# PCTEST ENGINEERING LABORATORY, INC.

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# CERTIFICATE OF COMPLIANCE

**MANUFACTURER NAME & ADDRESS:**
Matsushita Electric Industrial Co., Ltd.
1006 Oaza Kadoma, Kadoma,
Osaka, 571 JAPAN

**DATE & LOCATION OF TESTING:**
Date(s) of Tests: February 19-21, 2004
Test Report S/N: 15.240206091.ACJ
Test Site: PCTEST Lab, Columbia, MD
Project No.: ITPD-04-F010A

| | |
|---|---|
| **FCC ID:** | **ACJ9TGCF-734** |
| **APPLICANT:** | **Matsushita Electric Industrial Co., Ltd.** |

**SUMMARY:**

| | |
|---|---|
| Model No.: | CF-73mk3 |
| Equipment EUT Type: | Panasonic Notebook PC w/ Intel WLAN Model: WM3B2200BG & Siemens GPRS Module Model: MC46 |
| Max. Output Power: | 56.4 mW (17.5 dBm) |
| Frequency Range: | 2412 - 2462 MHz |
| FCC Classification: | FCC Part 15 Digital Transmission System (DTS) |
| FCC Rule Part(s): | Parts 15.247; ANSI C-63.4-2001 |
| Test Device Serial No.: | S/N: 3GKYA00020 |
| Installed Options: | ☒ WLAN ☐ Bluetooth ☒ GPRS Module ☐ Other |

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C-63.4-2001.

Grant Conditions: Power output is conducted. This device has been tested for SAR compliance for portable configurations. This device must not be co-located or operating with any other antenna or transmitter. End-users must be provided with operating conditions for satisfying RF exposure compliance.

I authorize and 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.*

Alfred Cirwithian
Vice President Engineering

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# TABLE OF CONTENTS

ATTESTATION STATEMENTS.....1
FCC PART 15.247 MEASUREMENT REPORT COVER PAGE.....2
1.0 INTRODUCTION.....3
1.1 EVALUATION PROCEDURE.....3
1.2 SCOPE.....3
1.3 PCTEST TEST LOCATION.....3
2.0 PRODUCT INFORMATION.....4
2.1 EQUIPMENT DESCRIPTION.....4
2.2 ENCLOSURE.....4
2.3 EMI SUPPRESSION DEVICE(S)/MODIFICATIONS.....4
3.0 DESCRIPTION OF TEST.....5
3.1 CONDUCTED EMISSIONS.....5
3.2 RADIATED EMISSIONS.....6
4.0 ANTENNA REQUIREMENTS.....7
5.0 TEST EQUIPMENT CALIBRATION DATA.....8
EXHIBIT A. SUMMARY OF TEST RESULTS.....9
EXHIBIT A. 6dB BANDWIDTH MEAUREMENT.....10
EXHIBIT A. OUTPUT POWER MEASUREMENT.....11-12
EXHIBIT A. POWER SPECTRAL DENSITY.....13
EXHIBIT A. BANDEDGE.....14-15
EXHIBIT A. RADIATED FUNDAMENTAL & HARMONIC MEASUREMENTS.....16-21
EXHIBIT A. RADIATED SPURIOUS MEASUREMENTS.....22
EXHIBIT A. RADIATED RESTRICTED BAND MEASUREMENTS.....23-24
EXHIBIT A. LINE CONDUCTED.....25
EXHIBIT B. LABELING REQUIREMENTS.....26-27
EXHIBIT C. BLOCK DIAGRAM/SCHEMATICS.....28
EXHIBIT D. PARTS LIST.....29
EXHIBIT E. OPERATIONAL DESCRIPTION.....30
EXHIBIT F. TEST SETUP PHOTOGRAPHS.....31
EXHIBIT G. EUT EXTERNAL/INTERNAL PHOTOGRAPHS.....32
EXHIBIT H. USER'S MANUAL.....33
EXHIBIT I. SAR MEASUREMENT REPORT.....34



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# Attestation Statements



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# MEASUREMENT REPORT

## A. General Information

| | |
|---|---|
| APPLICANT | Matsushita Electric Industrial Co., Ltd. |
| APPLICANT ADDRESS | 1006 Oaza Kadoma, Kadoma, Osaka, 571 JAPAN |
| TEST SITE | PCTEST ENGINEERING LABORATORY, INC. |
| TEST SITE ADDRESS | 6660-B Dobbin Road, Columbia, MD 21045 USA |
| FCC RULE PART(S) | Parts 15.247; ANSI C-63.4-2001 |
| MODEL NAME | CF-73mk3 |
| FCC ID | ACJ9TGCF-734 |
| Test Device Serial No.: | S/N: 3GKYA00020 ☐ Production ☒ Pre-Production ☐ Engineering |
| FCC CLASSIFICATION | FCC Part 15 Digital Transmission System (DTS) |
| DATE(S) OF TEST | February 19-21, 2004 |
| TESTS REPORT S/N: | 15.240206091.ACJ |
| PROJECT NO.: | ITPD-04-F010A |

## A.1 Test Facility / NVLAP Accreditation

**Measurements were performed at PCTEST Engineering Lab 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 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP) in EMC, Telecommunication, and FCC for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. (NVLAP Lab code: 100431-0).**
- **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.**



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# 1.0 INTRODUCTION

## 1.1 Evaluation Procedure

The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2001) and FCC Public Notice dated July 12, 1995 entitled "Guidance on Measurement for Direct Sequence Spread Spectrum System" were used in the measurement of **Panasonic Notebook PC w/ WLAN & GPRS Module.**

## 1.2 Scope

Measurement & determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission.

## 1.3 PCTEST Test Location

The map at the right shows the location of the PCTEST LABORATORY, its proximity to the FCC Laboratory, the Columbia vicinity are, the Baltimore-Washington Internt'l (BWI) airport, the city of Baltimore and the Washington, DC area. (see Figure 1.2-1).

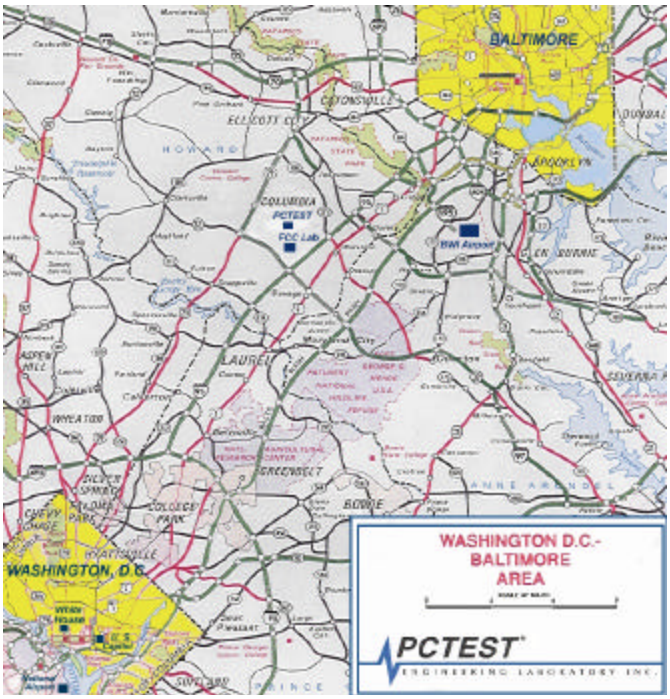


**Figure 1.3-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area**

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.



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# 2.0 PRODUCT INFORMATION

## 2.1 Equipment Description

The Equipment Under Test (EUT) is the ***Panasonic Notebook PC* w/ Intel WLAN & Siemens GPRS Module.** The EUT consisted of the following components(s):

**Table 2-1. EUT Equipment Description**

| Manufacturer / Model / Description | Serial Number |
|---|---|
| Panasonic Notebook PC w/ Intel WLAN & Siemens GPRS Module | 3GKYA00020 |

## 2.2 Enclosure

The EUT incorporates the following enclosure:

- none – The EUT is designed to be installed within the enclosure of a host computer.

## 2.3 EMI Suppression Device(s)/Modifications

EMI suppression device(s) added and/or modifications made during testing.

- none



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# 3.0 DESCRIPTION OF TEST

## 3.1 Conducted Emissions

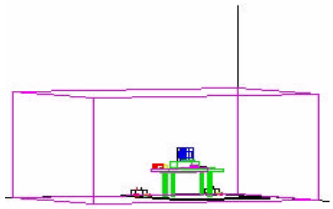

**Figure 3.1-1. Shielded Enclosure Line-Conducted Test Facility**

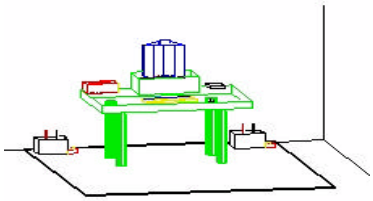

**Figure 3.1-2. Line Conducted Emission Test Set-Up**

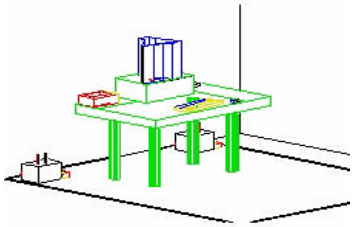

**Figure 3.1-3. Wooden Table & Bonded LISNs**

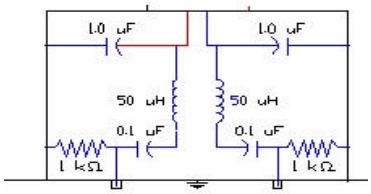


**Figure 3.1-4. LISN Schematic Diagram**

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure. It is manufactured by Ray Proof Series 81 (see Figure 3.1-1). The shielding effectiveness of the shielded room is in accordance with MIL-Std-285 or NSA 65-5. A 1m x 1.5m wooden table 80cm high is placed 40cm away from the vertical wall and 1.5m away from the sidewall of the shielded room (see Figure 3.1-2). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50µH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (See Figure 3.1-3). The EUT is powered from the Solar LISN and the support equipment is powered from the EMCO LISN. Power to the LISNs are filtered by a high-current high-insertion loss Ray Proof power line filters (100dB 14Hz-10GHz). The purpose of the filter is to attenuate ambient signal interference and this filter is also bonded to the shielded enclosure. All electrical cables are shielded by braided tinned copper zipper tubing with an inner diameter of ½". If the EUT is a DC-powered device, power will be derived from the source power supply it normally will be powered from and this supply line(s) will be connected to the Solar LISN. The LISN schematic diagram is shown (See Figure 3.1-4). All interconnecting cables more than 1 meter were shortened by non-inductive bundling (serpentine fashion) to a 1-meter length. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the spectrum analyzer to determine the frequency producing the maximum EME from the EUT. The spectrum was scanned from 150kHz to 30Mhz with a 20msec. sweep time. The frequencies producing the maximum level were re-examined using an EMI/Field Intensity Meter and Quasi-Peak adapter. The detector function was set to CISPR quasi-peak and average mode. The bandwidth of the receiver was set to 10kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each EME emission. Each emission was maximized by: switching power lines; varying the mode of operation or resolution; clock or data exchange speed; scrolling H patter to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Exhibit M. Each EME reported was calibrated using the HP8640B signal generator.



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## 3.2 Radiated Emissions

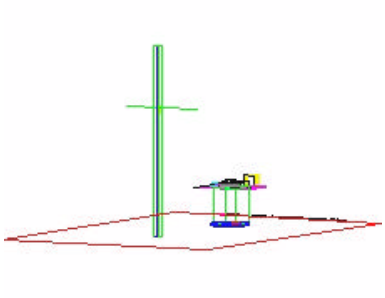

**Figure 3.2-1. Meter Test Site**

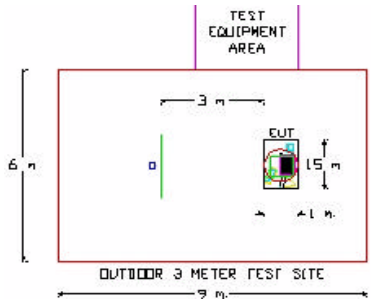


**Figure 3.2-2. Dimensions of Outdoor Test Site**

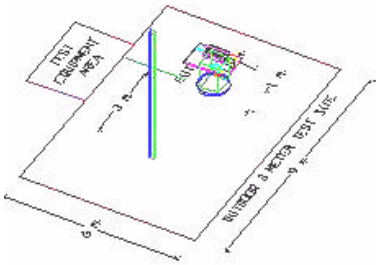

**Figure 3.2-3. Turntable and System Setup**

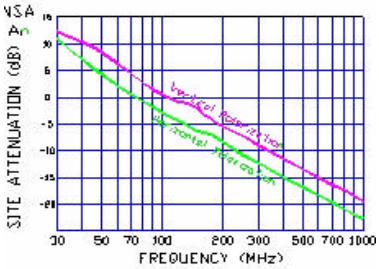


**Figure 3.2-4. Normalized Site Attenuation Curves (H&V)**

Preliminary measurements were made indoors at 1 meter using broadband antennas, broadband amplifier, and spectrum analyzer to determine the frequency producing the maximum EME. Appropriate precaution was taken to ensure that all EME from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using biconical antenna and from 200 to 1000 MHz using log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3meter test range using Roberts™ Dipole antennas or horn antenna (see Figure 3.2-1). The test equipment was placed on a wooden and plastic bench situated on a 1.5 x 2 meter area adjacent to the measurement area (see Figure 3.2-2). Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. Each frequency found during pre-scan measurements was re-examined and investigated using EMI/Field Intensity Meter and Quasi-Peak Adapter. The detector function was set to CISPR quasi-peak mode and the bandwidth of the receiver was set to 100kHz or 1 MHz depending on the frequency or type of signal. Above 1GHz the detector function was set to CISPR average mode (RBW = 1MHz, VBW = 10Hz).

The half-wave dipole antenna was tuned to the frequency found during preliminary radiated measurements. The EUT, support equipment and interconnecting cables were re-configured to the set-up producing the maximum emission for the frequency and were placed on top of a 0.8-meter high non-metallic 1 x 1.5 meter table (see Figure 3.2-3). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated; the antenna height was varied 1 to 4 meters and stopped at the azimuth or height producing the maximum emission. Each emission was maximized by: varying the mode of operation or resolution; clock or data exchange speed; scrolling H pattern to the EUT and/or support equipment, and powering the monitor from the floor mounted outlet box and the computer aux AC outlet, if applicable; and changing the polarity of the antenna, whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in Exhibit E-G. Each EME reported was calibrated using the HP8640B signal generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3.2-4.



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# 4.0 ANTENNA REQUIREMENTS

An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the applicant can be used with the device. The use of a permanently attached antennas or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with this requirement.

The antennas are **permanently attached antenna**.

There are no provisions for connection to an external antenna.

**Conclusion:**

The **Panasonic CF-73mk3** unit complies with the requirement of §15.203.

| Ch. | Frequency (MHz) | Ch. | Frequency (MHz) |
|---|---|---|---|
| 1 | 2412 | 7 | 2442 |
| 2 | 2417 | 8 | 2447 |
| 3 | 2422 | 9 | 2452 |
| 4 | 2427 | 10 | 2457 |
| 5 | 2432 | 11 | 2462 |
| 6 | 2437 | | |

**5.0 Frequency/ Channel Operations**



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# 5.0 TEST EQUIPMENT CALIBRATION DATA

Test Equipment Calibration is traceable to the National Institute of Standards and Technology (NIST).

| TYPE | MODEL | CAL. DUE DATE | CAL. INTERVAL | SERIAL No. |
|---|---|---|---|---|
| Microwave Spectrum Analyzer | HP 8566 (100Hz–22GHz) | 12/05/04 | Annual | 3638A08713 |
| Microwave Spectrum Analyzer | HP 8566 (100Hz-22GHz) | 04/17/04 | Annual | 2542A11898 |
| Spectrum Analyzer/Tracking Generator | HP 8591A (9kHz-1.8GHz) | 06/02/04 | Annual | 3144A02458 |
| Spectrum Analyzer | HP 8591A (9kHz-1.8GHz) | 10/15/04 | Annual | 3108A02053 |
| Spectrum Analyzer | HP 8594A (9kHz-2.9GHz) | 11/02/04 | Annual | 3051A00187 |
| Signal Generator | HP 8650B (500Hz-1GHz) | 06/02/04 | Annual | 2232A19558 |
| Signal Generator | HP 8640B (500Hz-1GHz) | 06/02/04 | Annual | 1851A09816 |
| Signal Generator | Rohde & Schwarz (0.1-1GHz) | 09/22/04 | Annual | 894215/012 |
| Ailtech/Eaton Receiver | NM 37/57A-SL (30MHz-1GHz) | 04/12/04 | Annual | 0792-03271 |
| Ailtech/Eaton Receiver | NM 37/57A (30MHz-1GHz) | 03/11/04 | Annual | 0805-03334 |
| Ailtech/Eaton Receiver | NM 17/27A (0.1-32MHz) | 09/17/04 | Annual | 0608-03241 |
| Quasi-Peak Adapter | HP 85650A | 08/09/04 | Annual | 2043A00301 |
| Ailtech/Eaton Adapter | CCA-7 CISPR/ANSI QP Adapter | 03/11/04 | Annual | 0194-04082 |
| RG58 Coax Test Cable | No.167 | | | n/a |
| Harmonic/Flicker Test System | HP 6841A (IEC 555-2/3) | | | 3531A00115 |
| Broadband Amplifier (2) | HP 8447D | | | 1145A00470, 1937A03348 |
| Broadband Amplifier | HP 8447F | | | 2443A03784 |
| Transient Limiter | HP 11947A (9kHz-200MHz) | | | 2820A00300 |
| Horn Antenna (2) | EMCO Model 3115 (1-18GHz) | | | 9704-5182, 9205-3874 |
| Horn Antenna | EMCO Model 3116 (18-40GHz) | | | 9203-2178 |
| Biconical Antenna (3) | Eaton 94455-1 | | | 1295, 1332, 1277 |
| Log-Spiral Antenna (2) | Ailtech/Eaton 93490-1 | | | 0227, 1104 |
| Log-Spiral Antenna | Singer 93490-1 | | | 147 |
| Roberts Dipoles | Compliance Design (1 set) A100 | | | 5118 |
| Ailtech Dipoles | DM-105A (1set) | | | 33448-111 |
| EMCO LISN (3) | 3816/2, 3816/2, 3725/2 | | | 1077, 1079, 2099 |
| 50-ohm Terminator | n/a | | | n/a |
| Microwave Preamp 40dB Gain | HP 83017A (0.5-26.5GHz) | | | 3123A00181 |
| Microwave Cables | MicroCoax (1.0-26.5GHz) | | | n/a |
| Ailtech/Eaton Receiver | NM37/57A-SL | | | 0792-03271 |
| Spectrum Analyzer | HP 8591A | | | 3034A01395 |
| Modulation Analyzer | HP 8901A | | | 2432A03467 |
| NTSC Pattern Generator | Leader 408 | | | 0377433 |
| Noise Figure Meter | HP 8970B, Ailtech 7510 | | | 3106A02189, TE31700 |
| Noise Generator | Ailtech 7010 | | | 1473 |
| Microwave Survey Meter | Holaday Model 1501 (2.45GHz) | | | 80931 |
| Digital Thermometer | Extech Instruments 421305 | | | 426966 |
| Attenuator | HP 8495A (0-70dB) DC-4GHz | | | |
| Bi-Directional Coax Coupler | Narda 3020A (50-1000MHz) | | | |
| Shielded Screen Room | RF Lindgren Model 26-2/2-0 | | | 6710 (PCT270) |
| Shielded Semi-Anechoic Chamber | Ray Proof Model S81 | | | R2437 (PCT278) |
| Environmental Chamber | Associated Systems 1025 | | | PCT285 |
| OATS | n/a | 12/31/2004 | Tri-annual | |

**Table 5-1. Annual Test Equipment Calibration Schedule**



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# EXHIBIT A – Test Results

## Summary

The intentional radiator has been tested in a simulated typical installation to demonstrate compliance with the relevant FCC performance and procedural standards.

The radio was transmitting at full power on the specified channels and at a data rate(s) specified above. The channels tested are high, middle and low of the allocated bands.

Final system data was gathered in a mode that tended to maximize emissions by varying the orientation of the EUT, orientation of power and I/O cabling, antenna search height, and antenna polarization.

| | |
|---|---|
| Test Date(s): | February 19-21, 2004 |
| Test Engineer: | Al Cirwithian |
| Method/System: | Digital Transmission System (DTS) |
| Data Rate(s) Tested: | 1Mbps, 2Mbps, 5.5Mbps, 11Mbps (B) |
| | 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps (G) |

| FCC Part Section(s) | RSS 210 Section | Test Description | Test Limit | Test Condition |
|---|---|---|---|---|
| TRANSMITTER MODE (TX) | | | | |
| 15.247(a)(2) | 5.9.1 | 6dB Bandwidth | > 500kHz | CONDUCTED |
| 15.247(b) | 6.22(o)(a3) | Transmitter Output Power | < 1 Watt | |
| 15.247(d) | 6.2.2(o)(b) | Transmitter Power Spectral Density | < 8dBm / 3kHz | |
| 15.247(c) | 5.9.1<br>6.2.2(o) (e1) | Occupied Band Width<br>Out-of-Band Emissions (Band Width at 20dB below) | Radiated <20dBc. Emissions in restricted bands must meet the radiated limits detailed in 15.209 | |
| 15.205<br>15.209 | 6.2.1<br>6.3 | General Field Strength Limits (Restricted Bands and Radiated Emission Limits) | < FCC 15.209 limits or<br>< RSS-210 table 3 limits<br>Emissions in restricted bands must meet the radiated limits detailed in 15.209 | RADIATED (30MHz-1GHz) (1-25 GHz) |
| 15.207 | 6.6 | AC Conducted Emissions 150kHz – 30MHz | EN55022 | Line Conducted |
| RECEIVER MODE (RX) | | | | |
| 15.207 | 7.4 | AC Conducted Emissions 150kHz – 30MHz | EN55022 | Line Conducted |
| 15.209 | 7.3 | General Field Strength Limits (Restricted Bands and Radiated Emissions Limits) | < FCC 15.209 limits or<br>< RSS-210 table 3 limits | Radiated (30MHz-1GHz) (1-25 GHz |
| RF EXPOSURE (SAR or MPE) | | | | |
| 2.1093/2.1091 | RSS-102 | SAR Test or MPE | 1.6 W/kg or mw/cm² | 3 Channels |

**Table A-1. Summary of Test Results**



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# EXHIBIT A – Test Results (Cont.)

## 6dB Bandwidth Measurement

§15.247(a)(2)

The bandwidth at 6dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – The transmitter shall have a minimum 6dB bandwidth of 500kHz (0.5MHz)

The spectrum analyzer is set to:

| | |
|---|---|
| RBW = | 100 kHz (7dB/div) |
| VBW = | 100 kHz |
| Span = | 40 MHz |
| Ref. Level = | 5 dBm |
| Sweep = | 4.84 ms |

| Frequency (MHz) | Channel No. | Test Results | |
|---|---|---|---|
| | | 6dB Bandwidth (MHz) | Pass/Fail |
| 2412 | 1 | N/A | Previously Certified |
| 2437 | 6 | N/A | Previously Certified |
| 2462 | 11 | N/A | Previously Certified |

– See next pages for actual measured spectrum plots

**Table A-2. Conducted Bandwidth Measurements**

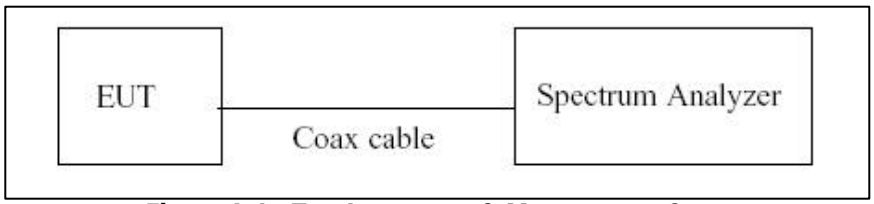


**Figure A-1. Test Instrument & Measurement Setup**



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## EXHIBIT A – Test Results (Cont.)

## Output Power Measurement 802.11B

§15.247(b)

A transmitter antenna terminal of EUT is connected to the input of a RF power sensor. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – The transmitter peak output power shall not exceed 1 watt.

| Frequency (MHz) | Channel No. | Test Results | | |
|---|---|---|---|---|
| | | Power Output (dBm) | Power Output (W) | Pass/Fail |
| 2412 | 1 | 17.30 | .0538 | Pass |
| 2437 | 6 | 17.50 | .0564 | Pass |
| 2462 | 11 | 15.72 | .0372 | Pass |

1See next pages for spectrum plots (Reference Only). Actual data is taken with a peak power meter.
2Max. Peak Power + Attenuation = dBm ⇒ Watts.

**Table A-3. Conducted Output Power Measurements**

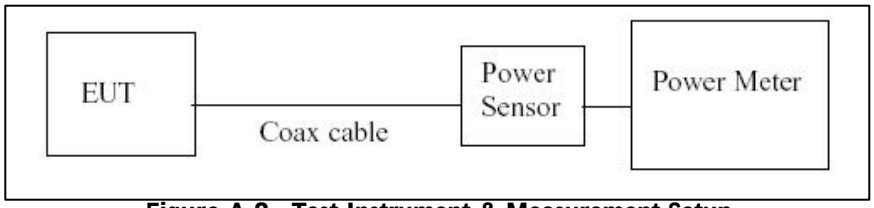


**Figure A-2. Test Instrument & Measurement Setup**



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# EXHIBIT A – Test Results (Cont.)

## Output Power Measurement 802.11G

§15.247(b)

A transmitter antenna terminal of EUT is connected to the input of a RF power sensor. Measurement is made while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – The transmitter peak output power shall not exceed 1 watt.

**Table A-3. Conducted Output Power Measurements**

| Frequency (MHz) | Channel No. | Test Results | | |
|---|---|---|---|---|
| | | Power Output (dBm) | Power Output (W) | Pass/Fail |
| 2412 | 1 | 14.30 | 0.027 | Pass |
| 2437 | 6 | 14.51 | 0.028 | Pass |
| 2462 | 11 | 12.70 | 0.019 | Pass |

3See next pages for spectrum plots (Reference Only). Actual data is taken with a peak power meter.
4Max. Peak Power + Attenuation = dBm ⇒ Watts.

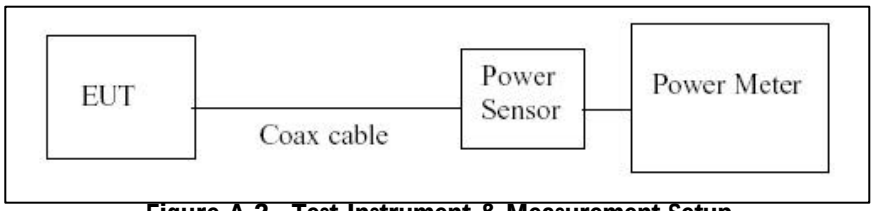


**Figure A-2. Test Instrument & Measurement Setup**



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# EXHIBIT A – Test Results (Cont.)

## Power Spectral Density

§15.247(d)

The peak power density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – The transmitter power density average over 1-second interval shall not be greater than 8dBm in any 3kHz BW.

The spectrum analyzer is set to:

| | |
|---|---|
| RBW = | 3 kHz (7dB/div) |
| VBW = | 3 kHz |
| Span = | 40 MHz |
| Ref. Level = | 8.0 dBm |
| Sweep = | 1000 sec |

**Table A-4. Conducted Power Density Measurements**

| Frequency (MHz) | Channel No. | Test Results | |
|---|---|---|---|
| | | Power Density (MHz) | Pass/Fail |
| 2412 | 1 | N/A | Previously Certified |
| 2437 | 6 | N/A | Previously Certified |
| 2462 | 11 | N/A | Previously Certified |

5See next pages for actual measured spectrum plots
6Peak Power Density + Attenuation = dBm

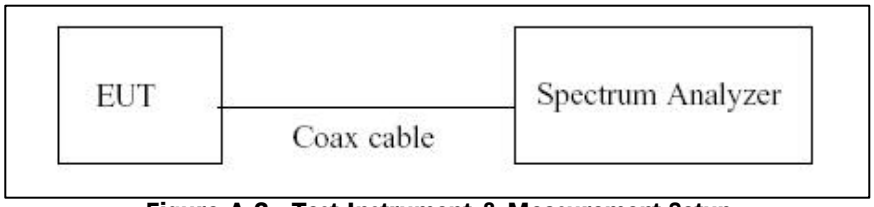


**Figure A-3. Test Instrument & Measurement Setup**



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# EXHIBIT A – Test Results (Cont.)

## Occupied BandEdge /BandEdge at 20dB below, & Out of Band Emissions

§15.247(c)

The bandwidth at 20dB down from the highest in-band spectral density is measured with a spectrum analyzer connected to the antenna terminal while the EUT is operating in transmission mode at the appropriate frequencies.

Minimum Standard – All conducted emission in any 100kHz bandwidth outside of the spread spectrum band must be at least 20dB lower than the highest in-band spectral density.

The spectrum analyzer is set to:

| | |
|---|---|
| RBW = | 100 kHz (7dB/div) |
| VBW = | 100 kHz |
| Span = | 50 MHz |
| Ref. Level = | 1.5 dBm |
| Sweep = | Suitable duration based on the EUT specification |

**Table A-5. Occupied BandEdge & Out of Band Measurements**

| Frequency (MHz) | Channel No. | Test Results | | | |
|---|---|---|---|---|---|
| | | Bandwidth at 20dB below (MHz) | Margin to Lower limit (MHz) | Margin to Lower limit (MHz) | Pass/Fail |
| 2412 | 1 | 2307.00 | 17.00 | 17.00 | Pass |
| 2437 | 6 | 2446.00 | 17.00 | N/A | Pass |
| 2462 | 11 | 2483.90 | 17.00 | 20.00 | Pass |

– See next pages for actual measured spectrum plots

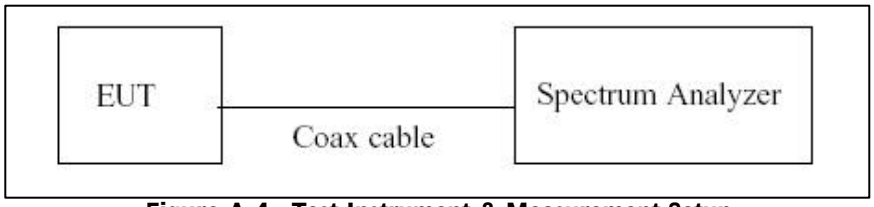


**Figure A-4. Test Instrument & Measurement Setup**



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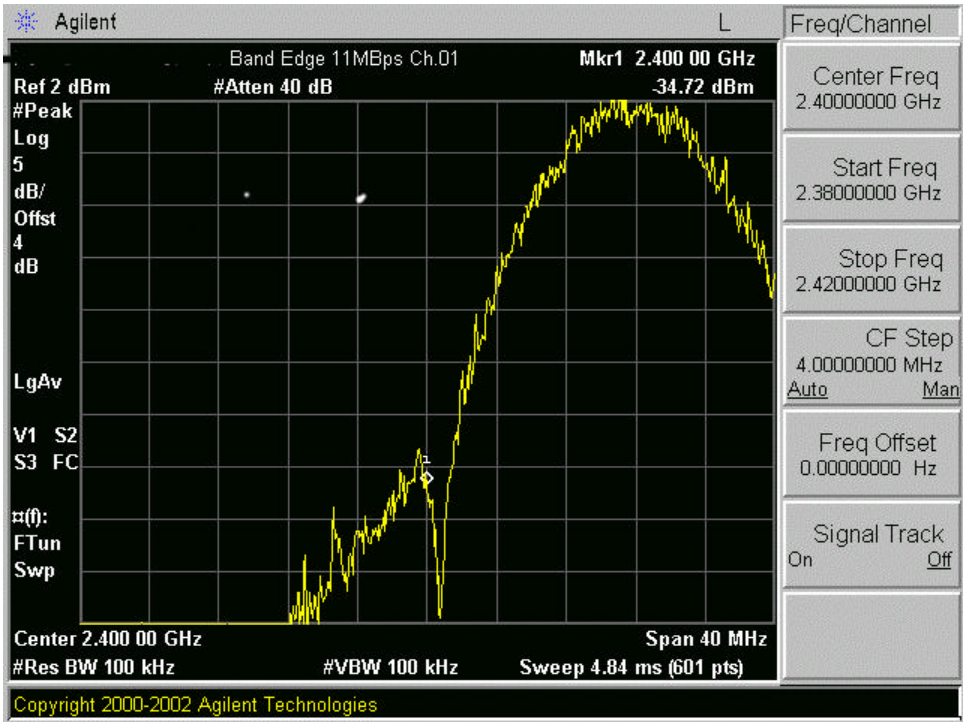
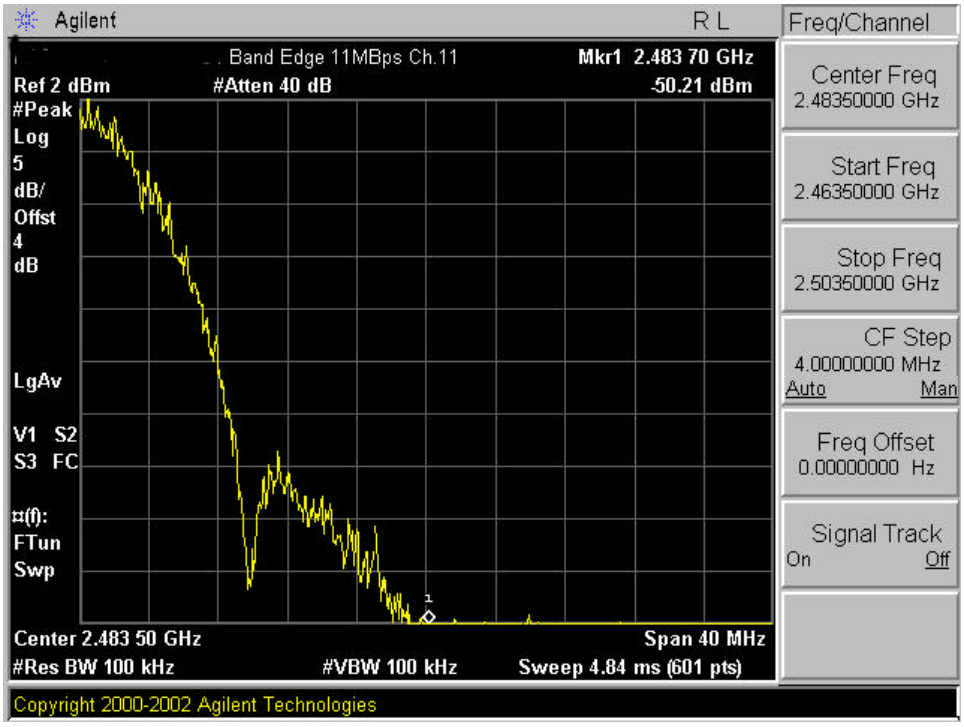
## EXHIBIT A – Test Results (Cont.)

## Occupied BandEdge /BandEdge at 20dB below, & Out of Band Emissions




**Plot A.X Occupied BandEdge 11 Mbps Ch. 01**




**Plot A.X Occupied BandEdge 11 Mbps Ch. 11**



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# EXHIBIT A – Test Results (Cont.)

## Radiated Measurements

§15.247(b) / §15.205 & §15.209

Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Channel: 01

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4824 | -112.0 | 40.4 | V | 35.4 | 58.8 | -18.6 |
| 7236 | -119.5 | 47.4 | V | 34.9 | 55.7 | -19.1 |
| 9648 | -135.0 | 50.3 | V | 22.3 | 13.0 | -31.7 |
| 12060 | -135.0 | 53.7 | V | 25.7 | 19.3 | - 28.3 |

**Table A-6. Peak Radiated Measurements @ 3 meters**

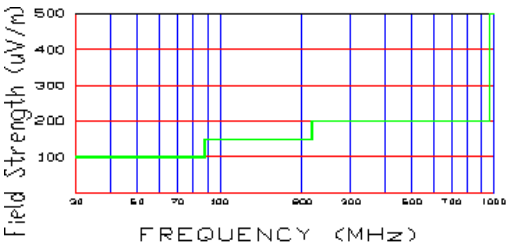


**Figure A-5. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Measurements (Cont.)

§15.247(b) / §15.205 & §15.209

Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Channel: 06

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4874 | -113.4 | 40.5 | V | 34.1 | 50.7 | -19.9 |
| 7311 | -120.5 | 48.0 | V | 34.5 | 53.1 | -19.5 |
| 9748 | -135 | 50.3 | V | 22.3 | 13.0 | -31.7 |
| 12185 | -135.0 | 53.7 | V | 25.7 | 19.3 | - 28.3 |

**Table A-7. Peak Radiated Measurements @ 3 meters**

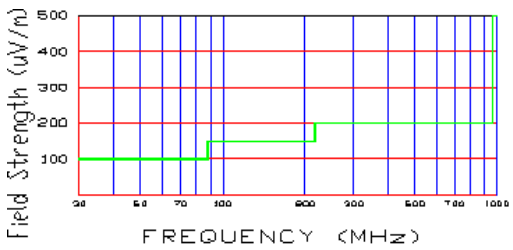


**Figure A-6. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Measurements (Cont.)

§15.247(b) / §15.205 & §15.209

Transfer Rate: 1 Mbps

Distance of Measurements: 3 Meters

Channel: 11

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4924 | -112.5 | 40.7 | V | 35.2 | 57.5 | -18.8 |
| 7386 | -120.9 | 48.2 | V | 34.3 | 51.9 | -19.7 |
| 9848 | -135.0 | 50.4 | V | 22.4 | 13.2 | -31.6 |
| 12310 | -135.0 | 53.8 | V | 25.8 | 19.5 | - 28.2 |

**Table A-8. Peak Radiated Measurements @ 3 meters**

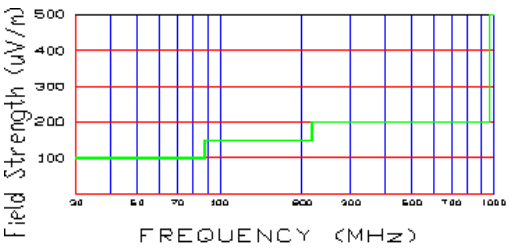


**Figure A-7. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Measurements (Cont.)

§15.247(b) / §15.205 & §15.209

Transfer Rate: 36 Mbps

Distance of Measurements: 3 Meters

Channel: 01

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4824 | -110.5 | 40.4 | V | 32.4 | 41.6 | -21.6 |
| 7236 | -126.2 | 47.4 | V | 28.2 | 25.8 | -25. 8 |
| 9648 | -135.0 | 50.3 | V | 22.3 | 13.0 | -31.7 |
| 12060 | -135.0 | 53.7 | V | 25.7 | 19.3 | - 28.3 |

**Table A-9. Peak Radiated Measurements @ 3 meters**

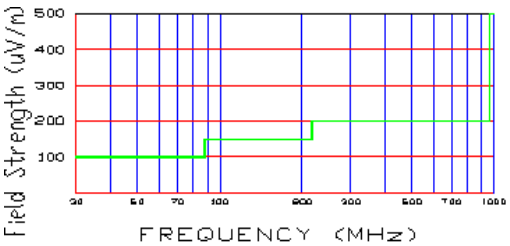


**Figure A-8. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Measurements (Cont.)

§15.247(b) / §15.205 & §15.209

Transfer Rate: 36 Mbps

Distance of Measurements: 3 Meters

Channel: 06

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4874 | -113.9 | 40.5 | V | 33.6 | 47.9 | -20.4 |
| 7311 | -124.5 | 48.0 | V | 30.5 | 33.5 | -23.5 |
| 9748 | -135.0 | 50.3 | V | 22.3 | 13.0 | -31.7 |
| 12185 | -135.0 | 53.7 | V | 25.7 | 19.27 | - 28.3 |

**Table A-10. Peak Radiated Measurements @ 3 meters**

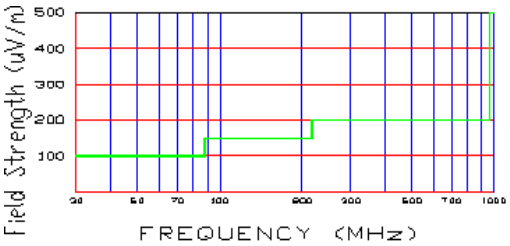


**Figure A-9. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Measurements (Cont.)

§15.247(b) / §15.205 & §15.209

Transfer Rate: 36 Mbps

Distance of Measurements: 3 Meters

Channel: 11

| Frequency (MHz) | Level (dBm) | AFCL (dB) | POL (H/V) | F/S (dBmV/m) | F/S (mV/m) | Margin (dB) |
|---|---|---|---|---|---|---|
| 4924 | -115.0 | 40.7 | V | 32.7 | 43.2 | -21.3 |
| 7386 | -123.1 | 48.2 | V | 32.1 | 40.3 | -21.9 |
| 9848 | -135.0 | 50.4 | V | 22.4 | 13.2 | -31.6 |
| 12310 | -135.0 | 53.8 | V | 25.8 | 19.5 | - 28.2 |

**Table A-11. Peak Radiated Measurements @ 3 meters**

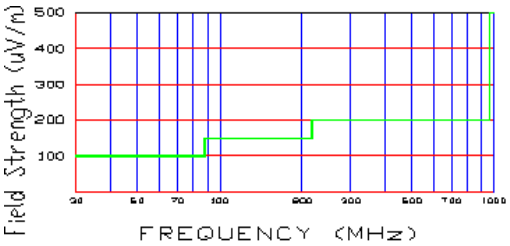


**Figure A-10. Radiated limits at 3 meters.**

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table G-1. (Note: * = Restricted Band measured frequency)

2. All harmonics/spurs are at least 20 dB below the highest emission in the authorized band using RBW = 100kHz

3. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

4. The peak emissions above 1 GHz are not more than 20 dB above the average limit.

5. The antenna is manipulated through typical positions, polarity and length during the tests.

6. The EUT is supplied with nominal AC voltage or/and a new/fully-recharged battery.

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported.

8. < - 135 dBm are below the analyzer floor level.

9. Above 1 GHz, the limit is 500 µV/m (54dBµ/m) at 3 meters radiated.



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## EXHIBIT A – Test Results (Cont.)

## Radiated Spurious Measurements

§15.205 / §15.209

Distance of Measurements: 3 Meters

| FREQ (MHz) | Level (dBm) | AFCL (dB/m) | POL (H/V) | Height (m) | Azimuth (° angle) | F/S (uV/M) | Margin (dB) |
|---|---|---|---|---|---|---|---|
| 24.9 | -82.5 | 4.0 | H | 2.8 | 30 | 26.7 | -7.2 |
| 153.6 | -84.6 | 13.9 | H | 2.5 | 190 | 65.3 | -6.1 |
| 175.5 | -84.5 | 13.5 | V | 2.3 | 190 | 63.3 | -8.5 |
| 187.5 | -86.9 | 15.9 | H | 1.6 | 170 | 63.2 | -6.5 |
| 434.6 | -94.8 | 24.5 | V | 1.3 | 180 | 68.4 | -5.2 |
| 473.0 | -97.4 | 25.5 | H | 1.1 | 200 | 56.7 | -3.8 |

**Table A-18. Radiated Measurements at 3-meters**

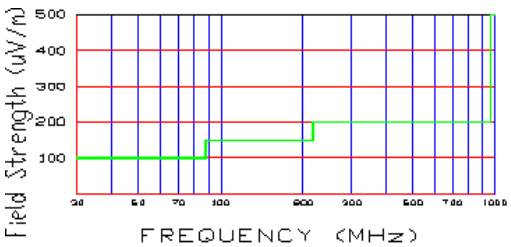


**Figure A-17. Radiated limits at 3 meters**

NOTES:

1. All emissions were investigated and the worst-case emissions are reported.

2. For hand-held devices, the EUT is rotated through three orthogonal axes to determine which configuration produces the maximum emissions.

3. The EUT is supplied with the minimal AC voltage or/and a new/fully re-charged battery.

4. The EUT was tested up to the 10th harmonic (25GHz) and no significant emission was found.

5. Above 1 GHz the limit is 500µV/m at 3 meters radiated.



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# EXHIBIT A – Test Results (Cont.)

## Radiated Restricted Band Measurements

§15.205 / §15.209

Special attention is made for the EUT's harmonic and spurious radiated emission in the restricted bands of operations. The EUT was tested from 9kHz and up to the tenth harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHZ. Above 1 GHz, average measurement was used, using RBW 1MHz – VBW 10Hz and linearly polarized horn antennas. All harmonics/spurs are at least 20dB below the highest emission in the authorized band using RBW = 100kHz. In addition, peak measurements were taken to ensure that the peak levels are not more than 20dB above the average limit. All out of band emissions, other than those created by the spreading sequence, data sequence, and the carrier modulation must not exceed the limits show in Table G-1 per Section 15.209.

| Frequency | F/S (mV/m) | Measured Distance (Meters) |
|---|---|---|
| 0.009 – 0.490 MHz | 2400/F (kHz) | 300 |
| 0.490 – 1.705 MHz | 24000/F (kHz) | 30 |
| 1.705 – 30.00 MHz | 30 | 30 |
| 30.00 – 88.00 MHz | 100 | 3 |
| 88.00 – 216.0 MHz | 150 | 3 |
| 216.0 – 960.0 MHz | 200 | 3 |
| Above 960.0 MHz | 500 | 3 |

**Table A-19. Restricted Band Limits**

### TEST MEASUREMENT EQUIPMENT

| | |
|---|---|
| Agilent E4448A | PSA Spectrum Analyzer 3 Hz - 50GHz |
| HP 8566B | Spectrum Analyzer 100Hz – 22GHz |
| HP 83017A | Microwave Analyzer 40dB Gain (0.5 – 26.5GHz) |
| HP 3784A | Digital Transmission Analyzer |
| EMCO 3115 | Horn Antenna (1 – 18GHz) |
| HP 8495A | 20dB Attenuator (DC-40GHz) 0 –70dB |
| HP 8493B | 10dB Attenuator |
| MicroCoax Cables | Low Loss Microwave Cables (1 – 26.5GHz) |
| CDI Dipoles | Dipole Antennas (30 – 1000MHz) |
| EMCO 3116 | Horn Antenna (18 – 40GHz) |



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## EXHIBIT A – Test Results (Cont.)

## Radiated Restricted Band Measurements (Cont.)

§15.205 /§15.209 courtesy

Operating Frequency: 2462 MHz

Distance of Measurements: 3 Meters

| FREQ (MHz) | Level (dBm) | AFCL (dB/m) | POL (H/V) | F/S (dBµV/m) | F/S (uV/M) | Margin (dB) |
|---|---|---|---|---|---|---|
| 2483.9 | -101.3 | 33.0 | V | 38.7 | 86.1 | -15.3 |
| 2484.5 | -98.5 | 33.0 | V | 41.5 | 118.9 | -12.5 |
| 2484.4 | -96.4 | 33.1 | V | 43.7 | 153.1 | -10.3 |
| 2485.3 | -99.0 | 33.1 | V | 41.1 | 113.5 | -12.9 |
| 2493.0 | -101.2 | 33.2 | V | 39.0 | 89.1 | -15.0 |
| 2496.0 | -119.5 | 33.2 | V | 20.7 | 10.8 | -33.3 |

**Table A-20. Radiated Restricted Band Measurements at 3-meters**

NOTES:

1. The antenna is manipulated through typical positions, polarity and length during the testing.

2. The EUT is supplied with the minimal AC voltage or/and a new/fully re-charged battery.

3. The spectrum is measured from 9kHz up to the 10th harmonic and the worst-case emissions are reported.

4. The conducted limits are shown on Figure A-14. Above 1 GHz the limit is 500µV/m.

5. < -135 dBm is below the analyzer measurement floor level.

6. Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz



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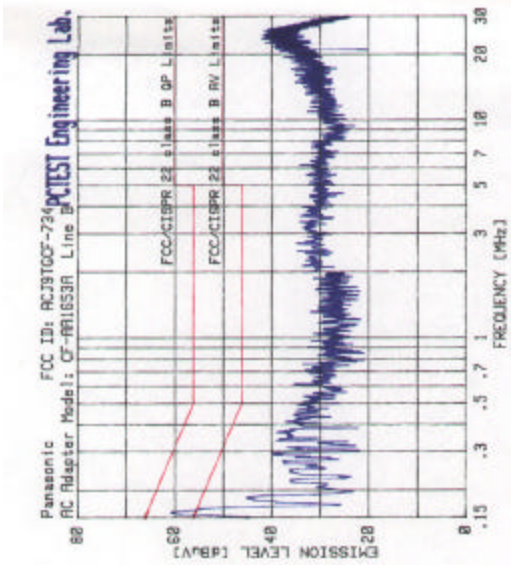
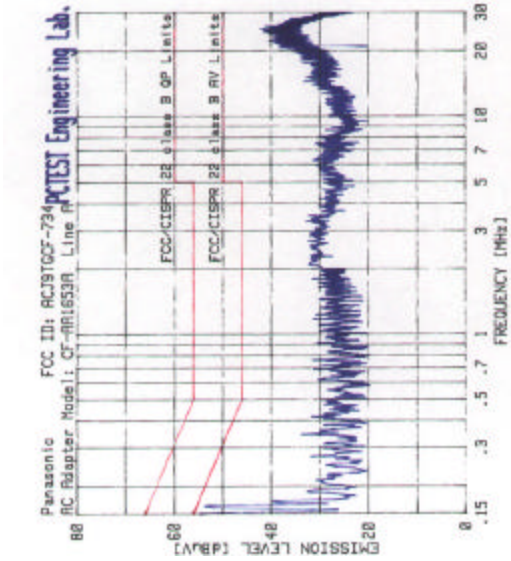
## EXHIBIT A – Test Results (Cont.)

## Line-Conducted Test Data

§15.207




| No. | Freq. [MHz] | Quasi-Pk [dBuV] | Limit [dBuV] | Margin [dB] | Average [dBuV] | Limit [dBuV] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1 | .158 | 52.85 | 65.98 | -13.13 | 28.26 | 55.00 | -27.74 |
| 2 | 23.602 | 34.81 | 60.00 | -25.19 | 22.27 | 50.00 | -27.73 |
| 3 | 23.822 | 34.67 | 60.00 | -25.33 | 22.46 | 50.00 | -27.54 |
| 4 | 24.661 | 33.93 | 60.00 | -26.07 | 22.59 | 50.00 | -27.41 |
| 5 | 25.589 | 32.56 | 60.00 | -27.44 | 22.88 | 50.00 | -27.12 |
| 6 | 24.258 | 35.19 | 60.00 | -24.81 | 22.31 | 50.00 | -27.69 |
| 7 | 24.786 | 35.17 | 60.00 | -24.83 | 22.56 | 50.00 | -27.44 |
| 8 | 22.715 | 32.36 | 60.00 | -27.64 | 21.66 | 50.00 | -28.34 |
| 9 | 24.122 | 34.13 | 60.00 | -25.87 | 22.77 | 50.00 | -27.23 |
| 10 | 23.859 | 31.93 | 60.00 | -28.07 | 23.43 | 50.00 | -26.57 |




| No. | Freq. [MHz] | Quasi-Pk [dBuV] | Limit [dBuV] | Margin [dB] | Average [dBuV] | Limit [dBuV] | Margin [dB] |
|---|---|---|---|---|---|---|---|
| 1 | .158 | 47.00 | 65.98 | -18.98 | 24.94 | 56.00 | -31.06 |
| 2 | .158 | 46.79 | 65.98 | -19.19 | 24.45 | 55.84 | -31.39 |
| 3 | 25.372 | 34.03 | 60.00 | -25.97 | 24.32 | 50.00 | -25.68 |
| 4 | 24.549 | 34.58 | 60.00 | -25.42 | 24.70 | 50.00 | -25.30 |
| 5 | 24.862 | 37.23 | 60.00 | -22.77 | 24.72 | 50.00 | -25.28 |
| 6 | 24.553 | 33.80 | 60.00 | -26.20 | 24.73 | 50.00 | -25.27 |
| 7 | 26.087 | 30.87 | 60.00 | -29.13 | 23.47 | 50.00 | -26.53 |
| 8 | 24.345 | 33.80 | 60.00 | -26.20 | 24.44 | 50.00 | -25.56 |
| 9 | 22.302 | 31.24 | 60.00 | -28.76 | 21.58 | 50.00 | -28.42 |
| 10 | 25.168 | 33.48 | 60.00 | -26.52 | 24.10 | 50.00 | -25.90 |

Notes:

1. All Modes of operation were investigated and the worst-case emissions are reported.
2. The limit for Class B device(s) from 150kHz to 30MHz are Specified in EN55022.
3. Line A = Phase; Line B = Neutral
4. Deviations to the Specifications: *None*.



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# EXHIBIT B – Labeling Requirements

## Sample Label & Location

New Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The sample label shown below shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the trade name, FCC ID, and the FCC logo must be displayed on the device per Section 15.19 (b)(2).

FCC ID: ACJ9TGCF-734

This device complies with Part 15 of the FCC Rules.
Operation is subject to the following two conditions.
(1) this device may not cause harmful interference, and
(2) this device must accept any interference received,
including interference that may cause undesired operation.



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## EXHIBIT B – Labeling Requirements (Cont.)

## Sample Label & Location

**FCC ID Label**

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# EXHIBIT C – Block Diagram/Schematics



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# EXHIBIT D – Parts List



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# EXHIBIT E – Operational Description



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# EXHIBIT F – Test Setup Photographs

The Line-Conducted and Radiated Test Pictures show the worst-case configuration and cable placement with a minimum margin to the specifications.



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# EXHIBIT G – EUT External/Internal Photographs



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# EXHIBIT H – User's Manual



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# EXHIBIT I – SAR MEASUREMENT REPORT



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