TESTING
No. L2264

HAC TEST REPORT

Product Name	WCDMA Digital Mobile Phone
Model Name	V.45
Model Number	V2002
FCC ID	2AA9WV2002
Applicant	VSN Technologies Inc. d/b/a VSN Mobile
Manufacturer	MOBIWIRE MOBILES (NINGBO) CO.,LTD
Date of issue	June 18, 2014

TA Technology (Shanghai) Co., Ltd.

GENERAL SUMMARY

Reference Standard(s)	**ANSI C63.19-2011:** American National Standard Methods of Measurement of Compatibility between Wireless Communications Devices and Hearing Aids **KDB285076 D01 HAC Guidance v04** Equipment Authorization Guidance for Hearing Aid Compatibility **KDB285076 D02 T-Coil testing for CMRS IP v01r01** Guidance for Performing T-Coil tests for Air Interfaces Supporting Voice over IP (e.g., LTE and Wi-Fi) to support CMRS based Telephone Services
Conclusion	This portable wireless equipment has been measured in all cases requested by the relevant standards. **General Judgment: T3**
Comment	The test result only responds to the measured sample.

Approved by Weizhong Yang
Weizhong Yang
Director

Revised by Minbao Ling
Minbao Ling
HAC Manager

Performed by Chen Shen
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HAC Engineer

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1. General Information

1.1. Notes of the Test Report

TA Technology (Shanghai) Co., Ltd. has obtained the accreditation of China National Accreditation Service for Conformity Assessment (CNAS), and accreditation number: L2264.

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform electromagnetic emissions measurements. The site recognition number is 428261.

TA Technology (Shanghai) Co., Ltd. has been listed by industry Canada to perform electromagnetic emission measurement. The site recognition number is 8510A.

TA Technology (Shanghai) Co., Ltd. guarantees the reliability of the data presented in this test report, which is the results of measurements and tests performed for the items under test on the date and under the conditions stated in this test report and is based on the knowledge and technical facilities available at TA Technology (Shanghai) Co., Ltd. at the time of execution of the test.

TA Technology (Shanghai) Co., Ltd. is liable to the client for the maintenance by its personnel of the confidentiality of all information related to the items under test and the results of the test. The sample under test was selected by the Client. This report only refers to the item that has undergone the test.

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If the electronic report is inconsistent with the printed one, it should be subject to the latter.

1.2. Testing Laboratory

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1.3. Applicant Information

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1.5. Information of EUT

General Information

Device Type:	Portable Device	
State of Sample:	Prototype Unit	
Product IMEI:	354044060001468	
Hardware Version:	V01	
Software Version:	V01	
Antenna Type:	Internal Antenna	
Device Operating Configurations:		
Tested Mode(s):	GSM 850/GSM 1900; UMTS Band II/UMTS Band IV /UMTS Band V	
Test Modulation:	(GSM)GMSK; (UMTS)QPSK	
Operating Frequency Range(s):	Mode	Tx (MHz)
	GSM 850	824.2 ~ 848.8
	GSM 1900	1850.2 ~ 1909.8
	UMTS Band II	1852.4 ~ 1907.6
	UMTS Band IV	1712.4 ~ 1752.6
	UMTS Band V	826.4 ~ 846.6
Power Class:	GSM 850: 4	
	GSM 1900: 1	
	UMTS Band II/IV/V: 3	
Power Level	GSM 850: level 5	
	GSM 1900: level 0	
	UMTS Band II/IV/V: all up bits	
Test Channel I/ Frequency(MHz): Middle	190/836.6 (GSM 850) 661/1880 (GSM 1900) 9400/1880 (UMTS Band II) 1413/1732.6 (UMTS Band IV) 4183/836.6 (UMTS Band V)	

Auxiliary Equipment Details

Name	Model	Manufacturer	S/N
Battery 1	178069957	/	MAX20140000253

Air-Interface	Band (MHz)	Type	HAC tested	Simultaneous Transmissions Note: Not to be tested	Reduced power 20.19(c)(1)	Voice Over Digital Transport (Data)
GSM	850	VO	Yes	Yes WIFI and BT	NA	NA
	1900	VO			NO	NA
	GPRS/EGPRS	DT	NA	Yes WIFI and BT	NA	NA
WCDMA	Band II	VO	NO#	Yes WIFI and BT	NA	NA
	Band IV	VO	NO#	Yes WIFI and BT	NA	NA
	Band V	VO	NO#	Yes WIFI and BT	NA	NA
	HSDPA/HSUPA/RMC/HSPA+	DT	NA	Yes WIFI and BT	NA	NA
WIFI	2450	DT	NA	Yes GSM, WCDMA(RMC) ,BT	NA	Yes
Bluetooth (BT)	2400	DT	NA	Yes GSM,GPRS,EGPRS, HSDPA/HSUPA/RMC/HSPA+, WIFI	NA	NA

VO Voice CMRS/PSTN Service only
V/D Voice CMRS/PSTN and Data Service
Digital Transport

*HAC Rating was based on concurrent voice and data modes, Non current mode was found to DT represent worst case rating for both M and T rating

1.6. The Ambient Conditions during Test

Temperature	Min. = 18°C, Max. = 28 °C
Relative humidity	Min. = 0%, Max. = 80%
Ground system resistance	< 0.5 Ω
Ambient noise is checked and found very low and in compliance with requirement of standards. Reflection of surrounding objects is minimized and in compliance with requirement of standards.	

1.7. T-Coil signal quality categories of each tested Mode

Band	Category
GSM 850	**T3**
GSM 1900	**T3**
UMTS Band II	**T4**
UMTS Band IV	**T4**
UMTS Band V	**T4**

1.8. Test Date

The test performed on June 7, 2014.

2. Test Information

2.1. Operational Conditions during Test

2.1.1. General Description of Test Procedures

The phone was tested in all normal configurations for the ear use. The EUT is mounted in the device holder equivalent as for classic dosimeter measurements. The acoustic output of the EUT shall coincide with the center point of the area formed by the dielectric wire and the middle bar of the arch's top frame The EUT shall be moved vertically upwards until it touches the frame. The fine adjustment is possible by sliding the complete. EUT holder on the yellow base plate of the Test Arch phantom. During the test, the EUT is selected on T-Coil mode, the LCD backlight is turn off and volume is adjusted to maximum level.

No associated T-coil measurement has been made in accordance with the guidance issued by OET in KDB publication 285076 D02 T-Coil testing for CMRS IP.

2.1.2. GSM Test Configuration

A communication link is set up with a System Simulator (SS) by RF cable, and a call is established. The Absolute Radio Frequency Channel Number (ARFCN) is allocated to 190 respectively in the case of GSM 850, allocated to 661 respectively in the case of GSM 1900. T-Coil configurations is measured in Speechcod/Hendset Low using System Simulator (SS) of CMU200 , at the same time the EUT shall be operated at its maximum RF output power setting.

2.1.3. WCDMA Test Configuration

A communication link is set up with a System Simulator (SS) by RF cable, and a call is established. The Absolute Radio Frequency Channel Number (ARFCN) are allocated to 9400 respectively in the case of WCDMA Band II, allocated to 1413 respectively in the case of WCDMA Band IV, allocated to 4183 respectively in the case of WCDMA Band V. T-Coil configurations is measured in voice mode with 12.2kps RMC using System Simulator (SS) of CMU200, at the same time the EUT shall be operated at its maximum RF output power setting.

2.2. T-Coil Measurements System Configuration

2.2.1. T-coil Measurement Set-up

These measurements are performed using the DASY5 automated dosimetric assessment system. It is made by Schmid & Partner Engineering AG (SPEAG) in Zurich, Switzerland. It consists of high precision robotics system (Stäubli), robot controller, Intel Core computer, near-field probe, probe alignment sensor. The robot is a six-axis industrial robot performing precise movements. Cell controller systems contain the power supply, robot controller, teach pendant (Joystick) and remote control, and are used to drive the robot motors. The Stäubli Robot is connected to the cell controller to allow software manipulation of the robot. A data acquisition electronic (DAE) circuit performs the signal amplification; signal multiplexing, AD-conversion, offset measurements, mechanical surface detection, collision detection, etc. is connected to the Electro-optical coupler (EOC). The EOC performs the conversion from the optical into digital electric signal of the DAE and transfers data to the PC plug-in card.

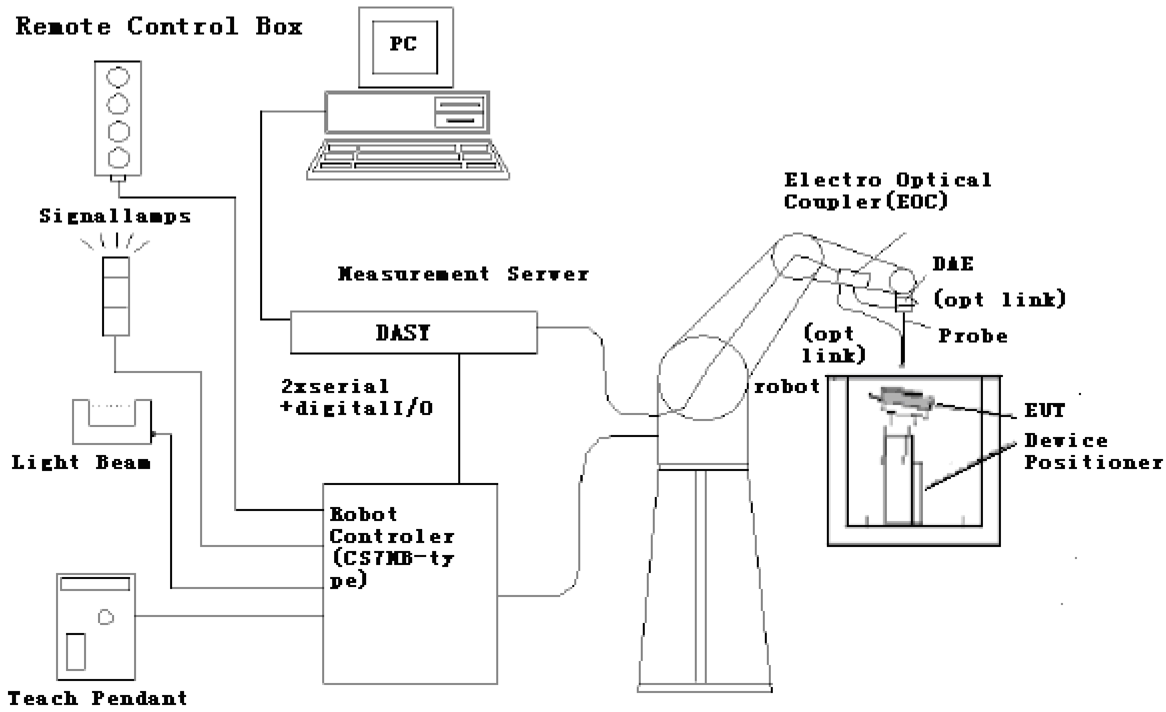
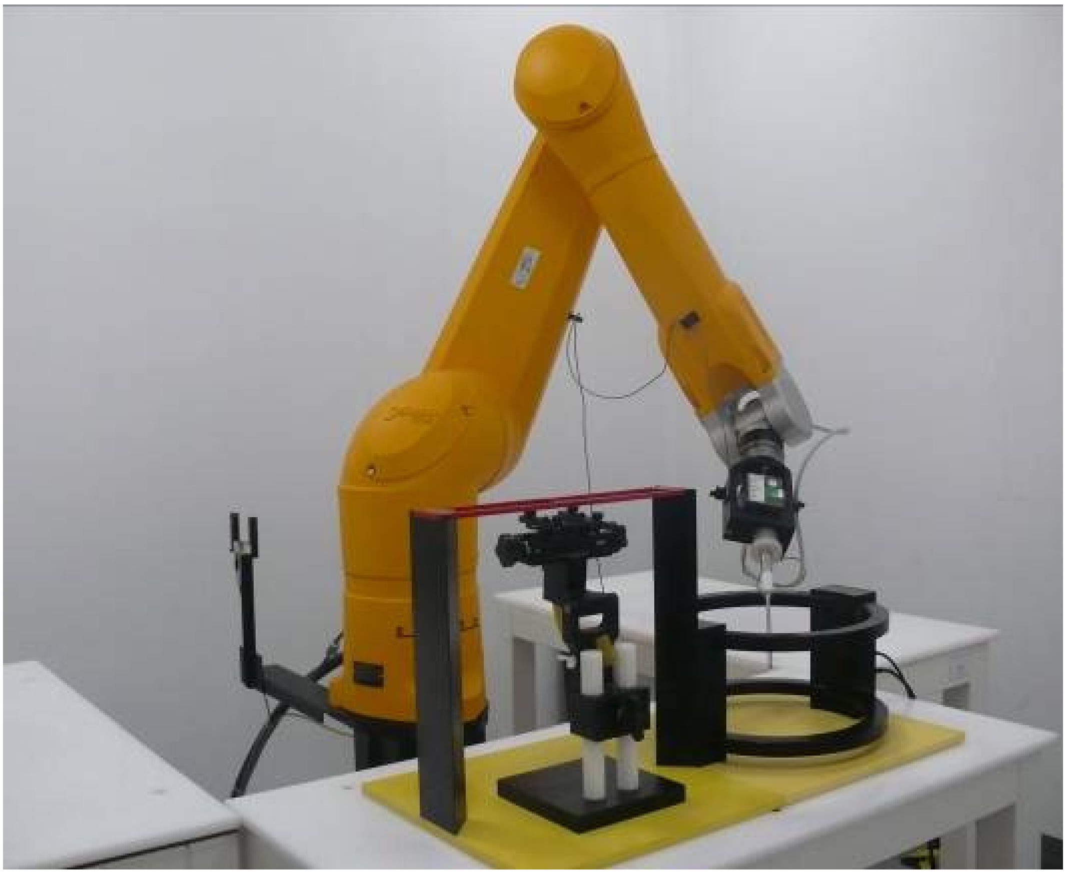


Figure 1 T-Coil Test Measurement Set-up

The DAE4 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 PC-card is accomplished through an optical downlink for data and status information and an optical uplink for commands and clock lines. The mechanical probe mounting device includes two different sensor systems for frontal and sidewise probe contacts. They are also used for mechanical surface detection and probe collision detection. The robot uses its own controller with a built in VME-bus computer.



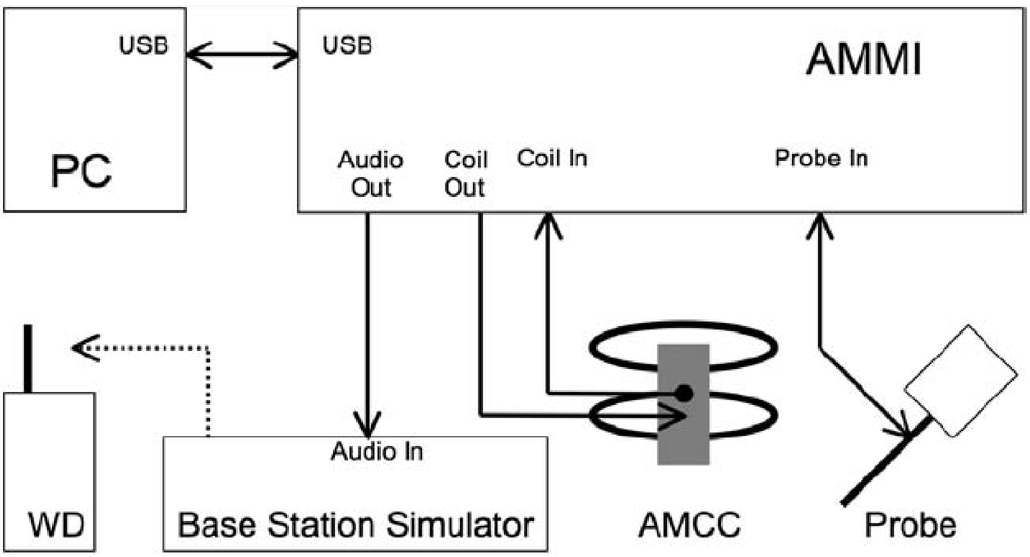


Figure 2 T-Coil Test Measurement Set-up

2.2.2. 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 <-100 dB, fully RF shielded)
sensitivity	<-50 dB A/m @ 1 kHz
pre-amplifier	40 dB, symmetric
dimensions	tip diameter / length: 6 / 290 mm, sensor according to ANSI-C63.19

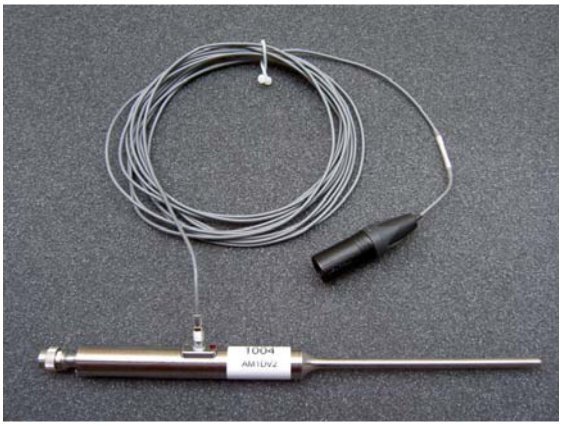


Figure 3 AM1D Probe

2.2.3. Audio Magnetic Measurement Instrument (AMMI)

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.

Figure 4 AMMI front panel

Port description:

Audio Out	BNC, audio signal to the base station simulator, for >500Ohm load
Coil Out	BNC, test and calibration signal to the AMCC (top connector), for 50Ohm load
Coil In	XLR, monitor signal from the AMCC BNO connector, 600 Ohm
Probe In	XLR, probe signal and phantom supply to the probe Lemo connector

Figure 5 AMMI rear side

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

2.2.4. Helmholtz Calibration Coil (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 10Ohm permits monitoring the current with a scale of 1:10

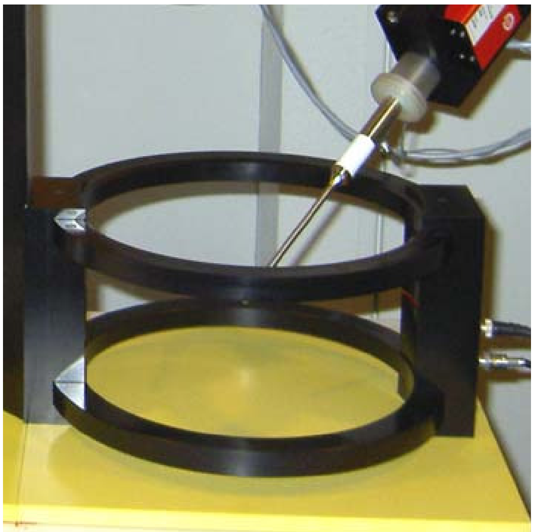


Figure 6 AMCC

Port description:

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

Specification:

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

2.2.5. Test Arch Phantom & Phone Positioner

The Test Arch phantom should be positioned horizontally on a stable surface. Reference markings on the Phantom allow the complete setup of all predefined phantom positions and measurement grids by manually teaching three points in the robot. It 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).

The Device reference point is set for the EUT at 6.3 mm, the Grid reference point is on the upper surface at the origin of the coordinates, and the “user point \Height Check 0.5 mm” is 0.5mm above the center, allowing verication of the gap of 0.5mm while the probe is positioned there.

The Phone Positioner supports accurate and reliable positioning of any phone with effect on near field <±0.5 dB.

Figure 7 T-coil Phantom & Device Holder

2.3. T-Coil measurement points and reference plane

The following figure illustrates the standard probe orientations. Position 1 is the perpendicular orientation of the probe coil; orientation 2 is the transverse orientation. The space between the measurement positions is not fixed. It is recommended that a scan of the WD be performed for each probe coil orientation and that the maximum level recorded be used as the reading for that orientation of the probe coil.

1) The reference plane is 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 EUT handset, which, in normal handset use, rest against the ear.

2) The measurement plane is parallel to, and 10 mm in front of, the reference plane.

3) The reference axis is normal to the reference plane and passes through the center of the receiver speaker section (or the center of the hole array); or may be centered on a secondary inductive source. The actual location of the measurement point shall be noted in the test report as the measurement reference point.

4) The measurement points may be located where the axial and radial field intensity measurements are optimum with regard to the requirements. However, the measurement points should be near the acoustic output of the EUT and shall be located in the same half of the phone as the EUT receiver. In a EUT handset with a centered receiver and a circularly symmetrical magnetic field, the measurement axis and the reference axis would coincide.

5) The relative spacing of each measurement orientation is not fixed. The axial and two radial orientations should be chosen to select the optimal position.

6) The measurement point for the axial position is located 10 mm from the reference plane on the measurement axis.

7) The actual location of the measurement point shall be noted in test reports and designated as the measurement reference point.

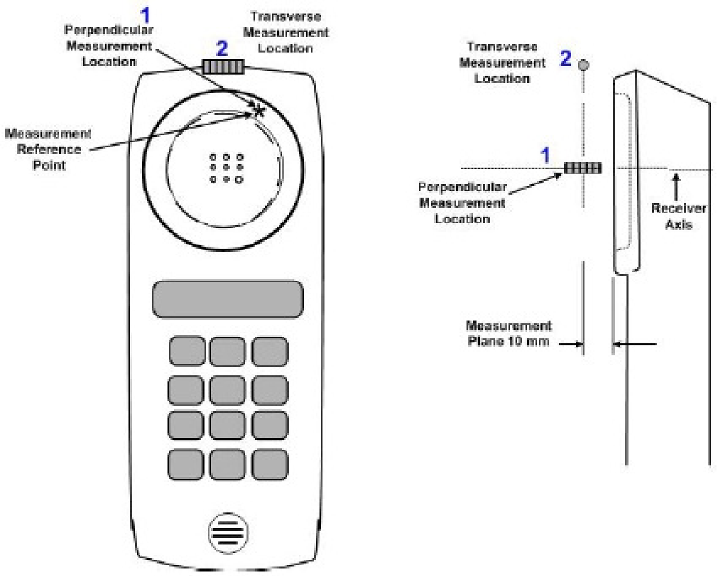


Figure 8 Axis and planes for EUT audio frequency magnetic field measurements

2.4. T-Coil Test Procedueres

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 7.4.2.1.

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 8.3.2.

4) The EUT was positioned in its intended test position, acoustic output point of the device perpendicular to the field probe.

5) The EUT 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 EUT audio output was positioned tangent (as physically possible) to the measurement plane.

6) The EUT’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 EUT by following the three steps, coarse resolution scan, fine resolution scans, and point measurement, as described in C63.19 per 7.4.4.2. 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.

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 there 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 EUT measurement since the DASY5 system had known the spectrum of the input signal by using a reference job.

11) In SEMCAD postprocessing, 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.

3. T-Coil Performance Requirements

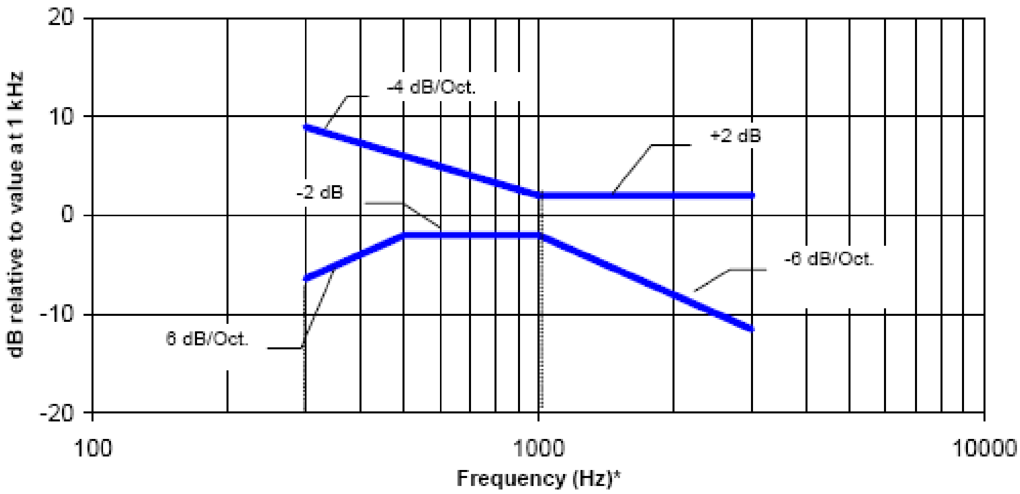
In order to be rated for T-Coil use, a EUT shall meet the requirements for signal level and signal quality contained in this part.

3.1.1. T-Coil coupling field intensity

When measured as specified in ANSI C63.19, the T-Coil signal shall be ≥ –18 dB (A/m) at 1 kHz, in a 1/3 octave band filter for all orientations.

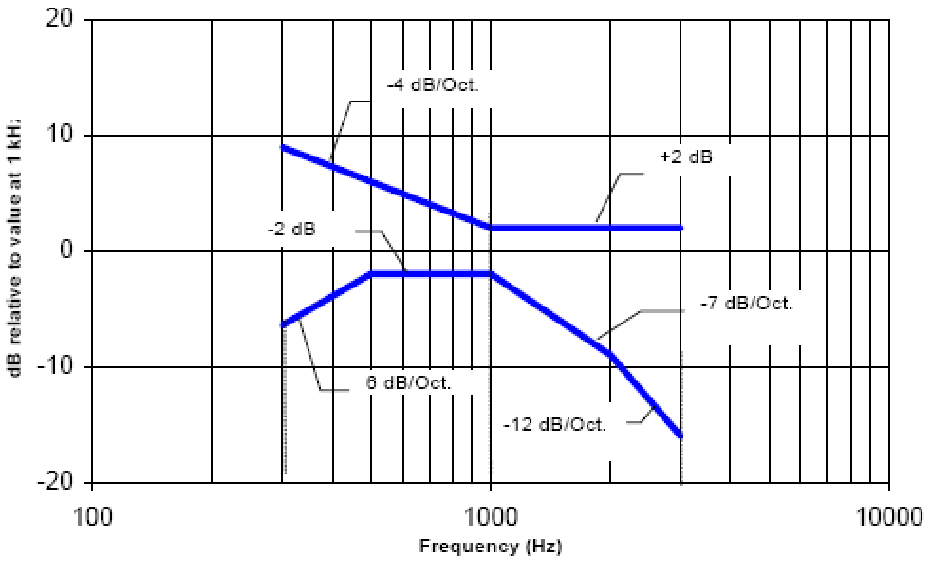
3.1.2. Frequency response

The frequency response of the axial component of the magnetic field, measured in 1/3 octave bands, shall follow the response curve specified in this sub-clause, over the frequency range 300 Hz to 3000 Hz. The following figures provide the boundaries for the specified frequency. These response curves are for true field strength measurements of the T-Coil signal. Thus the 6 dB/octave probe response has been corrected from the raw readings.



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

Figure 9 Magnetic field frequency response for EUTs with a field ≤ –15 dB (A/m) at 1 kHz



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

Figure 10 Magnetic field frequency response for EUTs with a field that exceeds –15 dB(A/m) at 1 kHz

3.1.3. Signal quality

This part provides the signal quality requirement for the intended T-Coil signal from a EUT. 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. So, the only criteria that can be measured is the RF immunity in T-Coil mode. This is measured using the same procedure as for the audio coupling mode and at the same levels.

The worst signal quality of the twoT-Coil signal measurements shall be used to determine the T-Coil mode category per Table 1

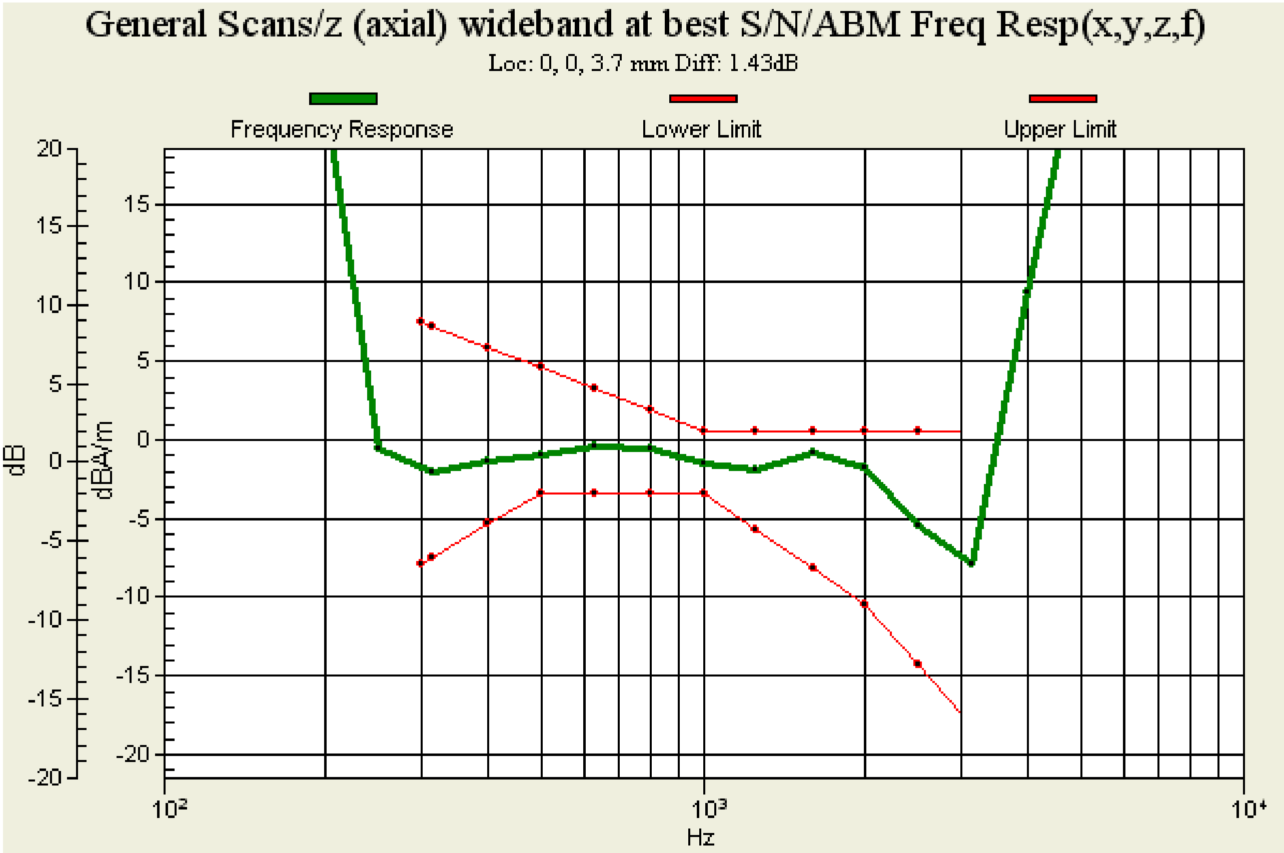
Table 1: T-Coil signal quality categories

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

4. Summary Test Results

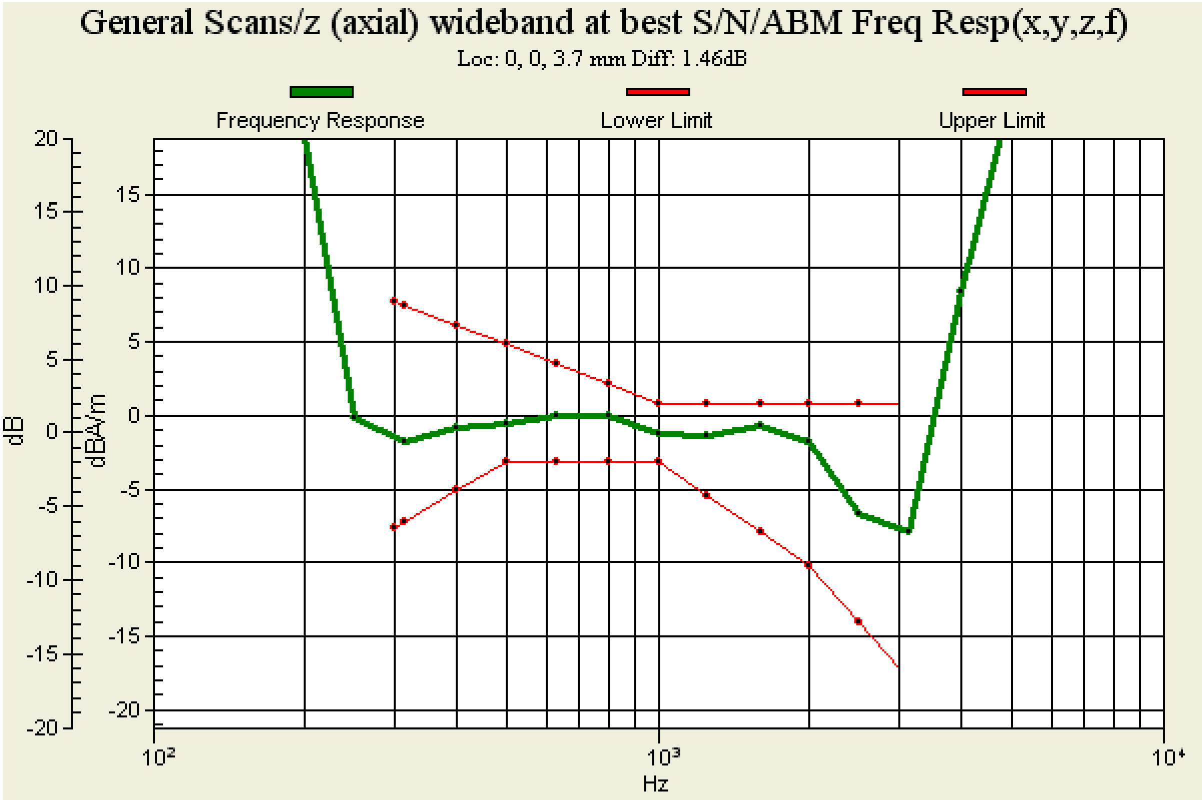
4.1. GSM 850

Band-Channel	Probe Orientation	Measurement Position (x,y)[mm]	ABM1≥ -18dB(A/m) (Signal)	SNR(ABM1/ ABM2)(dB)	Frequency Response	T-Rating
GSM 850-CH190	y (Radial):	(-8.3,-12.5)	-13.45	31.91	/	T4
	z (Axial):	(0,0)	1.02	23.38	Pass	T3



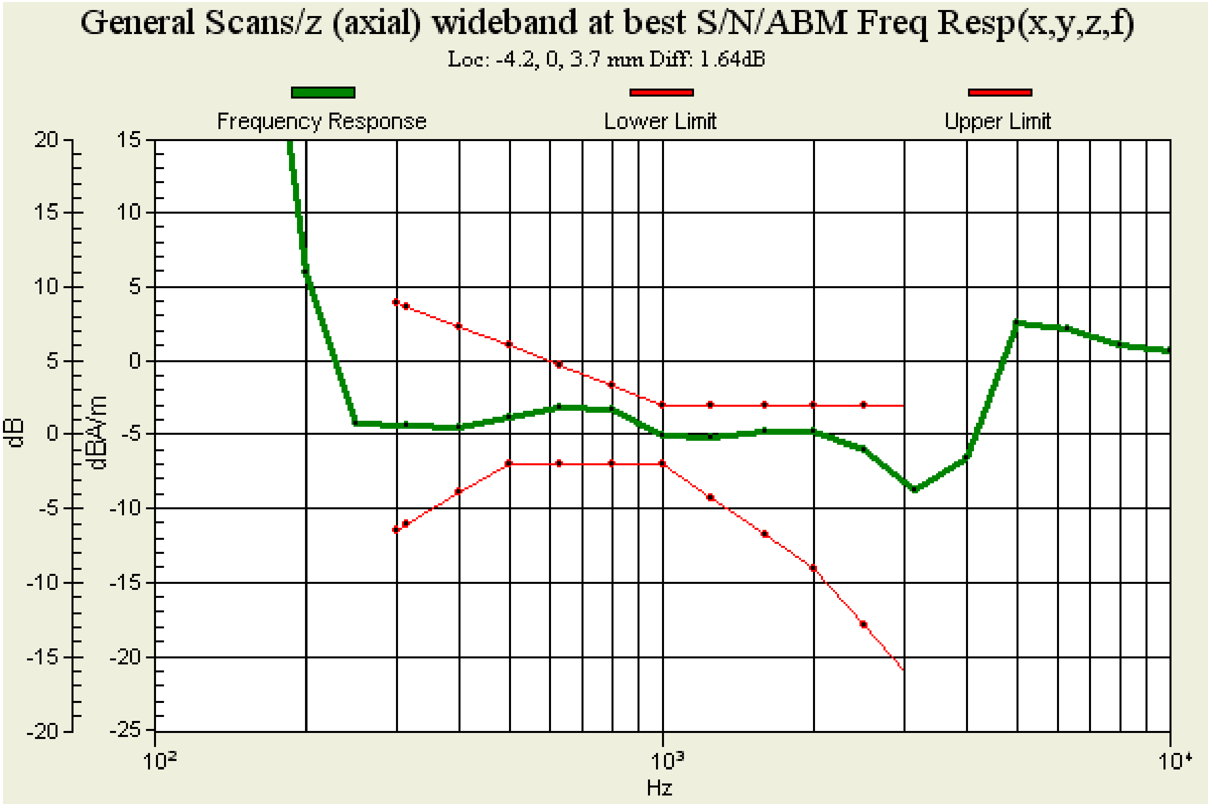
4.2. GSM 1900

Band-Channel	Probe Orientation	Measurement Position (x,y)[mm]	ABM1≥ -18dB(A/m) (Signal)	SNR(ABM1/ ABM2)(dB)	Frequency Response	T-Rating
GSM 1900-CH661	y (Radial):	(-4.2,-8.3)	-9.32	35.01	/	T4
	z (Axial):	(0,0)	0.87	26.51	Pass	T3



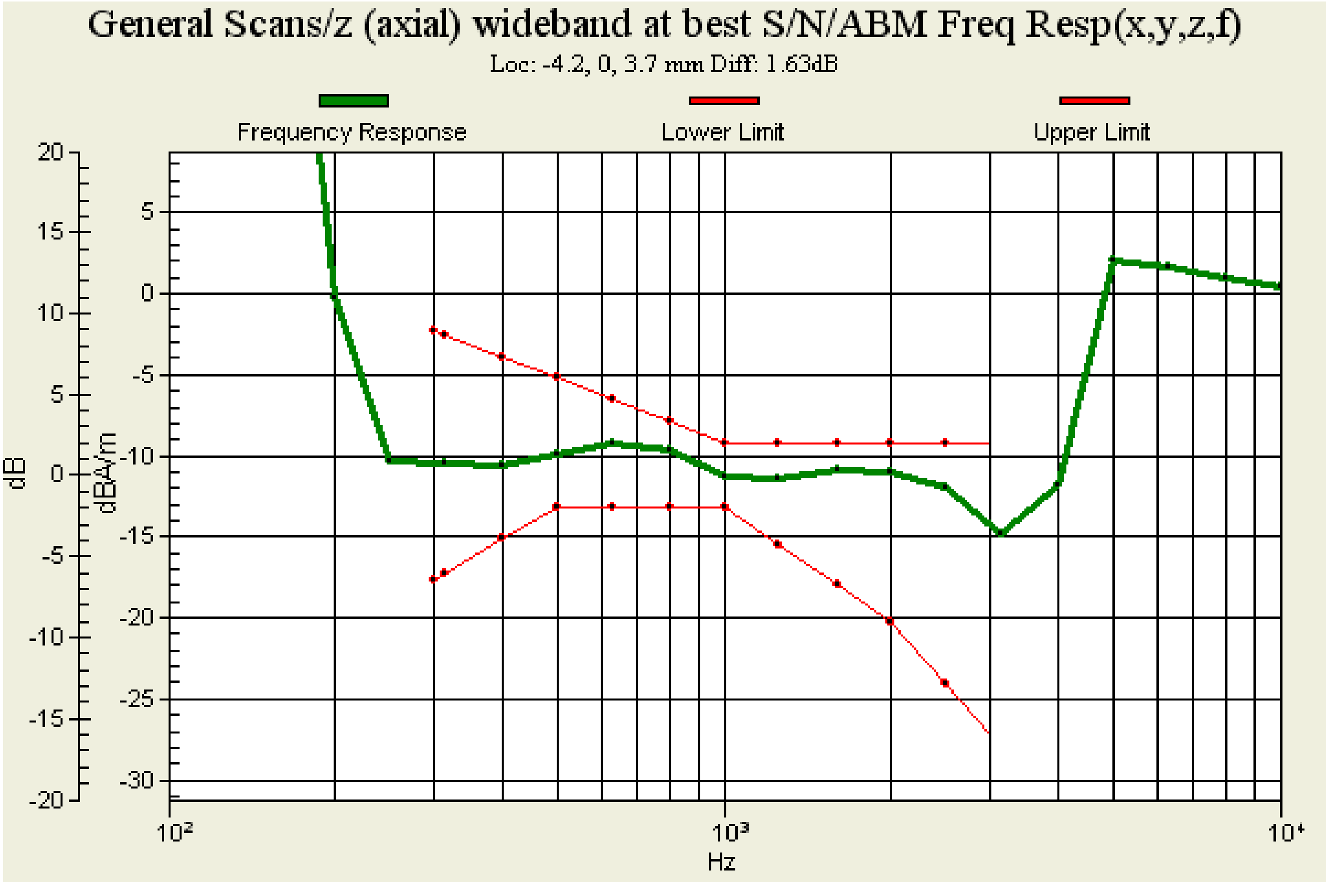
4.3. WCDMA Band II

Band-Channel	Probe Orientation	Measurement Position (x,y)[mm]	ABM1≥ -18dB(A/m) (Signal)	SNR(ABM1/ABM2)(dB)	Frequency Response	T-Rating
WCDMA Band II-CH9400	y (Radial):	(-4.2,8.3)	-9.94	43.29	/	T4
	z (Axial):	(-4.2,0)	-1.43	41.64	Pass	T4



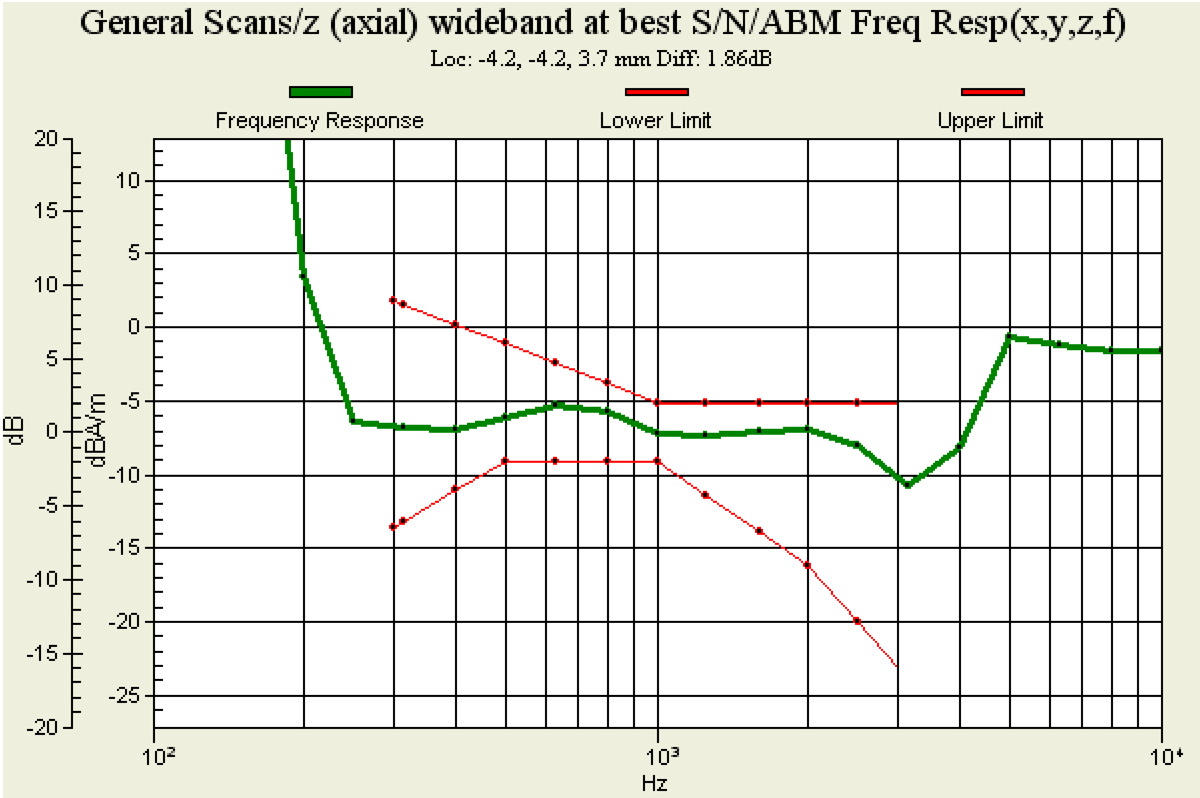
4.4. WCDMA Band IV

Band-Channel	Probe Orientation	Measurement Position (x,y)[mm]	ABM1≥ -18dB(A/m) (Signal)	SNR(ABM1/ABM2)(dB)	Frequency Response	T-Rating
WCDMA Band IV-CH1413	y (Radial):	(-4.2,8.3)	-9.69	43.34	/	T4
	z (Axial):	(-4.2,0)	-7.4	36.79	Pass	T4



4.5. WCDMA Band V

Band-Channel	Probe Orientation	Measurement Position (x,y)[mm]	ABM1≥ -18dB(A/m) (Signal)	SNR(ABM1/ABM2)(dB)	Frequency Response	T-Rating
WCDMA Band V-CH4183	y (Radial):	(-4.2,8.3)	-10.06	43.14	/	T4
	z (Axial):	(-4.2,-4.2)	-3.49	42.8	Pass	T4



Note:

1. The LCD backlight is turn off and volume is adjusted to maximum level during T-Coil testing.
2. Signal strength measurement scan plots are presented in Annex B.

5. Measurement Uncertainty

No.	Error source	Type	Uncertainty Value a_i (%)	Prob. Dist.	k	ABM 1c_i	ABM2 c_i	Std. Unc. ABM1 u_i' (%)	Std. Unc. ABM2 u_i' (%)	Degree of freedom V_{eff} or v_i
1	System Repeatability	A	0.016	N	1	1	1	0.016	0.016	9
Probe Sensitivity										
2	Reference Level	B	3.0	R	$\sqrt{3}$	1	1	3.0	3.0	∞
3	AMCC Geometry	B	0.4	R	$\sqrt{3}$	1	1	0.2	0.2	∞
4	AMCC Current	B	0.6	R	$\sqrt{3}$	1	1	0.4	0.4	∞
5	Probe Positioning during Calibration	B	0.1	R	$\sqrt{3}$	1	1	0.1	0.1	∞
6	Noise Contribution	B	0.7	R	$\sqrt{3}$	0.0143	1	0.0	0.4	∞
7	Frequency Slope	B	5.9	R	$\sqrt{3}$	0.1	1	0.3	3.5	∞
Probe System										
8	Repeatability / Drift	B	1.0	R	$\sqrt{3}$	1	1	0.6	0.6	∞
9	Linearity / Dynamic Range	B	0.6	N	1	1	1	0.4	0.4	∞
10	Acoustic Noise	B	1.0	R	$\sqrt{3}$	0.1	1	0.1	0.6	∞
11	Probe Angle	B	2.3	R	$\sqrt{3}$	1	1	1.4	1.4	∞
12	Spectral Processing	B	0.9	R	$\sqrt{3}$	1	1	0.5	0.5	∞
13	Integration Time	B	0.6	N	1	1	5	0.6	3.0	∞
14	Field Distribution	B	0.2	R	$\sqrt{3}$	1	1	0.1	0.1	∞
Test Signal										
15	Ref.Signal Spectral Response	B	0.6	R	$\sqrt{3}$	0	1	0.0	0.4	∞
Positioning										
16	Probe Positioning	B	1.9	R	$\sqrt{3}$	1	1	1.1	1.1	∞
17	Phantom Thickness	B	0.9	R	$\sqrt{3}$	1	1	0.5	0.5	∞

18	EUT Positioning	B	1.9	R	$\sqrt{3}$	1	1	1.1	1.1	∞
External Contributions										
19	RF Interference	B	0.0	R	$\sqrt{3}$	1	0.3	0.0	0.0	∞
20	Test Signal Variation	B	2.0	R	$\sqrt{3}$	1	1	1.2	1.2	∞
Combined Std. Uncertainty (ABM Field)		$u_c' = \sqrt{\sum_{i=1}^{20} c_i^2 u_i^2}$						4.1	6.1	
Expanded Std. Uncertainty		$u_e = 2u_c$		N	$k = 2$			**8.2**	**12.2**	

6. Main Test Instruments

No.	Name	Type	Serial Number	Calibration Date	Valid Period
01	Audio Magnetic 1D Field Probe	AM1DV3	3067	February 27, 2014	One year
02	Audio Magnetic Calibration Coil	SD HAC P02A	1112	N/A	N/A
03	Audio Measuring Instrument	AMMI	1101	N/A	N/A
04	DAE	DAE4	1317	January 16, 2014	One year
05	Software	DASY5, V5.2 Build 162	N/A	N/A	N/A
06	Software	SEMCAD X Version 14.0 Build 59	N/A	N/A	N/A
07	Universal Radio Communication Tester	CMU 200	118133	June 29, 2013	One year
08	TMFS	TMFS	1018	December 4, 2013	One year
09	Hygrothermograph	WS-1	64591	September 26, 2013	One year

*******END OF REPORT *******

ANNEX A: Test Layout

Picture 1: HAC T-Coil System Layout

ANNEX B: Graph Results

T-Coil GSM 850 Y transversal

Date: 6/7/2014
Communication System: UID 0, GSM (0); Frequency: 836.6 MHz;Duty Cycle: 1:8.30042
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 GSM850 HAC_TCoil_WD_Emission/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: 33.76
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 = 31.91 dB
ABM1 comp = -13.45 dBA/m
BWC Factor = 0.16 dB
Location: -8.3, -12.5, 3.7 mm

R.45 GSM850 HAC_TCoil_WD_Emission/General Scans/y (transversal) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
Measure Window Start: 300ms
Measure Window Length: 1000ms

BWC applied: 0.16 dB

Device Reference Point: 0, 0, -6.3 mm

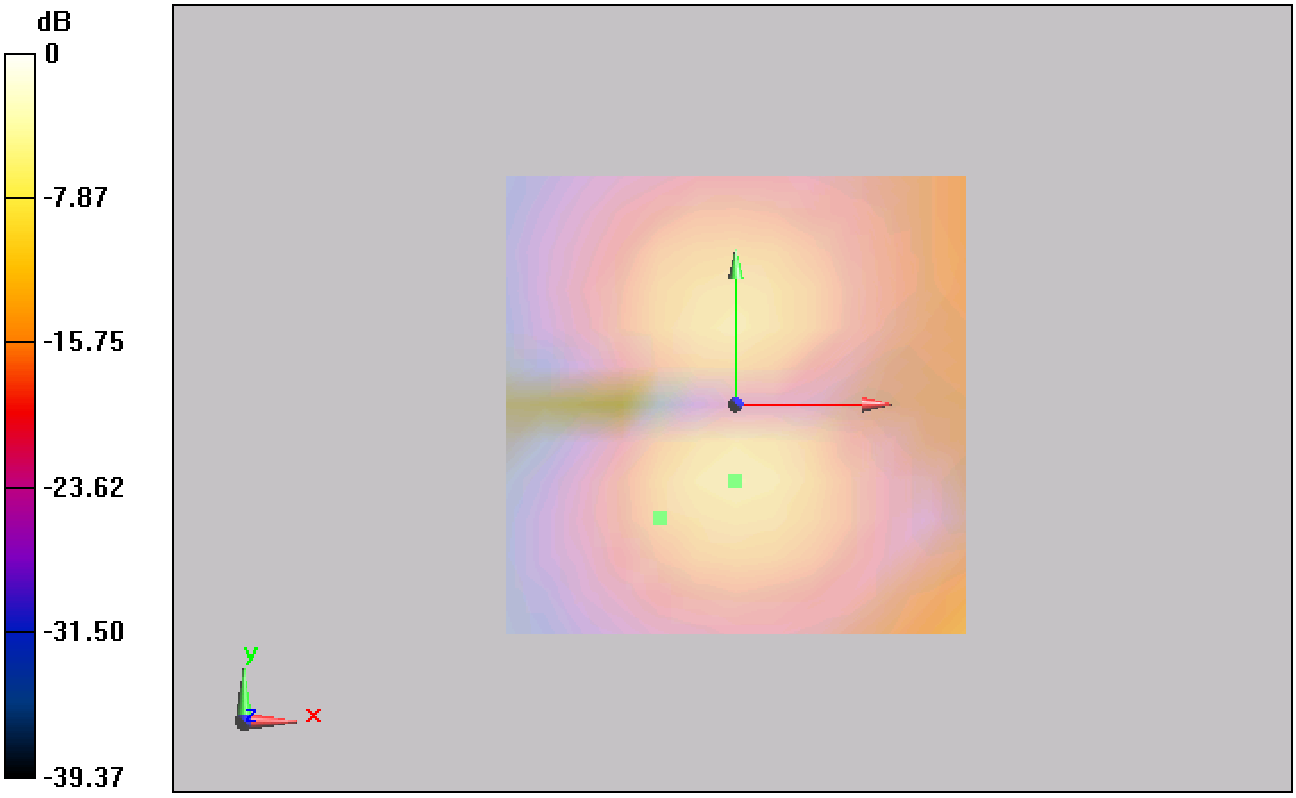
Category	**Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]**
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

ABM1 comp = -7.36 dBA/m

BWC Factor = 0.16 dB

Location: 0, -8.3, 3.7 mm



0 dB = 1.000 = 0.00 dB

Figure 11 T-Coil GSM 850 Y transversal

T-Coil GSM 850 Z Axial

Date: 6/7/2014 1
Communication System: UID 0, GSM (0); Frequency: 836.6 MHz;Duty Cycle: 1:8.30042
Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 GSM850 HAC_TCoil_WD_Emission/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: 33.76
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 = 23.38 dB
ABM1 comp = 1.02 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm

R.45 GSM850 HAC_TCoil_WD_Emission/General Scans/z (axial) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
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 comp = 1.02 dBA/m

BWC Factor = 0.16 dB

Location: 0, 0, 3.7 mm

R.45 GSM850 HAC_TCoil_WD_Emission/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: 66.12

Measure Window Start: 300ms

Measure Window Length: 2000ms

BWC applied: 10.81 dB

Device Reference Point: 0, 0, -6.3 mm

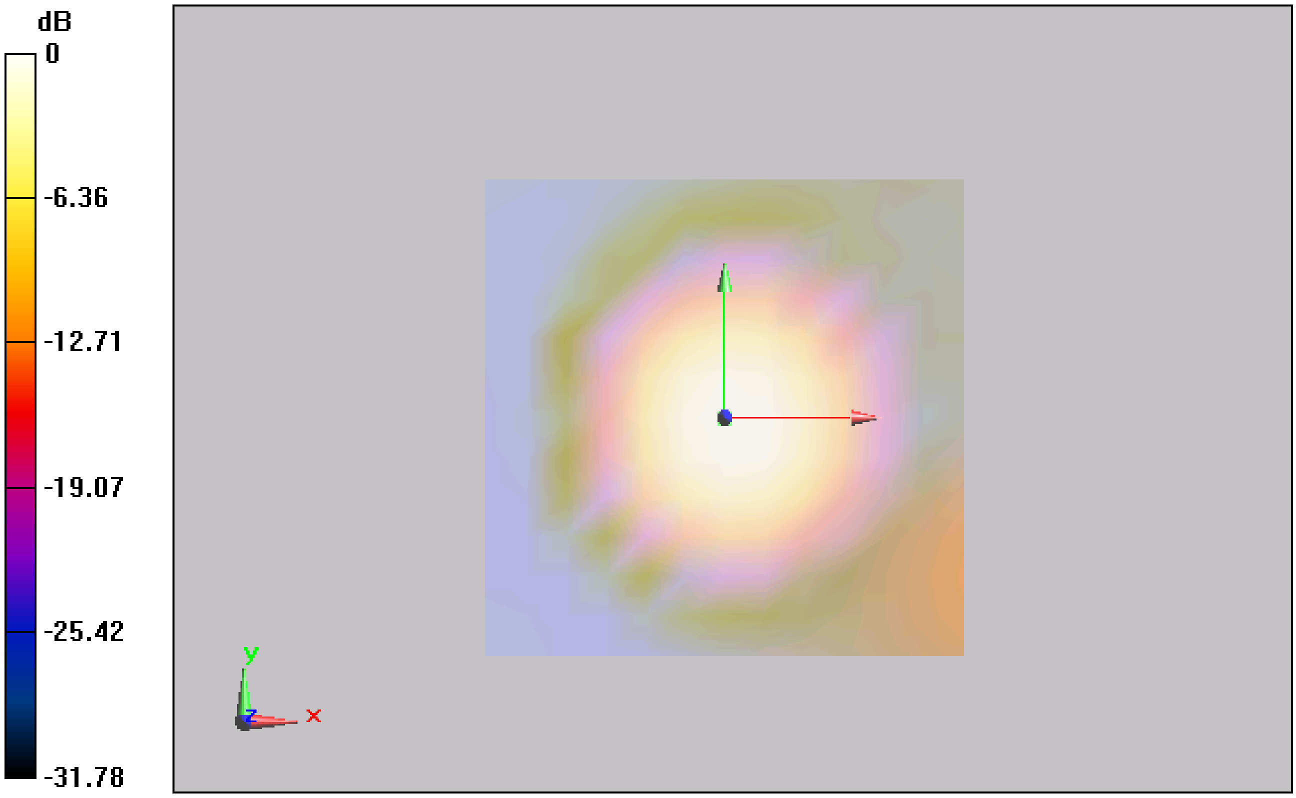
Category	Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

Diff = 1.43 dB

BWC Factor = 10.81 dB

Location: 0, 0, 3.7 mm



0 dB = 1.000 = 0.00 dB

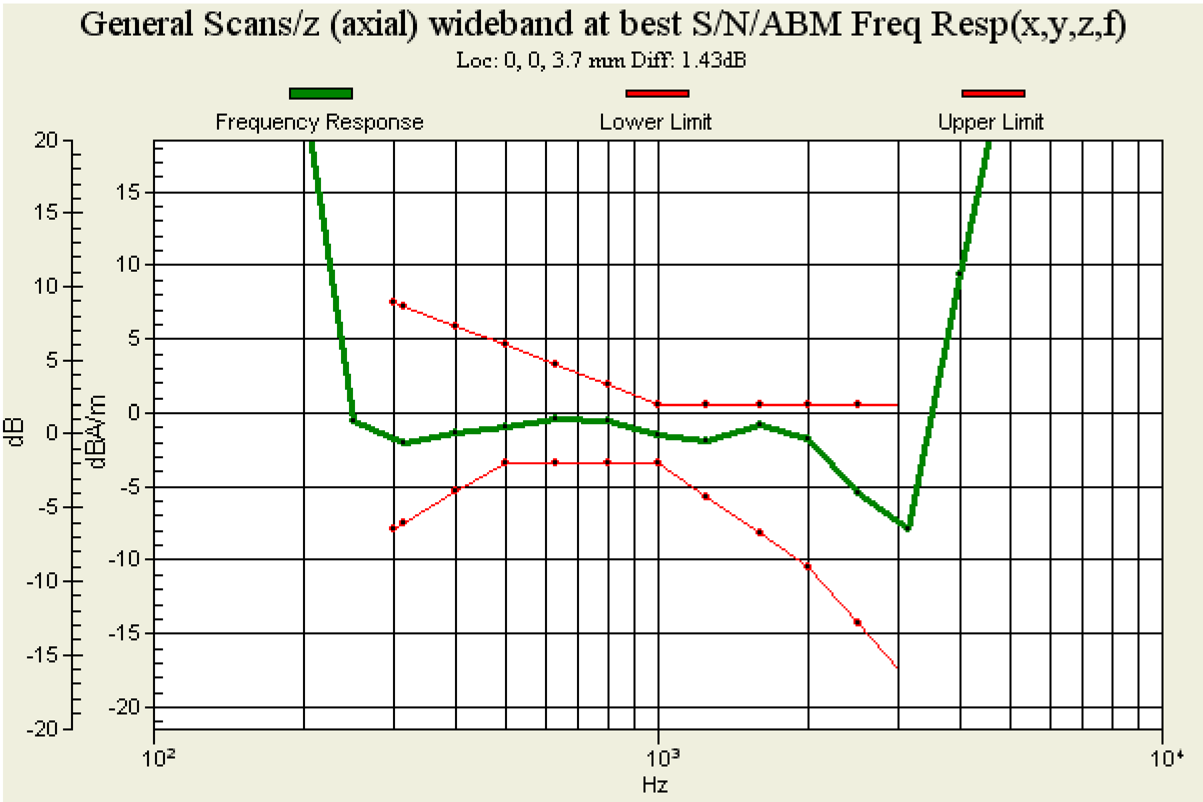


Figure 12 T-Coil GSM 850 Z Axial

T-Coil GSM 1900 Y transversal

Date: 6/7/2014
Communication System: UID 0, GSM (0); Frequency: 1880 MHz;Duty Cycle: 1:8.30042
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 GSM1900 HAC_TCoil_WD_Emission/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: 33.76
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 = 35.01 dB
ABM1 comp = -9.32 dBA/m
BWC Factor = 0.16 dB
Location: -4.2, -8.3, 3.7 mm

R.45 GSM1900 HAC_TCoil_WD_Emission/General Scans/y (transversal) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
Measure Window Start: 300ms
Measure Window Length: 1000ms

BWC applied: 0.16 dB

Device Reference Point: 0, 0, -6.3 mm

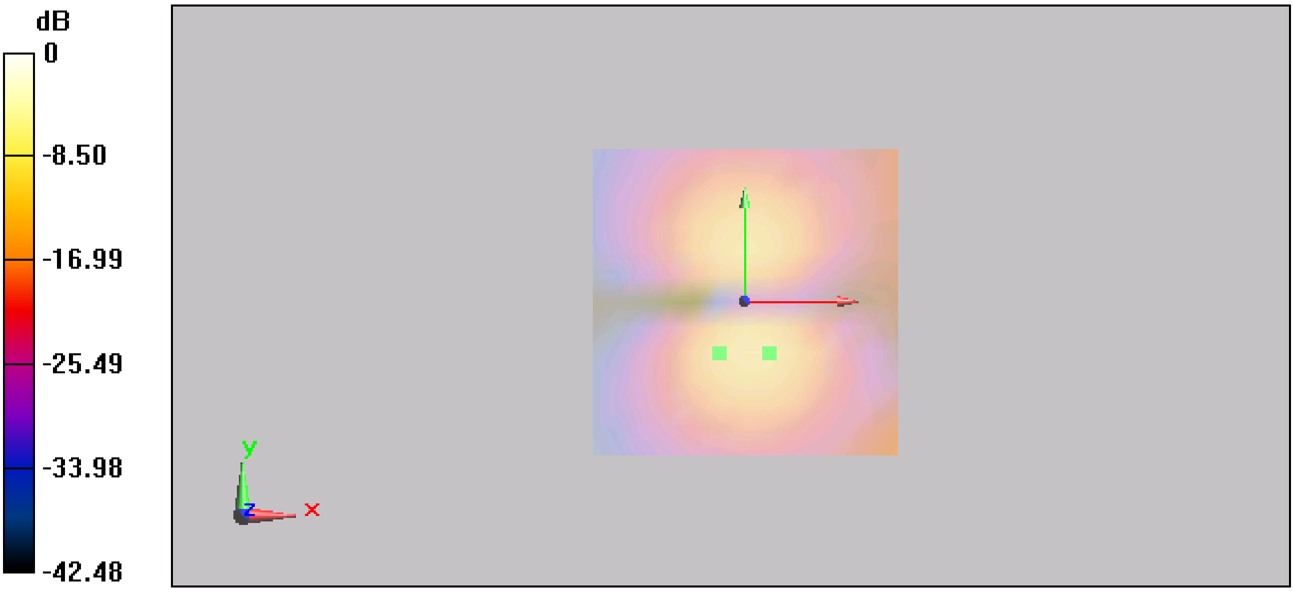
Category	**Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]**
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

ABM1 comp = -7.76 dBA/m

BWC Factor = 0.16 dB

Location: 4.2, -8.3, 3.7 mm



0 dB = 1.000 = 0.00 dB

Figure 13 T-Coil GSM 1900 Y transversal

T-Coil GSM 1900 Z Axial

Date: 6/7/2014
Communication System: UID 0, GSM (0); Frequency: 1880 MHz;Duty Cycle: 1:8.30042
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 GSM1900 HAC_TCoil_WD_Emission/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: 33.76
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 = 26.51 dB
ABM1 comp = 0.87 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm

R.45 GSM1900 HAC_TCoil_WD_Emission/General Scans/z (axial) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
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 comp = 0.87 dBA/m

BWC Factor = 0.16 dB

Location: 0, 0, 3.7 mm

R.45 GSM1900 HAC_TCoil_WD_Emission/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: 66.12

Measure Window Start: 300ms

Measure Window Length: 2000ms

BWC applied: 10.81 dB

Device Reference Point: 0, 0, -6.3 mm

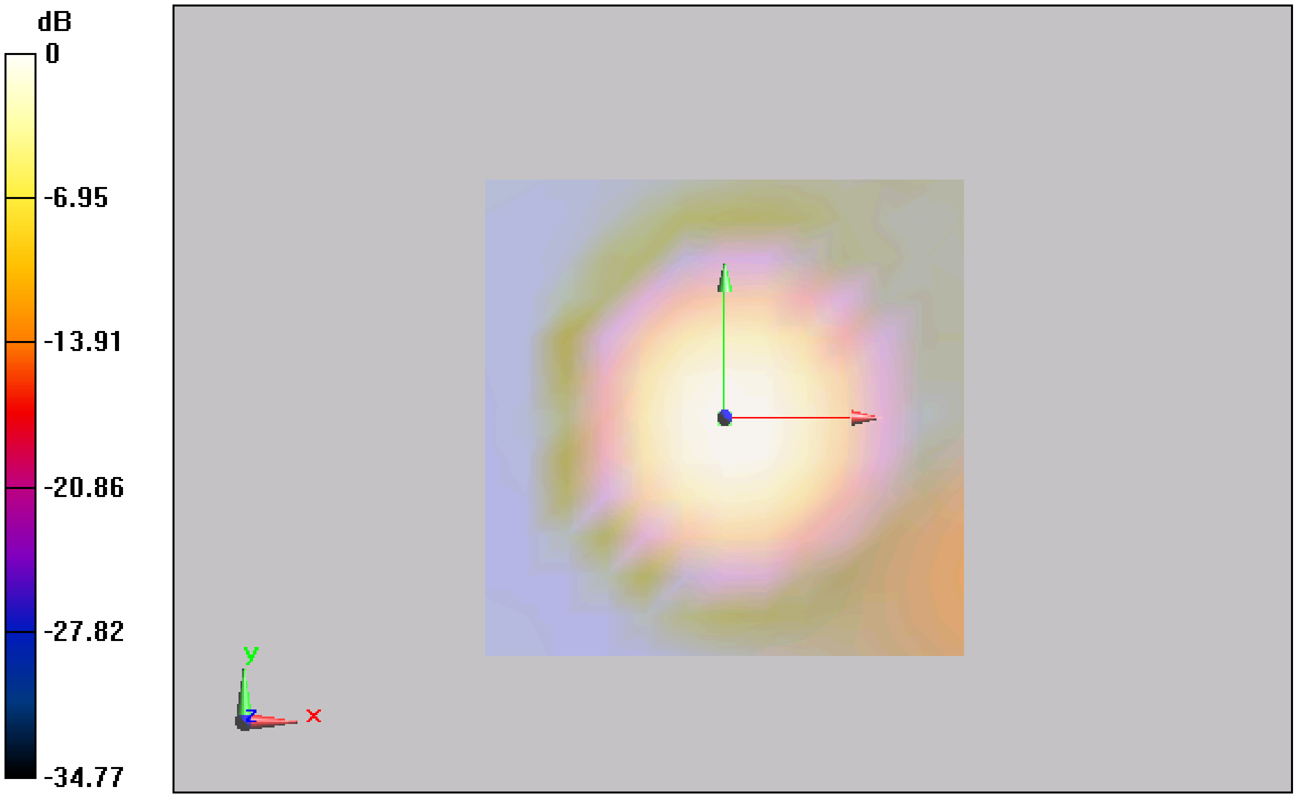
Category	**Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]**
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

Diff = 1.46 dB

BWC Factor = 10.81 dB

Location: 0, 0, 3.7 mm



0 dB = 1.000 = 0.00 dB

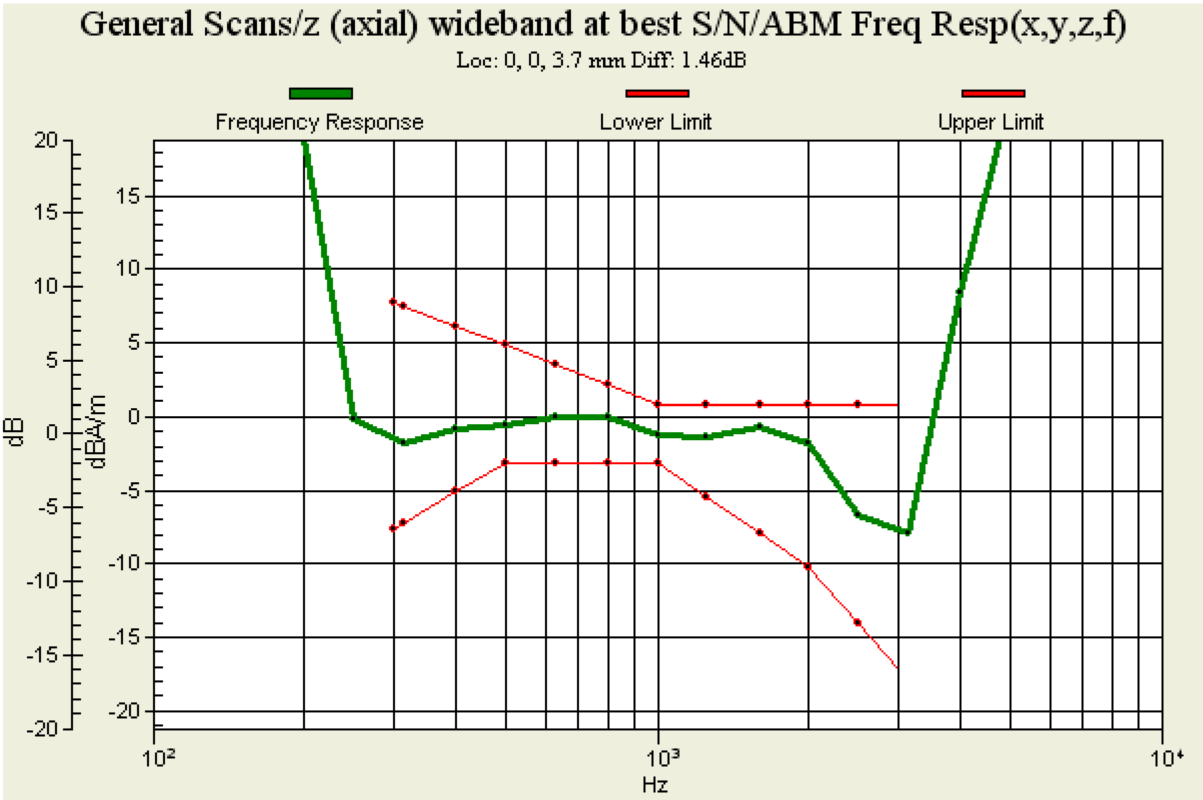


Figure 14 T-Coil GSM 1900 Z Axial

T-Coil WCDMA Band II Y transversal

Date: 6/7/2014
Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA II HAC_TCoil_WD_Emission/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: 33.76
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 = 43.29 dB
ABM1 comp = -9.94 dBA/m
BWC Factor = 0.16 dB
Location: -4.2, 8.3, 3.7 mm

R.45 WCDMA II HAC_TCoil_WD_Emission/General Scans/y (transversal) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
Measure Window Start: 300ms
Measure Window Length: 1000ms

BWC applied: 0.16 dB

Device Reference Point: 0, 0, -6.3 mm

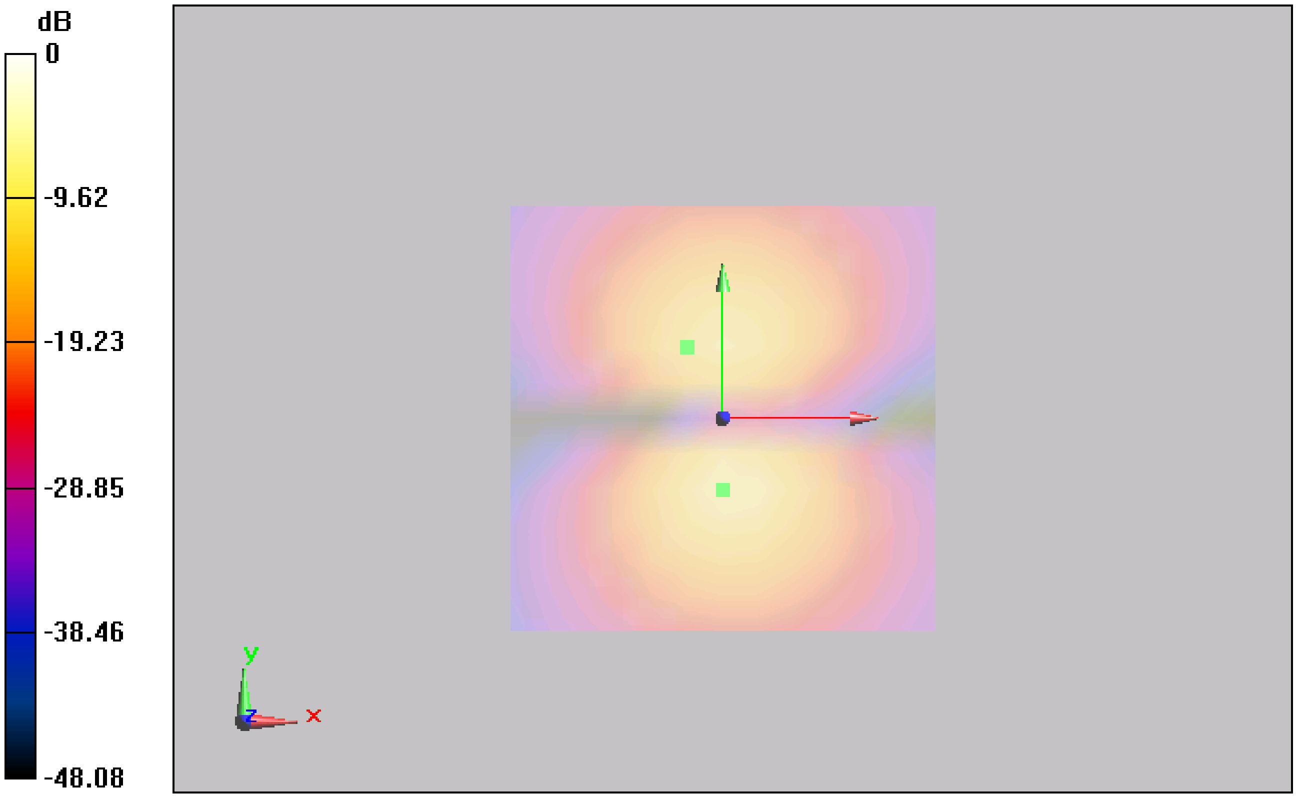
Category	Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

ABM1 comp = -7.30 dBA/m

BWC Factor = 0.16 dB

Location: 0, -8.3, 3.7 mm



0 dB = 1.000 = 0.00 dB

Figure 15 T-Coil WCDMA Band II Y transversal

T-Coil WCDMA Band II Z Axial

Date: 6/7/2014 1
Communication System: UID 0, WCDMA (0); Frequency: 1880 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA II HAC_TCoil_WD_Emission/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: 33.76
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 = 41.64 dB
ABM1 comp = -1.43 dBA/m
BWC Factor = 0.16 dB
Location: -4.2, 0, 3.7 mm

R.45 WCDMA II HAC_TCoil_WD_Emission/General Scans/z (axial) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
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 comp = 1.07 dBA/m

BWC Factor = 0.16 dB

Location: 0, 0, 3.7 mm

R.45 WCDMA II HAC_TCoil_WD_Emission/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: 66.12

Measure Window Start: 300ms

Measure Window Length: 2000ms

BWC applied: 10.81 dB

Device Reference Point: 0, 0, -6.3 mm

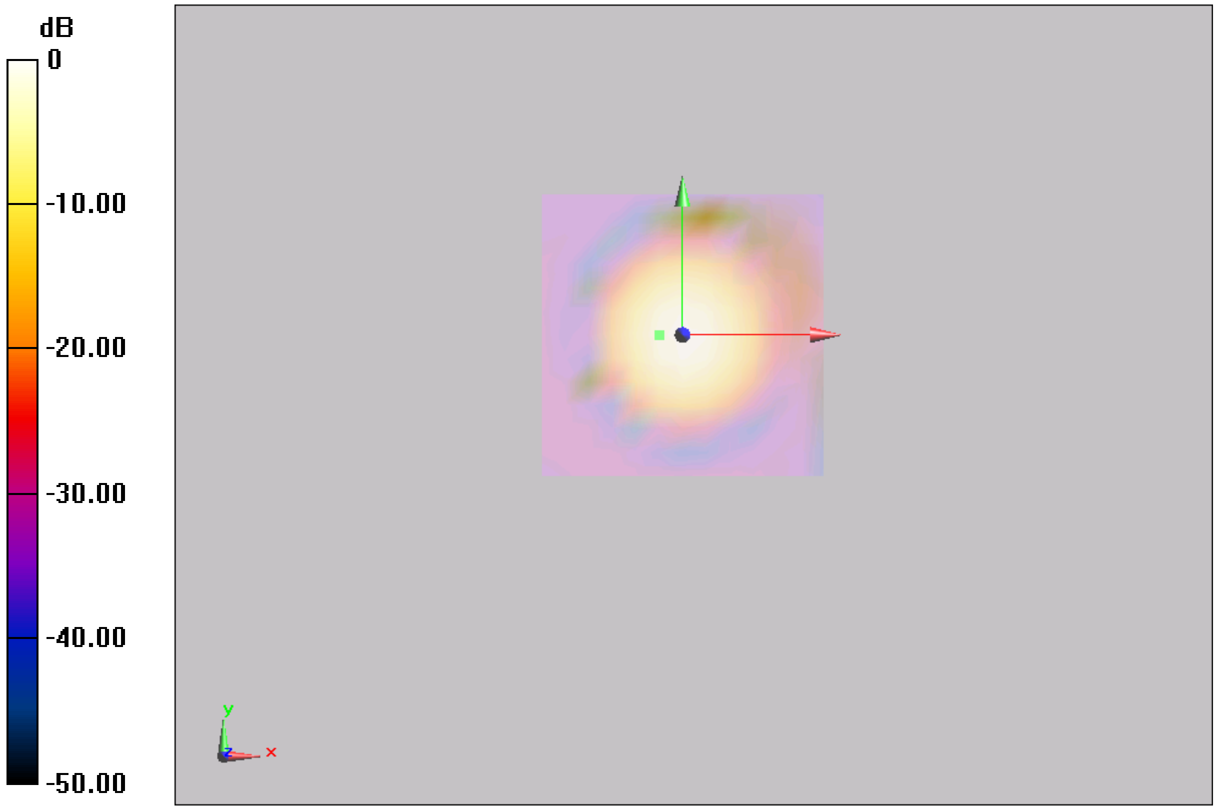
Category	Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

Diff = 1.64 dB

BWC Factor = 10.81 dB

Location: -4.2, 0, 3.7 mm



0 dB = 1.000 = 0.00 dB

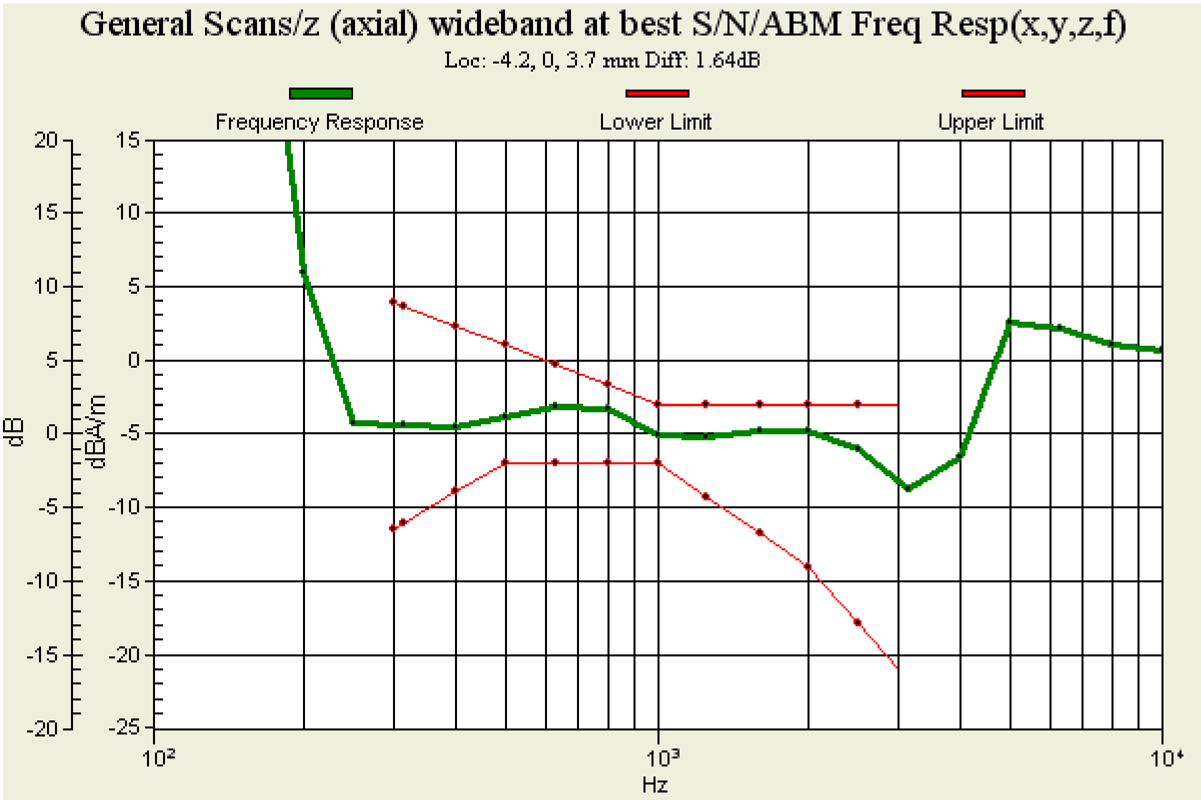


Figure 16 T-Coil WCDMA Band II Z Axial

T-Coil WCDMA Band IV Y transversal

Date: 6/7/2014

Communication System: UID 0, WCDMA (0); Frequency: 1732.6 MHz;Duty Cycle: 1:1

Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1 kg/m^3

Ambient Temperature:22.3 ℃

Phantom section: TCoil Section

DASY4 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: AM1DV3 - 3067; Calibrated: 2/27/2014

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA IV HAC_TCoil_WD_Emission/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: 33.76

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 = 43.34 dB

ABM1 comp = -9.69 dBA/m

BWC Factor = 0.16 dB

Location: -4.2, 8.3, 3.7 mm

R.45 WCDMA IV HAC_TCoil_WD_Emission/General Scans/y (transversal) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 33.76

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.16 dB

Device Reference Point: 0, 0, -6.3 mm

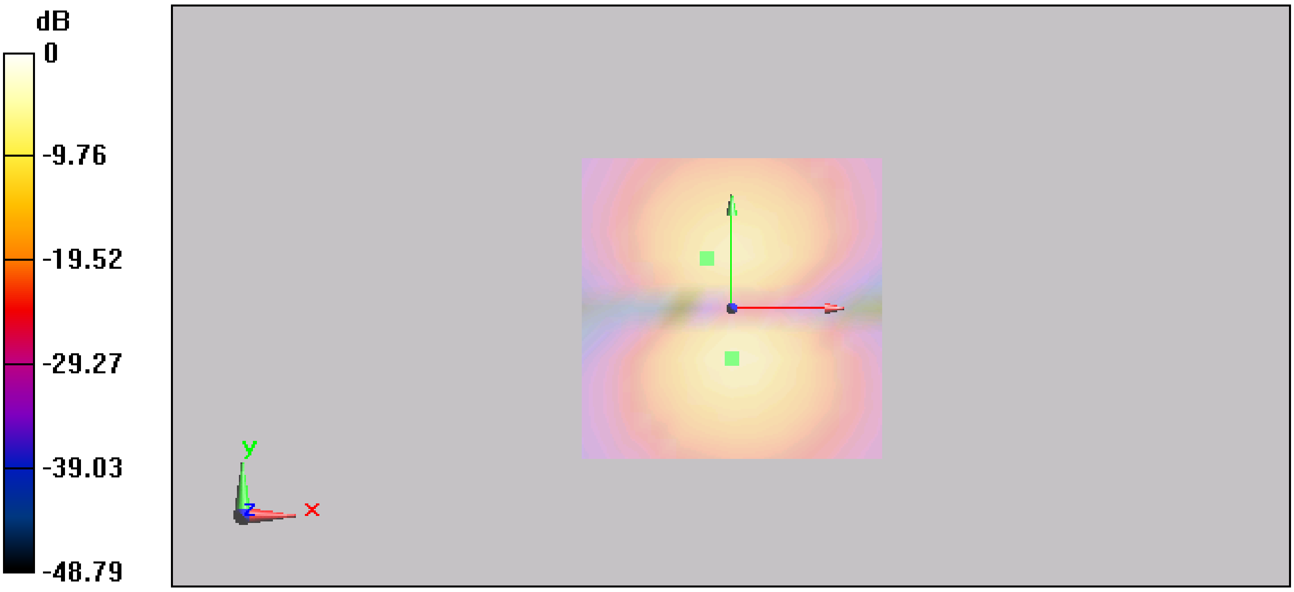
Category	**Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]**
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

ABM1 comp = -7.28 dBA/m

BWC Factor = 0.16 dB

Location: 0, -8.3, 3.7 mm



0 dB = 1.000 = 0.00 dB

Figure 17 T-Coil WCDMA Band IV Y transversal

T-Coil WCDMA Band IV Z Axial

Date: 6/7/2014 1
Communication System: UID 0, WCDMA (0); Frequency: 1732.6 MHz;Duty Cycle: 1:1
Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1 kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA IV HAC_TCoil_WD_Emission/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: 33.76
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 = 36.79 dB
ABM1 comp = -7.40 dBA/m
BWC Factor = 0.16 dB
Location: -4.2, 0, 3.7 mm

R.45 WCDMA IV HAC_TCoil_WD_Emission/General Scans/z (axial) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
Measure Window Start: 300ms
Measure Window Length: 1000ms

BWC applied: 0.16 dB
Device Reference Point: 0, 0, -6.3 mm

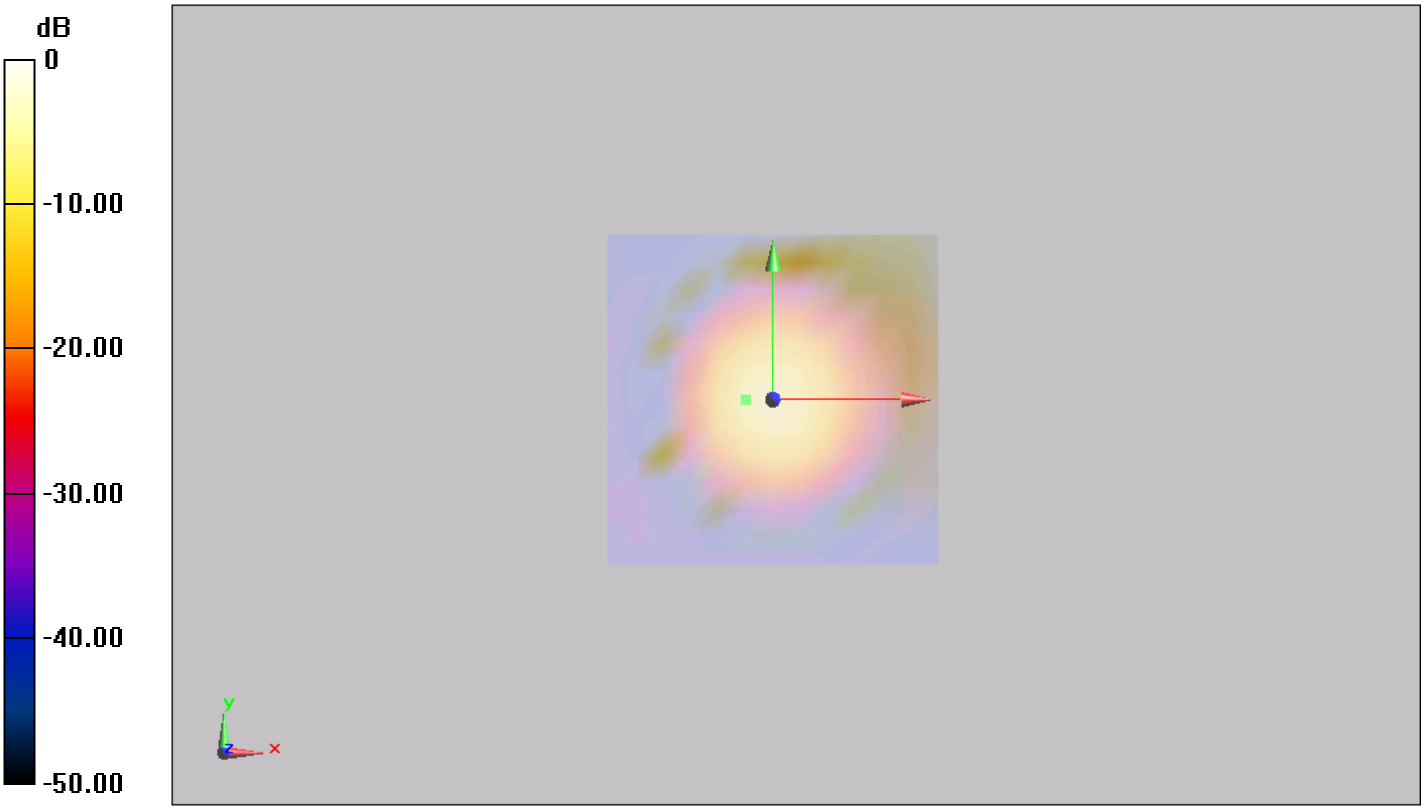
Category	Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:
ABM1 comp = -5.07 dBA/m
BWC Factor = 0.16 dB
Location: 0, 0, 3.7 mm

R.45 WCDMA IV HAC_TCoil_WD_Emission/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: 66.12
Measure Window Start: 300ms
Measure Window Length: 2000ms
BWC applied: 10.81 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:
Diff = 1.63 dB
BWC Factor = 10.81 dB
Location: -4.2, 0, 3.7 mm



0 dB = 1.000 = 0.00 dB

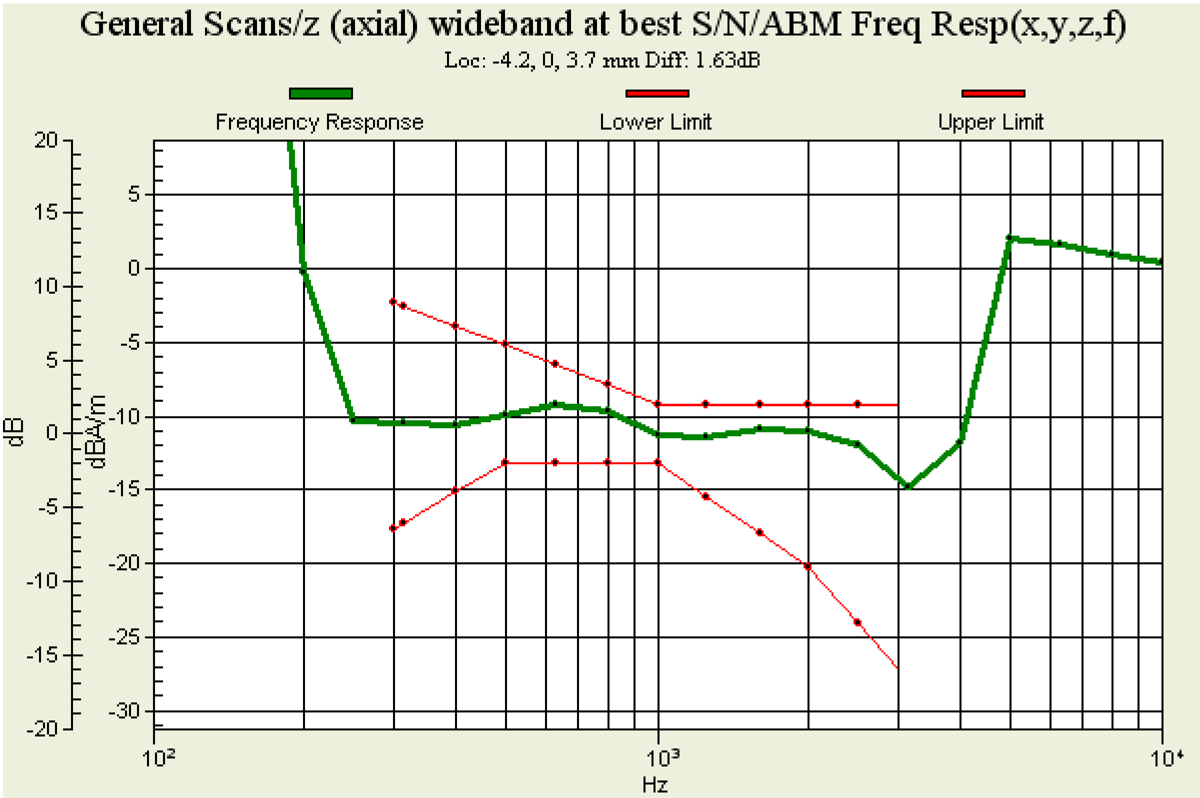


Figure 18 T-Coil WCDMA Band IV Z Axial

T-Coil WCDMA Band V Y transversal

Date: 6/7/2014

Communication System: UID 0, WCDMA (0); Frequency: 836.6 MHz;Duty Cycle: 1:1

Medium parameters used: σ = 0 S/m, ε_r = 1; ρ = 1 kg/m^3

Ambient Temperature:22.3 ℃

Phantom section: TCoil Section

DASY4 Configuration:

Sensor-Surface: 4mm (Mechanical Surface Detection)

Probe: AM1DV3 - 3067; Calibrated: 2/27/2014

Electronics: DAE4 Sn1317; Calibrated: 1/16/2014

Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;

Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA V HAC_TCoil_WD_Emission/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: 33.76

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 = 43.14 dB

ABM1 comp = -10.06 dBA/m

BWC Factor = 0.16 dB

Location: -4.2, 8.3, 3.7 mm

R.45 WCDMA V HAC_TCoil_WD_Emission/General Scans/y (transversal) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm

Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav

Output Gain: 33.76

Measure Window Start: 300ms

Measure Window Length: 1000ms

BWC applied: 0.16 dB

Device Reference Point: 0, 0, -6.3 mm

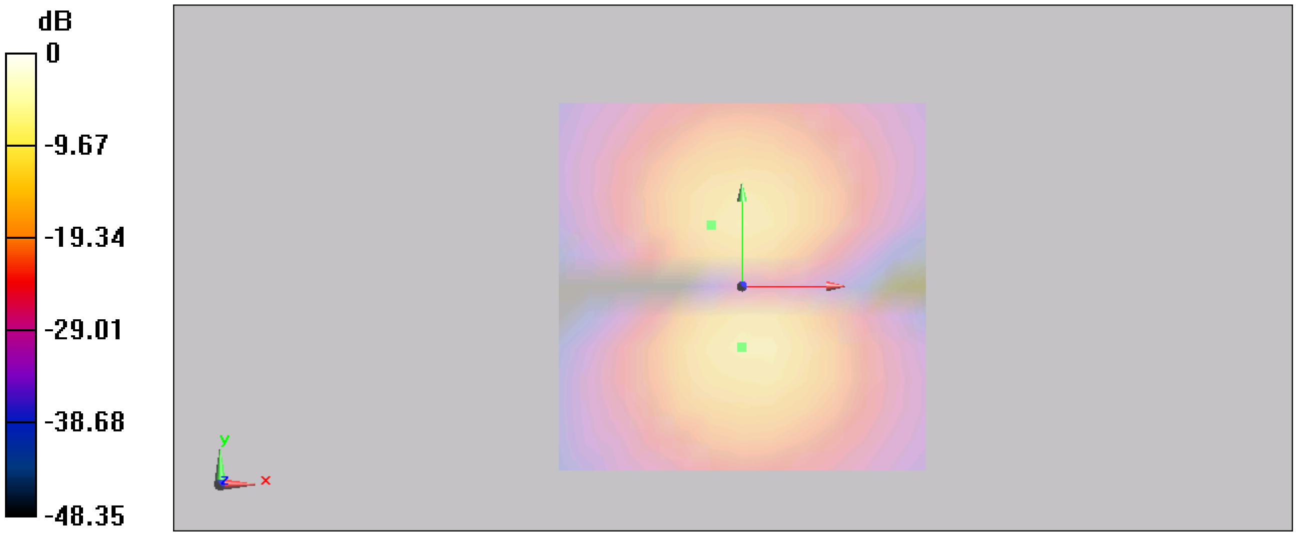
Category	**Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]**
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

ABM1 comp = -7.47 dBA/m

BWC Factor = 0.16 dB

Location: 0, -8.3, 3.7 mm



0 dB = 1.000 = 0.00 dB

Figure 19 T-Coil WCDMA Band V Y transversal

T-Coil WCDMA Band V Z Axial

Date: 6/7/2014
Communication System: UID 0, WCDMA (0); Frequency: 836.6 MHz;Duty Cycle: 1:1
Medium parameters used: $\sigma = 0$ S/m, $\varepsilon_r = 1$; $\rho = 1$ kg/m^3
Ambient Temperature:22.3 ℃
Phantom section: TCoil Section
DASY4 Configuration:
Sensor-Surface: 4mm (Mechanical Surface Detection)
Probe: AM1DV3 - 3067; Calibrated: 2/27/2014
Electronics: DAE4 Sn1317; Calibrated: 1/16/2014
Phantom: HAC Test Arch with AMCC; Type: SD HAC P01 BA;
Measurement SW: DASY52, Version 52.8 (7); SEMCAD X Version 14.6.10 (7164)

R.45 WCDMA V HAC_TCoil_WD_Emission/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: 33.76
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 = 42.80 dB
ABM1 comp = -3.49 dBA/m
BWC Factor = 0.16 dB
Location: -4.2, -4.2, 3.7 mm

R.45 WCDMA V HAC_TCoil_WD_Emission/General Scans/z (axial) 4.2mm 50 x 50/ABM Signal(x,y,z) (13x13x1): Measurement grid: dx=10mm, dy=10mm
Signal Type: Audio File (.wav) 48k_voice_1kHz_1s.wav
Output Gain: 33.76
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 comp = 0.94 dBA/m

BWC Factor = 0.16 dB

Location: 0, 0, 3.7 mm

R.45 WCDMA V HAC_TCoil_WD_Emission/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: 66.12

Measure Window Start: 300ms

Measure Window Length: 2000ms

BWC applied: 10.81 dB

Device Reference Point: 0, 0, -6.3 mm

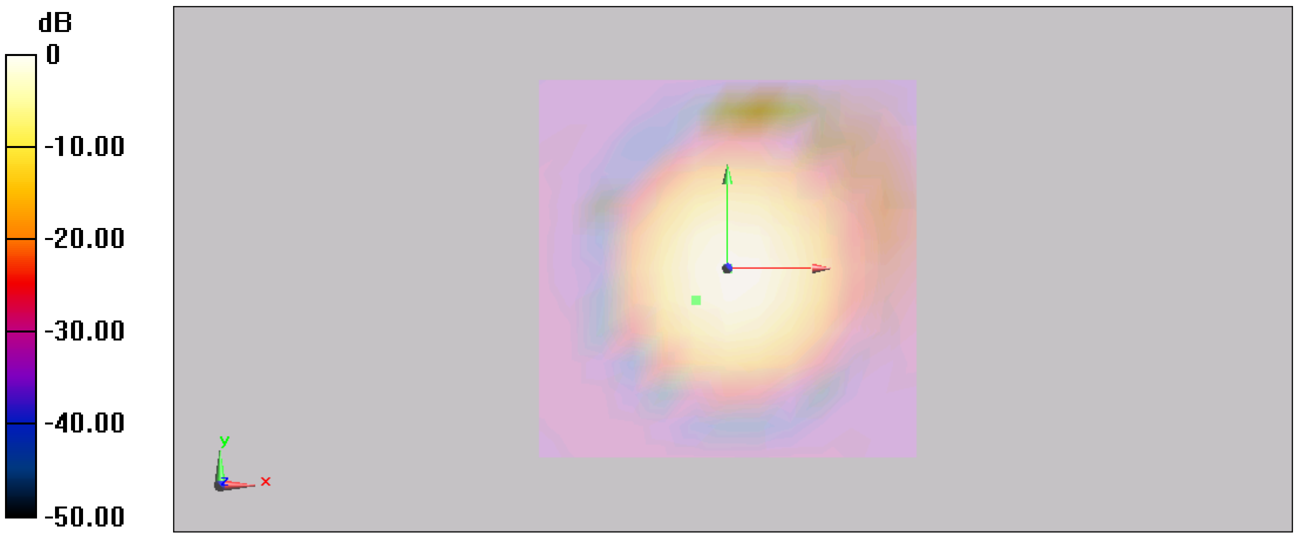
Category	Telephone parameters WD signal quality [(signal+noise)-to-noise ratio in decibels]
Category T1	0 dB to 10 dB
Category T2	10 dB to 20 dB
Category T3	20 dB to 30 dB
Category T4	> 30 dB

Cursor:

Diff = 1.86 dB

BWC Factor = 10.81 dB

Location: -4.2, -4.2, 3.7 mm



0 dB = 1.000 = 0.00 dB

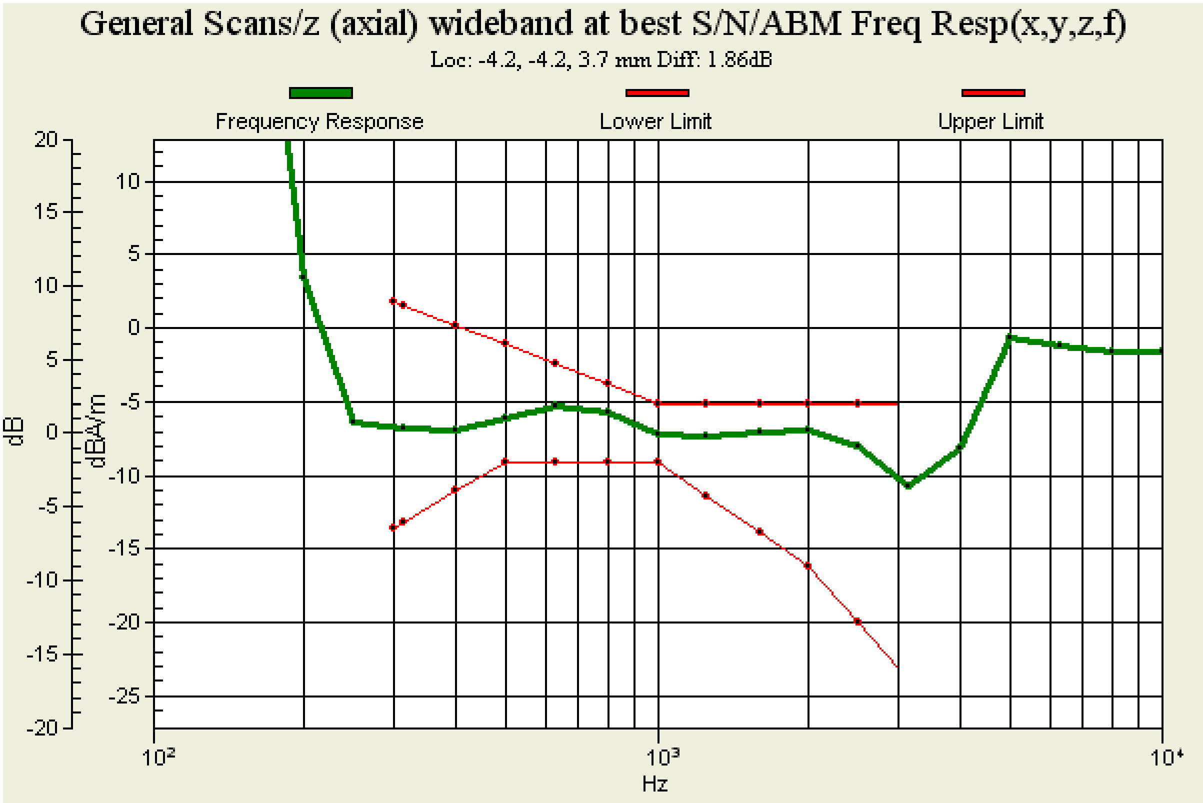


Figure 20 T-Coil WCDMA Band V Z Axial

ANNEX C: Probe Calibration Certificate

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 **Auden**

Certificate No: **AM1DV3-3067_Feb14**

CALIBRATION CERTIFICATE

Object: AM1DV3 - SN: 3067

Calibration procedure(s): QA CAL-24.v3
Calibration procedure for AM1D magnetic field probes and TMFS in the audio range

Calibration date: February 27, 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	01-Oct-13 (No:13976)	Oct-14
Reference Probe AM1DV2	SN: 1008	14-Jan-14 (No. AM1D-1008_Jan14)	Jan-15
DAE4	SN: 781	13-Sep-13 (No. DAE4-781_Sep13)	Sep-14

Secondary Standards	ID #	Check Date (in house)	Scheduled Check
AMCC	1050	01-Oct-13 (in house check Oct-13)	Oct-15
AMMI Audio Measuring Instrument	1062	26-Sep-12 (in house check Sep-12)	Sep-14

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

Issued: February 27, 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	**AM1DV3** Audio Magnetic 1D Field Probe
Type No	SP AM1 001 BA
Serial No	**3067**

Overall length	296 mm
Tip diameter	6.0 mm (at the tip)
Sensor offset	3.0 mm (centre of sensor from tip)
Internal Amplifier	20 dB

Manufacturer / Origin	Schmid & Partner Engineering AG, Zürich, Switzerland
Manufacturing date	February 17, 2009
Last calibration date	January 10, 2013

Calibration data

Connector rotation angle	(in DASY system)	**263.2** °	+/- 3.6 ° (k=2)
Sensor angle	(in DASY system)	**1.07** °	+/- 0.5 ° (k=2)
Sensitivity at 1 kHz	(in DASY system)	**0.00738 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%.

ANNEX D: DAE4 Calibration Certificate

TMC
In Collaboration with
s p e a g
CALIBRATION LABORATORY

Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China
Tel: +86-10-62304633-2079 Fax: +86-10-62304633-2504
E-mail: Info@emcite.com Http://www.emcite.com

ilac-MRA CNAS 校准 CNAS L0442

Client : TA(Shanghai) Certificate No: J14-2-0052

CALIBRATION CERTIFICATE

Object	DAE4 - SN: 1317
Calibration Procedure(s)	TMC-OS-E-01-198 Calibration Procedure for the Data Acquisition Electronics (DAEx)
Calibration date:	January 16, 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)℃ and humidity<70%.

Calibration Equipment used (M&TE critical for calibration)

Primary Standards	ID #	Cal Date(Calibrated by, Certificate No.)	Scheduled Calibration
Documenting Process Calibrator 753	1971018	01-July-13 (TMC, No:JW13-049)	July-14

	Name	Function	Signature
Calibrated by:	Yu Zongying	SAR Test Engineer	
Reviewed by:	Qi Dianyuan	SAR Project Leader	
Approved by:	Lu Bingsong	Deputy Director of the laboratory	

Issued: January 16, 2014

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

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CALIBRATION LABORATORY
Add: No.52 Huayuanbei Road, Haidian District, Beijing, 100191, China
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E-mail: Info@emcite.com Http://www.emcite.com

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 report provide only calibration results for DAE, it does not contain other performance test results.

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E-mail: Info@emcite.com Http://www.emcite.com

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	404.058 ± 0.15% (k=2)	404.060 ± 0.15% (k=2)	403.954 ± 0.15% (k=2)
Low Range	3.99002 ± 0.7% (k=2)	3.99910 ± 0.7% (k=2)	3.98303 ± 0.7% (k=2)

Connector Angle

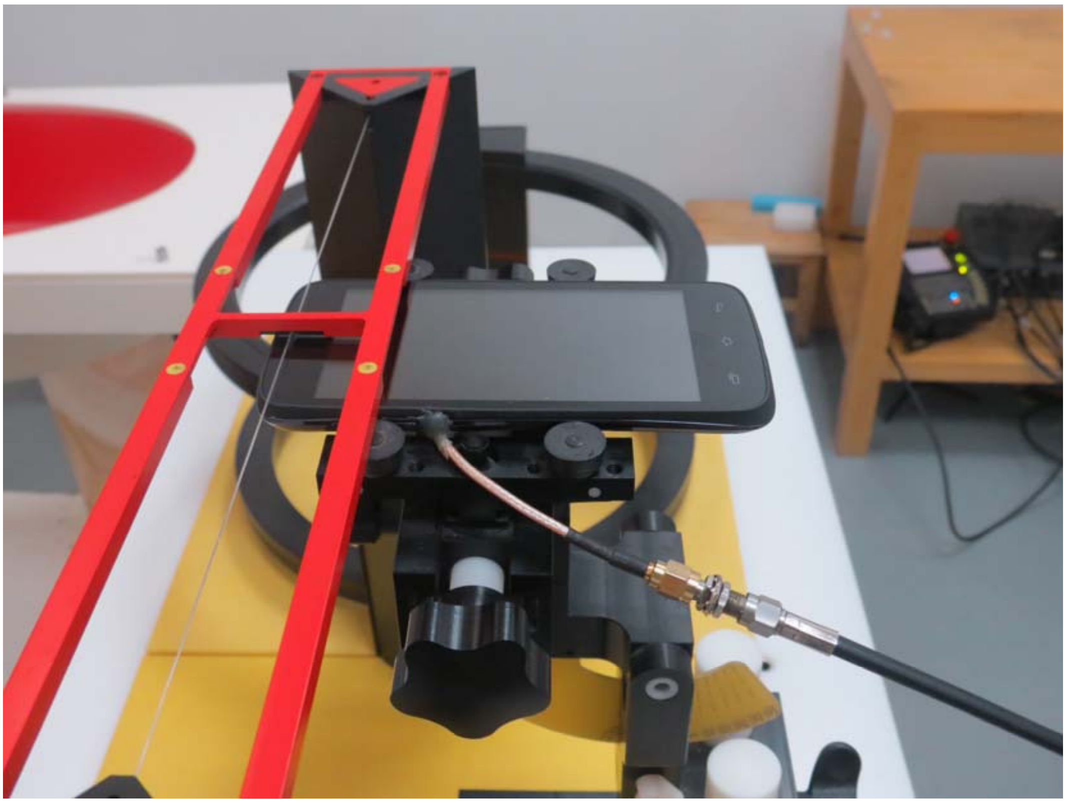
Connector Angle to be used in DASY system	119° ± 1 °

ANNEX E: The EUT Appearances and Test Configuration

a: EUT

b: Battery

Picture 2: Constituents of EUT



Picture 3: Test Setup