

FCC SAR TEST REPORT

Product Name: Video Baby Monitor
Trade Mark: LeapFrog
Model No.: LF2414 PU
Add. Model No.: LF2414-2 PU
Report Number: 24041010665SAR-1
Test Standards: FCC 47 CFR Part 2 §2.1093
ANSI/IEEE C95.1-1992
IEEE Std 1528-2013
FCC ID: EW780-3433-01
Test Result: PASS
Date of Issue: August 27, 2024

Prepared for:

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UTTR-SAR-IEEE Std 1528-2013-V1.1

Version

Version No.	Date	Description
V1.0	August 27, 2024	Original Report



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1. GENERAL INFORMATION**1.1. STATEMENT OF COMPLIANCE**

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Equipment Class	Mode	Highest Reported Body SAR _{1g} (0 cm Gap) (W/kg)
DTS	2.4G SRD	1.454

1.2. CLIENT INFORMATION

Applicant:	VTech Telecommunications Ltd.
Address of Applicant:	23/F, Tai Ping Industrial Centre, Block 1, 57 Ting Kok Road, Tai Po, Hong Kong.
Manufacturer:	VTech (Dongguan) Telecommunications Limited.
Address of Manufacturer:	VTech Science Park, Xia Ling Bei Management Zone, Liaobu, Dongguan, Guangdong, China.

1.3. EUT INFORMATION

1.3.1. General Description of EUT

Product Name:	Video Baby Monitor
Trade Mark:	LeapFrog
Model No.:	LF2414 PU
Add. Model No.:	LF2414-2 PU
FCC ID:	EW780-3433-01
DUT Stage:	Production Unit
Sample Number:	S202403282986-ZJA02/2
Sample Received Date:	March 28, 2024
Sample Tested Date:	April 24, 2024 to April 25, 2024

1.3.2. Description of Accessories

Adapter	
Model No.:	VT05EUS05100
Input:	100-240V~50/60Hz 0.15A
Output:	5.0V===1.0A 5.0W

Battery	
Model No.:	ICR18650-2.6Ah-3.6V-1S1P
Battery Type:	Rechargeable Lithium-ion Battery
Rated Voltage:	3.6 Vdc
Rated Capacity:	2600 mAh 9.36Wh

1.3.3. EUT Tx Frequency Bands

Band	Tx Frequency Range (Unit: MHz)	
2.4 GHz:	2405 - 2475	
	Channel 1	2405
	Channel 2	2407
	Channel 3	2409
	Channel 4	2411
	Channel 5	2413
	Channel 6	2415
	Channel 7	2418
	Channel 8	2420
	Channel 9	2422
	Channel 10	2424
	Channel 11	2426
	Channel 12	2428
	Channel 13	2430
	Channel 14	2433
	Channel 15	2435
	Channel 16	2437
	Channel 17	2439
	Channel 18	2441
	Channel 19	2444
	Channel 20	2446
	Channel 21	2450
	Channel 22	2452
	Channel 23	2454
	Channel 24	2456
	Channel 25	2458.5
	Channel 26	2460.5
	Channel 27	2462.5
	Channel 28	2467
	Channel 29	2469
	Channel 30	2471
	Channel 31	2473
Channel 32	2475	

1.3.4. Wireless Technologies

Antenna Type	Fixed External Antenna
--------------	------------------------

1.4. MAXIMUM CONDUCTED POWER

The maximum conducted average power including tune-up tolerance is shown as below.

Mode	Maximum Conducted Power (dBm)
2405 - 2475	17.5

1.5. OTHER INFORMATION

None.

1.6. TEST LOCATION

Shenzhen UnionTrust Quality and Technology Co., Ltd.

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1.7. TEST FACILITY

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

Shenzhen UnionTrust Quality and Technology Co., Ltd.

CNAS-Lab Code: L9069

The measuring equipment utilized to perform the tests documented in this report has been calibrated once a year or in accordance with the manufacturer's recommendations, and is traceable under the ISO/IEC 17025 to international or national standards. Equipment has been calibrated by accredited calibration laboratories.

A2LA-Lab Certificate No.: 4312.01

Shenzhen UnionTrust Quality and Technology Co., Ltd. has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Wireless Device Testing Laboratories

CAB identifier: CN0032

FCC Accredited Lab.

Designation Number: CN1194

Test Firm Registration Number: 259480

1.8. GUIDANCE STANDARD

The tests documented in this report were performed in accordance with FCC 47 CFR Part 2 §2.1093, IEEE Std 1528-2013, ANSI/IEEE C95.1-1992, the following FCC Published RF exposure KDB procedures:

KDB 865664 D01 v01r04

KDB 865664 D02 v01r02

KDB 447498 D01 v06

KDB 616217 D04 v01r02

2. SPECIFIC ABSORPTION RATE (SAR)

2.1. INTRODUCTION

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling, by appropriate techniques, to produce specific absorption rates (SARs) as averaged over the whole-body, any 1 g or any 10 g of tissue (defined as a tissue volume in the shape of a cube). All SAR values are to be averaged over any six-minute period. When portable device was used within 20 cm of the user's body, SAR evaluation of the device will be required. The SAR limit in chapter 2.3.

2.2. SAR DEFINITION

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

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

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

SAR measurement can be related to the electrical field in the tissue by

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

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

2.3. SAR LIMITS

Limits for Occupational/Controlled Exposure (W/kg)

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

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

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

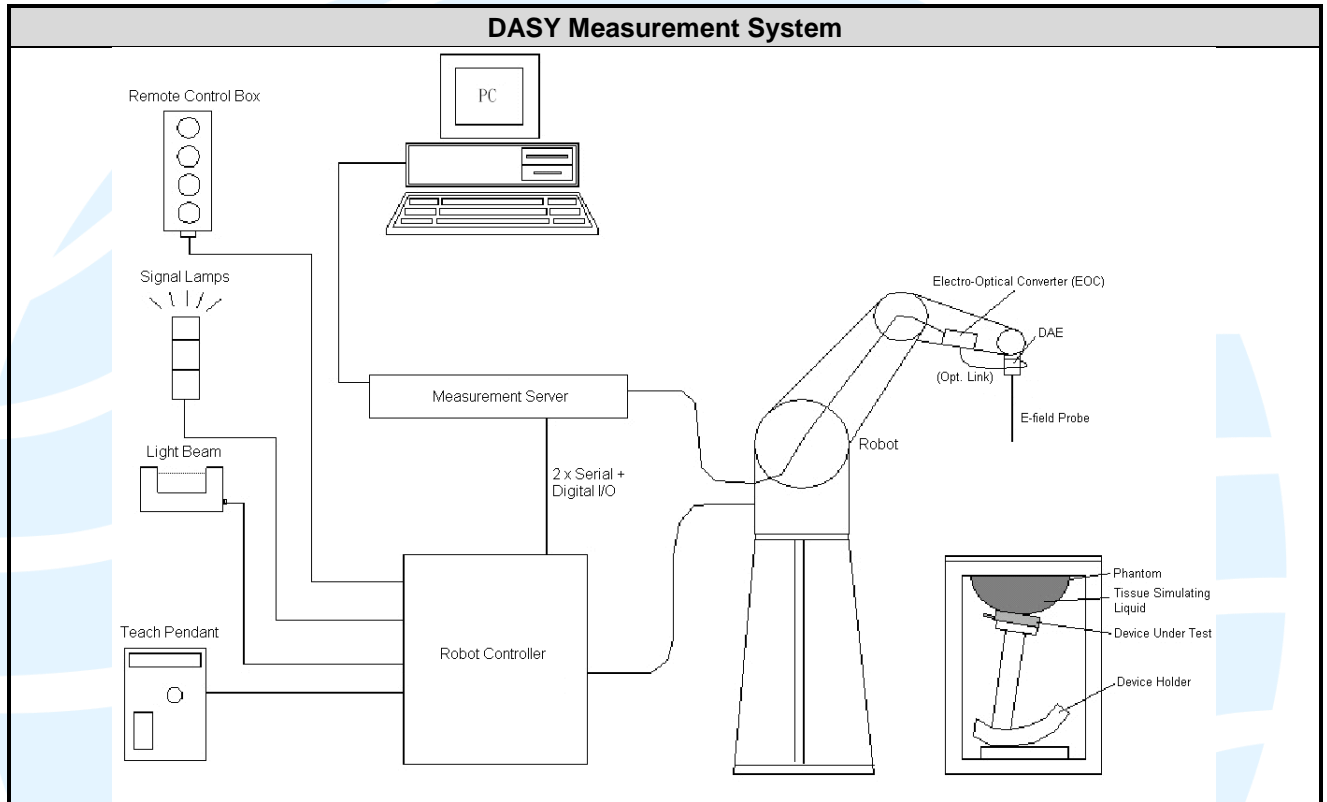
Note:

- 1) Whole-Body SAR is averaged over the entire body, partial-body SAR is averaged over any 1 gram of tissue defined as a tissue volume in the shape of a cube. SAR for hands, wrists, feet and ankles is averaged over any 10 grams of tissue defined as a tissue volume in the shape of a cube.
- 2) At frequencies above 6.0 GHz, SAR limits are not applicable and MPE limits for power density should be applied at 5 cm or more from the transmitting device.
- 3) The SAR limit is specified in FCC 47 CFR Part 2 §2.1093, ANSI/IEEE C95.1-1992.

3. SAR MEASUREMENT SYSTEM

3.1. 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 from the optical into digital electric signal of the DAE and transfers data to the PC.




3.1.1. Robot


The DASY system uses the high precision robots from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY4: CS7MB) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability ± 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)


3.1.2. Probe

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 μ W/g to 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 μ W/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 μ W/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	

3.1.3. 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 detectors for mechanical surface detection and emergency robot stop.	
Measurement Range	-100 to +300 mV (16-bit resolution and two range settings: 4mV, 400mV)	
Input Voltage Offset	$< 5\mu$ V (with auto zero)	
Input Bias Current	< 50 fA	
Dimensions	60 x 60 x 68 mm	

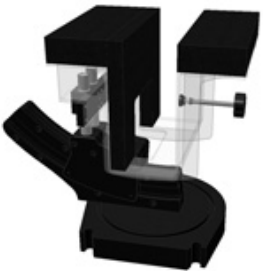
3.1.4. Phantom

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	

3.1.5. 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	

3.1.6. System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with 1/4 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. SAR SCAN PROCEDURE

3.2.1. SAR Reference Measurement (drift)

Prior to the SAR test, local SAR shall be measured at a stationary reference point where the SAR exceeds the lower detection limit of the measurement system.

3.2.2. Area Scan

Measurement procedures for evaluating the SAR of wireless device start with a coarse measurement grid to determine the approximate location of the local peak SAR values. This is known as the area-scan procedure. All antennas and radiating structures that may contribute to the measured SAR or influence the SAR distribution must be included in the area scan. The area scan measurement resolution must enable the extrapolation algorithms of the SAR system to correctly identify the peak SAR location(s) for subsequent zoom scan measurements to correctly determine the 1-g SAR. Area scans are performed at a constant distance from the phantom surface, determined by the measurement frequencies. When a measured peak is closer than 1/2 the zoom scan volume dimension (x, y) from the edge of the area scan region, unless the entire peak and gram-averaging volume are both captured within the zoom scan volume, the area scan must be repeated by shifting and expanding the area scan region to ensure all peaks are away from the area scan boundary. The area scan resolutions specified in the table below must be applied to the SAR measurements.

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

3.2.3. Zoom Scan

To evaluate the peak spatial-average SAR values with respect to 1 g or 10 g cubes, fine resolution volume scans, called zoom scans, are performed at the peak SAR locations identified during the area scan. If the cube volume within the zoom scan chosen to calculate the peak spatial-average SAR touches any boundary of the zoom-scan volume, the zoom scan shall be repeated with the center of the zoom-scan volume shifted to the new maximum SAR location. For any secondary peaks found in the area scan that are within 2 dB of the maximum peak and are not within this zoom scan, the zoom scan shall be performed for such peaks, unless the peak spatial-average SAR at the location of the maximum peak is more than 2 dB below the applicable SAR limit (i.e., 1 W/kg for a 1.6 W/kg 1 g limit, or 1.26 W/kg for a 2 W/kg 10 g limit). The zoom scan resolutions specified in the table below must be applied to the SAR measurements.

		≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: $\Delta x_{Zoom}, \Delta y_{Zoom}$		≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom Scan spatial resolution, normal to phantom surface	uniform grid: $\Delta Z_{Zoom}(n)$	≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta Z_{Zoom}(1)$: between 1 ST two points closest to phantom surface	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta Z_{Zoom}(n>1)$: between subsequent points	≤ 1.5· $\Delta Z_{Zoom}(n-1)$ mm
Minimum zoom scan volume	x, y, z	≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see IEEE Std 1528-2013 for details. * When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.			

3.2.4. SAR Drift Measurement

The local SAR (or conducted power) shall be measured at exactly the same location as in 3.2.1 section. The absolute value of the measurement drift (the difference between the SAR measured in 3.2.1 and 3.2.4 section) shall be recorded. The SAR drift shall be kept within ± 5%.

3.3. EQUIPMENT LIST

Equipment	Manufacturer	Model	S/N	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D2450V2	883	Jan. 02, 2024	3 Year
Data Acquisition Electronics	SPEAG	DAE4	662	Mar. 18, 2024	1 Year
Dosimetric E-Field Probe	SPEAG	ES3DV3	3090	Mar. 26, 2024	1 Year
ENA Series Network Analyzer	Agilent	8753ES	US39170317	Oct. 31, 2023	1 Year
Dielectric Assessment Kit	SPEAG	DAK-3.5	1056	N/A	N/A
USB/GPIB Interface	Agilent	82357B	N10149	N/A	N/A
Signal Generator	R&S	SMB100A	103718	Mar. 29, 2024	1 Year
POWER METER	R&S	NRP	101293	Oct. 27, 2023	1 Year
Thermometer	Shanghai Gao Zhi Precision Instrument Co., Ltd.	HB6801	18022507	Oct. 29, 2023	1 Year
Dual Directional Coupler	Agilent	778D	MY52180234	Oct. 27, 2023	1 Year
Amplifier	Mini-Circuit	ZHL42	QA1252001	Mar. 29, 2024	1 Year
DC Source	Agilent	66319B	MY43000795	Oct. 31, 2023	1 Year

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3.4. MEASUREMENT UNCERTAINTY

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

TABLE 1 EXPOSURE ASSESSMENT UNCERTAINTY FOR HANDSET SAR

Source of Uncertainty	Tolerance (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g) (± %)	Standard Uncertainty (10g) (± %)	Vi Veff
Measurement System								
Probe Calibration (< 3 GHz)	7.5	N (k=2)	2	1	1	3.75	3.75	∞
Probe Calibration (> 3 GHz)	6.3	N (k=2)	2	1	1	3.15	3.15	∞
Axial Isotropy	1.2	N (k=2)	2	0.7	0.7	0.42	0.42	∞
Hemispherical Isotropy	3.2	N (k=2)	2	0.7	0.7	1.12	1.12	∞
Boundary Effects	2	Rectangular	√3	1	1	1.15	1.15	∞
Linearity	0.9	N (k=2)	2	1	1	0.45	0.45	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Modulation Response	2.4	Rectangular	√3	1	1	1.39	1.39	∞
Readout Electronics	0.3	Normal	1	1	1	0.30	0.30	∞
Response Time	0	Rectangular	√3	1	1	0.00	0.00	∞
Integration Time	1.7	Rectangular	√3	1	1	0.98	0.98	∞
RF Ambient – Noise	3	Rectangular	√3	1	1	1.73	1.73	∞
RF Ambient – Reflections	3	Rectangular	√3	1	1	1.73	1.73	∞
Probe Positioner	0.4	Rectangular	√3	1	1	0.23	0.23	∞
Probe Positioning	6.7	Rectangular	√3	1	1	3.87	3.87	∞
Max. SAR Evaluation	4	Rectangular	√3	1	1	2.31	2.31	∞
Test Sample Related								
Device Positioning	2.3 / 2.4	Normal	1	1	1	2.30	2.40	30
Device Holder	2.8 / 2.8	Normal	1	1	1	2.80	2.80	30
Power Drift	5	Rectangular	√3	1	1	2.89	2.89	∞
Power Scaling	0	Rectangular	√3	1	1	0.00	0.00	∞
Phantom and Setup								
Phantom Uncertainty	7.9	Rectangular	√3	1	1	4.56	4.56	∞
SAR correction	1.2 / 0.97	Rectangular	√3	1	0.84	0.69	0.47	∞
Liquid Conductivity (Meas.)	2.5	Rectangular	√3	0.78	0.71	1.13	1.02	∞
Liquid Permittivity (Meas.)	2.5	Rectangular	√3	0.26	0.26	0.38	0.38	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	0.71	1.53	1.39	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.26	0.05	0.06	∞
Combined Standard Uncertainty (k = 1) (≤ 3 GHz)						9.64	9.62	
Combined Standard Uncertainty (k = 1) (> 3 GHz)						9.42	9.40	
Max. Expanded Uncertainty (k = 2)						19.27	19.23	

TABLE 2 SYSTEM VALIDATION Measurement uncertainty

Source of Uncertainty	Tolerance (± %)	Probability Distribution	Divisor	Ci (1g)	Ci (10g)	Standard Uncertainty (1g) (± %)	Standard Uncertainty (10g) (± %)	Vi Veff
Measurement System								
Probe Calibration (< 3 GHz)	7.5	N (k=2)	2	1	1	3.75	3.75	∞
Probe Calibration (> 3 GHz)	6.3	N (k=2)	2	1	1	3.15	3.15	∞
Axial Isotropy	1.2	N (k=2)	2	0.7	0.7	0.42	0.42	∞
Hemispherical Isotropy	3.2	N (k=2)	2	0.7	0.7	1.12	1.12	∞
Boundary Effects	2	Rectangular	√3	1	1	1.15	1.15	∞
Linearity	0.9	N (k=2)	2	1	1	0.45	0.45	∞
Detection Limits	0.25	Rectangular	√3	1	1	0.14	0.14	∞
Modulation Response	2.4	Rectangular	√3	1	1	1.39	1.39	∞
Readout Electronics	0.3	Normal	1	1	1	0.30	0.30	∞
Response Time	0	Rectangular	√3	1	1	0.00	0.00	∞
Integration Time	1.7	Rectangular	√3	1	1	0.98	0.98	∞
RF Ambient – Noise	3	Rectangular	√3	1	1	1.73	1.73	∞
RF Ambient – Reflections	3	Rectangular	√3	1	1	1.73	1.73	∞
Probe Positioner	0.4	Rectangular	√3	1	1	0.23	0.23	∞
Probe Positioning	6.7	Rectangular	√3	1	1	3.87	3.87	∞
Max. SAR Evaluation	4	Rectangular	√3	1	1	2.31	2.31	∞
Test Sample Related								
Device Positioning	2.3 / 2.4	Normal	1	1	1	2.30	2.40	30
Device Holder	2.8 / 2.8	Normal	1	1	1	2.80	2.80	30
Power Drift	5	Rectangular	√3	1	1	2.89	2.89	∞
Power Scaling	0	Rectangular	√3	1	1	0.00	0.00	∞
Phantom and Setup								
Phantom Uncertainty	7.9	Rectangular	√3	1	1	4.56	4.56	∞
SAR correction	1.2 / 0.97	Rectangular	√3	1	0.84	0.69	0.47	∞
Liquid Conductivity (Meas.)	2.5	Rectangular	√3	0.78	0.71	1.13	1.02	∞
Liquid Permittivity (Meas.)	2.5	Rectangular	√3	0.26	0.26	0.38	0.38	∞
Temp. unc. - Conductivity	3.4	Rectangular	√3	0.78	0.71	1.53	1.39	∞
Temp. unc. - Permittivity	0.4	Rectangular	√3	0.23	0.26	0.05	0.06	∞
Combined Standard Uncertainty (k = 1) (≤ 3 GHz)						9.64	9.62	
Combined Standard Uncertainty (k = 1) (> 3 GHz)						9.42	9.40	
Max. Expanded Uncertainty (k = 2)						19.27	19.23	

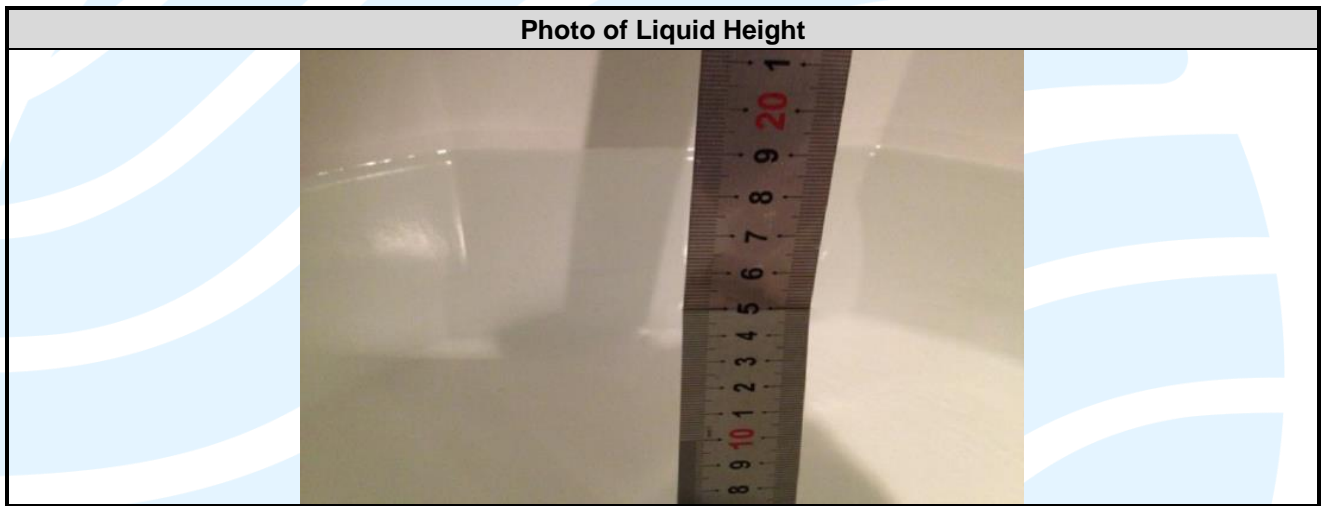
3.5. TISSUE DIELECTRIC PARAMETER MEASUREMENT & SYSTEM VERIFICATION

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval.

3.5.1. Tissue Simulating Liquids

The temperature of the tissue-equivalent medium used during measurement must also be within 18 °C to 25 °C and within ± 2 °C of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 3 - 4 days of use; or earlier if the dielectric parameters can become out of tolerance.

The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm with ≤ ± 0.5 cm variation for SAR measurements ≤ 3 GHz and ≥ 10.0 cm with ≤ ± 0.5 cm variation for measurements > 3 GHz. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.



Tissue Dielectric Parameters for Head and Body				
Target Frequency (MHz)	Head		Body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
750	41.9	0.89	55.5	0.96
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
1450	40.5	1.20	54.0	1.30
1640	40.3	1.29	53.8	1.40
1750	40.1	1.37	53.4	1.49
1800	40.0	1.40	53.3	1.52
1900	40.0	1.40	53.3	1.52
2000	40.0	1.40	53.3	1.52
2300	39.5	1.67	52.9	1.81
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16
3500	37.9	2.91	51.3	3.31
5200	36.0	4.66	49.0	5.30
5300	35.9	4.76	48.9	5.42
5500	35.6	4.96	48.6	5.65
5600	35.5	5.07	48.5	5.77
5800	35.3	5.27	48.2	6.00

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

The following table gives the recipes for tissue simulating liquids.

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	1.4	57.0	-	41.1	-
H835	0.1	-	1.0	1.4	57.0	-	40.5	-
H900	0.1	-	1.0	1.5	56.5	-	40.9	-
H1450	-	45.5	-	0.7	-	-	53.8	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	44.5	-	0.3	-	-	55.2	-
H1800	-	44.9	-	0.2	-	-	54.9	-
H1900	-	44.9	-	0.2	-	-	54.9	-
H2000	-	50	-	-	-	-	50	-
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	65.52	17.3
B750	0.2	-	0.2	0.8	48.8	-	50.0	-
B835	0.2	-	0.2	0.9	48.5	-	50.2	-
B900	0.2	-	0.2	0.9	48.2	-	50.5	-
B1450	-	34.0	-	0.3	-	-	65.7	-
B1640	-	32.5	-	0.3	-	-	67.2	-
B1750	-	29.4	-	0.4	-	-	70.2	-
B1800	-	29.5	-	0.4	-	-	70.1	-
B1900	-	29.5	-	0.3	-	-	70.2	-
B2000	-	30.0	-	0.2	-	-	69.8	-
B2300	-	31.0	-	0.1	-	-	68.9	-
B2450	-	31.4	-	0.1	-	-	68.5	-
B2600	-	31.8	-	0.1	-	-	68.1	-
B3500	-	28.8	-	0.1	-	-	71.1	-
B5G	-	-	-	-	-	10.7	78.6	10.7

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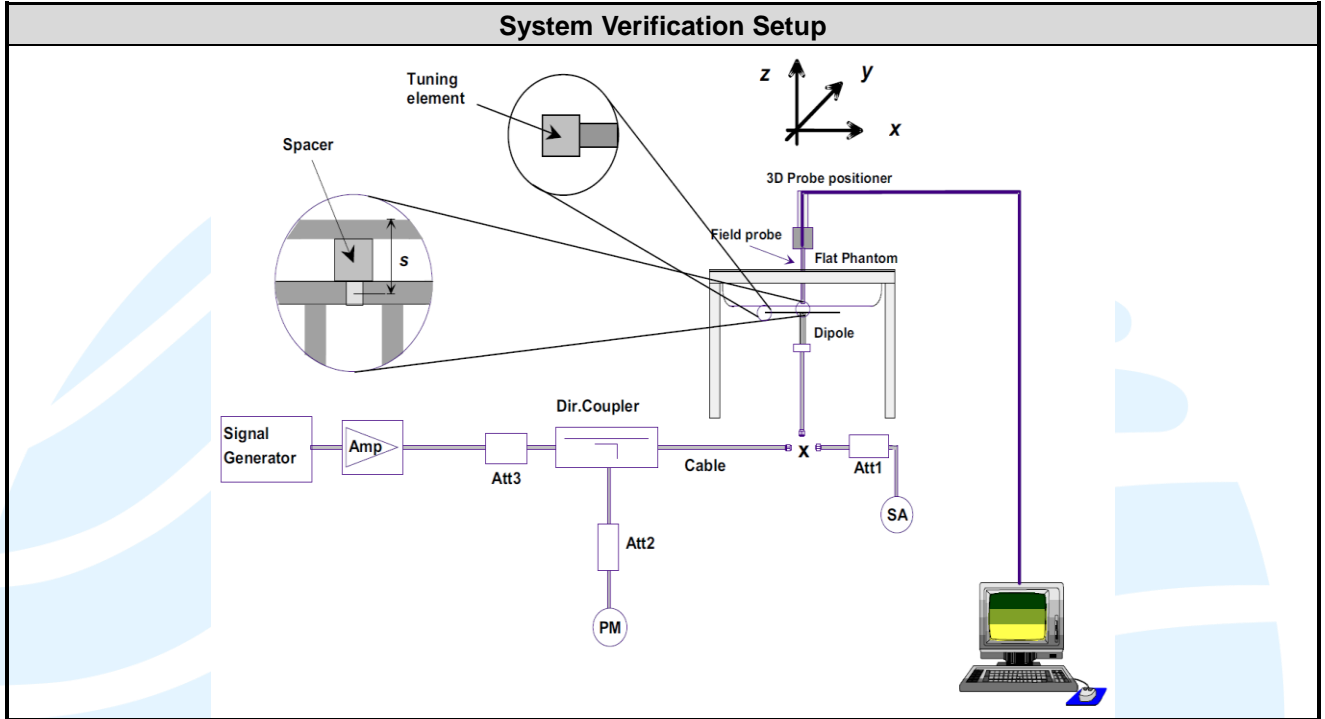
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3.5.2. System Check Description

The system check procedure provides a simple, fast, and reliable test method that can be performed daily or before every SAR measurement. The objective here is to ascertain that the measurement system has acceptable accuracy and repeatability. This test requires a flat phantom and a radiating source. The system verification setup is shown as below.



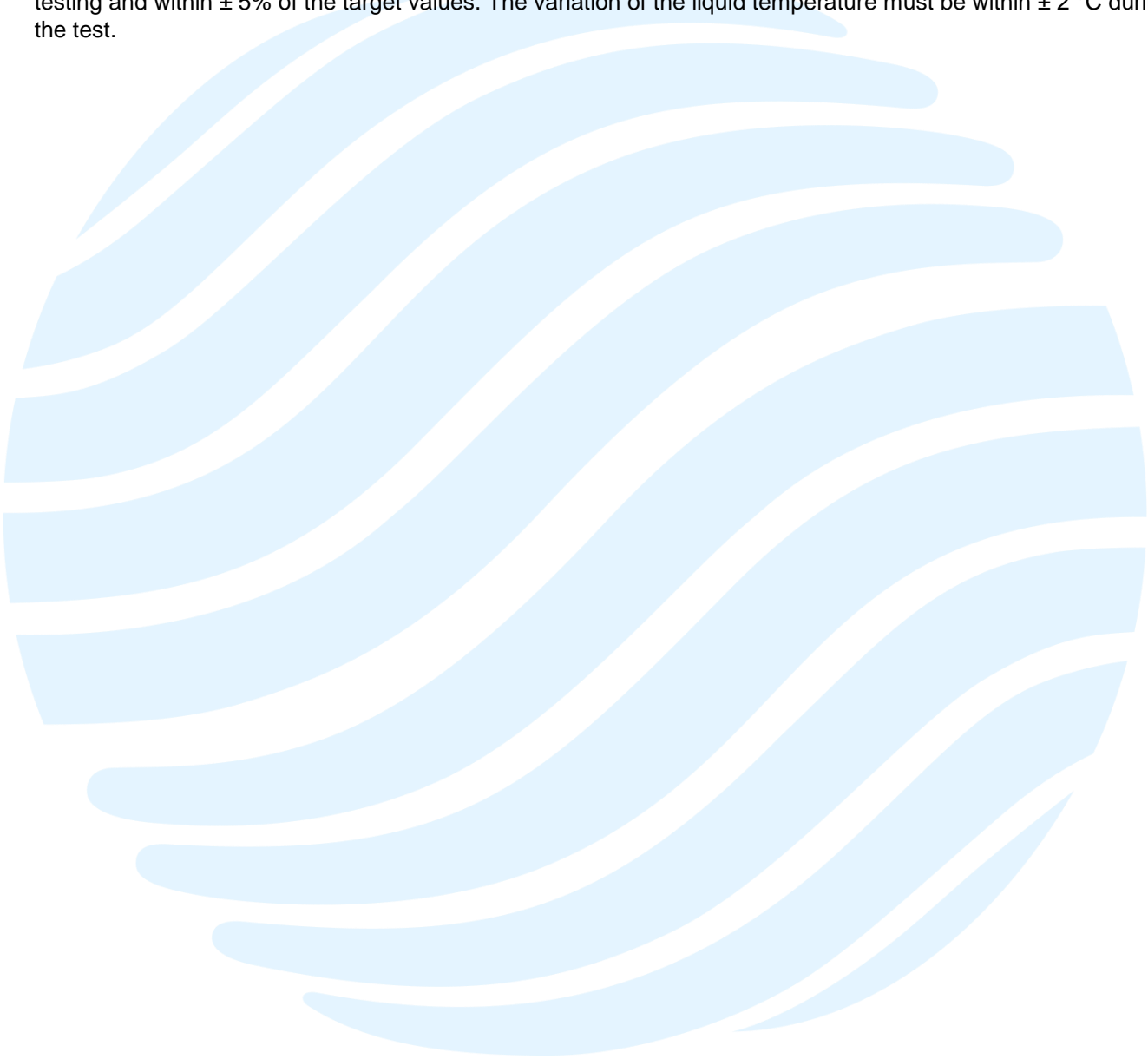
3.5.3. Tissue Verification

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

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (°C)	Measured Conductivity (σ)	Measured Permittivity (ϵ_r)	Target Conductivity (σ)	Target Permittivity (ϵ_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Apr. 25, 2024	Head	2405	21.5	1.775	38.820	1.80	39.20	-1.39	-0.97
Apr. 25, 2024	Head	2439	21.5	1.735	38.490	1.80	39.20	-3.61	-1.81
Apr. 25, 2024	Head	2475	21.5	1.810	37.970	1.80	39.20	0.56	-3.14

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within $\pm 5\%$ of the target values. The variation of the liquid temperature must be within $\pm 2^\circ\text{C}$ during the test.



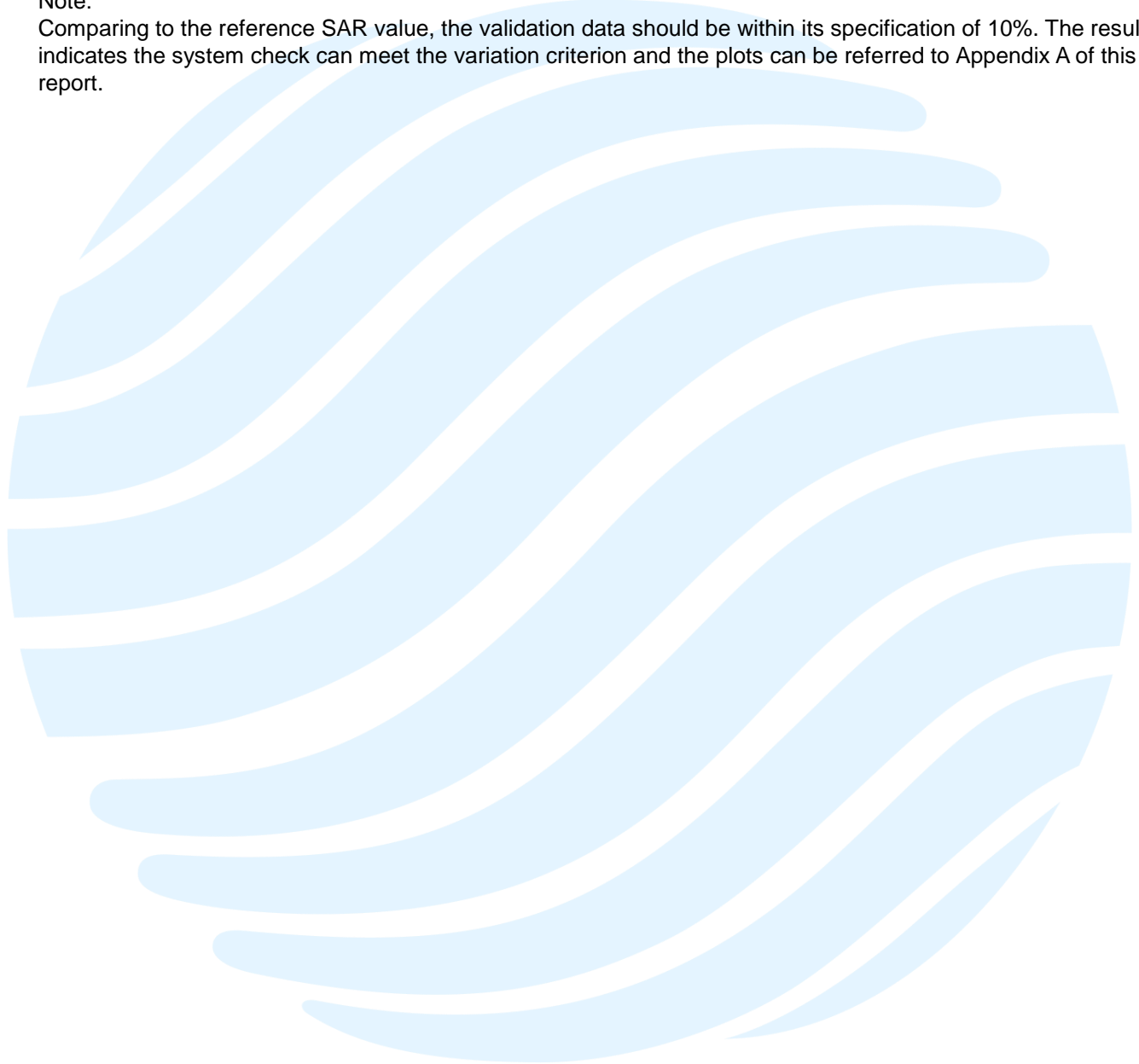
3.5.4. System Verification

The measuring result for system verification is tabulated as below.

Test Date	Tissue Type	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Apr. 25, 2024	Head	2405	53.70	14.200	56.80	5.77	883	3090	662
Apr. 25, 2024	Head	2439	53.70	14.200	56.80	5.77	883	3090	662
Apr. 25, 2024	Head	2475	53.70	14.200	56.80	5.77	883	3090	662

Note:

Comparing to the reference SAR value, 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.



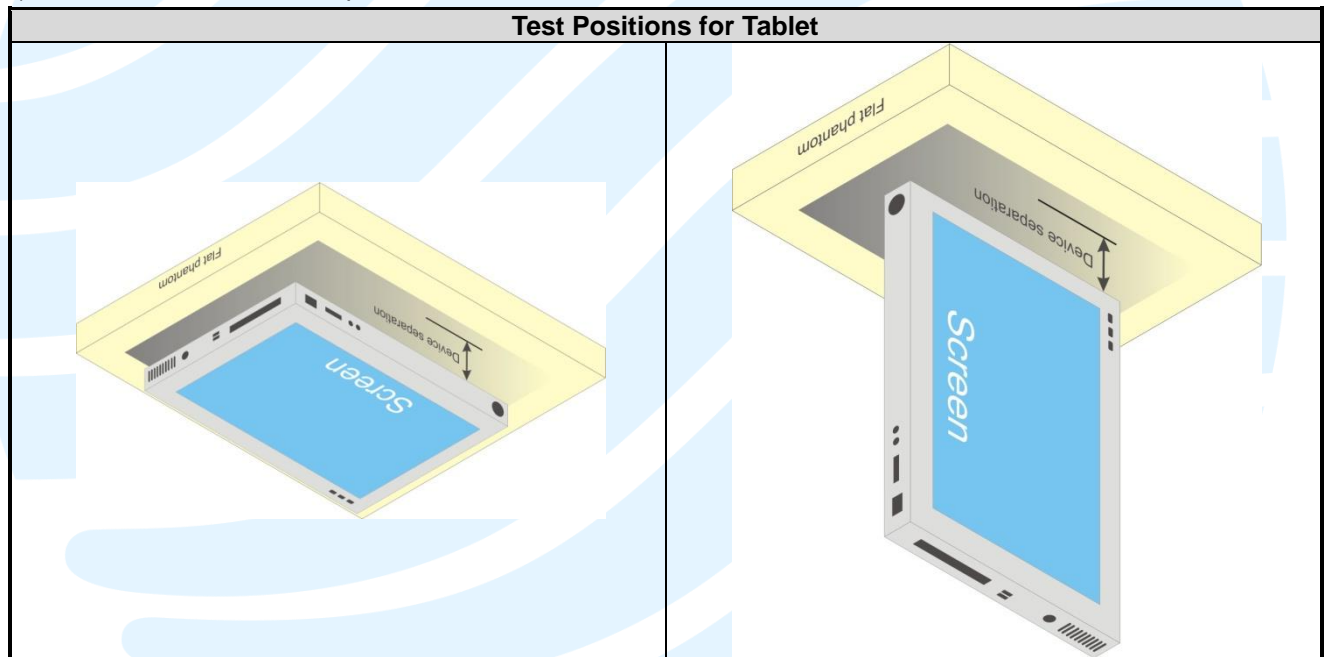
4. SAR MEASUREMENT EVALUATION

4.1. EUT TESTING POSITION

RF Exposure Conditions	Test Position	Separation Distance	SAR test exclusion
Body	Rear Face	0 cm	Note 4
	Left Side		
	Right Side		
	Top Side		
	Bottom Side		

Note:

- 1) Exposures from antennas through the front surface of the display section of a tablet are generally limited to the user's hands. Exposures to hands for typical consumer transmitters used in tablets are not expected to exceed the extremity SAR limit; therefore, SAR evaluation for the front surface of tablet display screens are generally not necessary.
- 2) When voice mode is supported on a tablet and it is limited to speaker mode or headset operations only, additional SAR testing for this type of voice use is not required.
- 3) Next to the ear operation is generally not expected for tablets with overall diagonal dimension > 20 cm. However, when next to the ear voice mode is supported, regardless of the overall dimension, phablets must be tested according to the requirements described in KDB Publication 648474 D04.
- 4) For SAR test exclusion, please refer to section 4.4



4.2. MEASURED CONDUCTED POWER RESULT

The measuring conducted average power is shown as below.

Band	Channel	Frequency (MHz)	Average Power (dBm)
2.4GHz	1	2405	16.97
	17	2439	15.12
	32	2475	15.53



4.3. SAR TEST EXCLUSION EVALUATIONS

4.3.1. Standalone SAR Test Exclusion Considerations

According to KDB 447498 D04, SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad \text{(B.1)}$$

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad \text{(B.2)}$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (B.1).

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)										
	5	10	15	20	25	30	35	40	45	50	
300	39	65	88	110	129	148	166	184	201	217	
450	22	44	67	89	112	135	158	180	203	226	
835	9	25	44	66	90	116	145	175	207	240	
1900	3	12	26	44	66	92	122	157	195	236	
2450	3	10	22	38	59	83	111	143	179	219	
3600	2	8	18	32	49	71	96	125	158	195	
5800	1	6	14	25	40	58	80	106	136	169	

Max. Tune-up Power (dBm)	Max. Tune-up Power (mW)	Left Side			Right Side			Top Side			Bottom Side		
		Ant. to Surface (cm)	Calculated Result (mW)	Require SAR Testing?	Ant. to Surface (cm)	Calculated Result (mW)	Require SAR Testing?	Ant. to Surface (cm)	Calculated Result (mW)	Require SAR Testing?	Ant. to Surface (cm)	Calculated Result (mW)	Require SAR Testing?
17.5	56.23	5.5	219	No	1.8	38	Yes	0	3	Yes	7.6	219	No

Note:

- 1) Based on the antenna location shown on appendix D of this report for SAR test exclusion.
- 2) The 1 mW Blanket Exemption applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power of no more than 1 mW, regardless of separation distance.

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4.4. SAR TESTING RESULTS

4.4.1. SAR Test Reduction Considerations

KDB 447498 D01 General RF Exposure Guidance

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:

- a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- b) ≤ 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
- c) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

4.4.2. SAR Results for Body Exposure Condition

Plot No.	Band	Test Position	Separation Distance (cm)	Channel	Duty Cycle	Antenna	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Measured SAR-10g (W/kg)	Scaling Factor	Scaled SAR-1g (W/kg)	Note
1	2.4G	Front Face	0	1	75.52%	Close	17.5	16.97	-0.08	0.129	0.0724	1.13	0.193	
	2.4G	Rear Face	0	1	75.52%	Close	17.5	16.97	0.08	0.916	0.365	1.13	1.370	
	2.4G	Rear Face	0	1	75.52%	Close	17.5	16.97	0.17	0.896	0.361	1.13	1.340	REPEAT
	2.4G	Right Side	0	1	75.52%	Close	17.5	16.97	0.12	0.00535	0.00311	1.13	0.008	
	2.4G	Top Side	0	1	75.52%	Close	17.5	16.97	0.10	0.316	0.149	1.13	0.473	
2	2.4G	Rear Face	0	17	75.52%	Close	17.5	15.12	0.14	0.584	0.249	1.73	1.338	
	2.4G	Rear Face	0	32	75.52%	Close	17.5	15.53	-0.09	0.74	0.306	1.57	1.542	
	2.4G	Front Face	0	1	75.52%	Open	17.5	16.97	0.11	0.227	0.118	1.13	0.340	
	2.4G	Rear Face	0	1	75.52%	Open	17.5	16.97	-0.03	0.972	0.418	1.13	1.454	
	2.4G	Rear Face	0	1	75.52%	Open	17.5	16.97	0.12	0.872	0.382	1.13	1.305	REPEAT
	2.4G	Right Side	0	1	75.52%	Open	17.5	16.97	0.06	0.113	0.0628	1.13	0.169	
	2.4G	Top Side	0	1	75.52%	Open	17.5	16.97	0.01	0.0254	0.0157	1.13	0.038	
	2.4G	Rear Face	0	17	75.52%	Open	17.5	15.12	0.10	0.506	0.229	1.73	1.159	
	2.4G	Rear Face	0	32	75.52%	Open	17.5	15.53	0.17	0.681	0.298	1.57	1.419	

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4.5. SAR MEASUREMENT VARIABILITY

4.5.1. Repeated Measurement

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)	Antenna	Channel	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
Body Exposure Condition											
2.4G	Rear Face	0	Close	1	1.370	1.340	1.0224	N/A	N/A	N/A	N/A
2.4G	Rear Face	0	Open	1	1.454	1.305	1.1142	N/A	N/A	N/A	N/A

*** End of Report ***

The test report is effective only with both signature and specialized stamp. The result(s) shown in this report refer only to the sample(s) tested. Without written approval of UnionTrust, this report can't be reproduced except in full.



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: UnionTrust

Date: 2024/4/25

System Check_H2450_24dBm

DUT: Dipole 2450 MHz

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

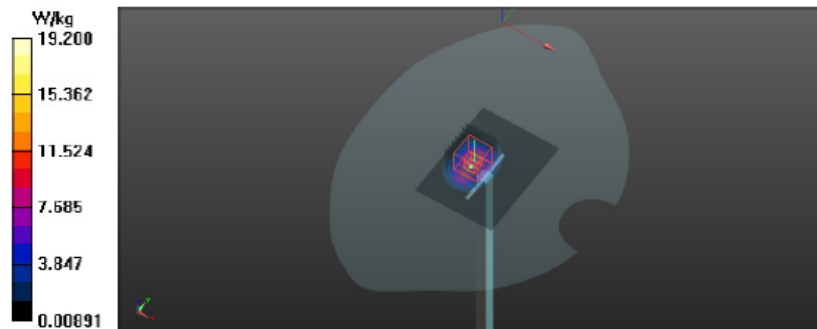
Medium: H2450 Medium parameters used: $f = 2450$ MHz; $\sigma = 1.744$ S/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3090; ConvF(4.63, 4.63, 4.63) @ 2450 MHz; Calibrated: 2024/3/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn662; Calibrated: 2024/3/18
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: TP/1378
- Postprocessing SW: SEMCAD, V1.8 Build 186

System check/Area Scan (61x81x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm
Maximum value of SAR (interpolated) = 19.2 W/kg

System check/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 79.94 V/m; Power Drift = 0.18 dB
Peak SAR (extrapolated) = 28.8 W/kg
SAR(1 g) = 14.2 W/kg; SAR(10 g) = 6.6 W/kg
Smallest distance from peaks to all points 3 dB below = 9.5 mm
Ratio of SAR at M2 to SAR at M1 = 50.6%
Maximum value of SAR (measured) = 18.6 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.

Test Laboratory: UnionTrust

Date: 2024/4/25

2.4GHz_Rear Face_0MM_1

DUT: EUT

Communication System: UID 0, 2.4GHz; Frequency: 2405 MHz; Duty Cycle: 1:1

Medium: H2450 Medium parameters used: $f = 2405$ MHz; $\sigma = 1.775$ S/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3090; ConvF(4.63, 4.63, 4.63) @ 2405 MHz; Calibrated: 2024/3/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn662; Calibrated: 2024/3/18
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: TP/1378
- Postprocessing SW: SEMCAD, V1.8 Build 186

Area Scan (51x101x1): Interpolated grid: $dx=1.200$ mm, $dy=1.200$ mm
Maximum value of SAR (interpolated) = 1.71 W/kg

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

Reference Value = 1.260 V/m; Power Drift = 0.08 dB

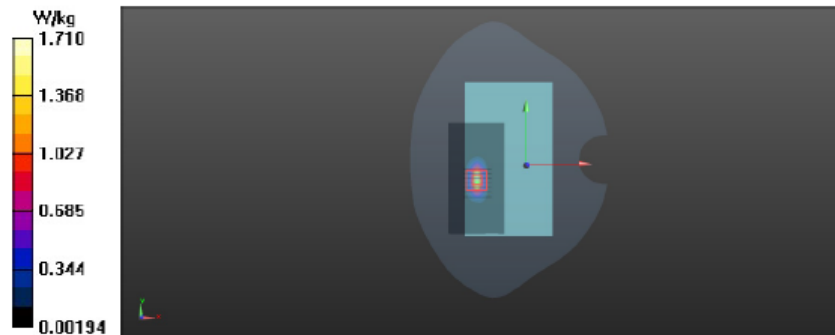
Peak SAR (extrapolated) = 2.33 W/kg

SAR(1 g) = 0.916 W/kg; SAR(10 g) = 0.365 W/kg

Smallest distance from peaks to all points 3 dB below = 7 mm

Ratio of SAR at M2 to SAR at M1 = 42.5%

Maximum value of SAR (measured) = 1.29 W/kg



Test Laboratory: UnionTrust

Date: 2024/4/25

2.4GHz_Rear Face_0MM_1

DUT: EUT

Communication System: UID 0, 2.4GHz; Frequency: 2405 MHz; Duty Cycle: 1:1

Medium: H2450 Medium parameters used: $f = 2405$ MHz; $\sigma = 1.775$ S/m; $\epsilon_r = 38.8$; $\rho = 1000$ kg/m³

DASY4 Configuration:

- Probe: ES3DV3 - SN3090; ConvF(4.63, 4.63, 4.63) @ 2405 MHz; Calibrated: 2024/3/26
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn662; Calibrated: 2024/3/18
- Phantom: SAM 1; Type: QD 000 P40 CB; Serial: TP/1378
- Postprocessing SW: SEMCAD, V1.8 Build 186

Area Scan (71x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 1.36 W/kg

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

Reference Value = 1.351 V/m; Power Drift = -0.03 dB

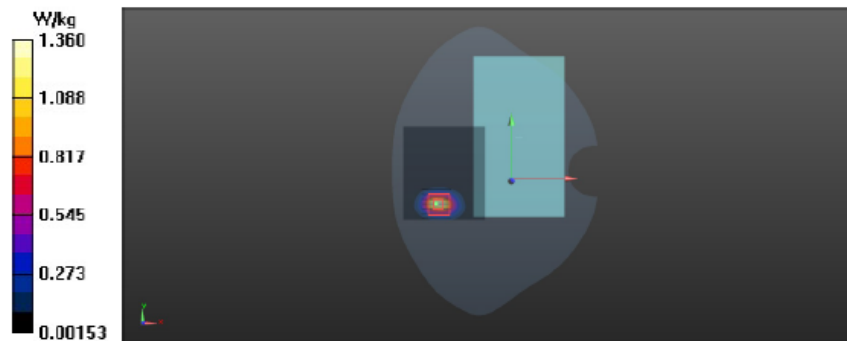
Peak SAR (extrapolated) = 2.23 W/kg

SAR(1 g) = 0.972 W/kg; SAR(10 g) = 0.418 W/kg

Smallest distance from peaks to all points 3 dB below = 8 mm

Ratio of SAR at M2 to SAR at M1 = 45.8%

Maximum value of SAR (measured) = 1.32 W/kg



APPENDIX C. CALIBRATION CERTIFICATE FOR PROBE AND DIPOLE

The calibration certificates are shown as follows.



APPENDIX D. PHOTOGRAPHS OF EUT AND SETUP

The photographs of EUT and setup are shown as follow

