
APPENDIX F: RELEVANT PAGES FROM DIPOLE VALIDATION KIT REPORTS



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

Client **Nokia Salo TCC**

Certificate No: **D835V2-480_Dec12**

CALIBRATION CERTIFICATE

Object **D835V2 - SN: 480**

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

Calibration date: **December 03, 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

Calibrated by: **Israe El-Naouq** Name: **Israe El-Naouq** Function: **Laboratory Technician**

Approved by: **Katja Pokovic** Name: **Katja Pokovic** Function: **Technical Manager**

Signature

Issued: December 3, 2012

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	835 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	41.4 $\pm$ 6 %	0.92 mho/m $\pm$ 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	2.39 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	9.40 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	6.16 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	54.5 $\pm$ 6 %	0.99 mho/m $\pm$ 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	2.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	9.51 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm ³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.59 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	6.27 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.8 Ω - 3.3 j Ω
Return Loss	- 29.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	46.7 Ω - 4.9 j Ω
Return Loss	- 24.3 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.391 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 28, 2003

DASY5 Validation Report for Head TSL

Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 480

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.92$ mho/m; $\epsilon_r = 41.4$; $\rho = 1000$ kg/m³

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: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

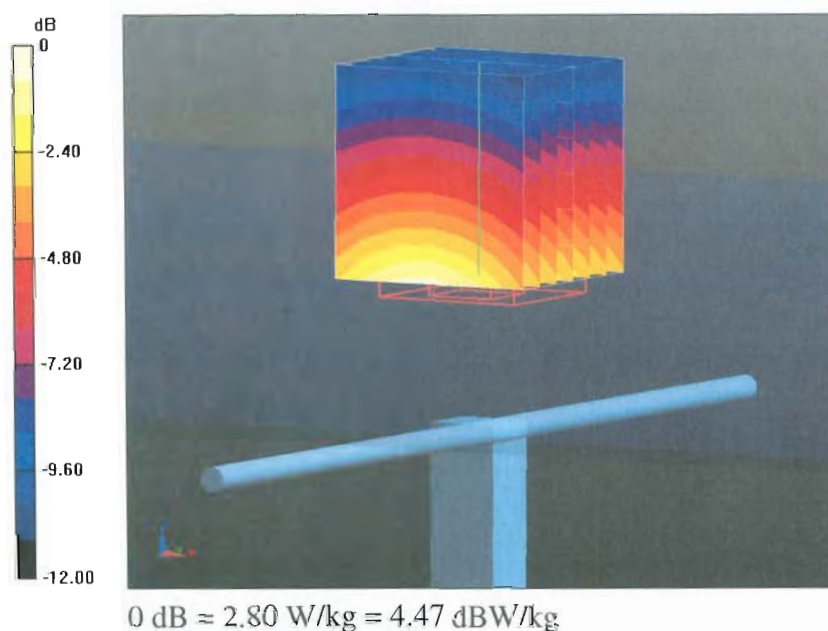
Measurement grid: $dx=5$ mm, $dy=5$ mm, $dz=5$ mm

Reference Value = 56.814 V/m; Power Drift = 0.00 dB

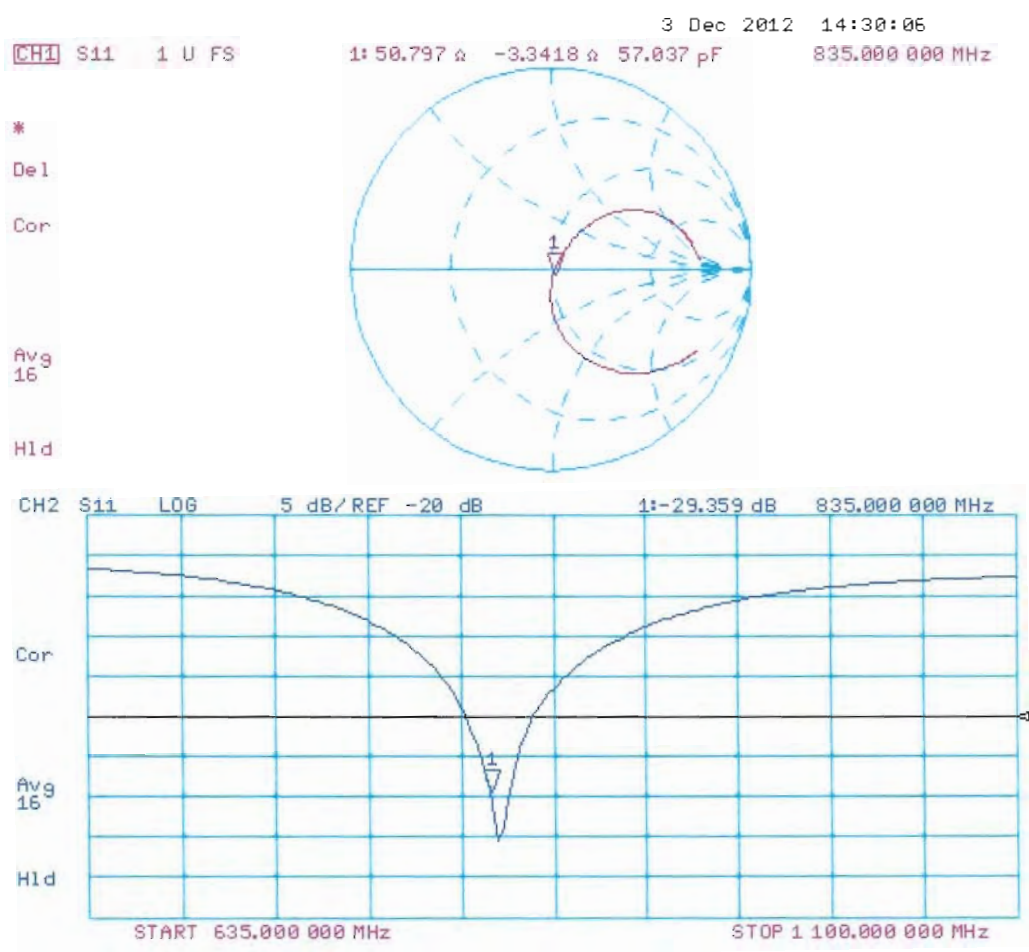
Peak SAR (extrapolated) = 3.60 W/kg

SAR(1 g) = 2.39 W/kg; SAR(10 g) = 1.56 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 03.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 480

Communication System: CW; Frequency: 835 MHz

Medium parameters used: $f = 835$ MHz; $\sigma = 0.99$ mho/m; $\epsilon_r = 54.5$; $\rho = 1000$ kg/m³

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: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.3(988); SEMCAD X 14.6.7(6848)

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

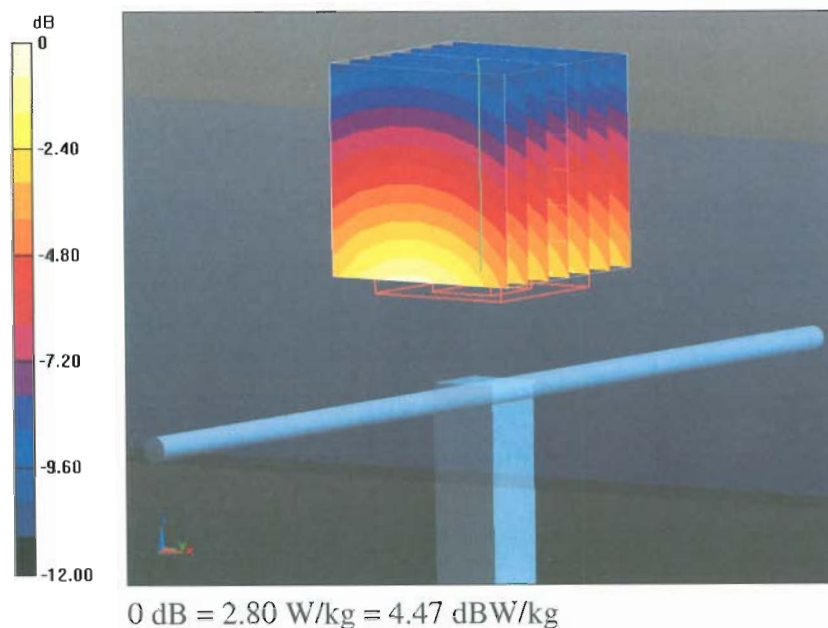
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 55.301 V/m; Power Drift = 0.00 dB

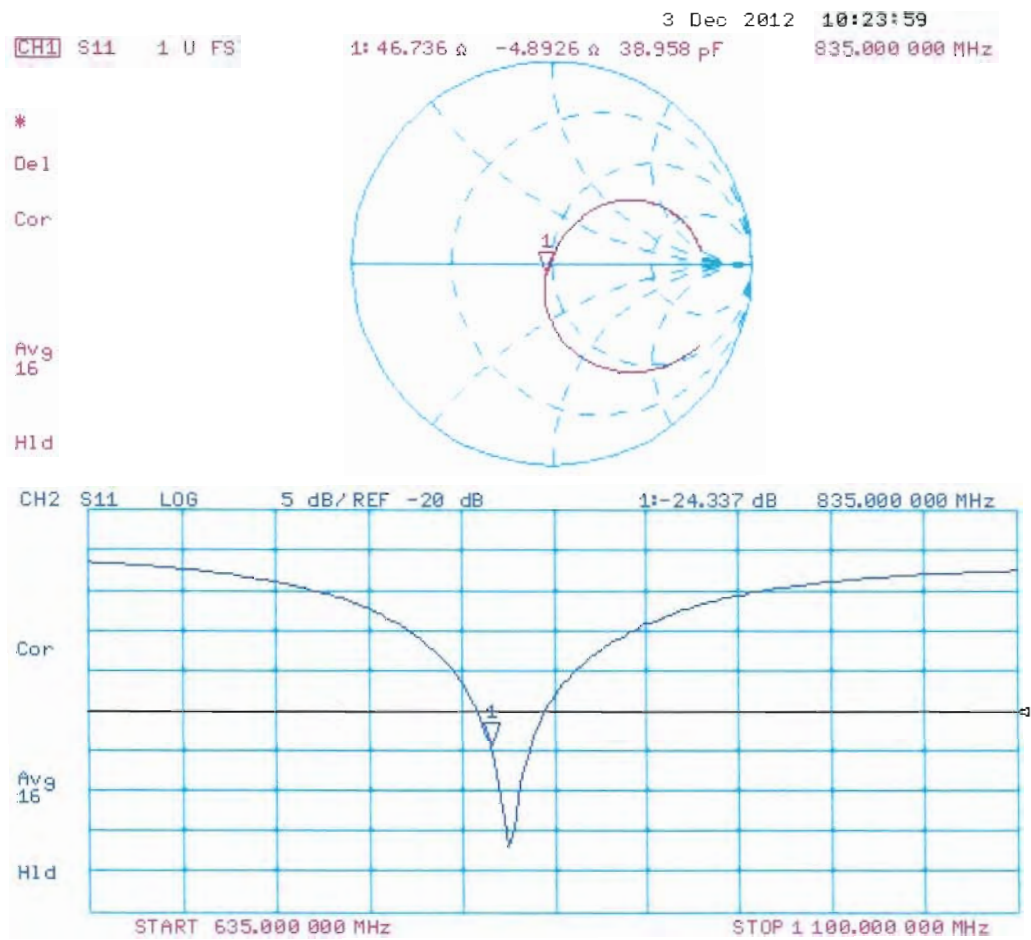
Peak SAR (extrapolated) = 3.53 W/kg

SAR(1 g) = 2.42 W/kg; SAR(10 g) = 1.59 W/kg

Maximum value of SAR (measured) = 2.80 W/kg



Impedance Measurement Plot for Body TSL





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Client **Nokia Salo TCC**

Certificate No: **D1900V2-5d013_Dec12**

CALIBRATION CERTIFICATE

Object **D1900V2 - SN: 5d013**

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

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Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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 $\pm$ 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 $\pm$ 0.2) °C	39.5 $\pm$ 6 %	1.38 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	40.6 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.28 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	21.2 W/kg $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

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

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	41.0 W/kg $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.41 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	21.6 W/kg $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$52.3 \Omega + 6.2 j\Omega$
Return Loss	- 23.8 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.4 \Omega + 5.9 j\Omega$
Return Loss	- 24.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.194 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	April 30, 2002

DASY5 Validation Report for Head TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d013

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.38$ mho/m; $\epsilon_r = 39.5$; $\rho = 1000$ kg/m³

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:

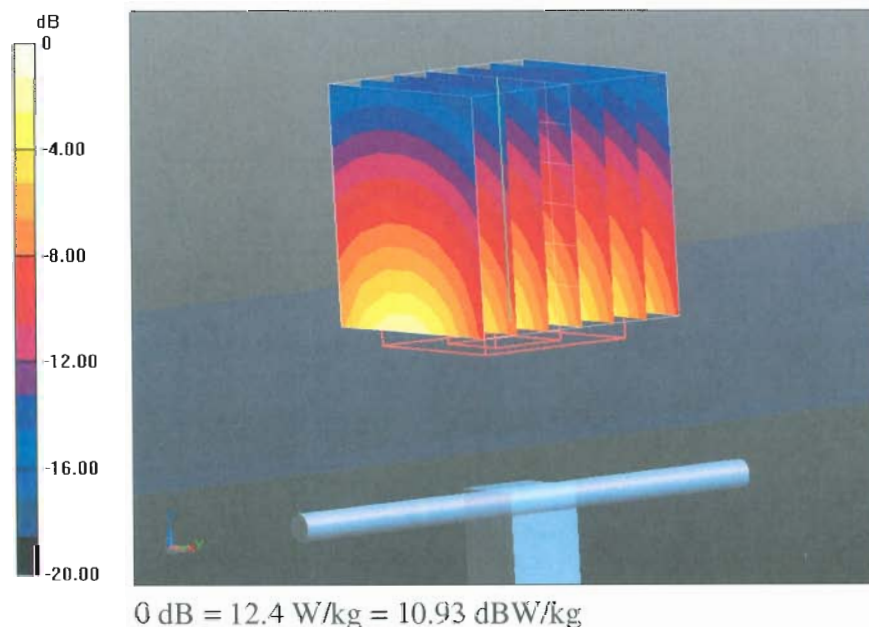
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 97.748 V/m; Power Drift = 0.04 dB

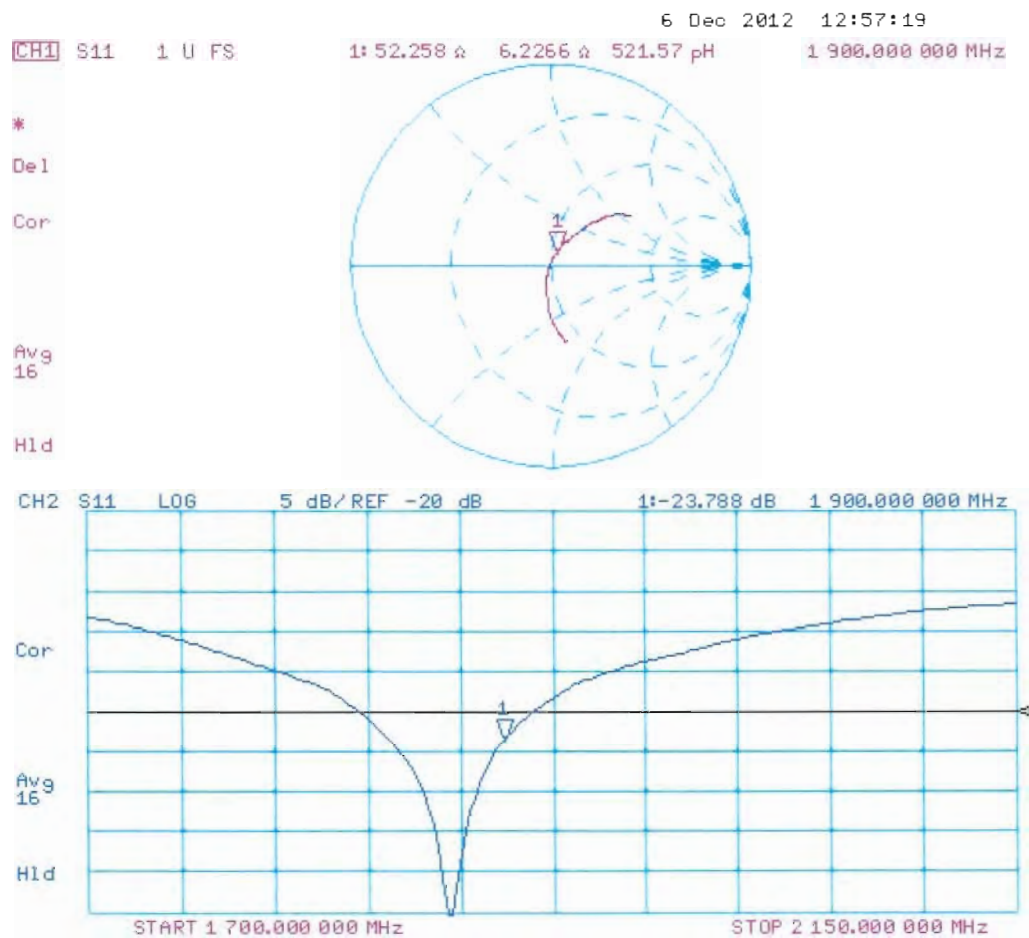
Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.28 W/kg

Maximum value of SAR (measured) = 12.4 W/kg



Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 06.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d013

Communication System: CW; Frequency: 1900 MHz

Medium parameters used: $f = 1900$ MHz; $\sigma = 1.52$ mho/m; $\epsilon_r = 52.2$; $\rho = 1000$ kg/m³

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:

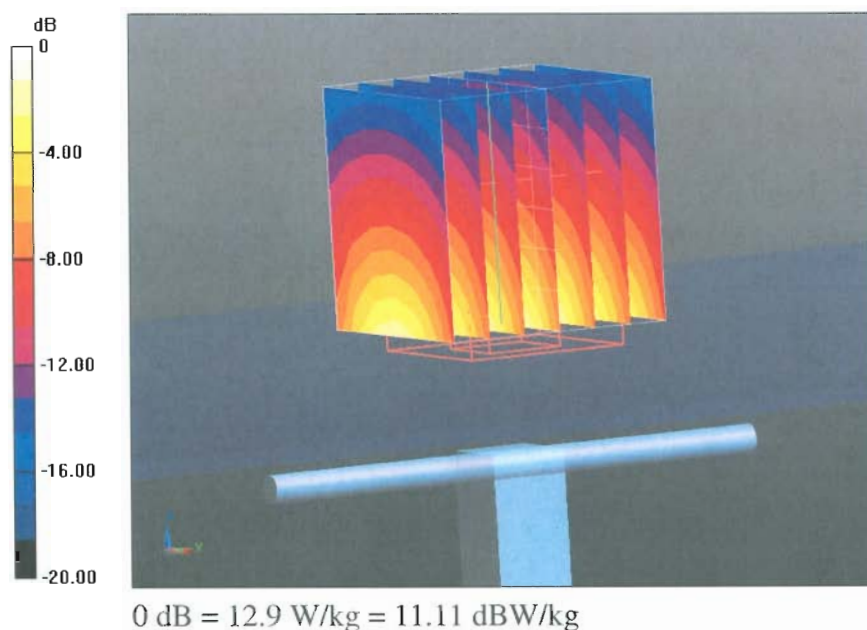
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 96.039 V/m; Power Drift = 0.04 dB

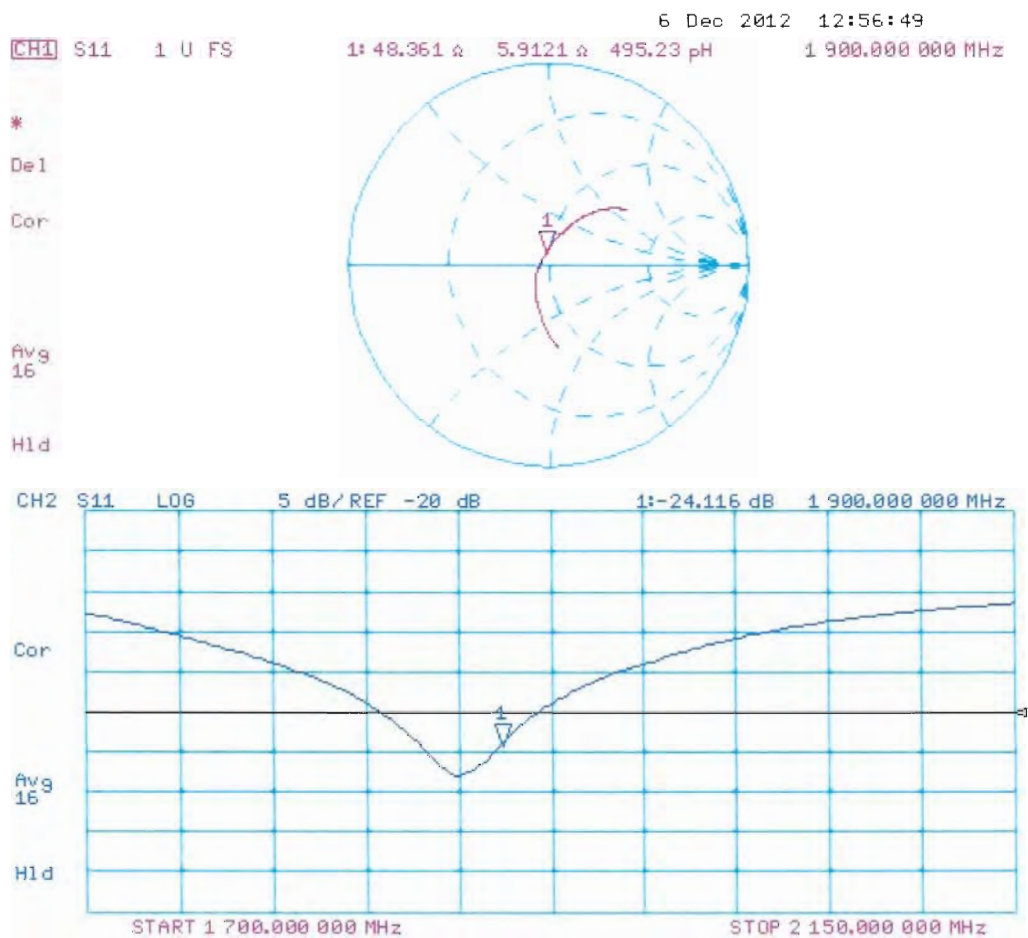
Peak SAR (extrapolated) = 18.0 W/kg

SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.41 W/kg

Maximum value of SAR (measured) = 12.9 W/kg



Impedance Measurement Plot for Body TSL





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Accreditation No.: **SCS 108**

Client **Nokia Salo TCC**

Certificate No: **D2450V2-729_Sep11**

CALIBRATION CERTIFICATE

Object **D2450V2 - SN: 729**

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

Calibration date: **September 13, 2011**

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

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

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date (Certificate No.)	Scheduled Calibration
Power meter EPM-442A	GB37480704	06-Oct-10 (No. 217-01266)	Oct-11
Power sensor HP 8481A	US37292783	06-Oct-10 (No. 217-01266)	Oct-11
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-11 (No. 217-01367)	Apr-12
Type-N mismatch combination	SN: 5047.2 / 06327	29-Mar-11 (No. 217-01371)	Apr-12
Reference Probe ES3DV3	SN: 3205	29-Apr-11 (No. ES3-3205_Apr11)	Apr-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-09)	In house check: Oct-11
RF generator R&S SMT-06	100005	04-Aug-99 (in house check Oct-09)	In house check: Oct-11
Network Analyzer HP 8753E	US37390585 S4206	18-Oct-01 (in house check Oct-10)	In house check: Oct-11

	Name	Function	Signature
Calibrated by:	Dimce Iliev	Laboratory Technician	

Approved by:	Katja Pokovic	Technical Manager
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Issued: September 13, 2011

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Glossary:

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ConvF	sensitivity in TSL / NORM x,y,z
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- IEC 62209-1, "Procedure to measure the Specific Absorption Rate (SAR) for hand-held devices used in close proximity to the ear (frequency range of 300 MHz to 3 GHz)", February 2005
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Additional Documentation:

- DASY4/5 System Handbook

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- 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	V52.6.2
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	10 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	2450 MHz $\pm$ 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 $\pm$ 0.2) °C	38.3 $\pm$ 6 %	1.85 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	250 mW input power	13.9 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	54.6 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.45 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	25.6 mW / g $\pm$ 16.5 % (k=2)

Body TSL parameters

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Body TSL parameters	22.0 °C	52.7	1.95 mho/m
Measured Body TSL parameters	(22.0 $\pm$ 0.2) °C	51.7 $\pm$ 6 %	2.04 mho/m $\pm$ 6 %
Body TSL temperature change during test	< 0.5 °C	----	----

SAR result with Body TSL

SAR averaged over 1 cm³ (1 g) of Body TSL	Condition	
SAR measured	250 mW input power	13.3 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	51.8 mW / g $\pm$ 17.0 % (k=2)

SAR averaged over 10 cm³ (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.18 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	24.4 mW / g $\pm$ 16.5 % (k=2)

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	$51.8 \Omega - 0.6 j\Omega$
Return Loss	- 34.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	$48.7 \Omega + 1.1 j\Omega$
Return Loss	- 35.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.148 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	January 09, 2003

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 729

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450$ MHz; $\sigma = 1.85$ mho/m; $\epsilon_r = 38.3$; $\rho = 1000$ kg/m³

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: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

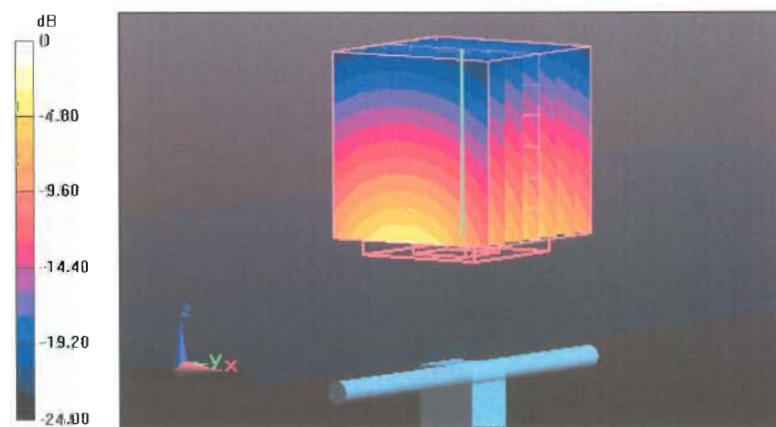
Measurement grid: dx=5mm, dy=5mm, dz=5mm

Reference Value = 102.5 V/m; Power Drift = 0.07 dB

Peak SAR (extrapolated) = 28.852 W/kg

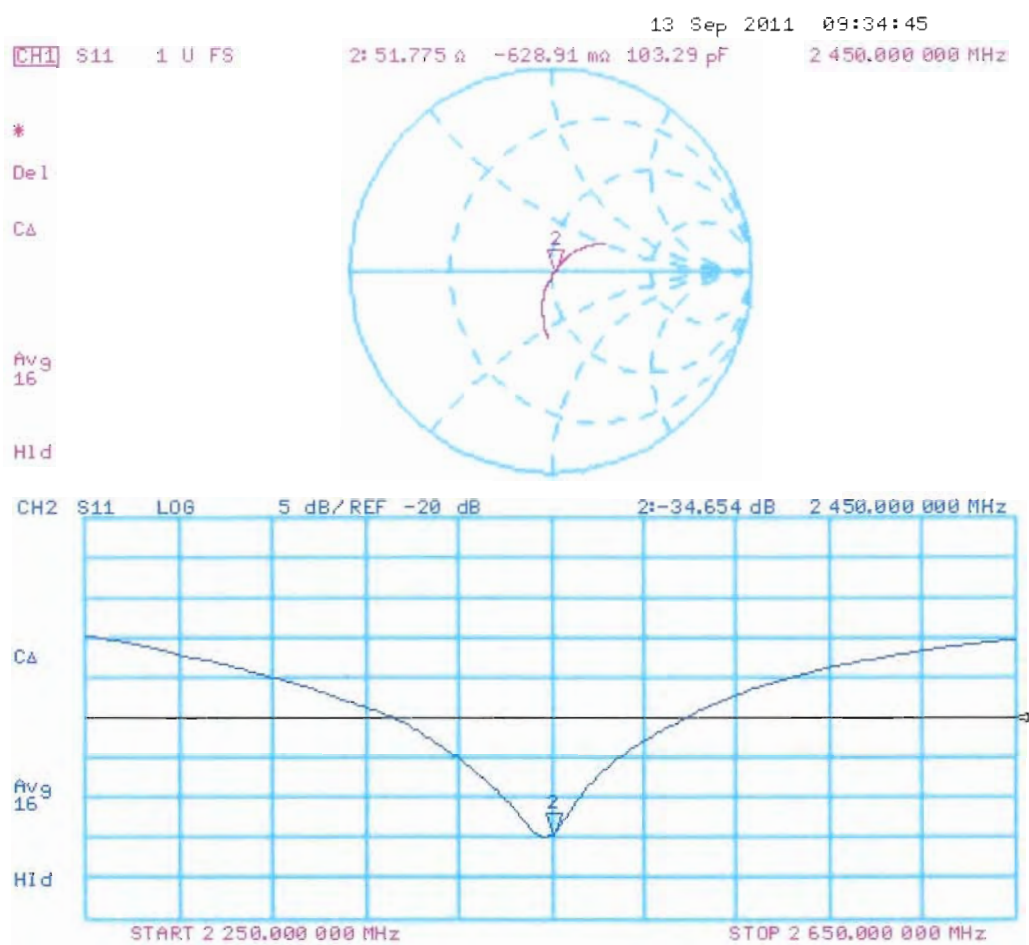
SAR(1 g) = 13.9 mW/g; SAR(10 g) = 6.45 mW/g

Maximum value of SAR (measured) = 18.134 mW/g



0 dB = 18.130mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.09.2011

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 729

Communication System: CW; Frequency: 2450 MHz

Medium parameters used: $f = 2450 \text{ MHz}$; $\sigma = 2.04 \text{ mho/m}$; $\epsilon_r = 51.7$; $\rho = 1000 \text{ kg/m}^3$

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: 29.04.2011
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 04.07.2011
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.6.2(482); SEMCAD X 14.4.5(3634)

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

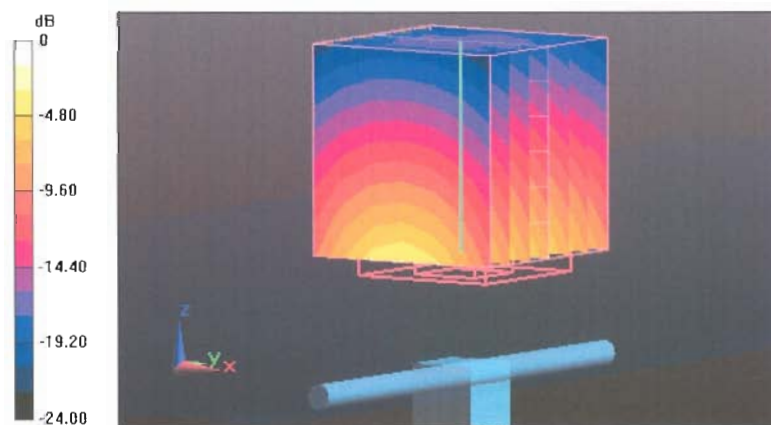
Measurement grid: $dx=5\text{mm}$, $dy=5\text{mm}$, $dz=5\text{mm}$

Reference Value = 96.035 V/m; Power Drift = -0.0016 dB

Peak SAR (extrapolated) = 27.393 W/kg

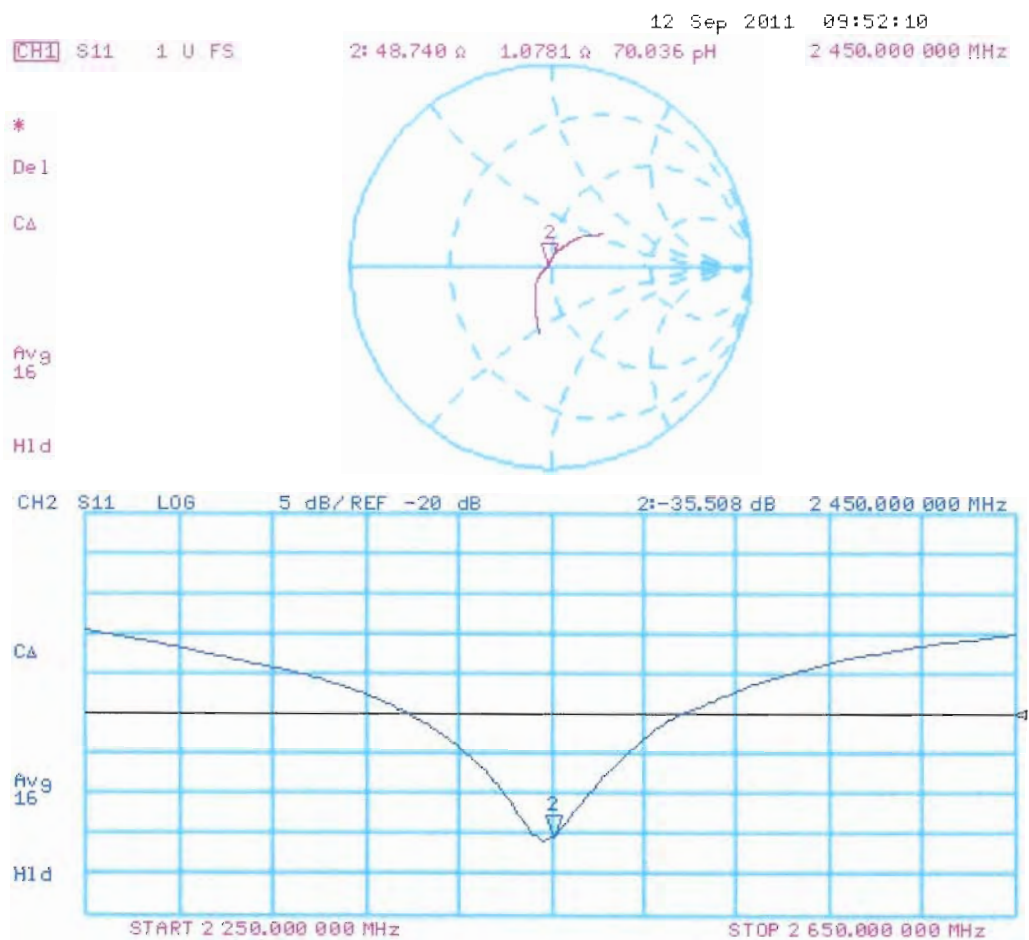
SAR(1 g) = 13.3 mW/g; SAR(10 g) = 6.18 mW/g

Maximum value of SAR (measured) = 17.569 mW/g



0 dB = 17.570mW/g

Impedance Measurement Plot for Body TSL



Dipole D2450V2 – SN:729 Antenna Parameters measured: 2013-04-16.

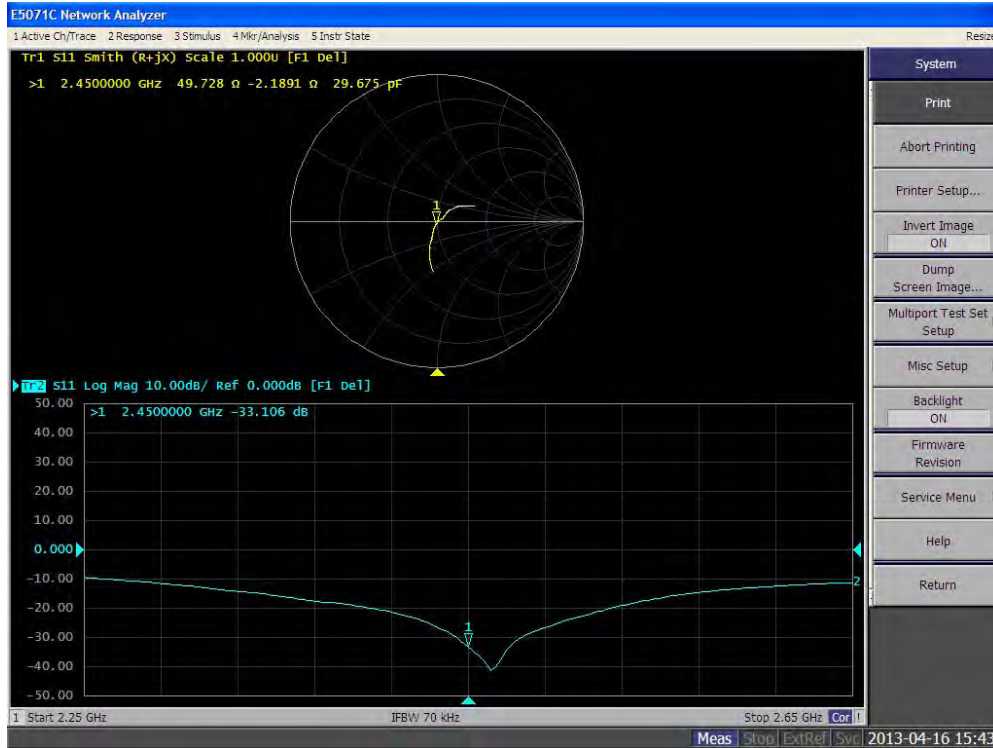
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	51.8 Ω - 0.6 j Ω	49.7 Ω - 2.2 j Ω
Return loss	-34.7 dB	-33.1 dB

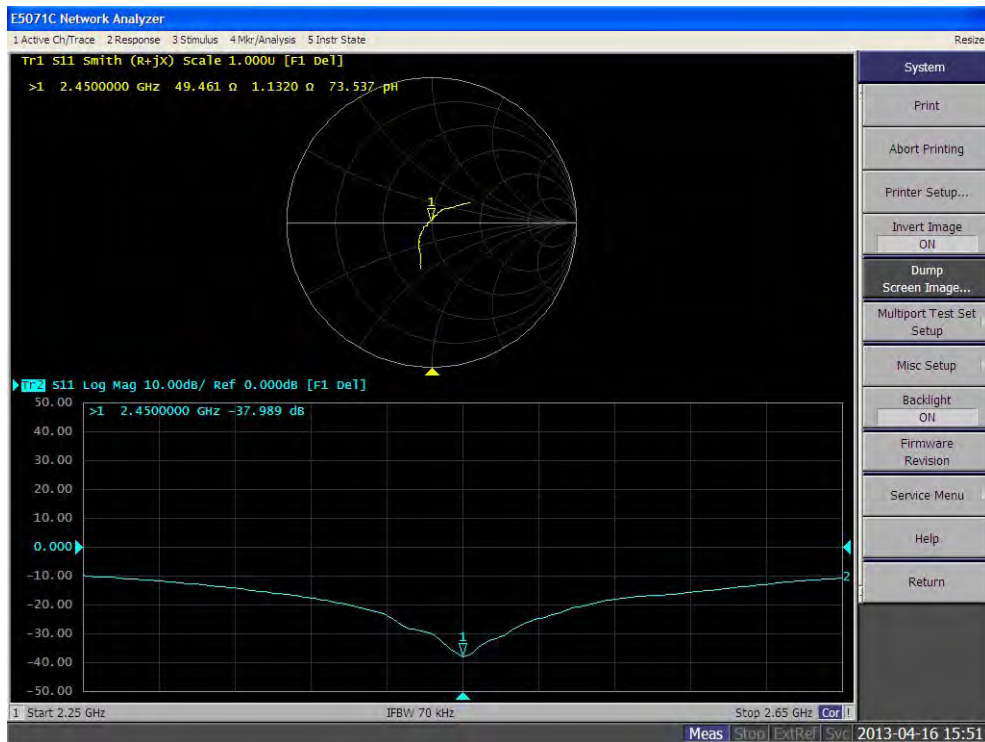
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	48.7 Ω - 1.1 j Ω	49.5 Ω 1.1 j Ω
Return loss	-35.5 dB	-38.0 dB

Impedance Measurement Plot for Head TSL 2450



Impedance Measurement Plot for Body TSL 2450





Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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

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

Calibrated by: **Israe El-Naouq** **Laboratory Technician**

Signature

Approved by: **Katja Pokovic** **Technical Manager**

Issued: December 11, 2012

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



Accredited by the Swiss Accreditation Service (SAS)

Accreditation No.: **SCS 108**

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Multilateral Agreement for the recognition of calibration certificates

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

- DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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 $\pm$ 1 MHz 5300 MHz $\pm$ 1 MHz 5500 MHz $\pm$ 1 MHz 5600 MHz $\pm$ 1 MHz 5800 MHz $\pm$ 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 $\pm$ 0.2) °C	34.6 $\pm$ 6 %	4.46 mho/m $\pm$ 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5200 MHz

SAR averaged over 1 cm³ (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	79.7 W/kg $\pm$ 19.9 % (k=2)

SAR averaged over 10 cm³ (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 $\pm$ 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 cm³ (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 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 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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 cm³ (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 j Ω
Return Loss	- 22.1 dB

Antenna Parameters with Head TSL at 5300 MHz

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

Antenna Parameters with Head TSL at 5500 MHz

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

Antenna Parameters with Head TSL at 5600 MHz

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

Antenna Parameters with Head TSL at 5800 MHz

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

Antenna Parameters with Body TSL at 5200 MHz

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

Antenna Parameters with Body TSL at 5300 MHz

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

Antenna Parameters with Body TSL at 5500 MHz

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

Antenna Parameters with Body TSL at 5600 MHz

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

Antenna Parameters with Body TSL at 5800 MHz

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

General Antenna Parameters and Design

Electrical Delay (one direction)	1.192 ns
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After long term use with 100W radiated power, only a slight warming of the dipole near the feedpoint can be measured.

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	June 09, 2006

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; $\sigma = 4.46$ mho/m; $\epsilon_r = 34.6$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 4.55$ mho/m; $\epsilon_r = 34.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 4.72$ mho/m; $\epsilon_r = 34.2$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 4.81$ mho/m; $\epsilon_r = 34$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 5.04$ mho/m; $\epsilon_r = 33.8$; $\rho = 1000$ kg/m³

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

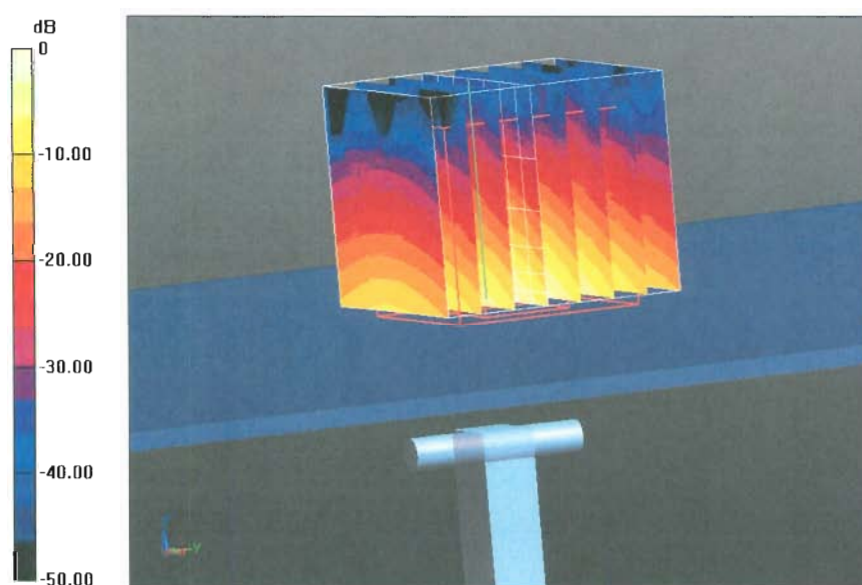
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5800 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm

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

11 Dec 2012 14:42:09

CH1 S11 1 U FS

1: 53.992 Ω -7.1230 Ω 4.2969 pF

5 200.000 000 MHz

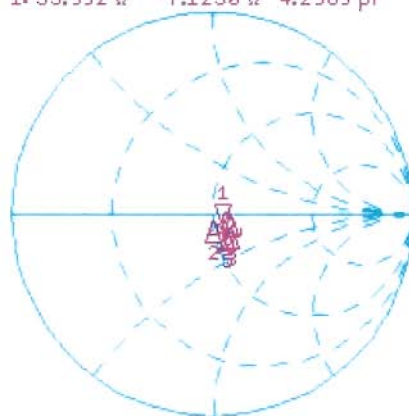
*

De1

Cor

Avg
16

H1d



CH1 Markers

2: 48.965 Ω
-4.4531 Ω
5.30000 GHz

3: 59.055 Ω
-8.7559 Ω
5.50000 GHz

4: 59.678 Ω
-1.7051 Ω
5.60000 GHz

5: 55.807 Ω
-8.9141 Ω
5.80000 GHz

CH2 S11

LOG

5 dB/ REF -20 dB

1: -22.119 dB

5 200.000 000 MHz

Cor

Avg
16

H1d



CH2 Markers

2: -26.722 dB
5.30000 GHz

3: -18.776 dB
5.50000 GHz

4: -20.955 dB
5.60000 GHz

5: -19.982 dB
5.80000 GHz

START 5 000.000 000 MHz

STOP 5 000.000 000 MHz

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; $\sigma = 5.4$ mho/m; $\epsilon_r = 47.1$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5300$ MHz; $\sigma = 5.51$ mho/m; $\epsilon_r = 46.9$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5500$ MHz; $\sigma = 5.76$ mho/m; $\epsilon_r = 46.6$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5600$ MHz; $\sigma = 5.88$ mho/m; $\epsilon_r = 46.4$; $\rho = 1000$ kg/m³, Medium parameters used: $f = 5800$ MHz; $\sigma = 6.17$ mho/m; $\epsilon_r = 46.1$; $\rho = 1000$ kg/m³

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

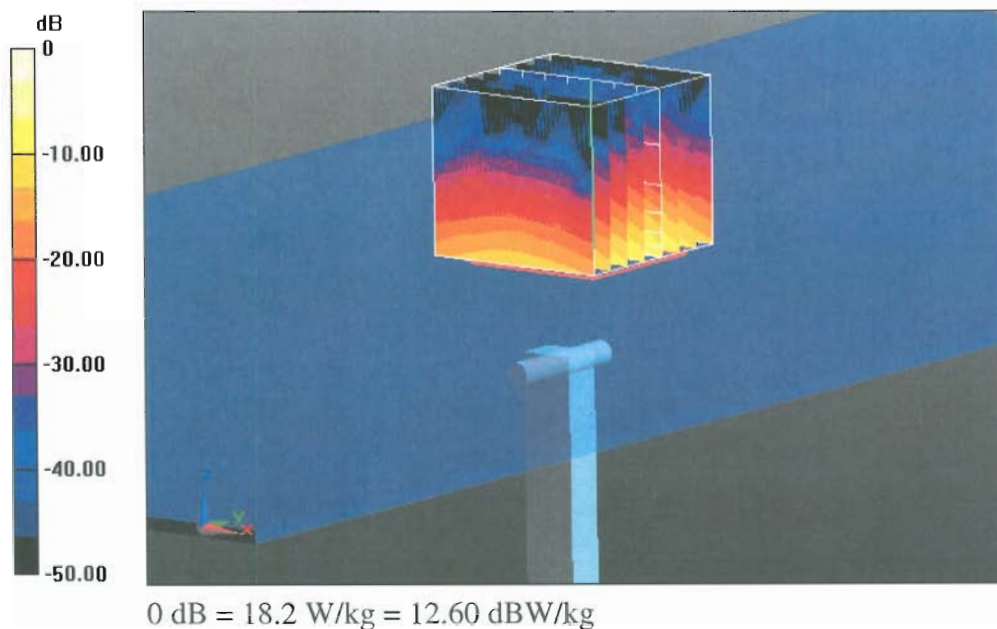
Peak SAR (extrapolated) = 32.8 W/kg

SAR(1 g) = 7.62 W/kg; SAR(10 g) = 2.12 W/kg

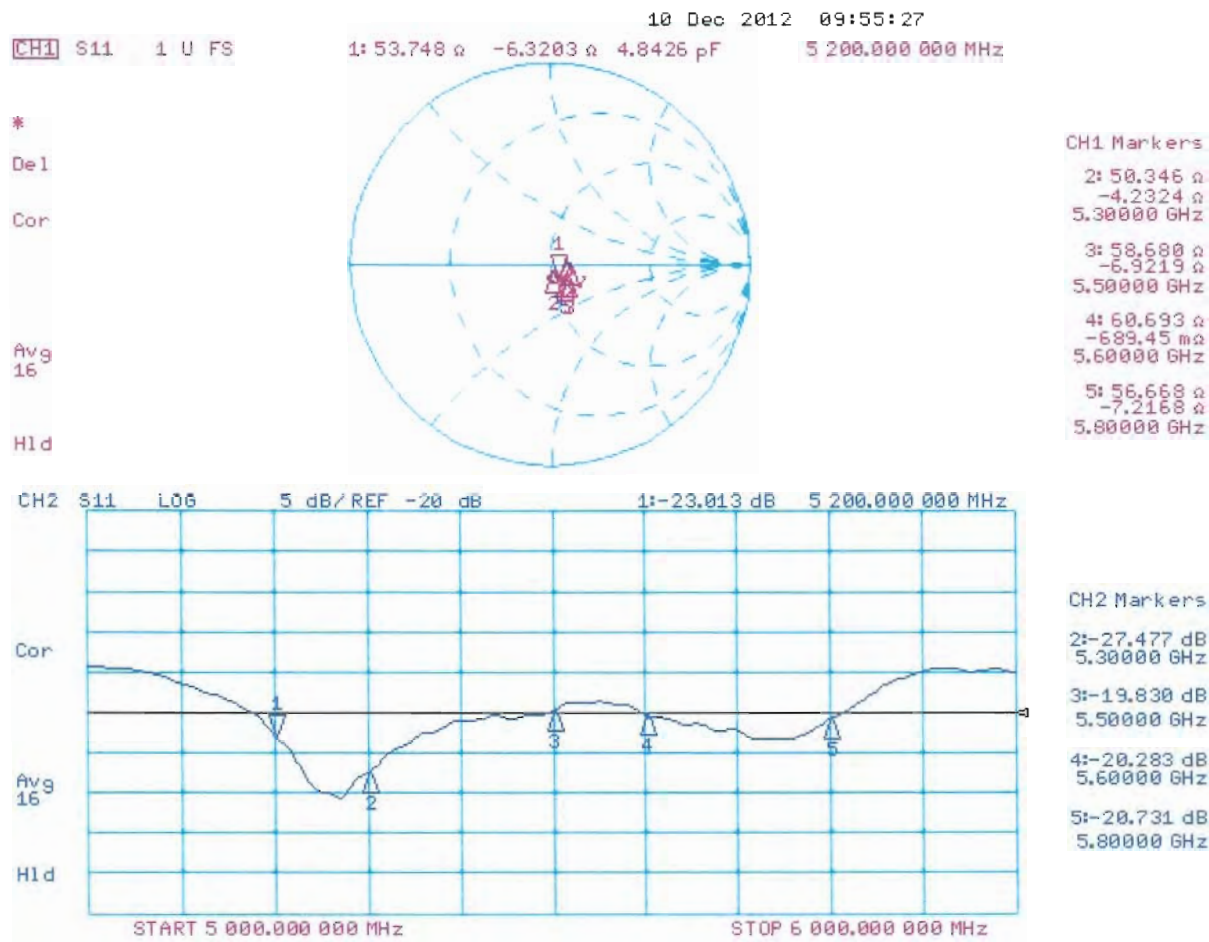
Maximum value of SAR (measured) = 18.7 W/kg

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



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	32.0	32.0	32.0
GPRS 2-slot	31.2	31.2	31.2
GPRS 3-slot	29.7	29.7	29.7
GPRS 4-slot	28.3	28.3	28.3
EGPRS 1-slot	26.0	26.0	26.0
EGPRS 2-slot	26.0	26.0	26.0
EGPRS 3-slot	25.0	25.0	25.0
EGPRS 4-slot	23.5	23.5	23.5

GSM/GPRS/EGPRS 1900 Head and Body-worn			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	30.0	30.0	30.0
GPRS 2-slot	27.5	27.5	27.5
GPRS 3-slot	25.7	25.7	25.7
GPRS 4-slot	24.5	24.5	24.5
EGPRS 1-slot	25.5	25.5	25.5
EGPRS 2-slot	25.5	25.5	25.5
EGPRS 3-slot	24.4	24.4	24.4
EGPRS 4-slot	23.3	23.3	23.3

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

Type: RM-875; Serial number: 004402/47/369117/2 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	32.89	32.82	32.78
GPRS 2-slot	32.69	32.68	32.61
GPRS 3-slot	31.13	31.19	31.10
GPRS 4-slot	29.64	29.63	29.80
EGPRS 1-slot	27.00	27.19	27.16
EGPRS 2-slot	27.00	27.15	27.18
EGPRS 3-slot	26.17	26.29	26.25
EGPRS 4-slot	24.83	25.03	24.97

Type: RM-875; Serial number: 004402/47/369118/0 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	30.41	30.49	30.63
GPRS 2-slot	28.37	28.59	28.68
GPRS 3-slot	26.68	26.74	26.64
GPRS 4-slot	25.52	25.50	25.57
EGPRS 1-slot	25.95	25.95	25.93
EGPRS 2-slot	25.96	25.98	26.08
EGPRS 3-slot	25.53	25.50	25.54
EGPRS 4-slot	24.50	24.46	24.50

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	23.0	23.0	23.0
WCDMA1900 (Band 2) Wireless Router			
Mode	Low channel	Mid channel	High channel
WCDMA	21.0	21.0	21.0

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

Type: RM-875; Serial number: 004402/47/369117/2 used for WCDMA850 (Band 5) Head, Body-worn and Wireless router SAR measurements

WCDMA850 (Band 5)			
Mode	Low channel	Mid channel	High channel
WCDMA	24.24	24.14	24.05

Type: RM-875; Serial number: 004402//47/369118/0 used for WCDMA1900 (Band 2) Head and Body-worn SAR measurements

WCDMA1900 (Band 2)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.52	23.52	23.56

Type: RM-875; Serial number: 004402/47/369116/4 used for WCDMA1900 (Band 2) Wireless router SAR measurements

WCDMA1900 (Band 2)			
Mode	Low channel	Mid channel	High channel
WCDMA	21.75	21.65	21.66

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

APPENDIX I: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WLAN TRANSMISSION MODES

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	14.0
b-mode WLAN DSSS 2 Mbps	16.0	16.0	16.0	16.0	14.0
b-mode WLAN DSSS 5.5 Mbps	16.0	16.0	16.0	16.0	14.0
b-mode WLAN DSSS 11 Mbps	16.0	16.0	16.0	16.0	14.0
g-mode WLAN OFDM 6 Mbps	16.0	16.0	16.0	16.0	14.0
g-mode WLAN OFDM 9 Mbps	16.0	16.0	16.0	16.0	14.0
g-mode WLAN OFDM 12 Mbps	16.0	16.0	16.0	16.0	14.0
g-mode WLAN OFDM 18 Mbps	16.0	16.0	16.0	16.0	14.0
g-mode WLAN OFDM 24 Mbps	15.0	15.0	15.0	15.0	14.0
g-mode WLAN OFDM 36 Mbps	15.0	15.0	15.0	15.0	14.0
g-mode WLAN OFDM 48 Mbps	14.0	14.0	14.0	14.0	14.0
g-mode WLAN OFDM 54 Mbps	14.0	14.0	14.0	14.0	14.0
n-mode MCS 0: OFDM 6.5 / 7.25 Mbps	14.0	14.0	14.0	14.0	14.0
n-mode MCS 1: OFDM 13.0 / 14.4 Mbps	14.0	14.0	14.0	14.0	14.0
n-mode MCS 2: OFDM 19.5 / 21.7 Mbps	12.0	12.0	12.0	14.0	12.0
n-mode MCS 3: OFDM 26.0 / 28.9 Mbps	12.0	12.0	12.0	14.0	12.0
n-mode MCS 4: OFDM 39.0 / 43.3 Mbps	12.0	12.0	12.0	14.0	12.0
n-mode MCS 5: OFDM 52.0 / 57.8 Mbps	12.0	12.0	12.0	14.0	12.0
n-mode MCS 6: OFDM 58.5 / 65.0 Mbps	11.0	11.0	11.0	14.0	11.0
n-mode MCS 7: OFDM 65.0 / 72.2 Mbps	11.0	11.0	11.0	14.0	11.0

Standard	Modulation	Data speed [MBPS]	RLAN 5 GHz / 20 MHz Tuning Targets					
			36	40	44	48	52	56
802.11g	BPSK	6	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	BPSK	9	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	12	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	18	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	24	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	36	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	64QAM	48	13.0	13.0	13.0	13.0	13.0	13.0
802.11g	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	13.0 / 14.4	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	19.5 / 21.7	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	26.0 / 28.9	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	52.0 / 57.8	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	58.5 / 65.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	65.0 / 72.2	11.0	11.0	11.0	11.0	11.0	11.0

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	13.0	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	27.0 / 30.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	40.5 / 45.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	54.0 / 60.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	81.0 / 90.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	108.0 / 120.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	121.5 / 135.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	135.0 / 150.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0

(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	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	BPSK	9	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	12	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	18	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	24	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	36	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	64QAM	48	13.0	13.0	13.0	13.0	13.0	13.0
802.11g	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	13.0 / 14.4	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	19.5 / 21.7	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	26.0 / 28.9	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	52.0 / 57.8	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	58.5 / 65.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	65.0 / 72.2	11.0	11.0	11.0	11.0	11.0	11.0

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	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	27.0 / 30.0	12.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	40.5 / 45.0	12.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	54.0 / 60.0	12.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	81.0 / 90.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	108.0 / 120.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	121.5 / 135.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	64QAM	135.0 / 150.0	10.0	10.0	10.0	10.0	10.0	10.0

(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	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	BPSK	9	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	12	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	18	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	24	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	36	14.0	14.0	14.0	14.0	14.0	14.0
802.11g	64QAM	48	13.0	13.0	13.0	13.0	13.0	13.0
802.11g	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	13.0 / 14.4	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	19.5 / 21.7	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	26.0 / 28.9	13.0	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	52.0 / 57.8	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	58.5 / 65.0	11.0	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	65.0 / 72.2	11.0	11.0	11.0	11.0	11.0	11.0

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	13.0	13.0	13.0	9.0
802.11n	QPSK	27.0 / 30.0	13.0	13.0	13.0	9.0
802.11n	QPSK	40.5 / 45.0	13.0	13.0	13.0	9.0
802.11n	16QAM	54.0 / 60.0	13.0	13.0	13.0	9.0
802.11n	16QAM	81.0 / 90.0	12.0	12.0	12.0	9.0
802.11n	64QAM	108.0 / 120.0	11.0	11.0	11.0	9.0
802.11n	64QAM	121.5 / 135.0	10.0	10.0	10.0	9.0
802.11n	64QAM	135.0 / 150.0	10.0	10.0	10.0	9.0

(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	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	BPSK	9	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	12	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	QPSK	18	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	24	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	16QAM	36	11.00	14.0	14.0	14.0	14.0	14.0
802.11g	64QAM	48	11.00	13.0	13.0	13.0	13.0	13.0
802.11g	64QAM	54	11.00	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	11.00	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	13.0 / 14.4	11.00	13.0	13.0	13.0	13.0	13.0
802.11n	QPSK	19.5 / 21.7	11.00	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	26.0 / 28.9	11.00	13.0	13.0	13.0	13.0	13.0
802.11n	16QAM	39.0 / 43.3	11.00	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	52.0 / 57.8	11.00	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	58.5 / 65.0	11.00	11.0	11.0	11.0	11.0	11.0
802.11n	64QAM	65.0 / 72.2	11.00	11.0	11.0	11.0	11.0	11.0

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	13.0	13.0	13.0	13.0
802.11n	QPSK	27.0 / 30.0	13.0	13.0	13.0	13.0
802.11n	QPSK	40.5 / 45.0	13.0	13.0	13.0	13.0
802.11n	16QAM	54.0 / 60.0	13.0	13.0	13.0	13.0
802.11n	16QAM	81.0 / 90.0	12.0	12.0	12.0	12.0
802.11n	64QAM	108.0 / 120.0	11.0	11.0	11.0	11.0
802.11n	64QAM	121.5 / 135.0	10.0	10.0	10.0	10.0
802.11n	64QAM	135.0 / 150.0	10.0	10.0	10.0	10.0

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

Type: RM-877; Serial number: 004402/47/126323/0 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	16.63	16.05	16.53	16.17	15.58
b-mode WLAN DSSS 2 Mbps	15.76	16.03	16.69	16.04	15.54
b-mode WLAN DSSS 5.5 Mbps	16.03	16.17	15.95	16.09	15.65
b-mode WLAN DSSS 11 Mbps	15.94	16.11	16.83	15.12	15.68
g-mode WLAN OFDM 6 Mbps	15.77	15.93	15.70	16.00	14.59
g-mode WLAN OFDM 9 Mbps	15.80	16.00	15.75	15.15	14.59
g-mode WLAN OFDM 12 Mbps	15.83	16.04	15.76	15.16	14.58
g-mode WLAN OFDM 18 Mbps	15.85	15.19	15.80	16.06	14.64
g-mode WLAN OFDM 24 Mbps	14.17	15.10	15.02	14.24	14.62
g-mode WLAN OFDM 36 Mbps	14.17	14.44	14.15	14.24	14.55
g-mode WLAN OFDM 48 Mbps	14.08	14.18	14.19	13.13	13.85
g-mode WLAN OFDM 54 Mbps	13.19	14.13	13.12	14.07	13.58
n-mode MCS 0: OFDM 6.5 / 7.25 Mbps	13.03	14.10	13.92	13.98	13.52
n-mode MCS 1: OFDM 13.0 / 14.4 Mbps	14.00	14.12	14.01	13.14	14.53
n-mode MCS 2: OFDM 19.5 / 21.7 Mbps	11.11	11.25	11.16	12.05	11.55
n-mode MCS 3: OFDM 26.0 / 28.9 Mbps	11.09	12.26	12.05	12.08	12.57
n-mode MCS 4: OFDM 39.0 / 43.3 Mbps	11.12	11.28	11.19	11.12	11.68
n-mode MCS 5: OFDM 52.0 / 57.8 Mbps	11.19	11.38	12.18	11.19	11.51
n-mode MCS 6: OFDM 58.5 / 65.0 Mbps	8.69	10.28	10.15	10.00	10.57
n-mode MCS 7: OFDM 65.0 / 72.2 Mbps	10.06	8.96	8.88	10.13	9.60

Type: RM-877; Serial number: 004402/47/126329/7 used for WLAN5000 Head and Body-worn 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	14.08	14.05	14.35	14.02	14.11	14.02
802.11g	BPSK	9	14.02	14.14	14.09	14.10	13.57	13.66
802.11g	QPSK	12	14.09	14.04	14.10	14.05	13.61	13.70
802.11g	QPSK	18	13.99	14.14	14.01	13.76	13.58	13.67
802.11g	16QAM	24	14.11	14.14	14.18	13.75	13.54	13.59
802.11g	16QAM	36	14.02	14.28	14.17	13.76	13.52	13.69
802.11g	64QAM	48	12.70	13.26	13.11	12.39	12.74	12.77
802.11g	64QAM	54	11.89	12.25	11.96	11.85	11.83	11.76
802.11n	BPSK	6.5 / 7.25	12.75	13.22	13.24	13.14	12.56	13.07
802.11n	QPSK	13.0 / 14.4	12.88	13.33	13.12	12.95	12.75	12.81
802.11n	QPSK	19.5 / 21.7	12.88	13.20	12.92	12.85	12.58	12.83
802.11n	16QAM	26.0 / 28.9	12.79	13.10	12.79	12.94	12.74	12.79
802.11n	16QAM	39.0 / 43.3	11.90	12.24	12.28	11.79	11.79	11.99
802.11n	64QAM	52.0 / 57.8	11.92	12.43	12.24	11.87	11.41	11.82
802.11n	64QAM	58.5 / 65.0	10.94	10.94	11.29	10.93	10.73	10.82
802.11n	64QAM	65.0 / 72.2	10.96	11.35	11.02	10.98	10.68	10.92

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	12.20	12.28	11.68	11.82	11.75	11.95	12.26
802.11n	QPSK	27.0 / 30.0	12.26	12.29	12.17	11.89	11.76	11.99	12.33
802.11n	QPSK	40.5 / 45.0	12.21	12.32	11.73	11.88	11.83	12.07	12.35
802.11n	16QAM	54.0 / 60.0	11.82	12.23	12.20	11.87	11.78	12.08	12.28
802.11n	16QAM	81.0 / 90.0	11.27	11.31	10.77	10.46	10.81	11.10	11.32
802.11n	64QAM	108.0 / 120.0	10.24	9.80	10.15	9.83	9.78	10.06	10.35
802.11n	64QAM	121.5 / 135.0	9.34	9.47	8.71	9.03	8.88	8.72	8.93
802.11n	64QAM	135.0 / 150.0	9.24	9.28	9.14	8.90	8.79	9.02	9.31

(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	14.30	14.40	14.41	14.51	14.28	14.07
802.11g	BPSK	9	13.97	14.28	14.40	14.29	14.20	14.15
802.11g	QPSK	12	14.38	14.27	14.43	14.51	14.26	13.97
802.11g	QPSK	18	14.04	14.34	14.39	14.39	14.21	14.08
802.11g	16QAM	24	14.03	14.10	14.22	14.22	14.22	14.01
802.11g	16QAM	36	14.09	14.38	14.43	14.24	14.17	14.07
802.11g	64QAM	48	13.12	13.10	13.12	13.44	13.03	13.31
802.11g	64QAM	54	12.17	12.07	12.04	12.49	12.15	12.19
802.11n	BPSK	6.5 / 7.25	13.09	13.11	13.49	13.40	13.24	13.09
802.11n	QPSK	13.0 / 14.4	13.10	13.05	13.43	13.32	13.46	13.18
802.11n	QPSK	19.5 / 21.7	13.19	13.04	13.20	13.40	13.44	13.23
802.11n	16QAM	26.0 / 28.9	13.19	13.28	13.52	13.53	13.43	13.33
802.11n	16QAM	39.0 / 43.3	12.24	12.28	12.21	12.51	12.07	11.92
802.11n	64QAM	52.0 / 57.8	12.26	12.19	12.29	12.58	12.11	12.18
802.11n	64QAM	58.5 / 65.0	11.21	11.35	11.19	11.13	11.41	11.15
802.11n	64QAM	65.0 / 72.2	11.20	11.33	11.25	11.15	11.31	11.03

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	11.26	12.64	12.29	12.43	12.18	12.52
802.11n	QPSK	27.0 / 30.0	11.31	12.69	12.31	12.10	12.21	12.21
802.11n	QPSK	40.5 / 45.0	11.34	12.67	12.32	12.11	12.25	12.20
802.11n	16QAM	54.0 / 60.0	11.30	12.65	11.98	12.03	12.19	12.12
802.11n	16QAM	81.0 / 90.0	11.33	11.34	11.01	11.20	11.18	11.26
802.11n	64QAM	108.0 / 120.0	10.36	10.42	10.03	10.28	10.33	10.16
802.11n	64QAM	121.5 / 135.0	9.44	9.49	9.20	8.92	9.51	9.05
802.11n	64QAM	135.0 / 150.0	9.38	9.42	9.47	9.20	9.35	9.32

(Tables continues)

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Standard	Modulation	Data speed [Mbps]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			116	120	124	128	132	136
802.11g	BPSK	6	14.33	14.17	14.32	14.28	14.00	14.23
802.11g	BPSK	9	14.26	14.22	14.39	14.19	14.07	14.27
802.11g	QPSK	12	14.32	14.24	14.23	14.24	14.48	14.30
802.11g	QPSK	18	14.34	14.23	14.35	14.35	14.12	14.24
802.11g	16QAM	24	14.23	14.19	14.31	14.40	13.96	14.14
802.11g	16QAM	36	14.45	14.30	14.31	14.34	14.60	14.34
802.11g	64QAM	48	13.24	13.19	13.11	13.41	13.11	13.19
802.11g	64QAM	54	11.98	12.33	12.38	12.24	12.21	12.33
802.11n	BPSK	6.5 / 7.25	13.08	13.39	13.35	13.33	13.13	13.34
802.11n	QPSK	13.0 / 14.4	13.14	13.21	13.42	13.37	13.12	13.29
802.11n	QPSK	19.5 / 21.7	13.44	13.42	13.48	13.47	13.70	13.13
802.11n	16QAM	26.0 / 28.9	13.20	13.41	13.14	13.41	13.16	13.14
802.11n	16QAM	39.0 / 43.3	12.26	12.11	12.18	12.30	12.31	12.36
802.11n	64QAM	52.0 / 57.8	12.21	12.24	12.22	12.22	12.32	12.43
802.11n	64QAM	58.5 / 65.0	11.21	11.49	11.18	10.88	11.30	11.24
802.11n	64QAM	65.0 / 72.2	11.26	11.31	10.99	11.32	11.23	11.18

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	12.12	12.29	12.34	8.69
802.11n	QPSK	27.0 / 30.0	12.53	12.36	12.38	8.35
802.11n	QPSK	40.5 / 45.0	12.20	12.37	12.46	8.38
802.11n	16QAM	54.0 / 60.0	12.48	11.96	12.45	8.34
802.11n	16QAM	81.0 / 90.0	11.30	11.05	11.04	8.39
802.11n	64QAM	108.0 / 120.0	10.24	10.22	10.19	8.38
802.11n	64QAM	121.5 / 135.0	9.02	9.66	9.32	8.35
802.11n	64QAM	135.0 / 150.0	9.28	9.10	9.15	8.30

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Standard	Modulation	Data speed [Mbps]	RLAN 5 GHz / 20 MHz channel bandwidth: Measured values					
			140	149	153	157	161	165
802.11g	BPSK	6	11.07	14.54	14.57	14.56	14.59	14.35
802.11g	BPSK	9	11.23	14.55	14.56	14.58	14.53	14.30
802.11g	QPSK	12	11.14	14.31	14.58	14.63	14.59	14.44
802.11g	QPSK	18	11.12	14.32	14.59	14.67	14.62	14.49
802.11g	16QAM	24	11.18	14.44	14.28	14.38	14.63	14.39
802.11g	16QAM	36	11.08	14.43	14.32	14.46	14.24	14.39
802.11g	64QAM	48	11.23	13.09	13.36	13.26	13.41	13.60
802.11g	64QAM	54	11.21	12.12	12.67	12.58	12.61	12.30
802.11n	BPSK	6.5 / 7.25	11.24	13.31	13.37	13.49	13.65	13.43
802.11n	QPSK	13.0 / 14.4	11.15	13.47	13.41	13.57	13.70	13.57
802.11n	QPSK	19.5 / 21.7	11.27	13.13	13.47	13.53	13.48	13.63
802.11n	16QAM	26.0 / 28.9	11.18	13.50	13.42	13.47	13.48	13.34
802.11n	16QAM	39.0 / 43.3	11.29	12.09	12.51	12.37	12.66	12.38
802.11n	64QAM	52.0 / 57.8	11.12	12.06	12.53	12.75	12.57	12.31
802.11n	64QAM	58.5 / 65.0	11.33	11.14	11.14	11.36	11.54	11.35
802.11n	64QAM	65.0 / 72.2	11.24	11.23	11.35	11.68	11.51	11.49

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	12.53	12.59	12.68	12.52
802.11n	QPSK	27.0 / 30.0	12.57	12.21	12.71	12.55
802.11n	QPSK	40.5 / 45.0	12.63	12.68	12.76	12.56
802.11n	16QAM	54.0 / 60.0	12.63	12.28	12.34	12.57
802.11n	16QAM	81.0 / 90.0	11.27	11.33	11.55	11.25
802.11n	64QAM	108.0 / 120.0	10.39	10.52	10.48	10.37
802.11n	64QAM	121.5 / 135.0	9.07	9.50	9.67	9.52
802.11n	64QAM	135.0 / 150.0	9.40	9.41	9.93	9.36