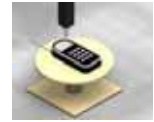




PCTEST ENGINEERING LABORATORY, INC.

6660-B Dobbin Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6554
<http://www.pctestlab.com>



HEARING AID COMPATIBILITY CERTIFICATE

Applicant Name:
SONY ERICSSON MOBILE COMMUNICATION INC.
7001 Development Drive
Research Triangle Park, NC 27709
USA

Date of Testing:
May 22 -23, 2006
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0605170377-R1

FCC ID: PY7AF042011

APPLICANT: SONY ERICSSON MOBILE COMMUNICATION 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 C63.19-2006 v3.12
FCC Classification: Licensed Transmitter Held to Ear (PCE)
EUT Type: Dual-Band GSM/PCS EDGE Phone with Bluetooth
Model(s): Charlotte
Tx Frequency: 824.20 - 848.80 MHz (Cellular GSM)
1850.20 - 1909.80 MHz (GSM PCS)
Test Device Serial No.: Pre-Production Sample [S/N: HAC #3]
Class II Permissive Change(s): Adding T-Coil Rating
HAC RF Emissions Category: M3 (ANSI C63.19-2006 v3.12)
Original Grant Date: 8/9/2006

C63.19 HAC Rated Category: T4 (SIGNAL TO NOISE CATEGORY)

This wireless portable device has been shown to be hearing-aid compatible under the above rated category, specified in ANSI/IEEE Std. C63.19-2006 and had been tested in accordance with the specified measurement procedures. The RF Emissions for this device was M3 and is covered under a separate test report. 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.

NOTE: This revised HAC Test Report supersedes and replaces the previously-issued test report (S/N: 0605170377) on the same subject EUT for the same type of testing as indicated.

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







| | | | | |
|-----------------------------------|---|---|---|--|
| FCC ID: PY7AF042011 |  | C63.19-2006 v3.12 §6 HAC TEST REPORT |  | Reviewed by: Quality Manager |
| Filename: 0605170377-R1 | Test Dates: May 22 -23, 2006 | EUT Type: Dual-Band GSM/PCS EDGE Phone with Bluetooth | Page 1 of 33 | |

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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-8658¹ 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-vitu*

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

| | | | | |
|----------------------------|---|--|---|---------------------------------|
| FCC ID: PY7AF042011 |  PCTEST | C63.19-2006 v3.12 §6 HAC TEST REPORT |  Sony Ericsson | Reviewed by: Quality Manager |
| Filename: 0605170377-R1 | Test Dates: May 22 -23, 2006 | EUT Type: Dual-Band GSM/PCS EDGE Phone with Bluetooth | | Page 3 of 33 |

2. TEST SITE LOCATION

I. 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 2-1).

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 C63.4-2003 on January 27, 2006 and Industry Canada.





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

II. Test Facility / A2LA 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, Hearing-Aid Compatibility (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 and Industry Canada Standards (RSS).
- 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.

| | | | | |
|-----------------------------------|---|---|---|--|
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3. EUT DESCRIPTION



Sony Ericsson

FCC ID: PY7AF042011
 Applicant: SONY ERICSSON MOBILE COMMUNICATION INC.
 7001 Development Drive
 Research Triangle Park, NC 27709
 USA
 Trade Name: Sony Ericsson
 Model(s): Charlotte
 Serial Number: HAC #3
 Tx Frequencies: 824.20 - 848.80 MHz (Cellular GSM)
 1850.20 - 1909.80 MHz (GSM PCS)

HW Version: 06W11
 SW Version: CXC1250442 RIDA002 060511
 Maximum Conducted Power (EMC/SAR): 32.2 dBm (GSM 850), 30.2 dBm (GSM 1900)
 Maximum Conducted Power (HAC): 32.6 dBm (GSM 850), 30.4 dBm (GSM 1900)
 Antenna: Fixed Antenna
 HAC Test Configurations: GSM850, 128, 190, 251, BT Off
 PCS GSM, 512, 661, 810, BT Off

FCC Classification: Licensed Transmitter Held to Ear (PCE)
 EUT Type: Dual-Band GSM/PCS EDGE Phone with Bluetooth

Table 3-1
Maximum RF Conducted Power Measured

| | Channel | Max Power (dBm) |
|------------|---------|-----------------|
| GSM | 128 | 32.20 |
| | 190 | 32.50 |
| | 251 | 32.50 |
| PCS | 512 | 29.60 |
| | 661 | 30.30 |
| | 810 | 30.40 |

| | | | | |
|----------------------------|---------------------------------|--|--|---------------------------------|
| FCC ID: PY7AF042011 | PCTEST | C63.19-2006 v3.12 §6 HAC TEST REPORT | | Reviewed by: Quality Manager |
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4. ANSI/IEEE C63.19 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 | 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 C63.19-2006 v3.12 [2] | | |

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 4-2 Articulation Weighting Factors | | |

| | | | | |
|-----------------------------------|---|---|---|--|
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III. MAGNETIC COUPLING

Axial Field Intensity

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

Radial Field Intensity

The radial components of the magnetic field, in the horizontal and vertical position along the measurement plane 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

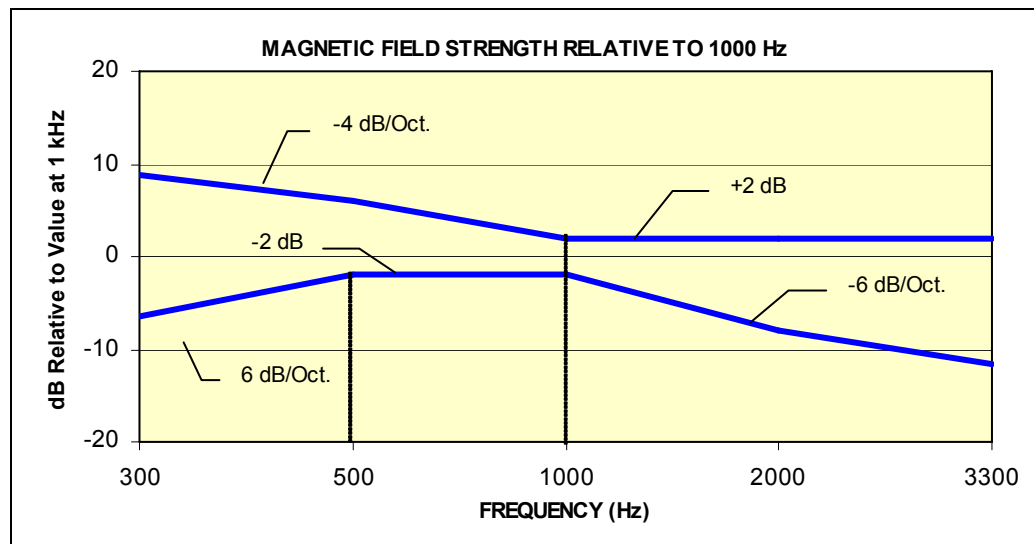




Figure 4-1
Magnetic field frequency response for Wireless Devices with an axial field between -10 dB to -13 dB (A/m) at 1 kHz

| | | | |
|----------------------------|--|---|---------------------------------|
| FCC ID: PY7AF042011 |  C63.19-2006 v3.12 §6 HAC TEST REPORT |  | Reviewed by: Quality Manager |
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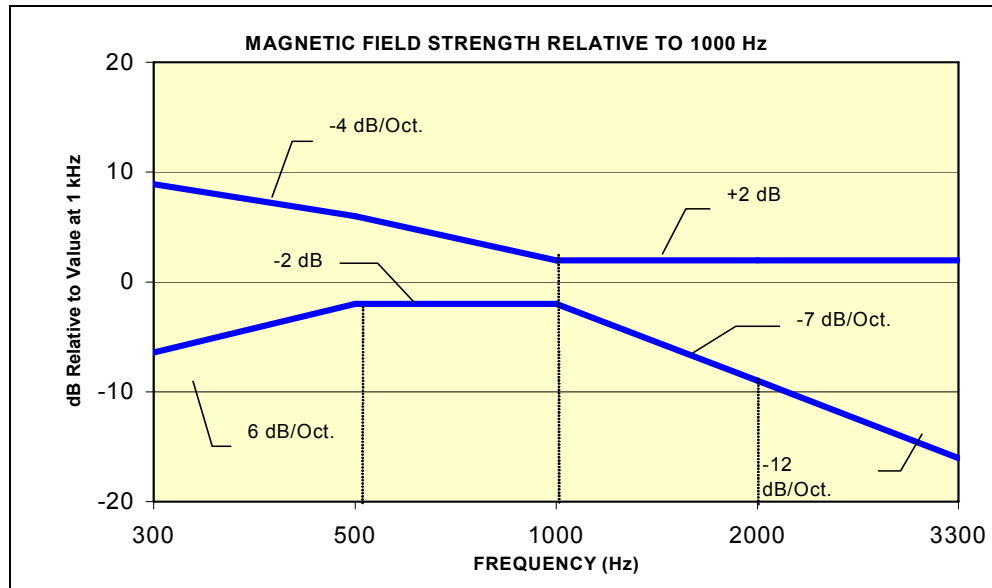


Figure 4-2
Magnetic Field frequency response for wireless devices with an axial field that exceeds -10
dB(A/m) at 1 kHz

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 4-3 Magnetic Coupling Parameters | | |

5. METHOD OF MEASUREMENT

I. Test Setup

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

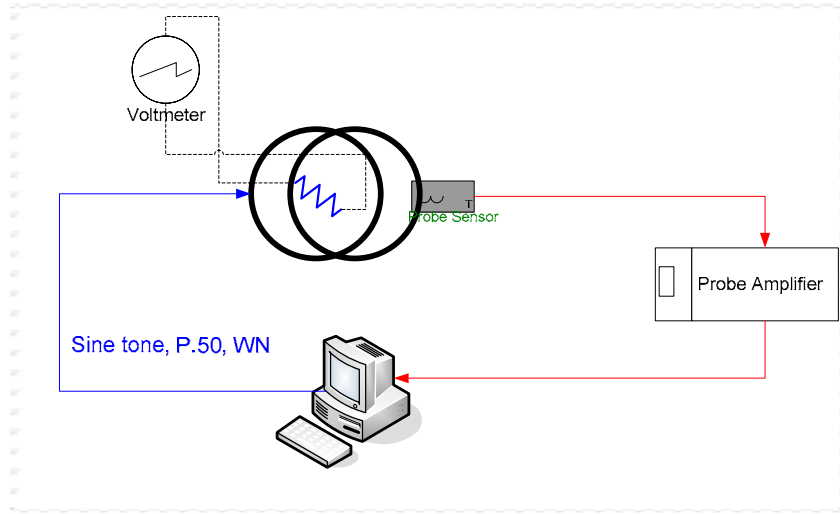


Figure 5-1 Validation Setup with Helmholtz Coil

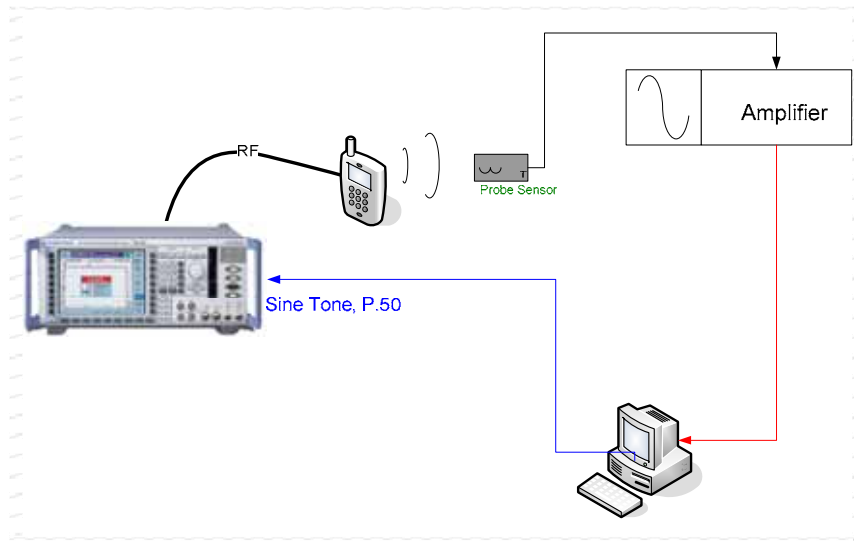




Figure 5-2 T-Coil Test Setup

| | | | | |
|--|--|--|---|---------------------------------|
| FCC ID: PY7AF042011 |  PCTEST | C63.19-2006 v3.12 §6 HAC TEST REPORT |  Sony Ericsson | Reviewed by: Quality Manager |
| Filename: 0605170377-R1 | Test Dates: May 22 -23, 2006 | EUT Type: Dual-Band GSM/PCS EDGE Phone with Bluetooth | | Page 9 of 33 |
| © 2006 PCTEST Engineering Laboratory, Inc. | | | | v2.0g |

II. 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)

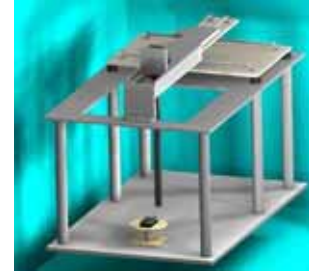


Figure 5-3
RF Near-Field Scanner

III. 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%

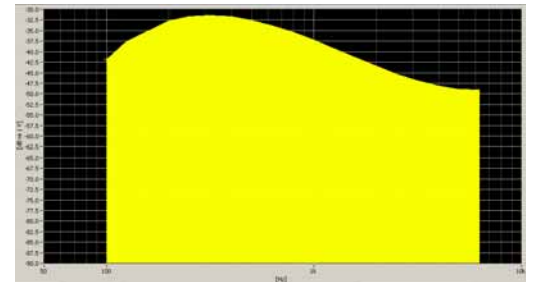


Figure 5-4
Spectral Characteristic of full P.50

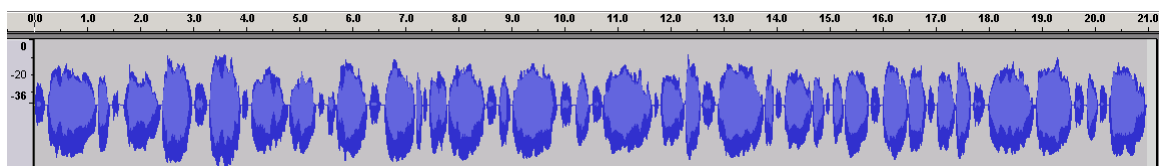


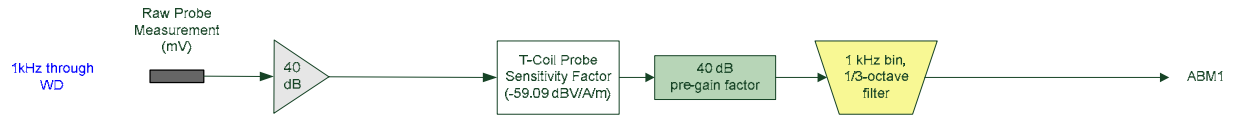


Figure 5-5
Temporal Characteristic of full P.50

| | | | | |
|-----------------------------------|---|---|---|--|
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ABM1 Measurement Block Diagram:



ABM2 Measurement Block Diagram:

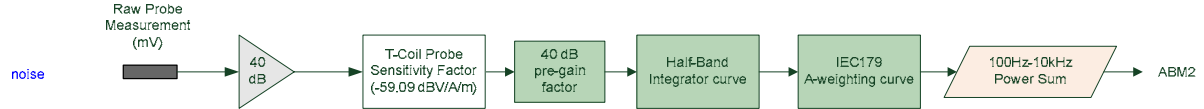


Figure 5-6 Magnetic Measurement Processing Steps

IV. Test Procedure

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:

$$-18 - 10 - 10 + AWF = -43 \text{ dBA/m}$$

2. Measurement System Validation (See Figure 5-1)
 - 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):



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

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

For the Helmholtz Coil, $N=20$; $r=0.08\text{m}$; $R=10.193\Omega$ and using $V=57\text{mV}$:

$$H_c = \frac{20 \cdot \left(\frac{0.057}{10.193}\right)}{0.08 \cdot \sqrt{1.25^3}} = 1.0003 \text{ A/m}$$

Therefore a pure tone of 1kHz was applied into the coils such that 57 mV was observed across the 10 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 (see Page 20).

| | | | |
|-----------------------------------|---|---|--|
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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 – 3300 Hz using the ITU-P.50 artificial speech signal as shown below:

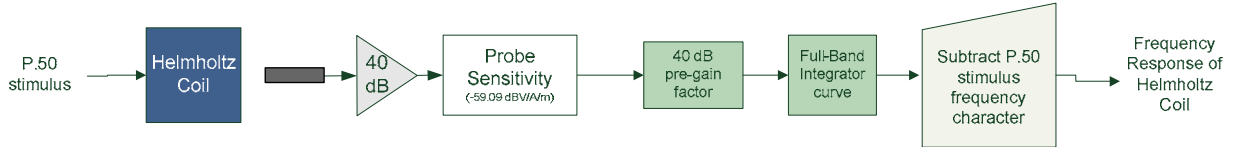




Figure 5-7 Frequency Response Validation

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 |

| | | | |
|-----------------------------------|---|---|--|
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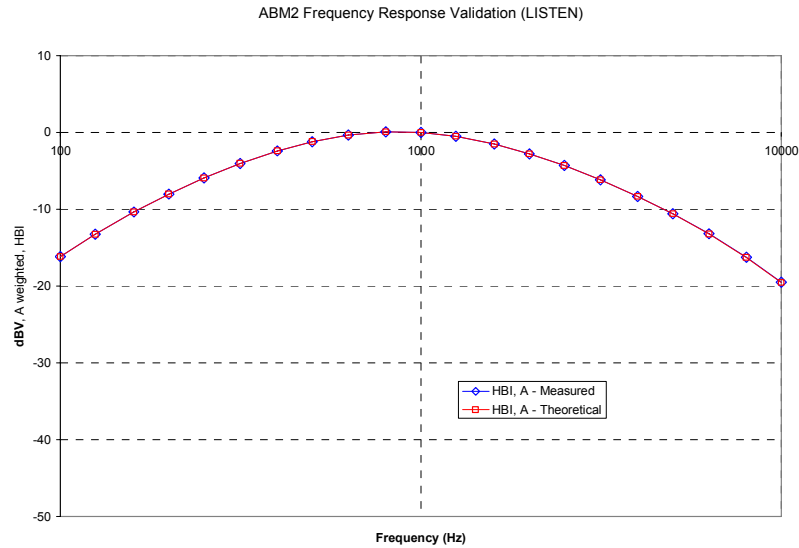


Figure 5-8
ABM2 Frequency Response Validation

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:

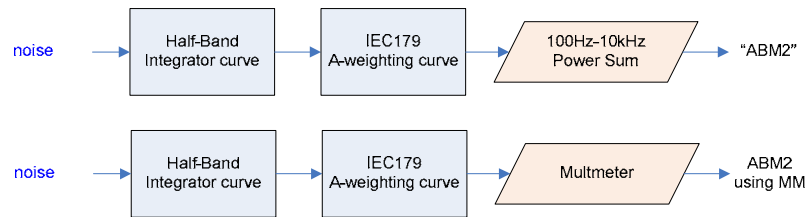


Figure 5-9
ABM2 Validation Block Diagram

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 |

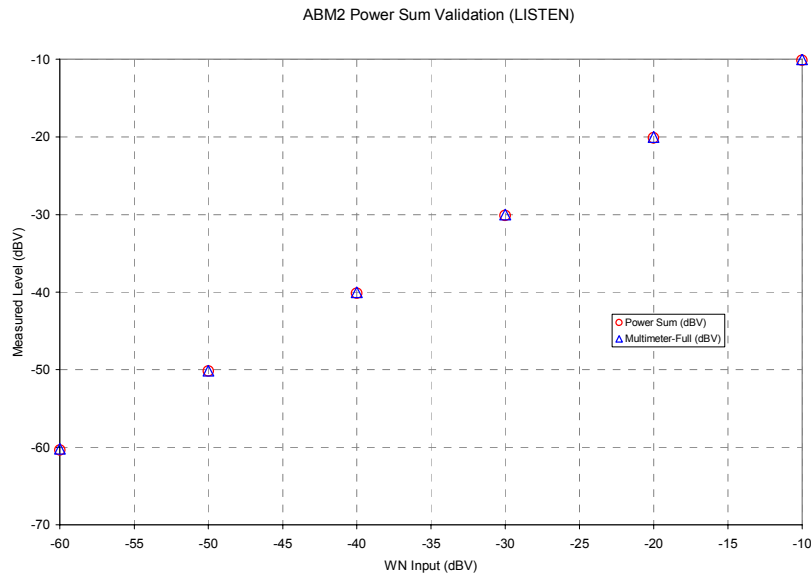


Figure 5-10
ABM2 Power Sum Validation

3. Measurement Test Setup

a. Fine scan above the WD (TEM)

- i. A 1 kHz tone was applied to the handset at 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:

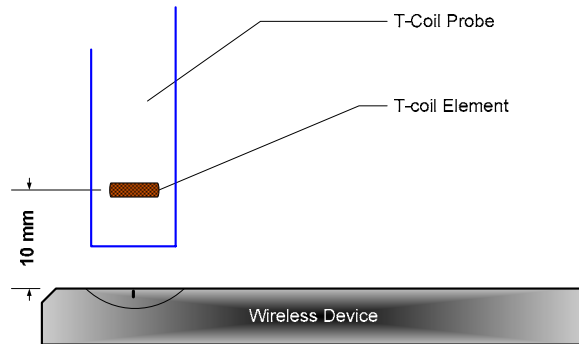


Figure 5-11
Measurement Distance

- ii. 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.
- iii. 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.

b. Speech Signal Setup to Base Station Simulator

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



| | | | | |
|-----------------------------------|---|---|---|--|
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Table 5-3
Reference Audio Input Levels

| 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 5-4
CMU200 Voltage Input Levels for Audio

| dBm0 Ref. | Voltage | | Notes |
|-----------|----------|-----------|--|
| 3.14 dBm0 | 990.5 mV | -0.08 dBV | From GSM "DECODER CAL". (What is needed through Encoder for FS) |
| -16 dBm0 | 109.4 mV | -19.2 dBV | For Speechcod/Handset Low |

- c. Real-Time Analyzer (RTA)
 - i. The Real-Time Analyzer was configured to analyze measurements using 1/3 Octave band weighted filtering.
- d. WD Radio Configuration Selection
 - i. The device was chosen to be tested in the worst-case ABM2 condition under at the maxima signal location (see below):

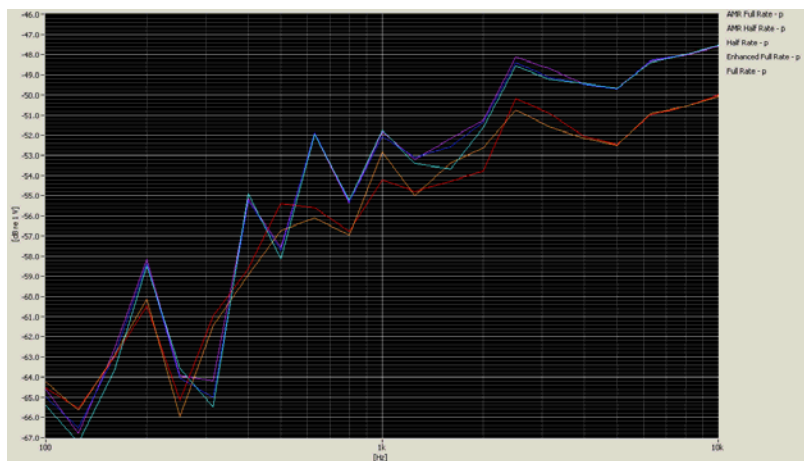




Figure 5-12
Vocoder Analysis for ABM Noise

- 4. 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 – 3300 Hz using digital linear averaging (limit lines

| | | | |
|-----------------------------------|---|---|--|
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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.

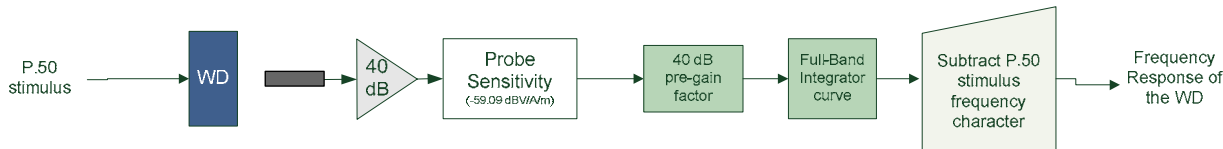
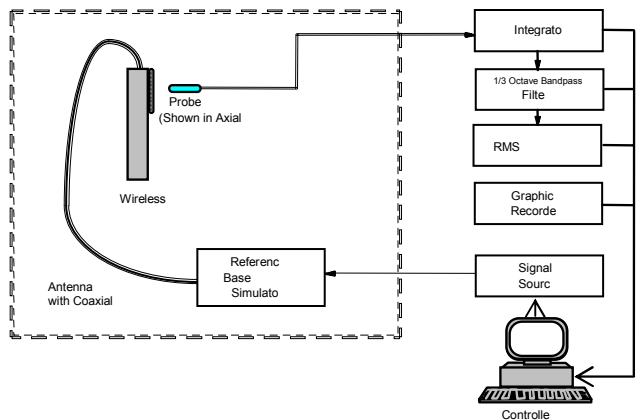


Figure 5-13 Frequency Response Block Diagram

- 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 according to acoustic 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.

V. Test Setup



**Figure 5-14
Audio Magnetic Field Test Setup**

VI. Deviation from C63.19 Test Procedure

Scan increments at 2mm;

| | | | |
|-----------------------------------|--|---|--|
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VII. Wireless Device Center 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 4175 (UMTS) | 835.00 |
| 190 (GSM) | 836.60 |
| PCS 1900 | |
| 661 (GSM) | 1880 |
| 600 (CDMA) | 1880 |
| UARFCN 9400 (UMTS) | 1880 |

VIII. RF Emission Effect on T-coil Measurements

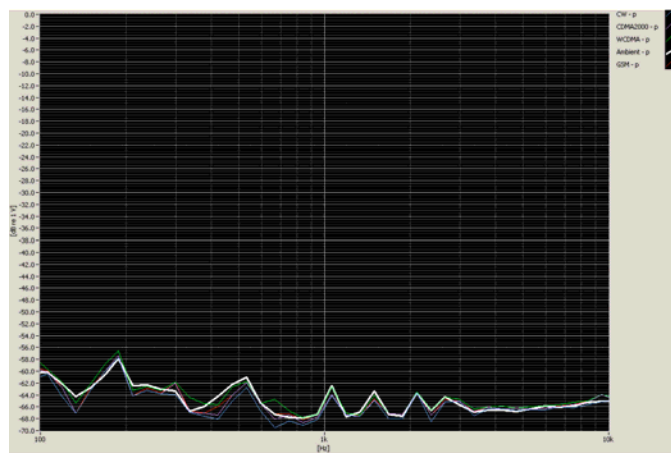




Figure 5-15

High power RF Emissions Effect with HAC Dipole on the T-coil Probe System

| | | | |
|-----------------------------------|---|---|--|
| FCC ID: PY7AF042011 |  PCTEST | C63.19-2006 v3.12 §6 HAC TEST REPORT |  Reviewed by: Quality Manager |
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IX. Test Flow

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

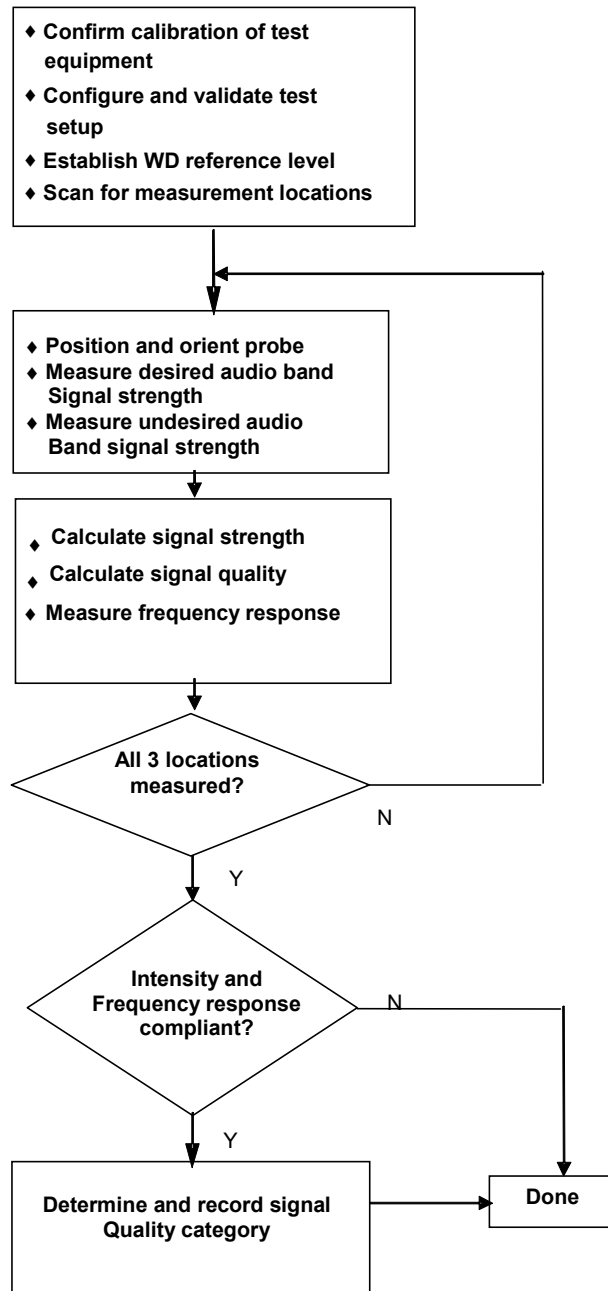




Figure 5-16
C63.19 T-Coil Signal Test Process

| | | | | |
|-----------------------------------|---|---|---|--|
| FCC ID: PY7AF042011 |  PCTEST | C63.19-2006 v3.12 §6 HAC TEST REPORT |  | Reviewed by: Quality Manager |
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6. TEST SUMMARY

I. T-Coil Test Summary

Table 6-1
Consolidated Table of Worst-case Results



| C63.19 Sec. | Band | Test Description | Minimum Limit* | Measured | Verdict |
|-------------|----------|--------------------------------|----------------|--------------|------------------|
| | | | <i>dBa/m</i> | <i>dBa/m</i> | <i>PASS/FAIL</i> |
| 7.3.1.1 | Cellular | Intensity, Axial | -13 | 6.3 | PASS |
| 7.3.1.2 | | Intensity, RadialH | -18 | -4.0 | PASS |
| 7.3.1.2 | | Intensity, RadialV | -18 | -5.0 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, Axial | 5 | 38.2 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, RadialH | 5 | 36.9 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, RadialV | 5 | 37.5 | PASS |
| 7.3.2 | | Frequency Response, Axial | 0 | 0.6 | PASS |
| 7.3.1.1 | PCS | Intensity, Axial | -13 | 6.4 | PASS |
| 7.3.1.2 | | Intensity, RadialH | -18 | -4.0 | PASS |
| 7.3.1.2 | | Intensity, RadialV | -18 | -5.0 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, Axial | 5 | 38.9 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, RadialH | 5 | 36.6 | PASS |
| 7.3.3 | | Signal-to-Noise/Noise, RadialV | 5 | 37.6 | PASS |
| 7.3.2 | | Frequency Response, Axial | 0 | 0.6 | PASS |

Note: The above summary table represents the worst-case numerical values according to configurations in Table 6-3.

Table 6-2
Consolidated Tabled Results with Rating

| | Volume Setting | Cellular | | | PCS | | |
|----------------------------|----------------|----------|---------|---------|-------|---------|---------|
| | | Axial | RadialH | RadialV | Axial | RadialH | RadialV |
| Freq. Response Margin | Maximum | PASS | PASS | PASS | PASS | PASS | PASS |
| Magnetic Intensity Verdict | | PASS | PASS | PASS | PASS | PASS | PASS |
| FCC SNR Verdict | | PASS | PASS | PASS | PASS | PASS | PASS |

Note: The above table represents the pass/fail verdict according to data in Table 6-3.

| | | | | |
|----------------------------|---|--|---|---------------------------------|
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II. Raw Handset Data

Table 6-3
Raw Data Results



| | Volume | Cellular Band | | | | | | | | |
|-----------------------|---------|---------------|--------|--------|---------|--------|--------|---------|--------|--------|
| | | Axial | | | RadialH | | | RadialV | | |
| | | 128 | 190 | 251 | 128 | 190 | 251 | 128 | 190 | 251 |
| Freq. Response Margin | Maximum | 0.60 | 0.97 | 0.83 | 0.47 | 0.74 | 0.79 | 0.55 | 0.87 | 0.61 |
| ABM1, dBA/m | | 6.34 | 6.39 | 6.39 | -3.95 | -3.94 | -3.95 | -4.98 | -4.98 | -4.98 |
| ABM2, dBA/m | | -32.61 | -31.78 | -32.97 | -40.85 | -41.44 | -41.03 | -43.08 | -43.13 | -42.43 |
| Ambient Noise (dBA/m) | | -60.01 | -60.01 | -60.01 | -61.10 | -61.10 | -61.10 | -60.50 | -60.50 | -60.50 |
| S+N/N (dB) | | 38.96 | 38.17 | 39.36 | 36.91 | 37.50 | 37.08 | 38.09 | 38.15 | 37.46 |
| S+N/N per orientation | | 38.17 | | | 36.91 | | | 37.46 | | |
| | Volume | PCS Band | | | | | | | | |
| | | Axial | | | RadialH | | | RadialV | | |
| | | 512 | 661 | 810 | 512 | 661 | 810 | 512 | 661 | 810 |
| Freq. Response Margin | Maximum | 0.65 | 0.64 | 0.87 | 0.93 | 0.62 | 0.76 | 0.70 | 0.89 | 0.59 |
| ABM1, dBA/m | | 6.39 | 6.38 | 6.41 | -3.96 | -3.98 | -3.97 | -5.00 | -4.99 | -4.98 |
| ABM2, dBA/m | | -33.24 | -32.69 | -32.52 | -40.81 | -41.33 | -40.57 | -42.76 | -42.62 | -42.65 |
| Ambient Noise (dBA/m) | | -60.01 | -60.01 | -60.01 | -61.10 | -61.10 | -61.10 | -60.50 | -60.50 | -60.50 |
| S+N/N (dB) | | 39.63 | 39.07 | 38.92 | 36.85 | 37.35 | 36.59 | 37.76 | 37.63 | 37.67 |
| S+N/N per orientation | | 38.92 | | | 36.59 | | | 37.63 | | |

Notes:

1. Power Configuration: PCL=5 (GSM), PCL=0 (PCS GSM)
2. Phone Condition: Mute on; Backlight on; Max Volume, BT Off, T-Coil HA Mode ON

III. RF Measurement Details for RT Category Determination

| | |
|---|----|
| RF Emissions Category (C63.19-2006) | M3 |
| RT Category | M3 |
| Signal to Noise Category (C63.19-2006): | T4 |

| | | | | |
|----------------------------|---|--|---|---------------------------------|
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IV. Frequency Response Graph

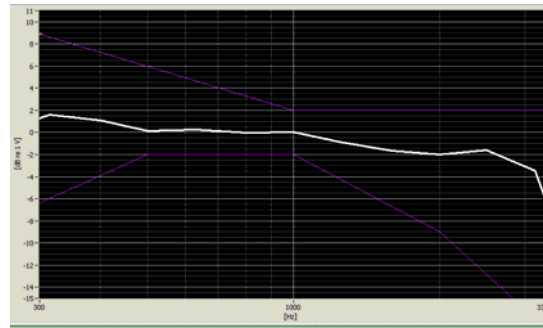
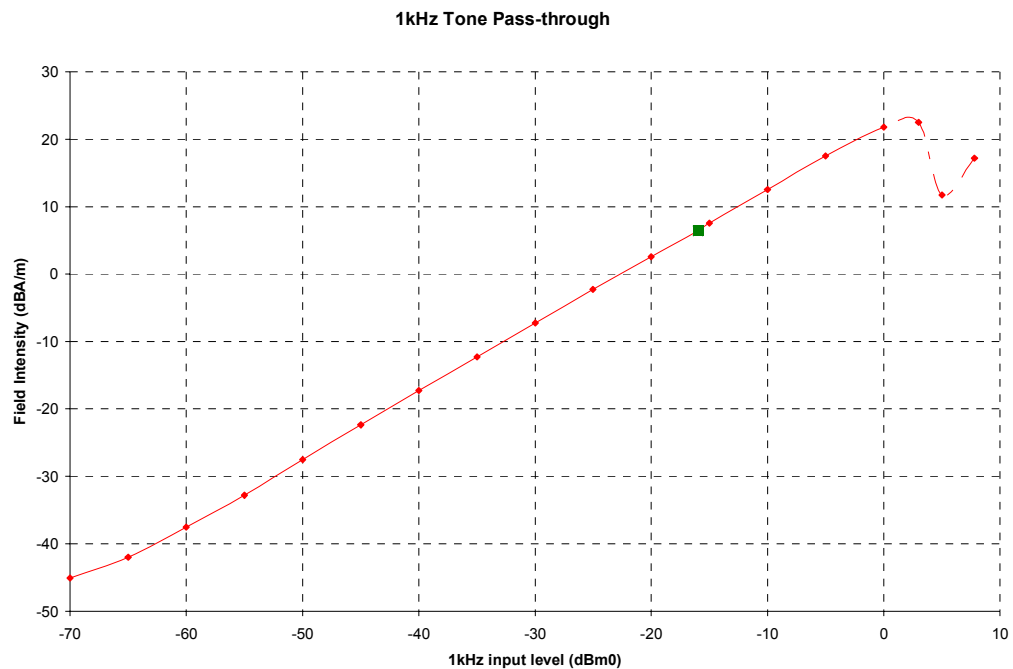




Figure 6-1
Axial Frequency Response

Note: User T-coil Mode (Settings->HAC->T-Coil Mode) was set to ON for Frequency Response compliance. This frequency response represents the worst-case ABM2 test configuration according to Table 6-3

V. 1 kHz Vocoder Application Check



This model was verified to be within the linear region for ABM1 measurements. This measurement was taken in the axial configuration above the maximum location, GSM850 band, channel 128.

| | | | |
|-----------------------------------|---|---|--|
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VI. Undesirable Audio Magnetic Band Plot (ABM2)

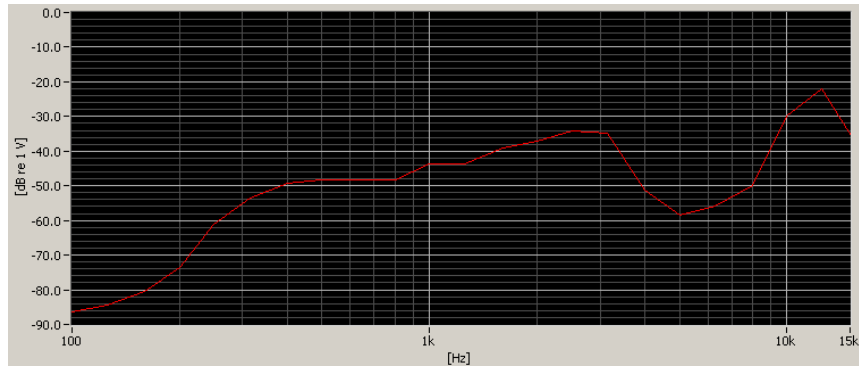


Figure 6-2
Worst-case ABM2 Plot for WD

Note: This plot represents the data from the configuration resulting in the highest ABM2 result shown in Table 6-3.

VII. T-Coil Validation Test Results

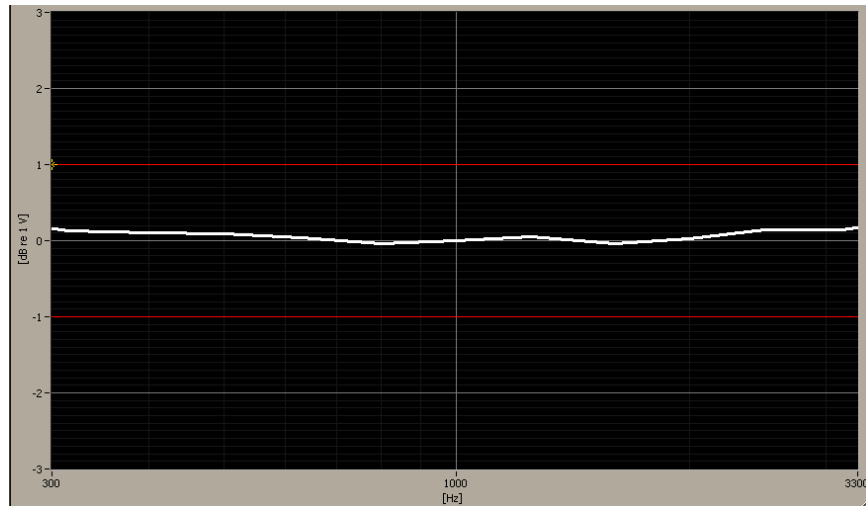




Figure 6-3
Helmholtz Coil Validation for Frequency Response

Table 6-4
Helmholtz Coil Validation Table of Results

| Item | Target | Measured dB About Target | Verdict |
|--|----------------------|--------------------------|---------|
| Frequency Response, from limits | $\pm 0.5 \text{ dB}$ | 0.17 | PASS |
| Magnetic Intensity, 0 dBA/m | 0 dB | 0.055 | PASS |
| 10 dB below lowest measurement signal (-18 dBA/m, T4 min.) | -48 | -60.01 | PASS |

| | | | | |
|-----------------------------------|---|---|---|--|
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7. MEASUREMENT UNCERTAINTY



Table 7-1
Uncertainty Estimation Table

| Contribution | Data +/- % | Data +/- dB | Data Type | Probability distribution | Divisor | Standard uncertainty | Standard Uncertainty (dB) |
|--|------------|-------------|---------------|--------------------------|---------|----------------------|---------------------------|
| ABM Noise | 7.0% | 0.29 | Std. Dev. | Normal k=1 | 1.00 | 7.0% | |
| RF Reflections | 4.7% | 0.20 | Specification | Rectangular | 1.73 | 2.7% | |
| 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% | |
| Probe Linearity | 2.4% | 0.10 | Std. Dev. | Normal k=1 | 1.00 | 2.4% | |
| Cable Loss | 2.8% | 0.12 | Specification | Rectangular | 1.73 | 1.6% | |
| 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 | 9.0% | 0.37 | Std. Dev. | Normal k=1 | 1.00 | 9.0% | |
| Positioner Accuracy | 1.0% | 0.04 | Specification | Rectangular | 1.73 | 0.6% | |
| Combined standard uncertainty, uc | | | | | | 17.7% | 0.71 |
| Expanded uncertainty (k=2), 95% confidence level | | | | | | 35.3% | 1.31 |

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.

| | | | |
|-----------------------------------|---|---|--|
| FCC ID: PY7AF042011 |  C63.19-2006 v3.12 §6 HAC TEST REPORT |  | Reviewed by: Quality Manager |
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8. EQUIPMENT LIST

| Manufacturer | Make / Equipment | Calibration Due | Asset No. |
|----------------------------|--|-----------------|----------------|
| MicroCoax | (1.0-26.5GHz) Microwave Cables | N/A | N/A |
| Rohde & Schwarz | (0.1-1000MHz) Signal Generator | September 2006 | 894215/012 |
| Narda | 3020A (50-1000MHz) Bi-Directional Coax Coupler | - | |
| HP | 34401A Multimeter | June 2007 | |
| NI | 4474 Data Acquisition Card | N/A | |
| Amplifier Research | 5S1G4 (5W, 800MHz-4.2GHz) | - | 22322 |
| Gigatronics | 80701A (0.05-18GHz) Power Sensor | April 2007 | 1833460 |
| TEM | T-coil Magnetometer | January 2007 | PCT920 |
| HP | 8594A Spectrum Analyzer | - | 3051A00187 |
| Gigatronics | 8657A Universal Power Meter | April 2007 | 1835256 |
| HP | 8753E (30kHz-6GHz) Network Analyzer | February 2007 | JP38020182 |
| Agilent | 8960 Base Station Simulator | July 2007 | GB41450275 |
| 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 |
| TEM | C63.19 Helmholtz Coil | March 2007 | PCT925 |
| Rohde & Schwarz | CMU200 Base Station Simulator | October 2006 | 650378 |
| Rohde & Schwarz | CMU200 Base Station Simulator | July 2007 | 833855/010 |
| SPEAG | DAE4 | October 2006 | 637 |
| Agilent | E4432B ESG-D Series Signal Generator | August 2008 | US40053896 |
| Optix | Fiber-Optic Line | N/A | N/A |
| SPEAG | Freospace 1880 MHz Dipole | February 2007 | 1002 |
| TDK | Freospace 1900 MHz Dipole | October 2007 | 130116 |
| SPEAG | Freospace 2450 MHz Dipole | February 2007 | 1004 |
| ETS | Freospace 835 MHz Dipole | February 2007 | A005 |
| SPEAG | Freospace 835 MHz Dipole | February 2007 | 1003 |
| EMCO | Freospace E-field Probe | January 2007 | 9704-1441 |
| SPEAG | Freospace E-field Probe | January 2007 | 2332 |
| SPEAG | Freospace 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 | 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 | June 2007 | 835360/079 |
| Rohde & Schwarz | NRV-Z53 Power Sensor | June 2007 | 846076/007 |
| Compliance Design | Roberts Dipoles (1 set) | N/A | N/A |
| 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

| | | | |
|-----------------------------------|---|---|--|
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9. CALIBRATION CERTIFICATES

| | | | | |
|-----------------------------------|---|---|---|--|
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I. System Manufacturer Certificates



Certificate of Calibration Conformance

This instrument identified below has been individually calibrated in compliance with the following standard(s):

Internal Quality Standards.

Environment: Laboratory MTE is maintained in a temperature-controlled environment with ambient conditions from 18 to 28 C, relative humidity less than 90%. The instrument under test has been calibrated in a suitable environment to maintaining accurate and reliable measurement quality.

Manufacturer: TEM Consulting
Model Number: T-Coil Probe Set
Serial Number: 1108 / 1109
Tracking Number: TEM051206
Date Completed: March 12, 2006

Operating Range: 100Hz – 10KHz
Instrument Type: T-Coil Probes

Test remarks: None

Calibration Traceability: All Measuring and Test Equipment (M/TE) identified below are traceable to the National Institute for Standards and Technology (NIST). Calibration Laboratory and Quality System controls are compliant with ISO/IEC 17025-1999.

Standards and Equipment Used:

Make / Model / Name/S/N / Recall Date
3478A Multimeter 2301A18249 6/30/2006
8116A Pulse/Function Generator 50Mhz
2516A01852 6/30/2006



Condition of Instrument Upon Receipt:

In tolerance to Internal Quality Standards

On Release:

In Tolerance to Internal Quality Standards

This document provides traceability of measurements to recognized national standards using controlled processes at the ETS-Lindgren Calibration Laboratory. This certificate and report may not be reproduced, except in full, without the written approval of ETS-Lindgren Calibration Laboratory in accordance with ISO/IEC 17025-1999. QAF 1127 (07/03)

| | | | | |
|-----------------------------------|---|---|---|--|
| FCC ID: PY7AF042011 |  | C63.19-2006 v3.12 §6 HAC TEST REPORT |  | Reviewed by: Quality Manager |
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Certificate of Calibration Conformance

Sensor Factor **0.6**
 Factor to convert dB mV to dB A/m



Dynamic Range

Probe **1108**

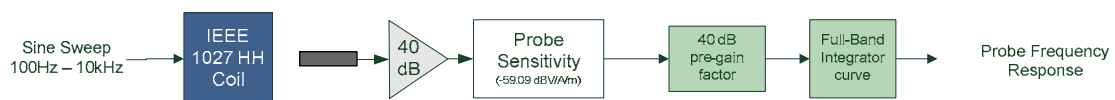
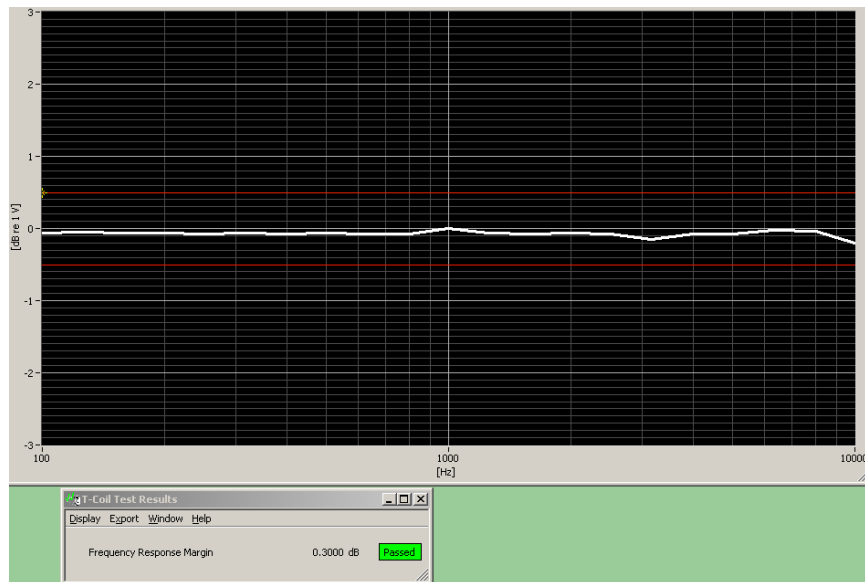
| Freq | Field Strength | | Output | Sensor Factor | Sensor Linearity |
|------|----------------|-----------------|--------|------------------------------|------------------------------|
| | Hz | dB (A/m) A/m | | dB mV + Scale → dB A/m | Delta to Calculated in dB |
| 1000 | 28 | 25.1 | 26.52 | 0.5 | 0.0 |
| 1000 | 23 | 14.1 | 14.99 | 0.5 | 0.0 |
| 1000 | 18 | 7.9 | 8.48 | 0.6 | 0.1 |

Probe **1109**

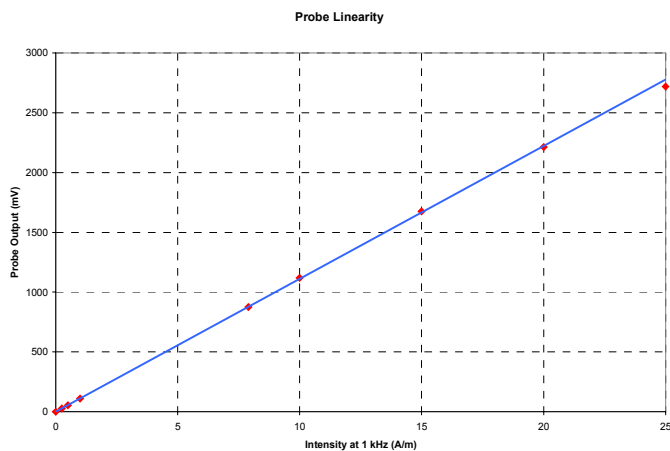
| Freq | Field Strength | | Output | Sensor Factor | Sensor Linearity |
|------|----------------|-----------------|--------|------------------------------|------------------------------|
| | Hz | dB (A/m) A/m | | dB mV + Scale → dB A/m | Delta to Calculated in dB |
| 1000 | 28 | 25.1 | 26.52 | 0.4 | 0.0 |
| 1000 | 23 | 14.1 | 14.85 | 0.4 | 0.0 |
| 1000 | 18 | 7.9 | 8.47 | 0.6 | 0.1 |

| | | | | |
|-----------------------------------|---|---|---|--|
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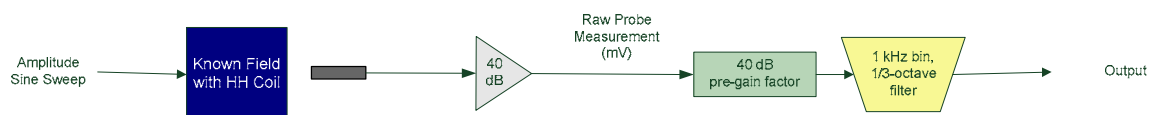
Frequency Response Check with probe system:





II. Linearity Check with probe system:



| F/S (A/m) | Output (mV) | Variation (dB) |
|-----------|-------------|----------------|
| 25 | 2718 | -0.09 |
| 20 | 2212 | -0.02 |
| 15 | 1676 | 0.03 |
| 10 | 1118 | 0.03 |
| 7.9 | 876 | -0.01 |
| 1 | 111.076 | 0.00 |
| 0.5 | 55.500 | 0.00 |
| 0.25 | 27.670 | -0.02 |
| 0 | 0 | 0.00 |





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10. 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(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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