APPENDIX C: DIELECTRIC PARAMETERS OF THE TISSUE SIMULANTS

Head tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		-		Ch 23230 782.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
782	2013-08-04	-	-	40.9	0.93	-	-
f (MHz)	Date	Dielectric Parameters					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
835	2013-08-19	41.2	0.88	41.1	0.89	41.0	0.90
f (MHz)	Date	Dielectric Parameters					
		Ch 1013 824.7 MHz		Ch 384 836.5 MHz		Ch 777 848.3 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2013-08-09	41.1	0.89	41.0	0.90	41.0	0.91
	2013-08-19	41.2	0.88	41.1	0.89	41.0	0.90
f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2013-07-29	41.4	0.89	41.4	0.89	41.3	0.90
f (MHz)	Date	Dielectric Parameters					
		Ch 20050 1720.0 MHz		Ch 20175 1732.5 MHz		Ch 20300 1745.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1732	2013-08-03	39.4	1.33	39.4	1.34	39.3	1.35
	2013-08-09	39.4	1.35	39.4	1.36	39.3	1.37
f (MHz)	Date	Dielectric Parameters					
		Ch 25 1851.25 MHz		Ch 600 1880.0 MHz		Ch 1175 1908.75 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1880	2013-08-03	39.2	1.36	39.0	1.39	38.9	1.42
	2013-08-12	39.3	1.36	39.1	1.39	39.0	1.42

(Table Continues)

(Table Continues)

f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
1880	2013-07-31	39.6	1.36	39.4	1.39	39.3	1.41
f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
1880	2013-07-31	39.6	1.36	39.4	1.39	39.3	1.41
f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
2437	2013-08-05	38.4	1.79	38.4	1.82	38.3	1.84
	2013-08-07	38.2	1.79	38.1	1.81	38.0	1.84
	2013-08-19	38.7	1.78	38.7	1.80	38.6	1.83

Head tissue simulant dielectric parameters used in the measurements 5180 – 5805 MHz:

f (MHz)	Date	Dielectric Parameters									
		Ch 36 5180.0 MHz		5210.0 MHz		Ch 44 5220.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5210	2013-08-01	35.4	4.45	35.4	4.49	35.4	4.50	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 56 5280.0 MHz		5290.0 MHz		Ch 60 5300.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5290	2013-08-02	35.4	4.54	35.3	4.55	35.3	4.57	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 100 5500.0 MHz		5520.0 MHz		Ch 116 5580.0 MHz		Ch 120 5600.0 MHz		Ch 136 5680.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5520	2013-08-03	34.7	4.76	34.7	4.79	34.6	4.85	34.6	4.87	34.5	4.95
	2013-08-10	34.6	4.74	34.6	4.76	34.5	4.81	34.5	4.84	34.4	4.92
	2013-08-20	34.8	4.77	34.8	4.80	34.7	4.86	34.7	4.88	34.5	4.96
f (MHz)	Date	Dielectric Parameters									
		5760.0MHz		Ch 153 5765 MHz		Ch 157 5785.0 MHz		Ch 161 5805.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5760	2013-08-04	34.4	5.04	34.4	5.05	34.3	5.07	34.3	5.09	-	-
	2013-08-06	34.3	5.02	34.2	5.02	34.2	5.04	34.2	5.06	-	-

Body tissue simulant dielectric parameters used in the measurements:

f (MHz)	Date	Dielectric Parameters					
		-		Ch 23230 782.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
782	2013-08-06	-	-	54.7	0.98	-	-
f (MHz)	Date	Dielectric Parameters					
		Ch 4132 826.4 MHz		Ch 4175 835.0 MHz		Ch 4233 846.6 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
835	2013-08-01	54.6	0.98	54.5	0.99	54.5	0.99
f (MHz)	Date	Dielectric Parameters					
		Ch 1013 824.7 MHz		Ch 384 836.5 MHz		Ch 777 848.3 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2013-08-05	53.6	0.95	53.5	0.96	53.5	0.97
	2013-08-09	53.9	0.98	53.8	0.98	53.8	0.99
f (MHz)	Date	Dielectric Parameters					
		Ch 128 824.2 MHz		Ch 190 836.6 MHz		Ch 251 848.8 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
836	2013-08-01	54.6	0.98	54.5	0.99	54.5	1.00
	2013-08-05	53.6	0.95	53.5	0.96	53.5	0.97
f (MHz)	Date	Dielectric Parameters					
		Ch 20050 1720.0 MHz		Ch 20175 1732.5 MHz		Ch 20300 1745.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1732	2013-08-05	52.4	1.42	52.4	1.44	52.3	1.45
	2013-08-06	52.3	1.42	52.2	1.44	52.2	1.45
f (MHz)	Date	Dielectric Parameters					
		Ch 25 1851.25 MHz		Ch 600 1880.0 MHz		Ch 1175 1908.75 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
1880	2013-08-02	52.5	1.44	52.4	1.47	52.3	1.49
	2013-08-03	52.4	1.44	52.2	1.47	52.1	1.50

(Table Continues)

(Table Continues)

f (MHz)	Date	Dielectric Parameters					
		Ch 512 1850.2 MHz		Ch 661 1880.0 MHz		Ch 810 1909.8 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
1880	2013-08-01	52.8	1.44	52.7	1.47	52.5	1.50
	2013-08-02	52.5	1.43	52.4	1.47	52.3	1.49
f (MHz)	Date	Dielectric Parameters					
		Ch 9262 1852.4 MHz		Ch 9400 1880.0 MHz		Ch 9538 1907.6 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
1880	2013-08-01	52.8	1.44	52.7	1.47	52.5	1.50
	2013-08-02	52.5	1.44	52.4	1.47	52.3	1.49
f (MHz)	Date	Dielectric Parameters					
		Ch 1 2412.0 MHz		Ch 6 2437.0 MHz		Ch 11 2462.0 MHz	
		ε_r	σ [S/m]	ε_r	σ [S/m]	ε_r	σ [S/m]
2437	2013-08-06	50.8	1.88	50.7	1.90	50.7	1.93

Body tissue simulant dielectric parameters used in the measurements 5180 – 5805 MHz:

f (MHz)	Date	Dielectric Parameters									
		Ch 36 5180.0 MHz		5210.0 MHz		Ch 44 5220.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5210	2013-08-07	48.8	5.39	48.7	5.44	48.7	5.45	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 56 5280.0 MHz		5290.0 MHz		Ch 60 5300.0 MHz		-		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5290	2013-08-07	48.4	5.49	48.4	5.50	48.4	5.52	-	-	-	-
	2013-08-10	48.1	5.51	48.1	5.53	48.1	5.55	-	-	-	-
f (MHz)	Date	Dielectric Parameters									
		Ch 100 5500.0 MHz		5520.0 MHz		Ch 116 5580.0 MHz		Ch 120 5600.0 MHz		Ch 136 5680.0 MHz	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5520	2013-08-08	47.9	5.82	47.9	5.85	47.8	5.93	47.8	5.96	47.6	6.07
f (MHz)	Date	Dielectric Parameters									
		5760.0MHz		Ch 153 5765 MHz		Ch 157 5785.0 MHz		Ch 161 5805.0 MHz		-	
		εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]	εr	σ [S/m]
5760	2013-08-09	47.1	6.18	47.1	6.19	47.0	6.22	47.0	6.26	-	-

APPENDIX D: CONDUCTED AVERAGE POWER MEASUREMENTS FOR WCDMA AND HSUPA

Type: RM-927; Serial:, 355906/05/001238/3, HW: 0106, SW: 1028.0305.1329.2000

D.1. WCDMA850 (band 5) Test results

Average power

Ch / *f*(MHz)	P [dBm]
4132	23.11
4175	23.11
4233	23.28

D.2. HSUPA850 Test results

Average power

Ch / *f* (MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
4132	21.60	21.19	20.64	21.86	22.35
4175	22.14	21.07	21.32	21.84	22.45
4233	22.24	21.31	20.65	21.94	22.45

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs a single HSUPA power control routine: MPR, and additional 1dB reduction to ensure PA linearity. As a result, the MPR for each of the Subtest modes is as follows:

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
0.0dB	2.0dB	1.0dB	2.0dB	0.0dB

D.3. WCDMA1900 (band 2) Test results

Average power

Ch / *f*(MHz)	P [dBm]
9262	23.27
9400	23.20
9538	23.22

D.4. HSUPA1900 Test results

Average power

Ch / *f* (MHz)	P [dBm]				
	Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
9262	21.68	21.17	20.75	21.13	22.30
9400	21.53	21.11	20.76	21.44	22.40
9538	21.44	20.99	20.59	21.18	22.21

Note: In HSUPA operation, the output power is reduced relative to the tuning target power for WCDMA. This device runs two separate HSUPA power control routines: MPR, and additional 1dB reduction to ensure PA linearity. As a result, the MPR for each of the Subtest modes is as follows:

Maximum Power Reduction (MPR)				
Subtest mode 1	Subtest mode 2	Subtest mode 3	Subtest mode 4	Subtest mode 5
0.0dB	2.0dB	1.0dB	2.0dB	0.0dB

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

Calibration Laboratory of
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Engineering AG
Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client **Nokia SD**

Certificate No: ES3-3275_Jan13

CALIBRATION CERTIFICATE

Object ES3DV3 - SN:3275

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

Calibration date: January 22, 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:	Jeton Kastrati	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: January 28, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3275

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	6.50	6.50	6.50	0.53	1.47	± 12.0 %
835	41.5	0.90	6.22	6.22	6.22	0.34	1.74	± 12.0 %
1750	40.1	1.37	5.27	5.27	5.27	0.80	1.11	± 12.0 %
1900	40.0	1.40	5.03	5.03	5.03	0.70	1.27	± 12.0 %
2450	39.2	1.80	4.43	4.43	4.43	0.74	1.28	± 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:3275

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	6.16	6.16	6.16	0.80	1.20	± 12.0 %
835	55.2	0.97	6.04	6.04	6.04	0.60	1.38	± 12.0 %
1750	53.4	1.49	4.96	4.96	4.96	0.65	1.43	± 12.0 %
1900	53.3	1.52	4.71	4.71	4.71	0.68	1.37	± 12.0 %
2450	52.7	1.95	4.28	4.28	4.28	0.74	1.15	± 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.

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: ES3-3276_Mar13

CALIBRATION CERTIFICATE

Object: ES3DV3 - SN:3276

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 15, 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:	Israe El-Naouq	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: March 18, 2013

DASY/EASY - Parameters of Probe: ES3DV3 - SN:3276

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	6.50	6.50	6.50	0.23	2.22	± 12.0 %
835	41.5	0.90	6.26	6.26	6.26	0.22	2.23	± 12.0 %
1750	40.1	1.37	5.51	5.51	5.51	0.45	1.57	± 12.0 %
1900	40.0	1.40	5.21	5.21	5.21	0.80	1.16	± 12.0 %
2450	39.2	1.80	4.65	4.65	4.65	0.66	1.42	± 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:3276

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	6.31	6.31	6.31	0.71	1.21	± 12.0 %
835	55.2	0.97	6.20	6.20	6.20	0.39	1.71	± 12.0 %
1750	53.4	1.49	4.91	4.91	4.91	0.47	1.63	± 12.0 %
1900	53.3	1.52	4.69	4.69	4.69	0.53	1.55	± 12.0 %
2450	52.7	1.95	4.26	4.26	4.26	0.73	1.08	± 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.

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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: EX3-3817_Jan13

CALIBRATION CERTIFICATE

Object: EX3DV4 - SN:3817

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:3817

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	9.47	9.47	9.47	0.32	0.90	± 12.0 %
835	41.5	0.90	9.07	9.07	9.07	0.20	1.29	± 12.0 %
1750	40.1	1.37	8.03	8.03	8.03	0.65	0.66	± 12.0 %
1900	40.0	1.40	7.77	7.77	7.77	0.80	0.59	± 12.0 %
2450	39.2	1.80	7.09	7.09	7.09	0.75	0.63	± 12.0 %
5200	36.0	4.66	5.14	5.14	5.14	0.40	1.80	± 13.1 %
5300	35.9	4.76	4.94	4.94	4.94	0.40	1.80	± 13.1 %
5500	35.6	4.96	4.84	4.84	4.84	0.40	1.80	± 13.1 %
5600	35.5	5.07	4.45	4.45	4.45	0.45	1.80	± 13.1 %
5800	35.3	5.27	4.53	4.53	4.53	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:3817

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	9.42	9.42	9.42	0.44	0.83	± 12.0 %
835	55.2	0.97	9.25	9.25	9.25	0.27	1.15	± 12.0 %
1750	53.4	1.49	7.80	7.80	7.80	0.48	0.80	± 12.0 %
1900	53.3	1.52	7.46	7.46	7.46	0.31	0.98	± 12.0 %
2450	52.7	1.95	7.13	7.13	7.13	0.80	0.50	± 12.0 %
5200	49.0	5.30	4.54	4.54	4.54	0.50	1.90	± 13.1 %
5300	48.9	5.42	4.34	4.34	4.34	0.50	1.90	± 13.1 %
5500	48.6	5.65	4.07	4.07	4.07	0.50	1.90	± 13.1 %
5600	48.5	5.77	3.79	3.79	3.79	0.55	1.90	± 13.1 %
5800	48.2	6.00	4.25	4.25	4.25	0.50	1.90	± 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.

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

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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: D1750V2-1081_Dec12

CALIBRATION CERTIFICATE

Object	D1750V2 - SN: 1081
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	December 05, 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 5, 2012

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Zeughausstrasse 43, 8004 Zurich, Switzerland

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	1750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	40.1	1.37 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.3 ± 6 %	1.34 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	9.04 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**36.5 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	4.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**19.4 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	53.4	1.49 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	51.8 ± 6 %	1.47 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	9.31 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**37.3 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.00 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.0 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.4 Ω - 0.2 jΩ
Return Loss	- 44.2 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.6 Ω + 0.2 jΩ
Return Loss	- 26.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.218 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	January 19, 2011

DASY5 Validation Report for Head TSL

Date: 05.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1081

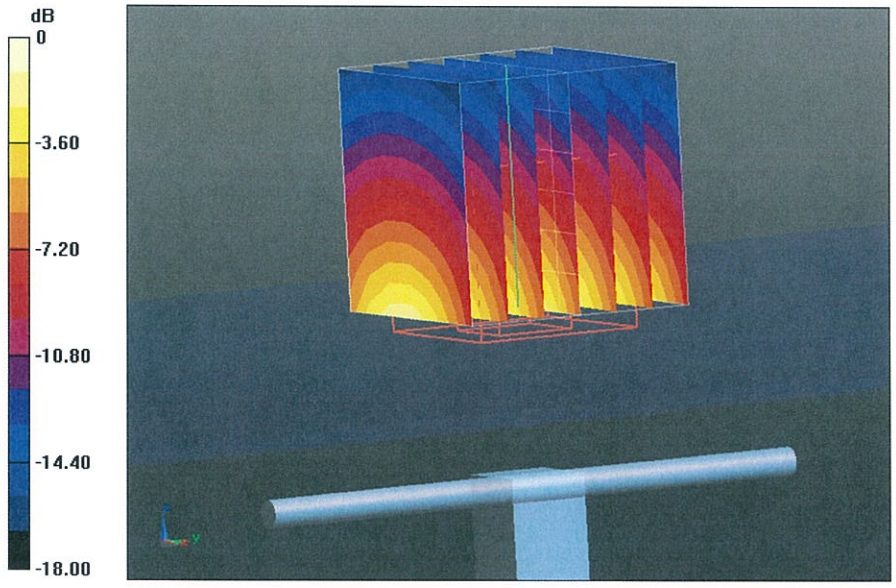
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.34 mho/m; ε_r = 39.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(5.22, 5.22, 5.22); 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)

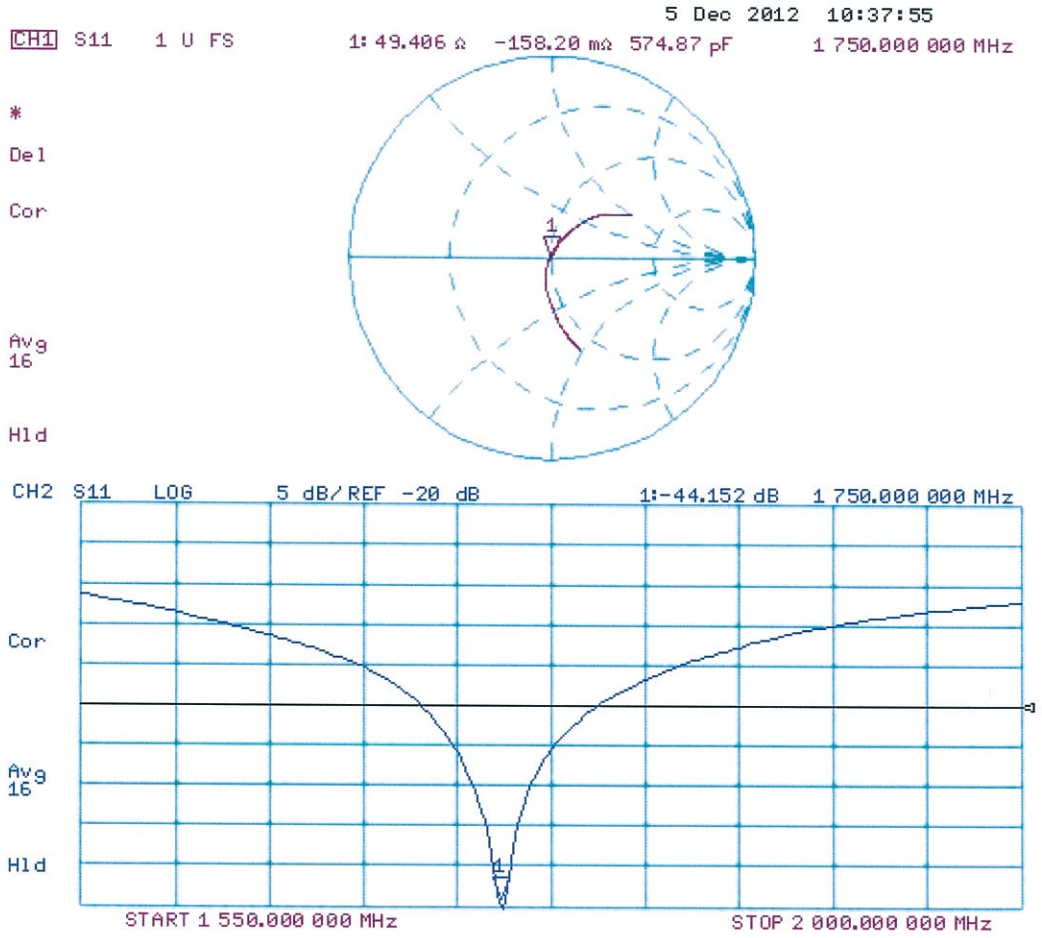
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.123 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.04 W/kg; SAR(10 g) = 4.82 W/kg
Maximum value of SAR (measured) = 11.1 W/kg



0 dB = 11.1 W/kg = 10.45 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 05.12.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1750 MHz; Type: D1750V2; Serial: D1750V2 - SN: 1081

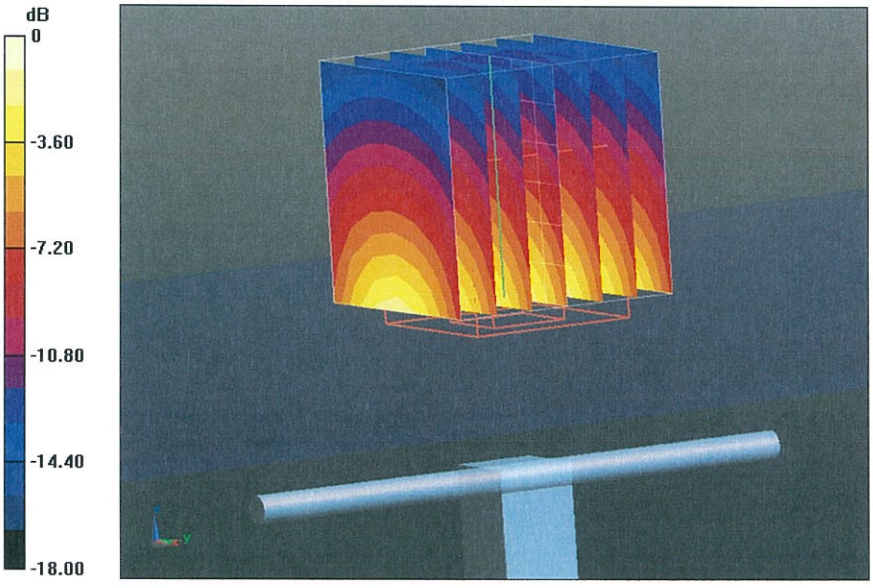
Communication System: CW; Frequency: 1750 MHz
Medium parameters used: f = 1750 MHz; σ = 1.47 mho/m; ε_r = 51.8; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.85, 4.85, 4.85); 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)

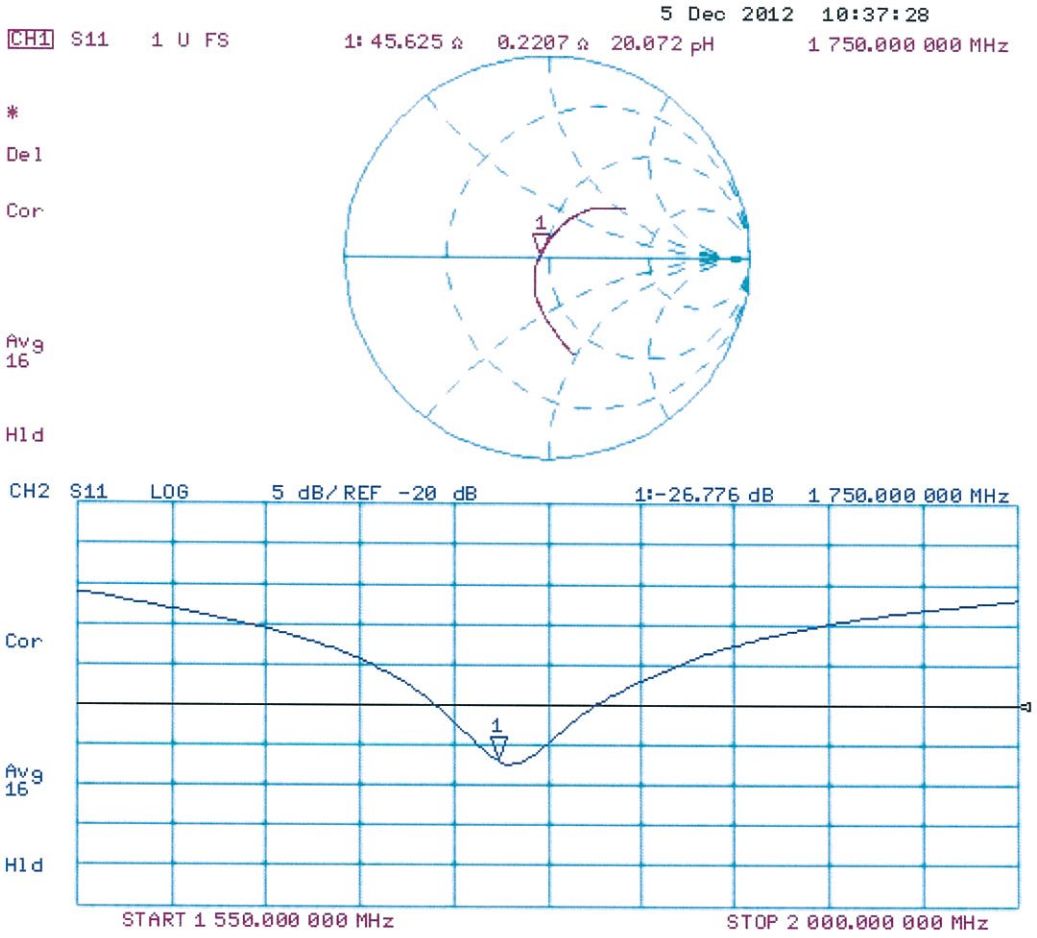
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 93.123 V/m; Power Drift = -0.00 dB
Peak SAR (extrapolated) = 16.1 W/kg
SAR(1 g) = 9.31 W/kg; SAR(10 g) = 5 W/kg
Maximum value of SAR (measured) = 11.7 W/kg



0 dB = 11.7 W/kg = 10.68 dBW/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: D1900V2-5d099_Jan13

CALIBRATION CERTIFICATE

Object	D1900V2 - SN: 5d099
Calibration procedure(s)	QA CAL-05.v9 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	January 14, 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 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	28-Dec-12 (No. ES3-3205_Dec12)	Dec-13
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: January 14, 2013

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Accreditation No.: SCS 108

Glossary:

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

Calibration is Performed According to the Following Standards:

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

Additional Documentation:

d) DASY4/5 System Handbook

Methods Applied and Interpretation of Parameters:

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

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	V52.8.5
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	39.4 ± 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	10.1 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**40.6 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	5.31 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**21.3 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	10.3 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**41.0 W/kg ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	5.42 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.6 W/kg ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	49.8 Ω + 5.6 jΩ
Return Loss	- 25.1 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	45.9 Ω + 5.6 jΩ
Return Loss	- 22.8 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.204 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	September 26, 2007

DASY5 Validation Report for Head TSL

Date: 14.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d099

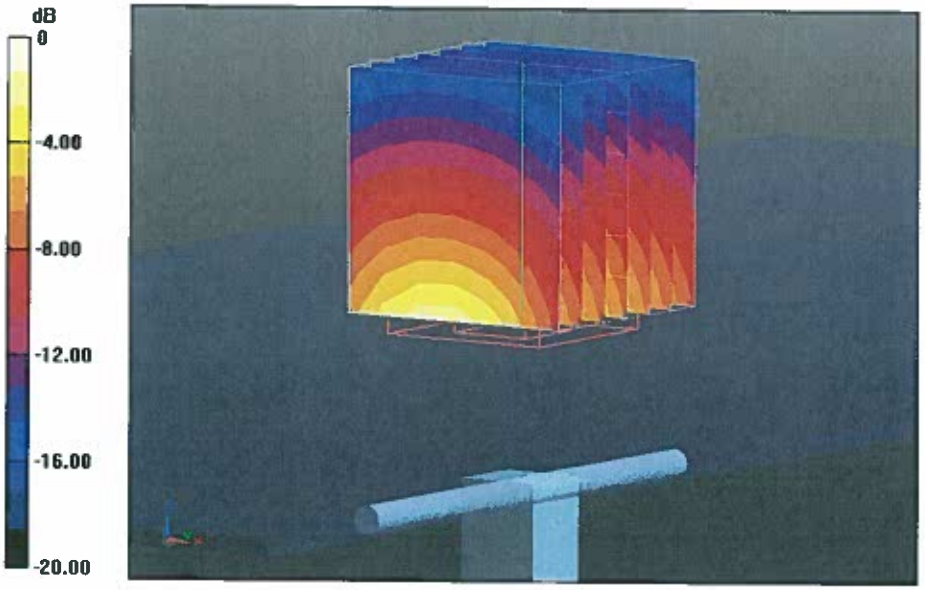
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.38 S/m; ε_r = 39.4; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.98, 4.98, 4.98); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

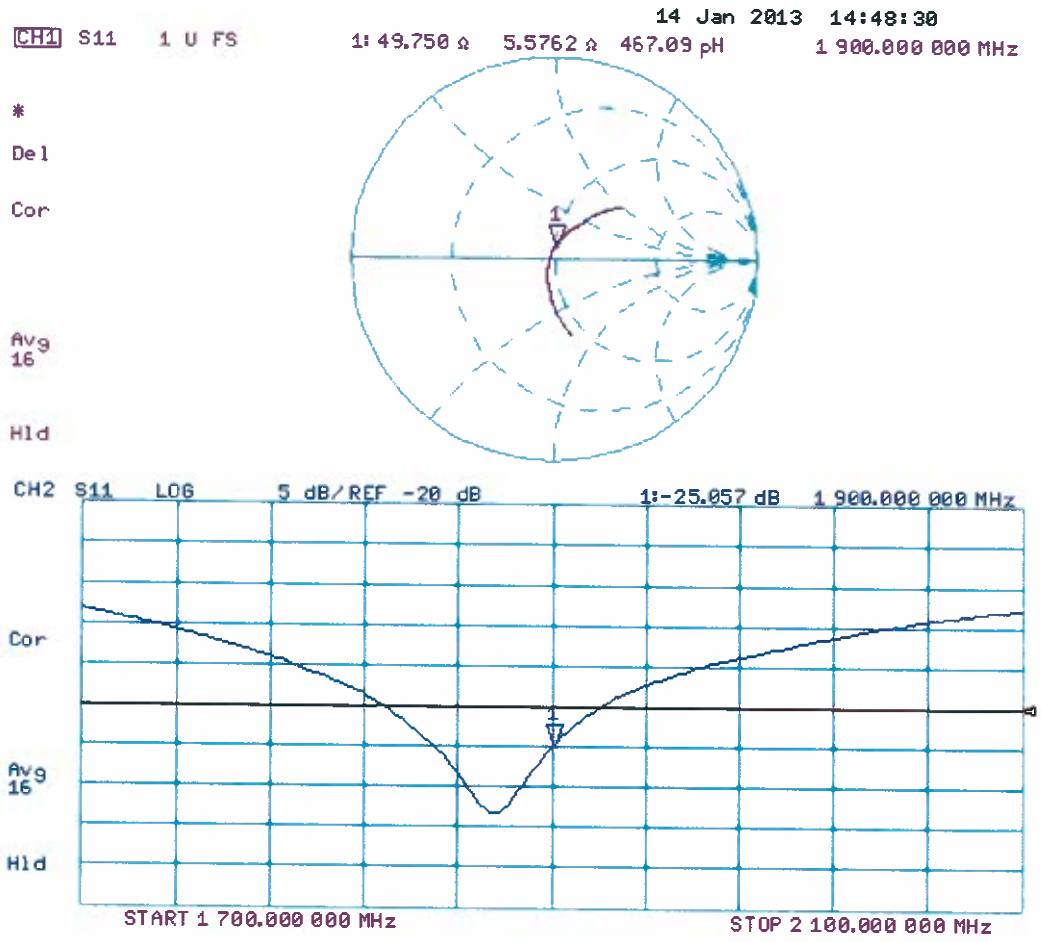
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.160 V/m; Power Drift = 0.06 dB
Peak SAR (extrapolated) = 18.3 W/kg
SAR(1 g) = 10.1 W/kg; SAR(10 g) = 5.31 W/kg
Maximum value of SAR (measured) = 12.5 W/kg



0 dB = 12.5 W/kg = 10.97 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 14.01.2013

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 1900 MHz; Type: D1900V2; Serial: D1900V2 - SN: 5d099

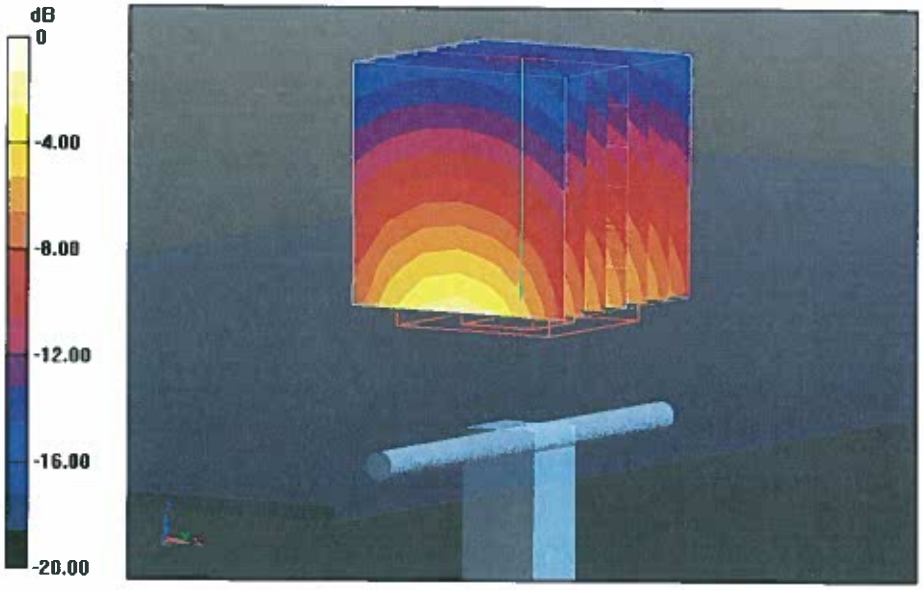
Communication System: CW; Frequency: 1900 MHz
Medium parameters used: f = 1900 MHz; σ = 1.52 S/m; ε_r = 52.2; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(4.6, 4.6, 4.6); Calibrated: 28.12.2012;
- Sensor-Surface: 3mm (Mechanical Surface Detection)
- Electronics: DAE4 Sn601; Calibrated: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.5(1059); SEMCAD X 14.6.8(7028)

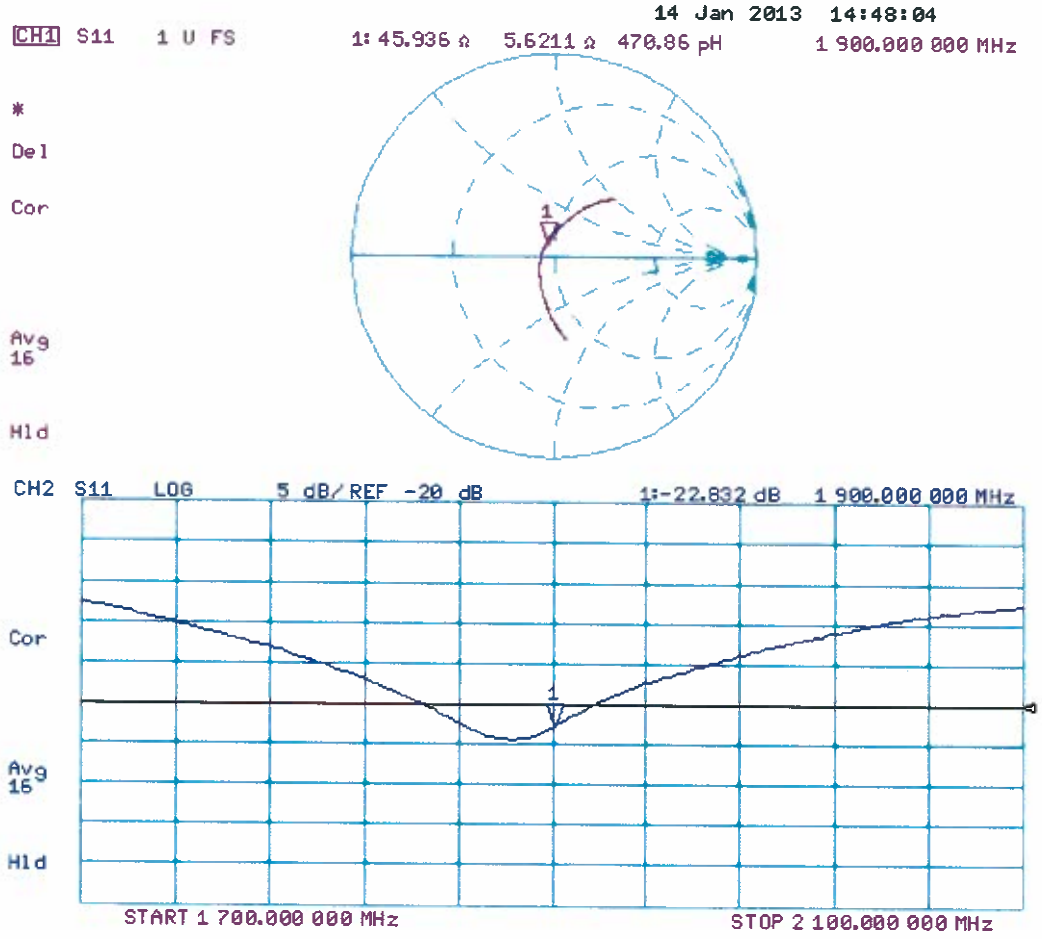
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 96.160 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 17.8 W/kg
SAR(1 g) = 10.3 W/kg; SAR(10 g) = 5.42 W/kg
Maximum value of SAR (measured) = 12.9 W/kg



0 dB = 12.9 W/kg = 11.11 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 SD**

Certificate No: D2450V2-800_Sep12

CALIBRATION CERTIFICATE

Object	D2450V2 - SN: 800
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 13, 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: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 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-11)	In house check: Oct-12

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

Issued: September 13, 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	V52.8.2
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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	39.2	1.80 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	39.9 ± 6 %	1.84 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	13.4 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**53.2 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	6.24 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**24.9 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	51.0 ± 6 %	2.01 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	13.0 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**50.9 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	6.05 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**23.9 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	54.9 Ω + 2.2 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	51.4 Ω + 3.7 jΩ
Return Loss	- 28.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.159 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	November 02, 2006

DASY5 Validation Report for Head TSL

Date: 13.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 800

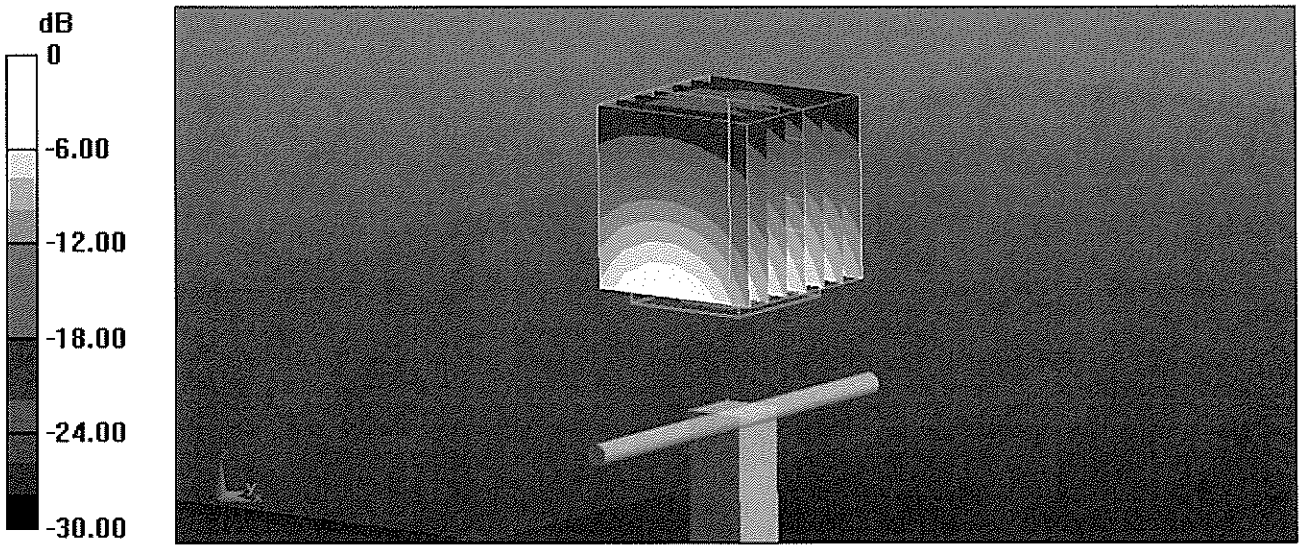
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 1.84 mho/m; ε_r = 39.9; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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: 27.06.2012
- Phantom: Flat Phantom 5.0 (front); Type: QD000P50AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

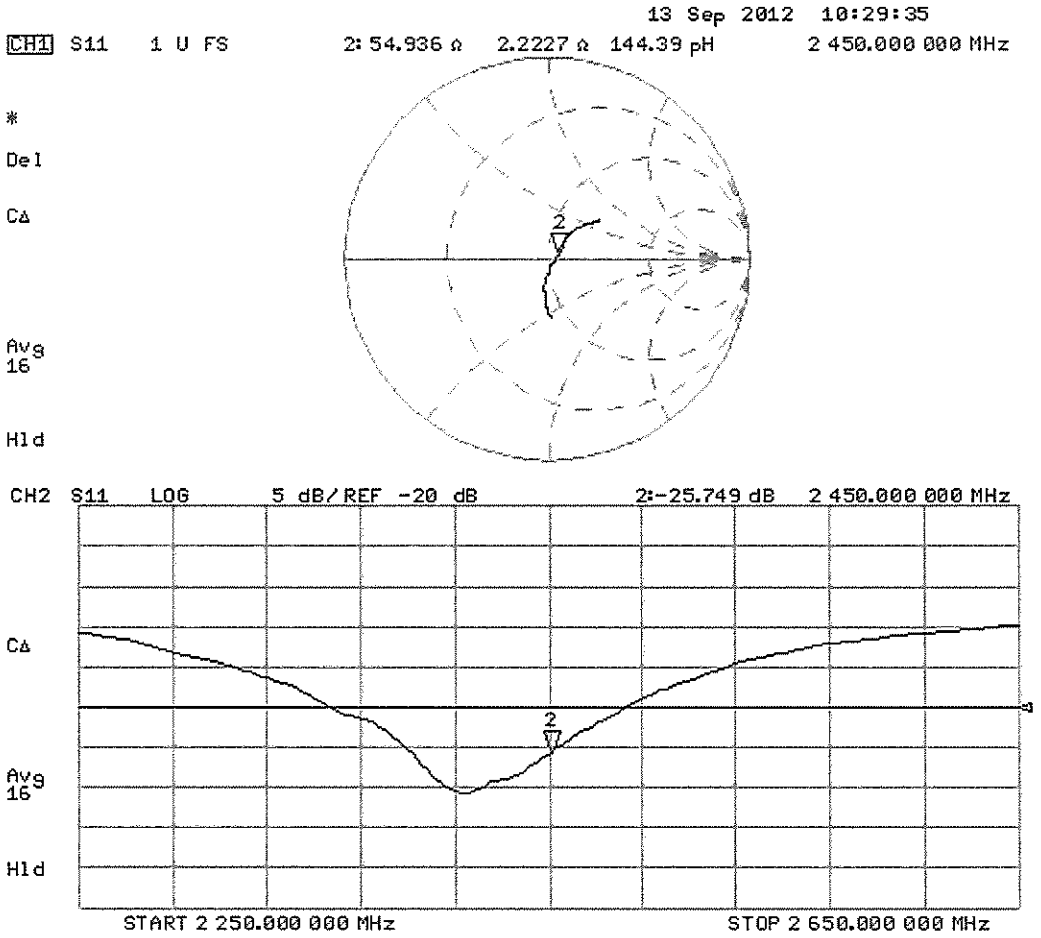
Dipole Calibration for Head Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 100.1 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 27.710 mW/g
SAR(1 g) = 13.4 mW/g; SAR(10 g) = 6.24 mW/g
Maximum value of SAR (measured) = 17.2 W/kg



0 dB = 17.2 W/kg = 24.71 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 13.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 2450 MHz; Type: D2450V2; Serial: D2450V2 - SN: 800

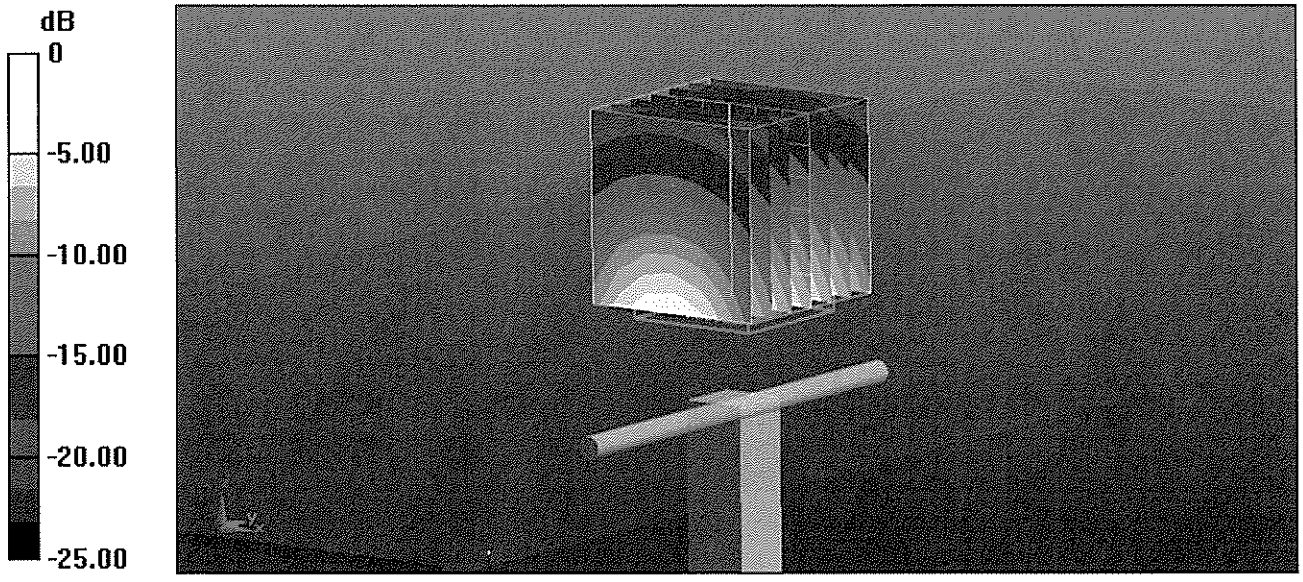
Communication System: CW; Frequency: 2450 MHz
Medium parameters used: f = 2450 MHz; σ = 2.01 mho/m; ε_r = 51; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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: 27.06.2012
- Phantom: Flat Phantom 5.0 (back); Type: QD000P50AA; Serial: 1002
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

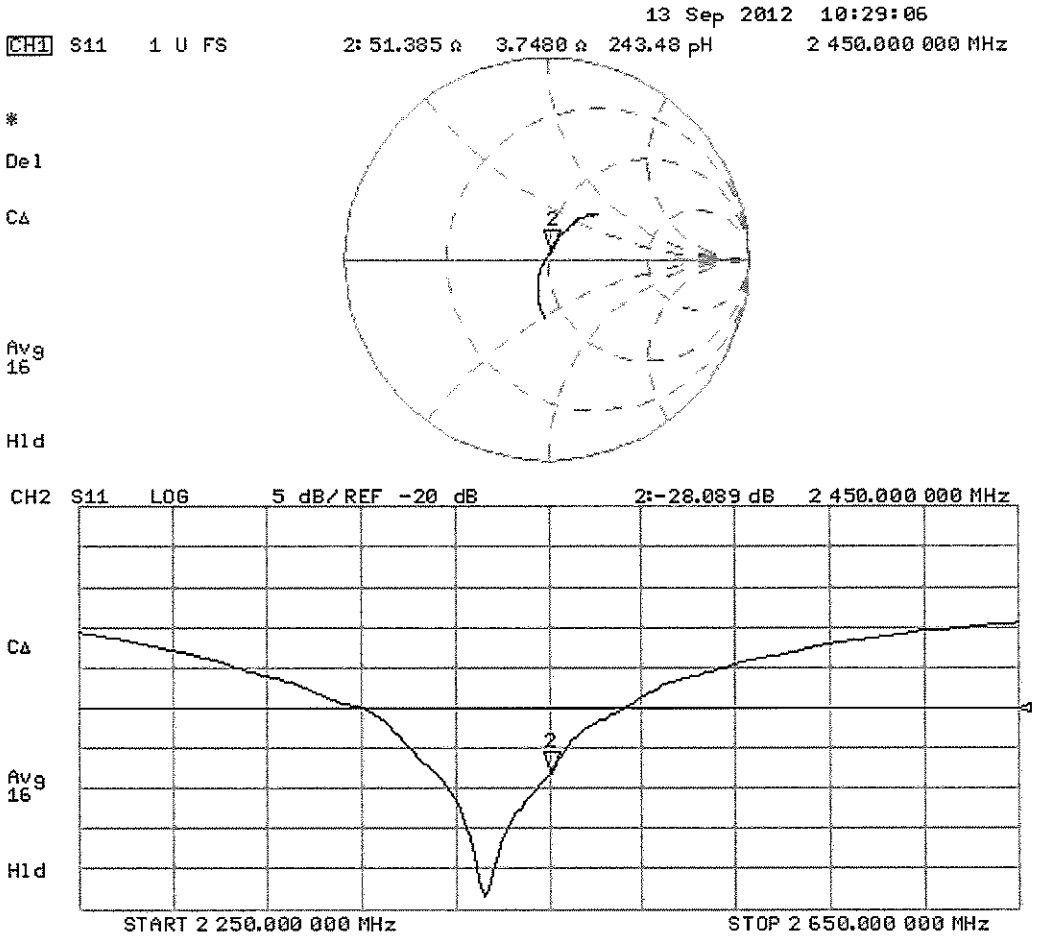
Dipole Calibration for Body Tissue/Pin=250 mW, d=10mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 95.223 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 26.601 mW/g
SAR(1 g) = 13 mW/g; SAR(10 g) = 6.05 mW/g
Maximum value of SAR (measured) = 16.9 W/kg



0 dB = 16.9 W/kg = 24.56 dB W/kg

Impedance Measurement Plot for Body TSL



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Accreditation No.: SCS 108

Client Nokia SD

Certificate No: D5GHzV2-1042_Nov12

CALIBRATION CERTIFICATE

Object	D5GHzV2 - SN: 1042
Calibration procedure(s)	QA CAL-22.v1 Calibration procedure for dipole validation kits between 3-6 GHz
Calibration date:	November 13, 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: 5047.2 / 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:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: November 13, 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) 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	34.8 ± 6 %	4.53 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	7.85 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.25 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.3 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	34.7 ± 6 %	4.63 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	8.15 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**80.9 W / kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.34 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.2 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	34.4 ± 6 %	4.83 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	8.40 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**83.3 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.38 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**23.5 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	34.2 ± 6 %	4.93 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5600 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	8.32 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**82.5 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 5800 MHz

The following parameters and calculations were applied.

	Temperature	Permittivity	Conductivity
Nominal Head TSL parameters	22.0 °C	35.3	5.27 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	34.0 ± 6 %	5.15 mho/m ± 6 %
Head TSL temperature change during test	< 0.5 °C	----	----

SAR result with Head TSL at 5800 MHz

SAR averaged over 1 cm^3 (1 g) of Head TSL	Condition	
SAR measured	100 mW input power	7.82 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**77.5 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Head TSL parameters	normalized to 1W	**22.1 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	46.8 ± 6 %	5.35 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	7.36 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**72.9 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.06 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 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	46.7 ± 6 %	5.47 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	7.54 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**74.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.12 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.0 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	46.3 ± 6 %	5.73 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	7.94 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**78.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.20 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**21.7 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	46.2 ± 6 %	5.86 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	8.04 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**79.7 W/kg ± 19.9 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	100 mW input power	2.23 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**22.0 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	45.9 ± 6 %	6.13 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	7.46 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	2.07 W/kg
SAR for nominal Body TSL parameters	normalized to 1W	**20.4 W/kg ± 19.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL at 5200 MHz

Impedance, transformed to feed point	47.7 Ω - 10.7 jΩ
Return Loss	- 19.1 dB

Antenna Parameters with Head TSL at 5300 MHz

Impedance, transformed to feed point	50.7 Ω - 7.3 jΩ
Return Loss	- 22.7 dB

Antenna Parameters with Head TSL at 5500 MHz

Impedance, transformed to feed point	47.0 Ω - 5.5 jΩ
Return Loss	- 23.9 dB

Antenna Parameters with Head TSL at 5600 MHz

Impedance, transformed to feed point	52.5 Ω - 8.1 jΩ
Return Loss	- 21.7 dB

Antenna Parameters with Head TSL at 5800 MHz

Impedance, transformed to feed point	54.6 Ω - 2.0 jΩ
Return Loss	- 26.4 dB

Antenna Parameters with Body TSL at 5200 MHz

Impedance, transformed to feed point	48.8 Ω - 9.6 jΩ
Return Loss	- 20.2 dB

Antenna Parameters with Body TSL at 5300 MHz

Impedance, transformed to feed point	51.0 Ω - 5.9 jΩ
Return Loss	- 24.5 dB

Antenna Parameters with Body TSL at 5500 MHz

Impedance, transformed to feed point	47.6 Ω - 4.4 jΩ
Return Loss	- 25.7 dB

Antenna Parameters with Body TSL at 5600 MHz

Impedance, transformed to feed point	53.7 Ω - 7.1 jΩ
Return Loss	- 22.3 dB

Antenna Parameters with Body TSL at 5800 MHz

Impedance, transformed to feed point	56.7 Ω - 1.0 jΩ
Return Loss	- 24.0 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.196 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	December 30, 2005

DASY5 Validation Report for Head TSL

Date: 13.11.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

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 = 4.53 mho/m; ε_r = 34.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 4.63 mho/m; ε_r = 34.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 4.83 mho/m; ε_r = 34.4; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 4.93 mho/m; ε_r = 34.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 5.15 mho/m; ε_r = 34; 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)

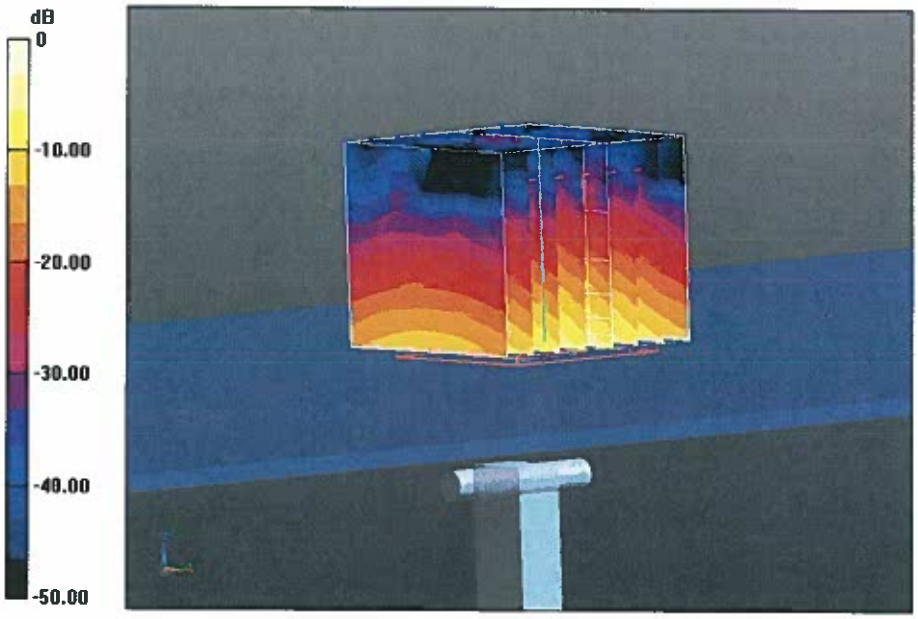
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 63.770 V/m; Power Drift = -0.04 dB
Peak SAR (extrapolated) = 28.5 W/kg
SAR(1 g) = 7.85 W/kg; SAR(10 g) = 2.25 W/kg
Maximum value of SAR (measured) = 18.0 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 = 63.429 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 30.4 W/kg
SAR(1 g) = 8.15 W/kg; SAR(10 g) = 2.34 W/kg
Maximum value of SAR (measured) = 18.9 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 = 63.178 V/m; Power Drift = 0.08 dB
Peak SAR (extrapolated) = 32.8 W/kg
SAR(1 g) = 8.4 W/kg; SAR(10 g) = 2.38 W/kg
Maximum value of SAR (measured) = 19.8 W/kg

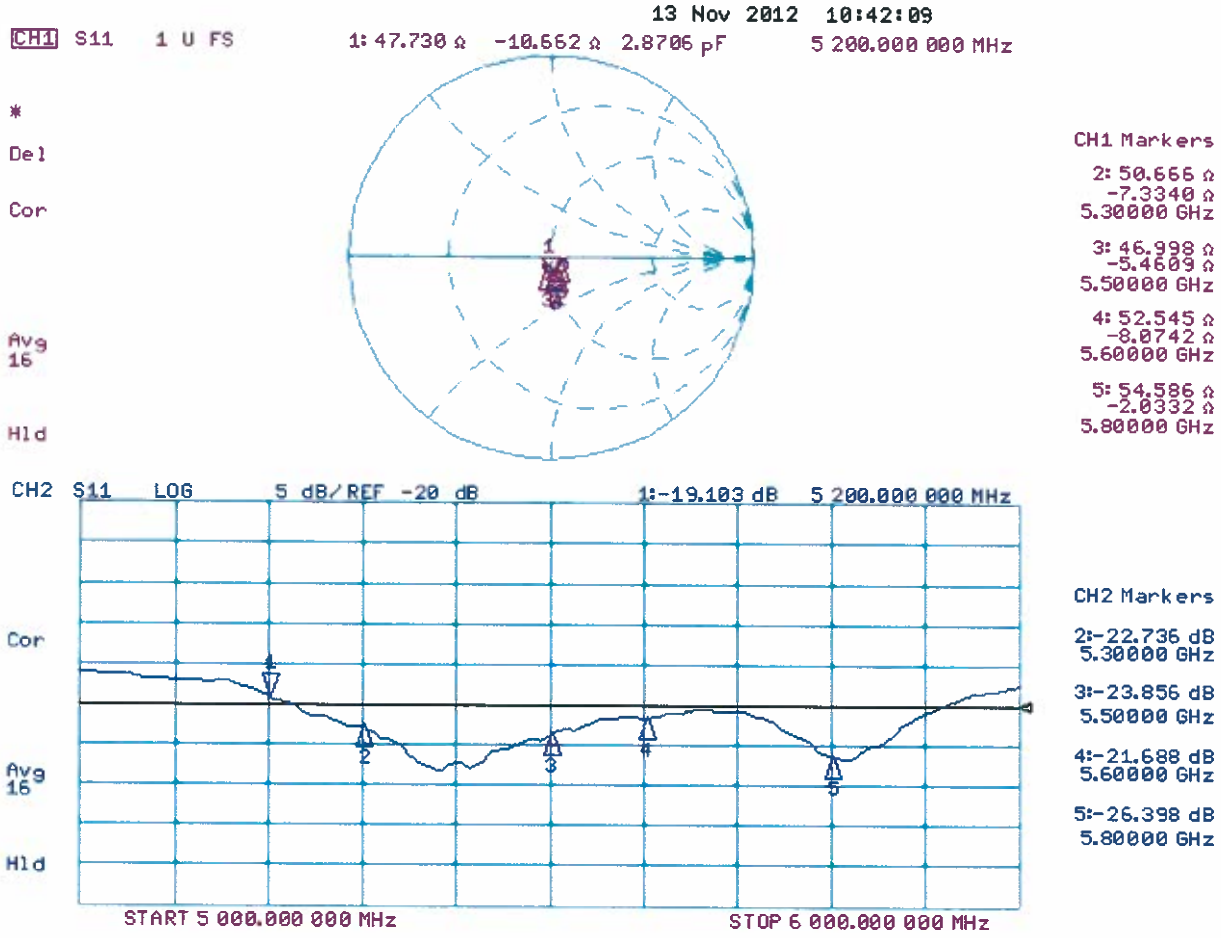
Dipole Calibration for Head Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 62.410 V/m; Power Drift = 0.09 dB
Peak SAR (extrapolated) = 32.6 W/kg
SAR(1 g) = 8.32 W/kg; SAR(10 g) = 2.37 W/kg

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 = 59.880 V/m; Power Drift = 0.07 dB
Peak SAR (extrapolated) = 32.0 W/kg
SAR(1 g) = 7.82 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 19.0 W/kg



0 dB = 19.0 W/kg = 12.79 dBW/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.11.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 5GHz; Type: D5GHzV2; Serial: D5GHzV2 - SN: 1042

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 = 5.35 mho/m; ε_r = 46.8; ρ = 1000 kg/m^3 , Medium parameters used: f = 5300 MHz; σ = 5.47 mho/m; ε_r = 46.7; ρ = 1000 kg/m^3 , Medium parameters used: f = 5500 MHz; σ = 5.73 mho/m; ε_r = 46.3; ρ = 1000 kg/m^3 , Medium parameters used: f = 5600 MHz; σ = 5.86 mho/m; ε_r = 46.2; ρ = 1000 kg/m^3 , Medium parameters used: f = 5800 MHz; σ = 6.13 mho/m; ε_r = 45.9; 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)

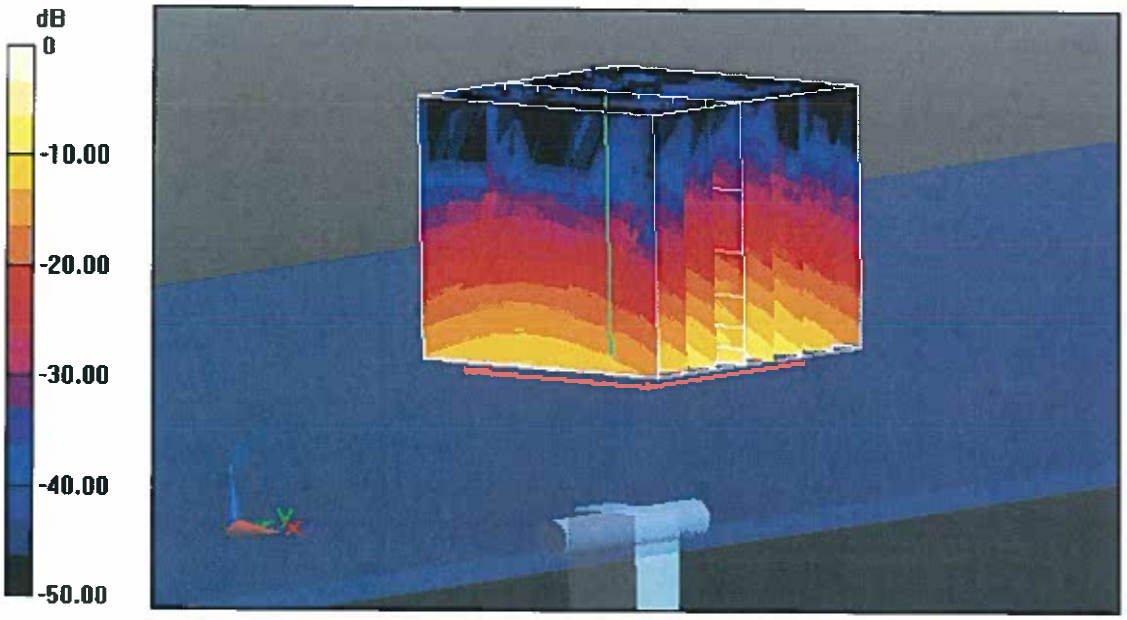
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5200 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.598 V/m; Power Drift = -0.03 dB
Peak SAR (extrapolated) = 29.3 W/kg
SAR(1 g) = 7.36 W/kg; SAR(10 g) = 2.06 W/kg
Maximum value of SAR (measured) = 17.7 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 = 58.989 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 30.7 W/kg
SAR(1 g) = 7.54 W/kg; SAR(10 g) = 2.12 W/kg
Maximum value of SAR (measured) = 18.2 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 = 59.380 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 34.4 W/kg
SAR(1 g) = 7.94 W/kg; SAR(10 g) = 2.2 W/kg
Maximum value of SAR (measured) = 19.6 W/kg

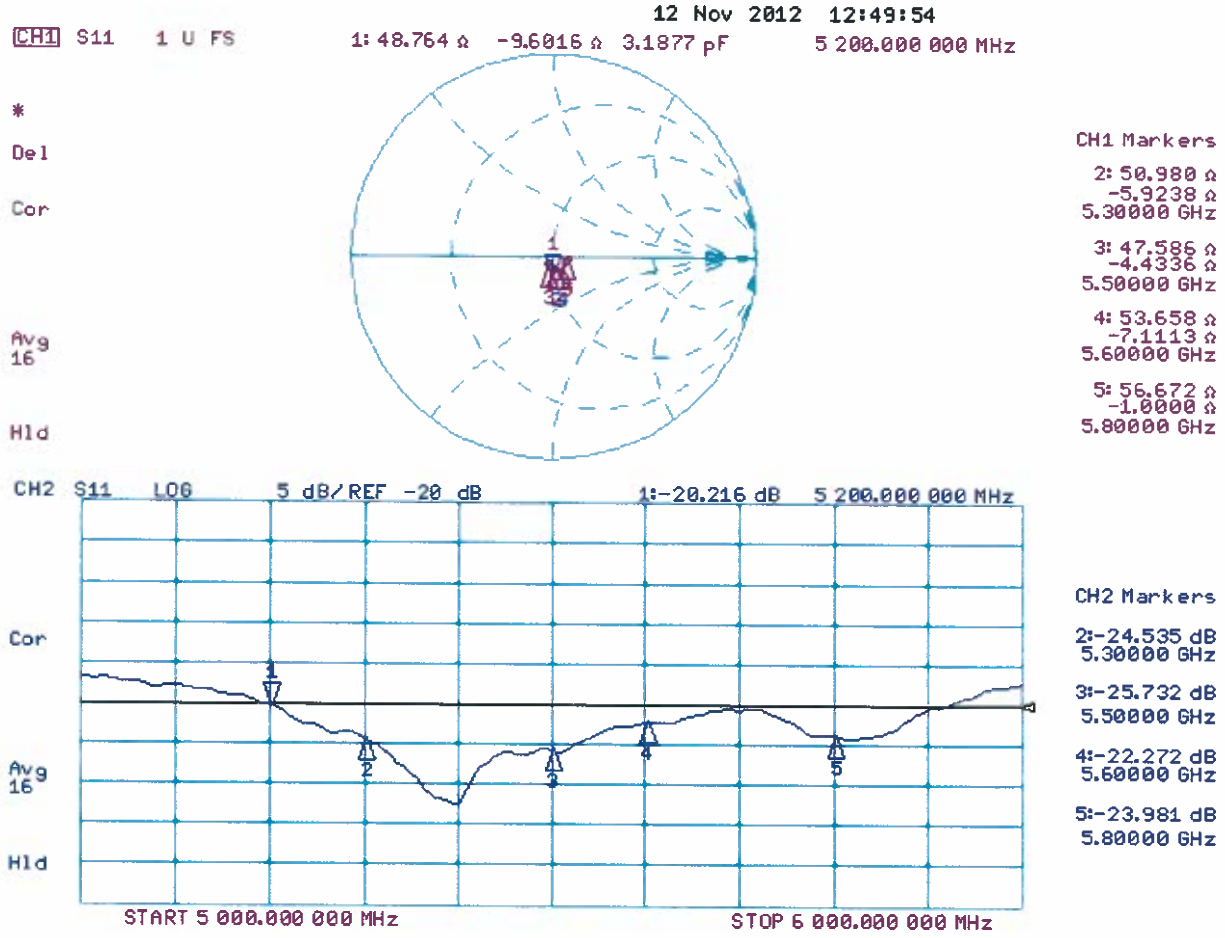
Dipole Calibration for Body Tissue/Pin=100mW, dist=10mm, f=5600 MHz/Zoom Scan, dist=1.4mm (8x8x7)/Cube 0: Measurement grid: dx=4mm, dy=4mm, dz=1.4mm
Reference Value = 58.795 V/m; Power Drift = 0.02 dB
Peak SAR (extrapolated) = 35.9 W/kg
SAR(1 g) = 8.04 W/kg; SAR(10 g) = 2.23 W/kg
Maximum value of SAR (measured) = 20.1 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 = 55.526 V/m; Power Drift = -0.02 dB
Peak SAR (extrapolated) = 35.1 W/kg
SAR(1 g) = 7.46 W/kg; SAR(10 g) = 2.07 W/kg
Maximum value of SAR (measured) = 18.9 W/kg



0 dB = 18.9 W/kg = 12.76 dBW/kg

Impedance Measurement Plot for Body TSL



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 SD

Certificate No: D750V3-1057_May12

CALIBRATION CERTIFICATE

Object: D750V3 - SN: 1057

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

Calibration date: May 10, 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: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 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	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:	Claudio Leubler	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: May 10, 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	V52.8.1
Extrapolation	Advanced Extrapolation	
Phantom	Modular Flat Phantom	
Distance Dipole Center - TSL	15 mm	with Spacer
Zoom Scan Resolution	dx, dy, dz = 5 mm	
Frequency	750 MHz ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.9	0.89 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	42.3 ± 6 %	0.92 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	2.16 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**8.44 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.41 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**5.53 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	55.5	0.96 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	55.6 ± 6 %	0.96 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	2.21 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**8.84 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.46 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**5.84 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	53.5 Ω - 1.8 jΩ
Return Loss	- 28.4 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	49.1 Ω - 3.4 jΩ
Return Loss	- 29.1 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.037 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	November 08, 2011

DASY5 Validation Report for Head TSL

Date: 10.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1057

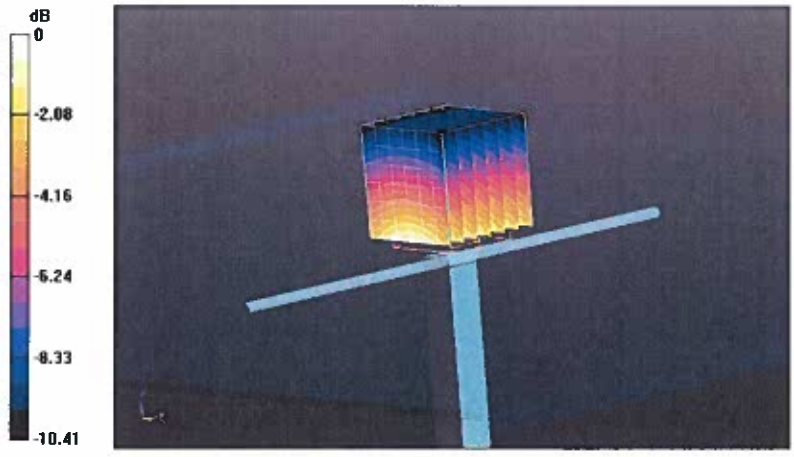
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.92 mho/m; ε_r = 42.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.33, 6.33, 6.33); 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 52.8.1(838); SEMCAD X 14.6.5(6469)

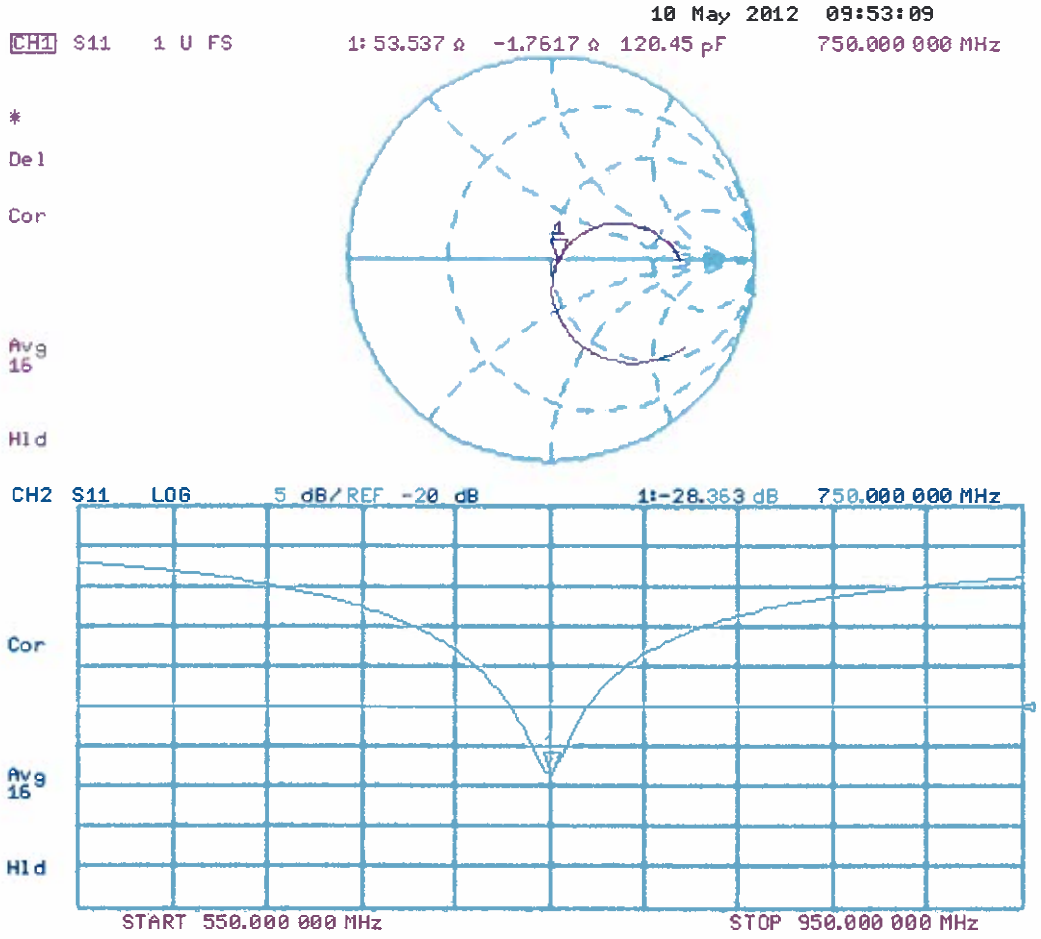
Dipole Calibration for Head Tissue/Pin=250mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 53.685 V/m; Power Drift = 0.00 dB
Peak SAR (extrapolated) = 3.259 mW/g
SAR(1 g) = 2.16 mW/g; SAR(10 g) = 1.41 mW/g
Maximum value of SAR (measured) = 2.52 mW/g



0 dB = 2.52 mW/g = 8.03 dB mW/g

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 10.05.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 750 MHz; Type: D750V3; Serial: D750V3 - SN: 1057

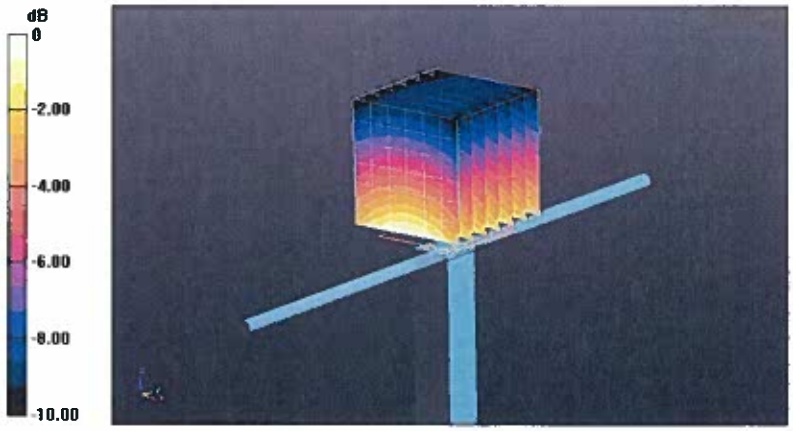
Communication System: CW; Frequency: 750 MHz
Medium parameters used: f = 750 MHz; σ = 0.96 mho/m; ε_r = 55.6; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(6.12, 6.12, 6.12); 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 52.8.1(838); SEMCAD X 14.6.5(6469)

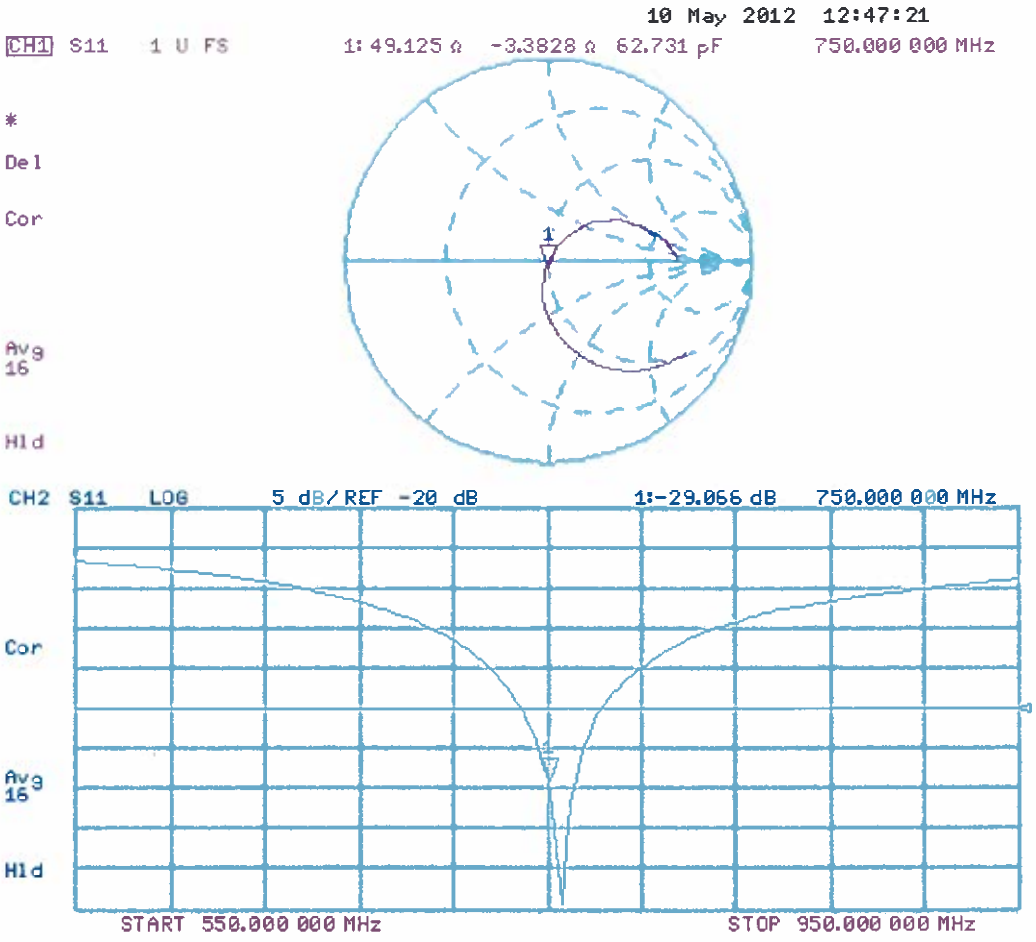
Dipole Calibration for Body Tissue/Pin=250mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 52.836 V/m; Power Drift = 0.05 dB
Peak SAR (extrapolated) = 3.299 mW/g
SAR(1 g) = 2.21 mW/g; SAR(10 g) = 1.46 mW/g
Maximum value of SAR (measured) = 2.59 mW/g



0 dB = 2.59 mW/g = 8.27 dB mW/g

Impedance Measurement Plot for Body TSL



Dipole D750V3 – SN: 1057 Antenna Parameters measured: 2013-05-10.

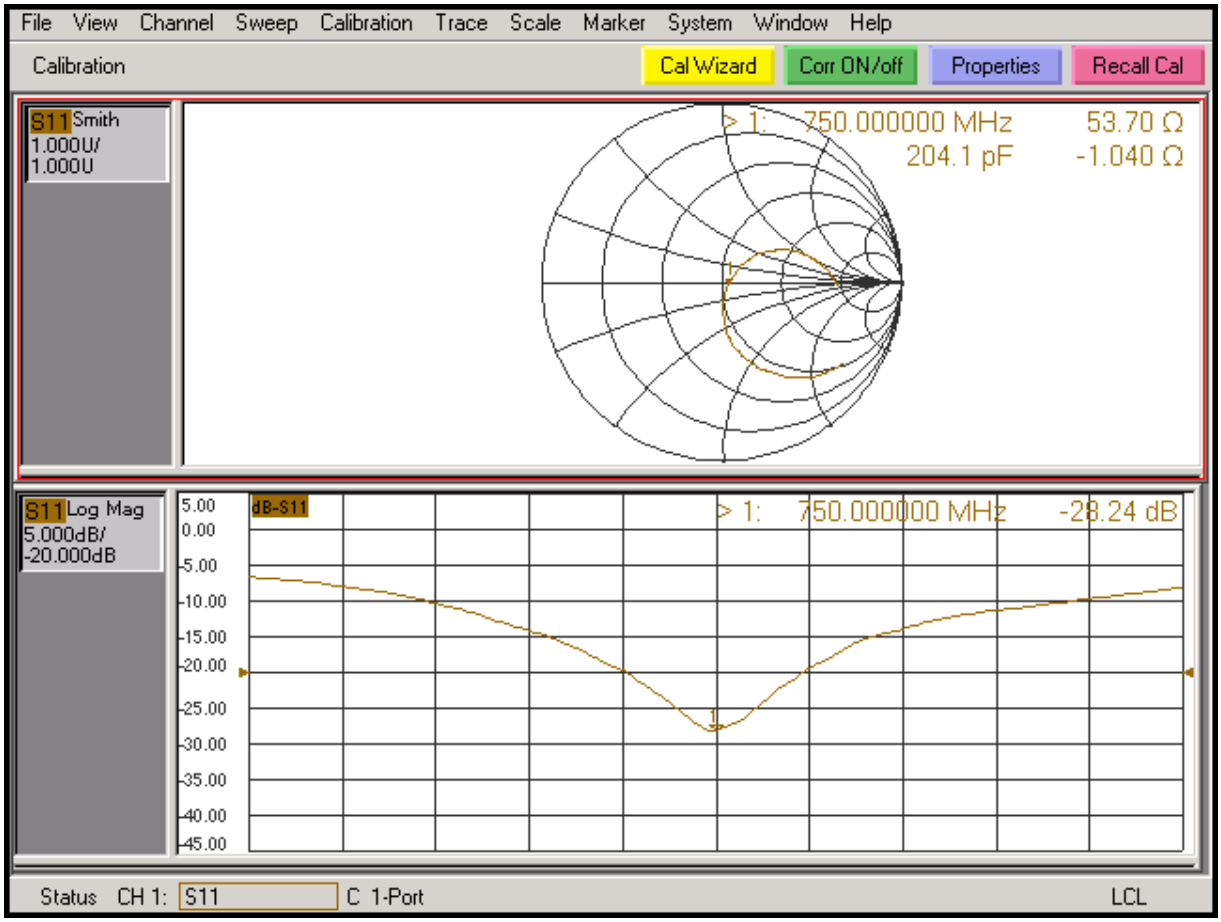
Antenna Parameters with Head TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	53.5 Ω - 1.8 jΩ	53.7 Ω - 1.04 jΩ
Return loss	-28.4 dB	-28.24 dB

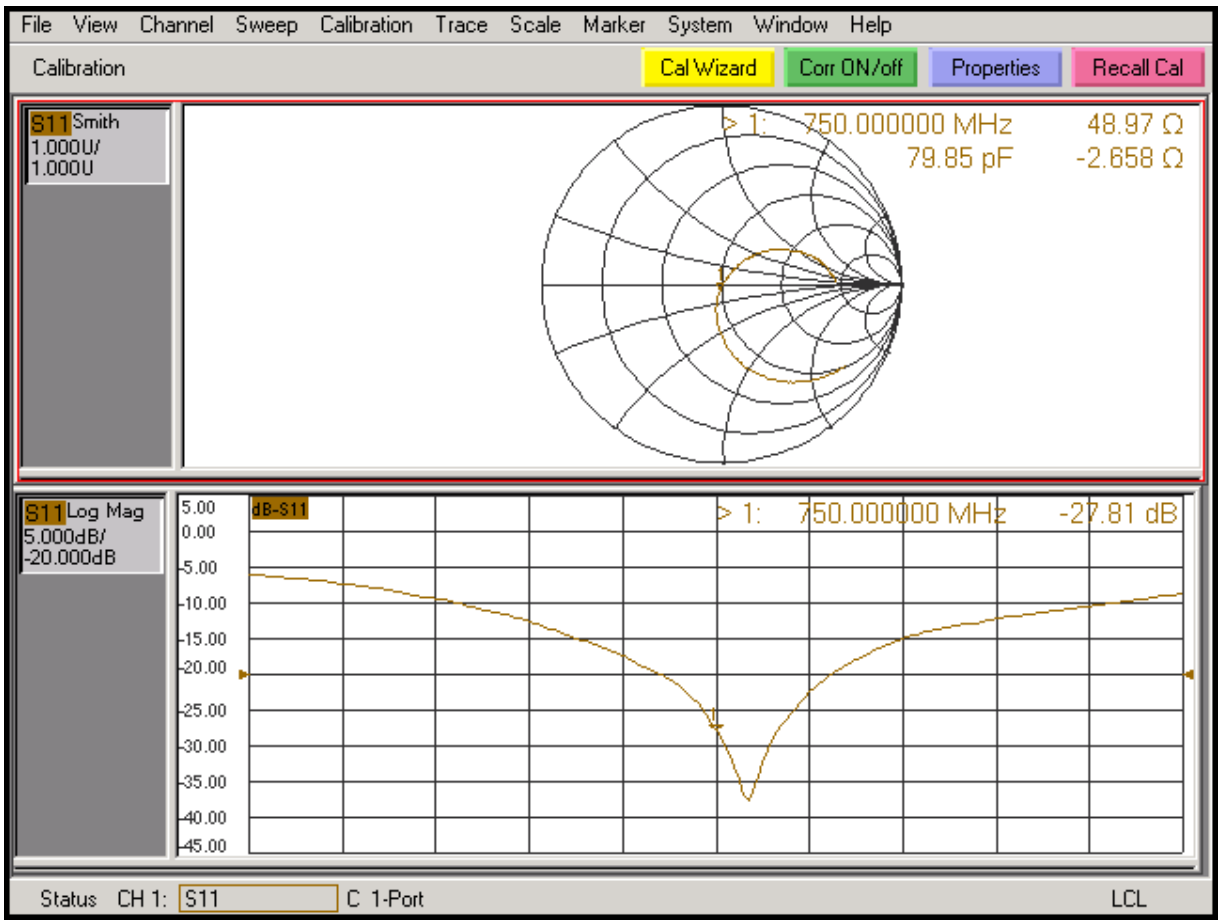
Antenna Parameters with Body TSL

	Calibration certificate	Annual measurement
Impedance, transformed to feed point	49.1 Ω - 3.4 jΩ	48.97 Ω - 2.66 jΩ
Return loss	-29.1 dB	-27.81 dB

Head TSL



Body TSL


File View Channel Sweep Calibration Trace Scale Marker System Window Help
Calibration
Cal Wizard
Corr ON/off
Properties
Recall Cal
S11 Smith
1.000U/
1.000U
> 1: 750.000000 MHz
48.97 Ω
79.85 pF
-2.658 Ω
S11 Log Mag
5.000dB/
-20.000dB
dB-S11
> 1: 750.000000 MHz
-27.81 dB
5.00
0.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
-45.00
Status CH 1: S11
C 1-Port
LCL

7022

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 SD

Certificate No: D835V2-4d040_Sep12

CALIBRATION CERTIFICATE

Object	D835V2 - SN: 4d040
Calibration procedure(s)	QA CAL-05.v8 Calibration procedure for dipole validation kits above 700 MHz
Calibration date:	September 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
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: 5058 (20k)	27-Mar-12 (No. 217-01530)	Apr-13
Type-N mismatch combination	SN: 5047.2 / 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-11)	In house check: Oct-12

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

Issued: September 12, 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	V52.8.2
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 ± 1 MHz	

Head TSL parameters

The following parameters and calculations were applied.

	Temperature	**Permittivity**	**Conductivity**
Nominal Head TSL parameters	22.0 °C	41.5	0.90 mho/m
Measured Head TSL parameters	(22.0 ± 0.2) °C	41.0 ± 6 %	0.90 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	2.38 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**9.49 mW /g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Head TSL	condition	
SAR measured	250 mW input power	1.56 mW / g
SAR for nominal Head TSL parameters	normalized to 1W	**6.23 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	55.2	0.97 mho/m
Measured Body TSL parameters	(22.0 ± 0.2) °C	53.3 ± 6 %	1.00 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	2.45 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**9.50 mW / g ± 17.0 % (k=2)**

SAR averaged over 10 cm^3 (10 g) of Body TSL	condition	
SAR measured	250 mW input power	1.61 mW / g
SAR for nominal Body TSL parameters	normalized to 1W	**6.29 mW / g ± 16.5 % (k=2)**

Appendix

Antenna Parameters with Head TSL

Impedance, transformed to feed point	50.7 Ω - 3.8 jΩ
Return Loss	- 28.3 dB

Antenna Parameters with Body TSL

Impedance, transformed to feed point	47.1 Ω - 5.0 jΩ
Return Loss	- 24.5 dB

General Antenna Parameters and Design

Electrical Delay (one direction)	1.393 ns

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

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

Additional EUT Data

Manufactured by	SPEAG
Manufactured on	September 20, 2005

DASY5 Validation Report for Head TSL

Date: 12.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d040

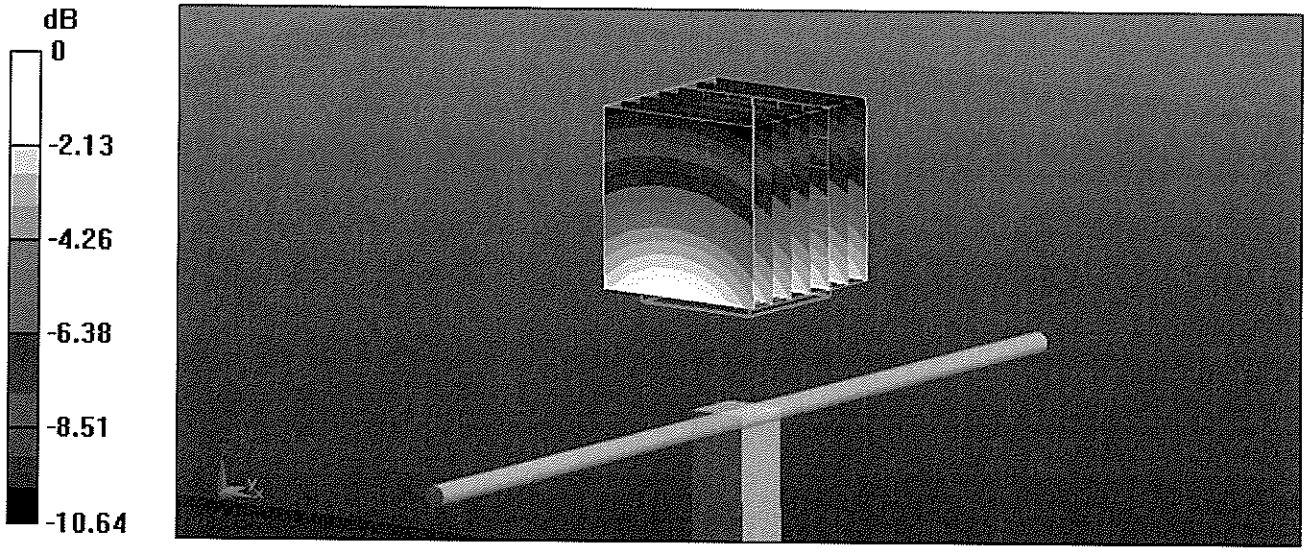
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 0.9 mho/m; ε_r = 41; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

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: 27.06.2012
- Phantom: Flat Phantom 4.9L; Type: QD000P49AA; Serial: 1001
- DASY52 52.8.2(969); SEMCAD X 14.6.6(6824)

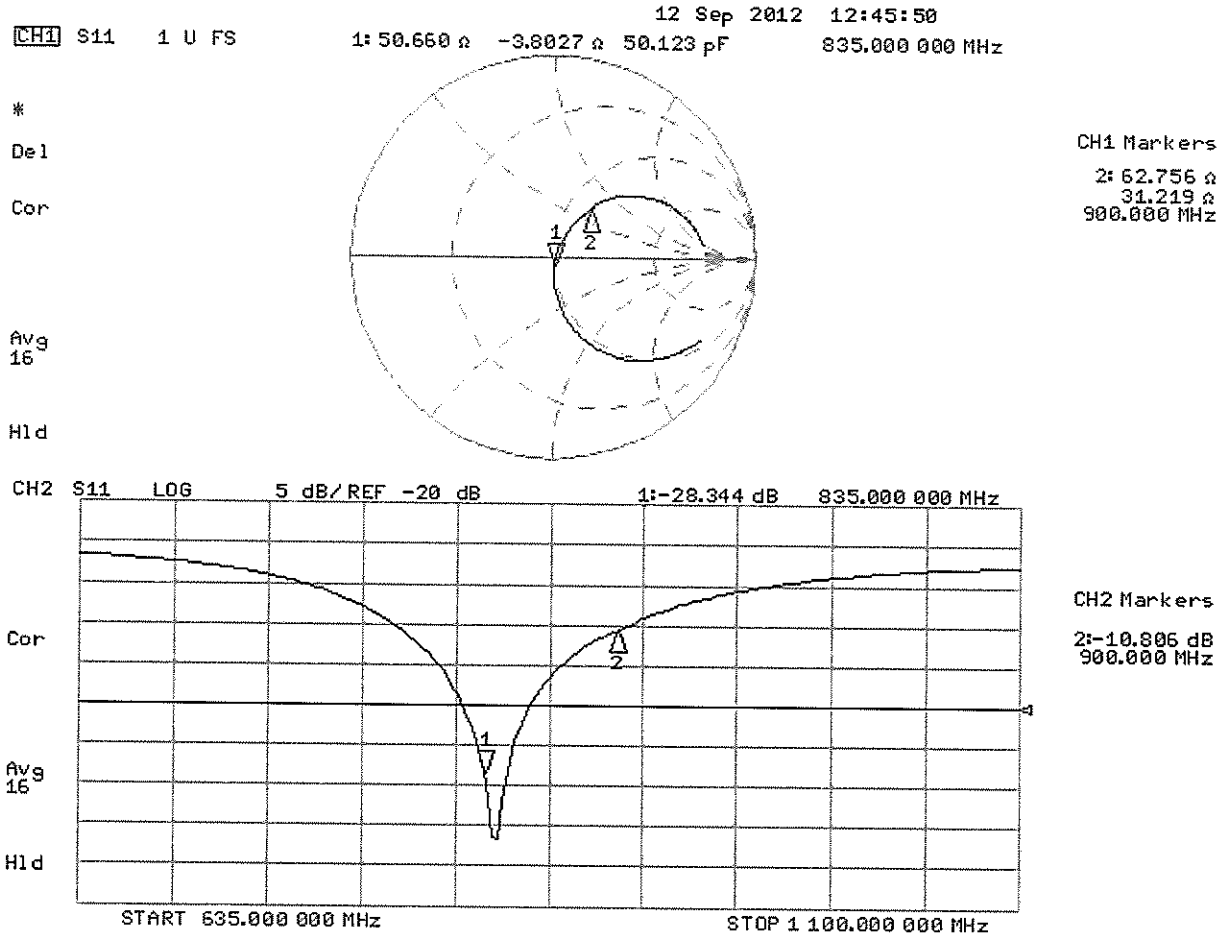
Dipole Calibration for Head Tissue/Pin=250 mW, d=15mm 2/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 57.255 V/m; Power Drift = -0.01 dB
Peak SAR (extrapolated) = 3.512 mW/g
SAR(1 g) = 2.38 mW/g; SAR(10 g) = 1.56 mW/g
Maximum value of SAR (measured) = 2.77 W/kg



0 dB = 2.77 W/kg = 8.85 dB W/kg

Impedance Measurement Plot for Head TSL



DASY5 Validation Report for Body TSL

Date: 12.09.2012

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: Dipole 835 MHz; Type: D835V2; Serial: D835V2 - SN: 4d040

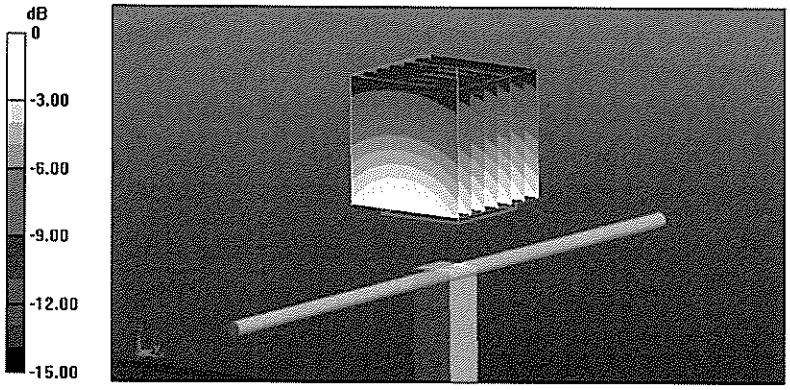
Communication System: CW; Frequency: 835 MHz
Medium parameters used: f = 835 MHz; σ = 1 mho/m; ε_r = 53.3; ρ = 1000 kg/m^3
Phantom section: Flat Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2007)

DASY52 Configuration:

- Probe: ES3DV3 - SN3205; ConvF(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 52.8.2(969); SEMCAD X 14.6.6(6824)

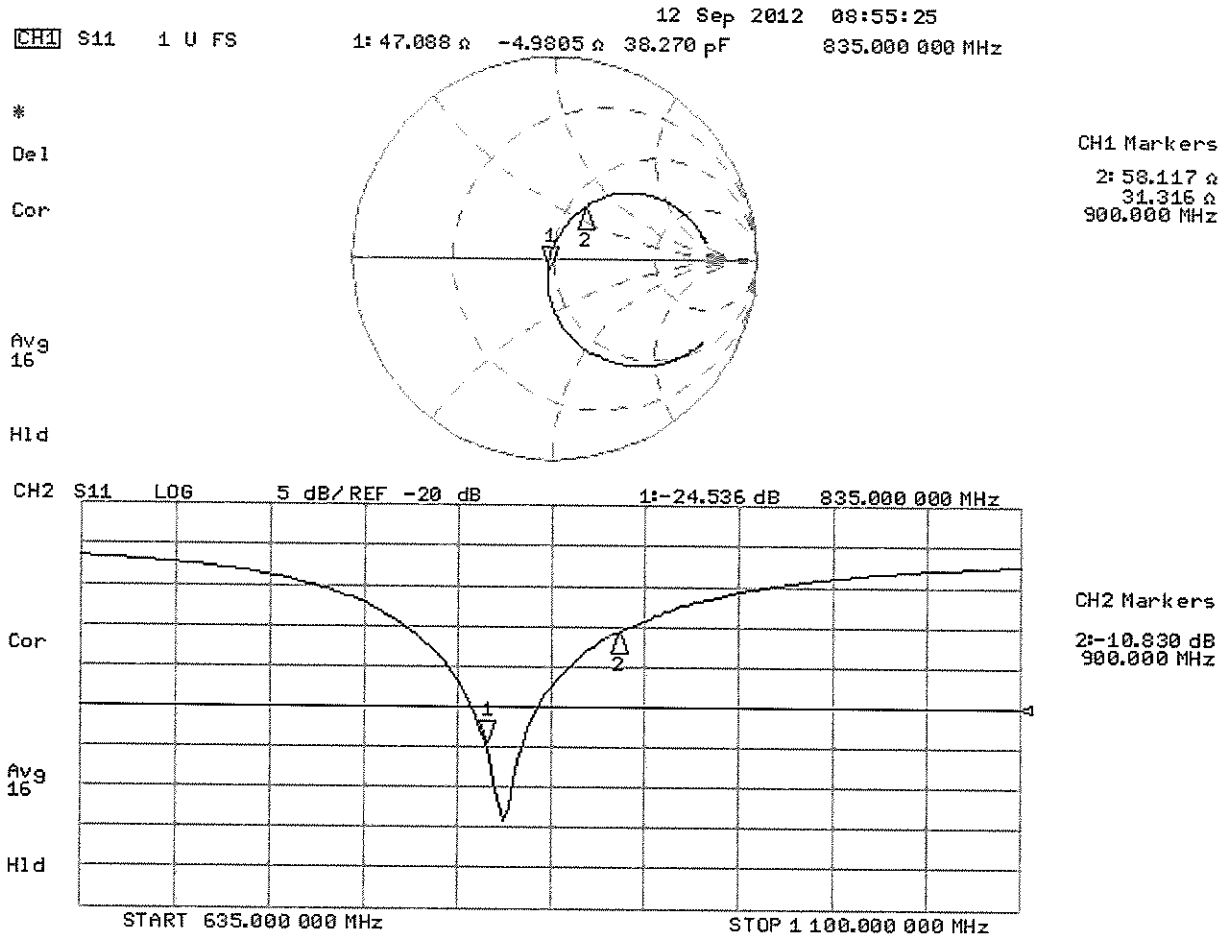
Dipole Calibration for Body Tissue/Pin=250 mW, d=15mm/Zoom Scan (7x7x7)/Cube 0:

Measurement grid: dx=5mm, dy=5mm, dz=5mm
Reference Value = 55.248 V/m; Power Drift = 0.01 dB
Peak SAR (extrapolated) = 3.563 mW/g
SAR(1 g) = 2.45 mW/g; SAR(10 g) = 1.61 mW/g
Maximum value of SAR (measured) = 2.85 W/kg



0 dB = 2.85 W/kg = 9.10 dB W/kg

Impedance Measurement Plot for Body TSL



APPENDIX G: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED LTE TRANSMISSION MODES

G.1 Power Tuning Targets

Band	Target Tuning Power in Head, Body-worn and WR mode measurements					
	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz
LTE750 (Band 13)	N/A	N/A	24.0	24.0	N/A	N/A
LTE1700/2100 (Band 4)	N/A	N/A	23.5	23.5	23.5	23.5

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

Type: RM-927; Serial number: 355906/05/001238/3 used for LTE750 (Band13) for Head, Body-worn and Wireless Router SAR measurements.

"Max Average Power (dBm)" column lists measured powers with MPR active. The "Reduced Power (dBm)" column lists measured powers with MPR and A-MPR active (as defined by 3GPP TS 36.101). A-MPR is not specified for LTE750 (Band 13) in this specification (Table 6.2.4-1).

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
779.5	23205	5	1	0	QPSK	24.26	-
779.5	23205	5	1	12	QPSK	24.34	-
779.5	23205	5	1	24	QPSK	24.17	-
779.5	23205	5	12	0	QPSK	23.15	-
779.5	23205	5	12	6	QPSK	23.27	-
779.5	23205	5	12	13	QPSK	23.16	-
779.5	23205	5	25	0	QPSK	23.14	-
779.5	23205	5	1	0	16QAM	23.17	-
779.5	23205	5	1	12	16QAM	23.16	-
779.5	23205	5	1	24	16QAM	23.03	-
779.5	23205	5	12	0	16QAM	22.22	-
779.5	23205	5	12	6	16QAM	22.33	-
779.5	23205	5	12	13	16QAM	22.22	-
779.5	23205	5	25	0	16QAM	22.15	-
782.0	23230	5	1	0	QPSK	24.04	-
782.0	23230	5	1	12	QPSK	24.16	-
782.0	23230	5	1	24	QPSK	24.04	-
782.0	23230	5	12	0	QPSK	23.19	-
782.0	23230	5	12	6	QPSK	23.12	-
782.0	23230	5	12	13	QPSK	23.17	-
782.0	23230	5	25	0	QPSK	23.10	-
782.0	23230	5	1	0	16QAM	23.21	-
782.0	23230	5	1	12	16QAM	23.25	-
782.0	23230	5	1	24	16QAM	22.87	-
782.0	23230	5	12	0	16QAM	22.19	-
782.0	23230	5	12	6	16QAM	22.18	-
782.0	23230	5	12	13	16QAM	22.24	-
782.0	23230	5	25	0	16QAM	22.17	-

(Table LTE750, 355906/05/001238/3 continues)

(Table LTE750, 355906/05/001238/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
784.5	23255	5	1	0	QPSK	24.13	-
784.5	23255	5	1	12	QPSK	24.28	-
784.5	23255	5	1	24	QPSK	24.01	-
784.5	23255	5	12	0	QPSK	23.20	-
784.5	23255	5	12	6	QPSK	23.29	-
784.5	23255	5	12	13	QPSK	23.22	-
784.5	23255	5	25	0	QPSK	23.19	-
784.5	23255	5	1	0	16QAM	22.65	-
784.5	23255	5	1	12	16QAM	22.55	-
784.5	23255	5	1	24	16QAM	22.63	-
784.5	23255	5	12	0	16QAM	22.19	-
784.5	23255	5	12	6	16QAM	22.25	-
784.5	23255	5	12	13	16QAM	22.14	-
784.5	23255	5	25	0	16QAM	22.35	-
782.0	23230	10	1	0	QPSK	24.08	-
782.0	23230	10	1	24	QPSK	24.31	-
782.0	23230	10	1	49	QPSK	24.03	-
782.0	23230	10	25	0	QPSK	23.07	-
782.0	23230	10	25	12	QPSK	23.15	-
782.0	23230	10	25	25	QPSK	23.17	-
782.0	23230	10	50	0	QPSK	23.09	-
782.0	23230	10	1	0	16QAM	22.62	-
782.0	23230	10	1	24	16QAM	23.34	-
782.0	23230	10	1	49	16QAM	22.30	-
782.0	23230	10	25	0	16QAM	22.13	-
782.0	23230	10	25	12	16QAM	22.25	-
782.0	23230	10	25	25	16QAM	22.20	-
782.0	23230	10	50	0	16QAM	22.20	-

(Table LTE750, 355906/05/001238/3 continues)

(Table LTE750, 355906/05/001238/3 continues)

779.5	23205	10	1	0	QPSK	24.06	-
779.5	23205	10	1	24	QPSK	24.26	-
779.5	23205	10	1	49	QPSK	24.02	-
779.5	23205	10	25	0	QPSK	23.06	-
779.5	23205	10	25	12	QPSK	23.15	-
779.5	23205	10	25	25	QPSK	23.13	-
779.5	23205	10	50	0	QPSK	23.09	-
779.5	23205	10	1	0	16QAM	22.63	-
779.5	23205	10	1	24	16QAM	23.33	-
779.5	23205	10	1	49	16QAM	22.43	-
779.5	23205	10	25	0	16QAM	22.19	-
779.5	23205	10	25	12	16QAM	22.26	-
779.5	23205	10	25	25	16QAM	22.26	-
779.5	23205	10	50	0	16QAM	22.21	-
782.0	23230	10	1	0	QPSK	24.06	-
782.0	23230	10	1	24	QPSK	24.27	-
782.0	23230	10	1	49	QPSK	24.05	-
782.0	23230	10	25	0	QPSK	23.06	-
782.0	23230	10	25	12	QPSK	23.15	-
782.0	23230	10	25	25	QPSK	23.20	-
782.0	23230	10	50	0	QPSK	23.09	-
782.0	23230	10	1	0	16QAM	22.62	-
782.0	23230	10	1	24	16QAM	23.35	-
782.0	23230	10	1	49	16QAM	22.43	-
782.0	23230	10	25	0	16QAM	22.16	-
782.0	23230	10	25	12	16QAM	22.26	-
782.0	23230	10	25	25	16QAM	22.21	-
782.0	23230	10	50	0	16QAM	22.21	-

Type: RM-927; Serial number: 355906/05/001243/3 used for LTE1700/2100 (Band4) for Head and Body-worn SAR measurements.

"Max Average Power (dBm)" column lists measured powers with MPR active. The "Reduced Power (dBm)" column lists measured powers with MPR and A-MPR active (as defined by 3GPP TS 36.101). A-MPR is not specified for LTE1700/2100 (Band 4) in this specification (Table 6.2.4-1).

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1712.5	19975	5	1	0	QPSK	23.78	-
1712.5	19975	5	1	12	QPSK	23.77	-
1712.5	19975	5	1	24	QPSK	23.77	-
1712.5	19975	5	12	0	QPSK	22.78	-
1712.5	19975	5	12	6	QPSK	22.78	-
1712.5	19975	5	12	13	QPSK	22.76	-
1712.5	19975	5	25	0	QPSK	22.69	-
1712.5	19975	5	1	0	16QAM	22.66	-
1712.5	19975	5	1	12	16QAM	22.70	-
1712.5	19975	5	1	24	16QAM	22.45	-
1712.5	19975	5	12	0	16QAM	21.83	-
1712.5	19975	5	12	6	16QAM	21.87	-
1712.5	19975	5	12	13	16QAM	21.82	-
1712.5	19975	5	25	0	16QAM	21.77	-
1732.5	20175	5	1	0	QPSK	23.62	-
1732.5	20175	5	1	12	QPSK	23.69	-
1732.5	20175	5	1	24	QPSK	23.66	-
1732.5	20175	5	12	0	QPSK	22.68	-
1732.5	20175	5	12	6	QPSK	22.66	-
1732.5	20175	5	12	13	QPSK	22.70	-
1732.5	20175	5	25	0	QPSK	22.59	-
1732.5	20175	5	1	0	16QAM	22.87	-
1732.5	20175	5	1	12	16QAM	22.88	-
1732.5	20175	5	1	24	16QAM	22.48	-
1732.5	20175	5	12	0	16QAM	21.80	-
1732.5	20175	5	12	6	16QAM	21.82	-
1732.5	20175	5	12	13	16QAM	21.80	-
1732.5	20175	5	25	0	16QAM	21.67	-

(Table LTE1700/2100, 355906/05/001243/3 continues)

(Table LTE1700/2100, 355906/05/001243/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1752.5	20375	5	1	0	QPSK	23.67	-
1752.5	20375	5	1	12	QPSK	23.80	-
1752.5	20375	5	1	24	QPSK	23.61	-
1752.5	20375	5	12	0	QPSK	22.78	-
1752.5	20375	5	12	6	QPSK	22.80	-
1752.5	20375	5	12	13	QPSK	22.74	-
1752.5	20375	5	25	0	QPSK	22.60	-
1752.5	20375	5	1	0	16QAM	22.66	-
1752.5	20375	5	1	12	16QAM	22.73	-
1752.5	20375	5	1	24	16QAM	22.71	-
1752.5	20375	5	12	0	16QAM	21.74	-
1752.5	20375	5	12	6	16QAM	21.81	-
1752.5	20375	5	12	13	16QAM	21.70	-
1752.5	20375	5	25	0	16QAM	21.76	-
1715.0	20000	10	1	0	QPSK	23.70	-
1715.0	20000	10	1	24	QPSK	23.71	-
1715.0	20000	10	1	49	QPSK	23.51	-
1715.0	20000	10	25	0	QPSK	22.65	-
1715.0	20000	10	25	12	QPSK	22.58	-
1715.0	20000	10	25	25	QPSK	22.62	-
1715.0	20000	10	50	0	QPSK	22.57	-
1715.0	20000	10	1	0	16QAM	23.00	-
1715.0	20000	10	1	24	16QAM	22.98	-
1715.0	20000	10	1	49	16QAM	22.72	-
1715.0	20000	10	25	0	16QAM	21.78	-
1715.0	20000	10	25	12	16QAM	21.70	-
1715.0	20000	10	25	25	16QAM	21.71	-
1715.0	20000	10	50	0	16QAM	21.66	-

(Table LTE1700/2100, 355906/05/001243/3 continues)

(Table LTE1700/2100, 355906/05/001243/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1732.5	20175	10	1	0	QPSK	23.63	-
1732.5	20175	10	1	24	QPSK	23.76	-
1732.5	20175	10	1	49	QPSK	23.73	-
1732.5	20175	10	25	0	QPSK	22.54	-
1732.5	20175	10	25	12	QPSK	22.58	-
1732.5	20175	10	25	25	QPSK	22.59	-
1732.5	20175	10	50	0	QPSK	22.48	-
1732.5	20175	10	1	0	16QAM	22.54	-
1732.5	20175	10	1	24	16QAM	22.61	-
1732.5	20175	10	1	49	16QAM	22.60	-
1732.5	20175	10	25	0	16QAM	21.74	-
1732.5	20175	10	25	12	16QAM	21.72	-
1732.5	20175	10	25	25	16QAM	21.74	-
1732.5	20175	10	50	0	16QAM	21.60	-
1750.0	20350	10	1	0	QPSK	23.56	-
1750.0	20350	10	1	24	QPSK	23.63	-
1750.0	20350	10	1	49	QPSK	23.60	-
1750.0	20350	10	25	0	QPSK	22.60	-
1750.0	20350	10	25	12	QPSK	22.66	-
1750.0	20350	10	25	25	QPSK	22.67	-
1750.0	20350	10	50	0	QPSK	22.49	-
1750.0	20350	10	1	0	16QAM	22.51	-
1750.0	20350	10	1	24	16QAM	22.71	-
1750.0	20350	10	1	49	16QAM	22.62	-
1750.0	20350	10	25	0	16QAM	21.68	-
1750.0	20350	10	25	12	16QAM	21.75	-
1750.0	20350	10	25	25	16QAM	21.81	-
1750.0	20350	10	50	0	16QAM	21.62	-

(Table LTE1700/2100, 355906/05/001243/3 continues)

(Table LTE1700/2100, 355906/05/001243/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1717.5	20025	15	1	0	QPSK	23.78	-
1717.5	20025	15	1	36	QPSK	23.60	-
1717.5	20025	15	1	74	QPSK	23.54	-
1717.5	20025	15	37	0	QPSK	22.55	-
1717.5	20025	15	37	18	QPSK	22.51	-
1717.5	20025	15	37	38	QPSK	22.50	-
1717.5	20025	15	75	0	QPSK	22.45	-
1717.5	20025	15	1	0	16QAM	22.96	-
1717.5	20025	15	1	36	16QAM	23.00	-
1717.5	20025	15	1	74	16QAM	22.58	-
1717.5	20025	15	37	0	16QAM	21.62	-
1717.5	20025	15	37	18	16QAM	21.65	-
1717.5	20025	15	37	38	16QAM	21.62	-
1717.5	20025	15	75	0	16QAM	21.50	-
1732.5	20175	15	1	0	QPSK	23.55	-
1732.5	20175	15	1	36	QPSK	23.61	-
1732.5	20175	15	1	74	QPSK	23.75	-
1732.5	20175	15	37	0	QPSK	22.47	-
1732.5	20175	15	37	18	QPSK	22.46	-
1732.5	20175	15	37	38	QPSK	22.54	-
1732.5	20175	15	75	0	QPSK	22.44	-
1732.5	20175	15	1	0	16QAM	22.60	-
1732.5	20175	15	1	36	16QAM	22.58	-
1732.5	20175	15	1	74	16QAM	22.54	-
1732.5	20175	15	37	0	16QAM	21.50	-
1732.5	20175	15	37	18	16QAM	21.49	-
1732.5	20175	15	37	38	16QAM	21.56	-
1732.5	20175	15	75	0	16QAM	21.45	-

(Table LTE1700/2100, 355906/05/001243/3 continues)

(Table LTE1700/2100, 355906/05/001243/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1747.5	20325	15	1	0	QPSK	23.53	-
1747.5	20325	15	1	36	QPSK	23.56	-
1747.5	20325	15	1	74	QPSK	23.62	-
1747.5	20325	15	37	0	QPSK	22.61	-
1747.5	20325	15	37	18	QPSK	22.50	-
1747.5	20325	15	37	38	QPSK	22.59	-
1747.5	20325	15	75	0	QPSK	22.53	-
1747.5	20325	15	1	0	16QAM	22.52	-
1747.5	20325	15	1	36	16QAM	22.65	-
1747.5	20325	15	1	74	16QAM	22.70	-
1747.5	20325	15	37	0	16QAM	21.67	-
1747.5	20325	15	37	18	16QAM	21.61	-
1747.5	20325	15	37	38	16QAM	21.64	-
1747.5	20325	15	75	0	16QAM	21.59	-
1720.0	20050	20	1	0	QPSK	23.64	-
1720.0	20050	20	1	49	QPSK	23.73	-
1720.0	20050	20	1	99	QPSK	23.53	-
1720.0	20050	20	50	0	QPSK	22.55	-
1720.0	20050	20	50	24	QPSK	22.54	-
1720.0	20050	20	50	50	QPSK	22.52	-
1720.0	20050	20	100	0	QPSK	22.54	-
1720.0	20050	20	1	0	16QAM	22.53	-
1720.0	20050	20	1	49	16QAM	22.65	-
1720.0	20050	20	1	99	16QAM	22.61	-
1720.0	20050	20	50	0	16QAM	21.64	-
1720.0	20050	20	50	24	16QAM	21.63	-
1720.0	20050	20	50	50	16QAM	21.64	-
1720.0	20050	20	100	0	16QAM	21.58	-

(Table LTE1700/2100, 355906/05/001243/3 continues)

(Table for LTE1700/2100, 355906/05/001243/3 continues)

Frequency (MHz)	Channel Number	Bandwidth (MHz)	RB Number	RB Offset	Modulation	Max Average Power (dBm)	Reduced Power(dBm)
1732.5	20175	20	1	0	QPSK	23.60	-
1732.5	20175	20	1	49	QPSK	23.70	-
1732.5	20175	20	1	99	QPSK	23.62	-
1732.5	20175	20	50	0	QPSK	22.49	-
1732.5	20175	20	50	24	QPSK	22.48	-
1732.5	20175	20	50	50	QPSK	22.55	-
1732.5	20175	20	100	0	QPSK	22.54	-
1732.5	20175	20	1	0	16QAM	22.55	-
1732.5	20175	20	1	49	16QAM	22.60	-
1732.5	20175	20	1	99	16QAM	22.61	-
1732.5	20175	20	50	0	16QAM	21.60	-
1732.5	20175	20	50	24	16QAM	21.62	-
1732.5	20175	20	50	50	16QAM	21.63	-
1732.5	20175	20	100	0	16QAM	21.54	-
1745.0	20300	20	1	0	QPSK	23.61	-
1745.0	20300	20	1	49	QPSK	23.75	-
1745.0	20300	20	1	99	QPSK	23.61	-
1745.0	20300	20	50	0	QPSK	22.50	-
1745.0	20300	20	50	24	QPSK	22.58	-
1745.0	20300	20	50	50	QPSK	22.55	-
1745.0	20300	20	100	0	QPSK	22.53	-
1745.0	20300	20	1	0	16QAM	22.80	-
1745.0	20300	20	1	49	16QAM	22.98	-
1745.0	20300	20	1	99	16QAM	22.69	-
1745.0	20300	20	50	0	16QAM	21.53	-
1745.0	20300	20	50	24	16QAM	21.56	-
1745.0	20300	20	50	50	16QAM	21.53	-
1745.0	20300	20	100	0	16QAM	21.55	-

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

H.1 Power Tuning Targets

GSM/GPRS/EGPRS 850 Head, Body-worn and Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	32.0	32.0	32.0
GPRS 2-slot	30.5	30.5	30.5
GPRS 3-slot	28.0	28.0	28.0
GPRS 4-slot	27.0	27.0	27.0
EGRPS 1-slot	26.0	26.0	26.0
EGPRS 2-slot	26.0	26.0	26.0
EGPRS 3-slot	24.0	24.0	24.0
EGPRS 4-slot	23.0	23.0	23.0

GSM/GPRS/EGPRS 1900 Head, Body-worn and Wireless Router			
Slot configuration	Low channel	Mid channel	High channel
GSM 1-slot	29.5	29.5	29.5
GPRS 2-slot	27.5	27.5	27.5
GPRS 3-slot	25.0	25.0	25.0
GPRS 4-slot	24.0	24.0	24.0
EGRPS 1-slot	25.0	25.0	25.0
EGPRS 2-slot	25.0	25.0	25.0
EGPRS 3-slot	23.0	23.0	23.0
EGPRS 4-slot	22.0	22.0	22.0

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

Type: RM-927; Serial number: 355906/05/001258/1 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	32.18	32.20	32.30
GPRS 2-slot	30.72	30.78	30.66
GPRS 3-slot	28.18	28.30	28.15
GPRS 4-slot	27.10	27.23	27.12
EGRPS 1-slot	26.18	26.10	26.27
EGPRS 2-slot	26.30	26.30	26.01
EGPRS 3-slot	24.20	24.10	24.30
EGPRS 4-slot	23.30	23.30	23.24

Type: RM-927; Serial number: 355906/05/001261/5 used for
- GSM/GPRS/EGPRS1900 Head, Body-worn, Wireless Router SAR measurements

GSM/GPRS/EGPRS 1900 Head, Body-worn			
Slot configuration	CH 512 1850.2 MHz	CH 661 1880.0 MHz	CH 810 1909.8 MHz
GSM 1-slot	29.84	29.84	29.68
GPRS 2-slot	27.52	27.55	27.59
GPRS 3-slot	25.02	25.06	25.11
GPRS 4-slot	24.04	24.16	24.20
EGRPS 1-slot	25.08	25.10	25.10
EGPRS 2-slot	25.07	25.06	25.08
EGPRS 3-slot	23.28	23.30	23.30
EGPRS 4-slot	22.12	22.20	22.30

APPENDIX I: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED WCDMA TRANSMISSION MODES

I.1 Power Tuning Targets

WCDMA 850 (Band 5) Head, Body-worn and Wireless Router			
Mode	Low channel	Mid channel	High channel
WCDMA	23.0	23.0	23.0

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

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

Type: RM-927; Serial number: 355906/05/001238/3 used for WCDMA850 (Band 5) Head, Body-worn and Wireless router SAR measurements

WCDMA850 (Band 5)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.04	23.16	23.23

Type: RM-927; Serial number: 355906/05/001243/3 used for WCDMA1900 (Band 2) Head and Body-worn SAR measurements

WCDMA1900 (Band 2)			
Mode	Low channel	Mid channel	High channel
WCDMA	23.27	23.20	23.22

Type: RM-927; Serial number: 355906/05/001239/1 used for WCDMA1900 (Band 2) Wireless router SAR measurements

WCDMA1900 (Band 2)			
Mode	Low channel	Mid channel	High channel
WCDMA	21.32	21.31	21.12

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

APPENDIX J: CONDUCTED POWER MEASUREMENTS FOR SUPPORTED CDMA TRANSMISSION MODES

J.1 Power Tuning Targets

CDMA 800, Head, Body-worn and Wireless Router Body			
Configuration	Low channel	Mid channel	High channel
CDMA 1X	24.5	24.5	24.5
CDMA EVDO	24.5	24.5	24.5
CDMA 1900 Head and Body-worn			
Configuration	Low channel	Mid channel	High channel
CDMA 1X	24.0	24.0	24.0
CDMA EVDO	24.0	24.0	24.0
CDMA 1900 Wireless Router Body			
Configuration	Low channel	Mid channel	High channel
CDMA 1X	21.0	21.0	21.0
CDMA EVDO	21.0	21.0	21.0

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

Type: RM-927; Serial number: 355906/05/001258/1 used for CDMA800 Head, Body-worn and Wireless Router SAR testing

Band			CDMA 800		
Radio Config	Service Option	SCH1 Rate	CH 1013 824.70 MHz	CH 384 836.52 MHz	CH 777 848.31 MHz
RC1	SO1	NA	NA	NA	NA
RC1	SO2	NA	24.65	24.87	24.75
RC1	SO3	NA	24.58	24.70	24.57
RC1	SO55	NA	24.69	24.83	24.75
RC2	SO9	NA	24.69	24.87	24.78
RC2	SO17	NA	24.53	24.70	24.61
RC2	SO55	NA	24.68	24.81	24.74
RC3	SO1	NA	NA	NA	NA
RC3	SO2	NA	24.77	24.89	24.76
RC3	SO3	NA	24.71	24.80	24.71
RC3	**SO55**	**NA**	**24.72**	**24.85**	**24.72**
RC3	SO32	0	24.69	24.82	24.72
RC3	SO32	9.6	24.7	24.82	24.71
RC3	SO32	19.2	24.67	24.81	24.7
RC3	SO32	38.4	24.72	24.84	24.71
RC3	SO32	76.8	24.69	24.84	24.7
RC3	SO32	153.6	24.71	24.85	24.72
RC3	SO33	9.6	NA	NA	NA
RC3	SO33	19.2	NA	NA	NA
RC3	SO33	38.4	NA	NA	NA
RC3	SO33	76.8	NA	NA	NA
RC3	SO33	153.6	NA	NA	NA

(Tables for CDMA800 / 355906/05/001258/1 continues)

(Tables for CDMA800 / 355906/05/001258/1 continues)

RC4	SO1	NA	NA	NA	NA
RC4	SO2	NA	24.8	24.85	24.78
RC4	SO3	NA	24.52	24.60	24.59
RC4	SO55	NA	24.7	24.83	24.72
RC4	SO32	0	24.68	24.81	24.73
RC4	SO32	9.6	24.69	24.89	24.73
RC4	SO32	19.2	24.71	24.82	24.74
RC4	SO32	38.4	24.68	24.86	24.73
RC4	SO32	76.8	24.7	24.85	24.74
RC4	SO32	153.6	24.65	24.86	24.72
RC4	SO33	9.6	NA	NA	NA
RC4	SO33	19.2	NA	NA	NA
RC4	SO33	38.4	NA	NA	NA
RC4	SO33	76.8	NA	NA	NA
RC4	SO33	153.6	NA	NA	NA
RC5	SO9	NA	24.77	24.85	24.74
RC5	SO17	NA	24.66	24.79	24.75
RC5	SO55	NA	24.71	24.8	24.71
RC5	SO33	9.6	NA	NA	NA
RC5	SO33	19.2	NA	NA	NA
RC5	SO33	38.4	NA	NA	NA
RC5	SO33	76.8	NA	NA	NA
RC5	SO33	153.6	NA	NA	NA

EVDO Rev 0

Radio Config	Data Rate	1013	384	777
RTAP	9.6	24.71	24.82	24.74
RTAP	19.2	24.59	24.81	24.78
RTAP	38.4	24.62	24.83	24.74
RTAP	76.8	24.59	24.82	24.76
RTAP	153.6	24.61	24.82	24.73

(Tables for CDMA800 / 355906/05/001258/1 continues)

(Tables for CDMA800 / 355906/05/001258/1 continues)

EVDO Rev A

Radio Config	Pckt Size	1013	384	777
RETAP	256	24.75	24.80	24.73
RETAP	512	24.59	24.79	24.77
RETAP	1024	24.62	24.79	24.71
RETAP	2048	24.59	24.82	24.75
RETAP	3072	24.62	24.78	24.72
RETAP	6144	24.56	24.82	24.76
RETAP	12288	24.60	24.79	24.72

Type: RM-927; Serial number: 355906/05/001261/5 used for CDMA1900 Head and Body-worn SAR testing

Band			CDMA 1900		
Radio Config	Service Option	SCH1 Rate	CH 25 1851.25 MHz	CH 600 1880.0 MHz	CH 1175 1908.75 MHz
RC1	S01	NA	NA	NA	NA
RC1	S02	NA	24.33	24.33	24.34
RC1	S03	NA	24.30	24.34	24.35
RC1	S055	NA	24.36	24.31	24.35
RC2	S09	NA	24.34	24.32	24.35
RC2	S017	NA	24.26	24.27	24.29
RC2	S055	NA	24.36	24.33	24.34
RC3	S01	NA	NA	NA	NA
RC3	S02	NA	24.29	24.32	24.30
RC3	S03	NA	24.21	24.22	24.21
RC3	**S055**	**NA**	**24.31**	**24.30**	**24.32**
RC3	S032	0	24.25	24.22	24.26
RC3	S032	9.6	24.30	24.28	24.30
RC3	S032	19.2	24.35	24.34	24.31
RC3	S032	38.4	24.34	24.32	24.32
RC3	S032	76.8	24.30	24.30	24.30
RC3	S032	153.6	24.29	24.31	24.35
RC3	S033	9.6	NA	NA	NA
RC3	S033	19.2	NA	NA	NA
RC3	S033	38.4	NA	NA	NA
RC3	S033	76.8	NA	NA	NA
RC3	S033	153.6	NA	NA	NA

(Tables for CDMA1900 / 355906/05/001261/5 continues)

(Tables for CDMA1900 / 355906/05/001261/5 continues)

RC4	SO1	NA	NA	NA	NA
RC4	SO2	NA	24.31	24.31	24.32
RC4	SO3	NA	24.26	24.19	24.24
RC4	SO55	NA	24.30	24.29	24.29
RC4	SO32	0	24.23	24.21	24.22
RC4	SO32	9.6	24.29	24.30	24.32
RC4	SO32	19.2	24.33	24.34	24.32
RC4	SO32	38.4	24.30	24.31	24.32
RC4	SO32	76.8	24.30	24.33	24.31
RC4	SO32	153.6	24.33	24.34	24.33
RC4	SO33	9.6	NA	NA	NA
RC4	SO33	19.2	NA	NA	NA
RC4	SO33	38.4	NA	NA	NA
RC4	SO33	76.8	NA	NA	NA
RC4	SO33	153.6	NA	NA	NA
RC5	SO9	NA	24.31	24.33	24.28
RC5	SO17	NA	24.19	24.18	24.20
RC5	SO55	NA	24.28	24.28	24.33
RC5	SO33	9.6	NA	NA	NA
RC5	SO33	19.2	NA	NA	NA
RC5	SO33	38.4	NA	NA	NA
RC5	SO33	76.8	NA	NA	NA
RC5	SO33	153.6	NA	NA	NA

EVDO Rev 0

Radio Config	Data Rate	1013	384	1175
RTAP	9.6	24.25	24.26	24.30
RTAP	19.2	24.27	24.23	24.31
RTAP	38.4	24.32	24.24	24.26
RTAP	76.8	24.27	24.23	24.30
RTAP	153.6	24.31	24.22	24.25

(Tables for CDMA1900 / 355906/05/001261/5 continues)

(Tables for CDMA1900 / 355906/05/001261/5 continues)

EVDO Rev A

Radio Config	Pckt Size	1013	384	1175
RETAP	256	24.31	24.20	24.26
RETAP	512	24.27	24.21	24.25
RETAP	1024	24.33	24.19	24.27
RETAP	2048	24.27	24.19	24.30
RETAP	3072	24.26	24.21	24.23
RETAP	6144	24.27	24.21	24.25
RETAP	12288	24.27	24.20	24.25

Type: RM-927; Serial number: 355906/05/001239/1 used for CDMA1900 Wireless Router SAR testing

Band			CDMA 1900		
Radio Config	Service Option	SCH1 Rate	CH 25 1851.25 MHz	CH 600 1880.0 MHz	CH 1175 1908.75 MHz
RC1	S01	NA	NA	NA	NA
RC1	S02	NA	21.15	21.17	21.05
RC1	S03	NA	21.14	21.17	21.17
RC1	S055	NA	21.16	21.18	21.14
RC2	S09	NA	21.12	21.17	21.13
RC2	S017	NA	21.17	21.18	21.20
RC2	S055	NA	21.11	21.18	21.11
RC3	S01	NA	NA	NA	NA
RC3	S02	NA	21.11	21.17	21.15
RC3	S03	NA	21.02	21.12	21.08
RC3	**S055**	**NA**	**21.15**	**21.18**	**21.12**
RC3	S032	0	21.02	21.20	21.14
RC3	S032	9.6	21.18	21.17	21.16
RC3	S032	19.2	21.18	21.27	21.17
RC3	S032	38.4	21.15	21.24	21.16
RC3	S032	76.8	21.18	21.19	21.18
RC3	S032	153.6	21.16	21.22	21.16
RC3	S033	9.6	NA	NA	NA
RC3	S033	19.2	NA	NA	NA
RC3	S033	38.4	NA	NA	NA
RC3	S033	76.8	NA	NA	NA
RC3	S033	153.6	NA	NA	NA

(Tables for CDMA1900 / 355906/05/001239/1 continues)

(Tables for CDMA1900 / 355906/05/001239/1 continues)

RC4	SO1	NA	NA	NA	NA
RC4	SO2	NA	21.11	21.18	21.17
RC4	SO3	NA	21.02	21.11	21.09
RC4	SO55	NA	21.17	21.21	21.14
RC4	SO32	0	21.09	21.11	21.11
RC4	SO32	9.6	21.16	21.21	21.16
RC4	SO32	19.2	21.15	21.21	21.16
RC4	SO32	38.4	21.15	21.23	21.16
RC4	SO32	76.8	21.16	21.22	21.19
RC4	SO32	153.6	21.12	21.23	21.18
RC4	SO33	9.6	NA	NA	NA
RC4	SO33	19.2	NA	NA	NA
RC4	SO33	38.4	NA	NA	NA
RC4	SO33	76.8	NA	NA	NA
RC4	SO33	153.6	NA	NA	NA
RC5	SO9	NA	21.13	21.17	21.15
RC5	SO17	NA	21.02	21.10	21.16
RC5	SO55	NA	21.11	21.21	21.14
RC5	SO33	9.6	NA	NA	NA
RC5	SO33	19.2	NA	NA	NA
RC5	SO33	38.4	NA	NA	NA
RC5	SO33	76.8	NA	NA	NA
RC5	SO33	153.6	NA	NA	NA

EVDO Rev 0

Radio Config	Data Rate	25	600	1175
RTAP	9.6	21.18	21.13	21.16
RTAP	19.2	21.15	21.15	21.20
RTAP	38.4	21.03	21.15	21.18
RTAP	76.8	21.10	21.11	21.11
RTAP	153.6	21.14	21.16	21.16

(Tables for CDMA1900 / 355906/05/001239/1 continues)

(Tables for CDMA1900 / 355906/05/001239/1 continues)

EVDO Rev A

Radio Config	Pckt Size	25	600	1175
RETAP	256	21.11	21.13	21.16
RETAP	512	21.09	21.18	21.21
RETAP	1024	21.11	21.19	21.18
RETAP	2048	21.11	21.19	21.19
RETAP	3072	21.12	21.16	21.11
RETAP	6144	21.08	21.14	21.17
RETAP	12288	21.11	21.15	21.14

APPENDIX K: CONDUCTED POWER RESULTS FOR WLAN2450 AND WLAN5000

K.1 Power Tuning Targets

WLAN 2.4 GHz: 20 MHz channel bandwidth							
			Tuning target				
Standard	Modulation	Data speed [MBPS]	CH 1	CH 2	CH 6	CH 10	CH 11
802.11b	BPSK	1	17	17	17	17	17
802.11b	QPSK	2	17	17	17	17	17
802.11b	QPSK	5.5	17	17	17	17	17
802.11b	QPSK	11	17	17	17	17	17
802.11g	BPSK	6	16	16	16	16	16
802.11g	BPSK	9	16	16	16	16	16
802.11g	QPSK	12	15	15	15	15	15
802.11g	QPSK	18	15	15	15	15	15
802.11g	16QAM	24	14	14	14	14	14
802.11g	16QAM	36	14	14	14	14	14
802.11g	64QAM	48	13	13	13	13	13
802.11g	64QAM	54	13	13	13	13	13
802.11n	BPSK	6.5 / 7.25	14	14	14	14	14
802.11n	QPSK	13.0 / 14.4	14	14	14	14	14
802.11n	QPSK	19.5 / 21.7	14	14	14	14	14
802.11n	16QAM	26.0 / 28.9	14	14	14	14	14
802.11n	16QAM	39.0 / 43.3	13	13	13	13	13
802.11n	64QAM	52.0 / 57.8	13	13	13	13	13
802.11n	64QAM	58.5 / 65.0	13	13	13	13	13
802.11n	64QAM	65.0 / 72.2	13	13	13	13	13

RLAN 5 GHz / 20 MHz channel bandwidth: TUNING TARGETS										
Standard	Modulation	Data speed [MBPS]	Channel							
			36	40	44	48	52	56	60	64
802.11a	BPSK	6	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	BPSK	9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	12	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	18	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	24	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	36	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	48	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	13.0 / 14.4	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	19.5 / 21.7	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	26.0 / 28.9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	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	12.0	12.0
802.11n	64QAM	58.5 / 65.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	65.0 / 72.2	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Tuning targets for WLAN 5 GHz continues)

(Tuning targets for WLAN 5 GHz continues)

RLAN 5 GHz / 20 MHz channel bandwidth: TUNING TARGETS										
Standard	Modulation	Data speed [MBPS]	Channel							
			100	104	108	112	116	120	124	128
802.11a	BPSK	6	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	BPSK	9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	12	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	18	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	24	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	36	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	48	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	13.0 / 14.4	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	19.5 / 21.7	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	26.0 / 28.9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	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	12.0	12.0
802.11n	64QAM	58.5 / 65.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	65.0 / 72.2	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Tuning targets for WLAN 5 GHz continues)

(Tuning targets for WLAN 5 GHz continues)

RLAN 5 GHz / 20 MHz channel bandwidth: TUNING TARGETS										
Standard	Modulation	Data speed [MBPS]	Channel							
			132	136	140	149	153	157	161	165
802.11a	BPSK	6	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	BPSK	9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	12	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	QPSK	18	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	24	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	16QAM	36	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	48	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11a	64QAM	54	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	BPSK	6.5 / 7.25	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	13.0 / 14.4	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	QPSK	19.5 / 21.7	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	26.0 / 28.9	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	16QAM	39.0 / 43.3	12.0	12.0	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	12.0	12.0
802.11n	64QAM	58.5 / 65.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11n	64QAM	65.0 / 72.2	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Tuning targets for WLAN 5 GHz continues)

(Tuning targets for WLAN 5 GHz continues)

RLAN 5 GHz / 40 MHz channel bandwidth: TUNING TARGETS									
Standard	Modulation	Data speed [MBPS]	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	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	27.0 / 30.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	40.5 / 45.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	16QAM	54.0 / 60.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
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	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
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

RLAN 5 GHz / 40 MHz channel bandwidth: TUNING TARGETS									
Standard	Modulation	Data speed [MBPS]	102 (100+104)	106 (104+108)	110 (108+112)	114 (112+116)	118 (116+120)	122 (120+124)	126 (124+128)
802.11n	BPSK	13.5 / 15.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	27.0 / 30.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	40.5 / 45.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	16QAM	54.0 / 60.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
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	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
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

(Tuning targets for WLAN 5 GHz continues)

(Tuning targets for WLAN 5 GHz continues)

RLAN 5 GHz / 40 MHz channel bandwidth: TUNING TARGETS									
Standard	Modulation	Data speed [MBPS]	130 (128+132)	134 (132+136)	138 (136+140)	151 (149+153)	155 (153+157)	159 (157+161)	163 (161+165)
802.11n	BPSK	13.5 / 15.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	27.0 / 30.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	QPSK	40.5 / 45.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
802.11n	16QAM	54.0 / 60.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
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	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
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

RLAN 5 GHz / 80 MHz channel bandwidth: TUNING TARGETS							
Standard	Modulation	Data speed [MBPS]	42 (36-48)	58 (52-64)	106 (100-112)	138 (132-144)	155 (149+161)
802.11ac	BPSK	29.3 / 32.5	10.0	10.0	10.0	10.0	10.0
802.11ac	QPSK	58.5 / 65.0	10.0	10.0	10.0	10.0	10.0
802.11ac	QPSK	87.8 / 97.5	10.0	10.0	10.0	10.0	10.0
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	10.0	10.0	10.0	10.0	10.0
802.11ac	64QAM	263.3 / 292.5	10.0	10.0	10.0	10.0	10.0
802.11ac	64QAM	292.5 / 325	10.0	10.0	10.0	10.0	10.0
802.11ac	256QAM	351 / 390	-	-	-	-	-
802.11ac	256QAM	390 / 433.3	-	-	-	-	-

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

Type: RM-927; Serial number: 355906/05/001240/9 used for WLAN2450 for SAR Head, Body-worn and Wireless Router measurements.

WLAN 2.4 GHz: 20 MHz channel bandwidth							
Standard	Modulation	Data speed [MBPS]	CH 1	CH 2	CH 6	CH 10	CH 11
802.11b	BPSK	1	18.03	17.93	17.92	17.77	17.87
802.11b	QPSK	2	18.11	17.88	17.85	17.73	17.78
802.11b	QPSK	5.5	18.20	18.11	18.05	17.98	18.00
802.11b	QPSK	11	18.10	17.84	17.84	17.80	17.84
802.11g	BPSK	6	16.82	16.79	16.68	16.69	16.60
802.11g	BPSK	9	17.01	16.77	16.70	16.65	16.56
802.11g	QPSK	12	15.90	15.81	15.68	15.76	15.62
802.11g	QPSK	18	15.98	15.80	15.75	15.58	15.66
802.11g	16QAM	24	14.89	14.83	14.81	14.62	14.58
802.11g	16QAM	36	14.80	14.74	14.85	14.67	14.80
802.11g	64QAM	48	14.08	13.93	13.52	13.49	13.59
802.11g	64QAM	54	13.83	13.60	13.60	13.89	13.60
802.11n	BPSK	6.5 / 7.25	14.96	14.79	14.62	14.54	14.58
802.11n	QPSK	13.0 / 14.4	14.97	14.84	14.65	14.62	14.61
802.11n	QPSK	19.5 / 21.7	15.01	14.62	14.67	14.64	14.68
802.11n	16QAM	26.0 / 28.9	14.76	14.66	14.70	14.64	14.65
802.11n	16QAM	39.0 / 43.3	13.88	13.71	13.75	13.44	13.55
802.11n	64QAM	52.0 / 57.8	13.82	13.69	13.61	13.51	13.42
802.11n	64QAM	58.5 / 65.0	13.94	13.85	13.57	13.53	13.69
802.11n	64QAM	65.0 / 72.2	13.92	13.82	13.59	13.47	13.57

Type: RM-927; Serial number: 355906/05/001344/9 used for WLAN5000 for SAR Head and Body-worn measurements.

RLAN 5 GHz / 20 MHz channel bandwidth:										
Standard	Modulation	Data speed [MBPS]	Channel							
			36	40	44	48	52	56	60	64
802.11a	BPSK	6	12.96	12.51	12.79	12.64	12.62	12.82	12.91	12.66
802.11a	BPSK	9	12.92	12.93	12.78	12.63	12.60	12.82	12.52	12.67
802.11a	QPSK	12	12.89	12.91	12.78	12.62	12.63	12.79	12.91	12.63
802.11a	QPSK	18	12.90	12.93	12.78	12.64	12.64	12.81	12.51	12.66
802.11a	16QAM	24	12.88	12.93	12.71	12.58	12.53	12.79	12.87	12.65
802.11a	16QAM	36	12.86	12.88	12.77	12.64	12.63	12.80	12.94	12.68
802.11a	64QAM	48	12.85	12.79	12.82	12.60	12.58	12.91	12.91	12.72
802.11a	64QAM	54	12.83	12.94	12.79	12.60	12.66	12.77	12.52	12.63
802.11n	BPSK	6.5 / 7.25	12.56	12.94	12.80	12.67	12.65	12.88	12.58	12.72
802.11n	QPSK	13.0 / 14.4	12.94	12.94	12.81	12.66	12.67	12.86	12.98	12.71
802.11n	QPSK	19.5 / 21.7	12.91	12.54	12.80	12.70	12.67	12.85	13.00	12.73
802.11n	16QAM	26.0 / 28.9	12.88	12.95	12.75	12.72	12.63	12.87	12.94	12.74
802.11n	16QAM	39.0 / 43.3	12.87	12.59	12.81	12.64	12.66	12.93	12.61	12.68
802.11n	64QAM	52.0 / 57.8	12.77	12.90	12.85	12.63	12.62	12.93	12.96	12.75
802.11n	64QAM	58.5 / 65.0	12.85	12.97	12.87	12.69	12.63	12.98	12.62	12.78
802.11n	64QAM	65.0 / 72.2	12.83	12.91	12.87	12.61	12.71	12.86	12.89	12.74
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Conducted powers for WLAN 5 GHz continues)

(Conducted powers for WLAN 5 GHz continues)

RLAN 5 GHz / 20 MHz channel bandwidth:									
Standard	Modulation	Data speed [MBPS]	Channel						
			100	104	108	112	116	120	124	128
802.11a	BPSK	6	12.90	12.70	12.65	12.45	12.88	12.85	12.79	12.78
802.11a	BPSK	9	12.90	12.70	12.66	12.46	12.88	12.87	12.77	12.79
802.11a	QPSK	12	12.91	12.73	12.68	12.82	12.87	12.86	12.75	12.76
802.11a	QPSK	18	12.89	12.71	12.62	12.81	12.91	12.85	12.78	12.77
802.11a	16QAM	24	12.89	12.67	12.58	12.82	12.85	12.85	12.73	12.69
802.11a	16QAM	36	12.91	12.69	12.61	12.33	12.78	12.84	12.77	12.79
802.11a	64QAM	48	12.86	12.81	12.67	12.86	12.88	12.81	12.76	12.71
802.11a	64QAM	54	12.98	12.75	12.61	12.43	12.92	12.89	12.71	12.73
802.11n	BPSK	6.5 / 7.25	12.97	12.78	12.71	12.88	12.94	12.93	12.83	12.83
802.11n	QPSK	13.0 / 14.4	12.96	12.79	12.71	12.50	12.95	12.93	12.86	12.84
802.11n	QPSK	19.5 / 21.7	12.97	12.80	12.70	12.91	12.95	12.93	12.82	12.82
802.11n	16QAM	26.0 / 28.9	12.92	12.76	12.64	12.89	12.44	12.93	12.79	12.84
802.11n	16QAM	39.0 / 43.3	13.02	12.74	12.71	12.93	12.86	12.81	12.78	12.84
802.11n	64QAM	52.0 / 57.8	12.91	12.81	12.68	12.50	12.88	13.02	12.81	12.77
802.11n	64QAM	58.5 / 65.0	13.00	12.83	12.68	12.57	12.98	12.91	12.87	12.79
802.11n	64QAM	65.0 / 72.2	13.03	12.70	12.68	12.90	12.90	12.83	12.77	12.78
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Conducted powers for WLAN 5 GHz continues)

(Conducted powers for WLAN 5 GHz continues)

RLAN 5 GHz / 20 MHz channel bandwidth:										
Standard	Modulation	Data speed [MBPS]	Channel							
			132	136	140	149	153	157	161	165
802.11a	BPSK	6	12.52	12.92	12.73	12.52	12.70	12.80	12.79	12.76
802.11a	BPSK	9	12.52	12.93	12.72	12.51	12.69	12.79	12.79	12.76
802.11a	QPSK	12	12.53	12.95	12.72	12.50	12.66	12.77	12.73	13.17
802.11a	QPSK	18	12.56	12.91	12.74	12.49	12.68	12.81	12.75	12.78
802.11a	16QAM	24	12.87	12.94	12.67	12.87	12.68	12.77	12.70	12.70
802.11a	16QAM	36	12.53	12.95	12.70	12.97	12.66	12.76	12.82	12.72
802.11a	64QAM	48	12.53	12.65	12.61	12.44	12.63	12.72	12.62	12.73
802.11a	64QAM	54	12.73	12.89	12.65	13.03	12.65	12.75	12.76	12.62
802.11n	BPSK	6.5 / 7.25	12.91	12.66	12.78	12.97	12.74	12.87	12.85	12.83
802.11n	QPSK	13.0 / 14.4	12.59	12.71	12.52	13.01	12.78	12.88	12.80	12.84
802.11n	QPSK	19.5 / 21.7	12.93	13.01	12.78	12.99	12.77	12.87	12.80	12.83
802.11n	16QAM	26.0 / 28.9	12.55	12.95	12.81	12.52	12.74	12.78	12.80	12.81
802.11n	16QAM	39.0 / 43.3	12.60	12.99	12.86	12.97	12.70	12.79	12.87	12.75
802.11n	64QAM	52.0 / 57.8	12.56	12.93	12.89	12.96	12.73	12.83	12.84	12.80
802.11n	64QAM	58.5 / 65.0	12.55	12.63	12.79	12.51	12.68	12.82	12.78	12.83
802.11n	64QAM	65.0 / 72.2	12.62	12.61	12.79	12.94	12.64	12.85	12.68	12.91
802.11ac	256QAM	78.0 / 86.7	-	-	-	-	-	-	-	-

(Conducted powers for WLAN 5 GHz continues)

(Conducted powers for WLAN 5 GHz continues)

RLAN 5 GHz / 40 MHz channel bandwidth:									
Standard	Modulation	Data speed [MBPS]	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	9.23	9.55	8.96	9.28	9.38	9.15	9.09
802.11n	QPSK	27.0 / 30.0	9.26	9.56	9.44	9.31	9.00	9.63	9.55
802.11n	QPSK	40.5 / 45.0	10.44	10.53	10.76	10.45	10.49	10.46	10.47
802.11n	16QAM	54.0 / 60.0	9.24	9.58	8.99	8.85	9.03	9.24	9.03
802.11n	16QAM	81.0 / 90.0	9.19	9.10	8.97	8.86	8.99	9.57	9.47
802.11n	64QAM	108.0 / 120.0	9.24	9.59	8.97	9.26	9.01	9.65	9.60
802.11n	64QAM	121.5 / 135.0	9.16	9.11	9.01	8.82	9.02	9.61	9.15
802.11n	64QAM	135.0 / 150.0	10.75	10.54	10.44	10.12	10.51	10.46	10.48
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

RLAN 5 GHz / 40 MHz channel bandwidth:									
Standard	Modulation	Data speed [MBPS]	102 (100+104)	106 (104+108)	110 (108+112)	114 (112+116)	118 (116+120)	122 (120+124)	126 (124+128)
802.11n	BPSK	13.5 / 15.0	9.45	9.30	8.94	9.15	9.18	9.14	9.10
802.11n	QPSK	27.0 / 30.0	9.48	9.33	9.01	9.19	9.24	9.17	9.13
802.11n	QPSK	40.5 / 45.0	10.38	10.53	10.55	10.26	10.76	10.43	10.72
802.11n	16QAM	54.0 / 60.0	9.02	8.84	9.07	9.22	9.20	9.14	9.09
802.11n	16QAM	81.0 / 90.0	9.06	9.29	8.97	9.10	9.17	9.03	9.14
802.11n	64QAM	108.0 / 120.0	8.97	8.89	8.99	9.21	9.18	9.16	9.12
802.11n	64QAM	121.5 / 135.0	9.42	9.24	9.03	9.23	9.21	9.18	9.07
802.11n	64QAM	135.0 / 150.0	10.71	10.55	10.56	10.27	10.41	10.44	10.73
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

(Conducted powers for WLAN 5 GHz continues)

(Conducted powers for WLAN 5 GHz continues)

RLAN 5 GHz / 40 MHz channel bandwidth:									
Standard	Modulation	Data speed [MBPS]	130 (128+132)	134 (132+136)	138 (136+140)	151 (149+153)	155 (153+157)	159 (157+161)	163 (161+165)
802.11n	BPSK	13.5 / 15.0	9.16	9.25	8.78	8.78	8.54	8.99	8.97
802.11n	QPSK	27.0 / 30.0	9.22	9.32	8.83	8.83	8.57	8.60	9.05
802.11n	QPSK	40.5 / 45.0	10.72	10.39	10.51	10.72	10.58	10.65	10.99
802.11n	16QAM	54.0 / 60.0	9.13	9.30	8.76	8.77	8.59	8.94	8.99
802.11n	16QAM	81.0 / 90.0	9.15	9.28	8.84	8.78	8.99	8.95	8.62
802.11n	64QAM	108.0 / 120.0	9.14	8.78	8.83	8.92	8.58	8.51	8.97
802.11n	64QAM	121.5 / 135.0	9.16	9.29	8.80	8.78	9.05	8.66	9.00
802.11n	64QAM	135.0 / 150.0	10.36	10.41	10.53	10.72	10.88	10.65	11.00
802.11ac	256QAM	162 / 180	-	-	-	-	-	-	-
802.11ac	256QAM	180 / 200	-	-	-	-	-	-	-

RLAN 5 GHz / 80 MHz channel bandwidth:							
Standard	Modulation	Data speed [MBPS]	42 (36-48)	58 (52-64)	106 (100-112)	138 (132-144)	155 (149+161)
802.11ac	BPSK	29.3 / 32.5	9.51	9.51	9.72	9.50	9.34
802.11ac	QPSK	58.5 / 65.0	9.47	9.50	9.30	9.49	9.33
802.11ac	QPSK	87.8 / 97.5	9.46	9.91	9.30	9.50	9.33
802.11ac	16QAM	117 / 130	9.45	9.91	9.31	9.50	9.33
802.11ac	16QAM	175.5 / 195.0	9.39	9.86	9.26	9.45	9.27
802.11ac	64QAM	234 / 260	9.50	9.97	9.79	9.56	9.77
802.11ac	64QAM	263.3 / 292.5	9.86	9.92	9.73	9.51	9.31
802.11ac	64QAM	292.5 / 325	9.89	9.95	9.34	9.53	9.46
802.11ac	256QAM	351 / 390	9.89	9.56	9.77	9.55	9.39
802.11ac	256QAM	390 / 433.3	9.90	9.97	9.36	9.55	9.38