SAR TEST REPORT

Applicant	VivaChek Biotech (Hangzhou) Co., Ltd
FCC ID	2APAPVGM90
Product	VivaChek Link Plus Blood Glucose Monitoring System
Brand	VivaChek
Model	VGM90
Report No.	R2306A0646-S1
Issue Date	August 28, 2023

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC 47 CFR § 2.1093, IEEE 1528-2013, ANSI C95.1: 1992, IEEE C95.1: 1991.** The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

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1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
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City:	Shanghai
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1.4 Laboratory Environment

Temperature	Min. = 18°C, Max. = 25 °C
Relative humidity	Min. = 30%, Max. = 70%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

2 Statement of Compliance

The maximum results of Specific Absorption Rate (SAR) found during testing for the EUT are as follows:

Table 1: Highest Reported SAR

Mode	Highest Reported SAR (W/kg)		Conclusion
	1g SAR Body-worn (Separation 15mm)	Extremity (Separation 0mm)	
LTE-M Band 2	0.142	0.620	Pass
LTE-M Band 4	**0.240**	**0.835**	Pass
LTE-M Band 12	0.153	0.188	Pass
LTE-M Band 13	0.171	0.167	Pass
Date of Testing: July 31, 2023 ~ August 4, 2023 Date of Sample Received: June 14, 2023			
Note: 1. The device is in compliance with SAR for Uncontrolled Environment /General Population exposure limits (1.6 W/kg and 4.0 W/kg) specified in ANSI C95.1: 1992/IEEE C95.1: 1991, and had been tested in accordance with the measurement methods and procedures specified in IEEE 1528-2013. 2. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

3 Description of Equipment Under Test

Client Information

Applicant	VivaChek Biotech (Hangzhou) Co., Ltd
Applicant address	Level 2, Block 2, 146 East Chaofeng Rd., Yuhang Economy Development Zone, Hangzhou, Zhejiang, P.R. China
Manufacturer	VivaChek Biotech (Hangzhou) Co., Ltd
Manufacturer address	Level 2, Block 2, 146 East Chaofeng Rd., Yuhang Economy Development Zone, Hangzhou, Zhejiang, P.R. China

General Technologies

EUT Stage	Design Verification Meter
Model	VGM90
SN	397A0000002
Hardware Version	PCBA #2079027101
Software Version	01
Antenna Type	FPC Antenna
Power Class	LTE-M Band 2/4/12/13: 5
Power Level	LTE-M Band 2/4/12/13: max power
EUT Accessory	
Battery	Manufacturer: Dongguan Xinkeda Energy Co.，Ltd Model: 453450
Type-C Cable	Manufacturer: Jiangxi Dishuo Technology Co., Ltd P/No: 1405013401 100cm Cable
Note: The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant.	

Wireless Technology and Frequency Range

Wireless Technology		Modulation	Operating mode	Tx (MHz)	Rx (MHz)
LTE-M	Band 2	QPSK, 16 QAM	Category M1	1850 ~ 1910	1930 ~ 1990
	Band 4			1710 ~ 1755	2110 ~ 2155
	Band 12			699 ~ 716	729 ~ 746
	Band 13			777 ~ 787	746 ~ 756

4 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1093, IEEE 1528- 2013, ANSI C95.1: 1992, IEEE C95.1: 1991, the following FCC Published RF exposure KDB procedures:

Reference Standards

KDB 447498 D01 General RF Exposure Guidance v06
KDB 648474 D04 Handset SAR v01r03
KDB 690783 D01 SAR Listings on Grants v01r03
KDB 865664 D01 SAR measurement 100 MHz to 6 GHz v01r04
KDB 865664 D02 RF Exposure Reporting v01r02
KDB 941225 D05 SAR for LTE Devices v02r05
KDB 941225 D05A LTE Rel.10 KDB Inquiry Sheet v01r02
KDB 941225 D06 Hotspot Mode v02r01

5 Operational Conditions during Test

5.1 Test Positions

5.1.1 Body Worn Configuration

Body-worn operating configurations should be tested with the belt-clips and holsters attached to the device and positioned against a flat phantom in normal use configurations.

Per FCC KDB Publication 648474 D04, Body-worn accessory exposure is typically related to voice mode operations when handsets are carried in body-worn accessories. The body-worn accessory procedures in FCC KDB Publication 447498 D01 should be used to test for body-worn accessory SAR compliance, without a headset connected to it. This enables the test results for such configuration to be compatible with that required for hotspot mode when the body-worn accessory test separation distance is greater than or equal to that required for hotspot mode, when applicable. When the reported SAR for a body-worn accessory, measured without a headset connected to the handset, is > 1.2 W/kg, the highest reported SAR configuration for that wireless mode and frequency band should be repeated for that body-worn accessory with a headset attached to the handset.

Accessories for Body-worn operation configurations are divided into two categories: those that do not contain metallic components and those that do contain metallic components. When multiple accessories that do not contain metallic components are supplied with the device, the device is tested with only the accessory that dictates the closest spacing to the body. Then multiple accessories that contain metallic components are tested with the device with each accessory. If multiple accessories share an identical metallic component (i.e. the same metallic belt-clip used with different holsters with no other metallic components) only the accessory that dictates the closest spacing to the body is tested.

Body-worn accessories may not always be supplied or available as options for some devices intended to be authorized for body-worn use. In this case, a test configuration with a separation distance between the back of the device and the flat phantom is used. Test position spacing was documented. Transmitters that are designed to operate in front of a person's face, as in push-to-talk configurations, are tested for SAR compliance with the front of the device positioned to face the flat phantom in head fluid. For devices that are carried next to the body such as a shoulder, waist or chest-worn transmitters, SAR compliance is tested with the accessories, including headsets and microphones, attached to the device and positioned against a flat phantom in a normal use configuration.

5.2 Measurement Variability

Per FCC KDB Publication 865664 D01, SAR measurement variability was assessed for each frequency band, which was determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media were required for SAR measurements in a frequency band, the variability measurement procedures were applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. These additional measurements were repeated after the completion of all measurements requiring the same head or body tissue-equivalent medium in a frequency band. The test device was returned to ambient conditions (normal room temperature) with the battery fully charged before it was re-mounted on the device holder for the repeated measurement(s) to minimize any unexpected variations in the repeated results.

SAR Measurement Variability was assessed using the following procedures for each frequency band:
1) When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.
2) A second repeated measurement was preformed only if the ratio of largest to smallest SAR for the original and first repeated measurements was > 1.20 or when the original or repeated measurement was ≥ 1.45 W/kg (~ 10% from the 1-g SAR limit).
3) A third repeated measurement was performed only if the original, first or second repeated measurement was ≥ 1.5 W/kg and the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20.
4) Repeated measurements are not required when the original highest measured SAR is < 0.80 W/kg

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.

5.3 Test Configuration

5.3.1 eMTC Test Configuration

eMTC as LTE technology to the Internet of Things development of a technology, the detailed technology based on 3GPP36.101 and 3GPP36.521-1.

For UE category M1 power class 5, the allowed Maximum Power Reduction (MPR) for the maximum output power as follows:

Table: Maximum Power Reduction (MPR) for Power Class 5

Table 6.2.3EA-2: Maximum Power Reduction (MPR) for Power Class 5

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	>2	>2	>3	>5	-	-	≤ 1
QPSK	>5	>5	-	-	-	-	≤ 2
16 QAM	≤ 2	≤ 2	>3	>5	-	-	≤ 1
16QAM	>2	>2	>5	-	-	-	≤ 2

For power measurements were performed on the configuration with the follow table from 3GPP36.521-1

Test Parameters for Channel Bandwidths				
	Downlink Configuration	Uplink Configuration		
Ch BW		Mod'n	RB allocation	
			FDD and HD-FDD	TDD
5MHz	N/A for Max UE output power testing	QPSK	1	1
5MHz		QPSK	3(Note 5)	3(Note 5)
10MHz		QPSK	1	1
10MHz		QPSK	4(Note 4), 5 (Note 5)	4(Note 4), 5(Note 5)
15MHz		QPSK	1	1
15MHz		QPSK	6	6
20MHz		QPSK	1	1
20MHz		QPSK	6	6

1) Initial test configuration.

Start with the largest channel bandwidth and measure SAR for QPSK, using the RB offset and Index required test channel combination with the highest maximum output power. For the remaining required test channels with RB offset and index configuration is determine the highest output power for that channel.

2) Higher order modulations

For 16 QAM modulation, apply the QPSK procedures in 1) to determine the configurations that may need SAR measurement. For each configuration identified as required for testing, SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > ½ dB higher than the same configuration in QPSK or when the report SAR for the QPSK configuration is > 75% limit.

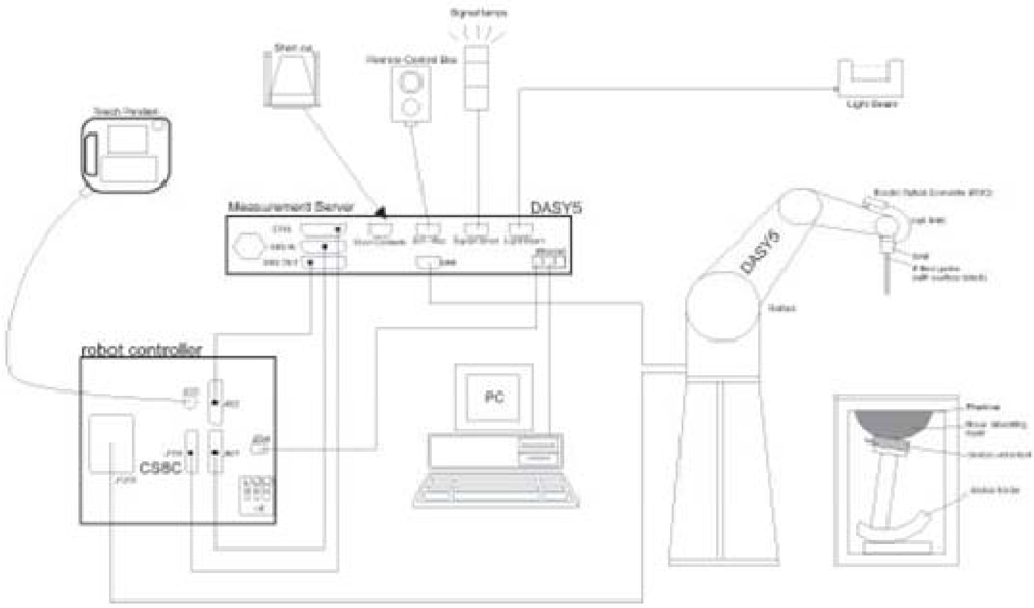
3) Other channel bandwidth standalone SAR test requirements

For the other channel bandwidths used by the device in a frequency band, apply all the procedures required for the largest channel bandwidth in 1) and 2) to determine the channels and RB configurations that need SAR testing, then only measure SAR when the highest maximum output power of a configuration requiring testing in the smaller channel bandwidth is > ½ dB higher than the equivalent channel configurations in the largest channel bandwidth configuration.

6 SAR Measurements System Configuration

6.1 SAR Measurement Set-up

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



- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- An isotropic Field probe optimized and calibrated for the targeted measurement.
- A data acquisition electronics (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.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP or Win7 and the DASY software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

6.2 DASY5 E-field Probe System

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

EX3DV4 Probe Specification

Construction	Symmetrical design with triangular core 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 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: ± 0.2dB (noise: typically < 1 μW/g)
Dimensions	Overall length: 330 mm (Tip: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm
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%.

E-field Probe Calibration

Each probe is calibrated according to a dosimetric assessment procedure with accuracy better than ± 10%. The spherical isotropy was evaluated and found to be better than ± 0.25dB. The sensitivity parameters (NormX, NormY, NormZ), the diode compression parameter (DCP) and the conversion factor (ConvF) of the probe are tested.

The free space E-field from amplified probe outputs is determined in a test chamber. This is performed in a TEM cell for frequencies bellow 1 GHz, and in a wave guide above 1 GHz for free space. For the free space calibration, the probe is placed in the volumetric center of the cavity and at the proper orientation with the field. The probe is then rotated 360 degrees.

E-field temperature correlation calibration is performed in a flat phantom filled with the appropriate simulated brain tissue. The measured free space E-field in the medium correlates to temperature rise in a dielectric medium. For temperature correlation calibration a RF transparent thermistor-based temperature probe is used in conjunction with the E-field probe.

SAR=C∆T/∆t

Where: ∆t = Exposure time (30 seconds),

C = Heat capacity of tissue (brain or muscle),

∆T = Temperature increase due to RF exposure.

Or

SAR=IEI^{2}σ/ρ

Where: σ = Simulated tissue conductivity,

ρ = Tissue density (kg/m^3).

6.3 SAR Measurement Procedure

Power Reference Measurement

The Power Reference Measurement and Power Drift Measurements are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface determines the closest measurement point to phantom surface. This distance cannot be smaller than the distance of sensor calibration points to probe tip as defined in the probe properties.

Area Scan

The area scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in DASY software can find the maximum found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE standard 1528 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan), if only one zoom scan follows the area scan, then only the absolute maximum will be taken as reference. For cases where multiple maximums are detected, the number of zoom scans has to be increased accordingly.
Area scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

	≤3 GHz	> 3 GHz
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	5 ± 1 mm	½·δ·ln(2) ± 0.5 mm
Maximum probe angle from probe axis to phantom surface normal at the measurement location	30° ± 1°	20° ± 1°
Maximum area scan spatial resolution: ΔxArea, ΔyArea	≤ 2 GHz: ≤ 15 mm 2 – 3 GHz: ≤ 12 mm	3 – 4 GHz: ≤ 12 mm 4 – 6 GHz: ≤ 10 mm
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be ≤ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Zoom Scan

Zoom scans are used assess the peak spatial SAR values within a cubic averaging volume containing 1 gram and 10 gram of simulated tissue. The zoom scan measures points (refer to table below) within a cube shoes base faces are centered on the maxima found in a preceding area scan job within the same procedure. When the measurement is done, the zoom scan evaluates the averaged SAR for 1 gram and 10 gram and displays these values next to the job's label.

Zoom scan parameters extracted from FCC KDB 865664 D01 SAR measurement 100 MHz to 6 GHz.

<table>
<tr><td colspan="3"></td><td>≤3GHz</td><td>> 3 GHz</td></tr>
<tr><td colspan="3">Maximum zoom scan spatial resolution: $\triangle x_{zoom}\triangle y_{zoom}$</td><td>≤2GHz: ≤8mm
2 – 3GHz: ≤5mm*</td><td>3 – 4GHz: ≤5mm*
4 – 6GHz: ≤4mm*</td></tr>
<tr><td rowspan="3">Maximum zoom scan spatial resolution, normal to phantom surface</td><td colspan="2">Uniform grid: $\triangle z_{zoom}(n)$</td><td>≤5mm</td><td>3 – 4GHz: ≤4mm
4 – 5GHz: ≤3mm
5 – 6GHz: ≤2mm</td></tr>
<tr><td rowspan="2">Graded grid</td><td>$\triangle z_{zoom}(1)$: between 1st two points closest to phantom surface</td><td>≤4mm</td><td>3 – 4GHz: ≤3mm
4 – 5GHz: ≤2.5mm
5 – 6GHz: ≤2mm</td></tr>
<tr><td>$\triangle z_{zoom}(n>1)$: between subsequent points</td><td colspan="2">$\leq 1.5 \cdot \triangle z_{zoom}(n-1)$</td></tr>
<tr><td>Minimum zoom scan volume</td><td colspan="2">X, y, z</td><td>≥30mm</td><td>3 – 4GHz: ≥28mm
4 – 5GHz: ≥25mm
5 – 6GHz: ≥22mm</td></tr>
<tr><td colspan="5">Note: δ is the penetration depth of a plane-wave at normal incidence to the tissue medium; see draft standard IEEE P1528-2011 for details.
* When zoom scan is required and the <u>reported</u> SAR from the area scan based 1-g SAR estimation procedures of KDB 447498 is ≤ 1.4W/kg, ≤8mm, ≤7mm and ≤5mm zoom scan resolution may be applied, respectively, for 2GHz to 3GHz, 3GHz to 4GHz and 4GHz to 6GHz.</td></tr>
</table>

Volume Scan Procedures

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

Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In DASY measurement software, the power reference measurement and power drift measurement procedures are used for monitoring the power drift of EUT during SAR test. Both these procedures measure the field at a specified reference position before and after the SAR testing. The software will calculate the field difference in dB. If the power drifts more than 5%, the SAR will be retested.

7 Main Test Equipment

Name of Equipment	Manufacturer	Type/Model	Serial Number	Last Cal.	Cal. Due Date
Network Analyzer	Agilent	E5071B	MY42404014	2023-05-12	2024-05-11
Dielectric Probe Kit	SPEAG	DAK-12	1171	2022-10-29	2023-10-28
Power Meter	Agilent	E4417A	GB41291714	2023-05-12	2024-05-11
Power Sensor	Agilent	N8481H	MY50350004	2023-05-12	2024-05-11
Power Sensor	Agilent	E9327A	US40441622	2023-05-12	2024-05-11
Power Sensor	Agilent	NRP18S	101955	2023-05-12	2024-05-11
Signal Generator	Agilent	N5181A	MY50140143	2023-05-12	2024-05-11
Dual Directional Coupler	UCL	UCL-DDC056G-S	20010600118	/	/
Amplifier	INDEXSAR	TPA-005060G01	13030502	2023-05-13	2024-05-12
Wireless Communication Tester	Anritsu	MT8820C	6201342015	2022-12-10	2023-12-09
Wireless Communication Tester	R&S	CMW 500	146734	2023-05-13	2024-05-12
E-field Probe	SPEAG	EX3DV4	7543	2022-12-10	2023-12-09
DAE	SPEAG	DAE4	1692	2022-11-18	2023-11-17
Validation Kit 750MHz	SPEAG	D750V3	1045	2020-08-28	2023-08-27
Validation Kit 1750MHz	SPEAG	D1750V2	1023	2022-06-21	2025-06-20
Validation Kit 1900MHz	SPEAG	D1900V2	5d060	2020-08-27	2023-08-26
Software for Tissue	SPEAG	DAK 3.0.4.1	/	/	/
Temperature Probe	Tianjin jinming	JM222	22112737	2023-05-13	2024-05-12
Twin SAM Phantom	SPEAG	SAM1	1667	/	/
Twin SAM Phantom	SPEAG	SAM2	1666	/	/
Hygrothermograph	Anymetr	HTC - 1	TA2023A007	2023-05-13	2024-05-12
TX90 XL	SPEAG	Staubli TX90 XL	/	/	/
Software for Test	SPEAG	DASY52	52.10.4.1527	/	/

8 Tissue Dielectric Parameter Measurements & System Check

8.1 Tissue Verification

The temperature of the tissue-equivalent medium used during measurement must also be within 18°C to 25°C and within ± 2°C of the temperature when the tissue parameters are characterized. The dielectric parameters must be measured before the tissue-equivalent medium is used in a series of SAR measurements. The parameters should be re-measured after each 24 hours of use; or earlier if the dielectric parameters can become out of tolerance.

Target values

Frequency (MHz)	ε_r	σ(s/m)
750	41.9	0.89
1750	40.1	1.37
1900	40.0	1.40

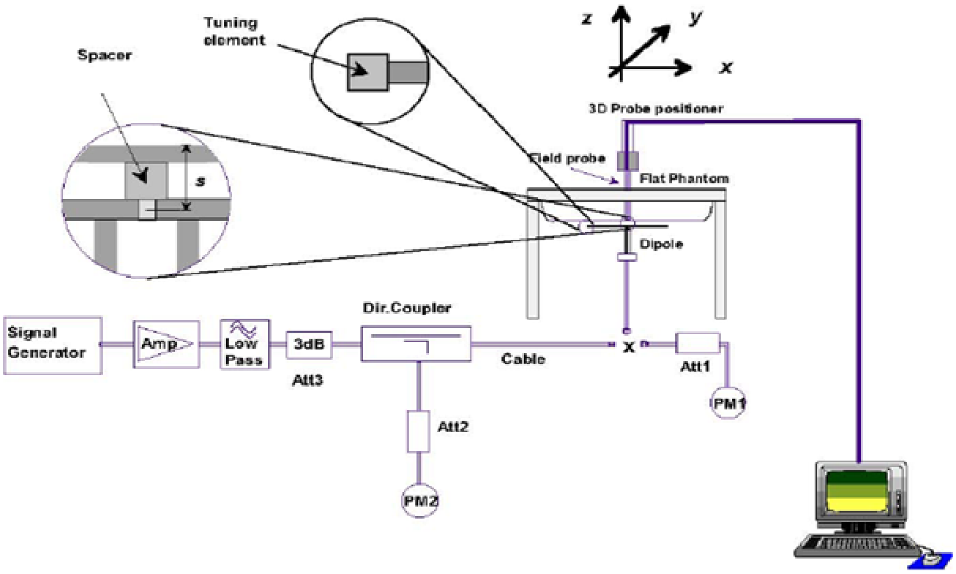
Measurements results

Frequency (MHz)	Test Date	Temp ℃	Measured Dielectric Parameters		Target Dielectric Parameters		Limit (Within ±5%)	
			ε_r	σ(s/m)	ε_r	σ(s/m)	Dev ε_r(%)	Dev σ(%)
750	2023/7/31	21.5	42.3	0.88	41.9	0.89	0.95	-1.12
1750	2023/8/2	21.5	40.2	1.34	40.1	1.37	0.25	-2.19
1900	2023/8/4	21.5	40.1	1.41	40.0	1.40	0.25	0.71
Note: The depth of tissue-equivalent liquid in a phantom must be ≥ 15.0 cm for SAR measurements ≤ 3 GHz and ≥ 10.0 cm for measurements > 3 GHz.								

8.2 System Check

The manufacturer calibrates the probes annually. Dielectric parameters of the tissue simulates were measured using the dielectric probe kit and the network analyzer. A system check measurement for every day was made following the determination of the dielectric parameters of the Tissue simulates, using the dipole validation kit. The dipole antenna was placed under the flat section of the twin SAM phantom.

System check is performed regularly on all frequency bands where tests are performed with the DASY system.



Picture 1 System Check setup

Picture 2 Setup Photo

Justification for Extended SAR Dipole Calibrations

Usage of SAR dipoles calibrated less than 3 years ago but more than 1 year ago were confirmed in maintaining return loss (< - 20 dB, within 20% of prior calibration) and impedance (within 5 ohm from prior calibration) requirements per extended calibrations in KDB 865664 D01:

Dipole		Date of Measurement	Return Loss (dB)	Δ %	Impedance (Ω)			
					Real	ΔΩ	Imaginary	ΔΩ
Dipole D750V3 SN: 1045	Head Liquid	8/28/2020	26.6	/	54.3	/	-2.29	/
		8/27/2021	26.2	-1.5	53.9	-0.4	-2.28	0.01
		8/26/2022	26.0	-0.8	52.1	-1.8	-2.25	0.03
Dipole D1900V2 SN: 5d060	Head Liquid	8/27/2020	23.3	/	52.5	/	6.58	/
		8/26/2021	23.0	-1.3	51.9	-0.6	6.54	-0.04
		8/25/2022	22.2	-3.5	51.2	-0.7	6.53	-0.01

System Check Results

Frequency (MHz)	Test Date	Temp ℃	250mW Measured SAR_{1g} (W/kg)	1W Normalized SAR_{1g} (W/kg)	1W Target SAR_{1g} (W/kg)	Δ % (Limit ±10%)	Plot No.
750	2023/7/31	21.5	2.13	8.52	8.37	1.79	1
1750	2023/8/2	21.5	8.95	35.80	36.80	-2.72	2
1900	2023/8/4	21.5	9.88	39.52	39.50	0.05	3
Note: Target Values used derive from the calibration certificate data storage and evaluation.							

8.3 SAR System Validation

Per FCC KDB 865664 D02v01, SAR system verification is required to confirm measurement accuracy. The SAR systems (including SAR probes, system components and software versions) used for this device were validated against its performance specifications prior to the SAR measurements. Reference dipoles are used with the required tissue-equivalent media for system validation, according to the procedures outlined in FCC KDB 865664 D01 and IEEE 1528-2013. Since SAR probe calibrations are frequency dependent, each probe calibration point must be validated at a frequency within the valid frequency range of the probe calibration point, using the system that normally operates with the probe for routine SAR measurements and according to the required tissue-equivalent media.

A tabulated summary of the system validation status, measurement frequencies, SAR probes, calibrated signal type(s) and tissue dielectric parameters has been included.

Frequency [MHz]	Date	Probe SN	Probe Type	Probe Cal Point		PERM (Er)	COND (Σ)	CW Validation		
								Sensitivity	Probe Linearity	Probe Isotropy
750	2022/12/10	7543	EX3DV4	750	Head	41.9	0.89	PASS	PASS	PASS
1750	2022/12/10	7543	EX3DV4	1750	Head	40.1	1.37	PASS	PASS	PASS
1900	2022/12/10	7543	EX3DV4	1900	Head	40.0	.1.40	PASS	PASS	PASS

NOTE: While the probes have been calibrated for both CW and modulated signals, all measurements were performed using communication systems calibrated for CW signals only. Modulations in the table above represent test configurations for which the measurement system has been validated per FCC KDB Publication 865664D01v01 for scenarios when CW probe calibrations are used with other signal types. SAR systems were validated for modulated signals with a periodic duty cycle, such as GMSK, or with a high peak to average ratio (>5dB), such as OFDM according to KDB 865664.

9 Normal and Maximum Output Power

KDB 447498 D01 at the maximum rated output power and within the tune-up tolerance range specified for the product, but not more than 2 dB lower than the maximum tune-up tolerance limit.

9.1 eMTC Mode

For UE category M1 power class 5, the allowed Maximum Power Reduction (MPR) for the maximum output power as follows:

Table 6.2.3EA-2: Maximum Power Reduction (MPR) for Power Class 5

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	>2	>2	>3	>5	-	-	≤ 1
QPSK	>5	>5	-	-	-	-	≤ 2
16 QAM	≤ 2	≤ 2	>3	>5	-	-	≤ 1
16QAM	>2	>2	>5	-	-	-	≤ 2

LTE-M Band 2	Channel /Freq.(MHz)	Index	QPSK RB# RBstart	16 QAM RB# RBstart	Maximum Output Power (dBm)					
					QPSK			16 QAM		
					Tune up	Result	Conclusion	Tune up	Result	Conclusion
1.4MHz	18607/1850.7	0	1#0	1#0	22.00	21.11	Pass	21.00	19.63	Pass
		0	6#0	5#0	20.00	19.05	Pass	20.00	18.99	Pass
	18900/1880	0	1#0	1#0	22.00	20.74	Pass	21.00	19.30	Pass
		0	6#0	5#0	20.00	18.60	Pass	20.00	18.58	Pass
	19193/1909.3	0	1#5	1#5	22.00	20.35	Pass	21.00	19.04	Pass
		0	6#0	5#0	20.00	18.35	Pass	20.00	18.23	Pass
3MHz	18615/1851.5	0	1#0	1#0	22.00	21.20	Pass	21.00	19.74	Pass
		0	6#0	5#0	20.00	19.14	Pass	20.00	19.19	Pass
	18900/1880	0	1#0	1#0	22.00	20.92	Pass	21.00	19.81	Pass
		0	6#0	5#0	20.00	18.62	Pass	20.00	18.45	Pass
	19185/1908.5	1	1#5	1#5	22.00	20.39	Pass	21.00	19.02	Pass
		1	6#0	5#0	20.00	18.53	Pass	20.00	18.48	Pass
5MHz	18625/1852.5	3	1#0	1#0	22.00	21.28	Pass	22.00	21.12	Pass
		0	6#0	5#0	21.00	19.94	Pass	21.00	19.94	Pass
	18900/1880	0	1#0	1#0	22.00	20.81	Pass	22.00	21.28	Pass
		0	6#0	5#0	21.00	19.45	Pass	21.00	19.54	Pass
	19175/1907.5	0	1#5	1#5	22.00	20.31	Pass	22.00	20.31	Pass
		3	6#0	5#0	21.00	19.30	Pass	21.00	19.52	Pass
10MHz	18650/1855	3	1#0	1#0	22.00	21.17	Pass	22.00	21.21	Pass
		0	4#0	4#0	22.00	21.22	Pass	22.00	20.72	Pass
	18900/1880	0	1#0	1#0	22.00	20.94	Pass	22.00	21.54	Pass
		0	4#0	4#0	22.00	20.82	Pass	22.00	20.75	Pass
	19150/1905	4	1#5	1#5	22.00	20.64	Pass	22.00	20.52	Pass

		7	4#2	4#2	22.00	20.62	Pass	22.00	20.49	Pass
15MHz	18675/1857.5	3	1#0	1#0	22.00	21.15	Pass	22.00	21.02	Pass
		0	6#0	5#0	22.00	21.06	Pass	22.00	21.24	Pass
	18900/1880	0	1#0	1#0	22.00	20.85	Pass	22.00	21.36	Pass
		0	6#0	5#0	22.00	20.76	Pass	22.00	20.79	Pass
	19125/1902.5	8	1#5	1#5	22.00	20.30	Pass	22.00	20.53	Pass
		11	6#0	5#0	22.00	20.37	Pass	22.00	20.64	Pass
20MHz	18700/1860	3	1#0	1#0	22.00	**21.10**	Pass	22.00	21.16	Pass
		0	6#0	5#0	22.00	21.08	Pass	22.00	21.21	Pass
	18900/1880	0	1#0	1#0	22.00	20.92	Pass	22.00	21.38	Pass
		0	6#0	5#0	22.00	20.78	Pass	22.00	20.88	Pass
	19100/1900	12	1#5	1#5	22.00	20.74	Pass	22.00	21.06	Pass
		15	6#0	5#0	22.00	20.43	Pass	22.00	20.88	Pass

LTE-M Band 4	Channel /Freq.(MHz)	Index	QPSK RB# RBstart	16 QAM RB# RBstart	Maximum Output Power (dBm)					
					QPSK			16 QAM		
					Tune up	Result	Conclusion	Tune up	Result	Conclusion
1.4MHz	19957 1710.7	0	1#0	1#0	23.00	21.83	Pass	22.00	20.98	Pass
		0	6#0	5#0	21.00	19.68	Pass	21.00	19.61	Pass
	20175/1732.5	0	1#0	1#0	23.00	21.56	Pass	22.00	20.11	Pass
		0	6#0	5#0	21.00	19.47	Pass	21.00	19.51	Pass
	20393/1754.3	0	1#5	1#5	23.00	21.49	Pass	22.00	20.11	Pass
		0	6#0	5#0	21.00	19.64	Pass	21.00	19.60	Pass
3MHz	19965/1711.5	0	1#0	1#0	23.00	21.86	Pass	22.00	20.47	Pass
		0	6#0	5#0	21.00	19.67	Pass	21.00	19.75	Pass
	20175/1732.5	0	1#0	1#0	23.00	21.68	Pass	22.00	20.20	Pass
		0	6#0	5#0	21.00	19.50	Pass	21.00	19.46	Pass
	20385/1753.5	1	1#5	1#5	23.00	21.45	Pass	22.00	20.16	Pass
		1	6#0	5#0	21.00	19.67	Pass	21.00	19.69	Pass
5MHz	19975/1712.5	0	1#0	1#0	23.00	21.86	Pass	23.00	21.68	Pass
		0	6#0	5#0	22.00	20.71	Pass	22.00	20.80	Pass
	20175/1732.5	0	1#0	1#0	23.00	21.72	Pass	23.00	21.97	Pass
		0	6#0	5#0	22.00	20.32	Pass	22.00	20.78	Pass
	20375/1752.5	3	1#5	1#5	23.00	21.53	Pass	23.00	21.36	Pass
		3	6#0	5#0	22.00	20.54	Pass	22.00	20.57	Pass
10MHz	20000/1715	0	1#0	1#0	23.00	21.81	Pass	23.00	21.85	Pass
		0	4#0	4#0	23.00	21.84	Pass	23.00	21.46	Pass
	20175/1732.5	0	1#0	1#0	23.00	21.75	Pass	23.00	21.91	Pass
		0	4#0	4#0	23.00	21.49	Pass	23.00	21.34	Pass
	20350/1750	7	1#5	1#5	23.00	21.64	Pass	23.00	21.39	Pass
		7	4#2	4#2	23.00	21.72	Pass	23.00	21.23	Pass
15MHz	20025/1717.5	0	1#0	1#0	23.00	21.92	Pass	23.00	21.71	Pass
		0	6#0	5#0	23.00	21.69	Pass	23.00	22.12	Pass

	20175/1732.5	0	1#0	1#0	23.00	21.84	Pass	23.00	22.12	Pass
		0	6#0	5#0	23.00	21.66	Pass	23.00	21.63	Pass
	20325/1747.5	11	1#5	1#5	23.00	21.49	Pass	23.00	21.54	Pass
		11	6#0	5#0	23.00	21.79	Pass	23.00	21.98	Pass
20MHz	20050/1720	0	1#0	1#0	23.00	21.76	Pass	23.00	21.71	Pass
		0	6#0	5#0	23.00	21.68	Pass	23.00	21.76	Pass
	20175/1732.5	0	1#0	1#0	23.00	**21.84**	Pass	23.00	21.92	Pass
		0	6#0	5#0	23.00	21.64	Pass	23.00	21.61	Pass
	20300/1745	15	1#5	1#5	23.00	21.51	Pass	23.00	21.27	Pass
		15	6#0	5#0	23.00	21.74	Pass	23.00	21.80	Pass

LTE-M Band 12	Channel /Freq.(MHz)	Index	QPSK RB# RBstart	16 QAM RB# RBstart	Maximum Output Power (dBm)					
					QPSK			16 QAM		
					Tune up	Result	Conclusion	Tune up	Result	Conclusion
1.4MHz	23017/699.7	0	1#0	1#0	22.00	20.35	Pass	21.00	19.31	Pass
		0	6#0	5#0	20.00	18.05	Pass	20.00	18.13	Pass
	23095/707.5	0	1#0	1#0	22.00	20.60	Pass	21.00	19.39	Pass
		0	6#0	5#0	20.00	18.02	Pass	20.00	18.24	Pass
	23173/715.3	0	1#5	1#5	22.00	20.51	Pass	21.00	19.55	Pass
		0	6#0	5#0	20.00	18.29	Pass	20.00	18.01	Pass
3MHz	23025/700.5	0	1#0	1#0	22.00	20.13	Pass	21.00	19.04	Pass
		0	6#0	5#0	20.00	18.02	Pass	20.00	18.02	Pass
	23095/707.5	0	1#0	1#0	22.00	20.56	Pass	21.00	19.35	Pass
		0	6#0	5#0	20.00	18.28	Pass	20.00	18.25	Pass
	23165/714.5	1	1#5	1#5	22.00	20.48	Pass	21.00	19.23	Pass
		1	6#0	5#0	20.00	18.25	Pass	20.00	18.16	Pass
5MHz	23035/701.5	3	1#0	1#0	22.00	20.38	Pass	22.00	20.74	Pass
		0	6#0	5#0	21.00	19.15	Pass	21.00	19.10	Pass
	23095/707.5	0	1#0	1#0	22.00	20.67	Pass	22.00	20.76	Pass
		0	6#0	5#0	21.00	19.18	Pass	21.00	19.31	Pass
	23155/713.5	0	1#5	1#5	22.00	20.66	Pass	22.00	21.06	Pass
		3	6#0	5#0	21.00	19.53	Pass	21.00	19.53	Pass
10MHz	23060/704	3	1#0	1#0	22.00	20.42	Pass	22.00	20.87	Pass
		0	4#0	4#0	22.00	20.21	Pass	22.00	20.07	Pass
	23095/707.5	0	1#0	1#0	22.00	20.61	Pass	22.00	20.69	Pass
		0	4#0	4#0	22.00	20.34	Pass	22.00	20.19	Pass
	23130/711	4	1#5	1#5	22.00	**20.69**	Pass	22.00	20.37	Pass
		7	4#2	4#2	22.00	20.50	Pass	22.00	20.13	Pass

LTE-M Band 13	Channel /Freq.(MHz)	Index	QPSK RB# RBstart	16 QAM RB# RBstart	Maximum Output Power (dBm)					
					QPSK			16 QAM		
					Tune up	Result	Conclusion	Tune up	Result	Conclusion
5MHz	23205/779.5	0	1#0	1#0	22.00	21.30	Pass	22.00	21.46	Pass
		0	6#0	5#0	21.00	19.48	Pass	21.00	19.53	Pass
	23230/782	0	1#0	1#0	22.00	21.18	Pass	22.00	21.39	Pass
		0	6#0	5#0	21.00	19.67	Pass	21.00	19.58	Pass
	23255/784.5	3	1#5	1#5	22.00	21.04	Pass	22.00	21.26	Pass
		3	6#0	5#0	21.00	19.84	Pass	21.00	19.95	Pass
10MHz	23230/782	0	1#0	1#0	22.00	**21.18**	Pass	22.00	21.29	Pass
		0	4#0	4#0	22.00	20.71	Pass	22.00	20.70	Pass

10 Measured and Reported (Scaled) SAR Results

10.1 EUT Antenna Locations

The Detailed Antenna Locations Refer to *Antenna Locations.*

Overall (Length x Width): 100.9mm x 61.6mm Overall Diagonal: 100 mm/Display Diagonal: 58 mm
Note: 1. Per FCC KDB 447498 D01, for each exposure position, testing of other requised 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: a) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100MHz b) ≤ 0.6 W/kg or 1.5 W/kg, for1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz. c) ≤ 0.4 W/kg or 1.0 Wkg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz. 2. When the original highest measured SAR is ≥ 0.80 W/kg, the measurement was repeated once.

10.2 Measured SAR Results

Note:

1. The value with blue color is the maximum SAR Value of each test band.
2. Initial test configuration is the highest channel bandwidth with QPSK modulation for eMTC mode.
3. Others modulations and channel bandwidth SAR test is required only when the highest maximum output power for the configuration in the other modulation or channel bandwidth is > ½ dB higher than the same configuration in the highest channel bandwidth with QPSK or when the report SAR for the QPSK configuration is > 75% limit.

Body-Worn SAR

Band	Test Position	Dist. (mm)	Mode	RB# RB start	Ch./Freq. (MHz)	Tune-up (dBm)	Measured power (dBm)	Measured SAR1g (W/Kg)	Power Drift (dB)	Scaling Factor	Report SAR1g (W/kg)	Conclusion	Plot No.
LTE-M Band 2	Back Side	15	QPSK	1#0	18700/1860	22.00	21.10	0.081	0.032	1.23	0.099	Pass	/
		15	QPSK	6#0	18700/1860	22.00	21.08	0.075	0.070	1.24	0.093	Pass	/
	Front Side	15	QPSK	1#0	18700/1860	22.00	21.10	0.095	0.040	1.23	0.117	Pass	/
		15	QPSK	6#0	18700/1860	22.00	21.08	0.115	0.160	1.24	0.142	Pass	4
LTE-M Band 4	Back Side	15	QPSK	1#0	20175/1732.5	23.00	21.84	0.116	-0.030	1.31	0.152	Pass	/
		15	QPSK	6#0	20300/1745	23.00	21.74	0.110	0.040	1.34	0.147	Pass	/
	Front Side	15	QPSK	1#0	20175/1732.5	23.00	21.84	0.184	0.020	1.31	0.240	Pass	5
		15	QPSK	6#0	20300/1745	23.00	21.74	0.139	0.030	1.34	0.186	Pass	/
LTE-M Band 12	Back Side	15	QPSK	1#5	23130/711	22.00	20.69	0.092	0.030	1.35	0.124	Pass	/
		15	QPSK	4#2	23130/711	22.00	20.50	0.101	-0.027	1.41	0.143	Pass	/
	Front Side	15	QPSK	1#5	23130/711	22.00	20.69	0.102	0.050	1.35	0.138	Pass	/
		15	QPSK	4#2	23130/711	22.00	20.50	0.108	0.012	1.41	0.153	Pass	6
LTE-M Band 13	Back Side	15	QPSK	1#0	23230/782	22.00	21.18	0.125	0.046	1.21	0.151	Pass	/
		15	QPSK	4#0	23230/782	22.00	20.71	0.123	0.025	1.35	0.166	Pass	/
	Front Side	15	QPSK	1#0	23230/782	22.00	21.18	0.124	0.011	1.21	0.150	Pass	/
		15	QPSK	4#0	23230/782	22.00	20.71	0.127	0.030	1.35	0.171	Pass	7

Product-Specific 10g SAR

Band	Test Position	Dist. (mm)	Mode	RB# RB start	Ch./Freq. (MHz)	Tune-up (dBm)	Measured power (dBm)	Measured SAR10g (W/Kg)	Power Drift (dB)	Scaling Factor	Report SAR10g (W/kg)	Conclusion	Plot No.
LTE-M Band 2	Back Side	0	QPSK	1#0	18700/1860	22.00	21.10	0.293	-0.120	1.23	0.360	Pass	/
		0	QPSK	6#0	18700/1860	22.00	21.08	0.298	0.090	1.24	0.368	Pass	/
	Front Side	0	QPSK	1#0	18700/1860	22.00	21.10	0.337	-0.027	1.23	0.415	Pass	/
		0	QPSK	6#0	18700/1860	22.00	21.08	0.330	-0.060	1.24	0.408	Pass	/
	Left Edge	0	QPSK	1#0	18700/1860	22.00	21.10	0.057	0.025	1.23	0.070	Pass	/
		0	QPSK	6#0	18700/1860	22.00	21.08	0.037	-0.014	1.24	0.046	Pass	/
	Right Edge	0	QPSK	1#0	18700/1860	22.00	21.10	0.107	0.020	1.23	0.132	Pass	/
		0	QPSK	6#0	18700/1860	22.00	21.08	0.091	-0.039	1.24	0.112	Pass	/
	Top Edge	0	QPSK	1#0	18700/1860	22.00	21.10	0.042	0.040	1.23	0.052	Pass	/

		0	QPSK	6#0	18700/1860	22.00	21.08	0.047	0.023	1.24	0.058	Pass	/
	Bottom Edge	0	QPSK	1#0	18700/1860	22.00	21.10	0.504	-0.040	1.23	0.620	Pass	8
		0	QPSK	6#0	18700/1860	22.00	21.08	0.485	0.060	1.24	0.599	Pass	/
LTE-M Band 4	Back Side	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.401	0.020	1.31	0.524	Pass	/
		0	QPSK	6#0	20300/1745	23.00	21.74	0.385	0.027	1.34	0.515	Pass	/
	Front Side	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.451	0.150	1.31	0.589	Pass	/
		0	QPSK	6#0	20300/1745	23.00	21.74	0.406	0.080	1.34	0.543	Pass	/
	Left Edge	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.044	0.011	1.31	0.057	Pass	/
		0	QPSK	6#0	20300/1745	23.00	21.74	0.053	-0.059	1.34	0.071	Pass	/
	Right Edge	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.107	0.100	1.31	0.140	Pass	/
		0	QPSK	6#0	20300/1745	23.00	21.74	0.107	0.013	1.34	0.143	Pass	/
	Top Edge	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.056	0.026	1.31	0.073	Pass	/
		0	QPSK	6#0	20300/1745	23.00	21.74	0.053	-0.013	1.34	0.071	Pass	/
	Bottom Edge	0	QPSK	1#0	20175/1732.5	23.00	21.84	0.639	-0.110	1.31	0.835	Pass	9
		0	QPSK	6#0	20300/1745	23.00	21.74	0.624	0.040	1.34	0.834	Pass	/
LTE-M Band 12	Back Side	0	QPSK	1#5	23130/711	22.00	20.69	0.127	0.039	1.35	0.172	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.133	0.032	1.41	0.188	Pass	10
	Front Side	0	QPSK	1#5	23130/711	22.00	20.69	0.099	0.170	1.35	0.134	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.092	0.028	1.41	0.130	Pass	/
	Left Edge	0	QPSK	1#5	23130/711	22.00	20.69	0.114	0.025	1.35	0.154	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.111	0.069	1.41	0.157	Pass	/
	Right Edge	0	QPSK	1#5	23130/711	22.00	20.69	0.108	0.140	1.35	0.146	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.102	0.013	1.41	0.144	Pass	/
	Top Edge	0	QPSK	1#5	23130/711	22.00	20.69	0.029	0.035	1.35	0.039	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.032	-0.016	1.41	0.045	Pass	/
	Bottom Edge	0	QPSK	1#5	23130/711	22.00	20.69	0.049	0.049	1.35	0.066	Pass	/
		0	QPSK	4#2	23130/711	22.00	20.50	0.035	0.025	1.41	0.049	Pass	/
LTE-M Band 13	Back Side	0	QPSK	1#0	23230/782	22.00	21.18	0.108	0.014	1.21	0.130	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.124	-0.110	1.35	0.167	Pass	11
	Front Side	0	QPSK	1#0	23230/782	22.00	21.18	0.113	-0.070	1.21	0.136	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.094	-0.039	1.35	0.127	Pass	/
	Left Edge	0	QPSK	1#0	23230/782	22.00	21.18	0.081	0.060	1.21	0.098	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.075	0.011	1.35	0.101	Pass	/
	Right Edge	0	QPSK	1#0	23230/782	22.00	21.18	0.117	0.110	1.21	0.141	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.101	0.025	1.35	0.136	Pass	/
	Top Edge	0	QPSK	1#0	23230/782	22.00	21.18	0.031	0.010	1.21	0.037	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.034	0.021	1.35	0.046	Pass	/
	Bottom Edge	0	QPSK	1#0	23230/782	22.00	21.18	0.055	0.170	1.21	0.066	Pass	/
		0	QPSK	4#0	23230/782	22.00	20.71	0.052	-0.018	1.35	0.070	Pass	/

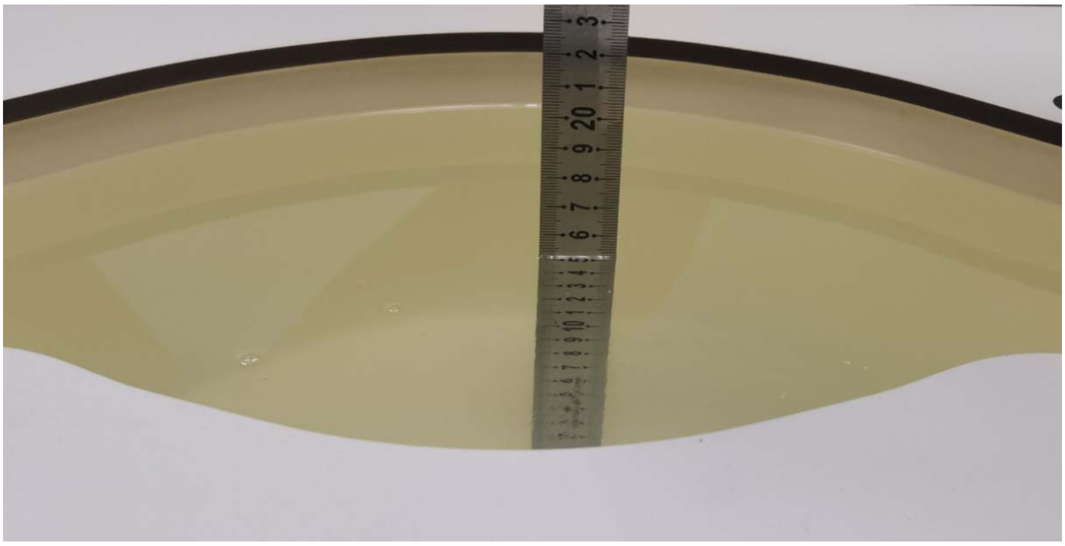
11 Measurement Uncertainty

Per KDB 865664 D01 SAR Measurement 100 MHz to 6 GHz, when the highest measured 1-g SAR within a frequency band is < 1.5 W/kg, the extensive SAR measurement uncertainty analysis described in IEEE Std 1528- 2013 is not required in SAR reports submitted for equipment approval. This also applies to the 10-g SAR required for phablets in KDB Publication 648474.

ANNEX A: Test Layout

Tissue Simulating Liquids

For the measurement of the field distribution inside the flat phantom with DASY, the phantom must be filled with around 25 liters of homogeneous tissue simulating liquid. For SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is ＞15 cm, which is shown as below.



Picture 3: Liquid depth in the flat Phantom

ANNEX B: System Check Results

Plot 1 System Performance Check at 750 MHz TSL

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3

Date: 2023/7/31

Communication System:CW (0); Frequency: 750 MHz;Duty Cycle: 1:1

Medium parameters used: f = 750 MHz; σ = 0.88 S/m; ε_r = 42.3; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(10.65, 10.65, 10.65); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

d=15mm,Pin=250mW/Area Scan (4x12x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 2.15 W/kg

d=15mm,Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 50.165V/m; Power Drift = -0.08 dB

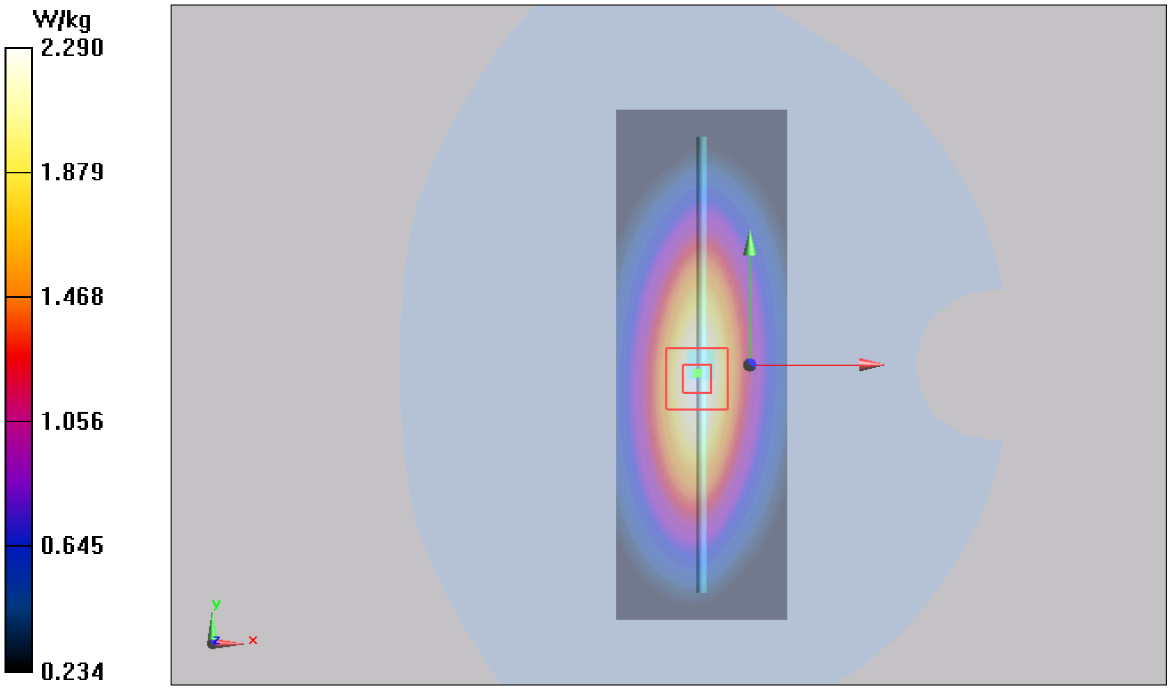
Peak SAR (extrapolated) = 3.16 W/kg

SAR(1 g) = 2.13 W/kg; SAR(10 g) = 1.41 W/kg

Smallest distance from peaks to all points 3 dB below = 8.7 mm

Ratio of SAR at M2 to SAR at M1 = 62.5%

Maximum value of SAR (measured) = 2.29 W/kg



Plot 2 System Performance Check at 1750 MHz TSL

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2

Date: 2023/8/2

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1

Medium parameters used: f = 1750 MHz; σ = 1.34 S/m; ε_r = 40.2; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.56, 8.56, 8.56); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

d=10mm, Pin=250mW/Area Scan (5x8x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 9.18 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 80.385 V/m; Power Drift = 0.075 dB

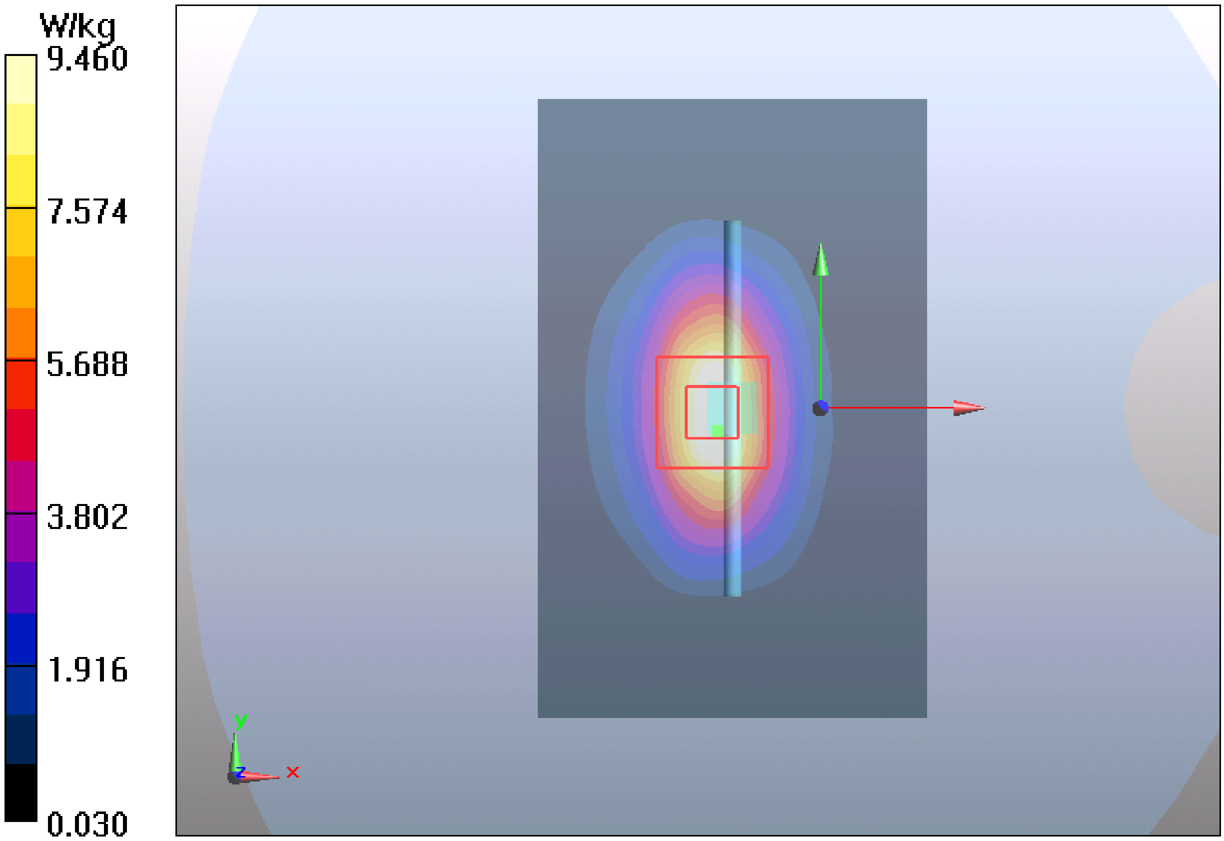
Peak SAR (extrapolated) = 15.5 W/kg

SAR(1 g) = 8.95 W/kg; SAR(10 g) = 4.8 W/kg

Smallest distance from peaks to all points 3 dB below = 10mm

Ratio of SAR at M2 to SAR at M1 = 53.5%

Maximum value of SAR (measured) = 9.46 W/kg



Plot 3 System Performance Check at 1900 MHz TSL

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2

Date: 2023/8/4

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1

Medium parameters used: f = 1900 MHz; σ = 1.41 S/m; ε_r = 40.1; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.29, 8.29, 8.29); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

d=10mm, Pin=250mW/Area Scan (4x7x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 10.23 W/kg

d=10mm, Pin=250mW/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 85.857V/m; Power Drift = 0.026 dB

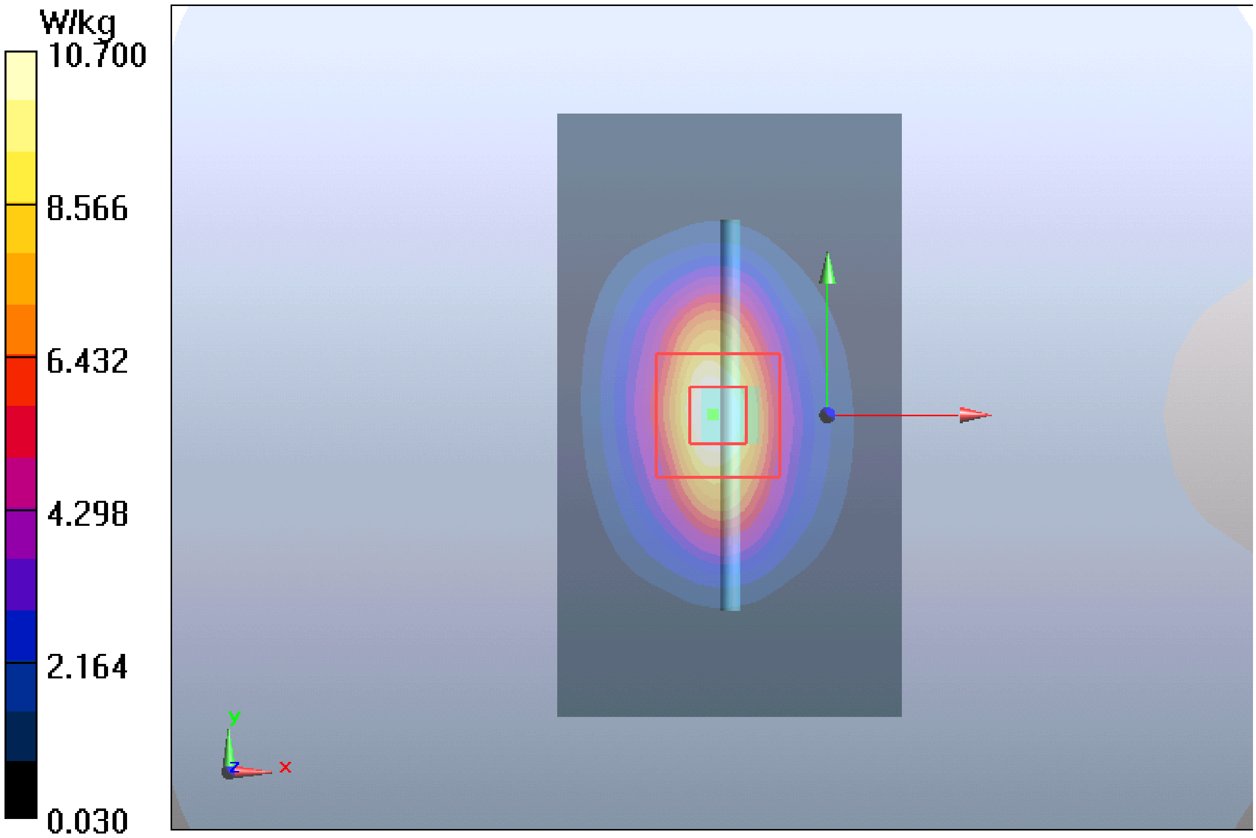
Peak SAR (extrapolated) = 17.84 W/kg

SAR(1 g) = 9.88 W/kg; SAR(10 g) = 4.9 W/kg

Smallest distance from peaks to all points 3 dB below = 11.4 mm

Ratio of SAR at M2 to SAR at M1 = 52.7%

Maximum value of SAR (measured) = 10.70 W/kg



ANNEX C: Highest Graph Results

Plot 4 LTE-M Band 2 6RB Back Front Low (Distance 15mm)

Date: 2023/8/4

Communication System: UID 0, LTE-M (0); Frequency: 1860 MHz; Duty Cycle: 1:1

Medium parameters used: f = 1860 MHz; σ = 1.39 S/m; ε_r = 39.098; ρ = 1000 kg/m^3

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.29, 8.29, 8.29); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Front Side Low/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.167 W/kg

Front Side Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.142 V/m; Power Drift = 0.16 dB

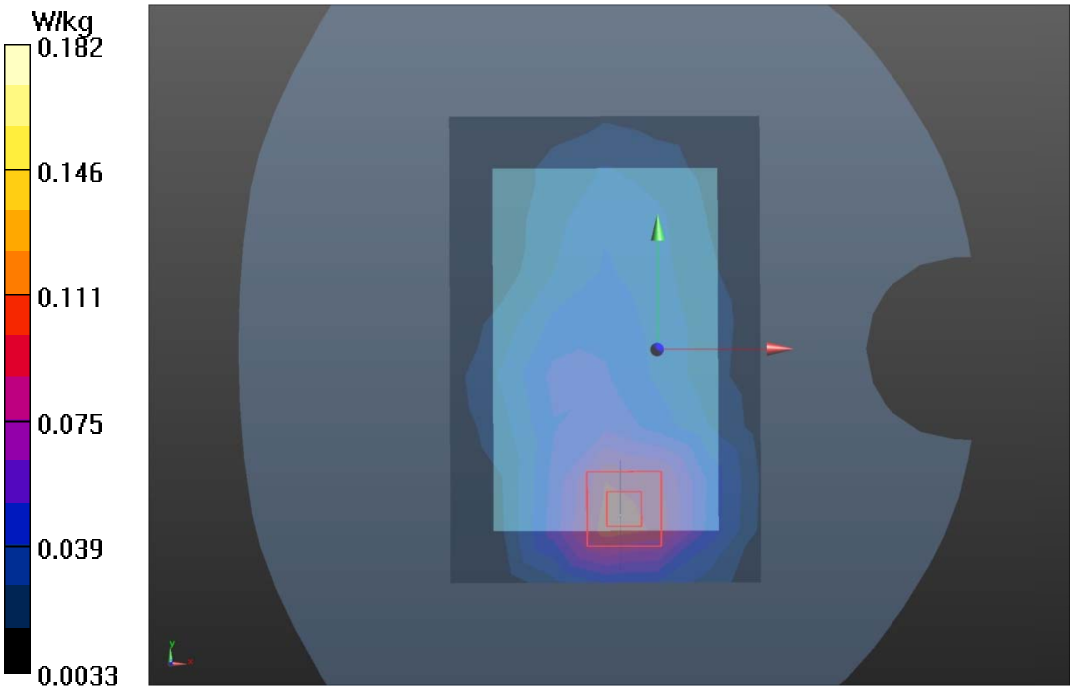
Peak SAR (extrapolated) = 0.288 W/kg

SAR(1 g) = 0.115 W/kg; SAR(10 g) = 0.067 W/kg

Smallest distance from peaks to all points 3 dB below = 17.2 mm

Ratio of SAR at M2 to SAR at M1 = 60.5%

Maximum value of SAR (measured) = 0.182 W/kg



Plot 5 LTE-M Band 4 1RB Front Side Middle (Distance 15mm)

Date: 2023/8/2

Communication System: UID 0, LTE-M (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.301 S/m; ε_r = 39.474; ρ = 1000 kg/m^3

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.56, 8.56, 8.56); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Front Side Middle /Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.189 W/kg

Front Side Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.268 V/m; Power Drift = 0.020 dB

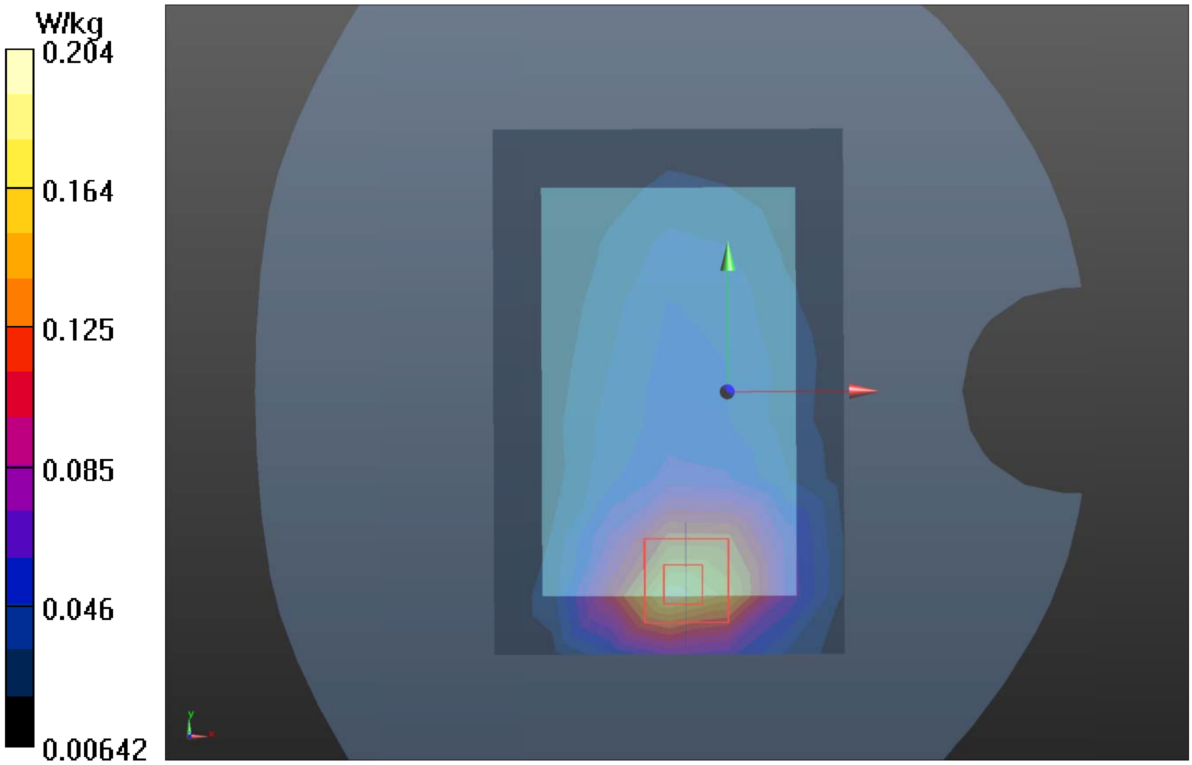
Peak SAR (extrapolated) = 0.301 W/kg

SAR(1 g) = 0.184 W/kg; SAR(10 g) = 0.108 W/kg

Smallest distance from peaks to all points 3 dB below = 14.5 mm

Ratio of SAR at M2 to SAR at M1 = 62.8%

Maximum value of SAR (measured) = 0.204 W/kg



Plot 6 LTE-M Band 12 4RB Front Side High (Distance 15mm)

Date: 2023/7/31

Communication System: UID 0, LTE-M (0); Frequency: 711 MHz;Duty Cycle: 1:1

Medium parameters used: f = 711 MHz; σ = 0.896 S/m; ε_r = 42.2; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(10.65, 10.65, 10.65); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Front Side High/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.109 W/kg

Front Side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.945 V/m; Power Drift = 0.012 dB

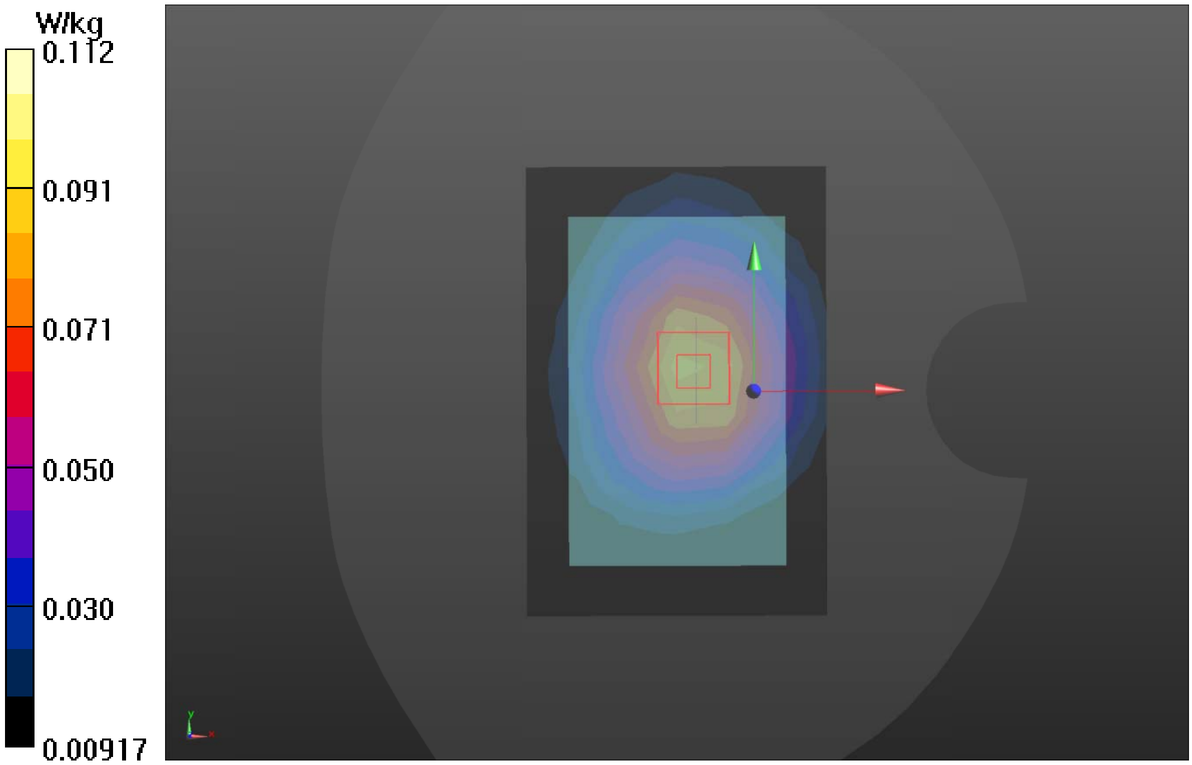
Peak SAR (extrapolated) = 0.149 W/kg

SAR(1 g) = 0.108 W/kg; SAR(10 g) = 0.075 W/kg

Smallest distance from peaks to all points 3 dB below = 13.4 mm

Ratio of SAR at M2 to SAR at M1 = 73.9%

Maximum value of SAR (measured) = 0.112 W/kg



Plot 7 LTE-M Band 13 4RB Front Side Middle (Distance 15mm)

Date: 2023/7/31

Communication System: UID 0, LTE-M (0); Frequency: 782 MHz;Duty Cycle: 1:1

Medium parameters used: f = 782 MHz; σ = 0.921 S/m; ε_r = 41.805; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(10.65, 10.65, 10.65); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Front Side Middle /Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.128 W/kg

Front Side Middle /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.25 V/m; Power Drift = 0.03 dB

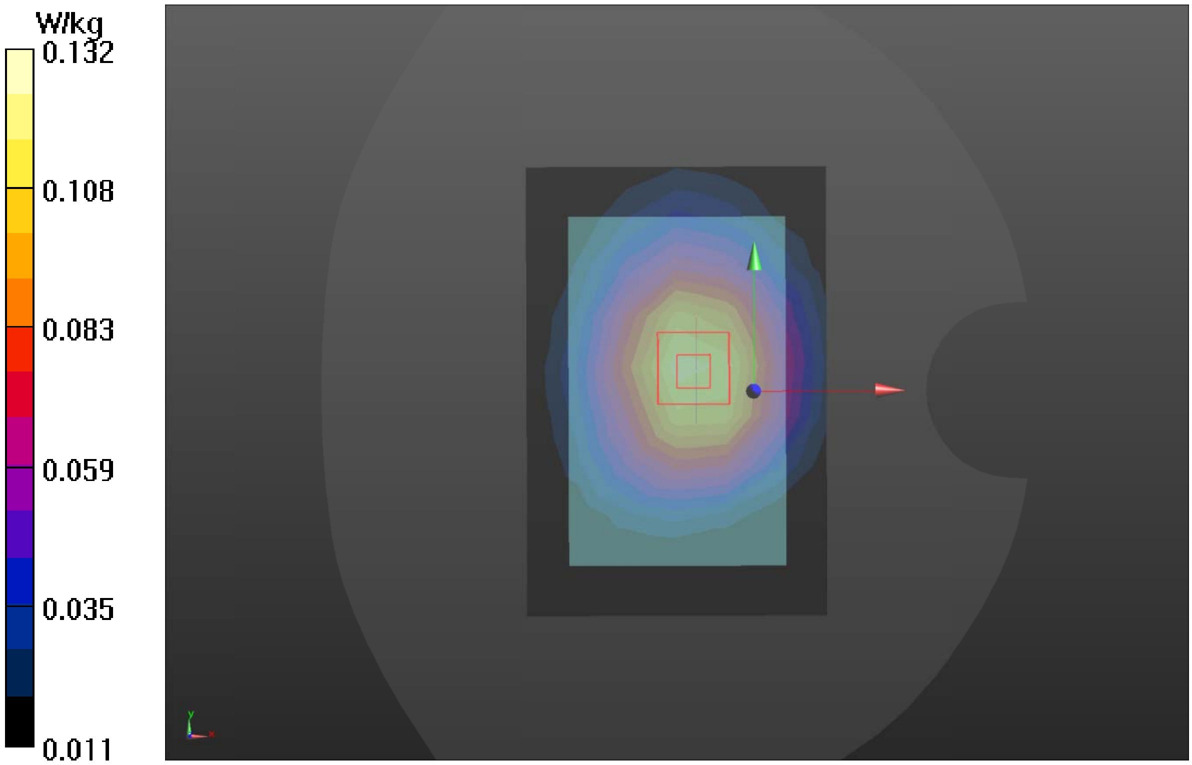
Peak SAR (extrapolated) = 0.224 W/kg

SAR(1 g) = 0.127 W/kg; SAR(10 g) = 0.082 W/kg

Smallest distance from peaks to all points 3 dB below = 12.8 mm

Ratio of SAR at M2 to SAR at M1 = 73.6%

Maximum value of SAR (measured) = 0.132 W/kg



Plot 8 LTE-M Band 2 1RB Bottom Edge Low (Distance 0mm)

Date: 2023/8/4

Communication System: UID 0, LTE-M (0); Frequency: 1860 MHz;Duty Cycle: 1:1

Medium parameters used: f = 1860 MHz; σ = 1.407 S/m; ε_r = 39.071; ρ = 1000 kg/m^3

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.29, 8.29, 8.29); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Bottom Edge Low/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.839 W/kg

Bottom Edge Low/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 26.82 V/m; Power Drift = -0.04 dB

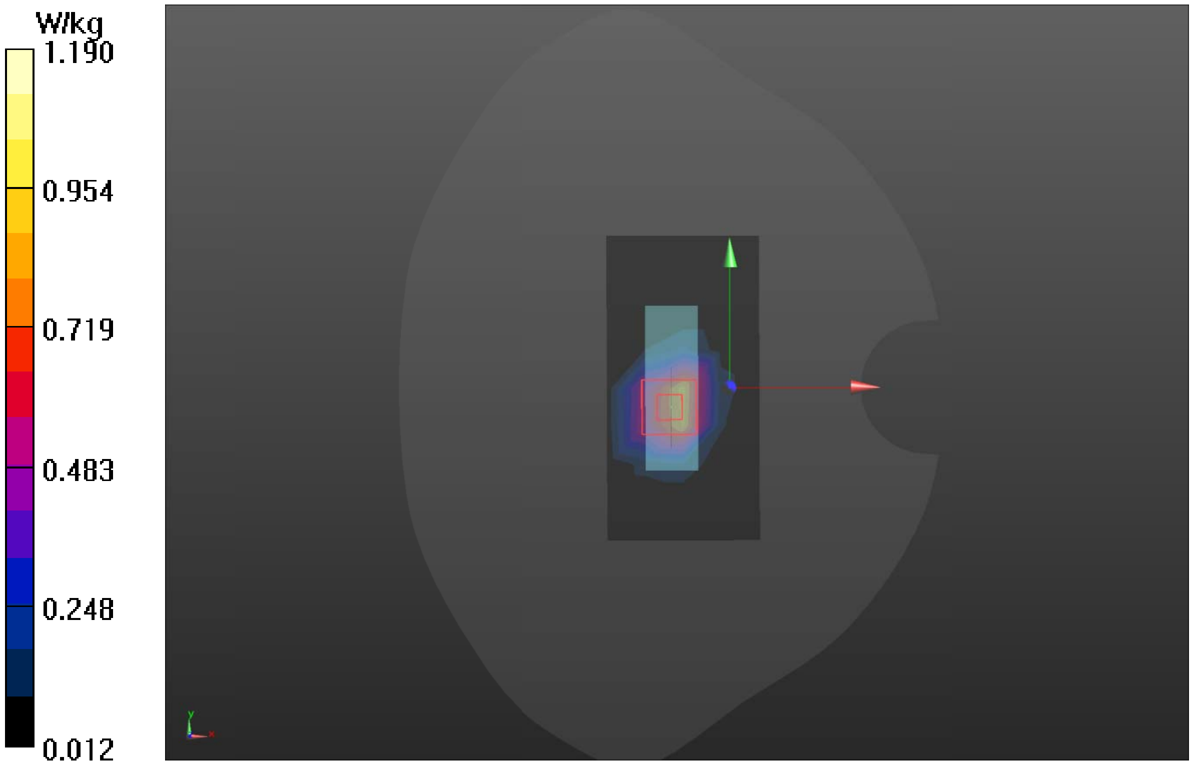
Peak SAR (extrapolated) = 2.01 W/kg

SAR(1 g) = 1.05 W/kg; SAR(10 g) = 0.504 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 56%

Maximum value of SAR (measured) = 1.19 W/kg



Plot 9 LTE-M Band 4 1RB Bottom Edge Middle (Distance 0mm)

Date: 2023/8/2

Communication System: UID 0, LTE-M (0); Frequency: 1732.5 MHz;Duty Cycle: 1:1

Medium parameters used (interpolated): f = 1732.5 MHz; σ = 1.313 S/m; ε_r = 39.384; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(8.56, 8.56, 8.56); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Bottom Edge Middle/Area Scan (5x9x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 1.23 W/kg

Bottom Edge Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 32.80 V/m; Power Drift = -0.11 dB

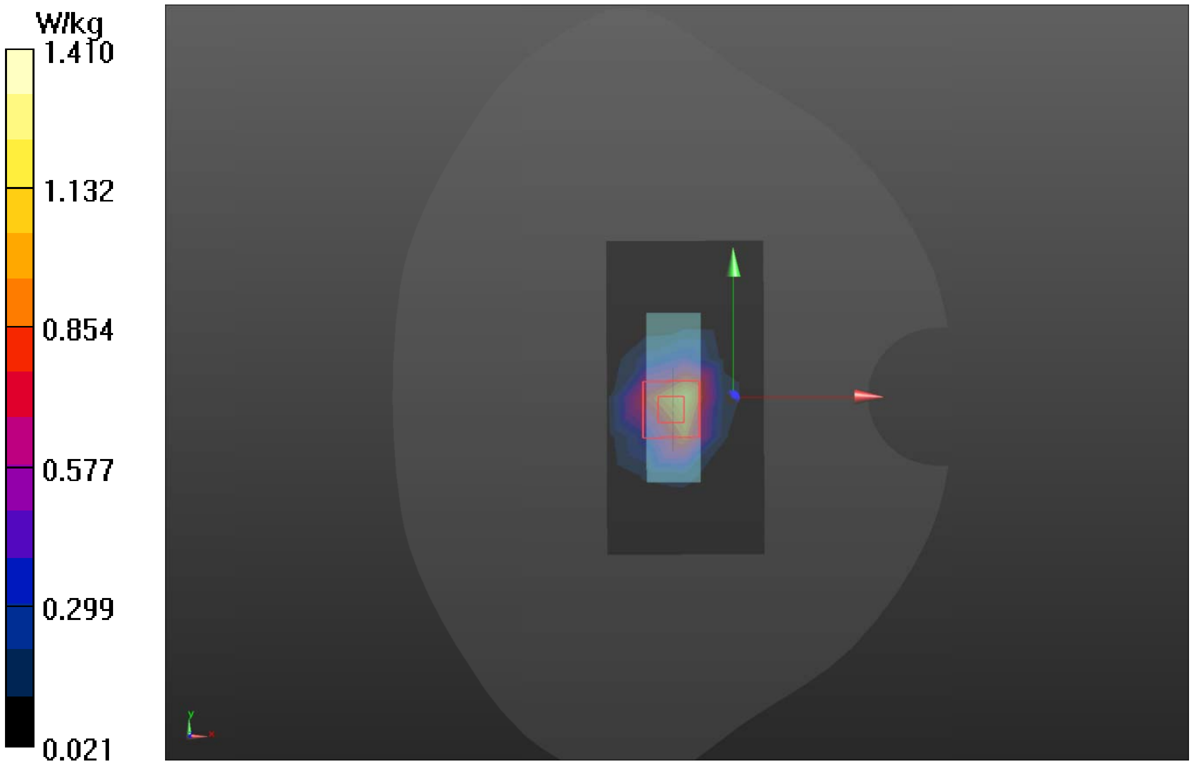
Peak SAR (extrapolated) = 2.27 W/kg

SAR(1 g) = 1.26 W/kg; SAR(10 g) = 0.639 W/kg

Smallest distance from peaks to all points 3 dB below = 10.7 mm

Ratio of SAR at M2 to SAR at M1 = 57.9%

Maximum value of SAR (measured) = 1.410 W/kg



Plot 10 LTE-M Band 12 4RB Back Side High (Distance 0mm)

Date: 2023/7/31

Communication System: UID 0, LTE-M (0); Frequency: 711 MHz;Duty Cycle: 1:1

Medium parameters used: f = 711 MHz; σ = 0.896 S/m; ε_r = 42.2; ρ = 1000 kg/m^3

Ambient Temperature: 22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(10.65, 10.65, 10.65); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Back Side High/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.198 W/kg

Back Side High/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 10.28 V/m; Power Drift = 0.032 dB

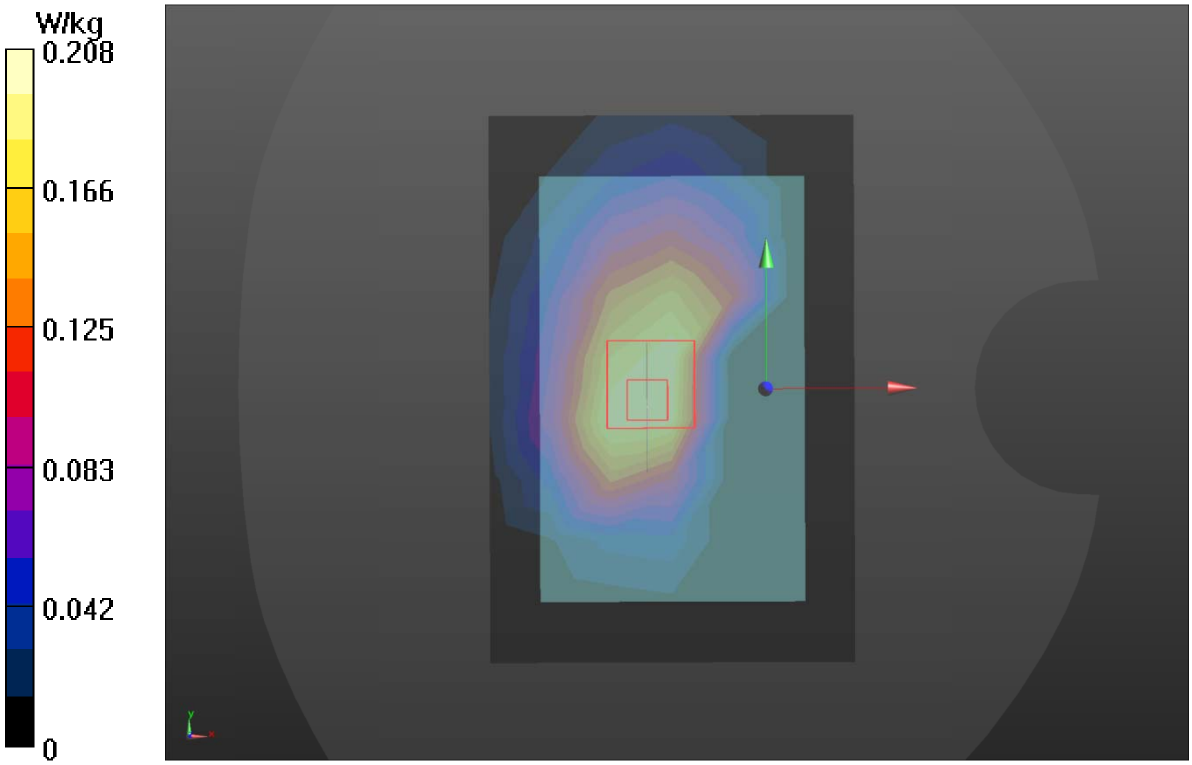
Peak SAR (extrapolated) = 0.293 W/kg

SAR(1 g) = 0.196 W/kg; SAR(10 g) = 0.133 W/kg

Smallest distance from peaks to all points 3 dB below = 16.3 mm

Ratio of SAR at M2 to SAR at M1 = 70%

Maximum value of SAR (measured) = 0.208 W/kg



Plot 11 LTE-M Band 13 4RB Back Side Middle (Distance 0mm)

Date: 2023/7/31

Communication System: UID 0, LTE-M (0); Frequency: 782 MHz;Duty Cycle: 1:1

Medium parameters used: f = 782 MHz; σ = 0.921 S/m; ε_r = 41.805; ρ = 1000 kg/m^3

Ambient Temperature:22.3 ℃ Liquid Temperature: 21.5℃

Phantom section: Flat Section

DASY5 Configuration:

Sensor-Surface: 1.4mm (Mechanical Surface Detection)

Probe: EX3DV4 - SN7543; ConvF(10.65, 10.65, 10.65); Calibrated: 2022/12/10

Electronics: DAE4 SN1692; Calibrated: 2022/11/18

Phantom: SAM 1; Type: QD000P40CD; Serial: TP:1666

Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

Back Side Middle/Area Scan (7x10x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (measured) = 0.183 W/kg

Back Side Middle/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 13.96 V/m; Power Drift = -0.11 dB

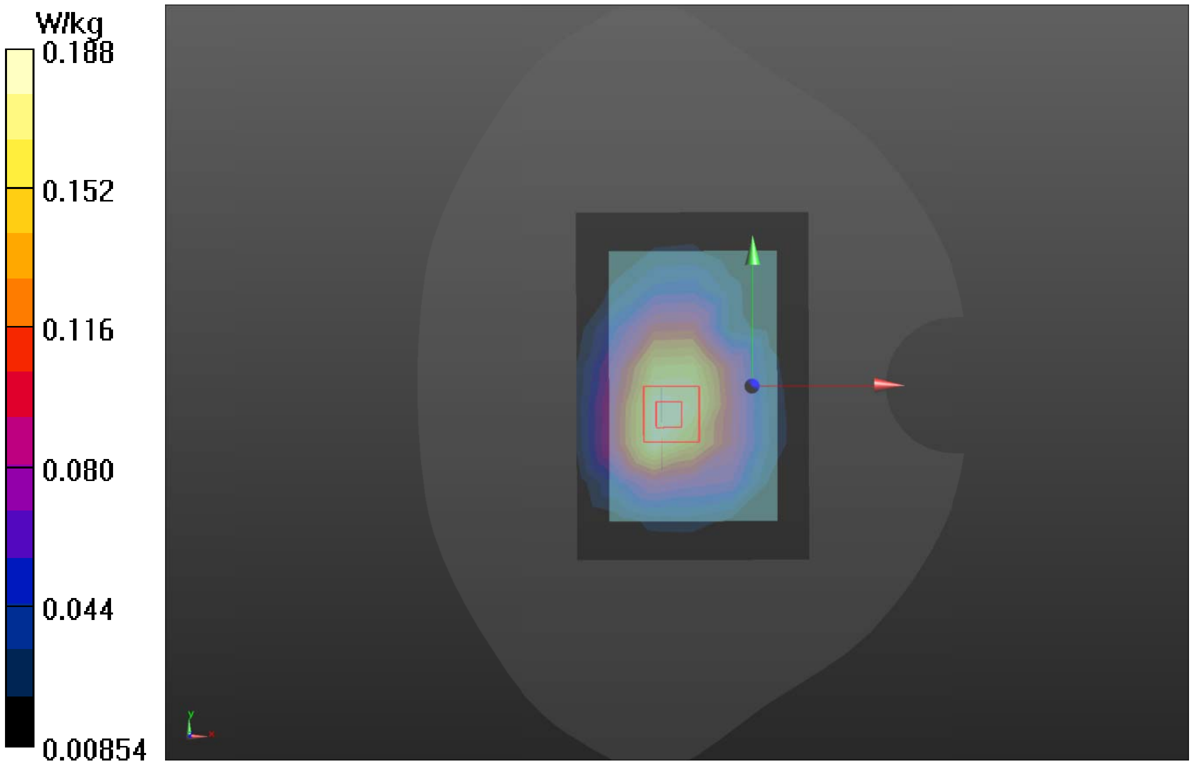
Peak SAR (extrapolated) = 0.253 W/kg

SAR(1 g) = 0.177 W/kg; SAR(10 g) = 0.124 W/kg

Smallest distance from peaks to all points 3 dB below = 23.1 mm

Ratio of SAR at M2 to SAR at M1 = 70.5%

Maximum value of SAR (measured) = 0.188 W/kg



ANNEX D: Probe Calibration Certificate (SN: 7543)

In Collaboration with s p e a g CALIBRATION LABORATORY

Add: No.52 HuaYuanBei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2117
E-mail: emf@caict.ac.cn http://www.caict.ac.cn

中国认可 国际互认 校准 CALIBRATION CNAS L0570

Client TA(Shanghai) Certificate No: Z22-60519

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN : 7543

Calibration Procedure(s): FF-Z11-004-02
Calibration Procedures for Dosimetric E-field Probes

Calibration date: December 10, 2022

This calibration Certificate documents the traceability to national standards, which realize the physical units of measurements(SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature(22±3)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Power Meter NRP2	101919	14-Jun-22(CTTL, No.J22X04181)	Jun-23
Power sensor NRP-Z91	101547	14-Jun-22(CTTL, No.J22X04181)	Jun-23
Power sensor NRP-Z91	101548	14-Jun-22(CTTL, No.J22X04181)	Jun-23
Reference 10dBAttenuator	18N50W-10dB	20-Jan-21(CTTL, No.J21X00486)	Jan-23
Reference 20dBAttenuator	18N50W-20dB	20-Jan-21(CTTL, No.J21X00485)	Jan-23
Reference Probe EX3DV4	SN 3846	20-May-22(SPEAG, No.EX3-3846_May22)	May-23
DAE4	SN 771	20-Jan-22(SPEAG, No.DAE4-771_Jan22)	Jan-23
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
SignalGenerator MG3700A	6201052605	14-Jun-22(CTTL, No.J22X04182)	Jun-23
Network Analyzer E5071C	MY46110673	14-Jan-22(CTTL, No.J22X00406)	Jan-23

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

Issued: December 15, 2022

In Collaboration with
s p e a g
CALIBRATION LABORATORY

CAICT

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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:7543

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm($\mu V/(V/m)^2$)[A]	0.61	0.68	0.54	±10.0%
DCP(mV)[B]	100.1	102.3	102.4	

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	197.8	±3.5%
		Y	0.0	0.0	1.0		217.2	
		Z	0.0	0.0	1.0		182.0	

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

[A] The uncertainties of Norm X, Y, Z do not affect the E^2-field uncertainty inside TSL (see Page 4).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainly is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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DASY/EASY – Parameters of Probe: EX3DV4 – SN:7543

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz][C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha[G]	Depth[G] (mm)	Unct. (*k*=2)
750	41.9	0.89	10.65	10.65	10.65	0.14	1.25	±12.7%
835	41.5	0.90	10.21	10.21	10.21	0.16	1.37	±12.7%
1750	40.1	1.37	8.56	8.56	8.56	0.23	1.04	±12.7%
1900	40.0	1.40	8.29	8.29	8.29	0.25	1.00	±12.7%
2000	40.0	1.40	8.33	8.33	8.33	0.21	1.08	±12.7%
2300	39.5	1.67	7.85	7.85	7.85	0.46	0.71	±12.7%
2450	39.2	1.80	7.65	7.65	7.65	0.48	0.72	±12.7%
2600	39.0	1.96	7.35	7.35	7.35	0.35	0.92	±12.7%
3300	38.2	2.71	7.15	7.15	7.15	0.33	1.00	±13.9%
3500	37.9	2.91	7.05	7.05	7.05	0.36	0.97	±13.9%
3700	37.7	3.12	6.75	6.75	6.75	0.32	1.06	±13.9%
3900	37.5	3.32	6.55	6.55	6.55	0.30	1.50	±13.9%
4100	37.2	3.53	6.61	6.61	6.61	0.30	1.40	±13.9%
4400	36.9	3.84	6.42	6.42	6.42	0.30	1.50	±13.9%
4600	36.7	4.04	6.35	6.35	6.35	0.40	1.30	±13.9%
4800	36.4	4.25	6.25	6.25	6.25	0.35	1.48	±13.9%
4950	36.3	4.40	6.06	6.06	6.06	0.35	1.50	±13.9%
5250	35.9	4.71	5.51	5.51	5.51	0.40	1.45	±13.9%
5600	35.5	5.07	4.90	4.90	4.90	0.40	1.50	±13.9%
5750	35.4	5.22	5.05	5.05	5.05	0.40	1.50	±13.9%

[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 up to 6 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ±10% if liquid compensation formula is applied to measured SAR values. 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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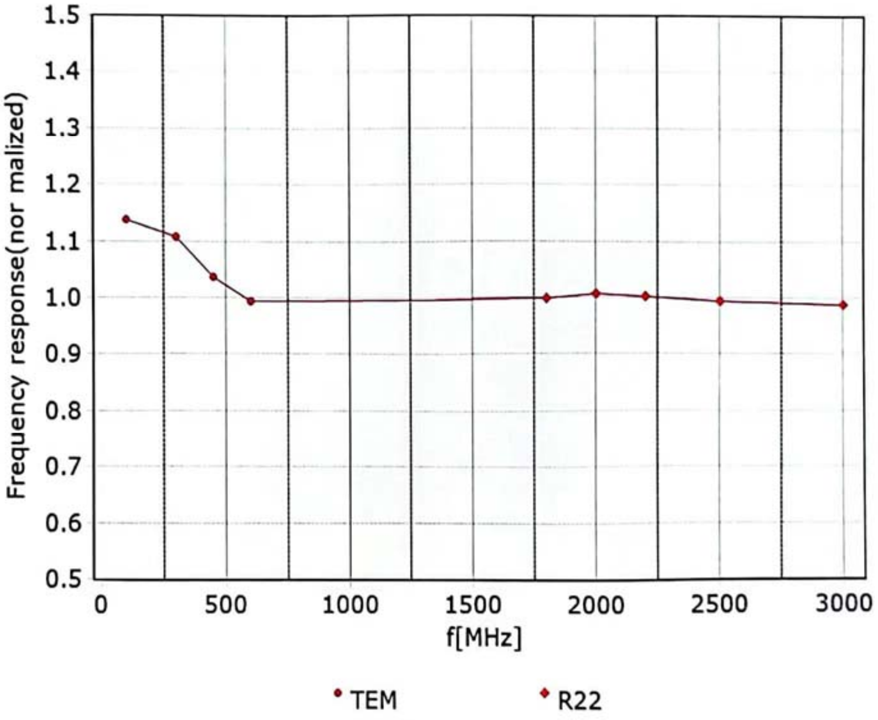
Frequency Response of E-Field
(TEM-Cell: ifi110 EXX, Waveguide: R22)



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

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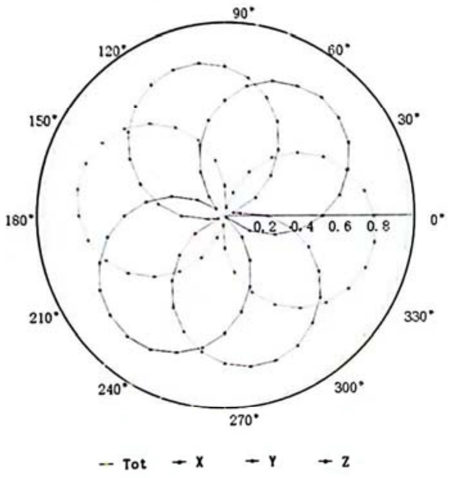
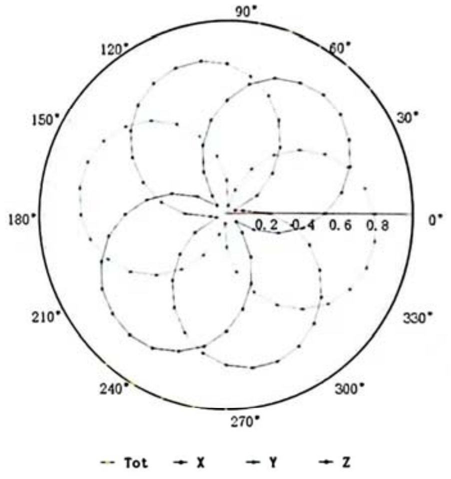
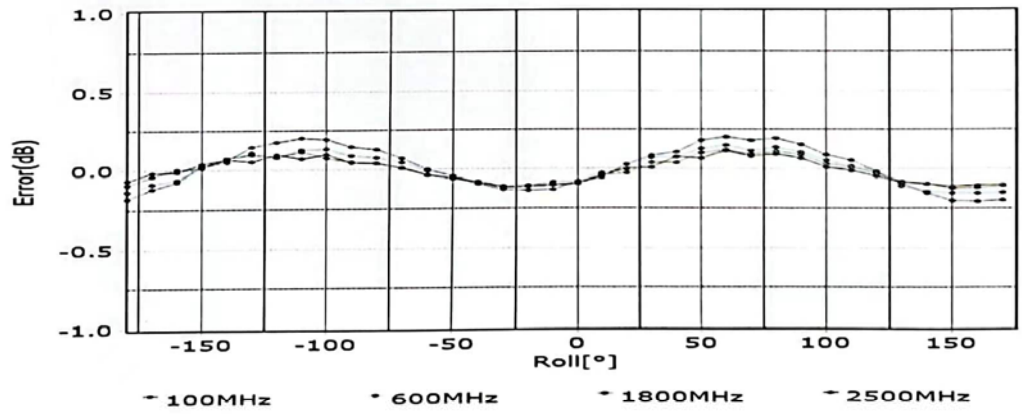
Receiving Pattern (Φ), θ=0°

f=600 MHz, TEM



f=1800 MHz, R22





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

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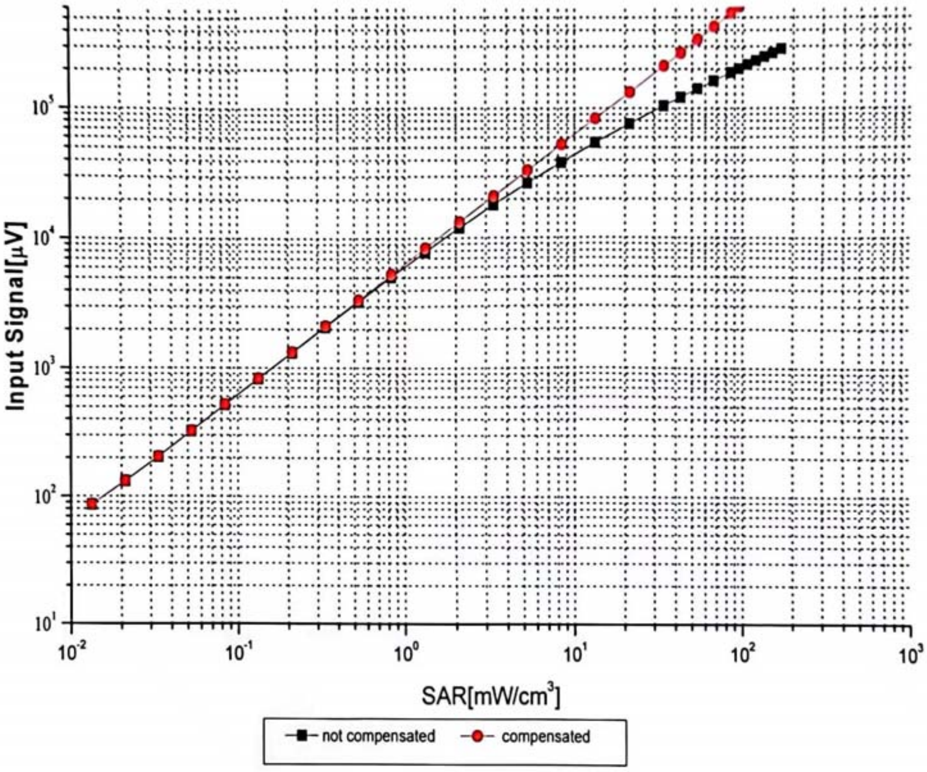
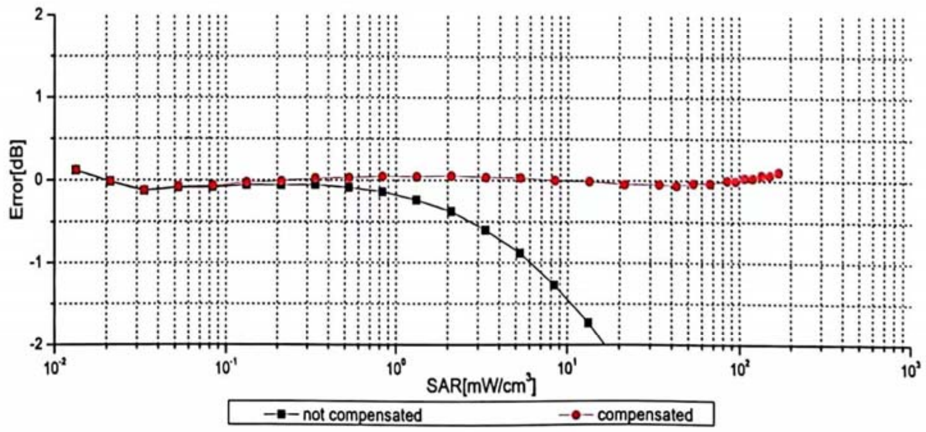
Dynamic Range f(SAR$_{head}$)
(TEM cell, f = 900 MHz)





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

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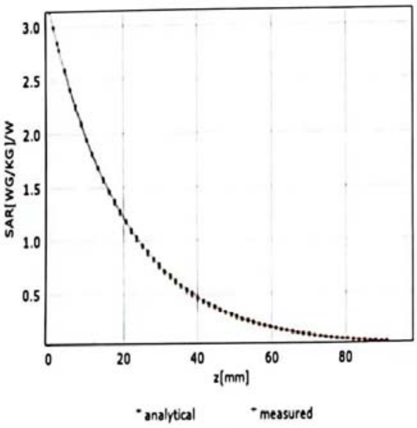
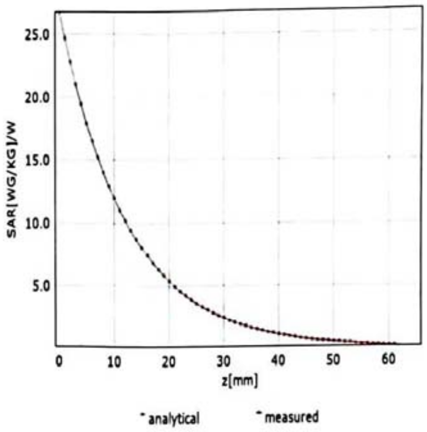
Conversion Factor Assessment

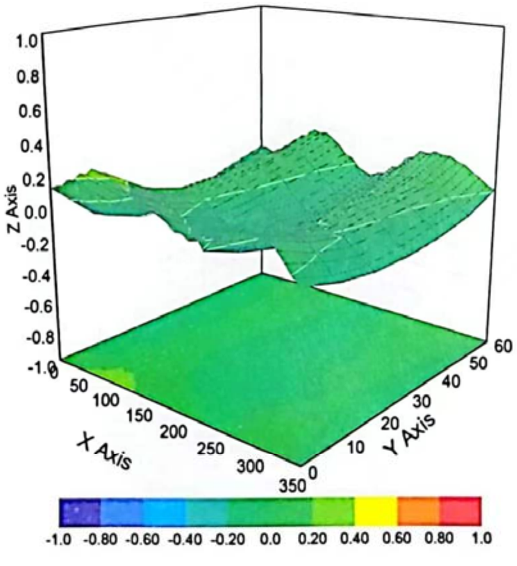
f=750 MHz,WGLS R9(H_convF)



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:7543

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	55.3
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disable
Probe Overall Length	337mm
Probe Body Diameter	9mm
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

ANNEX E: D750V3 Dipole Calibration Certificate

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Client **TA(Shanghai)** **Certificate No: Z20-60299**

CALIBRATION CERTIFICATE

Object	D750V3 - SN: 1045
Calibration Procedure(s)	FF-Z11-003-01 Calibration Procedures for dipole validation kits
Calibration date:	August 28, 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	106276	12-May-20 (CTTL, No.J20X02965)	May-21
Power sensor NRP6A	101369	12-May-20 (CTTL, No.J20X02965)	May-21
Reference Probe EX3DV4	SN 3617	30-Jan-20(SPEAG,No.EX3-3617_Jan20)	Jan-21
DAE4	SN 771	10-Feb-20(CTTL-SPEAG,No.Z20-60017)	Feb-21
Secondary Standards	**ID #**	**Cal Date(Calibrated by, Certificate No.)**	**Scheduled Calibration**
Signal Generator E4438C	MY49071430	25-Feb-20 (CTTL, No.J20X00516)	Feb-21
NetworkAnalyzer E5071C	MY46110673	10-Feb-20 (CTTL, No.J20X00515)	Feb-21

	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, 2020

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

b) IEC 62209-1, "Measurement procedure for assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices- Part 1: Device used next to the ear (Frequency range of 300MHz to 6GHz)", July 2016

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

d) KDB865664, SAR Measurement Requirements for 100 MHz to 6 GHz

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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

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Measurement Conditions

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

DASY Version	DASY52	V52.10.4
Extrapolation	Advanced Extrapolation	
Phantom	Triple Flat Phantom 5.1C	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.3 ± 6 %	0.87 mho/m ± 6 %
Head TSL temperature change during test	<1.0 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.07 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**8.37 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	1.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**5.57 W/kg ± 18.7 % (*k*=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	54.4 ± 6 %	0.94 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	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**8.58 W/kg ± 18.8 % (*k*=2)**
SAR averaged over 10 cm^3 (10 g) of Body TSL	Condition	
SAR measured	250 mW input power	1.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**5.70 W/kg ±18.7 % (*k*=2)**

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Appendix (Additional assessments outside the scope of CNAS L0570)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.3Ω- 2.29jΩ
Return Loss	- 26.6dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.7Ω- 4.58jΩ
Return Loss	- 25.6dB

General Antenna Parameters and Design

Electrical Delay (one direction)	0.900 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: 08.28.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1045

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 750 MHz; σ = 0.873 S/m; ε_r = 41.28; ρ = 1000 kg/m^3

Phantom section: Right Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(10.07, 10.07, 10.07) @ 750 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 54.97 V/m; Power Drift = -0.02 dB

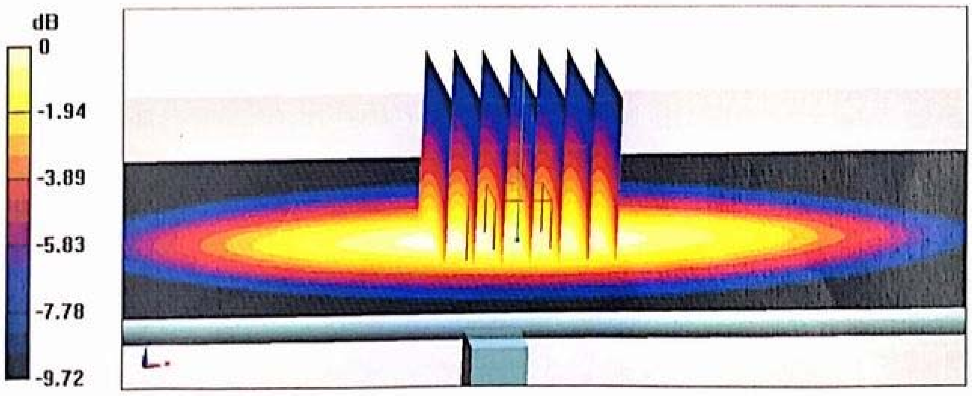
Peak SAR (extrapolated) = 3.00 W/kg

SAR(1 g) = 2.07 W/kg; SAR(10 g) = 1.38 W/kg

Smallest distance from peaks to all points 3 dB below: Larger than measurement grid

Ratio of SAR at M2 to SAR at M1 = 68.7%

Maximum value of SAR (measured) = 2.71 W/kg



0 dB = 2.71 W/kg = 4.33 dBW/kg

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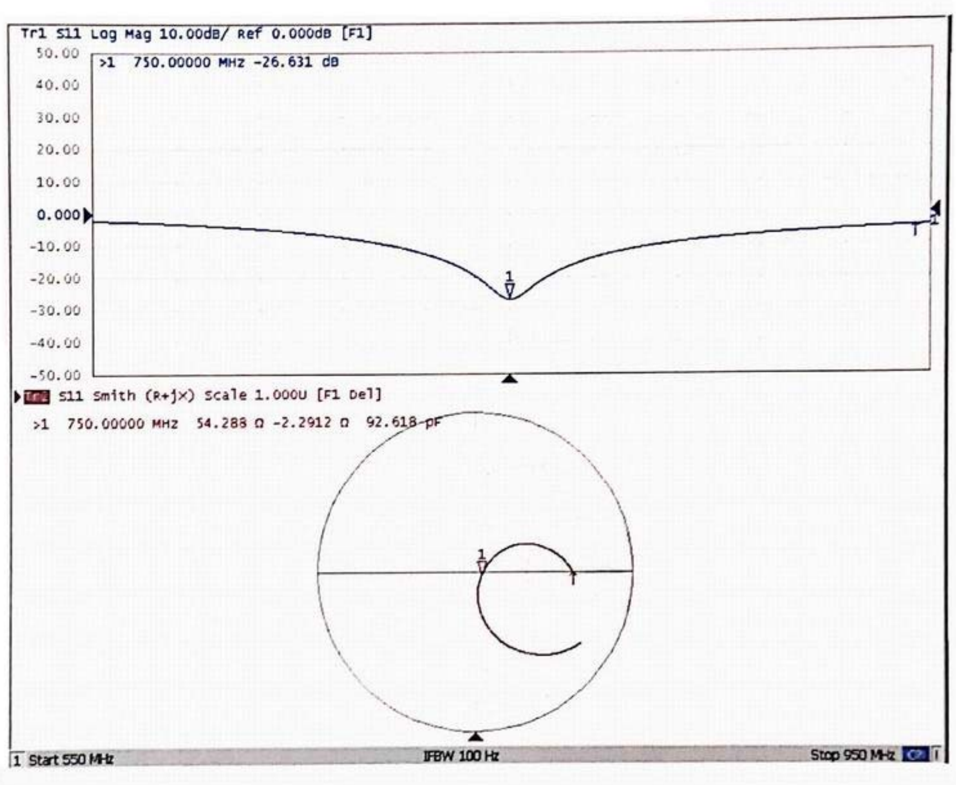
Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL Date: 08.28.2020

Test Laboratory: CTTL, Beijing, China

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1045

Communication System: UID 0, CW; Frequency: 750 MHz; Duty Cycle: 1:1

Medium parameters used: f = 750 MHz; σ = 0.94 S/m; ε_r = 54.36; ρ = 1000 kg/m^3

Phantom section: Center Section

DASY5 Configuration:

- Probe: EX3DV4 - SN3617; ConvF(9.8, 9.8, 9.8) @ 750 MHz; Calibrated: 2020-01-30
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn771; Calibrated: 2020-02-10
- Phantom: MFP_V5.1C (20deg probe tilt); Type: QD 000 P51 Cx; Serial: 1062
- Measurement SW: DASY52, Version 52.10 (4); SEMCAD X Version 14.6.14 (7483)

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

Reference Value = 53.84 V/m; Power Drift = -0.02 dB

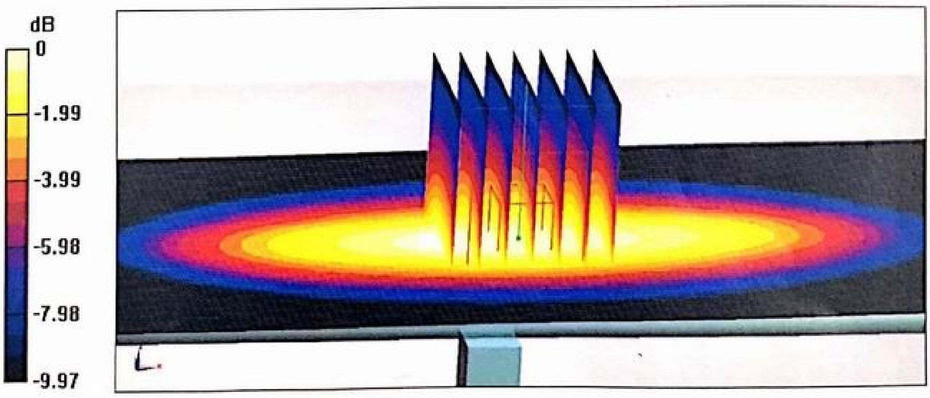
Peak SAR (extrapolated) = 3.14 W/kg

SAR(1 g) = 2.12 W/kg; SAR(10 g) = 1.41 W/kg

Smallest distance from peaks to all points 3 dB below = 18.4 mm

Ratio of SAR at M2 to SAR at M1 = 67.9%

Maximum value of SAR (measured) = 2.80 W/kg



0 dB = 2.80 W/kg = 4.47 dBW/kg

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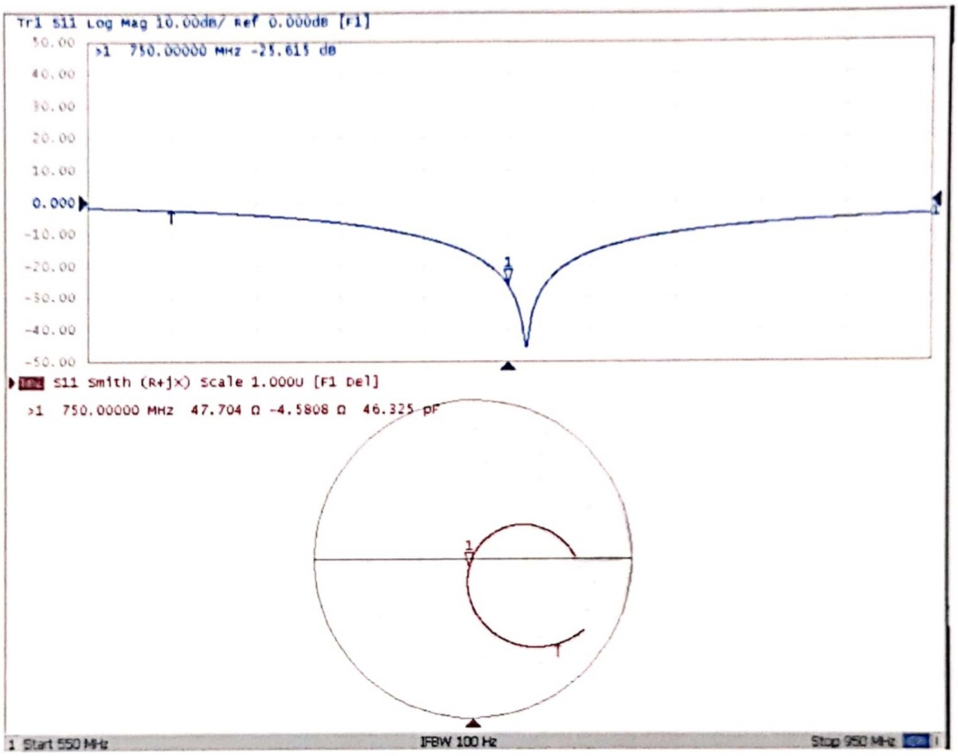
Impedance Measurement Plot for Body TSL



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