

FCC SAR Measurement and Test Report

For

Global Telecom Corp

17901 Von Karman Ave, Suite 600, Irvine, California 92614 United States of
America

FCC ID: S3KGLU194ST

Test Standards:	FCC Part 2.1093 ANSI / IEEE C95.1 ::2005+A1:2010 <u>ANSI / IEEE C95.3 : 2002(R2008)</u>
Product Description:	<u>LTE USB Dongle</u>
Tested Model:	<u>GLU194ST</u>
Report No.:	<u>WTX19X07051734W</u>
Sample Received Date:	<u>2019-07-29</u>
Tested Date:	<u>2019-07-29 to 2019-08-13</u>
Issued Date:	<u>2019-08-14</u>
Tested By:	<u>Ruler Liu / Engineer</u> <i>Ruler Liu</i>
Reviewed By:	<u>Silin Chen / EMC Manager</u> <i>Silin chen</i>
Approved & Authorized By:	<u>Jandy So / PSQ Manager</u> <i>Jandyso</i>
Prepared By:	

Shenzhen SEM Test Technology Co. Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,
Bao'an District, Shenzhen, P.R.C. (518101)

Tel.: +86-755-33663308 Fax.: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM. Test Technology Co., Ltd.

TABLE OF CONTENTS

1. General Information3

 1.1 Product Description for Equipment Under Test (EUT)3

 1.2 Test Standards5

 1.3 Test Methodology5

 1.4 Test Facility5

2. Summary of Test Results6

3. Specific Absorption Rate (SAR).....7

 3.1 Introduction.....7

 3.2 SAR Definition7

4. SAR Measurement System8

 4.1 The Measurement System8

 4.2 Probe8

 4.3 Probe Calibration Process10

 4.4 Phantom11

 4.5 Device Holder11

 4.6 Test Equipment List12

5. Tissue Simulating Liquids13

 5.1 Composition of Tissue Simulating Liquid13

 5.2 Tissue Dielectric Parameters for Head and Body Phantoms14

 5.3 Tissue Calibration Result15

6. SAR Measurement Evaluation16

 6.1 Purpose of System Performance Check16

 6.2 System Setup16

 6.3 Validation Results17

7. EUT Testing Position18

 7.1 EUT Antenna Position18

 7.2 EUT Testing Position19

8. SAR Measurement Procedures20

 8.1 Measurement Procedures20

 8.2 Spatial Peak SAR Evaluation20

 8.3 Area & Zoom Scan Procedures21

 8.4 Volume Scan Procedures21

 8.5 SAR Averaged Methods21

 8.6 Power Drift Monitoring21

9. SAR Test Result22

 9.1 Conducted RF Output Power22

 9.2 Test Results for Standalone SAR Test42

10. Measurement Uncertainty45

 10.1 Uncertainty for EUT SAR Test45

 10.2 Uncertainty for System Performance Check46

Annex A. Plots of System Performance Check48

Annex B. Plots of SAR Measurement54

Annex C. EUT Photos61

Annex D. Test Setup Photos63

Annex E. Calibration Certificate66

1. General Information

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Global Telecom Corp
Address of applicant: 17901 Von Karman Ave, Suite 600, Irvine, California 92614
United States of America

Manufacturer: Global Telecom Corp
Address of manufacturer: 17901 Von Karman Ave, Suite 600, Irvine, California 92614
United States of America

General Description of EUT:	
Product Name:	LTE USB Dongle
Brand Name:	Global Telecom
Model No.:	GLU194ST
Hardware version:	/
Software version:	/
Rated Voltage:	USB DC5V
Battery:	/
Adapter Model:	/
<i>The EUT Main board support LTE Band 25/26/41 function. It is designed to enable quick LTE mobile or fixed data service deployment to the remote customers. For more information see the following datasheet.</i>	
<i>Note: The test data is gathered from a production sample provided by the manufacturer.</i>	
<i>The USB cable USB cable for testing is not influence the radiating characteristics and output power of the transmitter</i>	
<i>The USB cable USB cable for testing is 10-inches.</i>	

Technical Characteristics of EUT:	
4G	
Support Networks:	FDD-LTE, TDD-LTE
Support Band:	FDD-LTE Band 25, 26, TDD-LTE Band 41
Uplink Frequency:	FDD-LTE Band 25: Tx: 1850-1915MHz, FDD-LTE Band 26: Tx: 814-849MHz, TDD-LTE Band 41: Tx: 2496-2690MHz
Downlink Frequency:	FDD-LTE Band 25: Rx: 1930-1995MHz, FDD-LTE Band 26: Tx: 859-894MHz, TDD-LTE Band 41: Rx: 2496-2690MHz
RF Output Power:	FDD-LTE Band 25: 24.00dBm, FDD-LTE Band 26: 23.78dBm, TDD-LTE Band 41: 24.42dBm
Type of Modulation:	QPSK, 16QAM
Antenna Type:	Integral Antenna
Antenna Gain:	FDD-LTE Band 25: 2.5dBi, FDD-LTE Band 26: 1.0dBi, TDD-LTE Band 41: 3.5dBi

1.2 Test Standards

The following report is prepared on behalf of the Global Telecom Corp in accordance with FCC 47 CFR Part 2.1093, ANSI/IEEE C95.1-2005, ANSI / IEEE C95.3 :2002, IEEE 1528-2013, KDB 447498 D01 v06, and KDB 941225 D05 SAR for LTE Devices v02r05 , KDB447498 D02 SAR Procedures for Dongle Xmtr v02r01,KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02.

The objective is to determine compliance with FCC Part 2.1093 of the Federal Communication Commissions rules.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02. The public notice KDB 447498 D01 v06 for Mobile and Portable Devices RF Exposure Procedure also.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM.Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

2. Summary of Test Results

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

Frequency Band	Body (0mm Gap)	SAR _{1g} Limit (W/kg)
	Maximum SAR _{1g} (W/kg)	
FDD-LTE 25	1.370	1.6
FDD-LTE 26	0.971	1.6
TDD-LTE 41	0.436	1.6

Remark:

*The highest reported SAR values for body is **1.370W/kg**.*

The device is in compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (1.6 W/kg) specified in FCC 47 CFR Part 2.1093 and ANSI/IEEE C95.1-2005, and had been tested in accordance with the measurement methods and procedure specified in IEEE 1528-2013 and KDB 865664 D01 v01r04 and KDB 865664 D02 v01r02

3. Specific Absorption Rate (SAR)

3.1 Introduction

SAR is related to the rate at which energy is absorbed per unit mass in an object exposed to a radio field. The 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.

3.2 SAR Definition

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:

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

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

SAR measurement can be either related to the temperature elevation in tissue by

$$\text{SAR} = C \left(\frac{\delta T}{\delta t} \right)$$

Where: C is the specific heat capacity, δT is the temperature rise and δt is the exposure duration, or related to the electrical field in the tissue by

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

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

However for evaluating SAR of low power transmitter, electrical field measurement is typically applied.

4. SAR Measurement System

4.1 The Measurement System

Comosar is a system that is able to determine the SAR distribution inside a phantom of human being according to different standards. The Comosar system consists of the following items:

- Main computer to control all the system
- 6 axis robot
- Data acquisition system
- Miniature E-field probe
- Phone holder
- Head simulating tissue

The following figure shows the system.



The EUT under test operating at the maximum power level is placed in the phone holder, under the phantom, which is filled with head simulating liquid. The E-Field probe measures the electric field inside the phantom. The OpenSAR software computes the results to give a SAR value in a 1g or 10g mass.

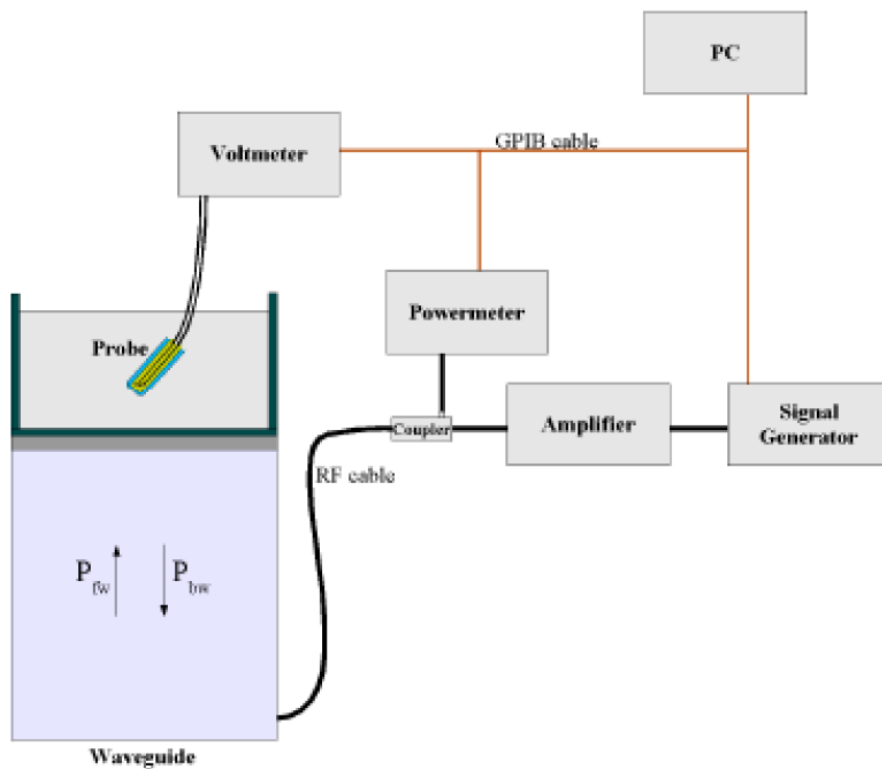
4.2 Probe

For the measurements the Specific Dosimetric E-Field Probe SSE5 SN 09/13 EP168 with following specifications is used

- Dynamic range: 0.01-100 W/kg
- Probe Length: 330 mm
- Length of Individual Dipoles: 4.5 mm
- Maximum external diameter: 8 mm
- Probe Tip External Diameter : 5 mm
- Distance between dipoles / probe extremity: 2.7mm

- Probe linearity: <0.25 dB
 - Axial Isotropy: <0.25 dB
 - Spherical Isotropy: <0.50 dB
 - Calibration range: 700 to 3000MHz for head & body simulating liquid.
- Angle between probe axis (evaluation axis) and surface normal line: less than 30°

Probe calibration is realized, in compliance with EN 62209-1 and IEEE 1528 STD, with CALISAR, Antenna proprietary calibration system. The calibration is performed with the EN 62209-1 annexe technique using reference guide at the five frequencies.



$$SAR = \frac{4(P_{fw} - P_{bw})}{ab\delta} \cos^2\left(\pi \frac{y}{a}\right) e^{-2z/\delta}$$

Where :

P_{fw} = Forward Power

P_{bw} = Backward Power

a and b = Waveguide dimensions

δ = Skin depth

Keithley configuration:

Rate = Medium; Filter = ON; RDGS = 10; Filter type = Moving Average; Range auto after each calibration, a SAR measurement is performed on a validation dipole and compared with a NPL calibrated probe, to verify it.

The calibration factors, CF(N), for the 3 sensors corresponding to dipole 1, dipole 2 and dipole 3 are:

$$CF(N)=SAR(N)/V_{lin}(N) \quad (N=1,2,3)$$

The linearised output voltage $V_{lin}(N)$ is obtained from the displayed output voltage $V(N)$ using

$$V_{lin}(N)=V(N)*(1+V(N)/DCP(N)) \quad (N=1,2,3)$$

where DCP is the diode compression point in mV.

4.3 Probe Calibration Process

Dosimetric Assessment Procedure

Each E-Probe/Probe Amplifier combination has unique calibration parameters. SATIMO Probe calibration procedure is conducted to determine the proper amplifier settings to enter in the probe parameters. The amplifier settings are determined for a given frequency by subjecting the probe to a known E-field density (1 mW/cm²) using an with CALISAR, Antenna proprietary calibration system.

Free Space Assessment Procedure

The free space E-field from amplified probe outputs is determined in a test chamber. This calibration can be performed in a TEM cell if the frequency is below 1 GHz and in a waveguide or other methodologies 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 rotated 360 degrees until the three channels show the maximum reading. The power density readings equates to 1mW/cm².

Temperature Assessment Procedure

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

Where:

$$SAR = C \frac{\Delta T}{\Delta t}$$

Δt = exposure time (30 seconds),

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

ΔT = temperature increase due to RF exposure.

SAR is proportional to $\Delta T / \Delta t$, the initial rate of tissue heating, before thermal diffusion takes place. The electric field in the simulated tissue can be used to estimate SAR by equating the thermally derived SAR to that with the E- field component.

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

Where:

σ = simulated tissue conductivity,

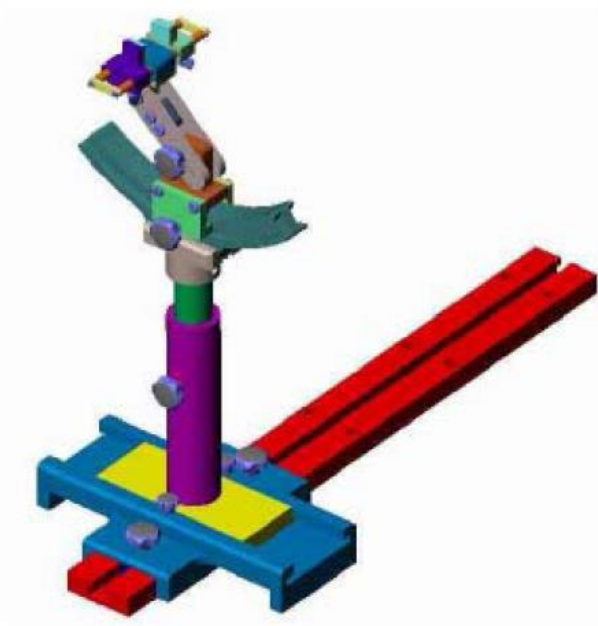
ρ = Tissue density (1.25 g/cm³ for brain tissue)

4.4 Phantom

For the measurements the Specific Anthropomorphic Mannequin (SAM) defined by the IEEE SCC-34/SC2 group is used. The phantom is a polyurethane shell integrated in a wooden table. The thickness of the phantom amounts to 2mm +/- 0.2mm. It enables the dosimetric evaluation of left and right phone usage and includes an additional flat phantom part for the simplified performance check. The phantom set-up includes a cover, which prevents the evaporation of the liquid.

4.5 Device Holder

The positioning system allows obtaining cheek and tilting position with a very good accuracy. In compliance with CENELEC, the tilt angle uncertainty is lower than 1°.



System Material	Permittivity	Loss Tangent
Delrin	3.7	0.005

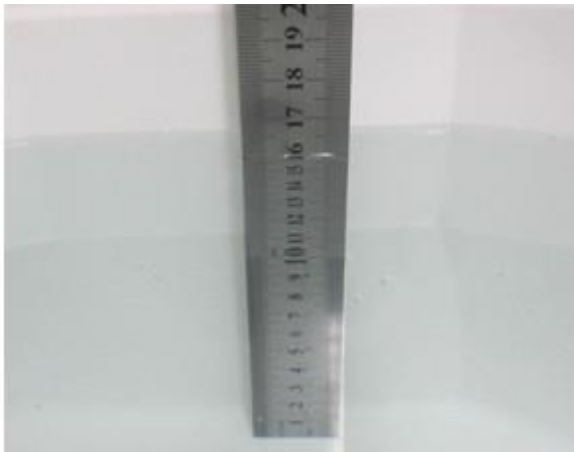
4.6 Test Equipment List

Description	Manufacturer	Model	Serial Number	Cal. Date	Due. Date
E-Field Probe	MVG	SSE5	SN 09/13 EP168	2019-05-22	2020-05-21
835MHz Dipole	MVG	SID835	SN 47/12 DIP 0G835-204	2019-03-16	2020-03-15
1900MHz Dipole	MVG	SID1900	SN 47/12 DIP 1G900-207	2019-03-16	2020-03-15
2600MHz Dipole	MVG	SID2600	SN 13/15 DIP 2G600-365	2019-03-16	2020-03-15
Dielectric Probe Kit	SATIMO	SCLMP	SN 47/12 OCPG49	2019-03-16	2020-03-15
SAM Phantom	SATIMO	SAM	SN/ 47/12 SAM95	N/A	N/A
MULTIMETER	KEITHLEY	Keithley 2000	4006367	2019-04-30	2020-04-29
Signal Generator	Rohde & Schwarz	SMR20	100047	2019-04-30	2020-04-29
Universal Tester	Rohde & Schwarz	CMU200	112012	2019-04-30	2020-04-29
Communications Tester	Rohde & Schwarz	CMW500	148650	2019-04-30	2020-04-29
Network Analyzer	HP	8753C	SEMT-1064	2019-04-30	2020-04-29
Directional Couplers	Agilent	778D	20160	2019-04-30	2020-04-29

5. Tissue Simulating Liquids

5.1 Composition of Tissue Simulating Liquid

For the measurement of the field distribution inside the SAM phantom with SMTIMO, the phantom must be filled with around 25 liters of homogeneous body tissue simulating liquid. For head SAR testing, the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15 cm. For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15 cm. Please see the following photos for the liquid height.



Liquid Height for Head SAR



Liquid Height for Body SAR

The Composition of Tissue Simulating Liquid

Frequency (MHz)	Water (%)	Salt (%)	Sugar (%)	HEC (%)	Preventol (%)	DGBE (%)
Body						
835	50.8	0.9	48.1	0.1	0.1	0
1900	70.2	0.4	0	0	0	29.4
2600	68.2	0.1	0	0	0	31.7

5.2 Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE SCC-34/SC-2 in P1528 have been incorporated in the following table. These head parameters are derived from planar layer models simulating the highest expected SAR for the dielectric properties and tissue thickness variations in a human head. Other head and body tissue parameters that have not been specified in P1528 are derived from the tissue dielectric parameters computed from the 4-Cole-Cole equations described in Reference [12] and extrapolated according to the head parameters specified in P1528.

Target Frequency (MHz)	Head		Body	
	Conductivity (σ)	Permittivity (ϵ_r)	Conductivity (σ)	Permittivity (ϵ_r)
150	0.76	52.3	0.80	61.9
300	0.87	45.3	0.92	58.2
450	0.87	43.5	0.94	56.7
750	0.89	41.9	0.96	55.5
835	0.90	41.5	0.97	55.2
900	0.97	41.5	1.05	55.0
915	0.98	41.5	1.06	55.0
1450	1.20	40.5	1.30	54.0
1610	1.29	40.3	1.40	53.8
1750	1.37	40.1	1.49	53.4
1800-2000	1.40	40.0	1.52	53.3
2450	1.80	39.2	1.95	52.7
3000	2.40	38.5	2.73	52.0
5800	5.27	35.3	6.00	48.2

5.3 Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using COMOSAR Dielectric Probe Kit and an Agilent Network Analyzer.

Calibration Result for Dielectric Parameters of Tissue Simulating Liquid

Body Tissue Simulating Liquid									
Freq. MHz.	Temp. (°C)	Conductivity			Permittivity			Limit (%)	Date
		Reading (σ)	Target (σ)	Delta (%)	Reading (ϵ_r)	Target (ϵ_r)	Delta (%)		
835	21.2	0.95	0.97	-2.06	54.85	55.20	-0.63	±5	2019-08-12
1900	21.3	1.50	1.52	-1.32	52.42	53.30	-1.65	±5	2019-08-12
2600	21.3	2.12	2.16	-1.85	52.24	52.50	-0.50	±5	2019-08-13

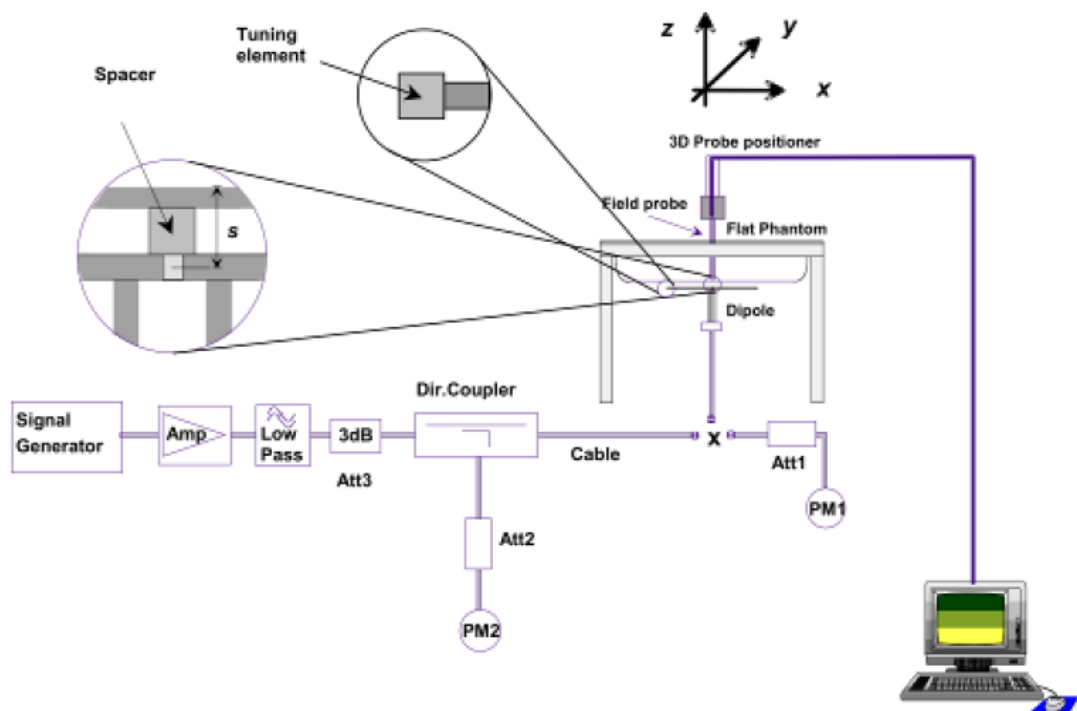
6. SAR Measurement Evaluation

6.1 Purpose of System Performance Check

The system performance check verifies that the system operates within its specifications. System and operator errors can be detected and corrected. It is recommended that the system performance check be performed prior to any usage of the system in order to guarantee reproducible results. The system performance check uses normal SAR measurements in a simplified setup with a well characterized source. This setup was selected to give a high sensitivity to all parameters that might fail or vary over time. The system check does not intend to replace the calibration of the components, but indicates situations where the system uncertainty is exceeded due to drift or failure.

6.2 System Setup

In the simplified setup for system evaluation, the EUT is replaced by a calibrated dipole and the power source is replaced by a continuous wave which comes from a signal generator at frequency 835 MHz, 1900 MHz and 2600 MHz. The calibrated dipole must be placed beneath the flat phantom section of the SAM twin phantom with the correct distance holder. The distance holder should touch the phantom surface with a light pressure at the reference marking and be oriented parallel to the long side of the phantom.



System Verification Setup Block Diagram



Setup Photo of Dipole Antenna

The output power on dipole port must be calibrated to 24 dBm(250 mW) before dipole is connected.

6.3 Validation Results

Comparing to the original SAR value provided by SATIMO, the validation data should be within its specification of 10 %. Table 6.1 shows the target SAR and measured SAR after normalized to 1W input power. The table below indicates the system performance check can meet the variation criterion.

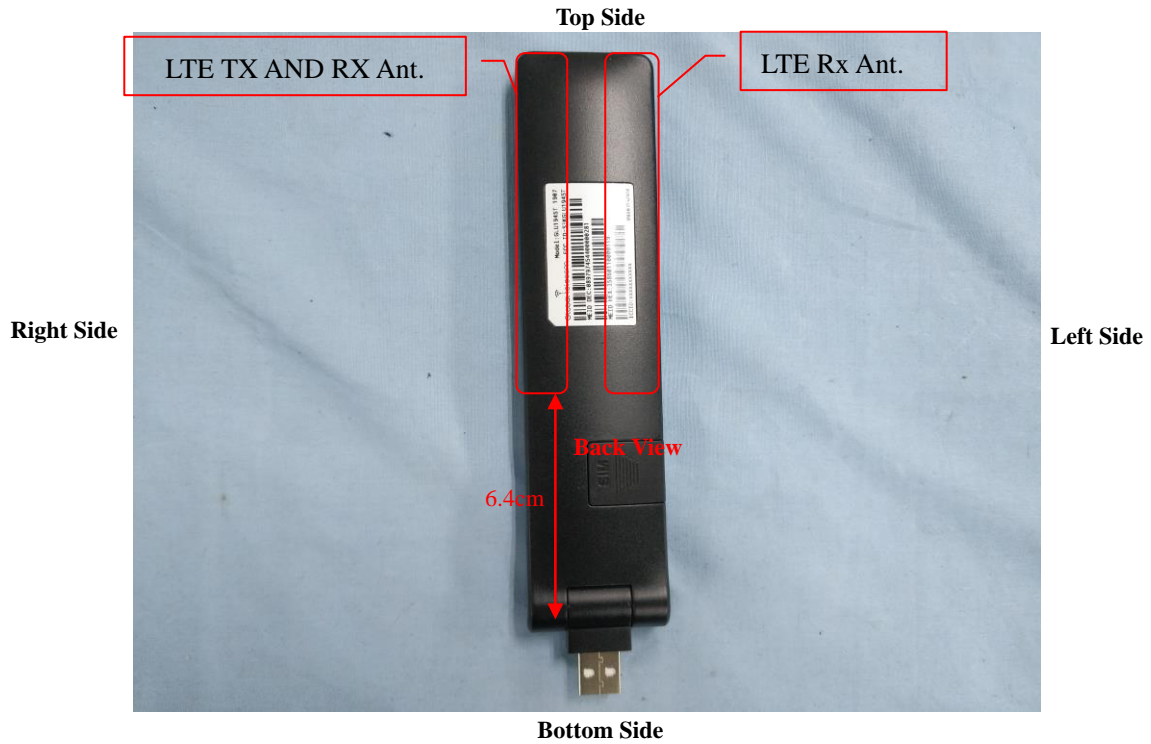
Frequency	Targeted SAR _{1g}	Measured SAR _{1g}	Normalized SAR _{1g}	Tolerance
MHz	(W/kg)	(W/kg)	(W/kg)	(%)
Body				
835	9.38	2.35	9.4	0.21
1900	39.10	9.78	39.12	0.05
2600	53.89	13.43	53.72	-0.32

Targeted and Measurement SAR

Please refer to Annex A for the plots of system performance check.

7. EUT Testing Position

7.1 EUT Antenna Position



Block Diagram for EUT Antenna Position

7.2 EUT Testing Position

Exclusion Distance Calculation				
Frequency Bands	Service	Maximum Tune-up Power	Average Power	Exclusion Distance
LTE_ Band 25	QPSK(20 MHz)	24.5dBm	24.5dBm	70mm
LTE_ Band 26	QPSK(15 MHz)	24.5dBm	24.5dBm	70mm
LTE_ Band 41	QPSK(20 MHz)	24.5dBm	24.5dBm	70mm

Note: Refer to Chapter 9.1 Conducted RF Output Power

Remark:

- Referring to KDB 447498 D01v06, the distance of the antennas to all adjacent edges SAR test exclusion for adjacent edges.

Body mode SAR assessments are required for this device. This EUT was tested in different positions for different SAR test modes, more information as below:

Body SAR tests, Test distance: 5mm						
Antennas	Front	Back	Right Side	Left Side	Top Side	Bottom Side
WWAN	Yes	Yes	Yes	Yes	Yes	Yes

- Referring to KDB 447498 D01,v06, Devices that are designed to operate on the body of users using lanyards and straps or without requiring additional body-worn accessories must be tested for SAR compliance using a conservative minimum test separation distance ≤ 5 mm to support compliance, so the test separation distances is 5 mm.

Please refer to Annex D for the EUT test setup photos.

8. SAR Measurement Procedures

8.1 Measurement Procedures

The measurement procedures are as follows:

- (a) Use base station simulator (if applicable) or engineering software to transmit RF power continuously (continuous Tx) in the highest power channel.
- (b) Keep EUT to radiate maximum output power or 100% factor (if applicable)
- (c) Measure output power through RF cable and power meter.
- (d) Place the EUT in the positions as Annex D demonstrates.
- (e) Set scan area, grid size and other setting on the SATIMO software.
- (f) Measure SAR results for the highest power channel on each testing position.
- (g) Find out the largest SAR result on these testing positions of each band
- (h) Measure SAR results for other channels in worst SAR testing position if the SAR of highest power channel is larger than 0.8 W/kg

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

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

8.2 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 SATIMO 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. 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
- (c) Generation of a high-resolution mesh within the measured volume
- (d) Interpolation of all measured values from the measurement grid to the high-resolution grid
- (e) Extrapolation of the entire 3D 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

8.3 Area & Zoom Scan Procedures

First Area Scan is used to locate the approximate location(s) of the local peak SAR value(s). The measurement grid within an Area Scan is defined by the grid extent, grid step size and grid offset. Next, in order to determine the EM field distribution in a three-dimensional spatial extension, Zoom Scan is required. The Zoom Scan measures 5x5x7 points with step size 8, 8 and 5 mm for 300 MHz to 3 GHz, and 8x8x8 points with step size 4, 4 and 2.5 mm for 3 GHz to 6 GHz. The Zoom Scan is performed around the highest E-field value to determine the averaged SAR-distribution over 10 g.

8.4 Volume Scan Procedures

The volume scan is used for assess overlapping SAR distributions for antennas transmitting in different frequency bands. It is equivalent to an oversized zoom scan used in standalone measurements. The measurement volume will be used to enclose all the simultaneous transmitting antennas. For antennas transmitting simultaneously in different frequency bands, the volume scan is measured separately in each frequency band. In order to sum correctly to compute the 1g aggregate SAR, the EUT remain in the same test position for all measurements and all volume scan use the same spatial resolution and grid spacing (step-size is 4, 4 and 2.5 mm). When all volume scan were completed, the software can combine and subsequently superpose these measurement data to calculating the multiband SAR.

8.5 SAR Averaged Methods

The local SAR inside the phantom is measured using small dipole sensing elements inside a probe body. The probe tip must not be in contact with the phantom surface in order to minimize measurements errors, but the highest local SAR will occur at the surface of the phantom.

An extrapolation is using to determinate this highest local SAR values. The extrapolation is based on a fourth-order least-square polynomial fit of measured data. The local SAR value is then extrapolated from the liquid surface with a 1mm step.

The measurements have to be performed over a limited time (due to the duration of the battery) so the step of measurement is high. It could vary between 5 and 8 mm. To obtain an accurate assessment of the maximum SAR averaged over 10g and 1 g requires a very fine resolution in the three dimensional scanned data array.

8.6 Power Drift Monitoring

All SAR testing is under the EUT install full charged battery and transmit maximum output power. In SATIMO 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.

9. SAR Test Result

9.1 Conducted RF Output Power

FDD-LTE Band 25:

Channel Bandwidth: 1.4 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.21	0
		1	3	23.12	0
		1	5	23.25	0
		3	0	23.09	0
		3	2	23.06	0
		3	3	23.16	0
		6	0	22.16	1
	MCH	1	0	23.44	0
		1	3	23.69	0
		1	5	23.54	0
		3	0	23.36	0
		3	2	23.36	0
		3	3	23.37	0
		6	0	22.15	1
	HCH	1	0	22.52	0
		1	3	22.91	0
		1	5	22.56	0
		3	0	22.88	0
		3	2	22.66	0
		3	3	22.81	0
		6	0	21.87	1
16QAM	LCH	1	0	22.86	1
		1	3	22.88	1
		1	5	22.48	1
		3	0	22.41	1
		3	2	22.4	1
		3	3	22.4	1
		6	0	21.47	2
	MCH	1	0	22.12	1
		1	3	22.13	1
		1	5	22.04	1
		3	0	22	1
		3	2	22.79	1
		3	3	22.88	1

		6	0	21.83	2
	HCH	1	0	22.19	1
		1	3	21.53	1
		1	5	21.93	1
		3	0	21.52	1
		3	2	21.77	1
		3	3	21.58	1
		6	0	21.58	2

Channel Bandwidth: 3 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.3	0
		1	7	22.82	0
		1	14	22.81	0
		8	0	22.25	1
		8	4	22.48	1
		8	7	22.49	1
		15	0	22.34	1
	MCH	1	0	22.86	0
		1	7	22.74	0
		1	14	23.79	0
		8	0	22.58	1
		8	4	22.59	1
		8	7	22.68	1
		15	0	22.73	1
	HCH	1	0	22.9	0
		1	7	22.89	0
		1	14	22.56	0
		8	0	21.78	1
		8	4	21.67	1
		8	7	21.55	1
		15	0	21.71	1
16QAM	LCH	1	0	22.61	1
		1	7	22.96	1
		1	14	22.95	1
		8	0	21.35	2
		8	4	21.49	2
		8	7	21.42	2
		15	0	21.42	2
	MCH	1	0	22.35	1
		1	7	22.27	1
		1	14	22.35	1

		8	0	21.73	2
		8	4	21.91	2
		8	7	21.82	2
		15	0	21.91	2
	HCH	1	0	22.58	1
		1	7	22.36	1
		1	14	21.77	1
		8	0	20.91	2
		8	4	20.94	2
		8	7	20.74	2
		15	0	20.98	2

Channel Bandwidth: 5 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.26	0
		1	12	23.32	0
		1	24	23.22	0
		12	0	22.08	1
		12	6	22.19	1
		12	13	22.98	1
		25	0	22.25	1
	MCH	1	0	22.81	0
		1	12	22.67	0
		1	24	22.61	0
		12	0	22.41	1
		12	6	22.58	1
		12	13	22.46	1
		25	0	22.76	1
	HCH	1	0	23.37	0
		1	12	22.92	0
		1	24	22.55	0
		12	0	21.86	1
		12	6	21.82	1
		12	13	21.61	1
		25	0	21.91	1
16QAM	LCH	1	0	22.92	1
		1	12	22.88	1
		1	24	22.82	1
		12	0	21.59	2
		12	6	21.6	2
		12	13	21.38	2
		25	0	21.72	2

	MCH	1	0	22.36	1
		1	12	22.19	1
		1	24	21.96	1
		12	0	21.68	2
		12	6	21.86	2
		12	13	21.63	2
		25	0	21.89	2
	HCH	1	0	22.78	1
		1	12	22.48	1
		1	24	21.52	1
		12	0	21.09	2
		12	6	21.1	2
		12	13	20.82	2
		25	0	21.32	2

Channel Bandwidth: 10 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.2	0
		1	24	23.06	0
		1	49	23.94	0
		25	0	22.87	1
		25	12	22.82	1
		25	25	22.87	1
		50	0	22.89	1
	MCH	1	0	22.78	0
		1	24	22.56	0
		1	49	23.1	0
		25	0	22.6	1
		25	12	22.42	1
		25	25	22.27	1
		50	0	22.29	1
	HCH	1	0	22.59	0
		1	24	22.99	0
		1	49	22.51	0
		25	0	22.86	1
		25	12	22.31	1
		25	25	21.82	1
		50	0	22.41	1
16QAM	LCH	1	0	22.01	1
		1	24	22.25	1
		1	49	22.34	1
		25	0	21.14	2

		25	12	21.94	2
		25	25	21.03	2
		50	0	21.13	2
	MCH	1	0	22.25	1
		1	24	22.13	1
		1	49	21.79	1
		25	0	21.83	2
		25	12	21.5	2
		25	25	21.41	2
		50	0	21.63	2
	HCH	1	0	22.71	1
		1	24	22.46	1
		1	49	21.6	1
		25	0	21.12	2
		25	12	21.13	2
		25	25	20.98	2
50		0	21.72	2	

Channel Bandwidth: 15 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.25	0
		1	37	23.87	0
		1	74	23.88	0
		37	0	22.25	1
		37	18	22.14	1
		37	38	22.08	1
		75	0	21.59	1
	MCH	1	0	22.56	0
		1	37	23.64	0
		1	74	23.41	0
		37	0	22.81	1
		37	18	22.8	1
		37	38	22.38	1
		75	0	22.88	1
	HCH	1	0	23.71	0
		1	37	23.36	0
		1	74	22.51	0
		37	0	22.24	1
		37	18	22.35	1
		37	38	22.6	1
		75	0	22.27	1
16QAM	LCH	1	0	22.31	1

		1	37	22.43	1
		1	74	22.48	1
		37	0	21.59	2
		37	18	21.47	2
		37	38	21.17	2
		75	0	21.31	2
	MCH	1	0	22.65	1
		1	37	22.17	1
		1	74	22.08	1
		37	0	21.98	2
		37	18	21.87	2
		37	38	21.49	2
	HCH	75	0	21.96	2
		1	0	22.36	1
		1	37	21.85	1
		1	74	21.67	1
		37	0	21.48	2
		37	18	21.08	2
		37	38	21.77	2
	75	0	21.10	2	

Channel Bandwidth: 20 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.97	0
		1	49	24.00	0
		1	99	23.91	0
		50	0	23.46	1
		50	25	23.47	1
		50	50	23.46	1
		100	0	22.02	1
	MCH	1	0	23.26	0
		1	49	23.84	0
		1	99	23.82	0
		50	0	23.35	1
		50	25	23.36	1
		50	50	23.36	1
		100	0	23.45	1
	HCH	1	0	23.55	0
		1	49	23.51	0
		1	99	23.52	0
		50	0	23.39	1
		50	25	23.36	1

		50	50	23.33	1
		100	0	23.37	1
16QAM	LCH	1	0	22.99	1
		1	49	22.36	1
		1	99	22.14	1
		50	0	21.39	2
		50	25	21.93	2
		50	50	21.03	2
		100	0	21.08	2
		MCH	1	0	22.89
	1		49	22.22	1
	1		99	21.6	1
	50		0	21.91	2
	50		25	21.74	2
	50		50	21.55	2
	100		0	21.77	2
	HCH	1	0	21.54	1
		1	49	22.54	1
		1	99	21.83	1
		50	0	21.34	2
		50	25	21.22	2
		50	50	21.67	2
		100	0	21.76	2

FDD-LTE Band 26: (814-824MHz)

Channel Bandwidth: 1.4 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.99	0
		1	3	23.13	0
		1	5	23.02	0
		3	0	22.85	0
		3	2	22.53	0
		3	3	22.95	0
		6	0	22.12	1
	MCH	1	0	23.17	0
		1	3	22.90	0
		1	5	23.10	0
		3	0	22.58	0
		3	2	22.98	0
		3	3	22.97	0

	HCH	6	0	22.02	1
		1	0	22.90	0
		1	3	22.86	0
		1	5	22.95	0
		3	0	22.96	0
		3	2	22.93	0
		3	3	22.96	0
		6	0	22.07	1
16QAM	LCH	1	0	22.35	1
		1	3	22.37	1
		1	5	22.37	1
		3	0	22.50	1
		3	2	22.24	1
		3	3	22.22	1
		6	0	21.00	2
	MCH	1	0	22.76	1
		1	3	22.77	1
		1	5	22.76	1
		3	0	21.83	1
		3	2	21.79	1
		3	3	21.85	1
		6	0	21.01	2
	HCH	1	0	22.06	1
		1	3	22.06	1
		1	5	22.11	1
		3	0	21.78	1
		3	2	21.75	1
		3	3	21.83	1
		6	0	21.21	2

Channel Bandwidth: 3 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.20	0
		1	7	23.18	0
		1	14	23.19	0
		8	0	22.14	1
		8	4	22.18	1
		8	7	22.14	1
		15	0	22.02	1
	MCH	1	0	23.24	0
		1	7	23.03	0
		1	14	23.07	0

		8	0	22.03	1		
		8	4	22.02	1		
		8	7	21.97	1		
		15	0	22.09	1		
	HCH	1	0	23.07	0		
		1	7	23.07	0		
		1	14	23.05	0		
		8	0	21.98	1		
		8	4	22.04	1		
		8	7	21.96	1		
		15	0	22.04	1		
		16QAM	LCH	1	0	22.10	1
				1	7	22.11	1
1	14			22.15	1		
8	0			20.99	2		
8	4			21.02	2		
8	7			21.01	2		
15	0			21.16	2		
MCH	1		0	22.12	1		
	1		7	22.01	1		
	1		14	22.03	1		
	8		0	21.00	1		
	8		4	21.00	2		
	8		7	20.95	2		
	15	0	20.89	2			
HCH	1	0	22.62	2			
	1	7	22.61	1			
	1	14	22.62	1			
	8	0	21.07	1			
	8	4	21.02	1			
	8	7	20.95	2			
	15	0	20.91	2			

Channel Bandwidth: 5 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.95	0
		1	12	22.99	0
		1	24	22.84	0
		12	0	22.10	1
		12	6	22.17	1
		12	13	22.05	1
		25	0	22.12	1

	MCH	1	0	23.17	0
		1	12	23.03	0
		1	24	23.05	0
		12	0	22.14	1
		12	6	21.97	1
		12	13	21.99	1
		25	0	22.01	1
	HCH	1	0	23.07	0
		1	12	23.01	0
		1	24	22.98	0
		12	0	22.00	1
		12	6	22.07	1
		12	13	21.92	1
		25	0	22.00	1
16QAM	LCH	1	0	22.99	1
		1	12	22.93	1
		1	24	22.86	1
		12	0	21.25	2
		12	6	21.25	2
		12	13	21.19	2
		25	0	21.31	2
	MCH	1	0	21.75	1
		1	12	21.67	1
		1	24	21.63	1
		12	0	21.02	2
		12	6	21.03	2
		12	13	21.01	2
		25	0	21.17	2
	HCH	1	0	21.95	1
		1	12	21.92	1
		1	24	21.89	1
		12	0	21.07	2
		12	6	21.08	2
		12	13	21.99	2
		25	0	21.30	2

Channel Bandwidth: 10 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.78	0
		1	24	23.10	0
		1	49	23.02	0
		25	0	22.99	1
		25	12	21.96	1
		25	25	22.00	1
		50	0	21.95	1
16QAM	LCH	1	0	22.72	1
		1	24	22.53	1
		1	49	22.50	1
		25	0	21.20	2
		25	12	21.21	2
		25	25	21.17	2
		50	0	21.16	2

FDD-LTE Band 26: (824-849MHz)

Channel Bandwidth: 1.4 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.41	0
		1	3	22.51	0
		1	5	22.40	0
		3	0	21.43	0
		3	2	21.47	0
		3	3	21.44	0
		6	0	21.50	1
	MCH	1	0	22.44	0
		1	3	22.57	0
		1	5	22.44	0
		3	0	21.53	0
		3	2	21.52	0
		3	3	21.55	0
		6	0	21.55	1
	HCH	1	0	22.56	0
		1	3	22.80	0
		1	5	22.60	0
		3	0	21.67	0
		3	2	21.74	0

		3	3	21.70	0
		6	0	21.79	1
16QAM	LCH	1	0	21.74	1
		1	3	21.87	1
		1	5	21.72	1
		3	0	21.70	1
		3	2	21.68	1
		3	3	21.68	1
		6	0	20.43	2
		MCH	1	0	21.93
	1		3	22.00	1
	1		5	21.91	1
	3		0	21.61	1
	3		2	21.66	1
	3		3	21.66	1
	6		0	20.47	2
	HCH	1	0	21.83	1
		1	3	22.00	1
		1	5	21.88	1
		3	0	21.82	1
		3	2	21.84	1
		3	3	21.84	1
		6	0	20.85	2

Channel Bandwidth: 3 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.37	0
		1	7	22.56	0
		1	14	22.42	0
		8	0	21.50	1
		8	4	21.51	1
		8	7	21.47	1
		15	0	21.48	1
	MCH	1	0	22.46	0
		1	7	22.68	0
		1	14	22.46	0
		8	0	21.57	1
		8	4	21.64	1
		8	7	21.55	1
		15	0	21.52	1
	HCH	1	0	22.63	0
		1	7	22.92	0

		1	14	22.67	0
		8	0	21.76	1
		8	4	21.81	1
		8	7	21.75	1
		15	0	21.73	1
16QAM	LCH	1	0	21.75	1
		1	7	21.93	1
		1	14	21.76	1
		8	0	20.55	2
		8	4	20.60	2
		8	7	20.52	2
		15	0	20.46	2
	MCH	1	0	21.92	1
		1	7	21.17	1
		1	14	21.98	1
		8	0	20.56	1
		8	4	20.54	2
		8	7	20.53	2
		15	0	20.54	2
	HCH	1	0	21.96	2
		1	7	21.99	1
		1	14	21.93	1
		8	0	20.65	1
		8	4	20.74	1
		8	7	20.65	2
		15	0	20.70	2

Channel Bandwidth: 5 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.35	0
		1	12	22.70	0
		1	24	22.37	0
		12	0	21.43	1
		12	6	21.52	1
		12	13	21.55	1
		25	0	21.52	1
	MCH	1	0	22.39	0
		1	12	22.77	0
		1	24	22.40	0
		12	0	21.50	1
		12	6	21.59	1
		12	13	21.52	1

	HCH	25	0	21.58	1
		1	0	22.61	0
		1	12	22.98	0
		1	24	22.62	0
		12	0	21.75	1
		12	6	21.86	1
		12	13	21.72	1
		25	0	21.73	1
16QAM	LCH	1	0	21.70	1
		1	12	21.95	1
		1	24	21.68	1
		12	0	20.51	2
		12	6	20.57	2
		12	13	20.55	2
		25	0	20.47	2
	MCH	1	0	21.67	1
		1	12	21.95	1
		1	24	21.74	1
		12	0	20.64	2
		12	6	20.72	2
		12	13	20.67	2
		25	0	20.59	2
	HCH	1	0	21.87	1
		1	12	21.94	1
		1	24	21.85	1
		12	0	20.74	2
		12	6	20.76	2
		12	13	20.69	2
		25	0	20.76	2

Channel Bandwidth: 10 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	22.99	0
		1	24	22.56	0
		1	49	22.36	0
		25	0	21.88	1
		25	12	21.62	1
		25	25	21.59	1
		50	0	21.58	1
	MCH	1	0	22.41	0
		1	24	22.62	0
		1	49	22.52	0

		25	0	21.66	1		
		25	12	21.63	1		
		25	25	21.69	1		
		50	0	21.62	1		
	HCH	1	0	22.59	0		
		1	24	22.80	0		
		1	49	22.62	0		
		25	0	21.81	1		
		25	12	21.79	1		
		25	25	21.73	1		
		50	0	21.73	1		
		16QAM	LCH	1	0	21.76	1
				1	24	21.88	1
1	49			21.74	1		
25	0			20.56	2		
25	12			20.55	2		
25	25			20.56	2		
50	0			20.54	2		
MCH	1		0	21.88	1		
	1		24	21.91	1		
	1		49	21.81	1		
	25		0	20.66	2		
	25		12	20.65	2		
	25		25	20.70	2		
	50	0	20.67	2			
HCH	1	0	21.98	1			
	1	24	21.91	1			
	1	49	21.97	1			
	25	0	20.78	2			
	25	12	20.74	2			
	25	25	20.73	2			
	50	0	20.75	2			

TDD-LTE Band 41:

Channel Bandwidth: 5 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.47	0
		1	12	24.12	0
		1	24	24.42	0

		12	0	23.17	1
		12	6	23.36	1
		12	13	23.15	1
		25	0	23.34	1
	MCH	1	0	23.47	0
		1	12	23.35	0
		1	24	23.46	0
		12	0	22.17	1
		12	6	22.39	1
		12	13	22.18	1
		25	0	22.39	1
		HCH	1	0	23.25
	1		12	23.28	0
	1		24	23.35	0
	12		0	22.08	1
	12		6	22.3	1
12	13		22.24	1	
25	0		22.33	1	
16QAM	LCH	1	0	23.49	1
		1	12	23.46	1
		1	24	23.47	1
		12	0	22.31	2
		12	6	22.32	2
		12	13	22.28	2
		25	0	22.42	2
	MCH	1	0	22.82	1
		1	12	22.79	1
		1	24	22.68	1
		12	0	21.35	2
		12	6	21.58	2
		12	13	21.37	2
		25	0	21.49	2
	HCH	1	0	21.61	1
		1	12	21.61	1
		1	24	21.8	1
		12	0	21.1	2
		12	6	21.36	2
		12	13	21.34	2
		25	0	21.35	2

Channel Bandwidth: 10 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		

QPSK	LCH	1	0	24.22	0
		1	24	23.9	0
		1	49	23.29	0
		25	0	23.12	1
		25	12	23.07	1
		25	25	23.15	1
		50	0	23.11	1
	MCH	1	0	23.43	0
		1	24	23.16	0
		1	49	22.97	0
		25	0	22.11	1
		25	12	22.03	1
		25	25	22.01	1
		50	0	22.09	1
	HCH	1	0	22.96	0
		1	24	22.93	0
		1	49	22.85	0
		25	0	21.9	1
		25	12	21.78	1
		25	25	21.52	1
		50	0	21.94	1
16QAM	LCH	1	0	23.45	1
		1	24	23.36	1
		1	49	23.45	1
		25	0	22.21	2
		25	12	22.15	2
		25	25	22.25	2
		50	0	22.2	2
	MCH	1	0	22.83	1
		1	24	22.58	1
		1	49	22.33	1
		25	0	21.35	2
		25	12	21.12	2
		25	25	21.12	2
		50	0	21.2	2
	HCH	1	0	21.53	1
		1	24	21.59	1
		1	49	21.58	1
		25	0	20.95	2
		25	12	20.84	2
		25	25	20.78	2
		50	0	20.97	2

Channel Bandwidth: 15 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.68	0
		1	37	23.37	0
		1	74	23.6	0
		37	0	23.19	1
		37	18	23.32	1
		37	38	23.26	1
		75	0	23.42	2
	MCH	1	0	23.87	0
		1	37	23.5	0
		1	74	23.24	0
		37	0	22.48	1
		37	18	22.46	1
		37	38	22.3	1
		75	0	22.45	2
	HCH	1	0	22.52	0
		1	37	22.51	0
		1	74	22.55	0
		37	0	22	1
		37	18	22.18	1
		37	38	22.23	1
		75	0	22.22	2
16QAM	LCH	1	0	22.81	1
		1	37	22.6	1
		1	74	22.66	1
		37	0	22.28	2
		37	18	22.4	2
		37	38	22.45	2
		75	0	22.5	2
	MCH	1	0	23.12	1
		1	37	22.77	1
		1	74	22.53	1
		37	0	21.58	2
		37	18	21.56	2
		37	38	21.4	2
		75	0	21.53	2
	HCH	1	0	21.68	1
		1	37	21.6	1
		1	74	22.08	1
		37	0	21.07	2
		37	18	21.19	2

		37	38	21.25	2
		75	0	21.25	2

Channel Bandwidth: 20 MHz					
Modulation	Channel	RB Configuration		Average Power [dBm]	MPR (dB)
		Size	Offset		
QPSK	LCH	1	0	23.27	0
		1	49	23.08	0
		1	99	23.05	0
		50	0	23.18	1
		50	25	23.1	1
		50	50	23.19	1
		100	0	23.17	1
	MCH	1	0	23.49	0
		1	49	23.52	0
		1	99	22.63	0
		50	0	22.56	1
		50	25	22.21	1
		50	50	21.89	1
		100	0	22.23	1
	HCH	1	0	23.18	0
		1	49	23.29	0
		1	99	23.49	0
		50	0	22.32	1
		50	25	22.35	1
		50	50	22.30	1
		100	0	22.34	1
16QAM	LCH	1	0	23.39	1
		1	49	23.44	1
		1	99	23.44	1
		50	0	22.24	2
		50	25	22.16	2
		50	50	22.25	2
		100	0	22.24	2
	MCH	1	0	22.88	1
		1	49	22.67	1
		1	99	21.88	1
		50	0	21.60	2
		50	25	21.32	2
		50	50	21.02	2
		100	0	21.33	2
HCH	1	0	21.67	1	
	1	49	21.84	1	

		1	99	21.86	1
		50	0	21.31	2
		50	25	21.59	2
		50	50	21.53	2
		100	0	21.56	2

Remark:

- Per KDB941225 D05 v02r05, Start with the largest channel bandwidth then measure SAR for QPSK with 1 RB allocation, 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 for 1 RB allocation; 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. 6 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.
- Per KDB941225 D05 v02r05, The procedures required for 1 RB allocation in 5.2.1 are applied to measure the SAR for QPSK with 50% RB allocation.
- Per KDB941225 D05 v02r05, For 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 in 5.2.1 and 5.2.2 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.
- Per KDB941225 D05 v02r05, For each modulation besides QPSK; e.g., 16-QAM, 64-QAM, apply the QPSK procedures in 5.2.1, 5.2.2, and 5.2.3 to determine the QAM 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 $> \frac{1}{2}$ dB higher than the same configuration in QPSK or when the reported SAR for the QPSK configuration is > 1.45 W/kg.

9.2 Test Results for Standalone SAR Test

Body SAR

LTE Band 25–Body SAR Test								
Plot No.	Mode	Test Position Body	Freque ncy	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
	Modulation, Bandwidth, RB		MHz					
1.	QPSK 20MHz 1RB	Back Side	1860.0	24.00	24.5	1.122	0.604	0.678
2.	QPSK 20MHz 1RB	Front Side	1860.0	24.00	24.5	1.122	1.062	1.192
3.	QPSK 20MHz 1RB	Front Side	1882.5	23.84	24.5	1.164	1.177	1.370
4.	QPSK 20MHz 1RB	Front Side	1905.0	23.55	24.5	1.245	0.894	1.113
5.	QPSK 20MHz 1RB	Right side	1860.0	24.00	24.5	1.122	0.556	0.624
6.	QPSK 20MHz 1RB	Left side	1860.0	24.00	24.5	1.122	0.104	0.117
7.	QPSK 20MHz 1RB	Bottom side	1860.0	24.00	24.5	1.122	0.041	0.046
8.	QPSK 20MHz 1RB	Top side	1860.0	24.00	24.5	1.122	0.061	0.068
9.	QPSK 20MHz 50%RB	Back Side	1860.0	24.00	24.5	1.122	0.338	0.379
10.	QPSK 20MHz 50%RB	Front Side	1860.0	24.00	24.5	1.122	0.517	0.580
11.	QPSK 20MHz 50%RB	Right side	1860.0	24.00	24.5	1.122	0.302	0.339
12.	QPSK 20MHz 50%RB	Left side	1860.0	24.00	24.5	1.122	0.055	0.062
13.	QPSK 20MHz 50%RB	Bottom side	1860.0	24.00	24.5	1.122	0.023	0.026
14.	QPSK 20MHz 50%RB	Top side	1860.0	24.00	24.5	1.122	0.033	0.037

LTE Band 26–Body SAR Test								
Plot No.	Mode	Test Position Body	Freque ncy	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
	Modulation, Bandwidth, RB		MHz					
15.	QPSK 15MHz 1RB	Back Side	819.0	23.78	24.0	1.052	0.655	0.689
16.	QPSK 15MHz 1RB	Front Side	819.0	23.78	24.0	1.052	0.923	0.971
17.	QPSK 15MHz 1RB	Right side	819.0	23.78	24.0	1.052	0.603	0.634
18.	QPSK 15MHz 1RB	Left side	819.0	23.78	24.0	1.052	0.309	0.325
19.	QPSK 15MHz 1RB	Bottom side	819.0	23.78	24.0	1.052	0.033	0.035
20.	QPSK 15MHz 1RB	Top side	819.0	23.78	24.0	1.052	0.051	0.054
21.	QPSK 15MHz 50%RB	Back Side	819.0	23.78	24.0	1.052	0.366	0.385
22.	QPSK 15MHz 50%RB	Front Side	819.0	23.78	24.0	1.052	0.519	0.546
23.	QPSK 15MHz 50%RB	Right side	819.0	23.78	24.0	1.052	0.298	0.313
24.	QPSK 15MHz 50%RB	Left side	819.0	23.78	24.0	1.052	0.155	0.163
25.	QPSK 15MHz 50%RB	Bottom side	819.0	23.78	24.0	1.052	0.017	0.018
26.	QPSK 15MHz 50%RB	Top side	819.0	23.78	24.0	1.052	0.022	0.023

LTE Band 41–Body SAR Test								
Plot No.	Mode	Test Position Body	Frequency	Output Power (dBm)	Rated Limit (dBm)	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
	Modulation, Bandwidth, RB		MHz					
27.	QPSK 5MHz 1RB	Back Side	2498.5	24.42	24.5	1.019	0.181	0.184
28.	QPSK 5MHz 1RB	Front Side	2498.5	24.42	24.5	1.019	0.428	0.436
29.	QPSK 5MHz 1RB	Right side	2498.5	24.42	24.5	1.019	0.141	0.144
30.	QPSK 5MHz 1RB	Left side	2498.5	24.42	24.5	1.019	0.078	0.079
31.	QPSK 5MHz 1RB	Bottom side	2498.5	24.42	24.5	1.019	0.042	0.043
32.	QPSK 5MHz 1RB	Top side	2498.5	24.42	24.5	1.019	0.08	0.081
33.	QPSK 5MHz 50%RB	Back Side	2498.5	24.42	24.5	1.019	0.113	0.115
34.	QPSK 5MHz 50%RB	Front Side	2498.5	24.42	24.5	1.019	0.231	0.235
35.	QPSK 5MHz 50%RB	Right side	2498.5	24.42	24.5	1.019	0.072	0.073
36.	QPSK 5MHz 50%RB	Left side	2498.5	24.42	24.5	1.019	0.038	0.039
37.	QPSK 5MHz 50%RB	Bottom side	2498.5	24.42	24.5	1.019	0.019	0.019
38.	QPSK 5MHz 50%RB	Top side	2498.5	24.42	24.5	1.019	0.042	0.043

Remark: Per KDB 447498 D01 v06, if the highest output channel SAR for each exposure position ≤ 0.8 W/kg other channels SAR tests are not necessary.

Repeated SAR

LTE Band 25–Body SAR Test								
Plot No.	Mode	Test Position	Frequency	Output Power	Rated Limit	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
	Modulation, Bandwidth, RB	Body	MHz	(dBm)	(dBm)			
39.	QPSK 20MHz 1RB	Front Side	1860.0	24.00	24.5	1.122	1.013	1.137
40.	QPSK 20MHz 50%RB	Front Side	1860.0	24.00	24.5	1.122	0.503	0.564

LTE Band 26–Body SAR Test								
Plot No.	Mode	Test Position	Frequency	Output Power	Rated Limit	Scaling Factor	SAR1g (W/kg)	Scaled SAR1g (W/kg)
	Modulation, Bandwidth, RB	Body	MHz	(dBm)	(dBm)			
41.	QPSK 15MHz 1RB	Front Side	819.0	23.78	24.0	1.052	0.892	0.938
42.	QPSK 15MHz 50%RB	Front Side	819.0	23.78	24.0	1.052	0.488	0.513

Remark:

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

10. Measurement Uncertainty

10.1 Uncertainty for EUT SAR Test

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	7.0	N	1	1	1	7.00	7.00	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	$(1_{Cp})^{1/2}$	$(1_{Cp})^{1/2}$	1.02	1.02	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	$(Cp)^{1/2}$	$(Cp)^{1/2}$	1.63	1.63	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
RF ambient Conditions – Noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algorithms for Max. SAR Evaluation	E.5	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Test Sample Related									
Test sample positioning	E.4.2	0.03	N	1	1	1	0.03	0.03	N-1
Device Holder Uncertainty	E.4.1	5.00	N	1	1	1	5.00	5.00	
Output power Variation - SAR drift measurement	E.2.9	12.02	R	$\sqrt{3}$	1	1	6.94	6.94	∞
SAR scaling	E6.5	0.0	R	$\sqrt{3}$	1	1	0.0	0.0	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E3.2	1.9	R	$\sqrt{3}$	1	0.84	1.10	0.90	∞
Liquid conductivity - deviation	E.3.2	5.00	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	∞

from target value										
Liquid conductivity measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	∞	
Liquid permittivity - deviation from target value	E.3.2	0.37	R	$\sqrt{3}$	0.6	0.49	0.13	0.10	∞	
Liquid permittivity measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	∞	
Combined Standard Uncertainty			RSS				12.98	12.53		
Expanded Uncertainty (95% Confidence interval)			K=2				25.32	24.43		

10.2 Uncertainty for System Performance Check

a	b	c	d	e= f(d,k)	f	g	h= c*f/e	i= c*g/e	k
Uncertainty Component	Sec.	Tol (+- %)	Prob. Dist.	Div.	Ci (1g)	Ci (10g)	1g Ui (+-%)	10g Ui (+-%)	Vi
Measurement System									
Probe calibration	E.2.1	7.0	N	1	1	1	7.00	7.00	∞
Axial Isotropy	E.2.2	2.5	R	$\sqrt{3}$	$(1_{Cp})^{1/2}$	$(1_{Cp})^{1/2}$	1.02	1.02	∞
Hemispherical Isotropy	E.2.2	4.0	R	$\sqrt{3}$	$(Cp)^{1/2}$	$(Cp)^{1/2}$	1.63	1.63	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
System detection limits	E.2.5	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	0	R	$\sqrt{3}$	0	0	0.0	0.0	∞
Readout Electronics	E.2.6	0.02	N	1	1	1	0.02	0.02	∞
Reponse Time	E.2.7	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Integration Time	E.2.8	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
RF ambient Conditions – Noise	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
RF ambient Conditions - Reflections	E.6.1	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Probe positioner Mechanical Tolerance	E.6.2	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Probe positioning with respect to Phantom Shell	E.6.3	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Extrapolation, interpolation and integration Algorithms for Max.	E.5.2	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞

SAR Evaluation									
Dipole									
Dipole axis to liquid Distance	8,E.4.2	1.00	N	$\sqrt{3}$	1	1	0.58	0.58	N-1
Input power and SAR drift measurement	8,6.6.2	12.02	R	$\sqrt{3}$	1	1	6.94	6.94	∞
Deviation of experimental dipole from numerical dipole	E.6.4	5.5	R	$\sqrt{3}$	1	1	3.20	3.20	∞
Phantom and Tissue Parameters									
Phantom Uncertainty (Shape and thickness tolerances)	E.3.1	0.05	R	$\sqrt{3}$	1	1	0.03	0.03	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E3.2	2.0	R	$\sqrt{3}$	1	0.84	1.10	1.10	∞
Liquid conductivity - deviation from target value	E.3.2	5.00	R	$\sqrt{3}$	0.64	0.43	1.85	1.24	
Liquid conductivity - measurement uncertainty	E.3.3	5.00	N	1	0.64	0.43	3.20	2.15	
Liquid permittivity - deviation from target value	E.3.2	0.37	R	$\sqrt{3}$	0.6	0.49	0.13	0.10	
Liquid permittivity - measurement uncertainty	E.3.3	10.00	N	1	0.6	0.49	6.00	4.90	M
Combined Standard Uncertainty			RSS				12.00	11.50	
Expanded Uncertainty (95% Confidence interval)			K=2				23.39	22.43	

Annex A. Plots of System Performance Check

MEASUREMENT 1

For Body Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 08/12/2019

Measurement duration: 12 minutes 21 seconds

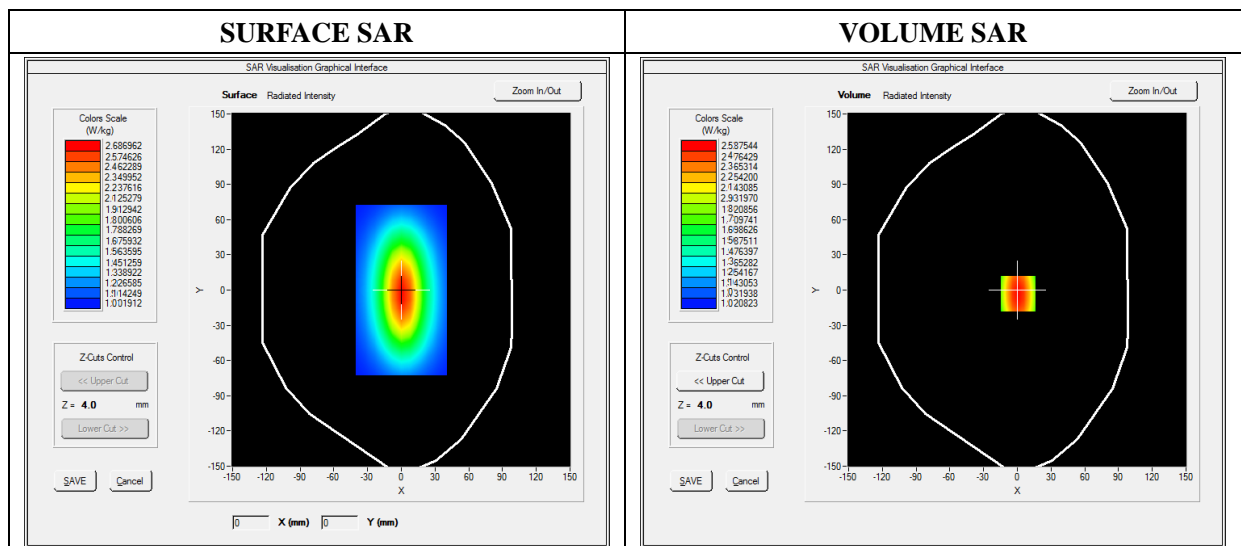
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 7.13; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW835
Signal	Duty Cycle 1:1

B. SAR Measurement Results

Frequency (MHz)	835.000000
Relative Permittivity (real part)	54.851214
Conductivity (S/m)	0.951454
Power Variation (%)	0.901472
Ambient Temperature	21.1
Liquid Temperature	21.3

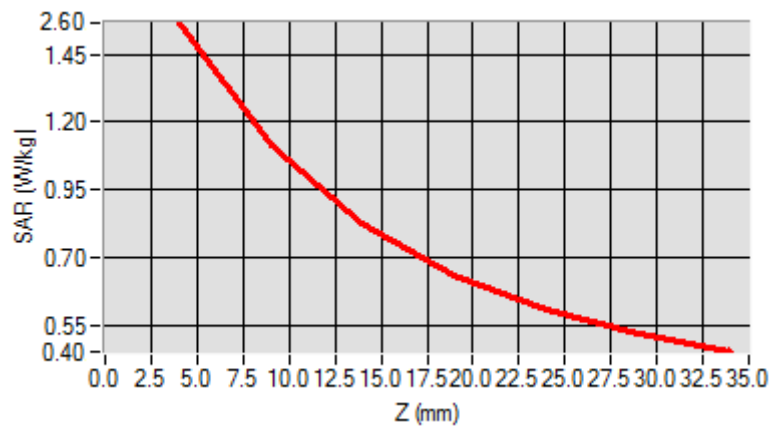


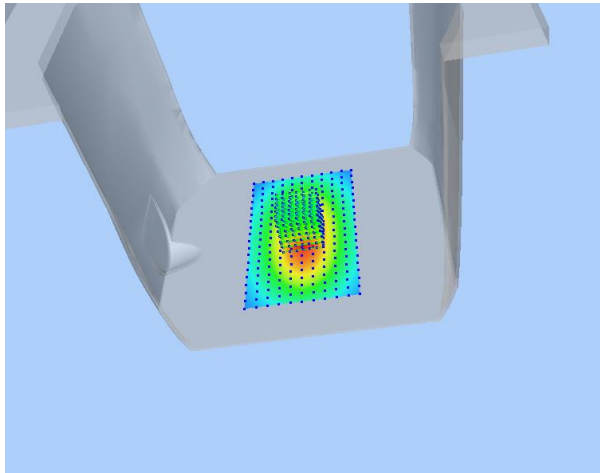
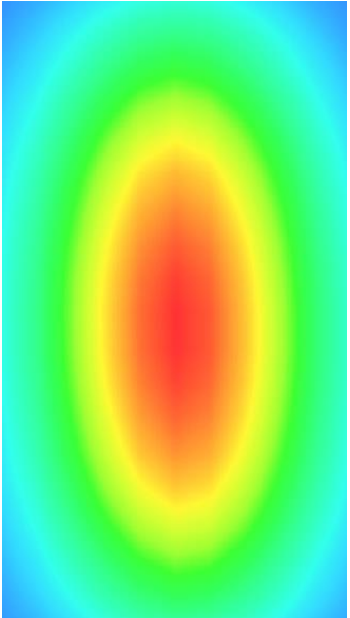
Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	1.028956
SAR 1g (W/Kg)	2.354211

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	2.5789	1.1300	0.8795	0.5940	0.5011	0.5100



3D screen shot	Hot spot position
	

MEASUREMENT 2

For Body Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 08/12/2019

Measurement duration: 12 minutes 21 seconds

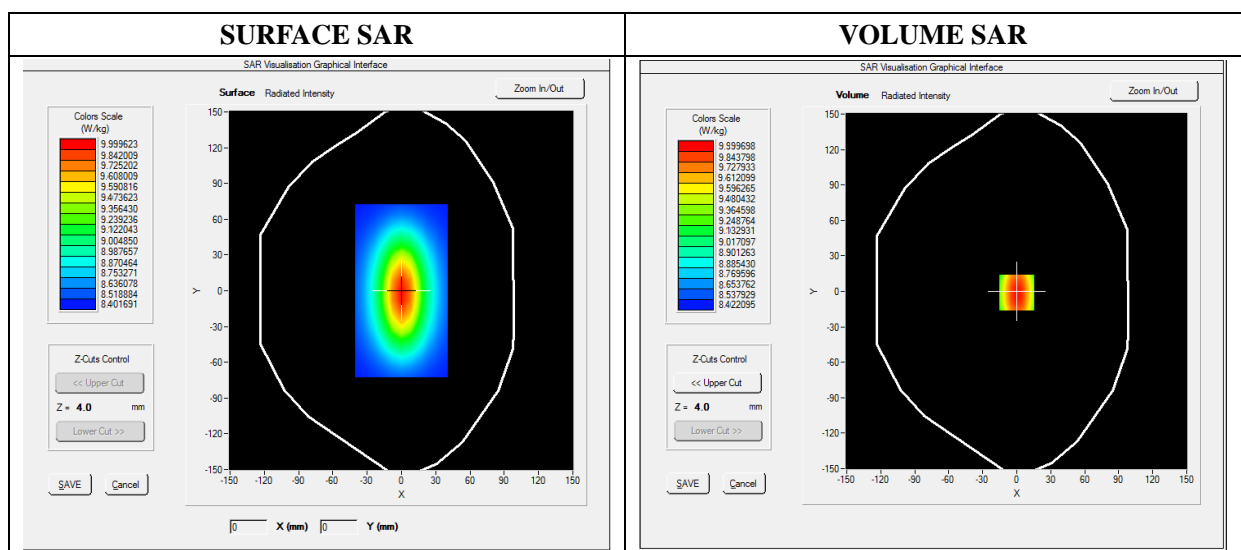
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.55; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW1900
Signal	Duty Cycle 1:1

B. SAR Measurement Results

Frequency (MHz)	1900.000000
Relative Permittivity (real part)	52.420415
Conductivity (S/m)	1.501966
Power Variation (%)	0.541872
Ambient Temperature	21.1
Liquid Temperature	21.3

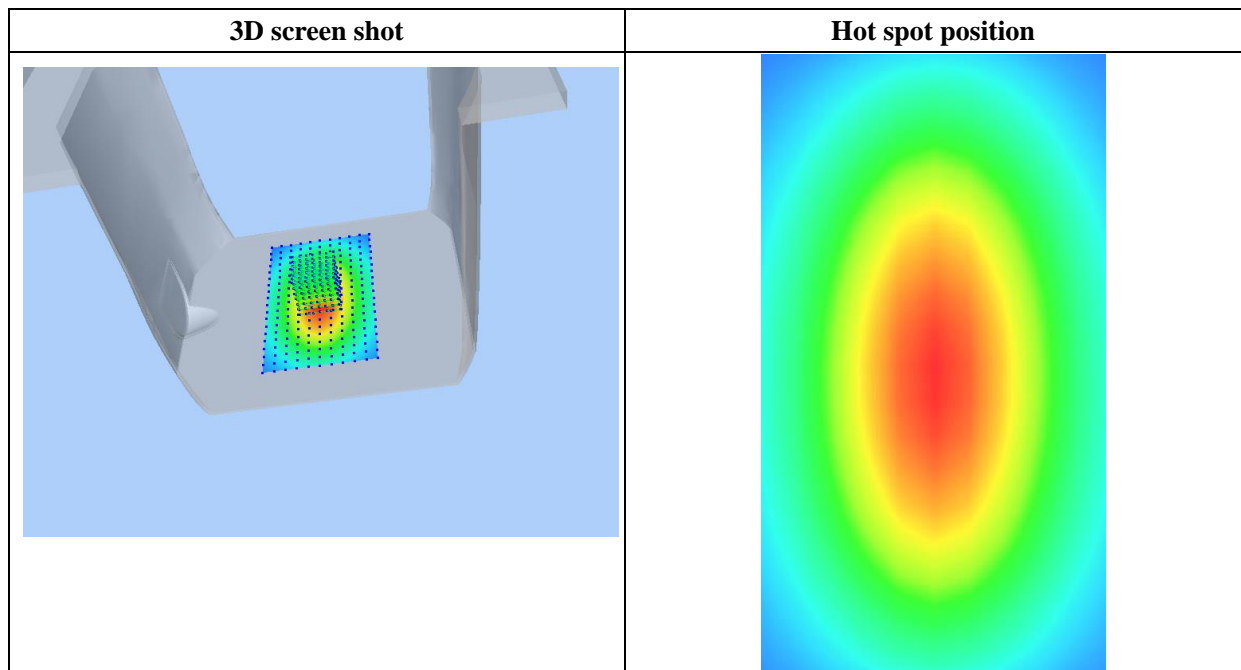
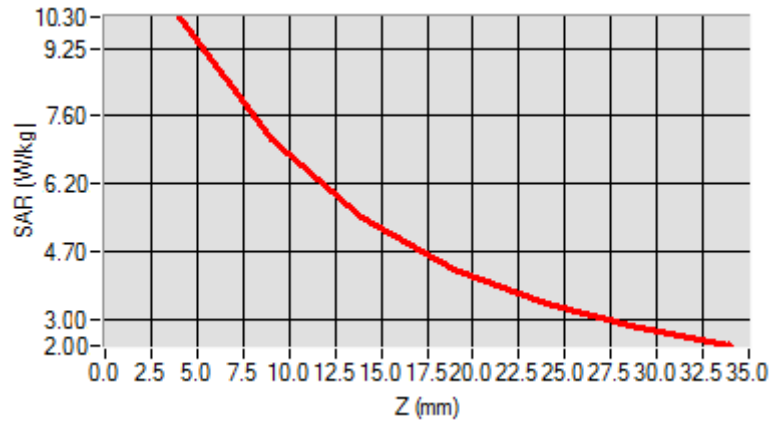


Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	5.134651
SAR 1g (W/Kg)	9.781550

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	10.2031	6.43001	4.9011	4.5325	3.1201	2.5024



MEASUREMENT 3

For Body Liquid

Type: Validation measurement (Fast, 75.00 %)

Date of measurement: 08/13/2019

Measurement duration: 12 minutes 21 seconds

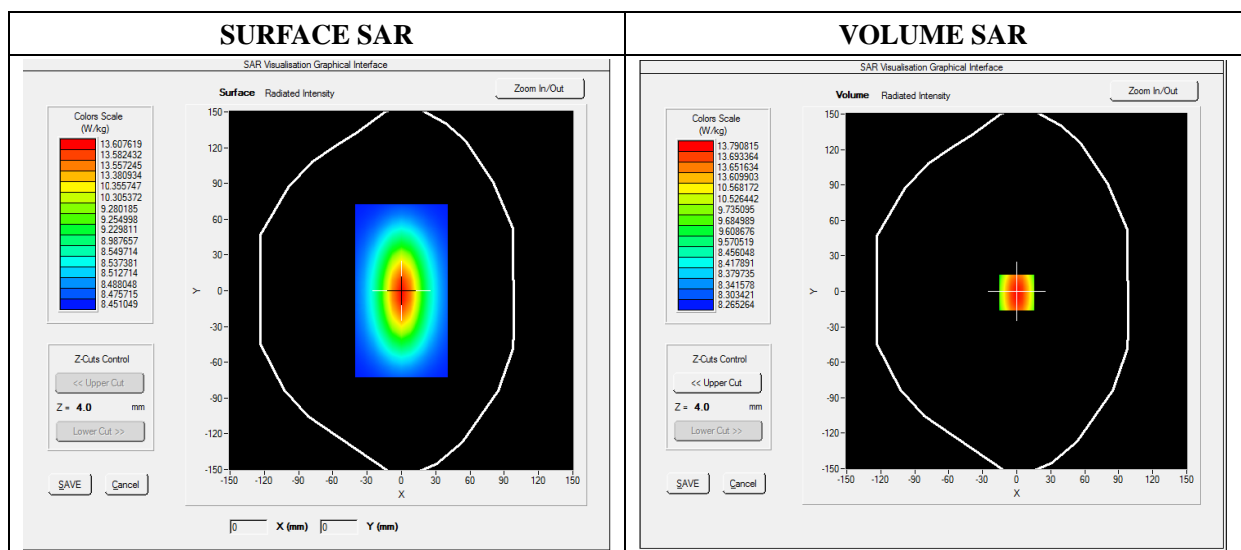
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 5.58; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Dipole
Band	CW2600
Signal	Duty Cycle 1:1

B. SAR Measurement Results

Frequency (MHz)	2600.000000
Relative Permittivity (real part)	52.241202
Conductivity (S/m)	2.120943
Power Variation (%)	1.038832
Ambient Temperature	21.1
Liquid Temperature	21.2

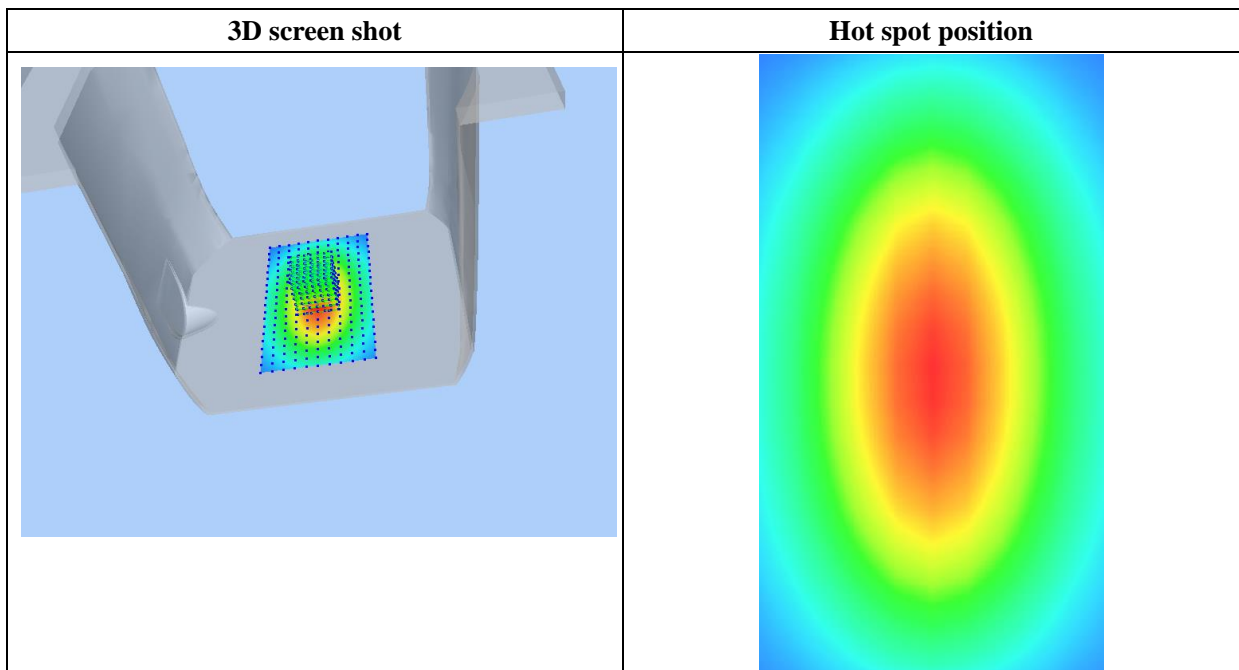
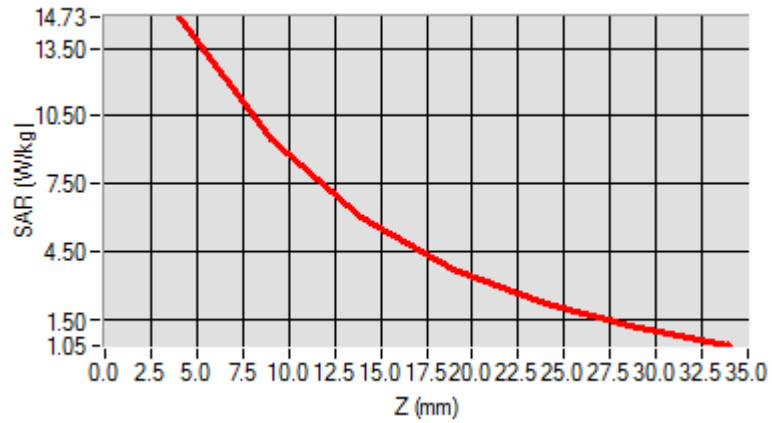


Maximum location: X=0.00, Y=0.00

SAR 10g (W/Kg)	6.083781
SAR 1g (W/Kg)	13.430481

Z Axis Scan

Z (mm)	0.00	4.00	9.00	14.00	19.00	24.00	29.00
SAR (W/Kg)	0.0000	13.6473	11.8441	9.3627	8.5782	6.4357	4.6342



Annex B. Plots of SAR Measurement

<u>BAND</u>	<u>PARAMETERS</u>
LTE Band 25	<u>Measurement 3: Flat Plane with Front device position on Middle Channel in LTE mode</u>
LTE Band 26	<u>Measurement 16: Flat Plane with Front device position on High Channel in LTE mode</u>
LTE Band 41	<u>Measurement 28: Flat Plane with Front device position on Low Channel in LTE mode</u>

Remark: SAR plot is showed the highest measured SAR in each exposure configuration, wireless mode and frequency band combination.

MEASUREMENT 3

Type: Phone measurement (Complete)

Date of measurement: 08/12/2019

Measurement duration: 12 minutes 3 seconds

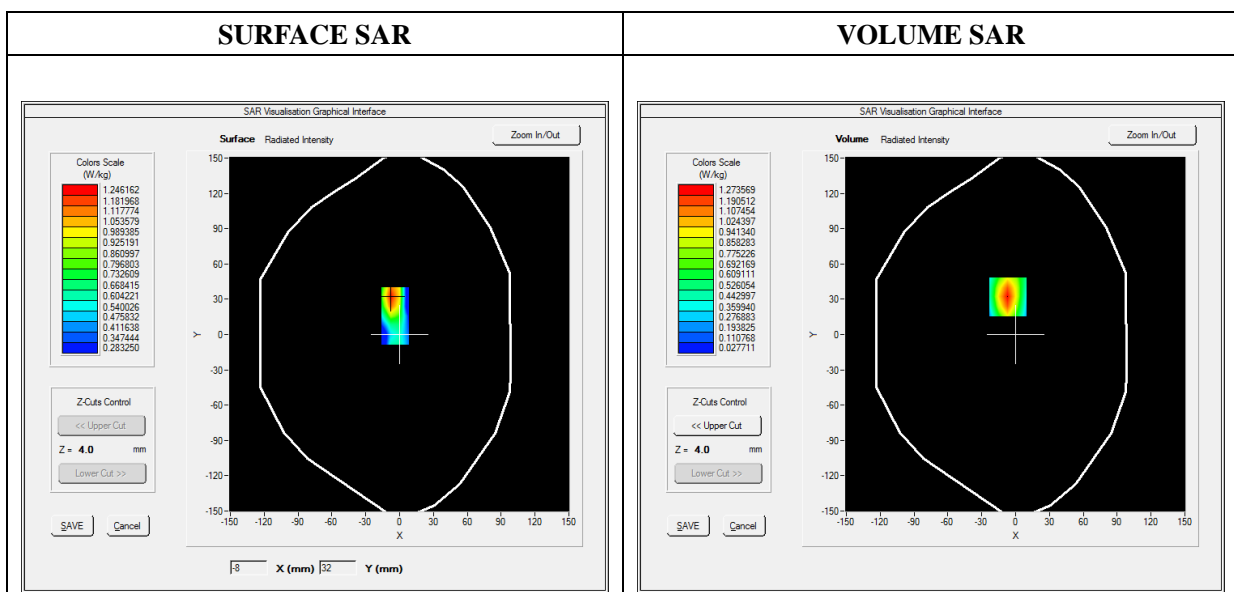
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 6.55; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Flat Plane
Device Position	Right
Band	LTE Band 25
Channels	QPSK, 20MHz, 1RB,Middle
Signal	Duty Cycle 1:1

B. SAR Measurement Results

Frequency (MHz)	1882.500000
Relative Permittivity (real part)	52.420415
Conductivity (S/m)	1.501966
Power Variation (%)	1.523573
Ambient Temperature	21.1
Liquid Temperature	21.3

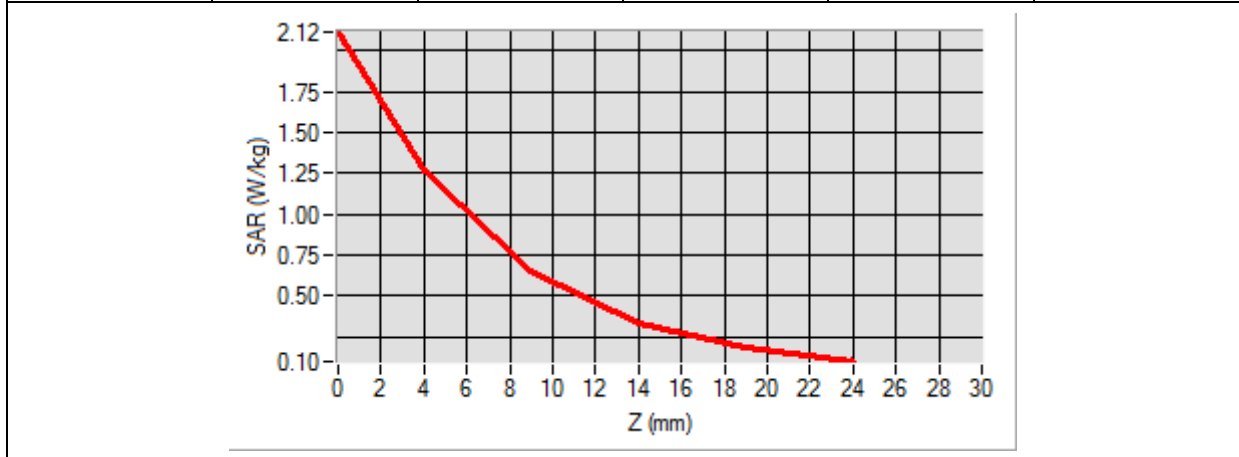


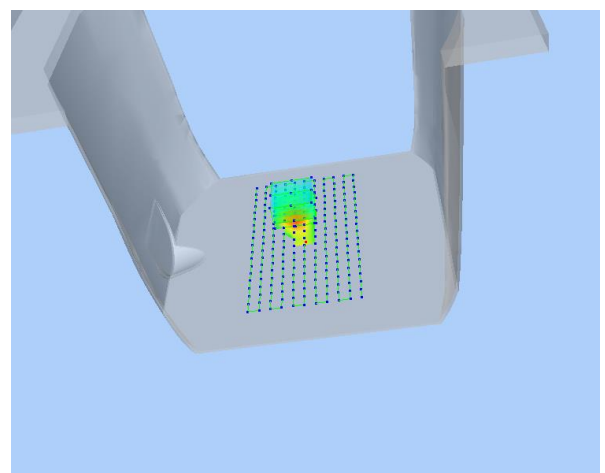
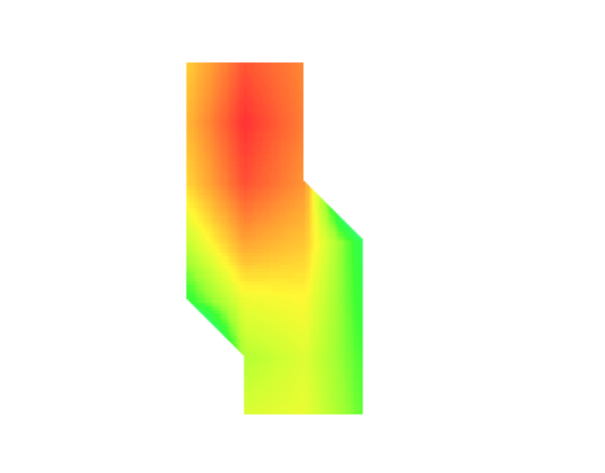
Maximum location: X=-7.00, Y=32.00

SAR Peak: 2.11 W/kg

SAR 10g (W/Kg)	0.588190
SAR 1g (W/Kg)	1.176885

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	2.1168	1.2736	0.6477	0.3299	0.1795



3D screen shot	Hot spot position
	

MEASUREMENT 16

Type: Phone measurement (Complete)

Date of measurement: 08/12/2019

Measurement duration: 12 minutes 3 seconds

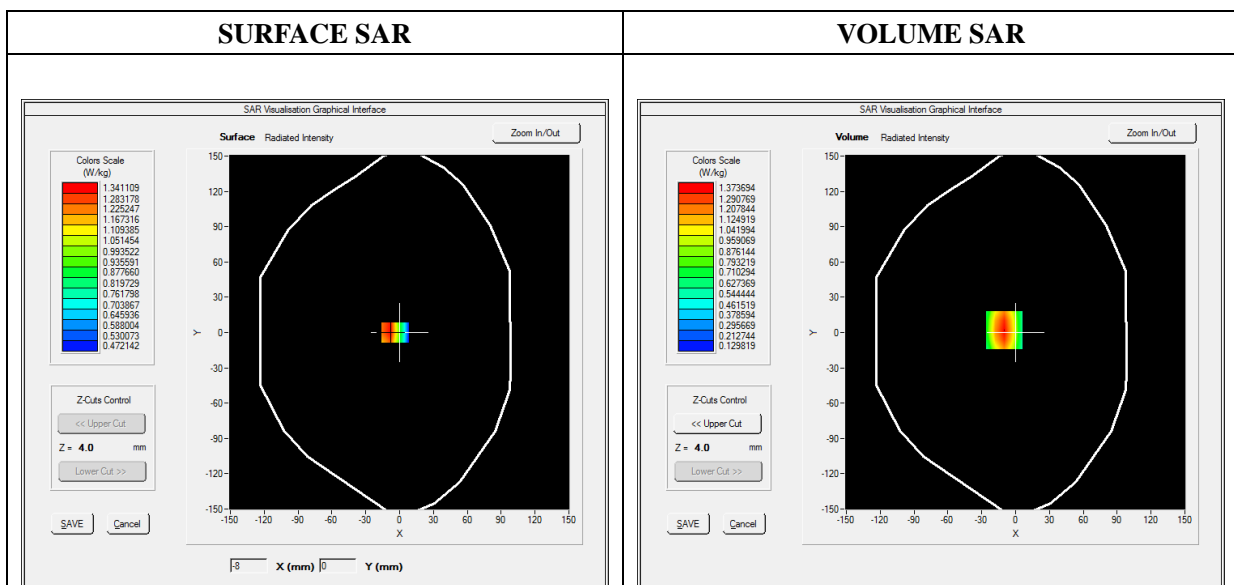
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 7.13; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Flat Plane
Device Position	Front
Band	LTE Band 26
Channels	QPSK, 15MHz, 1RB, High
Signal	Duty Cycle 1:1

B. SAR Measurement Results

Frequency (MHz)	841.500000
Relative Permittivity (real part)	54.851214
Conductivity (S/m)	0.951454
Power Variation (%)	1.037332
Ambient Temperature	21.1
Liquid Temperature	21.2

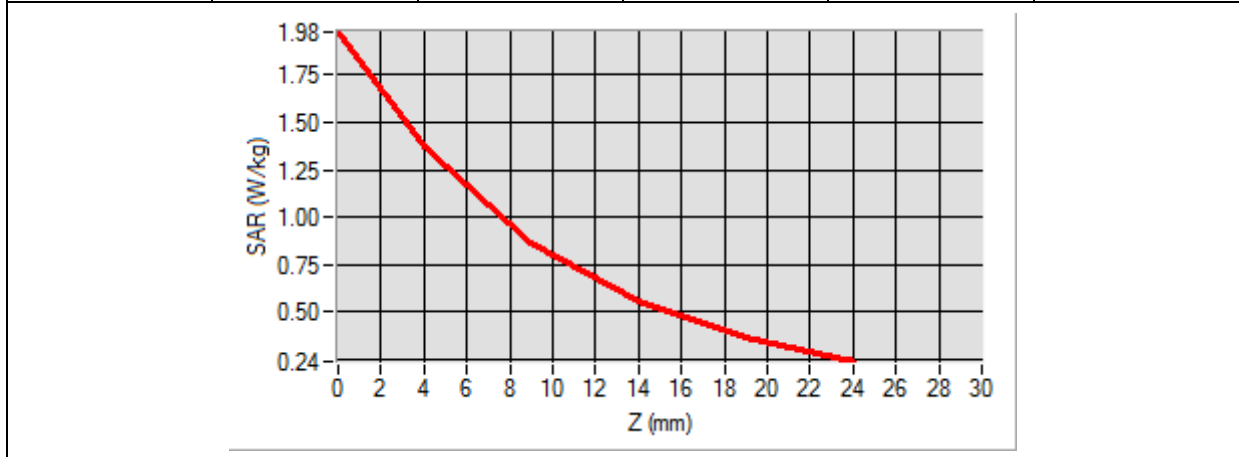


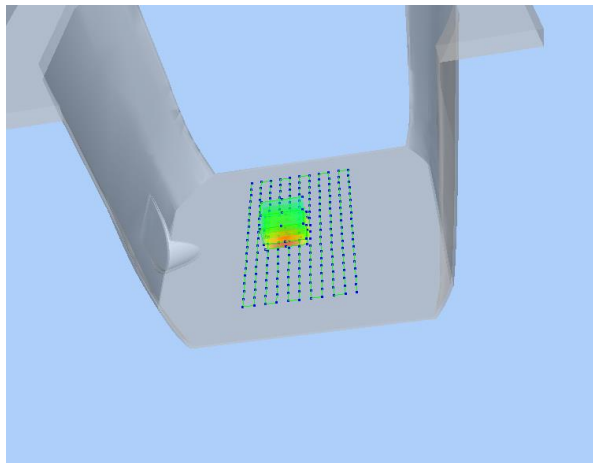

Maximum location: X=-10.00, Y=2.00

SAR Peak: 1.98 W/kg

SAR 10g (W/Kg)	0.793103
SAR 1g (W/Kg)	1.320906

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	1.9753	1.3737	0.8651	0.5528	0.3652



<p>3D screen shot</p>	<p>Hot spot position</p>
	

MEASUREMENT 28

Type: Phone measurement (Complete)

Date of measurement: 08/13/2019

Measurement duration: 12 minutes 3 seconds

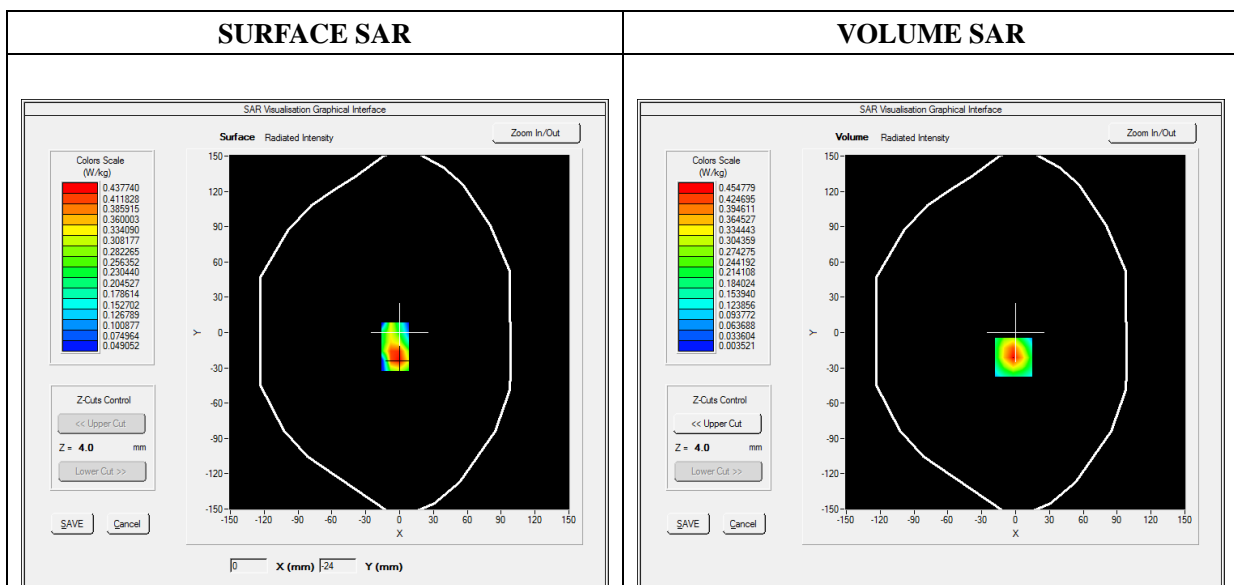
E-field Probe: SSE5 - SN 09/13 EP168; ConvF: 5.58; Calibrated: 05/22/2019

A. Experimental conditions

Area Scan	dx=8mm dy=8mm
Zoom Scan	dx=8mm dy=8mm dz=5mm
Phantom	Flat Plane
Device Position	Front
Band	LTE Band 41
Channels	QPSK, 5MHz, 1RB, Low
Signal	Duty Cycle 1:1.58

B. SAR Measurement Results

Frequency (MHz)	2498.500000
Relative Permittivity (real part)	52.241202
Conductivity (S/m)	2.120943
Power Variation (%)	2.492743
Ambient Temperature	21.1
Liquid Temperature	21.2

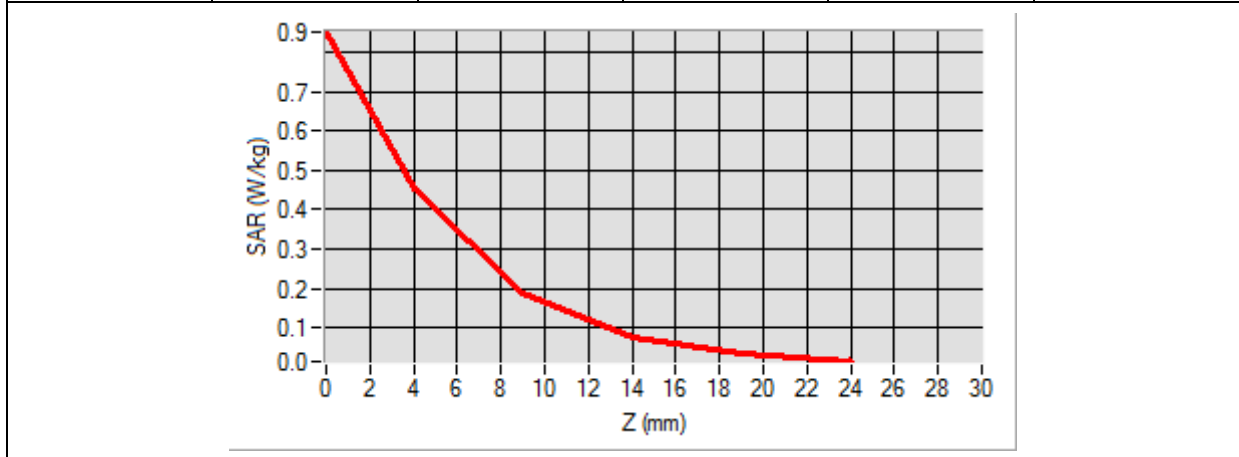


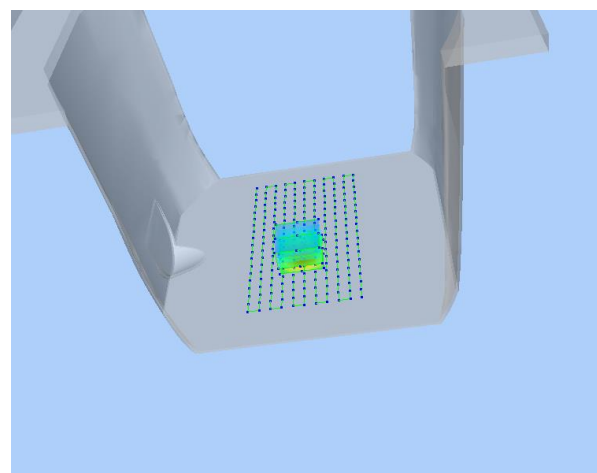
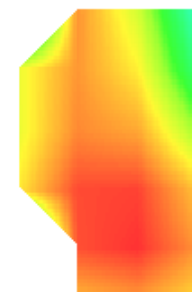
Maximum location: X=-2.00, Y=-21.00

SAR Peak: 0.86 W/kg

SAR 10g (W/Kg)	0.194919
SAR 1g (W/Kg)	0.428248

Z (mm)	0.00	4.00	9.00	14.00	19.00
SAR (W/Kg)	0.8513	0.4548	0.1888	0.0744	0.0316



3D screen shot	Hot spot position
	

Annex C. EUT Photos

EUT View Front



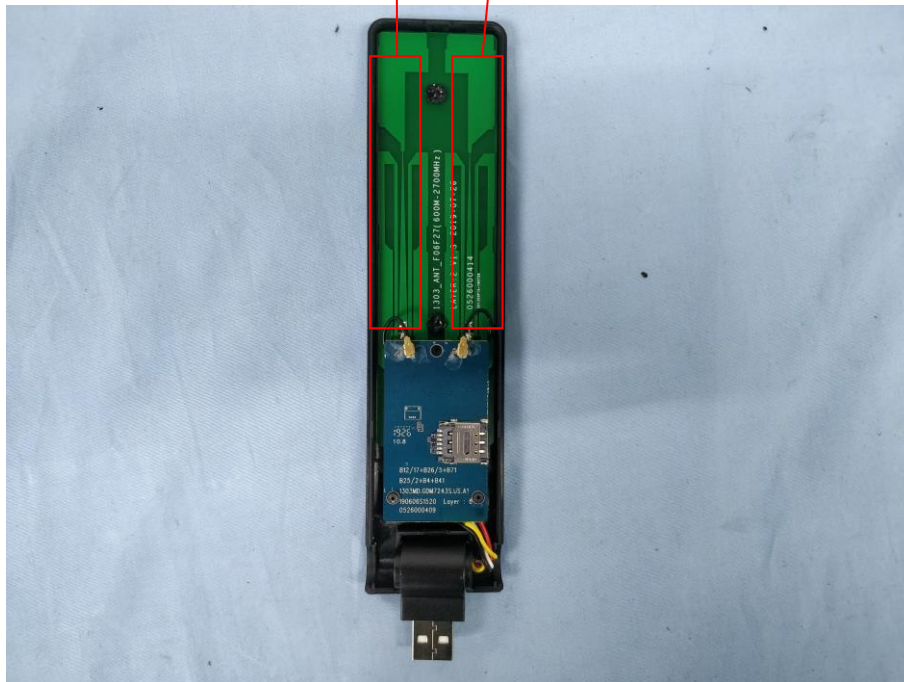
EUT View Back



Antenna View

LTE TX AND RX Ant.

LTE RX Ant.



Annex D. Test Setup Photos

Body mode Exposure Conditions

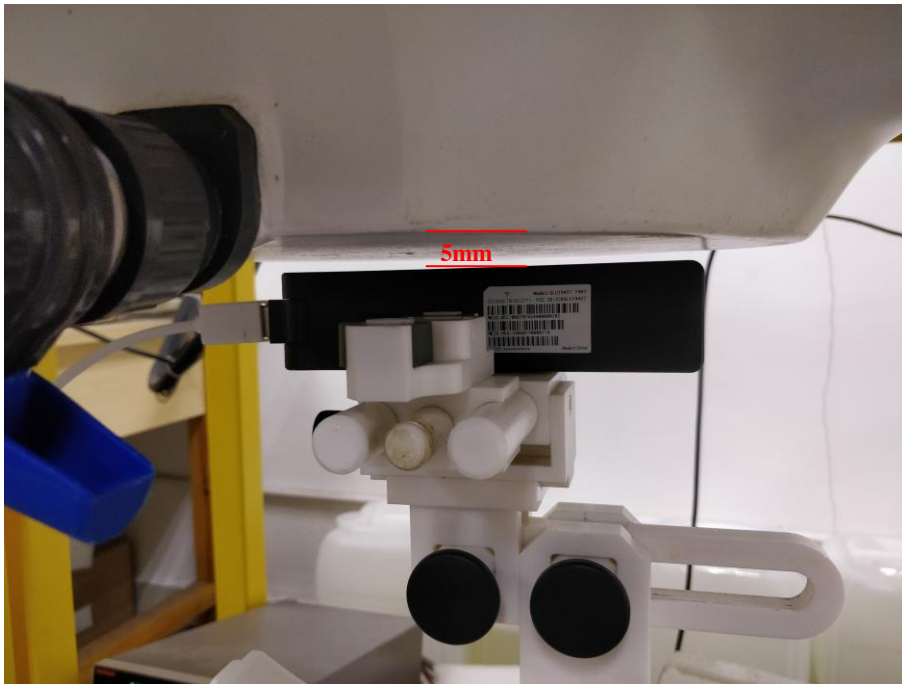
Body Front



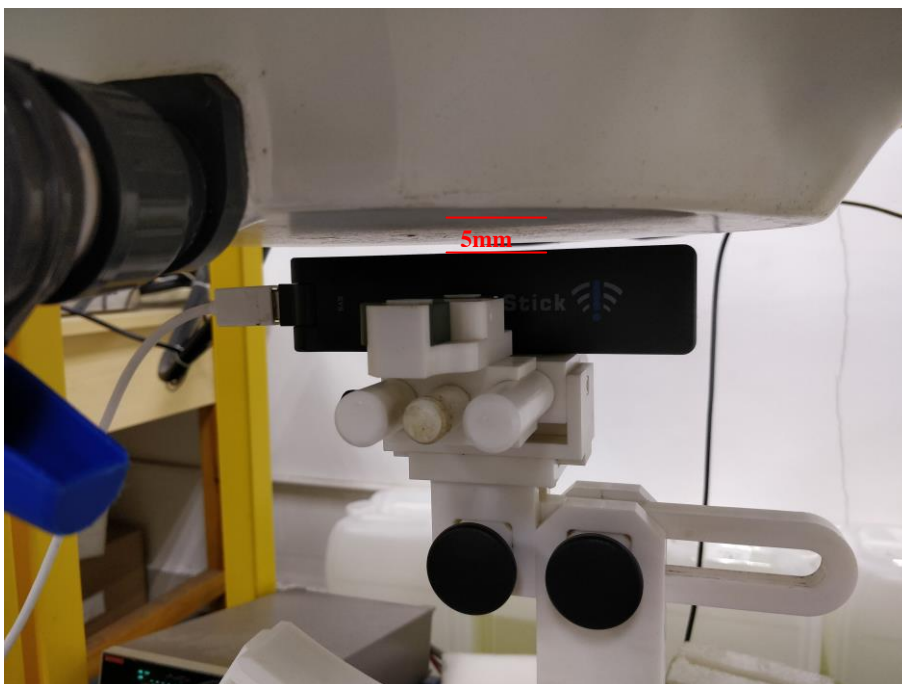
Body Back



Body Right



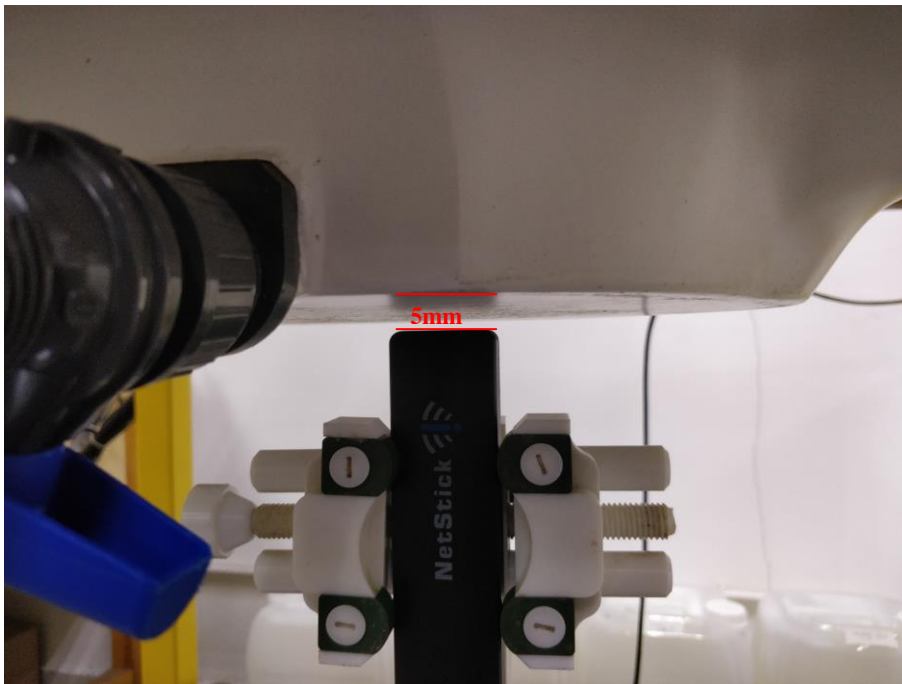
Body Left



Body Bottom



Body Top



Annex E. Calibration Certificate

Please refer to the exhibit for the calibration certificate

******* END OF REPORT *******