R052-DAS-11-104870-2/A Ed. 1

This report cancels and replaces the test report R052-DAS-11-104870-2/A Ed. 0

SAR TEST REPORT

According to the standard:
Supplement C (Edition 01-01) to
OET Bulletin 65 (Edition 97-01)

Equipment under test:
Bar code reader
INTERMEC SR61B

with Bluetooth module BLUEGIGA WT41
FCC ID: QOQWT41
IC certification number: 5123A-BGTWT41

Company:
INTERMEC STC

DISTRIBUTION: Mrs. BENOS **Company: INTERMEC STC**

Number of pages: 38 with 3 annexes

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0	Nov. 16, 2011	Creation	Emmanuel TOUTAIN	Yvon JUDEAUX
1	Dec. 13, 2011	2 and 19	Emmanuel TOUTAIN 	Yvon JUDEAUX 

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EQUIPMENT UNDER TEST:	Bar code reader with Bluetooth module
Reference:	INTERMEC SR61B
Serial number:	A13 *(Identical Prototype)*
MANUFACTURER:	-
APPLICANT:	
Company:	INTERMEC STC
Address:	Bâtiment "Les Allées du Lac A" 94 Rue du Lac 31681 LABEGE France
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Person(s) present(s) during the test:	Mrs. Virginie BENOS
DATE(S) OF TEST(S):	November 09, 2011
TEST SITE:	EMITECH Le Mans 9 Rue Maurice Trintignant 72100 Le Mans France
TEST(S) OPERATOR(S):	Emmanuel TOUTAIN

SUMMARY

1. INTRODUCTION

In this test report, Specific Absorption Rate (SAR) measurements for the portable device INTERMEC SR61B are presented.

The measurements were made according to the Supplement C to OET Bulletin 65 for evaluating compliance with FCC Guidelines (FCC 47 CFR § 2.1093 and IEEE Std C95.1) and RSS102 for general population/uncontrolled exposure.

2. REFERENCE DOCUMENTS

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

Reference	Document title	Date
Supplement C to OET Bulletin 65	Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions	2001
FCC 47 CFR	§ 2.1093 Radiofrequency radiation exposure evaluation: portable devices	-
IEEE Std C95.1	IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz.	1999
RSS102	Radio Standards Specification 102, Radio Frequency (RF) Exposure Compliance of Radiocommunication Apparatus (All Frequency Bands)	Issue 4 2010

3. PRESENTATION OF EQUIPMENT FOR TESTING PURPOSES

The portable device INTERMEC SR61B, using the Bluetooth standard and operating in the 2450MHz frequency band (integrated Bluetooth module: BLUEGIGA WT41, FCC ID: QOQWT41, IC certification number: 5123A-BGTWT41), is shown in Fig. 1. The antenna is integrated.

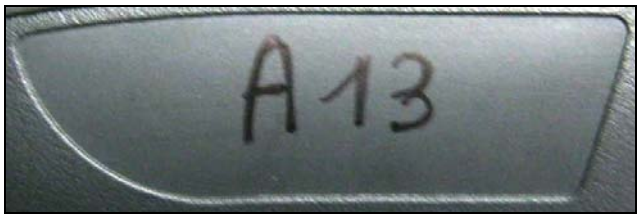
The intended use of the portable device is to be worn against the human body. For this test purpose, the portable device was placed against the phantom with its “left and right sides”, considering the worst case for exposure (see Fig. 6 and Fig. 7) at the closest distance from the body, as specified by the applicant.

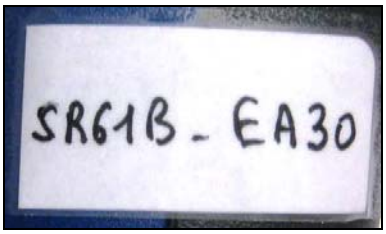
"Right side" for the testing

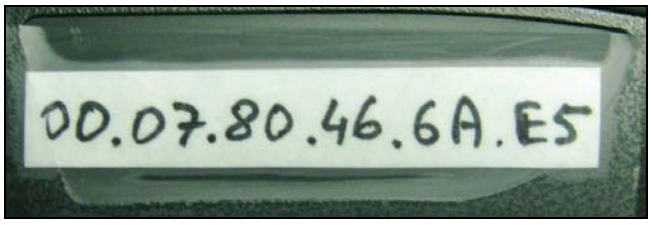
"Left side" for the testing

Rear, front and top views

Battery (Intermec Model: AB3)







Product marking *(Identical Prototype)*

Fig. 1: Photographs of the equipment under test

4. TESTS RESULTS SUMMARY

Object	Respected Standard? ≤ 1.6W/kg (partial body)		Remarks
	Yes	No	
SAR measurements on the "left side" at 0cm from the phantom (worst channel: 39)	X		Highest SAR value measured: 0.660W/kg

Conclusion:

The sample INTERMEC SR61B submitted to test when used with its "left and right sides" at 0cm from the human body is in conformity with the FCC Guidelines and RSS102 for general population/uncontrolled exposure according to the Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01).

5. ENVIRONNEMENTAL CONDITIONS

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

6. EQUIPMENT USED FOR THE TESTING

Platform ID	Platform	Equipment	Type	Manufacturer	Internal Number	Software Version	Calibration Periodicity	Last Calibration
1		922	Thermometer	Testo	6980		26 months	Sept 16, 2009
2	DASY4	DASY4	Software	Speag	7321	V4.5 Build 19	-	-
		ET3DV6	E-Field Probe	Speag	7195		14 months	Feb 21, 2011
		DAE3	Data acquisition	Speag	7192		14 months	Feb 22, 2011
		D2450V2	Dipole 2450MHz	Speag	7323		26 months	Nov 09, 2011
		ELI4	Phantom	Speag	7324		-	-
3	Liquid Measure	HP85070C	Software	Hewlett-Packard	-	C1.01	-	-
		HP8753D	Network analyzer	Hewlett-Packard	7216		26 months	Jan 22, 2010
		HP85070C	Dielectric probe	Hewlett-Packard	7218		-	-
4	System Validation	SME03	Signal generator	Rohde-Schwarz	7031		26 months	Oct 05, 2011
		ZHL42	Amplifier	Mini-circuits	7209		-	-
		PMC18-2	Power Supply	Kikusui	7214		-	-
		NRVS	Power meter	Rohde-Schwarz	7212		26 months	Oct 18, 2010
		NRV-Z31	Probe power meter	Rohde-Schwarz	7211		26 months	Oct 18, 2010
		3877	Coupler	Suhner	7208		26 months	Oct 04, 2011
		33-3-34	Attenuator	Weinschel Engineering	7213		26 months	Oct 04, 2011
		R411810124 R411806124	Attenuator	Radiall	7315		26 months	Oct 04, 2011
		909A	50 ohms load	HP	7314		26 months	Oct 04, 2011
		R404563000	50 ohms load	Radiall	7313		26 months	Oct 04, 2011

ET3DV6 Isotropic E-Field Probe Overview:

Construction Symmetrical design with triangular core
Calibration Conversion Factors (CF) for head and body liquid
Frequency 10 MHz to 3 GHz; Linearity: ± 0.2 dB (30 MHz to 3 GHz)
Directivity ± 0.2 dB in HSL (rotation around probe axis)
± 0.4 dB in HSL (rotation normal to probe axis)
Dynamic Range 5 µW/g to > 100 mW/g; Linearity: ± 0.2 dB
Dimensions Overall length: 330 mm (Tip: 16 mm)
Tip diameter: 6.8 mm (Body: 12 mm)
Distance from probe tip to dipole centers: 2.7 mm

ELI4 Elliptical phantom Overview:

Dimensions Length 600 mm ± 5 mm and width 400 mm ± 5 mm
Shape Ellipse
Thickness 2.0 mm with a tolerance of ± 0.2 mm
Liquid depth 150 mm

System Validation Kit Overview:

Construction	Symmetrical dipole with l/4 balun Enables measurement of feedpoint impedance with NWA Matched for use near flat phantoms filled with head/body simulating solutions
Return Loss	> 20 dB at specified validation position
Dimensions	D2450V2 dipole length: 51.8 mm

Mounting Device for Transmitters Overview:

Construction	Enables the position of the mounted transmitter device according to FCC specifications
Material	POM

7. MEASUREMENT RESULTS

The portable device antenna and battery are those specified by the manufacturer. The battery was fully charged before each measurement.

The output power and frequency are controlled using an internal test program supplied by the applicant. The portable device is set to transmit at its highest output peak power level with a continuous transmission in DH5 test mode.

The SAR tests were performed for each test position at the centre frequency. Then the configuration giving rise to the maximum mass-averaged SAR was used to test the low-end and the high-end frequencies of the transmitting band.

Measurement results (SAR values averaged over a mass of 1g): *(date of meas.: November 09, 2011)*

Configuration	Test Position	SAR 1g (W/kg)		
		Channel 0 2402 MHz	Channel 39 2441 MHz	Channel 78 2480 MHz
Portable device at 0cm from the phantom	Left side	0.294	**0.660**	0.632
	Right side	-	0.175	-

8. GRAPHICAL REPRESENTATION OF THE COARSE SCAN

The graphical representations of the coarse scan for the worst case are shown in Fig. 2 to Fig. 5.

DUT: INTERMEC SR61B

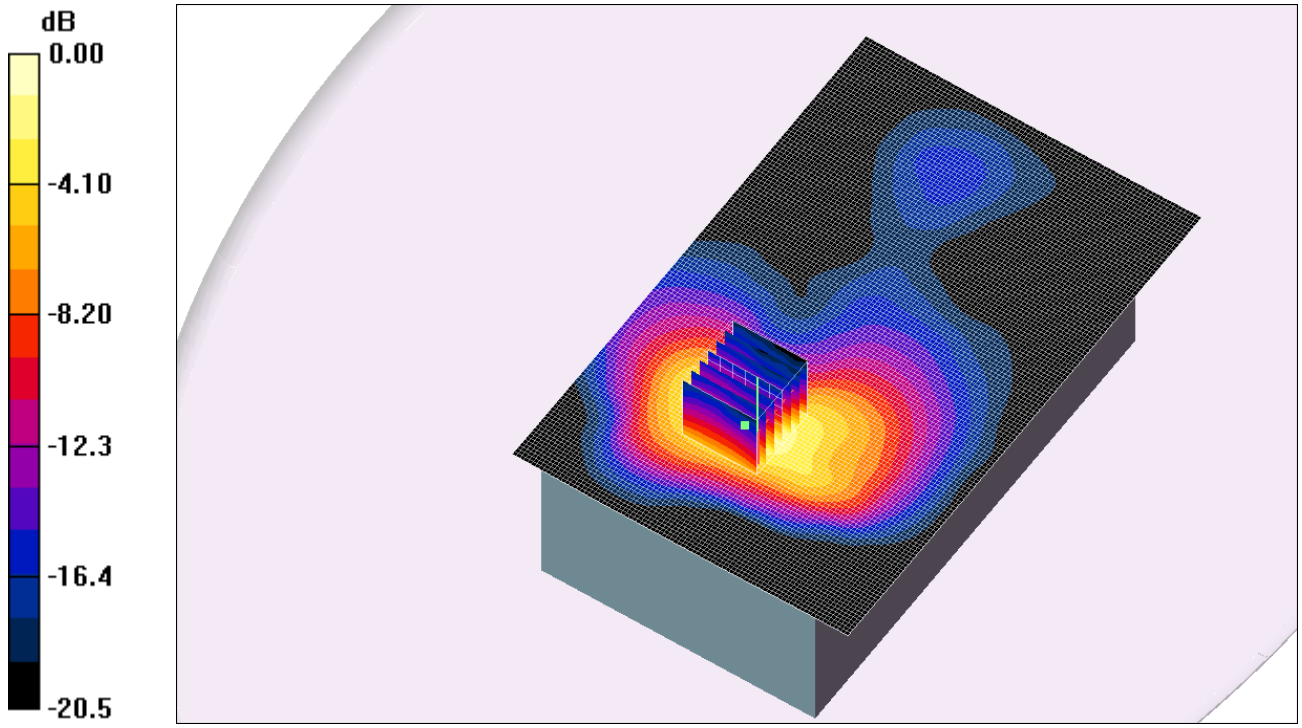
Communication System: Bluetooth; Frequency: 2402 MHz; Duty Cycle: 1:1.31
Medium parameters used: $\sigma = 1.99$ mho/m, $\varepsilon_r = 50.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 24.3°C, Liquid temperature: 22.0°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1546; ConvF(3.95, 3.95, 3.95); Calibrated: 2/21/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 2/22/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1067
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0cm, Low channel/Area Scan (91x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.278 mW/g

Position 0cm, Low channel/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 2.17 V/m; Power Drift = 0.189 dB
Peak SAR (extrapolated) = 0.811 W/kg
SAR(1 g) = 0.294 mW/g; SAR(10 g) = 0.135 mW/g
Maximum value of SAR (measured) = 0.321 mW/g



0 dB = 0.321mW/g

Fig. 2: SAR distribution for the channel 0 (2402 MHz), “left side” at 0cm from the phantom

DUT: INTERMEC SR61B

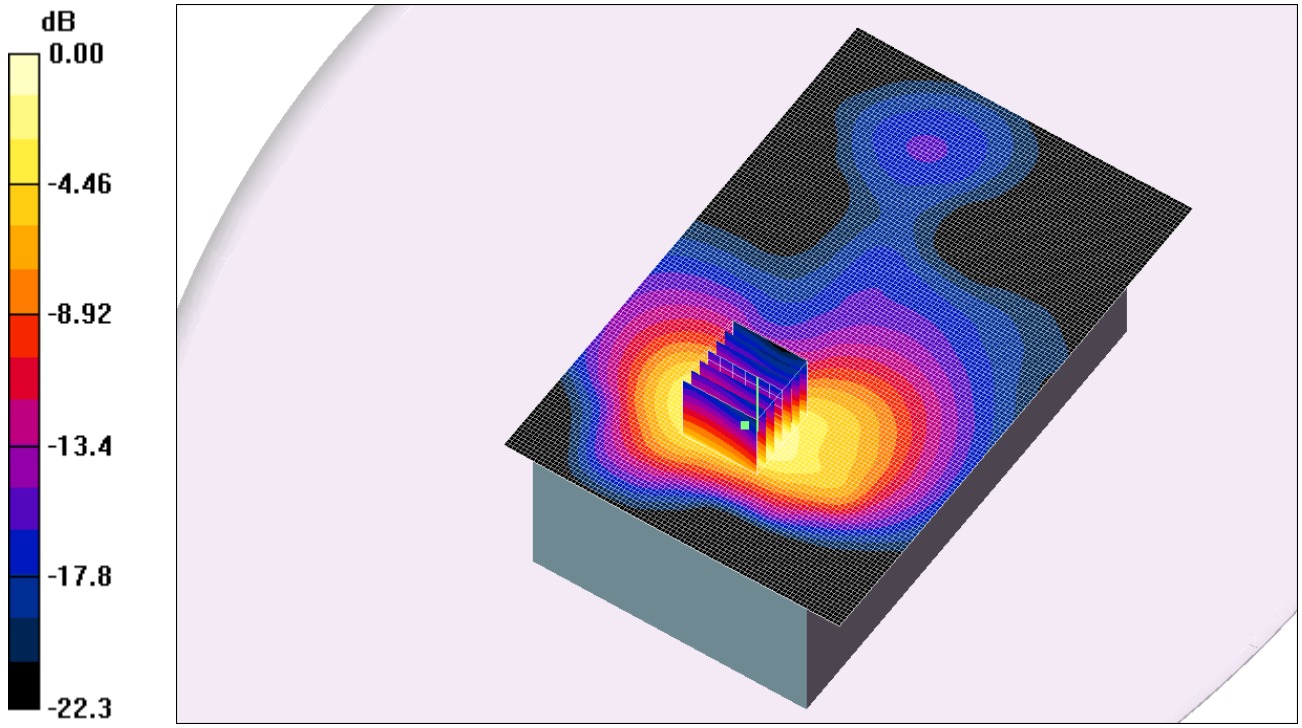
Communication System: Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.31
Medium parameters used: $\sigma = 1.99$ mho/m, $\varepsilon_r = 50.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 24.2°C, Liquid temperature: 22.2°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1546; ConvF(3.95, 3.95, 3.95); Calibrated: 2/21/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 2/22/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1067
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0cm, Middle channel/Area Scan (91x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.589 mW/g

Position 0cm, Middle channel/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.18 V/m; Power Drift = -0.071 dB
Peak SAR (extrapolated) = 1.83 W/kg
SAR(1 g) = 0.660 mW/g; SAR(10 g) = 0.299 mW/g
Maximum value of SAR (measured) = 0.714 mW/g



0 dB = 0.714mW/g

Fig. 3: SAR distribution for the channel 39 (2441 MHz), “left side” at 0cm from the phantom

DUT: INTERMEC SR61B

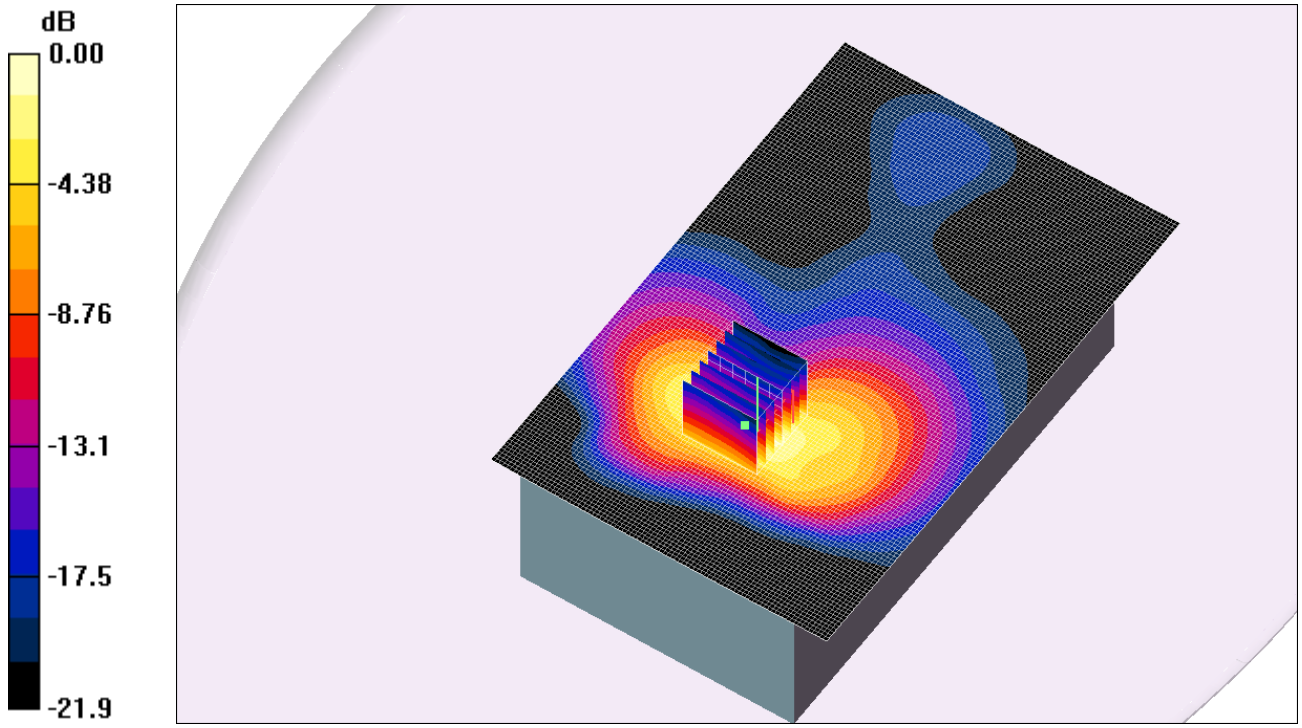
Communication System: Bluetooth; Frequency: 2480 MHz; Duty Cycle: 1:1.31
Medium parameters used: $\sigma = 1.99$ mho/m, $\varepsilon_r = 50.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 24.3°C, Liquid temperature: 22.1°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1546; ConvF(3.95, 3.95, 3.95); Calibrated: 2/21/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 2/22/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1067
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0cm, High channel/Area Scan (91x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.640 mW/g

Position 0cm, High channel/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.26 V/m; Power Drift = 0.099 dB
Peak SAR (extrapolated) = 1.81 W/kg
SAR(1 g) = 0.632 mW/g; SAR(10 g) = 0.280 mW/g
Maximum value of SAR (measured) = 0.688 mW/g



0 dB = 0.688mW/g

Fig. 4: SAR distribution for the channel 78 (2480 MHz), “left side” at 0cm from the phantom

DUT: INTERMEC SR61B

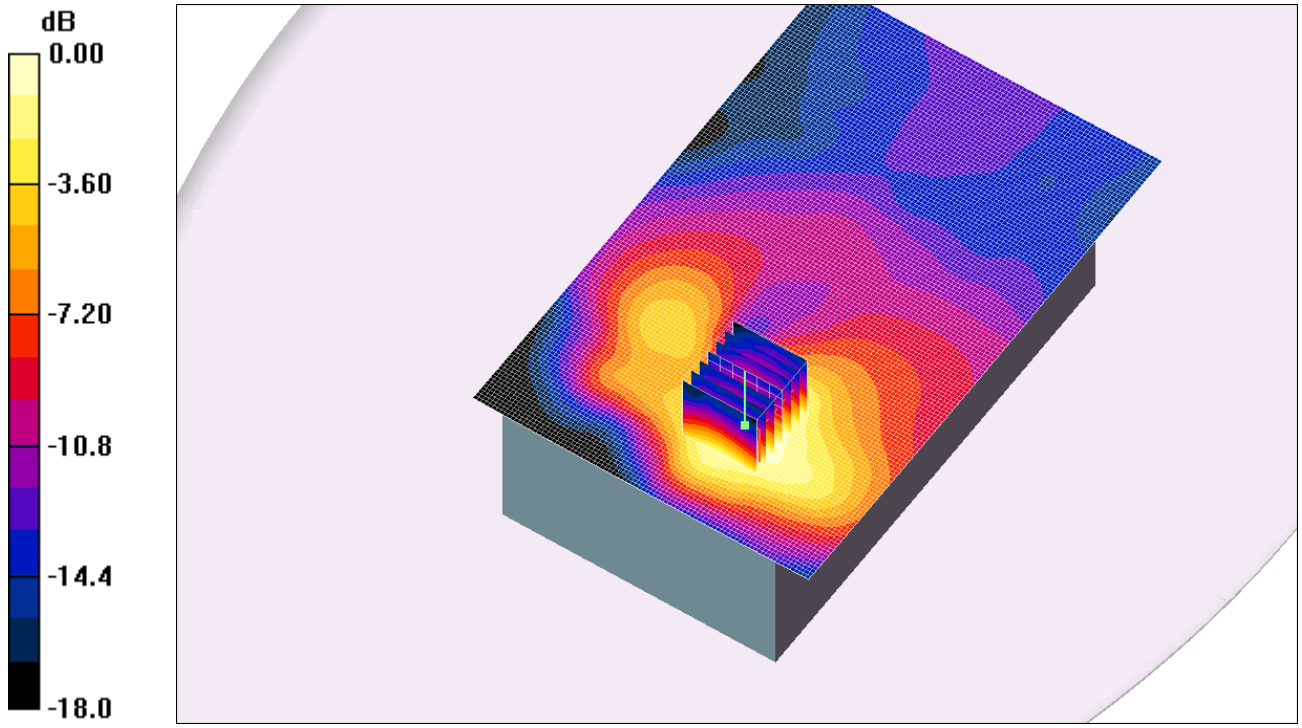
Communication System: Bluetooth; Frequency: 2441 MHz; Duty Cycle: 1:1.31
Medium parameters used: $\sigma = 1.99$ mho/m, $\varepsilon_r = 50.4$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 24.4°C, Liquid temperature: 22.1°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1546; ConvF(3.95, 3.95, 3.95); Calibrated: 2/21/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 2/22/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1067
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Position 0cm, Middle channel/Area Scan (91x141x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.181 mW/g

Position 0cm, Middle channel/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 3.51 V/m; Power Drift = -0.090 dB
Peak SAR (extrapolated) = 0.346 W/kg
SAR(1 g) = 0.175 mW/g; SAR(10 g) = 0.098 mW/g
Maximum value of SAR (measured) = 0.185 mW/g



0 dB = 0.185mW/g

Fig. 5: SAR distribution for the channel 39 (2441 MHz), “right side” at 0cm from the phantom

9. PHOTOGRAPHS OF THE EQUIPMENT UNDER TEST

The photographs of the equipment under test are shown in Fig. 6 and Fig. 7.

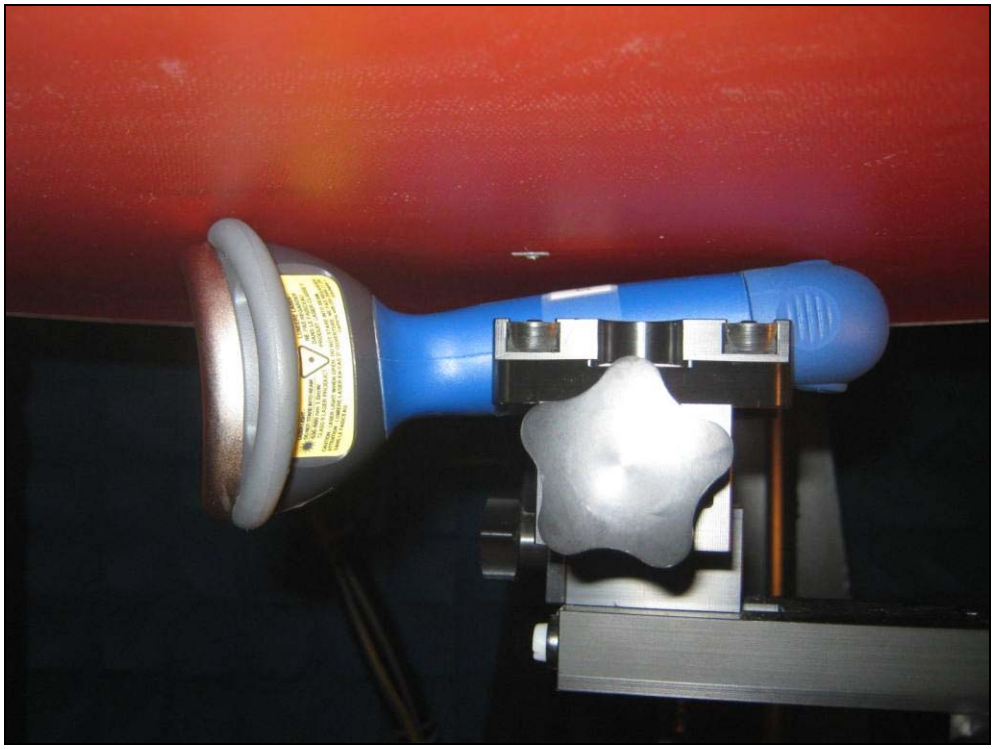


Fig. 6: “Left side” at 0cm from the phantom

Fig. 7: “Right side” at 0cm from the phantom

10. MEASUREMENT UNCERTAINTY

The expanded uncertainty with a confidence interval of 95 % shall not exceed 30 % for averaged SAR values in the range from 0.4 to 10 W/kg.

- Measurement uncertainty of SAR evaluations

The uncertainty of the measurements was evaluated according to the Supplement C to OET Bulletin 65 and determined by Schmid & Partner Engineering AG. The expanded uncertainty is ± 21.8 %.

ERROR SOURCES	Uncertainty Value (%)	Probability Distribution	Divisor	Ci	Standard Uncertainty (%)
Measurement Equipment					
Probe Calibration	± 5.9	Normal	1	1	± 5.9
Axial Isotropy	± 4.7	Rectangular	√3	0.7	± 1.9
Hemispherical Isotropy	± 9.6	Rectangular	√3	0.7	± 3.9
Boundary Effect	± 1.0	Rectangular	√3	1	± 0.6
Linearity	± 4.7	Rectangular	√3	1	± 2.7
System Detection Limits	± 1.0	Rectangular	√3	1	± 0.6
Readout Electronics	± 0.3	Normal	1	1	± 0.3
Response Time	± 0.8	Rectangular	√3	1	± 0.5
Integration Time	± 2.6	Rectangular	√3	1	± 1.5
RF Ambient Conditions - Noise	± 3.0	Rectangular	√3	1	± 1.7
RF Ambient Conditions - Reflections	± 3.0	Rectangular	√3	1	± 1.7
Probe Positioner Mechanical Tolerance	± 0.4	Rectangular	√3	1	± 0.2
Probe Positioning with respect to Phantom Shell	± 2.9	Rectangular	√3	1	± 1.7
Extrapolation, Interpolation and Integration Algorithms for Max. SAR Evaluation	± 1.0	Rectangular	√3	1	± 0.6
Test Sample Related					
Test Sample Positioning	± 2.9	Normal	1	1	± 2.9
Device Holder Uncertainty	± 3.6	Normal	1	1	± 3.6
Output Power Variation – SAR drift measurement	± 5.0	Rectangular	√3	1	± 2.9
Phantom and Tissue Parameters					
Phantom Uncertainty (shape and thickness tolerances)	± 4.0	Rectangular	√3	1	± 2.3
Liquid Conductivity Target - Tolerance	± 5.0	Rectangular	√3	0.64	± 1.8
Liquid Conductivity – Measurement Uncertainty	± 2.5	Normal	1	0.64	± 1.6
Liquid Permittivity Target - Tolerance	± 5.0	Rectangular	√3	0.6	± 1.7
Liquid Permittivity – Measurement Uncertainty	± 2.5	Normal	1	0.6	± 1.5
Combined standard uncertainty					± 10.9
Expanded uncertainty (confidence interval of 95%)					± 21.8

- Uncertainty of SAR system verification

The uncertainty of the system verification was evaluated according to the Supplement C to OET Bulletin 65 and determined by Schmid & Partner Engineering AG. The expanded uncertainty is ± 18.4 %.

ERROR DESCRIPTION	Uncertainty Value (%)	Probability Distribution	Divisor	Ci	Standard Uncertainty (%)
Measurement System					
Probe calibration	± 5.9	Normal	1	1	± 5.9
Axial isotropy	± 4.7	Rectangular	√3	1	± 2.7
Hemispherical isotropy	± 9.6	Rectangular	√3	0	± 0.0
Boundary effects	± 1.0	Rectangular	√3	1	± 0.6
Probe linearity	± 4.7	Rectangular	√3	1	± 2.7
System detection limit	± 1.0	Rectangular	√3	1	± 0.6
Readout electronics	± 0.3	Normal	1	1	± 0.3
Response time (CW)	± 0.0	Rectangular	√3	1	± 0.0
Integration time (CW)	± 0.0	Rectangular	√3	1	± 0.0
RF ambient conditions - Noise	± 3.0	Rectangular	√3	1	± 1.7
RF ambient conditions - Reflections	± 3.0	Rectangular	√3	1	± 1.7
Probe positioner	± 0.4	Rectangular	√3	1	± 0.2
Probe positioning	± 2.9	Rectangular	√3	1	± 1.7
Algorithms for Max. SAR Eval.	± 1.0	Rectangular	√3	1	± 0.6
Test Sample Related					
Dipole axis to liquid distance	± 2.0	Rectangular	√3	1	± 1.2
Input power and SAR drift meas.	± 4.7	Rectangular	√3	1	± 2.7
Phantom and Setup					
Phantom uncertainty	± 4.0	Rectangular	√3	1	± 2.3
Liquid conductivity (target)	± 5.0	Rectangular	√3	0.64	± 1.8
Liquid conductivity (meas.)	± 2.5	Normal	1	0.64	± 1.6
Liquid permittivity (target)	± 5.0	Rectangular	√3	0.6	± 1.7
Liquid permittivity (meas.)	± 2.5	Normal	1	0.6	± 1.5
Coverage Factor for 95% (k=2)					
Combined Standard Uncertainty					± 9.2
Expanded Standard Uncertainty					± 18.4

11. SPATIAL PEAK SAR EVALUATION

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

Spatial Peak SAR

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

Interpolation, Extrapolation and Detection of Maxima

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

Averaging and Determination of Spatial Peak SAR

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

12. TEST CONDITIONS

Standard:	Bluetooth
Crest factor:	1.31 (packet type DH5, Tx duration is 2871µs within a frame length of 3750µs)
Modulation:	GFSK
Power:	Class 1: max. 20 dBm (product specification)
Traffic Channel:	low channel: 0 (2402MHz), middle channel: 39 (2441MHz), high channel: 78 (2480MHz)
Test program:	"CSR BlueTest3" supplied by the applicant

Maximum conducted output power measurements results from "TRaC test report 9F2925WUS2" supplied by the applicant for the Bluetooth module BLUEGIGA WT41:
Low channel (2402MHz): 0.041W, Middle channel (2441MHz): 0.038W, High channel (2480MHz): 0.040W

Note: Conducted power measurements were performed with a temporary antenna connector instead of antenna. The setting up of a temporary antenna connector is not possible on the equipment presented, so these measurements could not be performed before and after each SAR test.

13. MEASUREMENT SYSTEM DESCRIPTION

The automated near-field scanning system Dosimetric Assessment System DASY4 from Schmid & Partner Engineering AG was used. The measurement is performed using platform n° 2 referenced in paragraph 6 ("Equipment used for the testing") of this report. The system consists of a computer controlled, high precision robotics system, robot controller, extreme near-field probes and the phantom containing the liquid. The six axis robot precisely positions the probe at the points of maximum electromagnetic field. A device holder made of low-loss dielectric material is used to maintain the test position of the equipment under test against the phantom. The measurements were conducted in an RF controlled environment (i.e. anechoic room). Fig. 8 shows the system.

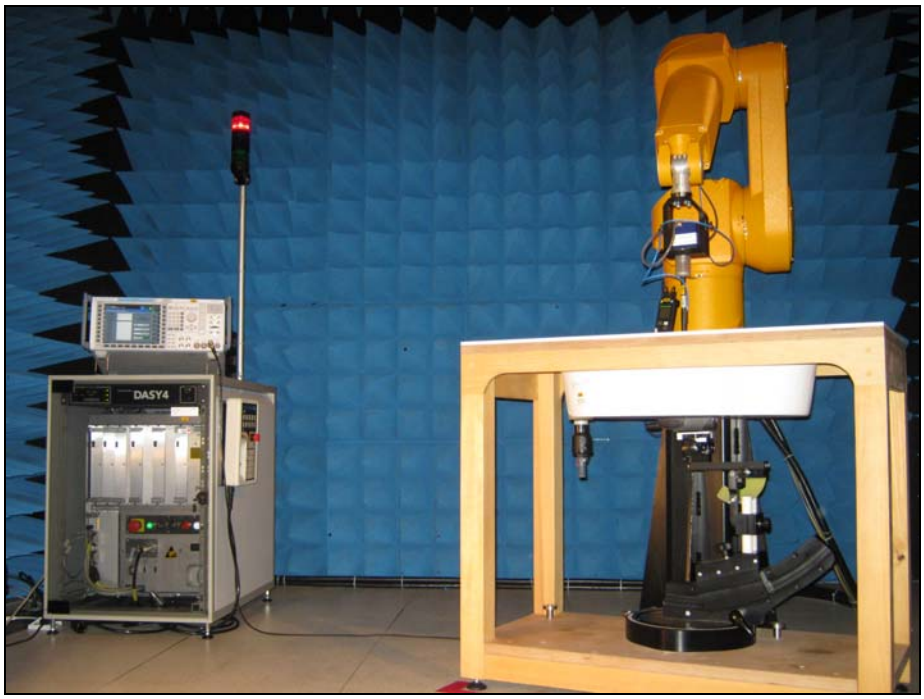


Fig. 8: The measurement setup with equipment under test.

14. LIQUID MEASUREMENT: TEST CONDITIONS & RESULTS

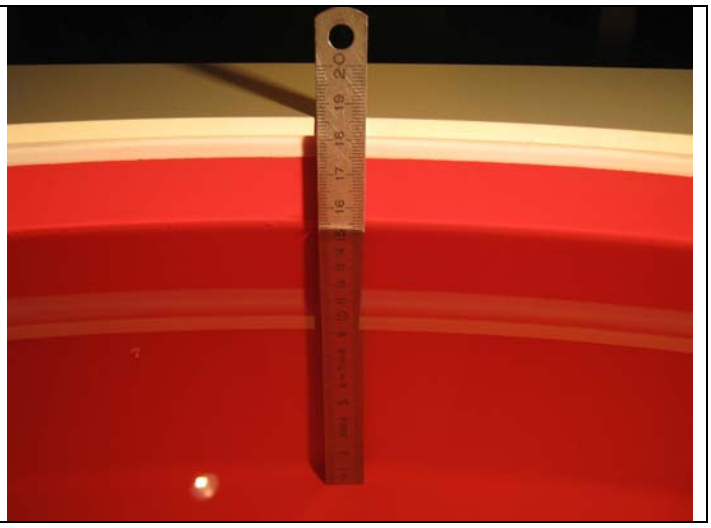
The measurement is performed using platform n° 3 referenced in paragraph 6 (“Equipment used for the testing”) of this report. The following ingredients (in % by weight) are theoretical and given for information.

2450 MHz liquid: Diethylenglykol-monobutylether 26.70 %
De-ionised water 73.20 %
NaCl salt 0.04 %

The dielectric parameters of the liquid were controlled prior to assessment (contact probe method). Dielectric properties measured *(date of meas.: November 09, 2011)*:

Frequency (MHz)	ε_r (F/m) Targeted value	ε_r (F/m) Measured value	σ (S/m) Targeted value	σ (S/m) Measured value	Liquid temperature (°C)	Ambient temperature (°C)
2440	52.7 ± 5 %	50.4	1.94 ± 5 %	1.99	22.2	24.0
2450	52.7 ± 5 %	50.3	1.95 ± 5 %	2.01		

The phantom should be filled to a depth of 15.0 ± 0.5 cm.
The liquid depth measured in the phantom was 15.3 cm as shown in the attached photograph.



15. SYSTEM VALIDATION: TEST CONDITIONS & RESULTS

The measurement is performed using platform n° 4 referenced in paragraph 6 (“Equipment used for the testing”) of this report.

Measurement conditions: The measurement is performed with the elliptical phantom ELI4 filled with liquid. The validation dipole input power was 250mW.
Prior to the assessment, the validation dipole is used to check whether the system was operating within its specification of ± 10 %.

Measurement results: The result is hereafter below and shown in Fig. 9.
(date of meas.: November 09, 2011)

Frequency (MHz)	SAR 1g (W/kg) Targeted value	SAR 1g (W/kg) Measured value
2450	12.8 ± 10 %	13.5

DUT: Dipole 2450 MHz

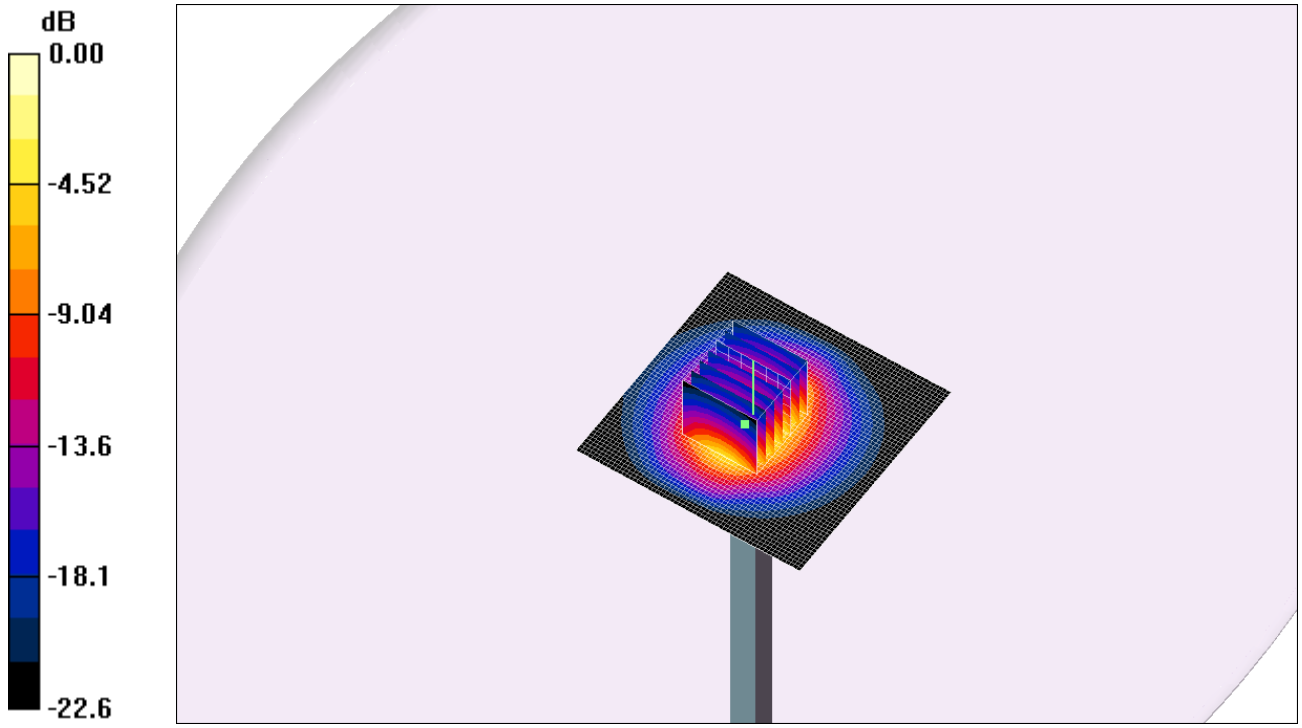
Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 2.01$ mho/m, $\varepsilon_r = 50.3$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 24.3°C, Liquid temperature: 22.1°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1546; ConvF(3.95, 3.95, 3.95); Calibrated: 2/21/2011
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE3 Sn402; Calibrated: 2/22/2011
- Phantom: ELI 4.0; Type: QDOVA001BA; Serial: 1067
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=10mm, Pin=250mW/Area Scan (61x61x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 15.8 mW/g

d=10mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 86.9 V/m; Power Drift = -0.021 dB
Peak SAR (extrapolated) = 32.9 W/kg
SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.1 mW/g
Maximum value of SAR (measured) = 14.5 mW/g



0 dB = 14.5mW/g

Fig. 9: 2450MHz validation result

□□□ End of report, 3 annexes to be forwarded □□□

ANNEX 1: ET3DV6 CALIBRATION CERTIFICATE

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

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Accreditation No.: SCS 108

Client **Emitech Le Mans**

Certificate No: ET3-1546_Feb11

CALIBRATION CERTIFICATE

Object ET3DV6 - SN:1546

Calibration procedure(s) QA CAL-01.v7, QA CAL-12.v6, QA CAL-23.v4, QA CAL-25.v3
Calibration procedure for dosimetric E-field probes

Calibration date: February 21, 2011

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-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	01-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	01-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 654	23-Apr-10 (No. DAE4-654_Apr10)	Apr-11
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

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

Issued: February 22, 2011

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

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Accreditation No.: SCS 108

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	modulation dependent linearization parameters
Polarization ω	ω 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., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \le 900$ 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* are numerical linearization parameters in dB assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media.
- *VR:* VR is the validity range of the calibration related to the average diode voltage or DAE voltage in mV.
- *ConvF and Boundary Effect Parameters:* Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \le 800$ 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.

Probe ET3DV6

SN:1546

Manufactured: October 16, 2000
Calibrated: February 21, 2011

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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1546

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.53	1.62	1.27	± 10.1 %
DCP (mV)[B]	95.6	95.3	96.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	131.7	±2.7 %
			Y	0.00	0.00	1.00	132.5	
			Z	0.00	0.00	1.00	116.1	

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 NormX,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: ET3DV6 - SN:1546

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	Depth (mm)	Unct. (k=2)
450	43.5	0.87	7.12	7.12	7.12	0.22	2.96	± 13.4 %
900	41.5	0.97	6.06	6.06	6.06	0.81	1.71	± 12.0 %
1810	40.0	1.40	4.99	4.99	4.99	0.60	2.51	± 12.0 %
1950	40.0	1.40	4.75	4.75	4.75	0.63	2.31	± 12.0 %
2450	39.2	1.80	4.27	4.27	4.27	0.87	1.75	± 12.0 %

[C] Frequency validity 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.
[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.

DASY/EASY - Parameters of Probe: ET3DV6- SN:1546

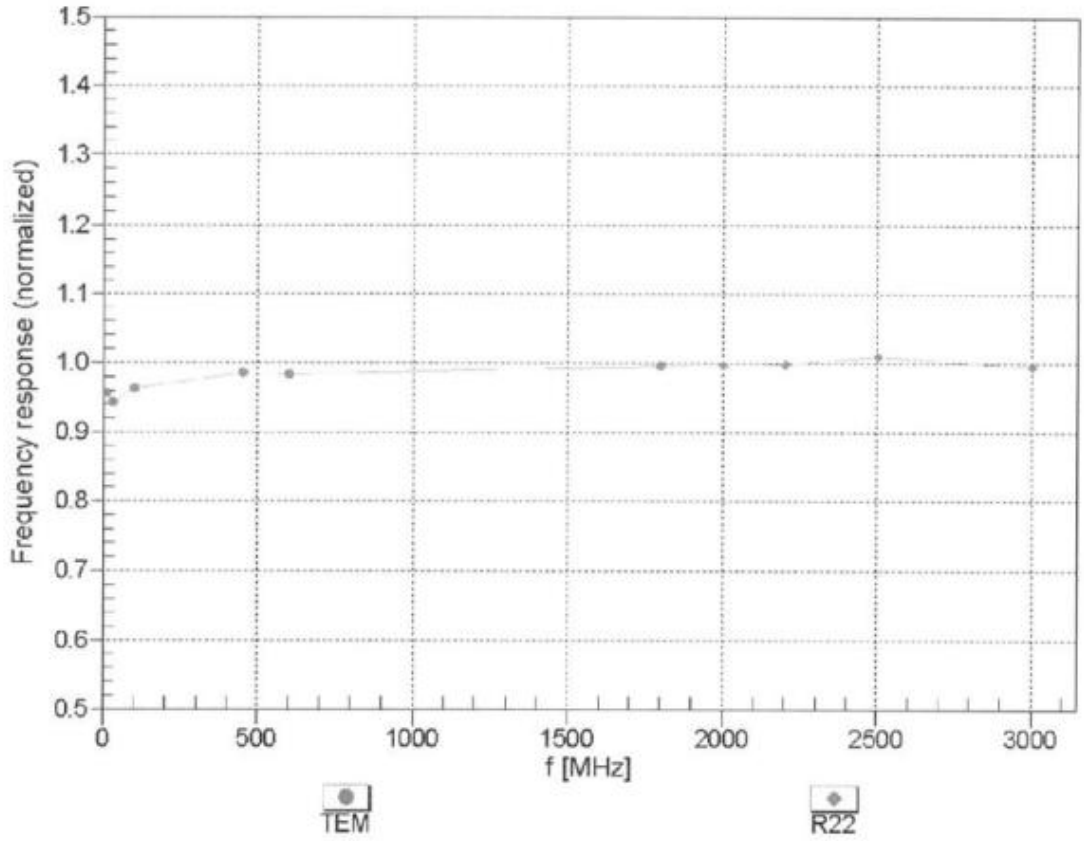
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
900	55.0	1.05	5.87	5.87	5.87	0.77	1.86	± 12.0 %
1810	53.3	1.52	4.52	4.52	4.52	0.69	2.57	± 12.0 %
2450	52.7	1.95	3.95	3.95	3.95	0.99	1.33	± 12.0 %

[C] Frequency validity 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.
[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.

ET3DV6– SN:1546 February 21, 2011

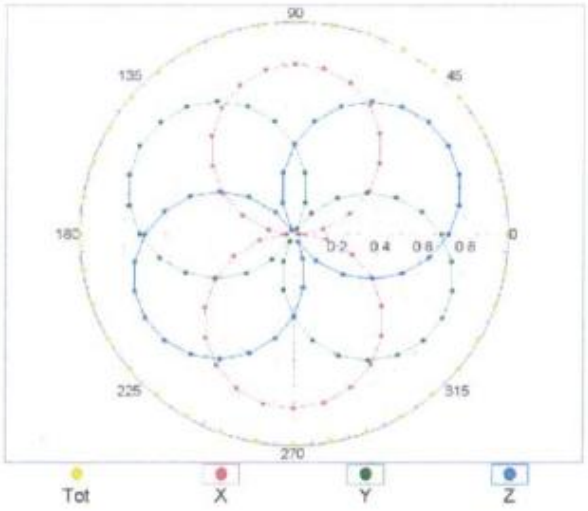
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



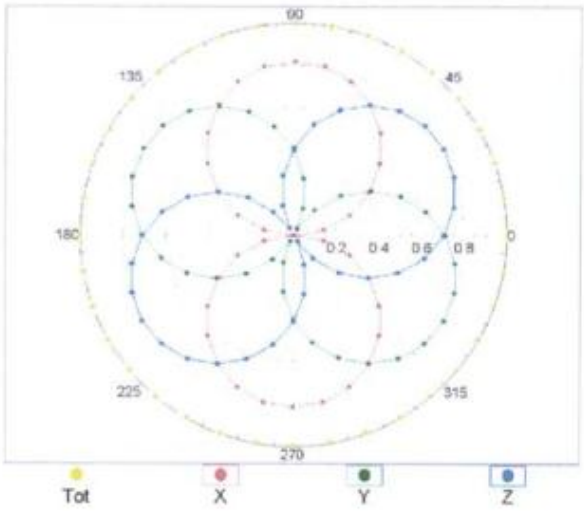
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

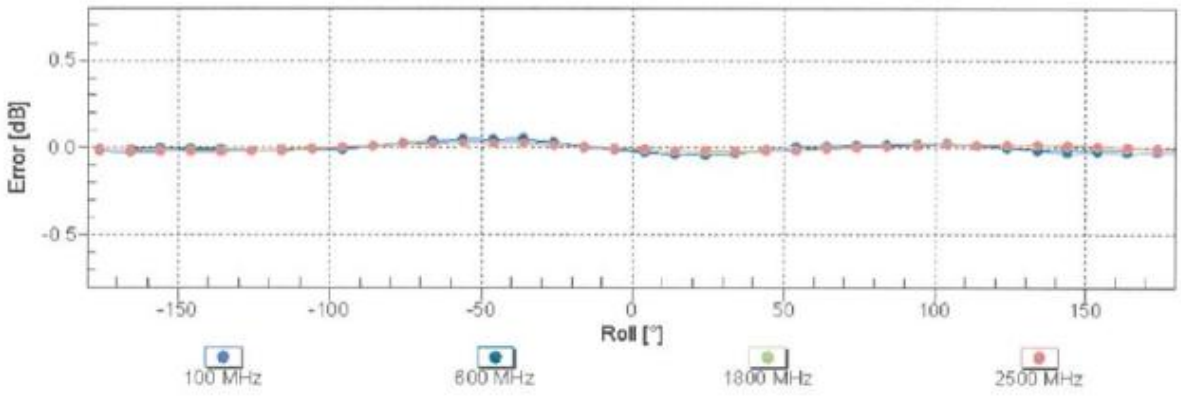
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



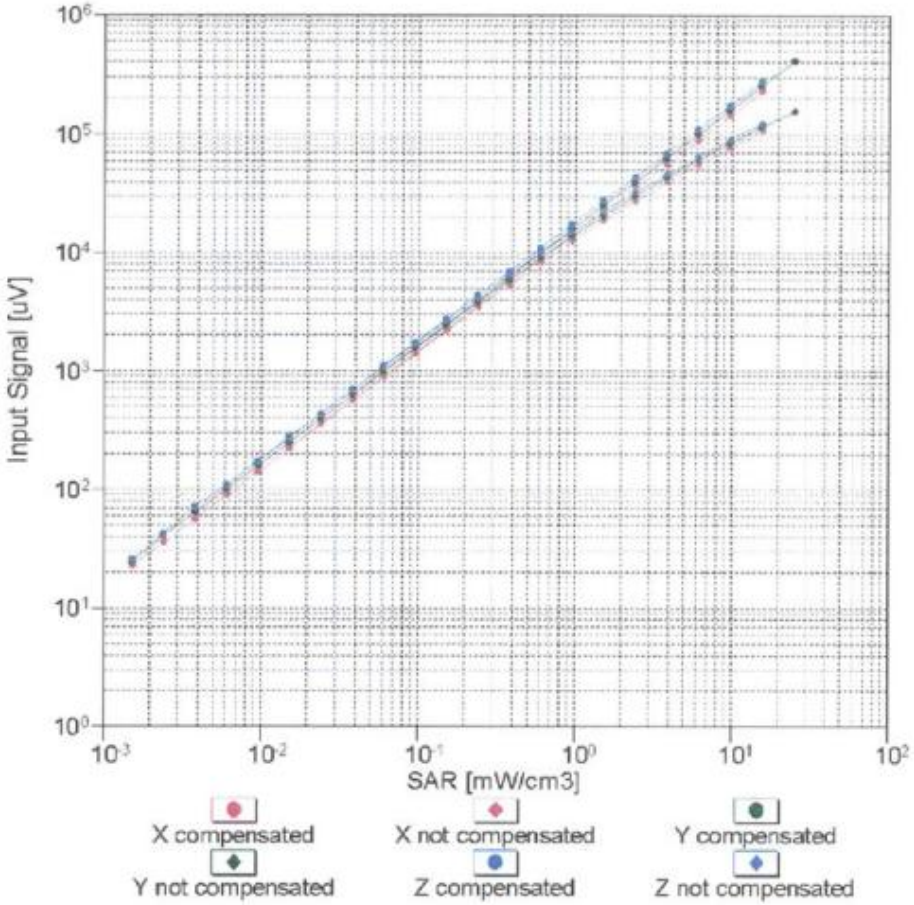
f=1800 MHz,R22

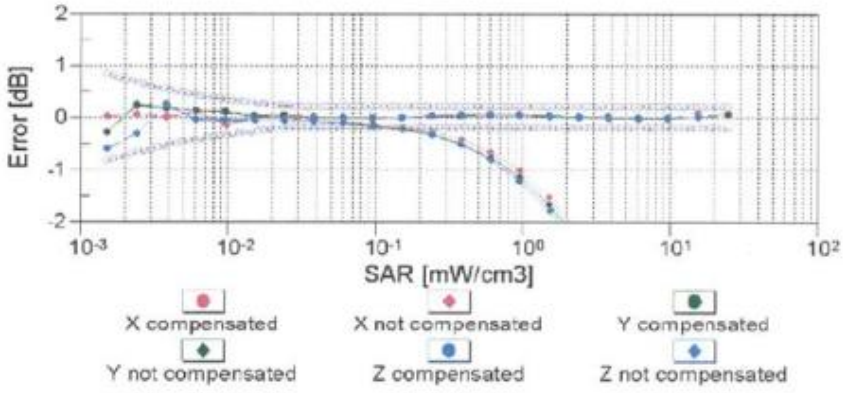




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)



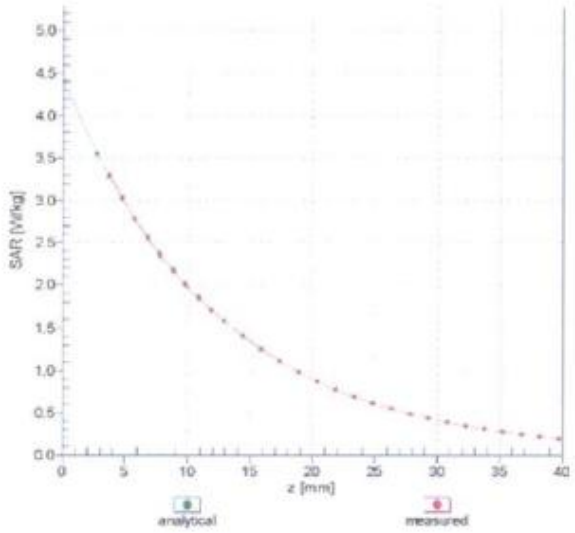


Uncertainty of Linearity Assessment: ± 0.6% (k=2)

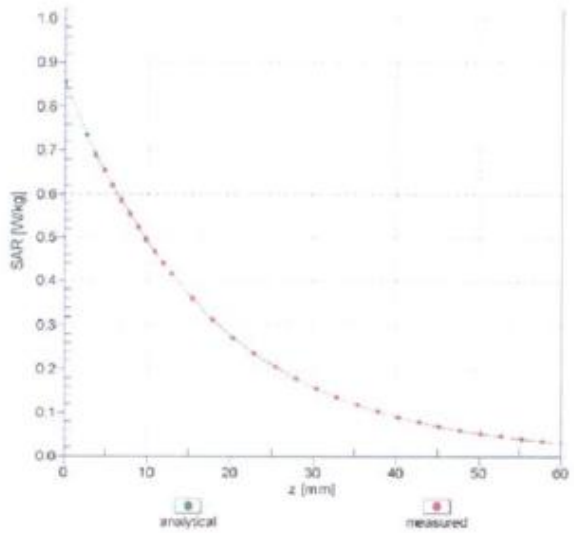
ET3DV6– SN:1546 February 21, 2011

Conversion Factor Assessment

f = 1810 MHz,WGLS R22 (H_convF)

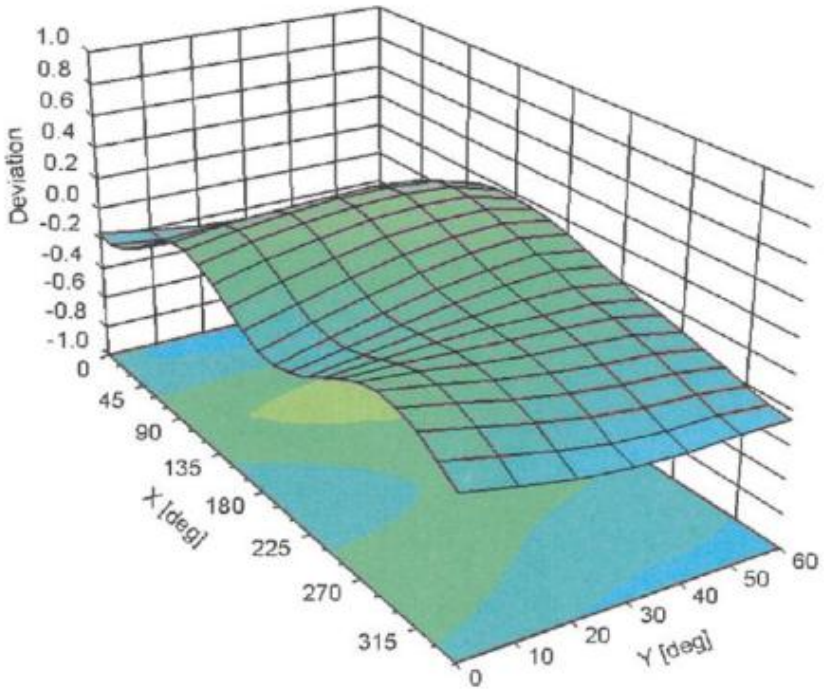


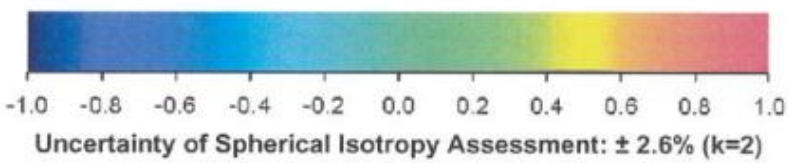
f = 900 MHz,WGLS R9 (H_convF)



Deviation from Isotropy in Air

Error (ϕ, ϑ), f = 900 MHz





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

DASY/EASY - Parameters of Probe: ET3DV6 - SN:1546

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

ANNEX 2: DAE3 CALIBRATION CERTIFICATE

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

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Accreditation No.: **SCS 108**

Client **Emitech LeMans**

Certificate No: **DAE3-402_Feb11**

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 402
Calibration procedure(s)	QA CAL-06.v22 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	February 22, 2011

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	28-Sep-10 (No:10376)	Sep-11
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	07-Jun-10 (in house check)	In house check: Jun-11

	Name	Function	Signature
Calibrated by:	Dominique Steffen	Technician	
Approved by:	Fin Bomholt	R&D Director	i.V.

Issued: February 22, 2011

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

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Accreditation No.: **SCS 108**

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	403.417 ± 0.1% (k=2)	403.326 ± 0.1% (k=2)	403.891 ± 0.1% (k=2)
Low Range	3.94691 ± 0.7% (k=2)	3.96101 ± 0.7% (k=2)	3.96567 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	143.5 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	200004.2	-0.26	-0.00
Channel X	+ Input	20002.61	3.11	0.02
Channel X	- Input	-19999.92	0.68	-0.00
Channel Y	+ Input	200005.8	2.48	0.00
Channel Y	+ Input	20001.88	1.78	0.01
Channel Y	- Input	-20001.43	-1.93	0.01
Channel Z	+ Input	200005.2	2.60	0.00
Channel Z	+ Input	19999.19	-0.81	-0.00
Channel Z	- Input	-20007.99	-8.49	0.04

Low Range		Reading (µV)	Difference (µV)	Error (%)
Channel X	+ Input	2000.1	0.18	0.01
Channel X	+ Input	200.18	0.18	0.09
Channel X	- Input	-200.08	-0.18	0.09
Channel Y	+ Input	2000.1	-0.02	-0.00
Channel Y	+ Input	199.26	-0.84	-0.42
Channel Y	- Input	-201.01	-1.11	0.56
Channel Z	+ Input	2000.1	0.33	0.02
Channel Z	+ Input	199.14	-0.86	-0.43
Channel Z	- Input	-201.28	-1.28	0.64

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	7.56	5.19
	- 200	-3.35	-5.39
Channel Y	200	-1.31	-1.60
	- 200	1.19	0.53
Channel Z	200	1.32	1.05
	- 200	-2.71	-2.57

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	-	2.63	0.17
Channel Y	200	3.13	-	3.91
Channel Z	200	2.47	-0.26	-

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	16347	16808
Channel Y	15850	14316
Channel Z	16451	16273

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	0.29	-0.61	1.18	0.30
Channel Y	-0.53	-2.16	0.93	0.36
Channel Z	-0.54	-1.46	1.59	0.43

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

ANNEX 3: D2450V2 CALIBRATION CERTIFICATE

EMITECH

CALIBRATION CERTIFICATE

Equipment under calibration:
Designation: 2450MHz dipole
Brand: Schmid & Partner Engineering AG
Type: D2450V2
Serial number: 831
Emitech number: 7323

Calibration date: November 09, 2011

Operator: Emmanuel TOUTAIN

Calibration procedure: PRTFIC000MET00050

Environnemental conditions :
Ambient Temperature: 24.0°C
Liquid Temperature: 22.2°C
Hygrometry: 58% HR

Equipment used:

EMITECH N°	DESIGNATION	BRAND	TYPE	CALIBRATION PERIODICITY	CALIBRATION DATE
7216	Network Analyser	Hewlett Packard	8753D	26 months	January 22, 2010
7217	Calibration kit	Hewlett Packard	85033D	26 months	January 22, 2010

Liquid measurements:

Frequency (MHz)	Liquid : Head		Liquid : Body (1)	
	Sigma	Epsilon	Sigma	Epsilon
2450	-	-	2.01	50.3

Note (1): dielectric properties according to Supplement C (Edition 01-01) to OET Bulletin 65 (Edition 97-01)

Return loss measurements:

Dipole	Frequency (MHz)	Liquid : Head		Liquid : Body	
		Return loss (dB)	Verdict (2) ≤ -20dB	Return loss (dB)	Verdict (2) ≤ -20dB
D2450V2	2450	-	-	-26.5	**PASS**

Note (2): The reference dipole shall have a return loss better than –20 dB.

Conclusion: In Tolerance
(in body tissue at 2450MHz according to the Supplement C to OET Bulletin 65)

Visa: