SAMSUNG ELECTRONICS Co., Ltd.,
Regulatory Compliance Group
IT R&D Center

416, Maetan-3dong,
Yeongtong-gu, Suwon-si,
Gyeonggi-do, Korea 443-742

TEST REPORT ON HAC

Model Tested:	**SGH-T379**
FCC ID (Requested):	**A3LSGHT379**
Job No:	**AI-043**
Report No:	**AI-043-T1**
Date issued:	**June 29, 2011**
Result Summary:	**T3 – 2007 (Signal To Noise Category)**

- Abstract –

This document reports on HAC Tests carried out in accordance with ANSI C63.19(2007) §6.3, §7.3, FCC Rule Part(s) FCC 47 CFR §20.19

Prepared By ______________________

Authorized By ______________________

Contents

1. GENERAL INFORMATION

Test Sample :	850/1900 GSM/GPRS EDGE and AWS PCS WCDMA/HSDPA Phone with Bluetooth
Model Number :	SGH-T379
Serial Number :	Identical prototype (S/N :# FI-116-H)
Manufacturer :	SAMSUNG ELECTRONICS Co., Ltd.
Address :	416 Maetan3-Dong, Yeongtong-gu, Suwon City Gyeonggi-Do, Korea 443-742
Test Standard :	ANSI C 63.19 (2007), FCC 47 CFR § 20.19, §6.3, §7.3
FCC Classification	Licensed Portable Transmitter Held to Ear (PCE)
Test Dates :	Jun. 17, 2011
Tested for :	FCC/TCB Certification

2. DESCRIPTION OF DEVICE

Tx Freq. Range :	824.2 ~ 848.8 MHz(GSM850) 1850.2 ~ 1909.8 MHz(GSM1900)	1712.4 ~ 1752.5 MHz(AWS WCDMA) 1850.2 ~ 1909.8 MHz(PCS WCDMA)
Rx Freq. Range :	869.2 ~ 893.8 MHz(GSM850) 1930.20 ~ 1989.80 MHz(GSM1900)	2112.4 ~ 2152.5 MHz(AWS WCDMA) 1932.4 ~ 1987.6 MHz(PCS WCDMA)
Antenna Configuration :	PIFA	
Antenna Manufacturer :	Gwang-Jin	
Antenna Dmimensions :	46.01X18.99X5.12(mm)	

Indicating Operating modes for Air Interfaces/Bands

Air Interface	Band(MHz)	Type	C63.19-2007 Tested	Simultaneous Transmissions Note:Not to be tested	Reduced Power 20.19 (c)(1)	Voice Over Digital Transport (Data)
GSM	835	Voice	Yes	Yes: BT	No	N/A
GSM	1900	Voice	Yes	Yes: BT	No	N/A
WCDMA	1700	Voice	Yes	Yes: BT	No	N/A
WCDMA	1900	Voice	Yes	Yes: BT	No	N/A
GSM	All band (835,1900)	Data	N/A	N/A	N/A	No
WCDMA	All band (1700,1900)	Data	N/A	N/A	N/A	Yes
BT	2450	Data	N/A	N/A	N/A	N/A

* HAC Rating was not based on concurrent voice and data mode.
Standalone mode was found to represent worst case rating for both M and T rating

3. Performance
3.1 RF EMISSIONS

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

Category	Telephone RF Parameters	
Near field Category	E-field emissions CW dB(V/m)	H-field emissions CW dB(A/m)
f < 960 MHz		
M1	56 to 61 + 0.5 x AWF	5.6 to 10.6 +0.5 x AWF
M2	51 to 56 + 0.5 x AWF	0.6 to 5.6 +0.5 x AWF
M3	46 to 51 + 0.5 x AWF	–4.4 to 0.6 +0.5 x AWF
M4	< 46 + 0.5 x AWF	< –4.4 + 0.5 x AWF
f > 960 MHz		
M1	46 to 51 + 0.5 x AWF	–4.4 to 0.6 +0.5 x AWF
M2	41 to 46 + 0.5 x AWF	–9.4 to –4.4 +0.5 x AWF
M3	36 to 41 + 0.5 x AWF	–14.4 to –9.4 +0.5 x AWF
M4	< 36 + 0.5 x AWF	< –14.4 + 0.5 x AWF

Table 4-1
Hearing aid and WD near-field categories as defined in ANSI C63.19-2007 [2]

3.2 ARTICULATION WEIGHTING FACTOR (AWF)

Standard	Technology	Articulation Weighing Factor (AWF)
T1/T1P1/3GPP	**UMTS (WCDMA)**	0
TIA/EIA/IS-2000	**CDMA**	0
iDEN™	**TDMA (22 and 11 Hz)**	0
J-STD-007	**GSM (217 Hz)**	-5

Table 4-2
Articulation Weighting Factors

3.3 MAGNETIC COUPLING

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 1 kHz in a 1/3 octave band filter per 7.3.1.

Frequency Response

The frequency response of the axial component of the magnetic field shall follow the response curve specified in EIA RS-504-1983, over the frequency range 300 Hz – 3000 Hz per 7.3.2.

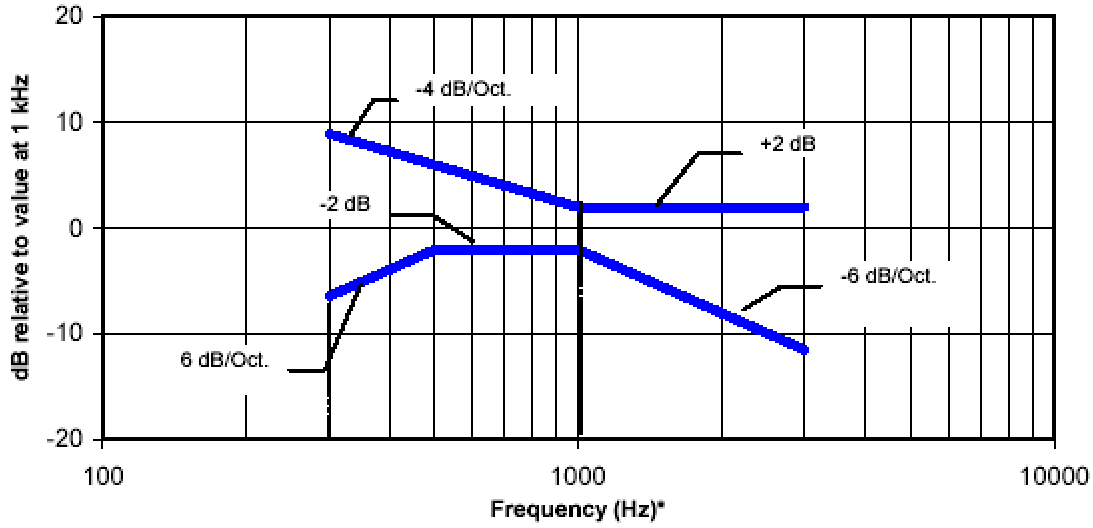


Figure 4-1
Magnetic field frequency response for Wireless Devices with an axial field below ≤ -15 dB (A/m) at 1 kHz

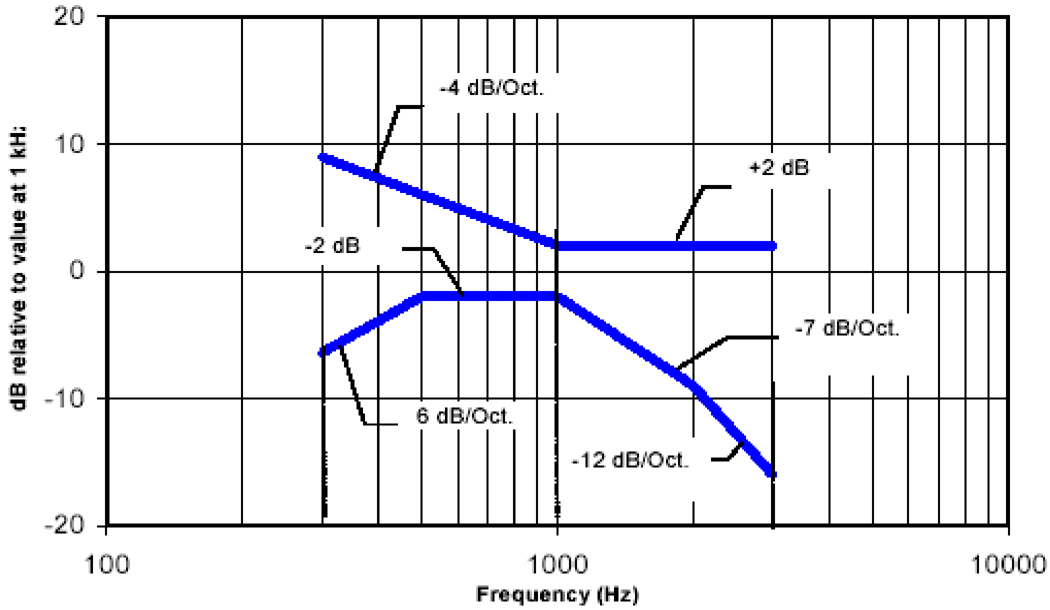


Figure 4-2
Magnetic Field frequency response for wireless devices with an axial field that exceeds –15 dB(A/m) at 1 kHz

Signal Quality

The table below provides 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 a hearing aid can have no immunity to an interference signal 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 coupling 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.

Category	Telephone RF Parameters
	Wireless Device Signal Quality (Signal + Noise-to-noise ratio in dB)
T1	0 to 10 dB
T2	10 to 20 dB
T3	20 to 30 dB
T4	> 30 dB

Table 4-3
Magnetic Coupling Parameters

4. DESCRIPTION OF TEST EQUIPMENT

4.1 HAC Measurement Setup

The equipment was connected as shown in an acoustic/RF hemi-anechoic chamber:

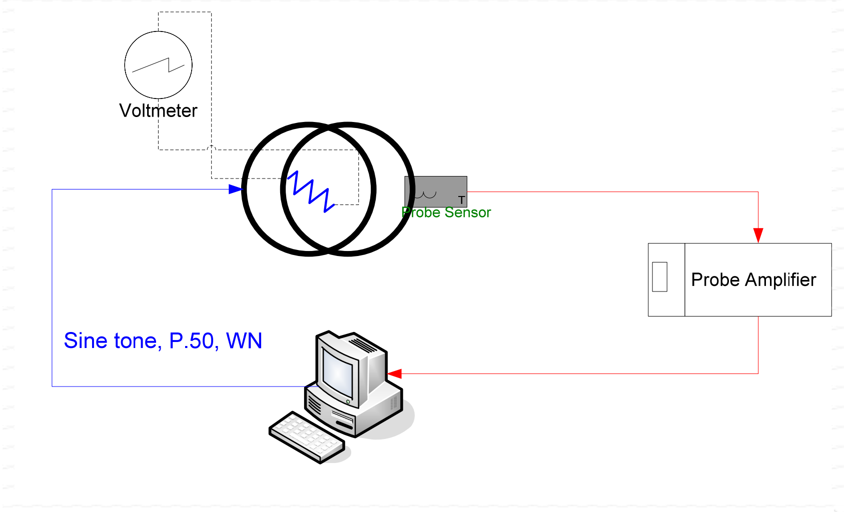


Figure 4-1 Validation Setup with Helmholtz Coil

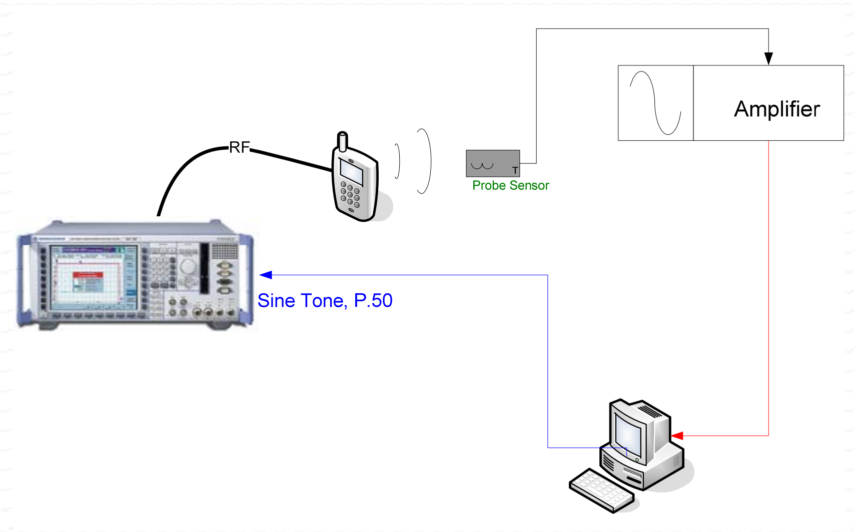


Figure 4-2 T-Coil Test Setup

4.2 Scanning Mechanism

Manufacturer:	TEM
Accuracy:	± 0.83 cm/meter
Minimum Step Size:	0.1 mm
Maximum speed	6.1 cm/sec
Line Voltage:	115 VAC
Line Frequency:	60 Hz
Material Composite:	Delrin (Acetal)
Data Control:	Parallel Port
Dynamic Range (X-Y-Z):	45 x 31.75 x 47 cm
Dimensions:	36” x 25” x 38”
Operating Area:	36” x 49” x 55”
Reflections:	< -20 dB (in anechoic chamber)

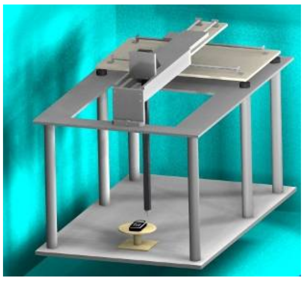


Figure 4-3
RF Near-Field Scanner

4.3 ITU-T P.50 Artificial Voice

Manufacturer:	ITU-T
Active Frequency Range:	100 Hz – 8 kHz
Stimulus Type:	Male and Female, no spaces
Single Sample Duration:	20.96 seconds
Activity Level:	100%

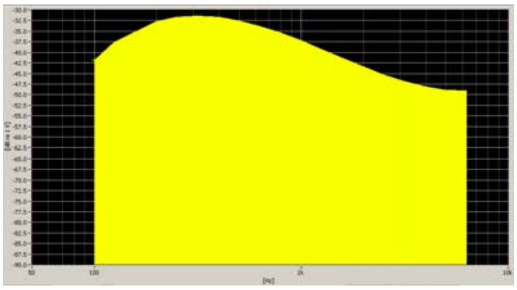


Figure 4-4
Spectral Characteristic of full P.50

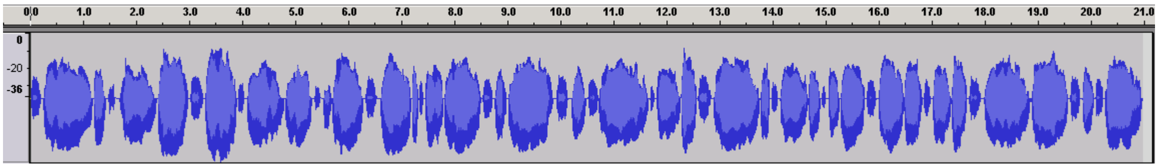
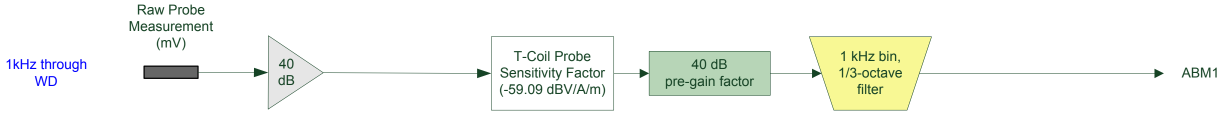


Figure 4-5
Temporal Characteristic of full P.50

ABM1 Measurement Block Diagram:



ABM2 Measurement Block Diagram:

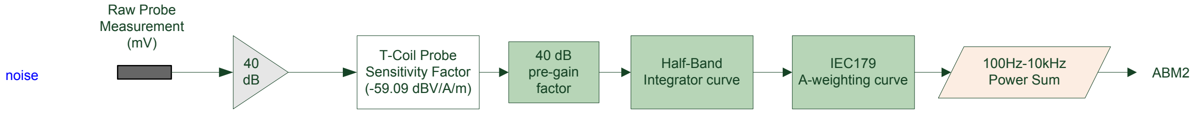


Figure 4-6 Magnetic Measurement Processing Steps

4.4 Equipment Calibration

Table 3.2 Test Equipment Calibration

Model	Description	Cal. Due Date	Serial No.
CMU200	Base Station Simulator	Oct/25/2011	109162
4474	Data Acquisition Card	N/A	N/A
Positioner	HAC Positioner	N/A	N/A
HAC System	HAC System controller with S/W	N/A	N/A
Axial T-coil Probe	Axial T-coil Probe	Jan/14/2012	TEM-1115
Radial T-coil Probe	Radial T-coil Probe	Jan/14/2012	TEM-1119
E4440A	PSA Spectrum analyzer	Feb/24/2012	MY45304704
E4419B	EPM Power Meter	Feb /25/2012	MY45103291
E9300B	Power Sensor	Mar/4/2012	MY41496209
Fluke87	RMS Multimeter	Dec/20/2011	65030199
E3640A	Power supply	Dec/20/2011	MY40009112
AMCC	H/H coil(Speag)	N/A	N/A

5. HAC MEASUREMENT PROCEDURE

The flow diagram below was followed (From C63.19):

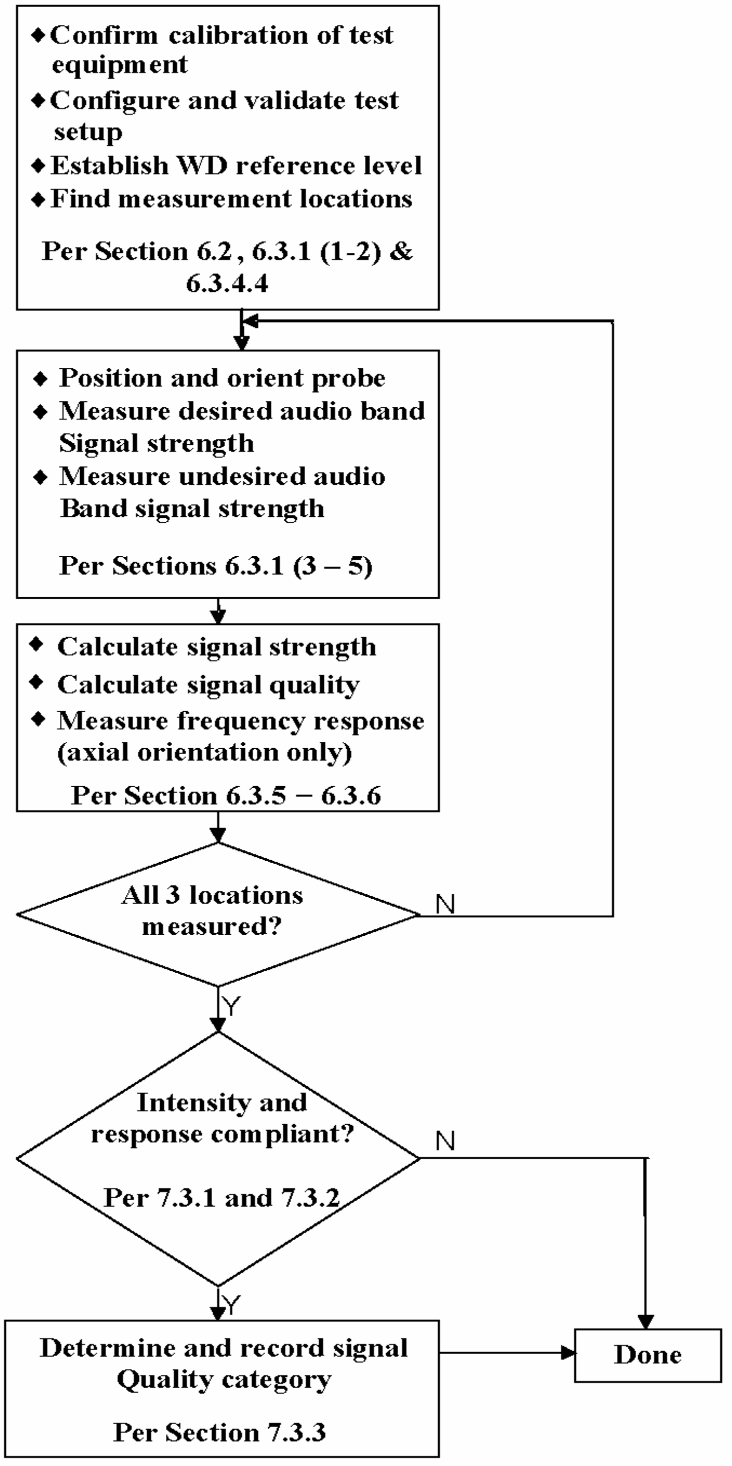


Figure 5-1 Test Procedure for T-coil Measurement

5.1 Ambient Noise Check per C63.19 §6.2.1

a. Ambient interference was monitored using a Real-Time Analyzer between 100-10,000 Hz with 1/3 octave filtering.
b. "A-weighting" and Half-Band Integration was applied to the measurements.
c. Since this measurement was measured in the same method as ABM2 measurements, this level was verified to be less than 10 dB below the lowest measurement signal (which is the highest ABM2 measurement for a T4 WD). Therefore the maximum noise level for a T4 WD with an ABM1 = -18 dBA/m is:

-18 - 30 - 10 = -58 dBA/m

5.2 Measurement System Validation (See Figure 4-1)

a. The measurement system including the probe, pre-amplifier and acquisition system were validated as an entire system to ensure the reliability of test measurements.

b. ABM1 Validation

The magnetic field at the center of the Helmholtz coil is given by the equation (per C63.19 Annex D.9.1):

$$H_c = \frac{NI}{r\sqrt{1.25^3}} = \frac{N(\frac{V}{R})}{r\sqrt{1.25^3}}$$

Where H_c = magnetic field strength in amperes per meter
N = number of turns per coil

For a Helmholtz Coil, N=20; r=0.143m; R=10.2Ω and using V=102mV:

$$H_c = \frac{20 \cdot (\frac{0.102}{10.2})}{0.143 \cdot \sqrt{1.25^3}} = 1.0007\, A/m$$

Therefore a pure tone of 1kHz was applied into the coils such that 102 mV was observed across the 10.2 Ω resistor. The voltmeter used for measurement was verified to be capable of measurements in the audio band range. This theoretically generates an expected field of 1 A/m in the center of the Helmholtz coil which was used to validate the probe measurement at 1 A/m. This was verified to be within ± 0.5 dB of the 1 A/m value.

c. Frequency Response Validation

The frequency response through the Helmholtz Coil was verified to be within 0.5 dB relative to 1 kHz, between 300 – 3000 Hz using the ITU-P.50 artificial speech signal as shown below:

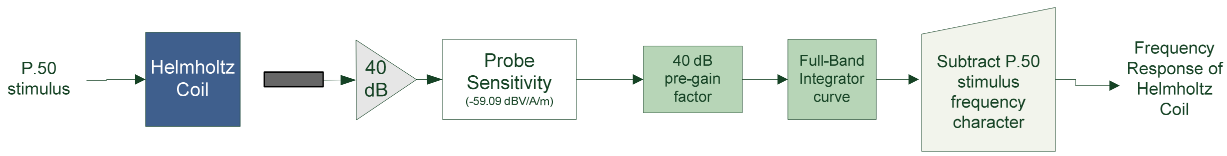


Figure 5-2 Frequency Response Validation

d. ABM2 Measurement Validation

WD noise measurements are filtered with A-weighting and Half-Band Integration over a frequency range of 100Hz – 10kHz to process ABM2 measurements. Below is the verification of the system processing A-weighting and Half-Band integration between system input to output within 0.5 dB of the theoretical result:

Table 5-1
ABM2 Frequency Response Validation

f (Hz)	HBI, A - Measured (dB re 1kHz)	HBI, A - Theoretical (dB re 1kHz)	dB Var.
100	-16.180	-16.170	-0.010
125	-13.257	-13.250	-0.007
160	-10.347	-10.340	-0.007
200	-8.017	-8.010	-0.007
250	-5.925	-5.920	-0.005
315	-4.045	-4.040	-0.005
400	-2.405	-2.400	-0.005
500	-1.212	-1.210	-0.002
630	-0.349	-0.350	0.001
800	0.071	0.070	0.001
1000	0.000	0.000	0.000
1250	-0.503	-0.500	-0.003
1600	-1.513	-1.510	-0.003
2000	-2.778	-2.780	0.002
2500	-4.316	-4.320	0.004
3150	-6.166	-6.170	0.004
4000	-8.322	-8.330	0.008
5000	-10.573	-10.590	0.017
6300	-13.178	-13.200	0.022
8000	-16.241	-16.270	0.029
10000	-19.495	-19.520	0.025

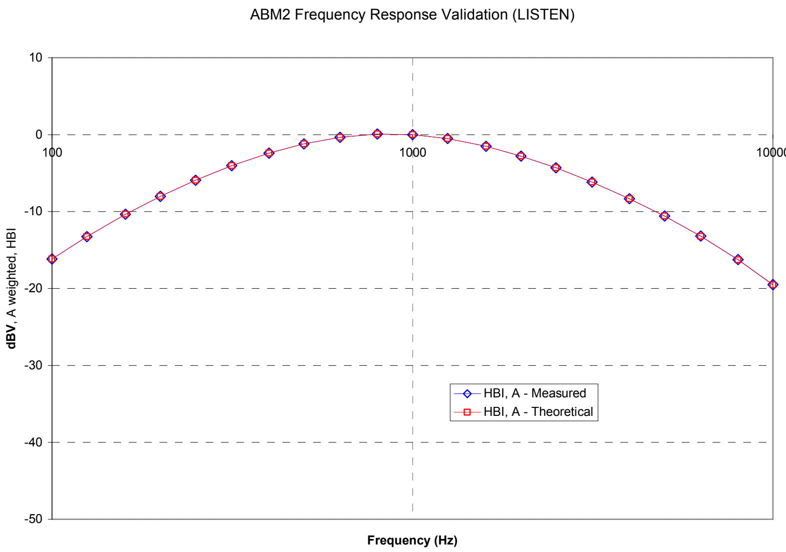


Figure 5-3
ABM2 Frequency Response Validation

The ABM2 result is a power sum from 100 Hz to 10 kHz with half-band integration and A-weighting. To verify the power sum measurement, a power sum over the full band was measured and verified to track with the source level (See Figure 5-9). Therefore the setup in this step was used to verify the power sum post-processing for ABM2 measurements. See below block diagram:

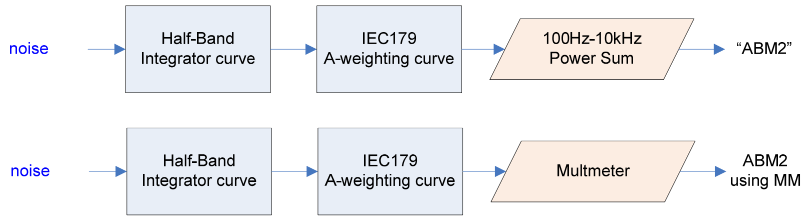


Figure 5-4 ABM2 Validation Block Diagram

The power summed output results for a known input were compared to the multi-meter results to verify any deviation in the post-processing implemented with the power-sum.

Table 5-2 ABM2 Power Sum Validation

WN Input (dBV)	Power Sum (dBV)	Multimeter-Full (dBV)	Dev (dB)
-60	-60.36	-60.2	0.16
-50	-50.19	-50.13	0.06
-40	-40.14	-40.03	0.11
-30	-30.13	-30.01	0.12
-20	-20.12	-20	0.12
-10	-10.14	-10	0.14

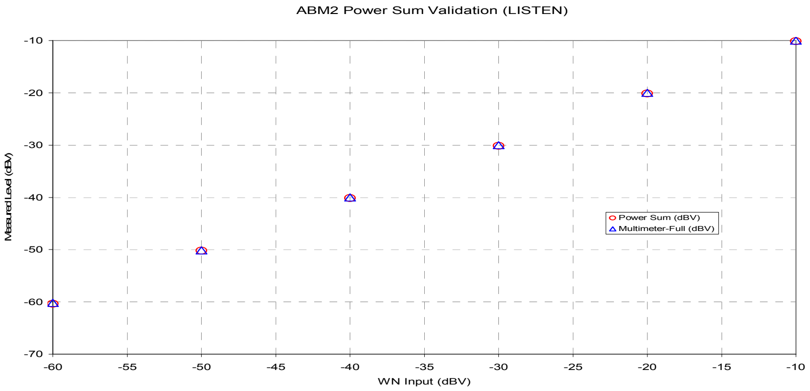


Figure 5-5 ABM2 Power Sum Validation

5.3 Measurement Test Setup

5.3.1 Fine scan above the WD (TEM)

a. A multi-tone signal was applied to the handset such that the phone acoustic output was stable within 1dB over the probe settling time and with the acoustic output level at the C63.19 specified levels (below). The measurement step size was in 2 mm increments at a distance of 10 mm between the surface of the wireless device as shown below:

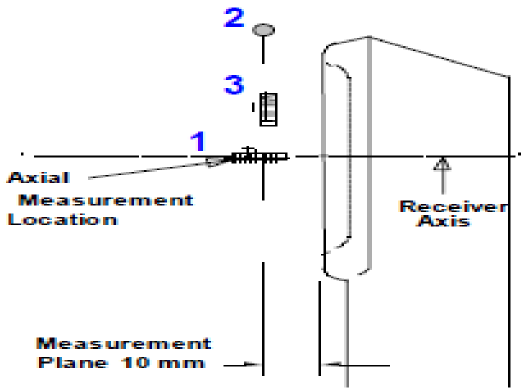


Figure 5-6
Measurement Distance

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b. After scanning, the planar field maximum point was determined. The position of the probe was moved to this location to setup the test using the sound check system.

c. These steps were repeated for the other T-coil orientations (of axial, radial transverse, or radial longitudinal) per Figure 5-16 after a T-coil orientation was fully measured with the sound check system.

5.3.2 Speech Signal Setup to Base Station Simulator

a. C63.19 Table 6-1 states audio reference input levels for various technologies:

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

The CMU200 audio levels were determined using base station simulator manufacturer calibration procedures resulting in the below corresponding voltages relative to handset test point level (in dBm0):

Table 5-3
CMU200 Voltage Input Levels for Audio

	GSM				
	Decoder Cal.		Encoder Cal.		Sensitivity (DUT R)
	Peak 1(mV)	Peak 1(dBV)	Peak 1(mV)	Peak 1(dBV)	
3.16dBm0	1074.36	0.62	1074.53	0.62	1.077
-16dBm0			118.64	-18.52	
	WCDMA				
	Decoder Cal.		Encoder Cal.		Sensitivity (DUT R)
	Peak 1(mV)	Peak 1(dBV)	Peak 1(mV)	Peak 1(dBV)	
3.16dBm0	1074.36	0.62	1074.53	0.62	1.077
-16dBm0			118.64	-18.52	

*** Encoder cal. value adjusts to Decoder cal. value.**

b. Real-Time Analyzer (RTA)
   i. The Real-Time Analyzer was configured to analyze measurements using 1/3 Octave band weighted filtering.

c. WD Radio Configuration Selection
   i. The worst case ABM2 for GSM was Enhanced Full Rate.
   ii. The device was chosen to be tested in the worst-case ABM2 condition under AMR rates for WCDMA(see below) :.

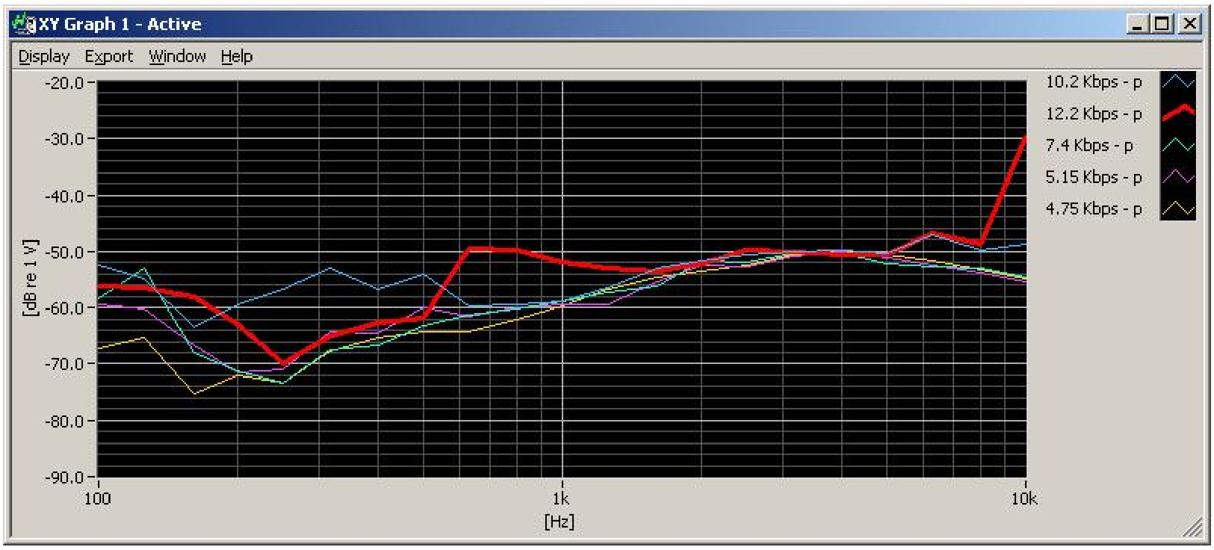


Figure 5-7 Vocoder Analysis for ABM Noise (WCDMA)

Table 5-4
The ABM2 levels of various AMR rates

ABM2 Pre-Test (dBA/m)						
12.2Kbps	10.2Kbps	7.4Kbps	5.15Kbps	4.75Kbps	Orientation	Channel
-40.47	-42	-45.34	-46.74	-47.95	Radial Transversal	1412
ABM1 Pre-Test (dBA/m)						
12.2Kbps	10.2Kbps	7.4Kbps	5.15Kbps	4.75Kbps	Orientation	Channel
11.74	11.34	11.13	11.16	11.06	Radial Transversal	1412

5.3.3 Signal Quality Data Analysis

a. Narrow-band Magnetic Intensity
   i. The standard specifies a 1 kHz 1/3 octave band minimum field intensity for a sine tone. The ABM1 measurements were evaluated at 1kHz with 1/3 octave band filtering over an averaged period of 10 seconds.

b. Frequency Response
   i. The appropriate frequency response curve was measured to curves in Figure 4-1 or Figure 4-2 between 300 – 3000 Hz using digital linear averaging (limit lines chosen according to measurement found in step 4a.) A linear average over 3x the length of the artificial voice signal (3x sampling) was performed. A 10 second delay was configured in the measurement process of the stimulus to ensure handset vocoder latency effects and echo cancellation devices (if any) were appropriately stabilized during measurements.
   ii. The appropriate post-processing was applied according to the system processing chain illustrated in Figure 5-13. All R10 frequencies were plotted with respect to 0dB at 1 kHz value and aligned with respect to the EIA-504 mask.

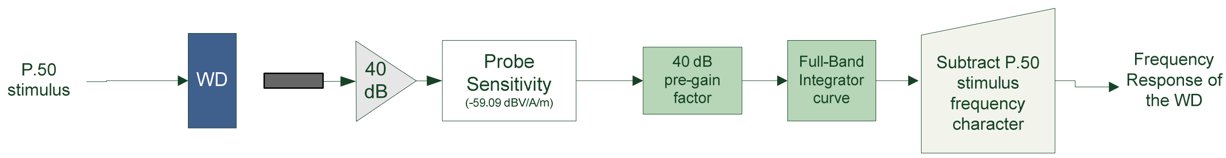


Figure 5-8 Frequency Response Block Diagram

   iii. The margin is represented by the closest measured data point on the curve to the EIA-504 limit lines, in dB.

c. Signal Quality Index
   i. Ensuring the WD was at maximum RF power, maximum volume, backlight on, display on, maximum contrast setting, keypad lights on (when possible) with no audio signal through the vocoder, the WD was measured over at least 100 Hz – 10,000 Hz, maximized over 5 seconds with a 50ms sample time for the ABM2 measurement (5 second time period is used in noise measurements under standards such as IEEE 269, etc.)
   ii. After applying half-band integration and A-weighting to the result, a power sum was applied over each 1/3 octave bandwidth frequency for an ABM2 value
   iii. This result was subtracted from the ABM1 result in step a, to obtain the Signal Quality.

5.3.4 Wireless Device Channels and Frequencies

The frequencies listed in the table below are those that lie in the center of the bands used for cellular telephony. Low, middle and high channels were tested in each band for FCC compliance evaluation to ensure the maximum emission is captured across the entire band.

To facilitate setting of a base station simulator for ABM measurements, specific band plan channel numbers are listed that may be used in lieu of the band center frequencies.

Table 5-5
Center Channels and Frequencies

Test frequencies & associated channels	
Channel	**Frequency (MHz)**
Cellular 850	
384 (CDMA)	836.52
UARFCN 4183(UMTS)	836.60
190 (GSM)	836.60
AWS 1730	
450 (CDMA)	1732.5
UARFCN 1412 (UMTS)	1732.4
PCS 1900	
661 (GSM)	1880
600 (CDMA)	1880
UARFCN 9400 (UMTS)	1880

5.3.5 RF Emission Effect on T-coil Measurements

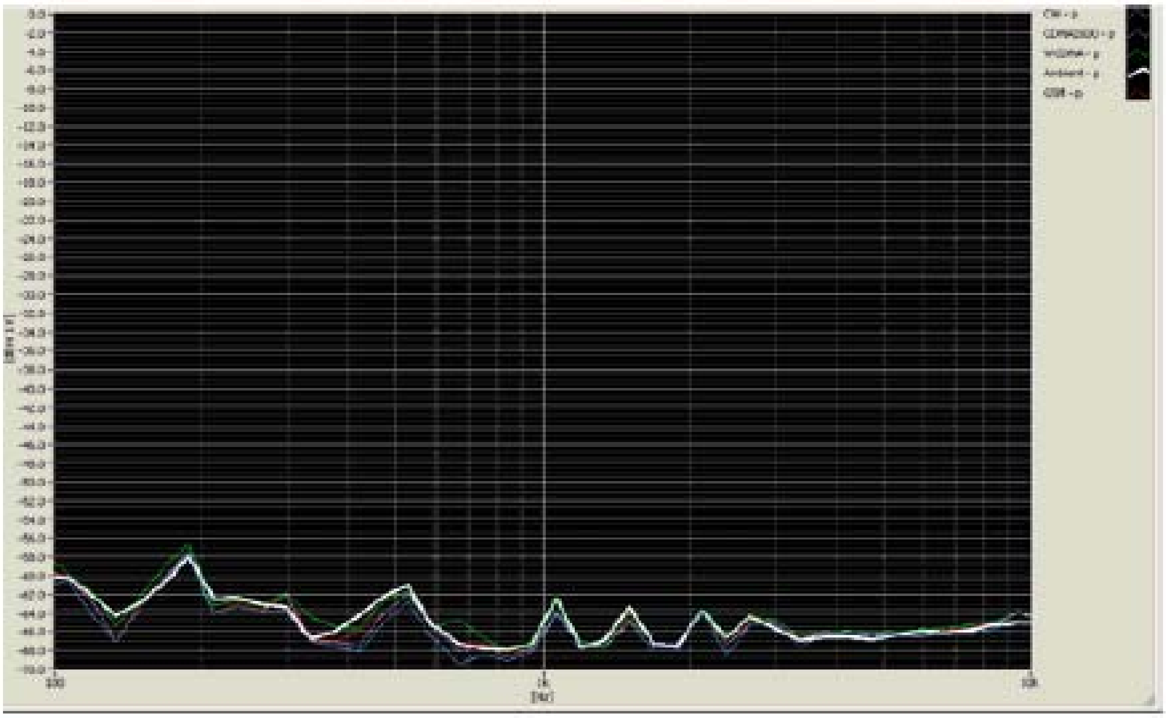


Figure 5-9
High Power RF Emissions Effect with HAC Dipole on the T-coil Probe System 10mm between dipole maximum and magnetic probe

6. MEASUREMENT UNCERTAINTY

Source of Uncertainty	Value %	Probability distribution	Divisor	c_i	u_i(y)	$(u_i(y))^2$	v_i or v_{eff}	$ui(y)^4/v_{eff}$
Measurement system								
ABM Noise	0.16	normal	1.000	1	0.16	0.024	4	0.0001469
RF Reflection	4.70	rectangular	1.732	1	2.71	7.363	∞	0
Reference Signal Level	12.20	rectangular	1.732	1	7.04	49.613	∞	0
Probe Coil Sensitivity	12.20	rectangular	1.732	1	7.04	49.613	∞	0
Probe Linearity	2.40	rectangular	1.732	1	1.39	1.920	∞	0
Cable Loss	2.80	rectangular	1.732	1	1.62	2.613	∞	0
Frequency Analyzer	5.00	rectangular	1.732	1	2.89	8.333	∞	0
System Repeatibility	2.04	normal	1.000	1	2.04	4.176	4	4.360
Positioner Accuracy	1.00	rectangular	1.732	1	0.58	0.333	∞	0
Test sample related								
WD Repeatibility	10.40	normal	1.000	1	10.40	108.137	4	2923.396
Phantom and set-up								
Positioning Accuracy	9.75	normal	1.000	1	9.75	95.045	4	2258.375
Combined Standard Uncertainty		normal			18.09	327.172	21	5186.131
Expanded Uncertainty		**normal k=**	**2**		35.45		21	

Notes:

1. Test equipments are calibrated according to techniques outlined in NIS81, NIS3003 and NIST Tech Note 1297.
2. All equipments have traceability according to NIST. Measurement Uncertainties are defined in further detail in NIS 81 and NIST Tech Note 1297 and UKAS M3003.

Measurement uncertainty reflects the quality and accuracy of a measured result as compared to the true value. Such statements are generally required when stating results of measurements so that it is clear to the intended audience that the results may differ when reproduced by different facilities. Measurement results vary due to the measurement uncertainty of the instrumentation, measurement technique, and test engineer. Most uncertainties are calculated using the tolerances of the instrumentation used in the measurement, the measurement setup variability, and the technique used in performing the test. While not generally included, the variability of the equipment under test also figures into the overall measurement uncertainty. Another component of the overall uncertainty is based on the variability of repeated measurements (so-called Type A uncertainty). This may mean that the Hearing Aid compatibility tests may have to be repeated by taking down the test setup and resetting it up so that there are a statistically significant number of repeat measurements to identify the measurement uncertainty. By combining the repeat measurement results with that of the instrumentation chain using the technique contained in NIS 81 and NIS 3003, the overall measurement uncertainty was estimated.

7. Test Results

7.1 Test Summary

Table 7-1
Table of Results for GSM and WCDMA

Mode	Band	Orientation	Measurement Item	Limit	Measured	Verdict	Result
GSM	**GSM850**	**Axial**	Intensity	-18	18.04	**PASS**	**T3**
			Frequency Response	0	0.94	**PASS**	
			SNNR	20	26.91	**PASS**	
		Radial Transverse	Intensity	-18	8.21	**PASS**	
			Frequency Response	0	0.88	**PASS**	
			SNNR	20	39.25	**PASS**	
		Radial Longitudinal	Intensity	-18	10.59	**PASS**	
			Frequency Response	0	1.47	**PASS**	
			SNNR	20	25.09	**PASS**	
	GSM1900	**Axial**	Intensity	-18	18.24	**PASS**	**T4**
			Frequency Response	0	0.9	**PASS**	
			SNNR	20	33.48	**PASS**	
		Radial Transverse	Intensity	-18	4.67	**PASS**	
			Frequency Response	0	0.89	**PASS**	
			SNNR	20	42.08	**PASS**	
		Radial Longitudinal	Intensity	-18	10.64	**PASS**	
			Frequency Response	0	1.38	**PASS**	
			SNNR	20	31.23	**PASS**	

Mode	Band	Orientation	Measurement Item	Limit	Measured	Verdict	Result
WCDMA	AWS WCDMA	Axial	Intensity	-18	17.96	PASS	T4
			Frequency Response	0	0.87	PASS	
			SNNR	20	58.87	PASS	
		Radial Transverse	Intensity	-18	8.09	PASS	
			Frequency Response	0	0.86	PASS	
			SNNR	20	47.58	PASS	
		Radial Longitudinal	Intensity	-18	8.49	PASS	
			Frequency Response	0	1.33	PASS	
			SNNR	20	50.02	PASS	
	PCS WCDMA	Axial	Intensity	-18	18	PASS	T4
			Frequency Response	0	0.87	PASS	
			SNNR	20	62.92	PASS	
		Radial Transverse	Intensity	-18	8.12	PASS	
			Frequency Response	0	0.87	PASS	
			SNNR	20	49.48	PASS	
		Radial Longitudinal	Intensity	-18	7.99	PASS	
			Frequency Response	0	0.87	PASS	
			SNNR	20	51.18	PASS	

*Note : The above results are tested in the worst case of ABM2 configuration.
(According to table 5-4, the worst case is Enhanced Full Rate configuration for GSM and AMR 12.2 Kbps configuration for WCDMA)

The measured T-coil category is T3 for GSM mode and T4 for WCDMA.
All raw data is in Section 7.2.

7.2 Raw Data for T-coil Measurement

Table 7-2
Raw Data for GSM

	GSM850								
	Axial			Radial Transverse			Radial Longitudinal		
	Ch.128	Ch.190	Ch.251	Ch.128	Ch.190	Ch.251	Ch.128	Ch.190	Ch.251
ABM1 (dBA/m)	18.23	18.04	18.07	8.24	8.21	8.21	10.59	10.76	10.61
ABM2(dBA/m)	-8.85	-8.87	-10.88	-31.11	-31.04	-32.41	-14.5	-14.45	-16.53
Frequency Response(dB)	0.99	1.01	0.94	0.9	0.88	0.91	1.52	1.55	1.47
SNNR(dB)	27.08	26.91	28.95	39.34	39.25	40.62	25.09	25.21	27.13
Ambient Noise(dBA/m)	-59.74			-59.95			-59.34		
Minimum of SNNR	26.91			39.25			25.09		

	GSM1900								
	Axial			Radial Transverse			Radial Longitudinal		
	Ch.512	Ch.661	Ch.810	Ch.512	Ch.661	Ch.810	Ch.512	Ch.661	Ch.810
ABM1 (dBA/m)	18.27	18.25	18.24	4.67	8.2	8.17	10.66	10.64	10.79
ABM2(dBA/m)	-15.21	-15.91	-17.03	-37.41	-38.15	-39.26	-20.57	-21.66	-23.15
Frequency Response(dB)	0.94	0.9	0.91	0.9	0.9	0.89	1.42	1.38	1.43
SNNR(dB)	33.48	34.16	35.28	42.08	46.36	47.44	31.23	32.3	33.94
Ambient Noise(dBA/m)	-59.74			-59.95			-59.34		
Minimum of SNNR	33.48			42.08			31.23		

WD Configuration :
1. Power configuration : Power Level is 33dBm for GSM850 and 30dBm for GSM1900
2. Phone condition : Mute On, Backlight On, Max Volume, Max Contrast, HAC mode On
3. Configuration : Enhanced Full Rate
4. X,Y Coordinate of T-coil measurement

	Axial	Radial Transverse	Radial Longitudinal
[X,Y] from Bottom left	**2.4, 2.6**	**2.0, 2.6**	**2.4, 3.0**

Raw Data for WCDMA

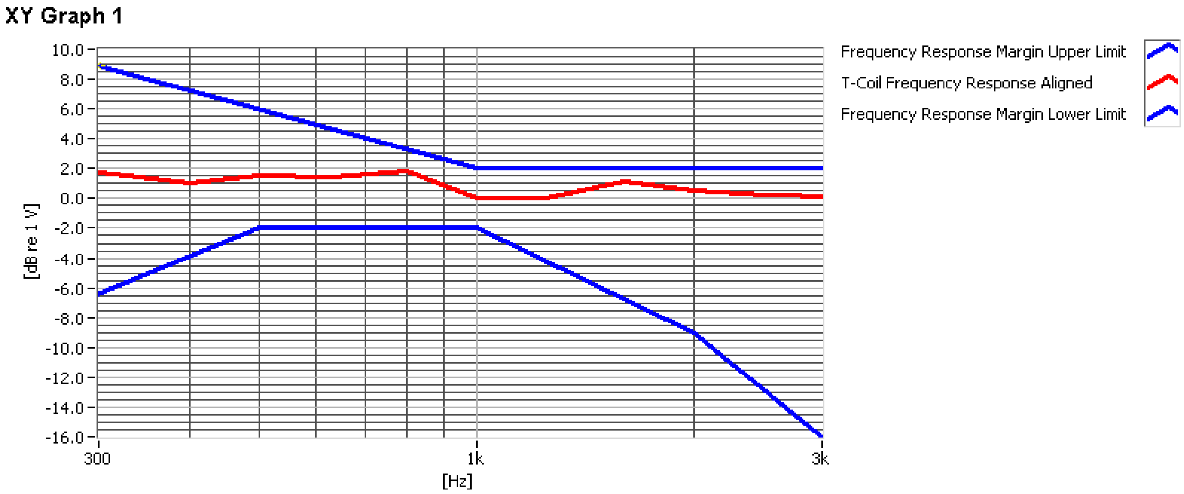
	AWS WCDMA								
	Axial			Radial Transverse			Radial Longitudinal		
	Ch.1312	Ch.1412	Ch.1862	Ch.1312	Ch.1412	Ch.1862	Ch.1312	Ch.1412	Ch.1862
ABM1 (dBA/m)	18	18.12	17.96	8.09	8.14	8.26	8.49	8.59	8.56
ABM2(dBA/m)	-43.51	-47.24	-40.91	-39.48	-47.04	-50.26	-41.53	-42.91	-45.13
Frequency Response(dB)	0.87	0.89	0.87	0.86	0.89	0.88	1.33	1.38	1.37
SNNR(dB)	61.51	65.35	58.87	47.58	55.18	58.54	50.02	51.49	53.69
Ambient Noise(dBA/m)	-59.74			-59.95			-59.34		
Minimum of SNNR	58.87			47.58			50.02		

	PCS WCDMA								
	Axial			Radial Transverse			Radial Longitudinal		
	Ch.9262	Ch.9400	Ch.9538	Ch.9262	Ch.9400	Ch.9538	Ch.9262	Ch.9400	Ch.9538
ABM1 (dBA/m)	18.11	18	18	8.13	8.12	8.14	8.04	7.99	8.2
ABM2(dBA/m)	-47	-47.51	-44.92	-50.67	-45	41.34	-44.48	-46	-42.98
Frequency Response(dB)	0.91	0.87	0.88	0.87	0.9	0.88	0.87	0.88	0.9
SNNR(dB)	65.11	65.51	62.92	58.8	53.13	49.48	52.52	53.99	51.18
Ambient Noise(dBA/m)	-59.74			-59.95			-59.34		
Minimum of SNNR	62.92			49.48			51.18		

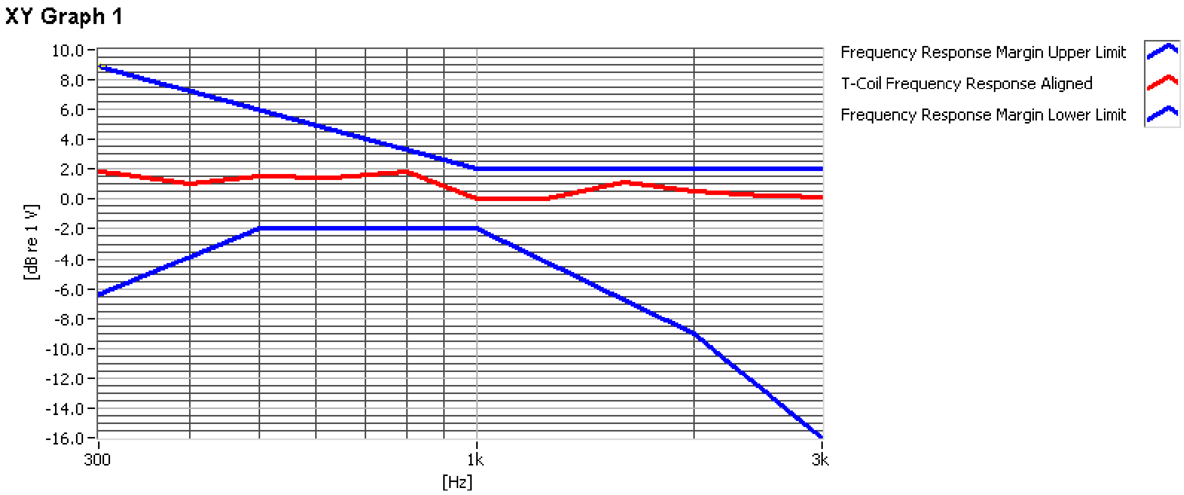
WD Configuration :
1. Power configuration : Power Control Bits = “All Up”
2. Phone condition : Mute On, Backlight On, Max Volume, Max Contrast, HAC mode On
3. AMR Configuration : 12.2 Kbps (EVRC)
4. X,Y Coordinate of T-coil measurement

	Axial	Radial Transverse	Radial Longitudinal
[X,Y] from Bottom left	**2.4, 2.6**	**2.2, 2.4**	**2.4, 3.0**

7.3 Frequency Response Graph



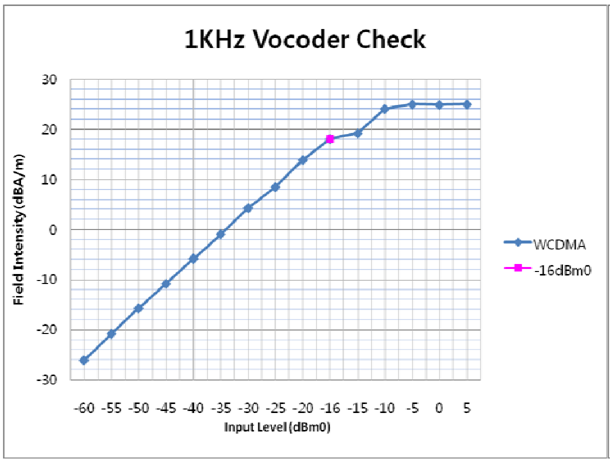
Note : This frequency response represents the worst-case ABM2 test configuration according to Table 7-2 for GSM

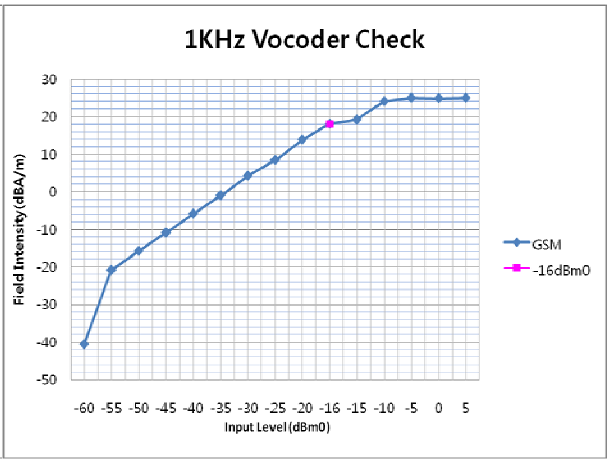


Note : This frequency response represents the worst-case ABM2 test configuration according to Table 7-2 for WCDMA

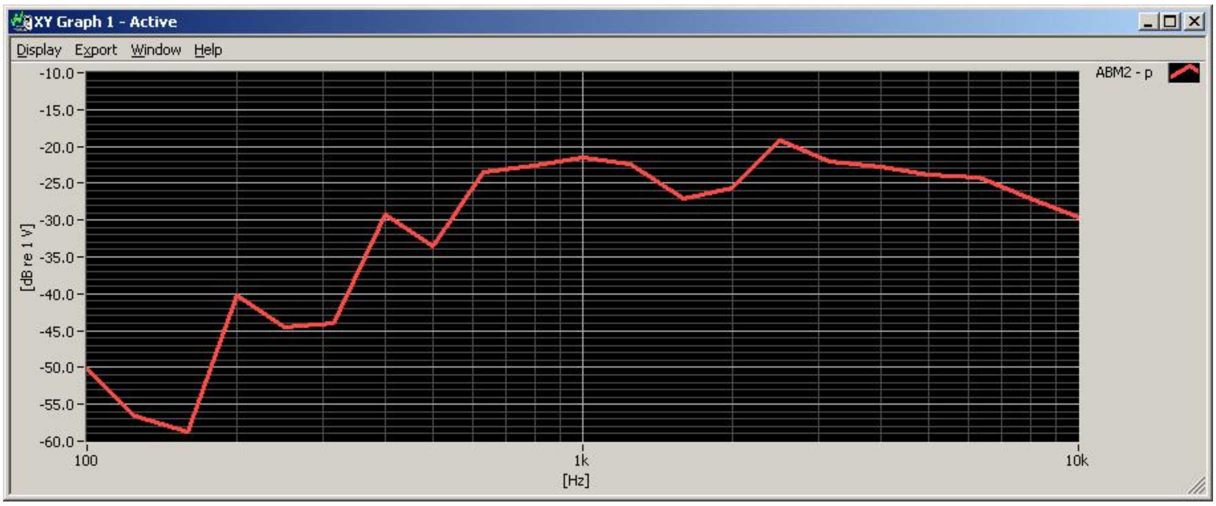
7.4 1KHz Vocoder Application Check

This model was verified to be within the linear region for ABM1 measurements. Two type of modes were tested in the axial configuration above the ABM1 maximum location/configuration derived from Table 7-1 & Table 7-2.





7.5 Undesirable Audio Magnetic Band Plot (ABM2)



Note : This plot represents the data from the location/configuration resulting in the highest ABM2 result regarding Table 7-2 for GSM and WCDMA

7.6 T-coil Validation Test Results

XY Graph 1

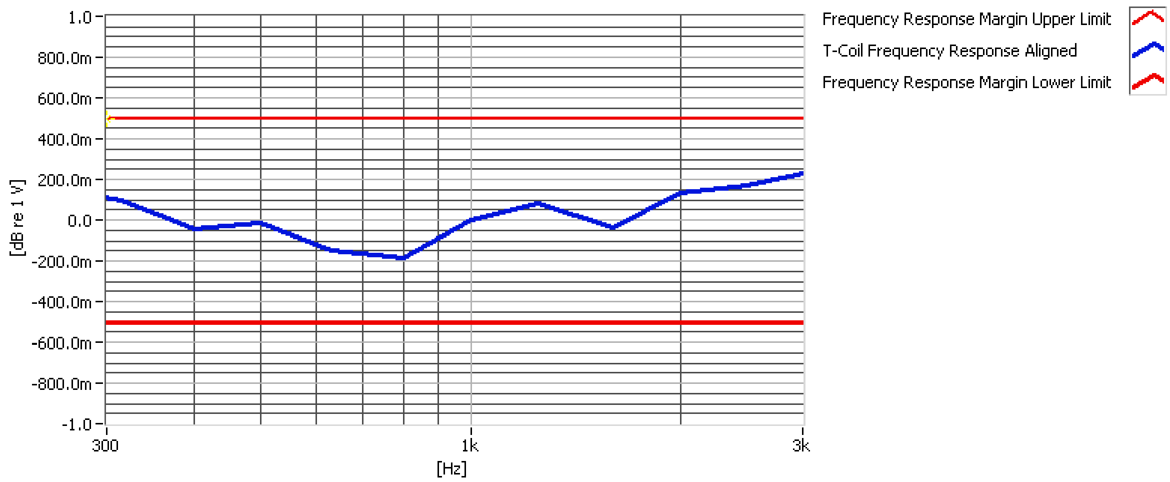


Figure 7-1
Helmholtz coil Validation for Frequency Response

Table 7-3
Table of Results for Helmholtz coil and Noise Validation

Orientation	Item	Target	Measured dB	Verdict
Helmholtz coil validation				
Axial	Frequency Response	0 ±0.5dB	0.23	PASS
	Magnetic Intensity, 0 dBA/m	0 ±0.5dB	0.04	PASS
Radial	Frequency Response	0 ±0.5dB	0.22	PASS
	Magnetic Intensity, 0 dBA/m	0 ±0.5dB	0.01	PASS
Noise Validation				
Axial		< -58dBA/m	-59.74	PASS
Radial Transverse		< -58dBA/m	-59.95	PASS
Radial Longitudinal		< -58dBA/m	-59.34	PASS

8. Conclusion

The measurements indicate that the wireless communications device complies with the HAC limits specified in accordance with the ANSI C63.19 standard and FCC WT Docket No. 01-309 RM-8658. Precise laboratory measures were taken to assure repeatability of the tests. The tested device complies with the requirements in respect to all parameters specific to the test. The test results and statements relate only to the item tested.

The measurement system and techniques presented in this evaluation are proposed in the ANSI standard as a means of best approximating wireless device compatibility with a hearing-aid. The literature is under continual re-construction.

9. Reference

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West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

AXIAL T COIL PROBE

Manufactured by:	**TEM CONSULTING**
Model No:	**AXIAL T COIL PROBE**
Serial No:	**TEM-1115**
Calibration Recall No:	**20385**

Submitted By:

Customer:	**STEVE LIU**
Company:	**PCTEST ENGINEERING LAB**
Address:	**6660-B DOBBIN ROAD**
	COLUMBIA MD 21045

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. **AXIAL T C TEM**

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratorie's calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Approved by:

Calibration Date: **14-Jan-11**

FC

Certificate No: **20385 - 2**

Felix Christopher
Quality Manager

QA Doc. #1051 Rev. 2.0 10/1/01

Certificate Page 1 of 1

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor, NY 14564, U.S.A.

ISO 9001:2008 Registered Company
Calibration Traceable to N.I.S.T.

ISO/IEC 17025
ACCREDITED
Certificate #1533.01/02

Phone: (585) 586-3900 Fax: (585) 586-4327

O.K to use
2011.6.16

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor NY 14564

ACCREDITATION ISO/IEC 17025
ACCREDITED
1533.01

REPORT OF CALIBRATION

for

TEM Consulting LP Axial T Coil Probe	**Model No.: Axial T Coil Probe**	**Serial No.: TEM-1115**
Company : PC Test Inc.		**I. D. No: XXXX**

Calibration results: **Before data:** .... **After data:** ....

Probe Sensitivity measured with Helmholtz Coil

Before & after data same: ...**X**......

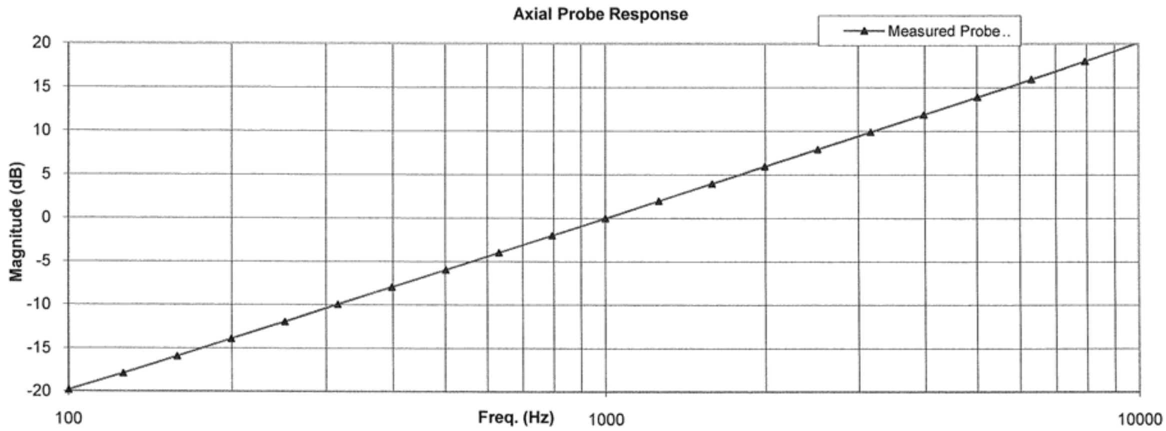
Helmholtz Coil;					
the number of turns on each coil;	**10**	**No.**			
the radius of each coil, in meters;	**0.204**	**m**	Laboratory Environment:		
the current in the coils, in amperes.;	**0.08**	**A**	Ambient Temperature:	**24.4**	**°C**
Helmholtz Coil Constant;	**6.98**	**A/m/V**	Ambient Humidity:	**27.6**	**% RH**
Helmholtz Coil magnetic field;	**5.93**	**A/m**	Ambient Pressure:	**100.3**	**kPa**
			Calibration Date:	**14-Jan-11**	**3:26 PM**
Probe Sensitivity at	**1000**	**Hz.**	Re-calibration Due:	**14-Jan-12**	
was	**-60.20**	**dBV/A/m**	Report Number:	**20385**	**-2**
	0.978	**mV/A/m**	Control Number:	**20385**	
Probe resistance	**888**	**Ohms**			

The above listed instrument meets or exceeds the tested manufacturer's specifications.

This Calibration is traceable through NIST test numbers: ,205342

The expanded uncertainty of calibration: 0.30dB at 95% confidence level with a coverage factor of k=2.

Graph represents Probes Frequency Response.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : **Rev. 5.0 Sept. 10, 2010 Doc. # 1038 HCATEMC**

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Cal. Date: 14-Jan-2011 3:26 PM Measurements performed by: ....

Calibrated on WCCL system type 9700 **Felix Christopher**

 Rev. 5.0 Sept. 10, 2010 Doc. # 1038 HCATEMC

HCATEMC_TEM-1115_Jan-14-2011

West Caldwell Calibration Laboratories Inc.

1575 State Route 96, Victor NY 14564
Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

for

TEM Consulting LP Axial T Coil Probe — Model No.: Axial T Coil Probe — Serial No.: TEM-1115

Company : PC Test Inc.

Test	Function		Tolerance		Measured values		
					Before	Out	Remarks
1.0	Probe Sensitivity at	1000 Hz.		dBV/A/m	-60.20		
				dB			
2.0	Probe Level Linearity			6	6.02		
			Ref. (0 dB)	0	0.00		
				-6	-6.02		
				-12	-12.03		
				Hz			
3.0	Probe Frequency Response			100	-19.8		
				126	-17.9		
				158	-15.9		
				200	-13.9		
				251	-11.9		
				316	-9.9		
				398	-8.0		
				501	-6.0		
				631	-4.0		
				794	-2.0		
			Ref. (0 dB)	1000	0.0		
				1259	2.0		
				1585	4.0		
				1995	6.0		
				2512	7.9		
				3162	9.9		
				3981	11.9		
				5012	13.9		
				6310	15.9		
				7943	18.0		
				10000	20.1		

Instruments used for calibration:			Date of Cal.	Traceablity No.	Due Date
HP	34401A	S/N US360641	8-Nov-2010	,205342	8-Nov-2011
HP	34401A	S/N US361024	8-Nov-2010	,205342	8-Nov-2011
HP	33120A	S/N S3604371	8-Nov-2010	,205342	8-Nov-2011
B&K	2133	S/N 1492410	1-Oct-2010	822/278767-10	1-Oct-2011

Cal. Date: 14-Jan-2011 3:26 PM — Tested by: Felix Christopher

Calibrated on WCCL system type 9700

Rev. 5.0 Sept. 10, 2010 Doc. # 1038 HCATEMC

West Caldwell Calibration Laboratories Inc.

Certificate of Calibration

for

RADIAL T COIL PROBE

Manufactured by:	TEM CONSULTING
Model No:	RADIAL T COIL PROBE
Serial No:	TEM-1119
Calibration Recall No:	20385

Submitted By:

Customer:	STEVE LIU
Company:	PCTEST ENGINEERING LAB
Address:	6660-B DOBBIN ROAD
	COLUMBIA MD 21045

The subject instrument was calibrated to the indicated specification using standards traceable to the National Institute of Standards and Technology or to accepted values of natural physical constants. This document certifies that the instrument met the following specification upon its return to the submitter.

West Caldwell Calibration Laboratories Procedure No. RADIAL T TEM

Upon receipt for Calibration, the instrument was found to be:

Within (X) see attached Report of Calibration.

the tolerance of the indicated specification.

West Caldwell Calibration Laboratorie's calibration control system meets the following requirements, ISO 10012-1 MIL STD 45662A, ANSI/NCSL Z540-1, IEC Guide 25, ISO 9001:2008 and ISO 17025

Note: With this Certificate, Report of Calibration is included.

Approved by:

Calibration Date: 14-Jan-11

Fc

Certificate No: 20385 - 1

Felix Christopher
Quality Manager

QA Doc. #1051 Rev. 2.0 10/1/01

Certificate Page 1 of 1

West Caldwell Calibration Laboratories, Inc.
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1575 State Route 96, Victor, NY 14564, U.S.A.

ISO 9001:2008 Registered Company
Calibration Traceable to N.I.S.T.
ISO/IEC 17025 ACCREDITED Certificate #1533.01/02

Phone: (585) 586-3900 Fax: (585) 586-4327

O.k to use
2011. 6.16

West Caldwell Calibration Laboratories, Inc.
uncompromised calibration
1575 State Route 96, Victor NY 14564

ACCREDITATION ISO/IEC 17025
ACCREDITED
1533.01

REPORT OF CALIBRATION

for

TEM Consulting LP Radial T Coil Probe **Model No.: Radial T Coil Probe** **Serial No.: TEM-1119**

Company : PC Test Inc. **I. D. No: XXXX**

Calibration results: **Before data:** .... **After data:** ....

Probe Sensitivity measured with Helmholtz Coil

Before & after data same: ...**X**......

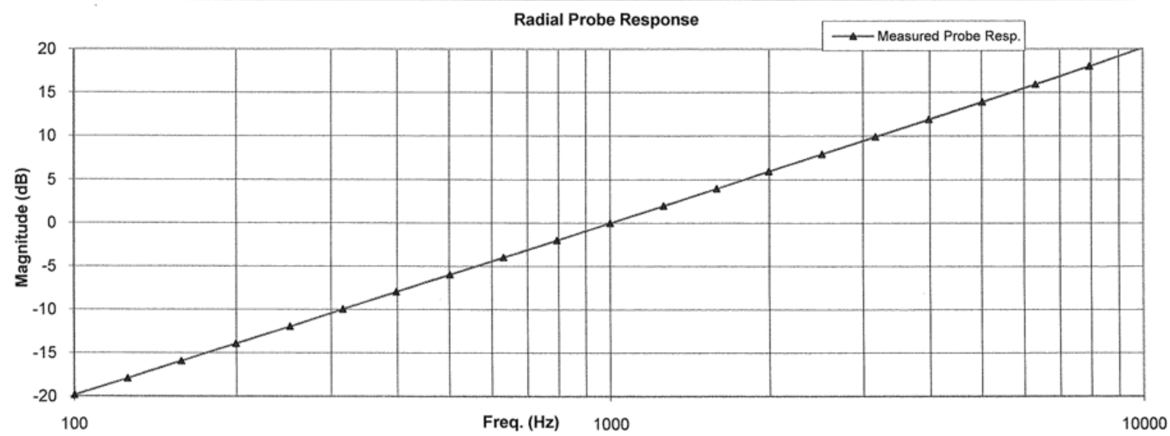
Helmholtz Coil;					
the number of turns on each coil;	10	No.			
the radius of each coil, in meters;	0.204	m	Laboratory Environment:		
the current in the coils, in amperes.;	0.08	A	Ambient Temperature:	24.4	°C
Helmholtz Coil Constant;	6.99	A/m/V	Ambient Humidity:	27.6	% RH
Helmholtz Coil magnetic field;	5.92	A/m	Ambient Pressure:	100.3	kPa
			Calibration Date:	14-Jan-11	5:27 PM
Probe Sensitivity at	1000	Hz.	Re-calibration Due:	14-Jan-12	
was	-60.18	dBV/A/m	Report Number:	20385	-1
	0.979	mV/A/m	Control Number:	20385	
Probe resistance	890	Ohms			

The above listed instrument meets or exceeds the tested manufacturer's specifications.

This Calibration is traceable through NIST test numbers: ,205342

The expanded uncertainty of calibration: 0.28dB at 95% confidence level with a coverage factor of k=2.

Graph represents Probes Frequency Response.



The above listed instrument was checked using calibration procedure documented in West Caldwell Calibration Laboratories Inc. procedure : **Rev. 5.0 Sept. 10, 2010 Doc. # 1038 HCRTEMC**

Calibration was performed by West Caldwell Calibration Laboratories Inc. under Operating Procedures intended to implement the requirements of ISO10012-1, IEC Guide 25, ANSI/NCSL Z540-1, (MIL-STD-45662A) and ISO 9001:2008, ISO 17025

Cal. Date: **14-Jan-2011** **5:27 PM** Measurements performed by: ....

Calibrated on WCCL system type 9700 **Felix Christopher**

 Rev. 5.0 Sept. 10, 2010 Doc. # 1038 HCRTEMC

HCRTEMC_TEM-1119_Jan-14-2011

West Caldwell Calibration Laboratories Inc.

1575 State Route 96, Victor NY 14564
Tel. (585) 586-3900 FAX (585) 586-4327

Calibration Data Record

for

TEM Consulting LP Radial T Coil Probe **Model No.: Radial T Coil Probe** **Serial No.: TEM-1119**

Company : PC Test Inc.

Test	Function		Tolerance		Measured values		
					Before	Out	Remarks
1.0	Probe Sensitivity at	1000 Hz.		dBV/A/m	-60.18		
				dB			
2.0	Probe Level Linearity			6	6.03		
			Ref. (0 dB)	0	0.00		
				-6	-6.02		
				-12	-12.03		
				Hz			
3.0	Probe Frequency Response			100	-19.8		
				126	-17.9		
				158	-15.9		
				200	-13.9		
				251	-11.9		
				316	-9.9		
				398	-8.0		
				501	-6.0		
				631	-4.0		
				794	-2.0		
			Ref. (0 dB)	1000	0.0		
				1259	2.0		
				1585	4.0		
				1995	6.0		
				2512	7.9		
				3162	9.9		
				3981	11.9		
				5012	13.9		
				6310	15.9		
				7943	18.0		
				10000	20.1		

Instruments used for calibration:			Date of Cal.	Traceability No.	Due Date
HP	34401A	S/N US360641	8-Nov-2010	,205342	8-Nov-2011
HP	34401A	S/N US361024	8-Nov-2010	,205342	8-Nov-2011
HP	33120A	S/N S3604371	8-Nov-2010	,205342	8-Nov-2011
B&K	2133	S/N 1492410	1-Oct-2010	822/278767-10	1-Oct-2011

Cal. Date: 14-Jan-2011 **5:27 PM** **Tested by: Felix Christopher**

Calibrated on WCCL system type 9700

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