



TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

Test Report Serial No:
RFI/SAR2/RP76813JD01A

Supersedes Test Report Serial No:
RFI/SAR1/RP76813JD01A

This Test Report Is Issued Under The Authority Of Scott D'Adamo, Operations Manager Global Approvals:	
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This report may be copied in full. The results in this report apply only to the sample(s) tested.

RFI Global Services Ltd

Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire RG23 8BG
Telephone: +44 (0)1256 312000 Facsimile: +44 (0)1256 312001
Email: info@rfi-global.com Website: www.rfi-global.com

Registered in England and Wales. Company number:2117901

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1. Customer Information

Company Name:	Datalogic Mobile S.r.l.
Address:	Via S. Vitalino, 13 - 40012 Calderara di Reno - Bologna Italy

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2. Equipment Under Test (EUT)

2.1. Identification of Equipment Under Test (EUT)

Description:	Mobile Computer
Brand Name:	Datalogic Mobile S.r.l.
Model Name or Number:	JOYA
Serial Number:	D10P00004
IMEI Number:	Not Applicable
Hardware Version Number:	Not Applicable
Software Version Number:	3.02.85.20081111
Hardware Revision of GSM Module:	Not Applicable
Software Revision of GSM Module:	Not Applicable
FCC ID Number:	U4G0126
Country of Manufacture:	Italy
Date of Receipt:	18 March 2010

2.2. Description of EUT

The equipment under test is a Mobile Computer (JOYA) with Wi-Fi (802.11 b/g) Radio Card capabilities.

2.3. Modifications Incorporated in the EUT

There has been no modification incorporated to the Equipment.

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2.4. Accessories

The following accessories were supplied with the EUT during testing:

Description:	Battery
Brand Name:	Datalogic Mobile S.r.l.
Model Name or Number:	None Stated
Serial Number:	D10P00004
Cable Length and Type:	Not Applicable
Country of Manufacture:	China
Connected to Port	3 Point Pin

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2.5. Additional Information Related to Testing

Equipment Category	Wi-Fi 802.11b/g		
Type of Unit	Portable Transceiver		
Intended Operating Environment:	Within Wi-Fi 802.11b/g Coverage		
Transmitter Maximum Average Conducted Output Power Characteristics for Module:	Wi-Fi	19 dBm - Manufacturers quoted output power	
Transmitter Frequency Range:	Wi-Fi	(2412 to 2462) MHz	
Transmitter Frequency Allocation of EUT When Under Test:	Channel Number	Channel Description	Frequency (MHz)
	1	Low	2412
	6	Middle	2437
	11	High	2462
Modulation(s):	0 Hz		
Modulation Scheme (Crest Factor):	1 (>98%)		
Antenna Type:	Internal		
Antenna Length:	Unknown		
Number of Antenna Positions:	1 Fixed (TX diversity set to main and Aux antenna only)		
Power Supply Requirement:	3.7 V / 2200mAh		
Battery Type(s):	Li-Ion / Li-Poly		

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3. Test Specification, Methods and Procedures

3.1. Test Specification

Reference:	OET Bulletin 65 Supplement C: (2001-01)
Title:	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
Purpose of Test:	To determine whether the equipment met the basic restrictions as defined in OET Bulletin 65 Supplement C: (2001-01) using the SAR averaging method as described in the test specification above.

3.2. Methods and Procedures Reference Documentation

The methods and procedures used were as detailed in:

Federal Communications Commission, "Evaluating compliance with FCC Guidelines for human exposure to radio frequency electromagnetic fields", OET Bulletin 65 Supplement C, FCC, Washington, D.C, 20554, 2001.

Thomas Schmid, Oliver Egger and Neils Kuster, "Automated E-field scanning system for dosimetric assessments", IEEE Transaction on microwave theory and techniques, Vol. 44, pp. 105-113, January 1996.

Neils Kuster, Ralph Kastle and Thomas Schmid, "Dosimetric evaluation of mobile communications equipment with know precision", IEICE Transactions of communications, Vol. E80-B, No.5, pp. 645-652, May 1997.

KDB 447498 D01 Mobile Portable RF Exposure v04.

KDB 248227 SAR Measurement Procedures for 802.11 a/b/g Transmitters Rev.1.2

3.3. Definition of Measurement Equipment

The measurement equipment used complied with the requirements of the standards referenced in the methods & procedures section above. Appendix 1 contains a list of the test equipment used.

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4. Deviations from the Test Specification

Test was performed as per "FCC KDB 447498 D01 Mobile Portable RF Exposure v04" and "KDB 248227 SAR Measurement Procedures for 802.11 a/b/g Transmitters Rev.1.2" and according to the body-worn procedures in OET Bulletin 65 Supplement C 01-01.

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5. Operation and Configuration of the EUT during Testing

5.1. Operating Modes

The EUT was tested in the following operating mode(s) unless otherwise stated:

- Wi-Fi Test Mode Continuous Transmit using test software “SMU v2.2.12” for card and unit settings and “SRU v2.1.12 to transmit and allocate channel and data rate. This was to cover all worst case modes, running Microsoft Windows CE Version 5.00.
- The EUT was tested in the Wi-Fi band at 1Mbit/s for 802.11b and 6 Mbits/s for 802.11g.
- Simultaneous transmission not supported and therefore not evaluated.
- The EUT was configured into test mode remotely through remote desktop control by connecting EUT to PC using microUSB cable.

5.2. Configuration and Peripherals

The EUT was tested in the following configuration(s) unless otherwise stated:

- Standalone Battery Powered Full Transmit.
- The Front and Rear of the EUT was tested, with the EUT in direct contact with the SAM phantom flat section as this is the most conservative positions.

Body Configuration

- a) The EUT was placed in a normal operating position where the centre of EUT was aligned with the centre reference point on the flat section of the ‘SAM’ phantom.
 - b) With the EUT touching the phantom at an imaginary centre line. The EUT was aligned with a marked plane (X and Y axis) consisting of two lines.
 - c) For the touch-safe position the EUT was gradually moved towards the flat section of the ‘SAM’ phantom until any point of the EUT touched the phantom.
 - d) SAR measurements were evaluated at maximum power and the unit was operated for an appropriate period prior to the evaluation in order to minimise the drift.
 - e) The device was keyed to operate continuously in the transmit mode for the duration of the test.
 - f) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the EUT and its antenna.
 - g) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.
-

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6. Summary of Test Results

Test Name	Specification Reference	Result
Specific Absorption Rate-Wi-Fi 802.11b/g Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied

Individual SAR Evaluation Calculation:

device, mode	Frequency (MHz)	P_x (mW)	P_{REF} (mW)	single SAR, W/kg	remarks
WLAN, 802.11b/g	2450	43	12	0.127	Routine Evaluation

* The device does not co-locate with any other transmitters; therefore simultaneous transmission was not evaluated.

6.1. Location of Tests

All the measurements described in this report were performed at the premises of RFI Global Services Ltd, Pavilion A, Ashwood Park, Ashwood Way, Basingstoke, Hampshire, RG23 8BG United Kingdom

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7. Measurements, Examinations and Derived Results

7.1. General Comments

This section contains test results only.

Measurement uncertainties are evaluated in accordance with current best practice. Our reported expanded uncertainties are based on standard uncertainties, which are multiplied by an appropriate coverage factor to provide a statistical confidence level of approximately 95%. Please refer to section 8 for details of measurement uncertainties.

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7.2. Test Results**7.2.1. Specific Absorption Rate - Wi-Fi 802.11b/g Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.120

Environmental Conditions:

Temperature Variation in Lab (°C):	24.0 to 24.0
Temperature Variation in Liquid (°C):	23.7 to 23.7

Results:

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Facing Phantom	Flat (SAM)	6	0.041	1.600	1.559	1, 2, 3	Complied
Rear of EUT Facing Phantom	Flat (SAM)	6	0.120	1.600	1.480	1, 2, 3	Complied
Front of EUT Facing Phantom	Flat (SAM)	6	0.018	1.600	1.582	1, 2, 4	Complied
Rear of EUT Facing Phantom	Flat (SAM)	6	0.053	1.600	1.547	1, 2, 4	Complied

Note(s):

- SAR measurements were performed with the EUT at a separation distance of 0mm from the 'SAM' phantom flat section.
- SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in the FCC Public Notice DA 02-1438 by the SCC-34/SC-2.
- 802.11b 1Mbit/s
- 802.11g 6Mbit/s

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7.2.2. Conducted Average Power Measurements

Channel Number	Frequency (GHZ)	Average TX Power (dBm)	Note
1	2.412	15.4	2.4GHz 802.11b (1Mbps)
6	2.437	16.3	
11	2.462	16.2	
1	2.412	10.0	2.4GHz 802.11b (11Mbps)
6	2.437	10.4	
11	2.462	10.9	
1	2.412	10.5	2.4GHz 802.11g (6Mbps)
6	2.437	10.9	
11	2.462	10.7	
1	2.412	8.6	2.4GHz 802.11g (54Mbps)
6	2.437	8.0	
11	2.462	7.0	

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8. Measurement Uncertainty

No measurement or test can ever be perfect and the imperfections give rise to error of measurement in the results. Consequently, the result of a measurement is only an approximation to the value of the measurand (the specific quantity subject to measurement) and is only complete when accompanied by a statement of the uncertainty of the approximation.

The expression of uncertainty of a measurement result allows realistic comparison of results with reference values and limits given in specifications and standards.

The uncertainty of the result may need to be taken into account when interpreting the measurement results.

The reported expanded uncertainties below are based on a standard uncertainty multiplied by an appropriate coverage factor, such that a confidence level of approximately 95% is maintained. For the purposes of this document “approximately” is interpreted as meaning “effectively” or “for most practical purposes”.

Test Name	Confidence Level	Calculated Uncertainty
Specific Absorption Rate – Wi-Fi & WLAN 2450 MHz Body Configuration 1g	95%	±19.33

The methods used to calculate the above uncertainties are in line with those recommended within the various measurement specifications. Where measurement specifications do not include guidelines for the evaluation of measurement uncertainty, the published guidance of the appropriate accreditation body is followed.

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Measurement Uncertainty (Continued)**8.1. Specific Absorption Rate Uncertainty at Wi-Fi & WLAN 2450 MHz Body 1g, Modulation Scheme calculated in accordance with IEC 62209-2 & IEEE 1528**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C _i (10g)	Standard Uncertainty		v _i or v _{eff}
							+ u (%)	- u (%)	
B	Probe calibration	11.800	11.800	normal (k=2)	2.0000	1.0000	5.900	5.900	∞
B	Axial Isotropy	0.500	0.500	normal (k=2)	2.0000	1.0000	0.250	0.250	∞
B	Hemispherical Isotropy	2.600	2.600	normal (k=2)	2.0000	1.0000	1.300	1.300	∞
B	Spatial Resolution	0.500	0.500	Rectangular	1.7321	1.0000	0.289	0.289	∞
B	Boundary Effect	0.769	0.769	Rectangular	1.7321	1.0000	0.444	0.444	∞
B	Linearity	0.600	0.600	Rectangular	1.7321	1.0000	0.346	0.346	∞
B	Detection Limits	0.200	0.200	Rectangular	1.7321	1.0000	0.115	0.115	∞
B	Readout Electronics	0.560	0.560	normal (k=2)	2.0000	1.0000	0.280	0.280	∞
B	Response Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	Integration Time	0.000	0.000	Rectangular	1.7321	1.0000	0.000	0.000	∞
B	RF Ambient conditions	3.000	3.000	Rectangular	1.7321	1.0000	1.732	1.732	∞
B	Probe Positioner Mechanical Restrictions	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Probe Positioning with regard to Phantom Shell	2.850	2.850	Rectangular	1.7321	1.0000	1.645	1.645	∞
B	Extrapolation and integration/ Maximum SAR evaluation	5.080	5.080	Rectangular	1.7321	1.0000	2.933	2.933	∞
A	Test Sample Positioning	2.920	2.920	normal (k=1)	1.0000	1.0000	2.920	2.920	10
A	Device Holder uncertainty	0.154	0.154	normal (k=1)	1.0000	1.0000	0.154	0.154	10
B	Phantom Uncertainty	4.000	4.000	Rectangular	1.7321	1.0000	2.309	2.309	∞
B	Drift of output power	5.000	5.000	Rectangular	1.7321	1.0000	2.887	2.887	∞
B	Liquid Conductivity (target value)	5.000	5.000	Rectangular	1.7321	0.6400	1.848	1.848	∞
A	Liquid Conductivity (measured value)	3.930	3.930	normal (k=1)	1.0000	0.6400	2.515	2.515	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	3.940	3.940	normal (k=1)	1.0000	0.6000	2.364	2.364	5
	Combined standard uncertainty			t-distribution			9.86	9.86	>400
	Expanded uncertainty			k = 1.96			19.33	19.33	>400

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Appendix 1. Test Equipment Used

RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
A034	Narda 20W Termination	Narda	374BNM	8706	Calibrated as part of system	-
A1094	Digital Camera	Sony	MVC – FD81	125805	-	-
A1097	SMA Directional Coupler	MidISCO	MDC6223-30	None	Calibrated as part of system	-
A1137	3dB Attenuator	Narda	779	04690	Calibrated as part of system	-
A1174	Dielectric Probe Kit	Agilent Technologies	85070C	Us99360072	Calibrated before use	-
A1328	Handset Positioner	Schmid & Partner Engineering AG	Modification	SD 000 H01 DA	-	-
A1182	Handset Positioner	Schmid & Partner Engineering AG	V3.0	None	-	-
A1234	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	450	30 April 2009	12
A1378	Probe	Schmid & Partner Engineering AG	EX3 DV3	3508	26 June 2009	12
A1566	SAM Phantom	Schmid & Partner Engineering AG	SAM a	002	Calibrated before use	-
A1322	2450 MHz Dipole Kit	Schmid & Partner Engineering AG	D2450V2	725	08 Jan 2009	24
A1497	Amplifier	Mini-Circuits	zh1-42w (sma)	e020105	Calibrated as part of system	-
A215	20 dB Attenuator	Narda	766-20	9402	Calibrated as part of system	-
C1144	Cable	Rosenberger MICRO-COAX	FA147AF00 1503030	41842-1	Calibrated as part of system	-
C1145	Cable	Rosenberger MICRO-COAX	FA147AF00 3003030	41843-1	Calibrated as part of system	-
C1146	Cable	Rosenberger MICRO-COAX	FA147AF03 0003030	41752-1	Calibrated as part of system	-
G0528	Robot Power Supply	Schmid & Partner Engineering AG	DASY	None	Calibrated before use	-
G087	PSU	Thurlby Thandar	CPX200	100701	Calibrated before use	-
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	15 Sept 2009	12

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RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
M1047	Robot Arm	Staubli	RX908 L	F00/SD89A1/A/01	Calibrated before use	-
M1159	Signal Generator	Agilent Technologies	E8241A	US42110332	Internal Check 04 December 2009	4
M1071	Spectrum Analyzer	Agilent	HP8590E	3647U00514	(Monitoring use only)	-
M1044	Diode Power Sensor	Rohde & Schwarz	NRV-Z1	893350/019	19 May 2009	12
M265	Diode Power Sensor	Rohde & Schwarz	NRV-Z1	893350/017	19 May 2009	12
M263	Dual Channel Power Meter	Rohde & Schwarz	NRVD	826558/004	20 May 2009	12
S256	SAR Lab	RFI	Site 56	N/A	Calibrated before use	-

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A.1.1. Calibration Certificates

This section contains the calibration certificates and data for the Probe(s) and Dipole(s) used, which are not included in the total number of pages for this report.



A1378
Checked on 01/07/2009
S Schweizerischer Kalibrierdienst
S 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 108**

Client **RFI**

Certificate No: **EX3-3508_Jun09**

CALIBRATION CERTIFICATE

Object **EX3DV3 - SN:3508**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-12.v5 and QA CAL-23.v3
Calibration procedure for dosimetric E-field probes**

Calibration date: **June 26, 2009**

Condition of the calibrated item **In Tolerance**

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	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	2-Jan-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: June 26, 2009

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



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 108**

Glossary:

TSL	tissue simulating liquid
NORM _{x,y,z}	sensitivity in free space
ConvF	sensitivity in TSL / NORM _{x,y,z}
DCP	diode compression point
Polarization φ	φ rotation around probe axis
Polarization ϑ	ϑ rotation around an axis that is in the plane normal to probe axis (at measurement center), i.e., $\vartheta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

- 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
- 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:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)_{x,y,z}** = NORM_{x,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*.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ 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 NORM_{x,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 EX3DV3

SN:3508

Manufactured:	December 19, 2003
Last calibrated:	June 24, 2008
Recalibrated:	June 26, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: EX3DV3 SN:3508

Sensitivity in Free Space^A

NormX	0.76 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormY	0.63 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$
NormZ	0.66 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$

Diode Compression^B

DCP X	95 mV
DCP Y	97 mV
DCP Z	94 mV

Sensitivity in Tissue Simulating Liquid (Conversion Factors)

Please see Page 8.

Boundary Effect

TSL **900 MHz** **Typical SAR gradient: 5 % per mm**

Sensor Center to Phantom Surface Distance		2.0 mm	3.0 mm
SAR _{be} [%]	Without Correction Algorithm	7.8	4.6
SAR _{be} [%]	With Correction Algorithm	0.5	0.3

TSL **1750 MHz** **Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance		2.0 mm	3.0 mm
SAR _{be} [%]	Without Correction Algorithm	5.8	2.7
SAR _{be} [%]	With Correction Algorithm	0.7	0.5

Sensor Offset

Probe Tip to Sensor Center **1.0 mm**

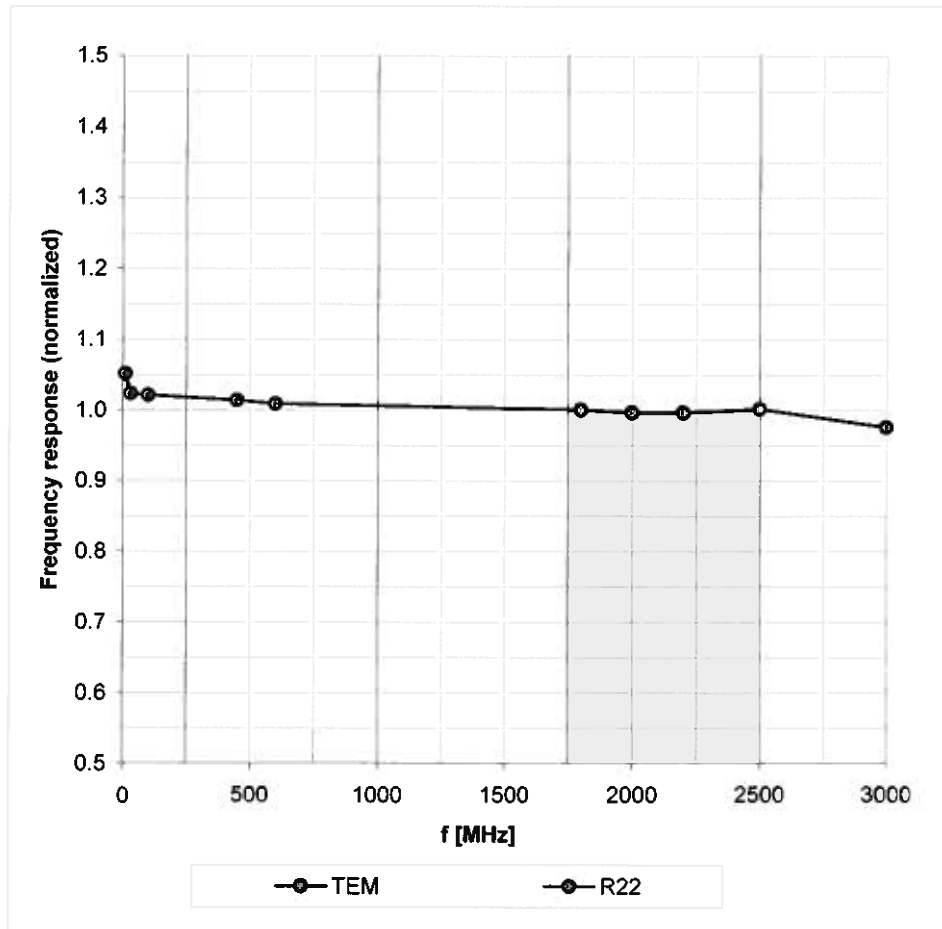
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

^A The uncertainties of NormX,Y,Z do not affect the E²-field uncertainty inside TSL (see Page 8).

^B Numerical linearization parameter: uncertainty not required.

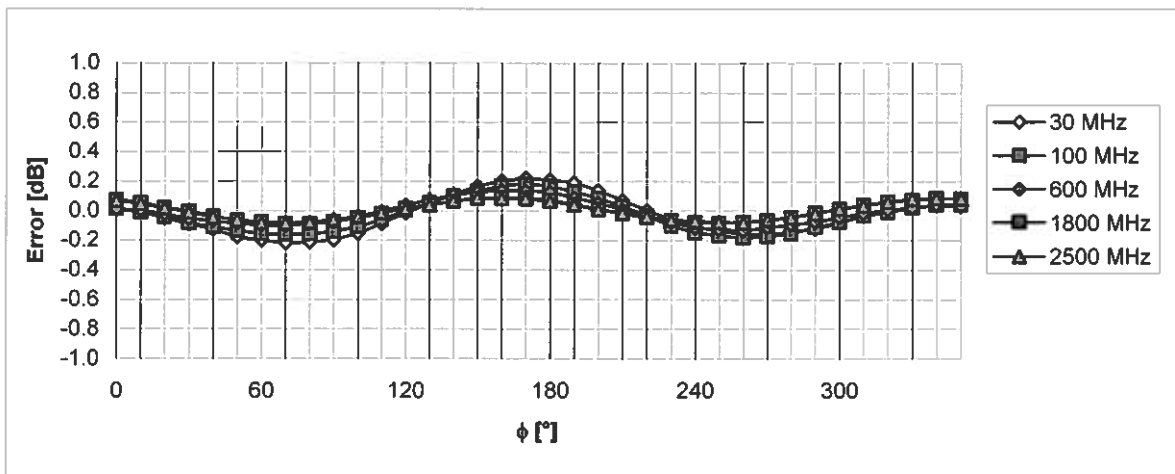
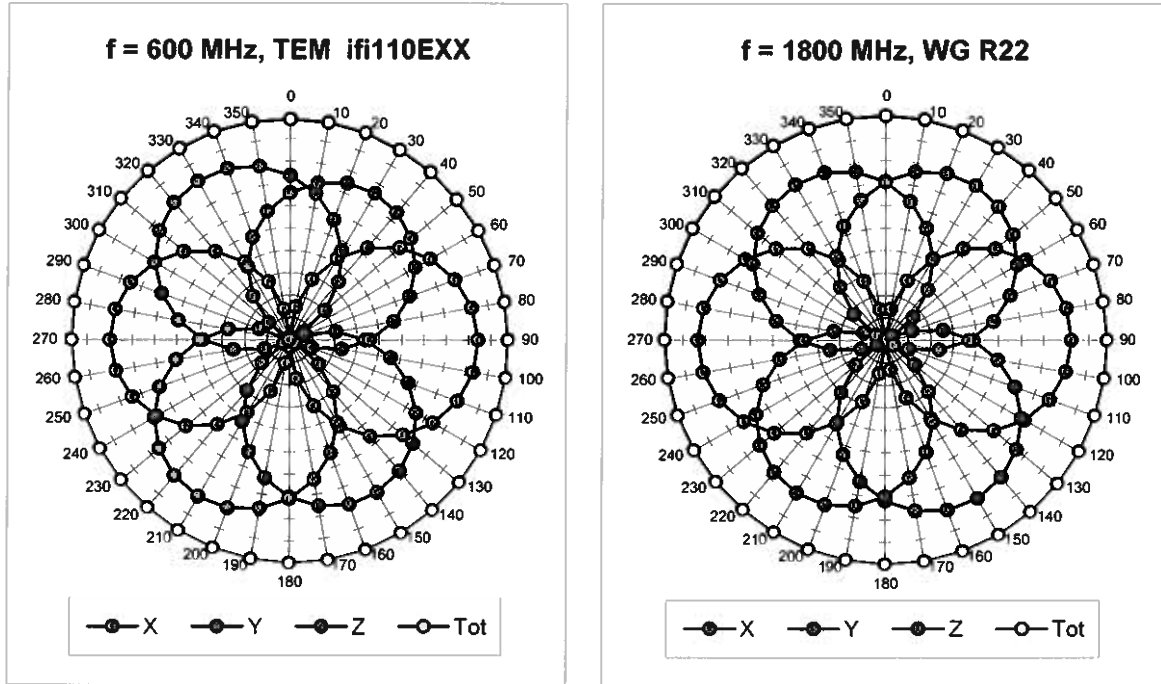
Frequency Response of E-Field

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



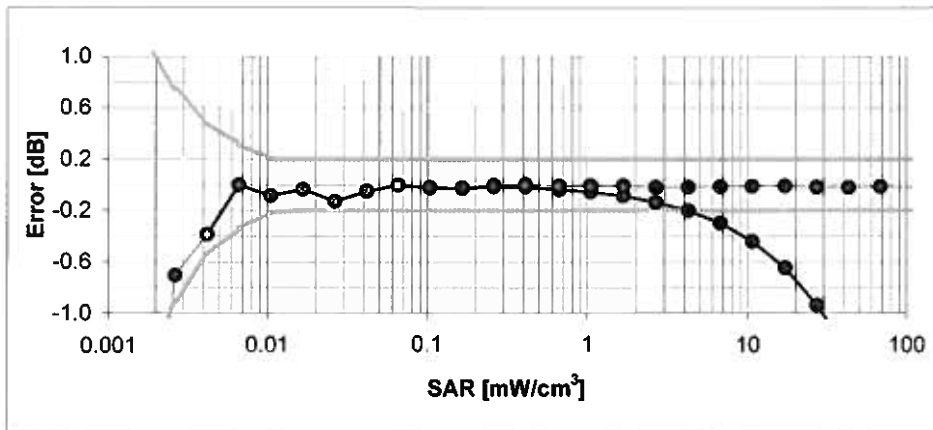
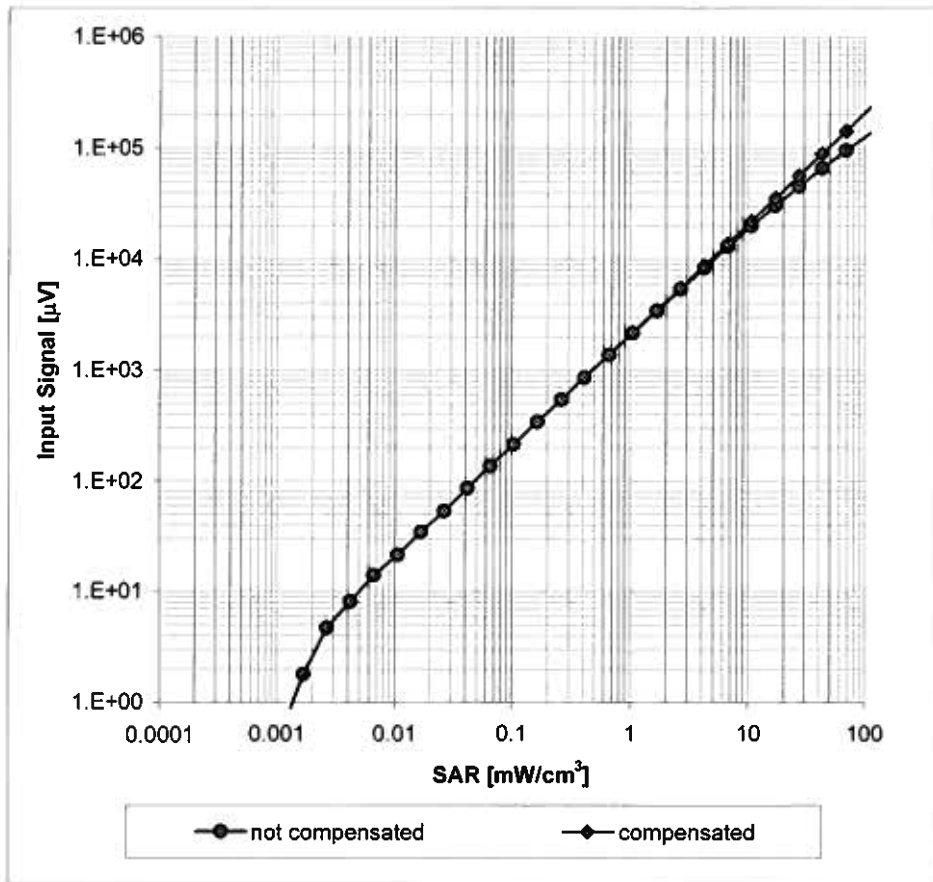
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

Receiving Pattern (ϕ), $\vartheta = 0^\circ$



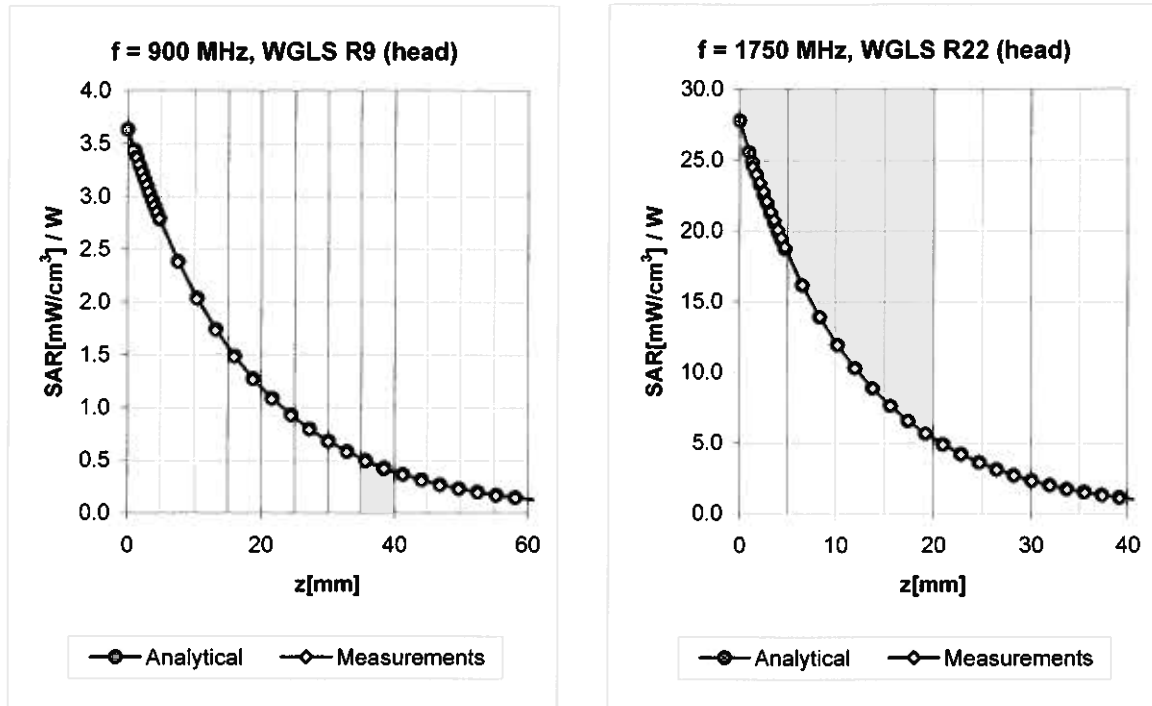
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

Dynamic Range f(SAR_{head}) (Waveguide R22, f = 1800 MHz)



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

Conversion Factor Assessment

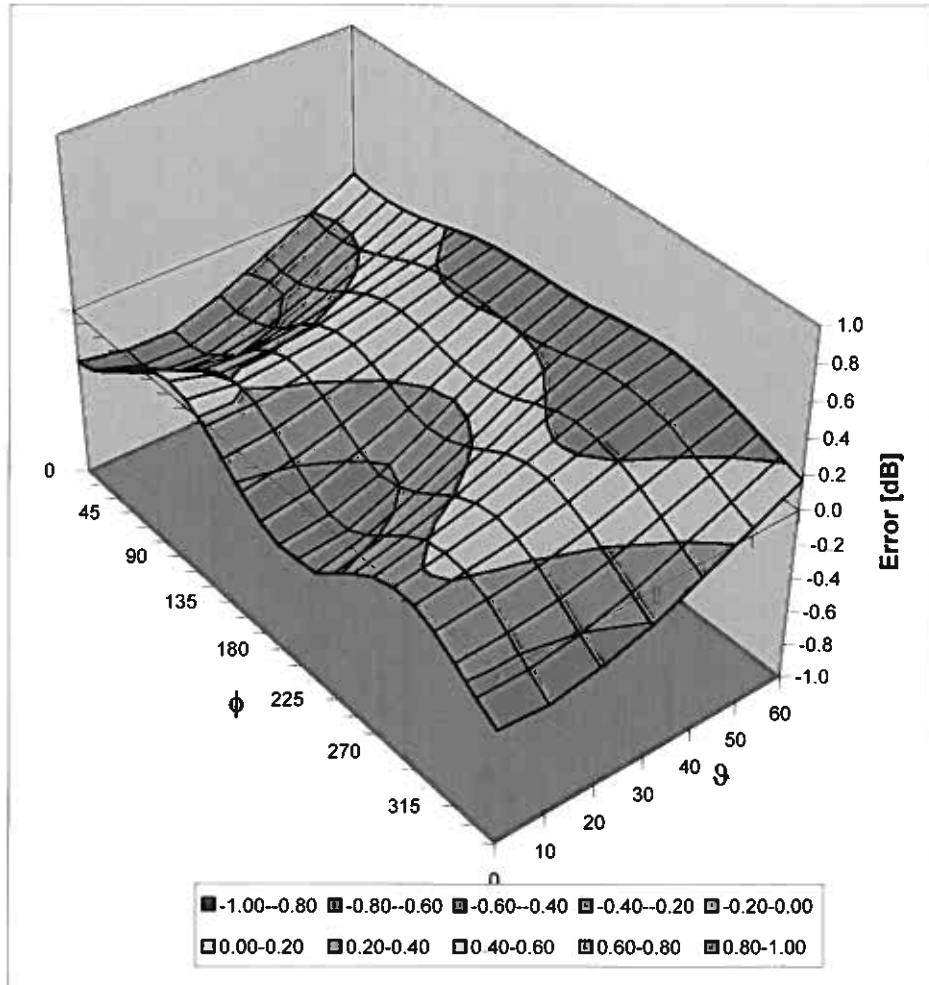


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.23	1.00	10.49 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.48	0.72	9.76 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.57	0.63	8.82 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.53	0.65	8.58 ± 11.0% (k=2)
2150	± 50 / ± 101	Head	39.7 ± 5%	1.53 ± 5%	0.36	0.69	8.33 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.36	0.75	7.77 ± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.30	0.51	11.32 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.45	0.75	9.99 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.55	0.63	8.59 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.48	0.68	8.23 ± 11.0% (k=2)
2150	± 50 / ± 100	Body	53.0 ± 5%	1.75 ± 5%	0.30	0.92	8.27 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.25	1.02	8.06 ± 11.0% (k=2)

^c The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

Deviation from Isotropy in HSL

Error (ϕ, ϑ), $f = 900$ MHz



Uncertainty of Spherical Isotropy Assessment: $\pm 2.6\%$ ($k=2$)

A1322

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



S Schweizerischer Kalibrierdienst
S Service suisse d'étalonnage
C 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 108**

Client **RFI**

Certificate No: **D2450V2-725_Jan09**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 725**

Calibration procedure(s) **QA CAL-05.v7
Calibration procedure for dipole validation kits**

Calibration date: **January 08, 2009**

Condition of the calibrated item **In Tolerance**

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	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: S5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

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

Issued: January 12, 2009

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



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 108**

Glossary:

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

Calibration is Performed According to the Following Standards:

- a) IEEE Std 1528-2003, "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
- c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "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", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

- d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

Measurement Conditions

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

DASY Version	DASY5	V5.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz \pm 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 \pm 0.2) °C	38.3 \pm 6 %	1.83 mho/m \pm 6 %
Head TSL temperature during test	(21.5 \pm 0.2) °C	---	---

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	52.1 mW / g \pm 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.12 mW / g
SAR normalized	normalized to 1W	24.5 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	24.3 mW / g \pm 16.5 % (k=2)

¹ Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.8 ± 6 %	2.01 mho/m ± 6 %
Body TSL temperature during test	(21.0 ± 0.2) °C	—	—

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR normalized	normalized to 1W	52.8 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	52.2 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR normalized	normalized to 1W	24.8 mW / g
SAR for nominal Body TSL parameters ²	normalized to 1W	24.7 mW /g ± 16.5 % (k=2)

² Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.4 Ω + 5.3 j Ω
Return Loss	- 23.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.0 Ω + 6.7 j Ω
Return Loss	- 23.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.153 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 16, 2002

DASY5 Validation Report for Head TSL

Date/Time: 08.01.2009 10:04:18

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN725

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 38.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.4, 4.4, 4.4); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

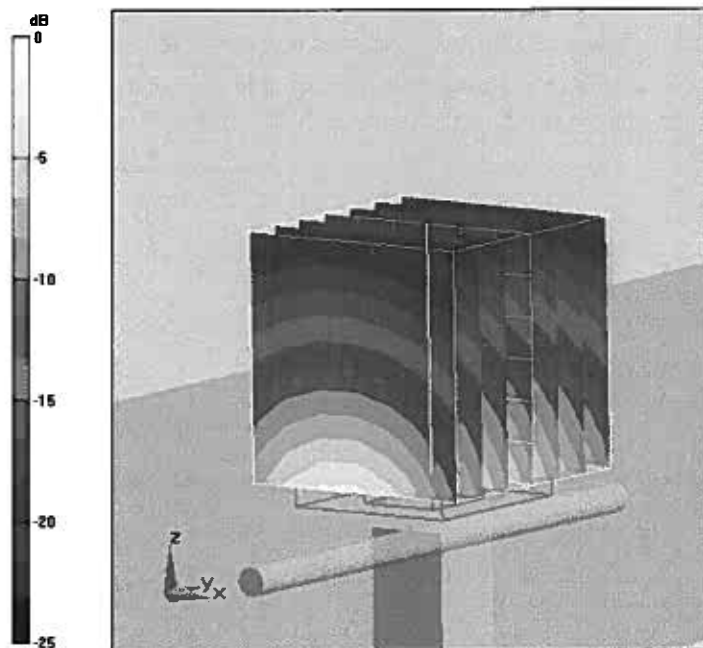
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.8 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 27.7 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.12 mW/g

Maximum value of SAR (measured) = 15.9 mW/g



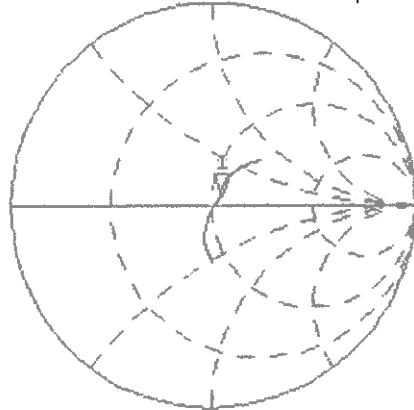
0 dB = 15.9mW/g

Impedance Measurement Plot for Head TSL

8 Jan 2009 09:18:44

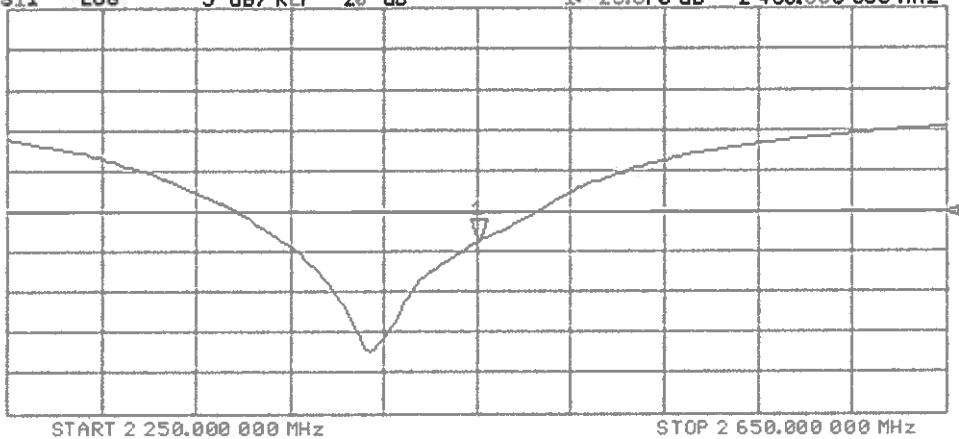
CH1 S11 1 U FS 1: 54.352 Ω 5.2852 Ω 343.33 μ H 2 450.000 000 MHz

*
Del
Cor
Avg
16



CH2 S11 LOG 5 dB/REF -20 dB 1: -23.670 dB 2 450.000 000 MHz

Cor
Avg
16



DASY5 Validation Report for Body TSL

Date/Time: 08.01.2009 12:28:21

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 2.02$ mho/m; $\epsilon_r = 53.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

- Probe: ES3DV2 - SN3025; ConvF(4.07, 4.07, 4.07); Calibrated: 28.04.2008
- Sensor-Surface: 3.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 120; SEMCAD X Version 13.4 Build 45

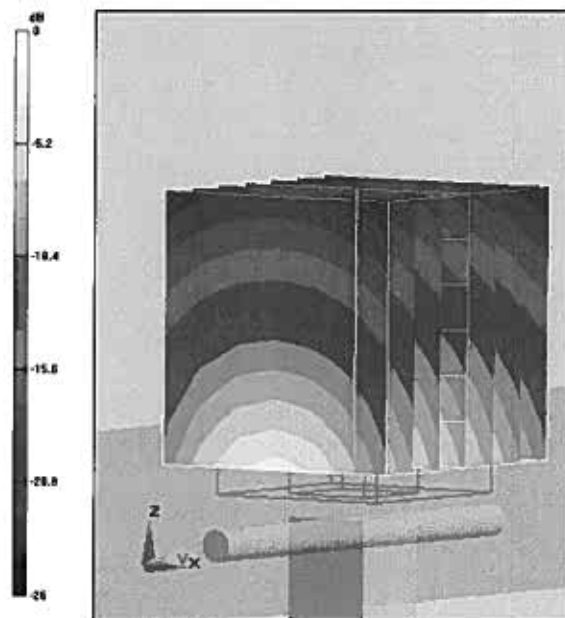
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 93.1 V/m; Power Drift = 0.00372 dB

Peak SAR (extrapolated) = 26.6 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.19 mW/g

Maximum value of SAR (measured) = 16.5 mW/g



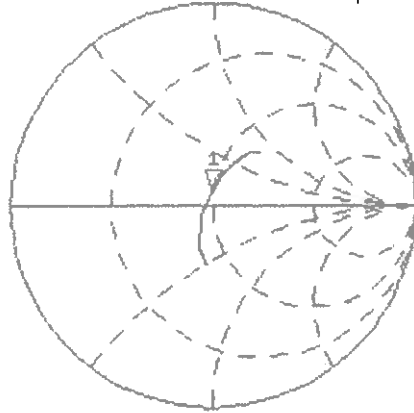
0 dB = 16.5mW/g

Impedance Measurement Plot for Body TSL

8 Jan 2009 09:24:58

CHI S11 1 U FS 1: 49.033 Ω 6.6719 Ω 433.41 pF 2 450.000 000 MHz

*
Del
Cor



Avg
16

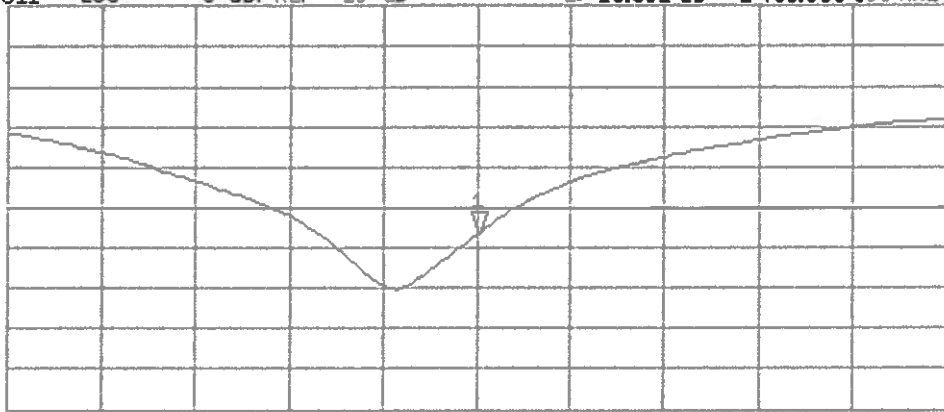
↑

CH2 S11 LOG 5 dB/REF -20 dB 1:-23.362 dB 2 450.000 000 MHz

Cor

Avg
16

↑



START 2 250.000 000 MHz

STOP 2 650.000 000 MHz

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

Appendix 2. Measurement Methods

A.2.1. Evaluation Procedure

The Specific Absorption Rate (SAR) evaluation was performed in the following manner:

- a) (i) The evaluation was performed in an applicable area of the phantom depending on the type of device being tested. For devices worn about the ear during normal operation, both the left and right ear positions were evaluated at the centre frequency of the band at maximum power. The side, which produced the greatest SAR, determined which side of the phantom would be used for the entire evaluation. The positioning of the head worn device relative to the phantom was dictated by the test specification identified in section 3.1 of this report.

(ii) For body worn devices or devices which can be operated within 20 cm of the body, the flat section of the SAM phantom was used where the size of the device(s) is normal. For bigger devices and base station the 2mm Oval phantom is used for evaluation. The type of device being evaluated dictated the distance of the EUT to the outer surface of the phantom flat section.
 - b) The SAR was determined by a pre-defined procedure within the DASY4 software. The exposed region of the phantom was scanned near the inner surface with a grid spacing of 20mm x 20mm or appropriate resolution.
 - c) A 5x5x7 matrix was performed around the greatest spatial SAR distribution found during the area scan of the applicable exposed region. SAR values were then calculated using a 3-D spline interpolation algorithm and averaged over spatial volumes of 1 and 10 grams.
 - d) If the EUT had any appreciable drift over the course of the evaluation, then the EUT was re-evaluated. Any unusual anomalies over the course of the test also warranted a re-evaluation.
-

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

A.2.2. Specific Absorption Rate (SAR) Measurements to OET Bulletin 65 Supplement C: (2001-01)

Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields

SAR measurements were performed in accordance with Appendix D of the standard FCC OET Bulletin 65 Supplement C: 2001, against appropriate limits for each measurement position in accordance with the standard.

The test was performed in a shielded enclosure with the temperature controlled to remain between +18.0°C and +25.0°C. The tissue equivalent material fluid temperature was controlled to give a maximum variation of $\pm 2.0^\circ\text{C}$

Prior to any SAR measurements on the EUT, system validation and material dielectric property measurements were conducted. In the absence of a detailed procedure within the specification, system validation and material dielectric property measurements were performed in accordance with Appendix C and Appendix D of FCC OET Bulletin 65 Supplement C: 2001.

Following the successful system validation and material dielectric property measurements, a SAR versus time sweep shall be performed within 10 mm of the phantom inner surface. If the EUT power output is stable after three minutes then the measurement probe will perform a coarse surface level scan at each test position in order to ascertain the location of the maximum local SAR level. Once this area had been established, a 5x5x7 cube of 343 points (5 mm spacing in each axis $\approx 27\text{g}$) will be centred at the area of concern. Extrapolation and interpolation will then be carried out on the 27g of tissue and the highest averaged SAR over a 10g cube determined.

Once the maximum interpolated SAR measurement is complete; the coarse scan is visually assessed to check for secondary peaks within 50% of the maximum SAR level. If there are any further SAR measurements required, extra 5x5x7 cubes shall be centred on each of these extra local SAR maxima.

At the end of each position test case a second time sweep shall be performed to check whether the EUT has remained stable throughout the test.

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

Appendix 3. SAR Distribution Scans

This appendix contains SAR distribution scans which are not included in the total number of pages for this report.

Scan Reference Number	Title
SCN/76183JD01/001	Front of EUT Facing Phantom Wi-Fi 802.11b CH6
SCN/76183JD01/002	Rear of EUT Facing Phantom Wi-Fi 802.11b CH6
SCN/76183JD01/003	Front of EUT Facing Phantom Wi-Fi 802.11g CH6
SCN/76183JD01/004	Rear of EUT Facing Phantom Wi-Fi 802.11g CH6
SCN/76183JD01/005	System Performance Check 2450MHz Body 24 03 10

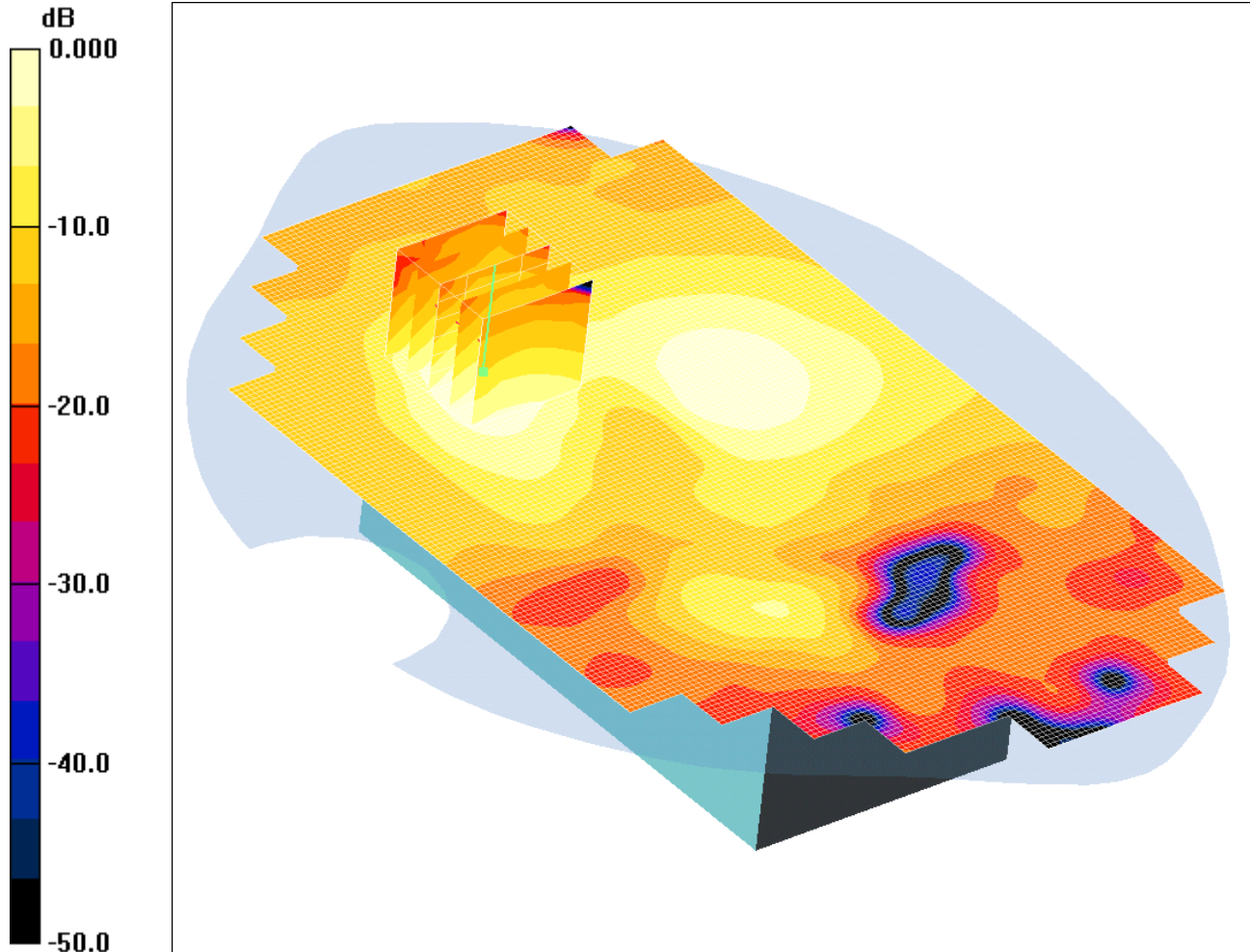
Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

SCN/76183JD01/001: Front of EUT Facing Phantom Wi-Fi 802.11b CH6

Date 24/03/2010

DUT: DATALOGIC JOYA ; Type: JOYA; Serial: D10P00004



0 dB = 0.045mW/g

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.06, 8.06, 8.06); Calibrated: 26/06/2009

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn450; Calibrated: 30/04/2009

- Phantom: SAM 12a; Type: SAM 4.0; Serial: TP:1193

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Front of EUT Facing Phantom - Middle/Area Scan (101x171x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.047 mW/g

Front of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.28 V/m; Power Drift = 0.264 dB

Peak SAR (extrapolated) = 0.073 W/kg

SAR(1 g) = 0.041 mW/g; SAR(10 g) = 0.022 mW/g

Maximum value of SAR (measured) = 0.045 mW/g

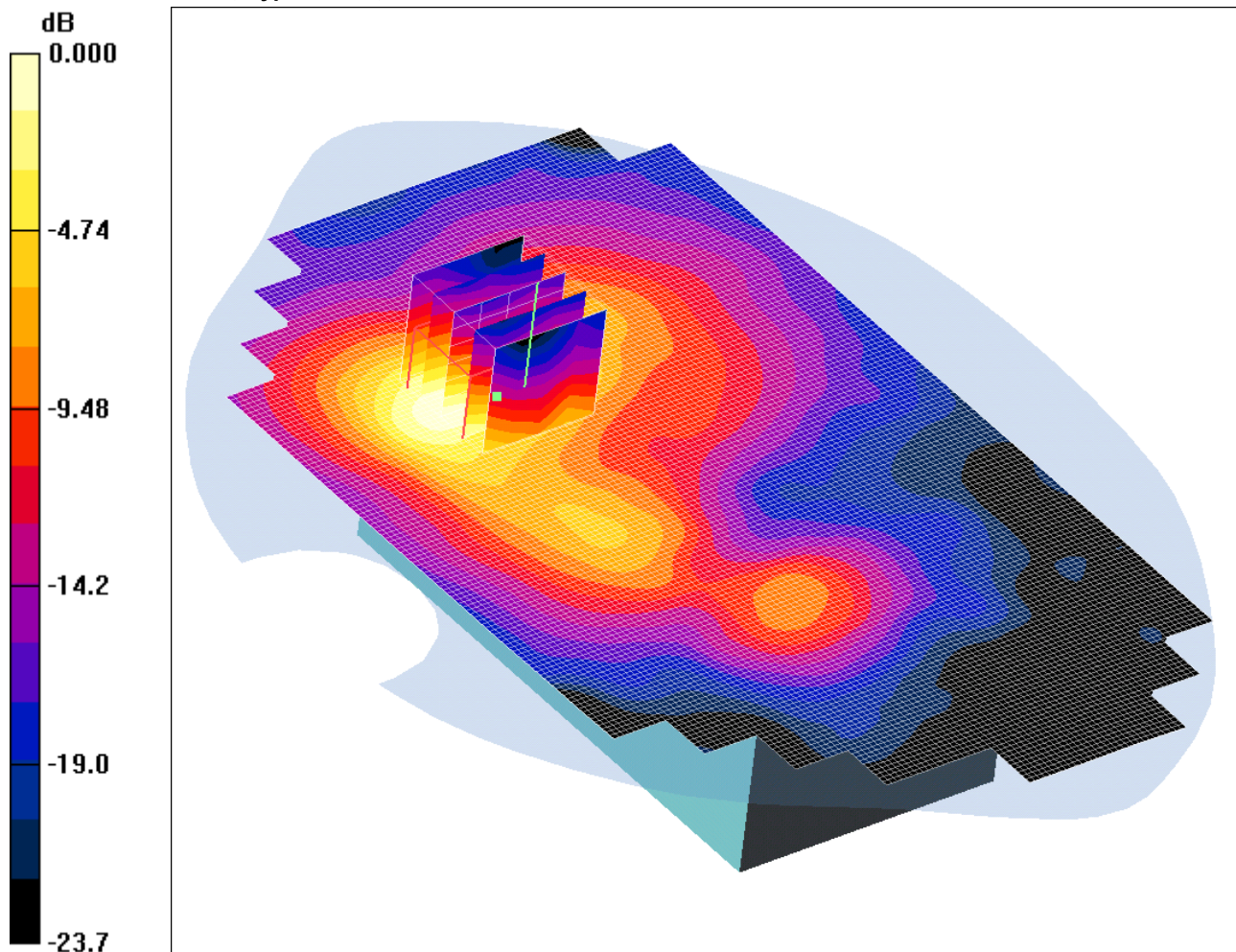
Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

SCN/76183JD01/002: Rear of EUT Facing Phantom Wi-Fi 802.11b CH6

Date 24/03/2010

DUT: DATALOGIC JOYA ; Type: JOYA; Serial: D10P00004



0 dB = 0.139mW/g

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.06, 8.06, 8.06); Calibrated: 26/06/2009

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn450; Calibrated: 30/04/2009

- Phantom: SAM 12a; Type: SAM 4.0; Serial: TP:1193

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Rear of EUT Facing Phantom - Middle/Area Scan (101x171x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.144 mW/g

Rear of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 2.28 V/m; Power Drift = -0.050 dB

Peak SAR (extrapolated) = 0.245 W/kg

SAR(1 g) = 0.120 mW/g; SAR(10 g) = 0.059 mW/g

Maximum value of SAR (measured) = 0.139 mW/g

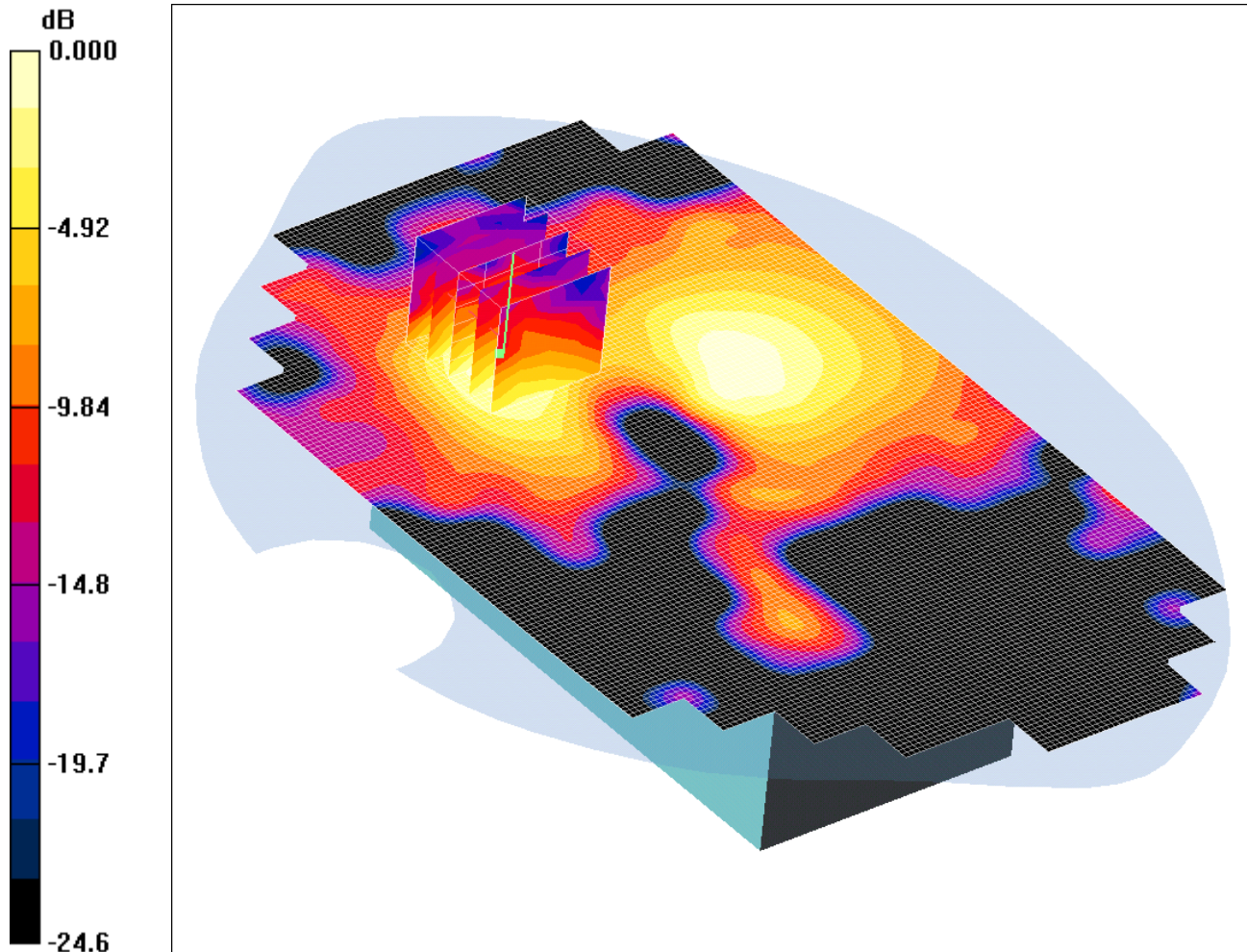
Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

SCN/76183JD01/003: Front of EUT Facing Phantom Wi-Fi 802.11g CH6

Date 24/03/2010

DUT: DATALOGIC JOYA ; Type: JOYA; Serial: D10P00004



0 dB = 0.020mW/g

Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.06, 8.06, 8.06); Calibrated: 26/06/2009

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn450; Calibrated: 30/04/2009

- Phantom: SAM 12a; Type: SAM 4.0; Serial: TP:1193

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Front of EUT Facing Phantom - Middle/Area Scan (101x171x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.020 mW/g

Front of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 0.636 V/m; Power Drift = 0.073 dB

Peak SAR (extrapolated) = 0.032 W/kg

SAR(1 g) = 0.018 mW/g; SAR(10 g) = 0.00929 mW/g

Maximum value of SAR (measured) = 0.020 mW/g

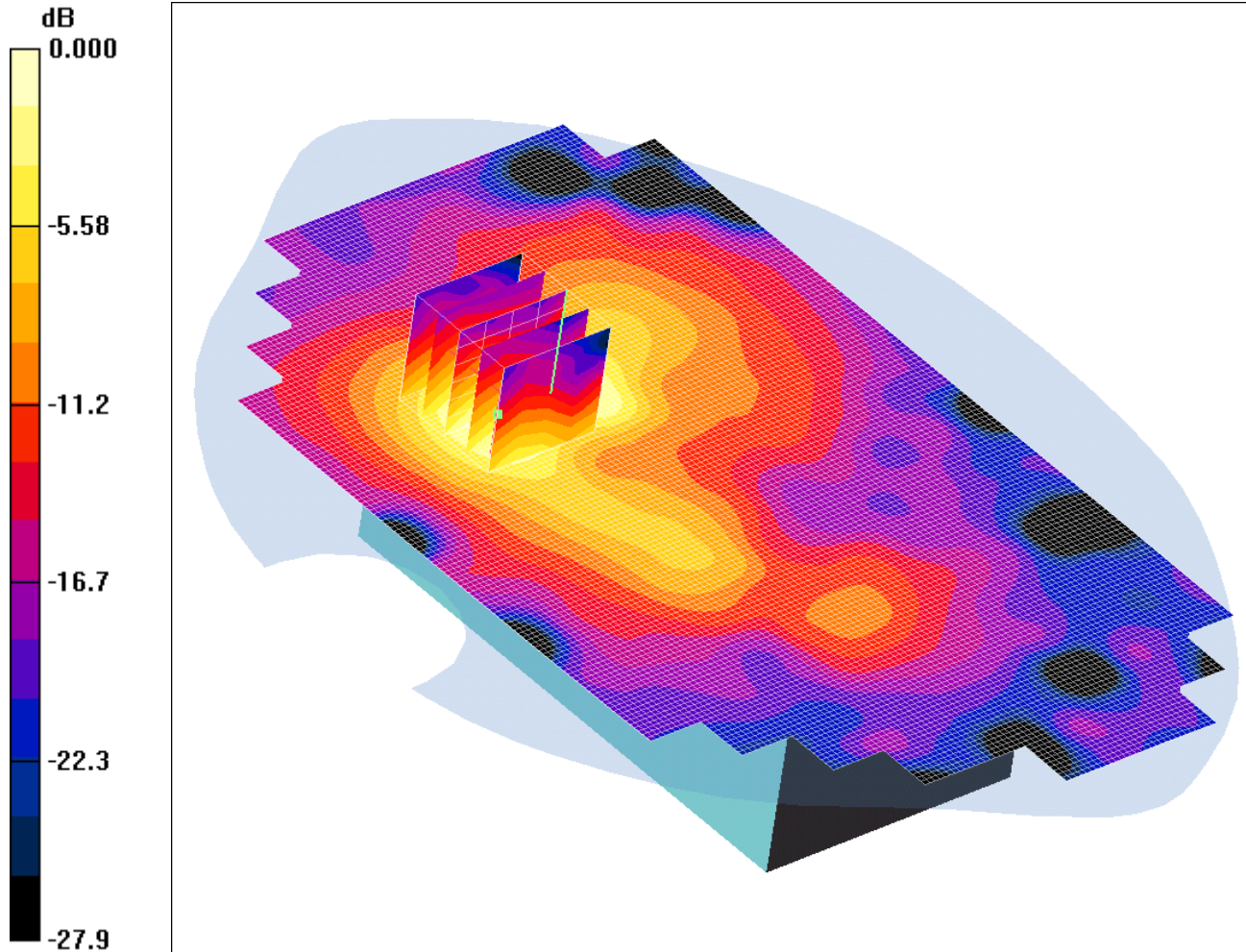
Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

SCN/76183JD01/004: Rear of EUT Facing Phantom Wi-Fi 802.11g CH6

Date 24/03/2010

DUT: DATALOGIC JOYA ; Type: JOYA; Serial: D10P00004



Communication System: WLAN; Frequency: 2437 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.96$ mho/m; $\epsilon_r = 50.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.06, 8.06, 8.06); Calibrated: 26/06/2009

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn450; Calibrated: 30/04/2009

- Phantom: SAM 12a; Type: SAM 4.0; Serial: TP:1193

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Rear of EUT Facing Phantom - Middle/Area Scan (101x171x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.059 mW/g

Rear of EUT Facing Phantom - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 1.59 V/m; Power Drift = -0.187 dB

Peak SAR (extrapolated) = 0.118 W/kg

SAR(1 g) = 0.053 mW/g; SAR(10 g) = 0.027 mW/g

Maximum value of SAR (measured) = 0.067 mW/g

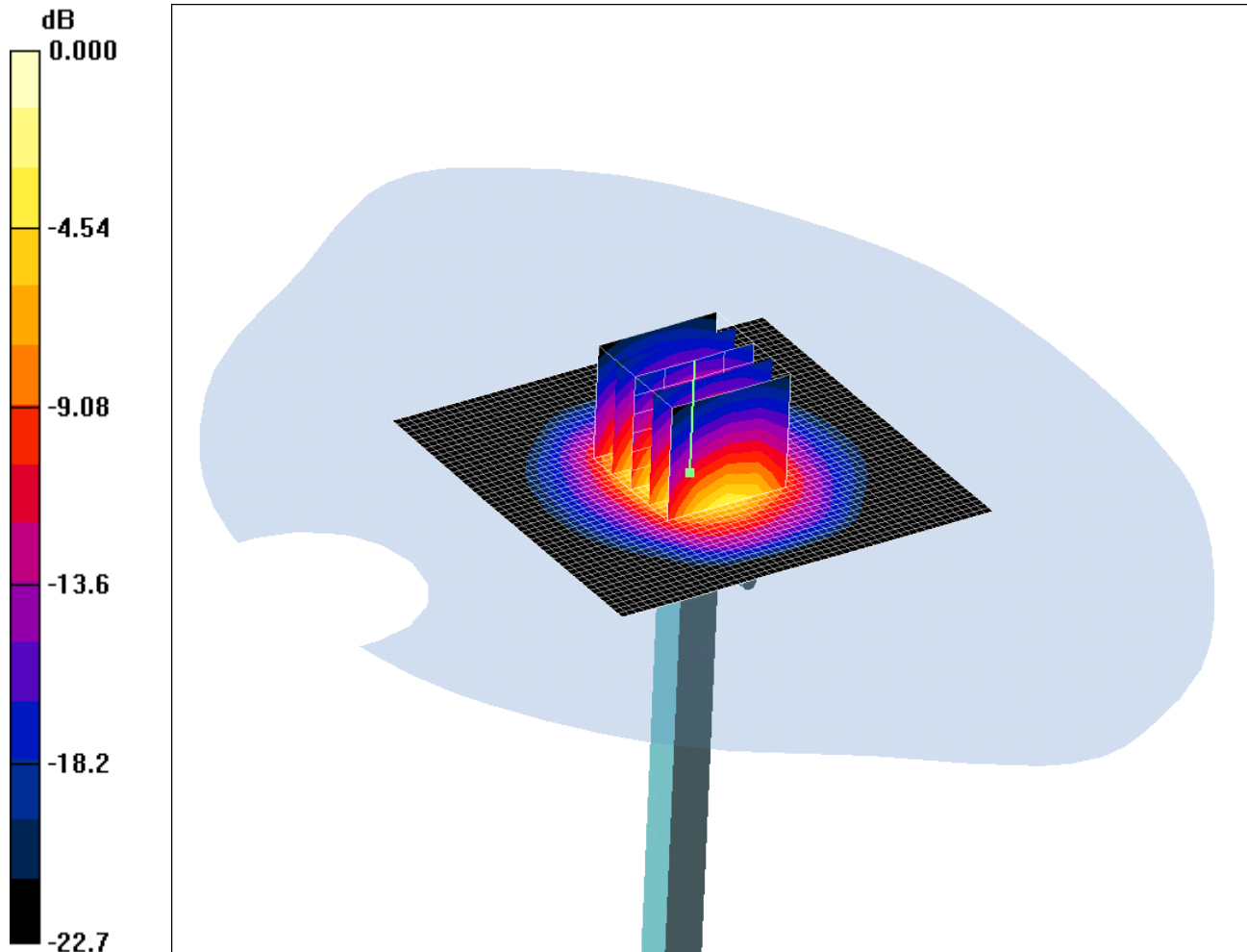
Test of: JOYA

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SCN/76183JD01/005: System Performance Check 2450MHz Body 24 03 10

Date 24/03/2010

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:725



0 dB = 15.1mW/g

Communication System: CW; Frequency: 2450 MHz; Duty Cycle: 1:1

Medium: 2450 MHz MSL Medium parameters used: $f = 2450$ MHz; $\sigma = 1.97$ mho/m; $\epsilon_r = 50.5$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.06, 8.06, 8.06); Calibrated: 26/06/2009

- Sensor-Surface: 4mm (Mechanical Surface Detection)

- Electronics: DAE3 Sn450; Calibrated: 30/04/2009

- Phantom: SAM 12a; Type: SAM 4.0; Serial: TP:1193

- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

d=10mm, Pin=250mW/Area Scan (51x51x1): Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 18.0 mW/g

d=10mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 85.8 V/m; Power Drift = 0.204 dB

Peak SAR (extrapolated) = 27.8 W/kg

SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.06 mW/g

Maximum value of SAR (measured) = 15.1 mW/g

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

Appendix 4. Photographs

This appendix contains the following photographs:

Photo Reference Number	Title
PHT/76183JD01/001	Test configuration for the measurement of Specific Absorption Rate (SAR)
PHT/76183JD01/002	Front of EUT Facing phantom
PHT/76183JD01/003	Rear of EUT Facing Phantom
PHT/76183JD01/004	Front of EUT
PHT/76183JD01/005	Rear of EUT
PHT/76183JD01/006	Internal View of EUT
PHT/76183JD01/007	Battery View
PHT/76183JD01/008	2450 MHz Body Fluid Level

Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

PHT/76183JD01/001: Test configuration for the measurement of Specific Absorption Rate (SAR)



Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

PHT/76183JD01/002: Front of EUT Facing phantom



Test of: JOYA

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PHT/76183JD01/003: Rear of EUT Facing Phantom



Test of: JOYA

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PHT/76183JD01/004: Front of EUT



Test of: JOYA

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PHT/76183JD01/005: Rear of EUT



Test of: JOYA

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PHT/76183JD01/006: Internal View of EUT



Test of: JOYA

To: OET Bulletin 65 Supplement C: (2001-01)

PHT/76183JD01/007: Battery View



Test of: JOYA

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PHT/76183JD01/008: 2450 MHz Body Fluid Level



Test of: JOYA

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Appendix 5. Validation of System

Prior to the assessment, the system was verified in the flat region of the phantom. A 2450 dipole was used. A forward power of 250 mW was applied to the dipole and the system was verified to a tolerance of $\pm 5\%$ for the 2450 dipole. The applicable verification (normalised to 1 Watt).

Date:24/03/2010

Validation Dipole and Serial Number:D2450V2:SN:725

Simulant	Frequency (MHz)	Room Temperature	Liquid Temperature	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	2450	24.0 °C	23.7 °C	ϵ_r	52.70	50.53	-4.12	5.00
				σ	1.95	1.97	1.03	5.00
				1g SAR	52.20	53.20	1.92	5.00
				10g SAR	24.70	24.24	-1.86	5.00

Test of: JOYA

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Appendix 6. Simulated Tissues

The body mixture consists of water and glycol. Visual inspection is made to ensure air bubbles are not trapped during the mixing process. The mixture is calibrated to obtain proper dielectric constant (permittivity) and conductivity of the tissue.

Ingredient	Frequency
	2450 MHz Body
De-Ionised Water	68.64
Diglycol Butyl Ether (DGBE)	31.37

Test of: JOYA

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Appendix 7. DASY4 System Details

A.7.1. DASY4 SAR Measurement System

RFI Global Services Ltd, SAR measurement facility utilises the Dosimetric Assessment System (DASY™) manufactured by Schmid & Partner Engineering AG (SPEAG™) of Zurich, Switzerland. The DASY4 system is comprised of the robot controller, computer, near-field probe, probe alignment sensor, and the SAM phantom containing brain or muscle equivalent material. The robot is a six-axis industrial robot performing precise movements to position the probe to the location (points) of maximum electromagnetic field (EMF). A cell controller system contains the power supply, robot controller; teach pendant (Joystick), and remote control. This is used to drive the robot motors. The Staubli robot is connected to the cell controller to allow software manipulation of the robot. The data acquisition electronics (DAE) performs signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection etc. The DAE is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card. The DAE3 utilises a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16-bit AD-converter and a command decoder and control logic unit. Transmission to the PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe-mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.

Test of: JOYA

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A.7.2. DASY4 SAR System Specifications**Robot System**

Positioner:	Stäubli Unimation Corp. Robot Model: RX90L
Repeatability:	0.025 mm
No. of Axis:	6
Serial Number:	F00/SD89A1/A/01
Reach:	1185 mm
Payload:	3.5 kg
Control Unit:	CS7
Programming Language:	V+

Data Acquisition Electronic (DAE) System

Serial Number:	DAE3 SN:450
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PC Controller

PC:	Dell Precision 340
Operating System:	Windows 2000
Data Card:	DASY4 Measurement Server
Serial Number:	1080

Data Converter

Features:	Signal Amplifier, multiplexer, A/D converted and control logic.
Software:	DASY4 Software
Connecting Lines:	Optical downlink for data and status info. Optical uplink for commands and clock.

PC Interface Card

Function:	24 bit (64 MHz) DSP for real time processing Link to DAE3 16 nit A/D converter for surface detection system serial link to robot direct emergency stop output for robot.
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DASY4 SAR System Specifications (Continued)**E-Field Probe**

Model:	EX3DV3
Serial No:	3508
Construction:	Triangular core
Frequency:	10 MHz to >6 GHz
Linearity:	±0.2 dB (30 MHz to 6 GHz)
Probe Length (mm):	330
Probe Diameter (mm):	12
Tip Length (mm):	20
Tip Diameter (mm):	2.5
Sensor X Offset (mm):	1
Sensor Y Offset (mm):	1
Sensor Z Offset (mm):	1

Phantom

Phantom:	SAM Phantom
Shell Material:	Fibreglass
Thickness:	2.0 ±0.1 mm
