	Front/Back	Left Edge	Right Edge	Top Edge	Bottom Edge
RFID	Distance to User		<5mm	<5mm	<5mm	<5mm	<5mm	<5mm	<5mm
	/	20.00	100.00	Yes	Yes	Yes	Yes	Yes	Yes
WLAN 2.4 G	Distance to User		<5mm	<5mm	<5mm	259mm	40.45 mm	185.55 mm	
	802.11b	15.00	31.62	Yes	Yes	Yes	No	No	No
	802.11g	13.00	19.95	Yes	Yes	Yes	No	No	No
	802.11n(HT20)	13.00	19.95	Yes	Yes	Yes	No	No	No
WLAN 5.2 G	Distance to User		<5mm	<5mm	<5mm	259mm	40.45 mm	185.55 mm	
	802.11a	13.00	19.95	Yes	Yes	Yes	No	No	No
	802.11n(HT20)	13.00	19.95	Yes	Yes	Yes	No	No	No
	802.11n(HT40)	12.00	15.85	Yes	Yes	Yes	No	No	No
WLAN 5.8 G	Distance to User		<5mm	<5mm	<5mm	259mm	40.45 mm	185.55 mm	
	802.11a	13.00	19.95	Yes	Yes	Yes	No	No	No
	802.11n(HT20)	13.00	19.95	Yes	Yes	Yes	No	No	No
	802.11n(HT40)	13.00	19.95	Yes	Yes	Yes	No	No	No
Bluetooth	Distance to User		<5mm	<5mm	90.95 mm	150.05 mm	<5mm	250.51 mm	
	BR/EDR	8.50	7.08	No	No	No	No	No	No
	BLE	9.50	8.91	No	No	No	No	No	No

Note:

- Maximum power is the source-based time-average power and represents the maximum RF output power including tune-up tolerance among production units
- Per KDB 447498 D01, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
- Per KDB 447498 D01, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
- Per KDB 447498 D01, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:
 
$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR}$$
  - 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
  - For < 50 mm distance, we just calculate mW of the exclusion threshold value (3.0) to do compare. This formula is  $[3.0] / [\sqrt{f(\text{GHz})}] \cdot [(\text{min. test separation distance, mm})] = \text{exclusion threshold of mW.}$
- Per KDB 447498 D01, 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.  $[\text{Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot (f(\text{MHz})/150)] \text{ mW}$ , at 100 MHz to 1500 MHz
  - b.  $[\text{Threshold at 50 mm in step 1}) + (\text{test separation distance} - 50 \text{ mm}) \cdot 10] \text{ mW}$  at  $> 1500 \text{ MHz}$  and  $\leq 6 \text{ GHz}$
6. Per KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions.
- a. When KDB Publication 447498 D01 SAR test exclusion applies to the OFDM configuration.
  - b. When the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is  $\leq 1.2 \text{ W/kg}$ .
7. Per KDB 248227 D01 SAR is not required for the following U-NII-1 and U-NII-2A bands conditions.
- a. When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is  $\leq 1.2 \text{ W/kg}$ , SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.
  - b. When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is  $\leq 1.2 \text{ W/kg}$ , SAR is not required for the band with lower maximum output power in that test configuration; otherwise, each band is tested independently for SAR.

# 10 TEST RESULT

## 10.1 RFID

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
<b>Body</b>													
RFID	Front Side	10	Mid	915.0	0.02	0.108	44.74	2.235	19.60	20.0	1.097	<b>0.265</b>	1#
	Back Side	10	Mid	915.0	0.14	0.023	44.74	2.235	19.60	20.0	1.097	0.056	/
	Left Edge	10	Mid	915.0	0.05	0.015	44.74	2.235	19.60	20.0	1.097	0.037	/
	Right Edge	10	Mid	915.0	-0.14	0.011	44.74	2.235	19.60	20.0	1.097	0.027	/
	Top Edge	10	Mid	915.0	0.03	0.014	44.74	2.235	19.60	20.0	1.097	0.034	/
	Bottom Edge	10	Mid	915.0	-0.08	0.012	44.74	2.235	19.60	20.0	1.097	0.029	/

Note: Refer to ANNEX C for the detailed test data for each test configuration.

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	10g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	10g Scaled SAR (W/kg)	Meas. No.
<b>Extremity</b>													
RFID	Front Side	0	Mid	915.0	-0.04	0.116	44.74	2.235	19.60	20.0	1.097	<b>0.285</b>	2#
	Back Side	0	Mid	915.0	-0.14	0.033	44.74	2.235	19.60	20.0	1.097	0.081	/
	Left Edge	0	Mid	915.0	-0.12	0.022	44.74	2.235	19.60	20.0	1.097	0.054	/
	Right Edge	0	Mid	915.0	0.03	0.017	44.74	2.235	19.60	20.0	1.097	0.042	/
	Top Edge	0	Mid	915.0	0.08	0.020	44.74	2.235	19.60	20.0	1.097	0.049	/
	Bottom Edge	0	Mid	915.0	-0.16	0.017	44.74	2.235	19.60	20.0	1.097	0.042	/

Note: Refer to ANNEX C for the detailed test data for each test configuration.

### 10.22.4G WIFI

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
<b>Body</b>													
802.11b	Front Side	10	1	2412.0	-0.15	0.059	99.62	1.004	14.68	15.0	1.076	0.064	/
	Back Side	10	1	2412.0	-0.05	0.022	99.62	1.004	14.68	15.0	1.076	0.024	/
	Left Edge	10	1	2412.0	-0.16	0.369	99.62	1.004	14.68	15.0	1.076	<b>0.399</b>	3#
Note: Refer to ANNEX C for the detailed test data for each test configuration.													

Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	10g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	10g Scaled SAR (W/kg)	Meas. No.
<b>Extremity</b>													
802.11b	Front Side	0	1	2412.0	0.07	0.085	99.62	1.004	14.68	15.0	1.076	0.092	/
	Back Side	0	1	2412.0	0.07	0.047	99.62	1.004	14.68	15.0	1.076	0.051	/
	Left Edge	0	1	2412.0	-0.02	0.737	99.62	1.004	14.68	15.0	1.076	<b>0.797</b>	4#
Note: Refer to ANNEX C for the detailed test data for each test configuration.													

### 10.35.2G WIFI

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
<b>Body</b>														
5.2G	802.11a	Front Side	10	44	5220.0	0.00	0.044	92.46	1.082	12.45	13.0	1.135	0.054	/
		Back Side	10	44	5220.0	-0.16	0.021	92.46	1.082	12.45	13.0	1.135	0.026	/
		Left Edge	10	44	5220.0	-0.05	0.317	92.46	1.082	12.45	13.0	1.135	<b>0.389</b>	5#
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	10g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	10g Scaled SAR (W/kg)	Meas. No.
<b>Extremity</b>														
5.2G	802.11a	Front Side	0	44	5220.0	0.07	0.071	92.46	1.082	12.45	13.0	1.135	0.087	/
		Back Side	0	44	5220.0	-0.07	0.039	92.46	1.082	12.45	13.0	1.135	0.048	/
		Left Edge	0	44	5220.0	0.12	0.335	92.46	1.082	12.45	13.0	1.135	<b>0.411</b>	6#
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

**10.45.8G WIFI**

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	1g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
<b>Body</b>														
5.8G	802.11n40	Front Side	10	151	5755.0	-0.02	0.071	98.52	1.015	12.35	13.0	1.161	0.084	/
		Back Side	10	151	5755.0	-0.04	0.033	98.52	1.015	12.35	13.0	1.161	0.039	/
		Left Edge	10	151	5755.0	0.12	0.215	98.52	1.015	12.35	13.0	1.161	<b>0.253</b>	<b>7#</b>
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

Fre. Band	Mode	Position	Dist. (mm)	Ch.	Freq. (MHz)	Power Drift (dB)	10g Meas SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Tune-up Power (dBm)	Meas. Power (dBm)	Scaling Factor	10g Scaled SAR (W/kg)	Meas. No.
<b>Extremity</b>														
5.8G	802.11n40	Front Side	0	151	5755.0	-0.02	0.044	98.52	1.015	12.35	13.0	1.161	0.052	/
		Back Side	0	151	5755.0	0.01	0.025	98.52	1.015	12.35	13.0	1.161	0.029	/
		Left Edge	0	151	5755.0	-0.13	0.228	98.52	1.015	12.35	13.0	1.161	<b>0.269</b>	<b>8#</b>
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

## 11 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are  $\leq 1.45$  W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is  $\leq 1.10$ , the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR repeated measurement procedure:

1. When the highest measured SAR is  $< 0.80$  W/kg, repeated measurement is not required.
2. When the highest measured SAR is  $\geq 0.80$  W/kg, repeat that measurement once.
3. If the ratio of largest to smallest SAR for the original and first repeated measurements is  $> 1.20$ , or when the original or repeated measurement is  $\geq 1.45$  W/kg, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is  $> 1.20$ , and the original, first or second repeated measurement is  $\geq 1.5$  W/kg, perform a third repeated measurement.

Note 1: For 1g SAR, the highest measured 1g SAR is  $0.369 < 0.80$  W/kg, repeated measurement is not required.

Note 2: For 10g SAR, the highest measured 10g SAR is  $0.737 < 2.0$  W/kg, repeated measurement is not required.

## 12 SIMULTANEOUS TRANSMISSION

Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna. When the sum of SAR 1g of all simultaneously transmitting antennas in an operating mode and exposure condition combination is within the SAR limit (SAR 1g 1.6 W/kg), the simultaneous transmission SAR is not required. When the sum of SAR 1g is greater than the SAR limit (SAR 1g 1.6 W/kg), SAR test exclusion is determined by the SAR to Peak Location Ratio (SPLSR).

### 12.1 Simultaneous Transmission Mode Consider

No.	Simultaneous Tx Combination	Body	Extremity
1	RFID + 2.4G WIFI	Yes	Yes
2	RFID + 5.2G WIFI	Yes	Yes
3	RFID + 5.8G WIFI	Yes	Yes

Note: 2.4G WLAN can't transmit simultaneously with Bluetooth or 5G WLAN.

## 12.2 Estimated SAR Calculation

According to KDB 447498 D01, when standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR was estimated according to following formula to result in substantially conservative SAR values of  $\leq 0.4$  W/kg to determine simultaneous transmission SAR test exclusion.

$$\text{Estimated SAR} = \frac{\text{Max. Tune Up Power (mw)}}{\text{Min Test Separation Distance}} * \frac{\sqrt{f_{\text{GHz}}}}{x} \quad (\text{where } x = 7.5 \text{ for 1-g SAR})$$

If the minimum test separation distance is  $< 5$  mm, a distance of 5 mm is used for estimated SAR calculation. When the test separation distance is  $> 50$  mm, the 0.4 W/kg is used for SAR-1g.

Band	Mode	Position	Antenna To user (mm)	SAR Testing	Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Frequency (GHz)	Calculation Distance/Gap (mm)	Estimated SAR (W/kg)
Bluetooth	GFSK	Front Side	5	NO	9.50	8.91	2480	5	0.374
		Back Side	5	NO	9.50	8.91	2480	5	0.374
		Left Edge	5	NO	9.50	8.91	2480	5	0.374
		Top Edge	5	NO	9.50	8.91	2480	5	0.374

## 12.3 Sum SAR of Simultaneous Transmission

### 12.3.1 Body Simultaneous Transmission SAR Evaluation for RFID with WLAN

Stand alone SAR				SUM SAR		
1	2	3	5			
RFID	2.4GWIFI	5.2GWIFI	5.8GWIFI	Sum SAR (1+2)	Sum SAR (1+3)	Sum SAR (1+4)
0.265	0.399	0.389	0.253	<b>0.664</b>	0.654	0.518

Note:

- 1: Only the worst simultaneous transmission combinations among all positions was shown in this table.
- 2: The highest Summed 1g SAR is 0.664 W/Kg < 1.6 W/kg, so Simultaneous Transmission SAR test is not required.

### 12.3.2 Extremity Simultaneous Transmission SAR Evaluation for RFID with WLAN

Stand alone SAR				SUM SAR		
1	2	3	5			
RFID	2.4GWIFI	5.2GWIFI	5.8GWIFI	Sum SAR (1+2)	Sum SAR (1+3)	Sum SAR (1+4)
0.285	0.797	0.411	0.269	<b>1.082</b>	0.696	0.554

Note:

- 1: Only the worst simultaneous transmission combinations among all positions was shown in this table.
- 2: The highest Summed 10g SAR is 1.082 W/Kg < 4.0 W/kg, so Simultaneous Transmission SAR test is not required.

## 13 TEST EQUIPMENTS LIST

Description	Manufacturer	Model	Serial No./Version	Cal. Date	Cal. Due
PC	Dell	N/A	N/A	N/A	N/A
Test Software	Speag	DASY5	52.8.8.1222	N/A	N/A
835MHz Validation Dipole	Speag	D835V2	SN: 4d187	2021/05/17	2024/05/16
2450MHz Validation Dipole	Speag	D2450V2	SN: 952	2021/05/19	2024/05/18
5GHz Validation Dipole	Speag	D5GHzV2	SN: 1200	2021/05/18	2024/05/17
E-Field Probe	Speag	EX3DV4	SN: 7510	2020/11/30	2021/11/29
Data Acquisition Electronics	Speag	DAE4	SN: 1454	2020/11/06	2021/11/05
Signal Generator	R&S	SMB100A	182396	2020/12/21	2021/12/20
Power Meter	R&S	NRVD-B2	7250BJ-0112/2011	2020/09/25	2021/09/24
Power Sensor	R&S	NRV-Z4	100381	2020/09/25	2021/09/24
Power Sensor	R&S	NRV-Z2	100211	2020/09/25	2021/09/24
Network Analyzer	Agilent	E5071B	MY42404001	2021/04/01	2022/03/31
Thermometer	Elitech	RC-4HC	EF720B004820	2020/12/24	2021/12/23
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Dielectric Probe Kit	SATIMO	SCLMP	SN 25/13 OCPG56	N/A	N/A
Phantom1	Speag	SAM	SN: 1859	N/A	N/A
Phantom2	Speag	ELI4	SN: 1012	N/A	N/A
Attenuator	COM-MW	ZA-S1-31	1305003187	N/A	N/A
Directional coupler	AA-MCS	AAMCS-UDC	000272	N/A	N/A

Note: For dipole antennas, BALUN has adopted 3 years as calibration intervals, and on annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss in within 20% of calibrated measurement.
4. Impedance (real or imaginary parts) in within 5 Ohms of calibrated measurement.

## ANNEX A SIMULATING LIQUID VERIFICATION RESULT

The dielectric parameters of the liquids were verified prior to the SAR evaluation using an SCLMP Dielectric Probe Kit.

Head Liquid

Date	Liquid Type	Fre. (MHz)	Temp. (°C)	Meas. Conductivity ( $\sigma$ ) (S/m)	Meas. Permittivity ( $\epsilon$ )	Target Conductivity ( $\sigma$ ) (S/m)	Target Permittivity ( $\epsilon$ )	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2021.06.16	Head	835	21.4	0.92	42.71	0.90	41.50	2.22	2.92
2021.06.16	Head	2450	21.4	1.84	39.93	1.80	39.20	2.22	1.86
2021.06.15	Head	5250	21.3	4.69	36.06	4.71	35.93	-0.42	0.36
2021.06.14	Head	5750	21.2	5.32	36.40	5.22	35.36	1.92	2.94

Note: The tolerance limit of Conductivity and Permittivity is  $\pm 5\%$ .

## ANNEX B SYSTEM CHECK RESULT

Comparing to the original SAR value provided by SPEAG, the validation data should be within its specification of 10 %(for 1 g).

Head liquid 1g

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)
2021.06.16	Head	835	100	0.902	9.02	9.76	-7.58
2021.06.16	Head	2450	100	4.810	48.10	53.00	-9.25
2021.06.15	Head	5250	100	7.580	75.80	77.80	-2.57
2021.06.14	Head	5750	100	8.170	81.70	77.20	5.83

Note: The tolerance limit of System validation  $\pm 10\%$ .

Head liquid 10g

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)
2021.06.16	Head	835	100	0.599	5.99	6.34	-5.52
2021.06.16	Head	2450	100	2.280	22.80	24.10	-5.39
2021.06.15	Head	5250	100	2.110	21.10	22.10	-4.52
2021.06.14	Head	5750	100	2.160	21.60	21.70	-0.46

# System Performance Check Data (835MHz)

Date: 2021.06.16

Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.916 \text{ S/m}$ ;  $\epsilon_r = 42.71$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature: 22.6 Liquid Temperature: 21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(9.94, 9.94, 9.94); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW835 Head 100mw/Area Scan (61x121x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.974 W/kg

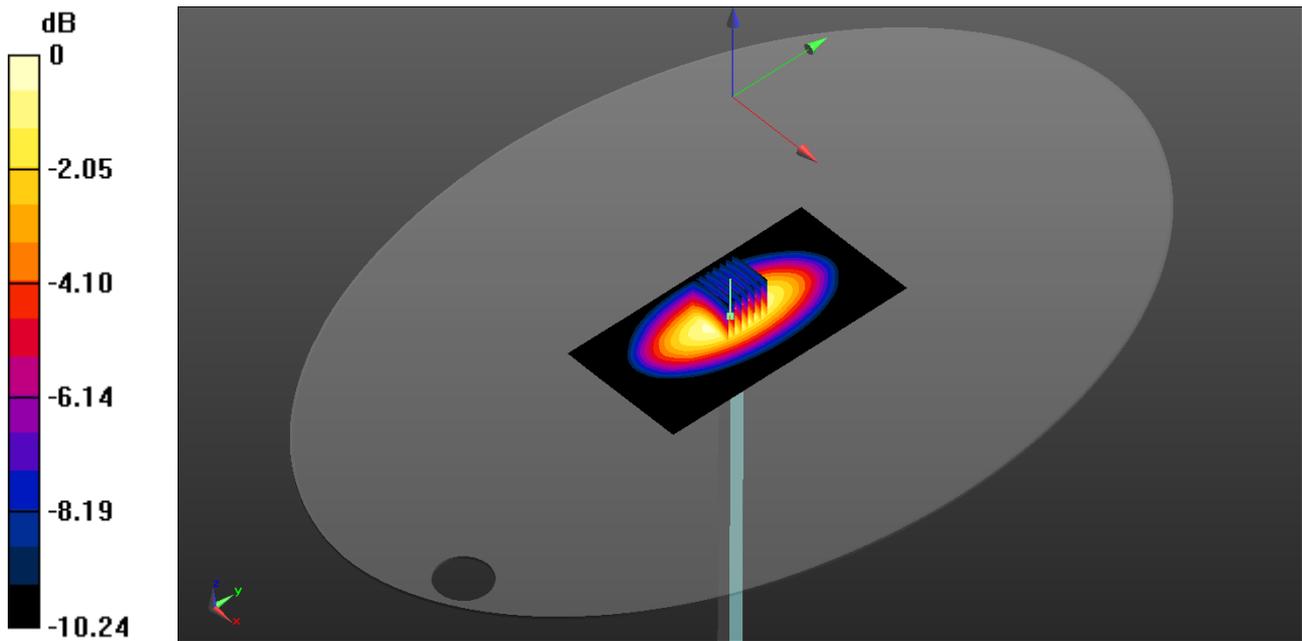
**CW835 Head 100mw/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 31.59 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.23 W/kg

**SAR(1 g) = 0.902 W/kg; SAR(10 g) = 0.599 W/kg**

Maximum value of SAR (measured) = 0.972 W/kg



0 dB = 0.972 W/kg

## System Performance Check Data (2450MHz)

Date: 2021.06.16

Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.836$  S/m;  $\epsilon_r = 39.925$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature: 22.6 Liquid Temperature: 21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.54, 7.54, 7.54); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW2450 Head 100mw/Area Scan (121x121x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 5.12 W/kg

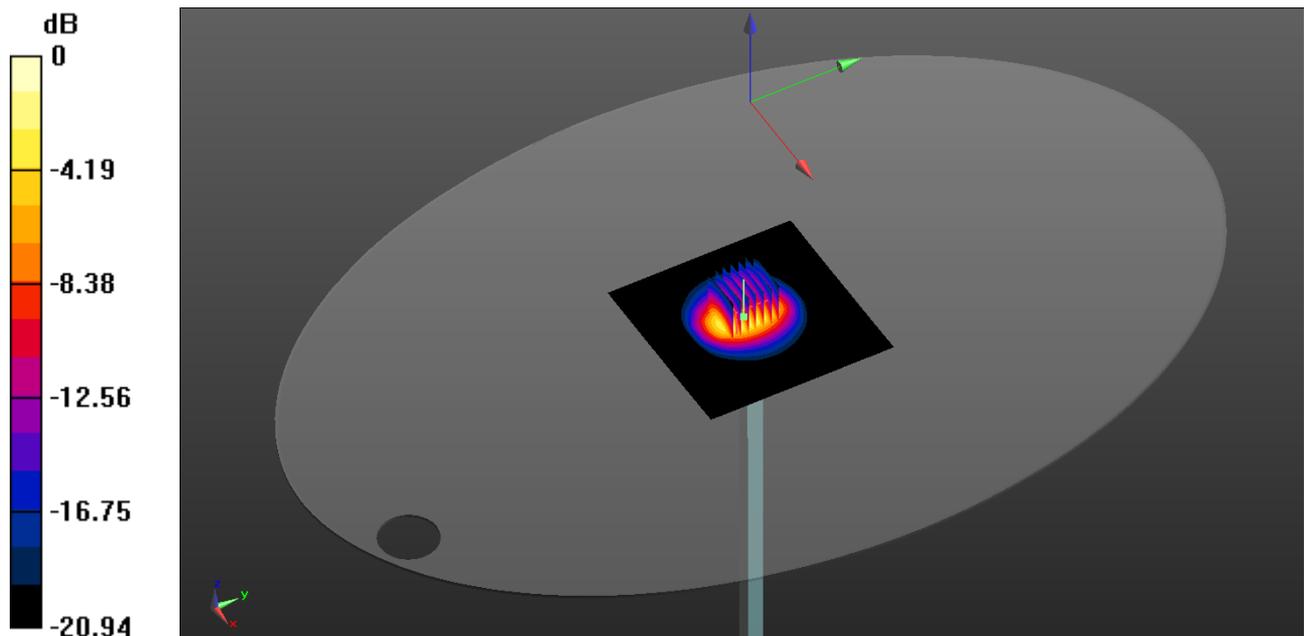
**CW2450 Head 100mw/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 45.72 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 9.42 W/kg

**SAR(1 g) = 4.81 W/kg; SAR(10 g) = 2.28 W/kg**

Maximum value of SAR (measured) = 5.52 W/kg



0 dB = 5.52 W/kg

## System Performance Check Data (5250MHz)

Date: 2021.06.15

Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5250$  MHz;  $\sigma = 4.689$  S/m;  $\epsilon_r = 36.058$   $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature: 22.3 Liquid Temperature: 21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.46, 5.46, 5.46); Calibrated: 2020.11.30;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW5250-Head-100mW/Area Scan (101x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 8.72 W/kg

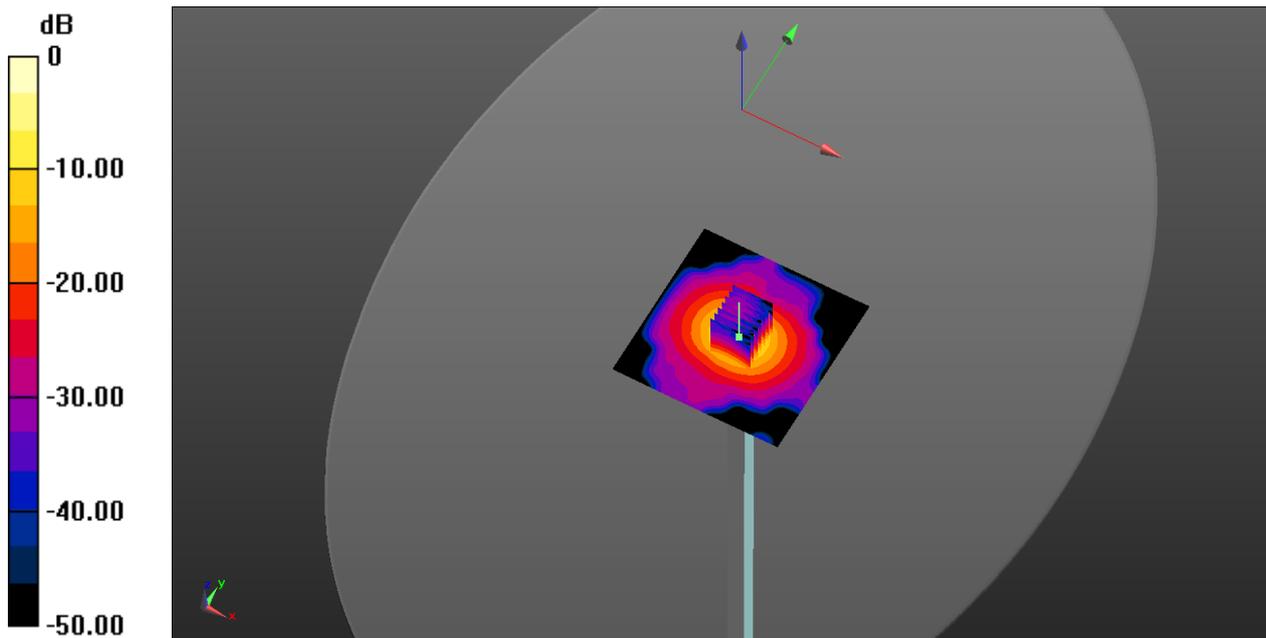
**CW5250-Head-100mW/Zoom Scan (7x7x21)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 36.12 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 34.2 W/kg

**SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.11W/kg**

Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg

# System Performance Check Data (5750MHz)

Date: 2021.06.14

Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz; Duty Cycle: 1:1

Medium parameters used:  $f = 5750$  MHz;  $\sigma = 5.315$  S/m;  $\epsilon_r = 36.402$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature: 22.4 Liquid Temperature: 21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(4.96, 4.96, 4.96); Calibrated: 2020.11.30;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**CW5750-Head-100mW/Area Scan (81x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 9.27 W/kg

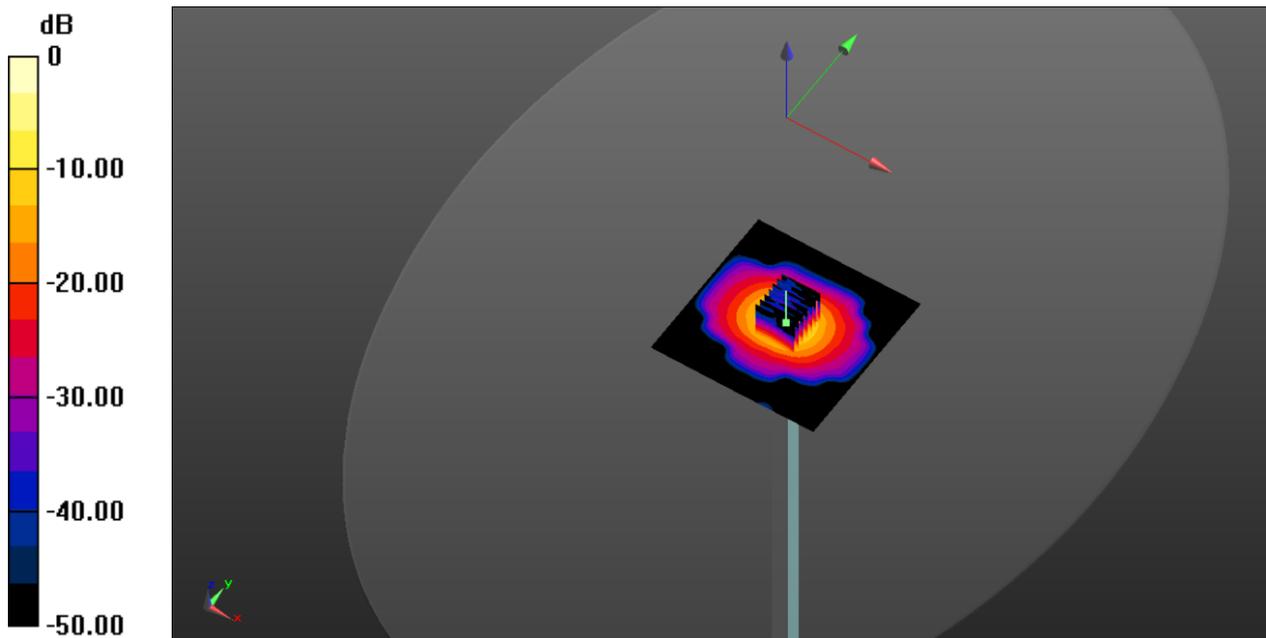
**CW5750-Head-100mW/Zoom Scan (7x7x21)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 34.22 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 41.3 W/kg

**SAR(1 g) = 8.17 W/kg; SAR(10 g) = 2.16 W/kg**

Maximum value of SAR (measured) = 17.8 W/kg



0 dB = 17.8 W/kg

## ANNEX C TEST DATA

### Meas.1 Body Plane With Front Side 10mm on Middle Channel in RFID mode

Date: 2021.06.16

Communication System Band: RFID; Frequency: 915 MHz; Duty Cycle: 1:2.235

Medium parameters used:  $f = 915 \text{ MHz}$ ;  $\sigma = 1.007 \text{ S/m}$ ;  $\epsilon_r = 42.284$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Ambient Temperature: 22.6 Liquid Temperature: 21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(9.94, 9.94, 9.94); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Area Scan (51x61x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 0.0986 W/kg

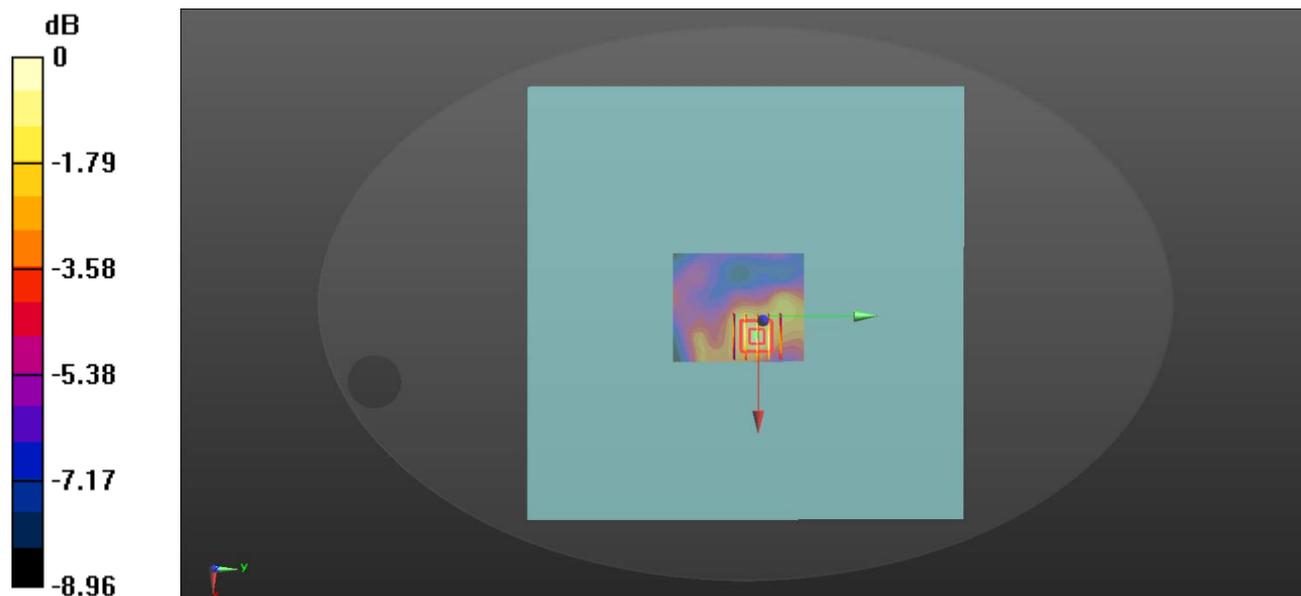
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid:  $dx=8\text{mm}$ ,  $dy=8\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 7.254 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 0.114 W/kg

**SAR(1 g) = 0.108 W/kg; SAR(10 g) = 0.090 W/kg**

Maximum value of SAR (measured) = 0.112 W/kg



0 dB = 0.112 W/kg

**Meas.2 Body Plane With Front Side 0mm on Low Channel in RFID mode**

Date: 2021.06.16

Communication System Band: RFID; Frequency: 902 MHz; Duty Cycle: 1:2.235

Medium parameters used:  $f = 902.4$  MHz;  $\sigma = 0.916$  S/m;  $\epsilon_r = 42.71$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.6 Liquid Temperature:21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(9.94, 9.94, 9.94); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Area Scan (51x61x1):** Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.286 W/kg

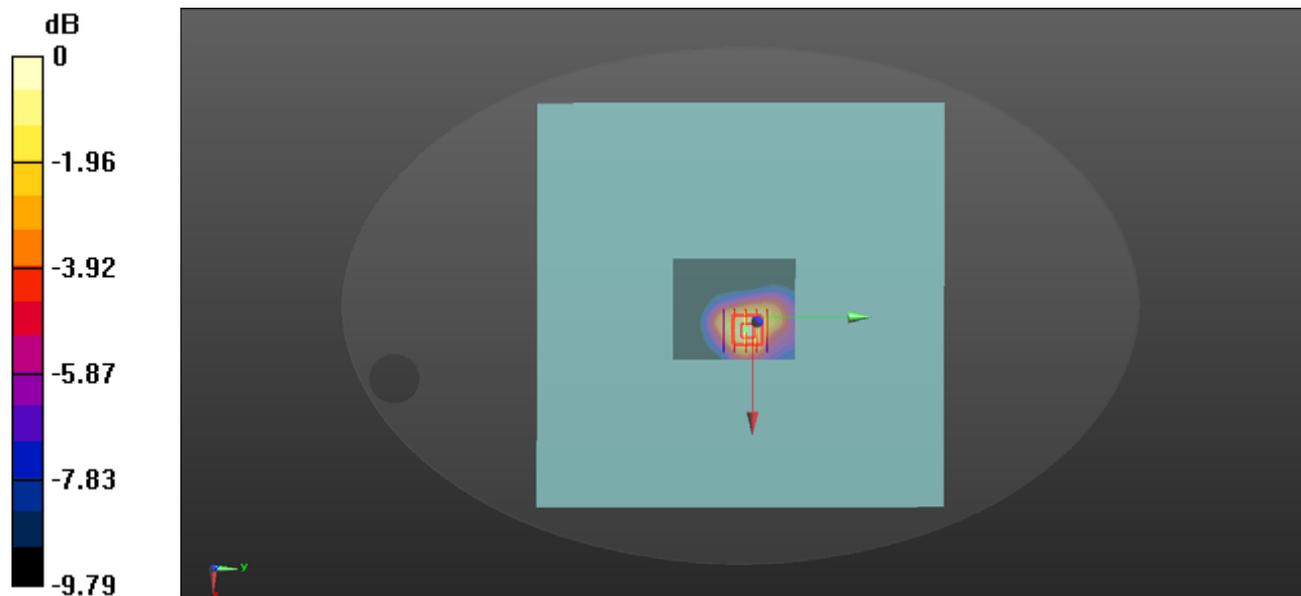
**Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.84 V/m; Power Drift = -0.04 dB

Peak SAR (extrapolated) = 0.317 W/kg

**SAR(1 g) = 0.286 W/kg; SAR(10 g) = 0.216 W/kg**

Maximum value of SAR (measured) = 0.300 W/kg



0 dB = 0.300 W/kg

**Meas.3 Body Plane With Left Edge 10mm on Low Channel in IEEE802.11b mode**

Date: 2021.06.16

Communication System Band: WLAN(b); Frequency: 2412 MHz; Duty Cycle: 1:1.004

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.792$  S/m;  $\epsilon_r = 40.415$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.6 Liquid Temperature:21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.54, 7.54, 7.54); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch1/Area Scan (61x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 0.483 W/kg

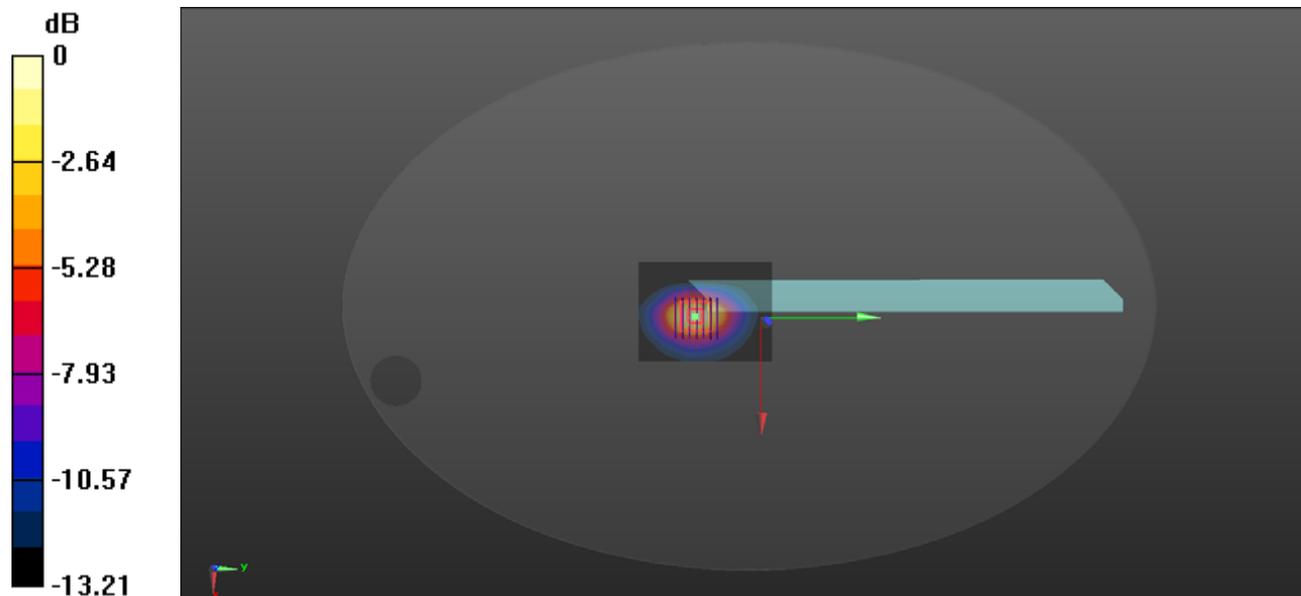
**Ch1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.059 V/m; Power Drift = -0.16 dB

Peak SAR (extrapolated) = 0.640 W/kg

**SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.190 W/kg**

Maximum value of SAR (measured) = 0.419 W/kg



**Meas.4 Body Plane With Left Edge 0mm on Low Channel in IEEE802.11b mode**

Date: 2021.06.16

Communication System Band: WLAN(b); Frequency: 2412 MHz; Duty Cycle: 1:1.004

Medium parameters used (interpolated):  $f = 2412$  MHz;  $\sigma = 1.792$  S/m;  $\epsilon_r = 40.415$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.6 Liquid Temperature:21.4

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(7.54, 7.54, 7.54); Calibrated: 2020.11.30;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch1/Area Scan (61x81x1):** Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 2.86 W/kg

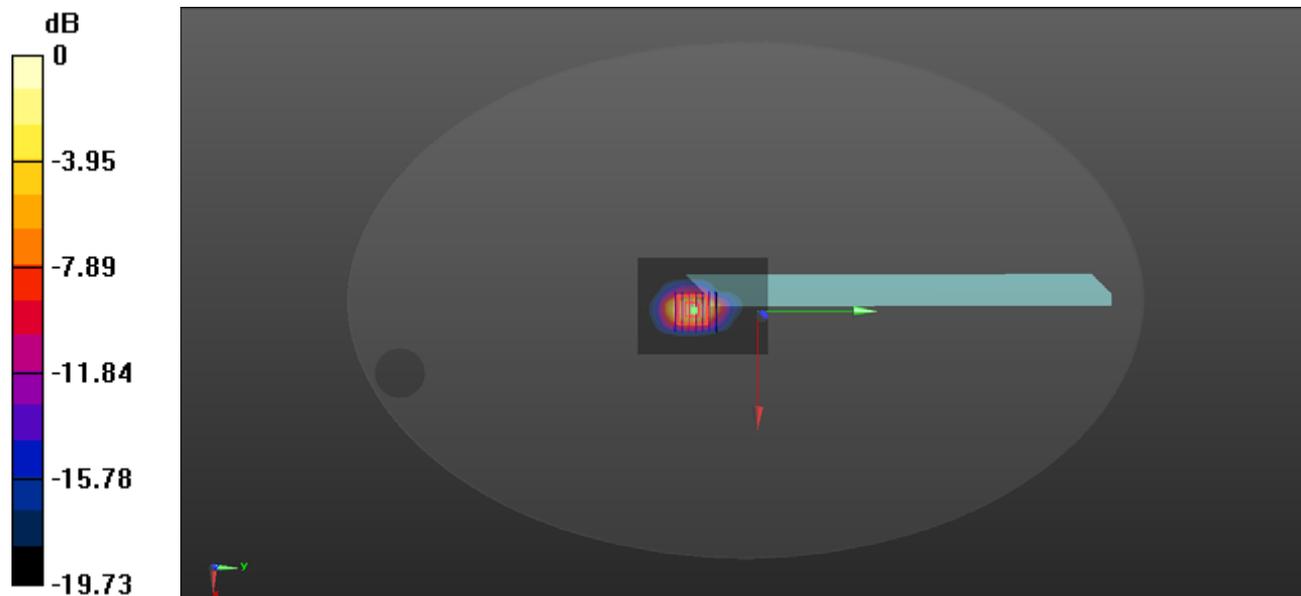
**Ch1/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 3.726 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 3.79 W/kg

**SAR(1 g) = 1.77 W/kg; SAR(10 g) = 0.737 W/kg**

Maximum value of SAR (measured) = 2.07 W/kg



0 dB = 2.07 W/kg

**Meas.5 Body Plane With Left Edge 10mm on Channel 44 in IEEE802.11a mode**

Date: 2021.06.15

Communication System Band: WLAN(a); Frequency: 5220 MHz; Duty Cycle: 1:1.082

Medium parameters used:  $f = 5220$  MHz;  $\sigma = 4.614$  S/m;  $\epsilon_r = 36.381$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.3 Liquid Temperature:21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.46, 5.46, 5.46); Calibrated: 2020.11.30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch44/Area Scan (81x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.537 W/kg

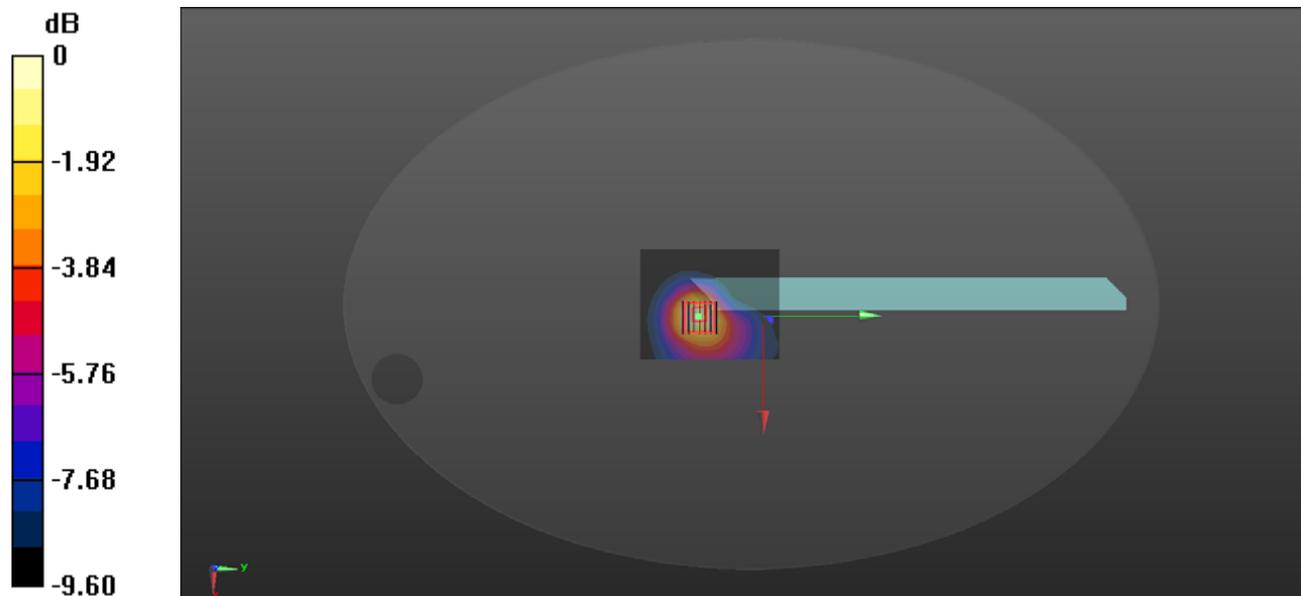
**Ch44/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.687 V/m; Power Drift = -0.05 dB

Peak SAR (extrapolated) = 1.14 W/kg

**SAR(1 g) = 0.317 W/kg; SAR(10 g) = 0.159 W/kg**

Maximum value of SAR (measured) = 0.517 W/kg



0 dB = 0.517 W/kg

**Meas.6 Body Plane With Left Edge 0mm on Channel 44 in IEEE802.11a mode**

Date: 2021.06.15

Communication System Band: WLAN(a); Frequency: 5220 MHz; Duty Cycle: 1:1.082

Medium parameters used:  $f = 5220$  MHz;  $\sigma = 4.614$  S/m;  $\epsilon_r = 36.381$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.3 Liquid Temperature:21.3

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(5.46, 5.46, 5.46); Calibrated: 2020.11.30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch44/Area Scan (81x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.99 W/kg

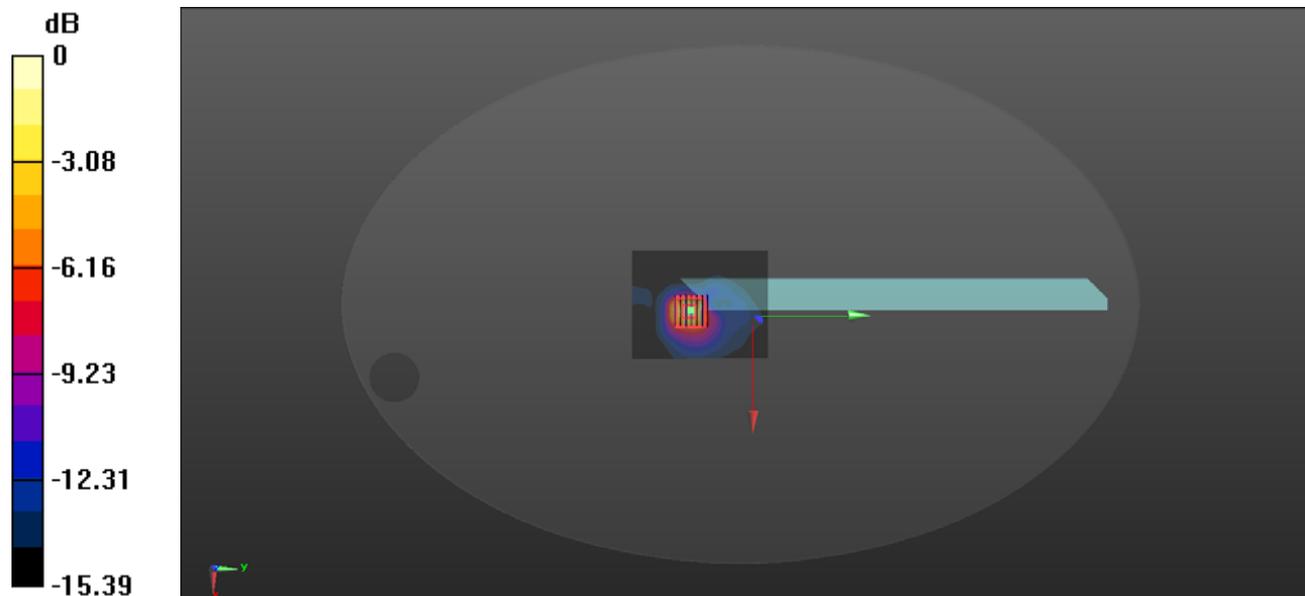
**Ch44/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.193 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 3.97 W/kg

**SAR(1 g) = 0.973 W/kg; SAR(10 g) = 0.335 W/kg**

Maximum value of SAR (measured) = 1.95 W/kg



0 dB = 1.95 W/kg

**Meas.7 Body Plane With Left Edge 10mm on Channel 151 in IEEE802.11n40 mode**

Date: 2021.06.14

Communication System Band: WLAN(n)40MHz; Frequency: 5755 MHz; Duty Cycle: 1:1.015

Medium parameters used (interpolated):  $f = 5755$  MHz;  $\sigma = 5.309$  S/m;  $\epsilon_r = 36.139$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.4 Liquid Temperature:21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(4.96, 4.96, 4.96); Calibrated: 2020.11.30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch151/Area Scan (81x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.349 W/kg

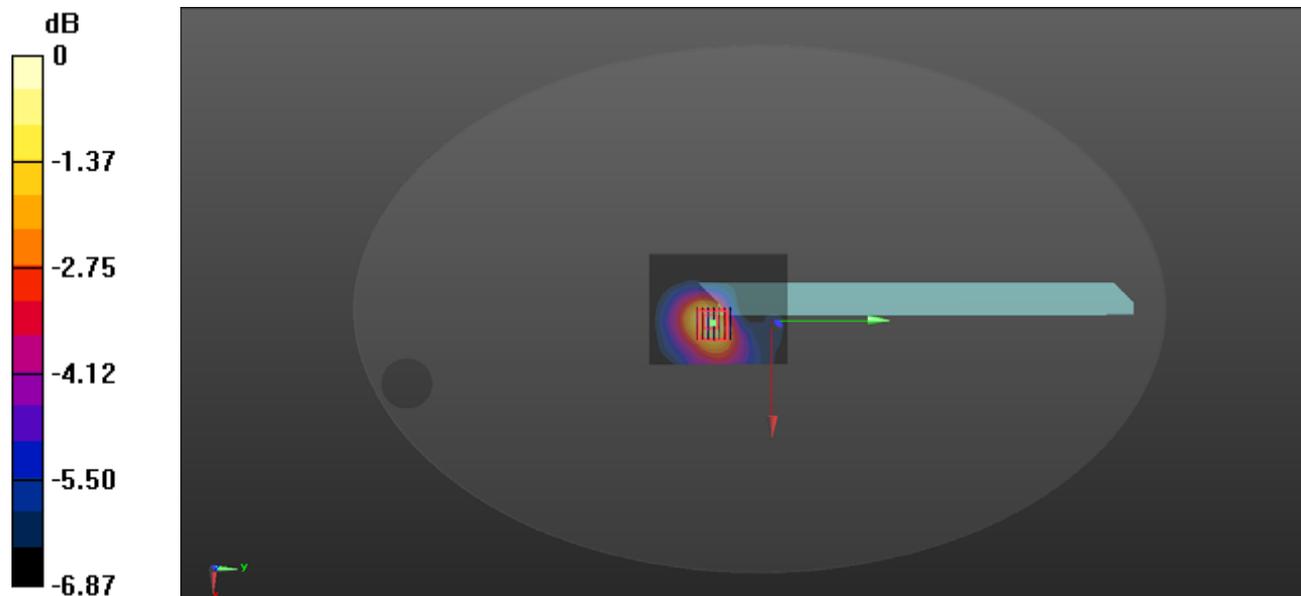
**Ch151/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 3.899 V/m; Power Drift = 0.12 dB

Peak SAR (extrapolated) = 0.641 W/kg

**SAR(1 g) = 0.215 W/kg; SAR(10 g) = 0.132 W/kg**

Maximum value of SAR (measured) = 0.344 W/kg



0 dB = 0.344 W/kg

**Meas.8 Body Plane With Left Edge 0mm on Channel 151 in IEEE802.11n40 mode**

Date: 2021.06.14

Communication System Band: WLAN(n)40MHz; Frequency: 5755 MHz; Duty Cycle: 1:1.015

Medium parameters used (interpolated):  $f = 5755$  MHz;  $\sigma = 5.309$  S/m;  $\epsilon_r = 36.139$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Ambient Temperature:22.4 Liquid Temperature:21.2

DASY5 Configuration:

- Probe: EX3DV4 - SN7510; ConvF(4.96, 4.96, 4.96); Calibrated: 2020.11.30;
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1454; Calibrated: 2020.11.06
- Phantom: ELI v4.0 (30deg probe tilt); Type: QDOVA001BB; Serial: TP:1012
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

**Ch151/Area Scan (81x101x1):** Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 1.07 W/kg

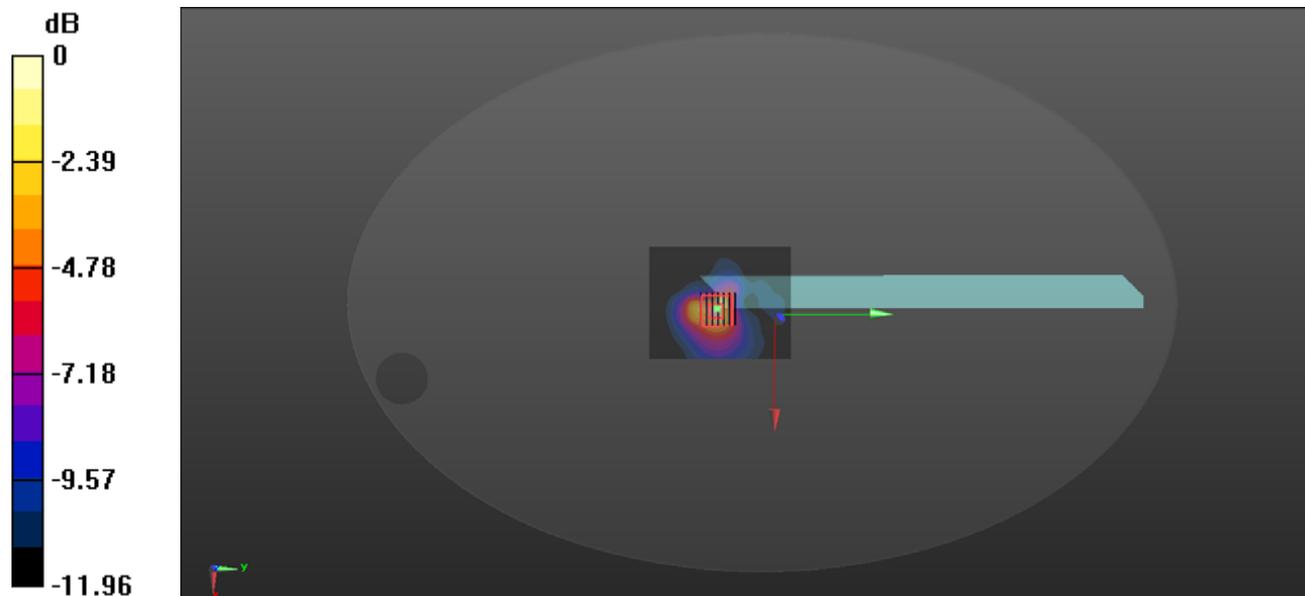
**Ch151/Zoom Scan (7x7x12)/Cube 0:** Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 4.118 V/m; Power Drift = -0.13 dB

Peak SAR (extrapolated) = 2.41 W/kg

**SAR(1 g) = 0.572 W/kg; SAR(10 g) = 0.228 W/kg**

Maximum value of SAR (measured) = 1.14 W/kg



0 dB = 1.14 W/kg

## **ANNEX D EUT EXTERNAL PHOTOS**

Please refer the document "BL-SZ20C0502-AW.pdf".

## **ANNEX E SAR TEST SETUP PHOTOS**

Please refer the document "BL-SZ20C0502-AS.pdf".

## **ANNEX F CALIBRATION REPORT**

Please refer the document "CALIBRATION REPORT.pdf".

--END OF REPORT--