JianYan Testing Group Shenzhen Co., Ltd.

Report No.: JYTSZ-R14-2200215

FCC SAR REPORT

Applicant:	TECNO MOBILE LIMITED
Address of Applicant:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Equipment Under Test (EUT)	
Product Name:	Mobile Phone
Model No.:	AD8
Trade mark	TECNO
FCC ID:	2ADYY-AD8
Applicable standards:	FCC 47 CFR Part 2.1093
Date of Test:	30 Oct., 2022 ~ 30 Oct., 2022
Test Result:	Maximum Reported 1-g SAR (W/kg) Head: 0.793 Body: 0.377 Hotspot: 0.589

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*04 Nov., 2022*	*Original*

Tested by:	Eric Wang	***Date:***	*04 Nov., 2022*
	Test Engineer		
Reviewed by:	Janet. Wei	***Date:***	*04 Nov., 2022*
	Project Engineer		

3 Contents

4 SAR Results Summary

This report was amended on FCC ID: 2ADYY-AD8 follow FCC Class II Permissive Change. The original report: JYTSZ-R14-2200160, issued by JianYan Testing Group Shenzhen Co., Ltd. The differences between them as below: Only the applicant and manufacturer addresses are updated, change the shape of the shield cover of PMU, change the size of QR code, delete：L3217 L3533 and Components position adjustment, Sub PCB: replace a capacitance(C123) with a diode(D102), update ANT1(2.4G Wi-Fi MIMO&BT) and ANT11(5G NR N77 N78 DRX2), ANT13(5G NR N41 DRX1). So retest: ANT1(2.4G Wi-Fi MIMO&BT).

The maximum results of Specific Absorption Rate (SAR) found during test as below:
<Highest Reported standalone SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest Reported 1-g SAR (W/kg)
Head	GSM 850	0.085	PCE	0.793
	PCS 1900	0.379		
	WCDMA Band II	0.781		
	WCDMA Band IV	0.621		
	WCDMA Band V	0.086		
	LTE Band 2	0.793		
	LTE Band 5	0.099		
	LTE Band 7	0.650		
	LTE Band 41 & Band 38	0.667		
	LTE Band 66 & Band 4	0.639		
	NR n41& n38	0.596		
	NR n71	0.050		
	NRn77 (3450MHz~3550MHz) & n78 (3450MHz~3550MHz)	0.383		
	NRn77 (3700MHz~3980MHz) & n78 (3700MHz~3800MHz)	0.443		
	WLAN 2.4GHz	0.151	DTS	
	Bluetooth	0.025	DSS	
	WLAN 5.2GHz	0.086	NII	
	WLAN 5.8GHz	0.213		
Body (10 mm Gap)	GSM 850	0.275	PCE	0.377
	PCS 1900	0.169		
	WCDMA Band II	0.191		
	WCDMA Band IV	0.189		
	WCDMA Band V	0.182		
	LTE Band 2	0.187		
	LTE Band 5	0.213		
	LTE Band 7	0.189		
	LTE Band 41 & Band 38	0.326		
	LTE Band 66 & Band 4	0.167		
	NR n41 & n38	0.377		
	NR n71	0.149		
	NR n77 (3450MHz~3550MHz) & n78	0.203		

	(3450MHz~3550MHz)			
	NR n77 (3700MHz~3980MHz) & n78 (3700MHz~3800MHz)	0.203		
	WLAN 2.4GHz	0.028	DTS	
	Bluetooth	0.004	DSS	
	WLAN 5.2GHz	0.016	NII	
	WLAN 5.8GHz	0.021		
Hotspot (10 mm Gap)	GSM 850	0.275	PCE	0.589
	PCS 1900	0.169		
	WCDMA Band II	0.191		
	WCDMA Band IV	0.189		
	WCDMA Band V	0.182		
	LTE Band 2	0.187		
	LTE Band 5	0.213		
	LTE Band 7	0.230		
	LTE Band 41 & Band 38	0.421		
	LTE Band 66 & Band 4	0.167		
	NR n41 & n38	0.589		
	NR n71	0.149		
	NR n77 (3450MHz~3550MHz) & n78 (3450MHz~3550MHz)	0.364		
	NR n77 (3700MHz~3980MHz) & n78 (3700MHz~3800MHz)	0.203		
	WLAN 2.4GHz	0.028	DTS	
	Bluetooth	0.004	DSS	
	WLAN 5.2GHz	0.016	NII	
	WLAN 5.8GHz	0.021		

<Highest Reportedsimultaneous SAR Summary>

Exposure Position	Frequency Band	Reported 1-g SAR (W/kg)	Equipment Class	Highest ReportedSimultaneous Transmission 1-g SAR (W/kg)
Right Cheek	EN-DC 2A_n41A	1.362	PCE	1.483
	WLAN 5GHz MIMO	0.121	DTS	
	NFC	0.000	DXX	

Note:

1. The highest simultaneous transmission is scalar summation of Reported standalone SAR per FCCKDB 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/uncontrolledexposure limits (1.6 W/kg) specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-2005, and hadbeen tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013.
3. For FDD-LTE Band 4 is full covered by FDD-LTE Band 66, so only FDD-LTE Band 66 was tested.
4. For FDD-LTE Band 38 is full covered by FDD-LTE Band 41, so only FDD-LTE Band 41 was tested.

5 General Information

5.1 Client Information

Applicant:	TECNO MOBILE LIMITED
Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Manufacturer:	TECNO MOBILE LIMITED
Address:	FLAT N 16/F BLOCK B UNIVERSAL INDUSTRIAL CENTRE 19-25 SHAN MEI STREET FOTAN NT HONGKONG
Factory:	SHENZHEN TECNO TECHNOLOGY CO.,LTD.
Address:	101,Building 24,Waijing Industrial Park,Fumin Community,Fucheng Street,Longhua District,Shenzhen City,P.R.China

5.2 General Description of EUT

Product Name:	Mobile Phone				
Model No.:	AD8				
Category of device	Portable device				
Operation Frequency:	GSM:	GSM850: 824.2~848.8 MHz	PCS 1900: 1850.2~1909.8 MHz		
	WCDMA:	Band II: 1852.4~1907.6 MHz	Band V: 826.4~846.6 MHz		
		Band IV: 1712.4~1752.6 MHz			
	LTE:	Band 2 :1850MHz~1910MHz	Band 4 :1710MHz~1755MHz		
		Band 5 :824MHz~849MHz	Band 7: 2500MHz~2570MHz		
		Band 38: 2570MHz~2620MHz	Band 41: 2535MHz~2655MHz		
		Band 66 :1710MHz~1780MHz			
	5G NR	n38:2570MHz~2620MHz	n41:2535MHz~2655MHz		
		n71: 663MHz~698MHz			
		n77:3450MHz~3550MHz	n77: 3700MHz~3980MHz		
		n78: 3450MHz~3550MHz	n78: 3700MHz~3800MHz		
	Wi-Fi:	2412MHz~2462MHz	5150MHz-5250MHz		
		5725MHz-5850MHz			
	Bluetooth: 2402 MHz ~ 2480 MHz				
	NFC : 13.56MHz				
Modulation technology:	GSM:	☒Voice(GMSK)	☒GPRS(GMSK)	☒EGPRS(GMSK, 8PSK)	
	WCDMA:	☒RMC(QPSK)	☒HSUPA(QPSK)	☒HSDPA(QPSK,16QAM)	
	LTE:	☒QPSK	☒16QAM	☒64QAM	☒256QAM
	5G NR：	☒CP-OFDM(QPSK,16QAM,64QAM,256QAM)			
		☒DFT-s-OFDM(π /2 -BPSK,QPSK,16QAM,64QAM,256QAM)			
	Wi-Fi:	☒802.11b(DSSS)	☒802.11a/g/n/ax (OFDM)		
	Bluetooth:	☒BDR(GFSK)	☒EDR(π /4-DQPSK, 8DPSK)	☒LE(GFSK)	
	NFC :	ASK			
	SA: NR n38, n41,n71 n77, n78				
	DC_2A - n78A, DC_5A - n78A, DC_7A - n78A, DC_7C - n78A, DC_38A - n78A, DC_41A - n78A, DC_41C - n78A, DC_66A - n78A, DC_2A - n77A,				

	DC_5A - n77A, DC_7A - n77A, DC_7C - n77A, DC_41A - n77A, DC_2A - n41A, DC_5A - n41A, DC_41A - n41A, DC_41c - n41A, DC_2A - n38A, DC_5A - n38A, DC_7A - n38A (LTE Band 7C and 41C only supportsdownlink)	
Antenna Type:	Internal Antenna	
Antenna Gain:	GSM850: -1.5dBi; PCS1900: -1.3dBi WCDMA Band II: -0.5dBi;; WCDMA Band V: -1.5dBi WCDMA Band IV: -0.5dBi LTE Band 2:-0.5dBi; LTE Band 4: -0.5dBi LTE Band 5: -1.5dBi; LTE Band 7: -0.4dBi LTE Band 38: -0.4dBi; LTE Band 41: -0.4dBi; LTE Band 66: -0.5dBi n38:-0.4dBi ; n41:-0.4dBi ; n77:0.2dBi; n78:0.2dBi; Bluetooth: 1.3dBi; ANT1 2.4G Wi-Fi:1.3dBi; ANT2 5G Wi-Fi:-0.9dBi; ANT4 2.4G Wi-Fi:1.2dBi; 5G Wi-Fi:-0.8dBi;	
(E)GPRS Class:	(E)GPRS Class: 12	
Dimensions (L*W*H):	166mm (L)× 74mm (W)× 9mm (H)	
Accessories information:	Adapter: Model: U450TSA Input: AC100-240V, 50/60Hz, 1.8A Output: DC 5.0V, 2.0A or 11.0V, 4.1A MAX	Battery: Rechargeable Li-ion Polymer Battery DC 3.87V,5040mAh
		Headset: Support headset

5.3 Maximum RF Output Power

Mode	Average Power (dBm)	
	GSM 850	PCS 1900
GSM (Voice)	32.67	30.10
GPRS (1 TX Slot)	32.69	30.15
GPRS (2 TX Slots)	31.99	29.38
GPRS (3 TX Slots)	30.30	27.52
GPRS (4 TX Slots)	29.24	26.40
EGPRS (1 TX Slot)	27.34	24.60
EGPRS (2 TX Slots)	26.28	23.62
EGPRS (3 TX Slots)	24.08	21.58
EGPRS (4 TX Slots)	22.96	20.40

Mode	Average Power (dBm)		
	WCDMA Band II	WCDMA Band IV	WCDMA Band V
AMR 12.2 kbps	23.35	23.98	23.14
RMC 12.2 kbps	23.41	24.01	23.11
HSDPA Sub-test 1	22.42	23.03	22.29
HSDPA Sub-test 2	21.87	22.59	21.76
HSDPA Sub-test 3	21.89	22.54	21.83
HSDPA Sub-test 4	21.89	22.52	21.76
HSUPA Sub-test 1	20.35	21.03	20.25
HSUPA Sub-test 2	20.82	21.52	20.79
HSUPA Sub-test 3	21.40	22.01	21.29
HSUPA Sub-test 4	20.34	21.03	20.30
HSUPA Sub-test 5	22.39	23.07	22.30

Mode	Average Power (dBm)				
	LTE Band 2	LTE Band 5	LTE Band 7	LTE Band 41	LTE Band 66
BW/1.4MHz	23.30	23.80	/	/	23.53
BW/3.0MHz	23.23	23.75	/	/	23.65
BW/5.0MHz	23.42	23.96	24.15	27.37	23.83
BW/10MHz	23.28	23.86	24.00	27.22	23.75
BW/15MHz	23.28	/	24.05	27.21	23.64
BW/20MHz	23.42	/	24.17	27.22	23.78

Mode	Average Power (dBm)			
	NR Band n41	NR Band n71	NR Band n77 3450-3550	NR Band n77 3700-3980
BW/10MHz	27.27	24.11	27.61	27.10
BW/15MHz	27.20	24.09	27.61	27.07
BW/20MHz	27.59	24.08	27.69	27.16
BW/30MHz	27.43	/	27.60	27.04
BW/40MHz	27.50	/	27.70	27.00
BW/50MHz	27.48	/	27.54	27.00
BW/60MHz	27.47	/	27.55	26.85
BW/80MHz	27.52	/	27.60	27.04
BW/90MHz	27.57	/	27.40	27.15
BW/100MHz	27.46	/	27.34	27.06

ANT 1:

WLAN 2.4 GHz Band Average Power (dBm)						
Mode/Band	b	g	n (HT-20)	n (HT-40)	ax20	ax40
WLAN 2.4GHz	16.53	14.41	13.94	13.61	11.16	11.75

ANT 4:

WLAN 2.4 GHz Band Average Power (dBm)						
Mode/Band	b	g	n (HT-20)	n (HT-40)	ax20	ax40
WLAN 2.4GHz	16.55	14.69	14.98	14.67	12.14	12.55

ANT 2:

WLAN 5.2 GHz Band Average Power (dBm)									
Mode/Band	a	ac 20	ac 40	ac 80	ax20	ax40	ax80	n 20	n 40
WLAN 5.2GHz	12.77	11.48	10.84	10.41	10.95	10.62	9.17	11.82	12.22

ANT 4:

WLAN 5.2 GHz Band Average Power (dBm)									
Mode/Band	a	ac 20	ac 40	ac 80	ax20	ax40	ax80	n 20	n 40
WLAN 5.2GHz	12.34	13.72	12.48	11.89	12.62	11.92	10.56	13.05	12.93

ANT 2:

WLAN 5.8 GHz Band Average Power (dBm)									
Mode/Band	a	ac 20	ac 40	ac 80	ax20	ax40	ax80	n 20	n 40
WLAN 5.8GHz	13.70	14.36	14.89	13.90	9.95	10.25	9.79	15.34	15.14

ANT 4:

WLAN 5.8 GHz Band Average Power (dBm)									
Mode/Band	a	ac 20	ac 40	ac 80	ax20	ax40	ax80	n 20	n 40
WLAN 5.8GHz	12.53	10.58	11.55	10.52	10.55	10.58	10.52	11.53	11.60

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=2
Bluetooth	7.85	6.96	7.19	-0.87	-1.07	-0.77	-0.90

NFC Band Average Power (dBm)	
Mode/Band	ASK
NFC	-45.42

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
2#	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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Email: info-JYTee@lets.com, Website: http://jyt.lets.com

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 SARdistribution in a biological body is complicated and is usually carried out by experimental techniques or numericalmodeling. The standard recommends limits for two tiers of groups, occupational/controlled and generalpopulation/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. Ingeneral, 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) anincremental mass (dm) contained in a volume element (dv) of a given density (ρ). The equation description is asbelow:

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

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 theelectrical 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 individualswho have no knowledge or control of their exposure. The general population/uncontrolled exposure limitsare applicable to situations in which the general public may be exposed or in which persons who areexposed as a consequence of their employment may not be made fully aware of the potential forexposure or cannot exercise control over their exposure. Members of the general public would comeunder this category when exposure is not employment-related; for example, in the case of a wirelesstransmitter that exposes persons in its vicinity.

7.2 Controlled Environment

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

8 SAR Measurement System

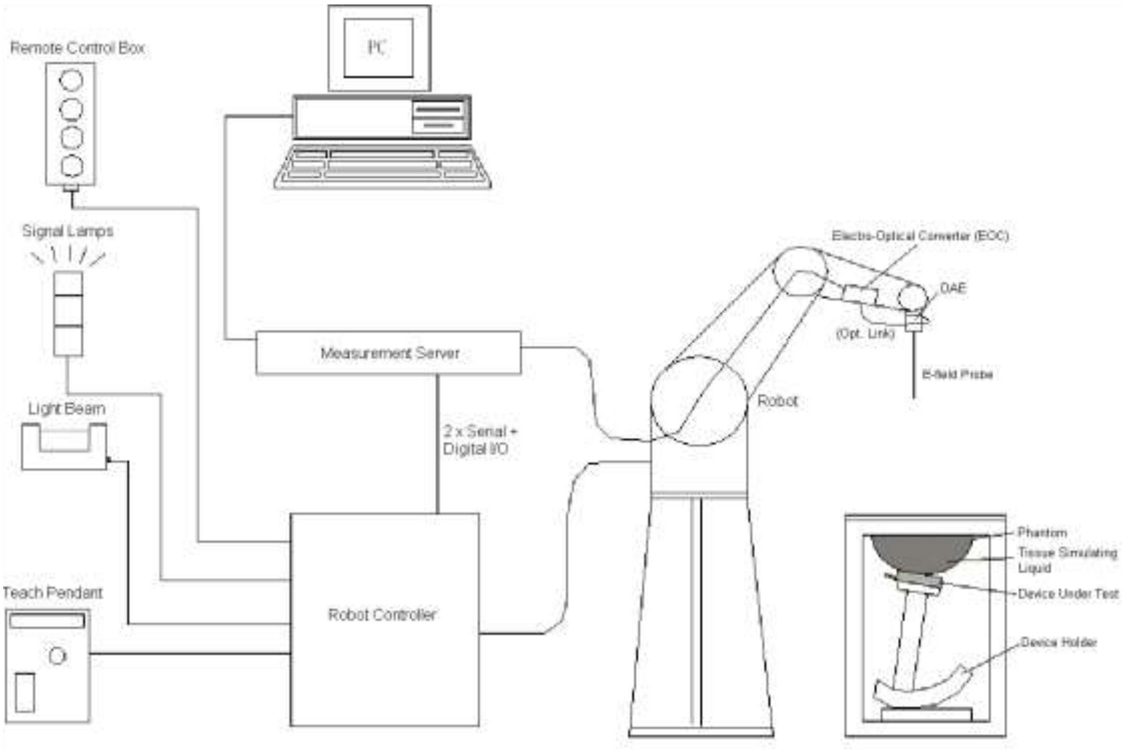

Fig.8.1 SPEAG DASY System Configurations

The DASY system for performance compliance tests is illustrated above graphically. This system consists of thefollowing 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 operationand 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	10MHz 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 Stäubliis used. The Stäublirobot 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 constructionshields)

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 actualposition of the probe tip with respect to the robot arm is measured, as well as the probe lengthand the horizontal probe offset. The software then corrects all movements, such that the robotcoordinates are valid for the probe tip.
The repeatability of this process is better than0.1 mm. If a position has been taught with analigned probe, the same position will be reachedwith another aligned probe within 0.1 mm, even ifthe other probe has different dimensions. Duringprobe rotations, the probe tip will keep its actualposition.

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. 8.7Photo 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

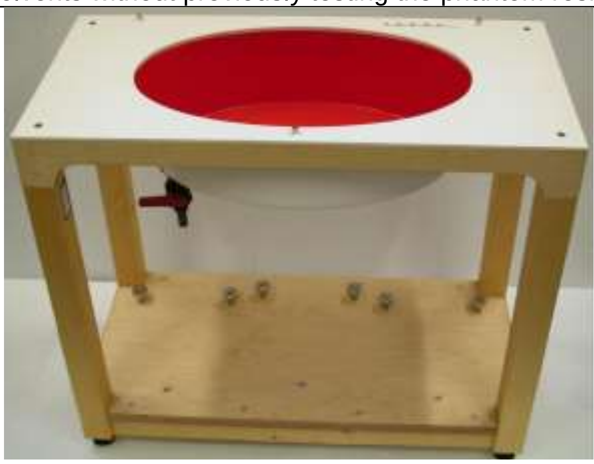

Fig.8.8 Photo of ELI4 Phantom

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:

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

WithV_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: $H_i = \sqrt{V_i} \cdot \frac{a_{i0} + a_{i1} f + a_{i2} f^2}{f}$

WithV_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

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

Manufacturer	Equipment Description	Model	Management Number	Cal. Information	
				Last Cal.	Due Date
SPEAG	2450MHz System Validation Kit	D2450V2	WXJ023-3	06.06.2022	06.05.2025
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	06.29.2022	06.28.2023
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-1	06.29.2022	06.28.2023
KEYSIGHT	E-Series Power Sensor	E9300H	WXJ075-2	06.29.2022	06.28.2023
KEYSIGHT	Signal Generator	N5173B	WXJ006-3	06.29.2022	06.28.2023
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 spectrum analyzer, 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 spectrum analyzer 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 head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm, which is shown in Fig. 9.1, 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. 9.2.

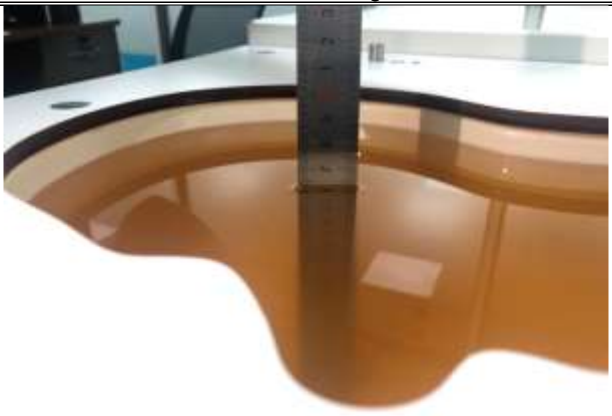

Fig. 9.1 Photo of Liquid Height for Head SAR

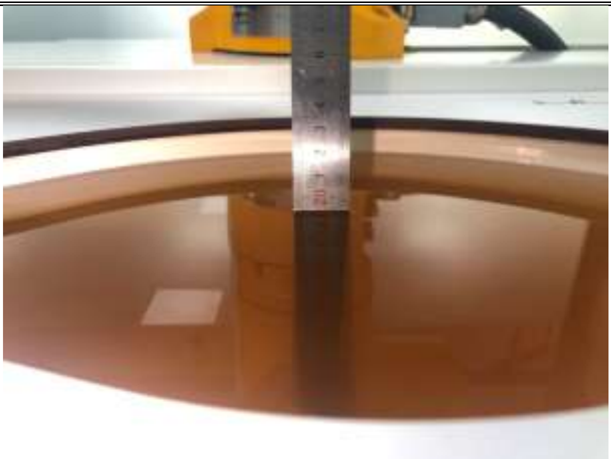

Fig. 9.2 Photo of Liquid Height for Body SAR

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 65supplement C and RSS 102 Issue 5.

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

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

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

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

Frequency (MHz)	Liquid Temp. (℃)	Conductivity (σ)	Permittivity (εr)	Conductivity Target(σ)	Permittivity Target(εr)	Delta (σ)%	Delta (εr)%	Limit (%)	Date (mm/dd/yy)
2450	22.1	1.73	38.22	1.80	39.20	-3.83	-2.50	±5	10.30.2022

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:

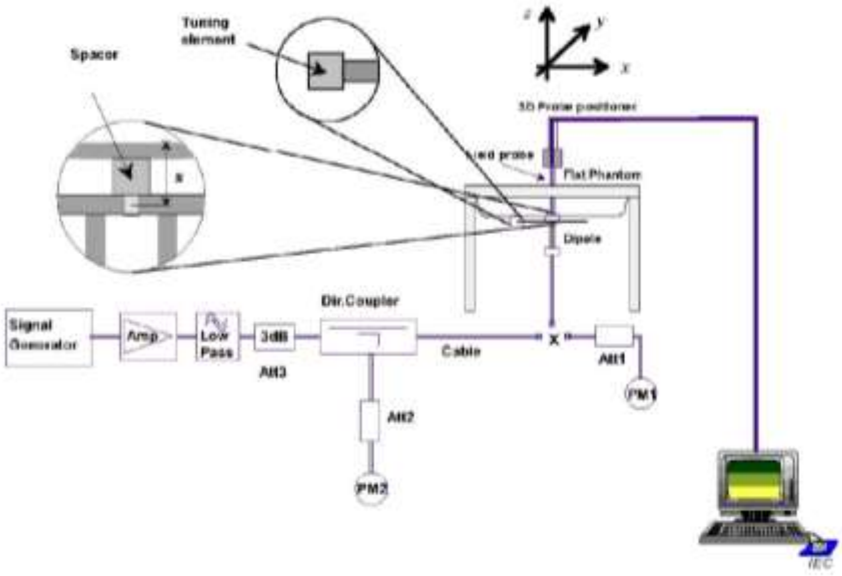

Fig.10.1 System Verification Setup Diagram

Fig.10.2 Photo of Dipole setup

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- **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.

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

Date (mm/dd/yy)	Frequency (MHz)	Power fed onto dipole (mW)	Measured 1g SAR (W/kg)	Normalized to1W 1g SAR (W/kg)	1W Target 1g SAR (W/kg)	Deviation (%)
10.30.2022	2450	40	2.060	51.50	53.4	-3.56

11 EUT Testing Position

This EUT was tested in ten different positions. They are right cheek/right tilted/left cheek/left tilted for head, Front/Back/Right Side/Top Side/Bottom Side of the EUT with phantom 10 mm gap, as illustrated below, please refer to Appendix B for the test setup photos.

11.1 Handset Reference Points

- The vertical centreline passes through two points on the front side of the handset – the midpoint of the width w_t of the handset at the level of the acoustic output, and the midpoint of the width w_b of the bottom of the handset.
- The horizontal line is perpendicular to the vertical centreline and passes the center of the acoustic output. The horizontal line is also tangential to the handset at point A.
- The two lines intersect at point A. Note that for many handsets, point A coincides with the center of the acoustic output; however, the acoustic output may be located elsewhere on the horizontal line. Also note that the vertical centreline is not necessarily parallel to the front face of the handset, especially for clamshell handsets, handsets with flip covers, and other irregularly shaped handsets.

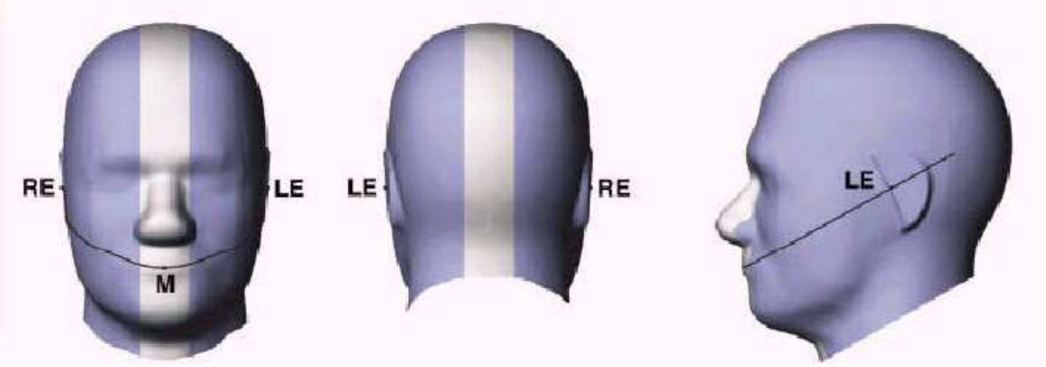


Fig.11.1 Illustration for Front, Back and Side of SAM Phantom

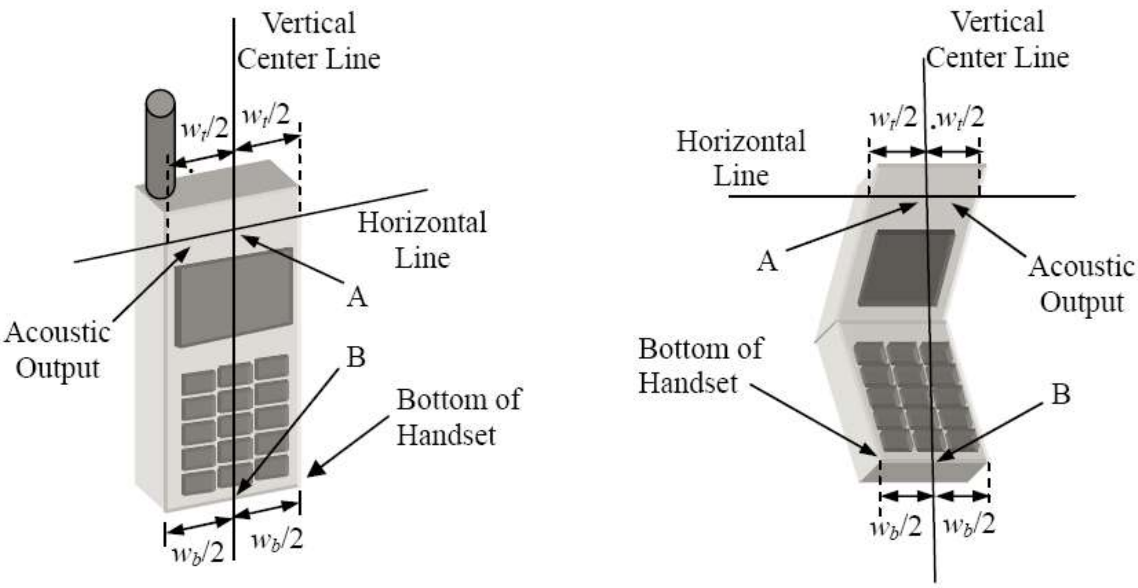


Fig. 11.2Illustration for Handset Vertical and Horizontal Reference Lines

11.2 Positioning for Cheek / Touch

- To position the device with the vertical center line of the body of the device and the horizontal line crossing the center piece in a plane parallel to the sagittal plane of the phantom. While maintaining the device in this plane, align the vertical center line with the reference plane containing the three ear and mouth reference point (M: Mouth, RE: Right Ear and LE: Left Ear) and align the center of the ear piece with the line RE-LE.
- To move the device towards the phantom with the ear piece aligned with the line LE-RE until the phone touched the ear. While maintaining the device in the reference plane and maintaining the phone contact with the ear, move the bottom of the phone until any point on the front side is in contact with the cheek of the phantom or until contact with the ear is lost (see below figure)

Fig. 11.3 Illustration for Cheek Position

11.3 Positioning for Ear / 15º Tilt

- To position the device in the “cheek” position described above.
- While maintaining the device the reference plane described above and pivoting against the ear, moves it outward away from the mouth by an angle of 15 degrees or until contact with the ear is lost (see figure below).

Fig.11.4 Illustration for Tilted Position

11.4 SAR Evaluations near the Mouth/Jaw Regions of the SAM Phantom

Antennas located near the bottom of a phone may require SAR measurements around the mouth and jawregions of the SAM head phantom. This typically applies to clam-shell style phones that are generallylonger in the unfolded normal use positions or to certain older style long rectangular phones.
Under these circumstances, the following procedures apply, adopted from the FCC guidance on SARhandsets document FCC KDB Publication 648474 D04v01r03. The SAR required in these regions of SAMshould be measured using a flat phantom. The phone should be positioned with a separation distance of4 mm between the ear reference point (ERP) and the outer surface of the flat phantom shell. Whilemaintaining this distance at the ERP location, the low (bottom) edge of the phone should be lowered fromthe phantom to establish the same separation distance between the peak SAR locations identified by thetruncated partial SAR distribution measured with the SAM phantom. The distance from the peak SARlocation to the phone is determined by the straight line passing perpendicularly through the phantomsurface. When it is not feasible to maintain 4 mm separation at the ERP while also establishing therequired separation at the peak SAR location, the top edge of the phone will be allowed to touch thephantom with a separation < 4 mm at the ERP. The phone should not be tilted to the left or right whileplaced in this inclined position to the flat phantom.

11.5 Body Worn Accessory Configurations

- To position the device parallel to the phantom surface with either keypad up or down.
- To adjust the device parallel to the flat phantom.
- To adjust the distance between the device surface and the flat phantom to 10 mm or holster surface and the flat phantom to 0 mm.

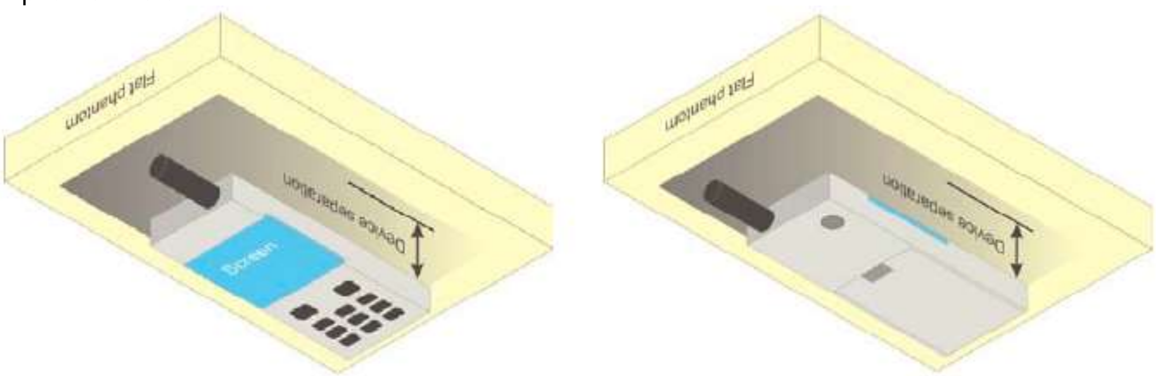


Fig.11.5 Illustration for Body Worn Position

11.6 Wireless Router (Hotspot) Configurations

Some battery-operated handsets have the capability to transmit and receive internet connectivity throughsimultaneous transmission of WIFI in conjunction with a separate licensed transmitter. The FCC hasprovided guidance in KDB Publication 941225 D06 where SAR test considerations for handsets (L x W ≥ 9 cm x 5 cm) are based on a composite test separation distance of 10 mm from the front, back and edgesof the device with antennas 2.5 cm or closer to the edge of the device, determined from general mixeduse conditions for this type of devices. Since the hotspot SAR results may overlap with the body-wornaccessory SAR requirements, the more conservative configurations can be considered, thus excluding some body-worn accessory SAR tests.

When the user enables the personal wireless router functions for the handset, actual operations includesimultaneous transmission of both the WIFI transmitter and another licensed transmitter. Bothtransmitters often do not transmit at the same transmitting frequency and thus cannot be evaluated forSAR under actual use conditions. Therefore, SAR must be evaluated for each frequency transmissionand mode separately and summed with the WIFI transmitter according to KDB 648474 publicationprocedures. The “Portable Hotspot” feature on the handset was NOT activated, to ensure the SARmeasurements were evaluated for a single transmission frequency RF signal.

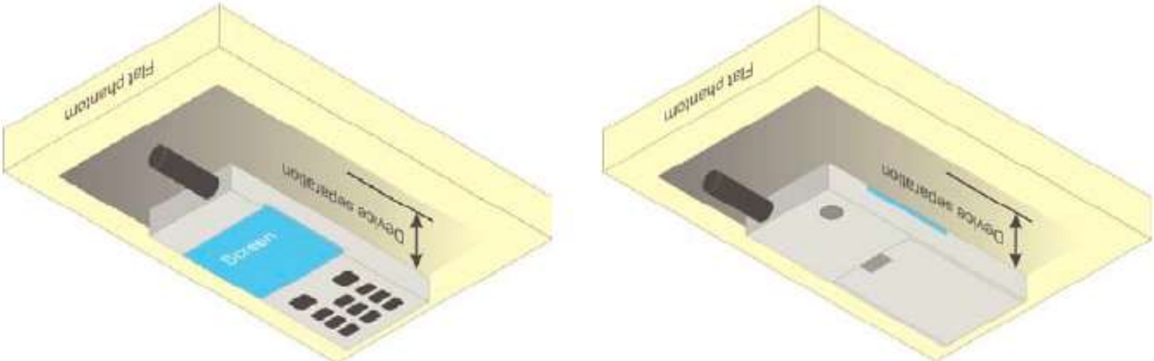


Fig.11.6 Illustration for Hotspot Position

12 Measurement Procedures

The measurement procedures are as below:

<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.

			≤ 3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface			5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location			30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: Δx_{Area}, Δy_{Area}			≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
			When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	
Maximum zoom scan spatial resolution: Δx_{Zoom}, Δy_{Zoom}			≤ 2 GHz: ≤ 8 mm 2 – 3 GHz: ≤ 5 mm*	3 – 4 GHz: ≤ 5 mm* 4 – 6 GHz: ≤ 4 mm*
Maximum zoom scan spatial resolution, normal to phantom surface	uniform grid: $\Delta z_{Zoom}(n)$		≤ 5 mm	3 – 4 GHz: ≤ 4 mm 4 – 5 GHz: ≤ 3 mm 5 – 6 GHz: ≤ 2 mm
	graded grid	$\Delta z_{Zoom}(1)$: between 1st two points closest to phantom surface	≤ 4 mm	3 – 4 GHz: ≤ 3 mm 4 – 5 GHz: ≤ 2.5 mm 5 – 6 GHz: ≤ 2 mm
		$\Delta z_{Zoom}(n>1)$: between subsequent points	≤ 1.5·$\Delta z_{Zoom}(n-1)$	
Minimum zoom scan volume	x, y, z		≥ 30 mm	3 – 4 GHz: ≥ 28 mm 4 – 5 GHz: ≥ 25 mm 5 – 6 GHz: ≥ 22 mm

Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.

* When zoom scan is required and the *reported* 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.

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

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

14 Exposure Positions Consideration

14.1 EUT Antenna Locations

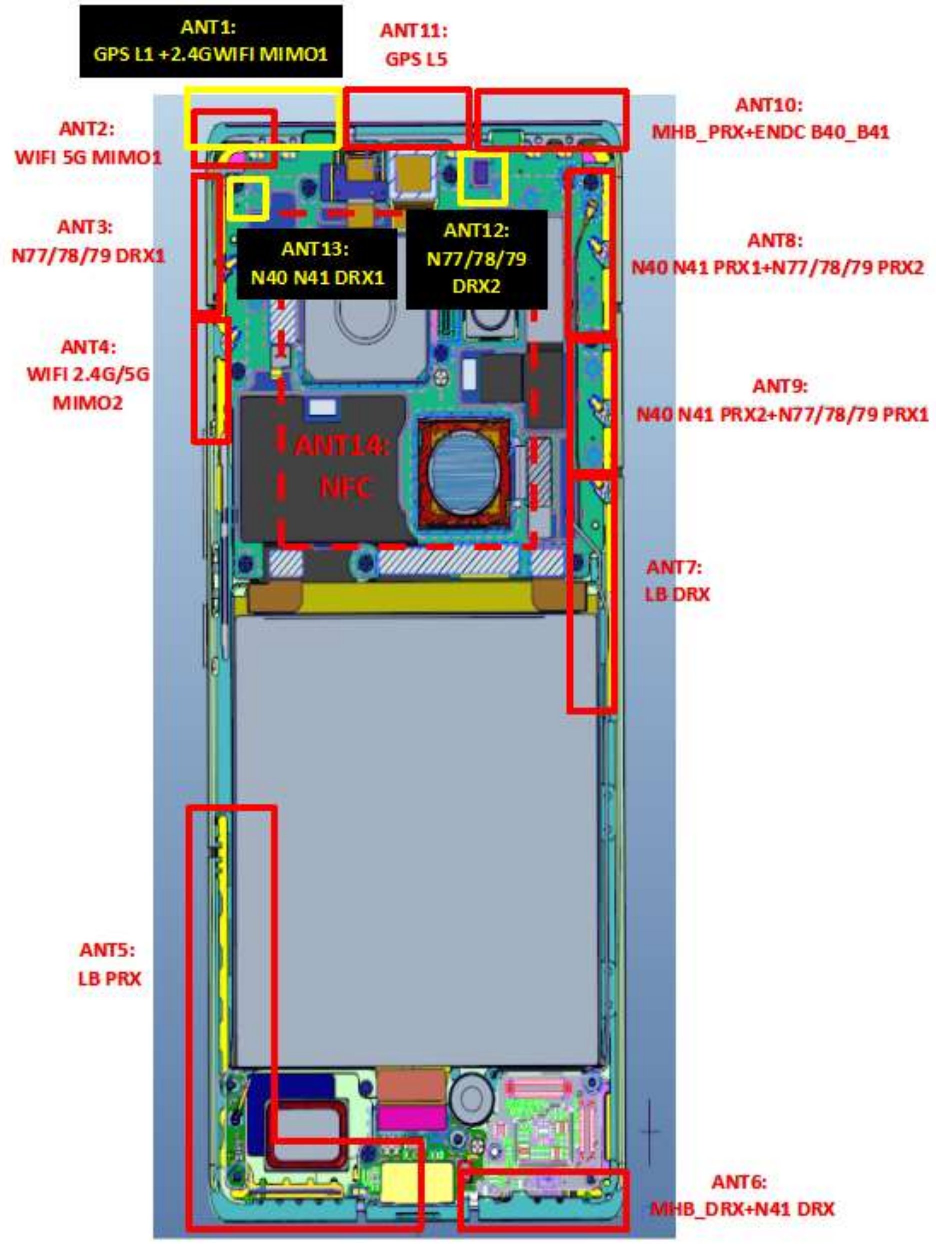


Fig.14.1 EUT Antenna Locations

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

Distance of Antennas to EUT edge/surface Test distance: 10mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G ANT 5	<25mm	<25mm	118mm	<25mm	<25mm	45mm
2G/3G/4G ANT 10	<25mm	<25mm	<25mm	156mm	35mm	<25mm
ANT8	<25mm	<25mm	<25mm	137mm	65mm	<25mm
ANT9	<25mm	<25mm	27mm	112mm	65mm	<25mm
WLAN 1& Bluetooth	<25mm	<25mm	<25mm	156mm	<25mm	50mm
WLAN 2	<25mm	<25mm	27mm	120mm	<25mm	65mm

Test Positions Test distance: 10mm						
Antennas	**Back**	**Front**	**Top Side**	**Bottom Side**	**Right Side**	**Left Side**
2G/3G/4G ANT 5	Yes	Yes	No	Yes	Yes	No
2G/3G/4G ANT 10	Yes	Yes	Yes	No	No	Yes
ANT8	Yes	Yes	Yes	No	No	Yes
ANT9	Yes	Yes	No	No	No	Yes
WLAN 1& Bluetooth	Yes	Yes	Yes	No	Yes	No
WLAN 2	Yes	Yes	No	No	Yes	No

Note:

1. ANT 5: GSM&WCDMA&LTE ANT (Below 1GHz) (Tx), NR n71 ANT(Tx)
2. ANT 10: GSM&WCDMA&LTE ANT (Above 1GHz) (Tx)(ExceptLTE Band 41).
3. ANT 8: LTE Band 41 ANT(Tx)，5G NR n41 ANT(Tx).
4. ANT 9: 5G NR n77/n78 ANT(Tx)
5. ANT 1: 2.4GHz WIFI & BT & GPS ANT
6. ANT 2: 5GHz WIFI ANT.
7. ANT 4: 2.4GHz WIFI&5GHz WIFI MIMO ANT.
8. Head/Body-worn/Hotspot mode SAR assessments are required.
9. Referring to KDB 941225 D06v02r01, when the overall device length and width are ≥ 9cm * 5cm, the test distance is 10mm. SAR must be measured for all sides and surfaces with a transmitting antenna located within 25mm from that surface or edge.
10. Per KDB 447498 D04v01, for handsets the test separation distance is determined by the smallest distance between the outer surface of the device and the user, which is 0 mm for head SAR, 10 mm for hotspot SAR, and 10 mm for body-worn SAR.
11. Per KDB 648474 D04 v01r03, when hotspot mode applies, 10-g extremity SAR is required only for the surfaces and edges with hotspot mode 1-g reported SAR > 1.2 W/kg

15 SAR Test Results Summary

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

15.1 Standalone Head SAR Data

➢ WLAN 2.4 GHz Head SAR

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)
	2.4GHz/802.11b ANT1	Right Cheek	1	2412	16.60	-0.06	17.0	0.062	1.096	1.000	0.068
	2.4GHz/802.11b ANT1	Right Tilted	1	2412	16.60	-0.02	17.0	0.077	1.096	1.000	0.084
	2.4GHz/802.11b ANT1	Left Cheek	1	2412	16.60	0.15	17.0	0.103	1.096	1.000	0.113
1	2.4GHz/802.11b ANT1	Left Tilted	1	2412	16.60	0.07	17.0	**0.138**	1.096	1.000	0.151
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

➢ Bluetooth Head SAR

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)
	BT/GFSK ANT1	Right Cheek	39	2441	7.78	0.03	8.0	0.010	1.052	1.000	0.011
	BT/GFSK ANT1	Right Tilted	39	2441	7.78	0.09	8.0	0.013	1.052	1.000	0.014
	BT/GFSK ANT1	Left Cheek	39	2441	7.78	-0.08	8.0	0.013	1.052	1.000	0.014
2	BT/GFSK ANT1	Left Tilted	39	2441	7.78	-0.05	8.0	**0.024**	1.052	1.000	0.025
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

15.2 Standalone Body SAR

➢ WLAN 2.4GHz Body SAR

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)
	2.4GHz/802.11b ANT1	Front	1	2412	16.60	-0.03	17.0	0.011	1.096	1.000	0.012
3	2.4GHz/802.11b ANT1	Back	1	2412	16.60	0.05	17.0	**0.026**	1.096	1.000	0.028
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

➢ Bluetooth Body SAR

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)
	BT/GFSK ANT1	Front	39	2441	7.78	-0.01	8.0	<0.001	1.052	1.000	<0.001
4	BT/GFSK ANT1	Back	39	2441	7.78	0.00	8.0	**0.004**	1.052	1.000	0.004
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

15.3 Body SAR in Hotspot Mode

➢ WLAN 2.4GHz Body SAR in Hotspot mode

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)
	2.4GHz/802.11b ANT1	Front	1	2412	16.60	-0.03	17.0	0.011	1.096	1.000	0.012
3	2.4GHz/802.11b ANT1	Back	1	2412	16.60	0.05	17.0	**0.026**	1.096	1.000	0.028
	2.4GHz/802.11b ANT1	Right	1	2412	16.60	0.16	0.0	0.015	0.022	1.000	0.000
	2.4GHz/802.11b ANT1	Top	1	2412	16.60	0.03	17.0	0.021	1.096	1.000	0.023
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

➢ Bluetooth Body SAR in Hotspot mode

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)
	BT/GFSK ANT1	Front	39	2441	7.78	-0.01	8.0	<0.001	1.052	1.000	<0.001
4	BT/GFSK ANT1	Back	39	2441	7.78	0.00	8.0	**0.004**	1.052	1.000	0.004
	BT/GFSK ANT1	Right	39	2441	7.78	0.03	8.0	<0.001	1.052	1.000	<0.001
	BT/GFSK ANT1	Top	39	2441	7.78	0.01	8.0	<0.001	1.052	1.000	<0.001
ANSI / IEEE C95.1 – SAFETY LIMIT Spatial Peak Uncontrolled Exposure/General Population					**1.6 W/kg (mW/g) Averaged over 1g**						

15.4 Multi-Band Simultaneous Transmission Considerations

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

15.5 SAR Simultaneous Transmission Analysis

Please refer to FCC ID: 2ADYY-AD8, report No. JYTSZ-R14-2200160.

WLAN

Position		Standalone SAR(W/kg)				Σ SAR_{1g} (W/kg)	
		1	2	3	4	1+2	3+4
		2.4GWIFI Ant1	2.4GWIFI Ant4	5GWIFI ANT2	5GWIFI ANT4	2.4GWLAN MIMO	5GWLAN MIMO
Head	Right Cheek	0.068	0.023	0.104	0.017	0.091	0.121
	Right Tilted	0.084	0.012	0.055	0.010	0.096	0.065
	Left Cheek	0.113	0.055	0.213	0.036	0.168	0.249
	Left Tilted	0.151	0.016	0.107	0.014	0.167	0.131
Body- worn	Front	0.012	0.007	0.003	0.010	0.019	0.013
	Back	0.028	0.016	0.013	0.021	0.044	0.034
Hotspot	Front	0.012	0.007	0.003	0.010	0.019	0.013
	Back	0.028	0.016	0.013	0.021	0.044	0.034
	Left	0.020	0.013	0.009	0.013	0.033	0.022
	Right	0.000	0.000	0.000	0.000	0.000	0.000
	Top	0.023	0.000	0.011	0.000	0.023	0.011
	Bottom	0.000	0.000	0.000	0.000	0.000	0.000

Position		Standalone SAR(W/kg)					Σ SAR_{1g} (W/kg)		
		1	2	3	4	5	1+2+5	1+3+5	1+4+5
		WWAN	2.4G WLAN MIMO	5G WLAN MIMO	BT	NFC			
Head	Right Cheek	1.362	0.091	0.121	0.011	0.000	1.453	**1.483**	1.373
	Right Tilted	1.364	0.096	0.065	0.014	0.000	1.460	1.429	1.378
	Left Cheek	1.113	0.168	0.249	0.014	0.000	1.281	1.362	1.127
	Left Tilted	1.099	0.167	0.131	0.025	0.000	1.266	1.230	1.124
Body-worn	Front	0.558	0.019	0.013	<0.001	0.000	0.577	0.571	0.558
	Back	0.702	0.044	0.034	0.004	0.000	0.746	0.736	0.706
Hotspot	Front	0.558	0.019	0.013	<0.001	0.000	0.577	0.571	0.558
	Back	0.702	0.044	0.034	0.004	0.000	0.746	0.736	0.706
	Left	1.009	0.033	0.022	0.011	0.000	1.042	1.031	1.020
	Right	0.192	0.000	0.000	<0.001	0.000	0.192	0.192	0.192
	Top	0.368	0.023	0.011	<0.001	0.000	0.391	0.379	0.368
	Bottom	0.183	0.000	0.000	0.000	0.000	0.183	0.183	0.183

15.6 Measurement Uncertainty

Per KDB865664 D01 SAR Measurement 100 MHz to 6 GHzv01r04, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2013 is not required in SAR reports submitted for equipment approval. The equivalent ratio (1.5/1.6) is applied to extremity and occupational exposure conditions.

15.7 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

[1]. FCC 47 CFR Part 2 “Frequency Allocations and Radio Treaty Matters; General Rules andRegulations”

[2]. ANSI/IEEE Std. C95.1-1992, “IEEE Standard for Safety Levels with Respect to Human Exposureto Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz”, September 1992

[3]. IEEE Std. 1528-2013, “Recommended Practice for Determining the Peak Spatial-AverageSpecific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices:Measurement Techniques”, September2013

[4]. SPEAG DASY52 System Handbook

[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

[7]. FCC KDB 648474 D04 v01r03, “SAR EVALUATION CONSIDERATIONS FOR WIRELESS HANDSETS”, October 2015

[8]. FCC KDB 941225 D01 v03r01, “3G SAR MEAUREMENT PROCEDURES”, October 2015

[9]. FCC KDB 941225 D05v02r05, “SAR EVALUATION CONSIDERATIONS FOR LTE DEVICES”, Dec 2015

[10]. FCC KDB 941225 D03 v01, “Recommended SAR Test Reduction Procedures for GSM / GPRS /EDGE”, December 2008

[11]. FCC KDB 941225 D06 v02r01, "SAR EVALUATION PROCEDURES FOR PORTABLE DEVICES WITH WIRELESS ROUTER CAPABILITIES", October 2015

[12]. FCC KDB 865664 D01 v01r04, “SAR MEASUREMENT REQUIREMENTS FOR 100 MHz TO 6 GHz”, August2015

Appendix A: Plots of SAR System Check

Test Laboratory: JYTSZ Date: 10.30.2022

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

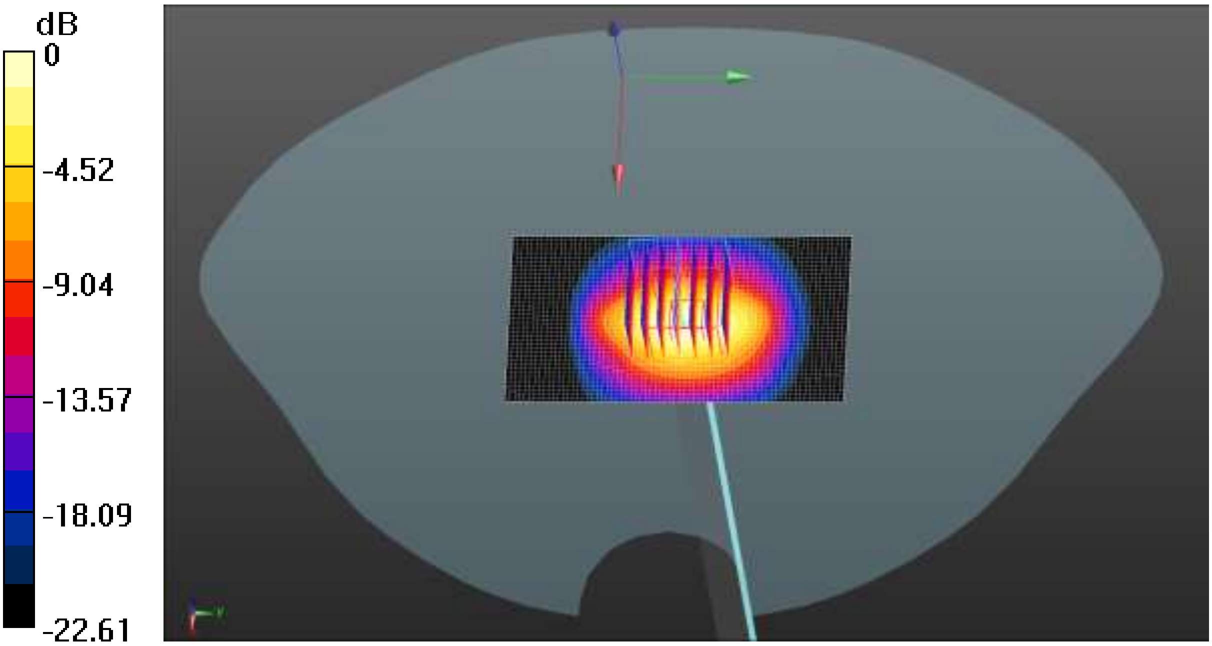
Communication System: UID 0, CW (0); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.728 S/m; ε_r = 38.219; ρ = 1000 kg/m^3
Phantom section: Flat Section

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 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)

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) = 3.84 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 = 41.81 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 4.61 W/kg
SAR(1 g) = 2.06 W/kg; SAR(10 g) = 0.983 W/kg
Smallest distance from peaks to all points 3 dB below = 11.5 mm
Ratio of SAR at M2 to SAR at M1 = 52.7%
Maximum value of SAR (measured) = 3.55 W/kg



0 dB = 3.55 W/kg = 5.50 dBW/kg

Appendix B: Plots of SAR Test Data

Test Laboratory: JYTSZ Date: 10.30.2022

DUT: Mobile Phone; Type: AD8; Serial: 1#

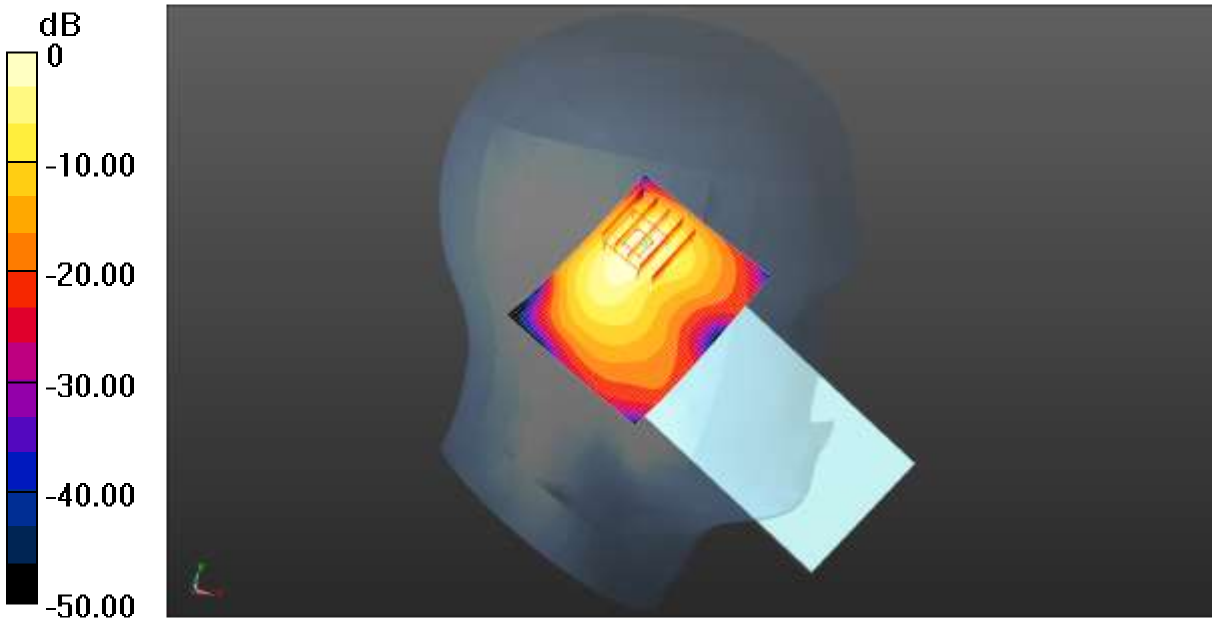
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.691 S/m; ε_r = 38.277; ρ = 1000 kg/m^3
Phantom section: Left Section

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)

2.4GWIFI Left Tilted/Low Channel/Area Scan (51x41x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.283 W/kg

2.4GWIFI Left Tilted/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.111 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.338 W/kg
SAR(1 g) = 0.138 W/kg; SAR(10 g) = 0.056 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 42%
Maximum value of SAR (measured) = 0.232 W/kg



0 dB = 0.232 W/kg = -6.35 dBW/kg

Test Laboratory: JYTSZ Date: 10.30.2022

DUT: Mobile Phone; Type: AD8; Serial: 1#

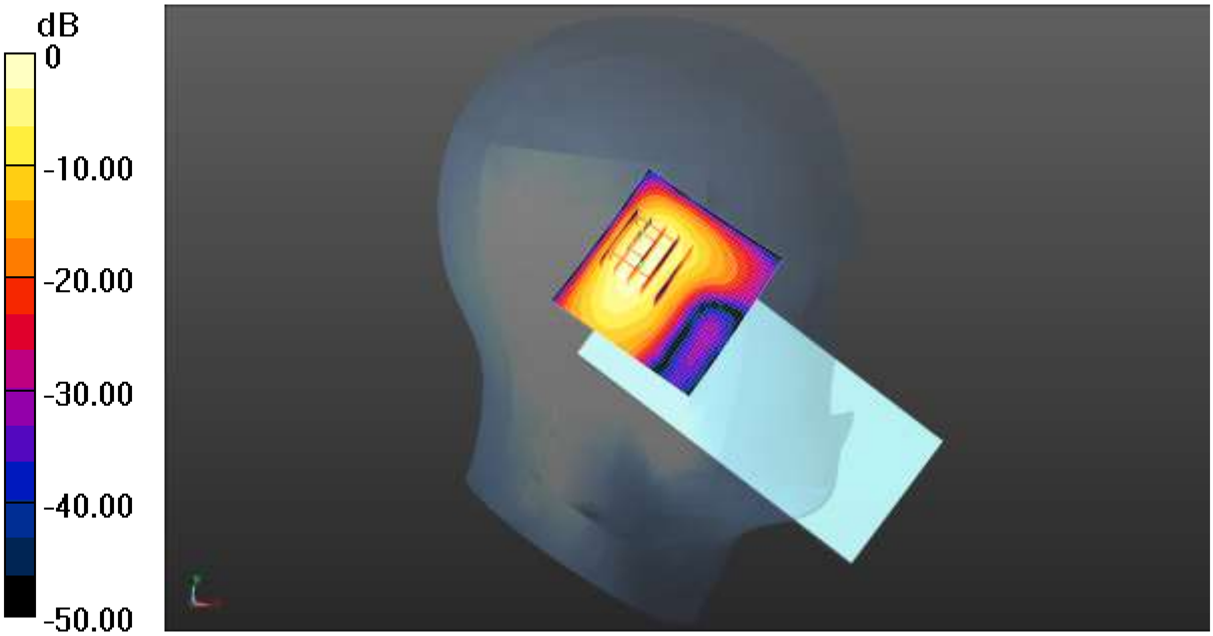
Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2441 MHz; σ = 1.713 S/m; ε_r = 38.236; ρ = 1000 kg/m^3
Phantom section: Left Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2441 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 Left Tilted/Middle Channel/Area Scan (41x41x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0556 W/kg

BT Left Tilted/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.413 V/m; Power Drift = -0.05 dB
Peak SAR (extrapolated) = 0.0590 W/kg
SAR(1 g) = 0.024 W/kg; SAR(10 g) = 0.00881 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 = 48.2%
Maximum value of SAR (measured) = 0.0377 W/kg



0 dB = 0.0377 W/kg = -14.24 dBW/kg

Test Laboratory: JYTSZ Date: 10.30.2022

DUT: Mobile Phone; Type: AD8; Serial: 1#

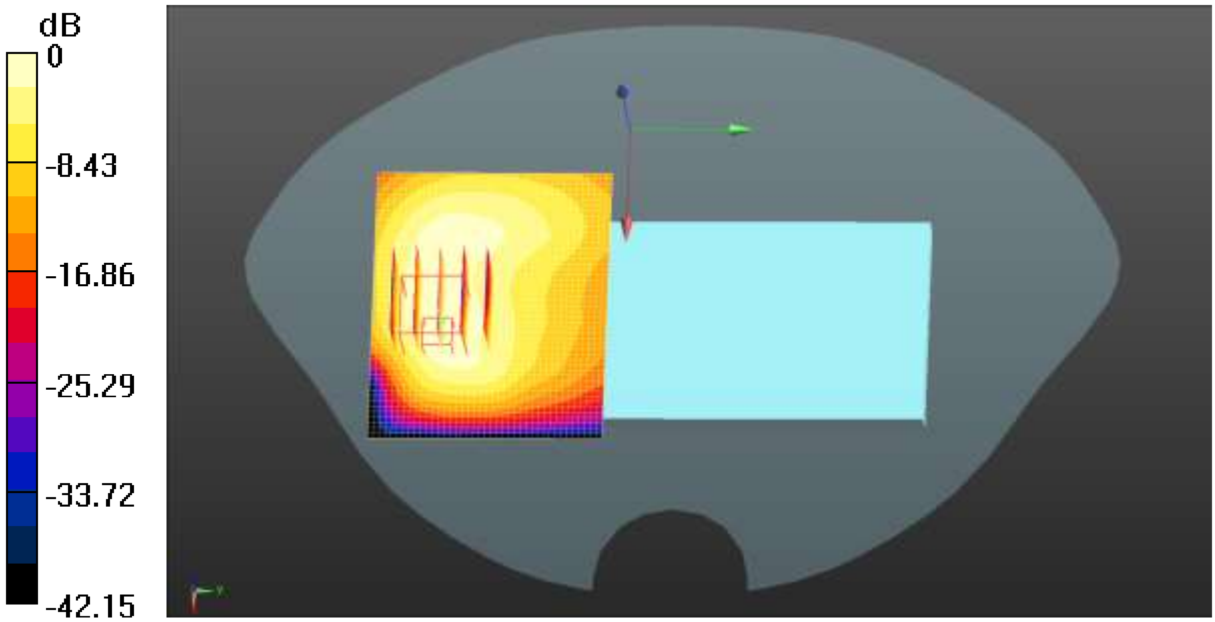
Communication System: UID 0, IEEE 802.11b WiFi 2.4 GHz (DSSS, 1 Mbps) (0);
Frequency: 2412 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2412 MHz; σ = 1.691 S/m; ε_r = 38.277; ρ = 1000 kg/m^3
Phantom section: Flat Section

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)

2.4GWIFI Body Back/Low Channel/Area Scan (51x41x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.0552 W/kg

2.4GWIFI Body Back/Low Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0.4650 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 0.0570 W/kg
SAR(1 g) = 0.026 W/kg; SAR(10 g) = 0.012 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 = 47.1%
Maximum value of SAR (measured) = 0.0450 W/kg



0 dB = 0.0450 W/kg = -13.47 dBW/kg

Test Laboratory: JYTSZ Date: 10.30.2022

DUT: Mobile Phone; Type: AD8; Serial: 1#

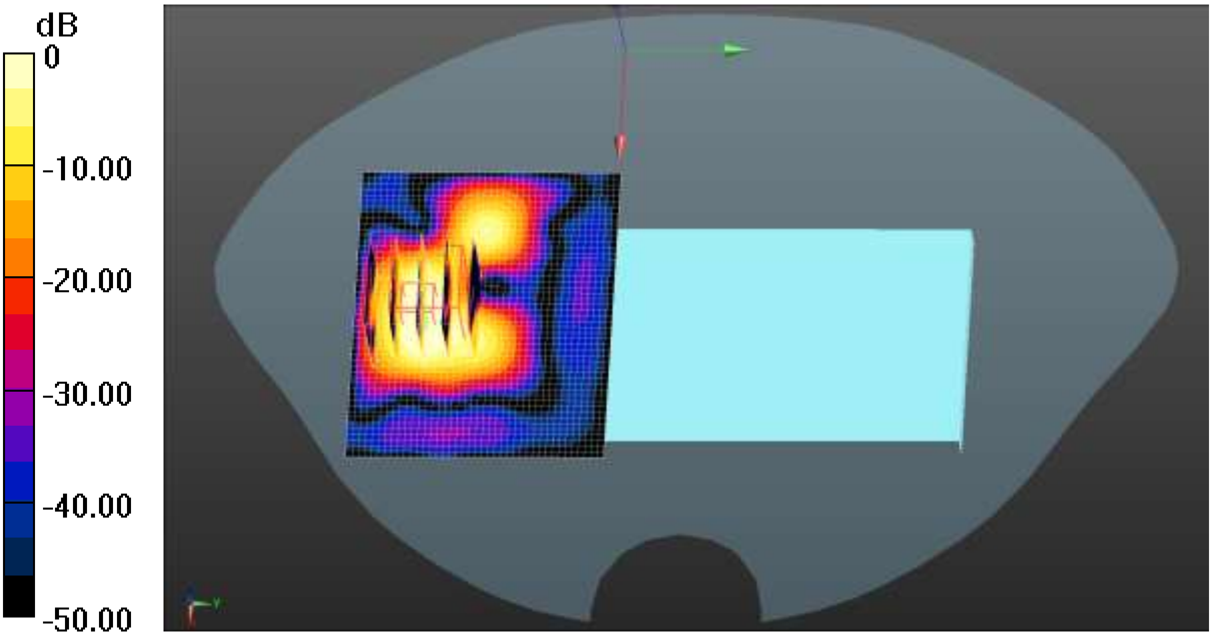
Communication System: UID 0, Bluetooth (0); Frequency: 2441 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2441 MHz; σ = 1.713 S/m; ε_r = 38.236; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7601; ConvF(7.74, 7.74, 7.74) @ 2441 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/Middle Channel/Area Scan (51x41x1): Interpolated grid: dx=1.200 mm, dy=1.200 mm
Maximum value of SAR (interpolated) = 0.00899 W/kg

BT Body Back/Middle Channel/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 0.0220 W/kg
SAR(1 g) = 0.00375 W/kg; SAR(10 g) = 0.00113 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 = 30.6%
Maximum value of SAR (measured) = 0.00613 W/kg



0 dB = 0.00613 W/kg = -22.13 dBW/kg

Appendix C: System Calibration Certificate

Calibration information for E-field probes

TTL In Collaboration with speag CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2512 Fax: +86-10-62304633-2504
E-mail: cttl@chinattl.com Http://www.chinattl.cn

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

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	
Reviewed by:	Lin Hao	SAR Test Engineer	
Approved by:	Qi Dianyuan	SAR Project Leader	

Issued: December 30, 2021

In Collaboration with
s p e a g
CALIBRATION LABORATORY

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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).

Certificate No:Z21-60407 Page 2 of 9

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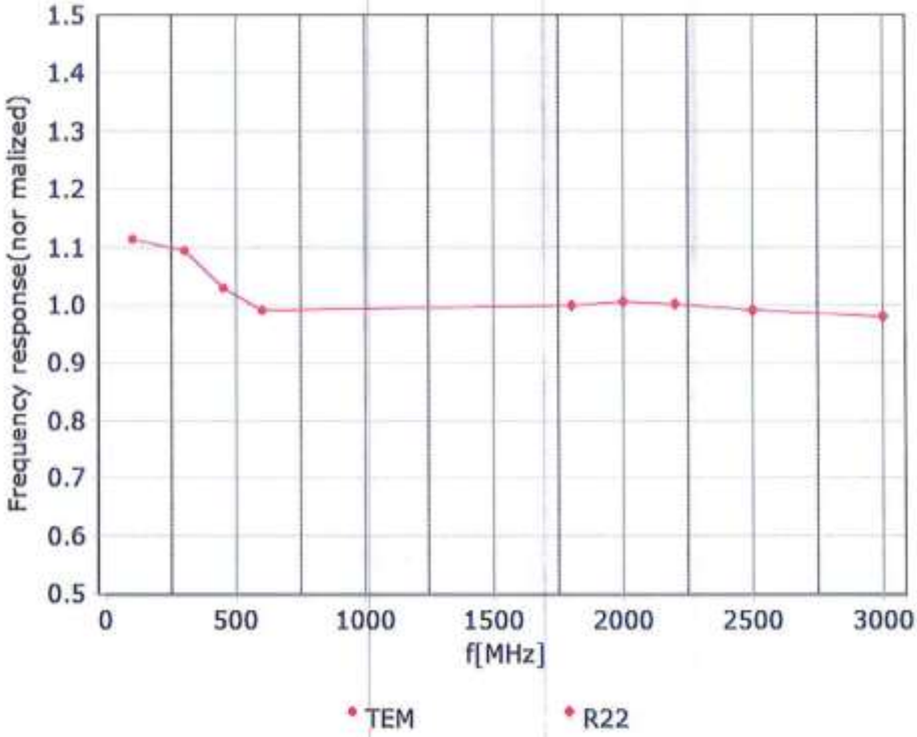
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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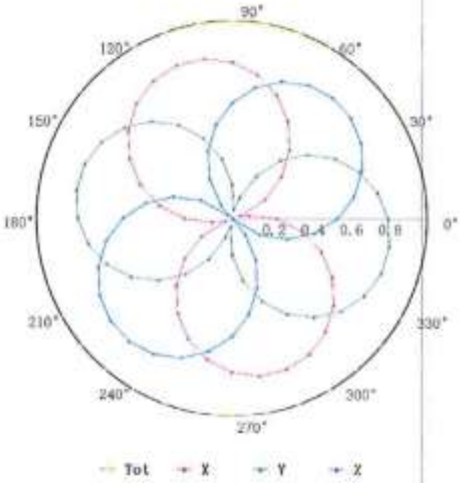
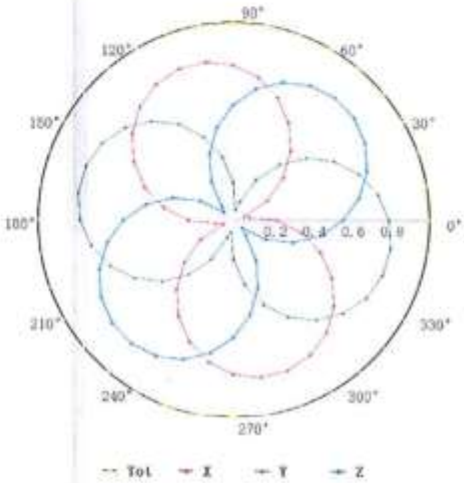
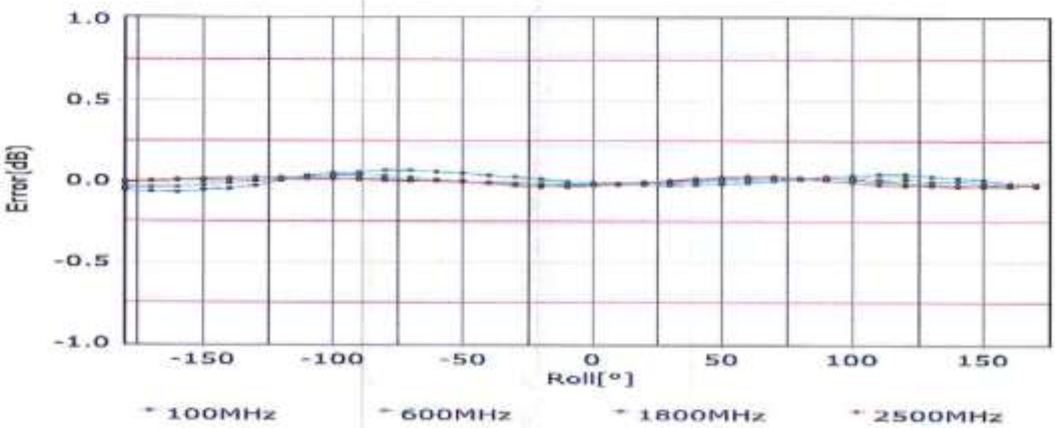
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM　　f=1800 MHz, R22







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

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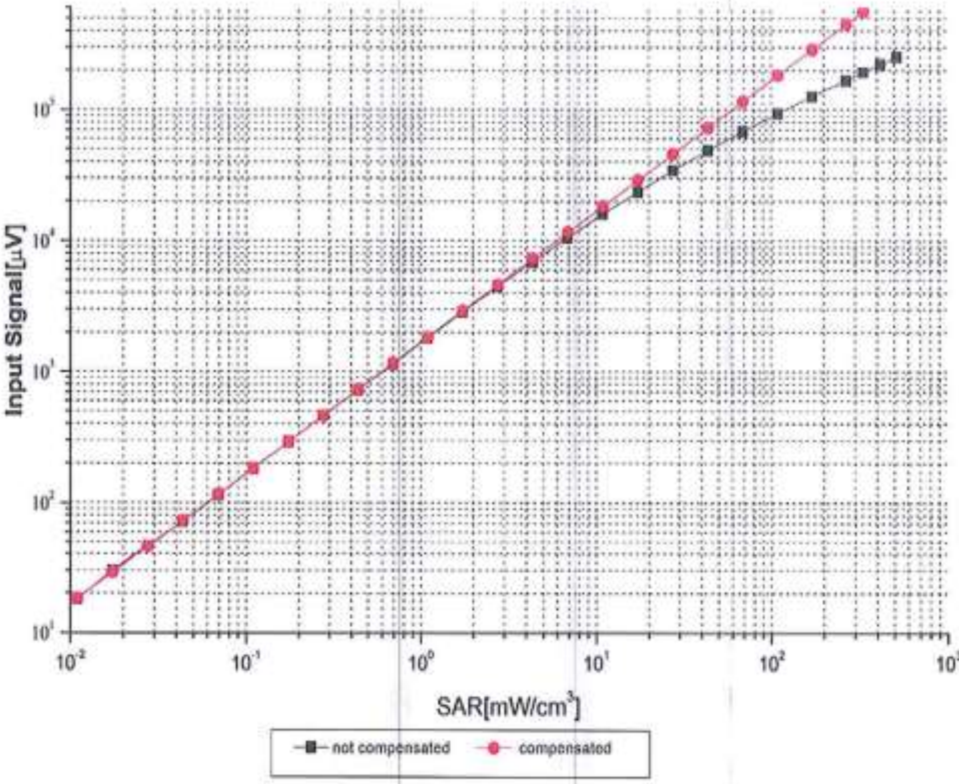
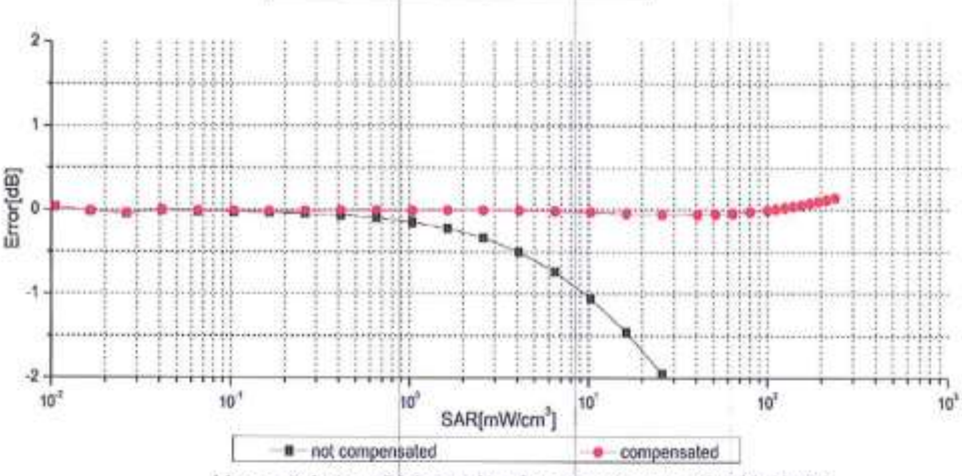
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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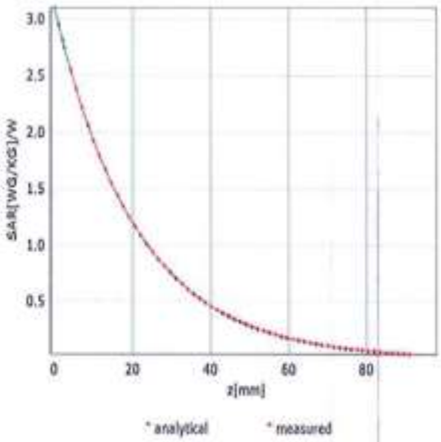
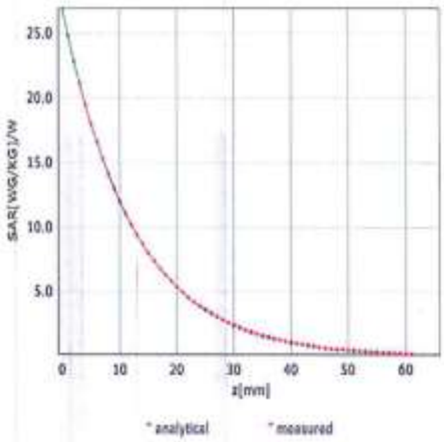
Conversion Factor Assessment

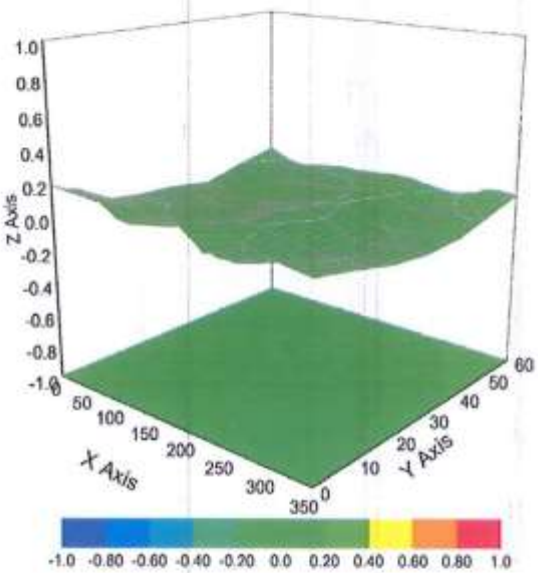
f=750 MHz,WGLS R9(H_convF)



f=1750 MHz,WGLS R22(H_convF)



Deviation from Isotropy in Liquid



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

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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: Z22-60212

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)℃ 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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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/m^3

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

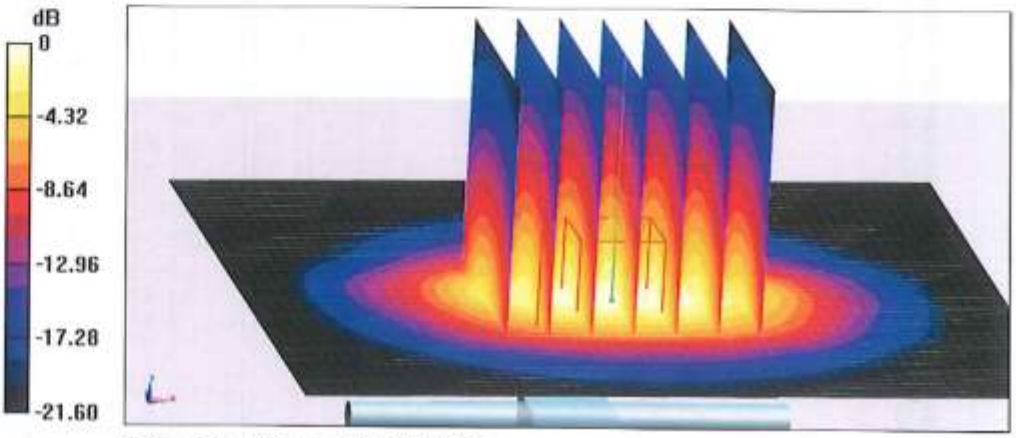
Peak SAR (extrapolated) = 27.3 W/kg

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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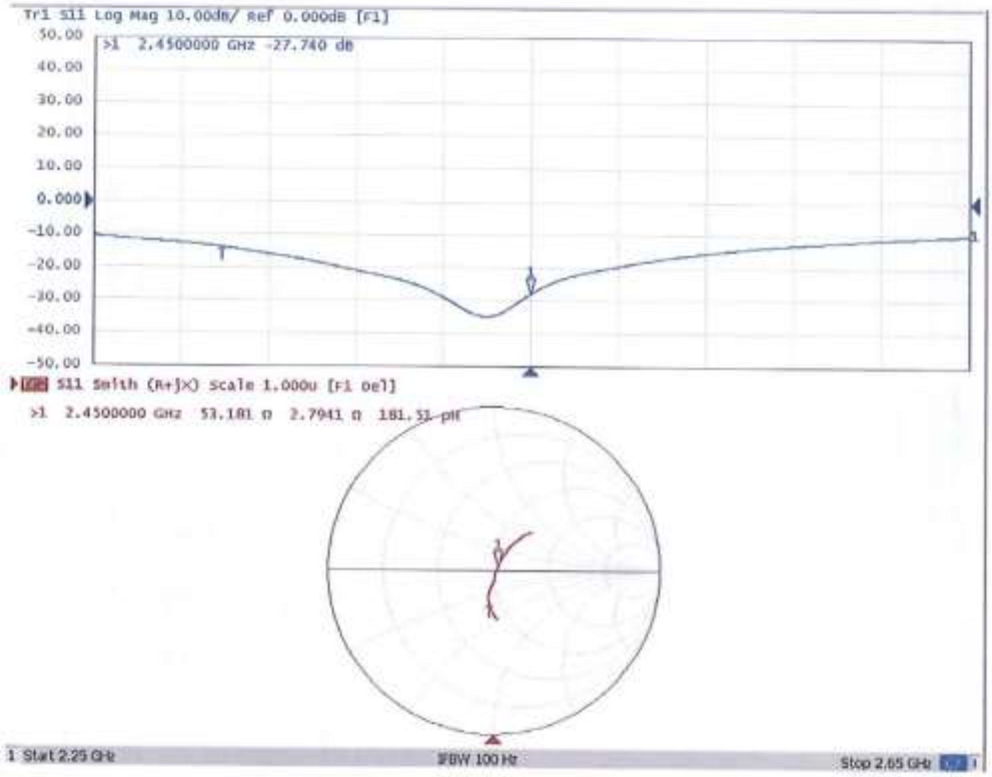
Impedance Measurement Plot for Head TSL



Calibration information for DAE

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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------