

## **APPENDIX C CALIBRATION DOCUMENTS**

1. SN: 1380 Probe Calibration Certificate
2. SN: D2450V2 Dipole Calibration Certificate



---

This document must not be copied or reproduced, except in full without the written permission of the Manager, EMC Technologies Pty Ltd. The certificate on page 3 may be reproduced in full.  
[www.emctech.com.au](http://www.emctech.com.au)

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



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

Accredited by the Swiss Accreditation Service (SAS)  
The Swiss Accreditation Service is one of the signatories to the EA  
Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **EMC Technologies**

Certificate No: **ET3-1380\_Dec07**

## CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1380**

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

Calibration date: **December 18, 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 ( $22 \pm 3$ )°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 E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe ES3DV2	SN: 3013	4-Jan-07 (SPEAG, No. ES3-3013_Jan07)	Jan-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, 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: December 18, 2007

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

Certificate No: ET3-1380\_Dec07

Page 1 of 9



This document must not be copied or reproduced, except in full without the written permission of the Manager, EMC Technologies Pty Ltd. The certificate on page 3 may be reproduced in full.  
[www.emctech.com.au](http://www.emctech.com.au)

ET3DV6 SN:1380

December 18, 2007

# Probe ET3DV6

## SN:1380

Manufactured:	August 16, 1999
Last calibrated:	December 12, 2006
Recalibrated:	December 18, 2007

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

Certificate No: ET3-1380\_Dec07

Page 3 of 9



This document must not be copied or reproduced, except in full without the written permission of the Manager, EMC Technologies Pty Ltd. The certificate on page 3 may be reproduced in full.  
[www.emctech.com.au](http://www.emctech.com.au)

ET3DV6 SN:1380

December 18, 2007

**DASY - Parameters of Probe: ET3DV6 SN:1380****Sensitivity in Free Space<sup>A</sup>****Diode Compression<sup>B</sup>**

NormX	1.64 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP X	90 mV
NormY	1.59 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Y	89 mV
NormZ	1.69 ± 10.1%	$\mu\text{V}/(\text{V}/\text{m})^2$	DCP Z	92 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	3.7 mm	4.7 mm
SAR <sub>be</sub> [%] Without Correction Algorithm	11.0	6.4
SAR <sub>be</sub> [%] With Correction Algorithm	0.8	0.6

**TSL 1810 MHz Typical SAR gradient: 10 % per mm**

Sensor Center to Phantom Surface Distance	3.7 mm	4.7 mm
SAR <sub>be</sub> [%] Without Correction Algorithm	12.4	7.9
SAR <sub>be</sub> [%] With Correction Algorithm	0.5	0.9

**Sensor Offset**Probe Tip to Sensor Center **2.7 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.



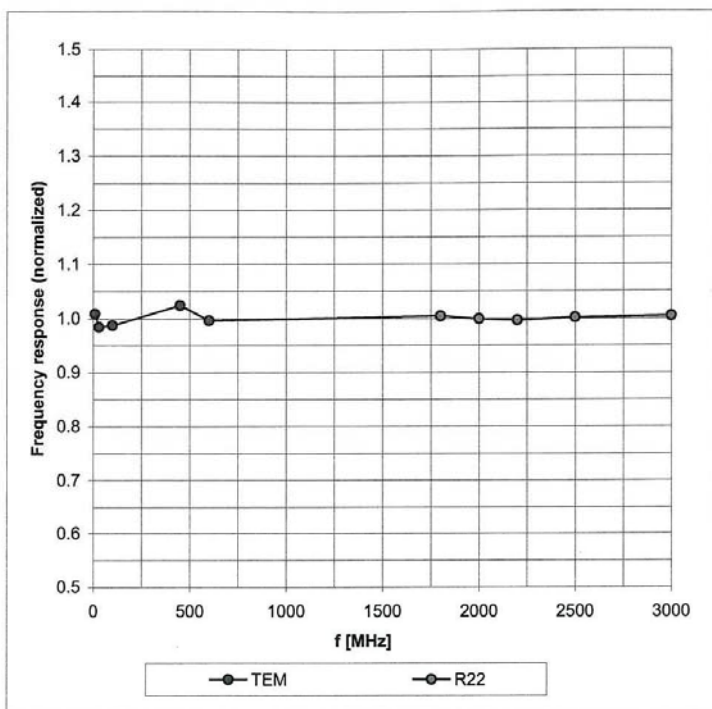


ET3DV6 SN:1380

December 18, 2007

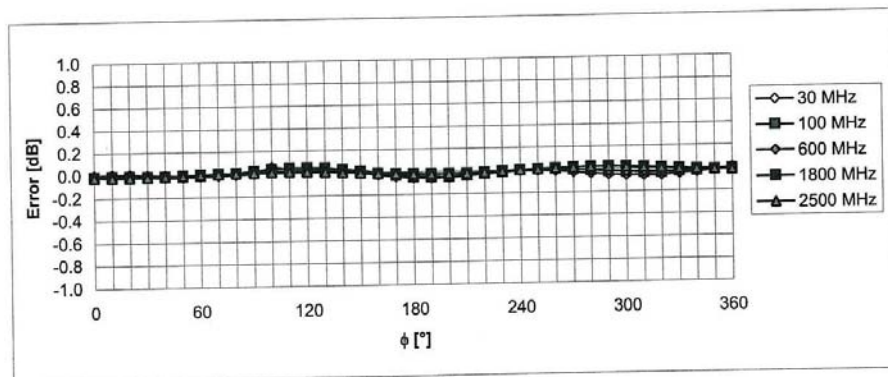
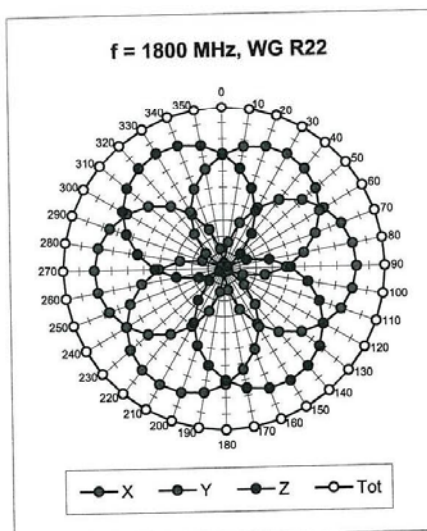
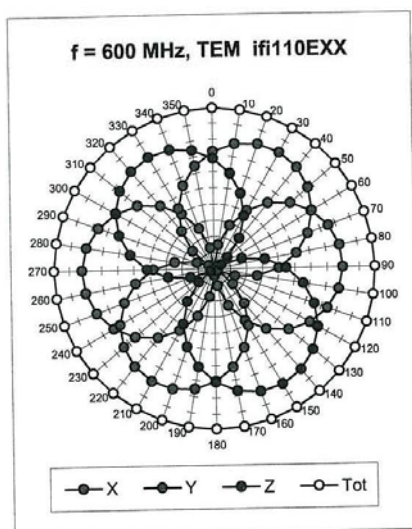
## Frequency Response of E-Field

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

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

ET3DV6 SN:1380

December 18, 2007

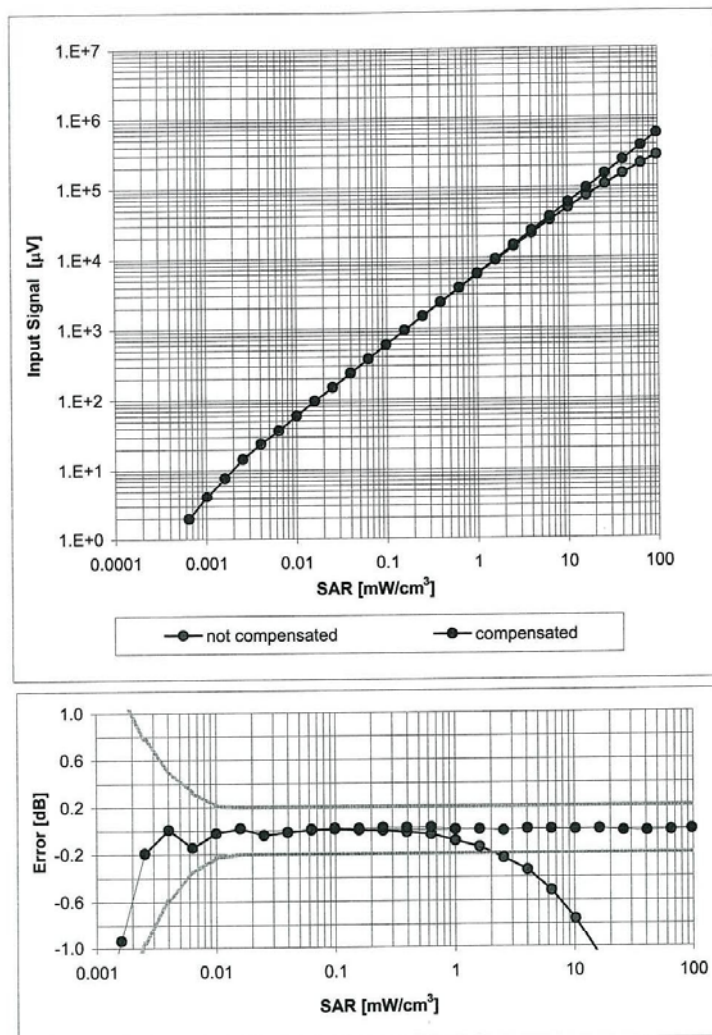
Receiving Pattern ( $\phi$ ),  $\theta = 0^\circ$ Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

ET3DV6 SN:1380

December 18, 2007

### Dynamic Range f(SAR<sub>head</sub>)

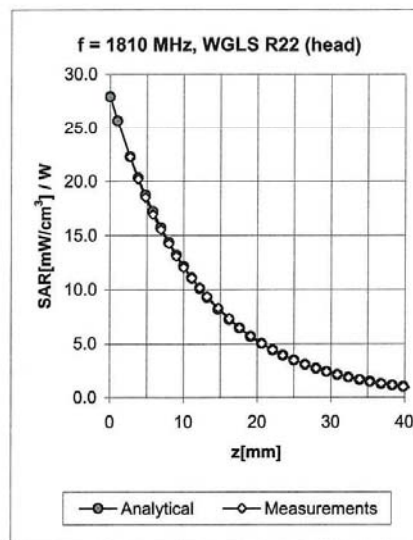
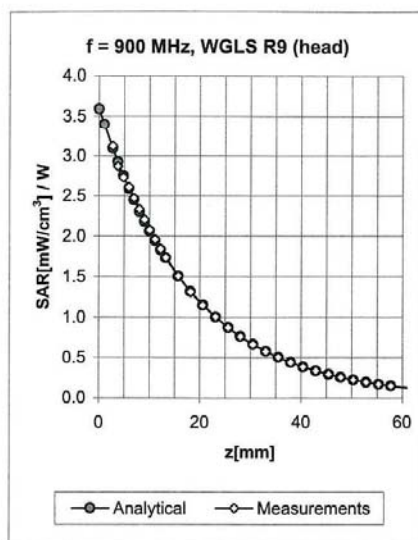
(Waveguide R22, f = 1800 MHz)

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

ET3DV6 SN:1380

December 18, 2007

## 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%	0.38	1.95	6.93 ± 13.3% (k=2)
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.77	1.96	6.30 ± 11.0% (k=2)
1640	± 50 / ± 100	Head	40.3 ± 5%	1.29 ± 5%	0.62	2.51	5.60 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.73	2.11	5.11 ± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.64	2.38	4.92 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.95	1.68	4.55 ± 11.8% (k=2)
450	± 50 / ± 100	Body	56.7 ± 5%	0.94 ± 5%	0.32	1.99	7.44 ± 13.3% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.82	1.93	6.03 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.89	1.79	4.79 ± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.71	2.12	4.55 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.99	1.58	4.18 ± 11.8% (k=2)

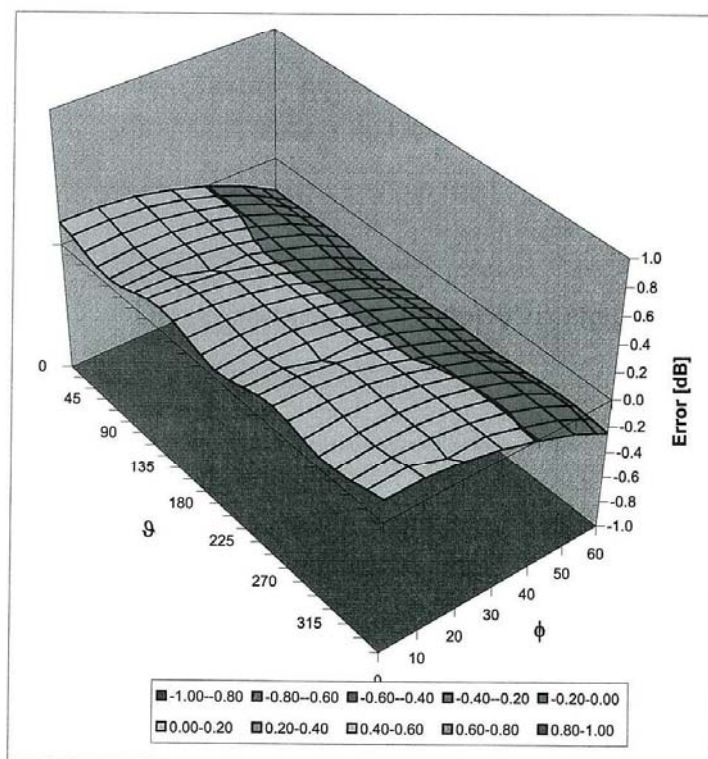
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.





ET3DV6 SN:1380

December 18, 2007

**Deviation from Isotropy in HSL**Error ( $\phi$ ,  $\theta$ ),  $f = 900$  MHzUncertainty of Spherical Isotropy Assessment:  $\pm 2.6\%$  ( $k=2$ )

Certificate No: ET3-1380\_Dec07

Page 9 of 9



This document must not be copied or reproduced, except in full without the written permission of the Manager, EMC Technologies Pty Ltd. The certificate on page 3 may be reproduced in full.  
[www.emctech.com.au](http://www.emctech.com.au)

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 Federal Office of Metrology and Accreditation  
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 **EMC Technologies**Certificate No: **D2450V2-724\_Dec06****CALIBRATION CERTIFICATE**Object **D2450V2 - SN: 724**Calibration procedure(s) **QA CAL-05.v6  
Calibration procedure for dipole validation kits**Calibration date: **December 13, 2006**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&amp;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 ES3DV2	SN 3025	19-Oct-06 (SPEAG, No. ES3-3025_Oct06)	Oct-07
DAE4	SN 601	15-Dec-05 (SPEAG, No. DAE4-601_Dec05)	Dec-06
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 **Marcel Fehr** Function **Laboratory Technician** Signature

Approved by: **Katja Pokovic** Technical Manager

Issued: December 14, 2006

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

Certificate No: D2450V2-724\_Dec06

Page 1 of 6



This document must not be copied or reproduced, except in full without the written permission of the Manager, EMC Technologies Pty Ltd. The certificate on page 3 may be reproduced in full.  
[www.emctech.com.au](http://www.emctech.com.au)

### 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	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	37.7 $\pm$ 6 %	1.77 mho/m $\pm$ 6 %
Head TSL temperature during test	(21.8 $\pm$ 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	13.5 mW / g
SAR normalized	normalized to 1W	54.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	53.3 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR normalized	normalized to 1W	25.0 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	24.7 mW / g $\pm$ 16.5 % (k=2)

<sup>1</sup> Correction to nominal TSL parameters according to d), chapter "SAR Sensitivities"

**DASY4 Validation Report for Head TSL**

Date/Time: 13.12.2006 12:39:25

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN724**

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

Medium: HSL U10 BB\_060425;

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.77$  mho/m;  $\epsilon_r = 37.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

**DASY4 Configuration:**

- Probe: ES3DV2 - SN3025 (HF); ConvF(4.5, 4.5, 4.5); Calibrated: 19.10.2006
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 15.12.2005
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; ;
- Measurement SW: DASY4, V4.7 Build 44; Postprocessing SW: SEMCAD, V1.8 Build 171

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

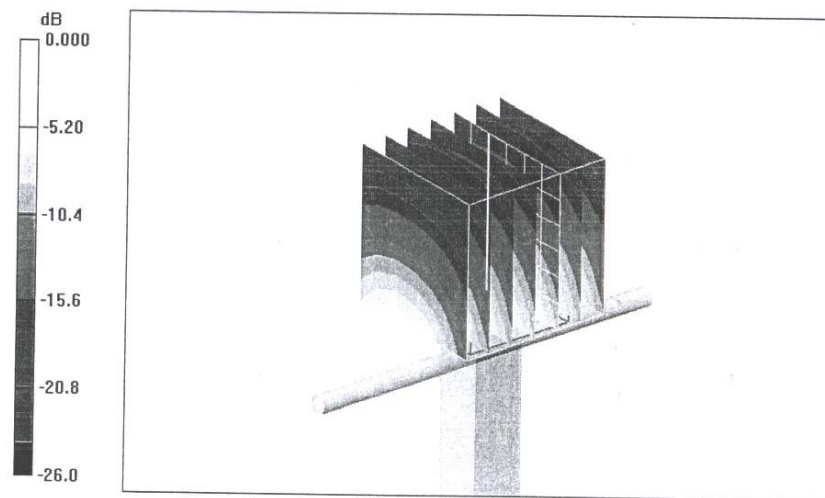
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 89.2 V/m; Power Drift = 0.053 dB

Peak SAR (extrapolated) = 28.4 W/kg

**SAR(1 g) = 13.5 mW/g; SAR(10 g) = 6.24 mW/g**

Maximum value of SAR (measured) = 15.0 mW/g



0 dB = 15.0mW/g