HAC RF Emissions Test Report

Test report no.:	Salo_HAC_0825_14	**Date of report:**	2008-06-25
Template version:	3.0	**Number of pages:**	24
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Measurements made by:	Ari Orte		
Tested devices:	RM-429		
FCC ID:	QMNRM-429	**IC:**	661X-RM429
Supplement reports:	Salo_HAC_0825_15		
Testing has been carried out in accordance with:	**ANSI C63.19-2007** American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids		
Documentation:	The documentation of the testing performed on the tested devices is archived for 15 years at TCC Nokia.		
Test results:	**The tested device complies with the requirements in respect of all parameters subject to the test.** The test results and statements relate only to the items tested. The test report shall not be reproduced except in full, without written approval of the laboratory.		

Date and signatures:

For the contents:

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Date: 2008.06.25
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1. SUMMARY OF HAC RF EMISSION TEST REPORT

1.1 Test Details

Period of test	2008-06-19 to 2008-06-25
SN, HW, SW and DUT numbers of tested device	SN: 004401/10/063985/1, HW: 0110, SW: 3.46, DUT: 25423
Batteries used in testing	BL-5C, DUT: 11546
State of sample	Prototype
Notes	AWF = -5 for GSM

1.2 Maximum Results

The maximum measured HAC RF emissions values and categories for electric and magnetic fields are given in section 1.2.1 and 1.2.2 respectively.

1.2.1 Electric field measurements

Band & Mode	Ch / Freq. [MHz]	Radiated power	Limit of E-field max. value in category M3 [V/m]	Maximum E-field value after exclusion [V/m]	Category
GSM850	251 / 848.8	32.4 dBm ERP	149.6 – 266.1	218.9	M3 (-5dB)
GSM1900	512 / 1850.2	30.4 dBm EIRP	47.3 – 84.1	65.6	M3 (-5dB)

1.2.2 Magnetic field measurements

Band & Mode	Ch / Freq. [MHz]	Radiated power	Limit of H-field max. value in category M3 [A/m]	Maximum H-field value after exclusion [A/m]	Category
GSM850	190 / 836.6	32.8 dBm ERP	0.45 – 0.80	0.29	M4 (-5dB)
GSM1900	661 / 1880.0	31.1 dBm EIRP	0.14 – 0.25	0.18	M3 (-5dB)

1.2.3 Overall RF emissions category of the tested device

Band & Mode	Combined category (E- and H-fields)	Pass / Fail
GSM850	M3	Pass
GSM1900	M3	Pass
Final Category	M3	Pass

1.2.4 Maximum Drift

Maximum drift during measurements	0.35 dB

1.2.5 Measurement Uncertainty

Extended Uncertainty (k=2) 95%, E-field	14.7 %
Extended Uncertainty (k=2) 95%, H-field	10.9 %

2. DESCRIPTION OF THE DEVICE UNDER TEST (DUT)

Modes of Operation	Bands	Modulation Mode	Duty Cycle	Transmitter Frequency Range (MHz)
GSM	850	GMSK	1/8	824 – 849
GSM	1900	GMSK	1/8	1850 – 1910

Outside of USA the transmitter of the device is capable of operating also in 900MHz and 1800MHz, which are not part of this filing.

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature [°C]:	21.0 to 23.0
Ambient humidity [RH %]:	30 to 60

3.2 Test Signal, Frequencies, and Output Power

The transmitter of the device was put into operation by using a call tester. Communications between the device and the call tester were established by air link.

For all tests the device output power was set to maximum power level; a fully charged battery was used for every test sequence.

The measurements were performed on low, middle and high channels.

4. DESCRIPTION OF THE TEST EQUIPMENT

4.1 Measurement system and components

The measurements were performed using an automated near-field scanning system, DASY 4, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.
The following table lists calibration dates of SPEAG components:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DAE 4	728	12 months	2009-04
E-field Probe ER3DV6	2333	12 months	2009-01
H-field Probe H3DV6	6053	12 months	2009-01
Dipole Validation Kit, CD835V3	1004	24 months	2009-02
Dipole Validation Kit, CD1880V3	1003	24 months	2009-02

Additional test equipment used in testing and validation:

Test Equipment	Model	Serial Number	Calibration interval	Calibration expiry
Signal Generator	SML03	101265	12 months	2008-07
Amplifier	ZHL-42 (SMA)	N072095-5	12 months	2008-07
Power Meter	NRVS	849305/028	12 months	2008-07
Power Sensor	NRV-Z32	839176/020	12 months	2008-07
Radio Communication Tester	CMU 200	101111	12 months	2008-07

4.1.1 Isotropic E-field probe ER3DV6

Construction
One dipole parallel, two dipoles normal to probe axis
Built-in shielding against static charges
PEEK enclosure material

Frequency
In air 100 MHz to >6 GHz; Linearity: ± 0.2 dB (100 MHz to 3 GHz)

Directivity
± 0.2 dB in air (rotation around probe axis)
± 0.4 dB in air (rotation normal to probe axis)

Dynamic Range
2 V/m to > 1000 V/m; Linearity: ± 0.2 dB

Dimensions
Overall length: 330 mm
Tip length: 16 mm
Body diameter: 12 mm
Tip diameter: 8 mm
Distance from probe tip to nearest point of dipole: 1.25 mm

Application
General near-field measurements up to 6 GHz
Field component measurements
Fast automatic scanning in phantoms

4.1.2 Isotropic H-field probe H3DV6

Construction	Three concentric loop sensors with 3.8 mm loop diameters Resistively loaded detector diodes for linear response Built-in shielding against static charges PEEK enclosure material
Frequency	200 MHz to 3 GHz; Output linearized (absolute accuracy ±6.0%, k=2)
Directivity	± 0.25 dB (spherical isotropy error)
Dynamic Range	10 mA/m to 2 A/m at 1 GHz
Dimensions	Overall length: 330 mm Tip length: 40 mm Body diameter: 12 mm Tip diameter: 6 mm Distance from probe tip to nearest point of dipole: 1.1 mm
Application	General magnetic near-field measurements up to 3 GHz Field component measurements, surface current measurements Measurements in air or liquids, low interaction

4.1.3 Device Holder

The Device Holder and Test Arch are manufactured by Speag (http://www.dasy4.com/hac). Test arch is used for all tests i.e. for both validation testing and device testing. The holder and test arch conforms to the requirements of ANSI C63.19.

The SPEAG device holder (see Section 5.1) was used to position the test device in all tests.

4.2 Validation of the System

The manufacturer calibrates the probes annually. Validation measurements are made regularly using the dipole validation kit. The power level used by manufacturer in dipole calibration is supplied to the dipole antenna. The antenna is scanned at 1.0cm distance between top surface of the dipole and calibration point of the probe.

System Validation, H-field and E-field

f [MHz]	Description	E-field [V/m]	H-field [A/m]
835	Reference result	160.0	0.452
	± 10% window	144.0 – 176.0	0.406 – 0.497
	2008-06-19	173.4	0.488
1880	Reference result	128.8	0.452
	± 10% window	115.9 – 141.7	0.406 – 0.497
	2008-06-19	130.7	0.437

Plots of the system validation scans are given in Appendix A.

5. DESCRIPTION OF THE TEST PROCEDURE

5.1 Test Arch and Device Holder

The test device was placed in the Device Holder (illustrated below) that is supplied by SPEAG. Using this positioner the tested device is positioned under Test Arch.

Device holder and Test Arch supplied by SPEAG

5.2 Scan Procedures

Near field scans of 5cm x 5cm were used for determination of the field distribution. Measurement plane distance from WD reference plane is 1.5cm. Scans were performed for both E- and H-field using appropriate probe. DASY software divides detected values into 3 x 3 sub grids as described in the C63.19 standard.

5.3 Scan area centered at the maximum magnetic T-coil coupling

Scanning centered at the maximum magnetic T-coil coupling was not applicable for the tested device.

5.4 Probe Modulation Factor

All raw measurements in DASY4 system are presented as RMS values. The measurement software then applies Probe Modulation Factor (PMF) to convert readings to “slot averaged” peak values as required by C63.19 standard.

Therefore PMF was assessed as described in C63.19 standard along with Speag's Application Note (AN_Hearing_Aid_Compatibility.pdf, section 28.8, "Definition / Determination of the Probe Modulation Factor").

Observed Modulation Factor:

$PMF_{(E)} = E\text{-field}_{(CW)} / E\text{-field}_{(Modulated)}$

$PMF_{(H)} = H\text{-field}_{(CW)} / H\text{-field}_{(Modulated)}$

Observed Crest Factor:

$CF_{(E)} = (PMF_{(E)})^2$

$CF_{(H)} = (PMF_{(H)})^2$

Modulation factors, GSM

f [MHz]	*p* [dBm]	E-field [V/m] Probe SN: 2333		H-field [A/m] Probe SN: 6053		PMF E-field	PMF H-field
		CW	GSM	CW	GSM		
835.0	20	95.6	33.9	0.452	0.173	2.82	2.61
1880.0	20	136.3	48.4	0.506	0.249	2.82	2.03

5.5 Slot Averaged Calculation Method

The slot-averaged values for the every measured signal type were calculated using observed duty cycles.

5.6 Sub-grid Exclusion

The measurement grid defined in C63.19 consists of 9 evenly sized blocks, which are used to define permissible exclusion areas. For both E- and H-field measurements three contiguous blocks may be excluded from the measurements except center block may never be excluded. There must be 4 blocks left that are common for both E- and H-field measurements, so maximum of 5 different blocks can be excluded (e.g. 3 blocks excluded from E-field and 2 blocks from H-field).

5.7 Category Limits

From remaining maximum values after exclusion process, Hearing Aid M-category is defined according to the category limits of C63.19 – 2007

		Limits for RF-parameters <960MHz				Limits for RF-parameters >960MHz			
Category	AWF [dB]	E-field [V/m]		H-field [A/m]		E-field [V/m]		H-field [A/m]	
		Min	Max	Min	Max	Min	Max	Min	Max
M1	0	631.0	1122.0	1.91	3.39	199.5	354.8	0.60	1.07
M1	-5	473.2	841.4	1.43	2.54	149.6	266.1	0.45	0.80
M2	0	354.8	631.0	1.07	1.91	112.2	199.5	0.34	0.60
M2	-5	266.1	473.2	0.80	1.43	84.1	149.6	0.25	0.45
M3	**0**	**199.5**	**354.8**	**0.60**	**1.07**	**63.1**	**112.2**	**0.19**	**0.34**
M3	**-5**	**149.6**	**266.1**	**0.45**	**0.80**	**47.3**	**84.1**	**0.14**	**0.25**
M4	0		<199.5		<0.60		<63.1		<0.19
M4	-5		<149.6		<0.45		<47.3		<0.14

6. MEASUREMENT UNCERTAINTY

Source of Uncertainty	Tolerance ±%	Probability Distribution	Div.	ci E	ci H	Standard Uncertainty ±%, E	Standard Uncertainty ±%, H	Remark
MEASUREMENT SYSTEM								
Probe Calibration	5.1	N	1	1	1	5.1	5.1	
Axial Isotropy	4.7	R	√3	1	1	2.7	2.7	
Sensor Displacement	16.5	R	√3	1	0.145	9.5	1.4	
Boundary Effect	2.4	R	√3	1	1	1.4	1.4	
Linearity	4.7	R	√3	1	1	2.7	2.7	SAR
Scaling to Peak Envelope Power	2.0	R	√3	1	1	1.2	1.2	
System Detection Limit	1.0	R	√3	1	1	0.6	0.6	
Readout Electronics	0.3	N	1	1	1	0.3	0.3	SAR
Response Time	0.8	R	√3	1	1	0.5	0.5	
Integration Time	2.6	R	√3	1	1	1.5	1.5	SAR
RF Ambient Conditions	3.0	R	√3	1	1	1.7	1.7	SAR
RF Reflections	12.0	R	√3	1	1	6.9	6.9	
Probe Positioner	1.2	R	√3	1	0.67	0.7	0.5	
Probe Positioning	4.7	R	√3	1	0.67	2.7	1.8	
Extrapolation and Interpolation	1.0	R	√3	1	1	0.6	0.6	SAR
TEST SAMPLE RELATED								
Device Positioning Vertical	4.7	R	√3	1	0.67	2.7	1.8	
Device Positioning Lateral	1.0	R	√3	1	1	0.6	0.6	
Device Holder and Test Arch	2.4	R	√3	1	1	1.4	1.4	
Power Drift	5.0	R	√3	1	1	2.9	2.9	SAR
TEST ARCH AND SETUP RELATED								
Test Arch Thickness	2.4	R	√3	1	0.67	1.4	0.9	
COMBINED STANDARD UNCERTAINTY						**14.7**	**10.9**	
Expanded Uncertainty on Power						**29.4**	**21.8**	
Expanded Uncertainty on Field						**14.7**	**10.9**	

7. RESULTS

The calculated maximum field values for the test device are tabulated below:

850MHz RF emissions test results

Option used	Test configuration	Ch 128 824.2MHz	Ch 190 836.6MHz	Ch 251 848.8MHz
GSM850	Power	32.5 dBm	32.8 dBm	32.4 dBm
Flip open	E-field [V/M]	194.8	202.0	**218.9**
	H-field [A/m]	0.292	**0.292**	0.286
	Category	M3 (-5dB)	M3 (-5dB)	M3 (-5dB)

1900MHz RF emissions test results

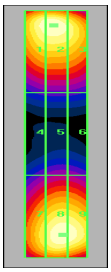
Option used	Test configuration	Ch 512 1850.2MHz	Ch 661 1880.0MHz	Ch 810 1909.8MHz
GSM 1900	Power	30.4 dBm	31.1 dBm	29.5 dBm
Flip open	E-field [V/M]	**65.6**	63.5	59.7
	H-field [A/m]	0.175	**0.180**	0.176
	Category	M3 (-5dB)	M3 (-5dB)	M3 (-5dB)

Plots of the measurement scans are shown in **Appendix B.** Excluded cells are colored orange.

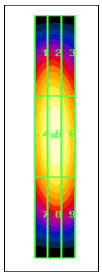
APPENDIX A: SYSTEM VALIDATION SCANS

SYSTEM VALIDATION DATA 850MHz

Date/Time: 2008-06-19 14:31:47 Test Laboratory: TCC Nokia **Type: D835V3; Serial: 1004**	Date/Time: 2008-06-19 14:16:52 Test Laboratory: TCC Nokia **Type: D835V3; Serial: 1004**
Communication System: CW835 Frequency: 835 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Dipole Section	Communication System: CW835 Frequency: 835 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Dipole Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333; Probe Notes: - ConvF(1, 1, 1); Calibrated: 21.01.2008 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 23.04.2008 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004 - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053; Probe Notes: - ; Calibrated: 21.01.2008 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 23.04.2008 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004 - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 173.5 V/m Probe Modulation Factor = 1.00 Device Reference Point: 0.000, 0.000, 354.7 mm Reference Value = 128.0 V/m; Power Drift = -0.009 dB **Hearing Aid Near-Field Category: M4 (AWF 0 dB)**	**H Scan - H3DV6 - measurement distance from the probe sensor center to CD835 Dipole = 10mm/Hearing Aid Compatibility Test (41x361x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.488 A/m Probe Modulation Factor = 1.00 Device Reference Point: 0.000, 0.000, 354.7 mm Reference Value = 0.520 A/m; Power Drift = -0.013 dB **Hearing Aid Near-Field Category: M4 (AWF 0 dB)**



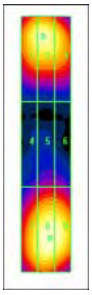
Grid 1 171.4 M4	Grid 2 173.5 M4	Grid 3 164.1 M4
Grid 4 86.1 M4	Grid 5 92.8 M4	Grid 6 92.1 M4
Grid 7 158.0 M4	Grid 8 173.2 M4	Grid 9 172.2 M4



Grid 1 0.416 M4	Grid 2 0.432 M4	Grid 3 0.401 M4
Grid 4 0.462 M4	Grid 5 0.488 M4	Grid 6 0.464 M4
Grid 7 0.395 M4	Grid 8 0.427 M4	Grid 9 0.412 M4

SYSTEM VALIDATION DATA 1900MHz

Date/Time: 2008-06-19 15:03:12 Test Laboratory: TCC Nokia **Type: CD1880V3; Serial: 1003**	Date/Time: 2008-06-19 14:07:07 Test Laboratory: TCC Nokia **Type: CD1880V3; Serial: 1003**
Communication System: CW1880 Frequency: 1880 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Dipole Section	Communication System: CW1880 Frequency: 1880 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Dipole Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333; Probe Notes: - ConvF(1, 1, 1); Calibrated: 21.01.2008 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 23.04.2008 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004 - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053; Probe Notes: - ; Calibrated: 21.01.2008 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 23.04.2008 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1004 - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 132.2 V/m Probe Modulation Factor = 1.00 Device Reference Point: 0.000, 0.000, 354.7 mm Reference Value = 137.1 V/m; Power Drift = -0.001 dB **Hearing Aid Near-Field Category: M2 (AWF 0 dB)**	**H Scan - H3DV6 - measurement distance from the probe sensor center to CD1880 Dipole = 10mm/Hearing Aid Compatibility Test (41x181x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.437 A/m Probe Modulation Factor = 1.00 Device Reference Point: 0.000, 0.000, 354.7 mm Reference Value = 0.463 A/m; Power Drift = -0.077 dB **Hearing Aid Near-Field Category: M2 (AWF 0 dB)**



Grid 1 127.1 M2	Grid 2 129.1 M2	Grid 3 123.3 M2
Grid 4 84.3 M3	Grid 5 90.3 M3	Grid 6 89.9 M3
Grid 7 123.7 M2	Grid 8 132.2 M2	Grid 9 131.0 M2

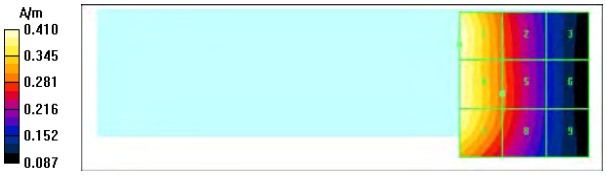
Grid 1 0.377 M2	Grid 2 0.396 M2	Grid 3 0.381 M2
Grid 4 0.413 M2	Grid 5 0.437 M2	Grid 6 0.422 M2
Grid 7 0.369 M2	Grid 8 0.393 M2	Grid 9 0.381 M2

APPENDIX B: MEASUREMENT SCANS

MEASUREMENT DATA GSM850, CHANNEL LOW (824.2 MHz)

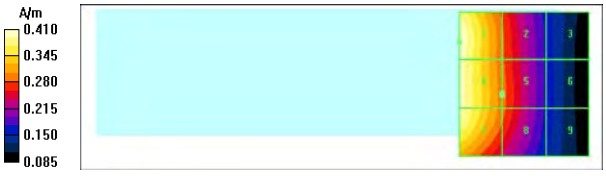
Date/Time: 2008-06-25 17:52:47 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:28:15 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM850 (ER3DV6) Frequency: 824.2 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM850 (H3DV6) Frequency: 824.2 MHz; Duty Cycle: 1:6.79 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 194.8 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 86.8 V/m; Power Drift = -0.116 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, Low/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.410 A/m Probe Modulation Factor = 2.61 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.097 A/m; Power Drift = -0.068 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

Grid 1 157.8 M3	Grid 2 193.9 M3	Grid 3 193.5 M3
Grid 4 158.4 M3	Grid 5 194.8 M3	Grid 6 194.7 M3
Grid 7 156.5 M3	Grid 8 180.2 M3	Grid 9 179.3 M3



Grid 1 0.410 M4	Grid 2 0.289 M4	Grid 3 0.169 M4
Grid 4 0.406 M4	Grid 5 0.292 M4	Grid 6 0.171 M4
Grid 7 0.399 M4	Grid 8 0.290 M4	Grid 9 0.169 M4

MEASUREMENT DATA GSM850, CHANNEL MIDDLE (836.6 MHz)

Date/Time: 2008-06-25 17:42:12 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:17:27 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM850 (ER3DV6) Frequency: 836.6 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM850 (H3DV6) Frequency: 836.6 MHz; Duty Cycle: 1:6.79 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 202.0 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 89.8 V/m; Power Drift = -0.044 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, mid/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.410 A/m Probe Modulation Factor = 2.61 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.097 A/m; Power Drift = -0.113 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**
	

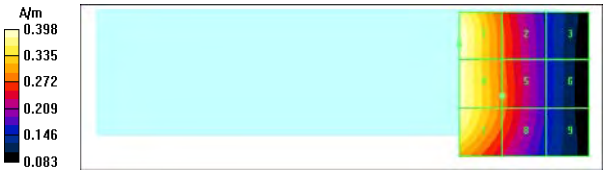
Grid 1 163.3 M3	Grid 2 200.9 M3	Grid 3 200.7 M3
Grid 4 164.6 M3	Grid 5 202.0 M3	Grid 6 201.8 M3
Grid 7 161.7 M3	Grid 8 187.6 M3	Grid 9 186.9 M3

Grid 1 0.410 M4	Grid 2 0.286 M4	Grid 3 0.167 M4
Grid 4 0.405 M4	Grid 5 0.292 M4	Grid 6 0.170 M4
Grid 7 0.399 M4	Grid 8 0.290 M4	Grid 9 0.168 M4

MEASUREMENT DATA GSM850, CHANNEL HIGH (848.8 MHz)

Date/Time: 2008-06-25 17:47:53 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:23:12 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM850 (ER3DV6) Frequency: 848.8 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM850 (H3DV6) Frequency: 848.8 MHz; Duty Cycle: 1:6.79 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 218.9 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 98.1 V/m; Power Drift = -0.026 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, high/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.398 A/m Probe Modulation Factor = 2.61 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.095 A/m; Power Drift = -0.033 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**

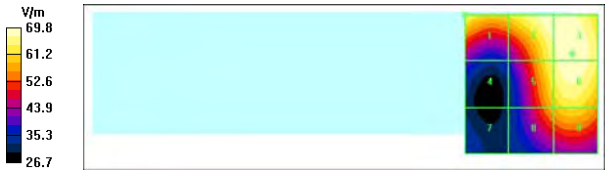
Grid 1 179.4 M3	Grid 2 218.3 M3	Grid 3 218.1 M3
Grid 4 180.8 M3	Grid 5 218.9 M3	Grid 6 218.7 M3
Grid 7 176.5 M3	Grid 8 202.4 M3	Grid 9 201.3 M3



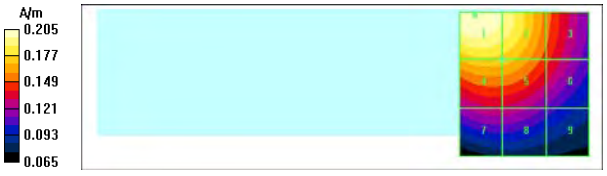
Grid 1 0.398 M4	Grid 2 0.280 M4	Grid 3 0.165 M4
Grid 4 0.395 M4	Grid 5 0.286 M4	Grid 6 0.167 M4
Grid 7 0.389 M4	Grid 8 0.284 M4	Grid 9 0.164 M4

MEASUREMENT DATA GSM1900, CHANNEL LOW (1850.2 MHz)

Date/Time: 2008-06-25 17:09:53 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:59:17 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM1900 (ER3DV6) Frequency: 1850.2 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM1900 (H3DV6) Frequency: 1850.2 MHz; Duty Cycle: 1:4.13 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, Low/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 69.8 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 22.0 V/m; Power Drift = -0.043 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, Low/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.205 A/m Probe Modulation Factor = 2.03 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.085 A/m; Power Drift = -0.010 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**

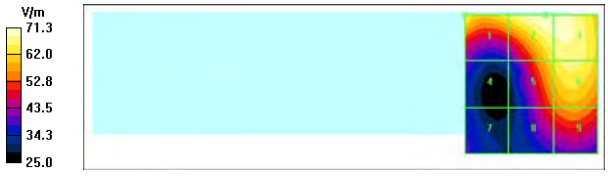
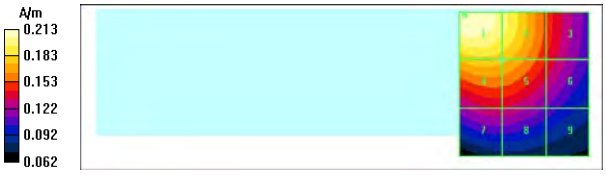


Grid 1 65.7 M3	Grid 2 69.1 M3	Grid 3 69.8 M3
Grid 4 42.5 M4	Grid 5 65.6 M3	Grid 6 69.5 M3
Grid 7 35.3 M4	Grid 8 58.1 M3	Grid 9 61.9 M3



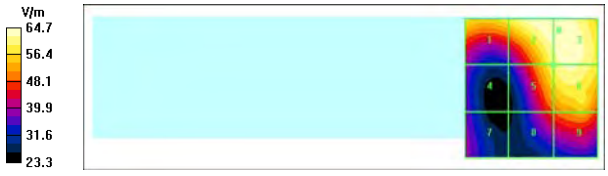
Grid 1 0.205 M3	Grid 2 0.196 M3	Grid 3 0.154 M3
Grid 4 0.175 M3	Grid 5 0.173 M3	Grid 6 0.144 M3
Grid 7 0.128 M4	Grid 8 0.128 M4	Grid 9 0.110 M4

MEASUREMENT DATA GSM1900, CHANNEL MIDDLE (1880 MHz)

Date/Time: 2008-06-25 16:53:34 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:47:41 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM1900 (ER3DV6) Frequency: 1880 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM1900 (H3DV6) Frequency: 1880 MHz; Duty Cycle: 1:4.13 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, Mid/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 71.3 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 21.7 V/m; Power Drift = -0.350 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, mid/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.213 A/m Probe Modulation Factor = 2.03 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.086 A/m; Power Drift = -0.040 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**
	
Grid 1 66.8 M3 / Grid 2 71.3 M3 / Grid 3 71.0 M3 Grid 4 42.1 M4 / Grid 5 63.5 M3 / Grid 6 66.9 M3 Grid 7 39.5 M4 / Grid 8 53.3 M3 / Grid 9 57.5 M3	Grid 1 0.213 M3 / Grid 2 0.198 M3 / Grid 3 0.150 M3 Grid 4 0.180 M3 / Grid 5 0.177 M3 / Grid 6 0.143 M3 Grid 7 0.132 M4 / Grid 8 0.132 M4 / Grid 9 0.111 M4

MEASUREMENT DATA GSM1900, CHANNEL HIGH (1909.8 MHz)

Date/Time: 2008-06-25 17:02:02 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**	Date/Time: 2008-06-25 18:54:20 Test Laboratory: TCC Nokia **Type: RM-429; Serial: 004401/10/063985/1**
Communication System: GSM1900 (ER3DV6) Frequency: 1909.8 MHz; Duty Cycle: 1:7.95 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1000 kg/m^3 Phantom section: E Device Section	Communication System: GSM1900 (H3DV6) Frequency: 1909.8 MHz; Duty Cycle: 1:4.13 Medium: Air; Medium Notes: Not Specified Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3 Phantom section: H Device Section
DASY4 Configuration: - Probe: ER3DV6 - SN2333 - ConvF(1, 1, 1); Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176	DASY4 Configuration: - Probe: H3DV6 - SN6053 - ; Calibrated: 2008-01-21 - Sensor-Surface: (Fix Surface) - Electronics: DAE4 Sn728; Calibrated: 2008-04-23 - Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: Not Specified - Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176
E Scan - ER3DV6 - measurement distance, sensor center to the Device = 15mm, High/Hearing Aid Compatibility Test (101x101x1): Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 64.7 V/m Probe Modulation Factor = 2.82 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 20.1 V/m; Power Drift = -0.036 dB **Hearing Aid Near-Field Category: M4 (AWF -5 dB)**	**H Scan - H3DV6 - measurement discance, sensor center to the Device = 15mm, high/Hearing Aid Compatibility Test (101x101x1):** Measurement grid: dx=5mm, dy=5mm Maximum value of peak Total field = 0.197 A/m Probe Modulation Factor = 2.03 Device Reference Point: 0.000, 0.000, 353.7 mm Reference Value = 0.086 A/m; Power Drift = -0.011 dB **Hearing Aid Near-Field Category: M3 (AWF -5 dB)**



Grid 1 58.5 M3	Grid 2 64.6 M3	Grid 3 64.7 M3
Grid 4 39.7 M4	Grid 5 59.7 M3	Grid 6 62.9 M3
Grid 7 39.0 M4	Grid 8 48.1 M3	Grid 9 53.5 M3

Grid 1 0.197 M3	Grid 2 0.186 M3	Grid 3 0.144 M3
Grid 4 0.176 M3	Grid 5 0.173 M3	Grid 6 0.140 M3
Grid 7 0.139 M4	Grid 8 0.138 M4	Grid 9 0.114 M4

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

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

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

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

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: ER3-2333_Jan08

CALIBRATION CERTIFICATE

Object	ER3DV6 - SN:2333
Calibration procedure(s)	QA CAL-02.v5 Calibration procedure for E-field probes optimized for close near field evaluations in air
Calibration date:	January 21, 2008
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe ER3DV6	SN: 2328	2-Oct-07 (SPEAG, No. ER3-2328_Oct07)	Oct-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 21, 2008

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

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Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: H3-6053_Jan08

CALIBRATION CERTIFICATE

Object	H3DV6 - SN:6053
Calibration procedure(s)	QA CAL-03.v5 Calibration procedure for H-field probes optimized for close near field evaluations in air
Calibration date:	January 21, 2008
Condition of the calibrated item	In Tolerance

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 (Calibrated by, Certificate No.)	Scheduled Calibration
Power meter E4419B	GB41293874	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41495277	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Power sensor E4412A	MY41498087	29-Mar-07 (METAS, No. 217-00670)	Mar-08
Reference 3 dB Attenuator	SN: S5054 (3c)	8-Aug-07 (METAS, No. 217-00719)	Aug-08
Reference 20 dB Attenuator	SN: S5086 (20b)	29-Mar-07 (METAS, No. 217-00671)	Mar-08
Reference 30 dB Attenuator	SN: S5129 (30b)	8-Aug-07 (METAS, No. 217-00720)	Aug-08
Reference Probe H3DV6	SN: 6182	2-Oct-07 (SPEAG, No. H3-6182_Oct07)	Oct-08
DAE4	SN: 654	20-Apr-07 (SPEAG, No. DAE4-654_Apr07)	Apr-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
RF generator HP 8648C	US3642U01700	4-Aug-99 (SPEAG, in house check Oct-07)	In house check: Oct-09
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-07)	In house check: Oct-08

	Name	Function	Signature
Calibrated by:	Katja Pokovic	Technical Manager	
Approved by:	Niels Kuster	Quality Manager	

Issued: January 21, 2008

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

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

S Schweizerischer Kalibrierdienst
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Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: CD835V3-1004_Feb07

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1004
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	February 13, 2007
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
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 (Calibrated by, Certificate No.)	Scheduled Calibration
DAE4	SN: 660	1-Mar-06 (SPEAG, No. DAE4-660_Mar06)	Calibration, Mar-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Calibration, Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Calibration, Dec-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB43310788	12-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-07
Power sensor HP 8481A	MY41093312	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Power sensor HP 8481A	MY41093315	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator R&S SMT06	SN: 100005	26-Jul-04 (SPEAG, in house check Nov-05)	In house check: Nov-07

	Name	Function	Signature
Calibrated by:	Claudio Leubler	Laboratory Technician	
Approved by:	Fin Bomholt	Technical Director	

Issued: March 6, 2007

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 180 mm
Frequency	**835 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.07 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**interpolated maximum**
Maximum measured	100 mW forward power	**0.452 A/m**

Uncertainty for H-field measurement: 8.2% (k=2)

E-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW forward power	161.7 V/m
Maximum measured above low end	100 mW forward power	158.3 V/m
Averaged maximum above arm	100 mW forward power	**160.0 V/m**

Uncertainty for E-field measurement: 12.8% (k=2)

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
800 MHz	16.8 dB	(42.5 – j11.2) Ohm
835 MHz	**26.1 dB**	**(52.9 + j4.2) Ohm**
900 MHz	15.6 dB	(57.3 – j16.4) Ohm
950 MHz	24.7 dB	(45.3 + j2.9) Ohm
960 MHz	19.1 dB	(51.7 + j11.2) Ohm

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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

3.3.2 DASY4 H-Field Result

Date/Time: 2/13/2007 10:40:13 AM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1004

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section

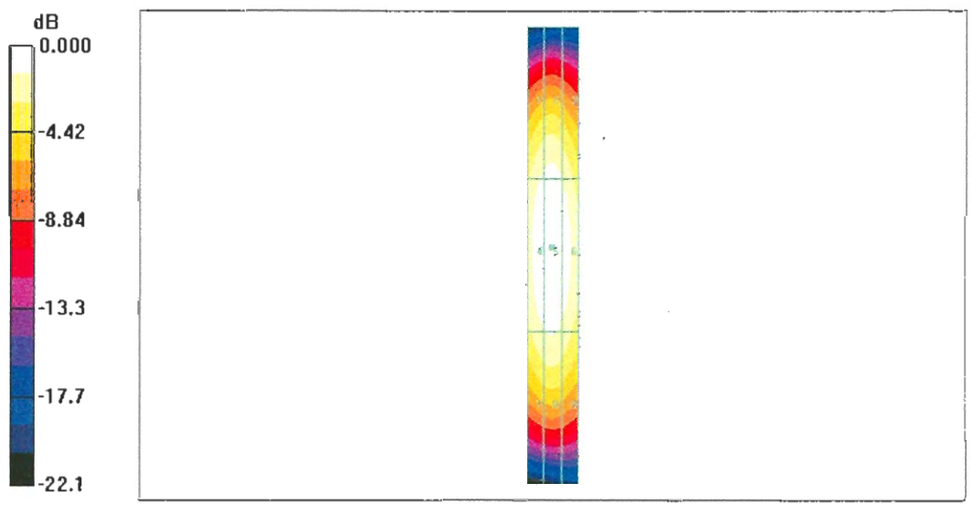
DASY4 Configuration:

- Probe: H3DV6 - SN6065: : Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660: Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

H Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.452 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.479 A/m; Power Drift = 0.012 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.393**	Grid 2 **0.408**	Grid 3 **0.380**
Grid 4 **0.436**	Grid 5 **0.452**	Grid 6 **0.425**
Grid 7 **0.374**	Grid 8 **0.387**	Grid 9 **0.365**



0 dB = 0.452A/m

3.3.3 DASY4 E-Field Result

Date/Time: 2/13/2007 2:25:30 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1004

Communication System: CW; Frequency: 835 MHz;Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section

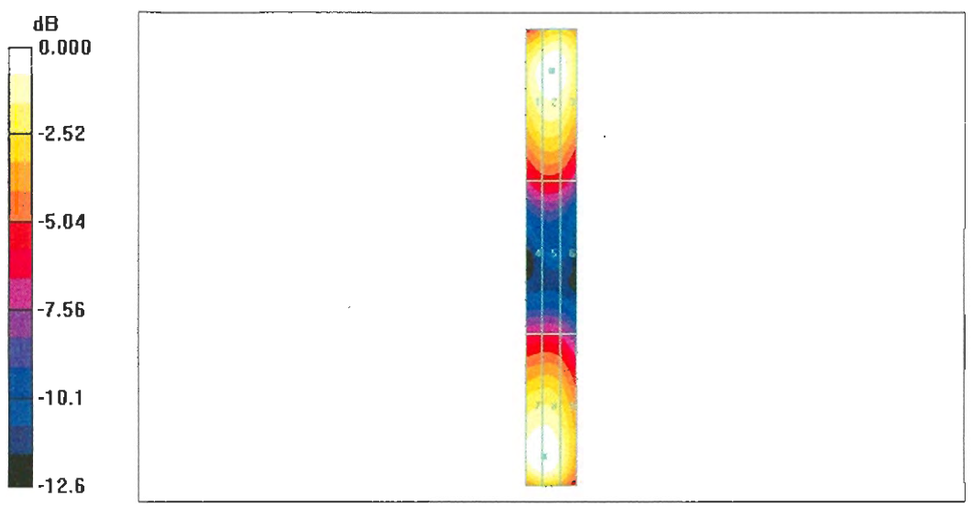
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD835 Dipole/Hearing Aid Compatibility Test (41x361x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 161.7 V/m
Probe Modulation Factor = 1.00
Reference Value = 107.2 V/m; Power Drift = 0.001 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **153.2**	Grid 2 **158.3**	Grid 3 **154.4**
Grid 4 **84.7**	Grid 5 **85.8**	Grid 6 **82.6**
Grid 7 **161.6**	Grid 8 **161.7**	Grid 9 **143.5**



0 dB = 161.7V/m

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
Swiss Calibration Service

Accredited by the Swiss Federal Office of Metrology and Accreditation
The Swiss Accreditation Service is one of the signatories to the EA Multilateral Agreement for the recognition of calibration certificates

Accreditation No.: SCS 108

Client **Nokia Salo TCC**

Certificate No: CD1880V3-1003_Feb07

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1003
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	February 12, 2007
Condition of the calibrated item	In Tolerance

This calibration certificate documents the traceability to national standards, which realize the physical units of measurements (SI).
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 (Calibrated by, Certificate No.)	Scheduled Calibration
DAE4	SN: 660	1-Mar-06 (SPEAG, No. DAE4-660_Mar06)	Calibration, Mar-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Calibration, Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Calibration, Dec-07

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB43310788	12-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-07
Power sensor HP 8481A	MY41093312	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Power sensor HP 8481A	MY41093315	10-Aug-03 (SPEAG, in house check Oct-06)	In house check: Oct-08
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator R&S SMT06	SN: 100005	26-Jul-04 (SPEAG, in house check Nov-05)	In house check: Nov-07

	Name	Function	Signature
Calibrated by:	Mike Meili	Laboratory Technician	M. Meili
Approved by:	Fin Bomholt	Technical Director	F. Bomholt

Issued: February 14, 2007

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B53
DASY PP Version	SEMCAD	V1.8 B172
Phantom	HAC Test Arch	SD HAC P01 BA, #1002
Distance Dipole Top - Probe Center	10 mm	
Scan resolution	dx, dy = 5 mm	area = 20 x 90 mm
Frequency	**1880 MHz** ± 1 MHz	
Forward power at dipole connector	20.0 dBm = 100mW	
Input power drift	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured	100 mW forward power	**0.452 A/m**

Uncertainty for H-field measurement: 8.2% (k=2)

E-field 10 mm above dipole surface	condition	**Interpolated maximum**
Maximum measured above high end	100 mW forward power	130.9 V/m
Maximum measured above low end	100 mW forward power	126.7 V/m
Averaged maximum above arm	100 mW forward power	**128.8 V/m**

Uncertainty for E-field measurement: 12.8% (k=2)

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1710 MHz	19.0 dB	(49.8 + j11.3) Ohm
1880 MHz	**19.9 dB**	**(53.7 + j9.9) Ohm**
1900 MHz	19.8 dB	(56.3 + j9.0) Ohm
1950 MHz	23.7 dB	(57.0 – j0.7) Ohm
2000 MHz	26.2 dB	(45.4 + j0.7) Ohm

3.2 Antenna Design and Handling

The calibration dipole has a symmetric geometry with a built-in two stub matching network, which leads to the enhanced bandwidth.
The dipole is built of standard semirigid coaxial cable. The internal matching line is open ended. The antenna is therefore open for DC signals.
Do not apply force to dipole arms, as they are liable to bend. The soldered connections near the feedpoint may be damaged. After excessive mechanical stress or overheating, check the impedance characteristics to ensure that the internal matching network is not affected.

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

3.3.2 DASY4 H-Field Result

Date/Time: 2/12/2007 4:55:48 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section

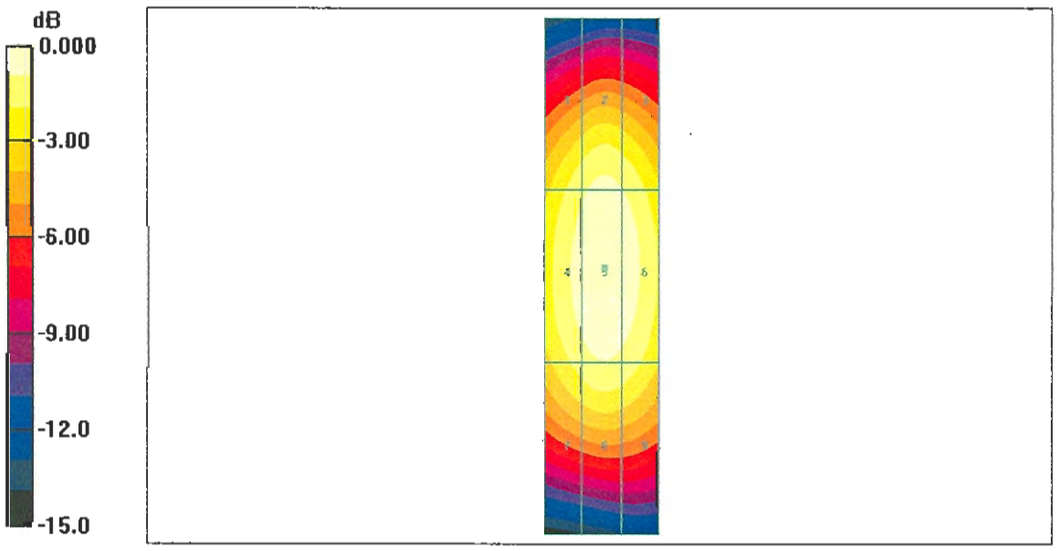
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

H Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 0.452 A/m
Probe Modulation Factor = 1.00
Reference Value = 0.476 A/m; Power Drift = 0.007 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.392**	Grid 2 **0.419**	Grid 3 **0.404**
Grid 4 **0.425**	Grid 5 **0.452**	Grid 6 **0.437**
Grid 7 **0.378**	Grid 8 **0.401**	Grid 9 **0.388**



0 dB = 0.452A/m

3.3.3 DASY4 E-Field Result

Date/Time: 2/12/2007 2:59:33 PM

Test Laboratory: SPEAG, Zurich, Switzerland

DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1003

Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium: Air
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section

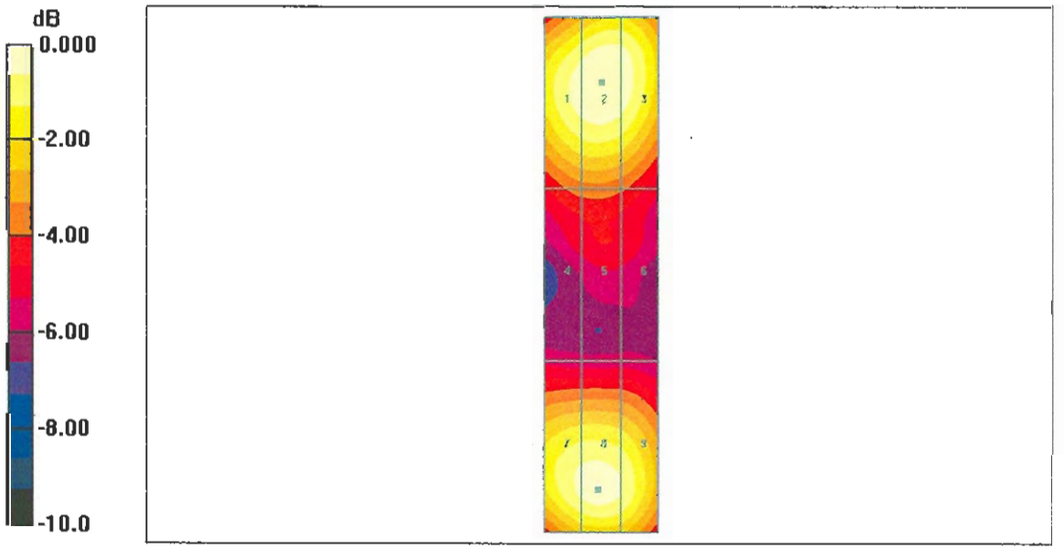
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 12/27/2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn660; Calibrated: 3/1/2006
- Phantom: HAC Test Arch 4.6; Type: SD HAC P01 BA; Serial: 1002
- Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172

E Scan - Sensor Center 10mm above CD1880V3 Dipole/Hearing Aid Compatibility Test (41x181x1):
Measurement grid: dx=5mm, dy=5mm
Maximum value of peak Total field = 130.9 V/m
Probe Modulation Factor = 1.00
Reference Value = 139.0 V/m; Power Drift = 0.015 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **126.8**	Grid 2 **130.9**	Grid 3 **127.9**
Grid 4 **86.2**	Grid 5 **87.1**	Grid 6 **84.0**
Grid 7 **123.9**	Grid 8 **126.7**	Grid 9 **121.4**



0 dB = 130.9V/m