
SAR Test Report

Report No.: AGC01684200404FH01

FCC ID : 2AV8HMTV101

APPLICATION PURPOSE : Original Equipment

PRODUCT DESIGNATION : Modeshift Validator

BRAND NAME : Modeshift

MODEL NAME : MTV101

APPLICANT : Telelink City Services .

DATE OF ISSUE : Jun. 12,2020

STANDARD(S) : IEEE Std. 1528:2013
FCC 47 CFR Part 2§2.1093:2013
IEEE Std C95.1™-2005

REPORT VERSION : V1.0

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Report Revise Record

Report Version	Revise Time	Issued Date	Valid Version	Notes
V1.0	/	Jun. 12,2020	Valid	Initial Release

Test Report	
Applicant Name	Telelink City Services .
Applicant Address	6 Panorama Sofia str., Richhill business center, block B, floor 2, 1766 Sofia, BULGARIA
Manufacturer Name	Telelink City Services .
Manufacturer Address	6 Panorama Sofia str., Richhill business center, block B, floor 2, 1766 Sofia, BULGARIA
Factory Name	Telelink City Services .
Factory Address	6 Panorama Sofia str., Richhill business center, block B, floor 2, 1766 Sofia, BULGARIA
Product Designation	Modeshift Validator
Brand Name	Modeshift
Model Name	MTV101
Applicable Standard	IEEE Std. 1528:2013 FCC 47 CFR Part 2§2.1093:2013 IEEE Std C95.1™-2005
Test Date	May 21,2020 to Jun. 01,2020
Report Template	AGCRT-US-4G/SAR (2018-01-01)

Note: The results of testing in this report apply to the product/system which was tested only.

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1. SUMMARY OF MAXIMUM SAR VALUE

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

Frequency Band	Highest Reported 10-g Extremity SAR(W/Kg)	SAR Test Limit (W/Kg)
	Limbs	
UMTS Band II	1.274	4.0
UMTS Band V	0.226	
LTE Band 2	1.633	
LTE Band 5	0.348	
WIFI 2.4G	0.377	
Simultaneous Reported SAR	1.930	
SAR Test Result	PASS	

This device is compliance with Specific Absorption Rate (SAR) for general population/uncontrolled exposure limits (4.0W/Kg) specified in IEEE Std. 1528:2013; FCC 47CFR § 2.1093; IEEE/ANSI C95.1:2005 and the following specific FCC Test Procedures:

- KDB 447498 D01 General RF Exposure Guidance v06
- KDB 648474 D04 Handset SAR v01r03
- KDB 865664 D01 SAR Measurement 100MHz to 6GHz v01r04
- KDB 941225 D01 3G SAR Procedures v03r01
- KDB 248227 D01 802 11 Wi-Fi SAR v02r02
- KDB 941225 D05 SAR for LTE Devices v02r05

2. GENERAL INFORMATION

2.1. EUT Description

General Information	
Product Designation	Modeshift Validator
Test Model	MTV101
Hardware Version	TPS530-MAIN-V1.6
Software Version	TPS530_ALL_V1.0.0
Device Category	Portable
RF Exposure Environment	Uncontrolled
Antenna Type	Internal
WCDMA	
Support Band	☒ UMTS FDD Band II ☒ UMTS FDD Band V ☐ UMTS FDD Band IV ☐ UMTS FDD Band I ☐ UMTS FDD Band III ☐ UMTS FDD Band VIII
HS Type	HSPA(HSUPA/HSDPA)
TX Frequency Range	FDD Band II: 1850-1910MHz; FDD Band V: 820-850MHz
RX Frequency Range	FDD Band II: 1930-1990MHz; FDD Band V: 869-894MHz
Release Version	Rel-6
Type of modulation	HSDPA:QPSK/16QAM; HSUPA:BPSK; WCDMA:QPSK
Antenna Gain	Band II:1.35dBii; Band V: 1.03dBi
Max. Average Power	Band II: 23.57dBm; Band V: 24.03dBm

EUT Description(Continue)

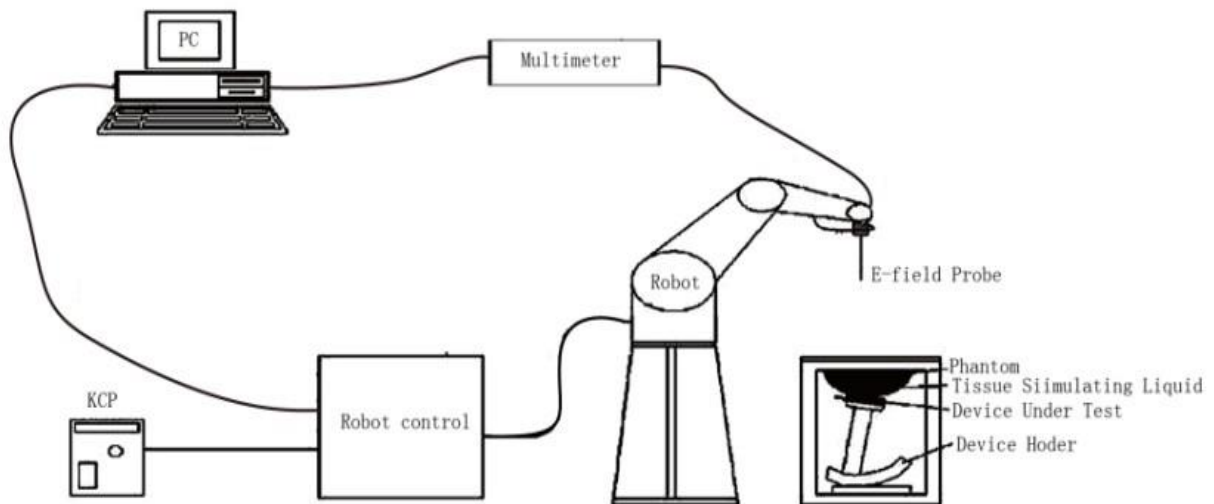
LTE	
Support Band	☒ FDD Band 2 ☐ FDD Band 4 ☒ FDD Band 5 ☐ FDD Band 7 ☐ FDD Band 12 ☐ FDD Band 17 ☐ FDD Band 25 ☐ FDD Band 26 ☐ TDD Band 41 (U.S. Bands) ☐ FDD Band 1 ☐ FDD Band 3 ☐ FDD Band 7 ☐ FDD Band 8 ☐ FDD Band 20 ☐ TDD Band 28 ☐ TDD Band 38 ☐ FDD Band 40 ☐ FDD Band 42 ☐ FDD Band 43 (Non-U.S. Bands)
TX Frequency Range	Band 2:1850-1910MHz; Band 5:824-849MHz;
RX Frequency Range	Band 2:1930-1990MHz; Band 5:869-894MHz;
Release Version	Rel-8
Type of modulation	QPSK, 16QAM
Antenna Gain	Band 2: 1.35dBi; Band 5:1.76dB;
Max. Average Power	Band 2: 22.14dBm; Band 5: 24.76dBm;
Bluetooth	
Bluetooth Version	☐ V2.0 ☐ V2.1 ☐ V2.1+EDR ☐ V3.0 ☐ V3.0+HS ☒ V4.0 ☐ V4.1
Operation Frequency	2402~2480MHz
Type of modulation	☒ GFSK ☒ π/4-DQPSK ☒ 8-DPSK
Peak Power	-2.142dBm
Antenna Gain	0dBi
WIFI	
WIFI Specification	☐ 802.11a ☒ 802.11b ☒ 802.11g ☒ 802.11n(20) ☒ 802.11n(40)
Operation Frequency	2412~2462MHz
Avg. Burst Power	11b: 13.14dBm,11g: 10.47dBm,11n(20): 10.41dBm,11n(40): 10.52dBm
Antenna Gain	0dBi
Power Supply	Input: 100-240V AC, 50Hz/60Hz Output: 12V DC, 2A

- Note:1.CMU200 can measure the average power and Peak power at the same time
 2.The sample used for testing is end product.
 3. The test sample has no any deviation to the test method of standard mentioned in page 1.

Product	Type
	☒ Production unit ☐ Identical Prototype

3. SAR MEASUREMENT SYSTEM

3.1. The SATIMO system used for performing compliance tests consists of following items



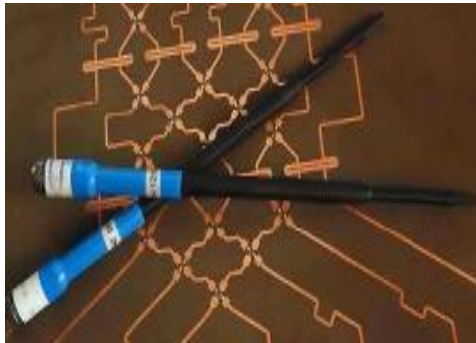
The COMOSAR system for performing compliance tests consists of the following items:

- The PC. It controls most of the bench devices and stores measurement data. A computer running WinXP and the Opensar software.
- The E-Field probe. The probe is a 3-axis system made of 3 distinct dipoles. Each dipole returns a voltage in function of the ambient electric field.
- The Keithley multimeter measures each probe dipole voltages.
- The SAM phantom simulates a human head. The measurement of the electric field is made inside the phantom.
- The liquids simulate the dielectric properties of the human head tissues.
- The network emulator controls the mobile phone under test.
- The validation dipoles are used to measure a reference SAR. They are used to periodically check the bench to make sure that there is no drift of the system characteristics over time.
- The phantom, the device holder and other accessories according to the targeted measurement.

3.2. COMOSAR E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SATIMO. 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. SATIMO conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528 and relevant KDB files.) The calibration data are in Appendix D.

Isotropic E-Field Probe Specification

Model	SSE5	
Manufacture	MVG	
Identification No.	SN 22/16 EP315	
Frequency	0.7GHz-3GHz Linearity:±0.06dB(0.7GHz-3GHz)	
Dynamic Range	0.01W/Kg-100W/Kg Linearity:±0.06dB	
Dimensions	Overall length:330mm Length of individual dipoles:4.5mm Maximum external diameter:8mm Probe Tip external diameter:5mm Distance between dipoles/ probe extremity:2.7mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 3 GHz with precisin of better 30%.	

3.3. Robot

The COMOSAR system uses the KUKA robot from SATIMO SA (France). For the 6-axis controller COMOSAR system, the KUKA robot controller version from SATIMO is used.

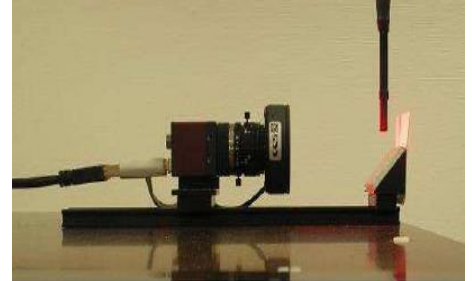
The XL robot series have many features that are important for our application:

- ☐ High precision (repeatability 0.02 mm)
- ☐ High reliability (industrial design)
- ☐ Jerk-free straight movements
- ☐ Low ELF interference (the closed metallic construction shields against motor control fields)
- ☐ 6-axis controller



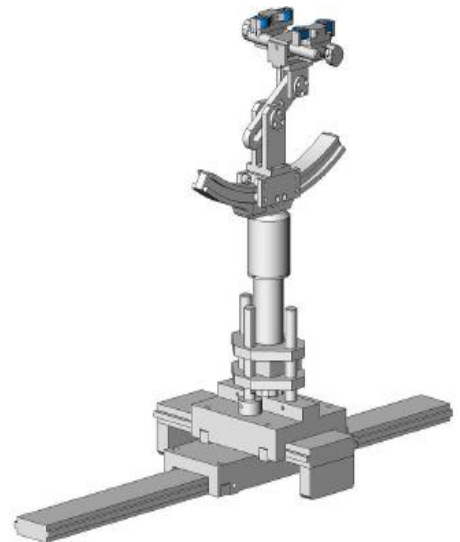
3.4. Video Positioning System

The video positioning system is used in OpenSAR to check the probe. Which is composed of a camera, LED, mirror and mechanical parts. The camera is piloted by the main computer with firewire link. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip. The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.



3.5. Device Holder

The COMOSAR device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR). Thus the device needs no repositioning when changing the angles. The COMOSAR device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity $\epsilon_r = 3$ and loss tangent $\delta = 0.02$. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.



3.6. SAM Twin Phantom

The SAM twin phantom is a fiberglass shell phantom with 2mm shell thickness (except the ear region where shell thickness increases to 6mm). It has three measurement areas:

- ☐ Left head
- ☐ Right head
- ☐ Flat phantom



The bottom plate contains three pair of bolts for locking the device holder. The device holder positions are adjusted to the standard measurement positions in the three sections. A white cover is provided to tap the phantom during off-periods to prevent water evaporation and changes in the liquid parameters. On the phantom top, three reference markers are provided to identify the phantom position with respect to the robot.

4. SAR MEASUREMENT PROCEDURE

4.1. Specific Absorption Rate (SAR)

SAR is related to the rate at which energy is absorbed per unit mass in 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 occupational/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 given mass density (ρ). The equation description is as below:

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

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

SAR can be obtained using either of the following equations:

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

$$SAR = c_h \left. \frac{dT}{dt} \right|_{t=0}$$

Where

SAR	is the specific absorption rate in watts per kilogram;
E	is the r.m.s. value of the electric field strength in the tissue in volts per meter;
σ	is the conductivity of the tissue in siemens per metre;
ρ	is the density of the tissue in kilograms per cubic metre;
c _h	is the heat capacity of the tissue in joules per kilogram and Kelvin;

$\left. \frac{dT}{dt} \right|_{t=0}$ is the initial time derivative of temperature in the tissue in kelvins per second

4.2. SAR Measurement Procedure

Step 1: Power Reference Measurement

The Power Reference Measurement and Power Drift Measurement are for monitoring the power drift of the device under test in the batch process. The minimum distance of probe sensors to surface is 2.7mm This distance cannot be smaller than the distance os sensor calibration points to probe tip as `defined in the probe properties,

Step 2: Area Scan

The Area Scan is used as a fast scan in two dimensions to find the area of high field values, before doing a fine measurement around the hot spot. The sophisticated interpolation routines implemented in SATIMO software can find the maximum locations even in relatively coarse grids. When an Area Scan has measured all reachable points, it computes the field maximal found in the scanned area, within a range of the global maximum. The range (in db) is specified in the standards for compliance testing. For example, a 2db range is required in IEEE Standard 1528 and IEC62209 standards, whereby 3db is a requirement when compliance is assessed in accordance with the ARIB standard (Japan) If one Zoom Scan follows the Area Scan, then only the absolute maximum will be taken as reference. For cases where multiple maximum are detected, the number of Zoom Scan has to be increased accordingly.

Area Scan Parameters extracted from KDB 865664 D01 SAR Measurement 100MHz to 6GHz

	$\leq 3 \text{ GHz}$	$> 3 \text{ GHz}$
Maximum distance from closest measurement point (geometric center of probe sensors) to phantom surface	$5 \pm 1 \text{ mm}$	$\frac{1}{2} \cdot \delta \cdot \ln(2) \pm 0.5 \text{ mm}$
Maximum probe angle from probe axis to phantom surface normal at the measurement location	$30^\circ \pm 1^\circ$	$20^\circ \pm 1^\circ$
Maximum area scan spatial resolution: $\Delta x_{\text{Area}}, \Delta y_{\text{Area}}$	$\leq 2 \text{ GHz: } \leq 15 \text{ mm}$ $2 - 3 \text{ GHz: } \leq 12 \text{ mm}$	$3 - 4 \text{ GHz: } \leq 12 \text{ mm}$ $4 - 6 \text{ GHz: } \leq 10 \text{ mm}$
	When the x or y dimension of the test device, in the measurement plane orientation, is smaller than the above, the measurement resolution must be $\leq$ the corresponding x or y dimension of the test device with at least one measurement point on the test device.	

Step 3: Zoom Scan

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

Zoom Scan Parameters extracted from KDB865664 d01 SAR Measurement 100MHz to 6GHz

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

Step 4: Power Drift Measurement

The Power Drift Measurement measures the field at the same location as the most recent power reference measurement within the same procedure, and with the same settings. The Power Drift Measurement gives the field difference in dB from the reading conducted within the same settings. This allows a user to monitor the power drift of the device under test within a batch process. The measurement procedure is the same as Step 1.

4.3. RF Exposure Conditions

Test Configuration and setting:

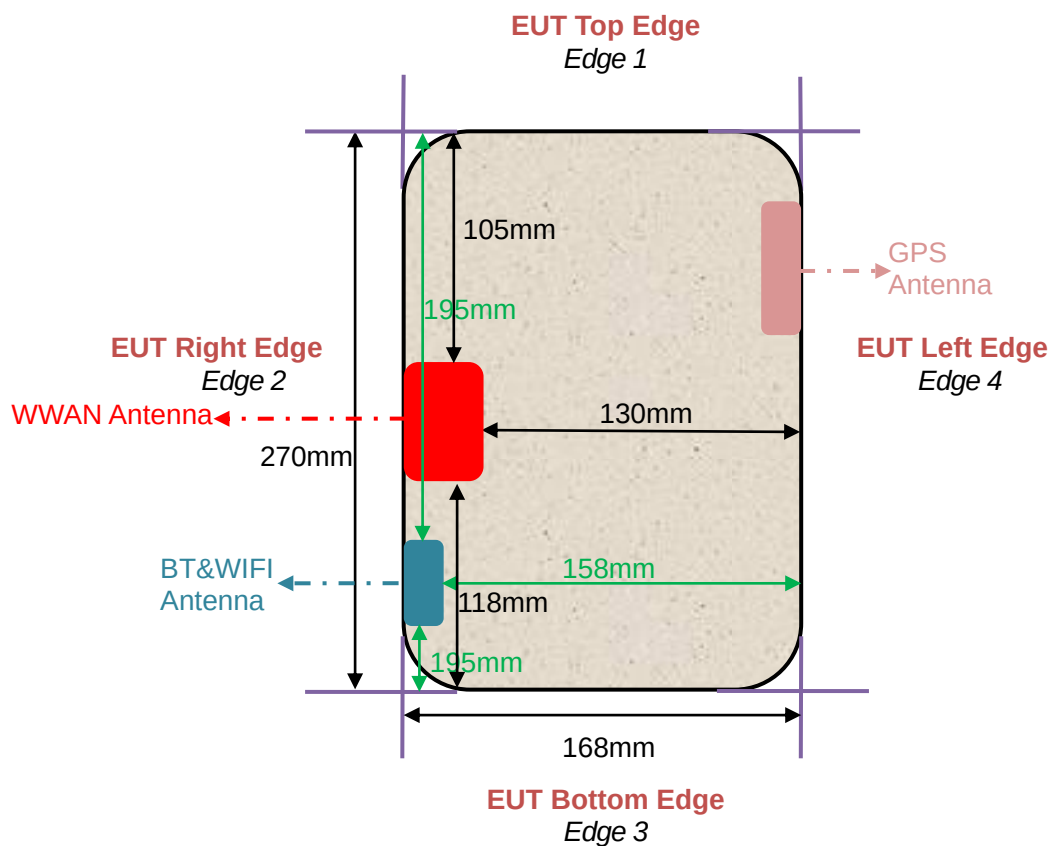
The EUT is a model of POS terminal. It supports WCDMA/HSPA, LTE, BT, WIFI.

For WWAN SAR testing, the device was controlled by using a base station emulator. Communication between the device and the emulator were established by air link. The distance between the EUT and the antenna is larger than 50cm, and the output power radiated from the emulator antenna is at least 30db smaller than the output power of EUT.

For WLAN testing, the EUT is configured with the WLAN continuous TX tool through engineering command.

Due the BT power is less than exemption limit, SAR is not required.

Antenna Location: (the back view)



For WWAN mode:

Test Configurations	Antenna to edges/surface	SAR required	Note
Limbs			
Back	45mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Front	6mm	Yes	--
Edge 1 (Top)	105mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Edge 2 (Right)	3mm	Yes	--
Edge 3 (Bottom)	118mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Edge 4 (Left)	130mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.

For WLAN mode:

Test Configurations	Antenna to edges/surface	SAR required	Note
Limbs			
Back	47mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Front	12mm	Yes	--
Edge 1 (Top)	195mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Edge 2 (Right)	3mm	Yes	--
Edge 3 (Bottom)	29mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.
Edge 4 (Left)	158mm	No	SAR is not required for the distance between the antenna and the edge is >25mm as FCC guidance.

5. TISSUE SIMULATING LIQUID

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 15cm. For head SAR testing the liquid height from the ear reference point (ERP) of the phantom to the liquid top surface is larger than 15cm For body SAR testing, the liquid height from the center of the flat phantom to the liquid top surface is larger than 15cm. The nominal dielectric values of the tissue simulating liquids in the phantom and the tolerance of 5% are listed in 5.2

5.1. The composition of the tissue simulating liquid

Ingredient (% Weight) Frequency (MHz)	Water	Nacl	Polysorbate 20	DGBE	1,2 Propanediol	Triton X-100
835 Body	54.00	1	0.0	15	0.0	30
1900 Body	70	1	0.0	9	0.0	20
2450 Body	70	1	0.0	9	0.0	20

5.2. Tissue Dielectric Parameters for Head and Body Phantoms

The head tissue dielectric parameters recommended by the IEEE 1528 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 IEEE 1528 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 IEEE 1528.

Target Frequency (MHz)	head		body	
	ϵ_r	σ (S/m)	ϵ_r	σ (S/m)
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
750	41.9	0.89	55.5	0.96
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	1.01	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1750	40.1	1.37	53.4	1.49
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	52.7	1.95
2600	39.0	1.96	52.5	2.16
3000	38.5	2.40	52.0	2.73

(ϵ_r = relative permittivity, σ = conductivity and $\rho = 1000 \text{ kg/m}^3$)

5.3. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using SATIMO Dielectric Probe Kit and R&S Network Analyzer ZVL6.

Tissue Stimulant Measurement for 835MHz					
Body	Fr. (MHz)	Dielectric Parameters ($\pm 5\%$)		Tissue Temp [$^{\circ}\text{C}$]	Test time
		ϵ_r 55.20(52.44-57.96)	δ [s/m]0.97(0.9215-1.0185)		
	835	53.62	0.96	20.9	May 21,2020
	836.6	52.81	0.97		

Tissue Stimulant Measurement for 1900MHz					
Body	Fr. (MHz)	Dielectric Parameters ($\pm 5\%$)		Tissue Temp [$^{\circ}\text{C}$]	Test time
		ϵ_r 53.30(50.635-55.965)	δ [s/m]1.52(1.444-1.596)		
	1880	40.53	1.40	20.6	May 21,2020
	1900	39.58	1.42		

Tissue Stimulant Measurement for 2450MHz					
Body	Fr. (MHz)	Dielectric Parameters ($\pm 5\%$)		Tissue Temp [$^{\circ}\text{C}$]	Test time
		ϵ_r 52.7(50.065-55.335)	δ [s/m]1.95(1.8525-2.0475)		
	2437	52.32	1.90	19.8	May 27,2020
	2450	51.61	1.92		

Tissue Stimulant Measurement for 835MHz					
Body	Fr. (MHz)	Dielectric Parameters ($\pm 5\%$)		Tissue Temp [$^{\circ}\text{C}$]	Test time
		ϵ_r 55.20(52.44-57.96)	δ [s/m]0.97(0.9215-1.0185)		
	835	54.69	0.98	20.1	Jun. 01,2020
	836.6	53.76	0.99		

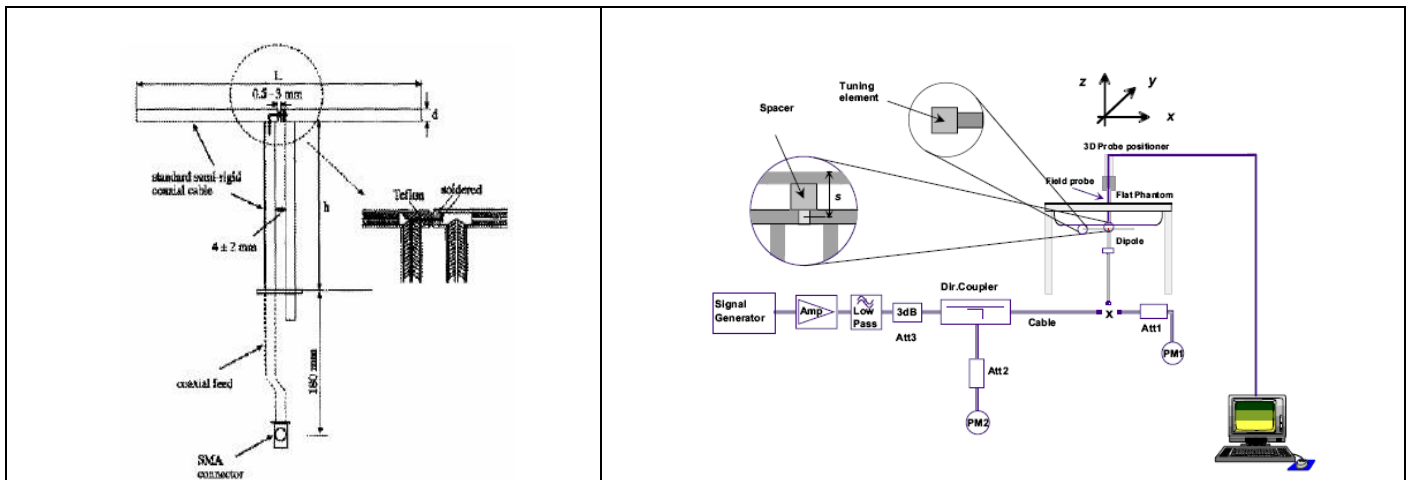
6. SAR SYSTEM CHECK PROCEDURE

6.1. SAR System Check Procedures

SAR system check is required to confirm measurement accuracy, according to the tissue dielectric media, probe calibration points and other system operating parameters required for measuring the SAR of a test device. The system verification must be performed for each frequency band and within the valid range of each probe calibration point required for testing the device. The same SAR probe(s) and tissue-equivalent media combinations used with each specific SAR system for system verification must be used for device testing. When multiple probe calibration points are required to cover substantially large transmission bands, independent system verifications are required for each probe calibration point. A system verification must be performed before each series of SAR measurements using the same probe calibration point and tissue-equivalent medium. Additional system verification should be considered according to the conditions of the tissue-equivalent medium and measured tissue dielectric parameters, typically every three to four days when the liquid parameters are remeasured or sooner when marginal liquid parameters are used at the beginning of a series of measurements.

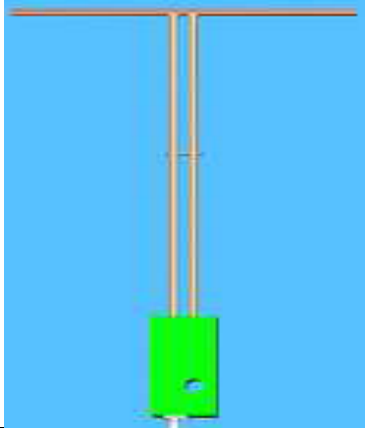
Each SATIMO system is equipped with one or more system check kits. These units, together with the predefined measurement procedures within the SATIMO software, enable the user to conduct the system check and system validation. System kit includes a dipole, and dipole device holder.

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



6.2. SAR System Check

6.2.1. Dipoles

	The dipoles used is based on the IEEE-1528 standard, and is complied with mechanical and electrical specifications in line with the requirements of IEEE. the table below provides details for the mechanical and electrical Specifications for the dipoles.
---	---

Frequency	L (mm)	h (mm)	d (mm)
835MHz	161.0	89.8	3.6
1900MHz	68	39.5	3.6
2450MHz	51.5	30.4	3.6

6.2.2. System Check Result

System Performance Check at 835MHz &1900MHz &2450MHz for Body								
Validation Kit: SN29/15 DIP 0G835-383& SN 46/11 DIP 1G900-187& SN46/11 DIP 2G450-189								
Frequency [MHz]	Target Value(W/Kg)		Reference Result ($\pm 10\%$)		Tested Value(W/Kg)		Tissue Temp. [°C]	Test time
	1g	10g	1g	10g	1g	10g		
835	9.95	6.50	8.955-10.945	5.85-7.15	10.65	6.73	20.9	May 21,2020
1900	40.82	20.99	36.738-44.902	18.891-23.089	42.89	21.31	20.6	May 21,2020
2450	54.45	24.16	49.005-59.895	21.744-26.576	51.53	23.19	19.8	May 27,2020
835	9.95	6.50	8.955-10.945	5.85-7.15	9.78	6.47	20.1	Jun. 01,2020

Note:

(1) We use a CW signal of 18dBm for system check, and then all SAR value are normalized to 1W forward power. The result must be within $\pm 10\%$ of target value.

7. EUT TEST POSITION

This EUT was tested in **front and Edge2**.

7.1. Test Position

- (1) To position the EUT parallel to the phantom surface.
- (2) To adjust the EUT parallel to the flat phantom.
- (3) To adjust the distance between the EUT surface and the flat phantom to **0mm**.

The SAR test procedure has been defined by FCC via KDB.

8. SAR EXPOSURE LIMITS

Limits for General Population/Uncontrolled Exposure (W/kg)

Type Exposure	Uncontrolled Environment Limit (W/kg)
Spatial Peak SAR (1g cube tissue for brain or body)	1.60
Spatial Average SAR (Whole body)	0.08
Spatial Peak SAR (Limbs)	4.0

9. TEST FACILITY

Test Site	Attestation of Global Compliance (Shenzhen) Co., Ltd
Location	1-2/F, Building 19, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China
Designation Number	CN1259
FCC Test Firm Registration Number	975832
A2LA Cert. No.	5054.02
Description	Attestation of Global Compliance(Shenzhen) Co., Ltd is accredited by A2LA

10. TEST EQUIPMENT LIST

Equipment description	Manufacturer/ Model	Identification No.	Current calibration date	Next calibration date
SAR Probe	MVG	SN 22/16 EP315	Jun. 04,2019	Jun. 03,2020
Phantom	SATIMO	SN_4511_SAM90	Validated. No cal required.	Validated. No cal required.
Liquid	SATIMO	-	Validated. No cal required.	Validated. No cal required.
Comm Tester	Agilent-8960	GB46310822	Oct. 08,2019	Oct. 07,2020
Comm Tester	R&S- CMW500	S/N120909	Jul. 02,2019	Jul. 01,2020
Multimeter	Keithley 2000	4114939	Sep. 09,2019	Sep. 08,2020
Dipole	SATIMO SID835	SN29/15 DIP 0G835-383	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID1900	SN 46/11 DIP 1G900-187	Apr. 26,2019	Apr. 25,2022
Dipole	SATIMO SID2450	SN46/11 DIP 2G450-189	Apr. 26,2019	Apr. 25,2022
Signal Generator	Agilent-E4438C	US41461365	Oct. 08,2019	Oct. 07,2020
Vector Analyzer	Agilent / E4440A	US41421290	Sep. 09,2019	Sep. 08,2020
Network Analyzer	Rhode & Schwarz ZVL6	SN101443	Oct. 08,2019	Oct. 07,2020
Attenuator	Warison /WATT-6SR1211	S/N:WRJ34AYM2F1	June 11,2019	June 10, 2020
Attenuator	Mini-circuits / VAT-10+	31405	June 11,2019	June 10, 2020
Amplifier	AS0104-55_55	1004793	June 12,2019	June 11,2020
Directional Couple	Werlatone/ C5571-10	SN99463	June 12,2019	June 11,2020
Directional Couple	Werlatone/ C6026-10	SN99482	June 12,2019	June 11,2020
Power Sensor	NRP-Z21	1137.6000.02	Sep. 09,2019	Sep. 08,2020
Power Sensor	NRP-Z23	US38261498	Feb. 18,2020	Feb. 17,2021
Power Viewer	R&S	V2.3.1.0	N/A	N/A

Note: Per KDB 865664 Dipole SAR Validation, AGC Lab has adopted 3 years calibration intervals. On annual basis, every measurement dipole has been evaluated and is in compliance with the following criteria:

1. There is no physical damage on the dipole;
2. System validation with specific dipole is within 10% of calibrated value;
3. Return-loss is within 20% of calibrated measurement;
4. Impedance is within 5Ω of calibrated measurement.

11. MEASUREMENT UNCERTAINTY

Measurement uncertainty for Dipole averaged over 1 gram / 10 gram									
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	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	0.57	R	$\sqrt{3}$	$\sqrt{0.5}$	$\sqrt{0.5}$	0.23	0.23	∞
Hemispherical Isotropy	E.2.2	0.915	R	$\sqrt{3}$	$\sqrt{0.5}$	$\sqrt{0.5}$	0.37	0.37	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	0.675	R	$\sqrt{3}$	1	1	0.39	0.39	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	3.0	R	$\sqrt{3}$	1	1	1.73	1.73	∞
Readout Electronics	E.2.6	0.021	N	1	1	1	0.021	0.021	∞
Response Time	E.2.7	0	R	$\sqrt{3}$	1	1	0	0	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
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	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
Test sample Related									
Test sample positioning	E.4.2	2.6	N	1	1	1	2.6	2.6	∞
Device holder uncertainty	E.4.1	3	N	1	1	1	3	3	∞
Output power variation—SAR drift measurement	E.2.9	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
SAR scaling	E.6.5	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				9.787	9.587	
Expanded Uncertainty (95% Confidence interval)			K=2				19.573	19.175	

System Validation uncertainty for Dipole averaged over 1 gram / 10 gram.									
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	5.831	N	1	1	1	5.83	5.83	∞
Axial Isotropy	E.2.2	0.57	R	$\sqrt{3}$	1	1	0.33	0.33	∞
Hemispherical Isotropy	E.2.2	0.915	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Linearity	E.2.4	0.675	R	$\sqrt{3}$	1	1	0.39	0.39	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	1	1	0.58	0.58	∞
Modulation response	E.2.5	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.021	N	1	1	1	0.021	0.021	∞
Response Time	E.2.7	0.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
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	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	$\sqrt{3}$	1	1	1.33	1.33	∞
System check source (dipole)									
Deviation of experimental dipole from numerical dipole	E.6.4	5.0	N	1	1	1	5.00	5.00	∞
Input power and SAR drift measurement	8,6.6.4	5.0	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2.0	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4.0	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4.0	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5.0	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				9.735	9.534	
Expanded Uncertainty (95% Confidence interval)			K=2				19.470	19.069	

System check uncertainty for Dipole averaged over 1 gram / 10 gram.									
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 drift	E.2.1.3	0.5	N	1	1	1	0.50	0.50	∞
Axial Isotropy	E.2.2	0.57	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Hemispherical Isotropy	E.2.2	0.915	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Boundary effect	E.2.3	1.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Linearity	E.2.4	0.675	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System detection limits	E.2.4	1.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Modulation response	E.2.5	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Readout Electronics	E.2.6	0.021	N	1	0	0	0.00	0.00	∞
Response Time	E.2.7	0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Integration Time	E.2.8	1.4	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-Noise	E.6.1	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
RF ambient conditions-reflections	E.6.1	3.0	R	$\sqrt{3}$	0	0	0.00	0.00	∞
Probe positioner mechanical tolerance	E.6.2	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Probe positioning with respect to phantom shell	E.6.3	1.4	R	$\sqrt{3}$	1	1	0.81	0.81	∞
Extrapolation, interpolation, and integrations algorithms for max. SAR evaluation	E.5	2.3	R	$\sqrt{3}$	0	0	0.00	0.00	∞
System check source (dipole)									
Deviation of experimental dipoles	E.6.4	2	N	1	1	1	2	2	∞
Input power and SAR drift measurement	8,6.6.4	5	R	$\sqrt{3}$	1	1	2.89	2.89	∞
Dipole axis to liquid distance	8,E.6.6	2	R	$\sqrt{3}$	1	1	1.15	1.15	∞
Phantom and tissue parameters									
Phantom shell uncertainty—shape, thickness, and permittivity	E.3.1	4	R	$\sqrt{3}$	1	1	2.31	2.31	∞
Uncertainty in SAR correction for deviations in permittivity and conductivity	E.3.2	1.9	N	1	1	0.84	1.90	1.60	∞
Liquid conductivity measurement	E.3.3	4	N	1	0.78	0.71	3.12	2.84	M
Liquid permittivity measurement	E.3.3	5	N	1	0.23	0.26	1.15	1.30	M
Liquid conductivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.78	0.71	1.13	1.02	∞
Liquid permittivity—temperature uncertainty	E.3.4	2.5	R	$\sqrt{3}$	0.23	0.26	0.33	0.38	∞
Combined Standard Uncertainty			RSS				5.564	5.205	
Expanded Uncertainty (95% Confidence interval)			K=2				11.128	10.410	

12. CONDUCTED POWER MEASUREMENT

UMTS BAND

HSDPA Setup Configuration:

- The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- The RF path losses were compensated into the measurements.
- A call was established between EUT and Based Station with following setting:
 - (1) Set Gain Factors(β_c and β_d) parameters set according to each
 - (2) Set RMC 12.2Kbps+HSDPA mode.
 - (3) Set Cell Power=-86dBm
 - (4) Set HS-DSCH Configuration Type to FRC (H-set 1, QPSK)
 - (5) Select HSDPA Uplink Parameters
 - (6) Set Delta ACK, Delta NACK and Delta CQI=8
 - (7) Set Ack - Nack Repetition Factor to 3
 - (8) Set CQI Feedback Cycle (k) to 4ms
 - (9) Set CQI Repetition Factor to 2
 - (10) Power Ctrl Mode=All Up bits
- The transmitted maximum output power was recorded.

Table C.10.2.4: β values for transmitter characteristics tests with HS-DPCCH

Sub-test	β_c (Note5)	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note1, Note 2)	CM (dB) (Note 3)	MPR (dB) (Note 3)
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15(Note 4)	15/15(Note 4)	64	12/15(Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Note 1: ΔACK , $\Delta NACK$ and $\Delta CQI = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$.

Note 2: For the HS-DPCCH power mask requirement test in clause 5.2C, 5.7A, and the Error Vector Magnitude (EVM) with HS-DPCCH test in clause 5.13.1A, and HSDPA EVM with phase discontinuity in clause

5.13.1AA, ΔACK and $\Delta NACK = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$, and $\Delta CQI = 24/15$ with $\beta_{hs} = 24/15 * \beta_c$.

Note 3: CM = 1 for $\beta_c/\beta_d = 12/15$, $\beta_{hs}/\beta_c = 24/15$. For all other combinations of DPDCH, DPCCH and HS-DPCCH the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.

Note 4: For subtest 2 the β_c/β_d ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $\beta_c = 11/15$ and $\beta_d = 15/15$.

HSUPA Setup Configuration:

- The EUT was connected to Base Station Agilent E5515C referred to the Setup Configuration.
- The RF path losses were compensated into the measurements.
- A call was established between EUT and Base Station with following setting * :
 - (1) Call Configs = 5.2B, 5.9B, 5.10B, and 5.13.2B with QPSK
 - (2) Set the Gain Factors (β_c and β_d) and parameters (AG Index) were set according to each specific sub-test in the following table, C11.1.3, quoted from the TS 34.121
 - (3) Set Cell Power = -86 dBm
 - (4) Set Channel Type = 12.2k + HSPA
 - (5) Set UE Target Power
 - (6) Power Ctrl Mode= Alternating bits
 - (7) Set and observe the E-TFCI
 - (8) Confirm that E-TFCI is equal to the target E-TFCI of 75 for sub-test 1, and other subtest's E-TFCI
- The transmitted maximum output power was recorded.

Table C.11.1.3: β values for transmitter characteristics tests with HS-DPCCH and E-DCH

Sub-test	β_c	β_d	β_d (SF)	β_c/β_d	β_{HS} (Note 1)	β_{ec}	β_{ed} (Note 4) (Note 5)	β_{ed} (SF)	β_{ed} (Code s)	CM (dB) (Note 2)	MPR (dB) (Note 2) (Note 6)	AG Index (Note 5)	E-TF CI
1	11/15 (Note 3)	15/15 (Note 3)	64	11/15 (Note 3)	22/15	209/225	1309/225	4	1	1.0	0.0	20	75
2	6/15	15/15	64	6/15	12/15	12/15	94/75	4	1	3.0	2.0	12	67
3	15/15	9/15	64	15/9	30/15	30/15	β_{ed1} : 47/15 β_{ed2} : 47/15	4 4	2	2.0	1.0	15	92
4	2/15	15/15	64	2/15	4/15	2/15	56/75	4	1	3.0	2.0	17	71
5	15/15	0	-	-	5/15	5/15	47/15	4	1	1.0	0.0	12	67

Note 1: For sub-test 1 to 4, ΔACK , $\Delta NACK$ and $\Delta CQI = 30/15$ with $\beta_{hs} = 30/15 * \beta_c$. For sub-test 5, ΔACK , $\Delta NACK$ and $\Delta CQI = 5/15$ with $\beta_{hs} = 5/15 * \beta_c$.

Note 2: CM = 1 for $\beta_c/\beta_d = 12/15$, $hs/c = 24/15$. For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.

Note 3: For subtest 1 the c/d ratio of 11/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signalled gain factors for the reference TFC (TF1, TF1) to $c = 10/15$ and $d = 15/15$.

Note 4: In case of testing by UE using E-DPDCH Physical Layer category 1, Sub-test 3 is omitted according to TS25.306 Table 5.1g.

Note 5: β_{ed} cannot be set directly; it is set by Absolute Grant Value.

Note 6: For subtests 2, 3 and 4, UE may perform E-DPDCH power scaling at max power which could results in slightly smaller MPR values.

UMTS BAND II

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 1900 RMC	1852.4	23.48
	1880	23.44
	1907.6	23.57
WCDMA 1900 AMR	1852.4	23.22
	1880	23.18
	1907.6	23.31
HSDPA Subtest 1	1852.4	22.54
	1880	22.64
	1907.6	22.78
HSDPA Subtest 2	1852.4	22.33
	1880	22.33
	1907.6	22.43
HSDPA Subtest 3	1852.4	21.92
	1880	22.27
	1907.6	22.47
HSDPA Subtest 4	1852.4	22.29
	1880	22.28
	1907.6	22.28
HSUPA Subtest 1	1852.4	22.66
	1880	22.40
	1907.6	22.04
HSUPA Subtest 2	1852.4	21.48
	1880	21.21
	1907.6	21.67
HSUPA Subtest 3	1852.4	21.14
	1880	20.82
	1907.6	21.18
HSUPA Subtest 4	1852.4	21.84
	1880	21.90
	1907.6	21.96
HSUPA Subtest 5	1852.4	21.55
	1880	21.25
	1907.6	21.74

UMTS BAND V

Mode	Frequency (MHz)	Avg. Burst Power (dBm)
WCDMA 850 RMC	826.4	24.03
	836.6	24.00
	846.6	23.76
WCDMA 850 AMR	826.4	23.85
	836.6	23.79
	846.6	23.52
HSDPA Subtest 1	826.4	22.90
	836.6	22.82
	846.6	22.71
HSDPA Subtest 2	826.4	22.36
	836.6	22.38
	846.6	22.38
HSDPA Subtest 3	826.4	22.13
	836.6	22.12
	846.6	22.34
HSDPA Subtest 4	826.4	22.46
	836.6	22.13
	846.6	22.32
HSUPA Subtest 1	826.4	22.04
	836.6	22.52
	846.6	22.82
HSUPA Subtest 2	826.4	21.67
	836.6	21.96
	846.6	21.50
HSUPA Subtest 3	826.4	21.73
	836.6	21.52
	846.6	21.08
HSUPA Subtest 4	826.4	22.36
	836.6	22.25
	846.6	22.33
HSUPA Subtest 5	826.4	21.29
	836.6	22.69
	846.6	21.47

According to 3GPP 25.101 sub-clause 6.2.2 , the maximum output power is allowed to be reduced by following the table.

Table 6.1aA: UE maximum output power with HS-DPCCH and E-DCH

UE Transmit Channel Configuration	CM(db)	MPR(db)
For all combinations of ,DPDCH,DPCCH HS-DPDCH,E-DPDCH and E-DPCCH	$0 \leq CM \leq 3.5$	$MAX(CM-1,0)$
Note: CM=1 for $\beta_c/\beta_d=12/15$, $\beta_{hs}/\beta_c=24/15$.For all other combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH the MPR is based on the relative CM difference.		

The device supports MPR to solve linearity issues (ACLR or SEM) due to the higher peak-to average ratios (PAR) of the HSUPA signal. This prevents saturating the full range of the TX DAC inside of device and provides a reduced power output to the RF transceiver chip according to the Cubic Metric (a function of the combinations of DPDCH, DPCCH, HS-DPCCH, E-DPDCH and E-DPCCH).

When E-DPDCH channels are present the beta gains on those channels are reduced firsts to try to get the power under the allowed limit. If the beta gains are lowered as far as possible, then a hard limiting is applied at the maximum allowed level.

The SW currently recalculates the cubic metric every time the beta gains on the E-DPDCH are reduced. The cubic metric will likely get lower each time this is done .However, there is no reported reduction of maximum output power in the HSUPA mode since the device also provides a compensation for the power back-off by increasing the gain of TX_AGC in the transceiver (PA) device.

The end effect is that the DUT output power is identical to the case where there is no MPR in the device.

LTE Band

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18607	18900	19193
1.4MHz	QPSK	1	0	0	21.66	21.36	21.63
			3	0	21.77	21.35	21.60
			5	0	21.73	21.40	21.50
		3	0	0	21.53	21.19	21.61
			2	0	21.53	21.17	21.60
			3	0	21.55	21.50	21.58
		6	0	1	20.60	20.34	20.61
	16QAM	1	0	1	21.12	20.23	20.32
			3	1	21.03	20.31	20.48
			5	1	20.93	20.29	20.27
		3	0	1	21.11	21.14	21.07
			2	1	21.02	21.05	21.05
			3	1	21.11	21.28	21.02
		6	0	2	19.65	19.08	19.71
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18615	18900	19185
3MHz	QPSK	1	0	0	21.33	21.18	21.78
			7	0	21.33	21.20	21.56
			14	0	21.45	21.23	21.47
		8	0	1	20.43	20.33	20.71
			4	1	20.46	20.33	20.70
			7	1	20.43	20.30	20.69
		15	0	1	20.45	20.31	20.69
	16QAM	1	0	1	20.34	20.08	20.36
			7	1	20.30	20.11	20.09
			14	1	20.26	20.30	20.03
		8	0	2	20.13	20.09	20.09
			4	2	20.12	20.02	20.08
			7	2	20.05	20.01	20.00
		15	0	2	19.63	19.18	19.51

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18625	18900	19175
5MHz	QPSK	1	0	0	21.32	21.30	21.60
			12	0	21.40	21.18	21.84
			24	0	21.59	21.21	21.59
		12	0	1	20.56	20.39	20.79
			6	1	20.55	20.39	20.79
			13	1	20.55	20.38	20.81
		25	0	1	20.54	20.37	20.77
	16QAM	1	0	1	20.54	20.36	21.07
			12	1	20.87	20.52	20.67
			24	1	20.74	20.58	20.51
		12	0	2	20.06	20.08	20.09
			6	2	20.06	20.06	20.08
			13	2	20.04	20.08	20.08
		25	0	2	19.48	19.58	19.96
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18650	18900	19150
10MHz	QPSK	1	0	0	21.44	21.11	21.73
			24	0	21.81	21.54	21.90
			49	0	21.55	21.39	21.44
		25	0	1	20.41	20.28	20.83
			12	1	20.48	20.29	20.83
			25	1	20.58	20.51	20.85
		50	0	1	20.50	20.34	20.72
	16QAM	1	0	1	20.29	19.98	21.06
			24	1	20.59	20.46	21.04
			49	1	20.29	20.23	20.32
		25	0	2	20.08	20.00	20.02
			12	2	20.09	20.02	20.02
			25	2	20.02	20.02	20.03
		50	0	2	19.53	19.37	19.83

Conducted Power of LTE Band 2(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18675	18900	19125
15MHz	QPSK	1	0	0	21.54	21.37	21.76
			37	0	21.57	21.34	21.63
			74	0	21.56	21.38	21.54
		36	0	1	20.59	20.35	20.69
			18	1	20.59	20.42	20.69
			38	1	20.58	20.35	20.69
		75	0	1	20.57	20.35	20.69
	16QAM	1	0	1	20.34	20.23	20.91
			37	1	20.60	20.23	20.77
			74	1	20.68	20.30	20.54
		36	0	2	20.08	20.04	20.00
			18	2	20.07	20.05	20.08
			38	2	20.07	20.04	20.09
		75	0	2	19.47	19.36	19.75
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					18700	18900	19100
20MHz	QPSK	1	0	0	21.60	21.47	21.76
			49	0	21.99	21.81	22.14
			99	0	21.46	21.84	21.69
		50	0	1	20.53	20.47	20.71
			25	1	20.53	20.47	20.71
			50	1	20.55	20.51	20.75
		100	0	1	20.58	20.41	20.75
	16QAM	1	0	1	20.05	20.14	20.92
			49	1	20.61	20.17	21.18
			99	1	20.19	20.29	20.99
		50	0	2	20.11	20.07	20.01
			25	2	20.11	20.07	20.01
			50	2	20.12	20.01	20.08
		100	0	2	19.61	19.45	19.93

Conducted Power of LTE Band 5(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					20407	20525	20643
1.4MHz	QPSK	1	0	0	24.63	23.80	23.91
			3	0	24.71	23.74	23.80
			5	0	24.72	23.60	23.77
		3	0	0	24.48	23.73	23.95
			2	0	24.56	23.72	23.94
			3	0	24.53	23.64	23.81
		6	0	1	23.70	22.74	22.83
	16QAM	1	0	1	24.05	23.21	23.05
			3	1	24.23	23.69	23.16
			5	1	23.77	23.42	23.03
		3	0	1	23.71	22.78	23.19
			2	1	23.71	22.77	23.08
			3	1	23.20	22.73	22.83
		6	0	2	22.70	22.05	21.74
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					20415	20525	20635
3MHz	QPSK	1	0	0	24.76	23.69	23.82
			7	0	24.64	23.69	23.67
			14	0	24.54	23.72	23.79
		8	0	1	23.54	22.89	22.90
			4	1	23.55	22.90	22.90
			7	1	23.53	22.77	22.84
		15	0	1	23.52	22.83	22.81
	16QAM	1	0	1	23.46	22.34	23.03
			7	1	23.36	22.28	22.85
			14	1	23.31	22.34	22.46
		8	0	2	22.47	21.86	21.99
			4	2	22.48	21.87	21.90
			7	2	22.41	21.90	21.95
		15	0	2	22.65	21.92	21.85

Conducted Power of LTE Band 5(dBm)							
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					20425	20525	20625
5MHz	QPSK	1	0	0	24.45	23.59	23.83
			13	0	24.27	23.73	23.68
			24	0	24.22	23.92	23.81
		12	0	1	23.64	22.92	22.98
			6	1	23.63	22.91	22.97
			13	1	23.45	22.84	22.84
		25	0	1	23.54	22.87	22.92
	16QAM	1	0	1	23.28	21.81	22.59
			13	1	23.40	21.94	22.72
			24	1	23.53	22.27	23.05
		12	0	2	22.62	21.86	22.22
			6	2	22.78	21.78	22.23
			13	2	22.63	21.62	22.09
		25	0	2	22.59	21.86	21.99
Bandwidth	Modulation	RB size	RB offset	Target MPR	Channel	Channel	Channel
					20450	20525	20600
10MHz	QPSK	1	0	0	22.63	21.63	22.63
			25	0	22.65	21.95	22.24
			49	0	22.57	21.51	22.36
		25	0	1	22.36	20.47	21.08
			13	1	22.30	21.22	20.74
			25	1	22.25	21.26	22.39
		50	0	1	21.42	20.80	23.50
	16QAM	1	0	1	21.39	21.54	21.40
			25	1	21.55	23.36	20.63
			49	1	20.20	23.01	21.36
		25	0	2	21.14	22.06	23.88
			13	2	21.36	22.08	23.16
			25	2	21.48	22.16	21.45
		50	0	2	19.46	22.15	20.87

The following tests were conducted according to the test requirements outlined in section 6.2 of the 3GPP TS36.101 specification.

UE Power Class: 3 (23 +/- 2dBm). The allowed Maximum Power Reduction (MPR) for the maximum output power due to higher order modulation and transmit bandwidth configuration (resource blocks) is specified in Table 6.2.3.3-1 of the 3GPP TS36.101.

Table 6.2.3.3-1 Maximum Power Reduction (MPR) for Power class3

Modulation	Maximum Power Reduction (MPR) for Power[RB]						MPR(dB)
	1.4MHz	3MHz	5MHz	10MHz	15MHz	20MHz	
QPSK	>5	>4	>8	>12	>16	>18	≤1
16QAM	≤5	≤4	≤8	≤12	≤16	≤18	≤1
16QAM	>5	>4	>8	>12	>16	>18	≤2

The allowed A-MPR values specified below in Table 6.2.4.3-1 of 3GPP TS36.101 are in addition to the allowed MPR requirements. All the measurements below were performed with A-MPR disabled, by using Network Signaling Value of "NS_01".3

Table 6.2.4.3-1: Additional Maximum Power Reduction (A-MPR) / Spectrum Emission requirements

Network Signaling value	Requirements (sub-clause)	E-UTRA Band	Channel bandwidth (MHz)	Resources Blocks (N_{RB})	A-MPR (dB)
NS_01	6.6.2.1.1	Table 5.2-1	1,4,3,5,10,15,20	Table 5.4.2-1	N/A
NS_03	6.6.2.2.3.1	2,4,10, 23, 25,35,36	3	>5	≤ 1
			5	>6	≤ 1
			10	>6	≤ 1
			15	>8	≤ 1
			20	>10	≤ 1
NS_04	6.6.2.2.3.2	41	5	>6	≤ 1
			10, 15, 20	Table 6.2.4.3-4	
NS_05	6.6.3.3.3.1	1	10,15,20	≥ 50	≤ 1
NS_06	6.6.2.2.3.3	12, 13, 14, 17	1,4, 3, 5, 10	Table 5.4.2-1	N/A
NS_07	6.6.2.2.3.3 6.6.3.3.3.2	13	10	Table 6.2.4.3-2	Table 6.2.4.3-2
NS_08	6.6.3.3.3.3	19	10, 15	> 44	≤ 3
NS_09	6.6.3.3.3.4	21	10, 15	> 40	≤ 1
				> 55	≤ 2
NS_10		20	15, 20	Table 6.2.4.3-3	Table 6.2.4.3-3
NS_11	6.6.2.2.1 6.6.3.3.13	231	1,4, 3, 5, 10,15,20	Table 6.2.4.3-5	Table 6.2.4.3-5
NS_12	6.6.3.3.5	26	1,4, 3, 5	Table 6.2.4.3-6	Table 6.2.4.3-6
NS_13	6.6.3.3.6	26	5	Table 6.2.4.3-7	Table 6.2.4.3-7
NS_14	6.6.3.3.7	26	10, 15	Table 6.2.4.3-8	Table 6.2.4.3-8
NS_15	6.6.3.3.8	26	1,4, 3, 5, 10, 15	Table 6.2.4.3-9 Table 6.2.4.3-10	Table 6.2.4.3-9, Table 6.2.4.3-10
NS_16	6.6.3.3.9	27	3, 5, 10	Table 6.2.4.3-11, Table 6.2.4.3-12, Table 6.2.4.3-13	
NS_17	6.6.3.3.10	28	5, 10	Table 5.4.2-1	N/A
	6.6.3.3.11	28	5	≥ 2	≤ 1
NS_18			10, 15, 20	≥ 1	≤ 4
NS_19			10, 15, 20	Table 6.2.4.3-15	Table 6.2.4.3-15
NS_20			5, 10, 15, 20	Table 6.2.4.3-14	Table 6.2.4.3-14
...					
NS_20	-	-	-	-	-

WIFI

Mode	Data Rate (Mbps)	Channel	Frequency(MHz)	Avg. Burst Power(dBm)
802.11b	1	01	2412	12.07
		06	2437	12.81
		11	2462	13.14
802.11g	6	01	2412	9.31
		06	2437	10.18
		11	2462	10.47
802.11n(20)	6.5	01	2412	9.17
		06	2437	10.00
		11	2462	10.41
802.11n(40)	13.5	03	2422	9.58
		06	2437	10.26
		09	2452	10.52

Bluetooth_V4.0(BR/EDR)

Modulation	Channel	Frequency(MHz)	Peak Power (dBm)
GFSK	0	2402	-5.065
	39	2441	-4.009
	78	2480	-5.320
$\pi/4$ -DQPSK	0	2402	-3.875
	39	2441	-2.216
	78	2480	-3.643
8-DPSK	0	2402	-3.453
	39	2441	-2.142
	78	2480	-3.367

Bluetooth_V4.0(BLE)

Modulation	Channel	Frequency(MHz)	Peak Power (dBm)
GFSK	0	2402	-4.975
	19	2440	-4.881
	39	2480	-5.225

13. TEST RESULTS

13.1. SAR Test Results Summary

13.1.1. Test position and configuration

1. The EUT is a model of POS terminal and is powered by adapter.
2. Based on FCC guidance,
 - a. Lab use the Body liquid with a separation of 0mm at flat phantom to test 10-g Extremity SAR on all surfaces and side edges with a transmitting antenna located at ≤ 25 mm from that surface or edge

13.1.2. Operation Mode

1. Per KDB 248227 D01v02r02, for 2.4GHz 802.11g/n SAR testing is not required when the highest reported SAR for DSSS is adjusted by the ratio of OFDM to DSSS specified maximum output power and the adjusted SAR is ≤ 1.2 W/kg.
2. Maximum Scaling SAR in order to calculate the Maximum SAR values to test under the standard Peak Power, Calculation method is as follows:
Maximum Scaling SAR = tested SAR (Max.) $\times$ [maximum turn-up power (mw)/ maximum measurement output power(mw)]
3. Proximity sensor, just for avoiding the wrong operation in the phone screen when call, and has no influence on output power or SAR result
4. Per KDB 941225 D05v02r03, start with the largest channel bandwidth and measure SAR for QPSK with 1RB allocation using the RB offset and required test channel combination with highest maximum output power for RB offsets at the upper edge, middle and lower edge of each required test channel.
5. Per KDB 941125 D05v02r03, 50% RB allocation for QPSK SAR testing follows 1RB QPSK allocation procedure.
6. Per KDB 941125 D05v02r03. 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 1RB allocation and the highest reported SAR is >1.45 W/Kg, the remaining required test channels must also be tested.
7. Per KDB 941125 D05v02r03. 16QAM output power for each RB allocation configuration is not 1/2 dB higher than the same configuration in QPSK and the reported SAR for the QPSK configuration is ≤ 1.45 W/Kg, Per KDB 941225 D05v02r02, 16QAM SAR testing is not required.
8. Per KDB 941125 D05v02r03. Smaller bandwidth output power for each RB allocation configuration is $>$ not 1/2 dB higher than the same configuration in the largest supported bandwidth, and the reported SAR for the largest supported bandwidth is ≤ 1.45 W/Kg. Per KDB 941125 D05v02r03, smaller bandwidth SAR testing is not required.

13.1.3. Test Result

SAR MEASUREMENT									
Depth of Liquid (cm):>15				Relative Humidity (%): 47.3					
Product: Modeshift Validator									
Test Mode: WCDMA Band II with QPSK modulation									
Position	Mode	Ch.	Fr. (MHz)	Power Drift (<±5%)	10-g Extremity SAR (W/kg)	Max. Tune-up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit (W/kg)
front	RMC 12.2kbps	9400	1880	-0.15	0.255	23.60	23.44	0.265	4.0
Edge 2(Right)	RMC 12.2kbps	9400	1880	0.22	1.228	23.60	23.44	1.274	4.0

Note:

- The test separation is 0mm of all above table.

SAR MEASUREMENT									
Depth of Liquid (cm):>15				Relative Humidity (%): 49.1					
Product: Modeshift Validator									
Test Mode: WCDMA Band V with QPSK modulation									
Position	Mode	Ch.	Fr. (MHz)	Power Drift (<±5%)	10-g Extremity SAR (W/kg)	Max. Tune-up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit (W/kg)
front	RMC 12.2kbps	4183	836.6	-0.11	0.125	24.10	24.00	0.128	4.0
Edge 2(Right)	RMC 12.2kbps	4183	836.6	0.05	0.221	24.10	24.00	0.226	4.0

Note:

- The test separation is 0mm of all above table.

SAR MEASUREMENT												
Depth of Liquid (cm):>15					Relative Humidity (%): 47.3							
Product: Modeshift Validator												
Test Mode: LTE Band 2												
BM MHz	MOD	Position	Test Mode		Ch.	Freq. (MHz)	Power Drift (<±5%)	10-g Extremity SAR (W/kg)	Max. Tune up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit (W/kg)
			UL RB Allocation	UL RB START								
20	QPSK	front	1	0	18900	1880	0.16	0.578	22.20	21.47	0.684	4.0
		Edge 2(Right)	1	0	18900	1880	0.32	1.380	22.20	21.47	1.633	4.0

Note:

- The test separation is 0mm of all above table.

SAR MEASUREMENT												
Depth of Liquid (cm):>15					Relative Humidity (%): 56.4							
Product: Modeshift Validator												
Test Mode: LTE Band 5												
BM MHz	MOD	Position	Test Mode		Ch.	Freq. (MHz)	Power Drift (<±5%)	10-g Extremity SAR (W/kg)	Max. Tune up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit (W/kg)
			UL RB Allocation	UL RB START								
10	QPSK	front	1	0	20525	836.5	-0.03	0.146	22.70	21.63	0.187	4.0
		Edge 2(Right)	1	0	20525	836.5	-0.10	0.272	22.70	21.63	0.348	4.0

Note:

- The test separation is 0mm of all above table.

SAR MEASUREMENT									
Depth of Liquid (cm):>15				Relative Humidity (%): 43.8					
Product: Modeshift Validator									
Test Mode:802.11b									
Position	Mode	Ch.	Fr. (MHz)	Power Drift (<±5%)	10-g Extremity SAR (W/kg)	Max. Tune-up Power (dBm)	Meas. output Power (dBm)	Scaled SAR (W/Kg)	Limit (W/kg)
front	DTS	6	2437	0.17	0.349	13.14	12.81	0.377	4.0
Edge 2(Right)	DTS	6	2437	-0.09	0.275	13.14	12.81	0.297	4.0

Note:

- According to KDB248227, SAR is not required for 802.11n HT20/HT40 channels when the maximum average output power is less than 1/4 dB higher than that measured on the corresponding 802.11a/b channels.
- All of above "DTS" means data transmitters.
- The test separation is 0mm of all above table.

NO	Simultaneous state	Handset
		Limbs
1	WCDMA+ WLAN 2.4GHz (data)	Yes
2	WCDMA+ Bluetooth(data)	Yes
3	LTE + WLAN 2.4GHz (data)	Yes
4	LTE + Bluetooth(data)	Yes

NOTE:

1. WIFI and BT share the same antenna, and cannot transmit simultaneously.
2. Simultaneous with every transmitter must be the same test position.
3. KDB 447498 D01, BT SAR is excluded as below table.
4. KDB 447498 D01, for handsets the test separation distance is determined by the smallest distance between the outer surface of the device and the user; which is 0mm for 0mm limbs SAR.
5. According to KDB 447498 D01 4.3.1, Standalone SAR test exclusion is as follow:
For 100 MHz to 6 GHz and test separation distances ≤ 50 mm, the 1-g and 10-g SAR test exclusion thresholds are determined by the following:

$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$$
for 1-g SAR, and ≤ 7.5 for 10-g extremity SAR³⁰, where
 - f(GHz) is the RF channel transmit frequency in GHz
 - Power and distance are rounded to the nearest mW and mm before calculation³¹
 - The result is rounded to one decimal place for comparison
 - The values 3.0 and 7.5 are referred to as numeric thresholds in step b) below
The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm, and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, a distance of 5 mm according to 4.1 f) is applied to determine SAR test exclusion.
6. If the test separation distance is < 5 mm, 5mm is used for excluded SAR calculation.
7. According to KDB 447498 D01 4.3.2, simultaneous transmission SAR test exclusion is as follow:
 - (1) Simultaneous transmission SAR test exclusion is determined for each operating configuration and exposure condition according to the reported standalone SAR of each applicable simultaneous transmitting antenna.
 - (2) Any transmitters and antennas should be considered when calculating simultaneous mode.
 - (3) For mobile phone and PC, it's the sum of all transmitters and antennas at the same mode with same position in each applicable exposure condition
 - (4) When the standalone SAR test exclusion of section 4.3.2 is applied to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to the following to det
$$[(\text{max. power of channel, including tune-up tolerance, mW}) / (\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})/x}] \text{ W/kg}$$
for test separation distances ≤ 50 mm;
where $x = 7.5$ for 1-g SAR, and $x = 18.75$ for 10-g SAR.

8. When the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR to peak location separation ratio. The simultaneous transmitting antennas in each operating mode and exposure condition combination must be considered one pair at a time to determine the SAR to peak location separation ratio to qualify for test exclusion. The ratio is determined by $(SAR1 + SAR2)1.5/R_i$, rounded to two decimal digits, and must be ≤ 0.04 for all antenna pairs in the configuration to qualify for 1-g SAR test exclusion.

Estimated SAR		Max Power including Tune-up Tolerance		Separation Distance (mm)	Estimated 10-g SAR (W/kg)
		dBm	mW		
BT	Limbs	-2	0.631	0	0.011

Sum of the SAR for WCDMA Band II & Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ 10-g SAR (W/Kg)	SPLSR (Yes/No)
		WCDMA Band II	Wi-Fi DTS Band	Bluetooth		
Limbs	Front	0.265	0.377		0.642	No
	Edge 2	1.274	0.297		1.571	No
	Front	0.265		0.011	0.276	No
	Edge 2	1.274		0.011	1.285	No

Note:

- According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than 1.6 W/Kg, SPLSR assessment is not required.
- SPLSR mean is “The SAR to Peak Location Separation Ratio “

Sum of the SAR for WCDMA Band V & Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ 10-g SAR (W/Kg)	SPLSR (Yes/No)
		WCDMA Band V	Wi-Fi DTS Band	Bluetooth		
Limbs	Front	0.128	0.377		0.505	No
	Edge 2	0.226	0.297		0.523	No
	Front	0.128		0.011	0.139	No
	Edge 2	0.226		0.011	0.237	No

Note:

- According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than 1.6 W/Kg, SPLSR assessment is not required.
- SPLSR mean is “The SAR to Peak Location Separation Ratio “

Sum of the SAR for LTE Band 2 & Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ 10-g SAR (W/Kg)	SPLSR (Yes/No)
		LTE Band 2	Wi-Fi DTS Band	Bluetooth		
Limbs	Front	0.684	0.377		1.061	No
	Edge 2	1.633	0.297		1.930	No
	Front	0.684		0.011	0.695	No
	Edge 2	1.633		0.011	1.644	No

Note:

- According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than 1.6 W/Kg, SPLSR assessment is not required.
- SPLSR mean is "The SAR to Peak Location Separation Ratio "

Sum of the SAR for LTE Band 5 & Wi-Fi & BT:

RF Exposure Conditions	Test Position	Simultaneous Transmission Scenario			Σ 10-g SAR (W/Kg)	SPLSR (Yes/No)
		LTE Band 5	Wi-Fi DTS Band	Bluetooth		
Limbs	Front	0.187	0.377		0.564	No
	Edge 2	0.348	0.297		0.645	No
	Front	0.187		0.011	0.198	No
	Edge 2	0.348		0.011	0.359	No

Note:

- According to KDB 447498 D01 General RF Exposure Guidance, when the simultaneous transmission SAR is less than 1.6 W/Kg, SPLSR assessment is not required.
- SPLSR mean is "The SAR to Peak Location Separation Ratio "

APPENDIX A. SAR SYSTEM CHECK DATA

Test Laboratory: AGC Lab

Date: May 21,2020

System Check Body 835 MHz

DUT: Dipole 835 MHz Type: SID 835

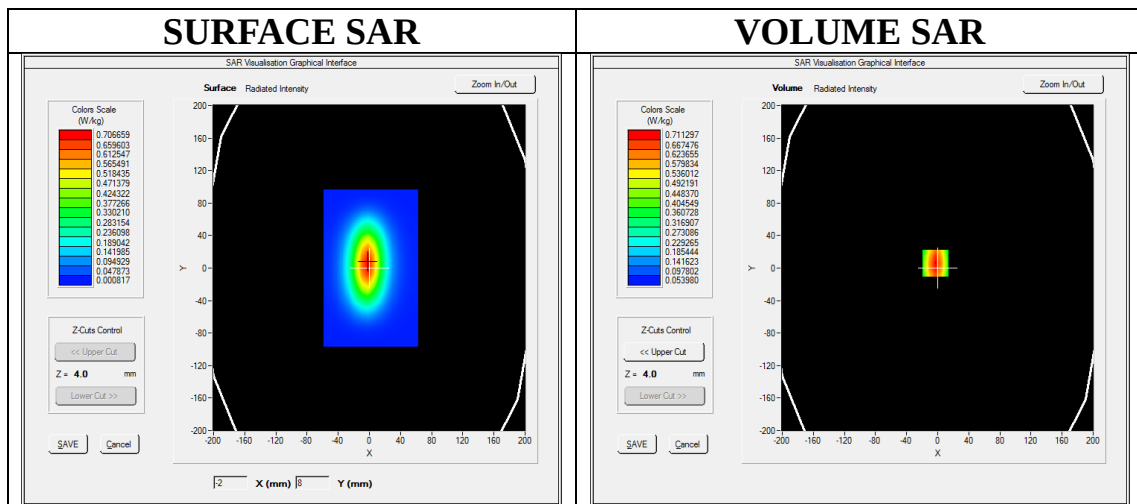
Communication System CW; Communication System Band: D835 (835.0 MHz); Duty Cycle: 1:1; Conv.F=5.19
Frequency: 835 MHz; Medium parameters used: $f = 835$ MHz; $\sigma = 0.96$ mho/m; $\epsilon_r = 53.62$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (°C):21.2, Liquid temperature (°C): 20.9

SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/System Check 835MHz Body/Area Scan: Measurement grid: dx=8mm, dy=8mm

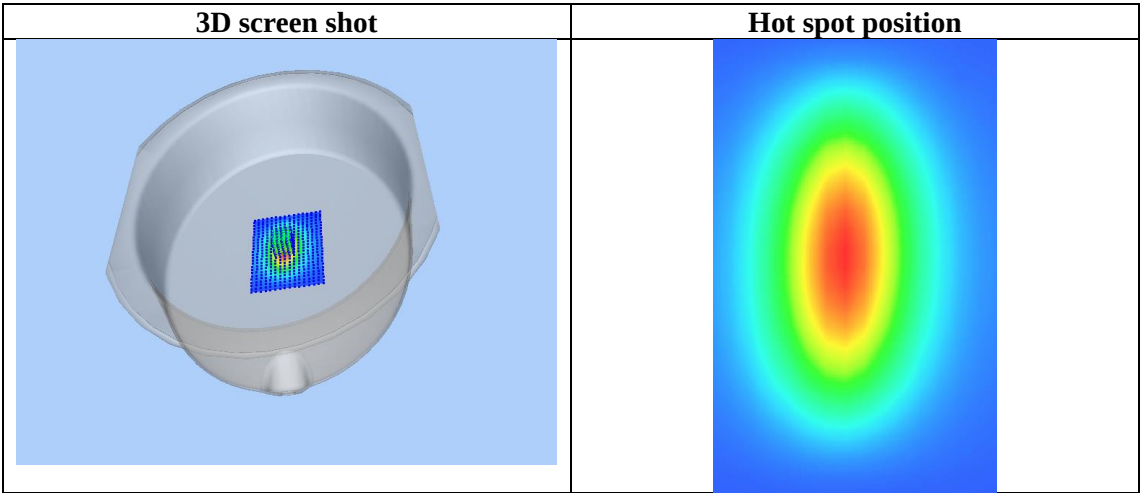
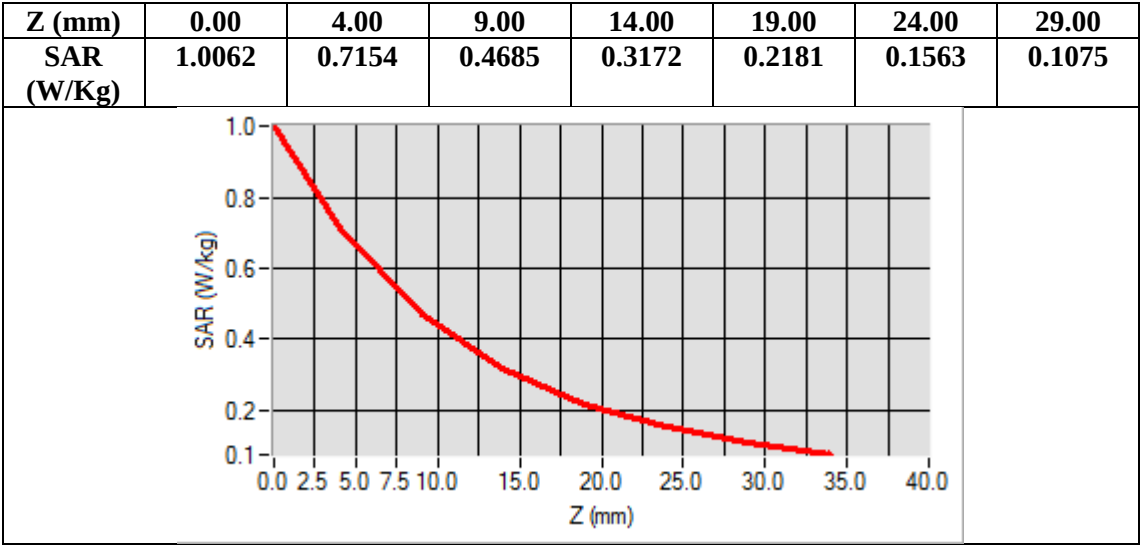
Configuration/System Check 835MHz Body/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm



Maximum location: X=-3.00, Y=6.00

SAR Peak: 1.00 W/kg

SAR 10g (W/Kg)	0.424927
SAR 1g (W/Kg)	0.671941



Test Laboratory: AGC Lab

Date: May 21,2020

System Check Body 1900MHz

DUT: Dipole 1900 MHz; Type: SID 1900

Communication System: CW; Communication System Band: D1900 (1900.0 MHz); Duty Cycle:1:1; Conv.F=4.60

Frequency: 1900 MHz; Medium parameters used: $f = 1850$ MHz; $\sigma = 1.42$ mho/m; $\epsilon_r = 39.58$; $\rho = 1000$ kg/m³ ;

Phantom section: Flat Section; Input Power=18dBm

Ambient temperature (°C):20.9, Liquid temperature (°C): 20.6

SATIMO Configuration:

Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315

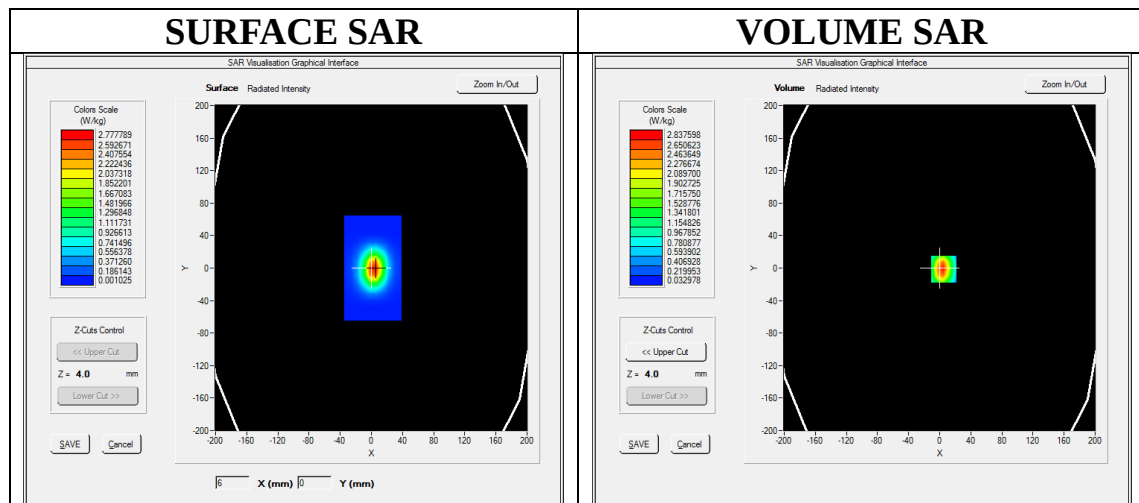
• Sensor-Surface: 4mm (Mechanical Surface Detection)

• Phantom: SAM twin phantom

• Measurement SW: OpenSAR V4_02_35

Configuration/System Check 1900MHz Body/Area Scan: Measurement grid: dx=8mm, dy=8mm

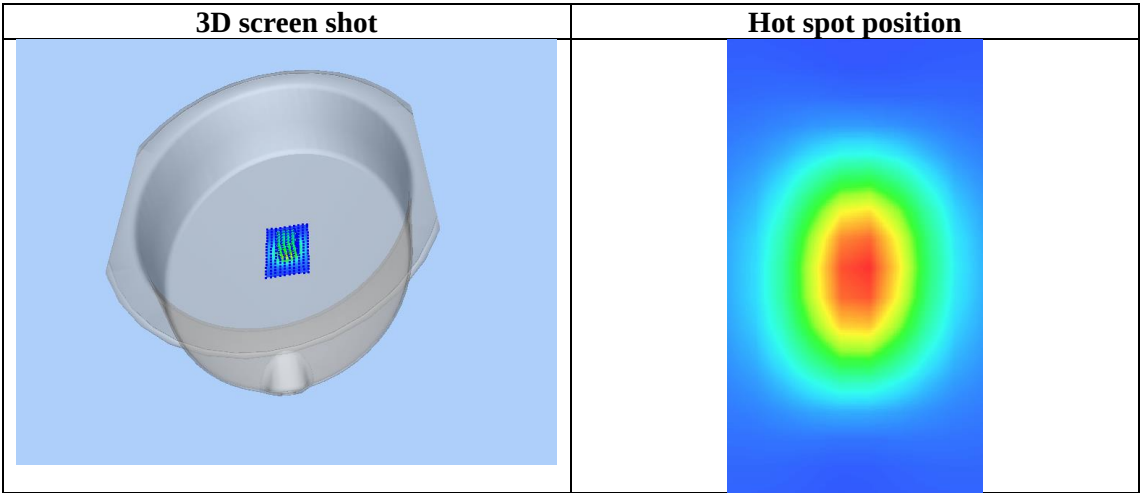
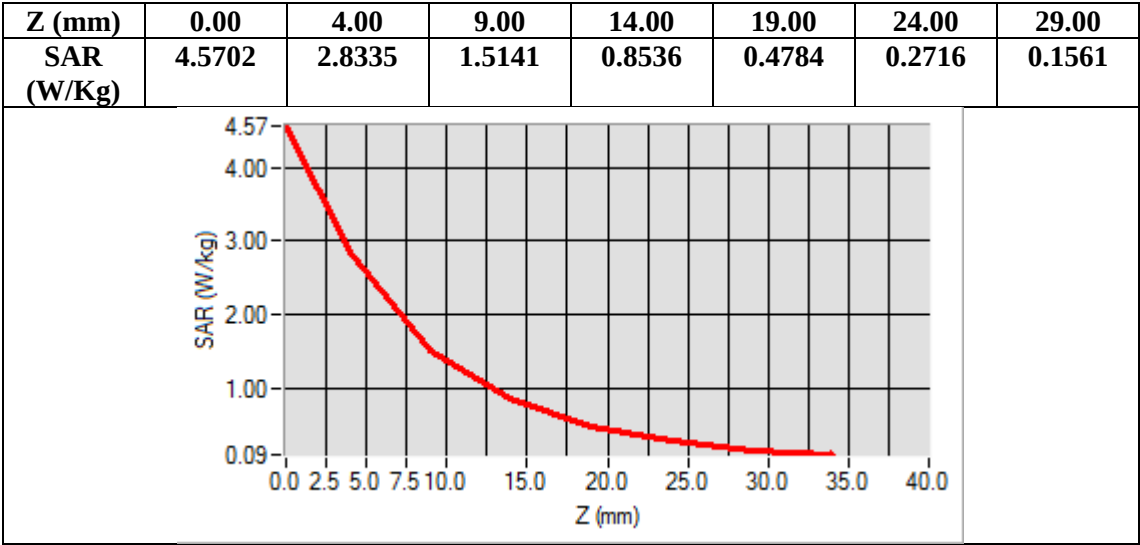
Configuration/System Check 1900MHz Body/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm



Maximum location: X=5.00, Y=-1.00

SAR Peak: 4.62 W/kg

SAR 10g (W/Kg)	1.344872
SAR 1g (W/Kg)	2.706348



Test Laboratory: AGC Lab
System Check Body 2450 MHz

Date: May 27,2020

DUT: Dipole 2450 MHz Type: SID 2450

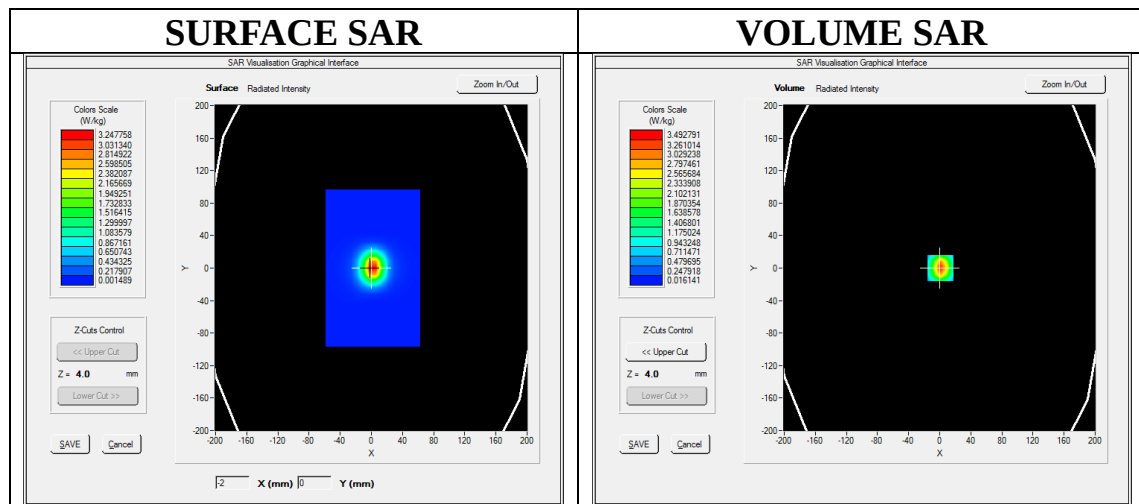
Communication System CW; Communication System Band: D2450 (2450.0 MHz); Duty Cycle: 1:1; Conv.F=4.24
Frequency: 2450 MHz; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.92$ mho/m; $\epsilon_r = 51.61$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature (°C):20.1, Liquid temperature (°C): 19.8

SATIMO Configuration

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/System Check 2450MHz Body/Area Scan: Measurement grid: dx=8mm, dy=8mm

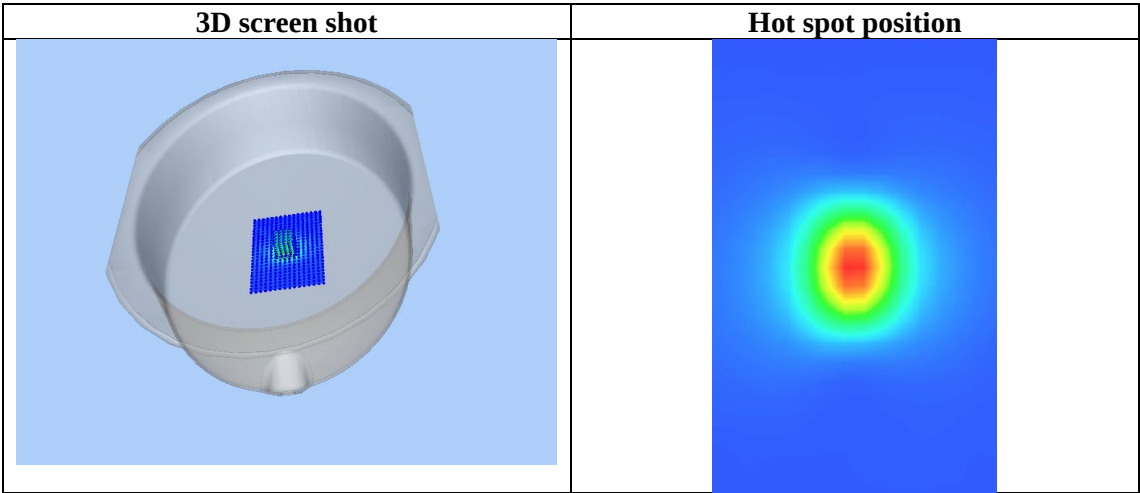
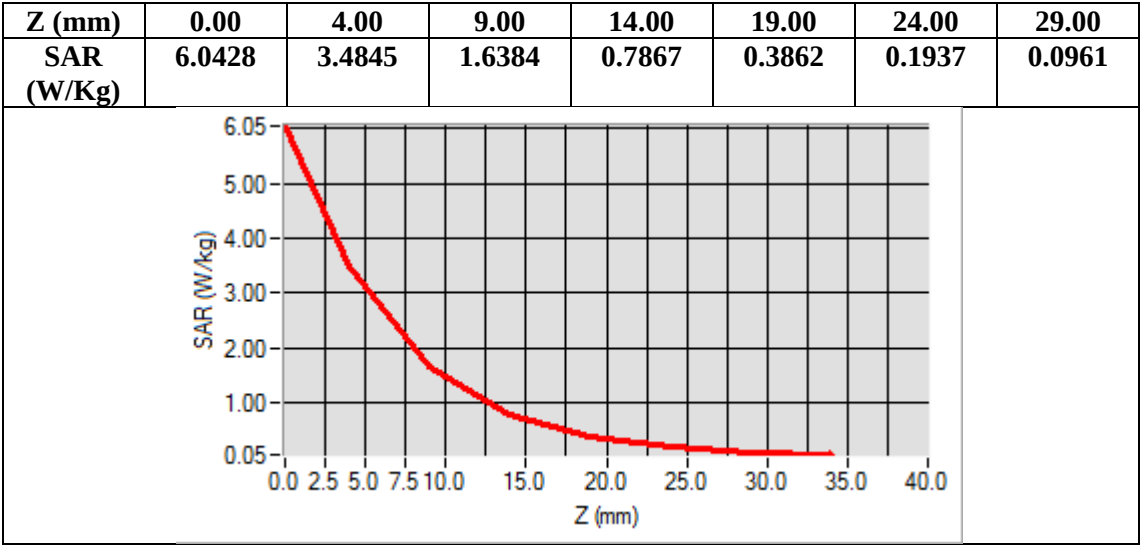
Configuration/System Check 2450MHz Body/Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm



Maximum location: X=1.00, Y=0.00

SAR Peak: 6.01 W/kg

SAR 10g (W/Kg)	1.462934
SAR 1g (W/Kg)	3.251087



Test Laboratory: AGC Lab
System Check Body 835 MHz
DUT: Dipole 835 MHz Type: SID 835

Date: Jun. 01,2020

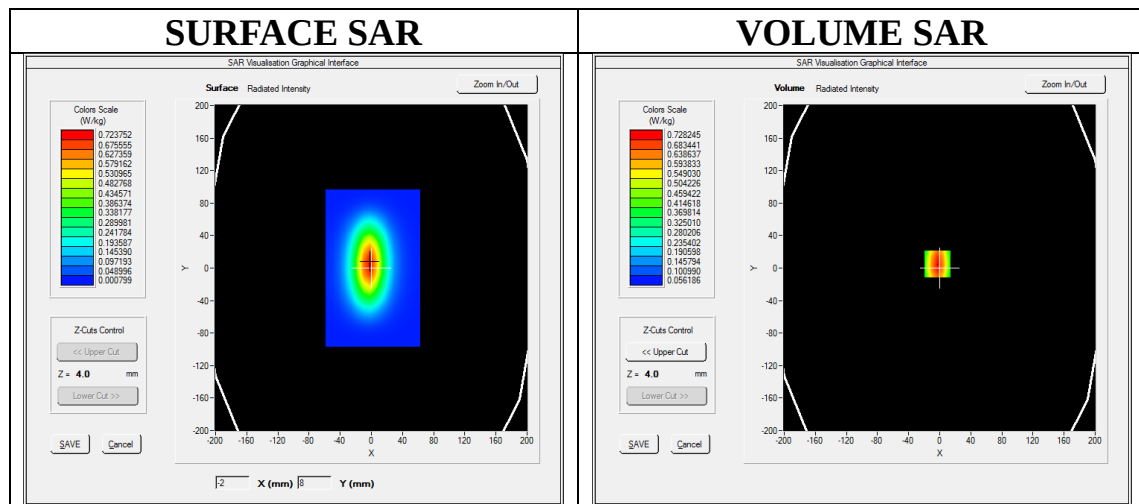
Communication System CW; Communication System Band: D835 (835.0 MHz); Duty Cycle: 1:1; Conv.F=5.19
Frequency: 835 MHz; Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.98 \text{ mho/m}$; $\epsilon_r = 54.69$; $\rho = 1000 \text{ kg/m}^3$;
Phantom section: Flat Section; Input Power=18dBm
Ambient temperature ($^{\circ}\text{C}$):20.3, Liquid temperature ($^{\circ}\text{C}$): 20.1

SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/System Check 835MHz Body/Area Scan: Measurement grid: dx=8mm, dy=8mm

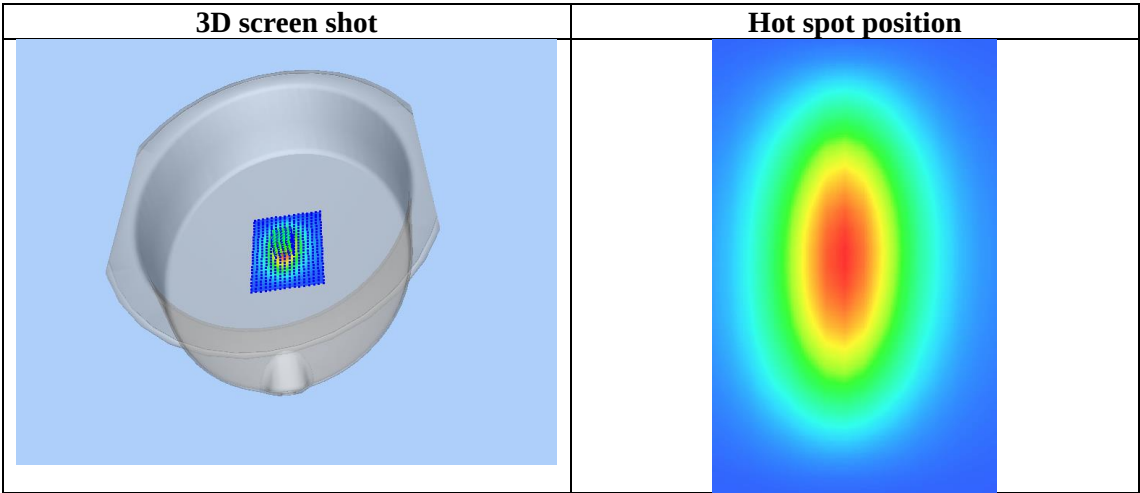
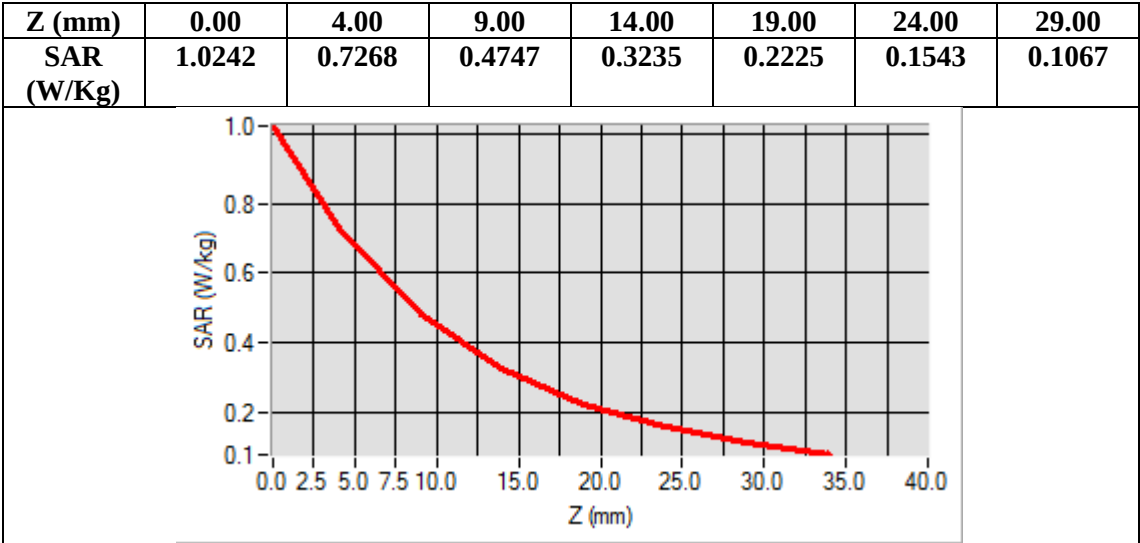
Configuration/System Check 835MHz Body/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm



Maximum location: X=-3.00, Y=5.00

SAR Peak: 1.02 W/kg

SAR 10g (W/Kg)	0.408432
SAR 1g (W/Kg)	0.617243



APPENDIX B. SAR MEASUREMENT DATA

Test Laboratory: AGC Lab

Date: May 21,2020

WCDMA Band II Mid-Edge 2(RMC)

DUT: Modeshift Validator; Type: MTV101

Communication System: UMTS; Communication System Band: Band II UTRA/FDD ;Duty Cycle:1:1; Conv.F=4.60
Frequency: 1880 MHz; Medium parameters used: $f = 1850$ MHz; $\sigma = 1.40$ mho/m; $\epsilon_r = 40.53$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section
Ambient temperature (°C): 20.9, Liquid temperature (°C): 20.6

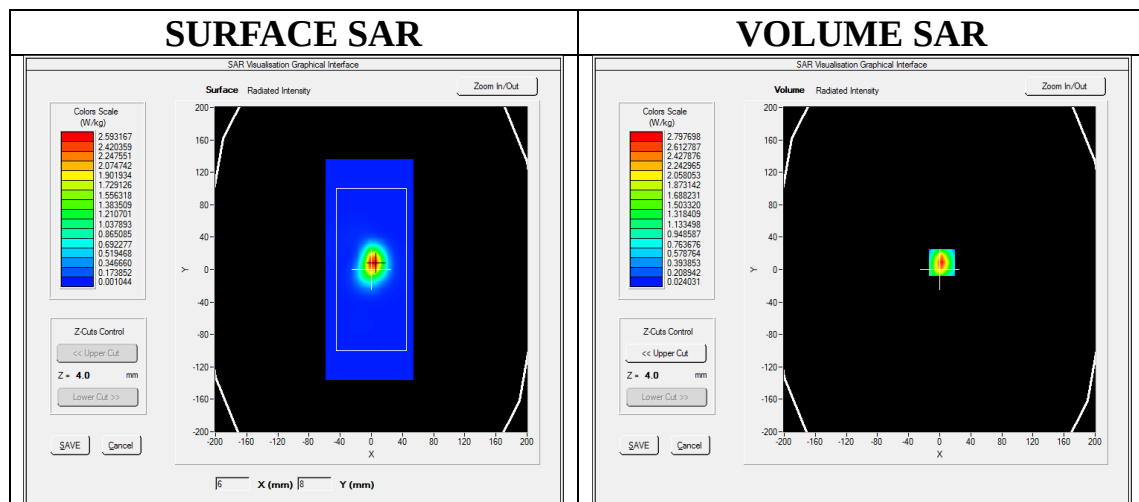
SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/ WCDMA band II Mid-Edge 2/Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/ WCDMA band II Mid-Edge 2/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm;

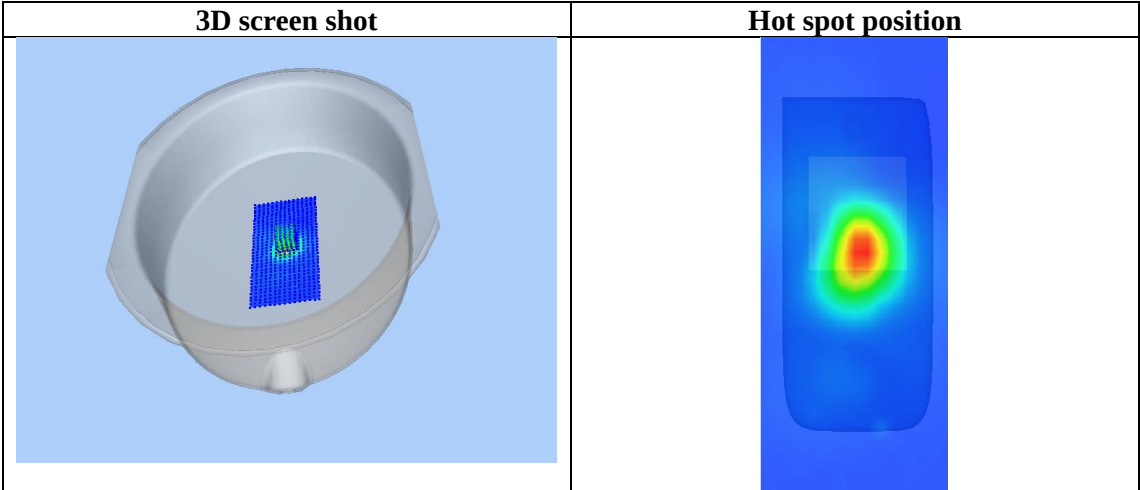
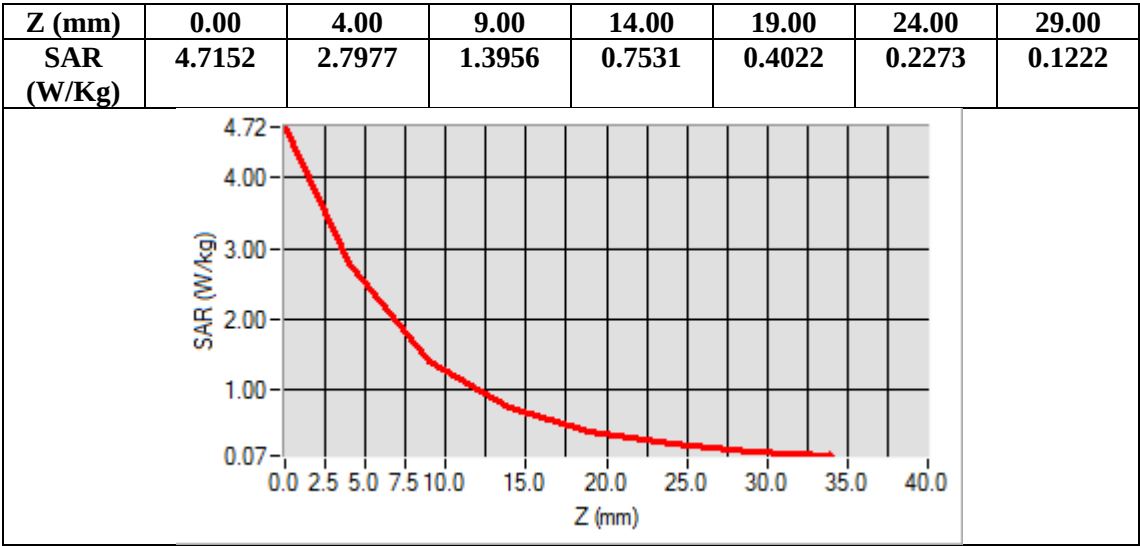
Area Scan	surf_sam_plan.txt, h= 5.00 mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Edge 2
Band	WCDMA band II
Channels	Middle
Signal	CDMA (Crest factor: 1.0)



Maximum location: X=3.00, Y=9.00

SAR Peak: 4.65 W/kg

SAR 10g (W/Kg)	1.228069
SAR 1g (W/Kg)	2.593715



Test Laboratory: AGC Lab

Date: May 21,2020

WCDMA Band V Mid-Edge 2 (RMC)

DUT: Modeshift Validator; Type: MTV101

Communication System: UMTS; Communication System Band: BAND V UTRA/FDD; Duty Cycle:1: 1; Conv.F=5.19; Frequency: 836.6 MHz; Medium parameters used: $f = 835\text{MHz}$; $\sigma = 0.97 \text{ mho/m}$; $\epsilon_r = 52.81$; $\rho = 1000 \text{ kg/m}^3$; Phantom section: Flat Section
Ambient temperature ($^{\circ}\text{C}$): 21.2, Liquid temperature ($^{\circ}\text{C}$): 20.9

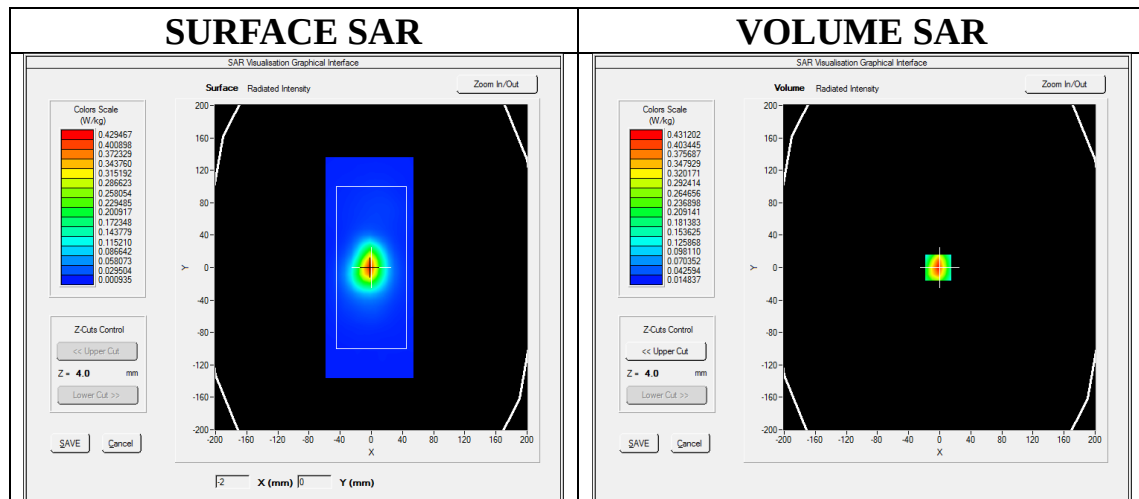
SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/ WCDMA Band V Mid- Edge 2/Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/ WCDMA Band V Mid- Edge 2/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm;

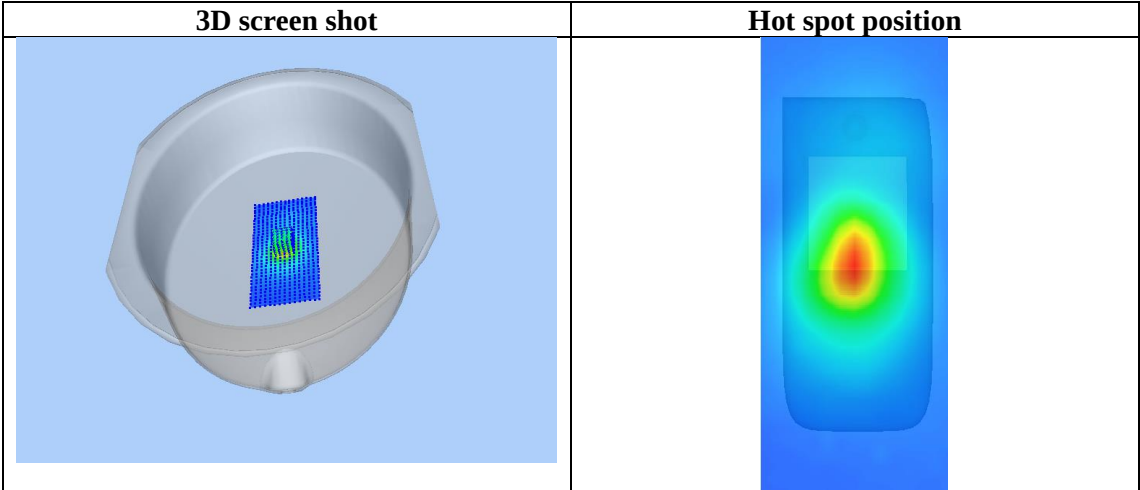
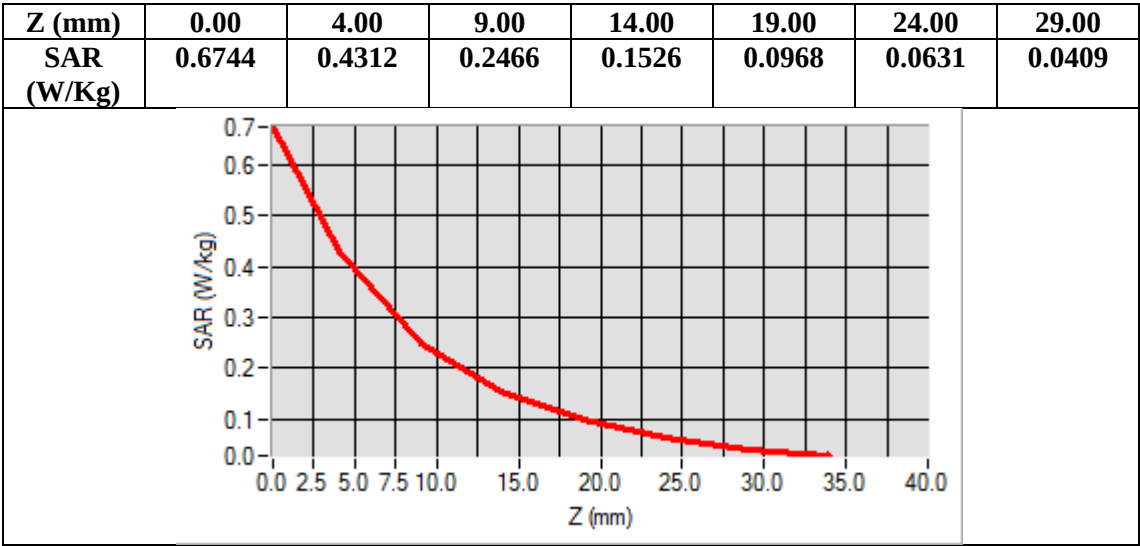
Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	5x5x7,dx=8mm dy=8mm dz=5mm,Complete
Phantom	Validation plane
Device Position	Edge 2
Band	WCDMA Band V
Channels	Middle
Signal	CDMA (Crest factor: 1.0)



Maximum location: X=-2.00, Y=0.00

SAR Peak: 0.67 W/kg

SAR 10g (W/Kg)	0.220724
SAR 1g (W/Kg)	0.402699



Test Laboratory: AGC Lab
LTE Band 2 Mid- Edge 2 (1 RB#0)
DUT: Modeshift Validator; Type: MTV101

Date: May 21,2020

Communication System: LTE; Communication System Band: LTE Band 2; Duty Cycle:1:1; Conv.F=4.60;
Frequency:1880MHz; Medium parameters used: $f = 1850$ MHz; $\sigma = 1.40$ mho/m; $\epsilon_r = 40.53$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section
Ambient temperature (°C): 20.9, Liquid temperature (°C): 20.6

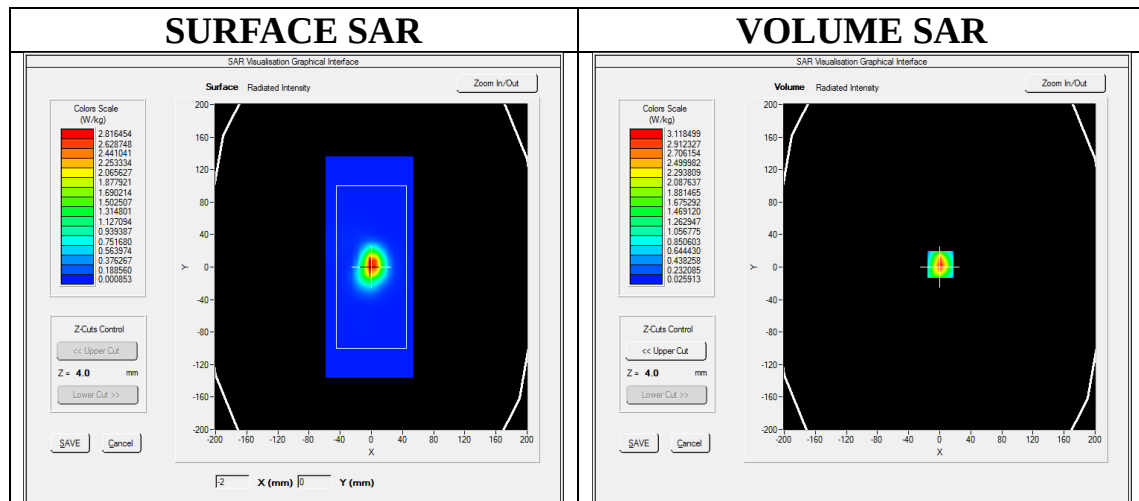
SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/ LTE Band 2 Mid- Edge 2/Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/ LTE Band 2 Mid- Edge 2/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5m;

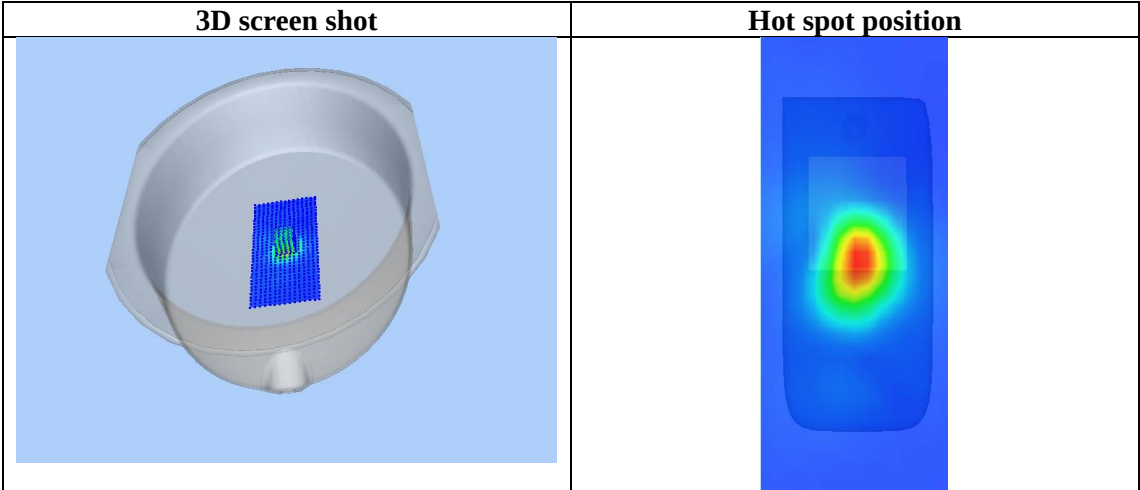
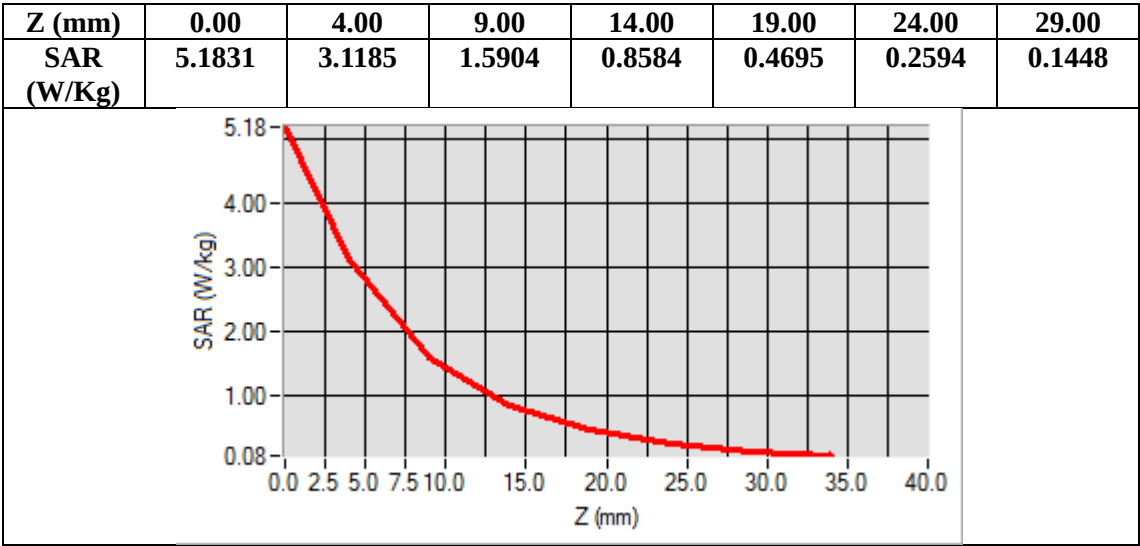
Area Scan	surf_sam_plan.txt, h= 5.00 mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Edge 2
Band	LTE Band 2
Channels	Middle
Signal	OFDM (Crest factor: 1.0)



Maximum location: X=1.00, Y=3.00

SAR Peak: 5.13 W/kg

SAR 10g (W/Kg)	1.380213
SAR 1g (W/Kg)	2.889137



Test Laboratory: AGC Lab
LTE Band 5 Mid-Edge2 (1 RB#0)
DUT: Modeshift Validator; **Type:** MTV101

Date: Jun. 01,2020

Communication System: LTE; Communication System Band: LTE Band 5; Duty Cycle:1:1; Conv.F=5.19
Frequency:836.5 MHz; Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 53.76$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section
Ambient temperature (°C): 20.3, Liquid temperature (°C): 20.1

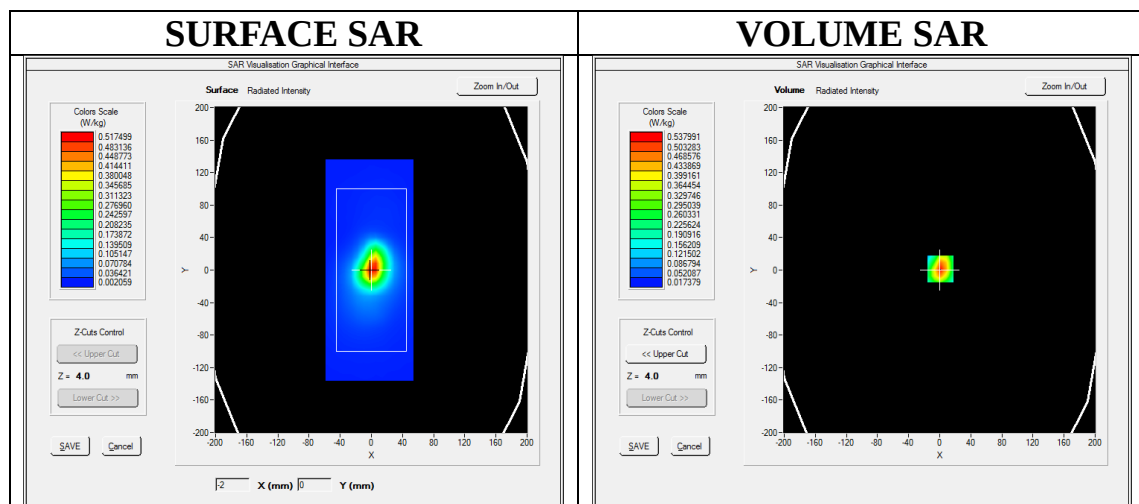
SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/ LTE Band 5 Mid- Edge2/Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/ LTE Band 5 Mid- Edge2/Zoom Scan: Measurement grid: dx=8mm,dy=8mm, dz=5mm;

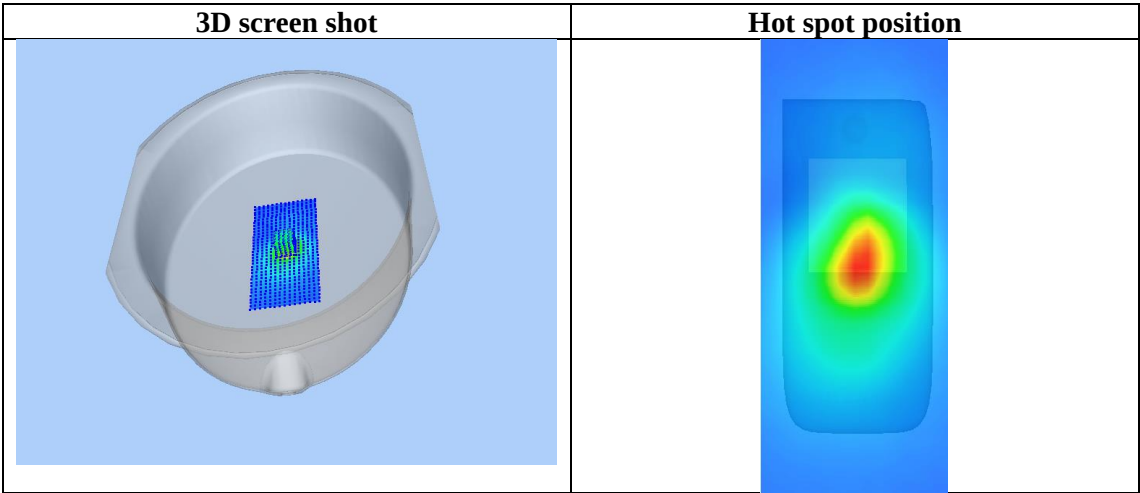
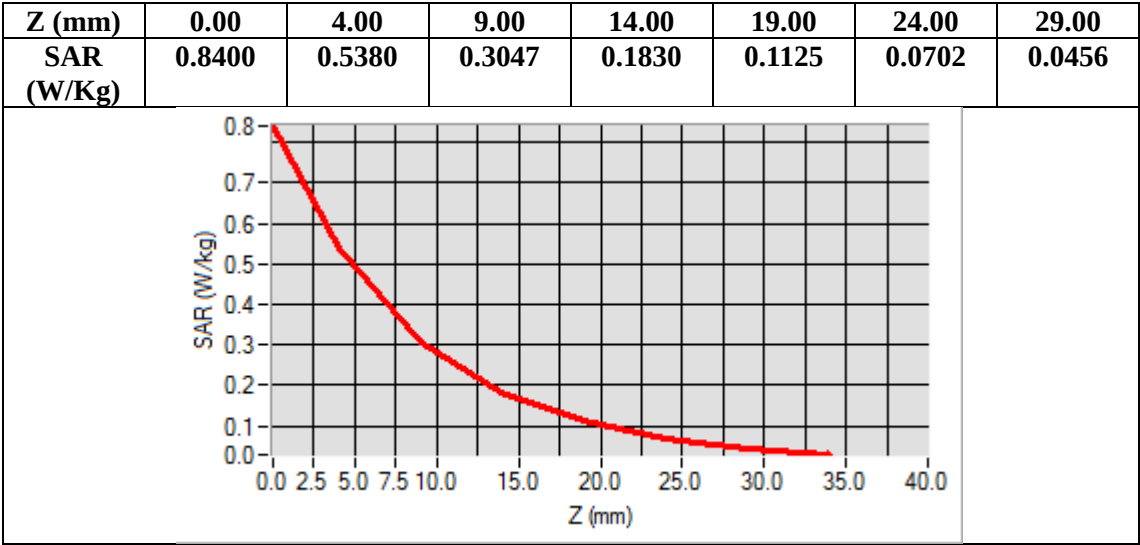
Area Scan	surf_sam_plan.txt, h= 5.00 mm
Zoom Scan	5x5x7,dx=8mm dy=8mm dz=5mm
Phantom	Validation plane
Device Position	Edge2
Band	LTE Band 5
Channels	Middle
Signal	OFDM (Crest factor: 1.0)



Maximum location: X=1.00, Y=1.00

SAR Peak: 0.84 W/kg

SAR 10g (W/Kg)	0.271699
SAR 1g (W/Kg)	0.504985



WIFI MODE

Test Laboratory: AGC Lab

802.11b Mid-Front

DUT: Modeshift Validator; Type: MTV101

Date: May 27,2020

Communication System: Wi-Fi; Communication System Band: 802.11b; Duty Cycle: 1:1; Conv.F=4.24;
Frequency: 2437 MHz; Medium parameters used: $f = 2450$ MHz; $\sigma = 1.90$ mho/m; $\epsilon_r = 52.32$; $\rho = 1000$ kg/m³ ;
Phantom section: Flat Section
Ambient temperature (°C):20.1, Liquid temperature (°C): 19.8

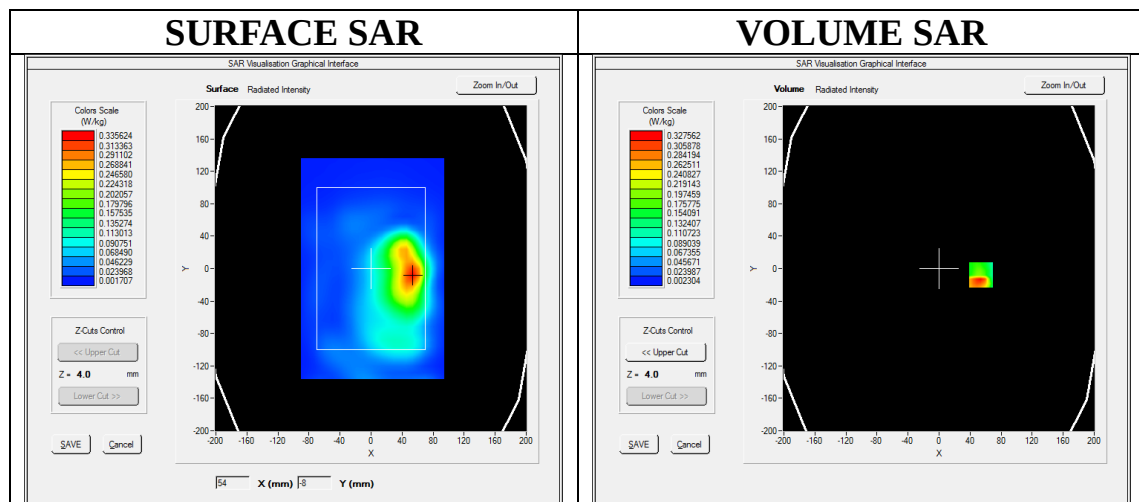
SATIMO Configuration:

- Probe: SSE5; Calibrated: Jun. 04,2019; Serial No.: SN 22/16 EP315
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Phantom: SAM twin phantom
- Measurement SW: OpenSAR V4_02_35

Configuration/802.11b Mid- Front /Area Scan: Measurement grid: dx=8mm, dy=8mm

Configuration/802.11b Mid- Front /Zoom Scan: Measurement grid: dx=5mm,dy=5mm, dz=5mm;

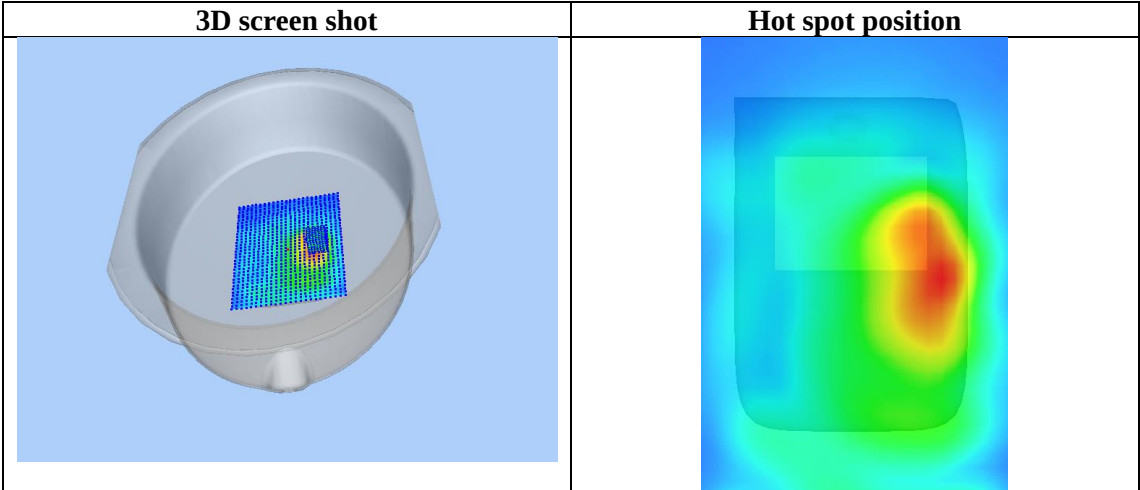
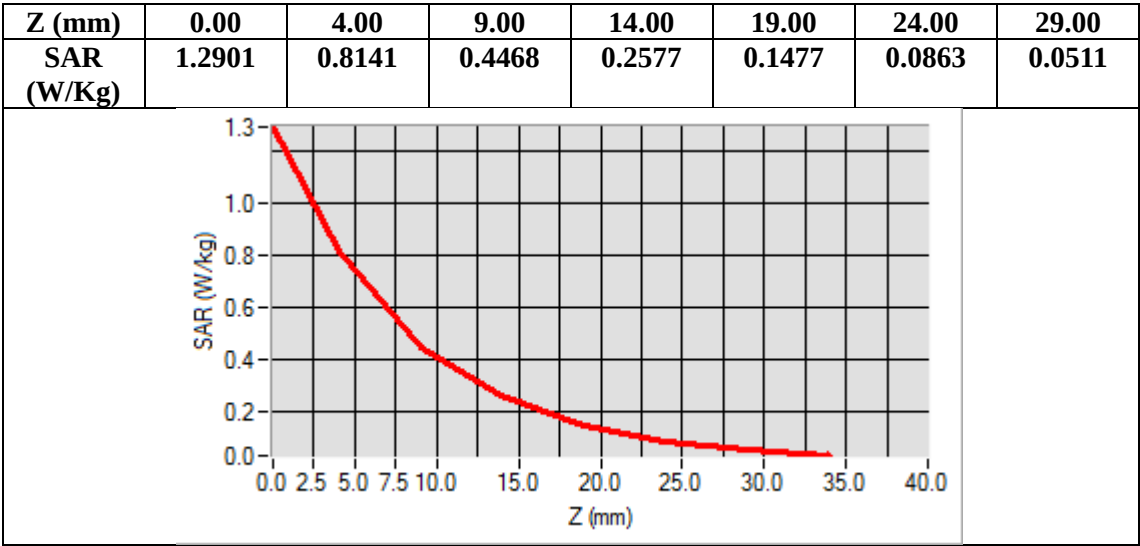
Area Scan	surf_sam_plan.txt, h= 5.00 mm
ZoomScan	7x7x7,dx=5mm dy=5mm dz=5mm
Phantom	Validation plane
Device Position	Front
Band	2450MHz
Channels	Middle
Signal	Crest factor: 1.0



Maximum location: X=54.00, Y=-8.00

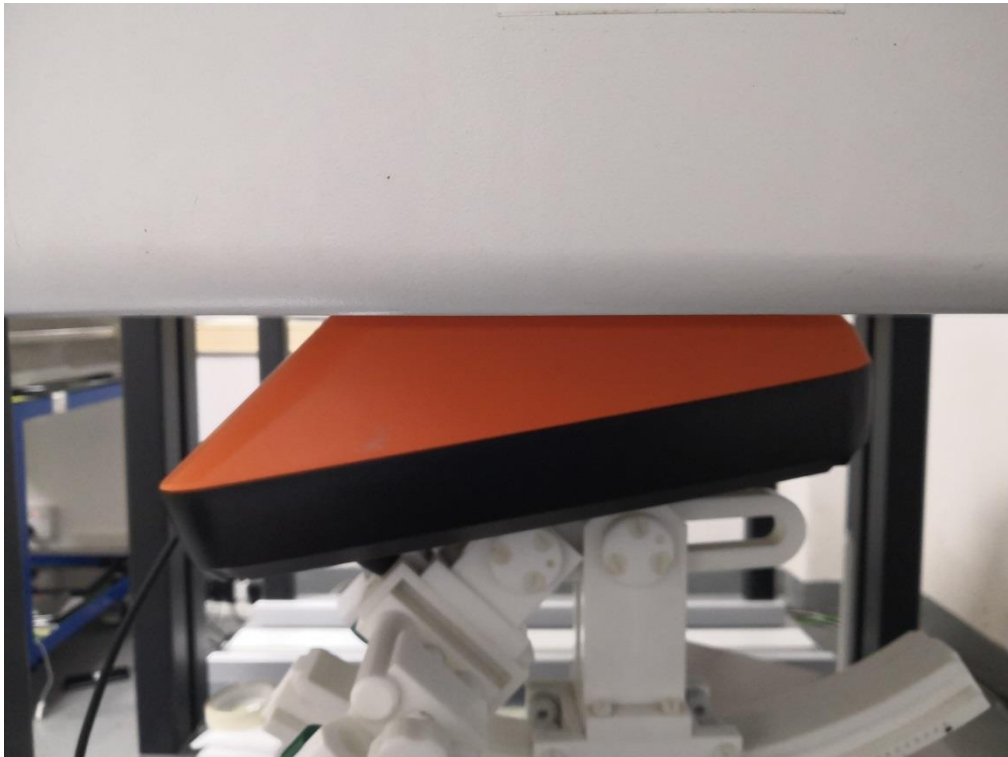
SAR Peak: 1.29 W/kg

SAR 10g (W/Kg)	0.349360
SAR 1g (W/Kg)	0.729762



APPENDIX C. TEST SETUP PHOTOGRAPHS

Limbs Front 0mm

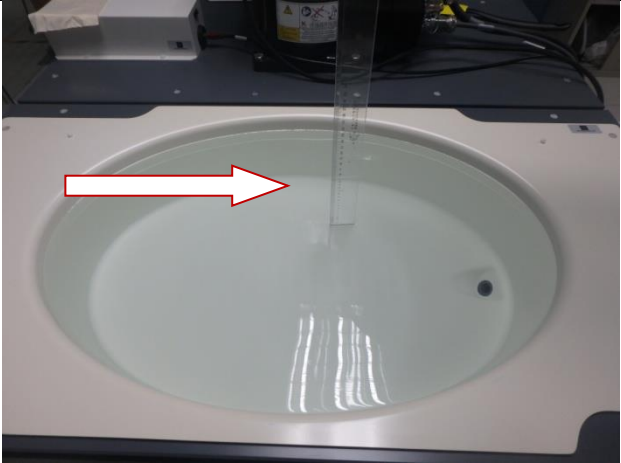
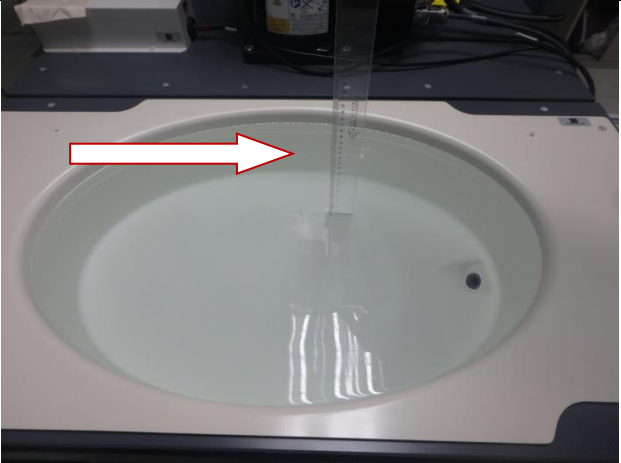
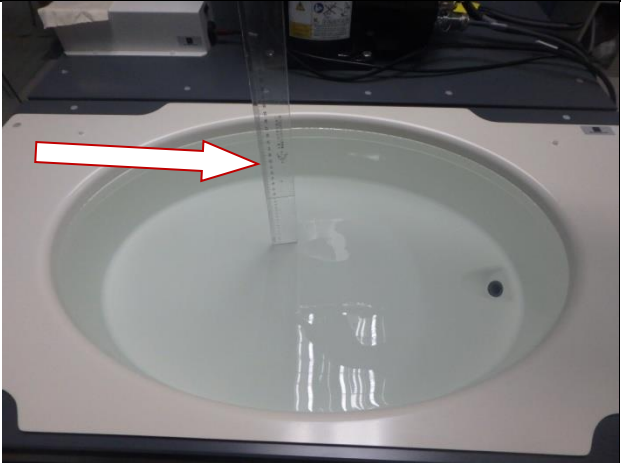


Edge 2(Right) 0mm



DEPTH OF THE LIQUID IN THE PHANTOM—ZOOM IN

Note : The position used in the measurement were according to IEEE 1528-2013

835MHz body	1900MHz body
	
2450MHz body	
	

APPENDIX D. CALIBRATION DATA

Refer to Attached files.