FCC SAR REPORT

Applicant: Autel Robotics Co., Ltd.

Address of Applicant: 18th Floor, Block C1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China

Equipment Under Test (EUT)

Product Name: Autel Smart Controller SE

Model No.: EF6

Trade mark: AUTEL ROBOTICS

FCC ID: 2AGNTEF6240958A

Applicable standards: FCC 47 CFR Part 2.1093

Date of Test: 28 Jun., 2022 ~ 03 Jul., 2022

Test Result: Maximum Reported 1-g SAR (W/kg)
Body: 0.638
Maximum Reported 10-g SAR (W/kg)
Limb: 0.962

Authorized Signature:

Bruce Zhang
Laboratory Manager

This report details the results of the testing carried out on one sample. The results contained in this test report do not relate to other samples of the same product and does not permit the use of the JYT product certification mark. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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2 Version

Version No.	Date	Description
00	*21 Jul., 2022*	*Original*

Tested by:	Vieta Zhang	***Date:***	*21 Jul., 2022*
	Test Engineer		
Reviewed by:	Janet. Wei	***Date:***	*21 Jul., 2022*
	Project Engineer		

3 Contents

4 SAR Results Summary

The maximum results of Specific Absorption Rate (SAR) found during test as bellows:

<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported 1-g SAR (W/kg)
Body (10mm gap)	WLAN 2.4GHz	0.491	DTS	0.638
	WLAN 5.8 GHz	0.638		
	Bluetooth	0.019		
	900MHz 16QAM	0.159		
	2.4GHz 16QAM	0.502		
	5.8GHz 16QAM	0.291		

Exposure Position	Frequency Band	Reported 10-g SAR (W/kg)	Equipment Class	Highest Reported 10-g SAR (W/kg)
Limb (0mm gap)	WLAN 2.4GHz	0.937	DTS	0.962
	WLAN 5.8 GHz	0.962		
	Bluetooth	0.035		
	900MHz 16QAM	0.157		
	2.4GHz 16QAM	0.479		
	5.8GHz 16QAM	0.218		

<Highest Reported simultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported Simultaneous Transmission 1-g SAR (W/kg)
Back	ANT 1 2.4GHz WIFI	0.638	DTS	1.586
	ANT 2 2.4GHz WIFI	0.446		
	ANT3 2.4GHz 16QAM	0.502		

Exposure Position	Frequency Band	Reported 10-g SAR (W/kg)	Equipment Class	Highest Reported Simultaneous Transmission 10-g SAR (W/kg)
Back	ANT 1 2.4GHz WIFI	0.830	DTS	2.246
	ANT 2 2.4GHz WIFI	0.937		
	ANT3 2.4GHz 16QAM	0.479		

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCC KDB 690783 D01 v01r03, and scalar SAR summation of all possible simultaneous transmission scenarios are < 1.6W/kg.
2. This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg@1g for body SAR and 4.0W/kg@10g for Limb SAR) 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.

5 General Information

5.1 Client Information

Applicant:	Autel Robotics Co., Ltd.
Address:	18th Floor, Block C1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China
Manufacturer:	Autel Robotics Co., Ltd.
Address:	18th Floor, Block C1, Nanshan iPark, No. 1001 Xueyuan Avenue, Nanshan District, Shenzhen, Guangdong, 518055, China
Factory:	Autel Robotics Co., Ltd.Guangming Branch
Address:	No.701, Jixie Factory, Building 4, Yanxiang Technology Industrial Park, Gaoxin Road, Dongzhou Community, Guangming street, Guangming district, Shenzhen, Guangdong, China

5.2 General Description of EUT

Product Name:	Autel Smart Controller SE		
Model No.:	EF6		
Category of device	Portable device		
Operation Frequency:	Wi-Fi:	2412MHz~2462MHz	5725MHz-5850MHz
	900MHz	904.0MHz~926.0MHz	
	2.4GHz	2403.5-2475.5MHz	
	5GHz	5728.0MHz~5847.0MHz	
Modulation technology:	Wi-Fi:	☒802.11b(DSSS)	☒802.11a/g/n/ac (OFDM)
	900MHz	☒QPSK	☒16QAM
	2.4GHz	☒QPSK	☒16QAM
	5GHz	☒QPSK	☒16QAM
Antenna Type:	Internal Antenna		
Antenna Gain:	906.0MHz~924.0MHz : 2.7dBi(declare by Applicant) 2403.5MHz~2475.5MHz: 1.1dBi(declare by Applicant) 5728.0MHz~5847.0MHz: 3.1 dBi ANT 1: 2.4G Wi-Fi: 1.1 dBi (declare by Applicant), ANT 2: 2.4G Wi-Fi: 1.9 dBi (declare by Applicant)i. ANT 1: 5.8G Wi-Fi: 3.6 dBi(declare by Applicant) ANT 2: 5.8G Wi-Fi: 3.1 dBi(declare by Applicant)		
Accessories information:	Model No.:RLC-537 Input: AC100-240V, 50/60Hz 0.85A Output:USB-C:5V, 3A; 9V, 3A; 12V, 2.5A USB-A:5V, 3A; 9V, 3A; 12V, 2.5A USB-A+ USB-C:5V, 3.4A	Battery: Rechargeable Li-ion Battery DC7.7V/1900mAh	

5.3 Maximum RF Output Power

ANT 1:

WLAN 2.4 GHz Band Average Power (dBm)				
Mode/Band	b	g	n (HT-20)	n (HT-40)
WLAN 2.4GHz	18.53	15.75	14.70	13.33

WLAN 5.8 GHz Band Average Power (dBm)						
Mode/Band	a	ac 20	ac 40	ac 80	n 20	n 40
WLAN 5.8GHz	16.01	15.75	15.79	15.48	15.85	15.78

Bluetooth Average Power (dBm)							
Mode/Band	1 Mbps (GFSK)	2 Mbps (π/4DQPSK)	3 Mbps (8DPSK)	BLE PHY 1M	BLE PHY 2M	BLE Coded PHY S=2	BLE Coded PHY S=8
Bluetooth	10.80	8.81	8.80	6.13	6.55	6.55	6.46

ANT 2:

WLAN 2.4 GHz Band Average Power (dBm)				
Mode/Band	b	g	n (HT-20)	n (HT-40)
WLAN 2.4GHz	19.68	16.36	15.51	14.22

WLAN 5.8 GHz Band Average Power (dBm)						
Mode/Band	a	ac 20	ac 40	ac 80	n 20	n 40
WLAN 5.8GHz	15.06	14.98	15.06	14.70	15.01	15.01

ANT 3:

900MHz Average Power (dBm)	
900MHz	25.31

2.4GHz Average Power (dBm)	
2.4GHz	25.78

5.8GHz Average Power (dBm)	
5.8GHz	26.40

5.4 Environment of Test Site

Temperature:	18°C ~25 °C
Humidity:	35%~75% RH
Atmospheric Pressure:	1010 mbar

5.5 Test Sample Plan

Sample Number	Used for Test Items
1#	SAR
***Remark**: JianYan Testing Group Shenzhen Co., Ltd. is only responsible for the test project data of the above samples, and will keep the above samples for a month.*	

5.6 Test Location

JianYan Testing Group Shenzhen Co., Ltd.
No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
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6 Introduction

6.1 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.

6.2 SAR Definition

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

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

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

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

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

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

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength. However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

7 RF Exposure Limits

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.

7.3 RF Exposure Limits

SAR Human Exposure Specified in ANSI/IEEE C95.1-1992 and Health Canada Safety Code 6

HUMAN EXPOSURE LIMITS		
	UNCONTROLLED ENVIRONMENT *General Population* (W/kg) or (mW/g)	CONTROLLED ENVIRONMENT *Occupational* (W/kg) or (mW/g)
SPATIAL PEAK SAR Brain	1.6	8.0
SPATIAL AVERAGE SAR Whole Body	0.08	0.4
SPATIAL PEAK SAR Hands, Feet, Ankles, Wrists	4.0	20

Note:

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 SAR Measurement System

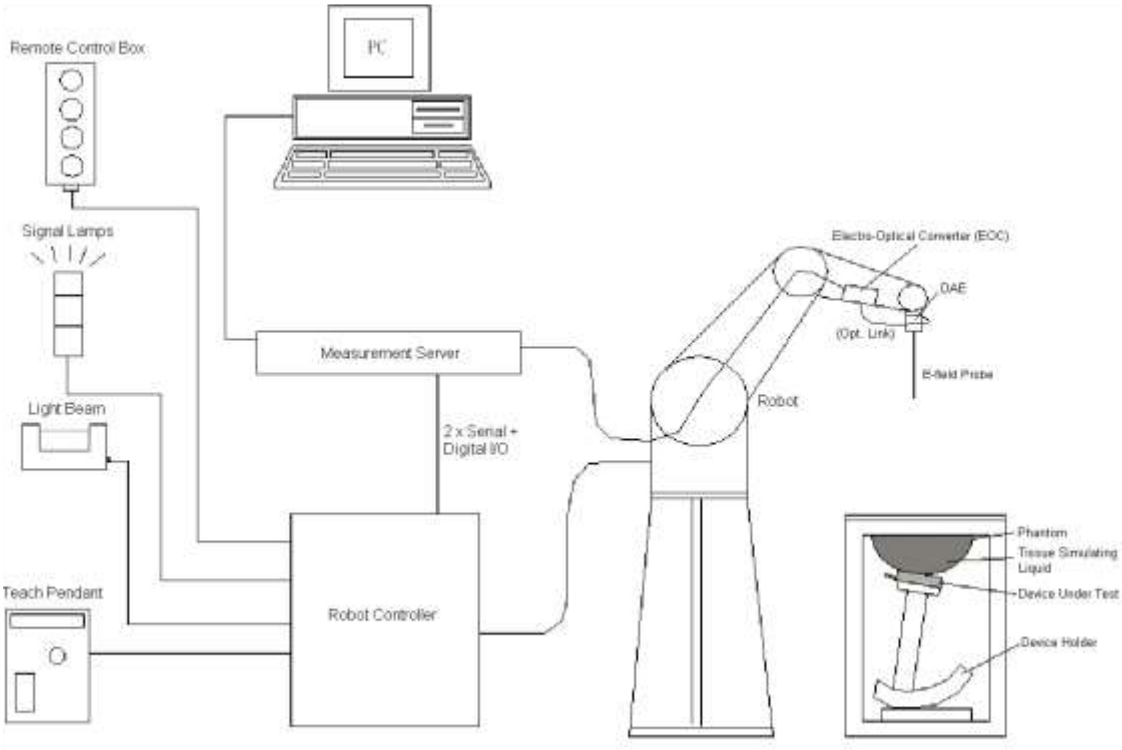

Fig. 8.1 SPEAG DASY System Configurations

The DASY system 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

Component details are described in the following sub-sections.

8.1 E-Field Probe

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

- **E-Field Probe Specification**
  <EX3DV4 Probe>

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Frequency Directivity	10 MHz to 6 GHz; Linearity: ± 0.2 dB ± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to 100 mW/g; Linearity: ± 0.2 dB (noise: typically < 1 µW/g)
Dimensions	Overall length: 330 mm (Tip: 20mm) Tip diameter: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1 mm

Fig. 8.2 Photo of E-Field Probe

- **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 ± 0.25 dB. The sensitivity parameters (Norm X, Norm Y and Norm Z), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested. The calibration data can be referred to appendix E of this report.

8.2 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 200 MOhm; the inputs are symmetrical and floating. Common mode rejection is above 80 dB.

Fig. 8.3 Photo of DAE

8.3 Robot

The SPEAG DASY system uses the high precision robots (DASY5: TX60L) type from Stäubli SA (France). For the 6-axis controller system, the robot controller version (DASY5: CS8c) from Stäubli is used. The Stäubli robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Low maintenance costs (virtually maintenance free due to direct drive gears; nobelt drives)
- Jerk-free straight movements
- Low ELF interference (motor control fields shielded via the closed metallic construction shields)

Fig. 8.4 Photo of Robot

8.4 Measurement Server

The measurement server is based on a PC/104 CPU board with CPU (DASY 5: 400MHz, Intel Celeron), chip-disk (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.

Fig. 8.5 Photo of Server for DASY5

8.5 Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

Fig. 8.6 Photo of Light Beam

8.6 Phantom

<SAM Twin Phantom>

Shell Thickness	2 ± 0.2 mm; Center ear point: 6 ± 0.2 mm
Filling Volume Dimensions	Approx. 25 liters Length: 1000mm; Width: 500mm; Height: adjustable feet
Measurement Areas	Left Head, Right Head, Flat phantom

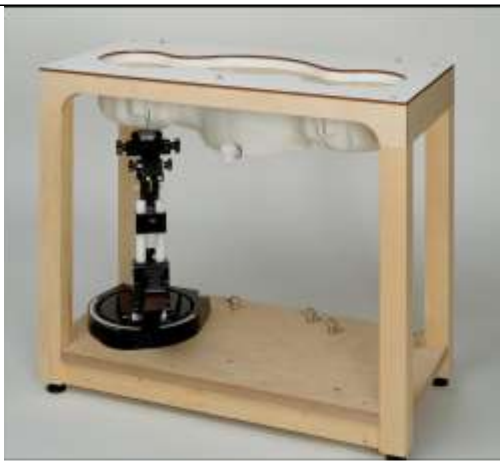

Fig. 8.7 Photo of SAM Twin Phantom

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 >

The ELI4 phantom is intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6 GHz. ELI4 is fully compatible with the latest draft of the standard IEC 62209-2 and all known tissue simulating liquids.

ELI4 has been optimized regarding its performance and can be integrated into a SPEAG standard phantom table. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points

The phantom can be used with the following tissue simulating liquids:

- Water-sugar based liquids can be left permanently in the phantom. Always cover the liquid if the system is not in use; otherwise the parameters will change due to water evaporation.
- DGBE based liquids should be used with care. As DGBE is a softener for most plastics, the liquid should be taken out of the phantom and the phantom should be dried when the system is not in use (desirable at least once a week).
- Do not use other organic solvents without previously testing the phantom resistiveness

Fig.8.8 Photo of ELI4 Phantom

8.7 Device Holder

<Device Holder for SAM Twin Phantom>

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 ± 0.5 mm 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-low 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.

Fig. 8.9 Photo of Device Holder

8.8 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 verifications 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], [mW/g]). 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	$ConvF_i$
	- Diode compression point	dcp_i
Device Parameters:	- Frequency	f
	- Crest	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:

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

With V_i = compensated signal of channel i, (i = x, y, z)
U_i = input signal of channel i, (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcp^i = diode compression point (DASY parameter)

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

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

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

With V_i = compensated signal of channel i, (i = x, y, z)
$Norm_i$ = senor sensitivity of channel i, (i = x, y, z), µV/ $(V/m)^2$
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 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.

$$SAR = E_{tot}^2 \cdot \frac{\sigma}{\rho \cdot 1000}$$

With SAR = local specific absorption rate in mW/g
E_{tot} = total field strength in V/m
σ = conductivity in (mho/m) or (Siemens/m)
ρ = equipment 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.

8.9 Test Equipment List

Manufacturer	Equipment Description	Model	Management Number	Cal. Information	
				Last Cal.	Due Date
SPEAG	835MHz System Validation Kit	D835V2	WXJ023-1	06.08.2022	06.07.2025
SPEAG	2450MHz System Validation Kit	D2450V2	WXJ023-3	06.06.2022	06.05.2025
SPEAG	5GHz System Validation Kit	D5GHzV2	WXJ023-14	02.05.2021	02.04.2024
SPEAG	Data Acquisition Electronics	DAE4	WXJ021	06.06.2022	06.05.2023
SPEAG	Dosimetric E-Field Probe	EX3DV4	WXJ022-1	12.28.2021	12.27.2022
SPEAG	DASY 52 Measurement Software	DASY 52	Version 52.10.4.1527	N.C.R	N.C.R
SPEAG	DASY 52 File Conversion Software	SEMCAD X	Version 14.6.14 (7483)	N.C.R	N.C.R
SPEAG	Phantom	Twin Phantom	WXG008-3	N.C.R	N.C.R
SPEAG	Phantom	ELI V5.0	WXG008-4	N.C.R	N.C.R
SPEAG	Phone Positioner	N/A	WXG008-5	N.C.R	N.C.R
Stäubli	Robot	TX60L	WXG008-2	N.C.R	N.C.R
KEYSIGHT	Network Analyzer	E5071C	WXJ091	03.30.2022	03.29.2023
KEYSIGHT	EPM Series Power Meter	N1914A	WXJ075	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-1	08.29.2021	08.28.2022
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-2	08.29.2021	08.28.2022
KEYSIGHT	Signal Generator	N5173B	WXJ006-3	10.27.2021	10.26.2022
Huber Suhner	RF Cable	SUCOFLEX	WXG008-13	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	WXG008-14	See Note 3	
Huber Suhner	RF Cable	SUCOFLEX	WXG008-15	See Note 3	
Weinschel	Attenuator	23-3-34	WXG008-16	See Note 3	
Anritsu	Directional Coupler	MP654A	WXG008-17	See Note 3	
SPEAG	Dielectric Assessment Kit	3.5 Probe	WXG008-7	See Note 4	
SPEAG	DAK Measurement Software	DAK	Version: DAK 3.5	N.C.R	
TXC	Broadband Amplifier	BBA018000	WXG008-11	See Note 5	

Note:

1. The calibration certificate of DASY can be referred to appendix C of this report.
2. Referring to KDB 865664 D01v01r04, 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 Speag.
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 1 W input power according to the ratio of 1 W 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. Attenuator insertion loss is calibrated by the network Analyzer, which the calibration is valid, before system check.
7. N.C.R means No Calibration Requirement.

9 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 body SAR testing, the liquid height from the center of the flat phantom to liquid top surface is larger than 15 cm, which is shown in Fig. 9.1.

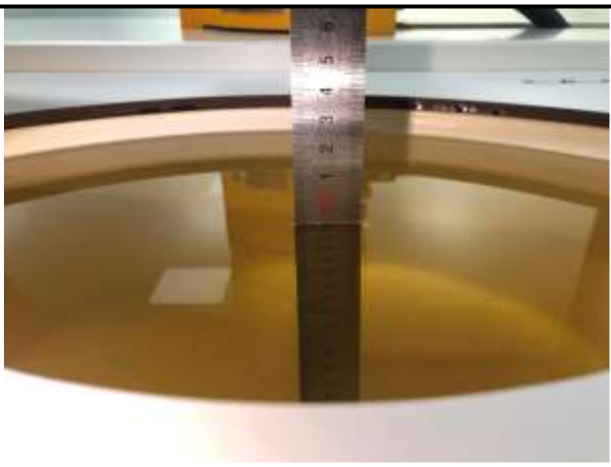

Fig. 9.2 Photo of Liquid Height for Body SAR (600MHz~6000MHz)(depth>15cm)

The relative permittivity and conductivity of the tissue material should be within ±5% of the values given in the table below recommended by the FCC OET 65 supplement C and RSS 102 Issue 5.

Target Frequency (MHz)	εr	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
3000	38.5	2.40
5800	35.3	5.27

(εr = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

The dielectric parameters of liquids were verified prior to the SAR evaluation using a Speag Dielectric Probe Kit and an Agilent Network Analyzer.
The following table shows the measuring results for simulating liquid.

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target(σ)	Permittivity Target(εr)	Delta (σ)%	Delta (εr)%	Limit (%)	Date (mm/dd/yy)
835	21.8	0.92	40.94	0.90	41.50	2.56	-1.36	±5	07.03.2022
2450	22.3	1.73	38.23	1.80	39.20	-3.89	-2.47	±5	06.28.2022
5800	22.1	5.48	34.61	5.27	35.30	3.98	-1.94	±5	07.01.2022

10 SAR System Verification

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:

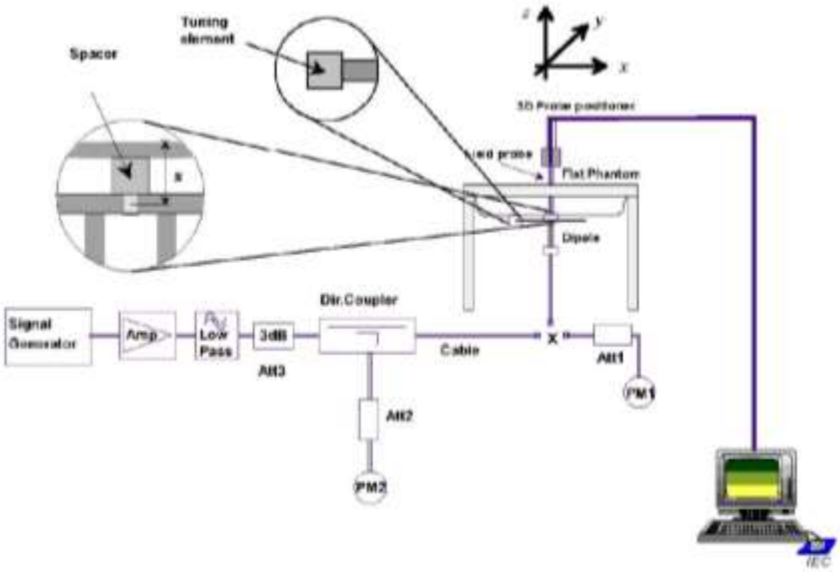

Fig.10.1 System Verification Setup Diagram

Fig.10.2 Photo of Dipole setup

- **System Verification Results**
  Comparing to the original SAR value provided by SPEAG, the verification data should be within its specification of 10%. The table as below indicates the system performance check can meet the variation criterion and the plots can be referred to Appendix C of this report.

Date (mm/dd/yy)	Frequency (MHz)	Power fed onto dipole (mW)	Measured 1g SAR (W/kg)	Normalized to 1W 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	Deviation (%)
07.03.2022	835	80	0.768	9.60	9.49	1.16
06.28.2022	2450	40	2.010	50.25	52.6	-4.47
07.01.2022	5800	40	3.170	79.25	80.90	-2.04

11 EUT Testing Position

11.1 Body Configurations

- To position the device parallel to the phantom surface.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 10 mm or 0 mm.

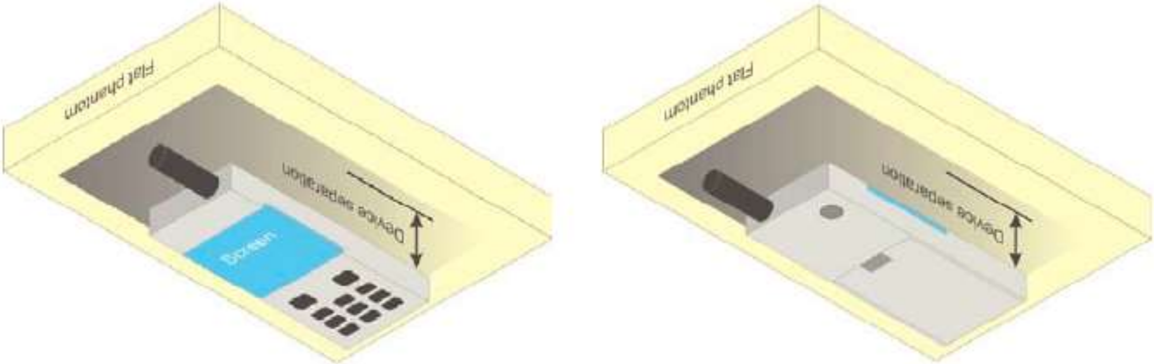

Fig.11.1 Illustration for Body Position

12 Measurement Procedures

The measurement procedures are as bellows:

<Conducted power measurement>

- For WWAN power measurement, use base station simulator to configure EUT WWAN transition in conducted connection with RF cable, at maximum power in each supported wireless interface and frequency band.
- Read the WWAN RF power level from the base station simulator.
- For WLAN/BT power measurement, use engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power in each supported wireless interface and frequency band.
- Connect EUT RF port through RF cable to the power meter or spectrum analyzer, and measure WLAN/BT output power.

<Conducted power measurement>

- Use base station simulator to configure EUT WWAN transmission in radiated connection, and engineering software to configure EUT WLAN/BT continuously transmission, at maximum RF power, in the highest power channel.
- Place the EUT in positions as Appendix B demonstrates.
- Set scan area, grid size and other setting on the DASY software.
- Measure SAR results for the highest power channel on each testing position.
- Find out the largest SAR result on these testing positions of each band.
- Measure SAR results for other channels in worst SAR testing position if the Reported SAR or highest power channel is larger than 0.8 W/kg.

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

- Power reference measurement
- Area scan
- Zoom scan
- Power drift measurement

12.1 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 10 g 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 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

12.2 Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement 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.

12.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10g. Area scan and zoom scan resolution setting follows KDB 865664 D01v01r04 quoted below.

<table>
<tr><td colspan="3"></td><td>≤ 3 GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface</td><td>5 ± 1 mm</td><td>½·δ·ln(2) ± 0.5 mm</td></tr>
<tr><td colspan="3">Maximum probe angle from probe axis to phantom surface normal at the measurement location</td><td>30° ± 1°</td><td>20° ± 1°</td></tr>
<tr><td colspan="3" rowspan="2">Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}</td><td>≤ 2 GHz: ≤ 15 mm
2 – 3 GHz: ≤ 12 mm</td><td>3 – 4 GHz: ≤ 12 mm
4 – 6 GHz: ≤ 10 mm</td></tr>
<tr><td colspan="2">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.</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}</td><td>≤ 2 GHz: ≤ 8 mm
2 – 3 GHz: ≤ 5 mm*</td><td>3 – 4 GHz: ≤ 5 mm*
4 – 6 GHz: ≤ 4 mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">uniform grid: $\Delta z_{Zoom}(n)$</td><td>≤ 5 mm</td><td>3 – 4 GHz: ≤ 4 mm
4 – 5 GHz: ≤ 3 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td rowspan="2">graded grid</td><td>$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤ 4 mm</td><td>3 – 4 GHz: ≤ 3 mm
4 – 5 GHz: ≤ 2.5 mm
5 – 6 GHz: ≤ 2 mm</td></tr>
<tr><td>$\Delta z_{Zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \Delta z_{Zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">x, y, z</td><td>≥ 30 mm</td><td>3 – 4 GHz: ≥ 28 mm
4 – 5 GHz: ≥ 25 mm
5 – 6 GHz: ≥ 22 mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 mm zoom scan resolution may be applied, respectively, for 2 GHz to 3 GHz, 3 GHz to 4 GHz and 4 GHz to 6 GHz.</td></tr>
</table>

12.4 Volume Scan Procedures

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

12.5 SAR Averaged Methods

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

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

12.6 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 drifts more than 5%, the SAR will be retested.

13 Conducted RF Output Power

13.1 WLAN 2.4 GHz Band Conducted Power

ANT 1:

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 b	802.11 g	802.11n (HT20)
CH 01	2412	18.10	15.41	14.16
CH 06	2437	**18.53**	15.61	14.59
CH 11	2462	18.24	**15.75**	14.70

Average Power (dBm)		
Channel	Frequency (MHz)	802.11n (HT40)
CH 03	2422	12.92
CH 06	2437	12.96
CH 09	2452	13.33

ANT 2:

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 b	802.11 g	802.11n (HT20)
CH 01	2412	**19.68**	15.63	15.08
CH 06	2437	19.30	**16.36**	15.51
CH 11	2462	19.29	16.16	15.38

Average Power (dBm)		
Channel	Frequency (MHz)	802.11n (HT40)
CH 03	2422	14.18
CH 06	2437	14.22
CH 09	2452	14.08

Note:

1. SAR test of WLAN 2.4GHz is performed.
2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. Per KDB 248227 D01v02r02, In the 2.4 GHz band, separate SAR procedures are applied to DSSS and OFDM configurations to simplify DSSS test requirements. 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.
4. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
5. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 100%, so the duty cycle factor is 1.

13.2 WLAN 5.8GHz Band Conducted Power

ANT 1:

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 a	802.11 ac20	802.11 n20
CH 149	5745	15.74	15.16	15.04
CH 157	5785	15.73	15.41	15.25
CH 165	5825	**16.01**	15.75	15.85

Average Power (dBm)			
Channel	Frequency (MHz)	802.11 ac40	802.11n 40
CH 151	5755	15.79	15.78
CH 159	5795	15.74	15.76

Average Power (dBm)		
Channel	Frequency (MHz)	802.11 ac80
CH 155	5775	15.48

ANT 2:

Average Power (dBm)				
Channel	Frequency (MHz)	802.11 a	802.11 ac20	802.11 n20
CH 149	5745	14.53	14.40	14.40
CH 157	5785	**15.06**	14.98	15.01
CH 165	5825	14.75	13.58	13.66

Average Power (dBm)			
Channel	Frequency (MHz)	802.11 ac40	802.11n 40
CH 151	5755	15.06	15.01
CH 159	5795	14.74	14.80

Average Power (dBm)		
Channel	Frequency (MHz)	802.11 ac80
CH 155	5775	14.70

Note:

1. SAR test of WLAN 5.2GHz is performed.
2. Per KDB 248227 D01v02r02, choose the highest output power channel to test SAR and determine further SAR exclusion.
3. The output power of all data rate were pre-scan, just the worst case (the lowest data rate) of all mode were shown in report.
4. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode, the actual duty cycle is 100%, so the duty cycle factor is 1.

13.3 900MHz Conducted Power

ANT 3:

1.4MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
904	19.48	19.74
915	19.57	19.88
926	19.70	19.74

10MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
909	22.71	22.72
915	22.79	22.73
921	22.84	22.84

20MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
914	25.25	25.28
915	25.28	25.27
916	**25.31**	25.31

Note:

1. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode ,the actual duty cycle is 100%, so the duty cycle factor is 1.00.

13.4 2.4GHz Conducted Power

ANT 3:

1.4MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
2403.5	**25.78**	25.77
2439.5	25.45	25.50
2475.5	25.39	24.46

10MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
2407.5	21.48	21.41
2439.5	20.32	20.36
2471.5	20.06	20.04

20MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
2412.5	21.44	21.48
2437.5	21.53	21.68
2462.5	20.09	20.52

Note:

1. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode , the actual duty cycle is 100%, so the duty cycle factor is 1.00.

13.5 5.8GHz Conducted Power

ANT 3:

1.4MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
5728	26.30	26.24
5788	26.13	26.15
5847	25.68	25.72

10MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
5733	26.25	26.29
5789	26.00	26.11
5842	25.07	24.97

20MHz:

Average Power (dBm)		
Channel	16QAM	QPSK
5738	**26.40**	26.39
5789	25.98	26.09
5839	25.06	25.14

Note:

2. Per KDB 248227 D01V02r02 section 2.2, when the EUT in continuously transmitting mode , the actual duty cycle is 100%, so the duty cycle factor is 1.00.

14 Exposure Positions Consideration

14.1 EUT Antenna Locations

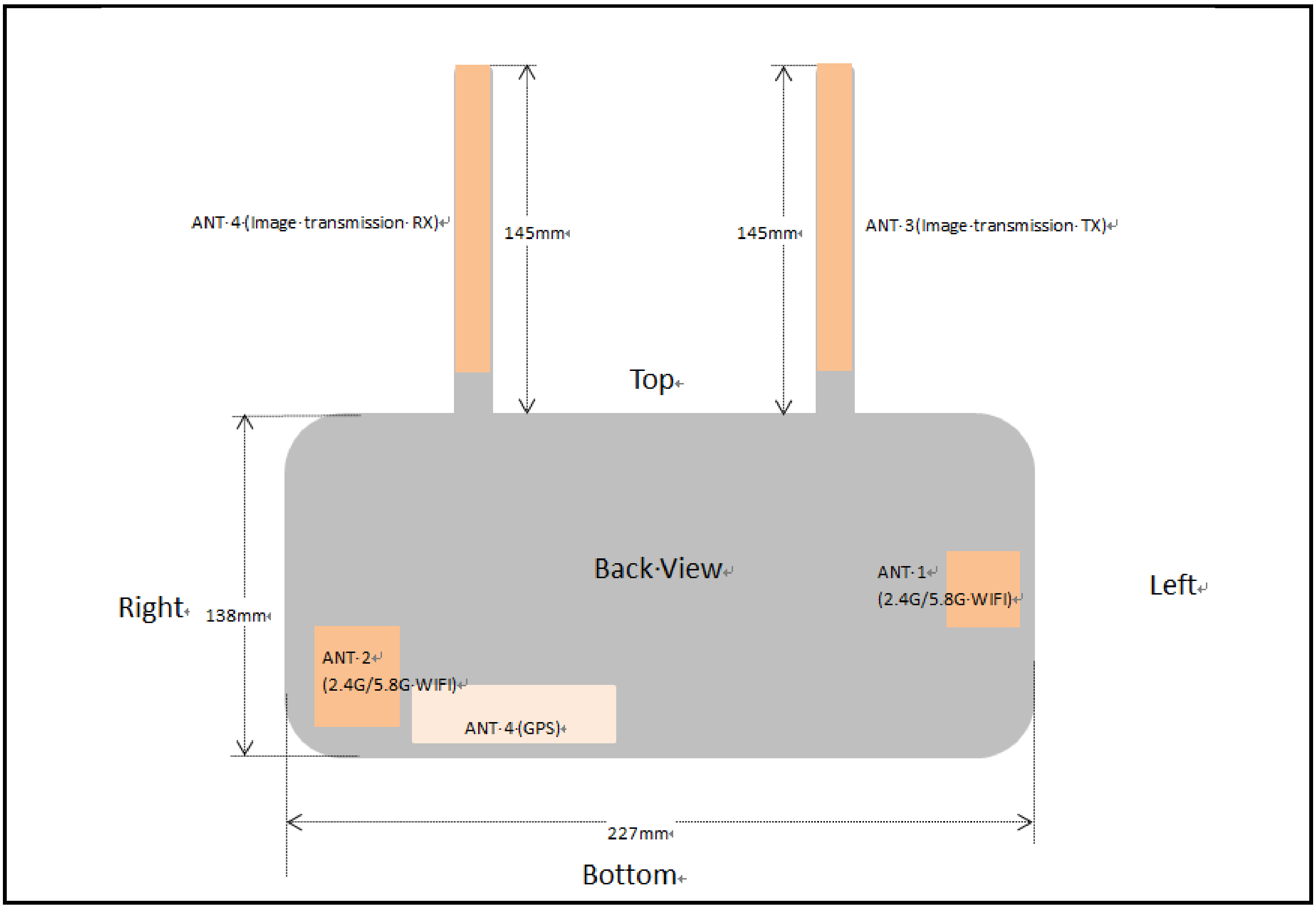

Fig.14.1 EUT Antenna Locations

Note: This antenna diagram is only used as a reference for the distance from the antenna to each edge. For the specific shape of the antenna, please refer to the physical photo.

14.2 Test Positions Consideration

1. This device consists of 5 RF chips, 3 internal antennas, and 2 external antennas. The detailed as below:

Work type	Corresponding antenna	Operation Frequency
2T2R	WiFi&BT ANT 1, WiFi ANT 2	2.4GHz WiFi&BT 5.8GHz WiFi
1T2R	Image transmission ANT 3 (TX) Image transmission ANT 4 (Only RX)	900MHz 2.4GHz, 5.8GHz
Only Rx	ANT 5 (GPS ANT)	GPS

Note: 1. 2T2R: 2 transmitting and 2 receiving.

2. WiFi&BT ANT 1, WiFi ANT 2 and GPS ANT are internal antenna. ANT 3 and ANT4 are external antenna.

14.3 Test Positions Consideration

For ANT 1, ANT 2 (Internal antenna) Body Mode:

SAR exclusion calculations for antenna														
Antennas	Freq. (MHz)	Max. tune-up Power		Distance of Antennas to EUT edge/surface (mm)					exclusion thresholds (mW)					
		dBm	mW	Back	Left	Right	Top	Bott.	Back	Left	Right	Top	Bott.
2.4G Wi-Fi ANT 1	2437	19.0	79.43	5	5	195	46	33	2.76	2.76	2916	187	99.6
5G Wi-Fi ANT 1	5825	16.5	44.7	5	5	195	46	33	1.37	1.37	2902	142	70.8
BT ANT 1	2402	11.0	12.58	5	5	195	46	33	2.78	2.78	2916	188	100
2.4G Wi-Fi ANT 2	2412	20.0	100	5	185	15	59	15	2.78	2638	22.4	301	22.4
5G Wi-Fi ANT 2	5785	15.5	35.48	5	185	15	59	15	1.38	2599	13.6	238	13.6

Test Positions					
Antennas	Back	Left Side	Right Side	Top Side	Bottom Side
2.4G Wi-Fi ANT 1	Yes	Yes	No	No	No
5G Wi-Fi ANT 1	Yes	Yes	No	No	No
BT ANT 1	Yes	Yes	No	No	No
2.4G Wi-Fi ANT 2	Yes	No	Yes	No	Yes
5G Wi-Fi ANT 2	Yes	No	Yes	No	Yes

For ANT 1, ANT 2 (Internal antenna) Limb Mode:

SAR exclusion calculations for antenna																
Antennas	Freq. (MHz)	Max. tune-up Power		Distance of Antennas to EUT edge/surface (mm)						exclusion thresholds (mW)					
		dBm	mW	Front	Back	Left	Right	Top	Bott.	Front	Back	Left	Right	Top	Bott.
2.4G Wi-Fi ANT 1	2437	19.0	79.43	5	5	5	195	46	33	6.9	6.9	6.9	7290	468	249
5G Wi-Fi ANT 1	5825	16.5	44.7	5	5	5	195	46	33	3.43	3.43	3.43	7255	355	177
BT ANT 1	2402	11.0	12.58	5	5	5	195	46	33	6.95	6.95	6.95	7290	470	250
2.4G Wi-Fi ANT 2	2412	20.0	100	5	5	185	15	59	15	6.95	6.95	6595	56	753	56
5G Wi-Fi ANT 2	5785	15.5	35.48	5	5	185	15	59	15	3.45	3.45	6497	34	595	34

Test Positions						
Antennas	Front	Back	Left Side	Right Side	Top Side	Bottom Side
2.4G Wi-Fi ANT 1	Yes	Yes	Yes	No	No	No
5G Wi-Fi ANT 1	Yes	Yes	Yes	No	No	No
BT ANT 1	Yes	Yes	Yes	No	No	No
2.4G Wi-Fi ANT 2	Yes	Yes	No	Yes	No	Yes
5G Wi-Fi ANT 2	Yes	Yes	No	Yes	No	Yes

Note:
1. The external antenna configurations are perpendicular and parallel with phantom.
2. Referring to KDB 941225 D07, The internal antennas will be tested on all surfaces and side edges except for front surface with a transmitting antenna located at < 25 mm from that surface or edge.
3. Per KDB 616217 D04v01r02, SAR evaluation for the front surface of tablet display screens is generally not necessary.
4. Per KDB 616217 D04v01r02, additional testing for hotspot SAR is not required.
5. Per KDB 616217 D04v01r02, when the reported SAR with the protrusions in place is > 1.2 W/kg, a KDB inquiry is required to determine if additional SAR measurements in more conservative test configurations are necessary

15 SAR Test Results Summary

15.1 Standalone Body SAR

- **WLAN 2.4GHz Body SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
1	2.4GHz/802.11b	Back	6	2437	18.53	-0.17	19.0	**0.441**	1.114	1.000	0.491
	2.4GHz/802.11b	Left	6	2437	18.53	0.04	19.0	0.349	1.114	1.000	0.389
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

ANT 2(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
2	2.4GHz/802.11b	Back	1	2412	19.68	-0.09	20.0	**0.369**	1.076	1.000	0.397
	2.4GHz/802.11b	Right	1	2412	19.68	0.09	20.0	0.108	1.076	1.000	0.116
	2.4GHz/802.11b	Bottom	1	2412	19.68	-0.11	20.0	0.341	1.076	1.000	0.367
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

- **WLAN 5.8GHz Body SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
3	5.8GHz/802.11a	Back	165	5825	16.01	0.02	16.5	**0.590**	1.119	1.000	0.660
	5.8GHz/802.11a	Left	165	5825	16.01	-0.19	16.5	0.384	1.119	1.000	0.430
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

ANT 2(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
4	5.8GHz/802.11a	Back	157	5785	15.06	-0.10	15.5	**0.432**	1.107	1.000	0.478
	5.8GHz/802.11a	Right	157	5785	15.06	-0.16	15.5	0.253	1.107	1.000	0.280
	5.8GHz/802.11a	Bottom	157	5785	15.06	-0.07	15.5	0.422	1.107	1.000	0.467
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

- **BT Body SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
5	BT/GFSK	Back	0	2402	10.80	0.08	11.0	**0.018**	1.047	1.000	0.019
	BT/GFSK	Left	0	2402	10.80	-0.18	11.0	0.003	1.047	1.000	0.003
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

➢ **900MHz Body SAR**

ANT3(External antenna):

Plot No.	Band/Mode	Test Position	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
6	900MHz/16QAM	Body Horizontal	916	25.31	-0.03	25.5	**0.152**	1.045	1.000	0.159
	900MHz/16QAM	Body Vertical	916	25.31	0.04	25.5	0.010	1.045	1.000	0.010
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**1.6 W/kg (mW/g) Averaged over 1g**						

➢ **2.4GHz Body SAR**

ANT 3(External antenna):

Plot No.	Band/Mode	Test Position	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
7	2.4GHz /16QAM	Body Horizontal	2403.5	25.78	0.07	26.0	**0.477**	1.052	1.000	0.502
	2.4GHz /16QAM	Body Vertical	2403.5	25.78	-0.08	26.0	0.028	1.052	1.000	0.029
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**1.6 W/kg (mW/g) Averaged over 1g**						

➢ **5.8GHz Body SAR**

ANT 3(External antenna):

Plot No.	Band/Mode	Test Position	. Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{1g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{1g} (W/kg)
8	5.8GHz/16QAM	Body Horizontal	5738	26.40	-0.07	26.5	**0.284**	1.023	1.000	0.291
	5.8GHz/16QAM	Body Vertical	5738	26.40	-0.12	26.5	0.016	1.023	1.000	0.016
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**1.6 W/kg (mW/g) Averaged over 1g**						

Note:

1. For external antenna, configurations are perpendicular and parallel with phantom.
2. Additional WLAN SAR testing was performed for simultaneous transmission analysis.
3. Per KDB 248227 D01v02r02, OFDM SAR is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg. For ANT 1, cuz the maximum output power specified for OFDM and DSSS are 39.81mW(16.0dBm) and 39.81mW(16.0dBm), the scaled SAR would be 0.304×(39.81/39.81)=0.304W/Kg < 1.2 W/kg, therefore, SAR is not required for OFDM For ANT 2, cuz the maximum output power specified for OFDM and DSSS are 44.67mW(16.5dBm) and 39.81mW(16.0dBm), the scaled SAR would be 0.122×(44.67/39.81)=0.167W/Kg < 1.2 W/kg, therefore, SAR is not required for OFDM.
4. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.

15.2 Standalone Limb SAR

➢ **WLAN 2.4GHz Limb SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
	2.4GHz/802.11b	Front	6	2437	18.53	0.15	19.0	0.138	1.114	1.000	0.154
9	2.4GHz/802.11b	Back	6	2437	18.53	-0.07	19.0	**0.745**	1.114	1.000	0.830
	2.4GHz/802.11b	Left	6	2437	18.53	0.09	19.0	0.416	1.114	1.000	0.463
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**4.0 W/kg (mW/g) Averaged over 10g**						

ANT 2(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
	2.4GHz/802.11b	Front	1	2412	19.68	-0.03	20.0	0.157	1.076	1.000	0.169
10	2.4GHz/802.11b	Back	1	2412	19.68	-0.12	20.0	**0.871**	1.076	1.000	0.937
	2.4GHz/802.11b	Right	1	2412	19.68	-0.13	20.0	0.304	1.076	1.000	0.327
	2.4GHz/802.11b	Bottom	1	2412	19.68	-0.06	20.0	0.034	1.076	1.000	0.037
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**4.0 W/kg (mW/g) Averaged over 10g**						

➢ **WLAN 5.8GHz Limb SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
	5.8GHz/802.11a	Front	165	5825	16.01	0.11	16.5	0.152	1.119	1.000	0.170
11	5.8GHz/802.11a	Back	165	5825	16.01	-0.04	16.5	**0.860**	1.119	1.000	0.962
	5.8GHz/802.11a	Left	165	5825	16.01	-0.05	16.5	0.381	1.119	1.000	0.426
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**4.0 W/kg (mW/g) Averaged over 10g**						

ANT 2(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
	5.8GHz/802.11a	Front	157	5785	15.06	-0.10	15.5	0.026	1.107	1.000	0.029
12	5.8GHz/802.11a	Back	157	5785	15.06	-0.07	15.5	**0.313**	1.107	1.000	0.346
	5.8GHz/802.11a	Right	157	5785	15.06	-0.19	15.5	0.086	1.107	1.000	0.095
	5.8GHz/802.11a	Bottom	157	5785	15.06	0.14	15.5	0.026	1.107	1.000	0.029
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**4.0 W/kg (mW/g) Averaged over 10g**						

➢ **BT Limb SAR**

ANT 1(Internal antenna):

Plot No.	Band/Mode	Test Position	CH.	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
	BT/GFSK	Front	0	2402	10.80	-0.17	11.0	0.028	1.047	1.000	0.029
13	BT/GFSK	Back	0	2402	10.80	-0.04	11.0	**0.033**	1.047	1.000	0.035
	BT/GFSK	Left	0	2402	10.80	0.03	11.0	0.006	1.047	1.000	0.006
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**4.0 W/kg (mW/g) Averaged over 10g**						

- **900MHz Limb SAR**

ANT3(External antenna):

Plot No.	Band/Mode	Test Position	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
14	900MHz/16QAM	Horizontal	916	25.31	0.01	25.5	**0.150**	1.045	1.000	0.157
	900MHz/16QAM	Vertical	916	25.31	0.06	25.5	0.009	1.045	1.000	0.009
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**4.0 W/kg (mW/g) Averaged over 10g**						

- **2.4GHz Limb SAR**

ANT 3(External antenna):

Plot No.	Band/Mode	Test Position	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
15	2.4GHz /16QAM	Horizontal	2403.5	25.78	0.05	26.0	**0.455**	1.052	1.000	0.479
	2.4GHz /16QAM	Vertical	2403.5	25.78	0.04	26.0	0.042	1.052	1.000	0.044
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**4.0 W/kg (mW/g) Averaged over 10g**						

- **5.8GHz Limb SAR**

ANT 3(External antenna):

Plot No.	Band/Mode	Test Position	Freq. (MHz)	Ave. Power (dBm)	Power Drift (dB)	Tune-Up Limit (dBm)	Meas. SAR_{10g} (W/kg)	Scaling Factor	D.C Factor	Reported SAR_{10g} (W/kg)
16	5.8GHz/16QAM	Horizontal	5738	26.40	-0.07	26.5	**0.213**	1.023	1.000	0.218
	5.8GHz/16QAM	Vertical	5738	26.40	-0.01	26.5	0.021	1.023	1.000	0.021
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population				**4.0 W/kg (mW/g) Averaged over 10g**						

Note:

5. For external antenna, configurations are perpendicular and parallel with phantom.
6. Additional WLAN SAR testing was performed for simultaneous transmission analysis.
7. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required when the measured SAR is ≥2.0W/kg.
8. According to KDB 865664 D02v01r02, SAR plot is required for the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.

15.3 Multi-Band Simultaneous Transmission Considerations

➢ **Simultaneous Transmission Capabilities**

According to FCC KDB Publication 447498 D04v01, transmitters are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. Possible transmission paths for the EUT are shown in below Figure and are color-coded to indicate communication modes which share the same path. Modes which share the same transmission path cannot transmit simultaneously with one another.

Path 1	Path 2
2.4GWiFiMIMO/ 5.8GWiFiMIMO/BT	900MHz/2.4GHz/5.8GHz

Fig.15.1 Simultaneous Transmission Paths

➢ **Multi-Band simultaneous Transmission Consideration**

	Position	Applicable Combination
Simultaneous Transmission Consideration	Body	WLAN 2.4 GHz MIMO +900MHz/2.4GHz/5GHz
		5 GHz MIMO +900MHz/2.4GHz/5GHz
		Bluetooth+900MHz/2.4GHz/5GHz
	Limb	WLAN 2.4 GHz MIMO +900MHz/2.4GHz/5GHz
		5 GHz MIMO +900MHz/2.4GHz/5GHz
		Bluetooth+900MHz/2.4GHz/5GHz

Note:

1. 900MHz,2.4GHz,5GHz shares the same antenna, and cannot transmit simultaneously.
2. 2.4GWiFi and 5GWiFi, cannot transmit simultaneously.
3. The Report SAR summation is calculated based on the same configuration and test position.
4. Per KDB 447498 D04v01, simultaneous transmission SAR is compliant if,
   - i. Scalar SAR summation < 1.6 W/kg for Body SAR_{1g} and <4.0 W/kg for Limb SAR_{10g}.
   - ii. SPLSR = $(SAR_1 + SAR_2)^{1.5}$ / (*min. separation distance, mm*), and the peak separation distance is determined from the square root of $[(x_1-x_2)^2 + (y_1-y_2)^2 + (z_1-z_2)^2]$, where (x_1, y_1, z_1) and (x_2, y_2, z_2) are the coordinates of the extrapolated peak SAR locations in the zoom scan If SPLSR ≤ 0.04, simultaneously transmission SAR measurement is not necessary
   - iii. Simultaneously transmission SAR measurement, and the Reported multi-band SAR < 1.6 W/kg for Body SAR_{1g} and <4.0 W/kg for Limb SAR_{10g}.

15.4 SAR Simultaneous Transmission Analysis

➢ **Body mode Simultaneous Transmission**

Position	Standalone SAR(W/kg)				Σ SAR_{1g} (W/kg)	
	1	2	3	4	1+2	3+4
	2.4GWLAN Ant1	2.4GWLAN An2	5GWLAN ANT1	5GWLAN ANT2	2.4GWLAN MIMO	5GWLAN MIMO
Front	0.000	0.000	0.000	0.000	0.000	0.000
Back	0.491	0.397	0.638	0.446	0.888	1.084
Left	0.389	0.000	0.430	0.000	0.389	0.430
Right	0.000	0.116	0.000	0.280	0.116	0.280
Top	0.000	0.000	0.000	0.467	0.000	0.467
Bottom	0.000	0.378	0.000	0.000	0.378	0.000

Position	Standalone SAR(W/kg)				Σ SAR_{1g} (W/kg)		
	1	2	3	4	1+4	2+4	3+4
	2.4GWLAN MIMO SAR_{1g}(W/kg)	5GWLAN MIMO SAR_{1g}(W/kg)	Bluetooth SAR_{1g}(W/kg)	900MHz/ 2.4GHz/5GHz SAR_{1g}(W/kg)			
Front	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Back	0.888	1.084	0.019	0.502	1.390	**1.586**	0.521
Left	0.389	0.430	0.003	0.000	0.389	0.430	0.003
Right	0.116	0.280	0.000	0.000	0.116	0.280	0.000
Top	0.000	0.467	0.000	0.000	0.000	0.467	0.000
Bottom	0.378	0.000	0.000	0.000	0.378	0.000	0.000

➢ **Limb mode Simultaneous Transmission**

Position	Standalone SAR(W/kg)				Σ SAR_{10g} (W/kg)	
	1	2	3	4	1+2	3+4
	2.4GWLAN Ant1	2.4GWLAN An2	5GWLAN ANT1	5GWLAN ANT2	2.4GWLAN MIMO	5GWLAN MIMO
Front	0.154	0.169	0.170	0.029	0.323	0.199
Back	0.830	0.937	0.962	0.346	1.767	1.308
Left	0.463	0.000	0.426	0.000	0.463	0.426
Right	0.000	0.327	0.000	0.095	0.327	0.095
Top	0.000	0.000	0.000	0.000	0.000	0.000
Bottom	0.000	0.873	0.000	0.286	0.873	0.286

Position	Standalone SAR(W/kg)				Σ SAR_{10g} (W/kg)		
	1	2	3	4	1+4	2+4	3+4
	2.4GWLAN MIMO SAR_{10g}(W/kg)	5GWLAN MIMO SAR_{10g}(W/kg)	Bluetooth SAR_{1g}(W/kg)	900MHz/ 2.4GHz/5GHz SAR_{1g}(W/kg)			
Front	0.323	0.199	0.011	0.000	0.323	0.199	0.011
Back	1.767	1.308	0.035	0.479	**2.246**	1.787	0.514
Left	0.463	0.426	0.006	0.000	0.463	0.426	0.006
Right	0.327	0.095	0.000	0.000	0.327	0.095	0.000
Top	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bottom	0.873	0.286	0.000	0.000	0.873	0.286	0.000

➢ **Simultaneous Transmission Conclusion**

The above numerical summed SAR results for all the case simultaneous transmission conditions were below the SAR limit. Therefore, the above analysis is sufficient to determine that simultaneous transmission cases will not exceed the SAR limit and therefore no measured volumetric simultaneous SAR summation is required per FCC KDB Publication 447498 D04v01.

15.5 Measurement Uncertainty

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly 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 knowledge of the behavior and properties of relevant materials and instruments, manufacture's 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 below Table.

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

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 evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations 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 DASY uncertainty Budget is shown in the following tables.

Uncertainty Component	Section	Uncert. Value	Prob. Dist.	Div.	(C_i) (1 g)	(C_i) (10 g)	Std. Unc. (1 g)	Std. Unc. (10 g)	V_i
Measurement System									
Probe Calibration	E.2.1	±7.4%	N	1	1	1	±7.4%	±7.4%	∞
Axial Isotropy	E.2.2	±1.2%	R	$\sqrt{3}$	0.7	0.7	±0.49%	±0.49%	∞
Hemispherical Isotropy	E.2.2	±3.2%	R	$\sqrt{3}$	0.7	0.7	±1.29%	±1.29%	∞
Boundary Effects	E.2.3	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Linearity	E.2.4	±0.9%	R	$\sqrt{3}$	1	1	±0.52%	±0.52%	∞
System Detection Limits	E.2.5	±0.25%	R	$\sqrt{3}$	1	1	±0.14%	±0.14%	∞
Readout Electronics	E.2.6	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	E.2.7	±0.8%	R	$\sqrt{3}$	1	1	±0.46%	±0.46%	∞
Integration Time	E.2.8	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	E.6.1	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
RF Ambient Reflections	E.6.1	±3.0%	R	$\sqrt{3}$	1	1	±1.73%	±1.73%	∞
Probe positioner mechanical tolerances	E.6.2	±0.4%	R	$\sqrt{3}$	1	1	±0.23%	±0.23%	∞
Probe positioning tolerance with respect to the phantom shell surface	E.6.3	±2.9%	R	$\sqrt{3}$	1	1	±1.68%	±1.68%	∞
Interpolation, extrapolation, and integration algorithm For max. SAR Evaluation.	E.5	±1.0%	R	$\sqrt{3}$	1	1	±0.58%	±0.58%	∞
Test Sample Related									
Device Positioning	E.4.2	±4.6%	N	1	1	1	±4.6%	±4.6%	M-1
Device Holder	E.4.1	±5.2%	N	1	1	1	±5.2%	±5.2%	M-1
Power Drift	6.6.2	±5.0%	R	$\sqrt{3}$	1	1	±2.89%	±2.89%	∞
Phantom and Setup									
Phantom Uncertainty	E.3.1	±4.0%	R	$\sqrt{3}$	1	1	±2.31%	±2.31%	∞
Liquid conductivity (measured value)	E.3.3	±2.97%	N	1	0.78	0.71	±2.32%	±2.11%	M
Liquid dielectric constant (measured value)	E.3.3	±3.08%	N	1	0.23	0.26	±0.71%	±0.8%	M
Liquid Conductivity - Temperature Uncertainty	E.3.4	±1.3%	R	$\sqrt{3}$	0.78	0.71	±0.59%	±0.53%	∞
Liquid Dielectric Constant - Temperature Uncertainty	E.3.4	±1.1%	R	$\sqrt{3}$	0.23	0.26	±0.15%	±0.17%	∞
Combined Standard Uncertainty (RSS)							±11.55%	±11.51%	
Expanded Uncertainty (95% Confidence Level, k = 2)							±23.11%	±23.01%	

Uncertainty Budget for frequency range 300 MHz to 3 GHz according to IEEE1528-2003

15.6 Measurement Conclusion

The SAR evaluation indicates that the EUT complies with the RF radiation exposure limits of the FCC and Industry Canada, with respect to all parameters subject to this test. These measurements were taken to simulate the RF effects of RF exposure under worst-case conditions. Precise laboratory measures were taken to assure repeatability of the tests. The results and statements relate only to the item(s) tested. Please note that the absorption and distribution of electromagnetic energy in the body are very complex phenomena that depend on the mass, shape, and size of the body, the orientation of the body with respect to the field vectors, and the electrical properties of both the body and the environment. Other variables that may play a substantial role in possible biological effects are those that characterize the environment (e.g. ambient temperature, air velocity, relative humidity, and body insulation) and those that characterize the individual (e.g. age, gender, activity level, debilitation, or disease). Because various factors may interact with one another to vary the specific biological outcome of an exposure to electromagnetic fields, any protection guide should consider maximal amplification of biological effects as a result of field-body interactions, environmental conditions, and physiological variables.

16 Reference

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[5]. FCC KDB 248227 D01 v02r02, “SAR GUIDANCE FOR IEEE 802.11 (Wi-Fi) TRANSMITTERS”, October 2015

[6]. FCC KDB 447498 D04 v01, “RF EXPOSURE PROCEDURES AND EQUIPMENT AUTHORIZATION POLICIES FOR MOBILE AND PORTABLE DEVICES”, November 2021

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[9]. FCC KDB 616217 D04 v01r02, “SAR EVALUATION CONSIDERATIONS FOR LAPTOP, NOTEBOOK, NETBOOK AND TABLET COMPUTERS”, October 2015

Appendix A: Plots of SAR System Check

Test Laboratory: JYTSZ Date: 07.03.2022

DUT: Dipole 835 MHz; Type: D835V2; Serial: SN:4D154

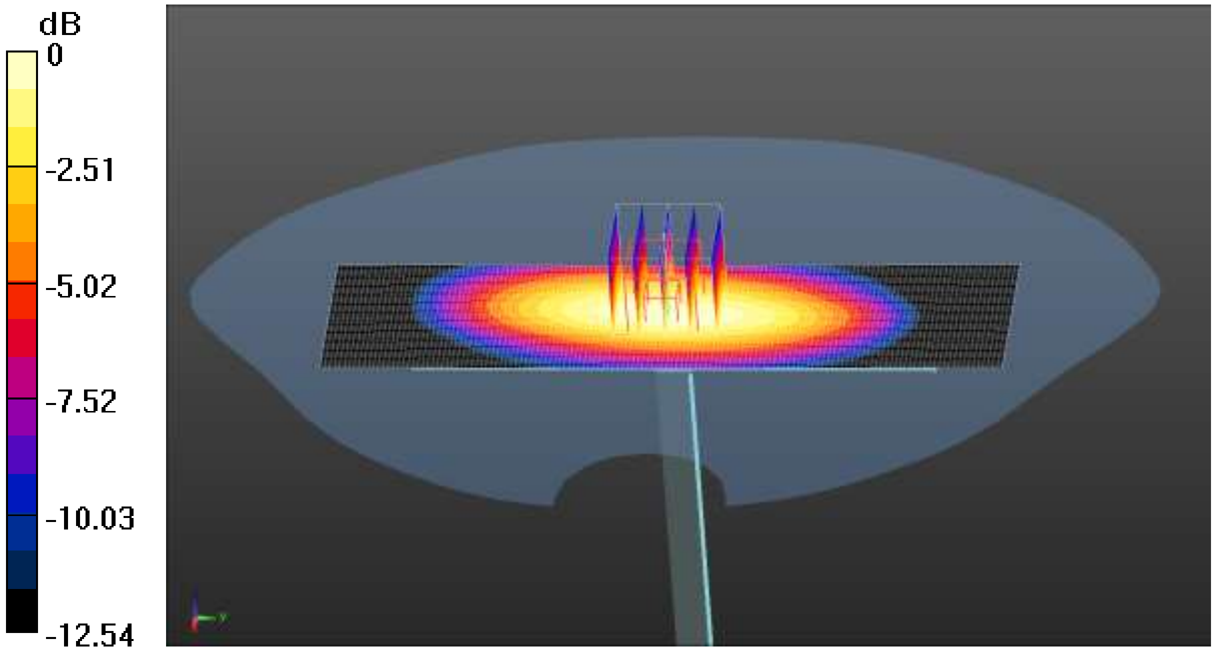
Communication System: UID 0, CW (0); Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.923 S/m; ε_r = 40.936; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7601; ConvF(10.20, 10.20, 10.20) @ 835 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Area Scan (41x141x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.964 W/kg

System Performance Check at Frequency 835 MHz Head Tissue/d=15mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 31.12 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.11 W/kg
SAR(1 g) = 0.768 W/kg; SAR(10 g) = 0.507 W/kg
Smallest distance from peaks to all points 3 dB below = 17.3 mm
Ratio of SAR at M2 to SAR at M1 = 62.9%
Maximum value of SAR (measured) = 1.02 W/kg



0 dB = 1.02 W/kg = 0.086 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: SN:910

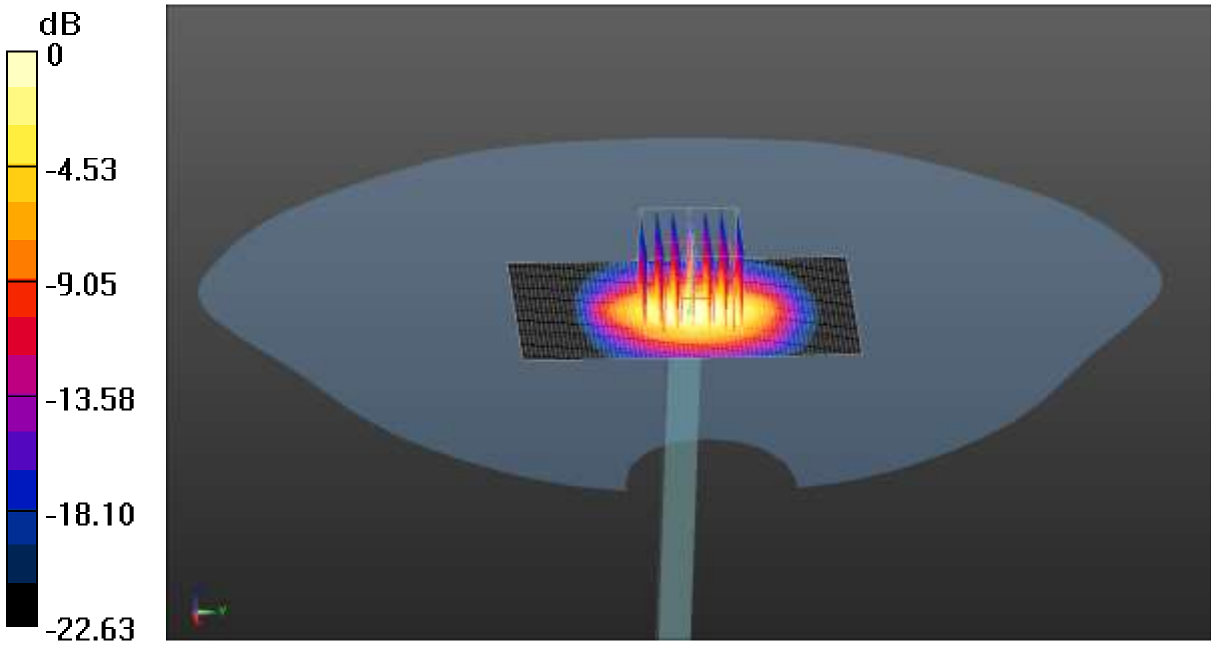
Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.731 S/m; ε_r = 38.227; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7601; ConvF(7.74, 7.74, 7.74) @ 2450 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency2450 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Area Scan (41x71x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 3.94 W/kg

System Performance Check at Frequency2450 MHz Head Tissue/d=10mm, Pin=40 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 41.17 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 4.71 W/kg
SAR(1 g) = 2.01 W/kg; SAR(10 g) = 0.986 W/kg
Smallest distance from peaks to all points 3 dB below = 9 mm
Ratio of SAR at M2 to SAR at M1 = 45.2%
Maximum value of SAR (measured) = 3.52 W/kg



0 dB = 3.52 W/kg = 5.47 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: SN:1182

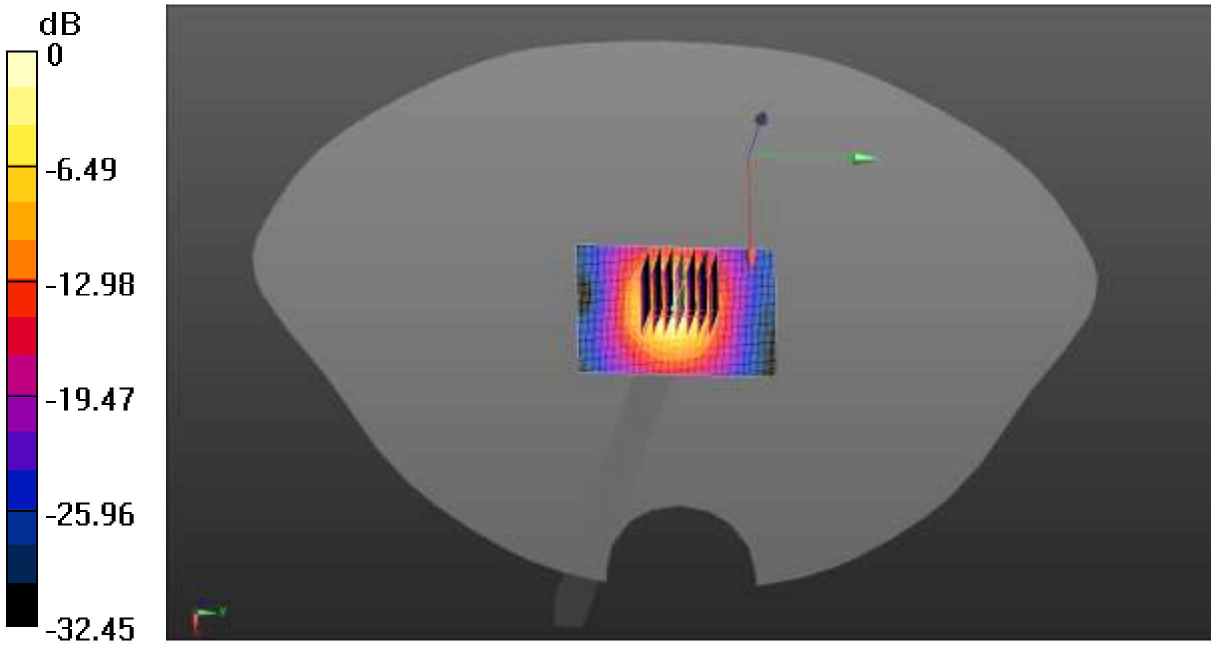
Communication System: UID 0, CW (0); Frequency: 5800 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.48 S/m; ε_r = 34.614; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 – SN7601; ConvF(5.04, 5.04, 5.04) @ 5800 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1452; Calibrated: 05.26.2021
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

System Performance Check at Frequency5800 MHz Head Tissue/d=10mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 43.21 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 13.7 W/kg
SAR(1 g) = 3.17 W/kg; SAR(10 g) = 0.883 W/kg
Smallest distance from peaks to all points 3 dB below = 11.4 mm
Ratio of SAR at M2 to SAR at M1 = 27.9%
Maximum value of SAR (measured) = 8.52 W/kg

System Performance Check at Frequency5800 MHz Head Tissue/d=10mm, Pin=80 mW, dist=1.4mm (EX-Probe)/Area Scan (51x71x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 8.82 W/kg



0 dB = 8.82 W/kg = 9.45 dBW/kg

Appendix B: Plots of SAR Test Data

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

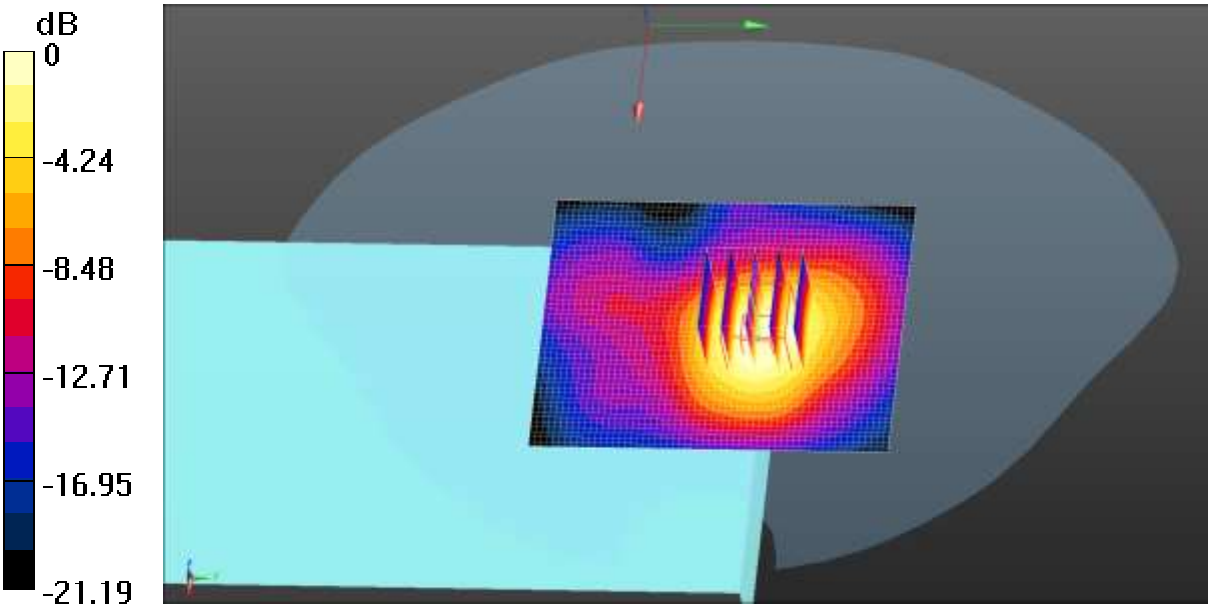
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.703 S/m; ε_r = 37.299; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2437 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G WIFI Body Back/Middle Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.696 W/kg

2.4G WIFI Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 12.59 V/m; Power Drift = -0.17 dB
Peak SAR (extrapolated) = 0.809 W/kg
SAR(1 g) = 0.441 W/kg; SAR(10 g) = 0.237 W/kg
Smallest distance from peaks to all points 3 dB below = 14.5 mm
Ratio of SAR at M2 to SAR at M1 = 54.3%
Maximum value of SAR (measured) = 0.662 W/kg



0 dB = 0.662 W/kg = -1.79 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

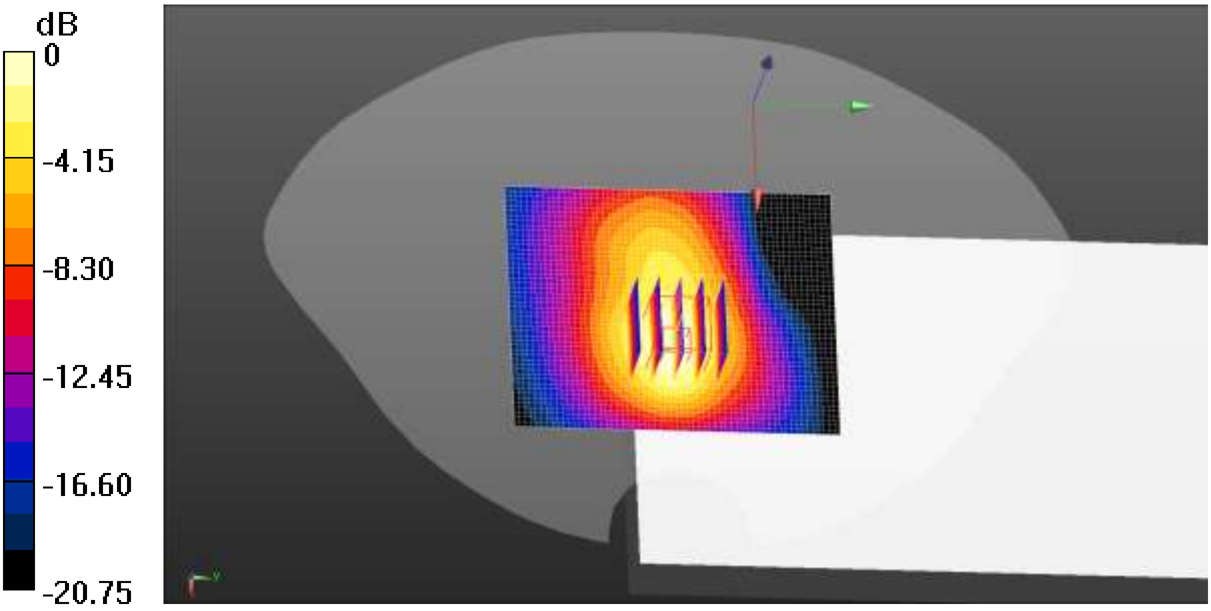
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.716 S/m; ε_r = 38.283; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2412 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G WIFI Body Back/Low Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.547 W/kg

2.4G WIFI Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 13.35 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 0.686 W/kg
SAR(1 g) = 0.369 W/kg; SAR(10 g) = 0.198 W/kg
Smallest distance from peaks to all points 3 dB below = 14.3 mm
Ratio of SAR at M2 to SAR at M1 = 53.2%
Maximum value of SAR (measured) = 0.564 W/kg



0 dB = 0.564 W/kg = -2.49 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

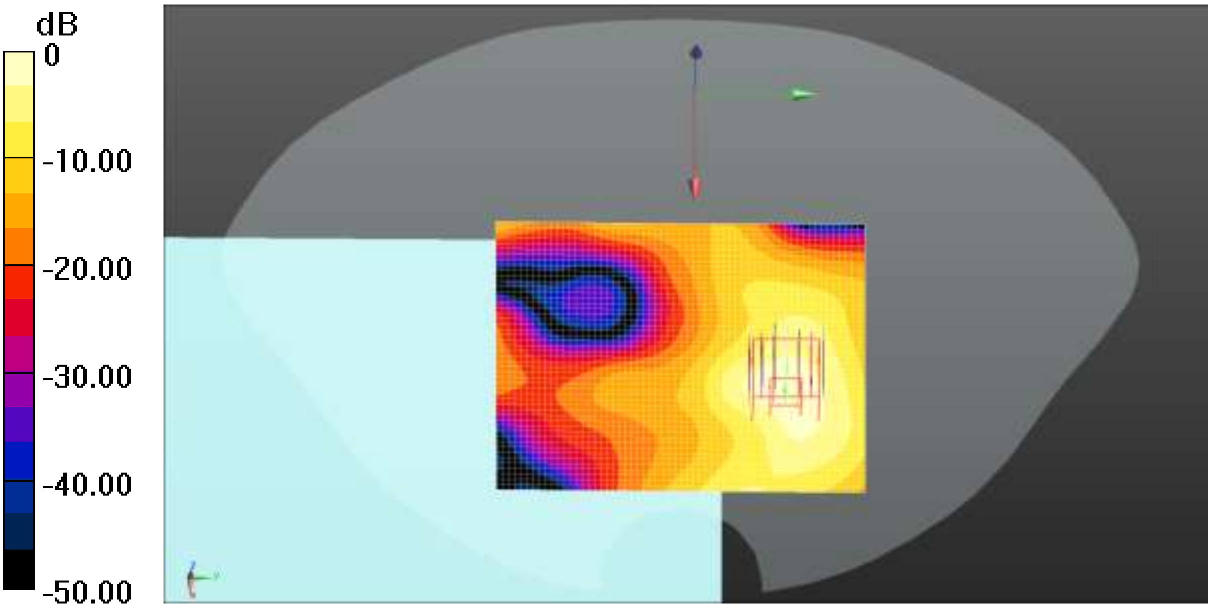
Communication System: UID 0, IEEE 802.11a WiFi 5GHz (0); Frequency: 5825 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 5.493 S/m; ε_r = 34.565; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5825 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G WIFI Body Back/High Channel/Area Scan (51x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.930 W/kg

5.8G WIFI Body Back/High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=5mm
Reference Value = 1.565 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 2.18 W/kg
SAR(1 g) = 0.570 W/kg; SAR(10 g) = 0.209 W/kg
Smallest distance from peaks to all points 3 dB below = 9.6 mm
Ratio of SAR at M2 to SAR at M1 = 21.3%
Maximum value of SAR (measured) = 1.35 W/kg



0 dB = 1.35 W/kg = 1.30 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

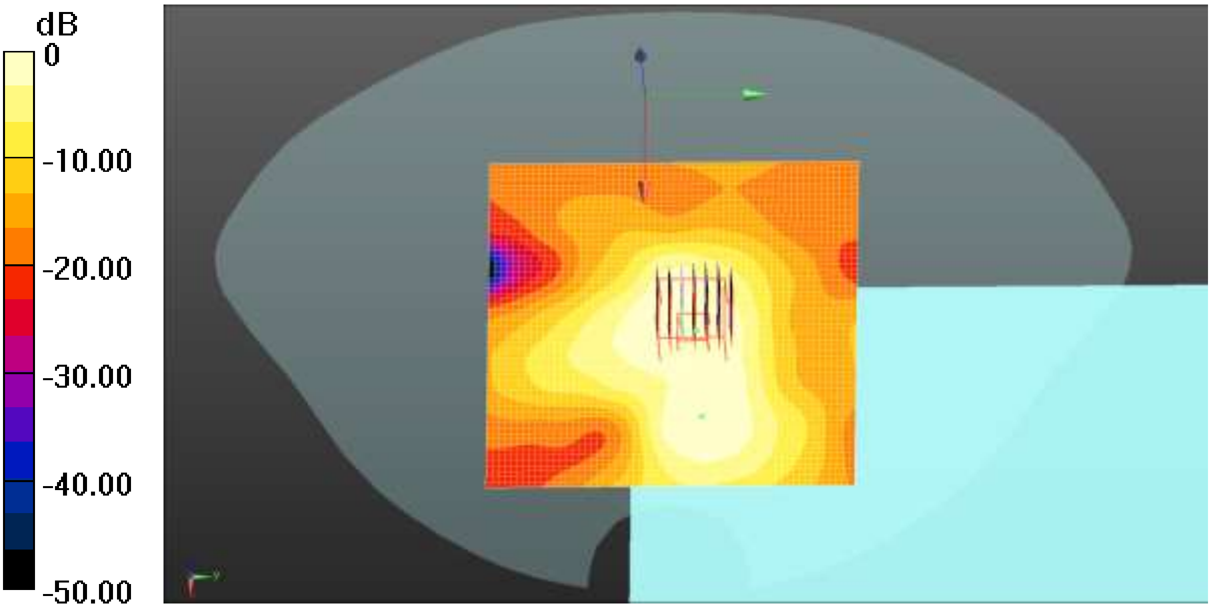
Communication System: UID 0, IEEE 802.11a WiFi 5GHz (0); Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.454 S/m; ε_r = 34.626; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5785 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G WIFI Body Back/Middle Channel/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.02 W/kg

5.8G WIFI Body Back/Middle Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=5mm
Reference Value = 12.93 V/m; Power Drift = -0.10 dB
Peak SAR (extrapolated) = 1.48 W/kg
SAR(1 g) = 0.403 W/kg; SAR(10 g) = 0.185 W/kg
Smallest distance from peaks to all points 3 dB below = 12.4 mm
Ratio of SAR at M2 to SAR at M1 = 22.2%
Maximum value of SAR (measured) = 0.928 W/kg



0 dB = 0.928 W/kg = -0.32 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

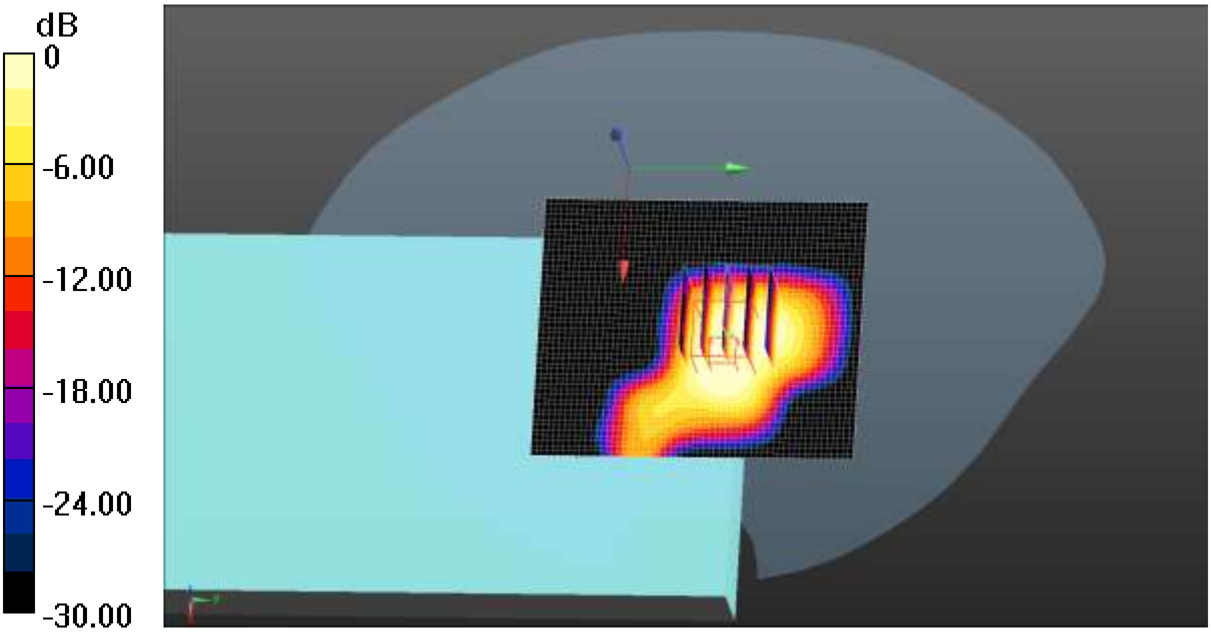
Communication System: UID 0, Bluetooth (0); Frequency: 2402 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.689 S/m; ε_r = 38.286; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2402 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

BT Body Back/Low Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0551 W/kg

BT Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 1.826 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 0.0350 W/kg
SAR(1 g) = 0.018 W/kg; SAR(10 g) = 0.0088 W/kg
Smallest distance from peaks to all points 3 dB below: Larger than measurement grid
Ratio of SAR at M2 to SAR at M1 = 50.4%
Maximum value of SAR (measured) = 0.0273 W/kg



0 dB = 0.0273 W/kg = -15.64 dBW/kg

Test Laboratory: JYTSZ Date: 07.03.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

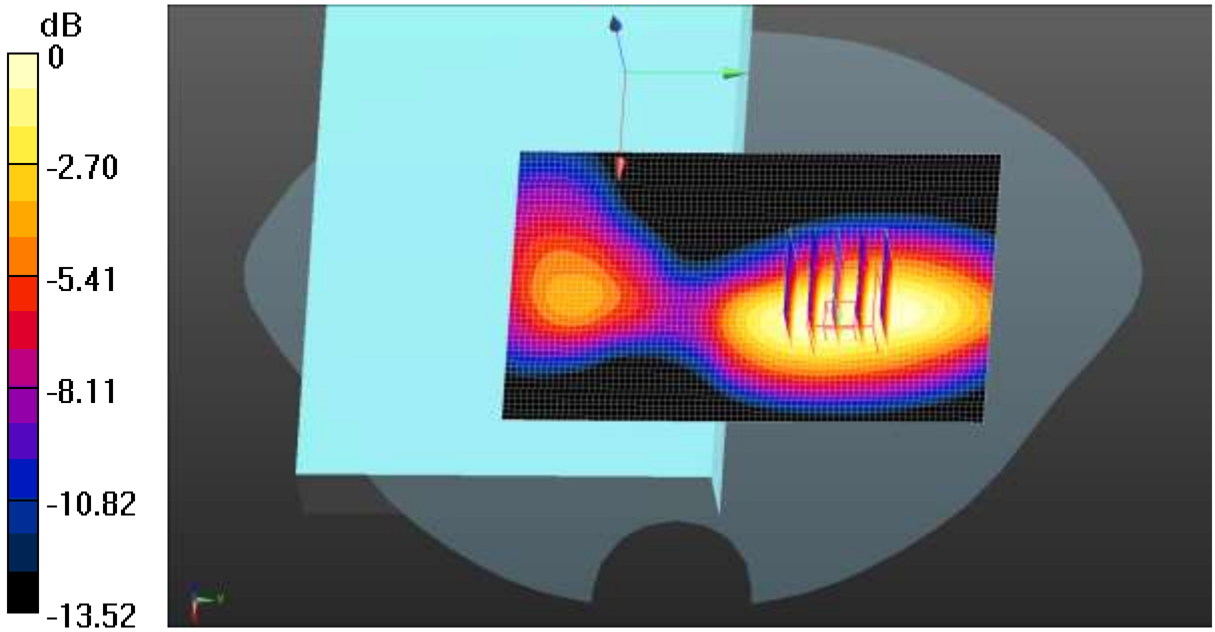
Communication System: UID 0, 900M (0); Frequency: 916 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 916 MHz; σ = 0.95 S/m; ε_r = 40.703; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(10.18, 10.18, 10.18) @ 916 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

900MHz Body Horizontal/High Channel/Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.212 W/kg

900MHz Body Horizontal/High Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 6.064 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 0.243 W/kg
SAR(1 g) = 0.152 W/kg; SAR(10 g) = 0.098 W/kg
Smallest distance from peaks to all points 3 dB below = 16.1 mm
Ratio of SAR at M2 to SAR at M1 = 64%
Maximum value of SAR (measured) = 0.203 W/kg



0 dB = 0.203 W/kg = -6.93 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

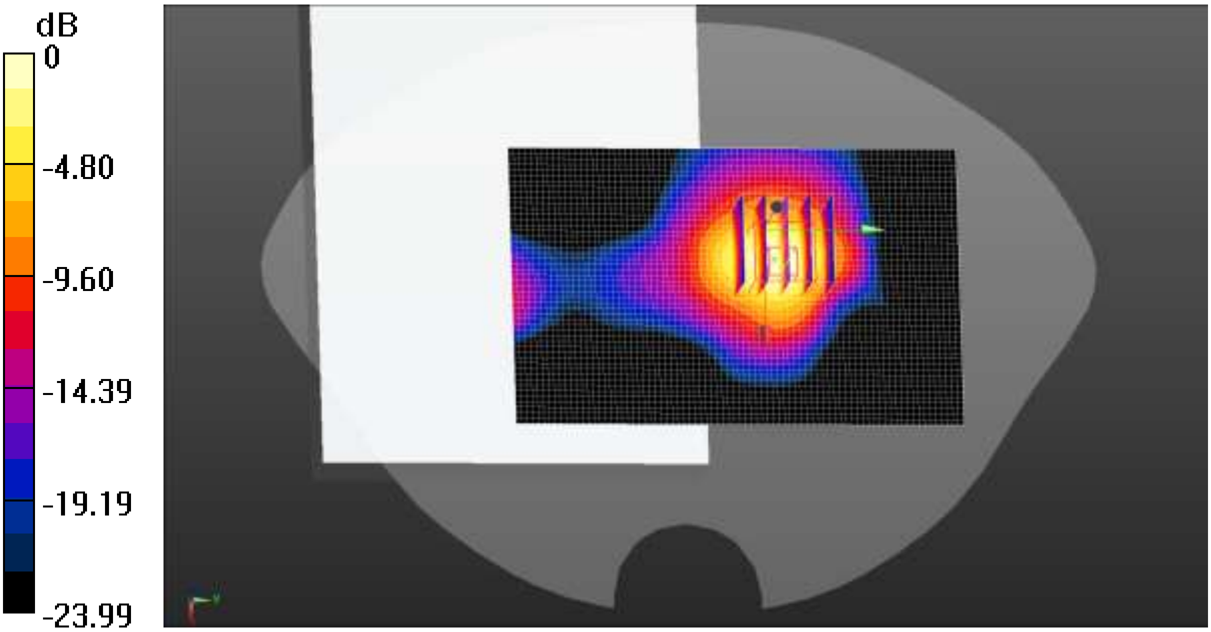
Communication System: UID 0, 2400M (0); Frequency: 2403.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2403.5 MHz; σ = 1.696 S/m; ε_r = 38.288; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2403.5 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G Body Horizontal/Low Channel/Area Scan (51x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.753 W/kg

2.4G Body Horizontal/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.166 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.916 W/kg
SAR(1 g) = 0.477 W/kg; SAR(10 g) = 0.228 W/kg
Smallest distance from peaks to all points 3 dB below = 9.6 mm
Ratio of SAR at M2 to SAR at M1 = 53.5%
Maximum value of SAR (measured) = 0.678 W/kg



0 dB = 0.678 W/kg = -1.69 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

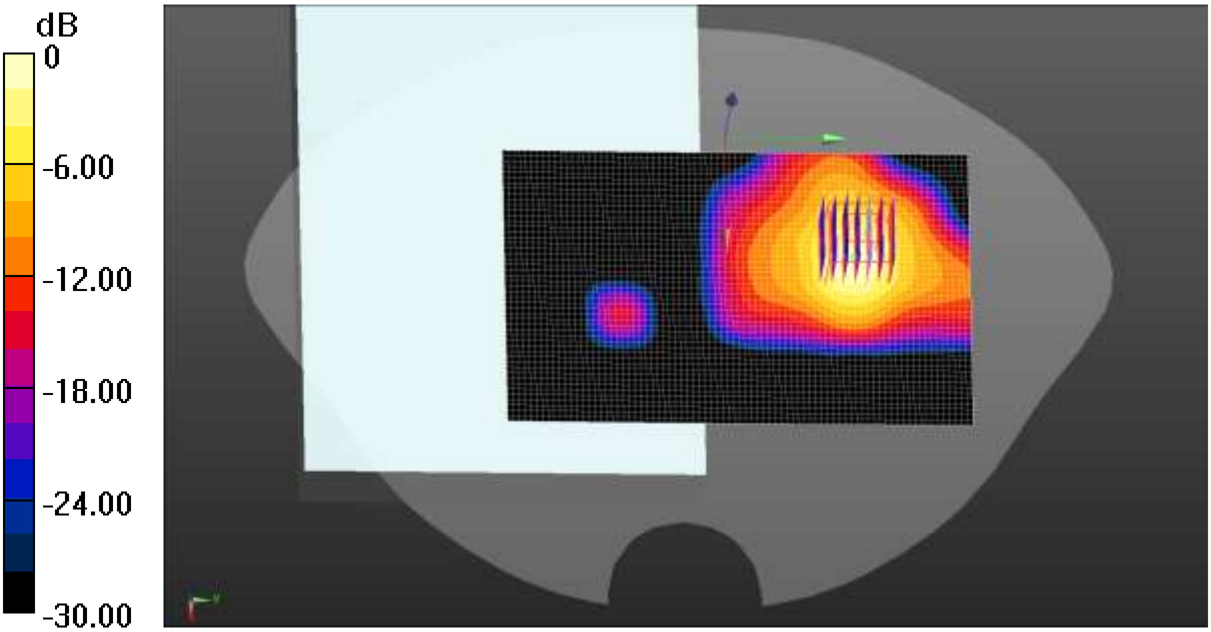
Communication System: UID 0, 5800M (0); Frequency: 5738 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5738 MHz; σ = 5.41 S/m; ε_r = 34.711; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5738 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G Body Horizontal/Low Channel/Area Scan (51x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 0.627 W/kg

5.8G Body Horizontal/Low Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.064 V/m; Power Drift = -12.27 dB
Peak SAR (extrapolated) = 0.985 W/kg
SAR(1 g) = 0.284 W/kg; SAR(10 g) = 0.106 W/kg
Smallest distance from peaks to all points 3 dB below = 11.2 mm
Ratio of SAR at M2 to SAR at M1 = 22.4%
Maximum value of SAR (measured) = 0.634 W/kg



0 dB = 0.634 W/kg = -1.98 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

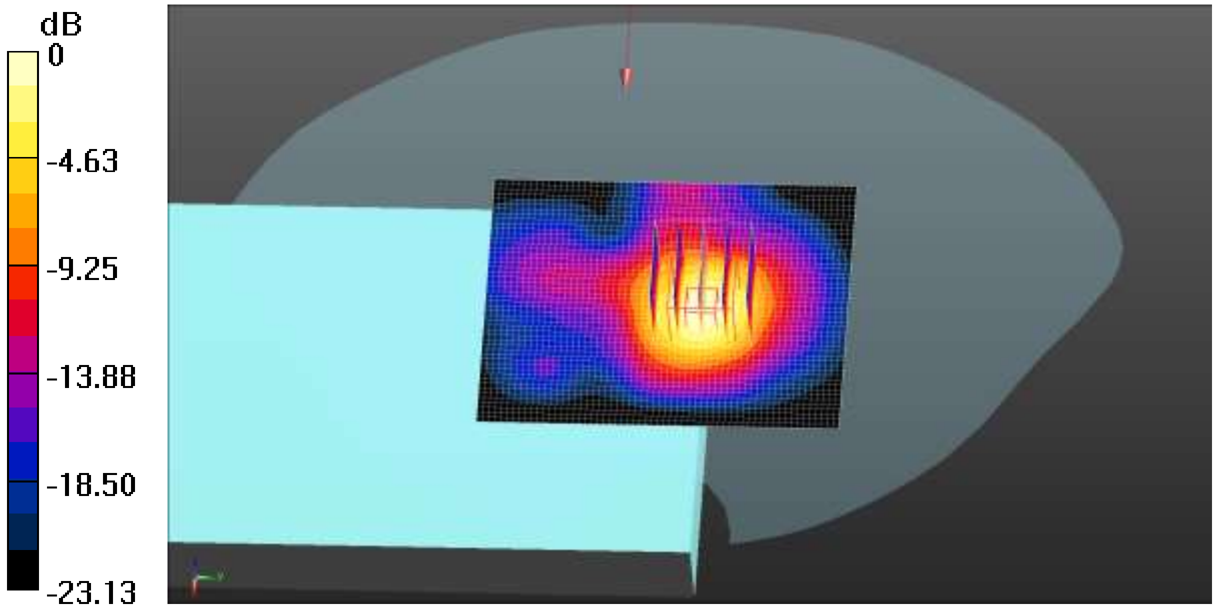
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.703 S/m; ε_r = 37.299; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2437 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G WIFI Limb Back/Middle Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 2.37 W/kg

2.4G WIFI Limb Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 20.87 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.09 W/kg
SAR(1 g) = 1.55 W/kg; SAR(10 g) = 0.745 W/kg
Smallest distance from peaks to all points 3 dB below = 10.7 mm
Ratio of SAR at M2 to SAR at M1 = 52.2%
Maximum value of SAR (measured) = 2.41 W/kg



0 dB = 2.41 W/kg = 3.82 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

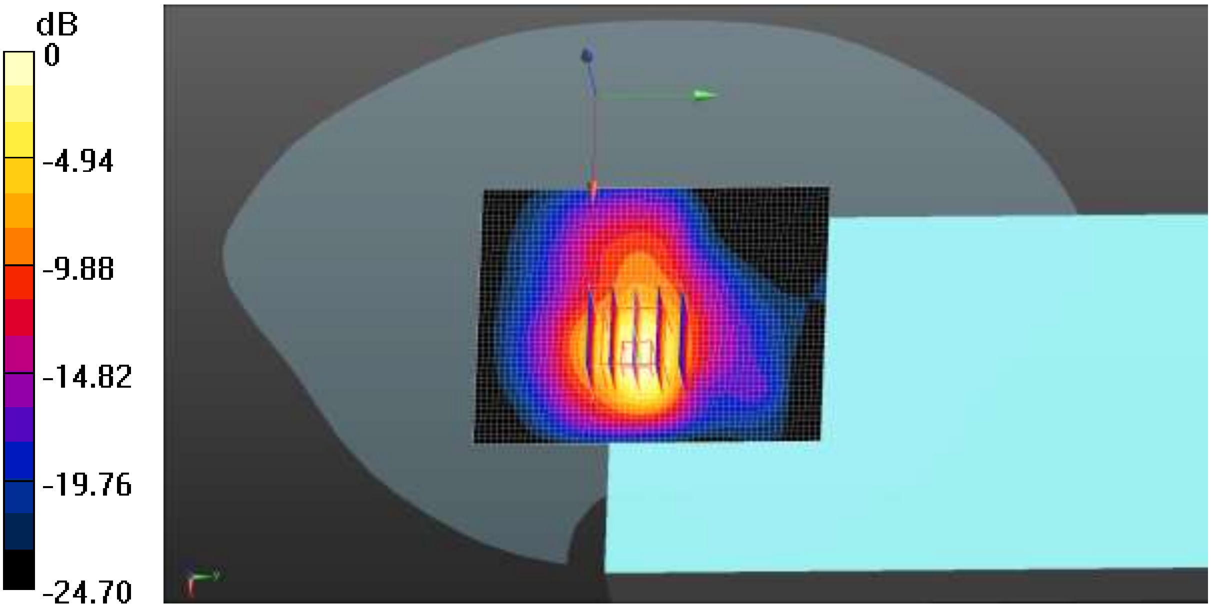
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.716 S/m; ε_r = 38.253; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2412 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G WIFI Limb Back/Low Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 2.78 W/kg

2.4G WIFI Limb Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 18.07 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 3.92 W/kg
SAR(1 g) = 1.89 W/kg; SAR(10 g) = 0.871 W/kg
Smallest distance from peaks to all points 3 dB below = 9.3 mm
Ratio of SAR at M2 to SAR at M1 = 48%
Maximum value of SAR (measured) = 3.17 W/kg



0 dB = 3.17 W/kg = 5.01 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

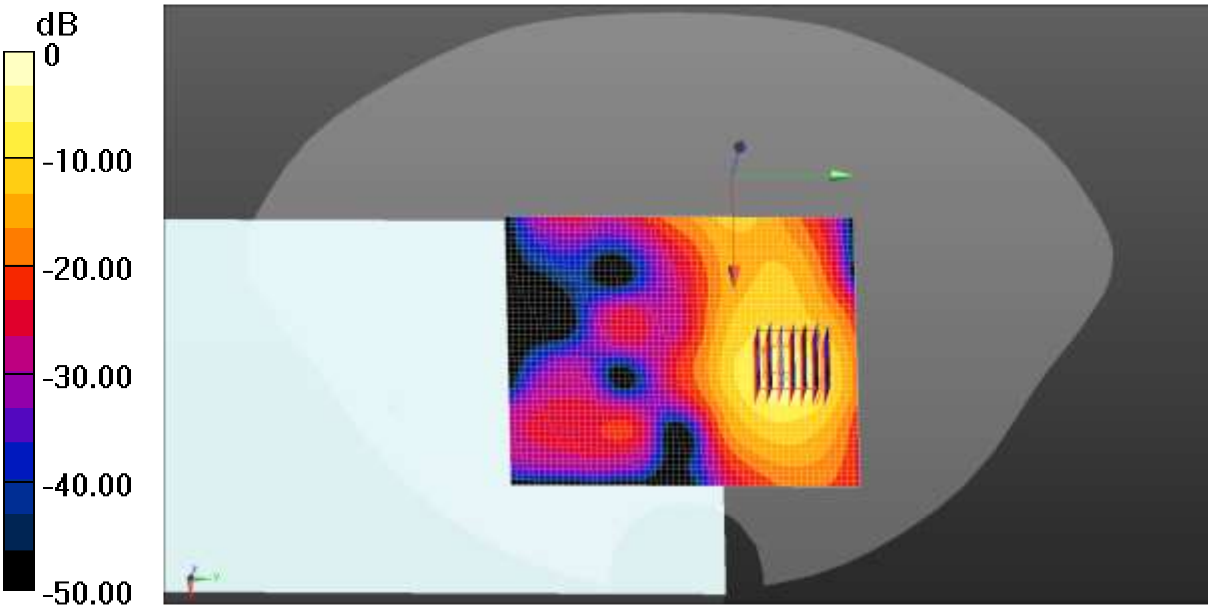
Communication System: UID 0, IEEE 802.11a WiFi 5GHz (0); Frequency: 5825 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5825 MHz; σ = 5.493 S/m; ε_r = 34.565; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5825 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G WIFI Limb Back/High Channel/Area Scan (51x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 3.81 W/kg

5.8G WIFI Limb Back/High Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=5mm
Reference Value = 2.361 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 12.9 W/kg
SAR(1 g) = 3.03 W/kg; SAR(10 g) = 0.860 W/kg
Smallest distance from peaks to all points 3 dB below = 6.1 mm
Ratio of SAR at M2 to SAR at M1 = 21.6%
Maximum value of SAR (measured) = 7.43 W/kg



0 dB = 7.43 W/kg = 8.71 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

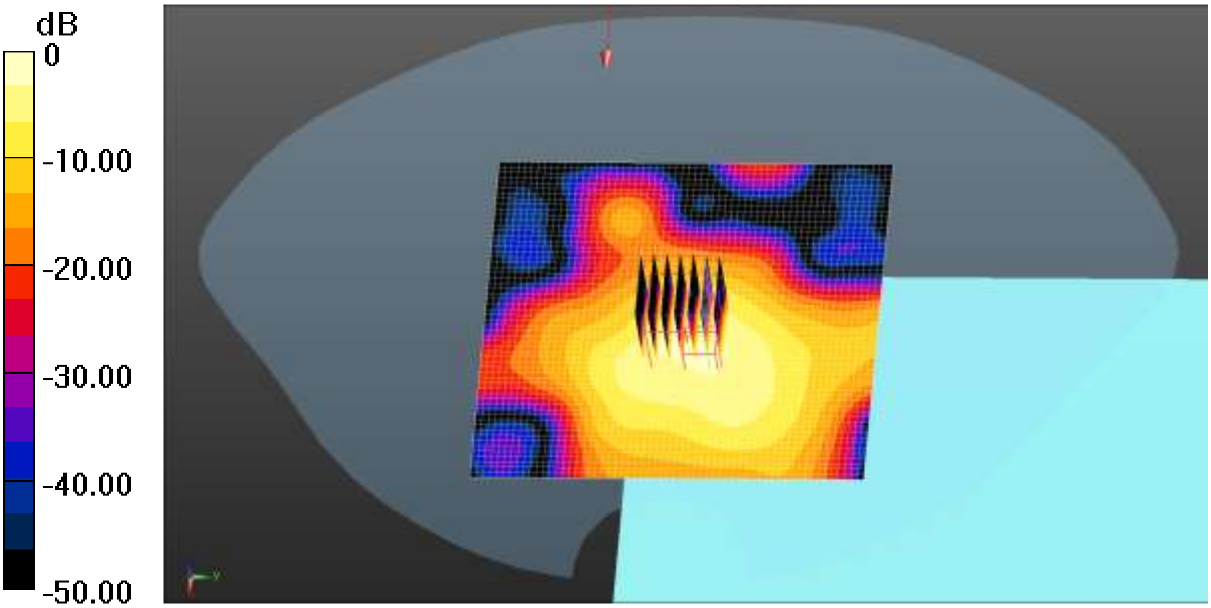
Communication System: UID 0, IEEE 802.11a WiFi 5GHz (0); Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5785 MHz; σ = 5.454 S/m; ε_r = 34.626; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5785 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G WIFI Limb Back/Middle Channel/Area Scan (61x61x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.54 W/kg

5.8G WIFI Limb Back/Middle Channel/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=4mm, dy=4mm, dz=5mm
Reference Value = 8.469 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 3.33 W/kg
SAR(1 g) = 0.890 W/kg; SAR(10 g) = 0.313 W/kg
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 21.4%
Maximum value of SAR (measured) = 2.04 W/kg



0 dB = 2.04 W/kg = 3.10 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

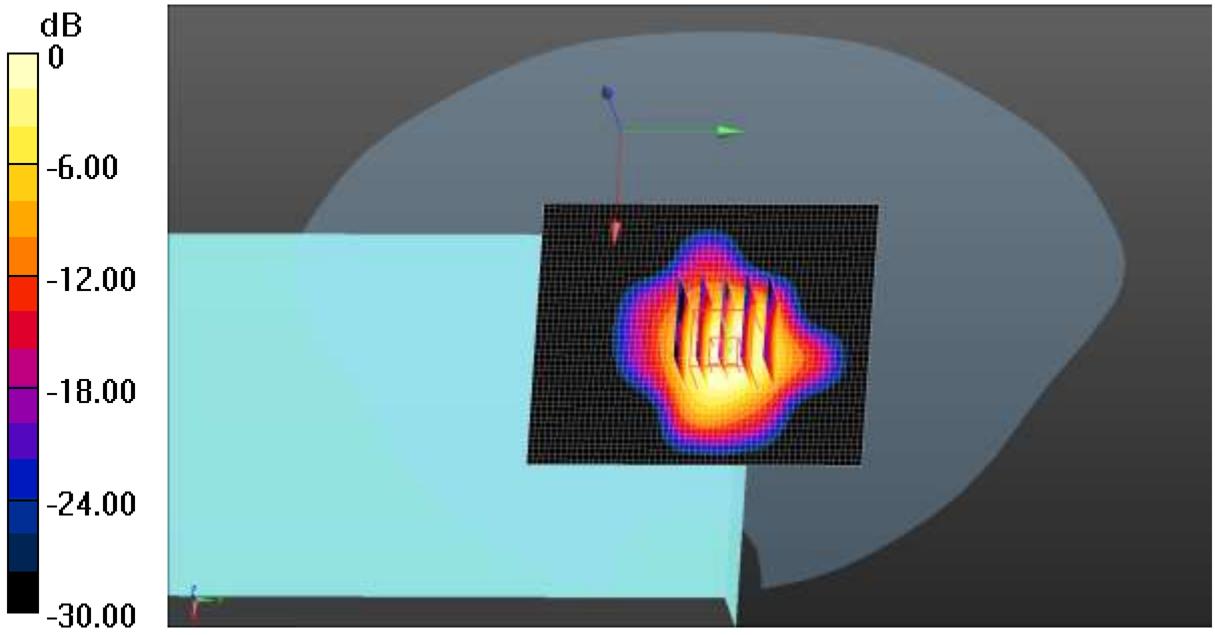
Communication System: UID 0, Bluetooth (0); Frequency: 2402 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2402 MHz; σ = 1.689 S/m; ε_r = 38.286; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2402 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

BT Limb Back/Low Channel/Area Scan (51x61x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.154 W/kg

BT Limb Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.287 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 0.150 W/kg
SAR(1 g) = 0.071 W/kg; SAR(10 g) = 0.033 W/kg
Smallest distance from peaks to all points 3 dB below = 9.7 mm
Ratio of SAR at M2 to SAR at M1 = 51.1%
Maximum value of SAR (measured) = 0.106 W/kg



0 dB = 0.106 W/kg = -9.75 dBW/kg

Test Laboratory: JYTSZ Date: 07.03.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

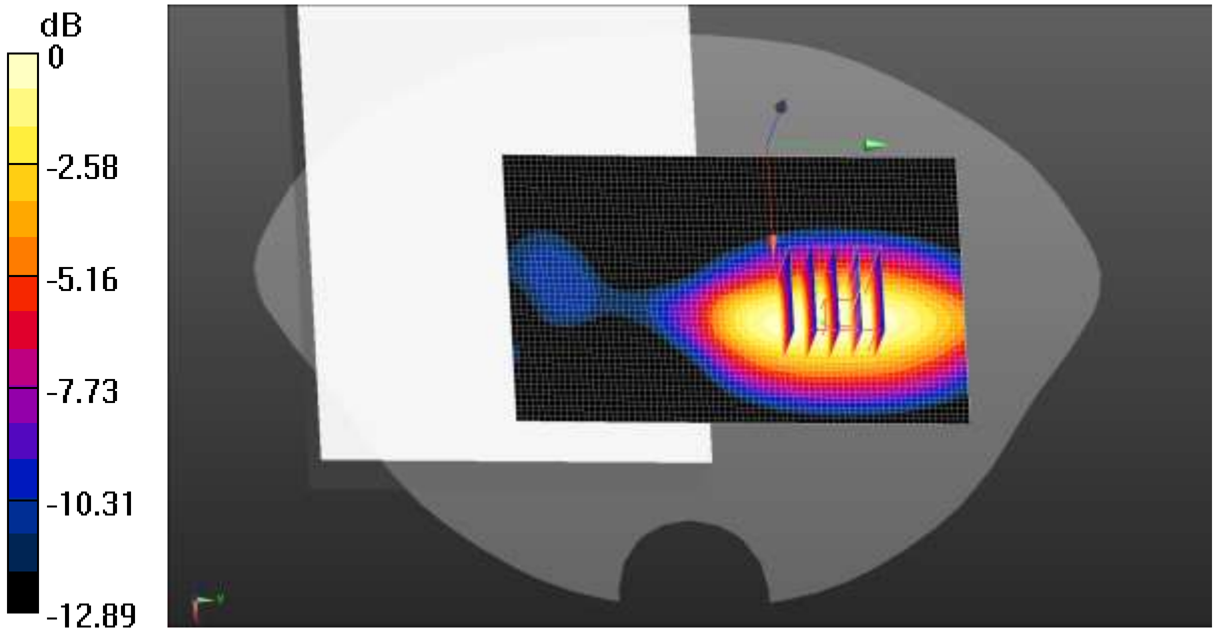
Communication System: UID 0, 900M (0); Frequency: 916 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 916 MHz; σ = 0.95 S/m; ε_r = 40.703; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(10.18, 10.18, 10.18) @ 916 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

900MHz Limb Horizontal/High Channel/Area Scan (51x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.341 W/kg

900MHz Limb Horizontal/High Channel/Zoom Scan (5x5x7)/Cube 0:
Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 7.015 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 0.394 W/kg
SAR(1 g) = 0.239 W/kg; SAR(10 g) = 0.150 W/kg
Smallest distance from peaks to all points 3 dB below = 14.4 mm
Ratio of SAR at M2 to SAR at M1 = 60.6%
Maximum value of SAR (measured) = 0.335 W/kg



0 dB = 0.335 W/kg = -4.75 dBW/kg

Test Laboratory: JYTSZ Date: 06.28.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

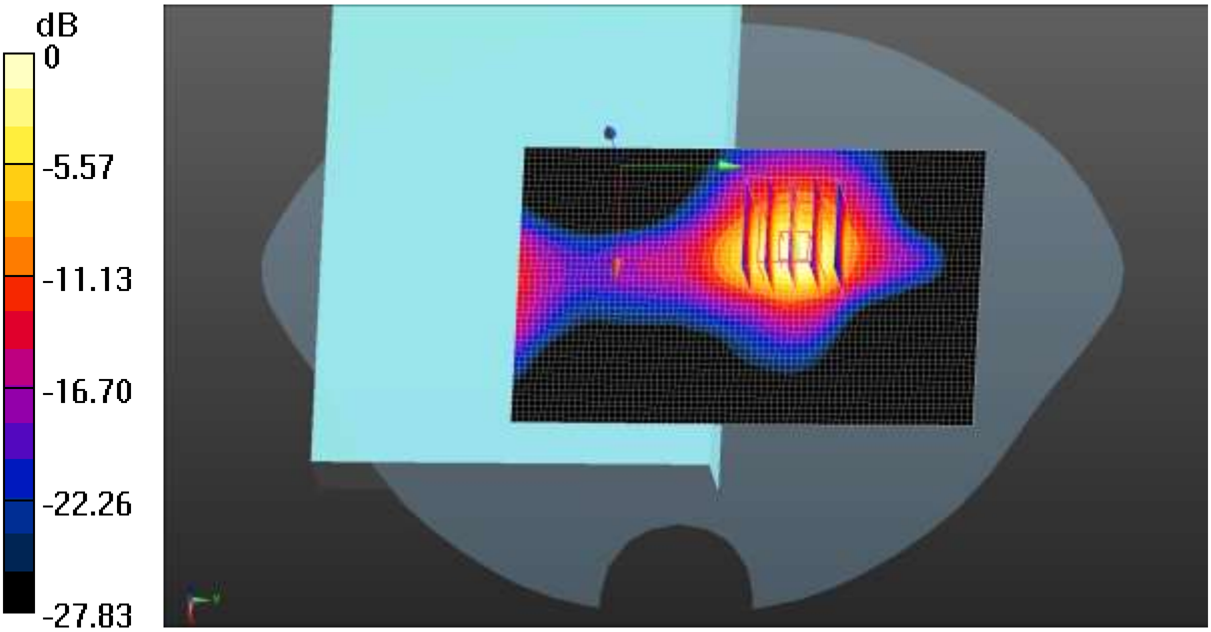
Communication System: UID 0, 2400M (0); Frequency: 2403.5 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2403.5 MHz; σ = 1.696 S/m; ε_r = 38.288; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2403.5 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

2.4G Limb Horizontal/Low Channel/Area Scan (51x81x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 1.74 W/kg

2.4G Limb Horizontal/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.346 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 1.95 W/kg
SAR(1 g) = 1.02 W/kg; SAR(10 g) = 0.455 W/kg
Smallest distance from peaks to all points 3 dB below = 8.2 mm
Ratio of SAR at M2 to SAR at M1 = 54.9%
Maximum value of SAR (measured) = 1.59 W/kg



0 dB = 1.59 W/kg = 2.01 dBW/kg

Test Laboratory: JYTSZ Date: 07.01.2022

DUT: Autel Smart Controller SE; Type: EF6; Serial: 1#

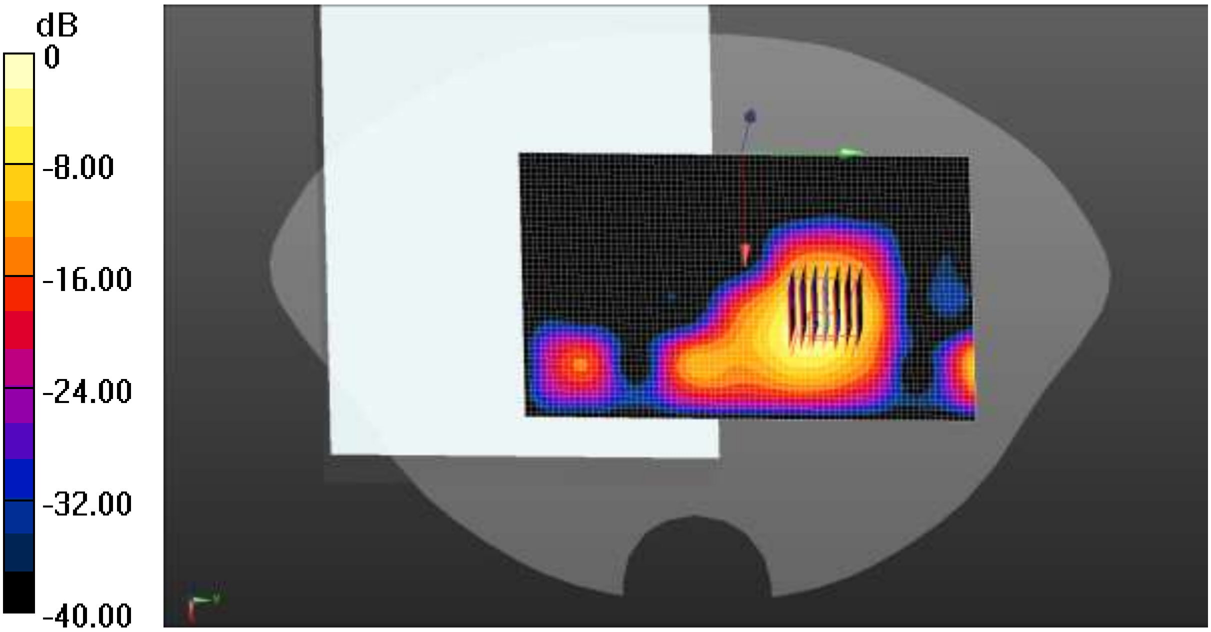
Communication System: UID 0, 5800M (0); Frequency: 5738 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 5738 MHz; σ = 5.41 S/m; ε_r = 34.711; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(5.04, 5.04, 5.04) @ 5738 MHz; Calibrated: 12.28.2021
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1373; Calibrated: 06.06.2022
- Phantom: SAM 5.0; Type: QD000P40CD; Serial: TP:1765
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

5.8G Limb Horizontal/Low Channel/Area Scan (51x81x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Maximum value of SAR (interpolated) = 1.03 W/kg

5.8G Limb Horizontal/Low Channel/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm
Reference Value = 1.714 V/m; Power Drift = -0.07 dB
Peak SAR (extrapolated) = 2.68 W/kg
SAR(1 g) = 0.685 W/kg; SAR(10 g) = 0.213 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 21.7%
Maximum value of SAR (measured) = 1.66 W/kg



0 dB = 1.66 W/kg = 2.20 dBW/kg

Appendix E: System Calibration Certificate

CTTL In Collaboration with s p e a g CALIBRATION LABORATORY
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Client JYT(formerly CCIS) Certificate No: Z21-60407

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 7601
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	December 28, 2021

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	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101547	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Power sensor NRP-Z91	101548	15-Jun-21(CTTL, No.J21X04466)	Jun-22
Reference 10dBAttenuator	18N50W-10dB	10-Feb-20(CTTL, No.J20X00525)	Feb-22
Reference 20dBAttenuator	18N50W-20dB	10-Feb-20(CTTL, No.J20X00526)	Feb-22
Reference Probe EX3DV4	SN 3617	27-Jan-21(SPEAG, No.EX3-3617_Jan21)	Jan-22
DAE4	SN 1555	20-Aug-21(SPEAG, No.DAE4-1555_Aug21/2)	Aug-22

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	16-Jun-21(CTTL, No.J21X04467)	Jun-22
Network Analyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan -22

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

Issued: December 30, 2021

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

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

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

Methods Applied and Interpretation of Parameters:

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

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7601

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm(μV/(V/m)^2)[A]	0.71	0.66	0.66	±10.0%
DCP(mV)[B]	109.8	108.5	107.3	

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	223.3	±2.1%
		Y	0.0	0.0	1.0		213.1	
		Z	0.0	0.0	1.0		208.0	

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.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7601

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	10.58	10.58	10.58	0.14	1.33	±12.1%
835	41.5	0.90	10.20	10.20	10.20	0.11	1.60	±12.1%
900	41.5	0.97	10.18	10.18	10.18	0.16	1.34	±12.1%
1750	40.1	1.37	8.62	8.62	8.62	0.25	1.00	±12.1%
1900	40.0	1.40	8.37	8.37	8.37	0.23	1.07	±12.1%
2300	39.5	1.67	7.94	7.94	7.94	0.51	0.73	±12.1%
2450	39.2	1.80	7.74	7.74	7.74	0.37	0.93	±12.1%
2600	39.0	1.96	7.49	7.49	7.49	0.43	0.86	±12.1%
5250	35.9	4.71	5.35	5.35	5.35	0.45	1.35	±13.3%
5600	35.5	5.07	4.96	4.96	4.96	0.50	1.30	±13.3%
5750	35.4	5.22	5.04	5.04	5.04	0.50	1.32	±13.3%

[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 below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. 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.

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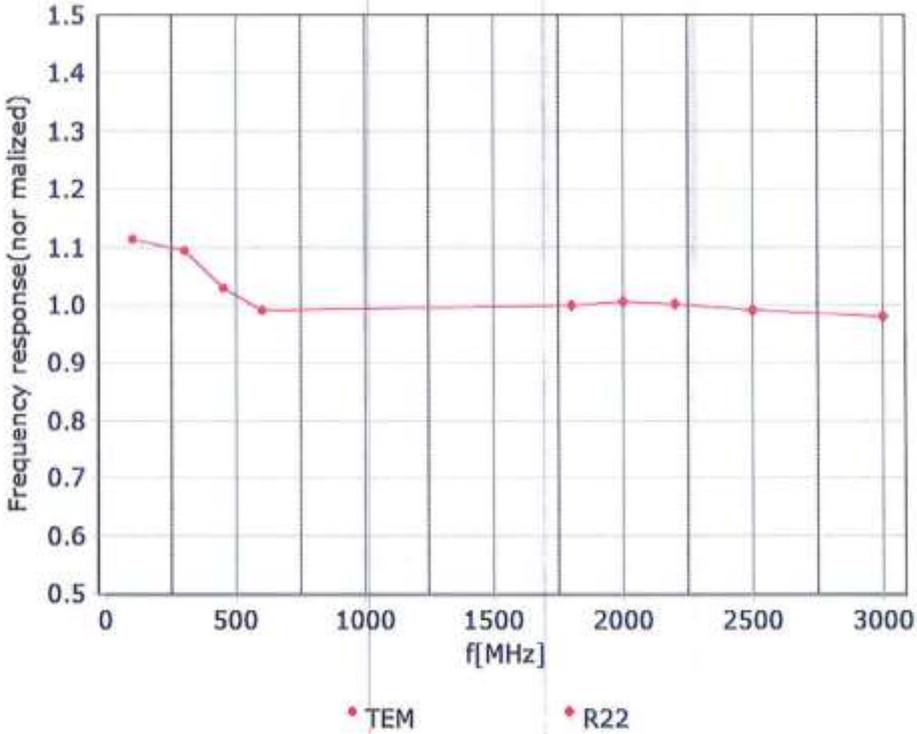
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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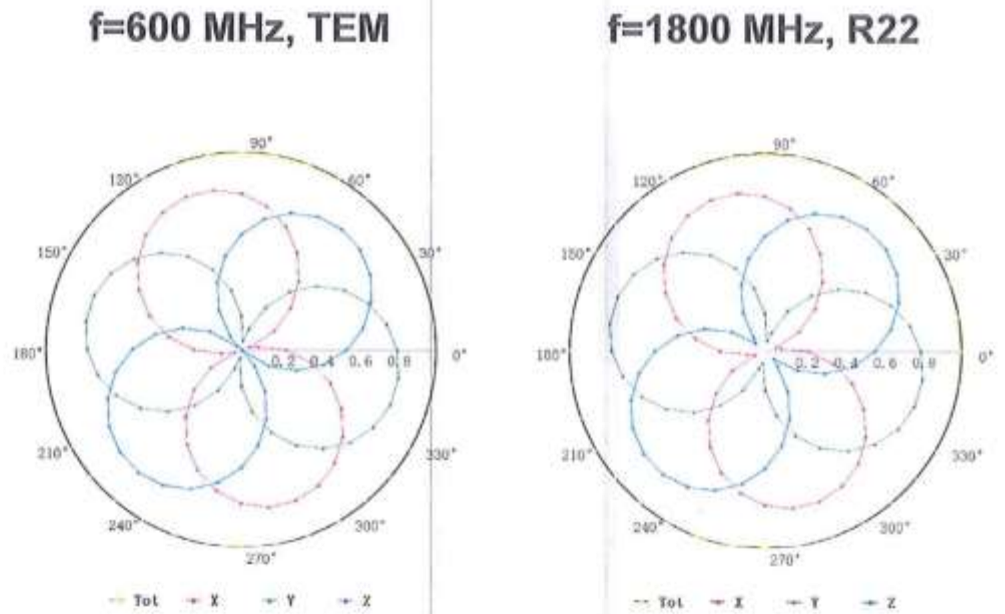
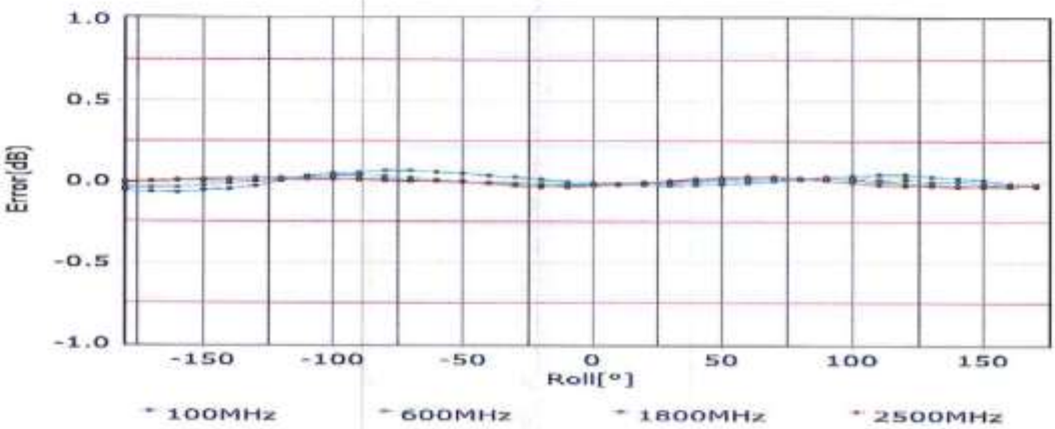
Receiving Pattern (Φ), θ=0°





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

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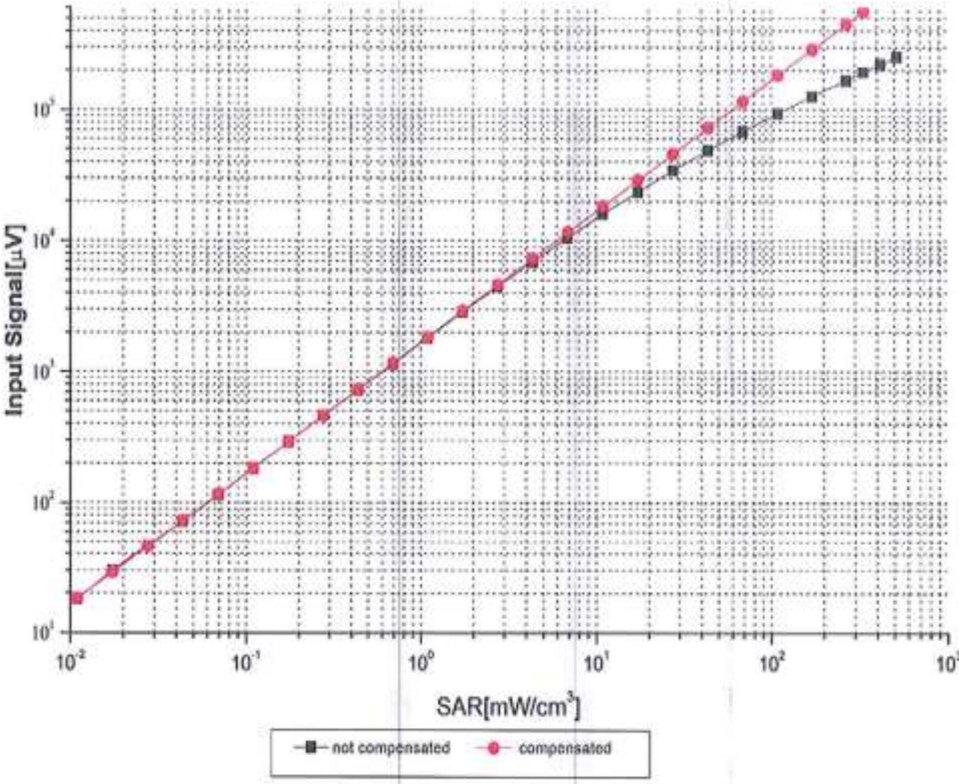
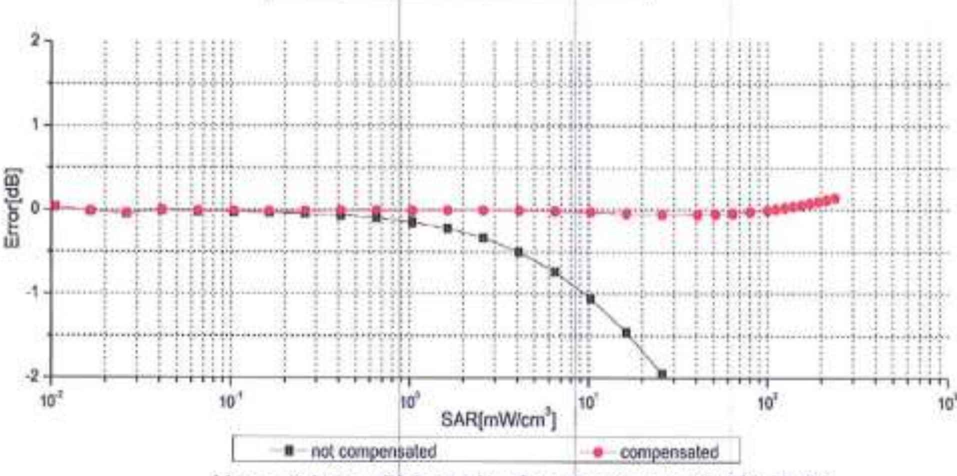
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)





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

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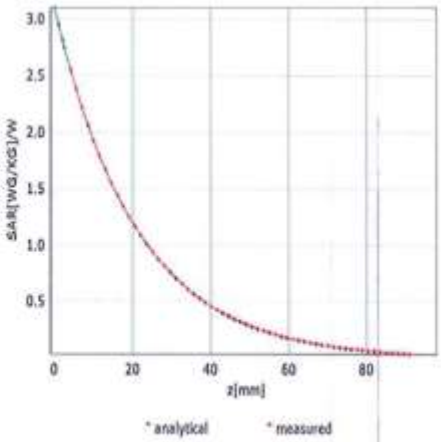
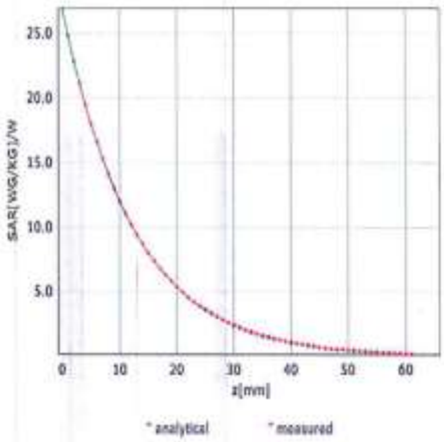
Conversion Factor Assessment

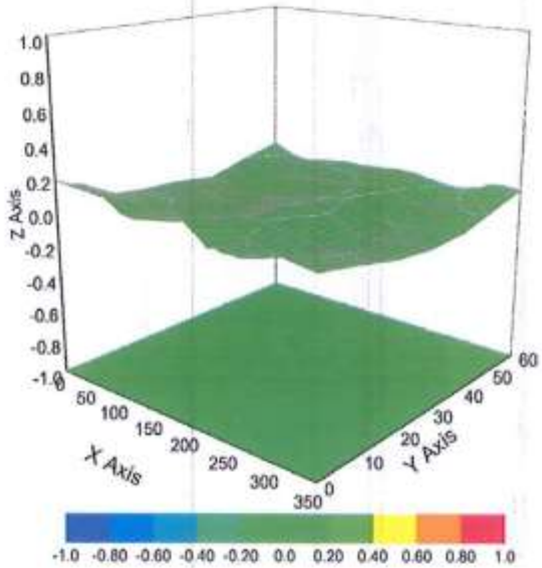
f=750 MHz,WGLS R9(H_convF)



f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



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

Certificate No:Z21-60407

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7601

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	59.4
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

Calibration information for Dipole

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Client JYT Certificate No: Z22-60210

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d154
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	June 8, 2022

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	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG,No.EX3-7464_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Jan-23
Secondary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL, No.J22X00409)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL, No.J22X00406)	Jan-23

	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: June 13, 2022

In Collaboration with
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CALIBRATION LABORATORY

CAICT

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

Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.9 ± 6 %	0.88 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	2.36 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.60 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.20 W/kg ± 18.7 % (*k*=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	48.9Ω- 3.78jΩ
Return Loss	- 28.0dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.310 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

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DASY5 Validation Report for Head TSL Date: 2022-06-08

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d154

Communication System: UID 0, CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium parameters used: f = 835 MHz; σ = 0.882 S/m; ε_r = 41.9; ρ = 1000 kg/m^3

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(9.96, 9.96, 9.96) @ 835 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- 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 = 59.20 V/m; Power Drift = -0.01 dB

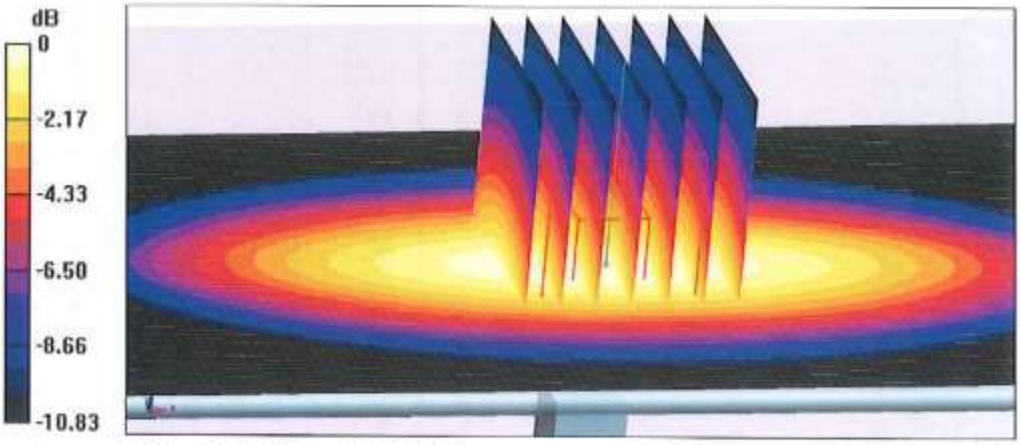
Peak SAR (extrapolated) = 3.58 W/kg

SAR(1 g) = 2.36 W/kg; SAR(10 g) = 1.53 W/kg

Smallest distance from peaks to all points 3 dB below = 18 mm

Ratio of SAR at M2 to SAR at M1 = 65.7%

Maximum value of SAR (measured) = 3.17 W/kg



0 dB = 3.17 W/kg = 5.01 dBW/kg

Certificate No: Z22-60210 Page 5 of 6

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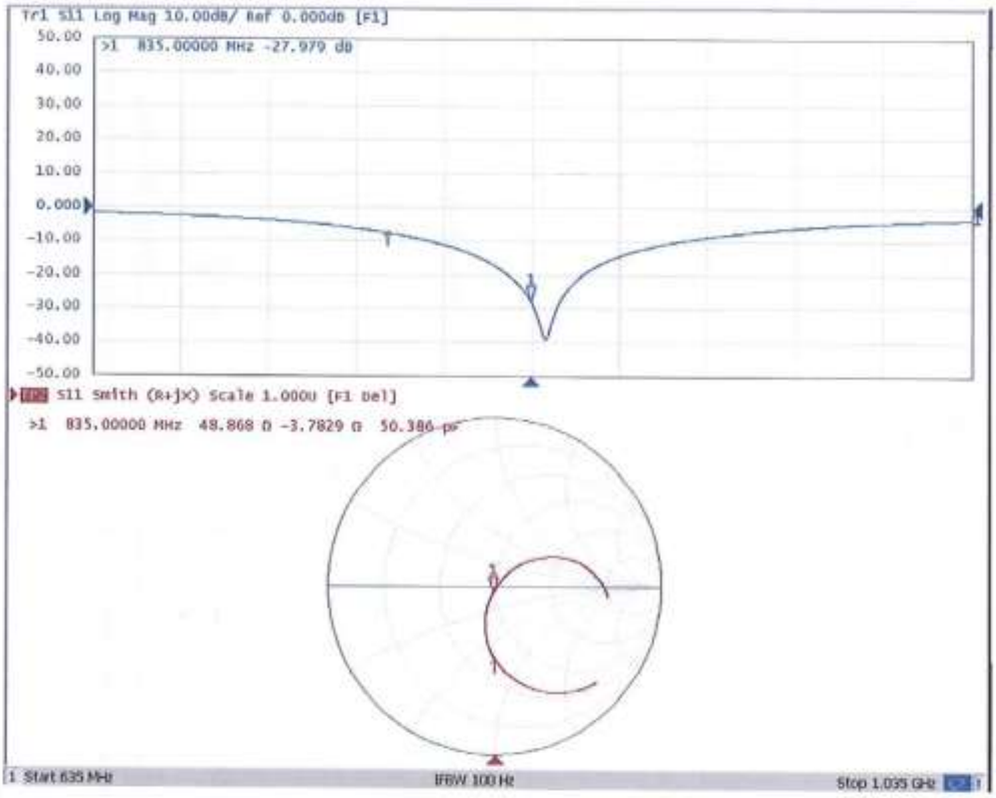
Impedance Measurement Plot for Head TSL



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Client JYT Certificate No: Z22-60212

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 910
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	June 6, 2022

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)°C 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	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Power sensor NRP8S	104291	24-Sep-21 (CTTL, No.J21X08326)	Sep-22
Reference Probe EX3DV4	SN 7464	26-Jan-22(SPEAG,No.EX3-7464_Jan22)	Jan-23
DAE4	SN 1556	12-Jan-22(CTTL-SPEAG,No.Z22-60007)	Jan-23
Secondary Standards	**ID #**	**Cal Date (Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	13-Jan-22 (CTTL, No. J22X00409)	Jan-23
Network Analyzer E5071C	MY46110673	14-Jan-22 (CTTL, No.J22X00406)	Jan-23

	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: June 13, 2022

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

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

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, 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	40.0 ± 6 %	1.81 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**53.4 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.19 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.8 W/kg ± 18.7 % (*k*=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.2Ω+ 2.79jΩ
Return Loss	- 27.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.066 ns

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

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

Additional EUT Data

Manufactured by	SPEAG

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E-mail: cttl@chinattl.com http://www.caict.ac.cn

DASY5 Validation Report for Head TSL Date: 2022-06-06

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 910

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

Medium parameters used: f = 2450 MHz; σ = 1.806 S/m; ε_r = 40.03; ρ = 1000 kg/m³

Phantom section: Right Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.77, 7.77, 7.77) @ 2450 MHz; Calibrated: 2022-01-26
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1556; Calibrated: 2022-01-12
- 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 = 97.85 V/m; Power Drift = -0.03 dB

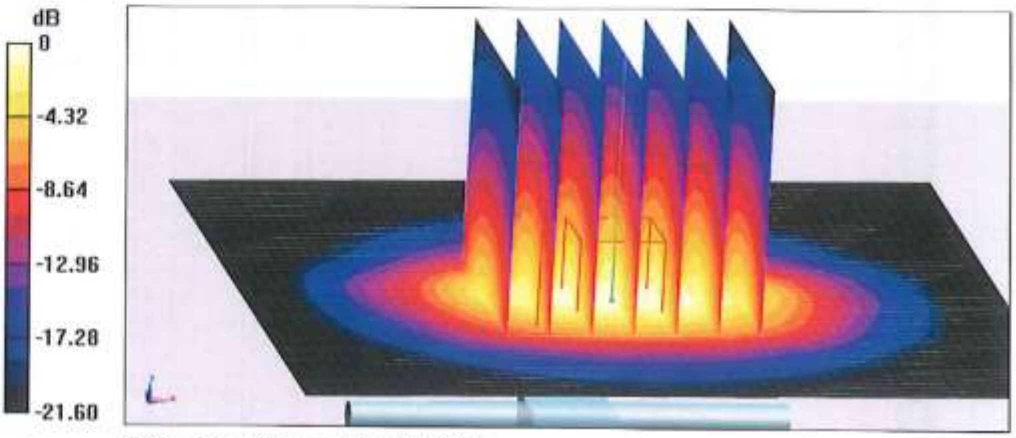
Peak SAR (extrapolated) = 27.3 W/kg

SAR(1 g) = 13.3 W/kg; SAR(10 g) = 6.19 W/kg

Smallest distance from peaks to all points 3 dB below = 8.5 mm

Ratio of SAR at M2 to SAR at M1 = 49.3%

Maximum value of SAR (measured) = 22.3 W/kg



0 dB = 22.3 W/kg = 13.48 dBW/kg

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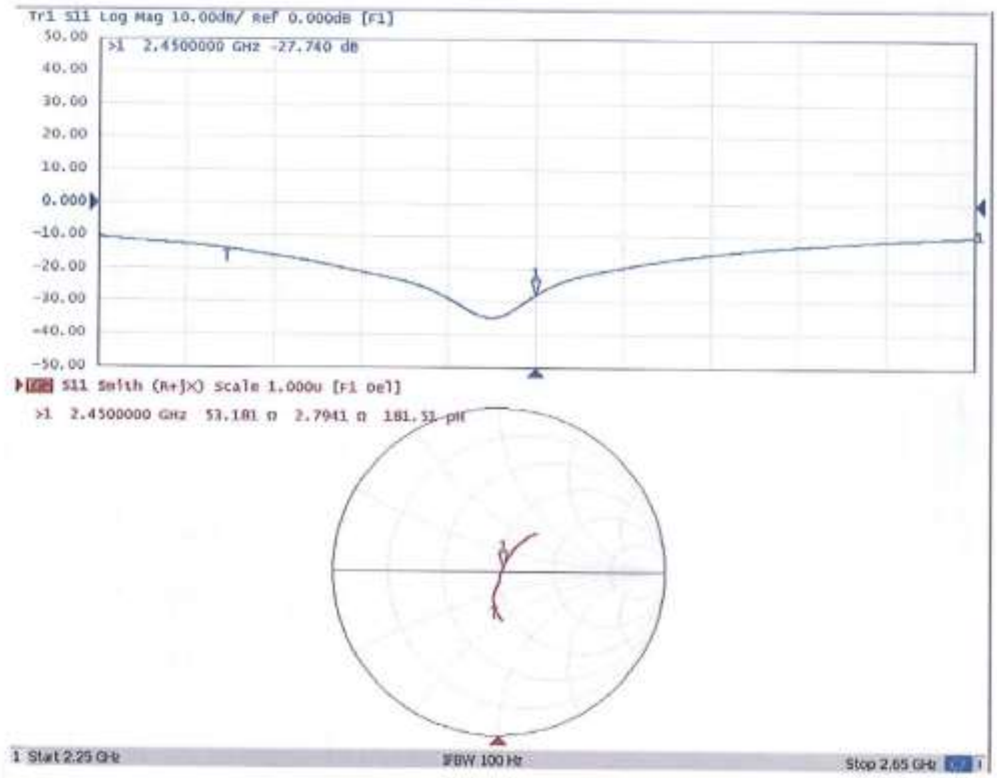
Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 0108**

Client **JYT (Auden)**

Certificate No: **D5GHzV2-1320_Feb21**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN:1320
Calibration procedure(s)	QA CAL-22.v6 Calibration Procedure for SAR Validation Sources between 3-10 GHz
Calibration date:	February 05, 2021

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)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	01-Apr-20 (No. 217-03100/03101)	Apr-21
Power sensor NRP-Z91	SN: 103244	01-Apr-20 (No. 217-03100)	Apr-21
Power sensor NRP-Z91	SN: 103245	01-Apr-20 (No. 217-03101)	Apr-21
Reference 20 dB Attenuator	SN: BH9394 (20k)	31-Mar-20 (No. 217-03106)	Apr-21
Type-N mismatch combination	SN: 310982 / 06327	31-Mar-20 (No. 217-03104)	Apr-21
Reference Probe EX3DV4	SN: 3503	30-Dec-20 (No. EX3-3503_Dec20)	Dec-21
DAE4	SN: 601	02-Nov-20 (No. DAE4-601_Nov20)	Nov-21

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB39512475	30-Oct-14 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: US37292783	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
Power sensor HP 8481A	SN: MY41092317	07-Oct-15 (in house check Oct-20)	In house check: Oct-22
RF generator R&S SMT-06	SN: 100972	15-Jun-15 (in house check Oct-20)	In house check: Oct-22
Network Analyzer Agilent E8358A	SN: US41080477	31-Mar-14 (in house check Oct-20)	In house check: Oct-21

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 5, 2021

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Accreditation No.: **SCS 0108**

Glossary:

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

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"

Additional Documentation:

e) 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%.

Measurement Conditions

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

DASY Version	DASY5	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 10.0 mm, dz = 10.0 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.8 ± 6 %	4.49 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.98 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.6 W/kg ± 19.5 % (k=2)**

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Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366, E-mail: info-JYTee@lets.com

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.6 ± 6 %	4.59 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.3 ± 6 %	4.78 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.67 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**85.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.47 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**24.4 W/kg ± 19.5 % (k=2)**

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Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366, E-mail: info-JYTee@lets.com

Head TSL parameters at 5600 MHz

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	34.2 ± 6 %	4.88 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	33.9 ± 6 %	5.09 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (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	**22.9 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.1 Ω - 3.9 jΩ
Return Loss	- 28.1 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.6 Ω + 3.1 jΩ
Return Loss	- 30.0 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	47.5 Ω + 1.2 jΩ
Return Loss	- 30.7 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	53.5 Ω + 2.1 jΩ
Return Loss	- 28.2 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	50.5 Ω + 7.6 jΩ
Return Loss	- 22.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint 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 feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG

DASY5 Validation Report for Head TSL

Date: 05.02.2021

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1320

Communication System: UID 0 - CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.49 S/m; ε_r = 34.8; ρ = 1000 kg/m^3
Medium parameters used: f = 5300 MHz; σ = 4.59 S/m; ε_r = 34.6; ρ = 1000 kg/m^3
Medium parameters used: f = 5500 MHz; σ = 4.78 S/m; ε_r = 34.3; ρ = 1000 kg/m^3
Medium parameters used: f = 5600 MHz; σ = 4.88 S/m; ε_r = 34.2; ρ = 1000 kg/m^3
Medium parameters used: f = 5800 MHz; σ = 5.09 S/m; ε_r = 33.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.8, 5.8, 5.8) @ 5200 MHz, ConvF(5.49, 5.49, 5.49) @ 5300 MHz, ConvF(5.25, 5.25, 5.25) @ 5500 MHz, ConvF(5.1, 5.1, 5.1) @ 5600 MHz, ConvF(5.01, 5.01, 5.01) @ 5800 MHz; Calibrated: 30.12.2020
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 02.11.2020
- Phantom: Flat Phantom 5.0 (front); Type: QD 000 P50 AA; Serial: 1001
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.70 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 7.98 W/kg; SAR(10 g) = 2.28 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70.8%
Maximum value of SAR (measured) = 17.9 W/kg

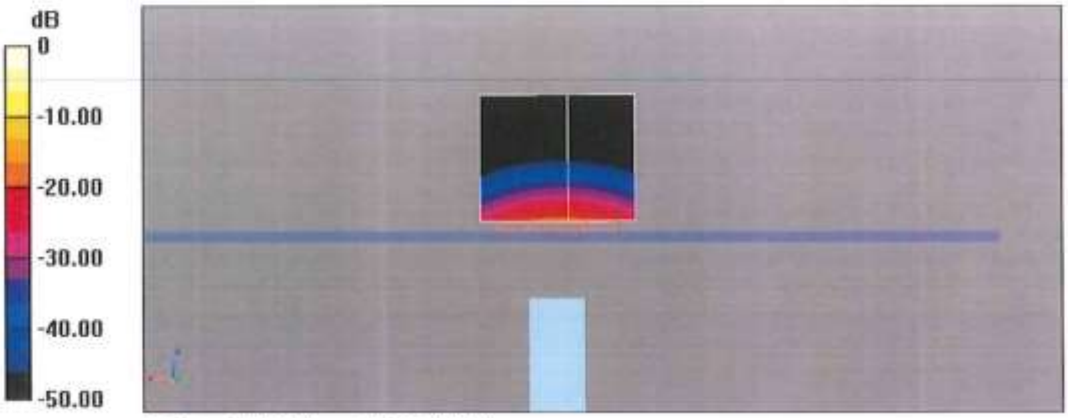
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.91 V/m; Power Drift = -0.08 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.34 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 70.8%
Maximum value of SAR (measured) = 18.3 W/kg

JianYan Testing Group Shenzhen Co., Ltd. Project No.: JYTSZR2206063
No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366, E-mail: info-JYTee@lets.com

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 76.98 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.67 W/kg; SAR(10 g) = 2.47 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 68.1%
Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 77.18 V/m; Power Drift = -0.09 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 8.40 W/kg; SAR(10 g) = 2.40 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 68.9%
Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 75.07 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 31.6 W/kg
SAR(1 g) = 8.17 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 = 67.3%
Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 20.1 W/kg = 13.03 dBW/kg

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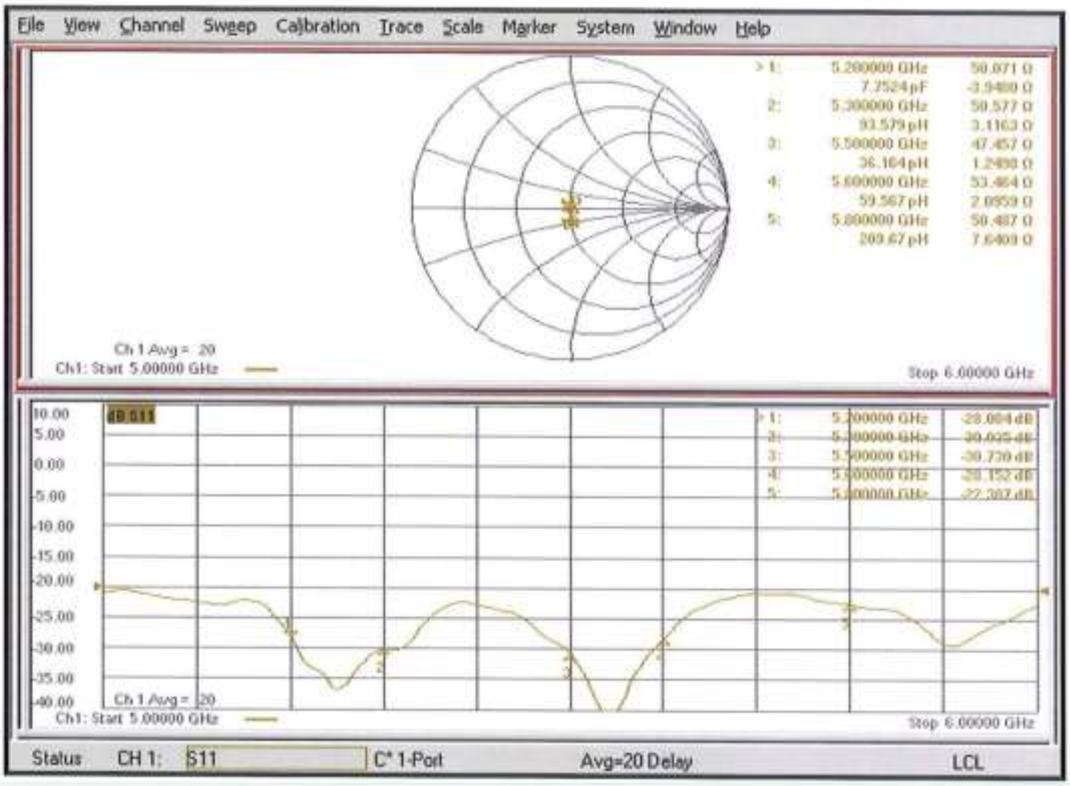
Telephone: +86 (0) 755 23118282 Fax: +86 (0) 755 23116366, E-mail: info-JYTee@lets.com

Impedance Measurement Plot for Head TSL



Certificate No: D5GHzV2-1320_Feb21 Page 9 of 9

Dipole Impedance and Return Loss calibration Report

Object: D5GHzV2 - SN: 1320

Calibration Date: February 05, 2022

Calibration reference: IEEE Std 1528:2013, IEC 62209-1:2006, FCC KDB 865664 D01

Calibrated By: (Janet Wei, SAR project engineer)

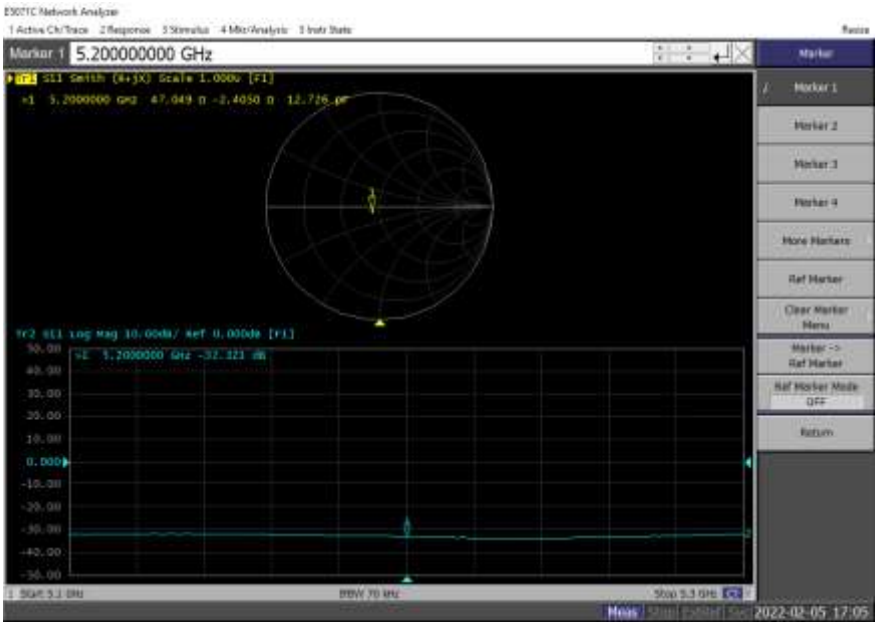
Reviewed By: (Winner Zhang, Technical manager)

Environment of Test Site

Temperature:	18 ~ 25°C
Humidity:	50~60% RH
Atmospheric Pressure:	1011 mbar

Test Data

Measurement Plot for Head TSL In 2022

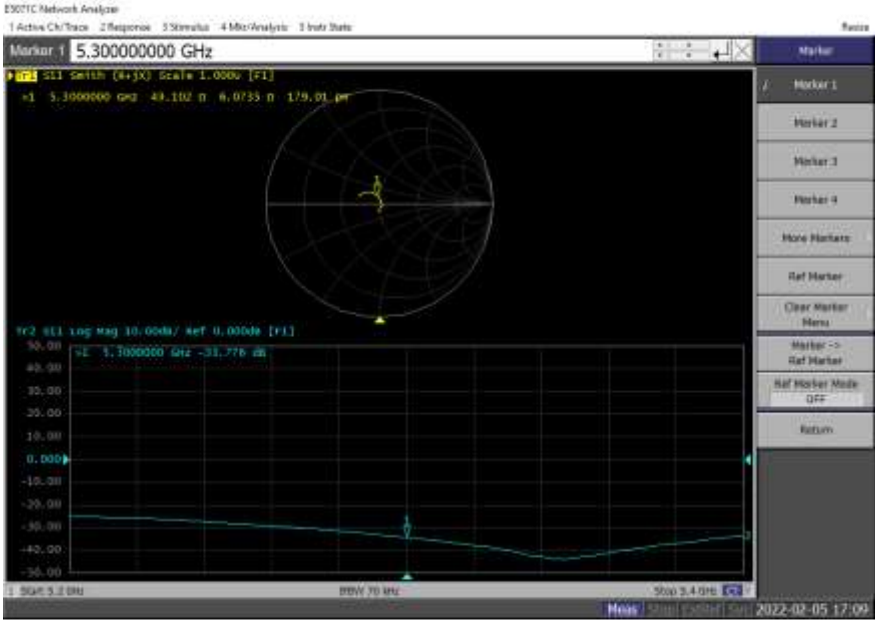


Comparison with Original report

Items	Calibrated By CTTL	Calibrated By JYT In 2022	Deviation	Limit
Impendence for Head TSL	50.10Ω-3.90jΩ	47.05Ω-2.41jΩ	-3.05Ω+1.49jΩ	±5Ω
Return Loss for Head TSL	-28.10dB	-32.32dB	15.02%	±20%(No less than 20 dB)

Result

Compliance

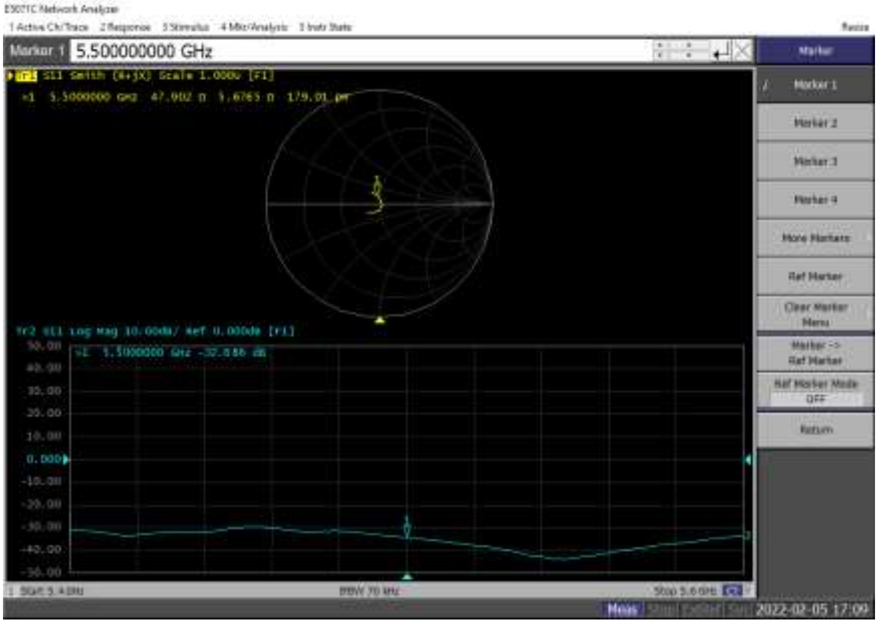


Comparison with Original report

Items	Calibrated By MVG	Calibrated By JYT In 2022	Deviation	Limit
Impendence for Head TSL	50.60+3.10jΩ	49.10Ω+6.07jΩ	-1.5Ω+2.97jΩ	±5Ω
Return Loss for Head TSL	-30.00dB	-33.78dB	12.60%	±20%(No less than 20 dB)

Result

Compliance

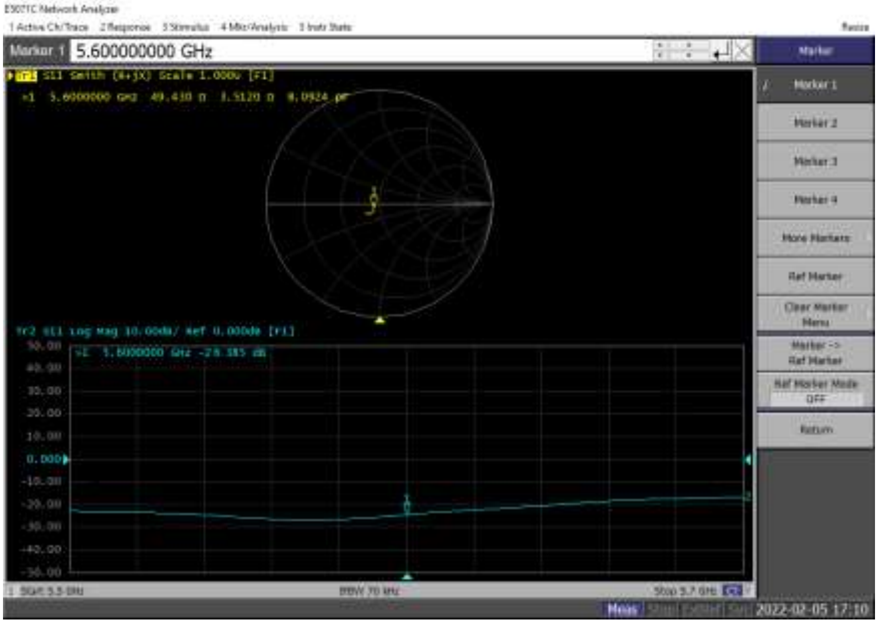


Comparison with Original report

Items	Calibrated By MVG	Calibrated By JYT In 2022	Deviation	Limit
Impendence for Head TSL	47.50+1.20jΩ	47.90Ω+5.68jΩ	0.40Ω-4.48jΩ	±5Ω
Return Loss for Head TSL	-30.70dB	-32.69dB	6.48%	±20%(No less than 20 dB)

Result

Compliance

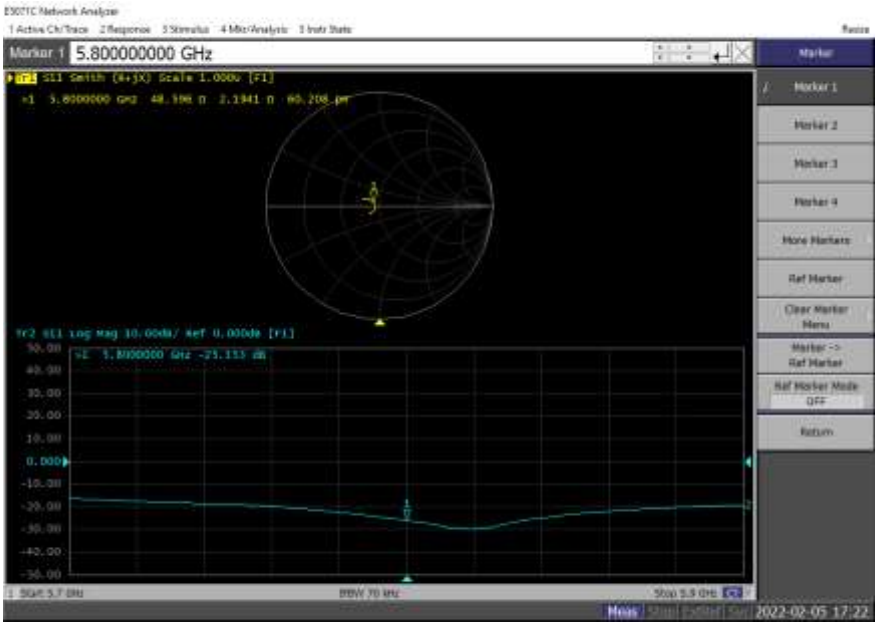


Comparison with Original report

Items	Calibrated By MVG	Calibrated By JYT In 2022	Deviation	Limit
Impendence for Head TSL	53.50+2.10jΩ	49.43Ω+3.51jΩ	-4.07Ω+1.41jΩ	±5Ω
Return Loss for Head TSL	-28.20dB	-26.39dB	-6.42%	±20%(No less than 20 dB)

Result

Compliance



Comparison with Original report

Items	Calibrated By MVG	Calibrated By JYT In 2022	Deviation	Limit
Impendence for Head TSL	50.50+7.60jΩ	48.60Ω+2.19jΩ	0.33Ω-2.42jΩ	±5Ω
Return Loss for Head TSL	-22.40dB	-25.35dB	13.17%	±20%(No less than 20 dB)

Result

Compliance

Calibration information for DAE

CTTL In Collaboration with s p e a g CALIBRATION LABORATORY

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

Client : JYT

Certificate No: Z22-60209

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1373
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	June 06, 2022

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	15-Jun-21 (CTTL, No.J21X04465)	Jun-22

	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 09, 2022

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Glossary:

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

Methods Applied and Interpretation of Parameters:

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

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DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	403.940 ± 0.15% (k=2)	403.903 ± 0.15% (k=2)	404.196 ± 0.15% (k=2)
Low Range	3.98687 ± 0.7% (k=2)	4.00795 ± 0.7% (k=2)	4.01128 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	347° ± 1 °

------End of Report------