APPENDIX E: RELEVANT PAGES FROM PROBE CALIBRATION REPORT(S)

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 Nokia Salo TCC **Certificate No:** EX3-3573_Jan13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3573

Calibration procedure(s): QA CAL-01.v8, QA CAL-14.v3, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: January 23, 2013

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 26, 2013

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3573

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	8.84	8.84	8.84	0.19	1.36	± 12.0 %
835	41.5	0.90	8.48	8.48	8.48	0.31	0.95	± 12.0 %
1750	40.1	1.37	7.33	7.33	7.33	0.58	0.69	± 12.0 %
1900	40.0	1.40	7.08	7.08	7.08	0.63	0.67	± 12.0 %
2450	39.2	1.80	6.47	6.47	6.47	0.36	0.85	± 12.0 %
2600	39.0	1.96	6.30	6.30	6.30	0.47	0.80	± 12.0 %
5200	36.0	4.66	4.51	4.51	4.51	0.45	1.80	± 13.1 %
5300	35.9	4.76	4.29	4.29	4.29	0.45	1.80	± 13.1 %
5500	35.6	4.96	4.17	4.17	4.17	0.45	1.80	± 13.1 %
5600	35.5	5.07	4.10	4.10	4.10	0.40	1.80	± 13.1 %
5800	35.3	5.27	4.08	4.08	4.08	0.45	1.80	± 13.1 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3573

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	8.63	8.63	8.63	0.37	0.99	± 12.0 %
835	55.2	0.97	8.52	8.52	8.52	0.27	1.23	± 12.0 %
1750	53.4	1.49	7.10	7.10	7.10	0.54	0.74	± 12.0 %
1900	53.3	1.52	6.80	6.80	6.80	0.28	1.05	± 12.0 %
2450	52.7	1.95	6.50	6.50	6.50	0.80	0.50	± 12.0 %
2600	52.5	2.16	6.22	6.22	6.22	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.04	4.04	4.04	0.50	1.90	± 13.1 %
5300	48.9	5.42	3.85	3.85	3.85	0.50	1.90	± 13.1 %
5500	48.6	5.65	3.56	3.56	3.56	0.55	1.90	± 13.1 %
5600	48.5	5.77	3.38	3.38	3.38	0.55	1.90	± 13.1 %
5800	48.2	6.00	3.60	3.60	3.60	0.60	1.90	± 13.1 %

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Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: EX3-3836_Mar13

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3836

Calibration procedure(s) QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: March 8, 2013

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: March 8, 2013

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	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., ϑ = 0 is normal to probe axis

Calibration is Performed According to the Following Standards:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization ϑ = 0 (f ≤ 900 MHz in TEM-cell; f > 1800 MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* 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 ≤ 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 *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy):* in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3836

Manufactured: November 7, 2011
Calibrated: March 8, 2013

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.40	0.47	0.45	± 10.1 %
DCP (mV)[B]	89.8	101.7	96.3	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	143.5	±3.0 %
		Y	0.0	0.0	1.0		155.5	
		Z	0.0	0.0	1.0		149.3	

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

[A] The uncertainties of NormX,Y,Z do not affect the E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	41.9	0.89	9.44	9.44	9.44	0.80	0.60	± 12.0 %
835	41.5	0.90	9.03	9.03	9.03	0.79	0.60	± 12.0 %
1750	40.1	1.37	8.11	8.11	8.11	0.31	0.98	± 12.0 %
1900	40.0	1.40	7.79	7.79	7.79	0.35	0.92	± 12.0 %
2600	39.0	1.96	6.82	6.82	6.82	0.42	0.86	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

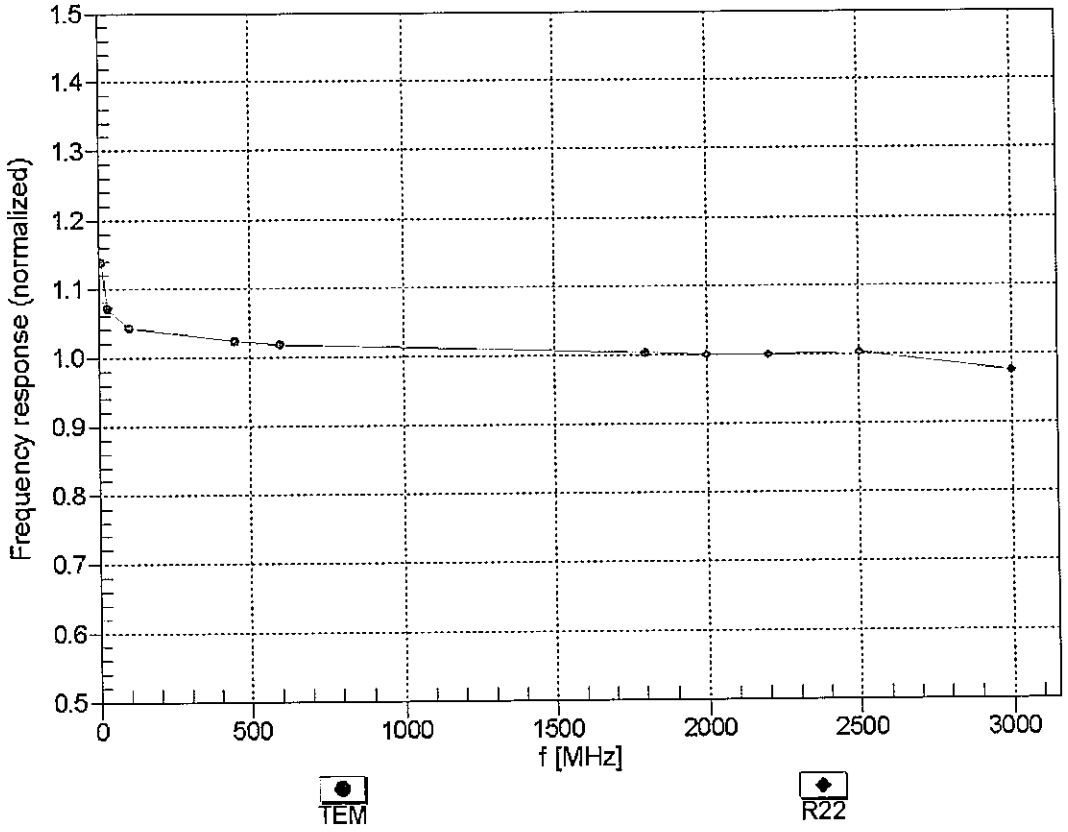
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
750	55.5	0.96	9.07	9.07	9.07	0.80	0.61	± 12.0 %
835	55.2	0.97	8.97	8.97	8.97	0.70	0.67	± 12.0 %
1750	53.4	1.49	7.57	7.57	7.57	0.67	0.67	± 12.0 %
1900	53.3	1.52	7.18	7.18	7.18	0.80	0.61	± 12.0 %
2600	52.5	2.16	6.70	6.70	6.70	0.64	0.50	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

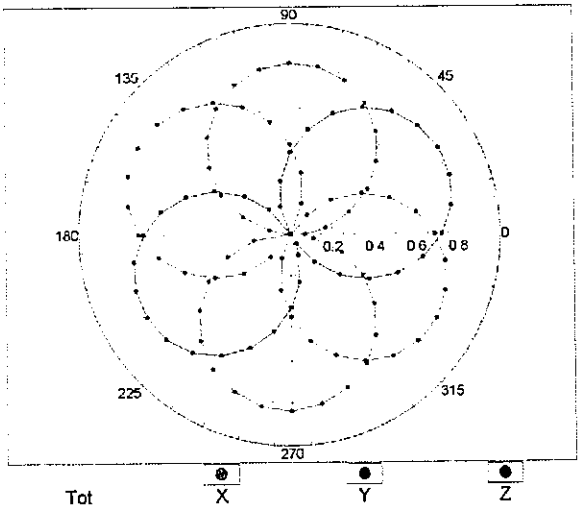
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



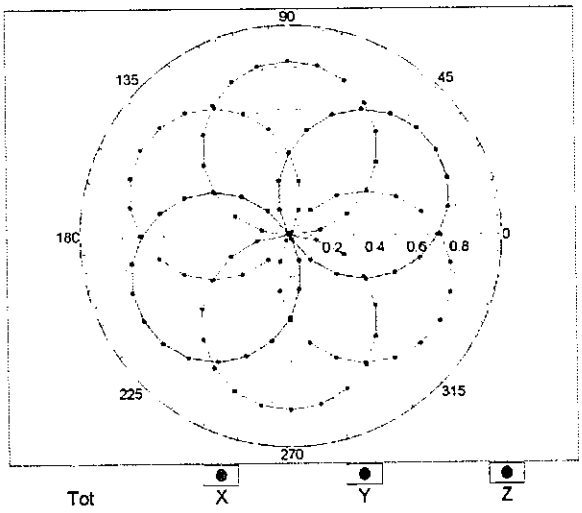
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

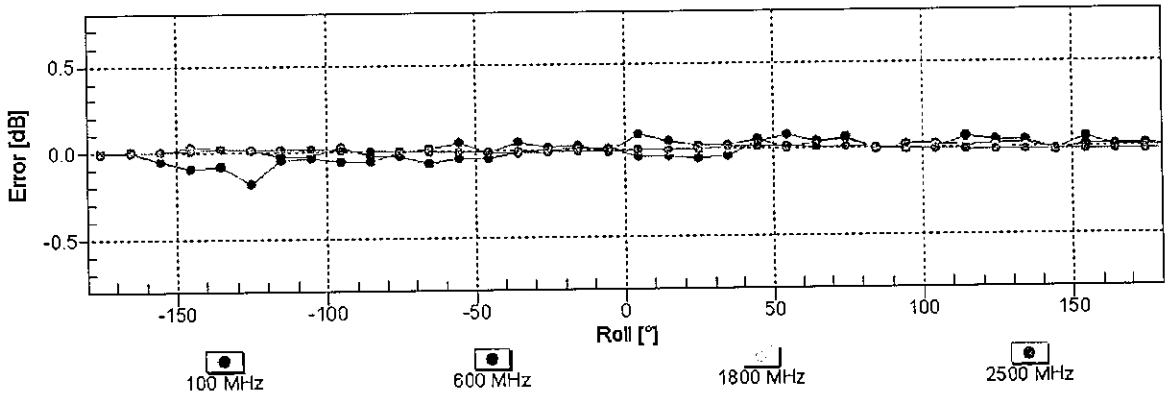
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



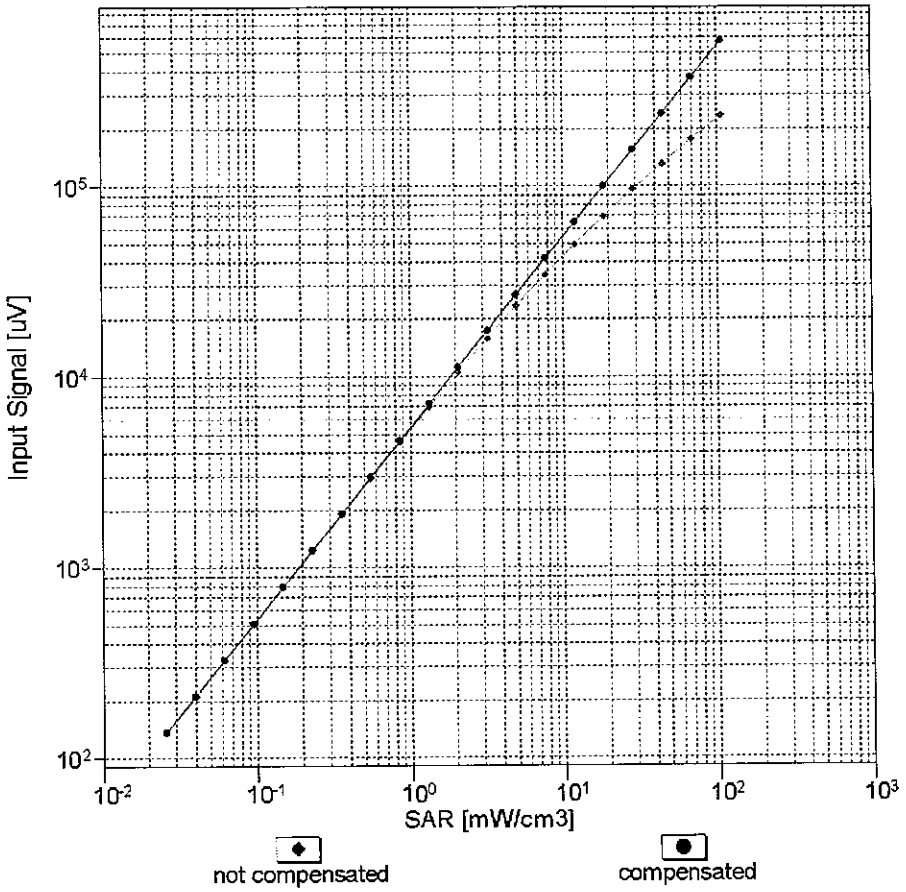
f=1800 MHz,R22

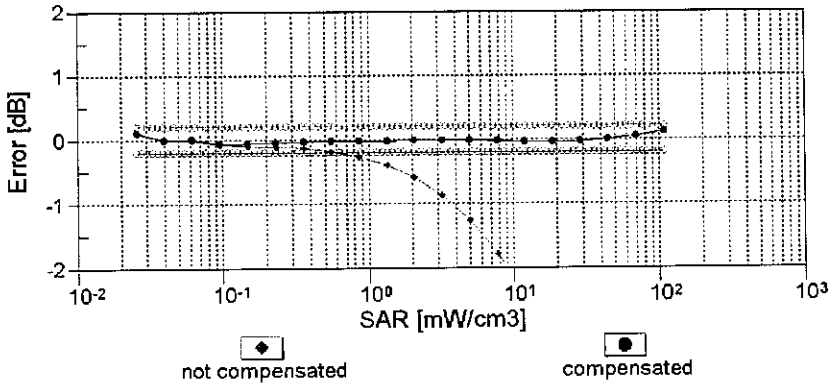




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

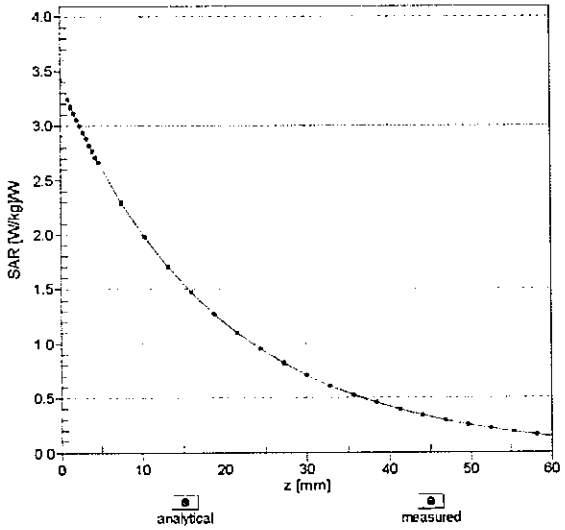




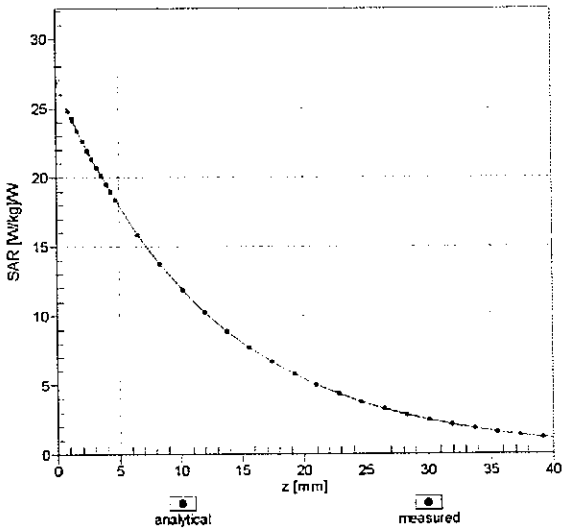
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

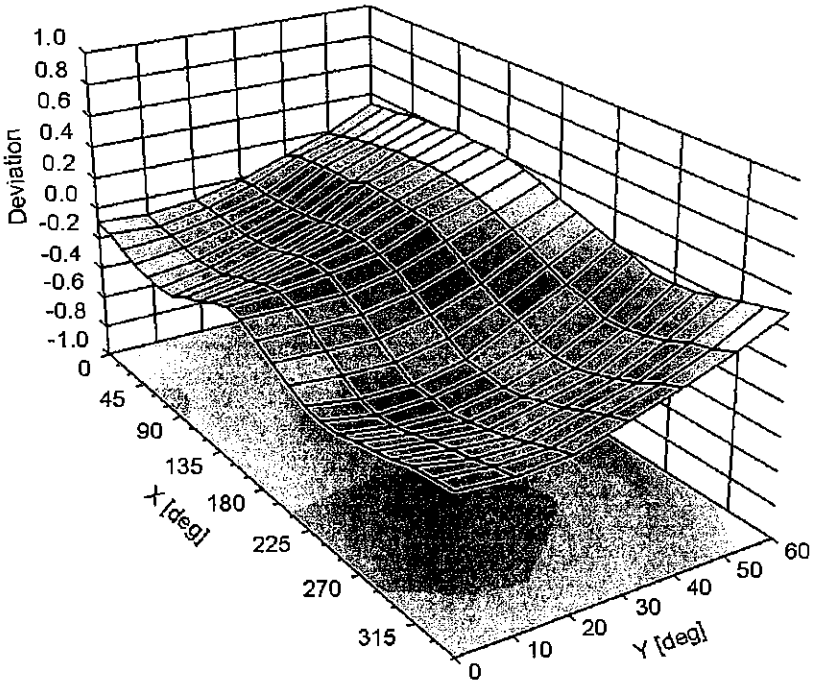


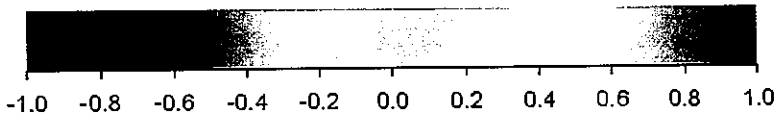
f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz





Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3836

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	44.6
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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Accreditation No.: SCS 108

Client Nokia Beijing TCC

Certificate No: EX3-3823_Dec12

CALIBRATION CERTIFICATE

Object EX3DV4 - SN:3823

Calibration procedure(s) QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: December 12, 2012

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
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Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	29-Dec-11 (No. ES3-3013_Dec11)	Dec-12
DAE4	SN: 660	20-Jun-12 (No. DAE4-660_Jun12)	Jun-13
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 12, 2012

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Glossary:

TSL	tissue simulating liquid
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,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:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \leq 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,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*.
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- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z, VRx,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 *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe EX3DV4

SN:3823

Manufactured: September 6, 2011
Calibrated: December 12, 2012

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

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3823

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	0.41	0.36	0.47	± 10.1 %
DCP (mV)[B]	100.6	102.8	99.2	

Modulation Calibration Parameters

UID	Communication System Name	PAR		A dB	B dB	C dB	VR mV	Unc[E] (k=2)
0	CW	0.00	X	0.0	0.0	1.0	134.4	±3.5 %
			Y	0.0	0.0	1.0	138.9	
			Z	0.0	0.0	1.0	114.7	

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 E^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3823

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	9.17	9.17	9.17	0.50	0.71	± 12.0 %
1750	40.1	1.37	7.86	7.86	7.86	0.52	0.71	± 12.0 %
1900	40.0	1.40	7.62	7.62	7.62	0.34	0.89	± 12.0 %
1950	40.0	1.40	7.33	7.33	7.33	0.39	0.80	± 12.0 %
2450	39.2	1.80	6.91	6.91	6.91	0.32	0.94	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

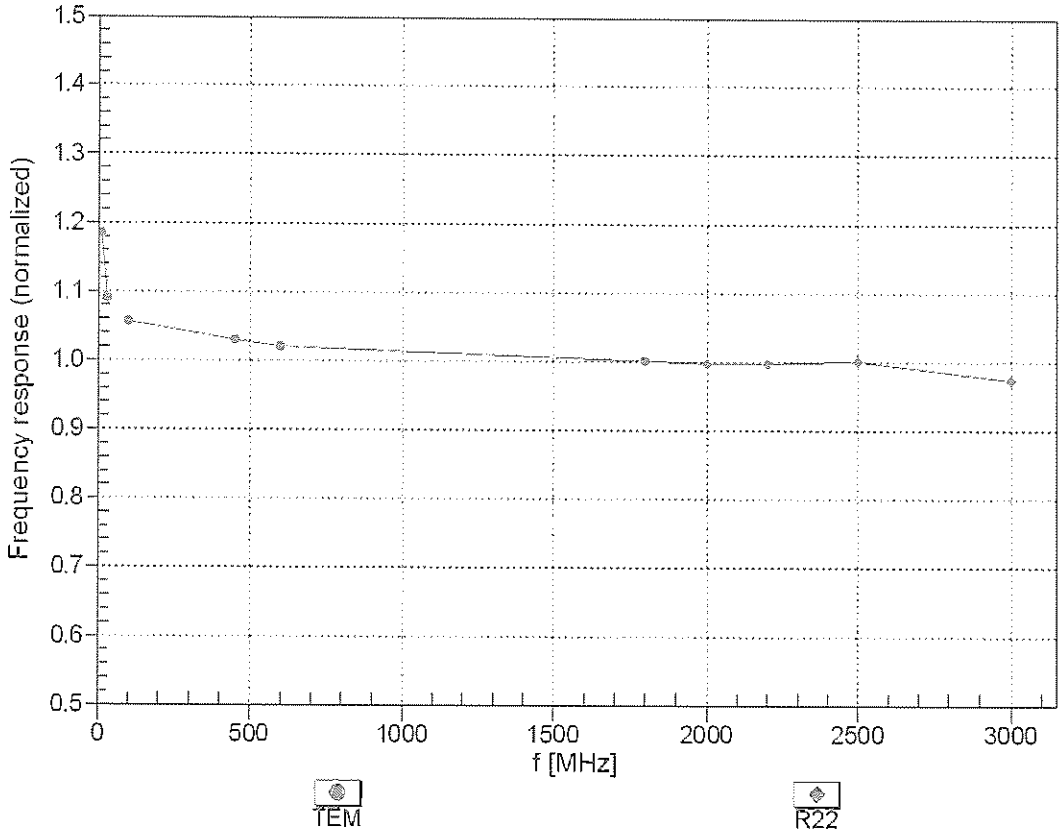
DASY/EASY - Parameters of Probe: EX3DV4 - SN:3823

Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	9.09	9.09	9.09	0.38	0.82	± 12.0 %
1750	53.4	1.49	7.50	7.50	7.50	0.32	0.92	± 12.0 %
1900	53.3	1.52	7.28	7.28	7.28	0.41	0.78	± 12.0 %
1950	53.3	1.52	7.48	7.48	7.48	0.43	0.78	± 12.0 %
2450	52.7	1.95	6.90	6.90	6.90	0.80	0.50	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

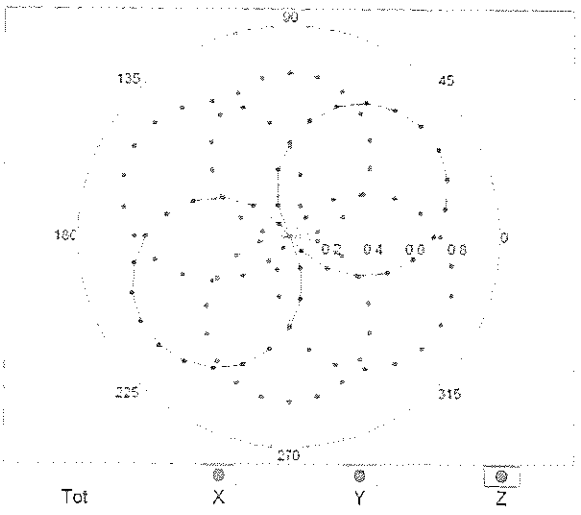
Frequency Response of E-Field
(TEM-Cell:ifi110 EXX, Waveguide: R22)



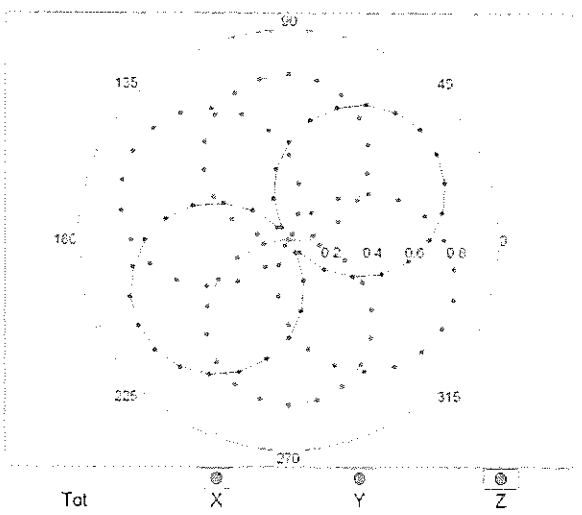
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

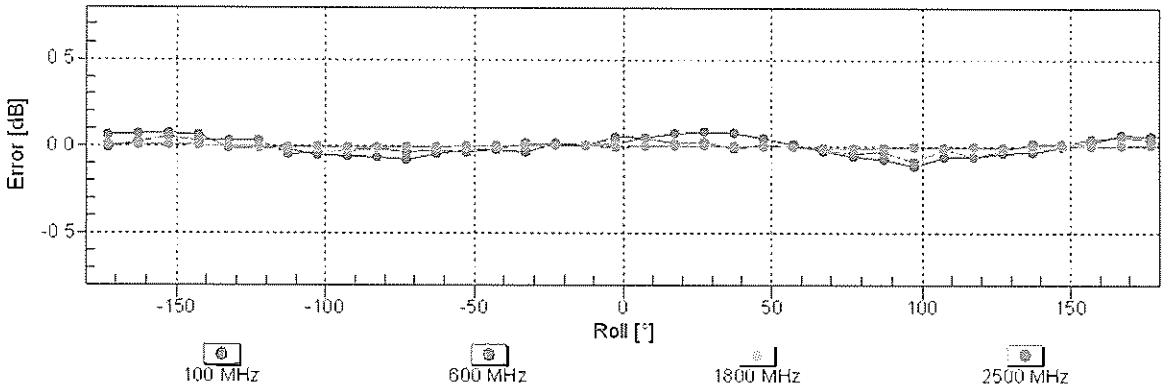
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



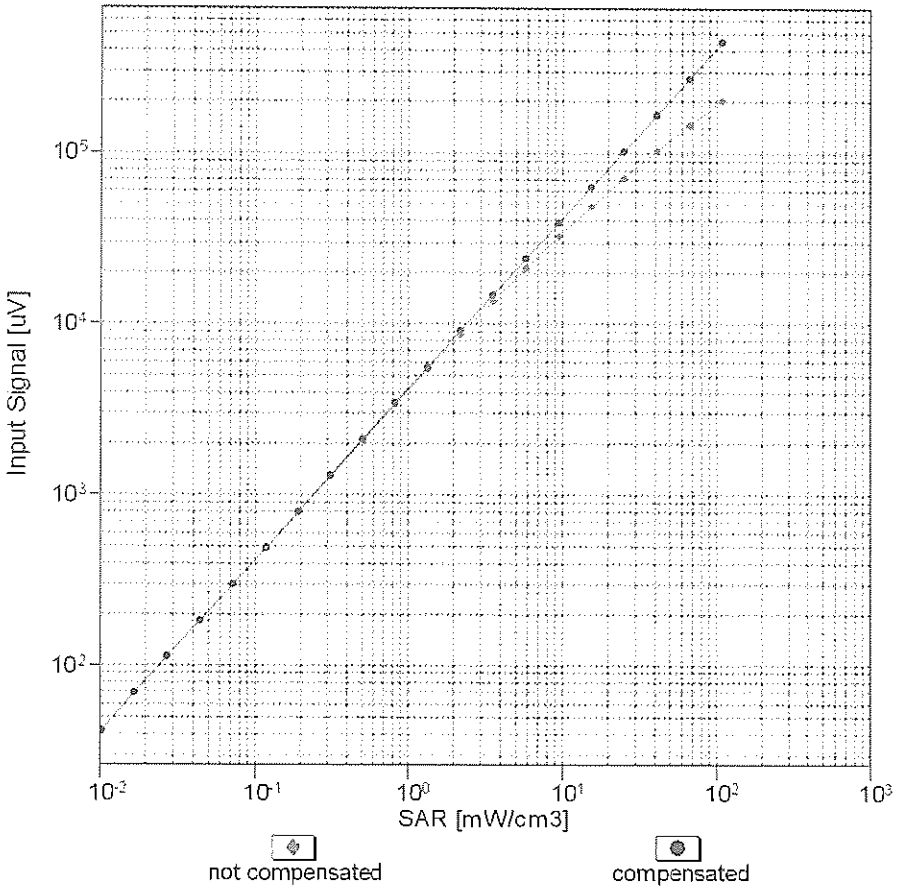
f=1800 MHz,R22

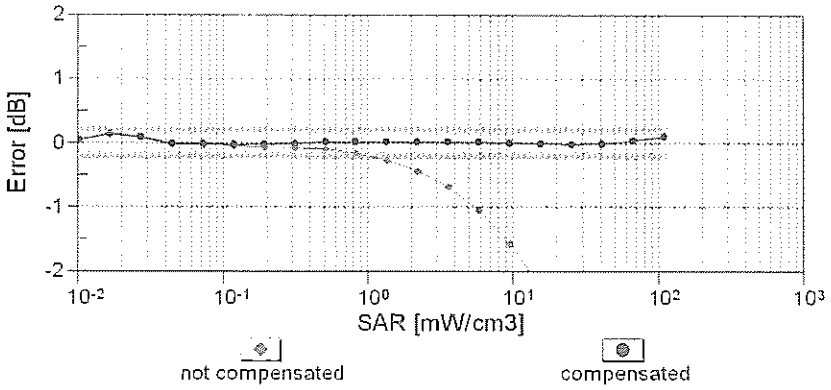




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

Dynamic Range f(SAR$_{head}$)
(TEM cell , f = 900 MHz)

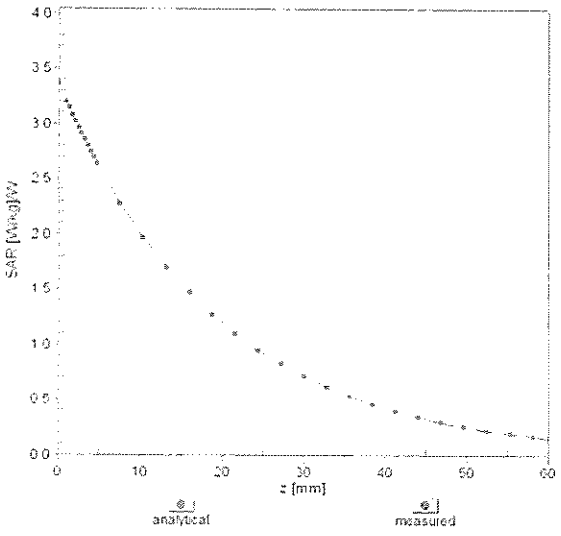




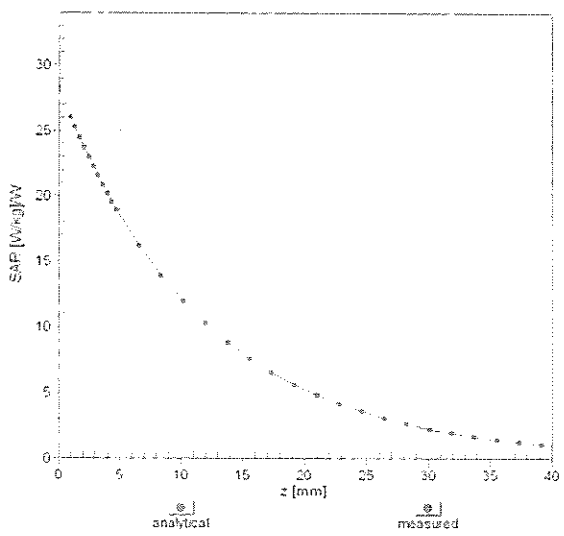
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

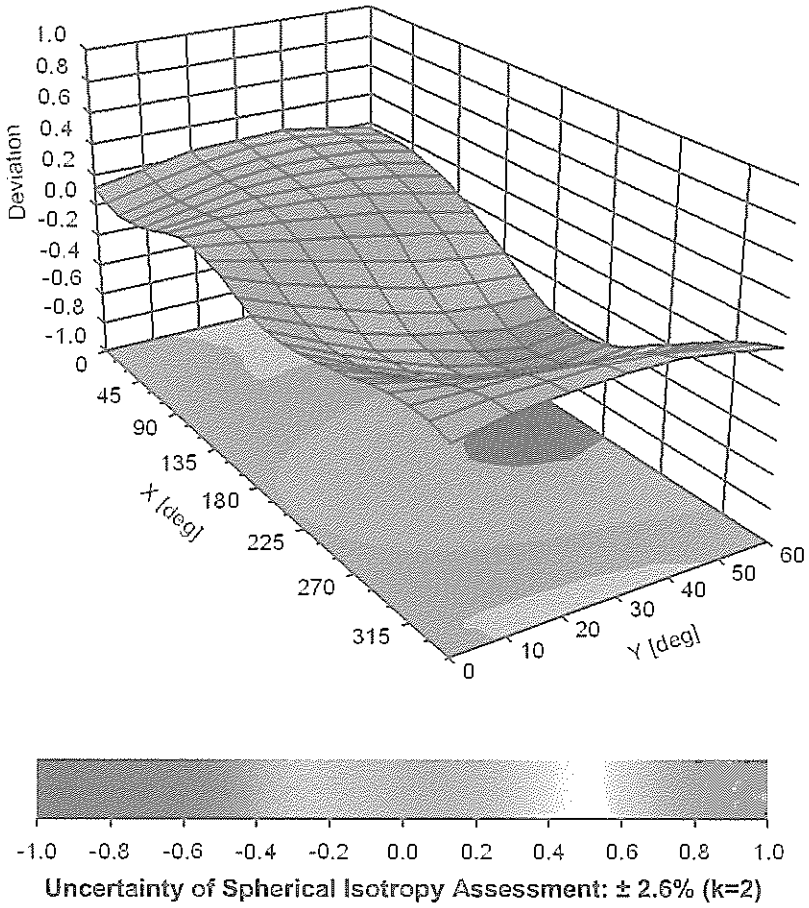


f = 1900 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: EX3DV4 - SN:3823

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-12.7
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

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client **Nokia Beijing TCC**

Certificate No: ES3-3195_Mar13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3195

Calibration procedure(s) QA CAL-01.v8, QA CAL-23.v4, QA CAL-25.v4
Calibration procedure for dosimetric E-field probes

Calibration date: March 8, 2013

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	29-Mar-12 (No. 217-01508)	Apr-13
Power sensor E4412A	MY41498087	29-Mar-12 (No. 217-01508)	Apr-13
Reference 3 dB Attenuator	SN: S5054 (3c)	27-Mar-12 (No. 217-01531)	Apr-13
Reference 20 dB Attenuator	SN: S5086 (20b)	27-Mar-12 (No. 217-01529)	Apr-13
Reference 30 dB Attenuator	SN: S5129 (30b)	27-Mar-12 (No. 217-01532)	Apr-13
Reference Probe ES3DV2	SN: 3013	28-Dec-12 (No. ES3-3013_Dec12)	Dec-13
DAE4	SN: 660	31-Jan-13 (No. DAE4-660_Jan13)	Jan-14
Secondary Standards	ID	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (in house check Apr-11)	In house check: Apr-13
Network Analyzer HP 8753E	US37390585	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

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

Issued: March 8, 2013

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
NORMx,y,z	sensitivity in free space
ConvF	sensitivity in TSL / NORMx,y,z
DCP	diode compression point
CF	crest factor (1/duty_cycle) of the RF signal
A, B, C, D	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:

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

Methods Applied and Interpretation of Parameters:

- *NORMx,y,z:* Assessed for E-field polarization $\vartheta = 0$ ($f \le 900$ MHz in TEM-cell; $f > 1800$ MHz: R22 waveguide). NORMx,y,z are only intermediate values, i.e., the uncertainties of NORMx,y,z does not affect the E^2-field uncertainty inside TSL (see below *ConvF*).
- *NORM(f)x,y,z = NORMx,y,z * frequency_response* (see Frequency Response Chart). This linearization is implemented in DASY4 software versions later than 4.2. The uncertainty of the frequency response is included in the stated uncertainty of *ConvF*.
- *DCPx,y,z:* DCP are numerical linearization parameters assessed based on the data of power sweep with CW signal (no uncertainty required). DCP does not depend on frequency nor media.
- *PAR:* PAR is the Peak to Average Ratio that is not calibrated but determined based on the signal characteristics
- *Ax,y,z; Bx,y,z; Cx,y,z; Dx,y,z; VRx,y,z: A, B, C, D* 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 $f \le 800$ 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 *NORMx,y,z * ConvF* whereby the uncertainty corresponds to that given for *ConvF*. A frequency dependent *ConvF* is used in DASY version 4.4 and higher which allows extending the validity from ± 50 MHz to ± 100 MHz.
- *Spherical isotropy (3D deviation from isotropy)*: in a field of low gradients realized using a flat phantom exposed by a patch antenna.
- *Sensor Offset*: The sensor offset corresponds to the offset of virtual measurement center from the probe tip (on probe axis). No tolerance required.

Probe ES3DV3

SN:3195

Manufactured: June 18, 2008
Calibrated: March 8, 2013

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

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

Basic Calibration Parameters

	Sensor X	Sensor Y	Sensor Z	Unc (k=2)
Norm ($\mu V/(V/m)^2$)[A]	1.41	1.18	1.43	± 10.1 %
DCP (mV)[B]	102.7	102.8	99.0	

Modulation Calibration Parameters

UID	Communication System Name		A dB	B dB√μV	C	D dB	VR mV	Unc[E] (k=2)
0	CW	X	0.0	0.0	1.0	0.00	168.3	±2.7 %
		Y	0.0	0.0	1.0		153.7	
		Z	0.0	0.0	1.0		170.1	

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^2-field uncertainty inside TSL (see Pages 5 and 6).
[B] Numerical linearization parameter: uncertainty not required.
[E] Uncertainty is determined using the max. deviation from linear response applying rectangular distribution and is expressed for the square of the field value.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

Calibration Parameter Determined in Head Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	41.5	0.90	6.39	6.39	6.39	0.30	2.05	± 12.0 %
1750	40.1	1.37	5.34	5.34	5.34	0.68	1.37	± 12.0 %
1900	40.0	1.40	5.14	5.14	5.14	0.53	1.61	± 12.0 %
1950	40.0	1.40	4.94	4.94	4.94	0.48	1.73	± 12.0 %
2300	39.5	1.67	4.73	4.73	4.73	0.72	1.39	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.80	1.33	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

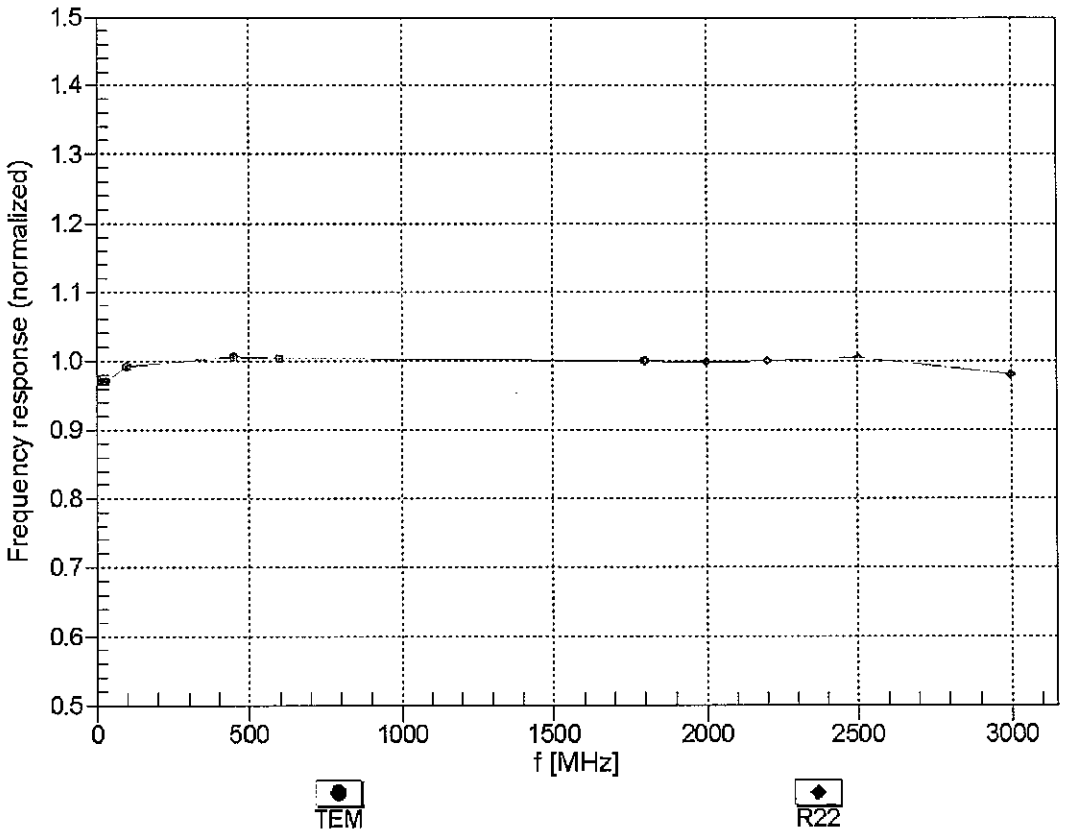
Calibration Parameter Determined in Body Tissue Simulating Media

f (MHz) [C]	Relative Permittivity [F]	Conductivity (S/m) [F]	ConvF X	ConvF Y	ConvF Z	Alpha	Depth (mm)	Unct. (k=2)
835	55.2	0.97	6.28	6.28	6.28	0.50	1.49	± 12.0 %
1750	53.4	1.49	4.98	4.98	4.98	0.44	1.69	± 12.0 %
1900	53.3	1.52	4.73	4.73	4.73	0.36	1.98	± 12.0 %
1950	53.3	1.52	4.84	4.84	4.84	0.46	1.72	± 12.0 %
2300	52.9	1.81	4.45	4.45	4.45	0.57	1.46	± 12.0 %
2450	52.7	1.95	4.31	4.31	4.31	0.71	1.17	± 12.0 %

[C] Frequency validity of ± 100 MHz only applies for DASY v4.4 and higher (see Page 2), else it is restricted to ± 50 MHz. The uncertainty is the RSS of the ConvF uncertainty at calibration frequency and the uncertainty for the indicated frequency band.
[F] At frequencies below 3 GHz, the validity of tissue parameters (ε and σ) can be relaxed to ± 10% if liquid compensation formula is applied to measured SAR values. At frequencies above 3 GHz, the validity of tissue parameters (ε and σ) is restricted to ± 5%. The uncertainty is the RSS of the ConvF uncertainty for indicated target tissue parameters.

Frequency Response of E-Field

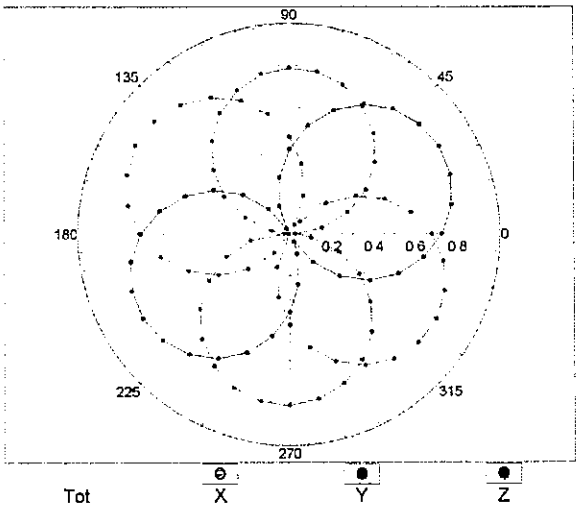
(TEM-Cell:ifi110 EXX, Waveguide: R22)



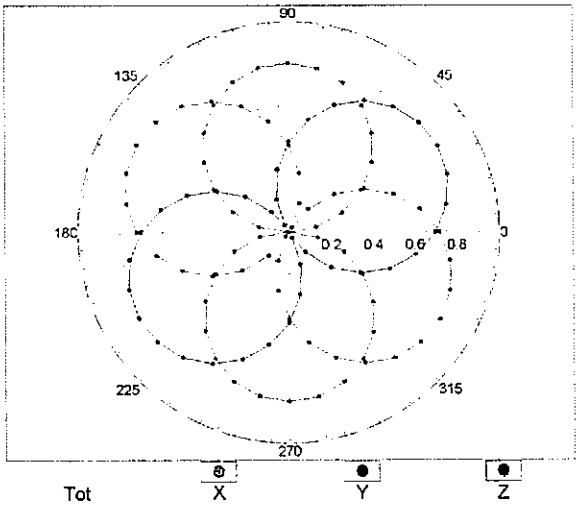
Uncertainty of Frequency Response of E-field: ± 6.3% (k=2)

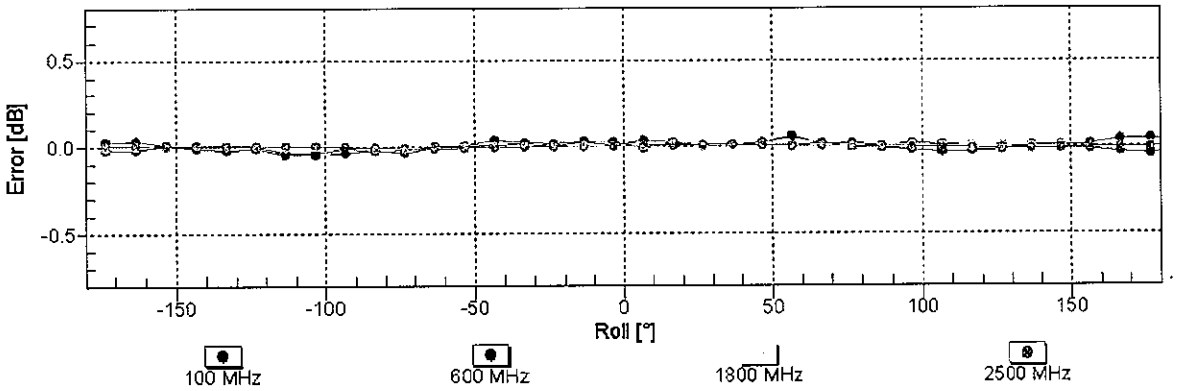
Receiving Pattern (ϕ), ϑ = 0°

f=600 MHz,TEM



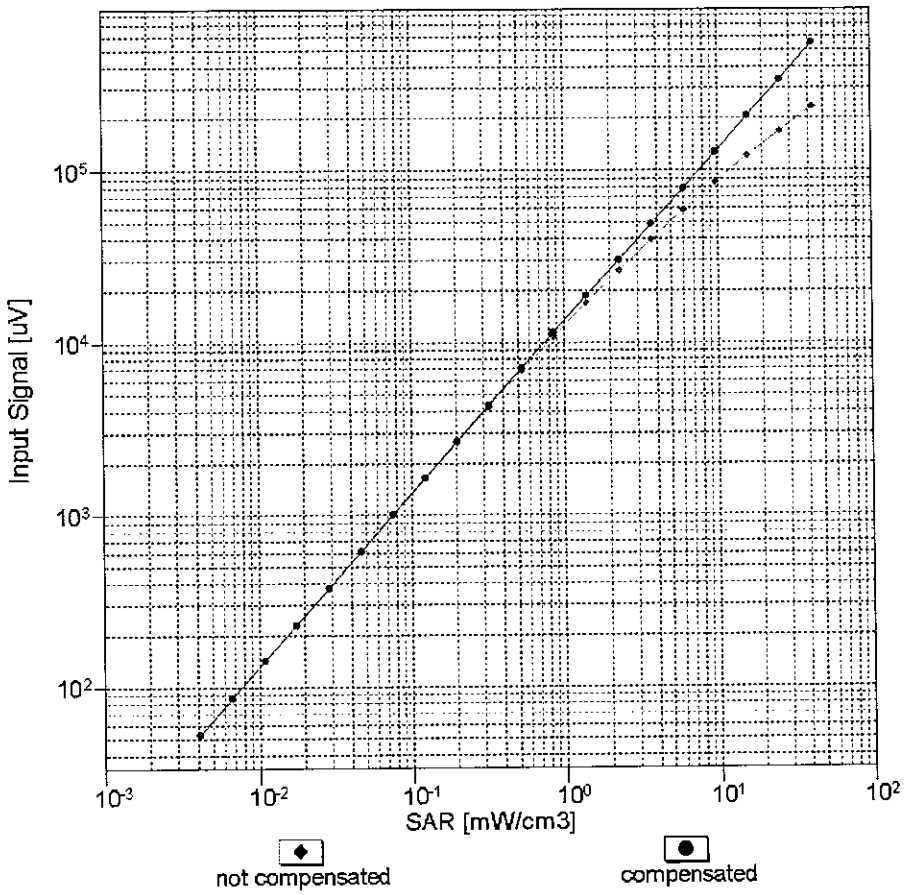
f=1800 MHz,R22

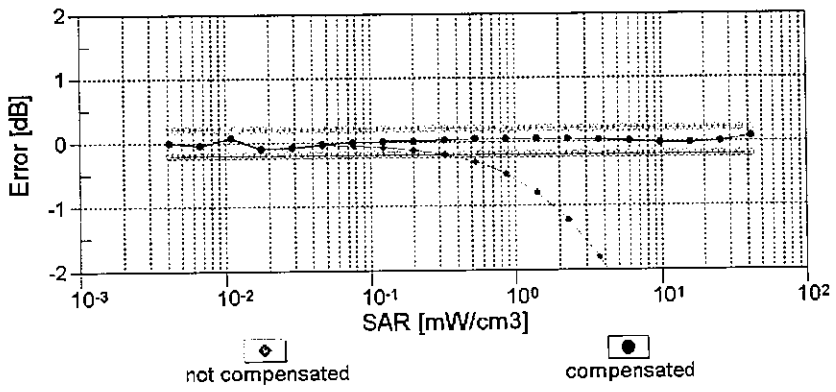




Uncertainty of Axial Isotropy Assessment: ± 0.5% (k=2)

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

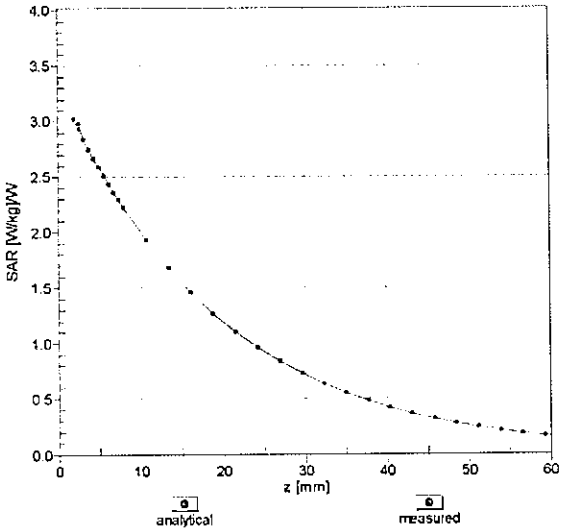




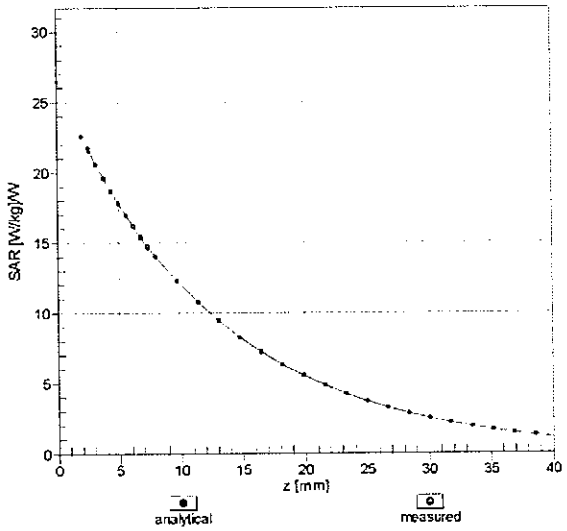
Uncertainty of Linearity Assessment: ± 0.6% (k=2)

Conversion Factor Assessment

f = 835 MHz,WGLS R9 (H_convF)

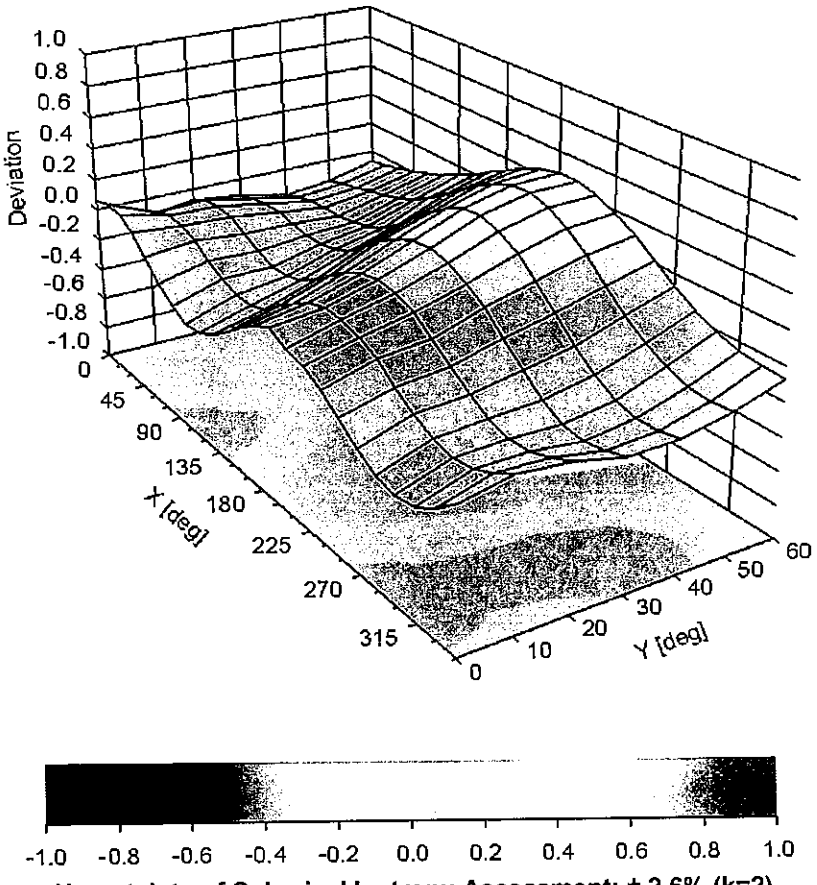


f = 1750 MHz,WGLS R22 (H_convF)



Deviation from Isotropy in Liquid

Error (ϕ, ϑ), f = 900 MHz



Uncertainty of Spherical Isotropy Assessment: ± 2.6% (k=2)

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3195

Other Probe Parameters

Sensor Arrangement	Triangular
Connector Angle (°)	-93.3
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

APPENDIX F: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORT(S)

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

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

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

Accreditation No.: SCS 108

Client Nokia Beijing TCC

Certificate No: D835V2-4d005_Mar12

CALIBRATION CERTIFICATE

Object D835V2 - SN: 4d005

Calibration procedure(s) QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: March 06, 2012

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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 6, 2012

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	52.7 Ω - 3.4 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.8 Ω - 5.1 jΩ
Return Loss	- 24.9 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.394 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	July 11, 2003

Date: 06.03.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d005

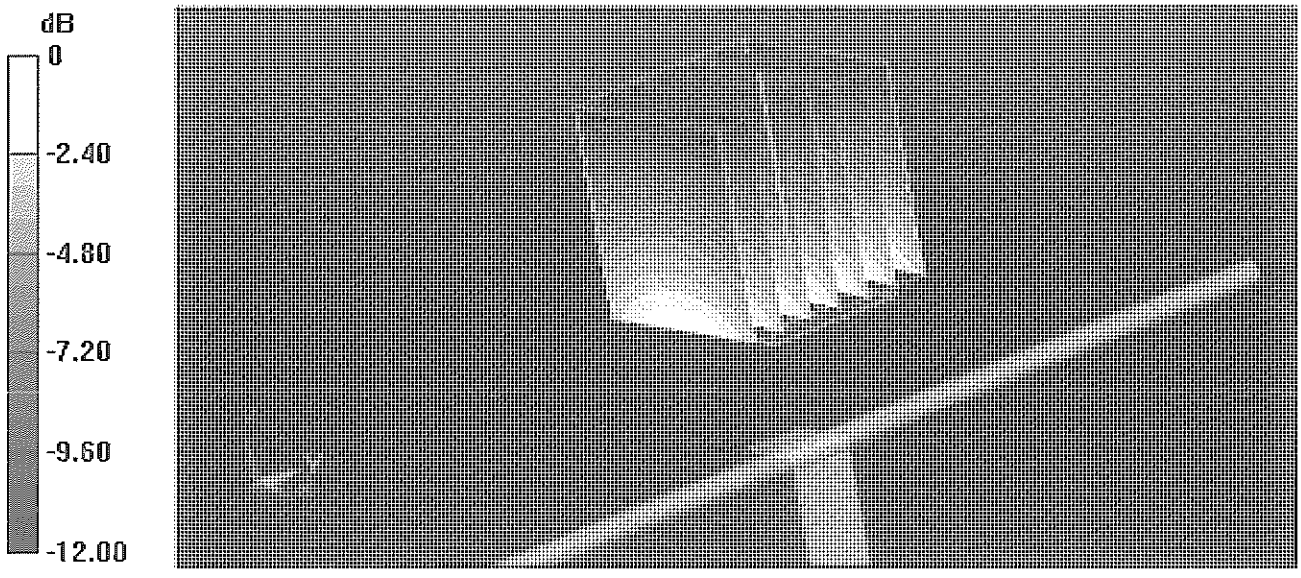
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.89 mho/m; ε_r = 41.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.07, 6.07, 6.07); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

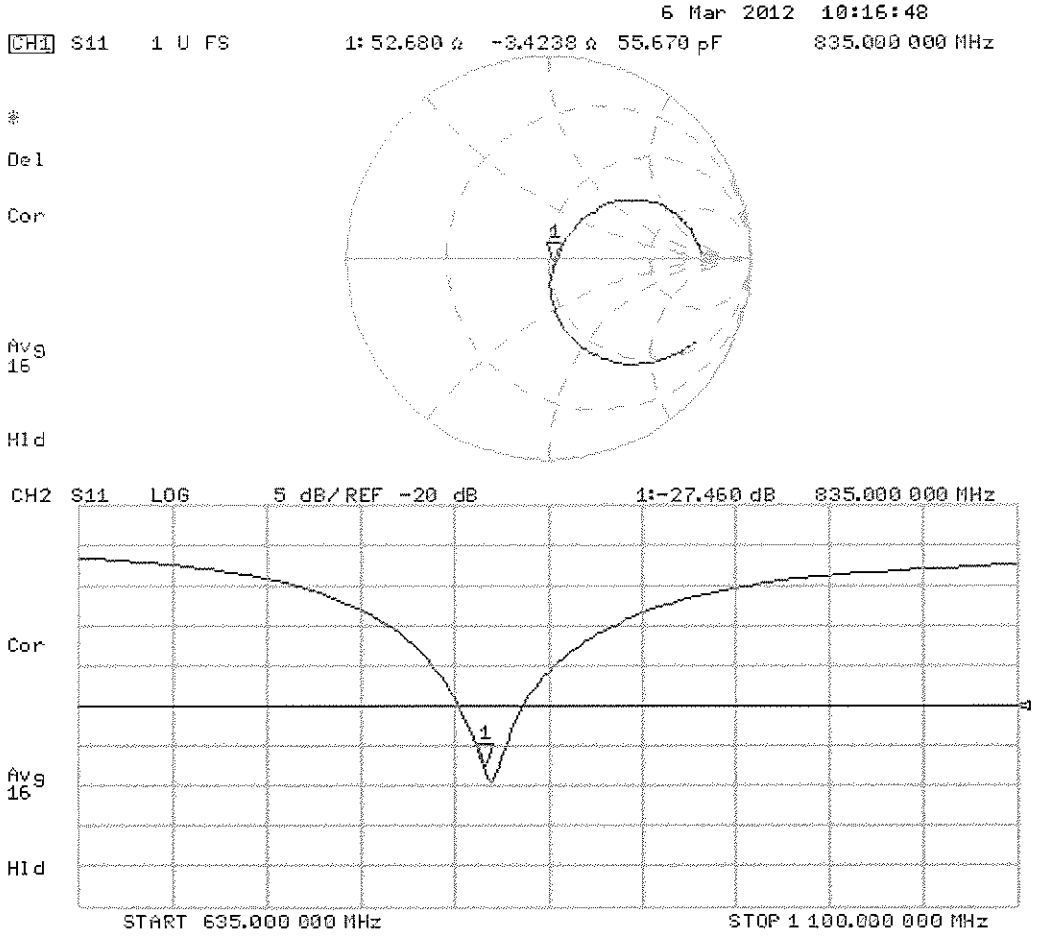
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.103 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 3.4310
SAR(1 g) = 2.32 mW/g; SAR(10 g) = 1.52 mW/g
Maximum value of SAR (measured) = 2.709 mW/g



0 dB = 2.710mW/g = 8.66 dB mW/g

Impedance Measurement Plot for Head TSL



Date: 05.03.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d005

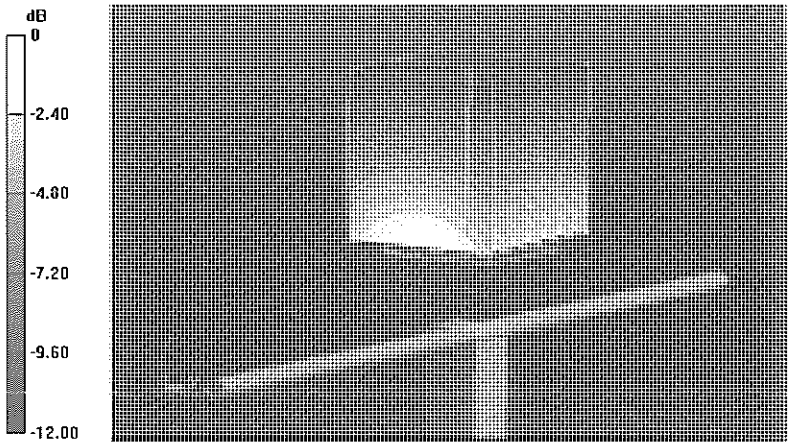
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 55; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.02, 6.02, 6.02); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

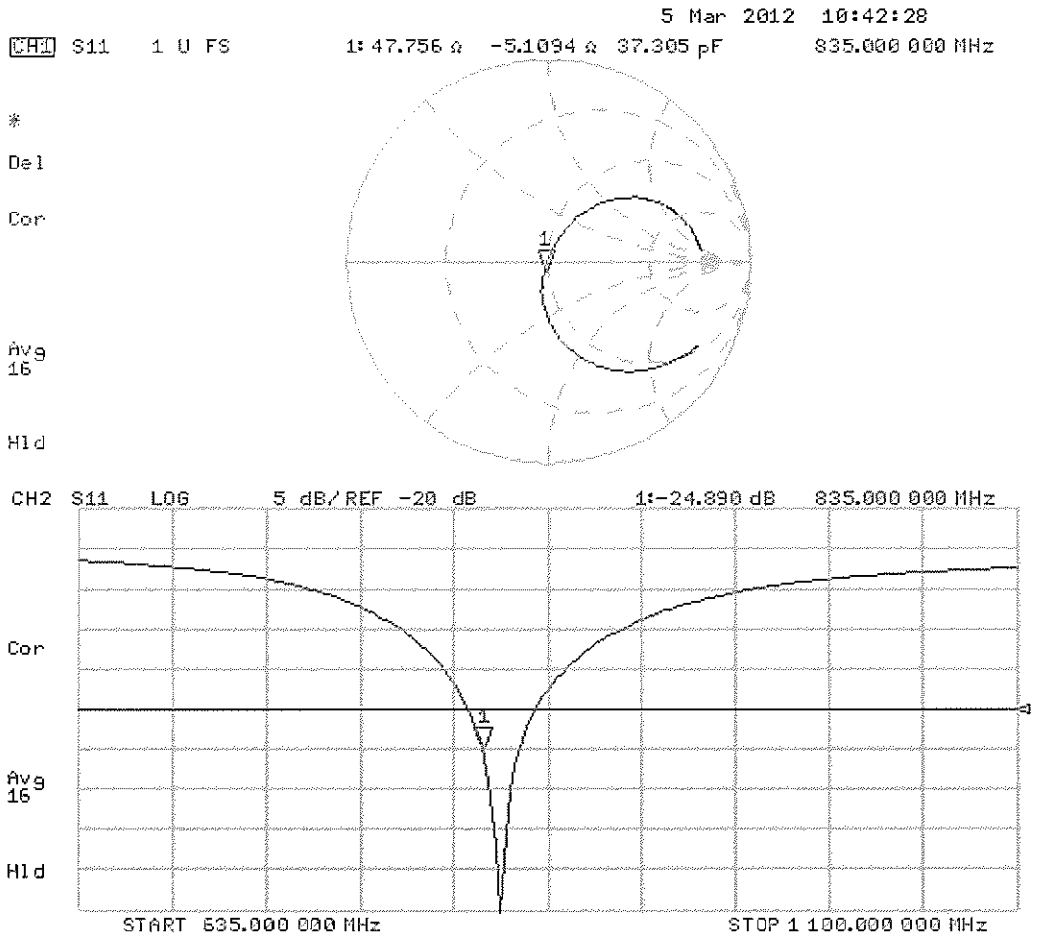
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.011 V/m; Power Drift = 0.0071 dB
Peak SAR (extrapolated) = 3.4950
SAR(1 g) = 2.42 mW/g; SAR(10 g) = 1.59 mW/g
Maximum value of SAR (measured) = 2.812 mW/g



0 dB = 2.810mW/g = 8.97 dB mW/g

Impedance Measurement Plot for Body TSL



Dipole D835V2 – SN: 4d005 Antenna Parameters

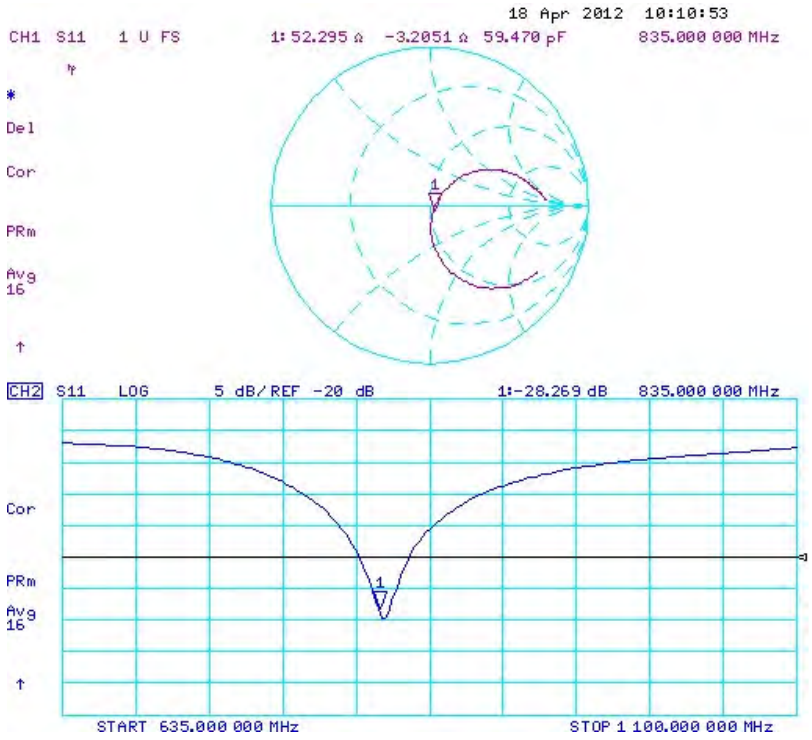
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement 2012-03-15
Impedance, transformed to feed point	52.7 Ω - 3.4 jΩ	52.3 Ω - 3.2 jΩ
Return loss	- 27.5 dB	- 28.3 dB

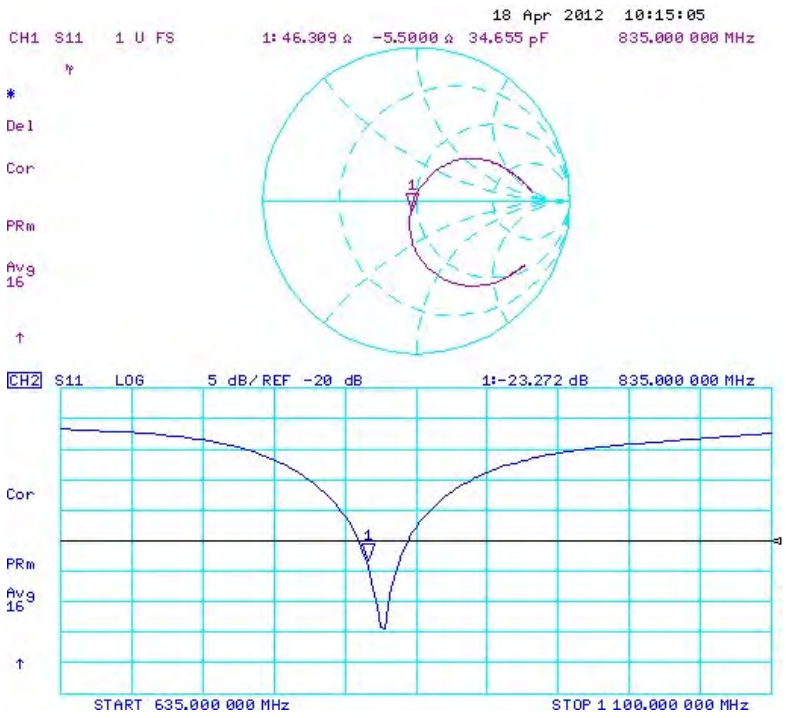
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement 2012-03-15
Impedance, transformed to feed point	47.8 Ω - 5.1 jΩ	46.3 Ω - 5.5 jΩ
Return loss	- 24.9 dB	- 23.3 dB

Impedance Measurement plot for Head TSL 835



Impedance Measurement plot for Body TSL 835



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

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

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

Accreditation No.: SCS 108

Client Nokia Beijing TCC

Certificate No: D1900V2-509_Dec12

CALIBRATION CERTIFICATE

Object D1900V2 - SN: 509

Calibration procedure(s) QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: December 06, 2012

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 6, 2012

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003

b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005

c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
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	39.5 ± 6 %	1.38 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	9.63 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**38.7 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.05 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**20.3 W/kg ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	53.3	1.52 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.2 ± 6 %	1.52 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	9.84 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**39.2 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.16 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	47.1 Ω - 5.1 jΩ
Return Loss	- 24.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	43.7 Ω - 5.2 jΩ
Return Loss	- 21.2 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 20, 1999

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 509

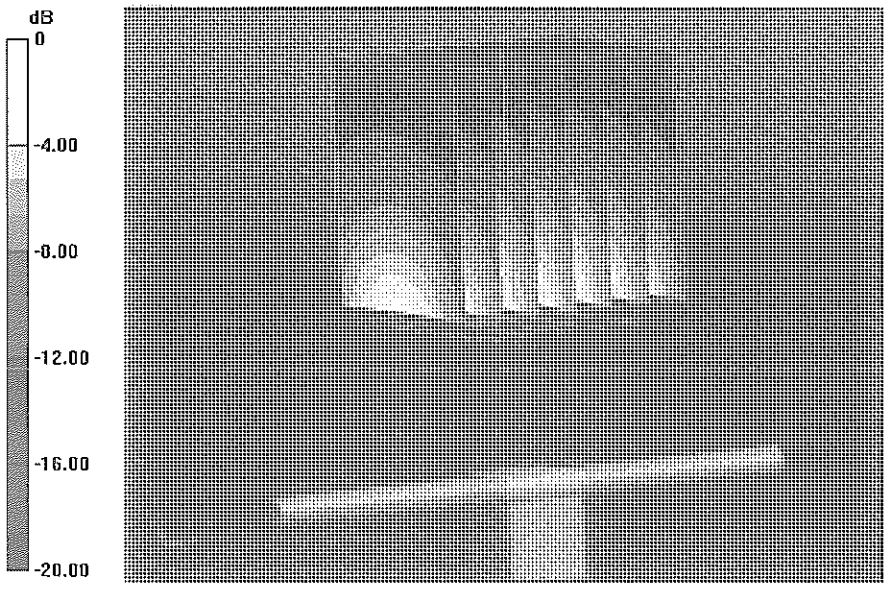
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 mho/m; ε_r = 39.5; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.01, 5.01, 5.01); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

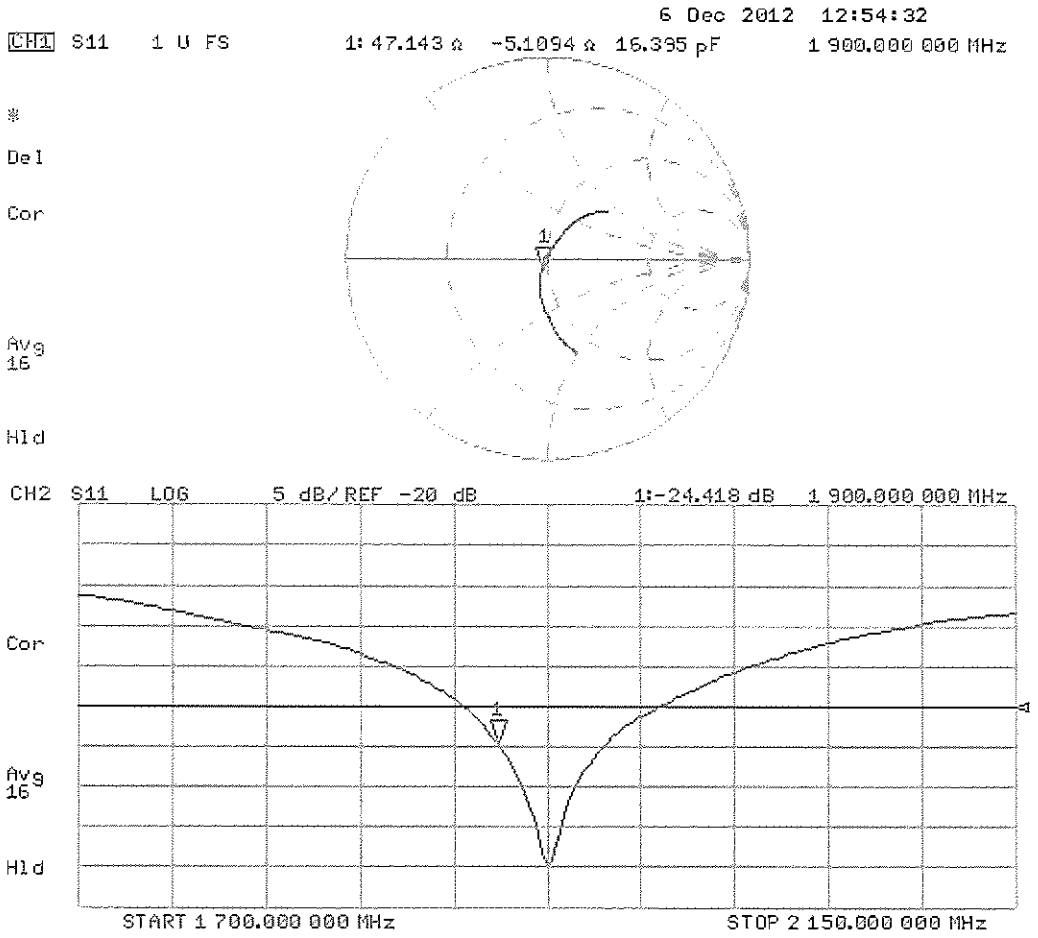
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.248 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.2 W/kg
SAR(1 g) = 9.63 W/kg; SAR(10 g) = 5.05 W/kg
Maximum value of SAR (measured) = 11.9 W/kg



0 dB = 11.9 W/kg = 10.76 dBW/kg

Impedance Measurement Plot for Head TSL



Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 509

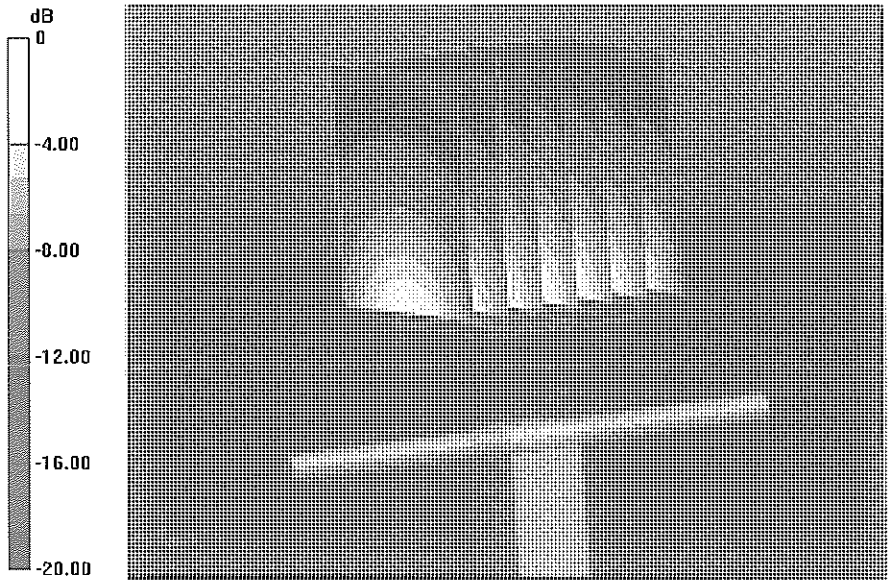
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 mho/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.62, 4.62, 4.62); Calibrated: 30.12.2011;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

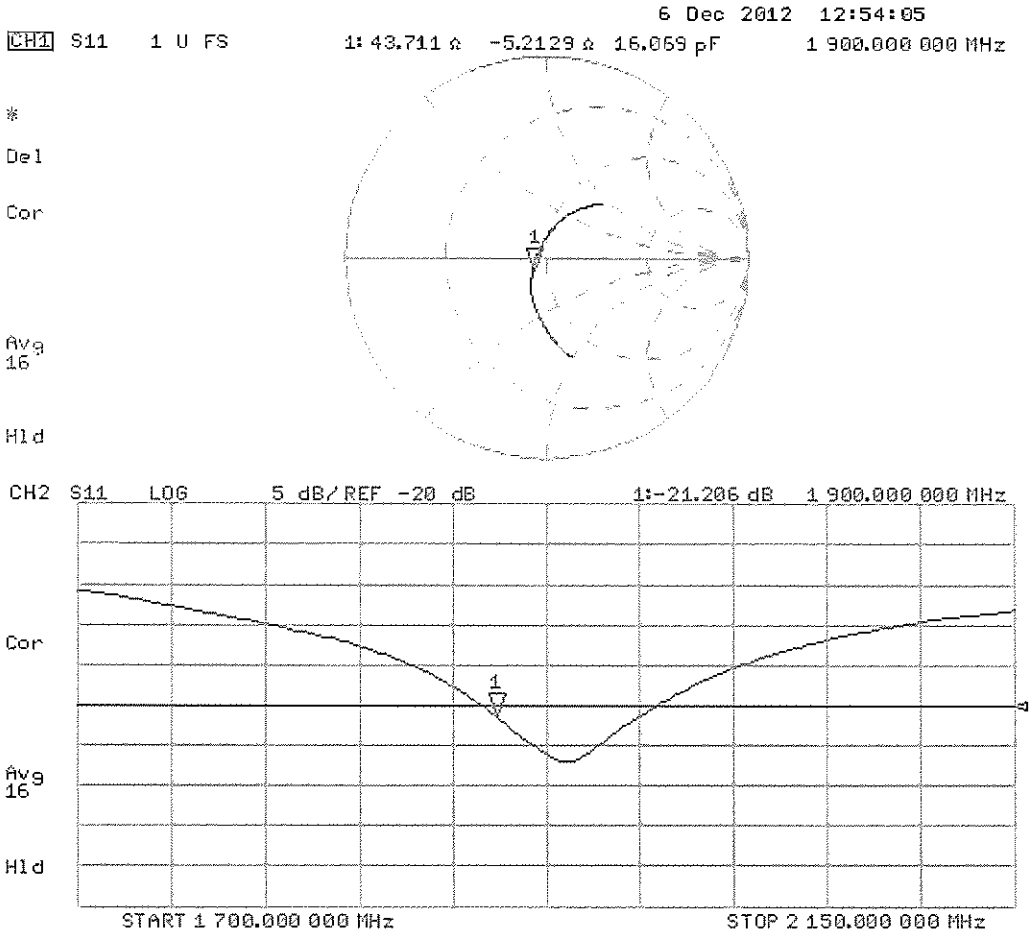
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 94.176 V/m; Power Drift = 0.04 dB
Peak SAR (extrapolated) = 17.4 W/kg
SAR(1 g) = 9.84 W/kg; SAR(10 g) = 5.16 W/kg
Maximum value of SAR (measured) = 12.4 W/kg



0 dB = 12.4 W/kg = 10.93 dBW/kg

Impedance Measurement Plot for Body 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 Nokia Beijing TCC

Certificate No: D2450V2-883_Feb12

CALIBRATION CERTIFICATE

Object: D2450V2 - SN: 883

Calibration procedure(s): QA CAL-05.v8
Calibration procedure for dipole validation kits above 700 MHz

Calibration date: February 23, 2012

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	05-Oct-11 (No. 217-01451)	Oct-12
Power sensor HP 8481A	US37292783	05-Oct-11 (No. 217-01451)	Oct-12
Reference 20 dB Attenuator	SN: 5086 (20g)	29-Mar-11 (No. 217-01368)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	30-Dec-11 (No. ES3-3205_Dec11)	Dec-12
DAE4	SN: 601	04-Jul-11 (No. DAE4-601_Jul11)	Jul-12

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-11)	In house check: Oct-12

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	Israe El-Naouq
Approved by:	Katja Pokovic	Technical Manager	

Issued: February 23, 2012

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEEE Std 1528-2003, "IEEE Recommended Practice for Determining the Peak Spatial-Averaged Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques", December 2003
b) IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
c) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

Measurement Conditions

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

DASY Version	DASY5	V52.8.0
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz ± 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	38.9 ± 6 %	1.86 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.8 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**54.3 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.36 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**25.2 mW /g ± 16.5 % (k=2)**

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	52.3 ± 6 %	2.02 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.2 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**51.8 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.12 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**24.2 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.1 Ω - 0.4 jΩ
Return Loss	- 28.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	50.4 Ω + 1.0 jΩ
Return Loss	- 39.6 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.165 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	October 06, 2011

Date: 23.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 883

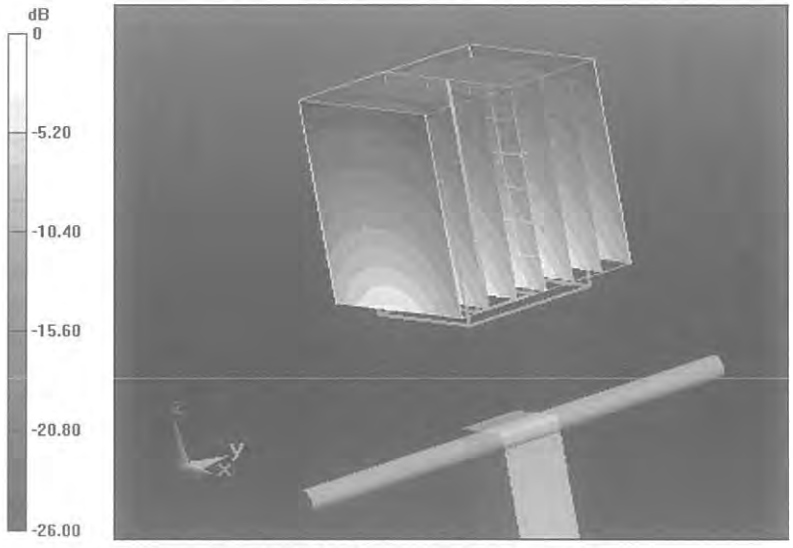
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.86 mho/m; ε_r = 38.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.45, 4.45, 4.45); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

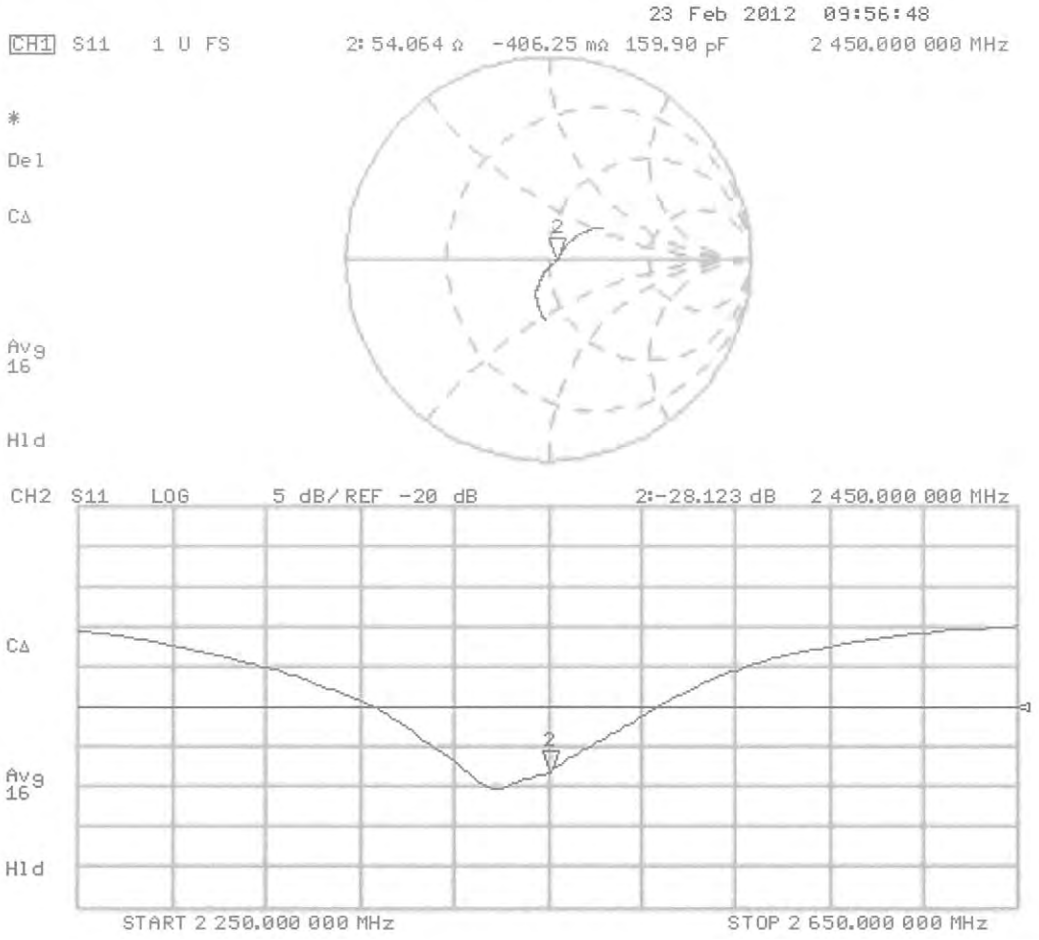
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.8 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 28.8960
SAR(1 g) = 13.8 mW/g; SAR(10 g) = 6.36 mW/g
Maximum value of SAR (measured) = 17.788 mW/g



0 dB = 17.790mW/g = 25.00 dB mW/g

Impedance Measurement Plot for Head TSL



Date: 23.02.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 883

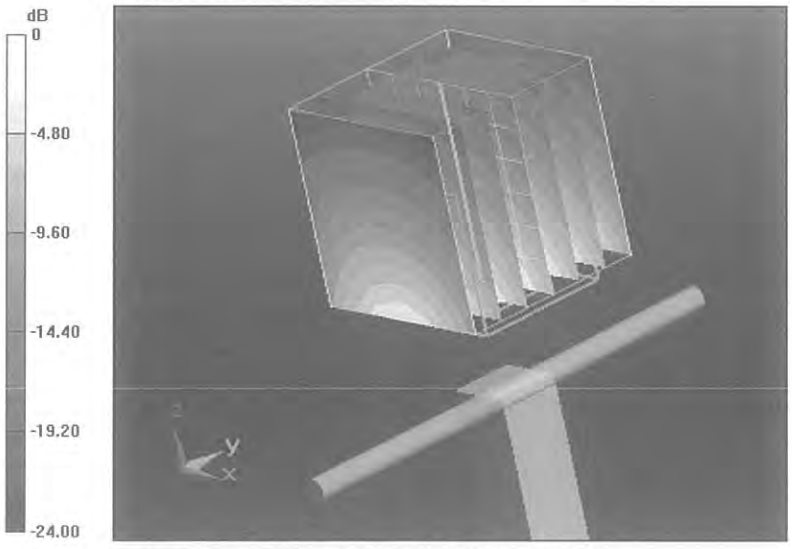
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.02 mho/m; ε_r = 52.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.26, 4.26, 4.26); Calibrated: 30.12.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.0(692); SEMCAD X 14.6.4(4989)

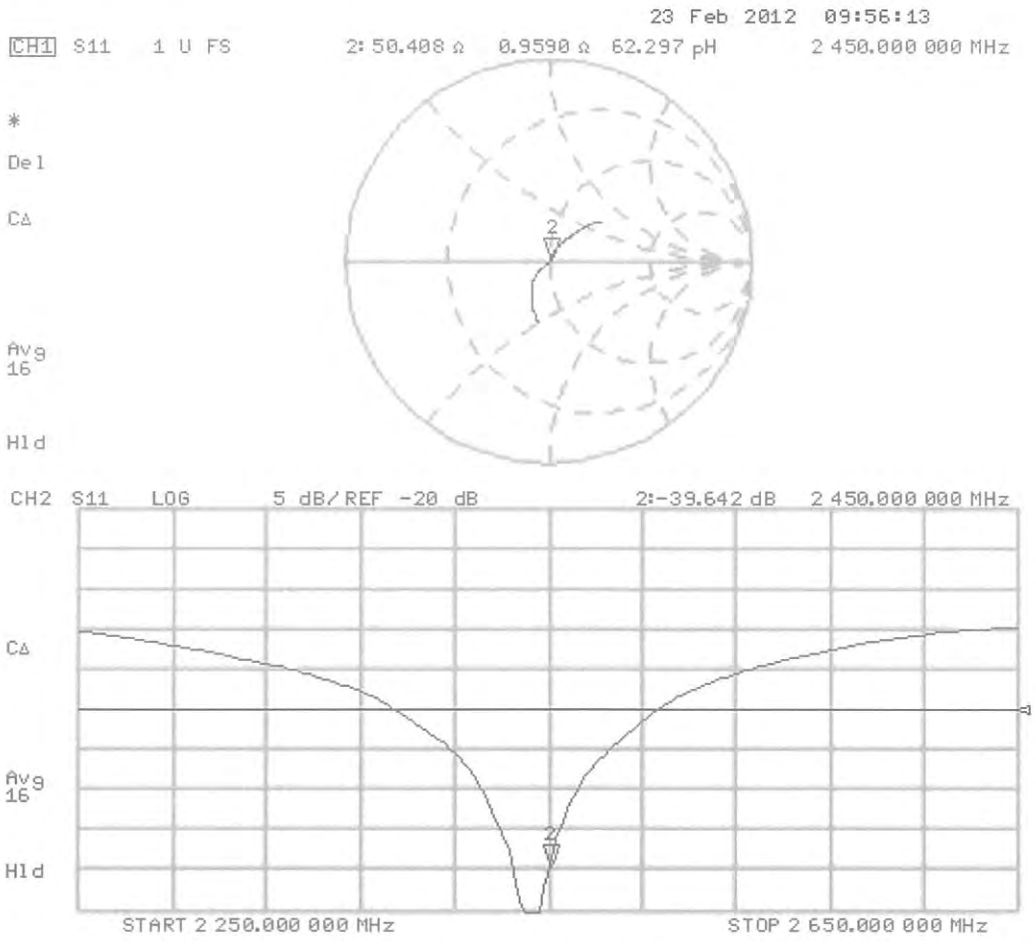
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.084 V/m; Power Drift = -0.00038 dB
Peak SAR (extrapolated) = 26.9170
SAR(1 g) = 13.2 mW/g; SAR(10 g) = 6.12 mW/g
Maximum value of SAR (measured) = 17.333 mW/g



0 dB = 17.330mW/g = 24.78 dB mW/g

Impedance Measurement Plot for Body TSL



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

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S Swiss Calibration Service

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

Accreditation No.: SCS 108

Client Nokia Salo TCC

Certificate No: D5GHzV2-1048_Dec12

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1048
Calibration procedure(s)	QA CAL-22.v1 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	December 11, 2012

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	01-Nov-12 (No. 217-01640)	Oct-13
Power sensor HP 8481A	US37292783	01-Nov-12 (No. 217-01640)	Oct-13
Reference 20 dB Attenuator	SN: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.3 / 06327	27-Mar-12 (No. 217-01533)	Apr-13
Reference Probe EX3DV4	SN: 3503	30-Dec-11 (No. EX3-3503_Dec11)	Dec-12
DAE4	SN: 601	27-Jun-12 (No. DAE4-601_Jun12)	Jun-13

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power sensor HP 8481A	MY41092317	18-Oct-02 (in house check Oct-11)	In house check: Oct-13
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-11)	In house check: Oct-13
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-12)	In house check: Oct-13

	Name	Function	Signature
Calibrated by:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 11, 2012

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

S Schweizerischer Kalibrierdienst
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Accreditation No.: SCS 108

Glossary:

TSL	tissue simulating liquid
ConvF	sensitivity in TSL / NORM x,y,z
N/A	not applicable or not measured

Calibration is Performed According to the Following Standards:

a) IEC 62209-2, "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", March 2010

b) Federal Communications Commission Office of Engineering & Technology (FCC OET), "Evaluating Compliance with FCC Guidelines for Human Exposure to Radiofrequency Electromagnetic Fields; Additional Information for Evaluating Compliance of Mobile and Portable Devices with FCC Limits for Human Exposure to Radiofrequency Emissions", Supplement C (Edition 01-01) to Bulletin 65

Additional Documentation:

c) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

- *Measurement Conditions:* Further details are available from the Validation Report at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated.
- *Antenna Parameters with TSL:* The dipole is mounted with the spacer to position its feed point exactly below the center marking of the flat phantom section, with the arms oriented parallel to the body axis.
- *Feed Point Impedance and Return Loss:* These parameters are measured with the dipole positioned under the liquid filled phantom. The impedance stated is transformed from the measurement at the SMA connector to the feed point. The Return Loss ensures low reflected power. No uncertainty required.
- *Electrical Delay:* One-way delay between the SMA connector and the antenna feed point. No uncertainty required.
- *SAR measured:* SAR measured at the stated antenna input power.
- *SAR normalized:* SAR as measured, normalized to an input power of 1 W at the antenna connector.
- *SAR for nominal TSL parameters:* The measured TSL parameters are used to calculate the nominal SAR result.

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

Measurement Conditions

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

DASY Version	DASY5	V52.8.3
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom V5.0	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy = 4.0 mm, dz = 1.4 mm	Graded Ratio = 1.4 (Z direction)
Frequency	5200 MHz ± 1 MHz 5300 MHz ± 1 MHz 5500 MHz ± 1 MHz 5600 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	34.6 ± 6 %	4.46 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**79.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.8 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.9	4.76 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.4 ± 6 %	4.55 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.6 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 W/kg ± 19.5 % (k=2)**

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	34.2 ± 6 %	4.72 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °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	8.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.2 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.37 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.4 W/kg ± 19.5 % (k=2)**

Head TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.5	5.07 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	4.81 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.41 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.1 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.7 W/kg ± 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	33.8 ± 6 %	5.04 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.93 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**78.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.26 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5200 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	49.0	5.30 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	47.1 ± 6 %	5.40 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5200 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**71.4 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.02 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5300 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.9	5.42 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.9 ± 6 %	5.51 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5300 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.45 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**73.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.09 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.7 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5500 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.6	5.65 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.6 ± 6 %	5.76 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °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	7.62 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**75.6 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5600 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.5	5.77 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.4 ± 6 %	5.88 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.73 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**76.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.14 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.2 W/kg ± 19.5 % (k=2)**

Body TSL parameters at 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	48.2	6.00 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	46.1 ± 6 %	6.17 mho/m ± 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Body TSL	Condition	
SAR measured	100 mW input power	7.25 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**71.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**19.8 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	54.0 Ω - 7.1 jΩ
Return Loss	- 22.1 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	49.0 Ω - 4.5 jΩ
Return Loss	- 26.7 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	59.1 Ω - 8.8 jΩ
Return Loss	- 18.8 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	59.7 Ω - 1.7 jΩ
Return Loss	- 21.0 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	55.8 Ω - 8.9 jΩ
Return Loss	- 20.0 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	53.7 Ω - 6.3 jΩ
Return Loss	- 23.0 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	50.3 Ω - 4.2 jΩ
Return Loss	- 27.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	58.7 Ω - 6.9 jΩ
Return Loss	- 19.8 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	60.7 Ω - 0.7 jΩ
Return Loss	- 20.3 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	56.7 Ω - 7.2 jΩ
Return Loss	- 20.7 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns

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

The dipole is made of standard semirigid coaxial cable. The center conductor of the feeding line is directly connected to the second arm of the dipole. The antenna is therefore short-circuited for DC-signals. On some of the dipoles, small end caps are added to the dipole arms in order to improve matching when loaded according to the position as explained in the "Measurement Conditions" paragraph. The SAR data are not affected by this change. The overall dipole length is still according to the Standard.
No excessive force must be applied to the dipole arms, because they might bend or the soldered connections near the feedpoint may be damaged.

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 09, 2006

DASY5 Validation Report for Head TSL

Date: 11.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1048

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 4.46 mho/m; ε_r = 34.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.55 mho/m; ε_r = 34.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.72 mho/m; ε_r = 34.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.81 mho/m; ε_r = 34; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.04 mho/m; ε_r = 33.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(5.41, 5.41, 5.41); Calibrated: 30.12.2011, ConvF(5.1, 5.1, 5.1); Calibrated: 30.12.2011, ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.76, 4.76, 4.76); Calibrated: 30.12.2011, ConvF(4.81, 4.81, 4.81); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

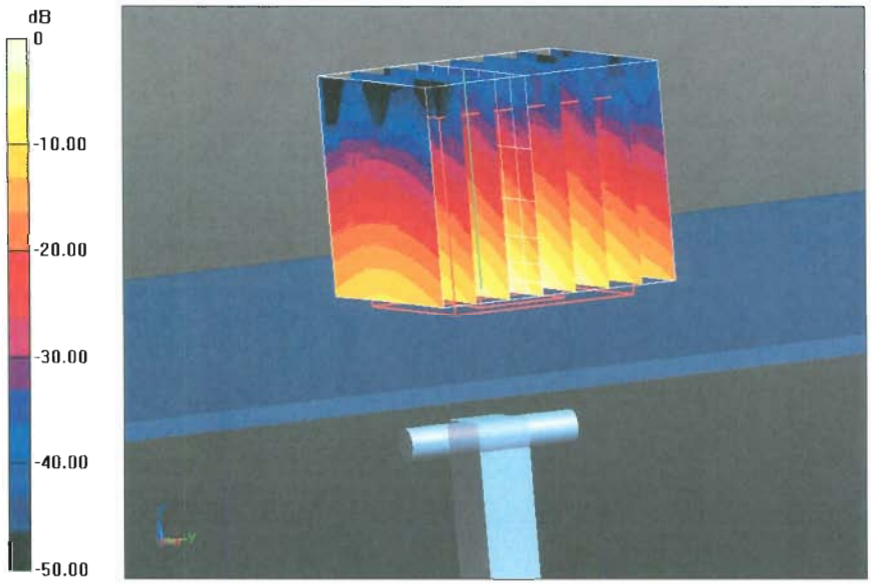
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.551 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 29.4 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.31 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 64.266 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 31.3 W/kg
SAR(1 g) = 8.34 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 19.6 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.310 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 32.5 W/kg
SAR(1 g) = 8.31 W/kg; SAR(10 g) = 2.37 W/kg
Maximum value of SAR (measured) = 19.8 W/kg

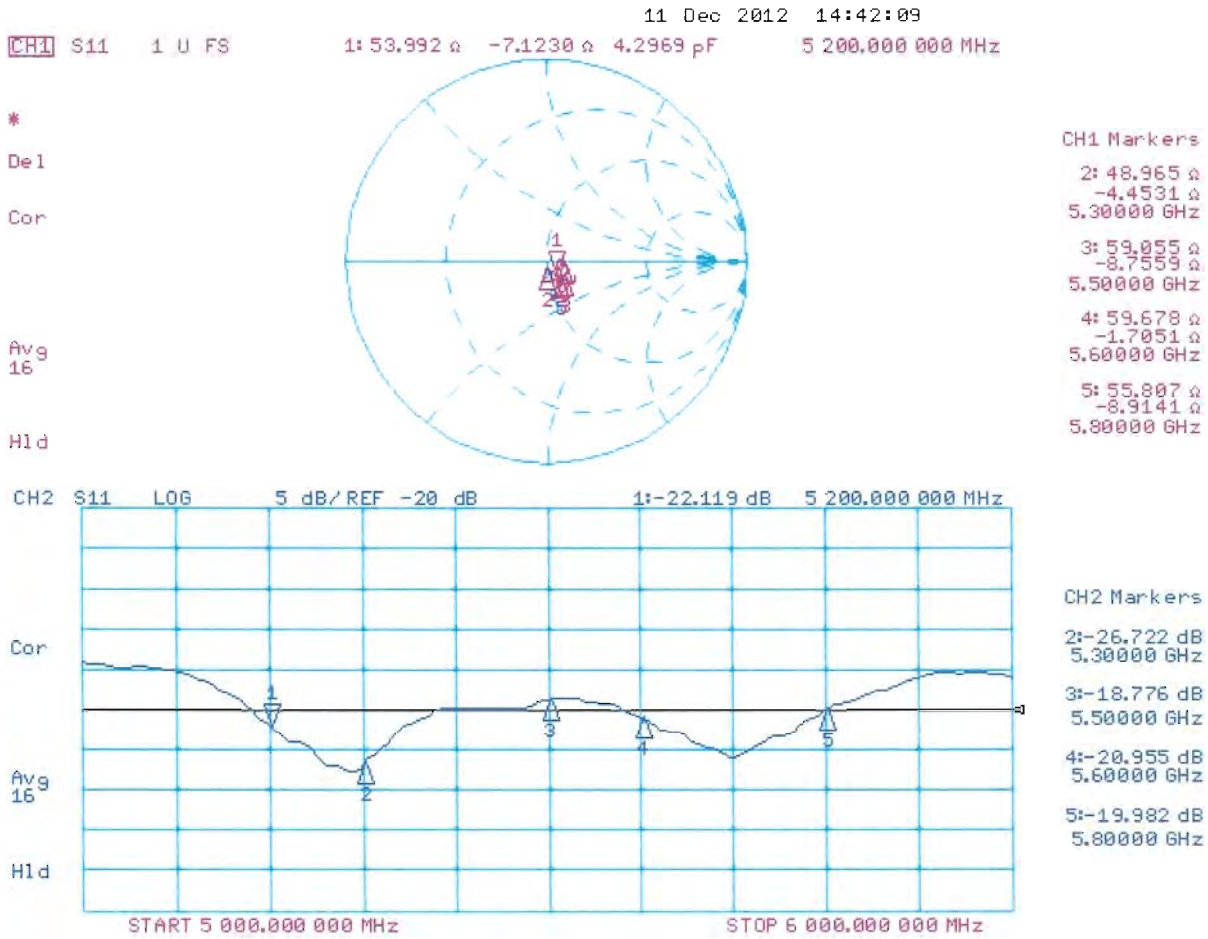
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.574 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 33.1 W/kg
SAR(1 g) = 8.41 W/kg; SAR(10 g) = 2.4 W/kg
Maximum value of SAR (measured) = 20.1 W/kg

Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 60.570 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.7 W/kg
SAR(1 g) = 7.93 W/kg; SAR(10 g) = 2.26 W/kg
Maximum value of SAR (measured) = 19.3 W/kg



0 dB = 19.3 W/kg = 12.86 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1048

Communication System: CW; Frequency: 5200 MHz, Frequency: 5300 MHz, Frequency: 5500 MHz, Frequency: 5600 MHz, Frequency: 5800 MHz
Medium parameters used: f = 5200 MHz; σ = 5.4 mho/m; ε_r = 47.1; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.51 mho/m; ε_r = 46.9; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.76 mho/m; ε_r = 46.6; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.88 mho/m; ε_r = 46.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.17 mho/m; ε_r = 46.1; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: EX3DV4 - SN3503; ConvF(4.91, 4.91, 4.91); Calibrated: 30.12.2011, ConvF(4.67, 4.67, 4.67); Calibrated: 30.12.2011, ConvF(4.43, 4.43, 4.43); Calibrated: 30.12.2011, ConvF(4.22, 4.22, 4.22); Calibrated: 30.12.2011, ConvF(4.38, 4.38, 4.38); Calibrated: 30.12.2011;
- Sensor-Surface: 1.4mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

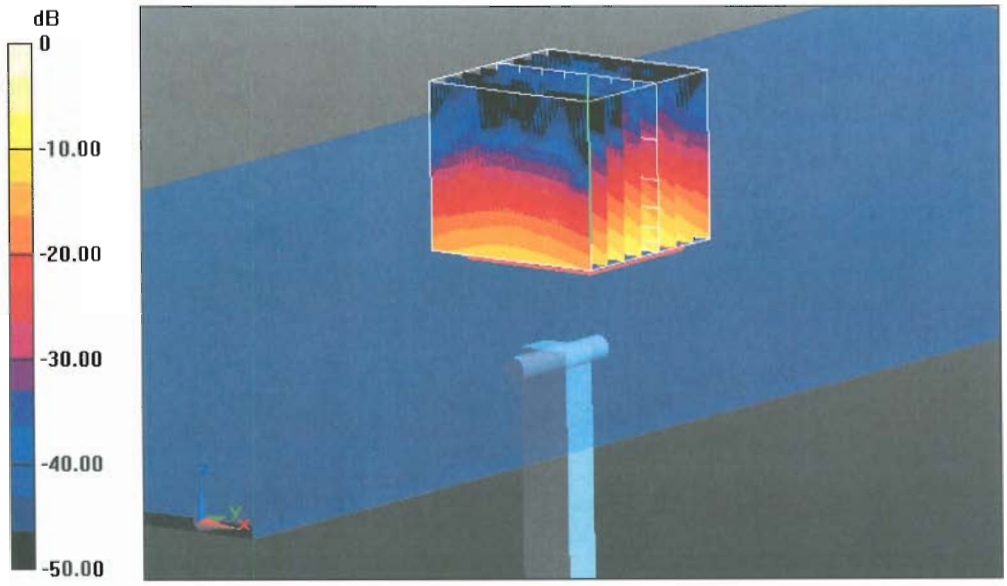
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.320 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 28.3 W/kg
SAR(1 g) = 7.2 W/kg; SAR(10 g) = 2.02 W/kg
Maximum value of SAR (measured) = 17.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5300 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.849 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 30.1 W/kg
SAR(1 g) = 7.45 W/kg; SAR(10 g) = 2.09 W/kg
Maximum value of SAR (measured) = 17.9 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5500 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.354 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 18.7 W/kg

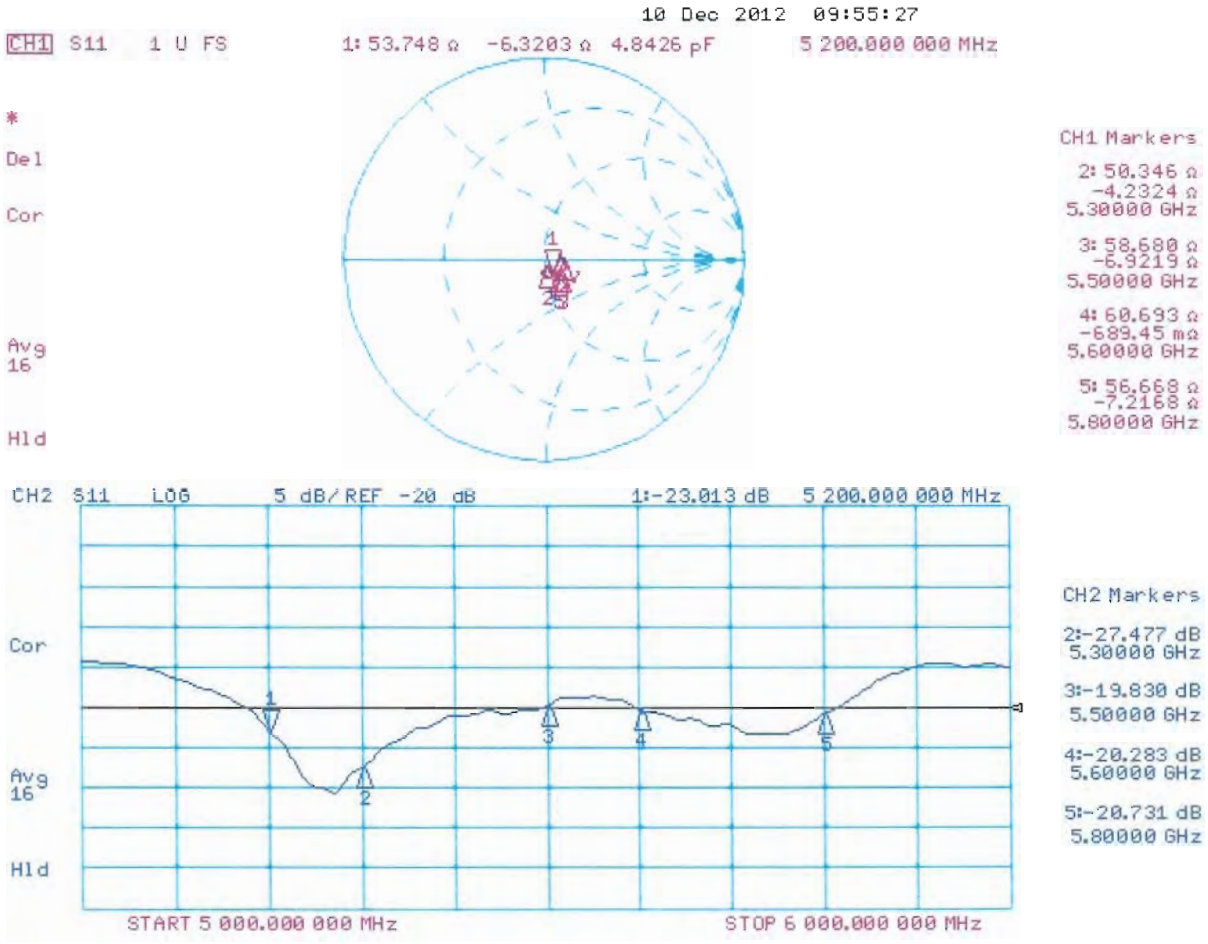
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 55.041 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 34.3 W/kg
SAR(1 g) = 7.73 W/kg; SAR(10 g) = 2.14 W/kg
Maximum value of SAR (measured) = 19.2 W/kg

Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 52.474 V/m; Power Drift = -0.06 dB
Peak SAR (extrapolated) = 33.8 W/kg
SAR(1 g) = 7.25 W/kg; SAR(10 g) = 2 W/kg
Maximum value of SAR (measured) = 18.2 W/kg



0 dB = 18.2 W/kg = 12.60 dBW/kg

Impedance Measurement Plot for Body TSL



APPENDIX G: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED GSM/GPRS/EGPRS TRANSMISSION MODES

G.1 Power Tuning Targets

GSM/GPRS/EGPRS 850 Head, Body-worn and Wireless Router Body			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.5	32.5	32.5
GPRS 2-slot	30.0	30.0	30.0
GPRS 3-slot	28.2	28.2	28.2
GPRS 4-slot	27.0	27.0	27.0
EGRPS 1-slot	26.5	26.5	26.5
EGPRS 2-slot	26.0	26.0	26.0
EGPRS 3-slot	25.0	25.0	25.0
EGPRS 4-slot	23.0	23.0	23.0

GSM/GPRS/EGPRS 1900 Head, Body-worn and Wireless Router Body			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	30.0	30.0	30.0
GPRS 2-slot	27.0	27.0	27.0
GPRS 3-slot	25.2	25.2	25.2
GPRS 4-slot	24.0	24.0	24.0
EGRPS 1-slot	25.5	25.5	25.5
EGPRS 2-slot	25.0	25.0	25.0
EGPRS 3-slot	24.0	24.0	24.0
EGPRS 4-slot	22.0	22.0	22.0

G.2 Conducted Power from the Samples used in the Testing

Type: RM-937; Serial number: 004402/47/288850/6 used for GSM/GPRS/EGPRS850 Head, Body-worn and Wireless Router SAR measurements

GSM/GPRS/EGPRS 850 Head, Body-worn and Wireless Router			
Slot configuration	CH 128 824.2 MHz	CH 190 836.6 MHz	CH 251 848.8 MHz
GSM 1-slot	32.79	32.80	32.80
GPRS 2-slot	29.94	30.31	30.30
GPRS 3-slot	28.34	28.49	28.44
GPRS 4-slot	27.18	27.33	27.26
EGRPS 1-slot	26.62	26.80	26.71
EGPRS 2-slot	26.08	26.13	26.15
EGPRS 3-slot	25.14	25.26	25.23
EGPRS 4-slot	22.95	23.00	23.03

Type: RM-937; Serial number: 004402/47/288850/6 used for GSM/GPRS/EGPRS1900 Head and Body-worn and Wireless Router SAR measurements

GSM/GPRS/EGPRS 1900 Head, Body-worn and Wireless Router			
Slot configuration	CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.8 MHz
GSM 1-slot	29.90	30.04	30.01
GPRS 2-slot	27.02	27.16	27.16
GPRS 3-slot	25.12	25.29	25.28
GPRS 4-slot	23.99	24.09	24.18
EGRPS 1-slot	25.39	25.49	25.63
EGPRS 2-slot	24.80	24.93	25.08
EGPRS 3-slot	23.97	24.10	24.18
EGPRS 4-slot	22.06	22.15	22.19

APPENDIX H: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WCDMA TRANSMISSION MODES

H.1 Power Tuning Targets

WCDMA 850 (Band 5) Head, Body-worn and Wireless Router			
Mode	Low channel	Mid channel	High channel
WCDMA	23.5	23.5	23.5

WCDMA1900 (Band 2) Head and Body-worn			
Mode	Low channel	Mid channel	High channel
WCDMA	23.5	23.5	23.5

H.2 Conducted Power from the Samples used in the Testing

Type: RM-937; Serial number: 004402/47/288851/4 used for WCDMA850 (Band 5) Head, Body-worn and Wireless router SAR measurements

WCDMA850 (Band 5)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.74	23.78	23.83

Type: RM-937; Serial number: 004402/47/288851/4 used for WCDMA1900 (Band 2) Head and Body-worn and Wireless Router SAR measurements

WCDMA1900 (Band 2)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.54	23.62	23.55

WCDMA and HSUPA Subtest mode conducted powers, measured from a separate, fully representative sample are presented in Appendix D.

APPENDIX I: CONDUCTED POWER RESULTS FOR WLAN2450 AND WLAN5000

I.1 Power Tuning Targets for Head, Body worn and Wireless Router Measurements

WLAN 2.4 GHz Tuning Targets					
Mode	CH 1	CH 2	CH 6	CH 10	CH 11
b-mode WLAN DSSS 1 Mbps	16.0	16.0	16.0	16.0	16.0
b-mode WLAN DSSS 2 Mbps	15.5	15.5	15.5	15.5	15.5
b-mode WLAN DSSS 5.5 Mbps	15.5	15.5	15.5	15.5	15.5
b-mode WLAN DSSS 11 Mbps	15.5	15.5	15.5	15.5	15.5
g-mode WLAN OFDM 6 Mbps	14.5	14.5	14.5	14.5	14.5
g-mode WLAN OFDM 9 Mbps	14.5	14.5	14.5	14.5	14.5
g-mode WLAN OFDM 12 Mbps	14.0	14.0	14.0	14.0	14.0
g-mode WLAN OFDM 18 Mbps	14.0	14.0	14.0	14.0	14.0
g-mode WLAN OFDM 24 Mbps	13.0	13.0	13.0	13.0	13.0
g-mode WLAN OFDM 36 Mbps	13.0	13.0	13.0	13.0	13.0
g-mode WLAN OFDM 48 Mbps	12.0	12.0	12.0	12.0	12.0
g-mode WLAN OFDM 54 Mbps	12.0	12.0	12.0	12.0	12.0
n-mode MCS 0: OFDM 6.5 / 7.25 Mbps	13.0	13.0	13.0	13.0	13.0
n-mode MCS 1: OFDM 13.0 / 14.4 Mbps	13.0	13.0	13.0	13.0	13.0
n-mode MCS 2: OFDM 19.5 / 21.7 Mbps	13.0	13.0	13.0	13.0	13.0
n-mode MCS 3: OFDM 26.0 / 28.9 Mbps	12.0	12.0	12.0	12.0	12.0
n-mode MCS 4: OFDM 39.0 / 43.3 Mbps	12.0	12.0	12.0	12.0	12.0
n-mode MCS 5: OFDM 52.0 / 57.8 Mbps	11.0	11.0	11.0	11.0	11.0
n-mode MCS 6: OFDM 58.5 / 65.0 Mbps	11.0	11.0	11.0	11.0	11.0
n-mode MCS 7: OFDM 65.0 / 72.2 Mbps	11.0	11.0	11.0	11.0	11.0

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz Tuning Targets					
			36	40	44	48	52	56
802.11g	BPSK	6	12.00	12.00	12.00	12.00	12.00	12.00
802.11g	BPSK	9	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	12	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	18	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	24	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	36	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	64QAM	48	11.00	11.00	11.00	11.00	11.00	11.00
802.11g	64QAM	54	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	BPSK	6.5 / 7.25	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	13.0 / 14.4	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	19.5 / 21.7	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	16QAM	26.0 / 28.9	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	16QAM	39.0 / 43.3	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	64QAM	52.0 / 57.8	10.00	10.00	10.00	10.00	10.00	10.00
802.11n	64QAM	58.5 / 65.0	9.00	9.00	9.00	9.00	9.00	9.00
802.11n	64QAM	65.0 / 72.2	9.00	9.00	9.00	9.00	9.00	9.00
802.11ac	256QAM	78.0 / 86.7	7.00	7.00	7.00	7.00	7.00	7.00

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz Tuning Targets						
			38 (36+40)	42 (40+44)	46 (44+48)	50 (48+52)	54 (52+56)	58 (56+60)	62 (60+64)
802.11n	BPSK	13.5 / 15.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	27.0 / 30.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	40.5 / 45.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	16QAM	54.0 / 60.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	16QAM	81.0 / 90.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	108.0 / 120.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	121.5 / 135.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
802.11n	64QAM	135.0 / 150.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
802.11ac	256QAM	162.0 / 180.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0
802.11ac	256QAM	180.0 / 200.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz Tuning Targets					
			60	64	100	104	108	112
802.11g	BPSK	6	12.00	12.00	12.00	12.00	12.00	12.00
802.11g	BPSK	9	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	12	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	18	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	24	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	36	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	64QAM	48	11.00	11.00	11.00	11.00	11.00	11.00
802.11g	64QAM	54	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	BPSK	6.5 / 7.25	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	13.0 / 14.4	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	19.5 / 21.7	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	16QAM	26.0 / 28.9	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	16QAM	39.0 / 43.3	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	64QAM	52.0 / 57.8	10.00	10.00	10.00	10.00	10.00	10.00
802.11n	64QAM	58.5 / 65.0	9.00	9.00	9.00	9.00	9.00	9.00
802.11n	64QAM	65.0 / 72.2	9.00	9.00	9.00	9.00	9.00	9.00
802.11ac	256QAM	78.0 / 86.7	7.00	7.00	7.00	7.00	7.00	7.00

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz Tuning Targets					
			102 (100+104)	106 (104+108)	110 (108+112)	114 (112+116)	118 (116+120)	122 (120+124)
802.11n	BPSK	13.5 / 15.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	27.0 / 30.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	40.5 / 45.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	16QAM	54.0 / 60.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	16QAM	81.0 / 90.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	108.0 / 120.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	121.5 / 135.0	9.0	9.0	9.0	9.0	9.0	9.0
802.11n	64QAM	135.0 / 150.0	8.0	8.0	8.0	8.0	8.0	8.0
802.11ac	256QAM	162.0 / 180.0	7.0	7.0	7.0	7.0	7.0	7.0
802.11ac	256QAM	180.0 / 200.0	7.0	7.0	7.0	7.0	7.0	7.0

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz Tuning Targets					
			116	120	124	128	132	136
802.11g	BPSK	6	12.00	12.00	12.00	12.00	12.00	12.00
802.11g	BPSK	9	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	12	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	18	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	24	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	36	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	64QAM	48	11.00	11.00	11.00	11.00	11.00	11.00
802.11g	64QAM	54	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	BPSK	6.5 / 7.25	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	13.0 / 14.4	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	19.5 / 21.7	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	16QAM	26.0 / 28.9	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	16QAM	39.0 / 43.3	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	64QAM	52.0 / 57.8	10.00	10.00	10.00	10.00	10.00	10.00
802.11n	64QAM	58.5 / 65.0	9.00	9.00	9.00	9.00	9.00	9.00
802.11n	64QAM	65.0 / 72.2	9.00	9.00	9.00	9.00	9.00	9.00
802.11ac	256QAM	78.0 / 86.7	7.00	7.00	7.00	7.00	7.00	7.00

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz Tuning Targets			
			126 (124+128)	130 (128+132)	134 (132+136)	138 (136+140)
802.11n	BPSK	13.5 / 15.0	12.0	12.0	12.0	12.0
802.11n	QPSK	27.0 / 30.0	12.0	12.0	12.0	12.0
802.11n	QPSK	40.5 / 45.0	11.0	11.0	11.0	11.0
802.11n	16QAM	54.0 / 60.0	11.0	11.0	11.0	11.0
802.11n	16QAM	81.0 / 90.0	10.0	10.0	10.0	10.0
802.11n	64QAM	108.0 / 120.0	10.0	10.0	10.0	10.0
802.11n	64QAM	121.5 / 135.0	9.0	9.0	9.0	9.0
802.11n	64QAM	135.0 / 150.0	8.0	8.0	8.0	8.0
802.11ac	256QAM	162.0 / 180.0	7.0	7.0	7.0	7.0
802.11ac	256QAM	180.0 / 200.0	7.0	7.0	7.0	7.0

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz Tuning Targets					
			140	149	153	157	161	165
802.11g	BPSK	6	12.00	12.00	12.00	12.00	12.00	12.00
802.11g	BPSK	9	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	12	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	QPSK	18	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	24	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	16QAM	36	11.50	11.50	11.50	11.50	11.50	11.50
802.11g	64QAM	48	11.00	11.00	11.00	11.00	11.00	11.00
802.11g	64QAM	54	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	BPSK	6.5 / 7.25	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	13.0 / 14.4	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	QPSK	19.5 / 21.7	11.50	11.50	11.50	11.50	11.50	11.50
802.11n	16QAM	26.0 / 28.9	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	16QAM	39.0 / 43.3	11.00	11.00	11.00	11.00	11.00	11.00
802.11n	64QAM	52.0 / 57.8	10.00	10.00	10.00	10.00	10.00	10.00
802.11n	64QAM	58.5 / 65.0	9.00	9.00	9.00	9.00	9.00	9.00
802.11n	64QAM	65.0 / 72.2	9.00	9.00	9.00	9.00	9.00	9.00
802.11ac	256QAM	78.0 / 86.7	7.00	7.00	7.00	7.00	7.00	7.00

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz Tuning Targets			
			151 (149+153)	155 (153+157)	159 (157+161)	163 (161+165)
802.11n	BPSK	13.5 / 15.0	12.0	12.0	12.0	12.0
802.11n	QPSK	27.0 / 30.0	12.0	12.0	12.0	12.0
802.11n	QPSK	40.5 / 45.0	11.0	11.0	11.0	11.0
802.11n	16QAM	54.0 / 60.0	11.0	11.0	11.0	11.0
802.11n	16QAM	81.0 / 90.0	10.0	10.0	10.0	10.0
802.11n	64QAM	108.0 / 120.0	10.0	10.0	10.0	10.0
802.11n	64QAM	121.5 / 135.0	9.0	9.0	9.0	9.0
802.11n	64QAM	135.0 / 150.0	8.0	8.0	8.0	8.0
802.11ac	256QAM	162.0 / 180.0	7.0	7.0	7.0	7.0
802.11ac	256QAM	180.0 / 200.0	7.0	7.0	7.0	7.0

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 80 MHz Tuning Targets				
			42 (36-48)	58 (52-64)	106 (100-112)	138 (132-144)	155 (149+161)
802.11ac	BPSK	29.3 / 32.5	11.0	11.0	11.0	11.0	11.0
802.11ac	QPSK	58.5 / 65.0	11.0	11.0	11.0	11.0	11.0
802.11ac	QPSK	87.8 / 97.5	11.0	11.0	11.0	11.0	11.0
802.11ac	16QAM	117 / 130	10.0	10.0	10.0	10.0	10.0
802.11ac	16QAM	175.5 / 195.0	10.0	10.0	10.0	10.0	10.0
802.11ac	64QAM	234 / 260	9.0	9.0	9.0	9.0	9.0
802.11ac	64QAM	263.3 / 292.5	8.0	8.0	8.0	8.0	8.0
802.11ac	64QAM	292.5 / 325	8.0	8.0	8.0	8.0	8.0
802.11ac	256QAM	351 / 390	7.0	7.0	7.0	7.0	7.0
802.11ac	256QAM	390 / 433.3	7.0	7.0	7.0	7.0	7.0

J.2 Conducted Power from the Samples used in the Testing

Type: RM-937; Serial number: 004402/47/288853/0 used for WLAN2450 Head, Body-worn and Wireless router SAR measurements

WLAN 2.4 GHz Conducted Power Measurements					
Mode	CH 1	CH 2	CH 6	CH 10	CH 11
b-mode WLAN DSSS 1 Mbps	16.75	16.49	16.58	16.45	16.56
b-mode WLAN DSSS 2 Mbps	16.18	15.87	16.03	15.92	15.82
b-mode WLAN DSSS 5.5 Mbps	16.37	16.19	16.22	16.11	15.97
b-mode WLAN DSSS 11 Mbps	16.30	15.96	15.96	15.88	16.05
g-mode WLAN OFDM 6 Mbps	14.71	14.61	14.76	14.92	14.96
g-mode WLAN OFDM 9 Mbps	14.70	14.61	14.78	14.94	15.02
g-mode WLAN OFDM 12 Mbps	14.09	14.17	14.40	14.47	14.59
g-mode WLAN OFDM 18 Mbps	14.24	14.18	14.25	14.48	14.63
g-mode WLAN OFDM 24 Mbps	13.22	13.11	13.27	13.39	13.45
g-mode WLAN OFDM 36 Mbps	13.11	13.32	13.29	13.41	13.50
g-mode WLAN OFDM 48 Mbps	12.22	12.28	12.13	12.42	12.44
g-mode WLAN OFDM 54 Mbps	12.23	12.29	12.14	12.38	12.41
n-mode MCS 0: OFDM 6.5 / 7.25 Mbps	13.27	13.34	13.47	13.48	13.52
n-mode MCS 1: OFDM 13.0 / 14.4 Mbps	13.31	13.35	13.37	13.61	13.55
n-mode MCS 2: OFDM 19.5 / 21.7 Mbps	13.32	13.39	13.39	13.53	13.58
n-mode MCS 3: OFDM 26.0 / 28.9 Mbps	12.23	12.26	12.36	12.59	12.61
n-mode MCS 4: OFDM 39.0 / 43.3 Mbps	12.28	12.30	12.48	12.51	12.61
n-mode MCS 5: OFDM 52.0 / 57.8 Mbps	11.47	11.14	11.36	11.49	11.70
n-mode MCS 6: OFDM 58.5 / 65.0 Mbps	11.47	11.12	11.40	11.59	11.49
n-mode MCS 7: OFDM 65.0 / 72.2 Mbps	11.48	11.38	11.46	11.60	11.62

Type: RM-937; Serial number: 004402/47/288855/5 used for WLAN5000 Head, Body-worn and 10-g Extremity measurements.

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			36	40	44	48	52	56
802.11g	BPSK	6	13.02	12.55	12.58	12.86	12.96	12.61
802.11g	BPSK	9	12.53	12.22	12.10	12.39	12.42	12.39
802.11g	QPSK	12	12.49	12.14	12.11	12.32	12.58	12.22
802.11g	QPSK	18	12.50	12.19	12.10	12.43	12.35	12.29
802.11g	16QAM	24	12.48	12.19	12.10	12.39	12.39	12.20
802.11g	16QAM	36	12.48	12.24	12.15	12.39	12.41	12.25
802.11g	64QAM	48	12.05	11.64	11.70	11.91	11.93	11.81
802.11g	64QAM	54	12.12	11.65	11.61	11.86	11.93	11.72
802.11n	BPSK	6.5 / 7.25	12.62	12.44	12.18	12.55	12.56	12.44
802.11n	QPSK	13.0 / 14.4	12.63	12.48	12.15	12.64	12.57	12.47
802.11n	QPSK	19.5 / 21.7	12.57	12.38	12.18	12.50	12.44	12.51
802.11n	16QAM	26.0 / 28.9	12.55	12.26	12.17	12.49	12.56	12.35
802.11n	16QAM	39.0 / 43.3	12.57	12.26	12.19	12.39	12.42	12.31
802.11n	64QAM	52.0 / 57.8	10.94	10.74	10.61	10.90	11.05	10.74
802.11n	64QAM	58.5 / 65.0	10.10	9.79	9.60	9.89	10.08	9.75
802.11n	64QAM	65.0 / 72.2	7.87	7.68	7.59	7.94	7.95	7.79
802.11ac	256QAM	78.0 / 86.7						

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz channel bandwidth: Measured values						
			38 (36+40)	42 (40+44)	46 (44+48)	50 (48+52)	54 (52+56)	58 (56+60)	62 (60+64)
802.11n	BPSK	13.5 / 15.0	11.55	11.33	11.37	11.65	11.45	11.29	11.24
802.11n	QPSK	27.0 / 30.0	11.60	11.38	11.36	11.67	11.54	11.25	11.31
802.11n	QPSK	40.5 / 45.0	10.66	10.42	10.41	10.74	10.59	10.31	10.36
802.11n	16QAM	54.0 / 60.0	10.62	10.36	10.39	10.64	10.56	10.29	10.35
802.11n	16QAM	81.0 / 90.0	9.63	9.28	9.46	9.69	9.66	9.34	9.41
802.11n	64QAM	108.0 / 120.0	9.40	9.15	9.43	9.54	9.52	9.34	9.39
802.11n	64QAM	121.5 / 135.0	8.44	8.22	8.50	8.67	8.41	8.32	8.31
802.11n	64QAM	135.0 / 150.0	7.66	7.26	7.46	7.71	7.52	7.42	7.31
802.11ac	256QAM	351 / 390							
802.11ac	256QAM	390 / 433.3							

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			60	64	100	104	108	112
802.11g	BPSK	6	12.70	12.70	12.88	12.99	12.68	12.66
802.11g	BPSK	9	12.24	12.23	12.37	12.44	12.25	12.11
802.11g	QPSK	12	12.25	12.17	12.49	12.45	12.19	12.12
802.11g	QPSK	18	12.27	12.09	12.21	12.46	12.34	12.12
802.11g	16QAM	24	12.28	12.07	12.23	12.46	12.25	12.11
802.11g	16QAM	36	12.24	12.10	12.26	12.46	12.29	12.15
802.11g	64QAM	48	11.66	11.65	11.77	11.91	11.58	11.56
802.11g	64QAM	54	11.69	11.65	11.69	11.93	11.60	11.61
802.11n	BPSK	6.5 / 7.25	12.29	12.45	12.58	12.52	12.37	12.18
802.11n	QPSK	13.0 / 14.4	12.32	12.37	12.59	12.55	12.40	12.20
802.11n	QPSK	19.5 / 21.7	12.34	12.29	12.61	12.54	12.45	12.22
802.11n	16QAM	26.0 / 28.9	12.32	12.34	12.41	12.50	12.36	12.18
802.11n	16QAM	39.0 / 43.3	12.35	12.17	12.44	12.54	12.33	12.20
802.11n	64QAM	52.0 / 57.8	10.56	10.77	10.68	10.92	10.54	10.53
802.11n	64QAM	58.5 / 65.0	9.59	9.72	9.55	9.78	9.45	9.45
802.11n	64QAM	65.0 / 72.2	7.61	7.73	7.74	7.72	7.50	7.33
802.11ac	256QAM	78.0 / 86.7						

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz channel bandwidth: Measured values					
			102 (100+104)	106 (104+108)	110 (108+112)	114 (112+116)	118 (116+120)	122 (120+124)
802.11n	BPSK	13.5 / 15.0	11.02	10.98	10.65	10.52	10.66	10.81
802.11n	QPSK	27.0 / 30.0	10.90	10.93	10.69	10.62	10.73	10.77
802.11n	QPSK	40.5 / 45.0	10.22	10.25	10.02	9.78	9.92	9.90
802.11n	16QAM	54.0 / 60.0	10.18	10.20	9.99	9.76	9.92	9.87
802.11n	16QAM	81.0 / 90.0	9.19	9.22	8.98	8.69	8.90	8.96
802.11n	64QAM	108.0 / 120.0	9.19	9.22	8.84	8.70	8.70	9.02
802.11n	64QAM	121.5 / 135.0	8.15	8.22	7.97	7.77	8.03	8.07
802.11n	64QAM	135.0 / 150.0	7.38	7.38	6.99	6.91	6.95	7.19
802.11ac	256QAM	351 / 390						
802.11ac	256QAM	390 / 433.3						

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			116	120	124	128	132	136
802.11g	BPSK	6	12.62	12.81	12.67	12.68	12.54	12.59
802.11g	BPSK	9	12.24	12.26	12.36	12.11	11.97	12.09
802.11g	QPSK	12	12.46	12.27	12.21	12.20	11.96	12.21
802.11g	QPSK	18	12.28	12.27	12.27	12.13	12.08	12.01
802.11g	16QAM	24	12.16	12.27	12.16	12.15	11.98	11.91
802.11g	16QAM	36	12.12	12.32	12.20	12.24	12.02	11.91
802.11g	64QAM	48	11.54	11.75	11.65	11.77	11.55	11.34
802.11g	64QAM	54	11.54	11.75	11.62	11.60	11.57	11.31
802.11n	BPSK	6.5 / 7.25	12.37	12.32	12.50	12.41	12.28	11.95
802.11n	QPSK	13.0 / 14.4	12.34	12.34	12.44	12.35	12.16	12.09
802.11n	QPSK	19.5 / 21.7	12.32	12.37	12.42	12.20	12.11	12.18
802.11n	16QAM	26.0 / 28.9	12.22	12.32	12.31	12.28	12.07	12.06
802.11n	16QAM	39.0 / 43.3	12.20	12.34	12.23	12.14	12.15	11.95
802.11n	64QAM	52.0 / 57.8	10.49	10.73	10.70	10.70	10.37	10.31
802.11n	64QAM	58.5 / 65.0	9.34	9.57	9.76	9.42	9.17	9.18
802.11n	64QAM	65.0 / 72.2	7.26	7.44	7.51	7.34	7.27	7.30
802.11ac	256QAM	78.0 / 86.7						

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz channel bandwidth: Measured values			
			126 (124+128)	130 (128+132)	134 (132+136)	138 (136+140)
802.11n	BPSK	13.5 / 15.0	10.77	10.73	10.62	10.55
802.11n	QPSK	27.0 / 30.0	10.68	10.57	10.64	10.61
802.11n	QPSK	40.5 / 45.0	10.03	9.86	9.81	9.77
802.11n	16QAM	54.0 / 60.0	9.99	9.81	9.76	9.80
802.11n	16QAM	81.0 / 90.0	8.97	8.83	8.76	8.71
802.11n	64QAM	108.0 / 120.0	8.96	8.83	8.72	8.72
802.11n	64QAM	121.5 / 135.0	7.98	7.81	7.78	7.82
802.11n	64QAM	135.0 / 150.0	7.16	6.97	6.91	6.89
802.11ac	256QAM	351 / 390				
802.11ac	256QAM	390 / 433.3				

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			140	149	153	157	161	165
802.11g	BPSK	6	12.49	12.73	12.60	12.41	12.42	12.30
802.11g	BPSK	9	12.04	12.21	12.07	11.88	11.90	11.79
802.11g	QPSK	12	11.94	12.23	12.09	11.90	11.98	11.81
802.11g	QPSK	18	12.01	12.25	12.10	11.91	11.94	11.81
802.11g	16QAM	24	12.03	12.17	12.08	11.91	11.79	11.79
802.11g	16QAM	36	11.83	12.05	12.12	11.92	11.82	11.82
802.11g	64QAM	48	11.33	11.45	11.42	11.42	11.26	11.30
802.11g	64QAM	54	11.32	11.45	11.48	11.37	11.27	11.32
802.11n	BPSK	6.5 / 7.25	11.84	12.27	12.14	12.14	11.90	11.96
802.11n	QPSK	13.0 / 14.4	12.10	12.31	12.18	11.99	11.98	11.87
802.11n	QPSK	19.5 / 21.7	12.08	12.33	12.19	11.99	12.08	11.89
802.11n	16QAM	26.0 / 28.9	12.18	12.31	12.18	11.96	11.86	11.87
802.11n	16QAM	39.0 / 43.3	12.11	12.17	12.19	11.97	11.86	11.90
802.11n	64QAM	52.0 / 57.8	10.38	10.45	10.44	10.43	10.29	10.36
802.11n	64QAM	58.5 / 65.0	9.31	9.38	9.31	9.37	9.04	9.10
802.11n	64QAM	65.0 / 72.2	7.35	7.40	7.48	7.30	7.15	7.18
802.11ac	256QAM	78.0 / 86.7						

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 40 MHz channel bandwidth: Measured values			
			151 (149+153)	155 (153+157)	159 (157+161)	163 (161+165)
802.11n	BPSK	13.5 / 15.0	10.65	10.59	10.37	10.21
802.11n	QPSK	27.0 / 30.0	10.70	10.48	10.44	10.47
802.11n	QPSK	40.5 / 45.0	9.91	9.78	9.81	9.46
802.11n	16QAM	54.0 / 60.0	9.82	9.84	9.78	9.71
802.11n	16QAM	81.0 / 90.0	8.88	8.82	8.72	8.70
802.11n	64QAM	108.0 / 120.0	8.76	8.81	8.68	8.68
802.11n	64QAM	121.5 / 135.0	7.94	7.89	7.71	7.75
802.11n	64QAM	135.0 / 150.0	7.13	7.12	6.91	6.80
802.11ac	256QAM	351 / 390				
802.11ac	256QAM	390 / 433.3				

(Tables continues)

(Tables continues)

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 80 MHz channel bandwidth: Measured values				
			42 (36-48)	58 (52-64)	106 (100-112)	138 (132-144)	155 (149+161)
802.11ac	BPSK	29.3 / 32.5	10.94	10.66	10.57	10.10	10.04
802.11ac	QPSK	58.5 / 65.0	11.00	10.55	10.51	10.21	10.05
802.11ac	QPSK	87.8 / 97.5	10.86	10.58	10.49	10.14	10.11
802.11ac	16QAM	117 / 130	9.78	9.47	9.32	9.12	8.95
802.11ac	16QAM	175.5 / 195.0	9.79	9.44	9.25	9.17	8.93
802.11ac	64QAM	234 / 260	8.80	8.65	8.56	8.22	7.95
802.11ac	64QAM	263.3 / 292.5	7.74	7.49	7.33	7.04	7.94
802.11ac	64QAM	292.5 / 325	7.88	7.44	7.31	7.08	6.80
802.11ac	256QAM	351 / 390	6.24	6.03	5.97	5.67	5.67
802.11ac	256QAM	390 / 433.3					