RE510-21-100276-1-A Ed. 0

SAR TEST REPORT

Partial tests – Fast SAR method

According to the standard:

EN 62209-2: 2010

Equipment under test:

Fabric WaveX for Functional Clothing Provider

Company:

SILVERTON TECH GMBH

DISTRIBUTION:

Company: SILVERTON TECH GMBH

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0	29/01/2021	Creation	A. BOUCLEY	G.Hyaumet – EMC and SAR lab manager

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This document is the result of testing a specimen or a sample of the product submitted. It does not imply an assessment of the conformity of the whole production of the tested sample.

EQUIPMENT UNDER TEST:	Fabric for Functional Clothing Provider
Reference:	WaveX
Serial Number:	Not communicated
Transmitter:	Mobile phone XIOAMI Mi A2 Lite
IMEI numbers:	IMEI 1: 863896047652596 IMEI 2: 863896047652604
MANUFACTURER:	SILVERTON TECH GMBH
APPLICANT:	
Company:	SILVERTON TECH GMBH
Address:	MEROWINGERPLATZ 1 40225 NORDRHEIN-WESTFALEN GERMANY
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Person(s) present(s) during the test:	**-**
DATE(S) OF TEST(S):	The 29 of January, 2021
TEST SITE:	**EMITECH** Parc d'Activités de Lanserre 21 rue de la Fuye 49610 Juigne sur Loire France
TEST OPERATOR:	A. BOUCLEY
REPORT WRITTEN BY:	A. BOUCLEY

SUMMARY

1. INTRODUCTION

In this test report, Specific Absorption Rate (SAR) measurements on the mobile phone XIAOMI Mi A2 Lite combined with the fabric referenced WaveX are presented.

The measurements were made according to the EN62209-2. Full SAR testing according to the referenced standard was not required by the applicant; measurements were conducted according to the test plan defined by the applicant and described in the § 6

The measurements were performed using the LTE standard in 2600MHz. The antenna of the mobile phone is integrated.

2. REFERENCE DOCUMENTS

The reference documents referred throughout this report are listed below.
These reference documents are applicable to the entire report, although extensions (version, date and amendment) are not repeated.

Reference	Document title	Date
EN 62209-2	Human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices - Human models, instrumentation, and procedures - Part 2: procedure to determine the specific absorption rate (SAR) for mobile wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz).	2010

3. PRESENTATION OF EQUIPMENT FOR TESTING PURPOSES

The fabric reference WaveX and the mobile phone are shown in Fig. 1 and Fig. 2.
Size of the sample of fabric provided: 200x100cm
Mobile phone was provided by the laboratory.

Fig. 1: Photographs of the fabric

Fig. 2: Photographs of the mobile phone XIAOMI Mi A2 Lite

4. ENVIRONNEMENTAL CONDITIONS

Condition	Measured Value
Liquid Temperature	*See Graphical Representations*
Ambient Temperature	*See Graphical Representations*

5. EQUIPMENT USED FOR THE TESTING

Plateform ID	Emitech N°	Category	Brand	Type
1 BTS Simulator	7041	Radio tester	Rohde-Schwarz	CMW500
2 DASY4	7321	Software	Speag	DASY4
	9485	E-Field Probe	Speag	ESDV3
	7192	Data acquisition	Speag	DAE3
	7337	Dipole 2600MHz	MVG	SID2600
	7204	Phantom	Speag	SAM
3 Liquid Measure	-	Software	Hewlett-Packard	HP85070C
	1402	Network analyzer	Hewlett-Packard	8753C
	9777	S parameter measure	Hewlett-Packard	85047A
	7218	Dielectric probe	Hewlett-Packard	HP85070C
	6980	Thermometer	Testo	922
4 System Validation	7418	Signal generator	Marconi	2031
	7209	Amplifier	Mini-circuits	ZHL42
	7132	Power Supply	Hewlett-Packard	E3610A
	7212	Power meter	Rohde-Schwarz	NRVS
	7211	Probe power meter	Rohde-Schwarz	NRV-Z31
	7035	Power meter	Rohde-Schwarz	NRVD
	7034	Probe power meter	Rohde-Schwarz	NRV-Z1
	7754	Coupler	Hewlett-Packard	86205A
	7213	Attenuator	Weinschel Engineering	33-3-34
	10760	Attenuator	Radiall	R414720000
	7419	Coaxial cable	Hytem	253023-01

6. MEASUREMENT RESULTS

The output power and frequency are controlled using a base station simulator. The mobile phone is set to transmit at its highest output peak power level.

The SAR tests were performed on the mobile phone for the test position at the center frequency of the operating band without the WaveX and with the WaveX set on the phantom.

Fast SAR evaluation has been conducted in agreement with the applicant. Full SAR measurements have not been requested by the applicant.

Fast SAR evaluation consisted in measurements with a zoom scan grid step bigger than those specified in the standard.

Fast SAR measurement parameters:

- Area scan with a grid spacing 15mm
- Zoom scan size 30 x 30 x 28 mm with a grid step 10x10x7 mm

Normative SAR measurement parameters:

- Area scan with a grid spacing 15mm
- Zoom scan size 30 x 30 x 30 mm with a grid step of 5 mm

Tests were performed in Body position with the rear side of the mobile phone at 0mm from the phantom and then at 0mm from the fabric.

Measurement results (SAR values averaged over a mass of 10g:

Date	Test Position	SAR 10g (W/kg) Channel 21100 2535 MHz	Attenuation (%)
29/01/2021	Rear side of mobile – 0 mm from phantom	2.13	Reference value
	Rear side of mobile – 0 mm from Fabric WaveX	0.0024	99.9

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s).

OPINIONS AND INTERPRETATIONS

The results of this report do not imply an assessment of the conformity of the whole requirements of the applicable standard(s).

Fast SAR method: uncertainties not evaluated.

Transceiving performances (radiated power and sensitivity) of the mobile phone, combined with the sample of the fabric, could be affected and have not been evaluated.

The tested phone could contain an antenna diversity technology, as MIMO or MISO. Thus, the radiated performances of the phone are dependent on the test set-up; an antenna diversity control could lead to different results from those reported in this test report.

7. GRAPHICAL REPRESENTATIONS OF THE COARSE SCAN

The graphical representations of the coarse scan are shown in Fig. 3 to Fig. 4.

Body position

DUT: XIAOMI Mi A2 Lite

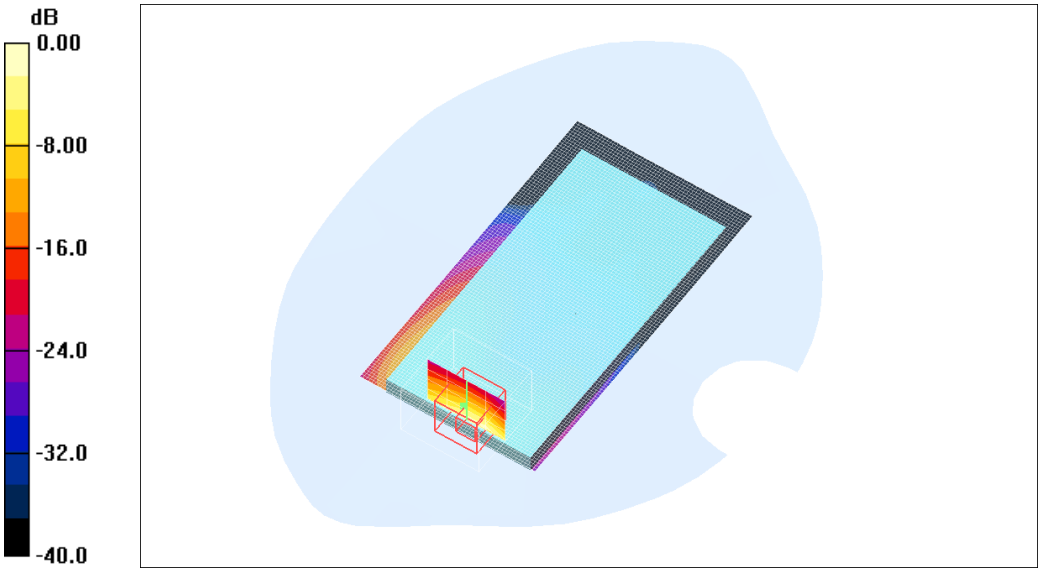
Communication System: LTE Band 7 BW20MHz; Frequency: 2535 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 2.01572 mho/m, ε_r = 35.5724; ρ = 1000 kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature = 22.3 deg C Liquid temperature = 21.9 deg C

DASY4 Configuration:
- Probe: ES3DV3 - SN3303; ConvF(4.53, 4.53, 4.53); Calibrated: 8/24/2020
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 8/19/2020
- Phantom: SAM 12; Type: QD; Serial: TP-1111
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0mm, Middle channel/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 5.09 mW/g

Position 0mm, Middle channel/Zoom Scan (7x7x7) (5x5x5)/Cube 0: Measurement grid: dx=10mm, dy=10mm, dz=7mm
Reference Value = 63.9 V/m; Power Drift = -0.012 dB
Peak SAR (extrapolated) = 13.5 W/kg
SAR(1 g) = 5.9 mW/g; SAR(10 g) = 2.13 mW/g
Maximum value of SAR (measured) = 9.76 mW/g



0 dB = 9.76mW/g

Fig. 3: Rear Side – Without WaveX

DUT: XIAOMI Mi A2 Lite - EMITECH

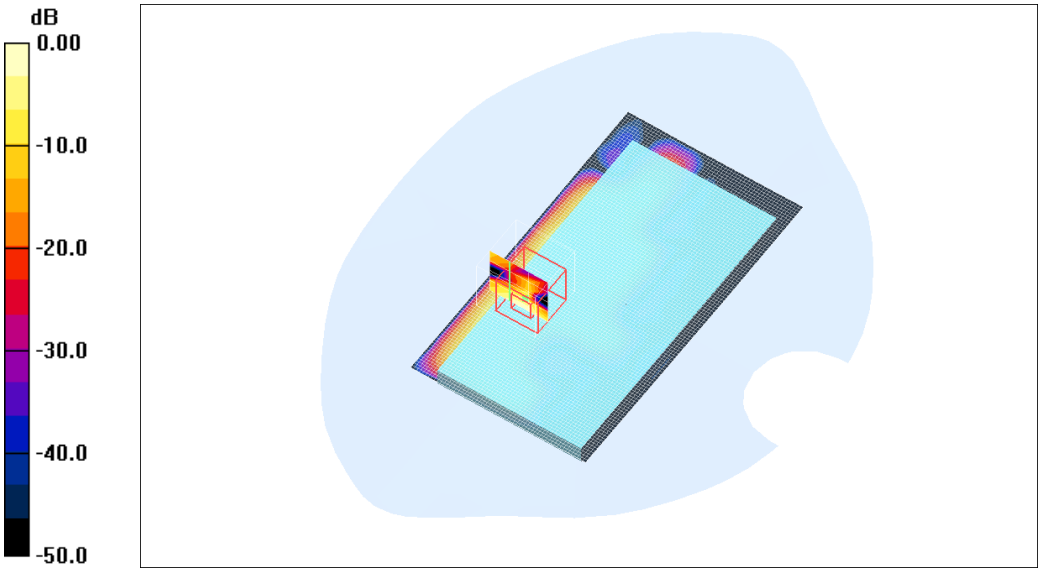
Communication System: LTE Band 7 BW20MHz; Frequency: 2535 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 2.01572 mho/m, ε_r = 35.5724; ρ = 1000 kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature = 22.3 deg C Liquid temperature = 21.9 deg C

DASY4 Configuration:
- Probe: ES3DV3 - SN3303; ConvF(4.53, 4.53, 4.53); Calibrated: 8/24/2020
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 8/19/2020
- Phantom: SAM 12; Type: QD; Serial: TP-1111
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0mm, Middle channel/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.014 mW/g

Position 0mm, Middle channel/Zoom Scan (7x7x7) (4x4x5)/Cube 0: Measurement grid: dx=10mm, dy=10mm, dz=7mm
Reference Value = 1.89 V/m; Power Drift = 0.092 dB
Peak SAR (extrapolated) = 0.018 W/kg
SAR(1 g) = 0.00648 mW/g; SAR(10 g) = 0.00239 mW/g
Maximum value of SAR (measured) = 0.01 mW/g



0 dB = 0.010mW/g

Fig. 4: Rear Side – With WaveX on the phantom

8. PHOTOGRAPHS OF THE EQUIPMENT UNDER TEST

The photographs of the mobile phone under test are shown in Fig.5 to Fig.6.

Body position

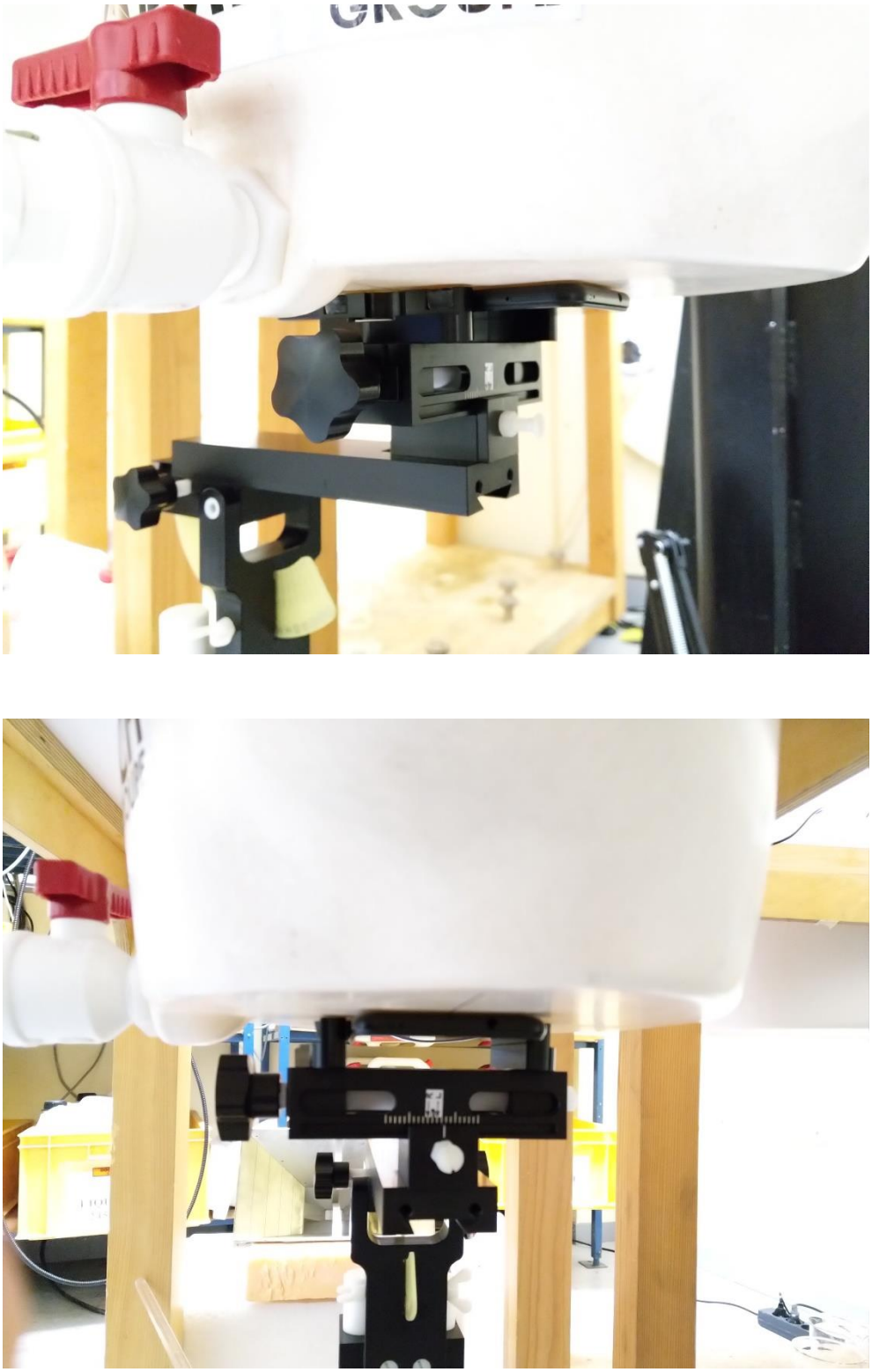
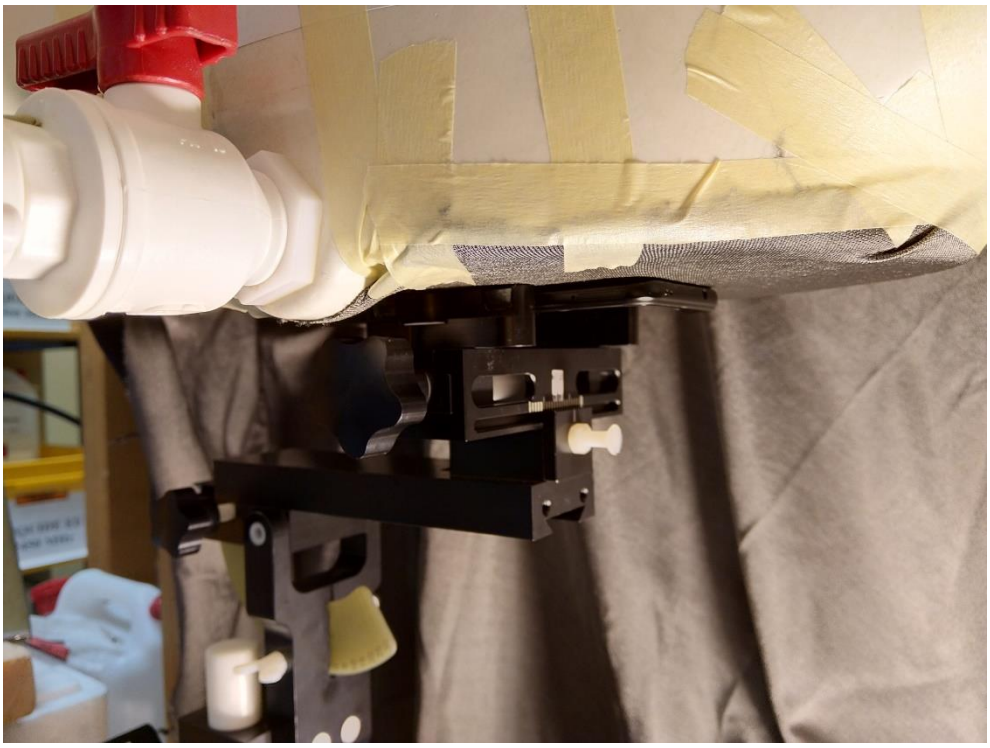


Fig. 5: Rear Side – Without WaveX



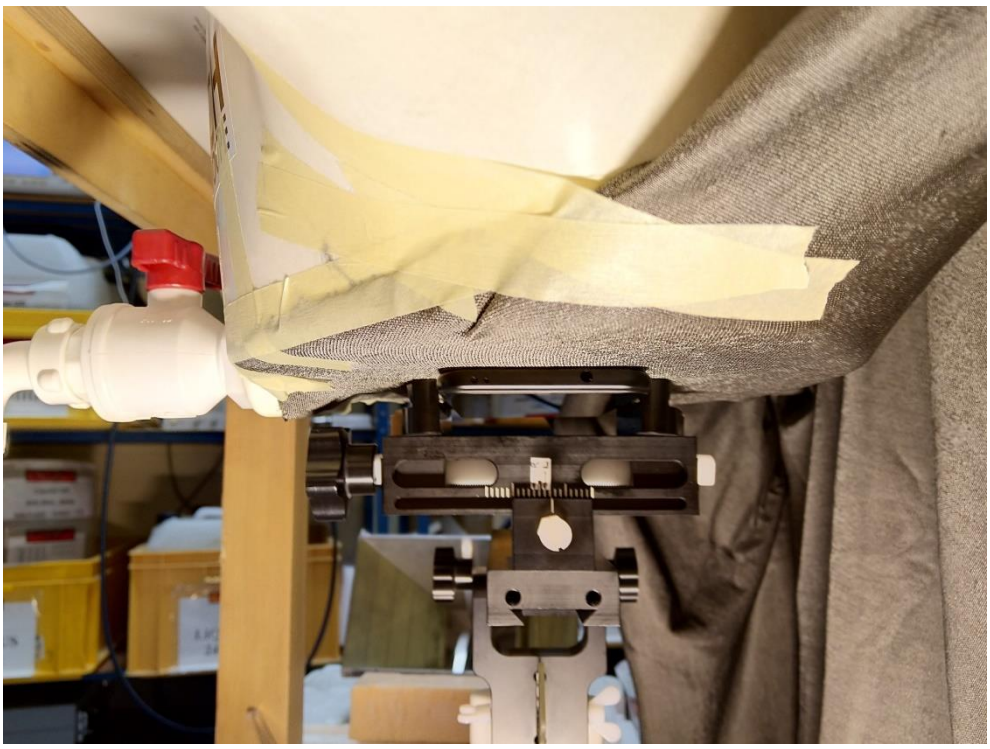


Fig. 6: Rear Side – With WaveX on the phantom

9. SPATIAL PEAK SAR EVALUATION

From Schmid & Partner Engineering AG, [DASY4 Manual, March 2003, Application Note: Spatial Peak SAR Evaluation].

Spatial Peak SAR

The DASY4 software includes all numerical procedures necessary to evaluate the spatial peak SAR values.
The spatial-peak SAR can be computed over any required mass.
The base for the evaluation is a “cube” measurement in a volume of 30mm3 (7x7x7 points). The measured volume includes the 1g and 10g cubes with the highest averaged SAR values. For that purpose, the center of the measured volume is aligned to the interpolated peak SAR value of a previously performed area scan. The entire evaluation of the spatial peak values is performed within the post-processing engine (SEMCAD). The system always gives the maximum values for the 1g and 10g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:
1. Extraction of the measured data (grid and values) from the Zoom Scan,
2. Calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters),
3. Generation of a high-resolution mesh within the measured volume,
4. Interpolation of all measured values from the measurement grid to the high-resolution grid,
5. Extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface,
6. Calculation of the averaged SAR within masses of 1g and 10g.

Interpolation, Extrapolation and Detection of Maxima

The probe is calibrated at the center of the dipole sensors which is located 1 to 2.7mm away from the probe tip. During measurements, the dipole sensors are 4mm above the phantom surface. Both distances are included as parameters in the probe configuration file. The software always knows exactly how far away the measured point is from the surface. As the probe cannot directly measure at the surface, the values between the deepest measured point and the surface must be extrapolated.
The interpolation, extrapolation and maximum search routines are all based on the modified Quadratic Shepard’s method [Robert J. Renka, “Multivariate Interpolation Of Large Sets Of Scattered Data”, University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148.].

Averaging and Determination of Spatial Peak SAR

The interpolated data is used to average the SAR over the 1g and 10g cubes by spatially discretizing the entire measured volume. The resolution of this spatial grid used to calculate the averaged SAR is 1mm or about 42875 interpolated points. The resulting volumes are defined as cubical volumes containing the appropriate tissue parameters that are centered at the location. The location is defined as the center of the incremental volume (voxel).

10. EQUIPMENT TEST CONDITIONS

The mobile phone is controlled during test using platform n° 1 (BTS simulator) referenced in paragraph 5 of this test report.

LTE band 7:

Standard:	LTE
Crest factor	1
Modulation:	QPSK
Traffic Channel:	Middle TCH = 21100
Maximum output power:	Class 3 = 23 dBm (± 2dB) (not measured)
Configuration:	Bandwith : 20 MHz, Number of ressource block : 1, Position of ressource block : Low

11. MEASUREMENT SYSTEM DESCRIPTION

The automated near-field scanning system Dosimetric Assessment System DASY4 from Schmid & Partner Engineering AG was used. The measurement is performed using platform n° 2 (DASY4) referenced in paragraph 5 of this test report. The system consists of a computer controlled, high precision robotics system, robot controller, extreme near-field probes and the phantom containing the liquid. The six axis robot precisely positions the probe at the points of maximum electromagnetic field. A device holder made of low-loss dielectric material is used to maintain the test position of the equipment under test against the phantom. The measurements were conducted in an RF controlled environment (i.e. anechoic room). Fig. 7 shows the system.

Fig. 7: The measurement setup

12. LIQUID MEASUREMENT: TEST CONDITIONS & RESULTS

The liquid measurement is performed using platform n° 3 (Liquid measure) referenced in paragraph 5 of this test report. The following ingredients (in % by weight) are theoretical and given for information.

2450 MHz liquid: Diethylenglykol-monobutylether 7.99 %
De-ionised water 71.88 %
Triton X-100 19.97%
NaCl salt 0.16 %

The dielectric parameters of the liquid for LTE2600 were controlled prior to assessment (contact probe method).
Dielectric properties measured:

Date	Frequency (MHz)	ε_r (F/m) Targeted value	ε_r (F/m) Measured value	σ (S/m) Targeted value	σ (S/m) Measured value	Liquid temperature (°C)	Ambient temperature (°C)
28/01/2021	2500	39.1 ± 10 %	35.565	1.86 ± 10 %	2.000	21.9	22.0
	2510	39.1 ± 10 %	35.499	1.87 ± 10 %	2.010		
	2535	39.1 ± 10 %	35.409	1.89 ± 10 %	2.042		
	2560	39.1 ± 10 %	35.290	1.92 ± 10 %	2.066		
	2565	39.0 ± 10 %	35.265	1.93 ± 10 %	2.072		
	2600	39.0 ± 10 %	35.110	1.96 ± 10 %	2.116		
29/01/2021	2500	39.1 ± 10 %	35.721	1.86 ± 10 %	1.975	22.0	22.1
	2510	39.1 ± 10 %	35.663	1.87 ± 10 %	1.985		
	2535	39.1 ± 10 %	35.572	1.89 ± 10 %	2.016		
	2560	39.1 ± 10 %	35.434	1.92 ± 10 %	2.043		
	2565	39.0 ± 10 %	35.403	1.93 ± 10 %	2.049		
	2600	39.0 ± 10 %	35.273	1.96 ± 10 %	2.093		

13. SYSTEM VALIDATION: TEST CONDITIONS & RESULTS

The system validation is performed using platform n° 4 (System validation) referenced in paragraph 5 of this test report.

Measurement conditions: The measurements were performed in the flat section of the SAM phantom filled with liquids. The validation dipole input power was 250mW.
Prior to the assessment, the validation dipole were used to check whether the system was operating within its specification of ± 10 %.

Measurement results: The results are hereafter below and shown in Fig. 8.

Date	Frequency (MHz)	SAR 10g (W/kg) Targeted value	SAR 10g (W/kg) Measured value
28/01/2021	2600	6.150 ± 10 %	6.490

DUT: Dipole 2600 MHz

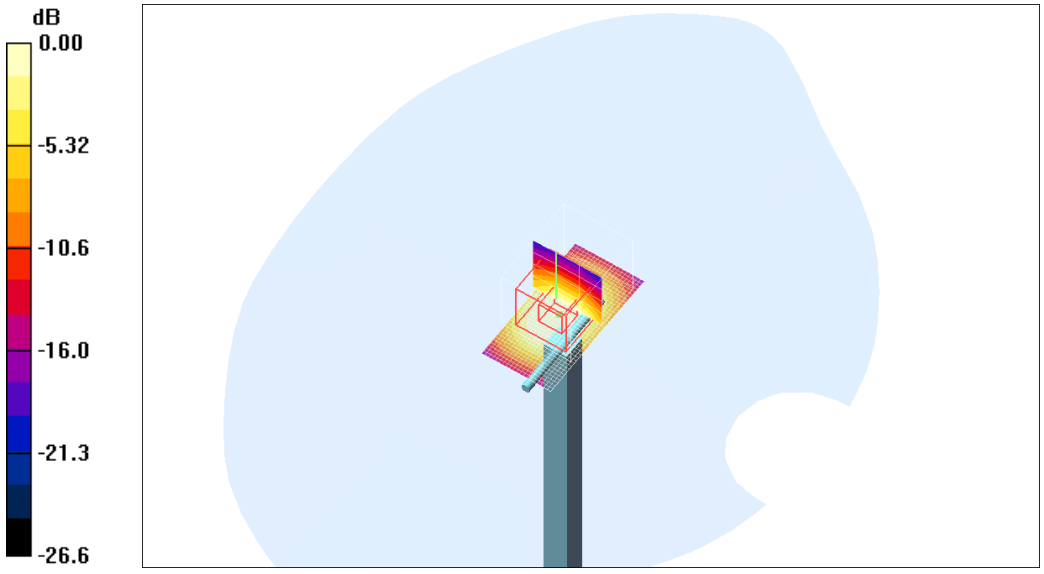
Communication System: CW; Frequency: 2600 MHz; Duty Cycle: 1:1
Medium parameters used: σ = 2.11561 mho/m, ε_r = 35.1099; ρ = 1000 kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature = 22.0 deg C Liquid temperature = 21.9 deg C

DASY4 Configuration:
- Probe: ES3DV3 - SN3303; ConvF(4.53, 4.53, 4.53); Calibrated: 8/24/2020
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 8/19/2020
- Phantom: SAM 12; Type: QD; Serial: TP-1111
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW/Area Scan (21x41x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 20.4 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (4x5x5)/Cube 0: Measurement grid: dx=10mm, dy=10mm, dz=7mm
Reference Value = 100.6 V/m; Power Drift = -0.011 dB
Peak SAR (extrapolated) = 35.5 W/kg
SAR(1 g) = 15.1 mW/g; SAR(10 g) = 6.49 mW/g
Maximum value of SAR (measured) = 15.9 mW/g



0 dB = 15.9mW/g

Fig. 8: 2600MHz validation result

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