SAR TEST REPORT

The following samples were submitted and identified on behalf of the client as:

Equipment Under Test	Louis Vuitton Tambour Horizon
Marketing Name	Louis Vuitton Tambour Horizon
Brand Name	LOUIS VUITTON
Model No.	QAD0
Company Name	LOUIS VUITTON MALLETIER
Company Address	2, rue du Pont Neuf 75001 PARIS
Standards	IEEE/ANSI C95.1-1992, IEEE 1528-2013
FCC ID	2ALDGQAD0
Date of Receipt	Dec. 16, 2020
Date of Test(s)	Jan. 21, 2021
Date of Issue	Feb. 03, 2021

In the configuration tested, the EUT complied with the standards specified above.

Remarks:

This report details the results of the testing carried out on one sample, the results contained in this test report do not relate to other samples of the same product. The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report.

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Signed on behalf of SGS

Clerk / Ruby Ou	Supervisor / Afu Chen	Asst. Manager / John Yeh
Ruby Ou	afu Chen	John Teh

Date: Feb. 03, 2021

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Revision History

Report Number	Revision	Description	Issue Date
EN/2020/C0002	Rev.00	Initial creation of document	Feb. 03, 2021

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0. Guidance applied

The SAR testing method and procedure for this device is in accordance with the following standards:

IEEE/ANSI C95.1-1992

IEEE 1528-2013

KDB248227D01v02r02

KDB865664D01v01r04

KDB865664D02v01r02

KDB447498D01v06

FCC 47 CFR Part2 (2.1093)

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1. General Information

1.1 Testing Laboratory

SGS Taiwan Ltd. Central RF Lab	
1F, No. 8, Alley 15, Lane 120, Sec. 1, NeiHu Road, Neihu District, Taipei City, 11493, Taiwan.	
FCC Designation Number	TW0027
Tel	+886-2-2299-3279
Fax	+886-2-2298-0488
Internet	http://www.tw.sgs.com/

1.2 Details of Applicant

Company Name	LOUIS VUITTON MALLETIER
Company Address	2, rue du Pont Neuf 75001 PARIS

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1.3 Description of EUT

Equipment Under Test	Louis Vuitton Tambour Horizon	
Brand Name	LOUIS VUITTON	
Marketing Name	Louis Vuitton Tambour Horizon	
Model No.	QAD0	
FCC ID	2ALDGQAD0	
Mode of Operation	☒WLAN802.11 b/g/n (20M) ☒Bluetooth	
Duty Cycle	WLAN802.11b/g/n(20M/)	96.7%
	Bluetooth	57.6%
TX Frequency Range (MHz)	WLAN802.11 b/g/n(20M)	2412 – 2472
	Bluetooth	2402 – 2480
Channel Number (ARFCN)	WLAN802.11 b/g/n(20M)	1 – 13
	Bluetooth	0 – 78

Extremity exposure

Max. SAR (10 g) (Unit: W/Kg)				
Band	Measured	Reported	Channel	Position
WLAN802.11b	0.25	0.26	11	Back side
Bluetooth	0.04	0.07	0	Back side

Next to mouth exposure

Max. SAR (1 g) (Unit: W/Kg)				
Band	Measured	Reported	Channel	Position
WLAN802.11b	0.06	0.06	11	Front side
Bluetooth	0.02	0.04	0	Front side

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WLAN802.11 b/g/n(20M) conducted power table:

Band	Mode	Channel	Frequency (MHz)	Data Rate	Max. Rated Avg. Power + Max. Tolerance (dBm)	Average power (dBm)
2450 MHz	802.11b	1	2412	1Mbps	16.00	15.98
		6	2437		16.00	15.61
		11	2462		16.00	15.92
		12	2467		16.00	15.90
		13	2472		16.00	15.97
	802.11g	1	2412	6Mbps	11.00	10.72
		6	2437		11.00	10.14
		11	2462		11.00	10.73
		12	2467		11.00	10.78
		13	2472		11.00	10.68
	802.11n HT20	1	2412	MCS0	11.00	10.79
		6	2437		11.00	10.09
		11	2462		11.00	10.62
		12	2467		11.00	10.71
		13	2472		11.00	10.75

Bluetooth conducted power table:

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)			Max. Rated Avg. Power + Max. Tolerance (dBm)		
			1Mbps	2Mbps	3Mbps	1Mbps	2Mbps	3Mbps
BR/EDR	CH 00	2402	10.68	8.34	8.40	11.00	11.00	11.00
	CH 39	2441	10.24	7.85	7.92			
	CH 78	2480	9.83	7.46	7.47			

Mode	Channel	Frequency (MHz)	Average Output Power (dBm)	Max. Rated Avg. Power + Max. Tolerance (dBm)
			GFSK	
LE	CH 37	2402	2.58	3
	CH 18	2442	1.95	
	CH 39	2480	1.45	

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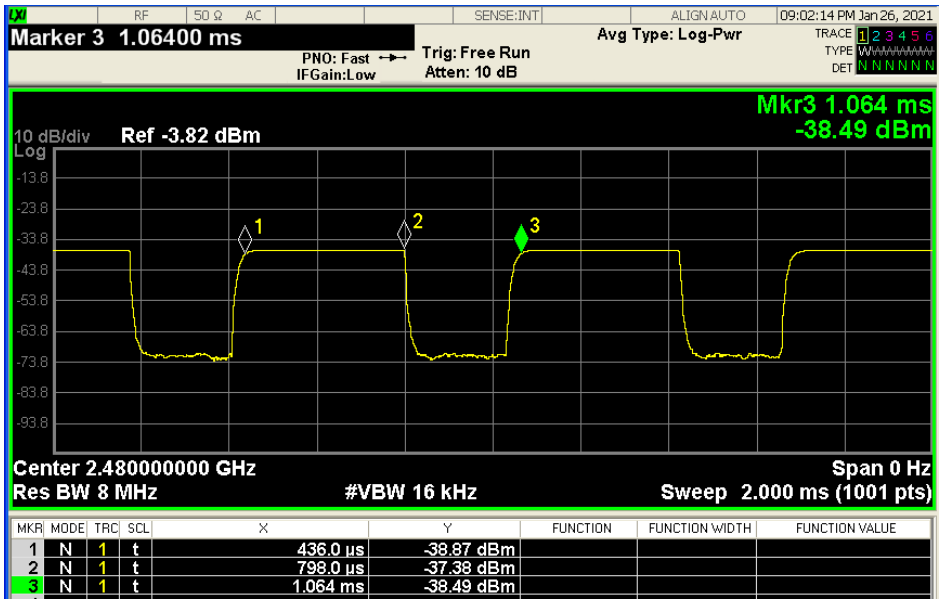
Bluetooth



Total time

628µs

Operating time

362µs

Duty cycle

(362/628)×100%=57.6%

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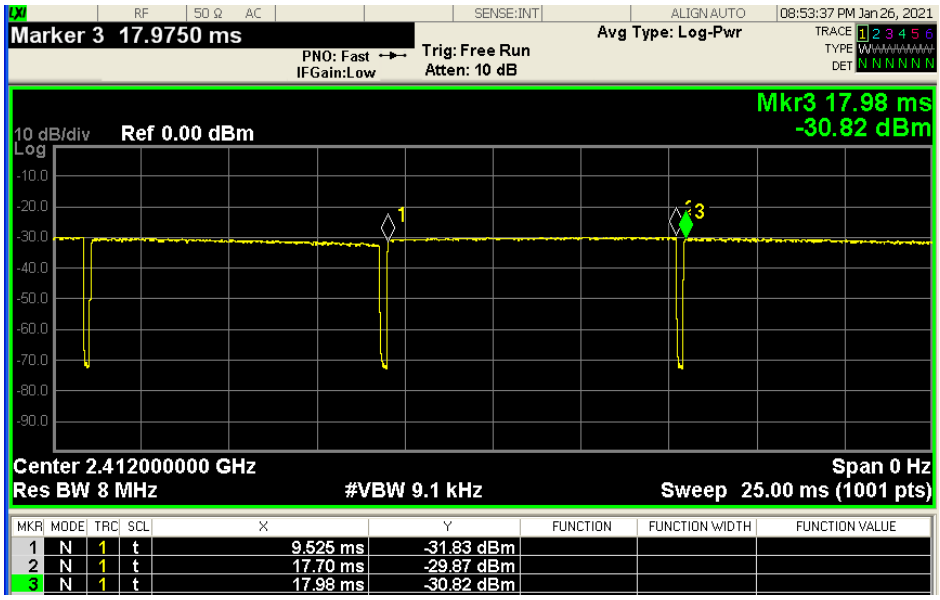
WLAN 802.11b



Total time

8.455µs

Operating time

8.175µs

Duty cycle

(8.175/8.455)×100%=96.7%

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1.4 Test Environment

Ambient Temperature: 22±2° C
Tissue Simulating Liquid: 22±2° C

1.5 Operation Description

1. Use chipset specific software to control the EUT, and makes it transmit in maximum power.

2. Measurements are performed respectively on the lowest, middle and highest channels of the operating band(s). The EUT is set to maximum power level during all tests, and at the beginning of each test the battery is fully charged.

3. During the SAR testing, the DASY 5 system checks power drift by comparing the e-field strength of one specific location measured at the beginning with that measured at the end of the SAR testing.

4. The device is a smart watch with WLAN802.11b/g/n & BT function (1Tx only), also, WLAN and BT use the same antenna path and the antenna is located on the metal body of watch, not on the watchband. Since there is the voice communication supported by the device, there are extremity exposure (10-g SAR<4) and next to mouth exposure (1g-SAR<1.6) needed to be considered based on KDB447498D01.

5. For extremity exposure, SAR is evaluated with the back of the device positioned in direct contact against the flat phantom. The wrist bands should be unstrapped and touching the phantom.

6. For next to mouth exposure, SAR is evaluated with the front of the device positioned at 10 mm from a flat phantom.

Note:

802.11b DSSS SAR Test Requirements:

1. SAR is measured for 2.4 GHz 802.11b DSSS mode using the highest measured maximum output power channel, when the reported SAR of the highest measured maximum output power channel for the exposure configuration is ≤ 0.8 W/kg, no

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further SAR testing is required for 802.11b DSSS in that exposure configuration.

2. When the reported SAR is > 0.8 W/kg, SAR is required for that exposure configuration using the next highest measured output power channel. When any reported SAR is > 1.2 W/kg, SAR is required for the third channel; i.e., all channels require testing.

802.11g/n OFDM SAR Test Exclusion Requirements:

3. SAR is not required for 802.11g/n since 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.

4. While 1-g SAR thresholds are specified in above for SAR test reduction and exclusion, these thresholds should be multiplied by 2.5 when 10-g extremity SAR is considered.
5. BT and WLAN use the same antenna path and Bluetooth may transmit simultaneously with WLAN.
6. According to KDB447498 D01, testing of other required channels is not required when the reported 1-g SAR for the highest output channel is ≤ 0.8 W/kg (or the reported 10-g SAR for the highest output channel is ≤ 2 W/kg), when the transmission band is ≤ 100MHz.
7. According to KDB865664 D01, SAR measurement variability must be assessed for each frequency band. When the original highest measured SAR is ≥ 0.8 W/kg, repeated that measurement once. Perform a second repeated measurement only if the ratio of largest to smallest SAR for the original and first repeated measurements is > 1.20 or when the original or repeated measurement is ≥ 1.45 W/kg (~10% from the 1-g SAR limit). The same procedures should be adapted for measurements according to extremity and occupational exposure limits by applying a factor of 2.5 for extremity exposure and a factor of 5 for occupational exposure to the corresponding SAR thresholds.
8. There are 2 type of wrist bands: Metal and Non-Metal. The 2 wrist bands were pre-tested, and the metal wrist band was tested fully for all required exposure conditions.

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1.6 The SAR Measurement System

A block diagram of the SAR measurement System is given in Fig. a. This SAR Measurement System uses a Computer-controlled 3-D stepper motor system (SPEAG DASY 5 professional system). The model EX3DV4 field probe is used to determine the internal electric fields. The SAR can be obtained from the equation SAR= σ ($|Ei|^2$)/ ρ where σ and ρ are the conductivity and mass density of the tissue-simulant.

The DASY 5 system for performing compliance tests consists of the following items:

1. A standard high precision 6-axis robot (Staubli RX family) with controller, teach pendant and software. An arm extension is for accommodating the data acquisition electronics (DAE).
2. A dosimetric probe, i.e., an isotropic E-field probe optimized and calibrated for usage intissue simulating liquid. The probe is equipped with an optical surface detector system.
3. A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

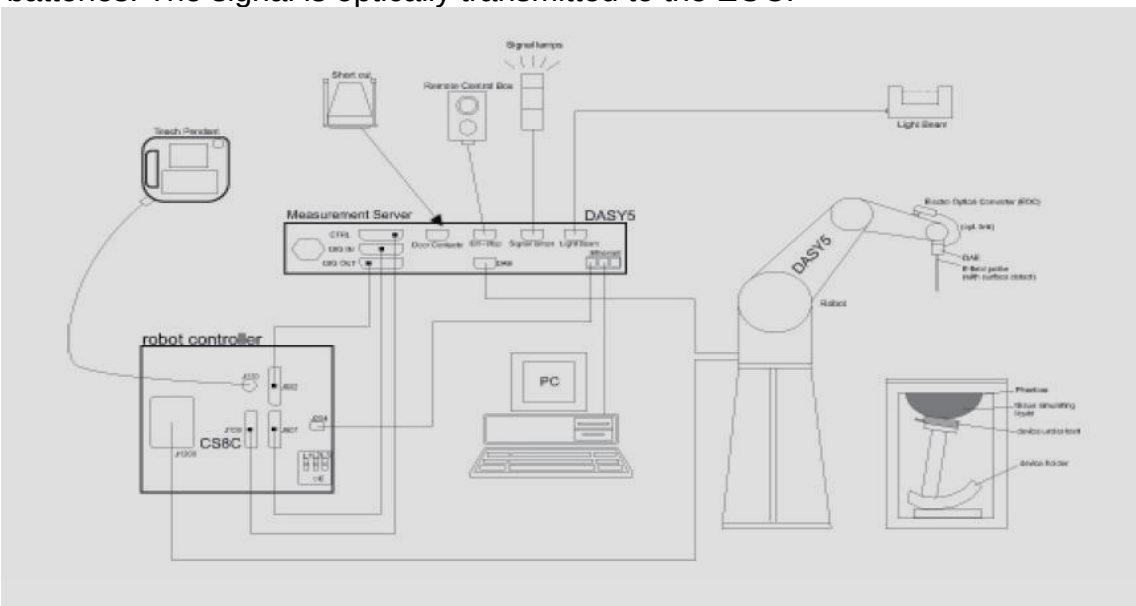

Fig. a The block diagram of SAR system

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4. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection. The EOC is connected to the measurement server.
5. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
6. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.
7. A computer operating Windows 7.
8. DASY 5 software.
9. Remote control with teach pendant and additional circuitry for robot safety such as warning lamps, etc.
10. The device holder for handheld mobile phones.
11. Tissue simulating liquid mixed according to the given recipes.
13. Validation dipole kits allowing to validate the proper functioning of the system.

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1.7 System Components

EX3DV4 E-Field Probe

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)	
Calibration	Basic Broad Band Calibration in air Conversion Factors (CF) for HSL 2450MHz Additional CF for other liquids and frequencies upon request	
Frequency	10 MHz to > 6 GHz	
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)	
Dynamic Range	10 µW/g to > 100 mW/g Linearity: ± 0.2 dB (noise: typically < 1 µW/g)	
Dimensions	Tip diameter: 2.5 mm	
Application	High precision dosimetric measurements in any exposure scenario (e.g., very strong gradient fields). Only probe which enables compliance testing for frequencies up to 6 GHz with precision of better 30%.	

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PHANTOM

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

DEVICE HOLDER

Construction	The device holder (Supporter) for Notebook is made by POM (polyoxymethylene resin) , which is non-metal and non-conductive. The height can be adjusted to fit varies kind of notebooks.	 Device Holder

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1.8 SAR System Verification

The microwave circuit arrangement for system verification is sketched in Fig. b. The daily system accuracy verification occurs within the flat section of the SAM phantom. A SAR measurement was performed to see if the measured SAR was within +/- 10% from the target SAR values. These tests were done at 2450MHz. The tests were conducted on the same days as the measurement of the DUT. The obtained results from the system accuracy verification are displayed in the table 1 (SAR values are normalized to 1W forward power delivered to the dipole). The liquid depth above the ear reference points was ≥ 15 cm ± 5 mm (frequency ≤ 3 GHz) or ≥ 10 cm ± 5 mm (frequency > 3 G Hz) in all the cases. It is seen that the system is operating within its specification, as the results are within acceptable tolerance of the reference values.

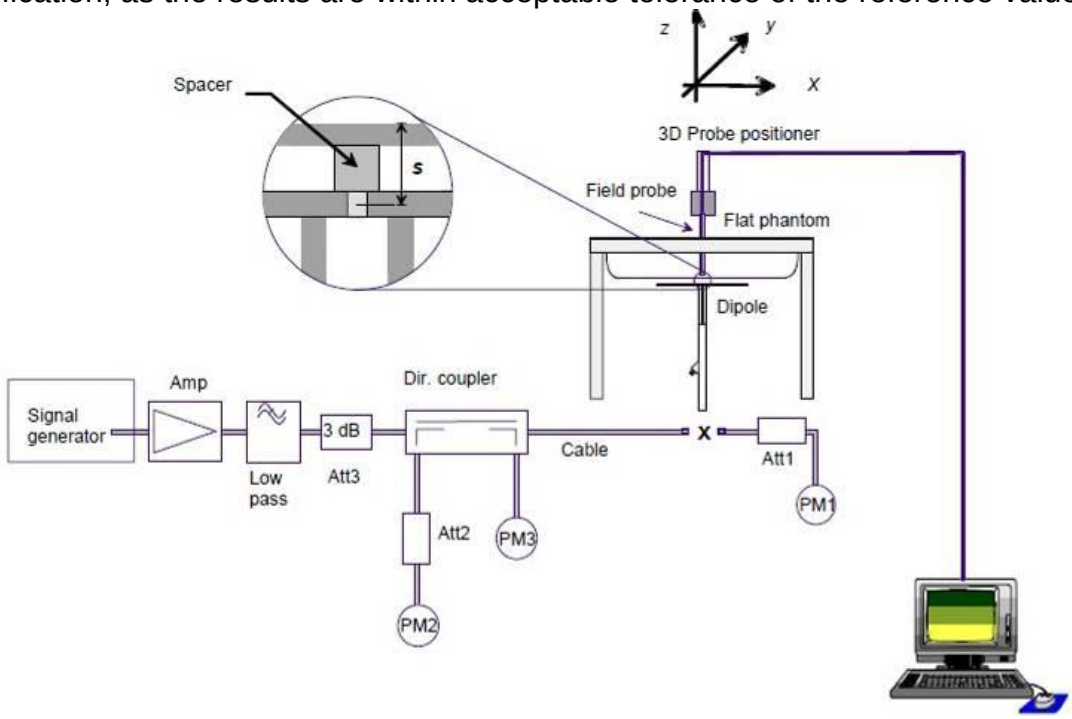

Fig. b The block diagram of system verification

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Validation Kit	S/N	Frequency (MHz)		1W Target SAR-1g (mW/g)	Pin=250mW Measured SAR-1g (mW/g)	Measured SAR-1g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D2450V2	727	2450	Head	52.6	13.60	54.40	3.42%	Jan, 21, 2021

Validation Kit	S/N	Frequency (MHz)		1W Target SAR-10g (mW/g)	Pin=250mW Measured SAR-10g (mW/g)	Measured SAR-10g normalized to 1W (mW/g)	Deviation (%)	Measured Date
D2450V2	727	2450	Head	24.7	6.30	25.20	2.02%	Jan, 21, 2021

Table 1. Results of system verification

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1.9 Tissue Simulant Fluid for the Frequency Band

The dielectric properties for this Head-simulant fluid were measured by using the Agilent Model 85070E Dielectric Probe (rates frequency band 200 MHz to 20 GHz) in conjunction with Network Analyzer.
All dielectric parameters of tissue simulates were measured within 24 hours of SAR measurements. The measured conductivity and permittivity are all within ± 5% of the target values.

Tissue Type	Measurement Date	Measured Frequency (MHz)	Target Dielectric Constant, εr	Target Conductivity, σ (S/m)	Measured Dielectric Constant, εr	Measured Conductivity, σ (S/m)	% dev εr	% dev σ
Head	Jan, 21. 2021	2402	39.285	1.757	37.947	1.836	-3.41%	4.48%
		2412	39.268	1.766	37.908	1.841	-3.46%	4.23%
		2437	39.223	1.788	37.848	1.852	-3.51%	3.55%
		2441	39.216	1.792	37.842	1.863	-3.50%	3.96%
		2450	39.200	1.800	37.823	1.874	-3.51%	4.11%
		2462	39.185	1.813	37.802	1.892	-3.53%	4.35%
		2480	39.162	1.833	37.768	1.911	-3.56%	4.27%

Table 2. Dielectric Parameters of Tissue Simulant Fluid

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The composition of the tissue simulating liquid:

Frequency (MHz)	Mode	Ingredient						Total amount
		DGMBE	Water	Salt	Preventol D-7	Cellulose	Sugar	
2450	Head	550 g	450 g	—	—	—	—	1.0L(Kg)

Table 3. Recipes for Tissue Simulating Liquid

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1.10 Evaluation Procedures

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 1 g and 10 g cubes. The algorithm to find the cube with highest averaged SAR is divided into the following stages:

1. The extraction of the measured data (grid and values) from the Zoom Scan.
2. The calculation of the SAR value at every measurement point based on all stored data (A/D values and measurement parameters)
3. The generation of a high-resolution mesh within the measured volume
4. The interpolation of all measured values from the measurement grid to the high-resolution grid
5. The extrapolation of the entire 3-D field distribution to the phantom surface over the distance from sensor to surface
6. The calculation of the averaged SAR within masses of 1g and 10g.

The probe is calibrated at the center of the dipole sensors that is located 1 to 2.7mm away from the probe tip. During measurements, the probe stops shortly above the phantom surface, depending on the probe and the surface detecting system. 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 angle between the probe axis and the surface normal line is less than 30 degree.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extreme of the SAR distribution. The uncertainty on the locations of the extreme is less than 1/20 of the grid size. Only local maximum within –2 dB of the global maximum are searched and passed for the Cube Scan measurement. In the Cube Scan, the interpolation function is used to extrapolate the Peak SAR from the lowest measurement points to the inner phantom surface (the extrapolation distance). The uncertainty increases with the extrapolation distance. To keep the uncertainty within 1% for the 1 g and 10 g cubes, the extrapolation distance should not be larger than 5mm.

The maximum search is automatically performed after each area scan measurement. It is based on splines in two or three dimensions. The procedure can find the maximum for most SAR distributions even with relatively large grid spacing. After the area scanning measurement, the probe is automatically moved to a position at the interpolated maximum. The following scan can directly use this position for reference, e.g., for a finer resolution grid or the cube evaluations. The 1g and 10g peak evaluations are only available for the predefined cube 7x7x7 scans. The routines are verified and optimized for the grid dimensions used in these cube measurements.

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The measured volume of 30x30x30mm contains about 30g of tissue.
The first procedure is an extrapolation (incl. Boundary correction) to get the points between the lowest measured plane and the surface. The next step uses 3D interpolation to get all points within the measured volume. In the last step, a 1g cube is placed numerically into the volume and its averaged SAR is calculated. This cube is the moved around until the highest averaged SAR is found. If the highest SAR is found at the edge of the measured volume, the system will issue a warning: higher SAR values might be found outside of the measured volume. In that case the cube measurement can be repeated, using the new interpolated maximum as the center.

1.11 Probe Calibration Procedures

For the calibration of E-field probes in lossy liquids, an electric field with an accurately known field strength must be produced within the measured liquid. For standardization purposes it would be desirable if all measurements which are necessary to assess the correct field strength would be traceable to standardized measurement procedures. In the following two different calibration techniques are summarized:

1.11.1 Transfer Calibration with Temperature Probes

In lossy liquids the specific absorption rate (SAR) is related both to the electric field (E) and the temperature gradient ($\delta T / \delta t$) in the liquid.

$$SAR = \frac{\sigma}{\rho}|E|^2 = c\frac{\delta T}{\delta t}$$

whereby σ is the conductivity, ρ the density and c the heat capacity of the liquid.

Hence, the electric field in lossy liquid can be measured indirectly by measuring the temperature gradient in the liquid. Non-disturbing temperature probes (optical probes or thermistor probes with resistive lines) with high spatial resolution (<1-2 mm) and fast reaction time (<1 s) are available and can be easily calibrated with high precision [1]. The setup and the exciting source have no influence on the calibration; only the relative positioning uncertainties of the standard temperature probe and the E-field probe to be calibrated must be considered. However, several problems limit the available accuracy of probe calibrations with temperature probes:

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1. The temperature gradient is not directly measurable but must be evaluated from temperature measurements at different time steps. Special precaution is necessary to avoid measurement errors caused by temperature gradients due to energy equalizing effects or convection currents in the liquid. Such effects cannot be completely avoided, as the measured field itself destroys the thermal equilibrium in the liquid. With a careful setup these errors can be kept small.
2. The measured volume around the temperature probe is not well defined. It is difficult to calculate the energy transfer from a surrounding gradient temperature field into the probe. These effects must be considered, since temperature probes are calibrated in liquid with homogeneous temperatures. There is no traceable standard for temperature rise measurements.
3. The calibration depends on the assessment of the specific density, the heat capacity and the conductivity of the medium. While the specific density and heat capacity can be measured accurately with standardized procedures (~ 2% for c; much better for ρ) , there is no standard for the measurement of the conductivity. Depending on the method and liquid, the error can well exceed ±5%.
4. Temperature rise measurements are not very sensitive and therefore are often performed at a higher power level than the E-field measurements. The nonlinearities in the system (e.g., power measurements, different components, etc.) must be considered.

Considering these problems, the possible accuracy of the calibration of E-field probes with temperature gradient measurements in a carefully designed setup is about ±10% (RSS) [2]. Recently, a setup which is a combination of the waveguide techniques and the thermal measurements was presented in [3]. The estimated uncertainty of the setup is ±5% (RSS) when the same liquid is used for the calibration and for actual measurements and ±7-9% (RSS) when not, which is in good agreement with the estimates given in [2].

1.11.2 Calibration with Analytical Fields

In this method a technical setup is used in which the field can be calculated analytically from measurements of other physical magnitudes (e.g., input power). This corresponds to the standard field method for probe calibration in air; however, there is no standard defined for fields in lossy liquids.
When using calculated fields in lossy liquids for probe calibration, several points must be considered in the assessment of the uncertainty:

1. The setup must enable accurate determination of the incident power.
2. The accuracy of the calculated field strength will depend on the

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assessment of the dielectric parameters of the liquid.

3. Due to the small wavelength in liquids with high permittivity, even small setups might be above the resonant cutoff frequencies. The field distribution in the setup must be carefully checked for conformity with the theoretical field distribution.

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1.12 Test Standards and Limits

According to FCC 47CFR §2.1093(d) The limits to be used for evaluation are based generally on criteria published by the American National Standards Institute (ANSI) for localized specific absorption rate (‘‘SAR’’) in Section 4.2 of ‘‘IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz,’’ ANSI/IEEE C95.1, By the Institute of Electrical and Electronics Engineers, Inc., New York, New York 10017. These criteria for SAR evaluation are similar to those recommended by the National Council on Radiation Protection and Measurements (NCRP) in ‘‘Biological Effects and Exposure Criteria for Radio frequency Electromagnetic Fields,’’ NCRP Report No. 86, Section 17.4.5. Copyright NCRP, 1986, Bethesda, Maryland 20814. SAR is a measure of the rate of energy absorption due to exposure to an RF transmitting source. SAR values have been related to threshold levels for potential biological hazards. The criteria to be used are specified in paragraphs (d)(1) and (d)(2) of this section and shall apply for portable devices transmitting in the frequency range from 100 kHz to 6 GHz. Portable devices that transmit at frequencies above 6 GHz are to be evaluated in terms of the MPE limits specified in § 1.1310 of this chapter. Measurements and calculations to demonstrate compliance with MPE field strength or power density limits for devices operating above 6 GHz should be made at a minimum distance of 5 cm from the radiating source.

1. Limits for Occupational/Controlled exposure: 0.4 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 8 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the spatial peak SAR shall not exceed 20 W/kg, as averaged over an 10 grams of tissue (defined as a tissue volume in the shape of a cube).
2. Occupational/Controlled limits apply when persons are exposed as a consequence of their employment provided these persons are fully aware of and exercise control over their exposure. Awareness of exposure can be accomplished by use of warning labels or by specific training or education through appropriate means, such as an RF safety program in a work environment.
3. Limits for General Population/Uncontrolled exposure: 0.08 W/kg as averaged over the whole-body and spatial peak SAR not exceeding 1.6 W/kg as averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube). Exceptions are the hands, wrists, feet and ankles where the

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spatial peak SAR shall not exceed 4 W/kg, as averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube). General Population/Uncontrolled limits apply when the general public may be exposed, or when persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or do not exercise control over their exposure. Warning labels placed on consumer devices such as cellular telephones will not be sufficient reason to allow these devices to be evaluated subject to limits for occupational/controlled exposure in paragraph (d)(1) of this section. (Table 4.)

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR (Brain)	1.60 W/Kg	8.00 W/Kg
Spatial Average SAR (Whole Body)	0.08 W/Kg	0.40 W/Kg
Spatial Peak SAR (Hands/Feet/Ankle/Wrist)	4.00 W/Kg	20.00 W/Kg

Table 4. RF exposure limits

Notes:

1. Uncontrolled environments are defined as locations where there is potential exposure of individuals who have no knowledge or control of their potential exposure.
2. Controlled environments are defined as locations where there is potential exposure of individuals who have knowledge of their potential exposure and can exercise control over their exposure.

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2. Summary of Results

2.1 Decision rules

Reported measurement data comply with IEEE 1528-2013:
Determining compliance shall be based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.2 Summary of Results

Extremity exposure

Mode	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Ducy cycle Scaling	Power Scaling	Averaged SAR over 10g (W/kg)		Plot page
									Measured	Reported	
WLAN802.11b	Back side	0	1	2412	16	15.98	1.03	100.47%	0.137	0.142	-
	Back side	0	6	2437	16	15.61	1.03	109.41%	0.175	0.198	-
	Back side	0	11	2462	16	15.92	1.03	101.87%	0.238	0.251	32
	Back side*	0	11	2462	16	15.92	1.03	101.87%	0.249	0.262	34
Bluetooth (GFSK)	Back side	0	0	2402	11	10.68	1.74	107.74%	0.035	0.065	36
	Back side*	0	0	2402	11	10.68	1.74	107.74%	0.027	0.051	-
	Back side	0	39	2441	11	10.24	1.74	119.22%	0.030	0.062	-
	Back side	0	78	2480	11	9.83	1.74	131.03%	0.026	0.058	-

* - Metal strap spot check

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Next to mouth exposure

Mode	Position	Distance (mm)	CH	Freq. (MHz)	Max. Rated Avg. Power + Max. Tolerance (dBm)	Measured Avg. Power (dBm)	Ducy cycle Scaling	Power Scaling	Averaged SAR over 1g (W/kg)		Plot page
									Measured	Reported	
WLAN802.11b	Front side	10	1	2412	16	15.98	1.03	100.47%	0.039	0.040	-
	Front side	10	6	2437	16	15.61	1.03	109.41%	0.040	0.045	-
	Front side	10	11	2462	16	15.92	1.03	101.87%	0.044	0.047	37
	Front side*	10	11	2462	16	15.92	1.03	101.87%	0.061	0.064	38
Bluetooth (GFSK)	Front side	10	0	2402	11	10.68	1.74	107.74%	0.015	0.028	39
	Front side*	10	0	2402	11	10.68	1.74	107.74%	0.019	0.035	40
	Front side	10	39	2441	11	10.24	1.74	119.22%	0.013	0.026	-
	Front side	10	78	2480	11	9.83	1.74	131.03%	0.011	0.026	-

* - Metal strap spot check

Note:

Scaling = $\frac{\text{reported SAR}}{\text{measured SAR}} = \frac{P2(mW)}{P1(mW)} = 10^{\left(\frac{P_2-P_1}{10}\right)}(dBm)$

Reported SAR = measured SAR * (scaling)

Where P2 is maximum specified power, P1 is measured conducted power

2.3 Reporting statements of conformity

The conformity statement in this report is based solely on the test results, measurement uncertainty is excluded.

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3. Simultaneous Transmission Analysis

Simultaneous Transmission Scenarios:

Simultaneous Transmit Configurations	Body
BT + WLAN	Yes

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3.1 Estimated SAR calculation

According to KDB447498 D01v06 – When standalone SAR test exclusion applies to an antenna that transmits simultaneously with other antennas, the standalone SAR must be estimated according to following to determine simultaneous transmission SAR test exclusion:

$$\text{Estimated SAR} = \frac{\text{Max. tune up power (mW)}}{\text{Min. test separation distance(mm)}} \times \frac{\sqrt{f(\text{GHz})}}{7.5}$$

If the minimum test separation distance is < 5mm, a distance of 5mm is used for estimated SAR calculation. When the test separation distance is >50mm, the 0.4W/kg is used for SAR-1g.

3.2 SPLSR evaluation and analysis

Per KDB447498D01, when the sum of SAR is larger than the limit, SAR test exclusion is determined by the SAR sum to peak location separation ratio(SPLSR).

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/Ri**, 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.

SAR1 and SAR2 are the highest reported or estimated SAR for each antenna in the pair, and Ri is the separation distance between the peak SAR locations for the antenna pair in mm.

When standalone test exclusion applies, SAR is estimated; the peak location is assumed to be at the feed-point or geometric center of the antenna.

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Extremity exposure

No.	Conditions	Position	Max. WLAN reported 10g-SAR	Max. BT reported 10g-SAR	SAR Sum (10g-SAR)
1	WLAN + BT	Back	0.262	0.065	0.327

Next to mouth exposure

No.	Conditions	Position	Max. WLAN reported 1g-SAR	Max. BT reported 1g-SAR	SAR Sum (1g-SAR)
1	WLAN + BT	Front	0.064	0.035	0.099

Note.

Simultaneous transmission SAR measurement (Volume Scan) is not required because either the sum of the 1-g SAR is < 1.6 W/kg (and/or 10-g SAR is < 4.0 W/kg) or the SPLSR is ≦ 0.04 for all circumstances that require SPLSR calculation.

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4. Instruments List

Manufacturer	Device	Type	Serial number	Date of last calibration	Date of next calibration
SPEAG	Dosimetric E-Field Probe	EX3DV4	3770	May.27,2020	May.26,2021
SPEAG	System Validation Dipole	D2450V2	727	Apr.22,2020	Apr.21,2021
SPEAG	Data acquisition Electronics	DAE4	856	Apr.23,2020	Apr.22,2021
SPEAG	Software	DASY 52 V52.10.4	N/A	Calibration not required	Calibration not required
SPEAG	Phantom	ELI	N/A	Calibration not required	Calibration not required
SPEAG	Dielectric Assessment Kit	DAKS-3.5	1053	Jan.28,2020	Jan.27,2021
Agilent	Dual-directional coupler	772D	MY46151242	Aug.17,2020	Aug.16,2021
		778D	MY48220468	Aug.17,2020	Aug.16,2021
Agilent	RF Signal Generator	N5181A	MY50141235	May.04,2020	May.03,2021
Anritsu	Power Meter	E4417A	MY51410006	Mar.09,2020	Mar.08,2021
Anritsu	Power Sensor	MA2411B	1306052	Oct.05.2020	Oct.04.2021
TECPEL	Digital thermometer	DTM-303A	TP130075	Sep.30.2020	Sep.29.2021

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5. Measurements

Date: 2021/1/21

Report No. :EN/2020/C0002

WLAN 802.11b_Body_Back side_CH 11_0mm

Communication System: WLAN 2.45G; Frequency: 2462 MHz; Duty cycle= 1:0.967

Medium parameters used: f = 2462 MHz; σ = 1.892 S/m; ε_r = 37.802; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2462 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.757 W/kg

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

Reference Value = 4.959 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 2.01 W/kg

SAR(1 g) = 0.630 W/kg; SAR(10 g) = 0.238 W/kg

Smallest distance from peaks to all points 3 dB below = 5.2 mm

Ratio of SAR at M2 to SAR at M1 = 39.7%

Maximum value of SAR (measured) = 1.07 W/kg

Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 4.959 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 1.51 W/kg

SAR(1 g) = 0.470 W/kg; SAR(10 g) = 0.184 W/kg

Smallest distance from peaks to all points 3 dB below = 5.3 mm

Ratio of SAR at M2 to SAR at M1 = 49.1%

Maximum value of SAR (measured) = 1.06 W/kg

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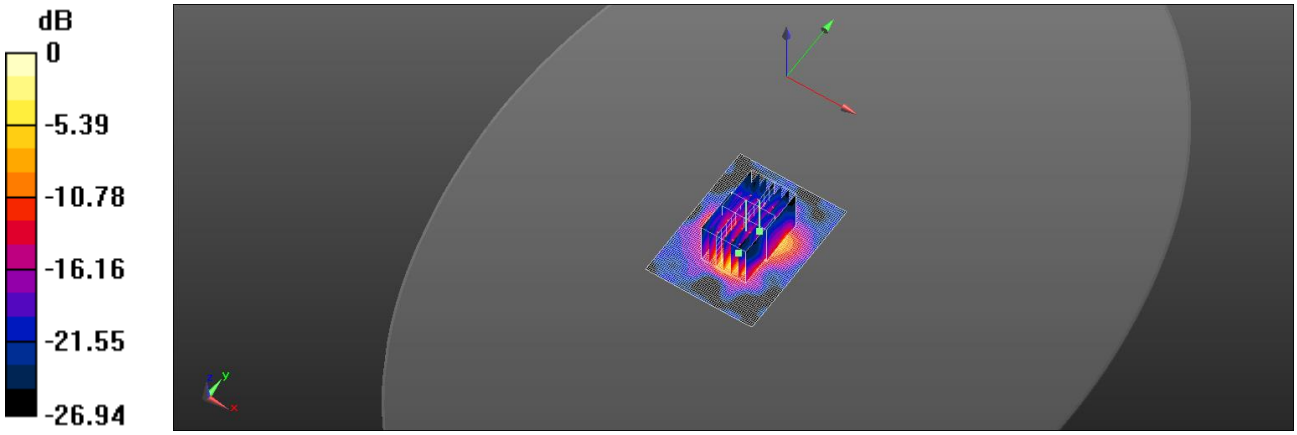

0 dB = 1.06 W/kg = 0.25 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

WLAN 802.11b_Body_Back side_CH 11_0mm_Repeat Metal strap

Communication System: WLAN 2.45G; Frequency: 2462 MHz; Duty cycle= 1:0.967

Medium parameters used: f = 2462 MHz; σ = 1.892 S/m; ε_r = 37.802; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2462 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.756 W/kg

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

Reference Value = 6.893 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 2.30 W/kg

SAR(1 g) = 0.729 W/kg; SAR(10 g) = 0.249 W/kg

Smallest distance from peaks to all points 3 dB below = 5.4 mm

Ratio of SAR at M2 to SAR at M1 = 38.4%

Maximum value of SAR (measured) = 1.34 W/kg

Zoom Scan (7x7x7)/Cube 1: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 6.893 V/m; Power Drift = -0.19 dB

Peak SAR (extrapolated) = 1.82 W/kg

SAR(1 g) = 0.508 W/kg; SAR(10 g) = 0.192 W/kg

Smallest distance from peaks to all points 3 dB below = 5.4 mm

Ratio of SAR at M2 to SAR at M1 = 41.3%

Maximum value of SAR (measured) = 1.12 W/kg

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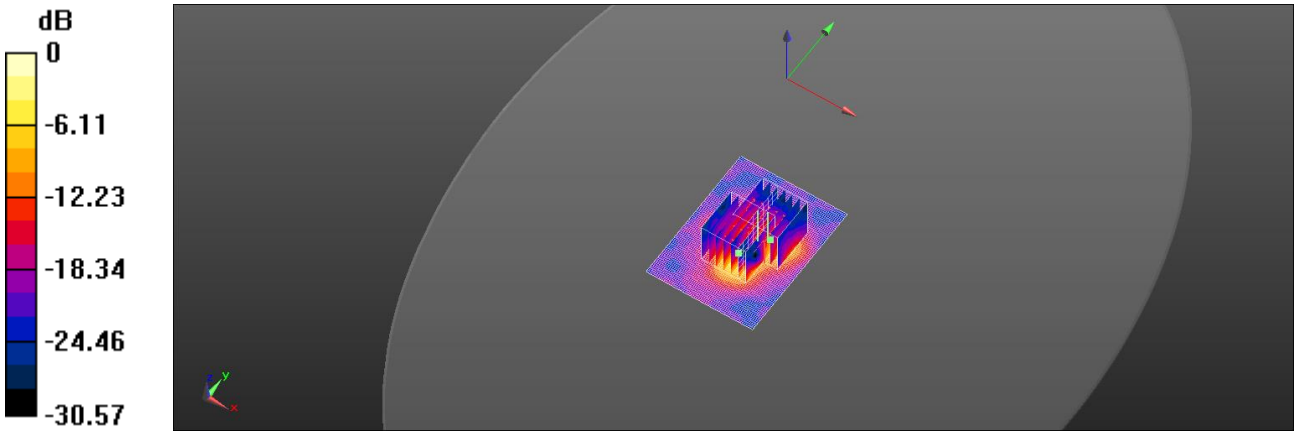

0 dB = 1.12 W/kg = 0.49 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

Bluetooth(GFSK)_Body_Back side_CH 0_0mm

Communication System: Bluetooth; Frequency: 2402 MHz; Duty cycle= 1:0.576

Medium parameters used: f = 2402 MHz; σ = 1.836 S/m; ε_r = 37.947; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2402 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.163 W/kg

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

Reference Value = 2.616 V/m; Power Drift = -0.13 dB

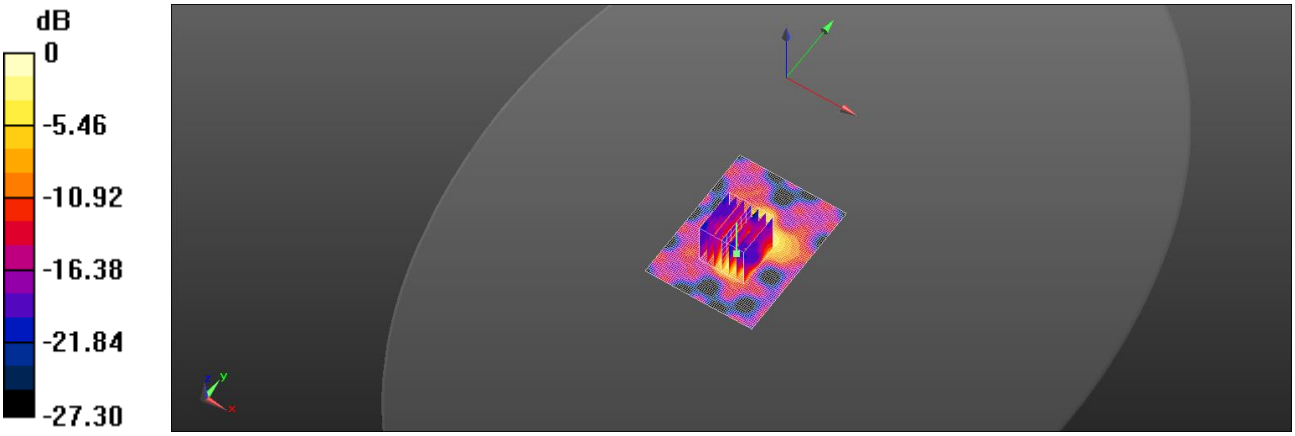
Peak SAR (extrapolated) = 0.272 W/kg

SAR(1 g) = 0.100 W/kg; SAR(10 g) = 0.035 W/kg

Smallest distance from peaks to all points 3 dB below = 5.5 mm

Ratio of SAR at M2 to SAR at M1 = 47.2%

Maximum value of SAR (measured) = 0.172 W/kg



0 dB = 0.172 W/kg = -7.64 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

WLAN 802.11b_Body_Front side_CH 11_10mm

Communication System: WLAN 2.45G; Frequency: 2462 MHz; Duty cycle= 1:0.967

Medium parameters used: f = 2462 MHz; σ = 1.892 S/m; ε_r = 37.802; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2462 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0957 W/kg

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

Reference Value = 2.402 V/m; Power Drift = -0.12 dB

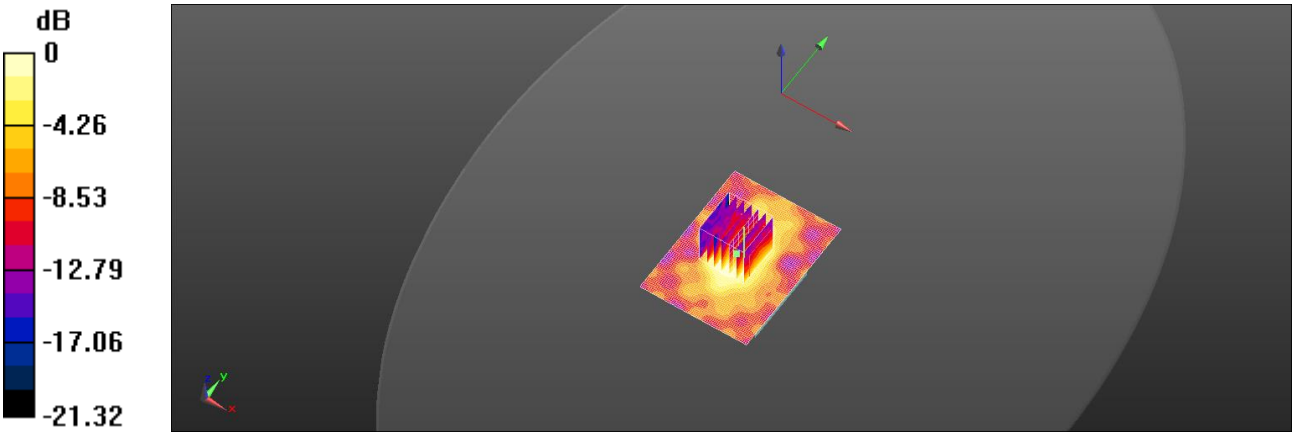
Peak SAR (extrapolated) = 0.0870 W/kg

SAR(1 g) = 0.044 W/kg; SAR(10 g) = 0.023 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 55.9%

Maximum value of SAR (measured) = 0.0610 W/kg



0 dB = 0.0610 W/kg = -12.15 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

WLAN 802.11b_Body_Front side_CH 11_10mm_Repeat Metal strap

Communication System: WLAN 2.45G; Frequency: 2462 MHz; Duty cycle= 1:0.967

Medium parameters used: f = 2462 MHz; σ = 1.892 S/m; ε_r = 37.802; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2462 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0972 W/kg

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

Reference Value = 2.396 V/m; Power Drift = -0.14 dB

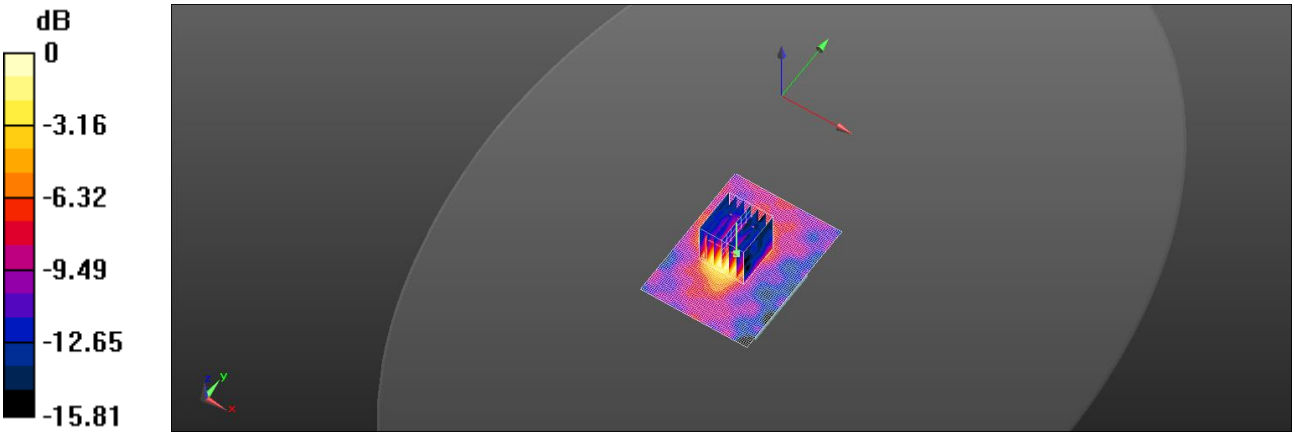
Peak SAR (extrapolated) = 0.117 W/kg

SAR(1 g) = 0.061 W/kg; SAR(10 g) = 0.030 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 53.4%

Maximum value of SAR (measured) = 0.0862 W/kg



0 dB = 0.0862 W/kg = -10.64 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

Bluetooth(GFSK)_Body_Front side_CH 0_10mm

Communication System: Bluetooth; Frequency: 2402 MHz; Duty cycle= 1:0.576

Medium parameters used: f = 2402 MHz; σ = 1.836 S/m; ε_r = 37.947; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2402 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0267 W/kg

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

Reference Value = 1.371 V/m; Power Drift = -0.13 dB

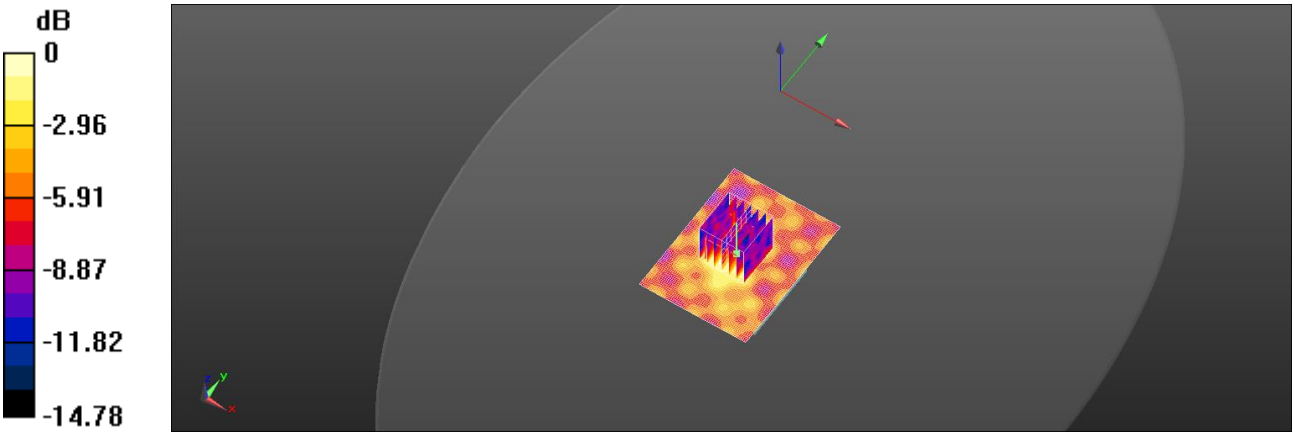
Peak SAR (extrapolated) = 0.0330 W/kg

SAR(1 g) = 0.015 W/kg; SAR(10 g) = 0.00804 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 49.2%

Maximum value of SAR (measured) = 0.0224 W/kg



0 dB = 0.0224 W/kg = -16.50 dBW/kg

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Date: 2021/1/21

Report No. :EN/2020/C0002

Bluetooth(GFSK)_Body_Front side_CH 0_10mm_Repeat Metal strap

Communication System: Bluetooth; Frequency: 2402 MHz; Duty cycle= 1:0.576

Medium parameters used: f = 2402 MHz; σ = 1.836 S/m; ε_r = 37.947; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2402 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Area Scan (61x81x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 0.0319 W/kg

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

Reference Value = 2.303 V/m; Power Drift = -0.19 dB

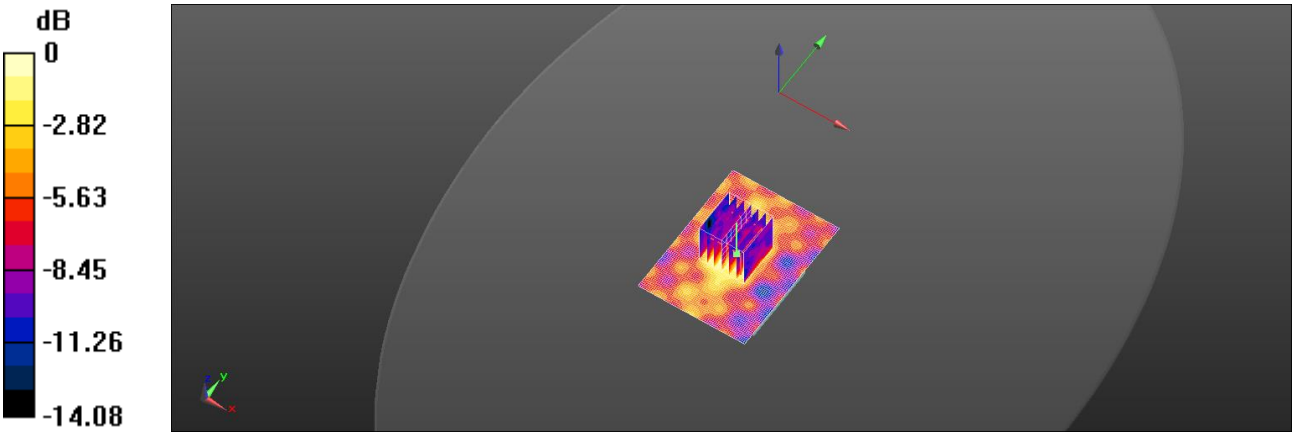
Peak SAR (extrapolated) = 0.0340 W/kg

SAR(1 g) = 0.019 W/kg; SAR(10 g) = 0.010 W/kg

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

Ratio of SAR at M2 to SAR at M1 = 58.5%

Maximum value of SAR (measured) = 0.0269 W/kg



0 dB = 0.0269 W/kg = -15.70 dBW/kg

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6. SAR System Performance Verification

Date: 2021/1/21

Report No. :EN/2020/C0002

Dipole 2450 MHz SN:727

Communication System: CW; Frequency: 2450 MHz; Duty cycle= 1:1

Medium parameters used: f = 2450 MHz; σ = 1.874 S/m; ε_r = 37.823; ρ = 1000 kg/m^3

Phantom section: Flat Section

Ambient temperature: 21.5°C; Liquid temperature: 21.9°C

DASY5 Configuration:

- Probe: EX3DV4 - SN3770; ConvF(7.4, 7.4, 7.4) @ 2450 MHz; Calibrated: 2020/5/27
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn856; Calibrated: 2020/4/23
- Phantom: ELI
- DASY52 52.10.4(1527); SEMCAD X 14.6.14(7483)

Pin=250mW/Area Scan (51x61x1): Interpolated grid: dx=12 mm, dy=12 mm

Maximum value of SAR (interpolated) = 21.7 W/kg

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

Reference Value = 104.2 V/m; Power Drift = 0.04 dB

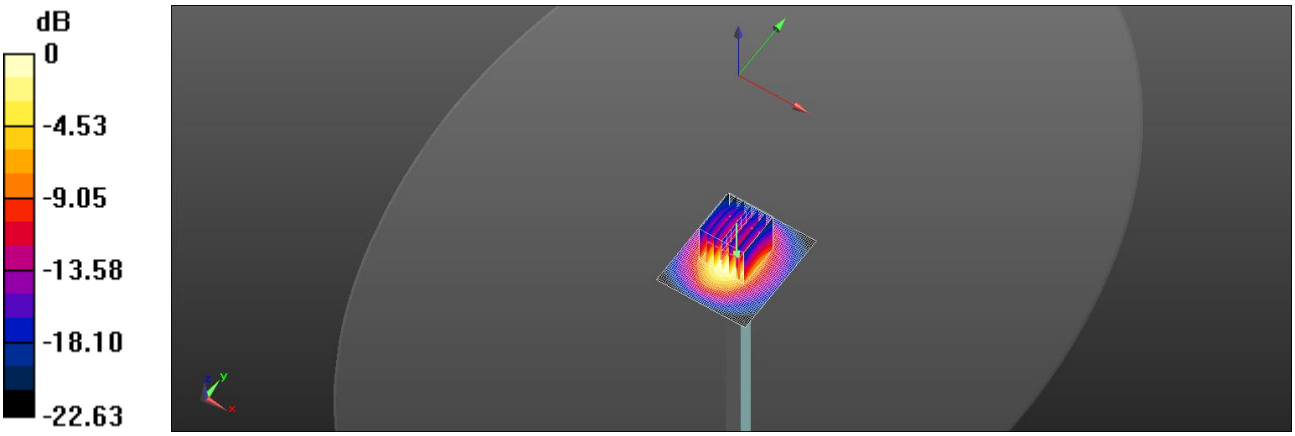
Peak SAR (extrapolated) = 28.0 W/kg

SAR(1 g) = 13.6 W/kg; SAR(10 g) = 6.3 W/kg

Smallest distance from peaks to all points 3 dB below = 9.5 mm

Ratio of SAR at M2 to SAR at M1 = 49.1%

Maximum value of SAR (measured) = 20.6 W/kg



0 dB = 20.6 W/kg = 13.14 dBW/kg

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7. Uncertainty Budget

Measurement Uncertainty evaluation template for DUT SAR test (0.3-3G)

A	c	D	e		f	g	h=c * f / e	i=c * g / e	k
Source of Uncertainty	Tolerance/ Uncertainty	Probability	Div	Div Value	ci (1g)	ci (10g)	Standard uncertainty	Standard uncertainty	vi, or Veff
Measurement system									
Probe calibration	6.00%	N	1	1	1	1	6.00%	6.00%	∞
Isotropy , Axial	3.50%	R	√3	1.732	1	1	2.02%	2.02%	∞
Isotropy, Hemispherical	9.60%	R	√3	1.732	1	1	5.54%	5.54%	∞
Modulation Response	2.40%	R	√3	1.732	1	1	1.40%	1.40%	∞
Boundary Effect	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Linearity	4.70%	R	√3	1.732	1	1	2.71%	2.71%	∞
Detection Limits	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Readout Electronics	0.30%	N	1	1	1	1	0.30%	0.30%	∞
Response time	0.80%	R	√3	1.732	1	1	0.46%	0.46%	∞
Integration Time	2.60%	R	√3	1.732	1	1	1.50%	1.50%	∞
Measurement drift (class A evaluation)	1.75%	R	√3	1.732	1	1	1.01%	1.01%	∞
RF ambient condition - noise	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
RF ambient conditions - reflections	3.00%	R	√3	1.732	1	1	1.73%	1.73%	∞
Probe positioner Mechanical restrictions	0.40%	R	√3	1.732	1	1	0.23%	0.23%	∞
Probe Positioning with respect to phantom	2.90%	R	√3	1.732	1	1	1.67%	1.67%	∞
Post-processing	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Max SAR Eval	1.00%	R	√3	1.732	1	1	0.58%	0.58%	∞
Test Sample related									
Test sample positioning	2.90%	N	1	1	1	1	2.90%	2.90%	M-1
Device Holder Uncertainty	3.60%	N	1	1	1	1	3.60%	3.60%	M-1
Drift of output power	5.00%	R	√3	1.732	1	1	2.89%	2.89%	∞
Phantom and Setup									
Phantom Uncertainty	4.00%	R	√3	1.732	1	1	2.31%	2.31%	∞
Liquid permittivity (mea.)	3.56%	N	1	1	0.64	0.43	2.28%	1.53%	M
Liquid Conductivity (mea.)	4.48%	N	1	1	0.6	0.49	2.69%	2.20%	M
Combined standard uncertainty		RSS					11.95%	11.72%	

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Appendixes

Refer to separated files for the following appendixes.

EN2020C0002 SAR_Appendix A Photographs

EN2020C0002 SAR_Appendix B DAE & Probe Cal. Certificate

EN2020C0002 SAR_Appendix C Phantom Description & Dipole Cal. Certificate

- End of Report -

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