



TEST REPORT

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FCC ID: 2BBGF-W541
Trademark: COROS
Model Number: W541
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IEEE 1528-2013 & Published RF Exposure KDB Procedures
Test Results PASS
Remark: This is SAR test report.
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1. Version

Report No.	Issue Date	Description	Approved
CTB25071300229RH04	Aug. 21, 2025	Original	Valid

2. PRODUCT INFORMATION AND TEST SETUP

2.1 Product Information

Model(s):	W541
Model Description:	N/A
Bluetooth Version:	Bluetooth 5.4
Wi-Fi Specification:	WIFI(2.4G): IEEE 802.11b/g/n/ax
Hardware Version:	V4.1
Software Version:	V3.0702
Operation Frequency:	WiFi: IEEE 802.11b/g/n/ax20: 2412-2462MHz/ 11 channel Bluetooth: 2402-2480MHz
Max. RF output power:	WiFi (2.4G): 22.144dBm Bluetooth BLE: 1M: 6.954dBm 2M: 7.487dBm Bluetooth EDR: 6.399dBm
Max.SAR:	0.74 W/Kg 1g Front of face 0.52 W/Kg 10g Wrist-worn
Type of Modulation:	WiFi (2.4G): DSSS, OFDM, OFDMA Bluetooth BLE: GFSK Bluetooth EDR: GFSK, $\pi/4$ DQPSK, 8DPSK
Antenna installation:	Loop antenna
Antenna Gain:	WiFi (2.4G): -4.2dBi Bluetooth BLE: -4.2dBi Bluetooth EDR: -4.2dBi
Ratings:	DC 5V charging from adapter DC 3.91V by battery

3 Equipment Used during Test

3.1 Equipment List

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Date	Calibration Due
Data acquisition electronics	SPEAG	DAE4	913	2025/6/26	2026/6/25
Dosimetric E-field Probes	SPEAG	EX3DV4	7350	2024/12/19	2025/12/18
SAR test software	SPEAG	DASY 52	52.10.3.1513	/	/
Dipole	SPEAG	D2450V2	801	2022/9/19	2025/9/18
Communication test set	R&S	CMW500	102698	2025/5/22	2026/5/21
Network analyzer	R&S	ZVB 8	100348	2025/5/22	2026/5/21
Dielectric Assessment Kit	SPEAG	DAK-3.5	3.0.0.26	/	/
power meter	Agilent	E4419B	GB42421440	2025/5/22	2026/5/21
MXA signal analyzer	Agilent	N5181A	MY49060920	2025/5/22	2026/5/21
RF Power Meter	Agilent	E9301A	MY41495675	2025/5/23	2026/5/22
Amplifier 300-4200MHz	SHW	SHWPA-00300420P30 40-S	22110401	2025/5/23	2026/5/22
Amplifier 2-6GHz	SHW	SHWPA-02000600P30 40-S	24072501	2025/5/23	2026/5/22
Thermometer and Hygrometer	SMART SENSOR	AR867	/	2025/6/3	2026/6/2
Phantom(S)	SPEAG	SAM 1	TP-1119	/	/

3.2 Test Equipment Calibration

All the test equipments used are valid and calibrated by CEPREI Certification Body that address is No.110 Dongguan Zhuang RD. Guangzhou, P.R.China.

FCC Test Firm Registration Number: CN1276

4 SAR Introduction

4.1 Introduction

This measurement report shows compliance of the EUT with ANSI/IEEE C95.1-2006 and FCC 47 CFR Part2 (2.1093).The test procedures, as described in IEEE 1528-2013 Standard for IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques(300MHz~6GHz) and Published RF Exposure KDB Procedures

4.2 SAR Definition

- ▶ SAR : Specific Absorption Rate
- ▶ The SAR characterize the absorption of energy by a quantity of tissue
- ▶ This is related to a increase of the temperature of these tissues during a time period.

$$DAS = \frac{d}{dt} \left(\frac{dW}{dm} \right) = \frac{d}{dt} \left(\frac{dW}{\rho dV} \right)$$

$$DAS = \frac{\sigma E^2}{\rho}$$

$$DAS = c_h \left. \frac{dT}{dt} \right|_{t=0}$$

SAR definition

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

▶ SAR : Specific Absorption Rate

- σ : Liquid conductivity

$$\circ \epsilon_r = \epsilon' - j\epsilon'' \text{ (complex permittivity of liquid)}$$

$$\circ \sigma = \frac{\epsilon'' \omega}{\epsilon_0}$$

- ρ : Liquid density

$$\circ \rho = 1000 \text{ g/L} = 1000 \text{ Kg/m}^3$$

where:

σ = conductivity of the tissue (S/m)
 ρ = mass density of the tissue (kg/m³)
 E = rms electric field strength (V/m)

5.2 DASY5 E-field Probe System

The SAR measurements were conducted with the dosimetric probe EX3DV4 (manufactured by SPEAG), designed in the classical triangular configuration and optimized for dosimetric evaluation.

5.3 Probe Specification

Construction Symmetrical design with triangular core

Interleaved sensors

Built-in shielding against static charges

PEEK enclosure material (resistant to organic solvents, e.g., DGBE)

Calibration ISO/IEC 17025 calibration service available.

Frequency 4 MHz – 10 GHz

Linearity: ± 0.2 dB (30 MHz – 10 GHz)

Directivity ± 0.1 dB in TSL (rotation around probe axis)

± 0.3 dB in TSL (rotation normal to probe axis)

Dynamic Range 10 μ W/g – >100 W/kg

Linearity: ± 0.2 dB (noise: typically <1 μ W/g)

Dimensions Overall length: 337 mm (tip: 20 mm)
Tip diameter: 2.5 mm (body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm

Application General dosimetry up to 10 GHz
Dosimetry in strong gradient fields
Compliance tests of Mobile Phones

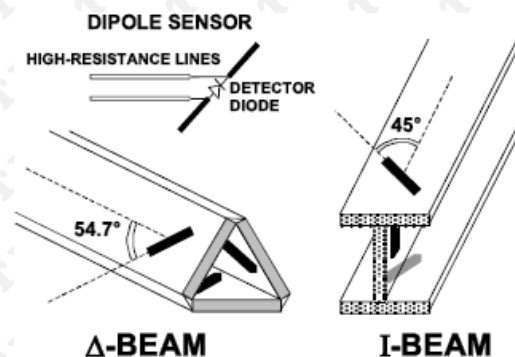
Compatibility DASY3, DASY4, DASY52 SAR and higher, EASY4/MRI



5.4 Isotropic E-Field Probe

The isotropic E-Field probe has been fully calibrated and assessed for isotropicity, and boundary effect within a controlled environment. Depending on the frequency for which the probe is calibrated the method utilized for calibration will change.

The E-Field probe utilizes a triangular sensor arrangement as detailed in the diagram below:



5.5 Phantoms

The phantom used for all tests i.e. for both system checks and device testing, was the twin-headed "SAM Phantom", manufactured by SPEAG. The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region, where shell thickness increases to 6mm).

System checking was performed using the flat section, whilst Head SAR tests used the left and right head profile sections. Body SAR testing also used the flat section between the head profiles.



SAM Twin Phantom

5.6 Device Holder

The device was placed in the device holder (illustrated below) that is supplied by SPEAG as an integral part of the DASY system.

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



Device holder supplied by SPEAG

6 SAR Test Procedure

6.1 Scanning Procedure

The DASY5 installation includes predefined files with recommended procedures for measurements and validation. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.

The “reference” and “drift” measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT's output power and should vary max. $\pm 5\%$.

The “surface check” measurement tests the optical surface detection system of the DASY5 system by repeatedly detecting the surface with the optical and mechanical surface detector and comparing the results. The output gives the detecting heights of both systems, the difference between the two systems and the standard deviation of the detection repeatability. Air bubbles or refraction in the liquid due to separation of the sugar-water mixture gives poor repeatability (above $\pm 0.1\text{mm}$). To prevent wrong results tests are only executed when the liquid is free of air bubbles. The difference between the optical surface detection and the actual surface depends on the probe and is specified with each probe (It does not depend on the surface reflectivity or the probe angle to the surface within $\pm 30^\circ$.)

Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values before running a detailed measurement around the hot spot. Before starting the area scan a grid spacing of $15\text{ mm} \times 15\text{ mm}$ is set. During the scan the distance of the probe to the phantom remains unchanged. After finishing area scan, the field maxima within a range of 2 dB will be ascertained.

Zoom Scan

Zoom Scans are used to estimate the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. The default Zoom Scan is done by $7 \times 7 \times 5$ points within a cube whose base is centered around the maxima found in the preceding area scan.

Spatial Peak Detection

The procedure for spatial peak SAR evaluation has been implemented and can determine values of masses of 1g and 10g, as well as for user-specific masses. The DASY5 system allows evaluations that combine measured data and robot positions, such as: • maximum search • extrapolation • boundary correction • peak search for averaged SAR. During a maximum search, global and local maxima searches are automatically performed in 2-D after each Area Scan measurement with at least 6 measurement points. It is based on the evaluation of the local SAR gradient calculated by the Quadratic Shepard's method. The algorithm will find the global maximum and all local maxima within -2 dB of the global maxima for all SAR distributions.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation.

Extrapolation routines require at least 10 measurement points in 3-D space. They are used in the Zoom Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the modified Quadratic Shepard's method for extrapolation. For a grid using $7 \times 7 \times 5$ measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1g and 10g cubes.

A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube $7 \times 7 \times 5$ scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 5mm steps.

Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4". The 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 incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation

The SEMCAD software 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:	Normi, ai0, ai1, ai2
	Conversion factor:	ConvFi
	Diode compression point:	Dcpi
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 DASY5 components. In the direct measuring mode of the multimeter 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:

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

Vi: compensated signal of channel (i = x, y, z) Ui: input signal of channel (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:

$$E - \text{fieldprobes : } E_i = \sqrt{\frac{V_i}{Norm_i \cdot ConvF}}$$

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

Vi: compensated signal of channel (i = x, y, z) Normi: sensor sensitivity of channel (i = x, y, z), [mV/(V/m)²] for E-field Probes ConvF: sensitivity enhancement in solution

aij: sensor sensitivity factors for H-field probes f: carrier frequency [GHz]

Ei: electric field strength of channel i in V/m Hi: magnetic field strength of channel i in A/m

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

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

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

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1'000}$$

SAR: local specific absorption rate in W/kg E_{tot} :

σ : conductivity in [mho/m] or [Siemens/m] ρ :

total field strength in V/m

equivalent tissue density in g/cm³

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid.

6.2 Extrapolation

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at different distances are necessary for the extrapolation. They are used in the Cube Scan to obtain SAR values between the lowest measurement points and the inner phantom surface. The routine uses the fourth order least square polynomial method for extrapolation. For a grid using 5x5x7 measurement points with 5mm resolution amounting to 343 measurement points, the uncertainty of the extrapolation routines is less than 1% for 1 g and 10 g cubes.

6.3 Test Position – Body Configurations

6.1.4.10 Limb-worn device

A limb-worn device is a unit whose intended use includes being strapped to the arm or leg of the user while transmitting (except in idle mode). It is similar to a body-worn device. Therefore, the test positions of 6.1.4.4 also apply. The strap shall be opened so that it is divided into two parts as shown in Figure 10. The device shall be positioned directly against the phantom surface with the strap straightened as much as possible and the back of the device towards the phantom.

If the strap cannot normally be opened to allow placing in direct contact with the phantom surface, it may be necessary to break the strap of the device but ensuring to not damage the antenna.

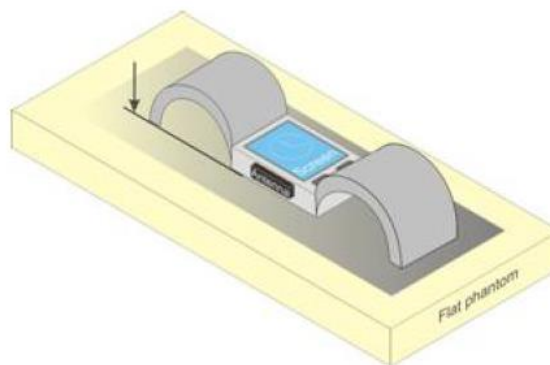


Figure 10 – Test position for limb-worn devices

7 Exposure limit

In order for users to be aware of the body-worn operating requirements for meeting RF exposure compliance, operating instructions and cautions statements are included in the user's manual.

7.1 Uncontrolled Environment

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. The general population/uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity.

7.2 Controlled Environment

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation). In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means.

Table 8.1 Human Exposure Limits

	UNCONTROLLED ENVIRONMENT General Population (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT Professional Population (W/kg) or (mW/g)
SPATIAL PEAK SAR ¹ Brain	1.60	8.00
SPATIAL AVERAGE SAR ² Whole Body	0.08	0.40
SPATIAL PEAK SAR ³ Hands, Feet, Ankles, Wrists	4.00	20.00

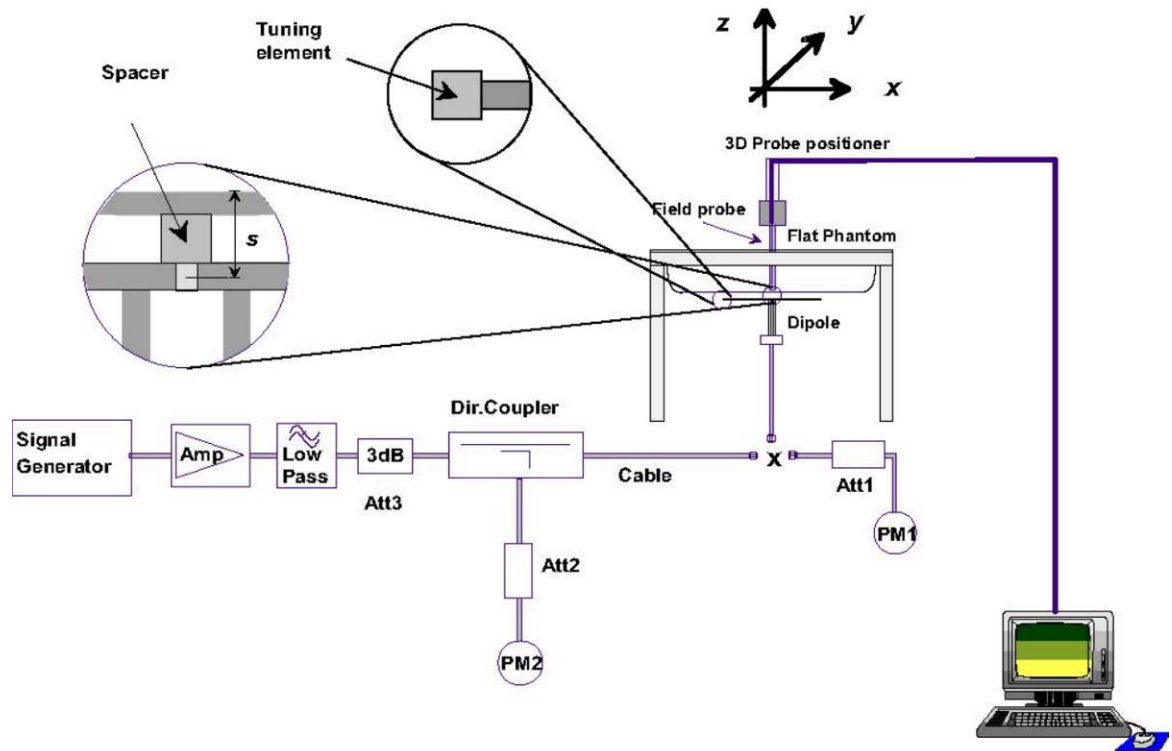
¹ The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

² The Spatial Average value of the SAR averaged over the whole body.

³ The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

8 System and liquid validation

8.1 System validation



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.

In the simplified setup for system evaluation, the DUT 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:

1. Signal Generator
2. Amplifier
3. Directional Coupler
4. Power Meter
5. Calibrated Dipole

The output power on dipole port must be calibrated to 30 dBm (1000 mW) before dipole is connected.

Numerical reference SAR values (W/kg) for reference dipole and flat phantom

Frequency (MHz)	1g SAR	10g SAR	Local SAR at surface(above feed-point)	Local SAR at surface(y = 2 cm offset from feedpoint)
300	3.02	2.04	4.40	2.10
450	4.92	3.28	7.20	3.20
750	8.49	5.55	12.6	4.59
835	9.56	6.22	14.1	4.90
900	10.9	6.99	16.4	5.40
1450	29.0	16.0	50.2	6.50
1800	38.4	20.1	69.5	6.80
1900	39.7	20.5	72.1	6.60
2000	41.1	21.1	74.6	6.50
2450	52.4	24.0	104	7.70
2600	55.3	24.6	113	8.29
3000	63.8	25.7	140	9.50

Table 1: system validation (10g/1g)

Measurement Date	Frequency (MHz)	Liquid Type (head/body)	Target SAR10g (W/kg)	Measured SAR10g (W/kg)	Normalized SAR10g (W/kg)	Deviation (±10%)
2025.7.31	2450	head	24.4	5.83	23.32	-4.43
Measurement Date	Frequency (MHz)	Liquid Type (head/body)	Target SAR1g (W/kg)	Measured SAR1g (W/kg)	Normalized SAR1g (W/kg)	Deviation (±10%)
2025.7.31	2450	head	52.0	13.62	54.48	4.77

Note: Below 5GHz, system check input power is 250mW.

8.2 liquid validation

The dielectric parameters were checked prior to assessment using the HP85070C dielectric probe kit. The dielectric parameters measured are reported in each correspondent section.

KDB 865664 recommended Tissue Dielectric Parameters

The head and body tissue parameters given in this below table should be used to measure the SAR of transmitters operating in 100 MHz to 6 GHz frequency range. The tissue dielectric parameters of the tissue medium at the test frequency should be within the tolerance required in this document. The dielectric parameters should be linearly interpolated between the closest pair of target frequencies to determine the applicable dielectric parameters corresponding to the device test frequency.

The head tissue dielectric parameters recommended by IEEE Std 1528-2013 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in 1528 are derived from tissue dielectric parameters computed from the 4-Cole-Cole equations described above and extrapolated according to the head parameters specified in 1528.

Target Frequency	Head/Body Tissue	
MHz	ϵ_r	σ (S/m)
150	52.3	0.76
300	45.3	0.87
450	43.5	0.87
835	41.5	0.90
900	41.5	0.97
915	41.5	0.98
1450	40.5	1.20
1610	40.3	1.29
1800-2000	40.0	1.40
2450	39.2	1.80
2600	39.0	1.96
3000	38.5	2.40
5800	35.3	5.27

8.3 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness Power drifts in a human head.

Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Table 2: Recommended Dielectric Performance of Tissue

Recommended Dielectric Performance of Tissue												
Ingredients (% by weight)	Frequency (MHz)											
	750		835		1800		1900		2450		2600	
Tissue	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body	Head	Body
Water	40.52	51.83	41.45	52.4	55.2	70.2	54.9	40.4	62.7	73.2	54.8	68.1
Salt (NaCl)	1.61	1.52	1.45	1.4	0.3	0.4	0.18	0.5	0.5	0.04	0.1	0.01
Sugar	57.67	46.45	56.0	45.0	0.0	0.0	0.0	58.0	0.0	0.0	0.0	0.0
HEC	0.1	0.1	1.0	1.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0
Bactericide	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0
Triton x-100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	36.8	0.0	0.0	0.0
DGBE	0.0	0.0	0.0	0.0	44.5	29.4	44.92	0.0	0.0	26.7	45.1	31.8
Dielectric	40.93	54.32	42.54	56.1	40.0	53.3	39.9	54.0	39.8	52.5	39.0	52.5
Conductivity	0.87	0.95	0.91	0.95	1.40	1.52	1.42	1.45	1.88	1.78	1.96	2.15

Table 3: Dielectric Performance of Head Tissue Simulating Liquid

Temperature: <u>21</u> °C , Relative humidity: <u>57</u> % ,				
Liquid type/ Band(MHz)	Measured Date	Description	Dielectric Parameters	
			ϵ_r	$\sigma(\text{s/m})$
2450	2025.7.31	Target Value $\pm 5\%$ window	39.2 37.24 — 41.16	1.80 1.71 — 1.89
		Measurement Value	38.674	1.743

9 System Verification Plots

Date/Time: 2025/7/31 9:22:49

System Check-2450

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2; Serial: D2450V2 - SN:801

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.743$ S/m; $\epsilon_r = 38.674$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

Probe: EX3DV4 - SN7350; ConvF(7.25, 7.25, 7.39) @ 2450 MHz; Calibrated: 2024/12/19

Modulation Compensation:

Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 2.0, 32.0$

Electronics: DAE4 Sn913; Calibrated: 2025/6/26

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1119

DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

System Performance Check at 2450MHz/d=5mm, Pin=250mW, dist=4.0mm (ES-Probe)/Area Scan (7x7x1):

Measurement grid: dx=10 mm, dy=10 mm

Maximum value of SAR (interpolated) = 17.108 W/kg

System Performance Check at 2450MHz/d=5mm, Pin=250mW, dist=4.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 94.67 V/m; Power Drift = -0.10 dB

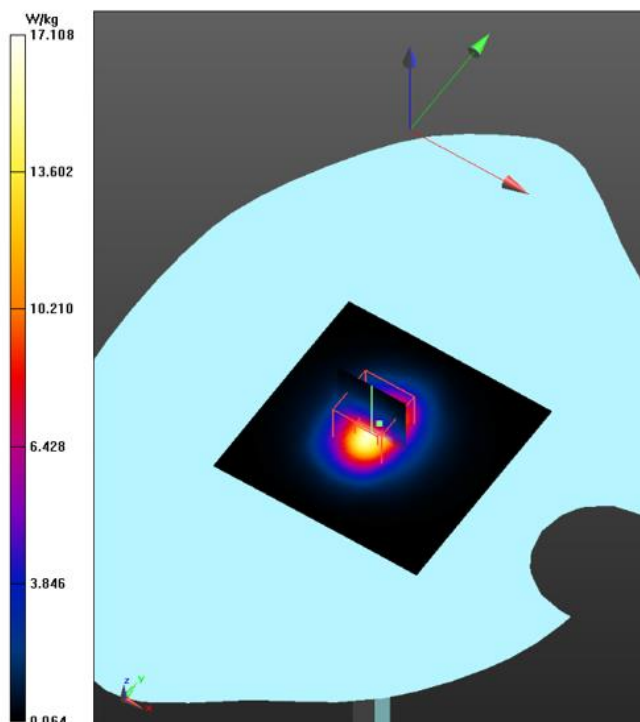
Peak SAR (extrapolated) = 31.7 W/kg

SAR(1 g) = 13.62 W/kg; SAR(10 g) = 5.83 W/kg

Smallest distance from peaks to all points 3 dB below = 10.1 mm

Ratio of SAR at M2 to SAR at M1 = 48.8%

Maximum value of SAR (measured) = 17.5 W/kg



10 Type a Measurement Uncertainty

The component of uncertainty may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainty by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table below :

Uncertainty Distribution	Normal	Rectangle	Triangular	U Shape
Multi-plying Factor(a)	$1/k(b)$	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) k is the coverage factor

Standard Uncertainty for Assumed Distribution

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B -sum- by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %.

The COMOSAR Uncertainty Budget is show in below table:

DASY5 Uncertainty Measurement uncertainty for 300MHz to 3GHz averaged over 1 gram/ 10 gram								
Error Description	Uncert. value	Prob. Dist.	Div.	(ci) 1g	(ci) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(vi) vef f
Measurement System								
Probe Calibration	±6.0 %	N	1	1	1	±6.0 %	±6.0 %	∞
Axial Isotropy	±4.7 %	R	√3	0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	√3	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	√3	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	√3	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	√3	1	1	±0.6 %	±0.6 %	∞
Modulation Responsem	±2.4 %	R	√3	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	√3	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	√3	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	√3	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	√3	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	√3	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	√3	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±2.0 %	R	√3	1	1	±1.2 %	±1.2 %	∞
Test Sample Related								
Device Positioning	±2.9 %	N	1	1	1	±2.9 %	±2.9 %	145
Device Holder	±3.6 %	N	1	1	1	±3.6 %	±3.6 %	5
Power Drift	±5.0 %	R	√3	1	1	±2.9 %	±2.9 %	∞
Power Scalingp	±0 %	R	√3	1	1	±0.0 %	±0.0 %	∞
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	√3	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	√3	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)DAK	±2.5 %	R	√3	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.) DAK	±2.5 %	R	√3	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity BB	±3.4 %	R	√3	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity BB	±0.4 %	R	√3	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±11.2 %	±11.1 %	361
Expanded STD Uncertainty						±22.3 %	±22.2 %	

11 Output Power Verification

11.1 Test Condition:

1. Conducted Measurement
EUT was set for low, mid, high channel with modulated mode and highest RF output power.
The base station simulator was connected to the antenna terminal.
2. Conducted Emissions Measurement Uncertainty
All test measurements carried out are traceable to national standards. The uncertainty of the measurement at a confidence level of approximately 95% (in the case where distributions are normal), with a coverage factor of 2, in the range 30MHz – 40GHz is $\pm 1.5\text{dB}$.
3. Environmental Conditions

Temperature	23°C
Relative Humidity	53%
Atmospheric Pressure	1019mbar
4. Tested By : Martin Feng

11.2 Test Procedures:

Mobile Phone radio output power measurement

1. The transmitter output port was connected to base station emulator.
2. Establish communication link between emulator and EUT and set EUT to operate at maximum output power all the time.
3. Select lowest, middle, and highest channels for each band and different possible test mode.
4. Measure the conducted peak burst power and conducted average burst power from EUT antenna port.

Test Result:

WIFI Mode (2.4G)

Mode	Channel number	Frequency (MHz)	Data rate(Mbps)	Average Output Power(dBm)	Average Tune up limited(dBm)
802.11b	1	2412	1	22.144	22.0±1
	6	2437	1	21.583	21.0±1
	11	2462	1	20.687	20.0±1
802.11g	1	2412	6	21.758	21.0±1
	6	2437	6	21.143	21.0±1
	11	2462	6	20.302	20.0±1
802.11n(HT20)	1	2412	MCS0	21.581	21.0±1
	6	2437	MCS0	21.166	21.0±1
	11	2462	MCS0	20.436	20.0±1
802.11ax20	1	2412	MCS0	19.369	19.0±1
	6	2437	MCS0	18.855	18.0±1
	11	2462	MCS0	18.059	18.0±1

Bluetooth Measurement Result

Mode	Frequency (MHz)	Average Output Power(dBm)	Tune up limited(dBm)
GFSK	2402	5.101	5.0±1
	2441	4.743	4.0±1
	2480	4.987	4.0±1
$\pi/4$ DQPSK	2402	5.994	5.0±1
	2441	5.31	5.0±1
	2480	5.665	5.0±1
8DPSK	2402	6.399	6.0±1
	2441	5.943	5.0±1
	2480	5.919	5.0±1

BLE 1M Measurement Result

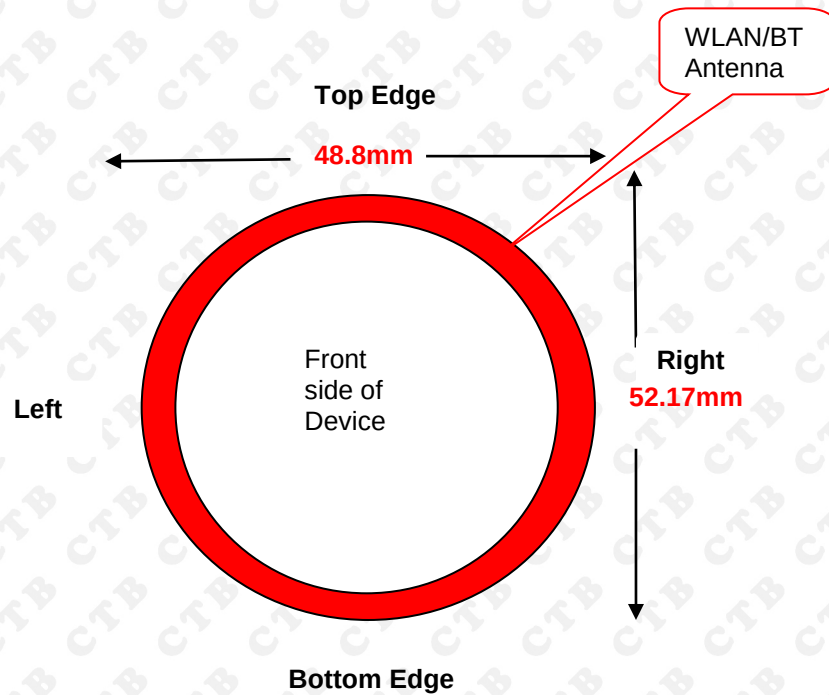
Channel number	Frequency (MHz)	Average Output Power(dBm)	Tune up limited(dBm)
0	2402	6.954	6.0±1
19	2440	6.344	6.0±1
39	2480	4.879	4.0±1

BLE 2M Measurement Result

Channel number	Frequency (MHz)	Average Output Power(dBm)	Tune up limited(dBm)
0	2402	7.487	7.0±1
19	2440	6.742	6.0±1
39	2480	5.41	5.0±1

12 Exposure Conditions Consideration

EUT antenna location:



Note:

1. Per KDB 447498 D01 General RF Exposure Guidance v06, 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 required 1-g SAR and the wrist-worn condition required 10-g extremity SAR.

13 RF Exposure

Standard Requirement:

According to §15.247 (i) and §1.1307(b)(1), systems operating under the provisions of this section shall be operated in a manner that ensures that the public is not exposed to radio frequency energy level in excess of the Commission's guidelines.

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:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f_{\text{GHz}}}] \leq 3.0 \text{ for 1-g SAR and } \leq 7.5 \text{ for 10-g extremity SAR,}^{16} \text{ where}$$

- f_{GHz} is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation¹⁷
- The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum *test separation distance* is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum *test separation distance* is < 5 mm, a distance of 5 mm is applied to determine SAR test exclusion.

Routine SAR evaluation refers to that specifically required by § 2.1093, using measurements or computer simulation. When routine SAR evaluation is not required, portable transmitters with output power greater than the applicable low threshold require SAR evaluation to qualify for TCB approval.

$$\text{Exclusion Thresholds} = P\sqrt{F} / D$$

P= Maximum turn-up power in mW

F= Channel frequency in GHz

D= Minimum test separation distance in mm

Test Distance (10mm)

Mode	MAX Power (dBm)	Tune Up Power (dBm)	Max Tune Up Power (dBm)	Max Tune Up Power (mW)	Exclusion Thresholds	Limit
2.4G WIFI 2412	22.144	22.0±1	23	199.53	30.99	3
Bluetooth 2402	6.399	6.0±1	7	5.01	0.78	3
BLE 2402	7.487	7.0±1	8	6.31	0.98	3

Test Distance (0mm)

Mode	MAX Power (dBm)	Tune Up Power (dBm)	Max Tune Up Power (dBm)	Max Tune Up Power (mW)	Exclusion Thresholds	Limit
2.4G WIFI 2412	22.144	22.0±1	23	199.53	61.98	7.5
Bluetooth 2402	6.399	6.0±1	7	5.01	1.55	7.5
BLE 2402	7.487	7.0±1	8	6.31	1.96	7.5

Result: BT SAR measurement is not required. 2.4G WIFI SAR measurement is required.

14 SAR Test Results

14.1 Test Condition:

1. SAR Measurement
The distance between the EUT and the antenna of the emulator is more than 50 cm and the output power radiated from the emulator antenna is at least 30 dB less than the output power of EUT.
2. Environmental Conditions

Temperature	23°C
Relative Humidity	57%
Atmospheric Pressure	1019mbar
3. Tested By : Martin Feng

14.2 Generally Test Procedures:

1. Establish communication link between EUT and base station emulation by air link.
2. Place the EUT in the selected test position. (Cheek, tilt or flat)
3. Perform SAR testing at middle or highest output power channel under the selected test mode. If the measured 1-g SAR is ≤ 0.8 W/kg, then testing for the other channel will not be performed.
4. When SAR is < 0.8 W/kg, no repeated SAR measurement is required

14.3 SAR Summary Test Result:

SAR Values of 2.4G WIFI

Test Plot	Test Mode	Test Positions	Channel	Power(dBm)		SAR 1g(W/Kg), Limit(1.6W/kg for front of face)		
				Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 1g(W/kg)	Scaling Factor	Scaled SAR 1g(W/kg)
1	DSSS	Front of face Distance: 10mm	Low	23	22.144	0.605	1.2178674	0.74

Note: Scaled SAR=SAR Value*10(0.1*Tune up Power-Conducted Power)

SAR Values of 2.4G WIFI

Test Plot	Test Mode	Test Positions	Channel	Power(dBm)		Limbs SAR 10g(W/Kg), Limit(4.0W/kg for Wrist-worn)		
				Maximum Turn-up Power(dBm)	Measured output power(dBm)	Measured SAR 10g(W/kg)	Scaling Factor	Scaled SAR 10g(W/kg)
2	DSSS	Wrist-worn Distance: 0mm	Low	23	22.144	0.431	1.2178674	0.52

Note: Scaled SAR=SAR Value*10(0.1*Tune up Power-Conducted Power)

14.4 Measurement variability consideration

Refer to FCC KDB 248227 section 5.2.1~5.2.2:

802.11b DSSS SAR Test Requirements:

SAR is measured for 2.4 GHz 802.11b DSSS using either a fixed test position or, when applicable, the initial test position procedure.

SAR test reduction is determined according to the following:

- 1) When the reported SAR of the highest measured maximum output power channel (section 3.1) for the exposure configuration is ≤ 0.8 W/kg,
no further SAR testing is required for 802.11b DSSS in that exposure configuration.
- 2) When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg,
SAR is required for the third channel; i.e., all channels require testing.

2.4 GHz 802.11g/n OFDM SAR Test Exclusion Requirements

When SAR measurement is required for 2.4 GHz 802.11g/n OFDM configurations, the measurement and test reduction procedures for OFDM are applied (section 5.3).

SAR is not required for the following 2.4 GHz OFDM conditions.

- 1) When KDB Publication 447498 SAR test exclusion applies to the OFDM configuration.
- 2) 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.

Note: 802.11b DSSS SAR test is required. The highest reported SAR for DSSS* the ratio of OFDM to DSSS(Max output power) is $0.74 \times 0.915 = 0.6771$ W/Kg < 1.2 W/Kg. so the OFDM SAR test is not required.

14.5 Repeated SAR

According to KDB 865664 D01v01r04 section 2.8.1, repeated measurements are required following the procedures as below:

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

When the original highest measured SAR is $\geq 0.80 \text{ W/kg}$, repeat that measurement once.

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 $\geq 1.45 \text{ W/kg}$ (~ 10% from the 1-g SAR limit).

Perform a third repeated measurement only if the original, first or second repeated measurement is $\geq 1.5 \text{ W/kg}$ and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20 .

No Repeated SAR:

14.6 Simultaneous Transmission SAR Analysis.

NO Simultaneous Transmission SAR Analysis.

Remark:

1. WLAN and Bluetooth share the same antenna, and cannot transmit simultaneously.

15 SAR Measurement Reference

References

1. FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules and Regulations”
2. IEEE Std. C95.1-2005, “IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3kHz to 300GHz”, 2005
3. IEEE Std. 1528-2013, “IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques”, June 2013
4. IEC 62209-2, “Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices—Human models, instrumentation, and procedures – Part 2: Procedure to determine the specific absorption rate(SAR) for wireless communication devices used in close proximity to the human body(frequency range of 30MHz to 6GHz)”, April 2010
5. FCC KDB 447498 D01 v06, “Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies”, Oct 23th, 2015
6. FCC KDB 941225 D06 v02r01, “SAR Evaluation Procedures for Portable Devices with Wireless Router Capabilities”, Oct 23th, 2015
7. FCC KDB865664 D01 v01r04, “SAR Measurement Requirements 100MHz to 6GHz”, Aug 7th, 2015
8. FCC KDB865664 D02 v01r02, “RF Exposure Compliance Reporting and Documentation Considerations ”, Oct 23th, 2015
9. FCC KDB648474 D04 v01r03, “SAR Evaluation Considerations for Wireless Handsets”, Oct 23th, 2015
10. FCC KDB 248227 D01 v02r02, SAR Guidance for IEEE 802.11 (Wi-Fi) Transmitters, Oct 23th, 2015.

16 Maximum SAR measurement Plots

Plot 1

Date/Time: 2025/7/31 14:36:24

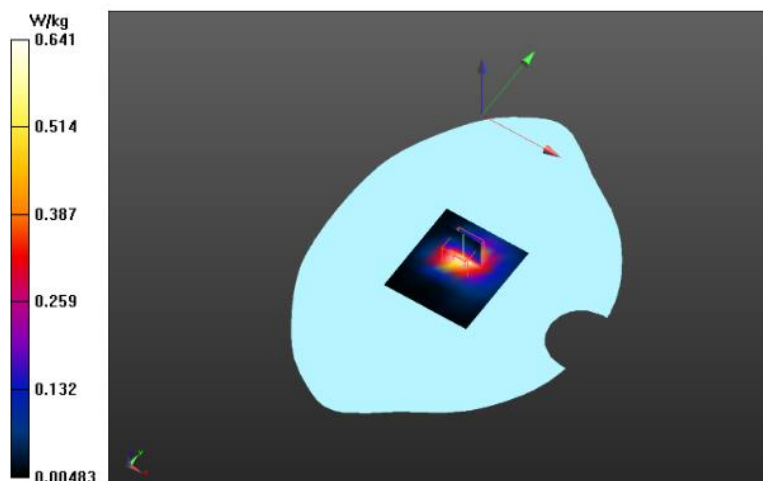
Communication System: UID 0, 2.4G WIFI (0); Communication System Band: 2.4G WIFI 11B; Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.838$ S/m; $\epsilon_r = 38.149$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

Probe: EX3DV4 - SN7350; ConvF(7.25, 7.25, 7.39) @ 2412 MHz; Calibrated: 2024/12/19
Modulation Compensation:
Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
Electronics: DAE4 Sn913; Calibrated: 2025/6/26
Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1119
DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Watch/Front/Area Scan (8x9x1): Measurement grid: $dx=10$ mm, $dy=10$ mm
Maximum value of SAR (measured) = 0.641 W/kg

Watch/Front/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 13.75 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 1.05 W/kg
SAR(1 g) = 0.605 W/kg; SAR(10 g) = 0.304 W/kg
Smallest distance from peaks to all points 3 dB below = 12.1 mm
Ratio of SAR at M2 to SAR at M1 = 56.8%
Maximum value of SAR (measured) = 0.685 W/kg



Plot 2

Date/Time: 2025/7/31 15:14:53

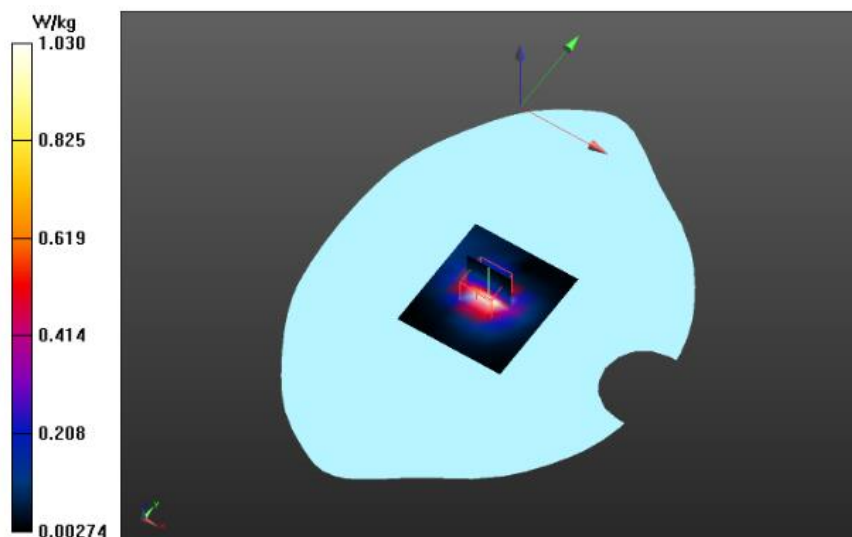
Communication System: UID 0, 2.4G WIFI (0); Communication System Band: 2.4G WIFI 11B; Frequency: 2412 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used (interpolated): $f = 2412$ MHz; $\sigma = 1.838$ S/m; $\epsilon_r = 38.149$; $\rho = 1000$ kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

Probe: EX3DV4 - SN7350; ConvF(7.25, 7.25, 7.39) @ 2412 MHz; Calibrated: 2024/12/19
Modulation Compensation:
Sensor-Surface: 4mm (Mechanical Surface Detection), $z = 1.0, 31.0$
Electronics: DAE4 Sn913; Calibrated: 2025/6/26
Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1119
DASY52 52.10.3(1513); SEMCAD X 14.6.13(7474)

Watch/Back/Area Scan (8x9x1): Measurement grid: $dx=10$ mm, $dy=10$ mm
Maximum value of SAR (measured) = 1.03 W/kg

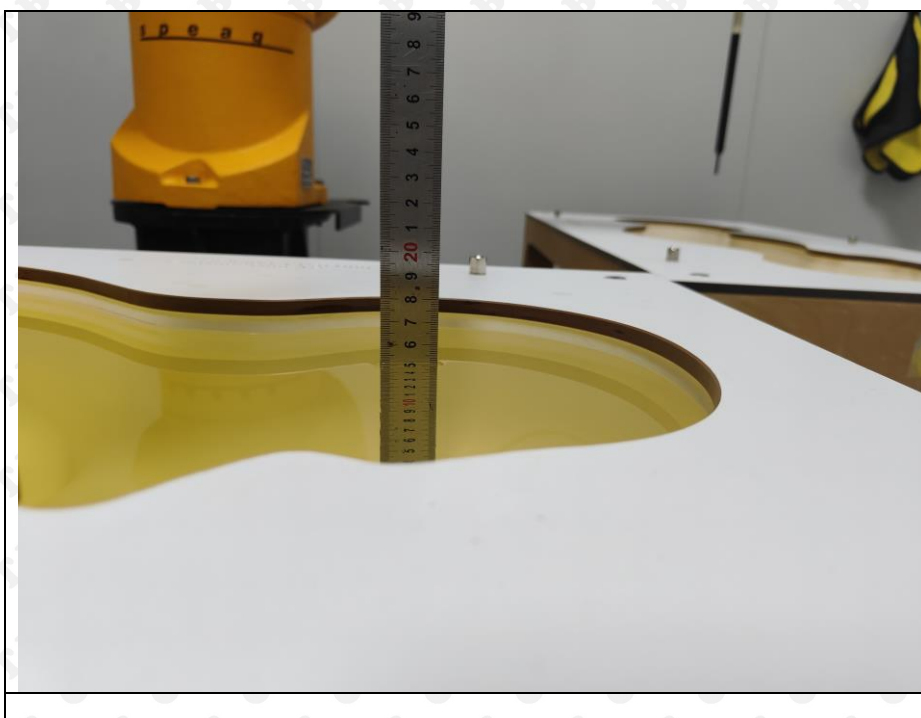
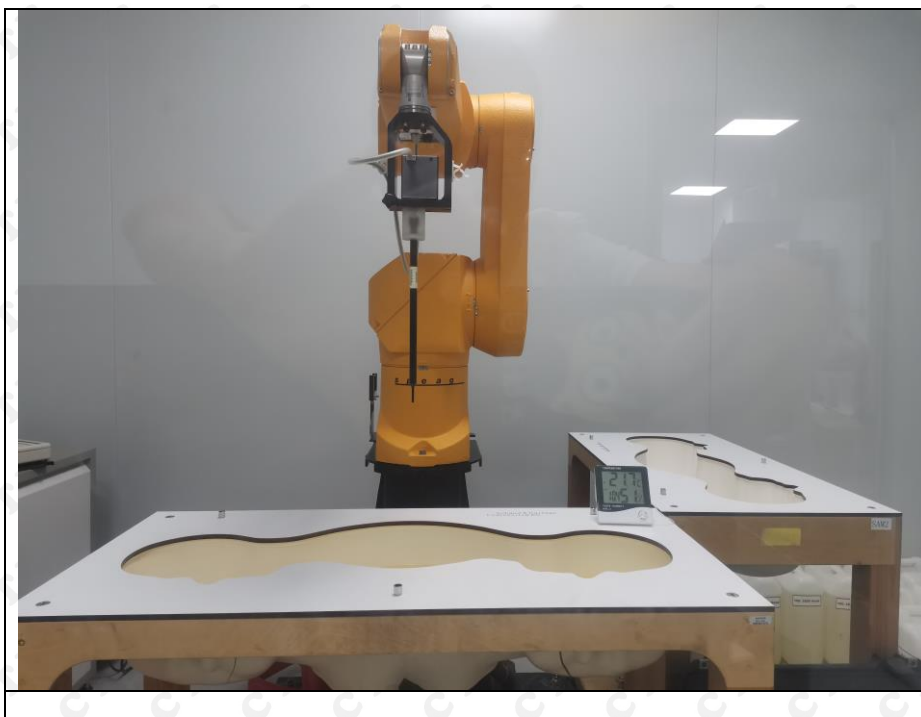
Watch/Back/Zoom Scan (7x7x7)/Cube 0: Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm
Reference Value = 23.21 V/m; Power Drift = 0.20 dB
Peak SAR (extrapolated) = 2.28 W/kg
SAR(1 g) = 0.992 W/kg; SAR(10 g) = 0.431 W/kg
Smallest distance from peaks to all points 3 dB below = 10.8 mm
Ratio of SAR at M2 to SAR at M1 = 47%
Maximum value of SAR (measured) = 1.14 W/kg



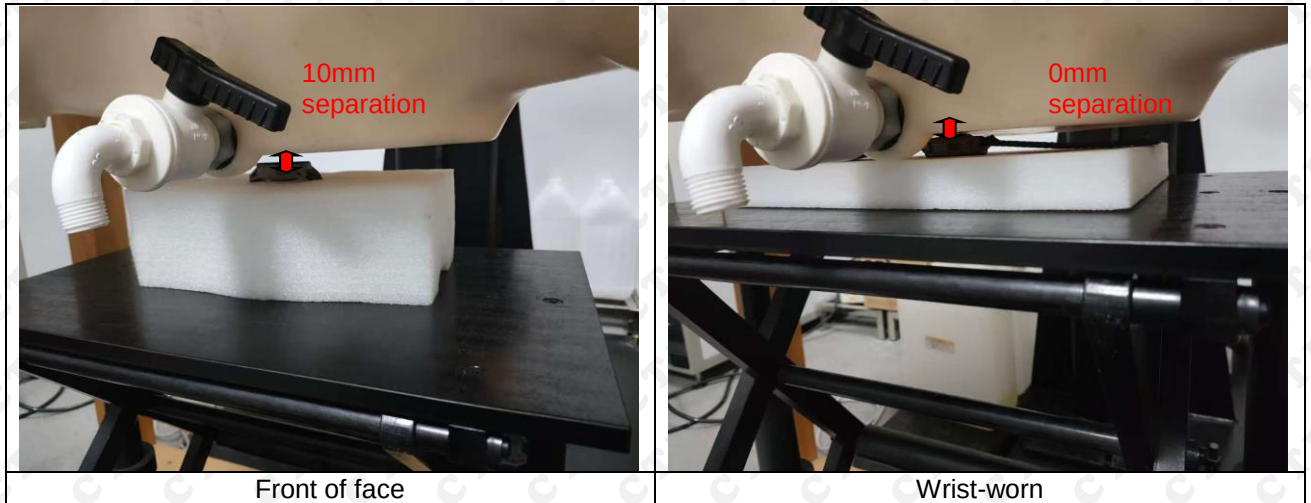
17 Calibration Reports-Probe and Dipole

The Probe, Dipole and DAE calibration please refer to the Attachment.

18 SAR System Photos



19 Setup Photo



20 EUT Photos
Front Side



Back Side



=====End of report=====