HAC TEST REPORT

Test Report No. : 10636726H-M-R1

Applicant	:	**Panasonic Mobile Communications Development of Europe Ltd**
Type of Equipment	:	**Digital Camera**
Model No.	:	**DMC-CM1**
FCC ID	:	**UCE314062A**
Test regulation	:	**FCC47 CFR 20.19** **ANSI C63.19 : 2011**
Test Result	:	**Complied**
HAC T Category	:	**T3**

1. This test report shall not be reproduced in full or partial, without the written approval of UL Japan, Inc.
2. The results in this report apply only to the sample tested.
3. This sample tested is in compliance with the limits of the above regulation.
4. The test results in this report are traceable to the national or international standards.
5. This test report covers HAC technical requirements. It does not cover administrative issues such as Manual or non-HAC test related Requirements. (if applicable)
6. This report is a revised version of 10636726H-M. 10636726H-M is replaced with this report.

Date of test: February 9, 2015

Representative test engineer:

Hisayoshi Sato
Engineer
Consumer Technology Division

Approved by :

Takayuki Shimada
Engineer
Consumer Technology Division

REVISION HISTORY

Original Test Report No.: 10636726H-M

Revision	Test report No.	Date	Page revised	Contents
- (Original)	10636726H-M	February 20, 2015	-	-
1	10636726H-M-R1	March 5, 2015	P.4	Correction of rating

CONTENTS PAGE

SECTION 1: Customer information

Company Name	:	Panasonic Mobile Communications Development of Europe Ltd
Address	:	Willoughby Road, Bracknell Berkshire RG12 8FP, UK
Telephone Number	:	+44 (0) 1344 706774
Facsimile Number	:	+44 (0) 1344 706796
Contact Person	:	Andrew James

SECTION 2: Equipment under test (E.U.T.)

2.1 Identification of E.U.T.

Type of Equipment	:	Digital Camera
Model No.	:	DMC-CM1
Serial No.	:	004401221416395
Rating	:	AC120V/60Hz (AC Adaptor) DC3.8V (Battery)
Option Battery	:	None
Body-worn Accessary	:	Typical Earphone
Receipt Date of Sample	:	January 7, 2015
Country of Mass-production	:	China
Condition of EUT	:	Production prototype (Not for Sale: This sample is equivalent to mass-produced items.)
Modification of EUT	:	No Modification by the test lab

2.2 Product description

General Specification

Power Supply (radio part input) : Cellular PA: 3.0V-4.2V (Depend on Battery voltage)
Cellular other RF part: 1.3V, 1.8V, 2.05V, 2.7V (Regulated voltage)
WLAN 5GHz Front-end module: 3.0V-4.2V (Depend on Battery voltage)
WLAN/BT other RF part: 1.3V, 1.8V, 3.0V (Regulated voltage)

Clock frequency(ies) in the system : 2.26GHz (Max)
See below table for other clock frequencies

Frequency	Device
32.768kHz	MSM8974AB
32.768kHz (X'tal)	BUYD2206
27.0MHz	TC358764AXBG, XO2-256-64UCBGA, BUYD2206
48.0MHz (X'tal)	WCN3680
24.0MHz	MSM8974AB, Sub Camera
19.2MHz	WTR1625L, MSM8974AB
19.2MHz (X'tal)	PM8941
9.6MHz	WCD9320
72MHz	Main Camera
27.12MHz	NFC IC

Hardware / Software version : Rev. PR / QRCT Version 3.0.32.0

Radio Specification

	IEEE802.11b	**IEEE802.11g/n (20 M band)**	**IEEE802.11a/n/ac (20 M band)**	**IEEE802.11n/ac (40 M band)**	**IEEE802.11ac (80 M band)**
Frequency of operation	2412-2462MHz	2412-2462MHz	5180-5240MHz 5260-5320MHz 5500-5700MHz 5745-5825MHz	5190-5230MHz 5270-5310MHz 5510-5670MHz 5755-5795MHz	5210MHz 5290MHz 5530-5610MHz 5775MHz
Type of modulation	DSSS (CCK, DQPSK, DBPSK)	OFDM-CCK (64QAM, 16QAM, QPSK, BPSK)	OFDM (64QAM, 16QAM, QPSK, BPSK)		OFDM (64QAM, 16QAM, QPSK, BPSK, 256QAM)
Channel spacing	5MHz		20MHz	40MHz	80MHz
Antenna type	Monopole				
Antenna Connector type	Spring type				
Antenna Gain	2.4GHz: -5.40dBi W52: -3.0dBi, W53: -3.5dBi, W56: -1.5dBi, W58: -1.8dBi				

	Bluetooth Ver.4.0 with EDR function	**GSM**	**W-CDMA**	**LTE**
Frequency of operation	2402-2480MHz	[Up Link] GSM850: 824 – 849MHz PCS: 1850 – 1910MHz [Down Link] GSM850: 869 – 894MHz PCS: 1930 – 1990MHz	[Up Link] Band II: 1850 – 1910MHz Band IV: 1710 – 1755MHz Band V: 824 – 849MHz [Down Link] Band II: 1930 – 1990MHz Band IV: 2110 – 2155MHz Band V: 869 – 894MHz	[Up Link] Band II: 1850 – 1910MHz Band IV: 1710 – 1755MHz Band V: 824 – 849MHz Band VII: 2500 – 2570MHz Band X VII: 704 – 716MHz [Down Link] Band II: 1930 – 1990MHz Band IV: 2110 – 2155MHz Band V: 869 – 894MHz Band VII: 2620 – 2690MHz Band X VII: 734 – 746MHz
Type of modulation	BT: FHSS (GFSK, π/4-DQPSK, 8-DPSK) LE: GFSK	GMSK , 8PSK	QPSK	QPSK, 16QAM
Channel spacing	BT: 1MHz, LE: 2MHz	200kHz	200kHz	100kHz
Antenna type	Monopole	Monopole	Main: Monopole Sub: Monopole	
Antenna Connector type	Spring type	Spring type	Main: Spring type Sub: Spring type	
Antenna Gain	-5.40dBi	GSM850: -0.9dBi PCS: 0.5dBi	Band II: 0.5dBi Band IV: 0.6dBi Band V: -0.9dBi	Band II: 0.5dBi Band IV: 0.6dBi Band V: -0.9dBi Band VII: -0.2dBi Band X VII: -1.5dBi

	NFC	**GPS/GLONASS**
Frequency of operation	13.56MHz	GPS: 1575.42MHz GLONASS: 1597.55-1605.89MHz
Type of modulation	ASK	GPS: BPSK GLONASS: BPSK
Channel spacing	-	GLONASS: 0.5625MHz
Antenna type	Loop	Monopole
Antenna Connector type	Spring type	Spring type
Antenna Gain	N/A	-2.9dBi

SECTION 3 : Test standard information

3.1 Requirements for compliance testing defined by the FCC

The Federal Communications Commission (FCC) has adopted specific hearing aid compatibility rules for digital wireless telephones.
The standard for compatibility of digital wireless phones with hearing aids is set forth in American National Standard Institute (ANSI) standard C63.19.
ANSI C63.19 contains two sets of standards: one for reduced radio frequency (RF) interference to enable acoustic coupling with hearing aids that do not operate in telecoil mode, and a separate standard to enable inductive coupling with hearing aids operating in telecoil mode. A digital wireless handset is considered hearing aid compatible for acoustic coupling if it meets a "U3" or "M3" rating under the ANSI standard. A digital wireless handset is considered hearing aid compatible for inductive coupling if it meets a "U3T" or "T3" rating under the ANSI standard.

The "M" rating indicates the amount of reduction of RF interference between telephones and hearing aids in acoustic coupling mode, while the "T" rating represents inductive coupling with hearing aids that are operating in telecoil mode.

The tests documented in this report were performed in accordance with ANSI C63.19-2011 Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids, FCC published procedure KDB 285076 D01 HAC Guidance, and KDB 285076 D02 T-Coil testing for CMRS IP v01r01.

Reference
[1]SPEAG uncertainty document (AN 15-7/AN19-17) for DASY 5 System from SPEAG (Schmid & Partner Engineering AG).

3.2 Procedure and result

No.	Item	Test Specification & Procedure	Limit	Result
1	HAC T-coil	FCC47 CFR 20.19 , ANSI C63.19, and published KDB procedures for HAC	ANSI C63.19	Complied T3
Note: UL Japan Inc. 's HAC T-coil Work Procedures 13-EM-W0436				

3.3 Limit

3.3.1 Axial and Radial Field Intensity

All orientations of the magnetic field, in the axial, horizontal and vertical position along the measurement plane shall be ≧ -18 dB(A/m) at 1kHz in a 1/3 octave band filter

3.3.2 Signal Quality

The table below prvides the signal quality requirement for the intended audio magnetic signal from a wireless device. Only the RF immunity of the hearing aid is measured in T-coil mode. It is assumed that ahearing aid can have no immunity to an interference siganal in the audio band, which is the intended reception band for this mode. The only criterion that can be measured is the RF immunity in T-coil mode. This is measured using the same procedure as the audio couplimg mode at the same levels.

The signal quality of the axial and radial components of the magnetic field was used to determine the T-coil mode category.

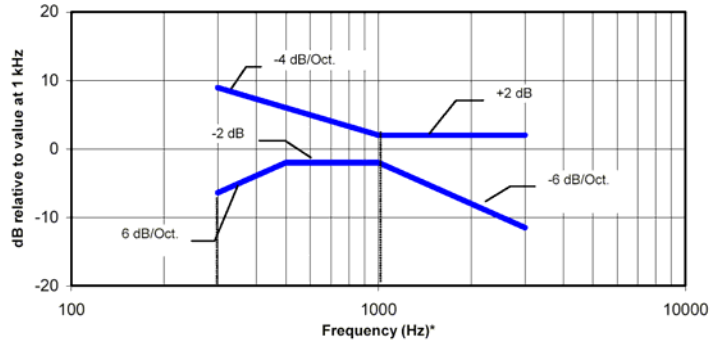
All digital transmission modes in all frequency bands contained in a HAC phone must meet T3 or T4 levels.

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

3.3.3 Frequency Response

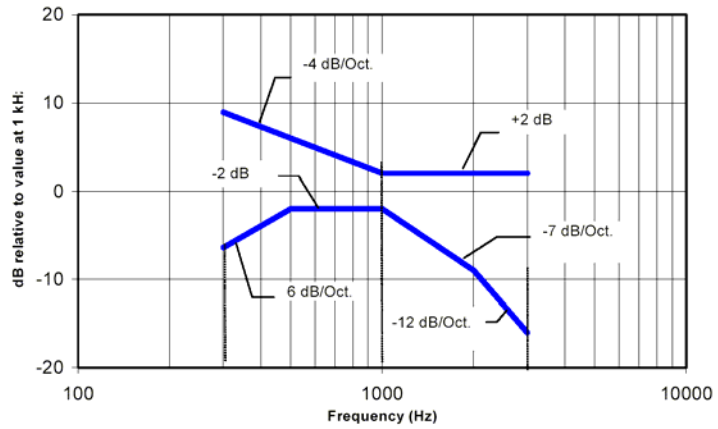
The frequency response of the axial component of the magnetic field shall follow the response curve specified, over the frequency range 300Hz – 3000Hz per.

Magnetic field frequency response for Wireless Devices with an axial field between ≦15dB (A/m) at 1kHz



NOTE—Frequency response is between 300 Hz and 3000 Hz.

Magnetic field frequency response for Wireless Devices with an axial field that exceeds -15dB (A/m) at 1kHz



E—Frequency response is between 300 Hz and 3000 Hz.

3.4 Test Location

*Shielded room for SAR testings
UL Japan, Inc. Ise EMC Lab.
4383-326 Asama-cho, Ise-shi, Mie-ken 516-0021 JAPAN
Telephone : +81 596 24 8999 Facsimile : +81 596 24 8124

SECTION 4 : Operation of E.U.T. during testing

4.1 Operating modes for HAC testing

4.1.1 Setting of EUT

<GSM850 >
Tx frequency band : 824.0MHz – 849.00MHz
Channel : 190ch(836.6MHz)/ Mid ch
Modulation : GSM (GMSK)
Power setting : Power class 5

<PCS1900 >
Frequency band : 1850.0MHz – 1910.0MHz
Channel : 661ch(1880.0MHz)/ Midch
Modulation : GSM (GMSK)
Power setting : Power class 0

<WCDDMA band II>
Frequency band : 1850.0MHz – 1910.0MHz
Channel : 9400ch(1880.0MHz)/ Midch
Modulation : GSM (GMSK)
Power setting : All up bits

<WCDDMA band IV>
Frequency band : 1710.0MHz – 1755.0MHz
Channel : 1412ch(1732.6MHz)/ Midch
Modulation : GSM (GMSK)
Power setting : All up bits

<WCDDMA band V>
Frequency band : 824.0MHz – 849.0MHz
Channel : 4183ch(836.6MHz)/ Midch
Modulation : GSM (GMSK)
Power setting : All up bits

<Other setting>
Volume max
Backlight off
Microphone off

Note: A communication link was set up with the Universal Radio communication Tester from Rohde & Schwarz(M/N: CMU200, SN: 106223 and 123230).

SECTION 5 : Test surrounding

5.1 Measurement uncertainty

The uncertainty budget has been determined for the DASY5 measurement system according to the SPEAG documents[1]and is given in the following Table.

Error Description	Uncertainty value ± %	Probability distribution	divisor	(ci) ABM1	(ci) ABM2	Standard Uncertainty ABM1	Standard Uncertainty 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	1	±0.4	±0.4
Probe Positioning during Calibr.	±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	±0.7	Rectangular	√3	0.1	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 Disturbation	±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

Note: [1] SPEAG documents Application Notes 25.6.2 Uncertainty Budget according to ANSI C63.19-2011.

SECTION 6 : Measurement results

6.1 HAC T-coil Results

Ambient temperature (deg.c.) : **24.0** Relative Humidity (%) : **43**
Atmospheric Pressure : **1009 hPa** Date : **February 9, 2015**

Mode	Channel	Probe orientation	Max ABM1 (dBA/m)	Max ABM1/ABM2 SNR (dB)	T-coil SNR Category	Frequency Response
GSM850 Voice Coder: Speechcod./Handset Low	836.6MHz(190ch)	z(Axial)	-2.89	21.44	**T3**	**OK**
GSM850 Voice Coder: Speechcod./Handset Low	836.6MHz(190ch)	y(Transversal)	-11.74	43.66	**T4**	-
PCS1900 Voice Coder: Speechcod./Handset Low	1880MHz(661ch)	z(Axial)	-4.73	24.23	**T3**	**OK**
PCS1900 Voice Coder: Speechcod./Handset Low	1880MHz(661ch)	y(Transversal)	-13.54	41.57	**T4**	-
WCDMA V Voice Coder: Speechcod./Handset Low	836.6MHz(4183ch)	z(Axial)	-4.20	44.77	**T4**	**OK**
WCDMA V Voice Coder: Speechcod./Handset Low	836.6MHz(4183ch)	y(Transversal)	-15.94	40.87	**T4**	-
WCDMA II Voice Coder: Speechcod./Handset Low	1880MHz(9400ch)	z(Axial)	-5.15	45.04	**T4**	**OK**
WCDMA II Voice Coder: Speechcod./Handset Low	1880MHz(9400ch)	y(Transversal)	-15.24	41.43	**T4**	-
WCDMA IV Voice Coder: Speechcod./Handset Low	1732.6(1412ch)	z(Axial)	-5.37	42.50	**T4**	**OK**
WCDMA IV Voice Coder: Speechcod./Handset Low	1732.6(1412ch)	y(Transversal)	-15.36	40.84	**T4**	-
LTE	Note tested No associated T-coil measurement has been made in accordance with KDB285076D02 T-Coil testing for CMRS IP.				-	-

Note(s):
Audio Band Magnetic signal - desired (ABM1): Measured quantity of the desired magnetic signal
Audio Band Magnetic signal - undesired (ABM2): Measured quantity of the undesired magnetic signal, such as interference from battery current and similar non-signal elements.

SECTION 7 Test instruments

Equipment used

Control No.	Instrument	Manufacturer	Model No	Serial No	Test Item	Calibration Date * Interval(month)
COTS-MSAR-03	Dasy5	Schmid&Partner Engineering AG	DASY5	-	HAC	-
MOS-26	Thermo-Hygrometer	CUSTOM	CTH-201	A08Q29	HAC	2014/05/20 * 12
MRBT-02	SAR robot	Schmid&Partner Engineering AG	TX60 Lspeag	F10/5E3LA1/A/01	HAC	2014/05/09 * 12
MAM-01-01	Audio Magnetic Measurement Instrument	Schmid&Partner Engineering AG	AMMI	1073	HAC	Pre Check
MAM-01-02	Audio Measurement Coil	Schmid&Partner Engineering AG	AMCC	35363804	HAC	Pre Check
MDAE-01	Data Acquisition Electronics	Schmid&Partner Engineering AG	DAE4	509	HAC	2014/07/28 * 12
MPB-06	Audio Magnetic Field Probe	Schmid&Partner Engineering AG	AM1DV2	1077	HAC	2014/12/09 * 12
-	Measurement room	-	-	-	Daily check Ambient Noise < -28dB (A/m)	

The expiration date of the calibration is the end of the expired month.
All equipment is calibrated with valid calibrations. Each measurement data is traceable to the national or international standards.

As for some calibrations performed after the tested dates, those test equipment have been controlled by means of an unbroken chains of calibrations.

APPENDIX 1 : HAC Measurement data

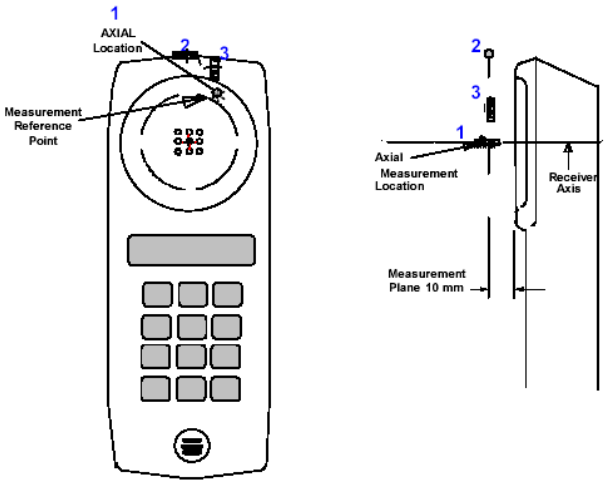
1. DASY5 HAC T-Coil measurement system and setup

1-a Input level

To determine correct input level, the Encoder / Decoder of Rohde & Schwarz CMU 200 base station simulator was calibrated for measurementd full-scale input voltage level.
Normal speech input levels

Standard	Technology	Input (dBm0)
TIA/EIA/IS 2000	CDMA	–18
TIA/EIA-136	TDMA (50 Hz)	–18
J-STD-007	GSM (217)	–16
T1/T1P1/3GPP [a]	UMTS (WCDMA)	–16
iDEN	TDMA (22 Hz and 11 Hz)	–18

1-b Measurement points and reference plane



NOTE—For reference purposes the grid used for Clause 4 testing of the WD in T-Coil mode has been added to this graphic.

2. Test procedure

a) Geometry & signal check
b) Background noise measurement. The background noise is measurement at the center of the listening area.
c) Coarse resolution axial scan (narrowband signal 1sec measurement times, 50 x 50cm grid with 4.2mm spacing). Only ABM1 is measured in order to find the location of the T-coil source.
d) Fine resolution axial, radial-transverse, & radial-lomgitudinal scans, positioned appropriately based on optimal ABM1 and ABM2 are measured in order to find the location of the SNR point.
e) ABM1 & ABM2 point measurement in axial, radial-transverse, & radial-lomgitudinal coil orientations, positioned appropriately based on optimal signal quality of fine resolution scans (narrowband signal, 2sec measurement times). SNR is calculated for each coil orientation.
f) Frequency Response point measurement in axial coil orientation, positioned appropriately based on optimal signals quality of fine resolution axial scan (broadband signal, 12sec measurement time)

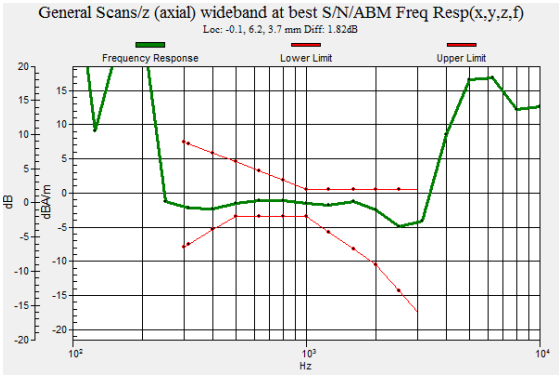
3. Measurement data

HAC T rate GSM850 GSM 836.6MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans/z (axial) wideband at best S/N/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: 71.51
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.81 dB
Device Reference Point: 0, 0, -6.3 mm

Cursor:
Diff = 1.82 dB
BWC Factor = 10.81 dB
Location: -0.1, 6.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



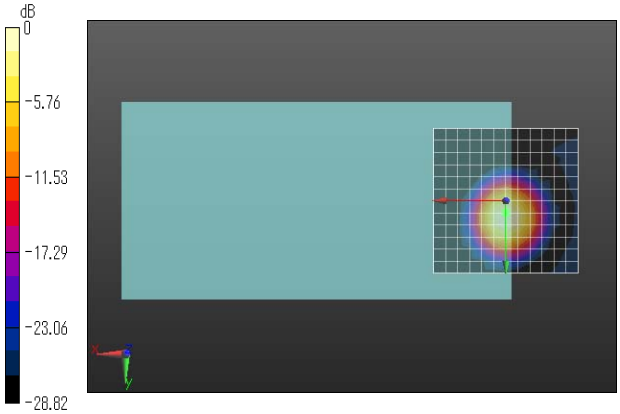
HAC T rate GSM850 GSM 836.6MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.52
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.17 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 21.44 dB
ABM1 comp = -2.89 dBA/m
BWC Factor = 0.17 dB
Location: 0, 4.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



0 dB = 11.81 = 21.44 dB

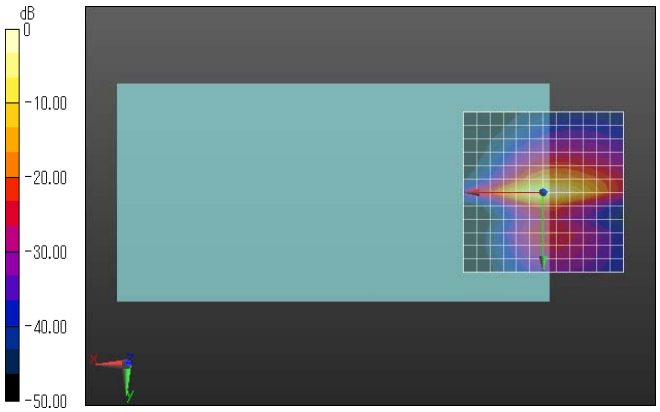
HAC T rate GSM850 GSM 836.6MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: GSM 850 (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.52
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.17 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 43.66 dB
ABM1 comp = -11.74 dBA/m
BWC Factor = 0.17 dB
Location: 0, 0, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



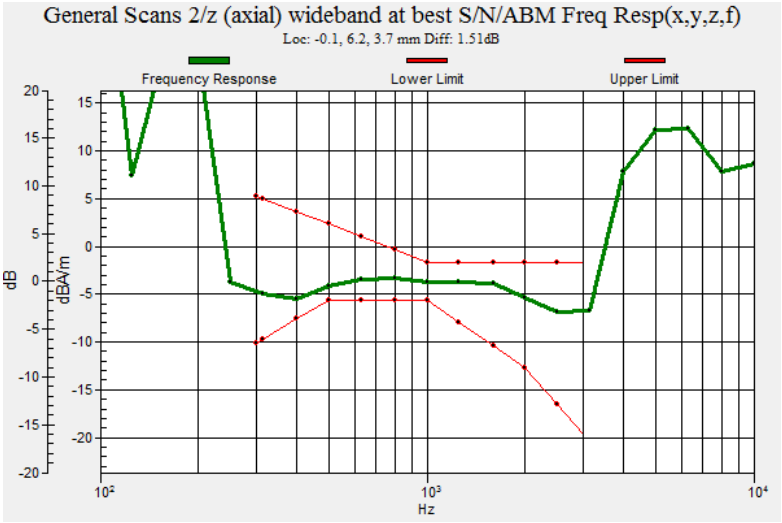
0 dB = 152.4 = 43.66 dB

HAC T rate PCS1900 GSM 1880.0MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/z (axial) wideband at best S/N/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: 71.51
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.81 dB
Device Reference Point: 0, 0, -6.3 mm

Cursor:
Diff = 1.51 dB
BWC Factor = 10.81 dB
Location: -0.1, 6.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



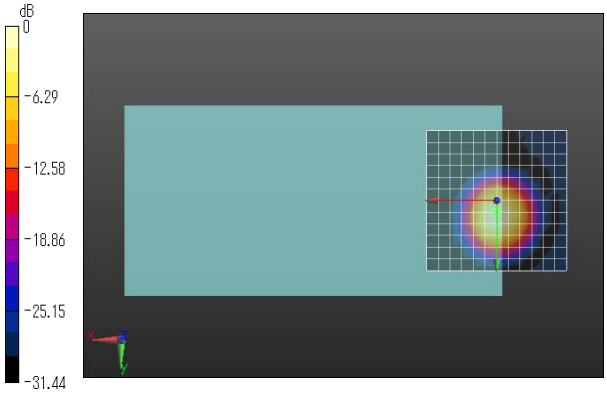
HAC T rate PCS1900 GSM 1880.0MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.52
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.17 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 24.23 dB
ABM1 comp = -4.73 dBA/m
BWC Factor = 0.17 dB
Location: 0, 4.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



0 dB = 16.28 = 24.23 dB

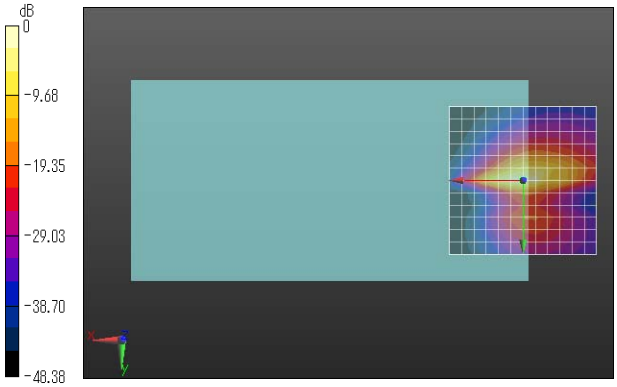
HAC T rate PCS1900 GSM 1880.0MHz
Communication System: UID 10021 - DAB, GSM-FDD (TDMA, GMSK); Communication System Band: PCS 1900 (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:8.6896

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 36.52
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.17 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 41.57 dB
ABM1 comp = -13.54 dBA/m
BWC Factor = 0.17 dB
Location: 0, 0, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



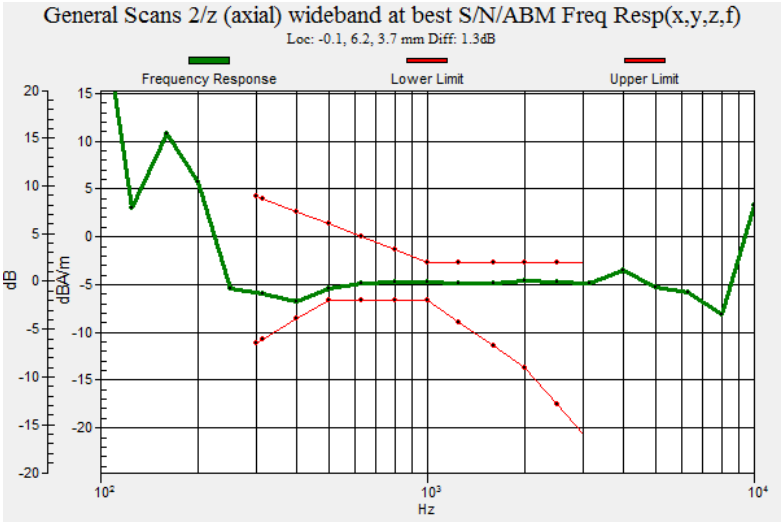
0 dB = 119.8 = 41.57 dB

HAC T rate WCDMA band V 836.6MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 5, UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:1.95434

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/z (axial) wideband at best S/N/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: 66.82
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.80 dB
Device Reference Point: 0, 0, -6.3 mm

Cursor:
Diff = 1.30 dB
BWC Factor = 10.80 dB
Location: -0.1, 6.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



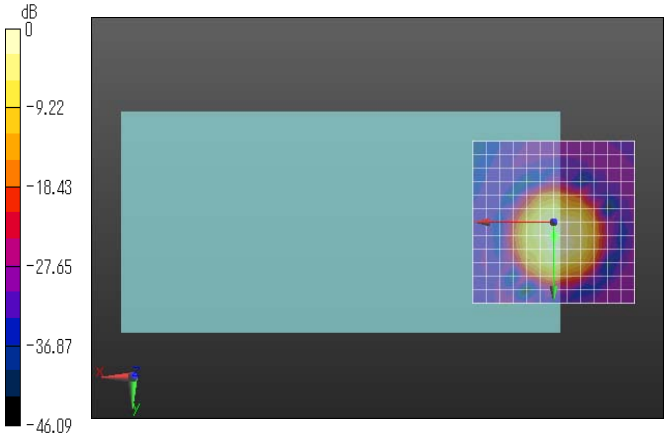
HAC T rate WCDMA band V 836.6MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 5, UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:1.95434

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 44.77 dB
ABM1 comp = -4.20 dBA/m
BWC Factor = 0.16 dB
Location: 0, 4.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.

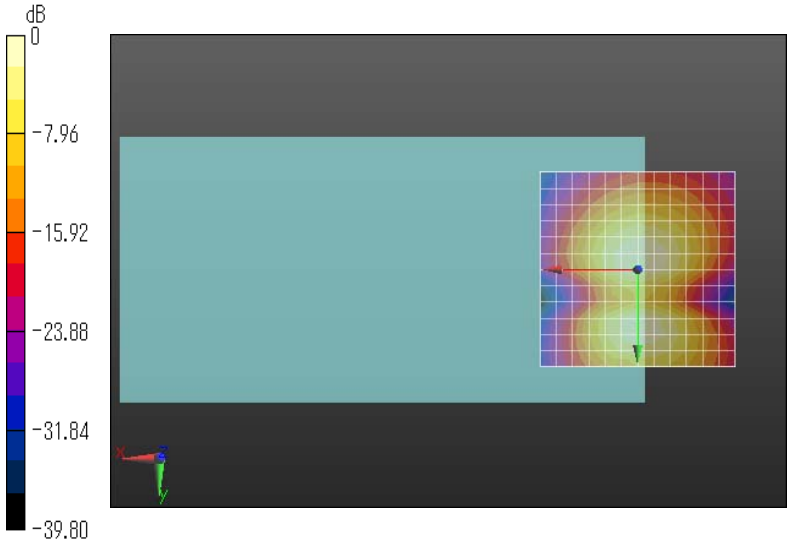


0 dB = 173.1 = 44.77 dB

HAC T rate WCDMA band V 836.6MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 5, UTRA/FDD (824.0 - 849.0 MHz); Frequency: 836.6 MHz;Duty Cycle: 1:1.95434
Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 40.87 dB
ABM1 comp = -15.94 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



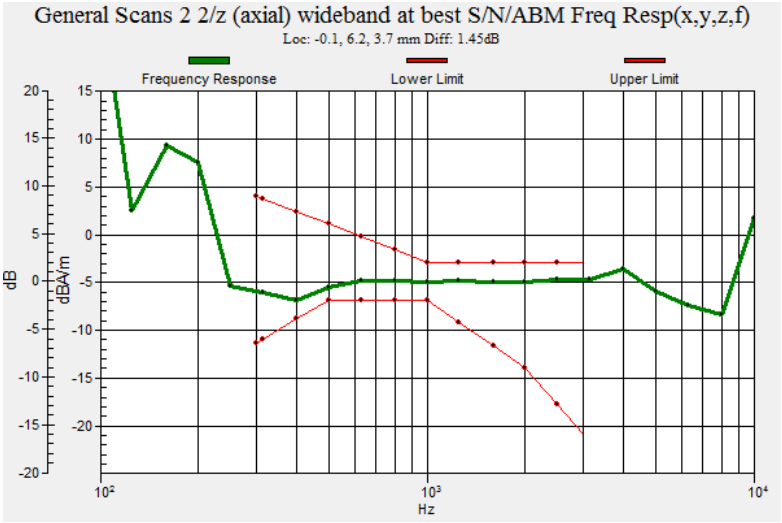
0 dB = 110.5 = 40.87 dB

HAC T rate WCDMA band II 1880MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 2, UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:1.95434

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2/z (axial) wideband at best S/N/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: 66.82
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.80 dB
Device Reference Point: 0, 0, -6.3 mm

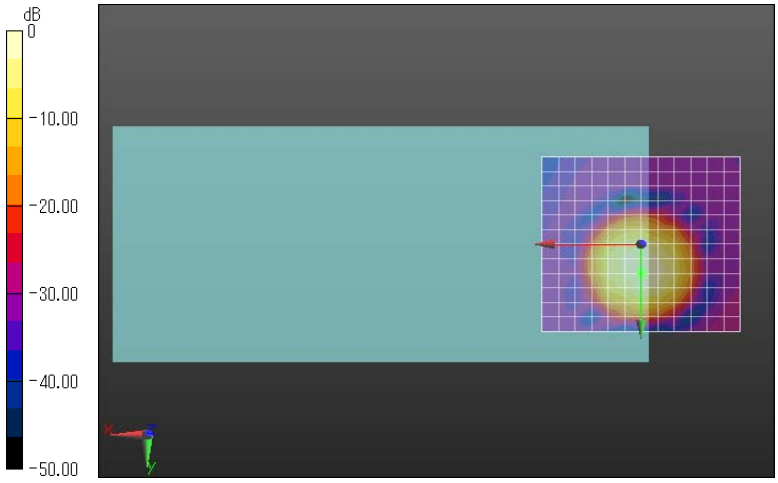
Cursor:
Diff = 1.45 dB
BWC Factor = 10.80 dB
Location: -0.1, 6.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



HAC T rate WCDMA band II 1880MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 2, UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:1.95434
Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 45.04 dB
ABM1 comp = -5.15 dBA/m
BWC Factor = 0.16 dB
Location: 0, 8.3, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



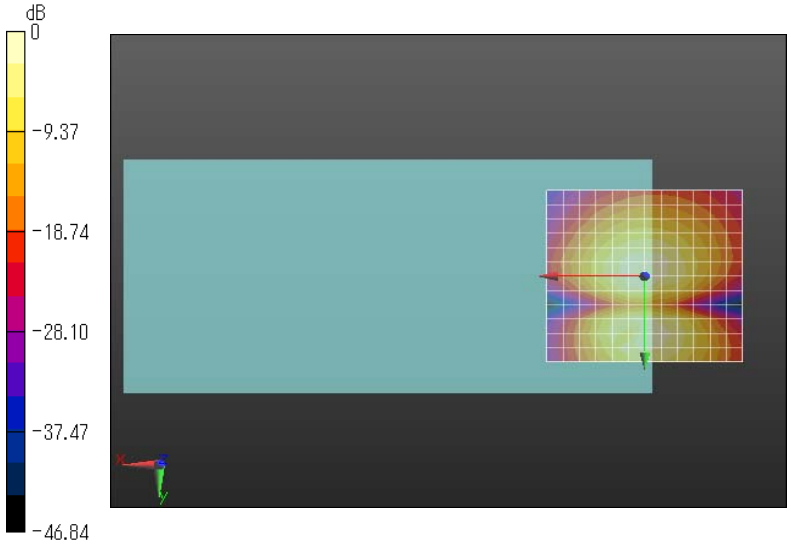
0 dB = 178.6 = 45.04 dB

HAC T rate WCDMA band II 1880MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 2, UTRA/FDD (1850.0 - 1910.0 MHz); Frequency: 1880 MHz;Duty Cycle: 1:1.95434

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:
Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
Sensor-Surface: 0mm (Fix Surface)
Electronics: DAE4 Sn509; Calibrated: 2014/07/28
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)
T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 41.43 dB
ABM1 comp = -15.24 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



0 dB = 117.8 = 41.42 dB

HAC T rate WCDMA band IV 1732.6MHz

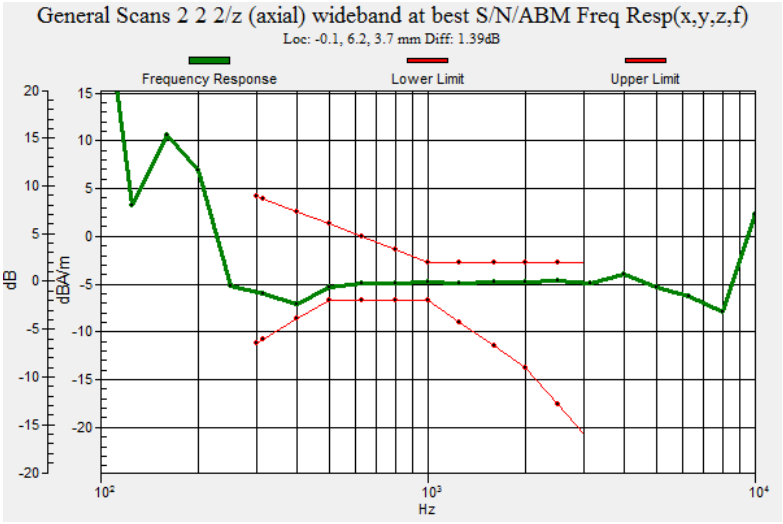
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 4, UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1732.6 MHz;Duty Cycle: 1:1.95434

Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:

- Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
  - Sensor-Surface: 0mm (Fix Surface)
  - Electronics: DAE4 Sn509; Calibrated: 2014/07/28
  - Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
  - DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2 2/z (axial) wideband at best S/N/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: 66.82
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.80 dB
Device Reference Point: 0, 0, -6.3 mm

Cursor:
Diff = 1.39 dB
BWC Factor = 10.80 dB
Location: -0.1, 6.2, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



HAC T rate WCDMA band IV 1732.6MHz

Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 4, UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1732.6 MHz;Duty Cycle: 1:1.95434

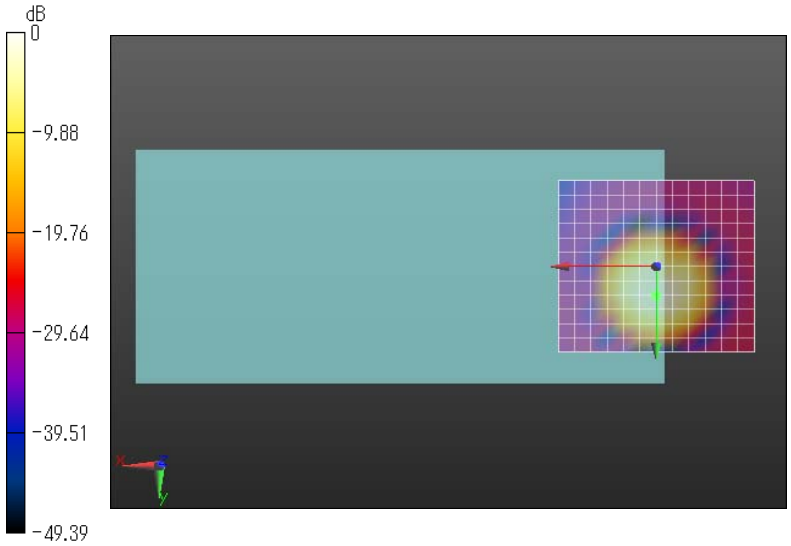
Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:

- Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
  - Sensor-Surface: 0mm (Fix Surface)
  - Electronics: DAE4 Sn509; Calibrated: 2014/07/28
  - Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
  - DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2 2/z (axial) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

Cursor:
ABM1/ABM2 = 42.50 dB
ABM1 comp = -5.37 dBA/m
BWC Factor = 0.16 dB
Location: 0, 8.3, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.



0 dB = 133.3 = 42.50 dB

HAC T rate WCDMA band IV 1732.6MHz
Communication System: UID 10011 - CAB, UMTS-FDD (WCDMA); Communication System Band: Band 4, UTRA/FDD (1710.0 - 1755.0 MHz); Frequency: 1732.6 MHz;Duty Cycle: 1:1.95434

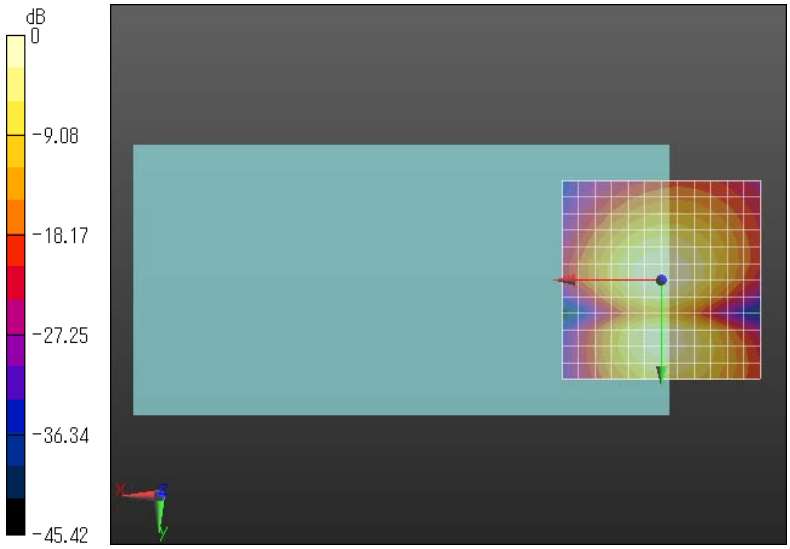
Phantom section: TCoil Section
Measurement Standard: DASY5 (IEEE/IEC/ANSI C63.19-2011)
DASY Configuration:

- Probe: AM1DV2 - 1077; ; Calibrated: 2014/12/09
  - Sensor-Surface: 0mm (Fix Surface)
  - Electronics: DAE4 Sn509; Calibrated: 2014/07/28
  - Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
  - DASY52 52.8.8(1222); SEMCAD X 14.6.10(7331)

T-Coil scan (scan for ANSI C63.19-2007 & 2011 compliance)/General Scans 2 2 2/y (transversal) 4.2mm 50 x 50/ABM SNR(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 34.12
Measure Window Start: 300ms
Measure Window Length: 1000ms
BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

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

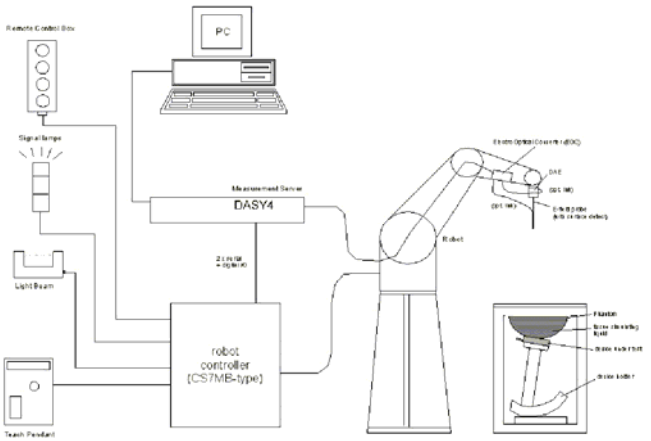
Cursor:
ABM1/ABM2 = 40.84 dB
ABM1 comp = -15.36 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm
Date: 2015/02/09
Ambient Temp. : 24.0 degree.C.

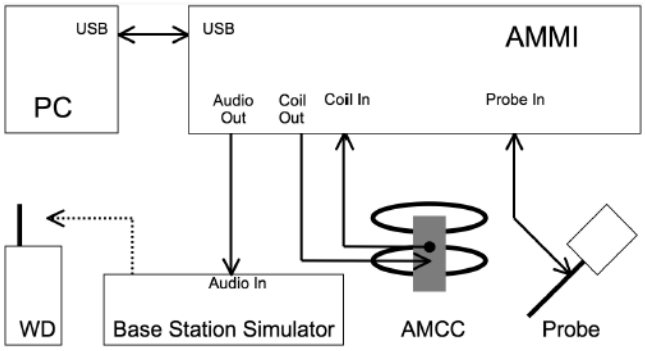


0 dB = 110.1 = 40.84 dB

APPENDIX 2 : System specifications

1. Configuration and peripherals





The DASY4 system for performing compliance tests consist of the following items:

1. A standard high precision 6-axis robot (Stäubli RX family) with controller and software.
   An arm extension for accommodating the data acquisition electronics (DAE).

2. A data acquisition electronic (DAE), which performs the signal amplification, signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. The unit is battery powered with standard or rechargeable batteries. The signal is optically transmitted to the EOC.

3. The Electro-optical converter (EOC) performs the conversion between optical and electrical of the signals for the digital communication to the DAE and for the analog signal from the optical surface detection.
   The EOC is connected to the measurement server.

4. The function of the measurement server is to perform the time critical tasks such as signal filtering, control of the robot operation and fast movement interrupts.

5. A probe alignment unit which improves the (absolute) accuracy of the probe positioning.

6. A computer operating Windows XP.

7. DASY4 software.

8. Remote control with teaches pendant and additional circuitry for robot safety such as warning lamps, etc.

9. The Test Arch Phantom for enables easy defined positioning of the phone and validation.

10. Audio Magnetic Probe is an active probe with a single sensor. The same probe coil is used to measure three orthogonal field components (axial, longitudinal, transversal). The probe is rotated to properly orient the coil for each field component. Probe's frequency response, Linearity and other characteristics are given in the certificate.

11. AMMI (Audio Magnetic Measurement instrument) is a desktop unit containing a sampling unit, a waveform generator for test, calibration signals and a USB interface. Front connectors include:

12. AMCC(Audio MagneticCalibration Coil) is a Helmoltz coil for calibration of the AM1D probe. The two horizontal coils create a homogeneous magnetic field in the z direction.

13. The device holder for handheld mobile phones.

2. Test system specifications

AM1DV2

Frequency range : 0.1 ~ 20kHz (RF sensitivity < -100dB, fully RF shielded)
Sensitivity : < -50dB A/m @ 1kHz
Pre-amplifier : 40dB, symmetric
Dimensions : Tip diameter/ length: 6/ 290mm, sensor according to ANSI-PC63.19
Calibration : Sensitivity at 1kHz 0.661V/(A/m)
(absolute accuracy ±2.2%, k=2)

Audio Magnetic Measurement Instrument (AMMI)

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

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

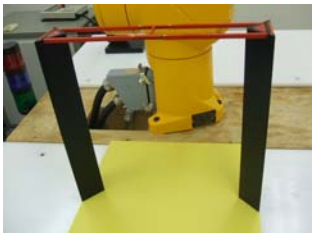
Audio Magnetic Calibration Coil (AMCC)

The Audio Magnetic Calibration Coil is a Helmholts 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 series resistor to approximately 50 ohm, and a shunt resistor of 10 ohm permits monitoring the current with a scale of 1:10.

a) Port description
- Coil in
Connector : BNC
Resistance : typically 50 Ohm
- Coil Monitor
Connector : BNO
Resistance : 10 Ohm ±1% (100mV correspondin to 1 A/m)
b) Specification
Dimentions : 370 x 370 x 196 mm, according to ANSI-PC63.19

Teat Arch Phantom

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



Phone Positioner
:Supports accurate and reliable positioning of any phone.
Effect on near field <+/- 0.5 dB

Robot TX60L

Number of Axes	:	6
Nominal Load	:	2 kg
Maximum Load	:	5kg
Reach	:	920mm
Repeatability	:	+/-0.03mm
Control Unit	:	CS8c
Programming Language	:	VAL3
Weight	:	52.2kg
Manuafacture	:	Stäubli Unimation Corp. Robot Model: TX60L

DASY5 Measurement server

Features	:	Intel ULV Celeron 400MHz 128MB chip disk and 128MB RAM 16 Bit A/D converter for surface detection system Vacuum Fluorescent Display Robot Interface Serial link to DAE (with watchdog supervision) Door contact port (Possibility to connect a light curtain) Emergency stop port (to connect the remote control) Signal lamps port Light beam port Three Ethernet connection ports Two USB 2.0 Ports Two serial links Expansion port for future applications
Dimensions	:	(L x W x H): 440 x 241 x 89 mm
Manufacture	:	Schimid & Partner Engineering AG

Data Acquisition Electronic (DAE)

Features	:	Signal amplifier, multiplexer, A/D converter and control logic Serial optical link for communication with DASY5 embedded system (fully remote controlled) 2 step probe touch detector for mechanical surface detection and emergency robot stop (not in -R version)
Measurement Range	:	1 µV to > 200 mV (16 bit resolution and two range settings: 4mV, 400mV)
Input Offset voltage	:	< 1 µV (with auto zero)
Input Resistance	:	200 MΩ
Battery Power	:	> 10 h of operation (with two 9 V battery)
Dimension	:	60 x 60 x 68 mm
Manufacture	:	Schimid & Partner Engineering AG

3. Audio Magnetic Field Probe Calibration (AM1DV2)

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

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

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

Accreditation No.: SCS 108

Client UL Japan (Vitec)

Certificate No: AM1DV2-1077_Dec14

CALIBRATION CERTIFICATE

Object	AM1DV2 - SN: 1077
Calibration procedure(s)	QA CAL-24.v3 Calibration procedure for AM1D magnetic field probes and TMFS in the audio range
Calibration date:	December 9, 2014

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-14 (No:15573)	Oct-15
Reference Probe AM1DV2	SN: 1008	14-Jan-14 (No. AM1D-1008_Jan14)	Jan-15
DAE4	SN: 781	12-Sep-14 (No. DAE4-781 Sep14)	Sep-15

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	1050	01-Oct-13 (in house check Oct-13)	Oct-16
AMMI Audio Measuring Instrument	1062	26-Sep-12 (in house check Sep-12)	Sep-15

	Name	Function	Signature
Calibrated by:	Leif Klysner	Laboratory Technician	
Approved by:	Katja Pokovic	Technical Manager	

Issued: December 10, 2014

References

[1] ANSI-C63.19-2007
American National Standard for Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
[2] ANSI-C63.19-2011
American National Standard, Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids.
[3] DASY5 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+2]. 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+2] 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 [3], 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 10 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 AF
Serial No	**1077**

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, Zurich, Switzerland
Manufacturing date	May 23, 2008
Last calibration date	December 13, 2013

Calibration data

Connector rotation angle	(in DASY system)	**130.2** °	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	**0.11** °	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	**0.0661 V / (A/m)**	+/- 2.2 % (k=2)

The reported uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k=2, which for a normal distribution corresponds to a coverage probability of approximately 95%.

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