TEST REPORT

Report Reference No. ....:	**CTA23112901607**	
FCC ID. .... :	**2A9LJ-ME10**	
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..................................:	Jan. 08, 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 ....:	**Meferi Technologies Co.,Ltd.**
Address..:	4501, 45th Floor, Building A, No. 530, Middle Tianfu Avenue, High-tech Zone, Chengdu, 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....................:	**Wearable Computer**
Trade Mark.....................................:	MEFERI
Manufacturer..................................:	Meferi Technologies Co.,Ltd.
Model/Type reference ....:	ME10
Listed Models ....:	ME10S, ME10P, ME10L, ME12, ME15, ME18
Ratings...:	DC 3.7V From battery and DC 5.0V From external circuit
Result...:	**PASS**

TEST REPORT

Equipment under Test	:	Wearable Computer
Model /Type	:	ME10
Listed Models	:	ME10S, ME10P, ME10L, ME12, ME15, ME18
Applicant	:	**Meferi Technologies Co.,Ltd.**
Address	:	4501, 45th Floor, Building A, No. 530, Middle Tianfu Avenue, High-tech Zone, Chengdu, China
Manufacturer	:	**Meferi Technologies Co.,Ltd.**
Address	:	4501, 45th Floor, Building A, No. 530, Middle Tianfu Avenue, High-tech Zone, Chengdu, 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	Jan. 08, 2024	Original

1 Statement of Compliance

<Highest SAR Summary>

This device is in 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.

<Highest SAR Summary>

Frequency Band	Highest Reported SAR		Simultaneous Reported SAR (W/Kg)
	Body SAR_{1g} (W/Kg) (0mm)	Limbs SAR_{10g} (W/Kg) (0mm)	
WLAN2.4G	0.624	0.303	Body: 1.481 Limbs: 0.850
WLAN5.2G	0.703	0.427	
WLAN5.6G	0.382	0.170	
WLAN5.8G	0.422	0.181	
SAR Test Limit (W/Kg)	Body:1.60W/Kg Limbs: 4W/Kg		
Test Result	PASS		

This device is in 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

2 General Information

2.1 Address of the test laboratory

Shenzhen CTA Testing Technology Co., Ltd.

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

2.2 Test Facility

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

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.

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

2.3 Client Information

Applicant	:	Meferi Technologies Co.,Ltd.
Address	:	4501, 45th Floor, Building A, No. 530, Middle Tianfu Avenue, High- tech Zone, Chengdu, China
Manufacturer	:	Meferi Technologies Co.,Ltd.
Address	:	4501, 45th Floor, Building A, No. 530, Middle Tianfu Avenue, High- tech Zone, Chengdu, China

2.4 Description of Equipment Under Test (EUT)

Product Name	:	Wearable Computer
Model No.	:	ME10
Listed Models	:	ME10S, ME10P, ME10L, ME12, ME15, ME18
Trade Mark	:	MEFERI
Test Power Supply	:	DC 3.7V battery inside
Test Sample No.	:	CTA231129016-1# (Engineer sample), CTA231129016-2# (Normal sample)
Tx Frequency	:	NFC:13.56MHz BT:2402~2480MHz 2.4G WIFI: 2412~2462MHz 5.2G WIFI:5180~5240MHz 5.3G WIFI: 5260-5320MHz 5.6G WIFI: 5500-5700MHz

		5.8G WIFI: 5745-5825MHz
Type of Modulation	:	NFC: ASK BT: GFSK, Π/4DQPSK, 8DPSK 2.4G WIFI: BPSK,QPSK,16QAM,64QAM, 1024QAM 5G WIFI: BPSK,QPSK,16QAM,64QAM, 256QAM, 1024QAM
Category of device	:	Portable device
Remark: The above DUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.		

2.5 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.

2.6 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 (2.1093:2013)
- 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

2.7 Environment of Test Site

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

2.8 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

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

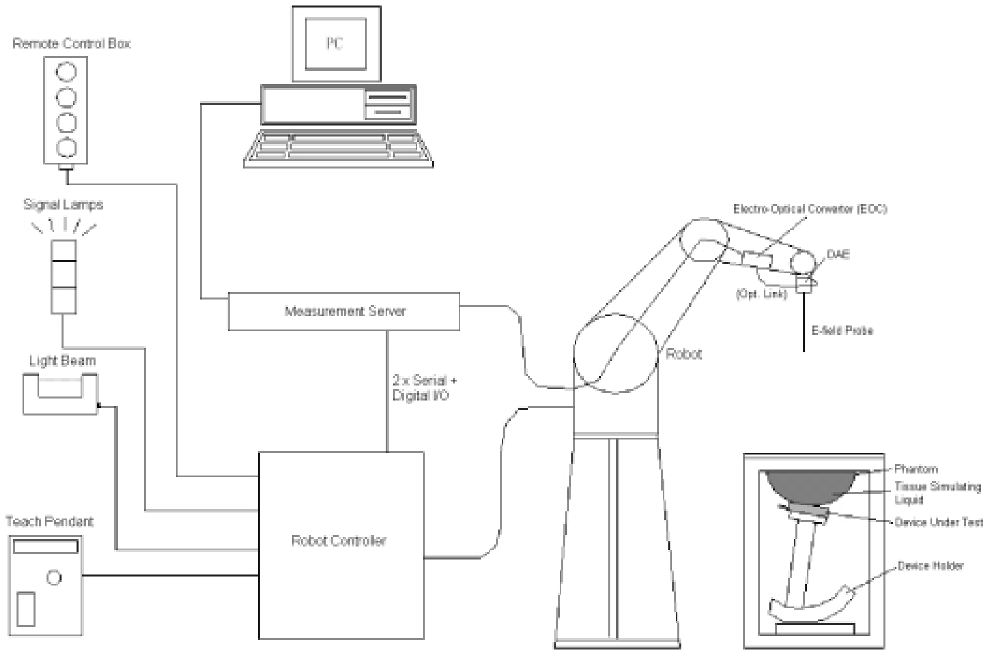
Where: C is the specific head capacity, δT is the temperature rise and δtisthe exposure duration, or related to the electrical field in the tissue by

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

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)	 **Photo of EX3DV4**
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	

- **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; Height: adjustable feet
Measurement Areas	Left Hand, Right Hand, Flat Phantom

Photo of SAM Phantom

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>

Shell Thickness	2 ± 0.2 mm (sagging: <1%)
Filling Volume	Approx. 30 liters
Dimensions	Major ellipse axis: 600 mm Minor axis:400 mm

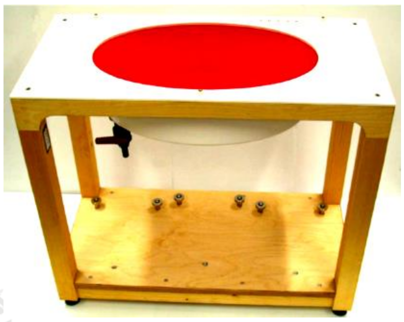


Photo of ELI4 Phantom

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:

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

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: $\mathbf{E_i} = \sqrt{\frac{\mathbf{V_i}}{\mathbf{Norm_i \cdot ConvF}}}$

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

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):

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

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	1102	May. 19,2023	May. 18,2026
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 C 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
	ε_r	σ	ε_r	Dev. (%)	σ	Dev. (%)		
2450	39.2	1.80	38.102	-2.80%	1.847	2.60%	22.4	01/02/2024
5250	35.9	4.71	36.640	2.06%	4.696	-0.29%	22.2	01/03/2024
5600	35.5	5.07	35.905	1.14%	4.996	-1.45%	22.5	01/04/2024
5750	35.4	5.22	34.851	-1.55%	5.332	2.14%	22.8	01/05/2024

7 System Verification Procedures

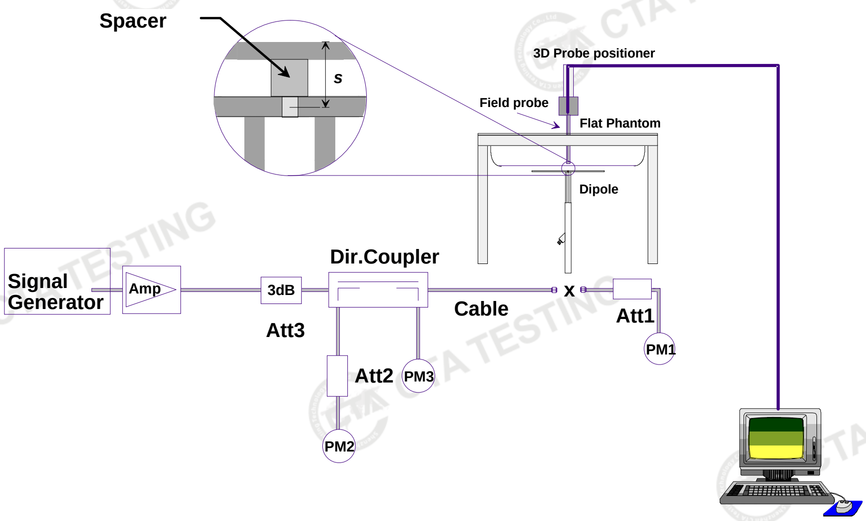
Each DASY system is equipped with one or more system validation kits. These units, together with the predefined measurement procedures within the DASY software, enable the user to conduct the system performance check and system validation. System validation kit includes a dipole, tripod holder to fix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

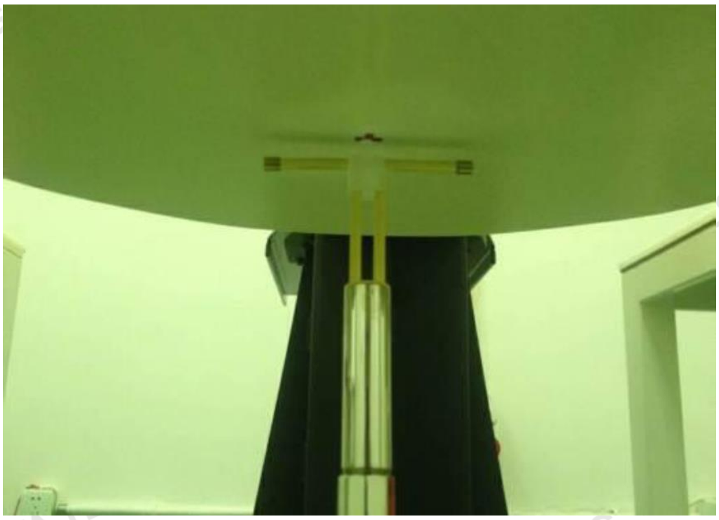


Photo of Dipole Setup

➢ 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 SAR 1g (W/kg)	Normalized SAR (W/kg)	Deviation (%)
01/02/2024	2450	250	52.7	13.63	54.50	3.42%
01/03/2024	5250	100	78.7	7.67	76.70	-2.54%
01/04/2024	5600	100	81.8	8.38	83.80	2.44%
01/05/2024	5725	100	77.3	7.87	78.70	1.81%

Date	Frequency (MHz)	Power fed onto reference dipole (mW)	Targeted SAR 10g (W/kg)	Measured SAR10g (W/kg)	Normalized SAR (W/kg)	Deviation (%)
01/02/2024	2450	250	24.5	6.40	25.58	4.41%
01/03/2024	5250	100	22.3	2.25	22.50	0.90%
01/04/2024	5600	100	23.1	2.42	24.20	4.76%
01/05/2024	5725	100	21.6	2.25	22.50	4.17%

8 EUT Testing Position

8.1 Body-Supported Device Configurations

According to KDB 616217 section 4.3, SAR should be separately assessed with each surface and separation distance positioned against the flat phantom that correspond to the intended use as specified by the manufacturer. The antennas in tablets are typically located near the back (bottom) surface and/or along the edges of the devices; therefore, SAR evaluation is required for these configurations. Exposures from antennas through the front (top) surface of the display section of a full-size tablet, away from the edges, 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, except for tablets that are designed to require continuous operations with the hand(s) next to the antenna(s).

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 0 mm.
- When each surface is measurement, the SAR Test Exclusion Threshold in KDB 447498 should be applied.

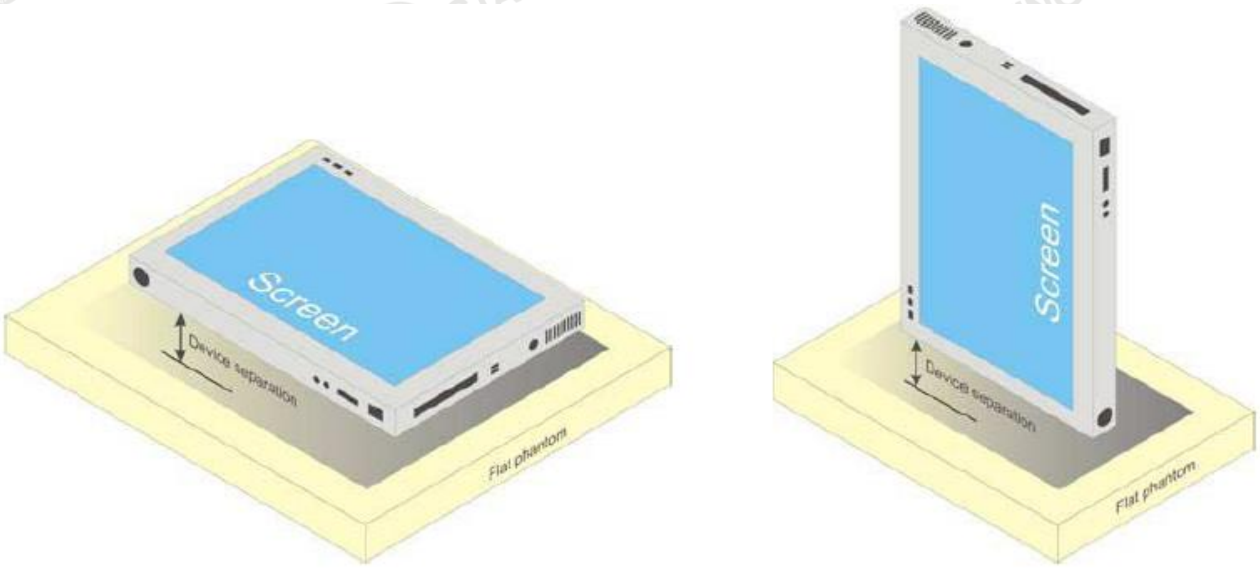


Fig.8.1 Illustration for Body Position

8.2 Limbs

Transmitters that are built-in within a wrist watch or similar wrist-worn devices typically operate in speaker mode for voice communication, with the device worn on the wrist and positioned next to the mouth. Next to the mouth exposure requires 1-g SAR and the wrist-worn condition requires 10-g extremity SAR. The 10-g extremity and 1-g SAR test exclusions may be applied to the wrist and face exposure conditions. When SAR evaluation is required, next to the mouth use is evaluated with the front of the device positioned at 10 mm from a flat phantom filled with head tissue-equivalent medium. The wrist bands should be strapped together to represent normal use conditions. SAR for wrist exposure is evaluated with the back of the device positioned in direct contact against a flat phantom filled with body tissue-equivalent medium. The wrist bands should be unstrapped and touching the phantom.

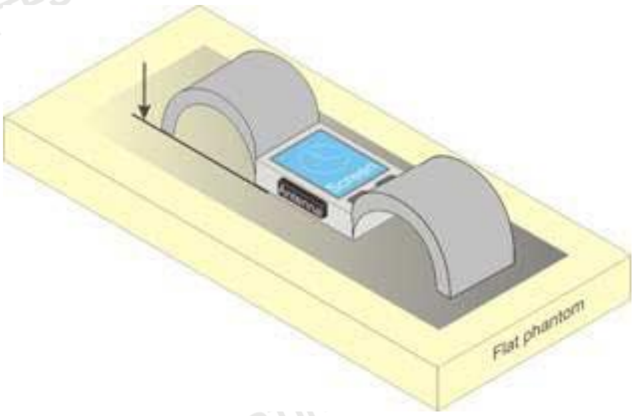


Fig.8.2 Illustration for Limbs

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}			$\leq$ 2 GHz: $\leq$ 8 mm 2 – 3 GHz: $\leq$ 5 mm*	3 – 4 GHz: $\leq$ 5 mm* 4 – 6 GHz: $\leq$ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		$\leq$ 5 mm	3 – 4 GHz: $\leq$ 4 mm 4 – 5 GHz: $\leq$ 3 mm 5 – 6 GHz: $\leq$ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	$\leq$ 4 mm	3 – 4 GHz: $\leq$ 3 mm 4 – 5 GHz: $\leq$ 2.5 mm 5 – 6 GHz: $\leq$ 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		$\geq$ 30 mm	3 – 4 GHz: $\geq$ 28 mm 4 – 5 GHz: $\geq$ 25 mm 5 – 6 GHz: $\geq$ 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 *reported* SAR from the *area scan based 1-g SAR estimation* procedures of KDB 447498 is $\leq$ 1.4 W/kg, $\leq$ 8 mm, $\leq$ 7 mm and $\leq$ 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 aggregateSAR, 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

General Note:

1 For each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode.

2 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.

3 The maximum output power specified for production units are determined for all applicable 802.11 transmission modes in each standalone and aggregated frequency band. Maximum output power is measured for the highest maximum output power configuration(s) in each frequency band according to the default power measurement procedures. For “Not required”, SAR Test reduction was applied from KDB 248227 guidance, Sec. 2.1, b), 1) when the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel in the initial test configuration, for each frequency band or when MIMO mode was not performed, due to for each antenna, transmit power in SISO operation is larger than (or equal to) the power in MIMO operation, RF exposure compliance of MIMO mode can be deduced from the compliance simultaneous transmission of antennas operating in SISO mode. Additional output power measurements were not necessary.

4 Per KDB 248227 D01v02r02, SAR test reduction is determined according to 802.11 transmission mode configurations and certain exposure conditions with multiple test positions. In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. For OFDM, in both 2.4 and 5 GHz bands, an initial test configuration must be determined for each standalone and aggregated frequency band, according to the transmission mode configuration with the highest maximum output power specified for production units to perform SAR measurements. If the same highest maximum output power applies to different combinations of channel bandwidths, modulations and data rates, additional procedures are applied to determine which test configurations require SAR measurement. When applicable, an initial test position may be applied to reduce the number of SAR measurements required for next to the ear, UMPC mini-tablet or hotspot mode configurations with multiple test positions.

5 For 2.4 GHz 802.11b DSSS, either the initial test position procedure for multiple exposure test positions or the DSSS procedure for fixed exposure position is applied; these are mutually exclusive. For 2.4 GHz and 5 GHz OFDM configurations, the initial test configuration is applied to measure SAR using either the initial test position procedure for multiple exposure test position configurations or the initial test configuration procedures for fixed exposure test conditions. Based on the reported SAR of the measured configurations and maximum output power of the transmission mode configurations that are not included in the initial test configuration, the subsequent test configuration and initial test position procedures are applied to determine if SAR measurements are required for the remaining OFDM transmission configurations. In general, the number of test channels that require SAR measurement is minimized based on maximum output power measured for the test sample(s).

6 For OFDM transmission configurations in the 2.4 GHz and 5 GHz bands, When the same maximum power is specified for multiple transmission modes in a frequency band, the largest channel bandwidth, lowest order modulation, lowest data rate and lowest order 802.11a/g/n/ac mode is used for SAR measurement, on the highest measured output power channel for each frequency band.

7 DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.18 The initial test position procedure is described in the following:

a) When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band.

b) 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.

c) 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.

8 Per 201904 TCBC workshops, General principles of FCC KDB Publication 248227 D01 can be applied to determine the SAR Initial Test Configurations and test reduction for 802.11ax SAR testing. For the table below the 802.11ax maximum power is SU (non-OFDMA), and the SU maximum power also higher than RU (OFDMA)

9 In applying the test guidance, the IEEE 802.11 mode with the maximum output power (out of all modes) should be considered for testing

10 For modes with the same maximum output power, the guidance from section 5.3.2 a) of FCC KDB Publication 248227 D01 should be applied, with 802.11ax being considered as the highest 802.11 mode for the appropriate frequency bands

11 When SAR testing for 802.11ax is required

a) If the maximum output power is highest for OFDMA scenarios, choose the tone size with the maximum number of tones and the highest maximum output power

b) Otherwise, consider the fully allocated channel for SAR testing

c) When SAR testing is required on RU sizes less than the fully allocated channel, use the RU number closest to the middle of the channel, choosing the higher RU number when two RUs are equidistant to the middle of the channel

<WLAN 2.4GHz Conducted Power>

Ant1

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power(dBm)	Conducted Average Output Power(dBm)	Tune-up
802.11b	1	2412	14.54	12.23	12.5±1.0
	6	2437	15.06	12.73	12.5±1.0
	11	2462	15.20	**12.88**	12.5±1.0
802.11g	1	2412	14.49	11.52	11.5±1.0
	6	2437	14.44	11.34	11.5±1.0
	11	2462	14.70	11.70	11.5±1.0
802.11n(HT20)	1	2412	14.20	10.78	11.5±1.0
	6	2437	14.64	11.41	11.5±1.0
	11	2462	14.85	11.70	11.5±1.0
802.11n(HT40)	3	2422	13.45	10.32	11.5±1.0
	6	2437	14.03	10.49	11.5±1.0
	9	2452	13.98	10.57	11.5±1.0
802.11ax(HT20)	1	2412	14.32	10.78	11.5±1.0
	6	2437	14.42	10.98	11.5±1.0
	11	2462	14.64	11.38	11.5±1.0
802.11ax(HT40)	3	2422	13.26	10.11	11.5±1.0
	6	2437	13.91	10.69	11.5±1.0
	9	2452	14.06	10.82	11.5±1.0

Ant2

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power(dBm)	Conducted Average Output Power(dBm)	Tune-up
802.11b	1	2412	15.04	12.66	12.5±1.0
	6	2437	15.49	13.15	12.5±1.0
	11	2462	15.59	**13.26**	12.5±1.0
802.11g	1	2412	14.79	11.80	11.5±1.0
	6	2437	15.06	11.93	11.5±1.0
	11	2462	14.91	11.84	11.5±1.0
802.11n(HT20)	1	2412	14.57	11.06	11.5±1.0
	6	2437	15.12	11.86	11.5±1.0
	11	2462	14.84	11.68	11.5±1.0
802.11n(HT40)	3	2422	13.78	10.57	11.5±1.0
	6	2437	14.31	10.70	11.5±1.0
	9	2452	14.49	11.00	11.5±1.0
802.11ax(HT20)	1	2412	14.77	11.20	11.5±1.0
	6	2437	15.33	11.85	11.5±1.0
	11	2462	15.15	11.81	11.5±1.0
802.11ax(HT40)	3	2422	13.85	10.61	11.5±1.0
	6	2437	14.41	11.16	11.5±1.0
	9	2452	14.45	11.15	11.5±1.0

MIMO mode

Mode	Channel	Frequency (MHz)	Conducted Peak Output Power(dBm)		Conducted Average Output Power(dBm)			
			Ant1	Ant2	Ant1	Tune-up	Ant2	Tune-up
802.11n(HT20)	1	2412	14.20	14.57	11.84	12.5±1.0	12.21	12.5±1.0
	6	2437	14.64	15.12	12.30	12.5±1.0	**12.78**	12.5±1.0
	11	2462	14.85	14.84	**12.47**	12.5±1.0	12.46	12.5±1.0
802.11n(HT40)	3	2422	13.45	13.78	10.45	11.5±1.0	10.78	11.5±1.0
	6	2437	14.03	14.31	10.86	11.5±1.0	11.14	11.5±1.0
	9	2452	13.98	14.49	10.90	11.5±1.0	11.41	11.5±1.0
802.11ax(HT20)	1	2412	14.32	14.77	10.83	11.5±1.0	11.28	11.5±1.0
	6	2437	14.42	15.33	11.18	11.5±1.0	12.09	11.5±1.0
	11	2462	14.64	15.15	11.41	11.5±1.0	11.92	11.5±1.0
802.11ax(HT40)	3	2422	13.26	13.85	10.04	11.5±1.0	10.63	11.5±1.0
	6	2437	13.91	14.41	10.31	11.5±1.0	10.81	11.5±1.0
	9	2452	14.06	14.45	10.57	11.5±1.0	10.96	11.5±1.0

<WLAN 5.2GHz Conducted Power>

Ant1

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	36	5180	**13.96**	13.0±1.0
	44	5220	13.43	13.0±1.0
	48	5240	13.41	13.0±1.0
802.11n(HT20)	36	5180	13.95	13.0±1.0
	44	5220	12.43	13.0±1.0
	48	5240	12.24	13.0±1.0
802.11n(HT40)	38	5190	13.33	13.0±1.0
	46	5230	12.71	13.0±1.0
802.11ac(HT20)	36	5180	13.89	13.0±1.0
	44	5200	12.58	13.0±1.0
	48	5240	12.55	13.0±1.0
802.11ac(HT40)	38	5190	13.35	13.0±1.0
	46	5230	12.75	13.0±1.0
802.11ac(HT80)	42	5210	13.28	13.0±1.0
802.11ax(HT20)	36	5180	13.92	13.0±1.0
	44	5220	12.81	13.0±1.0
	48	5240	12.78	13.0±1.0
802.11ax(HT40)	38	5190	13.42	13.0±1.0
	46	5230	12.89	13.0±1.0
802.11ax(HT80)	42	5210	13.21	13.0±1.0

Ant2

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	36	5180	**14.19**	13.5±1.0
	44	5220	13.69	13.5±1.0
	48	5240	13.88	13.5±1.0
802.11n(HT20)	36	5180	14.06	13.5±1.0
	44	5220	12.78	13.5±1.0
	48	5240	12.86	13.5±1.0
802.11n(HT40)	38	5190	13.42	13.5±1.0
	46	5230	12.92	13.5±1.0
802.11ac(HT20)	36	5180	13.98	13.5±1.0
	44	5220	12.65	13.5±1.0
	48	5240	12.80	13.5±1.0
802.11ac(HT40)	38	5190	13.55	13.5±1.0
	46	5230	12.90	13.5±1.0
802.11ac(HT80)	42	5210	13.09	13.5±1.0
802.11ax(HT20)	36	5180	14.05	13.5±1.0
	44	5220	12.85	13.5±1.0
	48	5240	12.93	13.5±1.0
802.11ax(HT40)	38	5190	13.55	13.5±1.0
	46	5230	12.94	13.5±1.0
802.11ax(HT80)	42	5210	13.28	13.5±1.0

MIMO mode

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)			
			Ant1	Tune-up	Ant2	Tune-up
802.11n(HT20)	36	5180	**13.95**	13.0±1.0	**14.06**	13.5±1.0
	44	5220	12.43	13.0±1.0	12.78	13.5±1.0
	48	5240	12.24	13.0±1.0	12.86	13.5±1.0
802.11n(HT40)	38	5190	13.33	13.0±1.0	13.42	13.5±1.0
	46	5230	12.71	13.0±1.0	12.92	13.5±1.0
802.11ac(HT20)	36	5180	13.89	13.0±1.0	13.98	13.5±1.0
	44	5220	12.58	13.0±1.0	12.65	13.5±1.0
	48	5240	12.55	13.0±1.0	12.80	13.5±1.0
802.11ac(HT40)	38	5190	13.35	13.0±1.0	13.55	13.5±1.0
	46	5230	12.75	13.0±1.0	12.90	13.5±1.0
802.11ac(HT80)	42	5210	13.28	13.0±1.0	13.09	13.5±1.0
802.11ax(HT20)	36	5180	13.92	13.0±1.0	14.05	13.5±1.0
	44	5220	12.81	13.0±1.0	12.85	13.5±1.0
	48	5240	12.78	13.0±1.0	12.93	13.5±1.0
802.11ax(HT40)	38	5190	13.42	13.0±1.0	13.55	13.5±1.0
	46	5230	12.89	13.0±1.0	12.94	13.5±1.0
802.11ax(HT80)	42	5210	13.21	13.0±1.0	13.55	13.5±1.0

<WLAN 5.3GHz Conducted Power>

Ant1

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	52	5260	13.57	13±1.0
	60	5300	**13.60**	13±1.0
	64	5320	13.45	13±1.0
802.11n(HT20)	52	5260	12.76	12±1.0
	60	5300	12.10	12±1.0
	64	5320	11.96	12±1.0
802.11n(HT40)	54	5270	12.00	12±1.0
	62	5310	12.19	12±1.0
802.11ac(HT20)	52	5260	12.26	12±1.0
	60	5300	12.16	12±1.0
	64	5320	11.96	12±1.0
802.11ac(HT40)	54	5270	12.34	12±1.0
	62	5310	12.19	12±1.0
802.11ac(HT80)	58	5290	12.18	12±1.0
802.11ax(HT20)	52	5260	12.70	12±1.0
	60	5300	12.33	12±1.0
	64	5320	11.85	12±1.0
802.11ax(HT40)	54	5270	12.57	12±1.0
	62	5310	12.33	12±1.0
802.11ax(HT80)	58	5290	12.29	12±1.0

Ant2

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	52	5260	**13.67**	13±1.0
	60	5300	13.25	13±1.0
	64	5320	13.05	13±1.0
802.11n(HT20)	52	5260	12.72	12±1.0
	60	5300	12.25	12±1.0
	64	5320	11.99	12±1.0
802.11n(HT40)	54	5270	12.47	12±1.0
	62	5310	12.32	12±1.0
802.11ac(HT20)	52	5260	12.70	12±1.0
	60	5300	12.41	12±1.0
	64	5320	11.91	12±1.0
802.11ac(HT40)	54	5270	12.58	12±1.0
	62	5310	12.42	12±1.0
802.11ac(HT80)	58	5290	12.23	12±1.0
802.11ax(HT20)	52	5260	12.83	12±1.0
	60	5300	12.39	12±1.0
	64	5320	12.13	12±1.0
802.11ax(HT40)	54	5270	12.51	12±1.0
	62	5310	12.34	12±1.0
802.11ax(HT80)	58	5290	12.17	12±1.0

MIMO mode

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)			
			Ant1	Tune-up	Ant2	Tune-up
802.11n(HT20)	52	5260	**12.76**	12.5±1.0	**12.72**	12.5±1.0
	60	5300	12.10	12.5±1.0	12.25	12.5±1.0
	64	5320	11.96	12.5±1.0	11.99	12.5±1.0
802.11n(HT40)	54	5270	12.00	12.5±1.0	12.47	12.5±1.0
	62	5310	12.19	12.5±1.0	12.32	12.5±1.0
802.11ac(HT20)	52	5260	12.26	12.5±1.0	12.70	12.5±1.0
	60	5300	12.16	12.5±1.0	12.41	12.5±1.0
	64	5320	11.96	12.5±1.0	11.91	12.5±1.0
802.11ac(HT40)	54	5270	12.34	12.5±1.0	12.58	12.5±1.0
	62	5310	12.19	12.5±1.0	12.42	12.5±1.0
802.11ac(HT80)	58	5290	12.18	12.5±1.0	12.23	12.5±1.0
802.11ax(HT20)	52	5260	12.70	12.5±1.0	12.53	12.5±1.0
	60	5300	12.33	12.5±1.0	12.39	12.5±1.0
	64	5320	11.85	12.5±1.0	12.13	12.5±1.0
802.11ax(HT40)	54	5270	12.57	12.5±1.0	12.51	12.5±1.0
	62	5310	12.33	12.5±1.0	12.34	12.5±1.0
802.11ax(HT80)	58	5290	12.29	12.5±1.0	12.32	12.5±1.0

<WLAN 5.6GHz Conducted Power>

Ant1

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	100	5500	**14.44**	13.5±1.0
	116	5580	14.04	13.5±1.0
	140	5700	12.84	13.5±1.0
802.11n(HT20)	100	5500	12.83	13±1.0
	116	5580	12.81	13±1.0
	140	5700	12.59	12±1.0
802.11n(HT40)	102	5510	13.26	13±1.0
	110	5550	13.12	13±1.0
	134	5670	13.07	13±1.0
802.11ac(HT20)	100	5500	13.01	13±1.0
	116	5580	12.78	13±1.0
	140	5700	11.80	12±1.0
802.11ac(HT40)	102	5510	13.16	13±1.0
	110	5550	13.12	13±1.0
	134	5670	13.13	13±1.0
802.11ac(HT80)	106	5530	13.17	13±1.0
802.11ax(HT20)	100	5500	13.12	13±1.0
	116	5580	12.84	13±1.0
	140	5700	11.80	12±1.0
802.11ax(HT40)	102	5510	13.16	13±1.0
	110	5550	13.12	13±1.0
	134	5670	13.16	13±1.0
802.11ax(HT80)	106	5530	13.13	13±1.0

Ant2

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	100	5500	**14.13**	13.5±1.0
	116	5580	13.78	13.5±1.0
	140	5700	12.79	13.5±1.0
802.11n(HT20)	100	5500	13.13	13±1.0
	116	5580	12.69	13±1.0
	140	5700	11.78	12±1.0
802.11n(HT40)	102	5510	13.05	13±1.0
	110	5550	13.08	13±1.0
	134	5670	13.18	13±1.0
802.11ac(HT20)	100	5500	12.92	13±1.0
	116	5580	12.65	13±1.0
	140	5700	11.70	12±1.0
802.11ac(HT40)	102	5510	13.08	13±1.0
	110	5550	12.99	13±1.0
	134	5670	13.15	13±1.0
802.11ac(HT80)	106	5530	12.89	13±1.0
802.11ax(HT20)	100	5500	13.18	13±1.0
	116	5580	12.74	13±1.0
	140	5700	11.83	12±1.0
802.11ax(HT40)	102	5510	13.17	13±1.0
	110	5550	13.18	13±1.0
	134	5670	13.23	13±1.0
802.11ax(HT80)	106	5530	13.12	13±1.0

MIMO mode

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)			
			Ant1	Tune-up	Ant2	Tune-up
802.11n(HT20)	100	5500	12.83	13±1.0	13.13	13±1.0
	116	5580	12.81	13±1.0	12.69	13±1.0
	140	5700	12.59	12±1.0	11.78	12±1.0
802.11n(HT40)	102	5510	**13.26**	13±1.0	13.05	13±1.0
	110	5550	13.12	13±1.0	13.08	13±1.0
	134	5670	13.07	13±1.0	13.18	13±1.0
802.11ac(HT20)	100	5500	13.01	13±1.0	12.92	13±1.0
	116	5580	12.78	13±1.0	12.65	13±1.0
	140	5700	11.80	12±1.0	11.70	12±1.0
802.11ac(HT40)	102	5510	13.16	13±1.0	13.08	13±1.0
	110	5550	13.12	13±1.0	12.99	13±1.0
	134	5670	13.13	13±1.0	13.15	13±1.0
802.11ac(HT80)	106	5530	13.17	13±1.0	12.89	13±1.0
802.11ax(HT20)	100	5500	13.12	13±1.0	13.18	13±1.0
	116	5580	12.84	13±1.0	12.74	13±1.0
	140	5700	11.80	12±1.0	11.83	12±1.0
802.11ax(HT40)	102	5510	13.16	13±1.0	13.17	13±1.0
	110	5550	13.12	13±1.0	13.18	13±1.0
	134	5670	13.16	13±1.0	**13.23**	13±1.0
802.11ax(HT80)	106	5530	13.13	13±1.0	12.58	13±1.0

<WLAN 5.8GHz Conducted Power>

Ant1

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	149	5745	11.24	11.5±1.0
	157	5785	12.43	12.5±1.0
	165	5825	**14.03**	13.5±1.0
802.11n(HT20)	149	5745	11.63	11.5±1.0
	157	5785	12.75	12.5±1.0
	165	5825	13.57	13.5±1.0
802.11n(HT40)	151	5755	11.07	11.0±1.0
	159	5795	12.13	12.0±1.0
802.11ac(HT20)	149	5745	10.85	11.5±1.0
	157	5785	11.93	12.5±1.0
	165	5825	13.59	13.5±1.0
802.11ac(HT40)	151	5755	10.92	11.0±1.0
	159	5795	12.03	12.0±1.0
802.11ac(HT80)	155	5775	11.74	11.5±1.0
802.11ax(HT20)	149	5745	10.81	11.5±1.0
	157	5785	11.90	12.5±1.0
	165	5825	13.67	13.5±1.0
802.11ax(HT40)	151	5755	11.00	11.0±1.0
	159	5795	12.01	12.0±1.0
802.11ax(HT80)	155	5775	11.67	11.5±1.0

Ant2

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
802.11a	149	5745	11.75	11.5±1.0
	157	5785	13.01	12.5±1.0
	165	5825	**14.41**	13.5±1.0
802.11n(HT20)	149	5745	10.71	11.5±1.0
	157	5785	11.80	12.5±1.0
	165	5825	13.52	13.5±1.0
802.11n(HT40)	151	5755	10.89	11.0±1.0
	159	5795	11.95	12.0±1.0
802.11ac(HT20)	149	5745	10.71	11.5±1.0
	157	5785	11.82	12.5±1.0
	165	5825	13.50	13.5±1.0
802.11ac(HT40)	151	5755	10.84	11.0±1.0
	159	5795	12.01	12.0±1.0
802.11ac(HT80)	155	5775	11.50	11.5±1.0
802.11ax(HT20)	149	5745	10.73	11.5±1.0
	157	5785	11.89	12.5±1.0
	165	5825	13.70	13.5±1.0
802.11ax(HT40)	151	5755	11.12	11.0±1.0
	159	5795	12.26	12.0±1.0
802.11ax(HT80)	155	5775	11.66	11.5±1.0

MIMO mode

Type	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)			
			Ant1	Tune-up	Ant2	Tune-up
802.11n(HT20)	149	5745	11.63	11.5±1.0	10.71	11.5±1.0
	157	5785	12.75	12.5±1.0	11.80	12.5±1.0
	165	5825	13.57	13.5±1.0	13.52	13.5±1.0
802.11n(HT40)	151	5755	11.07	11.0±1.0	10.89	11.0±1.0
	159	5795	12.13	12.0±1.0	11.95	12.0±1.0
802.11ac(HT20)	149	5745	10.85	11.5±1.0	10.71	11.5±1.0
	157	5785	11.93	12.5±1.0	11.82	12.5±1.0
	165	5825	13.59	13.5±1.0	13.50	13.5±1.0
802.11ac(HT40)	151	5755	10.92	11.0±1.0	10.84	11.0±1.0
	159	5795	12.03	12.0±1.0	12.01	12.0±1.0
802.11ac(HT80)	155	5775	11.74	11.5±1.0	11.50	11.5±1.0
802.11ax(HT20)	149	5745	10.81	11.5±1.0	10.73	11.5±1.0
	157	5785	11.90	12.5±1.0	11.89	12.5±1.0
	165	5825	**13.67**	13.5±1.0	**13.70**	13.5±1.0
802.11ax(HT40)	151	5755	11.00	11.0±1.0	11.12	11.0±1.0
	159	5795	12.01	12.0±1.0	12.26	12.0±1.0
802.11ax(HT80)	155	5775	11.67	11.5±1.0	12.42	11.5±1.0

<Bluetooth Conducted Power>

Mode	Channel	Frequency (MHz)	Conducted Average Output Power(dBm)	Tune-up
GFSK	0	2402	-1.87	-1±1.0
	39	2441	-1.36	-1±1.0
	78	2480	-0.51	0±1.0
π/4DQPSK	0	2402	-1.06	-1±1.0
	39	2441	-0.43	-1±1.0
	78	2480	0.38	0±1.0
8DPSK	0	2402	-1.05	-1±1.0
	39	2441	-0.41	-1±1.0
	78	2480	0.34	0±1.0
BLE1M(GFSK)	00	2402	6.39	6±1.0
	19	2440	6.28	6±1.0
	39	2480	5.12	5±1.0
BLE2M(GFSK)	00	2402	6.40	6±1.0
	19	2440	6.28	6±1.0
	39	2480	5.11	5±1.0

<NFC>

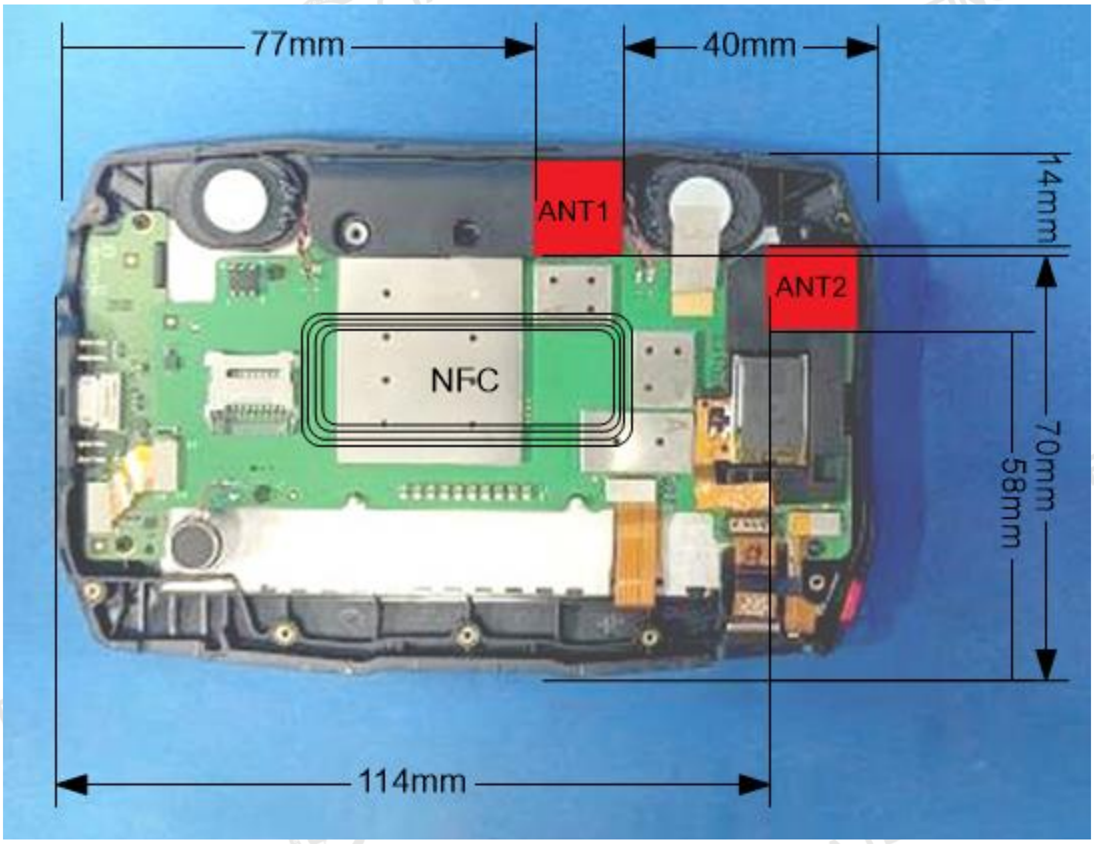
Mode	Frequency (MHz)	Field Strength (dBuV/m@3m)	Max Output Power(dBm)	Max Output Power(mW)
ASK	13.56	56.69	-38.51	0.00014093

Note: Max Power(dBm)=Field Strength of Fundamental(dBuV/m@3m)-95.2

10.2 Transmit Antennas

Top Side

Left Side



Right Side

Bottom Side

Back View

Antenna information:

Ant1:WLAN/BT TX RX antenna	Ant2:WLAN TX RX antenna

Distance of The Antenna to the EUT surface and edge						
Antennas	**Front**	**Back**	**Top Side**	**Bottom Side**	**Left Side**	**Right Side**
Ant1	10mm	<5mm	<5mm	70mm	77mm	40mm
Ant2	10mm	<5mm	14mm	58mm	114mm	<5mm

10.3 Standalone SAR Test Exclusion Considerations

General Note:

1 The below table, when the distance is < 50 mm exclusion threshold is "Ratio", when the distance is > 50 mm exclusion threshold is "mW"

2 Maximum power is the source-based time-average power and represents the maximum RF output power among production units

3 Per KDB 447498 D01v06, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.

4 Per KDB 447498 D01v06, standalone SAR test exclusion threshold is applied; If the test separation distance is < 5mm, 5mm is used to determine SAR exclusion threshold.

5 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.

6 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 50 mm in step 1) + (test separation distance - 50 mm)·(f(MHz)/150)] mW, at 100 MHz to 1500 MHz

b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm)·10] mW at > 1500 MHz and ≤ 6 GHz

7 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 considerations Ant1								
Wireless Interface	Frequency (MHz)	Configuration	Maximum Average Power		Separation Distance (mm)	Calculation Result	SAR Exclusion Thresholds	Standalone SAR Exclusion
			dBm	mW				
2.4GHz WLAN	2462	Front	13.50	22.387	10	3.5	3	no
		Left Side	13.50	22.387	77	22.387	366	yes
		Right Side	13.50	22.387	40	0.9	3	yes
		Top Side	13.50	22.387	5	7	3	no
		Bottom Side	13.50	22.387	70	22.387	296	yes
5.2 GHz WLAN	5180	Front	14.00	25.119	10	5.7	3	no
		Left Side	14.00	25.119	77	25.119	336	yes
		Right Side	14.00	25.119	40	1.4	3	yes
		Top Side	14.00	25.119	5	11.4	3	no
		Bottom Side	14.00	25.119	70	25.119	266	yes
5.3 GHz WLAN	5300	Front	14.00	25.119	10	5.8	3	no
		Left Side	14.00	25.119	77	25.119	335	yes
		Right Side	14.00	25.119	40	1.4	3	yes
		Top Side	14.00	25.119	5	11.6	3	no
		Bottom Side	14.00	25.119	70	25.119	265	yes
5.6 GHz WLAN	5500	Front	14.50	28.184	10	6.6	3	no
		Left Side	14.50	28.184	77	28.184	334	yes
		Right Side	14.50	28.184	40	1.7	3	yes
		Top Side	14.50	28.184	5	13.2	3	no
		Bottom Side	14.50	28.184	70	28.184	264	yes
5.8 GHz WLAN	5825	Front	14.50	28.184	10	6.8	3	no
		Left Side	14.50	28.184	77	28.184	332	yes
		Right Side	14.50	28.184	40	1.7	3	yes
		Top Side	14.50	28.184	5	13.6	3	no
		Bottom Side	14.50	28.184	70	28.184	262	yes
Bluetooth*	2402	Front	7.00	5.012	10	0.8	3	yes
		Left Side	7.00	5.012	77	5.012	367	yes
		Right Side	7.00	5.012	40	0.2	3	yes
		Top Side	7.00	5.012	5	1.6	3	yes
		Bottom Side	7.00	5.012	70	5.012	297	yes

Standalone SAR test exclusion considerations Ant2								
Wireless Interface	Frequency (MHz)	Configuration	Maximum Average Power		Separation Distance	Calculation Result	SAR Exclusion Thresholds	Standalone SAR Exclusion
			dBm	mW	(mm)			
2.4GHz WLAN	2462	Front	13.50	22.387	10	3.5	3	no
		Left Side	13.50	22.387	114	22.387	736	yes
		Right Side	13.50	22.387	5	7	3	no
		Top Side	13.50	22.387	14	2.5	3	yes
		Bottom Side	13.50	22.387	58	22.387	176	yes
5.2 GHz WLAN	5180	Front	14.50	28.184	10	6.4	3	no
		Left Side	14.50	28.184	114	28.184	706	yes
		Right Side	14.50	28.184	5	12.8	3	no
		Top Side	14.50	28.184	14	4.6	3	yes
		Bottom Side	14.50	28.184	58	28.184	146	yes
5.3 GHz WLAN	5300	Front	14.00	25.119	10	5.8	3	no
		Left Side	14.00	25.119	114	25.119	705	yes
		Right Side	14.00	25.119	5	11.6	3	no
		Top Side	14.00	25.119	14	4.1	3	yes
		Bottom Side	14.00	25.119	58	25.119	145	yes
5.6 GHz WLAN	5500	Front	14.50	28.184	10	6.6	3	no
		Left Side	14.50	28.184	114	28.184	704	yes
		Right Side	14.50	28.184	5	13.2	3	no
		Top Side	14.50	28.184	14	4.7	3	yes
		Bottom Side	14.50	28.184	58	28.184	144	yes
5.8 GHz WLAN	5825	Front	14.50	28.184	10	6.8	3	no
		Left Side	14.50	28.184	114	28.184	702	yes
		Right Side	14.50	28.184	5	13.6	3	no
		Top Side	14.50	28.184	14	4.9	3	yes
		Bottom Side	14.50	28.184	58	28.184	142	yes

Remark:

1. *Maximum average power including tune-up tolerance;*
2. *Bluetooth including BLE-Lower Energy Bluetooth and Classical Bluetooth;*
3. *When the minimum test separation distance is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion*
4. *Per KDB 648474, if overall diagonal dimension of the display section of a tablet lager than 20 cm, no need consider Hotspot mode.*

For NFC

Mode	Frequency (MHz)	Field Strength (dBuV/m@3m)	Max Output Power(dBm)	Max Output Power(mW)	Threshold Value (mW)	Standalone SAR Exclusion
ASK	13.56	56.69	-38.51	0.00014093	443	Yes

10.4 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

Per FCC KD B447498 D01, simultaneous transmission SAR test exclusion may be applied when the sum of the 1-g SAR for all the transmitting antenna in a specific a physical test configuration is ≤1.6 W/Kg. When the sum is greater than the SAR limit, SAR test exclusion is determined by the SAR to peak location separation ratio.

$$\text{Ratio}=\frac{(\text{SAR}_1+\text{SAR}_2)^{1.5}}{(\text{peak location separation,mm})}<0.04$$

Estimated stand alone SAR						
Communication system	Frequency (MHz)	Configuration	Maximum Power (dBm)	Separation Distance (mm)	Estimated SAR_{1-g} (W/kg)	Estimated SAR_{10-g} (W/kg)
Bluetooth	2402	Body	7	0	0.207	/
Bluetooth	2402	Limbs	7	0	/	0.083
NFC	13.56	Body & Limbs	-38.0	0	0.000	0.000

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
3. Body including Hotspot mode as body use distance is 0mm from manufacturer declaration of user manual.

10.5 SAR Test Results

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, WLAN5.2GHz 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 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 Ant1											
	802.11b	Front	0	11	2462	12.88	13.50	1.153	0.01	0.311	0.359
	802.11b	Rear	0	11	2462	12.88	13.50	1.153	0.05	0.541	**0.624**
	802.11b	Top Edge	0	11	2462	12.88	13.50	1.153	-0.03	0.532	0.614

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)
Measured / Reported SAR numbers-Limbs Ant1											
	802.11b	Rear	0	11	2462	12.88	13.50	1.153	-0.07	0.263	0.303

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 Ant2											
	802.11b	Front Side	0	11	2462	13.26	13.50	1.057	-0.11	0.321	0.339
#1	802.11b	Rear Side	0	11	2462	13.26	13.50	1.057	0.05	**0.558**	**0.590**
	802.11b	Right Edge	0	11	2462	13.26	13.50	1.057	-0.04	0.541	0.572

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)
Measured / Reported SAR numbers-Limbs Ant2											
	802.11b	Rear Side	0	11	2462	13.26	13.50	1.057	0.05	0.284	0.300

Remark: 6Per KDB 248227 D01v02r02, The highest reported SAR for OFDM is adjusted by the ratio of OFDM to DSSS specified maximum output power was ＜1.2W/Kg, So ODFM SAR test is not required.

SAR Values [WIFI 5.2G]

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 Ant1											
	802.11a	Front	0	36	5180	13.96	14.00	1.009	0.11	0.411	0.415
	802.11a	Rear	0	36	5180	13.96	14.00	1.009	-0.09	0.578	0.583
	802.11a	Top Edge	0	36	5180	13.96	14.00	1.009	0.07	0.615	**0.621**

Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)

Measured / Reported SAR numbers-Limbs Ant1											
	802.11a	Rear	0	36	5180	13.96	14.00	1.009	0.03	0.337	0.340
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 Ant2											
	802.11a	Front	0	36	5180	14.19	14.50	1.074	-0.07	0.421	0.452
	802.11a	Rear	0	36	5180	14.19	14.50	1.074	0.06	0.643	0.691
#2	802.11a	Right Edge	0	36	5180	14.19	14.50	1.074	-0.11	**0.655**	**0.703**
Plot No.	**Mode**	**Test Position**	**Gap (mm)**	**Ch.**	**Freq. (MHz)**	**Average Power (dBm)**	**Tune-Up Limit (dBm)**	**Scaling Factor**	**Power Drift (dB)**	**Measured SAR_{10g} (W/kg)**	**Reported SAR_{10g} (W/kg)**
Measured / Reported SAR numbers-Limbs Ant2											
	802.11a	Rear	0	36	5180	14.19	14.50	1.009	-0.11	0.398	0.427

Remark: Per KDB 248227 D01v02r02, when U-NII-1 and U-NII-2A bands both supported by the EUT, begin SAR measurement in the band with higher specified maximum output power. The highest reported SAR for the tested configuration is adjusted by the ratio of lower to higher specified maximum output power for the two bands. When the adjusted SAR is ≤ 1.2 W/kg, SAR is not required for the band with lower maximum output power.

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 Ant1											
	802.11a	Front	0	100	5500	14.44	14.50	1.014	-0.13	0.156	0.158
	802.11a	Rear	0	100	5500	14.44	14.50	1.014	0.09	0.356	0.361
#3	802.11a	Top Edge	0	100	5500	14.44	14.50	1.014	-0.07	**0.377**	**0.382**
Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)
Measured / Reported SAR numbers-Limbs Ant1											
	802.11a	Rear	0	100	5500	14.44	14.50	1.014	-0.07	0.168	0.170
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 Ant2											
	802.11a	Front	0	100	5500	14.13	14.50	1.089	0.05	0.142	0.155
	802.11a	Rear	0	100	5500	14.13	14.50	1.089	0.03	0.331	0.360
	802.11a	Right Edge	0	100	5500	14.13	14.50	1.089	0.09	0.349	**0.380**
Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)
Measured / Reported SAR numbers-Limbs Ant2											
	802.11a	Rear	0	100	5500	14.13	14.50	1.089	-0.03	0.146	0.159

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 Ant1											
	802.11a	Front Side	0	165	5825	14.03	14.50	1.114	-0.09	0.154	0.172
	802.11a	Rear Side	0	165	5825	14.03	14.50	1.114	0.11	0.359	0.400
	802.11a	Top Edge	0	165	5825	14.03	14.50	1.114	0.03	0.379	**0.422**
Plot No.	Mode	Test Position	Gap (mm)	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Power Drift (dB)	Measured SAR_{10g} (W/kg)	Reported SAR_{10g} (W/kg)
Measured / Reported SAR numbers-Limbs Ant1											

	802.11a	Rear	0	165	5825	14.03	14.50	1.114	-0.05	0.159	0.177
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 Ant2											
	802.11a	Front	0	165	5825	14.41	14.50	1.021	0.11	0.166	0.169
	802.11a	Rear	0	165	5825	14.41	14.50	1.021	-0.05	0.361	0.369
#4	802.11a	Right Edge	0	165	5825	14.41	14.50	1.021	0.07	**0.383**	**0.391**
Plot No.	**Mode**	**Test Position**	**Gap (mm)**	**Ch.**	**Freq. (MHz)**	**Average Power (dBm)**	**Tune-Up Limit (dBm)**	**Scaling Factor**	**Power Drift (dB)**	**Measured SAR_{10g} (W/kg)**	**Reported SAR_{10g} (W/kg)**
Measured / Reported SAR numbers-Limbs Ant1											
	802.11a	Rear	0	165	5825	14.41	14.50	1.021	0.07	0.177	0.181

Note:

1. Per KDB 865664 D01V01, for each frequency band, repeated SAR measurement is required only when the measured SAR is≥0.8W/Kg.
2. Per KDB 865664 D01V01, if the ratio of largest to smallest SAR for the original and first repeated measurement is≤1.2 and the measured SAR＜1.45W/Kg, only one repeated measurement is required.
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 ≥1.45W/Kg
4. The ratio is the difference in percentage between original and repeated measured SAR.

10.6 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 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	Spacing (mm)	Ch.	Original SAR (W/kg)	First Repeated SAR (W/kg)	The Ratio	Second Repeated SAR (W/kg)

10.7 Simultaneous Transmission Analysis

10.8.1 Introduction

Application Simultaneous Transmission information:

No.	Simultaneous Transmission Configurations	Body
1	2.4GHz WLAN Ant 1 + 2.4GHz WLAN Ant 2+NFC	Yes
2	5GHz WLAN Ant 1 + 5GHz WLAN Ant 2 + Bluetooth +NFC	Yes

10.8.2 Evaluation of Simultaneous SAR

Body Simultaneous transmission SAR

Exposure Position	1	2	3	4	5	6	1+2 Summed 1g SAR (W/kg)	3+4+5+6 Summed 1g SAR (W/kg)	SPLSR
	2.4GHz WLAN Ant 1	2.4GHz WLAN Ant 2	5GHz WLAN Ant 1	5GHz WLAN Ant 2	Bluetooth	NFC			
	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)	1g SAR (W/kg)			
Front	0.359	0.339	0.415	0.452	0.207	0	0.698	1.074	N/A
Rear	0.624	0.590	0.583	0.691	0.207	0	1.214	1.481	N/A
Top Edge	0.614	N/A	0.621	N/A	0.207	0	0.614	0.828	N/A
Right Edge	N/A	0.572	N/A	0.703	0.207	0	0.572	0.910	N/A

MAX. ΣSAR_{1g} =**1.481** W/kg<1.6 W/kg, so the Simultaneous transmission SAR with volume scan are not required.

Limbs Simultaneous transmission SAR

Exposure Position	1	2	3	4	5	6	1+2 Summed 10g SAR (W/kg)	3+4+5+6 Summed 10g SAR (W/kg)	SPLSR
	2.4GHz WLAN Ant 1	2.4GHz WLAN Ant 2	5GHz WLAN Ant 1	5GHz WLAN Ant 2	Bluetooth	NFC			
	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)	10g SAR (W/kg)			
Rear	0.303	0.300	0.340	0.427	0.083	0	0.603	0.850	N/A

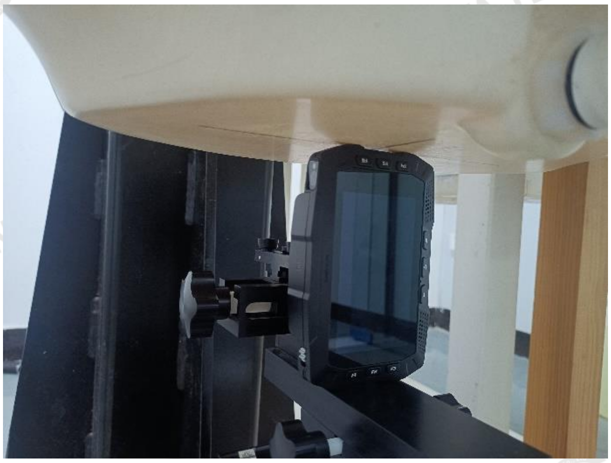
MAX. ΣSAR_{10g} =**0.850** W/kg<4.0W/kg, so the Simultaneous transmission SAR with volume scan are not required.

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

	
Front(0mm)	Back(0mm)
	
Top(0mm)	

Appendix B. Plots of SAR System Check

2450MHz System Check Date: 01/02/2024

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 = 1.847 S/m; εr = 38.102; 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: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (81x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm

Maximum value of SAR (interpolated) = 22.7 W/kg

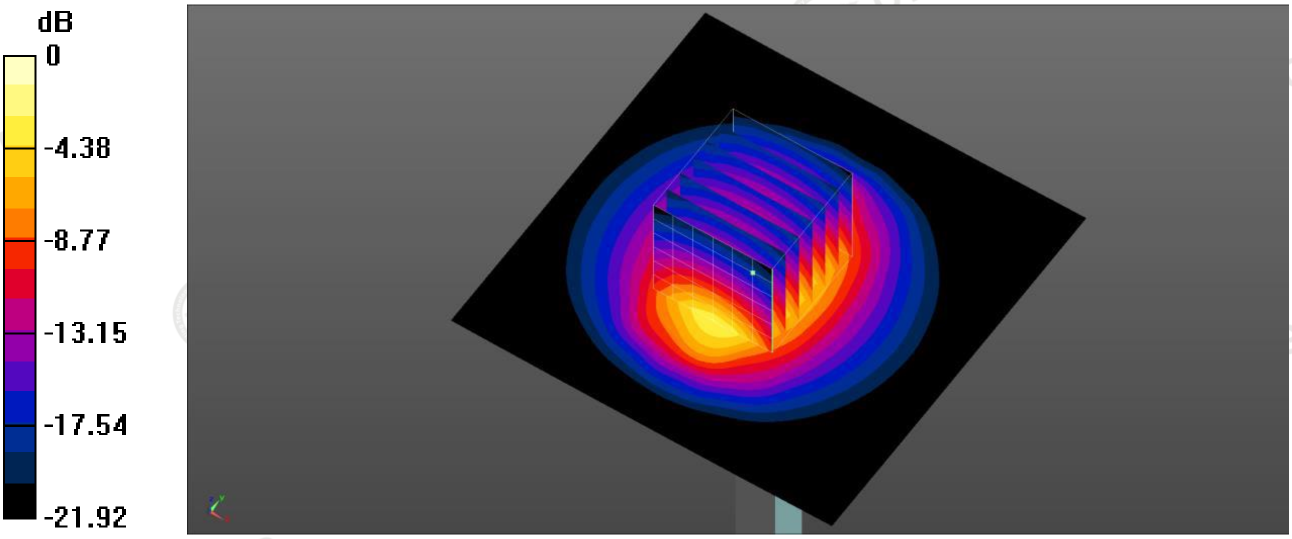
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 111.8 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 28.2 W/kg

SAR(1 g) = 13.63 W/kg; SAR(10 g) = 6.40 W/kg

Maximum value of SAR (measured) = 22.7 W/kg



0 dB = 22.7 W/kg

System Performance Check 2450MHz 250mW

5250MHz System Check Date: 01/03/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1102

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

Medium parameters used (interpolated): f = 5250 MHz; σ = 4.696 S/m; εr = 36.640; ρ = 1000 kg/m3

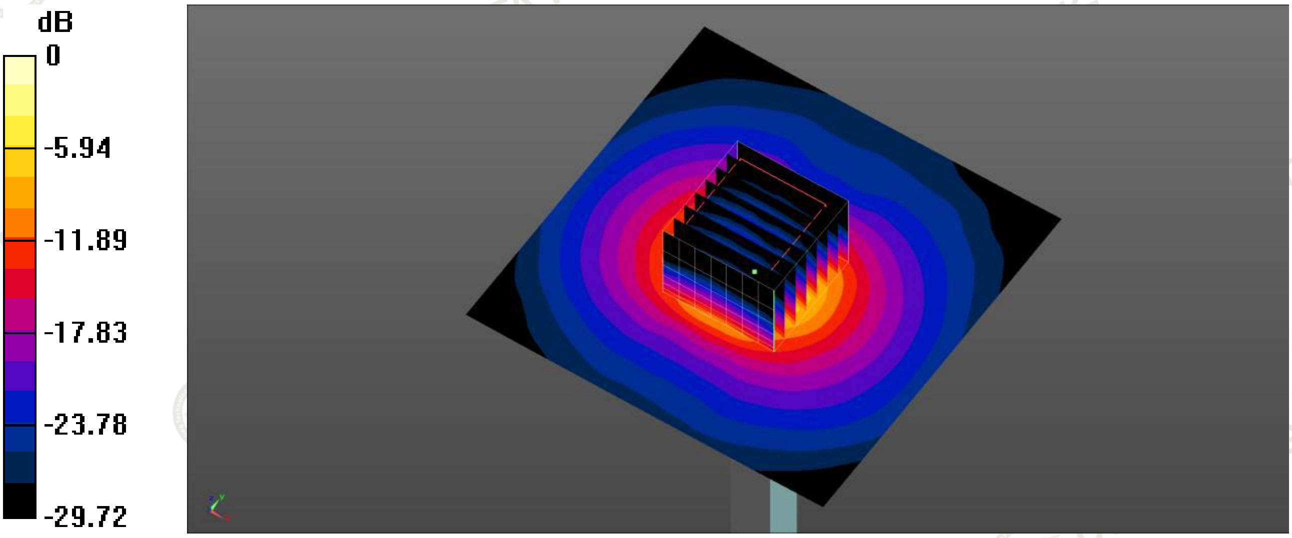
Phantom section: Flat Section

DASY5 Configuration:

•Probe: EX3DV4 – SN7380; ConvF(5.45, 5.45, 5.45); Calibrated: June 21, 2023;
•Sensor-Surface: 4mm (Mechanical Surface Detection)
•Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
•Phantom: SAM 1; Type: SAM;
•Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 19.2 W/kg
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 71.29 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 35.5 W/kg

SAR(1 g) = 7.67 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 20.3 W/kg



0 dB = 20.3 W/kg

System Performance Check 5250MHz 100mW

5600MHz System Check Date: 01/04/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1102

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

Medium parameters used (interpolated): f = 5600 MHz; σ = 4.996 S/m; εr = 35.905; 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: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 21.7 W/kg

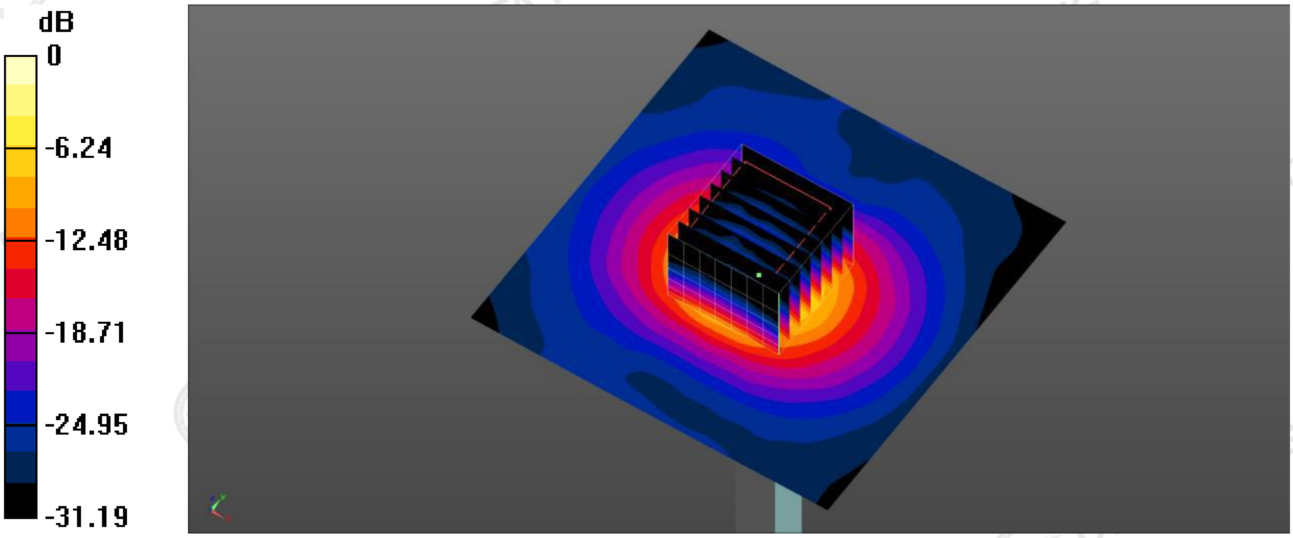
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 72.67 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 41.1 W/kg

SAR(1 g) = 8.38 W/kg; SAR(10 g) = 2.42 W/kg

Maximum value of SAR (measured) = 22.1 W/kg



0 dB = 22.1 W/kg

System Performance Check 5250MHz 100mW

5750MHz System Check

Date: 01/05/2024

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: 1102

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

Medium parameters used (interpolated): f = 5750 MHz; σ = 5.332 S/m; εr = 34.851; 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: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 20.1 W/kg

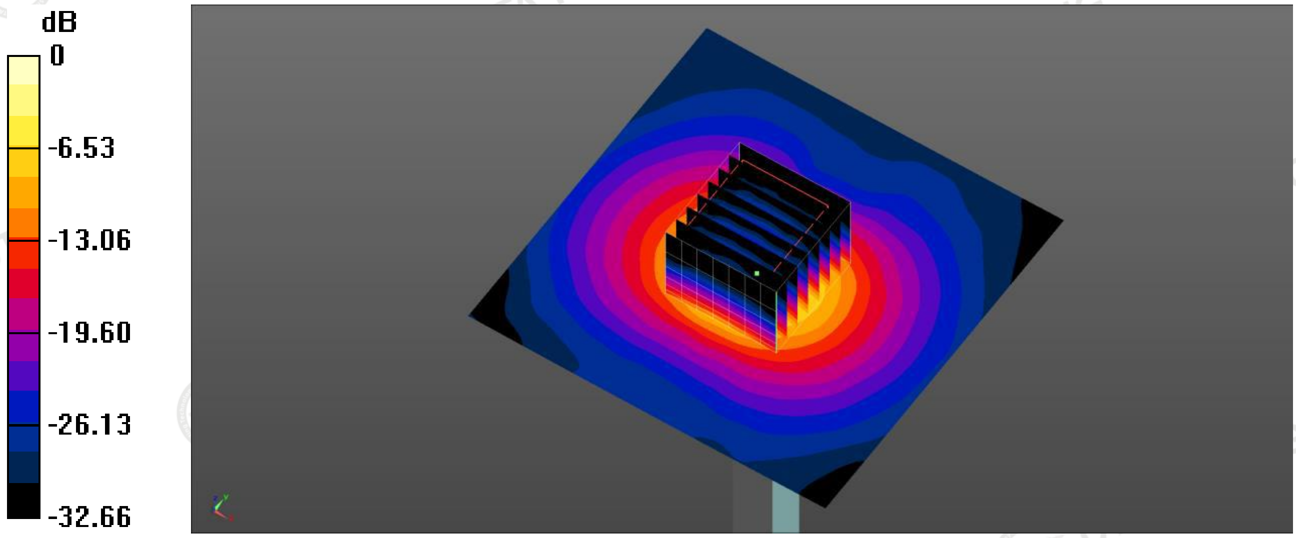
Zoom Scan (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

Reference Value = 68.37 V/m; Power Drift = 0.05 dB

Peak SAR (extrapolated) = 39.7 W/kg

SAR(1 g) = 7.87 W/kg; SAR(10 g) = 2.25 W/kg

Maximum value of SAR (measured) = 20.8 W/kg



0 dB = 20.8 W/kg

System Performance Check 5750MHz 100mW

Appendix C. Plots of SAR Test Data

#1
Date: 01/02/2024

WLAN 802.11b_Back_CH 11_0mm_Ant2

Communication System: UID 0, Generic (0); Frequency: 2462 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.899 S/m; εr = 53.478; ρ = 1000 kg/m3
Phantom section: Flat Section

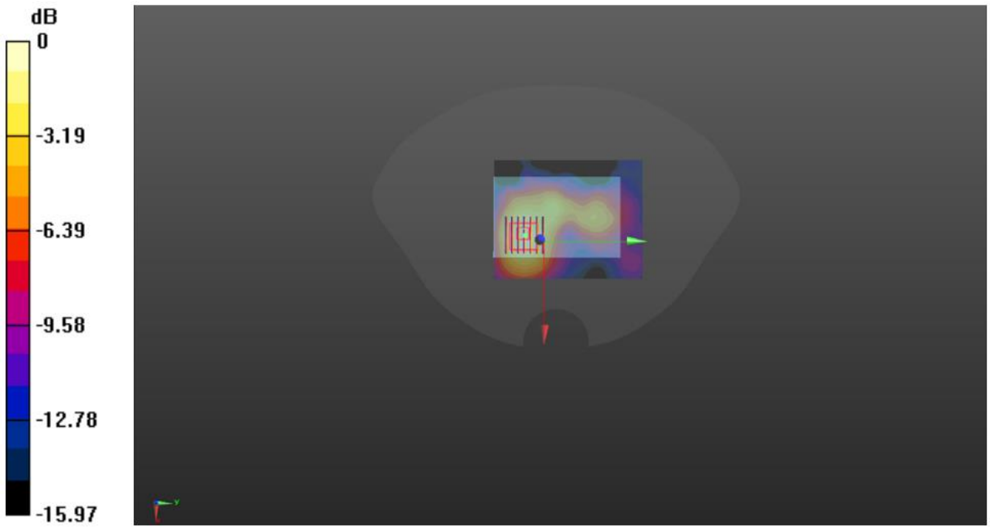
DASY5 Configuration:

- •Probe: EX3DV4 – SN7380; ConvF(7.50, 7.50, 7.50); Calibrated: June 21, 2023;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (81x126x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.852 W/Kg

Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.724 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.25 W/kg

SAR(1 g) = 0.558 W/Kg; SAR(10 g) = 0.284 W/Kg
Maximum value of SAR (measured) = 1.05 W/Kg



#2

Date: 01/03/2024

WLAN 802.11a 5.2G_Right side_CH 36_0mm_Ant2

Communication System: UID 0, Generic (0); Frequency: 5180 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5180 MHz; σ = 4.698 S/m; εr = 36.654; ρ = 1000 kg/m3
Phantom section: Flat Section

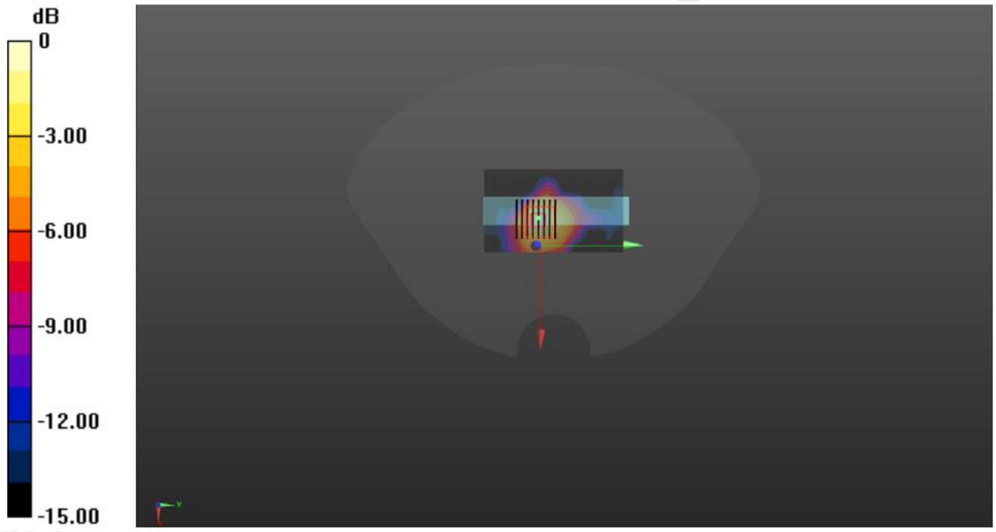
DASY5 Configuration:

- •Probe: EX3DV4 – SN7380; ConvF(5.45, 5.45, 5.45); Calibrated: June 21, 2023;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.13 W/Kg

Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 19.66 V/m; Power Drift = -0.11 dB
Peak SAR (extrapolated) = 1.57 W/kg

SAR(1 g) = 0.655 W/Kg; SAR(10 g) = 0.398 W/Kg
Maximum value of SAR (measured) = 1.33 W/Kg



#3

Date: 01/04/2024

WLAN 802.11a 5.6G_Top side_CH 100_0mm_Ant1

Communication System: UID 0, Generic (0); Frequency: 5500 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5500 MHz; σ = 4.989 S/m; εr = 35.887; ρ = 1000 kg/m3
Phantom section: Flat Section

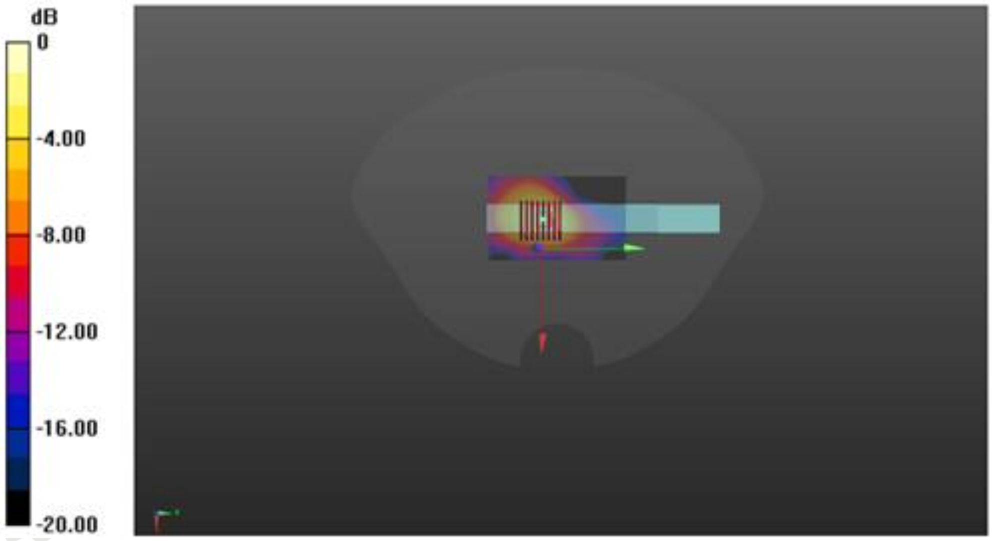
DASY5 Configuration:

- •Probe: EX3DV4 – SN7380; ConvF(4.86, 4.86, 4.86); Calibrated: June 21, 2023;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (61x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.750 W/Kg

Zoom Scan (8x8x15)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 16.79 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 1.01 W/kg

SAR(1 g) = 0.377 W/Kg; SAR(10 g) = 0.168 W/Kg
Maximum value of SAR (measured) = 0.941 W/Kg



#4

Date: 01/05/2024

WLAN 802.11a 5.8G_Right side_CH 165_0mm_Ant2

Communication System: UID 0, Generic (0); Frequency: 5825 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 5.244 S/m; εr = 35.658; ρ = 1000 kg/m3
Phantom section: Flat Section

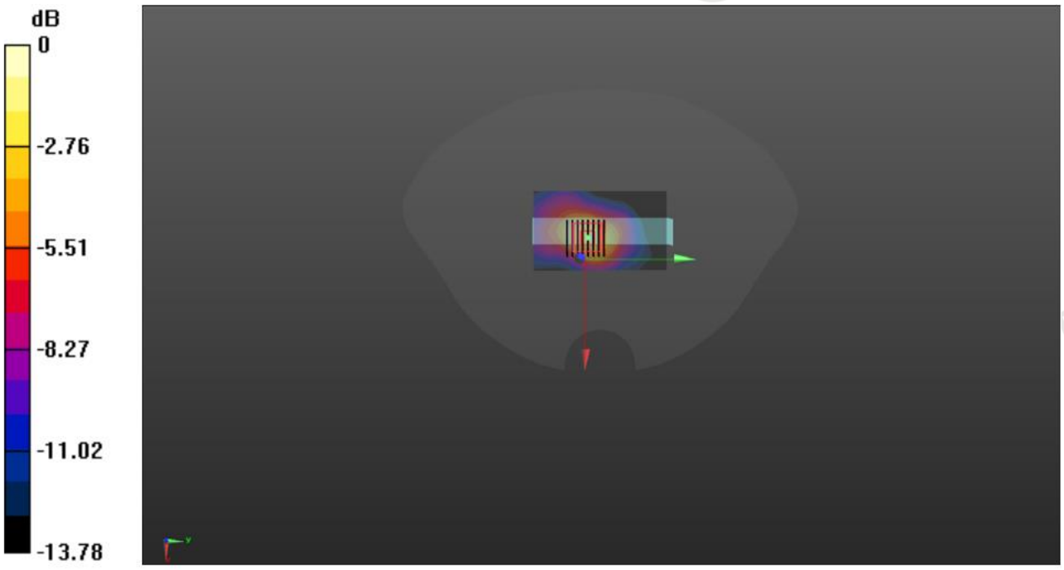
DASY5 Configuration:

- •Probe: EX3DV4 – SN7380; ConvF(4.96, 4.96, 4.96); Calibrated: June 21, 2023;
- •Sensor-Surface: 4mm (Mechanical Surface Detection)
- •Electronics: DAE3 Sn428; Calibrated: Aug.30,2023;
- •Phantom: SAM 1; Type: SAM;
- •Measurement SW: DASY52, Version 52.8 (2); SEMCAD X Version 14.6.10 (7164)

Area Scan (81x281x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.895 W/Kg

Zoom Scan (6x6x12)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm
Reference Value = 17.22 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 1.22 W/kg

SAR(1 g) = 0.383 W/Kg; SAR(10 g) = 0.177 W/Kg
Maximum value of SAR (measured) = 1.10 W/Kg



Appendix D. DASY System Calibration Certificate

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

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

ilac-MRA CNAS 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

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

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).

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

DASY/EASY – Parameters of Probe: EX3DV4 – SN:7380

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (*k*=2)
Norm(μV/(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.

In Collaboration with
speag
CALIBRATION LABORATORY

CAICT

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

DASY/EASY – Parameters of Probe: EX3DV4 – SN:7380

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity[F]	Conductivity (S/m)[F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (k=2)
750	41.9	0.89	10.02	10.02	10.02	0.17	1.27	±12.7%
835	41.5	0.90	9.62	9.62	9.62	0.18	1.30	±12.7%
1750	40.1	1.37	8.35	8.35	8.35	0.28	1.02	±12.7%
1900	40.0	1.40	8.05	8.05	8.05	0.24	1.11	±12.7%
2100	39.8	1.49	8.00	8.00	8.00	0.24	1.11	±12.7%
2300	39.5	1.67	7.75	7.75	7.75	0.65	0.67	±12.7%
2450	39.2	1.80	7.50	7.50	7.50	0.65	0.69	±12.7%
2600	39.0	1.96	7.35	7.35	7.35	0.47	0.85	±12.7%
3500	37.9	2.91	6.85	6.85	6.85	0.41	1.03	±13.9%
3700	37.7	3.12	6.69	6.69	6.69	0.43	1.03	±13.9%
3900	37.5	3.32	6.58	6.58	6.58	0.30	1.50	±13.9%
4100	37.2	3.53	6.62	6.62	6.62	0.35	1.25	±13.9%
4200	37.1	3.63	6.52	6.52	6.52	0.30	1.45	±13.9%
4400	36.9	3.84	6.44	6.44	6.44	0.30	1.50	±13.9%
4600	36.7	4.04	6.41	6.41	6.41	0.35	1.48	±13.9%
4800	36.4	4.25	6.36	6.36	6.36	0.35	1.50	±13.9%
4950	36.3	4.40	5.95	5.95	5.95	0.35	1.55	±13.9%
5250	35.9	4.71	5.45	5.45	5.45	0.40	1.55	±13.9%
5600	35.5	5.07	4.86	4.86	4.86	0.45	1.40	±13.9%
5750	35.4	5.22	4.96	4.96	4.96	0.45	1.40	±13.9%

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

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

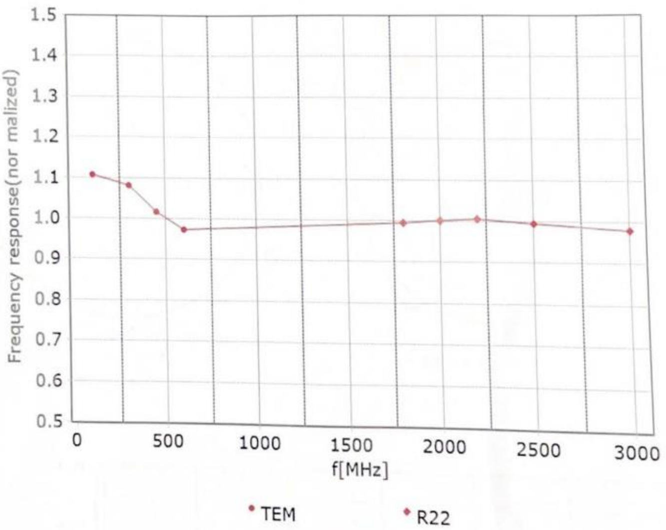
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter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

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)

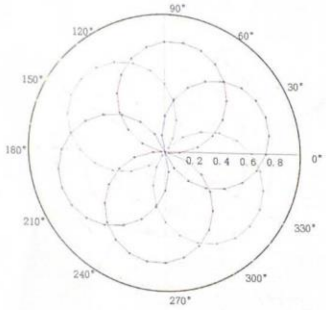
TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

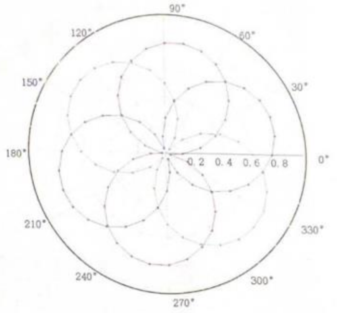
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

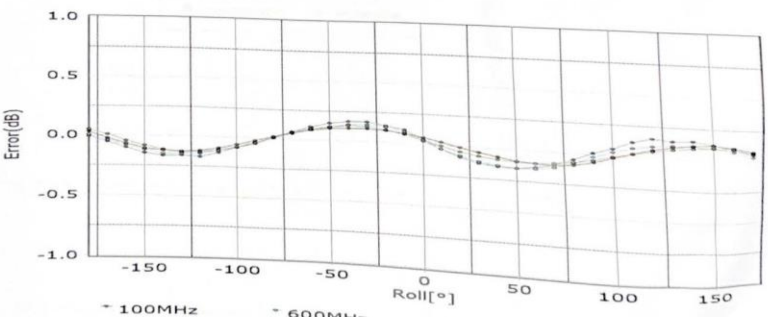
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





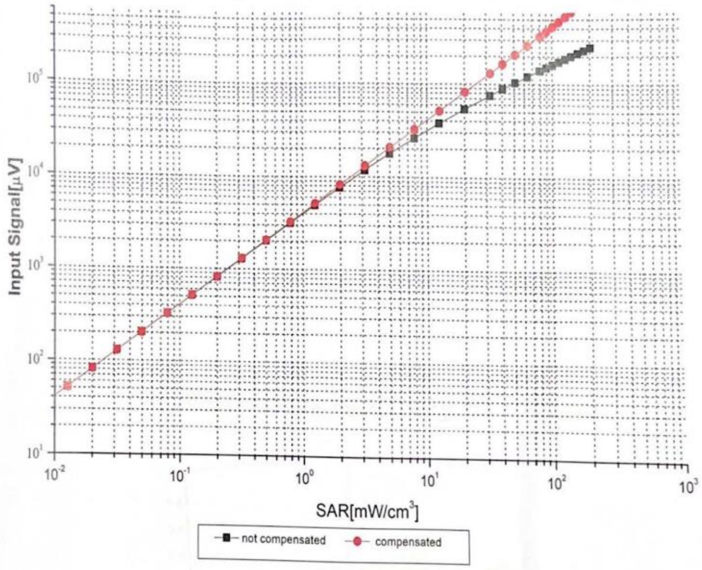
Uncertainty of Axial Isotropy Assessment: ±1.2% (k=2)

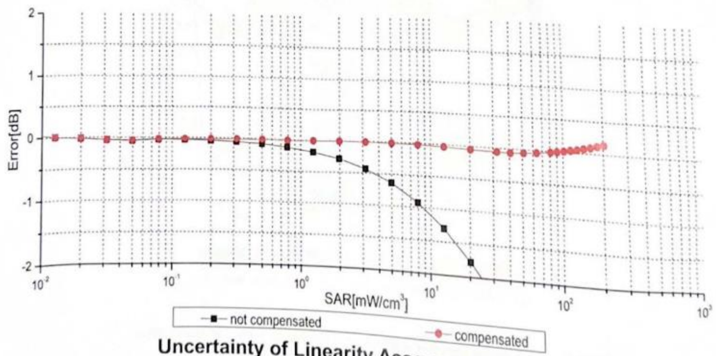
TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





Uncertainty of Linearity Assessment: ±0.9% (*k*=2)

Certificate No:J23Z60276

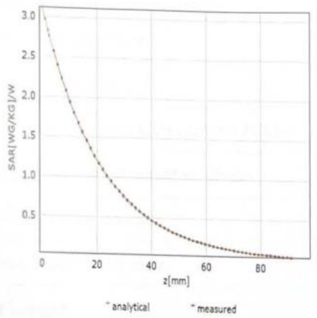
TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

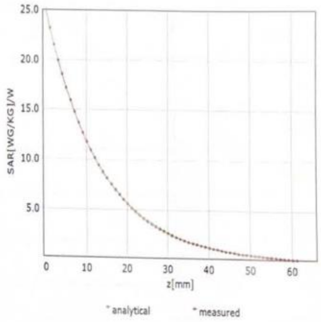
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

Conversion Factor Assessment

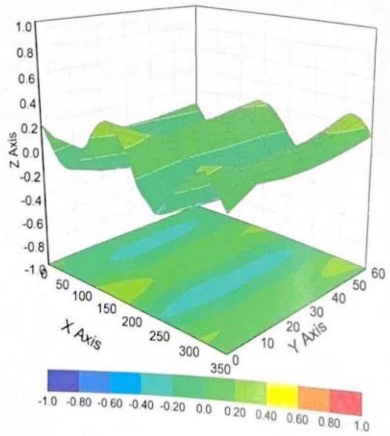
f=750 MHz,WGLS R9(H_convF)



f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



Uncertainty of Spherical Isotropy Assessment: ±3.2% (*k*=2)

Certificate No:J23Z60276

TTL In Collaboration with speag CALIBRATION LABORATORY

CAICT

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

DASY/EASY – Parameters of Probe: EX3DV4 – SN:7380

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	83.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	9mm
Tip Diameter	2.5mm
Probe Tip to Sensor X Calibration Point	1mm
Probe Tip to Sensor Y Calibration Point	1mm
Probe Tip to Sensor Z Calibration Point	1mm
Recommended Measurement Distance from Surface	1.4mm

TTL In Collaboration with speag CALIBRATION LABORATORY

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

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570 CAICT

Client : CTA Certificate No: J23Z60391

CALIBRATION CERTIFICATE

Object	DAE3 - SN: 428
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	August 30, 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
Process Calibrator 753	1971018	12-Jun-23 (CTTL, No.J23X05436)	Jun-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: September 06, 2023

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Glossary:

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

Methods Applied and Interpretation of Parameters:

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

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	404.468 ± 0.15% (k=2)	404.804 ± 0.15% (k=2)	404.579 ± 0.15% (k=2)
Low Range	3.95934 ± 0.7% (k=2)	3.95437 ± 0.7% (k=2)	3.91875 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	258.5° ± 1 °

In Collaboration with
TTL speag
CALIBRATION LABORATORY
Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191
Tel: +86-10-62304633-2117
E-mail: cttl@chinattl.com http://www.caict.ac.cn

中国认可 国际互认 校准 CALIBRATION CNAS L0570 CAICT

Client CTA Certificate No: J23Z60389

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 745
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 28, 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	106277	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Power sensor NRP8S	104291	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24
Secondary Standards	**ID #**	**Cal Date (Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

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

Issued: September 1, 2023

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Measurement Conditions

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

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.0 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.7 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.16 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.5 W/kg ± 18.7 % (*k*=2)**

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.2Ω+ 5.40jΩ
Return Loss	- 23.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.077 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

DASY5 Validation Report for Head TSL Date: 2023-08-28

Test Laboratory: CTTL, Beijing, China

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

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

Medium parameters used: f = 2450 MHz; σ = 1.835 S/m; ε_r = 39.03; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(7.68, 7.68, 7.68) @ 2450 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 101.5 V/m; Power Drift = -0.05 dB

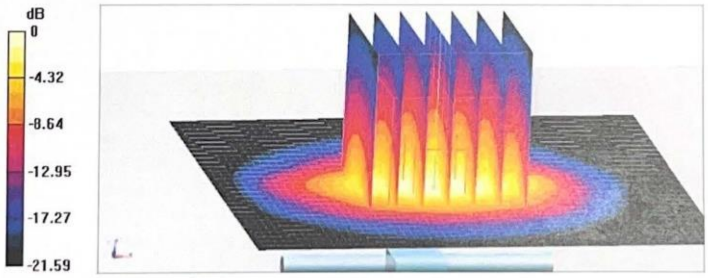
Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.16 W/kg

Smallest distance from peaks to all points 3 dB below = 9 mm

Ratio of SAR at M2 to SAR at M1 = 48.5%

Maximum value of SAR (measured) = 22.4 W/kg



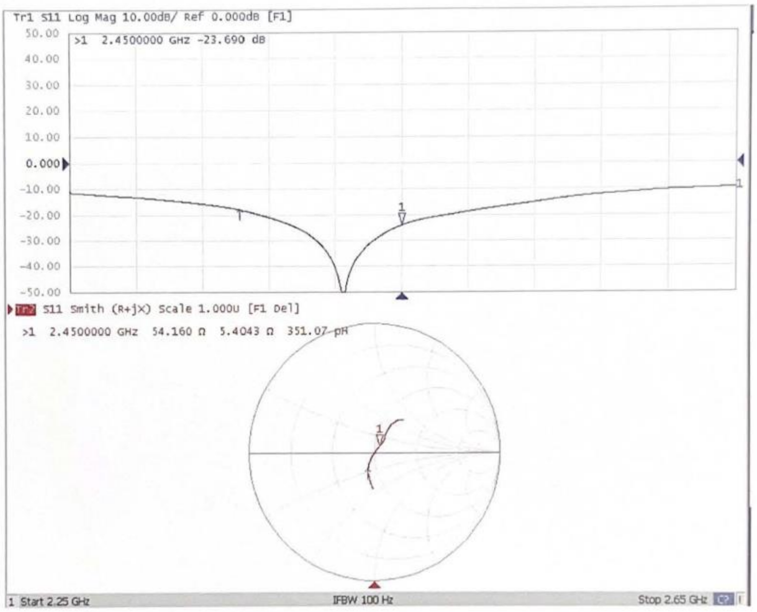
0 dB = 22.4 W/kg = 13.50 dBW/kg

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

Impedance Measurement Plot for Head TSL



TTL In Collaboration with speag CALIBRATION LABORATORY

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

ilac-MRA CNAS 中国认可 国际互认 校准 CALIBRATION CNAS L0570 CAICT

Client audix Certificate No: J23Z60245

CALIBRATION CERTIFICATE

Object: D5GHzV2 - SN: 1102

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

Calibration date: May 19, 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	106277	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Power sensor NRP8S	104291	22-Sep-22 (CTTL, No.J22X09561)	Sep-23
Reference Probe EX3DV4	SN 3617	31-Mar-23(CTTL-SPEAG,No.Z23-60161)	Mar-24
DAE4	SN 1556	11-Jan-23(CTTL-SPEAG,No.Z23-60034)	Jan-24

Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	05-Jan-23 (CTTL, No. J23X00107)	Jan-24
NetworkAnalyzer E5071C	MY46110673	10-Jan-23 (CTTL, No. J23X00104)	Jan-24

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

Issued: May 25, 2023

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

Measurement Conditions

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

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

Head TSL parameters at 5250MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.7 ± 6 %	4.73 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.88 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.7 W/kg ± 24.4 % (*k*=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 24.2 % (*k*=2)**

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

Head TSL parameters at 5600MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.1 ± 6 %	5.11 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**81.8 W/kg ± 24.4 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.1 W/kg ± 24.2 % (*k*=2)**

Head TSL parameters at 5750MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.9 ± 6 %	5.28 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.75 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.3 W/kg ± 24.4 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.6 W/kg ± 24.2 % (*k*=2)**

TTL In Collaboration with s p e a g CALIBRATION LABORATORY

CAICT

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

Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250MHz

Impedance, transformed to feed point	50.4Ω- 4.07jΩ
Return Loss	- 27.8dB

Antenna Parameters with Head TSL at 5600MHz

Impedance, transformed to feed point	56.8Ω+ 0.61jΩ
Return Loss	- 23.9dB

Antenna Parameters with Head TSL at 5750MHz

Impedance, transformed to feed point	52.5Ω+ 1.21jΩ
Return Loss	- 31.2dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.115 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

DASY5 Validation Report for Head TSL Date: 2023-05-19

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1102

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

Medium parameters used: f = 5250 MHz; σ = 4.73 S/m; ε_r = 35.7; ρ = 1000 kg/m³

Medium parameters used: f = 5600 MHz; σ = 5.112 S/m; ε_r = 35.1; ρ = 1000 kg/m³

Medium parameters used: f = 5750 MHz; σ = 5.277 S/m; ε_r = 34.88; ρ = 1000 kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(5.5, 5.5, 5.5) @ 5250 MHz; ConvF(5.01, 5.01, 5.01) @ 5600 MHz; ConvF(5.15, 5.15, 5.15) @ 5750 MHz; Calibrated: 2023-03-31
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2023-01-11
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- DASY52 52.10.4(1535); SEMCAD X 14.6.14(7501)

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

Reference Value = 50.36 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 32.0 W/kg

SAR(1 g) = 7.88 W/kg; SAR(10 g) = 2.23 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 64.8%

Maximum value of SAR (measured) = 18.3 W/kg

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

Reference Value = 50.96 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 36.3 W/kg

SAR(1 g) = 8.2 W/kg; SAR(10 g) = 2.32 W/kg

Smallest distance from peaks to all points 3 dB below = 7.4 mm

Ratio of SAR at M2 to SAR at M1 = 61.6%

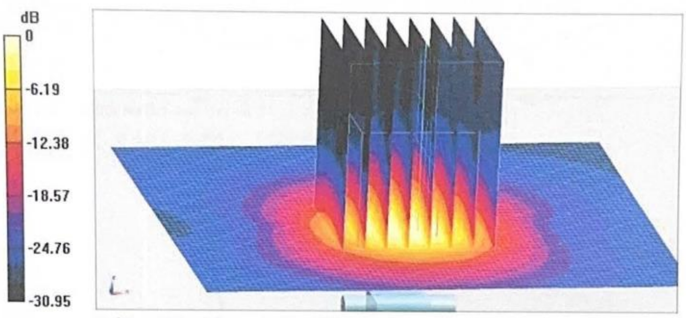
Maximum value of SAR (measured) = 19.6 W/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 49.04 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 35.9 W/kg
SAR(1 g) = 7.75 W/kg; SAR(10 g) = 2.17 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 60.5%
Maximum value of SAR (measured) = 19.0 W/kg



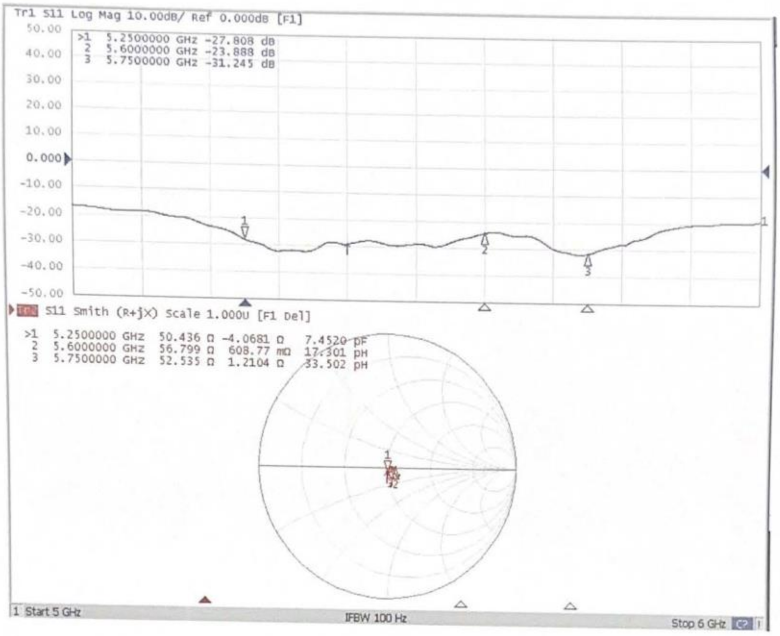
0 dB = 19.0 W/kg = 12.79 dBW/kg

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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

Impedance Measurement Plot for Head TSL



*****END OF REPORT*****