



## TEST REPORT FROM RFI GLOBAL SERVICES LTD

Test of: NTT docomo P-04A (EB-4024)

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

**Test Report Serial No:**  
RFI/SAR2/RP74358JD01A

**Supersedes Test Report Serial No:**  
RFI/SAR1/RP74358JD01A

<b>This Test Report Is Issued Under The Authority Of Stuart Thomas, General Manager Cellular Services:</b>		pp 
<b>Checked By: Scott D'Adamo</b> 	<b>Report Copy No: PDF01</b>	
<b>Issue Date: 12 January 2009</b>	<b>Test Dates: 11 December 2008</b>	

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This report may be copied in full. The results in this report apply only to the sample(s) tested.

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Registered in England and Wales. Company number: 2117901

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## **1. Customer Information**

<b>Company Name:</b>	Panasonic Mobile Communications Development of Europe Ltd
<b>Address:</b>	Panasonic House Willoughby Road Bracknell Berkshire RG12 8FP United Kingdom

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## **2. Equipment Under Test (EUT)**

The following information (with the exception of the date of receipt) has been supplied by the customer:

### **2.1. Description of EUT**

The equipment under test is a dual mode Cellular Mobile Telephone operating at PCS/GPRS1900MHz.

### **2.2. Identification of Equipment Under Test (EUT)**

Description:	Mobile Handset
Brand Name:	NTT docomo P-04A
Model Name or Number:	EB-4024
Serial Number:	Sample C22
IMEI Number:	35370502 0030067
Hardware Version Number:	REV D
Software Version Number:	A:03.01.006; C:0.31.35.1E
Hardware Revision of GSM Module:	Not Applicable
Software Revision of GSM Module:	Not Applicable
FCC ID Number:	UCE208013A
Country of Manufacture:	Japan
Date of Receipt:	11 December 2008

### **2.3. Modifications Incorporated in the EUT**

There were no modifications incorporated in the EUT during the duration of the test period.

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#### **2.4. Accessories**

The following accessories were supplied with the EUT during testing:

<b>Description:</b>	Micro-SD Memory Card
<b>Brand Name:</b>	Panasonic
<b>Connected to Port</b>	Dedicated micro-SD card port

<b>Description:</b>	Battery
<b>Brand Name:</b>	NTT docomo
<b>Model Name or Number:</b>	P17
<b>Serial Number:</b>	None Stated
<b>Cable Length and Type:</b>	Not Applicable
<b>Country of Manufacture:</b>	None Stated
<b>Connected to Port</b>	3 Pin Contact Point

<b>Description:</b>	Personal Hands-Free Set P01
<b>Brand Name:</b>	NTT docomo
<b>Model Name or Number:</b>	Earphone Set 01
<b>Serial Number:</b>	(Sample P6)
<b>Cable Length and Type:</b>	1.8m / multi-core
<b>Country of Manufacture:</b>	None Stated
<b>Connected to Port</b>	AV Out Port Unique to Manufacturer

#### **2.5. Support Equipment**

The following support equipment was used to exercise the EUT during testing:

<b>Description:</b>	Radio Communication Test Set
<b>Brand Name:</b>	R&S
<b>Model Name or Number:</b>	CMU200
<b>Serial Number:</b>	835687/011
<b>Cable Length and Type:</b>	2.0m Utiflex Cable
<b>Connected to Port:</b>	RF Input/Output (Air Link)

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**2.6. Additional Information Related to Testing**

Equipment Category	PCS1900 / GPRS1900		
Type of Unit	Portable Transceiver		
Intended Operating Environment:	Within GSM coverage		
Transmitter Maximum Output Power Characteristics:	PCS1900	30dBm	
Transmitter Frequency Range:	PCS1900	(1922 to 1975) MHz	
Transmitter Frequency Allocation of EUT When Under Test:	Channel Number	Channel Description	Frequency (MHz)
	512	Low	1850.2
	660	Middle	1879.8
	810	High	1909.8
Modulation(s):	GMSK: 217Hz		
Modulation Scheme (Crest Factor):	GSM:8.3, GPRS:4		
Antenna Type:	Internal		
Antenna Length:	Unknown		
Number of Antenna Positions:	1 Fixed		
Power Supply Requirement:	3.7v DC		
Battery Type(s):	Li-ion		

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### **3. Test Specification, Methods and Procedures**

#### **3.1. Test Specification**

<b>Reference:</b>	OET Bulletin 65 Supplement C: (2001-01)
<b>Title:</b>	Evaluating Compliance with FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields.
<b>Purpose of Test:</b>	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 v03.

KDB 648474 D01 SAR Handsets Multi Xmitter and Ant v01r05.

#### **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**

This device does not support simultaneous transmission.

Test was performed as per "KDB 447498 D01 Mobile Portable RF Exposure v03" and "SAR Handsets Multi Xmitter and Ant v01r02", according to the handset procedures in IEEE Std 1528-2003, OET Bulletin 65 Supplement C 01-01 and the specific FCC test procedures.

SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in KDB 648474 and OET Bulletin 65 Supplement C: (2001-01).

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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:

- PCS1900 call allocated.
- GPRS1900 data allocated.
- SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in KDB 648474 and OET Bulletin 65 Supplement C: (2001-01).

The reason for choosing this configuration was that it has been defined by the customer as being typical of normal use and likely to be worst case.

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## **5.2. Configuration and Peripherals**

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

- Standalone battery powered.
- EUT tested in Head and Body-worn configuration. The applied configurations for body-worn orientations where the corresponding edge(s) is closest to the user with the most conservative exposure condition.

### **Head Configuration**

- a) The handset was placed in a normal operating position with the centre of the ear-piece aligned with the ear canal on the phantom.
- b) With the ear-piece touching the phantom the centre line of the handset was aligned with an imaginary plane (X and Y axis) consisting of three lines connecting both ears and the mouth.
- c) For the cheek position the handset was gradually moved towards the cheek until any point of the mouth-piece or keypad touched the cheek.
- d) For the tilted position the EUT was positioned as for the cheek position, and then the horizontal angle was increased by fifteen degrees (the phone keypad was moved away from the cheek by fifteen degrees).
- e) 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.
- f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
- g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the handset and its antenna.
- h) The EUT was transmitting at full power throughout the duration of the test powered by a fully charged battery.

### **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 handset was gradually moved towards the flat section of the 'SAM' phantom until any point of the EUT touched the phantom.
  - d) For position(s) greater than 0mm separation the EUT was positioned as per the touch-safe position, and then the vertical height was decreased/adjusted as required.
  - e) 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.
  - f) The device was keyed to operate continuously in the transmit mode for the duration of the test.
  - g) The location of the maximum spatial SAR distribution (hot spot) was determined relative to the handset and its antenna.
  - h) 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-PCS1900 Head Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate-PCS1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied
Specific Absorption Rate- GPRS1900 Body Configuration 1g	OET Bulletin 65 Supplement C: (2001-01)	Complied

### **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 - PCS1900 Head Configuration 1g**

#### **Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.593

#### **Environmental Conditions:**

Temperature Variation in Lab (°C):	25.0 to 25.0
Temperature Variation in Liquid (°C):	25.0 to 24.1

#### **Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Touch	Left	660	0.593	1.600	1.007	1	Complied
Tilt	Left	660	0.349	1.600	1.251	1	Complied
Touch	Right	660	0.499	1.600	1.101	1	Complied
Tilt	Right	660	0.310	1.600	1.290	1	Complied

#### **Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in OET Bulletin 65 Supplement C: (2001-01).
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**7.2.2. Specific Absorption Rate - PCS1900 Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.268

**Environmental Conditions:**

Temperature Variation in Lab (°C):	25.0 to 24.0
Temperature Variation in Liquid (°C):	24.0 to 24.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Open Facing Phantom	Flat (SAM)	660	0.268	1.600	1.332	1, 2	Complied

**Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in OET Bulletin 65 Supplement C: (2001-01).
2. SAR measurements were performed with the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.

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**7.2.3. Specific Absorption Rate - GPRS1900 Body Configuration 1g****Test Summary:**

Tissue Volume:	1g
Maximum Level (W/kg):	0.428

**Environmental Conditions:**

Temperature Variation in Lab (°C):	25.0 to 24.0
Temperature Variation in Liquid (°C):	24.0 to 24.0

**Results:**

EUT Position	Phantom Configuration	Channel Number	Level (W/kg)	Limit (W/kg)	Margin (W/kg)	Note(s)	Result
Front of EUT Open Facing Phantom	Flat (SAM)	660	0.376	1.600	1.224	1, 2	Complied
Rear of EUT Open Facing Phantom	Flat (SAM)	660	0.428	1.600	1.172	1, 2	Complied
Rear of EUT Open Facing Phantom With PHF	Flat (SAM)	660	0.411	1.600	1.189	1, 2	Complied

**Note(s):**

1. SAR test was performed in the middle channel only as the measured levels were < 50% of the SAR limit as stated in OET Bulletin 65 Supplement C: (2001-01).
2. SAR measurements were performed with the EUT at a separation distance of 15mm from the 'SAM' phantom flat section.



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**7.2.4. EIRP/ERP Measurement**

Channel Number	Frequency (MHz)	GSM – TX Power before Test (dBm)	GPRS – TX Power before Test (dBm)	Note
512	1850.2	32.8	31.8	EIRP
660	1879.8	31.7	30.3	EIRP
810	1909.8	32.8	30.8	EIRP

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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-PCS1900 Head Configuration 1g	95%	18.44%
Specific Absorption Rate- PCS1900 Body Configuration 1g	95%	18.30%

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 1900 MHz Head 1g, PCS Modulation Scheme calculated in accordance with IEC 62209-1 & IEEE 1528**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10g)	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
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	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
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	0.584	0.584	normal (k=1)	1.0000	1.0000	0.584	0.584	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)	4.370	4.370	normal (k=1)	1.0000	0.6400	2.797	2.797	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.450	4.450	normal (k=1)	1.0000	0.6000	2.670	2.670	5
	Combined standard uncertainty			t-distribution			9.41	9.41	>300
	Expanded uncertainty			k = 1.96			18.44	18.44	>300

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**Measurement Uncertainty (Continued)****8.2. Specific Absorption Rate Uncertainty at 1900 MHz Body 1g, PCS Modulation Scheme calculated in accordance with IEC 62209-1 & IEEE 1528**

Type	Source of uncertainty	+ Value	- Value	Probability Distribution	Divisor	C <sub>i</sub> (10g)	Standard Uncertainty		v <sub>i</sub> or v <sub>eff</sub>
							+ u (%)	- u (%)	
B	Probe calibration	11.000	11.000	normal (k=2)	2.0000	1.0000	5.500	5.500	∞
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	1.730	1.730	Rectangular	1.7321	1.0000	0.999	0.999	∞
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	0.584	0.584	normal (k=1)	1.0000	1.0000	0.584	0.584	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)	4.170	4.170	normal (k=1)	1.0000	0.6400	2.669	2.669	5
B	Liquid Permittivity (target value)	5.000	5.000	Rectangular	1.7321	0.6000	1.732	1.732	∞
A	Liquid Permittivity (measured value)	4.230	4.230	normal (k=1)	1.0000	0.6000	2.538	2.538	5
	Combined standard uncertainty			t-distribution			9.34	9.34	>500
	Expanded uncertainty			k = 1.96			18.30	18.30	>500

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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	-	-
A1184	Data Acquisition Electronics	Schmid & Partner Engineering AG	DAE3	394	25 June 2008	12
A1378	Probe	Schmid & Partner Engineering AG	EX3 DV3	3508	24 June 2008	12
A1238	SAM Phantom	Schmid & Partners Engineering AG	SAM b	001	Calibrated before use	-
A1566	SAM Phantom	Schmid & Partners Engineering AG	SAM a	002	Calibrated before use	-
A1237	1900 MHz Dipole Kit	Schmid & Partner Engineering AG	D1900V2	540	11 June 2007	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	-

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RFI No.	Instrument	Manufacturer	Type No.	Serial No.	Date Last Calibrated	Cal. Interval (Months)
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	-
M010	NRV Power Meter	Rohde & Schwarz	NRV	882 317/065	08 May 2008	12
M1015	Network Analyser	Agilent Technologies	8753ES	US39172406	16 September 2008	12
M1047	Robot Arm	Staubli	RX908 L	F00/SD89A1/A/01	Calibrated before use	-
M1069	Diode Power Sensor	Rohde & Schwarz	NRV-Z2	838824/010	08 May 2008	12
M1129	Power Sensor	Rohde & Schwarz	URY-Z2	890242/16	12 June 2008	12
M1357	Digital Modulation Signal Generator	Anritsu	MG3681A	6200439099	Calibrated as part of system	-
M136	Temperature/Humidity /Pressure Meter	RS Components	None	None	Internal Calibration	-
A1516	GSM Test Set	Rohde & Schwarz	CMU200	835687/011	Communication use only	12
A1287	Power head	Rohde & Schwarz	URY-Z4	880 174/12	02 Jan 2008	12
M1270	Temperature/Humidity /Pressure Meter	RS Components	None	None	June 2008 (Internal Calibration)	12
M1093	Communications Test Set	Will'tek	4202S	0513018	-	-
C1092	Cable	RS Components	293-334	1087200-3 3402	Internal Calibration	-
A1531	Antenna	AARONIA AG	7025	02458	-	-
S256	SAR Lab	RFI	Site 56	N/A	Calibrated before use	-

**NB** In accordance with UKAS requirements, all the measurement equipment is on a calibration schedule.

Test of: NTT docomo P-04A (EB-4024)

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

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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 by RFI

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **RFI**

Certificate No: **EX3-3508\_Jun08**

## 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 24, 2008**

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 ( $22 \pm 3$ )°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-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41495277	1-Apr-08 (No. 217-00788)	Apr-09
Power sensor E4412A	MY41498087	1-Apr-08 (No. 217-00788)	Apr-09
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
DAE4	SN: 660	3-Sep-07 (No. DAE4-660_Sep07)	Sep-08

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-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: June 24, 2008

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





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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

### Glossary:

TSL	tissue simulating liquid
NORM <sub>x,y,z</sub>	sensitivity in free space
ConvF	sensitivity in TSL / NORM <sub>x,y,z</sub>
DCP	diode compression point
Polarization $\phi$	$\phi$ rotation around probe axis
Polarization $\vartheta$	$\vartheta$ 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<sub>x,y,z</sub>**: Assessed for E-field polarization  $\vartheta = 0$  ( $f \leq 900$  MHz in TEM-cell;  $f > 1800$  MHz: R22 waveguide). NORM<sub>x,y,z</sub> are only intermediate values, i.e., the uncertainties of NORM<sub>x,y,z</sub> does not effect the E<sup>2</sup>-field uncertainty inside TSL (see below *ConvF*).
- NORM(f)<sub>x,y,z</sub>** = NORM<sub>x,y,z</sub> \* *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<sub>x,y,z</sub>**: 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<sub>x,y,z</sub> \* *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  $\pm 50$  MHz to  $\pm 100$  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:	April 20, 2007
Recalibrated:	June 24, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

## DASY - Parameters of Probe: EX3DV3 SN:3508

### Sensitivity in Free Space<sup>A</sup>

### Diode Compression<sup>B</sup>

NormX	<b>0.77</b> ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	<b>94</b> mV
NormY	<b>0.64</b> ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	<b>93</b> mV
NormZ	<b>0.61</b> ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	<b>92</b> 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		<b>2.0 mm</b>	<b>3.0 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	8.7	5.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.4	0.2

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

Sensor Center to Phantom Surface Distance		<b>2.0 mm</b>	<b>3.0 mm</b>
SAR <sub>be</sub> [%]	Without Correction Algorithm	7.4	4.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.6	0.2

### Sensor Offset

Probe Tip to Sensor Center                      **1.0 mm**

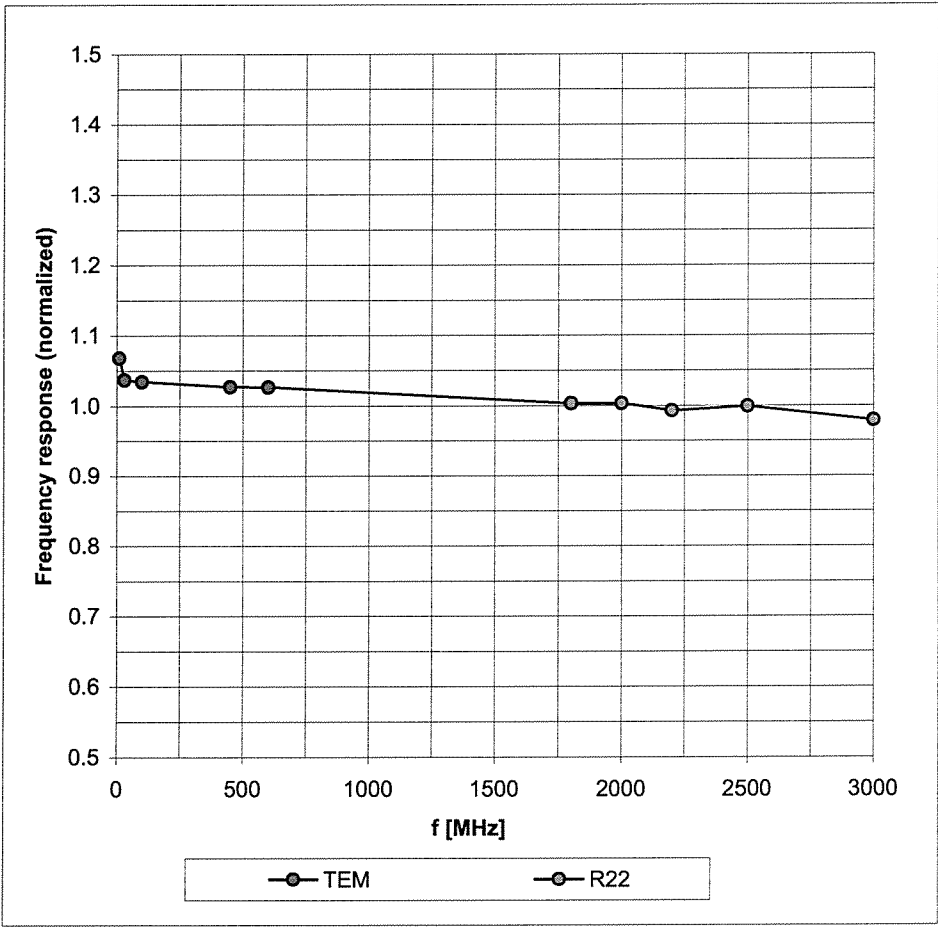
**The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.**

<sup>A</sup> The uncertainties of NormX,Y,Z do not affect the E<sup>2</sup>-field uncertainty inside TSL (see Page 8).

<sup>B</sup> Numerical linearization parameter: uncertainty not required.

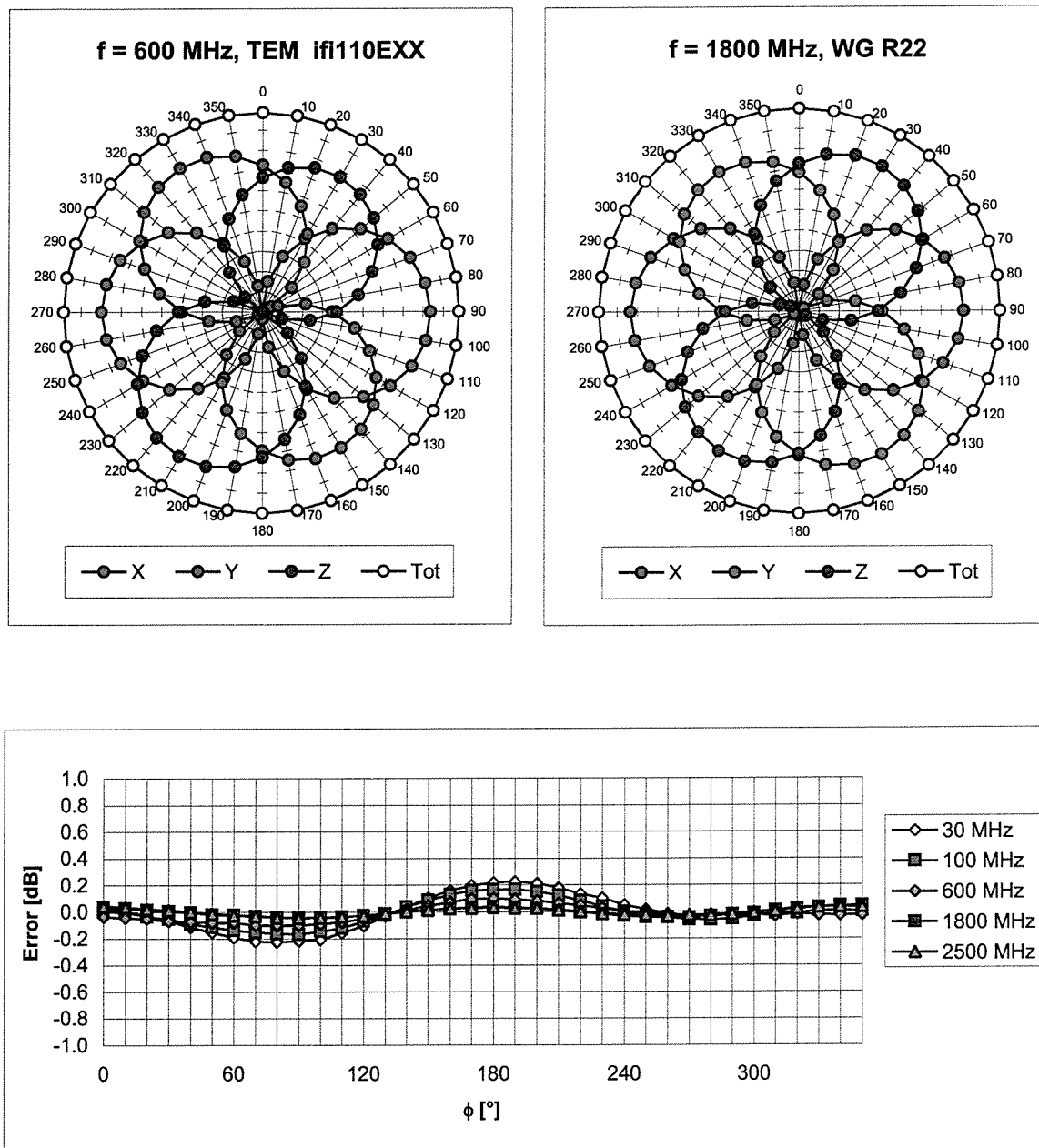
# Frequency Response of E-Field

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



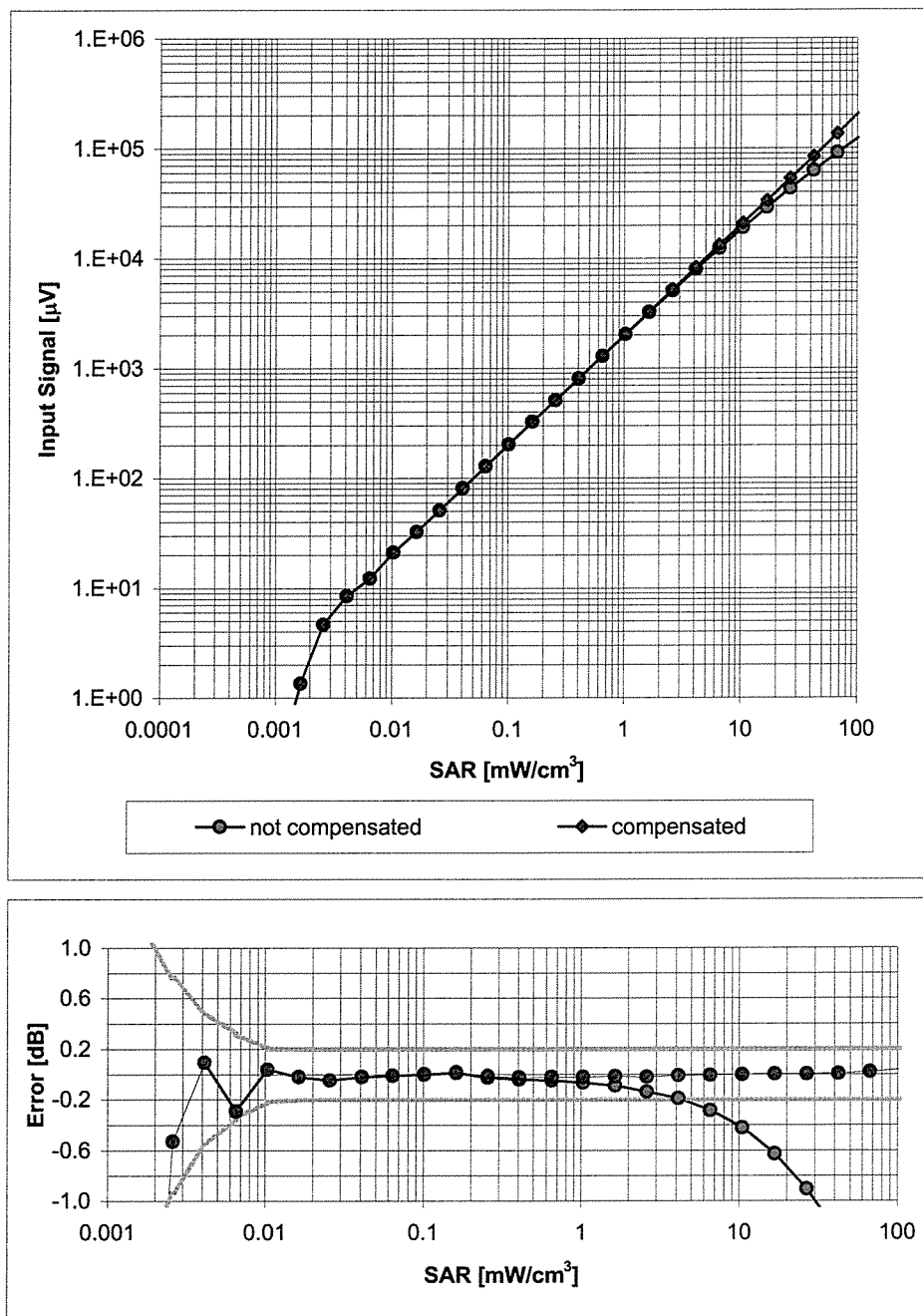
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )

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



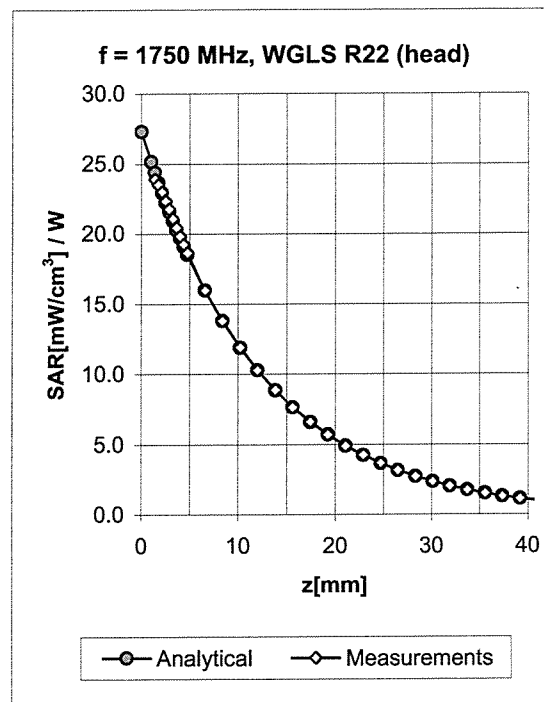
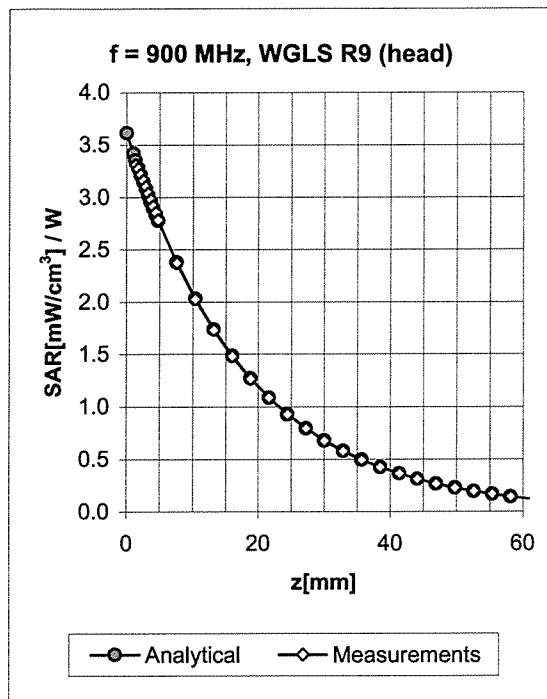
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

## Dynamic Range $f(\text{SAR}_{\text{head}})$ (Waveguide R22, $f = 1800$ MHz)



Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )

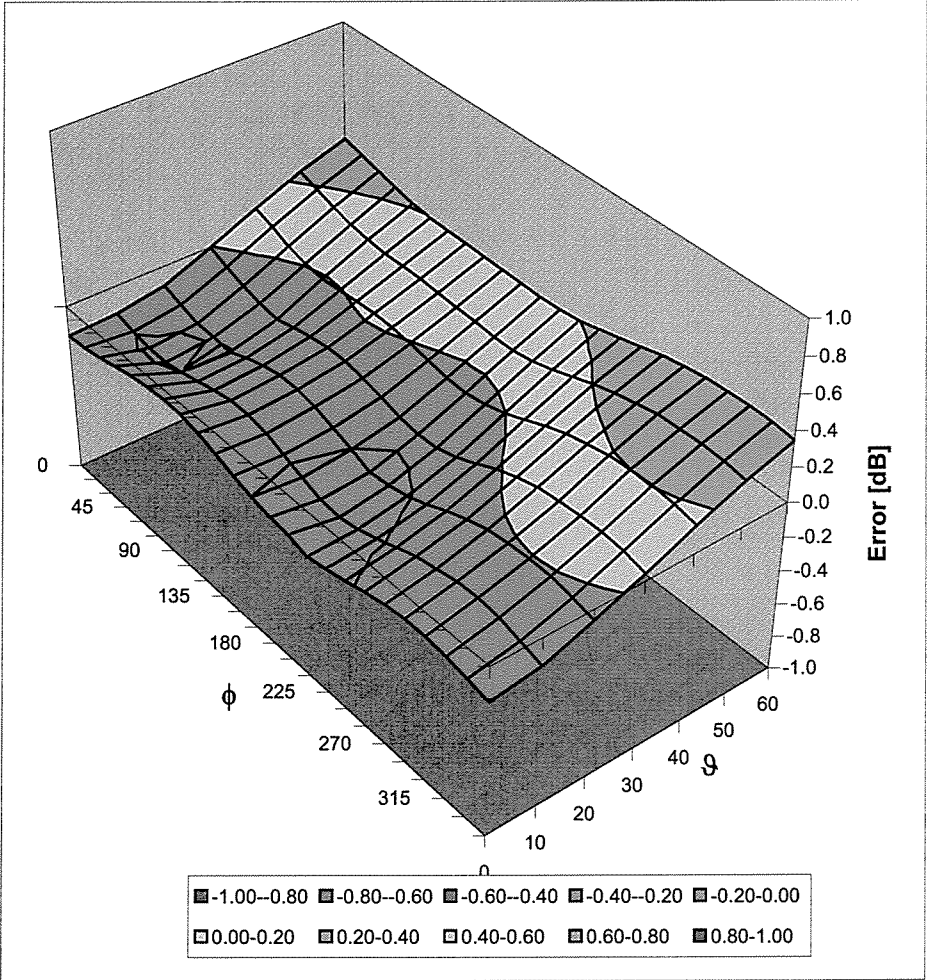
## Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
450	± 50 / ± 100	Head	43.5 ± 5%	0.87 ± 5%	0.37	0.78	10.89 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.68	0.67	10.14 ± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.76	0.58	9.08 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	0.58	8.83 ± 11.0% (k=2)
2150	± 50 / ± 101	Head	39.7 ± 5%	1.53 ± 5%	0.71	0.56	8.61 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.58	0.63	8.02 ± 11.0% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.64	0.41	11.73 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.85	0.61	10.21 ± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.58	0.70	8.80 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.62	0.68	8.29 ± 11.0% (k=2)
2150	± 50 / ± 100	Body	53.0 ± 5%	1.75 ± 5%	0.51	0.78	8.14 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.53	0.76	7.68 ± 11.0% (k=2)

<sup>c</sup> 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 ( $\phi$ ,  $\vartheta$ ),  $f = 900 \text{ MHz}$



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





A1237

20/06/07

NM

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client

**RFI**

Certificate No: **D1900V2-540\_Jun07**

## CALIBRATION CERTIFICATE

Object

**D1900V2 - SN: 540**

Calibration procedure(s)

**QA CAL-05.v7**

**Calibration procedure for dipole validation kits**

Calibration date:

**June 11, 2007**

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  $(22 \pm 3)^\circ\text{C}$  and humidity  $< 70\%$ .

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Reference 20 dB Attenuator	SN: 5086 (20g)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference 10 dB Attenuator	SN: 5047.2 (10r)	10-Aug-06 (METAS, No 217-00591)	Aug-07
Reference Probe ET3DV6	SN: 1507	19-Oct-06 (SPEAG, No. ET3-1507_Oct06)	Oct-07
Reference Probe ES3DV3	SN: 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN 601	30-Jan-07 (SPEAG, No. DAE4-601_Jan07)	Jan-08
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (SPEAG, in house check Oct-05)	In house check: Oct-07
RF generator Agilent E4421B	MY41000675	11-May-05 (SPEAG, in house check Nov-05)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07

Calibrated by:

Name

**Claudio Leubler**

Function

**Laboratory Technician**

Signature

Approved by:

**Katja Pokovic**

**Technical Manager**

Issued: June 14, 2007

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



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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 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	DASY4	V4.7
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	1900 MHz $\pm$ 1 MHz	

## Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	39.7 $\pm$ 6 %	1.46 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.5 $\pm$ 0.2) °C	---	---

## SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	condition	
SAR measured	250 mW input power	9.25 mW / g
SAR normalized	normalized to 1W	37.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>36.1 mW / g <math>\pm</math> 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	Condition	
SAR measured	250 mW input power	4.89 mW / g
SAR normalized	normalized to 1W	19.6 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>19.3 mW / g <math>\pm</math> 16.5 % (k=2)</b>

<sup>1</sup> 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	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.58 mho/m ± 6 %
Body TSL temperature during test	(21.2 ± 0.2) °C	---	---

## SAR result with Body TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.52 mW / g
SAR normalized	normalized to 1W	38.1 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>38.0 mW / g ± 17.0 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.14 mW / g
SAR normalized	normalized to 1W	20.6 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>20.7 mW / g ± 16.5 % (k=2)</b>

<sup>2</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$51.9 \Omega + 5.1 j\Omega$
Return Loss	- 25.4 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.7 \Omega + 4.8 j\Omega$
Return Loss	- 25.3 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 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	July 26, 2001

## DASY4 Validation Report for Head TSL

Date/Time: 11.06.2007 10:40:22

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: HSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.46$  mho/m;  $\epsilon_r = 39.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

### DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.97, 4.97, 4.97); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

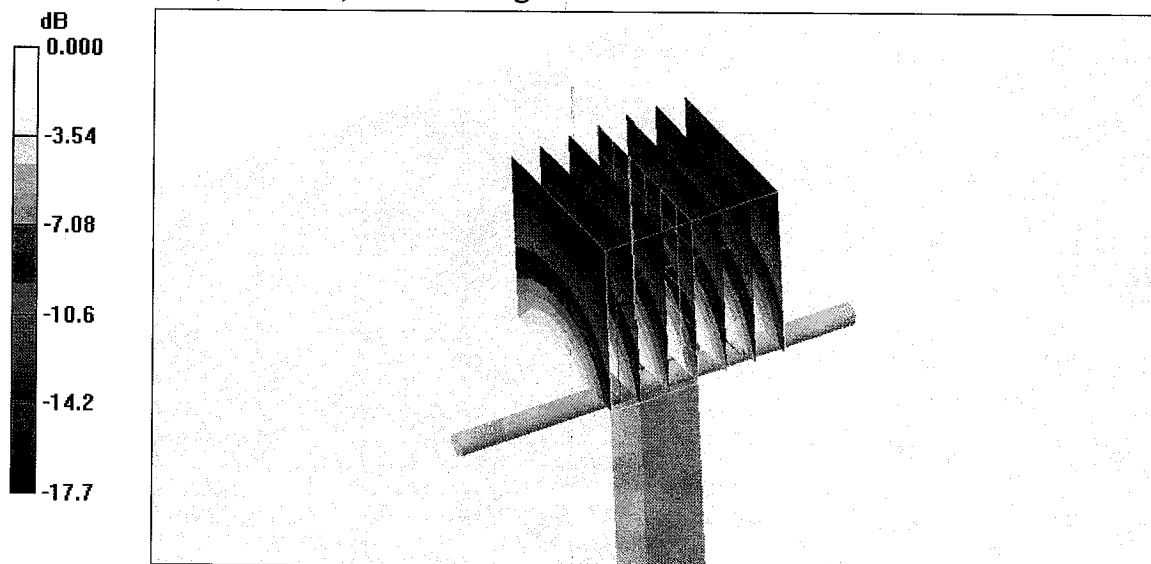
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.9 V/m; Power Drift = 0.054 dB

Peak SAR (extrapolated) = 15.7 W/kg

**SAR(1 g) = 9.25 mW/g; SAR(10 g) = 4.89 mW/g**

Maximum value of SAR (measured) = 10.2 mW/g

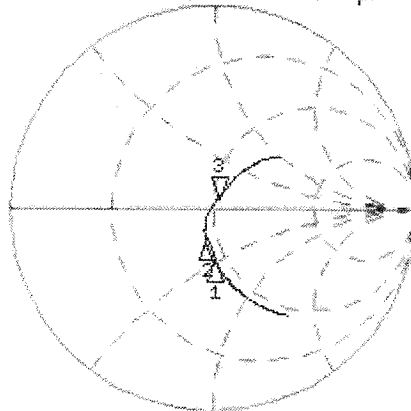


0 dB = 10.2mW/g

# Impedance Measurement Plot for Head TSL

11 Jun 2007 08:42:20  
 CH1 S11 1 U FS 3: 51.887  $\Omega$  5.1152  $\Omega$  428.48  $\mu\text{H}$  1 900.000 000 MHz

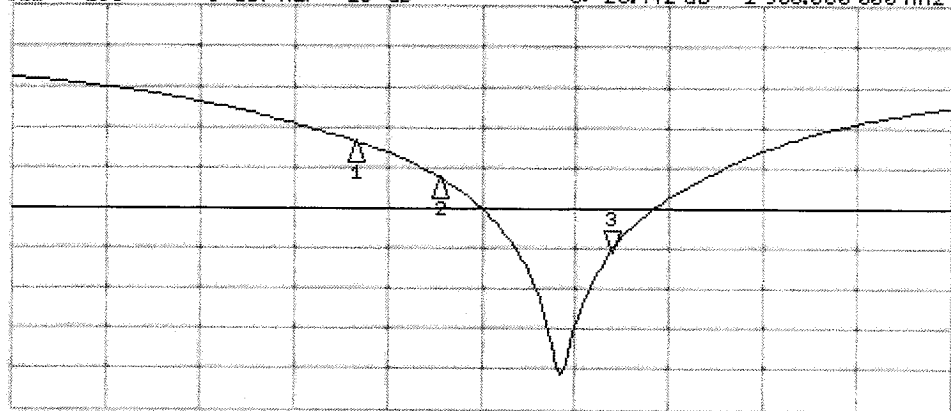
\*  
 Del  
 Cor  
 Avg  
 16  
 ↑



CH1 Markers  
 1: 44.473  $\Omega$   
 -24.576  $\Omega$   
 1.75000 GHz  
 2: 44.383  $\Omega$   
 -13.623  $\Omega$   
 1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 3: -25.442 dB 1 900.000 000 MHz

Cor  
 Avg  
 16  
 ↑



CH2 Markers  
 1: -11.765 dB  
 1.75000 GHz  
 2: -16.222 dB  
 1.80000 GHz

## DASY4 Validation Report for Body TSL

Date/Time: 11.06.2007 11:24:00

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:540**

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: MSL U10 BB;

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.59$  mho/m;  $\epsilon_r = 55.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

### DASY4 Configuration:

- Probe: ET3DV6 - SN1507 (HF); ConvF(4.43, 4.43, 4.43); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.01.2007
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:**

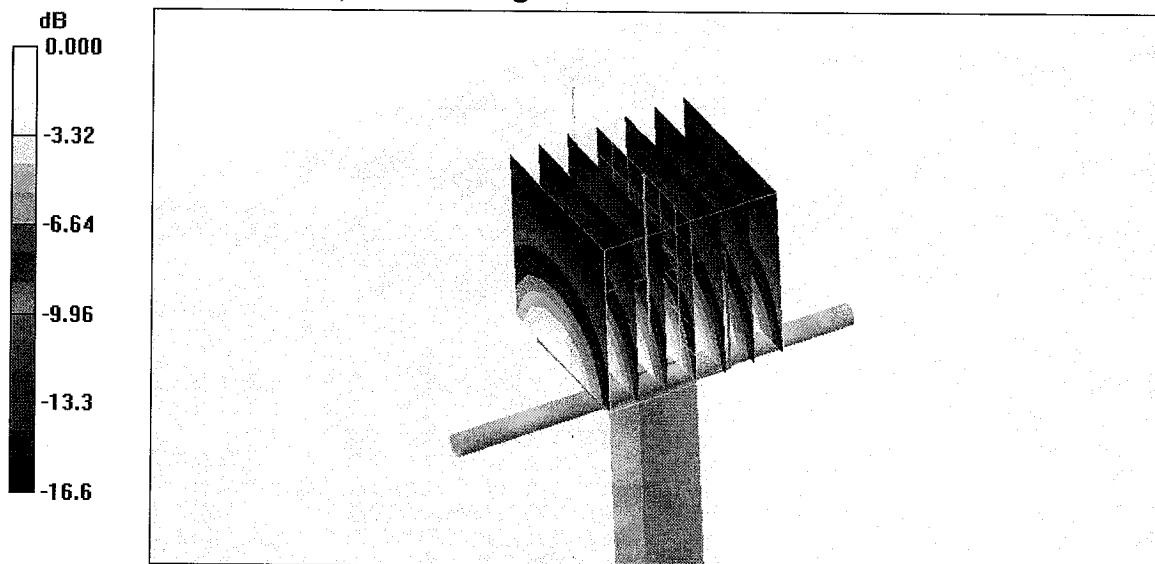
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 87.9 V/m; Power Drift = 0.027 dB

Peak SAR (extrapolated) = 15.8 W/kg

**SAR(1 g) = 9.52 mW/g; SAR(10 g) = 5.14 mW/g**

Maximum value of SAR (measured) = 10.6 mW/g



0 dB = 10.6mW/g



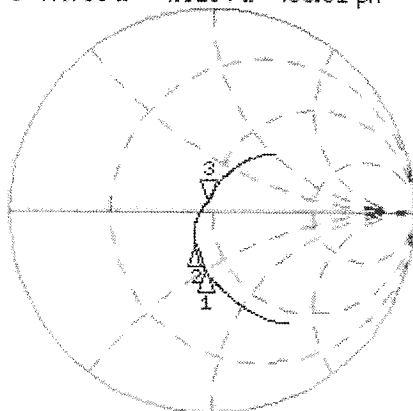
# Impedance Measurement Plot for Body TSL

11 Jun 2007 08:43:19  
 CH1 S11 1 U FS 3: 47.736  $\Omega$  4.8184  $\Omega$  403.61 pF 1 900.000 000 MHz

\*  
 Del  
 Cor

Avg  
 16

↑



CH1 Markers

1: 39.707  $\Omega$   
 -25.889  $\Omega$   
 1.75000 GHz

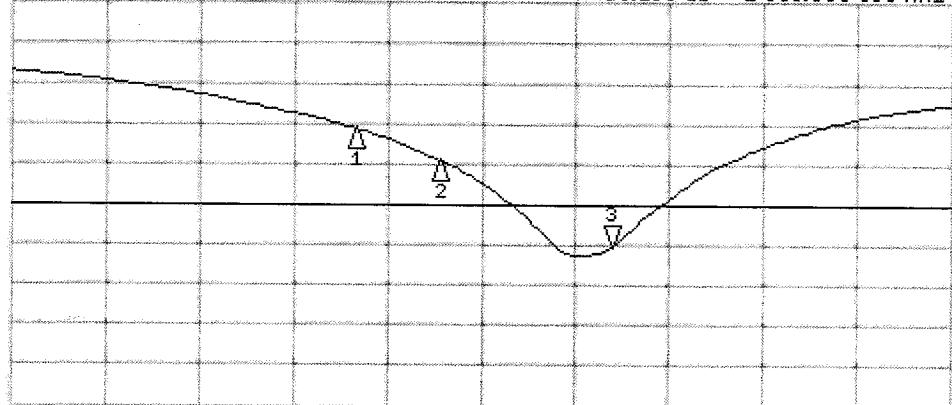
2: 40.176  $\Omega$   
 -14.076  $\Omega$   
 1.80000 GHz

CH2 S11 LOG 5 dB/REF -20 dB 3: -25.286 dB 1 900.000 000 MHz

Cor

Avg  
 16

↑



CH2 Markers

1: -10.505 dB  
 1.75000 GHz

2: -14.514 dB  
 1.80000 GHz

START 1 550.000 000 MHz

STOP 2 100.000 000 MHz

Test of: NTT docomo P-04A (EB-4024)

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

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## **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: NTT docomo P-04A (EB-4024)

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

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#### **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.

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Test of: NTT docomo P-04A (EB-4024)

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

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### **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/74358JD01/001	Touch Left PCS CH660
SCN/74358JD01/002	Tilt Left PCS CH660
SCN/74358JD01/003	Touch Right PCS CH660
SCN/74358JD01/004	Tilt Right PCS CH660
SCN/74358JD01/005	Front of EUT Facing Phantom PCS CH660
SCN/74358JD01/006	Front of EUT Facing Phantom GPRS CH660
SCN/74358JD01/007	Rear of EUT Facing Phantom GPRS CH660
SCN/74358JD01/008	Rear of EUT Facing Phantom With PHF GPRS CH660
SCN/74358JD01/009	System Performance Check 1900MHz Body 11 12 08

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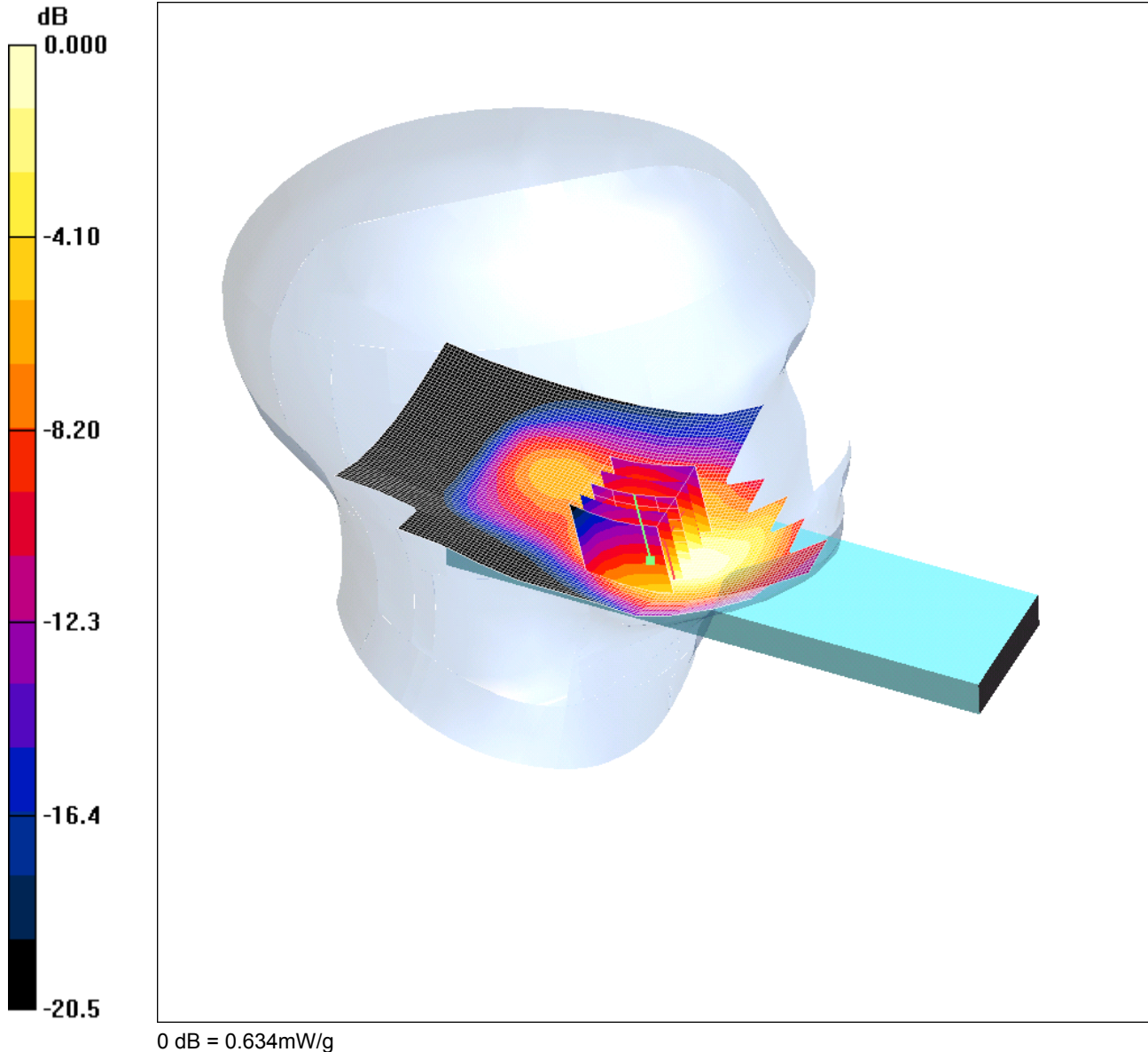
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/001: Touch Left PCS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



0 dB = 0.634mW/g

Communication System: PCS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz HSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.36$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.83, 8.83, 8.83); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

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

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

**Touch Left - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.732 mW/g

**Touch Left - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 5.15 V/m; Power Drift = 0.101 dB

Peak SAR (extrapolated) = 0.935 W/kg, **SAR(1 g) = 0.593 mW/g; SAR(10 g) = 0.357 mW/g**

Maximum value of SAR (measured) = 0.634 mW/g

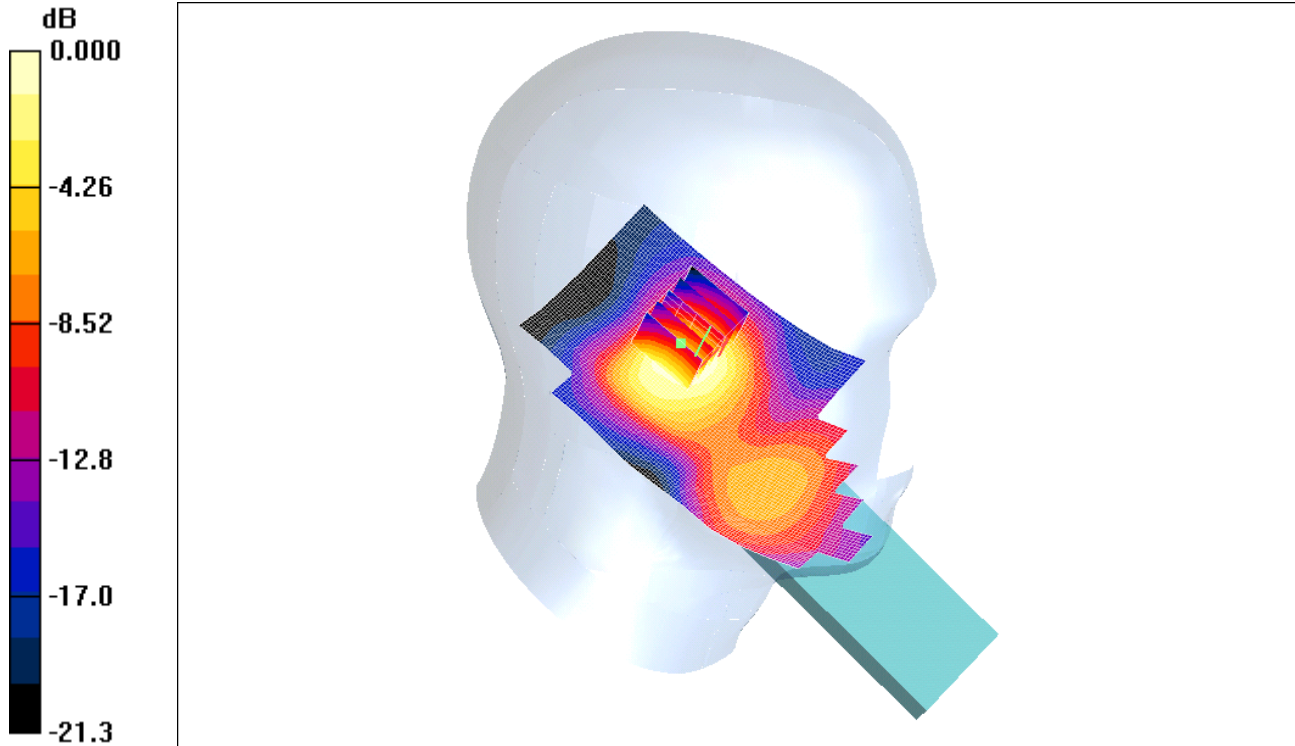
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/002: Tilt Left PCS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



0 dB = 0.370mW/g

Communication System: PCS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz HSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.36$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Left Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.83, 8.83, 8.83); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

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

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

**Tilt Left - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.415 mW/g

**Tilt Left - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.42 V/m; Power Drift = 0.109 dB

Peak SAR (extrapolated) = 0.539 W/kg

**SAR(1 g) = 0.349 mW/g; SAR(10 g) = 0.212 mW/g**

Maximum value of SAR (measured) = 0.370 mW/g

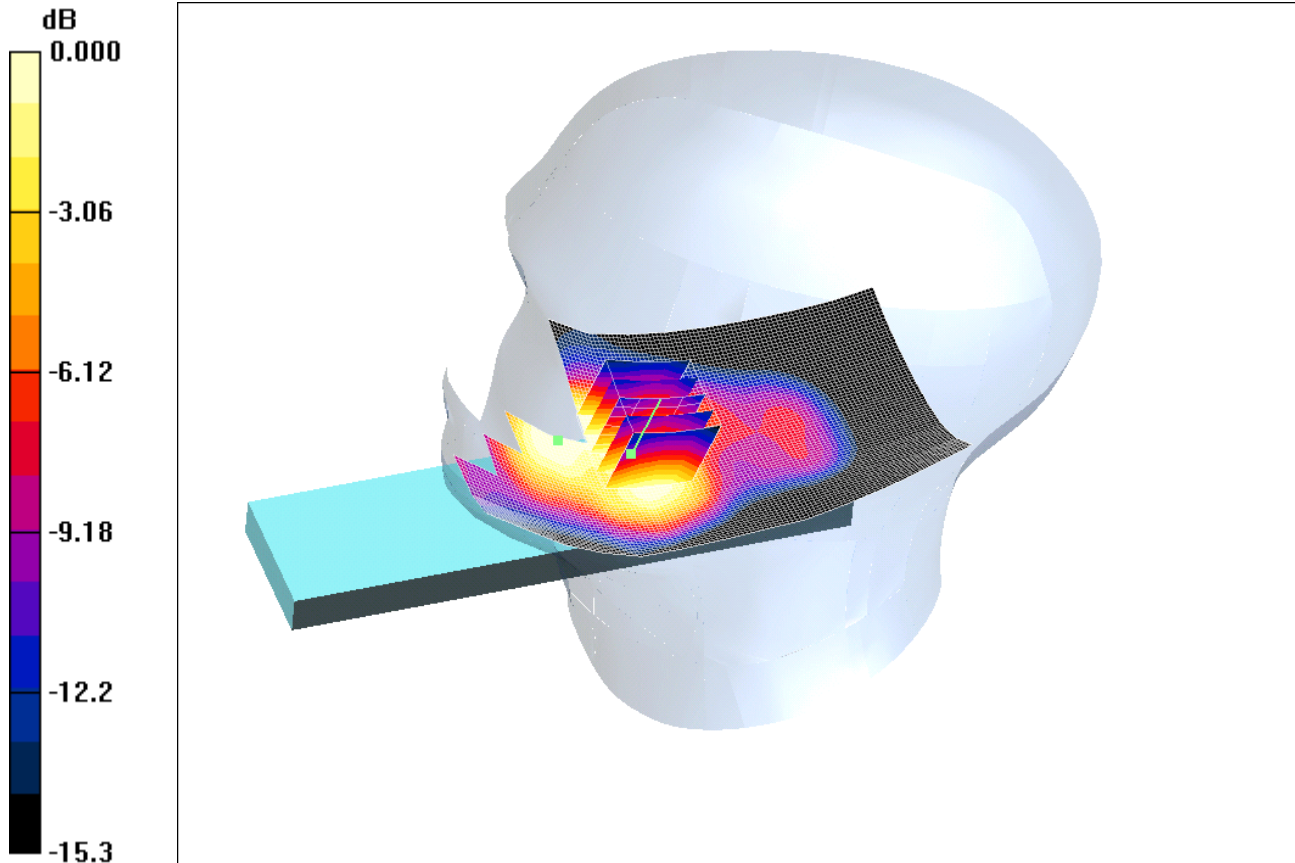
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/003: Touch Right PCS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



0 dB = 0.529mW/g

Communication System: PCS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz HSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.36$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.83, 8.83, 8.83); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

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

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

**Touch Right - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.558 mW/g

**Touch Right - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 6.94 V/m; Power Drift = -0.352 dB

Peak SAR (extrapolated) = 0.715 W/kg

**SAR(1 g) = 0.499 mW/g; SAR(10 g) = 0.324 mW/g**

Maximum value of SAR (measured) = 0.529 mW/g



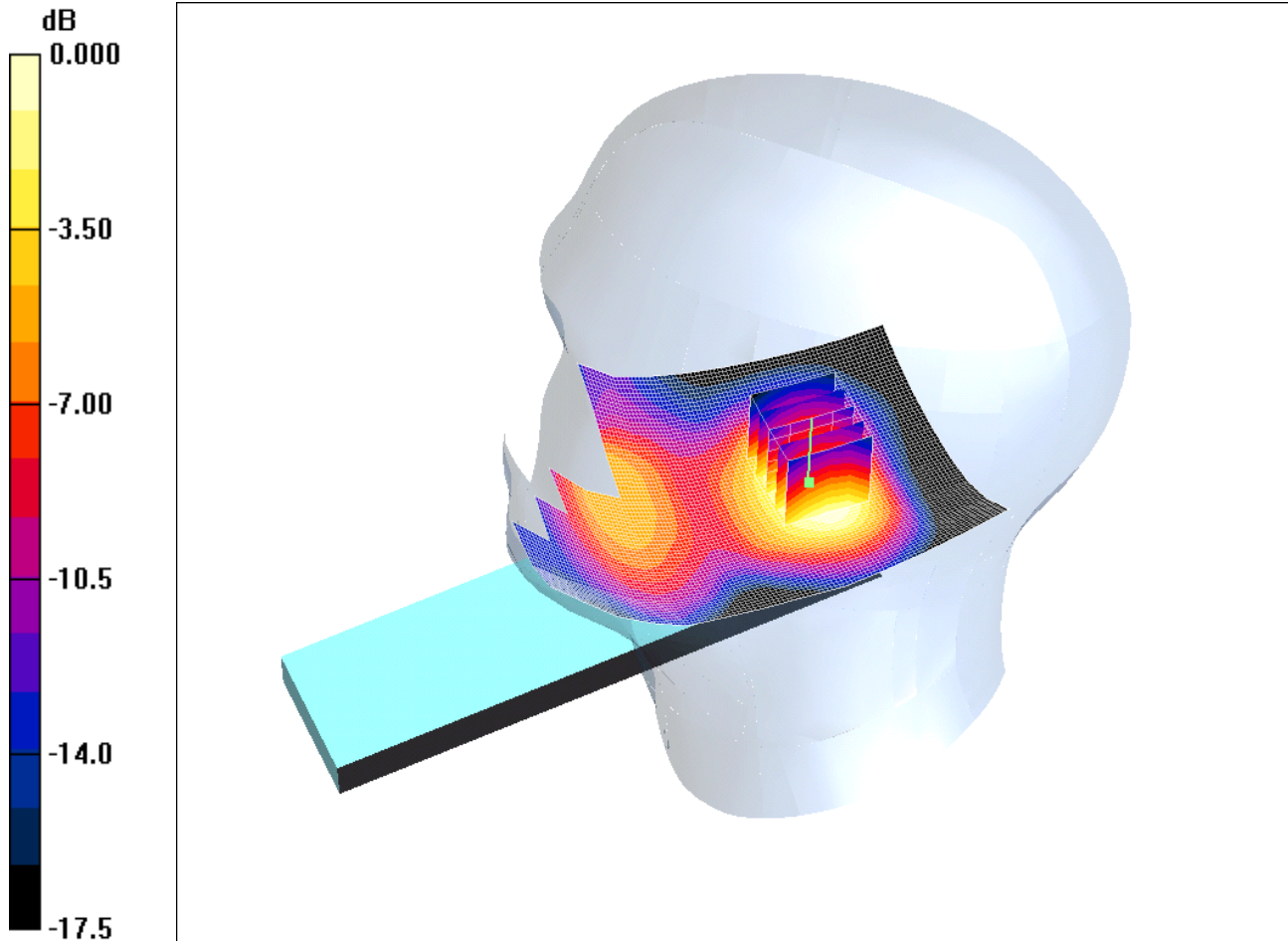
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/004: Tilt Right PCS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



Communication System: PCS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz HSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.36$  mho/m;  $\epsilon_r = 39.3$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Right Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.83, 8.83, 8.83); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

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

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

**Tilt Right - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.358 mW/g

**Tilt Right - Middle/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.3 V/m; Power Drift = 0.179 dB

Peak SAR (extrapolated) = 0.464 W/kg

**SAR(1 g) = 0.310 mW/g; SAR(10 g) = 0.192 mW/g**

Maximum value of SAR (measured) = 0.329 mW/g



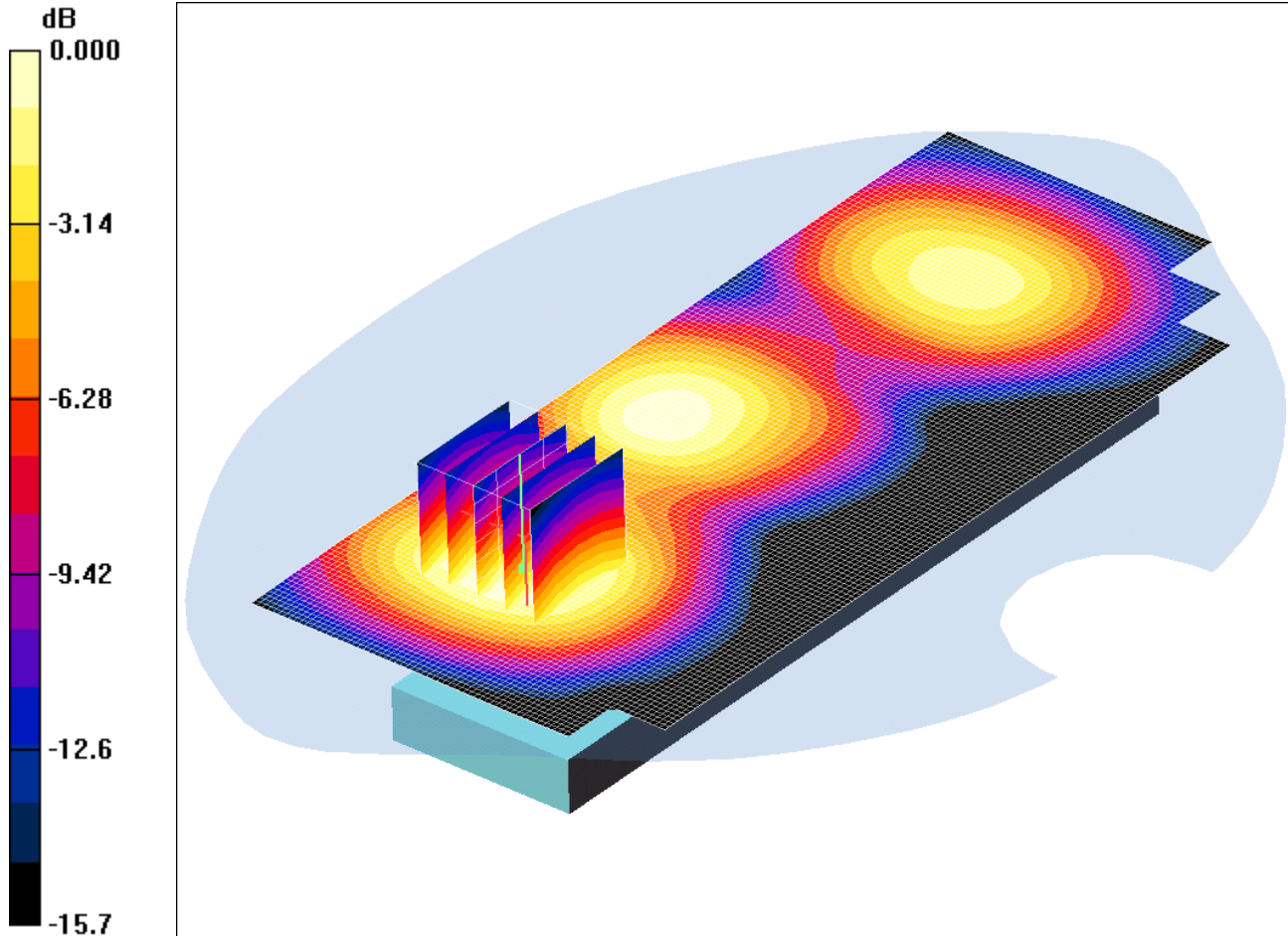
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/005: Front of EUT Facing Phantom PCS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



0 dB = 0.288mW/g

Communication System: PCS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:8.3

Medium: 1900 MHz MSL Medium parameters used (interpolated):  $f = 1879.8 \text{ MHz}$ ;  $\sigma = 1.52 \text{ mho/m}$ ;  $\epsilon_r = 53$ ;  $\rho = 1000 \text{ kg/m}^3$ 

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.29, 8.29, 8.29); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

- Phantom: SAM 12b; Type: SAM 4.0; Serial: TP:1207

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

**Front of EUT Facing Phantom - Middle/Area Scan (71x161x1):** Measurement grid:  $dx=15\text{mm}$ ,  $dy=15\text{mm}$ 

Maximum value of SAR (interpolated) = 0.301 mW/g

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

Reference Value = 8.18 V/m; Power Drift = 0.121 dB

Peak SAR (extrapolated) = 0.421 W/kg

**SAR(1 g) = 0.268 mW/g; SAR(10 g) = 0.168 mW/g**

Maximum value of SAR (measured) = 0.288 mW/g

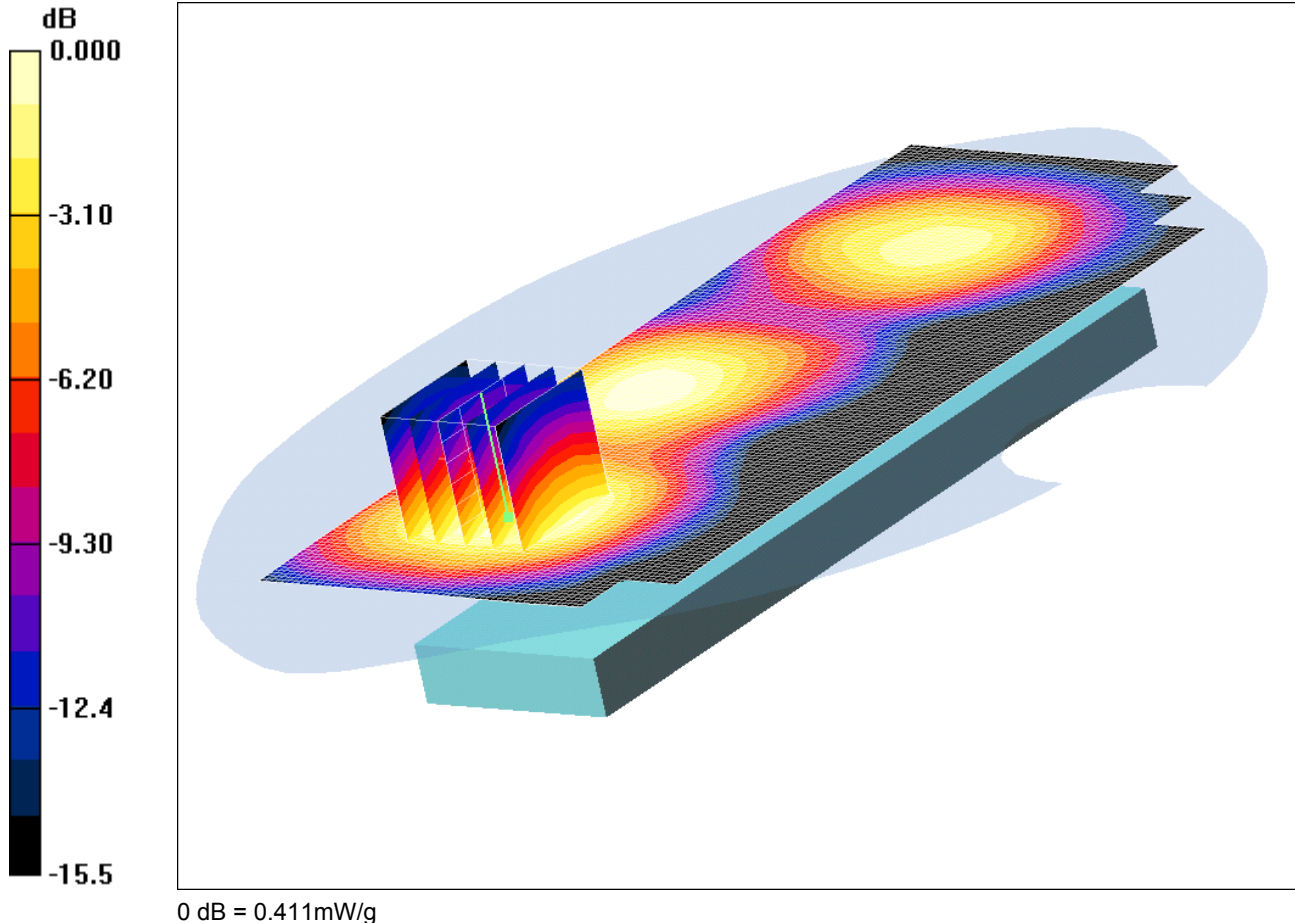
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/006: Front of EUT Facing Phantom GPRS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



Communication System: GPRS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:4

Medium: 1900 MHz MSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.29, 8.29, 8.29); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

- Phantom: SAM 12b; Type: SAM 4.0; Serial: TP:1207

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

**Front of EUT Facing Phantom - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.406 mW/g

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

Reference Value = 10.4 V/m; Power Drift = -0.035 dB

Peak SAR (extrapolated) = 0.607 W/kg

**SAR(1 g) = 0.376 mW/g; SAR(10 g) = 0.232 mW/g**

Maximum value of SAR (measured) = 0.411 mW/g

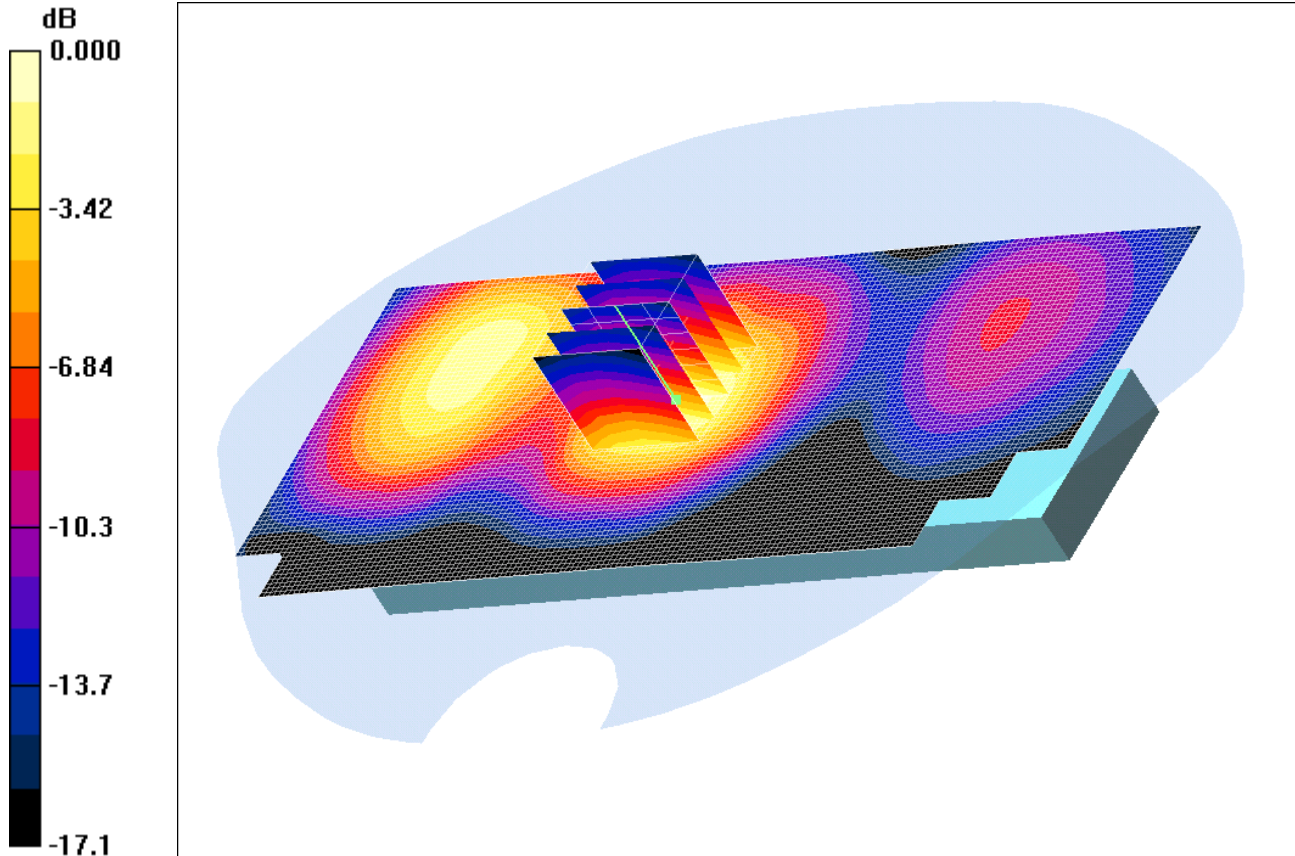
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/007: Rear of EUT Facing Phantom GPRS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



0 dB = 0.461mW/g

Communication System: GPRS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:4

Medium: 1900 MHz MSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.29, 8.29, 8.29); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

- Phantom: SAM 12b; Type: SAM 4.0; Serial: TP:1207

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

**Rear of EUT Facing Phantom - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.434 mW/g

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

Reference Value = 15.7 V/m; Power Drift = 0.388 dB

Peak SAR (extrapolated) = 0.777 W/kg

**SAR(1 g) = 0.428 mW/g; SAR(10 g) = 0.241 mW/g**

Maximum value of SAR (measured) = 0.461 mW/g



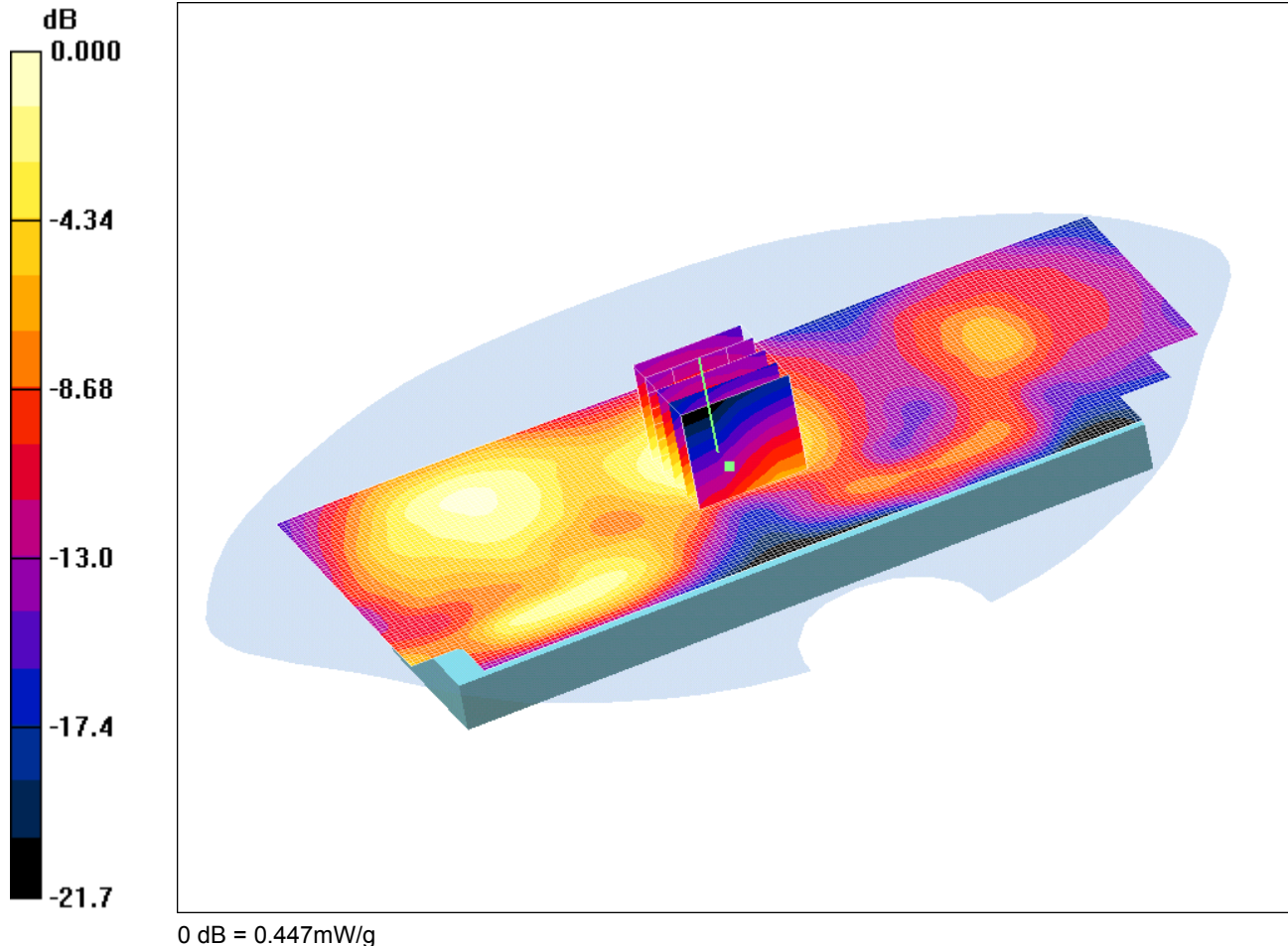
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/008: Rear of EUT Facing Phantom with PHF GPRS CH660

Date: 11/12/2008

DUT: Panasonic P-04A; Type: P-04A (Sample C22); Serial: 353705020030067



Communication System: GPRS 1900; Frequency: 1879.8 MHz; Duty Cycle: 1:4

Medium: 1900 MHz MSL Medium parameters used (interpolated):  $f = 1879.8$  MHz;  $\sigma = 1.52$  mho/m;  $\epsilon_r = 53$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.29, 8.29, 8.29); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

- Phantom: SAM 12b; Type: SAM 4.0; Serial: TP:1207

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

**Rear of EUT Facing Phantom - Middle/Area Scan (71x161x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.475 mW/g

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

Reference Value = 16.8 V/m; Power Drift = -0.025 dB

Peak SAR (extrapolated) = 0.675 W/kg

**SAR(1 g) = 0.411 mW/g; SAR(10 g) = 0.239 mW/g**

Maximum value of SAR (measured) = 0.447 mW/g

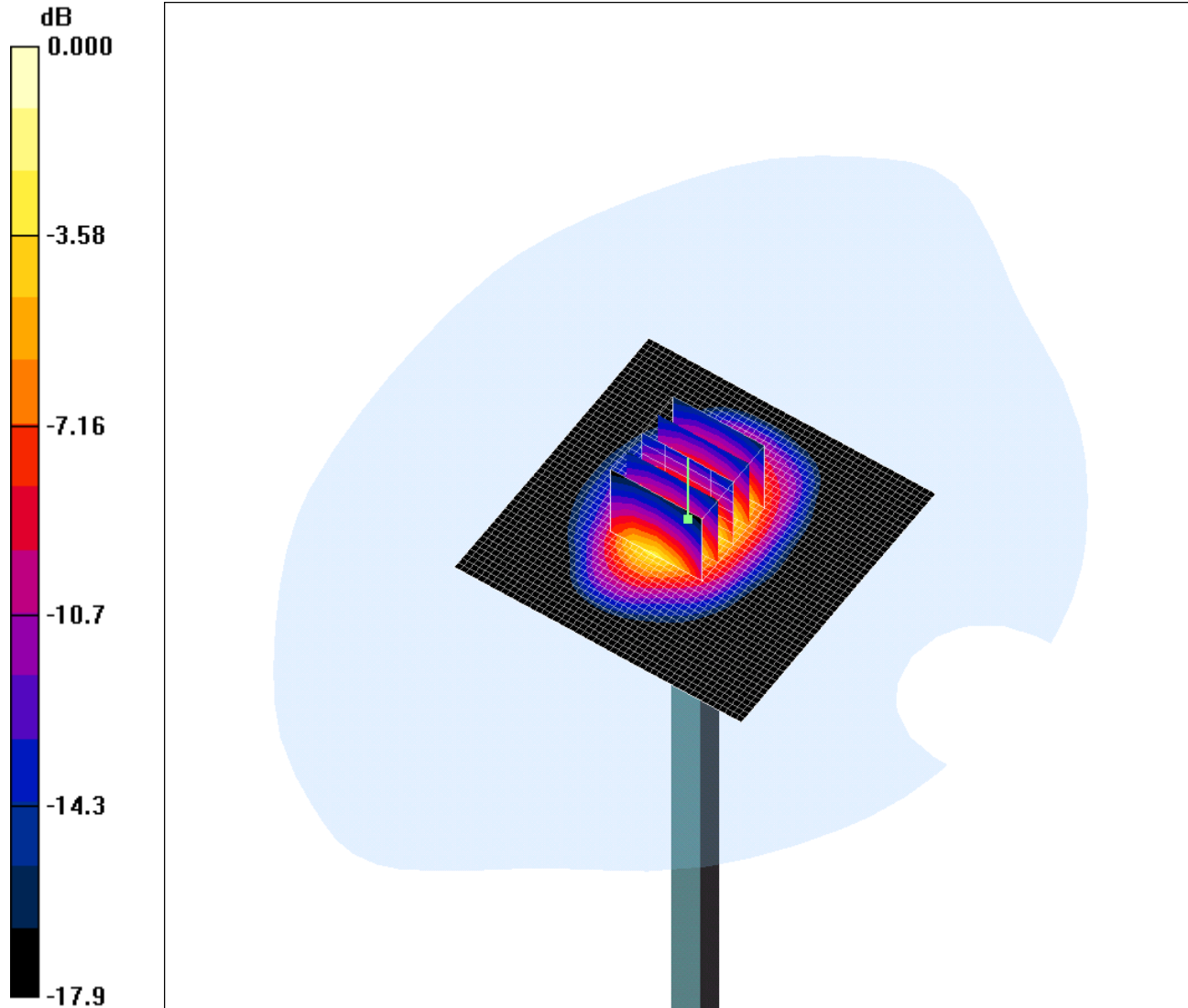
Test of: NTT docomo P-04A (EB-4024)

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

SCN/74358JD01/009: System Performance Check 1900MHz Body 11 12 08

Date: 11/12/2008

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: SN540



0 dB = 10.9mW/g

Communication System: CW; Frequency: 1900 MHz; Duty Cycle: 1:1

Medium: 1900 MHz MSL Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.54$  mho/m;  $\epsilon_r = 52.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV3 - SN3508; ConvF(8.29, 8.29, 8.29); Calibrated: 24/06/2008

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

- Electronics: DAE3 Sn394; Calibrated: 25/06/2008

- Phantom: SAM 12b; Type: SAM 4.0; Serial: TP:1207

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

**d=15mm, Pin=250mW/Area Scan (51x51x1):** Measurement grid: dx=20mm, dy=20mm

Maximum value of SAR (interpolated) = 12.7 mW/g

**d=15mm, Pin=250mW/Zoom Scan (5x5x7) (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 77.4 V/m; Power Drift = 0.004 dB

Peak SAR (extrapolated) = 18.2 W/kg

**SAR(1 g) = 9.79 mW/g; SAR(10 g) = 5.02 mW/g**

Maximum value of SAR (measured) = 10.9 mW/g

Test of: NTT docomo P-04A (EB-4024)

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

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## **Appendix 4. Photographs**

This appendix contains the following photographs:

Photo Reference Number	Title
PHT/74358JD01/001	Test configuration for the measurement of Specific Absorption Rate (SAR)
PHT/74358JD01/002	Touch Left
PHT/74358JD01/003	Tilt Left
PHT/74358JD01/004	Touch Right
PHT/74358JD01/005	Tilt Right
PHT/74358JD01/006	Front of EUT Facing Phantom
PHT/74358JD01/007	Rear of EUT Facing Phantom
PHT/74358JD01/008	Rear of EUT Facing Phantom With PHF
PHT/74358JD01/009	General Setup View
PHT/74358JD01/010	Front View of EUT
PHT/74358JD01/011	Rear View of EUT
PHT/74358JD01/012	Internal View of EUT
PHT/74358JD01/013	Battery View of EUT
PHT/74358JD01/014	Personal Hands free Kit
PHT/74358JD01/015	1900MHz Fluid Level

Note: These photographs have been removed from this document and placed in a separate document (RFI/SAR3/RP74358JD01A\_Part2).

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Test of: NTT docomo P-04A (EB-4024)

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

## **Appendix 5. Validation of System**

Prior to the assessment, the system was verified in the flat region of the phantom.

A 1900 MHz 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 1900 MHz dipole. The applicable verification (normalised to 1 Watt).

**Date: 11/12/2008**

**Validation Dipole and Serial Number: D1900V2: SN:540**

Simulant	Frequency (MHz)	Room Temperature	Liquid Temperature	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Body	1900	25.0 °C	24.0 °C	$\epsilon_r$	53.30	52.92	-0.71	5.00
				$\sigma$	1.52	1.54	1.35	5.00
				1g SAR	38.00	39.16	3.05	5.00
				10g SAR	20.70	20.08	-2.99	5.00

Simulant	Frequency (MHz)	Room Temperature	Liquid Temperature	Parameters	Target Value	Measured Value	Deviation (%)	Limit (%)
Head	1900	25.0 °C	25.0 °C	$\epsilon_r$	40.00	39.18	-2.05	5.00
				$\sigma$	1.40	1.38	-1.66	5.00

Test of: NTT docomo P-04A (EB-4024)

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

## **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
	1800/1900 MHz Body
De-Ionised Water	69.79%
Diglycol Butyl Ether (DGBE)	30.00%
Salt	0.20%

Ingredient	Frequency
	1800/1900 MHz Head
De-Ionised Water	55.41%
Diglycol Butyl Ether (DGBE)	44.51%
Salt	0.08%



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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.

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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:394
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**Cell 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:	$\pm 0.2$ 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 $\pm$ 0.1 mm

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