R052-DAS-10-106265-2/A Ed. 1

This report cancels and replaces the test report N° R052-DAS-10-106265-2/A Edition 0

SAR TEST REPORT

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

Equipment under test:
FHSS digital communication terminal
VOKKERO EVOLUTION3 ARF7672DN
FCC ID : U3Z-ARF7672
IC certification number : 7016A-ARF7672

Company:
ADEUNIS RF

DISTRIBUTION: M. SAGUIN **Company: ADEUNIS RF**

Number of pages: 34 with 3 annexes

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0	March 23, 2011	Creation	Emmanuel TOUTAIN	Yvon JUDEAUX
1	June 08, 2011	1, 4, 8, 10, 11, 17, 18, 19, Annexes	Emmanuel TOUTAIN	Yvon JUDEAUX

EQUIPMENT UNDER TEST:	FHSS digital communication terminal
Reference:	VOKKERO EVOLUTION3 ARF7672DN
Serial number:	M110600205 *(production unit)*
MANUFACTURER:	ADEUNIS RF
APPLICANT:	
Company:	ADEUNIS RF
Address:	283 Rue Louis Néel Parc Technologique Pré Roux 38920 CROLLES FRANCE
Contact person:	M. Pascal SAGUIN
Person(s) present(s) during the test:	-
DATE(S) OF TEST(S):	March 02, 2011
TEST SITE:	EMITECH laboratory at Le Mans (72) - FRANCE
TEST(S) OPERATOR(S):	Emmanuel TOUTAIN

SUMMARY

1. INTRODUCTION

In this test report, Specific Absorption Rate (SAR) measurements for the portable device VOKKERO EVOLUTION3 ARF7672DN 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

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 Fileds, 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

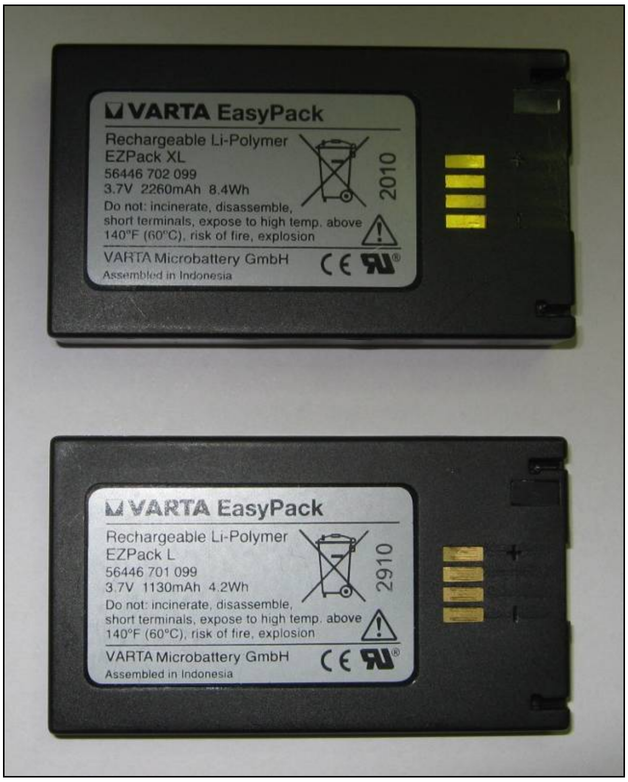
3. PRESENTATION OF EQUIPMENT FOR TESTING PURPOSES

The portable device VOKKERO EVOLUTION3 ARF7672DN with its accessories is shown in Fig. 1. The intended use of portable device operating in the frequency band 902.25 to 927.75MHz, as specified by the applicant, is being in contact with its front or rear side directly against the body. The antenna is a fixed external type.

The tested sample ARF7672DN, as declared by the applicant, is within the following ARF7672xx family products where xx relates to optional software features:

- ARF7672AA,
- ARF7672AN,
- ARF7672AS,
- ARF7672DA,
- ARF7672DN,
- ARF7672DS,
- ARF7672DT,
- ARF7672EA,
- ARF7672EF,
- ARF7672FA.

Front and rear views



Left sides view with batteries 2260mAh and 1130mAh

Headset reference “KEN 010”

Product marking

Fig. 1: Photographs of the equipment under test with its accessories

4. TESTS RESULTS SUMMARY

Object	Respected Standard ? ≤ 1.6W/kg		Remarks
	Yes	No	
SAR measurements at 0cm from the phantom (worst case: rear side on the channel 27 with 1130mAh battery)	X		Highest SAR value measured = 0.116W/kg

Conclusion:

The sample VOKKERO EVOLUTION3 ARF7672DN submitted to test with its accessories (headset, 1130mAh and 2260mAh batteries) when measured at 0cm from the phantom (front and rear sides in contact with the user's body) is in conformity with the FCC Guidelines and RSS102 for general population/uncontrolled exposure according to the Supplement C to OET Bulletin 65.

To declare, or not, the compliance with the specifications, it was not explicitly taken into account of uncertainty associated with the result(s).

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	Simulator	-	-	-	-	-	-	-
		922	Thermometer	Testo	6980		24 months	Sept 16, 2009
2	DASY4	DASY4	Software	Speag	7321	V4.5 Build 19	-	-
		ET3DV6	E-Field Probe	Speag	7196		19 months	Aug 24, 2009
		DAE4	Data acquisition	Speag	S/N900		12 months	Jan 24, 2011
		D900V2	900MHz Dipole	Speag	7194		24 months	Mar 02, 2011
		ELI4	Elliptical phantom	Speag	7324		-	-
3	Liquid Measure	HP85070C	Software	Hewlett-Packard	-	C1.01	-	-
		HP8753D	Network analyzer	Hewlett-Packard	7216		24 months	Dec 04, 2009
		HP85070C	Dielectric probe	Hewlett-Packard	7218		-	-
4	System Validation	2024	Signal generator	Marconi	7215		24 months	Aug 04, 2009
		ZHL42	Amplifier	Mini-circuits	7209		-	-
		PMC18-2	Power Supply	Kikusui	7214		-	-
		NRVS	Power meter	Rohde-Schwarz	7212		24 months	Oct 13, 2010
		NRV-Z31	Probe power meter	Rohde-Schwarz	7211		24 months	Oct 13, 2010
		3877	Coupler	Suhner	7208		24 months	Aug 03, 2009
		33-3-34	Attenuator	Weinschel Engineering	7213		24 months	Aug 03, 2009
		R411810124 R411806124	Attenuator	Radiall	7315		24 months	Aug 03, 2009
		909A	50 ohms load	HP	7314		24 months	Aug 03, 2009
		R404563000	50 ohms load	Radiall	7313		24 months	Aug 03, 2009

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

7. MEASUREMENT RESULTS

The wireless communication device antenna and batteries (1130 and 2260mAh) are those specified by the manufacturer. The batteries are fully charged before each measurement.
The output power and frequencies are controlled using an internal test program supplied by the applicant.
The wireless communication device is set to transmit at it highest output peak power level.
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.: March 02, 2011)

Configuration	Test Position	SAR 1g (W/kg) - Limit = 1.6 W/kg		
		Channel 27 902.25 MHz	Channel 01 915.25 MHz	Channel 26 927.75 MHz
Headset + 1130mAh battery	Front side at 0cm	-	0.113	-
	Rear side at 0cm	**0.116**	0.114	0.112
Headset + 2260mAh battery	Front side at 0cm	-	0.109	-
	Rear side at 0cm	-	0.0622	-

Note: The headset cable was positioned perpendicular to the phantom surface so that the impact on the measured SAR is minimized.

8. GRAPHICAL REPRESENTATION OF THE COARSE SCAN

The graphical representation of the coarse scan for the worst case is shown in Fig. 2.

DUT: VOKKERO ARF7672DN

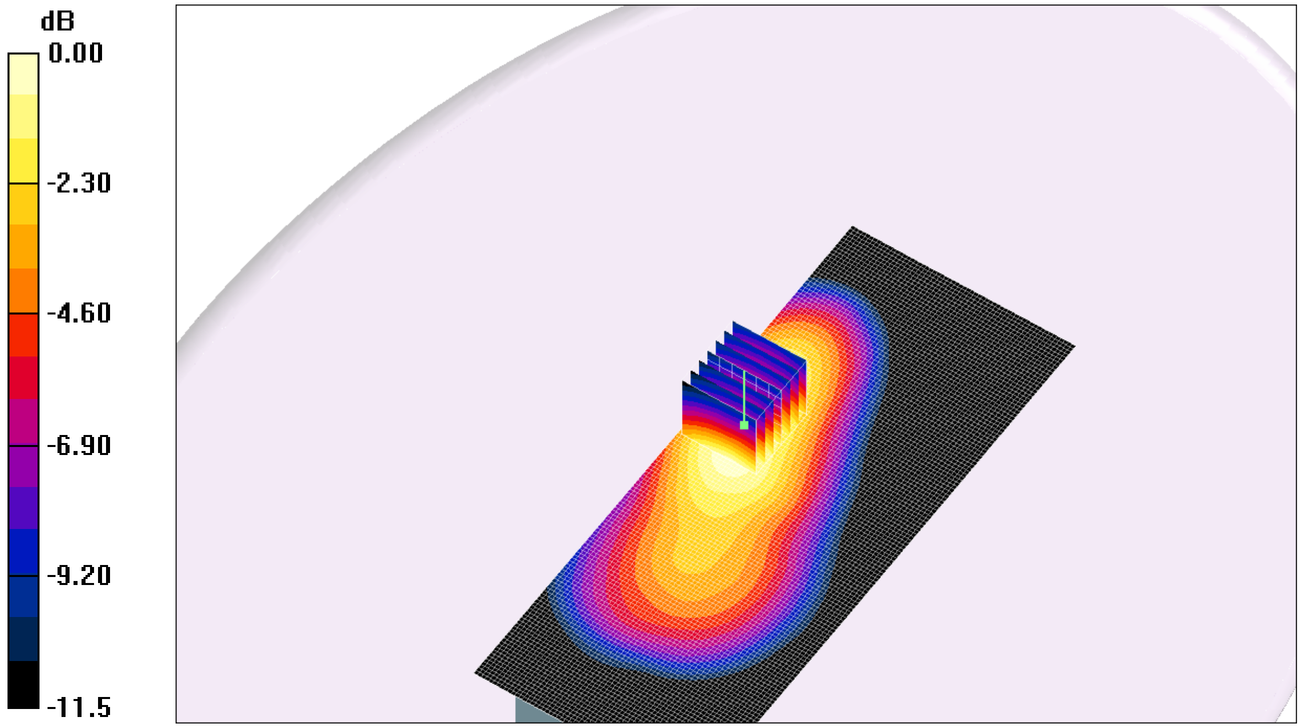
Communication System: VOKKERO US; Frequency: 902.25 MHz; Duty Cycle: 1:6.25
Medium parameters used: $\sigma = 1.05$ mho/m, $\varepsilon_r = 53.8$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 21.4°C, Liquid temperature: 20.8°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1544; ConvF(5.76, 5.76, 5.76); Calibrated: 8/24/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn900; Calibrated: 1/24/2011
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

Body Position - High/Area Scan (61x151x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 0.127 mW/g

Body Position - High/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 7.84 V/m; Power Drift = -0.100 dB
Peak SAR (extrapolated) = 0.162 W/kg
SAR(1 g) = 0.116 mW/g; SAR(10 g) = 0.078 mW/g
Maximum value of SAR (measured) = 0.126 mW/g



0 dB = 0.126mW/g

Fig. 2: SAR distribution for the rear side at 0cm with the headset and 1130mAh battery configuration on channel 27 (902.25MHz) (date of meas.: March 02, 2011)

9. PHOTOGRAPHS OF THE EQUIPMENT UNDER TEST

The photographs of the equipment under test are shown in Fig. 3 to Fig. 6.

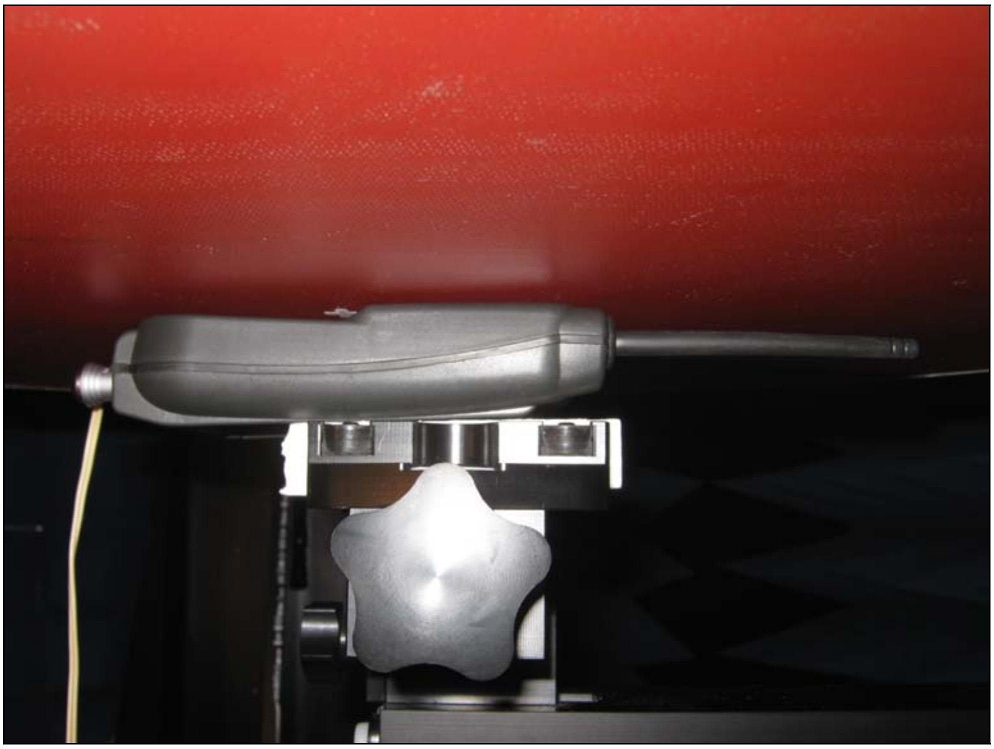


Fig. 3: front side at 0cm from the phantom with headset + 1130mAh battery

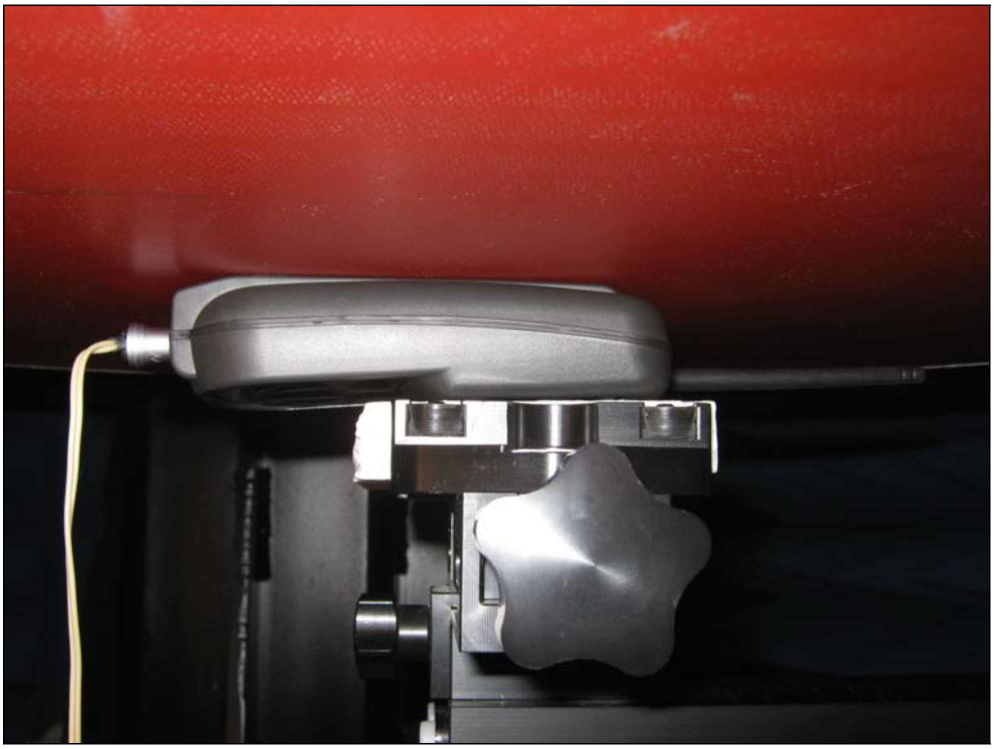


Fig. 4: rear side at 0cm from the phantom with headset + 1130mAh battery

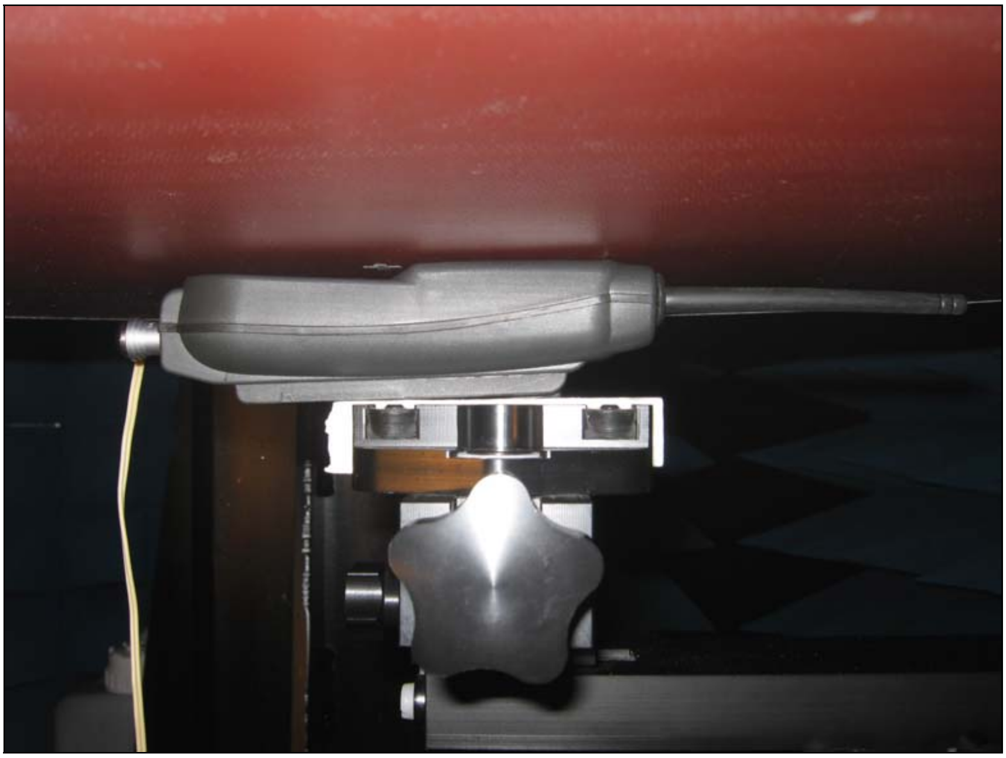


Fig. 5: front side at 0cm from the phantom with headset + 2260mAh battery

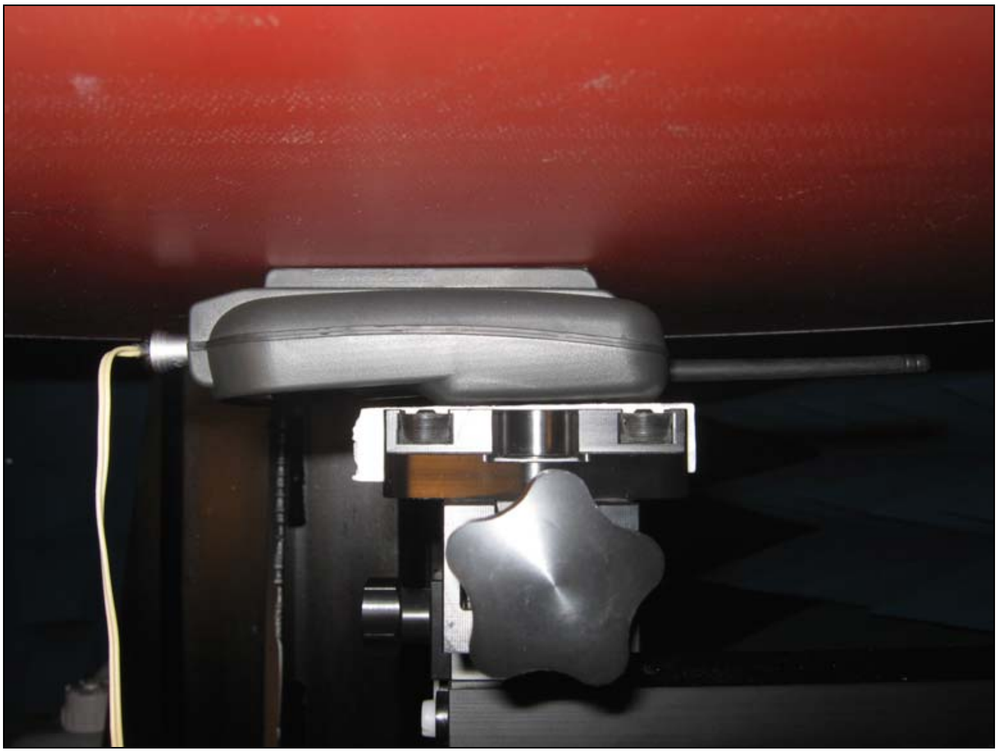


Fig. 6: rear side at 0cm from the phantom with headset + 2260mAh battery

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

Technology:	TDMA
Crest factor:	6.25 (Tx duration is 4.8ms within a frame length of 30ms, so the crest factor is 30/4.8 = 6.25)
Modulation:	GFSK
Traffic Channel:	low channel = 27 (902.25MHz), middle channel = 01 (915.25MHz), high channel = 26 (927.75MHz)
Maximum output power:	24dBm (product specification)

Maximum conducted output power measurements results from EMITECH test reports “R051-24-10-106265-3/A Ed. 0” and “R051-24-10-106265-4/A Ed. 0”: Low channel = 222.4mW, Middle channel = 232.9mW, High channel = 232.9mW

Test program:	Internal test program supplied by the applicant

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. 7 shows the system.

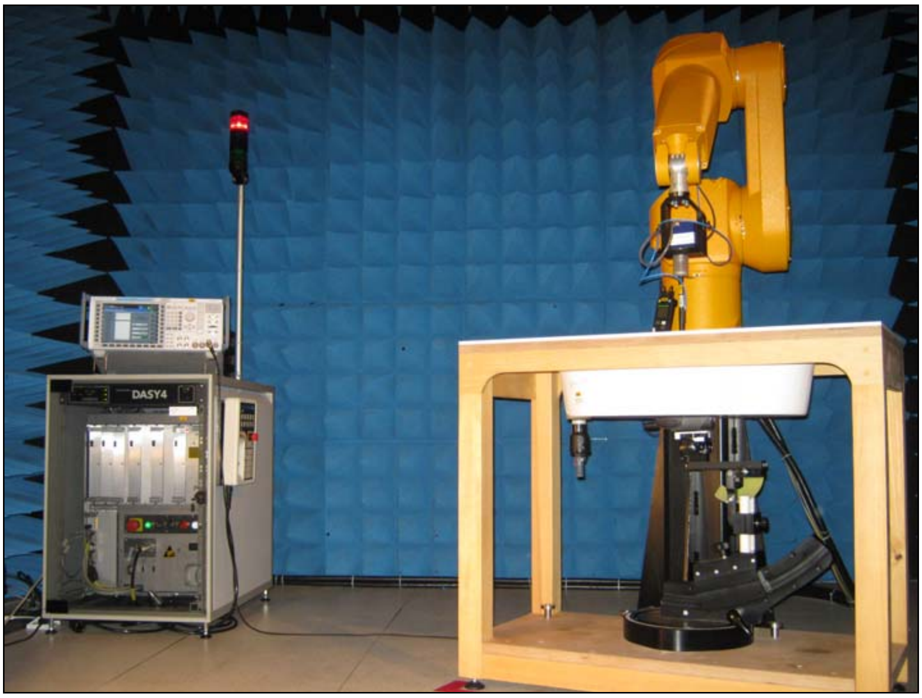


Fig. 7: The measurement setup with equipment under test.

14. LIQUID MEASUREMENT: TEST CONDITIONS & RESULTS

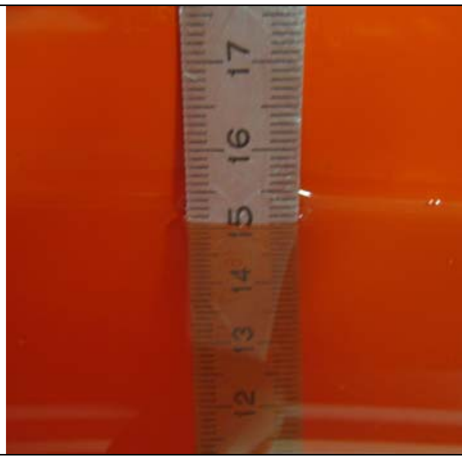
The measurement is performed using platform n° 3 referenced in paragraph 6 ("Equipment used for the testing") of this report. The following ingredients (in % by weight) are theoretical and given for information.

900 MHz liquid:
- Sugar 41.76 %
- De-ionised water 56.0 %
- NaCl salt 0.76 %
- HEC 1.21 %
- Bactericide 0.27 %

The dielectric parameters of the liquid were controlled prior to assessment (contact probe method). Dielectric properties measured (date of meas.: March 02, 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	Ambient temperature (°C)	Liquid temperature (°C)
900	55.0 ± 5 %	54.0	1.05 ± 5 %	1.04	20.8	22.1
915	55.0 ± 5 %	53.8	1.06 ± 5 %	1.05		

The phantom should be filled to a depth of 15.0 ± 0.5 cm.
The liquid depth measured in the phantom was 15.1cm 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. 8.
(date of meas.: March 02, 2011)

Frequency (MHz)	SAR 1g (W/kg) Targeted value	SAR 1g (W/kg) Measured value
900	2.775 ± 10 %	2.85

DUT: Dipole 900 MHz

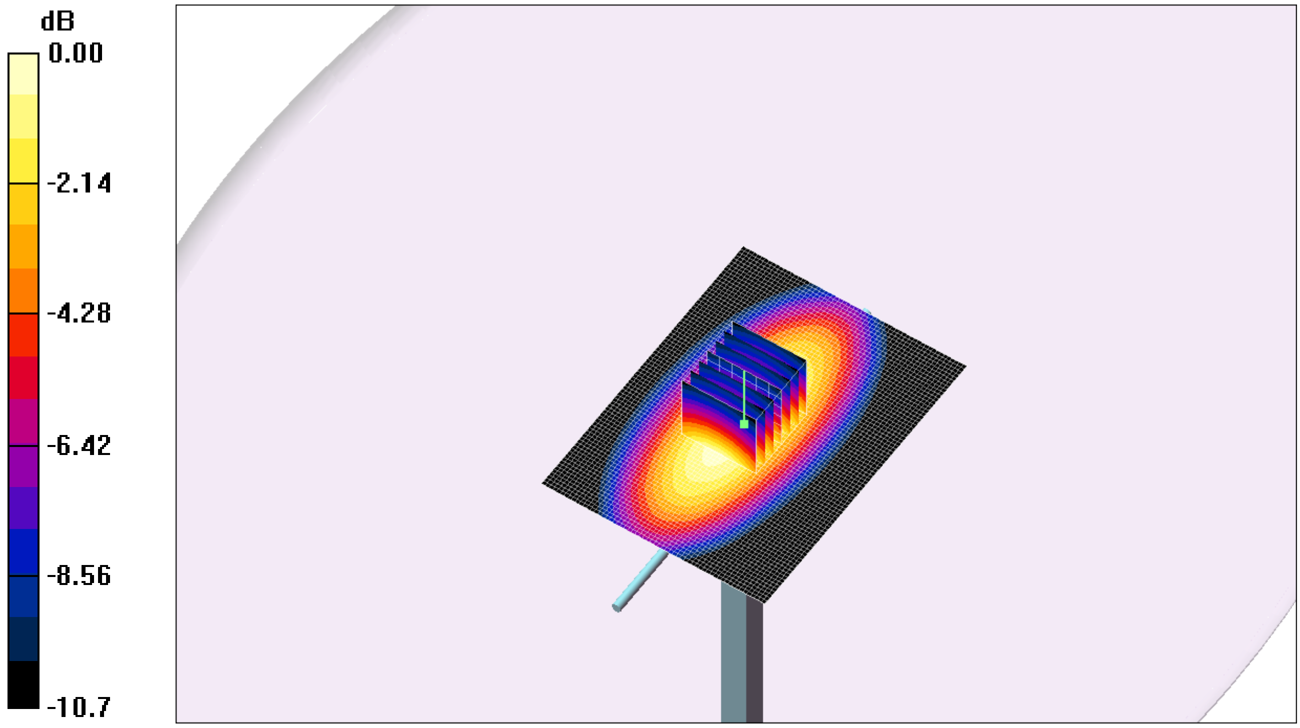
Communication System: CW; Frequency: 900 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 1.04$ mho/m, $\varepsilon_r = 54$; $\rho = 1000$ kg/m^3
Phantom section: Flat Section

Program Notes: Ambient temperature: 22.5°C, Liquid temperature: 20.6°C

DASY4 Configuration:
- Probe: ET3DV6 - SN1544; ConvF(5.76, 5.76, 5.76); Calibrated: 8/24/2009
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn900; Calibrated: 1/24/2011
- Phantom: ELI 4.0; Type: QDOVA001BA
- Measurement SW: DASY4, V4.5 Build 19; Postprocessing SW: SEMCAD, V1.8 Build 145

d=15mm, Pin=250mW/Area Scan (61x81x1): Measurement grid: dx=15mm, dy=15mm
Maximum value of SAR (interpolated) = 3.09 mW/g

d=15mm, Pin=250mW/Zoom Scan (7x7x7) (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.2 V/m; Power Drift = -0.015 dB
Peak SAR (extrapolated) = 4.05 W/kg
SAR(1 g) = 2.85 mW/g; SAR(10 g) = 1.86 mW/g
Maximum value of SAR (measured) = 3.10 mW/g



0 dB = 3.10mW/g

Fig. 8: 900MHz validation result (date of meas.: March 02, 2011)

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