Hearing Aid Compatibility (HAC)
T-Coil Test Report

for

Doro AB

on the

GSM Digital Mobile Telephone

Report Number	**:**	**HA912249B**
Trade Name	**:**	**Doro**
Model Name	**:**	**Doro PhoneEasy 338gsm**
FCC ID	**:**	**WS5DORO338G**
Date of Testing	**:**	**Jan. 25, 2009**
Date of Report	**:**	**Feb. 17, 2009**

- **Results Summary : T Category = T3 (ANSI C63.19-2007)**
- The test results refer exclusively to the presented test model/sample only.
- Without written approval of SPORTON International Inc., the test report shall not be reproduced except in full.
- Report Version: Rev.02

SPORTON International Inc.

No. 52, Hwa Ya 1st Rd., Hwa Ya Technology Park, Kwei-Shan Hsiang, Tao Yuan Hsien, Taiwan, R.O.C.

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1. Statement of Compliance

The Hearing Aid Compliance (HAC) maximum results found during testing for the **Doro AB GSM Digital Mobile Telephone Doro PhoneEasy 338gsm** are as follows (with expanded uncertainly ± 8.1% for AMB1 and ±12.3% for AMB2):

Reference (63.19)	Description	Verdict	Section
7.3.1.1	Axial Field Intensity	Pass	9.2.1
7.3.1.2	Radial Field Intensity	Pass	9.2.2
7.3.2	Frequency Response	Pass	9.2.3
7.3.3	Signal Quality	T3	9.2.4

Band	(S+N)/N in dB	T Rating
GSM850	21.0	T3
GSM1900	21.4	T3

They are in compliance with HAC limits specified in guidelines FCC 47 CFR §20.19 and ANSI Standard ANSI C63.19 for HAC Rated category.

Results Summary : T Category = T3 (ANSI C63.19-2007)

Approved by

Roy Wu
Manager

2. Administration Data

2.1 Testing Laboratory

Company Name :	Sporton International Inc.
Address :	No. 52, Hwa-Ya 1st RD., Hwa Ya Technology Park, Kwei-Shan Hsiang, TaoYuan Hsien, Taiwan, R.O.C.
Test Site :	SAR01-HY
Telephone Number :	886-3-327-3456
Fax Number :	886-3-328-4978

2.2 Detail of Applicant

Company Name :	Doro AB
Address :	Magistratsvägen 10 SE-226 43 Lund Sweden

2.3 Detail of Manufacturer

Company Name :	CK TELECOM LTD.
Address:	Technology Road, High-Tech Development Zone, Heyuan, Guangdong, P.R.China

2.4 Application Details

Date of reception of application:	Jan. 22, 2009
Start of test :	Jan. 25, 2009
End of test :	Jan. 25, 2009

3. General Information

3.1 Description of Device Under Test (DUT)

Product Feature & Specification	
DUT Type :	GSM Digital Mobile Telephone
Trade Name :	Doro
Model Name :	Doro PhoneEasy 338gsm
FCC ID :	WS5DORO338G
Tx Frequency :	GSM850 : 824 MHz ~ 849 MHz GSM1900 : 1850 MHz ~ 1910 MHz
Rx Frequency :	GSM850 : 869 MHz ~ 894 MHz GSM1900 : 1930 MHz ~ 1990 MHz
Maximum Output Power to Antenna :	GSM850 : 31.74 dBm GSM1900 : 29.75 dBm
Antenna Type :	Fixed Internal
HW Version :	CARE-V2.0
SW Version :	CARE-S01_DORO338_L14EN_204_090115_MCP32+16
Type of Modulation :	GMSK
DUT Stage :	Identical Prototype

3.2 Applied Standards

The Standard ANSI C63.19:2007 represents performance requirements for acceptable interoperability of hearing aids with wireless communications devices. When these parameters are met, a hearing aid operates acceptably in close proximity to a wireless communications device.

3.3 Test Conditions

3.3.1 Ambient Condition

Ambient Temperature (^{o}C)	20-24℃
Humidity (%)	<60%
Acoustic Ambient Noise	>10dB below the measurement level

3.3.2 Test Configuration

The device was controlled by using a base station emulator R&S CMU200. Communication between the device and the emulator was established by coaxial connection.

The DUT was set from the emulator to radiate maximum output power during all testing.

4. Hearing Aid Compliance (HAC)

4.1 Introduction

In September 2006, the T-Coil requirements of ANSI C63.19 Standard went into effect. The federal communication commission (FCC) adopted ANSI C63.19 as HAC test standard.

5. HAC T-Coil Measurement Setup

5.1 System Configuration

Figure 5.1: T-Coil setup with HAC Test Arch and AMCC

The DASY4 system for performance compliance tests is illustrated above graphically. This system consists of the following items:

- A standard high precision 6-axis robot with controller, a teach pendant and software
- A data acquisition electronic (DAE) attached to the robot arm extension
- A dosimetric probe equipped with an optical surface detector system
- The electro-optical converter (EOC) performs the conversion between optical and electrical signals
- A measurement server performs the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.
- A probe alignment unit which improves the accuracy of the probe positioning
- A computer operating Windows XP
- DASY4 software
- Remove control with teach pendant and additional circuitry for robot safety such as warming lamps, etc.
- The SAM twin phantom
- A device holder
- Dipole for evaluating the proper functioning of the system
- Arch Phantom

Some of the components are described in details in the following sub-sections.

5.2 AM1D probe

The AM1D probe is an active probe with a single sensor. It is fully RF-shielded and has a rounded tip 6mm in diameter incorporating a pickup coil with its center offset 3mm from the tip and the sides. The symmetric signal preamplifier in the probe is fed via the shielded symmetric output cable from the AMMI with a 48V “phantom” voltage supply. The 7-pin connector on the back in the axis of the probe does not carry any signals. It is mounted to the DAE for the correct orientation of the sensor. If the probe axis is tilted 54.7 degree from the vertical, the sensor is approximately vertical when the signal connector is at the underside of the probe (cable hanging downwards).

Specification:

Frequency range	0.1 ~ 20 kHz (RF sensitivity <-100dB, fully RF shielded)
Sensitivity	<-50dB A/m @ 1 kHz
Pre-amplifier	40 dB, symmetric
Dimensions	Tip diameter/ length: 6/ 290 mm, sensor according to ANSI-PC63.19

5.2.1 Probe Tip Description

HAC field measurements take place in the close near field with high gradients. Increasing the measuring distance from the source will generally decrease the measured field values (in case of the validation dipole approx. 10％per mm).

Magnetic field sensors are measuring the integral of the H-field across their sensor area surrounded by the loop. They are calibrated in a precise, homogeneous field. When measuring a gradient field, the result will be very close to the field in the center of the loop which is equivalent to the value of a homogeneous field equivalent to the center value. But it will be different from the field at the field at the border of the loop.

Consequently, two sensors with different loop diameters – both calibrated ideally – would give different results when measuring from the edge of the probe sensor elements. The behavior for electrically small E-field sensors is equivalent. See below for distance plots from a WD which show the conservative nature of field readings at the probe element center vs. measurements at the sensor end.

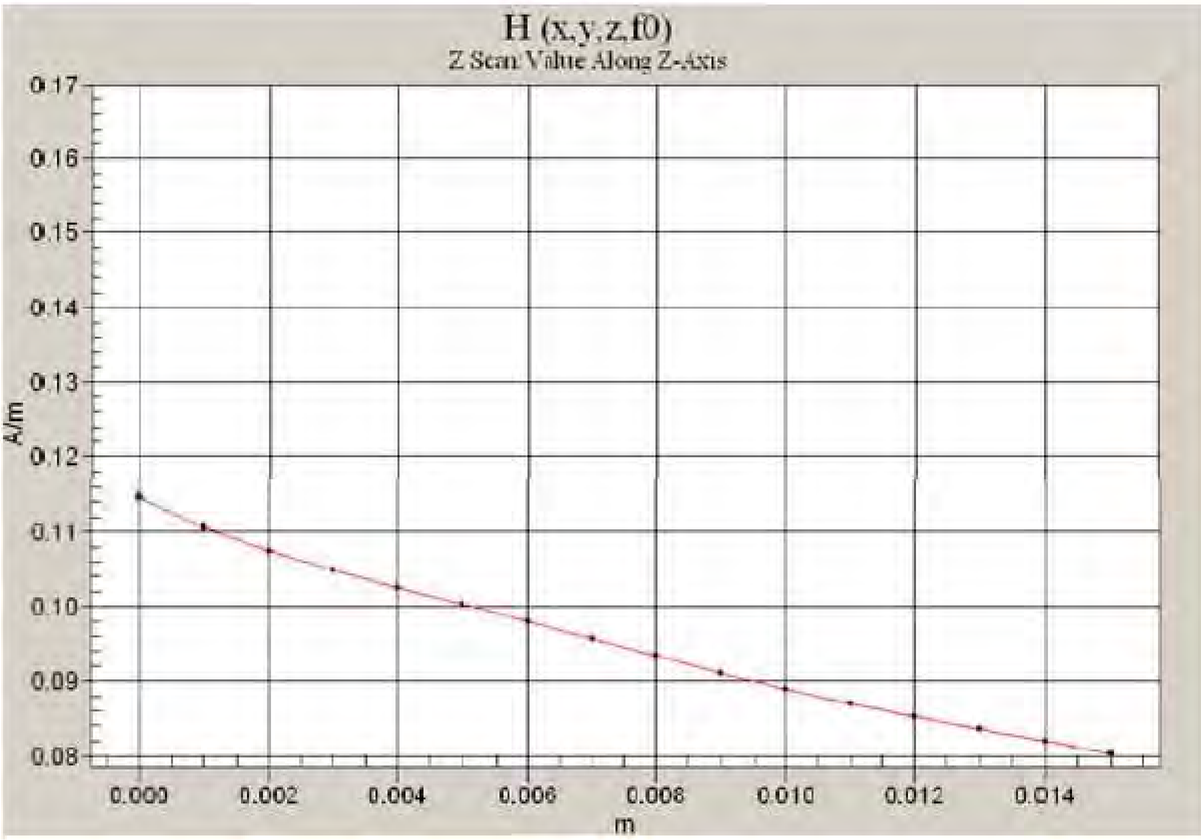


Figure 5.2: Z-Axis Scan at maximum point above a typical wireless device for H-field

5.2.2 Probe Calibration in AMCC

The probe sensitivity at 1 kHz is 0.0625214V/(A/m) (-24.0dBV/(A/m)) was calibrated by AMCC coil for verification of setup performance. The evaluated probe sensitivity was able to be compared to the calibration of the AM1D probe. The frequency response and sensitivity was shown in Figure 5.3. The probe signal is represented after application of an ideal integrator. The green curve represents the current though the AMCC, the blue curve the integrated probe signal. The DIFFERENCE between the two curves is equivalent to the frequency response of the probe system and shows the characteristics. The probe/system complies with the frequency response and linearity requirements in C63.19 according to the Speag's calibrated report as shown in Annex B (AM1D probe: SPAM100AF) (1)The frequency response has been tested within +/- 0.5 dB of ideal differentiator from 100 Hz to 10 kHz. (2)The linearity has also been tested within 0.1dB from 5 dB below limitation to 16 dB above noise level. The AMCC coil is qualified according to certificate report, SDHACPO02A as shown in Annex B.

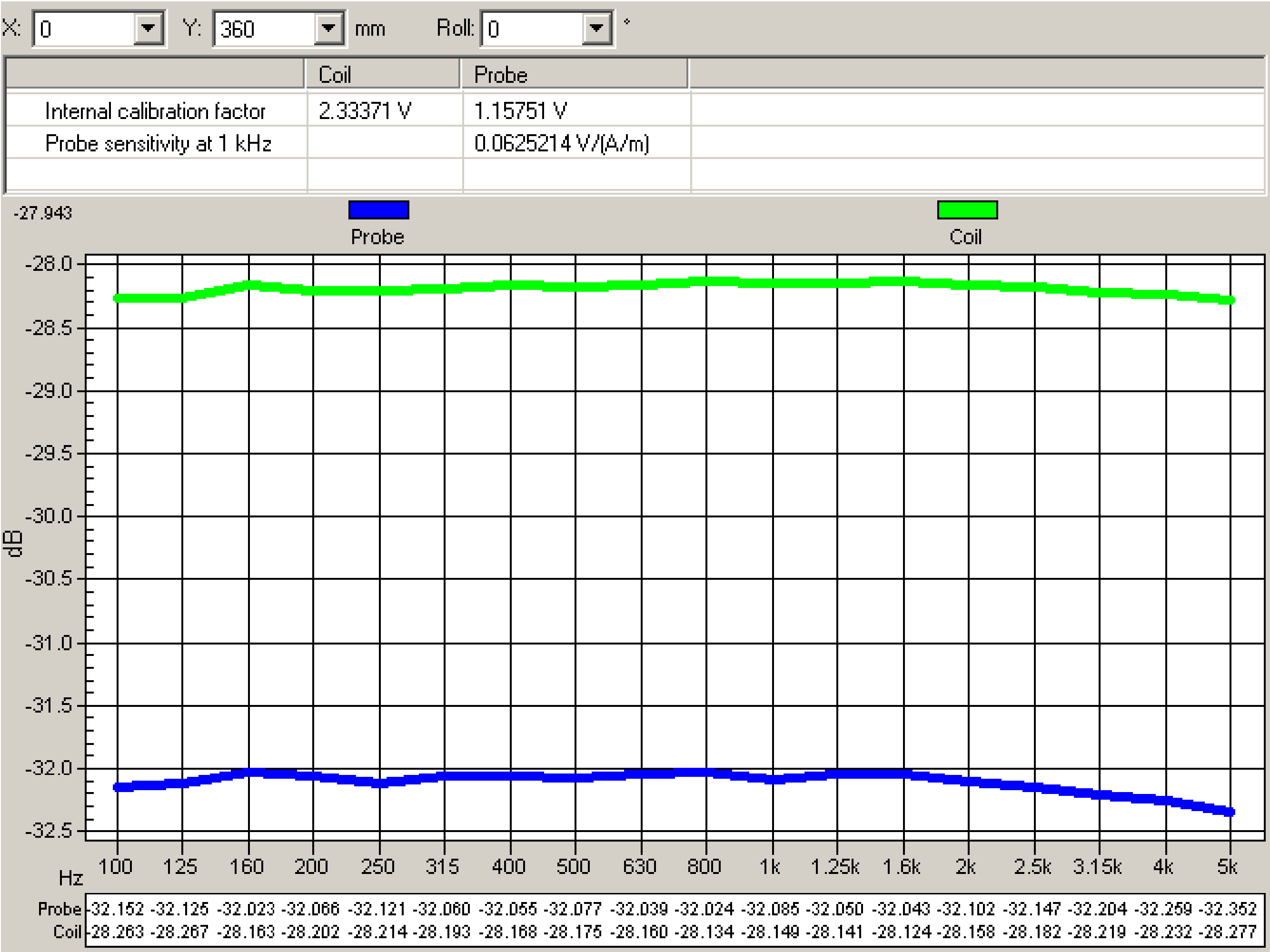


Figure 5.3: The frequency response and sensitivity of AM1D probe

5.3 AMCC

The Audio Magnetic Calibration coil is a Helmholtz Coil designed for calibration of the AM1D probe. The two horizontal coils generate a homogeneous magnetic field in the z direction. The DC input resistance is adjusted by a series resistor to approximately 50Ohm, and a shunt resistor of 10 Ohm permits monitoring the current with a scale of 1:10.

Port description:

Signal	Connector	Resistance
Coil In	BNC	typically 50 Ohm
Coil Monitor	BNO	10Ohm ±1%(100mV corresponding to 1 A/m)

Specification:

Dimensions	370 x 370 x 196 mm, according to ANSI C63.19

5.4 AMMI

Figure 5.4: AMMI front panel

The Audio Magnetic Measuring Instrument (AMMI) is a desktop 19-inch unit containing a sampling unit, a waveform generator for test and calibration signals, and a USB interface.
Specification:

Sampling rate	48 kHz/24 bit
Dynamic range	85 dB
Test signal generation	User selectable and predefined (vis PC)
Calibration	Auto-calibration/full system calibration using AMCC with monitor output
Dimensions	482 x 65 x 270 mm

5.5 DATA Acquisition Electronics (DAE)

The data acquisition electronics (DAE3) consists of a highly sensitive electrometer-grade preamplifier with auto-zeroing, a channel and gain-switching multiplexer, a fast 16 bit AD-converter and a command decoder and control logic unit. Transmission to the measurement server is accomplished through an optical downlink for data and status information as well as an optical uplink for commands and the clock.

The mechanical probe mounting device includes two different sensor systems for frontal and sideways probe contacts. They are used for mechanical surface detection and probe collision detection.

The input impedance of the DAE3 is 200M Ohm; the inputs are symmetrical and floating. Common mode rejection is above 80dB.

5.6 Robot

The DASY4 system uses the high precision robots RX90BL type out of the newer series from Stäubli SA (France). For the 6-axis controller DASY4 system, the CS7MB robot controller version from Stäubli is used. The RX robot series have many features that are important for our application:

- High precision (repeatability 0.02 mm)
- High reliability (industrial design)
- Jerk-free straight movements
- Low ELF interference (the closed metallic construction shields against motor control fields)
- 6-axis controller

5.7 Measurement Server

The DASY4 measurement server is based on a PC/104 CPU board with

166 MHz CPU
32 MB chipset and
64 MB RAM.

Communication with
the DAE3 electronic box
the 16-bit AD-converter system for optical detection and digital I/O interface.

The measurement server performs all the real-time data evaluation for field measurements and surface detection, controls robot movements and handles safety operations.

5.8 Phone Positioner

The phone positioner shown in Figure 5.5 is used to adjust DUT to the suitable position.

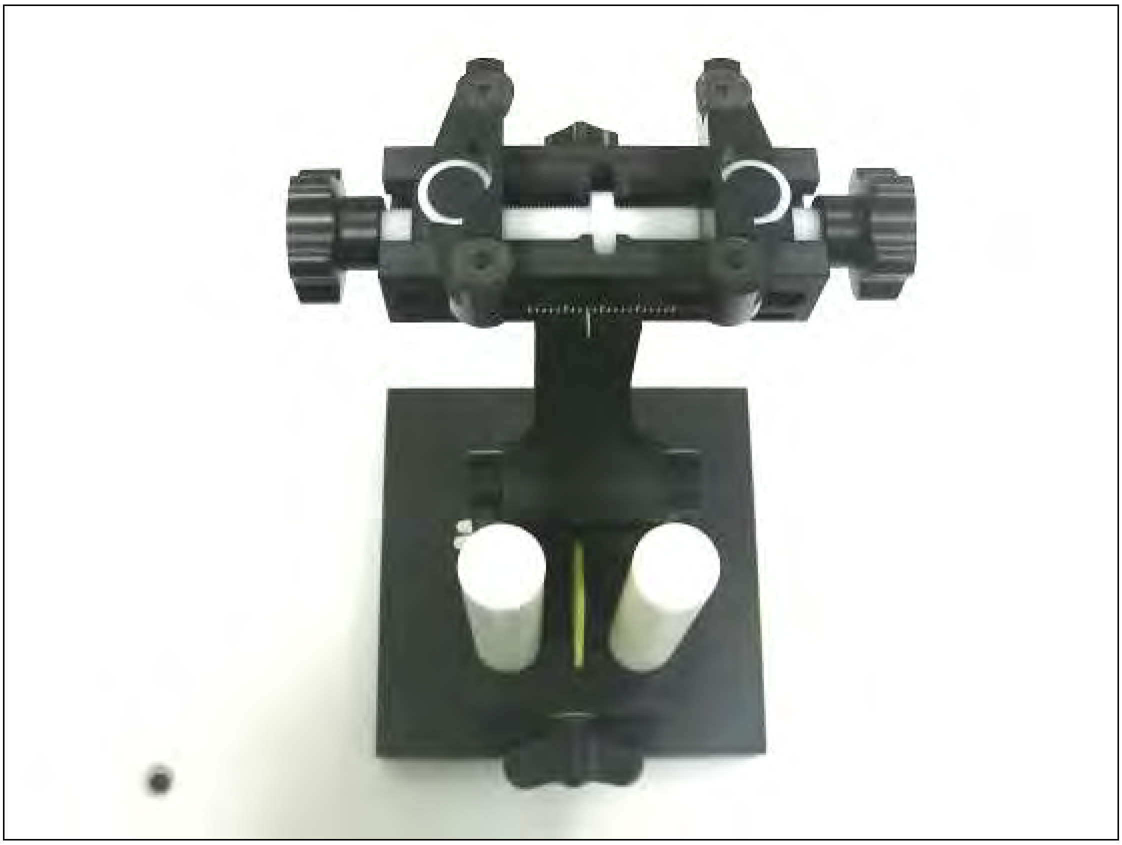


Figure 5.5: Phone Positioner

5.8.1 Test Arch Phantom

Construction	Enables easy and well defined positioning of the phone and validation dipoles as well as simple teaching of the robot.
Dimensions	370 x 370 x 370 mm

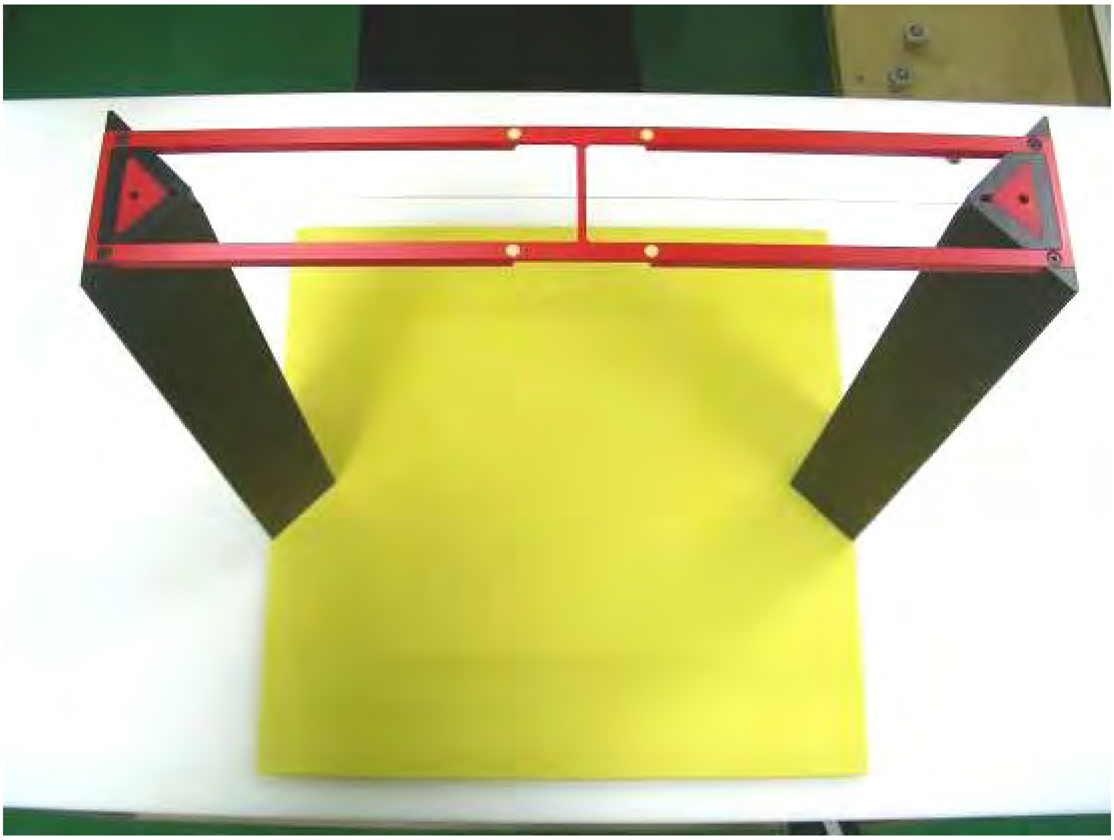


Figure 5.6: Test Arch Phantom

5.9 *Cabling of System*

The principal cabling of the T-Coil setup is shown in Figure 5.6. All cables provided with the basic setup have a length of approximately 5 m.

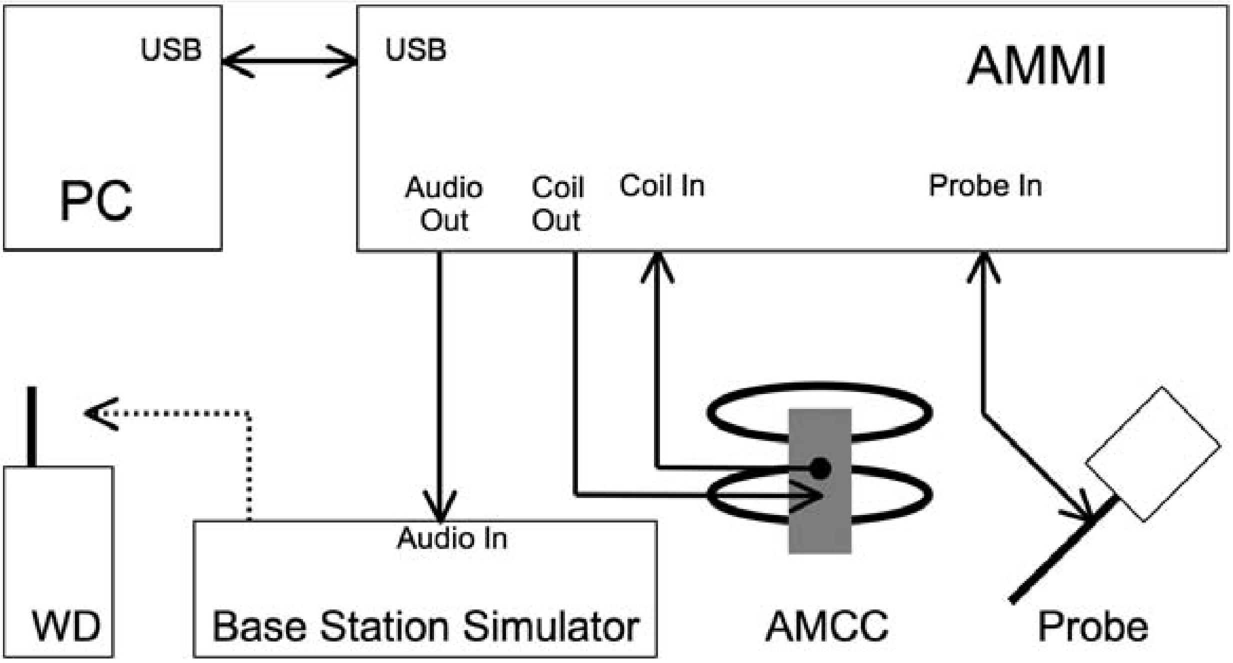


Figure 5.7: T-Coil setup cabling

5.10 HAC Extension Software for DASY4

Specification:

Precise teaching	Easy teaching with adaptive distance verification
Measurement area	Flexible selection of measurement area, predefined according to ANSI C63.19
Evaluation	ABM: spectral processing, filtering, weighting and evaluation according to ANSI C63.19
Report	Documentation ready for compliance report

5.11 Test Equipment List

Manufacturer	Name of Equipment	Type/Model	Serial Number	Calibration	
				Last Cal.	Due Date
SPEAG	Audio Magnetic 1D Field Probe	AM1DV2	1030	Apr. 16, 2008	Apr. 15, 2009
SPEAG	Audio Magnetic Calibration Coil	AMCC	1049	NCR	NCR
SPEAG	Audio Measuring Instrument	AMMI	1041	NCR	NCR
SPEAG	Data Acquisition Electronics	DAE3	577	Nov. 12, 2008	Nov. 11, 2009
SPEAG	Test Arch Phantom	N/A	N/A	NCR	NCR
SPEAG	Phone Positoiner	N/A	N/A	NCR	NCR

Table 5.1 Test Equipment List

5.12 Reference Input of Audio Signal Spectrum

With the reference job "use as reference" in the beginning of a procedure, measure the spectrum of the current when applied to the AMCC, i.e. the input magnetic field spectrum, as shown below Fig. 5.8 and Fig. 5.9. For this, the delay of the window shall be set to a multiple of the signal period and at least 2s. From the measurement on the device, using the same signal, the postprocessor deducts the input spectrum, so the result represents the net DUT response.

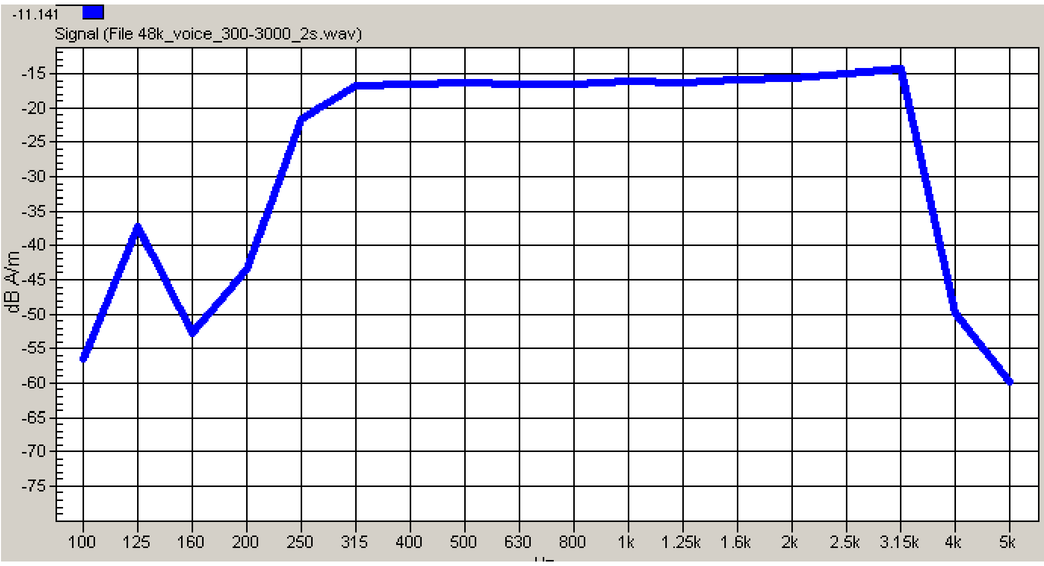


Figure 5.8: Audio signal spectrum of the broadband signal (48kHz_voice_300Hz~3 kHz)

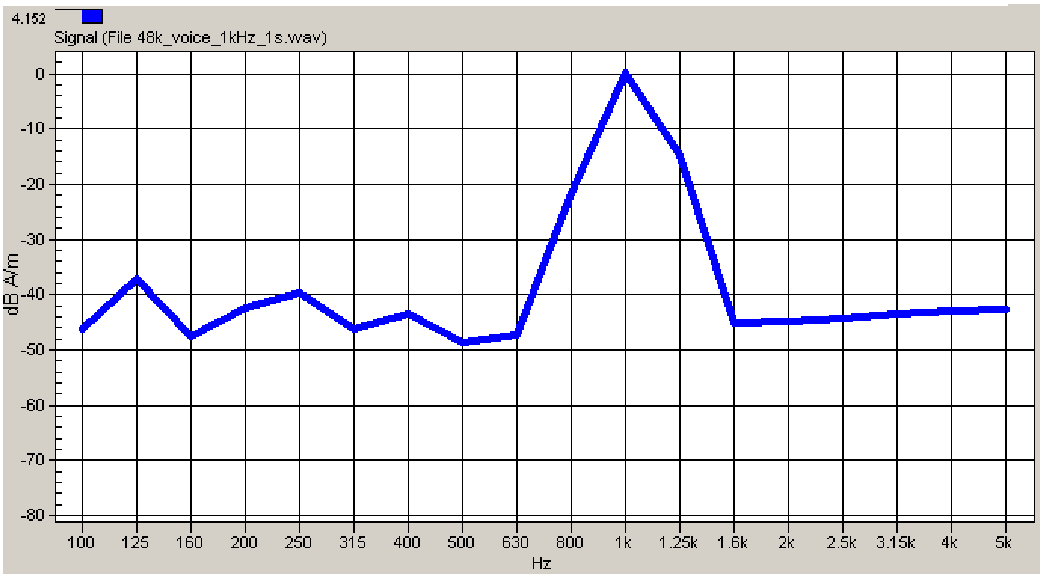


Figure 5.9: Audio signal spectrum of the narrowband signal (48kHz_voice_1kHz)

5.13 Signal Verification

According to ANSI C63.19:2007 section 6.3.2.1, the normal speech input level for HAC T-coil tests shall be set to -16 dBm0 for GSM and UMTS (WCDMA), and to -18 dBm0 for CDMA. This technical note shows a possibility to evaluate and set the correct level with the HAC T-Coil setup with a Rohde&Schwarz communication tester CMU200 with audio option B52 and B85.

Establish a call from the CMU200 to a wireless device. Select CMU200 Network Bitstream ”Decoder Cal” to have a 1kHz signal with a level of 3.14 dBm0 at the speech output. Run the measurement job and read the voltage level at the multi-meter display “Coil signal”. Read the RMS voltage corresponding to 3.14 dBm0 and note it. Calculate the desired signal levels of -16 dBm0:

3.14 dBm0 = -2.409 dBV
-16 dBm0 = -21.549 dBV

Determine the 1 kHz input level to generate the desired signal level of -18 dBm0. Select CMU200 Network Bitstream “Codec Cal” to loop the input via the codec to the output. Run the measurement job (AMMI 1kHz signal with gain 10 inserted) and read the voltage level at the multimeter display “Coil signal”. Calculate the required gain setting for the above levels:

Gain 10 = -20.038 dBV
Difference for -16 dBm0 = -21.549 - (-20.038) = -1.511 dB
Gain factor = 10 ^ ((-1.511) / 20) = 0.8403
Resulting Gain = 10 x 0.840 = 8.403

The predefined signal types have the following differences / factors compared to the 1 kHz sine signal:

Signal Type	Duration (s)	Peak to RMS (dB)	RMS (dB)	Gain Factor	Gain Setting
1kHz	1	16.2	-12.7	4.33	36.386
300Hz ~ 3kHz	2	21.6	-18.6	8.48	71.260

6. Description for DUT Testing Position

Figure 6.1 illustrate the references and reference plane that shall be used in a typical DUT emissions measurement. The principle of this section is applied to DUT with similar geometry.

- The grid is 5 cm by 5 cm area that is divided into 9 evenly sized blocks or sub-grids.
- The grid is centered on the audio frequency output transducer of the DUT.
- The grid is in a reference plane, which is defined as the planar area that contains the highest point in the area of the phone that normally rests against the user's ear. It is parallel to the centerline of the receiver area of the phone and is defined by the points of the receiver-end of the DUT handset, which, in normal handset use, rest against the ear.
- The measurement plane is parallel to, and 10 mm in front of, the reference plane.

Figure 6.1: A typical DUT reference and plane for HAC measurements

7. T-Coil Test Procedure

The following illustrate a typical test scan over a wireless communications device:

1. Geometry and signal check: system probe alignment, proper operation of the field probe, probe measurement system, other instrumentation, and the positioning system was confirmed. A surface calibration was performed before each setup change to ensure repeatable spacing and proper maintenance of the measurement plane using the test Arch.
2. Set the reference drive level of signal voice defined in C63.19 per 6.3.2.1, as shown in this report of section 5.12.
3. The ambient and test system background noise (dB A/m) was measured as well as ABM2 over the full measurement. The maximum noise level must be at least 10dB below the limit of C63.19 per 7.3.2.
4. The DUT was positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.
5. The DUT operation for maximum rated RF output power was configured and connected by using of coaxial cable connection to the base station simulator at the test channel and other normal operating parameters as intended for the test. The battery was ensured to be fully charged before each test. The center sub-grid was centered over the center of the acoustic output (also audio band magnetic output, if applicable). The DUT audio output was positioned tangent (as physically possible) to the measurement plane.
6. The DUT's RF emission field was eliminated from T-coil results by using a well RF-shielding of the probe, AM1D, and by using of coaxial cable connection to a Base Station Simulator. One test channel was pre-measurement to avoid this possibility.
7. Determined the optimal measurement locations for the DUT by following the three steps, coarse resolution scan, fine resolution scans, and point measurement, as described in C63.19 per 6.3.4.4. At each measurement locations, samples in the measurement window duration were evaluated to get ABM1 and the signal spectrum. The noise measurement was performed after the scan with the signal, the same happened, just with the voice signal switched off. The ABM2 was calculated from this second scan.

(1) Coarse resolution scans (1 kHz signal at 50 x 50 mm grid area with 10 mm spacing). Only ABM1 was measured in order to find the location of T-Coil source.

(2)Fine resolution scans (1 kHz signal at 10 x 10 mm grid area with 2 mm spacing). The positioned appropriately based on optimal AMB1 of coarse resolution scan. Both ABM1 and ABM2 were measured in order to find the location of the SNR point.

(3) Point measurement (1 kHz signal) for ABM1 and ABM2 in axial, radial transverse and radial longitudinal. The positioned appropriately based on optimal SNR of fine resolution scan. The SNR was calculated for axial, radial transverse and radial longitudinal orientation.

(4) Point measurement (300Hz to 3 kHz signal) for frequency response in axial. The positioned appropriately based on optimal SNR of fine resolution axial scan.

8. All results resulting from a measurement point in a T-Coil job were calculated from the signal samples during this window interval. ABM values were averaged over the sequence of these samples.
9. At an optimal point measurement, the SNR (ABM1/ABM2) was calculated for axial, radial transverse and radial longitudinal orientation, and the frequency response was measured in axial axis.
10. Corrected for the frequency response after the DUT measurement since the DASY4 system had known the spectrum of the input signal by using a reference job, as shown in this report of section 5.12.
11. In SEMCAD post-processing, the spectral points are in addition scaled with the high-pass (half-band) and the A-weighting, bandwidth compensated factor (BWC) and those results are final as shown in this report.
12. Classified the signal quality based on the table 8.1: T-Coil Signal Quality Categories.

8. T-Coil Signal Quality Categories

This section provides the signal quality requirement for the intended T-Coil signal from a WD. Only the RF immunity of the hearing aid is measured in T-Coil mode. It is assumed that a hearing aid can have no immunity to an interference signal in the audio band, which is the intended reception band for this mode. A device is assessed beginning by determining the category of the RF environment in the area of the T-Coil source.

The RF measurements made for the T-Coil evaluation are used to assign the category T1 through T4. The limitation is given in Table 8.1. This establishes the RF environment presented by the WD to a hearing aid.

Category	Telephone parameters WD signal quality ((signal + noise) to noise ratio in dB)
Category T1	0 to 10 dB
Category T2	10 to 20 dB
Category T3	20 to 30 dB
Category T4	> 30 dB

Table 8.1: T-Coil signal quality categories

9. Summary of Measurement Result

9.1 Test Result

9.1.1 Conducted Power

Band	GSM 850			GSM 1900		
Channel	**128**	**189**	**251**	**512**	**661**	**810**
GSM	31.63	31.66	31.74	29.75	29.47	29.20

※Unit: dBm

9.1.2 Magnitude Result

The Table 9.1 shows testing result in position coordinates which are defined as deviation from earpiece center in millimeters. Axial measurement location was defined by the manufacture of the device. Signal strength measurement scans are presented in Annex A.

Probe Position	Band	Chan.	Measurement Position (x mm, y mm)	Ambient Background Noise (dB A/m)	ABM2 (dB A/m)	ABM1 (dB A/m)	SNR (dB)
Radial 1 (Longitudinal)	GSM850	128	(6,2)	-48.57	-18.01	2.950	21.00
		189	(6,2)	-48.31	-18.77	2.640	21.40
		251	(6,2)	-47.25	-18.44	2.790	21.20
	GSM1900	512	(6,0)	-48.28	-19.68	2.930	22.60
		661	(6,2)	-48.10	-19.87	2.850	22.70
		810	(6,2)	-48.10	-18.79	2.580	21.40
Radial 2 (Transversal)	GSM850	128	(0,-6)	-42.74	-36.00	3.140	39.10
		189	(0,-6)	-42.41	-35.72	3.010	38.70
		251	(0,-6)	-42.49	-35.53	3.020	38.60
	GSM1900	512	(0,-6)	-42.13	-36.53	3.180	39.70
		661	(0,-6)	-42.14	-36.41	3.140	39.50
		810	(0,-6)	-42.06	-36.65	2.680	39.30
Axial	GSM850	128	(0,0)	-51.48	-29.36	11.90	41.30
		189	(0,0)	-51.37	-29.55	11.70	41.30
		251	(0,0)	-51.12	-30.08	11.70	41.80
	GSM1900	512	(0,0)	-51.19	-29.33	11.70	41.00
		661	(0,0)	-51.30	-29.70	11.70	41.40
		810	(0,0)	-51.26	-30.76	11.20	42.00

Table 9.1: Test Result for Various Positions

Remark:

1. The DUT does not has HAC mode.
2. The LCD backlight is turn off, and the volume is adjusted to maximum level during T-Coil testing.

9.1.3 Frequency Response

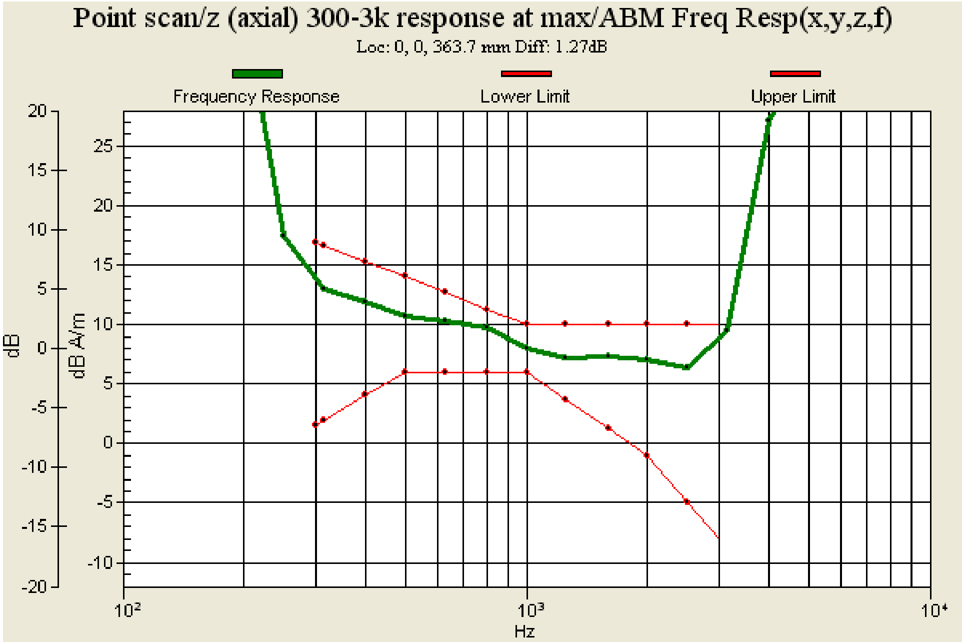


Figure 9.1: Frequency Response of GSM850 for Ch128

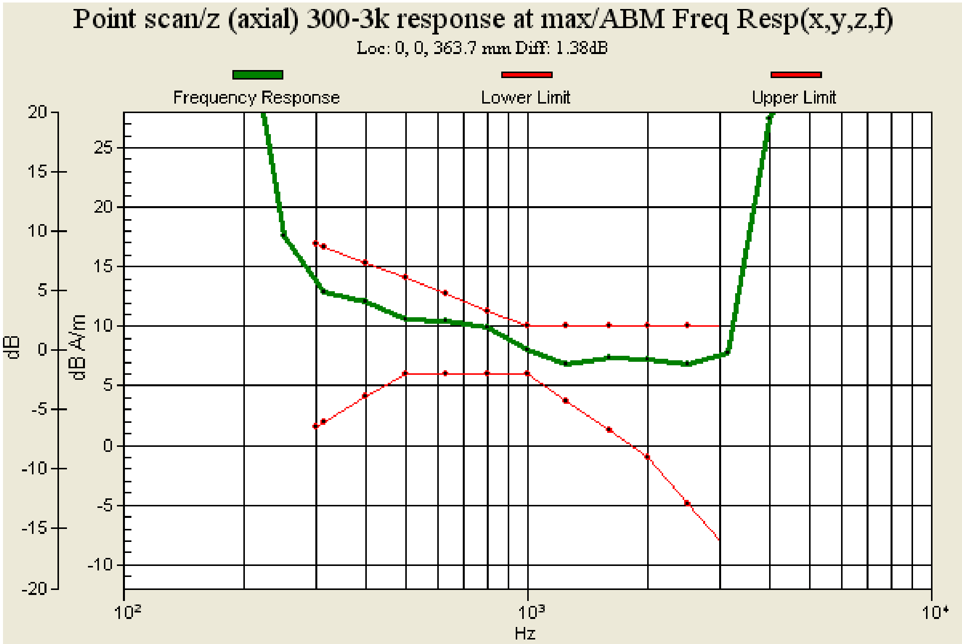


Figure 9.2: Frequency Response of GSM850 for Ch189

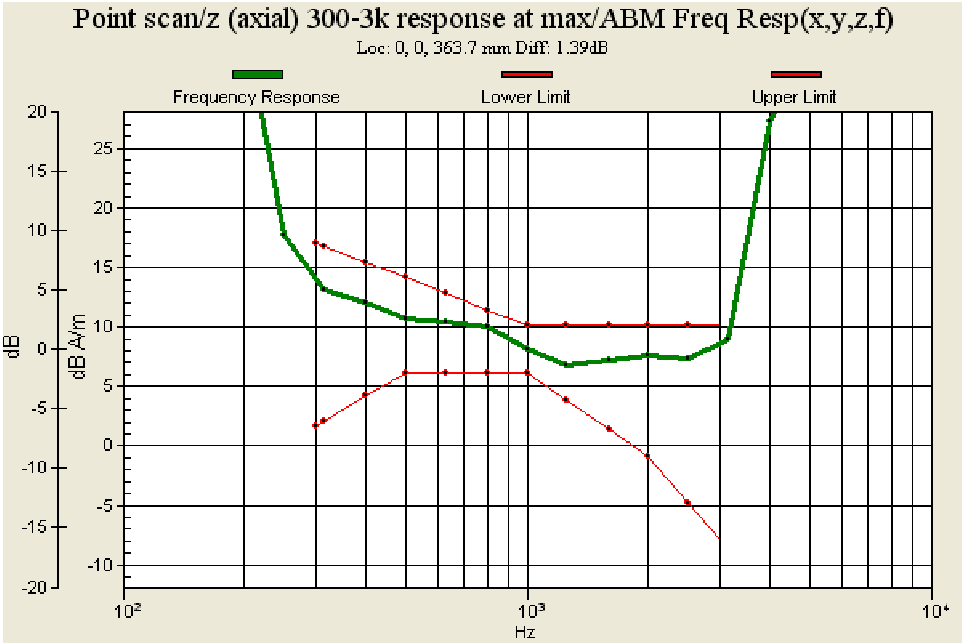


Figure 9.3: Frequency Response of GSM850 for Ch251

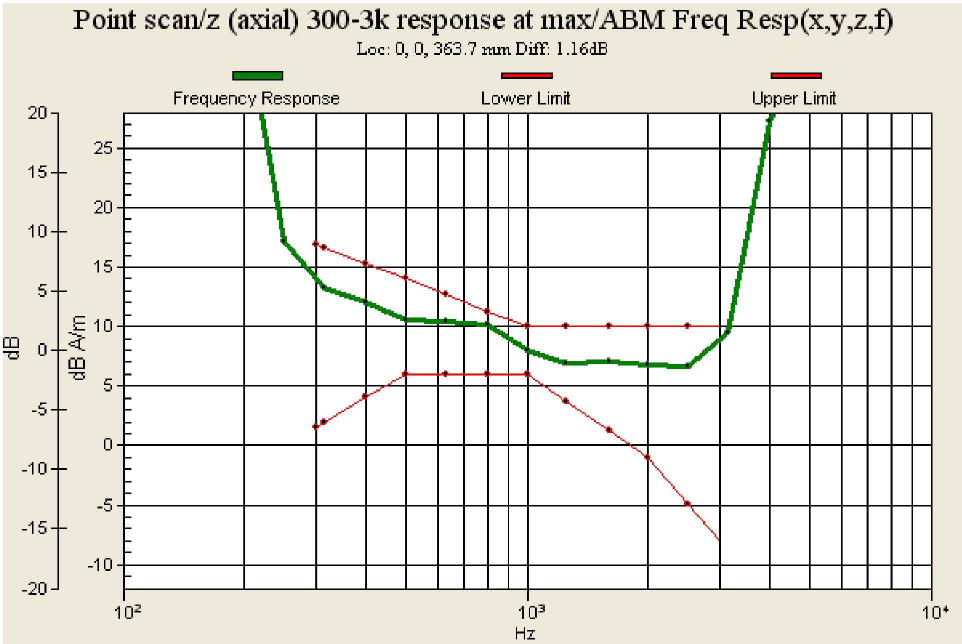


Figure 9.4: Frequency Response of GSM1900 for Ch512

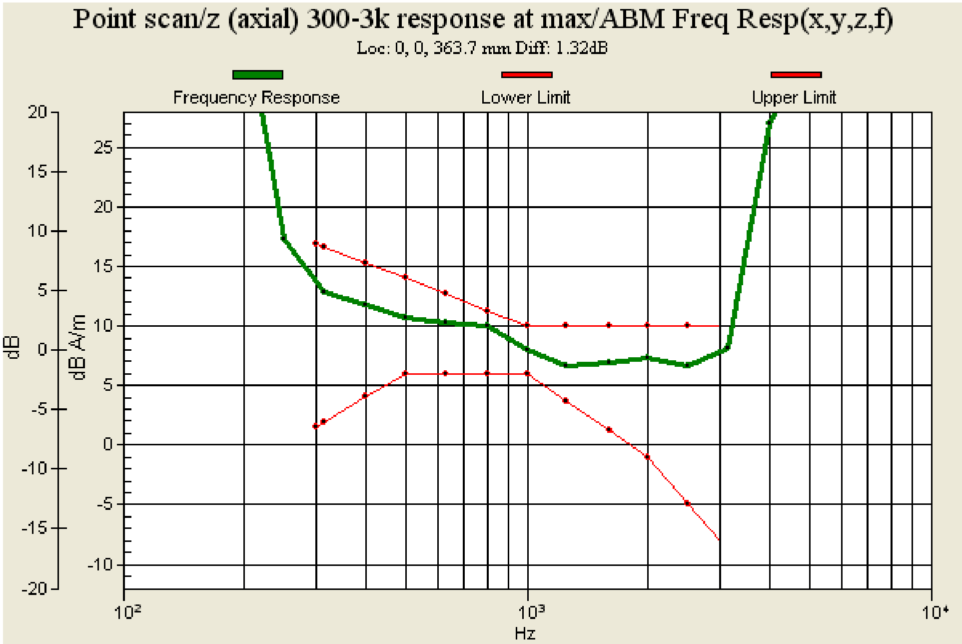


Figure 9.5: Frequency Response of GSM1900 for Ch661

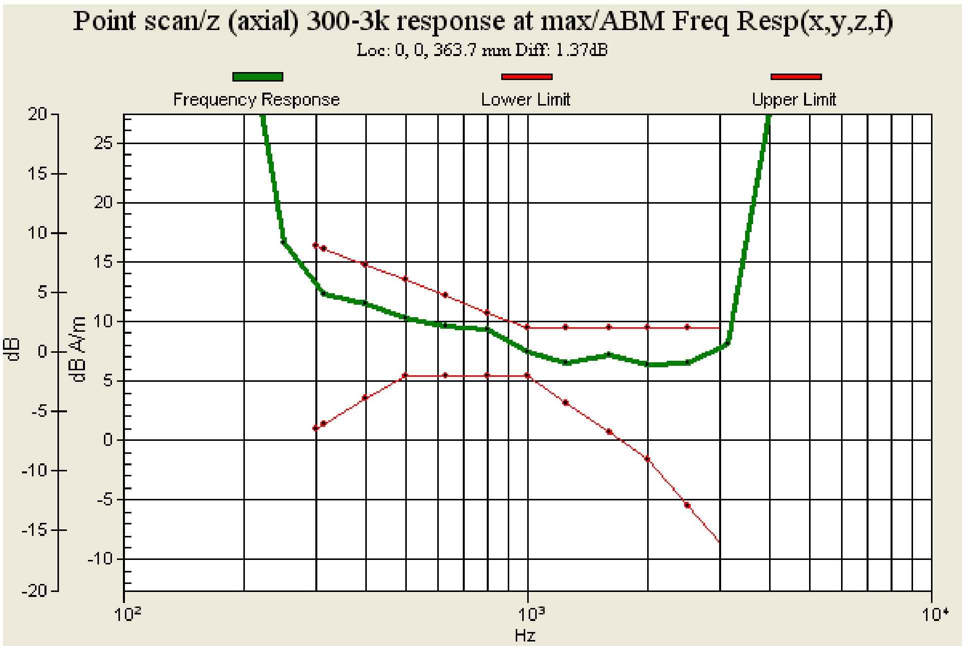


Figure 9.6: Frequency Response of GSM1900 for Ch810

9.2 T-Coil Coupling Field Intensity

9.2.1 Axial Field Intensity

Cell Phone Mode	Minimum limit (dB A/m)	Result (dB A/m)	Verdict
GSM850	-18	11.70	**Pass**
GSM1900	-18	11.20	**Pass**

9.2.2 Radial Field Intensity

Cell Phone Mode	Minimum limit (dB A/m)	Result (dB A/m)	Verdict
GSM850	-18	2.640	**Pass**
GSM1900	-18	2.580	**Pass**

9.2.3 Frequency Response at Axial Measurement Point

Cell Phone Mode	Verdict
GSM850	**Pass**
GSM1900	**Pass**

9.2.4 Signal Quality

Cell Phone Mode	Minimum limit (dB)				Minimum Result (dB)	Verdict
	T1	T2	T3	T4		
GSM850	0	10	20	>30	21.00	**T3**
GSM1900	0	10	20	>30	21.40	**T3**

10. Uncertainty Assessment

The component of uncertainly may generally be categorized according to the methods used to evaluate them. The evaluation of uncertainly by the statistical analysis of a series of observations is termed a Type A evaluation of uncertainty. The evaluation of uncertainty by means other than the statistical analysis of a series of observation is termed a Type B evaluation of uncertainty. Each component of uncertainty, however evaluated, is represented by an estimated standard deviation, termed standard uncertainty, which is determined by the positive square root of the estimated variance.

A Type A evaluation of standard uncertainty may be based on any valid statistical method for treating data. This includes calculating the standard deviation of the mean of a series of independent observations; using the method of least squares to fit a curve to the data in order to estimate the parameter of the curve and their standard deviations; or carrying out an analysis of variance in order to identify and quantify random effects in certain kinds of measurement.

A type B evaluation of standard uncertainty is typically based on scientific judgment using all of the relevant information available. These may include previous measurement data, experience and knowledge of the behavior and properties of relevant materials and instruments, manufacture's specification, data provided in calibration reports and uncertainties assigned to reference data taken from handbooks. Broadly speaking, the uncertainty is either obtained from an outdoor source or obtained from an assumed distribution, such as the normal distribution, rectangular or triangular distributions indicated in Table 10.1

Uncertainty Distributions	Normal	Rectangular	Triangular	U-shape
Multiplying factor[(a)]	$1/k$ (b)	$1/\sqrt{3}$	$1/\sqrt{6}$	$1/\sqrt{2}$

(a) standard uncertainty is determined as the product of the multiplying factor and the estimated range of variations in the measured quantity

(b) k is the coverage factor

Table 10.1: Uncertainty classification

The combined standard uncertainty of the measurement result represents the estimated standard deviation of the result. It is obtained by combining the individual standard uncertainties of both Type A and Type B evaluation using the usual "root-sum-squares" (RSS) methods of combining standard deviations by taking the positive square root of the estimated variances.

Expanded uncertainty is a measure of uncertainty that defines an interval about the measurement result within which the measured value is confidently believed to lie. It is obtained by multiplying the combined standard uncertainty by a coverage factor. Typically, the coverage factor ranges from 2 to 3. Using a coverage factor allows the true value of a measured quantity to be specified with a defined probability within the specified uncertainty range. For purpose of this document, a coverage factor two is used, which corresponds to confidence interval of about 95 %. The DASY4 uncertainty Budget is showed in Table 10.2.

Error Description	Uncertainty Value (± %)	Probability Distribution	Divisor	(Ci) ABM1	(Ci) ABM2	Std. Unc. ABM1	Std. Unc. ABM2
Probe Sensitivity							
Reference Level	± 3.0%	Normal	1	1	1	± 3.0%	± 3.0%
AMCC Geometry	± 0.4%	Rectangular	√3	1	1	± 0.2%	± 0.2%
AMCC Current	± 0.6%	Rectangular	√3	1	0.145	± 0.4%	± 0.4%
Probe Positioning during Calibration	± 0.1%	Rectangular	√3	1	1	± 0.1%	± 0.1%
Noise Contribution	± 0.7%	Rectangular	√3	0.0143	1	± 0.0%	± 0.4%
Frequency Slope	± 5.9%	Rectangular	√3	1	1	± 0.3%	± 3.5%
Probe System							
Repeatability/Drift	± 1.0%	Rectangular	√3	1	1	± 0.6%	± 0.6%
Linearity/Dynamic Range	± 0.6%	Rectangular	√3	1	1	± 0.4%	± 0.4%
Acoustic Noise	± 1.0%	Rectangular	√3	0.1	1	± 0.1%	± 0.6%
Probe Angle	± 2.3%	Rectangular	√3	1	1	± 1.4%	± 1.4%
Spectral Processing	± 0.9%	Rectangular	√3	1	1	± 0.5%	± 0.5%
Integration Time	± 0.6%	Normal	1	1	5	± 0.6%	± 3.0%
Field Distribution	± 0.2%	Rectangular	√3	1	1	± 0.1%	± 0.1%
Test Signal							
Ref. Signal Spectral Response	± 0.6%	Rectangular	√3	0	1	± 0.0%	± 0.4%
Positioning							
Probe Positioning	± 1.9%	Rectangular	√3	1	1	± 1.1%	± 1.1%
Phantom Thickness	± 0.9%	Rectangular	√3	1	1	± 0.5%	± 0.5%
DUT Positioning	± 1.9%	Rectangular	√3	1	1	± 1.1%	± 1.1%
External Contributions							
RF Interference	± 0.0%	Rectangular	√3	1	0.3	± 0.0%	± 0.0%
Test Signal Variation	± 2.0%	Rectangular	√3	1	1	± 1.2%	± 1.2%
Combined Uncertainty							
Combined Std. Uncertainty (ABM Field)						± 4.1%	± 6.1%
Expanded Std. Uncertainty						**± 8.1%**	**± 12.3%**

Table 10.2: Uncertainty of audio band magnetic measurements

11. References

[1] ANSI C63.19 2007, “American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids”
[2] DASY4 System Hand book.

Appendix A – HAC Measurement Data

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch128_X longitudinal

DUT: 912249

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.265005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 1.24 dB A/m
BWC Factor = 0.265005 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.228025 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

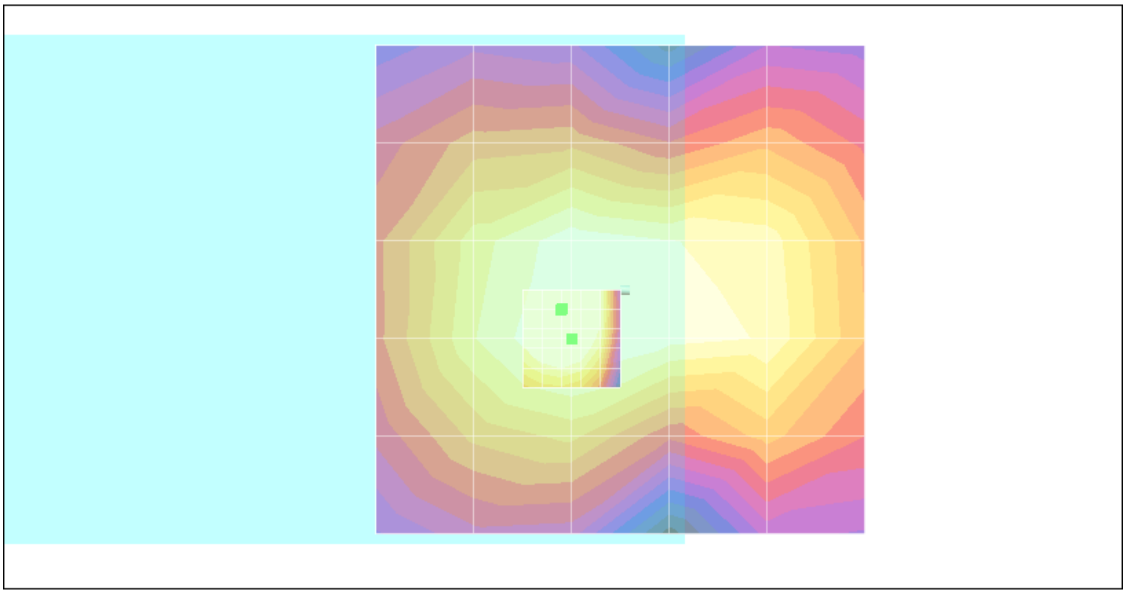
Cursor:
ABM1 comp = 2.26 dB A/m
BWC Factor = 0.228025 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.95 dB A/m
BWC Factor = 0.158027 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 21.0 dB
ABM1 comp = 2.95 dB A/m
BWC Factor = 0.158027 dB
Location: 6, 2, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch128_Y transversal

DUT: 912249

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.265005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.897 dB A/m
BWC Factor = 0.265005 dB
Location: -5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.228025 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

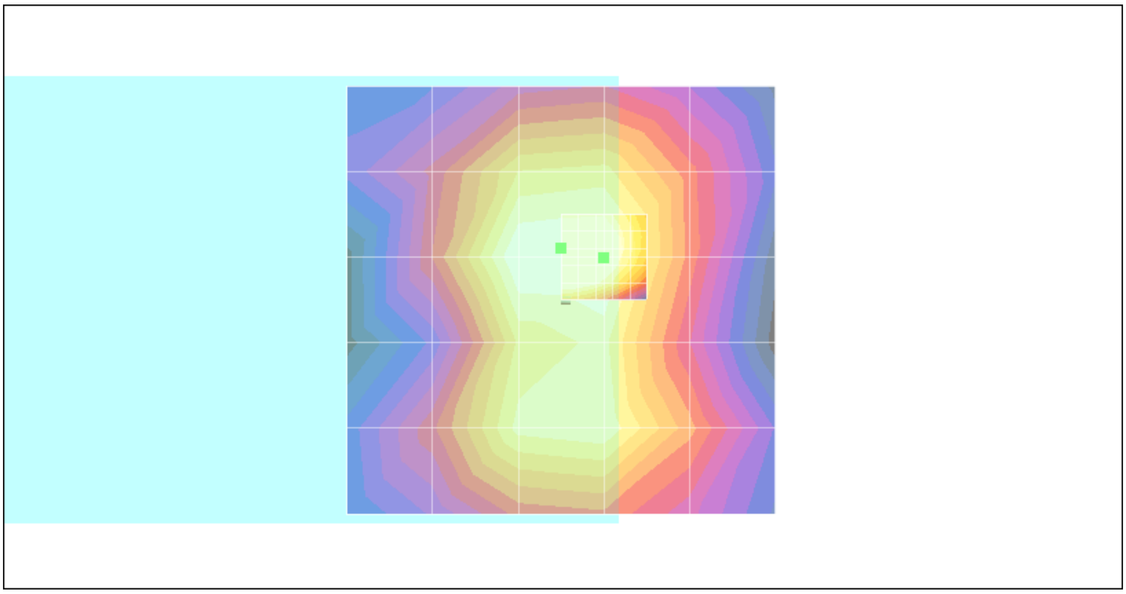
Cursor:
ABM1 comp = 3.28 dB A/m
BWC Factor = 0.228025 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 3.14 dB A/m
BWC Factor = 0.158027 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 39.1 dB
ABM1 comp = 3.14 dB A/m
BWC Factor = 0.158027 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch128_Z Axial

DUT: 912249

Communication System: GSM850; Frequency: 824.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.265005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 6.46 dB A/m
BWC Factor = 0.265005 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.228025 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 12.0 dB A/m
BWC Factor = 0.228025 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

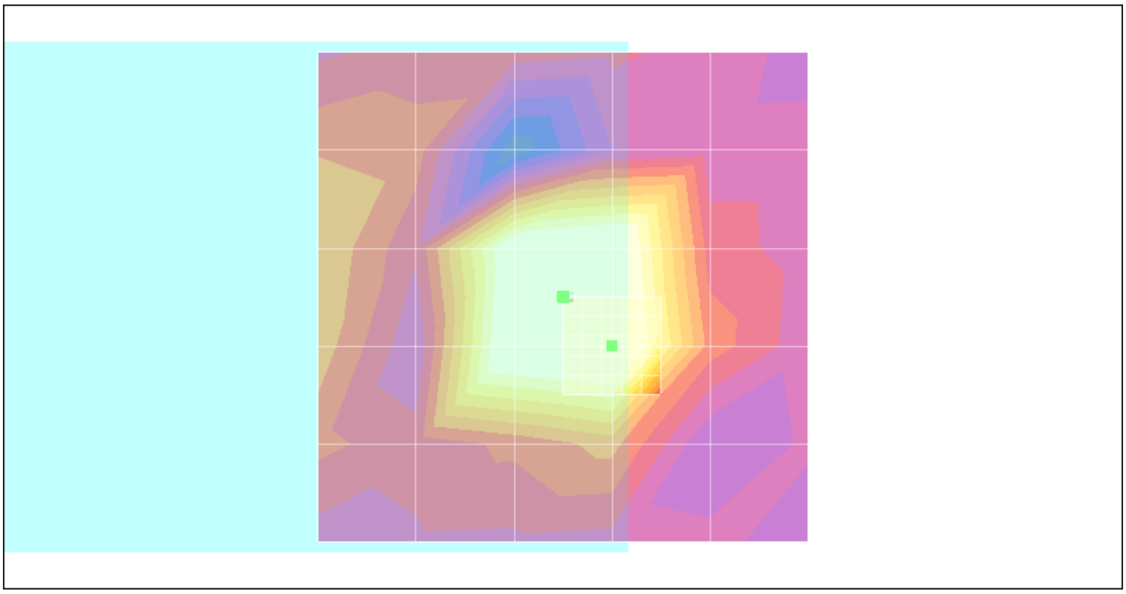
Cursor:
ABM1 comp = 11.9 dB A/m
BWC Factor = 0.158027 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.158027 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 41.3 dB
ABM1 comp = 11.9 dB A/m
BWC Factor = 0.158027 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.27 dB
BWC Factor = 10.8 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch189_X longitudinal

DUT: 912249

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.5 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.122986 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.810 dB A/m
BWC Factor = 0.122986 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.145992 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

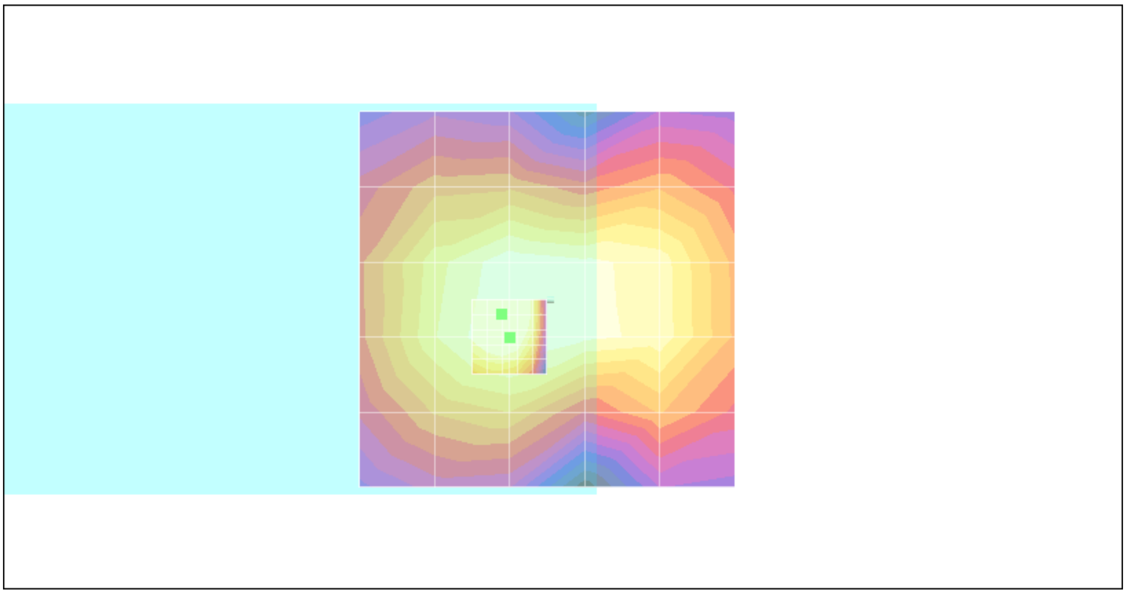
Cursor:
ABM1 comp = 2.12 dB A/m
BWC Factor = 0.145992 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.64 dB A/m
BWC Factor = 0.15103 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 21.4 dB
ABM1 comp = 2.64 dB A/m
BWC Factor = 0.15103 dB
Location: 6, 2, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2009/1/25

T-Coil_GSM850 Ch189_Y transversal

DUT: 912249

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.122986 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.589 dB A/m
BWC Factor = 0.122986 dB
Location: -5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.145992 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

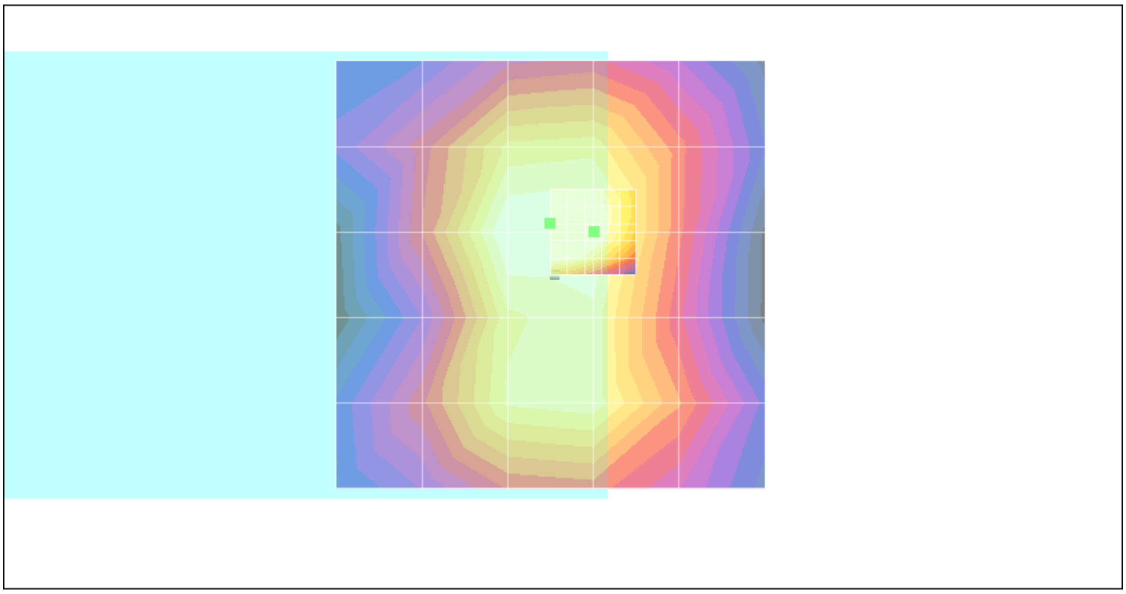
Cursor:
ABM1 comp = 3.05 dB A/m
BWC Factor = 0.145992 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 3.01 dB A/m
BWC Factor = 0.15103 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 38.7 dB
ABM1 comp = 3.01 dB A/m
BWC Factor = 0.15103 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch189_Z Axial

DUT: 912249

Communication System: GSM850; Frequency: 836.4 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.122986 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 5.81 dB A/m
BWC Factor = 0.122986 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.145992 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.145992 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

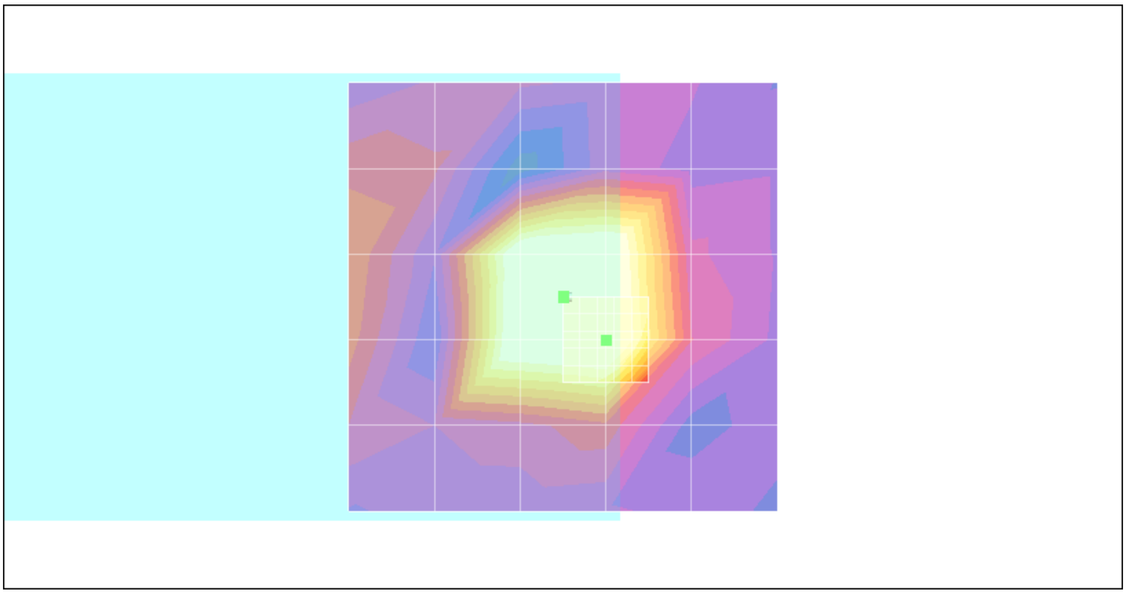
Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.15103 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 41.3 dB
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.15103 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.38 dB
BWC Factor = 10.8 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch251_X longitudinal

DUT: 912249

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.6 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.730 dB A/m
BWC Factor = 0.15103 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.150005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

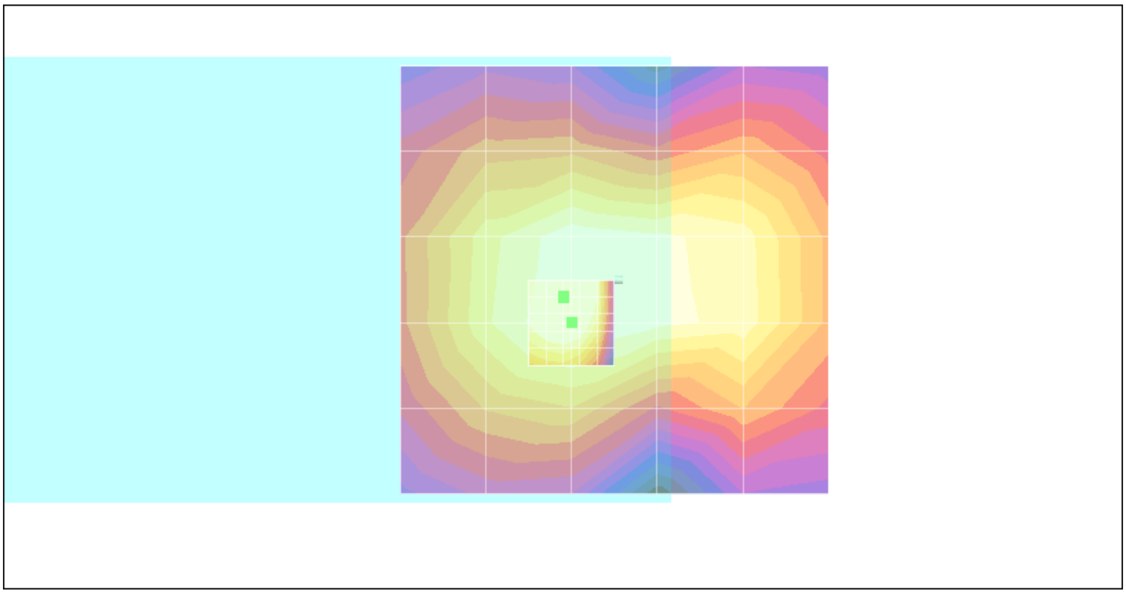
Cursor:
ABM1 comp = 2.08 dB A/m
BWC Factor = 0.150005 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.79 dB A/m
BWC Factor = 0.147017 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 21.2 dB
ABM1 comp = 2.79 dB A/m
BWC Factor = 0.147017 dB
Location: 6, 2, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch251_Y transversal

DUT: 912249

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature：22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.643 dB A/m
BWC Factor = 0.15103 dB
Location: -5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.150005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

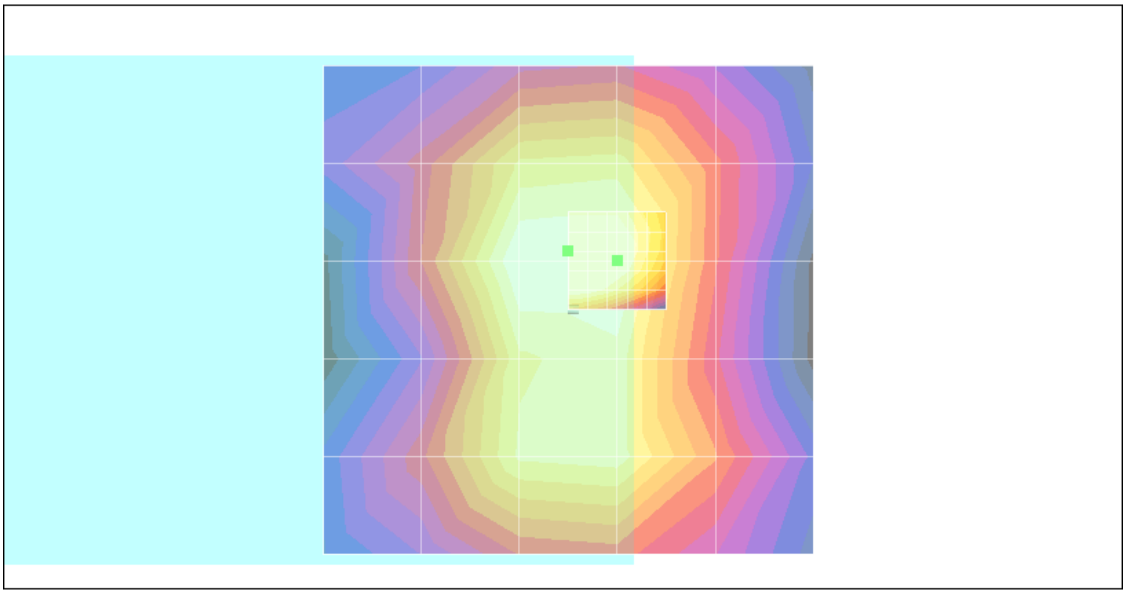
Cursor:
ABM1 comp = 3.13 dB A/m
BWC Factor = 0.150005 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 3.02 dB A/m
BWC Factor = 0.147017 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 38.6 dB
ABM1 comp = 3.02 dB A/m
BWC Factor = 0.147017 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM850 Ch251_Z Axial

DUT: 912249

Communication System: GSM850; Frequency: 848.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature：22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.15103 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 5.71 dB A/m
BWC Factor = 0.15103 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.150005 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 11.8 dB A/m
BWC Factor = 0.150005 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

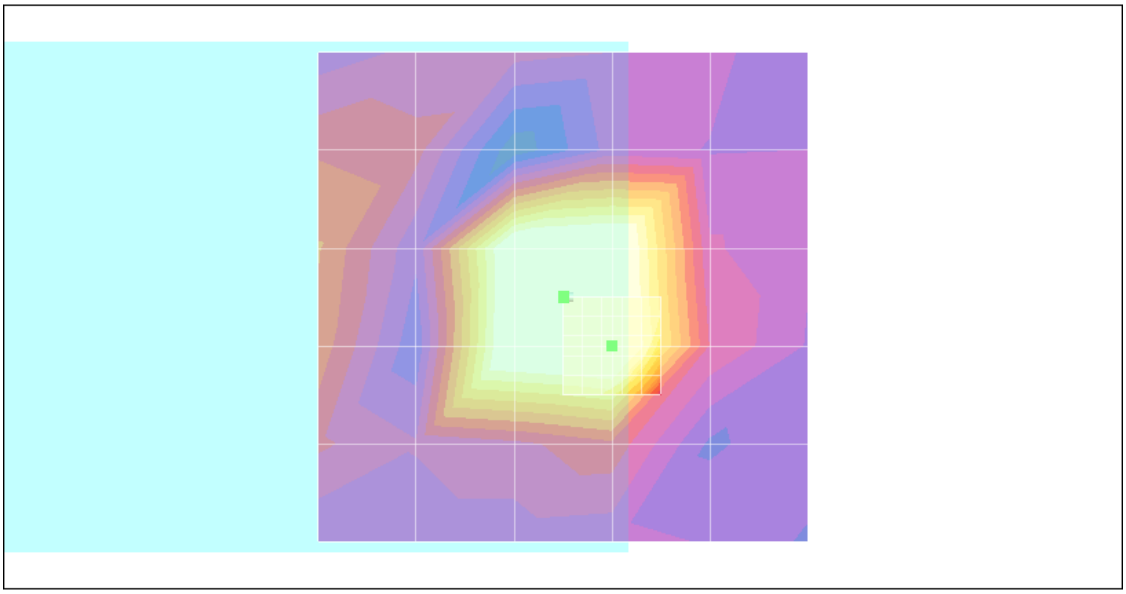
Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.147017 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.147017 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 41.8 dB
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.147017 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.39 dB
BWC Factor = 10.8 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch512_X longitudinal

DUT: 912249

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature：22.9 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.134026 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.826 dB A/m
BWC Factor = 0.134026 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.128037 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

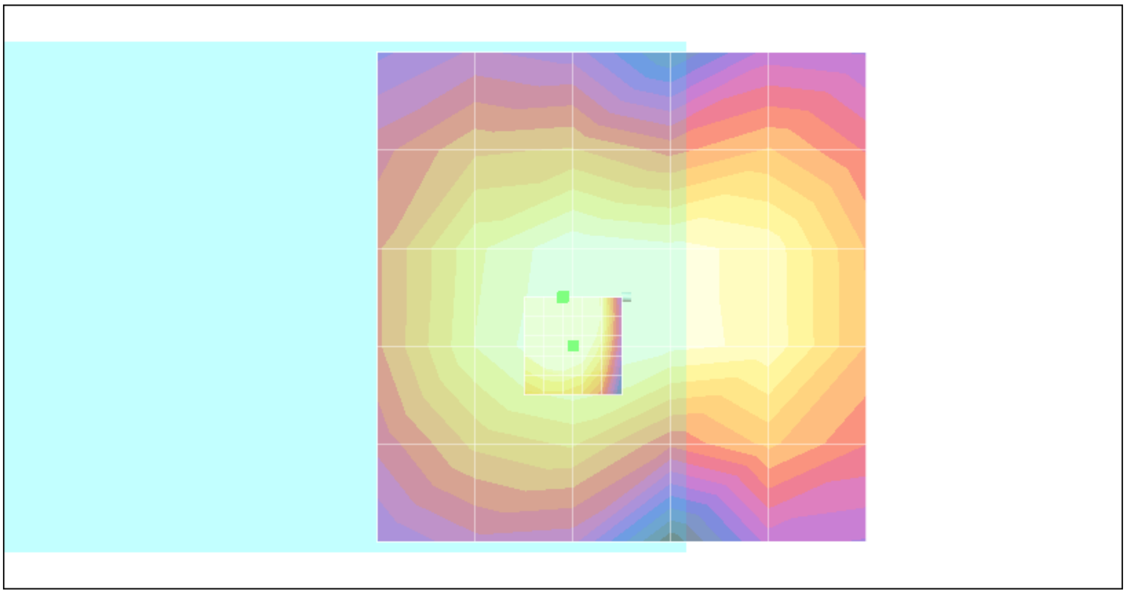
Cursor:
ABM1 comp = 2.26 dB A/m
BWC Factor = 0.128037 dB
Location: 6, 0, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.93 dB A/m
BWC Factor = 0.112961 dB
Location: 6, 0, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 22.6 dB
ABM1 comp = 2.93 dB A/m
BWC Factor = 0.112961 dB
Location: 6, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch512_Y transversal

DUT: 912249

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.4 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.134026 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.681 dB A/m
BWC Factor = 0.134026 dB
Location: 5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.128037 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

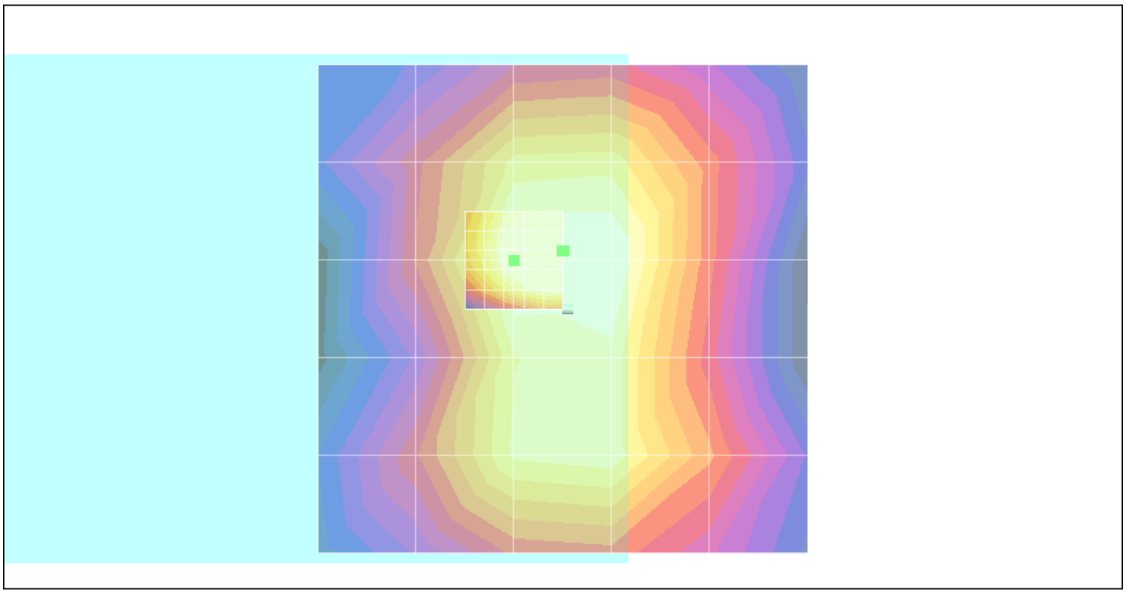
Cursor:
ABM1 comp = 3.22 dB A/m
BWC Factor = 0.128037 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 3.18 dB A/m
BWC Factor = 0.112961 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 39.7 dB
ABM1 comp = 3.18 dB A/m
BWC Factor = 0.112961 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch512_Z Axial

DUT: 912249

Communication System: PCS; Frequency: 1850.2 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.134026 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 5.95 dB A/m
BWC Factor = 0.134026 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.128037 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.128037 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

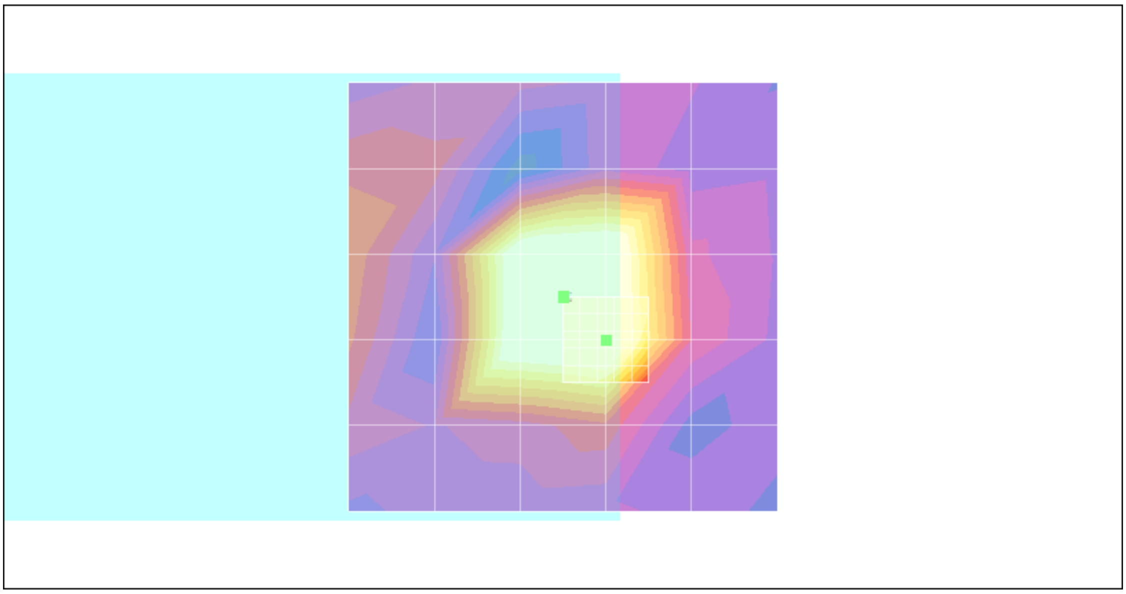
Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.112961 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.112961 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 41.0 dB
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.112961 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.8 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.16 dB
BWC Factor = 10.8 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch661_X longitudinal

DUT: 912249

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.101035 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.908 dB A/m
BWC Factor = 0.101035 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0929609 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

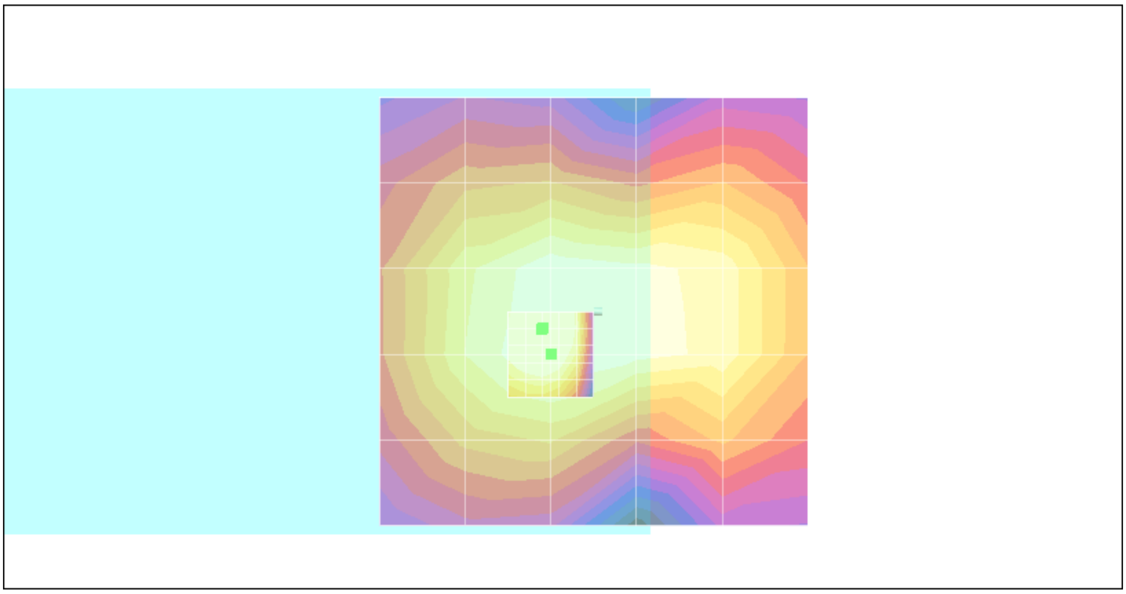
Cursor:
ABM1 comp = 2.17 dB A/m
BWC Factor = 0.0929609 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.85 dB A/m
BWC Factor = 0.0738626 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 22.7 dB
ABM1 comp = 2.85 dB A/m
BWC Factor = 0.0738626 dB
Location: 6, 2, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch661_Y transversal

DUT: 912249

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature：22.4 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.101035 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 0.671 dB A/m
BWC Factor = 0.101035 dB
Location: 5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0929609 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

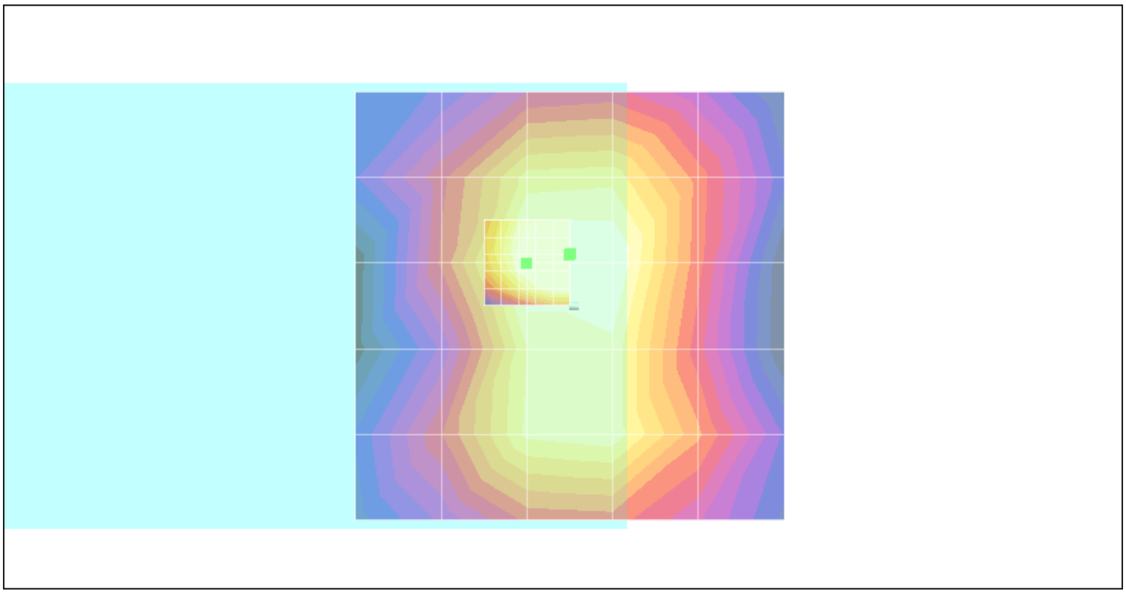
Cursor:
ABM1 comp = 3.13 dB A/m
BWC Factor = 0.0929609 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 3.14 dB A/m
BWC Factor = 0.0738626 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 39.5 dB
ABM1 comp = 3.14 dB A/m
BWC Factor = 0.0738626 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch661_Z Axial

DUT: 912249

Communication System: PCS; Frequency: 1880 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature：22.7 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.101035 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 5.64 dB A/m
BWC Factor = 0.101035 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0929609 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 11.8 dB A/m
BWC Factor = 0.0929609 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

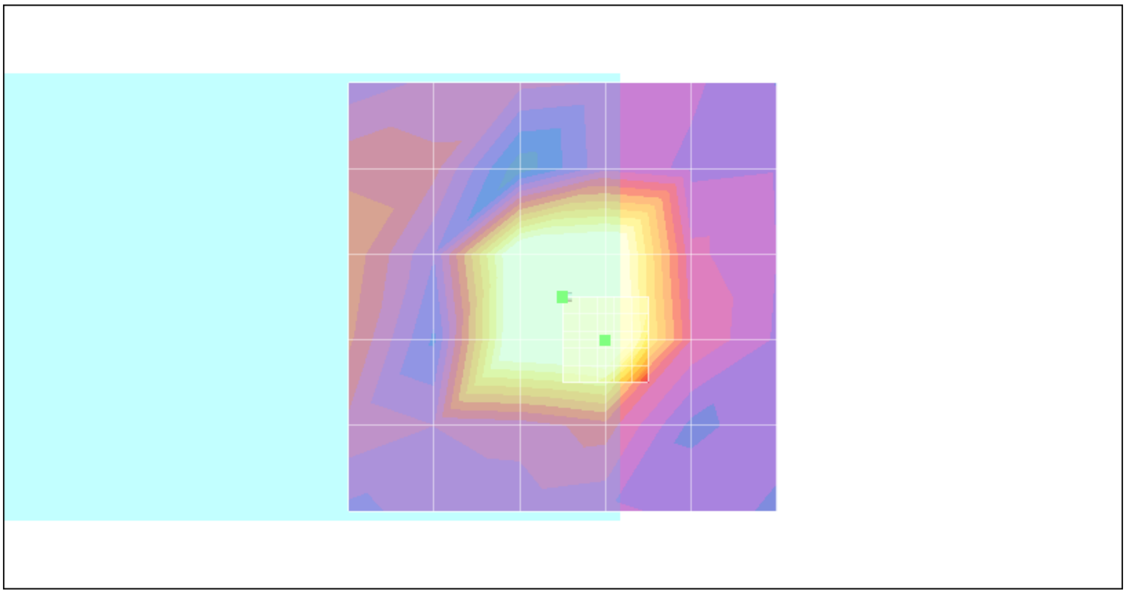
Cursor:
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.0738626 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0738626 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 41.4 dB
ABM1 comp = 11.7 dB A/m
BWC Factor = 0.0738626 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.7 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.32 dB
BWC Factor = 10.7 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab   Date: 2009/1/25

T-Coil_GSM1900 Ch810_X longitudinal

DUT: 912249

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.6 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/x (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0490235 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 1.03 dB A/m
BWC Factor = 0.0490235 dB
Location: 5, 5, 363.7 mm

Fine scan/x (longitudinal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0535999 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

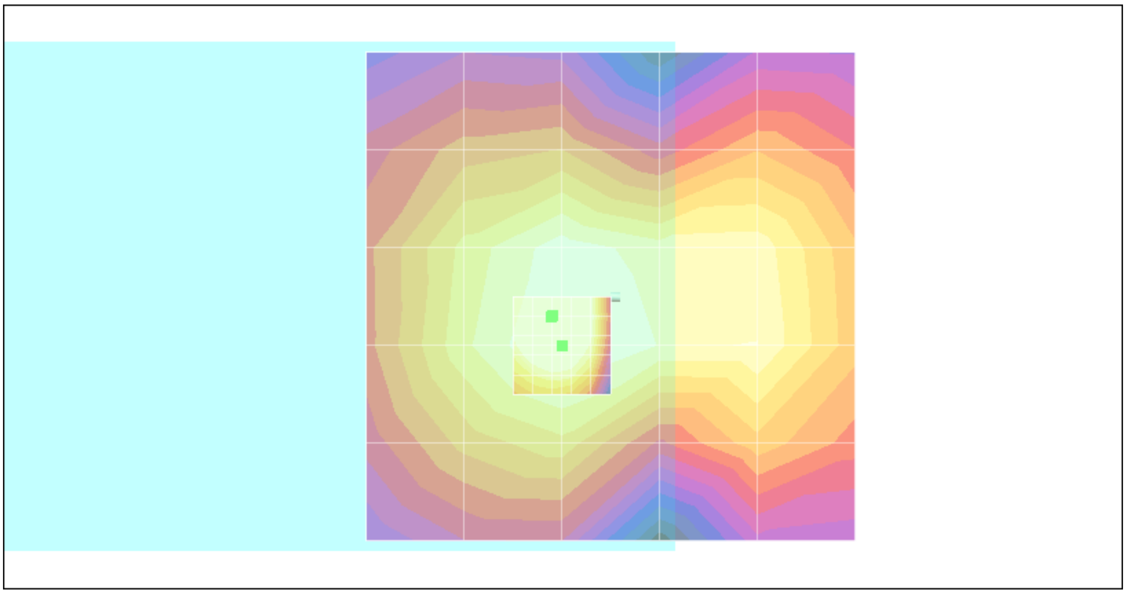
Cursor:
ABM1 comp = 1.90 dB A/m
BWC Factor = 0.0535999 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.58 dB A/m
BWC Factor = 0.0491963 dB
Location: 6, 2, 363.7 mm

Point scan/x (longitudinal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 21.4 dB
ABM1 comp = 2.58 dB A/m
BWC Factor = 0.0491963 dB
Location: 6, 2, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch810_Y transversal

DUT: 912249

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature : 22.9 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/y (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0490235 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 1.05 dB A/m
BWC Factor = 0.0490235 dB
Location: -5, -5, 363.7 mm

Fine scan/y (transversal) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0535999 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

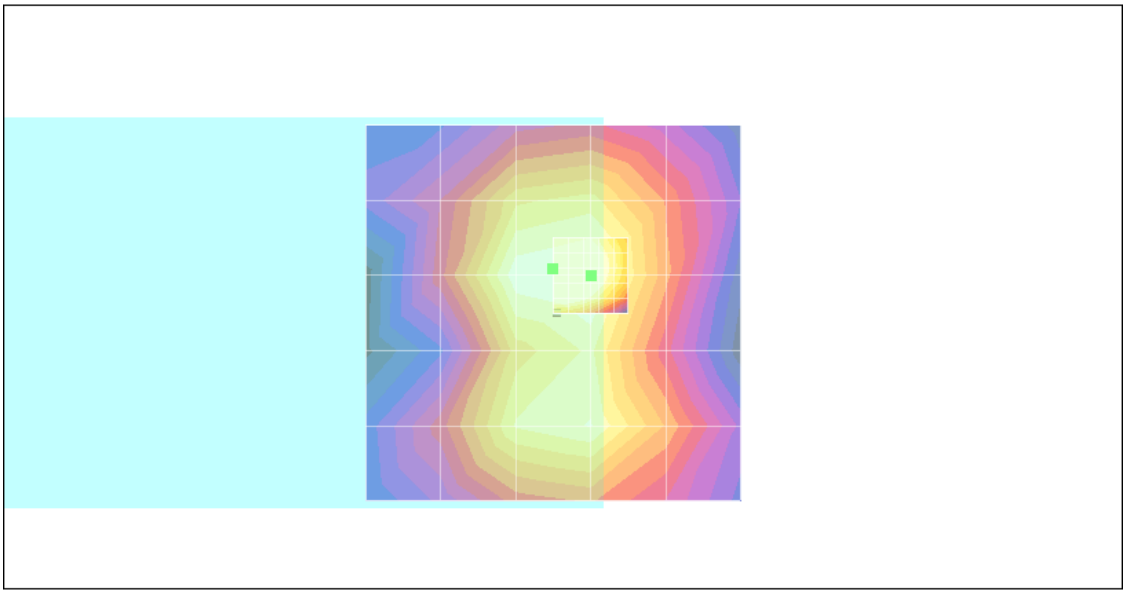
Cursor:
ABM1 comp = 2.78 dB A/m
BWC Factor = 0.0535999 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 2.68 dB A/m
BWC Factor = 0.0491963 dB
Location: 0, -6, 363.7 mm

Point scan/y (transversal) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 39.3 dB
ABM1 comp = 2.68 dB A/m
BWC Factor = 0.0491963 dB
Location: 0, -6, 363.7 mm



0 dB = 1.00A/m

Test Laboratory: Sporton International Inc. SAR/HAC Testing Lab Date: 2009/1/25

T-Coil_GSM1900 Ch810_Z Axial

DUT: 912249

Communication System: PCS; Frequency: 1909.8 MHz;Duty Cycle: 1:8.3
Medium: Air Medium parameters used: σ = 0 mho/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature : 22.5 ℃

DASY4 Configuration:
- Probe: AM1DV2 - 1030; ; Calibrated: 2008/4/16
- Sensor-Surface: 0mm (Fix Surface)
- Electronics: DAE3 Sn577; Calibrated: 2008/11/12
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 100x
- Measurement SW: DASY4, V4.7 Build 71; Postprocessing SW: SEMCAD, V1.8 Build 184

Coarse Scans/z (axial) scan 50 x 50 (grid 10) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0490235 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 6.95 dB A/m
BWC Factor = 0.0490235 dB
Location: -5, 5, 363.7 mm

Fine scan/z (axial) scan 10 x 10 (grid 2) with noise/ABM Signal(x,y,z) (6x6x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0535999 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1 comp = 11.1 dB A/m
BWC Factor = 0.0535999 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM Signal(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

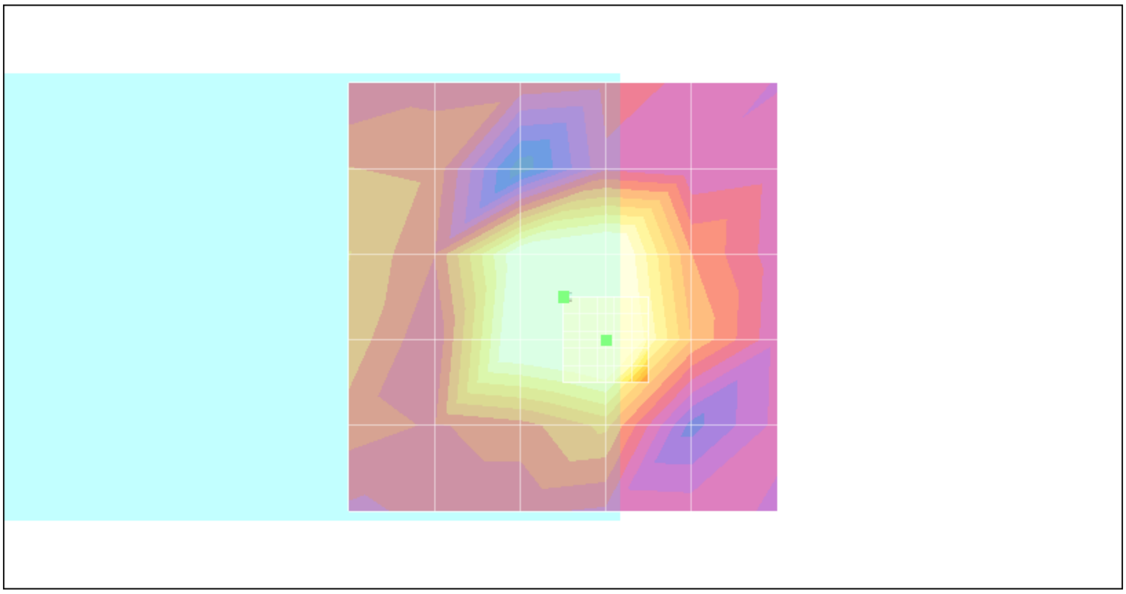
Cursor:
ABM1 comp = 11.2 dB A/m
BWC Factor = 0.0491963 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) scan at point with noise/ABM SNR(x,y,z) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.386
Measure Window Start: 0ms
Measure Window Length: 2000ms
BWC applied: 0.0491963 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
ABM1/ABM2 = 42.0 dB
ABM1 comp = 11.2 dB A/m
BWC Factor = 0.0491963 dB
Location: 0, 0, 363.7 mm

Point scan/z (axial) 300-3k response at max/ABM Freq Resp(x,y,z,f) (1x1x1):
Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_300-3000_2s.wav
Output Gain: 71.26
Measure Window Start: 2000ms
Measure Window Length: 4000ms
BWC applied: 10.7 dB
Device Reference Point: 0.000, 0.000, 353.7 mm

Cursor:
Diff = 1.37 dB
BWC Factor = 10.7 dB
Location: 0, 0, 363.7 mm



0 dB = 1.00A/m

Appendix B – Calibration Data

Please refer to the calibration certificates of DASY as below.

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

S Schweizerischer Kalibrierdienst
C Service suisse d'étalonnage
S Servizio svizzero di taratura
S Swiss Calibration Service

Accredited by the Swiss 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 **Sporton (Auden)**

Certificate No: **CD835V3-1045_Sep07**

CALIBRATION CERTIFICATE

Object	CD835V3 - SN: 1045
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	September 25, 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
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Dec-07
DAE4	SN: 903	19-Sep-07 (SPEAG, No. DAE4-903_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Nov-06)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator E4433B	MY 41310391	22-Nov-04 (SCV, TRS 001-021-0354)	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: September 27, 2007

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

References

[1] ANSI-C63.19-2006
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.
- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections.
It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the feed point.

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B55
DASY PP Version	SEMCAD	V1.8 B176
Phantom	HAC Test Arch	SD HAC P01 BA, #1070
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	< 0.05 dB	

2 Maximum Field values

H-field 10 mm above dipole surface	condition	**interpolated maximum**
Maximum measured	100 mW forward power	**0.453 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	168.2 V/m
Maximum measured above low end	100 mW forward power	165.9 V/m
Averaged maximum above arm	100 mW forward power	**167.1 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	Return Loss	Impedance
800 MHz	15.4 dB	(41.9 – j13.5) Ohm
835 MHz	**30.8 dB**	**(49.7 + j2.8) Ohm**
900 MHz	17.1 dB	(55.1 – j13.9) Ohm
950 MHz	18.9 dB	(48.6 + j11.1) Ohm
960 MHz	15.0 dB	(54.9 + j18.3) Ohm

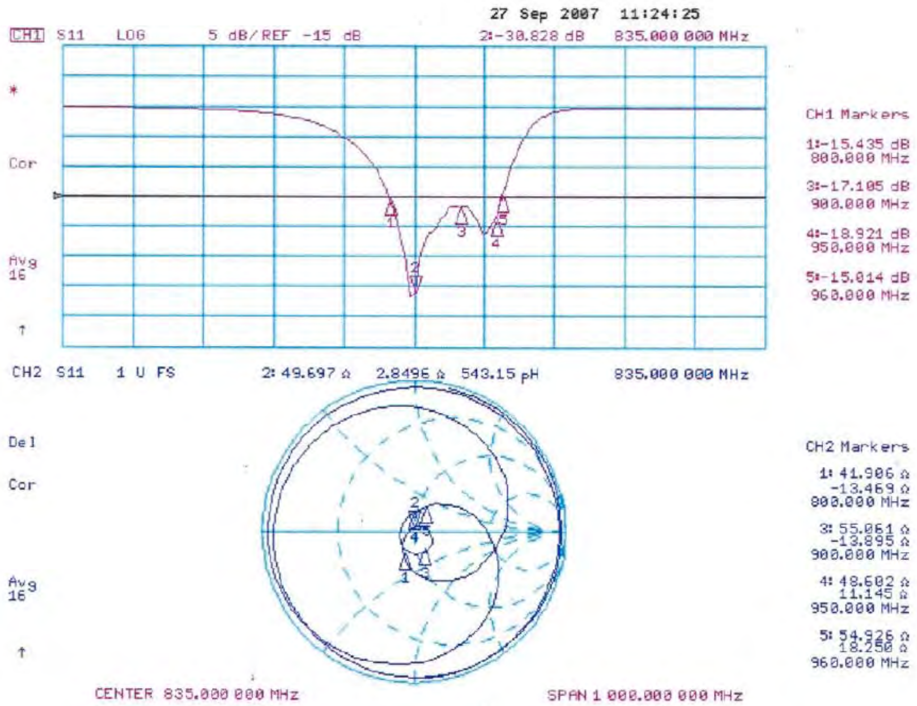
3.2 Antenna Design and Handling

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 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-field result

Date/Time: 25.09.2007 13:54:05

Test Laboratory: SPEAG Lab 2

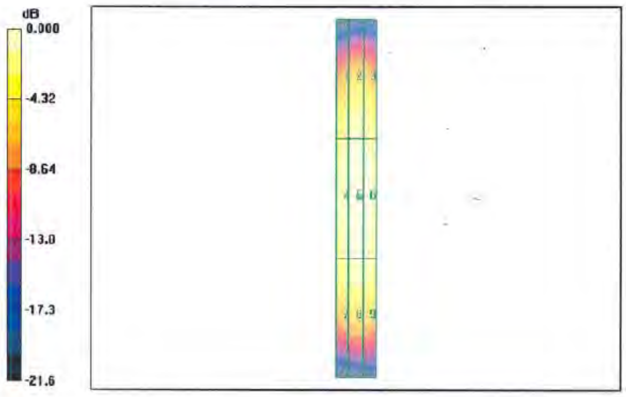
DUT: HAC-Dipole 835 MHz; Type: CD835V3; Serial: 1045
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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 = 0.453 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.477 A/m; Power Drift = 0.000 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.364** M4	Grid 2 **0.405** M4	Grid 3 **0.396** M4
Grid 4 **0.411** M4	Grid 5 **0.453** **M4**	Grid 6 **0.444** M4
Grid 7 **0.362** M4	Grid 8 **0.398** M4	Grid 9 **0.391** M4



0 dB = 0.453A/m

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Accreditation No.: **SCS 108**

Client **Sporton (Auden)**

Certificate No: **CD1880V3-1038_Sep07**

CALIBRATION CERTIFICATE

Object	CD1880V3 - SN: 1038
Calibration procedure(s)	QA CAL-20.v4 Calibration procedure for dipoles in air
Calibration date:	September 27, 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
Power meter EPM-442A	GB37480704	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Power sensor HP 8481A	US37292783	03-Oct-06 (METAS, No. 217-00608)	Oct-07
Probe ER3DV6	SN: 2336	27-Dec-06 (SPEAG, No. ER3-2336_Dec06)	Dec-07
Probe H3DV6	SN: 6065	27-Dec-06 (SPEAG, No. H3-6065-Dec06)	Dec-07
DAE4	SN: 903	19-Sep-07 (SPEAG, No. DAE4-903_Sep07)	Sep-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
Power meter EPM-4419B	GB42420191	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482A	US37295597	11-May-05 (SPEAG, in house check Nov-06)	In house check: Nov-07
Power sensor HP 8482H	3318A09450	08-Jan-02 (SPEAG, in house check Nov-06)	In house check: Nov-07
Network Analyzer HP 8753E	US37390585	18-Oct-01 (SPEAG, in house check Oct-06)	In house check: Oct-07
RF generator E4433B	MY 41310391	22-Nov-04 (SCV, TRS 001-021-0354)	In house check: Nov-07

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

Issued: September 28, 2007

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References

[1] ANSI-C63.19-2006
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

Methods Applied and Interpretation of Parameters:

- *Coordinate System:* y-axis is in the direction of the dipole arms. z-axis is from the basis of the antenna (mounted on the table) towards its feed point between the two dipole arms. x-axis is normal to the other axes. In coincidence with standard [1], the measurement planes (probe sensor center) are selected to be at a distance of 10 mm above the top edge of the dipole arms.
- *Measurement Conditions:* Further details are available from the hardcopies at the end of the certificate. All figures stated in the certificate are valid at the frequency indicated. The forward power to the dipole connector is set with a calibrated power meter connected and monitored with an auxiliary power meter connected to a directional coupler. While the dipole under test is connected, the forward power is adjusted to the same level.
- *Antenna Positioning:* The dipole is mounted on a HAC Test Arch phantom using the matching dipole positioner with the arms horizontal and the feeding cable coming from the floor. The measurements are performed in a shielded room with absorbers around the setup to reduce the reflections.
It is verified before the mounting of the dipole under the Test Arch phantom, that its arms are perfectly in a line. It is installed on the HAC dipole positioner with its arms parallel below the dielectric reference wire and able to move elastically in vertical direction without changing its relative position to the top center of the Test Arch phantom. The vertical distance to the probe is adjusted after dipole mounting with a DASY4 Surface Check job. Before the measurement, the distance between phantom surface and probe tip is verified. The proper measurement distance is selected by choosing the matching section of the HAC Test Arch phantom with the proper device reference point (upper surface of the dipole) and the matching grid reference point (tip of the probe) considering the probe sensor offset. The vertical distance to the probe is essential for the accuracy.
- *Feed Point Impedance and Return Loss:* These parameters are measured using a HP 8753E Vector Network Analyzer. The impedance is specified at the SMA connector of the dipole. The influence of reflections was eliminating by applying the averaging function while moving the dipole in the air, at least 70cm away from any obstacles.
- *E- field distribution:* E field is measured in the x-y-plane with an isotropic ER3D-field probe with 100 mW forward power to the antenna feed point. In accordance with [1], the scan area is 20mm wide, its length exceeds the dipole arm length (180 or 90mm). The sensor center is 10 mm (in z) above the top of the dipole arms. Two 3D maxima are available near the end of the dipole arms. Assuming the dipole arms are perfectly in one line, the average of these two maxima (in subgrid 2 and subgrid 8) is determined to compensate for any non-parallelity to the measurement plane as well as the sensor displacement. The E-field value stated as calibration value represents the maximum of the interpolated 3D-E-field, 10mm above the dipole surface.
- *H-field distribution:* H-field is measured with an isotropic H-field probe with 100mW forward power to the antenna feed point, in the x-y-plane. The scan area and sensor distance is equivalent to the E-field scan. The maximum of the field is available at the center (subgrid 5) above the feed point. The H-field value stated as calibration value represents the maximum of the interpolated H-field, 10mm above the dipole surface at the feed point.

1 Measurement Conditions

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

DASY Version	DASY4	V4.7 B55
DASY PP Version	SEMCAD	V1.8 B176
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	**0.471 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	138.9 V/m
Maximum measured above low end	100 mW forward power	138.8 V/m
Averaged maximum above arm	100 mW forward power	**138.9 V/m**

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

3 Appendix

3.1 Antenna Parameters

Frequency	**Return Loss**	**Impedance**
1710 MHz	19.2 dB	(48.9 + j10.9) Ohm
1880 MHz	**22.1 dB**	**(53.8 + j7.2) Ohm**
1900 MHz	22.1 dB	(56.5 + j5.2) Ohm
1950 MHz	26.1 dB	(54.3 – j2.9) Ohm
2000 MHz	19.1 dB	(40.1 + j0.4) Ohm

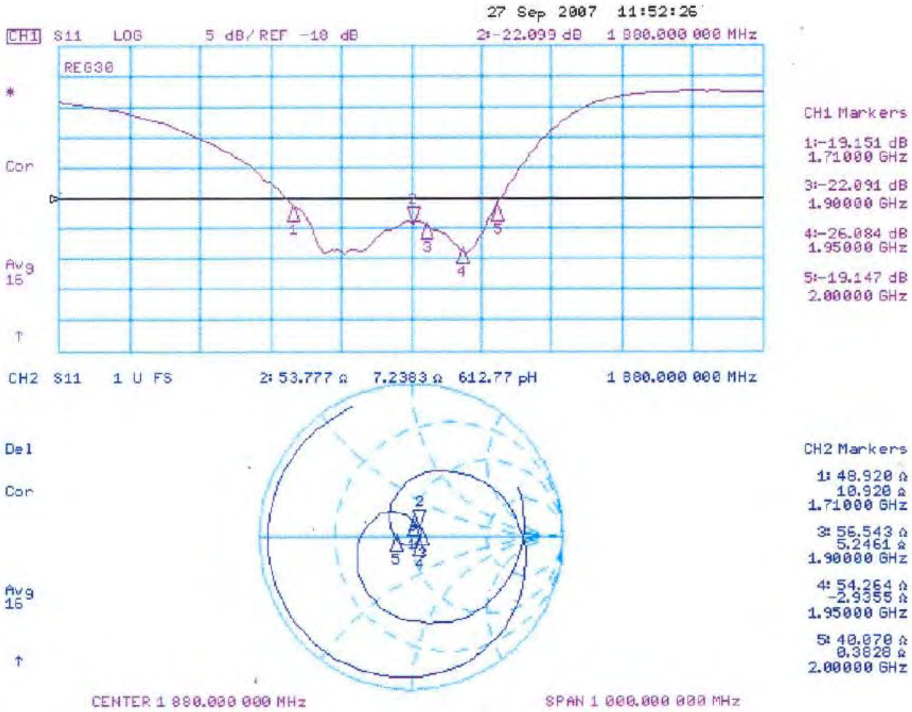
3.2 Antenna Design and Handling

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 Measurement Sheets

3.3.1 Return Loss and Smith Chart



3.3.2 DASY4 H-Field Result

Date/Time: 25.09.2007 15:53:23

Test Laboratory: SPEAG Lab 2

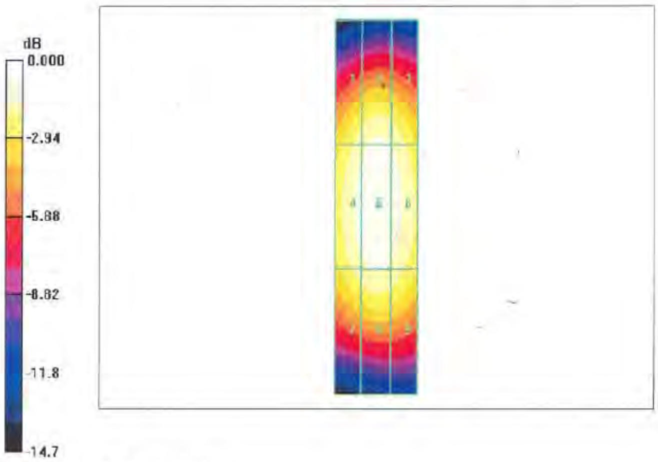
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1038
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Phantom section: H Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: H3DV6 - SN6065; ; Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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 = 0.471 A/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 0.498 A/m; Power Drift = 0.009 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak H-field in A/m

Grid 1 **0.404 M2**	Grid 2 **0.435 M2**	Grid 3 **0.418 M2**
Grid 4 **0.442 M2**	Grid 5 **0.471 M2**	Grid 6 **0.454 M2**
Grid 7 **0.402 M2**	Grid 8 **0.426 M2**	Grid 9 **0.410 M2**



0 dB = 0.471A/m

3.3.3 DASY4 E-Field Result

Date/Time: 27.09.2007 12:27:44

Test Laboratory: SPEAG Lab 2

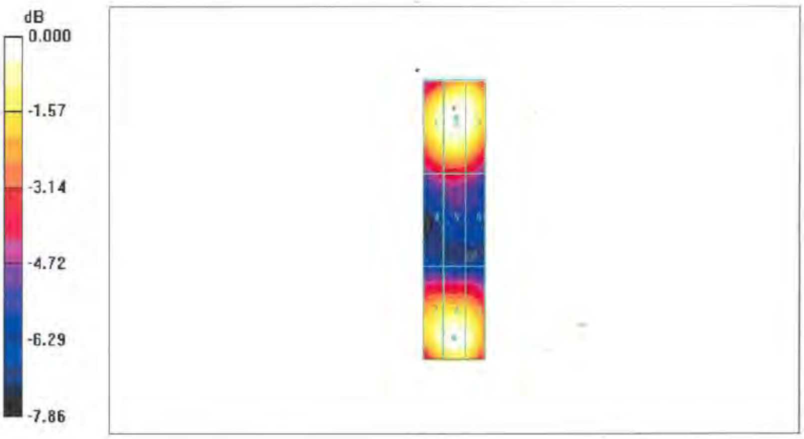
DUT: HAC Dipole 1880 MHz; Type: CD1880V3; Serial: 1038
Communication System: CW; Frequency: 1880 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 19.09.2007
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 174

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 = 138.9 V/m
Probe Modulation Factor = 1.00
Reference Value = 156.3 V/m; Power Drift = 0.002 dB
Hearing Aid Near-Field Category: M2 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **133.8 M2**	Grid 2 **138.9 M2**	Grid 3 **137.0 M2**
Grid 4 **89.9 M3**	Grid 5 **92.3 M3**	Grid 6 **89.1 M3**
Grid 7 **133.4 M2**	Grid 8 **138.8 M2**	Grid 9 **133.8 M2**



0 dB = 138.9V/m

3.3.3 DASY4 E-Field result

Date/Time: 25.09.2007 11:58:13

Test Laboratory: SPEAG Lab 2

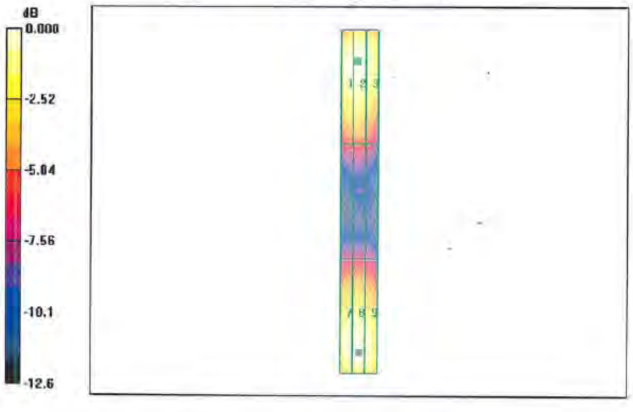
DUT: HAC-Dipole 835 MHz; Type: D835V3; Serial: 1045
Communication System: CW; Frequency: 835 MHz; Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ mho/m, $\varepsilon_r = 1$; $\rho = 1000$ kg/m^3
Phantom section: E Dipole Section
Measurement Standard: DASY4 (High Precision Assessment)
DASY4 Configuration:

- Probe: ER3DV6 - SN2336; ConvF(1, 1, 1); Calibrated: 27.12.2006
- Sensor-Surface: (Fix Surface)
- Electronics: DAE4 Sn903; Calibrated: 31.08.2006
- Phantom: HAC Test Arch with Coil; Type: SD HAC P01 BA; Serial: 1070
- Measurement SW: DASY4, V4.7 Build 55; Postprocessing SW: SEMCAD, V1.8 Build 176

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 = 168.2 V/m
Probe Modulation Factor = 1.00
Device Reference Point: 0.000, 0.000, 354.7 mm
Reference Value = 109.0 V/m; Power Drift = -0.007 dB
Hearing Aid Near-Field Category: M4 (AWF 0 dB)

Peak E-field in V/m

Grid 1 **164.2** **M4**	Grid 2 **165.9** **M4**	Grid 3 **157.1** **M4**
Grid 4 **87.2** **M4**	Grid 5 **88.4** **M4**	Grid 6 **84.0** **M4**
Grid 7 **163.2** **M4**	Grid 8 **168.2** **M4**	Grid 9 **161.1** **M4**



0 dB = 168.2V/m

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Accreditation No.: **SCS 108**

Client **SGS (Auden)**

Certificate No: **AM1DV2-1030_Apr08**

CALIBRATION CERTIFICATE

Object	AM1DV2 - SN: 1030
Calibration procedure(s)	QA CAL-24.v2 Calibration procedure for AM1D magnetic field probes and TMFS in the audio range
Calibration date	April 16, 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 (Certificate No.)	Scheduled Calibration
Keithley Multimeter Type 2001	SN: 0810278	03-Oct-07 (No: 6465)	Oct-08
Reference Probe AM1DV2	SN: 1008	23-Jan-08 (No. AM1D-1008_Jan08)	Jan-09
DAE4	SN: 781	2-Oct-07 (No. DAE4-781_Oct07)	Oct-08

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	1050	15-Aug-07 (in house check Aug-07)	Aug-09

	Name	Function	Signature
Calibrated by:	Mike Meili	RF Technician	
Approved by:	Fin Bomholt	R&D Director	F. Bomholt

Issued: April 17, 2008

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

References

[1] ANSI C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.

[2] DASY4 manual, Chapter: Hearing Aid Compatibility (HAC) T-Coil Extension

Description of the AM1D probe

The AM1D 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 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 nominally 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 a DASY system, the probe must be operated with the special probe cup provided (larger diameter).

Methods Applied and Interpretation of Parameters

- *Coordinate System:* The AM1D probe is mounted in the DASY system for operation with a HAC Test Arch phantom with AMCC Helmholtz calibration coil according to [2], with the tip pointing to "southwest" orientation.
- *Functional Test:* The functional test preceding calibration includes test of
  Noise level
  RF immunity (1kHz AM modulated signal). The shield of the probe cable must be well connected.
  Frequency response verification from 100 Hz to 5 kHz.
- *Connector Rotation:* The connector at the end of the probe does not carry any signals and is used for fixation to the DAE only. The probe is operated in the center of the AMCC Helmholtz coil using a 1 kHz magnetic field signal. Its angle is determined from the two minima at nominally +120° and −120° rotation, so the sensor in the tip of the probe is aligned to the vertical plane in z-direction, corresponding to the field maximum in the AMCC Helmholtz calibration coil.
- *Sensor Angle:* The sensor tilting in the vertical plane from the ideal vertical direction is determined from the two minima at nominally +120° and −120°. DASY system uses this angle to align the sensor for radial measurements to the x and y axis in the horizontal plane.
- *Sensitivity:* With the probe sensor aligned to the z-field in the AMCC, the output of the probe is compared to the magnetic field in the AMCC at 1 kHz. The field in the AMCC Helmholtz coil is given by the geometry and the current through the coil, which is monitored on the precision shunt resistor of the coil.

AM1D probe identification and configuration data

Item	**AM1DV2** Audio Magnetic 1D Field Probe
Type No	SP AM1 001 AE
Serial No	**1030**

Overall length	296 mm
Tip diameter	6.0 mm (at the tip)
Sensor offset	3.0 mm (centre of sensor from tip)
Internal Amplifier	40 dB

Manufacturer / Origin	Schmid & Partner Engineering AG, Zürich, Switzerland
Manufacturing date	2006
Last calibration date	N/A (probe replacement)

Calibration data

Connector rotation angle	(in DASY system)	**251.6 °**	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	**- 0.11 °**	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	**0.0648 V / (A/m)**	+/- 2.2 % (k=2)

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Accreditation No.: SCS 108

Client **Sporton (Auden)**

Certificate No: DAE3-577_Nov08

CALIBRATION CERTIFICATE

Object	DAE3 - SD 000 D03 AA - SN: 577
Calibration procedure(s)	QA CAL-06.v12 Calibration procedure for the data acquisition electronics (DAE)
Calibration date:	November 12, 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 (Certificate No.)	Scheduled Calibration
Fluke Process Calibrator Type 702	SN: 6295803	30-Sep-08 (No: 7673)	Sep-09
Keithley Multimeter Type 2001	SN: 0810278	30-Sep-08 (No: 7670)	Sep-09
Secondary Standards	**ID #**	**Check Date (in house)**	**Scheduled Check**
Calibrator Box V1.1	SE UMS 006 AB 1004	06-Jun-08 (in house check)	In house check: Jun-09

	Name	Function	Signature
Calibrated by:	Andrea Guntli	Technician	
Approved by:	Fin Bomholt	R&D Director	i.V.

Issued: November 12, 2008

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Accreditation No.: **SCS 108**

Glossary

DAE	data acquisition electronics
Connector angle	information used in DASY system to align probe sensor X to the robot coordinate system.

Methods Applied and Interpretation of Parameters

- *DC Voltage Measurement:* Calibration Factor assessed for use in DASY system by comparison with a calibrated instrument traceable to national standards. The figure given corresponds to the full scale range of the voltmeter in the respective range.
- *Connector angle*: The angle of the connector is assessed measuring the angle mechanically by a tool inserted. Uncertainty is not required.
- The following parameters as documented in the Appendix contain technical information as a result from the performance test and require no uncertainty.
  - *DC Voltage Measurement Linearity:* Verification of the Linearity at +10% and -10% of the nominal calibration voltage. Influence of offset voltage is included in this measurement.
  - *Common mode sensitivity:* Influence of a positive or negative common mode voltage on the differential measurement.
  - *Channel separation:* Influence of a voltage on the neighbor channels not subject to an input voltage.
  - *AD Converter Values with inputs shorted:* Values on the internal AD converter corresponding to zero input voltage
  - *Input Offset Measurement*: Output voltage and statistical results over a large number of zero voltage measurements.
  - *Input Offset Current:* Typical value for information; Maximum channel input offset current, not considering the input resistance.
  - *Input resistance:* DAE input resistance at the connector, during internal auto-zeroing and during measurement.
  - *Low Battery Alarm Voltage:* Typical value for information. Below this voltage, a battery alarm signal is generated.
  - *Power consumption:* Typical value for information. Supply currents in various operating modes.

DC Voltage Measurement

A/D - Converter Resolution nominal

High Range: 1LSB = 6.1μV , full range = -100...+300 mV

Low Range: 1LSB = 61nV , full range = -1.......+3mV

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

Calibration Factors	X	Y	Z
High Range	404.437 ± 0.1% (k=2)	403.882 ± 0.1% (k=2)	404.321 ± 0.1% (k=2)
Low Range	3.93985 ± 0.7% (k=2)	3.94699 ± 0.7% (k=2)	3.94542 ± 0.7% (k=2)

Connector Angle

Connector Angle to be used in DASY system	268 ° ± 1 °

Appendix

1. DC Voltage Linearity

High Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	200000	200000.5	0.00
Channel X	+ Input	20000	20006.28	0.03
Channel X	- Input	20000	-19997.96	-0.01
Channel Y	+ Input	200000	199999.8	0.00
Channel Y	+ Input	20000	20003.35	0.02
Channel Y	- Input	20000	-20003.31	0.02
Channel Z	+ Input	200000	200000.3	0.00
Channel Z	+ Input	20000	20006.28	0.03
Channel Z	- Input	20000	-19999.42	0.00

Low Range		Input (μV)	Reading (μV)	Error (%)
Channel X	+ Input	2000	2000	0.00
Channel X	+ Input	200	200.64	0.32
Channel X	- Input	200	-199.61	-0.19
Channel Y	+ Input	2000	2000	0.00
Channel Y	+ Input	200	199.39	-0.31
Channel Y	- Input	200	-201.03	0.52
Channel Z	+ Input	2000	2000	0.00
Channel Z	+ Input	200	199.42	-0.29
Channel Z	- Input	200	-200.73	0.36

2. Common mode sensitivity

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Common mode Input Voltage (mV)	High Range Average Reading (μV)	Low Range Average Reading (μV)
Channel X	200	13.38	13.83
	- 200	-13.53	-13.82
Channel Y	200	-5.55	-6.09
	- 200	5.06	5.66
Channel Z	200	-1.00	-0.72
	- 200	-0.80	-0.52

3. Channel separation

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	Input Voltage (mV)	Channel X (μV)	Channel Y (μV)	Channel Z (μV)
Channel X	200	-	1.66	0.50
Channel Y	200	1.90	-	3.95
Channel Z	200	-0.95	0.48	-

4. AD-Converter Values with inputs shorted

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec

	High Range (LSB)	Low Range (LSB)
Channel X	15967	16080
Channel Y	15851	16385
Channel Z	16197	16100

5. Input Offset Measurement

DASY measurement parameters: Auto Zero Time: 3 sec; Measuring time: 3 sec
Input 10MΩ

	Average (μV)	min. Offset (μV)	max. Offset (μV)	Std. Deviation (μV)
Channel X	1.13	-1.22	2.29	0.58
Channel Y	-1.51	-2.99	0.83	0.52
Channel Z	0.02	-0.89	0.92	0.38

6. Input Offset Current

Nominal Input circuitry offset current on all channels: <25fA

7. Input Resistance

	Zeroing (MOhm)	Measuring (MOhm)
Channel X	0.2000	198.6
Channel Y	0.2001	199.4
Channel Z	0.2000	198.8

8. Low Battery Alarm Voltage (verified during pre test)

Typical values	Alarm Level (VDC)
Supply (+ Vcc)	+7.9
Supply (- Vcc)	-7.6

9. Power Consumption (verified during pre test)

Typical values	Switched off (mA)	Stand by (mA)	Transmitting (mA)
Supply (+ Vcc)	+0.0	+6	+14
Supply (- Vcc)	-0.01	-8	-9