SAR TEST REPORT

For

Advanced Automotive Diagnostic Tool , THINKTOOL PROS+
FCC:2AWD8CRULTRA

Report Number: WT238002181

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Test report declaration

Applicant	:	Icarsoft Technology Inc.
Address	:	1629 K St. Suite 300 N.W. Washington D.C., 20006 United States.
Manufacturer	:	Icarsoft Technology Inc.
Address	:	1629 K St. Suite 300 N.W. Washington D.C., 20006 United States.
EUT Description	:	Advanced Automotive Diagnostic Tool , THINKTOOL PROS+
Model No.	:	CR Ultra P，CR Ultra，TKT04
Brand	:	iCarsoft
FCC	:	2AWD8CRULTRA

Test Standards:

IEEE Std 1528-2013, KDB941225 D06, KDB447498 D01, KDB 865664 D01,KDB865664 D02,KDB690783 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:	张强 (Zhang Qiang)	Date:	Dec. 22, 2023
Checked by:	万晓靖 (Wan Xiao Jing)	Date:	Dec. 22, 2023
Approved by:	林奕翔 (Lin Yi Xiang)	Date:	Dec. 22, 2023

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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)
2.4GWIFI	0.733
The highest simultaneous SAR value is 1.368 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

Device type :	Advanced Automotive Diagnostic Tool , THINKTOOL PROS+	
DUT Name:	CR Ultra P，CR Ultra，TKT04	
Type Identification:	iCarsoft	
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 :	Y8_tool_proplus_20201023_1413_V1.8	
Antenna type :	internal antenna with ipex connector	
Battery options :	SHENZHEN POWERCOME ELECTRONICS CO.,LTD	Rechargeable Polymer lithium-ion Battery. Battery model : PC944755-2S2P Battery Specification:DC7.6V, 6300mAh
SN:	850022568053	
Remark	This is a derivative report based on original report WT218002298. This report changes the Their electrical circuit design, layout, components used and internal wiring are identical,Only the appearance color of the product, the product trademark and the model name are different. 1. The model name is change from CR Ultra , TKT04 to CR Ultra P，CR Ultra，TKT04; All test data were reuse of those from the original report No.: 218002298.	

1.4 Product Function and Intended Use

CR Ultra P，CR Ultra，TKT04 is a Wireless Monitoring System , and it also has 2.4GWIFI / BTand 5G 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
RSS-102	Radio Frequency Exposure Compliance of Radio communication Apparatus (All Frequency Bands (Issue 5 of March 2015)
KDB941225 D06 Hotspot Mode v02r01	SAR Evaluation Procedures for portable Devices with Wireless Router Capabilities

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	2020.03.03	1year
☒	SAR Probe	EX3DV4	3881	SPEAG	2020.06.16	1year
☒	Software	85070	--	Agilent	--	--
☒	Software	DASY5	--	SPEAG	--	--
☒	System Validation Dipole,2450MHz	D2450V2	818	SPEAG	2018.08.31	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	2020.02.20	1year
☒	Power Sensor	NRP-Z21	102626	R&S	2020.06.04	1year
☒	Power Sensor	NRP-Z21	102627	R&S	2020.06.04	1year
☒	Network Analyzer	E5071C	MY46109550	Agilent	2020.02.20	1Year
☒	Flat Phantom	ELI4.0	TP-1904	SPEAG	NCR	NCR
☐	Twin Phantom	SAM	TP-1504	SPEAG	NCR	NCR
☒	Precision Thermometer	--	--	--	2020.08.07	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:

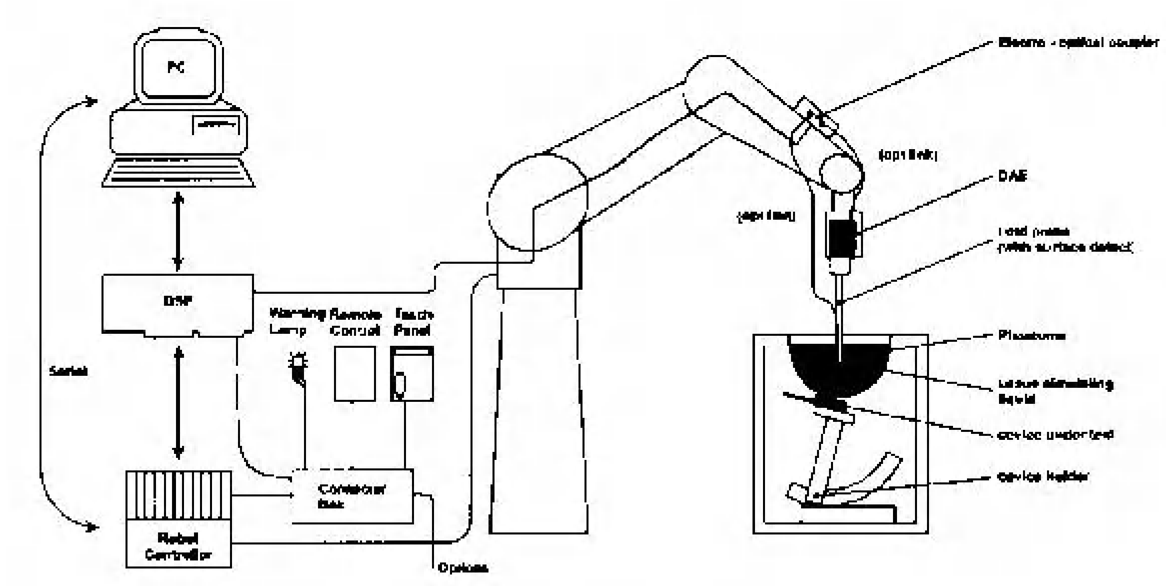
China National Accreditation Service for Conformity Assessment (CNAS) accredits the Laboratory for conformance to FCC standards, EMC international standards and EN standards. The Registration Number is CNAS L0579.

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 m³, 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

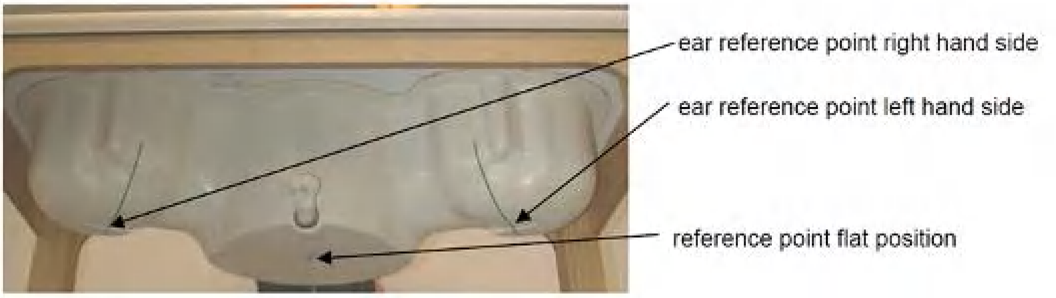
Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements

Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	 
Calibration	ISO/IEC 17025 calibration service available.	
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic range	10 μW/g to > 100 mW/g; Linearity: ± 0.2 dB (noise: typically<1 μW/g)	
Dimensions	Overall length: 337 mm (Tip: 20mm) Tip length: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1mm	
Application	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%.	

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:

<table>
<tr><td rowspan="3">Frequency</td><td rowspan="3">Maximum Area Scan resolution (Δxarea, Δyarea)</td><td rowspan="3">Maximum Zoom Scan spatial resolution(Δxzoom Δyzoom)</td><td colspan="3">Maximum Zoom Scan spatial resolution</td><td rowspan="3">Minimum zoom scan volume (x,y,z)</td></tr>
<tr><td>Uniform Grid</td><td colspan="2">Graded Grad</td></tr>
<tr><td>Δzzoom(n)</td><td>Δzzoom(1)</td><td>Δzzoom(n>1)</td></tr>
</table>

≤2GHz	≤15mm	≤8mm	≤5mm	≤4mm	≤1.5*Δzzoom(n-1)	≥30mm
2-3GHz	≤12mm	≤5mm	≤5mm	≤4mm	≤ 1.5* Δ zzoom(n-1)	≥30mm
3-4GHz	≤10mm	≤5mm	≤4mm	≤3mm	≤ 1.5* Δ zzoom(n-1)	≥28mm
4-5GHz	≤10mm	≤4mm	≤3mm	≤2.5mm	≤ 1.5* Δ zzoom(n-1)	≥25mm
5-6GHz	≤10mm	≤4mm	≤2mm	≤2mm	≤ 1.5* Δ zzoom(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:

$$V_i = U_i + U_i^2 \bullet cf/dcp_i$$

with V_i = compensated signal of channel i (i = x, y, z)

U_i = input signal of channel i (i = x, y, z)

cf = crest factor of exciting field (DASY parameter)

dcp_i = diode compression point (DASY parameter)

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

E-field probes: $E_i = (V_i / Norm_i \bullet ConvF)^{1/2}$

H-field probes: $H_i = (V_i)^{1/2} \bullet (a_{i0} + a_{i1}f + a_{i2}f^2)/f$

with V_i = compensated signal of channel i (i = x, y, z)

$Norm_i$ = 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(NaCl)	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:

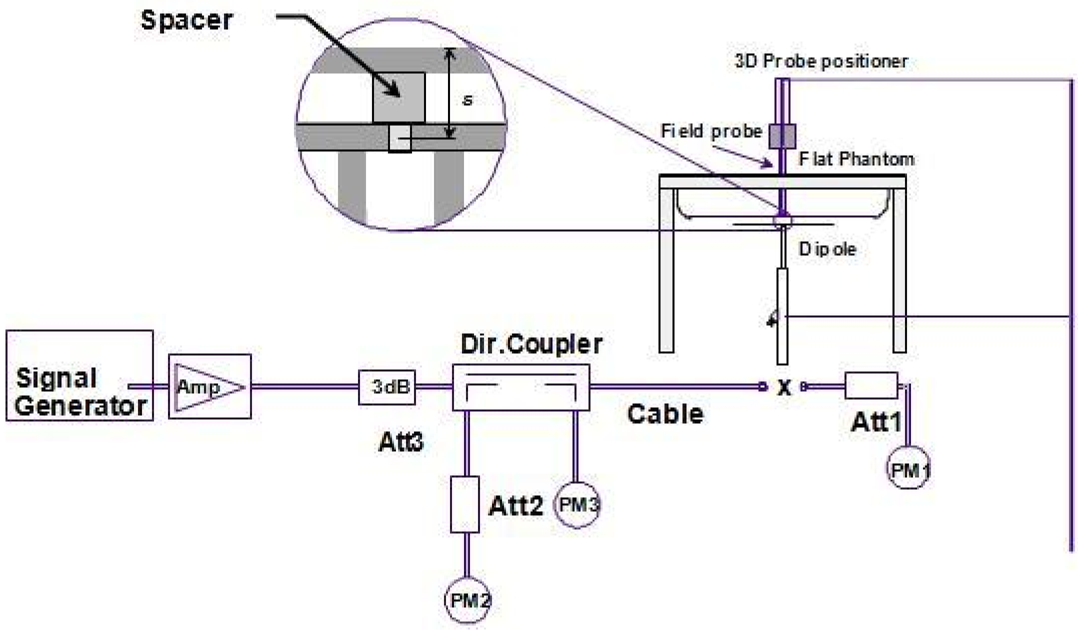
Used Target Frequency	Target Tissue		Measured Tissue		Liquid Temp	Test Date
	εr (+/-5%)	σ(S/m) (+/-5%)	εr	σ (S/m)		
2450MHz Head	39.60 (37.62~41.58)	1.75 (1.66~1.84)	38.13(2412MHz) 37.97 (2437 MHz) 36.88(2462 MHz)	1.81	22°C	2020.12.20
5.25GHz Head	35.90 (34.2~37.8)	4.71 (4.43~4.89)	36.89 (5180 MHz) 36.69 (5220 MHz) 36.49(5240 MHz)	4.64	22°C	2020.12.21
5.75GHz Head	35.40 (33.5~37.1)	5.22 (5.01~5.53)	35.31 (5745 MHz) 35.19 (5785 MHz) 35.00(5825 MHz)	5.22	22°C	2020.12.21
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	53.1 (47.79~58.41)	24.7 (22.23~27.17)	49.2	26.04	22°C	2020.12.20
D5.25V2 Head	76.5 (68.85~84.15)	21.8 (19.62~23.98)	80.5	22.2	22°C	2020.12.21
D5.75V2 Head	78.2 (70.38~86.02)	22.2 (19.98~24.42)	82.3	23.2	22°C	2020.12.21

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	16 [-4dB~~+0.5dB]
power adjust procedure	
5G WIFI	10 [-4dB~~+1.0dB]
power adjust procedure	
BT	3 [-1dB~~+1.0dB]
power adjust procedure	
BLE	-4 [-2dB~~+1.0dB]

11. MEASUREMENT RESULTS

Result: Passed

Date of testing	:	2020.10.13
Ambient temperature	:	20℃~22℃
Relative humidity	:	50~68%

11.1. Conducted Power

802.11b AV (dBm)					
Channel	Frequency (MHz)	Data Rate (bps)			
		1M	2M	5.5M	11M
CH 01	2,412	14.72	14.60	14.55	14.44
CH 06	2,437	16.02	15.68	15.65	15.71
CH 11	2,462	15.25	14.95	14.61	14.59

802.11g AV (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		6M	9M	12M	18M	24M	36M	48M	54M
CH 01	2,412	13.15	12.40	12.45	12.37	12.29	12.17	11.95	11.83

CH 06	2,437	13.99	13.80	13.77	13.83	13.88	13.55	13.27	13.12
CH 11	2,462	13.16	12.99	12.94	12.74	12.79	12.69	12.31	12.17

802.11n-HT20 AV (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 01	2,412	13.13	12.40	12.37	12.31	12.18	11.96	11.84	11.48
CH 06	2,437	14.16	14.04	14.05	13.89	13.79	13.43	13.34	13.15
CH 11	2,462	13.29	13.08	12.85	12.97	12.84	12.51	12.29	11.92

802.11n-HT40 AV (dBm)									
Channel	Frequency (MHz)	Data Rate (bps)							
		MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
CH 03	2,422	13.29	13.24	12.81	12.62	11.78	11.23	10.88	10.63
CH 06	2,437	13.39	13.35	13.08	12.93	12.09	11.62	11.30	11.02
CH 09	2,452	13.01	13.02	12.78	12.19	11.42	10.87	10.58	10.44

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				6M	9M	12M	18M	24M	36M	48M	54M
5.2G	802.11a	36	5180	**9.15**	9.20	9.12	9.04	8.92	8.70	8.58	9.15
5.2G	802.11a	40	5200	**9.79**	9.76	9.82	9.87	9.54	9.26	9.11	9.79
5.2G	802.11a	44	5220	**9.84**	9.79	9.59	9.64	9.54	9.16	9.02	9.84
5.2G	802.11a	48	5240	**10.68**	9.93	9.98	9.90	9.82	9.70	9.48	9.36

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11n (HT20)	36	5180	**9.72**	8.97	9.02	8.94	8.86	8.74	8.52	8.40
5.2G	802.11n (HT20)	40	5200	**9.88**	9.69	9.66	9.72	9.77	9.44	9.16	9.01
5.2G	802.11n (HT20)	48	5240	**9.65**	9.48	9.43	9.23	9.28	9.18	8.80	8.66

AV (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11n (HT40)	38	5190	**9.21**	8.46	8.51	8.43	8.35	8.23	8.01	7.89
5.2G	802.11n (HT40)	46	5230	**9.2**	9.01	8.98	9.04	9.09	8.76	8.48	8.33

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.2G	802.11ac (HT80)	42	5210	**9.15**	8.40	8.45	8.37	8.29	8.17	7.95	7.83
5.2G	802.11ac (HT80)	59	5290	**9.13**	8.94	8.91	8.97	9.02	8.69	8.41	8.26

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				6M	9M	12M	18M	24M	36M	48M	54M
5.8G	802.11a	149	5745	**9.03**	8.28	8.33	8.25	8.17	8.05	7.83	7.71
5.8G	802.11a	157	5785	**8.43**	8.24	8.21	8.27	8.32	7.99	7.71	7.56
5.8G	802.11a	165	5825	**8.13**	7.96	7.91	7.71	7.76	7.66	7.28	7.14

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11n (HT20)	149	5745	**8.51**	7.76	7.81	7.73	7.65	7.53	7.31	7.19
5.8G	802.11n (HT20)	157	5785	**8.13**	7.94	7.91	7.97	8.02	7.69	7.41	7.26
5.8G	802.11n (HT20)	165	5825	**7.85**	7.68	7.63	7.43	7.48	7.38	7.00	6.86

AV (dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11n (HT40)	151	5755	**8.53**	7.78	7.83	7.75	7.67	7.55	7.33	7.21
5.8G	802.11n (HT40)	159	5795	**8.82**	8.63	8.60	8.66	8.71	8.38	8.10	7.95

AV(dBm)											
Band	Mode	CH#	Freq (MHz)	Data Rate (bps)							
				MCS0	MCS1	MCS2	MCS3	MCS4	MCS5	MCS6	MCS7
5.8G	802.11ac (HT80)	155	5775	**8.43**	7.68	7.73	7.65	7.57	7.45	7.23	7.11

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.

Bluetooth 2.4GHz Band Conducted Power		
Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	0.060
CH 39	2,441	1.480
CH 78	2,480	3.500

BLE2.4GHz Band Conducted Power		
Channel	Frequency(MHz)	Average Power (dBm)
CH 0	2,402	-5.55
CH 19	2,440	-4.36
CH 39	2,480	-3.82

11.2.2.4G SAR results

General Notes:

Per 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.

Body Hotspot 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)
802.11b	Front Side	6	2437	16.02	16.5	1.117	0.234	0.261
802.11b	**Back Side**	**6**	**2437**	**16.02**	**16.5**	**1.117**	**0.656**	**0.733**
802.11b	Left Side	6	2437	16.02	16.5	1.117	0.008	0.009
802.11b	Right Side	6	2437	16.02	16.5	1.117	0.217	0.242
802.11b	Top Side	6	2437	16.02	16.5	1.117	0.189	0.211
802.11b	Bottom Side	6	2437	16.02	16.5	1.117	0.009	0.010

11.3.5.2G SAR results

Body Hotspot 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)
802.11a	Front Side	40	5200	9.98	10.0	1.005	0.265	0.266
802.11a	**Back Side**	**40**	**5200**	**9.98**	**10.0**	**1.005**	**0.632**	**0.635**
802.11a	Left Side	40	5200	9.98	10.0	1.005	0.007	0.007
802.11a	Right Side	40	5200	9.98	10.0	1.005	0.273	0.274
802.11a	Top Side	40	5200	9.98	10.0	1.005	0.188	0.189
802.11a	Bottom Side	40	5200	9.98	10.0	1.005	0.009	0.009

11.4.5.8G SAR results

Body Hotspot 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)
802.11a	Front Side	157	5785	8.43	8.5	1.016	0.124	0.126
802.11a	**Back Side**	**157**	**5785**	**8.43**	**8.5**	**1.016**	**0.384**	**0.390**
802.11a	Left Side	157	5785	8.43	8.5	1.016	0.004	0.004
802.11a	Right Side	157	5785	8.43	8.5	1.016	0.135	0.137
802.11a	Top Side	157	5785	8.43	8.5	1.016	0.117	0.119
802.11a	Bottom Side	157	5785	8.43	8.5	1.016	0.006	0.006

11.5.BT SAR results

Body Hotspot 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	39	2441	1.48	1.5	1.005	0.065	0.065
DH1	**Back Side**	**39**	**2441**	**1.48**	**1.5**	**1.005**	**0.134**	**0.135**
DH1	Left Side	39	2441	1.48	1.5	1.005	0.003	0.003
DH1	Right Side	39	2441	1.48	1.5	1.005	0.068	0.068
DH1	Top Side	39	2441	1.48	1.5	1.005	0.052	0.052
DH1	Bottom Side	39	2441	1.48	1.5	1.005	0.005	0.005

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	Hotspot
1	WiFi2.4G+WiFi5G	Yes
2	WiFi5G+BT	Yes

Table 7: Simultaneous Transmission Possibilities

Note:

1) Wi-Fi 2.4G and Bluetooth share the same Tx antenna and can’t transmit simultaneously.
2) Held to ear configurations are not applicable to Bluetooth and therefore were not considered for simultaneous transmission.

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	0.261	0.733	0.009	0.242	0.211	0.010
	5.2G Wi-Fi	0.266	0.635	0.007	0.274	0.189	0.009
	5.8G Wi-Fi	0.126	0.390	0.004	0.137	0.119	0.006
Σ10-g SAR(W/kg)		0.527	1.368	0.016	0.516	0.400	0.019

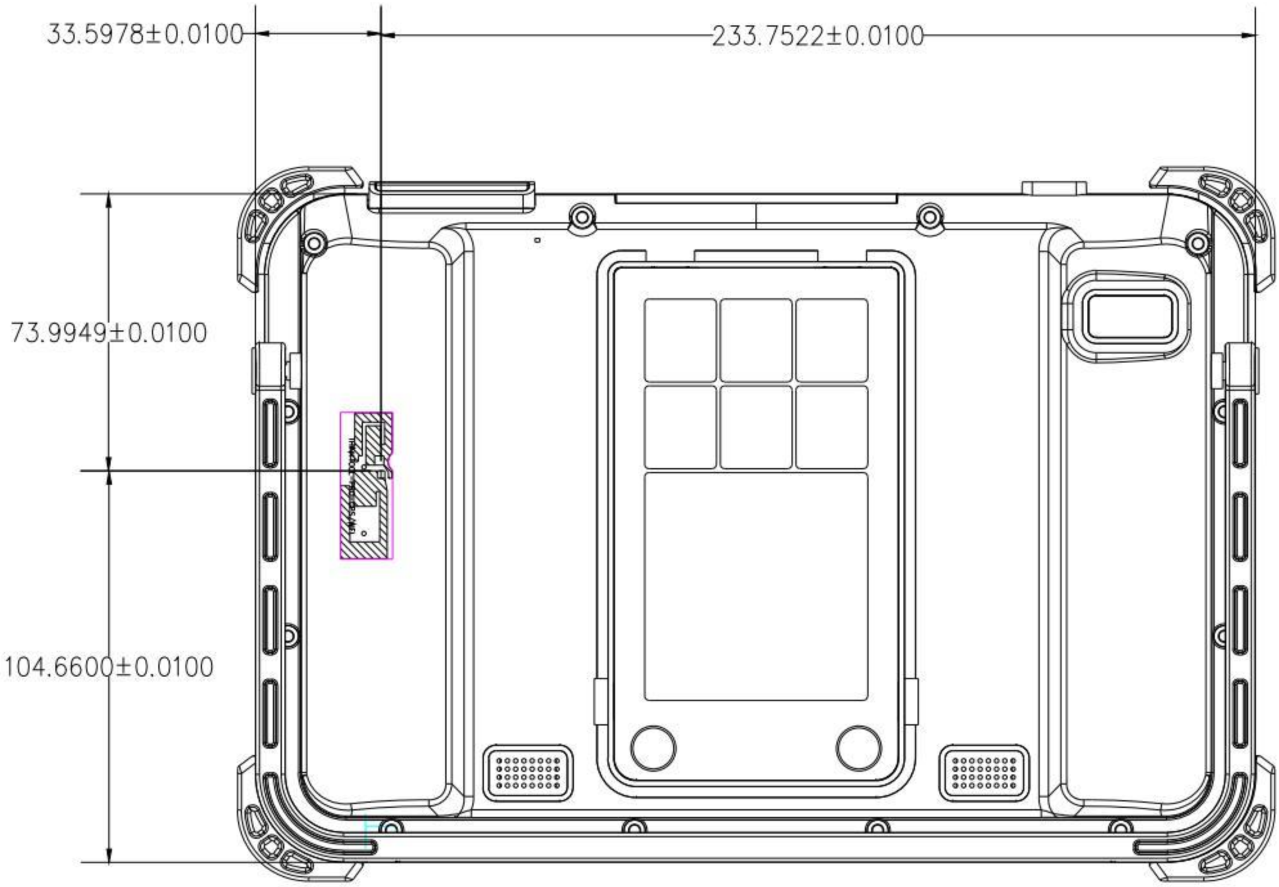
Test Position		Front Side (0mm)	Back Side (0mm)	Left Side (0mm)	Right Side (0mm)	Top Side (0mm)	Bottom Side (0mm)
MAX 1-g SAR (W/kg)	5.2G Wi-Fi	0.266	0.635	0.007	0.274	0.189	0.009
	5.8G Wi-Fi	0.126	0.390	0.004	0.137	0.119	0.006
	BT	0.065	0.135	0.003	0.068	0.052	0.005
Σ10-g SAR(W/kg)		0.331	0.770	0.010	0.342	0.241	0.014

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



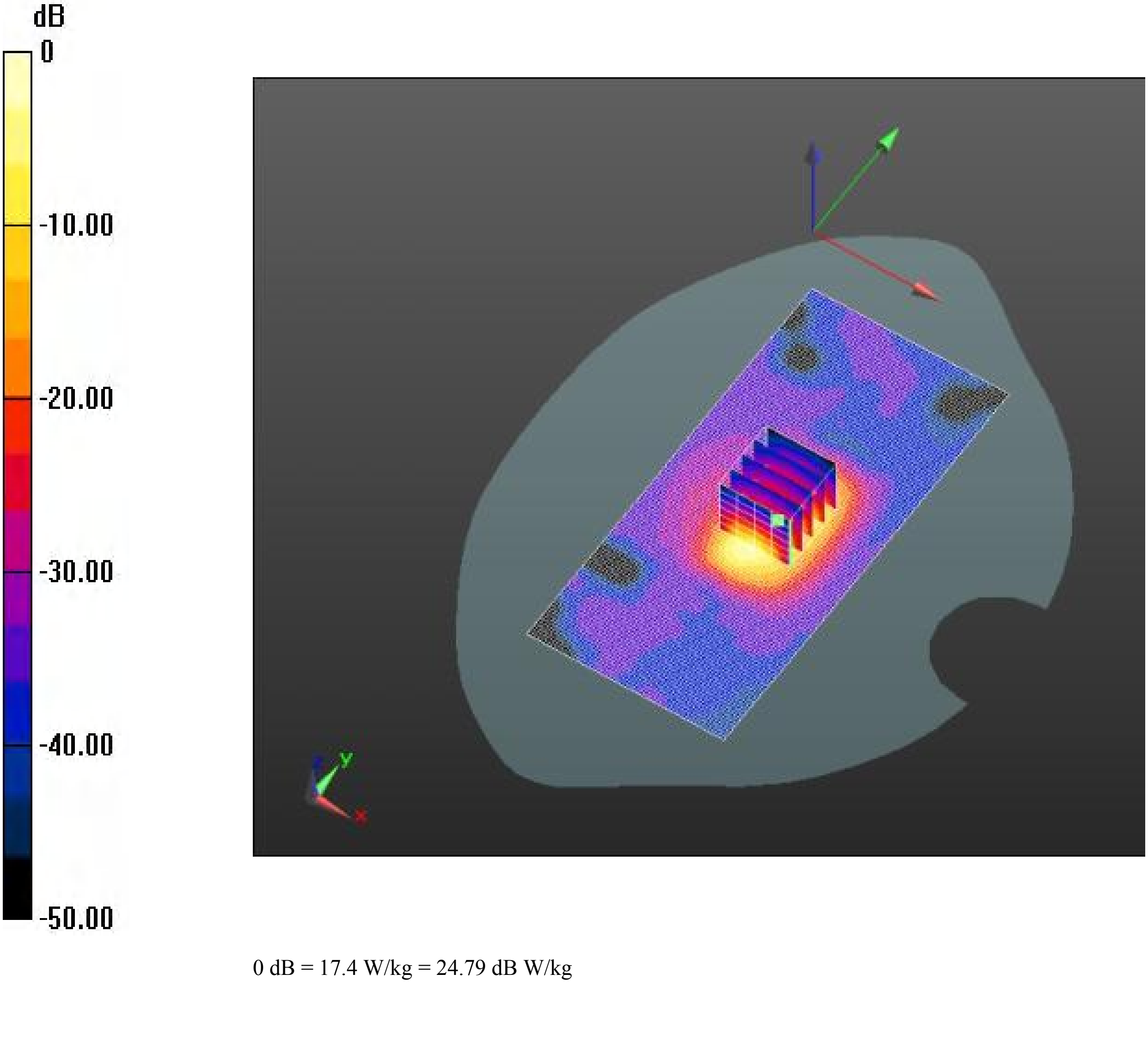
Mode	Front Side	Back Side	Left Side	Right Side	Top Side	Bottom Side
Main Antenna	YES	YES	YES	YES	YES	YES
Wi-Fi Antenna	YES	YES	YES	YES	YES	YES

APPENDIX A: SYSTEM CHECKING SCANS

SystemPerformanceCheck-D2450MHz for Head
Date: 2020.12.20.
DUT: Dipole 2450 MHz D2450V2; Type: D2450V2 SN: 818;
Communication System: CW; Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz;Duty Cycle: 1:1
Medium parameters used: f = 2450 MHz; σ = 1.81 mho/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)
DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(7.49,7.49,7.49); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.

Head/Dipole2450/Area Scan (61x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 84.317 V/m; Power Drift = 0.05 dB
Fast SAR: SAR(1 g) = 12.11 mW/g; SAR(10 g) = 6.59 mW/g
Maximum value of SAR (interpolated) = 17.4 W/kg

Head/Dipole2450/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 84.317 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.853 mW/g
SAR(1 g) = 12.3 mW/g; SAR(10 g) = 6.51 mW/g
Maximum value of SAR (measured) = 13.1 W/kg



0 dB = 17.4 W/kg = 24.79 dB W/kg

SystemPerformanceCheck-D5GHz for Head

Date: 2020.12.21.

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

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5250 MHz;Duty Cycle: 1:1

Medium parameters used: f = 5250 MHz; σ = 4.64 mho/m; ε_r = 36.7; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(5.29, 5.29, 5.29); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.

Head5.25/5.25G /Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 52.69 V/m; Power Drift = 0.02 dB

Fast SAR: SAR(1 g) = 8.51 mW/g; SAR(10 g) = 2.33 mW/g

Maximum value of SAR (interpolated) = 10.71 W/kg

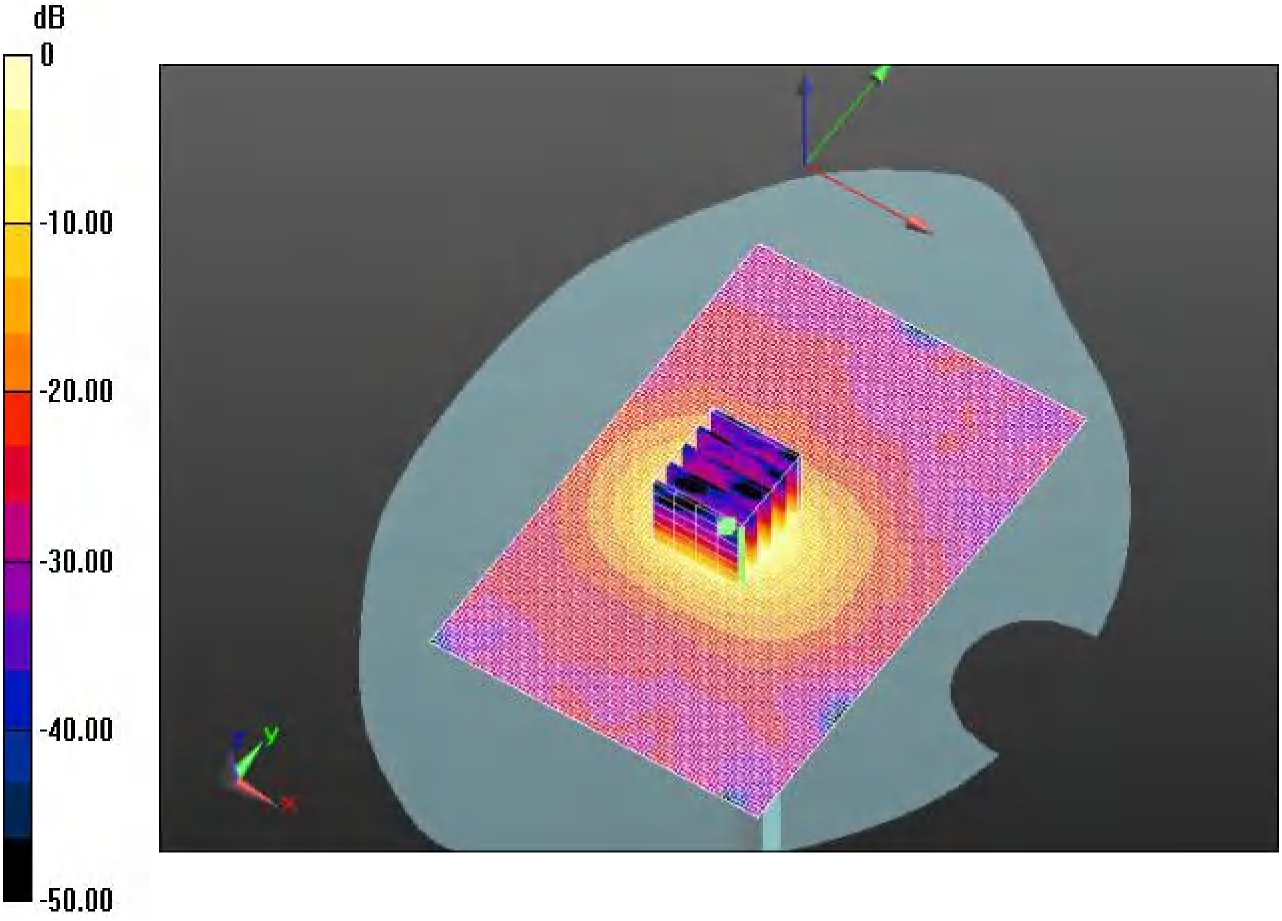
Head5.25/5.25G /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 52.69 V/m; Power Drift = 0.02 dB

Peak SAR (extrapolated) = 21.628 mW/g

SAR(1 g) = 8.05 mW/g; SAR(10 g) = 2.22 mW/g

Maximum value of SAR (measured) = 10.29 W/kg



0 dB = 9.71 W/kg = 18.80 dB W/kg

SystemPerformanceCheck-D5GHz for Head

Date: 2020.12.21.

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

Communication System: CW; Communication System Band: D5GHz (5000.0 - 6000.0 MHz); Frequency: 5750 MHz;Duty Cycle: 1:1

Medium parameters used: f = 5750 MHz; σ = 5.21 mho/m; ε_r = 35.2; ρ = 1000 kg/m^3

Phantom section: Flat Section

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

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(4.78, 4.78, 4.78); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.

Head5.75/5.75G /Area Scan (81x121x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Reference Value = 65.22 V/m; Power Drift = -0.01 dB

Fast SAR: SAR(1 g) = 8.10 mW/g; SAR(10 g) = 2.42 mW/g

Maximum value of SAR (interpolated) = 12.15 W/kg

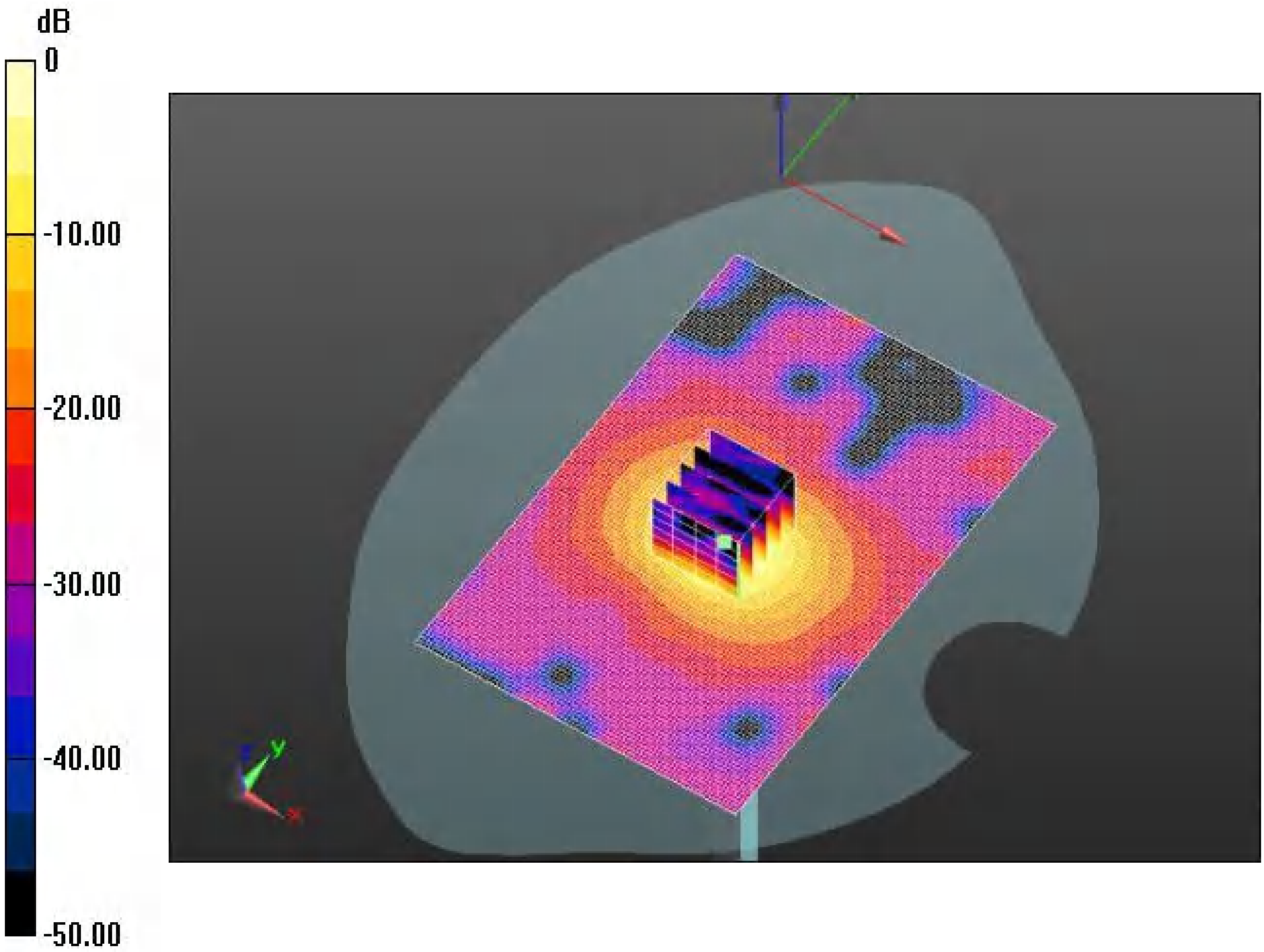
Head5.75/5.75G /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm

Reference Value = 65.22 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 22.355 mW/g

SAR(1 g) = 8.23mW/g; SAR(10 g) = 2.32 mW/g

Maximum value of SAR (measured) = 12.39 W/kg



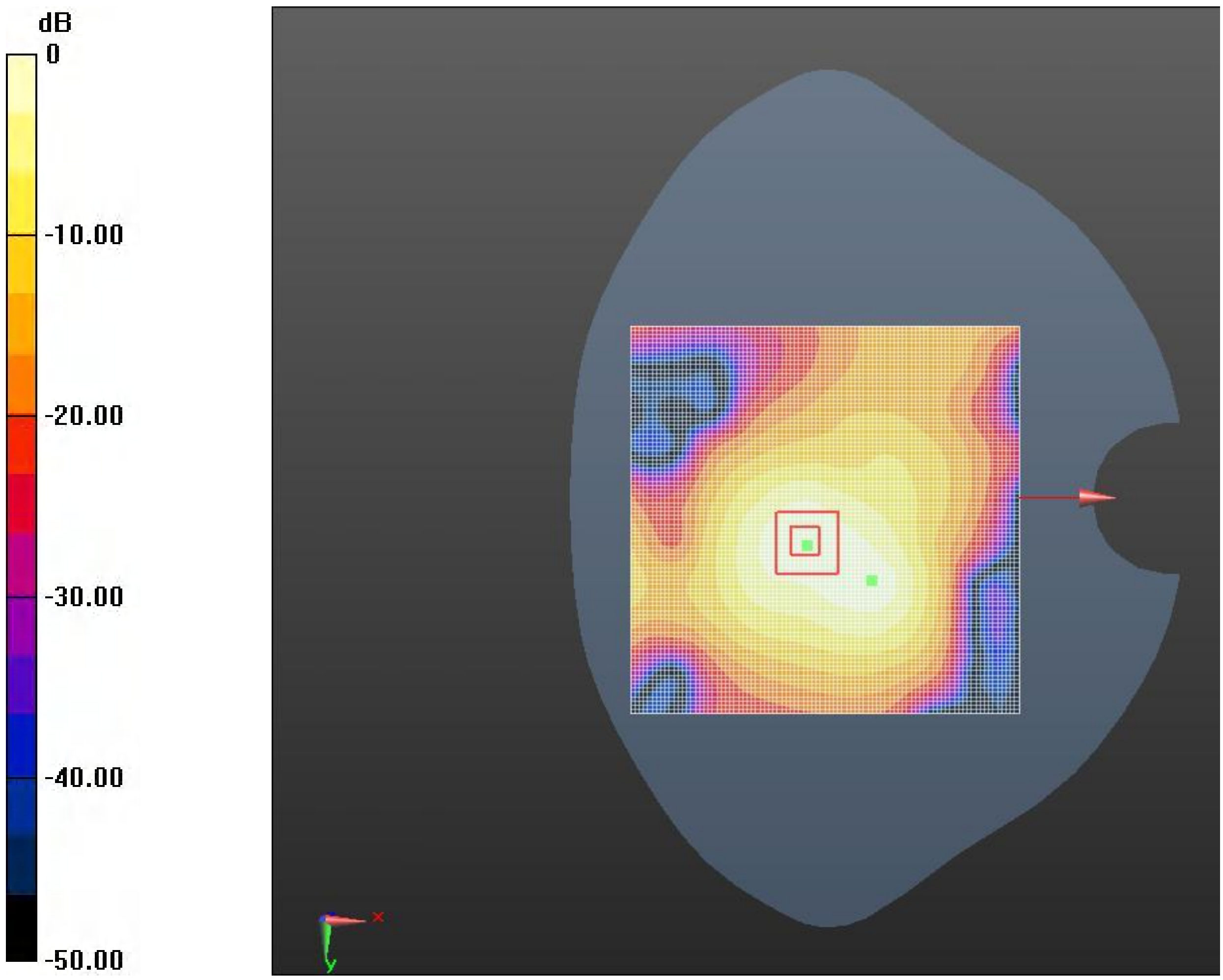
0 dB = 12.15 W/kg = 24.14 dB W/kg

APPENDIX B. MEASUREMENT SCANS

Date: 2020.12.20.
WiFi123 Body Back Side Mid 0MM
Medium: HSL2450

Communication System: WiFi 802.11 n; Communication System Band: Exported from older format (data unavailable - please correct).; Frequency: 2437 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 2437 MHz; σ = 1.829 mho/m; ε_r = 38.021; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(7.49, 7.49, 7.49); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.
802.11b-5mm/Back-Mid 2 2/Area Scan (91x91x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 8.591 V/m; Power Drift = -0.12 dB
Fast SAR: SAR(1 g) = 0.745 mW/g; SAR(10 g) = 0.381 mW/g
Maximum value of SAR (interpolated) = 0.861 W/kg
802.11b-5mm/Back-Mid 2 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.591 V/m; Power Drift = -0.12 dB
Peak SAR (extrapolated) = 1.460 mW/g
SAR(1 g) = 0.656 mW/g; SAR(10 g) = 0.385 mW/g
Maximum value of SAR (measured) = 0.825 W/kg



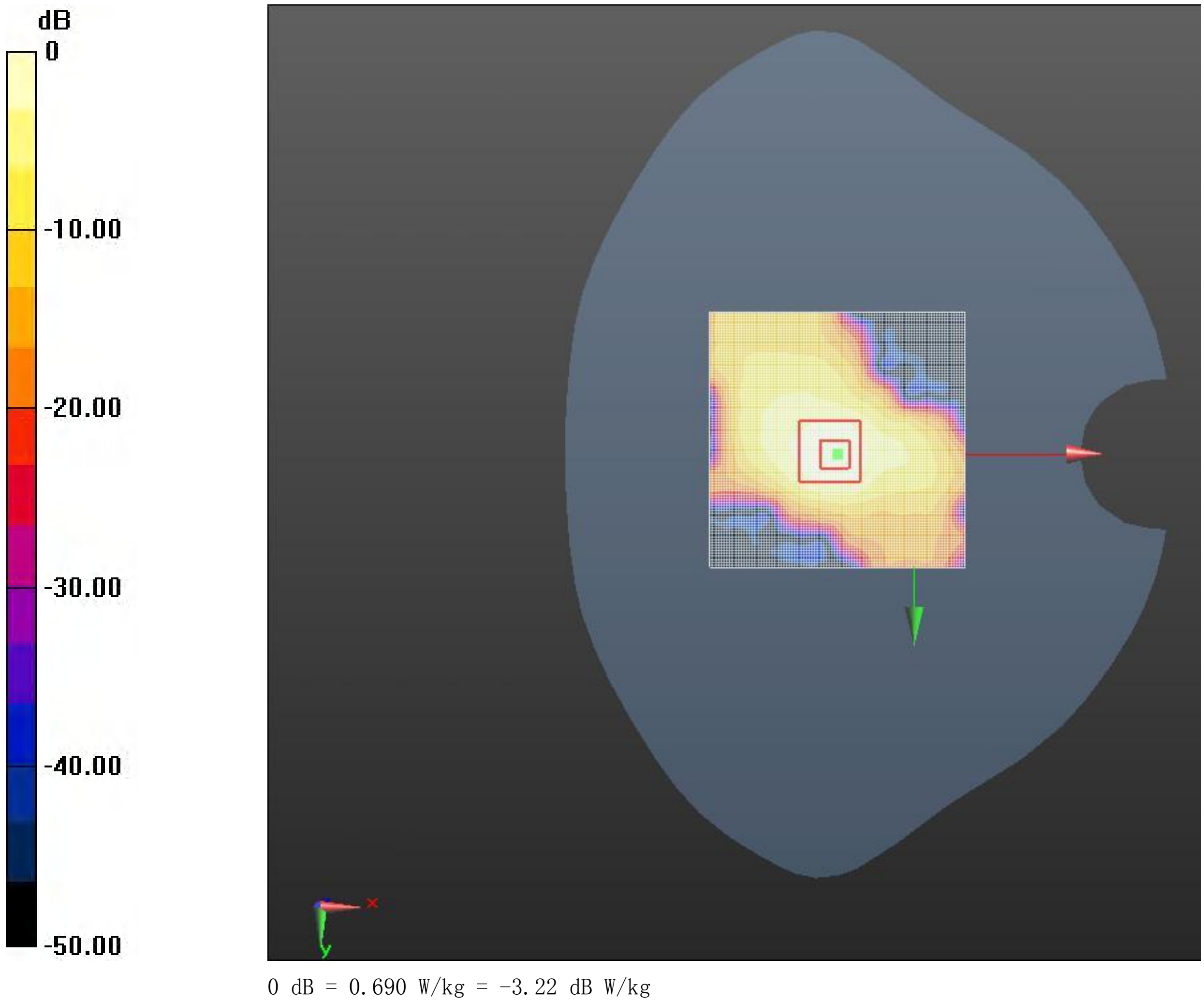
0 dB = 0.861 W/kg = -1.30 dB W/kg

Date:2020.12.21.

5.2G(802.11a)WiF Body Back Side Mid CH40
Medium: HSL 5G

Communication System: 5G; Communication System Band: 5.2G; Frequency: 5200 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5300 MHz; σ = 4.73 mho/m; ε_r = 35.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(5.29, 5.29, 5.29); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.
40/Facedown/Area Scan (91x91x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 8.604 V/m; Power Drift = 0.47 dB
Fast SAR: SAR(1 g) = 0.664 mW/g; SAR(10 g) = 0.244 mW/g
Maximum value of SAR (interpolated) = 0.690 W/kg
40/Facedown/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 8.604 V/m; Power Drift = 0.47 dB
Peak SAR (extrapolated) = 2.963 mW/g
SAR(1 g) = 0.632 mW/g; SAR(10 g) = 0.270 mW/g
Maximum value of SAR (measured) = 0.697 W/kg



0 dB = 0.690 W/kg = -3.22 dB W/kg

Date:

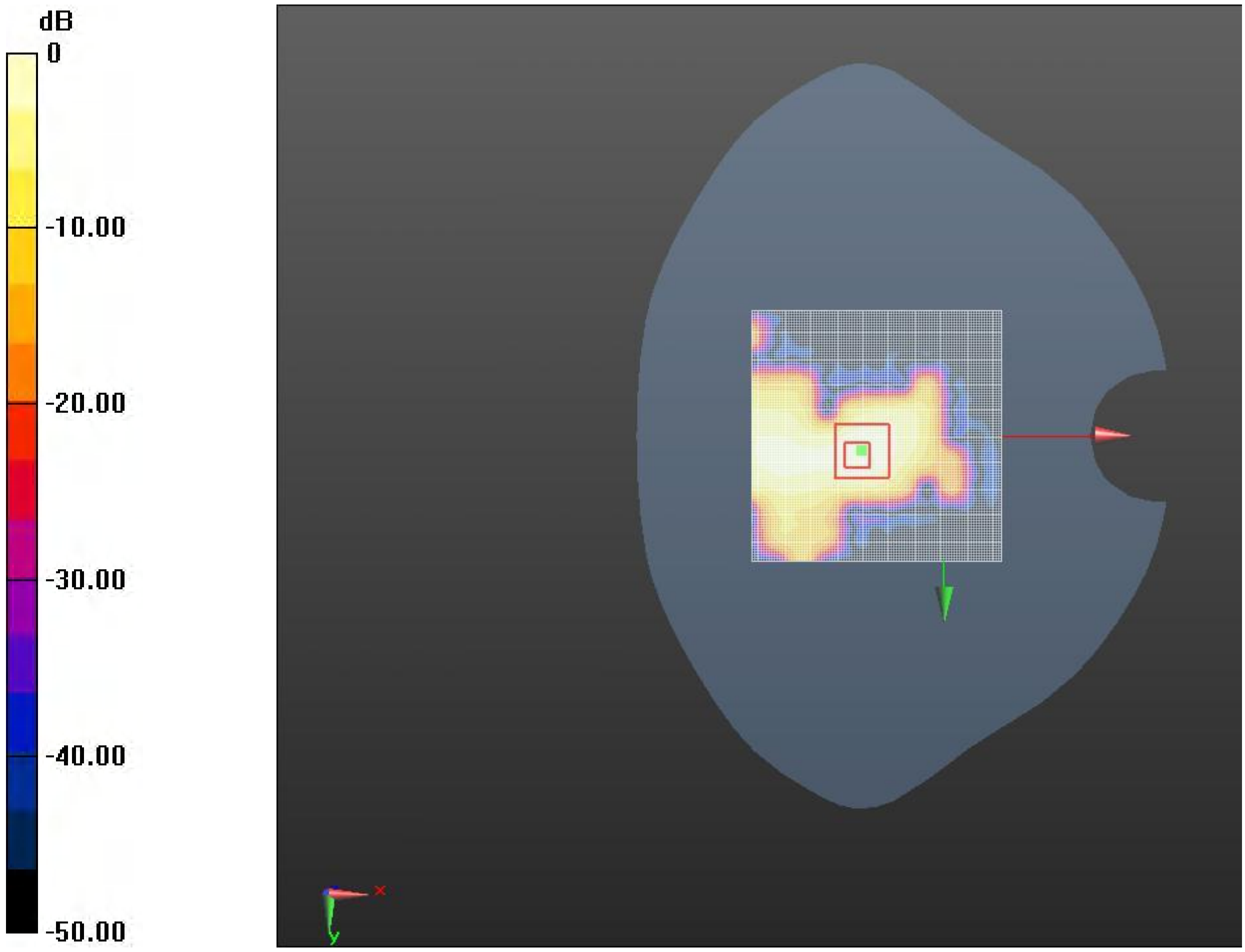
2020.12.21.

5.8G(802.11a)WiFi Body Back Side CH157
Medium: HSL 5G

Communication System: 5G; Communication System Band: 5.8G; Frequency: 5785 MHz;Duty Cycle: 1:1
Medium parameters used: f = 5800 MHz; σ = 5.07 mho/m; ε_r = 35.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(4.78, 4.78, 4.78); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.
157/Facedown/Area Scan (101x101x1): Interpolated grid: dx=1.000 mm, dy=1.000 mm
Reference Value = 5.974 V/m; Power Drift = -0.03 dB
Fast SAR: SAR(1 g) = 0.487 mW/g; SAR(10 g) = 0.172 mW/g
Maximum value of SAR (interpolated) = 0.491 W/kg

157/Facedown/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 5.974 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 1.192 mW/g
SAR(1 g) = 0.384 mW/g; SAR(10 g) = 0.146 mW/g
Maximum value of SAR (measured) = 0.407 W/kg



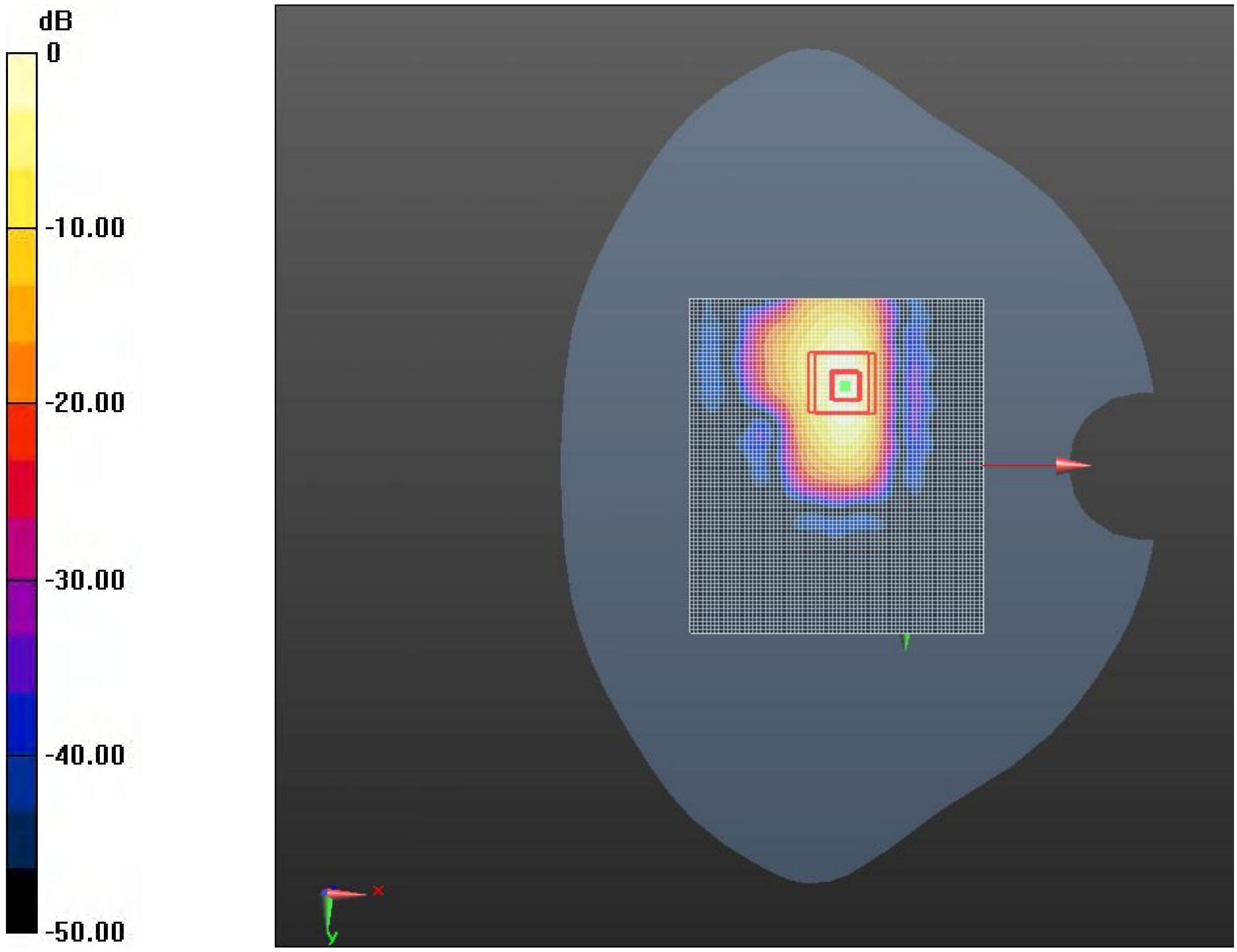
0 dB = 0.491 W/kg = -6.19 dB W/kg

Date:2020.12.20.
BT Body Back Side Low 0mm
Medium: HSL2450

Communication System: BT(GFSK,DH3); Communication System Band: ISM2.4GHz Band(2400.0-2483.5MHz); Frequency: 2402 MHz;Duty Cycle: 1:1.58489
Medium parameters used: f = 2441 MHz; σ = 1.85 mho/m; ε_r = 38.7; ρ = 1000 kg/m³
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY5 Configuration:Probe: EX3DV4 - SN3881; ConvF(7.49, 7.49, 7.49); Calibrated: 2020.06.16.; Electronics: DAE4 Sn876; Calibrated: 2020.03.03.

802.11b-5mm/Facedown-Low/Area Scan (71x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Reference Value = 3.367 V/m; Power Drift = 0.13 dB
Fast SAR: SAR(1 g) = 0.157 mW/g; SAR(10 g) = 0.098 mW/g
Maximum value of SAR (interpolated) = 0.217 W/kg
802.11b-5mm/Facedown-Low/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.367 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 0.420 mW/g
SAR(1 g) = 0.134 mW/g; SAR(10 g) = 0.095 mW/g
Maximum value of SAR (measured) = 0.206 W/kg



0 dB = 0.217 W/kg = -12.32 dB W/kg

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

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CNAS L0570

Client **SMQ** **Certificate No: Z20-60098**

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN : 3881
Calibration Procedure(s)	FF-Z11-004-01 Calibration Procedures for Dosimetric E-field Probes
Calibration date:	June 16, 2020

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	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101547	18-Jun-19(CTTL, No.J19X05125)	Jun-20
Power sensor NRP-Z91	101548	18-Jun-19(CTTL, No.J19X05125)	Jun-20
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	30-Jan-20(SPEAG, No.EX3-3617_Jan20/2)	Jan-21
DAE4	SN 1556	4-Feb-20(SPEAG, No.DAE4-1556_Feb20)	Feb-21

Secondary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
SignalGenerator MG3700A	6201052605	18-Jun-19(CTTL, No.J19X05127)	Jun-20
Network Analyzer E5071C	MY46110673	10-Feb-20(CTTL, No.J20X00515)	Feb-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: June 18, 2020

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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]	103.6	98.8	102.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc [E] (*k*=2)
0	CW	X	0.0	0.0	1.0	0.00	129.9	±2.2%
		Y	0.0	0.0	1.0		127.8	
		Z	0.0	0.0	1.0		147.3	

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

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 4 and Page 5).
[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	9.70	9.70	9.70	0.40	0.80	±12.1%
835	41.5	0.90	9.43	9.43	9.43	0.18	1.15	±12.1%
900	41.5	0.97	9.46	9.46	9.46	0.18	1.21	±12.1%
1750	40.1	1.37	8.30	8.30	8.30	0.20	1.13	±12.1%
1810	40.0	1.40	8.14	8.14	8.14	0.21	1.09	±12.1%
1900	40.0	1.40	7.92	7.92	7.92	0.21	1.18	±12.1%
2300	39.5	1.67	7.72	7.72	7.72	0.46	0.75	±12.1%
2450	39.2	1.80	7.49	7.49	7.49	0.44	0.80	±12.1%
2600	39.0	1.96	7.30	7.30	7.30	0.52	0.73	±12.1%
3300	38.2	2.71	7.00	7.00	7.00	0.42	0.95	±13.3%
3500	37.9	2.91	6.95	6.95	6.95	0.44	0.98	±13.3%
3700	37.7	3.12	6.69	6.69	6.69	0.46	0.95	±13.3%
3900	37.5	3.32	6.55	6.55	6.55	0.40	1.20	±13.3%
4200	37.1	3.63	6.38	6.38	6.38	0.35	1.33	±13.3%
4400	36.9	3.84	6.25	6.25	6.25	0.35	1.30	±13.3%
4600	36.7	4.04	6.20	6.20	6.20	0.40	1.30	±13.3%
4800	36.4	4.25	6.15	6.15	6.15	0.40	1.35	±13.3%
4950	36.3	4.40	6.00	6.00	6.00	0.40	1.35	±13.3%
5250	35.9	4.71	5.29	5.29	5.29	0.40	1.45	±13.3%
5600	35.5	5.07	4.70	4.70	4.70	0.45	1.50	±13.3%
5750	35.4	5.22	4.78	4.78	4.78	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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DASY/EASY – Parameters of Probe: EX3DV4 – SN:3881

Calibration Parameter Determined in Body 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	55.5	0.96	9.82	9.82	9.82	0.40	0.80	±12.1%
835	55.2	0.97	9.51	9.51	9.51	0.24	1.17	±12.1%
1750	53.4	1.49	7.98	7.98	7.98	0.20	1.24	±12.1%
1810	53.3	1.52	7.92	7.92	7.92	0.18	1.27	±12.1%
1900	53.3	1.52	7.81	7.81	7.81	0.19	1.28	±12.1%
2300	52.9	1.81	7.64	7.64	7.64	0.46	0.87	±12.1%
2450	52.7	1.95	7.54	7.54	7.54	0.53	0.80	±12.1%
2600	52.5	2.16	7.28	7.28	7.28	0.59	0.72	±12.1%

[C] Frequency validity above 300 MHz of ±100MHz only applies for DASY v4.4 and higher (Page 2), else it is restricted to ±50MHz. The uncertainty is the RSS of ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequency below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ±5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for the frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

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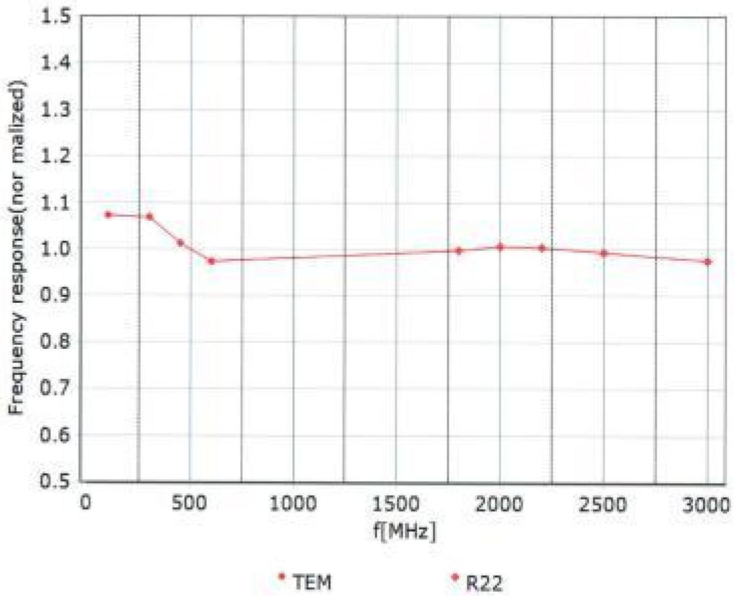
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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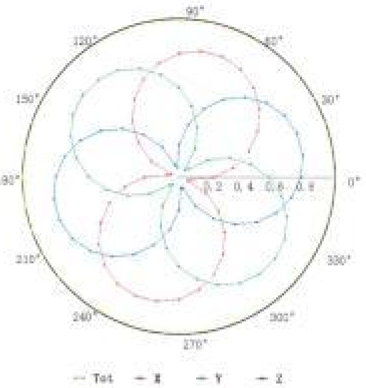
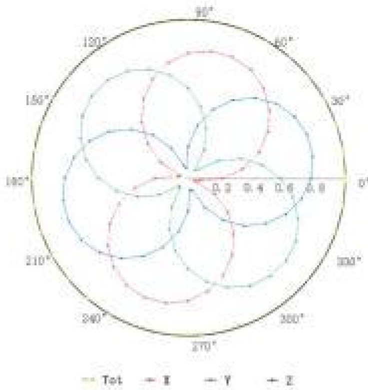
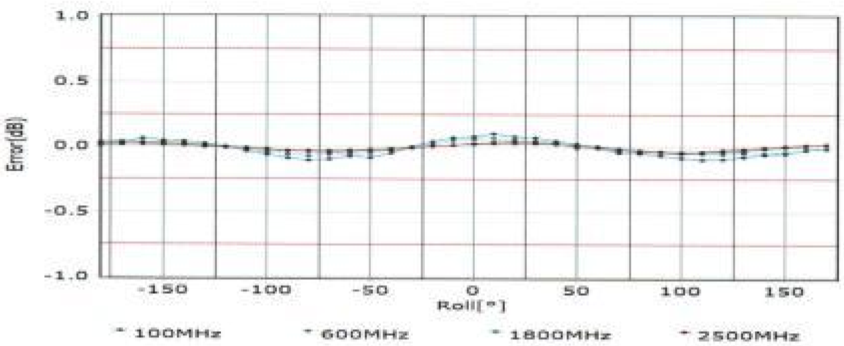
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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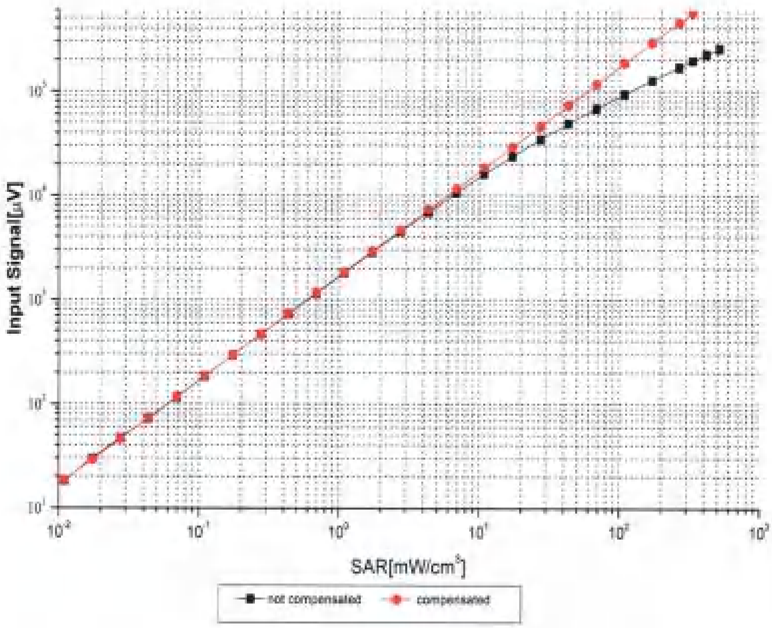
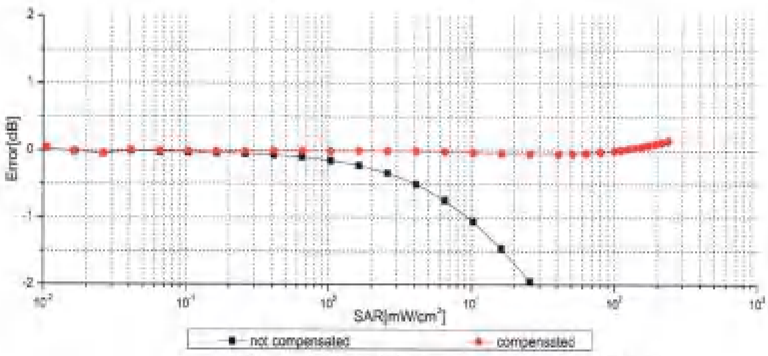
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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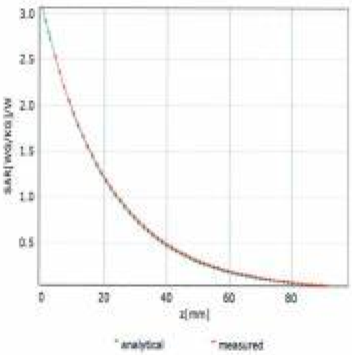
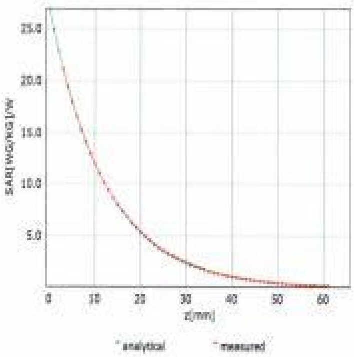
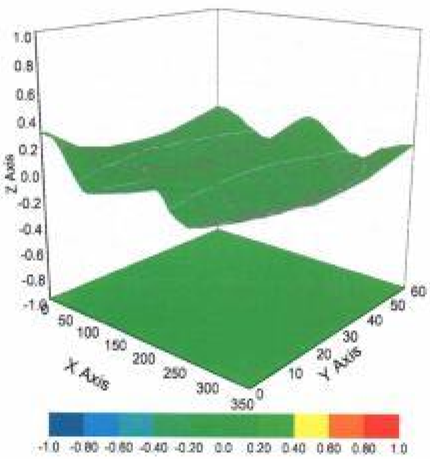
Conversion Factor Assessment

f=750 MHz,WGLS R9(H_convF) **f=1750 MHz,WGLS R22(H_convF)**





Deviation from Isotropy in Liquid



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

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:3881

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	125.7
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	10mm
Tip Length	10mm
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

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CALIBRATION
CNAS L0570

Client : SMQ

Certificate No: Z20-60099

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 876
Calibration Procedure(s)	FF-Z11-002-01 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	March 03, 2020

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	24-Jun-19 (CTTL, No.J19X05126)	Jun-20

	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 05, 2020

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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	405.491 ± 0.15% (k=2)	405.147 ± 0.15% (k=2)	405.366 ± 0.15% (k=2)
Low Range	3.98945 ± 0.7% (k=2)	3.97202 ± 0.7% (k=2)	3.99785 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	182° ± 1 °

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

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CNAS L0570

Client **SMQ** **Certificate No: Z18-60338**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 818
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 31, 2018

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 NRVD	102083	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Power sensor NRV-Z5	100542	01-Nov-17 (CTTL, No.J17X08756)	Oct-18
Reference Probe EX3DV4	SN 7464	12-Sep-17(SPEAG,No.EX3-7464_Sep17)	Sep-18
DAE4	SN 1524	13-Sep-17(SPEAG,No.DAE4-1524_Sep17)	Sep-18
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	23-Jan-18 (CTTL, No.J18X00560)	Jan-19
NetworkAnalyzer E5071C	MY46110673	24-Jan-18 (CTTL, No.J18X00561)	Jan-19

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

Issued: September 3, 2018

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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	52.10.1.1476
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	38.8 ± 6 %	1.80 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.1 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	6.19 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.7 mW /g ± 18.7 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	1.98 mho/m ± 6 %
Body TSL temperature change during test	<1.0 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.5 mW /g ± 18.8 % (k=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	6.13 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.4 mW /g ± 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	53.4Ω+ 3.63jΩ
Return Loss	- 26.4dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.6Ω+ 5.36jΩ
Return Loss	- 25.4dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.027 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

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DASY5 Validation Report for Head TSL Date: 08.31.2018

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 = 1.802 S/m; ε_r = 38.84; ρ = 1000 kg/m3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(7.89, 7.89, 7.89) @ 2450 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

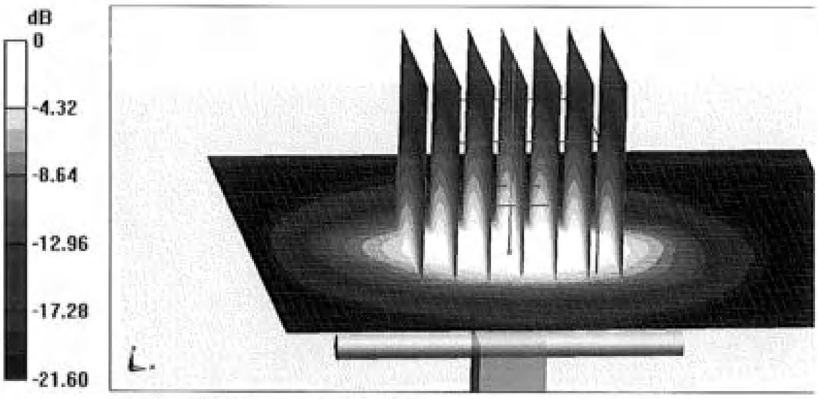
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 100.2 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 27.7 W/kg

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

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



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

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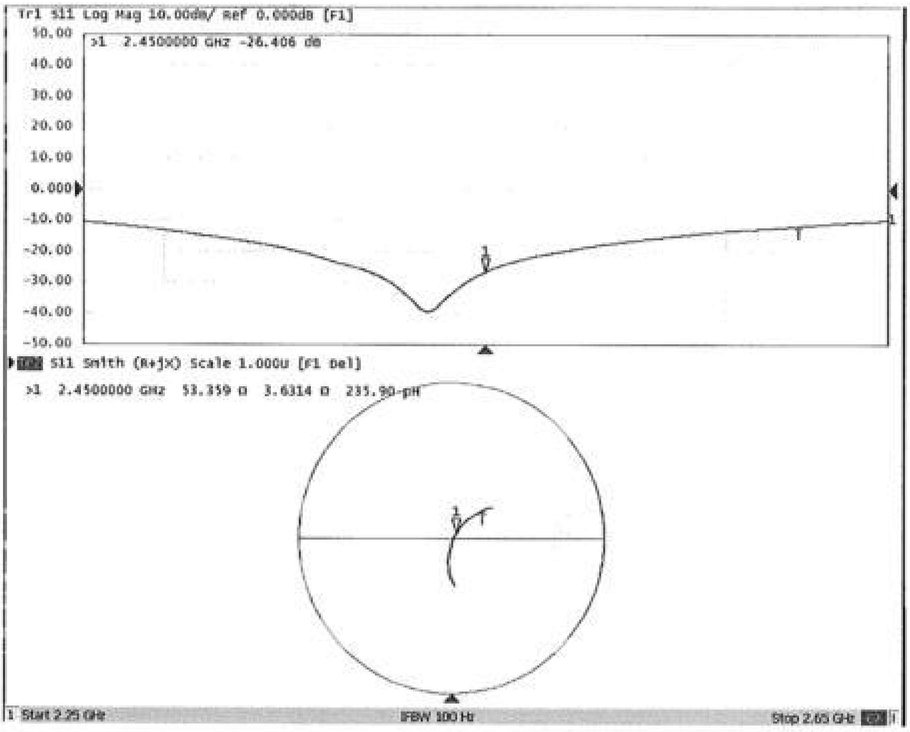
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 08.30.2018

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 = 1.982 S/m; ε_r = 52.34; ρ = 1000 kg/m3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN7464; ConvF(8.09, 8.09, 8.09) @ 2450 MHz; Calibrated: 9/12/2017
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1524; Calibrated: 9/13/2017
- Phantom: MFP_V5.1C ; Type: QD 000 P51CA; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (1); SEMCAD X Version 14.6.11 (7439)

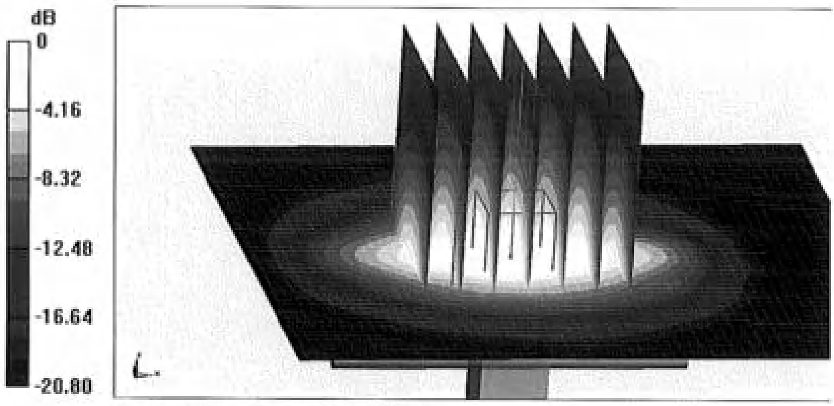
Dipole Calibration/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.69 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 26.4 W/kg

SAR(1 g) = 13 W/kg; SAR(10 g) = 6.13 W/kg

Maximum value of SAR (measured) = 21.4 W/kg



0 dB = 21.4 W/kg = 13.30 dBW/kg

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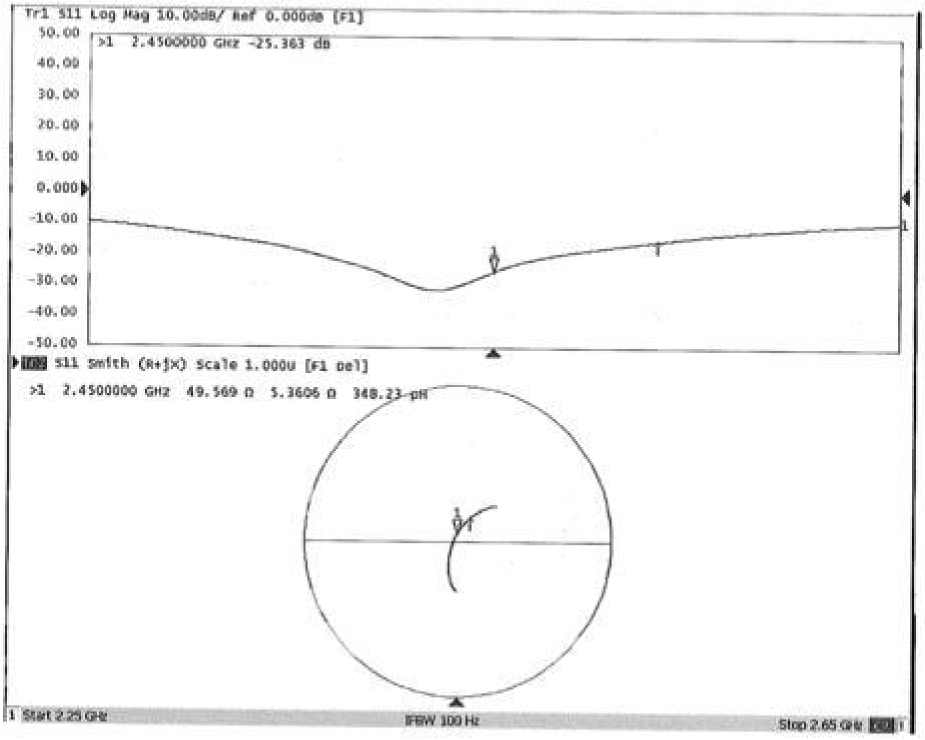
Impedance Measurement Plot for Body TSL



1) Per KDB865664D01 requirements for dipole calibration, the test laboratory has adopted three-year extended calibration interval. Each measured dipole is expected to evaluate with the following criteria at least on annual interval in Appendix D.

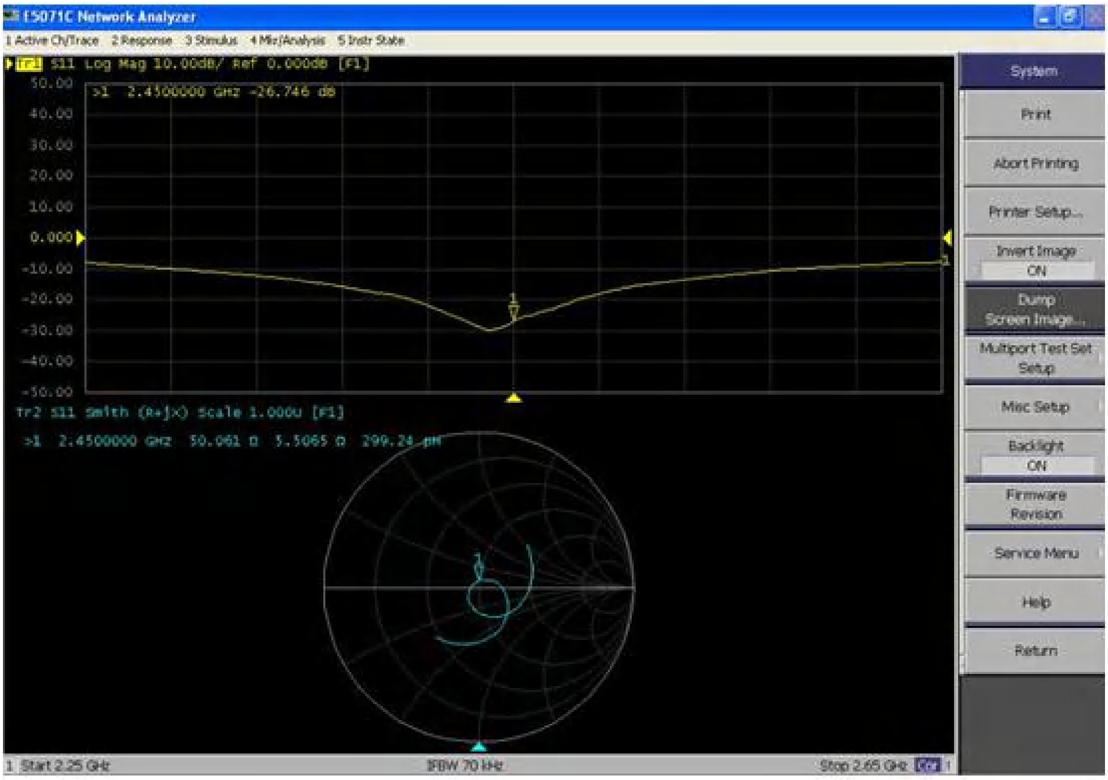
a) There is no physical damage on the dipole;

b) System check with specific dipole is within 10% of calibrated value;

c) The most recent return-loss result, measured at least annually, deviates by no more than 20% from the previous measurement.

d) The most recent measurement of the real or imaginary parts of the impedance, measured at least annually is within 5Ω from the previous measurement.

D2450MHz



D2450V2, serial No. 818 Extended Dipole Calibrations

	2450 Body					
Date of Measurement	Return-Loss (dB)	Delta(%)	Real Impedance(ohm)	Delta (ohm)	Imaginary Impedance(ohm)	Delta (ohm)
2018-08-31	-25.36		49.569		5.36	
2020-08-31	-26.74	5.44	50.061	0.646	5.50	2.61

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CNAS L0570

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

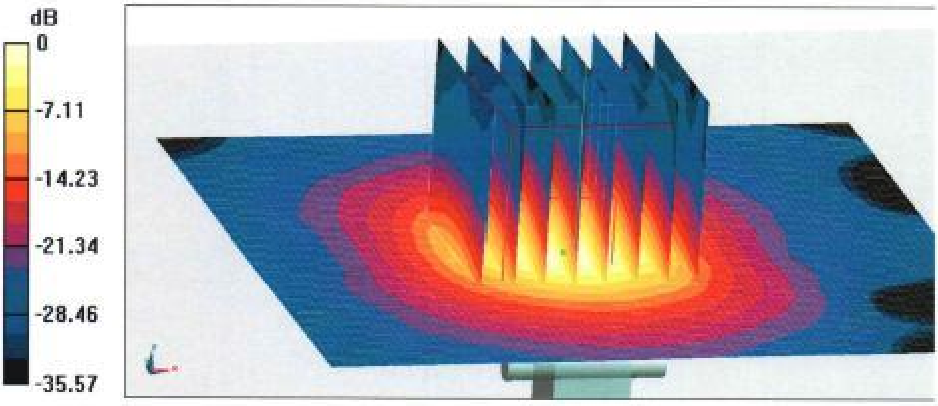
DASY5 Configuration:

- 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

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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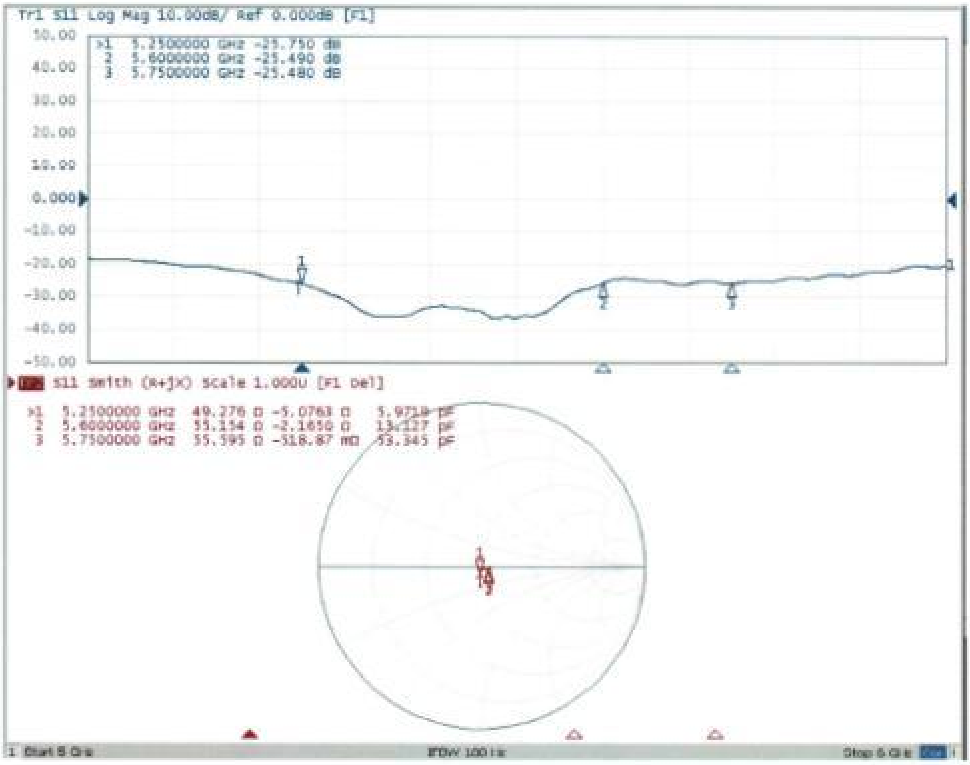
Impedance Measurement Plot for Head TSL



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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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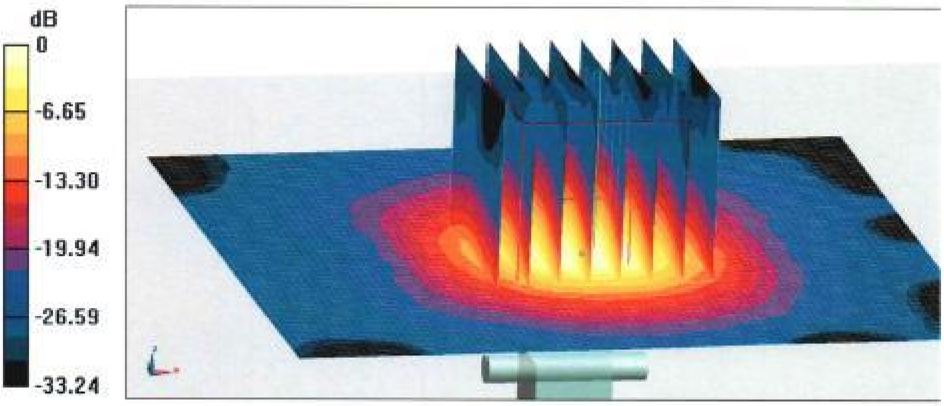
Dipole Calibration /Pin=100mW, d=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.40 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 34.0 W/kg
SAR(1 g) = 7.3 W/kg; SAR(10 g) = 2.03 W/kg
Smallest distance from peaks to all points 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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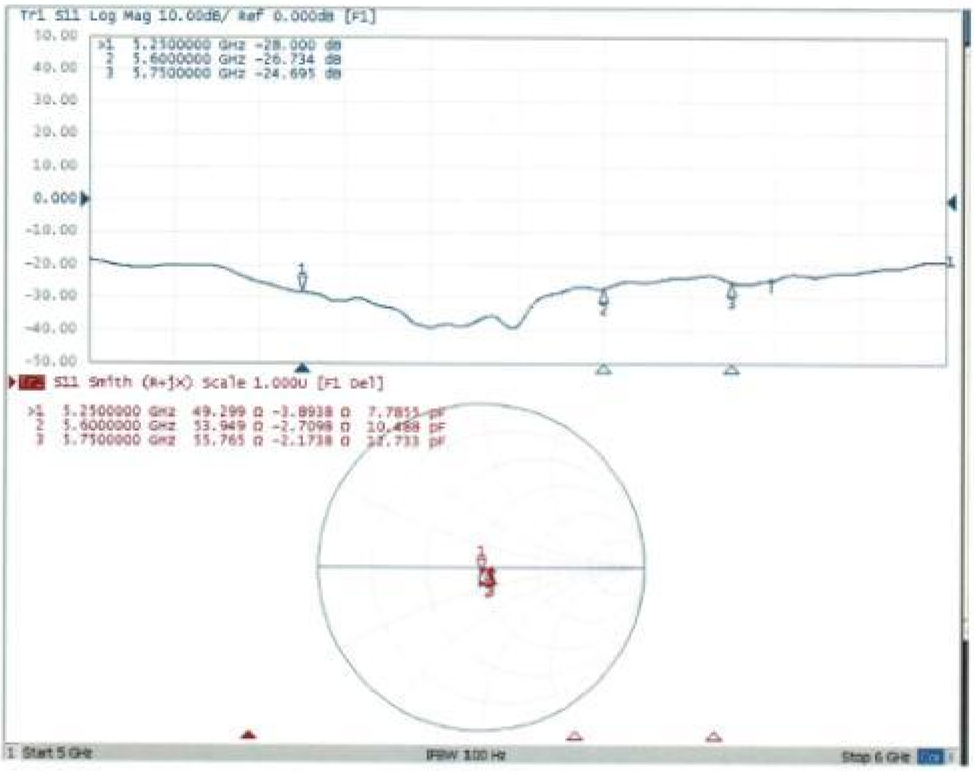
Impedance Measurement Plot for Body TSL



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 6: Front Side 0mm
	
Photo 7: Rear View 0mm	Photo 8: Left Side 0mm

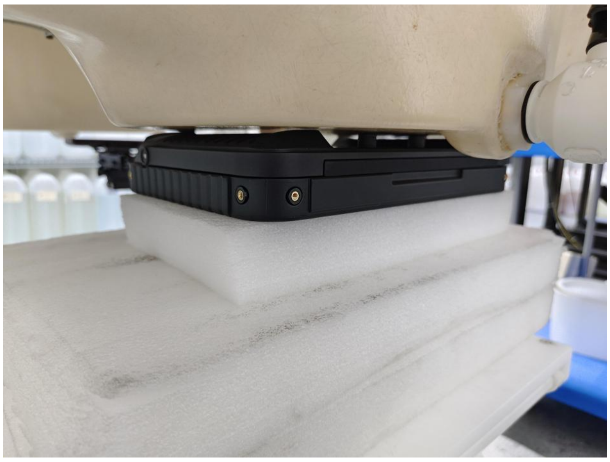
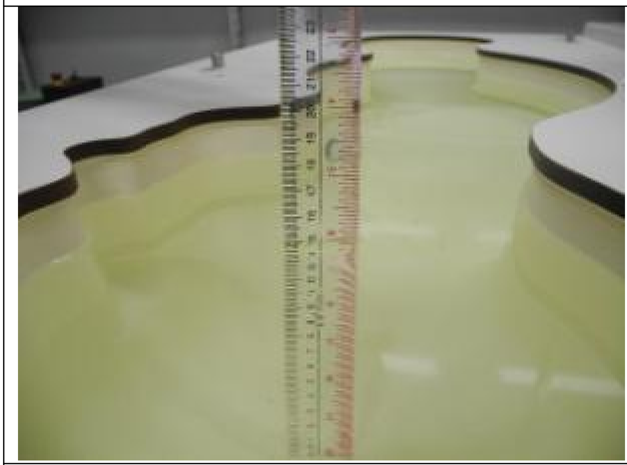
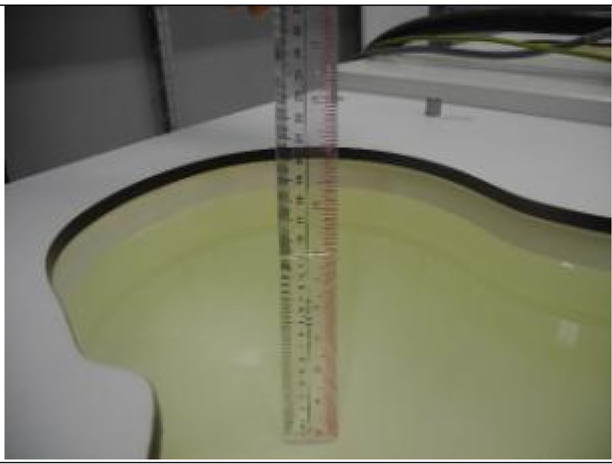



Photo 9: Right Side 0mm	Photo 10: Top Side 0mm
	

Photo 11: Bottom Side 0mm	N/A
	N/A

Photograph: Liquid depth

Photo 14: Head 2450 Depth (15.0cm)	Photo 15: Head 5G Depth (15.0cm)
	
N/A	N/A
N/A	N/A