FCC SAR Test Report

Report No.	:	**SA210125W001**
Applicant	:	**MUNIC**
Address	:	**100 Avenue de Stalingrad 94800 Villejuif – France**
Manufacturer	:	**MUNIC**
Address	:	**100 Avenue de Stalingrad 94800 Villejuif – France**
Product	:	**Telematic embedded system**
FCC ID	:	**A6GC4D-4MUSV8**
Brand	:	**Metromile/ MUNIC**
Model No.	:	**C4D-4MUSAA_V8**
Standards	:	**FCC 47 CFR Part 2 (2.1093) / IEEE C95.1:1992 / IEEE 1528:2013** **KDB 865664 D01 v01r04 / KDB 865664 D02 v01r02** **KDB 447498 D01 v06 / KDB 941225 D05 v02r05**
Sample Received Date	:	**Jan. 25, 2021**
Date of Testing	:	**Feb. 07, 2021 ~ Feb. 19, 2021**

CERTIFICATION: The above equipment have been tested by **BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's SAR characteristics under the conditions specified in this report. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product certification, approval, or endorsement by A2LA or any government agencies.

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ACCREDITED
Certificate # 3939.01

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Table of Contents

Release Control Record

Report No.	Reason for Change	Date Issued
SA210125W001	Initial release	Feb. 26, 2021

1. Summary of Maximum SAR Value

Equipment Class	Mode	Highest Reported Body SAR_{1g} (0 cm Gap) (W/kg)
PCB	LTE 2	1.11
	LTE 4	0.73
	LTE 12	0.20

Note:

1. The SAR limit **(Head & Body: SAR_{1g} 1.6 W/kg, Extremity: SAR_{10g} 4.0 W/kg)** for general population / uncontrolled exposure is specified in FCC 47 CFR part 2 (2.1093) and ANSI/IEEE C95.1-1992.

2. Description of Equipment Under Test

EUT Type	Telematic embedded system
FCC ID	A6GC4D-4MUSV8
Brand Name	Metromile/ MUNIC
Model Name	C4D-4MUSAA_V8
HW Version	HC4D-4MUSAA_V8.01
SW Version	SC4D-4MUSAA_V8.01
Tx Frequency Bands (Unit: MHz)	LTE Band 2(Cat M1) : 1850.7 ~ 1909.3 (1.4M), 1851.5 ~ 1908.5 (3M), 1852.5 ~ 1907.5 (5M), 1855 ~ 1905 (10M), 1857.5 ~ 1902.5 (15M), 1860 ~ 1900 (20M) LTE Band 4(Cat M1) : 1710.7 ~ 1754.3 (1.4M), 1711.5 ~ 1753.5 (3M), 1712.5 ~ 1752.5 (5M), 1715 ~ 1750 (10M), 1717.5 ~ 1747.5 (15M), 1720 ~ 1745 (20M) LTE Band 12(Cat M1) : 699.7 ~ 715.3 (1.4M), 700.5 ~ 714.5 (3M), 701.5 ~ 713.5 (5M), 704 ~ 711 (10M)
Uplink Modulations	LTE : QPSK, 16QAM
Maximum Tune-up Conducted Power (Unit: dBm)	Please refer to section 4.6.1 of this report.
Antenna Type	WWAN: FPC Antenna
EUT Stage	Identical Prototype

Note:

1. The above EUT information is declared by manufacturer and for more detailed features description please refers to the manufacturer's specifications or User's Manual.

2. The sample2 show in this report is verify the second sources component, More details information please refer to the Product Equivalence Declaration provided by the manufacturer.

3. SAR Measurement System

3.1 Definition of Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The SAR distribution in a biological body is complicated and is usually carried out by experimental techniques or numerical modeling. The standard recommends limits for two tiers of groups, occupational/controlled and general population/uncontrolled, based on a person's awareness and ability to exercise control over his or her exposure. In general, occupational/controlled exposure limits are higher than the limits for general population/uncontrolled.

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

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

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

SAR measurement can be related to the electrical field in the tissue by

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

Where: σ is the conductivity of the tissue, ρ is the mass density of the tissue and E is the RMS electrical field strength.

3.2 SPEAG DASY System

DASY system consists of high precision robot, probe alignment sensor, phantom, robot controller, controlled measurement server and near-field probe. The robot includes six axes that can move to the precision position of the DASY5 software defined. The DASY software can define the area that is detected by the probe. The robot is connected to controlled box. Controlled measurement server is connected to the controlled robot box. The DAE includes amplifier, signal multiplexing, AD converter, offset measurement and surface detection. It is connected to the Electro-optical coupler (ECO). The ECO performs the conversion form the optical into digital electric signal of the DAE and transfers data to the PC.

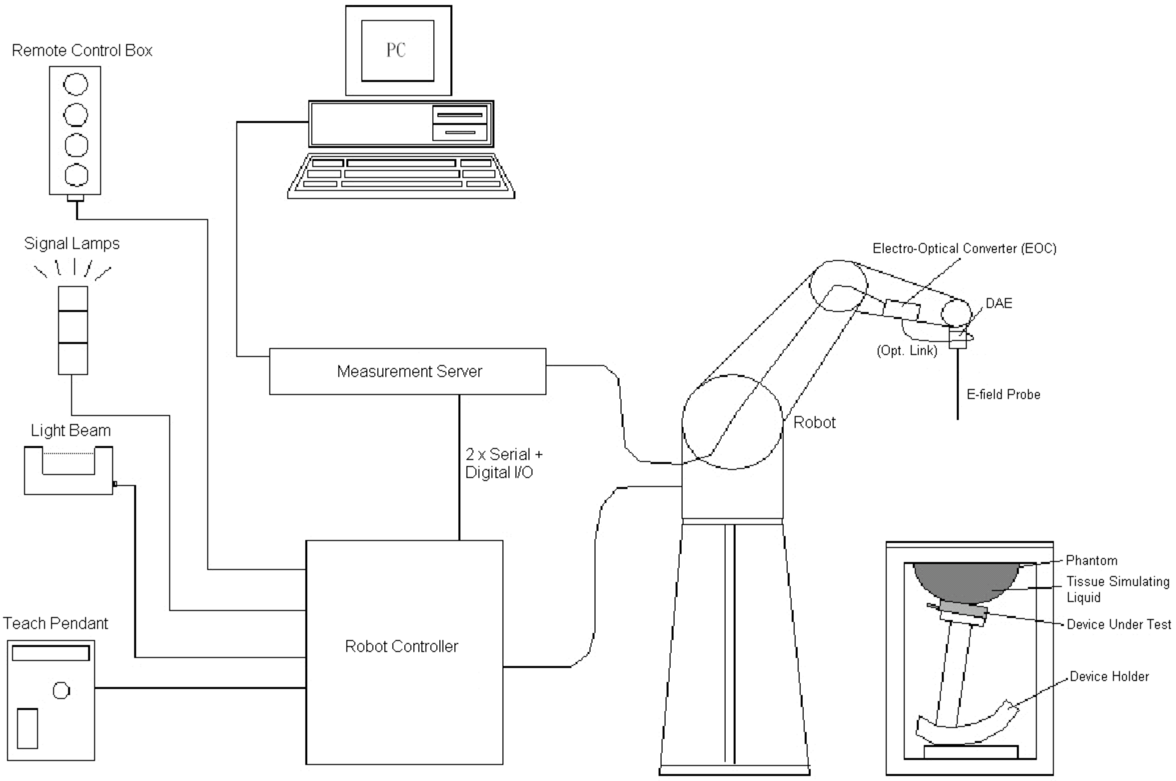


Fig-3.1 DASY System Setup

3.2.1 Robot

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

- High precision (repeatability ±0.035 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)

Fig-3.2 DASY5

3.2.2 Probes

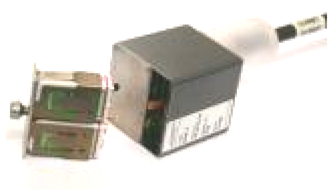
The SAR measurement is conducted with the dosimetric probe. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

Model	EX3DV4
Construction	Symmetrical design with triangular core. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 6 GHz Linearity: ± 0.2 dB
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: 20 mm) Tip diameter: 2.5 mm (Body: 12 mm) Typical distance from probe tip to dipole centers: 1 mm

Model	ES3DV3
Construction	Symmetrical design with triangular core. Interleaved sensors. Built-in shielding against static charges. PEEK enclosure material (resistant to organic solvents, e.g., DGBE).
Frequency	10 MHz to 4 GHz Linearity: ± 0.2 dB
Directivity	± 0.2 dB in HSL (rotation around probe axis) ± 0.3 dB in tissue material (rotation normal to probe axis)
Dynamic Range	5 µW/g to 100 mW/g Linearity: ± 0.2 dB
Dimensions	Overall length: 337 mm (Tip: 20 mm) Tip diameter: 3.9 mm (Body: 12 mm) Distance from probe tip to dipole centers: 2.0 mm

3.2.3 Data Acquisition Electronics (DAE)

Model	DAE3, DAE4
Construction	Signal amplifier, multiplexer, A/D converter and control logic. Serial optical link for communication with DASY embedded system (fully remote controlled). Two step probe touch detector for mechanical surface detection and emergency robot stop.
Measurement Range	-100 to +300 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset Voltage	< 5µV (with auto zero)
Input Bias Current	< 50 fA
Dimensions	60 x 60 x 68 mm



3.2.4 Phantoms

Model	Twin SAM	
Construction	The shell corresponds to the specifications of the Specific Anthropomorphic Mannequin (SAM) phantom defined in IEEE 1528 and IEC 62209-1. It enables the dosimetric evaluation of left and right hand phone usage as well as body mounted usage at the flat phantom region. A cover prevents evaporation of the liquid. Reference markings on the phantom allow the complete setup of all predefined phantom positions and measurement grids by teaching three points with the robot.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2 ± 0.2 mm (6 ± 0.2 mm at ear point)	
Dimensions	Length: 1000 mm Width: 500 mm Height: adjustable feet	
Filling Volume	approx. 25 liters	

Model	ELI	
Construction	Phantom for compliance testing of handheld and body-mounted wireless devices in the frequency range of 30 MHz to 6 GHz. ELI is fully compatible with the IEC 62209-2 standard and all known tissue simulating liquids. ELI has been optimized regarding its performance and can be integrated into our standard phantom tables. A cover prevents evaporation of the liquid. Reference markings on the phantom allow installation of the complete setup, including all predefined phantom positions and measurement grids, by teaching three points. The phantom is compatible with all SPEAG dosimetric probes and dipoles.	
Material	Vinylester, glass fiber reinforced (VE-GF)	
Shell Thickness	2.0 ± 0.2 mm (bottom plate)	
Dimensions	Major axis: 600 mm Minor axis: 400 mm	
Filling Volume	approx. 30 liters	

3.2.5 Device Holder

Model	Mounting Device	
Construction	In combination with the Twin SAM Phantom or ELI4, the Mounting Device enables the rotation of the mounted transmitter device in spherical coordinates. Rotation point is the ear opening point. Transmitter devices can be easily and accurately positioned according to IEC, IEEE, FCC or other specifications. The device holder can be locked for positioning at different phantom sections (left head, right head, flat).	
Material	POM	

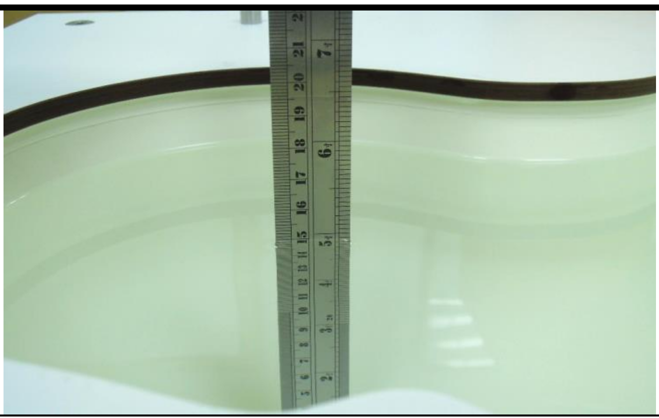
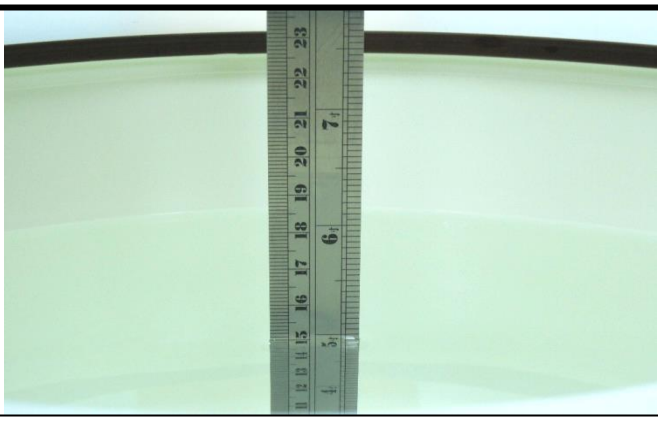
Model	Laptop Extensions Kit	
Construction	Simple but effective and easy-to-use extension for Mounting Device that facilitates the testing of larger devices according to IEC 62209-2 (e.g., laptops, cameras, etc.). It is lightweight and fits easily on the upper part of the Mounting Device in place of the phone positioner.	
Material	POM, Acrylic glass, Foam	

3.2.6 System Validation Dipoles

Model	D-Serial	
Construction	Symmetrical dipole with l/4 balun. Enables measurement of feed point impedance with NWA. Matched for use near flat phantoms filled with tissue simulating solutions.	
Frequency	750 MHz to 5800 MHz	
Return Loss	> 20 dB	
Power Capability	> 100 W (f < 1GHz), > 40 W (f > 1GHz)	

3.2.7 Tissue Simulating Liquids

For SAR measurement of the field distribution inside the phantom, the phantom must be filled with homogeneous tissue simulating liquid to a depth of at least 15 cm. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in Table-3.1.

<table>
<tr><td></td><td></td></tr>
<tr><td>Photo of Liquid Height for Head Position</td><td>Photo of Liquid Height for Body Position</td></tr>
</table>

The dielectric properties of the head tissue simulating liquids are defined in IEEE 1528, and KDB 865664 D01 Appendix A. For the body tissue simulating liquids, the dielectric properties are defined in KDB 865664 D01 Appendix A. The dielectric properties of the tissue simulating liquids were verified prior to the SAR evaluation using a dielectric assessment kit and a network analyzer.

Table-3.1 Targets of Tissue Simulating Liquid

Frequency (MHz)	Target Permittivity	Range of ±5%	Target Conductivity	Range of ±5%
For Head				
750	41.9	39.8 ~ 44.0	0.89	0.85 ~ 0.93
835	41.5	39.4 ~ 43.6	0.90	0.86 ~ 0.95
900	41.5	39.4 ~ 43.6	0.97	0.92 ~ 1.02
1450	40.5	38.5 ~ 42.5	1.20	1.14 ~ 1.26
1640	40.3	38.3 ~ 42.3	1.29	1.23 ~ 1.35
1750	40.1	38.1 ~ 42.1	1.37	1.30 ~ 1.44
1800	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
1900	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2000	40.0	38.0 ~ 42.0	1.40	1.33 ~ 1.47
2300	39.5	37.5 ~ 41.5	1.67	1.59 ~ 1.75
2450	39.2	37.2 ~ 41.2	1.80	1.71 ~ 1.89
2600	39.0	37.1 ~ 41.0	1.96	1.86 ~ 2.06
3500	37.9	36.0 ~ 39.8	2.91	2.76 ~ 3.06
5200	36.0	34.2 ~ 37.8	4.66	4.43 ~ 4.89
5300	35.9	34.1 ~ 37.7	4.76	4.52 ~ 5.00
5500	35.6	33.8 ~ 37.4	4.96	4.71 ~ 5.21
5600	35.5	33.7 ~ 37.3	5.07	4.82 ~ 5.32
5800	35.3	33.5 ~ 37.1	5.27	5.01 ~ 5.53

The following table gives the recipes for tissue simulating liquids.

Table-3.2 Recipes of Tissue Simulating Liquid

Tissue Type	Bactericide	DGBE	HEC	NaCl	Sucrose	Triton X-100	Water	Diethylene Glycol Mono-hexylether
H750	0.2	-	0.2	1.5	56.0	-	42.1	-
H835	0.2	-	0.2	1.5	57.0	-	41.1	-
H900	0.2	-	0.2	1.4	58.0	-	40.2	-
H1450	-	43.3	-	0.6	-	-	56.1	-
H1640	-	45.8	-	0.5	-	-	53.7	-
H1750	-	47.0	-	0.4	-	-	52.6	-
H1800	-	44.5	-	0.3	-	-	55.2	-
H1900	-	44.5	-	0.2	-	-	55.3	-
H2000	-	44.5	-	0.1	-	-	55.4	-
H2300	-	44.9	-	0.1	-	-	55.0	-
H2450	-	45.0	-	0.1	-	-	54.9	-
H2600	-	45.1	-	0.1	-	-	54.8	-
H3500	-	8.0	-	0.2	-	20.0	71.8	-
H5G	-	-	-	-	-	17.2	65.5	17.3

3.3 SAR System Verification

The system check verifies that the system operates within its specifications. It is performed daily or before every SAR measurement. The system check uses normal SAR measurements in the flat section of the phantom with a matched dipole at a specified distance. The system verification setup is shown as below.

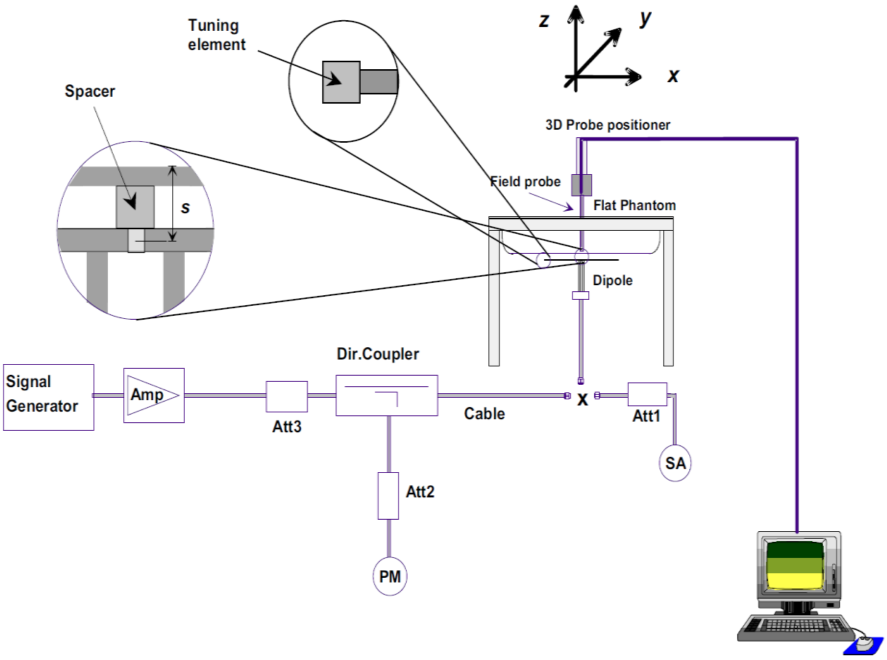


Fig-3.4 System Verification Setup

The validation dipole is placed beneath the flat phantom with the specific spacer in place. The distance spacer is touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom. The spectrum analyzer measures the forward power at the location of the system check dipole connector. The signal generator is adjusted for the desired forward power (250 mW is used for 700 MHz to 3 GHz, 100 mW is used for 3.5 GHz to 6 GHz) at the dipole connector and the power meter is read at that level. After connecting the cable to the dipole, the signal generator is readjusted for the same reading at power meter.

After system check testing, the SAR result will be normalized to 1W forward input power and compared with the reference SAR value derived from validation dipole certificate report. The deviation of system check should be within 10 %.

3.4 SAR Measurement Procedure

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

(a) Power reference measurement
(b) Area scan
(c) Zoom scan
(d) Power drift measurement

The SAR measurement procedures for each of test conditions are as follows:

(a) Make EUT to transmit maximum output power
(b) Measure conducted output power through RF cable
(c) Place the EUT in the specific position of phantom
(d) Perform SAR testing steps on the DASY system
(e) Record the SAR value

3.4.1 Area & Zoom Scan Procedure

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g. According to KDB 865664 D01, the resolution for Area and Zoom scan is specified in the table below.

Items	<= 2 GHz	2-3 GHz	3-4 GHz	4-5 GHz	5-6 GHz
Area Scan (Δx, Δy)	<= 15 mm	<= 12 mm	<= 12 mm	<= 10 mm	<= 10 mm
Zoom Scan (Δx, Δy)	<= 8 mm	<= 5 mm	<= 5 mm	<= 4 mm	<= 4 mm
Zoom Scan (Δz)	<= 5 mm	<= 5 mm	<= 4 mm	<= 3 mm	<= 2 mm
Zoom Scan Volume	>= 30 mm	>= 30 mm	>= 28 mm	>= 25 mm	>= 22 mm

Note:

When zoom scan is required and report SAR is <= 1.4 W/kg, the zoom scan resolution of Δx / Δy (2-3GHz: <= 8 mm, 3-4GHz: <= 7 mm, 4-6GHz: <= 5 mm) may be applied.

3.4.2 Volume Scan Procedure

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.

3.4.3 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 drift more than 5%, the SAR will be retested.

3.4.4 Spatial Peak SAR Evaluation

The procedure for spatial peak SAR evaluation has been implemented according to the test standard. It can be conducted for 1g and 10g, as well as for user-specific masses. The DASY software includes all numerical procedures necessary to evaluate the spatial peak SAR value.

The base for the evaluation is a "cube" measurement. The measured volume must include the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan.

The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

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

3.4.5 SAR Averaged Methods

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

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

4. SAR Measurement Evaluation

4.1 EUT Configuration and Setting

<Connections between EUT and System Simulator>

For WWAN SAR testing, the EUT was linked and controlled by base station emulator (Agilent E5515C is used for GSM/WCDMA/CDMA, and Anritsu MT8820C is used for LTE). Communication between the EUT and the emulator was established by air link. The distance between the EUT and the communicating antenna of the emulator is larger than 50 cm and the output power radiated from the emulator antenna is at least 30 dB smaller than the output power of EUT. The EUT was set from the emulator to radiate maximum output power during SAR testing.

<Considerations Related to LTE for Setup and Testing>

This device contains LTE transmitter which follows 3GPP standards, is category 3, supports both QPSK and 16QAM modulations, and supported LTE band and channel bandwidth is listed in below. The output power was tested per 3GPP TS 36.521-1 maximum transmit procedures for both QPSK and 16QAM modulation. The results please refer to section 4.6 of this report.

EUT Supported LTE Band and Channel Bandwidth						
LTE Band	BW 1.4 MHz	BW 3 MHz	BW 5 MHz	BW 10 MHz	BW 15 MHz	BW 20 MHz
2	V	V	V	V	V	V
4	V	V	V	V	V	V
12	V	V	V	V		

The LTE maximum power reduction (MPR) in accordance with 3GPP TS 36.101 is active all times during LTE operation. The allowed MPR for the maximum output power is specified in below.

Modulation	Channel Bandwidth / RB Configurations						LTE MPR Setting (dB)
	BW 1.4 MHz	BW 3 MHz	BW 5 MHz	BW 10 MHz	BW 15 MHz	BW 20 MHz	
QPSK	> 5	> 4	> 8	> 12	> 16	> 18	1
16QAM	<= 5	<= 4	<= 8	<= 12	<= 16	<= 18	1
16QAM	> 5	> 4	> 8	> 12	> 16	> 18	2

Note: MPR is according to the standard and implemented in the circuit (mandatory).

In addition, the device is compliant with additional maximum power reduction (A-MPR) requirements defined in 3GPP TS 36.101 section 6.2.4 that was disabled for all FCC compliance testing.

During LTE SAR testing, the related parameters of operating band, channel bandwidth, uplink channel number, modulation type, and RB was set in base station simulator. When the EUT has registered and communicated to base station simulator, the simulator set to make EUT transmitting the maximum radiated power.

4.2 EUT Testing Position

4.2.1 Body Exposure Conditions

This EUT was tested for five surfaces of the EUT as Front Face, Rear Face, Left Side, Right Side, Top Side. The separation distance between this EUT and phantom is 0 cm.

4.3 Tissue Verification

The measuring results for tissue simulating liquid are shown as below.

Test Date	Tissue Type	Frequency (MHz)	Liquid Temp. (℃)	Measured Conductivity (σ)	Measured Permittivity (ε_r)	Target Conductivity (σ)	Target Permittivity (ε_r)	Conductivity Deviation (%)	Permittivity Deviation (%)
Feb. 19, 2021	Head	750	22.5	0.904	41.128	0.89	41.90	1.57	-1.84
Feb. 07, 2021	Head	1750	22.4	1.326	40.765	1.37	40.10	-3.21	1.66
Feb. 08, 2021	Head	1900	22.6	1.374	39.599	1.40	40.00	-1.86	-1.00

Note:

The dielectric properties of the tissue simulating liquid must be measured within 24 hours before the SAR testing and within ±5% of the target values. Liquid temperature during the SAR testing must be within ±2 ℃.

4.4 System Verification

The measuring result for system verification is tabulated as below.

Test Date	Mode	Frequency (MHz)	1W Target SAR-1g (W/kg)	Measured SAR-1g (W/kg)	Normalized to 1W SAR-1g (W/kg)	Deviation (%)	Dipole S/N	Probe S/N	DAE S/N
Feb. 19, 2021	Head	750	8.21	2.16	8.64	5.24	1067	3873	1341
Feb. 07, 2021	Head	1750	35.60	9.61	38.44	7.98	1071	3873	1341
Feb. 08, 2021	Head	1900	39.40	10.40	41.60	5.58	5d159	3873	1341

Note:

Comparing to the reference SAR value provided by SPEAG, the validation data should be within its specification of 10 %. The result indicates the system check can meet the variation criterion and the plots can be referred to Appendix A of this report.

4.5 Maximum Output Power

4.6.1 Maximum Conducted Power

The maximum conducted average power (Unit: dBm) including tune-up tolerance is shown as below.

Mode	LTE 2	LTE 4	LTE 12
QPSK / 16QAM	24 / 24	23 / 23	24 / 24

4.6.2 Measured Conducted Power Result

The measuring conducted average power (Unit: dBm) is shown as below.

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 18607	Mid CH 18900	High CH 19193	Low CH 18607	Mid CH 18900	High CH 19193
			1850.7 MHz	1880.0 MHz	1909.3 MHz	1850.7 MHz	1880.0 MHz	1909.3 MHz
2 / 1.4M	1	0	22.92	22.89	23.10	22.86	22.76	23.01
	1	5	22.94	22.83	23.10	22.86	22.72	23.01
	3	0	22.93	22.83	23.12	22.89	22.80	23.03
	3	3	22.95	22.86	23.03	22.84	22.83	23.02
	6	0	22.93	22.80	23.07	22.81	22.77	22.97

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 18615	Mid CH 18900	High CH 19185	Low CH 18615	Mid CH 18900	High CH 19185
			1851.5 MHz	1880.0 MHz	1908.5 MHz	1851.5 MHz	1880.0 MHz	1908.5 MHz
2 / 3M	1	0	22.94	22.91	23.09	22.83	22.82	23.04
	1	5	22.90	22.84	23.10	22.83	22.75	22.99
	3	0	22.92	22.86	23.12	22.85	22.81	23.03
	3	3	22.88	22.86	23.05	22.89	22.78	23.05
	6	0	22.90	22.81	23.01	22.81	22.71	23.00

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 18625	Mid CH 18900	High CH 19175	Low CH 18625	Mid CH 18900	High CH 19175
			1852.5 MHz	1880.0 MHz	1907.5 MHz	1852.5 MHz	1880.0 MHz	1907.5 MHz
2 / 5M	1	0	22.95	22.86	23.10	22.84	22.78	23.04
	1	5	22.95	22.81	23.10	22.80	22.78	22.98
	3	0	22.95	22.86	23.09	22.85	22.79	23.00
	3	3	22.88	22.87	23.06	22.86	22.82	23.01
	6	0	22.88	22.84	23.04	22.81	22.72	22.97

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 18650	Mid CH 18900	High CH 19150	Low CH 18650	Mid CH 18900	High CH 19150
			1855.0 MHz	1880.0 MHz	1905.0 MHz	1855.0 MHz	1880.0 MHz	1905.0 MHz
2 / 10M	1	0	22.92	22.89	23.10	22.84	22.75	23.00
	1	5	22.95	22.81	23.11	22.85	22.74	23.01
	3	0	22.96	22.85	23.12	22.87	22.77	23.06
	3	3	22.94	22.81	23.06	22.90	22.76	23.06
	6	0	22.93	22.84	23.01	22.85	22.71	23.01

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 18675 1857.5 MHz	QPSK Mid CH 18900 1880.0 MHz	QPSK High CH 19125 1902.5 MHz	16QAM Low CH 18675 1857.5 MHz	16QAM Mid CH 18900 1880.0 MHz	16QAM High CH 19125 1902.5 MHz
2 / 15M	1	0	22.99	22.89	23.07	22.88	22.82	23.00
	1	5	22.93	22.86	23.06	22.84	22.75	23.01
	3	0	22.93	22.86	23.13	22.91	22.77	23.07
	3	3	22.95	22.86	23.06	22.84	22.80	23.02
	6	0	22.93	22.82	23.06	22.86	22.74	22.94

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 18700 1860.0 MHz	QPSK Mid CH 18900 1880.0 MHz	QPSK High CH 19100 1900.0 MHz	16QAM Low CH 18700 1860.0 MHz	16QAM Mid CH 18900 1880.0 MHz	16QAM High CH 19100 1900.0 MHz
2 / 20M	1	0	23.00	22.93	**23.15**	22.91	22.83	23.06
	1	5	22.97	22.89	23.12	22.88	22.80	23.03
	3	0	22.99	22.91	23.14	22.93	22.85	23.08
	3	3	22.96	22.88	23.11	22.92	22.84	23.07
	6	0	22.94	22.86	23.09	22.87	22.79	23.02

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 19957	Mid CH 20175	High CH 20393	Low CH 19957	Mid CH 20175	High CH 20393
			1710.7 MHz	1732.5 MHz	1754.3 MHz	1710.7 MHz	1732.5 MHz	1754.3 MHz
4 / 1.4M	1	0	22.22	22.15	22.18	22.23	22.10	22.16
	1	5	22.24	22.10	22.18	22.21	22.04	22.14
	3	0	22.23	22.10	22.20	22.22	22.10	22.14
	3	3	22.24	22.12	22.10	22.13	22.09	22.09
	6	0	22.22	22.06	22.14	22.18	22.11	22.12

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 19965	Mid CH 20175	High CH 20385	Low CH 19965	Mid CH 20175	High CH 20385
			1711.5 MHz	1732.5 MHz	1753.5 MHz	1711.5 MHz	1732.5 MHz	1753.5 MHz
4 / 3M	1	0	22.24	22.17	22.17	22.20	22.16	22.19
	1	5	22.20	22.11	22.18	22.18	22.07	22.12
	3	0	22.22	22.13	22.20	22.18	22.11	22.14
	3	3	22.17	22.12	22.12	22.18	22.04	22.12
	6	0	22.19	22.07	22.08	22.18	22.05	22.15

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 19975	Mid CH 20175	High CH 20375	Low CH 19975	Mid CH 20175	High CH 20375
			1712.5 MHz	1732.5 MHz	1752.5 MHz	1712.5 MHz	1732.5 MHz	1752.5 MHz
4 / 5M	1	0	22.25	22.12	22.18	22.21	22.12	22.19
	1	5	22.25	22.08	22.18	22.15	22.10	22.11
	3	0	22.25	22.13	22.17	22.18	22.09	22.11
	3	3	22.17	22.13	22.13	22.15	22.08	22.08
	6	0	22.17	22.10	22.11	22.18	22.06	22.12

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20000	Mid CH 20175	High CH 20350	Low CH 20000	Mid CH 20175	High CH 20350
			1715.0 MHz	1732.5 MHz	1750.0 MHz	1715.0 MHz	1732.5 MHz	1750.0 MHz
4 / 10M	1	0	22.22	22.15	22.18	22.21	22.09	22.15
	1	5	22.25	22.08	22.19	22.20	22.06	22.14
	3	0	22.26	22.12	22.20	22.20	22.07	22.17
	3	3	22.23	22.07	22.13	22.19	22.02	22.13
	6	0	22.22	22.10	22.08	22.22	22.05	22.16

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20025	Mid CH 20175	High CH 20325	Low CH 20025	Mid CH 20175	High CH 20325
			1717.5 MHz	1732.5 MHz	1747.5 MHz	1717.5 MHz	1732.5 MHz	1747.5 MHz
4 / 15M	1	0	22.29	22.15	22.15	22.25	22.16	22.15
	1	5	22.23	22.13	22.14	22.19	22.07	22.14
	3	0	22.23	22.13	22.21	22.24	22.07	22.18
	3	3	22.24	22.12	22.13	22.13	22.06	22.09
	6	0	22.22	22.08	22.13	22.23	22.08	22.09

LTE Band / BW	RB Size	RB Offset	QPSK			16QAM		
			Low CH 20050	Mid CH 20175	High CH 20300	Low CH 20050	Mid CH 20175	High CH 20300
			1720.0 MHz	1732.5 MHz	1745.0 MHz	1720.0 MHz	1732.5 MHz	1745.0 MHz
4 / 20M	1	0	**22.30**	22.19	22.23	22.28	22.17	22.21
	1	5	22.27	22.16	22.20	22.23	22.12	22.16
	3	0	22.29	22.18	22.22	22.26	22.15	22.19
	3	3	22.25	22.14	22.18	22.21	22.10	22.14
	6	0	22.23	22.12	22.16	22.24	22.13	22.17

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 23017 699.7 MHz	QPSK Mid CH 23095 707.5 MHz	QPSK High CH 23173 715.3 MHz	16QAM Low CH 23025 700.5 MHz	16QAM Mid CH 23095 707.5 MHz	16QAM High CH 23165 714.5 MHz
12 / 1.4M	1	0	22.63	22.63	22.72	22.63	22.57	22.69
	1	5	22.65	22.58	22.72	22.61	22.51	22.67
	3	0	22.60	22.54	22.70	22.64	22.59	22.69
	3	3	22.69	22.64	22.68	22.62	22.65	22.71
	6	0	22.66	22.57	22.71	22.63	22.63	22.70

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 23025 700.5 MHz	QPSK Mid CH 23095 707.5 MHz	QPSK High CH 23165 714.5 MHz	16QAM Low CH 23025 700.5 MHz	16QAM Mid CH 23095 707.5 MHz	16QAM High CH 23165 714.5 MHz
12 / 3M	1	0	22.65	22.65	22.71	22.60	22.63	22.72
	1	5	22.61	22.59	22.72	22.58	22.54	22.65
	3	0	22.59	22.57	22.70	22.60	22.60	22.69
	3	3	22.62	22.64	22.70	22.67	22.60	22.74
	6	0	22.63	22.58	22.65	22.63	22.57	22.73

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 23035 701.5 MHz	QPSK Mid CH 23095 707.5 MHz	QPSK High CH 23155 713.5 MHz	16QAM Low CH 23035 701.5 MHz	16QAM Mid CH 23095 707.5 MHz	16QAM High CH 23155 713.5 MHz
12 / 5M	1	0	22.66	22.60	22.72	22.61	22.59	22.72
	1	5	22.66	22.56	22.72	22.55	22.57	22.64
	3	0	22.62	22.57	22.67	22.60	22.58	22.66
	3	3	22.62	22.65	22.71	22.64	22.64	22.70
	6	0	22.61	22.61	22.68	22.63	22.58	22.70

LTE Band / BW	RB Size	RB Offset	QPSK Low CH 23060 704.0 MHz	QPSK Mid CH 23095 707.5 MHz	QPSK High CH 23130 711.0 MHz	16QAM Low CH 23060 704.0 MHz	16QAM Mid CH 23095 707.5 MHz	16QAM High CH 23130 711.0 MHz
12 / 10M	1	0	22.71	22.67	**22.77**	22.68	22.64	22.74
	1	5	22.68	22.64	22.74	22.63	22.59	22.69
	3	0	22.66	22.62	22.72	22.68	22.64	22.74
	3	3	22.70	22.66	22.76	22.70	22.66	22.76
	6	0	22.67	22.63	22.73	22.69	22.65	22.75

4.6 SAR Testing Results

4.7.1 SAR Test Reduction Considerations

<KDB 447498 D01, General RF Exposure Guidance>

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

(1) ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz

(2) ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz

(3) ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

<KDB 941225 D05, SAR Evaluation Considerations for LTE Devices>

(1) QPSK with 1 RB and 50% RB allocation

Start with the largest channel bandwidth and measure SAR, using the RB offset and required test channel combination with the highest maximum output power among RB offsets at the upper edge, middle and lower edge of each required test channel. When the reported SAR is ≤ 0.8 W/kg, testing of the remaining RB offset configurations and required test channels is not required; otherwise, SAR is required for the remaining required test channels and only for the RB offset configuration with the highest output power for that channel. When the reported SAR of a required test channel is > 1.45 W/kg, SAR is required for all three RB offset configurations for that required test channel.

(2) QPSK with 100% RB allocation

SAR is not required when the highest maximum output power for 100% RB allocation is less than the highest maximum output power in 50% and 1 RB allocations and the highest reported SAR for 1 RB and 50% RB allocation are ≤ 0.8 W/kg. Otherwise, SAR is measured for the highest output power channel; and if the reported SAR is > 1.45 W/kg, the remaining required test channels must also be tested.

(3) Higher order modulations

SAR is required only when the highest maximum output power for the configuration in the higher order modulation is > 1/2 dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

(4) Other channel bandwidth

SAR is required when the highest maximum output power of the smaller channel bandwidth is > 1/2 dB higher than the equivalent channel configurations in the largest channel bandwidth configuration or the reported SAR of a configuration for the largest channel bandwidth is > 1.45 W/kg.

4.7.2 SAR Results for Body Exposure Condition (Separation Distance is 0 cm Gap)

Plot No.	Band	Mode	Test Position	Separation Distance (cm)	Ch.	Sample	RB#	RB Offset	Max. Tune-up Power (dBm)	Measured Conducted Power (dBm)	Power Drift (dB)	Measured SAR-1g (W/kg)	Scaling Factor	Scaled SAR-1g (W/kg)
	LTE 2	QPSK20M	Front Face	0	19100	1	1	0	24.0	23.15	0.13	0.331	1.22	0.40
	LTE 2	QPSK20M	Rear Face	0	19100	1	1	0	24.0	23.15	0.14	0.336	1.22	0.41
	LTE 2	QPSK20M	Left Side	0	19100	1	1	0	24.0	23.15	0.13	0.900	1.22	1.09
	LTE 2	QPSK20M	Right Side	0	19100	1	1	0	24.0	23.15	-0.11	0.072	1.22	0.09
	LTE 2	QPSK20M	Top Side	0	19100	1	1	0	24.0	23.15	0.08	0.748	1.22	0.91
	LTE 2	QPSK20M	Left Side	0	18700	1	1	0	24.0	23.00	0.1	0.841	1.26	1.06
	LTE 2	QPSK20M	Left Side	0	18900	1	1	0	24.0	22.93	0.02	0.843	1.28	1.08
	LTE 2	QPSK20M	Top Side	0	18700	1	1	0	24.0	23.00	-0.02	0.742	1.26	0.93
	LTE 2	QPSK20M	Top Side	0	18900	1	1	0	24.0	22.93	-0.03	0.736	1.28	0.94
	LTE 2	QPSK20M	Front Face	0	19100	1	3	0	24.0	23.14	0.12	0.333	1.22	0.41
	LTE 2	QPSK20M	Rear Face	0	19100	1	3	0	24.0	23.14	-0.02	0.332	1.22	0.40
	LTE 2	QPSK20M	Left Side	0	19100	1	3	0	24.0	23.14	0.04	0.902	1.22	1.10
	LTE 2	QPSK20M	Right Side	0	19100	1	3	0	24.0	23.14	0.04	0.071	1.22	0.09
	LTE 2	QPSK20M	Top Side	0	19100	1	3	0	24.0	23.14	0.1	0.756	1.22	0.92
	LTE 2	QPSK20M	Left Side	0	18700	1	3	0	24.0	22.99	0.12	0.845	1.26	1.07
	LTE 2	QPSK20M	Left Side	0	18900	1	3	0	24.0	22.91	0.12	0.837	1.29	1.08
	LTE 2	QPSK20M	Top Side	0	18700	1	3	0	24.0	22.99	0.03	0.754	1.26	0.95
	LTE 2	QPSK20M	Top Side	0	18900	1	3	0	24.0	22.91	-0.03	0.754	1.29	0.97
1	LTE 2	QPSK20M	Left Side	0	19100	1	6	0	24.0	23.09	0.13	0.900	1.23	**1.11**
	LTE 2	QPSK20M	Top Side	0	19100	1	6	0	24.0	23.09	0.04	0.757	1.23	0.93
	LTE 2	QPSK20M	Left Side	0	19100	2	6	0	24.0	23.09	0.07	0.791	1.23	0.98
	LTE 4	QPSK20M	Front Face	0	20050	1	1	0	23.0	22.30	0.16	0.349	1.17	0.41
	LTE 4	QPSK20M	Rear Face	0	20050	1	1	0	23.0	22.30	-0.03	0.349	1.17	0.41
	LTE 4	QPSK20M	Left Side	0	20050	1	1	0	23.0	22.30	0.02	0.613	1.17	0.72
	LTE 4	QPSK20M	Right Side	0	20050	1	1	0	23.0	22.30	0.06	0.048	1.17	0.06
	LTE 4	QPSK20M	Top Side	0	20050	1	1	0	23.0	22.30	0.01	0.622	1.17	0.73
	LTE 4	QPSK20M	Front Face	0	20050	1	3	0	23.0	22.29	0.14	0.352	1.18	0.41
	LTE 4	QPSK20M	Rear Face	0	20050	1	3	0	23.0	22.29	-0.02	0.350	1.18	0.41
	LTE 4	QPSK20M	Left Side	0	20050	1	3	0	23.0	22.29	0.01	0.619	1.18	0.73
	LTE 4	QPSK20M	Right Side	0	20050	1	3	0	23.0	22.29	0.03	0.048	1.18	0.06
2	LTE 4	QPSK20M	Top Side	0	20050	1	3	0	23.0	22.29	0.12	0.624	1.18	**0.73**
	LTE 4	QPSK20M	Top Side	0	20050	2	3	0	23.0	22.29	-0.07	0.598	1.18	0.70
3	LTE 12	QPSK10M	Front Face	0	23130	1	1	0	24.0	22.77	0.06	0.150	1.33	**0.20**
	LTE 12	QPSK10M	Rear Face	0	23130	1	1	0	24.0	22.77	0.01	0.093	1.33	0.12
	LTE 12	QPSK10M	Left Side	0	23130	1	1	0	24.0	22.77	0.16	0.064	1.33	0.08
	LTE 12	QPSK10M	Right Side	0	23130	1	1	0	24.0	22.77	0.05	0.015	1.33	0.02
	LTE 12	QPSK10M	Top Side	0	23130	1	1	0	24.0	22.77	0.04	0.138	1.33	0.18
	LTE 12	QPSK10M	Front Face	0	23130	1	3	3	24.0	22.76	0	0.149	1.33	0.20
	LTE 12	QPSK10M	Rear Face	0	23130	1	3	3	24.0	22.76	0.07	0.093	1.33	0.12
	LTE 12	QPSK10M	Left Side	0	23130	1	3	3	24.0	22.76	0.16	0.065	1.33	0.09
	LTE 12	QPSK10M	Right Side	0	23130	1	3	3	24.0	22.76	0.08	0.015	1.33	0.02
	LTE 12	QPSK10M	Top Side	0	23130	1	3	3	24.0	22.76	-0.07	0.137	1.33	0.18
	LTE 12	QPSK10M	Front Face	0	23130	2	1	0	24.0	22.77	-0.09	0.149	1.33	0.20

4.7.3 SAR Measurement Variability

According to KDB 865664 D01, SAR measurement variability was assessed for each frequency band, which is determined by the SAR probe calibration point and tissue-equivalent medium used for the device measurements. When both head and body tissue-equivalent media are required for SAR measurements in a frequency band, the variability measurement procedures should be applied to the tissue medium with the highest measured SAR, using the highest measured SAR configuration for that tissue-equivalent medium. Alternatively, if the highest measured SAR for both head and body tissue-equivalent media are ≤ 1.45 W/kg and the ratio of these highest SAR values, i.e., largest divided by smallest value, is ≤ 1.10, the highest SAR configuration for either head or body tissue-equivalent medium may be used to perform the repeated measurement. These additional measurements are repeated after the completion of all measurements 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.

SAR repeated measurement procedure:

1. When the highest measured SAR is < 0.80 W/kg, repeated measurement is not required.
2. When the highest measured SAR is >= 0.80 W/kg, repeat that measurement once.
3. 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, perform a second repeated measurement.
4. If the ratio of largest to smallest SAR for the original, first and second repeated measurements is > 1.20, and the original, first or second repeated measurement is >= 1.5 W/kg, perform a third repeated measurement.

Band	Test Position	Ch.	Original Measured SAR-1g (W/kg)	1st Repeated SAR-1g (W/kg)	L/S Ratio	2nd Repeated SAR-1g (W/kg)	L/S Ratio	3rd Repeated SAR-1g (W/kg)	L/S Ratio
LTE 2	Left Side	19100	0.902	0.888	1.02	N/A	N/A	N/A	N/A

Test Engineer : Dennis Ye,

5. Calibration of Test Equipment

Equipment	Manufacturer	Model	SN	Cal. Date	Cal. Interval
System Validation Dipole	SPEAG	D750V3	1067	Aug. 28, 2020	1 Year
System Validation Dipole	SPEAG	D1750V2	1071	Aug. 29, 2020	1 Year
System Validation Dipole	SPEAG	D1900V2	5d159	Aug. 27, 2020	1 Year
Dielectric Probe Kit	SPEAG	DAK-3.5	1076	Aug. 19, 2020	1 Year
Dosimetric E-Field Probe	SPEAG	EX3DV4	3873	Aug. 27, 2020	1 Year
Data Acquisition Electronics	SPEAG	DAE4	1341	Aug. 26, 2020	1 Year
Radio Communication Analyzer	R&S	CMW500	166205	Oct. 14, 2020	1 Year
ENA Series Network Analyzer	Agilent	E5071C	MY46214638	Jun. 03, 2020	1 Year
Spectrum Analyzer	KEYSIGHT	N9010A	MY54510355	Jul. 08, 2020	1Year
MXG Analog Signal Generator	KEYSIGHT	N5183A	MY50143024	Mar. 26, 2020	1 Year
Power Sensor	R&S	NRP-Z21	105007	Oct. 14, 2020	1 Year
Power Meter	ANRITSU	ML2495A	1506002	Feb. 24, 2021	1 Year
Power Sensor	ANRITSU	MA2411B	1339353	Feb. 24, 2021	1 Year
Temp. & Humi. Recorder	CLOCK	HTC-1	157248	Jun. 07, 2020	1 Year
Electronic Thermometer	YONGFA	YF-160A	120100323	Jun. 07, 2020	1 Year
Coupler	Woken	0110A056020-10	COM27RW1A3	Jul. 01, 2020	1 Year

6. Measurement Uncertainty

DASY5 Uncertainty Budget								
Error Description	**Uncertainty Value (±%)**	**Probability**	**Divisor**	**(Ci) 1g**	**(Ci) 10g**	**Standard Uncertainty (1g) (±%)**	**Standard Uncertainty (10g) (±%)**	**(Vi) Veff**
Measurement System								
Probe Calibration	6.0	N	1	1	1	6.0	6.0	∞
Axial Isotropy	4.7	R	1.732	0.7	0.7	1.9	1.9	∞
Hemispherical Isotropy	9.6	R	1.732	0.7	0.7	3.9	3.9	∞
Boundary Effects	1.0	R	1.732	1	1	0.6	0.6	∞
Linearity	4.7	R	1.732	1	1	2.7	2.7	∞
System Detection Limits	1.0	R	1.732	1	1	0.6	0.6	∞
Modulation Response	3.2	R	1.732	1	1	1.8	1.8	∞
Readout Electronics	0.3	N	1	1	1	0.3	0.3	∞
Response Time	0.0	R	1.732	1	1	0.0	0.0	∞
Integration Time	2.6	R	1.732	1	1	1.5	1.5	∞
RF Ambient Noise	3.0	R	1.732	1	1	1.7	1.7	∞
RF Ambient Reflections	3.0	R	1.732	1	1	1.7	1.7	∞
Probe Positioner	0.4	R	1.732	1	1	0.2	0.2	∞
Probe Positioning	2.9	R	1.732	1	1	1.7	1.7	∞
Max. SAR Eval.	2.0	R	1.732	1	1	1.2	1.2	∞
Test Sample Related								
Device Positioning	3.0	N	1	1	1	3.0	3.0	35
Device Holder	3.6	N	1	1	1	3.6	3.6	12
Power Drift	5.0	R	1.732	1	1	2.9	2.9	∞
Power Scaling	0.0	R	1.732	1	1	0.0	0.0	∞
Phantom and Setup								
Phantom Uncertainty	6.1	R	1.732	1	1	3.5	3.5	∞
SAR correction	0.0	R	1.732	1	0.84	0.0	0.0	∞
Liquid Conductivity Repeatability	0.2	N	1	0.78	0.71	0.1	0.1	5
Liquid Conductivity (target)	5.0	R	1.732	0.78	0.71	2.3	2.0	∞
Liquid Conductivity (mea.)	2.5	R	1.732	0.78	0.71	1.1	1.0	∞
Temp. unc. - Conductivity	3.4	R	1.732	0.78	0.71	1.5	1.4	∞
Liquid Permittivity Repeatability	0.15	N	1	0.23	0.26	0.0	0.0	5
Liquid Permittivity (target)	5.0	R	1.732	0.23	0.26	0.7	0.8	∞
Liquid Permittivity (mea.)	2.5	R	1.732	0.23	0.26	0.3	0.4	∞
Temp. unc. - Permittivity	0.83	R	1.732	0.23	0.26	0.1	0.1	∞
Combined Std. Uncertainty						11.4%	11.4%	1013
Coverage Factor for 95 %						K=2	K=2	
Expanded STD Uncertainty						22.9%	22.7%	

Uncertainty budget for frequency range 30 MHz to 3 GHz

7. Information on the Testing Laboratories

We, BV 7LAYERS COMMUNICATIONS TECHNOLOGY (SHENZHEN) CO. LTD., were founded in 2015 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

Add: No. B102, Dazu Chuangxin Mansion, North of Beihuan Avenue, North Area, Hi-Tech Industry Park, Nanshan District, Shenzhen, Guangdong, China
Tel: 86-755-8869-6566
Fax: 86-755-8869-6577

Email: customerservice.SW@cn.bureauveritas.com
Web Site: www.bureauveritas.com

The road map of all our labs can be found in our web site also.

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Appendix A. SAR Plots of System Verification

The plots for system verification with largest deviation for each SAR system combination are shown as follows.

Test Laboratory: Bureau Veritas ADT SAR/HAC Testing Lab   Date: 2021/02/19

System Check_HSL750_210219

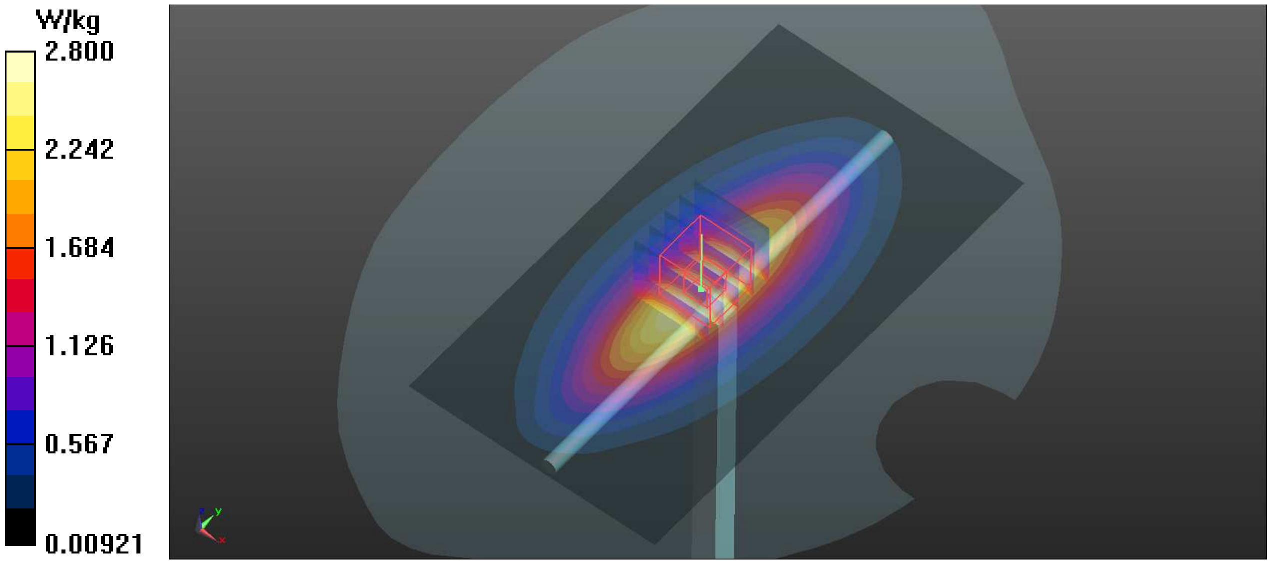
DUT: Dipole:750 MHz;Type:D750V3

Communication System: CW; Frequency: 750 MHz;Duty Cycle: 1:1
Medium: HSL750_0219 Medium parameters used: f = 750 MHz; σ = 0.904 S/m; ε_r = 41.128; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(9.79, 9.79, 9.79); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (71x131x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.80 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 55.53 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 3.18 W/kg
SAR(1 g) = 2.16 W/kg; SAR(10 g) = 1.45 W/kg
Maximum value of SAR (measured) = 2.84 W/kg



System Check_HSL1750_210207

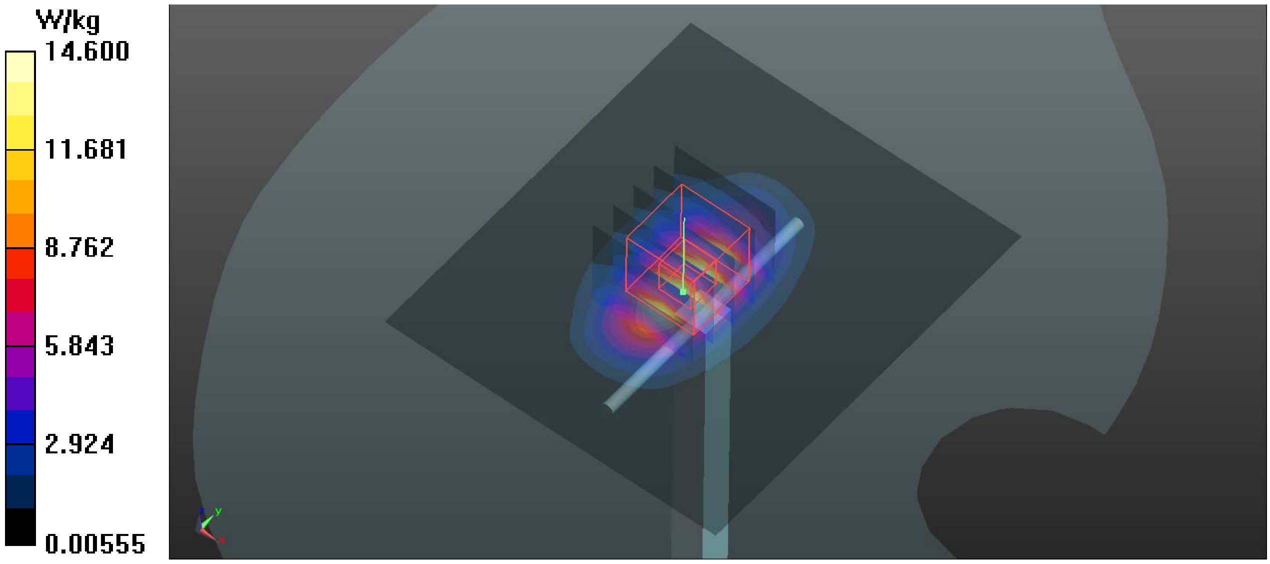
DUT: Dipole:1750 MHz;Type:D1750V2

Communication System: CW; Frequency: 1750 MHz;Duty Cycle: 1:1
Medium: HSL1750_0207 Medium parameters used: f = 1750 MHz; σ = 1.326 S/m; ε_r = 40.765; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(8.17, 8.17, 8.17); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (71x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 14.6 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 104.8 V/m; Power Drift = 0.14 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.61 W/kg; SAR(10 g) = 5.19 W/kg
Maximum value of SAR (measured) = 14.5 W/kg



System Check_HSL1900_210208

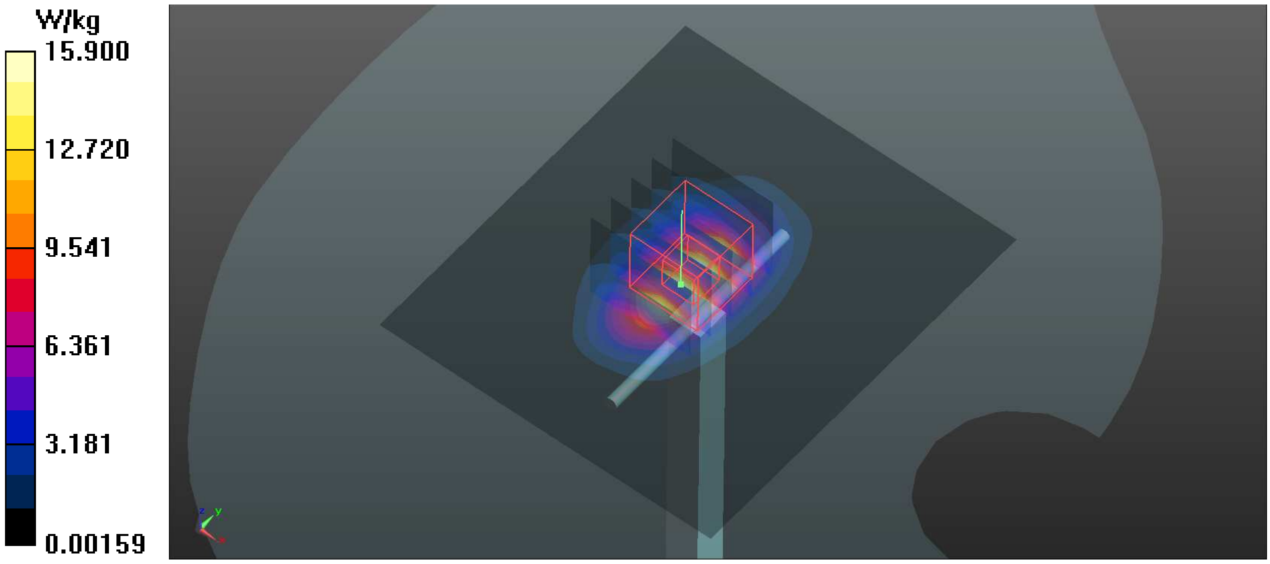
DUT: Dipole:1900MHz;Type:D1900V2

Communication System: CW; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900_0208 Medium parameters used: f = 1900 MHz; σ = 1.374 S/m; ε_r = 39.599; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.6℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(8.37, 8.37, 8.37); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Pin=250mW/Area Scan (71x81x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 15.9 W/kg

Pin=250mW/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 103.0 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 19.0 W/kg
SAR(1 g) = 10.4 W/kg; SAR(10 g) = 5.43 W/kg
Maximum value of SAR (measured) = 15.9 W/kg



Appendix B. SAR Plots of SAR Measurement

The SAR plots for highest measured SAR in each exposure configuration, wireless mode and frequency band combination, and measured SAR > 1.5 W/kg are shown as follows.

P01 LTE 2_QPSK20M_Left Side_0mm_Ch19100_6RB_OS0

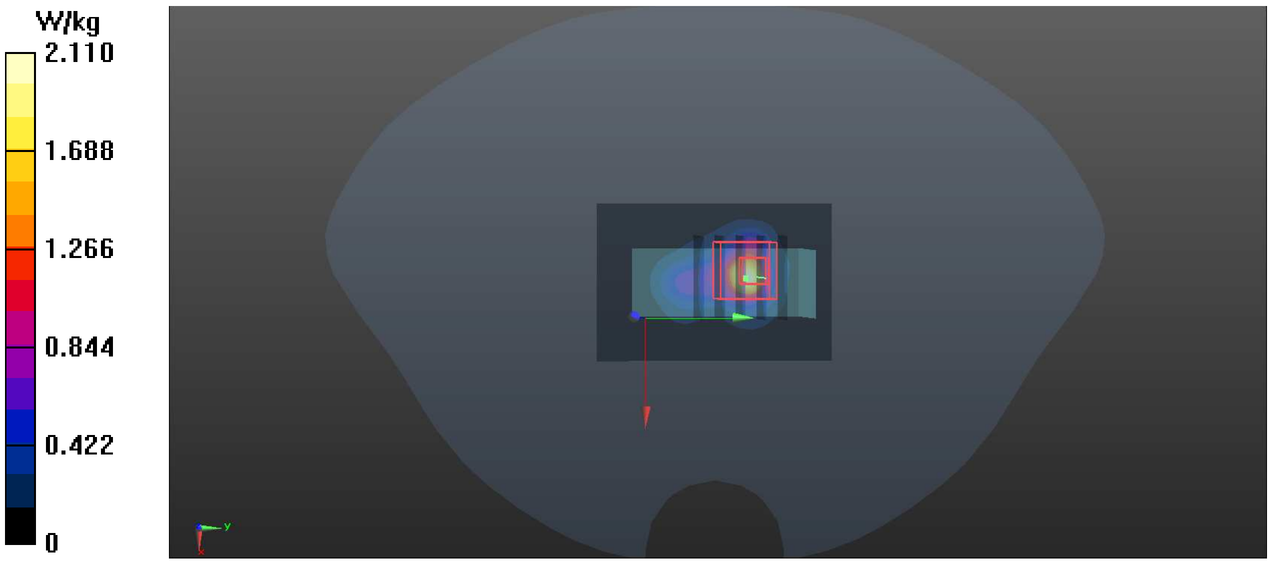
DUT: A210125W001

Communication System: LTE; Frequency: 1900 MHz;Duty Cycle: 1:1
Medium: HSL1900_0208 Medium parameters used: f = 1900 MHz; σ = 1.374 S/m; ε_r = 39.599; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.6℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(8.37, 8.37, 8.37); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

- Area Scan (41x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 2.11 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.64 V/m; Power Drift = 0.13 dB
Peak SAR (extrapolated) = 2.27 W/kg
SAR(1 g) = 0.900 W/kg; SAR(10 g) = 0.353 W/kg
Maximum value of SAR (measured) = 1.43 W/kg



P02 LTE 4_QPSK20M_Top Side_0mm_Ch20050_3RB_OS0

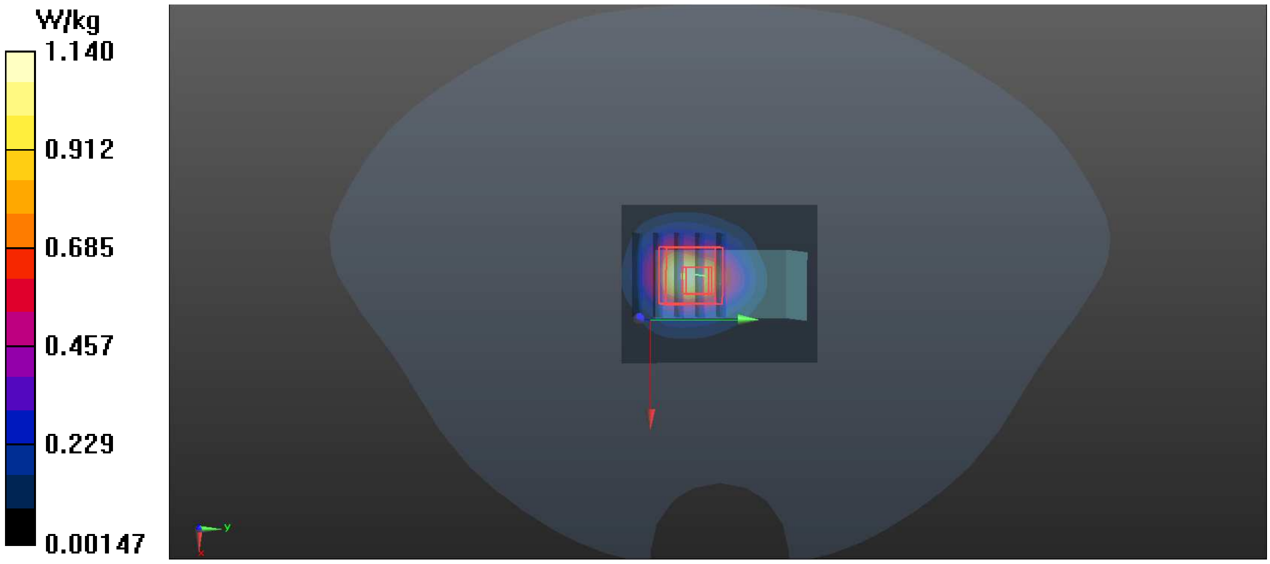
DUT: A210125W001

Communication System: LTE; Frequency: 1720 MHz;Duty Cycle: 1:1
Medium: HSL1750_0207 Medium parameters used: f = 1720 MHz; σ = 1.319 S/m; ε_r = 40.805; ρ = 1000 kg/m^3
Ambient Temperature：23.4℃; Liquid Temperature：22.4℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(8.17, 8.17, 8.17); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

- Area Scan (41x51x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 1.14 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 20.18 V/m; Power Drift = 0.12 dB
Peak SAR (extrapolated) = 1.16 W/kg
SAR(1 g) = 0.624 W/kg; SAR(10 g) = 0.324 W/kg
Maximum value of SAR (measured) = 0.958 W/kg



P03 LTE 12_QPSK10M_Front Face_0mm_Ch23130_1RB_OS0

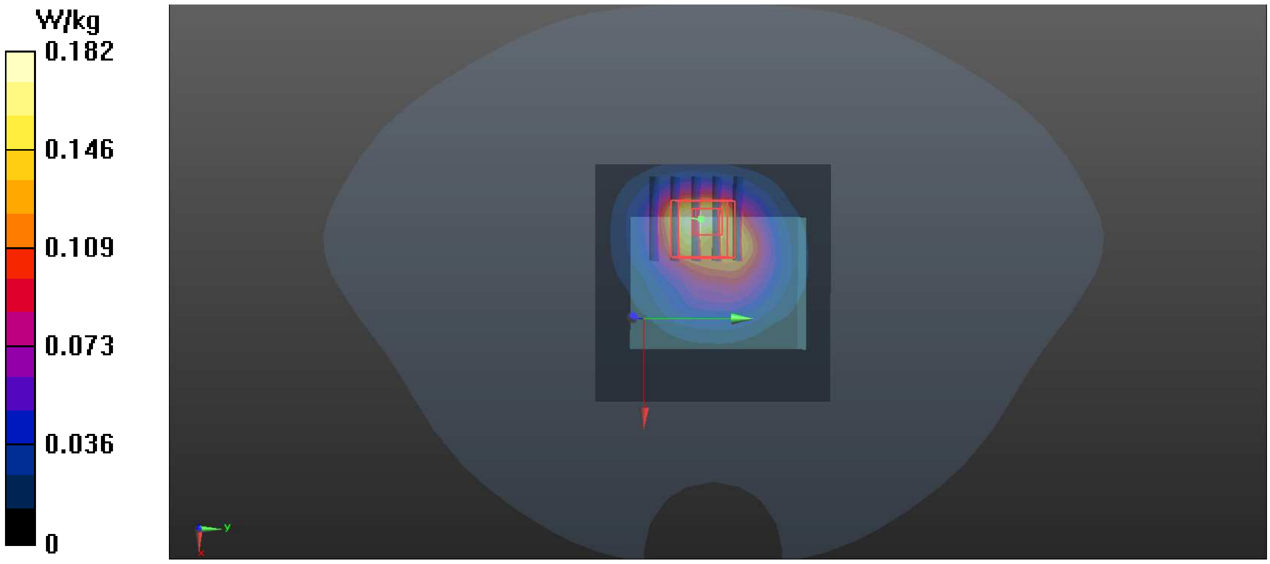
DUT: A210125W001

Communication System: LTE; Frequency: 711 MHz;Duty Cycle: 1:1
Medium: HSL750_0219 Medium parameters used: f = 711 MHz; σ = 0.867 S/m; ε_r = 41.485; ρ = 1000 kg/m^3
Ambient Temperature：23.3℃; Liquid Temperature：22.5℃

DASY5 Configuration:
- Probe: EX3DV4 - SN3873; ConvF(9.79, 9.79, 9.79); Calibrated: 2020/08/27;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1341; Calibrated: 2020/08/26
- Phantom: Front Phantom with CRP v5.0; Type: QD000P40CD; Serial: TP:1695
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

- Area Scan (61x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm
Maximum value of SAR (interpolated) = 0.182 W/kg

- Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm
Reference Value = 8.837 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 0.344 W/kg
SAR(1 g) = 0.150 W/kg; SAR(10 g) = 0.077 W/kg
Maximum value of SAR (measured) = 0.268 W/kg



Appendix C. Calibration Certificate for Probe and Dipole

The SPEAG calibration certificates are shown as follows.

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
www.speag.swiss, info@speag.swiss

1341
ADT-CN

IMPORTANT NOTICE

USAGE OF THE DAE4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is fixed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 0108

Client **ADT-CN (Auden)**

Certificate No: DAE4-1341_Aug20

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1341
Calibration procedure(s)	QA CAL-06.v30 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	August 26, 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)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Sep-19 (No:25949)	Sep-20

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	09-Jan-20 (in house check)	In house check: Jan-21
Calibrator Box V2.1	SE UMS 006 AA 1002	09-Jan-20 (in house check)	In house check: Jan-21

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	i.V.

Issued: August 26, 2020

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

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 following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

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

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

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

Calibration Factors	X	Y	Z
High Range	403.733 ± 0.02% (k=2)	403.943 ± 0.02% (k=2)	403.650 ± 0.02% (k=2)
Low Range	3.98077 ± 1.50% (k=2)	3.99231 ± 1.50% (k=2)	3.99865 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	170.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200032.99	0.21	0.00
Channel X	+ Input	20010.39	4.82	0.02
Channel X	- Input	-20003.57	1.85	-0.01
Channel Y	+ Input	200032.83	0.07	0.00
Channel Y	+ Input	20006.23	0.83	0.00
Channel Y	- Input	-20006.77	-1.16	0.01
Channel Z	+ Input	200032.43	-0.55	-0.00
Channel Z	+ Input	20004.65	-0.74	-0.00
Channel Z	- Input	-20006.21	-0.56	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2000.92	-0.31	-0.02
Channel X	+ Input	201.33	0.05	0.02
Channel X	- Input	-198.68	0.22	-0.11
Channel Y	+ Input	2001.02	-0.19	-0.01
Channel Y	+ Input	200.38	-0.80	-0.40
Channel Y	- Input	-199.65	-0.69	0.35
Channel Z	+ Input	2001.47	0.40	0.02
Channel Z	+ Input	200.69	-0.41	-0.21
Channel Z	- Input	-200.17	-1.21	0.61

2. Common mode sensitivity

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

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	12.23	10.80
	- 200	-9.82	-11.86
Channel Y	200	-6.23	-6.25
	- 200	4.89	4.21
Channel Z	200	-22.63	-22.96
	- 200	21.68	21.59

3. Channel separation

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

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	-3.95	-2.72
Channel Y	200	5.05	-	-2.13
Channel Z	200	9.91	3.43	-