SAR TEST REPORT

For

THINKTOOL mini、ThinkTool Platinum S6、ThinkTool Lite、THINKSCAN Max、MUCAR VO6、THINKSCAN Sensor、THINKSCAN Actuator
FCC ID:2AUARTOOLMINI

Report Number： WT218002457

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Test report declaration

Applicant	:	THINKCAR TECH CO. LTD.
Address	:	2606,building 4,phase II,TiananYungu,Gangtou community,Bantian, Longgang District, Shenzhen
Manufacturer	:	THINKCAR TECH CO. LTD.
Address	:	2606,building 4,phase II,TiananYungu,Gangtou community,Bantian, Longgang District, Shenzhen
EUT Description	:	THINKTOOL mini、ThinkTool Platinum S6、ThinkTool Lite、THINKSCAN Max、MUCAR V06、THINKSCAN Sensor、THINKSCAN Actuator
Model No.	:	TKT02、TK909、V06、TK952、TK953
Brand	:	THINKCAR、MUCAR
FCC ID	:	2AUARTOOLMINI

Test Standards:

IEEE Std 1528-2013, KDB941225 D06, KDB447498 D01, KDB 865664 D01,KDB865664 D02,KDB690783 D01，KDB248227 D01

The EUT described above is tested by Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory to determine the compliance of the applicable standards stated above. Shenzhen Academy of Metrology and Quality Inspection EMC Laboratory is assumed full responsibility for the accuracy of the test results.

The results documented in this report only apply to the tested sample, under the conditions and modes of operation as described herein.

The test report shall not be reproduced in part without written approval of the laboratory.

Project Engineer:	(Zhang Qiang)	Date:	Nov.30, 2021
Checked by:	(Shi Changda)	Date:	Nov.30, 2021
Approved by:	(Lin Yixiang)	Date:	Nov.30, 2021

TABLE OF CONTENTS

1. REPORTED SAR SUMMARY

1.1. Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing are as follows.

Band	Max Reported SAR(W/kg)
	1-g Gap(0mm)
2.4G WIFI	0.56
The highest simultaneous SAR value is 1.04 W/kg per KDB690783-D01	

Table 1: Summary of test result

Note:

The SAR values listed on grants should be rounded to two decimal places. All SAR values less than 0.10 W/kg, after rounding, should be listed using the less-than symbol; for example, “The highest reported SAR value is < 0.10 W/kg.”

The device is in compliance with Specific Absorption Rate (SAR) for general population/ uncontrolled exposure limits according to the FCC rule 2.1093，the ANSI/IEEE C95.1:1992, the NCRP Report Number 86 for uncontrolled environment, according to the Industry Canada Radio Standards Specification RSS-102 for General Population/ Uncontrolled exposure, and had been tested in accordance with the measurement methods and procedures specified in IEEE Std 1528-2013& IEEE Std 1528a-2005.

1.2. RF exposure limits (ICNIRP Guidelines)

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR*(Brain/Body)	**1.60mW/g**	8.00mW/g
Spatial Average SAR** (Whole Body)	0.08mW/g	0.40mW/g
Spatial Peak SAR***(Limbs)	4.00mW/g	20.00mW/g

Table 2: RF exposure limits

The limit applied in this test report is shown in bold letters

Notes:

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

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

*** The Spatial Peak value of the SAR averaged over any 1 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time. Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure. 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 if employment or occupation.)

1.3 Ratings and System Details

EUT Description:	THINKTOOL mini、ThinkTool Platinum S6、ThinkTool Lite、THINKSCAN Max、MUCAR V06、THINKSCAN Sensor、THINKSCAN Actuator	
Model No:	TKT02、TK909、V06、TK952、TK953	
Brand:	THINKCAR、MUCAR	
IMEI No :	--	
Exposure category:	Uncontrolled environment / General population	
Test Device Production information	Production Unit	
Operating Mode(s)	2.4G WIFI/5G WIFI/BT	
Test modulation	Wi-Fi(OFDM/DSSS)	
Operating Frequency Range(s)	Transmitter Frequency Range	Receiver Frequency Range
Frequnency:	Bluetooth Dual mode: 2402-2480MHz 2.4GHz: Wi-Fi: 802.11b/g/n(HT20): 2412MHz ~2462 MHz; 802.11n(HT40): 2422MHz ~2452 MHz 5GHz: Wi-Fi: U-NII-1: 5.15-5.25GHz; U-NII-3: 5.725-5.850GHz	
Power Class :	--	
Hardware version :	BSK-Y8-V3	
Software version :	V1.0.0	
Antenna type :	internal antenna with ipex connector	
Battery options :	SHENZHEN POWERCOME ELECTRONICS CO.,LTD	Rechargeable Polymer Iithium-ion Battery. Battery model : PC944755-2S2P Battery Specification:DC7.6V, 6300mAh
Remark	their electrical circuit design, layout, component using the above model and internal wiring is the same, the difference is the appearance of the color, shape, memory size and model name.	

1.4 Product Function and Intended Use

The EUT is an TKT02, and it also has 2.4GHz WIFI /BT and 5GHz WIFI transmitter unit.

1.5 Test specification(s)

IEEE Std 1528-2013	Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate(SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques
FCC 47 CFR Part 2 (2.1093)	FCC Limits for Maximum Permissible Exposure (MPE)
KDB447498 D01 General RF Exposure Guidance v06	Mobile and Portable Device RF Exposure Procedures and Equipment Authorization Policies
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04	SAR Measurement Requirements for 100 MHz to 6 GHz
KDB 865664 D02 RF Exposure Reporting v01r02	RF Exposure Compliance Reporting and Documentation Considerations
KDB 690783 D01 SAR Listings on Grants v01r03	SAR Listings on Equipment Authorization Grants
KDB 248227 D01v02r02	SAR Measurement Procedures for 802.11Transmitters

1.6 List of Test and Measurement Instruments

	Equipment	Model No.	Serial No.	Manufacturer	Last Calibration Date	Period
☒	SAR test system	TX60L	F08/5AY8A1/A/01+F08/	SPEAG	NCR	NCR
☒	Electronic Data Transmitter	DAE4	876	SPEAG	2021.03.11	1year
☒	SAR Probe	EX3DV4	3881	SPEAG	2021.07.23	1year
☒	Software	85070	--	Agilent	--	--
☒	Software	DASY5	--	SPEAG	--	--
☒	System Validation Dipole,2450MHz	D2450V2	818	SPEAG	2021.08.26	3year
☒	Dielectric Probe Kit	85070E	MY44300455	Agilent	NCR	NCR
☒	System Validation Dipole,5GHz	D5GzV2	1185	SPEAG	2019.12.31	3year
☐	Dual-directional coupler,0.10-2.0GHz	778D	MY48220198	Agilent	NCR	NCR
☒	Dual-directional coupler,2.00-18GHz	772D	MY46151160	Agilent	NCR	NCR
☒	Power Amplifier	ZVE-8G	SC280800926	MINI-CIRCUITS	NCR	NCR
☒	Power Amplifier	ZHL42W	81709	MINI-CIRCUITS	NCR	NCR
☒	Signal Generator	SMR20	100047	R&S	2021.02.19	1year
☒	Power Sensor	NRP-Z21	102626	R&S	2021.06.04	1year
☒	Power Sensor	NRP-Z21	102627	R&S	2021.06.04	1year
☒	Network Analyzer	E5071C	MY46109550	Agilent	2021.02.19	1Year
☒	Flat Phantom	ELI4.0	TP-1904	SPEAG	NCR	NCR
☐	Twin Phantom	SAM	TP-1504	SPEAG	NCR	NCR
☒	Precision Thermometer	--	--	--	2021.07.26	1Year

Table 3: List of Test and Measurement Equipment

Note: All the test equipments are calibrated once a year, except the dipoles, which are calibrated every three years. Moreover, we have self-calibration every year to the dipoles.

2. GENERAL INFORMATION

2.1. Report information

This report is not a certificate of quality; it only applies to the sample of the specific product/equipment given at the time of its testing. The results are not used to indicate or imply that they are application to the similar items. In addition, such results must not be used to indicate or imply that SMQ approves recommends or endorses the manufacture, supplier or use of such product/equipment, or that SMQ in any way guarantees the later performance of the product/equipment.

The sample/s mentioned in this report is/are supplied by Applicant, SMQ therefore assumes no responsibility for the accuracy of information on the brand name, model number, origin of manufacture or any information supplied.

Additional copies of the report are available to the Applicant at an additional fee. No third part can obtain a copy of this report through SMQ, unless the applicant has authorized SMQ in writing to do so.

2.2. Laboratory Accreditation and Relationship to Customer

The testing report were performed by the Shenzhen Academy of Metrology and quality Inspection EMC Laboratory (Guangdong EMC compliance testing center), in their facilities located at NETC Building, No.4 Tongfa Rd., Xili, Nanshan, Shenzhen, China. At the time of testing, Laboratory is accredited by the following organizations:

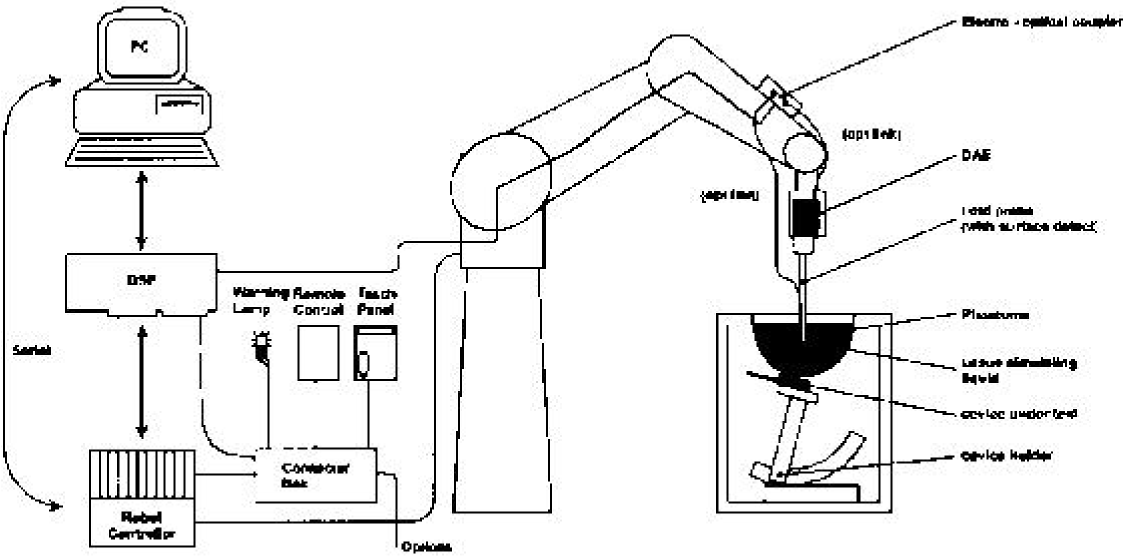
China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

The Laboratory is Accredited Testing Laboratory of FCC with Designation number CN1165 and Site registration number 582918.

The Laboratory is registered to perform emission tests with Innovation, Science and Economic Development (ISED), and the registration number is 11177A.

3. SAR MEASUREMENT SYSTEM CONFIGURATION

3.1. SAR Measurement Set-up



The DASY5 system for performing compliance tests consists of the following items:

● A standard high precision 6-axis robot (Stäubli RX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
● A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid. The probe is equipped with an optical surface detector system.
● A data acquisition electronic (DAE) which performs the signal amplification, signal multiplexing, ● AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
● A unit to operate the optical surface detector which is connected to the EOC.
● The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY5 measurement server.
● The DASY5 measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation.
● A computer operating Windows XP.
● DASY5 software and SEMCAD data evaluation software.
Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
● The generic twin phantom enabling the testing of left-hand and right-hand usage.
● The device holder for handheld mobile phones.
● Tissue simulating liquid mixed according to the given recipes.
● System checks dipoles allowing validating the proper functioning of the system.
● Test environment
● The DASY5 measurement system is placed at the head end of a room with dimensions: 4.5 x 4 x 3 m^3, the SAM phantom is placed in a distance of 1.3 m from the side walls and

1.1m from the rear wall.
Picture 1 of the photo documentation shows a complete view of the test environment.

3.2. Probe description

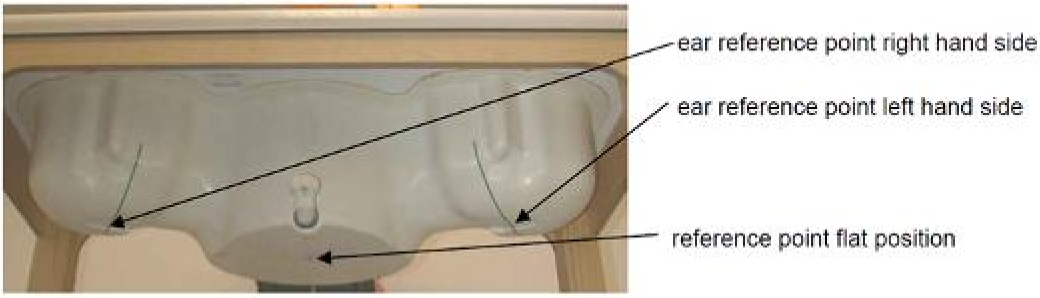
Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

<table>
<tr><td>Construction</td><td>Symmetrical design with triangular core
Interleaved sensors
Built-in shielding against static charges
PEEK enclosure material (resistant to organic solvents, e.g., DGBE)</td><td rowspan="7">
</td></tr>
<tr><td>Calibration</td><td>ISO/IEC 17025 calibration service available.</td></tr>
<tr><td>Frequency</td><td>10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)</td></tr>
<tr><td>Directivity</td><td>± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in tissue material (rotation normal to probe axis)</td></tr>
<tr><td>Dynamic range</td><td>10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically<1 μW/g)</td></tr>
<tr><td>Dimensions</td><td>Overall length: 337 mm (Tip: 20mm)
Tip length: 2.5 mm (Body: 12mm)
Typical distance from probe tip to dipole centers: 1mm</td></tr>
<tr><td>Application</td><td>High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.</td></tr>
</table>

Phantom description

The used SAM Phantom meets the requirements specified in Edition 01-01 of Supplement C to OET Bulletin 65 for Specific Absorption Rate (SAR) measurements.

The phantom consists of a fibreglass shell integrated in a wooden table. It allows left-hand and right-hand head as well as body-worn measurements with a maximum liquid depth of 18 cm in head position and 22 cm in planar position (body measurements). The thickness of the Phantom shell is 2 mm +/- 0.1 mm.



ELI4 Phantom

Shell Thickness	2mm+/- 0.2mm
Filling Volume	Approximately 30 liters
Measurement Areas	Flat phantom
The ELI4 phantom is in intended for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30MHz to 6GHz. ELI4 is fully compatible with the lastest draft of the standard IEC 62209-2 and all known tissue simulating liquids.	

The phantom shell material is resistant to all ingredients used in the tissue-equivalent liquid recipes. The shell of the phantom including ear spacers is constructed from low permittivity and low loss material, with a relative permittivity≤5 and a loss tangent ≤0.05.

3.3. Device holder description

The DASY5 device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. 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. This device holder is used for standard mobile phones or PDA's only. If necessary an additional support of polystyrene material is used. Larger DUT's (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.

Therefore those devices are normally only tested at the flat part of the SAM.

4. SAR MEASUREMENT PROCEDURE

4.1. Scanning procedure

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

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

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

● The area scan measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strenth is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The standard scan uses large grid spacing for faster measurement. Standard grid spacing for head measurements is 15 mm in x- and

y- dimension(≤2GHz)，12 mm in x- and y- dimension(2-4 GHz) and 10mm in x- and y- dimension(4-6GHz). If a finer resolution is needed, the grid spacing can be reduced. Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation.
Results of this coarse scan are shown in Appendix B.

● A "zoom scan" measures the field in a volume around the 2D peak SAR value acquired in the previous "coarse" scan. This is a fine grid with maximum scan spatial resolution: Δxzoom, Δyzoom ≤2GHZ≤ 8 mm, 2-4GHz - ≤ 5 mm and 4-6 GHz-≤ 4 mm; Δzzoom ≤ 3GHz - ≤ 5 mm, 3-4 GHz- ≤ 4 mm and 4-6GHz-≤2mm where the robot additionally moves the probe along the z-axis away from the bottom of the Phantom. DASY5 is also able to perform repeated zoom scans if more than 1 peak is found during area scan. Test results relevant for the specified standard (see chapter 1.5.) are shown in table form in chapter 3.2.

● A Z-axis scan measures the total SAR value at the x-and y-position of the maximum SAR value found during the cube scan. The probe is moved away in z-direction from the bottom of the SAM phantom in 2mm steps. This measurement shows the continuity of the liquid and can - depending in the field strength- also show the liquid depth. A z-axis scan of the measurement with maximum SAR value is shown in Appendix B.

The following table summarizes the area scan and zoom scan resolutions per FCC KDB 865664D01:

Frequency	Maximum Area Scan resolution (Δx area, Δy area)	Maximum Zoom Scan spatial resolution(Δx zoom Δy zoom)	Maximum Zoom Scan spatial resolution			Minimum zoom scan volume (x,y,z)
			Uniform Grid	Graded Grad		
			Δ zzoom(n)	Δ zzoom(1)	Δz zoom(n>1)	
≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤ 1.5* Δz zoom(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤ 1.5* Δz zoom(n-1)	≥30mm
3-4GHz	≤10mm	≤5mm	≤4mm	≤3mm	≤ 1.5* Δz zoom(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤ 1.5* Δz zoom(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤ 1.5* Δz zoom(n-1)	≥22mm

Spatial Peak SAR Evaluation

● The spatial peak SAR - value for 1 and 10 g is evaluated after the Cube measurements have been done. The bases of the evaluation are the SAR values measured at the points of the fine cube grid consisting of 5 x 5 x 7 points (with 8mm horizontal resolution) or 7 x 7 x 7 points (with 5mm horizontal resolution).

● The algorithm that finds the maximal averaged volume is separated into three different stages.

● The data between the dipole center of the probe and the surface of the phantom are extrapolated. This data cannot be measured since the center of the dipole is 2.7 mm away from the tip of the probe and the distance between the surface and the lowest measuring point is about 1 mm (see probe calibration sheet). The extrapolated data from a cube measurement can be visualized by selecting 'Graph Evaluated'.

● The maximum interpolated value is searched with a straight-forward algorithm. Around this maximum the SAR - values averaged over the spatial volumes (1g or 10 g) are computed using the 3d-spline interpolation algorithm. If the volume cannot be evaluated (i.e., if a part of the grid was cut off by the boundary of the measurement area) the evaluation will be started on the corners of the bottom plane of the cube.

● All neighboring volumes are evaluated until no neigh boring volume with a higher average value is found.

● Extrapolation

● The extrapolation is based on a least square algorithm [W. Gander, Computermathematik, p.168-180]. Through the points in the first 3 cm along the z-axis, polynomials of order four are calculated. These polynomials are then used to evaluate the points between the surface and the probe tip. The points, calculated from the surface, have a distance of 1 mm from each other.

Interpolation

● The interpolation of the points is done with a 3d-Spline. The 3d-Spline is composed of three one-dimensional splines with the "Not a knot"-condition [W. Gander, Computermathematik, p.141-150] (x, y and z -direction) [Numerical Recipes in C, Second Edition, p.123ff].

● Volume Averaging

● At First the size of the cube is calculated. Then the volume is integrated with the trapezoidal algorithm. 8000 points (20x20x20) are interpolated to calculate the average.

● Advanced Extrapolation

● DASY5 uses the advanced extrapolation option which is able to compansate boundary effects on E-field probes.

6.1.1. Data Storage and Evaluation

Data Storage

The DASY5 software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension DAE4. The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

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

Data Evaluation by SEMCAD

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

Probe parameters: - Sensitivity Normi, ai0, ai1, ai2
- Conversion factor ConvFi
- Diode compression point Dcpi
Device parameters: - Frequency f
- Crest factor cf
Media parameters: - Conductivity σ
- Density ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY5 components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.
The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.
If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

Vi = Ui + Ui2 • cf/dcpi

withVi = compensated signal of channel i (i = x, y, z)
Ui = input signal of channel i (i = x, y, z)
cf = crest factor of exciting field (DASY parameter)
dcpi= diode compression point (DASY parameter)

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

E-field probes: Ei = (Vi / Normi • ConvF)1/2

H-field probes: Hi = (Vi)1/2 • (ai0 + ai1f + ai2f2)/f

with Vi = compensated signal of channel i (i = x, y, z)
Normi = sensor sensitivity of channel i (i = x, y, z)
[mV/(V/m)2] for E-field Probes
ConvF = sensitivity enhancement in solution
aij = sensor sensitivity factors for H-field probes
f = carrier frequency [GHz]
Ei = electric field strength of channel i in V/m

Hi = magnetic field strength of channel i in A/m

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

Etot = (Ex2 + EY2 + Ez2)1/2

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

SAR = (Etot2 • σ) / (ρ • 1000)

with SAR = local specific absorption rate in mW/g

Etot = total field strength in V/m

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

ρ = equivalent tissue density in g/cm3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

P_{pwe} = Etot2 / 3770 or P_{pwe} = Htot2 • 37.7

with P_{pwe} = equivalent power density of a plane wave in mW/cm2

Etot = total electric field strength in V/m

Htot = total magnetic field strength in A/m

7. SYSTEM VERIFICATION PROCEDURE

7.1. Tissue Verification

The simulating liquids should be checked at the beginning of a series of SAR measurements to determine of the dielectric parameter are within the tolerances of the specified target values. The measured conductivity and relative permittivity should be within ±5% of the target values.

The following materials are used for producing the tissue-equivalent materials

Ingredient (% by weight)	Frequency Band	
	2450	5G
Tissue Type	Head	Head
Water	62.7	56
Salt(NaCI)	0.5	0.0
Sugar	0.0	0.0
HEC	0.0	0.0
Bactericide	0.0	0.0
Triton X-100	0.0	17.24
DGBE	36.8	0.0

Table 4 : Tissue Dielectric Properties

Salt: 99+% Pure Sodium Chloride; Sugar” 98+% Pure Sucrose; Water: De-ionized, 16MΩ+ resistivity
HEC: Hydroxyethyl Cellulose; DGBE: 99+% Di(ethylene glycol) butyl ether,
[2-(2-butoxyethoxy)ethanol] Triton X-100(ultra pure): Polyethylene glycol
mono[4-(1,1,3,3-tetramethylbutyl)phenyl]ether

Head Tissue-equivalent liquid measurements:

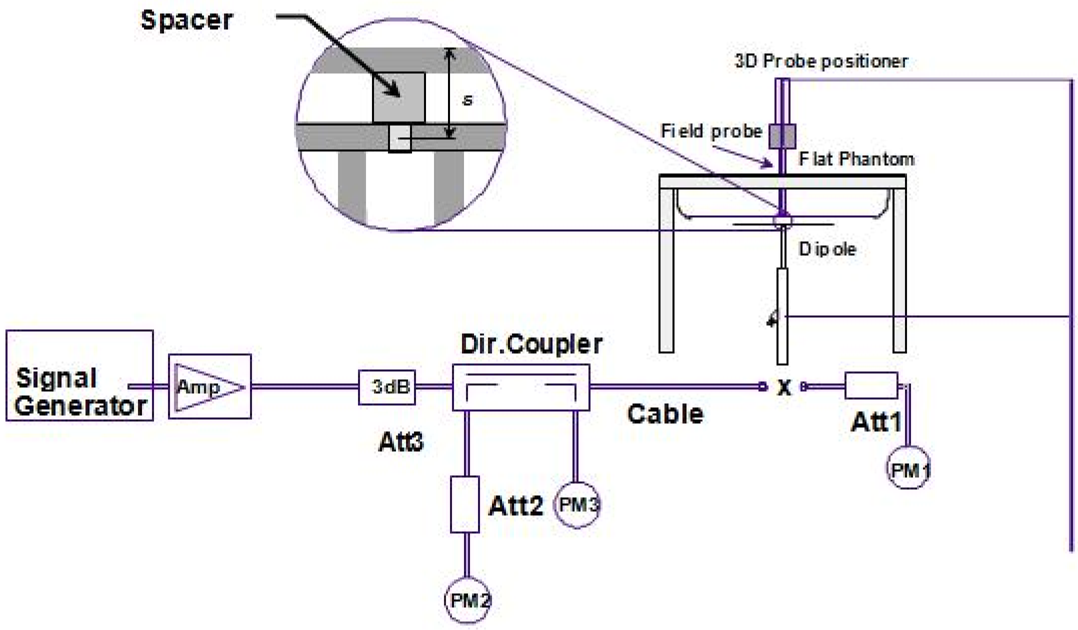
Used Target Frequency	Target Tissue		Measured Tissue		Liquid Temp	Test Date
	ε r (+/-5%)	σ (S/m) (+/-5%)	ε r	σ (S/m)		
2450MHz Head	39.2 (37.24~41.16)	1.80 (1.71~1.89)	39.19	1.84	22° C	2021.11.23
5.25GHz Head	36.0 (34.20~37.80)	4.66 (4.43~4.89)	35.76	4.66	22° C	2021.11.23
5.75GHz Head	35.3 (33.54~37.07)	5.27 (5.01~5.53)	34.80	5.26	22° C	2021.11.24
ε_r= Relative permittivity, σ = Conductivity						

System checking, Head Tissue-equivalent liquid:

System Check	Target SAR (1W) (+/-10%)		Measured SAR (Normalized to 1W)		Liquid Temp.	Test Date
	1-g (W/kg)	10-g (W/kg)	1-g (W/kg)	10-g (W/kg)		
D2450V2 Head	51.6 (46.44~56.76)	23.64 (21.28~26.00)	52.24	23.96	22° C	2021.11.23
D5.25V2 Head	76.1 (68.50~83.71)	21.7 (19.54~23.87)	77.30	22.30	22° C	2021.11.23
D5.75V2 Head	78.0 (70.21~85.80)	22.1 (19.90~24.31)	75.90	21.40	22° C	2021.11.24

System Checking

The manufacturer calibrates the probes annually. A system check measurement was made following the determination of the dielectric parameters of the tissue-equivalent liquid, using the dipole validation kit. A power level of 250mW was supplied to the dipole antenna, which was placed under the flat section of the twin SAM phantom.



The system checking results (dielectric parameters and SAR values) are given in the table below.

The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The system check is performed with tissue equivalent material according to IEEE P1528 (described above). The following table shows system check results for all frequency bands and tissue liquids used during the tests (Graphic Plot(s) see Appendix A).

8. SAR MEASUREMENT VARIABILITY AND UNCERTAINTY

8.1. SAR measurement variability

Per KDB865664 D01 SAR measurement 100MHz to 6GHz v01r04, SAR measurement variability must be assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. The additional measurements are repeated after the completion of all measurement requiring the same head or body tissue-equivalent medium in a frequency band. The test device should be returned to ambient conditions (normal room temperature) with the battery fully charged before it is re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

1) Repeated measurement is not required when the original highest measured SAR is <0.80 W/kg; step2) through 4) do not apply.
2) When the original highest measured SAR is ≥0.8 W/kg， repeat that measurement once.
3) Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is >1.20 or when the original or repeated measurement is ≥1.45 W/kg(~10% from the 1-g SAR limit).
4) Perform a third repeated measurement only if the original, first or second repeated measurement is ≥1.5W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is >1.20.

The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.

8.2. SAR measurement uncertainty

Per KDB865664 D01 SAR Measurement 100MHz to 6GHz v01r03, when the highest measured 1-g SAR within a frequency band is <1.5W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528-2003 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.

9. Test Configuration

Test positions as described in the tables above are in accordance with the specified test standard.

KDB 447498 D01 General RF Exposure Guidance:

Testing of the required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid band or highest output power channel is:

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

10.TUNE-UP LIMIT

power adjust procedure	
2.4G WIFI	9.5 [-3dB~~+1.0dB]
power adjust procedure	
5.2G WIFI	9.5 [-3dB~~+1.0dB]
5.8G WIFI	9.0 [-3dB~~+1.0dB]
power adjust procedure	
BT	4.0 [-2.0dB~~+1.0dB]
power adjust procedure	
BLE	-3.0 [-2.0dB~~+1.0dB]

11. MEASUREMENT RESULTS

Date of testing : 2021.9.22-2021.9.29

Ambient temperature : 20℃~22℃

Relative humidity : 50~68%

11.1. Conducted Power

802.11b Average Power (dBm)					
Channel	Frequency (MHz)	Data Rate (bps)			
		1M	2M	5.5M	11M
CH 01	2,412	9.38	9.26	9.21	9.10
CH 06	2,437	9.34	9.00	8.97	9.03
CH 11	2,462	9.53	9.23	8.89	8.87

802.11g Average Power (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		6M	9M	12M	18M	24M	36M	48M	54M
CH 01	2,412	8.47	7.72	7.77	7.69	7.61	7.49	7.27	7.15
CH 06	2,437	8.75	8.56	8.53	8.59	8.64	8.31	8.03	7.88
CH 11	2,462	8.67	8.50	8.45	8.25	8.30	8.20	7.82	7.68

802.11n-HT20 Average Power (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 01	2,412	8.55	7.82	7.79	7.73	7.60	7.38	7.26	6.90
CH 06	2,437	8.90	8.78	8.79	8.63	8.53	8.17	8.08	7.89
CH 11	2,462	8.70	8.49	8.26	8.38	8.25	7.92	7.70	7.33

802.11n-HT40 Average Power (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 03	2,422	7.79	7.74	7.31	7.12	6.28	5.73	5.38	5.13
CH 06	2,437	7.85	7.81	7.54	7.39	6.55	6.08	5.76	5.48
CH 09	2,452	7.87	7.88	7.64	7.05	6.28	5.73	5.44	5.30

Band (GHz)	Mode	Data Rate	CH#	Freq (MHz)	Average Power (dBm)
5.2	802.11a	6Mbps	36	5180	9.82
			40	5200	9.76
			48	5240	9.29
	802.11n (HT20)	MCS0	36	5180	9.34
			40	5200	9.42
			48	5240	9.26
	802.11n (HT40)	MCS0	38	5190	9.75
			46	5230	9.42
	802.11ac (HT20)	MCS0	36	5180	9.58
			40	5200	9.38
			48	5240	8.87
	802.11ac (HT40)	MCS0	38	5190	9.64
			46	5230	9.23
	802.11ac (HT80)	MCS0	42	5210	9.36
5.8	802.11a	6Mbps	149	5745	9.24
			157	5785	8.60
			165	5825	8.22
	802.11n (HT20)	MCS0	149	5745	8.13
			157	5785	8.26
			165	5825	8.11
	802.11n (HT40)	MCS0	151	5755	8.96
			159	5795	8.29
	802.11ac (HT20)	MCS0	149	5745	8.50
			157	5785	8.58
			165	5825	8.10
	802.11ac (HT40)	MCS0	151	5755	8.70
			159	5795	7.91
	802.11ac (HT80)	MCS0	155	5775	8.34

Note(s):

1. For each frequency band, testing at higher data rates and higher order modulations is not required when the maximumaverage output power for each of these configurations is < ¼ dB higher than those measured at the lowest data rate.

Power measurements to determine worst-case data rates

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				6	9	12	18	24	36	48	54
5.2G	802.11a	36	5180	9.82	9.07	9.12	9.04	8.96	8.84	8.62	8.50

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11n (HT20)	40	5200	9.42	8.69	8.66	8.60	8.47	8.25	8.13	7.77

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11n (HT40)	38	5190	9.75	9.63	9.64	9.48	9.38	9.02	8.93	8.74

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11ac (HT20)	36	5180	9.58	8.85	8.82	8.76	8.63	8.41	8.29	7.93

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11ac (HT40)	38	5190	9.67	9.55	9.56	9.40	9.30	8.94	8.85	8.66

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11ac (HT80)	42	5210	9.36	9.15	8.92	9.04	8.91	8.58	8.36	7.99

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				6	9	12	18	24	36	48	54
5.8G	802.11a	149	5745	9.24	8.49	8.54	8.46	8.38	8.26	8.04	7.92

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11n (HT20)	157	5785	8.26	7.51	7.56	7.48	7.40	7.28	7.06	6.94

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11n (HT40)	151	5755	8.96	8.75	8.52	8.64	8.51	8.18	7.96	7.59

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11ac (HT20)	157	5785	8.58	7.89	7.86	7.80	7.67	7.45	7.33	6.97

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11ac (HT40)	151	5755	8.70	8.58	8.59	8.43	8.33	7.97	7.88	7.69

Average Power (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (Mbps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11ac (HT80)	155	5775	8.34	8.15	8.12	8.18	8.23	7.90	7.62	7.47

Bluetooth 2.4GHz Band Conducted Power		
Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	3.15
CH 39	2,441	4.21
CH 78	2,480	4.53

BLE2.4GHz(1M) Band Conducted Power		
Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	-3.85
CH 19	2,440	-2.78
CH 39	2,480	-2.35

BLE2.4GHz(2M) Band Conducted Power		
Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	-3.68
CH 19	2,440	-2.64
CH 39	2,480	-2.25

11.2. 2.4GHz SAR results

General Notes:

1Per KDB447498 D01v06, testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is :≤0.8 W/kg or 2.0W/kg, for 1-g or 10-g respectively, when the transmission band is ≤100MHz. When the maximum output power variation across the required test channels is >1/2 dB, instead of the middle channel, the highest output power channel must be used.

SAR test reduction for 802.11 Wi-Fi transmission mode configurations are considered separately for DSSS and OFDM. An initial test position is determined to reduce the number of tests required for certain exposure configurations with multiple test positions. An initial test configuration is determined for each frequency band and aggregated band according to maximum output power, channel bandwidth, wireless mode configurations and other operating parameters to streamline the measurement requirements. For 2.4 GHz DSSS, either the initial test position or DSSS procedure is applied to reduce the number of SAR tests; these are mutually exclusive. For OFDM, an initial test position is only applicable to next to the ear, UMPC mini-tablet and hotspot mode configurations, which is tested using the initial test configuration to facilitate test reduction. For other exposure conditions with a fixed test position, SAR test reduction is determined using only the initial test configuration.

The multiple test positions require SAR measurements in head, hotspot mode or UMPC mini-tablet configurations may be reduced according to the highest reported SAR determined using the initial test position(s) by applying the DSSS or OFDM SAR measurement procedures in the required wireless mode test configuration(s). The initial test position(s) is measured using the highest measured maximum output power channel in the required wireless mode test configuration(s). When the reported SAR for the initial test position is:

≤ 0.4 W/kg, further SAR measurement is not required for the other test positions in that exposure configuration and wireless mode combination within the frequency band or aggregated band. DSSS and OFDM configurations are considered separately according to the required SAR procedures.

> 0.4 W/kg, SAR is repeated using the same wireless mode test configuration tested in the initial test position to measure the subsequent next closet/smallest test separation distance and maximum coupling test position, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions are tested.

For subsequent test positions with equivalent test separation distance or when exposure is dominated by coupling conditions, the position for maximum coupling condition should be tested.

When it is unclear, all equivalent conditions must be tested.

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

The additional power measurements required for this step should be limited to those necessary for identifying subsequent highest output power channels to apply the test reduction.

When the specified maximum output power is the same for both UNII 1 and UNII 2A, begin SAR measurements in UNII 2A with the channel with the highest measured output power. If the reported SAR for UNII 2A is ≤ 1.2 W/kg, SAR is not required for UNII 1; otherwise treat the remaining bands separately and test them independently for SAR.

When the specified maximum output power is different between UNII 1 and UNII 2A, begin SAR with the band that has the higher specified maximum output. If the highest reported SAR for the band with the highest specified power is ≤ 1.2 W/kg, testing for the band with the lower specified output power is not required; otherwise test the remaining bands independently for SAR.

To determine the initial test position, Area Scans were performed to determine the position with the Maximum Value of SAR (measured). The position that produced the highest Maximum Value of SAR is considered the worst case position; thus used as the initial test position.

Body Exposure Condition (Separation Distance is 0 cm)

Area Scan								
Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
802.11b	**Front Side**	**11**	**2462**	**9.53**	**10.5**	**1.250**	**0.451**	**0.56**
802.11b	Back Side	11	2462	9.53	10.5	1.250	0.096	0.12
802.11b	Left Side	11	2462	9.53	10.5	1.250	0.046	0.06
802.11b	Right Side	11	2462	9.53	10.5	1.250	0.084	0.11
802.11b	Top Side	11	2462	9.53	10.5	1.250	0.015	0.02
802.11b	Bottom Side	11	2462	9.53	10.5	1.250	0.272	0.34

11.3.5.2G SAR results

Body Exposure Condition (Separation Distance is 0 cm)

Area Scan								
Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
802.11a	**Front Side**	**36**	**5180**	**9.82**	**10.5**	**1.169**	**0.390**	**0.46**
802.11a	Back Side	36	5180	9.82	10.5	1.169	0.101	0.12
802.11a	Left Side	36	5180	9.82	10.5	1.169	0.036	0.04
802.11a	Right Side	36	5180	9.82	10.5	1.169	0.065	0.08
802.11a	Top Side	36	5180	9.82	10.5	1.169	0.037	0.04
802.11a	Bottom Side	36	5180	9.82	10.5	1.169	0.260	0.30

11.4.5.8G SAR results

Body Exposure Condition (Separation Distance is 0 cm)

Area Scan								
Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
802.11a	**Front Side**	**149**	**5745**	**9.24**	**10.0**	**1.191**	**0.405**	**0.48**
802.11a	Back Side	149	5745	9.24	10.0	1.191	0.039	0.05
802.11a	Left Side	149	5745	9.24	10.0	1.191	0.048	0.06
802.11a	Right Side	149	5745	9.24	10.0	1.191	0.053	0.06
802.11a	Top Side	149	5745	9.24	10.0	1.191	0.041	0.05
802.11a	Bottom Side	149	5745	9.24	10.0	1.191	0.136	0.16

11.5.BT SAR results

Body Exposure Condition (Separation Distance is 0 cm)

Mode	Test Position	Ch.	Freq. (MHz)	Burst Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
DH1	**Front Side**	**78**	**2480**	**4.53**	**5.0**	**1.114**	**0.064**	**0.07**
DH1	Back Side	78	2480	4.53	5.0	1.114	0.010	0.01
DH1	Left Side	78	2480	4.53	5.0	1.114	0.015	0.02
DH1	Right Side	78	2480	4.53	5.0	1.114	0.011	0.01
DH1	Top Side	78	2480	4.53	5.0	1.114	0.009	0.01
DH1	Bottom Side	78	2480	4.53	5.0	1.114	0.013	0.01

11.6. Repeated SAR results

Remark:

1. Per KDB 865664 D01v01r04, for each frequency band, repeated SAR measurement is required only when the measured SAR is ≥0.8W/kg.
2. Per KDB 865664 D01v01r04, if the ratio among the repeated measurement is ≤ 1.2 and the measured SAR<1.45W/kg, only one repeated measurement is required.
3. The ratio is the difference in percentage between original and repeated measured SAR.
4. All measurement SAR result is scaled-up to account for tune-up tolerance and is compliant.

Band	Mode	Test Position	Ch.	Freq. (MHz)	Average Power (dBm)	Tune-Up Limit (dBm)	Scaling Factor	Measured SAR (W/kg)	Reported SAR (W/kg)
--	--	--	--	--	--	--	--	--	--

11.7. Simultaneous Transmission Possibilities

The Simultaneous Transmission Possibilities of this device are as below:

No.	Configuration	Support
1	WiFi2.4G+WiFi5G	Yes
2	WiFi5G+BT	Yes

Table 5: Simultaneous Transmission Possibilities

Note:

1) Wi-Fi 2.4G and Bluetooth share the same Tx antenna and can't transmit simultaneously.

11.8. SAR Summation Scenario

Test Position		Front Side (0mm)	Back Side (0mm)	Left Side (0mm)	Right Side (0mm)	Top Side (0mm)	Bottom Side (0mm)
MAX 1-g SAR (W/kg)	2.4G Wi-Fi	0.56	0.12	0.06	0.11	0.02	0.34
	5.2G Wi-Fi	0.46	0.12	0.04	0.08	0.04	0.30
	5.8G Wi-Fi	0.48	0.05	0.06	0.06	0.05	0.16
Σ1-g SAR(W/kg)		1.04	0.24	0.12	0.19	0.07	0.64

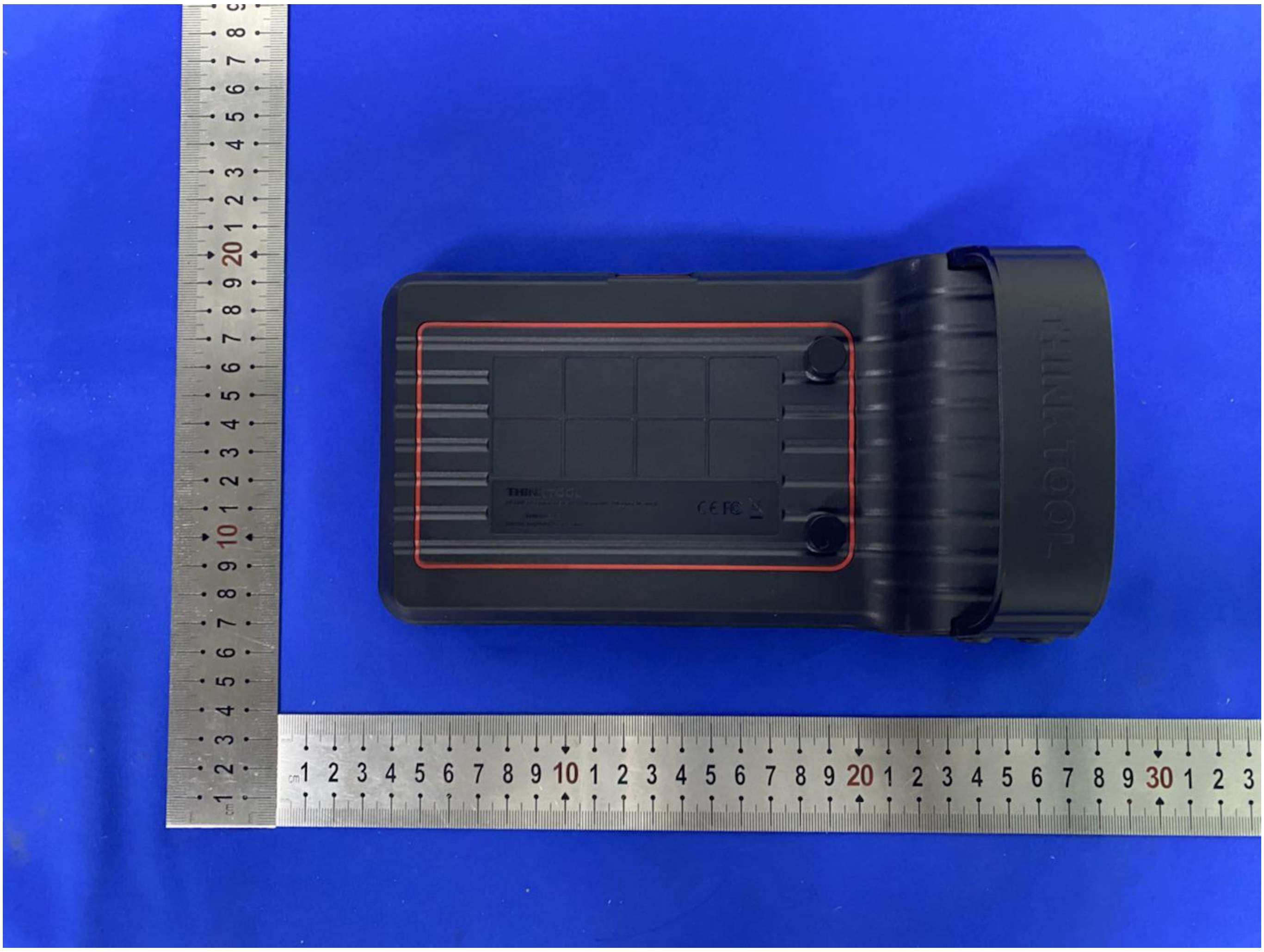
Test Position		Front Side (0mm)	Back Side (0mm)	Left Side (0mm)	Right Side (0mm)	Top Side (0mm)	Bottom Side (0mm)
MAX 1-g SAR (W/kg)	5.2G Wi-Fi	0.46	0.12	0.04	0.08	0.04	0.30
	5.8G Wi-Fi	0.48	0.05	0.06	0.06	0.05	0.16
	BT	0.07	0.01	0.02	0.01	0.01	0.01
Σ1-g SAR(W/kg)		0.55	0.13	0.08	0.09	0.06	0.31

11.9. Simultaneous Transmission Conclusion

The above numeral summed SAR results and SPLSR analysis is sufficient to determine that simultaneous cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scan is not required per KDB 447498 D01v06

12. EXPOSURE POSITIONS CONSIDERATION

12.1. Multiple Transmitter Evaluation



Mode	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Wi-Fi/BT Antenna	YES	YES	YES	YES	YES	YES

APPENDIX A: SYSTEM CHECKING SCANS

Date/Time: 2021-11-23

Dipole2450V2

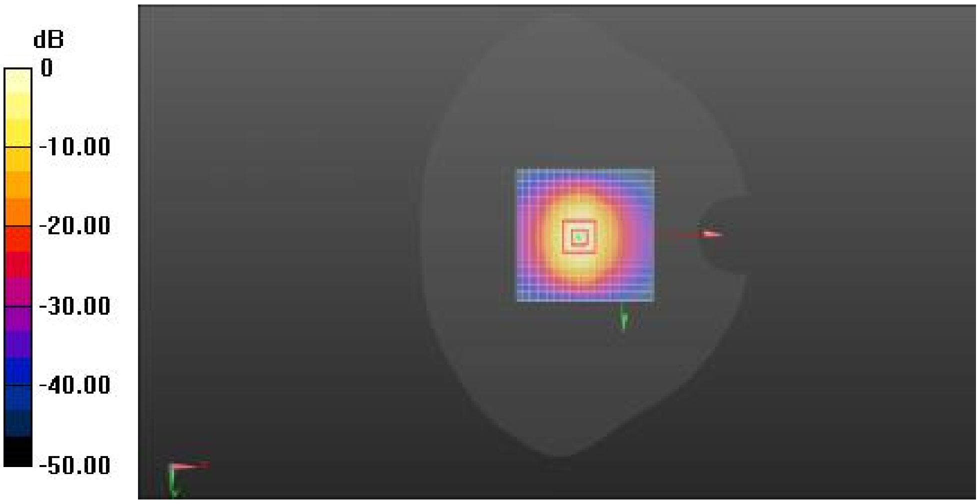
Communication System: UID 0, CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;Communication System PAR: 0 dB; PMF: 1
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 39.19; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(8.07, 8.07, 8.07) @ 2450 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM1; Type: QD 000 P41 AA;
- DASY52 52.8.8(1222）; SEMCAD X 14.6.14(7483)

Head/Dipole2450/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 109.6 V/m; Power Drift = 0.11 dB
Fast SAR: SAR(1 g) = 13.15 W/kg; SAR(10 g) = 6.01 W/kg
Maximum value of SAR (interpolated) = 23.4 W/kg

Head/Dipole2450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 109.6 V/m; Power Drift =0.11 dB
Peak SAR (extrapolated) = 27.7 W/kg
SAR(1 g) = 13.06 W/kg; SAR(10 g) = 5.99 W/kg
Smallest distance from peaks to all points 3 dB below = 8.9 mm
Ratio of SAR at M2 to SAR at M1 = 46.4%
Maximum value of SAR (measured) = 22.8 W/kg



0 dB = 23.4 W/kg = 13.89 dBW/kg

Date/Time: 2021-11-23

Dipole 5.2GV2

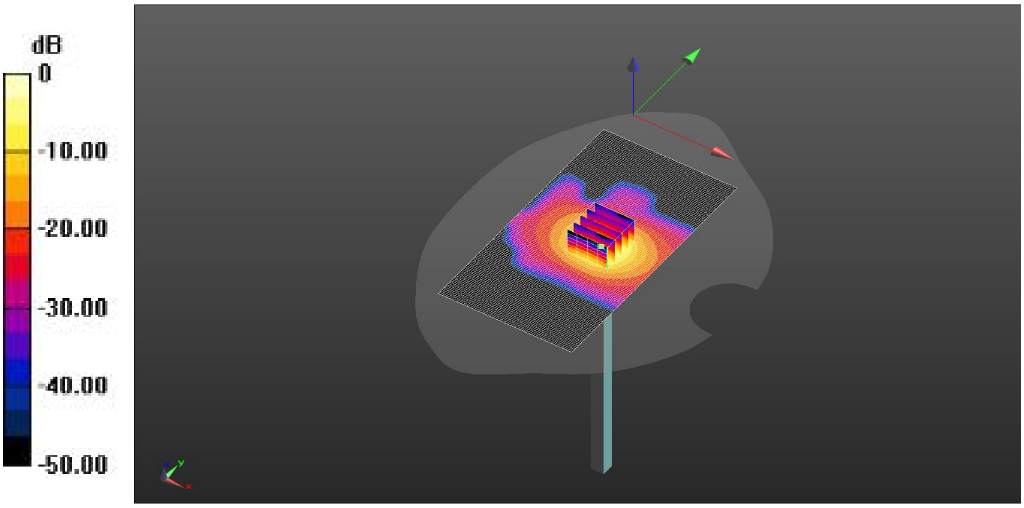
Communication System: UID 0, CW (0); Communication System Band: CW5250; Frequency: 5250 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5200 MHz; σ = 4.66 S/m; ε_r = 35.76; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(5.5, 5.5, 5.5) @ 5250 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM2; Type: QD 000 P41 AA;
- DASY52 52.8.8(1222）; SEMCAD X 14.6.14(7483)

Head5.3/5.250G 3/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 66.00 V/m; Power Drift = 0.02 dB
Fast SAR: SAR(1 g) = 7.84 W/kg; SAR(10 g) = 2.28 W/kg
Maximum value of SAR (interpolated) = 18.9 W/kg

Head5.3/5.250G 3/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 66.00 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 31.9 W/kg
SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.23 W/kg
Smallest distance from peaks to all points 3 dB below = 7.1 mm
Ratio of SAR at M2 to SAR at M1 = 64.8%
Maximum value of SAR (measured) = 18.4 W/kg



0 dB = 18.9 W/kg = 12.51 dBW/kg

Date/Time: 2021-11-24

Dipole 5.75GV2

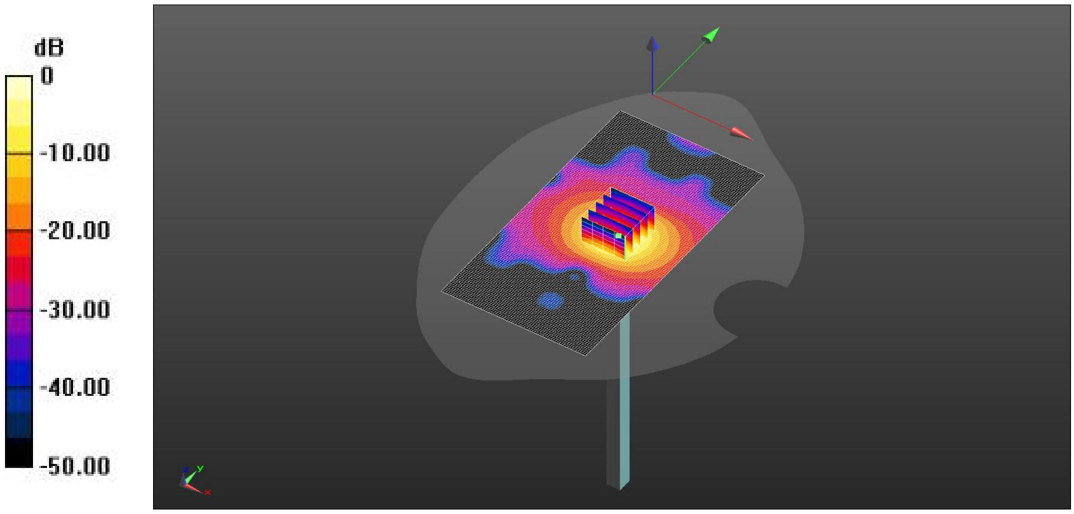
Communication System: UID 0, CW (0); Communication System Band: CW5750; Frequency: 5750 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5750 MHz; σ = 5.26 S/m; ε_r = 34.80; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(4.93, 4.93, 4.93) @ 5750 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM2; Type: QD 000 P41 AA;
- DASY52 52.8.8(1222）; SEMCAD X 14.6.14(7483)

Head5.8/5.75G 4/Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 61.93 V/m; Power Drift = 0.00 dB
Fast SAR: SAR(1 g) = 7.66 W/kg; SAR(10 g) = 2.20 W/kg
Maximum value of SAR (interpolated) = 19.5 W/kg

Head5.8/5.75G 4/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 61.93 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 35.9 W/kg
SAR(1 g) = 7.59 W/kg; SAR(10 g) = 2.14 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 57.5%
Maximum value of SAR (measured) = 18.8 W/kg



0 dB = 19.5 W/kg = 12.21 dBW/kg

APPENDIX B.   MEASUREMENT SCANS

Date/Time: 2021-11-23

2.4GWiFi-Body Faceup 0mm

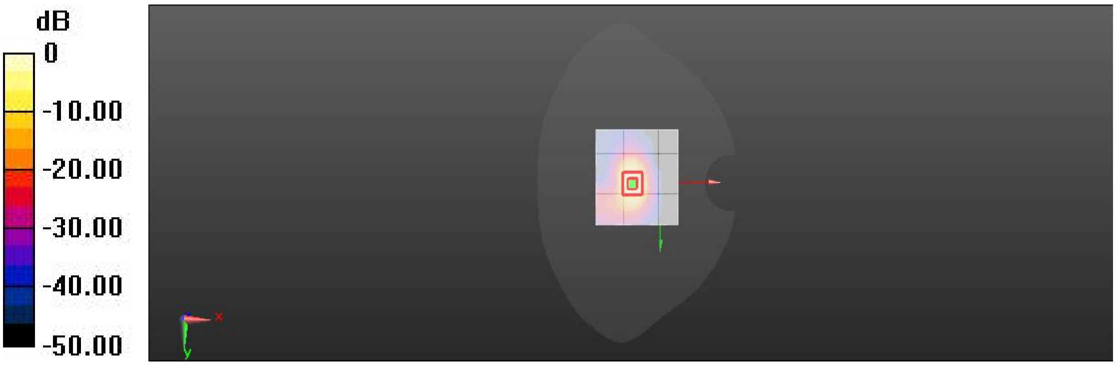
Communication System: UID 0, 802.11b WiFi 2.4GHz(DSSS,11Mbps); Communication System Band: 802.11b; Frequency: 2462 MHz;Communication System PAR: 3.599 dB; PMF: 1
Medium parameters used (interpolated): f = 2462 MHz; σ = 1.891 S/m; ε_r = 37.993; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(7.56, 7.56, 7.56) @ 2462 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM-1; Type: QD 000 P40 CC;
- DASY52 52.8.8(1222); SEMCAD X 14.6.14(7483)

2.4G WIFI/Faceup-High-0mm/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 16.11 V/m; Power Drift = 0.07 dB
Fast SAR: SAR(1 g) = 0.458 W/kg; SAR(10 g) = 0.223 W/kg
Maximum value of SAR (interpolated) = 0.531 W/kg

2.4G WIFI/Faceup-High-0mm/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 16.11 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 0.94 W/kg
SAR(1 g) = 0.451 W/kg; SAR(10 g) = 0.218 W/kg
Smallest distance from peaks to all points 3 dB below = 8.2 mm
Ratio of SAR at M2 to SAR at M1 = 46.7%
Maximum value of SAR (measured) = 0.519 W/kg



0 dB = 0.531 W/kg = 0.54 dBW/kg

Date/Time: 2021-11-23

5.2GWiFi-Body Faceup 0mm

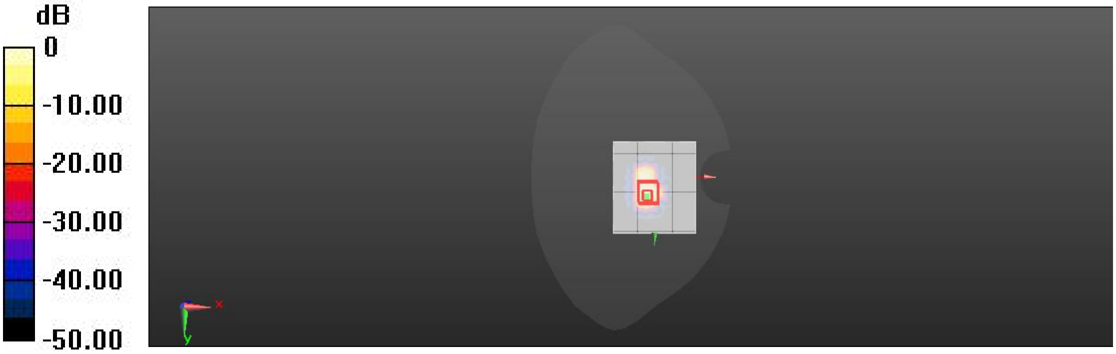
Communication System: UID 0, 5G; Communication System Band: 5.2G; Frequency: 5180 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5180 MHz; σ = 4.50 S/m; ε_r = 35.55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(5.22, 5.22, 5.22) @ 5180 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM-2; Type: QD 000 P40 CC;
- DASY52 52.8.8(1222); SEMCAD X 14.6.14(7483)

5.2G WIFI/Faceup-0mm/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 14.68 V/m; Power Drift = -0.06 dB
Fast SAR: SAR(1 g) = 0.407 W/kg; SAR(10 g) = 0.194 W/kg
Maximum value of SAR (interpolated) = 0.446 W/kg

5.2G WIFI/Faceup-0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 14.68 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 0.851 W/kg
SAR(1 g) = 0.390 W/kg; SAR(10 g) = 0.189 W/kg
Smallest distance from peaks to all points 3 dB below = 6.4 mm
Ratio of SAR at M2 to SAR at M1 = 23.3%
Maximum value of SAR (measured) = 0.433 W/kg



0 dB = 0.446 W/kg = -3.05 dBW/kg

Date/Time: 2021-11-24

5.8GWiFi-Body Faceup 0mm

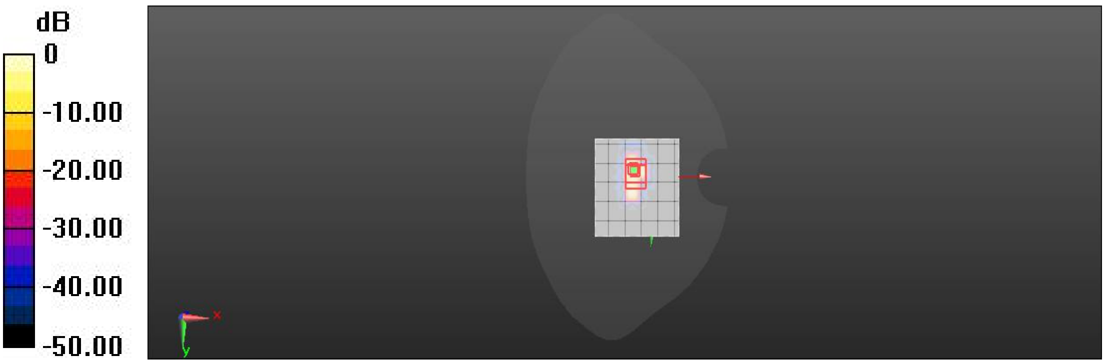
Communication System: UID 0, 5G; Communication System Band: 5.8G; Frequency: 5745 MHz;Communication System PAR: 0 dB; PMF: 1.12202e-005
Medium parameters used: f = 5750 MHz; σ = 5.17 S/m; ε_r = 35.36; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(4.79, 4.79, 4.79) @ 5785 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 1.0, 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM-2; Type: QD 000 P40 CC;
- DASY52 52.8.8(1222); SEMCAD X 14.6.14(7483)

5.8G WIFI/Faceup-0mm/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 15.06 V/m; Power Drift = 0.06 dB
Fast SAR: SAR(1 g) = 0.414 W/kg; SAR(10 g) = 0.197 W/kg
Maximum value of SAR (interpolated) = 0.450 W/kg

5.8G WIFI/Faceup-0mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 15.06 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.985 W/kg
SAR(1 g) = 0.405 W/kg; SAR(10 g) = 0.191 W/kg
Smallest distance from peaks to all points 3 dB below = 8.1 mm
Ratio of SAR at M2 to SAR at M1 = 18.5%
Maximum value of SAR (measured) = 0.448 W/kg



0 dB = 0.450 W/kg = -6.14 dBW/kg

Date/Time: 2021-11-23

BT Body Faceup-0mm

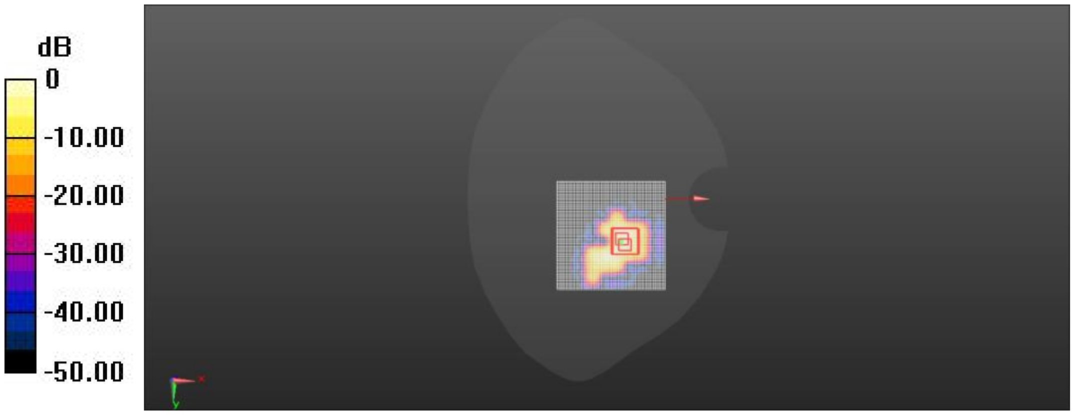
Communication System: UID 10670 - AAA, Bluetooth Low Energy; Communication System Band: ISM 2.4 GHz Band (2400.0 - 2483.5 MHz); Frequency: 2480 MHz;Communication System PAR: 2.192 dB; PMF: 1.2844
Medium parameters used: f = 2450 MHz; σ = 1.97 S/m; ε_r = 37.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3881; ConvF(8.07, 8.07, 8.07) @ 2480 MHz; Calibrated: 2021/7/23
- Sensor-Surface: 4mm (Mechanical Surface Detection), z = 31.0
- Electronics: DAE4 Sn876; Calibrated: 2021/3/11
- Phantom: SAM1; Type: QD 000 P41 AA;
- DASY52 52.8.8(1222); SEMCAD X 14.6.14(7483)

Flat/Face up Mid/Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 1.378 V/m; Power Drift = 0.09 dB
Fast SAR: SAR(1 g) = 0.068 W/kg; SAR(10 g) = 0.028 W/kg
Maximum value of SAR (interpolated) = 0.084 W/kg

Flat/Face up Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 1.378 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 0.147 W/kg
SAR(1 g) = 0.064 W/kg; SAR(10 g) = 0.025 W/kg
Smallest distance from peaks to all points 3 dB below = 9.7 mm
Ratio of SAR at M2 to SAR at M1 = 32.8%
Maximum value of SAR (measured) = 0.075 W/kg



0 dB = 0.071 W/kg = -0.69 dBW/kg

APPENDIX C: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

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Client SMQ

Certificate No: Z21-60261

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 3881
Calibration Procedure(s)	FF-Z11-004-02 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	July 23, 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 1556	15-Jan-21(SPEAG, No.DAE4-1556_Jan21)	Jan-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	21-Jan-21(CTTL, No.J20X00515)	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: July 25, 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:3881

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (*k*=2)
Norm(μV/(V/m)²)[A]	0.27	0.27	0.35	±10.0%
DCP(mV)[B]	101.1	100.1	105.5	

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	119.1	±2.9%
		Y	0.0	0.0	1.0		116.7	
		Z	0.0	0.0	1.0		141.2	

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:3881

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	9.92	9.92	9.92	0.40	0.72	±12.1%
835	41.5	0.90	9.52	9.52	9.52	0.18	1.16	±12.1%
900	41.5	0.97	9.50	9.50	9.50	0.35	0.86	±12.1%
1750	40.1	1.37	8.29	8.29	8.29	0.22	0.95	±12.1%
1810	40.0	1.40	8.09	8.09	8.09	0.18	1.11	±12.1%
1900	40.0	1.40	7.99	7.99	7.99	0.21	1.16	±12.1%
2300	39.5	1.67	7.75	7.75	7.75	0.34	0.88	±12.1%
2450	39.2	1.80	7.56	7.56	7.56	0.40	0.85	±12.1%
2600	39.0	1.96	7.33	7.33	7.33	0.60	0.66	±12.1%
3300	38.2	2.71	7.05	7.05	7.05	0.41	0.89	±13.3%
3500	37.9	2.91	6.89	6.89	6.89	0.40	0.93	±13.3%
3700	37.7	3.12	6.59	6.59	6.59	0.35	1.10	±13.3%
3900	37.5	3.32	6.40	6.40	6.40	0.30	1.52	±13.3%
4200	37.1	3.63	6.31	6.31	6.31	0.35	1.38	±13.3%
4400	36.9	3.84	6.23	6.23	6.23	0.35	1.32	±13.3%
4600	36.7	4.04	6.15	6.15	6.15	0.40	1.30	±13.3%
4800	36.4	4.25	6.10	6.10	6.10	0.40	1.32	±13.3%
4950	36.3	4.40	5.91	5.91	5.91	0.40	1.32	±13.3%
5250	35.9	4.71	5.22	5.22	5.22	0.40	1.45	±13.3%
5600	35.5	5.07	4.72	4.72	4.72	0.45	1.45	±13.3%
5750	35.4	5.22	4.79	4.79	4.79	0.45	1.50	±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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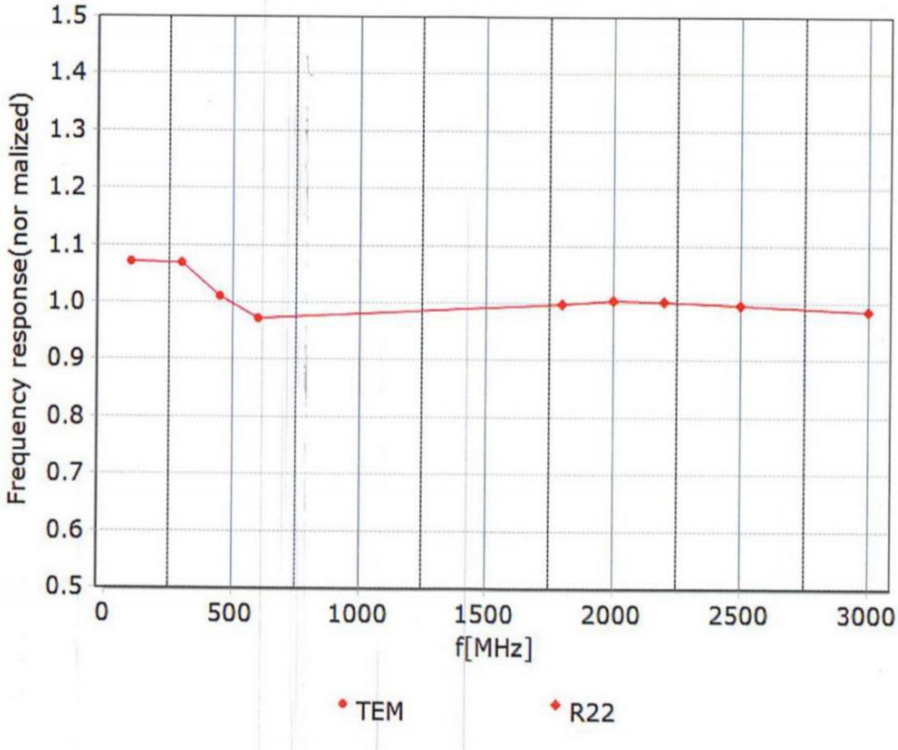
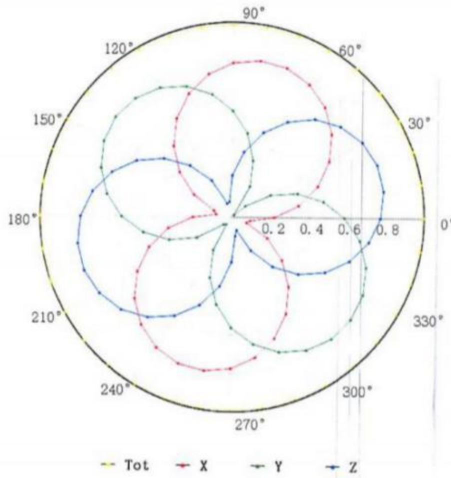
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



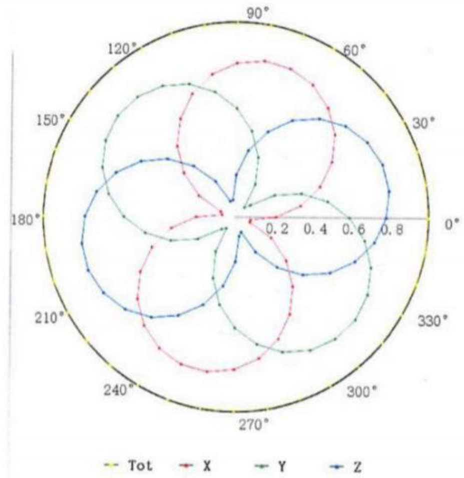
Uncertainty of Frequency Response of E-field: ±7.4% (*k*=2)

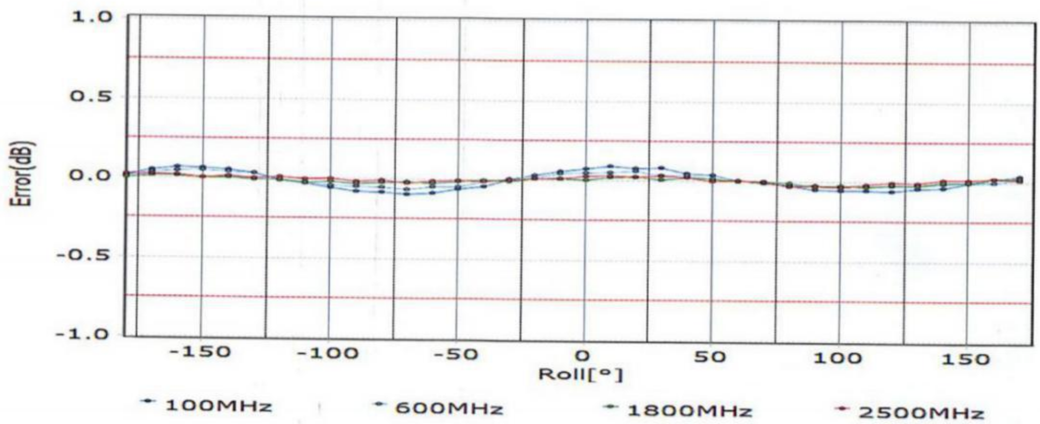
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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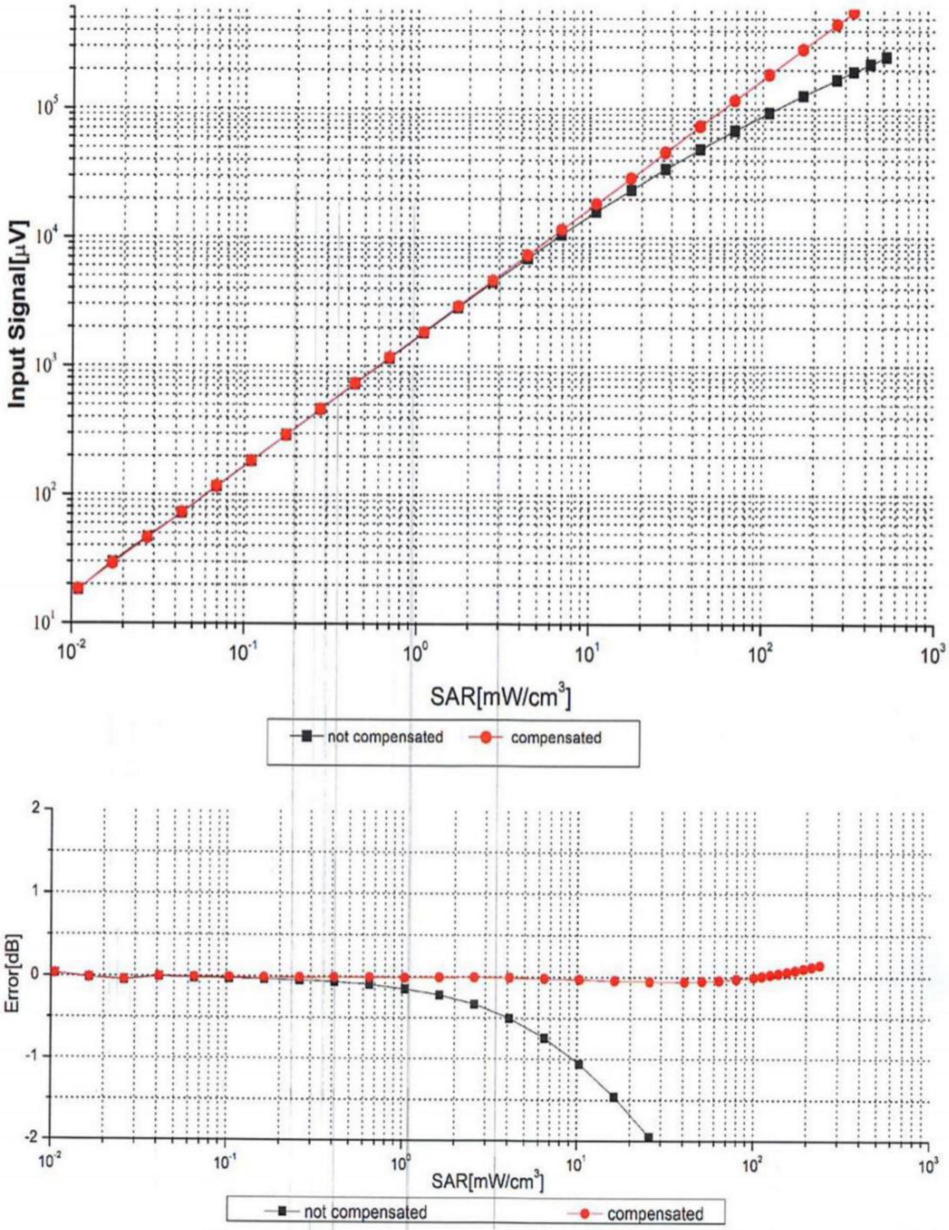
Dynamic Range f(SAR_{head})
(TEM cell, f = 900 MHz)



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

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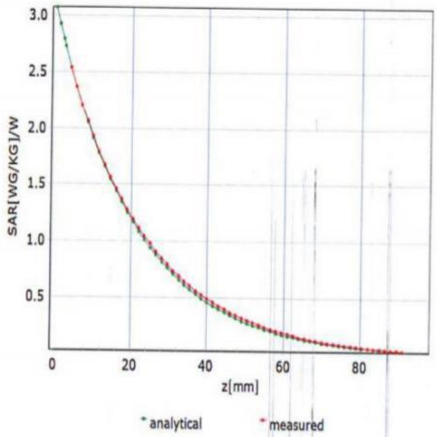
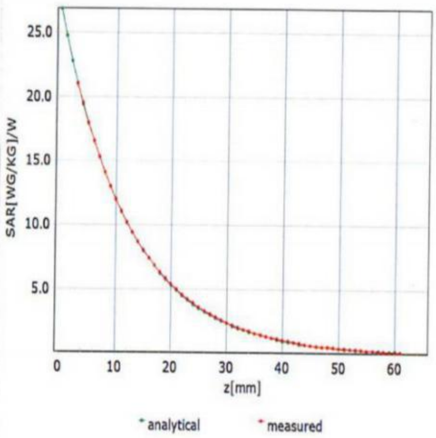
Conversion Factor Assessment

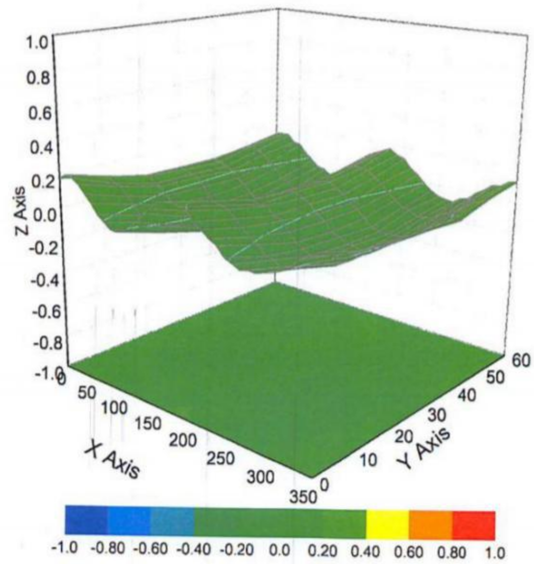
f=750 MHz,WGLS R9(H_convF)



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:3881

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	127
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

4b6810/01

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CNAS L0570

Client : **SMQ**

Certificate No: Z21-60057

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 876
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	March 11, 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
Process Calibrator 753	1971018	16-Jun-20 (CTTL, No.J20X04342)	Jun-21

	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: March 13, 2021

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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	405.498 ± 0.15% (k=2)	405.157 ± 0.15% (k=2)	405.372 ± 0.15% (k=2)
Low Range	3.98811 ± 0.7% (k=2)	3.97133 ± 0.7% (k=2)	3.99797 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	181.5° ± 1 °

APPENDIX D: RELEVANT PAGES FROM DAE& DIPOLE VALIDATION KIT REPORT(S)

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Client SMQ Certificate No: Z21-60306

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 818
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 26, 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	106277	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Power sensor NRP8S	104291	23-Sep-20 (CTTL, No.J20X08336)	Sep-21
Reference Probe EX3DV4	SN 7517	03-Feb-21(CTTL-SPEAG,No.Z21-60001)	Feb-22
DAE3	SN 536	06-Nov-20(CTTL-SPEAG,No.Z20-60452)	Nov-21
Secondary Standards	**ID #**	**Cal Date (Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	01-Feb-21 (CTTL, No.J21X00593)	Jan-22
NetworkAnalyzer E5071C	MY46110673	14-Jan-21 (CTTL, No.J21X00232)	Jan-22

	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: August 31, 2021

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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) 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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, 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%.

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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	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 %	1.77 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	12.9 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**52.2 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	5.91 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.8 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	53.7Ω+ 3.89jΩ
Return Loss	- 25.7dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.071 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

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DASY5 Validation Report for Head TSL Date: 08.26.2021

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 818

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

Medium parameters used: f = 2450 MHz; σ = 1.772 S/m; ε_r = 40.04; ρ = 1000 kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7517; ConvF(7.34, 7.34, 7.34) @ 2450 MHz; Calibrated: 2021-02-03
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn536; Calibrated: 2020-11-06
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 107.9 V/m; Power Drift = -0.02 dB

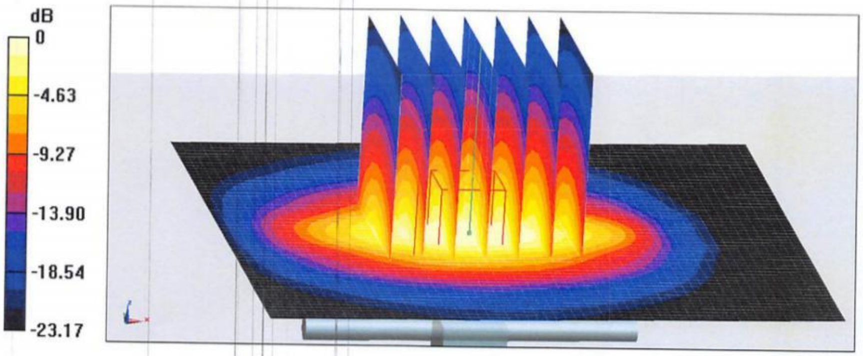
Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 12.9 W/kg; SAR(10 g) = 5.91 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 46.9%

Maximum value of SAR (measured) = 22.0 W/kg



0 dB = 22.0 W/kg = 13.42 dBW/kg

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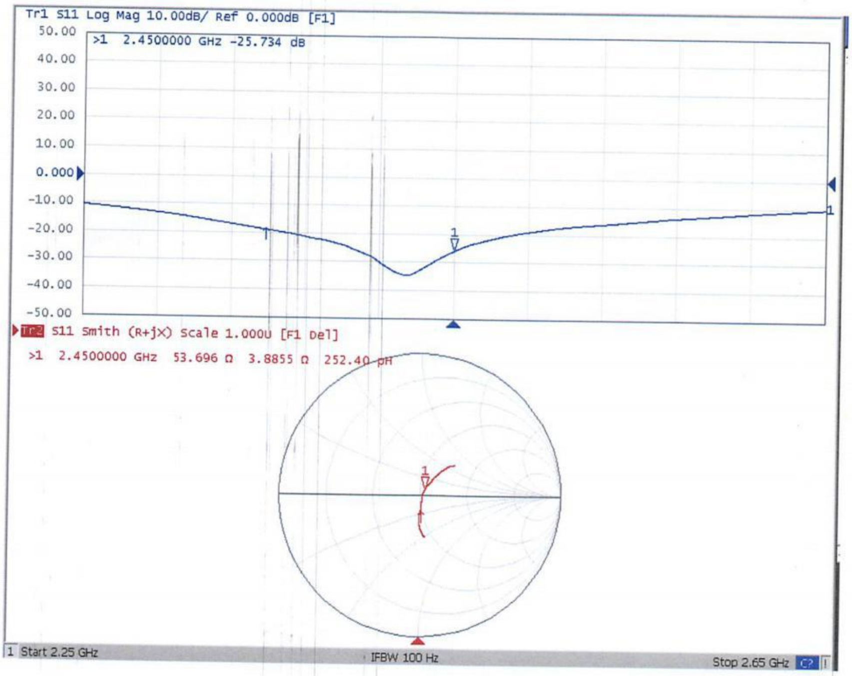
Impedance Measurement Plot for Head TSL



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Client **SMQ** **Certificate No: Z20-60041**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1185
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	December 31, 2019

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	106276	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
Power sensor NRP6A	101369	11-Apr-19 (CTTL, No.J19X02605)	Apr-20
ReferenceProbe EX3DV4	SN 3617	31-Jan-19(SPEAG,No.EX3-3617_Jan19)	Jan-20
DAE4	SN 1555	22-Aug-19(CTTL-SPEAG,No.Z19-60295)	Aug-20
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-19 (CTTL, No.J19X00336)	Jan-20
NetworkAnalyzerE5071C	MY46110673	24-Jan-19 (CTTL, No.J19X00547)	Jan-20

	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: January 7, 2019

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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) 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 assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, 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%.

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Measurement Conditions

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

DASY Version	DASY52	V52.10.3
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.8 ± 6 %	4.65 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.61 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.5 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.8 W/kg ± 24.2 % (k=2)**

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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	36.2 ± 6 %	5.03 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.99 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.2 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.27 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 24.2 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	36.0 ± 6 %	5.19 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.80 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.2 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	100 mW input power	2.21 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 24.2 % (k=2)**

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Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.7 ± 6 %	5.32 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.43 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.2 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.08 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 24.2 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	48.0 ± 6 %	5.79 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.70 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.9 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.17 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 W/kg ± 24.2 % (k=2)**

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Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.7 ± 6 %	6.02 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.30 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**72.9 W/kg ± 24.4 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	100 mW input power	2.03 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.2 W/kg ± 24.2 % (k=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	49.3Ω - 5.08jΩ
Return Loss	- 25.8dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	55.2Ω - 2.17jΩ
Return Loss	- 25.5dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	55.6Ω - 0.52jΩ
Return Loss	- 25.5dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	49.3Ω - 3.89jΩ
Return Loss	- 28.0dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.9Ω - 2.71jΩ
Return Loss	- 26.7dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	55.8Ω - 2.17jΩ
Return Loss	- 24.7dB

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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 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

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DASY5 Validation Report for Head TSL Date: 12.31.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1185

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

Medium parameters used: f = 5250 MHz; σ = 4.652 S/m; ε_r = 36.81; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.027 S/m; ε_r = 36.19; ρ = 1000 kg/m3, Medium parameters used: f = 5750 MHz; σ = 5.19 S/m; ε_r = 35.96; ρ = 1000 kg/m3,

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(5.39, 5.39, 5.39) @ 5250 MHz; ConvF(5.06, 5.06, 5.06) @ 5600 MHz; ConvF(5.07, 5.07, 5.07) @ 5750 MHz; Calibrated: 1/31/2019
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.41 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 31.5 W/kg
SAR(1 g) = 7.61 W/kg; SAR(10 g) = 2.17 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.3%
Maximum value of SAR (measured) = 18.1 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.02 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 36.2 W/kg
SAR(1 g) = 7.99 W/kg; SAR(10 g) = 2.27 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 62.7%
Maximum value of SAR (measured) = 19.5 W/kg

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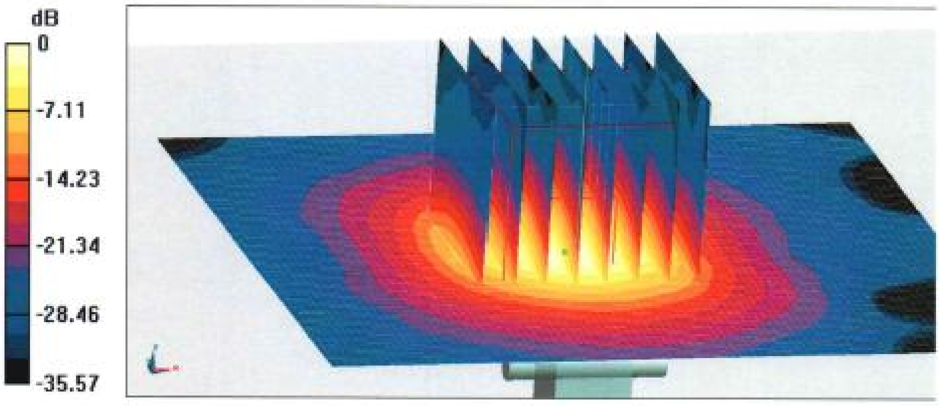
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.14 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 36.9 W/kg
SAR(1 g) = 7.8 W/kg; SAR(10 g) = 2.21 W/kg
Smallest distance from peaks to all points 3 dB below = 7.5 mm
Ratio of SAR at M2 to SAR at M1 = 59.5%
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

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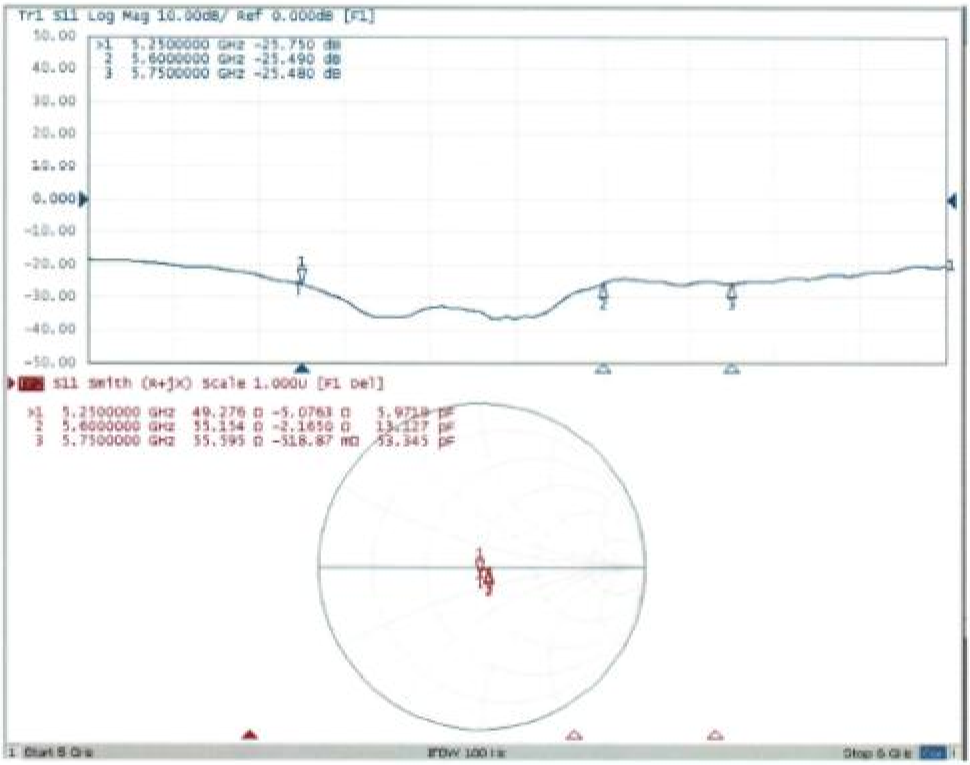
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 12.30.2019

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1185

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

Medium parameters used: f = 5250 MHz; σ = 5.317 S/m; ε_r = 48.69; ρ = 1000 kg/m3, Medium parameters used: f = 5600 MHz; σ = 5.79 S/m; ε_r = 48.02; ρ = 1000 kg/m3, Medium parameters used: f = 5750 MHz; σ = 6.019 S/m; ε_r = 47.69; ρ = 1000 kg/m3,

Phantom section: Right Section

DASY5 Configuration:

- Probe: SN3617; ConvF(4.76, 4.76, 4.76) @ 5250 MHz; ConvF(4.23, 4.23, 4.23) @ 5600 MHz; ConvF(4.36, 4.36, 4.36) @ 5750 MHz; Calibrated: 1/31/2019,
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1555; Calibrated: 8/22/2019
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (3); SEMCAD X Version 14.6.13 (7474)

Dipole Calibration /Pin=100mW, d=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.27 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 29.5 W/kg
SAR(1 g) = 7.43 W/kg; SAR(10 g) = 2.08 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 65.1%
Maximum value of SAR (measured) = 17.5 W/kg

Dipole Calibration /Pin=100mW, d=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.02 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.7 W/kg; SAR(10 g) = 2.17 W/kg
Smallest distance from peaks to all points 3 dB below = 7.2 mm
Ratio of SAR at M2 to SAR at M1 = 61.7%
Maximum value of SAR (measured) = 18.8 W/kg

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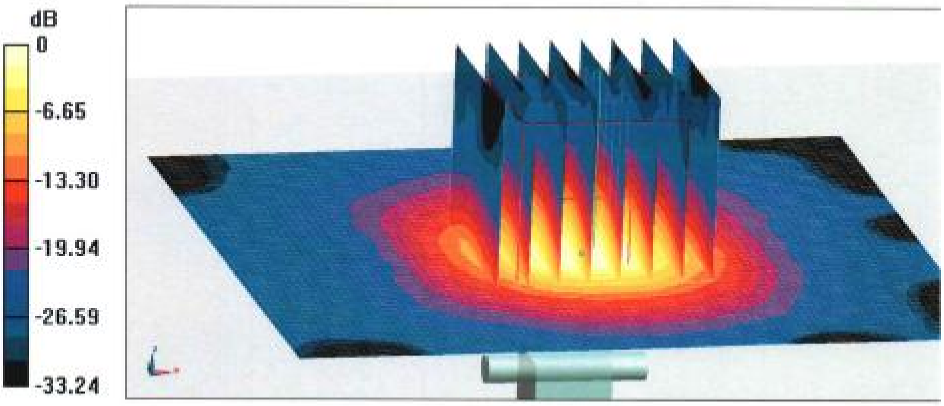
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.40 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.3 W/kg; SAR(10 g) = 2.03 W/kg
Smallest distance from peaks to all points 3 dB below = 7.4 mm
Ratio of SAR at M2 to SAR at M1 = 59.9%
Maximum value of SAR (measured) = 18.1 W/kg



0 dB = 18.1 W/kg = 12.58 dBW/kg

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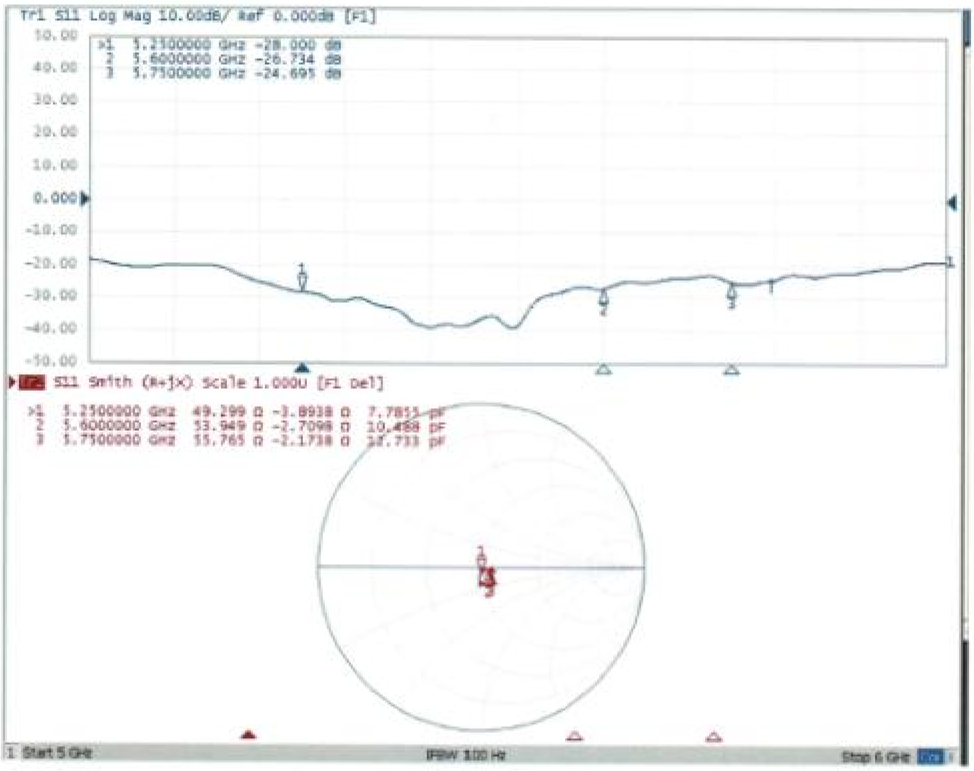
Impedance Measurement Plot for Body TSL



12.2. Simultaneous Transmission Conclusion

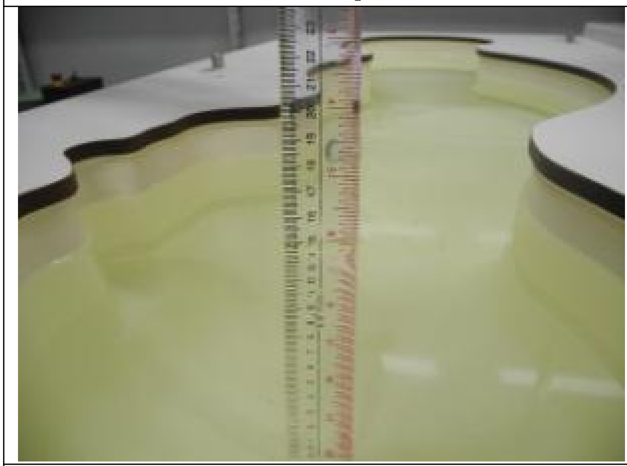
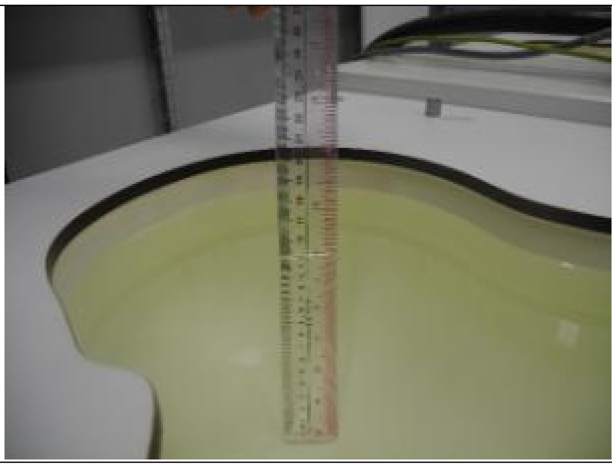
The above numeral summed SAR results and SPLSR analysis is sufficient to determine that simultaneous cases will not exceed the SAR limit and therefore simultaneous transmission SAR with Volume Scan is not required per KDB 447498 D01v06

13. Photographs of the Test Set-Up

Photo 1: Measurement System DASY5	Photo 2: Front Side 0mm
	
Photo 3: Rear View 0mm	Photo 4: Left Side 0mm
	
Photo 5: Right Side 0mm	Photo 6: Top Side 0mm
	

Photo 7: Bottom Side 0mm	Photo 8: Sample photos
	

Photograph: Liquid depth

Photo 8: Head 2450 Depth (15.0cm)	Photo 9: Head 5G Depth (15.0cm)
	
N/A	N/A
N/A	N/A