Shenzhen CTA Testing Technology Co., Ltd.

Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China

TEST REPORT

Report Reference No.......................:	**CTA24042901201**
FCC ID .... :	**2ATY8-IPASONP3ES**
Compiled by (position+printed name+signature)..:	File administrators Zoey Cao — Zoey Cao
Supervised by (position+printed name+signature)..:	Project Engineer Amy Wen — Amy Wen
Approved by (position+printed name+signature)..:	RF Manager Eric Wang — Eric Wang
Date of issue.......................................:	May 24, 2024
Testing Laboratory Name ....:	**Shenzhen CTA Testing Technology Co., Ltd.**
Address...:	Room 106, Building 1, Yibaolai Industrial Park, Qiaotou Community, Fuhai Street, Bao'an District, Shenzhen, China
Applicant's name ....:	**Wuhan Ipason Technology Co., Ltd.**
Address...:	5th Floor, Multifunctional Building, No. 1, Ipason Avenue, Shekou Street, Huangpi District, Wuhan City, Hubei Province, China
Test specification.......................... :	
Standard ....:	**IEC 62209-2:2010; IEEE 1528:2013; FCC 47 CFR Part 2.1093; ANSI/IEEE C95.1:2005; Reference FCC KDB 447498; KDB 248227; KDB 616217; KDB 865664**

Test item description..................... :	**Notebook Computer**
Trade Mark...:	IPASON
Manufacturer..:	Wuhan Ipason Technology Co., Ltd.
Model/Type reference ....:	IPASON P3 EyeSafe
Listed Models ....:	N/A
Rating ....:	DC 7.6V from battery or DC 20V from AC/DC ADAPTER
Result..:	**PASS**

TEST REPORT

Equipment under Test	:	Notebook Computer
Model /Type	:	IPASON P3 EyeSafe
Series Model No.		N/A
Applicant	:	**Wuhan Ipason Technology Co., Ltd.**
Address	:	5th Floor, Multifunctional Building, No. 1, Ipason Avenue, Shekou Street, Huangpi District, Wuhan City, Hubei Province, China
Manufacturer	:	**Wuhan Ipason Technology Co., Ltd.**
Address	:	5th Floor, Multifunctional Building, No. 1, Ipason Avenue, Shekou Street, Huangpi District, Wuhan City, Hubei Province, China

Test Result:	**PASS**

The test report merely corresponds to the test sample.
It is not permitted to copy extracts of these test result without the written permission of the test laboratory.

Contents

Version

Version No.	Date	Description
R00	May 24, 2024	Original

1 Statement of Compliance

<Highest SAR Summary>

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013 The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

Frequency Band	Highest Reported 1g-SAR(W/Kg)	Simultaneous Reported SAR (W/Kg)
	Body (0mm)	
WLAN2.4G	0.759	1.038
WLAN5.2G/ WLAN5.3G	0.622	
WLAN5.6G	0.706	
WLAN5.8G	0.698	
SAR Test Limit (W/Kg)	1.60	
Test Result	PASS	

2 General Information

2.1 General Remarks

Date of receipt of test sample	:	April 29, 2024
Testing commenced on	:	May 16, 2024
Testing concluded on	:	May 22, 2024

2.2 Description of Equipment Under Test (EUT)

Product Name:	Notebook Computer
Model/Type reference:	IPASON P3 EyeSafe
Power supply:	DC 7.6V from battery or DC 20V from AC/DC ADAPTER
Testing sample ID:	CTA240429012-1# (Engineer sample) CTA240429012-2# (Normal sample)
Hardware version:	P3ADL08
Software version:	22h2
Tx Frequency:	SRD: BT:2402~2480MHz 2.4G WIFI: 2412~2462MHz 5G WIFI: 5180~5240MHz, 5260~5320MHz, 5725~5825MHz
Type of Modulation:	BT: GFSK, Π/4DQPSK, 8DPSK 2.4G WIFI: BPSK, QPSK,16QAM,64QAM 5G WIFI: BPSK, QPSK,16QAM,64QAM, 256QAM, 1024QAM
Category of device:	Desktop device
Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.	

2.3 Device Category and SAR Limits

This device belongs to portable device category because its radiating structure is allowed to be used within 20 centimeters of the body of the user. Limit for General Population/Uncontrolled exposure should be applied for this device, it is 1.6 W/kg as averaged over any 1 gram of tissue.

2.4 Applied Standard

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

- FCC 47 CFR Part 2 (2.1093)
- ANSI/IEEE C95.1:2005
- IEEE Std 1528:2013
- KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz v01r04

- KDB 865664 D02 RF Exposure Reporting v01r02
- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02
- KDB 616217 D04 SAR for laptop and tablets v01r02

2.5 Test Facility

FCC-Registration No.: 517856 Designation Number: CN1318

Shenzhen CTA Testing Technology Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements.

A2LA-Lab Cert. No.: 6534.01

Shenzhen CTA Testing Technology Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform electromagnetic emission measurement.

ISED#: 27890 CAB identifier: CN0127

Shenzhen CTA Testing Technology Co., Ltd. has been listed by Innovation, Science and Economic Development Canada to perform electromagnetic emission measurement.

The 3m-Semi anechoic test site fulfils CISPR 16-1-4 according to ANSI C63.10 and CISPR 16-1-4:2010.

2.6 Environment of Test Site

Items	Required	Actual
Temperature (℃)	18-25	22~23
Humidity (%RH)	30-70	55~65

2.7 Test Configuration

The device was controlled by using a base station emulator. Communication between the device and the emulator was established by air link. The distance between the EUT and the antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during all tests. For WLAN SAR testing, WLAN engineering testing software installed on the EUT can provide continuous transmitting RF signal.

3 Specific Absorption Rate (SAR)

3.1 Introduction

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

3.2 SAR Definition

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

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\mathbf{SAR} = \mathbf{C}\left(\frac{\boldsymbol{\delta}\mathbf{T}}{\boldsymbol{\delta}\mathbf{t}}\right)$$

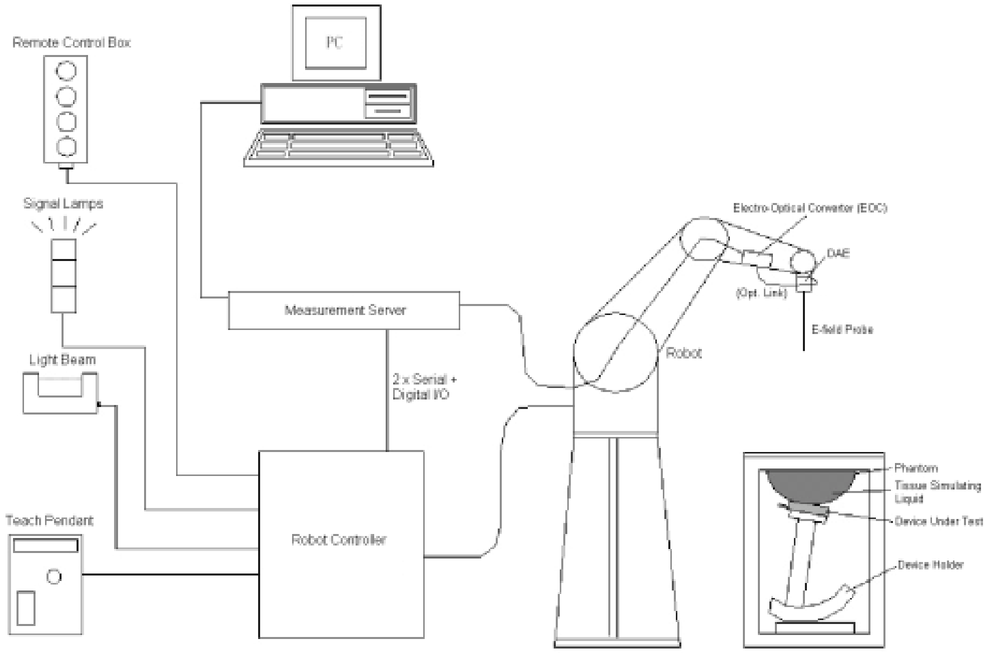
Where: C is the specific head capacity, δT is the temperature rise and δtisthe exposure duration, or related to the electrical field in the tissue by

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

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

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

4 SAR Measurement System



DASY System Configurations

The DASYsystem for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Tissue simulating liquid
- Dipole for evaluating the proper functioning of the system

components are described in details in the following sub-sections.

4.1 E-Field Probe

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

- **E-Field Probe Specification**

<EX3DV4 Probe>

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 W/kg; Linearity: ± 0.2 dB (noise: typically< 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Photo of EX3DV4

- **E-Field Probe Calibration**

Each probe needs to be calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy shall be evaluated and within ± 0.25dB. The sensitivity parameters (NormX, NormY, and NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix C of this report.

4.2 Data Acquisition Electronics (DAE)

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

The input impedance of the DAE is 200MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

Photo of DAE

4.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60XL) type from Stäubli SA (France). For the 6-axis controllersystem, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäublirobot 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)

Photo of DASY5

4.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY5: 400 MHz, Intel Celeron), chipdisk (DASY5: 128 MB), RAM (DASY5: 128 MB). The necessary circuits for communication with the DAE electronic box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY I/O board, which is directly connected to the PC/104 bus of the CPU board.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

Photo of Server for DASY5

4.5 Phantom

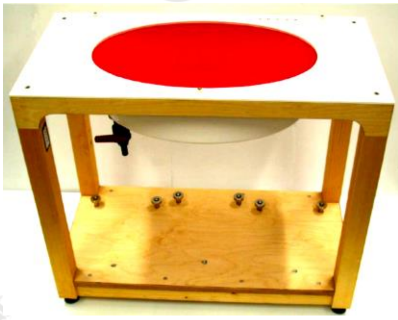
<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm	
Filling Volume	Approx. 25 liters	
Dimensions	Length: 1000 mm; Width: 500 mm;	

<table>
<tr><td></td><td>Height: adjustable feet</td><td rowspan="2">
Photo of SAM Phantom</td></tr>
<tr><td>Measurement Areas</td><td>Left Hand, Right Hand, Flat Phantom</td></tr>
</table>

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

<ELI4 Phantom>

<table>
<tr><td>Shell Thickness</td><td>2 ± 0.2 mm (sagging: <1%)</td><td rowspan="3">
Photo of ELI4 Phantom</td></tr>
<tr><td>Filling Volume</td><td>Approx. 30 liters</td></tr>
<tr><td>Dimensions</td><td>Major ellipse axis: 600 mm
Minor axis:400 mm</td></tr>
</table>

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

4.6 Device Holder

The SAR in the phantom is approximately inversely proportional to the square of the distance between the source and the liquid surface. For a source at 5 mm distance, a positioning uncertainty of ±0.5mm would produce a SAR uncertainty of ± 20%. Accurate device positioning is therefore crucial for accurate and repeatable measurements. The positions in which the devices must be measured are defined by the standards.

The DASY device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (ERP).Thus the device needs no repositioning when changing the angles.

The DASY device holder is constructed of low-loss POM material having the following dielectric parameters: relative permittivity ε = 3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

Device Holder

4.7 Data Storage and Evaluation

➢ Data Storage

The DASY software stores the assessed data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all the necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files. The post-processing software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of erroneous parameter settings. For example, if a measurement has been performed with an incorrect crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be reevaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type (e.g., [V/m], [A/m], [W/kg]). Some of these units are not available in certain situations or give meaningless results, e.g., a SAR-output in a non-lose media, will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

➢ Data Evaluation

The DASY post-processing software (SEMCAD) automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software：

Probe parameters： - Sensitivity $Norm_i$, a_{i0}, a_{i1}, a_{i2}

- Conversion factor $ConvF_i$

- Diode compression point dcp_i

Device parameters: - Frequency f

- Crest factor cf

Media parameters: - Conductivity σ

- Density ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multi-meter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics. If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power.

The formula for each channel can be given as:

$$\mathbf{V_i = U_i + U_i^2 \cdot \frac{cf}{dcp_i}}$$

with V_i= compensated signal of channel i, (i = x, y, z)

U_i = input signal of channel i, (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

From the compensated input signals, the primary field data for each channel can be evaluated:

E-field Probes: $\mathbf{E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}}$

H-field Probes: $\mathbf{H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}}$

with V_i = compensated signal of channel i,(i= x, y, z)

$Norm_i$= sensor sensitivity of channel i, (i= x, y, z), μV/(V/m)^2 for E-field Probes

ConvF= sensitivity enhancement in solution

a_{ij}= sensor sensitivity factors for H-field probes

f = carrier frequency [GHz]

E_i= electric field strength of channel iin V/m

H_i= magnetic field strength of channel iin A/m

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$\mathbf{E_{tot} = \sqrt{E_x^2 + E_y^2 + E_z^2}}$$

The primary field data are used to calculate the derived field units.

$$\mathbf{SAR} = \mathbf{E}_{\mathbf{tot}}^{2} \cdot \frac{\boldsymbol{\sigma}}{\boldsymbol{\rho} \cdot \mathbf{1000}}$$

with SAR = local specific absorption rate in W/kg

E_{tot}= total field strength in V/m

σ = conductivity in [mho/m] or [Siemens/m]

ρ = equivalent tissue density in g/cm^3

Note that the density is set to 1, to account for actual head tissue density rather than the density of the tissue simulating liquid.

5 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	745	Aug. 28,2023	Aug. 27,2026
SPEAG	5GHz System Validation Kit	D5GHzV2	1301	Feb.16, 2023	Feb.15, 2026
Rohde & Schwarz	UNIVERSAL RADIO COMMUNICATION TESTER	CMW500	1201.0002K50-104209-JC	Nov.05, 2023	Nov.04, 2024
SPEAG	Data Acquisition Electronics	DAE3	428	Aug.30,2023	Aug.29,2024
SPEAG	Dosimetric E-Field Probe	EX3DV4	7380	June 21,2023	June 20,2024
Agilent	ENA Series Network Analyzer	E5071C	MY46317418	Oct.25, 2023	Oct.24, 2024
SPEAG	DAK	DAK-3.5	1226	NCR	NCR
SPEAG	SAM Twin Phantom	QD000P40CD	1802	NCR	NCR
SPEAG	ELI Phantom	QDOVA004AA	2058	NCR	NCR
AR	Amplifier	ZHL-42W	QA1118004	NCR	NCR
Agilent	Power Meter	N1914A	MY50001102	Oct.25, 2023	Oct.24, 2024
Agilent	Power Sensor	N8481H	MY51240001	Oct.25, 2023	Oct.24, 2024
R&S	Spectrum Analyzer	N9020A	MY51170037	Oct.25, 2023	Oct.24, 2024
Agilent	Signal Generation	N5182A	MY48180656	Oct.25, 2023	Oct.24, 2024
Worken	Directional Coupler	0110A05601O-10	COM5BNW1A2	Oct.25, 2023	Oct.24, 2024

Note:

1. The calibration certificate of DASY can be referred to appendix D of this report.
2. The dipole calibration interval can be extended to 3 years with justification. The dipoles are also not physically damaged, or repaired during the interval.
3. The Insertion Loss calibration of Dual Directional Coupler and Attenuator were characterized via the network analyzer and compensated during system check.
4. The dielectric probe kit was calibrated via the network analyzer, with the specified procedure (calibrated in pure water) and calibration kit (standard) short circuit, before the dielectric measurement. The specific procedure and calibration kit are provided by Agilent.
5. In system check we need to monitor the level on the power meter, and adjust the power amplifier level to have precise power level to the dipole; the measured SAR will be normalized to 1W input power according to the ratio of 1W to the input power to the dipole. For system check, the calibration of the power amplifier is deemed not critically required for correct measurement; the power meter is critical and we do have calibration for it

6 Tissue Simulating Liquids

For the measurement of the field distribution inside the SAM phantom with DASY, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For 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, which is shown in Fig. 6.1. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm, which is shown as followed:

Photo of Liquid Height for Head SAR

Photo of Liquid Height for Body SAR

The following table gives the recipes for tissue simulating liquid.

Frequency (MHz)	Water (%)	Sugar (%)	Cellulose (%)	Salt (%)	Preventol (%)	DGBE (%)	Conductivity (σ)	Permittivity (εr)
For Head								
835	40.3	57.9	0.2	1.4	0.2	0	0.90	41.5
1800,1900,2000	55.2	0	0	0.3	0	44.5	1.40	40.0
2450	55.0	0	0	0	0	45.0	1.80	39.2
2600	54.8	0	0	0.1	0	45.1	1.96	39.0
For Body								
835	50.8	48.2	0	0.9	0.1	0	0.97	55.2
1800,1900,2000	70.2	0	0	0.4	0	29.4	1.52	53.3
2450	68.6	0	0	0	0	31.4	1.95	52.7
2600	65.5	0	0	0	0	31.5	2.16	52.5

The following table shows the measuring results for simulating liquid.

Measured Frequency (MHz)	Target Tissue		Measured Tissue				Liquid Temp.	Test Data
	εr	σ	εr	Dev. (%)	σ	Dev. (%)		
2450	39.2	1.80	39.035	-0.42%	1.787	-0.72%	22.2	05/16/2024
5250	35.9	4.71	36.955	2.94%	4.635	-1.60%	22.2	05/20/2024
5600	35.5	5.07	35.102	-1.12%	4.954	-2.28%	22.2	05/22/2024
5750	35.4	5.22	35.421	0.06%	5.116	-2.00%	22.5	05/22/2024

7 System Verification Procedures

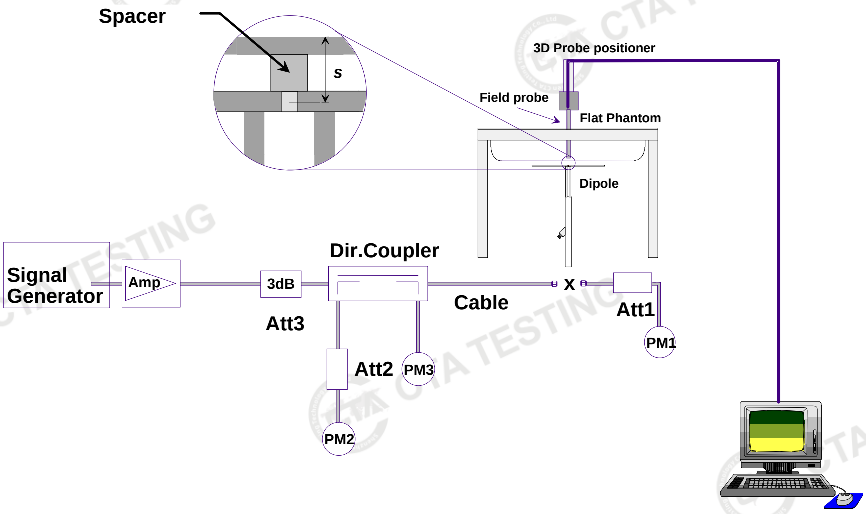
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix it underneath the flat phantom and a corresponding distance holder.

➢ **Purpose of System Performance check**

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

➢ **System Setup**

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



System Setup for System Evaluation

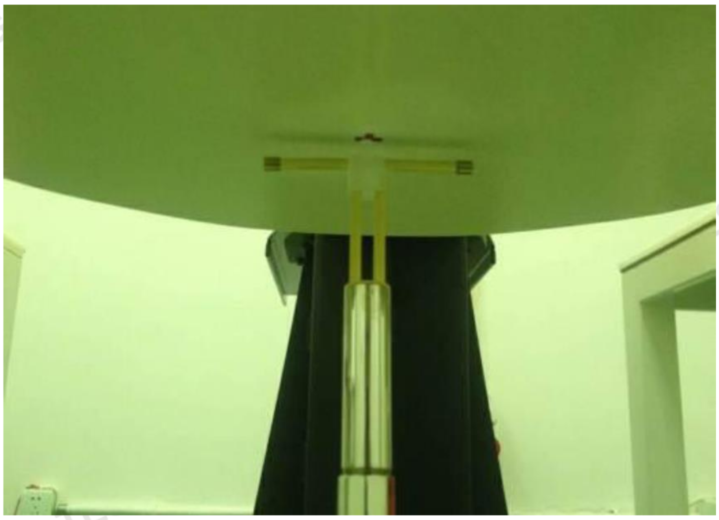


Photo of Dipole Setup

- **Validation Results**

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

Date	Frequency (MHz)	Power fed onto reference dipole (mW)	Targeted SAR 1g (W/kg)	Measured SAR1g (W/kg)	Normalized SAR (W/kg)	Deviation (%)
05/16/2024	2450	250	52.7	13.23	52.90	0.38%
05/20/2024	5250	100	77.7	7.98	79.80	2.70%
05/22/2024	5600	100	81.6	7.86	78.60	-3.68%
05/22/2024	5750	100	78.0	7.90	79.00	1.28%

8 EUT Testing Position

8.1 Body-Supported Device Configurations

For laptop PC, according to KDB 616217 D04, SAR evaluation is required for the bottom surface of the keyboard. This EUT was tested in the base of EUT directly against the flat phantom. The required minimum test separation distance for incorporating transmitters and antennas into laptop computer display is determined with the display screen opened at an angle of 90° to the keyboard compartment.

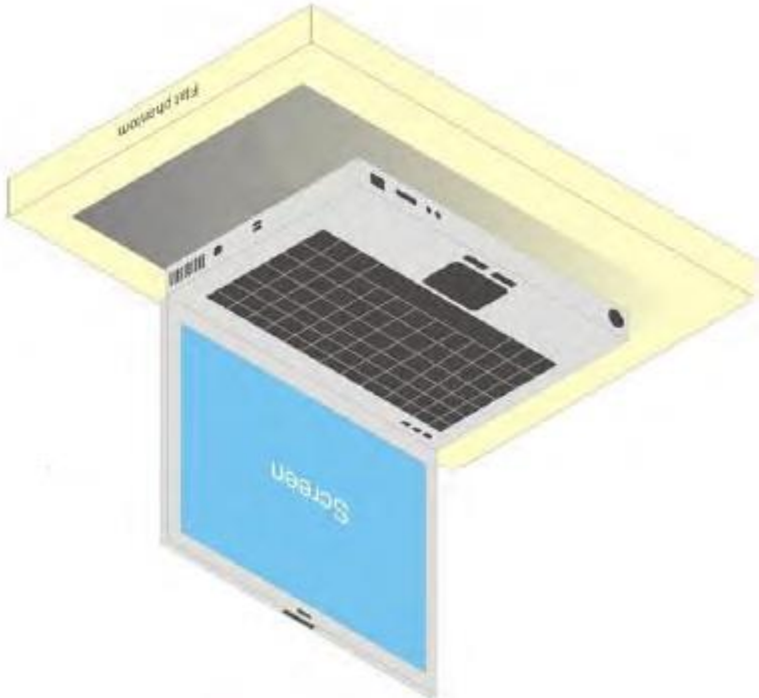


illustration for Laptop Setup

For full-size tablet, according to KDB 616217 D04, SAR evaluation is required for back surface and edges of the devices. The back surface and edges of the tablet are tested with the tablet touching the phantom. 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. 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.

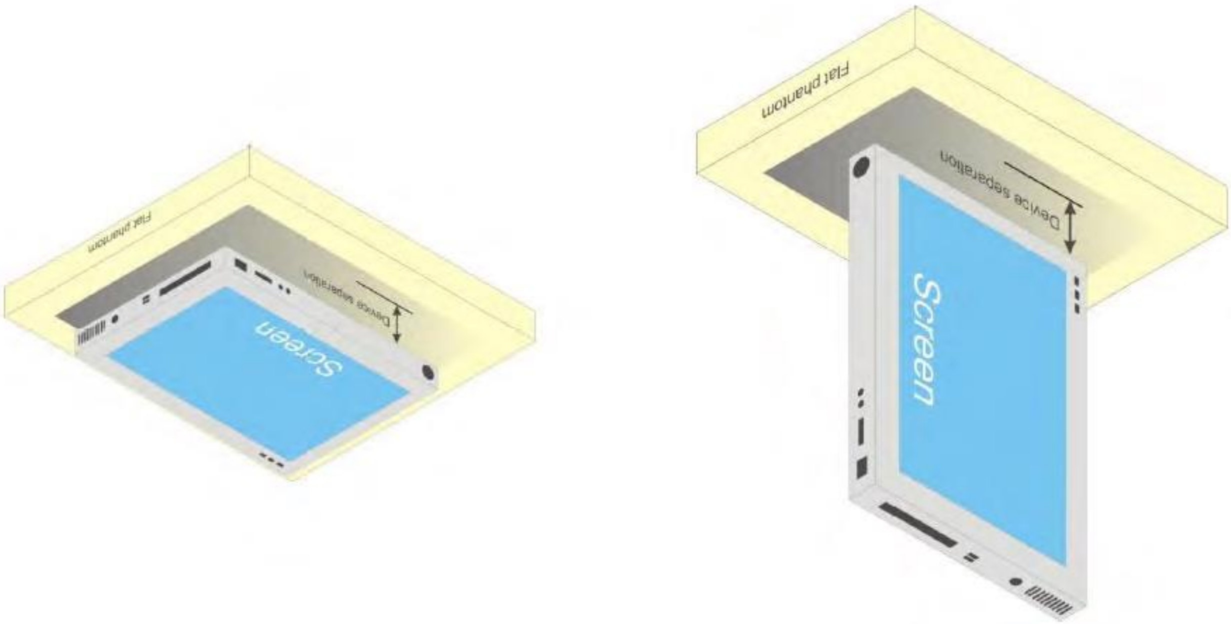


illustration for Tablet Setup

9 Measurement Procedures

The measurement procedures are as follows:

(a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the middle channel.
(b) Keep EUT to radiate maximum output power or 100% duty factor (if applicable)
(c) Measure output power through RF cable and power meter.
(d) Place the EUT in the positions as setup photos demonstrates.
(e) Set scan area, grid size and other setting on the DASY software.
(f) Measure SAR transmitting at the middle channel for all applicable exposure positions.
(g) Identify the exposure position and device configuration resulting the highest SAR
(h) Measure SAR at the lowest and highest channels at the worst exposure position and device configuration if applicable.

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

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

9.1 Spatial Peak SAR Evaluation

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

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

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

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

9.2 Power Reference Measurement

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

9.3 Area Scan Procedures

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

Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

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

9.4 Zoom Scan Procedures

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

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

			≤ 3 GHz	> 3 GHz
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{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 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm
Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details. * When zoom scan is required and the <u>*reported*</u> SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is ≤ 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.				

9.5 Volume Scan Procedures

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

9.6 Power Drift Monitoring

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

10 TEST CONDITIONS AND RESULTS

10.1 Conducted Power

<WLAN 2.4GHz Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
802.11b	1	2412	11.85	12.0
	6	2437	11.97	12.0
	11	2462	11.80	12.0
802.11g	1	2412	11.92	12.0
	6	2437	11.97	12.0
	11	2462	11.70	12.0
802.11n(HT20)	1	2412	11.71	12.0
	6	2437	11.78	12.0
	11	2462	11.71	12.0
802.11n(HT40)	3	2422	12.21	13.0
	6	2437	12.22	13.0
	9	2452	12.50	13.0

<WLAN 5.2GHz Conducted Power>

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
802.11a	36	5180	12.11	13.0
	40	5200	11.57	13.0
	48	5240	11.07	13.0
802.11n(HT20)	36	5180	12.50	13.0
	40	5200	11.94	13.0
	48	5240	11.75	13.0
802.11n(HT40)	38	5190	11.14	13.0
	46	5230	11.77	13.0
802.11ac(VHT20)	36	5180	11.46	13.0
	40	5200	11.67	13.0
	48	5240	11.07	13.0
802.11ac(VHT40)	38	5190	11.78	13.0
	46	5230	11.93	13.0
802.11ac(VHT80)	42	5210	11.85	13.0
802.11ax(HE20)	36	5180	11.12	13.0
	40	5200	11.65	13.0
	48	5240	12.11	13.0
802.11ax(HE40)	38	5190	10.53	13.0
	46	5230	11.59	13.0
802.11ax(HE80)	42	5210	11.78	13.0

<WLAN 5.3GHz Conducted Power>

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
802.11a	52	5260	11.18	12.0
	56	5280	10.85	12.0
	64	5320	10.66	12.0
802.11n(HT20)	52	5260	11.03	12.0
	56	5280	11.12	12.0
	64	5320	11.17	12.0
802.11n(HT40)	54	5270	11.07	12.0
	62	5310	10.81	12.0
802.11ac(VHT20)	52	5260	11.58	12.0
	56	5280	14.41	15.0
	64	5320	14.24	15.0
802.11ac(VHT40)	54	5270	10.48	11.0
	62	5310	10.29	11.0
802.11ac(VHT80)	58	5290	11.22	12.0
802.11ax(HE20)	52	5260	11.90	13.0
	56	5280	11.04	12.0
	64	5320	11.18	12.0
802.11ax(HE40)	54	5270	11.86	13.0
	62	5310	11.48	12.0
802.11ax(HE80)	58	5290	10.36	11.0

<WLAN 5.6GHz Conducted Power>

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
802.11a	100	5500	11.64	13.0
	116	5580	10.97	12.0
	140	5700	11.73	13.0
802.11n(HT20)	100	5500	11.68	13.0
	116	5580	11.67	13.0
	140	5700	11.22	12.0
802.11n(HT40)	102	5510	10.02	11.0
	110	5550	12.33	13.0
	134	5670	11.98	13.0
802.11ac(VHT20)	100	5500	11.16	12.0
	116	5580	11.39	12.0
	140	5700	12.51	13.0
802.11ac(VHT40)	102	5510	11.04	12.0
	110	5550	11.51	12.0
	134	5670	11.83	13.0
802.11ac(VHT80)	106	5530	10.79	12.0
	122	5610	10.98	12.0
802.11ax(HE20)	100	5500	11.13	12.0
	116	5580	11.52	12.0
	140	5700	12.11	13.0
802.11ax(HE40)	102	5510	10.93	12.0
	110	5550	11.45	12.0
	134	5670	11.59	13.0
802.11ax(HE80)	106	5530	11.06	12.0
	122	5610	11.31	12.0

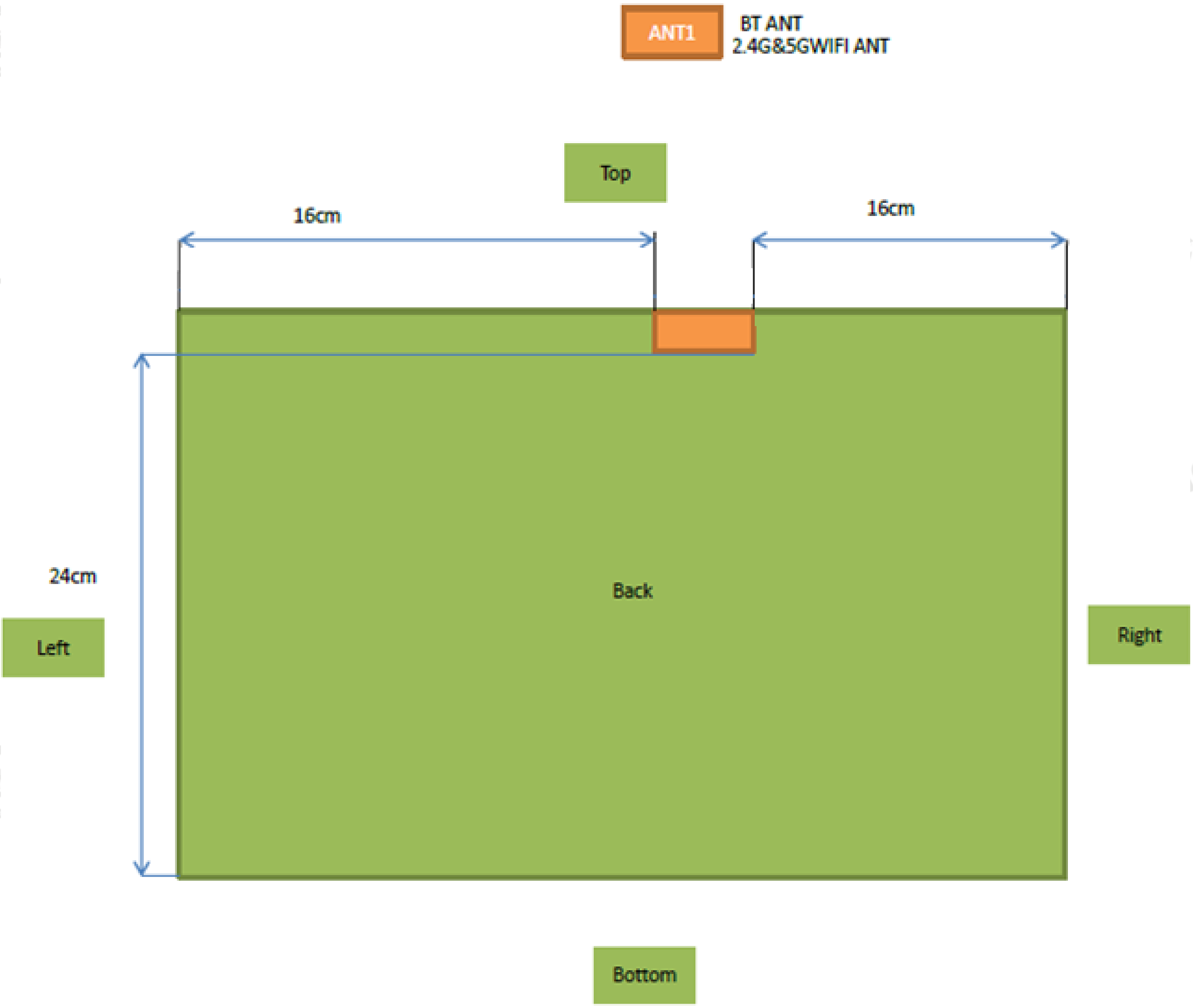
<WLAN 5.8GHz Conducted Power>

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
802.11a	149	5745	11.16	12.5
	157	5785	11.38	12.5
	165	5825	11.57	12.5
802.11n(HT20)	149	5745	10.79	12.5
	157	5785	12.17	12.5
	165	5825	11.87	12.5
802.11n(HT40)	151	5755	10.99	12.5
	159	5795	11.92	12.5
802.11ac(VHT20)	149	5745	10.72	12.5
	157	5785	11.02	12.5
	165	5825	11.78	12.5
802.11ac(VHT40)	151	5755	10.96	12.5
	159	5795	11.37	12.5
802.11ac(VHT80)	155	5775	11.07	12.5
802.11ax(HE20)	149	5745	10.72	12.5
	157	5785	10.96	12.5
	165	5825	11.68	12.5
802.11ax(HE40)	151	5755	10.71	12.5
	159	5795	11.19	12.5
802.11ax(HE80)	155	5775	10.85	12.5

<Bluetooth Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power(dBm)	Conducted Average Output Power(dBm)	Tune-up limit (dBm)
GFSK	0	2402	10.06	8.12	9.0
	39	2441	9.98	8.08	9.0
	78	2480	5.80	3.81	4.0
π/4DQPSK	0	2402	10.16	8.16	9.0
	39	2441	9.51	7.52	8.0
	78	2480	4.77	2.77	4.0
8DPSK	0	2402	9.77	7.86	9.0
	39	2441	9.07	7.11	8.0
	78	2480	4.36	2.43	3.0
BLE 1M	0	2402	-3.85	-6.84	-6.0
	19	2440	-3.03	-6.01	-5.0
	39	2480	-5.17	-8.09	-7.0
BLE 2M	0	2402	-3.84	-6.75	-6.0
	19	2440	-3.06	-5.96	-5.0
	39	2480	-5.06	-7.98	-7.0

10.2 Transmit Antennas



10.3 SAR Test Exclusion and Estimated SAR

SAR Test Exclusion Considerations

Per KDB 447498 D01v06, the 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

[(max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] ·[√f(GHz)] ≤ 3.0 for 1-g SAR and ≤ 7.5 for 10-g extremity SAR

- f(GHz) is the RF channel transmit frequency in GHz.
- Power and distance are rounded to the nearest mW and mm before calculation.
- The result is rounded to one decimal place for comparison.

Per KDB 447498 D01v06, at 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

a) [Threshold at 50mm)+(test separation distance-50mm)*(f(MHz)/150)]mW, at 100MHz to 1500MHz
b) [Threshold at 50mm)+(test separation distance-50mm)*10]mW at > 1500MHz and ≤ 6GHz

Estimated SAR

Per KDB447498 requires when the standalone SAR test exclusion of section 4.3.1 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to determine simultaneous transmission SAR test exclusion;

● (max. power of channel, including tune-up tolerance, mW)/(min. test separation distance, mm)] • [√ f(GHz)/x] W/kg for test separation distances ≤ 50 mm;

where x = 7.5 for 1-g SAR, and x = 18.75 for 10-g SAR.

● 0.4 W/kg for 1-g SAR and 1.0 W/kg for 10-g SAR, when the test separation distances is > 50 mm

The below table, exemption limits for routine evaluation based on frequency and separation distance was according to SAR-based Exemption – §1.1307(b)(3)(i)(B).

	Standalone SAR Test Exclusion and Estimated SAR								
Wireless Interface	Frequency (MHz)	Configuration	Max. Power With tune-up		Distance (mm)	Calculation Result	SAR Exclusion Thresholds	Standalone SAR Exclusion	Estimated SAR (W/Kg)
			dBm	mW					
WIFI2.4G	2450	Back	13.0	19.953	5	6.2	3	No	N/A
WIFI5.2G	5200	Back	13	19.953	5	9.1	3	No	N/A
WIFI5.3G	5300	Back	15.0	31.623	5	14.6	3	No	N/A
WIFI5.6G	5600	Back	13.0	19.953	5	9.4	3	No	N/A
WIFI5.8 G	5785	Back	12.5	17.783	5	8.6	3	No	N/A
Bluetooth	2450	Back	9.0	7.943	5	2.5	3	Yes	0.332

Remark:

1. Maximum average power including tune-up tolerance;
2 When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion

10.4 SAR Test Results Summary

General Note:

1 Per KDB 447498 D01v06, the reported SAR is the measured SAR value adjusted for maximum tune-up tolerance.

a) Tune-up scaling Factor = tune-up limit power (mW) / EUT RF power (mW), where tune-up limit is the maximum rated power among all production units.

b) For SAR testing of WLAN signal with non-100% duty cycle, the measured SAR is scaled-up by the duty cycle scaling factor which is equal to "1/(duty cycle)"

c) For WLAN/Bluetooth: Reported SAR(W/kg)= Measured SAR(W/kg)* Duty Cycle scaling factor * Tune-up scaling factor

2 Per KDB 447498 D01v06, for each exposure position, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:

- ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
- ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
- ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

3 Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.

WLAN Note:

1 Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.

2 Per KDB 248227 D01v02r02, WLAN 5.2GHz SAR testing is not required when the WLAN5.3GHz band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for WLAN5.2GHz band.

3 When the reported SAR of the test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position on the highest maximum output power channel, until the report SAR is ≤ 0.8 W/kg or all required test position are tested.

4 For all positions / configurations, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions / configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

5 For WLAN SAR testing was performed on single antenna RF power in SISO mode is larger or equal to the single antenna RF power in MIMO mode, and for RF exposure assessment of MIMO mode simultaneous transmission exclusion analysis was performed with SAR test results of each antenna in SISO mode.

6 Per KDB 248227 D01v02r02, the simultaneous SAR provisions in KDB publication 447498 should be applied to determine simultaneous transmission SAR test exclusion for WiFi MIMO. If the sum of 1g single transmission chain SAR measurements is < 1.6W/kg and SAR peak to location ratio ≤ 0.04, no additional SAR measurements for MIMO.

7 During SAR testing the WLAN transmission was verified using a spectrum analyzer.

SAR Results

<Body SAR>

SAR Values [WIFI 2.4G]

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Measured / Reported SAR numbers-Body											
#1	802.11b	Back	0	6	2437	11.97	12.0	1.007	-0.07	0.754	0.759

Remark: The highest reported SAR for OFDM is adjusted by the ratio of OFDM to DSSS specified maximum output power was ＜1.2 W/kg. So ODFM SAR test is not required.

SAR Values [WIFI 5.3G]

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Measured / Reported SAR numbers-Body											
#2	802.11ac(VHT20)	Back	0	64	5320	14.24	15.0	1.191	0.03	0.522	0.622

Remark: Per KDB 248227 D01v02r02, WLAN 5.2GHz SAR testing is not required when the WLAN5.3GHz band highest reported SAR for a test configuration is ≤ 1.2 W/kg, SAR is not required for WLAN5.2GHz band.

SAR Values [WIFI 5.6G]

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Measured / Reported SAR numbers-Body											
#3	802.11ac(VHT20)	Back	0	140	5700	12.51	13.0	1.119	0.06	0.631	0.706

SAR Values [WIFI 5.8G]

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{1g} (W/kg)	Reported SAR_{1g} (W/kg)
Measured / Reported SAR numbers-Body											
#3	802.11n(HT20)	Back	0	157	5785	12.17	12.5	1.079	-0.11	0.647	0.698

10.5 SAR Measurement Variability

SAR measurement variability must be 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. The following procedures are applied to determine if repeated measurements are required.

1 Repeated measurement is not required when the original highest measured SAR is < 0.80 W/kg; steps 2) through 4) do not apply.

2 When the original highest measured SAR is ⩾ 0.80 W/kg, repeat that measurement once.

3 Perform a second repeated measurement only 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 (~ 10% from the 1-g SAR limit).

4 Perform a third repeated measurement only if the original, first or second repeated measurement is ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.

SAR Measurement Variability

Band	Mode	Test Position	Ch.	Spacing (mm)	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)
--	--	--	--	--	--	--	--	--
--	--	--	--	--	--	--	--	--

10.6 Simultaneous Transmission Analysis

Application Simultaneous Transmission information:

No.	Simultaneous Transmission Configurations	Body
1	5GHz WLAN + Bluetooth	Yes

Note: BT and wifi share the same antenna, it cannot transmitting simultaneously on 2.4GHz band at the same time.

10.8.2 Evaluation of Simultaneous SAR

Simultaneous transmission SAR

Exposure Position	1	2	2+3 Summed 1g SAR (W/kg)	SPLSR
	5GHz WLAN	Bluetooth		
	SAR_{1g} (W/kg)	SAR_{1g} (W/kg)		
Bottom	0.706	0.332	1.038	N/A

MAX. ΣSAR_{1g} =**1.038**W/kg<1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required.

11 Measurement Uncertainty

NO	Source	Uncert. ai（%）	Prob. Dist.	Div. k	ci (1g)	ci (10g)	Stand.Uncert. ui (1g)	Stand.Uncert. ui (10g)	*Veff*
1	Repeat	0. 4	N	1	1	1	0. 4	0. 4	9
				Instrument					
2	Probe calibration	7	N	2	1	1	3.5	3.5	∞
3	Axial isotropy	4.7	R	$\sqrt{3}$	0.7	0.7	1.9	1.9	∞
4	Hemispherical isotropy	9.4	R	$\sqrt{3}$	0.7	0.7	3.9	3.9	∞
5	Boundary effect	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
6	Linearity	4.7	R	$\sqrt{3}$	1	1	2.7	2.7	∞
7	Detection limits	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
8	Readout electronics	0.3	N	1	1	1	0.3	0.3	∞
9	Response time	0.8	R	$\sqrt{3}$	1	1	0.5	0.5	∞
10	Integration time	2.6	R	$\sqrt{3}$	1	1	1.5	1.5	∞
11	Ambient noise	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
12	Ambient reflections	3.0	R	$\sqrt{3}$	1	1	1.7	1.7	∞
13	Probe positioner mech. restrictions	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
14	Probe positioning with respect to phantom shell	2.9	R	$\sqrt{3}$	1	1	1.7	1.7	∞
15	Max.SAR evaluation	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞

Test sample related									
16	Device positioning	3.8	N	1	1	1	3.8	3.8	99
17	Device holder	5.1	N	1	1	1	5.1	5.1	5
18	Drift of output power	5.0	R	$\sqrt{3}$	1	1	2.9	2.9	∞
Phantom and set-up									
19	Phantom uncertainty	4.0	R	$\sqrt{3}$	1	1	2.3	2.3	∞
20	Liquid conductivity (target)	5.0	R	$\sqrt{3}$	0.64	0.43	1.8	1.2	∞
21	Liquid conductivity (meas)	2.5	N	1	0.64	0.43	1.6	1.2	∞
22	Liquid Permittivity (target)	5.0	R	$\sqrt{3}$	0.6	0.49	1.7	1.5	∞
23	Liquid Permittivity (meas)	2.5	N	1	0.6	0.49	1.5	1.2	∞
Combined standard			RSS	$U_C = \sqrt{\sum_{i=1}^{n} C_i^2 U_i^2}$			11.4%	11.3%	236
Expanded uncertainty(P=95%)		$U = k U_c$,k=2					**22.8%**	**22.6%**	

Appendix A. EUT Photos and Test Setup Photos

Bottom(0mm)

Appendix B. Plots of SAR System Check

2450MHz System Check

Date: 05/16/2024

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: 745

Communication System: CW; Frequency: 2450 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2450 MHz; σ = 1.787 S/m; εr = 39.035; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- •Probe: EX3DV4 – SN7380; ConvF(7.50, 7.50, 7.50); Calibrated: June 21, 2023;
- •Sensor-Surface: 3mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- •DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (71x71x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 19.8 W/kg

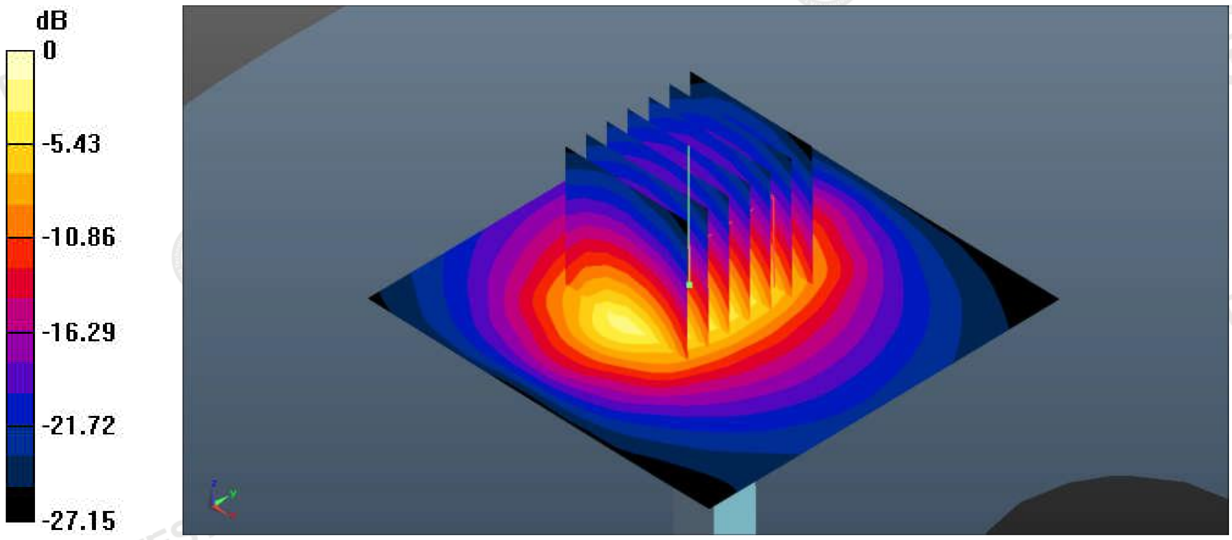
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 101.54 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 24.5 W/kg

SAR(1 g) = 13.23 W/kg; SAR(10 g) = 6.19 W/kg

Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 18.8 W/kg

System Performance Check 2450MHz 250mW

5250MHz System Check

Date: 05/20/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1301

Communication System: CW; Frequency: 5250 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5250 MHz; σ = 4.635 S/m; εr = 36.955; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(5.45, 5.45, 5.45) ; Calibrated: 6/21/2023
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 9.65 W/kg

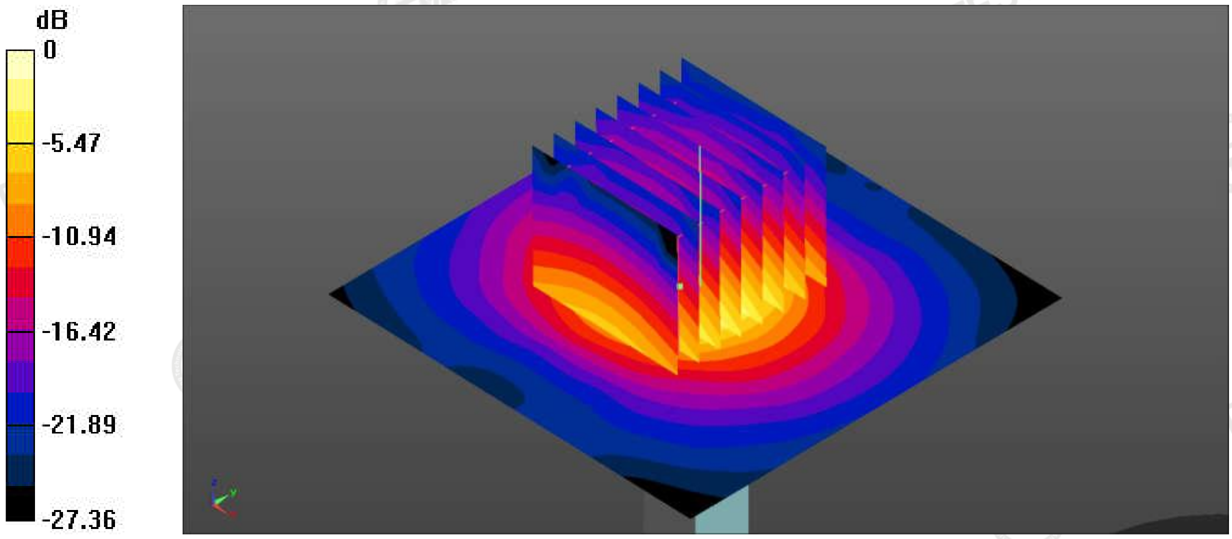
Zoom Scan (7x7x13): Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 35.24 V/m; Power Drift = -0.12 dB

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.36 W/kg

Maximum value of SAR (measured) = 11.60 W/kg



0 dB = 11.60 W/kg

System Performance Check 5250MHz 100mW

5600MHz System Check

Date: 05/22/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1301

Communication System: CW; Frequency: 5600 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5600 MHz; σ = 4.954 S/m; εr = 35.102; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(4.86, 4.86, 4.86) ; Calibrated: 6/21/2023
- Sensor- Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 11.2 W/kg

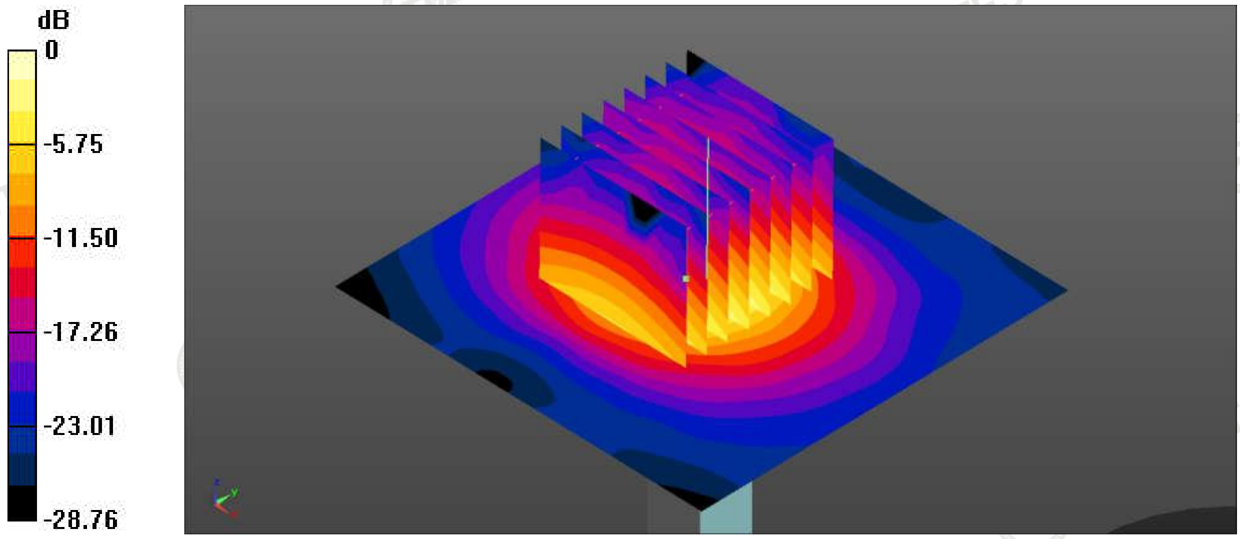
Zoom Scan (7x7x13): Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 33.74 V/m; Power Drift = -0.09 dB

Peak SAR (extrapolated) = 18.8 W/kg

SAR(1 g) = 7.86 W/kg; SAR(10 g) = 2.29 W/kg

Maximum value of SAR (measured) = 11.1 W/kg



0 dB = 11.1

System Performance Check 5600MHz 100mW

5750MHz System Check Date: 05/22/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1301

Communication System: CW; Frequency: 5750 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5750 MHz; σ = 5.116 S/m; εr = 35.421; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(4.96, 4.96, 4.96) ; Calibrated: 6/21/2023
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 18.8 W/kg

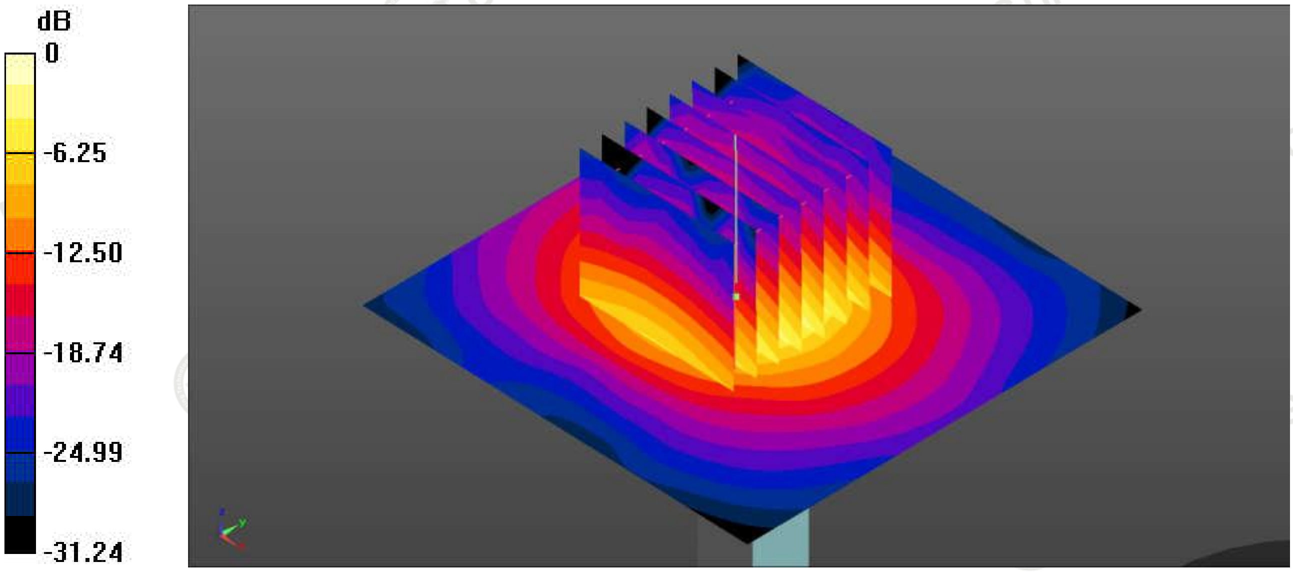
Zoom Scan (7x7x13): Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 43.11 V/m; Power Drift = -0.15 dB

Peak SAR (extrapolated) = 20.5 W/kg

SAR(1 g) = 7.90 W/kg; SAR(10 g) = 2.21 W/kg

Maximum value of SAR (measured) = 19.1 W/kg



0 dB = 19.1 W/kg

System Performance Check 5750MHz 100mW

Appendix C. Plots of SAR Test Data

#1.

Date: 05/16/2024

WLAN2.4GHz_802.11b 1Mbps_Back_0mm_Ch06

Communication System: UID 0, Generic WIFI(0); Frequency: 2437 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 2437 MHz; σ = 1.715 S/m; εr = 40.207; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(7.50, 7.50, 7.50); Calibrated: June 21, 2023
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (9x18x1): Interpolated grid: dx= 12mm, dy= 12mm

Maximum value of SAR (interpolated) = 1.17 W/Kg

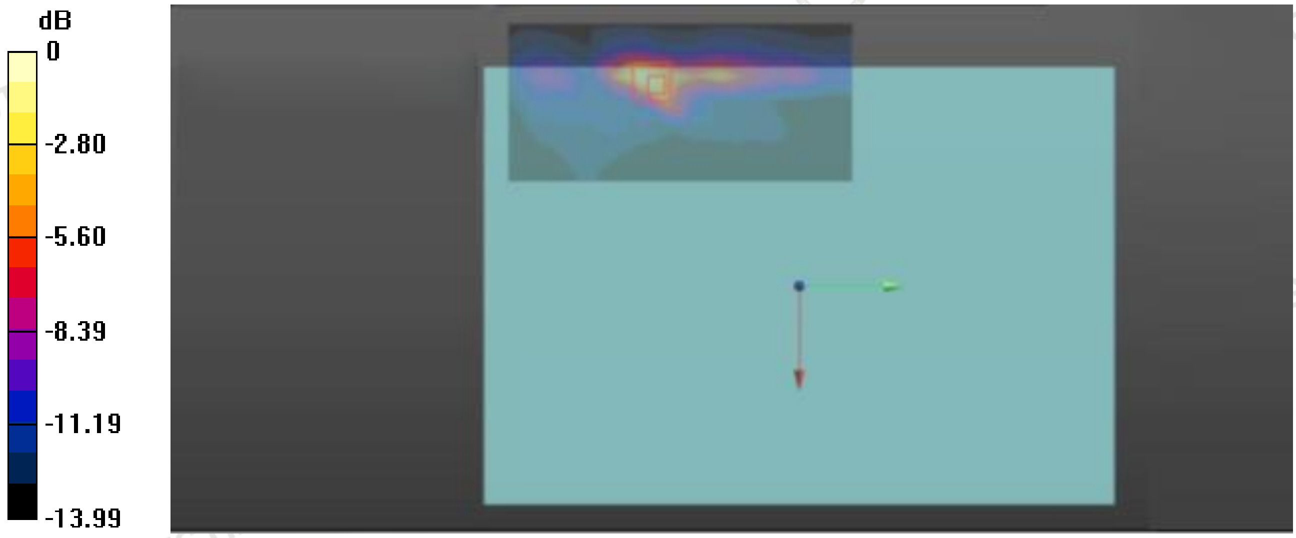
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 8.774 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 1.52 W/kg

SAR(1 g) = 0.754 W/Kg; SAR(10 g) = 0.482 W/Kg

Maximum value of SAR (measured) = 1.09 W/Kg



#2.

Date: 05/20/2024

WLAN5.3GHz_802.11ac(VHT20) MCS0_Back _0mm_Ch64

Communication System: UID 0, Generic WIFI(0); Frequency: 5320 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5320 MHz; σ = 4.569 S/m; εr = 36.45; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(5.45, 5.45, 5.45); Calibrated: June 21, 2023
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (11x23x1): Interpolated grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 0.705 W/Kg

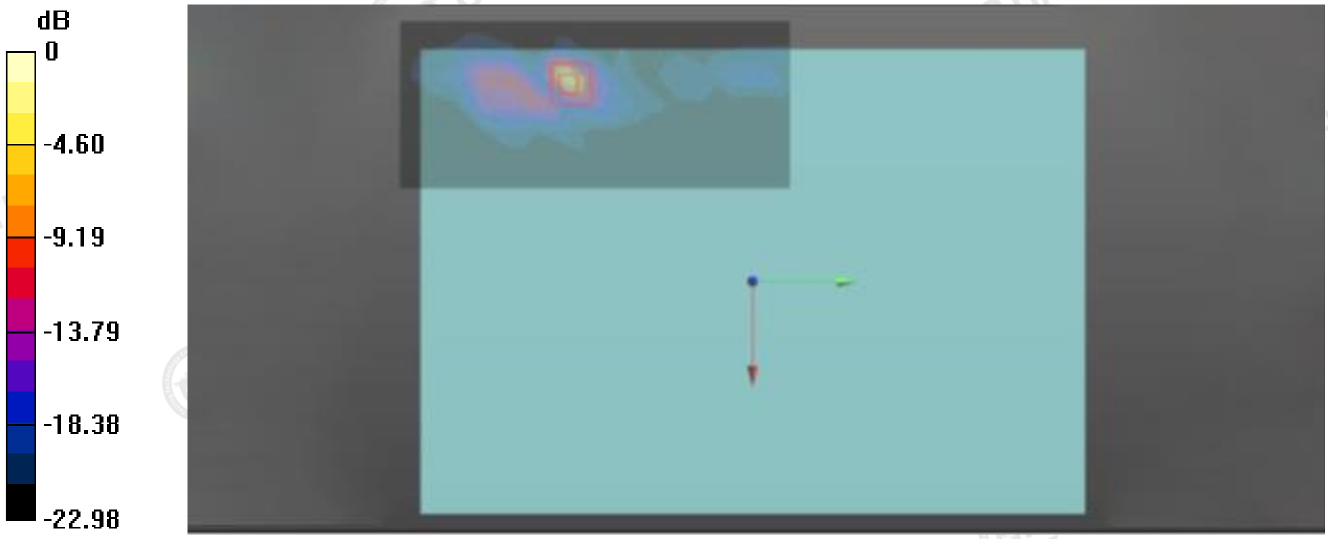
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 1.326 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) =1.10 W/kg

SAR(1 g) = 0.522 W/Kg; SAR(10 g) = 0.243 W/Kg

Maximum value of SAR (measured) = 0.811 W/Kg



#3.

Date: 05/22/2024

WLAN5.6GHz_802.11ac(VHT20) MCS0_Back_0mm_Ch140

Communication System: UID 0, Generic WIFI(0); Frequency: 5700 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5700 MHz; σ = 5.076 S/m; εr = 35.722; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(4.86, 4.86, 4.86); Calibrated: June 21, 2023
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (8x23x1): Interpolated grid: dx= 10mm, dy= 10mm

Maximum value of SAR (interpolated) = 1.02 W/Kg

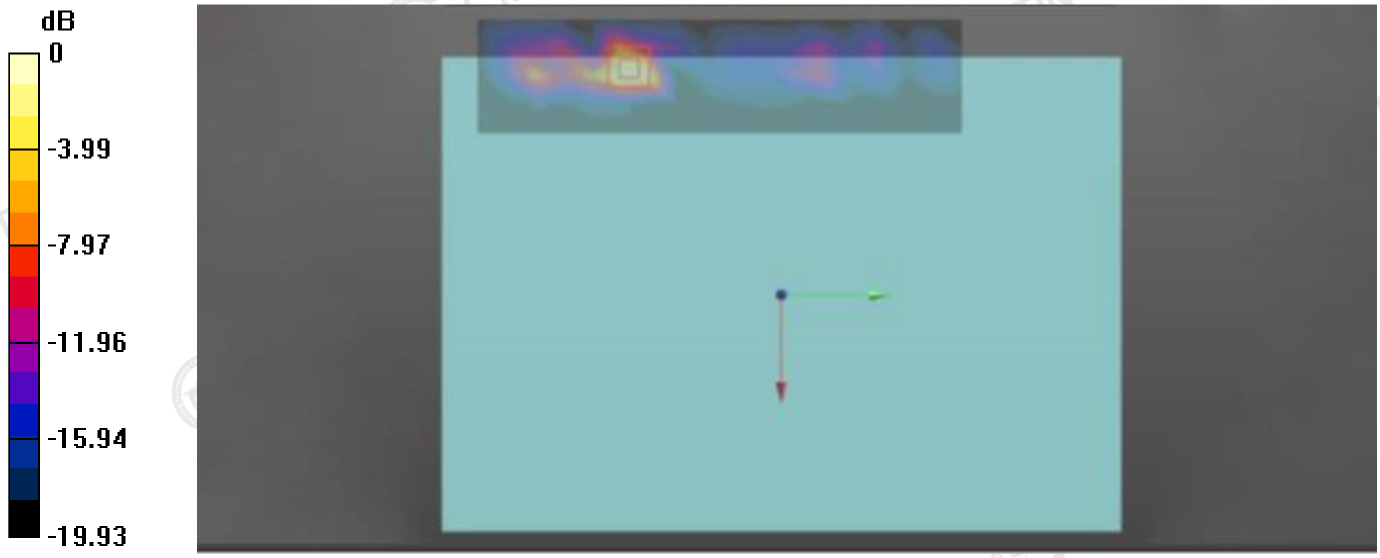
Zoom Scan (7x7x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 1.887 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 1.25 W/kg

SAR(1 g) = 0.631 W/Kg; SAR(10 g) = 0.308 W/Kg

Maximum value of SAR (measured) = 1.17 W/Kg



#4.

Date: 05/22/2024

WLAN5.8GHz_802.11n(HT20) MCS0_Back _0mm_Ch157

Communication System: UID 0, Generic WIFI(0); Frequency: 5785 MHz; Duty Cycle: 1:1

Medium parameters used (interpolated): f = 5785 MHz; σ = 5.985 S/m; εr = 48.710; ρ = 1000 kg/m3

Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7380; ConvF(4.96, 4.96, 4.96); Calibrated: June 21, 2023
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- Phantom: Twin-SAM V8.0 ; Type: QD 000 P41 AA; Serial: 1974;
- DASY52 52.10.2(1495); SEMCAD X 14.6.12(7450)

Area Scan (11x17x1): Interpolated grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 1.12 W/Kg

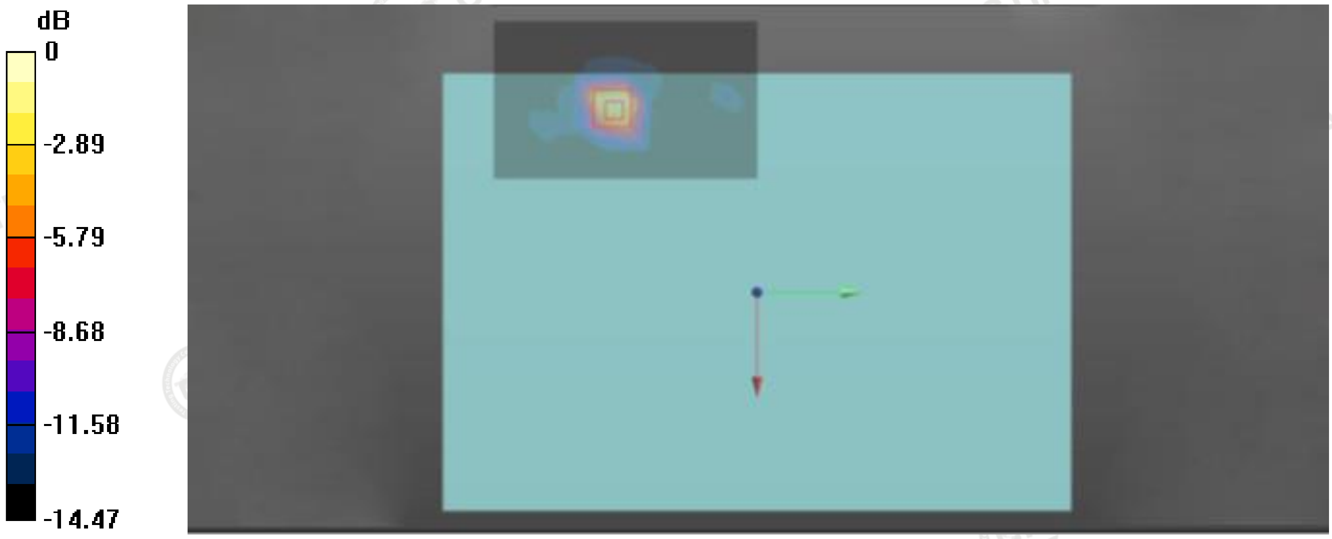
Zoom Scan (8x8x12)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 1.954 V/m; Power Drift = -0.11 dB

Peak SAR (extrapolated) = 1.32 W/kg

SAR(1 g) = 0.647 W/Kg; SAR(10 g) = 0.354 W/Kg

Maximum value of SAR (measured) = 1.10 W/Kg



Appendix D. DASY System Calibration Certificate

In Collaboration with
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CALIBRATION LABORATORY

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中国认可 国际互认 校准 CALIBRATION CNAS L0570

CAICT

Client ruixiang Certificate No: J23Z60276

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN : 7380

Calibration Procedure(s): FF-Z11-004-02
Calibration Procedures for Dosimetric E-field Probes

Calibration date: June 21, 2023

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	101919	12-Jun-23(CTTL, No.J23X05435)	Jun-24
Power sensor NRP-Z91	101547	12-Jun-23(CTTL, No.J23X05435)	Jun-24
Power sensor NRP-Z91	101548	12-Jun-23(CTTL, No.J23X05435)	Jun-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 7517	27-Jan-23(SPEAG, No.EX-7517_Jan23)	Jan-24
DAE4	SN 1555	25-Aug-22(SPEAG, No.DAE4-1555_Aug22)	Aug-23
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	12-Jun-23(CTTL, No.J23X05434)	Jun-24
Network Analyzer E5071C	MY46110673	10-Jan-23(CTTL, No.J23X00104)	Jan-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	18-Jan-23(SPEAG, No.OCP-DAK3.5-1040_Jan23)	Jan-24

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

Issued: June 27, 2023

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: J23Z60276 Page 1 of 9

TTL In Collaboration with s p e a g CALIBRATION LABORATORY CAICT

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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:7380

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$)[A]	0.44	0.35	0.41	±10.0%
DCP(mV)[B]	100.5	101.6	100.6	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	161.9	±2.2%
		Y	0.0	0.0	1.0		139.0	
		Z	0.0	0.0	1.0		149.3	

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 4).
[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.