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: November 26-27, 2004
Test Report S/N: 15.241126670.ACJ
Test Site: PCTEST Lab, Columbia, MD
Project No.: ITPD-04-F131A

FCC ID:	**ACJ9TGCF-29BA**
APPLICANT:	**Matsushita Electric Industrial Co. Ltd.**

SUMMARY:

Model No.:	CF-29
Equipment EUT Type:	Notebook PC w/ Intel WLAN
Max. Output Power:	18.85 dBm Peak Conducted (b) 23.67 dBm Peak Conducted (g) 20.14 dBm Peak Conducted (a)
Frequency Range:	2412 - 2462 MHz (DSSS/OFDM) 5745 – 5825 MHz (OFDM)
FCC Classification:	Digital Transmission System (DTS)
FCC Rule Part(s):	Parts 15.247; ANSI C-63.4-2001
Test Device Serial No.:	S/N: 4DKSA00060

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.

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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Attestation Statements

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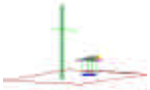
MEASUREMENT REPORT



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-29
FCC ID	ACJ9TGCF-29BA
Test Device Serial No.:	S/N: 4DKSA00060 ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION	Digital Transmission System (DTS)
DATE(S) OF TEST	November 26-27, 2004
TESTS REPORT S/N:	15.241126670.ACJ
PROJECT NO.:	ITPD-04-F131A

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.**

Deviation from measurement procedure……..NONE

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).

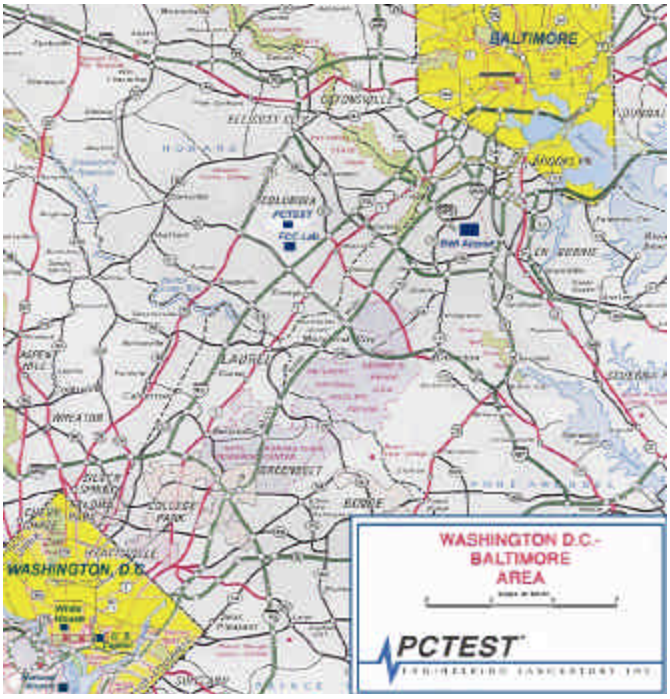

Figure 1.3-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

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 CF-29.*** The EUT consisted of the following components(s):

Table 2-1. EUT Equipment Description

Manufacturer / Model / Description	Serial Number
Panasonic Notebook PC w/ WLAN, CDMA & Bluetooth	4DKSA00060

2.2 Enclosure

The EUT incorporates the following enclosure:

- none

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

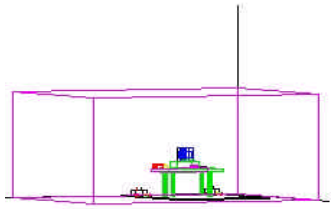

Figure 3.1-1. Shielded Enclosure Line-Conducted Test Facility

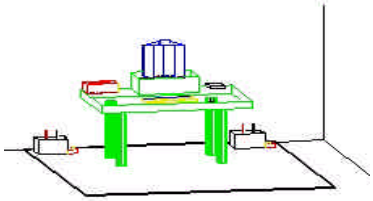

Figure 3.1-2. Line Conducted Emission Test Set-Up

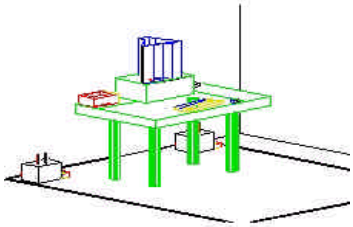

Figure 3.1-3. Wooden Table & Bonded LISNs

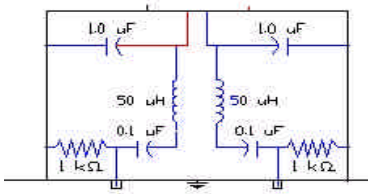

Figure 3.1-4. LISN Schematic Diagram

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

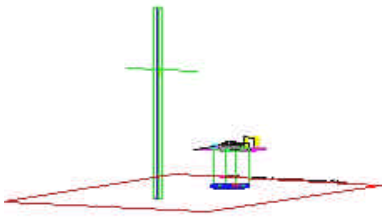

Figure 3.2-1. Meter Test Site

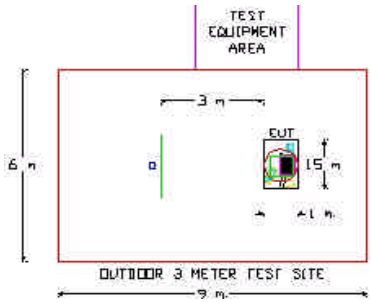

Figure 3.2-2. Dimensions of Outdoor Test Site

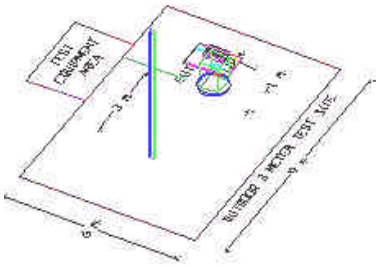

Figure 3.2-3. Turntable and System Setup

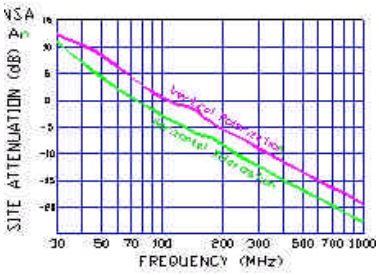

Figure 3.2-4. Normalized Site Attenuation Curves (H&V)

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** for stand alone operation

There are provisions for connection to an external antenna. Please refer to Panasonic's application cover letter for details.

Conclusion:

The **Panasonic CF-29** 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		

Ch.	Frequency (MHz)	Ch.	Frequency (MHz)
-	:	157	5785
-	:	-	:
-	:	-	:
-	:	-	:
-	:	-	:
149	5745	165	5825

4.1 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 E4448A (100Hz–50GHz)	12/05/04	Annual	3638A08713
Microwave Spectrum Analyzer	HP 8566 (100Hz-22GHz)	04/17/05	Annual	2542A11898
Spectrum Analyzer/Tracking Generator	HP 8591A (9kHz-1.8GHz)	06/02/05	Annual	3144A02458
Spectrum Analyzer	HP 8591A (9kHz-1.8GHz)	10/15/05	Annual	3108A02053
Spectrum Analyzer	HP 8594A (9kHz-2.9GHz)	11/02/05	Annual	3051A00187
Signal Generator	HP 8650B (500Hz-1GHz)	06/02/05	Annual	2232A19558
Signal Generator	HP 8640B (500Hz-1GHz)	06/02/05	Annual	1851A09816
Signal Generator	Rohde & Schwarz (0.1-1GHz)	09/22/05	Annual	894215/012
Ailtech/Eaton Receiver	NM 37/57A-SL (30MHz-1GHz)	04/12/05	Annual	0792-03271
Ailtech/Eaton Receiver	NM 37/57A (30MHz-1GHz)	03/11/05	Annual	0805-03334
Ailtech/Eaton Receiver	NM 17/27A (0.1-32MHz)	09/17/05	Annual	0608-03241
Quasi-Peak Adapter	HP 85650A	08/09/05	Annual	2043A00301
Ailtech/Eaton Adapter	CCA-7 CISPR/ANSI QP Adapter	03/11/05	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
Anritsu Power Meter	ML2487A	04/05/05	2 Years	6K00001785
Anritsu Wide Band Sensor	MA2491A	04/05/05	2 Years	31193
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):	November 26-27, 2004
Test Engineer:	Steve Liu
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 (A/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 6.2.2(o) (e1)	Occupied Band Width 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 15.209	6.2.1 6.3	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	< FCC 15.209 limits or < RSS-210 table 3 limits 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 < 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 – 802.11b

§15.247(a)(2)

The bandwidth at 6 dB 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 (5dB/div)
VBW = 100 kHz
Span = 40 MHz
Sweep = 4.857 ms

Frequency (MHz)	Channel No.	Test Results	
		6dB Bandwidth (MHz)	Pass/Fail
2412	1	9.98	Pass
2437	6	9.98	Pass
2462	11	9.98	Pass

– See next pages for actual measured spectrum plots

Table A-2. Conducted Bandwidth Measurements

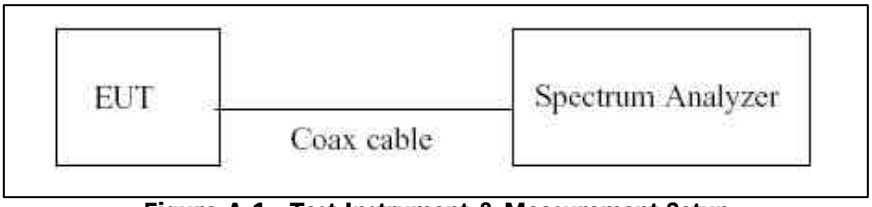

Figure A-1. Test Instrument & Measurement Setup

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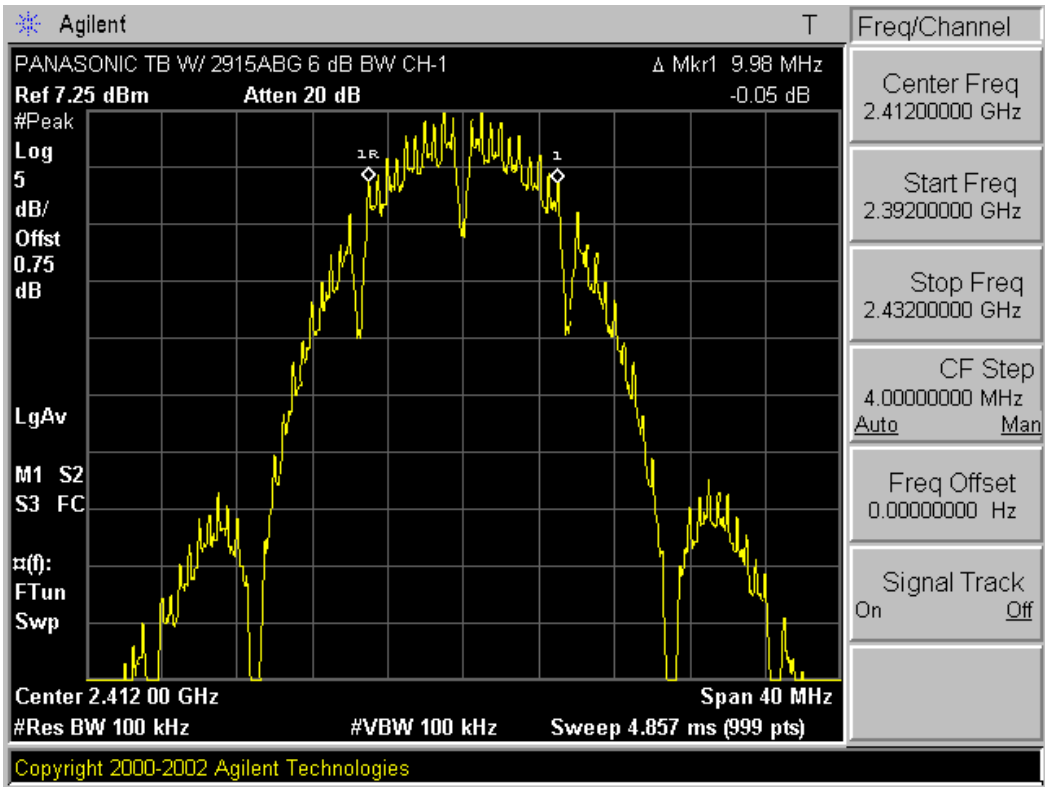

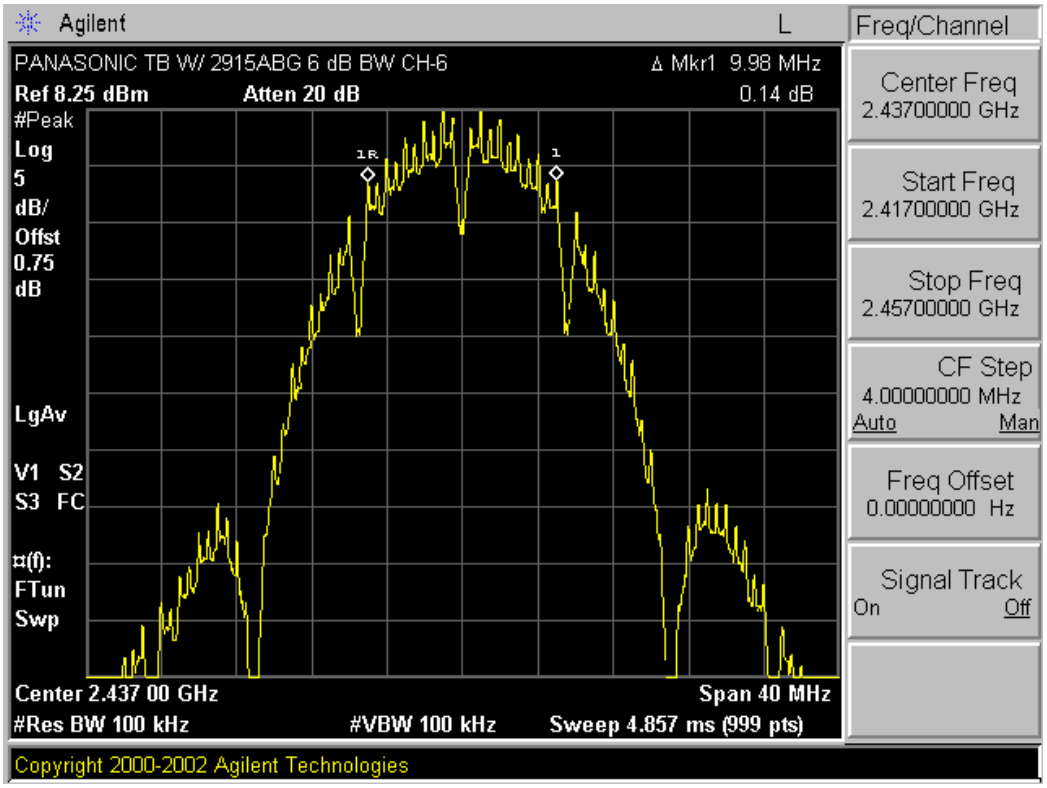

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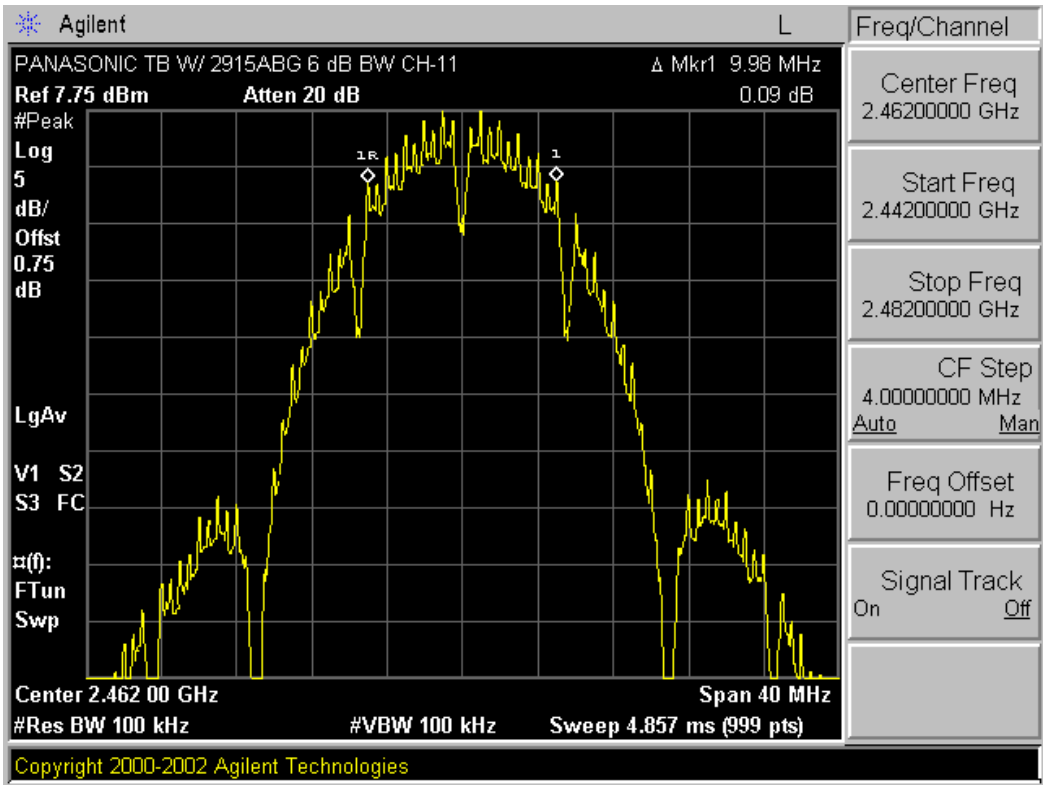

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EXHIBIT A – Test Results (Cont.)

6dB Bandwidth Measurement – 802.11g

§15.247(a)(2)

The bandwidth at 6 dB 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 (5dB/div)
VBW =	100 kHz
Span =	20 MHz
Sweep =	2.462 ms

Frequency (MHz)	Channel No.	Test Results	
		6dB Bandwidth (MHz)	Pass/Fail
2412	1	16.27	Pass
2437	6	16.27	Pass
2462	11	15.15	Pass

– See next pages for actual measured spectrum plots

Table A-2. Conducted Bandwidth Measurements

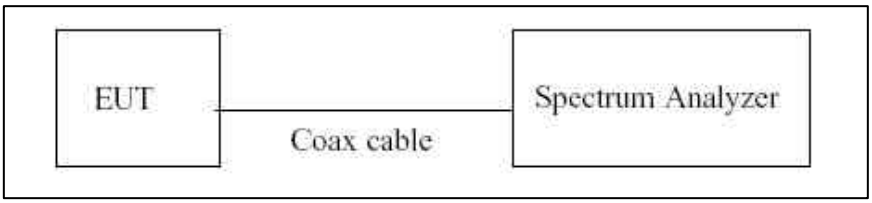

Figure A-1. Test Instrument & Measurement Setup

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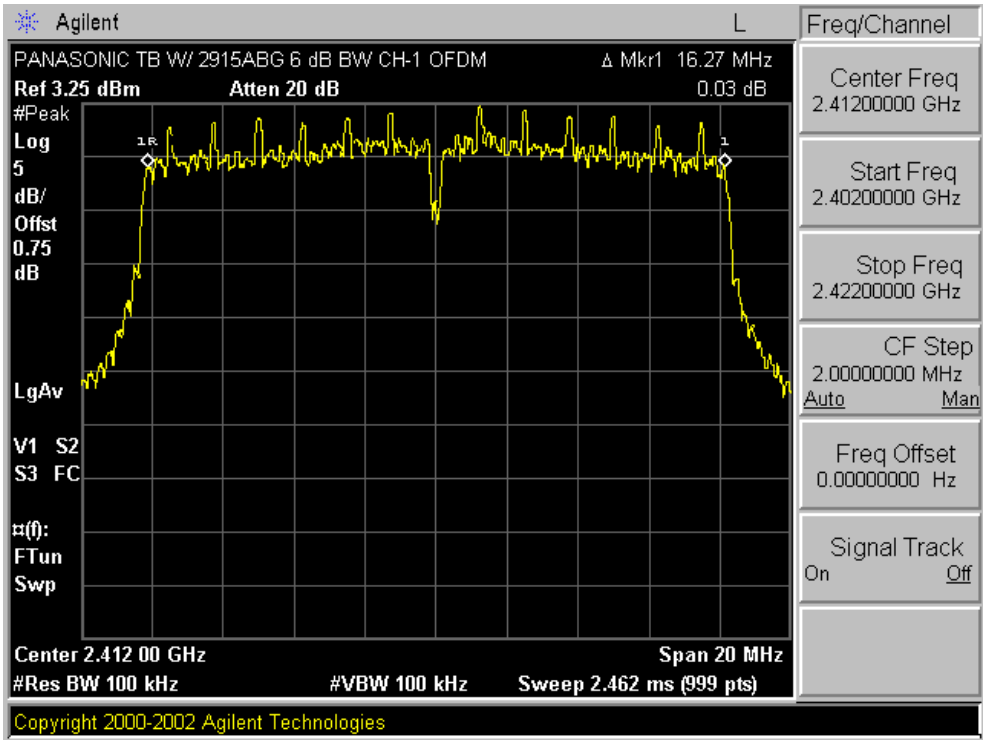

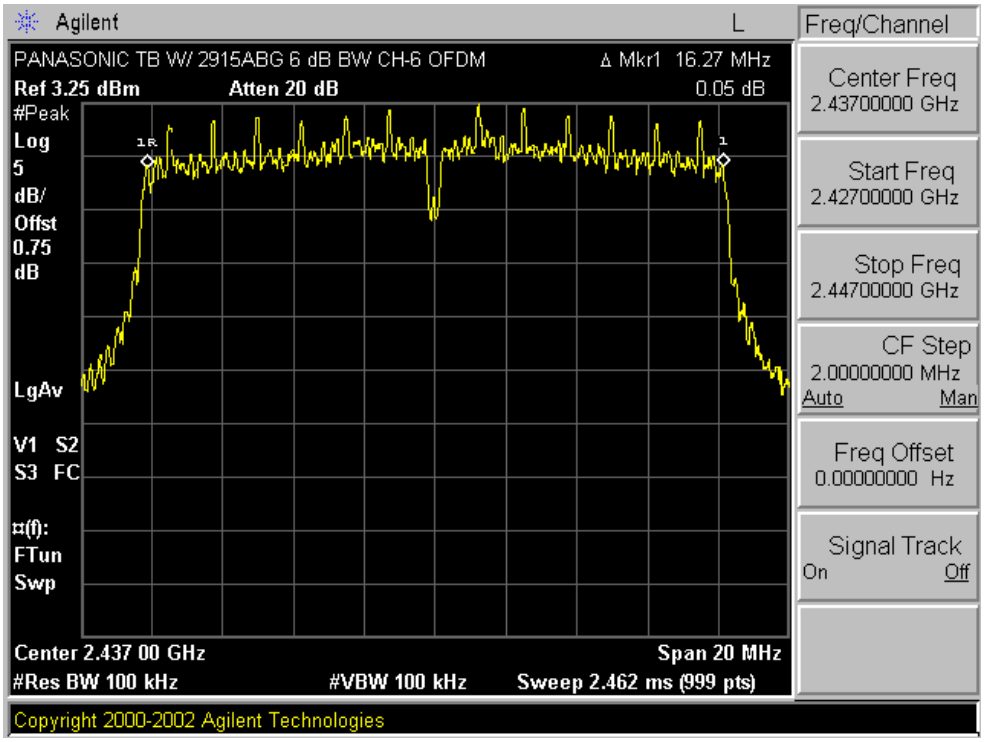

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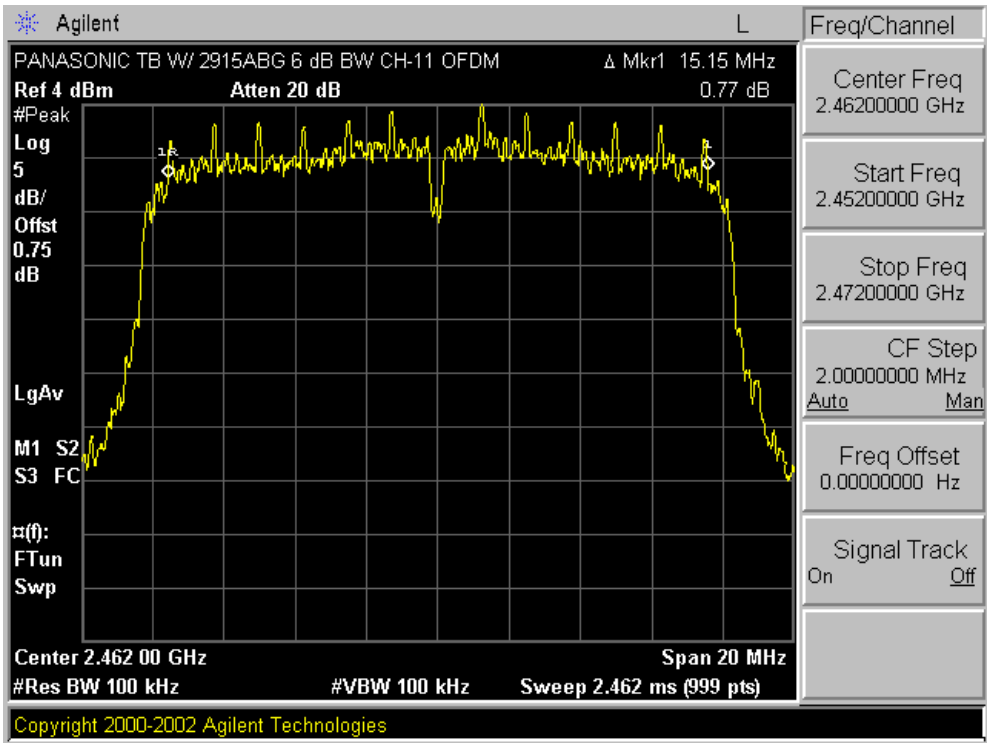

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EXHIBIT A – Test Results (Cont.)

6dB Bandwidth Measurement – 802.11a (5.8 GHz)

§15.247(a)(2)

The bandwidth at 6 dB 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 (5dB/div)
VBW = 100 kHz
Span = 20 MHz
Sweep = 2.44 ms

Frequency (MHz)	Channel No.	Test Results	
		6dB Bandwidth (MHz)	Pass/Fail
5745	149	16.40	Pass
5785	157	16.37	Pass
5825	165	16.37	Pass

– See next pages for actual measured spectrum plots

Table A-2. Conducted Bandwidth Measurements

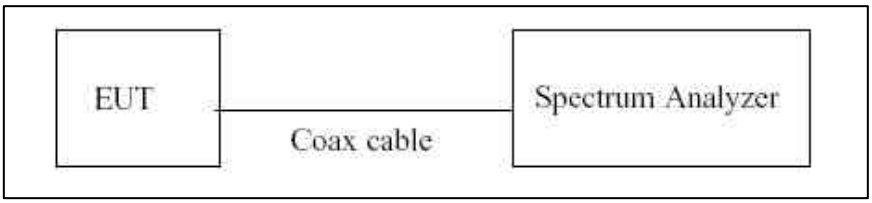

Figure A-1. Test Instrument & Measurement Setup

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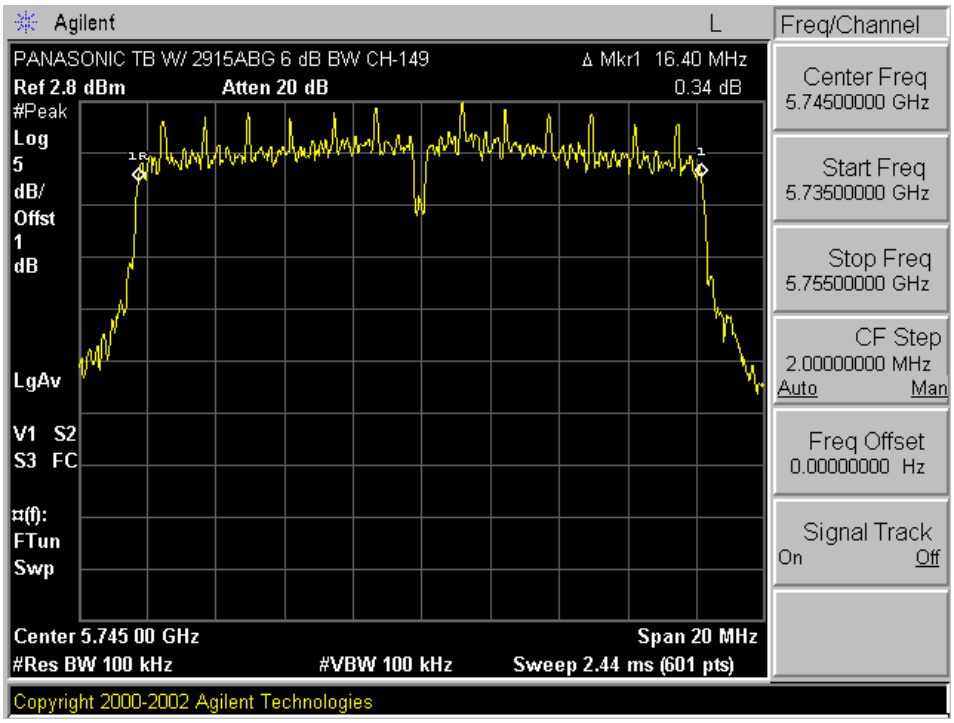

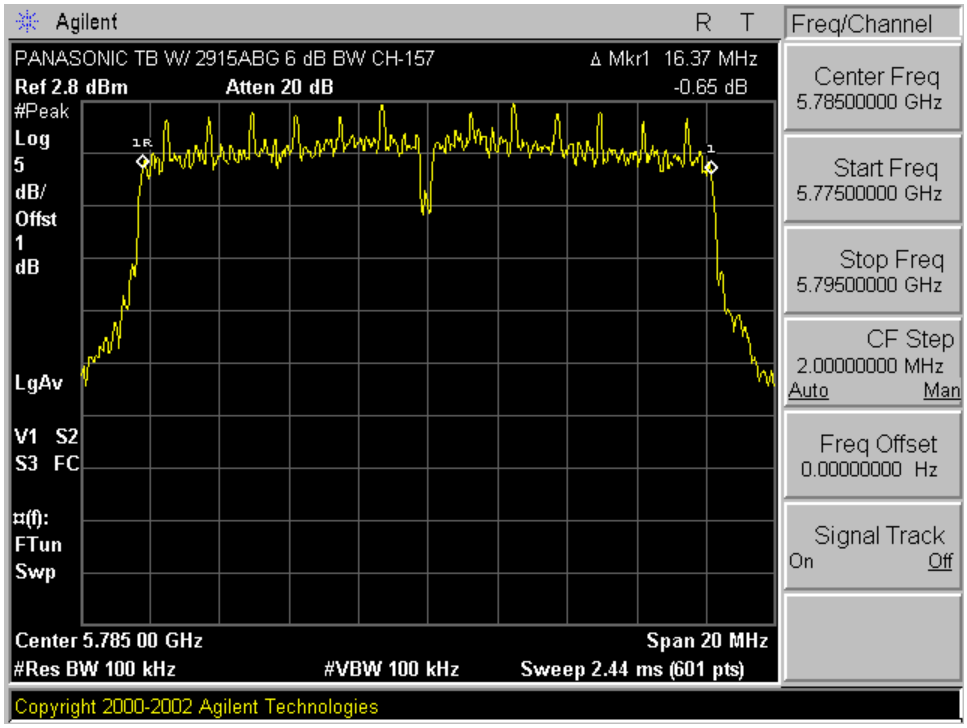

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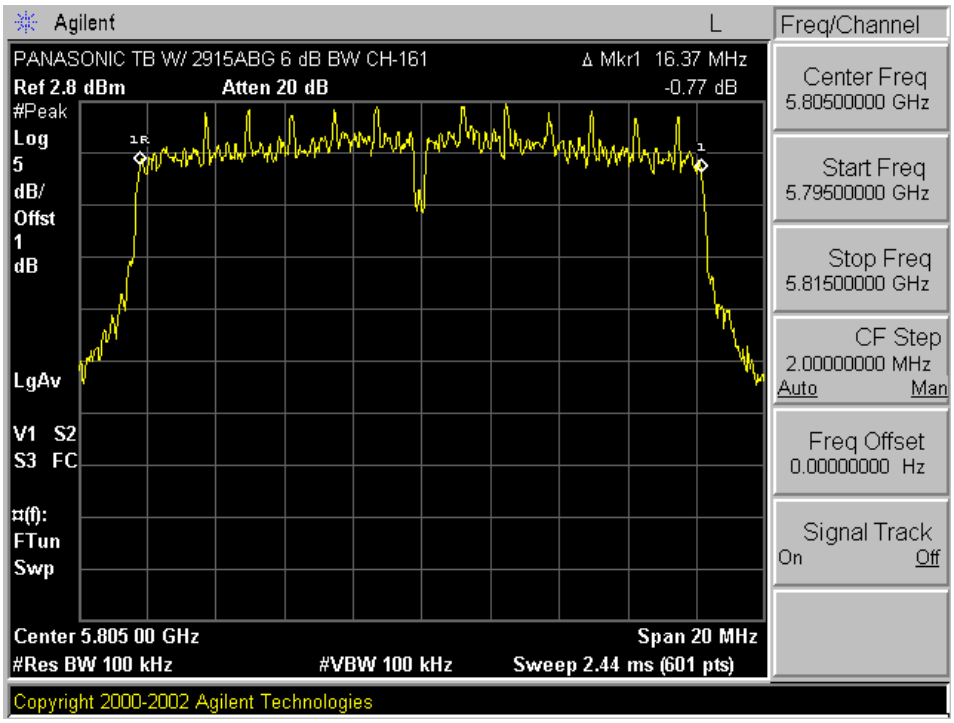

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EXHIBIT A – Test Results (Cont.)

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.

Freq (MHz)	Chan	Rate (MBps)	Measured Power (dBm)	Cable Loss (dB)	Average Power (dBm)	Peak Power (dBm)
2412	1	1	15.15	0.75	15.90	18.25
		2	15.10	0.75	15.85	18.20
		5.5	15.09	0.75	15.84	18.19
		11	15.75	0.75	16.50	**18.85**
2437	6	1	15.24	0.75	15.99	18.14
		2	15.46	0.75	16.21	18.36
		5.5	15.38	0.75	16.13	18.28
		11	15.75	0.75	16.50	18.65
2462	11	1	15.26	0.75	16.01	18.11
		2	15.41	0.75	16.16	18.26
		5.5	15.39	0.75	16.14	18.24
		11	15.16	0.75	15.91	18.01

Table A-3. Conducted Output Power Measurements

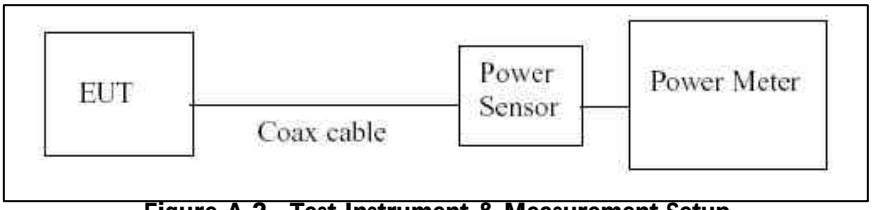

Figure A-2. Test Instrument & Measurement Setup

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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.

Freq (MHz)	Chan	Rate (MBps)	Measured Power (dBm)	Cable Loss (dB)	Average Power (dBm)	Peak Power (dBm)
2412	1	6	13.97	0.75	14.72	23.32
		9	13.58	0.75	14.33	22.93
		12	13.59	0.75	14.34	22.94
		18	13.49	0.75	14.24	22.84
		24	13.70	0.75	14.45	23.05
		36	13.64	0.75	14.39	22.99
		48	13.47	0.75	14.22	22.82
		54	13.44	0.75	14.19	22.79
2437	6	6	13.95	0.75	14.70	23.20
		9	14.42	0.75	15.17	**23.67**
		12	13.62	0.75	14.37	22.87
		18	14.34	0.75	15.09	23.59
		24	13.71	0.75	14.46	22.96
		36	13.65	0.75	14.40	22.90
		48	13.50	0.75	14.25	22.75
		54	13.46	0.75	14.21	22.71
2462	11	6	14.35	0.75	15.10	23.65
		9	14.10	0.75	14.85	23.40
		12	14.00	0.75	14.75	23.30
		18	14.11	0.75	14.86	23.41
		24	14.24	0.75	14.99	23.54
		36	14.12	0.75	14.87	23.42
		48	14.02	0.75	14.77	23.32
		54	13.95	0.75	14.70	23.25

Table A-4. Conducted Output Power Measurements

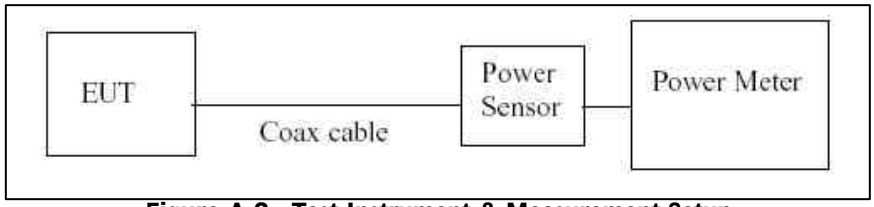

Figure A-3. Test Instrument & Measurement Setup

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EXHIBIT A – Test Results (Cont.)

Output Power Measurement 802.11a (5.8 GHz)

§15.247(b)(1)

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.

Freq (MHz)	Chan	Rate (MBps)	Measured Avg. Power (dBm)	Cable Loss (dB)	Average Power (dBm)	Peak Power (dBm)
5745	149	6	12.67	1	13.67	19.47
		9	12.68	1	13.68	19.48
		12	12.63	1	13.63	19.43
		18	12.60	1	13.60	19.40
		24	12.52	1	13.52	19.32
		36	11.57	1	12.57	18.37
		48	11.54	1	12.54	18.34
		54	9.61	1	10.61	16.41
5785	157	6	12.65	1	13.65	19.70
		9	13.08	1	14.08	20.13
		12	13.03	1	14.03	20.08
		18	12.98	1	13.98	20.03
		24	12.90	1	13.90	19.95
		36	11.67	1	12.67	18.72
		48	11.59	1	12.59	18.64
		54	9.68	1	10.68	16.73
5855	165	6	13.09	1	14.09	**20.14**
		9	13.00	1	14.00	20.10
		12	13.04	1	14.04	20.14
		18	12.94	1	13.94	20.04
		24	12.89	1	13.89	19.99
		36	11.67	1	12.67	18.77
		48	11.60	1	12.60	18.70
		54	9.74	1	10.74	16.84

Table A-4. Conducted Output Power Measurements

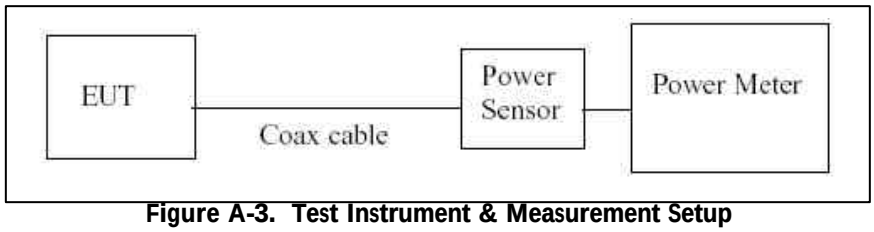

Figure A-3. Test Instrument & Measurement Setup

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EXHIBIT A – Test Results (Cont.)

Power Spectral Density (802.11a/b/g)

§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 =	3 MHz
Sweep =	1000 sec

Table A-7. Conducted Power Density Measurements

Frequency (MHz)	Channel No.	Mode	Test Results	
			Power Density (dBm)	Pass/Fail
2412	1	B	-8.40 dBm	Pass
2437	6	B	-7.42 dBm	Pass
2462	11	B	-7.82 dBm	Pass
2412	1	G	-10.63 dBm	Pass
2437	6	G	-11.60 dBm	Pass
2462	11	G	-11.09 dBm	Pass
5745	149	A	-11.03 dBm	Pass
5785	157	A	-10.92 dBm	Pass
5825	165	A	-12.71 dBm	Pass

1See next pages for actual measured spectrum plots
2Peak Power Density + Attenuation = dBm

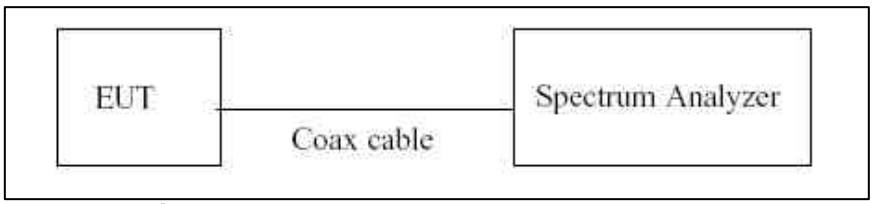

Figure A-6. Test Instrument & Measurement Setup

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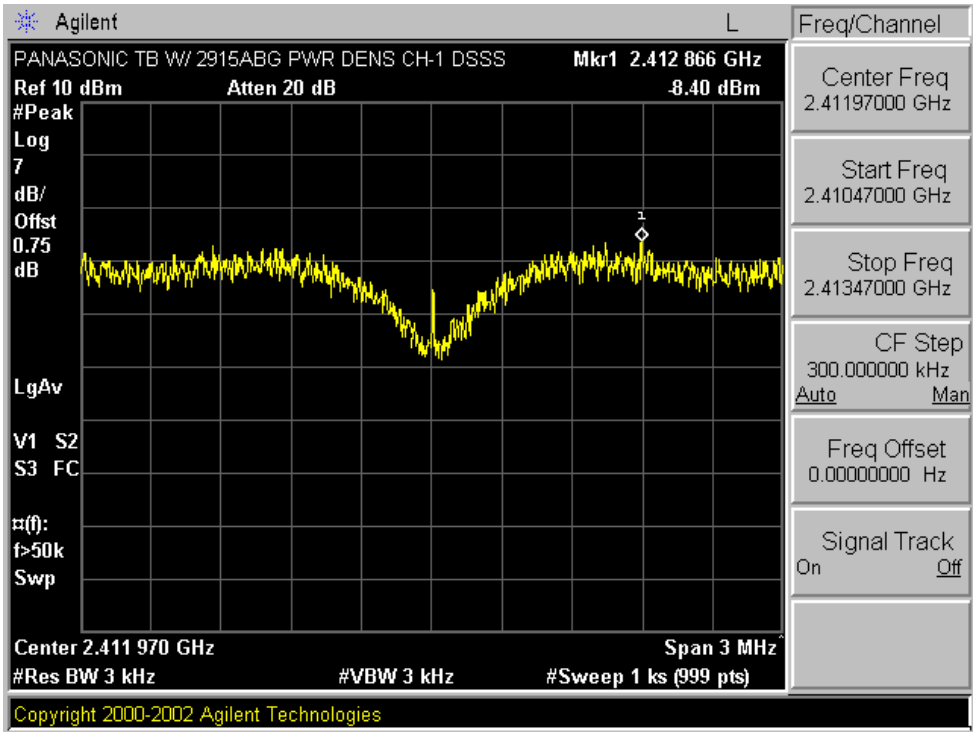

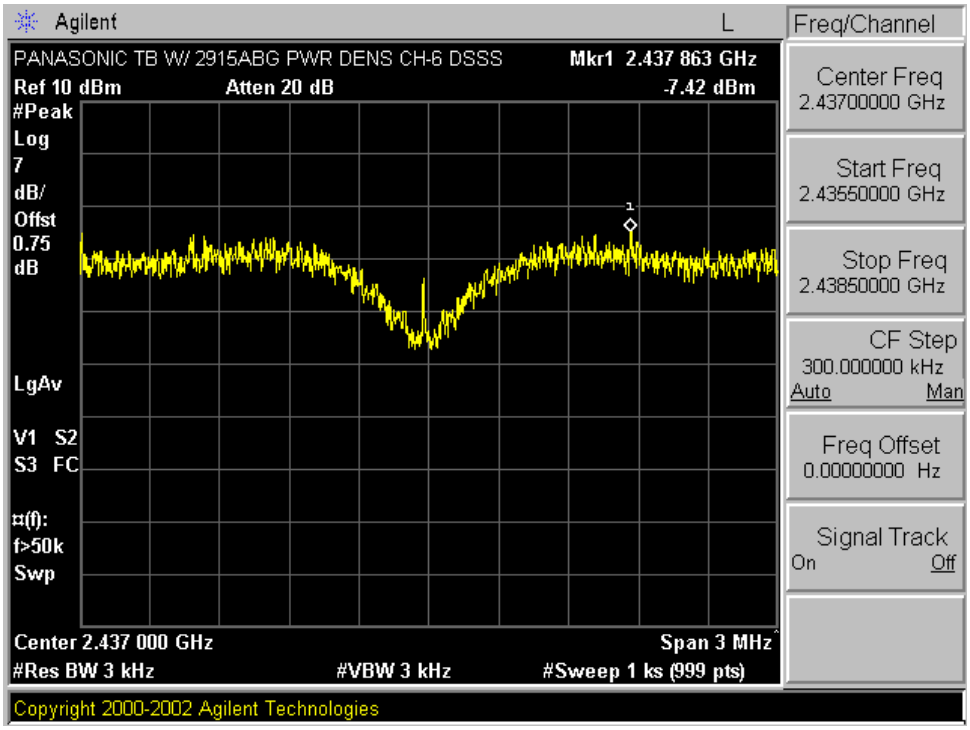

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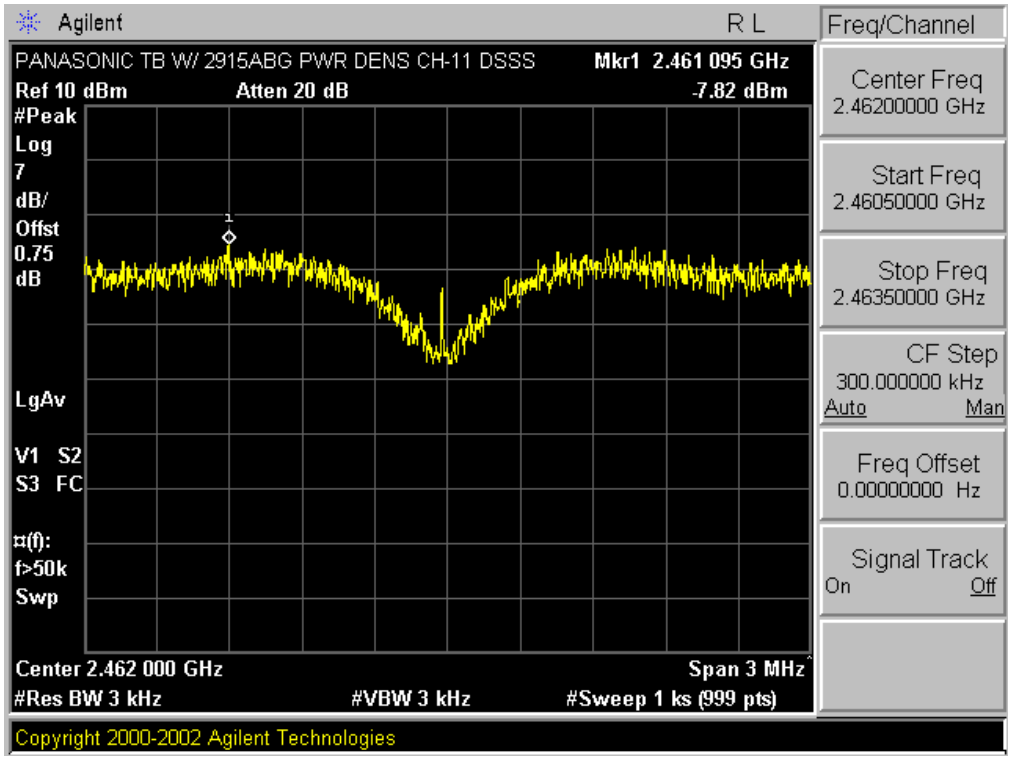

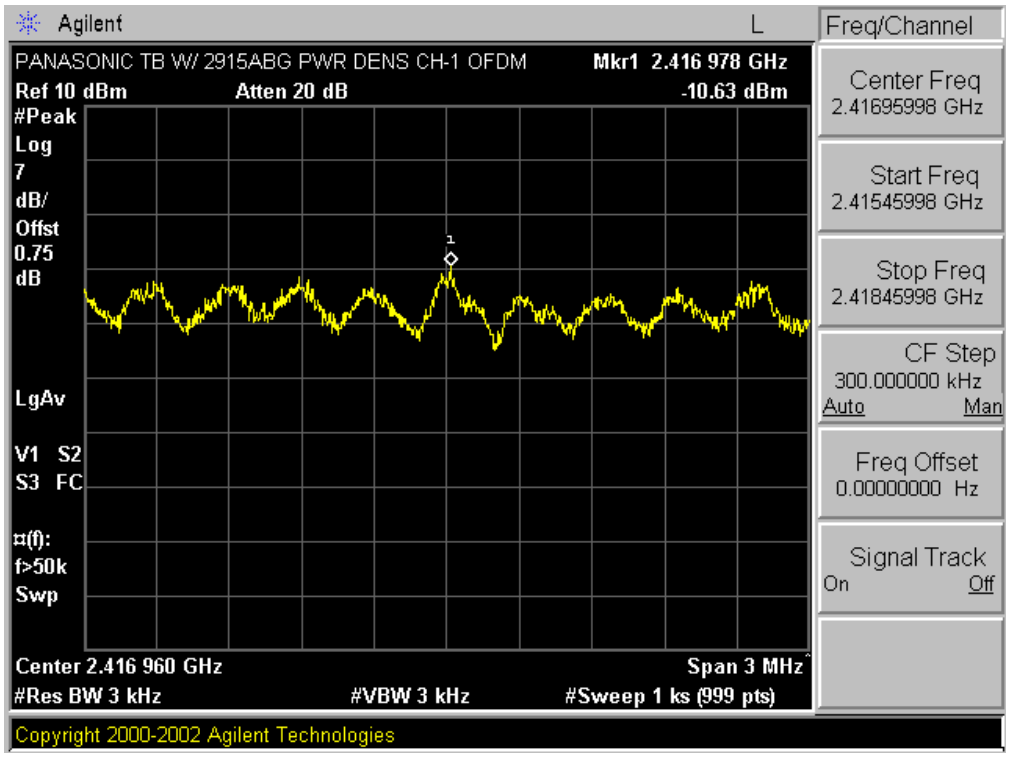

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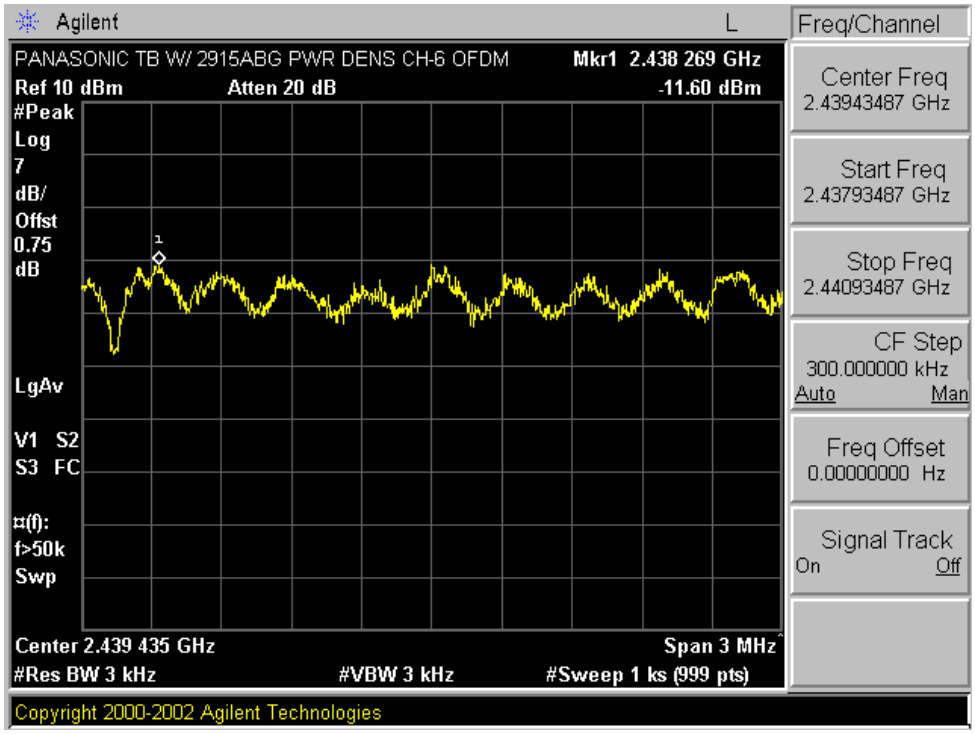

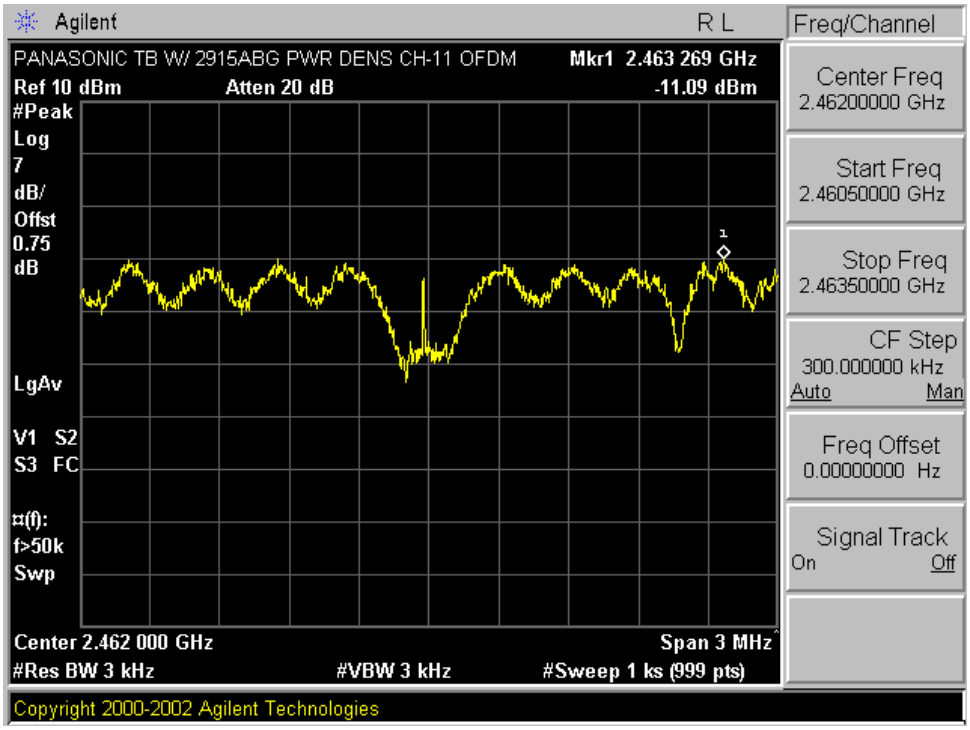

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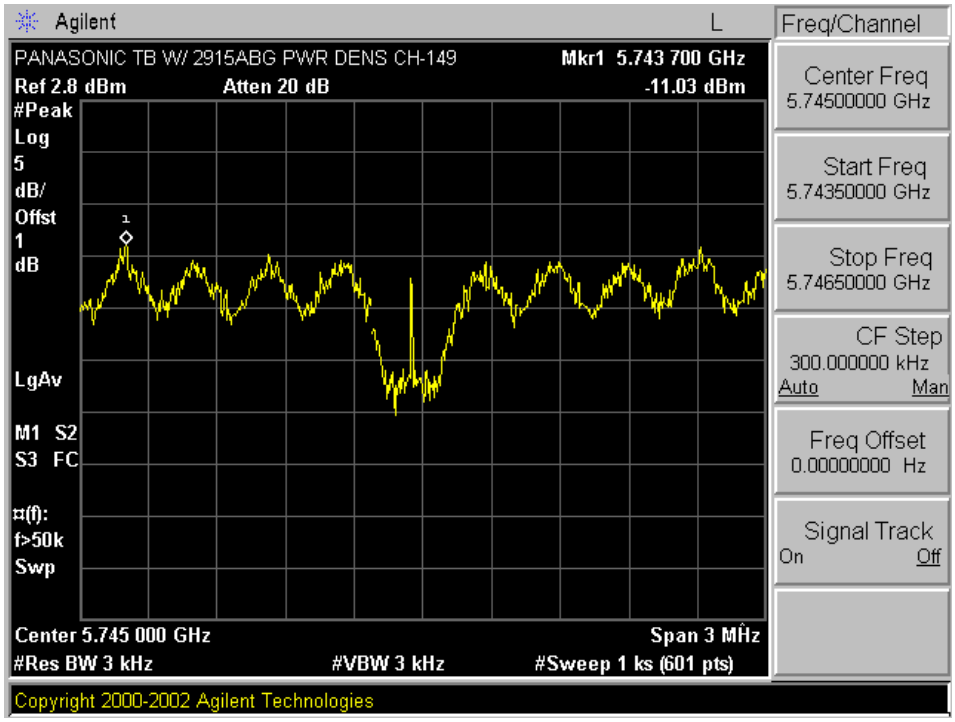

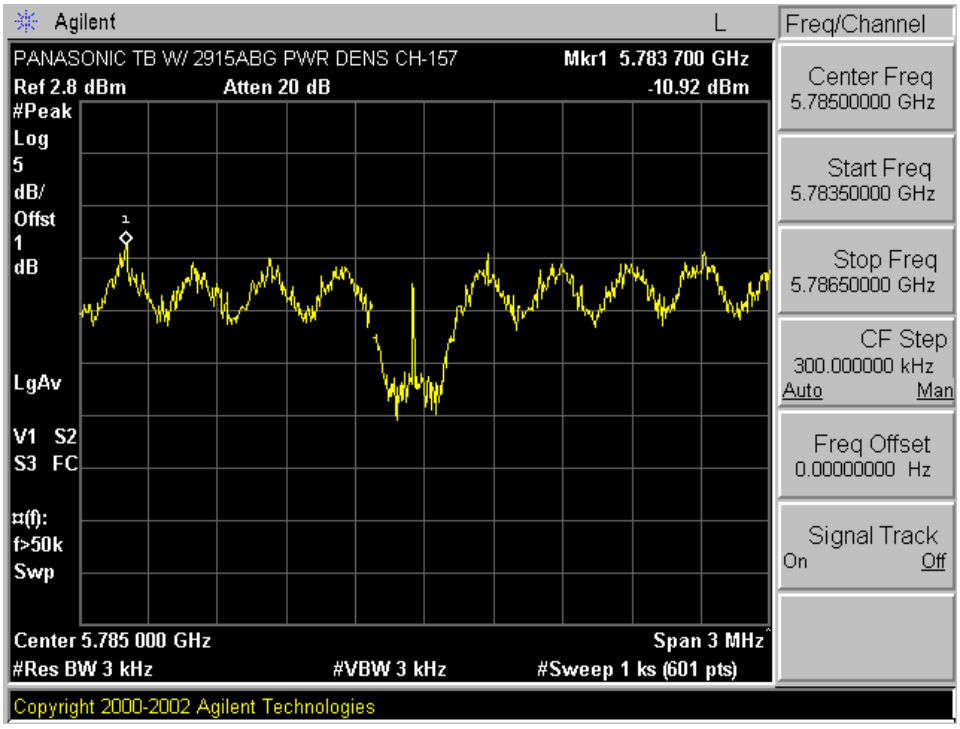

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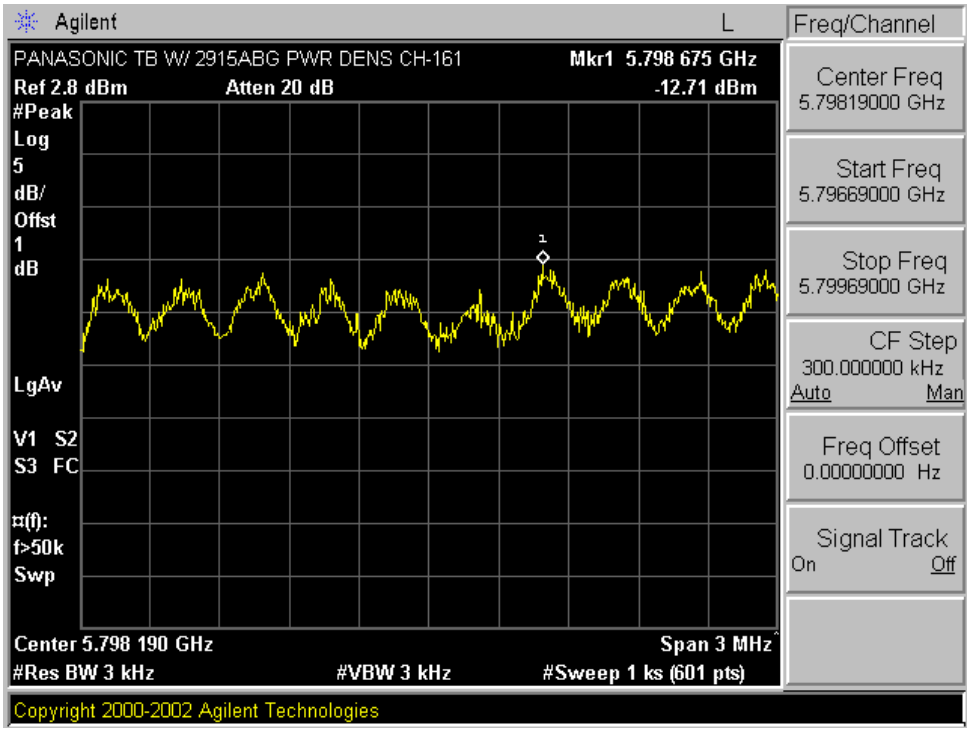

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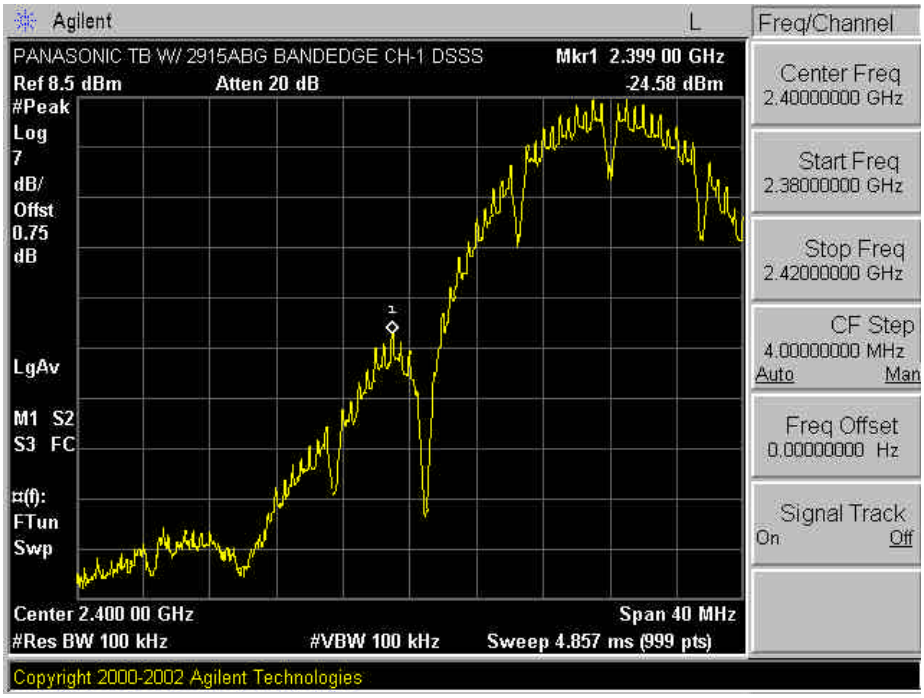
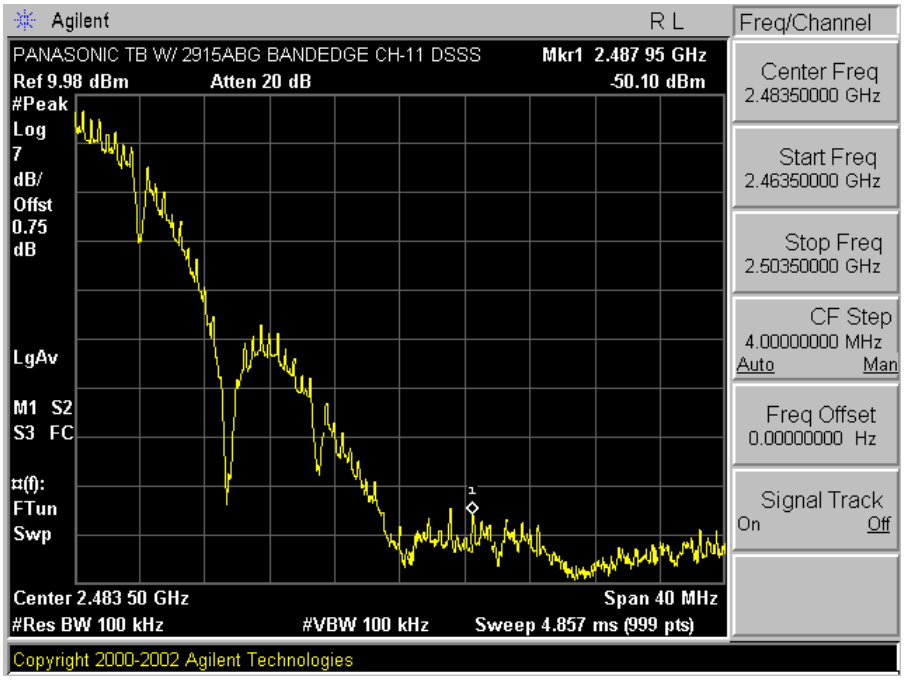
EXHIBIT A – Test Results (Cont.)

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





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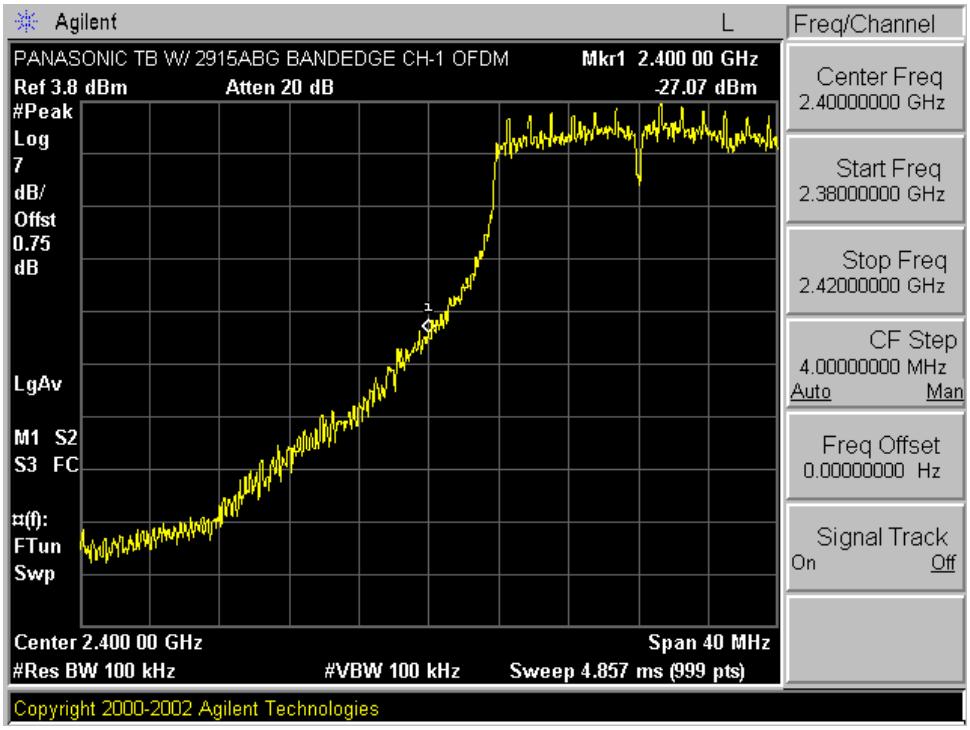

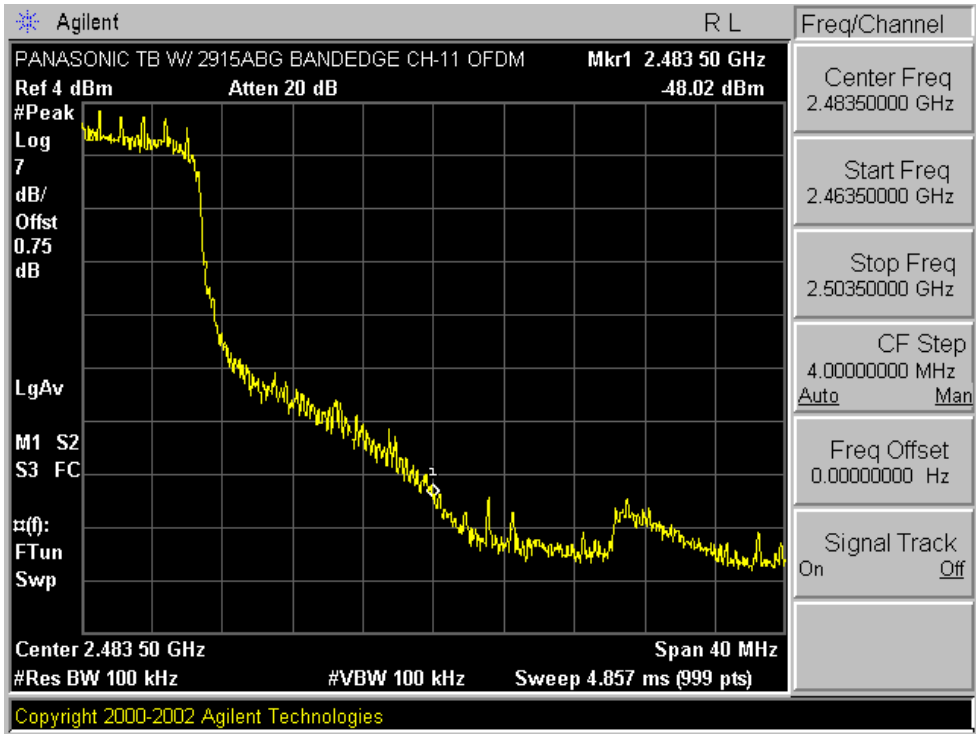

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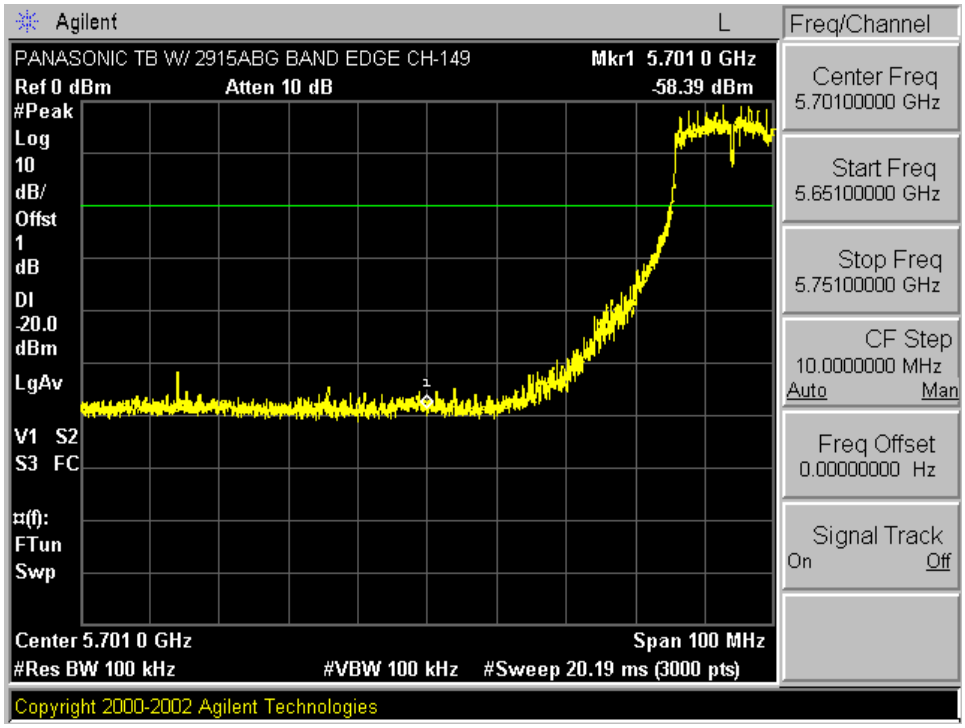

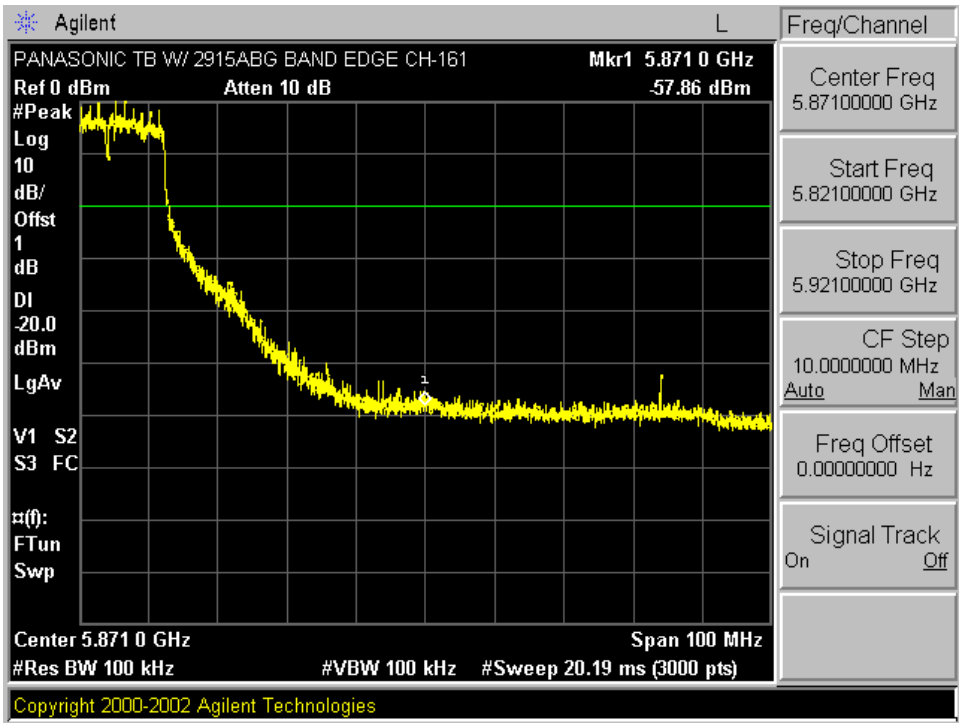

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EXHIBIT A – Test Results (Cont.)

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	F/S (dBuV/m)	F/S (uV/m)	Margin (dB)
4802	-108.1	40.39	V	39.29	92.15	-14.71
7203	-117	47.42	V	37.42	74.30	-16.58
9604	-123.8	50.3	V	33.50	47.32	-20.50
12005	-135	53.7	V	25.7	19.28	-28.3

Table A-6. Peak Radiated Measurements @ 3 meters

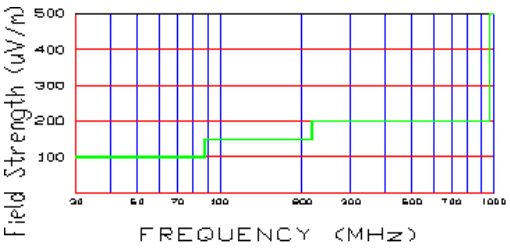

Figure A-5. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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 (dBuV/m)	F/S (uV/m)	Margin (dB)
4880	-107.8	40.5	V	39.70	96.61	-14.3
7320	-116.8	48	V	38.20	81.28	-15.8
9760	-124.3	50.3	V	33.00	44.67	-21.0
12200	-135	53.7	V	25.70	19.28	-28.3

Table A-7. Peak Radiated Measurements @ 3 meters

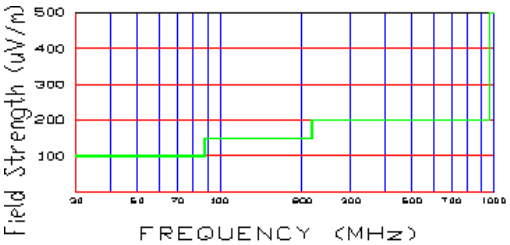

Figure A-6. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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 (dBuV/m)	F/S (uV/m)	Margin (dB)
4958	-108.1	40.7	V	39.6	95.50	-14.4
7437	-117.2	48.2	V	38	79.43	-16
9916	-124	50.4	V	33.4	46.77	-20.6
12395	-135	53.8	V	25.8	19.50	-108.1

Table A-8. Peak Radiated Measurements @ 3 meters

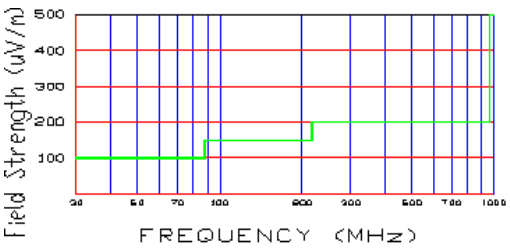

Figure A-7. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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	F/S (dBuV/m)	F/S (uV/m)	Margin (dB)
4802	-107.5	40.39	V	39.89	98.74	-14.11
7203	-117.5	47.42	V	36.92	70.15	-17.08
9604	-124.3	50.3	V	33.00	44.67	-21.00
12005	-135	53.7	V	25.7	19.28	-28.3

Table A-9. Peak Radiated Measurements @ 3 meters

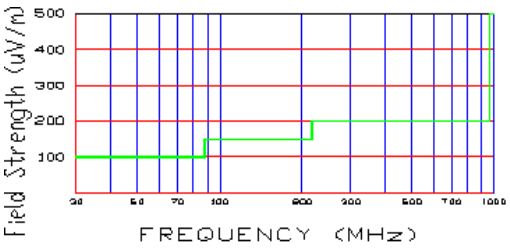

Figure A-8. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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 (dBuV/m)	F/S (uV/m)	Margin (dB)
4880	-108.6	40.5	V	38.90	88.10	-15.1
7320	-118.9	48	V	36.10	63.83	-17.9
9760	-123.3	50.3	V	34.00	50.12	-20.0
12200	-135	53.7	V	25.70	19.28	-28.3

Table A-10. Peak Radiated Measurements @ 3 meters

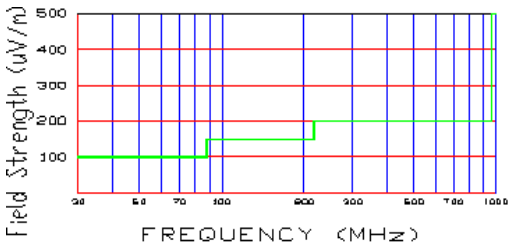

Figure A-9. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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 (dBuV/m)	F/S (uV/m)	Margin (dB)
4958	-108.8	40.7	V	38.9	88.10	-15.1
7437	-118.5	48.2	V	36.7	68.39	-17.3
9916	-124	50.4	V	33.4	46.77	-20.6
12395	-135	53.8	V	25.8	19.50	-28.2

Table A-11. Peak Radiated Measurements @ 3 meters

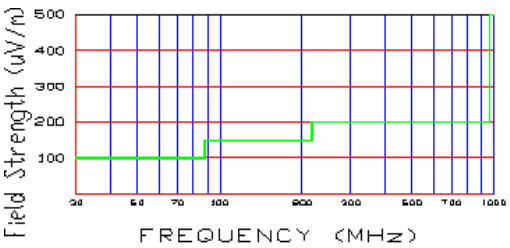

Figure A-10. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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: 149

Frequency (MHz)	Level (dBm)	AFCL (dB)	POL	F/S (dBuV/m)	F/S (uV/m)	Margin (dB)
11490	-117	52.8	V	43.3	146.22	-10.7
17235	-124.5	62.3	V	40.8	109.65	-13.2
22980	-131	66	V	38	79.43	-16
28725	-129	69	V	41	112.20	-13

Table A-12. Peak Radiated Measurements @ 3 meters

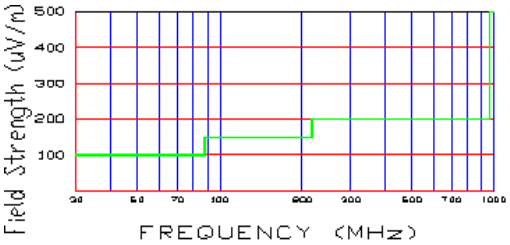

Figure A-11. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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: 157

Frequency (MHz)	Level (dBm)	AFCL (dB)	POL	F/S (dBuV/m)	F/S (uV/m)	Margin (dB)
11570	-116.7	52.9	V	43.6	151.36	-10.4
17355	-122.9	62.5	V	40.6	107.15	-13.4
23140	135	66.4	V	38.4	83.18	-15.6
28925	-135	69.4	V	41.4	117.49	-12.6

Table A-13. Peak Radiated Measurements @ 3 meters

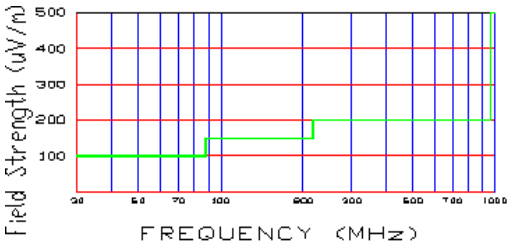

Figure A-12. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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: 161

Frequency (MHz)	Level (dBm)	AFCL (dB)	POL	F/S (dBuV/m)	F/S (uV/m)	Margin (dB)
11650	-113.7	53	V	42.8	138.04	-11.2
17475	-125.1	63.7	V	42.7	136.46	-11.3
23300	-130	66.9	V	38.9	88.10	-15.1
29125	-134	69.9	V	41.9	124.45	-12.1

Table A-14. Peak Radiated Measurements @ 3 meters

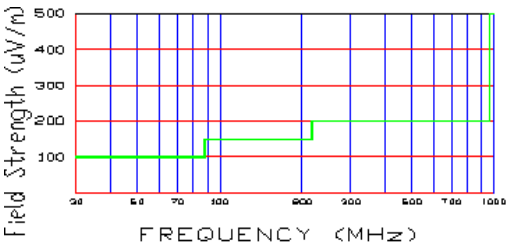

Figure A-13. Radiated limits at 3 meters.

NOTES:

1. All harmonics in the restricted bands specified in §15.205 are below the limit shown in Table A-19. (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 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 RSS-210.

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

Data Rate: 6 Mbps

FREQ (MHz)	Level (dBm)	AFCL (dB/m)	POL (H/V)	F/S (dBµV/m)	F/S (uV/M)	Margin (dB)
2483.8	-101.0	33.0	V	39.0	89.1	-15.0
2484.5	-97.0	33.0	V	43.0	141.3	-11.0
2484.4	-97.0	33.1	V	43.1	142.9	-10.9
2485.1	-99.0	33.1	V	41.1	113.5	-12.9
2493.0	-101.9	33.2	V	38.3	82.2	-15.7
2496.0	-119.3	33.2	V	20.9	11.1	-33.1

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. The data in the table are Average Measurements > 1GHz using RBW = 1 MHz VBW = 10 Hz

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

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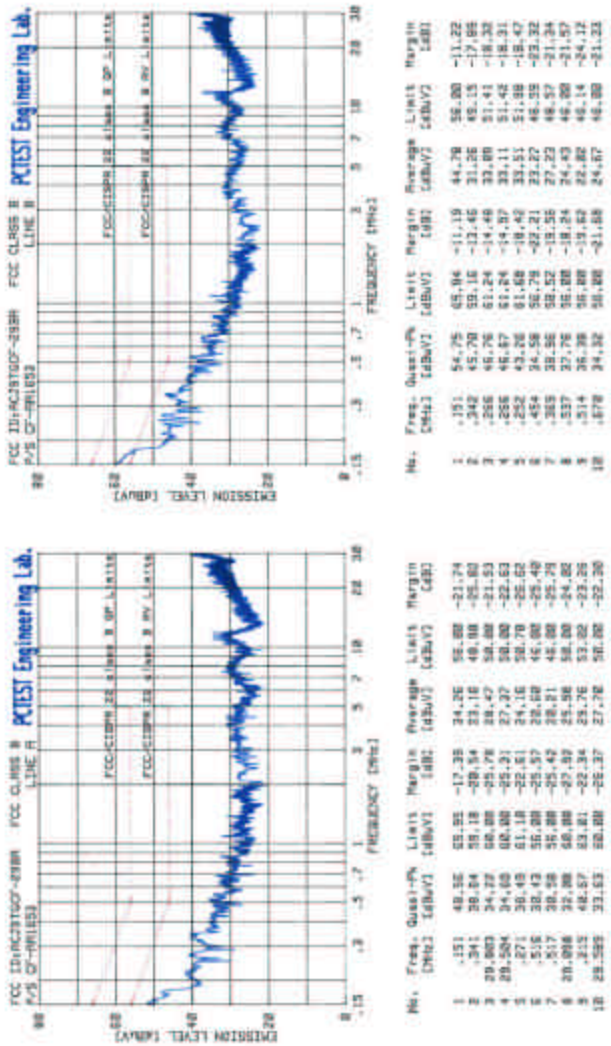
EXHIBIT A – Test Results (Cont.)

Line-Conducted Test Data

§15.207



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 A – Test Results (Cont.)

Receiver Spurious Measurements

§15.205 / §15.209

Operating Frequency: 2462 MHz

Distance of Measurements: 3 Meters

Data Rate: 6 Mbps

FREQ (MHz)	Level (dBm)	AFCL (dB/m)	POL (H/V)	Height (m)	Azimuth (° angle)	F/S (uV/M)	Margin (dB)
66.3	-78.5	5.8	V	2.3	90	51.9	-5.7
87	-79.3	8.3	V	2.0	210	63.1	-4
132.3	-82.3	12.4	H	1.8	190	71.7	-6.4
233.33	-83.4	18.0	H	1.4	190	120.3	-4.4
330	-88.2	21.7	V	1.3	180	106.0	-5.5
561	-96.3	27.4	H	1.1	200	79.5	-8.0

Table A-18. Radiated Measurements at 3-meters

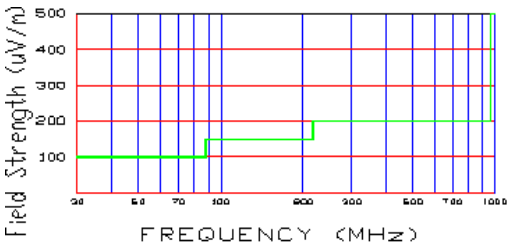

Figure A-17. Radiated limits at 3 meters

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 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-29BA

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

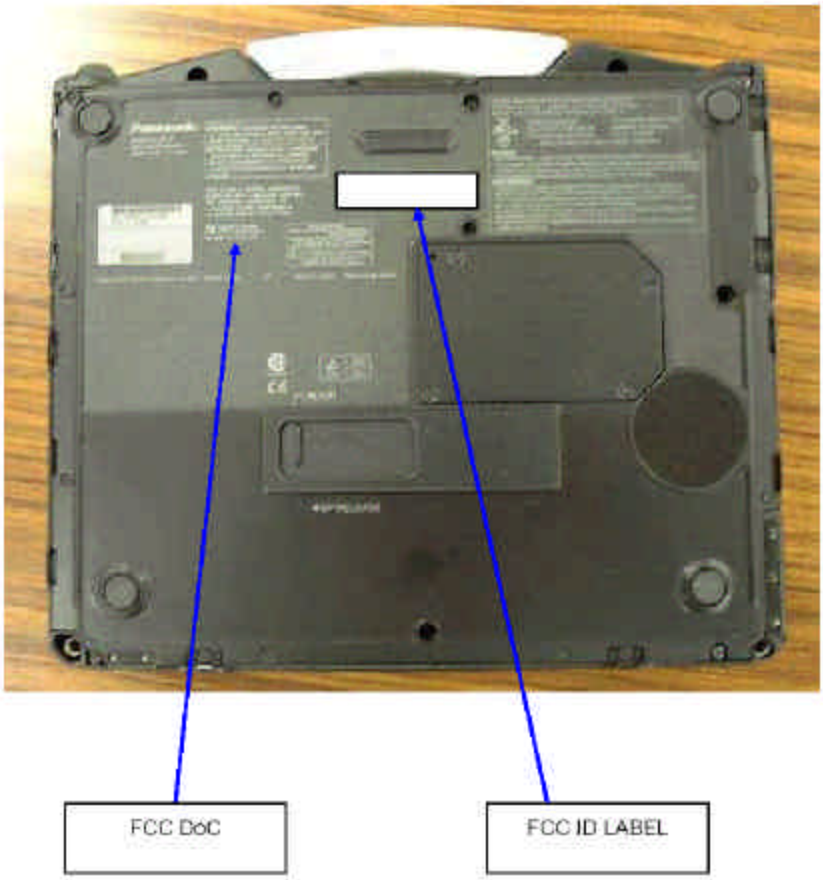

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EXHIBIT C – Block Diagram/Schematics

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EXHIBIT D – Operational Description

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EXHIBIT E – 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 F – EUT External/Internal Photographs

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EXHIBIT G – User's Manual

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EXHIBIT H – SAR MEASUREMENT REPORT

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