

## Appendix B : Plot of system verification test.

### ■ 2450B

Date/Time: 12/12/2014 3:55:00 PM

Test Laboratory: Kostec Co., Ltd.

#### SystemPerformanceCheck-2450B

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

Communication System: UID 0, CW (0); Communication System Band: D2450 (2450.0 MHz); Frequency: 2450 MHz; Communication System PAR: 0 dB; PMF: 1  
Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.89$  S/m;  $\epsilon_r = 51.57$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(7.52, 7.52, 7.52); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 9/18/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

#### System Performance Check at Frequencies above 1 GHz/ $d=10$ mm, Pin=xx mW, dist=2.0mm (EX-Probe)/Area Scan (61x61x1):

Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 7.53 W/kg

#### System Performance Check at Frequencies above 1 GHz/ $d=10$ mm, Pin=xx mW, dist=2.0mm (EX-Probe)/Zoom Scan (7x7x7)

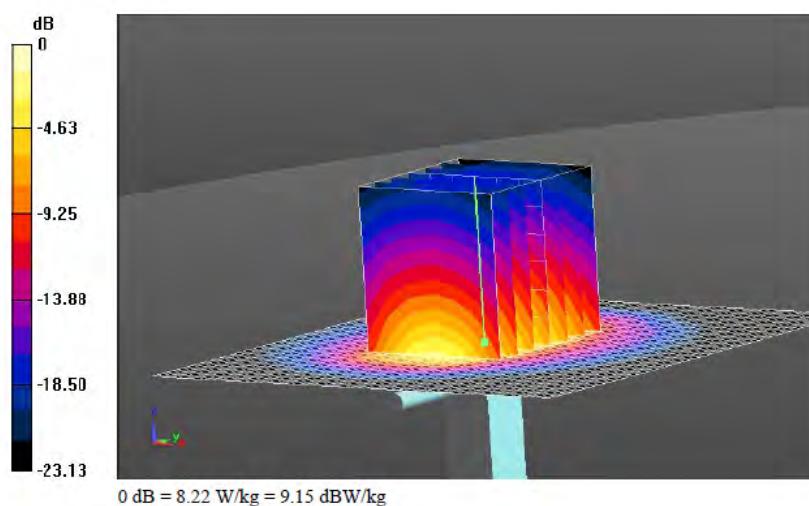
(7x7x7)/Cube 0: Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 65.60 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 11.3 W/kg

SAR(1 g) = 5.29 W/kg; SAR(10 g) = 2.38 W/kg

Maximum value of SAR (measured) = 8.22 W/kg



## ■ 835B

Date/Time: 12/15/2014 9:04:23 AM

Test Laboratory: Kostec Co., Ltd.

### GSM850

**DUT: Dipole 835 MHz D835V2; Type: D835V2; Serial: D835V2 - SN:xxx**

Communication System: UID 0, CW (0); Communication System Band: D835 (835.0 MHz); Frequency: 835 MHz; Communication System PAR: 0 dB; PMF: 1  
Medium parameters used:  $f = 835 \text{ MHz}$ ;  $\sigma = 0.96 \text{ S/m}$ ;  $\epsilon_r = 54.33$ ;  $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

#### DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(9.96, 9.96, 9.96); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 12/3/2010
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Configuration 2/System performance check(835B)/Area Scan (61x81x1):** Interpolated grid:  $dx=1.500 \text{ mm}$ ,  $dy=1.500 \text{ mm}$

Maximum value of SAR (interpolated) = 1.20 W/kg

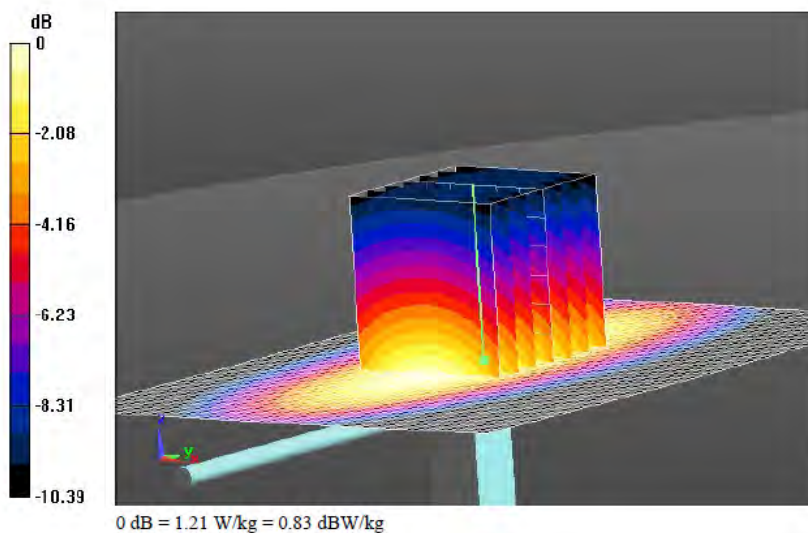
**Configuration 2/System performance check(835B)/Zoom Scan (7x7x7)/Cube 0:** Measurement grid:  $dx=5\text{mm}$ ,  $dy=5\text{mm}$ ,  $dz=5\text{mm}$

Reference Value = 36.20 V/m; Power Drift = -0.02 dB

Peak SAR (extrapolated) = 1.43 W/kg

SAR(1 g) = 0.960 W/kg; SAR(10 g) = 0.631 W/kg

Maximum value of SAR (measured) = 1.21 W/kg



## ■ 1900B

Date/Time: 12/16/2014 7:05:55 AM

Test Laboratory: Kostec Co., Ltd.

### GSM 1900 Verification

DUT: Dipole 1900 MHz D1900V2; Type: D1900V2; Serial: D1900V2 - SN:Sd160

Communication System: UID 0, CW (0); Communication System Band: D1900 (1900.0 MHz); Frequency: 1900 MHz; Communication System PAR: 0 dB; PMF: 1  
Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.5$  S/m;  $\epsilon_r = 52.81$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

#### DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(7.9, 7.9, 7.9); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 9/18/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Verification/Area Scan (51x61x1): Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 6.10 W/kg

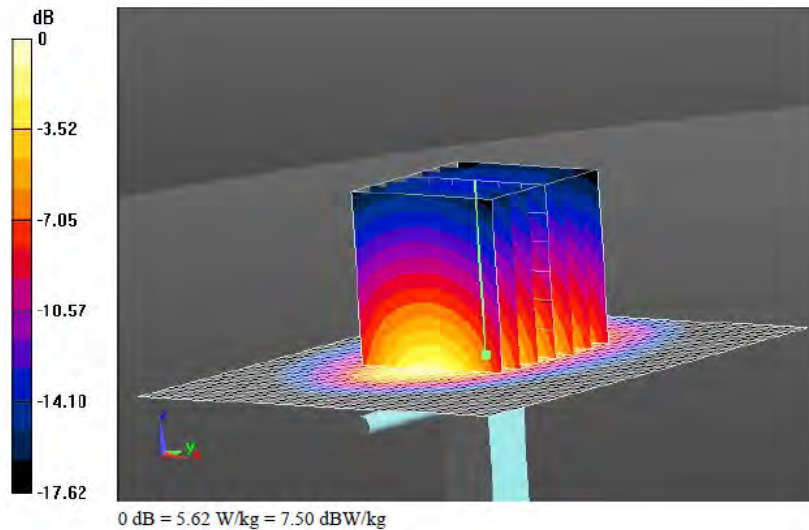
Configuration/Verification/Zoom Scan (7x7x7)/Cube 0: Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 62.21 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 7.18 W/kg

SAR(1 g) = 3.91 W/kg; SAR(10 g) = 2.02 W/kg

Maximum value of SAR (measured) = 5.62 W/kg



## Appendix C : Plot of SAR test.

### Test Plot list

No	Configuration	Type	Mode	Freq	CH	Test position	1 g SAR (W/Kg)
1	Body-worn	GSM850	GPRS 2TX	836.6	190	Rear	0.955*
2	Body-worn	GSM1900	GPRS 2TX	1909.8	810	Rear	0.938
3	Body-worn	WLAN	802.11b	2437	6	Front	0.043

\*Max SAR value



No	Configuration	Type	Mode	Freq	CH	Test position	1 g SAR (W/Kg)
1	Body-worn	GSM850	GPRS 2TX	836.6	190	Rear	0.955*

Date/Time: 12/15/2014 11:37:02 AM

Test Laboratory: Kostec Co., Ltd.

#### GSM850 GPRS 2TX\_Mid\_Rear

DUT: Bluebird Inc; Type: P3500; Serial: Proto type

Communication System: UID 0, GSM 850 GPRS 2TX (0); Communication System Band: GSM 850; Frequency: 836.6 MHz; Communication System PAR: 6.18 dB; PMF: 6.18

Medium parameters used:  $f = 836.6$  MHz;  $\sigma = 0.96$  S/m;  $\epsilon_r = 54.34$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(9.96, 9.96, 9.96); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 9/18/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Bluebird Rear/Area Scan (131x61x1): Interpolated grid: dx=1.500 mm, dy=1.500 mm

Maximum value of SAR (interpolated) = 0.926 W/kg

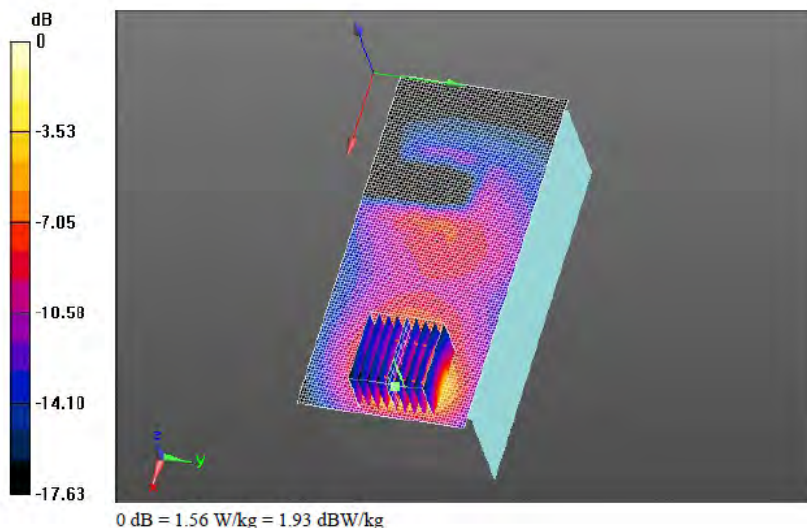
Configuration/Bluebird Rear/Zoom Scan (9x9x7)/Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 15.78 V/m; Power Drift = -0.07 dB

Peak SAR (extrapolated) = 2.76 W/kg

SAR(1 g) = 0.955 W/kg; SAR(10 g) = 0.453 W/kg

Maximum value of SAR (measured) = 1.56 W/kg



No	Configuration	Type	Mode	Freq	CH	Test position	1 g SAR (W/Kg)
2	Body-worn	GSM1900	GPRS 2TX	1909.8	810	Rear	0.938

Date/Time: 12/16/2014 11:13:38 PM

Test Laboratory: Kostec Co., Ltd.

### GSM 1900 GPRS 2TX\_High Rear

DUT: Bluebird Inc; Type: P3500; Serial: Proto type

Communication System: UID 0, GSM 1900 GPRS 2TX (0); Communication System Band: GSM 1900 GPRS 2TX; Frequency: 1909.8 MHz; Communication System PAR: 6.18 dB; PMF: 6.18

Medium parameters used:  $f = 1909.8$  MHz;  $\sigma = 1.51$  S/m;  $\epsilon_r = 52.798$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2011)

DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(7.9, 7.9, 7.9); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 9/18/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

**Configuration 2/GSM 1900 GPRS High Rear/Area Scan (141x71x1):** Interpolated grid:  $dx=1.500$  mm,  $dy=1.500$  mm

Maximum value of SAR (interpolated) = 1.23 W/kg

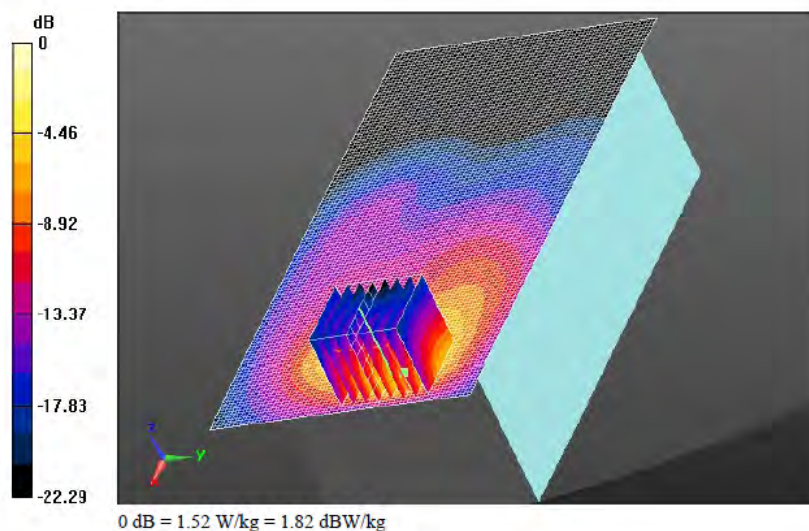
**Configuration 2/GSM 1900 GPRS High Rear/Zoom Scan (7x8x7)/Cube 0:** Measurement grid:  $dx=5$ mm,  $dy=5$ mm,  $dz=5$ mm

Reference Value = 4.848 V/m; Power Drift = -0.17 dB

Peak SAR (extrapolated) = 2.20 W/kg

SAR(1 g) = 0.938 W/kg; SAR(10 g) = 0.395 W/kg

Maximum value of SAR (measured) = 1.52 W/kg



No	Configuration	Type	Mode	Freq	CH	Test position	1 g SAR (W/Kg)
3	Body-worn	WLAN	802.11b	2437	6	Front	0.043

Date/Time: 12/12/2014 5:55:26 PM

Test Laboratory: Kostec Co., Ltd.

802.11\_2437\_front

DUT: Bluebird Inc; Type: P3500; Serial: Proto type

Communication System: UID 0, 2450 FCC (0); Communication System Band: 2405WiFi; Frequency: 2437 MHz; Communication System PAR: 0 dB; PMF: 1.12202e-005

Medium parameters used (interpolated):  $f = 2437$  MHz;  $\sigma = 1.874$  S/m;  $\epsilon_r = 51.614$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY Configuration:

- Probe: EX3DV4 - SN3664; ConvF(7.52, 7.52, 7.52); Calibrated: 9/22/2014;
  - Modulation Compensation:
- Sensor-Surface: 2mm (Mechanical Surface Detection),  $z = 1.0, 31.0$
- Electronics: DAE4 Sn1240; Calibrated: 9/18/2014
- Phantom: ELI v5.0; Type: QDOVA002AA; Serial: TP:xxxx
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

Configuration/Bluebird\_WLAN\_Middle\_FRONT/Area Scan (211x111x1); Interpolated grid: dx=1.000 mm, dy=1.000 mm

Maximum value of SAR (interpolated) = 0.0641 W/kg

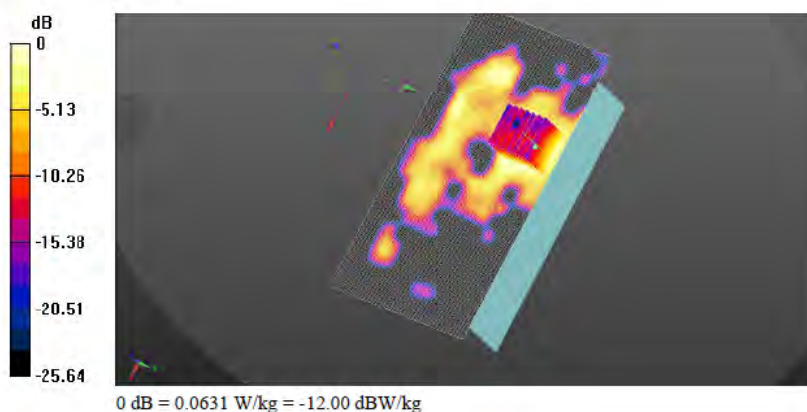
Configuration/Bluebird\_WLAN\_Middle\_FRONT/Zoom Scan (7x7x7)/Cube 0; Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 1.893 V/m; Power Drift = 0.19 dB

Peak SAR (extrapolated) = 0.0910 W/kg

SAR(1 g) = 0.043 W/kg; SAR(10 g) = 0.023 W/kg

Maximum value of SAR (measured) = 0.0631 W/kg



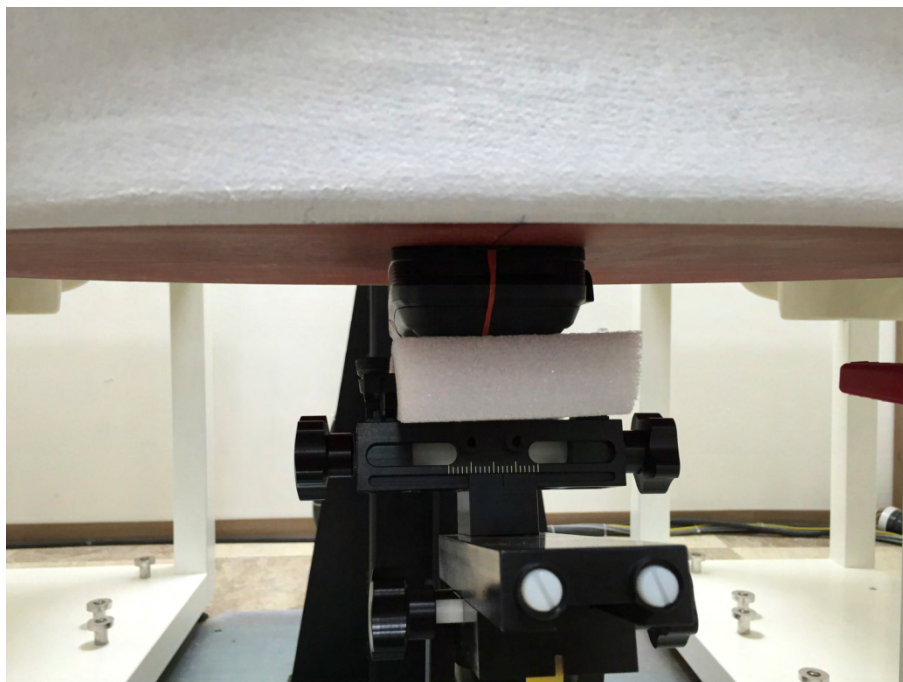


## Appendix D: DUT setup photos

### Body worn configuration



[FRONT 1]

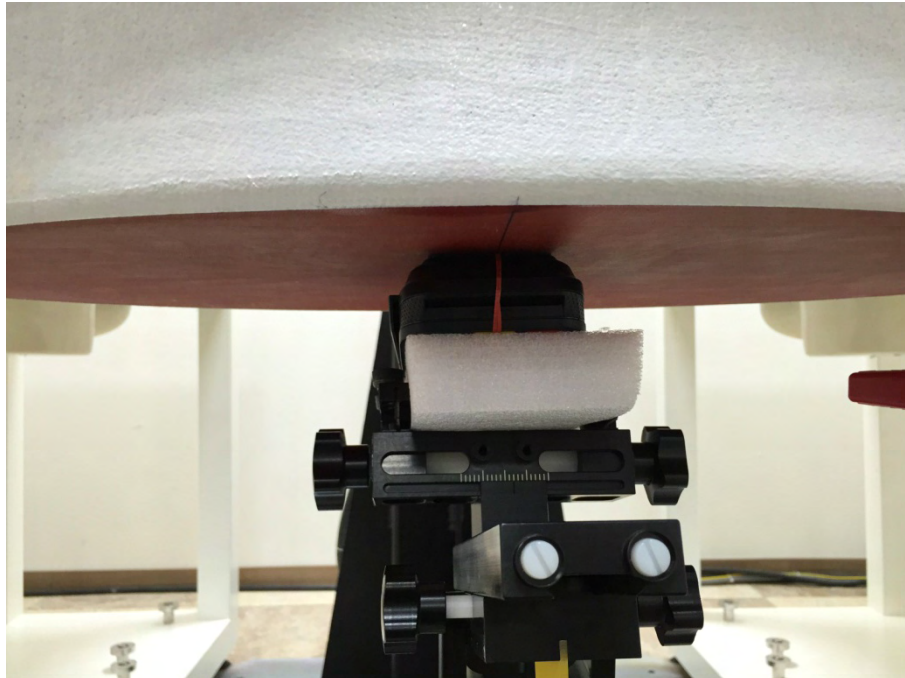


[FRONT 2]





[REAR 1]



[REAR 2]

## Appendix E: System Certificate & calibration

### E-1: Probe Calibration

EX3DV4 – SN:3664

September 22, 2014

# Probe EX3DV4

## SN:3664

Manufactured: October 20, 2008  
Calibrated: September 22, 2014

Calibrated for DASY/EASY Systems  
(Note: non-compatible with DASY2 system!)

EX3DV4- SN:3664

September 22, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3664

### Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ( $\mu\text{V}/(\text{V/m})^2$ ) <sup>A</sup>	0.64	0.49	0.51	$\pm 10.1 \%$
DCP (mV) <sup>B</sup>	95.7	99.0	102.5	

### Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB $\sqrt{\mu\text{V}}$	C	D dB	VR mV	Unc <sup>E</sup> (k=2)
0	CW	X	0.0	0.0	1.0	0.00	166.8	$\pm 2.7 \%$
		Y	0.0	0.0	1.0		169.5	
		Z	0.0	0.0	1.0		162.3	

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 Pages 5 and 6).

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

<sup>E</sup> Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

EX3DV4- SN:3664

September 22, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3664

### Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
450	43.5	0.87	11.31	11.31	11.31	0.16	1.90	± 13.3 %
835	41.5	0.90	10.04	10.04	10.04	0.28	1.05	± 12.0 %
900	41.5	0.97	9.86	9.86	9.86	0.29	1.04	± 12.0 %
1810	40.0	1.40	8.29	8.29	8.29	0.32	0.83	± 12.0 %
1900	40.0	1.40	8.29	8.29	8.29	0.72	0.57	± 12.0 %
2450	39.2	1.80	7.58	7.58	7.58	0.50	0.70	± 12.0 %
5200	36.0	4.66	5.48	5.48	5.48	0.35	1.80	± 13.1 %
5300	35.9	4.76	5.29	5.29	5.29	0.35	1.80	± 13.1 %
5500	35.6	4.96	5.10	5.10	5.10	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.85	4.85	4.85	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.85	4.85	4.85	0.40	1.80	± 13.1 %

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.





EX3DV4- SN:3664

September 22, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3664

### Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) <sup>C</sup>	Relative Permittivity <sup>F</sup>	Conductivity (S/m) <sup>F</sup>	ConvF X	ConvF Y	ConvF Z	Alpha <sup>G</sup>	Depth <sup>G</sup> (mm)	Unct. (k=2)
835	55.2	0.97	9.96	9.96	9.96	0.58	0.76	± 12.0 %
1900	53.3	1.52	7.90	7.90	7.90	0.40	0.80	± 12.0 %
2450	52.7	1.95	7.52	7.52	7.52	0.80	0.53	± 12.0 %
5200	49.0	5.30	4.69	4.69	4.69	0.50	1.90	± 13.1 %
5800	48.2	6.00	4.32	4.32	4.32	0.50	1.90	± 13.1 %

<sup>C</sup> Frequency validity above 300 MHz of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band. Frequency validity below 300 MHz is ± 10, 25, 40, 50 and 70 MHz for ConvF assessments at 30, 64, 128, 150 and 220 MHz respectively. Above 5 GHz frequency validity can be extended to ± 110 MHz.

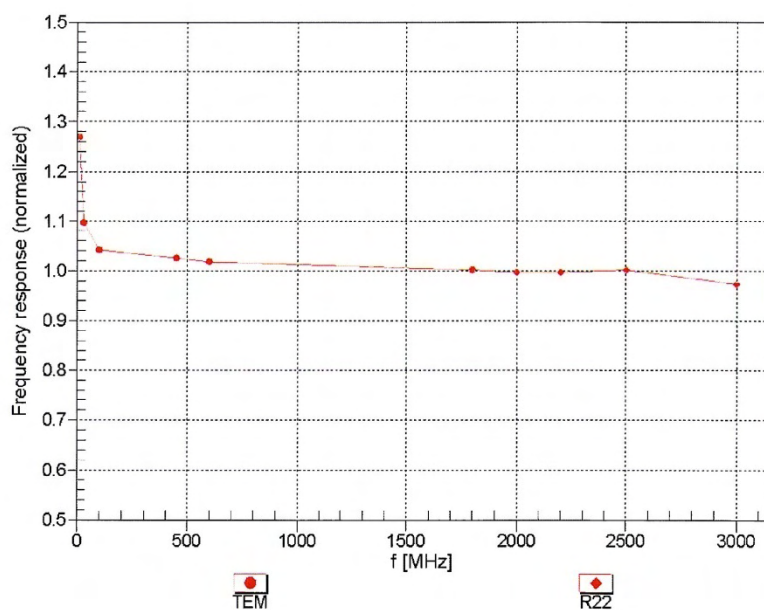
<sup>F</sup> At frequencies below 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters ( $\epsilon$  and  $\sigma$ ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

<sup>G</sup> Alpha/Depth are determined during calibration. SPEAG warrants that the remaining deviation due to the boundary effect after compensation is always less than ± 1% for frequencies below 3 GHz and below ± 2% for frequencies between 3-6 GHz at any distance larger than half the probe tip diameter from the boundary.

EX3DV4- SN:3664

September 22, 2014

### Frequency Response of E-Field (TEM-Cell: ifi110 EXX, Waveguide: R22)



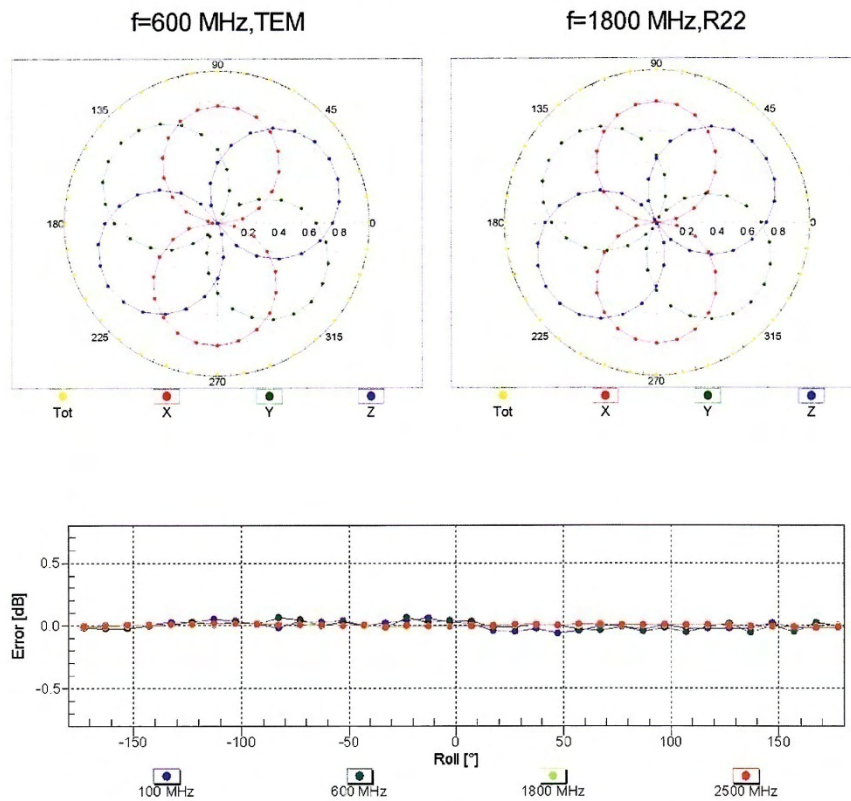
Uncertainty of Frequency Response of E-field:  $\pm 6.3\%$  ( $k=2$ )



EX3DV4- SN:3664

September 22, 2014

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

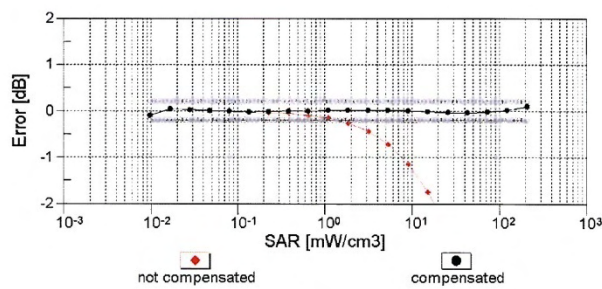
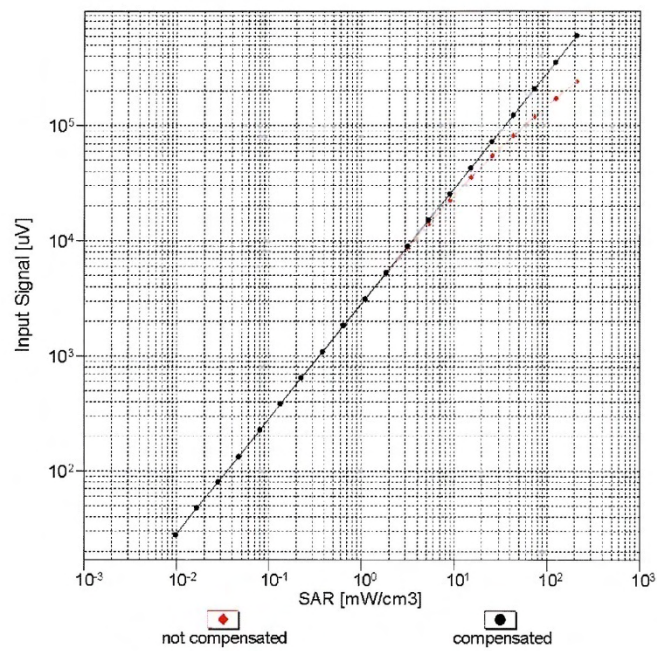


Uncertainty of Axial Isotropy Assessment:  $\pm 0.5\%$  ( $k=2$ )

EX3DV4- SN:3664

September 22, 2014

### Dynamic Range $f(\text{SAR}_{\text{head}})$ (TEM cell , $f_{\text{eval}} = 1900 \text{ MHz}$ )



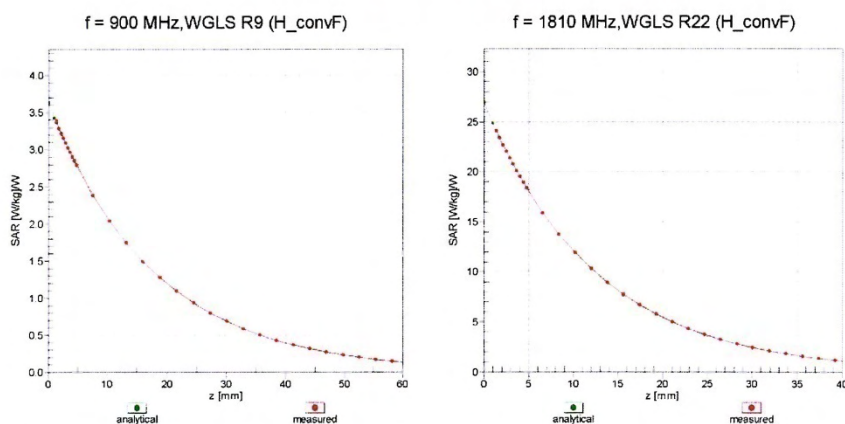
Uncertainty of Linearity Assessment:  $\pm 0.6\%$  ( $k=2$ )



EX3DV4- SN:3664

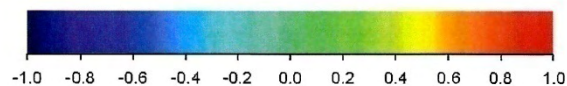
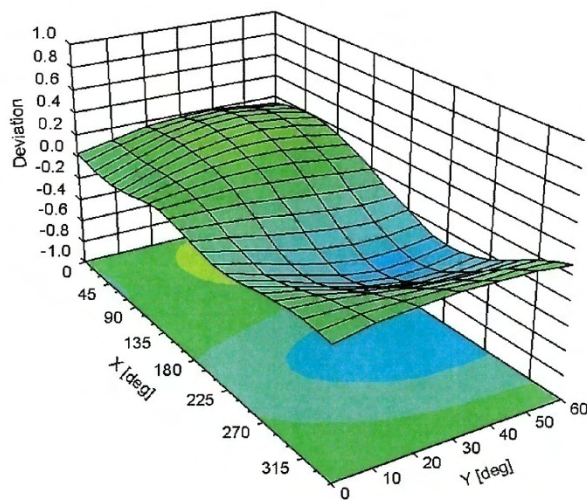
September 22, 2014

## Conversion Factor Assessment



## Deviation from Isotropy in Liquid

Error ( $\phi$ ,  $\theta$ ),  $f = 900 \text{ MHz}$



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

Certificate No: EX3-3664\_Sep14

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EX3DV4- SN:3664

September 22, 2014

## DASY/EASY - Parameters of Probe: EX3DV4 - SN:3664

### Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-62.8
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	9 mm
Tip Diameter	2.5 mm
Probe Tip to Sensor X Calibration Point	1 mm
Probe Tip to Sensor Y Calibration Point	1 mm
Probe Tip to Sensor Z Calibration Point	1 mm
Recommended Measurement Distance from Surface	1.4 mm

## E-2: Dipole antenna Calibration (835 MHz)

**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 **One-Tech (Dymstec)**

Certificate No: **D835V2-4d172\_Jul14**

### CALIBRATION CERTIFICATE

Object **D835V2 - SN: 4d172**

Calibration procedure(s) **QA CAL-05.v9  
Calibration procedure for dipole validation kits above 700 MHz**

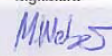

Calibration date: **July 10, 2014**

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 (MATE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20K)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	30-Apr-14 (No. DAE4-601_Apr14)	Apr-15
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator F&S SMT-06	100005	04-Aug-99 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

Calibrated by:	Name Michael Weber	Function Laboratory Technician	Signature 
Approved by:	Ketja Pokovic	Technical Manager	

Issued: July 11, 2014

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Certificate No: D835V2-4d172\_Jul14

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



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

Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

**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:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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.

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%.





### Measurement Conditions

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

DASY Version	DASY5	V52.8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.1 $\pm$ 6 %	0.94 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.23 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.55 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.03 W/kg $\pm$ 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	53.8 $\pm$ 6 %	1.02 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °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	2.50 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.50 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.63 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.30 W/kg $\pm$ 16.5 % (k=2)

## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.6 $\Omega$ - 2.0 j $\Omega$
Return Loss	- 29.9 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 $\Omega$ - 4.3 j $\Omega$
Return Loss	- 26.1 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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	SPIEAG
Manufactured on	November 11, 2013

## DASY5 Validation Report for Head TSL

Date: 10.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d172**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 0.94$  S/m;  $\epsilon_r = 41.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.22, 6.22, 6.22); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

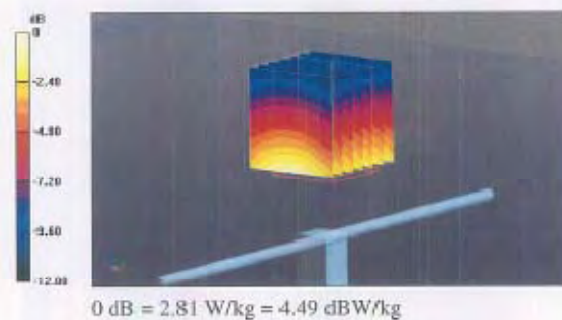
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 56.39 V/m; Power Drift = 0.01 dB

Peak SAR (extrapolated) = 3.59 W/kg

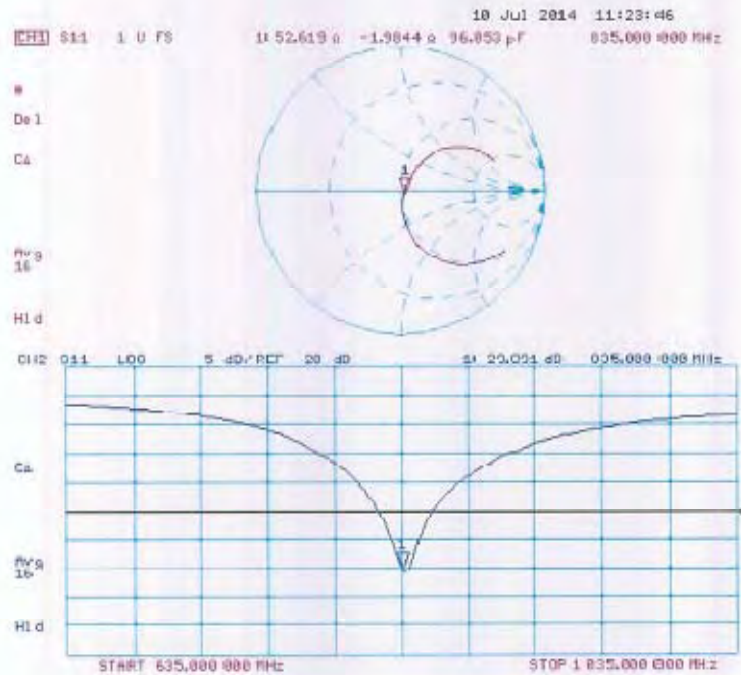
**SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.55 W/kg**

Maximum value of SAR (measured) = 2.81 W/kg





### Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 09.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d172**

Communication System: UID 0 - CW; Frequency: 835 MHz

Medium parameters used:  $f = 835$  MHz;  $\sigma = 1.02$  S/m;  $\epsilon_r = 53.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.09, 6.09, 6.09); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

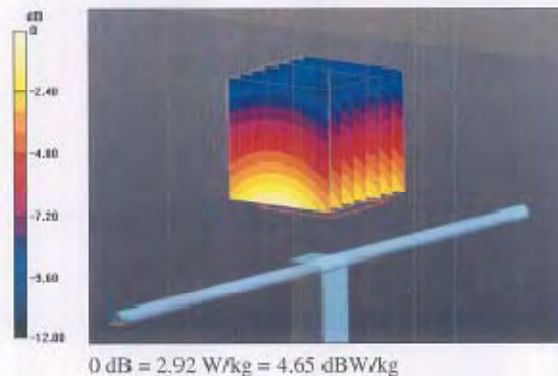
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.24 V/m; Power Drift = -0.01 dB

Peak SAR (extrapolated) = 3.71 W/kg

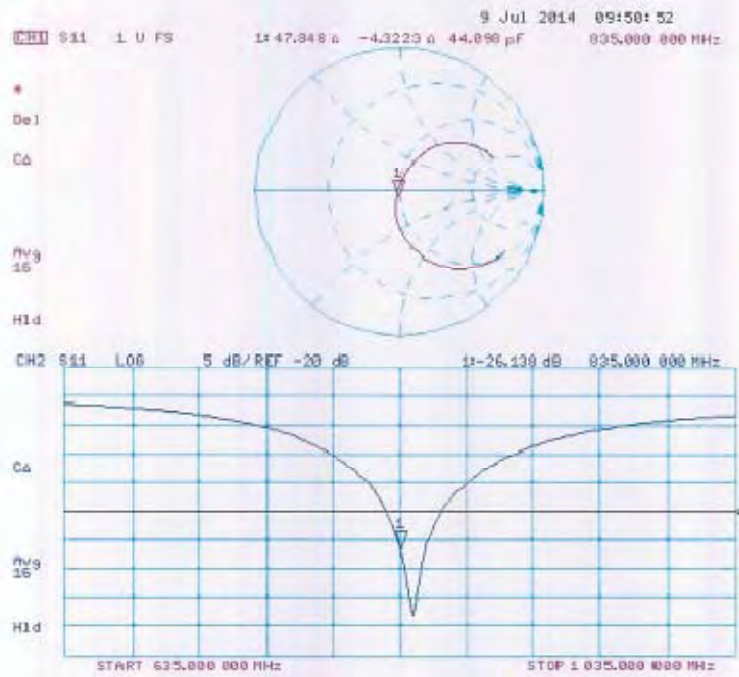
SAR(1 g) = 2.5 W/kg; SAR(10 g) = 1.63 W/kg

Maximum value of SAR (measured) = 2.92 W/kg





### Impedance Measurement Plot for Body TSL



## Dipole antenna Calibration (1 900 MHz)

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Client **EMC Compliance (Dymstec)**

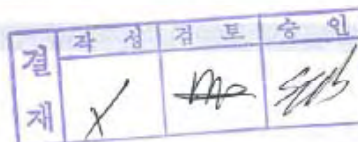
Certificate No: **D1900V2-5d160 Apr14**

### CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d160**

Calibration procedure(s) **QA CAL-05.v9**  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **April 23, 2014**





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	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SN: 5058 (20k)	03-Apr-14 (No. 217-01918)	Apr-15
Type-N mismatch combination	SN: 5047.2 / 06327	03-Apr-14 (No. 217-01921)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3-3205_Dec13)	Dec-14
DAE4	SN: 601	25-Apr-13 (No. DAE4-601_Apr13)	Apr-14
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator R&S SMT-06	100005	04-Aug-92 (in house check Oct-13)	In house check: Oct-16
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	In house check: Oct-14

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

Issued: April 23, 2014

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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:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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.



### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.1 ± 6 %	1.36 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.90 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.1 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.0 W/kg ± 16.5 % (k=2)

### Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.4 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °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	10.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	40.2 W/kg ± 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.34 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.3 W/kg ± 16.5 % (k=2)

## Appendix

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$50.8 \Omega + 5.9 j\Omega$
Return Loss	- 24.6 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$47.6 \Omega + 6.7 j\Omega$
Return Loss	- 22.8 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.197 ns
----------------------------------	----------

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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 20, 2011

## DASY5 Validation Report for Head TSL

Date: 23.04.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d160**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.36$  S/m;  $\epsilon_r = 39.1$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.06, 5.06, 5.06); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

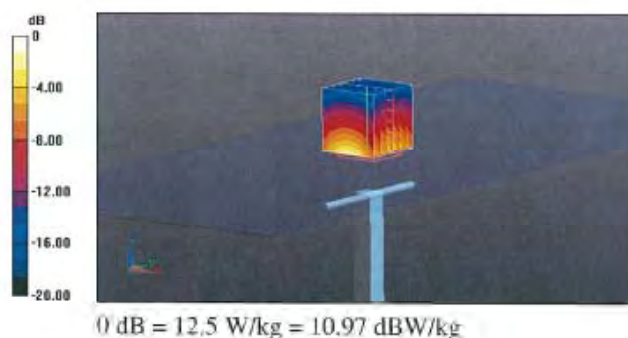
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 98.620 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.1 W/kg

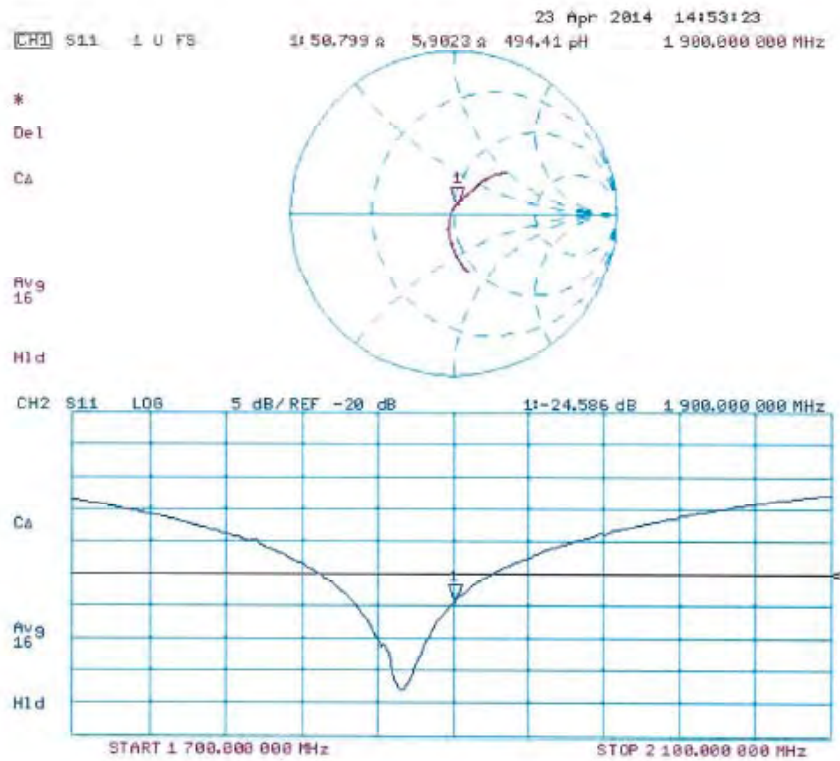
**SAR(1 g) = 9.9 W/kg; SAR(10 g) = 5.2 W/kg**

Maximum value of SAR (measured) = 12.5 W/kg





## Impedance Measurement Plot for Head TSL





**DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d160**

Communication System: UID 0 - CW; Frequency: 1900 MHz

Medium parameters used:  $f = 1900$  MHz;  $\sigma = 1.52$  S/m;  $\epsilon_r = 52.4$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASYS (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 25.04.2013
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.7(1137); SEMCAD X 14.6.10(7164)

**Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:**

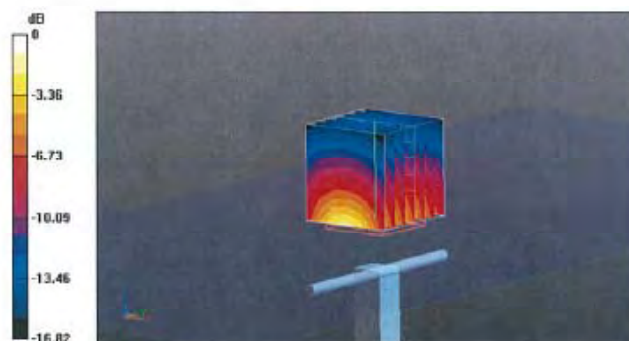
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.072 V/m; Power Drift = 0.01 dB

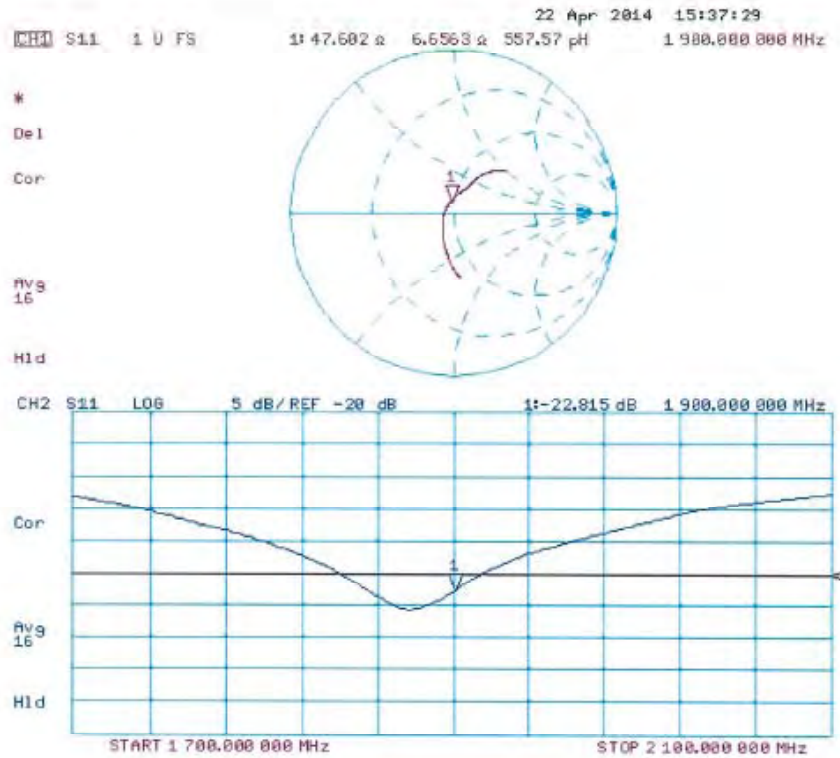
Peak SAR (extrapolated) = 17.6 W/kg

**SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.34 W/kg**

Maximum value of SAR (measured) = 12.7 W/kg



0 dB = 12.7 W/kg = 11.04 dBW/kg



## Dipole antenna Calibration (2 450 Mhz)

**Calibration Laboratory of  
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Accreditation No.: **SCS 108**

Client **EMC Compliance (Dym-stec)**

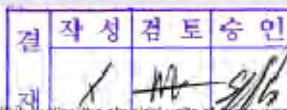
Certificate No: **D2450V2-895\_Jul14**

### CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 895**

Calibration procedure(s) **QA CAL-05.v9**  
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: **July 24, 2014**



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&PE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM 442A	GB37480704	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	US37292783	09-Oct-13 (No. 217-01827)	Oct-14
Power sensor HP 8481A	MY41092317	09-Oct-13 (No. 217-01828)	Oct-14
Reference 20 dB Attenuator	SHL 5056 (20k)	09-Apr-14 (No. 217-01916)	Apr-15
Type-N mismatch combination	SN: 5047 2 / 08327	09-Apr-14 (No. 217-01821)	Apr-15
Reference Probe ES3DV3	SN: 3205	30-Dec-13 (No. ES3/3205_Dec13)	Dec-14
DAE4	SN: 884	30-Apr-14 (No. DAE4-801_Apr14)	Apr-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
HF generator R&S SMT-08	#00005	04-Aug-09 (in house check Oct-13)	in house check: Oct-16
Network Analyzer HP 8755E	US37390585 S4206	18-Oct-01 (in house check Oct-13)	in house check: Oct-14

Calibrated by: **Claudio Leubler** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature  
  


Issued: July 24, 2014

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Certificate No: **D2450V2-895\_Jul14**

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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:**

- IEEE Std 1528-2013, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", June 2013
- 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
- KDB 865664, "SAR Measurement Requirements for 100 MHz to 6 GHz"

**Additional Documentation:**

- 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.

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%.





### Measurement Conditions

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

DASY Version	IDASY5	V52-8.8
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

### Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	37.8 $\pm$ 6 %	1.85 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

### SAR result with Head TSL

SAR averaged over 1 cm <sup>3</sup> (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.4 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	52.5 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.20 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	24.5 W/kg $\pm$ 16.5 % (k=2)

### 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 $\pm$ 0.2) °C	50.6 $\pm$ 6 %	2.03 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °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	13.1 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	50.9 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm <sup>3</sup> (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.01 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	23.6 W/kg $\pm$ 16.5 % (k=2)



## Appendix (Additional assessments outside the scope of SCS108)

### Antenna Parameters with Head TSL

Impedance, transformed to feed point	$53.0 \Omega + 1.6 j\Omega$
Return Loss	- 29.5 dB

### Antenna Parameters with Body TSL

Impedance, transformed to feed point	$50.6 \Omega + 3.7 j\Omega$
Return Loss	- 28.7 dB

### General Antenna Parameters and Design

Electrical Delay (one direction)	1.157 ns
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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. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.

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	June 19, 2012

## DASY5 Validation Report for Head TSL

Date: 24.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 895**

Communication System: UID 0 - C'W; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 1.85$  S/m;  $\epsilon_r = 37.8$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/TEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

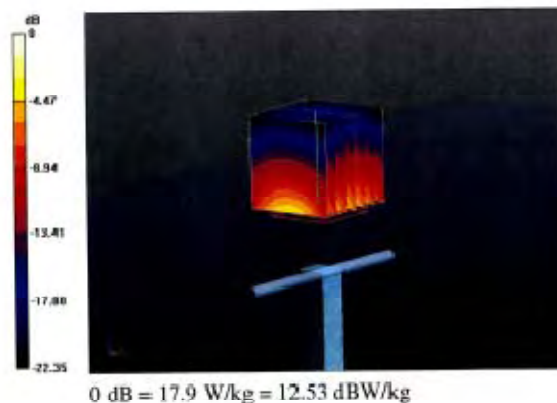
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.2 V/m; Power Drift = 0.08 dB

Peak SAR (extrapolated) = 27.9 W/kg

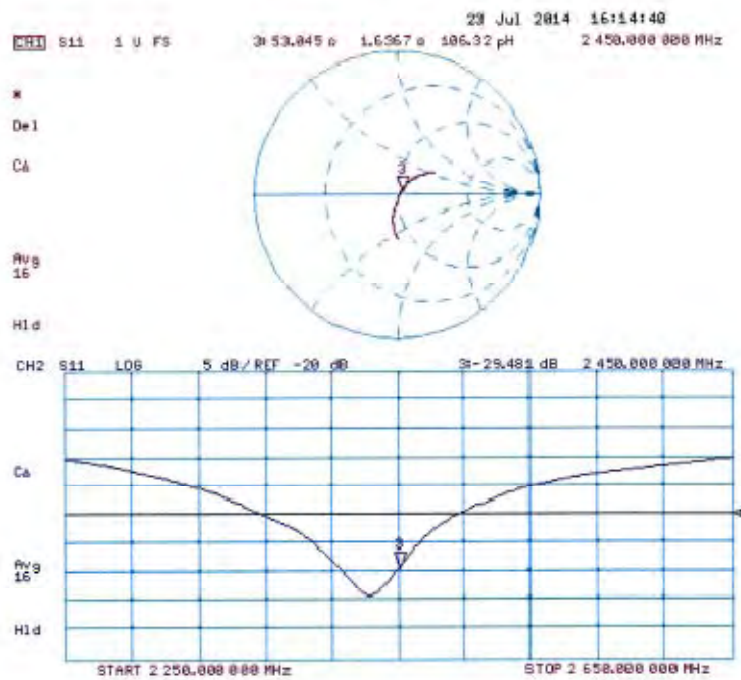
**SAR(1 g) = 13.4 W/kg; SAR(10 g) = 6.2 W/kg**

Maximum value of SAR (measured) = 17.9 W/kg





### Impedance Measurement Plot for Head TSL





## DASY5 Validation Report for Body TSL

Date: 16.07.2014

Test Laboratory: SPEAG, Zurich, Switzerland

**DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 895**

Communication System: UTD 0 - CW; Frequency: 2450 MHz

Medium parameters used:  $f = 2450$  MHz;  $\sigma = 2.03$  S/m;  $\epsilon_r = 50.6$ ;  $\rho = 1000$  kg/m<sup>3</sup>

Phantom section: Flat Section

Measurement Standard: DASY5 (IEEE/TEC/ANSI C63.19-2011)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.35, 4.35, 4.35); Calibrated: 30.12.2013;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 30.04.2014
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

### Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

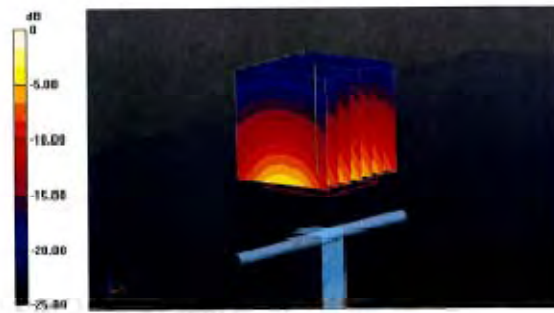
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 95.39 V/m; Power Drift = -0.00 dB

Peak SAR (extrapolated) = 27.6 W/kg

**SAR(1 g) = 13.1 W/kg; SAR(10 g) = 6.01 W/kg**

Maximum value of SAR (measured) = 17.3 W/kg



0 dB = 17.3 W/kg = 12.38 dBW/kg



### Impedance Measurement Plot for Body TSL

