TCC Nokia

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T117 (EN ISO/IEC 17025)

HAC T-Coil Signal Test Report

Test report no.:	Salo_HAC_0749_04	**Date of report:**	2007-12-17
Template version:	3.0	**Number of pages:**	21
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Responsible test engineer:	Ari Orte	**Product contact person:**	Dai Xuejun
Measurements made by:	Ari Orte		
Tested devices:	RM-391 (Hearing aid mode)		
FCC ID:	QTLRM-391		
Supplement reports:	Salo_HAC_0749_03		
Testing has been carried out in accordance with:	**ANSI C63.19-2006** 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:

Digitally signed by Ari Orte
Date: 2007.12.17 14:53:43 +02'00'

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1. SUMMARY OF HAC T-COIL SIGNAL TEST REPORT

1.1 Test Details

Period of test	2007-11-29 to 2007-11-30
SN, HW, SW and EUT numbers of tested device	SN: 001004/00/261411/4, HW: 0424, SW: Pt06w47_07w46_fam, DUT: 12371
Batteries used in testing	BL-4B, EUT: 12355, 12356
State of sample	Prototype unit
Notes	AWF = -5

1.2 Summary of T-Coil Test Results

1.2.1 T-Coil Coupling Field Intensity

1.2.1.1 Axial Field Intensity

Mode	Minimum limit [dB (A/m)]	Result [dB (A/m)]	Verdict
GSM850	-13	22.8	Pass
GSM1900	-13	22.7	Pass

1.2.1.2 Radial Field Intensity

Mode	Minimum limit [dB (A/m)]	Minimum Result [dB (A/m)]	Verdict
GSM850	-18	11.5	Pass
GSM1900	-18	12.9	Pass

1.2.2 Frequency Response at Axial Measurement Point

Mode	Verdict
GSM850	Pass
GSM1900	Pass

1.2.3 Signal Quality

Mode	Minimum limit [dB]				Minimum result [dB]	Category assessment
	T1	T2	T3	T4		
GSM850	-15	-5	5	15	50.5	T4
GSM1900	-15	-5	5	15	56.0	T4

1.2.4 Overall HAC rating of the tested device

Mode	RF emissions category at T-coil axial measurement point (E- and H-fields)*	Category assessment, T-Coil signal quality	HAC category of the tested device (RF emissions and T-coil requirements combined)
GSM850	M3	T4	M3/T3
GSM1900	M3	T4	

*See separate report 'Salo_HAC_0749_03.pdf'

2. DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)

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

2.1 Picture of Device

See HAC RF Emissions Test Report 'Salo_HAC_0749_03.pdf'

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	20.4 to 22.2
Ambient humidity (RH %):	31 to 39

3.2 WD Control

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. Speech coding was processed with EFR speech codec for GSM.

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

In all operating bands the measurements were performed on middle channel.

3.3 WD Parameters

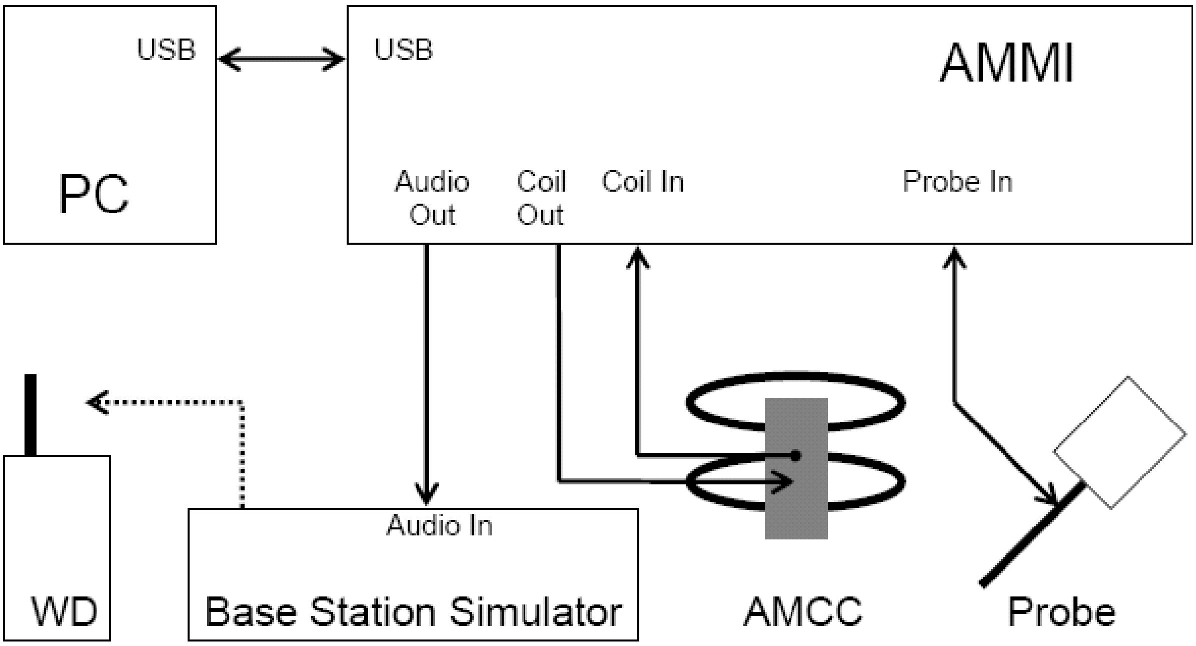
HAC mode was switched on from the WD user interface, volume setting was set to maximum and microphone was muted.

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 software version 4.7, manufactured by Schmid & Partner Engineering AG (SPEAG) in Switzerland.

Components and signal paths of used measurement system are pictured below:



The following table lists calibration dates of measurement equipment:

Test Equipment	Serial Number	Calibration interval	Calibration expiry
DAE4	555	12 months	2008-03
R&S CMU200 Radio Communication Test Set	101111	12 months	2008-07
AM1DV3 Audio Magnetic Probe	3036	12 months	2008-02
AMMI Audio Magnetic Measurement Instrument	1002	-	-
AMCC Helmholtz Audio Magnetic Calibration Coil	1004	-	-

4.1.1 Audio Magnetic Probe AM1DV3

Construction	Fully RF shielded metal construction (RF sensitivity < -100dB)
System calibration	Calibrated using Helmholtz coil according to manufacturers instructions
Frequency range	0.1 – 20 kHz (HOX! test signal is limited to required BW of 300 to 3000 Hz, ANSI C63.19)
Sensitivity	< -50 dB A/m
Dimensions	Overall length: 290 mm; Tip diameter: 6 mm

4.1.2 Audio Magnetic Measurement Instrument AMMI

Sampling Rate	48 kHz / 24 bit
Dynamic Range	85 dB
Test Signal Generation	User selectable and predefined (via PC)
System calibration	Auto-calibration / full system calibration using AMCC with monitor output

4.1.3 Audio Magnetic Calibration Coil AMCC

Dimensions	370 x 370 x 196 mm (ANSI-C63.19 compliant)

4.1.4 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 Verification of the System

Audio Magnetic Probe AM1D is calibrated in AMCC Helmholtz Audio Magnetic Calibration Coil before each measurement procedure using calibration and reference signals.

R&S CMU200 audio codec and SPEAG AMMI audio paths (gain) were calibrated according to manufacturer's instructions.

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 positioner under Test Arch.

Device holder and Test Arch supplied by SPEAG

5.2 Test Positions

The device was positioned such that Device Reference Plane was touching the bottom of the Test Arch. The acoustic output is aligned with the intersection of the Test Arch's middle bar and dielectric wire. The WD is positioned always this way to ensure repeatability of the measurements. Coordinate system depicted below is used to define exact locations of measurement points relative to the center of the acoustic output.

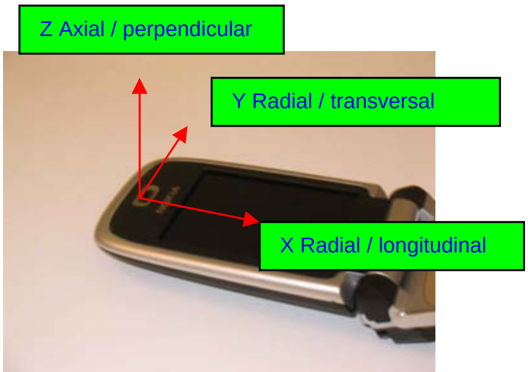


Photo of the device positioned under Test Arch and coordinate system (The EUT in picture is generic phone sample and does not represent the actual equipment under test)

5.3 T-coil Scan Procedures

Manufacturer can either define measurement locations for WD categorization or optimum locations can be found using following procedure; First, coarse scans in all measurement orientations, centered at the earpiece, are made to find approximate locations of optimum signal. More accurate fine scans are made in these locations to find final measurement points.

5.4 Measurement procedure and used test signals

During measurements signal is fed to WD via communication tester. Proper gain setting is used in software to ensure correct signal level fed to communication tester speech input. Measurement software compares fed signal and signal from measurement probe and applies proper filtering and integration procedures.

Broadband voice-like signal (300...3000Hz) is used during scans and frequency response measurement to ensure proper operation of WD vocoder and audio enhancement algorithms.

Both signal (ABM1) and undesired audio noise (ABM2) are measured consequently to enable determination of signal+noise to noise ratio (SNR).

In final measurement sine signal is used to determine signal strength @ 1025 Hz.

5.5 T-coil Requirements and Category Limits

RF Emissions

Wireless device has to fulfill RF emission requirements at the axial measurement location.

Axial Field Intensity

The axial component of the magnetic field shall be ≥-13dB(A/m) at 1 kHz, in 1/3 octave band filter.

Radial Field Intensity

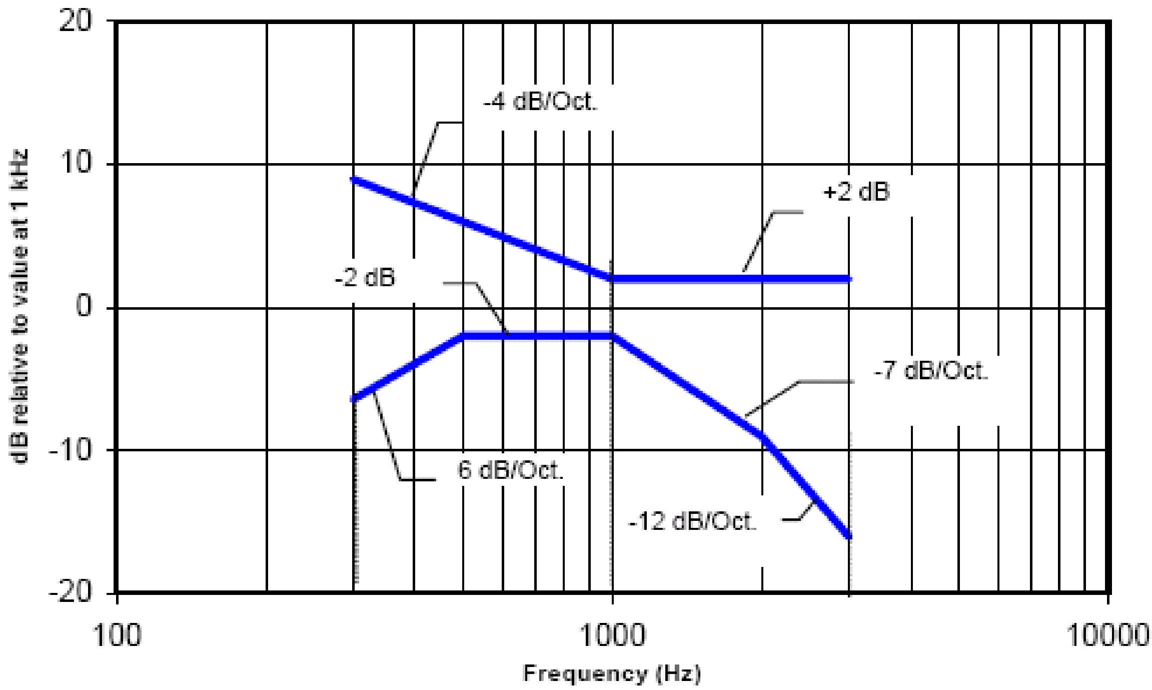
The radial components of the magnetic field shall be ≥-18dB(A/m) at 1 kHz, in 1/3 octave band filter.

Signal Quality
The worst result of three T-coil signal measurements is used to define WD Hearing Aid T-category according to the category limits:

Category	T1	T2	T3	T4
Limits for Signal Quality AWF 0 [dB]	-20	-10	0	10
Limits for Signal Quality AWF -5 [dB]	-15	-5	5	15

Frequency Response

Frequency response of the axial component must be between the limits pointed by frequency curves below:



Frequency response window applicable for devices with axial field strength > -10dB(A/m)

6. MEASUREMENT UNCERTAINTY

Source of Uncertainty	Tolerance ±%	Probability Distribution	Div.	c ABM1	c ABM2	Standard Uncertainty ±%, ABM1	Standard Uncertainty ±%, ABM2
PROBE SENSITIVITY							
Reference level	3.0	N	1.0	1	1	3.0	3.0
AMCC geometry	0.4	R	√3	1	1	0.2	0.2
AMCC current	0.6	R	√3	1	1	0.4	0.4
Probe positioning during calibration	0.1	R	√3	1	1	0.1	0.1
Noise contribution	0.7	R	√3	0.0143	1	0.0	0.4
Frequency slope	5.9	R	√3	0.1	1.0	0.3	3.5
PROBE SYSTEM							
Repeatability / Drift	1.0	R	√3	1	1	0.6	0.6
Linearity / Dynamic range	0.6	R	√3	1	1	0.4	0.4
Acoustic noise	1.0	R	√3	0.1	1	0.1	0.6
Probe angle	2.3	R	√3	1	1	1.4	1.4
Spectral processing	0.9	R	√3	1	1	0.5	0.5
Integration time	0.6	N	1.0	1	5	0.6	3.0
Field disturbation	0.2	R	√3	1	1	0.1	0.1
TEST SIGNAL							
Reference signal spectral response	0.6	R	√3	0	1	0.0	0.4
POSITIONING							
Probe positioning	1.9	R	√3	1	1	1.1	1.1
Phantom thickness	0.9	R	√3	1	1	0.5	0.5
EUT Positioning	1.9	R	√3	1	1	1.1	1.1
EXTERNAL CONTRIBUTIONS							
RF interference	0.0	R	√3	1	1	0.0	0.0
Test signal variation	2.0	R	√3	1	1	1.2	1.2
COMBINED UNCERTAINTY							
Combined Standard Uncertainty (ABM field)						4.1	6.1
Expanded Standard Uncertainty [%]						8.1	12.3

7. RESULTS

Measurement location coordinates are defined as deviation from earpiece center in millimeters. Coordinate system is defined in chapter 4.2

Axial measurement location was defined by the manufacturer of the device as the center of the earpiece. Maximum values for axial field are listed for informative purposes although results at earpiece center were used in evaluating T-category of the device.

GSM 850 results

	Radial 1 (longitudinal)		Radial 2 (transversal)		Axial			
					Max signal		Earpiece	
	x	y	x	y	x	y	x	y
Measurement location (x,y) [mm]	-15.8	16.6	-5	6.4	-3	14.2	0	0
Signal strength [dB A/m]	11.5		22.9		22.9		22.8	
ABM2 [dB A/m]	-39.0		-43.1		-38.0		-38.7	
Signal quality [dB]	50.5		66.0		60.9		61.5	
Ambient background noise at point (0,0) ABM [dB A/m]	-54.1		-54.1		-54.1		-54.1	

GSM 1900 results

	Radial 1 (longitudinal)		Radial 2 (transversal)		Axial			
					Max signal		Earpiece	
	x	y	x	y	x	y	x	y
Measurement location (x,y) [mm]	-13.2	14.6	-1.8	7.4	-2.2	13	0	0
Signal strength [dB A/m]	12.9		23.4		22.9		22.7	
ABM2 [dB A/m]	-43.1		-42.8		-39.6		-39.8	
Signal quality [dB]	56.0		66.2		62.5		62.5	
Ambient background noise at point (0,0) ABM [dB A/m]	-54.1		-54.1		-54.1		-54.1	

Plots of the signal strength measurement scans are presented in Appendix A.

APPENDIX A: MEASUREMENT SCANS

Axial Measurements, GSM850

Date/Time: 11/30/2007 14:45:31
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM850
Frequency: 836.6 MHz; Duty Cycle: 1:7
Medium: Air; Medium Notes: Not Specified
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: AMB with Coil Section

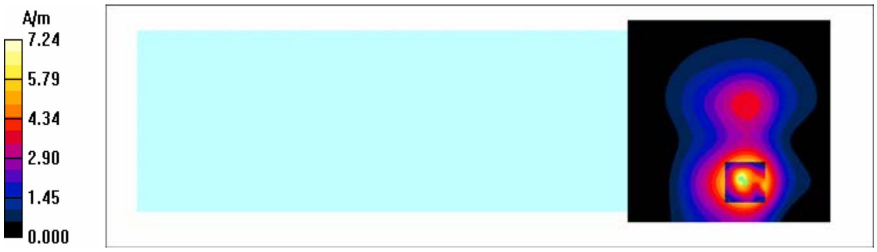
DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Coarse scan/z (axial) scan 50 x 50 (grid 10) with noise/ABM Interpolated Signal(x,y,z) (51x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 17.1908 dB A/m
BWC Factor = 10.8 dB
Location: -4, 15, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Interpolated Signal(x,y,z) (51x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 15.1826 dB A/m
BWC Factor = 10.8 dB
Location: -3, 14.2, 363.7 mm

Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 22.8744 dB A/m
BWC Factor = 0.00408141 dB
Location: -3, 14.2, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 60.8702 dB
BWC Factor = 0.00408141 dB
Location: -3, 14.2, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -37.9959 dB A/m
Location: -3, 14.2, 363.7 mm

Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 22.7801 dB A/m
BWC Factor = 0.00408141 dB
Location: 0, 0, 363.7 mm
Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 61.5263 dB
BWC Factor = 0.00408141 dB
Location: 0, 0, 363.7 mm
Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -38.7462 dB A/m
Location: 0, 0, 363.7 mm



Background noise 5mm above Grid Reference/z (axial) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.1082 dB A/m
Location: 0, 0, 368.7 mm

Axial Measurements GSM1900

Date/Time: 12/4/2007 10:38:17
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM1900
Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: Air; Medium Notes: Not Specified
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: AMB with Coil Section

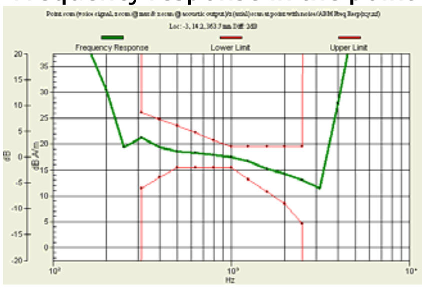
DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 22.8871 dB A/m
BWC Factor = 0.00642518 dB
Location: -2.2, 13, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 62.4948 dB
BWC Factor = 0.00642518 dB
Location: -2.2, 13, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -39.6077 dB A/m
Location: -2.2, 13, 363.7 mm

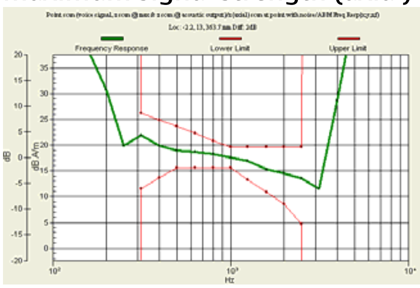
Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 22.7288 dB A/m
BWC Factor = 0.00642518 dB
Location: 0, 0, 363.7 mm
Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 62.5338 dB
BWC Factor = 0.00642518 dB
Location: 0, 0, 363.7 mm
Point scan (sinewave signal, z scan @ acoustic output)/z (axial) scan at point of ACOUSTIC OUTPUT with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -39.805 dB A/m
Location: 0, 0, 363.7 mm

Background noise 5mm above Grid Reference/z (axial) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.0687 dB A/m
Location: 0, 0, 368.7 mm

Frequency response in the point of maximum signal strength (axial)

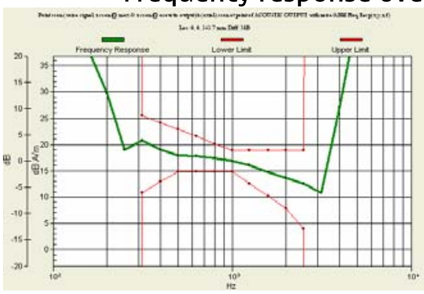


GSM850

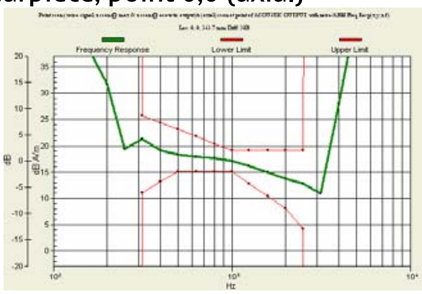


GSM1900

Frequency response over earpiece, point 0,0 (axial)



GSM850



GSM1900

Radial1 Measurements GSM850

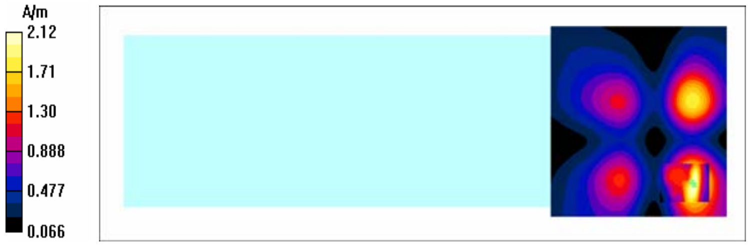
Date/Time: 11/30/2007 14:50:03
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM850
Frequency: 836.6 MHz; Duty Cycle: 1:7
Medium: Air; Medium Notes: Not Specified
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: AMB with Coil Section

DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Coarse scan/x (longitudinal) scan 50 x 50 (grid 10) with noise/ABM Interpolated Signal(x,y,z) (51x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 6.5148 dB A/m
BWC Factor = 10.8 dB
Location: -15, 16, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Interpolated Signal(x,y,z) (71x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 6.58983 dB A/m
BWC Factor = 10.8 dB
Location: -15.8, 16.6, 363.7 mm

Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal)
scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 11.5271 dB A/m
BWC Factor = 0.00408141 dB
Location: -15.8, 16.6, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal)
scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 50.5045 dB
BWC Factor = 0.00408141 dB
Location: -15.8, 16.6, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal)
scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -38.9774 dB A/m
Location: -15.8, 16.6, 363.7 mm



Background noise 5mm above Grid Reference/x (longitudinal) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.144 dB A/m
Location: 0, 0, 368.7 mm

Radial1 Measurements GSM1900

Date/Time: 12/4/2007 10:42:47
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM1900
Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: Air; Medium Notes: Not Specified
Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Phantom section: AMB with Coil Section

DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 12.8898 dB A/m
BWC Factor = 0.00642518 dB
Location: -13.2, 14.6, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 55.998 dB
BWC Factor = 0.00642518 dB
Location: -13.2, 14.6, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/x (longitudinal) scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -43.1082 dB A/m
Location: -13.2, 14.6, 363.7 mm

Background noise 5mm above Grid Reference/x (longitudinal) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.1455 dB A/m
Location: 0, 0, 368.7 mm

Radial2 Measurements GSM850

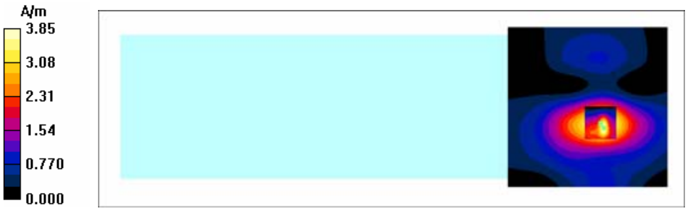
Date/Time: 11/30/2007 14:54:41
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM850
Frequency: 836.6 MHz; Duty Cycle: 1:7
Medium: Air; Medium Notes: Not Specified
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: AMB with Coil Section

DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Coarse scan/y (transversal) scan 50 x 50 (grid 10) with noise/ABM Interpolated Signal(x,y,z) (51x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 11.7188 dB A/m
BWC Factor = 10.8 dB
Location: -4, 5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Interpolated Signal(x,y,z) (51x51x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 = 16.5808 dB A/m
BWC Factor = 10.8 dB
Location: -5, 6.4, 363.7 mm

Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 22.9069 dB A/m
BWC Factor = 0.00408141 dB
Location: -5, 6.4, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 66.056 dB
BWC Factor = 0.00408141 dB
Location: -5, 6.4, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -43.1491 dB A/m
Location: -5, 6.4, 363.7 mm



Background noise 5mm above Grid Reference/y (transversal) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.1712 dB A/m
Location: 0, 0, 368.7 mm

Radial2 Measurements GSM1900

Date/Time: 12/4/2007 10:47:24
Test Laboratory: TCC Nokia
Type: RM-391; Serial: 001004/00/261411/4
Communication System: GSM1900
Frequency: 1880 MHz; Duty Cycle: 1:8.3
Medium: Air; Medium Notes: Not Specified
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: AMB with Coil Section

DASY4 Configuration:
- Probe: AM1DV3 - 3036; Calibrated: 2/16/2007
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE4 Sn555; Calibrated: 3/15/2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1004
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1 comp = 23.3846 dB A/m
BWC Factor = 0.00642518 dB
Location: -1.8, 7.4, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM1/ABM2 = 66.2107 dB
BWC Factor = 0.00642518 dB
Location: -1.8, 7.4, 363.7 mm
Point scan (sinewave signal, z,x,y scan @ max)/y (transversal) scan at point with noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -42.8261 dB A/m
Location: -1.8, 7.4, 363.7 mm

Background noise 5mm above Grid Reference/y (transversal) noise/ABM Noise(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Cursor:
ABM2 = -54.0996 dB A/m
Location: 0, 0, 368.7 mm

APPENDIX B: AUDIO MAGNETIC PROBE AM1DV3 S/N 3036 **CALIBRATION DOCUMENT**

Schmid & Partner Engineering AG

s p e a g

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info@speag.com, http://www.speag.com

Client Nokia Salo TCC

Certificate of test and configuration

Item	**AM1DV3** Audio Magnetic 1D Field Probe
Type No	SP AM1 001 BA
Series No	**3036**
Manufacturer / Origin	Schmid & Partner Engineering AG, Zürich, Switzerland

Description of the item

The Audio Magnetic Field Probe is a fully shielded magnetic field probe for the frequency range from 100 Hz to 20 kHz. The pickup coil is compliant with the dimensional requirements of [1]. The probe includes a symmetric 20dB low noise amplifier for the signal available at the shielded 3 pin connector at the side. Power is supplied via the same connector (phantom power supply) and monitored via the LED near the connector. The 7 pin connector at the end of the probe does not carry any signals, but determines the angle of the sensor when mounted on the DAE. The probe supports mechanical detection of the surface. The single sensor in the probe is arranged in a tilt angle allowing measurement of 3 orthogonal field components when rotating the probe by 120° around its axis. It is aligned with the perpendicular component of the field, if the probe axis is tilted 35.3° above the measurement plane, using the connector rotation and Sensor angle stated below.
The probe is fully RF shielded when operated with the matching signal cable (shielded) and allows measurement of audio magnetic fields in the close vicinity of RF emitting wireless devices according to [1] without additional shielding.

Handling of the item

The probe is manufactured from stainless steel. In order to maintain the performance and calibration of the probe, it must not be opened. The probe is designed for operation in air and shall not be exposed to humidity or liquids. For proper operation of the surface detection and emergency stop functions in the DASY4 system, the probe must be operated with the special probe cup provided (larger diameter). Verify that the probe can slide in the probe cup rubber smoothly.

Functional test, configuration data and sensitivity

The probe configuration data were evaluated after a functional test including noise level and RF immunity. Connector rotation, sensor angle and sensitivity are specific for this probe.

DASY4 configuration data for the probe

Configuration item	Condition	Configuration Data	Dimension
Overall length	mounted on DAE in DASY4 system	296	mm
Tip diameter	at the cylindrical part	6	mm
Sensor offset	center of sensor, from tip	3	mm
Connector rotation	Evaluated in homogeneous 1 kHz magnetic field generated with AMCC Helmholtz Calibration Coil	**-5.0**	°
Sensor angle		**1.31**	°
Sensitivity	at 1 kHz	**0.007364**	V / (A/m)

Standards [1] ANSI-C63.19-2006

Test date 16.02.2007 MM / FB

Issue date 16.02.2007

Signature F. Bomholt