



ESTECH Co., Ltd.

Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea

TEL: 82-2-867-3201
FAX: 82-2-867-3204

APPENDIX A : Validation Test Data of Tissue



ESTECH Co., Ltd.

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TEL: 82-2-867-3201
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- Head Tissue(2450MHz)



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SubTitle

June 05, 2009

Frequency	e'	e''
2.400000000 GHz	37.4497	13.4212
2.401963461 GHz	37.4375	13.4376
2.403926921 GHz	37.4330	13.4534
2.405890382 GHz	37.4326	13.4606
2.407853843 GHz	37.4330	13.4618
2.409817303 GHz	37.4345	13.4783
2.411788795 GHz	37.4296	13.4728
2.413760288 GHz	37.4380	13.4839
2.415731780 GHz	37.4221	13.4816
2.417703272 GHz	37.4239	13.4844
2.419674764 GHz	37.4336	13.4836
2.421654321 GHz	37.4378	13.4791
2.423633878 GHz	37.4379	13.4831
2.425613435 GHz	37.4417	13.4815
2.427592991 GHz	37.4363	13.4819
2.429572548 GHz	37.4375	13.4906
2.431560202 GHz	37.4318	13.4803
2.433547856 GHz	37.4588	13.4738
2.435535511 GHz	37.4504	13.4738
2.437523165 GHz	37.4428	13.4678
2.439510819 GHz	37.4371	13.4711
2.441506604 GHz	37.4552	13.4635
2.443502388 GHz	37.4571	13.4526
2.445498173 GHz	37.4472	13.4404
2.447493958 GHz	37.4301	13.4394
2.449489743 GHz	37.4248	13.4396
2.451493691 GHz	37.4124	13.4511
2.453497640 GHz	37.4223	13.4500
2.455501589 GHz	37.4085	13.4464
2.457505537 GHz	37.4020	13.4315
2.459509486 GHz	37.3897	13.4429
2.461521632 GHz	37.3740	13.4301
2.463533778 GHz	37.3676	13.4422
2.465545923 GHz	37.3410	13.4491
2.467558069 GHz	37.3418	13.4499
2.469570215 GHz	37.3309	13.4495
2.471590592 GHz	37.3043	13.4564
2.473610968 GHz	37.2981	13.4683
2.475631345 GHz	37.2801	13.4791
2.477651722 GHz	37.2622	13.4898
2.479672098 GHz	37.2384	13.4999
2.481700739 GHz	37.2141	13.5158
2.483729380 GHz	37.1983	13.5356
2.485758021 GHz	37.1759	13.5339
2.487786662 GHz	37.1591	13.5491
2.489815303 GHz	37.1477	13.5708
2.491852243 GHz	37.1239	13.5838
2.493889182 GHz	37.0974	13.5935
2.495926121 GHz	37.0763	13.6097
2.497963061 GHz	37.0602	13.6352
2.500000000 GHz	37.0537	13.6529

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- 2450MHz Body Tissue

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SubTitle

June 05, 2009

Frequency	ϵ'	ϵ''
2.400000000 GHz	52.1859	13.9910
2.401963461 GHz	52.1987	13.9971
2.403926921 GHz	52.1862	14.0010
2.405890382 GHz	52.1739	14.0049
2.407853843 GHz	52.1444	14.0040
2.409817303 GHz	52.1441	14.0114
2.411788795 GHz	52.1330	14.0251
2.413760288 GHz	52.1255	14.0268
2.415731780 GHz	52.1196	14.0415
2.417703272 GHz	52.1107	14.0449
2.419674764 GHz	52.1095	14.0424
2.421654321 GHz	52.0956	14.0447
2.423633878 GHz	52.0770	14.0492
2.425613435 GHz	52.0651	14.0678
2.427592991 GHz	52.0703	14.0761
2.429572548 GHz	52.0632	14.0925
2.431560202 GHz	52.0611	14.0950
2.433547856 GHz	52.0306	14.0811
2.435535511 GHz	52.0295	14.0900
2.437523165 GHz	52.0131	14.1108
2.439510819 GHz	52.0128	14.1262
2.441506604 GHz	52.0137	14.1250
2.443502388 GHz	51.9989	14.1290
2.445498173 GHz	51.9950	14.1415
2.447493958 GHz	51.9802	14.1455
2.449489743 GHz	51.9597	14.1567
2.451493691 GHz	51.9604	14.1785
2.453497640 GHz	51.9672	14.1699
2.455501589 GHz	51.9693	14.1750
2.457505537 GHz	51.9482	14.1797
2.459509486 GHz	51.9449	14.1689
2.461521632 GHz	51.9329	14.1922
2.463533778 GHz	51.9387	14.2001
2.465545923 GHz	51.9194	14.2177
2.467558069 GHz	51.9235	14.2125
2.469570215 GHz	51.9035	14.2236
2.471590592 GHz	51.9123	14.2277
2.473610968 GHz	51.9118	14.2363
2.475631345 GHz	51.9012	14.2428
2.477651722 GHz	51.9092	14.2404
2.479672098 GHz	51.8987	14.2469
2.481700739 GHz	51.8886	14.2566
2.483729380 GHz	51.8790	14.2696
2.485758021 GHz	51.8764	14.2734
2.487786662 GHz	51.8733	14.2854
2.489815303 GHz	51.8551	14.2946
2.491852243 GHz	51.8592	14.2859
2.493889182 GHz	51.8627	14.2970
2.495926121 GHz	51.8378	14.2922
2.497963061 GHz	51.8367	14.3170
2.500000000 GHz	51.8256	14.3169



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APPENDIX B : Validation Test Data

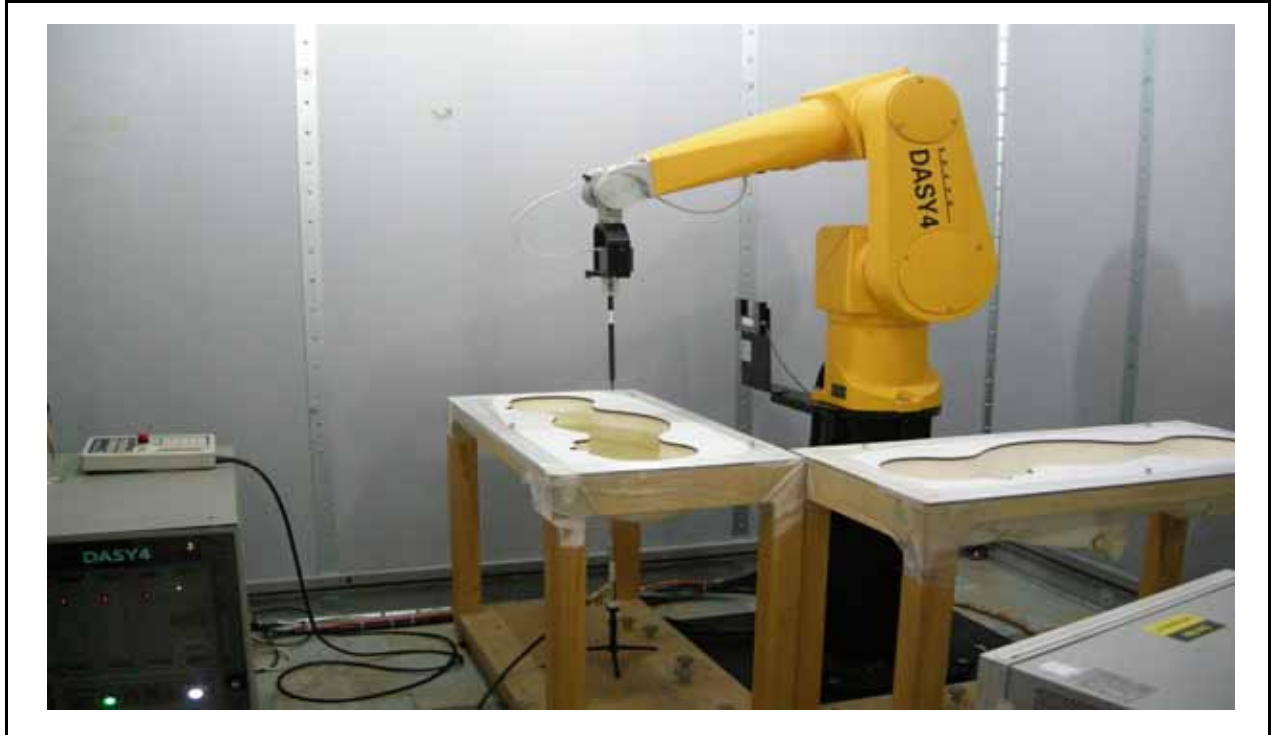


ESTECH Co., Ltd.

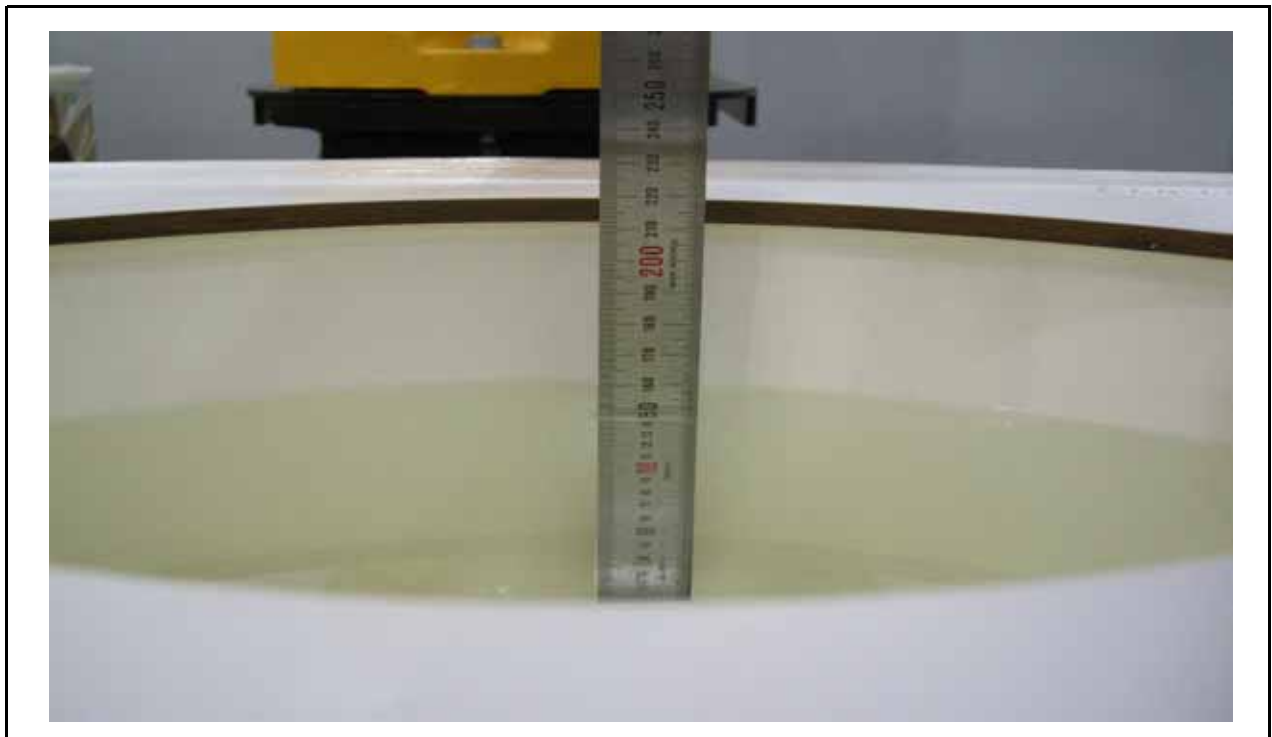
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Dipole Validation



Liquid depth



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- 2450MHz Validation

Date: 2009-06-05

Test Laboratory: ESTECH

validation

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

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

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.83$ mho/m; $\epsilon_r = 37.4$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.44, 4.44, 4.44); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x61x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 17.6 mW/g

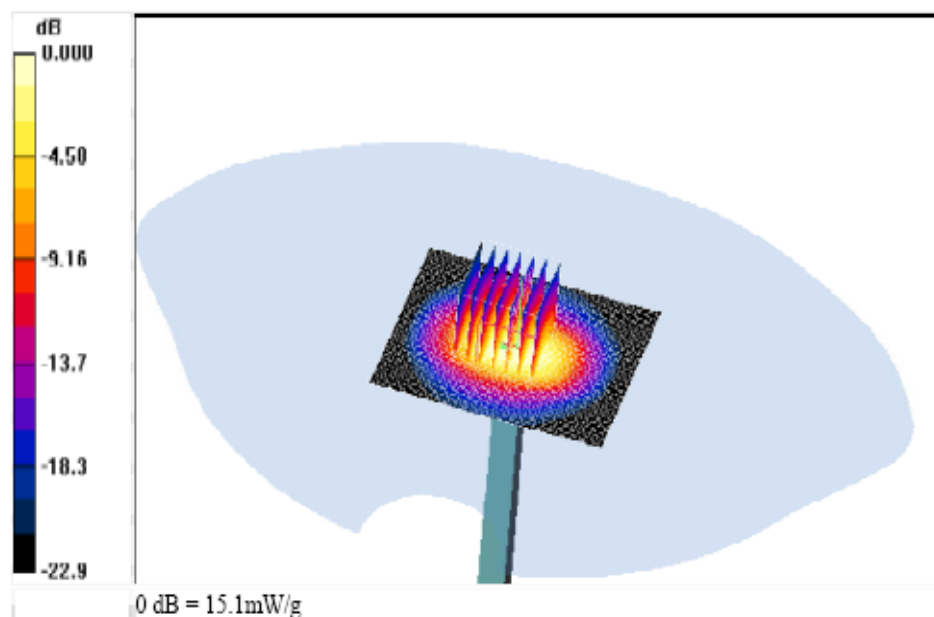
Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 91.6 V/m; Power Drift = -0.032 dB

Peak SAR (extrapolated) = 27.6 W/kg

SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.03 mW/g

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





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APPENDIX C : SAR Test Data

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- 2450MHz 802.11b Battery : Standard

Date: 2009-06-05

Test Laboratory: ESTECH

BODY FRONT 11b

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.001 mW/g

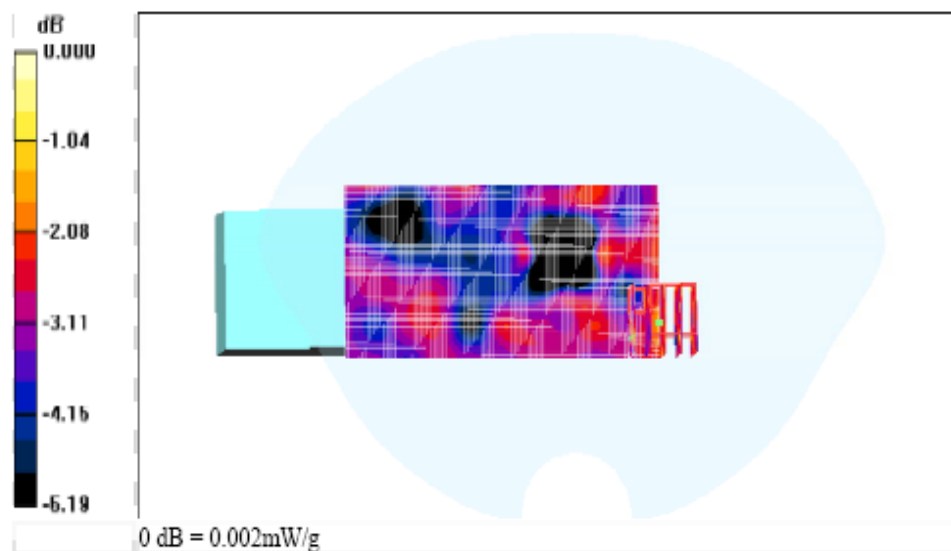
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 0.647 V/m; Power Drift = 0.790 dB

Peak SAR (extrapolated) = 0.002 W/kg

SAR(1 g) = 0.00128 mW/g; SAR(10 g) = 0.00112 mW/g

Maximum value of SAR (measured) = 0.002 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.007 mW/g

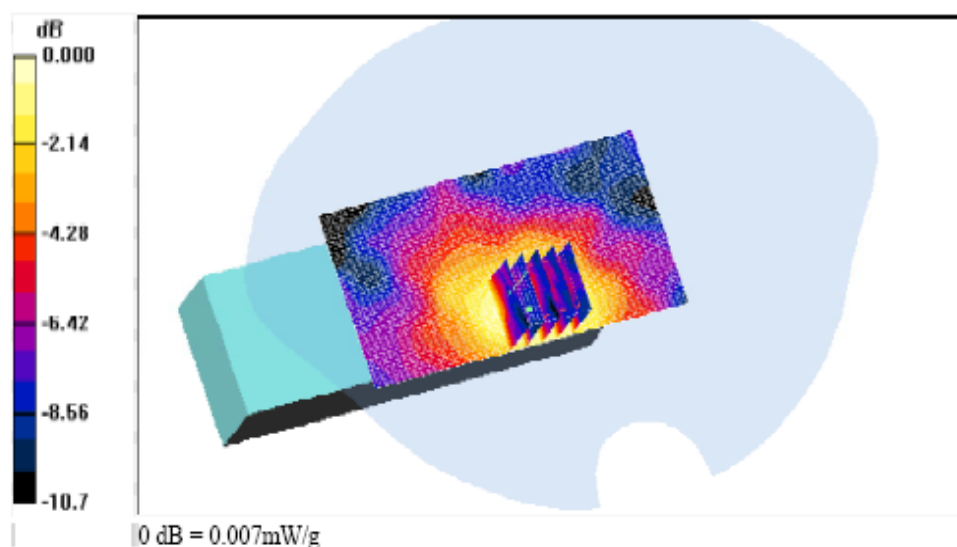
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.10 V/m; Power Drift = 0.401 dB

Peak SAR (extrapolated) = 0.018 W/kg

SAR(1 g) = 0.00691 mW/g; SAR(10 g) = 0.00404 mW/g

Maximum value of SAR (measured) = 0.007 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22°C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.006 mW/g

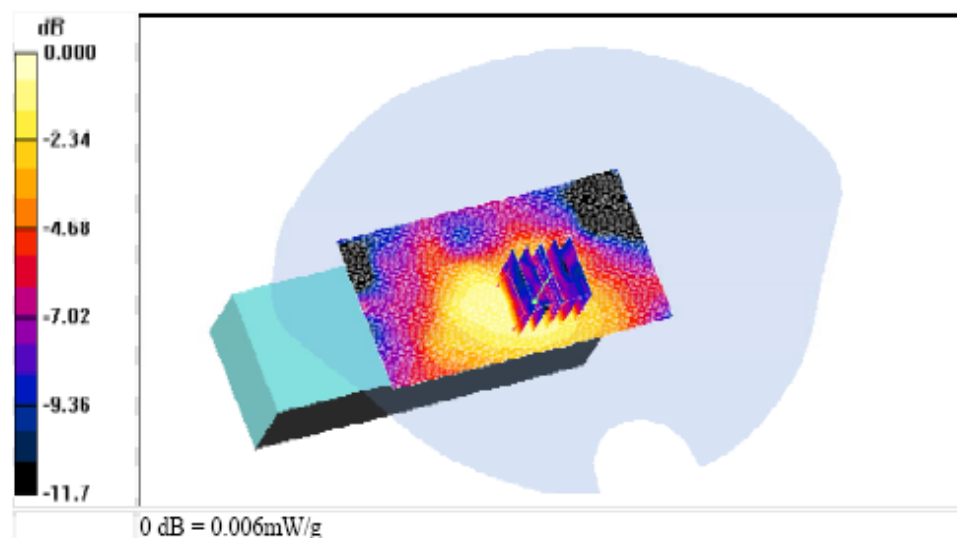
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.15 V/m; Power Drift = -0.339 dB

Peak SAR (extrapolated) = 0.012 W/kg

SAR(1 g) = 0.00525 mW/g; SAR(10 g) = 0.0031 mW/g

Maximum value of SAR (measured) = 0.006 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b HI

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.007 mW/g

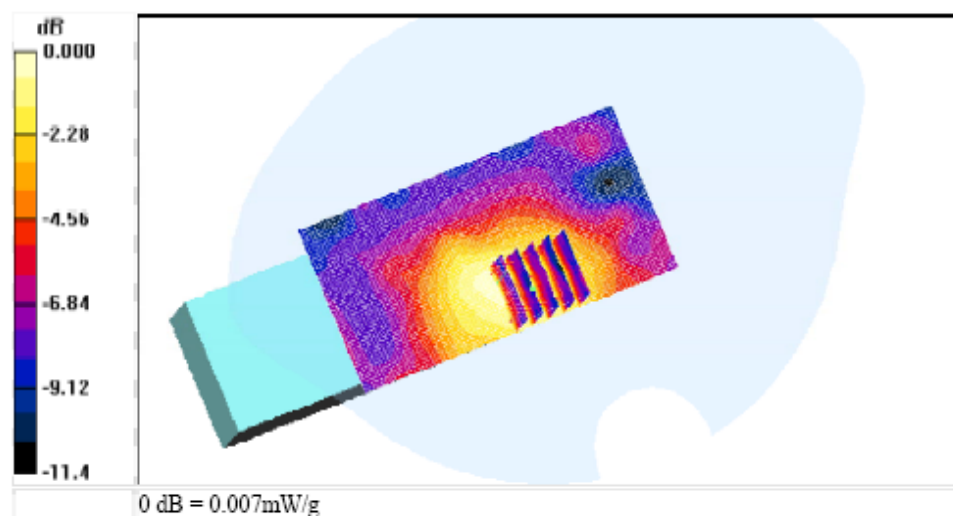
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.15 V/m; Power Drift = 0.265 dB

Peak SAR (extrapolated) = 0.018 W/kg

SAR(1 g) = 0.00682 mW/g; SAR(10 g) = 0.004 mW/g

Maximum value of SAR (measured) = 0.007 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

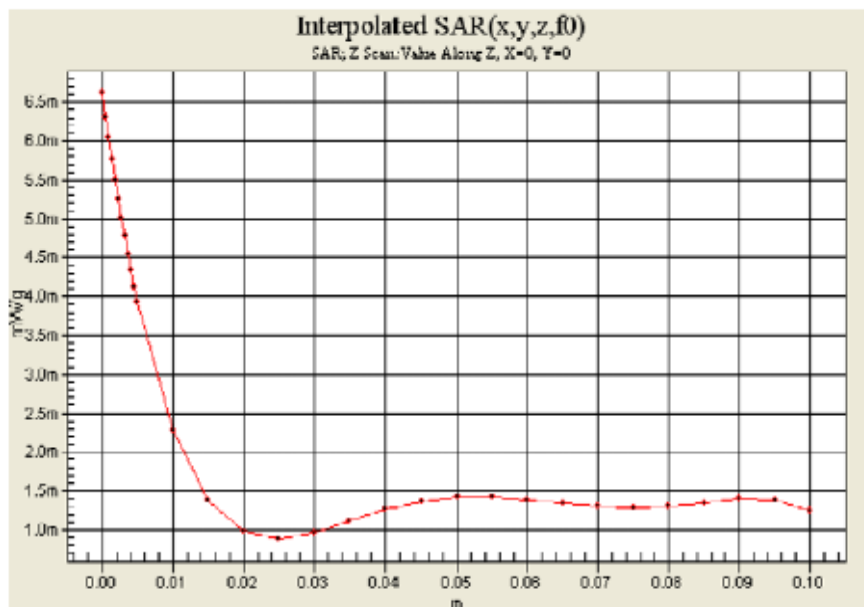
Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.007 mW/g

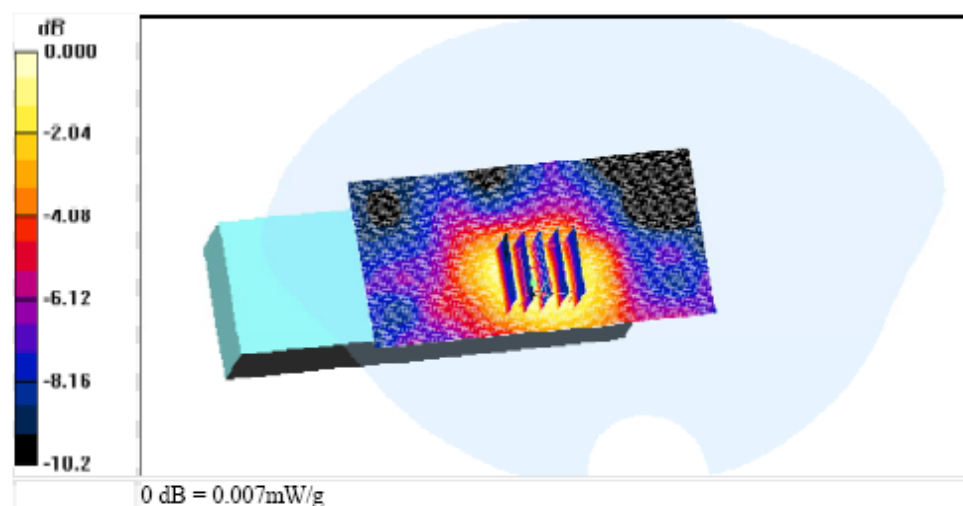
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.02 V/m; Power Drift = 0.160 dB

Peak SAR (extrapolated) = 0.016 W/kg

SAR(1 g) = 0.00662 mW/g; SAR(10 g) = 0.00394 mW/g

Maximum value of SAR (measured) = 0.007 mW/g



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- 2450MHz 802.11g

Date: 2009-06-05

Test Laboratory: ESTECH

BODY FRONT 11g

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASy4 (High Precision Assessment)

DASy4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASy4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.004 mW/g

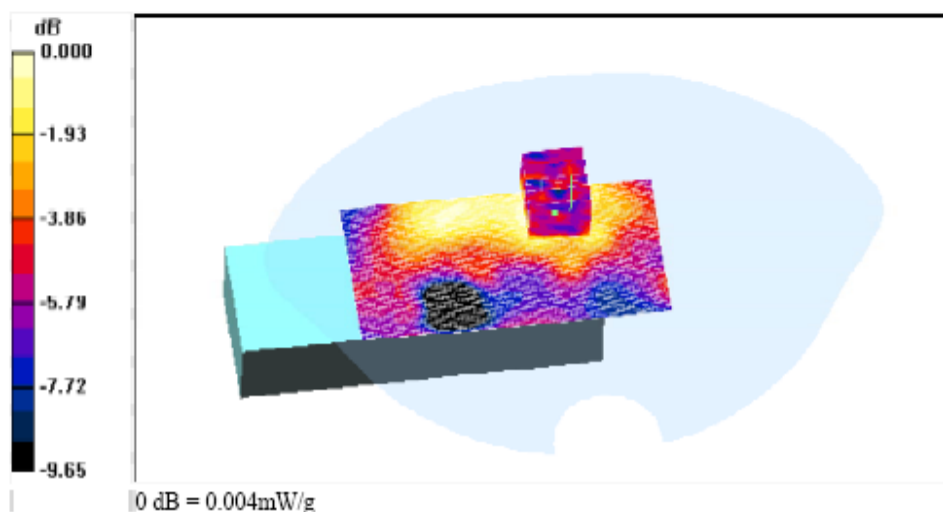
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 0.875 V/m; Power Drift = 0.409 dB

Peak SAR (extrapolated) = 0.007 W/kg

SAR(1 g) = 0.00405 mW/g; SAR(10 g) = 0.00257 mW/g

Maximum value of SAR (measured) = 0.004 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.008 mW/g

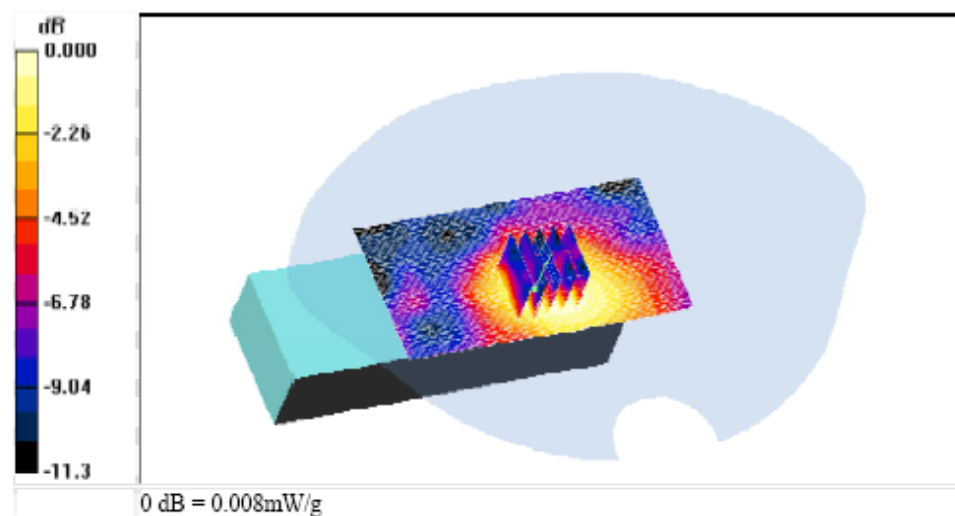
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.59 V/m; Power Drift = 0.290 dB

Peak SAR (extrapolated) = 0.013 W/kg

SAR(1 g) = 0.00744 mW/g; SAR(10 g) = 0.00445 mW/g

Maximum value of SAR (measured) = 0.008 mW/g



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FAX: 82-2-867-3204

Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g HI

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.008 mW/g

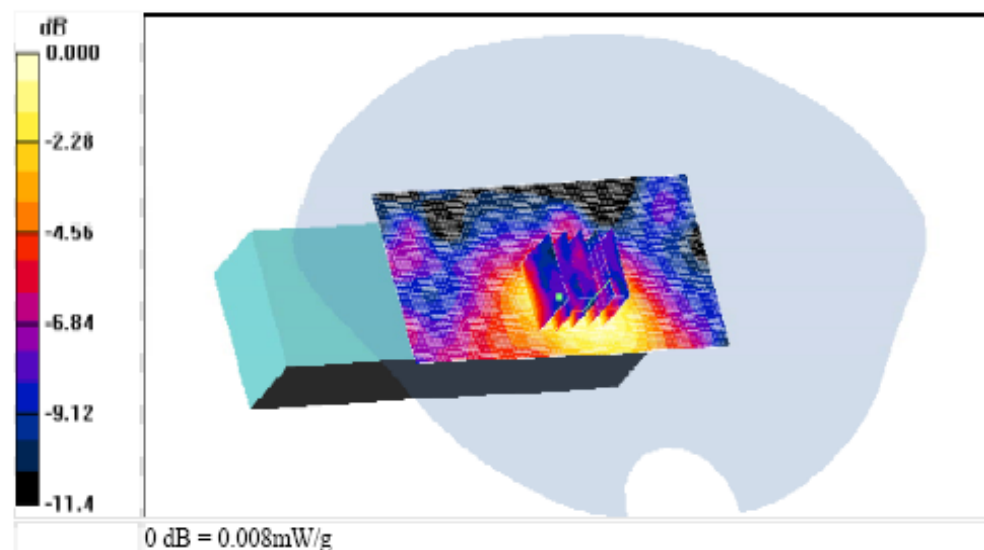
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.15 V/m; Power Drift = 0.267 dB

Peak SAR (extrapolated) = 0.015 W/kg

SAR(1 g) = 0.00764 mW/g; SAR(10 g) = 0.00439 mW/g

Maximum value of SAR (measured) = 0.008 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g HI

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2462 MHz; Duty Cycle: 1:1

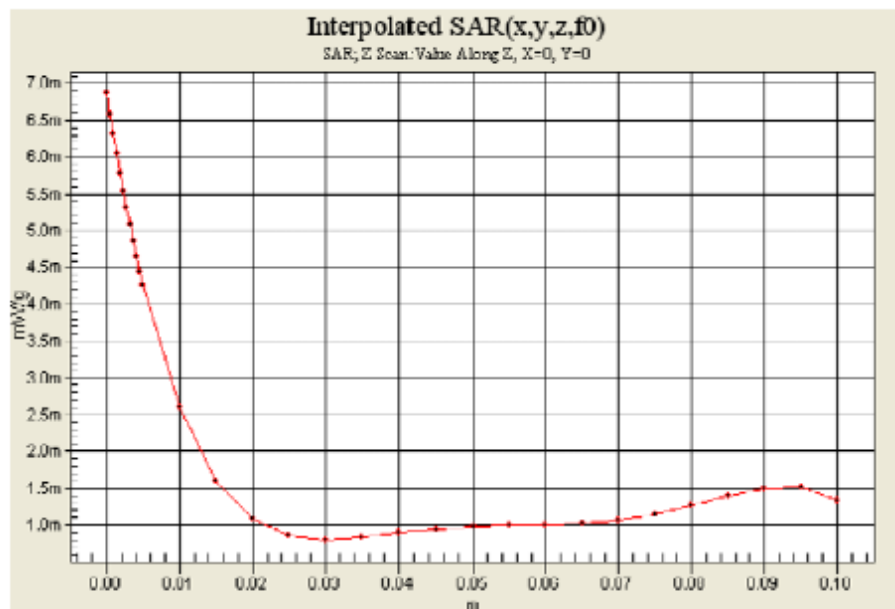
Medium parameters used: $f = 2462$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186



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- 2450MHz 802.11b Battery : Extended

Date: 2009-06-05

Test Laboratory: ESTECH

BODY FRONT 11b

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.006 mW/g

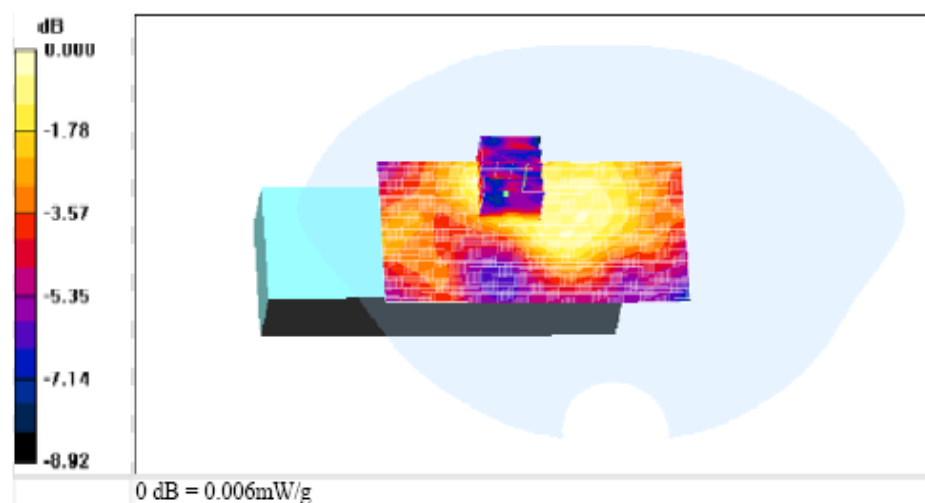
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.48 V/m; Power Drift = 0.357 dB

Peak SAR (extrapolated) = 0.009 W/kg

SAR(1 g) = 0.00539 mW/g; SAR(10 g) = 0.00362 mW/g

Maximum value of SAR (measured) = 0.006 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22°C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.013 mW/g

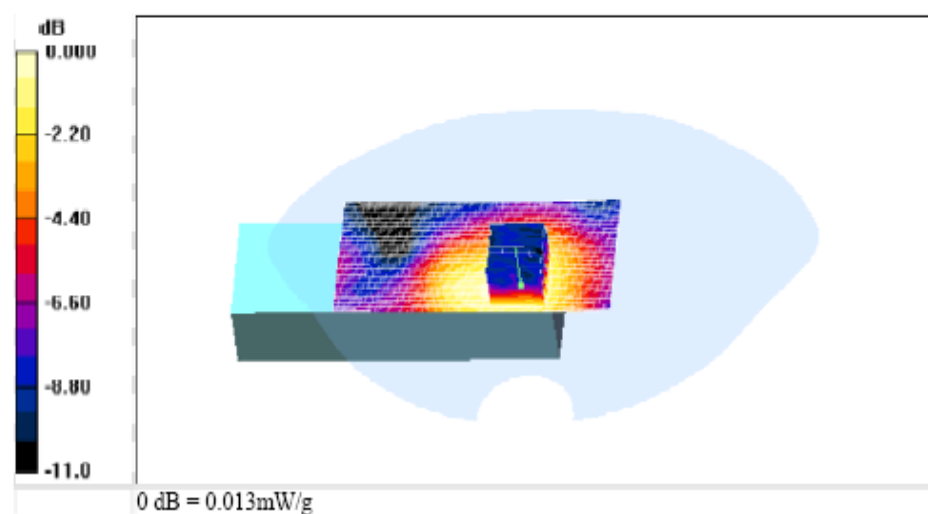
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 2.27 V/m; Power Drift = 0.215 dB

Peak SAR (extrapolated) = 0.023 W/kg

SAR(1 g) = 0.013 mW/g; SAR(10 g) = 0.00748 mW/g

Maximum value of SAR (measured) = 0.013 mW/g



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FAX: 82-2-867-3204

Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b-LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.015 mW/g

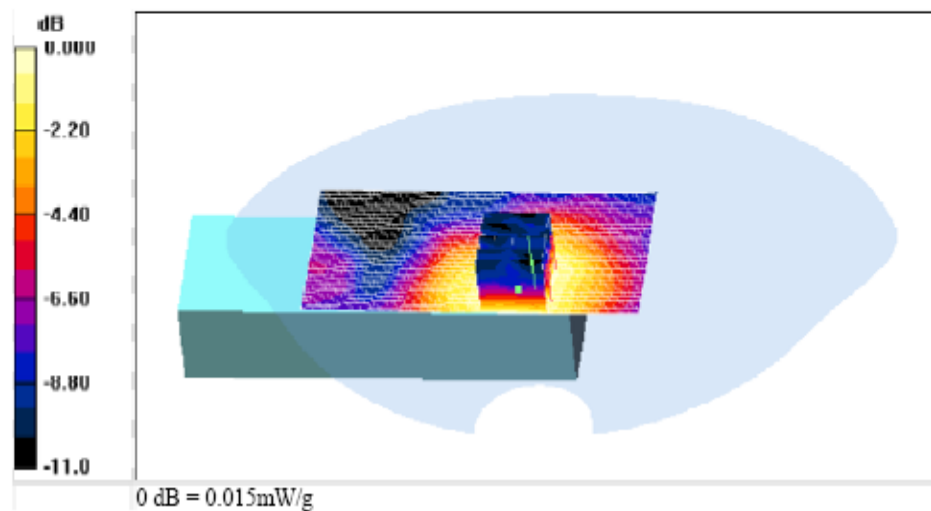
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 2.43 V/m; Power Drift = 0.309 dB

Peak SAR (extrapolated) = 0.025 W/kg

SAR(1 g) = 0.014 mW/g; SAR(10 g) = 0.00844 mW/g

Maximum value of SAR (measured) = 0.015 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11b-HI

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DAS4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.009 mW/g

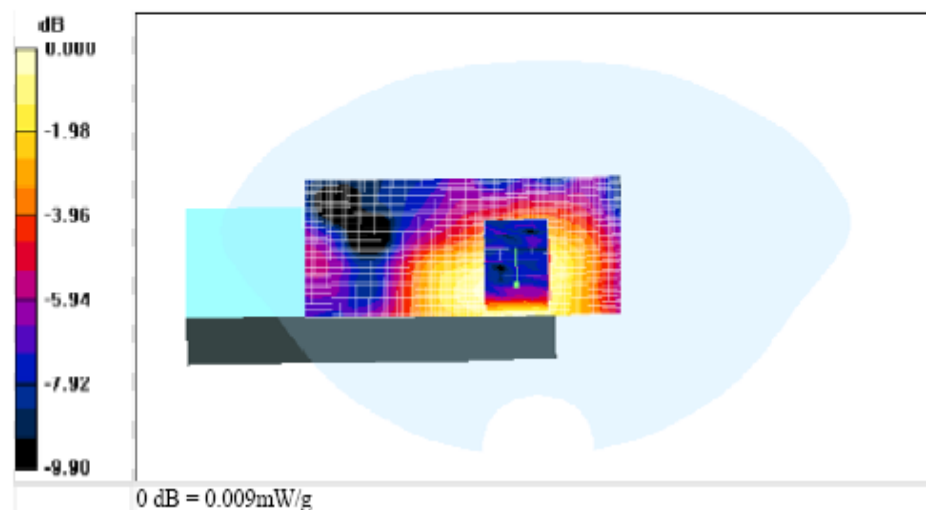
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.98 V/m; Power Drift = 0.009 dB

Peak SAR (extrapolated) = 0.016 W/kg

SAR(1 g) = 0.00888 mW/g; SAR(10 g) = 0.00538 mW/g

Maximum value of SAR (measured) = 0.009 mW/g



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Date: 2009-06-05

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BODY REAR 11b-LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

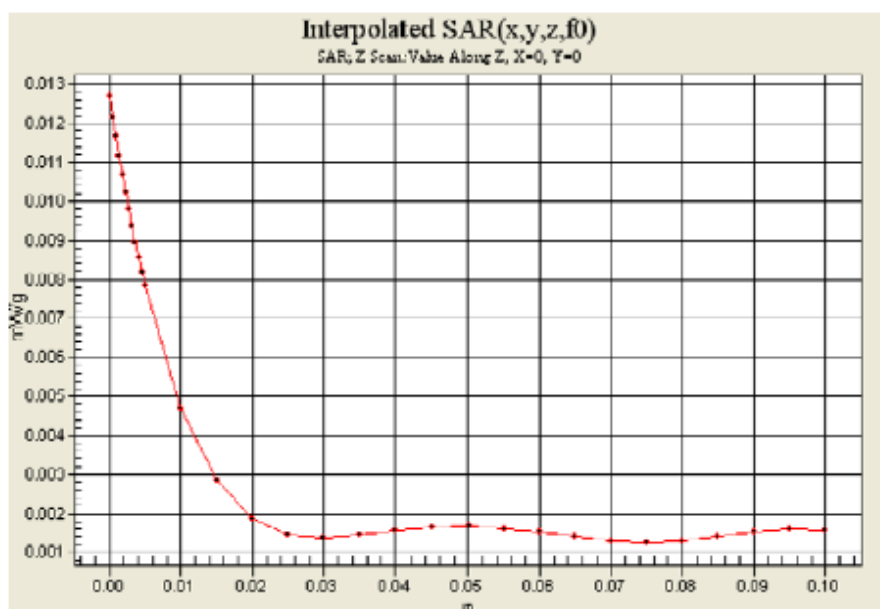
Medium parameters used: $f = 2412$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%



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- 2450MHz 802.11g

Date: 2009-06-05

Test Laboratory: ESTECH

BODY FRONT 11g

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.004 mW/g

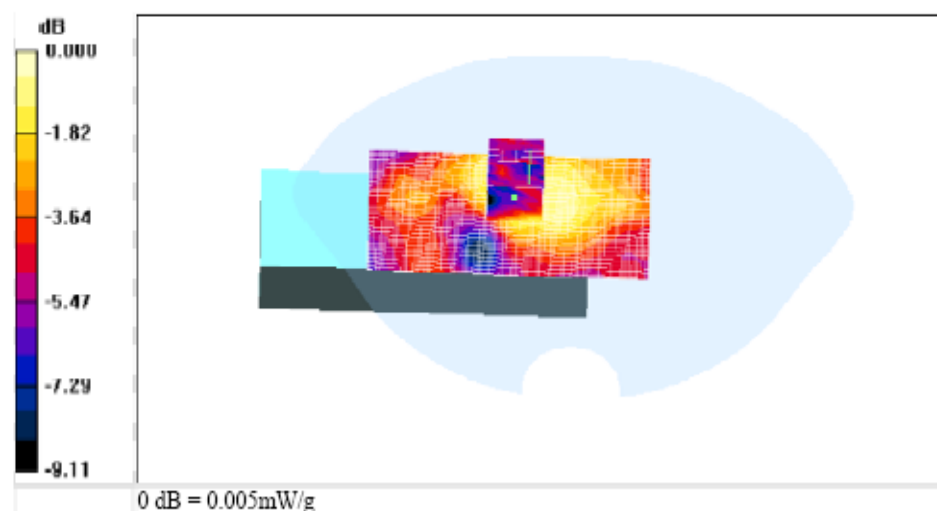
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.44 V/m; Power Drift = 0.241 dB

Peak SAR (extrapolated) = 0.010 W/kg

SAR(1 g) = 0.0045 mW/g; SAR(10 g) = 0.00305 mW/g

Maximum value of SAR (measured) = 0.005 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g

DUT: 6100; Type: BAR TYPE; Serial: XXXX

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

Medium parameters used (interpolated): $f = 2437$ MHz; $\sigma = 1.91$ mho/m; $\epsilon_r = 52$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.010 mW/g

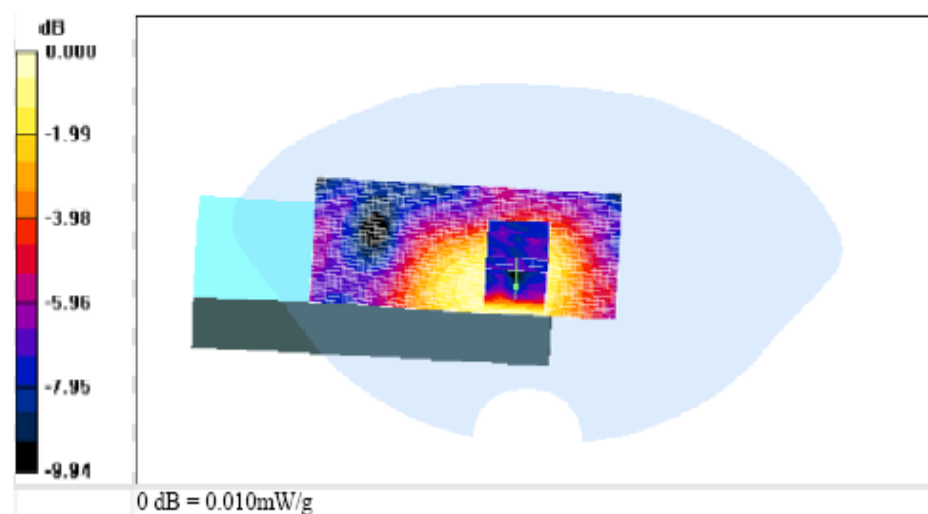
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 2.11 V/m; Power Drift = -0.074 dB

Peak SAR (extrapolated) = 0.019 W/kg

SAR(1 g) = 0.00947 mW/g; SAR(10 g) = 0.00585 mW/g

Maximum value of SAR (measured) = 0.010 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g-LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2412 \text{ MHz}$; $\sigma = 1.88 \text{ mho/m}$; $\epsilon_r = 52.1$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22°C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: $dx=15\text{mm}$, $dy=15\text{mm}$

Maximum value of SAR (interpolated) = 0.012 mW/g

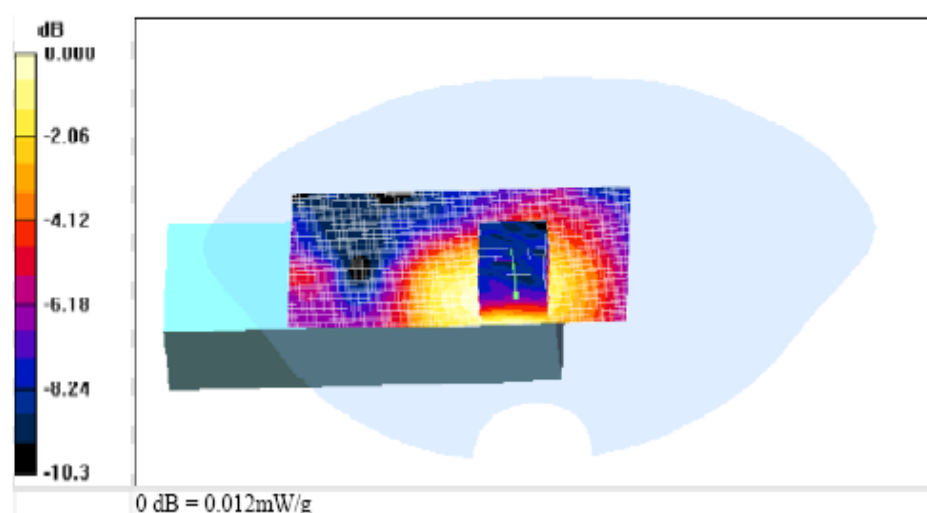
Zoom Scan (5x5x7)/Cube 0: Measurement grid: $dx=7.5\text{mm}$, $dy=7.5\text{mm}$, $dz=5\text{mm}$

Reference Value = 2.26 V/m; Power Drift = -0.089 dB

Peak SAR (extrapolated) = 0.022 W/kg

SAR(1 g) = 0.011 mW/g; SAR(10 g) = 0.00693 mW/g

Maximum value of SAR (measured) = 0.012 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g-HI

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2462 MHz; Duty Cycle: 1:1

Medium parameters used: $f = 2462$ MHz; $\sigma = 1.94$ mho/m; $\epsilon_r = 51.9$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%

Area Scan (51x101x1): Measurement grid: dx=15mm, dy=15mm

Maximum value of SAR (interpolated) = 0.007 mW/g

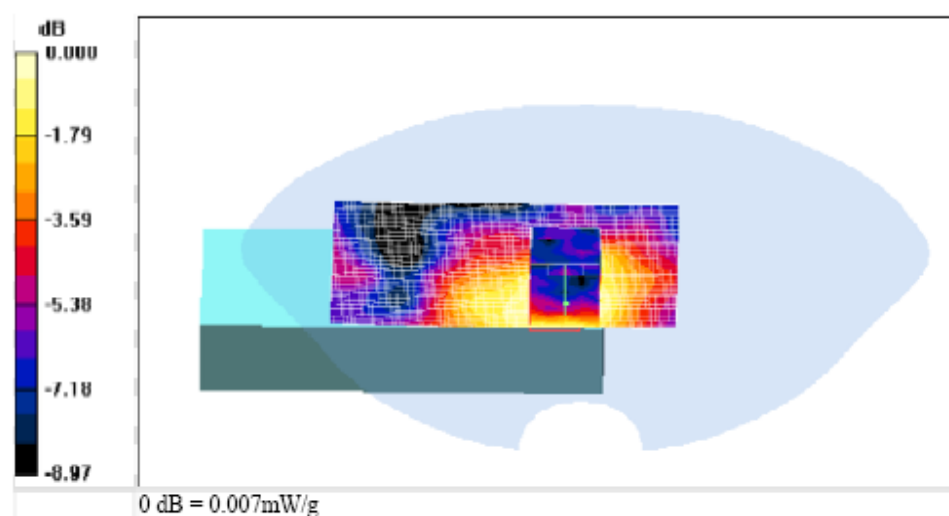
Zoom Scan (5x5x7)/Cube 0: Measurement grid: dx=7.5mm, dy=7.5mm, dz=5mm

Reference Value = 1.71 V/m; Power Drift = 0.165 dB

Peak SAR (extrapolated) = 0.022 W/kg

SAR(1 g) = 0.00691 mW/g; SAR(10 g) = 0.0044 mW/g

Maximum value of SAR (measured) = 0.007 mW/g



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Date: 2009-06-05

Test Laboratory: ESTECH

BODY REAR 11g-LOW

DUT: 6100; Type: BAR TYPE; Serial: XXXX

Communication System: Wireless; Frequency: 2412 MHz; Duty Cycle: 1:1

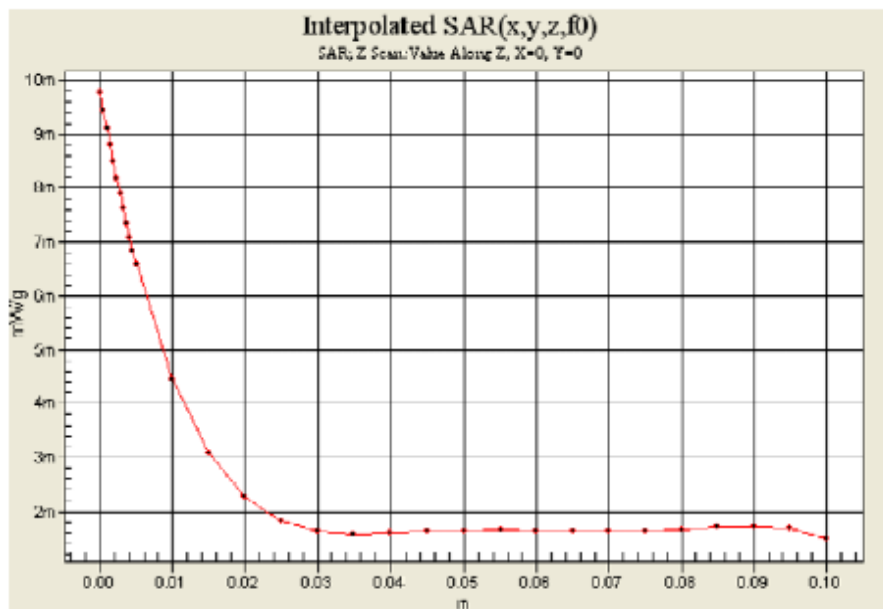
Medium parameters used: $f = 2412$ MHz; $\sigma = 1.88$ mho/m; $\epsilon_r = 52.1$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY4 (High Precision Assessment)

DASY4 Configuration:

- Probe: ES3DV3 - SN3123; ConvF(4.16, 4.16, 4.16); Calibrated: 2009-01-20
- Sensor-Surface: 4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn551; Calibrated: 2009-04-28
- Phantom: SAM 1800; Type: SAM; Serial: TP 1263
- Measurement SW: DASY4, V4.7 Build 80; Postprocessing SW: SEMCAD, V1.8 Build 186
- Temperature : 22 °C, Humidity : 48%





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APPENDIX D : Calibration Certificates



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 **Estech (Dymstec)**

Certificate No: **ES3-3123_Jan09**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3123**

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

Calibration date: **January 20, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
 The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ 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-09 (No. ES3-3013_Jan09)	Jan-10
DAE4	SN: 660	9-Sep-08 (No. DAE4-660_Sep08)	Sep-09

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

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

Issued: January 20, 2009

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



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

Glossary:

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

Calibration is Performed According to the Following Standards:

- IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

Methods Applied and Interpretation of Parameters:

- NORM_{x,y,z}**: Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORM_{x,y,z} are only intermediate values, i.e., the uncertainties of NORM_{x,y,z} does not effect the E²-field uncertainty inside TSL (see below ConvF).
- NORM(f)_{x,y,z}** = NORM_{x,y,z} * frequency_response (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of ConvF.
- DCPx,y,z**: DCP are numerical linearization parameters assessed based on the data of power sweep (no uncertainty required). DCP does not depend on frequency nor media.
- ConvF and Boundary Effect Parameters**: Assessed in flat phantom using E-field (or Temperature Transfer Standard for $f \leq 800$ MHz) and inside waveguide using analytical field distributions based on power measurements for $f > 800$ MHz. The same setups are used for assessment of the parameters applied for boundary compensation (alpha, depth) of which typical uncertainty values are given. These parameters are used in DASY4 software to improve probe accuracy close to the boundary. The sensitivity in TSL corresponds to NORM_{x,y,z} * ConvF whereby the uncertainty corresponds to that given for ConvF. A frequency dependent ConvF is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- Spherical isotropy (3D deviation from isotropy)**: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- Sensor Offset**: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3123

Manufactured:	July 11, 2006
Last calibrated:	December 18, 2007
Recalibrated:	January 20, 2009

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

DASY - Parameters of Probe: ES3DV3 SN:3123

Sensitivity in Free Space^A

Diode Compression^B

NormX	$1.36 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP X	92 mV
NormY	$1.35 \pm 10.1\%$	$\mu V/(V/m)^2$	DCP Y	93 mV
NormZ	$1.11 \pm 10.1\%$	$\mu V/(V/m)^2$	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	3.0 mm	4.0 mm	
	SAR _{be} [%] Without Correction Algorithm	9.5	5.6	
	SAR _{be} [%] With Correction Algorithm	0.8	0.6	
TSL	1810 MHz	Typical SAR gradient: 10 % per mm		
	Sensor Center to Phantom Surface Distance	3.0 mm	4.0 mm	
	SAR _{be} [%] Without Correction Algorithm	11.1	7.1	
	SAR _{be} [%] With Correction Algorithm	0.9	0.6	

Sensor Offset

Probe Tip to Sensor Center **2.0 mm**

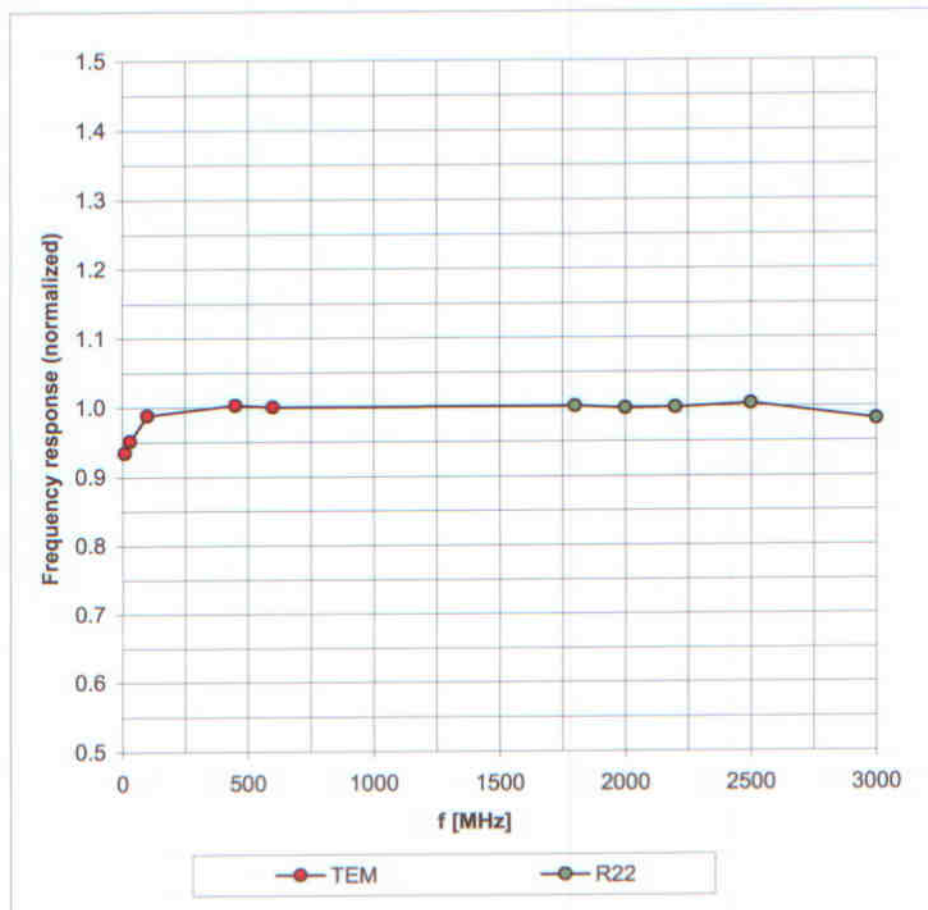
The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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

^B Numerical linearization parameter: uncertainty not required.

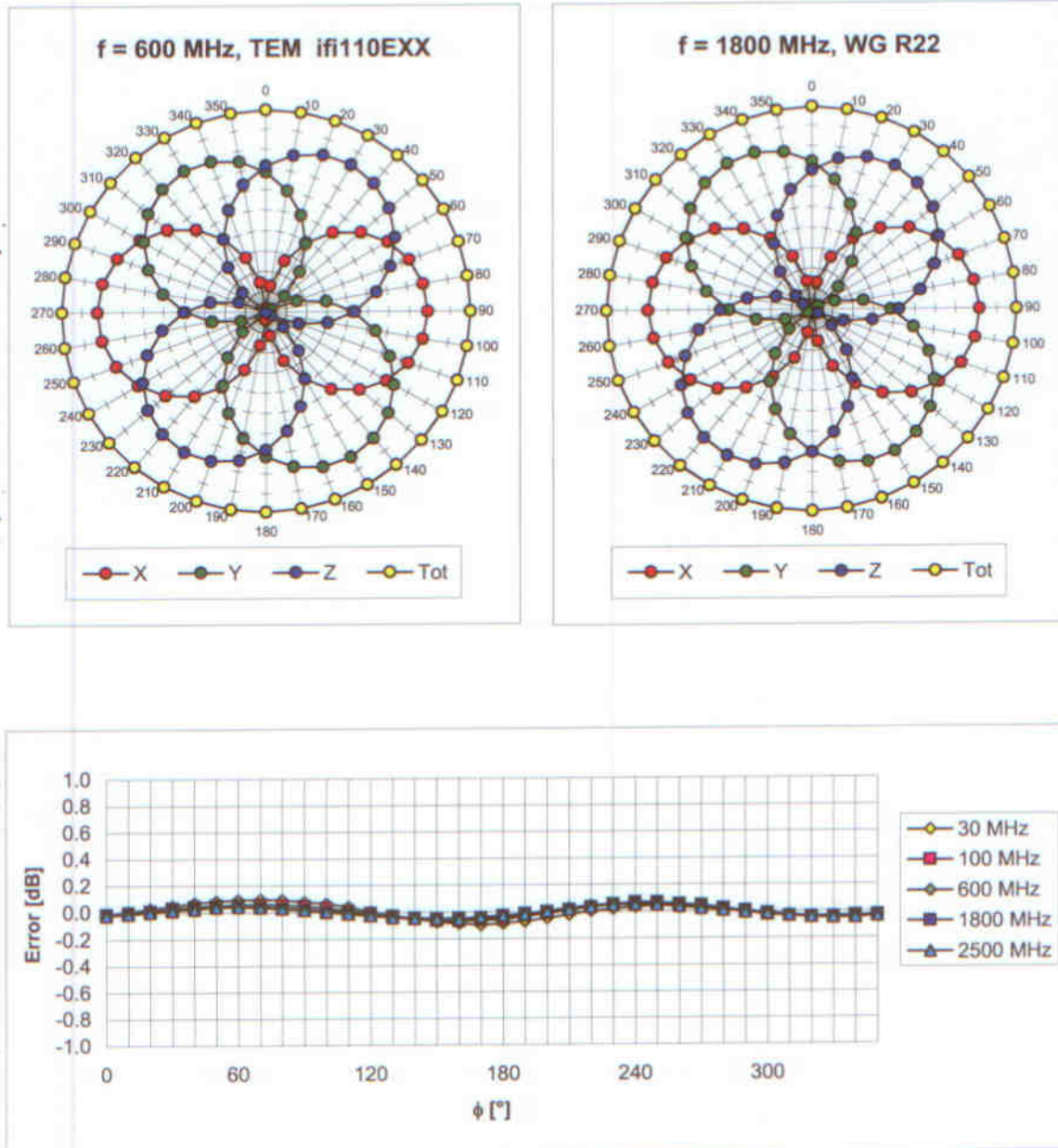
Frequency Response of E-Field

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



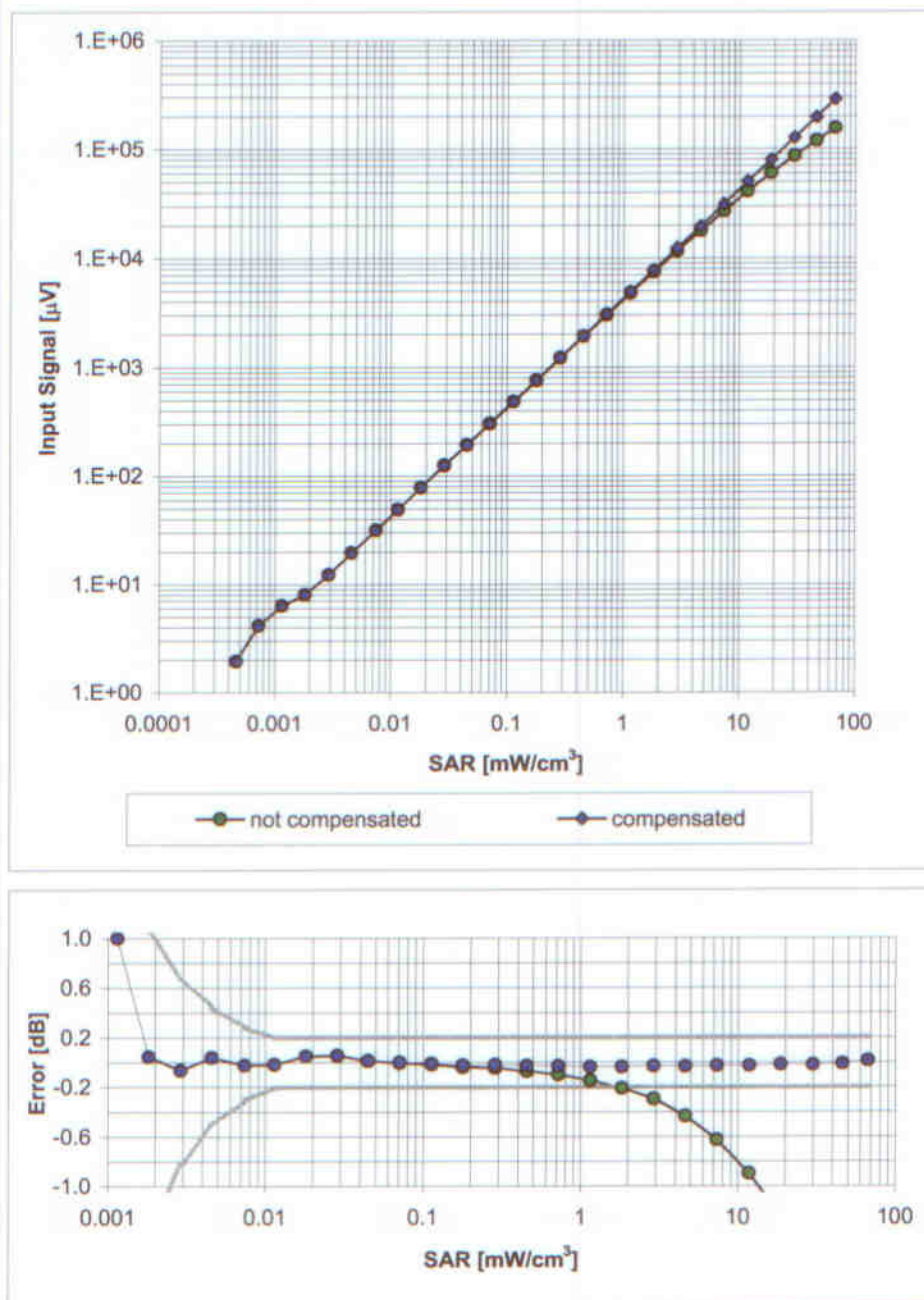
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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



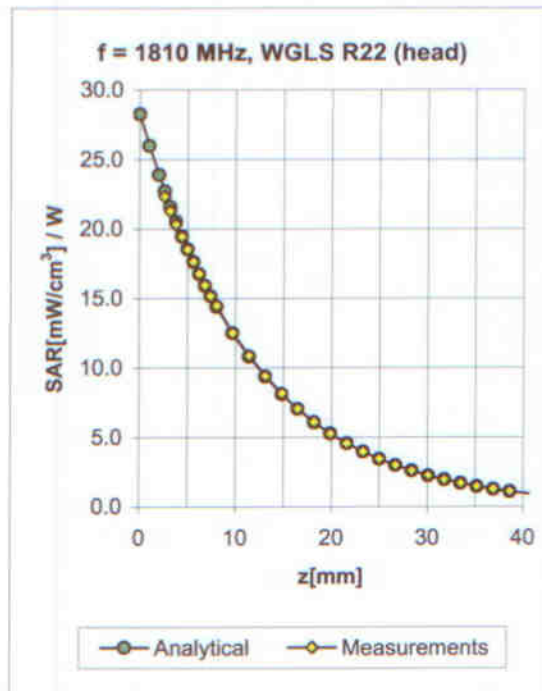
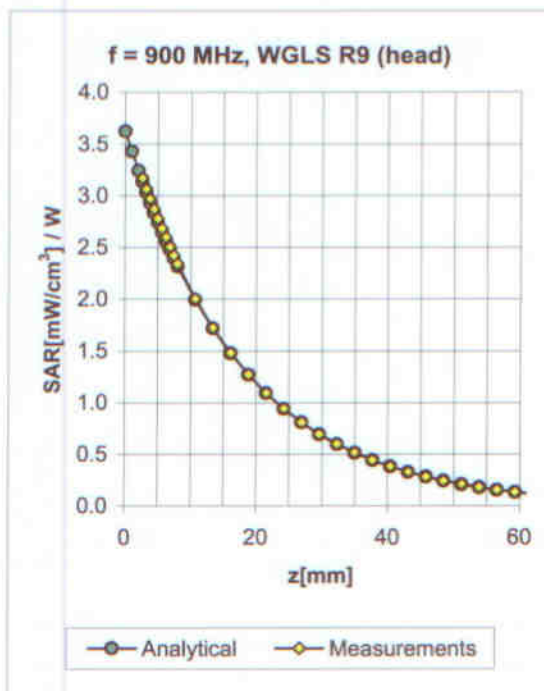
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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



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

Conversion Factor Assessment

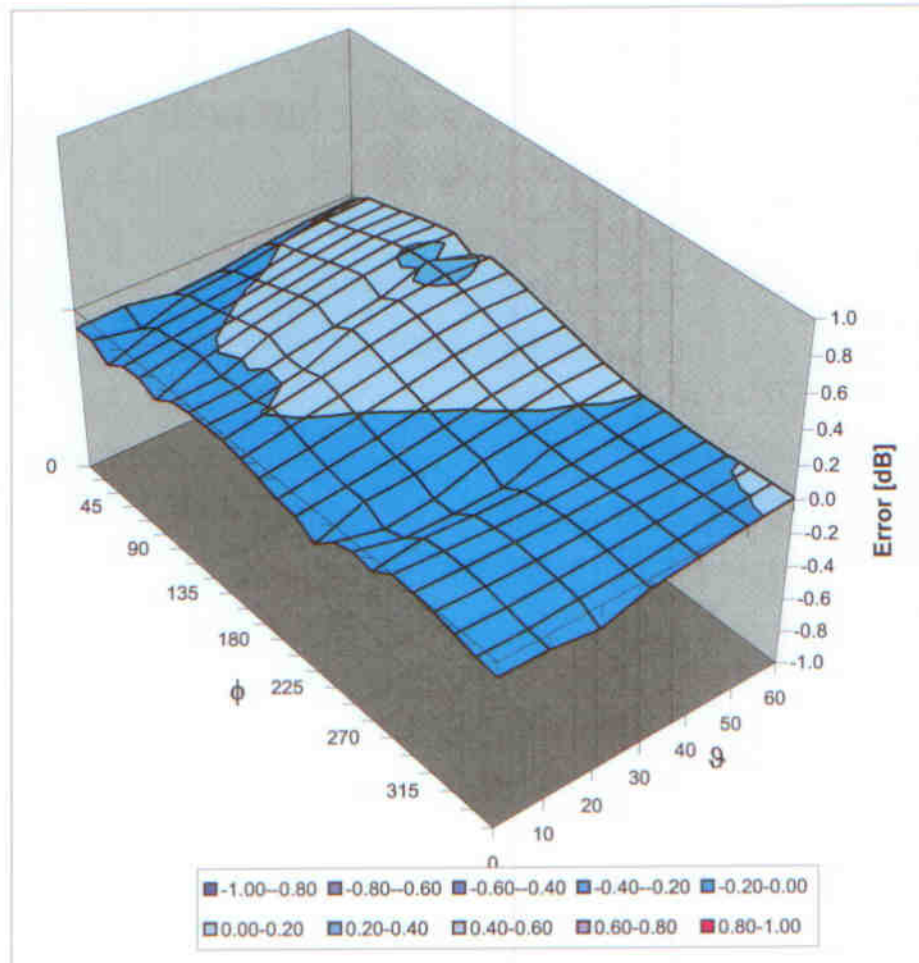


f [MHz]	Validity [MHz] ^c	TSL	Permittivity	Conductivity	Alpha	Depth	ConvF Uncertainty
900	± 50 / ± 100	Head	41.5 ± 5%	0.97 ± 5%	0.93	1.04	5.87 ± 11.0% (k=2)
1810	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.45	1.61	4.92 ± 11.0% (k=2)
1900	± 50 / ± 100	Head	40.0 ± 5%	1.40 ± 5%	0.46	1.59	4.84 ± 11.0% (k=2)
2450	± 50 / ± 100	Head	39.2 ± 5%	1.80 ± 5%	0.37	1.83	4.44 ± 11.0% (k=2)
900	± 50 / ± 100	Body	55.0 ± 5%	1.05 ± 5%	0.80	1.19	5.84 ± 11.0% (k=2)
1810	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.42	1.68	4.81 ± 11.0% (k=2)
1900	± 50 / ± 100	Body	53.3 ± 5%	1.52 ± 5%	0.24	2.33	4.66 ± 11.0% (k=2)
2450	± 50 / ± 100	Body	52.7 ± 5%	1.95 ± 5%	0.55	1.38	4.16 ± 11.0% (k=2)

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

Deviation from Isotropy in HSL

Error (ϕ , ϑ), $f = 900$ MHz



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



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Accreditation No.: **SCS 108**

Client **Estech (Dymstec)**

Certificate No: **D2450V2-741_Feb09**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 741**

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

Calibration date: **February 17, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	08-Oct-08 (No. 217-00898)	Oct-09
Power sensor HP 8481A	US37292783	08-Oct-08 (No. 217-00898)	Oct-09
Reference 20 dB Attenuator	SN: S5086 (20g)	01-Jul-08 (No. 217-00864)	Jul-09
Type-N mismatch combination	SN: 5047.2 / 06327	01-Jul-08 (No. 217-00867)	Jul-09
Reference Probe ES3DV2	SN: 3025	28-Apr-08 (No. ES3-3025_Apr08)	Apr-09
DAE4	SN: 601	14-Mar-08 (No. DAE4-601_Mar08)	Mar-09

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-07)	In house check: Oct-09
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-08)	In house check: Oct-09

	Name	Function	Signature
Calibrated by:	Jeton Kastrati	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager
--------------	---------------	-------------------

Issued: February 19, 2009

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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.

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

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.0 $\pm$ 6 %	1.82 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 ³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.1 mW / g
SAR normalized	normalized to 1W	52.4 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	51.7 mW /g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.07 mW / g
SAR normalized	normalized to 1W	24.3 mW / g
SAR for nominal Head TSL parameters ¹	normalized to 1W	24.1 mW /g $\pm$ 16.5 % (k=2)

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

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$54.9 \Omega + 3.6 j\Omega$
Return Loss	- 24.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.158 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	December 01, 2003

DASY5 Validation Report for Head TSL

Date/Time: 17.02.2009 10:37:08

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN741

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

Medium: HSL U10 BB

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.82$ mho/m; $\epsilon_r = 38$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC)

DASY5 Configuration:

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

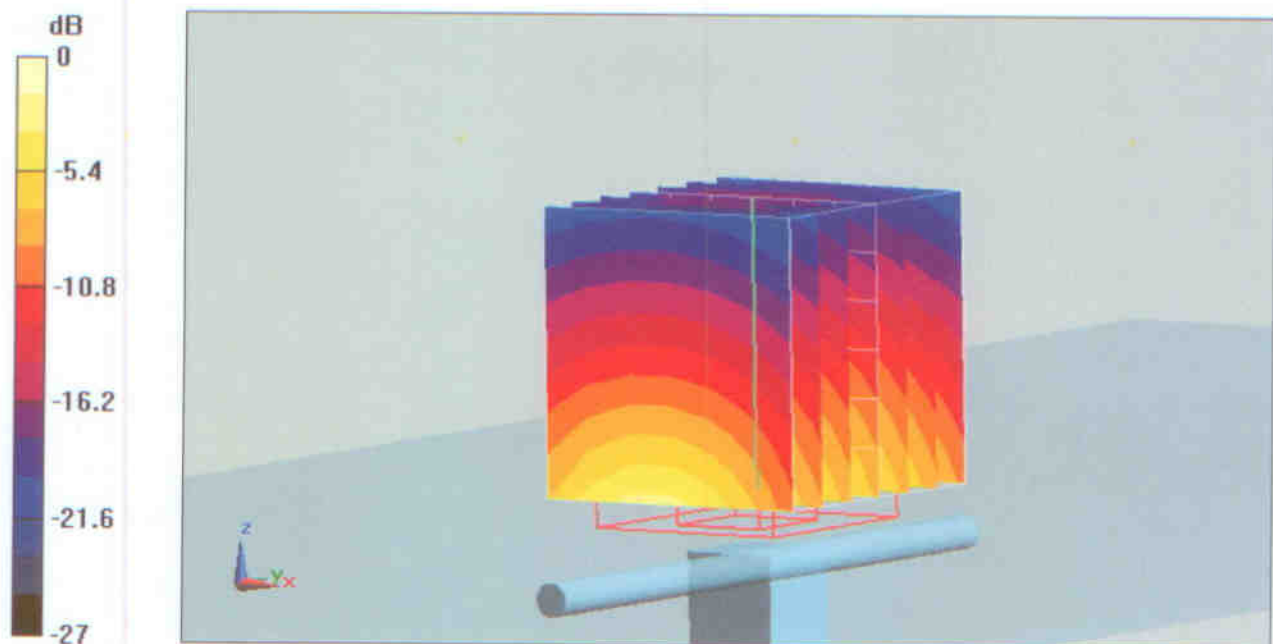
Pin = 250 mW; d = 10 mm/Zoom Scan (7x7x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.3 V/m; Power Drift = -0.00454 dB

Peak SAR (extrapolated) = 27.4 W/kg

SAR(1 g) = 13.1 mW/g; SAR(10 g) = 6.07 mW/g

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



0 dB = 15.8mW/g

Impedance Measurement Plot for Head TSL

17 Feb 2009 09:26:45

* CH1 S11 1 U FS

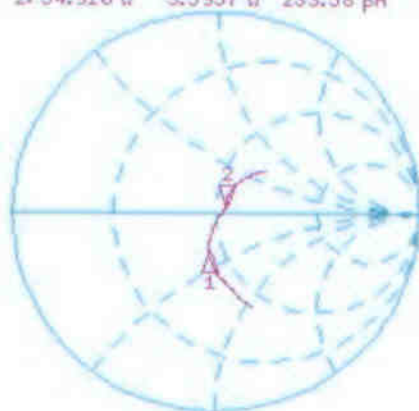
2: 54.910 Ω 3.5957 Ω 233.58 μH 2 450.000 000 MHz

Del

Cor

Avg
16

↑



CH1 Markers

1: 43.104 Ω
2: 18.135 Ω
2.30000 GHz

CH2 S11 L06 5 dB/REF -20 dB 2: -24.734 dB 2 450.000 000 MHz

Cor

Avg
16

↑



CH2 Markers

1: -13.783 dB
2: -24.734 dB
2.30000 GHz

START 2 100.000 000 MHz

STOP 2 650.000 000 MHz



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Accreditation No.: SCS 108

Client **Estech (Dymstec)**

Certificate No: DAE4-551_Apr09

CALIBRATION CERTIFICATE

Object **DAE4 - SD 000 D04 BJ - SN: 551**

Calibration procedure(s) **QA CAL-06.v12
Calibration procedure for the data acquisition electronics (DAE)**

Calibration date: **April 28, 2009**

Condition of the calibrated item **In Tolerance**

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.

All calibrations have been conducted in the closed laboratory facility: environment temperature $(22 \pm 3)^{\circ}\text{C}$ and humidity $< 70\%$.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

Calibrated by:	Name Andrea Guntli	Function Technician	Signature 
Approved by:	Name Fin Bomholt	Function R&D Director	Signature 

Issued: April 28, 2009

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle:* The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
 - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
 - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
 - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
 - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
 - *Input Offset Measurement:* Output voltage and statistical results over a large number of zero voltage measurements.
 - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
 - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.
 - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
 - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1 μ V , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.....+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	403.998 $\pm$ 0.1% (k=2)	404.263 $\pm$ 0.1% (k=2)	403.969 $\pm$ 0.1% (k=2)
Low Range	3.97341 $\pm$ 0.7% (k=2)	3.94946 $\pm$ 0.7% (k=2)	3.91775 $\pm$ 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	139 ° $\pm$ 1 °
---	-----------------

Appendix

1. DC Voltage Linearity

High Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	200000	200000.4	0.00
Channel X + Input	20000	20006.78	0.03
Channel X - Input	20000	-19998.97	-0.01
Channel Y + Input	200000	199999.8	0.00
Channel Y + Input	20000	20002.88	0.01
Channel Y - Input	20000	-20002.48	0.01
Channel Z + Input	200000	199999.7	0.00
Channel Z + Input	20000	19999.66	0.00
Channel Z - Input	20000	-20004.57	0.02

Low Range	Input (μV)	Reading (μV)	Error (%)
Channel X + Input	2000	1999.9	0.00
Channel X + Input	200	200.17	0.08
Channel X - Input	200	-199.69	-0.16
Channel Y + Input	2000	2000.1	0.00
Channel Y + Input	200	199.53	-0.24
Channel Y - Input	200	-200.47	0.23
Channel Z + Input	2000	1999.9	0.00
Channel Z + Input	200	199.43	-0.28
Channel Z - Input	200	-200.90	0.45

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	3.85	3.16
	- 200	-2.00	-3.11
Channel Y	200	-1.29	-1.09
	- 200	0.16	0.16
Channel Z	200	9.46	9.24
	- 200	-11.38	-11.43

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.86	-0.08
Channel Y	200	1.66	-	4.58
Channel Z	200	-1.36	0.54	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15900	15026
Channel Y	16697	15562
Channel Z	16542	15582

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Input 10M Ω

	Average (μ V)	min. Offset (μ V)	max. Offset (μ V)	Std. Deviation (μ V)
Channel X	0.65	-0.21	1.67	0.25
Channel Y	-1.02	-1.68	-0.60	0.22
Channel Z	-0.27	-0.93	0.28	0.23

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2002	200.0
Channel Y	0.2000	202.6
Channel Z	0.2001	201.8

8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9



ESTECH Co., Ltd.

Rm.1015, World Venture Center II,
426-5, Gasan-dong, Geumcheon-gu,
Seoul, 153-803, Korea

TEL: 82-2-867-3201
FAX: 82-2-867-3204

APPENDIX E : Test Setup Photo

BODY LCD UP - Distance 15 mm



BODY LCD DOWN - Distance 15 mm

