



**Ant 0\_802.11g\_CH06\_orientation B**

Date/Time: 4/28/2009 10:57:47 AM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

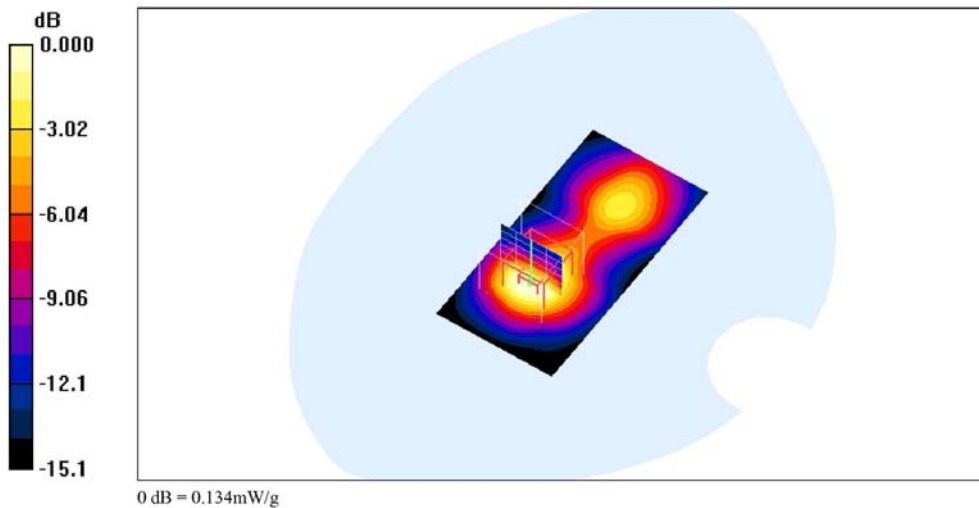
Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0\_802.11g\_CH06\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.180 mW/g

**Ant 0\_802.11g\_CH06\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 4.57 V/m; Power Drift = 0.046 dB  
Peak SAR (extrapolated) = 0.226 W/kg  
**SAR(1 g) = 0.123 mW/g; SAR(10 g) = 0.064 mW/g**  
Maximum value of SAR (measured) = 0.134 mW/g





Ant 0\_802.11b\_CH11\_orientation A

Date/Time: 4/28/2009 9:46:39 AM

Test Laboratory: Electronics Testing Center, Taiwan

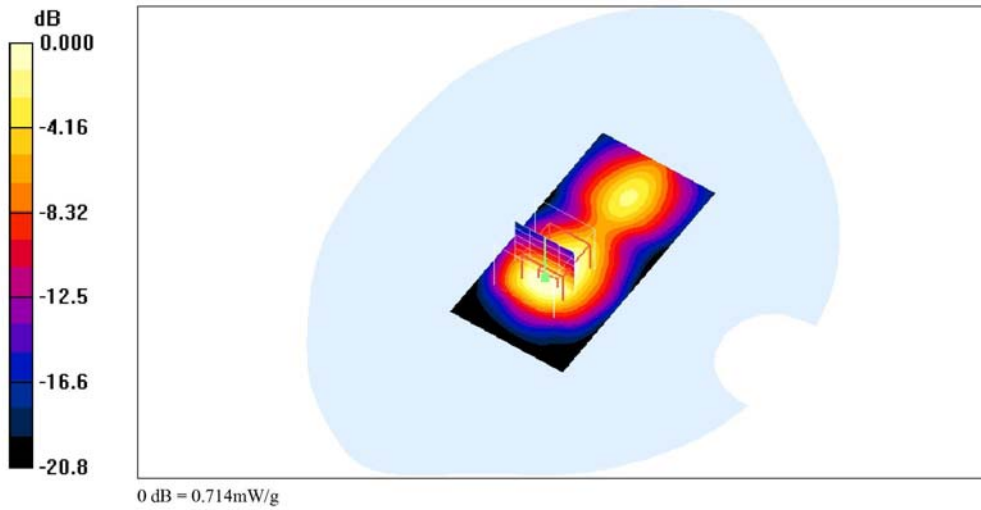
DUT: USB dongle; Type: WNDA3100V2; Serial: N/A  
Program Name: Unnamed Program

Communication System: IEEE 802.11b/g/n; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.99$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:  
- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008  
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346  
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

Ant 0\_802.11b\_CH11\_orientation A/Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 14.8 V/m; Power Drift = -0.188 dB  
Peak SAR (extrapolated) = 1.28 W/kg  
SAR(1 g) = 0.679 mW/g; SAR(10 g) = 0.349 mW/g  
Maximum value of SAR (measured) = 0.714 mW/g

Ant 0\_802.11b\_CH11\_orientation A/Area Scan (41x81x1): Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.957 mW/g





**Ant 0\_802.11b\_CH01\_orientation A**

Date/Time: 4/28/2009 10:01:47 AM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2412 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.93$  mho/m;  $\epsilon_r = 50.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0\_802.11b\_CH01\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 14.5 V/m; Power Drift = 0.098 dB

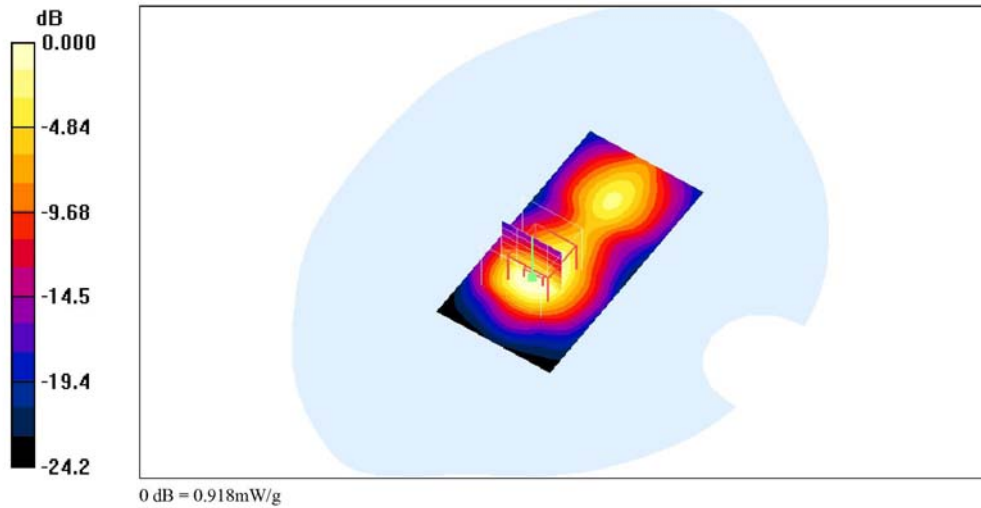
Peak SAR (extrapolated) = 1.70 W/kg

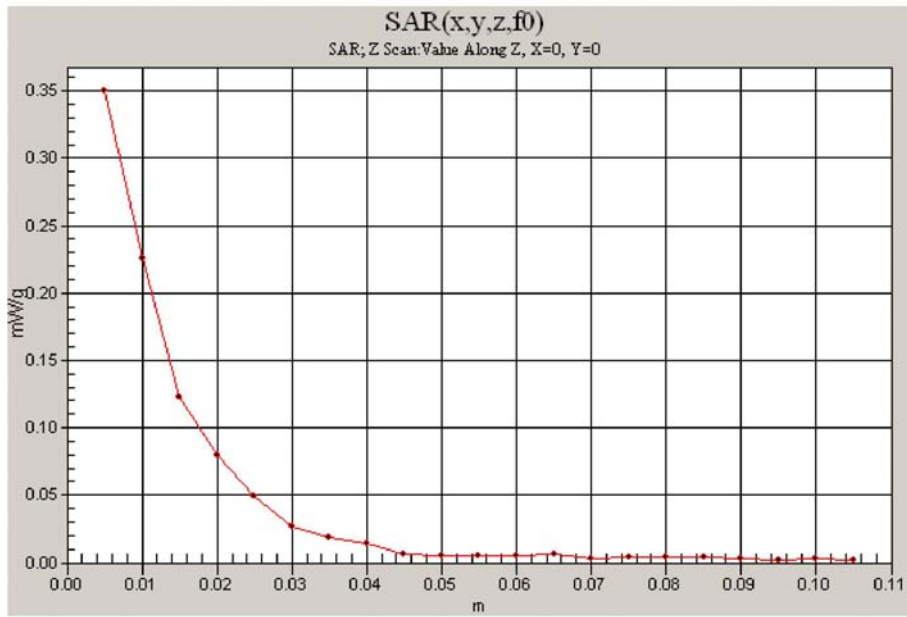
**SAR(1 g) = 0.858 mW/g; SAR(10 g) = 0.416 mW/g**

Maximum value of SAR (measured) = 0.918 mW/g

**Ant 0\_802.11b\_CH01\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 1.17 mW/g







**Ant 0\_802.11b\_CH11\_orientation B**

Date/Time: 4/28/2009 12:07:46 PM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2462 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2462$  MHz;  $\sigma = 1.99$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0\_802.11b\_CH11\_orientation B/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 7.34 V/m; Power Drift = 0.002 dB

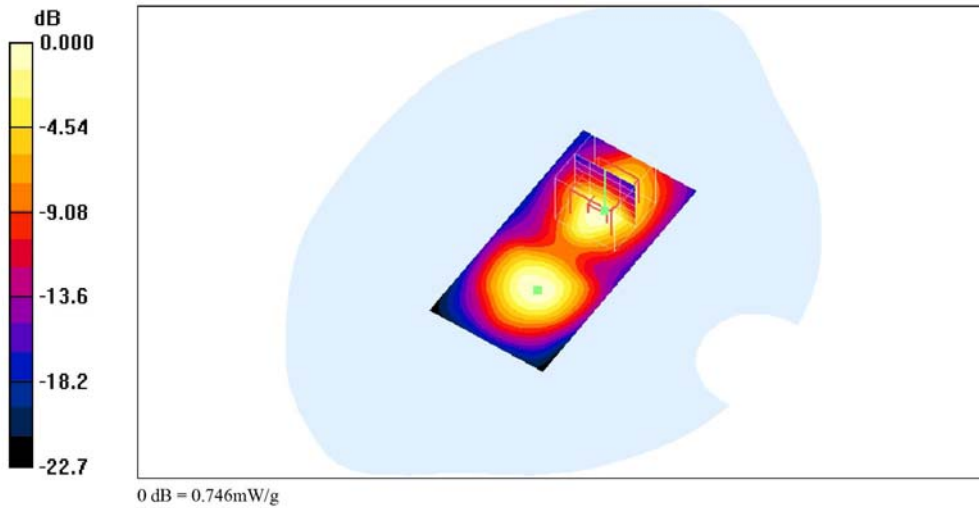
Peak SAR (extrapolated) = 1.33 W/kg

**SAR(1 g) = 0.666 mW/g; SAR(10 g) = 0.320 mW/g**

Maximum value of SAR (measured) = 0.746 mW/g

**Ant 0\_802.11b\_CH11\_orientation B/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.766 mW/g





**Ant 0\_802.11b\_CH01\_orientation B**

Date/Time: 4/28/2009 11:40:56 AM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2412 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2412$  MHz;  $\sigma = 1.93$  mho/m;  $\epsilon_r = 50.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0\_802.11b\_CH01\_orientation B/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 9.61 V/m; Power Drift = -0.064 dB

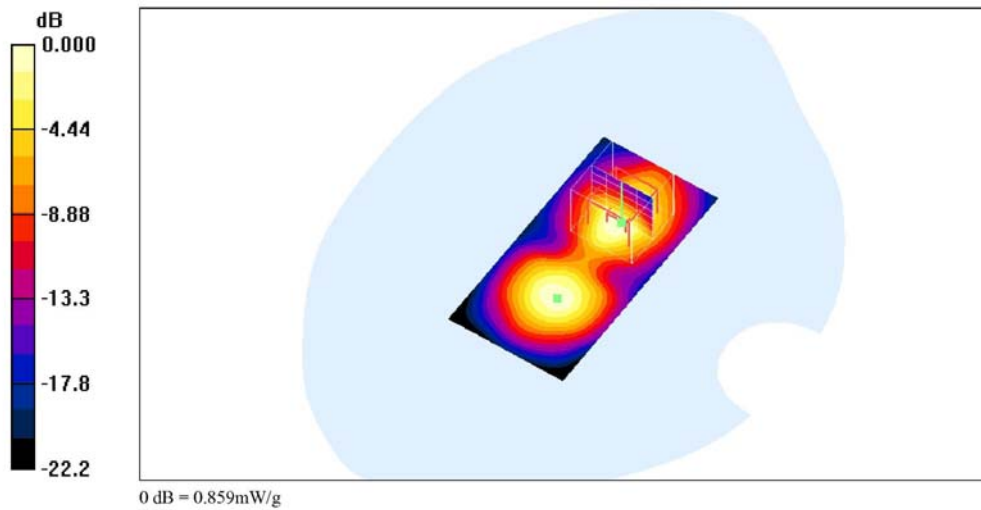
Peak SAR (extrapolated) = 1.56 W/kg

**SAR(1 g) = 0.775 mW/g; SAR(10 g) = 0.373 mW/g**

Maximum value of SAR (measured) = 0.859 mW/g

**Ant 0\_802.11b\_CH01\_orientation B/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.917 mW/g





**Ant 1\_802.11g\_CH06\_orientation A**

Date/Time: 4/28/2009 11:14:42 AM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 1\_802.11g\_CH06\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 4.02 V/m; Power Drift = 0.053 dB

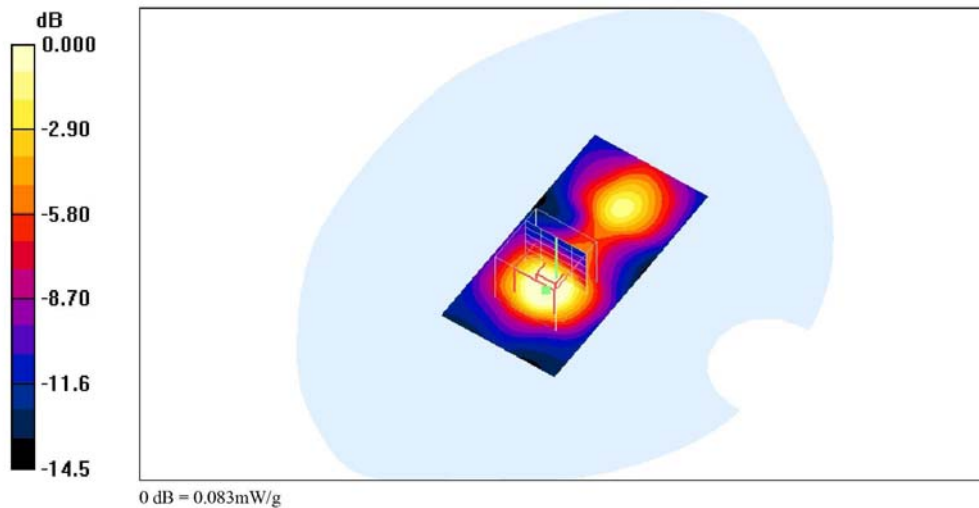
Peak SAR (extrapolated) = 0.125 W/kg

**SAR(1 g) = 0.073 mW/g; SAR(10 g) = 0.043 mW/g**

Maximum value of SAR (measured) = 0.083 mW/g

**Ant 1\_802.11g\_CH06\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.119 mW/g





**Ant 0+1\_802.11gn HT20\_CH06\_orientation A**

Date/Time: 4/8/2009 11:32:36 AM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WND3100V2; Serial: N/A**

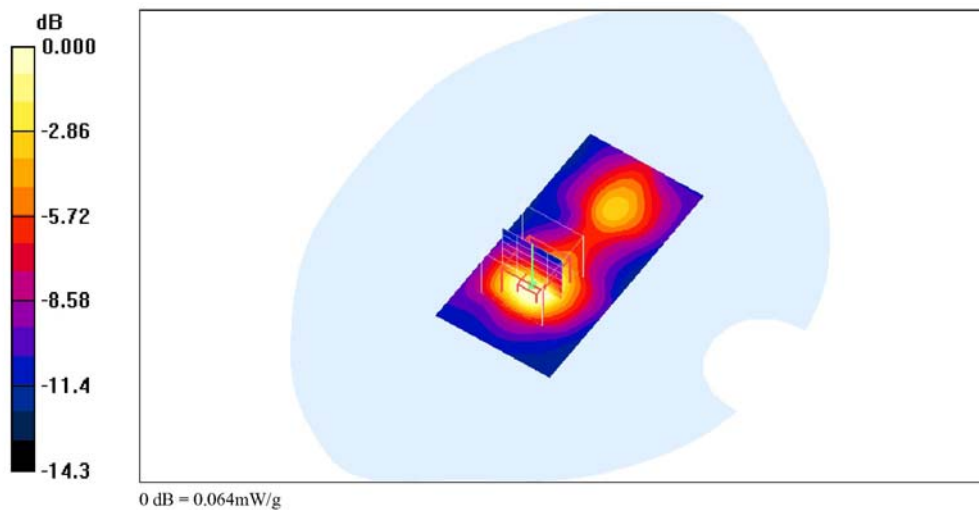
Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 21 degC; Liquid temperature: 22 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0+1\_802.11gn HT20\_CH06\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.087 mW/g

**Ant 0+1\_802.11gn HT20\_CH06\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 3.01 V/m; Power Drift = 0.093 dB  
Peak SAR (extrapolated) = 0.117 W/kg  
SAR(1 g) = 0.060 mW/g; SAR(10 g) = 0.031 mW/g  
Maximum value of SAR (measured) = 0.064 mW/g







**Ant 0+1\_802.11gn HT40\_CH09\_orientation A**

Date/Time: 4/8/2009 11:49:11 AM

Test Laboratory: Electronics Testing Center, Taiwan

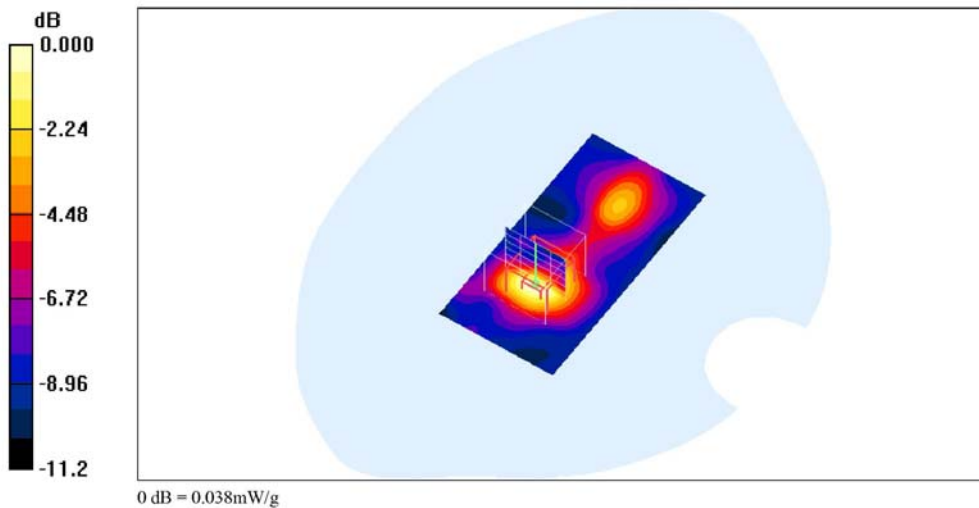
**DUT: USB dongle; Type: WND3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2452 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2452$  MHz;  $\sigma = 1.98$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 21 degC; Liquid temperature: 22 degC;  
Phantom section: Flat Section

DASY4 Configuration:  
- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008  
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346  
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0+1\_802.11gn HT40\_CH09\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.042 mW/g

**Ant 0+1\_802.11gn HT40\_CH09\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 2.13 V/m; Power Drift = 0.018 dB  
Peak SAR (extrapolated) = 0.066 W/kg  
SAR(1 g) = **0.035 mW/g**; SAR(10 g) = **0.018 mW/g**  
Maximum value of SAR (measured) = 0.038 mW/g





**Ant 0+1\_802.11gn HT40\_CH03\_orientation A**

Date/Time: 4/8/2009 12:06:16 PM

Test Laboratory: Electronics Testing Center, Taiwan

**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2422 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2422$  MHz;  $\sigma = 1.94$  mho/m;  $\epsilon_r = 50.9$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 21 degC; Liquid temperature: 22 degC;  
Phantom section: Flat Section

DASY4 Configuration:

- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0+1\_802.11gn HT40\_CH03\_orientation A/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm

Reference Value = 3.04 V/m; Power Drift = 0.116 dB

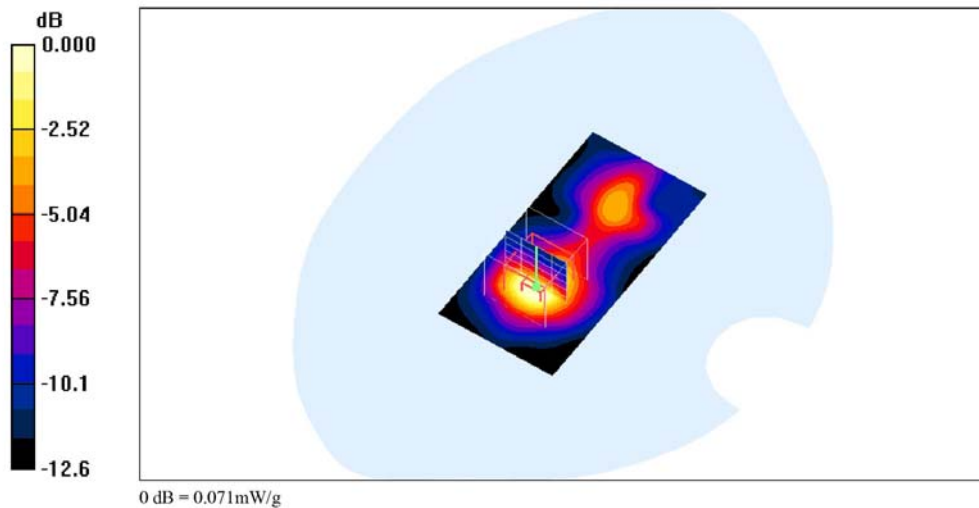
Peak SAR (extrapolated) = 0.141 W/kg

**SAR(1 g) = 0.066 mW/g; SAR(10 g) = 0.034 mW/g**

Maximum value of SAR (measured) = 0.071 mW/g

**Ant 0+1\_802.11gn HT40\_CH03\_orientation A/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.086 mW/g





**Ant 0\_802.11b\_CH06\_orientation A\_5mm increments**

Date/Time: 4/28/2009 9:37:03 PM

Test Laboratory: Electronics Testing Center, Taiwan

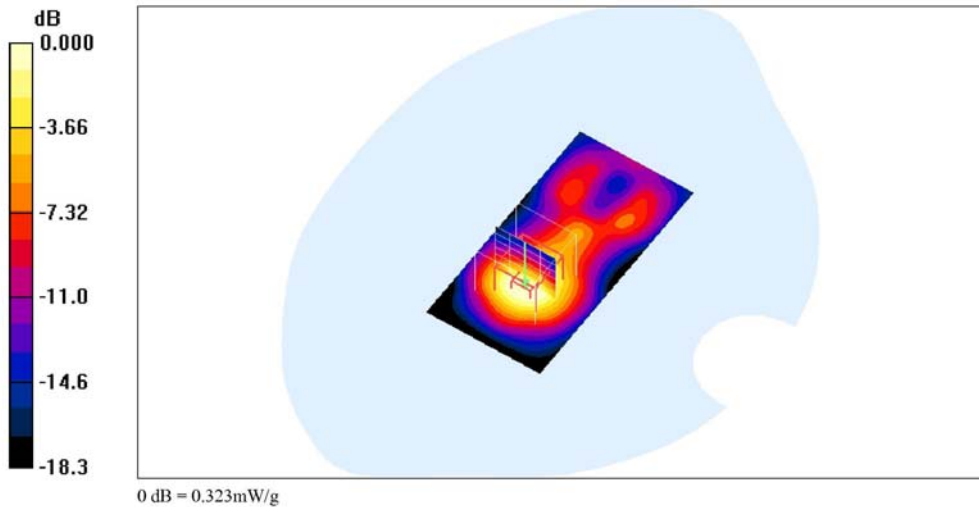
**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11b/g/n; Frequency: 2437 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 2437$  MHz;  $\sigma = 1.96$  mho/m;  $\epsilon_r = 50.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 21 degC;  
Phantom section: Flat Section

DASY4 Configuration:  
- Probe: EX3DV4 - SN3555; ConvF(6.17, 6.17, 6.17); Calibrated: 9/19/2008  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008  
- Phantom: SAM 12-1; Type: SAM4.0; Serial: TP-1346  
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 0\_802.11b\_CH06\_orientation A\_5mm increments/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.402 mW/g

**Ant 0\_802.11b\_CH06\_orientation A\_5mm increments/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 7.07 V/m; Power Drift = -0.056 dB  
Peak SAR (extrapolated) = 0.579 W/kg  
**SAR(1 g) = 0.299 mW/g; SAR(10 g) = 0.150 mW/g**  
Maximum value of SAR (measured) = 0.323 mW/g





**Ant 1\_802.11a\_CH40\_orientation B\_5mm increments**

Date/Time: 5/24/2009 9:29:06 PM

Test Laboratory: Electronics Testing Center, Taiwan

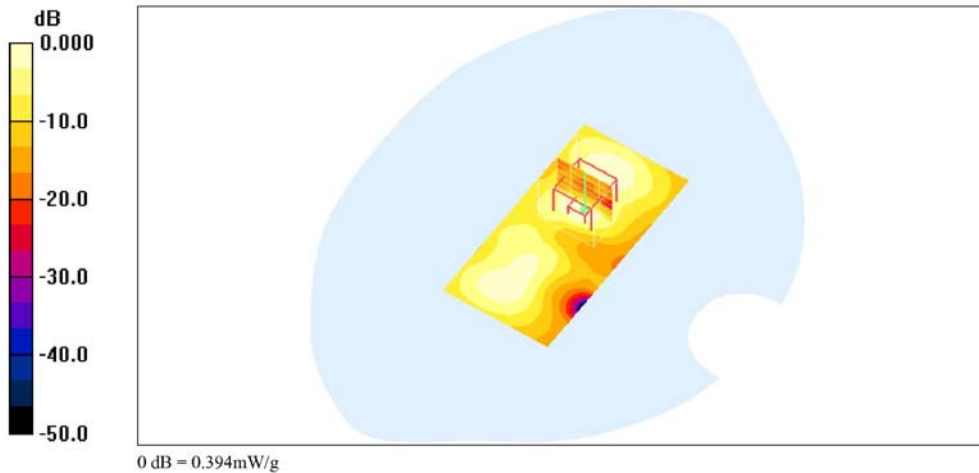
**DUT: USB dongle; Type: WNDA3100V2; Serial: N/A**

Communication System: IEEE 802.11a; Frequency: 5200 MHz; Duty Cycle: 1:1  
Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.18$  mho/m;  $\epsilon_r = 49.2$ ;  $\rho = 1000$  kg/m<sup>3</sup>  
Air temperature: 22 degC; Liquid temperature: 22.5 degC;  
Phantom section: Flat Section

DASY4 Configuration:  
- Probe: EX3DV4 - SN3555; ConvF(4.08, 4.08, 4.08); Calibrated: 9/19/2008  
- Sensor-Surface: 4mm (Mechanical Surface Detection)  
- Electronics: DAE4 Sn629; Calibrated: 9/23/2008  
- Phantom: SAM 12-2; Type: SAM4.0; Serial: TP-1347  
- Measurement SW: DASY4, V4.6 Build 23; Postprocessing SW: SEMCAD, V1.8 Build 160

**Ant 1\_802.11a\_CH40\_orientation B\_5mm increments/Area Scan (41x81x1):** Measurement grid: dx=15mm, dy=15mm  
Maximum value of SAR (interpolated) = 0.434 mW/g

**Ant 1\_802.11a\_CH40\_orientation B\_5mm increments/Zoom Scan (5x5x7)/Cube 0:** Measurement grid: dx=8mm, dy=8mm, dz=5mm  
Reference Value = 2.33 V/m; Power Drift = 0.155 dB  
Peak SAR (extrapolated) = 0.662 W/kg  
**SAR(1 g) = 0.312 mW/g; SAR(10 g) = 0.103 mW/g**  
Maximum value of SAR (measured) = 0.394 mW/g





## ANNEX C: DIPOLE CERTIFICATE

**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 **ETC (Auden)**

Certificate No: **D2450V2-764\_Sep08**

CALIBRATION CERTIFICATE																																															
Object	D2450V2 - SN: 764																																														
Calibration procedure(s)	QA CAL-05.v7 Calibration procedure for dipole validation kits																																														
Calibration date:	September 24, 2008																																														
Condition of the calibrated item	In Tolerance																																														
<p>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.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity &lt; 70%.</p> <p>Calibration Equipment used (M&amp;TE critical for calibration)</p> <table border="1"> <thead> <tr> <th>Primary Standards</th> <th>ID #</th> <th>Cal Date (Certificate No.)</th> <th>Scheduled Calibration</th> </tr> </thead> <tbody> <tr> <td>Power meter EPM-442A</td> <td>GB37480704</td> <td>04-Oct-07 (No. 217-00736)</td> <td>Oct-08</td> </tr> <tr> <td>Power sensor HP 8481A</td> <td>US37292783</td> <td>04-Oct-07 (No. 217-00736)</td> <td>Oct-08</td> </tr> <tr> <td>Reference 20 dB Attenuator</td> <td>SN: S5086 (20g)</td> <td>01-Jul-08 (No. 217-00864)</td> <td>Jul-09</td> </tr> <tr> <td>Type-N mismatch combination</td> <td>SN: 5047.2 / 06327</td> <td>01-Jul-08 (No. 217-00867)</td> <td>Jul-09</td> </tr> <tr> <td>Reference Probe ES3DV2</td> <td>SN: 3025</td> <td>28-Apr-08 (No. ES3-3025_Apr08)</td> <td>Apr-09</td> </tr> <tr> <td>DAE4</td> <td>SN: 601</td> <td>14-Mar-08 (No. DAE4-601_Mar08)</td> <td>Mar-09</td> </tr> </tbody> </table> <table border="1"> <thead> <tr> <th>Secondary Standards</th> <th>ID #</th> <th>Check Date (in house)</th> <th>Scheduled Check</th> </tr> </thead> <tbody> <tr> <td>Power sensor HP 8481A</td> <td>MY41092317</td> <td>18-Oct-02 (in house check Oct-07)</td> <td>In house check: Oct-09</td> </tr> <tr> <td>RF generator R&amp;S SMT-06</td> <td>100005</td> <td>4-Aug-99 (in house check Oct-07)</td> <td>In house check: Oct-09</td> </tr> <tr> <td>Network Analyzer HP 8753E</td> <td>US37390585 S4206</td> <td>18-Oct-01 (in house check Oct-07)</td> <td>In house check: Oct-08</td> </tr> </tbody> </table>				Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration	Power meter EPM-442A	GB37480704	04-Oct-07 (No. 217-00736)	Oct-08	Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08	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-07)	In house check: Oct-08
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Calibrated by:	Name Jeton Kastrati	Function Laboratory Technician	Signature 																																												
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 																																												
Issued: September 25, 2008																																															
This calibration certificate shall not be reproduced except in full without written approval of the laboratory.																																															



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**S** Servizio svizzero di taratura  
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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) DASY4/5 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.

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

**Head TSL parameters**

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Head TSL parameters</b>	22.0 °C	39.2	1.80 mho/m
<b>Measured Head TSL parameters</b>	(22.0 $\pm$ 0.2) °C	39.8 $\pm$ 6 %	1.80 mho/m $\pm$ 6 %
<b>Head TSL temperature during test</b>	(22.0 $\pm$ 0.2) °C	---	---

**SAR result with Head TSL**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Head TSL</b>	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>53.6 mW /g <math>\pm</math> 17.0 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Head TSL</b>	condition	
SAR measured	250 mW input power	6.19 mW / g
SAR normalized	normalized to 1W	24.8 mW / g
SAR for nominal Head TSL parameters <sup>1</sup>	normalized to 1W	<b>24.9 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	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	50.7 ± 6 %	1.97 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 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	12.7 mW / g
SAR normalized	normalized to 1W	50.8 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>49.5 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	5.83 mW / g
SAR normalized	normalized to 1W	23.3 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>22.9 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	52.3 $\Omega$ + 0.5 j $\Omega$
Return Loss	- 32.7 dB

**Antenna Parameters with Body TSL**

Impedance, transformed to feed point	47.8 $\Omega$ + 3.5 j $\Omega$
Return Loss	- 27.5 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.151 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	April 10, 2004



**DASY5 Validation Report for Head TSL**

Date/Time: 24.09.2008 12:28:28

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN764**

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

Medium: HSL U10 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.8$  mho/m;  $\epsilon_r = 39.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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 119; SEMCAD X Version 13.2 Build 87

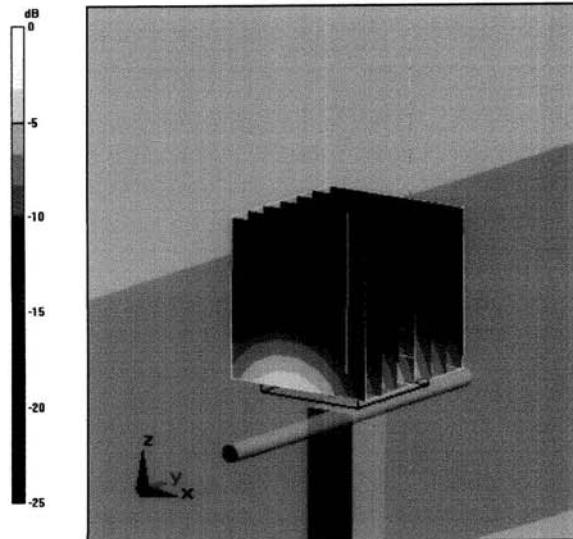
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.2 V/m; Power Drift = 0.014 dB

Peak SAR (extrapolated) = 27.6 W/kg

**SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.19 mW/g**

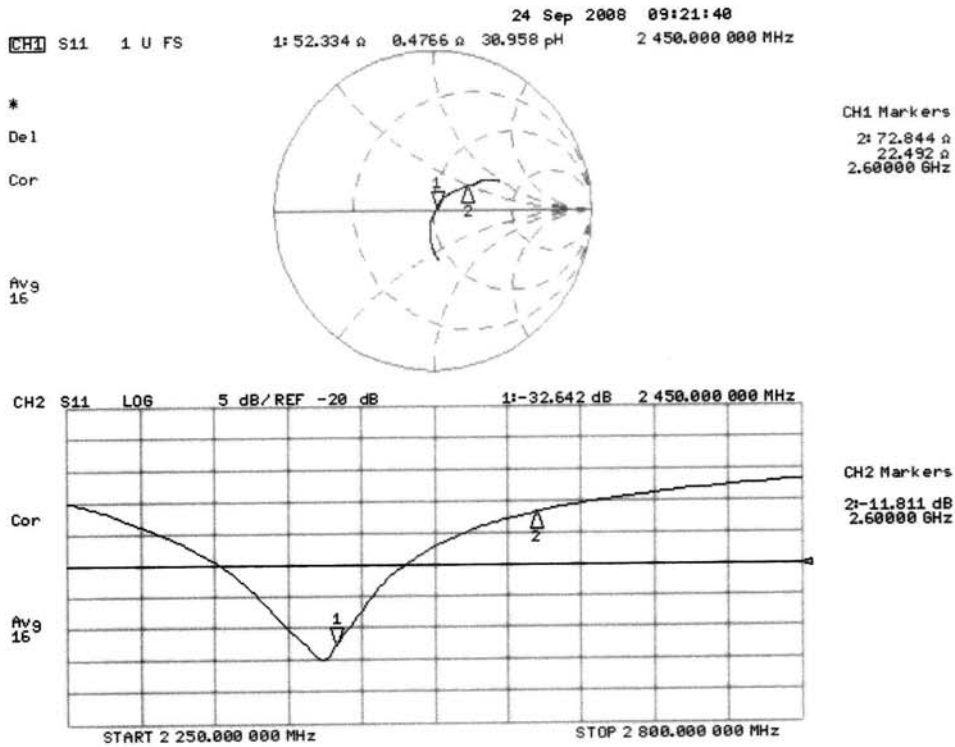
Maximum value of SAR (measured) = 15.8 mW/g



0 dB = 15.8mW/g



### Impedance Measurement Plot for Head TSL





**DASY5 Validation Report for Body TSL**

Date/Time: 18.09.2008 13:33:00

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:764**

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

Medium: MSL U10 BB

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.97$  mho/m;  $\epsilon_r = 50.7$ ;  $\rho = 1000$  kg/m<sup>3</sup>

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 119; SEMCAD X Version 13.2 Build 87

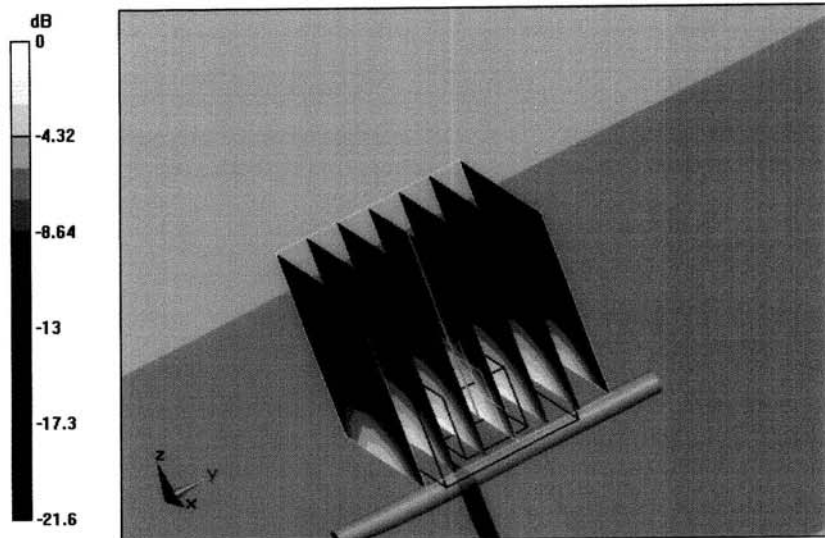
**Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0:** Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.8 V/m; Power Drift = 0.029 dB

Peak SAR (extrapolated) = 26.4 W/kg

**SAR(1 g) = 12.7 mW/g; SAR(10 g) = 5.83 mW/g**

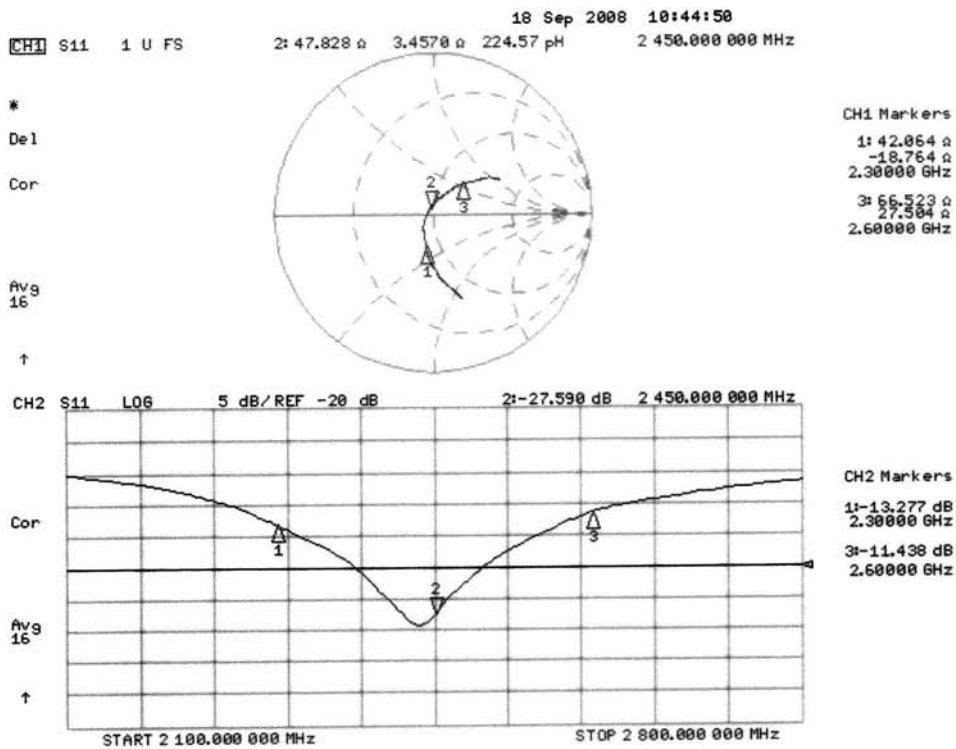
Maximum value of SAR (measured) = 15.7 mW/g



0 dB = 15.7mW/g



### Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **ETC (Auden)**

Certificate No: **D5GHzV2-1030\_Sep08**

**CALIBRATION CERTIFICATE**

Object **D5GHzV2 - SN: 1030**

Calibration procedure(s) **QA CAL-22.v1  
Calibration procedure for dipole validation kits between 3-6 GHz**

Calibration date: **September 19, 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 ± 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	04-Oct-07 (No. 217-00736)	Oct-08
Power sensor HP 8481A	US37292783	04-Oct-07 (No. 217-00736)	Oct-08
Reference 20 dB Attenuator	SN: 5086 (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 EX3DV4	SN: 3503	8-Mar-08 (No. EX3-3503_Mar08)	Mar-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-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	<b>Jeton Kastrati</b>	<b>Laboratory Technician</b>	
Approved by:	<b>Katja Pokovic</b>	<b>Technical Manager</b>	

Issued: September 22, 2008

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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) IEC Std 62209 Part 2, "Evaluation of Human Exposure to Radio Frequency Fields from Handheld and Body-Mounted Wireless Communication Devices in the Frequency Range of 30 MHz to 6 GHz: Human models, Instrumentation, and Procedures"; Part 2: "Procedure to determine the Specific Absorption Rate (SAR) for including accessories and multiple transmitters", Draft Version 0.9, December 2004
- b) 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:**

- c) 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.

<b>DASY Version</b>	DASY5	V5.0
<b>Extrapolation</b>	Advanced Extrapolation	
<b>Phantom</b>	Modular Flat Phantom V5.0	
<b>Distance Dipole Center - TSL</b>	10 mm	with Spacer
<b>Area Scan resolution</b>	dx, dy = 10 mm	
<b>Zoom Scan Resolution</b>	dx, dy = 4.0 mm, dz = 2.5 mm	
<b>Frequency</b>	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

**Body TSL parameters at 5200 MHz**

The following parameters and calculations were applied.

	<b>Temperature</b>	<b>Permittivity</b>	<b>Conductivity</b>
<b>Nominal Body TSL parameters</b>	22.0 °C	49.0	5.30 mho/m
<b>Measured Body TSL parameters</b>	(22.0 ± 0.2) °C	47.6 ± 6 %	5.43 mho/m ± 6 %
<b>Body TSL temperature during test</b>	(22.0 ± 0.2) °C	---	---

**SAR result with Body TSL at 5200 MHz**

<b>SAR averaged over 1 cm<sup>3</sup> (1 g) of Body TSL</b>	condition	
SAR measured	100 mW input power	7.47 mW / g
SAR normalized	normalized to 1W	74.7 mW / g
SAR for nominal Body TSL parameters <sup>1</sup>	normalized to 1W	<b>74.0 mW / g ± 19.9 % (k=2)</b>

<b>SAR averaged over 10 cm<sup>3</sup> (10 g) of Body TSL</b>	condition	
SAR measured	100 mW input power	2.08 mW / g
SAR normalized	normalized to 1W	20.8 mW / g
SAR for nominal Body TSL parameters <sup>1</sup>	normalized to 1W	<b>20.7 mW / g ± 19.5 % (k=2)</b>

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





**Body TSL parameters at 5500 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.78 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	---	---

**SAR result with Body TSL at 5500 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	condition	
SAR measured	100 mW input power	7.80 mW / g
SAR normalized	normalized to 1W	78.0 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>77.2 mW / g ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.15 mW / g
SAR normalized	normalized to 1W	21.5 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>21.3 mW / g ± 19.5 % (k=2)</b>

**Body TSL parameters at 5800 MHz**

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.20 mho/m ± 6 %
Body TSL temperature during test	(22.0 ± 0.2) °C	---	---

**SAR result with Body TSL at 5800 MHz**

SAR averaged over 1 cm <sup>3</sup> (1 g) of Body TSL	condition	
SAR measured	100 mW input power	6.87 mW / g
SAR normalized	normalized to 1W	68.7 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>67.8 mW / g ± 19.9 % (k=2)</b>

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	100 mW input power	1.89 mW / g
SAR normalized	normalized to 1W	18.9 mW / g
SAR for nominal Body TSL parameters <sup>2</sup>	normalized to 1W	<b>18.7 mW / g ± 19.5 % (k=2)</b>

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



**Appendix**

**Antenna Parameters with Body TSL at 5200 MHz**

Impedance, transformed to feed point	52.2 $\Omega$ - 7.0 j $\Omega$
Return Loss	-22.9 dB

**Antenna Parameters with Body TSL at 5500 MHz**

Impedance, transformed to feed point	55.5 $\Omega$ - 0.4 j $\Omega$
Return Loss	-25.6 dB

**Antenna Parameters with Body TSL at 5800 MHz**

Impedance, transformed to feed point	58.9 $\Omega$ -1.4 j $\Omega$
Return Loss	-21.6 dB

**General Antenna Parameters and Design**

Electrical Delay (one direction)	1.198 ns
----------------------------------	----------

After long term use with 40 W 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 09, 2004



**DASY5 Validation Report for Body TSL**

Date/Time: 19.09.2008 17:49:06

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 5GHz; Type: D5GHz; Serial: D5GHzV2 - SN:1030**

Communication System: CW-5GHz; Frequency: 5200 MHzFrequency: 5500 MHzFrequency: 5800 MHz;  
Duty Cycle: 1:1

Medium: MSL 5800 MHz

Medium parameters used:  $f = 5200$  MHz;  $\sigma = 5.43$  mho/m;  $\epsilon_r = 47.6$ ;  $\rho = 1000$  kg/m<sup>3</sup> Medium parameters used:  $f = 5500$  MHz;  $\sigma = 5.78$  mho/m;  $\epsilon_r = 46.9$ ;  $\rho = 1000$  kg/m<sup>3</sup> Medium parameters used:  $f = 5800$  MHz;  $\sigma = 6.2$  mho/m;  $\epsilon_r = 46.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

**DASY5 Configuration:**

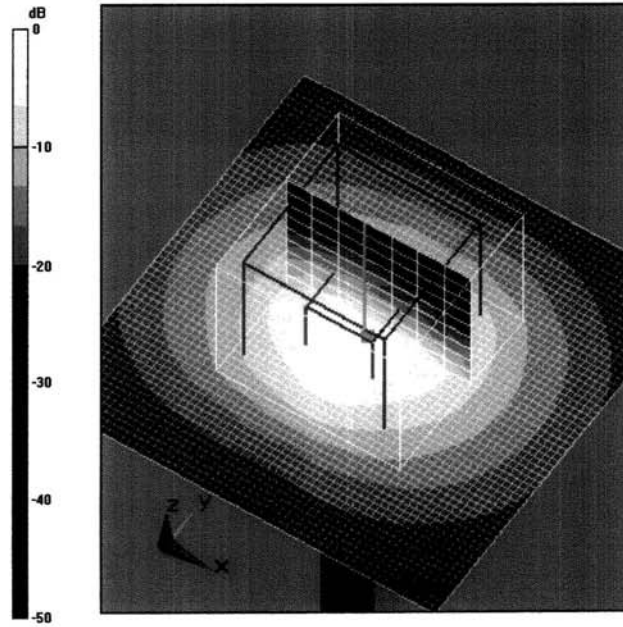
- Probe: EX3DV4 - SN3503; ConvF(4.95, 4.95, 4.95)ConvF(4.61, 4.61, 4.61)ConvF(4.74, 4.74, 4.74); Calibrated: 08.03.2008
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 14.03.2008
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.0 Build 119; SEMCAD X Version 13.2 Build 87

**d=10mm, Pin=100mW, f=5200 MHz/Area Scan (61x61x1):** Measurement grid: dx=10mm, dy=10mm  
Maximum value of SAR (interpolated) = 15.5 mW/g

**d=10mm, Pin=100mW, f=5200 MHz/Zoom Scan (8x8x10), dist=2mm (8x8x10)/Cube 0:**  
Measurement grid: dx=4mm, dy=4mm, dz=2.5mm  
Reference Value = 57.4 V/m; Power Drift = 0.063 dB  
Peak SAR (extrapolated) = 28.6 W/kg  
**SAR(1 g) = 7.47 mW/g; SAR(10 g) = 2.08 mW/g**  
Maximum value of SAR (measured) = 15.8 mW/g

**d=10mm, Pin=100mW, f=5500 MHz/Zoom Scan (8x8x10), dist=2mm (8x8x10)/Cube 0:**  
Measurement grid: dx=4mm, dy=4mm, dz=2.5mm  
Reference Value = 57.1 V/m; Power Drift = 0.043 dB  
Peak SAR (extrapolated) = 32.1 W/kg  
**SAR(1 g) = 7.8 mW/g; SAR(10 g) = 2.15 mW/g**  
Maximum value of SAR (measured) = 16.7 mW/g

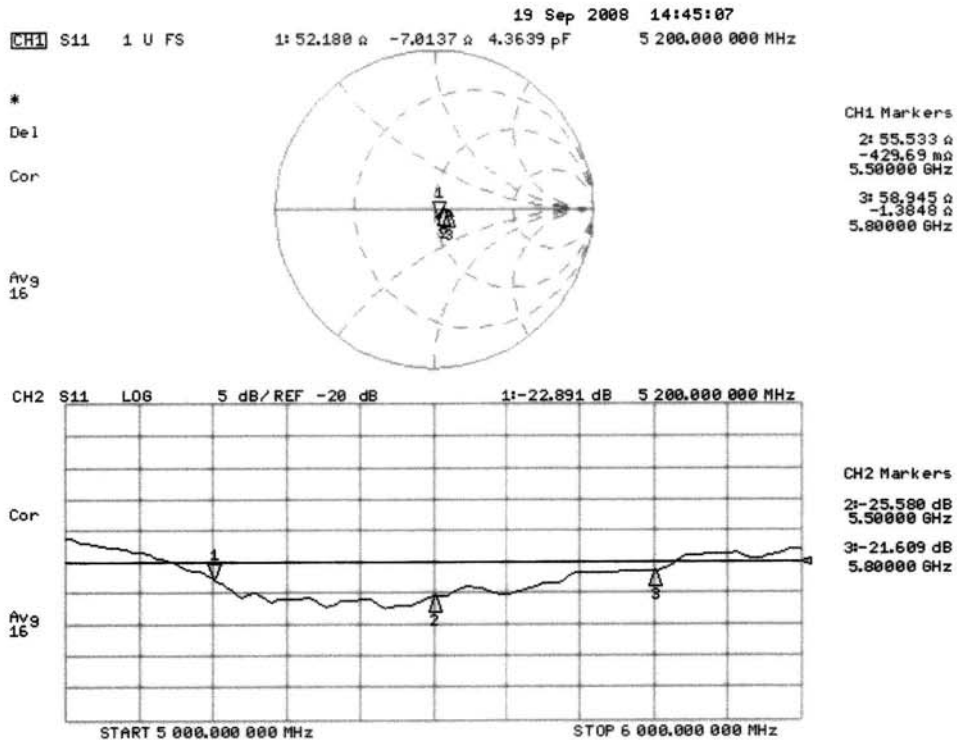
**d=10mm, Pin=100mW, f=5800 MHz/Zoom Scan (8x8x10), dist=2mm (8x8x10)/Cube 0:**  
Measurement grid: dx=4mm, dy=4mm, dz=2.5mm  
Reference Value = 52.2 V/m; Power Drift = -0.037 dB  
Peak SAR (extrapolated) = 29.7 W/kg  
**SAR(1 g) = 6.87 mW/g; SAR(10 g) = 1.89 mW/g**  
Maximum value of SAR (measured) = 15 mW/g



0 dB = 15mW/g



### Impedance Measurement Plot for Body TSL





## ANNEX D: PROBE CERTIFICATE

**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 **ETC (Auden)**

Certificate No: **EX3-3555\_Sep08**

### CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3555**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-14.v3 and QA CAL-23.v3  
Calibration procedure for dosimetric E-field probes**

Calibration date: **September 19, 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 ± 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)	1-Jul-08 (No. 217-00865)	Jul-09
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-08 (No. 217-00787)	Apr-09
Reference 30 dB Attenuator	SN: S5129 (30b)	1-Jul-08 (No. 217-00866)	Jul-09
Reference Probe ES3DV2	SN: 3013	2-Jan-08 (No. ES3-3013_Jan08)	Jan-09
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-07)	In house check: Oct-08

Calibrated by:	Name <b>Katja Pokovic</b>	Function <b>Technical Manager</b>	Signature 
Approved by:	Name <b>Niels Kuster</b>	Function <b>Quality Manager</b>	

Issued: September 20, 2008

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



**Calibration Laboratory of**  
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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 $\varphi$	$\varphi$ 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.



EX3DV4 SN:3555

September 19, 2008

# Probe EX3DV4

## SN:3555

Manufactured:	July 13, 2004
Last calibrated:	September 27, 2007
Recalibrated:	September 19, 2008

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)





EX3DV4 SN:3555

September 19, 2008

**DASY - Parameters of Probe: EX3DV4 SN:3555**

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

Diode Compression<sup>B</sup>

NormX	0.40 ± 10.1%	μV/(V/m) <sup>2</sup>	DCP X	95 mV
NormY	0.41 ± 10.1%	μV/(V/m) <sup>2</sup>	DCP Y	103 mV
NormZ	0.40 ± 10.1%	μV/(V/m) <sup>2</sup>	DCP Z	93 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 <sub>be</sub> [%]	Without Correction Algorithm	10.4	6.0
SAR <sub>be</sub> [%]	With Correction Algorithm	0.8	0.5

TSL                    1750 MHz      Typical SAR gradient: 10 % per mm

Sensor Center to Phantom Surface Distance		2.0 mm	3.0 mm
SAR <sub>be</sub> [%]	Without Correction Algorithm	8.6	4.6
SAR <sub>be</sub> [%]	With Correction Algorithm	0.6	0.1

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.

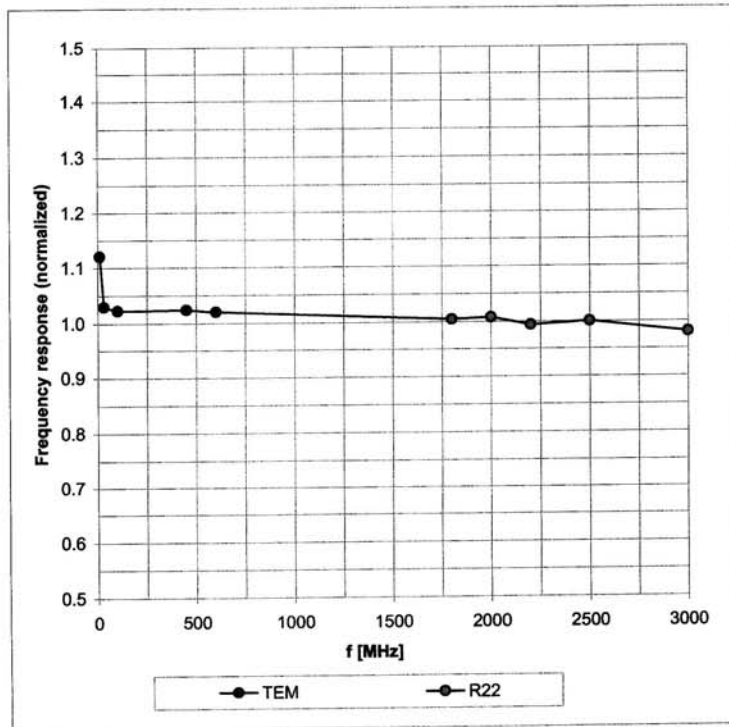


EX3DV4 SN:3555

September 19, 2008

### Frequency Response of E-Field

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



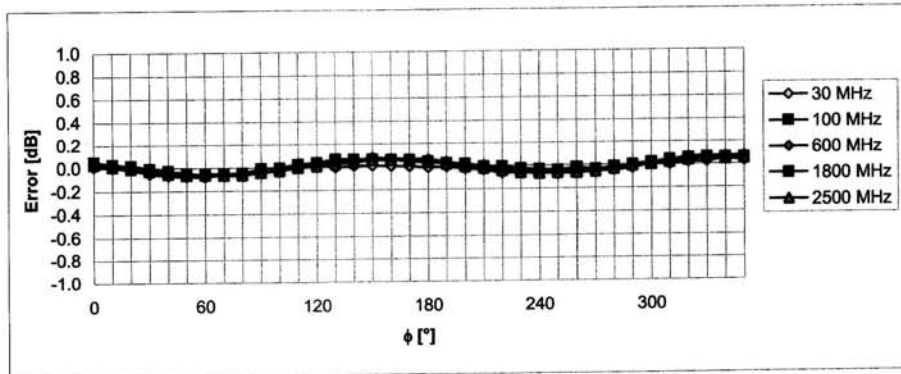
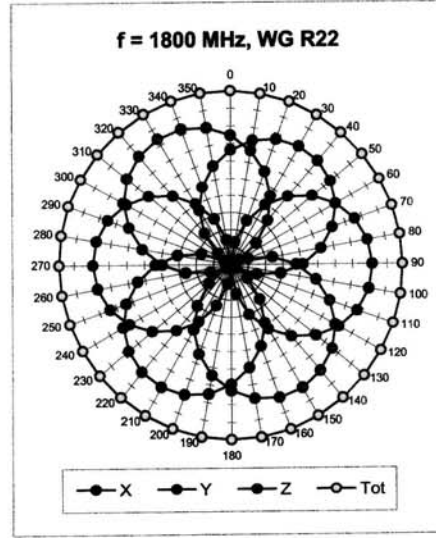
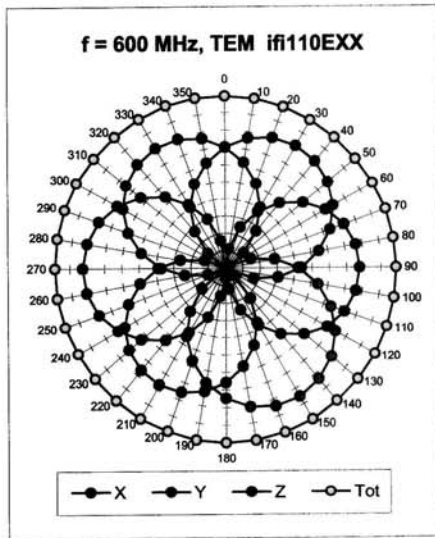
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  (k=2)



EX3DV4 SN:3555

September 19, 2008

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



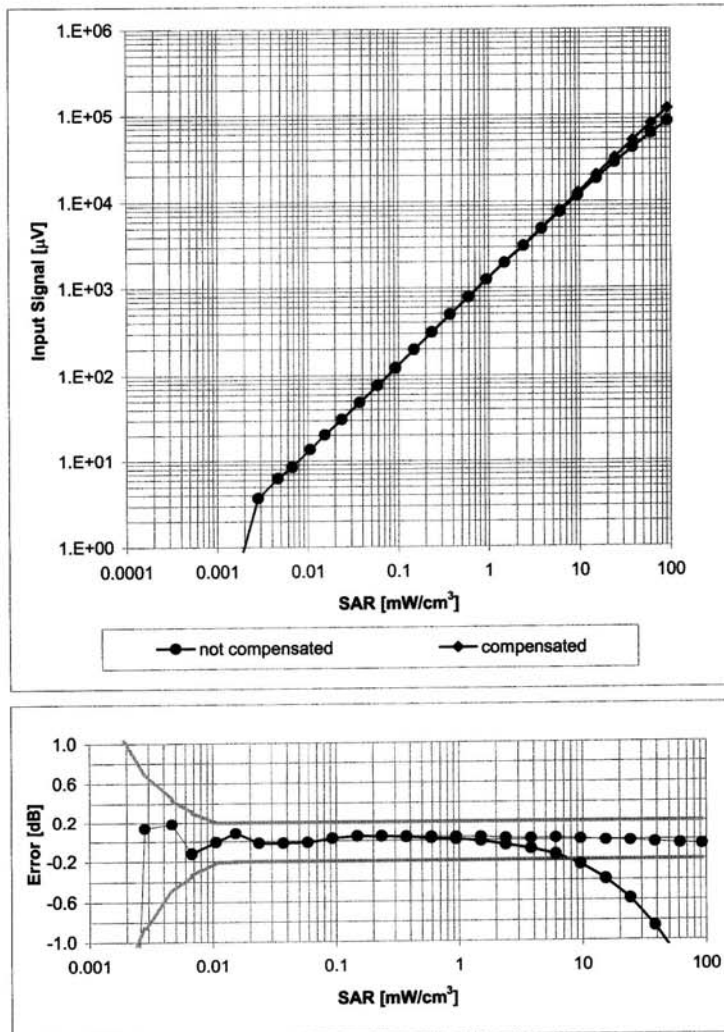
Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )



EX3DV4 SN:3555

September 19, 2008

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



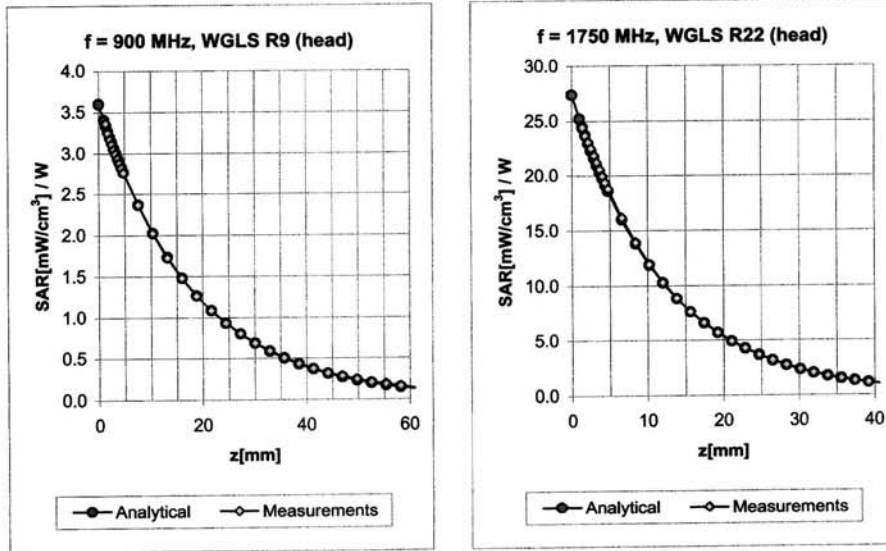
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )



EX3DV4 SN:3555

September 19, 2008

### Conversion Factor Assessment



f [MHz]	Validity [MHz] <sup>c</sup>	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF	Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.29	1.13	8.03	± 11.0% (k=2)
1750	± 50 / ± 100	Head	40.1 ± 5%	1.37 ± 5%	0.39	0.79	7.03	± 11.0% (k=2)
1950	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.66	0.62	6.68	± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.47	0.72	6.40	± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.30	1.17	8.01	± 11.0% (k=2)
1750	± 50 / ± 100	Body	53.4 ± 5%	1.49 ± 5%	0.38	0.85	6.87	± 11.0% (k=2)
1950	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.32	0.92	6.70	± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.34	1.00	6.17	± 11.0% (k=2)
5200	± 50 / ± 100	Body	49.0 ± 5%	5.30 ± 5%	0.48	1.70	4.08	± 13.1% (k=2)
5500	± 50 / ± 100	Body	48.6 ± 5%	5.65 ± 5%	0.48	1.70	3.86	± 13.1% (k=2)
5800	± 50 / ± 100	Body	48.2 ± 5%	6.00 ± 5%	0.48	1.70	3.82	± 13.1% (k=2)

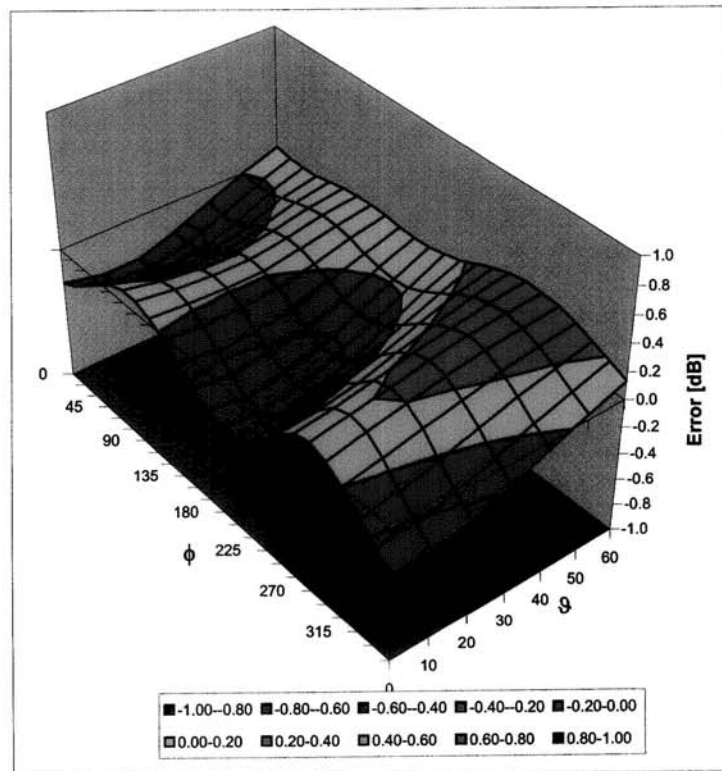
<sup>c</sup> The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.



EX3DV4 SN:3555

September 19, 2008

### Deviation from Isotropy in HSL Error ( $\phi$ , $\theta$ ), $f = 900$ MHz



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

