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Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

APPENDIX D: PROBE & DIPOLE CALIBRATION DATA

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Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **ET3-1643_Mar10**

CALIBRATION CERTIFICATE

Object **ET3DV6 - SN:1643**

Calibration procedure(s) **QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2**
Calibration procedure for dosimetric E-field probes

Calibration date: **March 9, 2010**

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

All calibrations have been conducted in the closed laboratory facility; environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41495277	1-Apr-09 (No. 217-01030)	Apr-10
Power sensor E4412A	MY41498087	1-Apr-09 (No. 217-01030)	Apr-10
Reference 3 dB Attenuator	SN: S5054 (3c)	31-Mar-09 (No. 217-01026)	Mar-10
Reference 20 dB Attenuator	SN: S5086 (20b)	31-Mar-09 (No. 217-01028)	Mar-10
Reference 30 dB Attenuator	SN: S5129 (30b)	31-Mar-09 (No. 217-01027)	Mar-10
Reference Probe ES3DV2	SN: 3013	30-Dec-09 (No. ES3-3013_Dec09)	Dec-10
DAE4	SN: 660	29-Sep-09 (No. DAE4-660_Sep09)	Sep-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-09)	In house check: Oct10


Calibrated by:	Name Jeton Kastirali	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Technical Manager	

Issued: March 10, 2010

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

Certificate No: ET3-1643_Mar10

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Accreditation No.: **SCS 108**

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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}; A, B, C** are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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.

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ET3DV6 SN:1643

March 9, 2010


Probe ET3DV6

SN:1643

Manufactured:	November 7, 2001
Last calibrated:	March 10, 2009
Recalibrated:	March 9, 2010

Calibrated for DASY Systems

(Note: non-compatible with DASY2 system!)

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ET3DV6 SN:1643

March 9, 2010

DASY - Parameters of Probe: ET3DV6 SN:1643

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.75	2.01	1.79	± 10.1%
DCP (mV) ^B	93.2	91.0	90.9	

Modulation Calibration Parameters


UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	300.0	± 1.5%
			Y	0.00	0.00	1.00	300.0	
			Z	0.00	0.00	1.00	300.0	

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 Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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ET3DV6 SN:1643


March 9, 2010

DASY - Parameters of Probe: ET3DV6 SN:1643

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz]^C	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.01	6.01	6.01	0.42	2.35 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.99	4.99	4.99	0.62	2.35 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.74	4.74	4.74	0.79	2.10 ± 11.0%

^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.

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ET3DV6 SN:1643


March 9, 2010

DASY - Parameters of Probe: ET3DV6 SN:1643

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz]^C	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.93	5.93	5.93	0.33	2.77 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.58	4.58	4.58	0.75	2.63 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.54	4.54	4.54	0.99	2.20 ± 11.0%

^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.

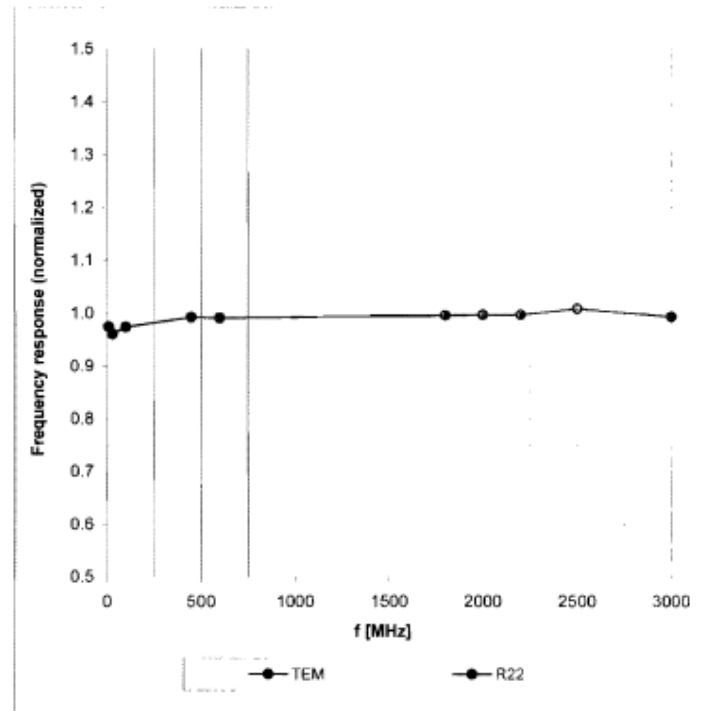
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ET3DV6 SN:1643


March 9, 2010

Frequency Response of E-Field

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



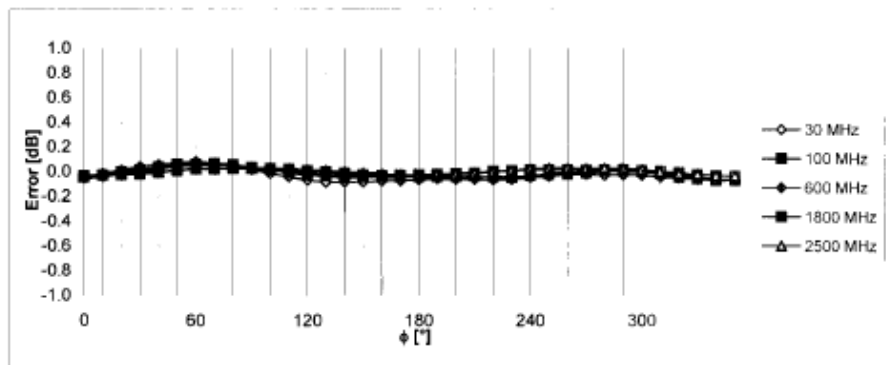
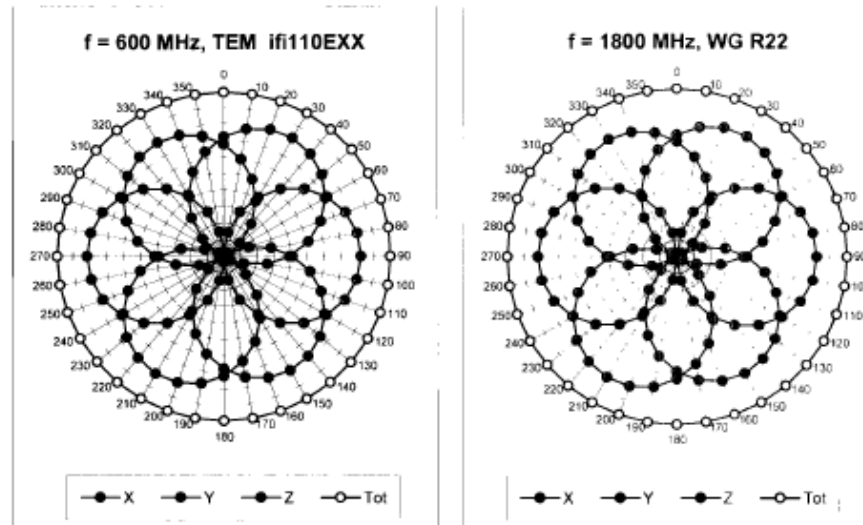
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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



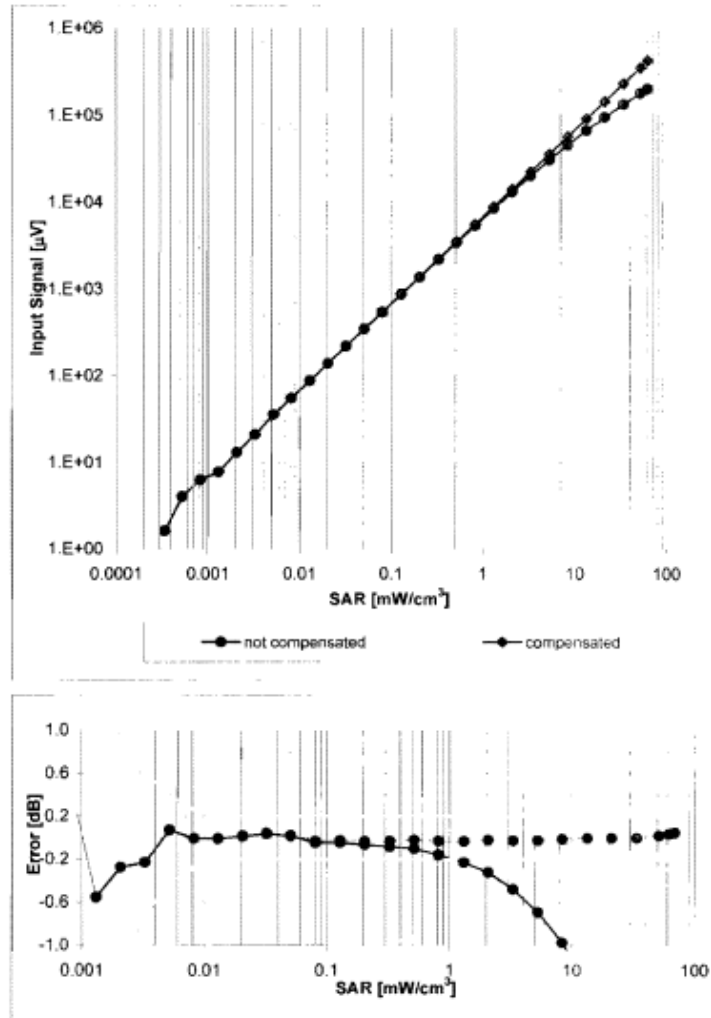
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ (k=2)

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ET3DV6 SN:1643

March 9, 2010

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



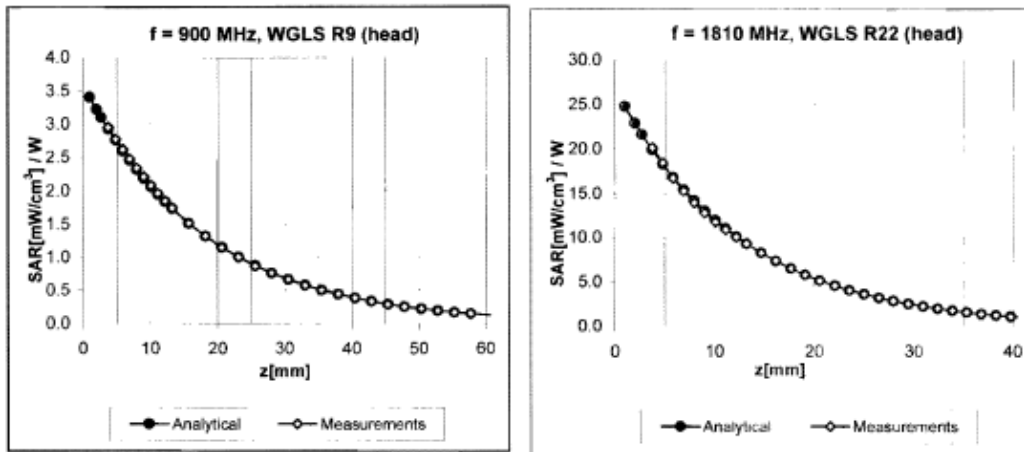
Uncertainty of Linearity Assessment: $\pm 0.6\%$ ($k=2$)

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ET3DV6 SN:1643

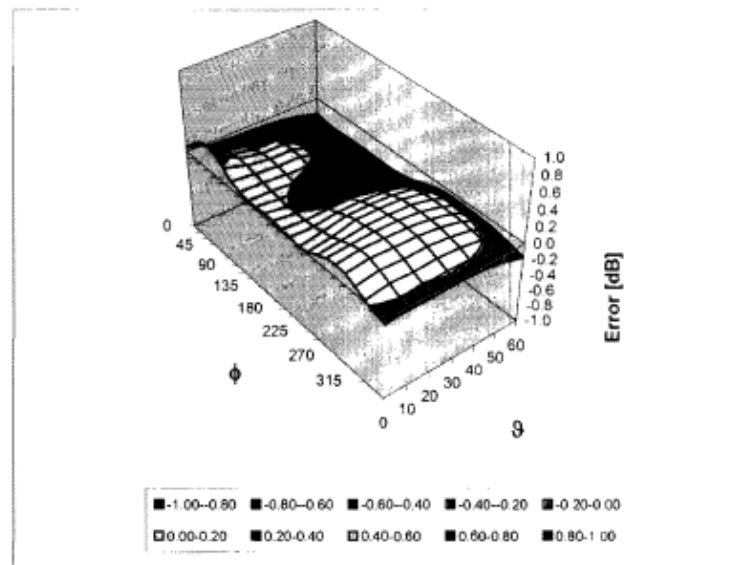
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Conversion Factor Assessment




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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March 9, 2010

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	4 mm

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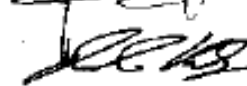
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Accreditation No.: **SCS 108**


Client: **RTS (RIM Testing Services)**

Certificate No: **ET3-1644_Nov10**

CALIBRATION CERTIFICATE			
Object	ET3DV6 - SN:1644		
Calibration procedure(s)	QA CAL-01.v6, QA CAL-23.v3 and QA CAL-25.v2 Calibration procedure for dosimetric E-field probes		
Calibration date	November 16, 2010		
<p>This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI). The measurements and the uncertainties with confidence probability are given on the following pages and are part of the certificate.</p> <p>All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.</p> <p>Calibration Equipment used (NISTE critical for calibration)</p>			
Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293674	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498067	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5056 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES30V2	SN: 3013	30-Dec-09 (No. E53-3013_Dec09)	Dec-10
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-09 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11
Calibrated by:	Name Jeran Kastrell	Function Laboratory Technician	Signature 
Approved by:	Name Katja Polonko	Technical Manager	
<p>This calibration certificate shall not be reproduced except in full without written approval of the laboratory.</p> <p>Issued: November 17, 2010</p>			

Certificate No: **ET3-1644_Nov10**

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Accreditation No.: **SCS 108**

Glossary:


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$NORM_{x,y,z}$	sensitivity in free space
$ConvF$	sensitivity in TSL / $NORM_{x,y,z}$
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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., $\theta = 0$ is normal to probe axis

Calibration is Performed According to the Following Standards:

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- 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 $\theta = 0$ ($f \leq 900$ 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 E^2 -field uncertainty inside TSL (see below $ConvF$).
- $NORM(f)_{x,y,z} = NORM_{x,y,z} \cdot \text{frequency_response}$ (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of $ConvF$.
- $DCP_{x,y,z}$: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- $A_{x,y,z}$; $B_{x,y,z}$; $C_{x,y,z}$; $VR_{x,y,z}$: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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 $NORM_{x,y,z} \cdot ConvF$ 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.

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ET3DV6 SN:1644

November 16, 2010


Probe ET3DV6

SN:1644

Manufactured:	November 7, 2001
Last calibrated:	November 11, 2009
Recalibrated:	November 16, 2010

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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ET3DV6 SN:1644

November 16, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1644

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$) ^A	1.83	1.95	2.01	± 10.1%
DCP (mV) ^B	97.9	97.9	96.6	

Modulation Calibration Parameters


UID	Communication System Name	PAR		A dB	B dBμV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	143.5	± 3.4 %
			Y	0.00	0.00	1.00	146.8	
			Z	0.00	0.00	1.00	148.4	

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 E-field uncertainty inside TSL (see Pages 5 and 6).

^B Numerical conversion parameter, uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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ET3DV6 SN:1644


November 16, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1644

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz] ¹	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc. (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.69 ± 5%	6.54	6.54	6.54	0.31	3.05 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.00	6.00	6.00	0.27	3.46 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.09	5.09	5.09	0.40	2.50 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.50 ± 5%	4.42	4.42	4.42	0.99	1.27 ± 11.0%

¹ The validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 21). The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.

	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 19(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

ET3DV6 SN:1644


November 16, 2010

DASY/EASY - Parameters of Probe: ET3DV6 SN:1644

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz] ¹	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	5.14	5.14	5.14	0.31	3.06 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	5.93	5.93	5.93	0.36	2.71 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.59	4.59	4.59	0.32	2.60 ± 11.0%
2450	± 50 / ± 100	62.7 ± 5%	1.95 ± 5%	4.05	4.05	4.05	0.99	1.23 ± 11.0%

¹ 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.

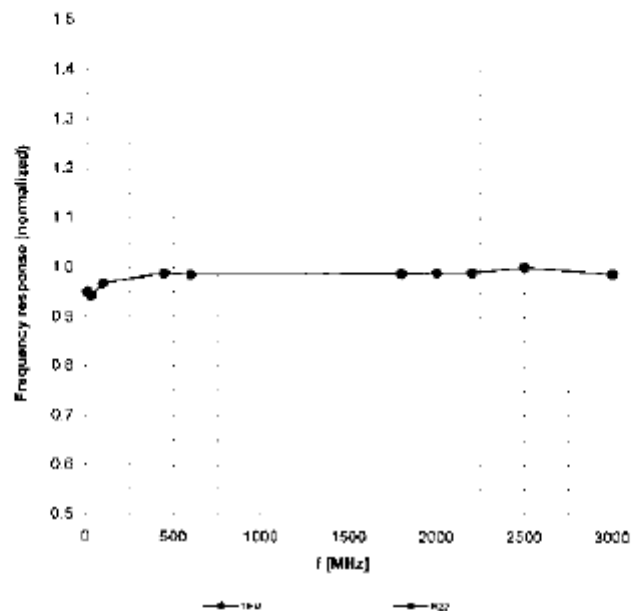
	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 20(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

ET3DV6 SN:1644


November 16, 2010

Frequency Response of E-Field

{TEM-Cell: #110 EXX, Waveguide: R22}



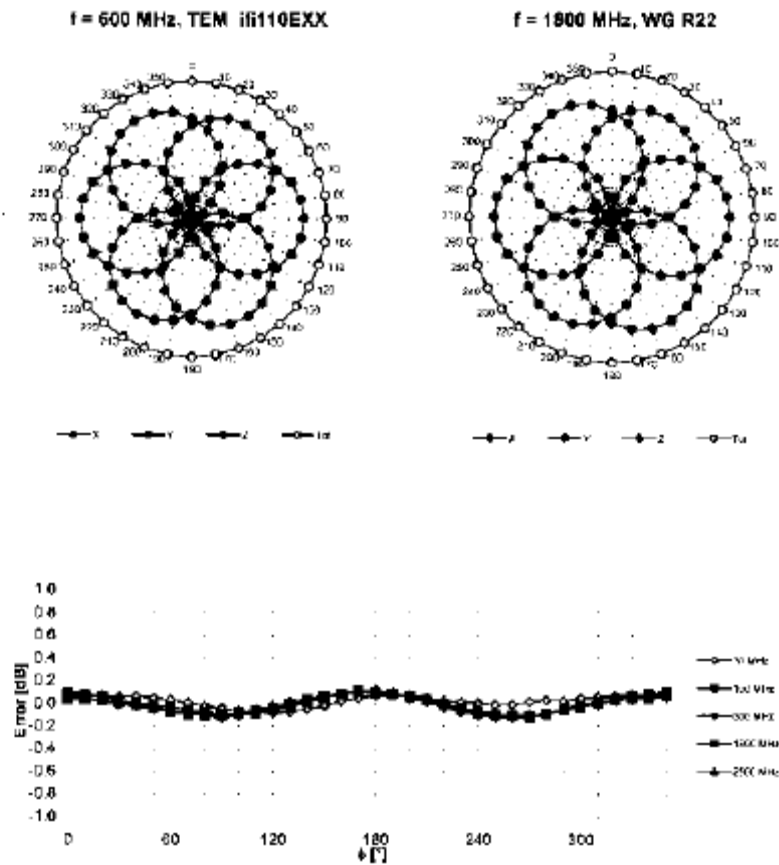
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 21(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW


ET3DV6 \$N:1644

November 16, 2010

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



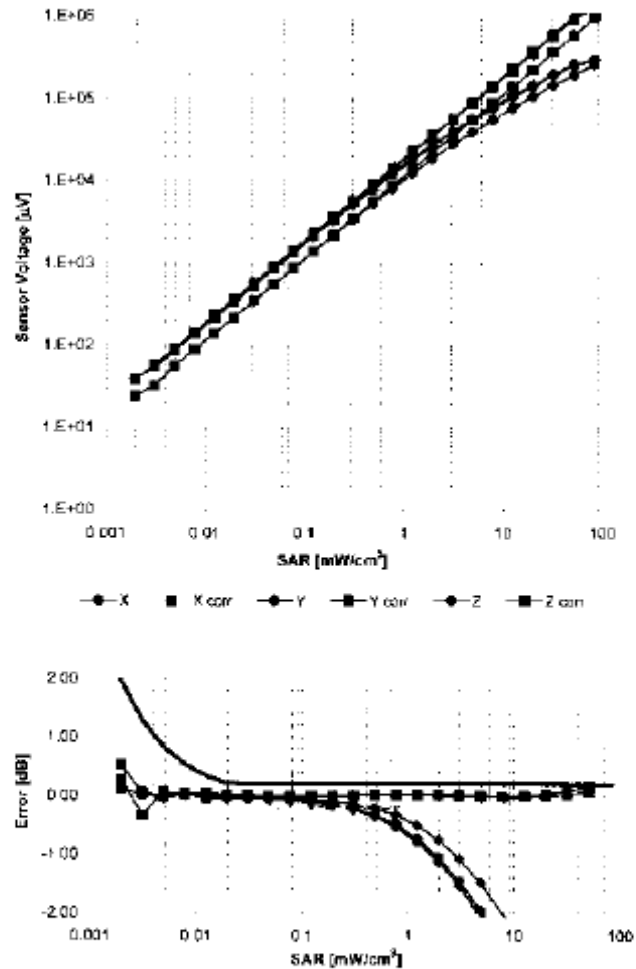
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 22(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW


ET3DV6 SN:1644

November 16, 2010

Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



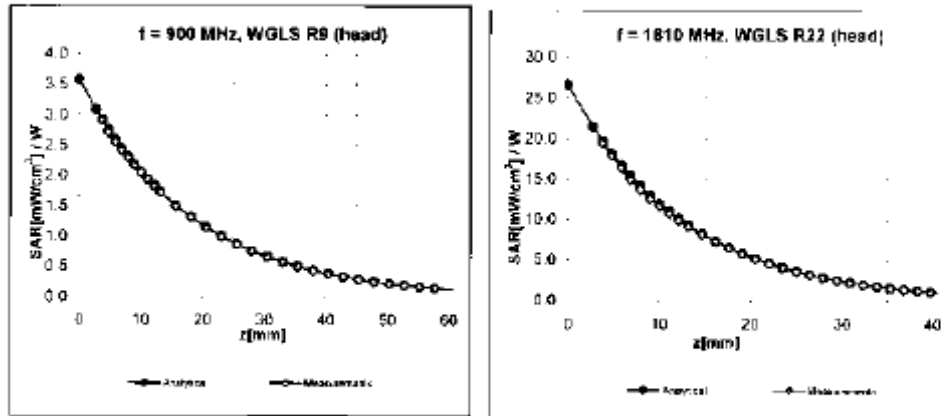
Uncertainty of Linearity Assessment: $\pm 0.6\%$ (k=2)

	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 23(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

ET3DV6 SN:1644

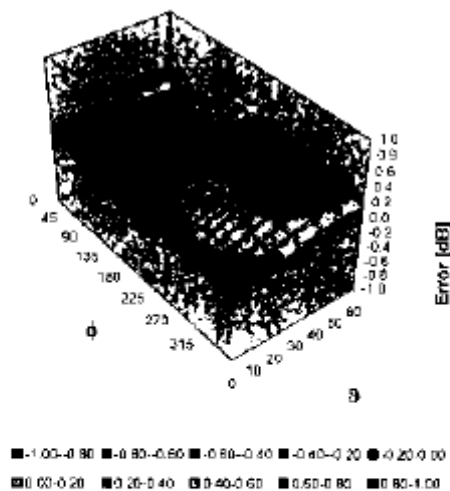
November 16, 2010

Conversion Factor Assessment




Deviation from Isotropy in HSL

Error (ϕ , θ), $f = 900$ MHz



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


	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 24(81)
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ET3DV6 SN:1644

November 16, 2010

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	enabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	6.8 mm
Probe Tip to Sensor X Calibration Point	2.7 mm
Probe Tip to Sensor Y Calibration Point	2.7 mm
Probe Tip to Sensor Z Calibration Point	2.7 mm
Recommended Measurement Distance from Surface	3.7 mm

	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 25(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **ES3-3225_Jan11**

CALIBRATION CERTIFICATE

Object **ES3DV3 - SN:3225**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-23.v4 and QA CAL-25.v3**
Calibration procedure for dosimetric E-field probes

Calibration date: **January 13, 2011**

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	GB41293674	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41498087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37380585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name Jeton Kasirati	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Technical Manager	


Issued: January 15, 2011

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Certificate No: **ES3-3225_Jan11**

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Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

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Accreditation No.: **SCS 108**

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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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.

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ES3DV3 SN:3225

January 13, 2011


Probe ES3DV3

SN:3225

Manufactured:	September 1, 2009
Last calibrated:	December 11, 2009
Recalibrated:	January 13, 2011

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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ES3DV3 SN:3225

January 13, 2011

DASY/EASY - Parameters of Probe: ES3DV3 SN:3225

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	1.26	1.21	1.31	± 10.1%
DCP (mV) ^B	102.1	100.8	99.1	

Modulation Calibration Parameters


UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	149.8	± 2.6 %
			Y	0.00	0.00	1.00	148.1	
			Z	0.00	0.00	1.00	110.7	

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 Pages 5 and 6).

^B Numerical linearization parameter; uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value

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ES3DV3 SN:3225


January 13, 2011

DASY/EASY - Parameters of Probe: ES3DV3 SN:3225

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz]^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	41.9 ± 5%	0.89 ± 5%	6.47	6.47	6.47	0.89	1.08 ± 11.0%
900	± 50 / ± 100	41.5 ± 5%	0.97 ± 5%	6.11	6.11	6.11	0.81	1.10 ± 11.0%
1810	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	5.26	5.26	5.26	0.37	1.68 ± 11.0%
1950	± 50 / ± 100	40.0 ± 5%	1.40 ± 5%	4.98	4.98	4.98	0.48	1.51 ± 11.0%
2450	± 50 / ± 100	39.2 ± 5%	1.80 ± 5%	4.60	4.60	4.60	0.52	1.54 ± 11.0%
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	4.52	4.52	4.52	0.53	1.58 ± 11.0%

^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.

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Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

ES3DV3 SN:3225


January 13, 2011

DASY/EASY - Parameters of Probe: ES3DV3 SN:3225

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz][Ⓒ]	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
750	± 50 / ± 100	55.5 ± 5%	0.96 ± 5%	6.30	6.30	6.30	0.76	1.17 ± 11.0%
900	± 50 / ± 100	55.0 ± 5%	1.05 ± 5%	6.12	6.12	6.12	0.72	1.20 ± 11.0%
1810	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.88	4.88	4.88	0.26	2.70 ± 11.0%
1950	± 50 / ± 100	53.3 ± 5%	1.52 ± 5%	4.89	4.89	4.89	0.33	2.28 ± 11.0%
2450	± 50 / ± 100	52.7 ± 5%	1.95 ± 5%	4.43	4.43	4.43	0.99	1.04 ± 11.0%
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	4.29	4.29	4.29	0.99	1.05 ± 11.0%

[Ⓒ] 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.

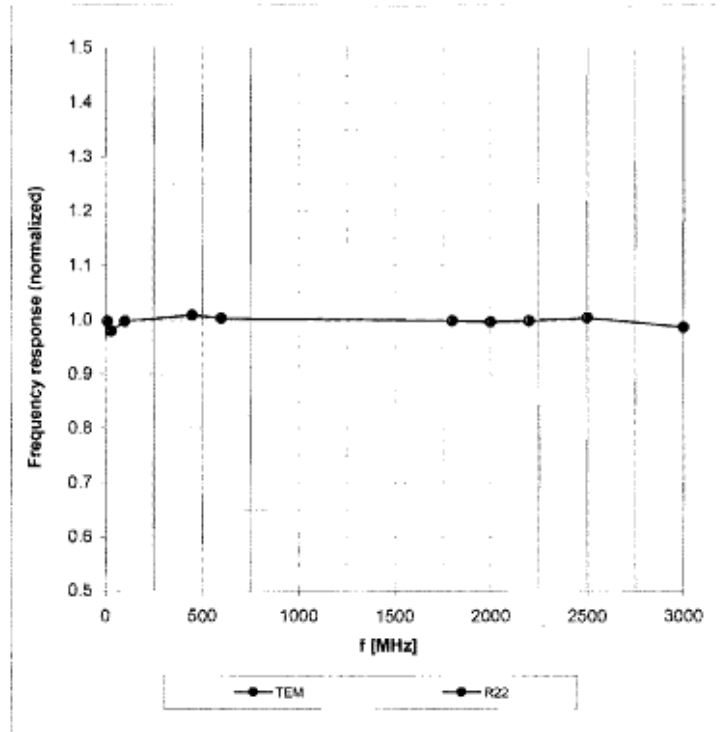
	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 31(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

ES3DV3 SN:3225


January 13, 2011

Frequency Response of E-Field

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



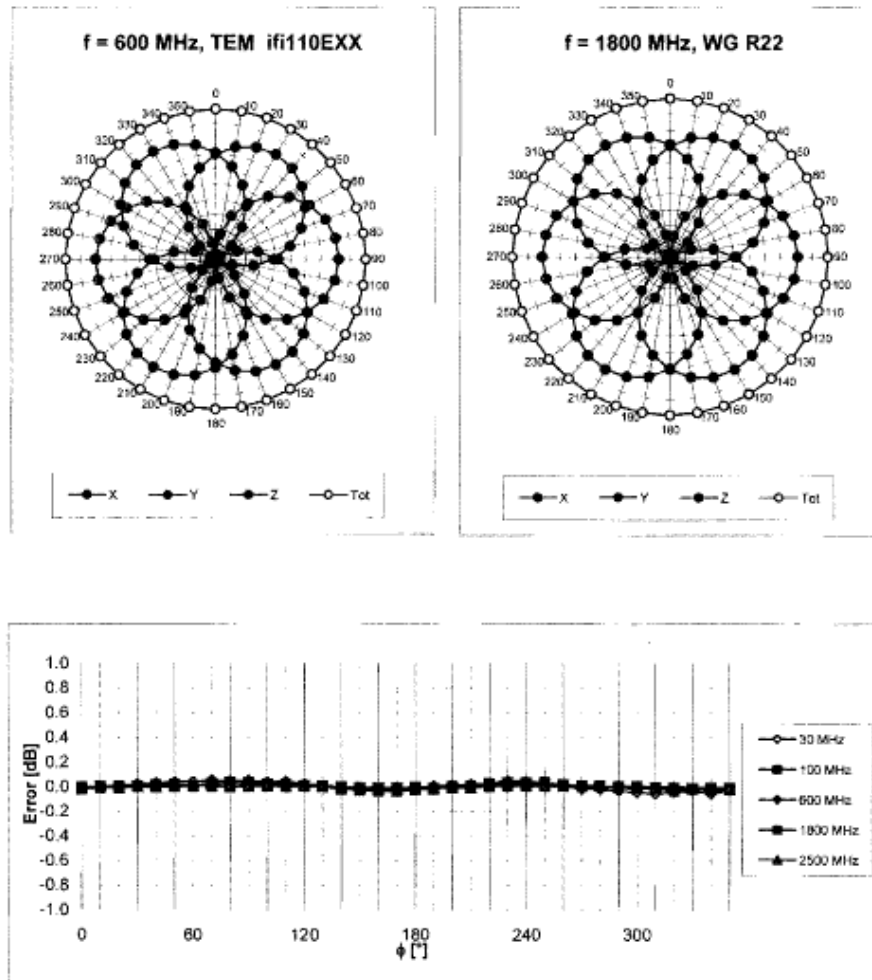
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ ($k=2$)

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Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW


ES3DV3 SN:3225

January 13, 2011

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



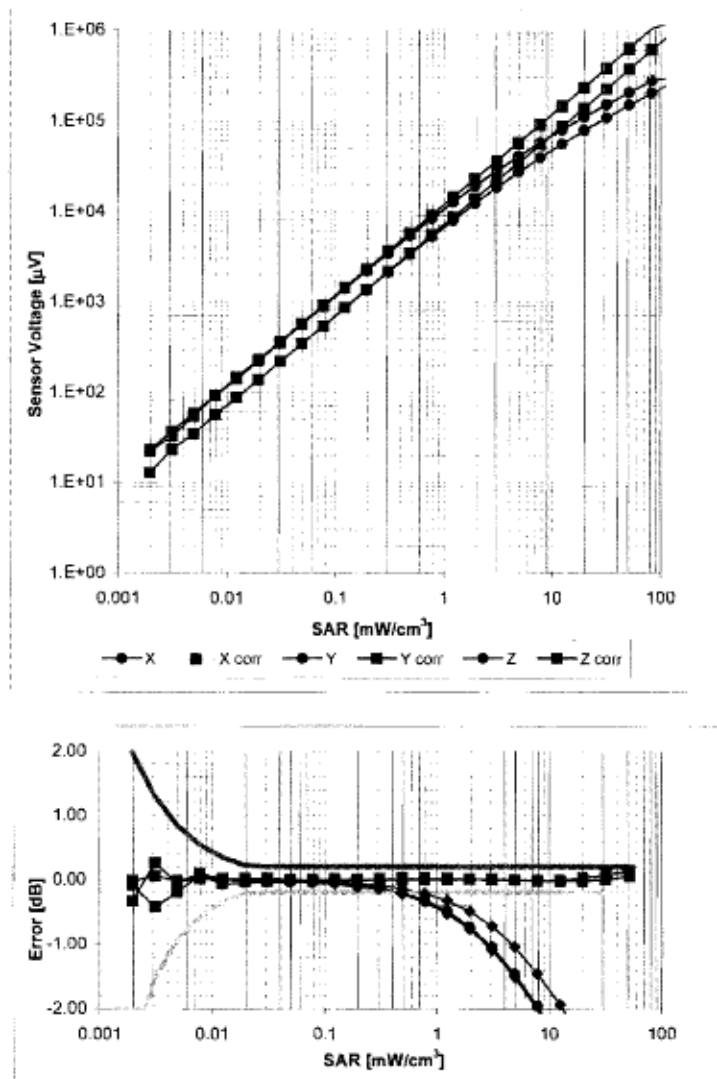
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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ES3DV3 SN:3225

January 13, 2011

Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



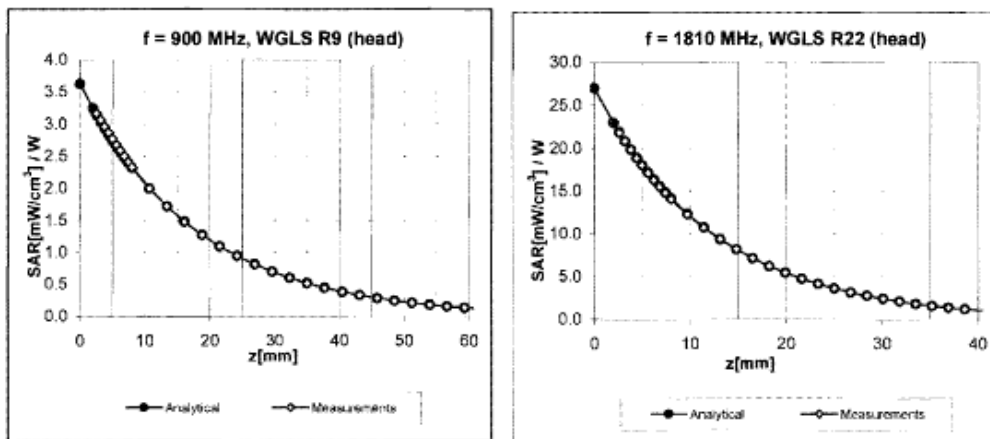
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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ES3DV3 SN:3225

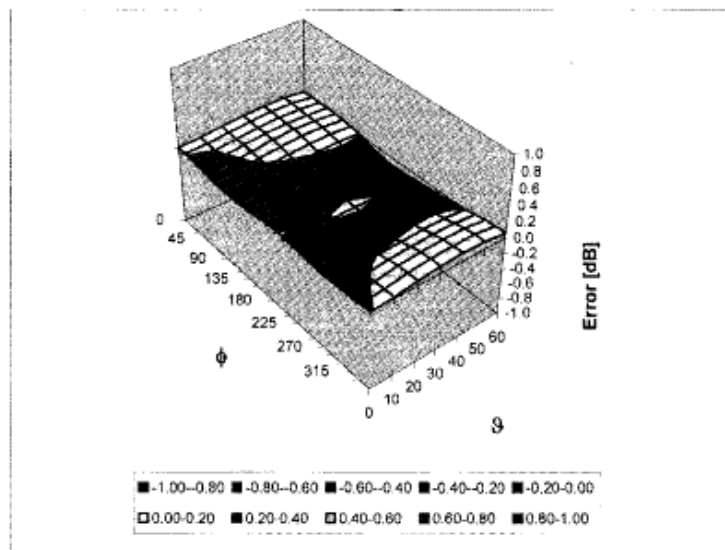
January 13, 2011

Conversion Factor Assessment




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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ES3DV3 SN:3225

January 13, 2011

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
Mechanical Surface Detection Mode	enabled
Optical Surface Detection Mode	disabled
Probe Overall Length	337 mm
Probe Body Diameter	10 mm
Tip Length	10 mm
Tip Diameter	4 mm
Probe Tip to Sensor X Calibration Point	2 mm
Probe Tip to Sensor Y Calibration Point	2 mm
Probe Tip to Sensor Z Calibration Point	2 mm
Recommended Measurement Distance from Surface	3 mm

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Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **EX3-3548_Jan11**

CALIBRATION CERTIFICATE

Object **EX3DV4 - SN:3548**

Calibration procedure(s) **QA CAL-01.v7, QA CAL-14.v3, QA CAL-23.v4 and QA CAL-25.v3**
Calibration procedure for dosimetric E-field probes

Calibration date: **January 20, 2011**

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

All calibrations have been conducted in the closed laboratory facility: environment temperature (22 ± 3)°C and humidity < 70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41495277	1-Apr-10 (No. 217-01136)	Apr-11
Power sensor E4412A	MY41496087	1-Apr-10 (No. 217-01136)	Apr-11
Reference 3 dB Attenuator	SN: S5054 (3c)	30-Mar-10 (No. 217-01159)	Mar-11
Reference 20 dB Attenuator	SN: S5086 (20b)	30-Mar-10 (No. 217-01161)	Mar-11
Reference 30 dB Attenuator	SN: S5129 (30b)	30-Mar-10 (No. 217-01160)	Mar-11
Reference Probe ES3DV2	SN: 3013	29-Dec-10 (No. ES3-3013_Dec10)	Dec-11
DAE4	SN: 660	20-Apr-10 (No. DAE4-660_Apr10)	Apr-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-10)	In house check: Oct-11


Calibrated by: **Katja Pokovic** **Technical Manager**
Approved by: **Niels Kuster** **Quality Manager**

Signature



Issued: January 20, 2011

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S Servizio svizzero di taratura
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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

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
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C	modulation dependent linearization parameters
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.
- DCP_{x,y,z}**: DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- A_{x,y,z}; B_{x,y,z}; C_{x,y,z}; VR_{x,y,z}**: A, B, C are numerical linearization parameters assessed based on the data of power sweep for specific modulation signal. The parameters do not depend on frequency nor media. VR is the maximum calibration range expressed in RMS voltage across the diode.
- 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.

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EX3DV4 SN:3548

January 20, 2011


Probe EX3DV4

SN:3548

Manufactured:	November 16, 2004
Last calibrated:	January 21, 2010
Recalibrated:	January 20, 2011

Calibrated for DASY/EASY Systems

(Note: non-compatible with DASY2 system!)

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EX3DV4 SN:3548

January 20, 2011

DASY/EASY - Parameters of Probe: EX3DV4 SN:3548

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu\text{V}/(\text{V}/\text{m})^2$) ^A	0.35	0.44	0.45	± 10.1%
DCP (mV) ^B	101.4	100.4	99.2	

Modulation Calibration Parameters


UID	Communication System Name	PAR		A dB	B dBuV	C	VR mV	Unc ^E (k=2)
10000	CW	0.00	X	0.00	0.00	1.00	128.8	± 2.9 %
			Y	0.00	0.00	1.00	139.9	
			Z	0.00	0.00	1.00	142.9	

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 Pages 5 and 6).

^B Numerical linearization parameter: uncertainty not required.

^E Uncertainty is determined using the maximum deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

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EX3DV4 SN:3548


January 20, 2011

DASY/EASY - Parameters of Probe: EX3DV4 SN:3548

Calibration Parameter Determined in Head Tissue Simulating Media

f [MHz]	Validity [MHz]^c	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
2600	± 50 / ± 100	39.0 ± 5%	1.96 ± 5%	7.08	7.08	7.08	0.23	1.34 ± 11.0%
5200	± 50 / ± 100	36.0 ± 5%	4.66 ± 5%	5.01	5.01	5.01	0.40	1.80 ± 13.1%
5500	± 50 / ± 100	35.6 ± 5%	4.96 ± 5%	4.63	4.63	4.63	0.50	1.80 ± 13.1%
5800	± 50 / ± 100	35.3 ± 5%	5.27 ± 5%	4.42	4.42	4.42	0.50	1.80 ± 13.1%

^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.

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EX3DV4 SN:3548


January 20, 2011

DASY/EASY - Parameters of Probe: EX3DV4 SN:3548

Calibration Parameter Determined in Body Tissue Simulating Media

f [MHz]	Validity [MHz]^C	Permittivity	Conductivity	ConvF X	ConvF Y	ConvF Z	Alpha	Depth Unc (k=2)
2600	± 50 / ± 100	52.5 ± 5%	2.16 ± 5%	7.12	7.12	7.12	0.67	0.71 ± 11.0%
5200	± 50 / ± 100	49.0 ± 5%	5.30 ± 5%	4.79	4.79	4.79	0.45	1.90 ± 13.1%
5500	± 50 / ± 100	48.6 ± 5%	5.65 ± 5%	4.29	4.29	4.29	0.50	1.90 ± 13.1%
5800	± 50 / ± 100	48.2 ± 5%	6.00 ± 5%	4.08	4.08	4.08	0.60	1.90 ± 13.1%

^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.

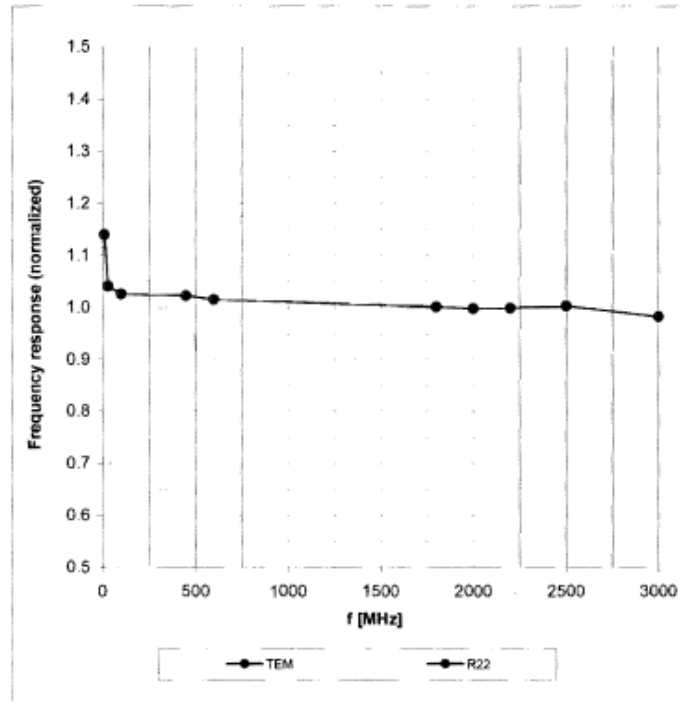
	Document Appendix D for the BlackBerry® Smartphone Model RDU71CW/RDV71UW SAR Report			Page 42(81)
Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

EX3DV4 SN:3548


January 20, 2011

Frequency Response of E-Field

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



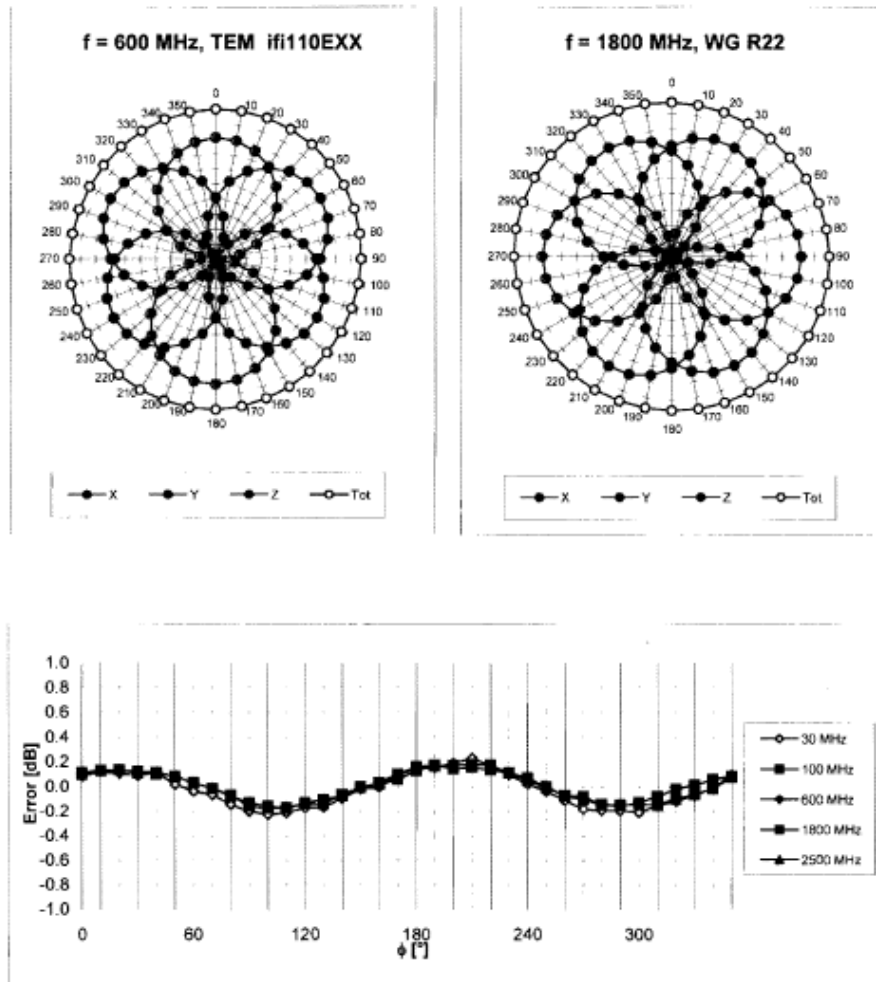
Uncertainty of Frequency Response of E-field: $\pm 6.3\%$ (k=2)

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EX3DV4 SN:3548

January 20, 2011

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



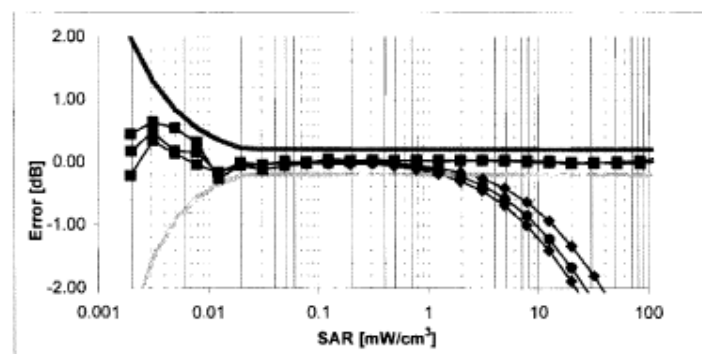
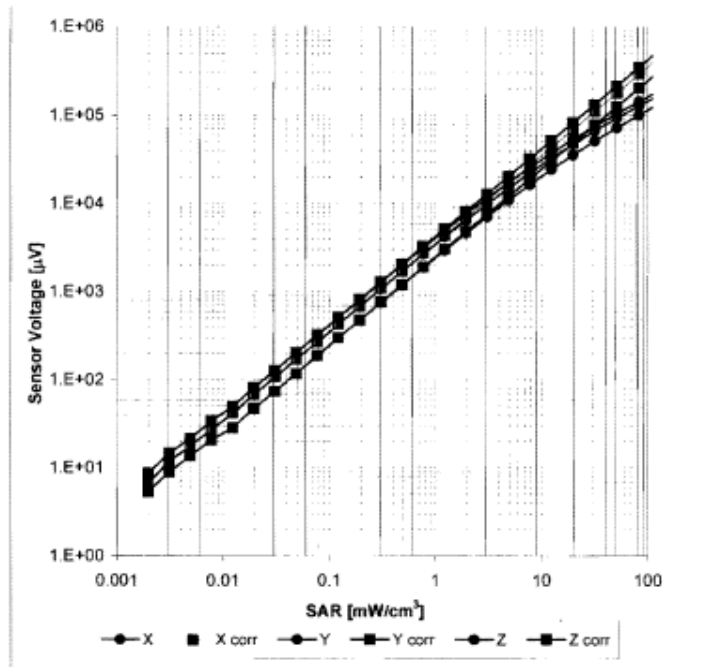
Uncertainty of Axial Isotropy Assessment: $\pm 0.5\%$ ($k=2$)

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EX3DV4 SN:3548

January 20, 2011

Dynamic Range f(SAR_{head}) (TEM cell, f = 900 MHz)



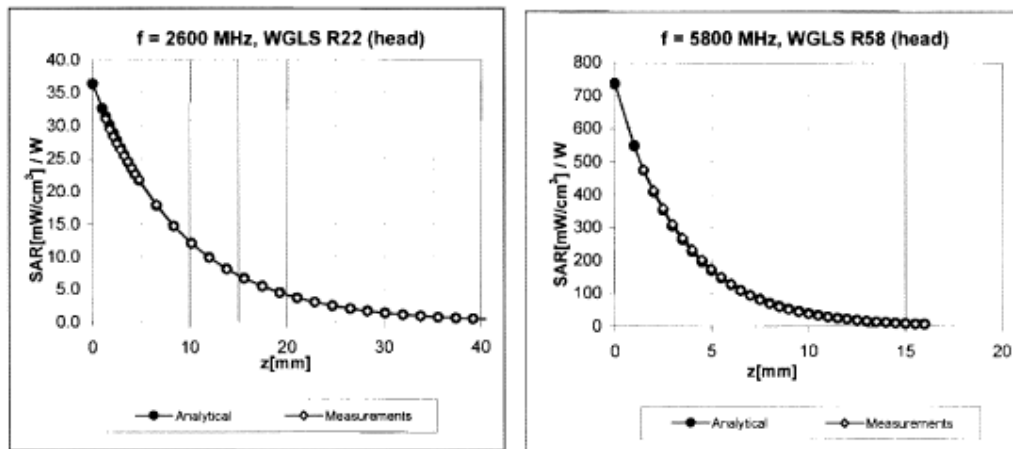
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

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EX3DV4 SN:3548

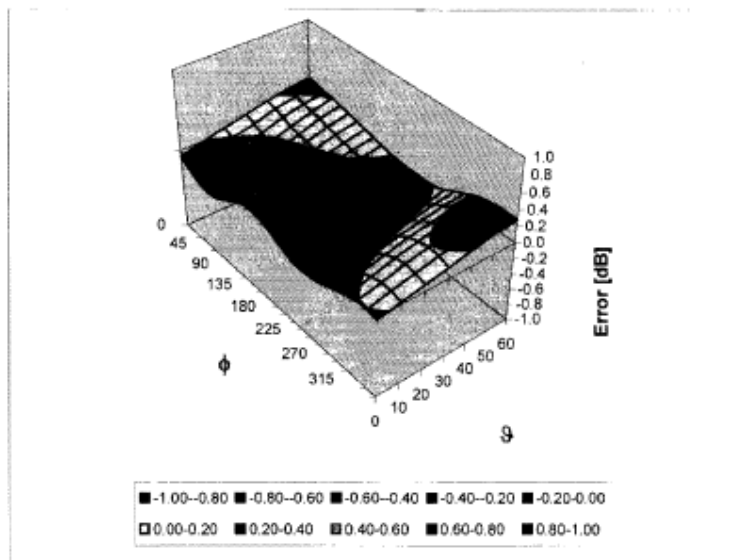
January 20, 2011

Conversion Factor Assessment




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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EX3DV4 SN:3548

January 20, 2011

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	Not applicable
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	2 mm

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Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **D835V2-446_Jan11**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 446**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits

Calibration date: **January 21, 2011**

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by: **Dimce Iliev** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Technical Manager

Signature




Issued: January 21, 2011

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

Certificate No: D835V2-446_Jan11

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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 1528-2003, "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
- 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:

- 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.

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Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz ± 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 ± 0.2) °C	41.3 ± 6 %	0.89 mho/m ± 6 %
Head TSL temperature during test	(21.8 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	2.39 mW / g
SAR normalized	normalized to 1W	9.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	9.63 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR normalized	normalized to 1W	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	6.27 mW /g ± 16.5 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.6 Ω - 7.7 $j\Omega$
Return Loss	- 22.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.386 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	October 24, 2001

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DASY5 Validation Report for Head TSL

Date/Time: 21.01.2011 10:18:05

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN:446

Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1

Medium: HSL900

Medium parameters used: $f = 835 \text{ MHz}$; $\sigma = 0.89 \text{ mho/m}$; $\epsilon_r = 41.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.03, 6.03, 6.03); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=15mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

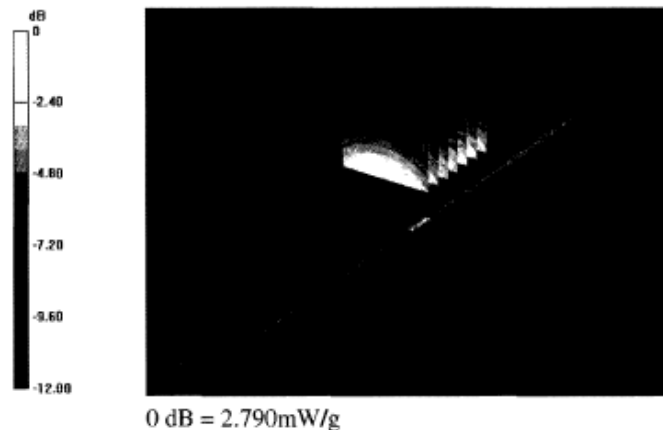
grid: dx=5mm, dy=5mm, dz=5mm


Reference Value = 57.426 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 3.600 W/kg

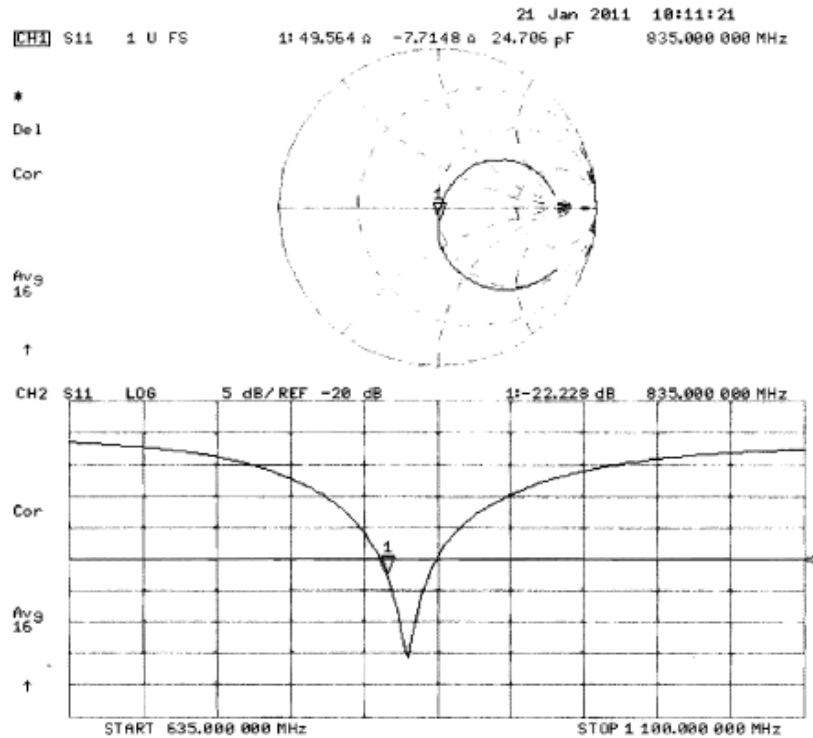
SAR(1 g) = 2.39 mW/g; SAR(10 g) = 1.56 mW/g


Maximum value of SAR (measured) = 2.790 mW/g



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Impedance Measurement Plot for Head TSL



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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 **RTS (RIM Testing Services)**

Certificate No: **D1900V2-545_Jan11**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 545**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits

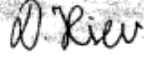

Calibration date: **January 13, 2011**

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

Calibrated by:	Name Dimitre Iliev	Function Laboratory Technician	Signature 
Approved by:	Name Katja Pokovic	Function Technical Manager	Signature 

Issued: January 14, 2011

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Author Data Andrew Becker	Dates of Test Feb 7 – May 25, 2011	Test Report No RTS-3933-1105-11B RTS-2580-1106-09	FCC ID: L6ARDU70CW L6ARDV70UW	IC ID 2503A-RDU70CW 2503A-RDV70UW

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



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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**

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 1528-2003, "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
- 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:

- 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.

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Measurement Conditions

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

DASY Version	DASY5	V52.6
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	1900 MHz ± 1 MHz	

Head TSL parameters


The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.5 ± 6 %	1.43 mho/m ± 6 %
Head TSL temperature during test	(21.2 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.2 mW / g
SAR normalized	normalized to 1W	40.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	40.0 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.26 mW / g
SAR normalized	normalized to 1W	21.0 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.8 mW / g ± 16.5 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω + 1.8 j Ω
Return Loss	- 34.4 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.199 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	November 15, 2001

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DASY5 Validation Report for Head TSL

Date/Time: 13.01.2011 14:52:49

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN:545

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

Medium: HSL U12 BB

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.43$ mho/m; $\epsilon_r = 38.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.09, 5.09, 5.09); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement

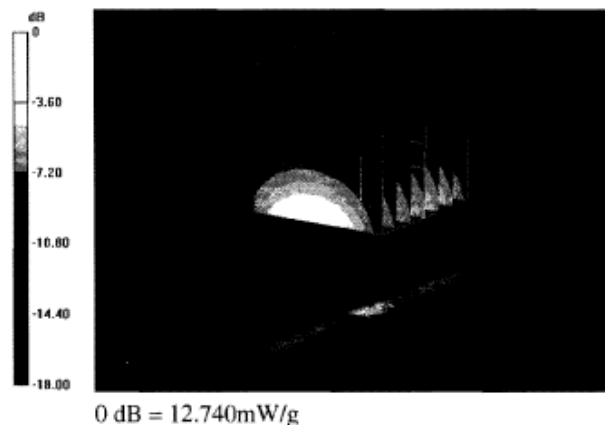
grid: dx=5mm, dy=5mm, dz=5mm


Reference Value = 98.053 V/m; Power Drift = 0.03 dB

Peak SAR (extrapolated) = 18.648 W/kg

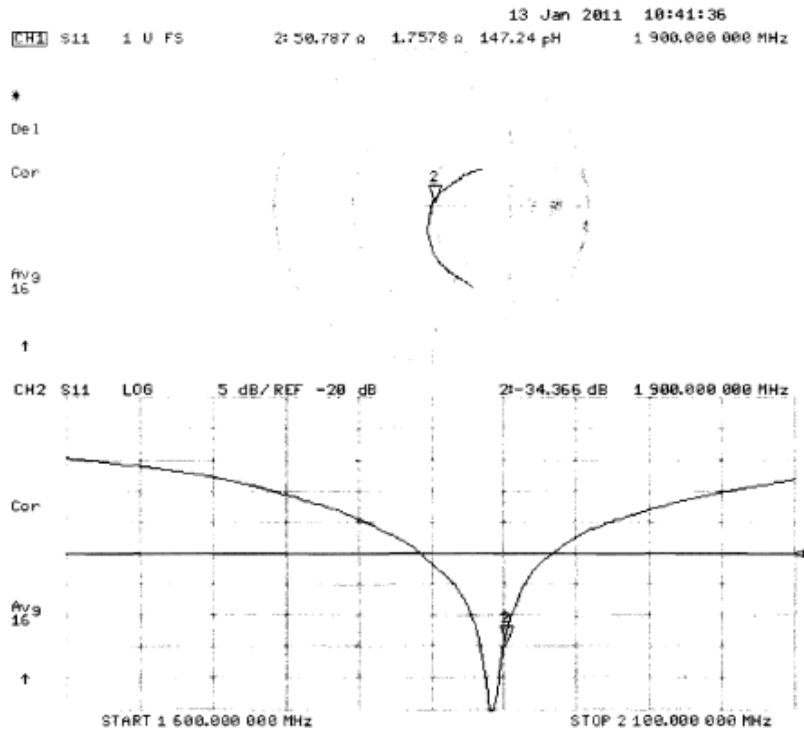
SAR(1 g) = 10.2 mW/g; SAR(10 g) = 5.26 mW/g


Maximum value of SAR (measured) = 12.743 mW/g



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Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **D2450V2-747_Nov09**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 747**

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

Calibration date: **November 11, 2009**

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	06-Oct-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe ES3DV3	SN: 3205	26-Jun-09 (No. ES3-3205_Jun09)	Jun-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

	Name	Function	Signature
Calibrated by:	Mike Meil	Laboratory Technician	

	Name	Function
Approved by:	Katja Pokovic	Technical Manager

Issued: November 16, 2009

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Multilateral Agreement for the recognition of calibration certificates

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 1528-2003, "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
- 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:

- 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.

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Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V4.9	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 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 ± 0.2) °C	39.1 ± 6 %	1.78 mho/m ± 6 %
Head TSL temperature during test	(21.3 ± 0.2) °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR normalized	normalized to 1W	53.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	53.4 mW /g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.23 mW / g
SAR normalized	normalized to 1W	24.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	24.9 mW /g ± 16.5 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	51.9 Ω + 0.9 j Ω
Return Loss	- 33.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.161 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

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DASY5 Validation Report for Head TSL

Date/Time: 11.11.2009 15:04:10

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN:747

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

Medium: HSL U11 BB

Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 1.79 \text{ mho/m}$; $\epsilon_r = 39.2$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.53, 4.53, 4.53); Calibrated: 26.06.2009
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Head/d=10mm, Pin=250 mW, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) (7x7x7)/Cube 0:

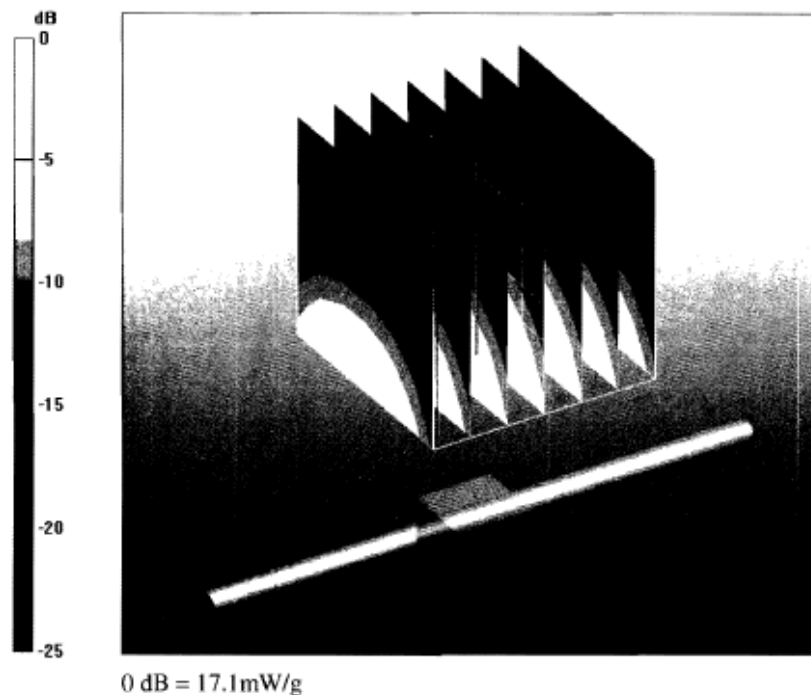
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$


Reference Value = 101.3 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 27 W/kg

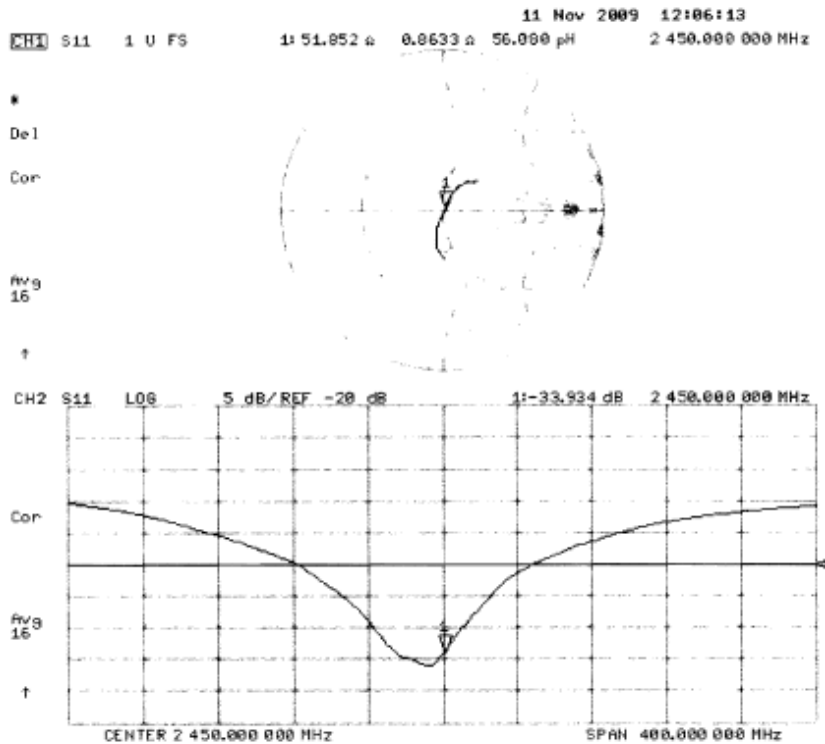
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.23 mW/g


Maximum value of SAR (measured) = 17.1 mW/g



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Impedance Measurement Plot for Head TSL



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Accreditation No.: **SCS 108**

Client **RTS (RIM Testing Services)**

Certificate No: **D5GHzV2-1033_Nov09**

CALIBRATION CERTIFICATE

Object **D5GHzV2 - SN: 1033**

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

Calibration date: **November 13, 2009**

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	06-Oct-09 (No. 217-01086)	Oct-10
Power sensor HP 8481A	US37292783	06-Oct-09 (No. 217-01086)	Oct-10
Reference 20 dB Attenuator	SN: 5086 (20g)	31-Mar-09 (No. 217-01025)	Mar-10
Type-N mismatch combination	SN: 5047.2 / 06327	31-Mar-09 (No. 217-01029)	Mar-10
Reference Probe EX3DV4	SN: 3503	11-Mar-09 (No. EX3-3503_Mar09)	Mar-10
DAE4	SN: 601	07-Mar-09 (No. DAE4-601_Mar09)	Mar-10
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-09)	In house check: Oct-10

Calibrated by: **Jeton Kastrati** Function: **Laboratory Technician**


Approved by: **Katja Pokovic** Technical Manager

Signature



Issued: November 16, 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:


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

- 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.

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Measurement Conditions

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

DASY Version	DASY5	V5.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Area Scan resolution	dx, dy = 10 mm	
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 2.5 mm	
Frequency	5200 MHz ± 1 MHz 5500 MHz ± 1 MHz 5800 MHz ± 1 MHz	

Head TSL parameters at 5200 MHz


The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	36.0	4.66 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.4 ± 6 %	4.54 mho/m ± 6 %
Head TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.75 mW / g
SAR normalized	normalized to 1W	77.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	77.2 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.19 mW / g
SAR normalized	normalized to 1W	21.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	21.8 mW / g ± 19.5 % (k=2)

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Head TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.6	4.96 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	35.6 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Head TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	8.29 mW / g
SAR normalized	normalized to 1W	82.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	82.9 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.32 mW / g
SAR normalized	normalized to 1W	23.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	23.2 mW / g ± 19.5 % (k=2)

Head TSL parameters at 5800 MHz


The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.2 ± 6 %	5.10 mho/m ± 6 %
Head TSL temperature during test	(22.5 ± 0.2) °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm ³ (1 g) of Head TSL	condition	
SAR measured	100 mW input power	7.62 mW / g
SAR normalized	normalized to 1W	76.2 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	75.6 mW / g ± 19.9 % (k=2)

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

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Body TSL parameters at 5500 MHz


The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.5 ± 6 %	5.86 mho/m ± 6 %
Body TSL temperature during test	(22.5 ± 0.2) °C	-----	-----

SAR result with Body TSL at 5500 MHz

SAR averaged over 1 cm ³ (1 g) of Body TSL	condition	
SAR measured	100 mW input power	8.22 mW / g
SAR normalized	normalized to 1W	82.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	81.9 mW / g ± 19.9 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.28 mW / g
SAR normalized	normalized to 1W	22.8 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	22.7 mW / g ± 19.5 % (k=2)

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Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	50.1 Ω - 9.2 j Ω
Return Loss	-20.7 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	51.2 Ω - 4.2 j Ω
Return Loss	-27.3 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	56.0 Ω - 2.6 j Ω
Return Loss	-24.2 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	51.1 Ω - 3.0 j Ω
Return Loss	-29.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.202 ns
----------------------------------	----------


After long term use with 40 W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals.

No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 09, 2004

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DASY5 Validation Report for Head TSL

Date/Time: 12.11.2009 13:12:49

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1033

Communication System: CW; Frequency: 5200 MHz, Frequency: 5500 MHz, Frequency: 5800 MHz; Duty Cycle: 1:1

Medium: HSL 3-6 GHz

Medium parameters used: $f = 5200$ MHz; $\sigma = 4.53$ mho/m; $\epsilon_r = 35.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.81$ mho/m; $\epsilon_r = 34.8$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.08$ mho/m; $\epsilon_r = 34.3$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.36, 5.36, 5.36), ConvF(4.85, 4.85, 4.85), ConvF(4.74, 4.74, 4.74); Calibrated: 11.03.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration D5GHzV2 Dipole (Head)/d=10mm, Pin=250mW, f=5200 MHz/Area Scan

(91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 15.4 mW/g

Configuration D5GHzV2 Dipole/d=10mm, Pin=250mW, f=5200 MHz/Zoom Scan

(4x4x2.5mm), dist=2mm (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 64.7 V/m; Power Drift = 0.035 dB

Peak SAR (extrapolated) = 30 W/kg

SAR(1 g) = 7.75 mW/g; SAR(10 g) = 2.19 mW/g

Maximum value of SAR (measured) = 15.3 mW/g

Configuration D5GHzV2 Dipole/d=10mm, Pin=250mW, f=5500 MHz/Zoom Scan

(4x4x2.5mm), dist=2mm (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 65.4 V/m; Power Drift = 0.057 dB

Peak SAR (extrapolated) = 33.8 W/kg

SAR(1 g) = 8.29 mW/g; SAR(10 g) = 2.32 mW/g

Maximum value of SAR (measured) = 16.5 mW/g


Configuration D5GHzV2 Dipole/d=10mm, Pin=250mW, f=5800 MHz/Zoom Scan

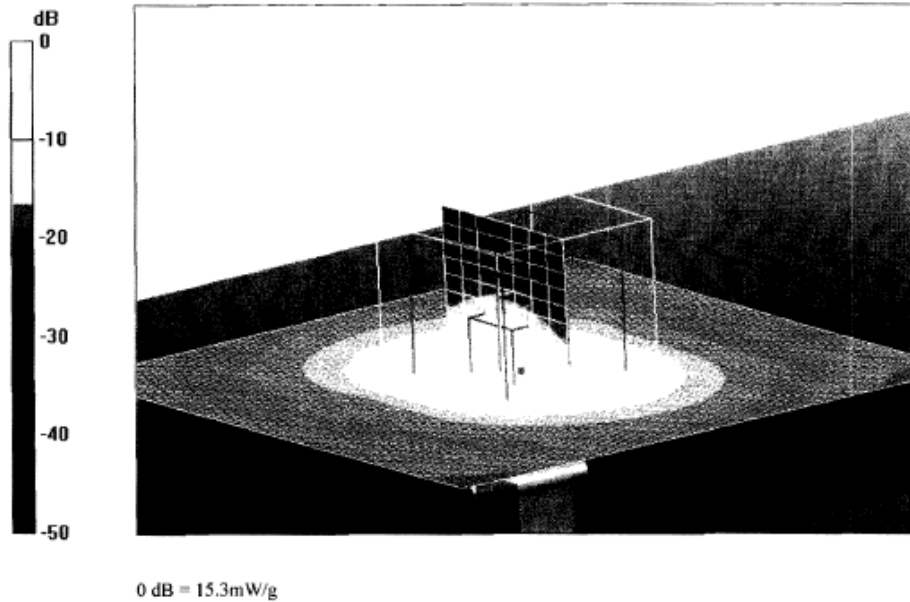
(4x4x2.5mm), dist=2mm (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm


Reference Value = 61.7 V/m; Power Drift = 0.067 dB

Peak SAR (extrapolated) = 32.4 W/kg

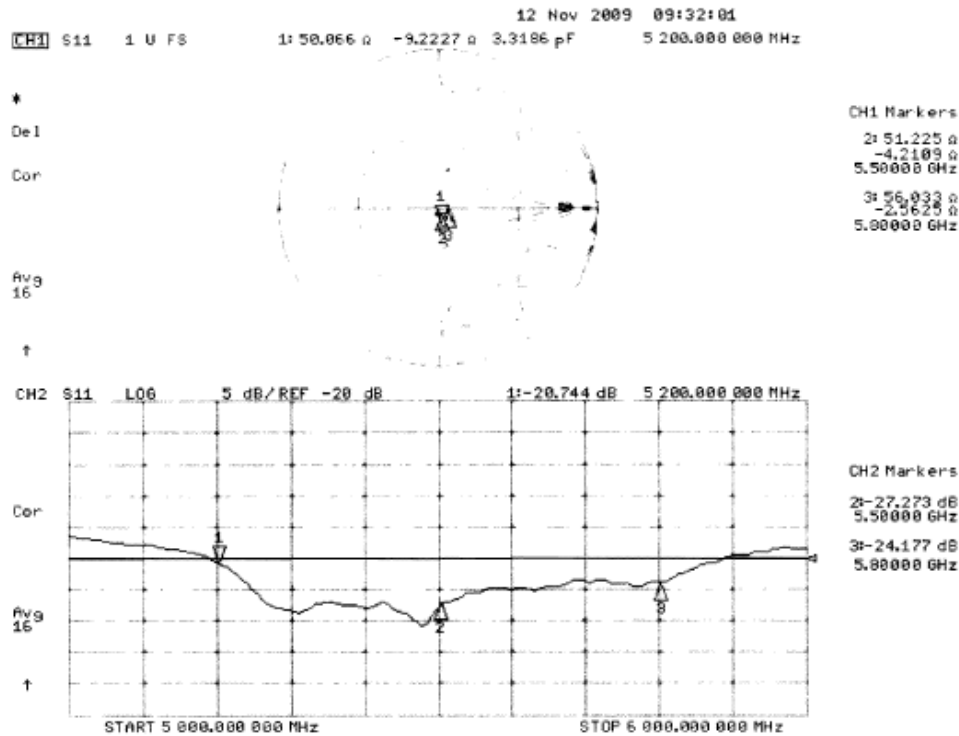
SAR(1 g) = 7.62 mW/g; SAR(10 g) = 2.15 mW/g


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Impedance Measurement Plot for Head TSL



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DASY5 Validation Report for Body TSL

Date/Time: 13.11.2009 12:28:18

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN:1033

Communication System: CW; Frequency: 5500 MHz; Duty Cycle: 1:1

Medium: MSL 3-6 GHz

Medium parameters used: $f = 5500$ MHz; $\sigma = 5.83$ mho/m; $\epsilon_r = 47.6$; $\rho = 1000$ kg/m³

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.37, 4.37, 4.37); Calibrated: 11.03.2009
- Sensor-Surface: 2mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 07.03.2009
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- Measurement SW: DASY5, V5.2 Build 157; SEMCAD X Version 14.0 Build 57

Configuration D5GHzV2 Dipole/d=10mm, Pin=250mW, f=5500 MHz/Area Scan

(91x91x1): Measurement grid: dx=10mm, dy=10mm

Maximum value of SAR (interpolated) = 16.2 mW/g

Configuration D5GHzV2 Dipole/d=10mm, Pin=250mW, f=5500 MHz/Zoom Scan

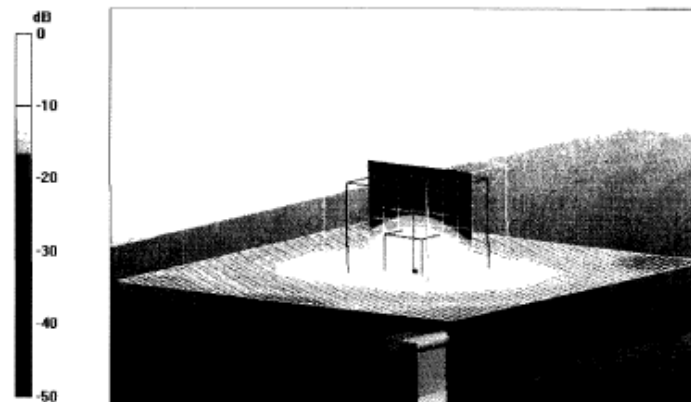
(4x4x2.5mm), dist=2mm (8x8x10)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=2.5mm

Reference Value = 59.5 V/m; Power Drift = -0.044 dB


Peak SAR (extrapolated) = 33.3 W/kg

SAR(1 g) = 8.22 mW/g; SAR(10 g) = 2.28 mW/g

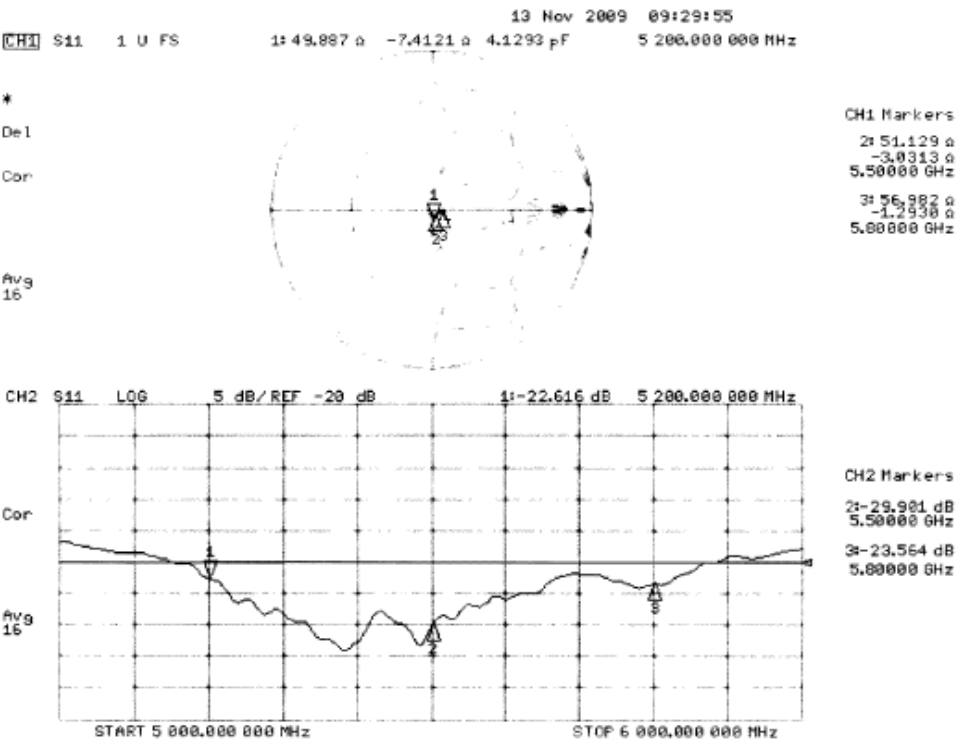
Maximum value of SAR (measured) = 16.4 mW/g




0 dB = 16.4mW/g

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Impedance Measurement Plot for Body TSL



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



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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 **RTS (RIM Testing Services)**

Certificate No: **D1800V2-2d020_Jan11**

CALIBRATION CERTIFICATE

Object **D1800V2 - SN: 2d020**

Calibration procedure(s) **QA CAL-05.v8**
Calibration procedure for dipole validation kits

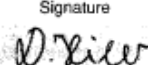
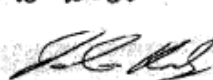
Calibration date: **January 13, 2011**

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	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: 5086 (20g)	30-Mar-10 (No. 217-01158)	Mar-11
Type-N mismatch combination	SN: 5047.2 / 06327	30-Mar-10 (No. 217-01162)	Mar-11
Reference Probe ES3DV3	SN: 3205	30-Apr-10 (No. ES3-3205_Apr10)	Apr-11
DAE4	SN: 601	10-Jun-10 (No. DAE4-601_Jun10)	Jun-11
Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	4-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimitre Iliev	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 13, 2011

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

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Calibration Laboratory of
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Zeughausstrasse 43, 8004 Zurich, Switzerland



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

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 1528-2003, "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
- 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:

- 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.

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Measurement Conditions

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

DASY Version	DASY5	V52.6
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	1800 MHz ± 1 MHz	

Head TSL parameters


The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	40.0	1.40 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	38.6 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature during test	(21.3 ± 0.2) °C	****	****

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.78 mW / g
SAR normalized	normalized to 1W	39.1 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	39.2 mW / g ± 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.13 mW / g
SAR normalized	normalized to 1W	20.5 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	20.5 mW / g ± 16.5 % (k=2)

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Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	46.5 Ω - 7.3 j Ω
Return Loss	- 21.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.216 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.

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	September 07, 2001

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DASY5 Validation Report for Head TSL

Date/Time: 13.01.2011 12:34:12

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1800 MHz; Type: D1800V2; Serial: D1800V2 - SN:2d020

Communication System: CW; Frequency: 1800 MHz; Duty Cycle: 1:1

Medium: HSL U12 BB

Medium parameters used: $f = 1800 \text{ MHz}$; $\sigma = 1.38 \text{ mho/m}$; $\epsilon_r = 38.7$; $\rho = 1000 \text{ kg/m}^3$

Phantom section: Flat Section

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

DASY5 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.05, 5.05, 5.05); Calibrated: 30.04.2010
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 10.06.2010
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- Measurement SW: DASY52, V52.6.1 Build (408)
- Postprocessing SW: SEMCAD X, V14.4.2 Build (2595)

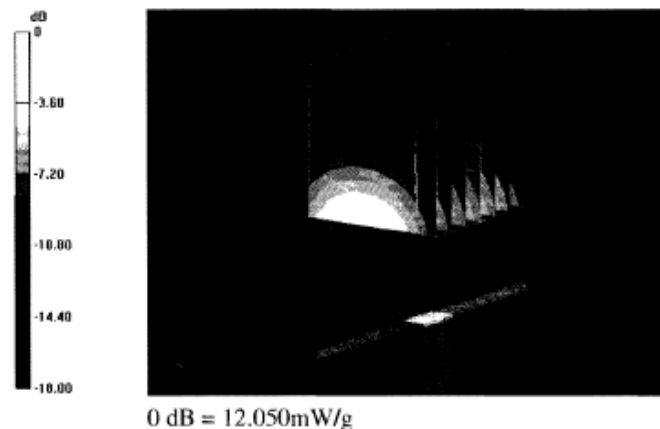
Pin=250 mW /d=10mm, dist=3.0mm (ES-Probe)/Zoom Scan (7x7x7) /Cube 0: Measurement grid: dx=5mm, dy=5mm, dz=5mm


Reference Value = 96.654 V/m; Power Drift = 0.04 dB

Peak SAR (extrapolated) = 17.902 W/kg

SAR(1 g) = 9.78 mW/g; SAR(10 g) = 5.13 mW/g

Maximum value of SAR (measured) = 12.051 mW/g



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Impedance Measurement Plot for Head TSL

