TEST REPORT

Applicant:	Handheld Group AB
Address:	Strandgatan 40, 531 60 Lidköping, Sweden
Equipment Type:	DDU7
Model Name:	DDU7
Brand Name:	Handheld
FCC ID:	YY3-DDU7
ISED Number:	11695A-DDU7
Test Standard:	RSS-102 Issue 6 (refer to section 3.1)
Maximum SAR:	Body (1 g): 1.15 W/kg
Sample Arrival Date:	Dec. 24, 2024
Test Date:	Dec. 28, 2024 –Dec. 29, 2024
Date of Issue:	Mar. 13, 2025

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Xiong Lining

Checked by: Xu Rui

Approved by: Tolan Tu

(Testing Director)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Mar. 13, 2025	Initial Issue

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1 GENERAL INFORMATION

1.1 Test Laboratory

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

1.2 Test Location

Name	Shenzhen BALUN Technology Co., Ltd.
Location	☐ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	☑ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China
Accreditation Certificate	The laboratory is a testing organization accredited by ISED as a accredited testing laboratory. The company number is 11524A and CAB identifier number is CN0030.

1.3 Test Environment Condition

Ambient Temperature	18℃ to 25℃
Ambient Relative Humidity	30% to 70%

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	Handheld Group AB
Address	Strandgatan 40, 531 60 Lidköping, Sweden

2.2 Manufacturer Information

Manufacturer	Handheld Group AB
Address	Strandgatan 40, 531 60 Lidköping, Sweden

2.3 Factory Information

Factory	N/A
Address	N/A

2.4 General Description for Equipment under Test (EUT)

EUT Name	DDU7
Model Name Under Test	DDU7
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	N/A
Software Version	N/A
Dimensions (Approx.)	189mm*155mm*29mm
Weight (Approx.)	N/A

2.5 Technical Information

Network and Wireless connectivity	Bluetooth (BR+EDR+BLE) WIFI 2.4G: 802.11b, 802.11g, 802.11n(HT20/40), 802.11ac(VHT20/40), 802.11ax(HE20/40) WIFI 5G: 802.11a, 802.11n(HT20/40), 802.11ac(VHT20/40/80), 802.11ax(HE20/40/80) GNSS; GPS L1c; GLONASS G1; BDS B1I; Galileo E1

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	2.4G WIFI, 5G WIFI, Bluetooth	
Frequency Range	802.11b/g/ n(HT20/HT40)	2412 MHz ~ 2462 MHz
	802.11ac (VHT20/VHT40)	2412 MHz ~ 2462 MHz
	802.11ax (HE20/HE40)	2412 MHz ~ 2462 MHz
	802.11a/ n(HT20/HT40)	5150 MHz ~ 5250 MHz
		5725 MHz ~ 5850 MHz
	802.11ac(VHT20/VHT40/VHT80)	5150 MHz ~ 5250 MHz
		5725 MHz ~ 5850 MHz
	802.11ax (HE20/HE40/HE80)	5150 MHz ~ 5250 MHz
		5725 MHz ~ 5850 MHz
	Bluetooth	2402 MHz ~ 2480 MHz
Antenna Type	WLAN: PIFA Antenna Bluetooth: PIFA Antenna	
Hotspot Function	N/A	
Exposure Category	General Population/Uncontrolled exposure	
Product Type	Portable Device	
EUT Type	☒ Production unit	☐ Identical prototype

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	RSS-102 Issue 6	Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
2	RSS-102.SAR.MEAS	Measurement Procedure for Assessing Specific Absorption Rate (SAR) Compliance in Accordance with RSS-102
3	IEC/IEEE 62209-1528:2020	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
4	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
5	ANSI C95.1-1992	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz
6	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
7	KDB 447498 D01 v06	447498 D01 General RF Exposure Guidance
8	KDB 248227 D01 v02r02	SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters
9	KDB 616217 D04v01r02	SAR for laptop and tablets

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 and 4.0 W/kg as averaged over any 10 gram of tissue.

Table of Exposure Limits:

Body Region	Average SAR (W/kg)	Averaging Time (minutes)20	Mass Average (g)
Whole Body	0.08	6	Whole Body
Localized Head, Neck and Trunk	1.6	6	1
Localized Limbs	4.0	6	10

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 (0mm)	Body (0mm)
2.4G WLAN	0.13	**1.15**
5.2G WLAN	1.15	
5.8G WLAN	1.05	
Bluetooth	0.20	
Limit (W/kg)	1.60	
Verdict	Pass	

3.4 Test Uncertainty

3.4.1 Measurement uncertainly evaluation for SAR test

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in IEC/IEEE 62209-1528:2020 This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

1) System Measurement Uncertainty (frequency range from 300 MHz to 3 GHz)

DASY8 Uncertainty Budget

(Frequency band: 300 MHz–3 GHz range)

Symbol	Error Description	Uncert. value	Prob.Dist.	Div.	(ci)(1 g)	(ci)(10 g)	Std. Unc. (1 g)	Std. Unc. (10 g)
Measurement System Errors								
CF	Probe Calibration	±12.0%	N	2	1	1	±6.0%	±6.0%
CFdrift	Probe Calibration Drift	±1.7%	R	√3	1	1	±1.0%	±1.0%
LIN	Probe Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%
BBS	Broadband Signal	±3.0%	R	√3	1	1	±1.7%	±1.7%
ISO	Probe Isotropy	±7.6%	R	√3	1	1	±4.4%	±4.4%
DAE	Other Probe+Electronic	±0.7%	N	1	1	1	±0.7%	±0.7%
AMB	RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Δsys	Probe Positioning	±0.006 mm	N	1	0.14	0.14	±0.10%	±0.10%
DAT	Data Processing	±1.2%	N	1	1	1	±1.2%	±1.2%
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)DAK	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
LIQ(Tσ)	Conductivity (temp.)BB	±3.3%	R	√3	0.78	0.71	±1.5%	±1.4%
EPS	Phantom Permittivity	±14.0%	R	√3	0	0	±0%	±0%
DIS	Distance DUT – TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
Dxyz	Device Positioning	±1.0%	N	1	1	1	±1.0%	±1.0%
H	Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
MOD	DUT Modulationm	±2.4%	R	√3	1	1	±1.4%	±1.4%
TAS	Time-average SAR	±1.7%	R	√3	1	1	±1.0%	±1.0%
RFdrift	DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
VAL	Val Antenna Unc.val	±0.0%	N	1	1	1	±0%	±0%
RFin	Unc. Input Powerval	±0.0%	N	1	1	1	±0%	±0%
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9%	N	1	1	0.84	±1.9%	±1.6%
C(R)	SAR scalingp	±0%	R	√3	1	1	±0%	±0%
u(ΔSAR)	Combined Uncertainty						±10.9%	±10.9%

U	**Expanded Uncertainty**						±21.9%	±21.8%

2) System Measurement Uncertainty (frequency range from 3 GHz to 6 GHz)

DASY8 Uncertainty Budget

(Frequency band: 3 GHz–6 GHz range)

Symbol	Error Description	Uncert. value	Prob.Dist.	Div.	(ci)(1 g)	(ci)(10 g)	Std. Unc. (1 g)	Std. Unc. (10 g)
Measurement System Errors								
CF	Probe Calibration	±13.1%	N	2	1	1	±6.55%	±6.55%
CF_{drift}	Probe Calibration Drift	±1.7%	R	√3	1	1	±1.0%	±1.0%
LIN	Probe Linearity	±4.7%	R	√3	1	1	±2.7%	±2.7%
BBS	Broadband Signal	±2.6%	R	√3	1	1	±1.5%	±1.5%
ISO	Probe Isotropy	±7.6%	R	√3	1	1	±4.4%	±4.4%
DAE	Other Probe+Electronic	±1.2%	N	1	1	1	±1.2%	±1.2%
AMB	RF Ambient	±1.8%	N	1	1	1	±1.8%	±1.8%
Δ_{sys}	Probe Positioning	±0.005 mm	N	1	0.29	0.29	±0.15%	±0.15%
DAT	Data Processing	±2.3%	N	1	1	1	±2.3%	±2.3%
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)^{DAK}	±2.5%	N	1	0.78	0.71	±2.0%	±1.8%
LIQ($T\sigma$)	Conductivity (temp.)^{BB}	±3.4%	R	√3	0.78	0.71	±1.5%	±1.4%
EPS	Phantom Permittivity	±14.0%	R	√3	0.25	0.25	±2.0%	±2.0%
DIS	Distance DUT – TSL	±2.0%	N	1	2	2	±4.0%	±4.0%
D_{xyz}	Device Positioning	±1.0%	N	1	1	1	±1.0%	±1.0%
H	Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%
MOD	DUT Modulation^{m}	±2.4%	R	√3	1	1	±1.4%	±1.4%
TAS	Time-average SAR	±1.7%	R	√3	1	1	±1.0%	±1.0%
RF_{drift}	DUT drift	±2.5%	N	1	1	1	±2.5%	±2.5%
VAL	Val Antenna Unc.^{val}	±0.0%	N	1	1	1	±0%	±0%
RF_{in}	Unc. Input Power^{val}	±0.0%	N	1	1	1	±0%	±0%
Correction to the SAR results								
C(ε, σ)	Deviation to Target	±1.9%	N	1	1	0.84	±1.9%	±1.6%
C(R)	SAR scaling^{p}	±0%	R	√3	1	1	±0%	±0%
u(ΔSAR)	Combined Uncertainty						±11.6%	±11.5%
U	**Expanded Uncertainty**						±23.3%	±23.0%

3.4.2 Measurement uncertainly evaluation for system check

This measurement uncertainty budget is suggested by IEC/IEEE 62209-1528. The break down of the individual uncertainties is as follows:

Uncertainty Component	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10 g)	1g Ui (+-%)	10 g Ui (+-%)	Vi v_{eff}
Measurement System								
Probe calibration	6.7	N	1	1	1	6.70	6.70	∞
Axial Isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.90	1.90	∞
Hemispherical Isotropy	9.6	R	$\sqrt{3}$	0.7	0.7	3.88	3.88	∞
Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	4.7	R	$\sqrt{3}$	1	1	2.71	2.71	∞
System detection limits	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Readout Electronics	0.3	N	1	1	1	0.30	0.30	∞
Response Time	0.0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
Integration Time	0.0	R	$\sqrt{3}$	1	1	0.00	0.00	∞
RF ambient Conditions - Noise	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
RF ambient Conditions - Reflections	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Probe positioner Mechanical Tolerance	0.8	R	$\sqrt{3}$	1	1	0.46	0.46	∞
Probe positioning with respect to Phantom Shell	6.7	R	$\sqrt{3}$	1	1	3.87	3.87	∞
Extrapolation, interpolation and integration Algoritms for Max. SAR Evaluation	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Test sample Related								
Deviation of exp. dipole	5.5	R	$\sqrt{3}$	1	1	3.18	3.18	∞
Dipole Axis to Liquid Dist.	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Input power & SAR drift	3.4	R	$\sqrt{3}$	1	1	1.96	1.96	∞
Phantom and Tissue Parameters								
Phantom Uncertainty (Shape and thickness tolerances)	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Liquid conductivity (deviation from target values)	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.03	∞
Liquid conductivity - measurement uncertainty	5.0	N	1	0.78	0.71	3.90	3.55	∞
Liquid permittivity (deviation from target values)	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Liquid permittivity - measurement uncertainty	5.0	N	1	0.23	0.26	1.15	1.30	∞
Combined Standard Uncertainty	/	/	RSS			11.29	11.18	/
Expanded Uncertainty (95% Confidence interval)	/	k	2			22.57	22.36	/

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 (ρ). The equation description is as below:

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

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

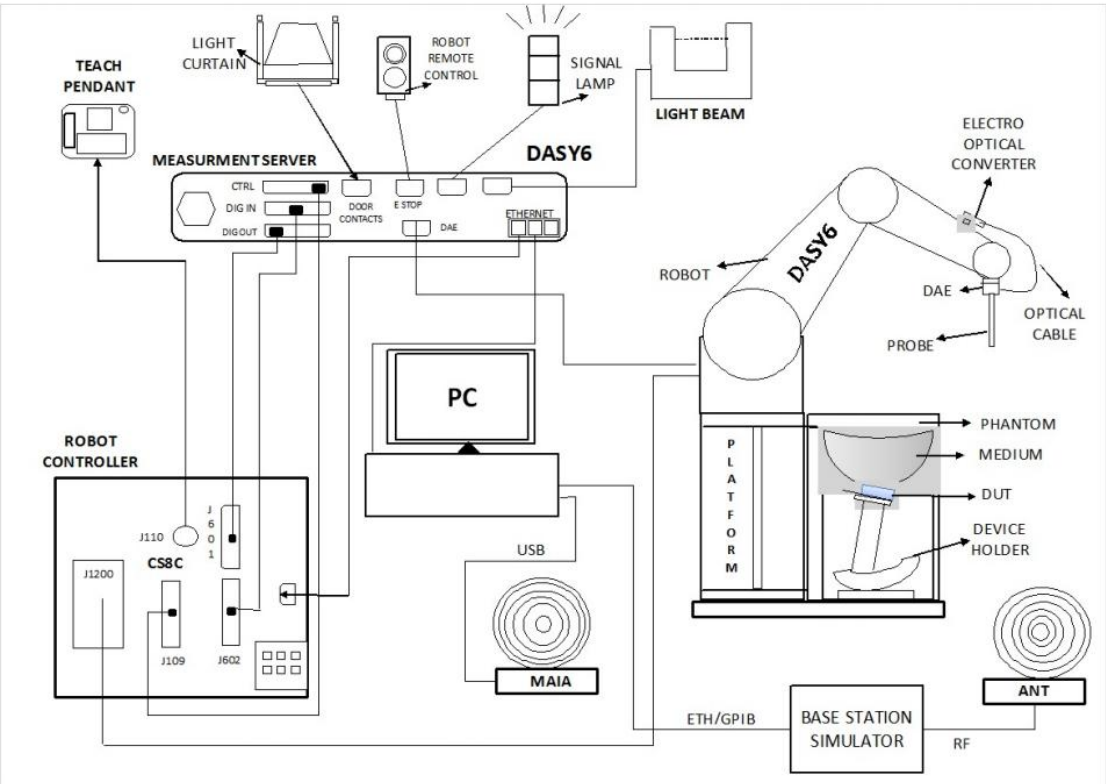
$$\mathbf{SAR} = \frac{\boldsymbol{\sigma}\mathbf{E}^{\mathbf{2}}}{\boldsymbol{\rho}}$$

Where: σ is the conductivity of the tissue,

ρis 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

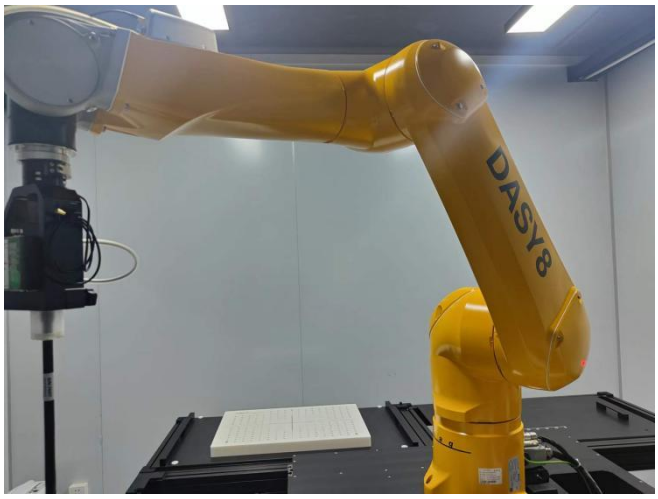


The DASY system for performing compliance tests consists of the following items:

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 DASY measurement server.
6. The DASY measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
7. DASY 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 ±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 _elds 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.

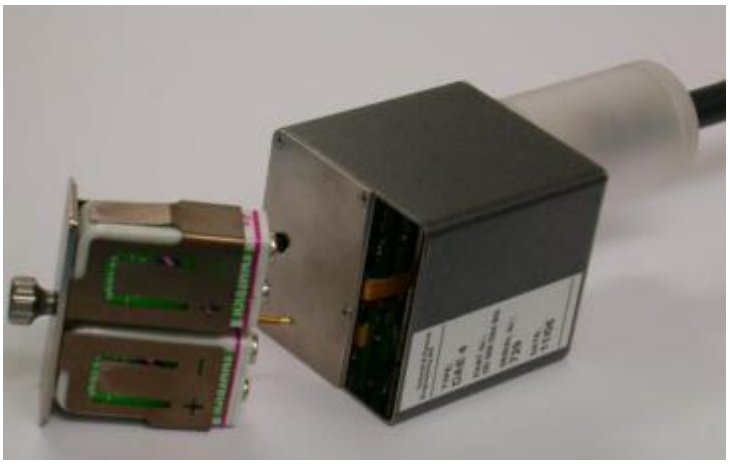
Construction	Symmetrical design with triangular core Built-in optical fiber for surface detection system Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., glycolether)
Calibration	ISO/IEC 17025 calibration service available
Frequency	4 MHz to 10 GHz; Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ; ± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic range	5 µW/g to > 100 mW/g; Linearity: ± 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 IEC/IEEE 62209-1528, with CALISAR, Antennessa proprietary calibration system. The calibration is performed with the IEC/IEEE 62209-1528 annexe technique using reference guide at the five frequencies.

4.2.4 Data Acquisition Electronics

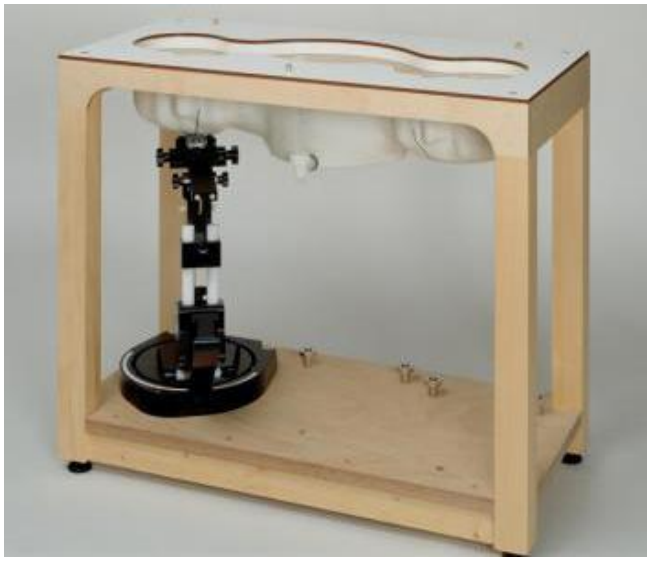
The data acquisition electronics (DAE) consist of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converte and a command decoder with a control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information, as well as an optical uplink for commands and the clock.



- Input Impedance: 200MOhm
- The Inputs: Symmetrical and Floating
- Commom 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 head
- Right head
- Flat phantom

Photo of Phantom SN1859

Serial Number	Material	Length	Height
SN 1859 SAM	Vinylester, glass fiber reinforced	1000	500

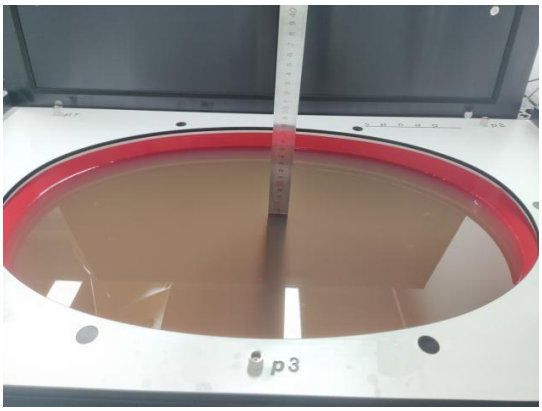
4.2.6 Device Holder

The DASY 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°. 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. Incompliance with CENELEC, the tilt angle uncertainty is lower than 1°.

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%.

Head Liquid Depth	Body Liquid Depth
	

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

The following table gives the recipes for tissue simulating liquid.

TSL	Manufacturer / Model	Freq Range (MHz)	Main Ingredients
Head WideBand	SPEAG HBBL600-10000V6	600-10000	Ethanediol, Sodium petroleum sulfonate, Hexylene Glycol / 2-Methyl-pentane-2.4-diol, Alkoxylated alcohol

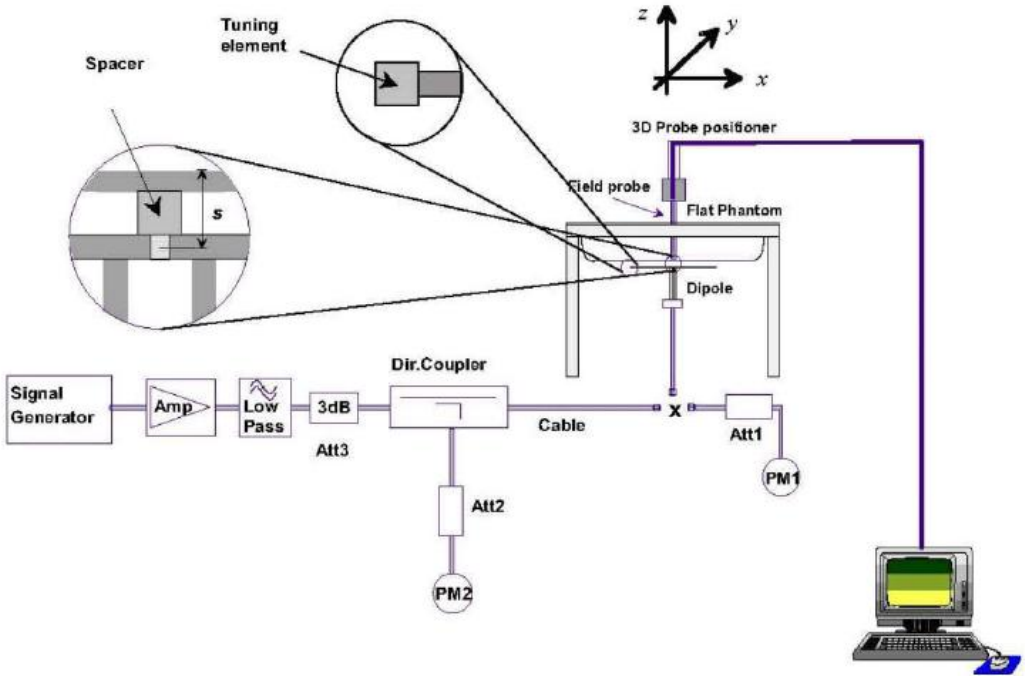
5 SYSTEM VERIFICATION

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

Tablet Exposure Condition

This DUT was tested in four different positions. They are back side, left edge, right edge and top edge in these positions, the surface of DUT is touching with phantom 0mm.

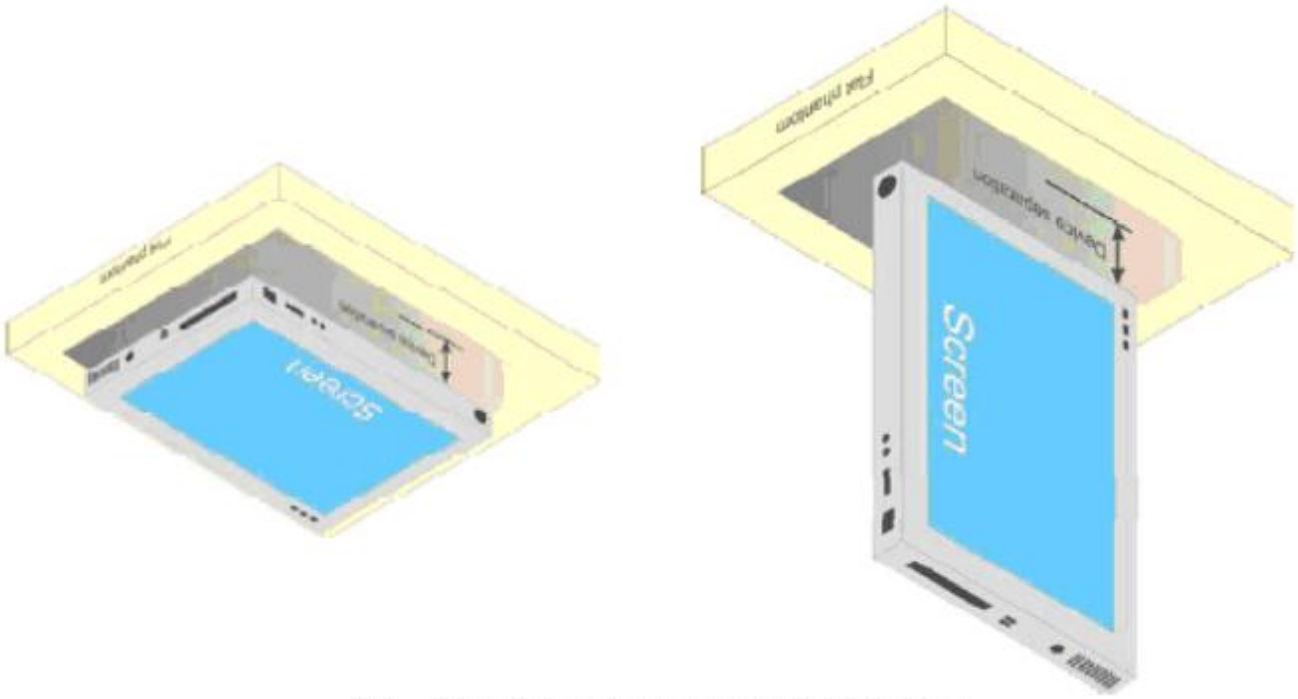
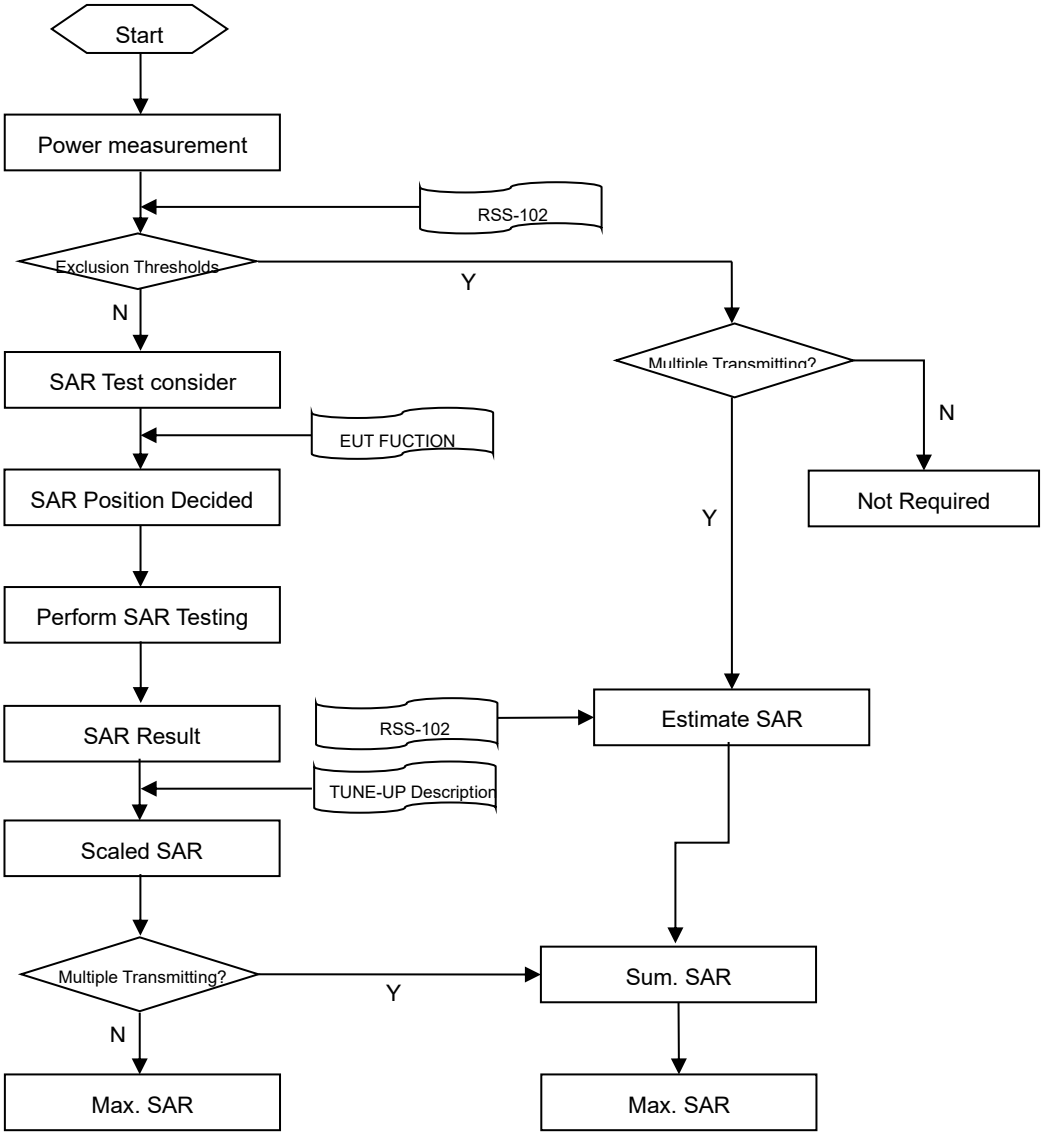


Fig Illustration for Lap-touching Position

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. Boththe 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 or 10 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 IEC/IEEE 62209-1528:2020.

Area scan Parameter	≤3GHz	3 GHz < f ≤ 10 GHz
Maximum distance between the measured points (geometric centre of the sensors) and the inner phantom surface	5±1 mm	½·δ·ln(2)±0.5 mm
Maximum spacing between adjacent measured points in mm	20, or half of the corresponding zoom scan length, whichever is smaller	60 / f, or half of the corresponding zoom scan length, whichever is smaller
Maximum angle between the probe axis and the phantom surface normal	5° (flat phantom only) 30° (other phantoms)	5° (flat phantom only) 20° (other phantoms)
Tolerance in the probe angle	1°	1°
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium.		

Zoom scan Parameter	≤3GHz	3 GHz < f ≤ 10 GHz
Maximum distance between the closest measured points and the phantom surface	5 mm	½·δ·ln(2) mm
Maximum angle between the probe axis and the phantom surface normal	5° (flat phantom only) 30° (other phantoms)	5° (flat phantom only) 20° (other phantoms)
Maximum spacing between measured points in the x- and y-directions (Δx and Δy, in mm)	8 mm	24 / f mm
For uniform grids: Maximum spacing between measured points in the direction normal to the phantom shell	5 mm	10 / (f − 1)
For graded grids: Maximum spacing between the two closest measured points in the direction normal to the phantom shell	4 mm	12 / f mm
For graded grids: Maximum incremental increase in the spacing between measured points in the direction normal to the phantom shell	1.5 mm	1.5 mm
Minimum edge length of the zoom scan volume in the x- and y-directions	30 mm	22 mm
Minimum edge length of the zoom scan volume in the direction normal to the phantom shell	30 mm	22 mm
Tolerance in the probe angle	1°	1°
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium.		

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 to16 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 1 g or 10 g. Area scan and zoom scan resolution setting follows IEC/IEEE 62209-1528:2020 quoted below.

When the 1 g or 10 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 OUPUT POWER

8.1 WIFI

8.1.1 2.4G WIFI ANT 1

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	16.89	18.00	Yes
		6	2437	16.79	18.00	Yes
		11	2462	16.79	18.00	Yes
	802.11g	1	2412	14.73	15.50	No
		6	2437	14.90	16.00	No
		11	2462	14.66	15.50	No
	802.11n(HT20)	1	2412	14.36	15.50	No
		6	2437	14.44	15.50	No
		11	2462	14.39	15.50	No
	802.11n(HT40)	3	2422	15.48	16.50	No
		6	2437	15.47	16.50	No
		9	2452	15.48	16.50	No
	VHT(20 MHz)	1	2412	14.35	15.50	No
		6	2437	14.48	15.50	No
		11	2462	14.47	15.50	No
	VHT(40 MHz)	3	2422	15.23	16.00	No
		6	2437	15.47	16.50	No
		9	2452	15.47	16.50	No
	802.11ax(HE20)	1	2412	14.22	15.00	No
		6	2437	14.33	15.50	No
		11	2462	14.54	15.50	No
	802.11ax(HE40)	3	2422	17.56	18.50	No
		6	2437	17.57	18.50	No
		9	2452	17.77	19.00	No

Note: According KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions. 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.

Adjusted SAR = Report SAR * (max power (OFDM)/ max power (DSSS)) = 0.118 * (79.43mW/63.10mW) = 0.149 W/Kg, so the 2.4G OFDM SAR test is not required.

8.1.2 2.4G WIFI ANT 2

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	16.84	18.00	Yes
		6	2437	16.71	17.50	Yes
		11	2462	16.65	17.50	Yes
	802.11g	1	2412	14.02	15.00	No
		6	2437	14.85	16.00	No
		11	2462	14.64	15.50	No
	802.11n(HT20)	1	2412	14.32	15.50	No
		6	2437	14.36	15.50	No
		11	2462	14.31	15.50	No
	802.11n(HT40)	3	2422	15.12	16.00	No
		6	2437	15.31	16.50	No
		9	2452	15.29	16.50	No
	VHT(20 MHz)	1	2412	14.41	15.50	No
		6	2437	14.47	15.50	No
		11	2462	14.34	15.50	No
	VHT(40 MHz)	3	2422	15.45	16.50	No
		6	2437	15.41	16.50	No
		9	2452	15.11	16.00	No
	802.11ax(HE20)	1	2412	14.27	15.50	No
		6	2437	14.26	15.50	No
		11	2462	14.18	15.00	No
	802.11ax(HE40)	3	2422	17.26	18.50	No
		6	2437	17.50	18.50	No
		9	2452	17.47	18.50	No

Note: According KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions. 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.

Adjusted SAR = Report SAR * (max power (OFDM)/ max power (DSSS)) = 0.051 * (70.79mW/63.10mW) = 0.057 W/Kg, so the 2.4G OFDM SAR test is not required.

8.1.3 2.4G WIFI MIMO

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	14.44	15.50	Yes
		6	2437	14.37	15.50	Yes
		11	2462	14.31	15.50	Yes
	802.11g	1	2412	17.04	18.00	No
		6	2437	17.86	19.00	No
		11	2462	17.64	18.50	No
	802.11n(HT20)	1	2412	17.65	18.50	No
		6	2437	17.52	18.50	No
		11	2462	17.60	18.50	No
	802.11n(HT40)	3	2422	18.55	19.50	No
		6	2437	18.38	19.50	No
		9	2452	17.38	18.50	No
	VHT(20 MHz)	1	2412	17.69	18.50	No
		6	2437	17.73	18.50	No
		11	2462	17.45	18.50	No
	VHT(40 MHz)	3	2422	18.63	19.50	No
		6	2437	18.58	19.50	No
		9	2452	17.35	18.50	No
	802.11ax(HE20)	1	2412	17.56	18.50	No
		6	2437	17.48	18.50	No
		11	2462	17.43	18.50	No
	802.11ax(HE40)	3	2422	18.48	19.50	No
		6	2437	18.60	19.50	No
		9	2452	18.53	19.50	No

Note: According KDB 248227 D01 SAR is not required for the following 2.4 GHz OFDM conditions. 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.

Adjusted SAR = Report SAR * (max power (OFDM)/ max power (DSSS)) = 0.131 * (89.13mW/35.48mW) = 0.329 W/Kg, so the 2.4G OFDM SAR test is not required.

8.1.4 5G WIFI ANT 1

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	13.43	14.50	No
		40	5200	13.89	15.00	No
		48	5240	14.09	15.00	No
	802.11n(HT20)	36	5180	14.13	15.00	No
		40	5200	13.97	15.00	No
		48	5240	14.09	15.00	No
	802.11n(HT40)	38	5190	11.63	12.50	No
		46	5230	11.55	12.50	No
	802.11ac(VHT20)	36	5180	14.16	15.00	No
		40	5200	13.92	15.00	No
		48	5240	14.24	15.00	No
	802.11ac(VHT40)	38	5190	11.67	12.50	No
		46	5230	11.84	13.00	No
	802.11ac(VHT80)	42	5210	9.88	11.00	No
	802.11ax(HE20)	36	5180	13.99	15.00	No
		40	5200	13.73	14.50	No
		48	5240	14.10	15.00	No
	802.11ax(HE40)	38	5190	13.81	15.00	Yes
		46	5230	13.75	15.00	Yes
	802.11ax(HE80)	42	5210	13.24	14.00	No
5.8 (5.725~5.85)	802.11a	149	5745	8.61	9.50	Yes
		157	5785	8.82	10.00	Yes
		165	5825	9.16	10.00	Yes
	802.11n(HT20)	149	5745	8.60	9.50	No
		157	5785	8.33	9.50	No
		165	5825	8.35	9.50	No
	802.11n(HT40)	151	5755	6.20	7.00	No
		159	5795	6.12	7.00	No
	802.11ac(VHT20)	149	5745	8.63	9.50	No
		157	5785	8.36	9.50	No
		165	5825	8.14	9.00	No
	802.11ac(VHT40)	151	5755	6.21	7.00	No
		159	5795	6.17	7.00	No
	802.11ac(VHT80)	155	5775	3.86	5.00	No
	802.11ax(HE20)	149	5745	8.44	9.50	No
		157	5785	8.66	9.50	No
		165	5825	8.18	9.00	No
	802.11ax(HE40)	151	5755	8.24	9.00	No
		159	5795	8.13	9.00	No

	802.11ax(HE80)	155	5775	7.57	8.50	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

8.1.5 5G WIFI ANT2

Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	13.36	14.50	No
		40	5200	13.33	14.50	No
		48	5240	13.56	14.50	No
	802.11n(HT20)	36	5180	13.18	14.00	No
		40	5200	12.38	13.50	No
		48	5240	12.53	13.50	No
	802.11n(HT40)	38	5190	10.91	12.00	No
		46	5230	10.50	11.50	No
	802.11ac(VHT20)	36	5180	12.81	14.00	No
		40	5200	12.50	13.50	No
		48	5240	12.80	14.00	No
	802.11ac(VHT40)	38	5190	11.68	12.50	No
		46	5230	11.41	12.50	No
	802.11ac(VHT80)	42	5210	9.53	10.50	No
	802.11ax(HE20)	36	5180	13.56	14.50	No
		40	5200	13.14	14.00	No
		48	5240	12.96	14.00	No
	802.11ax(HE40)	38	5190	13.77	15.00	Yes
		46	5230	13.28	14.50	Yes
	802.11ax(HE80)	42	5210	12.83	14.00	No
5.8 (5.725~5.85)	802.11a	149	5745	12.39	13.50	Yes
		157	5785	12.36	13.50	Yes
		165	5825	12.49	13.50	Yes
	802.11n(HT20)	149	5745	11.31	12.50	No
		157	5785	11.38	12.50	No
		165	5825	11.20	12.00	No
	802.11n(HT40)	151	5755	9.33	10.50	No
		159	5795	9.40	10.50	No
	802.11ac(VHT20)	149	5745	11.32	12.50	No
		157	5785	11.18	12.00	No
		165	5825	11.22	12.00	No
	802.11ac(VHT40)	151	5755	9.36	10.50	No
		159	5795	9.19	10.00	No
	802.11ac(VHT80)	155	5775	7.07	8.00	No

	802.11ax(HE20)	149	5745	11.35	12.50	No
		157	5785	10.97	12.00	No
		165	5825	11.00	12.00	No
	802.11ax(HE40)	151	5755	11.70	12.50	No
		159	5795	11.26	12.50	No
	802.11ax(HE80)	155	5775	10.38	11.50	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

8.1.6 5G WIFI MIMO

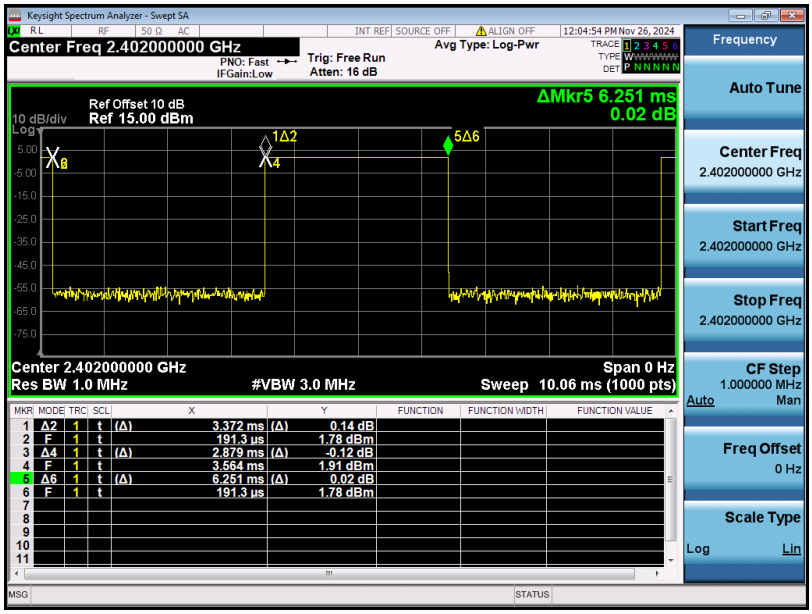
Band (GHz)	Mode	Channel	Freq. (MHz)	Conducted Power (dBm)	Tune-up Power Limit (dBm)	SAR Test Require.
5.2 (5.15~5.25)	802.11a	36	5180	13.30	14.50	No
		40	5200	13.43	14.50	No
		48	5240	13.61	14.50	No
	802.11n(HT20)	36	5180	14.25	15.00	No
		40	5200	13.92	15.00	No
		48	5240	14.04	15.00	No
	802.11n(HT40)	38	5190	12.00	13.00	No
		46	5230	11.67	12.50	No
	802.11ac(VHT20)	36	5180	14.23	15.00	No
		40	5200	13.83	15.00	No
		48	5240	13.94	15.00	No
	802.11ac(VHT40)	38	5190	12.04	13.00	No
		46	5230	11.71	12.50	No
	802.11ac(VHT80)	42	5210	10.01	11.00	No
	802.11ax(HE20)	36	5180	14.14	15.00	No
		40	5200	13.61	14.50	No
		48	5240	13.69	14.50	No
	802.11ax(HE40)	38	5190	14.21	15.00	Yes
		46	5230	13.74	14.50	Yes
	802.11ax(HE80)	42	5210	13.42	14.50	No
5.8 (5.725~5.85)	802.11a	149	5745	11.42	12.50	Yes
		157	5785	11.37	12.50	Yes
		165	5825	11.55	12.50	Yes
	802.11n(HT20)	149	5745	11.20	12.00	No
		157	5785	11.32	12.50	No
		165	5825	11.19	12.00	No
	802.11n(HT40)	151	5755	9.62	10.50	No
		159	5795	9.55	10.50	No

	802.11ac(VHT20)	149	5745	11.31	12.50	No
		157	5785	11.01	12.00	No
		165	5825	11.21	12.00	No
	802.11ac(VHT40)	151	5755	9.64	10.50	No
		159	5795	9.81	11.00	No
	802.11ac(VHT80)	155	5775	7.83	9.00	No
	802.11ax(HE20)	149	5745	10.61	11.50	No
		157	5785	11.03	12.00	No
		165	5825	10.81	12.00	No
	802.11ax(HE40)	151	5755	10.73	11.50	No
		159	5795	11.08	12.00	No
	802.11ax(HE80)	155	5775	9.94	11.00	No
Note: When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition); otherwise, each band is tested independently for SAR.						

8.2 Bluetooth

Mode	GFSK			π/4-DQPSK		
Channel	0	39	78	0	39	78
Frequency (MHz)	2402	2441	2480	2402	2441	2480
Conducted Power (dBm)	**4.75**	5.44	5.14	4.49	5.6	5.13
Tune-Up Limit (dBm)	5.50	6.50	6.00	5.50	6.50	6.00
SAR Test Require	Yes	Yes	Yes	NO	NO	NO
Mode	8-DPSK			/		
Channel	0	39	78	/	/	/
Frequency (MHz)	2402	2441	2480	/	/	/
Conducted Power (dBm)	4.93	5.42	5.20	/	/	/
Tune-Up Limit (dBm)	6.00	6.50	6.00	/	/	/
SAR Test Require	NO	NO	NO	/	/	/
Mode	BLE-1Mbps			BLE-2Mbps		
Channel	0	19	39	0	19	39
Frequency (MHz)	2402	2440	2480	2402	2440	2480
Conducted Power (dBm)	-3.14	-2.77	-3.22	-3.15	-2.87	-3.21
Tune-Up Limit (dBm)	-2.00	-2.00	-2.00	-2.00	-2.00	-2.00
SAR Test Require	NO	NO	NO	NO	NO	NO
Note: Since Bluetooth BR mode is the maximum output power mode，SAR measurements were performed with test software using DH5 modulation, and SAR measurement is not required for the EDR and LE. When the secondary mode is ≤ ¼ dB higher than the primary mode.						

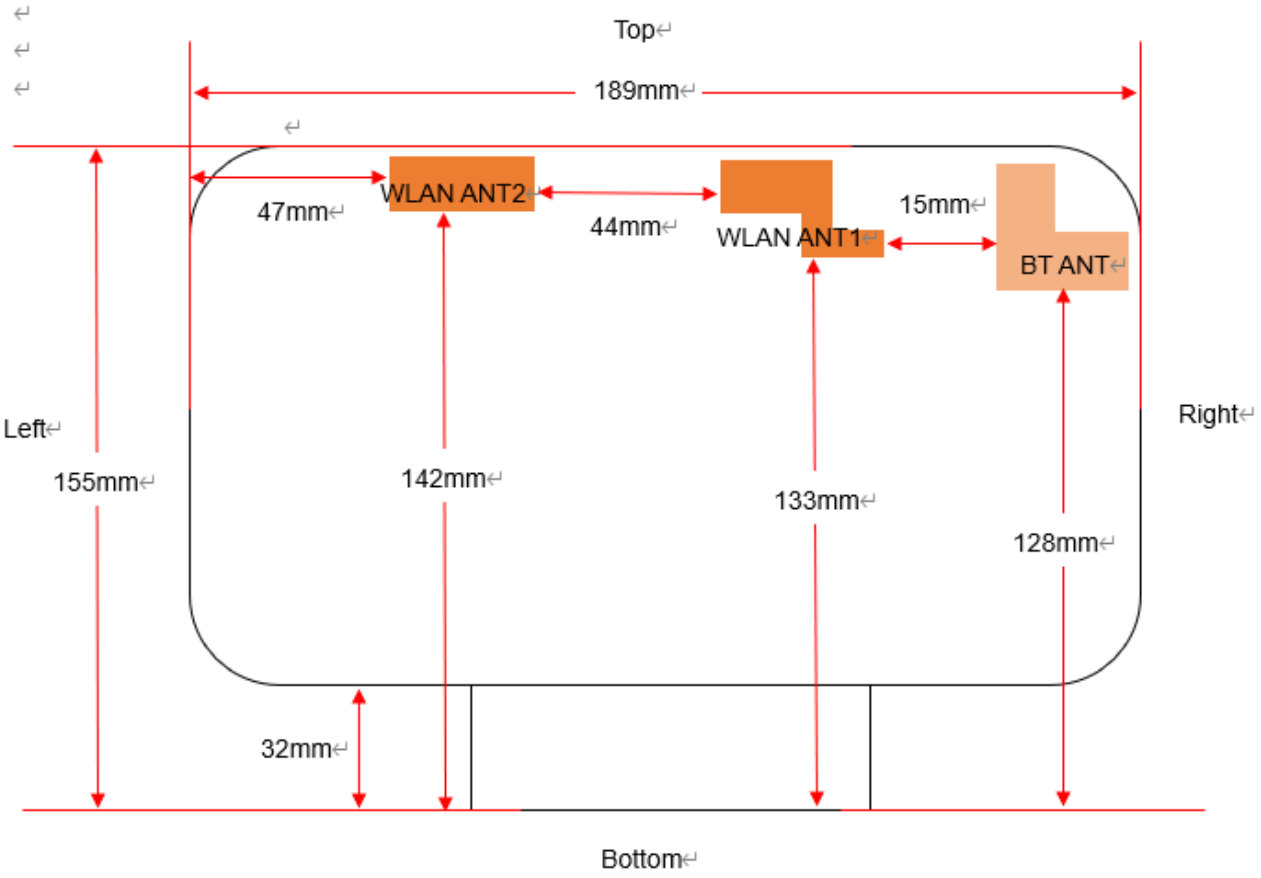
The Bluetooth duty cycle is 46.05 % as following figure, according to 2016 Oct. TCB workshop for Bluetooth SAR scaling need further consideration and the maximum duty cycle is 100%, therefore the actual duty cycle will be scaled up to 100% for Bluetooth reported SAR calculation.



9 TEST EXCLUSION CONSIDERATION

9.1 Antenna location sketch

EUT Front View:



WLAN ANT.1

Position	Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance(mm)	＜5mm	116mm	44mm	＜5mm	142mm

WLAN ANT.2

Position	Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance(mm)	＜5mm	47mm	115mm	＜5mm	133mm

BT ANT

Position	Back Side	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance(mm)	＜5mm	160mm	＜5mm	＜5mm	128mm

9.3 SAR Test Exclusion Consideration Table

According with RSS-102 Issue 6, SAR evaluation is required if the separation distance between the user and/or bystander and the antenna and/or radiating element of the device is less than or equal to 20 cm, except when the device operates at or below the applicable output power level (adjusted for tune-up tolerance) for the specified separation distance defined in Table.

Exemption Limits (mW)					
Frequency (MHz)	At separation distance of ≤5 mm	At separation distance of 10 mm	At separation distance of 15 mm	At separation distance of 20 mm	At separation distance of 25 mm
≤300	45	116	139	163	189
450	32	71	87	104	124
835	21	32	41	54	72
1900	6	10	18	33	57
2450	3	7	16	32	56
3500	2	6	15	29	50
5800	1	5	13	23	32
Frequency (MHz)	At separation distance of 30 mm	At separation distance of 35 mm	At separation distance of 40 mm	At separation distance of 45 mm	At separation distance of >50 mm
≤300	216	246	280	319	362
450	147	175	208	248	296
835	96	129	172	228	298
1900	92	138	194	257	323
2450	89	128	170	209	245
3500	72	94	114	134	158
5800	41	54	74	102	128

9.3.1 Tablet mode SAR Test Exclusion Consideration

BT ANT Body RF exposure scenarios

Band	Max. Tune-up Power		Test Position Configurations				
	dBm	mW	Back Side (with keyboard)	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance to User (mm)			＜5.0	160	＜5.0	＜5.0	128
SAR Test Required							
Bluetooth	Exclusion Threshold		3.0	245	3.0	3.0	245
	6.5	4.47	Yes	No	Yes	Yes	No

WALN ANT 1 Body RF exposure scenarios

Band	Max. Tune-up Power		Test Position Configurations				
	dBm	mW	Back Side (with keyboard)	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance to User (mm)			＜5.0	116	44	＜5.0	142
SAR Test Required							
WLAN 2.4 G	Exclusion Threshold		3.0	245	201	3.0	245
	19.0	79.43	Yes	No	No	Yes	Yes
WLAN 5.2 G	Exclusion Threshold		1.0	128	104	1	128
	15.0	31.62	Yes	No	No	Yes	Yes
WLAN 5.8 G	Exclusion Threshold		1.0	128	104	1	128
	10.0	10.00	Yes	No	No	Yes	Yes

WALN ANT 2 Body RF exposure scenarios

Band	Max. Tune-up Power		Test Position Configurations				
	dBm	mW	Back Side (with keyboard)	Left Edge	Right Edge	Top Edge	Bottom Edge
Distance to User (mm)			＜5.0	47	115	＜5.0	133
SAR Test Required							
WLAN 2.4 G	Exclusion Threshold		3.0	245	245	3.0	245
	18.5	70.79	Yes	No	No	Yes	No
WLAN 5.2 G	Exclusion Threshold		1.0	128	128	1	128
	15.0	31.62	Yes	No	No	Yes	No
WLAN 5.8 G	Exclusion Threshold		1.0	128	128	1	128
	13.5	22.39	Yes	No	No	Yes	No

10 TEST RESULT

10.1 WIFI 2.4GHz

10.1.1 WIFI 2.4GHz Body SAR

Antenna	Test Position	Dist.	Test Mode	Test Channel	Freq.(MHz)	Power Drift (dB)	Meas 1-g SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
Body														
1	Back side	0mm	802.11b	6	2437	0.12	0.063	92.56	1.080	16.79	18.00	1.321	0.090	
	Top side			6	2437	0.18	0.020	92.56	1.080	16.79	18.00	1.321	0.029	
	Back side			1	2412	-0.06	0.056	92.56	1.080	16.89	18.00	1.291	0.078	
	Back side			11	2462	0.02	0.083	92.56	1.080	16.79	18.00	1.321	0.118	
2	Back side	0mm	802.11b	6	2437	0.11	0.017	92.56	1.080	16.71	17.50	1.199	0.022	
	Top side			6	2437	0.17	0.027	92.56	1.080	16.71	17.50	1.199	0.035	
	Top side			1	2412	-0.07	0.036	92.56	1.080	16.84	18.00	1.306	0.051	
	Top side			11	2462	0.01	0.020	92.56	1.080	16.65	17.50	1.216	0.026	
MIMO	Back side	0mm	802.11b	6	2437	-0.15	0.076	92.56	1.080	14.37	15.50	1.297	0.107	
	Top side			6	2437	0.01	0.025	92.56	1.080	14.37	15.50	1.297	0.035	
	Back side			1	2412	0.08	0.095	92.56	1.080	14.44	15.50	1.276	0.131	1
	Back side			11	2462	-0.05	0.080	92.56	1.080	14.31	15.50	1.315	0.114	
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

10.2WIFI 5GHz

10.2.1 WIFI 5.2GHz Body SAR

Antenna	Test Position	Dist.	Test Mode	Test Channel	Freq.(MHz)	Power Drift (dB)	Meas 1-g SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
Body														
1	Back side	0mm	802.11ax40	38	5190	0.06	0.462	77.00	1.299	13.81	15.00	1.315	0.789	
	Top side			38	5190	-0.02	0.183	77.00	1.299	13.81	15.00	1.315	0.313	
	Back side			46	5230	0.15	0.520	77.00	1.299	13.75	15.00	1.334	0.901	
2	Back side	0mm	802.11ax40	38	5190	0.05	0.303	77.00	1.299	13.77	15.00	1.327	0.522	
	Top side			38	5190	-0.03	0.226	77.00	1.299	13.77	15.00	1.327	0.390	
	Top side			46	5230	-0.16	0.309	77.00	1.299	13.28	14.50	1.324	0.531	
MIMO	Back side	0mm	802.11ax40	38	5190	-0.09	0.739	77.00	1.299	14.21	15.00	1.199	1.151	2
	Top side			38	5190	0.04	0.351	77.00	1.299	14.21	15.00	1.199	0.547	
	Back side			46	5230	0.09	0.720	77.00	1.299	13.74	14.50	1.191	1.114	
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

10.2.2 WIFI 5.8GHz Body SAR

Antenna	Test Position	Dist.	Test Mode	Test Channel	Freq.(MHz)	Power Drift (dB)	Meas 1-g SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
Body														
1	Back side	0mm	802.11a	157	5785	0.03	0.722	96.80	1.033	8.82	10.00	1.312	0.979	
	Top side			157	5785	0.17	0.175	96.80	1.033	8.82	10.00	1.312	0.237	
	Back side			149	5745	-0.02	0.756	96.80	1.033	8.61	9.50	1.227	0.959	
	Back side			165	5825	0.02	0.618	96.80	1.033	9.16	10.00	1.213	0.775	
2	Back side	0mm	802.11a	157	5785	-0.05	0.555	96.80	1.033	12.36	13.50	1.300	0.745	
	Top side			157	5785	-0.08	0.744	96.80	1.033	12.36	13.50	1.300	0.999	
	Top side			149	5745	0.13	0.666	96.80	1.033	12.39	13.50	1.291	0.888	
	Top side			165	5825	0.09	0.522	96.80	1.033	12.49	13.50	1.262	0.680	
MIMO	Back side	0mm	802.11a	157	5785	0.05	0.746	96.80	1.033	11.37	12.50	1.297	1.000	
	Top side			157	5785	0.15	0.610	96.80	1.033	11.37	12.50	1.297	0.817	
	Back side			149	5745	-0.09	0.790	96.80	1.033	11.42	12.50	1.282	1.047	3
	Back side			165	5825	0.10	0.670	96.80	1.033	11.55	12.50	1.245	0.861	
Note: Refer to ANNEX C for the detailed test data for each test configuration.														

10.3 Bluetooth

Test Position	Dist.	Test Mode	Test Channel	Freq.(MHz)	Power Drift (dB)	Meas 1-g SAR (W/kg)	Duty cycle (%)	Duty cycle Factor	Meas. Power (dBm)	Max. tune-up power (dBm)	Scaling Factor	1g Scaled SAR (W/kg)	Meas. No.
Body													
Back side	0mm	GFSK	39	2441	0.15	0.073	46.05	2.172	5.44	6.50	1.276	0.202	4
Right side			39	2441	-0.11	0.026	46.05	2.172	5.44	6.50	1.276	0.072	
Top side			39	2441	0.12	0.050	46.05	2.172	5.44	6.50	1.276	0.139	
Back side			0	2402	-0.13	0.054	46.05	2.172	4.75	5.50	1.189	0.139	
Back side			78	2480	0.13	0.066	46.05	2.172	5.14	6.00	1.219	0.175	
Note: Refer to ANNEX C for the detailed test data for each test configuration.													

11 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). According KDB 447498 D01, simultaneous transmission:

a) SPLSR = (SAR1 + SAR2)^1.5 / R_i (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.
SAR1 is the highest reported or estimated SAR for the first of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition.
SAR2 is the highest reported or estimated SAR for the second of a pair of simultaneous transmitting antennas, in a specific test operating mode and exposure condition as the first.

b) If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary.

c) Simultaneously transmission SAR measurement, and the reported multi-band SAR < 1.6W/kg.

11.1 Simultaneous Transmission Mode Considerations

Note: This product WLAN and Bluetooth can't transmit simultaneously, so simultaneous transmission evaluation is not required in this report.

12 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	DASY8	16.2.2.1588	N/A	N/A
2450MHz Validation Dipole	Speag	D2450V2	SN: 952	2024/05/07	2027/05/06
5GHz Validation Dipole	Speag	D5GHzV2	SN: 1200	2024/05/09	2027/05/08
Data Acquisition Electronicsr	Speag	DAE4	SN: 540	2024/02/22	2025/02/21
E-Field Probe	Speag	EX3DV4	SN: 7510	2024/06/25	2025/06/24
Signal Generator	R&S	SMB100A	177746	2024/04/24	2025/04/23
Power Meter	R&S	NRVD-B2	835843/014	2024/08/08	2025/08/07
Power Sensor	R&S	NRV-Z4	100381	2024/08/08	2025/08/07
Power Sensor	R&S	NRV-Z2	100211	2024/08/08	2025/08/07
Wireless Communication Test Set	Anritsu	MT8820C	6201144551	2024/05/29	2025/05/28
Network Analyzer	Agilent	E5071C	MY56301409	2024/03/09	2025/03/08
Thermometer	Elitech	RC-4HC	EF724701275	2024/08/05	2025/08/04
Thermometer	Elitech	DT-322	220511131	2024/04/18	2025/04/17
Power Amplifier	SATIMO	6552B	22374	N/A	N/A
Dielectric Probe Kit	Speag	DAK3.5	SN: 1312	N/A	N/A
Phantom	Speag	SAM	SN: 1859	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 a DAK3.5 Dielectric Probe Kit.

Date	Fre. (MHz)	Meas. Conductivity(σ) (S/m)	Meas. Permittivity (ε)	Target Conductivity(σ) (S/m)	Target Permittivity (ε)	Conductivity Tolerance (%)	Permittivity Tolerance (%)
2024.12.28	2402	21.2	1.80	38.43	1.76	39.29	2.27
2024.12.28	2412	21.2	1.81	38.42	1.77	39.27	2.26
2024.12.28	2437	21.2	1.82	38.41	1.79	39.22	1.68
2024.12.28	2441	21.2	1.83	38.41	1.79	39.22	2.23
2024.12.28	2450	21.2	1.83	38.40	1.80	39.20	1.67
2024.12.28	2462	21.2	1.83	38.37	1.81	39.19	1.11
2024.12.28	2480	21.2	1.85	38.31	1.83	39.16	1.09
2024.12.29	5190	21.5	4.54	35.11	4.64	36.00	-2.16
2024.12.29	5230	21.5	4.57	35.03	4.69	35.95	-2.56
2024.12.29	5250	21.5	4.59	34.98	4.71	35.93	-2.55
2024.12.29	5745	21.5	5.10	34.20	5.21	35.37	-2.11
2024.12.29	5750	21.5	5.11	34.18	5.22	35.36	-2.11
2024.12.29	5785	21.5	5.14	34.11	5.25	35.32	-2.10
2024.12.29	5825	21.5	5.18	34.04	5.30	35.27	-2.26
Note: The tolerance limit of Conductivity and Permittivity is± 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).

Date	Liquid Type	Freq. (MHz)	Power (mW)	Measured SAR (W/kg)	Normalized SAR (W/kg)	Dipole SAR (W/kg)	Tolerance (%)
2024.12.28	Head	2450	100	5.430	54.30	52.60	3.23
2024.12.29	Head	5250	100	7.650	76.50	77.70	-1.54
2024.12.29	Head	5750	100	7.780	77.80	77.60	0.26
Note: The tolerance limit of System validation ±10%.							

System Performance Check Data (2450MHz)

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL		D2450	CW, 0--	2450.0, 50	7.75	1.83	38.4	22.6	21.2

Hardware Setup

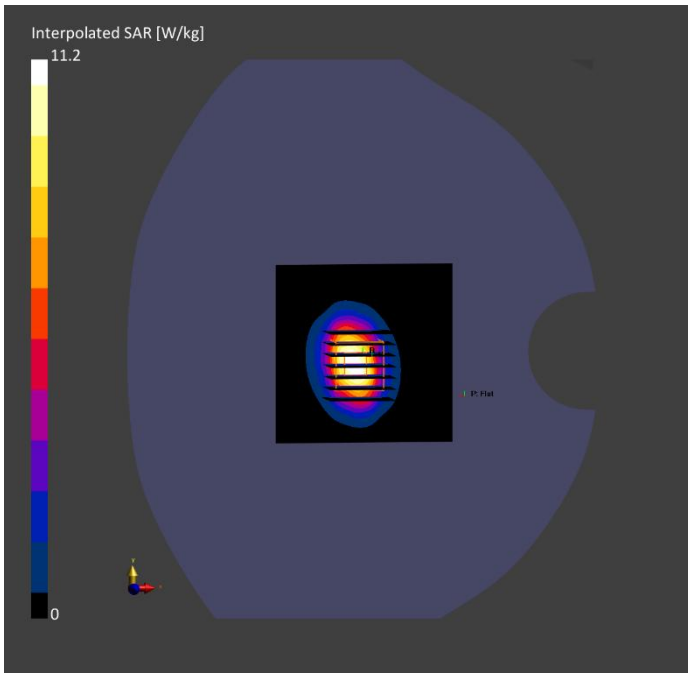
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-28	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	80.0 x 80.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	10.0 x 10.0	5.0 x 5.0 x 1.5
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-28	2024-12-28
psSAR1g [W/kg]	5.36	5.43
psSAR10g [W/kg]	2.58	2.53
Power Drift [dB]	-0.06	0.06
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		80.4
Dist 3dB Peak [mm]		8.9


Interpolated SAR [W/kg]
11.2
0

System Performance Check Data (5250MHz)

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL		D5GHz	CW, 0--	5250.0, 25	5.74	4.59	35.0	23.0	21.5

Hardware Setup

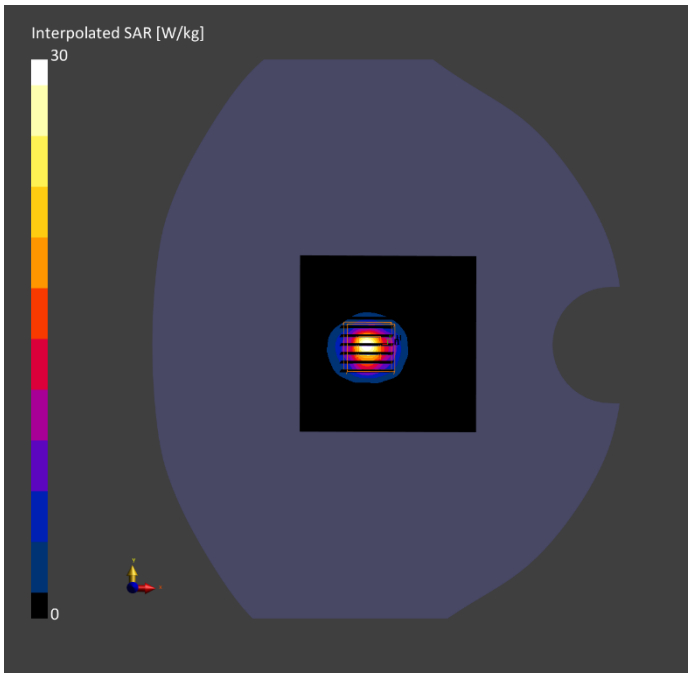
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-29	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	80.0 x 80.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-29	2024-12-29
psSAR1g [W/kg]	7.18	7.65
psSAR10g [W/kg]	2.10	2.18
Power Drift [dB]	0.01	-0.05
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		64.3
Dist 3dB Peak [mm]		6.8


Interpolated SAR [W/kg]
30
0

System Performance Check Data (5750MHz)

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL	FRONT, 5.00	D5GHz	CW, 0--	5750.0, 75	5.04	5.11	34.2	23.0	21.5

Hardware Setup

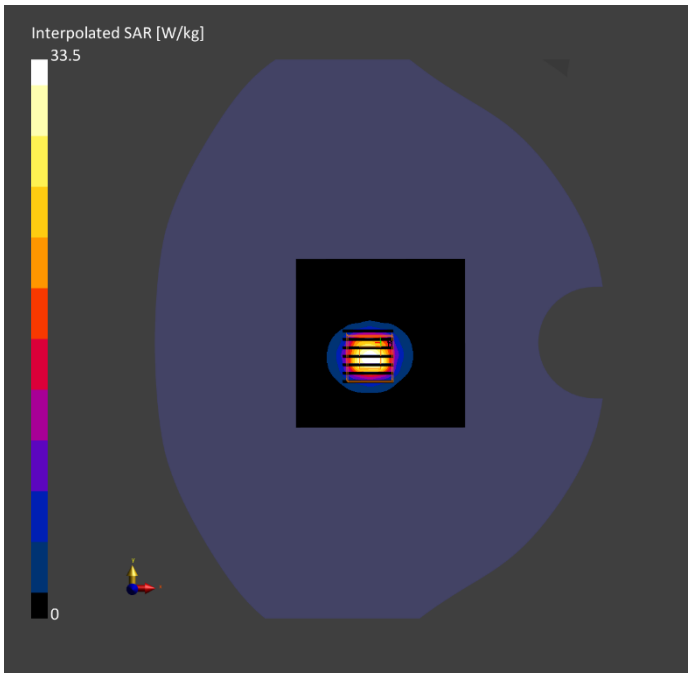
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-29	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	80.0 x 80.0	22.0 x 22.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 1.4
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-29	2024-12-29
psSAR1g [W/kg]	6.53	7.78
psSAR10g [W/kg]	2.09	2.21
Power Drift [dB]	0.10	0.07
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		60.1
Dist 3dB Peak [mm]		7.4


Interpolated SAR [W/kg]
33.5
0

ANNEX C TEST DATA

Meas.1 Body 0mm Back side WLAN 2.4G Ch1 MIMO

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL	BACK, 0.00	WLAN 2.4GHz	WLAN, 10695-AAC	2412.0, 3	7.75	1.81	38.4	22.6	21.2

Hardware Setup

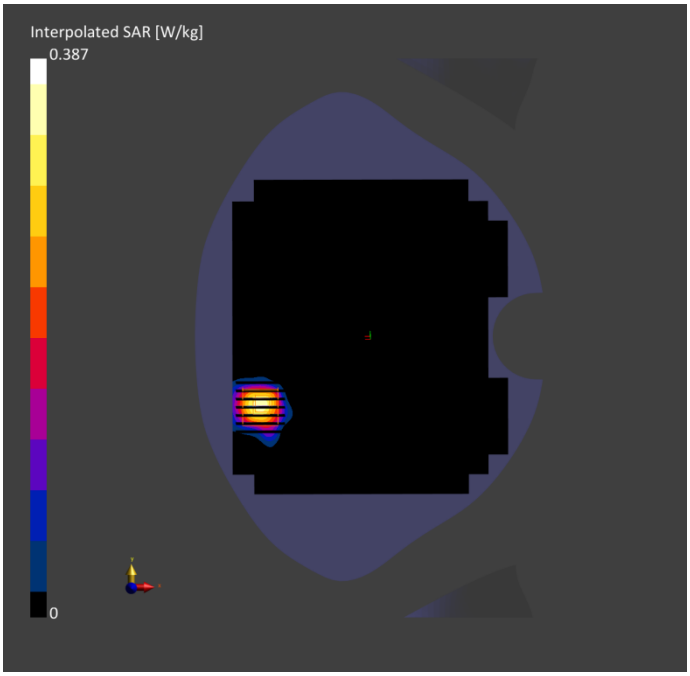
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-28	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	168.0 x 192.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	12.0 x 12.0	5.0 x 5.0 x 5.0
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Y	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-28	2024-12-28
psSAR1g [W/kg]	0.072	0.095
psSAR10g [W/kg]	0.034	0.031
Power Drift [dB]	0.18	0.08
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		22.4
Dist 3dB Peak [mm]		3.0


Interpolated SAR [W/kg]
0.387
0

Meas.2 Body 0mm Back side WLAN 5.2G Ch38 MIMO

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL	BACK, 0.00	WLAN 5GHz	WLAN, 10317-AAD	5190.0, 38	5.74	4.54	35.1	23.0	21.5

Hardware Setup

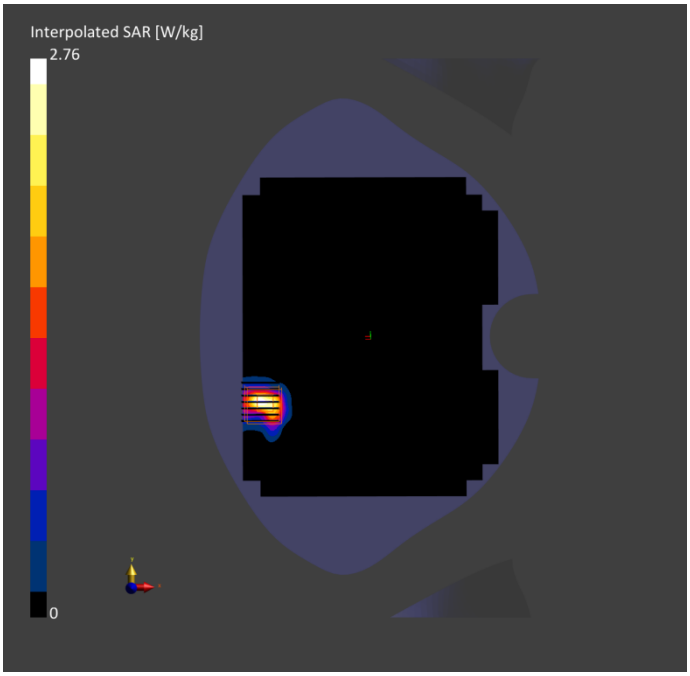
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-29	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	160.0 x 200.0	24.0 x 24.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 2.0
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-29	2024-12-29
psSAR1g [W/kg]	0.666	0.739
psSAR10g [W/kg]	0.220	0.262
Power Drift [dB]	-0.11	0.1
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		58.0
Dist 3dB Peak [mm]		3.2


Interpolated SAR [W/kg]
2.76
0

Meas.3 Body 0mm Back side WLAN 5.8G Ch149 MIMO

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL	BACK, 0.00	WLAN 5GHz	WLAN, 10400-AAE	5745.0, 149	5.04	5.10	34.2	23.0	21.5

Hardware Setup

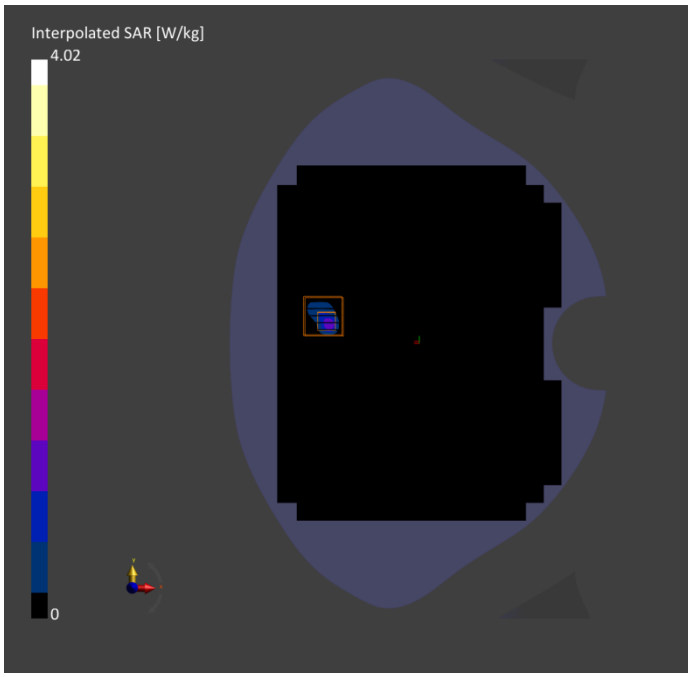
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-29	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	160.0 x 200.0	24.0 x 24.0 x 22.0
Grid Steps [mm]	10.0 x 10.0	4.0 x 4.0 x 2.0
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.4
MAIA	N/A	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-29	2024-12-29
psSAR1g [W/kg]	0.698	0.790
psSAR10g [W/kg]	0.161	0.177
Power Drift [dB]	0.17	0.02
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		48.1
Dist 3dB Peak [mm]		4.7


Interpolated SAR [W/kg]
4.02
0

Meas.4 Body 0mm Back side BT Ch39

Exposure Conditions

Phantom Section, TSL	Position, Test Distance [mm]	Band	Group, UID	Frequency [MHz], Channel Number	Conversion Factor	TSL Conductivity [S/m]	TSL Permittivity	Ambient Temperature [℃]	Liquid Temperature [℃]
Flat, HSL	BACK, 0.00	ISM 2.4 GHz Band	Bluetooth, 10670-AAA	2441.0, 39	7.75	1.83	38.4	22.6	21.2

Hardware Setup

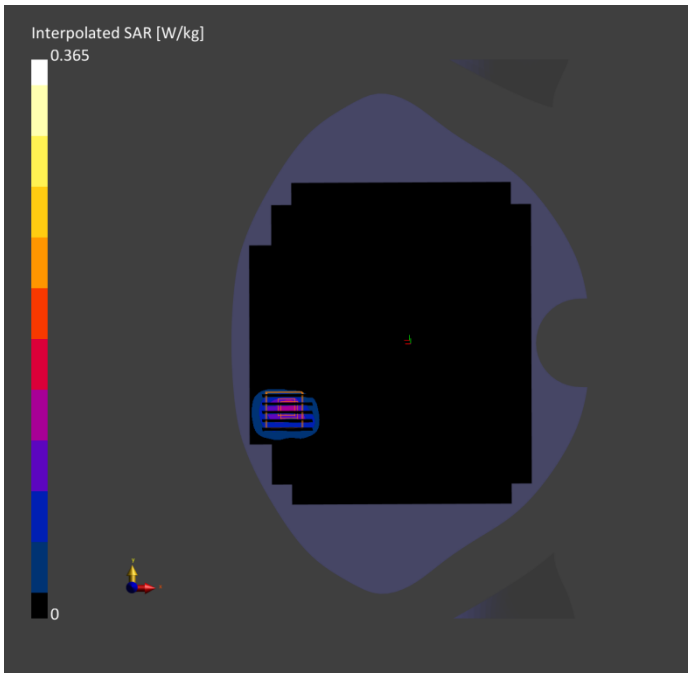
Phantom	TSL, Measured Date	Probe, Calibration Date	DAE, Calibration Date
Twin-SAM V5.0 (30deg probe tilt) - 1859	HBBL-600-10000 2024-12-28	EX3DV4 - SN7510, 2024-06-25	DAE4 Sn540, 2024-02-22

Scan Setup

	Area Scan	Zoom Scan
Grid Extents [mm]	144.0 x 192.0	30.0 x 30.0 x 30.0
Grid Steps [mm]	12.0 x 12.0	5.0 x 5.0 x 5.0
Sensor Surface [mm]	3.0	1.4
Graded Grid	Yes	Yes
Grading Ratio	1.5	1.5
MAIA	Y	N/A
Surface Detection	VMS + 6p	VMS + 6p
Scan Method	Measured	Measured

Measurement Results

	Area Scan	Zoom Scan
Date	2024-12-28	2024-12-28
psSAR1g [W/kg]	0.065	0.073
psSAR10g [W/kg]	0.026	0.028
Power Drift [dB]	0.00	-0.14
Power Scaling	Disabled	Disabled
Scaling Factor [dB]		
TSL Correction	No correction	No correction
M2/M1 [%]		36.6
Dist 3dB Peak [mm]		5.1


Interpolated SAR [W/kg]
0.365
0

ANNEX D EUT EXTERNAL PHOTOS

Please refer the document “BL-SH24A0814-AW.pdf”.

ANNEX E SAR TEST SETUP PHOTOS

Please refer the document “BL-SH24A0814-AS.pdf”.

ANNEX F CALIBRATION REPORT

Please refer the document “BL-SH24A0814-AC.pdf”.

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--END OF REPORT--