BNetzA-CAB-02/21-102

TEST REPORT

Test Report No.: 1-9201-24-01-03_TR1-R01

Deutsche Akkreditierungsstelle
D-PL-12047-01-00

Testing Laboratory

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Accredited Testing Laboratory:
The testing laboratory (area of testing) is accredited according to DIN EN ISO/IEC 17025 (2018-03) by the Deutsche Akkreditierungsstelle GmbH (DAkkS).
The accreditation is valid for the scope of testing procedures as stated in the accreditation certificate with the registration number: D-PL-12047-01-00.
ISED Testing Laboratory Recognized Listing Number: DE0001
FCC designation number: DE0002

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Test Standards

IEC/IEEE 62209-1528-2020	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)
RSS-102 Issue 6	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)

For further applied test standards please refer to section 3 of this test report.

Test Item

Kind of test item:	CardioMessenger Smart
Device type:	portable device
Model name:	**CardioMessenger Smart 4G**
S/N serial number:	91189500
FCC-ID:	QRI-CMSMART4GWW2
ISED Number:	4708A-CMSMART4GWW2
Product Marketing Name (PMN):	CardioMessenger Smart 4G
Hardware Version Identification No. (HVIN):	CMSMART4GWW2
IMEI-Number:	353123530000200
Hardware status:	CardioMessenger Smart 4G mit LP1 Rev Cx
Software status:	SMARTAPP 1.x
Firmware version:	ULP_HIGH_1_37_0, ULP_LOW_1_17_0, M0C.400005
Frequency:	see technical details
Antenna:	integrated antenna
Battery option:	Lithium-ion battery UF463443GU 3.7 V / 820 mAh
Test sample status:	production unit
Exposure category:	general population / uncontrolled environment

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Test Report authorised:

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1 Table of contents

2 General information

2.1 Notes and disclaimer

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2.2 Application details

Date of receipt of order:	2025-01-13
Date of receipt of test item:	2025-01-13
Start of test:	2025-02-12
End of test:	2025-02-20

2.3 Statement of compliance

The SAR values found for the CardioMessenger Smart 4G CardioMessenger Smart are below the maximum recommended levels of 1.6 W/Kg as averaged over any 1 g tissue according to the FCC rule §2.1093, the Health Canada's Safety Code 6 and the Industry Canada Radio Standards Specification RSS-102 for General Population/Uncontrolled exposure.

2.4 Technical details

Band tested for this test report	Technology	Lowest transmit frequency/MHz	Highest transmit frequency/MHz	Lowest receive Frequency/MHz	Highest receive Frequency/MHz	Kind of modulation	Power Class	Tested power control level	GPRS/EGPRS mobile station class	Test channel low	Test channel middle	Test channel high	Maximum P_{avg}/dBm
☐	GSM	880.2	914.8	925.2	959.8	GMSK 8-PSK	4 E2	5	B	975	37	124	22.9
☐	GSM DCS	1710.2	1784.8	1805.2	1879.8	GMSK 8-PSK	1 E2	0	B	512	698	885	20.0
☒	GSM cellular	824.2	848.8	869.2	893.8	GMSK 8-PSK	4 E2	5	B	128	190	251	22.4
☒	GSM PCS	1850.2	1909.8	1930.2	1989.8	GMSK 8-PSK	1 E2	0	B	512	661	810	22.9
☐	LTE FDD 1 CatM-1	1920	1980	2110	2170	QPSK	3	max	--	18100	18300	18500	23.4
☒	LTE FDD 2 CatM-1	1850	1910	1930	1990	QPSK	3	max	--	18700	18900	19100	23.8
☐	LTE FDD 3 CatM-1	1710	1785	1805	1880	QPSK	3	max	--	19300	19575	19850	23.6
☒	LTE FDD 4 CatM-1	1710	1755	2110	2155	QPSK	3	max	--	20050	20175	20300	23.6
☒	LTE FDD 5 CatM-1	824	849	869	894	QPSK	3	max	--	20450	20525	20600	23.9
☐	LTE FDD 8 CatM-1	880	915	925	960	QPSK	3	max	--	21500	21625	21750	23.8
☒	LTE FDD 12 CatM-1	704	711	734	741	QPSK	3	max	--	23060	23095	23130	23.9
☐	LTE FDD 18 CatM-1	815	830	860	875	QPSK	3	max	--	23900	23925	23950	24.0
☐	LTE FDD 19 CatM-1	830	845	875	890	QPSK	3	max	--	24050	24075	24100	23.9
☐	LTE FDD 20 CatM-1	832	862	791	821	QPSK	3	max	--	24250	24300	24350	24.4
☒	LTE FDD 26 CatM-1	814	849	859	894	QPSK	3	max	--	26765	26865	26965	23.8
☐	LTE FDD 28 CatM-1	703	748	758	803	QPSK	3	max	--	27310	27435	27560	23.9
☐	ULP-AMI-P	405	405	402	405	2-FSK	-	max	--	--	--	--	-16

Module: Telit Cinterion ME910G1-WW

2.5 Transmitter and Antenna Operating Configurations

Simultaneous transmission conditions
GSM / GPRS / EDGE / LTE + ULP-AMI-P

Table 1: Simultaneous transmission conditions

3 Test standards/ procedures references

Test Standard	Version	Test Standard Description
RSS-102 Issue 6	2023-12	Radio Frequency Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)
RSS-102 Supplementary Procedures SPR-002	2022-10	SPR-002 — Supplementary Procedure for Assessing Compliance of Equipment Operating from 3 kHz to 10 MHz with RSS-102
Canada's Safety Code No. 6	2015-06	Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz
IEEE Std. C95-3	2002	IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF and Microwave
IEC/IEEE 62209-1528-2020	2020-10-19	Measurement procedure for the assessment of specific absorption rate of human exposure to radio frequency fields from hand-held and body-mounted wireless communication devices – Part 1528: Human models, instrumentation, and procedures (Frequency range of 4 MHz to 10 GHz)

FCC KDBs:

KDB 865664D01v01	August 7, 2015	FCC OET SAR measurement requirements 100 MHz to 6 GHz
KDB 865664D02v01	October 23, 2015	RF Exposure Compliance Reporting and Documentation Considerations
KDB 447498D01v06	October 23, 2015	Mobile and Portable Devices RF Exposure Procedures and Equipment Authorization Policies
KDB 648474D04v01	October 23, 2015	SAR Evaluation Considerations for Wireless Handsets
KDB 941225D05v02	October 23, 2015	SAR for LTE Devices
KDB 941225D05Av01	October 23, 2015	LTE Rel. 10 KDB Inquiry Sheet
KDB 941225D07v01	October 23, 2015	UMPS Mini Tablet

3.1 RF exposure limits

RF Exposure levels according CFR 47 – Part 1, §1.1310 / RSS 102 Issue 06 / safety Code 6:

Human Exposure	Uncontrolled Environment General Population	Controlled Environment Occupational
Spatial Peak SAR* (Brain and Trunk)	**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 2: RF exposure limits (100 kHz to 6 GHz)

The limit applied in this test report is shown in bold letters

Notes:

* The Spatial Peak value of the SAR averaged over any 1 gram of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time

** The Spatial Average value of the SAR averaged over the whole body.

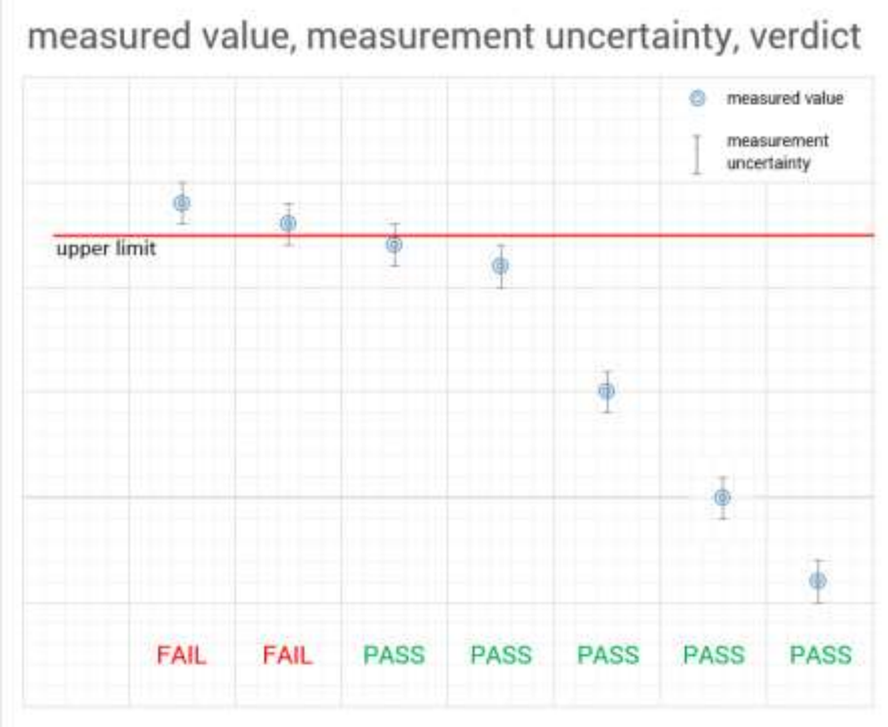
*** The Spatial Peak value of the SAR averaged over any 10 grams of tissue (defined as a tissue volume in the shape of a cube) and over the appropriate averaging time.

Uncontrolled Environments are defined as locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Controlled Environments are defined as locations where there is exposure that may be incurred by persons who are aware of the potential for exposure, (i.e. as a result of employment or occupation).

4 Reporting statements of conformity – decision rule

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3.
The measurement uncertainty is mentioned in this test report, see chapter 9, but is not taken into account - neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 20% that the decision might be wrong."



5 Summary of Measurement Results

☒	**No deviations from the technical specifications ascertained**		
☐	Deviations from the technical specifications ascertained		
Maximum SAR value reported for 1g (W/kg)			
		PCB	**ULP-AMI-P estimated**
body worn 0 mm distance		**1.550**	**0.003**
collocated situations	**ΣSAR_{1g} evaluation PCB & ULP-AMI-P**	**1.553**	

5.1 SAR measurement variability and measurement uncertainty analysis

This analysis is required for worst case results larger than 0.8 W/kg.

frequency band	highest original measurement result at worst case position (W/kg)	repeated measurement result at worst case position (W/kg)	ratio <1.2
GSM 835	1.330	1.350	1.02
GSM 1900	1.020	1.040	1.02
LTE FDD 2	1.110	1.150	1.04
LTE FDD 4	1.030	1.060	1.03

6 Test Environment

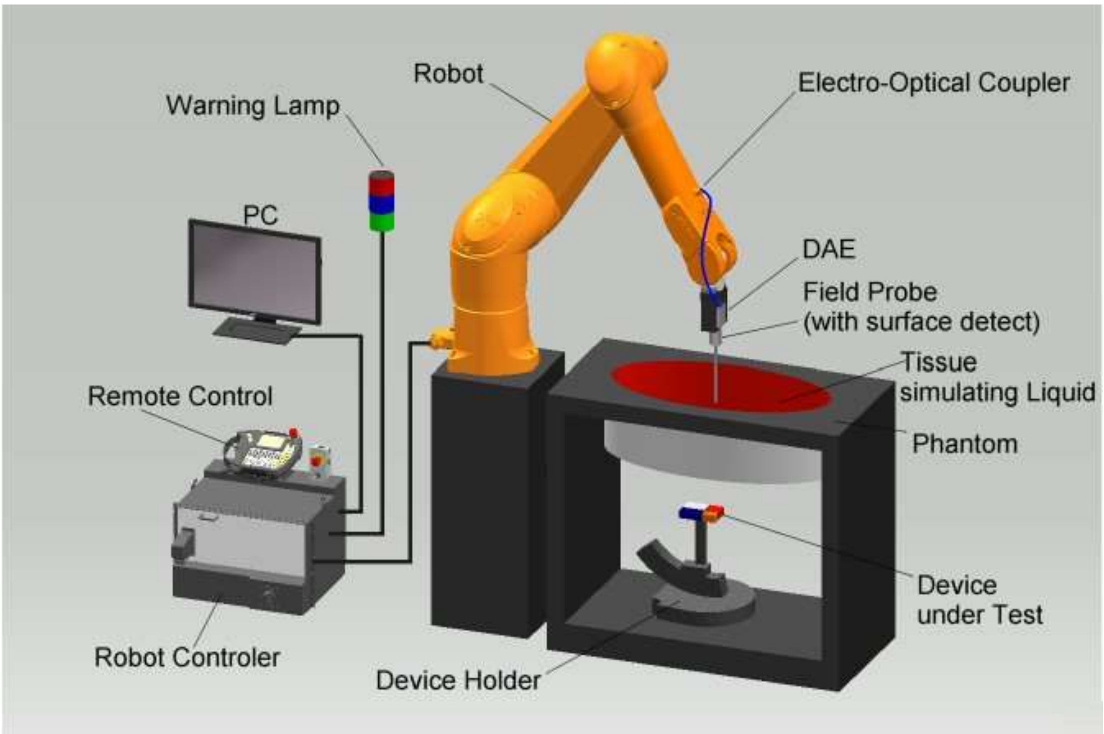
Ambient temperature:	20 – 24 °C
Tissue Simulating liquid:	20 – 24 °C
Relative humidity content:	40 – 50 %
Air pressure:	not relevant for this kind of testing
Power supply:	230 V / 50 Hz

NOTE: For the SAR measurements the exact temperature values for each test are shown in the SAR result tables and are also at the bottom of each measurement plot.

7 Test Set-up

7.1 Measurement system

7.1.1 System Description



- The DASY system for performing compliance tests consists of the following items:
- A standard high precision 6-axis robot (Stäubli RX/TX family) with controller and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A dosimetric probe, i.e. an isotropic E-field probe optimized and calibrated for usage in tissue simulating liquid.
- A data acquisition electronic (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.
- The Electro-Optical Coupler (EOC) performs the conversion from the optical into a digital electric signal of the DAE. The EOC is connected to the DASY measurement server.
- The DASY measurement server, which performs all real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operation. A computer operating Windows.
- DASY software and SEMCAD data evaluation software.
- Remote control with teach panel and additional circuitry for robot safety such as warning lamps, etc.
- The generic twin phantom enabling the testing of left-hand and right-hand usage.
- The triple flat and eli phantom for the testing of handheld and body-mounted wireless devices.
- The device holder for handheld mobile phones and mounting device adaptor for laptops
- Tissue simulating liquid mixed according to the given recipes.
- System check dipoles allowing to validate the proper functioning of the system.

7.1.2 Test environment

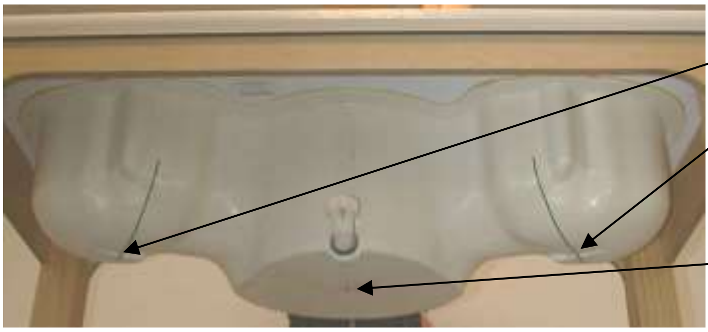
The DASY measurement system is placed in a laboratory room within an environment which avoids influence on SAR measurements by ambient electromagnetic fields and any reflection from the environment. The pictures at the beginning of the photo documentation show a complete view of the test environment. The system allows the measurement of SAR values larger than 0.005 W/kg.

7.1.3 Probe description

Isotropic E-Field Probe EX3DV4 for Dosimetric Measurements	
Technical data according to manufacturer information	
Construction	Symmetrical design with triangular core Interleaved sensors Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	ISO/IEC 17025 calibration service available.
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 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 W/kg; Linearity: ± 0.2 dB (noise: typically<1 µW/g)
Dimensions	Overall length: 337 mm (Tip: 20mm) Tip length: 2.5 mm (Body: 12mm) Typical distance from probe tip to dipole centers: 1mm
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%.

7.1.4 Phantom description

The used SAM Phantom meets the requirements specified in FCC KDB865664 D01 for Specific Absorption Rate (SAR) measurements.
The phantom consists of a fibreglass shell integrated in a wooden table. It allows left-hand and right-hand head as well as body-worn measurements with a maximum liquid depth of 18 cm in head position and 22 cm in planar position (body measurements). The thickness of the Phantom shell is 2 mm +/- 0.1 mm.



7.1.5 Device holder description

The DASY device holder has two scales for device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear openings). The plane between the ear openings and the mouth tip has a rotation angle of 65°. 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. This device holder is used for standard mobile phones or PDA’s only. If necessary an additional support of polystyrene material is used.

Larger DUT’s (e.g. notebooks) cannot be tested using this device holder. Instead a support of bigger polystyrene cubes and thin polystyrene plates is used to position the DUT in all relevant positions to find and measure spots with maximum SAR values.
Therefore those devices are normally only tested at the flat part of the SAM.

7.1.6 Scanning procedure

- The DASY installation includes predefined files with recommended procedures for measurements and system check. They are read-only document files and destined as fully defined but unmeasured masks. All test positions (head or body-worn) are tested with the same configuration of test steps differing only in the grid definition for the different test positions.
- The „reference“ and „drift“ measurements are located at the beginning and end of the batch process. They measure the field drift at one single point in the liquid over the complete procedure. The indicated drift is mainly the variation of the DUT’s output power and should vary max. +/- 5 %.
- The highest integrated SAR value is the main concern in compliance test applications. These values can mostly be found at the inner surface of the phantom and cannot be measured directly due to the sensor offset in the probe. To extrapolate the surface values, the measurement distances to the surface must be known accurately. A distance error of 0.5mm could produce SAR errors of 6% at 1800 MHz. Measurements can be performed in a fixed plane or by following an arbitrary surface.
- For an automatic and accurate detection of the phantom surface, the DASY system uses Mechanical Surface Detection:

  Mechanical Surface Detection
  Mechanical surface detection uses the probe collision detector built into the DAE. It is extremely accurate if the probe is normal to the surface (0.05 mm). For angled probes, the distance increases, because the detection is at the edge of the probe tip. It can be used in any liquid with any kind of probe. If the surface is strongly angled with respect to the probe, the probe slides along the surface and is defected sideways. The second switch system in the DAE will detect this situation and the probe will move backward until the touch condition is cleared. However, there will be some remaining uncertainty in the final probe position. In the job description, the desired distance from the probe sensors to the phantom surface can be entered. The detection is always at touch, but the probe will move backward from the surface the indicated distance before starting the measurement.

  Mother Scan in cDASY6/DASY8 Module SAR
  The cDASY6/DASY8 Module SAR provides the possibility to do a Mother Scan in which a high resolution Area Scan is done in the phantom filled with liquid to a fixed level using a special teaching probe. This mother scan data is used to recreate the phantom inner surface in software, and all future area and/or zoom scans, and a surface detection check is no longer required.

- The „area scan“ measures the SAR above the DUT or verification dipole on a parallel plane to the surface. It is used to locate the approximate location of the peak SAR with 2D spline interpolation. The robot performs a stepped movement along one grid axis while the local electrical field strength is measured by the probe. The probe is touching the surface of the SAM during acquisition of measurement values. The scan uses different grid spacings for different frequency measurements. Standard grid spacing for head measurements in frequency ranges ≤ 2GHz is 15 mm in x- and y- dimension. For higher frequencies a finer resolution is needed, thus for the grid spacing is reduced according the following table:

Area scan grid spacing for different frequency ranges	
Frequency range	Grid spacing
≤ 2 GHz	≤ 15 mm
2 – 4 GHz	≤ 12 mm
4 – 6 GHz	≤ 10 mm

  Grid spacing and orientation have no influence on the SAR result. For special applications where the standard scan method does not find the peak SAR within the grid, e.g. mobile phones with flip cover, the grid can be adapted in orientation. Results of this coarse scan are shown in annex B.

- A „zoom scan" measures the field in a volume around the 2D peak SAR value acquired in the previous „coarse" scan. It uses a fine meshed grid where the robot moves the probe in steps along all the 3 axis (x, y and z-axis) starting at the bottom of the Phantom. The grid spacing for the cube measurement is varied according to the measured frequency range, the dimensions are given in the following table:

Zoom scan grid spacing and volume for different frequency ranges			
Frequency range	Grid spacing for x, y axis	Grid spacing for z axis	Minimum zoom scan volume
≤ 2 GHz	≤ 8 mm	≤ 5 mm	≥ 30 mm
2 – 3 GHz	≤ 5 mm*	≤ 5 mm	≥ 28 mm
3 – 4 GHz	≤ 5 mm*	≤ 4 mm	≥ 28 mm
4 – 5 GHz	≤ 4 mm*	≤ 3 mm	≥ 25 mm
5 – 6 GHz	≤ 4 mm*	≤ 2 mm	≥ 22 mm

* When zoom scan is required and the reported SAR from the area scan based 1-g SAR estimation procedures of KDB Publication 447498 is ≤ 1.4 W/kg, ≤ 8 mm, ≤ 7 mm and ≤ 5 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.

- DASY provides an auto-extending feature to expand the size of the measurement area of the zoom scan as long as the maximum is found too close to the edge of the measured range, which eliminates the need to re-measure cubes whose maximum is found on the boundary of the defined measurement cube.

- To meet the requirements of **IEC 62209-2 AMD1 from 2019** it is necessary to perform graded grid measurements to avoid measurement mistakes.

  Below 3 GHz it defines:
  Horizontal grid step ≤ 8mm
  Vertical grid step ≤ 5mm for uniform spacing

  For variable spacing in vertical direction the maximum distance between the two closest measured points to the phantom shell (M1 and M2) shall be ≤ 4 mm and the spacing between farther points shall increase by a factor ≤ 1.5. Zoom Scan size ≤ 30 mm by 30 mm by 30 mm.

  Above 3 GHz it defines:
  Horizontal grid step ≤ (24/*f* [GHz]) mm
  Vertical grid step ≤ (10/(*f* [GHz] − 1)) mm for uniform spacing

  For variable spacing in vertical direction the maximum distance between the two closest measured points to the phantom shell (M1 and M2) shall be ≤ (12/*f* [GHz]) mm and the spacing between farther points shall increase by a factor ≤ 1.5. Zoom Scan size ≤ 22 mm by 22 mm by 22 mm.

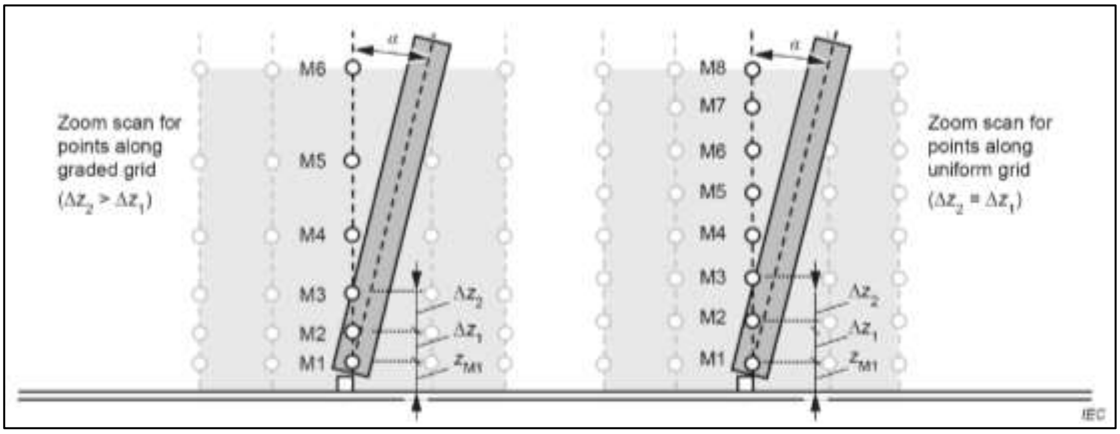
  <u>If the zoom scan measured as defined above complies with both of the following criteria, or if the peak spatial-average SAR is below 0.1 W/kg, no additional measurements are needed:</u>

  1) the smallest horizontal distance from the local SAR peaks to all points 3 dB below the SAR peak shall be larger than the horizontal grid steps in both *x* and y directions (Δx, Δy). This shall be checked for the measured zoom scan plane conformal to the phantom at the distance z_{M1}. The minimum distance shall be recorded in the SAR test report;
  2) the ratio of the SAR at the second measured point (M2) to the SAR at the closest measured point (M1) at the *x*-*y* location of the measured maximum SAR value shall be at least 30 %. This ratio (in %) shall be recorded in the SAR test report.

If one or both of the above criteria are not met, the zoom scan measurement shall be repeated using a finer resolution while keeping the other zoom scan parameters compatible with the basic requirements for zoom scans.

New horizontal and vertical grid steps shall be determined from the measured SAR distribution so that the above criteria are met. Compliance with the above two criteria shall be demonstrated for the new measured zoom scan. The size of the higher resolution zoom scan and all other parameters shall apply. The closest point to the phantom shell shall be 2 mm or less for graded grids and the grading factor shall be 1.5 or less. Uncertainties due to field distortion between the media boundary and the dielectric enclosure of the probe should also be minimized, which is achieved if the distance between the phantom surface and physical tip of the probe is larger than the probe tip diameter. Other methods may utilize correction procedures to compensate for boundary effects that enable high precision measurements closer than half the probe tip diameter. For all measurement points, the angle of the probe normal to the flat phantom surface shall be less than 5°. If this cannot be achieved, an additional uncertainty evaluation is required.

Orientation of the probe with respect to the line normal to the phantom surface, shown at two different locations:



NOTE M1 to M8 are example measurement points used for extrapolation to the surface. The maximum of the angle α between the evaluation axis and the surface normal line is called the probe angle. The distance z_{M1} is from the phantom shell to the first measurement point M1, and its maximum value is 1.4mm fixed for the DASY system equipped with an EX-Probe. The distances Δz_i (i = 1, 2, 3, ...) are the distances from measurement points M_i to M_{i-1}. For uniform grids, Δz_i are equal. For graded grids, $\Delta z_{i+1} > \Delta z_i$. $R_z = \Delta z_{i+1}/\Delta z_i$ is a ratio with a maximum value (defined in the table below). The z direction corresponds to the vertical direction, the x direction is horizontal and the y direction is horizontal into the page.

NOTE 1: The evaluation of the zoom scan is typically done by the post-processor by interpolation and extrapolation and without reconstruction of the field. More focused induced SAR distributions (e.g., for more localized sources such as capacitively coupled sources) require a more dense grid such that the same integration and extrapolation algorithms can be used for the same assessment uncertainty.

NOTE 2: The minimum ratio of 30 % is derived from the plane wave penetration depth at 6 GHz.

Detailed parameters can be seen in the following table:

Table 8 – Zoom scan parameters

Parameter	DUT transmit frequency being tested	
	$f \leq 3$ GHz	3 GHz < $f \leq 6$ GHz
Maximum distance between the closest measured points and the phantom surface (z_{M1} in Figure 14 and Table 2, in mm)	5	δ ln(2)/2 [a]
Maximum angle between the probe axis and the flat phantom surface normal (α in Figure 14)	5°	5°
Maximum spacing between measured points in the x- and y-directions (Δx and Δy, in mm)	8	$24/f$ [b,c]
For uniform grids: Maximum spacing between measured points in the direction normal to the phantom shell (Δz_1 in Figure 14, in mm)	5	$10/(f - 1)$
For graded grids: Maximum spacing between the two closest measured points in the direction normal to the phantom shell (Δz_1 in Figure 14, in mm)	4	$12/f$
For graded grids: Maximum incremental increase in the spacing between measured points in the direction normal to the phantom shell ($R_z = \Delta z_2/\Delta z_1$ in Figure 14)	1,5	1,5
Minimum edge length of the zoom scan volume in the x- and y-directions (L_z in 7.2.5.3, in mm)	30	22
Minimum edge length of the zoom scan volume in the direction normal to the phantom shell (L_h in 7.2.5.3, in mm)	30	22
Tolerance in the probe angle	1°	1°

[a] δ is the penetration depth for a plane-wave incident normally on a planar half-space.

[b] This is the maximum spacing allowed, which may not work for all circumstances.

[c] f is the frequency in GHz.

Table M.1 – Minimum probe requirements as a function of frequency and parameters of the tissue equivalent liquid

1	2	3	4	5	6	7	8
Frequency MHz	Relative permittivity	Conductivity S/m	Wavelength in the medium (λ) mm	Plane wave Skin Depth (δ) mm	Maximum Diameter mm	50 % Distance for M1 ($z_{50\%}$ = δ ln(2)/2) mm	Min. distance for M1 (z_{M1}) mm
300	45.3	0.87	146.6	40.1	8.0	16.0	5.0
450	43.5	0.87	101.1	42.9	8.0	14.9	5.0
750	41.5	0.89	61.8	30.6	8.0	13.8	5.0
835	41.5	0.9	55.8	38.9	8.0	13.5	5.0
900	41.5	0.97	51.7	36.1	8.0	12.5	5.0
1 450	40.5	1.20	32.5	28.6	8.0	9.9	5.0
1 800	40.0	1.40	26.4	24.3	8.0	8.4	5.0
2 000	40.0	1.40	23.7	24.2	8.0	8.4	5.0
2 450	39.2	1.80	19.8	18.7	6.5	6.5	5.0
2 600	39.0	1.96	18.5	17.2	6.2	5.9	5.0
3 000	38.5	2.40	16.1	13.9	5.4	4.8	5.0
4 000	37.4	3.43	12.3	9.6	4.1	3.3	3.3
5 000	36.2	4.45	10.0	7.3	3.3	2.5	2.5
5 200	36.0	4.66	9.6	7.0	3.2	2.4	2.4
5 400	35.8	4.86	9.3	6.7	3.1	2.3	2.3
5 600	35.5	5.07	9.0	6.4	3.0	2.2	2.2
5 800	35.3	5.27	8.7	6.1	2.9	2.1	2.1
6 000	35.1	5.48	8.4	5.9	2.8	2.0	2.0

Further probe parameters can be seen in Annex M of IEC 62209-2.

7.1.7 Spatial Peak SAR Evaluation

The cDASY6/DASY8 Module SAR software includes all numerical procedures necessary to evaluate the spatial peak SAR values. Based on the IEEE 1528 standard, a new algorithm has been implemented. The spatial-peak SAR can be computed over any required mass.
The base for the evaluation is a "cube" measurement in a volume of 30mm^3 below 3GHz or 22mm^3 above 3GHz. The measured volume must include the 1 g and 10 g 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. If the 10g cube or both cubes are not entirely inside the measured volumes, the system issues a warning regarding the evaluated spatial peak values within the post-processing engine. This means that if the measured volume is shifted, higher values might be possible. To get the correct values a finer measurement grid for the area scan is used. In complicated field distributions, a large grid spacing for the area scan might miss some details and give an incorrectly interpolated peak location. The cDASY6/DASY8 Module SAR allows to automatically extend the grid to make sure that both cubes are inside the measured volume.

The entire evaluation of the spatial peak values is performed within the application in case of cDASY6/DASY8 Module SAR software. The system always gives the maximum values for the 1 g and 10 g cubes. The cDASY6/DASY8 software allow to automatically extend the grid to make sure that both cubes are inside the measured volume. 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 1 g and 10 g The significant parts are outlined in more detail within the following sections.

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 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 choice of the coordinate system defining the location of the measurement points has no influence on the uncertainty of the interpolation, Maxima Search and extrapolation routines. 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.].

Thereby, the interpolation scheme combines a least-square fitted function method and a weighted average method which are the two basic types of computational interpolation and approximation. The cDASY6/DASY8 routines construct a once-continuously differentiable function that interpolates the measurement values as follows:

- For each measurement point a trivariate (3-D) / bivariate (2-D) quadratic is computed. It interpolates the measurement values at the data point and forms a least-square fit to neighbouring measurement values.
- the spatial location of the quadratic with respect to the measurement values is attenuated by an inverse distance weighting. This is performed since the calculated quadratic will fit measurement values at nearby points more accurate than at points located further away.
- After the quadratics are calculated at all measurement points, the interpolating function is calculated as a weighted average of the quadratics.

There are two control parameters that govern the behavior of the interpolation method.

One specifies the number of measurement points to be used in computing the least-square fits for the local quadratics. These measurement points are the ones nearest the input point for which the quadratic is being computed.

The second parameter specifies the number of measurement points that will be used in calculating the weights for the quadratics to produce the final function. The input data points used there are the ones nearest the point at which the interpolation is desired. Appropriate defaults are chosen for each of the control parameters.

The trivariate quadratics that have been previously computed for the 3-D interpolation and whose input data are at the closest distance from the phantom surface, are used in order to extrapolate the fields to the surface of the phantom.

In order to determine all the field maxima in 2-D (Area Scan) and 3-D (Zoom Scan), the measurement grid is refined by a default factor of 10 (area) and 5 (zoom), respectively, and the interpolation function is used to evaluate all field values between corresponding measurement points. Subsequently, a linear search is applied to find all the candidate maxima. In a last step, non physical maxima are removed and only those maxima which are within 2 dB of the global maximum value are retained.

Important: To be processable by the interpolation/extrapolation scheme, the Area Scan requires at least6 measurement points. The Zoom Scan requires at least 10 measurement points to allow the application of these algorithms.

In the Area Scan, the gradient of the interpolation function is evaluated to find all the extrema of the SAR distribution. The uncertainty on the locations of the extrema is less than 1/20 of the grid size. Only local maxima within 2 dB of the global maximum are searched and passed for the Zoom Scan measurement.

In the Zoom 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 5 mm.

Averaging and Determination of spatial Peak SAR

Within cDASY6/DASY8 Module SAR software, the measured grid is interpolated to a high resolution grid, where the resolution is around 1mm and chosen such that the cube volume is a multiple of the resolution. Points which are outside of the measured grid are masked out and set to zero. Then, the antiderivative of the interpolated grid is computed by using a Gaussian quadrature consecutively for all spatial dimensions.

The antiderivative is used to compute all cube averages of the volume with the same resolution as the interpolated grid. The maximum of these SAR averages is reported. If the cube containing the maximum averaged SAR touches the surface of the measured volume, an appropriate warning is issued within the Post-processing engine.

7.1.8 Data Storage and Evaluation

Data Storage

The DASY software stores the acquired data from the data acquisition electronics as raw data (in microvolt readings from the probe sensors), together with all necessary software parameters for the data evaluation (probe calibration data, liquid parameters and device frequency and modulation data) in measurement files with the extension ".DA4", ".DA5x". The software evaluates the desired unit and format for output each time the data is visualized or exported. This allows verification of the complete software setup even after the measurement and allows correction of incorrect parameter settings. For example, if a measurement has been performed with a wrong crest factor parameter in the device setup, the parameter can be corrected afterwards and the data can be re-evaluated.

The measured data can be visualized or exported in different units or formats, depending on the selected probe type ([V/m], [A/m], [°C], [W/kg], [mW/cm²], [dBrel], etc.). Some of these units are not available in certain situations or show meaningless results, e.g., a SAR output in a lossless media will always be zero. Raw data can also be exported to perform the evaluation with other software packages.

Data Evaluation by SEMCAD

The SEMCAD software automatically executes the following procedures to calculate the field units from the microvolt readings at the probe connector. The parameters used in the evaluation are stored in the configuration modules of the software:

Probe parameters:	- Sensitivity	$Norm_i$, a_{i0}, a_{i1}, a_{i2}
	- Conversion factor	$ConvF_i$
	- Diode compression point	Dcpi
Device parameters:	- Frequency	f
	- Crest factor	cf
Media parameters:	- Conductivity	σ
	- Density	ρ

These parameters must be set correctly in the software. They can be found in the component documents or they can be imported into the software from the configuration files issued for the DASY components. In the direct measuring mode of the multimeter option, the parameters of the actual system setup are used. In the scan visualization and export modes, the parameters stored in the corresponding document files are used.

The first step of the evaluation is a linearization of the filtered input signal to account for the compression characteristics of the detector diode. The compensation depends on the input signal, the diode type and the DC-transmission factor from the diode to the evaluation electronics.

If the exciting field is pulsed, the crest factor of the signal must be known to correctly compensate for peak power. The formula for each channel can be given as:

$$V_i = U_i + U_i^2 \cdot cf/dcp_i$$

with	V_i	= compensated signal of channel i	(i = x, y, z)
	U_i	= input signal of channel i	(i = x, y, z)
	cf	= crest factor of exciting field	(DASY parameter)
	dcp_i	= diode compression point	(DASY parameter)

From the compensated input signals the primary field data for each channel can be evaluated:

E-field probes: $$E_i = (V_i / Norm_i \cdot ConvF)^{1/2}$$

H-field probes: $$H_i = (V_i)^{1/2} \cdot (a_{i0} + a_{i1}f + a_{i2}f^2)/f$$

with	V_i	= compensated signal of channel i	(i = x, y, z)
	$Norm_i$	= sensor sensitivity of channel i [mV/(V/m)^2] for E-field Probes	(i = x, y, z)
	ConvF	= sensitivity enhancement in solution	
	a_{ij}	= sensor sensitivity factors for H-field probes	
	f	= carrier frequency [GHz]	
	E_i	= electric field strength of channel i in V/m	
	H_i	= magnetic field strength of channel i in A/m	

The RSS value of the field components gives the total field strength (Hermitian magnitude):

$$E_{tot} = (E_x^2 + E_Y^2 + E_z^2)^{1/2}$$

The primary field data are used to calculate the derived field units.

$$SAR = (E_{tot}^2 \cdot \sigma) / (\rho \cdot 1000)$$

with	SAR	= local specific absorption rate in W/kg
	E_{tot}	= total field strength in V/m
	σ	= conductivity in [mho/m] or [Siemens/m]
	ρ	= equivalent tissue density in g/cm^3

Note that the density is normally set to 1 (or 1.06), to account for actual brain density rather than the density of the simulation liquid. The power flow density is calculated assuming the excitation field to be a free space field.

$$P_{pwe} = E_{tot}^2 / 3770 \quad \text{or} \quad P_{pwe} = H_{tot}^2 \cdot 37.7$$

with	P_{pwe}	= equivalent power density of a plane wave in mW/cm^2
	E_{tot}	= total electric field strength in V/m
	H_{tot}	= total magnetic field strength in A/m

Data Evaluation in cDASY6/DASY8

cDASY6/DASY8 features basic evaluation capabilities comparable to the above described SEMCAD evaluation.

7.1.9 Tissue simulating liquids: dielectric properties

The following materials are used for producing the tissue-equivalent materials.

HBBL600-10000MHz Simulating Head Liquid, Manufactured by SPEAG:

Ingredients	(% by weight)
Water	50-65%
Mineral oil	10-30%
Emulsifiers	8-25%
Sodium salt	0-1.5%

Table 3: Head tissue dielectric properties

7.1.10 Tissue simulating liquids: parameters

Freq. (MHz)	Target head tissue		Measurement **head** tissue					Measurement date
	Permittivity	Conductivity [S/m]	Permittivity	Dev. %	Conductivity ε"	[S/m]	Dev. %	
713	42.13	0.89	43.1	2.3	21.60	0.86	-3.8	2025-02-13
725	42.07	0.89	43.1	2.3	21.33	0.86	-3.5	
738	42.00	0.89	43.0	2.4	21.05	0.86	-3.2	
750	41.94	0.89	43.0	2.5	20.78	0.87	-2.9	
835	41.50	0.90	42.6	2.6	19.17	0.89	-1.0	2025-02-12
842	41.50	0.91	42.6	2.6	19.06	0.89	-1.6	
847	41.50	0.91	42.6	2.6	18.98	0.89	-2.0	
852	41.50	0.92	42.6	2.5	18.90	0.90	-2.4	
835	41.50	0.90	42.8	3.2	19.27	0.89	-0.6	2025-02-13
842	41.50	0.91	42.8	3.2	19.15	0.90	-1.1	
847	41.50	0.91	42.8	3.2	19.07	0.90	-1.6	
852	41.50	0.92	42.8	3.2	19.00	0.90	-2.0	
1710	40.13	1.35	41.6	3.7	13.96	1.33	-1.5	2025-02-14
1720	40.11	1.35	41.6	3.7	13.95	1.33	-1.5	
1747	40.08	1.37	41.6	3.7	13.90	1.35	-1.4	
1750	40.07	1.37	41.6	3.7	13.89	1.35	-1.4	
1775	40.04	1.39	41.5	3.7	13.85	1.37	-1.3	
1785	40.02	1.39	41.5	3.7	13.83	1.37	-1.3	
1900	40.00	1.40	41.4	3.5	13.65	1.44	3.0	2025-02-14
1922	40.00	1.40	41.4	3.4	13.62	1.46	4.1	
1950	40.00	1.40	41.3	3.3	13.59	1.47	5.3	
1978	40.00	1.40	41.3	3.2	13.56	1.49	6.6	
1900	40.00	1.40	39.9	-0.3	13.41	1.42	1.3	2025-02-20
1922	40.00	1.40	39.9	-0.4	13.38	1.43	2.2	
1950	40.00	1.40	39.8	-0.4	13.35	1.45	3.4	
1978	40.00	1.40	39.8	-0.5	13.32	1.47	4.7	

Table 4: Parameter of the head tissue simulating liquid (HSL)

Note: The dielectric properties have been measured using the contact probe method at 22°C.

*) as the liquid parameters deviation is ≥ ± 5% an extrapolation according IEC / IEEE 62209-1528 chapter 7.8.2 approach 3 is necessary. The DASY software is capable to perform the necessary corrections directly from the tissue and measurement data. The uncertainties in this document have been adjusted accordingly.

For detailed information see chapter 8.2.6 SAR correction for deviations of complex permittivity from targetson page 46.

7.1.11 Measurement uncertainty evaluation for SAR test

DASY6/8 Uncertainty Budget According to IEC/IEEE 62209-1528 (Frequency band: 300 MHz - 3 GHz range)								
Symbol	Error Description	Uncertainty Value	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	Standard Uncertainty ± %, (1g)	± %, (10g)
Measurement System Errors								
CF	Probe Calibration Repeat.	± 12.0 %	Normal	2	1	1	± 6.0 %	± 6.0 %
CFdrift	Probe Calibration Drift	± 1.7 %	Rectangular	√3	1	1	± 1.0 %	± 1.0 %
LIN	Probe linearity	± 4.7 %	Rectangular	√3	1	1	± 2.7 %	± 2.7 %
BBS	Broadband Signal	± 3.0 %	Rectangular	√3	1	1	± 1.7 %	± 1.7 %
ISO	Probe Isotropy (axial)	± 7.6 %	Rectangular	√3	1	1	± 4.4 %	± 4.4 %
DAE	Data Acquisition	± 0.3 %	Normal	1	1	1	± 0.3 %	± 0.3 %
AMB	RF Ambient	± 1.8 %	Normal	1	1	1	± 1.8 %	± 1.8 %
Δ_{sys}	Probe Positioning	± 0.006 mm	Normal	1	0.14	0.14	± 0.1 %	± 0.1 %
DAT	Data Processing	± 1.2 %	Normal	1	1	1	± 1.2 %	± 1.2 %
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)[DAK]	± 2.5 %	Normal	1	0.78	0.71	± 2.0 %	± 1.8 %
LIQ(Tσ)	Conductivity (temp.)[BB]	± 3.3 %	Rectangular	√3	0.78	0.71	± 1.5 %	± 1.4 %
EPS	Phantom Permittivity	± 14.0 %	Rectangular	√3	0	0	± 0.0 %	± 0.0 %
DIS	Distance DUT - TSL	± 2.0 %	Normal	1	2	2	± 4.0 %	± 4.0 %
D_{xyz}	Device Positioning	± 1.0 %	Normal	1	1	1	± 1.0 %	± 1.0 %
H	Device Holder	± 3.6 %	Normal	1	1	1	± 3.6 %	± 3.6 %
MOD	DUT Modulation[m]	± 2.4 %	Rectangular	√3	1	1	± 1.4 %	± 1.4 %
TAS	Time-average SAR	± 1.7 %	Rectangular	√3	1	1	± 1.0 %	± 1.0 %
RF_{drift}	DUT drift	± 2.5 %	Normal	1	1	1	± 2.5 %	± 2.5 %
VAL	Val Antenna Unc.[val]	± 0.0 %	Normal	1	1	1	± 0.0 %	± 0.0 %
RF_{in}	Unc. Input Power[val]	± 0.0 %	Normal	1	1	1	± 0.0 %	± 0.0 %
Correction to the SAR results								
C(ε, σ)	Deviation to Target	± 1.9 %	Normal	1	1	0.84	± 1.9 %	± 1.6 %
C(R)	SAR scaling[p]	± 0.0 %	Rectangular	√3	1	1	± 0.0 %	± 0.0 %
u(ΔSAR)	**Combined Uncertainty**						± 11.0 %	± 10.9 %
U	**Expanded Uncertainty**						± **21.9** %	± **21.7** %

Table 5: Measurement uncertainties

Worst-Case uncertainty budget for DASY6/8 assessed according to IEC/IEEE 62209-1528 [4]. The budget is valid for the frequency range 300MHz - 3 GHz and represents a worst-case analysis. For specific tests and configurations, the uncertainty could be considerable smaller. All listed error components have υ_{eff} equal to ∞.

Footnote details:

[m] SMC calibration is a new method for determining the total deviation from linearity. The uncertainty is ≤ 2.4% for psSAR ≤ 2 W/kg, ≤ 4.8% for psSAR1g/10g ≤ 4 W/kg and ≤ 9.6% for psSAR1g/10g ≤ 10 W/kg (see modulation calibration parameter uncertainty in the probe calibration certificate);
[BB] if SPEAG's broad-band liquids (BBL) are used that have low temperature coefficients;
[DAK] if SPEAG's high precision dielectric probe kit (DAK) is applied;
[p] if power scaling is used, error item "SAR Scaling" must be adjusted accordingly;
[val] only applies in case of validation measurements.

7.1.12 Measurement uncertainty evaluation for System Check

Repeatability Budget for System Check (Frequency band: 300MHz - 6GHz range) with DASY6/8 System								
Symbol	Error Description	Uncertainty Value	Probability Distribution	Divisor	c_i (1g)	c_i (10g)	Standard Uncertainty ± %, (1g)	Standard Uncertainty ± %, (10g)
Measurement System Errors								
CF	Probe Calibration Repeat.	± 3.6 %	Normal	2	2	1	± 5.1 %	± 2.5 %
CFdrift	Probe Calibration Drift	± 1.7 %	Rectangular	√3	1	1	± 1.0 %	± 1.0 %
LIN	Probe linearity	± 4.7 %	Rectangular	√3	0	0	± 0.0 %	± 0.0 %
BBS	Broadband Signal	± 0.0 %	Rectangular	√3	0	0	± 0.0 %	± 0.0 %
ISO	Probe Isotropy (axial)	± 4.7 %	Rectangular	√3	0	0	± 0.0 %	± 0.0 %
DAE	Data Acquisition	± 0.3 %	Normal	1	0	0	± 0.0 %	± 0.0 %
AMB	RF Ambient	± 0.6 %	Normal	1	0	0	± 0.0 %	± 0.0 %
Δ_{sys}	Probe Positioning	± 0.2 %	Normal	1	0.33	0.33	± 0.1 %	± 0.1 %
DAT	Data Processing	± 0.0 %	Normal	1	1	1	± 0.0 %	± 0.0 %
Phantom and Device Errors								
LIQ(σ)	Conductivity (meas.)[DAK]	± 2.5 %	Normal	1	0.78	0.71	± 2.0 %	± 1.8 %
LIQ(Tσ)	Conductivity (temp.)[BB]	± 3.4 %	Rectangular	√3	0.78	0.71	± 1.5 %	± 1.4 %
EPS	Phantom Permittivity	± 14.0 %	Rectangular	√3	0	0	± 0.0 %	± 0.0 %
DIS	Distance Phantom - DUT	± 1.0 %	Normal	1	2	2	± 2.0 %	± 2.0 %
MOD	DUT Modulation[m]	± 0.0 %	Rectangular	√3	1	1	± 0.0 %	± 0.0 %
TAS	Time-average SAR	± 0.0 %	Rectangular	√3	1	1	± 0.0 %	± 0.0 %
VAL	Validation antenna	± 0.0 %	Normal	1	1	1	± 0.0 %	± 0.0 %
P_{in}	Accepted power	± 1.2 %	Normal	1	1	1	± 1.2 %	± 1.2 %
Correction to the SAR results								
C(ε, σ)	Deviation to Target	± 1.9 %	Normal	1	1	0.84	± 1.9 %	± 1.6 %
u(ΔSAR)	**Combined Uncertainty**						± 6.5 %	± 4.5 %
U	**Expanded Uncertainty**						± **13.0** %	± **9.1** %

Table 6: Repeatability of the system check (300MHz - 6 GHz).

All listed error components have v_{eff} equal to ∞.

Footnote details:

[BB] if SPEAG's broad-band liquids (BBL) are used that have low temperature coefficients;
[DAK] if SPEAG's high precision dielectric probe kit (DAK) is applied.

Note: Worst case probe calibration uncertainty has been applied for all probes used during the measurements.

7.1.13 System check

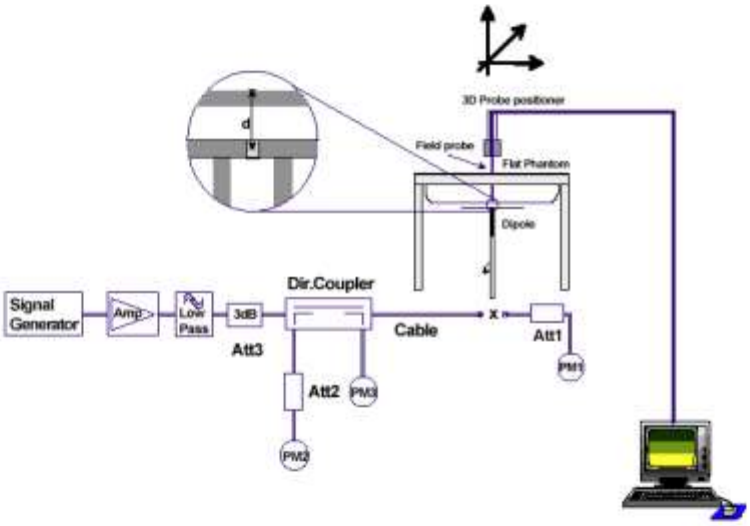
The system check is performed for verifying the accuracy of the complete measurement system and performance of the software. The following table shows system check results for all frequency bands and tissue liquids used during the tests (plot(s) see annex A).

System performence check (1000 mW)									
System validation Kit	Probe	Frequency	Target SAR_{1g}	Target SAR_{10g}	Measured SAR_{1g}	SAR_{1g}	Measured SAR_{10g}	SAR_{10g}	Measured date
		MHz	W/kg (+/- 10%)		W/kg	dev.	W/kg	dev.	
D750V3 S/N: 1041	EX3DV4 S/N: 7566	750	8.52	5.60	8.00	-6.1%	5.28	-5.7%	2025-02-13
D835V2 S/N: 4d153	EX3DV4 S/N: 7566	835	9.63	6.27	9.06	-5.9%	5.98	-4.6%	2025-02-12
D835V2 S/N: 4d153	EX3DV4 S/N: 7566	835	9.63	6.27	8.86	-8.0%	5.86	-6.5%	2025-02-13
D1750V2 S/N: 1093	EX3DV4 S/N: 7852	1750	36.10	19.30	33.20	-8.0%	18.08	-6.3%	2025-02-14
D1900V2 S/N: 5d009	EX3DV4 S/N: 7852	1900	39.10	20.60	41.00	4.9%	21.40	3.9%	2025-02-14
D1900V2 S/N: 5d009	EX3DV4 S/N: 7566	1900	39.10	20.60	38.80	-0.8%	20.40	-1.0%	2025-02-20

Table 7: Results system check

7.1.14 System check procedure

The system check is performed by using a validation dipole which is positioned parallel to the planar part of the SAM phantom at the reference point. The distance of the dipole to the SAM phantom is determined by a plexiglass spacer. The dipole is connected to the signal source consisting of signal generator and amplifier via a directional coupler, N-connector cable and adaption to SMA. It is fed with a power of 100 mW or 50 mW if used Powersource1. To adjust this power a power meter is used. The power sensor is connected to the cable before the system check to measure the power at this point and do adjustments at the signal generator. At the outputs of the directional coupler both return loss as well as forward power are controlled during the validation to make sure that emitted power at the dipole is kept constant. This can also be checked by the power drift measurement after the test (result on plot).
System check results have to be equal or near the values determined during dipole calibration (target SAR in table above) with the relevant liquids and test system.



7.1.15 System validation

The system validation is performed in a similar way as a system check. It needs to be performed once a SAR measurement system has been established and allows an evaluation of the system accuracy with all components used together with the specified system. It has to be repeated at least once a year or when new system components are used (DAE, probe, phantom, dipole, liquid type).
In addition to the procedure used during system check a system validation also includes checks of probe isotropy, probe modulation factor and RF signal.

8 Detailed Test Results

8.1 Conducted power measurements

For the measurements the Rohde & Schwarz Radio Communication Tester CMW500 was used.
The output power was measured using an integrated RF connector and attached RF cable.
The conducted output power was also checked before and after each SAR measurement. The resulting power values were within a 0.2 dB tolerance of the values shown below.

Note: CMW500 measures GSM peak and average output power for active timeslots.
For SAR the time based average power is relevant. The difference in-between depends on the duty cycle of the TDMA signal:

No. of timeslots	***1***
Duty Cycle	1 : 8
time based avg. power compared to slotted avg. power	- 9.03 dB

The signalling modes differ as follows:

mode	***coding scheme***	***modulation***
GPRS	CS1 to CS4	GMSK
EGPRS (EDGE)	MCS1 to MCS4	GMSK
EGPRS (EDGE)	MCS5 to MCS9	8PSK

Apart from modulation change (GMSK/8PSK) coding schemes differ in code rate without influence on the RF signal. Therefore one coding scheme per mode was selected for conducted power measurements.

8.1.1 Conducted power measurements GSM 850 MHz

Conducted output power GSM 850 MHz (dBm)							
SN: 91189525		**Slotted avg. power**			**Time based avg. power**		
TS	mod.	CH 128	CH 190	CH 251	CH 128	CH 190	CH 251
		824.2 MHz	836.6 MHz	848.8 MHz	824.2 MHz	836.6 MHz	848.8 MHz
1	GMSK	31.4	31.4	31.4	**22.4**	**22.4**	**22.4**
1	8PSK	26.5	26.5	26.4	17.5	17.5	17.4

Table 8: Test results conducted power measurement GSM 850 MHz

8.1.2 Conducted power measurements GSM 1900 MHz

Conducted output power GSM 1900 MHz (dBm)							
SN: 91189525		**Slotted avg. power**			**Time based avg. power**		
TS	mod.	CH 512	CH 661	CH 810	CH 512	CH 661	CH 810
		1850.2 MHz	1880.0 MHz	1909.8 MHz	1850.2 MHz	1880.0 MHz	1909.8 MHz
1	GMSK	26.6	26.3	26.9	**17.6**	**17.3**	**17.9**
1	8PSK	23.0	22.7	22.6	14.0	13.7	13.6

Table 9: Test results conducted power measurement GSM 1900 MHz

8.1.3 Conducted power measurements LTE FDD 2 CatM-1 1900 MHz

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	1850.7	18607	1.4	RB_1_low_NBposLow	QPSK	21.52
low	1850.7	18607	1.4	RB_1_low_NBposLow	16QAM	21.57
low	1850.7	18607	1.4	RB_6_NBposLow	QPSK	21.60
low	1850.7	18607	1.4	RB_6_NBposLow	QPSK	21.62
low	1850.7	18607	1.4	RB_1_low_NBposLow	16QAM	22.75
low	1850.7	18607	1.4	RB_1_low_NBposLow	QPSK	23.79
mid	1880	18900	1.4	RB_6_NBposMid	QPSK	21.31
mid	1880	18900	1.4	RB_1_mid_NBposMid	16QAM	22.58
mid	1880	18900	1.4	RB_1_mid_NBposMid	QPSK	23.71
high	1909.3	19193	1.4	RB_1_high_NBposHigh	QPSK	21.12
high	1909.3	19193	1.4	RB_6_NBposHigh	QPSK	21.41
high	1909.3	19193	1.4	RB_6_NBposHigh	QPSK	21.63
high	1909.3	19193	1.4	RB_1_high_NBposHigh	16QAM	22.18
high	1909.3	19193	1.4	RB_1_high_NBposHigh	QPSK	23.50
low	1851.5	18615	3	RB_6_NBposLow	QPSK	21.54
low	1851.5	18615	3	RB_1_low_NBposLow	16QAM	22.65
low	1851.5	18615	3	RB_1_low_NBposLow	QPSK	23.83
mid	1880	18900	3	RB_6_NBposMid	QPSK	21.29
mid	1880	18900	3	RB_1_mid_NBposMid	16QAM	22.56
mid	1880	18900	3	RB_1_mid_NBposMid	QPSK	23.56
high	1908.5	19185	3	RB_6_NBposHigh	QPSK	21.31
high	1908.5	19185	3	RB_6_NBposHigh	QPSK	21.40
high	1908.5	19185	3	RB_1_high_NBposHigh	16QAM	22.21
high	1908.5	19185	3	RB_1_high_NBposHigh	QPSK	23.12
high	1908.5	19185	3	RB_1_high_NBposHigh	QPSK	23.49
low	1852.5	18625	5	RB_6_NBposLow	QPSK	22.54
low	1852.5	18625	5	RB_1_low_NBposLow	16QAM	22.63
low	1852.5	18625	5	RB_1_low_NBposLow	QPSK	22.64
low	1852.5	18625	5	RB_6_NBposLow	QPSK	22.79
low	1852.5	18625	5	RB_1_low_NBposLow	16QAM	23.11
low	1852.5	18625	5	RB_1_low_NBposLow	QPSK	23.74
mid	1880	18900	5	RB_6_NBposMid	QPSK	22.40
mid	1880	18900	5	RB_1_mid_NBposMid	QPSK	23.56
mid	1880	18900	5	RB_1_mid_NBposMid	16QAM	23.66
high	1907.5	19175	5	RB_6_NBposHigh	QPSK	22.32
high	1907.5	19175	5	RB_6_NBposHigh	QPSK	22.36
high	1907.5	19175	5	RB_1_high_NBposHigh	16QAM	22.64
high	1907.5	19175	5	RB_1_high_NBposHigh	QPSK	23.43
high	1907.5	19175	5	RB_1_high_NBposHigh	QPSK	23.46
low	1855	18650	10	RB_6_NBposMid	QPSK	22.54
low	1855	18650	10	RB_6_NBposLow	QPSK	22.55
low	1855	18650	10	RB_6_NBposHigh	QPSK	22.62
low	1855	18650	10	RB_1_high_NBposHigh	QPSK	23.53
low	1855	18650	10	RB_1_low_NBposLow	QPSK	23.56
low	1855	18650	10	RB_1_mid_NBposMid	QPSK	23.56

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	1855	18650	10	RB_1_high_NBposHigh	16QAM	23.62
low	1855	18650	10	RB_1_low_NBposLow	16QAM	23.71
low	1855	18650	10	RB_1_mid_NBposMid	16QAM	23.74
mid	1880	18900	10	RB_6_NBposLow	QPSK	22.45
mid	1880	18900	10	RB_6_NBposMid	QPSK	22.50
mid	1880	18900	10	RB_6_NBposHigh	QPSK	22.55
mid	1880	18900	10	RB_1_high_NBposHigh	QPSK	23.37
mid	1880	18900	10	RB_1_mid_NBposMid	QPSK	23.41
mid	1880	18900	10	RB_1_mid_NBposMid	16QAM	23.49
mid	1880	18900	10	RB_1_low_NBposLow	QPSK	23.52
mid	1880	18900	10	RB_1_high_NBposHigh	16QAM	23.58
mid	1880	18900	10	RB_1_low_NBposLow	16QAM	23.60
high	1905	19150	10	RB_6_NBposMid	QPSK	22.43
high	1905	19150	10	RB_6_NBposHigh	QPSK	22.45
high	1905	19150	10	RB_1_low_NBposLow	QPSK	22.46
high	1905	19150	10	RB_6_NBposLow	QPSK	22.48
high	1905	19150	10	RB_1_high_NBposHigh	QPSK	23.26
high	1905	19150	10	RB_1_mid_NBposMid	QPSK	23.34
high	1905	19150	10	RB_1_high_NBposHigh	16QAM	23.35
high	1905	19150	10	RB_1_mid_NBposMid	16QAM	23.40
high	1905	19150	10	RB_1_low_NBposLow	16QAM	23.64
low	1857.5	18675	15	RB_1_low_NBposLow	16QAM	23.01
low	1857.5	18675	15	RB_6_NBposLow	QPSK	23.62
low	1857.5	18675	15	RB_1_low_NBposLow	QPSK	23.80
mid	1880	18900	15	RB_6_NBposMid	QPSK	23.33
mid	1880	18900	15	RB_1_mid_NBposMid	QPSK	23.47
mid	1880	18900	15	RB_1_mid_NBposMid	16QAM	23.67
high	1902.5	19125	15	RB_1_high_NBposHigh	16QAM	22.65
high	1902.5	19125	15	RB_6_NBposHigh	QPSK	23.25
high	1902.5	19125	15	RB_6_NBposHigh	QPSK	23.26
high	1902.5	19125	15	RB_1_high_NBposHigh	QPSK	23.33
high	1902.5	19125	15	RB_1_high_NBposHigh	QPSK	23.50
low	1860	18700	20	RB_1_low_NBposLow	16QAM	23.02
low	1860	18700	20	RB_6_NBposLow	QPSK	23.58
low	1860	18700	20	RB_1_low_NBposLow	QPSK	23.77
mid	1880	18900	20	RB_1_mid_NBposMid	16QAM	23.53
mid	1880	18900	20	RB_6_NBposMid	QPSK	23.53
mid	1880	18900	20	RB_1_mid_NBposMid	QPSK	23.54
high	1900	196	20	RB_1_high_NBposHigh	16QAM	22.63
high	1900	196	20	RB_6_NBposHigh	QPSK	23.18
high	1900	196	20	RB_1_high_NBposHigh	QPSK	23.42

Table 10: Test results conducted power measurement LTE FDD 2 CatM-1 1900 MHz.

8.1.4 Conducted power measurements LTE FDD 4 CatM-1 1700 MHz

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	1710.7	19957	1.4	RB_6_NBposLow	QPSK	21.14
low	1710.7	19957	1.4	RB_1_low_NBposLow	16QAM	21.76
low	1710.7	19957	1.4	RB_1_low_NBposLow	QPSK	23.51
mid	1732.5	20175	1.4	RB_6_NBposMid	QPSK	21.01
mid	1732.5	20175	1.4	RB_1_mid_NBposMid	16QAM	22.25
mid	1732.5	20175	1.4	RB_1_mid_NBposMid	QPSK	23.17
high	1754.3	20393	1.4	RB_6_NBposHigh	QPSK	21.25
high	1754.3	20393	1.4	RB_1_high_NBposHigh	16QAM	22.04
high	1754.3	20393	1.4	RB_1_high_NBposHigh	QPSK	23.38
low	1711.5	19965	3	RB_6_NBposLow	QPSK	21.13
low	1711.5	19965	3	RB_1_low_NBposLow	16QAM	22.41
low	1711.5	19965	3	RB_1_low_NBposLow	QPSK	23.57
mid	1732.5	20175	3	RB_6_NBposMid	QPSK	20.98
mid	1732.5	20175	3	RB_1_mid_NBposMid	16QAM	22.23
mid	1732.5	20175	3	RB_1_mid_NBposMid	QPSK	23.23
high	1753.5	20385	3	RB_6_NBposHigh	QPSK	21.24
high	1753.5	20385	3	RB_1_high_NBposHigh	16QAM	22.22
high	1753.5	20385	3	RB_1_high_NBposHigh	QPSK	23.47
low	1712.5	19975	5	RB_6_NBposLow	QPSK	22.29
low	1712.5	19975	5	RB_1_low_NBposLow	16QAM	22.72
low	1712.5	19975	5	RB_1_low_NBposLow	QPSK	23.41
mid	1732.5	20175	5	RB_6_NBposMid	QPSK	22.15
mid	1732.5	20175	5	RB_1_mid_NBposMid	QPSK	22.98
mid	1732.5	20175	5	RB_1_mid_NBposMid	16QAM	23.24
high	1752.5	20375	5	RB_6_NBposHigh	QPSK	22.23
high	1752.5	20375	5	RB_1_high_NBposHigh	16QAM	22.37
high	1752.5	20375	5	RB_1_high_NBposHigh	QPSK	23.20
low	1715	20000	10	RB_6_NBposHigh	QPSK	22.24
low	1715	20000	10	RB_6_NBposMid	QPSK	22.36
low	1715	20000	10	RB_6_NBposLow	QPSK	22.45
low	1715	20000	10	RB_1_high_NBposHigh	QPSK	23.18
low	1715	20000	10	RB_1_high_NBposHigh	16QAM	23.25
low	1715	20000	10	RB_1_mid_NBposMid	QPSK	23.33
low	1715	20000	10	RB_1_mid_NBposMid	16QAM	23.40
low	1715	20000	10	RB_1_low_NBposLow	QPSK	23.42
low	1715	20000	10	RB_1_low_NBposLow	16QAM	23.45
mid	1732.5	20175	10	RB_6_NBposMid	QPSK	22.07
mid	1732.5	20175	10	RB_6_NBposLow	QPSK	22.09
mid	1732.5	20175	10	RB_6_NBposHigh	QPSK	22.21
mid	1732.5	20175	10	RB_1_mid_NBposMid	16QAM	23.07
mid	1732.5	20175	10	RB_1_low_NBposLow	QPSK	23.08
mid	1732.5	20175	10	RB_1_mid_NBposMid	QPSK	23.08
mid	1732.5	20175	10	RB_1_low_NBposLow	16QAM	23.12
mid	1732.5	20175	10	RB_1_high_NBposHigh	QPSK	23.13
mid	1732.5	20175	10	RB_1_high_NBposHigh	16QAM	23.26

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
high	1750	20350	10	RB_6_NBposHigh	QPSK	22.41
high	1750	20350	10	RB_6_NBposLow	QPSK	22.47
high	1750	20350	10	RB_6_NBposMid	QPSK	22.48
high	1750	20350	10	RB_1_high_NBposHigh	QPSK	23.23
high	1750	20350	10	RB_1_mid_NBposMid	QPSK	23.41
high	1750	20350	10	RB_1_high_NBposHigh	16QAM	23.44
high	1750	20350	10	RB_1_low_NBposLow	QPSK	23.45
high	1750	20350	10	RB_1_mid_NBposMid	16QAM	23.50
high	1750	20350	10	RB_1_low_NBposLow	16QAM	23.54
low	1717.5	20025	15	RB_1_low_NBposLow	16QAM	22.85
low	1717.5	20025	15	RB_1_low_NBposLow	QPSK	23.37
low	1717.5	20025	15	RB_6_NBposLow	QPSK	23.41
mid	1732.5	20175	15	RB_1_mid_NBposMid	QPSK	22.97
mid	1732.5	20175	15	RB_6_NBposMid	QPSK	23.06
mid	1732.5	20175	15	RB_1_mid_NBposMid	16QAM	23.22
high	1747.5	20325	15	RB_1_high_NBposHigh	16QAM	22.53
high	1747.5	20325	15	RB_1_high_NBposHigh	QPSK	23.28
high	1747.5	20325	15	RB_6_NBposHigh	QPSK	23.45
low	1720	20050	20	RB_1_low_NBposLow	16QAM	22.80
low	1720	20050	20	RB_6_NBposLow	QPSK	23.36
low	1720	20050	20	RB_1_low_NBposLow	QPSK	**23.44**
mid	1732.5	20175	20	RB_1_mid_NBposMid	QPSK	22.94
mid	1732.5	20175	20	RB_6_NBposMid	QPSK	23.05
mid	1732.5	20175	20	RB_1_mid_NBposMid	16QAM	**23.19**
high	1745	20300	20	RB_1_high_NBposHigh	16QAM	23.05
high	1745	20300	20	RB_1_high_NBposHigh	QPSK	**23.22**
high	1745	20300	20	RB_6_NBposHigh	QPSK	23.37

Table 11: Test results conducted power measurement LTE FDD 4 1700 MHz.

8.1.5 Conducted power measurements LTE FDD 5 CatM-1 850 MHz

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	824.7	20407	1.4	RB_1_low_NBposLow	16QAM	22.16
low	824.7	20407	1.4	RB_1_low_NBposLow	QPSK	23.47
low	824.7	20407	1.4	RB_6_NBposLow	QPSK	21.50
mid	836.5	20525	1.4	RB_1_mid_NBposMid	16QAM	22.43
mid	836.5	20525	1.4	RB_1_mid_NBposMid	QPSK	23.31
mid	836.5	20525	1.4	RB_6_NBposMid	QPSK	21.55
high	848.3	20643	1.4	RB_1_high_NBposHigh	16QAM	22.00
high	848.3	20643	1.4	RB_1_high_NBposHigh	QPSK	23.39
high	848.3	20643	1.4	RB_6_NBposHigh	QPSK	21.53
low	825.5	20415	3	RB_1_low_NBposLow	16QAM	22.25
low	825.5	20415	3	RB_1_low_NBposLow	QPSK	23.53
low	825.5	20415	3	RB_6_NBposLow	QPSK	21.70
mid	836.5	20525	3	RB_1_mid_NBposMid	16QAM	22.46
mid	836.5	20525	3	RB_1_mid_NBposMid	QPSK	23.40
mid	836.5	20525	3	RB_6_NBposMid	QPSK	21.51
high	847.5	20635	3	RB_1_high_NBposHigh	16QAM	22.91
high	847.5	20635	3	RB_1_high_NBposHigh	QPSK	23.27
high	847.5	20635	3	RB_6_NBposHigh	QPSK	21.47
low	826.5	20425	5	RB_1_low_NBposLow	QPSK	23.36
low	826.5	20425	5	RB_1_low_NBposLow	16QAM	23.51
mid	836.5	20525	5	RB_6_NBposMid	QPSK	22.54
mid	836.5	20525	5	RB_1_mid_NBposMid	16QAM	23.16
mid	836.5	20525	5	RB_1_mid_NBposMid	QPSK	23.25
low	826.5	20425	5	RB_6_NBposLow	QPSK	22.49
high	846.5	20625	5	RB_1_high_NBposHigh	16QAM	22.87
high	846.5	20625	5	RB_1_high_NBposHigh	QPSK	23.21
high	846.5	20625	5	RB_6_NBposHigh	QPSK	22.51
low	829	20450	10	RB_1_high_NBposHigh	QPSK	23.53
low	829	20450	10	RB_1_low_NBposLow	QPSK	23.55
low	829	20450	10	RB_1_mid_NBposMid	QPSK	23.65
low	829	20450	10	RB_1_high_NBposHigh	16QAM	23.66
low	829	20450	10	RB_1_mid_NBposMid	16QAM	23.72
low	829	20450	10	RB_1_low_NBposLow	16QAM	23.75
low	829	20450	10	RB_6_NBposLow	QPSK	22.71
low	829	20450	10	RB_6_NBposMid	QPSK	22.64
low	829	20450	10	RB_6_NBposHigh	QPSK	22.73
mid	836.5	20525	10	RB_1_high_NBposHigh	QPSK	23.61
mid	836.5	20525	10	RB_1_mid_NBposMid	QPSK	23.63
mid	836.5	20525	10	RB_1_low_NBposLow	QPSK	23.68
mid	836.5	20525	10	RB_1_high_NBposHigh	16QAM	23.71
mid	836.5	20525	10	RB_1_mid_NBposMid	16QAM	23.76
mid	836.5	20525	10	RB_1_low_NBposLow	16QAM	23.79
mid	836.5	20525	10	RB_6_NBposLow	QPSK	22.71
mid	836.5	20525	10	RB_6_NBposMid	QPSK	22.66
mid	836.5	20525	10	RB_6_NBposHigh	QPSK	22.70

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
high	844	20600	10	RB_1_low_NBposLow	QPSK	22.64
high	844	20600	10	RB_1_high_NBposHigh	QPSK	23.49
high	844	20600	10	RB_1_mid_NBposMid	QPSK	23.58
high	844	20600	10	RB_1_mid_NBposMid	16QAM	23.69
high	844	20600	10	RB_1_high_NBposHigh	16QAM	23.72
high	844	20600	10	RB_1_low_NBposLow	16QAM	23.87
high	844	20600	10	RB_6_NBposLow	QPSK	22.69
high	844	20600	10	RB_6_NBposMid	QPSK	22.73
high	844	20600	10	RB_6_NBposHigh	QPSK	22.62

Table 12: Test results conducted power measurement LTE FDD 5 CatM-1 850 MHz.

8.1.6 Conducted power measurements LTE FDD 12 CatM-1 700 MHz

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	699.7	23017	1.4	RB_1_low_NBposLow	16QAM	22.13
low	699.7	23017	1.4	RB_1_low_NBposLow	QPSK	23.41
low	699.7	23017	1.4	RB_6_NBposLow	QPSK	21.32
mid	707.5	23095	1.4	RB_1_mid_NBposMid	16QAM	22.61
mid	707.5	23095	1.4	RB_1_mid_NBposMid	QPSK	23.58
mid	707.5	23095	1.4	RB_6_NBposMid	QPSK	21.53
high	715.3	23173	1.4	RB_1_high_NBposHigh	16QAM	22.25
high	715.3	23173	1.4	RB_1_high_NBposHigh	QPSK	23.60
high	715.3	23173	1.4	RB_6_NBposHigh	QPSK	21.59
low	700.5	23025	3	RB_1_low_NBposLow	16QAM	22.16
low	700.5	23025	3	RB_1_low_NBposLow	QPSK	23.32
low	700.5	23025	3	RB_6_NBposLow	QPSK	21.48
mid	707.5	23095	3	RB_1_mid_NBposMid	16QAM	22.64
mid	707.5	23095	3	RB_1_mid_NBposMid	QPSK	23.46
mid	707.5	23095	3	RB_6_NBposMid	QPSK	21.48
high	714.5	23165	3	RB_1_high_NBposHigh	16QAM	22.20
high	714.5	23165	3	RB_1_high_NBposHigh	QPSK	23.61
high	714.5	23165	3	RB_6_NBposHigh	QPSK	21.63
low	701.5	23035	5	RB_1_low_NBposLow	16QAM	22.92
low	701.5	23035	5	RB_1_low_NBposLow	QPSK	23.41
low	701.5	23035	5	RB_6_NBposLow	QPSK	22.32
mid	707.5	23095	5	RB_1_mid_NBposMid	QPSK	23.41
mid	707.5	23095	5	RB_1_mid_NBposMid	16QAM	23.53
mid	707.5	23095	5	RB_6_NBposMid	QPSK	22.47
high	713.5	23155	5	RB_1_high_NBposHigh	16QAM	23.08
high	713.5	23155	5	RB_1_high_NBposHigh	QPSK	23.52
high	713.5	23155	5	RB_6_NBposHigh	QPSK	22.58
low	704	23060	10	RB_1_high_NBposHigh	QPSK	23.69
low	704	23060	10	RB_1_high_NBposHigh	16QAM	**23.78**
low	704	23060	10	RB_1_low_NBposLow	QPSK	23.25
low	704	23060	10	RB_1_low_NBposLow	16QAM	23.56
low	704	23060	10	RB_1_mid_NBposMid	QPSK	23.46
low	704	23060	10	RB_1_mid_NBposMid	16QAM	23.58
low	704	23060	10	RB_6_NBposHigh	QPSK	22.75
low	704	23060	10	RB_6_NBposLow	QPSK	22.38
low	704	23060	10	RB_6_NBposMid	QPSK	22.49
mid	707.5	23095	10	RB_1_high_NBposHigh	QPSK	23.76
mid	707.5	23095	10	RB_1_high_NBposHigh	16QAM	23.77
mid	707.5	23095	10	RB_1_low_NBposLow	QPSK	23.59
mid	707.5	23095	10	RB_1_low_NBposLow	16QAM	23.67
mid	707.5	23095	10	RB_1_mid_NBposMid	QPSK	23.72
mid	707.5	23095	10	RB_1_mid_NBposMid	16QAM	**23.81**
mid	707.5	23095	10	RB_6_NBposHigh	QPSK	22.76
mid	707.5	23095	10	RB_6_NBposLow	QPSK	22.62
mid	707.5	23095	10	RB_6_NBposMid	QPSK	22.66

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
high	711	23130	10	RB_1_high_NBposHigh	QPSK	23.61
high	711	23130	10	RB_1_high_NBposHigh	16QAM	23.75
high	711	23130	10	RB_1_low_NBposLow	QPSK	23.63
high	711	23130	10	RB_1_low_NBposLow	16QAM	**23.93**
high	711	23130	10	RB_1_mid_NBposMid	QPSK	23.73
high	711	23130	10	RB_1_mid_NBposMid	16QAM	23.74
high	711	23130	10	RB_6_NBposHigh	QPSK	22.69
high	711	23130	10	RB_6_NBposLow	QPSK	22.80
high	711	23130	10	RB_6_NBposMid	QPSK	22.70

Table 13: Test results conducted power measurement LTE FDD12 CatM-1 700 MHz.

8.1.7 Conducted power measurements LTE FDD 26 CatM-1 850 MHz

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
low	814.7	26697	1.4	RB_6_NBposLow	QPSK	21.27
low	814.7	26697	1.4	RB_1_low_NBposLow	16QAM	22.03
low	814.7	26697	1.4	RB_1_low_NBposLow	QPSK	23.45
mid	831.5	26865	1.4	RB_6_NBposMid	QPSK	21.22
mid	831.5	26865	1.4	RB_1_mid_NBposMid	16QAM	22.37
mid	831.5	26865	1.4	RB_1_mid_NBposMid	QPSK	23.23
high	848.3	27033	1.4	RB_6_NBposHigh	QPSK	21.31
high	848.3	27033	1.4	RB_1_high_NBposHigh	16QAM	22.02
high	848.3	27033	1.4	RB_1_high_NBposHigh	QPSK	23.38
low	815.5	26705	3	RB_6_NBposLow	QPSK	21.27
low	815.5	26705	3	RB_1_low_NBposLow	16QAM	22.06
low	815.5	26705	3	RB_1_low_NBposLow	QPSK	23.46
mid	831.5	26865	3	RB_6_NBposMid	QPSK	21.14
mid	831.5	26865	3	RB_1_mid_NBposMid	16QAM	22.31
mid	831.5	26865	3	RB_1_mid_NBposMid	QPSK	23.16
high	847.5	27025	3	RB_6_NBposHigh	QPSK	21.28
high	847.5	27025	3	RB_1_high_NBposHigh	16QAM	21.98
high	847.5	27025	3	RB_1_high_NBposHigh	QPSK	23.35
low	816.5	26715	5	RB_6_NBposLow	QPSK	22.36
low	816.5	26715	5	RB_1_low_NBposLow	16QAM	23.13
low	816.5	26715	5	RB_1_low_NBposLow	QPSK	23.22
mid	831.5	26865	5	RB_6_NBposMid	QPSK	22.34
mid	831.5	26865	5	RB_1_mid_NBposMid	QPSK	23.13
mid	831.5	26865	5	RB_1_mid_NBposMid	16QAM	23.16
high	846.5	27015	5	RB_6_NBposHigh	QPSK	22.41
high	846.5	27015	5	RB_1_high_NBposHigh	16QAM	22.91
high	846.5	27015	5	RB_1_high_NBposHigh	QPSK	23.17
low	819	26740	10	RB_6_NBposLow	QPSK	22.23
low	819	26740	10	RB_6_NBposMid	QPSK	22.34
low	819	26740	10	RB_6_NBposHigh	QPSK	22.37
low	819	26740	10	RB_1_low_NBposLow	QPSK	23.23
low	819	26740	10	RB_1_mid_NBposMid	QPSK	23.36
low	819	26740	10	RB_1_low_NBposLow	16QAM	23.45
low	819	26740	10	RB_1_high_NBposHigh	QPSK	23.45
low	819	26740	10	RB_1_mid_NBposMid	16QAM	23.52
low	819	26740	10	RB_1_high_NBposHigh	16QAM	**23.54**
mid	831.5	26865	10	RB_6_NBposMid	QPSK	22.41
mid	831.5	26865	10	RB_6_NBposLow	QPSK	22.48
mid	831.5	26865	10	RB_6_NBposHigh	QPSK	22.61
mid	831.5	26865	10	RB_1_mid_NBposMid	QPSK	23.48
mid	831.5	26865	10	RB_1_low_NBposLow	QPSK	23.49
mid	831.5	26865	10	RB_1_low_NBposLow	16QAM	23.58
mid	831.5	26865	10	RB_1_high_NBposHigh	QPSK	23.62
mid	831.5	26865	10	RB_1_high_NBposHigh	16QAM	23.63
mid	831.5	26865	10	RB_1_mid_NBposMid	16QAM	**23.64**

Channel	Frequency [MHz]	Channel	Bandwidth [MHz]	Resource block allocation	Modulatio	P_{avg} [dBm]
high	844	26990	10	RB_6_NBposMid	QPSK	22.60
high	844	26990	10	RB_6_NBposHigh	QPSK	22.60
high	844	26990	10	RB_6_NBposLow	QPSK	22.63
high	844	26990	10	RB_1_high_NBposHigh	QPSK	23.43
high	844	26990	10	RB_1_mid_NBposMid	QPSK	23.47
high	844	26990	10	RB_1_high_NBposHigh	16QAM	23.55
high	844	26990	10	RB_1_low_NBposLow	QPSK	23.62
high	844	26990	10	RB_1_mid_NBposMid	16QAM	23.75
high	844	26990	10	RB_1_low_NBposLow	16QAM	**23.80**
low	821.5	26765	15	RB_1_low_NBposLow	16QAM	23.16
low	821.5	26765	15	RB_1_low_NBposLow	QPSK	23.21
low	821.5	26765	15	RB_6_NBposLow	QPSK	23.44
mid	831.5	26865	15	RB_1_mid_NBposMid	16QAM	22.92
mid	831.5	26865	15	RB_1_mid_NBposMid	QPSK	23.04
mid	831.5	26865	15	RB_6_NBposMid	QPSK	23.36
high	841.5	26965	15	RB_1_high_NBposHigh	16QAM	23.14
high	841.5	26965	15	RB_1_high_NBposHigh	QPSK	23.18
high	841.5	26965	15	RB_6_NBposHigh	QPSK	23.57

Table 14: Test results conducted power measurement LTE FDD 26 CatM-1 850 MHz.

8.1.8 Standalone SAR Test Exclusion according to FCC KDB 447498 D04

Technology	Frequency [MHz]		Ref.	Note	Output Power [dBm]				Output Power [mW]		Share of Limit
	f_{Min}	f_{Max}	#	#	$P_{Cond.}$	P_{EIRP}	P_{ERP}	$P_{RF\ Exp}$	P_{Result}	P_{Limit}	%
ULP-AMI-P	402	405			-16.0	-16.0	-18.2	**-16.0**	**0.03**	**26**	**0.1%**

Table 15: Standalone SAR test exclusion considerations in **head position**

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time- averaged power or maximum time-averaged ERP, whichever is greater.
If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of λ/4.
As for devices with antennas of length greater than λ/4 where the gain is not well defined, but always less than that of a half-wave dipole (length λ/2), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.
The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.
The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).
This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (2).

$$P_{th}(mW) = \begin{cases} ERP_{20cm}\left(\frac{d}{20\ cm}\right)^{x} & , d \leq 20\ cm \\ ERP_{20cm} & , 20\ cm \leq d \leq 40\ cm \end{cases} \quad (2)$$

where

$$x = -\log_{10}\left(\frac{60}{ERP_{20cm}\sqrt{f}}\right) \quad (3)$$

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} is per Formula (1).

8.1.9 Standalone SAR Test Exclusion according to RSS-102 Issue 6

Table 11: Power limits for exemption from routine SAR evaluation based on the separation distance

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

The exemption limits in Table 11 of RSS 102 are based on measurements and simulations of half-wave dipole antennas at separation distances of 5 mm to 50 mm from a flat phantom, which provides a SAR value of approximately 0.4 W/kg for 1 g of tissue.

For limb-worn devices where the 10 gram of tissue applies, the exemption limits for routine evaluation in table 11of RSS 102 are multiplied by a factor of 2.5.

For controlled-use devices where the 8 W/kg for 1 gram of tissue applies, the exemption limits for routine evaluation in table 11 of RSS 102 are multiplied by a factor of 5.

When the operating frequency of the device is between two frequencies located in table 11 of RSS102, linear interpolation shall be applied for the applicable separation distance. If the separation distance of the device is between two distances located in table 11 of RSS 102, linear interpolation may be applied for the applicable frequency. Alternatively, the limit corresponding to the smaller distance may be employed. For example, in case of a 7 mm separation distance, either use the exception value for a 5 mm separation distance or interpolate between the limits corresponding to 5 mm and 10 mm separation distances.

For implanted medical devices, the exemption limit for routine SAR evaluation is set at an output power of 1 mW, regardless of frequency.

The SAR levels from exempted transmitters shall be included in the compliance assessment and the determination of the TER.

Technology	Note	Frequency min [MHz]	Output Power [dBm]	Output Power [mW]	Limit [mW]	Share of Limit [%]
ULP-AMI-P	A	402	-16.0	0.03	36.2	0.1

Table 16: Standalone SAR test exclusion considerations

P_{avg}* - maximum possible output power declared by manufacturer. Output power level shall be the higher of the maximum conducted or equivalent isotropically radiated power (e.i.r.p.) source-based, time-averaged output power. For controlled use devices where the 8 W/kg for 1g of tissue applies, the exemption limits for routine evaluation in Table are multiplied by a factor of 5. For limb-worn devices where the 10g value applies, the exemption limits for routine evaluation in Table 1 are multiplied by a factor of 2.5. If the operating frequency of the device is between two frequencies located in Table, linear interpolation shall be applied for the applicable separation distance. For test separation distance less than 5 mm, the exemption limits for a separation distance of 5 mm can be applied to determine if a routine evaluation is required.

8.2 SAR test results

8.2.1 General description of test procedures

- The DUT is tested using CMW 500 communications tester as controller unit to set test channels and maximum output power to the DUT, as well as for measuring the conducted peak power.
- Test positions as described in the tables below are in accordance with the specified test standard.
- According to IEC/IEEE 62209-1528 the SAR test shall be performed at the channel producing the highest rated output power.
  - When the width of the transmit frequency band ($\Delta f = f_{high} - f_{low}$) exceeds 1 % of its centre frequency fc, the channels at the lowest and highest frequencies of the transmit band shall also be tested.
  - When the width of the transmit frequency band exceeds 10 % of its centre frequency. The following formula shall be used to determine the number of channels, N_c, to be tested:

$$\mathrm{Nc} = 2 \times roundup\,[\frac{10 * (fhigh - flow)}{fc}] + 1$$

where
f_c is the centre frequency channel of the transmission band in Hz;
f_{high} is the highest frequency channel of the transmission band in Hz;
f_{low} is the lowest frequency channel of the transmission band in Hz;
N_c is the number of channels

- According to KDB 447498 D01 testing of other required channels within the operating mode of a frequency band is not required when the reported 1-g or 10-g SAR for the mid-band or highest output power channel is:
  - ≤ 0.8 W/kg or 2.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≤ 100 MHz
  - ≤ 0.6 W/kg or 1.5 W/kg, for 1-g or 10-g respectively, when the transmission band is between 100 MHz and 200 MHz
  - ≤ 0.4 W/kg or 1.0 W/kg, for 1-g or 10-g respectively, when the transmission band is ≥ 200 MHz

8.2.2 Results overview

Ch.	Freq. (MHz)	test cond.	position	cond. P_{max} (dBm)		SAR_{1g} (W/kg)		SAR_{10g} (W/kg)		liquid (°C)
				declared*	meas.	meas.	extrap.	meas.	extrap.	
measured / extrapolated SAR numbers - Body worn - GSM 850 MHz - 0 mm distance										
190	836.6	1 time slot	front	32.0	31.4	1.170	1.343	0.716	0.822	21.9
190	836.6	1 time slot	back	32.0	31.4	1.100	1.263	0.703	0.807	21.9
190	836.6	1 time slot	left	32.0	31.4	0.676	0.776	0.447	0.513	21.9
190	836.6	1 time slot	right	32.0	31.4	1.040	1.194	0.679	0.780	21.9
190	836.6	1 time slot	top	32.0	31.4	0.204	0.234	0.127	0.146	21.9
190	836.6	1 time slot	bottom	32.0	31.4	0.095	0.109	0.061	0.070	21.9
128	824.2	1 time slot	front	32.0	31.4	1.200	1.378	0.737	0.846	21.9
251	848.8	1 time slot	front	32.0	31.4	1.330	1.527	0.806	0.925	21.9
251	848.8	1 time slot	front**	32.0	31.4	**1.350**	**1.550**	0.809	0.929	21.9
251	848.8	1 time slot	front**	32.0	31.4	1.340	1.539	**0.814**	**0.935**	21.9
128	824.2	1 time slot	back	32.0	31.4	1.010	1.160	0.662	0.760	21.9
251	848.8	1 time slot	back	32.0	31.4	1.040	1.194	0.674	0.774	21.9
128	824.2	1 time slot	right	32.0	31.4	1.020	1.171	0.670	0.769	21.9
251	848.8	1 time slot	right	32.0	31.4	1.010	1.160	0.659	0.757	21.9
measured / extrapolated SAR numbers - Body worn - GSM 1900 MHz - 0 mm distance										
810	1909.8	1 time slot	front	27.0	26.9	1.010	1.034	0.525	0.537	20.2
810	1909.8	1 time slot	back	27.0	26.9	0.982	1.005	0.567	0.580	20.2
810	1909.8	1 time slot	left	27.0	26.9	0.235	0.240	0.124	0.127	20.2
810	1909.8	1 time slot	right	27.0	26.9	0.664	0.679	0.309	0.316	20.2
810	1909.8	1 time slot	top	27.0	26.9	0.112	0.115	0.064	0.065	20.2
810	1909.8	1 time slot	bottom	27.0	26.9	0.278	0.284	0.145	0.148	20.2
512	1850.2	1 time slot	front	27.0	26.6	1.000	1.096	0.530	0.581	20.2
661	1880.0	1 time slot	front	27.0	26.3	0.817	0.960	0.437	0.513	20.2
512	1850.2	1 time slot	back	27.0	26.6	1.020	1.118	0.592	0.649	20.2
661	1880.0	1 time slot	back	27.0	26.3	0.994	**1.168**	0.574	**0.674**	20.2
512	1850.2	1 time slot	back**	27.0	26.6	**1.040**	1.140	**0.607**	0.666	20.2

Table 17: Test results SAR GSM (see max. SAR plot Annex B: DASY measurement results, page 54)
* - maximum possible output power declared by manufacturer
** - repeated at the highest SAR measurement according to the FCC KDB 865664

Ch.	Freq. (MHz)	test cond.	position	cond. P_{max} (dBm)		SAR_{1g} (W/kg)		SAR_{10g} (W/kg)		liquid (°C)
				declared*	meas.	meas.	extrap.	meas.	extrap.	
measured / extrapolated SAR numbers - Body worn - LTE FDD 2 CatM-1 20MHz BW 1900 MHz - 0 mm distance										
18700	1860	RB_1_low_NBposLow/QPSK	front	24.0	23.8	1.040	1.097	0.559	0.589	21.0
18700	1860	RB_1_low_NBposLow/QPSK	back	24.0	23.8	1.110	1.170	0.649	0.684	21.0
18700	1860	RB_1_low_NBposLow/QPSK	left	24.0	23.8	0.222	0.234	0.122	0.129	21.0
18700	1860	RB_1_low_NBposLow/QPSK	right	24.0	23.8	0.701	0.739	0.384	0.405	21.0
18700	1860	RB_1_low_NBposLow/QPSK	top	24.0	23.8	0.119	0.125	0.069	0.073	21.0
18700	1860	RB_1_low_NBposLow/QPSK	bottom	24.0	23.8	0.327	0.345	0.172	0.181	21.0
18900	1880	RB_1_mid_NBposMid/QPSK	front	24.0	23.5	1.000	1.112	0.535	0.595	21.0
19100	1900	RB_1_high_NBposHigh/QPSK	front	24.0	23.4	1.080	**1.234**	0.570	0.651	21.0
18900	1880	RB_1_mid_NBposMid/QPSK	back	24.0	23.5	1.050	1.167	0.613	0.681	21.0
19100	1900	RB_1_high_NBposHigh/QPSK	back	24.0	23.4	1.050	1.200	0.609	0.696	21.0
18700	1860	RB_1_low_NBposLow/QPSK	back**	24.0	23.8	**1.150**	1.213	**0.674**	**0.711**	21.0
measured / extrapolated SAR numbers - Body worn - LTE FDD 4 CatM-1 20MHz BW 1750 MHz - 0 mm distance										
20050	1720.0	RB_1_low_NBposLow/QPSK	front	24.0	23.4	0.973	1.107	0.580	0.660	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	back	24.0	23.4	1.030	1.172	0.612	0.696	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	left	24.0	23.4	0.229	0.261	0.123	0.140	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	right	24.0	23.4	1.030	1.172	0.598	0.680	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	top	24.0	23.4	0.092	0.105	0.056	0.064	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	bottom	24.0	23.4	0.193	0.220	0.108	0.123	21.0
20175	1732.5	RB_1_mid_NBposMid/16QAM	front	24.0	23.2	0.815	0.982	0.475	0.572	21.0
20300	1745.0	RB_1_high_NBposHigh/16QAM	front	24.0	23.2	0.743	0.889	0.433	0.518	21.0
20175	1732.5	RB_1_mid_NBposMid/16QAM	back	24.0	23.2	0.926	1.116	0.549	0.662	21.0
20300	1745.0	RB_1_high_NBposHigh/16QAM	back	24.0	23.2	0.861	1.030	0.511	0.612	21.0
20175	1732.5	RB_1_mid_NBposMid/16QAM	right	24.0	23.2	0.725	0.874	0.410	0.494	21.0
20300	1745.0	RB_1_high_NBposHigh/16QAM	right	24.0	23.2	0.623	0.746	0.357	0.427	21.0
20050	1720.0	RB_1_low_NBposLow/QPSK	back**	24.0	23.4	**1.060**	**1.206**	**0.637**	**0.725**	21.0

Table 18: Test results SAR LTE CatM-1 (see max. SAR plot Annex B: DASY measurement results)

* - maximum possible output power declared by manufacturer
** - repeated at the highest SAR measurement according to the FCC KDB 865664

Ch.	Freq. (MHz)	test cond.	position	cond. P_{max} (dBm)		SAR_{1g} (W/kg)		SAR_{10g} (W/kg)		liquid (°C)
				declared*	meas.	meas.	extrap.	meas.	extrap.	
measured / extrapolated SAR numbers - Body worn - LTE FDD 5 CatM-1 10MHz BW 800 MHz - 0 mm distance										
20600	844.0	RB_1_low_NBposLow/16QAM	front	24.0	23.9	0.202	0.208	0.125	0.129	21.1
20600	844.0	RB_1_low_NBposLow/16QAM	back	24.0	23.9	0.180	0.185	0.119	0.123	21.1
20600	844.0	RB_1_low_NBposLow/16QAM	left	24.0	23.9	0.119	0.123	0.080	0.082	21.1
20600	844.0	RB_1_low_NBposLow/16QAM	right	24.0	23.9	0.165	0.170	0.111	0.114	21.1
20600	844.0	RB_1_low_NBposLow/16QAM	top	24.0	23.9	0.027	0.028	0.017	0.018	21.1
20600	844.0	RB_1_low_NBposLow/16QAM	bottom	24.0	23.9	0.014	0.014	0.008	0.008	21.1
20450	829.0	RB_1_low_NBposLow/16QAM	front	24.0	23.8	**0.203**	**0.215**	**0.127**	**0.135**	21.1
20525	836.5	RB_1_low_NBposLow/16QAM	front	24.0	23.8	**0.203**	0.213	0.126	0.132	21.1
measured / extrapolated SAR numbers - Body worn - LTE FDD 12 CatM-1 10MHz BW 700 MHz - 0 mm distance										
23130	711.0	RB_1_low_NBposLow/16QAM	front	24.0	23.9	0.128	0.130	0.082	0.083	21.1
23130	711.0	RB_1_low_NBposLow/16QAM	back	24.0	23.9	0.149	0.151	0.102	0.104	21.1
23130	711.0	RB_1_low_NBposLow/16QAM	left	24.0	23.9	0.079	0.080	0.054	0.055	21.1
23130	711.0	RB_1_low_NBposLow/16QAM	right	24.0	23.9	0.143	0.145	0.098	0.100	21.1
23130	711.0	RB_1_low_NBposLow/16QAM	top	24.0	23.9	0.030	0.030	0.019	0.019	21.1
23130	711.0	RB_1_low_NBposLow/16QAM	bottom	24.0	23.9	0.015	0.015	0.009	0.009	21.1
23060	704.0	RB_1_mid_NBposMid/16QAM	back	24.0	23.8	**0.165**	**0.174**	**0.114**	**0.120**	21.1
23095	707.5	RB_1_high_NBposHigh/16QAM	back	24.0	23.8	0.159	0.166	0.110	0.115	21.1
measured / extrapolated SAR numbers - Body worn - LTE FDD 26 CatM-1 10MHz BW 800 MHz - 0 mm distance										
26990	844.0	RB_1_low_NBposLow/16QAM	front	24.0	23.8	0.212	0.222	0.131	0.137	21.1
26990	844.0	RB_1_low_NBposLow/16QAM	back	24.0	23.8	0.175	0.183	0.116	0.121	21.1
26990	844.0	RB_1_low_NBposLow/16QAM	left	24.0	23.8	0.108	0.113	0.071	0.074	21.1
26990	844.0	RB_1_low_NBposLow/16QAM	right	24.0	23.8	0.165	0.173	0.111	0.116	21.1
26990	844.0	RB_1_low_NBposLow/16QAM	top	24.0	23.8	0.032	0.034	0.018	0.019	21.1
26990	844.0	RB_1_low_NBposLow/16QAM	bottom	24.0	23.8	0.014	0.015	0.008	0.008	21.1
26740	819	RB_1_high_NBposHigh/16QAM	front	24.0	23.5	0.230	**0.256**	0.143	**0.159**	21.1
26865	831.5	RB_1_mid_NBposMid/16QAM	front	24.0	23.6	**0.233**	0.253	**0.144**	0.156	21.1

Table 19: Test results SAR LTE CatM-1 (see max. SAR plot Annex B: DASY measurement results)
* - maximum possible output power declared by manufacturer

8.2.3 Over-Estimated stand alone 1g/10g-SAR - according 447498 D01

Estimated stand alone SAR $_{1(g)\ /\ 10(g)}$						
Communication system	freq. (GHz)	distance (mm)	P_{avg} (dBm)	P_{avg} (mW)	$estimated_{1-g}$ (W/kg)	$estimated_{10-g}$ (W/kg)
ULP-AMI-P	0.402	5	-16	0.03	0.0004	0.0002

Table 20: Estimated stand alone SAR_{max} for Bluetooth 2450MHz head and body[1]

1

Calculated according 447498 D01 General RF Exposure Guidance v06
(Standalone SAR test exclusion considerations):

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:

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)] · [$\sqrt{f_{(GHz)}} / x$] with x =7.5 for 1-g SAR, and x = 18.75 for 10-g extremity SAR, *where*

- $f_{(GHz)}$ is the RF channel transmit frequency in GHz
- Power and distance are rounded to the nearest mW and mm before calculation
- The result is rounded to one decimal place for comparison

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 is applied to determine SAR test exclusion.

8.2.4 Over-Estimated stand alone 1g/10g-SAR - according RSS 102

SAR values from exempted transmitters shall be included in the total exposure assessment. A SAR value of 0.4 W/kg for 1 g, 1 W/kg for 10 g, or an estimated SAR value based on the ratio of the power level and the power exemption limit may be used to determine the standalone SAR value for test configurations that do not require a SAR evaluation based on test reductions or on the exemption limits outlined in section 6.3 of RSS 102. The estimated SAR value, $SAR_{estimated}$ is calculated using equation (2):

$$SAR_{estimated} = \frac{Pmax}{Pmax,exemption} \ x\ 0.25\ x\ SAR_{limit}\ W/kg \quad (2)$$

where:

- $Pmax$ is the maximum power level including tune-up tolerance for the exempted transmitter
- $Pmax, exemption$ is the maximum power level of exemption at the same frequency and distance for the exempted transmitter
- SAR_{limit} is the applicable SAR limit (e.g. 1.6 W/kg for 1 g or 4 W/kg for 10 g)

Distance and power are adjusted according to the exemption guidelines of 6.3 SAR exemption limits table 11:

Frequency (MHz)	≤ 5 mm (mW)	10 mm (mW)	15 mm (mW)	20 mm (mW)	25 mm (mW)	30 mm (mW)	35 mm (mW)	40 mm (mW)	45 mm (mW)	> 50 mm (mW)
≤ 300	45	116	139	163	189	216	246	280	319	362
450	32	71	87	104	124	147	175	208	248	296
835	21	32	41	54	72	96	129	172	228	298
1900	6	10	18	33	57	92	138	194	257	323
2450	3	7	16	32	56	89	128	170	209	245
3500	2	6	15	29	50	72	94	114	134	158
5800	1	5	13	23	32	41	54	74	102	128

Estimated stand alone SAR $_{1(g)\ /\ 10(g)}$							
Communication system	freq. (GHz)	distance (mm)	$P_{max,avg}$ (dBm)	$Pmax,_{avg}$ (mW)	$P_{max,exemption}$ (mW)	$estimated_{1-g}$ (W/kg)	$estimated_{10-g}$ (W/kg)
ULP-AMI-P	0.402	5	-16	0.0	3.0	0.003	0.004

Table 21: Estimated stand alone SAR_{max} for excempted technologies

8.2.5 Multiple Transmitter Information

The following tables list information which is relevant for the decision if a simultaneous transmit evaluation is necessary according to FCC KDB 447498D01 General RF Exposure Guidance v06.

Frequency band	Position	SAR_{max} /W/kg		**ΣSAR_{1g}**
		WWAN	ULP-AMI-P	<1.6W/kg
GSM 850	front	1.550	0.003	**1.553**
	back	1.263	0.003	1.266
	left	0.776	0.003	0.779
	right	1.194	0.003	1.197
	top	0.234	0.003	0.237
	bottom	0.109	0.003	0.112
GSM 1900	front	1.096	0.003	1.099
	back	1.168	0.003	1.171
	left	0.240	0.003	0.243
	right	0.679	0.003	0.682
	top	0.115	0.003	0.118
	bottom	0.284	0.003	0.287
LTE 2	front	1.234	0.003	1.237
	back	1.213	0.003	1.216
	left	0.234	0.003	0.237
	right	0.739	0.003	0.742
	top	0.125	0.003	0.128
	bottom	0.345	0.003	0.348
LTE 4	front	1.107	0.003	1.110
	back	1.206	0.003	1.209
	left	0.261	0.003	0.264
	right	1.172	0.003	1.175
	top	0.105	0.003	0.108
	bottom	0.220	0.003	0.223
LTE 5	front	0.215	0.003	0.218
	back	0.185	0.003	0.188
	left	0.123	0.003	0.126
	right	0.170	0.003	0.173
	top	0.028	0.003	0.031
	bottom	0.014	0.003	0.017
LTE 12	front	0.130	0.003	0.133
	back	0.174	0.003	0.177
	left	0.080	0.003	0.083
	right	0.145	0.003	0.148
	top	0.030	0.003	0.033
	bottom	0.015	0.003	0.018
LTE 26	front	0.256	0.003	0.259
	back	0.183	0.003	0.186
	left	0.113	0.003	0.116
	right	0.173	0.003	0.176
	top	0.034	0.003	0.037
	bottom	0.015	0.003	0.018

Table 22: SAR_{max} WWAN and ULP-AMI-P 405MHz, ΣSAR_{1g} evaluation

NOTE: The ISED Extrapolation for the ULP-AMI-P was used in the summation as it represents the most conservative case between FCC KDB 447498D01 and ISED RSS 102 Extrapolation.

Conclusion:

ΣSAR < 1.6 W/kg, therefore simultaneous transmissions SAR measurement with the enlarged zoom scan measurement and volume scan post-processing procedures is **not** required.

8.2.6 SAR correction for deviations of complex permittivity from targets

The max reported SAR values are once more corrected wherever the deviation of the liquid parameters is larger than ± 5%.

According IEC / IEEE 62209-1528 chapter 7.8.2 SAR correction formula
there is a linear relationship between the percentage change in SAR (denoted ΔSAR) and the percentage change in the permittivity and conductivity from the target values (denoted $\Delta\varepsilon_r$ and Δσ, respectively).
The relationship is given by:

$$\Delta SAR = c_\varepsilon \Delta\varepsilon_r + c_\sigma \Delta\sigma$$

where
$c_\varepsilon = \partial(\Delta SAR)\ \partial(\Delta\varepsilon)$ is the coefficient representing the sensitivity of SAR to permittivity where SAR is normalized to output power;
$c_\sigma = \partial(\Delta SAR)\ \partial(\Delta\sigma)$ is the coefficient representing the sensitivity of SAR to conductivity, where SAR is normalized to output power.

The values of c_ε and c_σ have a simple relationship with frequency that can be described using polynomial equations. For dipole antennas at frequencies from 4 MHz to 6 GHz, the **1 g averaged SAR** c_ε and c_σ are given by

$c_\varepsilon = -7.854\times10^{-4} \times f^3 + 9.402\times10^{-3} \times f^2 - 2.742\times10^{-2} \times f - 0.2026$
$c_\sigma = 9.804\times10^{-3} \times f^3 - 8.661\times10^{-2} \times f^2 + 2.981\times10^{-2} \times f + 0.7829$

where f is the frequency in GHz. Above 6 GHz, the sensitivity is non-varying with frequency due to the small penetration depth; the values of $c_\varepsilon = -0,198$ and $c_\sigma = 0$ shall be used.

For frequencies from 4 MHz to 6 GHz, the **10 g averaged SAR** c_ε and c_σ are given by:

$c_\varepsilon = 3.456\times10^{-3} \times f^3 - 3.531\times10^{-2} \times f^2 + 7.675\times10^{-2} \times f - 0.1860$
$c_\sigma = 4.479\times10^{-3} \times f^3 - 1.586\times10^{-2} \times f^2 - 0.197\,2 \times f + 0.7717$

where f is the frequency in GHz. Above 6 GHz, the sensitivity is non-varying with frequency due to the small penetration depth; the values of $c_\varepsilon = -0,250$ and $c_\sigma = 0$ shall be used.

NOTE:
The Tables in the uncertainties of this report are updated accordingly with the values from table 6 – Root-mean-squared error SAR correction formula as a function of the maximum change in permittivity or conductivity:

Max. change in ε_r or σ	RMS uncertainty for SAR_{1g} %	RMS uncertainty for SAR_{10g} %
±5 %	1.2	0.97
±10 %	1.9	1.6

NOTE:
The DASY software is capable of directly correcting the measured values according to the above-described procedure, fully compliant to IEC / IEEE 62209-1528, so that no further evaluation is necessary.

9 Test equipment and ancillaries used for tests

To simplify the identification of the test equipment and/or ancillaries which were used, the reporting of the relevant test cases only refer to the test item number as specified in the table below.

Equipment	Type	Manufacturer	Serial No.	Last Calibration	Frequency (months)
Dosimetric E-Field Probe	EX3DV4	Schmid & Partner Engineering AG	7566	August 12, 2024	12
Dosimetric E-Field Probe	EX3DV4	Schmid & Partner Engineering AG	7852	November 13, 2024	12
750 MHz System Validation Dipole	D750V3	Schmid & Partner Engineering AG	1041	May 11, 2023	36
835 MHz System Validation Dipole	D835V2	Schmid & Partner Engineering AG	4d153	May 11, 2023	36
1750 MHz System Validation Dipole	D1750V2	Schmid & Partner Engineering AG	1093	August 15, 2024	36
1900 MHz System Validation Dipole	D1900V2	Schmid & Partner Engineering AG	5d009	May 12, 2023	36
Data acquisition electronics	DAE4	Schmid & Partner Engineering AG	1387	August 8, 2024	12
Data acquisition electronics	DAE4ip	Schmid & Partner Engineering AG	1842	November 06, 2024	12
Software	V16.4.0.5005	Schmid & Partner Engineering AG	---	N/A	--
SAM Twin Phantom V8.0	QD 000 P41 AA	Schmid & Partner Engineering AG	2163	N/A	--
SAM Twin Phantom V8.0	QD 000 P41 A	Schmid & Partner Engineering AG	2061	N/A	--
Universal Radio Communication Tester	CMW500	Rohde & Schwarz	166977	December 13, 2023	24
Network Analyser 300 kHz to 6 GHz	8753ES	Agilent Technologies)*	US39174 436	December 14, 2023	24
Dielectric Probe Kit	85033D	Hewlett Packard	3423A060 60	January 04, 2021	36
Dielectric Assessment Kit (DAK)	DAK 200MHz – 20GHz Package	Schmid & Partner Engineering AG	1127	N/A	--
Powersource1	SE UMS 160 CC	Schmid & Partner Engineering AG	4342	May 15, 2024	24
Signal Generator	SML03	Rohde & Schwarz	102519	December 05, 2023	24
RF Power Amplifier	BLMA 0760-6 (6 Watt)	BONN Elektronik	1510273	N/A	--
Power Meter	NRP	Rohde & Schwarz	101367	December 05, 2024	12
Power Meter Sensor	NRP Z22	Rohde & Schwarz	100227	December 03, 2024	12
Power Meter Sensor	NRP Z22	Rohde & Schwarz	100234	December 03, 2024	12
Directional Coupler	778D	Hewlett Packard	19171	December 05, 2024	12

)* : Network analyzer probe calibration against air, distilled water and a shorting block performed before measuring liquid parameters.

10 Observations

No observations exceeding those reported with the single test cases have been made.

Annex A: System performance check

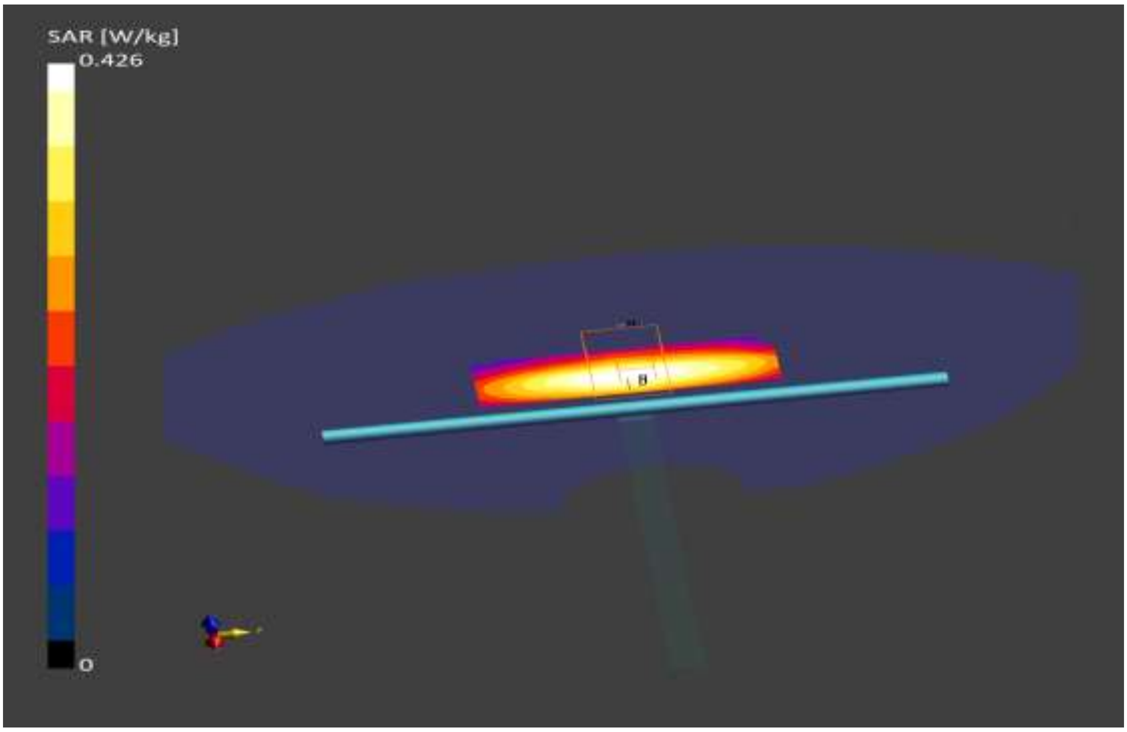
Date/Time: 2025-02-13, 14:03 2025-02-13, 14:10

SystemPerformanceCheck-D750

DUT: Dipole; Type: D750V3; Serial: SN1041
Communication System: CW; Communication System Frequency: 750.0 MHz
Medium parameters used: f = 750.0 MHz, σ = 0.867 S/m; ε_r=43.0; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.31, 10.08, 9.25); Calibrated: 2024-08-12
- Sensor-Surface: 1.4 mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/750.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.402 W/kg; SAR(10 g) = 0.266 W/kg

HBBL-600-10000/750.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = 0.06 dB
SAR(1 g) = 0.400 W/kg; SAR(10 g) = 0.264 W/kg



Additional information:
ambient temperature: 21.6°C; liquid temperature: 21.1°C;

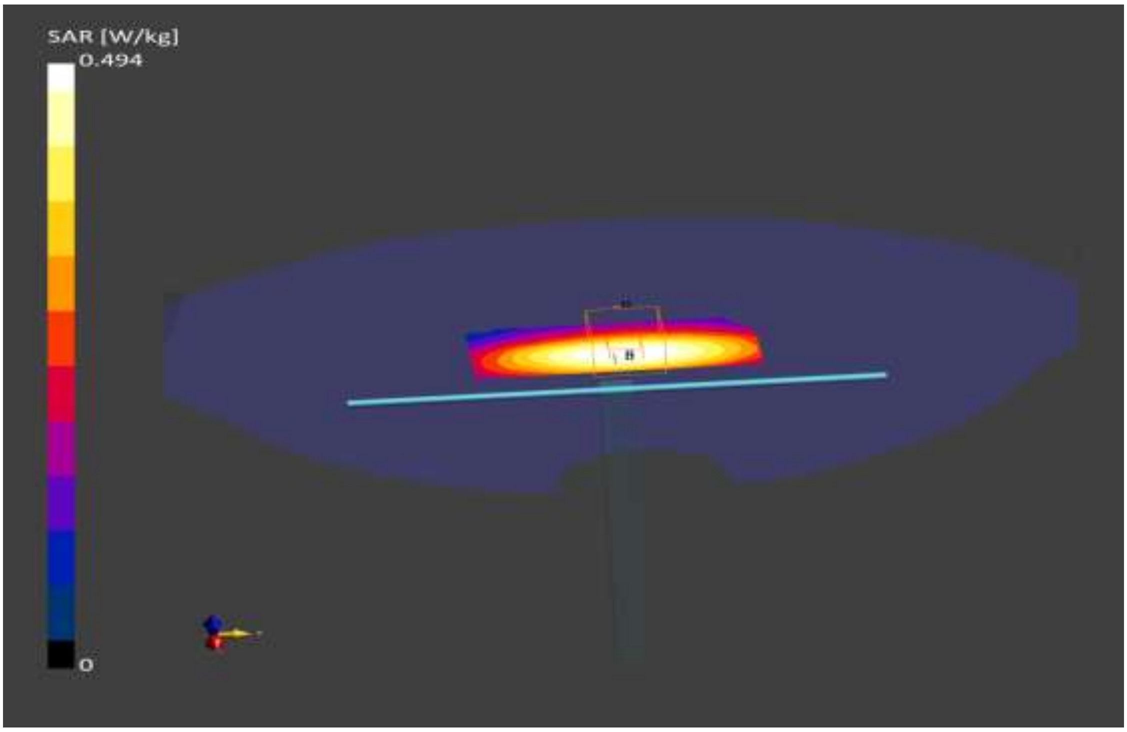
Date/Time: 2025-02-12, 11:01 2025-02-12, 11:07

SystemPerformanceCheck-D835

DUT: Dipole; Type: D835V2; Serial: SN4d153
Communication System: CW; Communication System Frequency: 835.0 MHz
Medium parameters used: f = 835.0 MHz, σ = 0.890 S/m; ε_r=42.6; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4 mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/835.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.464 W/kg; SAR(10 g) = 0.305 W/kg

HBBL-600-10000/835.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = 0.08 dB
SAR(1 g) = 0.453 W/kg; SAR(10 g) = 0.299 W/kg



Additional information:
ambient temperature: 22.9°C; liquid temperature: 21.9°C;

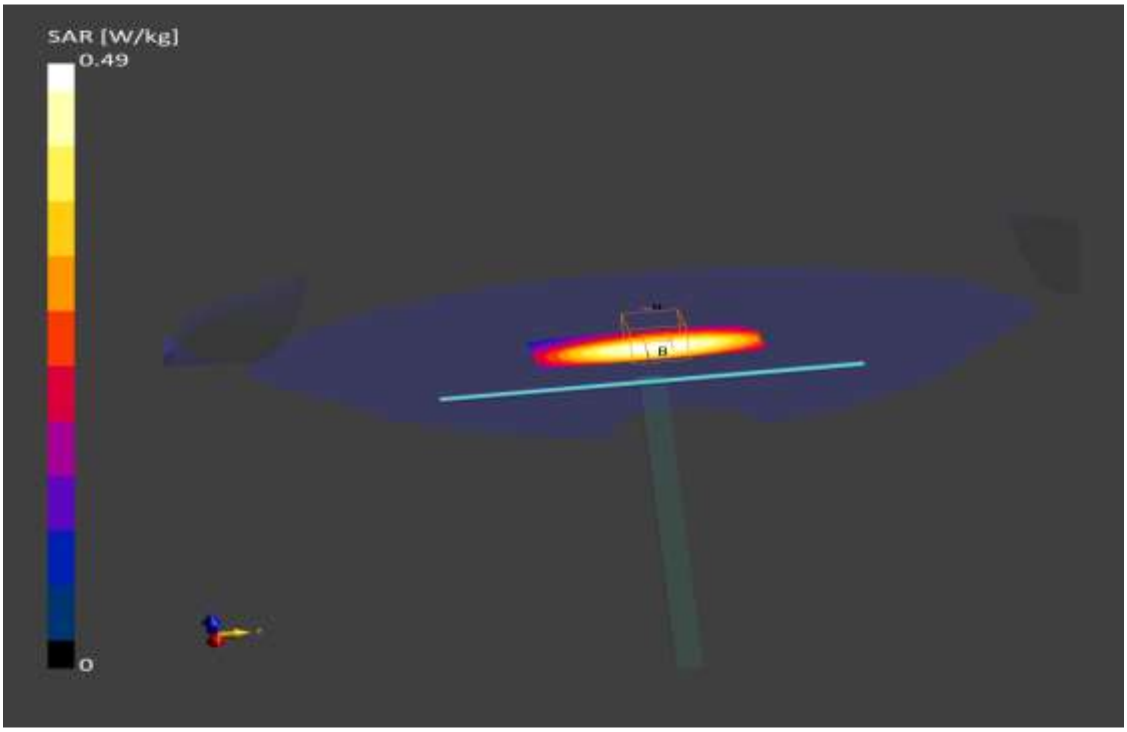
Date/Time: 2025-02-13, 09:16 2025-02-13, 09:23

SystemPerformanceCheck-D835

DUT: Dipole; Type: D835V2; Serial: SN4d153
Communication System: CW; Communication System Frequency: 835.0 MHz
Medium parameters used: f = 835.0 MHz, σ = 0.894 S/m; ε_r=42.8; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4 mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/835.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.455 W/kg; SAR(10 g) = 0.298 W/kg

HBBL-600-10000/835.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = -0.00 dB
SAR(1 g) = 0.443 W/kg; SAR(10 g) = 0.293 W/kg



Additional information:
ambient temperature: 21.6°C; liquid temperature: 21.1°C;

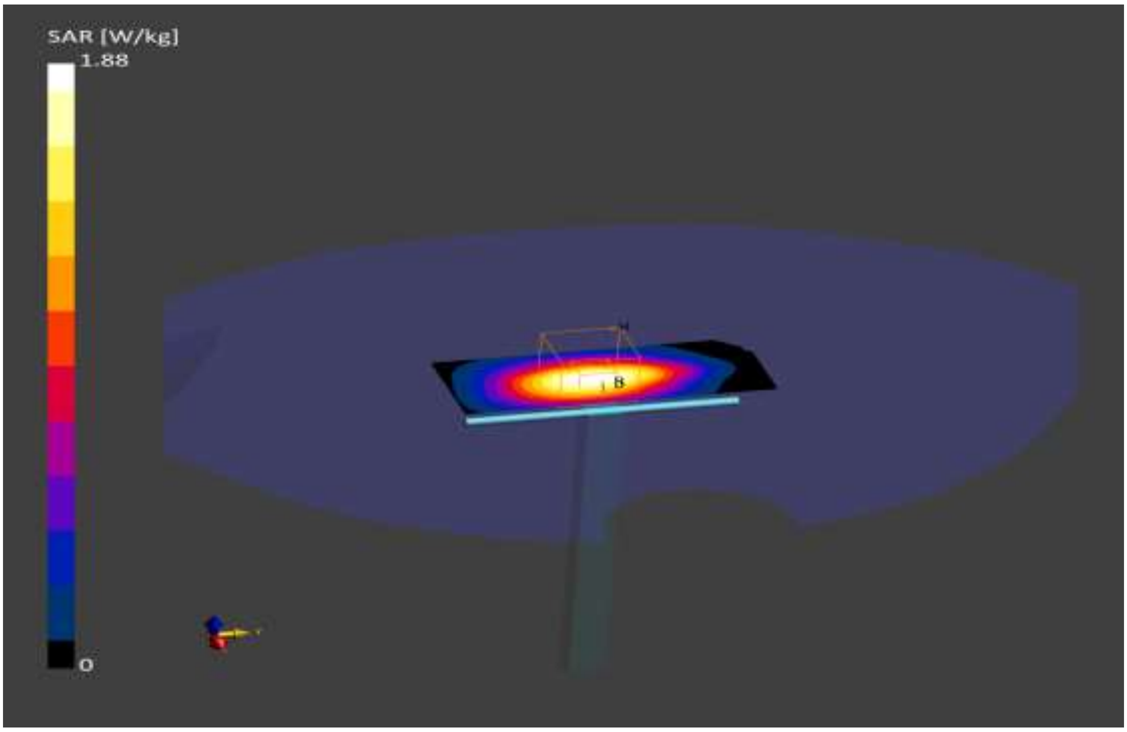
Date/Time: 2025-02-14, 10:12 2025-02-14, 10:17

SystemPerformanceCheck-D1750

DUT: Dipole; Type: D1750V2; Serial: SN1093
Communication System: CW; Communication System Frequency: 1750.0 MHz
Medium parameters used: f = 1750.0 MHz, σ = 1.35 S/m; ε_r=41.6; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 8
DASY Configuration:
- Probe: EX3DV4 - SN7852; ConvF(7.33, 7.57, 7.89); Calibrated: 2024-11-13
- Sensor-Surface: 1.4 mm
- DAE: DAE4ip Sn1842; Calibrated: 2024-11-06
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2163;
- Software: DASY8 Module SAR V16.4.0.5005

HBBL-600-10000/1750.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 1.68 W/kg; SAR(10 g) = 0.913 W/kg

HBBL-600-10000/1750.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = 0.16 dB
SAR(1 g) = 1.66 W/kg; SAR(10 g) = 0.904 W/kg



Additional information:
ambient temperature: 21.8°C; liquid temperature: 21.0°C;

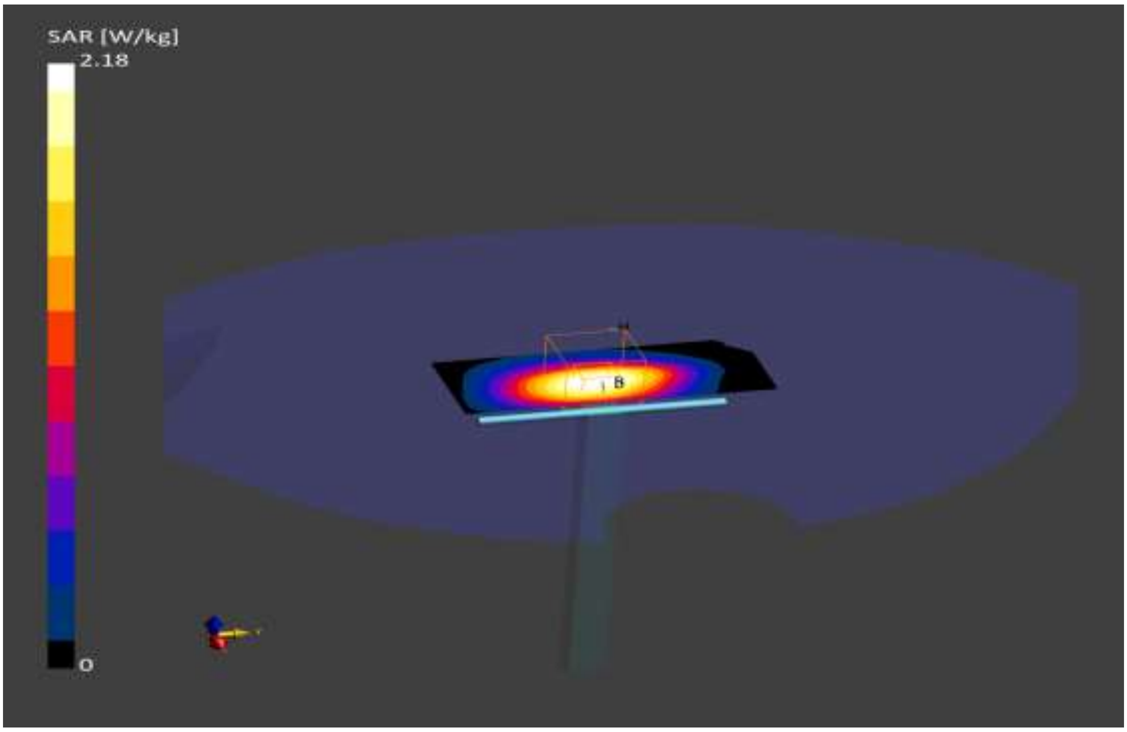
Date/Time: 2025-02-14, 10:23 2025-02-14, 10:28

SystemPerformanceCheck-D1900

DUT: Dipole; Type: D1900V2; Serial: SN5d009
Communication System: CW; Communication System Frequency: 1900.0 MHz
Medium parameters used: f = 1900.0 MHz, σ = 1.44 S/m; ε_r=41.4; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 8
DASY Configuration:
- Probe: EX3DV4 - SN7852; ConvF(6.86, 7.08, 7.38); Calibrated: 2024-11-13
- Sensor-Surface: 1.4 mm
- DAE: DAE4ip Sn1842; Calibrated: 2024-11-06
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2163;
- Software: DASY8 Module SAR V16.4.0.5005

HBBL-600-10000/1900.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 2.01 W/kg; SAR(10 g) = 1.08 W/kg

HBBL-600-10000/1900.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = -0.04 dB
SAR(1 g) = 2.05 W/kg; SAR(10 g) = 1.07 W/kg



Additional information:
ambient temperature: 21.5°C; liquid temperature: 21.0°C;

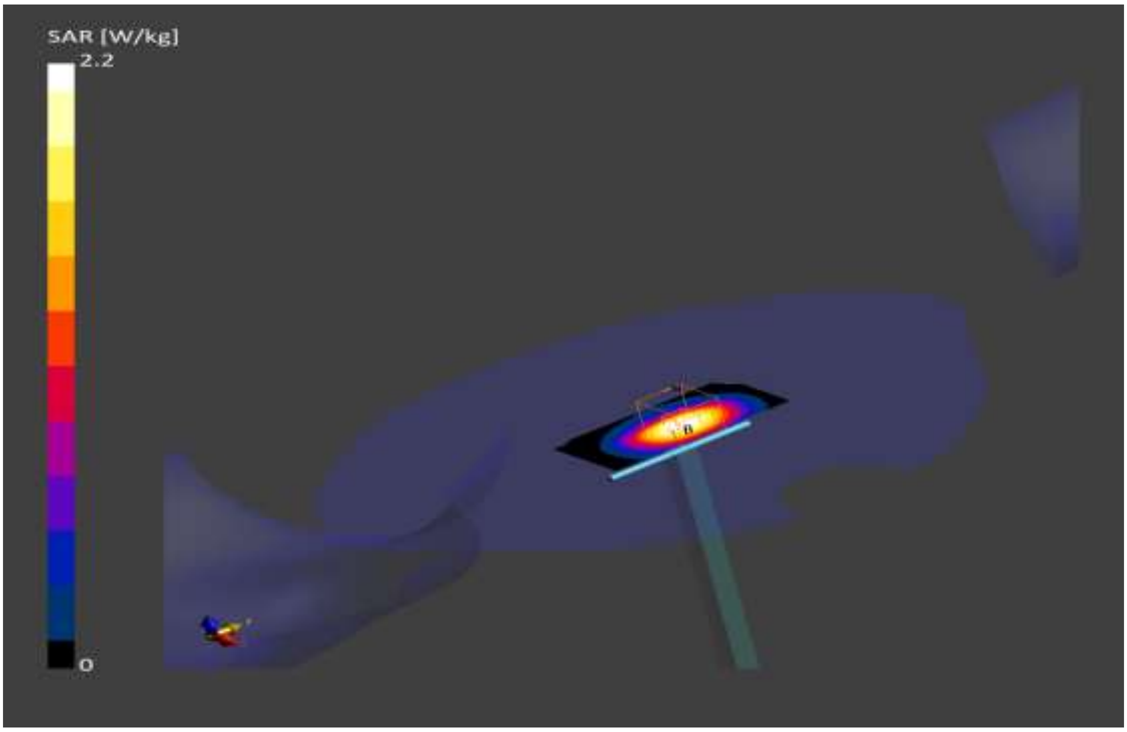
Date/Time: 2025-02-20, 09:50 2025-02-20, 09:56

SystemPerformanceCheck-D1900

DUT: Dipole; Type: D1900V2; Serial: SN5d009
Communication System: CW; Communication System Frequency: 1900.0 MHz
Medium parameters used: f = 1900.0 MHz, σ = 1.42 S/m; ε_r=39.9; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(8.13, 7.95, 7.3); Calibrated: 2024-08-12
- Sensor-Surface: 1.4 mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/1900.0MHz/Area Scan (10.0 x 15.0 x 1.0) :
Grid Extents [mm]: 40.0 x 90.0
Maximum value of SAR (interpolated) - SAR(1 g) = 2.03 W/kg; SAR(10 g) = 1.07 W/kg

HBBL-600-10000/1900.0MHz/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
SPC Power = 17.0 dBm
Power Drift = -0.00 dB
SAR(1 g) = 1.94 W/kg; SAR(10 g) = 1.02 W/kg



Additional information:
ambient temperature: 22.1°C; liquid temperature: 20.2°C;

Annex B: DASY measurement results

SAR plots for **the highest measured SAR** in each exposure configuration, wireless mode and frequency band combination according to FCC KDB 865664 D02

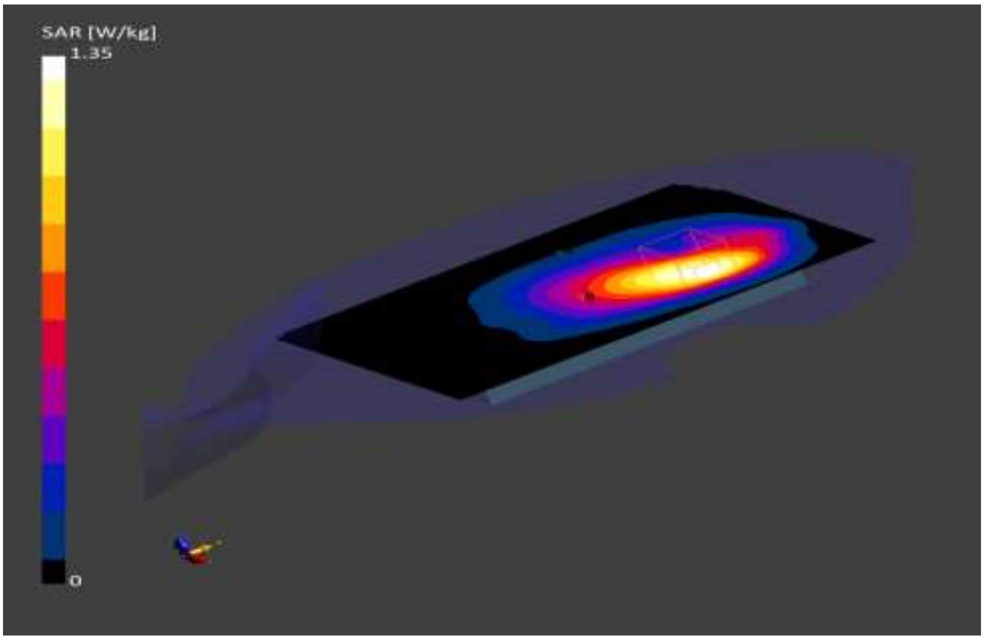
Date/Time: 2025-02-12, 14:54 2025-02-12, 15:03

IEC_IEEE 62209-1528 GSM850

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: GPRS-FDD (TDMA, GMSK, TN 0); Communication System Band: GSM 850; Communication System Frequency: 848.8 MHz
Medium parameters used: f = 848.8 MHz, σ = 0.895 S/m; ε_r=42.6; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/FRONT, 0 mm - Channel 251/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 1.27 W/kg; SAR(10 g) = 0.820 W/kg

HBBL-600-10000/FRONT, 0 mm - Channel 251/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.04 dB
SAR(1 g) = 1.35 W/kg; SAR(10 g) = 0.809 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 11.9
M2/M1 [%]: 83.8



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 22.1°C; liquid temperature: 21.9°C;

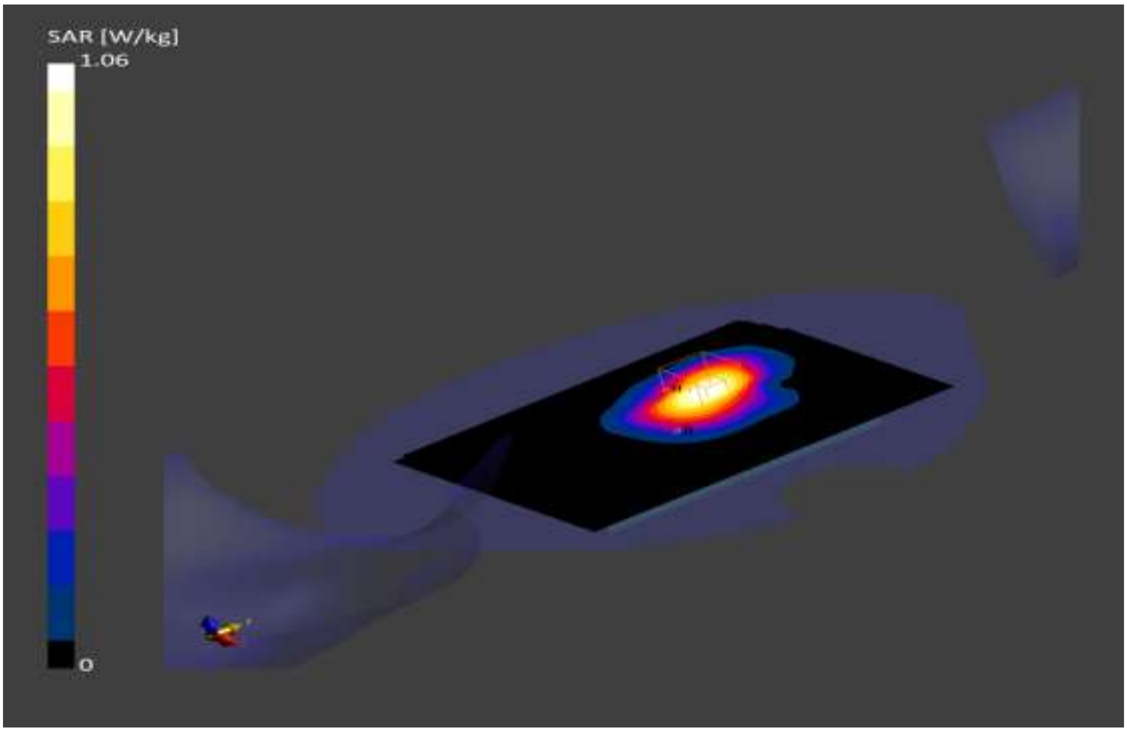
Date/Time: 2025-02-20, 12:33 2025-02-20, 12:40

IEC_IEEE 62209-1528-GSM1900

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: GPRS-FDD (TDMA, GMSK, TN 0); Communication System Band: PCS 1900;
Communication System Frequency: 1880.0 MHz
Medium parameters used: f = 1880.0 MHz, σ = 1.41 S/m; ε_r=39.9; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(8.13, 7.95, 7.3); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/BACK, 0 mm - Channel 661/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.980 W/kg; SAR(10 g) = 0.551 W/kg

HBBL-600-10000/BACK, 0 mm - Channel 661/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.01 dB
SAR(1 g) = 0.994 W/kg; SAR(10 g) = 0.574 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 12.3
M2/M1 [%]: 87.2



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 23.1°C; liquid temperature: 20.2°C;

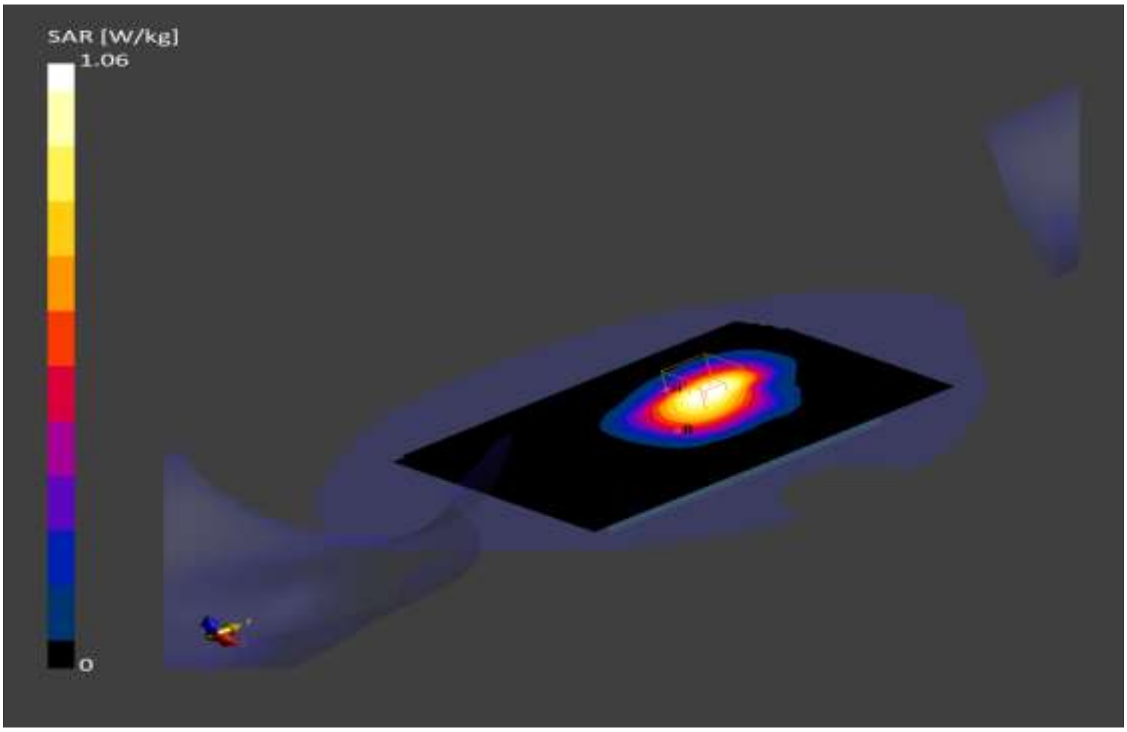
Date/Time: 2025-02-20, 12:49 2025-02-20, 12:56

IEC_IEEE 62209-1528-GSM1900

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: GPRS-FDD (TDMA, GMSK, TN 0); Communication System Band: PCS 1900;
Communication System Frequency: 1850.2 MHz
Medium parameters used: f = 1850.2 MHz, σ = 1.39 S/m; ε_r=39.9; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(8.13, 7.95, 7.3); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/BACK, 0 mm - Channel 512/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.594 W/kg

HBBL-600-10000/BACK, 0 mm - Channel 512/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.01 dB
SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.607 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 13.3
M2/M1 [%]: 85.3



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 23.1°C; liquid temperature: 20.2°C;

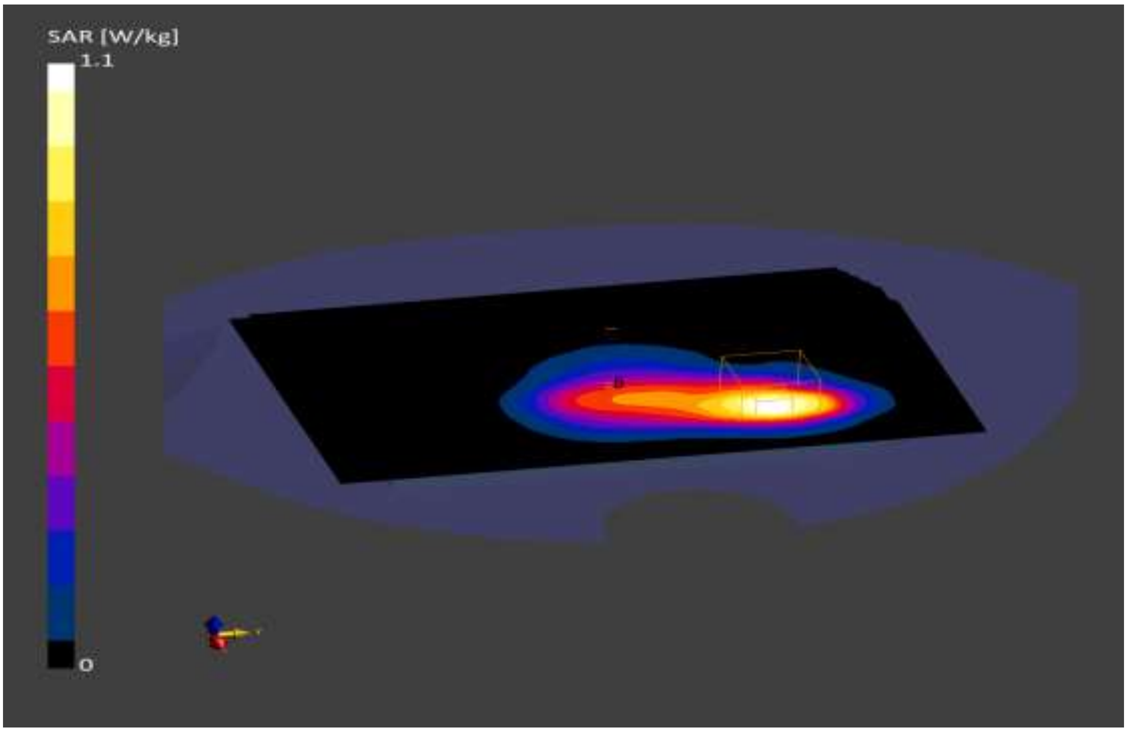
Date/Time: 2025-02-14, 11:36 2025-02-14, 11:41

EN62209-2-LTE FDD 2 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK) RBPosition:High AntennaCfg:SISO;
Communication System Band: Band 2; Communication System Frequency: 1900.0 MHz
Medium parameters used: f = 1900.0 MHz, σ = 1.44 S/m; ε_r=41.4; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 8
DASY Configuration:
- Probe: EX3DV4 - SN7852; ConvF(6.86, 7.08, 7.38); Calibrated: 2024-11-13
- Sensor-Surface: 1.4mm
- DAE: DAE4ip Sn1842; Calibrated: 2024-11-06
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2163;
- Software: DASY8 Module SAR V16.4.0.5005

HBBL-600-10000/FRONT, 0 mm - Channel 19100/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.990 W/kg; SAR(10 g) = 0.517 W/kg

HBBL-600-10000/FRONT, 0 mm - Channel 19100/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.01 dB
SAR(1 g) = 1.08 W/kg; SAR(10 g) = 0.570 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 9.7
M2/M1 [%]: 83.8



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 22.1°C; liquid temperature: 21.0°C;

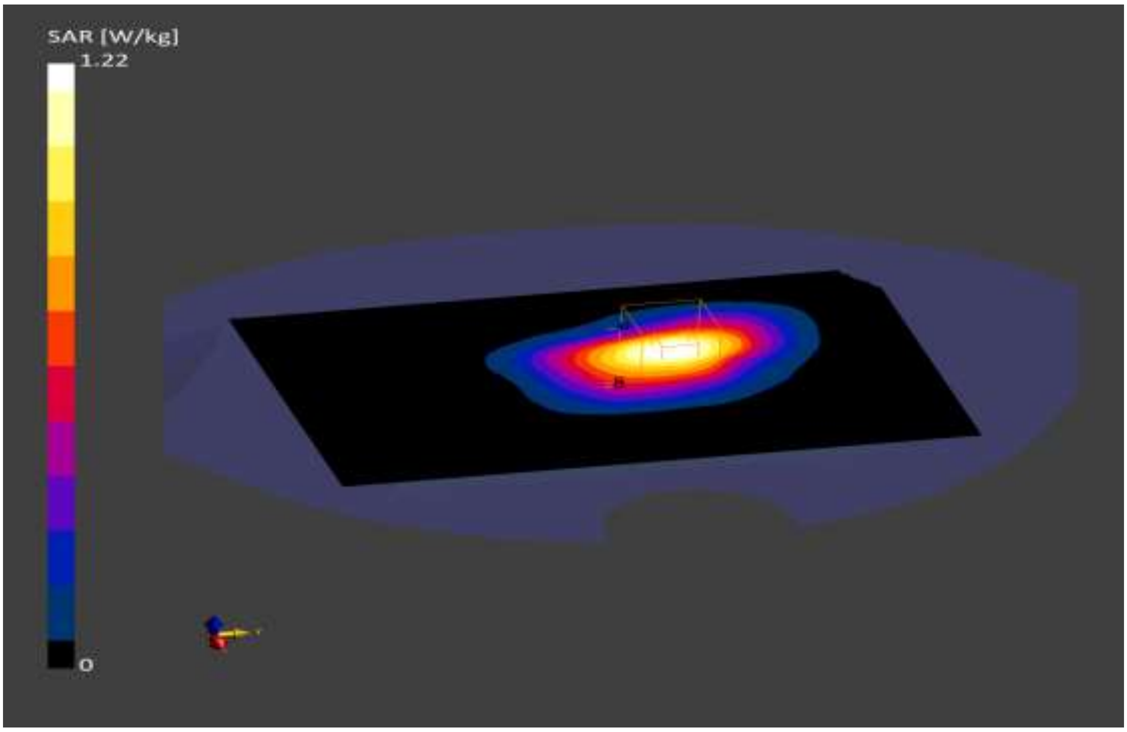
Date/Time: 2025-02-14, 13:21 2025-02-14, 13:26

EN62209-2-LTE FDD 2 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK) RBPosition:Low AntennaCfg:SISO;
Communication System Band: Band 2; Communication System Frequency: 1860.0 MHz
Medium parameters used: f = 1860.0 MHz, σ = 1.42 S/m; ε_r=41.4; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 8
DASY Configuration:
- Probe: EX3DV4 - SN7852; ConvF(6.86, 7.08, 7.38); Calibrated: 2024-11-13
- Sensor-Surface: 1.4mm
- DAE: DAE4ip Sn1842; Calibrated: 2024-11-06
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2163;
- Software: DASY8 Module SAR V16.4.0.5005

HBBL-600-10000/BACK, 0 mm - Channel 18700/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 1.10 W/kg; SAR(10 g) = 0.617 W/kg

HBBL-600-10000/BACK, 0 mm - Channel 18700/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.10 dB
SAR(1 g) = 1.15 W/kg; SAR(10 g) = 0.674 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 13.0
M2/M1 [%]: 85.9



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 22.1°C; liquid temperature: 21.0°C;

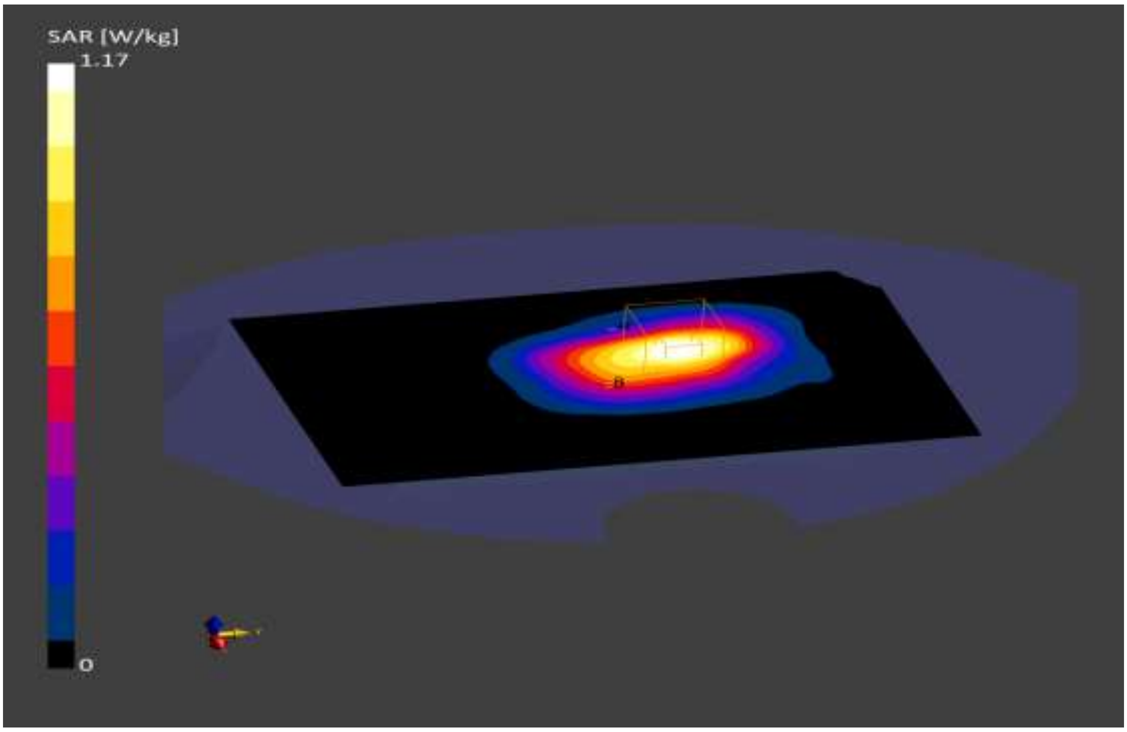
Date/Time: 2025-02-14, 13:11 2025-02-14, 13:16

EN62209-2-LTE FDD 4 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 20 MHz, QPSK) RBPosition:Low AntennaCfg:SISO;
Communication System Band: Band 4; Communication System Frequency: 1720.0 MHz
Medium parameters used: f = 1720.0 MHz, σ = 1.33 S/m; ε_r=41.6; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 8
DASY Configuration:
- Probe: EX3DV4 - SN7852; ConvF(7.33, 7.57, 7.89); Calibrated: 2024-11-13
- Sensor-Surface: 1.4mm
- DAE: DAE4ip Sn1842; Calibrated: 2024-11-06
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2163;
- Software: DASY8 Module SAR V16.4.0.5005

HBBL-600-10000/BACK, 0 mm - Channel 20050/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 1.04 W/kg; SAR(10 g) = 0.599 W/kg

HBBL-600-10000/BACK, 0 mm - Channel 20050/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = 0.02 dB
SAR(1 g) = 1.06 W/kg; SAR(10 g) = 0.637 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 13.5
M2/M1 [%]: 87.9



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 22.7°C; liquid temperature: 21.0°C;

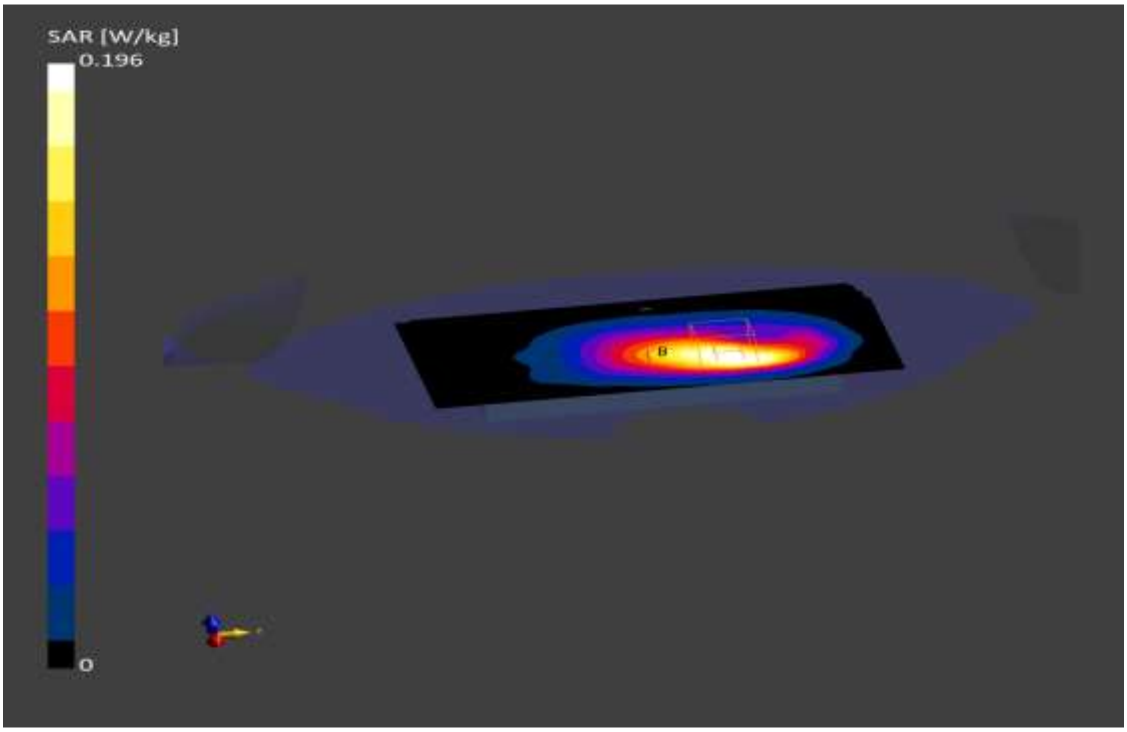
Date/Time: 2025-02-13, 10:29 2025-02-13, 10:35

EN62209-2-LTE FDD 5 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) RBPosition:Low AntennaCfg:SISO;
Communication System Band: Band 5; Communication System Frequency: 829.0 MHz
Medium parameters used: f = 829.0 MHz, σ = 0.892 S/m; ε_r=42.9; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/FRONT, 0 mm - Channel 20450/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.188 W/kg; SAR(10 g) = 0.123 W/kg

HBBL-600-10000/FRONT, 0 mm - Channel 20450/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.01 dB
SAR(1 g) = 0.203 W/kg; SAR(10 g) = 0.127 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 12.8
M2/M1 [%]: 86.6



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 22.4°C; liquid temperature: 21.1°C;

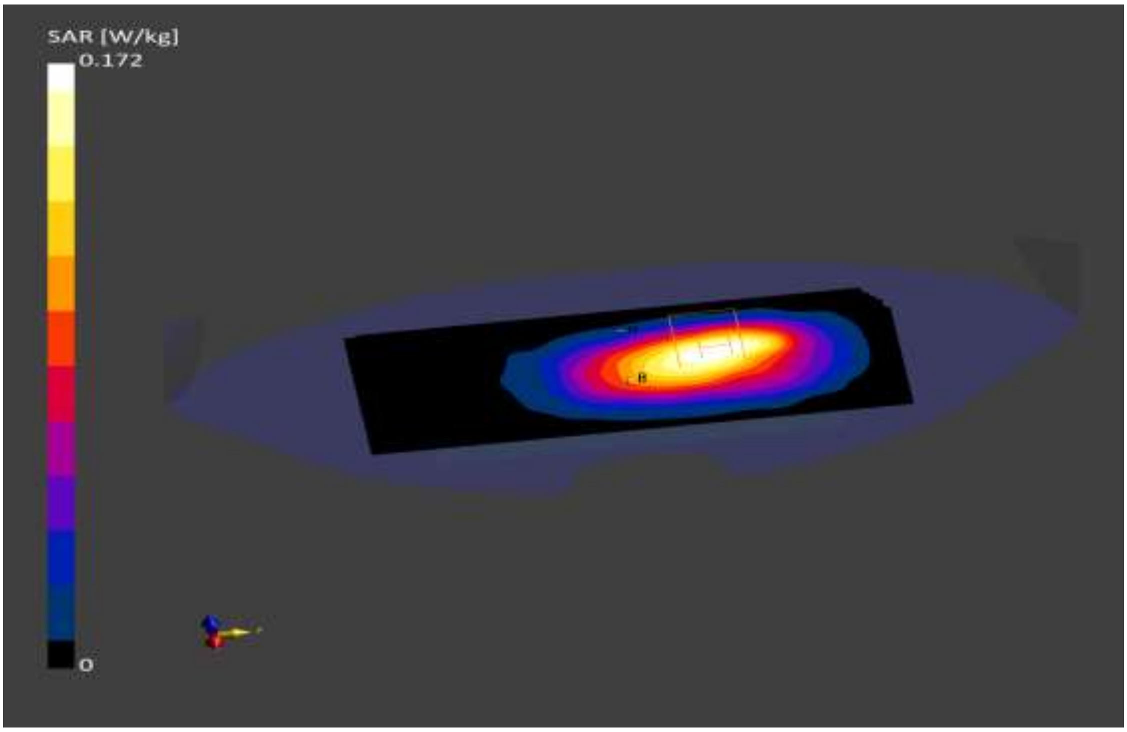
Date/Time: 2025-02-13, 13:30 2025-02-13, 13:37

EN62209-2-LTE FDD 12 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) RBPosition:Mid AntennaCfg:SISO;
Communication System Band: Band 12; Communication System Frequency: 704.0 MHz
Medium parameters used: f = 704.0 MHz, σ = 0.853 S/m; ε_r=43.1; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.31, 10.08, 9.25); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/BACK, 0 mm - Channel 23060/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.165 W/kg; SAR(10 g) = 0.112 W/kg

HBBL-600-10000/BACK, 0 mm - Channel 23060/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = 0.04 dB
SAR(1 g) = 0.165 W/kg; SAR(10 g) = 0.114 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 19.7
M2/M1 [%]: 91.1



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 23.1°C; liquid temperature: 21.1°C;

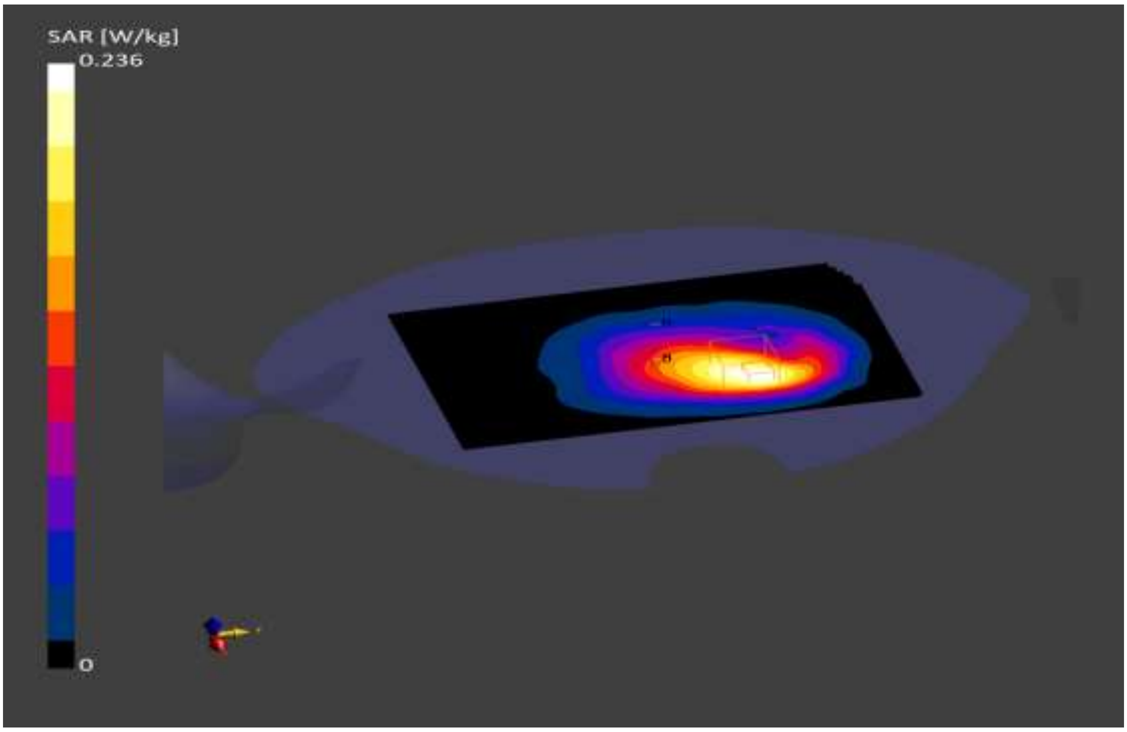
Date/Time: 2025-02-13, 12:04 2025-02-13, 12:13

EN62209-2-LTE FDD 26 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) RBPosition:High AntennaCfg:SISO;
Communication System Band: Band 26; Communication System Frequency: 819.0 MHz
Medium parameters used: f = 819.0 MHz, σ = 0.889 S/m; ε_r=42.9; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/FRONT, 0 mm - Channel 26740/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.217 W/kg; SAR(10 g) = 0.141 W/kg

HBBL-600-10000/FRONT, 0 mm - Channel 26740/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.00 dB
SAR(1 g) = 0.230 W/kg; SAR(10 g) = 0.143 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 12.0
M2/M1 [%]: 85.7



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 23.1°C; liquid temperature: 21.1°C;

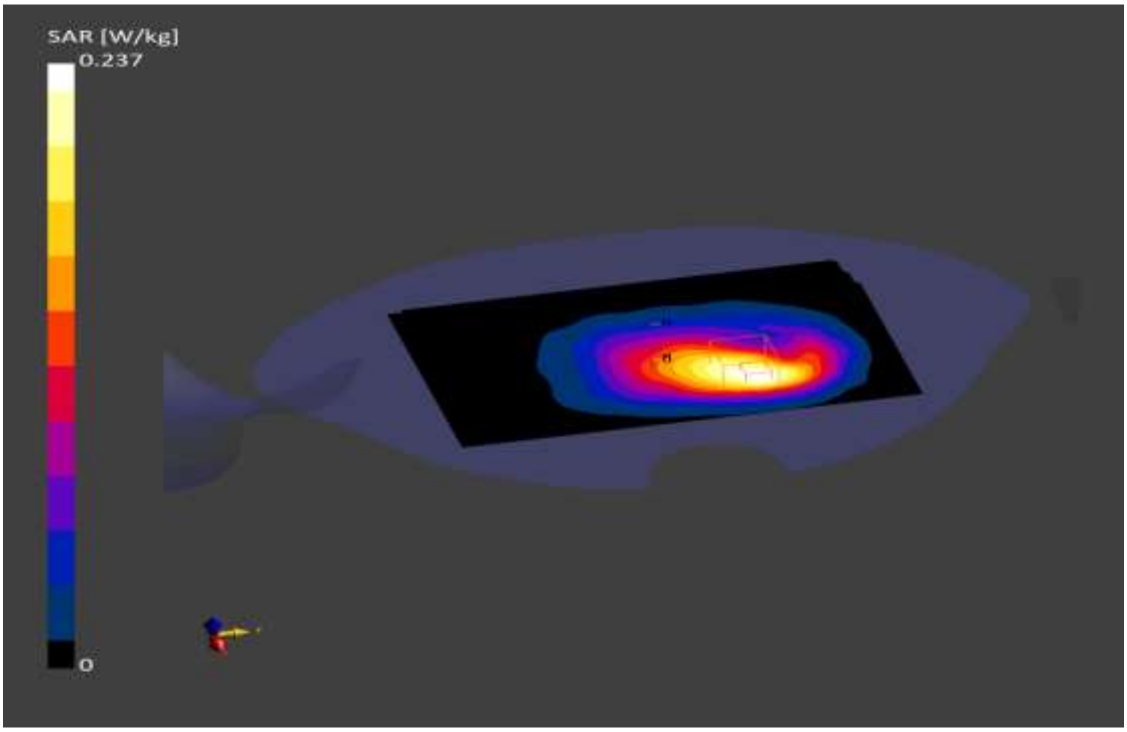
Date/Time: 2025-02-13, 12:18 2025-02-13, 12:26

EN62209-2-LTE FDD 26 CatM1

DUT: CardioMessenger Smart; Type: CardioMessenger Smart 4G; Serial: 91189500
Communication System: LTE-FDD (SC-FDMA, 1 RB, 10 MHz, 16-QAM) RBPosition:Mid AntennaCfg:SISO;
Communication System Band: Band 26; Communication System Frequency: 831.5 MHz
Medium parameters used: f = 831.5 MHz, σ = 0.893 S/m; ε_r=42.8; ρ= 1000 kg/m3
Phantom Section: Flat
Measurement Standard: DASY 6
DASY Configuration:
- Probe: EX3DV4 - SN7566; ConvF(10.03, 9.81, 9.01); Calibrated: 2024-08-12
- Sensor-Surface: 1.4mm
- DAE: DAE4 Sn1387; Calibrated: 2024-08-08
- Phantom: Twin-SAM V8.0 (30deg probe tilt); Serial: 2061;
- Software: cDASY6 (16.4.0.5005)

HBBL-600-10000/FRONT, 0 mm - Channel 26865/Area Scan (15.0 x 15.0 x 1.0) :
Grid Extents [mm]: 60.0 x 60.0
Maximum value of SAR (interpolated) - SAR(1 g) = 0.220 W/kg; SAR(10 g) = 0.143 W/kg

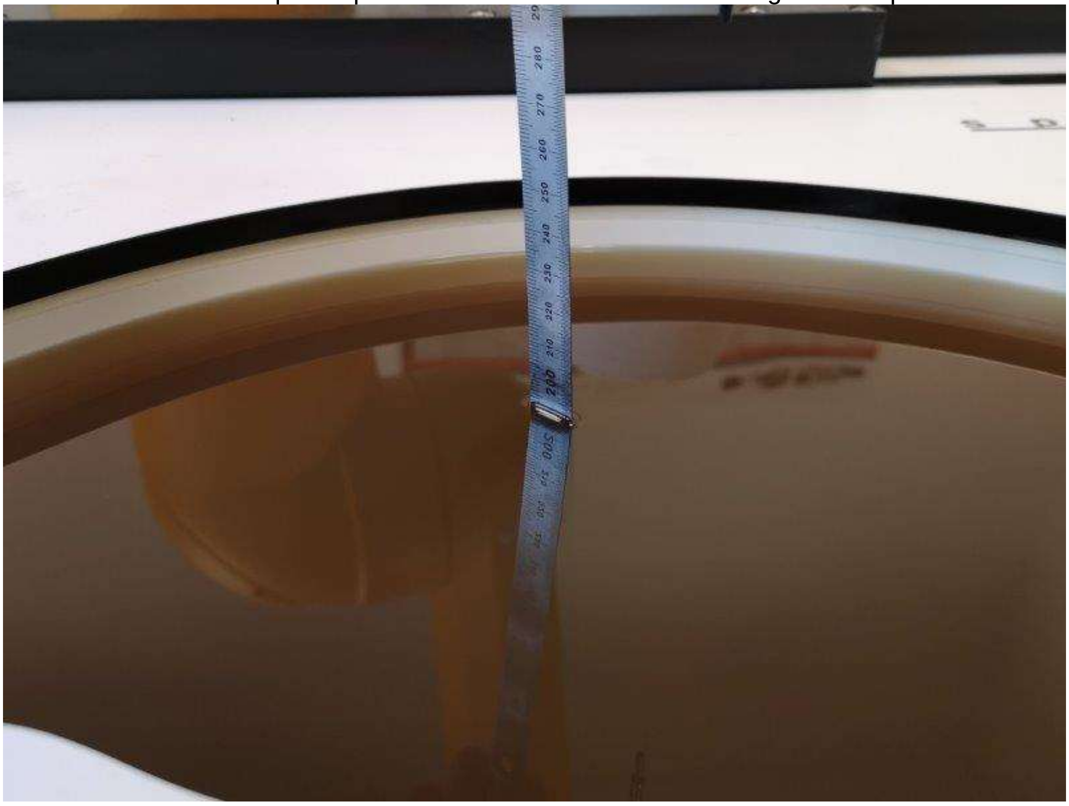
HBBL-600-10000/FRONT, 0 mm - Channel 26865/Zoom Scan (6.0 x 6.0 x 1.5) :
Grid Extents [mm]: 30.0 x 30.0 x 30.0
Graded Grid: Ratio 1.5 - Distance Sensor to Surface 1.4 mm
Power Drift = -0.02 dB
SAR(1 g) = 0.233 W/kg; SAR(10 g) = 0.144 W/kg
Additional Info for IEC 62209-2 AMD1:
TDist 3dB Peak [mm]: 11.9
M2/M1 [%]: 84.8



Additional information:
position or distance of DUT to SAM: 0 mm
ambient temperature: 23.1°C; liquid temperature: 21.1°C;

Annex B.1: Liquid depth

Photo 1: Liquid depth HBBL600-10000MHz Simulating Head Liquid



Annex C: Photo documentation

Photo documentation is described in the additional document:
1-9201-24-01-03_TR1-A101-R01_Photos

Annex D: Calibration parameters

Calibration parameters are described in the additional document:
1-9201-24-01-03_TR1-A201-R01_Caldata

Annex E: RSS-102 Annex A

ISEDRF documents are described in the additional document:
1-9201-24-01-03_TR1-A301-R01_ISED - RSS-102 Annex A

Annex F: Document History

Version	Applied Changes	Date of Release
	Initial Release	2025-02-24

Annex G: Further Information

Glossary

BW	-	Bandwidth
DUT	-	Device under Test
EUT	-	Equipment under Test
FCC	-	Federal Communication Commission
FCC ID	-	Company Identifier at FCC
HW	-	Hardware
Inv. No.	-	Inventory number
ISED	-	Innovation, Science and Economic Development Canada
LTE	-	Long Term Evolution
N/A	-	not applicable
PCB	-	PCS Licensed Transmitter
PCE	-	Personal Consumption Expenditure (PCS Licensed Transmitter held to ear)
PCS	-	Personal Consumption Services
OET	-	Office of Engineering and Technology
RB	-	resource block(s)
SAR	-	Specific Absorption Rate
S/N	-	Serial Number
SW	-	Software