PCTEST ENGINEERING LABORATORY, INC.
6660-B Dobbin Road, Columbia, MD 21045 USA
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HEARING AID COMPATIBILITY CERTIFICATE

Applicant Name:
UTStarcom, Inc.
33 Wood Avenue South 3rd Floor
Iselin, NJ 08830
USA

Date of Testing:
March 22 -23, 2006
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
HAC.0603140174.O6Y

FCC ID:	**O6Y-CDM7075A**
APPLICANT:	**UTSTARCOM, INC.**

Scope of Test:	Audio Band Magnetic Testing (T-Coil)
Application Type:	Class II Permissive Change
FCC Rule Part(s):	§ 20.19(b), §6.3(v), §7.3(v)
HAC Standard:	ANSI PC63.19-2005 D3.6
FCC Classification:	Licensed Transmitter Held to Ear (PCE)
EUT Type:	Tri-Mode Dual-Band Phone
Model(s):	CDM7075A, CDM220SP
Tx Frequency:	824.04 - 848.97 MHz (AMPS) 824.70 - 848.31 MHz (CDMA) 1851.25 - 1908.75 MHz (PCS)
Test Device Serial No.:	*Pre-Production Sample* [S/N: HAC #1]

PC63.19 HAC Rated Category:	**T4 (T-COIL ONLY)**

This wireless portable device has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std. PC63.19 and had been tested in accordance with the specified measurement procedures. Hearing-Aid Compatibility is based on the assumption that all production units will be designed electrically identical to the device tested in this report.

I attest to the accuracy of data. All measurements reported herein were performed by me or were made under my supervision and are correct to the best of my knowledge and belief. I assume full responsibility for the completeness of these measurements and vouch for the qualifications of all persons taking them.

PCTEST certifies that no party to this application has been denied the FCC benefits pursuant to Section 5301 of the Anti-Drug Abuse Act of 1988, 21 U.S.C. 862.

Randy Ortanez
President

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1. INTRODUCTION

On July 10, 2003, the Federal Communications Commission (FCC) adopted new rules requiring wireless manufacturers and service providers to provide digital wireless phones that are compatible with hearing aids. The FCC has modified the exemption for wireless phones under the Hearing Aid Compatibility Act of 1998 (HAC Act) in WT Docket 01-309 RM-8658[1] to extend the benefits of wireless telecommunications to individuals with hearing disabilities. These benefits encompass business, social and emergency communications, which increase the value of the wireless network for everyone. An estimated more than 10% of the population in the United States show signs of hearing impairment and of that fraction, almost 80% use hearing aids. Approximately 500 million people worldwide suffer from hearing loss.

Compatibility Tests Involved:

The standard calls for wireless communications devices to be measured for:

- RF Electric-field emissions
- RF Magnetic-field emissions
- T-coil mode, magnetic-signal strength in the audio band
- T-coil mode, magnetic-signal frequency response through the audio band
- T-coil mode, magnetic-signal and noise articulation index

The hearing aid must be measured for:

- RF immunity in microphone mode
- RF immunity in T-coil mode

In the following tests and results, this report includes the evaluation for a wireless communications device.

Figure 1-1 Hearing Aid *in-situ*

[1] FCC Rule & Order, WT Docket 01-309 RM-8658

2. TEST SITE LOCATION

2.1 INTRODUCTION

The map at the right shows the location of the PCTEST LABORATORY in Columbia, Maryland. It is in proximity to the FCC Laboratory, the Baltimore-Washington International (BWI) airport, the city of Baltimore and Washington, DC (See Figure 2).

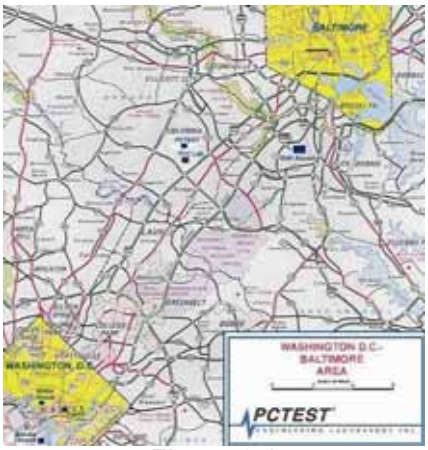
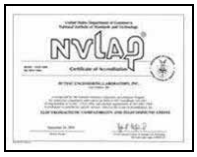


Figure 2-1
Map of the Greater Baltimore and Metropolitan Washington, D.C. area

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49' 38" W longitude. The facility is 1.5 miles north of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4 on October 19, 2002.

2.2 Test Facility / NVLAP Accreditation:

Measurements were performed at an independent accredited PCTEST Engineering Lab located in Columbia, MD 21045, U.S.A.



- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC 2451).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, CTIA Test Plans, and wireless testing for FCC, HAC, CTIA OTA and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules.
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) in AMPS and CDMA mobile phones.

3. EUT DESCRIPTION

FCC ID:	O6Y-CDM7075A
Manufacturer:	UTStarcom, Inc. 33 Wood Avenue South 3rd Floor Iselin, NJ 08830 USA
Trade Name:	UTStarcomm
Model(s):	CDM7075A, CDM220SP
Serial Number:	HAC #1
Tx Frequencies:	824.04 - 848.97 MHz (AMPS) 824.70 - 848.31 MHz (CDMA) 1851.25 - 1908.75 MHz (PCS)
Antenna Configurations:	Extendable Antenna
Maximum Conducted Power (EMC/SAR):	24.5 dBm (Cellular CDMA), 24.5 dBm (PCS CDMA)
Maximum Conducted Power (HAC):	24.5 dBm (Cellular CDMA), 24.5 dBm (PCS CDMA)
HAC Test Configurations:	Cellular CDMA, Channels 1013, 384, 777; Antenna In Cellular CDMA, Channels 1013, 384, 777; Antenna Out PCS CDMA, Channels 25, 600, 1175; Antenna In PCS CDMA, Channels 25, 600, 1175; Antenna Out
FCC Classification:	Licensed Transmitter Held to Ear (PCE)
EUT Type:	Tri-Mode Dual-Band Phone

Figure 3-1
Device Under Test

4. ANSI/IEEE PC63.19 PERFORMANCE CATEGORIES

I. 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	Hearing aid RF Parameters		Telephone RF Parameters	
Near field Category	E-field immunity CW dB(V/m)	H-field immunity CW dB(A/m)	E-field emissions CW dB(V/m)	H-field emissions CW dB(A/m)
M1	30.0 to 35.0	–23.0 to –18.0	46 to 51 + 0.5 x AWF	–4.4 to 0.6 +0.5 x AWF
M2	35.0 to 40.0	–18.0 to –13.0	41 to 46 + 0.5 x AWF	–9.4 to –4.4 +0.5 x AWF
M3	40.0 to 45.0	–13.0 to –8.0	36 to 41 + 0.5 x AWF	–14.4 to –9.4 +0.5 x AWF
M4	> 45.0	> –8.0	< 36 + 0.5 x AWF	< –14.4 + 0.5 x AWF

Table 6.1
Hearing aid and WD near-field categories as defined in draft ANSI PC63.19. During testing, the hearing aid must maintain an input-referenced interference level of less than 55 dB and a gain compression of less than 6 dB.

II. ARTICULATION WEIGHTING FACTOR (AWF)

Standard	Technology	Articulation Weighing Factor (AWF)
T1/T1P1/3GPP	UMTS (WCDMA)	0
IS-95	CDMA	0
iDEN™	TDMA (22 and 11 Hz)	0
J-STD-007	GSM (217 Hz)	-5

Table 6.2
AWF has been developed from information presented to the committee regarding the interference potential of the various modulation types according to ANSI PC63.19

III. MAGNETIC COUPLING

Axial Field Intensity

The axial component of the magnetic field, directed along the measurement axis an located at the measurement plane, shall be ≥ - 13dB(A/m) at 1 kHz.

Radial Field Intensity

The radial components of the magnetic field, in the horizontal and vertical position along the measurement plant shall be both ≥ -18 dB(A/m) at 1 kHz.

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 – 3300 Hz

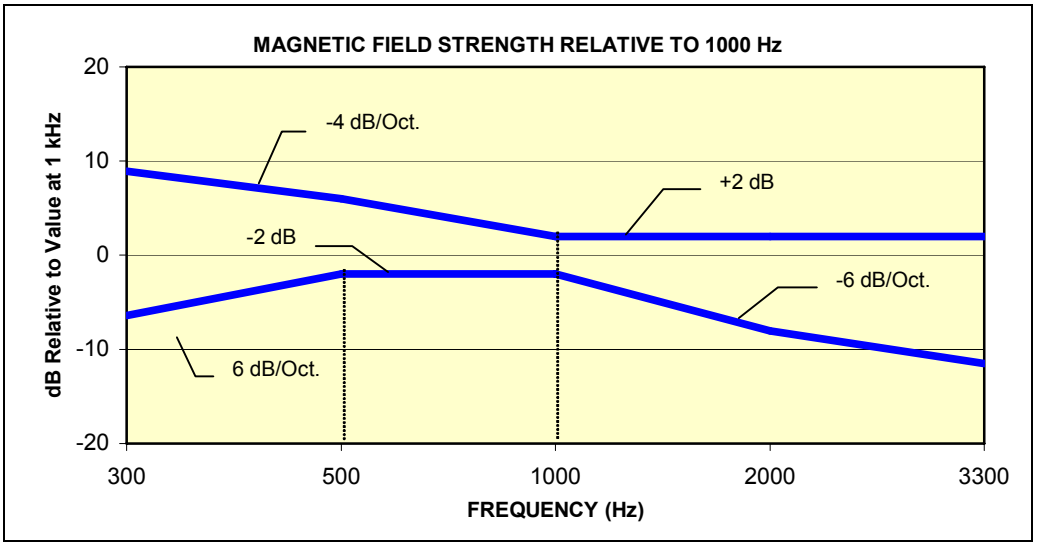


Figure 4-1 Magnetic field frequency response for Wireless Devices with an axial field between –10 dB to –13 dB (A/m) at 1 kHz

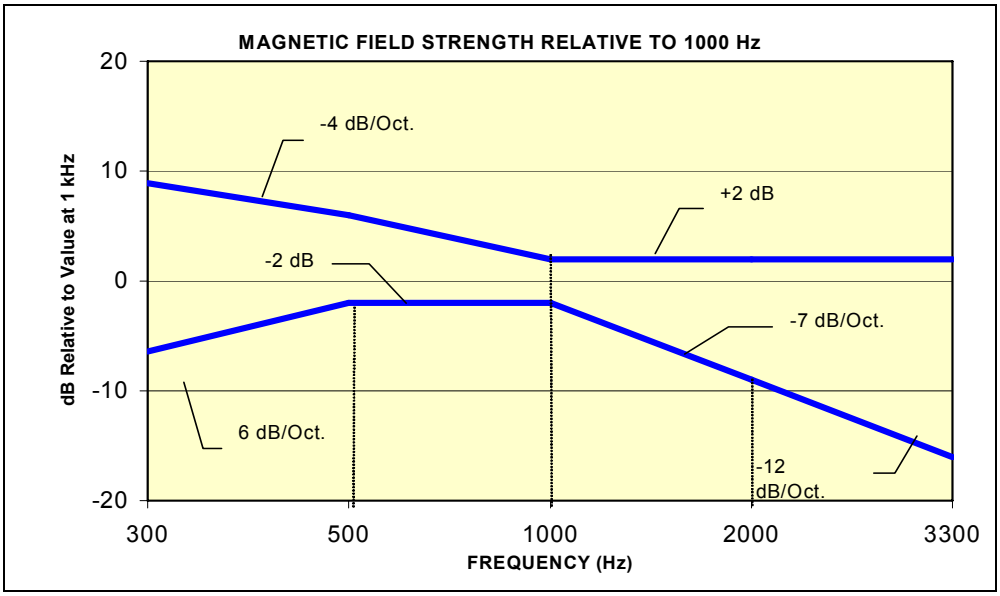


Figure 4-2 Magnetic Field frequency response for wireless devices with an axial field that exceeds –10 dB(A/m) at 1 kHz

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.

A device is classified beginning with its RF emissions category (i.e. M1 through M4). If the device meets the additional requirements here, it qualifies for the T-designation (T1, etc.)

Category	Hearing aid RF Parameters	Telephone RF Parameters
	Near field immunity (w/ 0.6W CW into dipole)	**Wireless Device Signal Quality (Signal + Noise-to-noise ratio in dB)**
T1	75 to 85 dB (IRIL)	-10 to -20 dB + AWF
T2	65 to 75 dB (IRIL)	0 to -10 dB + AWF
T3	55 to 65 dB (IRIL)	10 to 0 dB + AWF
T4	< 55 dB (IRIL)	> 10 dB + AWF

Table 4-1 Magnetic Coupling Parameters

IV. 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 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.

Test frequencies & associated channels	
Channel	**Frequency (MHz)**
Cellular 850	
384 (CDMA)	**836.52**
UARFCN 4175 (UMTS)	**835.00**
190 (GSM)	**836.60**
PCS 1900	
661 (GSM)	**1880**
600 (CDMA)	**1880**
UARFCN 9400 (UMTS)	**1880**
SMR 800	
370 (*i*DEN)	**813.5**
SMR 900	
281 (*i*DEN)	**898.5**

Table 4-2 Test channels and frequencies

5. METHOD OF MEASUREMENT

I. Test Setup

Connect the equipment as shown:

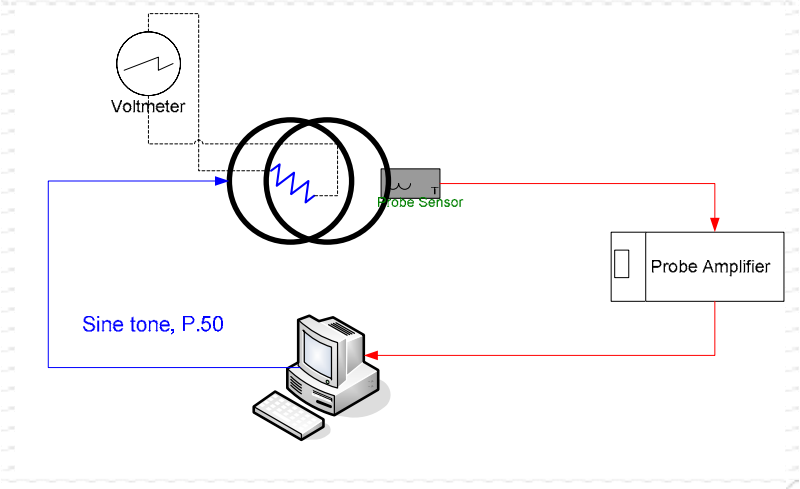


Figure 5-1 Validation Setup with Helmholtz Coil

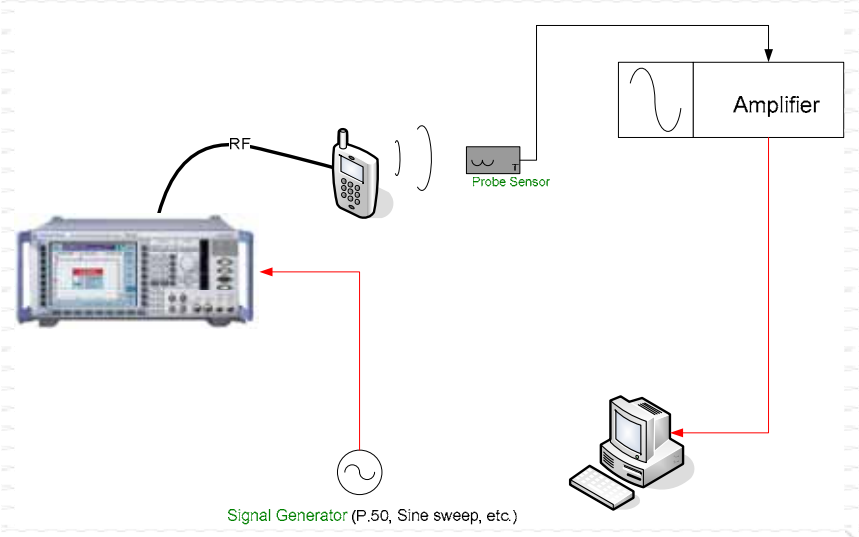


Figure 5-2 T-Coil Test Setup

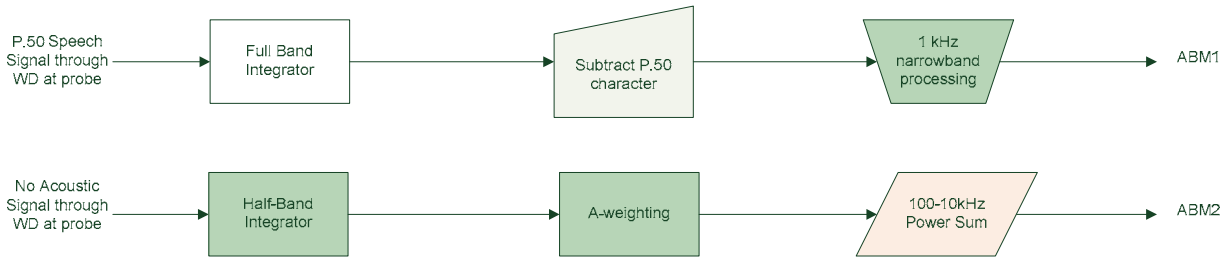


Figure 5-3 Magnetic Measurement Processing Steps

II. Test Procedure

1. System Check
   a. Ambient Noise Check
      i. The filtering was set to "A-weighting" and Half-Band Integrating
      ii. Undesired ambient interference was monitored using a Real-Time Analyzer at 300-3300 Hz with 1/3 octave filtering in the chamber.
   b. System Validation – Helmholtz Coil (See Figure 5-1)
      i. A Helmholtz Coil was driven with a 1 kHz tone at a sufficient voltage to generate 1 A/m at the center of the Helmholtz Coil (See Helmholtz Coil sensitivity). This value was measured and was verified to be within ± 0.5 dB.
      ii. A noise measurement was taken in the same setup and was verified to be greater than 10 dB below the lowest measurement signal. For the maximum noise level for a T4 WD at -18 dBA/m: -18 - 10 - 10 - AWF= -43 dBA/m.
      iii. The frequency response through the Helmholtz Coil was verified to be within 0.5 dB relative to 1 kHz, between 300 – 3300 Hz using the ITU-P.50 artificial speech signal.
2. The Wireless Device was setup and connected to the base station simulator as shown in Figure 5-2. The tests were performed in a hemi-anechoic acoustic/RF chamber.
3. Test Setup
   a. Coarse Scan
      i. A multitone signal was applied to the handset such that the phone acoustic output was stable within 1dB and with the acoustic output level at the C63.19 specified levels (below). This allowed for a course scan to be measured above the phone to find the "hot spot". After determining the "hot spot", the following measurements were made while the probe was held stationary with the positioner.
      ii. The steps were repeated for the different T-coil configurations per Figure 5-5.
   b. Speech Signal to CMU200
      i. A 0.5Vrms CMU audio level input represents 0 dBm0 in the CMU200 under the Handset bit-stream setting ("Speechcod/Handset" for GSM/WCDMA, "8k Enhanced" for CDMA). Care was taken to ensure proper conversion between dBV and dBm0. C63.19 Table 6-1 states for various technologies:

Standard	Technology	Input Level (dBm0)
TIA/EIA/IS 2000	CDMA	-18
J-STD-007	GSM (217)	-16
T1/T1P1/3GPP [2]	UMTS (WCDMA)	-16
iDEN™	TDMA (22 and 11 Hz)	-18

[2] For UMTS refer to 3GPP TS26.131 and TS26.132 (http://www.3gpp.org).

c. Real-Time Analyzer (RTA)
    i. The Real-Time Analyzer was configured to measure signals using 1/3 Octave band weighted filtering.
    ii. The measurement was averaged over 3x the length of the artificial voice signal (3x sampling). A 10 second delay was configured in the measurement process of the stimulus to ensure processor latency effects and echo cancellation devices (if any) were appropriately stabilized during measurements.

4. Data Analysis
    a. Narrow-band Magnetic Intensity
        i. The standard specifies a 1 kHz 1/3 octave band minimum field intensity. The measurements were compared to this limit.
    b. Frequency Response
        i. The appropriate frequency response curve was measured to curves in Figure 4-1 or Figure 4-2 between 300 – 3300 Hz (limit lines chosen according to measurement found in step 4a.) The appropriate post-processing was applied according to processing chain illustrated in Figure 5-3. All R10 frequencies were plotted with respect to 0dB at 1 kHz value and plotted between the EIA-504 curves.
        ii. The margin is represented by the closest measured data point on the curve to the limit lines, in dB.
    c. Signal Quality
        i. Ensuring the WD was at maximum power, backlight on, maximum contrast setting, with no audio signal through the vocoder, the WD was measured over 100 Hz – 10,000 Hz, averaged over 5 seconds
        ii. After applying half-band integration and A-weighting to the measurement, a power sum was applied to 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.

III. Test Setup

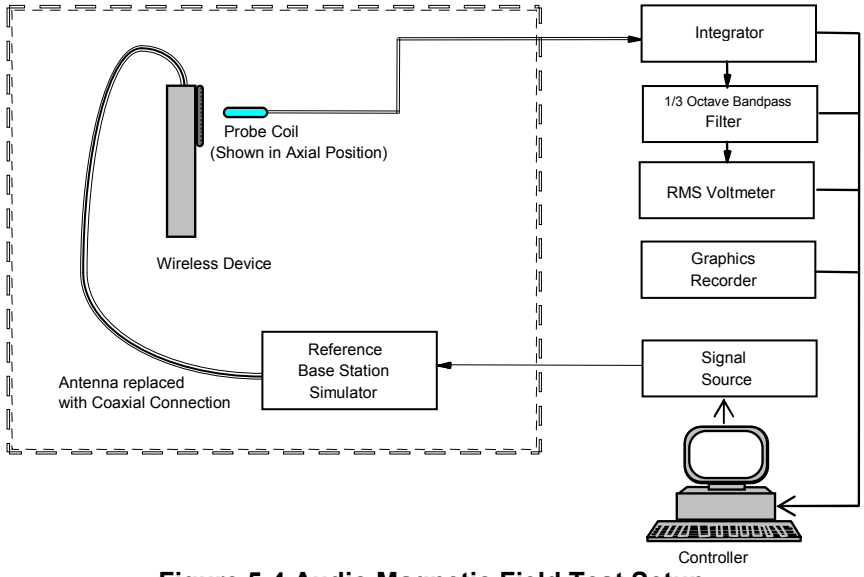


Figure 5-4 Audio Magnetic Field Test Setup

IV. Test Flow

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

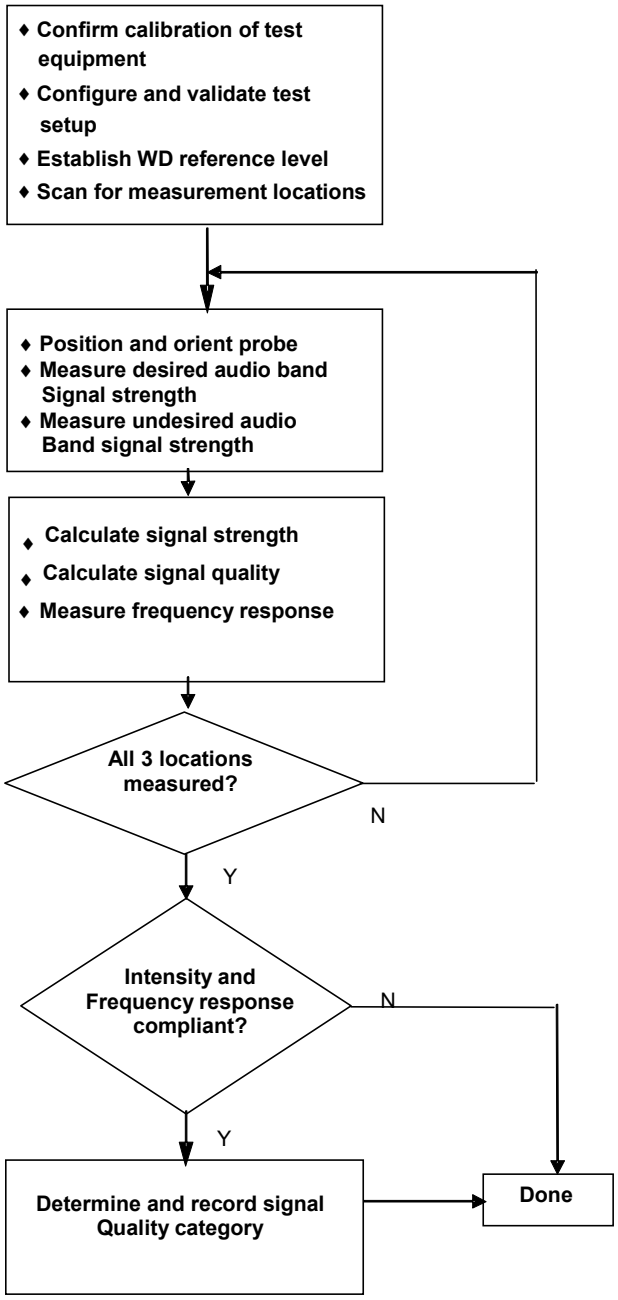


Figure 5-5 C63.19 T-Coil Signal Test Process

6. SYSTEM SPECIFICATIONS

I. Precision Probe Position System

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)

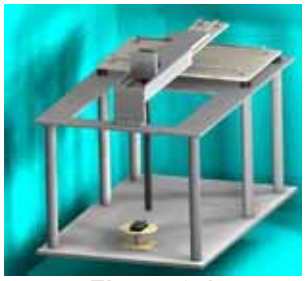


Figure 6-1
RF Near-Field Scanner

II. Measurement Software

Manufacturer:	TEM
Model:	EM Scan
Weighting Filters:	A, B, C Message Weighting
Integrators:	Half Band, Full Band
Octave Band Filters:	Full Band and Fractional

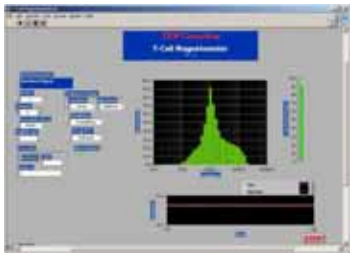


Figure 6-2 Measurement Software

III. T-Coil Probes

Manufacturer:	TEM
T-coil orientations:	Axial, Radial
Model:	MN3001
Sensitivity at 1 kHz:	-60.5 dB (V/A/m)
Coil Max. Dimensions (L x OD):	6.55 mm X 2.29 mm
Wire Size:	51 AWG
DC Resistance:	900 Ω
Sensitivity Tolerance:	±0.5 dB
Standards:	FCC Part 68, IEEE 1027-1996

Figure 6-3 T-Coil Probes

IV. Amplifier

Manufacturer:	Listen, Inc.
Frequency Range:	20 Hz to 100 kHz (± 0.1 dB)
Gain:	-20 to 60 ± 0.2 dB in steps of 20 ± 0.1 dB
Input Noise:	<1.8μV_{rms} (A-weighted), <3.0μV_{rms} (20 kHz), @ 20 - 60 dB
Total Harmonic Distortion:	<0.005%
Input/Output Impedance:	1 MΩ / 600 Ω
Dimensions:	5.5" H (139.7 mm), 2.5" W (63.5 mm), 7.5" D (190.5 mm)

Figure 6-4 Amplifier

V. Helmholtz Coil

See IEEE PC63.19, Annex D9 for Helmholtz Coil specifications

Manufacturer:	TEM
Radius:	80 mm
Windings:	20 turns of no. 24 AWG enameled magnet wire
Sensitivity at Calibration Center:	17.549 A/m/V
Standard(s) calibrated:	IEEE 1027

Figure 6-5 Helmholtz Coil

VI. Data Acquisition Card

Manufacturer:	National Instruments
Model:	PCI-4474
Max. Sampling Rate:	102.4 kS/s
Flatness (re to 1 kHz):	±0.1 dB, DC to 0.4535 fs, max, DC-coupled
Anti-aliasing:	45 kHz alias-free bandwidth
Analog I/O Connectors:	SMB Male
Resolution:	24 bit
Dynamic Range:	110 dB

Figure 6-6 Data Acquisition Card

VII. Real-Time Analyzer

Manufacturer:	Listen, Inc.
Filters:	1/1, 1/3, 1/6, 1/12, 1/24 octave
Filter Type:	True Digital Recursive
Weightings:	A, B, or C weighting filters
Compliant to Standards:	ANSI S1.11 and IEC 1260

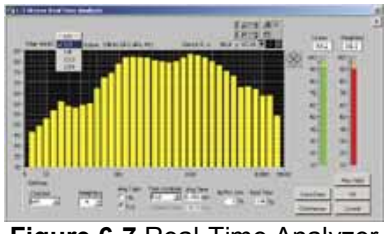


Figure 6-7 Real-Time Analyzer

VIII. Acoustic Test Frequencies

The test frequencies and 1/3 octave test bandwidths to be used for the test are from ISO 3-1973 and ISO 266-1975.

1/3 - Octave band (Hz)	Included frequencies (Hz)
100	89.1 - 112.0
125	112 - 141
160	141 - 178
200	179 - 224
250	224 - 282
315	282 - 355
400	355 - 447
500	447 - 562
630	562 - 708
800	708 - 891
1000	891 - 1120
1250	1120 - 1410
1600	1410 - 1780
2000	1780 - 2240
2500	2240 - 2820
3150	2820 - 3550
4000	3550 - 4470
5000	4470 - 5620

Table 6-1 Acoustic test frequencies

NOTE: The required measurement points for WD testing use frequencies from 300 to 3150 Hz. See PC63.19 Section 7.3.

IX. 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

Figure 6-8 P.50 Artificial Voice Signal

7. TEST SUMMARY

I. T-Coil Test Summary

CDMA Mode

Table 7-1 Table of Results

C63.19 Sec.	Band	Test Description	Minimum Limit*	Measured	Verdict
			dBA/m	*dBA/m*	*PASS/FAIL*
7.3.1.1	Cellular	Intensity, Axial	-13	7.0	PASS
7.3.1.2		Intensity, RadialH	-18	-0.5	PASS
7.3.1.2		Intensity, RadialV	-18	-2.8	PASS
7.3.3		Signal-to-Noise/Noise, Axial	0	56.9	PASS
7.3.3		Signal-to-Noise/Noise, RadialH	0	53.5	PASS
7.3.3		Signal-to-Noise/Noise, RadialV	0	54.2	PASS
7.3.2		Frequency Response, Axial	0	1.8	PASS
7.3.1.1	PCS	Intensity, Axial	-13	7.1	PASS
7.3.1.2		Intensity, RadialH	-18	-0.7	PASS
7.3.1.2		Intensity, RadialV	-18	-0.3	PASS
7.3.3		Signal-to-Noise/Noise, Axial	0	56.9	PASS
7.3.3		Signal-to-Noise/Noise, RadialH	0	54.5	PASS
7.3.3		Signal-to-Noise/Noise, RadialV	0	55.3	PASS
7.3.2		Frequency Response, Axial	0	2.0	PASS

Table 7-2 Consolidated Tabled Results with Rating

	Volume Setting	Cellular			PCS			C63.19 RATING
		Axial	RadialH	RadialV	Axial	RadialH	RadialV	
Freq. Response Margin	Maximum	PASS	PASS	PASS	PASS	PASS	PASS	T4
Magnetic Intensity Verdict		PASS	PASS	PASS	PASS	PASS	PASS	
FCC SNR Verdict		PASS	PASS	PASS	PASS	PASS	PASS	

Note: Radial Frequency Response not required for rating category determination

II. T-Coil Validation Test Results

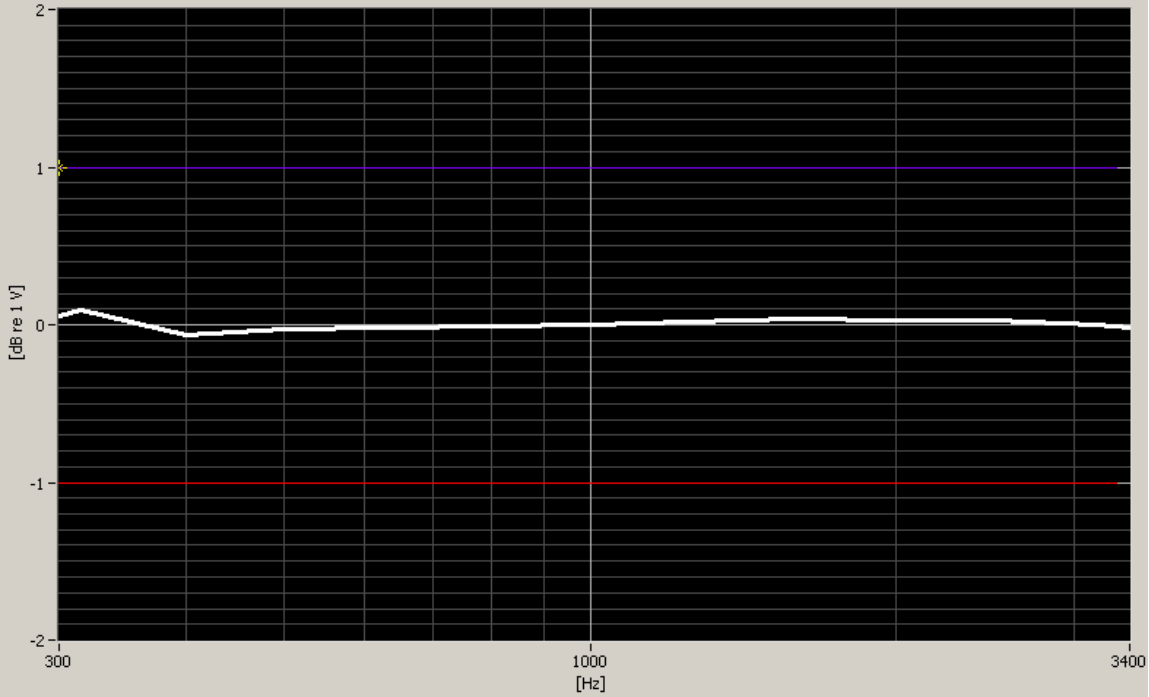


Figure 7-1 Helmholtz Coil Validation for Frequency Response

Table 7-3 Helmholtz Coil Validation Table of Results

Item	Target	Measured	Verdict
Magnetic Intensity, dBA/m	*0 dBA/m*	-0.1 dBA/m	**PASS**
Frequency Response, from limits	*± 1 dB*	± 0.2 dB	**PASS**
1kHz 0 dBA/m Signal / Noise		58.8 dB	**PASS**

III. Raw Handset Data

Table 7-4 Raw Data Results

	Volume	Cellular Band								
		Axial			RadialH			RadialV		
		1013	384	777	1013	384	777	1013	384	777
Freq. Response Margin	Maximum	2.0	1.8	2.0	2.0	1.9	2.0	2.0	2.0	2.0
ABM1, dBA/m		7.1	7.1	7	-0.2	-0.2	-0.5	-2.8	-2.4	-2.3
S+N/N		57	57	56.9	53.5	55	54.6	54.2	54.4	54.7
S+N/N per orientation		56.9			53.5			54.2		
	Volume	PCS Band								
		Axial			RadialH			RadialV		
		25	600	1175	25	600	1175	25	600	1175
Freq. Response Margin	Maximum	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
ABM1, dBA/m		7.2	7.1	7.3	-0.6	-0.4	-0.7	-0.2	-0.3	-0.3
S+N/N		56.9	56.9	56.9	54.6	54.7	54.5	55.3	55.3	56
S+N/N per orientation		56.9			54.5			55.3		

WD Configuration

Test Dates: March 22 -23, 2006
Facility: PCTEST Engineering Laboratory, Inc.
Radio Configuration: RC1/SO3
Power Configuration: All up power bits (Max Power)
Phone Condition: Mute on; Backlight on; Max Volume

IV. Frequency Response Graphs

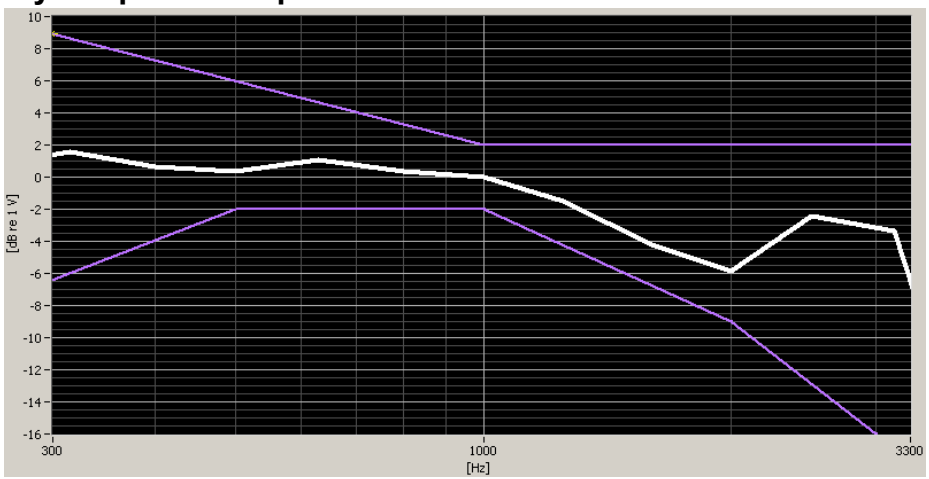


Figure 7-2 Axial Frequency Response

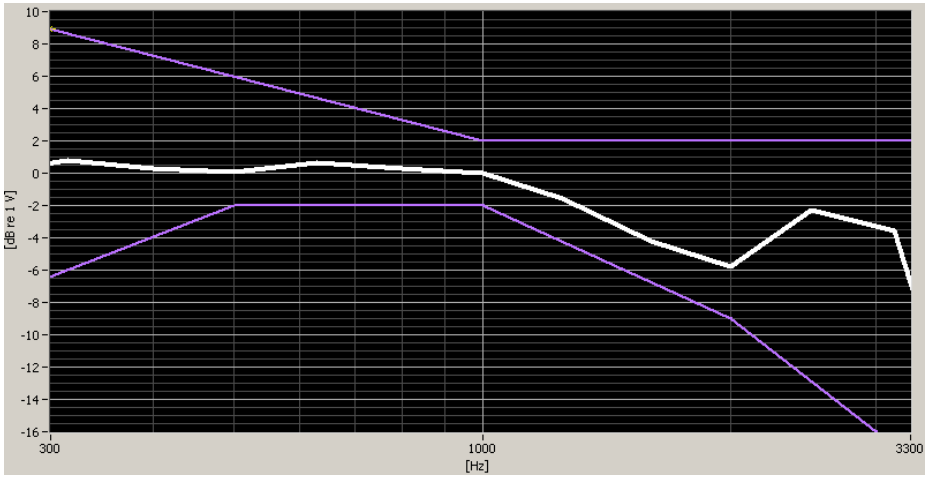


Figure 7-3 Radial (Transverse) Frequency Response

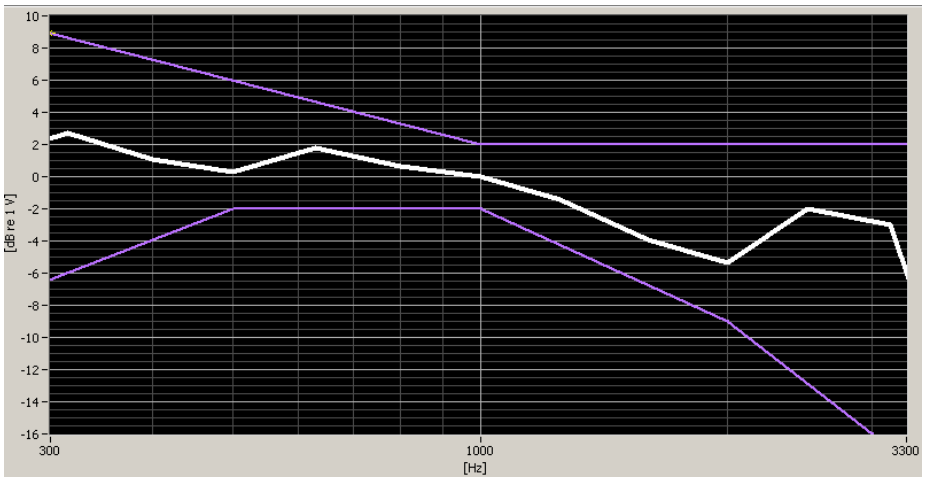


Figure 7-4 Radial (Longitudinal) Frequency Response

8. MEASUREMENT UNCERTAINTY

Table 8-1 Uncertainty Estimation Table

Contribution	Data +/- %	Data +/- dB	Data Type	Probability distribution	Divisor	Standard uncertainty	Standard Uncertainty (dB)
RF Reflections	12.2%	0.50	Specification	Rectangular	1.73	7.0%	
ABM Noise	12.2%	0.50	Specification	Rectangular	1.73	7.0%	
Reference Signal Level	12.2%	0.50	Specification	Rectangular	1.73	7.0%	
Positioning Accuracy	10.0%	0.41	Uncertainty	Rectangular	1.73	5.8%	
Probe Coil Sensitivity	12.2%	0.50	Specification	Rectangular	1.73	7.0%	
Cable Loss	2.4%	0.10	Specification	Normal k=2	2.00	1.2%	
Frequency Analyzer	5.0%	0.21	Specification	Rectangular	1.73	2.9%	
System Repeatability	5.0%	0.21	Std. Dev.	Normal k=1	1.00	5.0%	
WD Repeatability	12.2%	0.50	Std. Dev.	Normal k=1	1.00	12.2%	
Positioner Accuracy	1.0%	0.04	Specification	Rectangular	1.73	0.6%	
Combined standard uncertainty, uc						20.4%	0.81
Expanded uncertainty (k=2), 95% confidence level						40.8%	1.49

Notes:
1. Test equipments are calibrated according to techniques outlined in NIS81, NIS3003 and NIST Tech Note 1297. 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 immunity 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.

9. EQUIPMENT LIST

Manufacturer	Make / Equipment	Calibration Due	Asset No.
MicroCoax	(1.0-26.5GHz) Microwave Cables	N/A	N/A
HP	8648D (9kHz-4GHz) Signal Generator	-	3613A00315
Rohde & Schwarz	(0.1-1000MHz) Signal Generator	September 2006	894215/012
Narda	3020A (50-1000MHz) Bi-Directional Coax Coupler	-	
HP	34401A Multimeter	August 2006	
NI	4474 Data Acquisition Card	N/A	
HP	437B Power Meter	May 2006	3125U24437
Amplifier Research	5S1G4 (5W, 800MHz-4.2GHz)	-	22322
Gigatronics	80701A (0.05-18GHz) Power Sensor	April 2006	1833460
HP	8482H (30mW-3W) Power Sensor	-	2237A02084
TEM	T-coil Mangetometer	January 2007	PCT920
HP	8594A Spectrum Analyzer	-	3051A00187
Gigatronics	8657A Universal Power Meter	April 2006	1835256
HP	8753E (30kHz-6GHz) Network Analyzer	February 2007	JP38020182
Agilent	8960 Base Station Simulator	January 2007	
PCTEST	9-pin Audio Cable	N/A	N/A
TEM	Axial Telecoil Probe	March 2007	TEM-1109
TEM	Radial Telecoil Probe	March 2007	TEM-1108
Agilent	Base Station Simulator	May 2006	661
TEM	C63.19 Helmholtz Coil	March 2007	PCT925
Rohde & Schwarz	CMD80 Base Station Simulator	May 2006	830805/005
Rohde & Schwarz	CMU200 Base Station Simulator	September 2006	650378
SPEAG	DAE4	October 2006	637
Agilent	ESG-D Signal Generator	October 2006	
Optix	Fiber-Optic Line	N/A	
SPEAG	Freespace 1880 MHz Dipole	February 2007	1002
TDK	Freespace 1900 MHz Dipole	October 2007	130116
SPEAG	Freespace 2450 MHz Dipole	February 2007	1004
ETS	Freespace 835 MHz Dipole	February 2007	A005
SPEAG	Freespace 835 MHz Dipole	February 2007	1003
EMCO	Freespace E-field Probe	January 2007	9704-1441
SPEAG	Freespace E-field Probe	January 2007	2332
SPEAG	Freespace H-field Probe	October 2006	6180
TEM	HAC Positioner	N/A	PCT918
Bruel & Kjaer	HATS System	January 2007	687
Hosa	High Precision TRS Cable	N/A	
EMCO	Model 3115 (1-18GHz) Horn Antenna	October 2006	9203-2178
TEM	HAC System Controller with Software	October 2006	9704-5182
Rohde & Schwarz	NRVS Power Meter	April 2006	
RF Lindgren Model 26-2/2-0	Shielded Screen Room	N/A	6710 (PCT270)
Ray Proof Model S81	Shielded Semi-Anechoic Chamber	-	R2437 (PCT278)
AudioScan	Telecoil Magnetic Field Simulator	February 2007	22005

* Traceable to NIST

10. CALIBRATION CERTIFICATES

TEM Consulting, LP

140 River Rd.
Georgetown, Texas 78628

Certificate of Calibration

Date: October 12, 2005
Cert I.D.: 1017-051012

Calibration Standard(s)

The instrument identified below has been individually calibrated to the following standards:

IEEE Standard 1027

Instrument Identification

Manufacturer: TEM Consulting, LP
Unit Description: Helmholtz Coil

Calibration Instrumentation

Equipment Used	Make/Model - S/N	Calibration Date
Digital Multi-Meter	Fluke 8860A - SN 3085046	1/26/04
Ruler		

TEM Consulting, LP

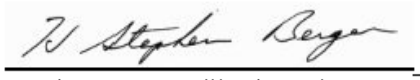
www.temconsulting.com

140 River Rd.
Georgetown, Tx. 78628

Tel: (512) 864-3365
Mobile (512) 466-0833
Fax: (512) 869-8709
E-MAIL stephen.berger@ieee.org

Calibration Instrumentation

Equipment Used	Make/Model - S/N	Calibration Date
Digital Multi-Meter	Fluke 8860A - SN 3085046	1/26/04
Helmholtz Coil	TEM Consulting	NA

Calibration Completed by: 

Stephen Berger, Calibration Laboratory Supervisor

TEM Consulting, LP

140 River Rd.
Georgetown, Texas 78628

Certificate of Calibration

Date: January 12, 2005
Cert I.D.: 1013-040112

Calibration Standard(s)

The instrument identified below has been individually calibrated to the following standards:

ANSI C63.19-2001

Instrument Identification

Manufacturer: TEM Consulting, LP
Unit Description: T-Coil Magnetometer – Sound Level Meter with Radial Probe
Model Number: TEM Consulting MN 3001
Serial Number: SBI 1001

Calibration Results

Magnetometer: 108.7 dB = 1 A/m (0 dB(A/m))
Output: 0 dB = 0.365 Vrms

Frequency	Output Relative to dB re 1kHz
250	-19.1
315	-14.9
400	-10.8
500	-7.2
630	-5.0
800	-2.0
1000	0.0
1250	1.9
1600	3.1
2000	4.0
2500	4.8
3150	5.1
4000	5.1
5000	5.0

Calibration Traceability: All measurements are traceable to the National Institute of Standards and Technology (NIST).

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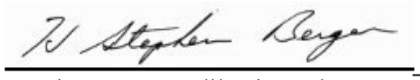
Calibration Instrumentation

Equipment Used	Make/Model - S/N	Calibration Date
Digital Multi-Meter	Fluke 8860A - SN 3085046	1/26/04
Helmholtz Coil	TEM Consulting	NA

Calibration Completed by: 

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Instrument Identification

Manufacturer: TEM Consulting, LP
Unit Description: T-Coil Magnetometer – Sound Level Meter with Radial Probe
Model Number: TEM Consulting MN 3001
Serial Number: SBI 1001

Calibration Results

Magnetometer: 108.0 dB = 1 A/m (0 dB(A/m))
Output: 0 dB = 0.361 Vrms

Frequency	Output Relative to dB re 1kHz
250	-19.2
315	-15.0
400	-10.8
500	-7.4
630	-5.0
800	-2.1
1000	0.0
1250	1.8
1600	3.0
2000	4.0
2500	4.8
3150	5.0
4000	5.0
5000	5.0

Calibration Traceability: All measurements are traceable to the National Institute of Standards and Technology (NIST).

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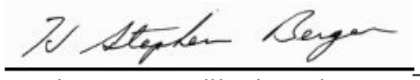
Calibration Instrumentation

Equipment Used	Make/Model - S/N	Calibration Date
Digital Multi-Meter	Fluke 8860A - SN 3085046	1/26/04
Helmholtz Coil	TEM Consulting	NA

Calibration Completed by: 

Stephen Berger, Calibration Laboratory Supervisor

11. CONCLUSION

The measurements indicate that the wireless communications device complies with the HAC limits specified in accordance with the ANSI PC63.19 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(s) 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.

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