SAR Compliance Test Report

Date of Report	20/12/2016	**Client's Contact person:**	Gabriele Isola
Number of pages:	30	**Responsible Test engineer:**	Ilpo Joensuu
Testing laboratory:	Verkotan Oy Elektroniikkatie 17 90590 Oulu Finland	**Client:**	CAEN RFID srl Via Vetraia, 11 55049 Viareggio (LU) Italy
Tested device	**R1170IU**		
Related reports:	-		
Testing has been carried out in accordance with:	**47CFR §2.1093** Radiofrequency Radiation Exposure Evaluation: Portable Devices **FCC published RF exposure KDB procedures** **IEEE 1528 - 2013** IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Technique		
Documentation:	The test report must always be reproduced in full; reproduction of an excerpt only is subject to written approval of the testing laboratory		
Test Results:	**The EUT complies with the requirements in respect of all parameters subject to the test.** The test results relate only to devices specified in this document		

Date and signatures: 20.12.2016

For the contents:

Miia Nurkkala

Digitally signed by Miia Nurkkala
Date: 2016.12.20 10:55:35 +02'00'

Laboratory Manager

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1. SUMMARY OF SAR TEST REPORT

1.1 Test Details

Equipment under Test (EUT):

Product:	R1170IU qIDmini Keyfob Bluetooth UHF RFID Reader
Manufacturer:	CAEN RFID
Serial Number:	0674045316451124, 0674045316381063
FCC ID Number:	UVECAENRFID017
Hardware Version:	HW 0203
DUT Number:	23117, 23118
Battery Type used in testing:	Li-Ion 3.7V, 570mAh
Portable/ Mobile device	Portable
State of the Sample	Production sample

Testing information:

Testing performed:	12-15.12.2016
Notes:	Body-worn configuration SAR is tested in this report.
Document name:	FCC SAR report_R1170IU_20122016.docx
Temperature °C	22±2 / Controlled
Humidity RH%	20±20 / Controlled
Measurement performed by:	Ilpo Joensuu

1.2 Maximum Results

The maximum reported* SAR value for Body-worn configuration with 5 mm separation distance is shown in a table below. The device conforms to the requirements of the standards when the maximum reported SAR value is less than or equal to the limit. The SAR limit specified in FCC 47 CFR part 2 (2.1093) for Body is SAR_{1g} 1.6 W/kg,

Equipment Class	System	Highest Reported* SAR_{1g}(W/kg) in Body-Worn Condition	Result
DSS	**UHF RFID**	**1.56**	**PASS**

* Reported SAR Values are scaled to upper limit of power tuning tolerance.

1.2.1 Maximum Drift

Maximum Drift During Measurements	-0.81 dB

1.2.2 Measurement Uncertainty

Expanded Uncertainty (k=2) 95 %	23.4%

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

The DUT is a handheld RFID reader. When the device transmits for RFID operation it is typically hold in the operator's hand. However, the product can also be used in a body-worn configuration with a lanyard. Body-worn configuration SAR is tested in this report.

Device Category	Portable
Exposure Environment	Uncontrolled

2.1 Supported Frequency Bands and Operational Modes

TX Frequency bands	Modes of Operation	Transmitter Frequency Range (MHz)
	RFID	**902.75 - 927.25**
	BLuetooth	**2402-2480**

Common features	
RFID Duty Cycle	30.88%
Battery	Li-Ion 3.7V, 570mAh
Size	(W)99 x (L)54 x (H)20 mm^3 max
RFID Antenna type	Integrated UHF loop antenna

2.2 Simultaneous Transmission possibilities

Bluetooth and RFID can not transmit simultaneously.

2.3 Test exlusions

The maximum peak conducted power from the BLUETOOTH module (FCC ID: T9J-RN42) is 4mW so the SAR exclusion threshold (Appendix A of KDB 447498 D01) for 5mm separation distance is not exceeded. Thus, Bluetooth SAR is not measured.

2.4 Power Drift

Once the EUT is set to transmit in a room temperature with a fully loaded battery, it transmits with maximum power typical to the sample. As a function of time, possibly due to heating the transmitted power drops, causing drift to SAR results. Conducted power vs time curve is presented in figure 1. Channel 25 was used for the measurement. According to the EUT manufacturer this is a standard behaviour of the device thus drift is not considered in the SAR result scaling. Each SAR test was started with device in room temperature and with fully loaded battery.

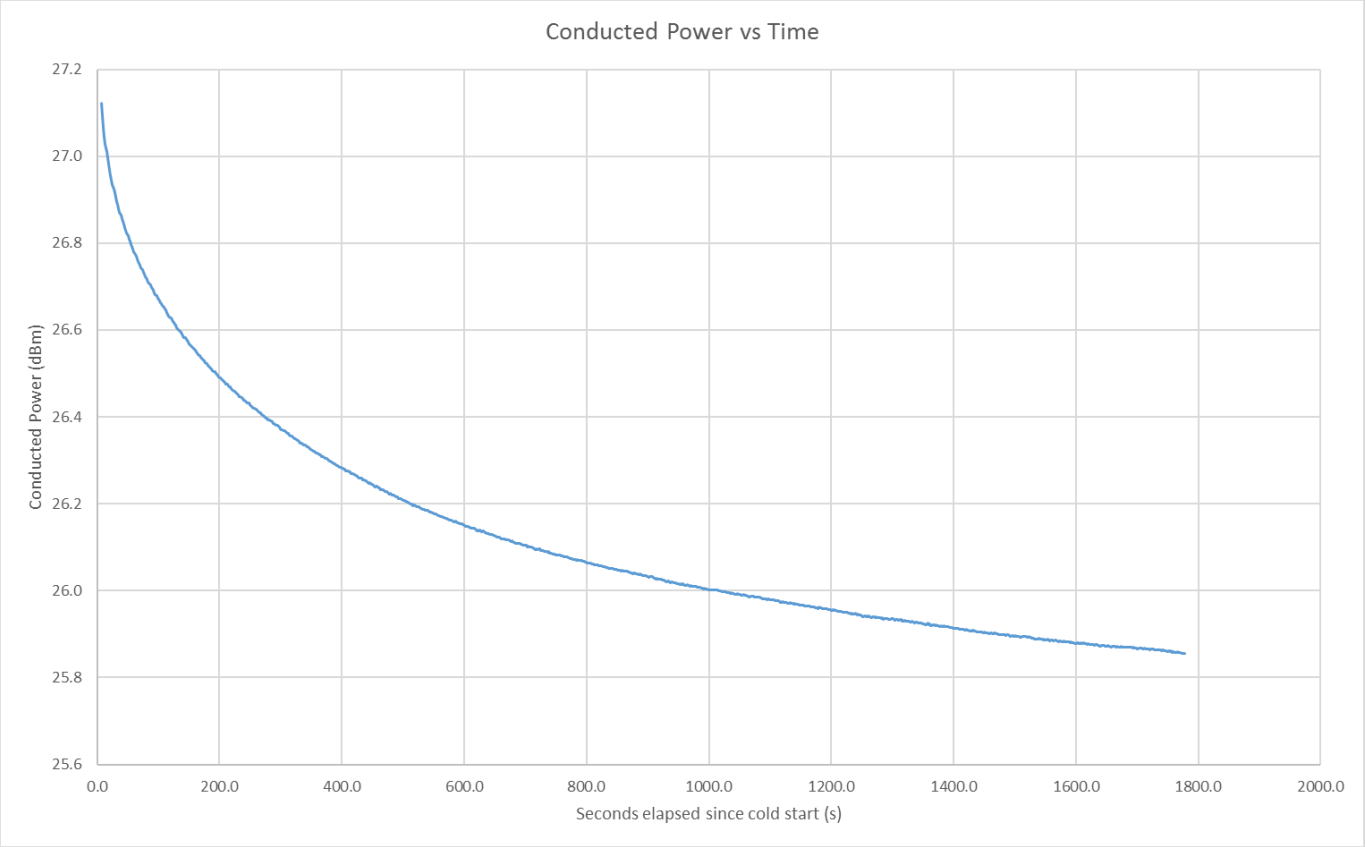


Figure 1 EUT conducted power vs time curve.

3. OUTPUT POWER

3.1 Maximum output power

From a Customer;

Mode	Upper Limit (dBm)		
	CH 0 902.75 GHz	CH 25 915.25 GHz	CH 49 927.25 GHz
RFID	27.5	27.0	26.5

3.2 Tested maximum conducted power

Mode	Upper Limit (dBm)		
	CH 0 902.75 GHz	CH 25 915.25 GHz	CH 49 927.25 GHz
RFID	26.97	26.47	25.67

4. TEST EQUIPMENT

Dasy4 near field scanning system, manufactured by SPEAG was used for SAR testing. The test system consists of high precision robotics system (Staubli), robot controller, computer, near-field probe, probe alignment sensor, and a phantom containing the tissue equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location of maximum electromagnetic field.

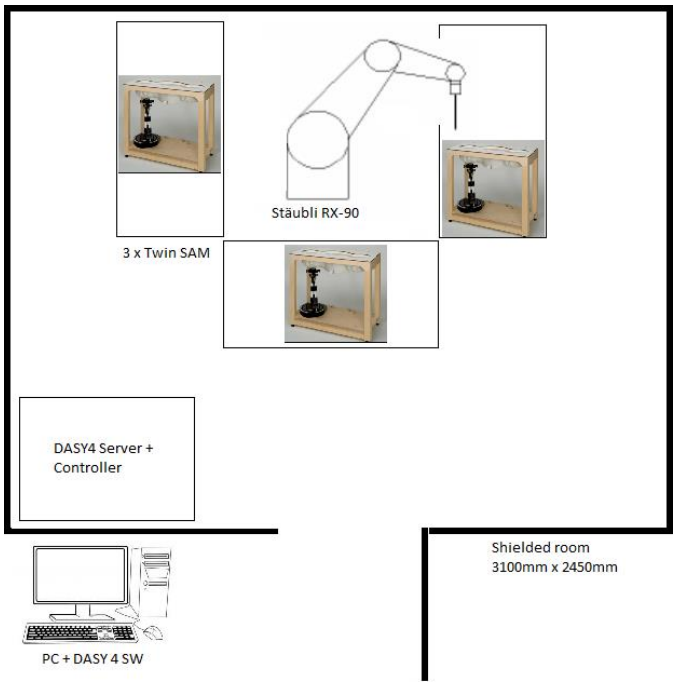


Figure 2 Schematic Laboratory Picture

4.1 Test Equipment List

Main used test system components are listed below. For full equipment list and calibration intervals, please contact the testing laboratory.

Test Equipment	Model	Serial Number	Calibration Date	Calibration Expiry
DAE	DAE3	371	04/2016	01/2017
Probe	EX3DV4	3570	01/2016	01/2017
Dipole	D835V2	448	01/2016	01/2019
DASY Software	v4.7	na	na	na
Signal Generator	SMIQ06B	834968/023	na	na
Amplifier	AR 5S1G4	27573	na	na
Power Reflection Meter	R&S NRT	835065/049	12/2015	12/2016
Power Sensor	NRT Z-44	835374/021	01/2016	01/2017

4.1.1 Isotropic E-field Probe Type EX3DV4

Construction	Symmetrical design with triangular core Built-in shielding against static charges PEEK enclosure material (resistant to organic solvents, e.g., DGBE)
Calibration	Calibration certificate in Appendix D
Frequency	10 MHz to >6 GHz (dosimetry); Linearity: ± 0.2 dB (30 MHz to 6 GHz)
Directivity	± 0.3 dB in HSL (rotation around probe axis) ± 0.5 dB in tissue material (rotation normal to probe axis)
Dynamic Range	10 µW/g to > 100 mW/g, Linearity: ± 0.2 dB
Dimensions	Overall length: 330 mm Tip length: 10 mm Body diameter: 12 mm Tip diameter: 2.5 mm Distance from probe tip to dipole centers: 1.0 mm
Application	General dosimetry up to 6 GHz Compliance tests of mobile phones Fast automatic scanning in arbitrary phantoms

4.2 Phantoms

The phantom used in SAR tests was the flat phantom section of the twin-headed "SAM Phantom", manufactured by SPEAG. The phantom conforms to the requirements of IEEE 1528 and FCC published RF Exposure KDB Procedures.

4.3 Tissue Simulants

Recommended values for the dielectric parameters of the tissue simulants are given in IEEE 1528 and FCC published RF Exposure KDB Procedures. The dielectric parameters of the used tissue simulants were within ±5% of the recommended values in all frequencies used. SAR testing was carried out within 24 hours of measuring the dielectric parameters. Depth of the tissue simulant was at least 15.0 cm from the inner surface of the flat phantom.

4.3.1 Recipes

Ingredient	**Body (% by weight)**
	835 MHz
Deionised Water	69.25
Tween 20	30.0
Salt	0.75

4.4 System Validation Status

Frequency [MHz]	**Dipole Type / SN**	**Probe Type / SN**	**Calibrated Signal Type**	**DAE Unit / SN**	**Validation Done**	
					Head tissue simulant	**Body tissue simulant**
835	D835/D448	EX3DV4 / 3570	CW	DAE3 / 371	04/2016	04/2016

4.5 System Check

Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Input Power	Measured SAR_{1g} [W/kg]	1 W Target SAR_{1g} [W/kg]	1 W Normalized SAR_{1g} [W/kg]	$Deviation_{1g}$ (%)	Plot #
12.12.2016	B835	21.6	835	250mW	2.51	9.55	10.04	5.1%	1
13.12.2016	B835	20.4	835	250mW	2.56	9.55	10.24	7.2%	2
14.12.2016	B835	20.0	835	250mW	2.47	9.55	9.88	3.5%	3

4.5.1 Tissue Simulant Verification

				Target		Measured			
Date	Tissue Type	Tissue Temp. [°C]	Frequency [MHz]	Conductivity, σ [S/m]	Dielectric Constant [ε]	Conductivity σ [S/m]	Dielectric Constant [ε]	Deviation σ (%)	Deviation ε (%)
12.12.2016	B835	22	835	0.98	55.2	1.02	54.1	3.4	-2.0
			902.75	1.05	55	1.06	53.8	0.5	-2.2
			915.25	1.06	55	1.06	53.7	0.7	-2.3
			927.25	1.06	55	1.07	53.7	0.8	-2.3
13.12.2016	B835	22	835	0.98	55.2	1.0	53.5	3.3	-3.0
			902.75	1.05	55	1.04	53.2	-0.8	-3.2
			915.25	1.06	55	1.05	53.2	-0.5	-3.3
			927.25	1.06	55	1.06	53.1	-0.3	-3.4
14.12.2016	B835	22	835	0.98	55.2	1.0	53.5	3.0	-3.0
			902.75	1.05	55	1.04	53.2	-1.0	-3.2
			915.25	1.06	55	1.05	53.2	-0.7	-3.3
			927.25	1.06	55	1.06	53.1	-0.4	-3.3

5. TEST PROCEDURE

The DUT was set to transmit continuously at a maximum power level using a manufacturer specified software.

5.1.1 Body-worn Configuration, 5 mm separation distance

The DUT was placed below the flat phantom using a SPEAG device holder. The DUT was lifted towards the phantom until correct separation distance was reached. Pictures of the test positions are in appendix A.

5.2 Scan Procedures

First, area scans were used for determination of the field distribution. Next, a zoom scan with 7x7x7 points covering a volume of 30x30x30mm was performed around the highest E-field value to determine the averaged SAR value. Power drift was determined by measuring the same point at the start of the area scan and again at the end of the zoom scan.

5.3 SAR Averaging Methods

The maximum SAR value is averaged over a cube of tissue using interpolation and extrapolation.

Extrapolation routines are used to obtain SAR values between the lowest measurement points and the inner phantom surface. The extrapolation distance is determined by the surface detection distance and the probe sensor offset. Several measurements at dierent distances are necessary for the extrapolation.

The interpolation, extrapolation and maximum search routines within Dasy47 are all based on the modified Quadratic Shepard's method (Robert J. Renka," Multivariate Interpolation of Large Sets of Scattered Data", University of North Texas ACM Transactions on Mathematical Software, vol. 14, no. 2, June 1988, pp. 139-148).

6. MEASUREMENT UNCERTAINTY

Uncertainty Budget
IEEE 1528-2013

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		0.7	0.7	±1.9 %	±1.9 %	∞
Hemispherical Isotropy	±9.6 %	R	1.73	0.7	0.7	±3.9 %	±3.9 %	∞
Boundary Effects	±1.0 %	R	1.73	1	1	±0.6 %	±0.6 %	∞
Linearity	±4.7 %	R	1.73	1	1	±2.7 %	±2.7 %	∞
System Detection Limits	±1.0 %	R	1.73	1	1	±0.6 %	±0.6 %	∞
Modulation Response^m	±2.4 %	R	1.73	1	1	±1.4 %	±1.4 %	∞
Readout Electronics	±0.3 %	N	1	1	1	±0.3 %	±0.3 %	∞
Response Time	±0.8 %	R	1.73	1	1	±0.5 %	±0.5 %	∞
Integration Time	±2.6 %	R	1.73	1	1	±1.5 %	±1.5 %	∞
RF Ambient Noise	±3.0 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
RF Ambient Reflections	±3.0 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
Probe Positioner	±0.4 %	R	1.73	1	1	±0.2 %	±0.2 %	∞
Probe Positioning	±2.9 %	R	1.73	1	1	±1.7 %	±1.7 %	∞
Max. SAR Eval.	±2.0 %	R	1.73	1	1	±1.2 %	±1.2 %	∞
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	1.73	1	1	±2.9 %	±2.9 %	∞
Power Scaling	±6 %	R	1.73	1	1	±3.5 %	± 3.5%	∞
Phantom and Setup								
Phantom Uncertainty	±6.1 %	R	1.73	1	1	±3.5 %	±3.5 %	∞
SAR correction	±1.9 %	R	1.73	1	0.84	±1.1 %	±0.9 %	∞
Liquid Conductivity (mea.)	±2.5 %	R	1.73	0.78	0.71	±1.1 %	±1.0 %	∞
Liquid Permittivity (mea.)	±2.5 %	R	1.73	0.26	0.26	±0.3 %	±0.4 %	∞
Temp. unc. - Conductivity	±3.4 %	R	1.73	0.78	0.71	±1.5 %	±1.4 %	∞
Temp. unc. - Permittivity	±0.4 %	R	1.73	0.23	0.26	±0.1 %	±0.1 %	∞
Combined Std. Uncertainty						±11.7 %	±11.6 %	361
Expanded STD Uncertainty						**±23.4 %**	**±23.3 %**	

7. TEST RESULTS

7.1 Body-Worn Configuration, 5 mm separation distance

Band	Channel	Test Position*	Maximun Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Measurement Dudy Cycle	Normal Mode Dudy Cycle	Measured SAR_{1g} [mW/g]	Time averaged SAR_{1g} [mW/g]	Scaling Factor	Reported SAR_{1g} [mW/g]	Plot #
UHF	25	front	27	26.73	-0.679	1	1:3.24	2.86	0.88	1.06	0.94	
UHF	25	back	27	26.73	-0.182	1	1:3.24	4.05	1.25	1.06	1.33	
UHF	25	right	27	26.73	-0.16	1	1:3.24	0.407	0.13	1.06	**0.13**	9
UHF	25	left	27	26.73	0.251	1	1:3.24	0.48	0.15	1.06	**0.16**	8
UHF	25	top	27	26.73	-0.376	1	1:3.24	1.05	0.32	1.06	**0.34**	6
UHF	25	bottom	27	26.73	-0.313	1	1:3.24	0.0393	0.01	1.06	**0.01**	7
UHF	0	front	27.5	27.23	-0.743	1	1:3.24	2.89	0.89	1.06	0.95	
UHF	0	back	27.5	27.23	-0.381	1	1:3.24	4.05	1.25	1.06	1.33	
UHF	49	front	26.5	25.93	-0.418	1	1:3.24	1.81	0.56	1.14	0.64	
UHF	49	back	26.5	25.93	-0.635	1	1:3.24	3.17	0.98	1.14	1.12	

Repeated SAR Measurements:

Band	Channel	Test Position*	Maximun Power [dBm]	Conducted Power [dBm]	Power Drift [dB]	Measurement Dudy Cycle	Normal Mode Dudy Cycle	Measured SAR_{1g} [mW/g]	Time averaged SAR_{1g} [mW/g]	Scaling Factor	Reported SAR_{1g} [mW/g]	Plot #
UHF	25	front 2	27	26.73	-0.401	1	1:3.24	2.78	0.86	1.06	0.91	
UHF	25	back 2	27	26.73	-0.22	1	1:3.24	4.33	1.34	1.06	1.42	
UHF	25	back 3	27	26.73	-0.284	1	1:3.24	4.72	1.46	1.06	**1.55**	
UHF	25	back 4	27	26.73	-0.742	1	1:3.24	3.79	1.17	1.06	1.24	
UHF	0	back2	27.5	27.23	-0.587	1	1:3.24	4.75	1.47	1.06	**1.56**	5
UHF	0	back3	27.5	27.23	-0.216	1	1:3.24	4.24	1.31	1.06	1.39	
UHF	0	front 2	27.5	27.23	-0.658	1	1:3.24	3.5	1.08	1.06	**1.15**	4
UHF	0	front 3	27.5	27.23	-0.594	1	1:3.24	3.14	0.97	1.06	1.03	
UHF	49	back2	26.5	25.93	-0.81	1	1:3.24	3.28	1.01	1.14	1.15	
UHF	49	back2	26.5	25.93	-0.321	1	1:3.24	3.19	0.98	1.14	1.12	

*Pictures of the test position are presented in appendix A.

APPENDIX A: PHOTOS OF THE DUT

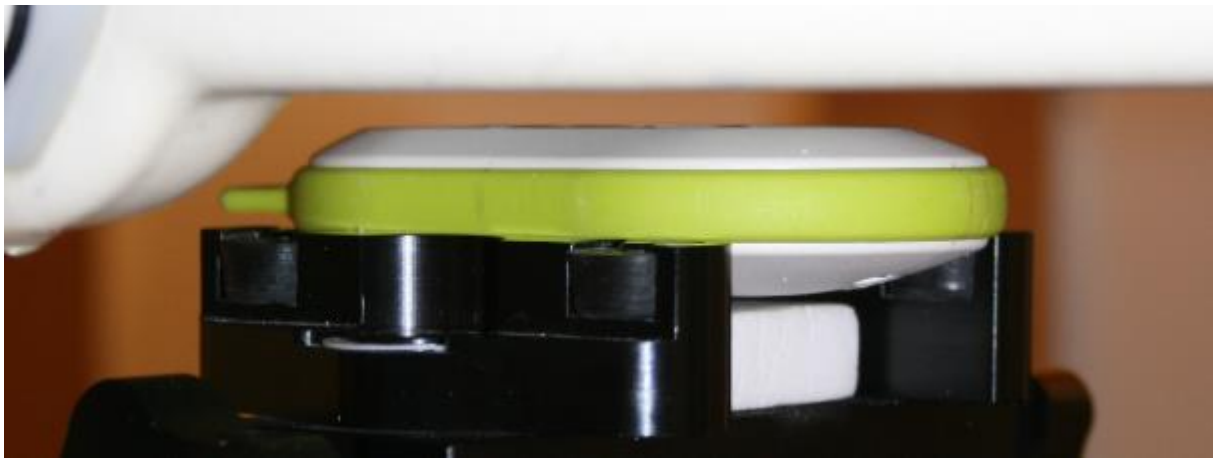
Top

Left

Right

Bottom

Front:



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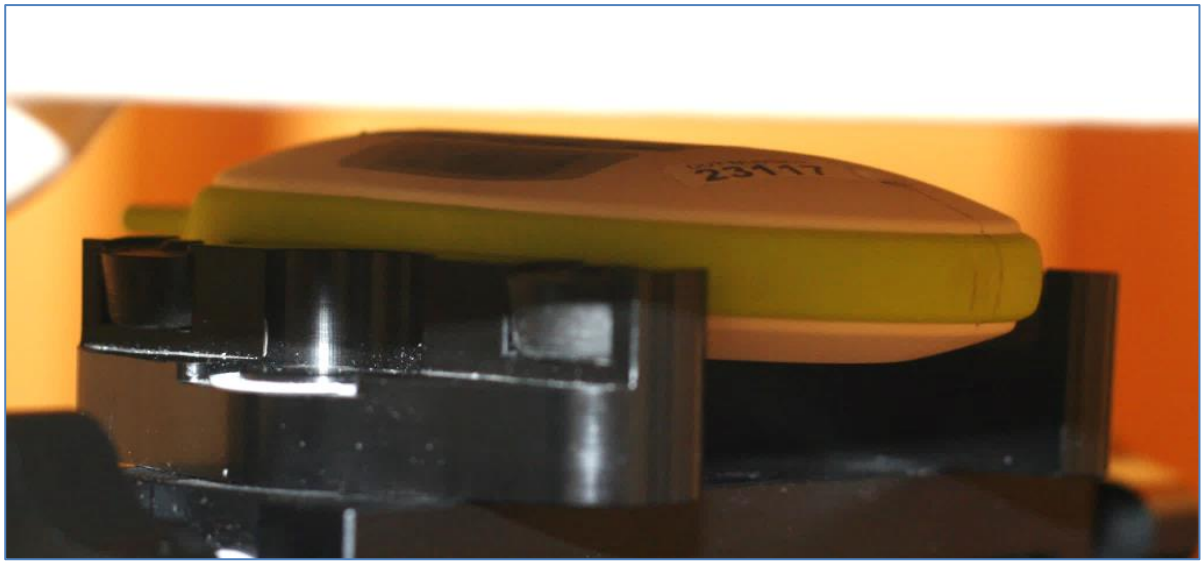
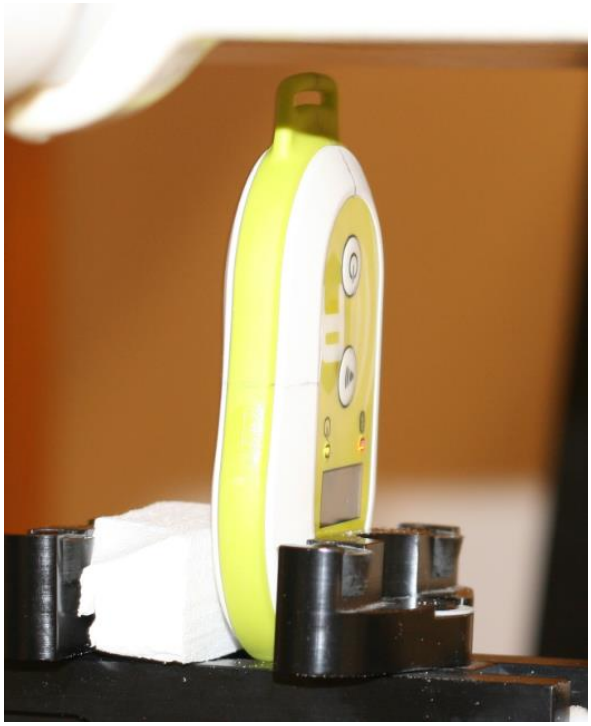


Top:

Bottom:



Left:

Right:

APPENDIX B: SYSTEM CHECK SCAN

Date/Time: 12.12.2016 17:58:16

Test Laboratory: Verkotan Oy
File Name: 12_12_2016_Body_SystemPerformanceCheck-D835.da4

Plot 1

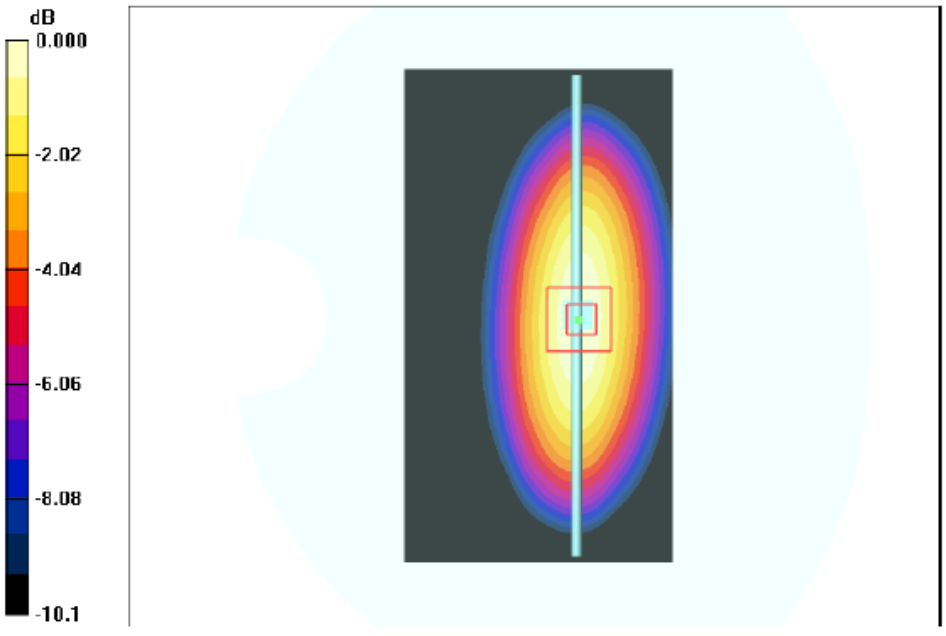
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:448
Program Name: System Performance Check at 835 MHz

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 1.02 mho/m; ε_r = 54.1; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=15mm, Pin=250mW/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.70 mW/g

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 46.9 V/m; Power Drift = 0.067 dB
Peak SAR (extrapolated) = 3.67 W/kg
SAR(1 g) = 2.51 mW/g; SAR(10 g) = 1.67 mW/g
Maximum value of SAR (measured) = 2.69 mW/g



0 dB = 2.69mW/g

Date/Time: 13.12.2016 19:13:51

Test Laboratory: Verkotan Oy

Plot 2

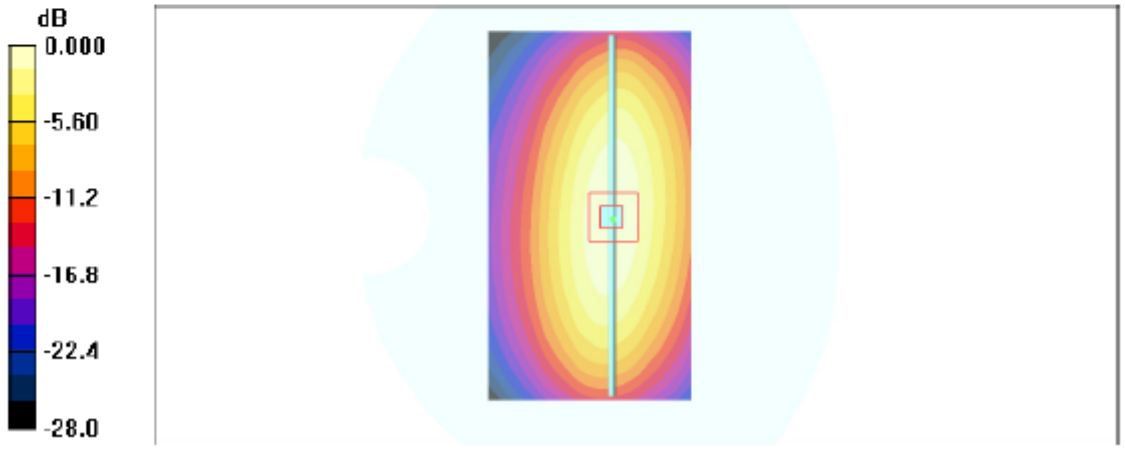
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:448
Program Name: System Performance Check at 835 MHz

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=15mm, Pin=250mW/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.70 mW/g

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.5 V/m; Power Drift = 0.063 dB
Peak SAR (extrapolated) = 3.77 W/kg
SAR(1 g) = 2.56 mW/g; SAR(10 g) = 1.68 mW/g
Maximum value of SAR (measured) = 2.76 mW/g



0 dB = 2.76mW/g

Date/Time: 14.12.2016 19:27:16

Test Laboratory: Verkotan Oy

Plot 3

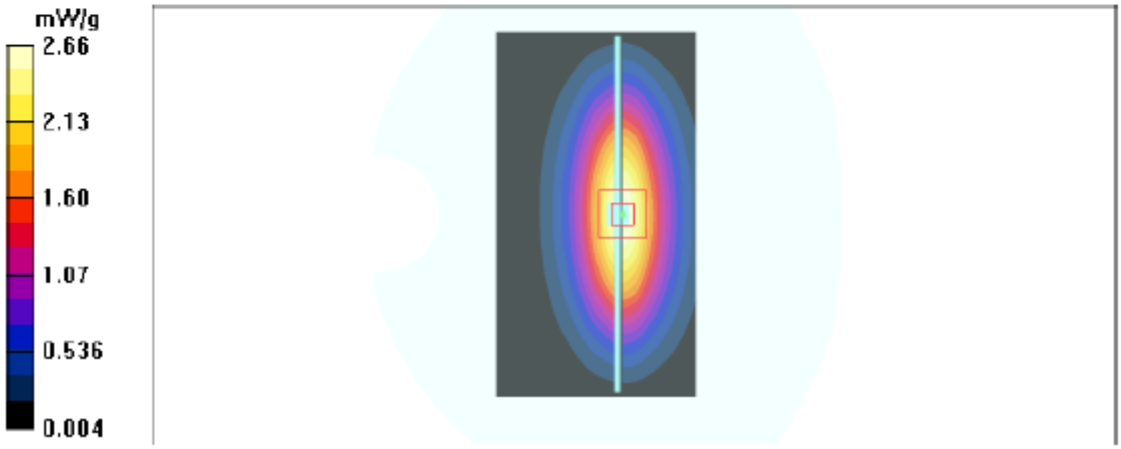
DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:448
Program Name: System Performance Check at 835 MHz

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium parameters used: f = 835 MHz; σ = 0.999 mho/m; ε_r = 53.5; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

d=15mm, Pin=250mW/Area Scan (61x111x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 2.66 mW/g

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 50.0 V/m; Power Drift = -0.175 dB
Peak SAR (extrapolated) = 3.62 W/kg
SAR(1 g) = 2.47 mW/g; SAR(10 g) = 1.63 mW/g
Maximum value of SAR (measured) = 2.66 mW/g



APPENDIX C: MEASUREMENT SCAN

Date/Time: 15.12.2016 12:52:11

Test Laboratory: Verkotan Oy

DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Plot 4

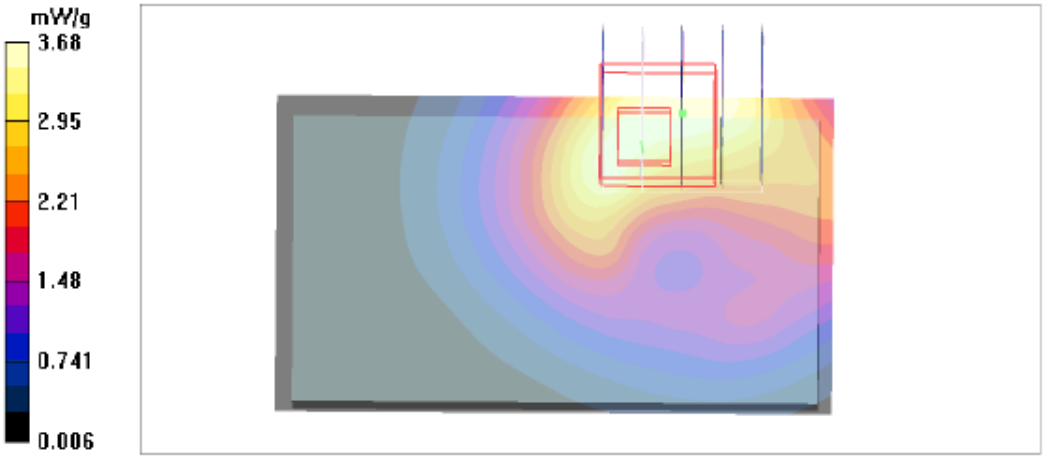
Communication System: RFID; Frequency: 902.75 MHz;Duty Cycle: 1:1
Medium parameters used: f = 903 MHz; σ = 1.04 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

front 5mm rep2/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.68 mW/g

front 5mm rep2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 42.9 V/m; Power Drift = -0.658 dB
Peak SAR (extrapolated) = 5.43 W/kg
SAR(1 g) = 3.5 mW/g; SAR(10 g) = 2.13 mW/g

Maximum value of SAR (measured) = 3.72 mW/g



Date/Time: 14.12.2016 22:55:54

Test Laboratory: Verkotan Oy

Plot 5

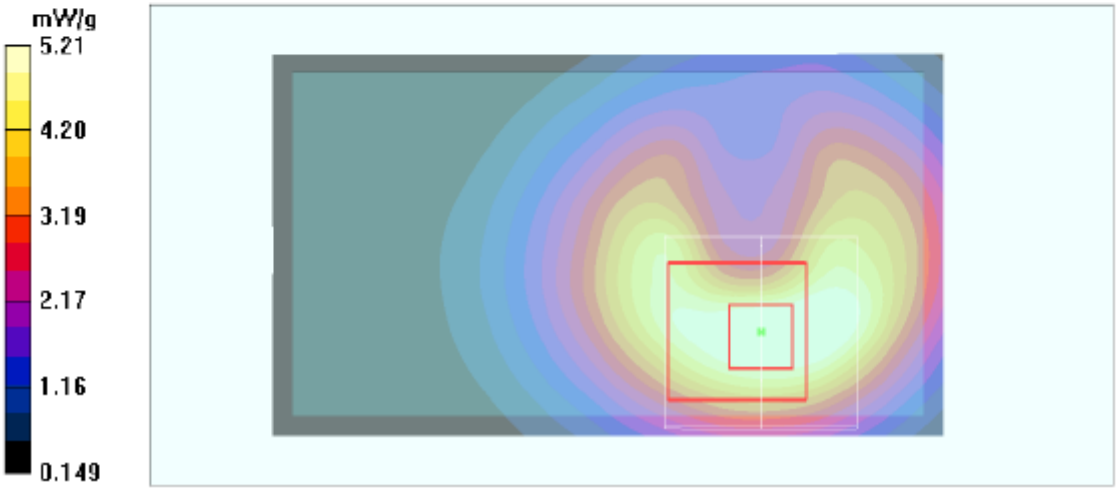
DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Communication System: RFID; Frequency: 902.75 MHz;Duty Cycle: 1:1
Medium parameters used: f = 903 MHz; σ = 1.04 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Back 5mmLow check 2/Area Scan (41x71x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 5.63 mW/g

Back 5mmLow check 2/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 58.6 V/m; Power Drift = -0.587 dB
Peak SAR (extrapolated) = 8.06 W/kg
SAR(1 g) = 4.75 mW/g; SAR(10 g) = 2.8 mW/g
Maximum value of SAR (measured) = 5.21 mW/g



Date/Time: 13.12.2016 15:27:14

Test Laboratory: Verkotan Oy

Plot 6

DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Communication System: RFID; Frequency: 915.25 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 915.25 MHz; σ = 1.07 mho/m; ε_r = 53.7; ρ = 1000 kg/m^3
Phantom section: Flat Section

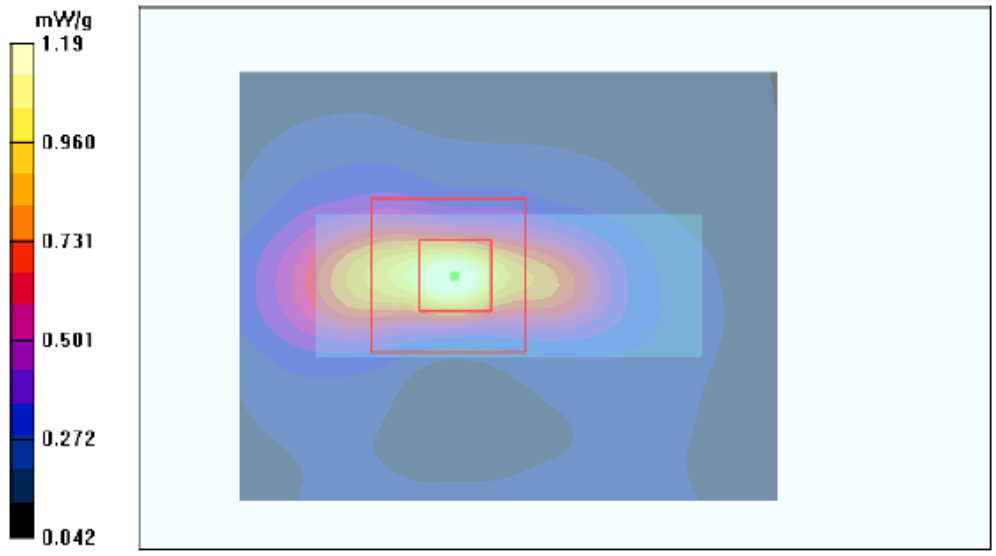
DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Top 5mm Mid/Area Scan (51x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 1.24 mW/g

Top 5mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 32.2 V/m; Power Drift = -0.376 dB
Peak SAR (extrapolated) = 1.91 W/kg
SAR(1 g) = 1.05 mW/g; SAR(10 g) = 0.538 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 1.19 mW/g



Date/Time: 13.12.2016 19:59:01

Test Laboratory: Verkotan Oy

Plot 7

DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Communication System: RFID; Frequency: 915.25 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 915.25 MHz; σ = 1.05 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

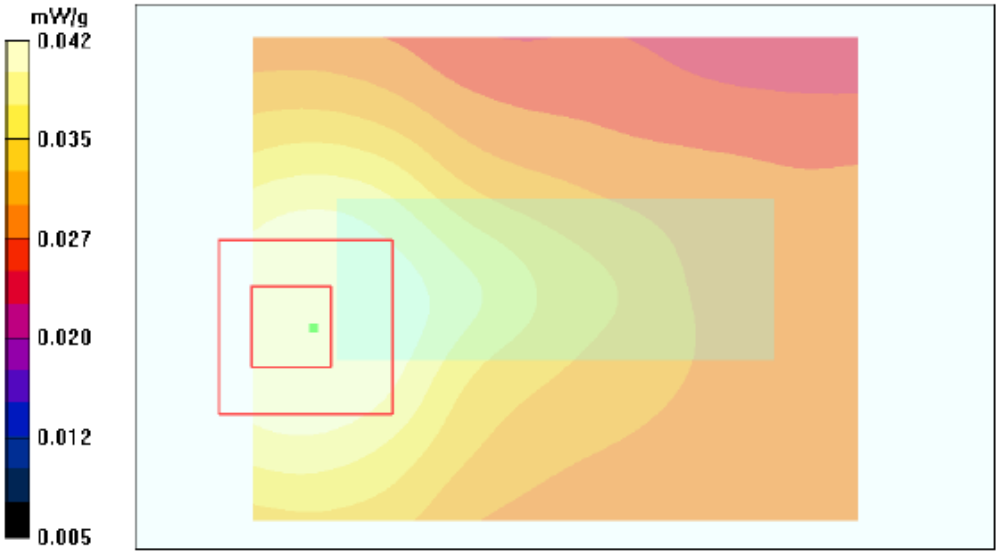
DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Bottom 5mm Mid/Area Scan (51x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.044 mW/g

Bottom 5mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 5.72 V/m; Power Drift = -0.313 dB
Peak SAR (extrapolated) = 0.050 W/kg
SAR(1 g) = 0.039 mW/g; SAR(10 g) = 0.029 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.042 mW/g



Date/Time: 14.12.2016 08:31:28

Test Laboratory: Verkotan Oy

Plot 8

DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Communication System: RFID; Frequency: 915.25 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 915.25 MHz; σ = 1.05 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

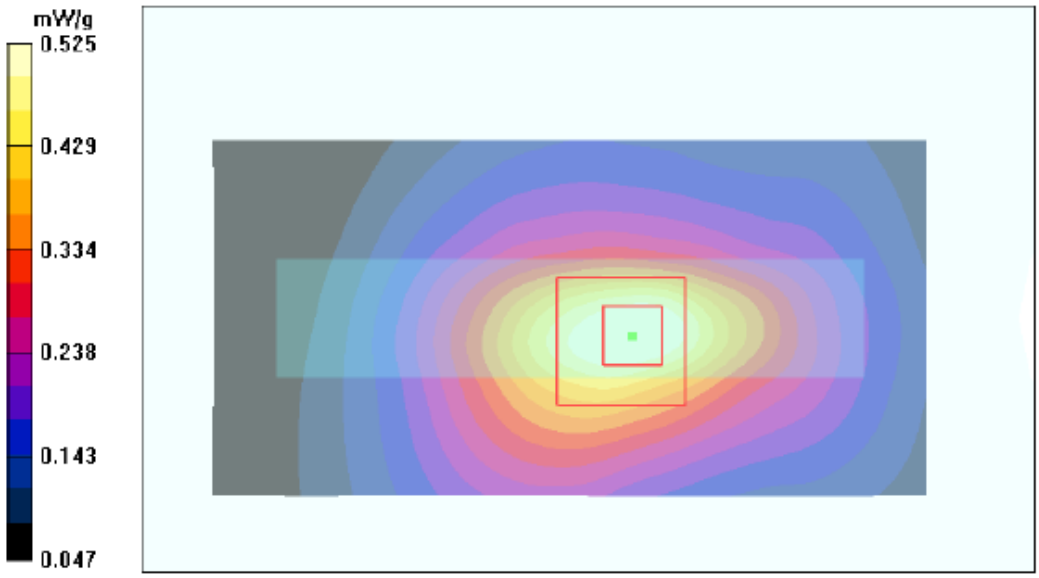
DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Left side 5mm Mid/Area Scan (81x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.549 mW/g

Left side 5mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 20.0 V/m; Power Drift = 0.251 dB
Peak SAR (extrapolated) = 0.672 W/kg
SAR(1 g) = 0.480 mW/g; SAR(10 g) = 0.318 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.525 mW/g



Date/Time: 14.12.2016 08:45:25

Test Laboratory: Verkotan Oy

Plot 9

DUT: qIDmini; Type: RFID; Serial: 0674045316451124
Program Name: Body Configuration

Communication System: RFID; Frequency: 915.25 MHz;Duty Cycle: 1:1
Medium parameters used (interpolated): f = 915.25 MHz; σ = 1.05 mho/m; ε_r = 53.2; ρ = 1000 kg/m^3
Phantom section: Flat Section

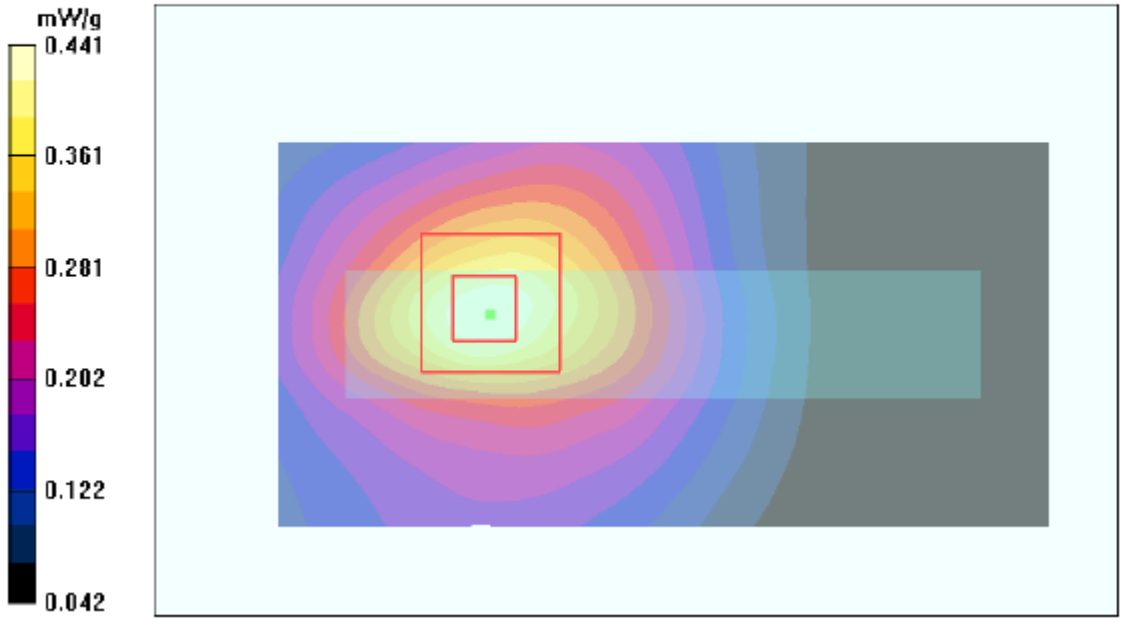
DASY4 Configuration:
- Probe: EX3DV4 - SN3570; ConvF(8.17, 8.17, 8.17); Calibrated: 15.01.2016
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn371; Calibrated: 22.04.2016
- Phantom: SAM_2; Type: SAM Twin; Serial: TP-1142
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186

Right side 5mm Mid/Area Scan (81x41x1): Measurement grid: dx=15mm, dy=15mm

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (interpolated) = 0.440 mW/g

Right side 5mm Mid/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm
Reference Value = 15.2 V/m; Power Drift = -0.160 dB
Peak SAR (extrapolated) = 0.549 W/kg
SAR(1 g) = 0.407 mW/g; SAR(10 g) = 0.275 mW/g

Info: Interpolated medium parameters used for SAR evaluation.
Maximum value of SAR (measured) = 0.441 mW/g



APPENDIX D: RELEVANT PAGES FROM PROBE CALIBRATION REPORTS

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
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 Verkotan

Certificate No: EX3-3570_Jan16

CALIBRATION CERTIFICATE

Object	EX3DV4 - SN:3570
Calibration procedure(s)	QA CAL-01.v9, QA CAL-14.v4, QA CAL-23.v5, QA CAL-25.v6 Calibration procedure for dosimetric E-field probes
Calibration date:	January 15, 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 E4419B	GB41293874	01-Apr-15 (No. 217-02128)	Mar-16
Power sensor E4412A	MY41498087	01-Apr-15 (No. 217-02128)	Mar-16
Reference 3 dB Attenuator	SN: S5054 (3c)	01-Apr-15 (No. 217-02129)	Mar-16
Reference 20 dB Attenuator	SN: S5277 (20x)	01-Apr-15 (No. 217-02132)	Mar-16
Reference 30 dB Attenuator	SN: S5129 (30b)	01-Apr-15 (No. 217-02133)	Mar-16
Reference Probe ES3DV2	SN: 3013	31-Dec-15 (No. ES3-3013_Dec15)	Dec-16
DAE4	SN: 660	23-Dec-15 (No. DAE4-660_Dec15)	Dec-16
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-13)	In house check: Apr-16
Network Analyzer HP 8753E	US37390585	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: January 19, 2016

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3570

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.50	0.47	0.49	± 10.1 %
DCP (mV)[B]	102.5	99.6	99.8	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	156.4	±2.5 %
		Y	0.0	0.0	1.0		150.7	
		Z	0.0	0.0	1.0		140.1	

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:3570

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)
750	55.5	0.96	8.41	8.41	8.41	0.43	0.93	± 12.0 %
835	55.2	0.97	8.17	8.17	8.17	0.27	1.25	± 12.0 %
1750	53.4	1.49	6.96	6.96	6.96	0.39	0.83	± 12.0 %
1900	53.3	1.52	6.77	6.77	6.77	0.27	1.03	± 12.0 %
2450	52.7	1.95	6.50	6.50	6.50	0.35	0.86	± 12.0 %
2600	52.5	2.16	6.26	6.26	6.26	0.23	1.05	± 12.0 %
5250	48.9	5.36	3.78	3.78	3.78	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.25	3.25	3.25	0.55	1.90	± 13.1 %
5750	48.3	5.94	3.48	3.48	3.48	0.60	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.

APPENDIX E: RELEVANT PAGES FROM DIPOLE CALIBRATION REPORTS

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
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 **Verkotan**

Certificate No: **D835V2-448_Jan16**

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 448
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 15, 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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 15, 2016

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

Certificate No: D835V2-448_Jan16 Page 1 of 8

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.0 ± 6 %	0.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**9.27 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.53 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**6.01 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.2 ± 6 %	1.01 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	2.46 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**9.55 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**6.29 W/kg ± 16.5 % (k=2)**