

HAC T-Coil Signal Test Report

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Measurements made by:	Ari Orte		
Tested devices:	RM-207 (Hearing aid mode active), HW: 0002		
FCC ID:	QTKRM-207	IC:	
Supplement reports:	'Salo_HAC_0723_01.pdf'		
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:			

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1. SUMMARY OF HAC T-COIL SIGNAL TEST REPORT

1.1 Test Details

Period of test	2007-05-31
SN, HW, SW and EUT numbers of tested device	SN: 004401/01/289647/4, HW: 0002, SW: ws0647_07w15 DUT: 11939
Batteries used in testing	BL-5C, DUT: 10561, 11727, 11735
State of sample	Prototype unit
Notes	AWF = -5 for GSM, 0 for WCDMA

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	5.2	Pass
WCDMA1700(/2100)	-13	4.3	Pass
GSM1900	-13	4.5	Pass

1.2.1.2 Radial Field Intensity

Mode	Minimum limit [dB (A/m)]	Minimum Result [dB (A/m)]	Verdict
GSM 850	-18	7.2	Pass
WCDMA1700(/2100)	-18	6.2	Pass
GSM 1900	-18	6.2	Pass

1.2.2 Frequency Response at Axial Measurement Point

Mode	Verdict
GSM 850	Pass
WCDMA1700(/2100)	Pass
GSM 1900	Pass

1.2.3 Signal Quality

Mode	Minimum limit [dB]				Minimum result [dB]	Category
	T1	T2	T3	T4		
GSM 850	-15	-5	5	15	47.1	T4
WCDMA1700(/2100)	-20	-10	0	10	51.2	T4
GSM 1900	-15	-5	5	15	43.2	T4

Mode	RF emissions category at T-coil axial measurement point (E- and H-fields)*	HAC category of the tested device (RF emissions and T-coil requirements combined)
GSM 850	M3	M3/T3
WCDMA1700(/2100)	M4	M4/T4
GSM 1900	M3	M3/T3

*See separate report 'Salo_HAC_0723_01.pdf'

2. DESCRIPTION OF THE EQUIPMENT UNDER TEST (EUT)

Modes and Bands of Operation	GSM 850 / 1900	WCDMA 850 / 1700(/2100) / 1900
Modulation Mode	GMSK	QPSK
Duty Cycle	1/8	1
Transmitter Frequency Range (MHz)	824 – 849	826 – 847
	1850 - 1910	1712 - 1753 1852 - 1908

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

2.1 Picture of Device

*See HAC RF report 'Salo_HAC_0723_01.pdf'

3. TEST CONDITIONS

3.1 Temperature and Humidity

Ambient temperature (°C):	19.0 to 22.0
Ambient humidity (RH %):	45 to 65

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 and with AMR 12.2 kbps for WCDMA.

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

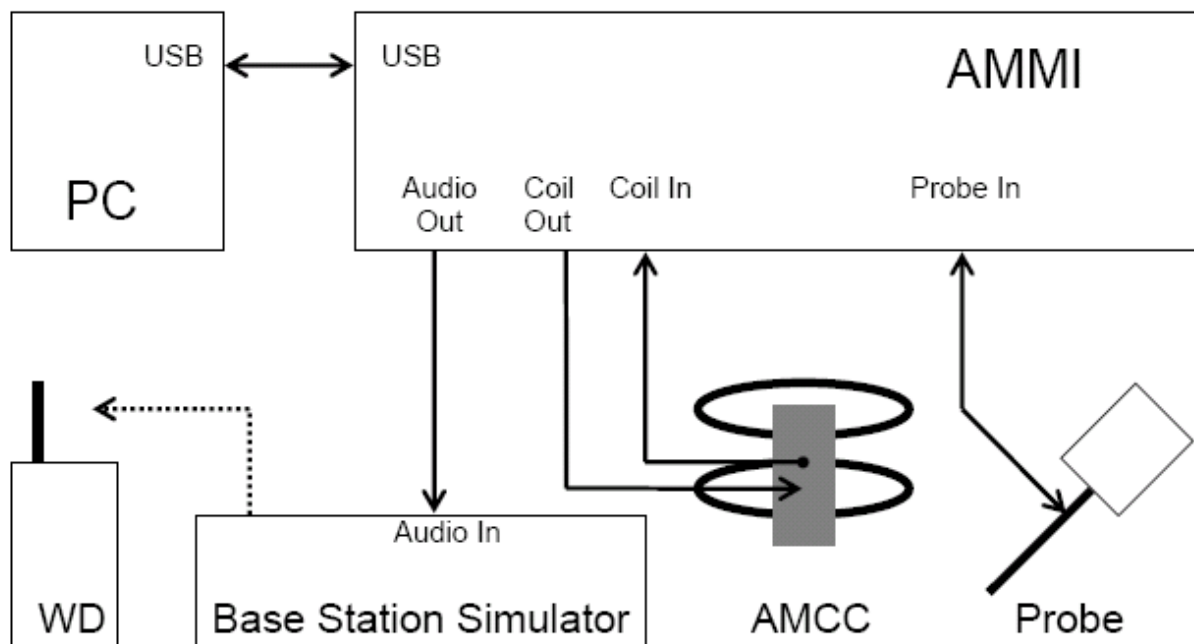
HAC mode was switched on from the WD user interface, volume setting was set to 5/10 and microphone was muted.

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
DAE V4	555	12 months	2008-03
R&S CMU200 Radio Communication Test Set	101111	12 months	2007-07
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)
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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 positioned 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.

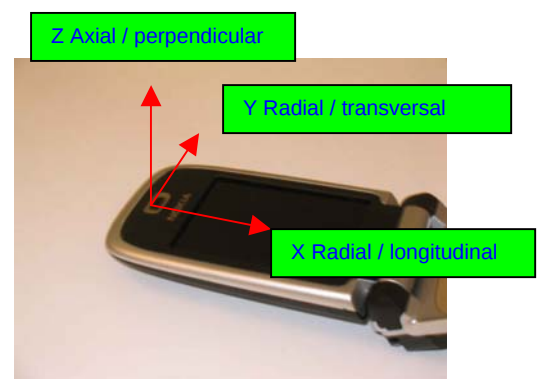


Photo of the device positioned under Test Arch and coordinate system (The EUT in picture is generic phone sample and does not represent the actual equipment under test)

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

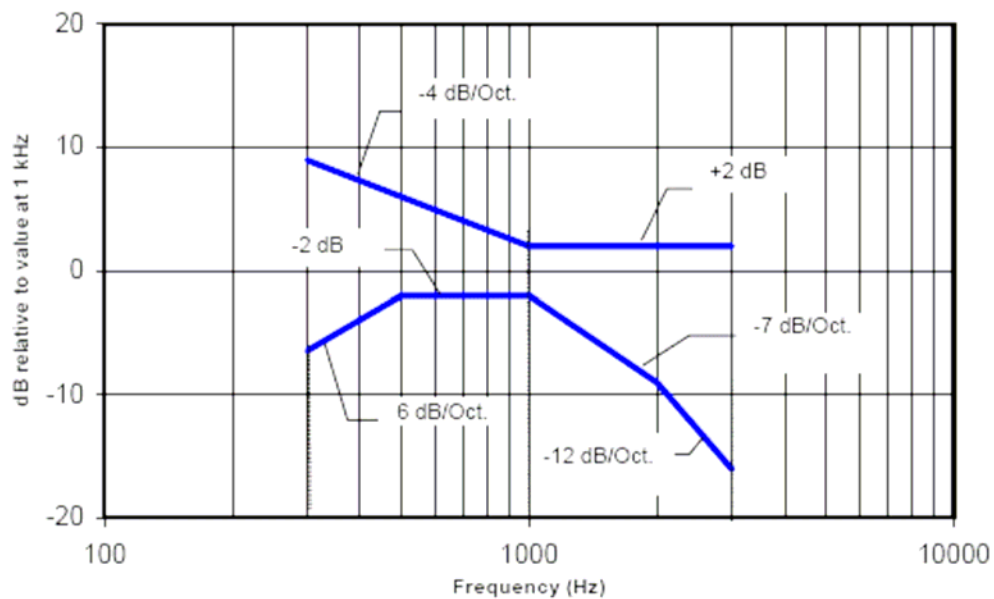
The axial component of the magnetic field shall be $\geq -13\text{dB(A/m)}$ at 1 kHz, in 1/3 octave band filter.

Radial Field Intensity

The radial components of the magnetic field shall be $\geq -18\text{dB(A/m)}$ at 1 kHz, in 1/3 octave band filter.

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)

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

6. MEASUREMENT UNCERTAINTY

Error Description	Uncertainty value [%]	Prob. Dist.	Div.	c ABM1	c ABM2	Std. Unc. ABM1 [%]	Std. Unc. ABM2 [%]
PROBE SENSITIVITY							
Reference level	3.0	N	1.0	1	1	3.0	3.0
AMCC geometry	0.4	R	1.7	1	1	0.2	0.2
AMCC current	0.6	R	1.7	1	1	0.4	0.4
Probe positioning during calibration	0.1	R	1.7	1	1	0.1	0.1
Noise contribution	0.7	R	1.7	0.0143	1	0.0	0.4
Frequency slope	5.9	R	1.7	0.1	1.0	0.3	3.5
PROBE SYSTEM							
Repeatability / Drift	1.0	R	1.7	1	1	0.6	0.6
Linearity / Dynamic range	0.6	R	1.7	1	1	0.4	0.4
Acoustic noise	1.0	R	1.7	0.1	1	0.1	0.6
Probe angle	2.3	R	1.7	1	1	1.4	1.4
Spectral processing	0.9	R	1.7	1	1	0.5	0.5
Integration time	0.6	N	1.0	1	5	0.6	3.0
Field disturbance	0.2	R	1.7	1	1	0.1	0.1
TEST SIGNAL							
Reference signal spectral response	0.6	R	1.7	0	1	0.0	0.4
POSITIONING							
Probe positioning	1.9	R	1.7	1	1	1.1	1.1
Phantom thickness	0.9	R	1.7	1	1	0.5	0.5
DUT positioning	1.9	R	1.7	1	1	1.1	1.1
EXTERNAL CONTRIBUTIONS							
RF interference	0.0	R	1.7	1	1	0.0	0.0
Test signal variation	2.0	R	1.7	1	1	1.2	1.2
COMBINED UNCERTAINTY							
Combined Std. uncertainty (ABM field)						4.1	6.1
Expanded Std. uncertainty [%]						8.1	12.3

7. RESULTS

Measurement position 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 but results at earpiece center were used in evaluating T-category of the device.

GSM results

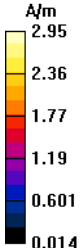
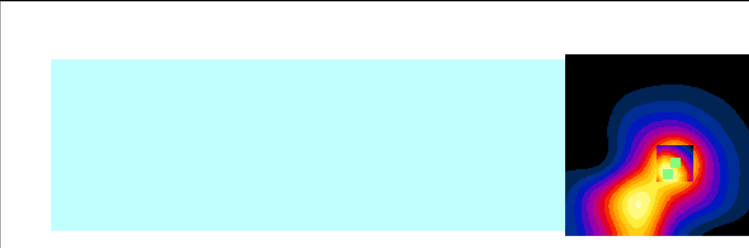
Mode	Radial 1 (longitudinal)		Radial 2 (transversal)		Axial			
	850	1900	850	1900	850		1900	
Measurement position (x,y) [mm]	1.2;13.2	0.8;15	1.2;13.2	2.4;13.8	-2.8;8	0;0	-2.8;8	0;0
Signal strength [dB A/m]	7.2	6.2	7.2	6.9	10.5	5.2	9.5	4.5
ABM2 [dB A/m]	-39.8	-38.7	-39.8	-44.7	-40.3	-42.1	-40.1	-38.7
Signal quality [dB]	47.1	44.8	47.1	51.6	50.8	47.3	49.6	43.2
Ambient background noise at point (0,0) ABM [dB A/m]	-52.2	-54.0	-53.9	-54.2	-53.5	-53.5	-49.9	-49.9

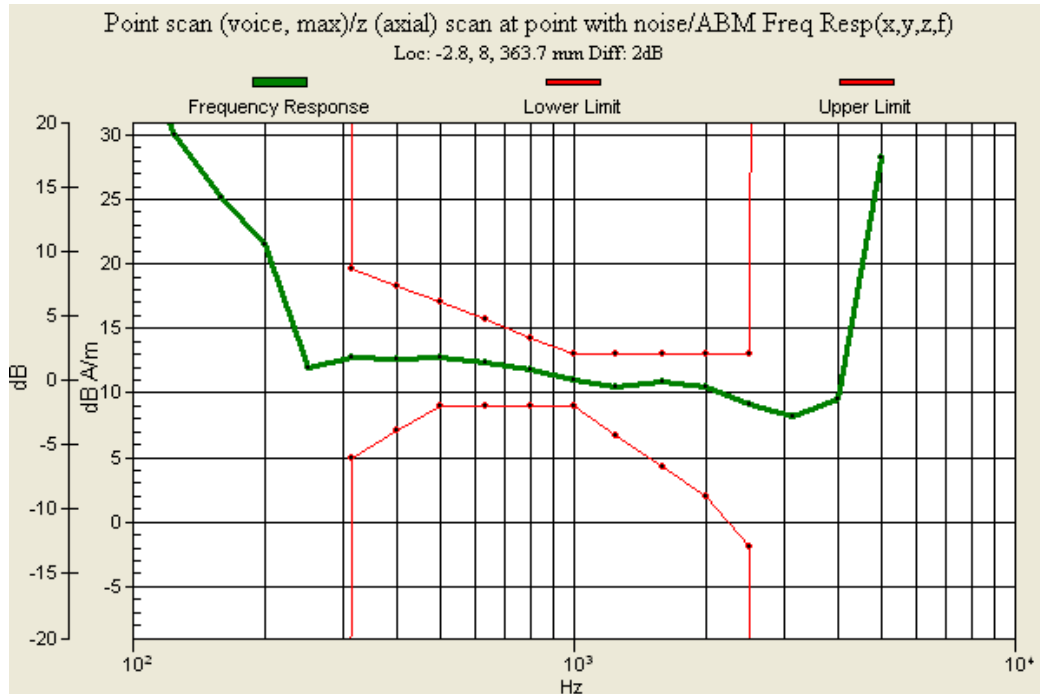
WCDMA 1700(/2100) results

	Radial 1 (longitudinal)	Radial 2 (transversal)	Axial	
Measurement position (x,y) [mm]	1;14.6	3;13.4	-3;8.8	0;0
Signal strength [dB A/m]	6.2	6.8	9.5	4.3
ABM2 [dB A/m]	-48.4	-44.5	-47.0	-48.3
Signal quality [dB]	54.6	51.2	56.5	52.7
Ambient background noise at point (0,0) ABM [dB A/m]	-53.8	-53.9	-53.7	-53.7

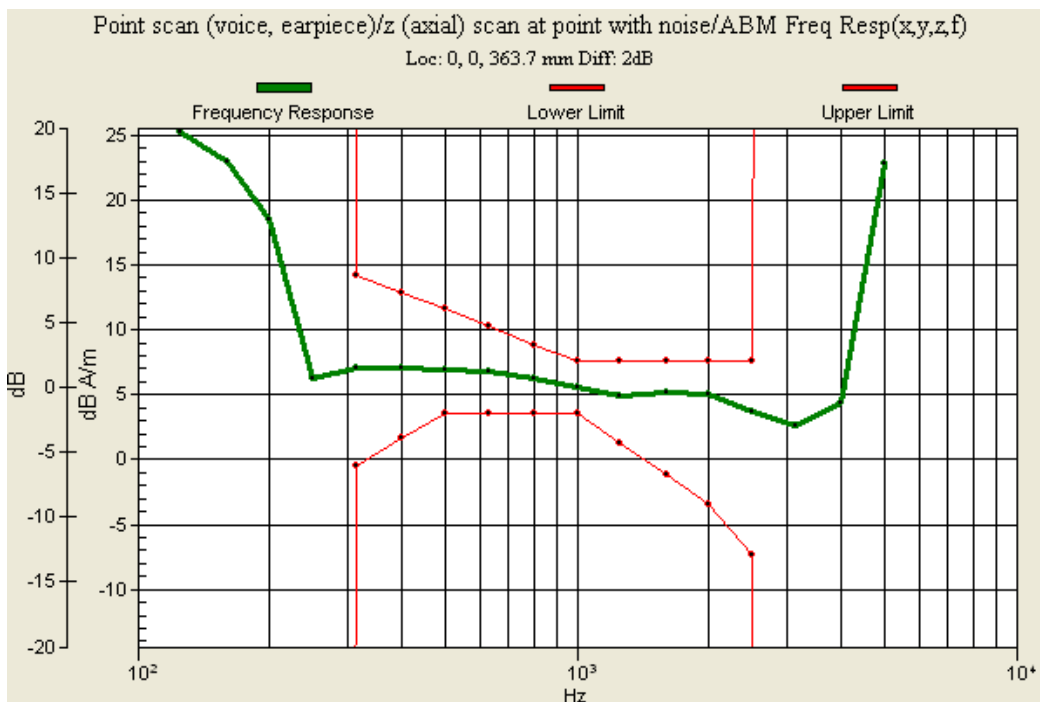
Plots of the signal strength measurement scans are presented in Appendix A.

APPENDIX A: MEASUREMENT SCANS, GSM

Date/Time: 2007-05-31 9:37:38 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM850 Frequency: 836.6 MHz; Duty Cycle: 1:7 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 9.39018 dB A/m BWC Factor = 10.8 dB Location: -5, 5, 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 = -53.5063 dB A/m Location: 0, 0, 368.7 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 = 10.938 dB A/m BWC Factor = 10.8 dB Location: -2.8, 8, 363.7 mm	
Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 10.5203 dB A/m BWC Factor = 0.0058176 dB Location: -2.8, 8, 363.7 mm	Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 5.22719 dB A/m BWC Factor = 0.00651198 dB Location: 0, 0, 363.7 mm
Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -40.291 dB A/m Location: -2.8, 8, 363.7 mm	Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -42.1155 dB A/m Location: 0, 0, 363.7 mm
Point scan (sinewave, max)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 50.8113 dB BWC Factor = 0.0058176 dB Location: -2.8, 8, 363.7 mm	Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 47.3427 dB BWC Factor = 0.00651198 dB Location: 0, 0, 363.7 mm
	

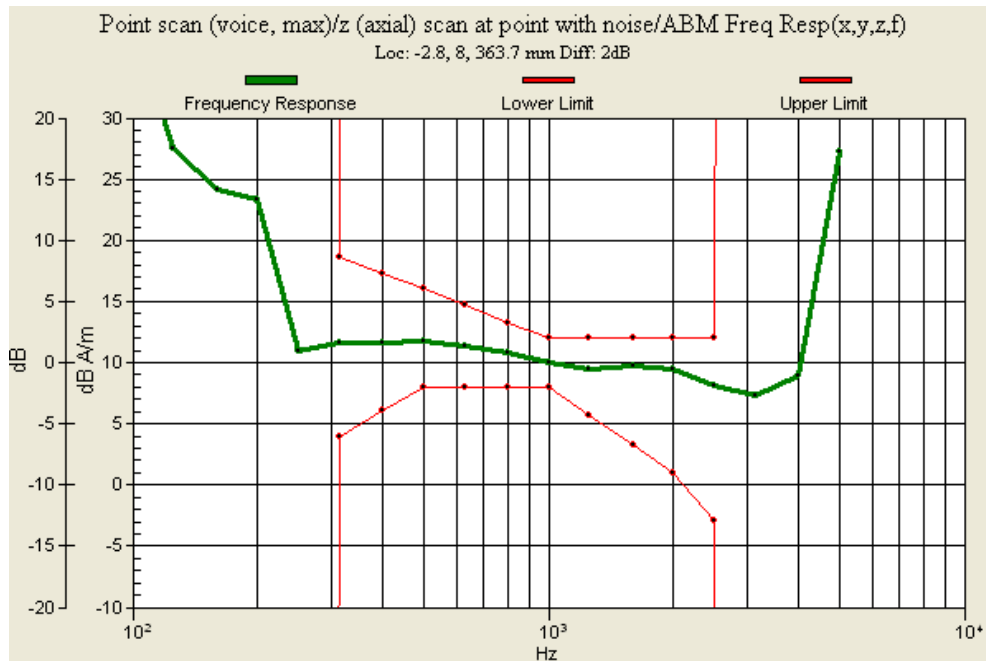


Frequency response in GSM850 mode, the point of maximum signal strength (axial)

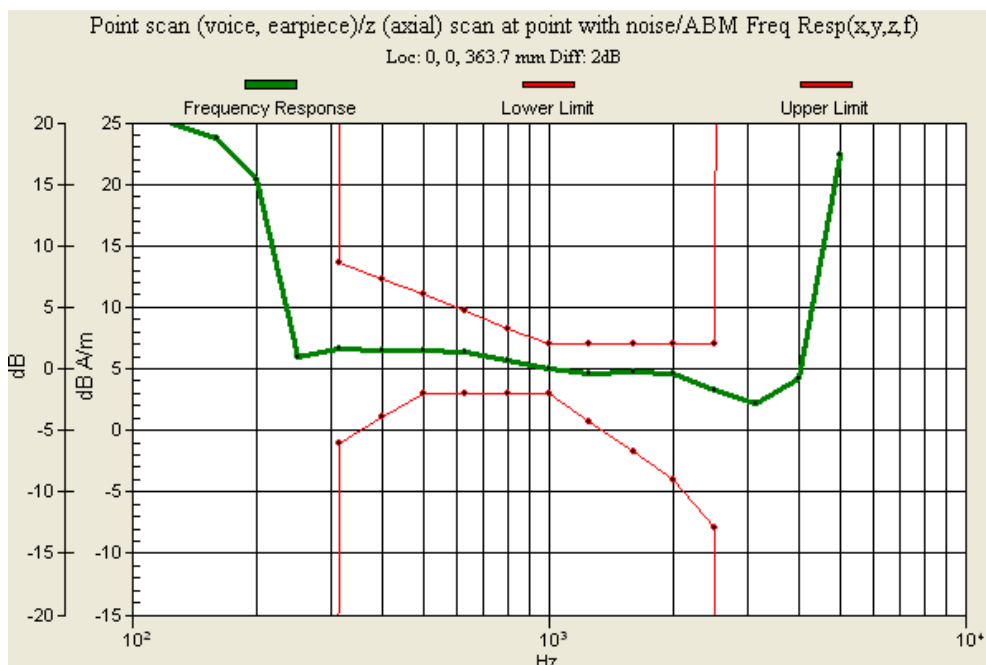


Frequency response in GSM850 mode, point 0,0 (axial)

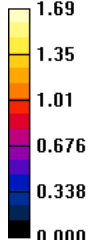
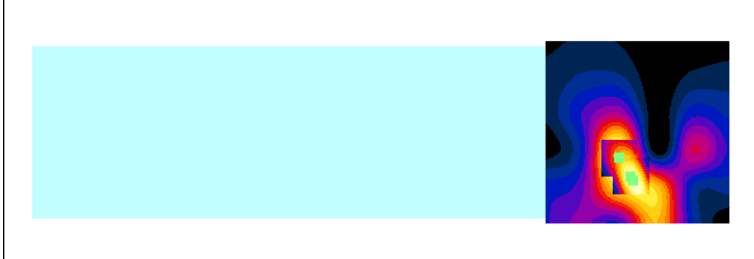
Date/Time: 2007-05-31 12:12:45 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM1900 Frequency: 1880 MHz; Duty Cycle: 1:8.3 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 9.5424 dB A/m BWC Factor = 0.007727 dB Location: -2.8, 8, 363.7 mm Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -40.0836 dB A/m Location: -2.8, 8, 363.7 mm Point scan (sinewave, max)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 49.626 dB BWC Factor = 0.007727 dB Location: -2.8, 8, 363.7 mm	Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 4.54598 dB A/m BWC Factor = 0.00790057 dB Location: 0, 0, 363.7 mm Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -38.7009 dB A/m Location: 0, 0, 363.7 mm Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 43.2468 dB BWC Factor = 0.00790057 dB 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 = -49.8654 dB A/m Location: 0, 0, 368.7 mm	



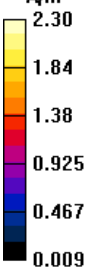
Frequency response in GSM1900 mode, the point of maximum signal strength (axial)



Frequency response in GSM1900 mode, point 0,0 (axial)

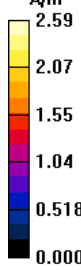
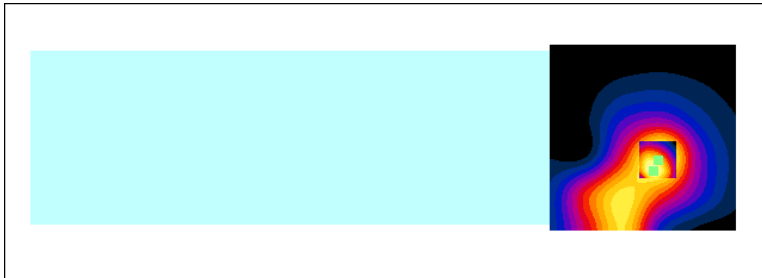
Date/Time: 2007-05-31 9:42:06 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM850 Frequency: 836.6 MHz; Duty Cycle: 1:7 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 4.54854 dB A/m BWC Factor = 10.8 dB Location: 5, 7, 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 = -52.2356 dB A/m Location: 0, 0, 368.7 mm
Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Interpolated Signal(x,y,z) (51x51x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 = 7.39209 dB A/m BWC Factor = 10.8 dB Location: 1.8, 12, 363.7 mm	
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 7.22662 dB A/m BWC Factor = 0.0058176 dB Location: 1.2, 13.2, 363.7 mm	
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -39.827 dB A/m Location: 1.2, 13.2, 363.7 mm	
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 47.0537 dB BWC Factor = 0.0058176 dB Location: 1.2, 13.2, 363.7 mm	
A/m 	

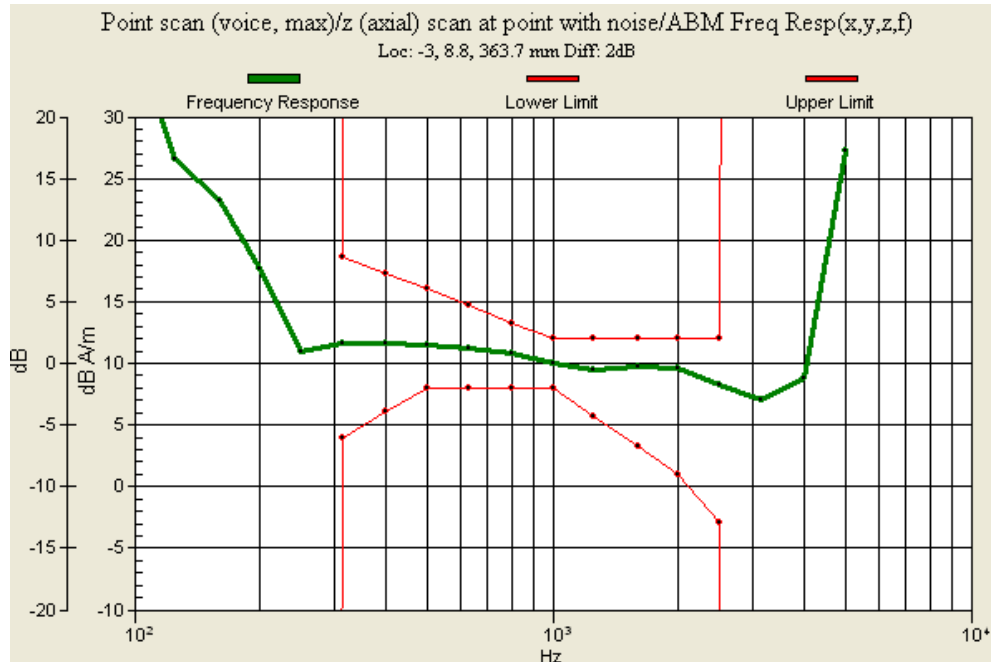
Date/Time: 2007-05-31 12:17:14 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM1900 Frequency: 1880 MHz; Duty Cycle: 1:8.3 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 6.16188 dB A/m BWC Factor = 0.007727 dB Location: 0.8, 15, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -38.6518 dB A/m Location: 0.8, 15, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 44.8137 dB BWC Factor = 0.007727 dB Location: 0.8, 15, 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 = -54.0125 dB A/m Location: 0, 0, 368.7 mm	

Date/Time: 2007-05-31 9:46:41 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM850 Frequency: 836.6 MHz; Duty Cycle: 1:7 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 7.24496 dB A/m BWC Factor = 10.8 dB Location: 2, 15, 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 = -53.8706 dB A/m Location: 0, 0, 368.7 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 = 8.36694 dB A/m BWC Factor = 10.8 dB Location: 2.2, 13.2, 363.7 mm	
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 7.22662 dB A/m BWC Factor = 0.0058176 dB Location: 1.2, 13.2, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -39.827 dB A/m Location: 1.2, 13.2, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 47.0537 dB BWC Factor = 0.0058176 dB Location: 1.2, 13.2, 363.7 mm	
A/m  2.30 1.84 1.38 0.925 0.467 0.009	

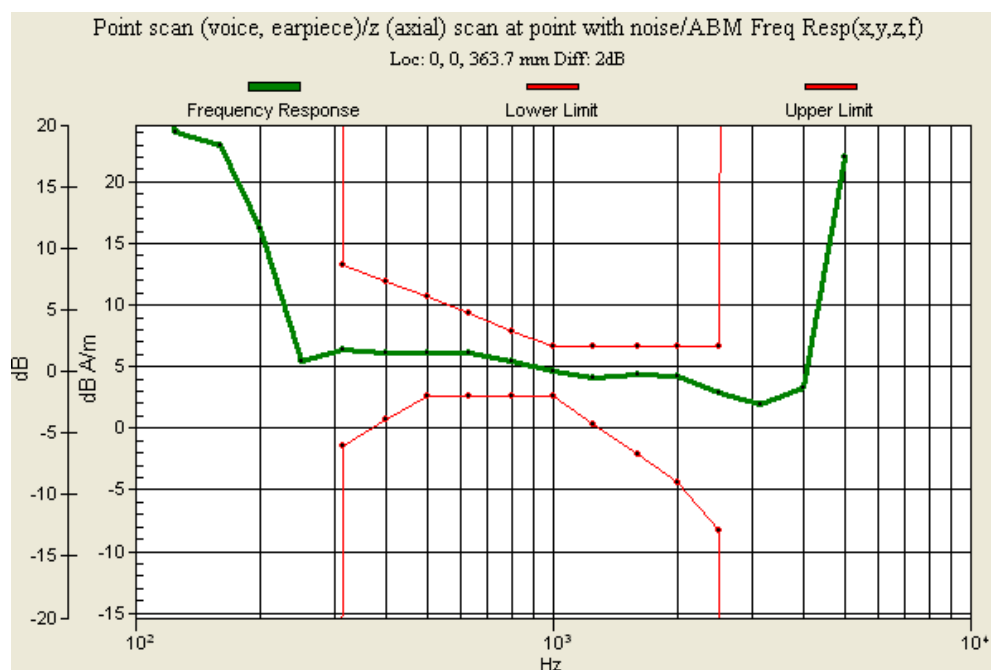
Date/Time: 2007-05-31 12:21:49 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: GSM1900 Frequency: 1880 MHz; Duty Cycle: 1:8.3 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 6.88088 dB A/m BWC Factor = 0.007727 dB Location: 2.4, 13.8, 363.7 mm Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -44.7135 dB A/m Location: 2.4, 13.8, 363.7 mm Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 51.5944 dB BWC Factor = 0.007727 dB Location: 2.4, 13.8, 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 = -54.2488 dB A/m Location: 0, 0, 368.7 mm	

APPENDIX B: MEASUREMENT SCANS, WCDMA

Date/Time: 2007-05-31 14:25:00 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: WCDMA1700/2100 Frequency: 1732.4 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 8.26956 dB A/m BWC Factor = 10.8 dB Location: -4, 6, 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 = -53.6926 dB A/m Location: 0, 0, 368.7 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 = 10.0092 dB A/m BWC Factor = 10.8 dB Location: -3, 8.8, 363.7 mm	
Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 9.543 dB A/m BWC Factor = 0.0057308 dB Location: -3, 8.8, 363.7 mm Point scan (sinewave, max)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -46.9899 dB A/m Location: -3, 8.8, 363.7 mm Point scan (sinewave, max)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 56.5329 dB BWC Factor = 0.0057308 dB Location: -3, 8.8, 363.7 mm	Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 4.34451 dB A/m BWC Factor = 0.0059912 dB Location: 0, 0, 363.7 mm Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -48.3826 dB A/m Location: 0, 0, 363.7 mm Point scan (sinewave, earpiece)/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 52.7271 dB BWC Factor = 0.0059912 dB Location: 0, 0, 363.7 mm
A/m  2.59 2.07 1.55 1.04 0.518 0.000	

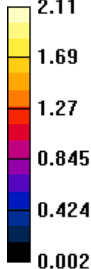
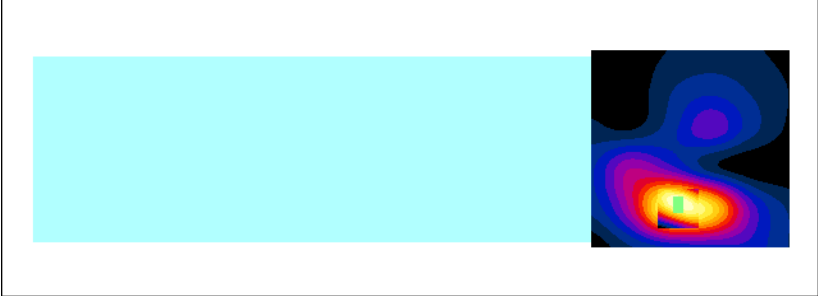


Frequency response in WCDMA1700/2100 mode, the point of maximum signal strength (axial)



Frequency response in WCDMA1700/2100 mode, point 0,0 (axial)

Date/Time: 2007-05-31 14:29:30 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: WCDMA1700/2100 Frequency: 1732.4 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 4.06421 dB A/m BWC Factor = 10.8 dB Location: 5, 9, 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 = -53.8303 dB A/m Location: 0, 0, 368.7 mm
Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise 2/ABM Interpolated Signal(x,y,z) (51x51x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 = 6.43037 dB A/m BWC Factor = 10.8 dB Location: 1, 14.6, 363.7 mm	Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Interpolated Signal(x,y,z) (51x51x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 = 6.43077 dB A/m BWC Factor = 10.8 dB Location: 1.6, 14, 363.7 mm
Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 6.23679 dB A/m BWC Factor = 0.0057308 dB Location: 1, 14.6, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -48.3893 dB A/m Location: 1, 14.6, 363.7 mm Point scan (sinewave, max)/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 54.6261 dB BWC Factor = 0.0057308 dB Location: 1, 14.6, 363.7 mm	
A/m 	

Date/Time: 2007-05-31 14:34:07 Test Laboratory: TCC Nokia Type: RM-207; Serial: 004401/01/289647/4 Communication System: WCDMA1700/2100 Frequency: 1732.4 MHz; Duty Cycle: 1:1 Medium: Air; Medium Notes: Not Specified Medium parameters used: $\sigma = 0$ mho/m, $\epsilon_r = 1$; $\rho = 1$ kg/m³ Phantom section: AMB with Coil Section	DASY4 Configuration: - Probe: AM1DV3 - 3036; Calibrated: 2007-02-16 - Sensor-Surface: 0mm (Fix Surface) - Electronics: DAE4 Sn555; Calibrated: 2007-03-15 - Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x - Measurement SW: DASY4, V4.7 Build 53; Postprocessing SW: SEMCAD, V1.8 Build 172
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 = 6.49823 dB A/m BWC Factor = 10.8 dB Location: 3, 15, 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 = -53.9388 dB A/m Location: 0, 0, 368.7 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 = 7.17942 dB A/m BWC Factor = 10.8 dB Location: 3, 13.4, 363.7 mm	
Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1 comp = 6.79119 dB A/m BWC Factor = 0.0057308 dB Location: 3, 13.4, 363.7 mm Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM Noise(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM2 = -44.4608 dB A/m Location: 3, 13.4, 363.7 mm Point scan (sinewave, max)/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1): Measurement grid: dx=10mm, dy=10mm Cursor: ABM1/ABM2 = 51.252 dB BWC Factor = 0.0057308 dB Location: 3, 13.4, 363.7 mm	
A/m 	

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

See document 'Salo_HAC_0723_02_Appendix C.pdf'

APPENDIX D: R&S CMU200 CALIBRATION DOCUMENT

See document 'Salo_HAC_0723_02_Appendix D.pdf'