SAR Test Report

Product Name	:	802.11a/b/g/n/ac RTL8821CE Combo module
Model No.	:	RTL8821CE
FCC ID	:	TX2-RTL8821CE

Host Equipment Name	:	Notebook PC
Model No.	:	TP401M,R406M,J401M

Applicant	:	ASUSTeK COMPUTER INC.
Address	:	4F, No. 150, LI-TE Rd., PEITOU, TAIPEI 112, TAIWAN

Date of Receipt	:	June. 13, 2018
Date of Test	:	June. 13, 2018 ~ Nov. 22, 2018
Issued Date	:	Nov. 26, 2018
Report No.	:	1862087R-RF-US-P06V03
Report Version	:	V1.2

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration of the equipment and evaluated measurement uncertainty herein.

This report must not be used to claim product endorsement by A2LA, TAF any agency of the government.

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Test Report Certification

Issued Date: Nov. 26, 2018
Report No: 1862087R-RF-US-P06V03

Product Name	:	802.11a/b/g/n/ac RTL8821CE Combo module
Applicant	:	ASUSTeK COMPUTER INC.
Address	:	4F, No. 150, LI-TE Rd., PEITOU, TAIPEI 112, TAIWAN
Model No.	:	RTL8821CE
EUT Voltage	:	100-240V~50/60Hz 0.8A
Brand Name	:	ASUS
Applicable Standard	:	FCC KDB Publication 248227 D01v02r02 FCC KDB Publication 447498 D01v06 FCC KDB Publication 865664 D01v01r04 FCC KDB Publication KDB 616217 D04v01r02 IEEE Std. 1528-2013 FCC 47CFR §2.1093 ANSI C95.1-2005
Test Result	:	Max. SAR Measurement (1g) 2.4G Wi-Fi: **1.001** W/kg 5 G Wi-Fi:**0.948** W/kg 2.4G Wi-Fi+BT：**1.201** W/kg
Performed Location	:	DEKRA Testing and Certification (Suzhou) Co., Ltd. No.99 Hongye Rd., Suzhou Industrial Park, Suzhou, 215006, Jiangsu, China TEL: +86-512-6251-5088 / FAX: +86-512-6251-5098 FCC Designation Number: CN1199

Documented By : Kathy Feng

Reviewed By : Frank he

Approved By : Jack zhang

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Description **Page**

History of This Test Report

REPORT NO.	VERSION	DESCRIPTION	ISSUED DATE
1862087R-RF-US-P06V03	V1.0	Initial Issued Report	Oct. 24, 2018
1862087R-RF-US-P06V03	V1.1	1) We added the information of YAGEO antenna on the section 1.1. 2) We added the output power of 2472MHz on the 802.11 b/g/n20 and 2462 on the n40 in page 29. 3) In the new SAR report, the host model that shows on section 9 is the same as the section 1.1. 4) We redid the 5600MHz and 5750MHz system checks.	Nov. 22, 2018
1862087R-RF-US-P06V03	V1.2	1) We have explained that in page 30. 2) Since the dipole antenna calibration are more than one year ，We increased the return loss and impedance in page 83-86. 3) The “Cali. Due date” is same thing in page 24.	Nov. 26, 2018

1. General Information

1.1. EUT Description

Product Name	802.11a/b/g/n/ac RTL8821CE Combo module
Brand Name	ASUS
Model No.	RTL8821CE
Host Equipment Name	Notebook PC
Model No	TP401M,R406M,J401M
Working Voltage	100-240V~50/60Hz 0.8A
Frequency Range	**For 2.4GHz Band** 802.11b/g/n/ac(20MHz): 2412~2472MHz 802.11n/ac(40MHz): 2422~2462MHz **For 5GHz Band** 802.11a/n/ac(20MHz): 5180~5320MHz, 5500~5580MHz, 5660~5720MHz, 5745~5825MHz 802.11n/ac(40MHz): 5190~5310MHz, 5510~5710MHz, 5755~5795MHz 802.11ac(80MHz):5210MHz,5290MHz,5530MHz,5610MHz ,5690MHz ,5775MHz
Channel Number	**For 2.4GHz Band** 802.11b/g/n(20MHz): 13 802.11n(40MHz): 9 **For 5GHz Band** 802.11a/n/ac(20MHz): 25 802.11n/ac(40MHz): 12 802.11ac(80MHz): 6
Type of Modulation	802.11b: DSSS
	802.11a/b/g/n/ac: OFDM
Data Rate	802.11b: 1/2/5.5/11 Mbps
	802.11a: 6/9/12/18/24/36/48/54 Mbps
	802.11n: up to 150 Mbps
	802.11ac: up to 433.3 Mbps
Antenna Type	Reference to Antenna List
Peak Antenna Gain	Reference to Antenna List
Power Adapter	MFR: PI, M/N: AD2088320 Input: AC100-240V, 50-60Hz, 0.8A Output: DC 19V,1.75A

Note1: The host equipment is both a notebook and tablet.

2: Different models are only for different market. There is not any change in design, circuitry or construction for this device, including RF parameters (antenna, software, firmware and hardware versions, power, frequency ranges, etc.) TP401M was used for testing.

802.11a/b/g/n/ac Antenna List

Antenna	Manufacturer	Model No.	Used in Host Type	Peak Gain
PIFA Antenna	YAGEO	ANTA0AA12061WLAN1	TP401M,R406M,J401M	1.86dBi for 2.4G(NB) 1.83dBi for 2.4G(TABLET) -0.06dBi for 5G(NB) -0.11dBi for 5G(TABLET)
		ANTA0AA12061WLAN2		0.44dBi for 2.4G(NB) 0.42dBi for 2.4G(TABLET) -0.43dBi for 5G(NB) -0.46dBi for 5G(TABLET)
PIFA Antenna	INPAQ	METP401-1-NH / AN-000219B-001H/ WA-F-LB-02-119(Main)	TP401M,R406M,J401M	-0.43dBi for 2.4G -0.32dBi for 5.2G -0.70dBi for 5.5G -0.23dBi for 5.8G
		METP401-2-NH / AN-000430B-001H/ WA-F-LB-01-047(Aux)		-0.58dBi for 2.4G -1.39dBi for 5.2G -0.86dBi for 5.5G -0.49dBi for 5.8G
Note:The test value of YAGEO antenna is smaller than that of INPAQ antenna,we only need to measure INPAQ antenna				

For 2.4GHz Band

802.11b/g/n/ac(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
01	2412 MHz	02	2417 MHz	03	2422 MHz	04	2427 MHz
05	2432 MHz	06	2437 MHz	07	2442 MHz	08	2447 MHz
09	2452 MHz	10	2457 MHz	11	2462 MHz	12	2467 MHz
13	2472 MHz	N/A	N/A	N/A	N/A	N/A	N/A
802.11n/ac(40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
03	2422 MHz	04	2427 MHz	05	2432 MHz	06	2437 MHz
07	2442 MHz	08	2447 MHz	09	2452 MHz	10	2457 MHz
11	2462 MHz	N/A	N/A	N/A	N/A	N/A	N/A

For 5.0GHz Band

802.11a/n/ac(20MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
36	5180 MHz	40	5200 MHz	44	5220 MHz	48	5240 MHz
52	5260 MHz	56	5280 MHz	60	5300 MHz	64	5320 MHz
100	5500 MHz	104	5520 MHz	108	5540 MHz	112	5560 MHz
116	5580 MHz	120	5600 MHz	124	5620 MHz	128	5640 MHz
132	5660 MHz	136	5680 MHz	140	5700 MHz	144	5720 MHz
149	5745 MHz	153	5765 MHz	157	5785 MHz	161	5805 MHz
165	5825 MHz	N/A	N/A	N/A	N/A	N/A	N/A
802.11n/ac(40MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
38	5190 MHz	46	5230 MHz	54	5270 MHz	62	5310 MHz
102	5510 MHz	110	5550 MHz	118	5590 MHz	126	5630 MHz
134	5670 MHz	142	5710 MHz	151	5755 MHz	159	5795 MHz
802.11ac(80MHz) Working Frequency of Each Channel:							
Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
42	5210 MHz	58	5290 MHz	106	5530MHz	122	5610 MHz
138	5690 MHz	155	5775MHz	N/A	N/A	N/A	N/A

1.2. Test Environment

Ambient conditions in the laboratory:

Items	**Required**	**Actual**
Temperature (°C)	18-25	21.5± 2
Humidity (%RH)	30-70	52

1.3. Power Reduction for SAR

RF Power in this host configuration is maintained at fixed levels reduced from the original modular filing. No sensor based or switched power reduction is implemented in this host configuration.

1.4. Guidance Documents

1) FCC KDB Publication 447498 D01v06 (General SAR Guidance)
2) FCC KDB Publication 865664 D01v01r04 (SAR measurement 100 MHz to 6 GHz)
3) FCC KDB Publication 248227 D01v02r02 (SAR Considerations for 802.11 Devices)
4) FCC KDB Publication 616217 D04 v01r02 (SAR Evaluation Considerations for Laptop, Notebook,

Netbook and Tablet Computers)

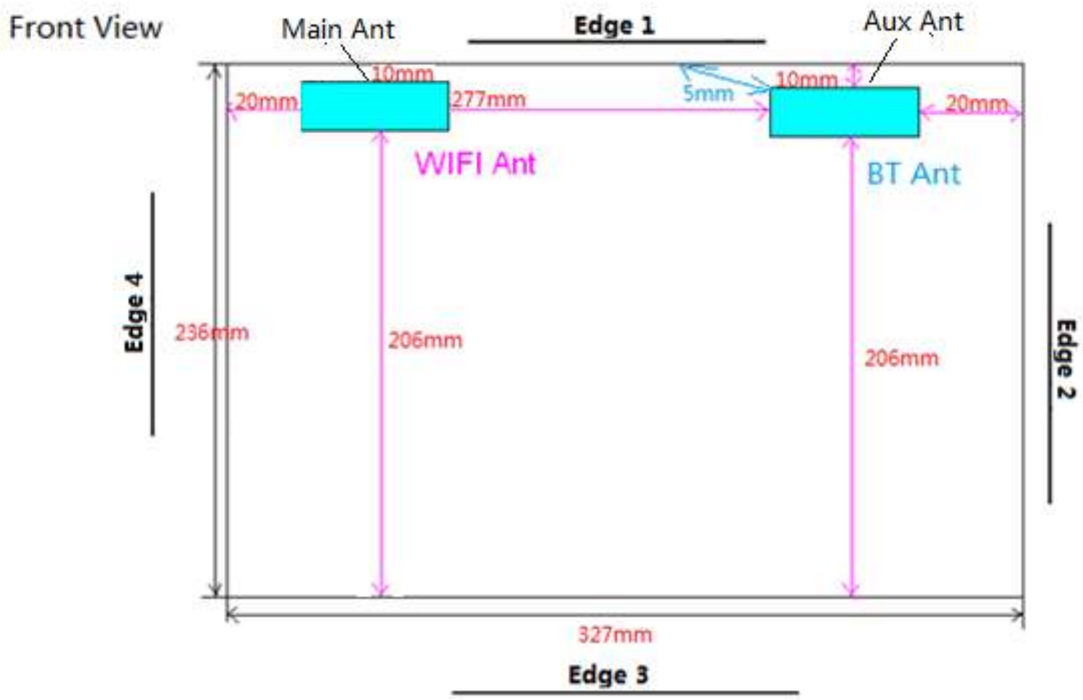
5) IEEE Std. 1528-2013 (IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques)

6) IEC 62209-2: 2010 (Human exposure to radio frequency fields from hand- held and bodymounted wireless communication devices — Human models, instrumentation, and procedures)

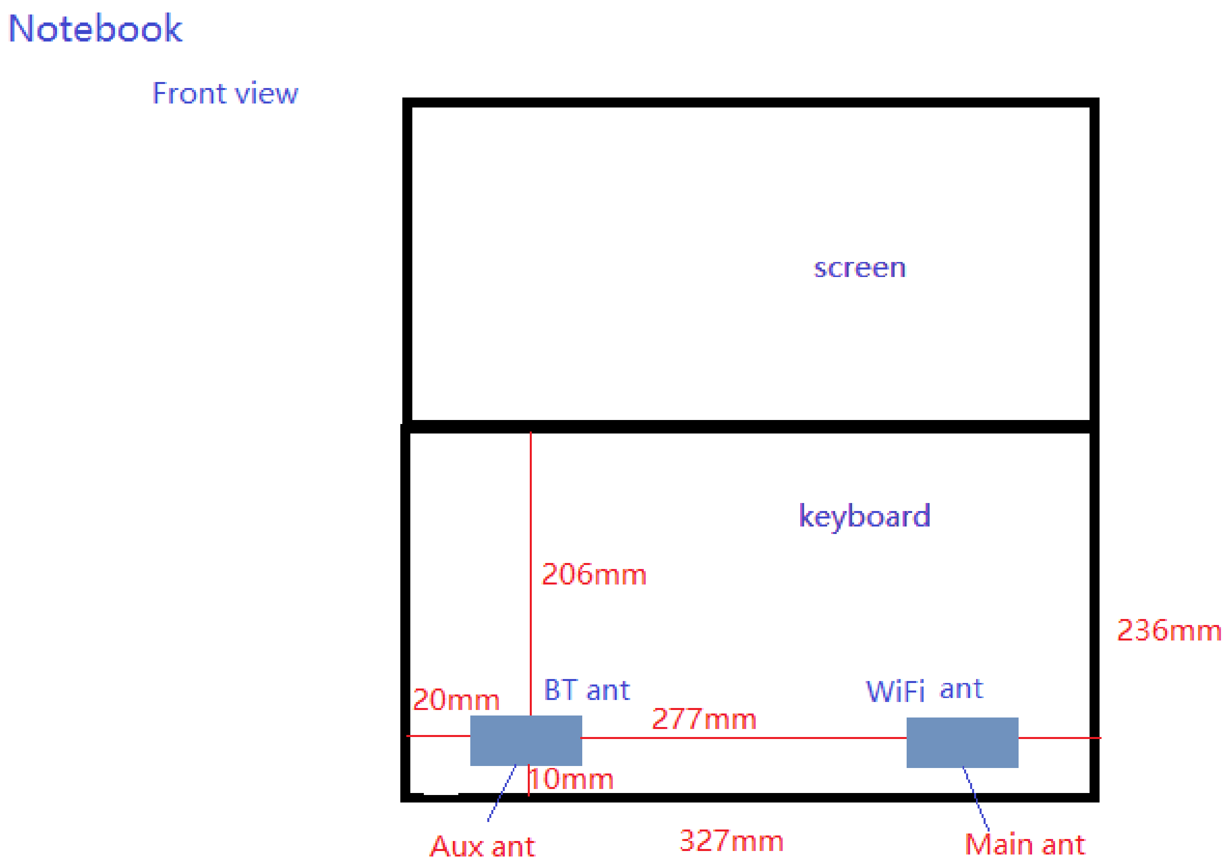
7) FCC 47CFR §2.1093 Radiofrequency radiation exposure evaluation: portable devices

8) ANSI C95.1-2005 - IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

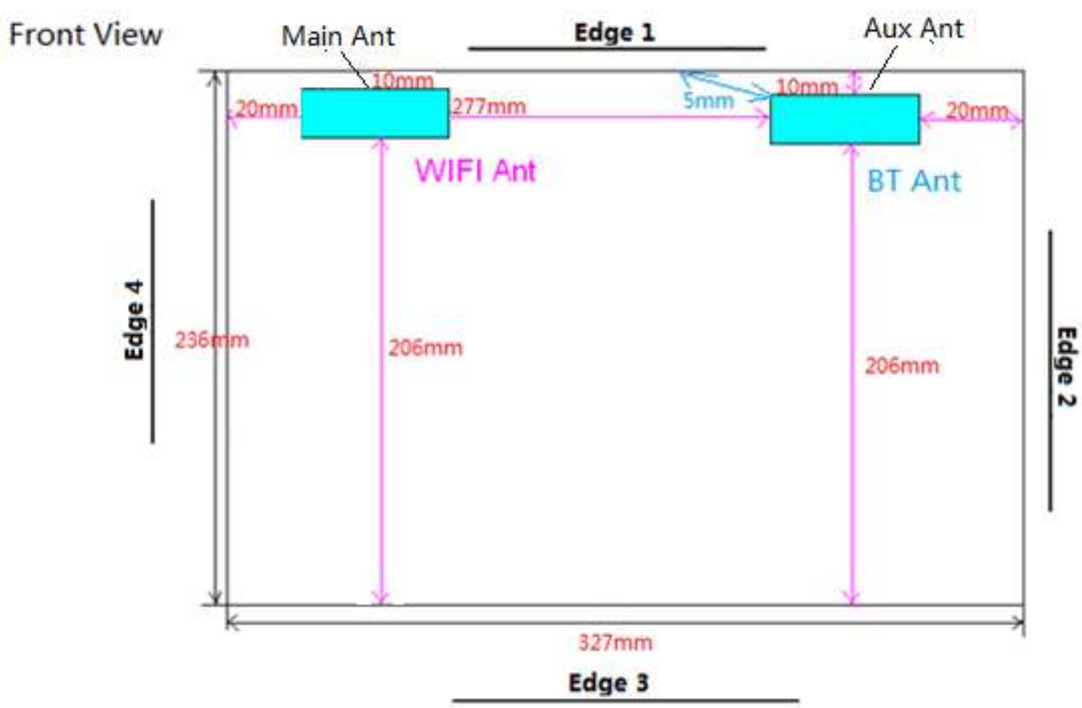
Tablet(YAGEO)



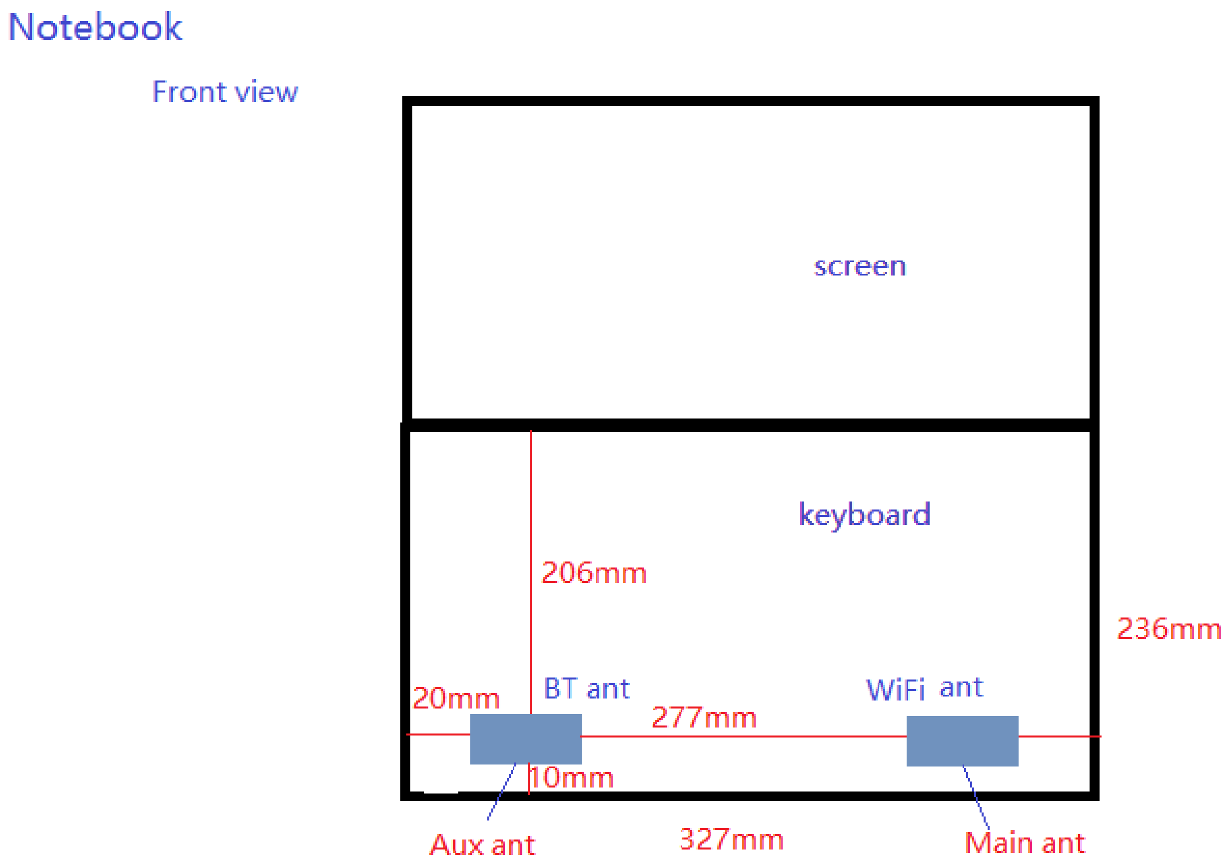
NB(YAGEO)



Tablet(INPAQ)



NB(INPAQ)


Notebook
Front view
screen
keyboard
206mm
236mm
20mm
BT ant
277mm
WiFi ant
10mm
Aux ant
327mm
Main ant

1.5. Simultaneous Transmission Configurations

According to FCC KDB Publication 447498 D01v06,transmitter are considered to be transmitting simultaneously when there is overlapping transmission, with the exception of transmissions during network hand-offs with maximum hand-off duration less than 30 seconds. This device contains multiple transmitters that may operate simultaneously, and therefore requires a simultaneously transmission analysis according to FCC KDB Publication 447498 D01v06 procedures.

Table 1-1

Simultaneous Transmission Scenarios

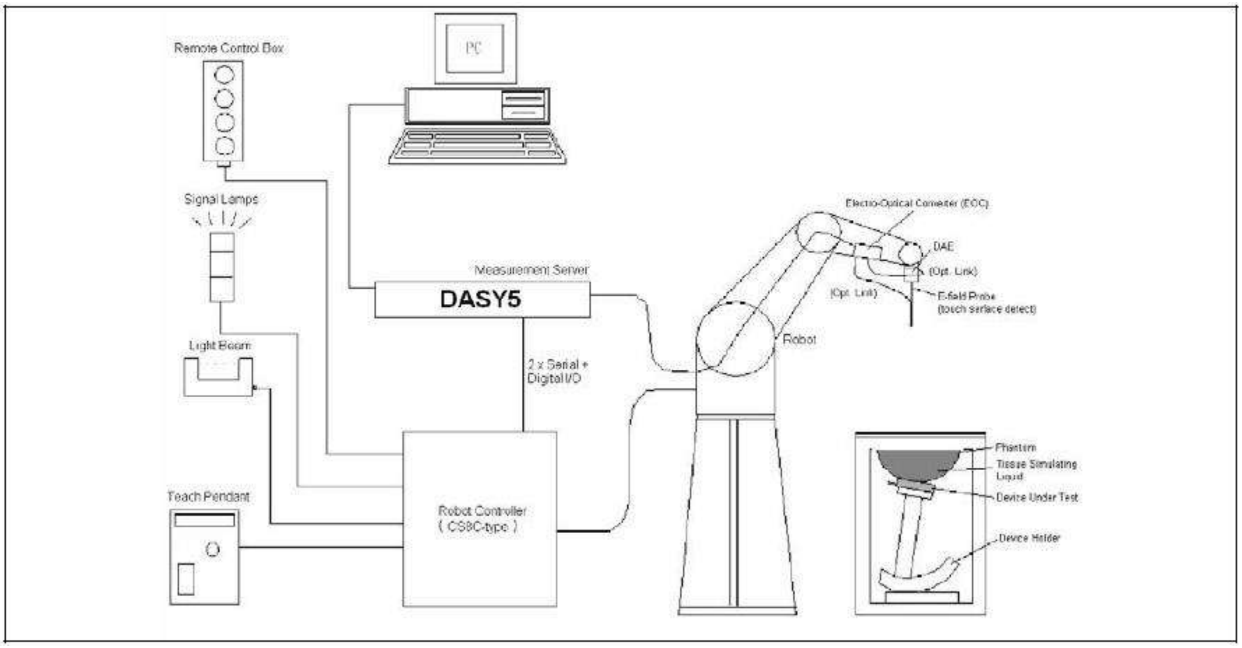
Ref.	Simultaneous Transmit Configurations	Head	Body-Worn
		IEEE1528	FCC KDB447498 D01V06
1	5GHz Wi-Fi + BT	No	Yes

Note1: The 2.4G WLAN and 5G WLAN cannot transmit simultaneously.

2: The 2.4G WLAN and BT cannot transmit simultaneously.

2. SAR Measurement System

2.1. DASY5 System Description



The DASY5 system for performing compliance tests consists of the following items:

- A standard high precision 6-axis robot with controller, teach pendant and software. An arm extension for accommodating the data acquisition electronics (DAE).
- A data acquisition electronics (DAE) which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.
- The Electro-optical converter (EOC) performs the conversion from optical to electrical signals for the digital communication to the DAE. To use optical surface detection, a special version of the EOC is required. The EOC signal is transmitted to the measurement server.
- The Light Beam used is for probe alignment. This improves the (absolute) accuracy of the probe positioning.
- A computer running WinXP and the DASY5 software.
- Remote control and teach pendant as well as additional circuitry for robot safety such as warning lamps, etc.
- The phantom, the device holder and other accessories according to the targeted measurement.

2.1.1. Applications

Predefined procedures and evaluations for automated compliance testing with all worldwide standards, e.g., IEEE 1528, OET 65, IEC 62209-1, IEC 62209-2, EN 50360, EN 50383 and others.

2.1.2. Area Scans

Area scans are defined prior to the measurement process being executed with a user defined variable spacing between each measurement point (integral) allowing low uncertainty measurements to be conducted. Scans defined for FCC applications utilize a 10mm^2 step integral, with 1mm interpolation used to locate the peak SAR area used for zoom scan assessments.

When an Area Scan has measured all reachable points, it computes the field maxima found in the scanned area, within a range of the global maximum. The range (in dB) is specified in the standards for compliance testing. For example, a 2 dB range is required in IEEE 1528-2013, EN 50361 and IEC 62209 standards, whereby 3 dB is a requirement when compliance is assessed in accordance with the ARIB standard (Japan).

2.1.3. Zoom Scan (Cube Scan Averaging)

Zoom Scans are used to assess the peak spatial SAR values within a cubic averaging volume containing 1 g and 10 g of simulated tissue. A density of 1000 kg/m^3 is used to represent the head and body tissue density and not the phantom liquid density, in order to be consistent with the definition of the liquid dielectric properties, i.e. the side length of the 1 g cube is 10mm, with the side length of the 10 g cube 21,5mm.

The zoom scan integer steps can be user defined so as to reduce uncertainty, but normal practice for typical test applications utilize a physical step of 7x7x7 (5mmx5mmx5mm) providing a volume of 30mm in the X & Y axis, and 30mm in the Z axis.

2.1.4. Uncertainty of Inter-/Extrapolation and Averaging

In order to evaluate the uncertainty of the interpolation, extrapolation and averaged SAR calculation algorithms of the Postprocessor, DASY5 allows the generation of measurement grids which are artificially predefined by analytically based test functions. Therefore, the grids of area scans and zoom scans can be filled with uncertainty test data, according to the SAR benchmark functions of IEEE 1528.The three analytical functions shown in equations as below are used to describe the possible range of the expected SAR distributions for the tested handsets. The field gradients are covered by the spatially flat distribution f1, the spatially steep distribution f3 and f2 accounts for H-field cancellation on the phantom/tissue surface.

$$f_1(x,y,z) = Ae^{-\frac{z}{2a}}\cos^2\left(\frac{\pi}{2}\frac{\sqrt{x'^2+y'^2}}{5a}\right)$$
$$f_2(x,y,z) = Ae^{-\frac{z}{a}}\frac{a^2}{a^2+x'^2}\left(3-e^{-\frac{2z}{a}}\right)\cos^2\left(\frac{\pi}{2}\frac{y'}{3a}\right)$$
$$f_3(x,y,z) = A\frac{a^2}{\frac{a^2}{4}+x'^2+y'^2}\left(e^{-\frac{2z}{a}}+\frac{a^2}{2(a+2z)^2}\right)$$

2.2. DASY5 E-Field Probe

The SAR measurement is conducted with the dosimetric probe manufactured by SPEAG. The probe is specially designed and calibrated for use in liquid with high permittivity. The dosimetric probe has special calibration in liquid at different frequency.

SPEAG conducts the probe calibration in compliance with international and national standards (e.g. IEEE 1528, EN 62209-1, IEC 62209, etc.) under ISO 17025. The calibration data are in Appendix D**.**

2.2.1. Isotropic E-Field Probe Specification

<table>
<tr><td>Model</td><td colspan="2">EX3DV4</td></tr>
<tr><td>Construction</td><td colspan="2">Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)</td></tr>
<tr><td>Frequency</td><td>10 MHz to 6 GHz
Linearity: ± 0.2 dB (30 MHz to 6 GHz)</td><td rowspan="4"></td></tr>
<tr><td>Directivity</td><td>± 0.3 dB in HSL (rotation around probe axis)
± 0.5 dB in tissue material (rotation normal to probe axis)</td></tr>
<tr><td>Dynamic Range</td><td>10 µW/g to 100 mW/g
Linearity: ± 0.2 dB (noise: typically < 1 µW/g)</td></tr>
<tr><td>Dimensions</td><td>Overall length: 330 mm (Tip: 20 mm)
Tip diameter: 2.5 mm (Body: 12 mm)
Typical distance from probe tip to dipole centers: 1 mm</td></tr>
<tr><td>Application</td><td colspan="2">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%.</td></tr>
</table>

2.3. Boundary Detection Unit and Probe Mounting Device

The DASY probes use a precise connector and an additional holder for the probe, consisting of a plastic tube and a flexible silicon ring to center the probe. The connector at the DAE is flexibly mounted and held in the default position with magnets and springs. Two switching systems in the connector mount detect frontal and lateral probe collisions and trigger the necessary software response.

2.4. DATA Acquisition Electronics (DAE) and Measurement Server

The data acquisition electronics (DAE) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit.
Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.
The input impedance of the DAE4 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

The DASY5 measurement server is based on a PC/104 CPU board with a 400MHz intel ULV Celeron, 128MB chipdisk and 128MB RAM. The necessary circuits for communication with the DAE electronics box, as well as the 16 bit AD converter system for optical detection and digital I/O interface are contained on the DASY5 I/O board, which is directly connected to the PC/104 bus of the CPU board.

2.5. Robot

The DASY5 system uses the high precision robots TX90 XL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY5 system, the CS8C robot controller version from Stäubli is used.
The XL robot series have many features that are important for our application:

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

2.6. Light Beam Unit

The light beam switch allows automatic "tooling" of the probe. During the process, the actual position of the probe tip with respect to the robot arm is measured, as well as the probe length and the horizontal probe offset. The software then corrects all movements, such that the robot coordinates are valid for the probe tip.
The repeatability of this process is better than 0.1 mm. If a position has been taught with an aligned probe, the same position will be reached with another aligned probe within 0.1 mm, even if the other probe has different dimensions. During probe rotations, the probe tip will keep its actual position.

2.7. Device Holder

The DASY5 device holder is designed to cope with different positions given in the standard. It has two scales for the device rotation (with respect to the body axis) and the device inclination (with respect to the line between the ear reference points). The rotation center for both scales is the ear reference point (EPR).
Thus the device needs no repositioning when changing the angles.
The DASY5 device holder has been made out of low-loss POM material having the following dielectric parameters: relative permittivity εr =3 and loss tangent δ = 0.02. The amount of dielectric material has been reduced in the closest vicinity of the device, since measurements have suggested that the influence of the clamp on the test results could thus be lowered.

2.8. SAM Twin Phantom

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

- ➢ Left head
- ➢ Right head
- ➢ Flat phantom

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

3. Tissue Simulating Liquid

3.1. The composition of the tissue simulating liquid

INGREDIENT (% Weight)	2450MHz Body	5250MHz Body	5600MHz Body	5750MHz Body
Water	73.2	75.68	75.68	75.68
Salt	0.01	0.43	0.43	0.43
Sugar	0.00	0.00	0.00	0.00
HEC	0.00	0.00	0.00	0.00
Preventol	0.00	0.00	0.00	0.00
DGBE	26.7	4.42	4.42	4.42
Triton X-100	0.00	19.47	19.47	19.47

3.2. Tissue Calibration Result

The dielectric parameters of the liquids were verified prior to the SAR evaluation using DASY5 Dielectric Probe Kit and Agilent Vector Network Analyzer E5071C

For FCC:

Body Tissue Simulant Measurement				
Frequency [MHz]	Description	Dielectric Parameters		Tissue Temp. [°C]
		ε r	σ [s/m]	
2450MHz	Reference result ± 5% window	52.7 50.07 to 55.34	1.95 1.85 to 2.05	N/A
	10-18-2018	52.25	1.95	21.0
5250MHz	Reference result ± 5% window	49.0 46.55 to 51.45	5.36 5.09 to 5.63	N/A
	10-18-2018	49.2	5.41	21.0
5600MHz	Reference result ± 5% window	48.5 46.10 to 50.90	5.77 5.48 to 6.06	N/A
	10-18-2018	48.15	5.87	21.0
5750MHz	Reference result ± 5% window	48.3 45.86 to 50.69	5.94 5.65 to 6.24	N/A
	10-18-2018	47.84	6.09	21.0
5250MHz	Reference result ± 5% window	49.0 46.55 to 51.45	5.36 5.09 to 5.63	N/A
	12-05-2018	49.19	5.37	21.0
5600MHz	Reference result ± 5% window	48.5 46.10 to 50.90	5.77 5.48 to 6.06	N/A
	12-05-2018	48.2	5.85	21.0
5750MHz	Reference result ± 5% window	48.3 45.86 to 50.69	5.94 5.65 to 6.24	N/A
	12-05-2018	47.72	6.12	21.0

3.3. Tissue Dielectric Parameters for Head and Body Phantoms

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

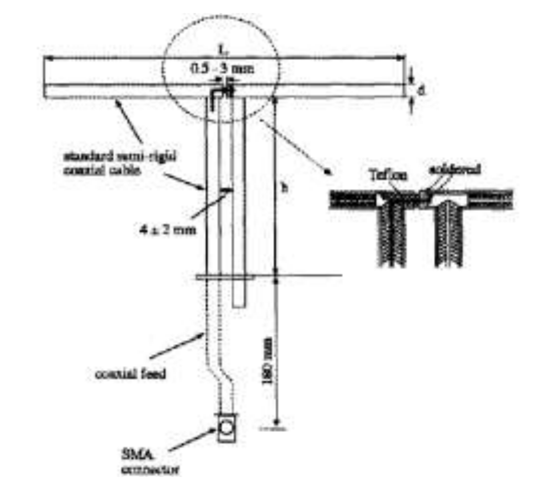
Target Frequency	Head		Body	
(MHz)	ε_r	σ (S/m)	ε_r	σ (S/m)
150	52.3	0.76	61.9	0.80
300	45.3	0.87	58.2	0.92
450	43.5	0.87	56.7	0.94
835	41.5	0.90	55.2	0.97
900	41.5	0.97	55.0	1.05
915	41.5	0.98	55.0	1.06
1450	40.5	1.20	54.0	1.30
1610	40.3	1.29	53.8	1.40
1800 – 2000	40.0	1.40	53.3	1.52
2450	39.2	1.80	**52.3**	**1.95**
3000	38.5	2.40	52.0	2.73
5800	35.3	5.27	**48.6**	**6.19**

(ε_r = relative permittivity, σ = conductivity and ρ = 1000 kg/m^3)

4. SAR Measurement Procedure

4.1. SAR System Validation

4.1.1. Validation Dipoles



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

Frequency	L (mm)	h (mm)	d (mm)
2450MHz	53.5	30.4	3.6
5GHz	20.6	14.2	3.6

4.1.2. Validation Result

System Performance Check at 2450MHz, 5250,5600,5750MHz for Body **Validation Dipole: D2450V2, SN: 839**				
2450 MHz	Reference result ± 10% window	49.8 44.82 to 54.78	23.3 20.97 to 25.63	N/A
	10-18-2018	50.0	22.8	21.0
Validation Dipole: D5GHzV2, SN: 1203				
5250 MHz	Reference result ± 10% window	73.7 66.33 to 81.07	20.8 18.72 to 22.88	N/A
	10-18-2018	76.8	21.9	21.0
5250 MHz	Reference result ± 10% window	73.7 66.33 to 81.07	20.8 18.72 to 22.88	N/A
	12-05-2018	79.1	21.8	21.0
5600 MHz	Reference result ± 10% window	78.8 70.92 to 86.68	22.3 20.07 to 24.53	N/A
	10-18-2018	79.4	23.8	21.0
5600 MHz	Reference result ± 10% window	78.8 70.92 to 86.68	22.3 20.07 to 24.53	N/A

	12-05-2018	80.5	21.9	21.0
5750 MHz	Reference result ± 10% window	75.2 67.68 to 82.72	21.1 18.99 to 23.21	N/A
	10-18-2018	76.3	21.7	21.0
5750 MHz	Reference result ± 10% window	75.2 67.68 to 82.72	21.1 18.99 to 23.21	N/A
	12-05-2018	79.6	21.2	21.0
Note: All SAR values are normalized to 1W forward power.				

4.2. SAR Measurement Procedure

The DASY 5 calculates SAR using the following equation,

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

σ: represents the simulated tissue conductivity

ρ: represents the tissue density

The EUT is set to transmit at the required power in line with product specification, at each frequency relating to the LOW, MID, and HIGH channel settings.

Pre-scans are made on the device to establish the location for the transmitting antenna, using a large area scan in either air or tissue simulation fluid.

The EUT is placed against the Universal Phantom where the maximum area scan dimensions are larger than the physical size of the resonating antenna. When the scan size is not large enough to cover the peak SAR distribution, it is modified by either extending the area scan size in both the X and Y directions, or the device is shifted within the predefined area.

The area scan is then run to establish the peak SAR location (interpolated resolution set at $1mm^2$) which is then used to orient the center of the zoom scan. The zoom scan is then executed and the 1g and 10g averages are derived from the zoom scan volume (interpolated resolution set at $1mm^3$).

4.3. SAR Measurement Conditions for 802.11 Device

4.3.1. Duty Factor Control

Unless it is permitted by specific KDB procedures or continuous transmission is specifically restricted by the device, the reported SAR must be scaled to 100% transmission duty factor to determine compliance at the maximum tune-up tolerance limit.

4.3.2. Initial Test Position SAR Test Reduction Procedure

DSSS and OFDM configurations are considered separately according to the required SAR procedures. SAR is measured in the initial test position using the 802.11 transmission mode configuration required by the DSSS procedure or initial test configuration and subsequent test configuration(s) according to the OFDM procedures.16 The initial test position procedure is described in the following:

When the reported SAR of the initial test position is ≤ 0.4 W/kg, further SAR measurement is not required for the other (remaining) test positions in that exposure configuration and 802.11 transmission mode combinations within the frequency band or aggregated band. SAR is also not required for that exposure configuration in the subsequent test configuration(s).

a) When the reported SAR of the initial test position is > 0.4 W/kg, SAR is repeated for the 802.11 transmission mode configuration tested in the initial test position using subsequent highest extrapolated or estimated 1-g SAR conditions determined by area scans or next closest/smallest test separation distance and maximum RF coupling test positions based on manufacturer justification, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.

b) For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.
Additional power measurements may be required for this step, which should be limited to those necessary for identifying the subsequent highest output power channels.

5. SAR Exposure Limits

SAR assessments have been made in line with the requirements of IEEE-1528, FCC Supplement C, and comply with ANSI/IEEE C95.1-1992 “Uncontrolled Environments” limits. These limits apply to a location which is deemed as “Uncontrolled Environment” which can be described as a situation where the general public may be exposed to an RF source with no prior knowledge or control over their exposure.

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

Type Exposure	Uncontrolled Environment Limit
Spatial Peak SAR (1g cube tissue for brain or body)	1.60 W/kg
Spatial Average SAR (whole body)	0.08 W/kg
Spatial Peak SAR (10g for hands, feet, ankles and wrist)	4.00 W/kg

6. Test Equipment List

Instrument	Manufacturer	Model No.	Serial No.	Cali. Due Date
Stäubli Robot TX60L	Stäubli	TX60L	F10/5C90A1/A/01	N/A
Controller	Stäubli	SP1	S-0034	N/A
Dipole Validation Kits	Speag	D2400V2	839	2019.02.09
Dipole Validation Kits	Speag	D5GHzV2	1078	2019.02.09
SAM Twin Phantom	Speag	SAM	TP-1561/1562	N/A
Device Holder	Speag	SD 000 H01 HA	N/A	N/A
Data Acquisition Electronic	Speag	DAE4	1220	2019.02.08
E-Field Probe	Speag	EX3DV4	3710	2019.02.18
SAR Software	Speag	DASY5	V5.2 Build 162	N/A
Power Amplifier	Mini-Circuit	ZVA-183-S+	N657400950	N/A
Directional Coupler	Agilent	778D	20160	N/A
Universal Radio Communication Tester	R&S	CMU 200	117088	2019.03.10
Programmable Temperature & Humidity meter	Gaoyu	TH-1P-B	WIT-05121302	2019.01.04
Vector Network	Agilent	E5071C	MY48367267	2019.03.10
Signal Generator	Agilent	E4438C	MY49070163	2019.03.10
Power Meter	Anritsu	ML2495A	0905006	2019.10.29
Wide Bandwidth Sensor	Anritsu	MA2411B	0846014	2019.10.29

7. Measurement Uncertainty

DASY5 Uncertainty according to IEEE std. 1528-2013 Measurement uncertainty for 300 MHz to 3 GHz averaged over 1 gram / 10 gram.								
Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) V_{eff}
Measurement System								
Probe Calibration	±6.0%	N	1	1	1	±6.0%	±6.0%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.4%	R	$\sqrt{3}$	1	1	±0.2%	±0.2%	∞
Probe Positioning	±2.9%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Max. SAR Eval.	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±11.0%	±10.8%	387
Expanded STD Uncertainty						±22.0%	±21.5%	

DASY5 Uncertainty according to IEEE std. 1528-2013 Measurement uncertainty for 3 GHz to 6 GHz averaged over 1 gram / 10 gram.								
Error Description	Uncert. value	Prob. Dist.	Div.	(c_i) 1g	(c_i) 10g	Std. Unc. (1g)	Std. Unc. (10g)	(v_i) V_{eff}
Measurement System								
Probe Calibration	±6.55%	N	1	1	1	±6.55%	±6.55%	∞
Axial Isotropy	±4.7%	R	$\sqrt{3}$	0.7	0.7	±1.9%	±1.9%	∞
Hemispherical Isotropy	±9.6%	R	$\sqrt{3}$	0.7	0.7	±3.9%	±3.9%	∞
Boundary Effects	±2.0%	R	$\sqrt{3}$	1	1	±1.2%	±1.2%	∞
Linearity	±4.7%	R	$\sqrt{3}$	1	1	±2.7%	±2.7%	∞
System Detection Limits	±1.0%	R	$\sqrt{3}$	1	1	±0.6%	±0.6%	∞
Readout Electronics	±0.3%	N	1	1	1	±0.3%	±0.3%	∞
Response Time	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Integration Time	±2.6%	R	$\sqrt{3}$	1	1	±1.5%	±1.5%	∞
RF Ambient Noise	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
RF Ambient Reflections	±3.0%	R	$\sqrt{3}$	1	1	±1.7%	±1.7%	∞
Probe Positioner	±0.8%	R	$\sqrt{3}$	1	1	±0.5%	±0.5%	∞
Probe Positioning	±9.9%	R	$\sqrt{3}$	1	1	±5.7%	±5.7%	∞
Max. SAR Eval.	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Test Sample Related								
Device Positioning	±2.9%	N	1	1	1	±2.9%	±2.9%	145
Device Holder	±3.6%	N	1	1	1	±3.6%	±3.6%	5
Power Drift	±5.0%	R	$\sqrt{3}$	1	1	±2.9%	±2.9%	∞
Phantom and Setup								
Phantom Uncertainty	±4.0%	R	$\sqrt{3}$	1	1	±2.3%	±2.3%	∞
Liquid Conductivity (target)	±5.0%	R	$\sqrt{3}$	0.64	0.43	±1.8%	±1.2%	∞
Liquid Conductivity (meas.)	±2.5%	N	1	0.64	0.43	±1.6%	±1.1%	∞
Liquid Permittivity (target)	±5.0%	R	$\sqrt{3}$	0.6	0.49	±1.7%	±1.4%	∞
Liquid Permittivity (meas.)	±2.5%	N	1	0.6	0.49	±1.5%	±1.2%	∞
Combined Std. Uncertainty						±12.8%	±12.6%	330
Expanded STD Uncertainty						±25.6%	±25.2%	

8. Conducted Power Measurement

For 2.4GHz:

Test Mode	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
802.11b	2412	15.34	100	16.0	1.164
	2437	17.03	100	17.5	1.114
	2462	16.41	100	16.5	1.021
	2467	13.23	100	13.5	1.064
	2472	8.92	100	9.0	1.019
802.11g	2412	14.95	100	15.0	1.012
	2437	17.53	100	18.0	1.114
	2462	15.28	100	15.5	1.052
	2467	14.04	100	14.5	1.112
	2472	8.09	100	8.5	1.099
802.11n(20MHz)	2412	13.63	100	14.0	1.089
	2437	17.52	100	18.0	1.117
	2462	14.84	100	15.0	1.038
	2467	13.91	100	14.0	1.021
	2472	6.23	100	6.5	1.064
802.11n(40MHz)	2422	12.67	100	13.0	1.079
	2437	15.31	100	15.5	1.045
	2452	13.52	100	14.0	1.117
	2457	13.85	100	14.0	1.035
	2462	10.58	100	11.0	1.102

For 5GHz:

Mode 1: Transmit by 802.11a					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
36	5180	8.17	100	9.1	1.239
40	5200	8.95	100	9.1	1.035
44	5220	8.34	100	9.1	1.191
48	5240	8.38	100	9.1	1.180
52	5260	8.86	100	9.1	1.057
60	5300	8.53	100	9.1	1.140
64	5320	8.47	100	9.1	1.156
100	5500	8.45	100	9.1	1.161
114	5580	8.23	100	9.1	1.222
140	5700	8.81	100	9.1	1.069
149	5745	8.61	100	9.1	1.119
157	5785	8.35	100	9.1	1.189
165	5825	8.13	100	9.1	1.250
Mode 2: Transmit by 802.11n(20MHz)					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
36	5180	8.28	100	9.0	1.180
40	5200	8.45	100	9.0	1.135
44	5220	8.56	100	9.0	1.107
48	5240	8.92	100	9.0	1.019
52	5260	8.69	100	9.0	1.074
60	5300	8.13	100	9.0	1.222
64	5320	8.51	100	9.0	1.119
100	5500	8.33	100	9.0	1.167
114	5580	8.75	100	9.0	1.059
140	5700	8.54	100	9.0	1.112
149	5745	8.48	100	9.0	1.127
157	5785	8.35	100	9.0	1.161
165	5825	8.36	100	9.0	1.159

Mode 3: Transmit by 802.11n(40MHz)					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
38	5190	8.28	100	9.0	1.180
46	5230	8.41	100	9.0	1.146
54	5270	8.09	100	9.0	1.233
62	5310	8.57	100	9.0	1.104
102	5510	8.03	100	9.0	1.250
110	5550	8.57	100	9.0	1.104
132	5670	8.53	100	9.0	1.114
151	5755	8.75	100	9.0	1.059
159	5795	8.54	100	9.0	1.112
Mode 4: Transmit by 802.11ac(20MHz)					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
36	5180	8.57	100	9.0	1.104
40	5200	8.36	100	9.0	1.159
44	5220	8.64	100	9.0	1.086
48	5240	8.81	100	9.0	1.045
52	5260	8.61	100	9.0	1.094
60	5300	8.16	100	9.0	1.213
64	5320	8.45	100	9.0	1.135
100	5500	8.79	100	9.0	1.050
114	5580	8.89	100	9.0	1.026
140	5700	8.57	100	9.0	1.104
149	5745	8.48	100	9.0	1.127
157	5785	8.79	100	9.0	1.050
165	5825	8.54	100	9.0	1.112

Mode 5: Transmit by 802.11ac(40MHz)					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
38	5190	8.39	100	9.0	1.151
46	5230	8.46	100	9.0	1.132
54	5270	8.23	100	9.0	1.194
62	5310	8.83	100	9.0	1.040
102	5510	8.01	100	9.0	1.256
110	5550	8.61	100	9.0	1.094
132	5670	8.31	100	9.0	1.172
151	5755	8.55	100	9.0	1.109
159	5795	8.56	100	9.0	1.107
Mode 6: Transmit by 802.11ac(80MHz)					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
42	5210	8.16	100	9.0	1.213
58	5290	8.38	100	9.0	1.153
106	5530	8.23	100	9.0	1.194
155	5775	8.76	100	9.0	1.057

Note1:The output power is limited by SAR value.

Note2:The Tune-up power of 802.11a is the worst.

BT

Mode : Bluetooth-DH5					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
00	2402	3.58	100	4.00	1.102
39	2441	3.25	100	4.00	1.189
78	2480	3.78	100	4.00	1.052
Mode : Bluetooth-2DH5					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
00	2402	3.79	100	4.00	1.050
39	2441	3.28	100	4.00	1.180
78	2480	3.23	100	4.00	1.194
Mode : Bluetooth-3DH5					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor

00	2402	3.28	100	4.00	1.180
39	2441	3.43	100	4.00	1.140
78	2480	3.41	100	4.00	1.146
Mode : Bluetooth-BLE					
Channel No.	Frequency (MHz)	Avg. Power (dBm)	Duty cycle (%)	Tune-up Power (dBm)	Scaling Factor
00	2402	2.04	100	3.00	1.57
19	2440	2.15	100	3.00	1.53
39	2480	2.02	100	3.00	1.58

9. Test Procedures

9.1. SAR Test Results Summary

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.5 ± 2						Relative Humidity (%): 52			
Liquid Temperature (°C) : 21.0 ± 2						Depth of Liquid (cm):>15			
Product: 802.11a/b/g/n/ac RTL8821CE Combo module									
Frequency: 2412 ~ 2472 MHz									
Test Mode: 802.11b									
PAD(INPAQ)									
Test Position Body (0mm gap)	Antenna Position	Frequency (MHz)	Frame Power (dBm)	Power Drift (<±0.2)	SAR 1g (W/kg)	Scaling Factor	Duty factor	Scaled SAR 1g (W/kg)	Limit (W/kg)
Back	Fixed	2437	17.03	0.03	0.899	1.114	1.0	**1.001**	1.6
Back*	Fixed	2437	17.03	-0.12	0.830	1.114	1.0	0.925	1.6
Back	Fixed	2462	16.41	0.16	0.466	1.021	1.0	0.476	1.6
Edge 1	Fixed	2437	17.03	0.09	0.289	1.114	1.0	0.322	1.6
Edge 4	Fixed	2437	17.03	0.14	0.055	1.114	1.0	0.061	1.6
PAD(YAGEO)									
Back	Fixed	2437	17.03	0.13	0.816	1.114	1.0	0.909	1.6
Edge 1	Fixed	2437	17.03	-0.08	0.137	1.114	1.0	0.153	1.6
NB(INPAQ)									
Bottom	Fixed	2437	17.03	-0.03	0.445	1.114	1.0	0.496	1.6

Note 1: * - repeated at the highest measured SAR according to the FCC KDB 865664

2: When the reported SAR of the initial test position is > 0.4 W/kg, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.

3: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

4: Reported SAR were scaled to the maximum duty factor to demonstrate compliance per FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02.

5: All the tests were bsed on the host(Host name: Notebook PC;Host model: TP401M.

6: The test value of YAGEO antenna is smaller than that of INPAQ antenna, we only need to measure INPAQ antenna in the report.

SAR MEASUREMENT									
Ambient Temperature (°C) : 21.5 ± 2						Relative Humidity (%): 52			
Liquid Temperature (°C) : 21.0 ± 2						Depth of Liquid (cm):>15			
Product: 802.11a/b/g/n/ac RTL8821CE Combo module									
Frequency: 5180~5825MHz									
Test Mode:802.11a									
PAD(INPAQ)									
Test Position Body (0mm gap)	Antenna Position	Frequency (MHz)	Frame Power (dBm)	Power Drift (<±0.2)	SAR 1g (W/kg)	Scaling Factor	Duty factor	Scaled SAR 1g (W/kg)	Limit (W/kg)
Back	Fixed	5200	8.95	0.06	0.916	1.035	1.0	**0.948**	1.6
Back*	Fixed	5200	8.95	0.11	0.896	1.035	1.0	0.927	1.6
Edge 1	Fixed	5200	8.95	0.19	0.185	1.035	1.0	0.191	1.6
Edge4	Fixed	5200	8.95	0.15	0.0139	1.035	1.0	0.014	1.6
Back	Fixed	5240	8.38	0.13	0.458	1.180	1.0	0.540	1.6
Back	Fixed	5260	8.86	0.15	0.770	1.057	1.0	0.814	1.6
Back	Fixed	5300	8.53	0.39	0.785	1.140	1.0	0.895	1.6
Back	Fixed	5580	8.23	0.14	0.707	1.222	1.0	0.864	1.6
Back	Fixed	5700	8.81	0.18	0.748	1.069	1.0	0.800	1.6
Back	Fixed	5745	8.61	0.27	0.750	1.119	1.0	0.839	1.6
Back	Fixed	5785	8.35	0.19	0.784	1.189	1.0	0.932	1.6
PAD(YAGEO)									
Back	Fixed	5200	8.95	0.07	0.882	1.035	1.0	0.913	1.6
NB(INPAQ)									
Bottom	Fixed	5200	8.95	0.23	0.447	1.035	1.0	0.463	1.6

Note 1: * - repeated at the highest measured SAR according to the FCC KDB 865664

2: When the reported SAR of the initial test position is > 0.4 W/kg, on the highest maximum output power channel, until the reported SAR is ≤ 0.8 W/kg or all required test positions (left, right, touch, tilt or subsequent surfaces and edges) are tested.

3: For all positions/configurations tested using the initial test position and subsequent test positions, when the reported SAR is > 0.8 W/kg, SAR is measured for these test positions/configurations on the subsequent next highest measured output power channel(s) until the reported SAR is ≤ 1.2 W/kg or all required channels are tested.

4: Reported SAR were scaled to the maximum duty factor to demonstrate compliance per FCC KDB

248227 D01 802.11 Wi-Fi SAR v02r02.

5: All the tests were bsed on the host(Host name: Notebook PC;Host model: TP401M

6: The test value of YAGEO antenna is smaller than that of INPAQ antenna, we only need to measure INPAQ antenna in the report.

7:NB bottom SAR value is less than PAD back value.

8: The tune up power of 802.11a is higher than other modes, so the 802.11a mode is shown in the report.

9.2. Test position and configuration

1. Liquid tissue depth was at least 15.0 cm for all frequencies.
2. The manufacturer has confirmed that the device(s) tested have the same physical, mechanical and thermal characteristics and are within operational tolerances expected for production units.
3. SAR results were scaled to the maximum allowed power to demonstrate compliance per FCC KDB Publication 447498 D01v06.
4. Reported SAR were scaled to the maximum duty factor to demonstrate compliance per FCC KDB 248227 D01 802.11 Wi-Fi SAR v02r02.
5. SAR was performed with the device configured in the positions according to KDB 447498 D01 SAR Procedures for general, body SAR was performed with the device to phantom separation distance of 0mm.
6. Because of the screen can ratating, so addition tests are performed at three positions(Edge 1, Back, Edge 4).

WLAN Notes:

When the maximum extrapolated peak SAR of the zoom scan for the maximum output channel is <1.6 W/kg and the reported 1g averaged SAR is <0.8 W/kg, SAR testing on other default channels is not required.

9.3. SAR Test Exclusions Applied

Wi-Fi/Bluetooth

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances<50mm is defined by the following equation:

$$\frac{Max\ Power\ of\ Channel\ (mW)}{Test\ Separation\ Dist\ (mm)} * \sqrt{Frequency(GHz)} \leq 3.0$$

Per FCC KDB 447498 D01v06, the SAR exclusion threshold for distances>50mm is defined by the following equation:

$$\frac{[\text{Power allowed at numeric threshold for 50 mm in step 1}) + (\text{Test separation distance} - 50\ \text{mm}) \cdot (\text{Frequency}(\text{MHz})/150)]\ \text{mW}}{\text{Test Separation Dist}(\text{mm})} * \sqrt{Frequency(GHz)}$$

The power exclusion threshold :

According to the maximum power of 2.4GHz WIFI, the maximum exclusion distance is 13.5mm, so the edge1; edge4 and back surface should be tested.

According to the maximum power of 5GHz WIFI, the maximum exclusion distance is 3.48mm, so the edge1; edge4 and back surface should be tested.

The maximum BT power is less than 10dBm(7dBm), so BT can be excluded.

Simultaneous Transmission Analysis

Estimation SAR of BT

2.4G Bluetooth Antenna	Separation distances(mm)	Tune-up（mW）	Estimation SAR(W/kg)	Test SAR(Y/N)
BT	5	5.0	0.2	N

Note: Based on the maximum conducted power of Bluetooth and the antenna to use separation distance,

[(*max. power of channel, including tune-up tolerance, mW*) / (*min. test separation distance, mm*)]·[$\sqrt{f_{(GHz)}}/x$] W/kg, for *test separation distances* $\leq$ 50 mm;

where $x = 7.5$ for 1-g SAR and $x = 18.75$ for 10-g SAR.

Simultaneous Transmission Scenario with Bluetooth

Simult Tx	Configuration	2.4G WLAN SAR (W/kg)	Estimation Bluetooth SAR (W/kg)	∑ SAR (W/kg)
Body	Back	1.001	0.2	1.201
	Configuration	5G WLAN SAR (W/kg)	Estimation Bluetooth SAR (W/kg)	∑ SAR (W/kg)
	Back	0.948	0.2	1.148

Appendix A. SAR System Validation Data

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

System Check Body 2450MHz

DUT: Dipole 2450 MHz D2450V2; Type: D2450V2

Communication System: UID 0, CW; Communication System Band: D2450(2450MHz); Duty Cycle: 1:1;

Frequency: 2450 MHz; Medium parameters used: f = 2450 MHz; σ = 1.95 S/m; εr = 52.25; ρ = 1000 kg/m3 ;

Phantom section: Flat Section ; Input Power=250mW

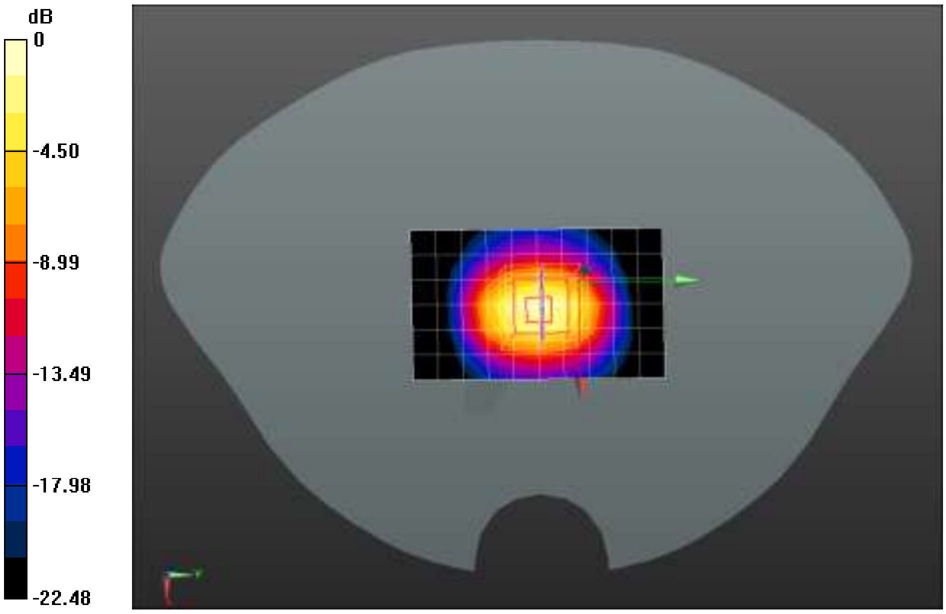
Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/System Check Body 2450MHz/Area Scan (7x11x1): Measurement grid: dx=10mm, dy=10mm, Maximum value of SAR (measured) = 11.9 W/kg

Configuration/System Check Body 2450MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm, Reference Value = 75.15 V/m; Power Drift = 0.02 Db;Peak SAR (extrapolated) = 24.7 W/kg;**SAR(1 g) = 12.5 W/kg; SAR(10 g) = 5.7 W/kg ;**Maximum value of SAR (measured) = 13.4 W/kg



0 dB = 13.4 W/kg = 11.27 dBW/kg

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

System Check Body 5250MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5250 MHz; Medium parameters used: f = 5250 MHz; σ = 5.41 S/m; εr = 49.2; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

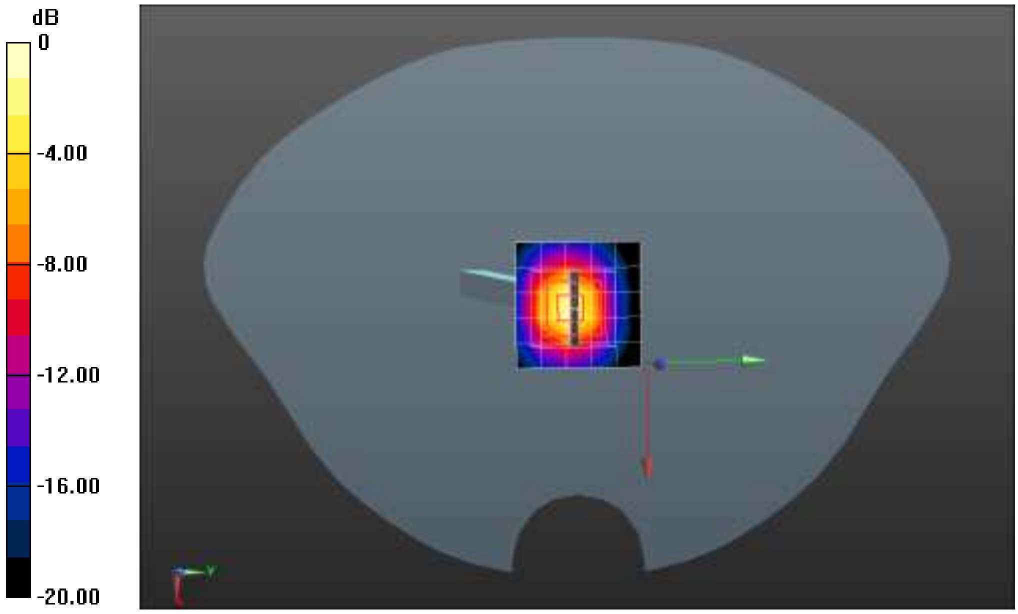
Configuration/Body 5250MHz/Area Scan (6x6x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 7.69 W/kg

Configuration/Body 5250MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;Reference Value = 39.37 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 43.5 W/kg

SAR(1 g) = 7.68 W/kg; SAR(10 g) = 2.19 W/kg;Maximum value of SAR (measured) = 9.61 W/kg



0 dB = 9.61 W/kg = 9.83 dBW/kg

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

System Check Body 5600MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5600 MHz; Medium parameters used: f = 5600 MHz; σ = 5.87 S/m; εr = 48.15; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(3.93, 3.93, 3.93); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

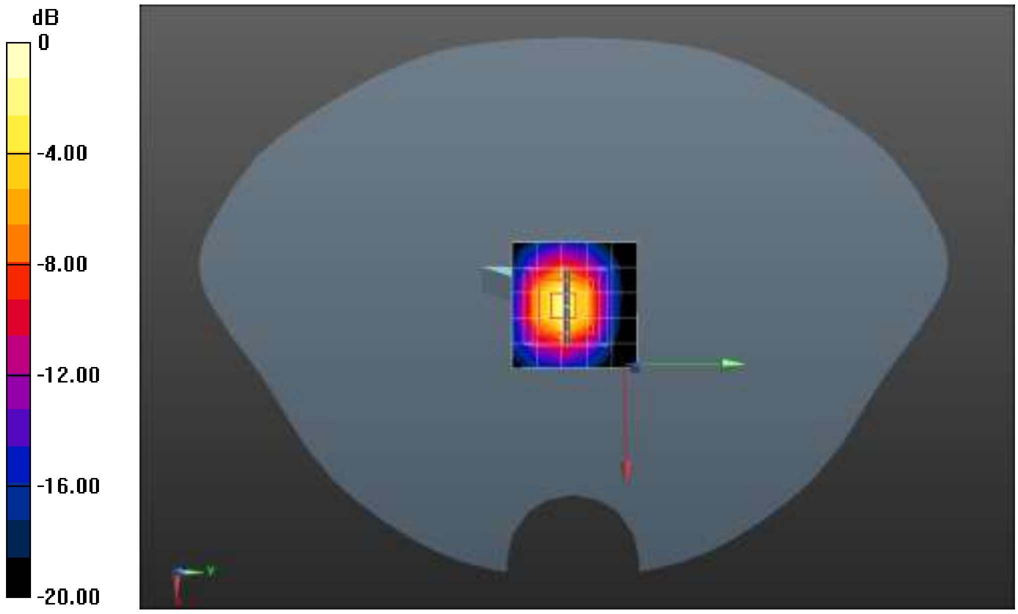
Configuration/Body 5600MHz/Area Scan (6x6x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 9.08 W/kg

Configuration/Body 5600MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;Reference Value = 41.00 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 70.5 W/kg

SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.38 W/kg;Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

System Check Body 5750MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5750 MHz; Medium parameters used: f = 5750 MHz; σ = 6.09 S/m; εr = 47.84; ρ = 1000 kg/m3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.06 4.06, 4.06); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

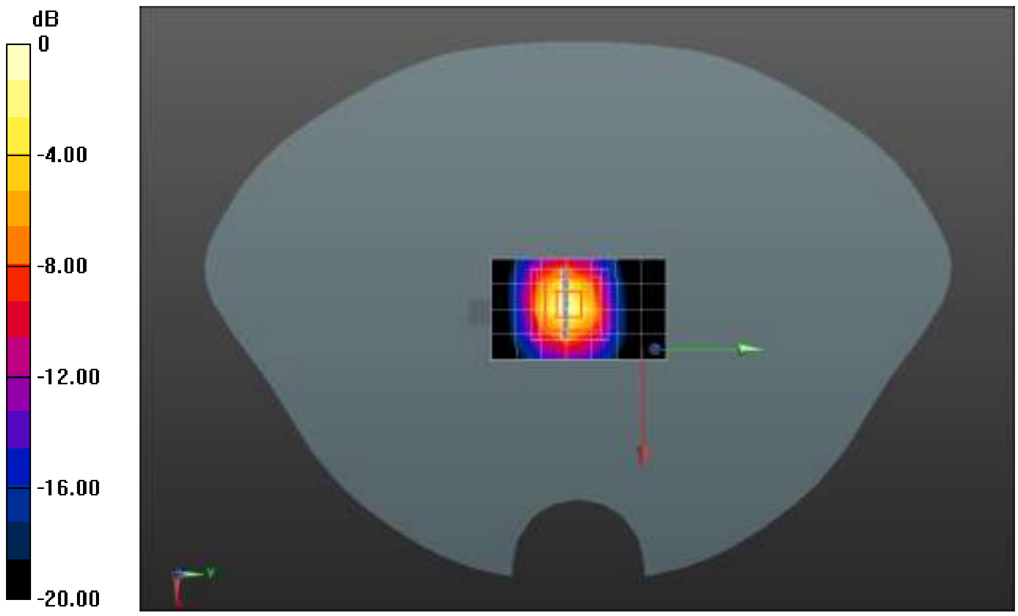
Configuration/Body 5750MHz/Area Scan (5x8x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 29.8 W/kg

Configuration/Body 5750MHz/Zoom Scan (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm;Reference Value = 45.49 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 61.2 W/kg

SAR(1 g) = 7.63 W/kg; SAR(10 g) = 2.11 W/kg;Maximum value of SAR (measured) = 28.6 W/kg



0 dB = 28.6 W/kg = 14.56 dBW/kg

Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

System Check Body 5250MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5250 MHz; Medium parameters used: f = 5250 MHz; σ = 5.37 S/m; ε_r = 49.19; ρ = 1000 kg/m^3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

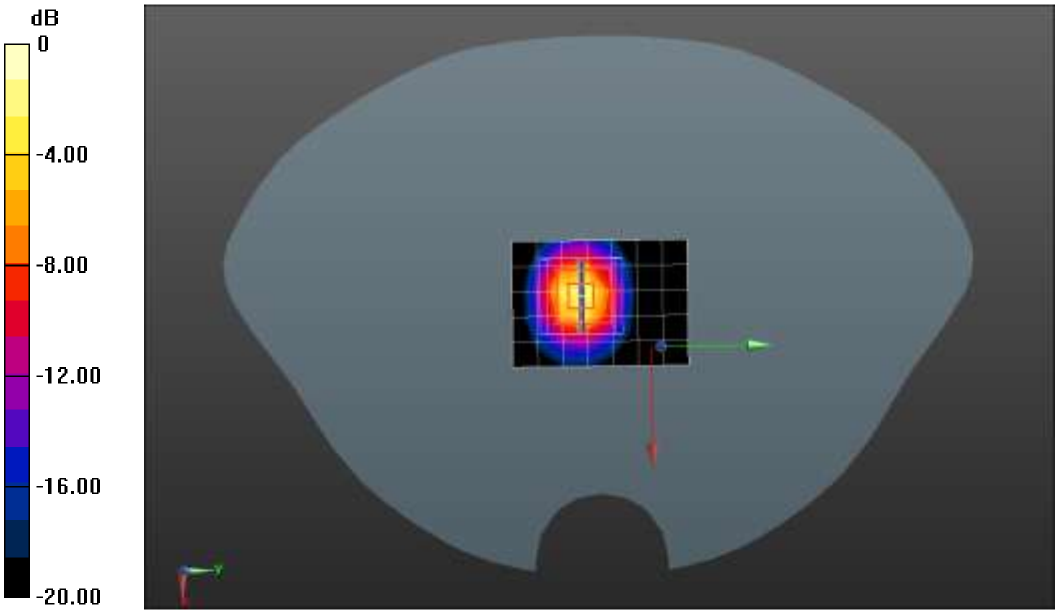
Configuration/System Check Body 5250MHz/Area Scan (6x8x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 7.43 W/kg

Configuration/System Check Body 5250MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;Reference Value = 25.50 V/m; Power Drift = 0.89 dB

Peak SAR (extrapolated) = 59.9 W/kg

SAR(1 g) = 7.91 W/kg; SAR(10 g) = 2.18 W/kg

Maximum value of SAR (measured) = 10.4 W/kg



0 dB = 10.4 W/kg = 10.17 dBW/kg

Date/Time:12/05/2018

Test Laboratory: DEKRA Lab

System Check Body 5600MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5600 MHz; Medium parameters used: f = 5600 MHz; σ = 5.85 S/m; ε_r = 48.2; ρ = 1000 kg/m^3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(3.93, 3.93, 3.93); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

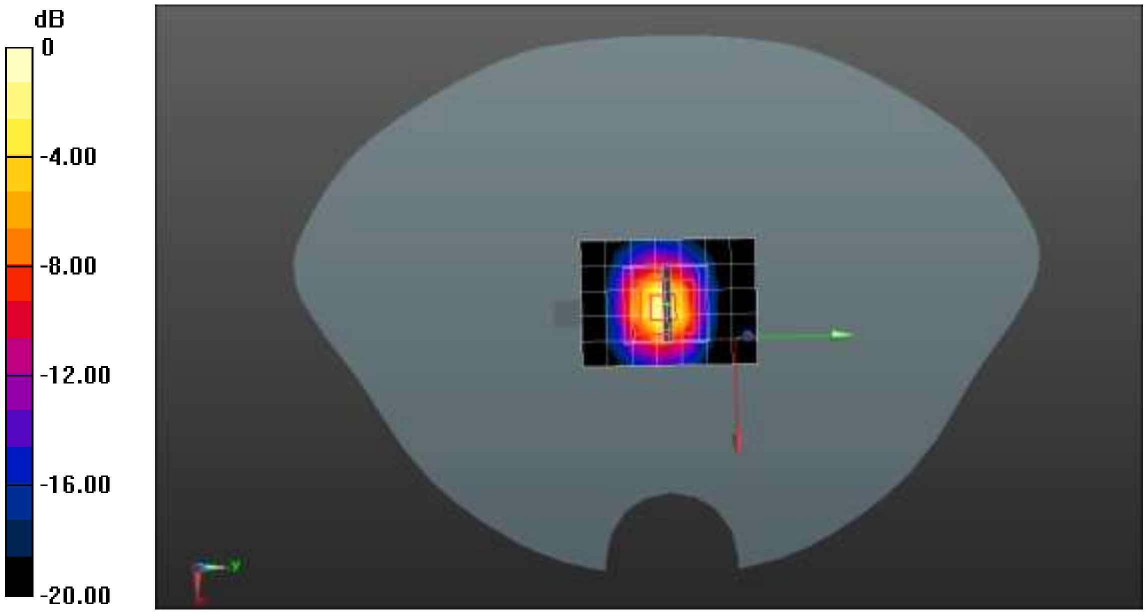
Configuration/System Check Body 5600MHz/Area Scan (6x8x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 13.5 W/kg

Configuration/System Check Body 5600MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;Reference Value = 48.64 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 45.9 W/kg

SAR(1 g) = 8.05 W/kg; SAR(10 g) = 2.19 W/kg

Maximum value of SAR (measured) = 17.0 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

System Check Body 5750MHz

DUT: Dipole D5GHzV2; Type: D5GHzV2

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1; Frequency: 5750 MHz; Medium parameters used: f = 5750 MHz; σ = 6.12 S/m; ε_r = 47.72; ρ = 1000 kg/m^3 ; Phantom section: Flat Section ; Input Power=100mW

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.06, 4.06, 4.06); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

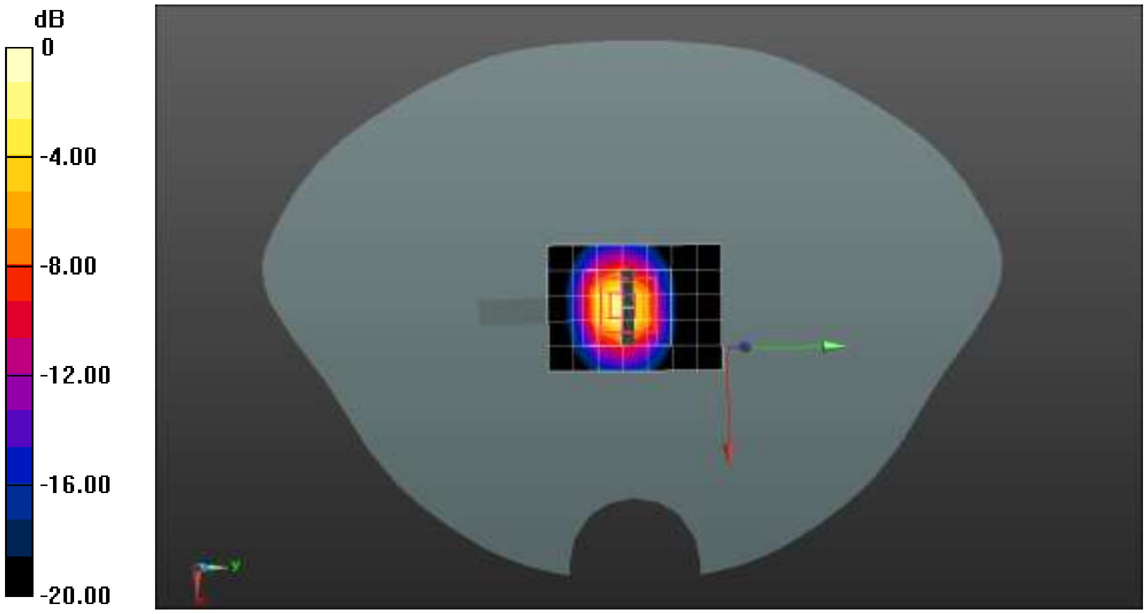
Configuration/System Check Body 5750MHz/Area Scan (6x8x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 11.0 W/kg

Configuration/System Check Body 5750MHz/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm;Reference Value = 41.64 V/m; Power Drift = 0.20 dB

Peak SAR (extrapolated) = 37.9 W/kg

SAR(1 g) = 7.96 W/kg; SAR(10 g) = 2.12 W/kg

Maximum value of SAR (measured) = 13.8 W/kg



0 dB = 13.8 W/kg = 11.40 dBW/kg

Appendix B.SAR measurement Data

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body-Back PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2437MHz Body-back/Area Scan (10x13x1): Measurement grid: dx=12mm, dy=12mm

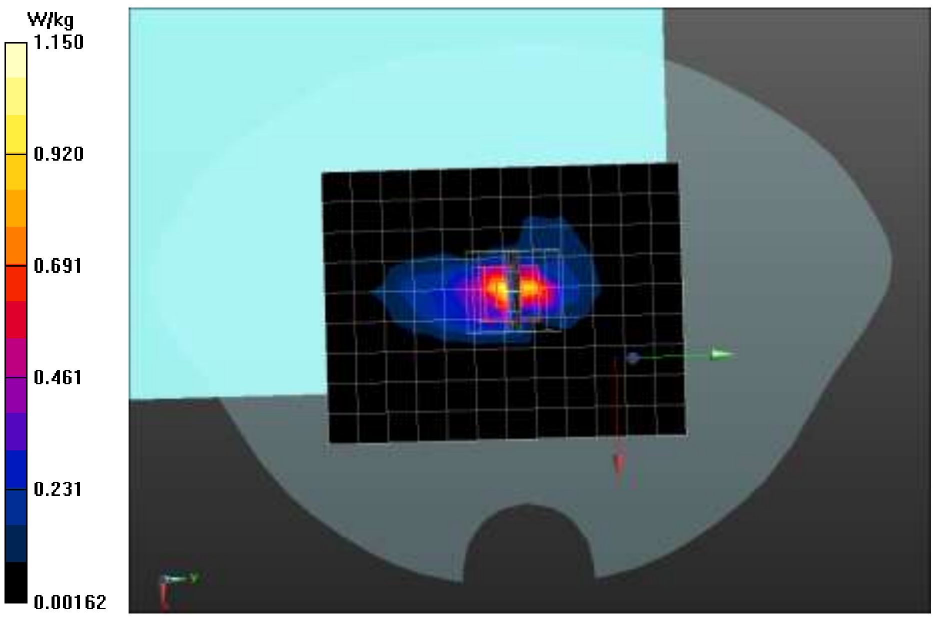
Maximum value of SAR (measured) = 1.02 W/kg

Configuration/802.11b 2437MHz Body-back/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 12.20 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 2.21 W/kg

SAR(1 g) = 0.899 W/kg; SAR(10 g) = 0.338 W/kg

Maximum value of SAR (measured) = 1.15 W/kg



Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body-Back*

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

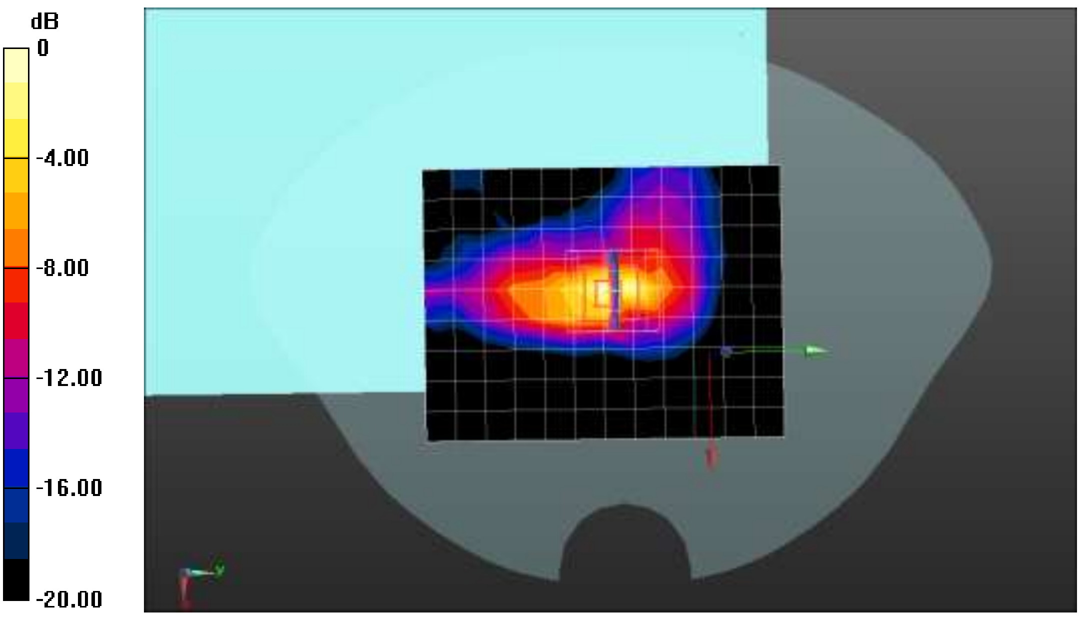
Configuration/802.11b 2437MHz Body-back/Area Scan (10x13x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.943 W/kg

Configuration/802.11b 2437MHz Body-back/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 12.20 V/m; Power Drift = -0.12 dB; Peak SAR (extrapolated) = 2.04 W/kg

SAR(1 g) = 0.830 W/kg; SAR(10 g) = 0.312 W/kg Maximum value of SAR (measured) = 1.06 W/kg



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

Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body-Back PAD YAGEO

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; $\sigma = 1.96$ S/m; $\varepsilon_r = 52.31$; $\rho = 1000$ kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2437MHz Body-back/Area Scan (10x13x1): Measurement grid: dx=12mm, dy=12mm

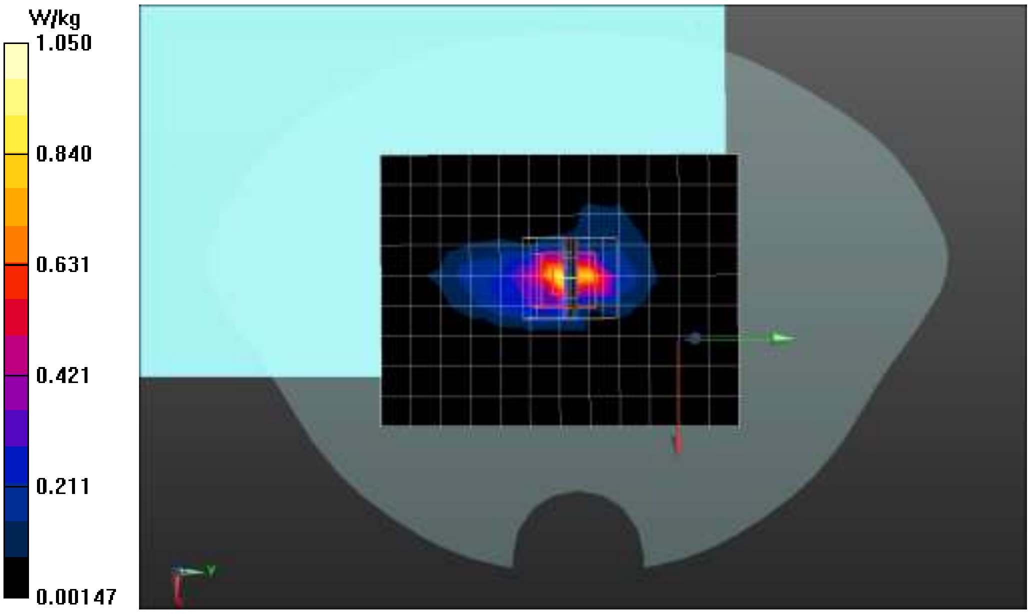
Maximum value of SAR (measured) = 0.927 W/kg

Configuration/802.11b 2437MHz Body-back/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 12.20 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 2.01 W/kg

SAR(1 g) = 0.816 W/kg; SAR(10 g) = 0.307 W/kg

Maximum value of SAR (measured) = 1.05 W/kg



Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body-Edge1 PAD YAGEO

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561

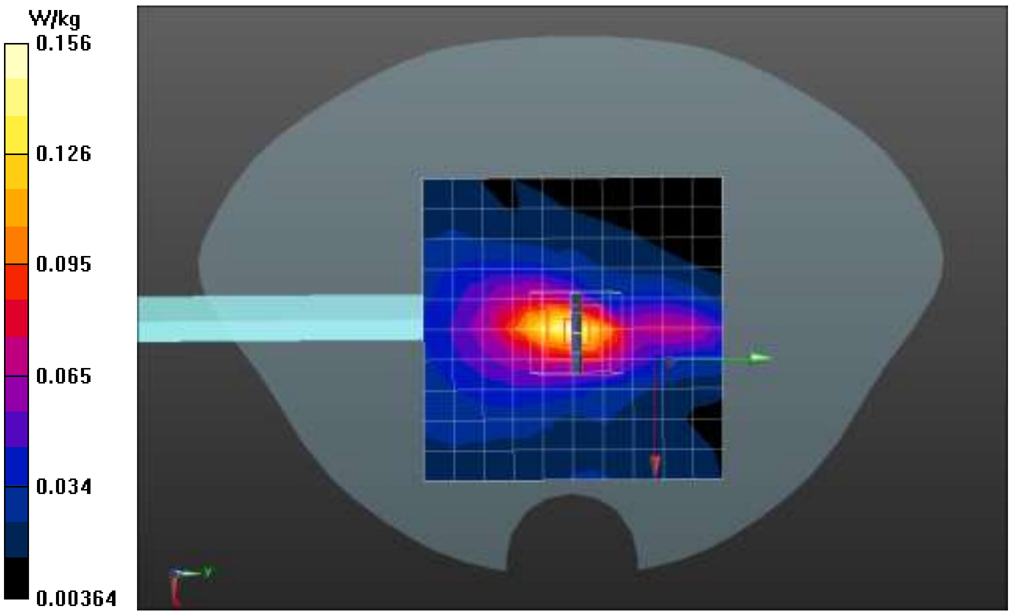
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2437MHz Body-Edge 1/Area Scan (11x11x1): Measurement grid: dx=12mm, dy=12mm;Maximum value of SAR (measured) = 0.156 W/kg

Configuration/802.11b 2437MHz Body-Edge1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 6.243 V/m; Power Drift = -0.08 dB

Peak SAR (extrapolated) = 0.284 W/kg

SAR(1 g) = 0.137 W/kg; SAR(10 g) = 0.069 W/kg;Maximum value of SAR (measured) = 0.119 W/kg



Date/Time: 10/18/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body-Bottom NB INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

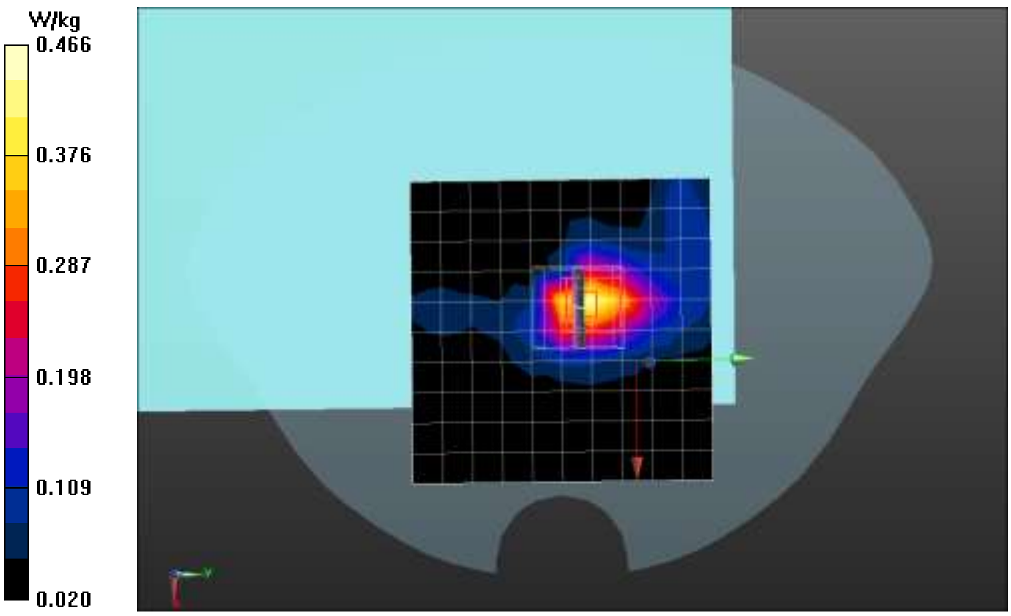
Configuration/802.11b 2437MHz Body-bottom/Area Scan (11x11x1): Measurement grid: dx=12mm, dy=12mm

Maximum value of SAR (measured) = 0.451 W/kg

Configuration/802.11b 2437MHz Body bottom /Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 14.27 V/m; Power Drift = -0.03 dB

Peak SAR (extrapolated) = 1.11 W/kg

SAR(1 g) = 0.445 W/kg; SAR(10 g) = 0.214 W/kg;Maximum value of SAR (measured) = 0.466 W/kg



Date/Time: 10/19/2018

Test Laboratory: DEKRA Lab

802.11b 2462MHz Body-Back PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11g; Duty Cycle: 1:1.0;

Frequency: 2462 MHz; Medium parameters used: f = 2462 MHz; σ = 2.01 S/m; ε_r = 52.21; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2462MHz Body-back/Area Scan (10x13x1): Measurement grid: dx=12mm, dy=12mm

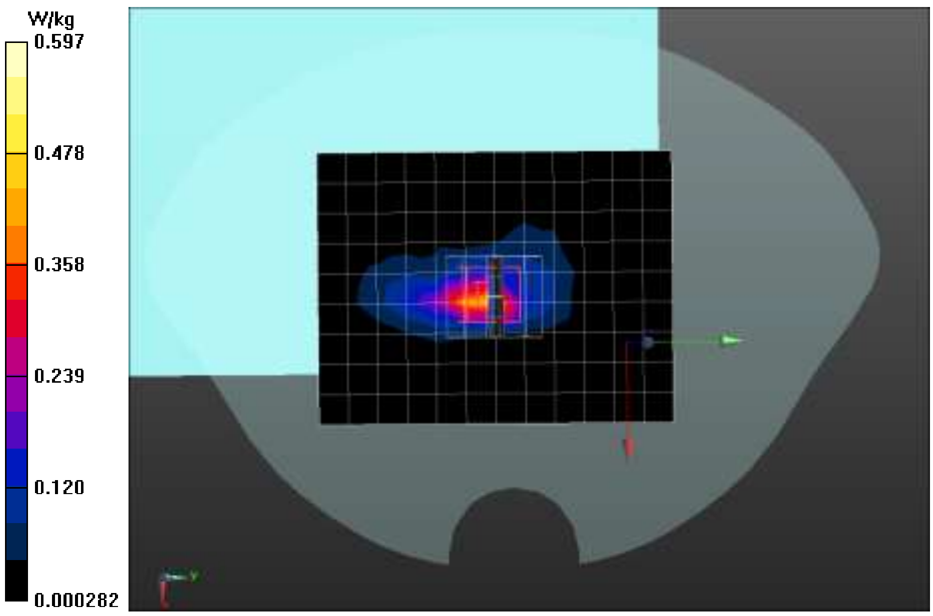
Maximum value of SAR (measured) = 0.452 W/kg

Configuration/802.11b 2462MHz Body-back/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 12.89 V/m; Power Drift = 0.16 dB

Peak SAR (extrapolated) = 1.16 W/kg

SAR(1 g) = 0.466 W/kg; SAR(10 g) = 0.176 W/kg

Maximum value of SAR (measured) = 0.597 W/kg



Date/Time: 10/19/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body Edge1 PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11g; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2437MHz Body-Edge1/Area Scan (7x12x1): Measurement grid: dx=12mm, dy=12mm

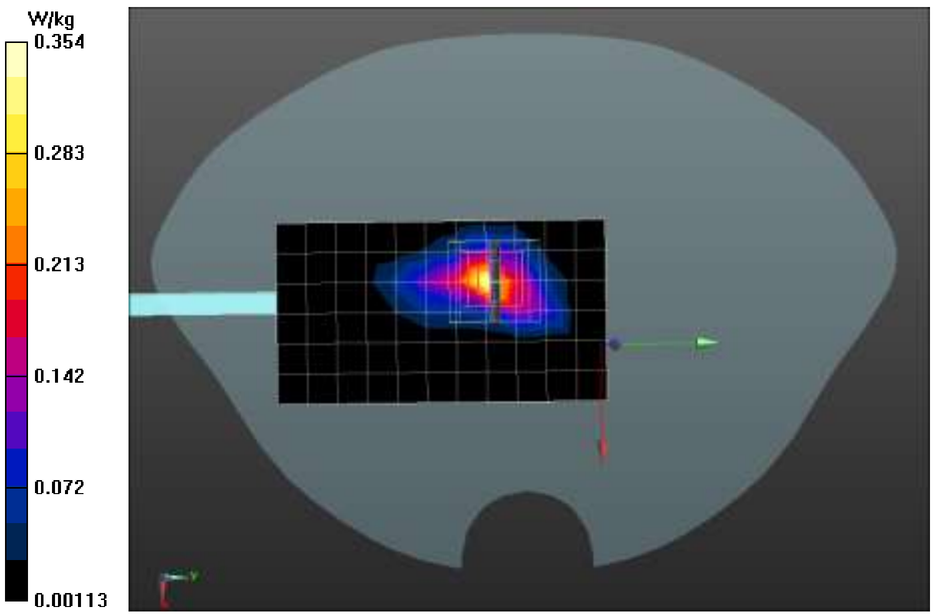
Maximum value of SAR (measured) = 0.351 W/kg

Configuration/802.11b 2437MHz Body-Edge1/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 9.296 V/m; Power Drift =0.09 dB

Peak SAR (extrapolated) = 0.688 W/kg

SAR(1 g) = 0.289 W/kg; SAR(10 g) = 0.120 W/kg

Maximum value of SAR (measured) = 0.354 W/kg



Date/Time: 10/19/2018

Test Laboratory: DEKRA Lab

802.11b 2437MHz Body Edge4 PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, Wi-Fi (0); Communication System Band: 802.11b; Duty Cycle: 1:1.0;

Frequency: 2437 MHz; Medium parameters used: f = 2437 MHz; σ = 1.96 S/m; ε_r = 52.31; ρ = 1000 kg/m^3 ;

Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(7.42, 7.42, 7.42); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM1; Type: SAM; Serial: TP1561
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11b 2437MHz Body-Edge4/Area Scan (7x11x1): Measurement grid: dx=12mm, dy=12mm

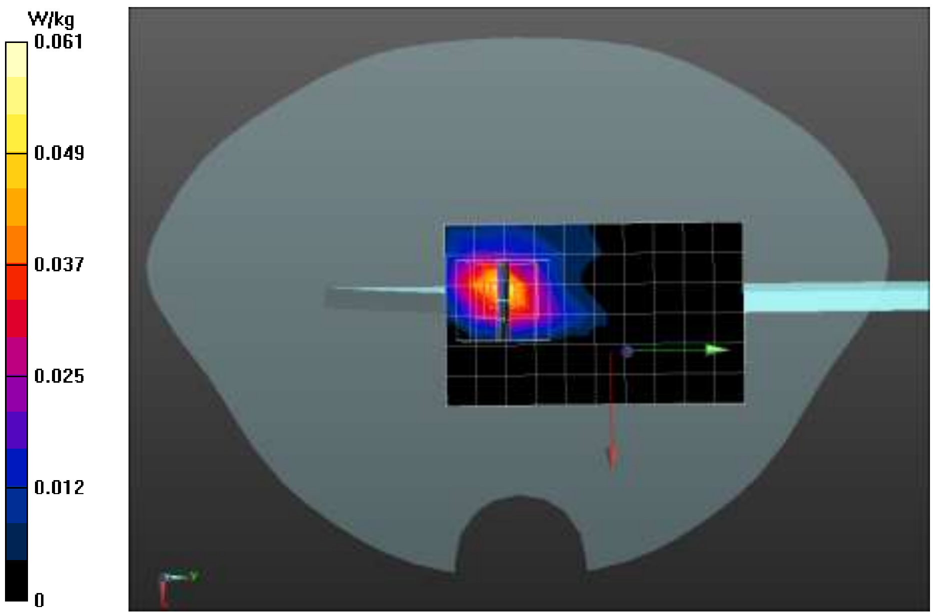
Maximum value of SAR (measured) = 0.0581 W/kg

Configuration/802.11b 2437MHz Body-Edge4/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm;Reference Value = 5.174 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 0.127 W/kg

SAR(1 g) = 0.055 W/kg; SAR(10 g) = 0.025 W/kg

Maximum value of SAR (measured) = 0.0613 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body-back PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.3 S/m; ε_r = 49.29; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

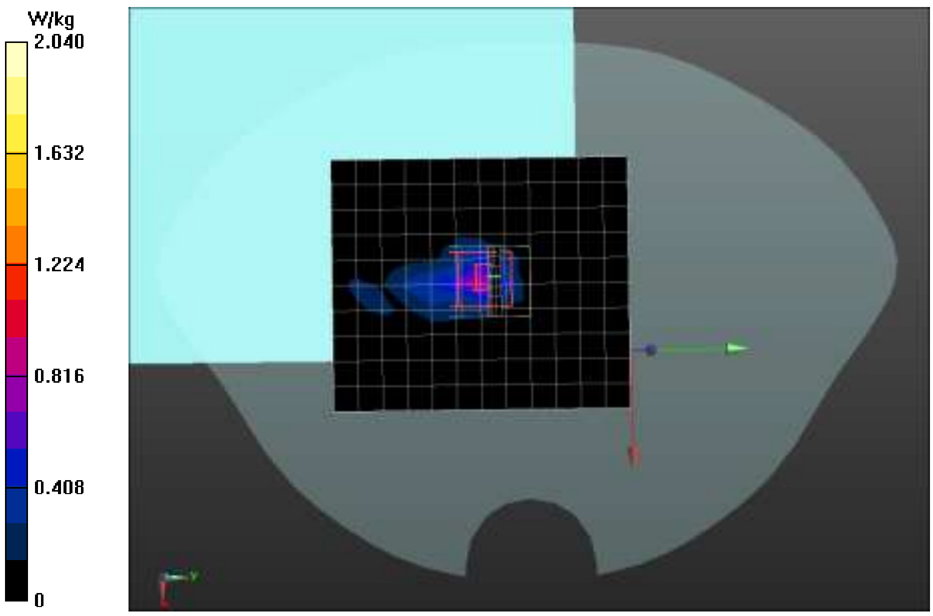
Configuration/802.11a 5200Hz Body-Back/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.872 W/kg

Configuration/802.11a 5200Hz Body-Back/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm;Reference Value = 2.037 V/m; Power Drift = 0.06 dB

Peak SAR (extrapolated) = 3.90 W/kg

SAR(1 g) = 0.916 W/kg; SAR(10 g) = 0.261 W/kg

Maximum value of SAR (measured) = 2.04 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body-back

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.41 S/m; εr = 49.2; ρ = 1000 kg/m3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

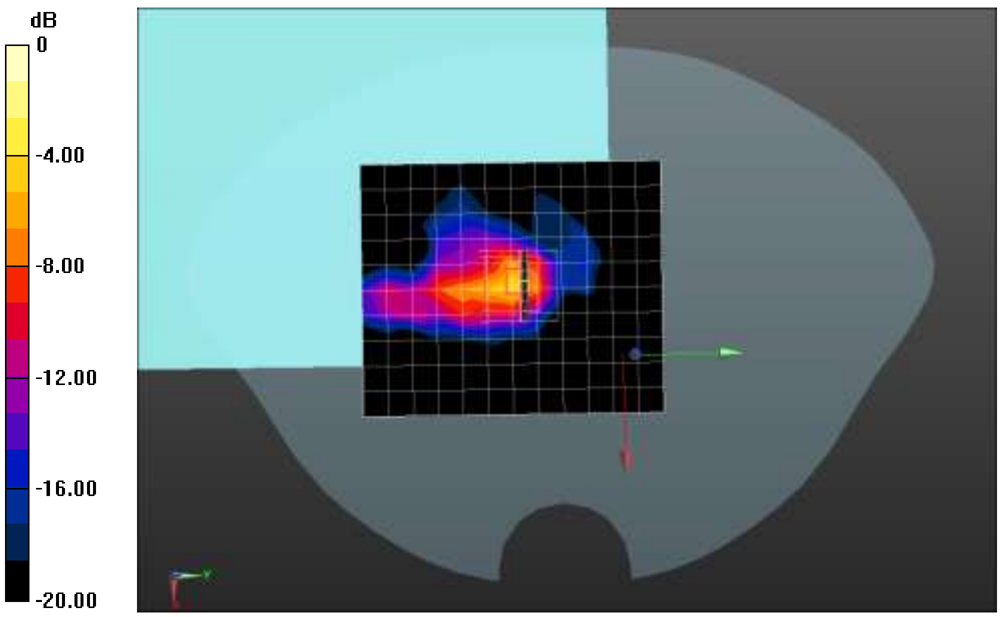
- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

Configuration/802.11a 5200Hz Body-Back/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm; Maximum value of SAR (measured) = 0.852 W/kg

Configuration/802.11a 5200Hz Body-Back/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm; Reference Value = 2.037 V/m; Power Drift = 0.11 dB

Peak SAR (extrapolated) = 3.81 W/kg

SAR(1 g) = 0.896 W/kg; SAR(10 g) = 0.255 W/kg Maximum value of SAR (measured) = 2.00 W/kg



0 dB = 2.00 W/kg = 3.01 dBW/kg

Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body-back PAD YAGEO

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.3 S/m; ε_r = 49.29; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

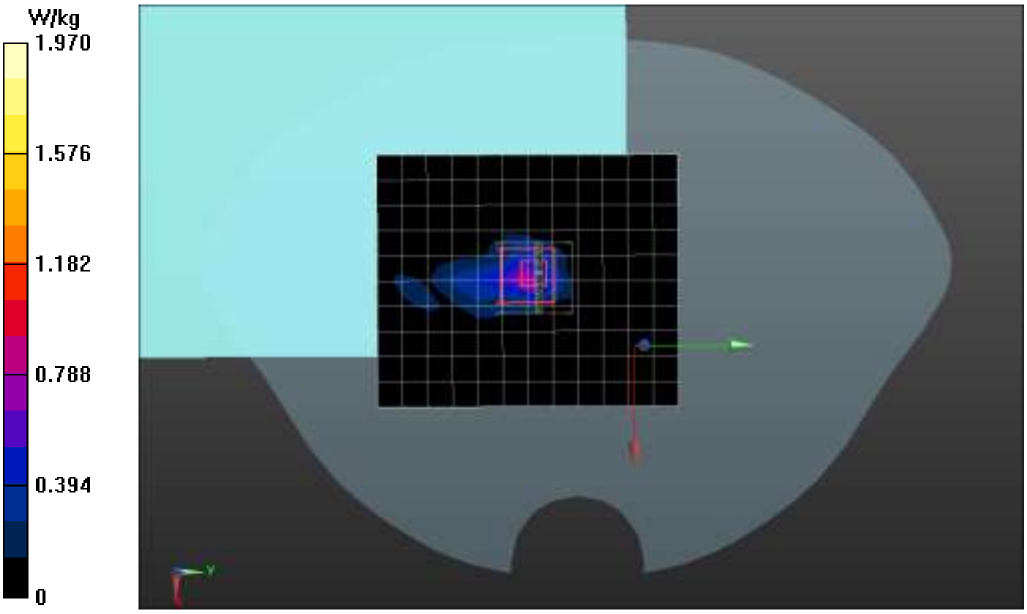
Configuration/802.11a 5200Hz Body-Back/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.839 W/kg

Configuration/802.11a 5200Hz Body-Back/Zoom Scan (8x8x6)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2mm;Reference Value = 2.037 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 3.75 W/kg

SAR(1 g) = 0.882 W/kg; SAR(10 g) = 0.251 W/kg

Maximum value of SAR (measured) = 1.97 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body-bottom NB INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.3 S/m; ε_r = 49.29; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

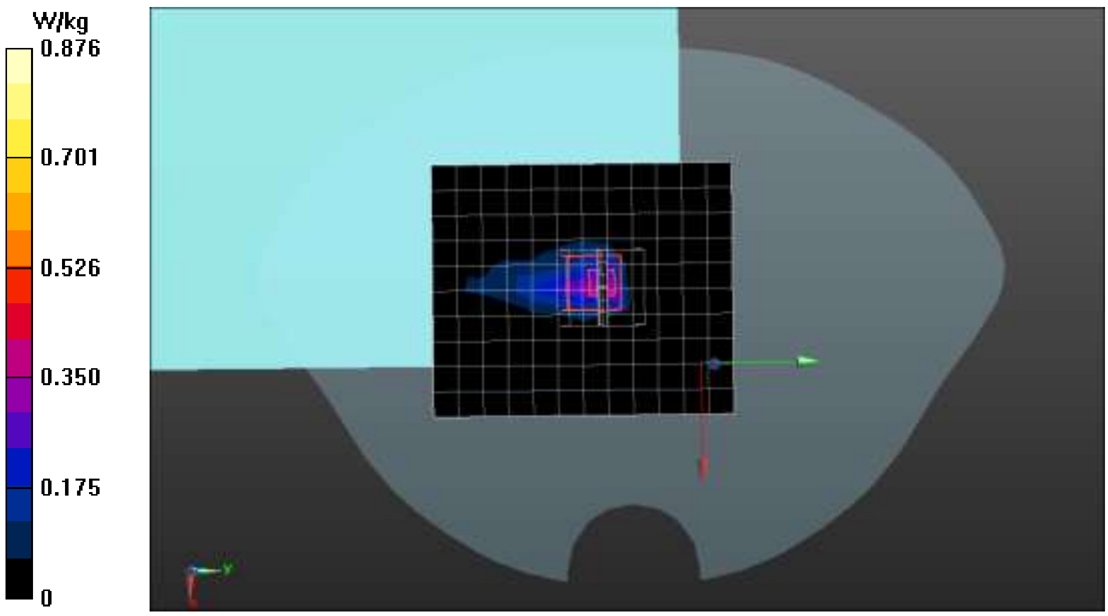
Configuration/802.11a 5200Hz Body-Bottom/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (measured) = 0.418 W/kg

Configuration/802.11a 5200Hz Body-Bottom/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 1.208 V/m; Power Drift = 0.23 dB

Peak SAR (extrapolated) = 1.88 W/kg

SAR(1 g) = 0.447 W/kg; SAR(10 g) = 0.122 W/kg;Maximum value of SAR (measured) = 0.876 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body-Edge1 PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.3 S/m; ε_r = 49.29; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

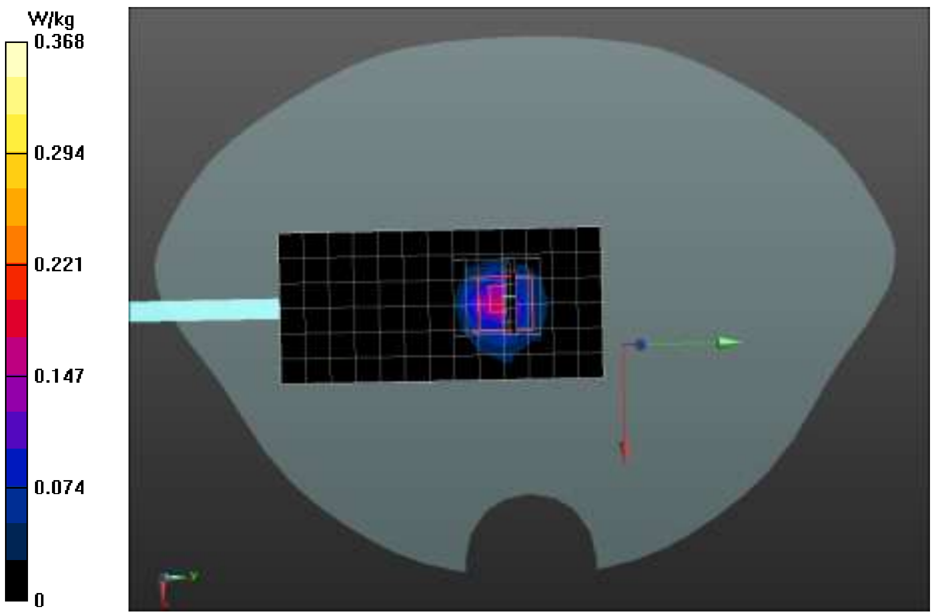
Configuration/802.11a 5200Hz Body-Edge1/Area Scan (7x14x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.192 W/kg

Configuration/802.11a 5200Hz Body-Edge1/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 3.871 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.641 W/kg

SAR(1 g) = 0.185 W/kg; SAR(10 g) = 0.060 W/kg

Maximum value of SAR (measured) = 0.368 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5200MHz Body Edge4 PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5200 MHz; Medium parameters used: f = 5200 MHz; σ = 5.3 S/m; ε_r = 49.29; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

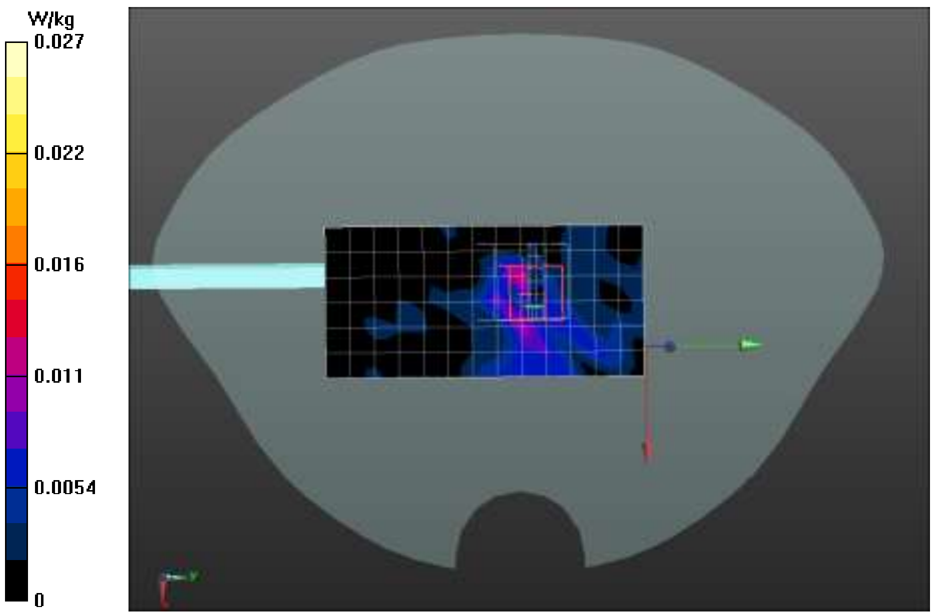
Configuration/802.11a 5200Hz Body-Edge4/Area Scan (7x14x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.0137 W/kg

Configuration/802.11a 5200Hz Body-Edge4/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 1.396 V/m; Power Drift =0.15 dB

Peak SAR (extrapolated) = 0.135 W/kg

SAR(1 g) = 0.014 W/kg; SAR(10 g) = 0.00539 W/kg

Maximum value of SAR (measured) = 0.0270 W/kg



Date/Time: 10/22/2018

Test Laboratory: DEKRA Lab

802.11a 5240MHz Body-back PAD INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5240 MHz; Medium parameters used: f = 5240 MHz; σ = 5.36 S/m; ε_r = 49.21; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

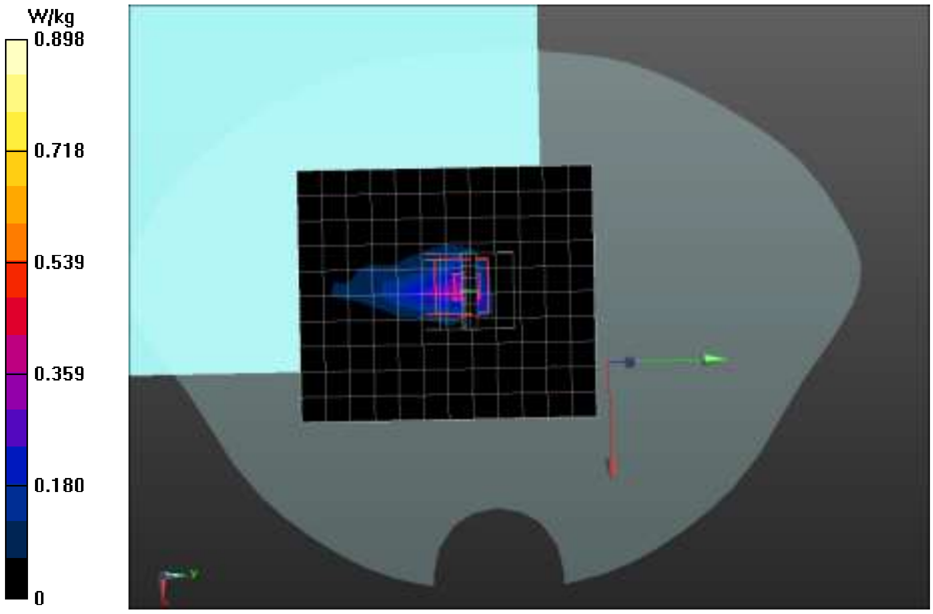
Configuration/802.11a 5240Hz Body-Back/Area Scan (11x13x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.428 W/kg

Configuration/802.11a 5240Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 1.216 V/m; Power Drift = 0.13 dB

Peak SAR (extrapolated) = 1.93 W/kg

SAR(1 g) = 0.458 W/kg; SAR(10 g) = 0.125 W/kg

Maximum value of SAR (measured) = 0.898 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5260MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5260 MHz; Medium parameters used: f = 5260 MHz; σ = 5.39 S/m; ε_r = 49.17; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

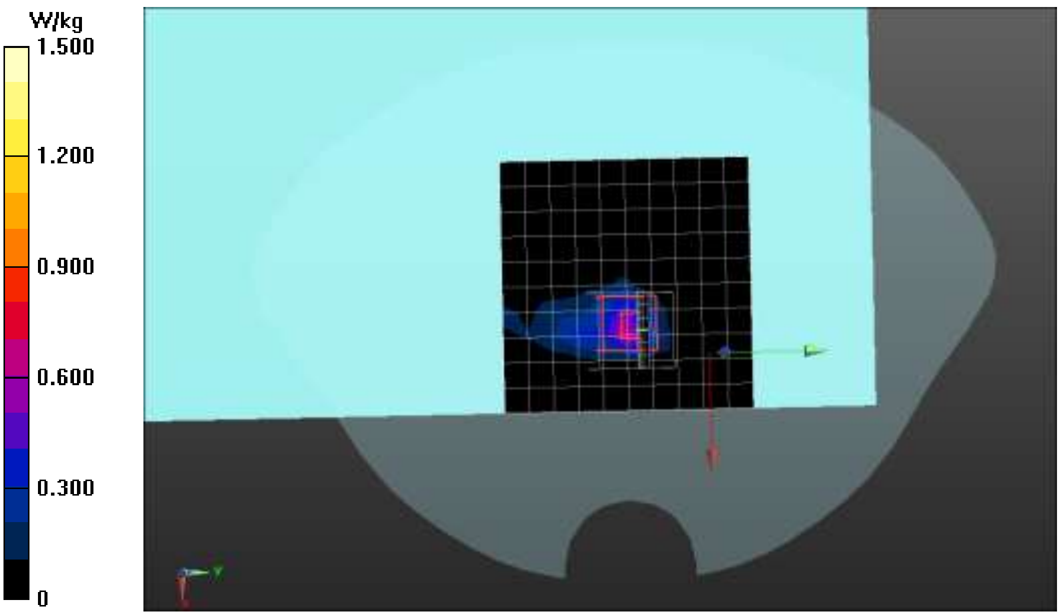
Configuration/802.11a 5260Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.659 W/kg

Configuration/802.11a 5260Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 9.514 V/m; Power Drift = 0.15 dB

Peak SAR (extrapolated) = 3.37 W/kg

SAR(1 g) = 0.770 W/kg; SAR(10 g) = 0.218 W/kg

Maximum value of SAR (measured) = 1.50 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5300MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5300 MHz; Medium parameters used: f = 5300 MHz; σ = 5.45 S/m; ε_r = 49.1; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.44, 4.44, 4.44); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

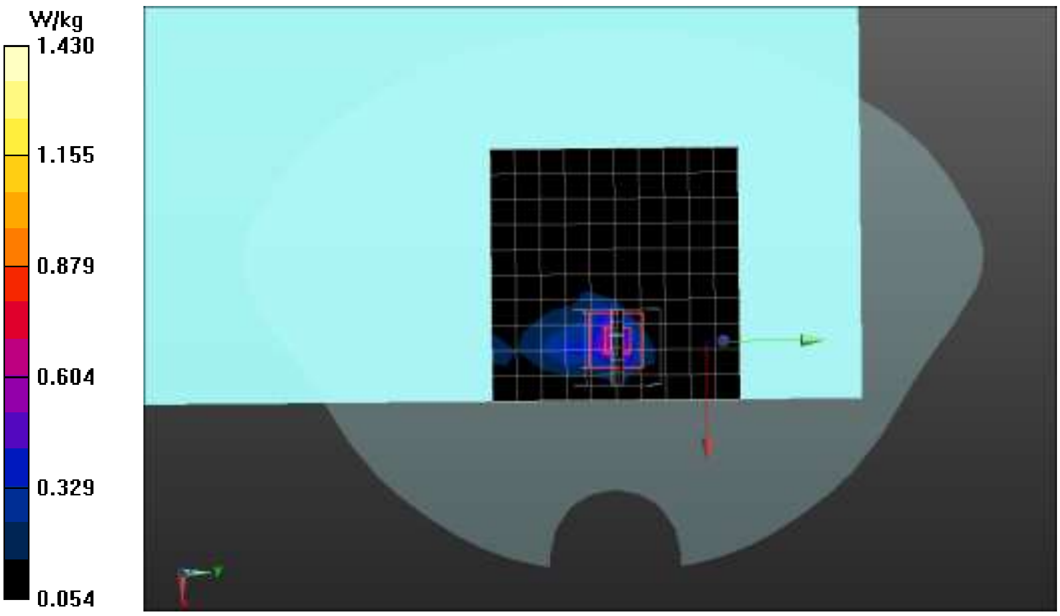
Configuration/802.11a 5300Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.716 W/kg

Configuration/802.11a 5300Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 5.093 V/m; Power Drift = 0.39 dB

Peak SAR (extrapolated) = 3.14 W/kg

SAR(1 g) = 0.785 W/kg; SAR(10 g) = 0.268 W/kg

Maximum value of SAR (measured) = 1.43 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5580MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5580 MHz; Medium parameters used: f = 5580 MHz; σ = 5.83 S/m; ε_r = 48.26; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(3.93, 3.93, 3.93); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

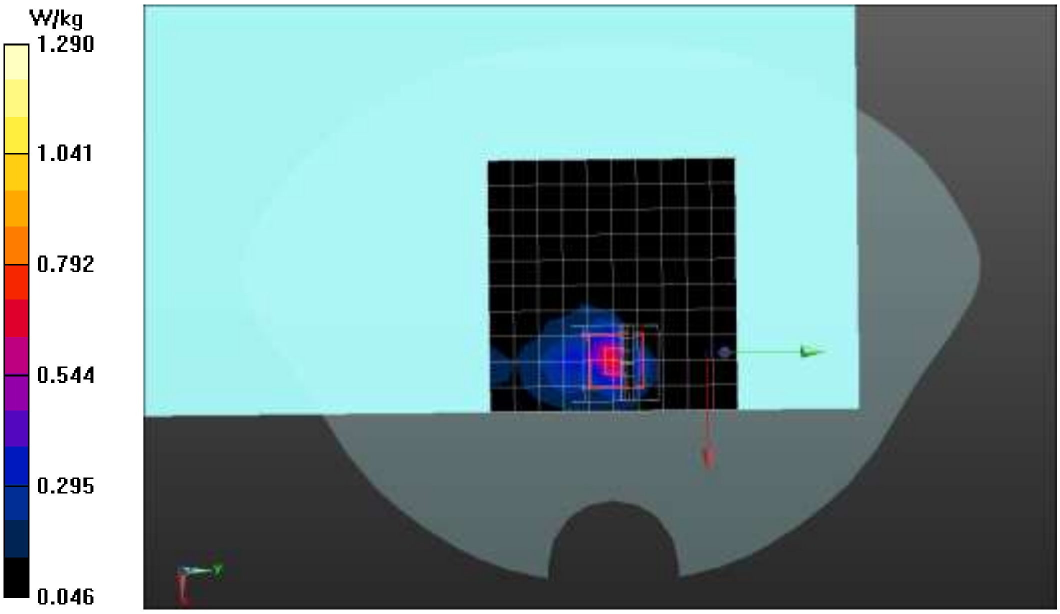
Configuration/802.11a 5580Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.760 W/kg

Configuration/802.11a 5580Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 4.565 V/m; Power Drift = 0.14 dB

Peak SAR (extrapolated) = 2.61 W/kg

SAR(1 g) = 0.707 W/kg; SAR(10 g) = 0.268 W/kg

Maximum value of SAR (measured) = 1.29 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5700MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5700 MHz; Medium parameters used: f = 5700 MHz; σ = 6.05 S/m; ε_r = 47.89; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(3.93, 3.93, 3.93); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

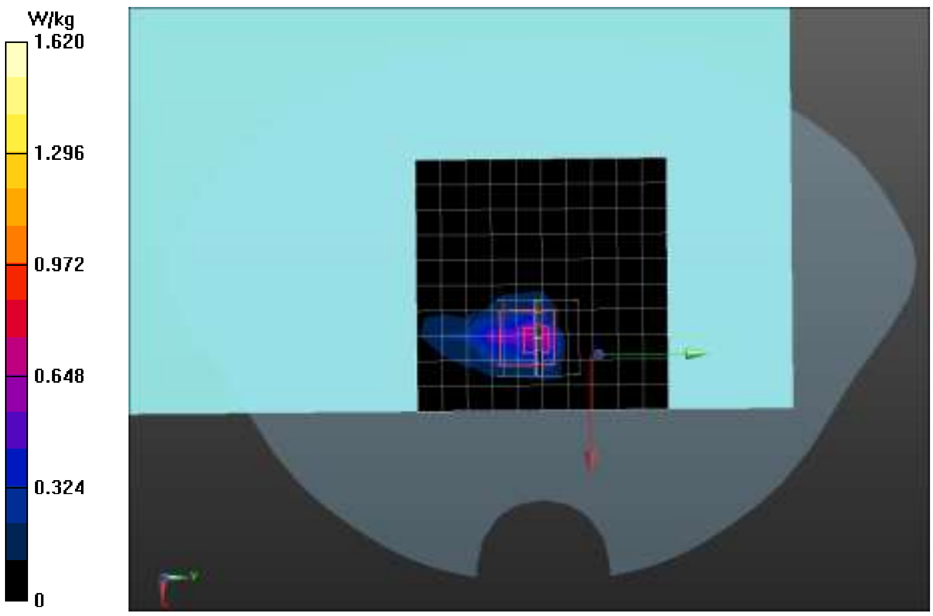
Configuration/802.11a 5700Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.733 W/kg

Configuration/802.11a 5700Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 6.413 V/m; Power Drift = 0.18 dB

Peak SAR (extrapolated) = 3.45 W/kg

SAR(1 g) = 0.748 W/kg; SAR(10 g) = 0.227 W/kg

Maximum value of SAR (measured) = 1.62 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5745MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5745 MHz; Medium parameters used: f = 5745 MHz; σ = 6.11 S/m; ε_r = 47.75; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.06, 4.06, 4.06); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

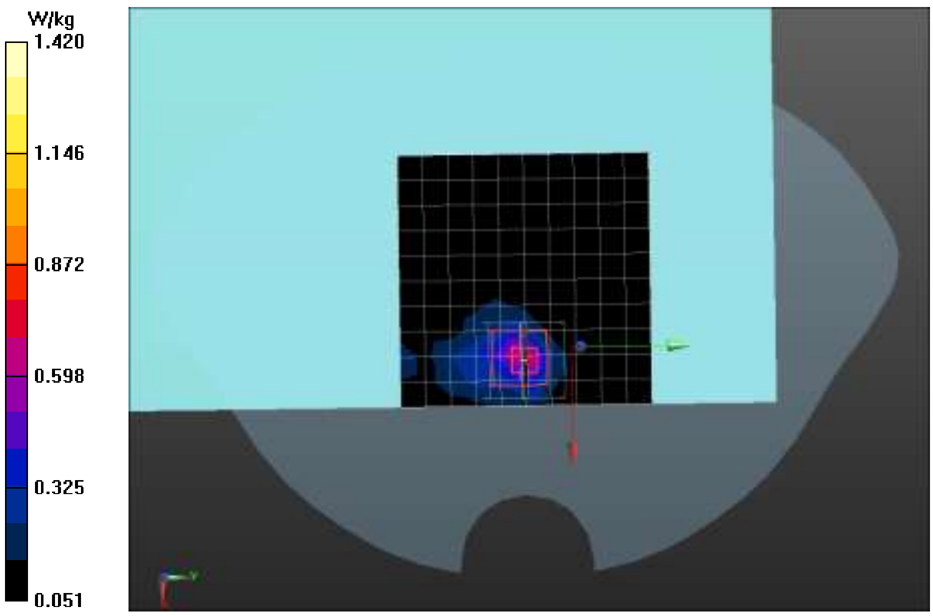
Configuration/802.11a 5745Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.788 W/kg

Configuration/802.11a 5745Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 4.649 V/m; Power Drift = 0.27 dB

Peak SAR (extrapolated) = 2.77 W/kg

SAR(1 g) = 0.750 W/kg; SAR(10 g) = 0.280 W/kg

Maximum value of SAR (measured) = 1.42 W/kg



Date/Time: 12/05/2018

Test Laboratory: DEKRA Lab

802.11a 5785MHz Body-back INPAQ

DUT: NB; Type: TP401M

Communication System: UID 0, CW (0); Communication System Band: 5GHz(5000.0-6000.0MHz); Duty Cycle: 1:1.0; Frequency: 5785 MHz; Medium parameters used: f = 5785 MHz; σ = 6.17 S/m; ε_r = 47.66; ρ = 1000 kg/m^3 ; Phantom section: Flat Section

Ambient temperature (℃): 21.5, Liquid temperature (℃): 21.0

DASY5 Configuration:

- Probe: EX3DV4 - SN3710; ConvF(4.06, 4.06, 4.06); Calibrated: 23/02/2018;
- Sensor-Surface: 4mm (Mechanical Surface Detection), Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn1220; Calibrated: 16/02/2018
- Phantom: SAM2; Type: SAM; Serial: TP1562
- Measurement SW: DASY52, Version 52.8 (8); SEMCAD X Version 14.6.10 (7331)

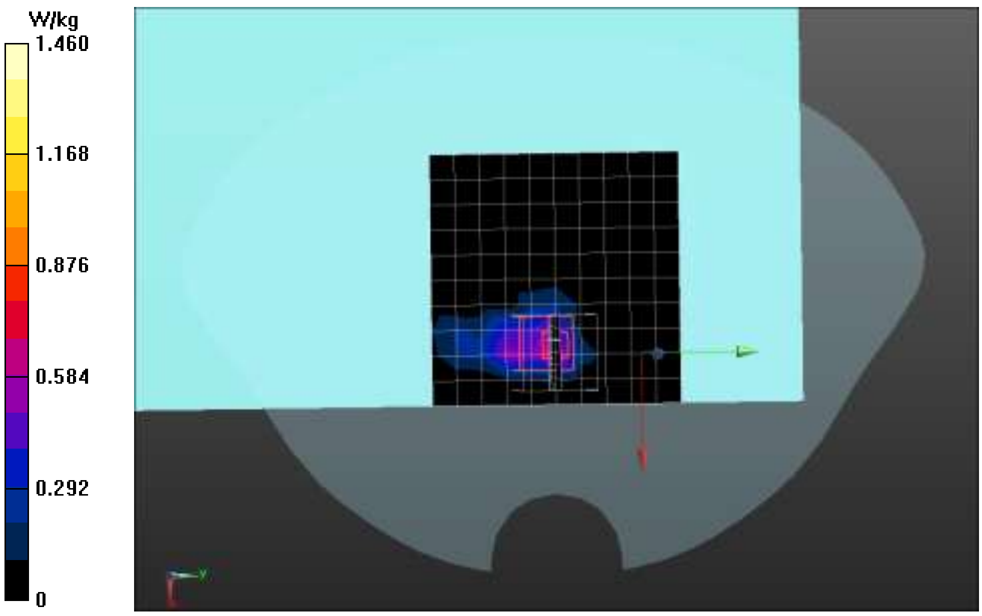
Configuration/802.11a 5785Hz Body-Back/Area Scan (11x11x1): Measurement grid: dx=10mm, dy=10mm;Maximum value of SAR (measured) = 0.707 W/kg

Configuration/802.11a 5785Hz Body-Back/Zoom Scan (7x7x6)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=2mm;Reference Value = 6.049 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 0.784 W/kg; SAR(10 g) = 0.247 W/kg

Maximum value of SAR (measured) = 1.46 W/kg



Appendix C. Probe Calibration Data

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: **SCS 0108**

Client: DEKRA-CN (Auden)

Certificate No: **EX3-3710_Feb18**

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3710

Calibration procedure(s): QA CAL-01.v9, QA CAL-12.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6
Calibration procedure for dosimetric E-field probes

Calibration date: February 23, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID	Cal Date (Certificate No.)	Scheduled Calibration
Power meter NRP	SN: 104778	04-Apr-17 (No. 217-02521/02522)	Apr-18
Power sensor NRP-Z91	SN: 103244	04-Apr-17 (No. 217-02521)	Apr-18
Power sensor NRP-Z91	SN: 103245	04-Apr-17 (No. 217-02525)	Apr-18
Reference 20 dB Attenuator	SN: S5277 (20x)	07-Apr-17 (No. 217-02528)	Apr-18
Reference Probe ES3DV2	SN: 3013	30-Dec-17 (No. ES3-3013_Dec17)	Dec-18
DAE4	SN: 660	21-Dec-17 (No. DAE4-660_Dec17)	Dec-18
Secondary Standards	ID	Check Date (in house)	Scheduled Check
Power meter E4419B	SN: GB41293874	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: MY41498087	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
Power sensor E4412A	SN: 000110210	06-Apr-16 (in house check Jun-16)	In house check: Jun-18
RF generator HP 8648C	SN: US3642U01700	04-Aug-99 (in house check Jun-16)	In house check: Jun-18
Network Analyzer HP 8753E	SN: US37390585	18-Oct-01 (in house check Oct-17)	In house check: Oct-18

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 27, 2018

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	modulation dependent linearization parameters
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., ϑ = 0 is normal to probe axis
Connector Angle	information used in DASY system to align probe sensor X to the robot coordinate system

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, ", "Measurement procedure for the assessment of Specific Absorption Rate (SAR) from hand-held and body-mounted devices used next to the ear (frequency range of 300 MHz to 6 GHz)", July 2016
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. *VR* is the maximum calibration range expressed in RMS voltage across the diode.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for f ≤ 800 MHz) and inside waveguide using analytical field distributions based on power measurements for f > 800 MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.
- *Connector Angle*: The angle is assessed using the information gained by determining the *NORMx* (no uncertainty required).

Certificate No: EX3-3710_Feb18 Page 2 of 11

Probe EX3DV4

SN:3710

Manufactured: July 21, 2009
Calibrated: February 23, 2018

Calibrated for DASY/EASY Systems
(Note: non-compatible with DASY2 system!)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.39	0.38	0.47	± 10.1 %
DCP (mV)[B]	99.6	101.6	101.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB$\sqrt{\mu V}$	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	151.4	±3.0 %
		Y	0.0	0.0	1.0		140.4	
		Z	0.0	0.0	1.0		159.1	

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

[A] The uncertainties of Norm X,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	43.5	0.87	10.54	10.54	10.54	0.15	1.25	± 13.3 %
750	41.9	0.89	9.95	9.95	9.95	0.48	0.80	± 12.0 %
835	41.5	0.90	9.38	9.38	9.38	0.35	0.95	± 12.0 %
900	41.5	0.97	9.26	9.26	9.26	0.35	1.02	± 12.0 %
1810	40.0	1.40	8.14	8.14	8.14	0.37	0.80	± 12.0 %
1900	40.0	1.40	8.00	8.00	8.00	0.33	0.85	± 12.0 %
2450	39.2	1.80	7.33	7.33	7.33	0.28	0.92	± 12.0 %
2600	39.0	1.96	7.11	7.11	7.11	0.38	0.80	± 12.0 %
3500	37.9	2.91	7.05	7.05	7.05	0.30	1.20	± 13.1 %
5250	35.9	4.71	5.23	5.23	5.23	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.76	4.76	4.76	0.45	1.80	± 13.1 %
5750	35.4	5.22	4.85	4.85	4.85	0.45	1.80	± 13.1 %

[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4– SN:3710

February 23, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha [G]	Depth [G] (mm)	Unc (k=2)
450	56.7	0.94	10.83	10.83	10.83	0.09	1.20	± 13.3 %
750	55.5	0.96	9.87	9.87	9.87	0.48	0.80	± 12.0 %
835	55.2	0.97	9.60	9.60	9.60	0.47	0.82	± 12.0 %
900	55.0	1.05	9.46	9.46	9.46	0.50	0.83	± 12.0 %
1810	53.3	1.52	7.77	7.77	7.77	0.35	0.90	± 12.0 %
1900	53.3	1.52	7.64	7.64	7.64	0.44	0.80	± 12.0 %
2450	52.7	1.95	7.42	7.42	7.42	0.37	0.88	± 12.0 %
2600	52.5	2.16	7.23	7.23	7.23	0.23	1.05	± 12.0 %
3500	51.3	3.31	6.53	6.53	6.53	0.25	1.25	± 13.1 %
5250	48.9	5.36	4.44	4.44	4.44	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.93	3.93	3.93	0.50	1.90	± 13.1 %
5750	48.3	5.94	4.06	4.06	4.06	0.50	1.90	± 13.1 %

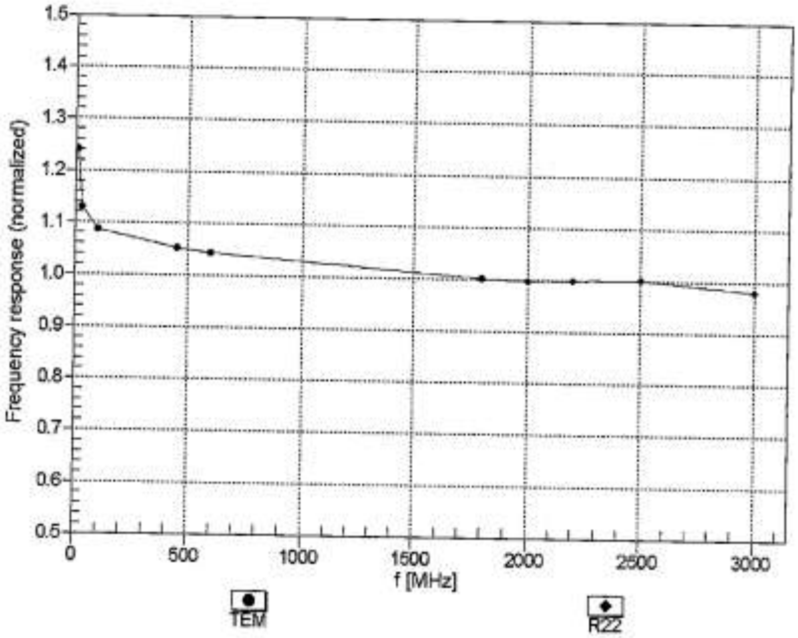
[C] Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.
[G] Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4-- SN:3710

February 23, 2018

Frequency Response of E-Field

(TEM-Cell:ifi110 EXX, Waveguide: R22)



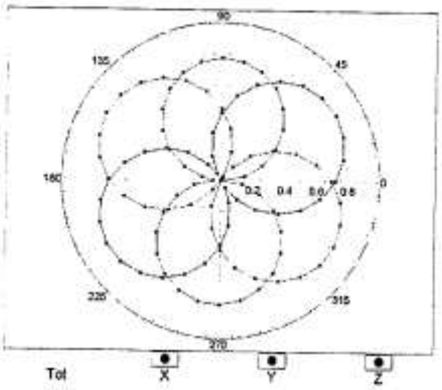
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

EX3DV4– SN:3710

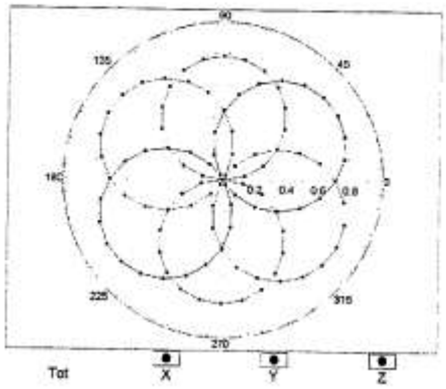
February 23, 2018

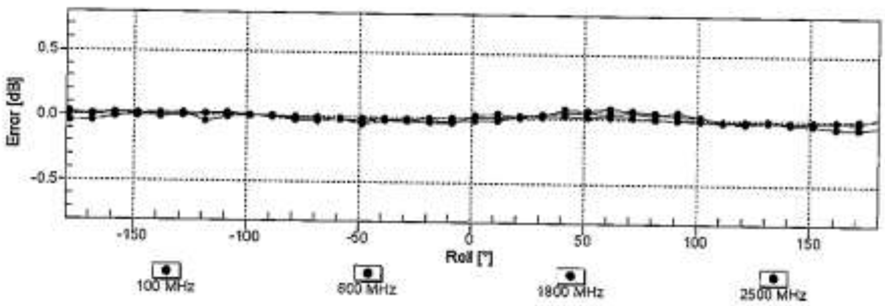
Receiving Pattern (ϕ), $\vartheta = 0°$

f=600 MHz,TEM



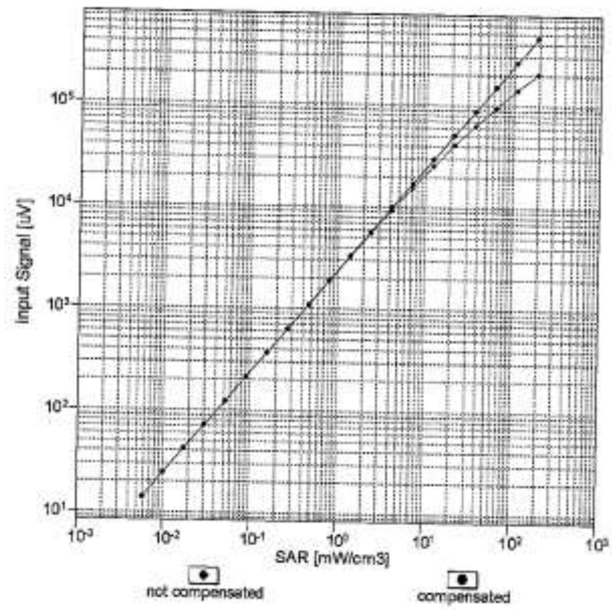
f=1800 MHz,R22

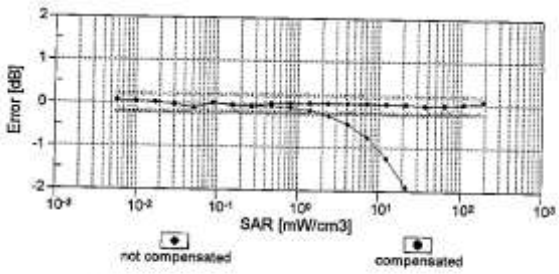




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR_{head})
(TEM cell , f_{eval}= 1900 MHz)



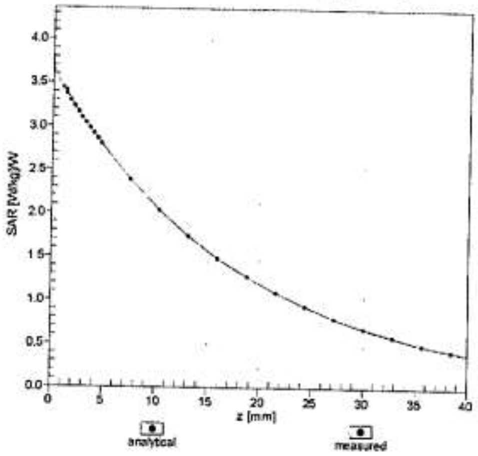


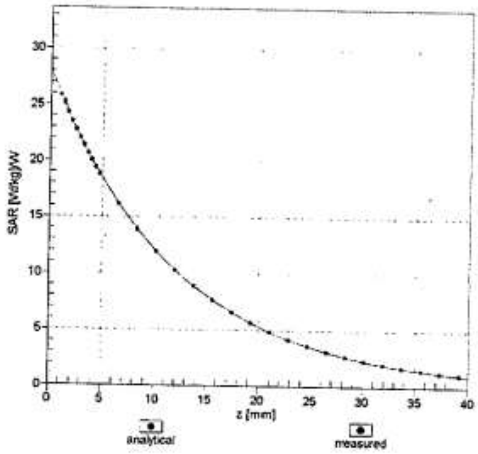
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

EX3DV4– SN:3710

February 23, 2018

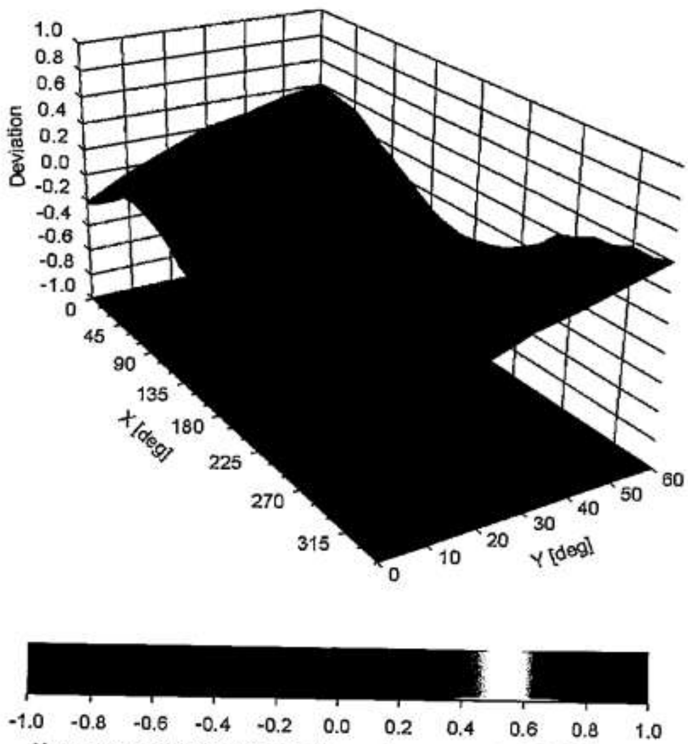
Conversion Factor Assessment





Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

EX3DV4– SN:3710

February 23, 2018

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3710

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	81.5
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

Appendix D. Dipole Calibration Data

Calibration Laboratory of
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Accreditation No.: **SCS 0108**

Client **QTK-CN (Auden)**

Certificate No: **D2450V2-839_Feb16**

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 839
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	February 09, 2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 7349	31-Dec-15 (No. EX3-7349_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Michael Weber	Laboratory Technician	M.Weber
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 10, 2016

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Certificate No: D2450V2-839_Feb16 Page 1 of 8

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Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
d) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

e) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.7 ± 6 %	1.84 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.0 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**51.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.03 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.9 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.9 ± 6 %	2.00 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	12.6 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**49.8 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.87 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**23.3 W/kg ± 16.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL

Impedance, transformed to feed point	55.4 Ω + 2.0 jΩ
Return Loss	- 25.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.2 Ω + 6.4 jΩ
Return Loss	- 23.9 dB

General Antenna Parameters and Design

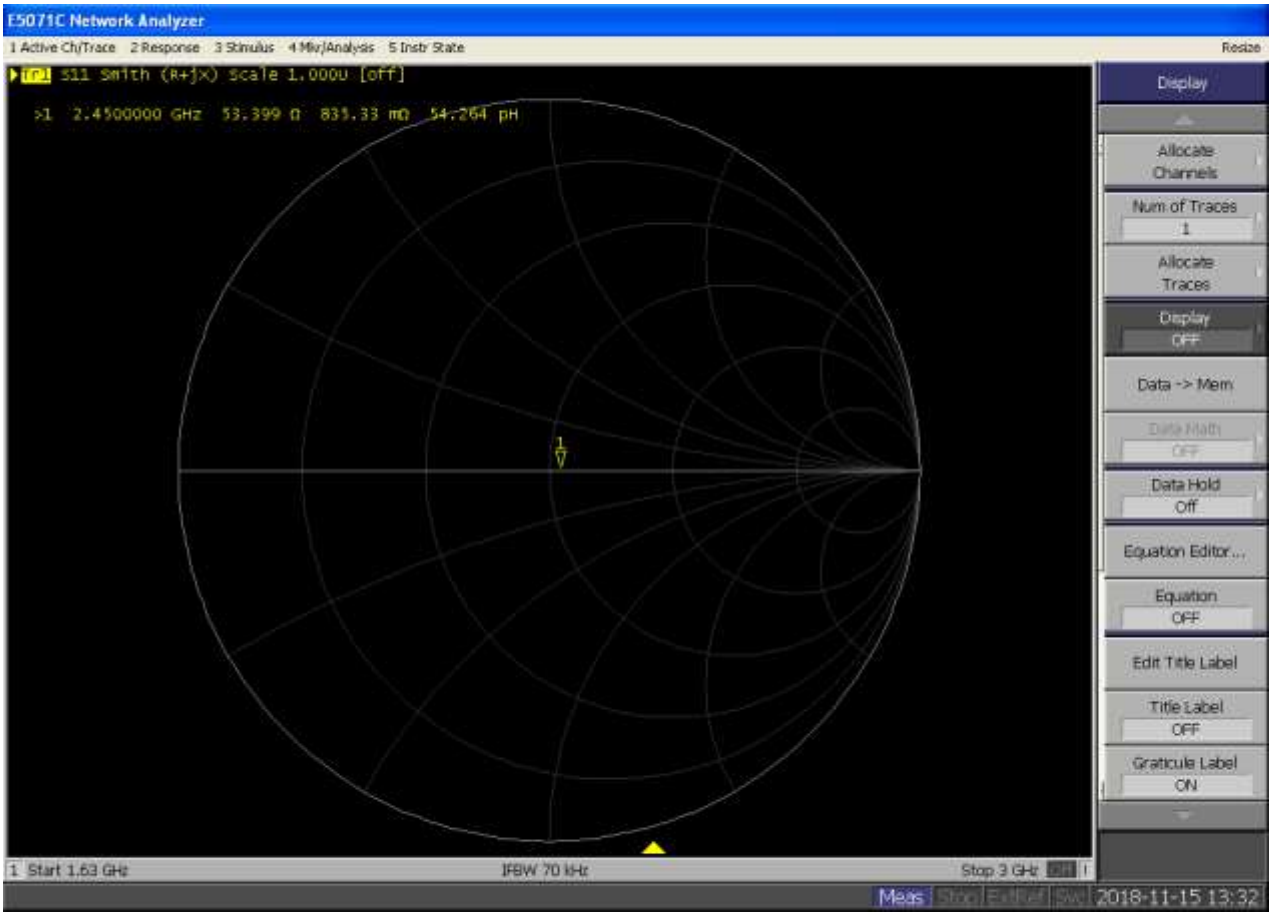
Electrical Delay (one direction)	1.143 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 20, 2009


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S11 Smith (R+jX) Scale 1.000U [off]
>1 2.4500000 GHz 53.399 Ω 835.33 mΩ 54.264 pH
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Allocate Channels
Num of Traces 1
Allocate Traces
Display OFF
Data -> Mem
Data Math OFF
Data Hold Off
Equation Editor...
Equation OFF
Edit Title Label
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Graticule Label ON
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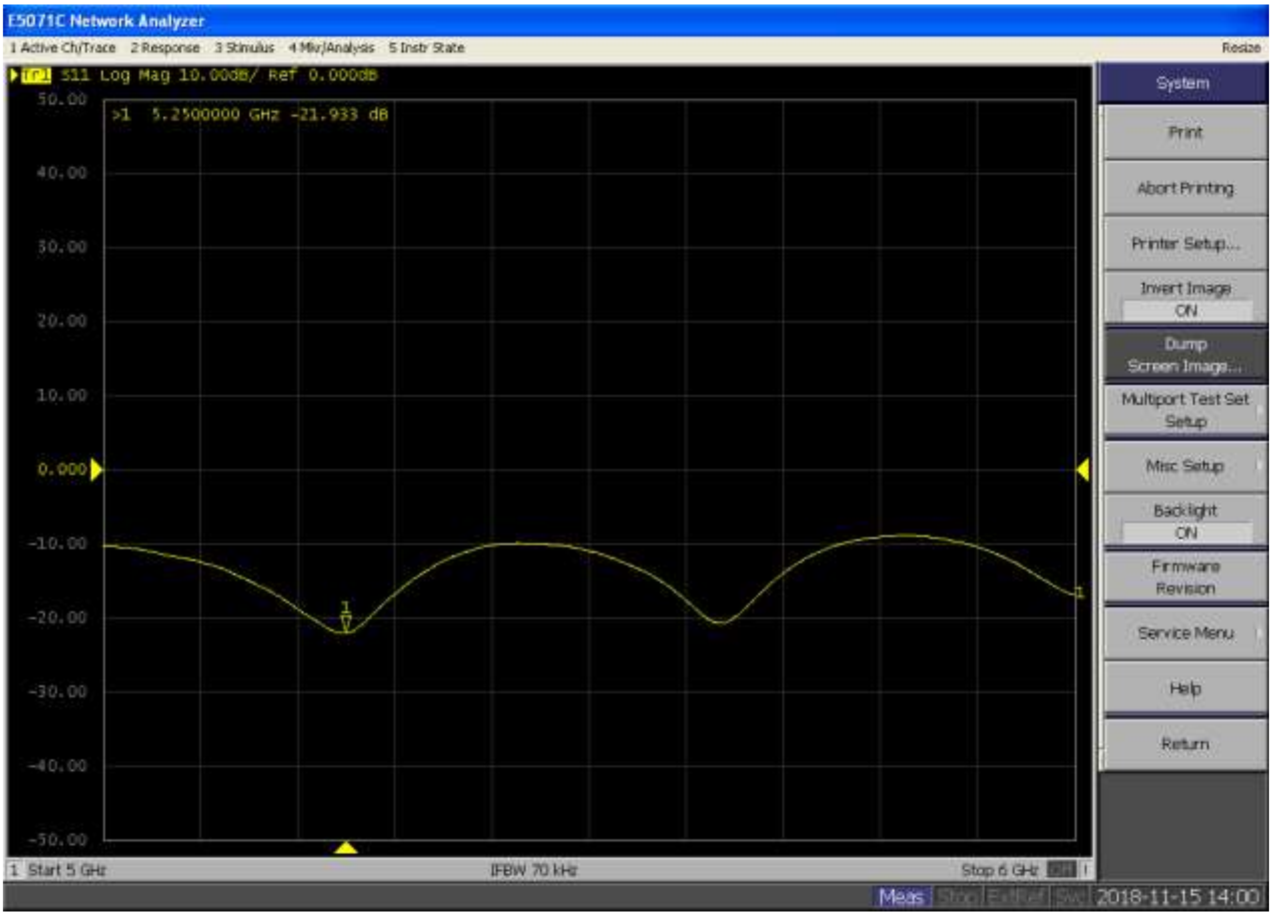
IFBW 70 kHz
Stop 3 GHz
Meas
2018-11-15 13:32


E5071C Network Analyzer
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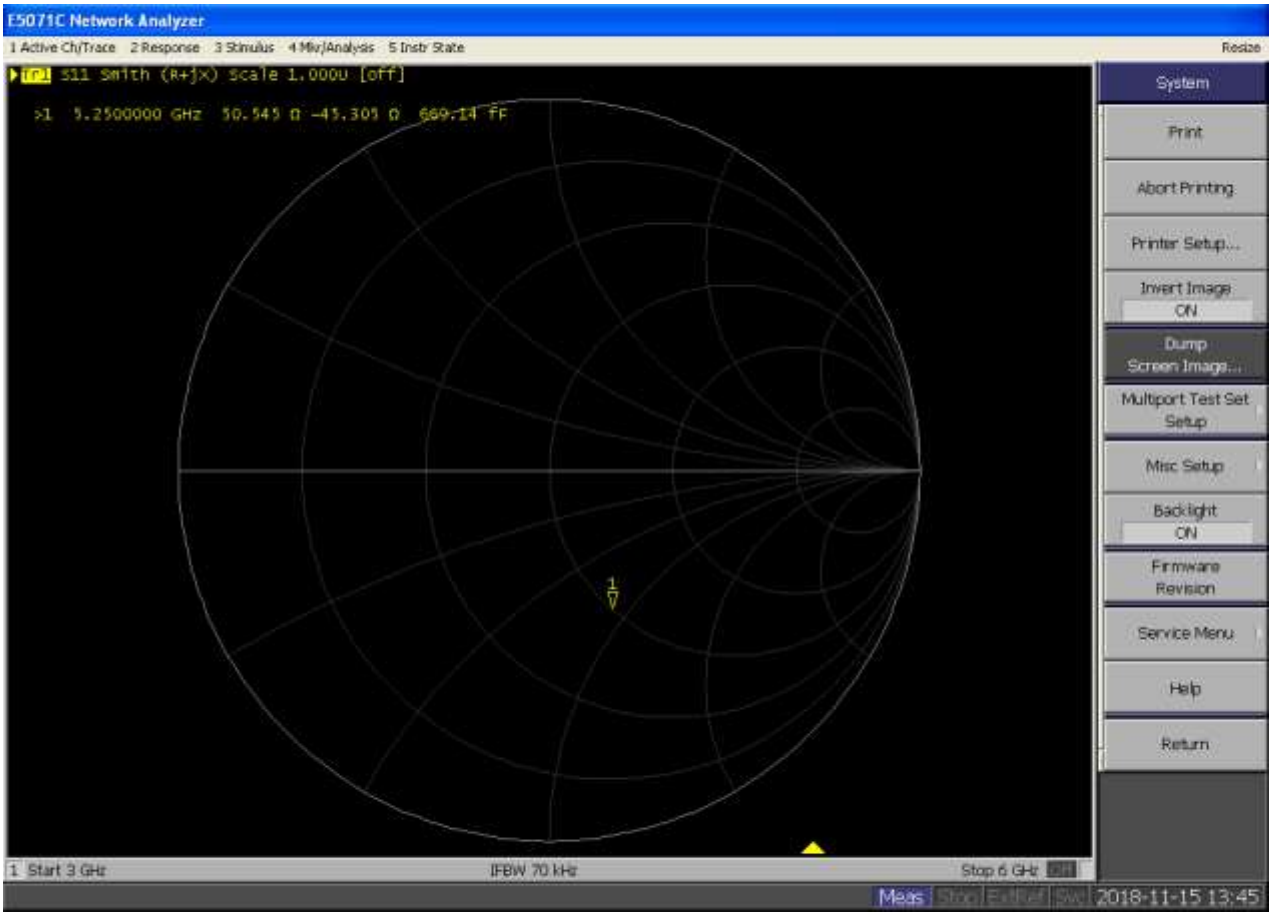
Resize
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 5.2500000 GHz -21.933 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
System
Print
Abort Printing
Printer Setup...
Invert Image ON
Dump Screen Image...
Multiport Test Set Setup
Misc Setup
Backlight ON
Firmware Revision
Service Menu
Help
Return
1 Start 5 GHz
IFBW 70 kHz
Stop 6 GHz
Meas
2018-11-15 14:00


E5071C Network Analyzer
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Resize
Tr1 S11 Smith (R+jX) Scale 1.000U [off]
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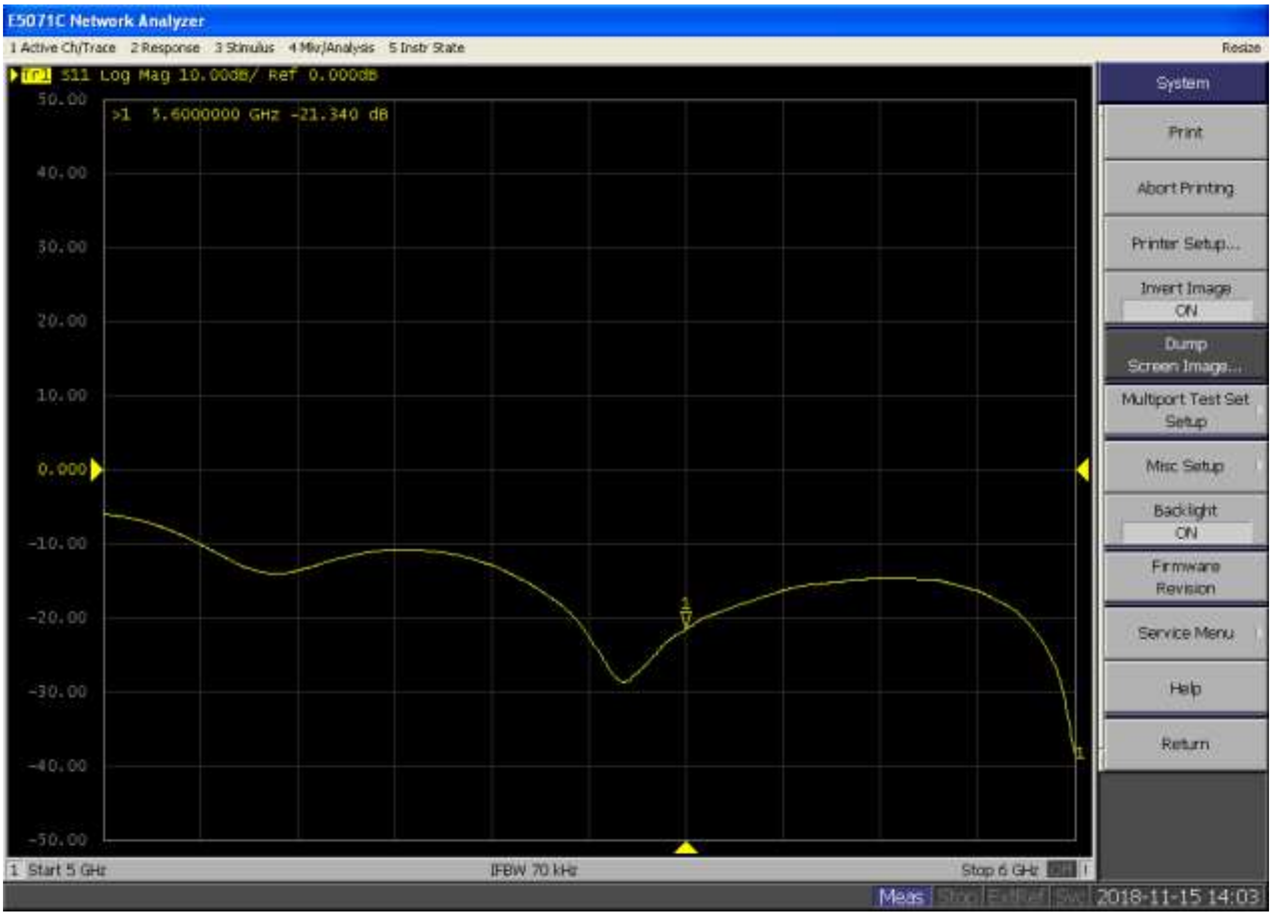
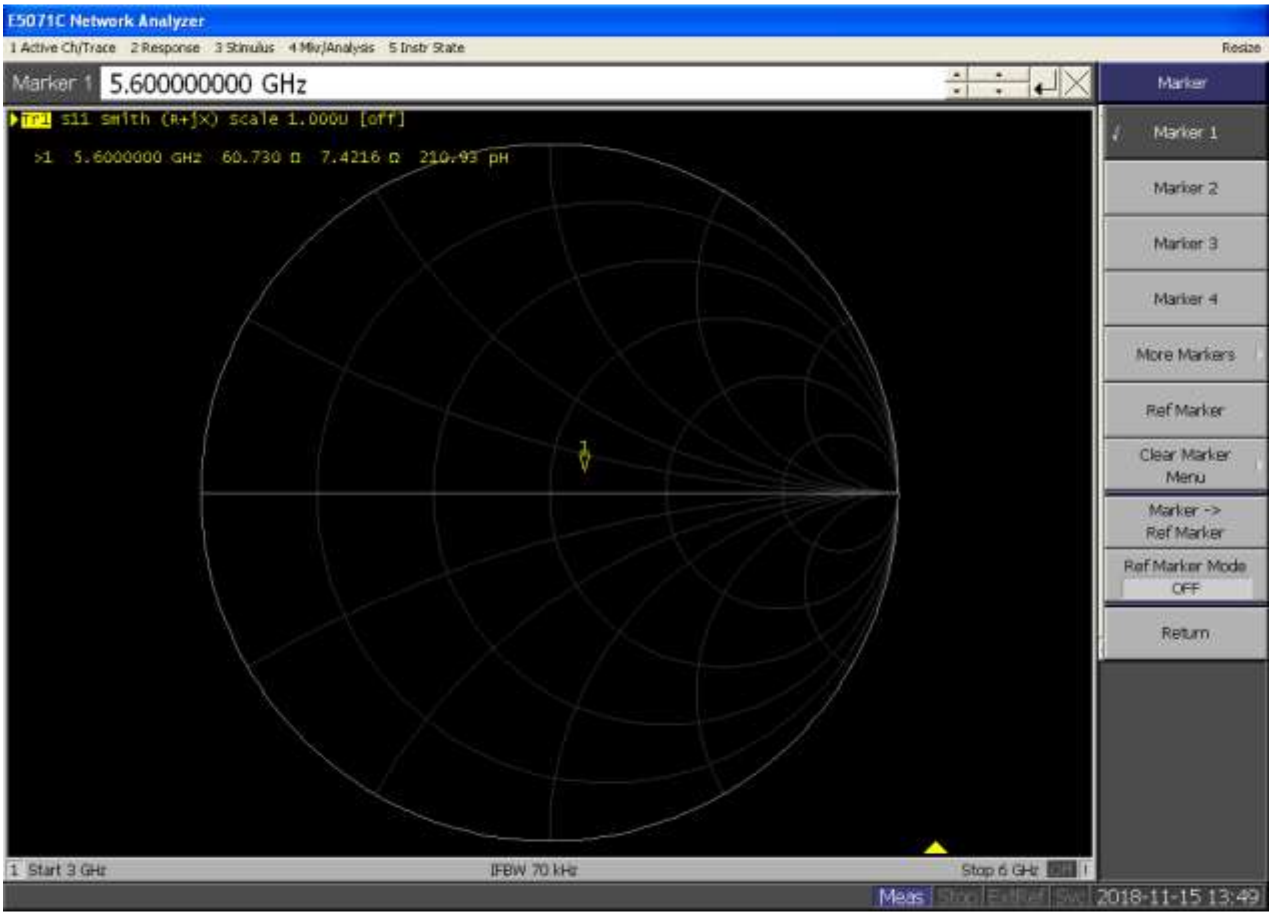
System
Print
Abort Printing
Printer Setup...
Invert Image ON
Dump Screen Image...
Multiport Test Set Setup
Misc Setup
Backlight ON
Firmware Revision
Service Menu
Help
Return
1 Start 3 GHz
IFBW 70 kHz
Stop 6 GHz
Meas
2018-11-15 13:45


E5071C Network Analyzer
1 Active Ch/Trace 2 Response 3 Stimulus 4 Mkr/Analysis 5 Instr State
Resize
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 5.6000000 GHz -21.340 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
System
Print
Abort Printing
Printer Setup...
Invert Image ON
Dump Screen Image...
Multiport Test Set Setup
Misc Setup
Backlight ON
Firmware Revision
Service Menu
Help
Return
1 Start 5 GHz
IFBW 70 kHz
Stop 6 GHz
Meas
2018-11-15 14:03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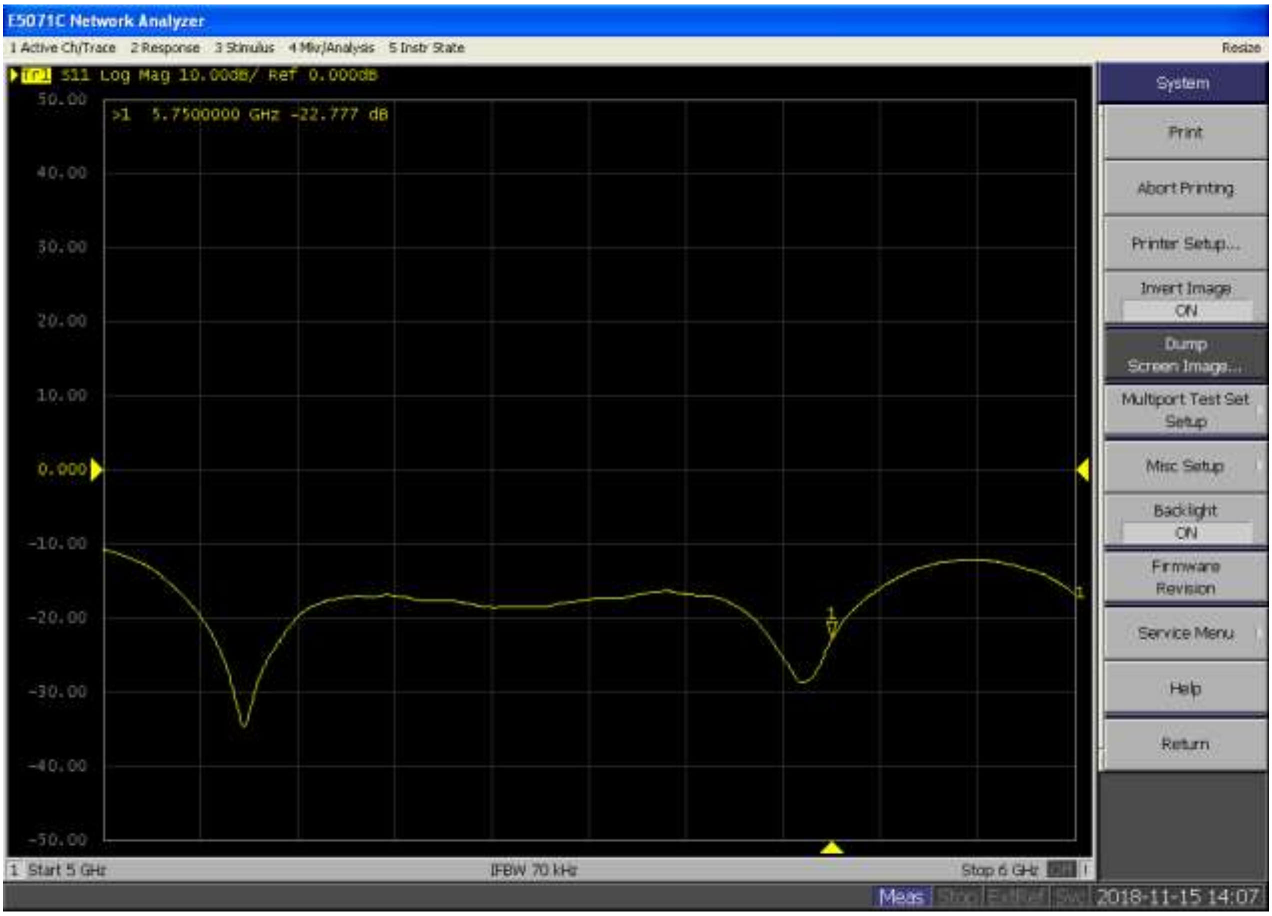
Marker 1 5.600000000 GHz
Tr1 S11 Smith (R+jX) Scale 1.000U [off]
>1 5.6000000 GHz 60.730 Ω 7.4216 Ω 210.93 pH
1 Start 3 GHz
IFBW 70 kHz
Stop 6 GHz
Marker
Marker 1
Marker 2
Marker 3
Marker 4
More Markers
Ref Marker
Clear Marker Menu
Marker -> Ref Marker
Ref Marker Mode OFF
Return
2018-11-15 13:49


E5071C Network Analyzer
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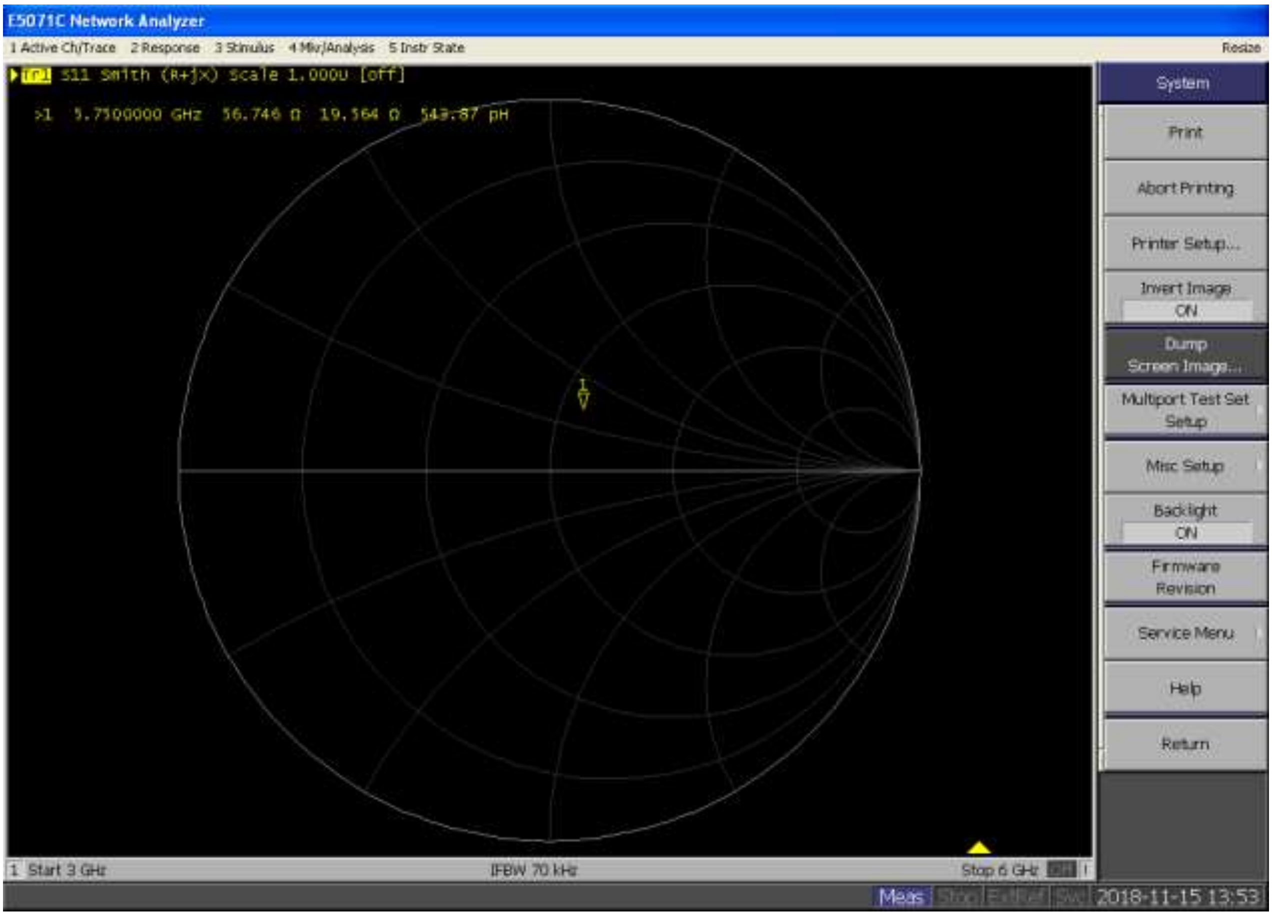
Tr1 S11 Log Mag 10.00dB/ Ref 0.000dB
>1 5.7500000 GHz -22.777 dB
50.00
40.00
30.00
20.00
10.00
0.000
-10.00
-20.00
-30.00
-40.00
-50.00
1 Start 5 GHz
IFBW 70 kHz
Stop 6 GHz
System
Print
Abort Printing
Printer Setup...
Invert Image ON
Dump Screen Image...
Multiport Test Set Setup
Misc Setup
Backlight ON
Firmware Revision
Service Menu
Help
Return
2018-11-15 14:07



Note:From KDB 865664 D01v01r04 clause3.2.2 2）c)&d)

c) When the most recent return-loss result, measured at least annually, deviates by more than 20% from the previous measurement (i.e. value in dB × 0.2) or not meeting the required 20 dB minimum return-loss requirement.24

d) When the most recent measurement of the real or imaginary parts of the impedance, measured at least annually, deviates by more than 5 Ω from the previous measurement.

Since the dipole antenna calibration are more than one year ， We increased the return loss and impedance

DASY5 Validation Report for Head TSL

Date: 08.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

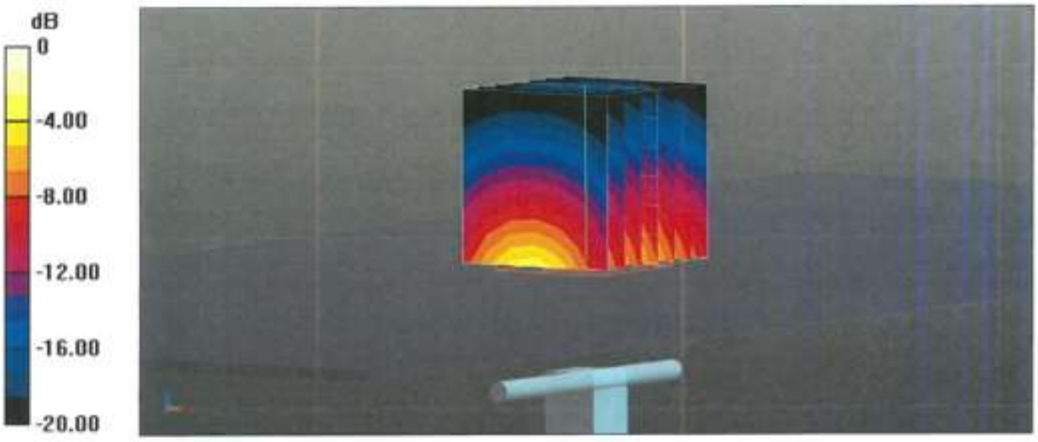
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 839

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 S/m; ε_r = 38.7; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

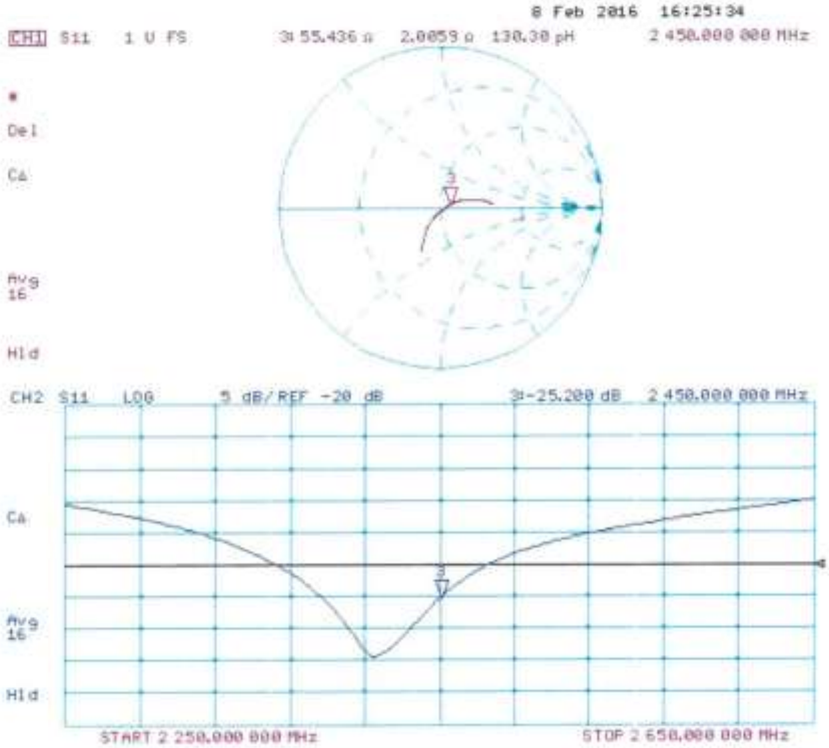
- Probe: EX3DV4 - SN7349; ConvF(7.76, 7.76, 7.76); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 113.0 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 26.2 W/kg
SAR(1 g) = 13 W/kg; SAR(10 g) = 6.03 W/kg
Maximum value of SAR (measured) = 21.2 W/kg



0 dB = 21.2 W/kg = 13.26 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 09.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

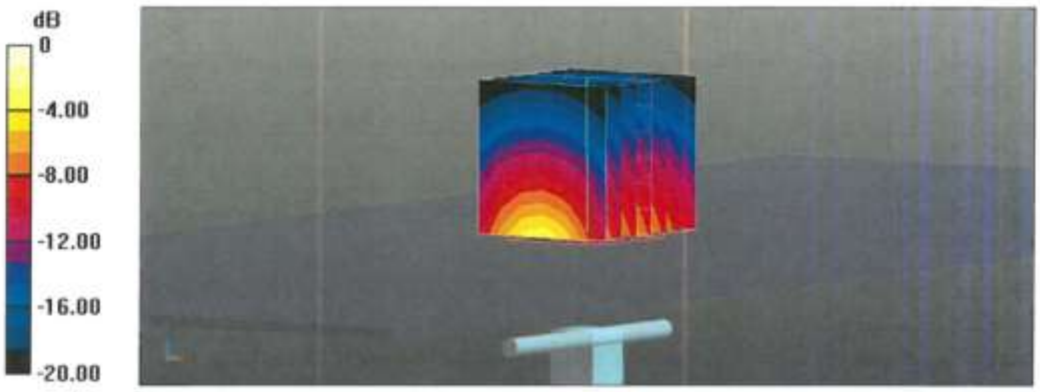
DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 839

Communication System: UID 0 - CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; $\sigma = 2$ S/m; $\varepsilon_r = 52.9$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

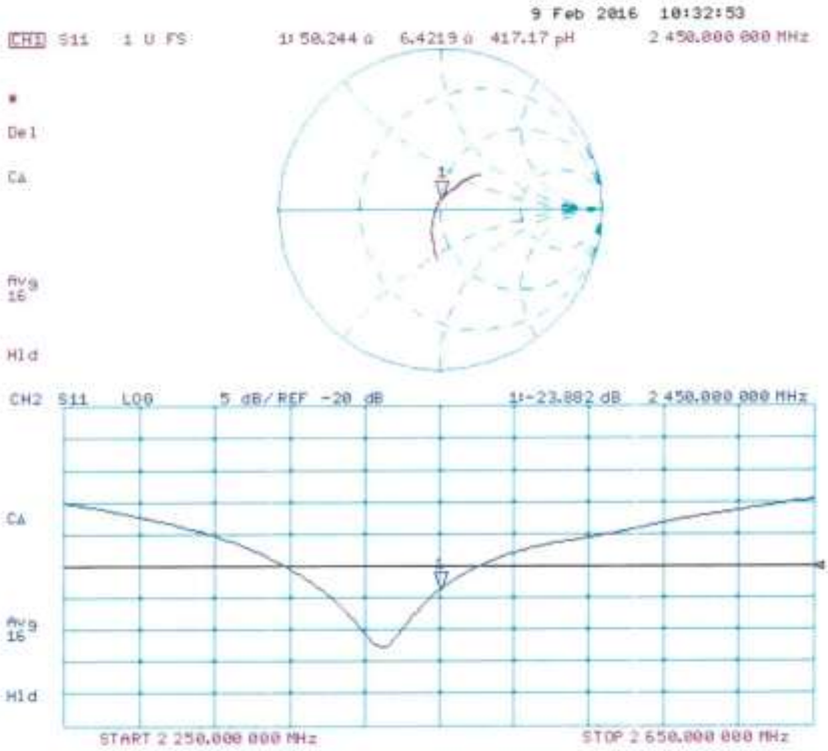
- Probe: EX3DV4 - SN7349; ConvF(7.79, 7.79, 7.79); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:
Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 105.1 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 25.0 W/kg
SAR(1 g) = 12.6 W/kg; SAR(10 g) = 5.87 W/kg
Maximum value of SAR (measured) = 20.4 W/kg



0 dB = 20.4 W/kg = 13.10 dBW/kg

Impedance Measurement Plot for Body TSL



Certificate No: D2450V2-839_Feb16 Page 8 of 8

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
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Servizio svizzero di taratura
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The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **QTK-CN (Auden)**

Certificate No: **D5GHzV2-1078_Feb16**

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1078
Calibration procedure(s)	QA CAL-22.v2 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	February 10, 2016

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	US37292783	07-Oct-15 (No. 217-02222)	Oct-16
Power sensor HP 8481A	MY41092317	07-Oct-15 (No. 217-02223)	Oct-16
Reference 20 dB Attenuator	SN: 5058 (20k)	01-Apr-15 (No. 217-02131)	Mar-16
Type-N mismatch combination	SN: 5047.2 / 06327	01-Apr-15 (No. 217-02134)	Mar-16
Reference Probe EX3DV4	SN: 3503	31-Dec-15 (No. EX3-3503_Dec15)	Dec-16
DAE4	SN: 601	30-Dec-15 (No. DAE4-601_Dec15)	Dec-16

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100972	15-Jun-15 (in house check Jun-15)	In house check: Jun-18
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-15)	In house check: Oct-16

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 11, 2016

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: D5GHzV2-1078_Feb16 Page 1 of 13

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
Swiss Calibration Service

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The Swiss Accreditation Service is one of the signatories to the EA
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
b) IEC 62209-2, "Procedure to determine the Specific Absorption Rate (SAR) for wireless communication devices used in close proximity to the human body (frequency range of 30 MHz to 6 GHz)", March 2010
c) KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

Measurement Conditions

DASY system configuration, as far as not given on page 1.

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5250 MHz ± 1 MHz 5600 MHz ± 1 MHz 5750 MHz ± 1 MHz	

Head TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	35.9	4.71 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.2 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.71 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**76.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.7 ± 6 %	4.90 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.11 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.35 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.3 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.4	5.22 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.5 ± 6 %	5.05 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.79 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.24 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5250 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.36 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.46 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5250 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.10 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.8 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.94 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.8 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5750 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.3	5.94 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.2 ± 6 %	6.15 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5750 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.58 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.13 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.1 W/kg ± 19.5 % (k=2)**

Appendix (Additional assessments outside the scope of SCS 0108)

Antenna Parameters with Head TSL at 5250 MHz

Impedance, transformed to feed point	51.7 Ω - 7.8 jΩ
Return Loss	- 22.2 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	56.9 Ω - 5.9 jΩ
Return Loss	- 21.5 dB

Antenna Parameters with Head TSL at 5750 MHz

Impedance, transformed to feed point	55.8 Ω - 1.3 jΩ
Return Loss	- 25.0 dB

Antenna Parameters with Body TSL at 5250 MHz

Impedance, transformed to feed point	52.3 Ω - 6.5 jΩ
Return Loss	- 23.4 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	58.3 Ω - 3.4 jΩ
Return Loss	- 21.6 dB

Antenna Parameters with Body TSL at 5750 MHz

Impedance, transformed to feed point	56.2 Ω + 0.4 jΩ
Return Loss	- 24.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns

After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 26, 2008

DEKRA

DASY5 Validation Report for Head TSL

Date: 04.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole D5GHzV2; Type: D5GHzV2; Serial: D5GHzV2 - SN:1078

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 4.55 S/m; ε_r = 35.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.9 S/m; ε_r = 34.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 5.05 S/m; ε_r = 34.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

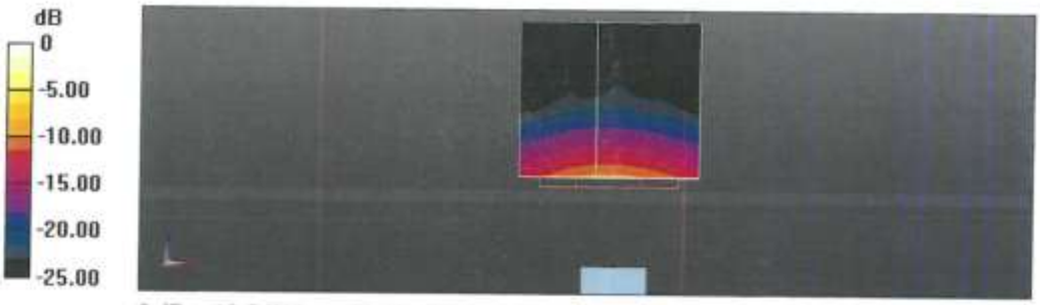
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.53, 5.53, 5.53); Calibrated: 31.12.2015, ConvF(4.99, 4.99, 4.99); Calibrated: 31.12.2015, ConvF(4.95, 4.95, 4.95); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.58 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 28.2 W/kg
SAR(1 g) = 7.71 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 17.5 W/kg

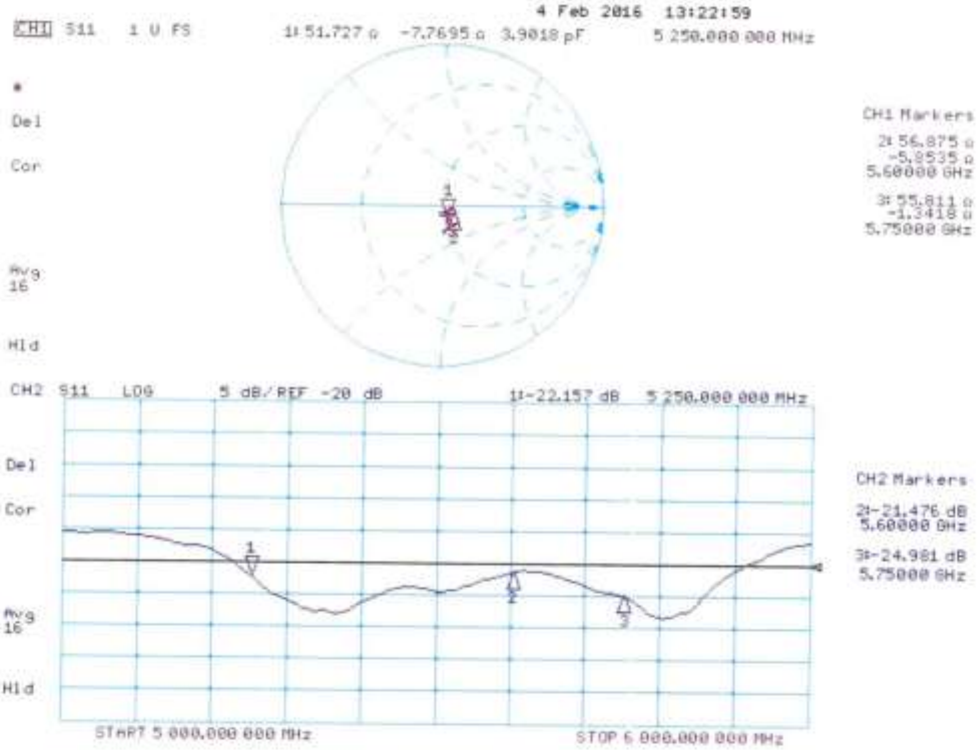
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 72.43 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 8.11 W/kg; SAR(10 g) = 2.35 W/kg
Maximum value of SAR (measured) = 18.8 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 70.73 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 31.4 W/kg
SAR(1 g) = 7.79 W/kg; SAR(10 g) = 2.24 W/kg
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 18.3 W/kg = 12.62 dBW/kg

Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date: 10.02.2016

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1078

Communication System: UID 0 - CW; Frequency: 5250 MHz, Frequency: 5600 MHz, Frequency: 5750 MHz
Medium parameters used: f = 5250 MHz; σ = 5.46 S/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.94 S/m; ε_r = 46.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5750 MHz; σ = 6.15 S/m; ε_r = 46.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

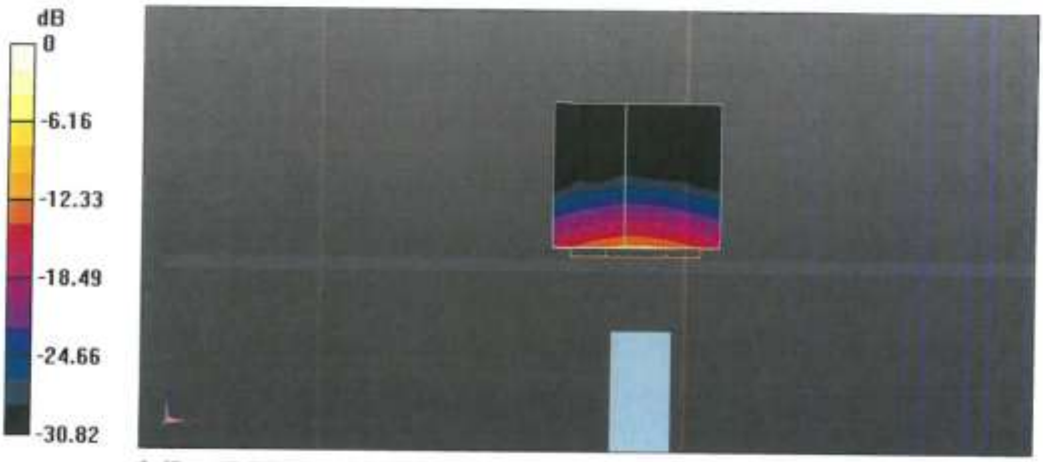
DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.85, 4.85, 4.85); Calibrated: 31.12.2015, ConvF(4.35, 4.35, 4.35); Calibrated: 31.12.2015, ConvF(4.3, 4.3, 4.3); Calibrated: 31.12.2015;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.12.2015
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1258); SEMCAD X 14.6.10(7372)

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5250 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.04 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 27.8 W/kg
SAR(1 g) = 7.42 W/kg; SAR(10 g) = 2.1 W/kg
Maximum value of SAR (measured) = 17.0 W/kg

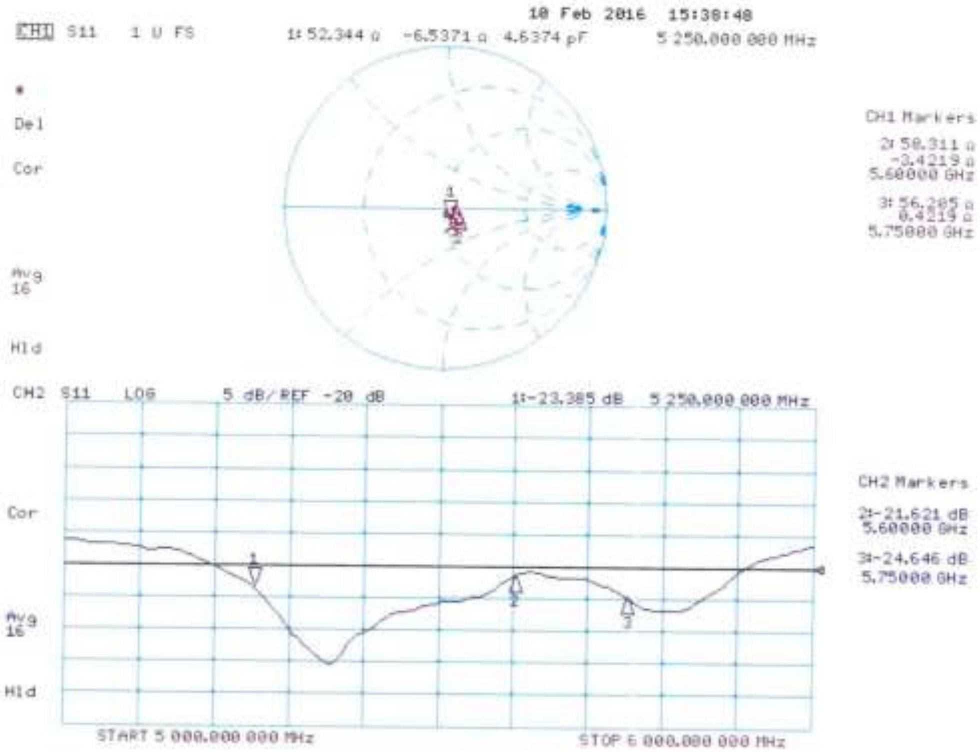
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 66.76 V/m; Power Drift = 0.03 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 19.1 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5750 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.46 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 32.4 W/kg
SAR(1 g) = 7.58 W/kg; SAR(10 g) = 2.13 W/kg
Maximum value of SAR (measured) = 18.3 W/kg



0 dB = 17.0 W/kg = 12.30 dBW/kg

Impedance Measurement Plot for Body TSL



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Appendix E. DAE Calibration Data

Schmid & Partner Engineering AG

s p e a g

Zeughausstrasse 43, 8004 Zurich, Switzerland
Phone +41 44 245 9700, Fax +41 44 245 9779
info@speag.com, http://www.speag.com

1220

IMPORTANT NOTICE

USAGE OF THE DAE 4

The DAE unit is a delicate, high precision instrument and requires careful treatment by the user. There are no serviceable parts inside the DAE. Special attention shall be given to the following points:

Battery Exchange: The battery cover of the DAE4 unit is closed using a screw, over tightening the screw may cause the threads inside the DAE to wear out.

Shipping of the DAE: Before shipping the DAE to SPEAG for calibration, remove the batteries and pack the DAE in an antistatic bag. This antistatic bag shall then be packed into a larger box or container which protects the DAE from impacts during transportation. The package shall be marked to indicate that a fragile instrument is inside.

E-Stop Failures: Touch detection may be malfunctioning due to broken magnets in the E-stop. Rough handling of the E-stop may lead to damage of these magnets. Touch and collision errors are often caused by dust and dirt accumulated in the E-stop. To prevent E-stop failure, the customer shall always mount the probe to the DAE carefully and keep the DAE unit in a non-dusty environment if not used for measurements.

Repair: Minor repairs are performed at no extra cost during the annual calibration. However, SPEAG reserves the right to charge for any repair especially if rough unprofessional handling caused the defect.

DASY Configuration Files: Since the exact values of the DAE input resistances, as measured during the calibration procedure of a DAE unit, are not used by the DASY software, a nominal value of 200 MOhm is given in the corresponding configuration file.

Important Note:
Warranty and calibration is void if the DAE unit is disassembled partly or fully by the Customer.

Important Note:
Never attempt to grease or oil the E-stop assembly. Cleaning and readjusting of the E-stop assembly is allowed by certified SPEAG personnel only and is part of the annual calibration procedure.

Important Note:
To prevent damage of the DAE probe connector pins, use great care when installing the probe to the DAE. Carefully connect the probe with the connector notch oriented in the mating position. Avoid any rotational movement of the probe body versus the DAE while turning the locking nut of the connector. The same care shall be used when disconnecting the probe from the DAE.

Schmid & Partner Engineering

TN_BR040315AD DAE4.doc 11.12.2009

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss Accreditation Service (SAS)
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Client **DEKRA-CN (Auden)**

Certificate No: **DAE4-1220_Feb18**

CALIBRATION CERTIFICATE

Object	DAE4 - SD 000 D04 BM - SN: 1220
Calibration procedure(s)	QA CAL-06.v29 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	February 16, 2018

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	31-Aug-17 (No:21092)	Aug-18
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Auto DAE Calibration Unit	SE UWS 053 AA 1001	04-Jan-18 (in house check)	In house check: Jan-19
Calibrator Box V2.1	SE UMS 006 AA 1002	04-Jan-18 (in house check)	In house check: Jan-19

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Laboratory Technician	
Approved by:	Sven Kühn	Deputy Manager	

Issued: February 16, 2018

This calibration certificate shall not be reproduced except in full without written approval of the laboratory.

Certificate No: DAE4-1220_Feb18 Page 1 of 5

Calibration Laboratory of
Schmid & Partner
Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 0108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* Typical value for information: DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1µV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	405.183 ± 0.02% (k=2)	404.901 ± 0.02% (k=2)	404.132 ± 0.02% (k=2)
Low Range	3.97774 ± 1.50% (k=2)	3.99519 ± 1.50% (k=2)	3.98704 ± 1.50% (k=2)

Connector Angle

Connector Angle to be used in DASY system	176.0 ° ± 1 °

Appendix (Additional assessments outside the scope of SCS0108)

1. DC Voltage Linearity

High Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	200034.43	0.20	0.00
Channel X	+ Input	20006.79	1.37	0.01
Channel X	- Input	-20001.57	3.35	-0.02
Channel Y	+ Input	200031.32	-2.97	-0.00
Channel Y	+ Input	20006.26	0.93	0.00
Channel Y	- Input	-20005.47	-0.45	0.00
Channel Z	+ Input	200033.78	-0.60	-0.00
Channel Z	+ Input	20005.34	0.05	0.00
Channel Z	- Input	-20005.69	-0.57	0.00

Low Range		Reading (μV)	Difference (μV)	Error (%)
Channel X	+ Input	2001.87	0.22	0.01
Channel X	+ Input	201.68	0.05	0.03
Channel X	- Input	-198.33	0.11	-0.05
Channel Y	+ Input	2001.15	-0.34	-0.02
Channel Y	+ Input	201.02	-0.46	-0.23
Channel Y	- Input	-199.38	-0.85	0.43
Channel Z	+ Input	2001.23	-0.26	-0.01
Channel Z	+ Input	200.84	-0.64	-0.32
Channel Z	- Input	-199.92	-1.37	0.69

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	10.44	8.23
	- 200	-7.03	-9.21
Channel Y	200	-8.37	-9.19
	- 200	7.98	7.71
Channel Z	200	12.54	12.17
	- 200	-14.72	-14.67

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.55	-4.00
Channel Y	200	7.74	-	2.39
Channel Z	200	9.99	5.68	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15877	14370
Channel Y	16017	16451
Channel Z	15705	16147

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	0.92	-0.09	2.09	0.38
Channel Y	0.34	-0.78	1.81	0.44
Channel Z	-0.85	-2.66	0.62	0.47

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance (Typical values for information)

	Zeroing (kOhm)	Measuring (MOhm)
Channel X	200	200
Channel Y	200	200
Channel Z	200	200

8. Low Battery Alarm Voltage (Typical values for information)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (Typical values for information)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.01	+6	+14
Supply (- Vcc)	-0.01	-8	-9