FCC SAR Test Report

Report No.	:	**W7L-A241112W001SA02**
Applicant	:	**Xiaomi Communications Co., Ltd.**
Address	:	**#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085**
Manufacturer	:	**Xiaomi Communications Co., Ltd.**
Address	:	**#019, 9th Floor, Building 6, 33 Xi'erqi Middle Road, Haidian District, Beijing, China, 100085**
Product	:	**Wireless Earphones**
FCC ID	:	**2AFZZM2438E1**
Brand	:	**Xiaomi**
Model No.	:	**M2438E1**
Standards	:	**FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1992 / IEEE 1528:2013** **KDB 865664 D01 v01r04 / KDB 865664 D02 v01r02 / KDB 447498 D01 v06** **KDB 248227 D01 v02r02**
Sample Received Date	:	**Dec. 11, 2024**
Date of Testing	:	**Dec. 14, 2024 ~ Dec. 28, 2024**
FCC Designation No.	:	**CN1171** **FCC Site Registration No. : 525120**

CERTIFICATION: The above equipment have been tested by **BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by A2LA or any government agencies.

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Approved By : Luke Lu / Manager

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Release Control Record

Report No.	Reason for Change	Date Issued
W7L-A241112W001SA02	Initial release	Jan. 02, 2025

1. Summary of Maximum SAR Value

Equipment Class	Operating Mode	Highest Head SAR_{1g} (0 cm Gap) (W/kg)
DTS	WLAN 2.4GHz	0.43
	BLE	0.68
NII	WLAN 5GHz	1.09
DSS	Bluetooth	0.99
Highest Simultaneous Transmission SAR		Head SAR_{1g} (0 cm Gap) (W/kg)
		1.13

Note:

1. The SAR limit **(Head & Body: SAR_{1g} 1.6 W/kg)** for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

2. Description of Equipment Under Test

EUT Type	Wireless Earphones
FCC ID	2AFZZM2438E1
Brand Name	Xiaomi
Model Name	M2438E1
HW Version	V3
SW Version	O71_W_2.0.4.8_241211
Tx Frequency Bands (Unit: MHz)	WLAN : 2412 ~ 2472, 5180 ~ 5320, 5500 ~ 5700, 5745 ~ 5825 Bluetooth : 2402 ~ 2480
Uplink Modulations	802.11b : DSSS 802.11a/g/n : OFDM Bluetooth : GFSK, π/4-DQPSK, 8-DPSK
Maximum Tune-up Conducted Power (Unit: dBm)	Please refer to section 4.5.1 of this report.
Antenna Type	PIFA Antenna
EUT Stage	Identical Prototype

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

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:

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

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

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

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

3.2 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

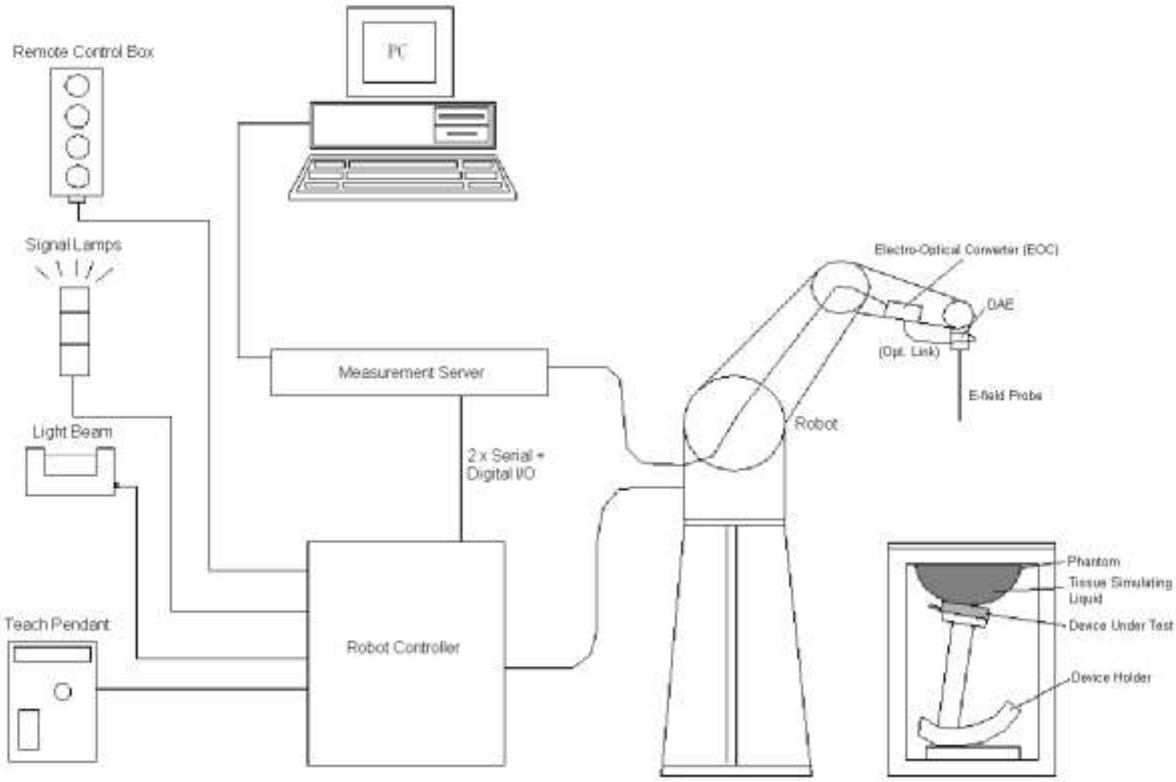


Fig-3.1 DASY System Setup

3.2.1 Robot

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

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

Fig-3.2 DASY5

3.2.2 Probes

The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Model	ES3DV3
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm

3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm

3.2.4 Phantoms

Model	Twin SAM
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet
Filling Volume	approx. 25 liters

Model	ELI
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.
Material	Vinylester, glass fiber reinforced (VE-GF)
Shell Thickness	2.0 ± 0.2 mm (bottom plate)
Dimensions	Major axis: 600 mm Minor axis: 400 mm
Filling Volume	approx. 30 liters

3.2.5 Device Holder

Model	Mounting Device
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).
Material	POM

Model	Laptop Extensions Kit
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.
Material	POM, Acrylic glass, Foam

3.2.6 System Validation Dipoles

Model	D-Serial
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.
Frequency	750 MHz to 5800 MHz
Return Loss	> 20 dB
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)

3.2.7 Tissue Simulating Liquids

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% are listed in Table-3.1.

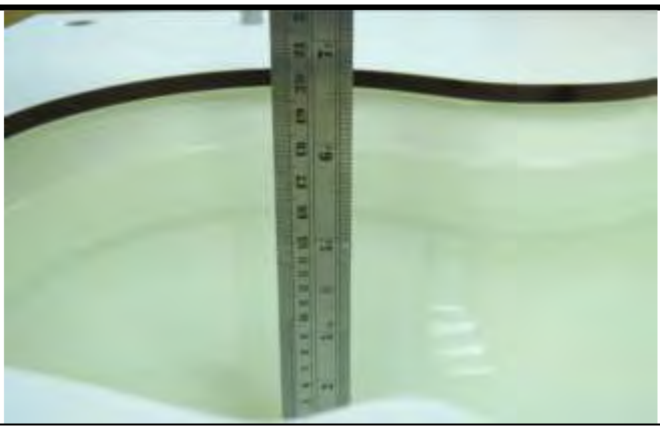


Photo of Liquid Height for Head Position

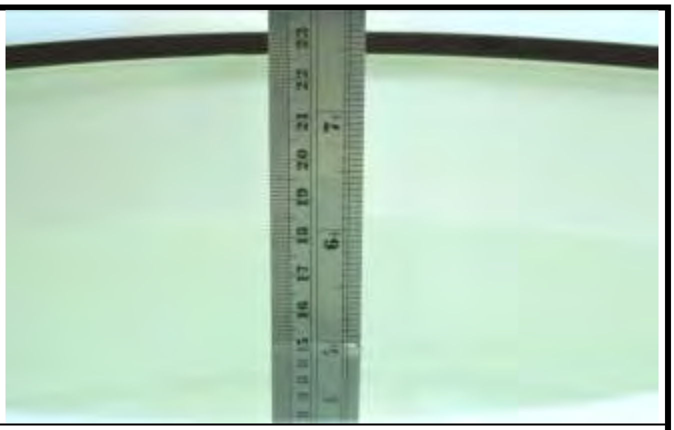


Photo of Liquid Height for Body Position

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528, and KDB 865664 D01 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit and a network analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of ±5%	Target Conductivity	Range of ±5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53

The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.5	17.3

3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.

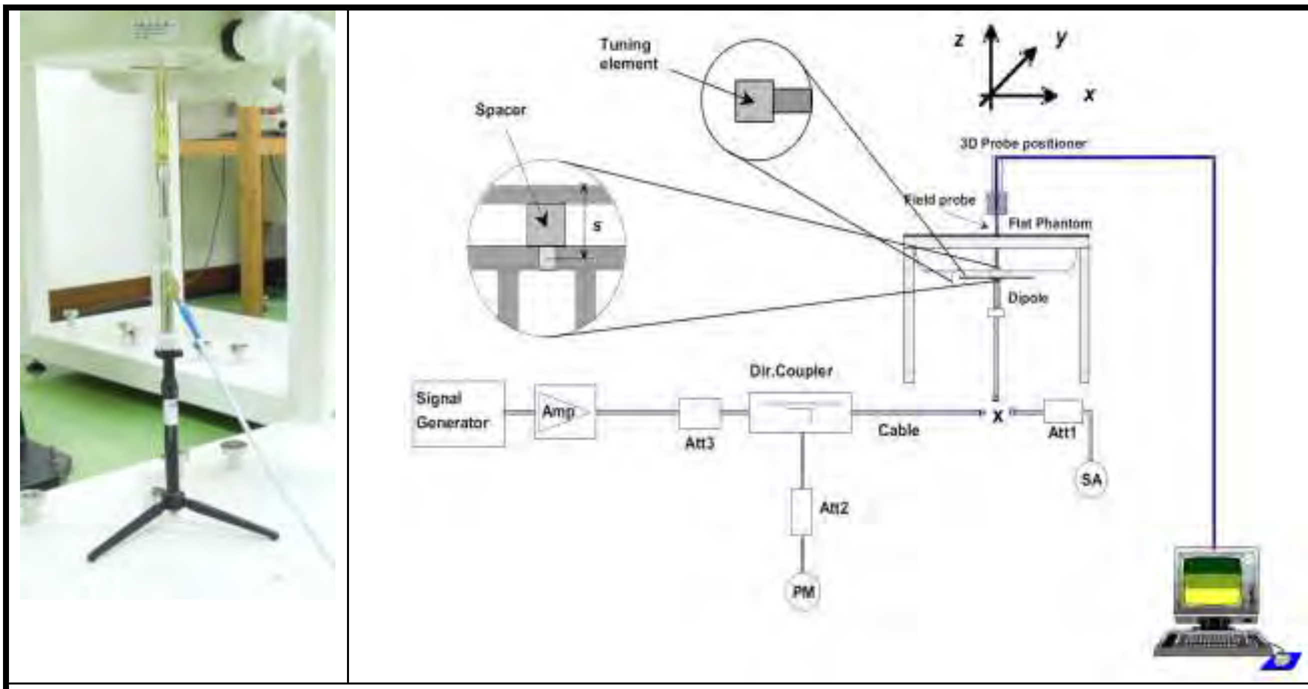


Fig-3.4 System Verification Setup

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

3.4 SAR Measurement Procedure

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

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

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

3.4.1 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. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15 mm	<= 12 mm	<= 12 mm	<= 10 mm	<= 10 mm
Zoom Scan (Δx, Δy)	<= 8 mm	<= 5 mm	<= 5 mm	<= 4 mm	<= 4 mm
Zoom Scan (Δz)	<= 5 mm	<= 5 mm	<= 4 mm	<= 3 mm	<= 2 mm
Zoom Scan Volume	>= 30 mm	>= 30 mm	>= 28 mm	>= 25 mm	>= 22 mm

Note:

When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

3.4.2 Volume Scan Procedure

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

3.4.3 Power Drift Monitoring

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

3.4.4 Spatial Peak SAR Evaluation

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

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

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

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

3.4.5 SAR Averaged Methods

In DASY, the interpolation and extrapolation are both based on the modified Quadratic Shepard's method. The interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5 mm.

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

<Considerations Related to WLAN for Setup and Testing>

In general, various vendor specific external test software and chipset based internal test modes are typically used for SAR measurement. These chipset based test mode utilities are generally hardware and manufacturer dependent, and often include substantial flexibility to reconfigure or reprogram a device. A Wi-Fi device must be configured to transmit continuously at the required data rate, channel bandwidth and signal modulation, using the highest transmission duty factor supported by the test mode tools for SAR measurement. The test frequencies established using test mode must correspond to the actual channel frequencies. When 802.11 frame gaps are accounted for in the transmission, a maximum transmission duty factor of 92 - 96% is typically achievable in most test mode configurations. A minimum transmission duty factor of 85% is required to avoid certain hardware and device implementation issues related to wide range SAR scaling. In addition, a periodic transmission duty factor is required for current generation SAR systems to measure SAR correctly. The reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

According to KDB 248227 D01, this device has installed WLAN engineering testing software which can provide continuous transmitting RF signal. During WLAN SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

Initial Test Configuration

An initial test configuration is determined for OFDM transmission modes in 2.4 GHz and 5 GHz bands according to the channel bandwidth, modulation and data rate combination(s) with the highest maximum output power specified for production units in each standalone and aggregated frequency band. When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band.

Subsequent Test Configuration

SAR measurement requirements for the remaining 802.11 transmission mode configurations that have not been tested in the initial test configuration are determined separately for each standalone and aggregated frequency band, in each exposure condition, according to the maximum output power specified for production units. Additional power measurements may be required to determine if SAR measurements are required for subsequent highest output power channels in a subsequent test configuration. When the highest reported SAR for the initial test configuration according to the initial test position or fixed exposure position requirements, is adjusted by the ratio of the subsequent test configuration to initial test configuration specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for that subsequent test configuration.

SAR Test Configuration and Channel Selection

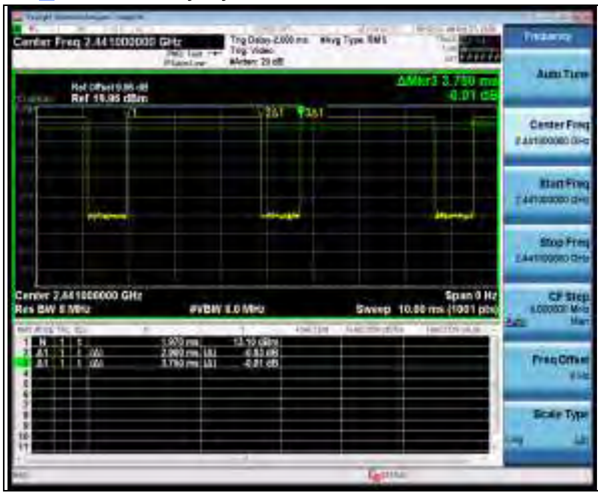
When multiple channel bandwidth configurations in a frequency band have the same specified maximum output power, the initial test configuration is using largest channel bandwidth, lowest order modulation, lowest data rate, and lowest order 802.11 mode (i.e., 802.11a is chosen over 802.11n then 802.11ac or 802.11g is chosen over

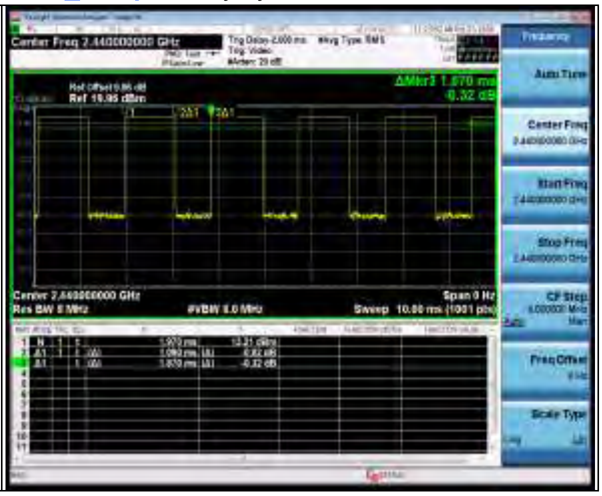
802.11n). After an initial test configuration is determined, if multiple test channels have the same measured maximum output power, the channel chosen for SAR measurement is determined according to the following.
1) The channel closest to mid-band frequency is selected for SAR measurement.
2) For channels with equal separation from mid-band frequency; for example, high and low channels or two mid-band channels, the higher frequency (number) channel is selected for SAR measurement.

For devices that operate in both U-NII bands using the same transmitter and antenna(s), SAR test reduction is determined according to the following.
1) When the same maximum output power is specified for both bands, begin SAR measurement in U-NII-2A band by applying the OFDM SAR requirements. If the highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for U-NII-1 band for that configuration (802.11 mode and exposure condition).
2) When different maximum output power is specified for the bands, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power in that test configuration.

<Considerations Related to Bluetooth for Setup and Testing>
This device has installed Bluetooth engineering testing software which can provide continuous transmitting RF signal. During Bluetooth SAR testing, this device was operated to transmit continuously at the maximum transmission duty with specified transmission mode, operating frequency, lowest data rate, and maximum output power.

<Duty Cycle of Test Signal>
<Left Ear>
BT_GFSK: Duty cycle = 2.900 / 3.750 = 77.33%   **BLE_2Mbps:** Duty cycle = 1.070 / 1.870 = 57.22%





<Right Ear>

BT_GFSK: Duty cycle = 2.890 / 3.750 = 77.07% **BLE_2Mbps:** Duty cycle = 1.080 / 1.870 = 57.75%

Note: Bluetooth SAR scaling need further consideration, and the theoretical maximum duty cycle for GFSK and BLE is 83.3% and 86%, therefore the actual duty cycle will be scaled up to the theoretical value of Bluetooth reported SAR calculation.

4.2 EUT Testing Position

4.2.1 Head Exposure Conditions

This EUT was tested for all the close to the human body of intended use surfaces of the EUT. The separation distance between this EUT and phantom is 0 cm.

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Dec. 14, 2024	Head	2450	22.5	1.833	39.632	1.80	39.20	1.83	1.10
Dec. 26, 2024	Head	5250	22.4	4.610	37.322	4.71	35.90	-2.12	3.96
Dec. 27, 2024	Head	5600	22.4	5.025	36.769	5.07	35.50	-0.89	3.57
Dec. 28, 2024	Head	5750	22.6	5.194	36.537	5.22	35.40	-0.50	3.21

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2 ℃

4.4 System Verification

The measuring result for system verification is tabulated as below.

<1g>

Test Date	Mode	Frequency (MHz)	1W Target SAR-10g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Dec. 14, 2024	Head	2450	53.10	13.20	52.80	-0.56	893	3873	1389
Dec. 26, 2024	Head	5250	77.70	7.95	79.50	2.32	1133	3873	1389
Dec. 27, 2024	Head	5600	82.40	8.25	82.50	0.12	1133	3873	1389
Dec. 28, 2024	Head	5750	78.60	7.78	77.80	-1.02	1133	3873	1389

<10g>

Test Date	Mode	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-10g (W/kg)	Normalized to 1W SAR-10g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Dec. 14, 2024	Head	2450	24.90	6.37	25.48	2.33	893	3873	1389
Dec. 26, 2024	Head	5250	22.00	2.29	22.90	4.09	1133	3873	1389
Dec. 27, 2024	Head	5600	23.20	2.34	23.40	0.86	1133	3873	1389
Dec. 28, 2024	Head	5750	22.00	2.21	22.10	0.45	1133	3873	1389

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.5 Maximum Output Power

4.5.1 Maximum Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

<Left Ear>

Bluetooth			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
BT_GFSK	0	2402	13.50
	39	2441	13.50
	78	2480	13.50
BT_DQPSK	0	2402	10.50
	39	2441	10.50
	78	2480	10.50
BT_8DPSK	0	2402	10.50
	39	2441	10.50
	78	2480	10.50
BLE_1Mbps	0	2404	13.50
	19	2440	13.50
	39	2480	13.50
BLE_2Mbps	1	2404	13.50
	19	2440	13.50
	38	2478	13.50

2.4GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
802.11b 1Mbps	1	2412	9.5
	7	2442	9.5
	13	2472	9.5
802.11g 6Mbps	1	2412	9.5
	7	2442	10.0
	13	2472	10.0
802.11n-HT20 MCS0	1	2412	9.5
	7	2442	10.0
	13	2472	10.0

5.2GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
802.11a 6Mbps	36	5180	11.5
	40	5200	11.5
	44	5220	11.5
	48	5240	11.5

802.11n-HT20 MCS0	36	5180	11.5
	40	5200	11.5
	44	5220	11.5
	48	5240	11.5

5.3GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
802.11a 6Mbps	52	5260	11.5
	56	5280	11.5
	60	5300	11.5
	64	5320	11.0
802.11n-HT20 MCS0	52	5260	11.5
	56	5280	11.5
	60	5300	11.5
	64	5320	11.0

5.5GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
802.11a 6Mbps	100	5500	10.0
	116	5580	10.5
	124	5620	10.5
	132	5660	10.5
	140	5700	11.5
	144	5720	11.0
802.11n-HT20 MCS0	100	5500	10.0
	116	5580	10.5
	124	5620	10.5
	132	5660	10.5
	140	5700	11.5
	144	5720	11.0

5.8GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Tune up limit (dBm)**
802.11a 6Mbps	149	5745	11.5
	157	5785	10.5
	165	5825	10.5
802.11n-HT20 MCS0	149	5745	11.0
	157	5785	10.5
	165	5825	10.5

<Right Ear>

Bluetooth			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
BT_GFSK	0	2402	13.50
	39	2441	13.50
	78	2480	13.50
BT_DQPSK	0	2402	10.50
	39	2441	10.50
	78	2480	10.50
BT_8DPSK	0	2402	10.50
	39	2441	10.50
	78	2480	13.50
BLE_1Mbps	0	2404	13.50
	19	2440	13.50
	39	2480	13.50
BLE_2Mbps	1	2404	13.50
	19	2440	13.50
	38	2478	13.50

2.4GHz WLAN			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
802.11b 1Mbps	1	2412	10.0
	7	2442	10.0
	13	2472	10.0
802.11g 6Mbps	1	2412	10.0
	7	2442	10.5
	13	2472	10.5
802.11n-HT20 MCS0	1	2412	10.0
	7	2442	10.5
	13	2472	10.5

5.2GHz WLAN			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
802.11a 6Mbps	36	5180	11.5
	40	5200	11.5
	44	5220	11.5
	48	5240	11.5
802.11n-HT20 MCS0	36	5180	11.0
	40	5200	11.5
	44	5220	11.5

	48	5240	11.5

5.3GHz WLAN			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
802.11a 6Mbps	52	5260	11.5
	56	5280	11.5
	60	5300	10.0
	64	5320	10.0
802.11n-HT20 MCS0	52	5260	11.5
	56	5280	11.5
	60	5300	10.0
	64	5320	10.0

5.5GHz WLAN			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
802.11a 6Mbps	100	5500	9.0
	116	5580	9.0
	124	5620	9.5
	132	5660	10.0
	140	5700	10.0
	144	5720	10.0
802.11n-HT20 MCS0	100	5500	9.0
	116	5580	9.0
	124	5620	9.5
	132	5660	10.0
	140	5700	10.0
	144	5720	10.0

5.8GHz WLAN			
Mode	Channel	Frequency (MHz)	Tune up limit (dBm)
802.11a 6Mbps	149	5745	10.0
	157	5785	10.0
	165	5825	10.0
802.11n-HT20 MCS0	149	5745	10.0
	157	5785	10.0
	165	5825	10.0

4.5.2 Measured Conducted Power Result

The measuring conducted average power (Unit: dBm) is shown as below.

<Left Ear>

Bluetooth			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
BT_GFSK	0	2402	**11.72**
	39	2441	11.60
	78	2480	11.54
BT_DQPSK	0	2402	8.82
	39	2441	8.96
	78	2480	8.73
BT_8DPSK	0	2402	8.83
	39	2441	8.94
	78	2480	9.07
BLE_1Mbps	0	2404	12.22
	19	2440	12.26
	39	2480	12.28
BLE_2Mbps	1	2404	11.47
	19	2440	11.88
	38	2478	12.33

2.4GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11b 1Mbps	1	2412	8.00
	7	2442	7.92
	13	2472	7.73
802.11g 6Mbps	1	2412	7.79
	7	2442	**8.53**
	13	2472	8.52
802.11n-HT20 MCS0	1	2412	7.58
	7	2442	8.34
	13	2472	8.26

5.2GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	36	5180	9.98
	40	5200	**10.31**
	44	5220	10.15
	48	5240	10.13
802.11n-HT20 MCS0	36	5180	9.96

	40	5200	10.29
	44	5220	10.14
	48	5240	10.16

5.3GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	52	5260	**10.12**
	56	5280	10.05
	60	5300	9.84
	64	5320	9.72
802.11n-HT20 MCS0	52	5260	10.10
	56	5280	9.99
	60	5300	9.94
	64	5320	9.81

5.5GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	100	5500	8.36
	116	5580	9.16
	124	5620	9.43
	132	5660	9.55
	140	5700	10.21
	144	5720	9.81
802.11n-HT20 MCS0	100	5500	8.43
	116	5580	9.25
	124	5620	9.36
	132	5660	9.43
	140	5700	**10.29**
	144	5720	9.39

5.8GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	149	5745	**9.95**
	157	5785	8.83
	165	5825	8.89
802.11n-HT20 MCS0	149	5745	9.84
	157	5785	9.06
	165	5825	9.01

<Right Ear>

Bluetooth			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
BT_GFSK	0	2402	12.05
	39	2441	**12.06**
	78	2480	12.04
BT_DQPSK	0	2402	8.88
	39	2441	8.85
	78	2480	8.90
BT_8DPSK	0	2402	8.81
	39	2441	8.70
	78	2480	9.10
BLE_1Mbps	0	2404	12.11
	19	2440	12.18
	39	2480	12.23
BLE_2Mbps	1	2404	11.93
	19	2440	11.58
	38	2478	12.28

2.4GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11b 1Mbps	1	2412	8.23
	7	2442	8.22
	13	2472	8.14
802.11g 6Mbps	1	2412	8.40
	7	2442	**8.99**
	13	2472	8.94
802.11n-HT20 MCS0	1	2412	8.18
	7	2442	8.90
	13	2472	8.87

5.2GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	36	5180	9.88
	40	5200	**10.05**
	44	5220	9.88
	48	5240	9.90
802.11n-HT20 MCS0	36	5180	9.47
	40	5200	9.96
	44	5220	9.92

	48	5240	10.02

5.3GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	52	5260	**9.91**
	56	5280	9.88
	60	5300	8.55
	64	5320	8.42
802.11n-HT20 MCS0	52	5260	9.89
	56	5280	9.80
	60	5300	8.50
	64	5320	8.39

5.5GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	100	5500	7.37
	116	5580	7.66
	124	5620	8.34
	132	5660	8.38
	140	5700	8.56
	144	5720	8.50
802.11n-HT20 MCS0	100	5500	7.21
	116	5580	7.30
	124	5620	8.35
	132	5660	8.40
	140	5700	**8.66**
	144	5720	8.36

5.8GHz WLAN			
Mode	**Channel**	**Frequency (MHz)**	**Average power (dBm)**
802.11a 6Mbps	149	5745	8.65
	157	5785	8.58
	165	5825	8.55
802.11n-HT20 MCS0	149	5745	**8.66**
	157	5785	8.61
	165	5825	8.55

4.6 SAR Testing Results

4.6.1 SAR Test Reduction Considerations

<KDB 447498 D01, General RF Exposure Guidance>

1. Testing of other required channels within the operating mode of a frequency band is not required when the reported SAR for the mid-band or highest output power channel is:
   (1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
   (2) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
   (3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz
2. Per KDB 447498 D01v06, the scaled SAR is the measured SAR value adjusted for maximum tune-up tolerance.
   (1) For BT: Scaled SAR(W/kg) = Measured SAR(W/kg) * Duty Cycle Scaling Factor * Tune-up Scaling Factor

<KDB 248227 D01, SAR Guidance for Wi-Fi Transmitters>

(1) For handsets operating next to ear, hotspot mode or mini-tablet configurations, the initial test position procedures were applied. The test position with the highest extrapolated peak SAR will be used as the initial test position. When the reported SAR of initial test position is <= 0.4 W/kg, SAR testing for remaining test positions is not required. Otherwise, SAR is evaluated at the subsequent highest peak SAR positions until the reported SAR result is <= 0.8 W/kg or all test positions are measured.

(2) For WLAN 2.4 GHz, the highest measured maximum output power channel for DSSS was selected for SAR measurement. When the reported SAR is <= 0.8 W/kg, no further SAR testing is required. Otherwise, SAR is evaluated at the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel. For OFDM modes (802.11g/n), SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and it is <= 1.2 W/kg.

(3) For WLAN 5 GHz, the initial test configuration was selected according to the transmission mode with the highest maximum output power. When the reported SAR of initial test configuration is > 0.8 W/kg, SAR is required for the subsequent highest measured output power channel until the reported SAR result is <= 1.2 W/kg or all required channels are measured. For other transmission modes, SAR is not required when the highest reported SAR for initial test configuration is adjusted by the ratio of subsequent test configuration to initial test configuration specified maximum output power and it is <= 1.2 W/kg.

(4) For WLAN MIMO mode, the power-based standalone SAR test exclusion or the sum of SAR provision in KDB 447498 to determine simultaneous transmission SAR test exclusion should be applied. Otherwise, SAR for MIMO mode will be measured with all applicable antennas transmitting simultaneously at the specified maximum output power of MIMO operation.

4.6.2 SAR Results for Head Exposure Condition (Separation Distance is 0 cm Gap)

<Left Ear>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Duty Cycle %	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Duty Cycle Scaling Factor	Tune-up Scaling Factor	Scaled SAR-1g (W/kg)
	BT	GFSK	Test Position 1	0cm	39	77.33	13.50	11.60	0.12	0.324	1.077	1.549	0.540
	BT	GFSK	Test Position 2	0cm	39	77.33	13.50	11.60	0.13	0.344	1.077	1.549	0.574
	BT	GFSK	Test Position 3	0cm	39	77.33	13.50	11.60	0.02	0.124	1.077	1.549	0.207
	BT	GFSK	Test Position 4	0cm	39	77.33	13.50	11.60	-0.11	0.099	1.077	1.549	0.165
	BT	GFSK	Test Position 5	0cm	39	77.33	13.50	11.60	-0.17	0.052	1.077	1.549	0.086
	BT	GFSK	Test Position 6	0cm	39	77.33	13.50	11.60	-0.17	0.050	1.077	1.549	0.083
	BT	GFSK	Left Cheek	0cm	39	77.33	13.50	11.60	0.05	0.164	1.077	1.549	0.274
P01	BT	GFSK	Test Position 2	0cm	0	77.33	13.50	11.72	0.16	0.438	1.077	1.507	**0.711**
	BT	GFSK	Test Position 2	0cm	78	77.33	13.50	11.54	0.15	0.248	1.077	1.570	0.419
	BLE	2Mbps	Test Position 2	0cm	19	57.22	13.50	11.88	0.17	0.117	1.503	1.452	0.255
P02	BLE	2Mbps	Test Position 2	0cm	1	57.22	13.00	11.47	0.12	0.189	1.503	1.422	**0.404**
	BLE	2Mbps	Test Position 2	0cm	38	57.22	13.50	12.33	0.15	0.093	1.503	1.309	0.183
	WLAN 2.4G	802.11b	Test Position 1	0cm	1	99.64	9.50	8.00	0.19	0.192	1.004	1.413	0.272
P03	WLAN 2.4G	802.11b	Test Position 2	0cm	1	99.64	9.50	8.00	0.16	0.239	1.004	1.413	**0.339**
	WLAN 2.4G	802.11b	Test Position 3	0cm	1	99.64	9.50	8.00	-0.03	0.088	1.004	1.413	0.125
	WLAN 2.4G	802.11b	Test Position 4	0cm	1	99.64	9.50	8.00	0.00	0.055	1.004	1.413	0.078
	WLAN 2.4G	802.11b	Test Position 5	0cm	1	99.64	9.50	8.00	-0.09	0.028	1.004	1.413	0.040
	WLAN 2.4G	802.11b	Test Position 6	0cm	1	99.64	9.50	8.00	-0.17	0.028	1.004	1.413	0.039
	WLAN 2.4G	802.11b	Left Cheek	0cm	1	99.64	9.50	8.00	-0.19	0.136	1.004	1.413	0.193
	WLAN 2.4G	802.11b	Test Position 2	0cm	6	99.64	9.50	7.92	0.15	0.188	1.004	1.439	0.272
	WLAN 2.4G	802.11b	Test Position 2	0cm	11	99.64	9.50	7.73	0.13	0.155	1.004	1.503	0.234
	WLAN 5G	802.11a	Test Position 1	0cm	52	99.02	11.50	10.12	0.17	0.179	1.010	1.374	0.248
	WLAN 5G	802.11a	Test Position 2	0cm	52	99.02	11.50	10.12	0.15	0.328	1.010	1.374	0.455
	WLAN 5G	802.11a	Test Position 3	0cm	52	99.02	11.50	10.12	0.09	0.536	1.010	1.374	0.744
	WLAN 5G	802.11a	Test Position 4	0cm	52	99.02	11.50	10.12	0.00	0.003	1.010	1.374	0.004
	WLAN 5G	802.11a	Test Position 5	0cm	52	99.02	11.50	10.12	-0.14	0.090	1.010	1.374	0.124
	WLAN 5G	802.11a	Test Position 6	0cm	52	99.02	11.50	10.12	0.09	0.002	1.010	1.374	0.002
	WLAN 5G	802.11a	Left Cheek	0cm	52	99.02	11.50	10.12	-0.09	0.015	1.010	1.374	0.020
P04	WLAN 5G	802.11a	Test Position 3	0cm	56	99.02	11.50	10.05	0.16	0.596	1.010	1.396	**0.841**
	WLAN 5G	802.11a	Test Position 3	0cm	60	99.02	11.50	9.84	-0.08	0.541	1.010	1.466	0.801
	WLAN 5G	802.11a	Test Position 3	0cm	64	99.02	11.00	9.72	0.19	0.503	1.010	1.343	0.682
	WLAN 5G	802.11a	Test Position 1	0cm	140	99.02	11.50	10.21	0.00	0.516	1.010	1.346	0.701
	WLAN 5G	802.11a	Test Position 2	0cm	140	99.02	11.50	10.21	0.04	0.678	1.010	1.346	0.922
	WLAN 5G	802.11a	Test Position 3	0cm	140	99.02	11.50	10.21	-0.02	0.642	1.010	1.346	0.873
	WLAN 5G	802.11a	Test Position 4	0cm	140	99.02	11.50	10.21	0.06	0.190	1.010	1.346	0.258
	WLAN 5G	802.11a	Test Position 5	0cm	140	99.02	11.50	10.21	-0.06	0.391	1.010	1.346	0.531
	WLAN 5G	802.11a	Test Position 6	0cm	140	99.02	11.50	10.21	0.16	0.085	1.010	1.346	0.115
	WLAN 5G	802.11a	Left Cheek	0cm	140	99.02	11.50	10.21	0.13	0.221	1.010	1.346	0.300
	WLAN 5G	802.11a	Test Position 2	0cm	100	99.02	10.00	8.36	-0.09	0.614	1.010	1.459	0.905
	WLAN 5G	802.11a	Test Position 2	0cm	116	99.02	10.50	9.16	0.07	0.736	1.010	1.361	1.012
	WLAN 5G	802.11a	Test Position 2	0cm	124	99.02	10.50	9.43	0.12	0.843	1.010	1.279	1.089
P05	WLAN 5G	802.11a	Test Position 2	0cm	132	99.02	10.50	9.55	0.14	0.867	1.010	1.245	**1.090**
	WLAN 5G	802.11a	Test Position 2	0cm	144	99.02	11.00	9.81	-0.01	0.668	1.010	1.315	0.887
	WLAN 5G	802.11a	Test Position 3	0cm	100	99.02	10.00	8.36	0.03	0.578	1.010	1.459	0.852
	WLAN 5G	802.11a	Test Position 3	0cm	116	99.02	10.50	9.16	0.15	0.692	1.010	1.361	0.952
	WLAN 5G	802.11a	Test Position 3	0cm	124	99.02	10.50	9.43	-0.06	0.791	1.010	1.279	1.022
	WLAN 5G	802.11a	Test Position 3	0cm	132	99.02	10.50	9.55	0.02	0.816	1.010	1.245	1.026
	WLAN 5G	802.11a	Test Position 3	0cm	144	99.02	11.00	9.81	0.11	0.623	1.010	1.315	0.828
	WLAN 5G	802.11a	Test Position 1	0cm	149	97.20	11.50	9.95	0.13	0.432	1.029	1.429	0.635
P06	WLAN 5G	802.11a	Test Position 2	0cm	149	97.20	11.50	9.95	-0.02	0.734	1.029	1.429	**1.079**
	WLAN 5G	802.11a	Test Position 3	0cm	149	97.20	11.50	9.95	0.03	0.543	1.029	1.429	0.798

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Duty Cycle %	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Duty Cycle Scaling Factor	Tune-up Scaling Factor	Scaled SAR-1g (W/kg)
	WLAN 5G	802.11a	Test Position 4	0cm	149	97.20	11.50	9.95	-0.07	0.188	1.029	1.429	0.276
	WLAN 5G	802.11a	Test Position 5	0cm	149	97.20	11.50	9.95	0.02	0.359	1.029	1.429	0.528
	WLAN 5G	802.11a	Test Position 6	0cm	149	97.20	11.50	9.95	0.15	0.111	1.029	1.429	0.163
	WLAN 5G	802.11a	Left Cheek	0cm	149	97.20	11.50	9.95	0.13	0.278	1.029	1.429	0.409
	WLAN 5G	802.11a	Test Position 2	0cm	157	97.20	10.50	8.83	0.09	0.617	1.029	1.469	0.933
	WLAN 5G	802.11a	Test Position 2	0cm	165	97.20	10.50	8.89	0.18	0.499	1.029	1.449	0.744

<Right Ear>

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Duty Cycle %	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Duty Cycle Scaling Factor	Tune-up Scaling Factor	Scaled SAR-1g (W/kg)
	BT	GFSK	Test Position 1	0cm	39	77.07	13.50	12.06	0.10	0.505	1.081	1.393	0.761
	BT	GFSK	Test Position 2	0cm	39	77.07	13.50	12.06	0.13	0.641	1.081	1.393	0.965
	BT	GFSK	Test Position 3	0cm	39	77.07	13.50	12.06	-0.17	0.282	1.081	1.393	0.425
	BT	GFSK	Test Position 4	0cm	39	77.07	13.50	12.06	0.07	0.118	1.081	1.393	0.178
	BT	GFSK	Test Position 5	0cm	39	77.07	13.50	12.06	-0.15	0.067	1.081	1.393	0.100
	BT	GFSK	Test Position 6	0cm	39	77.07	13.50	12.06	-0.11	0.065	1.081	1.393	0.097
	BT	GFSK	Right Cheek	0cm	39	77.07	13.50	12.06	0.06	0.185	1.081	1.393	0.279
P07	BT	GFSK	Test Position 2	0cm	0	77.07	13.50	12.05	0.13	0.657	1.081	1.396	**0.992**
	BT	GFSK	Test Position 2	0cm	78	77.07	13.50	12.04	0.15	0.521	1.081	1.400	0.788
	BLE	2Mbps	Test Position 2	0cm	19	57.75	13.50	11.58	0.17	0.294	1.489	1.556	**0.681**
P08	BLE	2Mbps	Test Position 2	0cm	1	57.75	13.50	11.93	0.18	0.296	1.489	1.435	0.633
	BLE	2Mbps	Test Position 2	0cm	38	57.75	13.50	12.28	0.16	0.225	1.489	1.324	0.444
	WLAN 2.4G	802.11b	Test Position 1	0cm	1	99.03	10.00	8.23	0.12	0.255	1.010	1.503	0.387
	WLAN 2.4G	802.11b	Test Position 2	0cm	1	99.03	10.00	8.23	-0.13	0.258	1.010	1.503	0.392
	WLAN 2.4G	802.11b	Test Position 3	0cm	1	99.03	10.00	8.23	-0.13	0.162	1.010	1.503	0.246
	WLAN 2.4G	802.11b	Test Position 4	0cm	1	99.03	10.00	8.23	-0.02	0.026	1.010	1.503	0.040
	WLAN 2.4G	802.11b	Test Position 5	0cm	1	99.03	10.00	8.23	-0.14	0.010	1.010	1.503	0.014
	WLAN 2.4G	802.11b	Test Position 6	0cm	1	99.03	10.00	8.23	0.06	0.014	1.010	1.503	0.022
	WLAN 2.4G	802.11b	Right Cheek	0cm	1	99.03	10.00	8.23	0.17	0.050	1.010	1.503	0.077
P09	WLAN 2.4G	802.11b	Test Position 2	0cm	6	99.03	10.00	8.22	-0.15	0.279	1.010	1.507	**0.425**
	WLAN 2.4G	802.11b	Test Position 2	0cm	11	99.03	10.00	8.14	-0.08	0.269	1.010	1.535	0.417
	WLAN 5G	802.11a	Test Position 1	0cm	52	99.02	11.50	9.91	-0.13	0.305	1.010	1.442	0.444
P10	WLAN 5G	802.11a	Test Position 2	0cm	52	99.02	11.50	9.91	0.17	0.656	1.010	1.442	**0.955**
	WLAN 5G	802.11a	Test Position 3	0cm	52	99.02	11.50	9.91	-0.03	0.443	1.010	1.442	0.645
	WLAN 5G	802.11a	Test Position 4	0cm	52	99.02	11.50	9.91	-0.06	0.060	1.010	1.442	0.088
	WLAN 5G	802.11a	Test Position 5	0cm	52	99.02	11.50	9.91	-0.03	0.236	1.010	1.442	0.344
	WLAN 5G	802.11a	Test Position 6	0cm	52	99.02	11.50	9.91	-0.02	0.030	1.010	1.442	0.043
	WLAN 5G	802.11a	Right Cheek	0cm	52	99.02	11.50	9.91	-0.10	0.081	1.010	1.442	0.117
	WLAN 5G	802.11a	Test Position 2	0cm	56	99.02	11.50	9.88	0.06	0.603	1.010	1.452	0.884
	WLAN 5G	802.11a	Test Position 2	0cm	60	99.02	10.00	8.55	0.09	0.595	1.010	1.396	0.839
	WLAN 5G	802.11a	Test Position 2	0cm	64	99.02	10.00	8.42	0.08	0.604	1.010	1.439	0.878
	WLAN 5G	802.11a	Test Position 1	0cm	140	99.02	10.00	8.56	0.10	0.250	1.010	1.393	0.352
	WLAN 5G	802.11a	Test Position 2	0cm	140	99.02	10.00	8.56	-0.05	0.365	1.010	1.393	0.514
	WLAN 5G	802.11a	Test Position 3	0cm	140	99.02	10.00	8.56	0.17	0.343	1.010	1.393	0.483
	WLAN 5G	802.11a	Test Position 4	0cm	140	99.02	10.00	8.56	-0.01	0.077	1.010	1.393	0.108
	WLAN 5G	802.11a	Test Position 5	0cm	140	99.02	10.00	8.56	-0.06	0.190	1.010	1.393	0.267
	WLAN 5G	802.11a	Test Position 6	0cm	140	99.02	10.00	8.56	0.09	0.023	1.010	1.393	0.033
	WLAN 5G	802.11a	Right Cheek	0cm	140	99.02	10.00	8.56	0.19	0.096	1.010	1.393	0.135
	WLAN 5G	802.11a	Test Position 2	0cm	100	99.02	9.00	7.37	-0.03	0.474	1.010	1.455	0.697
	WLAN 5G	802.11a	Test Position 2	0cm	116	99.02	9.00	7.66	-0.01	0.384	1.010	1.361	0.528
	WLAN 5G	802.11a	Test Position 2	0cm	124	99.02	9.50	8.34	0.06	0.626	1.010	1.306	0.826
P11	WLAN 5G	802.11a	Test Position 2	0cm	132	99.02	10.00	8.38	0.10	0.578	1.010	1.452	**0.848**
	WLAN 5G	802.11a	Test Position 2	0cm	144	99.02	10.00	8.50	0.00	0.345	1.010	1.413	0.492
	WLAN 5G	802.11a	Test Position 1	0cm	149	99.02	10.00	8.65	0.14	0.167	1.010	1.365	0.230

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Duty Cycle %	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Duty Cycle Scaling Factor	Tune-up Scaling Factor	Scaled SAR-1g (W/kg)
	WLAN 5G	802.11a	Test Position 2	0cm	149	99.02	10.00	8.65	-0.11	0.285	1.010	1.365	0.393
P12	WLAN 5G	802.11a	Test Position 3	0cm	149	99.02	10.00	8.65	-0.18	0.310	1.010	1.365	**0.427**
	WLAN 5G	802.11a	Test Position 4	0cm	149	99.02	10.00	8.65	0.05	0.099	1.010	1.365	0.136
	WLAN 5G	802.11a	Test Position 5	0cm	149	99.02	10.00	8.65	0.00	0.163	1.010	1.365	0.225
	WLAN 5G	802.11a	Test Position 6	0cm	149	99.02	10.00	8.65	-0.04	0.022	1.010	1.365	0.031
	WLAN 5G	802.11a	Right Cheek	0cm	149	99.02	10.00	8.65	0.08	0.089	1.010	1.365	0.123
	WLAN 5G	802.11a	Test Position 3	0cm	157	99.02	10.00	8.58	-0.01	0.247	1.010	1.387	0.346
	WLAN 5G	802.11a	Test Position 3	0cm	165	99.02	10.00	8.55	-0.12	0.233	1.010	1.396	0.329

Note:

1. According to the antenna position, the Left Cheek / Right Cheek position cannot be touch the antenna for testing, the more conservative body position is used instead to test, and verified that Left Cheek / Right Cheek position.
2. Bluetooth and BLE have the same technology and modulation. Therefore, BLE SAR testing was performed in the worst position from Bluetooth.

4.6.3 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 ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 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 >= 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 >= 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 >= 1.5 W/kg, perform a third repeated measurement.

Band	Test Position	Separation Distance (cm)	Ch.	Original Measured SAR-1g (W/kg)	1st Repeated SAR-1g (W/kg)	L/S Ratio	2nd Repeated SAR-1g (W/kg)	L/S Ratio	3rd Repeated SAR-1g (W/kg)	L/S Ratio
WLAN 5G	Test Position 2	0cm	132	0.867	0.852	1.017	N/A	N/A	N/A	N/A

4.6.4 Simultaneous Multi-band Transmission Evaluation

The simultaneous transmission possibilities for this device are listed as below.

Simultaneous TX Combination	Capable Transmit Configurations	Head Exposure Condition
1	WLAN5G + BT	Yes

Note :

1. The 2.4G WLAN and 5G WLAN cannot transmit simultaneously.
2. The 2.4G WLAN and BT cannot transmit simultaneously.
3. Refer to the operational description document provided by the manufacturer, in simultaneous transmission scenarios the BT is only control signal as well as a link between buds, and the occupied duty cycle is 5%, therefore, BT SAR was estimated based on standalone results to performed sim-Tx analysis with Wi-Fi.

<SAR Summation Analysis>

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 SPLSR.

Test Position	1	2	3	4	1+2 Summed 1g SAR (W/kg)	3+4 Summed 1g SAR (W/kg)
	Bluetooth Left Ear	WLAN 5GHz Left Ear	Bluetooth Right Ear	WLAN 5GHz Right Ear		
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)		
Test Position 1 at 0cm	0.033	0.701	0.046	0.444	**0.73**	**0.49**
Test Position 2 at 0cm	0.043	1.090	0.060	0.955	**1.13**	**1.02**
Test Position 3 at 0cm	0.012	1.026	0.026	0.645	**1.04**	**0.67**
Test Position 4 at 0cm	0.010	0.276	0.011	0.136	**0.29**	**0.15**
Test Position 5 at 0cm	0.005	0.531	0.006	0.344	**0.54**	**0.35**
Test Position 6 at 0cm	0.005	0.163	0.006	0.043	**0.17**	**0.05**
Left Cheek at 0cm	0.017	0.409			**0.43**	**0.00**
Right Cheek at 0cm			0.017	0.135	**0.00**	**0.15**

Summary:

1. The SAR summation of maximum SAR of WWAN and WLAN/BT for each position is under the SAR limitation (**Head & Body: SAR_{1g} 1.6 W/kg**). Therefore, the simultaneous transmission condition is compliant with the SAR criterion.

Test Engineer： Rikou Lu, and Jiawei Tu

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Due Data
System Validation Dipole	SPEAG	D2450V2	893	Jun. 15, 2024	Jun. 14, 2025
System Validation Dipole	SPEAG	D5GHzV2	1133	Jun. 15, 2024	Jun. 14, 2025
Dosimetric E-Field Probe	SPEAG	EX3DV4	3873	Sep. 29, 2024	Sep. 28, 2025
Data Acquisition Electronics	SPEAG	DAE4	1389	Nov. 11, 2024	Nov. 10, 2025
Dielectric Probe Kit	SPEAG	DAK-3.5	1076	Aug. 20, 2024	Aug. 19, 2025
ENA Series Network Analyzer	Agilent	E5071C	MY46214638	Apr. 28, 2024	Apr. 27, 2025
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510355	Jan. 31, 2024	Jan. 30, 2025
MXG Analog Signal Generator	KEYSIGHT	N5183A	MY50143024	Jan. 31, 2024	Jan. 30, 2025
Power Meter	Agilent	N1914A	MY52180044	Jan. 30, 2024	Jan. 29, 2025
Power Sensor	Agilent	E9304A H18	MY52050011	Jan. 30, 2024	Jan. 29, 2025
Power Meter	ANRITSU	ML2495A	1506002	Jan. 30, 2024	Jan. 29, 2025
Power Sensor	ANRITSU	MA2411B	1339353	Jan. 30, 2024	Jan. 29, 2025
Temp. & Humi. Recorder	HUATO	A2000TH	HE20107712	Apr. 29, 2024	Apr. 28, 2025
Electronic Thermometer	YONGFA	YF-160A	120100323	Apr. 29, 2024	Apr. 28, 2025
Coupler	Woken	0110A056020-10	COM27RW1A3	May. 20, 2024	May. 19, 2025

6. Measurement Uncertainty

DASY5 Uncertainty Budget								
Error Description	Uncertainty Value (±%)	Probability	Divisor	(Ci) 1g	(Ci) 10g	Standard Uncertainty (1g) (±%)	Standard Uncertainty (10g) (±%)	(Vi) Veff
Measurement System								
Probe Calibration	6.0	N	1	1	1	6.0	6.0	∞
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9	∞
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6	∞
Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6	∞
Modulation Response	3.2	R	1.732	1	1	1.8	1.8	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.0	R	1.732	1	1	0.0	0.0	∞
Integration Time	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7	∞
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2	∞
Test Sample Related								
Device Positioning	3.0	N	1	1	1	3.0	3.0	35
Device Holder	3.6	N	1	1	1	3.6	3.6	12
Power Drift	5.0	R	1.732	1	1	2.9	2.9	∞
Power Scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5	∞
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0	∞
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1	5
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0	∞
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0	∞
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0	5
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8	∞
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4	∞
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1	∞
Combined Std. Uncertainty						11.4%	11.4%	1013
Coverage Factor for 95 %						K=2	K=2	
Expanded STD Uncertainty						22.9%	22.7%	

Uncertainty budget for frequency range 30 MHz to 3 GHz

DASY5 Uncertainty Budget								
Error Description	**Uncertainty Value (±%)**	**Probability**	**Divisor**	**(Ci) 1g**	**(Ci) 10g**	**Standard Uncertainty (1g) (±%)**	**Standard Uncertainty (10g) (±%)**	**(Vi) Veff**
Measurement System								
Probe Calibration	6.55	N	1	1	1	6.5	6.5	∞
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9	∞
Boundary Effects	2.0	R	1.732	1	1	1.2	1.2	∞
Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6	∞
Modulation Response	3.2	R	1.732	1	1	1.8	1.8	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.0	R	1.732	1	1	0.0	0.0	∞
Integration Time	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2	∞
Probe Positioning	6.7	R	1.732	1	1	3.9	3.9	∞
Max. SAR Eval.	4.0	R	1.732	1	1	2.3	2.3	∞
Test Sample Related								
Device Positioning	3.0	N	1	1	1	3.0	3.0	35
Device Holder	3.6	N	1	1	1	3.6	3.6	12
Power Drift	5.0	R	1.732	1	1	2.9	2.9	∞
Power Scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty	6.6	R	1.732	1	1	3.8	3.8	∞
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0	∞
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1	5
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0	∞
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0	∞
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0	5
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8	∞
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4	∞
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1	∞
Combined Std. Uncertainty						12.5%	12.5%	1458
Coverage Factor for 95 %						K=2	K=2	
Expanded STD Uncertainty						25.0%	24.9%	

Uncertainty budget for frequency range 3 GHz to 6 GHz

7. Information on the Testing Laboratories

We, BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD., were founded in 2015 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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Web Site: www.bureauveritas.com

The road map of all our labs can be found in our web site also.

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Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Test Laboratory: BV 7LAYERS SAR/HAC Testing Lab Date: 2024/12/14

System Check_HSL2450_20241214

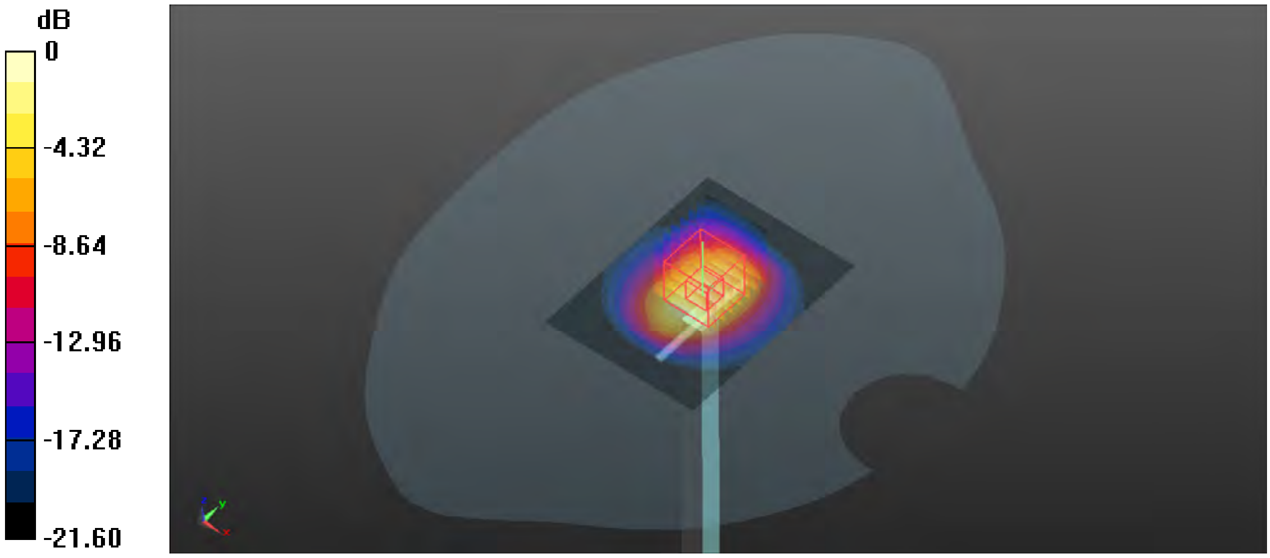
DUT: Dipole:2450 MHz;Type:D2450V2

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1
Medium: HSL2450_1214 Medium parameters used: f = 2450 MHz; σ = 1.833 S/m; ε_r = 39.632; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2450 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=250mW/Area Scan (61x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 20.1 W/kg

Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 112.2 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 24.9 W/kg
SAR(1 g) = 13.2 W/kg; SAR(10 g) = 6.37 W/kg
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 53.5%
Maximum value of SAR (measured) = 19.4 W/kg



0 dB = 19.4 W/kg

Test Laboratory: BV 7LAYERS SAR/HAC Testing Lab Date: 2024/12/26

System Check_HSL5250_20241226

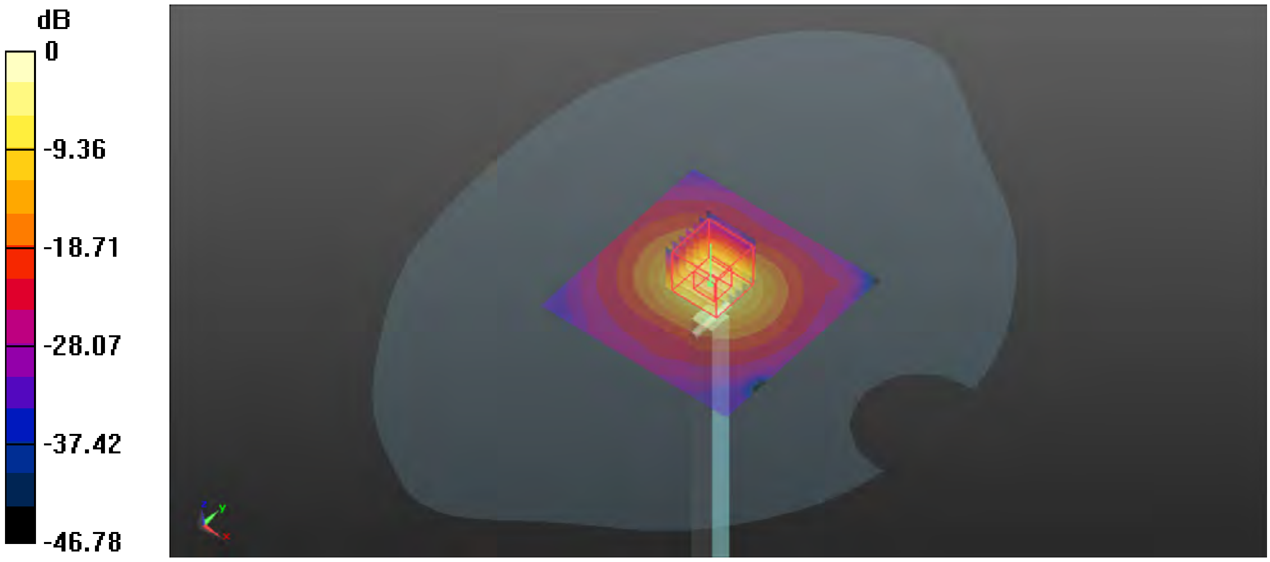
DUT: Dipole 5GHzV2;Type:D5GHzV2

Communication System: CW; Frequency: 5250 MHz;Duty Cycle: 1:1
Medium: HSL5G_1226 Medium parameters used: f = 5250 MHz; σ = 4.61 S/m; ε_r = 37.322; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(5.16, 5.16, 5.16) @ 5250 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=100mW/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.4 W/kg

Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 56.27 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 7.95 W/kg; SAR(10 g) = 2.29 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 55.1%
Maximum value of SAR (measured) = 16.3 W/kg



0 dB = 16.3 W/kg

System Check_HSL5600_20241227

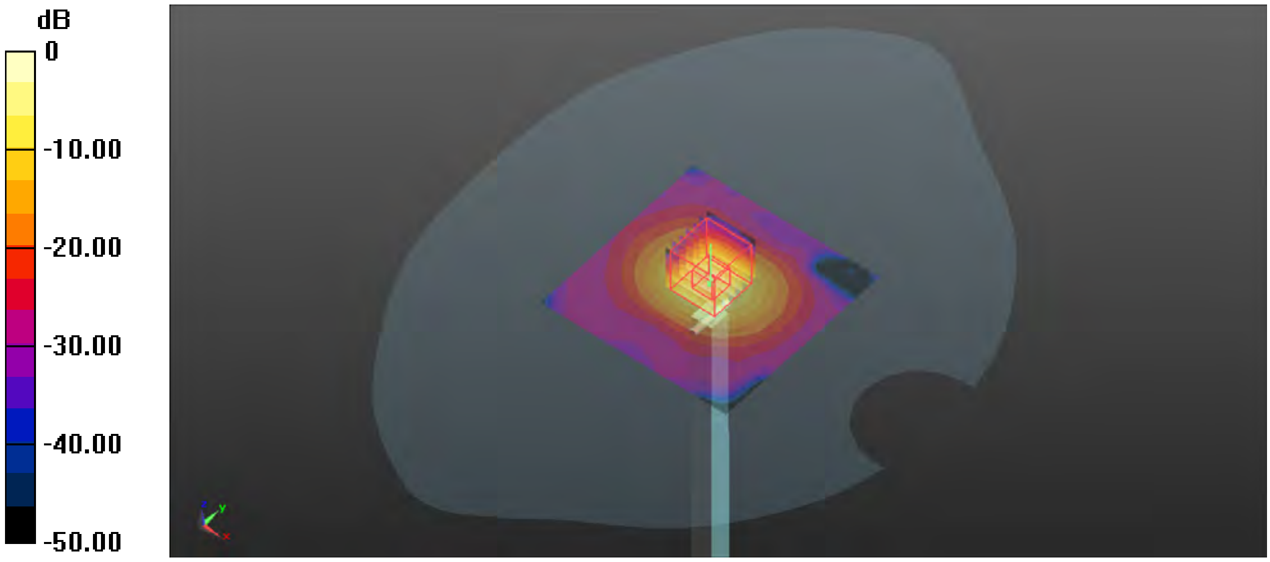
DUT: Dipole 5GHzV2;Type:D5GHzV2

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1
Medium: HSL5G_1227 Medium parameters used: f = 5600 MHz; $\sigma = 5.025$ S/m; $\varepsilon_r = 36.769$; $\rho = 1000$ kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.56, 4.56, 4.56) @ 5600 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=100mW/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.3 W/kg

Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 57.18 V/m; Power Drift = 0.19 dB
Peak SAR (extrapolated) = 37.2 W/kg
SAR(1 g) = 8.25 W/kg; SAR(10 g) = 2.34 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 52.1%
Maximum value of SAR (measured) = 17.4 W/kg



0 dB = 17.4 W/kg

Test Laboratory: BV 7LAYERS SAR/HAC Testing Lab Date: 2024/12/28

System Check_HSL5750_20241228

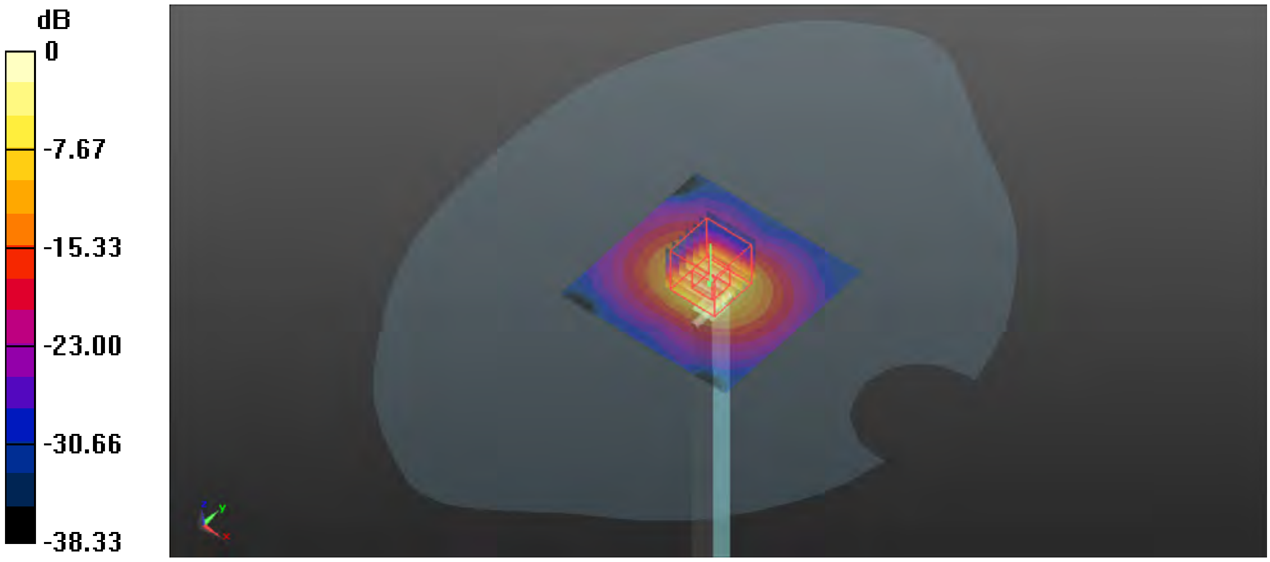
DUT: Dipole 5GHzV2;Type:D5GHzV2

Communication System: CW; Frequency: 5750 MHz;Duty Cycle: 1:1
Medium: HSL5G_1228 Medium parameters used: f = 5750 MHz; σ = 5.194 S/m; ε_r = 36.537; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.6℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.62, 4.62, 4.62) @ 5750 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Pin=100mW/Area Scan (81x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 16.5 W/kg

Pin=100mW/Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 59.85 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 35.6 W/kg
SAR(1 g) = 7.78 W/kg; SAR(10 g) = 2.21 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 50.8%
Maximum value of SAR (measured) = 16.6 W/kg



0 dB = 16.6 W/kg

Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

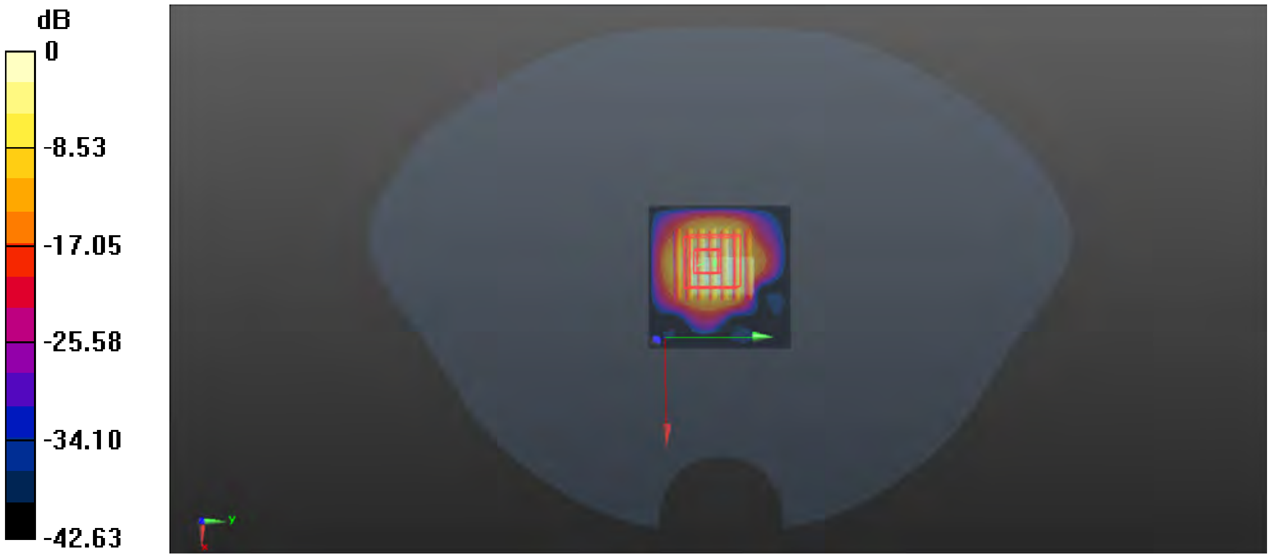
P01 Bluetooth_GFSK_Test Position 2_0cm_Ch0_Left Ear

Communication System: BT; Frequency: 2402 MHz;Duty Cycle: 1:1.077
Medium: HSL2450_1214 Medium parameters used: f = 2402 MHz; σ = 1.803 S/m; ε_r = 39.687; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2402 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.04 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 16.79 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 1.31 W/kg
SAR(1 g) = 0.438 W/kg; SAR(10 g) = 0.183 W/kg
Smallest distance from peaks to all points 3 dB below = 5.4 mm
Ratio of SAR at M2 to SAR at M1 = 33.7%
Maximum value of SAR (measured) = 0.758 W/kg



0 dB = 0.758 W/kg

Test Laboratory: BV 7LAYERS SAR/HAC Testing Lab Date: 2024/12/14

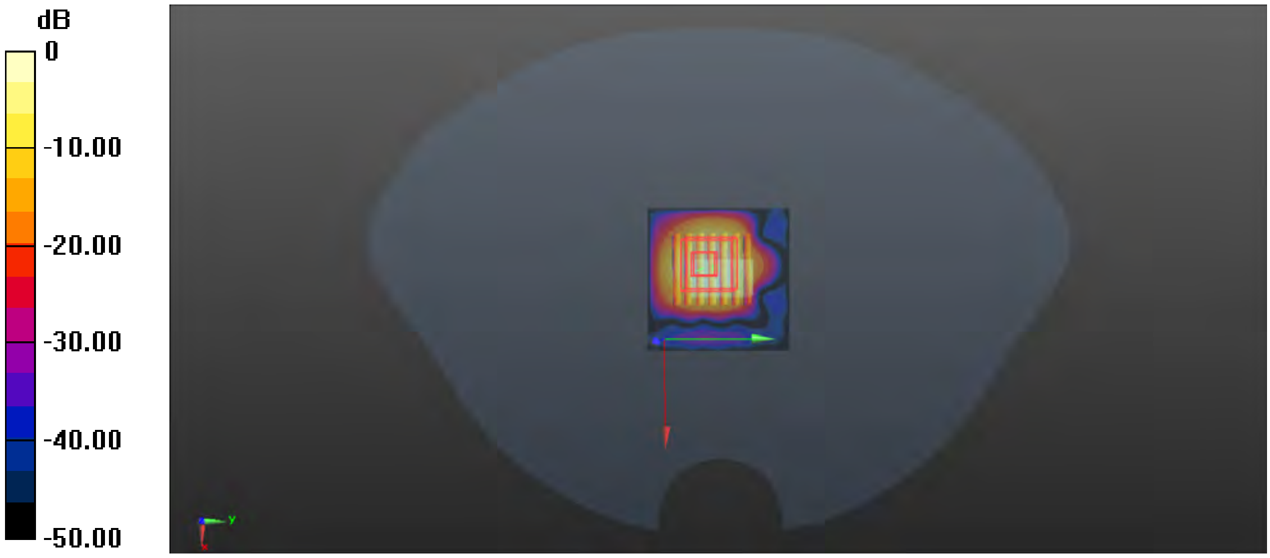
P02 Bluetooth_BLE 2M_Test Position 2_0cm_Ch1_Left Ear

Communication System: BT; Frequency: 2404 MHz;Duty Cycle: 1:1.503
Medium: HSL2450_1214 Medium parameters used: f = 2404 MHz; σ = 1.805 S/m; ε_r = 39.684; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2404 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.439 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 11.16 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 0.569 W/kg
SAR(1 g) = 0.189 W/kg; SAR(10 g) = 0.078 W/kg
Smallest distance from peaks to all points 3 dB below = 6.3 mm
Ratio of SAR at M2 to SAR at M1 = 34.5%
Maximum value of SAR (measured) = 0.316 W/kg



0 dB = 0.316 W/kg

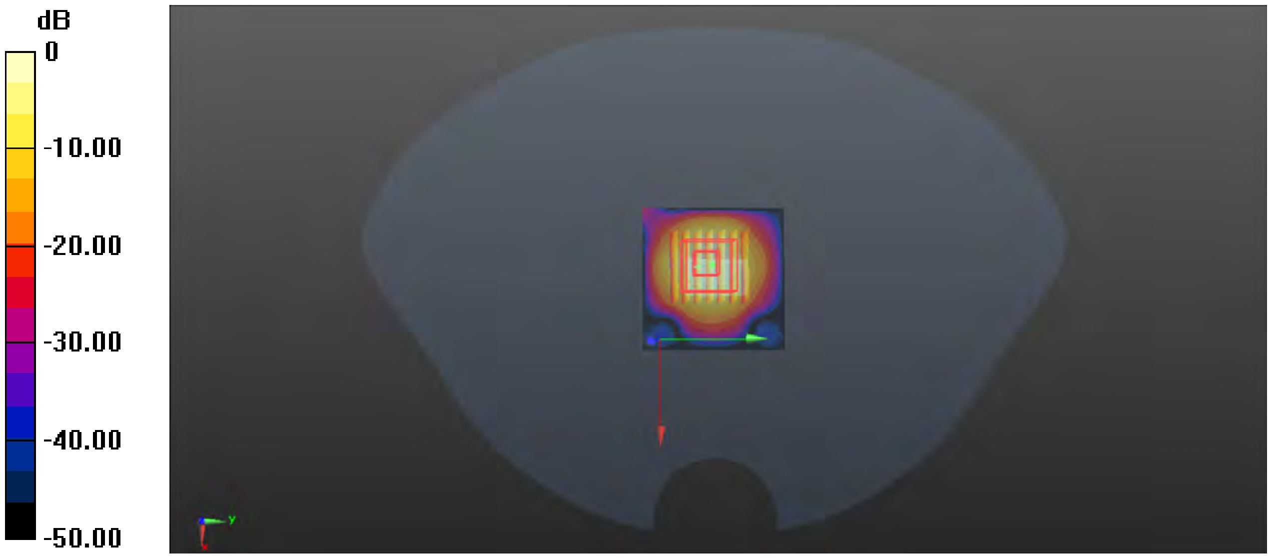
P03 WLAN 2.4GHz_802.11b 1Mbps_Test Position 2_0cm_Ch1_Left Ear

Communication System: 802.11b; Frequency: 2412 MHz;Duty Cycle: 1:1.004
Medium: HSL2450_1214 Medium parameters used: f = 2412 MHz; σ = 1.809 S/m; ε_r = 39.672; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2412 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.580 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.92 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 0.657 W/kg
SAR(1 g) = 0.239 W/kg; SAR(10 g) = 0.102 W/kg
Smallest distance from peaks to all points 3 dB below = 5.8 mm
Ratio of SAR at M2 to SAR at M1 = 38%
Maximum value of SAR (measured) = 0.386 W/kg



0 dB = 0.386 W/kg

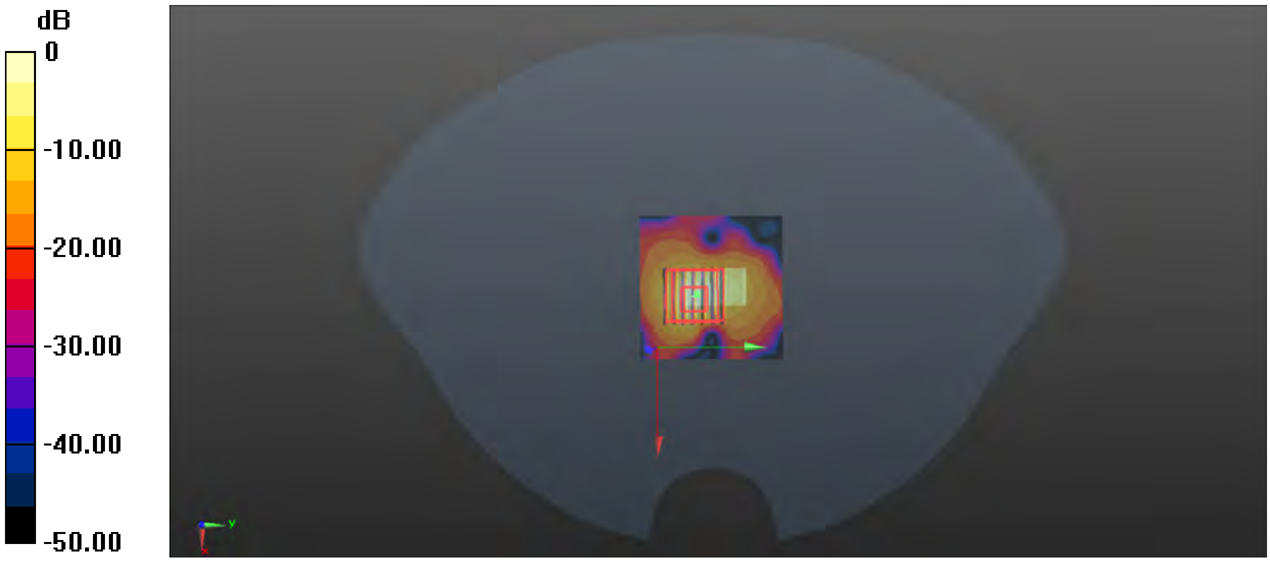
P04 WLAN 5GHz_802.11a 6Mbps_Test Position 3_0cm_Ch56_Left Ear

Communication System: 802.11a; Frequency: 5280 MHz;Duty Cycle: 1:1.01
Medium: HSL5G_1226 Medium parameters used: f = 5280 MHz; σ = 4.654 S/m; ε_r = 37.266; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(5.16, 5.16, 5.16) @ 5280 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.16 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 13.07 V/m; Power Drift = 0.16 dB
Peak SAR (extrapolated) = 3.42 W/kg
SAR(1 g) = 0.596 W/kg; SAR(10 g) = 0.149 W/kg
Smallest distance from peaks to all points 3 dB below = 4 mm
Ratio of SAR at M2 to SAR at M1 = 50.9%
Maximum value of SAR (measured) = 1.25 W/kg



0 dB = 1.25 W/kg

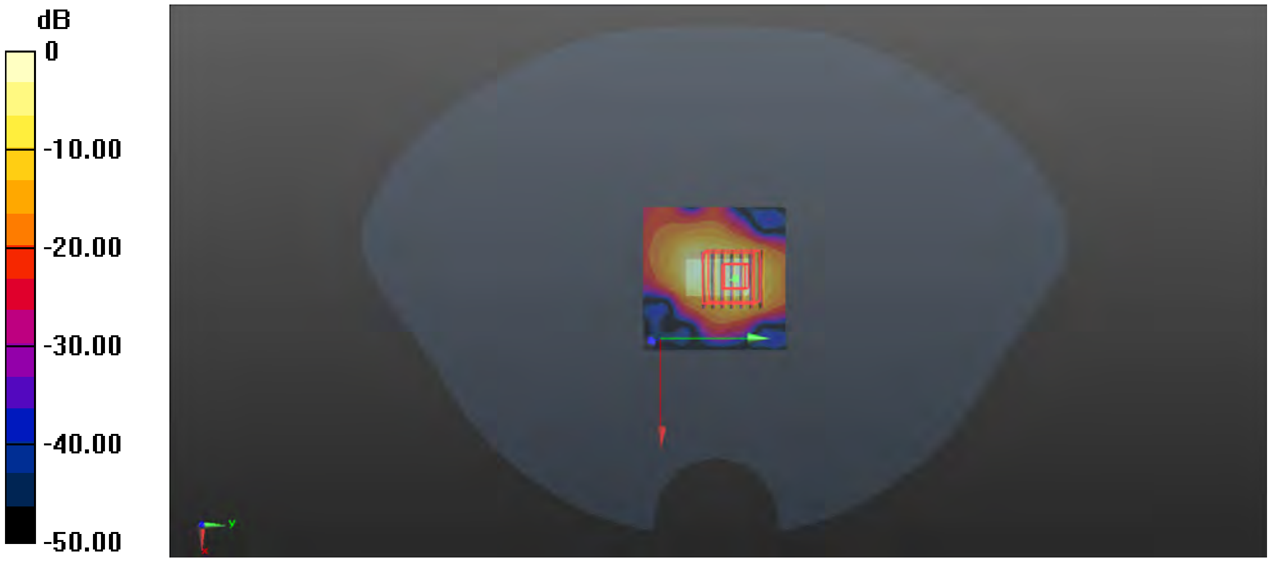
P05 WLAN 5GHz_802.11a 6Mbps_Test Position 2_0cm_Ch132_Left Ear

Communication System: 802.11a; Frequency: 5660 MHz;Duty Cycle: 1:1.01
Medium: HSL5G_1227 Medium parameters used: f = 5660 MHz; σ = 5.063 S/m; ε_r = 36.632; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.56, 4.56, 4.56) @ 5660 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 2.24 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 11.57 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 5.37 W/kg
SAR(1 g) = 0.867 W/kg; SAR(10 g) = 0.212 W/kg
Smallest distance from peaks to all points 3 dB below = 5.4 mm
Ratio of SAR at M2 to SAR at M1 = 47.4%
Maximum value of SAR (measured) = 2.18 W/kg



0 dB = 2.18 W/kg

Test Laboratory: BV 7LAYERS SAR/HAC Testing Lab Date: 2024/12/28

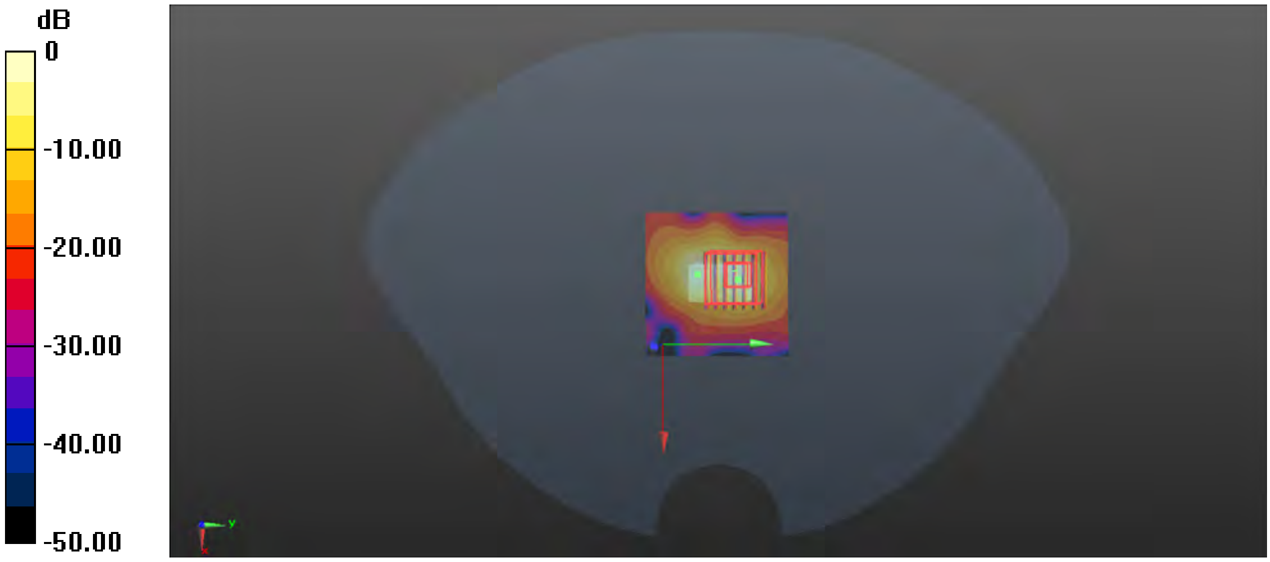
P06 WLAN 5GHz_802.11a 6Mbps_Test Position 2_0cm_Ch149_Left Ear

Communication System: 802.11a; Frequency: 5745 MHz;Duty Cycle: 1:1.029
Medium: HSL5G_1228 Medium parameters used: f = 5745 MHz; σ = 5.192 S/m; ε_r = 36.536; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.6℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.62, 4.62, 4.62) @ 5745 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.52 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.412 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 5.08 W/kg
SAR(1 g) = 0.734 W/kg; SAR(10 g) = 0.172 W/kg
Smallest distance from peaks to all points 3 dB below = 4.5 mm
Ratio of SAR at M2 to SAR at M1 = 45.6%
Maximum value of SAR (measured) = 1.80 W/kg



0 dB = 1.80 W/kg

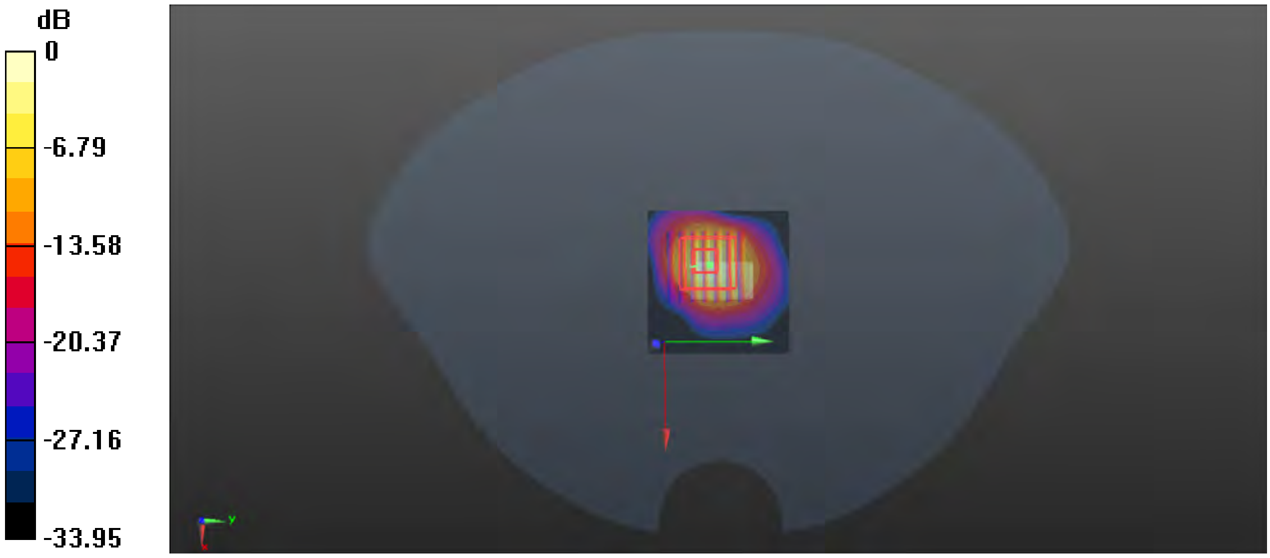
P07 Bluetooth_GFSK_Test Position 2_0cm_Ch0_Right Ear

Communication System: BT; Frequency: 2402 MHz;Duty Cycle: 1:1.081
Medium: HSL2450_1214 Medium parameters used: f = 2402 MHz; σ = 1.803 S/m; ε_r = 39.687; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2402 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.13 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.96 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.04 W/kg
SAR(1 g) = 0.657 W/kg; SAR(10 g) = 0.223 W/kg
Smallest distance from peaks to all points 3 dB below = 5.4 mm
Ratio of SAR at M2 to SAR at M1 = 33%
Maximum value of SAR (measured) = 1.18 W/kg



0 dB = 1.18 W/kg

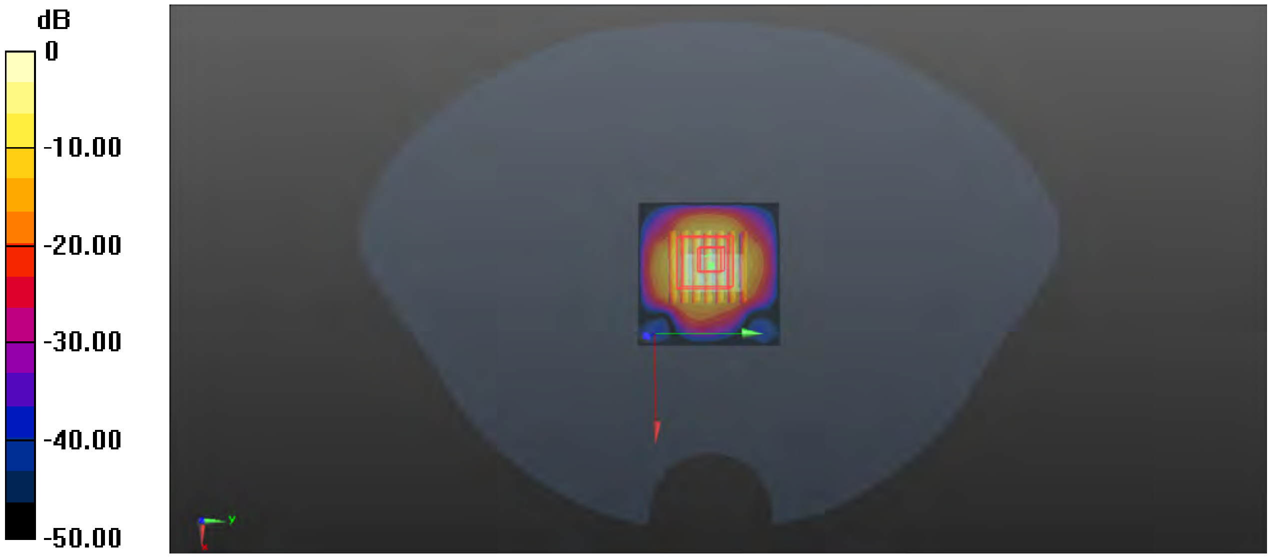
P08 Bluetooth_BLE 2M_Test Position 2_0cm_Ch19_Right Ear

Communication System: BT; Frequency: 2440 MHz;Duty Cycle: 1:1.489
Medium: HSL2450_1214 Medium parameters used: f = 2440 MHz; σ = 1.827 S/m; ε_r = 39.646; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2440 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.720 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.95 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 0.881 W/kg
SAR(1 g) = 0.294 W/kg; SAR(10 g) = 0.115 W/kg
Smallest distance from peaks to all points 3 dB below = 6.1 mm
Ratio of SAR at M2 to SAR at M1 = 37.8%
Maximum value of SAR (measured) = 0.511 W/kg



0 dB = 0.511 W/kg

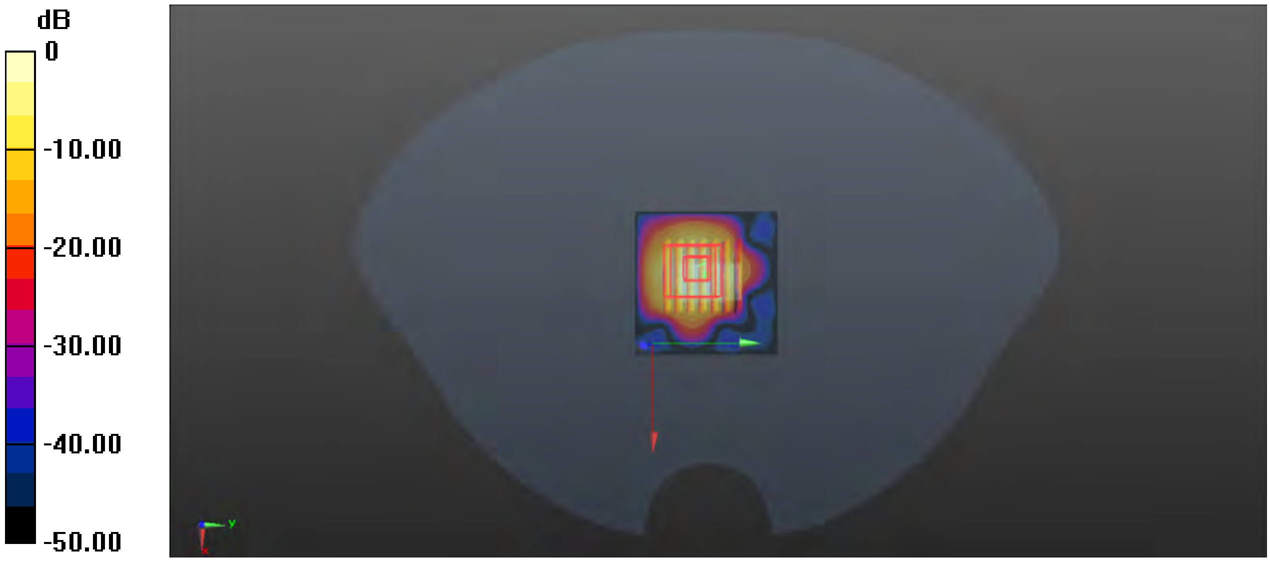
P09 WLAN 2.4GHz_802.11b 1Mbps_Test Position 2_0cm_Ch6_Right Ear

Communication System: 802.11b; Frequency: 2437 MHz;Duty Cycle: 1:1.01
Medium: HSL2450_1214 Medium parameters used: f = 2437 MHz; σ = 1.825 S/m; ε_r = 39.649; ρ = 1000 kg/m^3
Ambient Temperature：23.6℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(7.46, 7.46, 7.46) @ 2437 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (51x51x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.625 W/kg

- Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.54 V/m; Power Drift = -0.15 dB
Peak SAR (extrapolated) = 0.761 W/kg
SAR(1 g) = 0.279 W/kg; SAR(10 g) = 0.114 W/kg
Smallest distance from peaks to all points 3 dB below = 5.7 mm
Ratio of SAR at M2 to SAR at M1 = 39.1%
Maximum value of SAR (measured) = 0.450 W/kg



0 dB = 0.450 W/kg

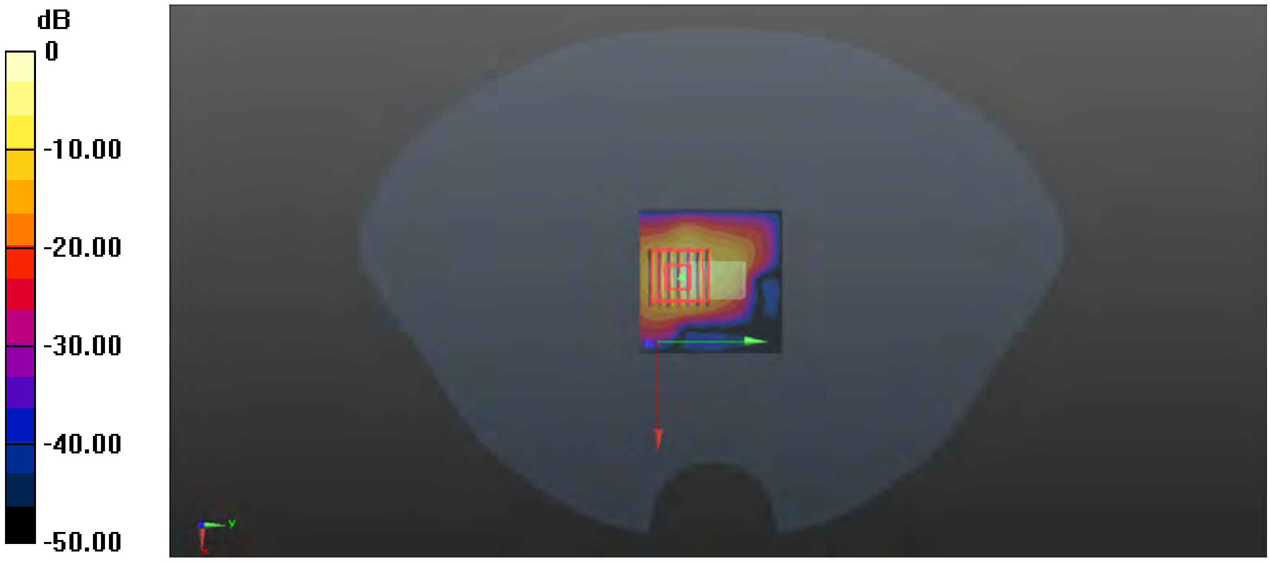
P10 WLAN 5GHz_802.11a 6Mbps_Test Position 2_0cm_Ch52_Right Ear

Communication System: 802.11a; Frequency: 5260 MHz;Duty Cycle: 1:1.01
Medium: HSL5G_1226 Medium parameters used: f = 5260 MHz; σ = 4.624 S/m; ε_r = 37.297; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(5.16, 5.16, 5.16) @ 5260 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.19 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 6.996 V/m; Power Drift = 0.17 dB
Peak SAR (extrapolated) = 3.97 W/kg
SAR(1 g) = 0.656 W/kg; SAR(10 g) = 0.144 W/kg
Smallest distance from peaks to all points 3 dB below = 4.7 mm
Ratio of SAR at M2 to SAR at M1 = 49.4%
Maximum value of SAR (measured) = 1.58 W/kg



0 dB = 1.58 W/kg

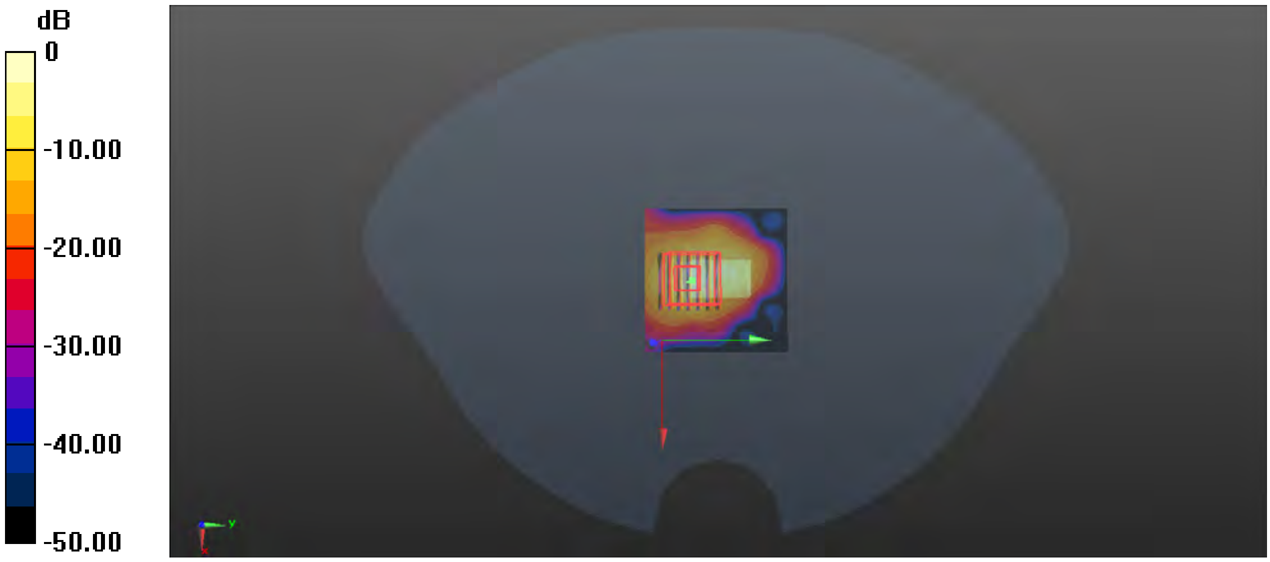
P11 WLAN 5GHz_802.11a 6Mbps_Test Position 2_0cm_Ch132_Right Ear

Communication System: 802.11a; Frequency: 5660 MHz;Duty Cycle: 1:1.01
Medium: HSL5G_1227 Medium parameters used: f = 5660 MHz; σ = 5.063 S/m; ε_r = 36.632; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.56, 4.56, 4.56) @ 5660 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.37 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.576 V/m; Power Drift = 0.10 dB
Peak SAR (extrapolated) = 3.88 W/kg
SAR(1 g) = 0.578 W/kg; SAR(10 g) = 0.132 W/kg
Smallest distance from peaks to all points 3 dB below = 4.8 mm
Ratio of SAR at M2 to SAR at M1 = 46.7%
Maximum value of SAR (measured) = 1.36 W/kg



0 dB = 1.36 W/kg

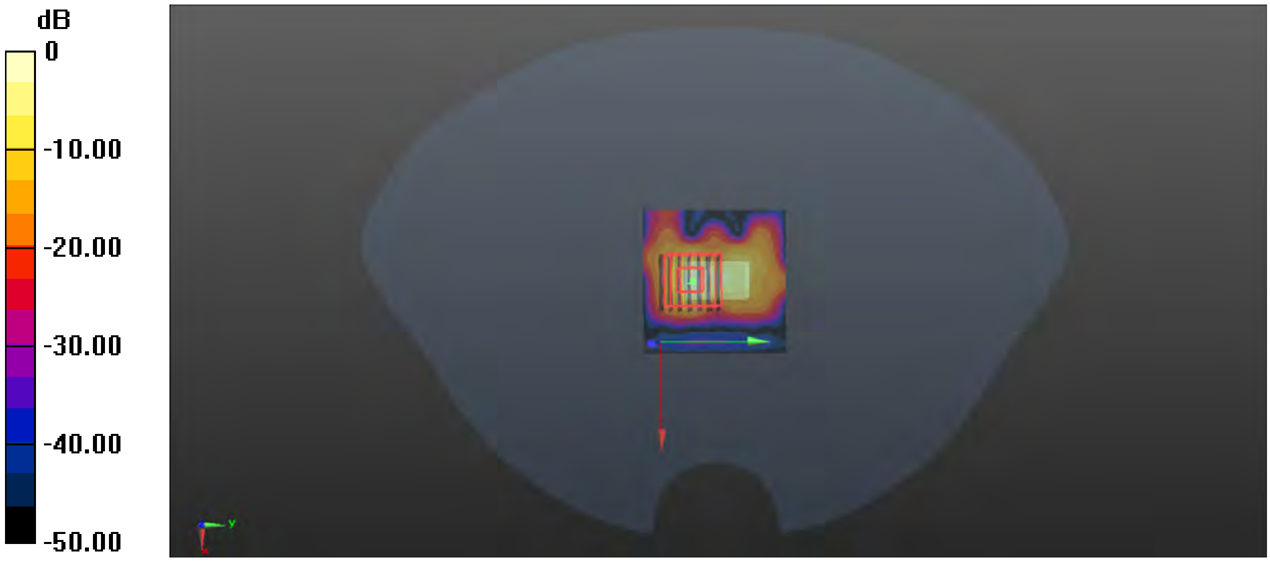
P12 WLAN 5GHz_802.11a 6Mbps_Test Position 3_0cm_Ch149_Right Ear

Communication System: 802.11a; Frequency: 5745 MHz;Duty Cycle: 1:1.01
Medium: HSL5G_1228 Medium parameters used: f = 5745 MHz; σ = 5.192 S/m; ε_r = 36.536; ρ = 1000 kg/m^3
Ambient Temperature：23.5℃; Liquid Temperature：22.6℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(4.62, 4.62, 4.62) @ 5745 MHz; Calibrated: 2024/09/29
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1389; Calibrated: 2024/11/11
- Phantom: SAM (30deg probe tilt) with CRP v5.0; Type: QD000P40CD; Serial: TP:1781
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

- Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.882 W/kg

- Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 8.082 V/m; Power Drift = -0.18 dB
Peak SAR (extrapolated) = 2.23 W/kg
SAR(1 g) = 0.310 W/kg; SAR(10 g) = 0.063 W/kg
Smallest distance from peaks to all points 3 dB below = 4 mm
Ratio of SAR at M2 to SAR at M1 = 46.2%
Maximum value of SAR (measured) = 0.818 W/kg



0 dB = 0.818 W/kg

Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.

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校准
CALIBRATION
CNAS L0570

Client **B.V.ADT** **Certificate No: 24J02Z000329**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 893
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	June 15, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	17-May-24 (CTTL, No. J24X04107)	May-25
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25
Reference Probe EX3DV4	SN 7307	28-May-24(SPEAG, No. EX-7307_May24)	May-25
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	**ID #**	**Cal Date (Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 22, 2024

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020

b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.80 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.1 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 W/kg ± 18.7 % (*k*=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.1Ω+ 7.70jΩ
Return Loss	- 22.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.069 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Date: 2024-06-15

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 893

Communication System: UID 0, CW; Frequency: 2450 MHz

Medium parameters used: f = 2450 MHz; σ = 1.804 S/m; ε_r = 39.05; ρ = 1000 kg/m^3

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(7.37, 7.34, 7.95) @ 2450 MHz; Calibrated: 2024-05-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 101.1 V/m; Power Drift = -0.03 dB

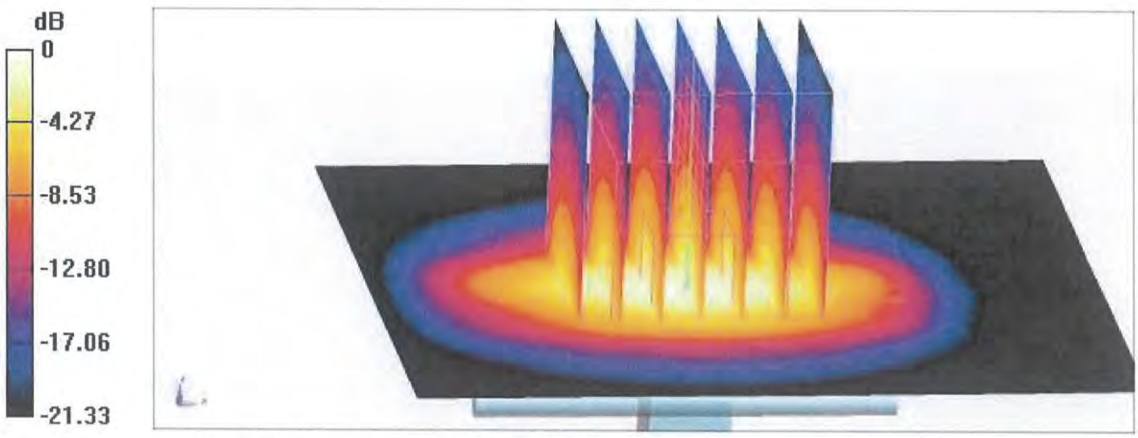
Peak SAR (extrapolated) = 25.9 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.23 W/kg

Smallest distance from peaks to all points 3 dB below = 8.9 mm

Ratio of SAR at M2 to SAR at M1 = 52%

Maximum value of SAR (measured) = 21.5 W/kg



0 dB = 21.5 W/kg = 13.32 dBW/kg

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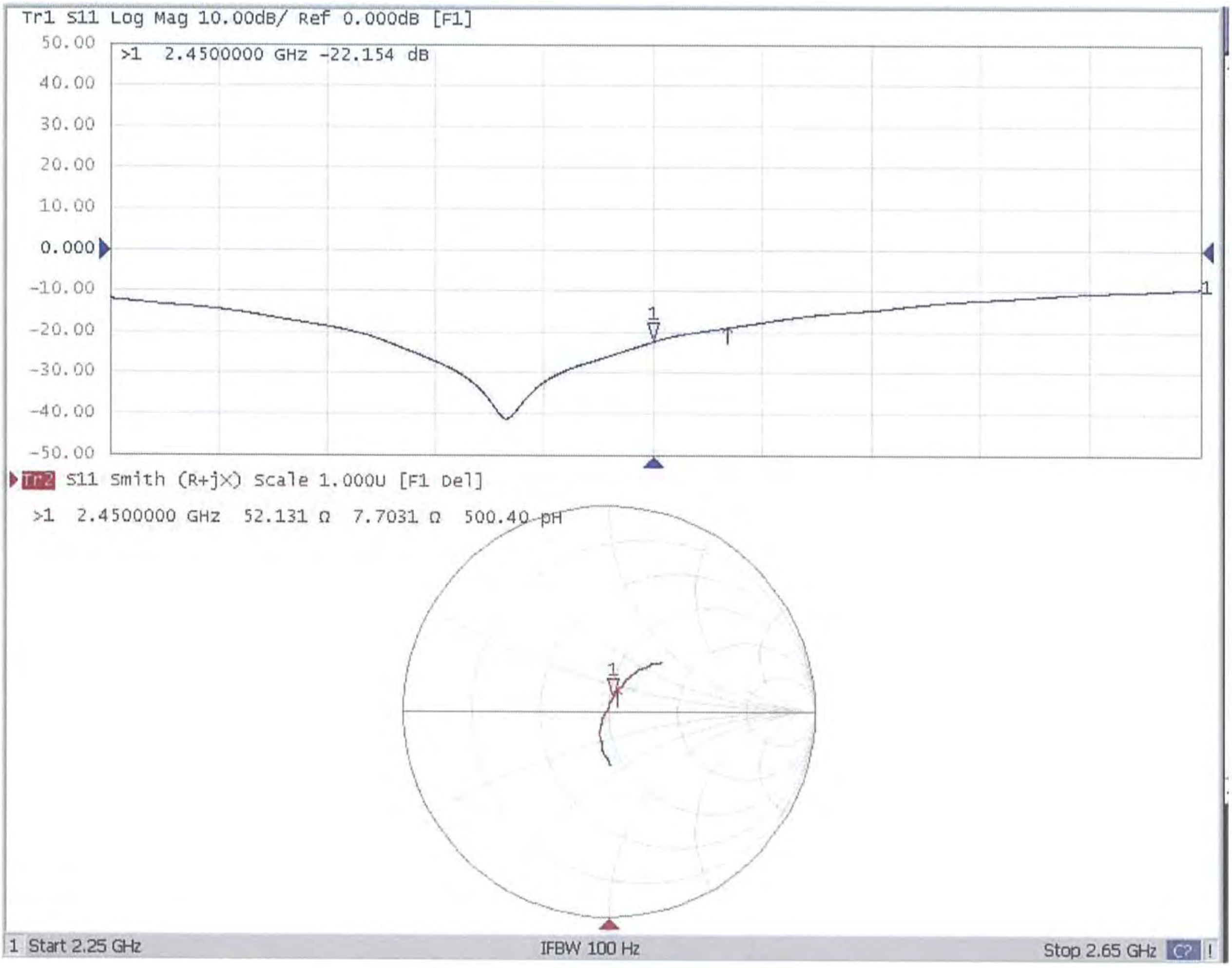
Impedance Measurement Plot for Head TSL



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Client **B.V.ADT** **Certificate No: 24J02Z000331**

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1133

Calibration Procedure(s): FF-Z11-003-01
Calibration Procedures for dipole validation kits

Calibration date: June 15, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106276	17-May-24 (CTTL, No. J24X04107)	May-25
Power sensor NRP6A	101369	17-May-24 (CTTL, No. J24X04107)	May-25
Reference Probe EX3DV4	SN 7307	28-May-24(SPEAG, No. EX-7307_May24)	May-25
DAE4	SN 1556	03-Jan-24(CTTL-SPEAG, No.24J02Z80002)	Jan-25
Secondary Standards	**ID #**	**Cal Date (Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Dec-23 (CTTL, No. J23X13426)	Dec-24
NetworkAnalyzer E5071C	MY46110673	25-Dec-23 (CTTL, No. J23X13425)	Dec-24
OCP DAK-3.5(weighted)	1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

	Name	Function	Signature
Calibrated by:	Zhao Jing	SAR Test Engineer	
Reviewed by:	Lin Jun	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: June 22, 2024

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Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORMx,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC/IEEE 62209-1528, "Measurement Procedure for The Assessment of Specific Absorption Rate of Human Exposure to Radio Frequency Fields from Hand-held and Body-mounted Wireless Communication Devices- Part 1528: Human Models, Instrumentation and Procedures (Frequency range of 4 MHz to 10 GHz)", October 2020

b) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor k=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.2 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.76 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.7 W/kg ± 24.4 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.0 W/kg ± 24.2 % (*k*=2)**

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Head TSL parameters at 5600MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	5.02 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.4 W/kg ± 24.4 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 24.2 % (*k*=2)**

Head TSL parameters at 5750MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	5.19 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.86 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.6 W/kg ± 24.4 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.0 W/kg ± 24.2 % (*k*=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250MHz

Impedance, transformed to feed point	48.7Ω- 4.61jΩ
Return Loss	- 26.3dB

Antenna Parameters with Head TSL at 5600MHz

Impedance, transformed to feed point	54.4Ω+ 2.46jΩ
Return Loss	- 26.4dB

Antenna Parameters with Head TSL at 5750MHz

Impedance, transformed to feed point	54.0Ω- 0.52jΩ
Return Loss	- 28.1dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.112 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Date: 2024-06-15

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1133

Communication System: CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz

Medium parameters used: f = 5250 MHz; σ = 4.648 S/m; ε_r = 36.22; ρ = 1000 kg/m^3

Medium parameters used: f = 5600 MHz; σ = 5.023 S/m; ε_r = 35.61; ρ = 1000 kg/m^3

Medium parameters used: f = 5750 MHz; σ = 5.185 S/m; ε_r = 35.39; ρ = 1000 kg/m^3

Phantom section: Right Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:

- Probe: EX3DV4 - SN7307; ConvF(5.37, 5.49, 5.89) @ 5250 MHz; ConvF(4.66, 4.74, 5.05) @ 5600 MHz; ConvF(4.69, 4.76, 5.08) @ 5750 MHz; Calibrated: 2024-05-28
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2024-01-03
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 57.23 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 31.0 W/kg

SAR(1 g) = 7.76 W/kg; SAR(10 g) = 2.2 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 65.9%

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

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 58.59 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 35.2 W/kg

SAR(1 g) = 8.24 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 7.2 mm

Ratio of SAR at M2 to SAR at M1 = 63.4%

Maximum value of SAR (measured) = 19.5 W/kg

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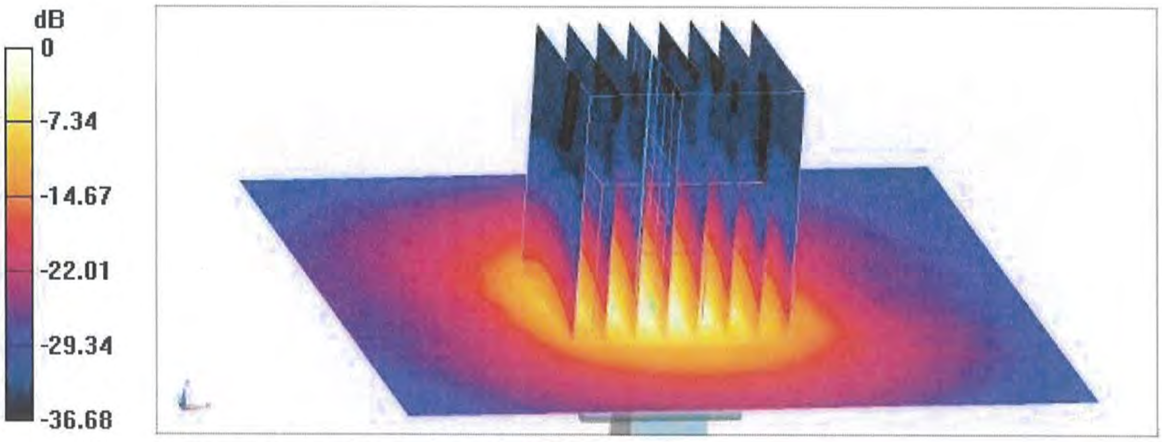
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 57.19 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 34.6 W/kg
SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.2 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 62.4%
Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

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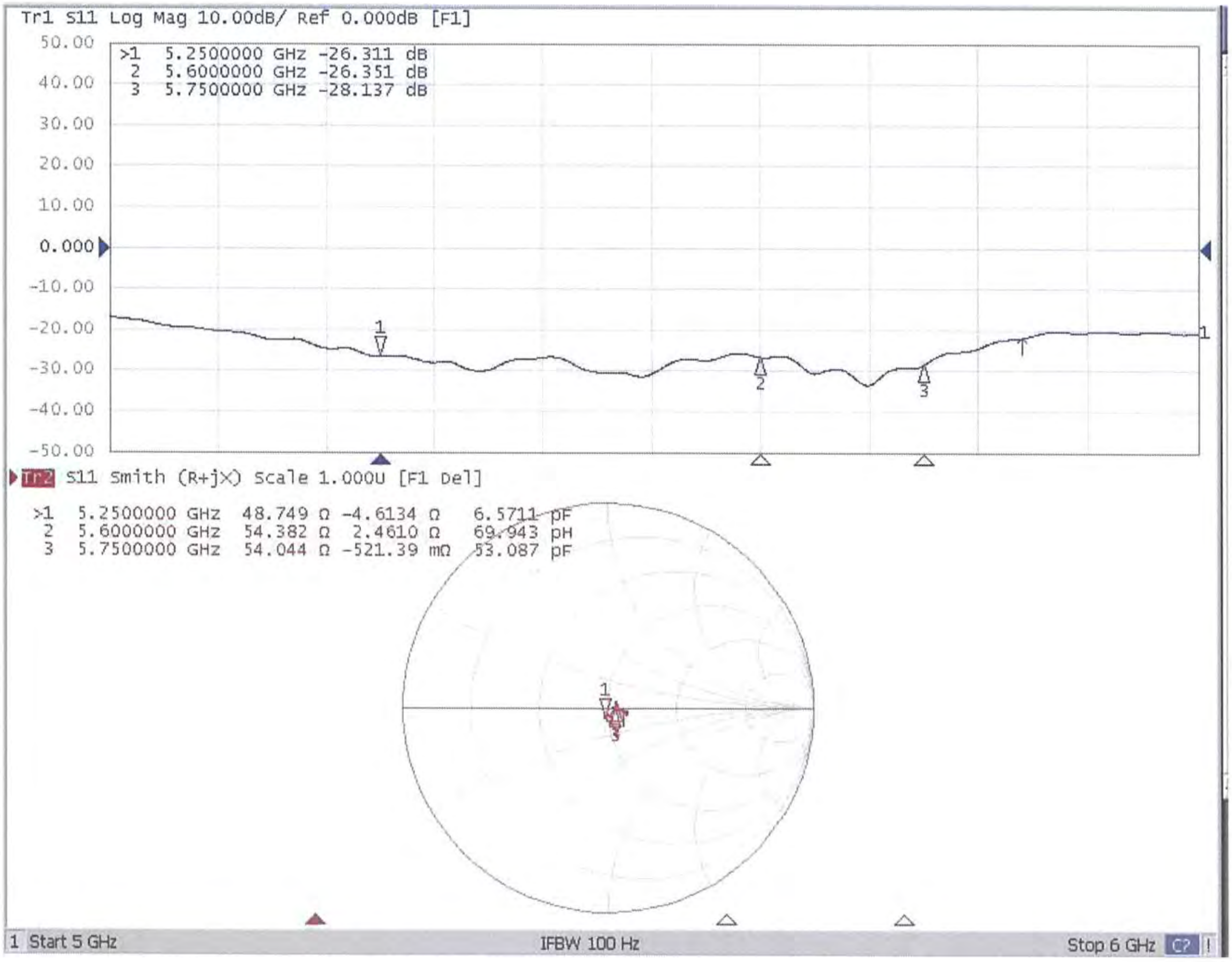
Impedance Measurement Plot for Head TSL



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CNAS L0570

Client : B.V.ADT

Certificate No: 24J02Z000881

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1389
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	November 11, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Process Calibrator 753	1971018	11-Jun-24 (CTTL, No.24J02X005147)	Jun-25

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

Issued: November 13, 2024

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Glossary:

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

Methods Applied and Interpretation of Parameters:

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

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DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	403.775 ± 0.15% (k=2)	403.739 ± 0.15% (k=2)	404.203 ± 0.15% (k=2)
Low Range	3.98142 ± 0.7% (k=2)	3.96476 ± 0.7% (k=2)	4.02443 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	131° ± 1 °

In Collaboration with
s p e a g
CALIBRATION LABORATORY
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Client ADT-SZ

Certificate No: 24J02Z000608

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 3873
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	September 29, 2024

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	106277	19-Oct-23(CTTL, No.J23X11026)	Oct-24
Power sensor NRP8S	104291	19-Oct-23(CTTL, No.J23X11026)	Oct-24
Power sensor NRP8S	104292	19-Oct-23(CTTL, No.J23X11026)	Oct-24
Reference 10dBAttenuator	18N50W-10dB	19-Jan-23(CTTL, No.J23X00212)	Jan-25
Reference 20dBAttenuator	18N50W-20dB	19-Jan-23(CTTL, No.J23X00211)	Jan-25
Reference Probe EX3DV4	SN 7307	28-May-24(SPEAG, No.EX-7307_May24)	May-25
DAE4	SN 771	19-Jan-24(SPEAG, No.DAE4-771_Jan24)	Jan-25
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	12-Jun-24(CTTL, No.24J02X005419)	Jun-25
SignalGenerator APSIN26G	181-33A6D0700-1959	26-Mar-24(CTTL, No.24J02X002468)	Mar-25
Network Analyzer E5071C	MY46110673	25-Dec-23(CTTL, No.J23X13425)	Dec-24
Reference 10dBAttenuator	BT0520	11-May-23(CTTL, No.J23X04061)	May-25
Reference 20dBAttenuator	BT0267	11-May-23(CTTL, No.J23X04062)	May-25
OCP DAK-3.5	SN 1040	22-Jan-24(SPEAG, No.OCP-DAK3.5-1040_Jan24)	Jan-25

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

Issued: October 05, 2024

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Glossary:

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

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013

b) IEC 62209-1, "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016

c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010

d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

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

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3873

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (*k*=2)
Norm(µV/(V/m)^2)[A]	0.38	0.46	0.49	±10.0%
DCP(mV)[B]	101.7	100.5	100.8	

Calibration Results for Modulation Response

UID	Communication System Name		A dB	B dB√µV	C	D dB	VR mV	Max Dev.	Max Unc[E] (*k*=2)
0	CW	X	0.0	0.0	1.0	0.00	145.7	±1.9%	±4.7%
		Y	0.0	0.0	1.0		163.2		
		Z	0.0	0.0	1.0		166.7		
10352-AAA	Pulse Waveform (200Hz, 10%)	X	8.17	78.52	15.33	10.00	60	±3.7%	±9.6%
		Y	4.26	71.20	12.59		60		
		Z	7.06	76.11	14.65		60		
10353-AAA	Pulse Waveform (200Hz, 20%)	X	20.00	86.77	16.46	6.99	80	±2.3%	±9.6%
		Y	3.94	71.75	11.79		80		
		Z	18.89	85.28	16.34		80		
10354-AAA	Pulse Waveform (200Hz, 40%)	X	20.00	84.46	13.98	3.98	95	±1.4%	±9.6%
		Y	1.52	66.22	8.57		95		
		Z	20.00	83.76	14.28		95		
10355-AAA	Pulse Waveform (200Hz, 60%)	X	0.31	60.00	4.60	2.22	120	±1.4%	±9.6%
		Y	0.39	60.18	4.80		120		
		Z	0.52	60.99	5.72		120		
10387-AAA	QPSK Waveform, 1 MHz	X	1.56	65.11	14.09	1.00	150	±2.3%	±9.6%
		Y	1.50	64.29	13.32		150		
		Z	1.51	64.02	13.40		150		
10388-AAA	QPSK Waveform, 10 MHz	X	2.14	67.53	15.04	0.00	150	±1.2%	±9.6%
		Y	2.05	66.50	14.33		150		
		Z	2.04	66.35	14.29		150		
10396-AAA	64-QAM Waveform, 100 kHz	X	3.30	73.51	20.73	3.01	150	±0.6%	±9.6%
		Y	2.72	69.25	18.47		150		
		Z	2.97	70.62	19.24		150		
10414-AAA	WLAN CCDF, 64-QAM, 40MHz	X	4.91	65.87	15.58	0.00	150	±3.6%	±9.6%
		Y	4.80	65.38	15.23		150		
		Z	4.90	65.61	15.39		150		

Note: For details on UID parameters see Appendix

The reported uncertainty of measurement is stated as the standard uncertainty of Measurement multiplied by the coverage factor *k*=2, which for a normal distribution Corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 5).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN: 3873

Sensor Model Parameters

	C1 fF	C2 fF	α V^{-1}	T1 $ms.V^{-2}$	T2 $ms.V^{-1}$	T3 ms	T4 V^{-2}	T5 V^{-1}	T6
X	50.52	382.08	36.23	10.64	0.00	5.10	0.73	0.33	1.02
Y	47.84	364.98	36.61	13.54	0.00	5.08	0.00	0.43	1.02
Z	52.98	404.85	36.75	18.85	0.00	5.10	0.00	0.47	1.02

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	16.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:3873

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (*k*=2)
750	41.9	0.89	9.87	9.87	9.87	0.12	1.29	±12.7%
835	41.5	0.90	9.47	9.47	9.47	0.16	1.19	±12.7%
900	41.5	0.97	9.42	9.42	9.42	0.19	1.12	±12.7%
1750	40.1	1.37	8.31	8.31	8.31	0.18	1.19	±12.7%
1900	40.0	1.40	7.97	7.97	7.97	0.19	1.11	±12.7%
2300	39.5	1.67	7.71	7.71	7.71	0.39	0.77	±12.7%
2450	39.2	1.80	7.46	7.46	7.46	0.40	0.78	±12.7%
2600	39.0	1.96	7.31	7.31	7.31	0.48	0.71	±12.7%
3300	38.2	2.71	6.90	6.90	6.90	0.40	0.95	±13.9%
3500	37.9	2.91	6.71	6.71	6.71	0.40	1.01	±13.9%
3700	37.7	3.12	6.50	6.50	6.50	0.38	1.04	±13.9%
3900	37.5	3.32	6.40	6.40	6.40	0.30	1.50	±13.9%
4100	37.2	3.53	6.30	6.30	6.30	0.30	1.40	±13.9%
5250	35.9	4.71	5.16	5.16	5.16	0.35	1.65	±13.9%
5600	35.5	5.07	4.56	4.56	4.56	0.40	1.52	±13.9%
5800	35.3	5.27	4.62	4.62	4.62	0.40	1.52	±13.9%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

[F] At frequency up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

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