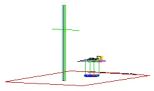
PCTEST ENGINEERING LABORATORY, INC.
6660-B Dobbin Road, Columbia, MD 21045 USA
Tel. 410.290.6652 / Fax 410.290.6554
http://www.pctestlab.com



CERTIFICATE OF COMPLIANCE
FCC PART 15.407 Class II Permissive Change

Applicant Name:
Panasonic Corporation of North America
One Panasonic Way, 4B-8
Secaucus, NJ 07094
United States

Date of Testing:
July 28 - 29, 2008
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0807241013.ACJ

FCC ID:	**ACJ9TGCF-523**
APPLICANT:	**Panasonic Corporation of North America**

Model(s):	CF-52
EUT Type:	Toughbook Model: CF-52
Max. RF Output Power:	22.54 mW (13.53 dBm) Conducted (802.11a UNII Band III) 22.96 mW (13.61 dBm) Conducted (802.11n UNII Band III)
Frequency Range:	5470MHz – 5725MHz (UNII Band III)
FCC Classification:	Unlicensed National Information Infrastructure (UNII)
FCC Rule Part(s):	Part 15.407
Test Device Serial No.:	8CTSC00120
Class II Permissive Change:	Add UNII-III Band to FCC Grant
Original Grant Date:	06/26/2008

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-63.4-2003. If the EUT contains any additional embedded transmitters, then those transmitters were active during all tests. The JBC portion of this EUT is covered in the DOC report. Radiated data was taken with the highest gain antenna.

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

Grant Conditions: Listed output power is conducted.

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

Randy Ortanez
President

ACCREDITED
TESTING LABORATORY
CERTIFICATE #2041.01

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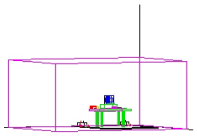
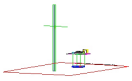


MEASUREMENT REPORT
FCC Part 15.407



§ 2.1033 General Information

APPLICANT:	Panasonic Corporation of North America
APPLICANT ADDRESS:	One Panasonic Way, 4B-8
	Secaucus, NJ 07094
TEST SITE:	PCTEST ENGINEERING LABORATORY, INC.
TEST SITE ADDRESS:	6660-B Dobbin Road, Columbia, MD 21045 USA
FCC RULE PART(S):	Part 15.407
MODEL NAME:	CF-52
FCC ID:	ACJ9TGCF-523
Test Device Serial No.:	8CTSC00120 ☐ Production ☒ Pre-Production ☐ Engineering
FCC CLASSIFICATION:	Unlicensed National Information Infrastructure (UNII)
DATE(S) OF TEST:	July 28 - 29, 2008
TEST REPORT S/N:	0807241013.ACJ

Test Facility / Accreditations

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

- PCTEST facility is an FCC registered (PCTEST Reg. No. 90864) test facility with the site description report on file and has met all the requirements specified in Section 2.948 of the FCC Rules and Industry Canada (IC-2451).
- PCTEST Lab is accredited to ISO 17025 by U.S. National Institute of Standards and Technology (NIST) under the National Voluntary Laboratory Accreditation Program (NVLAP Lab code: 100431-0) in EMC, FCC and Telecommunications.
- PCTEST Lab is accredited to ISO 17025-2005 by the American Association for Laboratory Accreditation (A2LA) in Specific Absorption Rate (SAR) testing, Hearing Aid Compatibility (HAC) testing, CTIA Test Plans, and wireless testing for FCC and Industry Canada Rules.
- PCTEST Lab is a recognized U.S. Conformity Assessment Body (CAB) in EMC and R&TTE (n.b. 0982) under the U.S.-EU Mutual Recognition Agreement (MRA).
- PCTEST TCB is a Telecommunication Certification Body (TCB) accredited to ISO/IEC Guide 65 by the American National Standards Institute (ANSI) in all scopes of FCC Rules and Industry Canada Standards (RSS).
- PCTEST facility is an IC registered (IC-2451) test laboratory with the site description on file at Industry Canada.
- PCTEST is a CTIA Authorized Test Laboratory (CATL) for AMPS, CDMA, and EvDO wireless devices and for Over-the-Air (OTA) Antenna Performance testing for AMPS, CDMA, GSM, GPRS, EGPRS, UMTS (W-CDMA), CDMA 1xEVDO, and CDMA 1xRTT.

1.0 INTRODUCTION

1.1 Scope

Measurement and 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.

1.2 PCTEST Test Location

The map below 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 1-1*).

These measurement tests were conducted at the PCTEST Engineering Laboratory, Inc. facility in New Concept Business Park, Guilford Industrial Park, Columbia, Maryland. The site address is 6660-B Dobbin Road, Columbia, MD 21045. The test site is one of the highest points in the Columbia area with an elevation of 390 feet above mean sea level. The site coordinates are 39° 11'15" N latitude and 76° 49'38" W longitude. The facility is 1.5 miles North of the FCC laboratory, and the ambient signal and ambient signal strength are approximately equal to those of the FCC laboratory. There are no FM or TV transmitters within 15 miles of the site. The detailed description of the measurement facility was found to be in compliance with the requirements of § 2.948 according to ANSI C63.4-2003 on January 27, 2006 and Industry Canada.

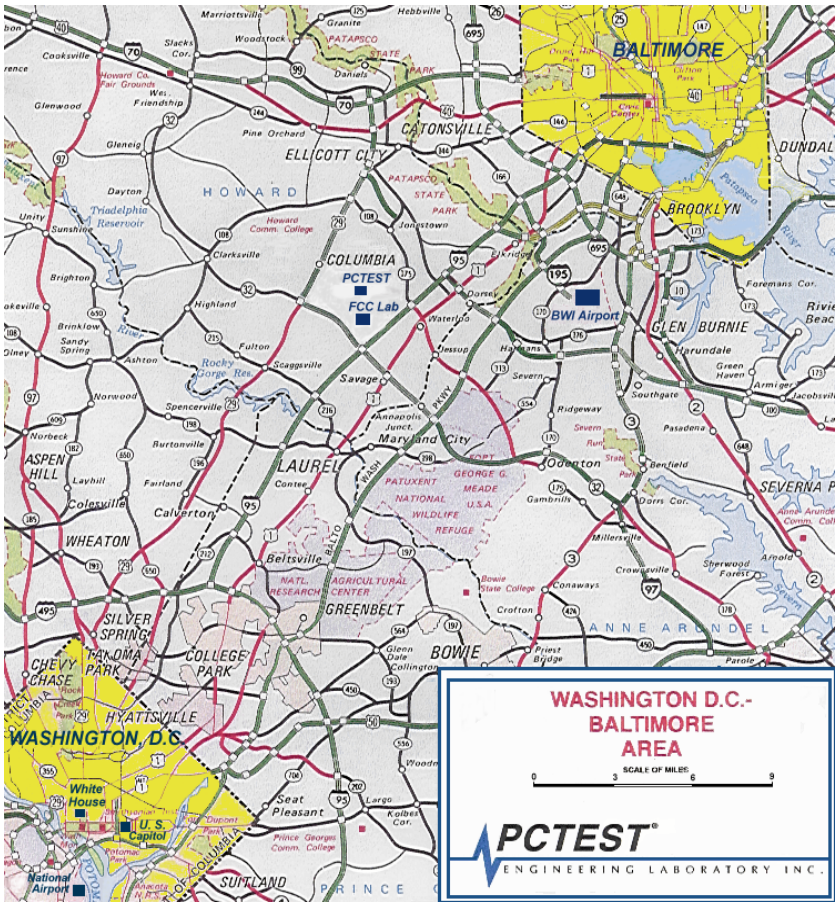


Figure 1-1. Map of the Greater Baltimore and Metropolitan Washington, D.C. area

2.0 PRODUCT INFORMATION

2.1 Equipment Description

The Equipment Under Test (EUT) is the **Panasonic Toughbook Model: CF-52 FCC ID: ACJ9TGCF-523**. The EUT consisted of the following component(s):

Manufacturer / Model	FCC ID	Description
Panasonic / Model: CF-52	ACJ9TGCF-523	Toughbook Model: CF-52
Intel / Model: 512AN_MMW	PD9512ANM	802.11a/b/g/n Wireless LAN Module
Alps / Model: UGNZA	N/A	Bluetooth Module
Qualcomm / Model: UNDP-1	J9CUNDP-1	CDMA/EvDO/GSM/EDGE/WCDMA Module

Table 2-1. EUT Equipment Description

Note: The testing in this report covers two additional models of the 512AN_MMW. The additional models are 512AG_MMW (802.11a/b/g) which has the 11n function disabled by EEPROM setting and 512BG_MMW (802.11b/g) which has both 11n and 11a function disabled by EEPROM setting. There are no electrical differences between the modules.

2.2 EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

2.3 Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label 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 and FCC ID must be displayed on the device per Section 15.19(b)(2).

Please see attachment for FCC ID label and label location.

3.0 DESCRIPTION OF TEST

3.1 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 C63.4-2003) and FCC Public Notice DA 02-2138 dated August 30, 2002 entitled "Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands" were used in the measurement of **Panasonic Toughbook Model: CF-52 FCC ID: ACJ9TGCF-523.**

Deviation from measurement procedure……..……..None.

3.2 Conducted Emissions

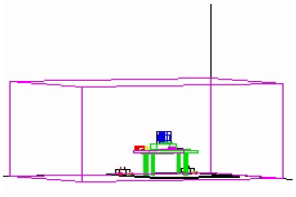


Figure 3-1. Shielded Enclosure Line-Conducted Test Facility

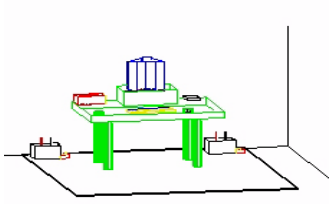


Figure 3-2. Line Conducted Emission Test Set-Up

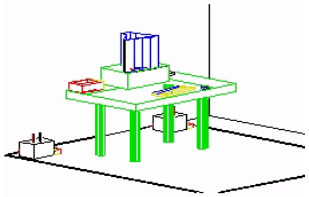


Figure 3-3. Wooden Table & Bonded LISNs

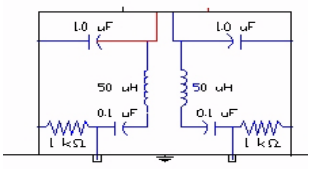


Figure 3-4. LISN Schematic Diagram

The line-conducted facility is located inside a 16'x20'x10' shielded enclosure, manufactured by Ray Proof Series 81 (*see Figure 3-1*). 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 3-2*). Solar Electronics and EMCO Model 3725/2 (10kHz-30MHz) 50Ω/50μH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room (*see Figure 3-3).* 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 filter (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 (s*ee Figure 3-4*). All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion). 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 spectrum analyzer. The detector function was set to CISPR quasi-peak and average mode. The bandwidth of the analyzer 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 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; whichever determined the worst-case emission. Photographs of the worst-case emission can be seen in the test setup photographs. Each EME reported was calibrated using the Agilent E8257D (250kHz – 20GHz) PSG Signal Generator.

3.3 Radiated Emissions

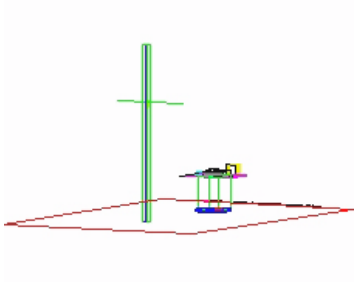


Figure 3-5. 3-Meter Test Site

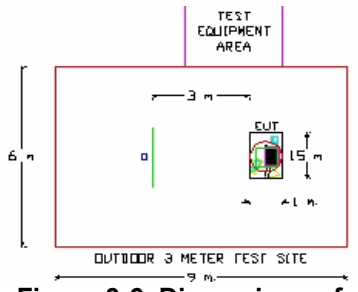


Figure 3-6. Dimensions of Outdoor Test Site

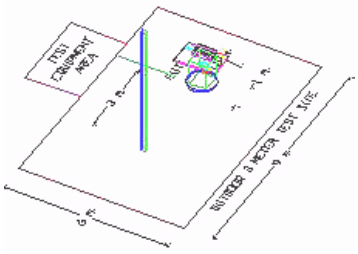


Figure 3-7. Turntable and System Setup

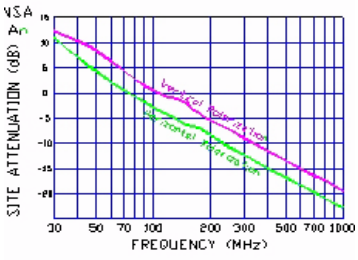


Figure 3-8. Normalized Site Attenuation Curves (H&V)

Preliminary measurements were made indoors at 1-meter using broadband antennas, broadband amplifiers, and spectrum analyzers 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, and turntable azimuth with respect to the antenna was noted for each frequency found. The spectrum was scanned from 30 to 200 MHz using a bi-conical antenna and from 200 to 1000 MHz using a log-spiral antenna. Above 1 GHz, linearly polarized double ridge horn antennas were used.

Final measurements were made outdoors at 3-meter test range using Roberts™ Dipole antennas or horn antennas (*see Figure 3-5*). The test equipment was placed on a wooden and plastic bench situated on a 1.5m x 2m area adjacent to the measurement area (*see Figure 3-6*). 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 detector function was set to CISPR quasi-peak mode and the bandwidth of the spectrum analyzer was set to 100kHz for frequencies below 1GHz or 1MHz for frequencies above 1GHz. Above 1GHz the detector function was set to 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 3-7*). The EUT, support equipment, and interconnecting cables were re-arranged and manipulated to maximize each EME emission. The turntable containing the system was rotated and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and 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 the test setup photographs. Each EME reported was calibrated using the .Agilent E8257D (250kHz – 20GHz) PSG Signal Generator. The Theoretical Normalized Site Attenuation Curves for both horizontal and vertical polarization are shown in Figure 3-8.

4.0 ANTENNA REQUIREMENTS

Excerpt from §15.203 of the FCC Rules/Regulations:
"An intentional radiator antenna shall be designed to ensure that no antenna other than that furnished by the responsible party can be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section."

- The antennas of the Toughbook Model: CF-52 are **permanently attached.**
- There are no provisions for connection to an external antenna.

Conclusion:

The **Panasonic Toughbook Model: CF-52 FCC ID: ACJ9TGCF-523** unit complies with the requirement of §15.203.

Ch.	Frequency (MHz)
100	5500
:	:
120	5600
:	:
140	5700

Table 4-1. 802.11a Frequency / Channel Operations

Ch.	Frequency (MHz)
102	5510
:	:
118	5590
:	:
134	5670

Table 4-2. 802.11n Frequency / Channel Operations

5.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model	Description	Calibration Date	Cal Interval	Calibration Due	Serial No.
-	No.165	(30MHz - 1000MHz) RG58 Coax Cable	N/A		N/A	N/A
-	No.166	(1000-26500MHz) Microwave RF Cable	N/A		N/A	N/A
-	No.167	(100kHz - 100MHz) RG58 Coax Cable	N/A		N/A	N/A
Agilent	11713A	Attenuation/Switch Driver	12/13/07	Annual	12/13/08	3439A02645
Agilent	8447D	Broadband Amplifier	N/A		N/A	1937A03348
Agilent	8447D	Broadband Amplifier	N/A		N/A	2443A01900
Agilent	8449B	(1-26.5GHz) Pre-Amplifier	12/13/07	Annual	12/12/08	3008A00985
Agilent	85650A	Quasi-Peak Adapter	3/13/08	Annual	3/13/09	2043A00301
Agilent	8566B	(100Hz–22GHz) Spectrum Analyzer	12/13/07	Annual	12/13/08	3638A08713
Agilent	8566B	Opt. 462 Impulse Bandwidth	12/13/07	Annual	12/12/08	3701A22204
Agilent	8591A	(9kHz-1.8GHz) Spectrum Analyzer	9/18/07	Annual	9/18/08	3144A02458
Agilent	E4407B	ESA Spectrum Analyzer	3/13/08	Annual	3/13/09	US39210313
Agilent	E4448A	(3Hz-50GHz) Spectrum Analyzer	1/24/08	Annual	1/24/09	US42510244
Agilent	E8257D	(250kHz-20GHz) Signal Generator	3/8/07	Biennial	3/8/09	MY45470194
Emco	3115	Horn Antenna (1-18GHz)	9/24/07	Biennial	9/23/09	9704-5182
Emco	3115	Horn Antenna (1-18GHz)	10/4/07	Biennial	10/3/09	9205-3874
Emco	3116	Horn Antenna (18 - 40GHz)	8/25/05	Triennial	8/24/08	9203-2178
Emco	3121C-DB4	Dipole Antenna	1/23/07	Biennial	1/22/09	00023951
Emco	3816/2	LISN	8/9/06	Biennial	8/8/08	9707-1077
Emco	3816/2	LISN	8/9/06	Biennial	8/8/08	9707-1079
MiniCircuits	VHF-3100+	High Pass Filter	N/A		N/A	30721
Rohde & Schwarz	NRVD	Dual Channel Power Meter	12/12/06	Biennial	12/11/08	101695
Rohde & Schwarz	NRVS	Single Channel Power Meter	7/3/07	Biennial	7/2/09	835360/0079
Rohde & Schwarz	NRV-Z32	Peak Power Sensor (100uW-2W)	12/21/06	Biennial	12/20/08	100155
Rohde & Schwarz	NRV-Z33	Peak Power Sensor (1mW-20W)	11/28/06	Biennial	11/27/08	100004
Rohde & Schwarz	NRV-Z53	Power Sensor	7/3/07	Biennial	7/2/09	846076/0007
Solar Electronics	8012-50-R-24-BNC	LISN	11/8/07	Biennial	11/8/09	0310233

Table 5-1. Annual Test Equipment Calibration Schedule

6.0 TEST RESULTS

6.1 Summary

Company Name: Panasonic Corporation of North America

FCC ID: ACJ9TGCF-523

Method/System: Unlicensed National Information Infrastructure (UNII)

Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps (802.11a)

13.5/15, 27/30, 40/45, 54/60, 81/90, 108/120, 121.5/135, 135/150Mbps (802.11n)

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
TRANSMITTER MODE (Tx)					
N/A	26 dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 6.2
15.407 (a)(1)	Maximum Conducted Output Power	< 11 + 10log$_{10}$(B) dBm (5470 – 5725MHz)		PASS	Section 6.3
15.407 (a)(1), (5)	Peak Power Spectral Density	< 11dBm/MHz (5470 – 5725MHz)		PASS	Section 6.4
15.407(a)(6)	Peak Excursion	< 13 dB/MHz maximum difference		PASS	Section 6.5
15.407(g)	Frequency Stability	N/A		PASS	Section 6.6
15.407(b)(1), (6)	Undesirable Emissions	< -27 dBm/MHz EIRP (5470-5725)	RADIATED	PASS	Section 6.7
15.205, 15.407(b)(1), (5), (6)	General Field Strength Limits (Restricted Bands and Radiated Emission Limits)	Emissions in restricted bands must meet the radiated limits detailed in 15.209 (RSS-210 table 3 limits)		PASS	Section 6.8
15.207	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.207 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Section 6.9
RECEIVER MODE (Rx) / DIGITAL DEVICE					
15.107	AC Conducted Emissions 150kHz – 30MHz	< FCC 15.107 limits or < RSS-Gen table 2 limits	LINE CONDUCTED	PASS	Part 15B Test Report
15.109	General Field Strength Limits (Restricted Bands and Radiated Emissions Limits)	< FCC 15.109 limits or < RSS-210 table 3 limits	RADIATED (30MHz-1GHz) (1-25 GHz)	PASS	Part 15B Test Report
RF EXPOSURE					
15.407(f), 2.1091/2.1093	MPE Test	1 mW/cm² (MPE Limit) @ 20 cm	MPE	PASS	MPE Report

Table 6-1. Summary of Test Results

6.2 26dB Bandwidth Measurement

The bandwidth at 26dB 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. ***The 26dB bandwidth is used to determine the conducted power limits.***

Frequency [MHz]	Channel No.	802.11 Mode	Measured 26dB Bandwidth [MHz]
5500	100	a	19.677
5600	120	a	19.863
5700	140	a	19.475
5510	102	n	38.519
5590	118	n	38.504
5670	134	n	38.362

Table 6-2. Conducted Bandwidth Measurements

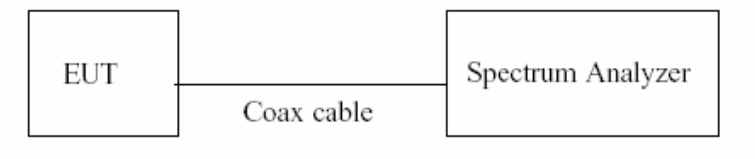
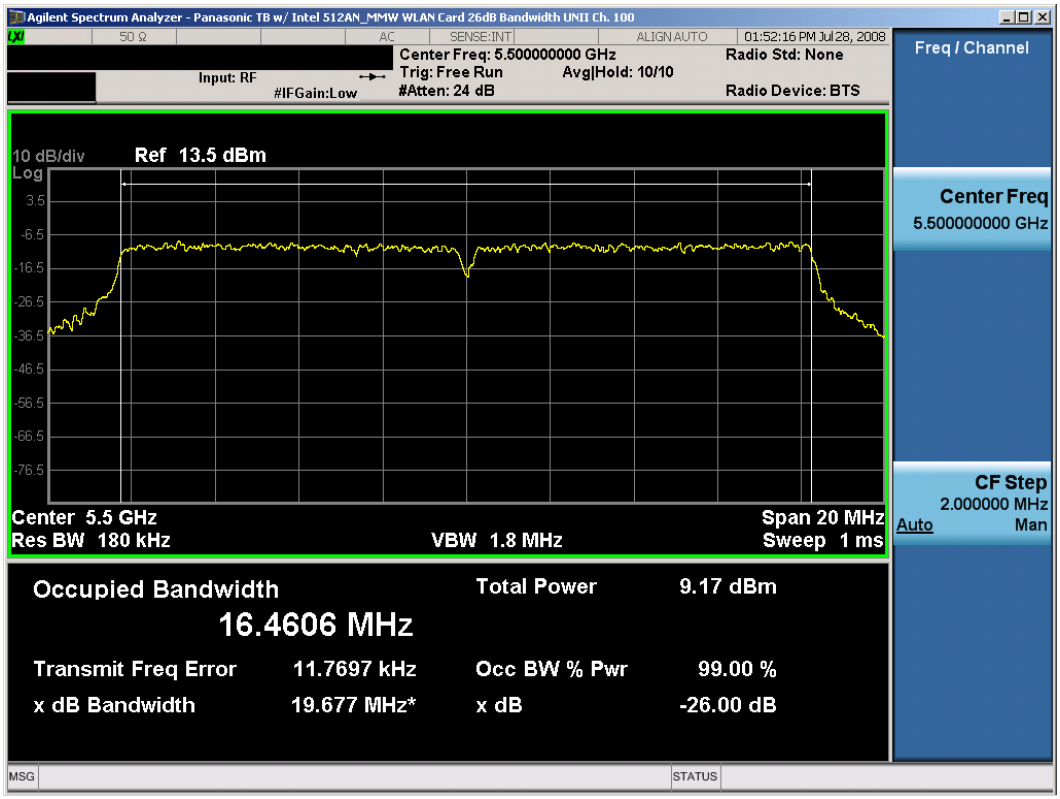
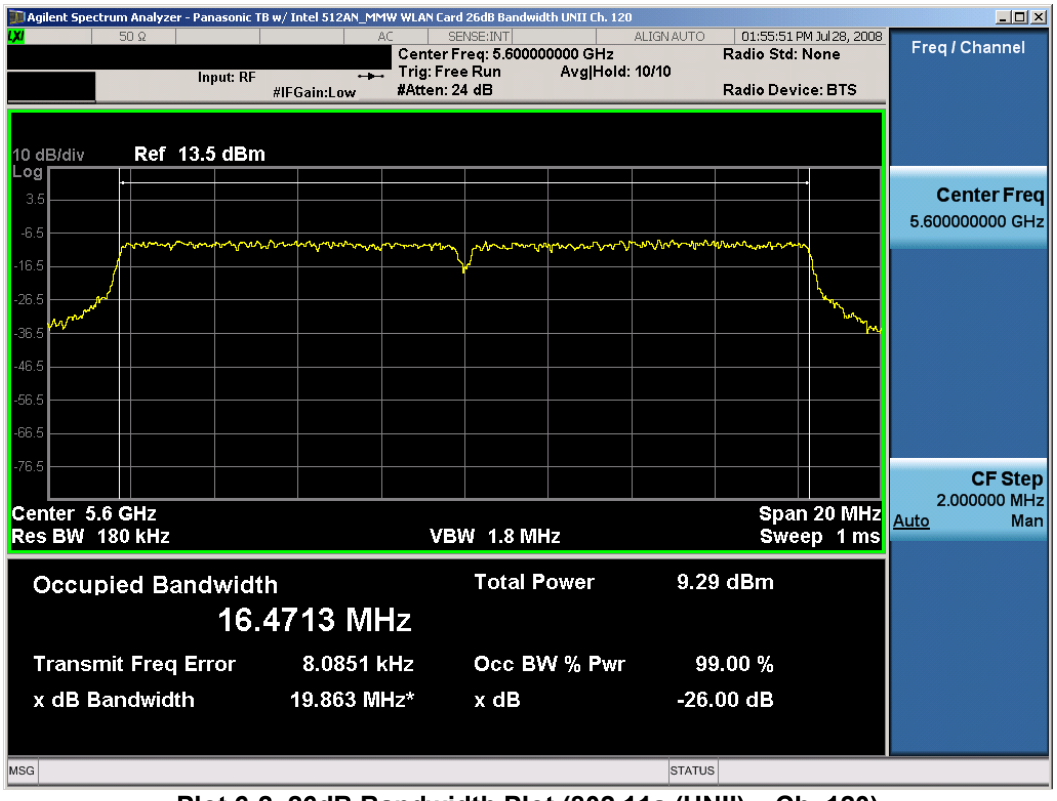


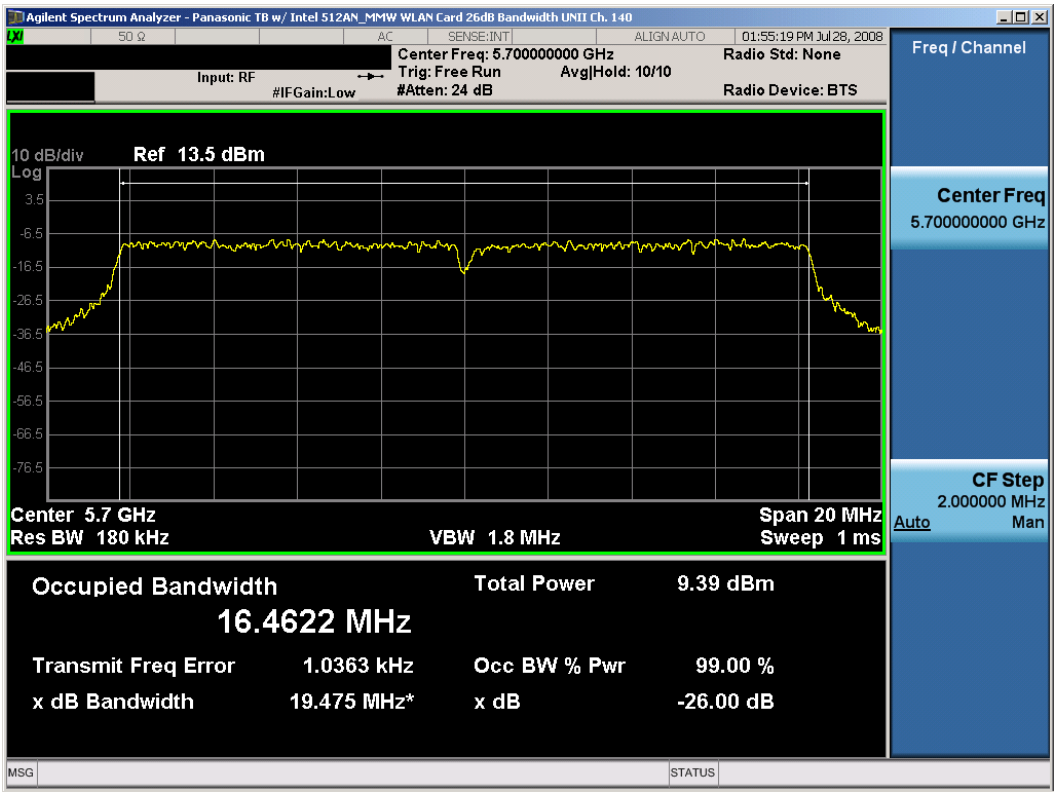
Figure 6-1. Test Instrument & Measurement Setup



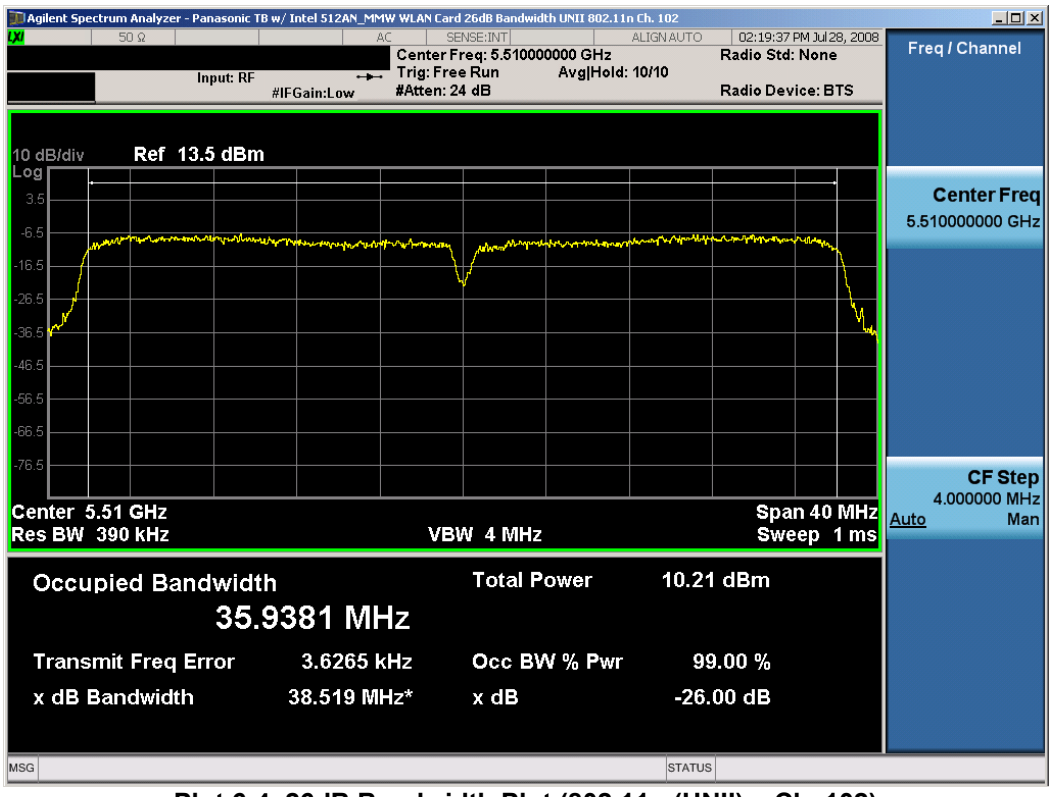
Plot 6-1. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 100)



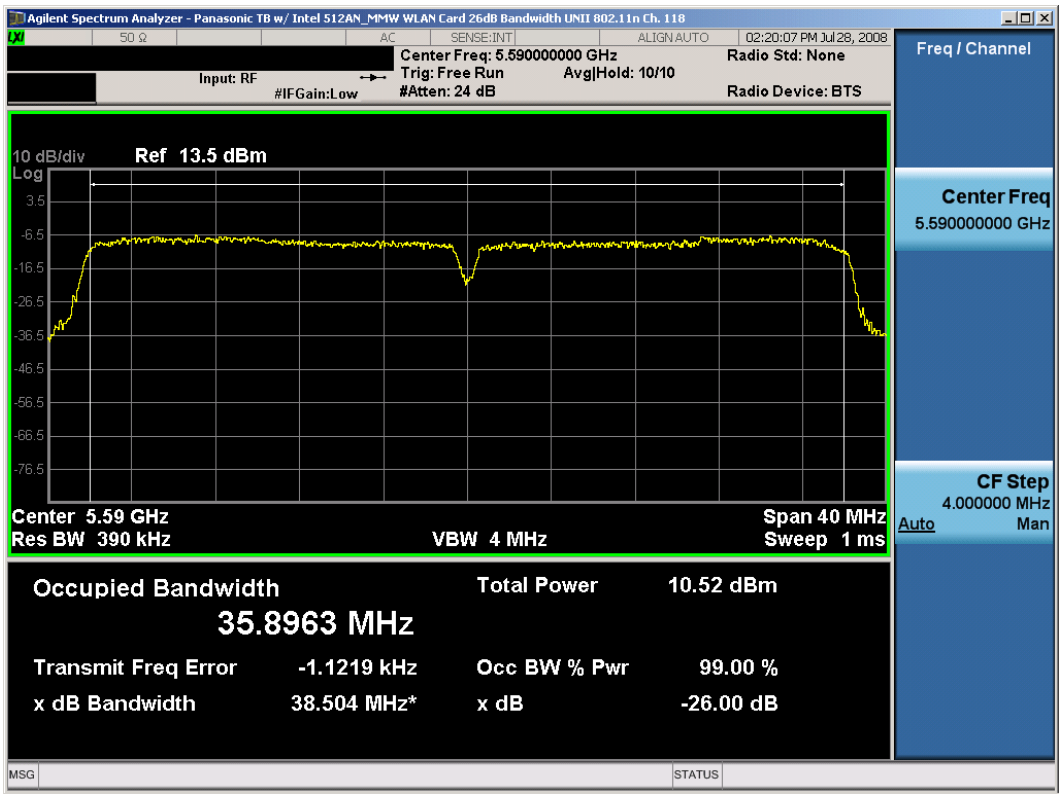
Plot 6-2. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 120)



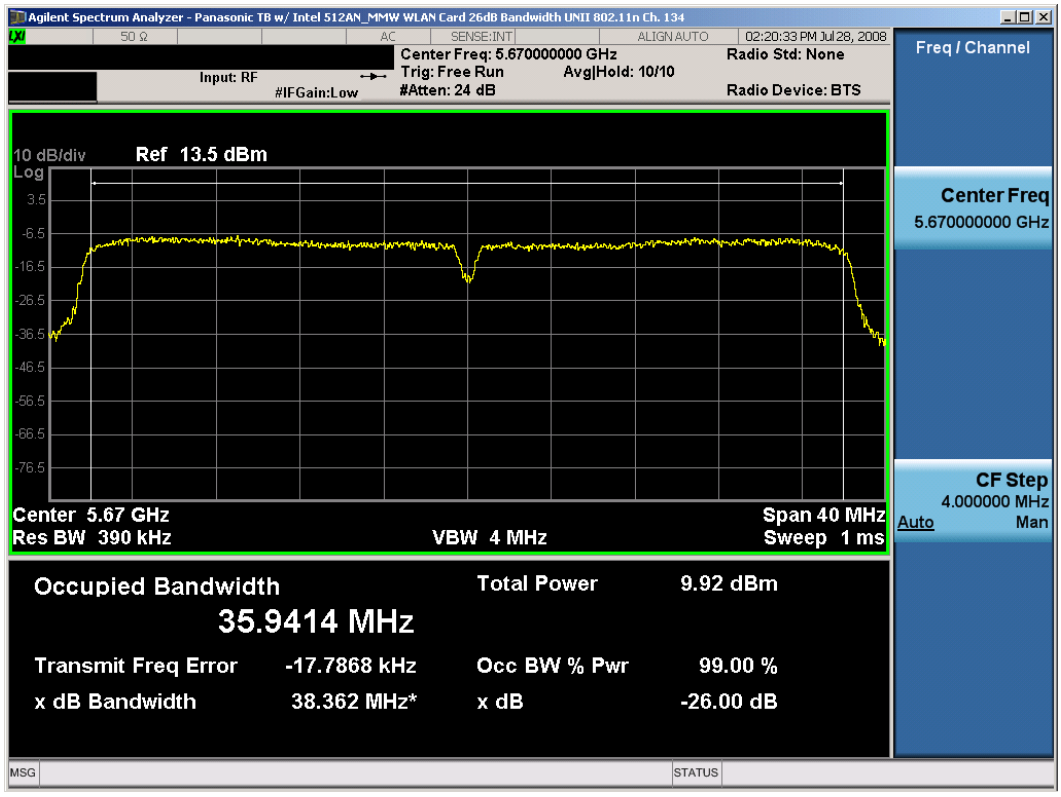
Plot 6-3. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 140)



Plot 6-4. 26dB Bandwidth Plot (802.11n (UNII) – Ch. 102)



Plot 6-5. 26dB Bandwidth Plot (802.11n (UNII) – Ch. 118)



Plot 6-6. 26dB Bandwidth Plot (802.11n (UNII) – Ch. 134)

6.3 Output Power Measurement – 802.11a/n

§15.407 (a)(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. ***In the 5.47 – 5.725GHz band, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11 dBm + 10log$_{10}$(26dB BW).***

Freq [MHz]	Channel	Data Rate [Mbps]	20MHz BW Measured Power [dBm]
5500	100	6	13.39
		9	13.28
		12	13.13
		18	13.11
		24	13.07
		36	13.06
		48	11.11
		54	9.24
5600	120	6	13.31
		9	13.26
		12	13.19
		18	13.14
		24	13.05
		36	12.97
		48	11.56
		54	9.15
5700	140	6	**13.53**
		9	13.47
		12	13.40
		18	13.35
		24	13.21
		36	13.19
		48	11.85
		54	9.91

Table 6-3. 802.11a UNII Band III Conducted Output Power Measurements

Freq [MHz]	Channel	Data Rate [Mbps]	MCS Index	40MHz Measured Power [dBm]
5510	102	13.5/15	HT0	13.16
		27/30	HT1	13.05
		40/45	HT2	12.85
		54/60	HT3	12.51
		81/90	HT4	12.54
		108/120	HT5	10.50
		121.5/135	HT6	8.65
		135/150	HT7	6.72
5590	118	13.5/15	HT0	13.20
		27/30	HT1	13.13
		40/45	HT2	13.01
		54/60	HT3	12.65
		81/90	HT4	12.43
		108/120	HT5	11.13
		121.5/135	HT6	9.17
		135/150	HT7	7.21
5670	134	13.5/15	HT0	13.32
		27/30	HT1	**13.61**
		40/45	HT2	13.13
		54/60	HT3	13.46
		81/90	HT4	13.41
		108/120	HT5	11.48
		121.5/135	HT6	9.61
		135/150	HT7	7.63

Table 6-4. 802.11n UNII Band III Conducted Output Power Measurements

6.4 Peak Power Spectral Density

§15.407 (a)(1),(5)

The spectrum analyzer was connected to the antenna teminal while the EUT was operating in a continuous transmission mode at the appropriate center frequencies. ***The maximum permissible peak power spectral density 11dBm/MHz in the 5.47GHz – 5.725 GHz band.***

Frequency [MHz]	Channel No.	802.11 Mode	Measured Power Density [dBm]	Maximum Permissible Power Density [dBm/MHz]	Margin [dB]
5500	100	a	1.698	11.0	-9.30
5600	120	a	2.113	11.0	-8.89
5700	140	a	1.173	11.0	-9.83
5510	102	n	6.434	11.0	-4.57
5590	118	n	7.099	11.0	-3.90
5670	134	n	6.627	11.0	-4.37

Table 6-5. Conducted Power Spectral Density Measurements

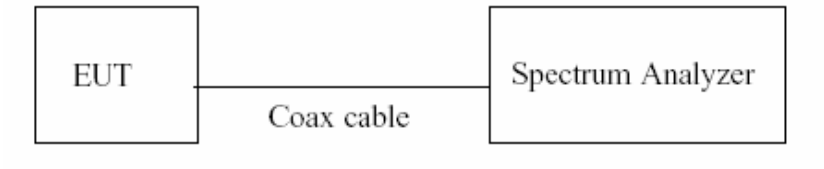
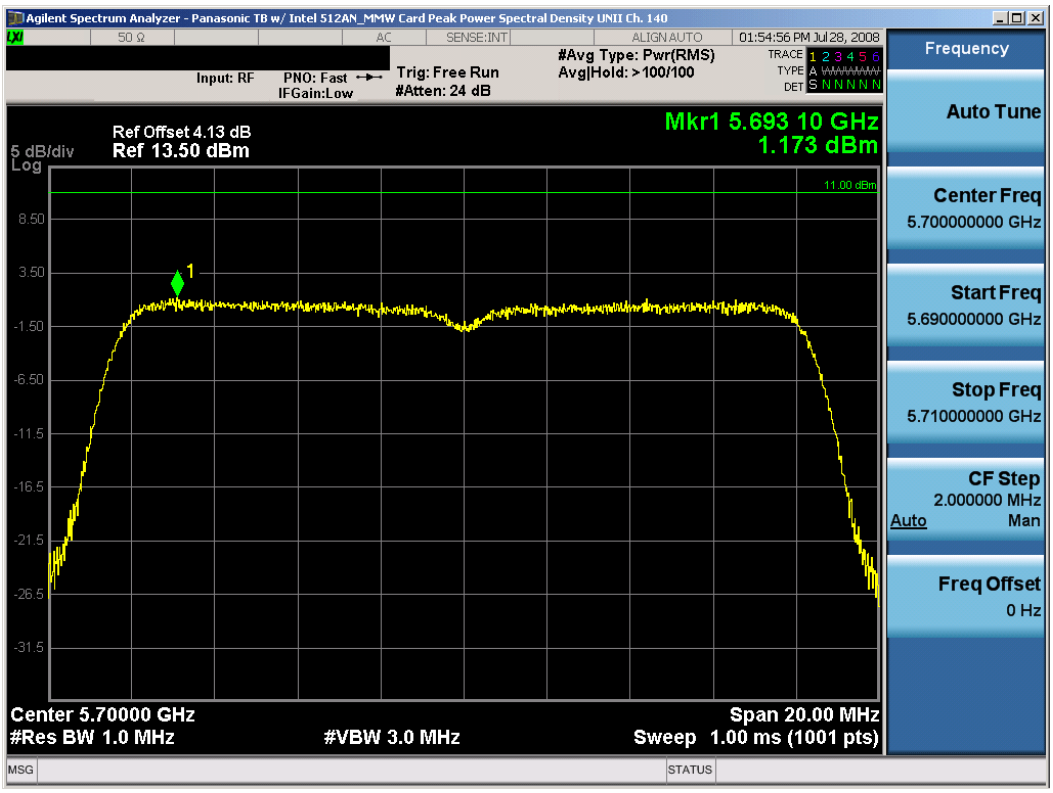


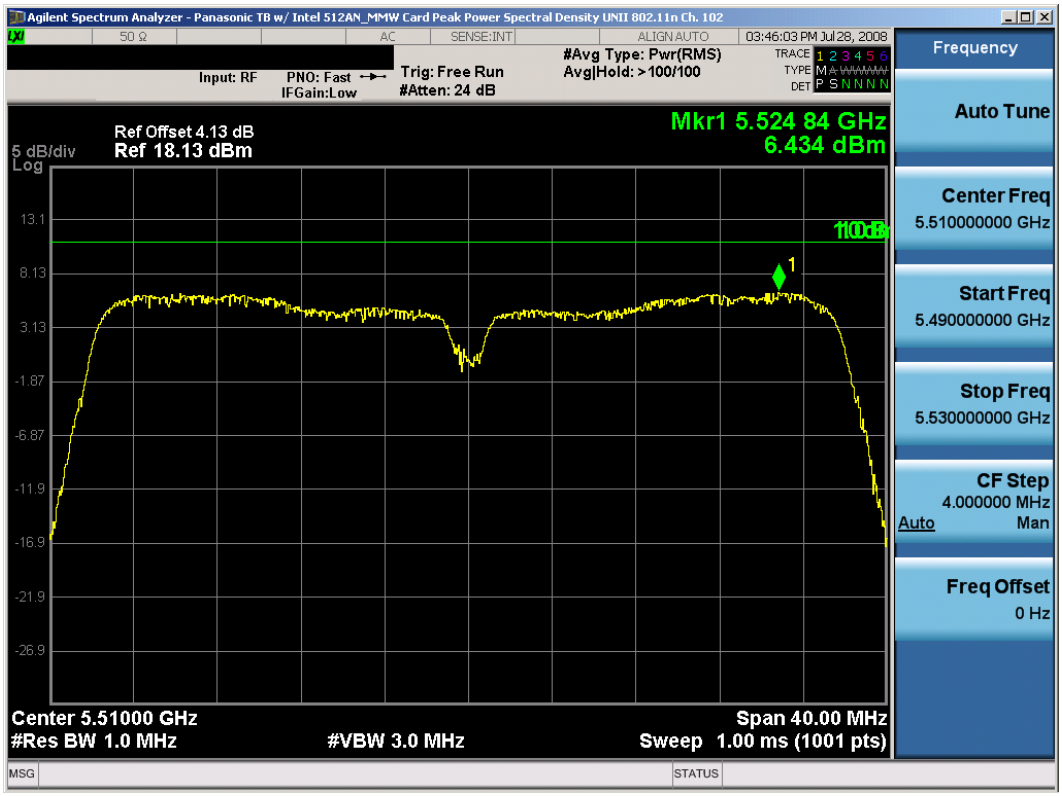
Figure 6-2. Test Instrument & Measurement Setup

Plot 6-7. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 100)

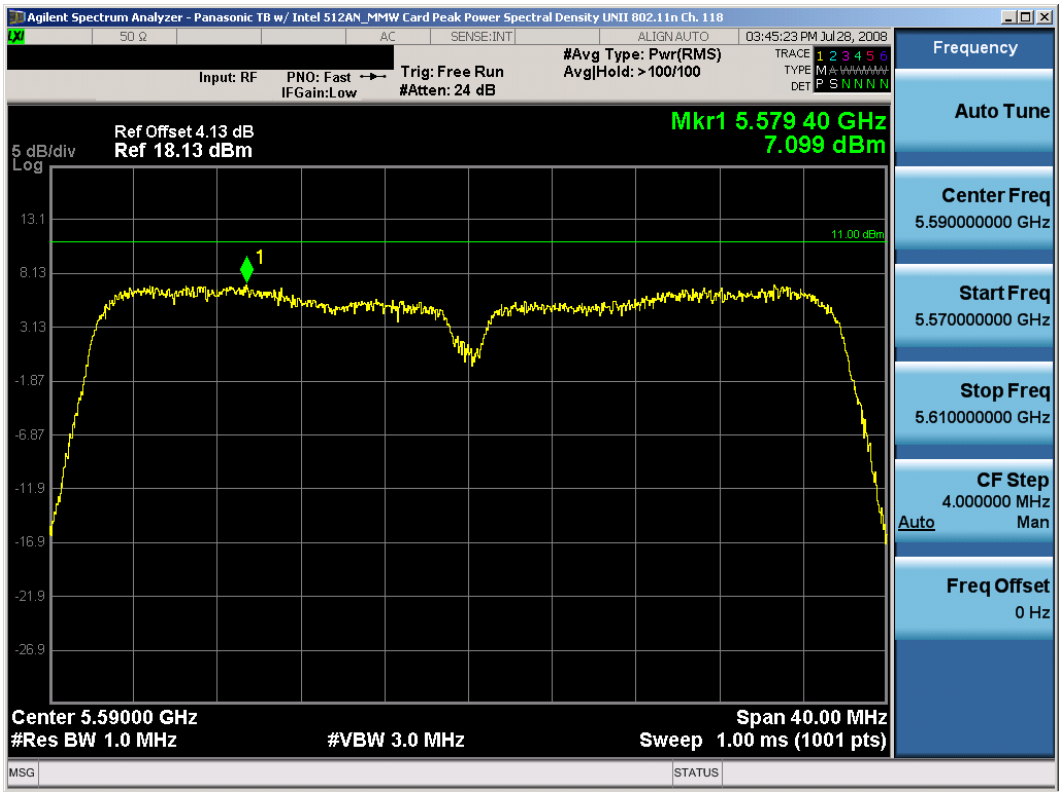
Plot 6-8. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 120)



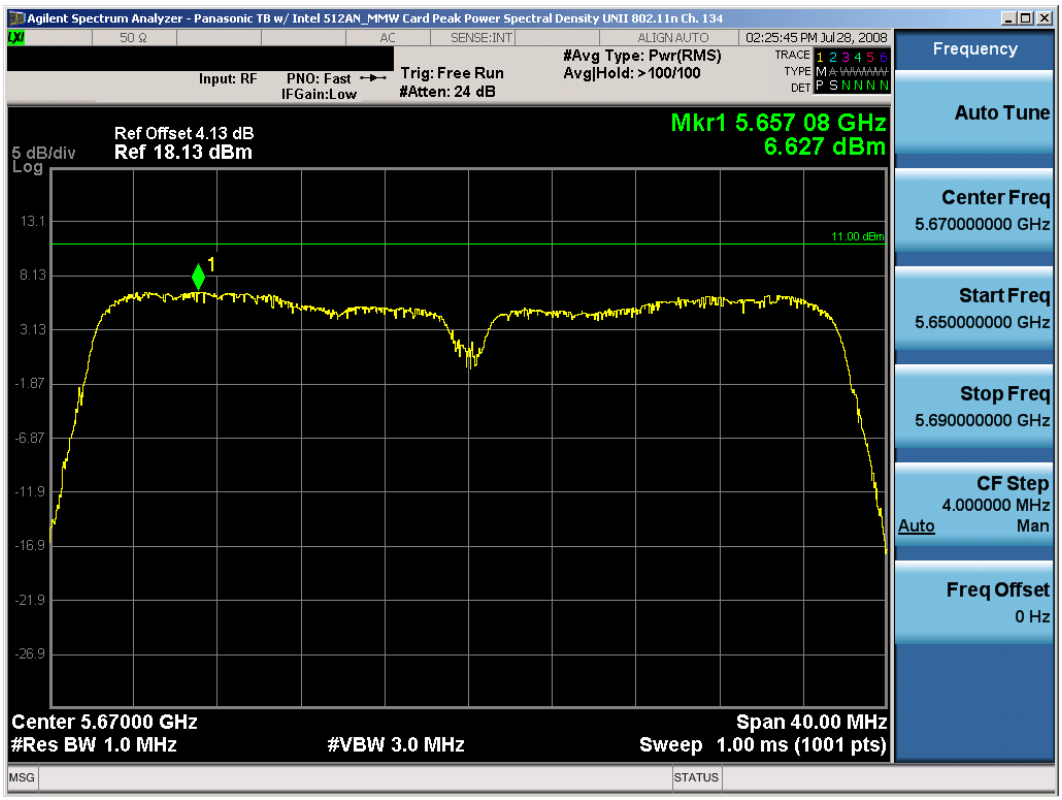
Plot 6-9. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 140)



Plot 6-10. Peak Power Spectral Density Plot (802.11n (UNII) – Ch. 102)



Plot 6-11. Peak Power Spectral Density Plot (802.11n (UNII) – Ch. 118)



Plot 6-12. Peak Power Spectral Density Plot (802.11n (UNII) – Ch. 134)

6.5 Peak Excursion Ratio

§15.407(a)(6)

The spectrum analyzer was connected to the antenna terminal while the EUT was operating in the continuous transmission mode at the appropriate center frequencies. ***The largest permissible difference between the modulation envelope (measured using a peak hold function) and the maximum conducted output power is 13 dBm/MHz.***

Frequency [MHz]	Channel No.	802.11 Mode	Measured Peak Excursion Ratio [dBm]	Maximum Permissible Peak Excursion Ratio [dBm/MHz]	Margin [dB]
5500	100	a	8.44	13.0	-4.56
5600	120	a	8.06	13.0	-4.94
5700	140	a	8.55	13.0	-4.45
5510	102	n	8.96	13.0	-4.04
5590	118	n	8.83	13.0	-4.17
5670	134	n	9.08	13.0	-3.92

Table 6-6. Conducted Peak Excursion Ratio Measurements

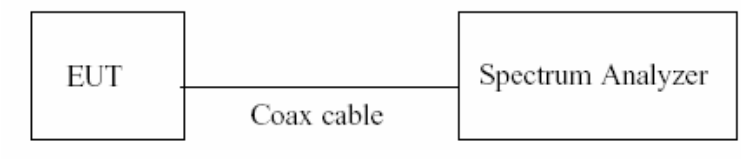
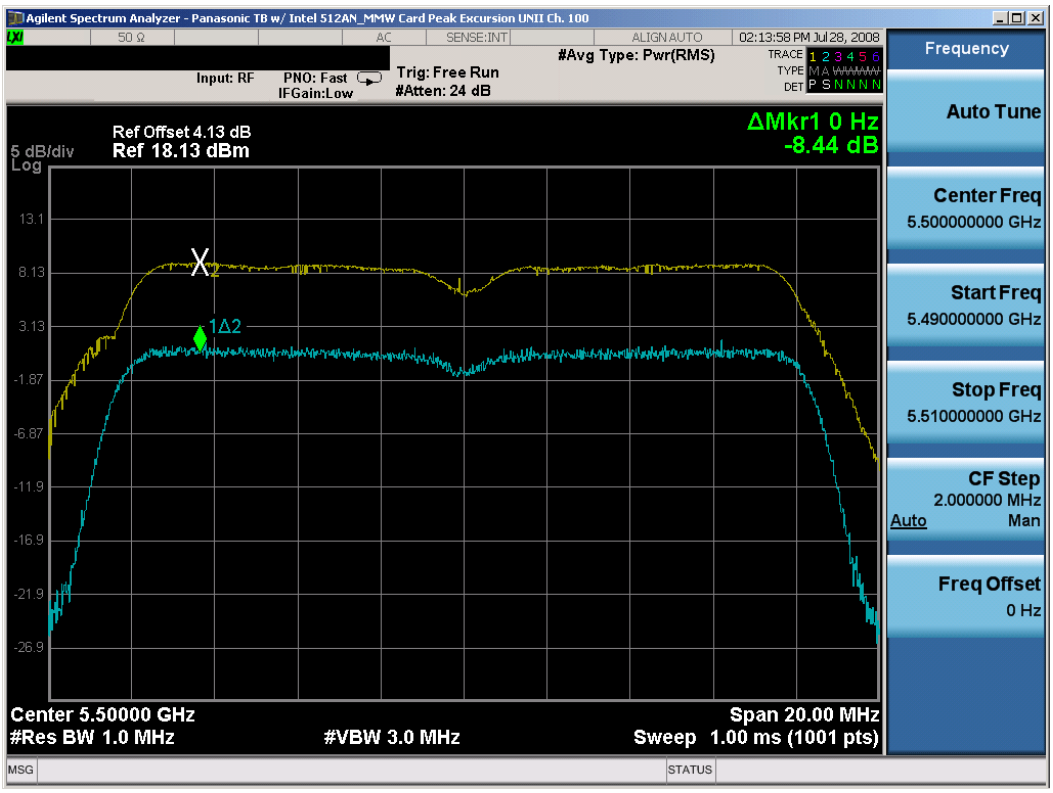
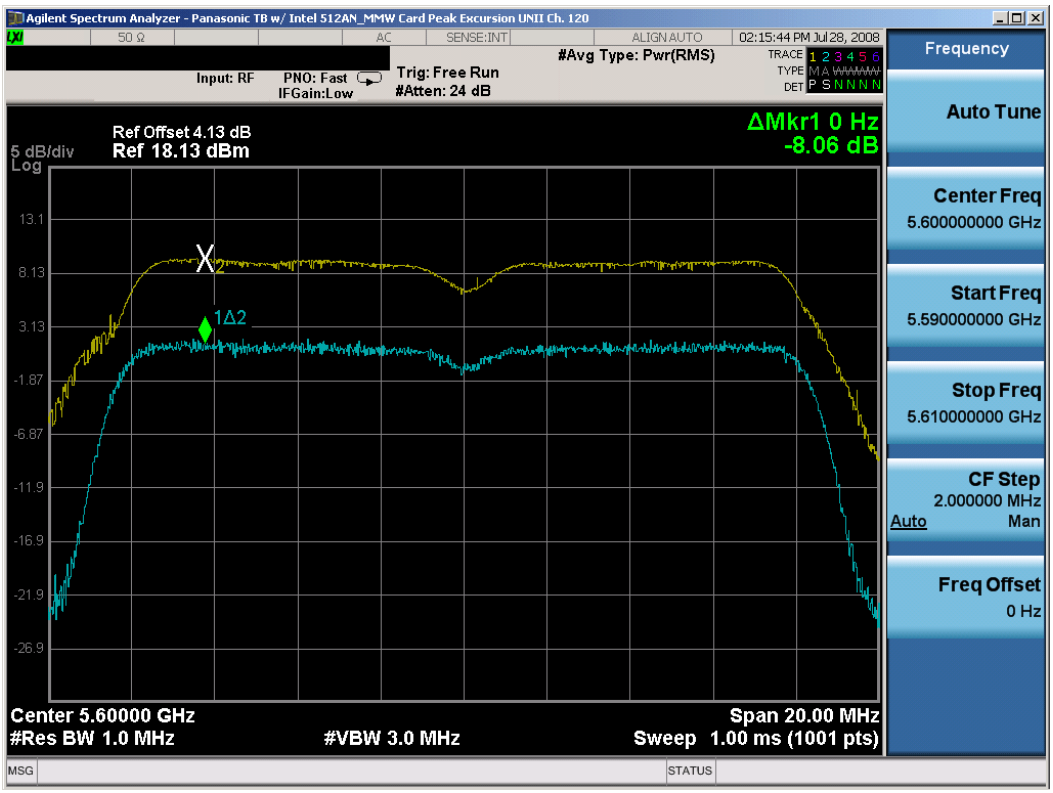


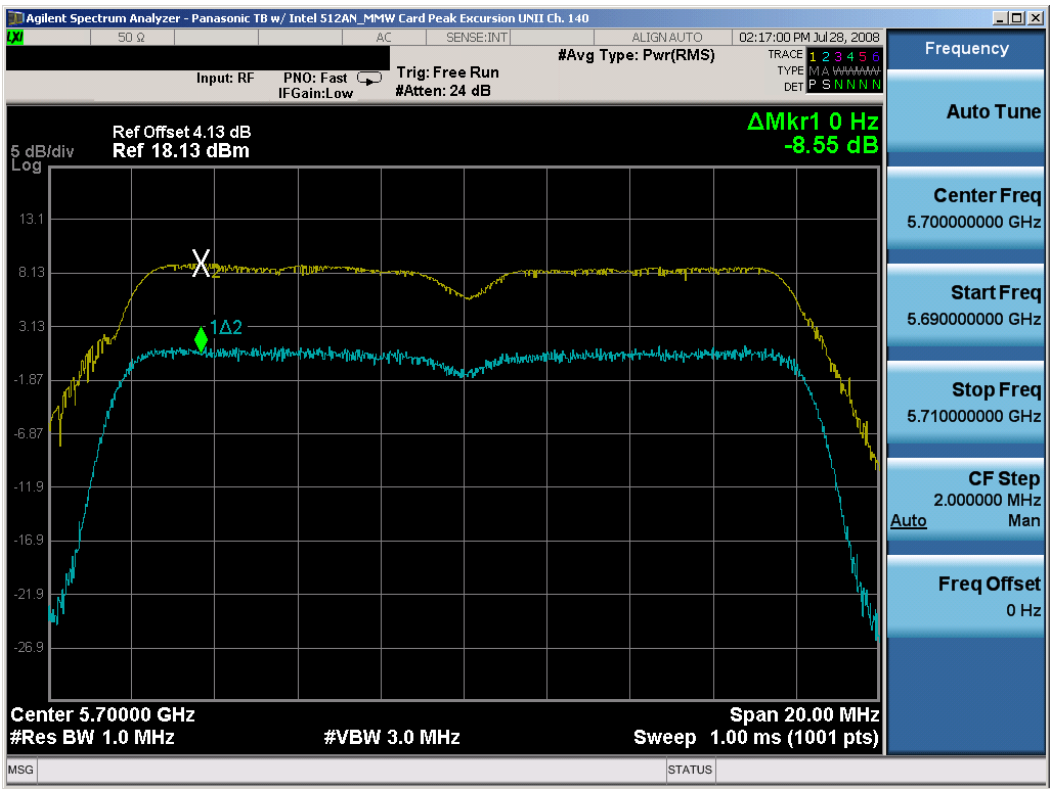
Figure 6-3. Test Instrument & Measurement Setup



Plot 6-13. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 100)

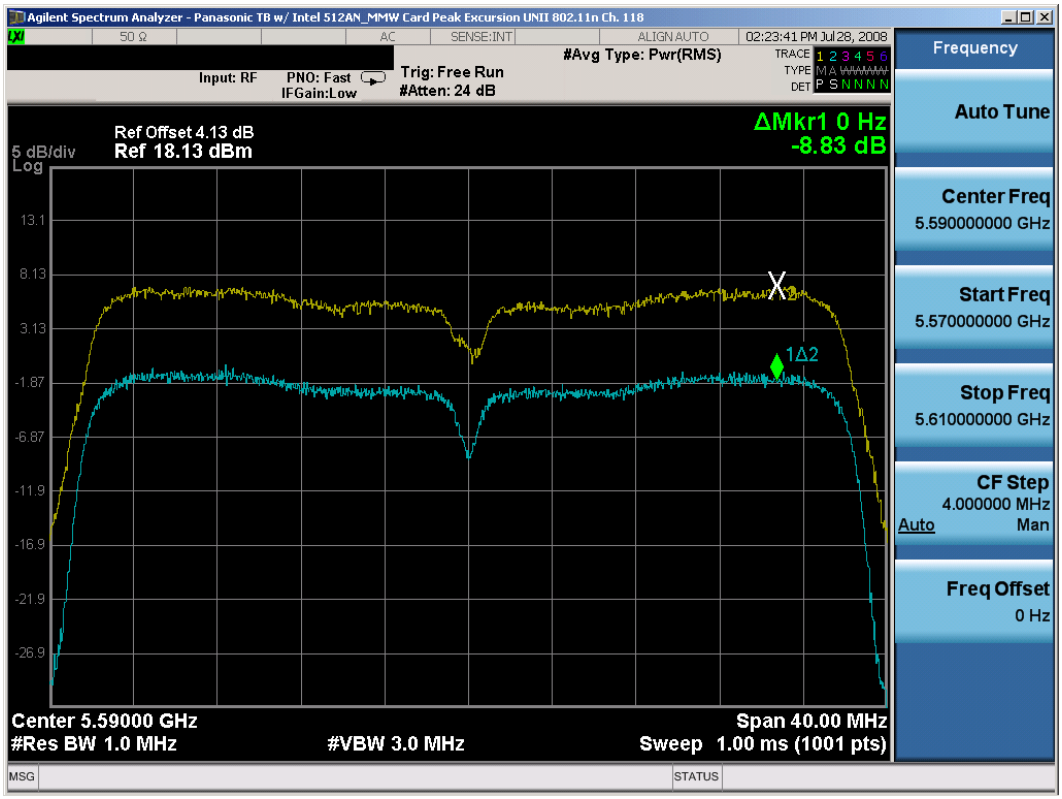


Plot 6-14. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 120)

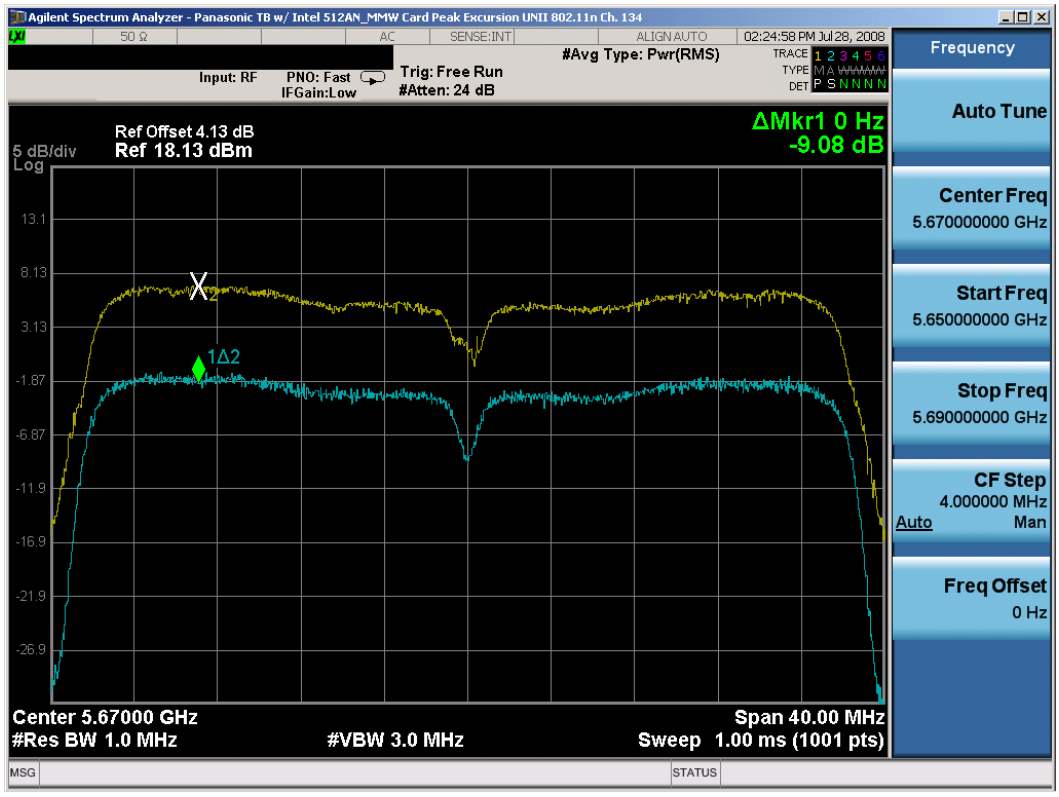


Plot 6-15. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 140)

Plot 6-16. Peak Excursion Ratio Plot (802.11n (UNII) – Ch. 102)



Plot 6-17. Peak Excursion Ratio Plot (802.11n (UNII) – Ch. 118)



Plot 6-18. Peak Excursion Ratio Plot (802.11n (UNII) – Ch. 134)

6.6 Frequency Stability

§15.407(g)

The EUT was placed inside of an environmental chamber as the temperature in the chamber was varied between -30°C and +50°C. The temperature was incremented by 10° intervals and the unit was allowed to stabilize at each temperature before each measurement. The center frequency of the transmitting channel was evaluated at each temperature and the frequency deviation from the channel's center frequency was recorded.

OPERATING FREQUENCY: 5,600,000,000 Hz

CHANNEL: 120

REFERENCE VOLTAGE: 11.1 VDC

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	11.10	+ 20 (Ref)	5,600,004,883	4,883	0.000087
100 %		- 30	5,600,009,714	9,714	0.000173
100 %		- 20	5,600,013,333	13,333	0.000238
100 %		- 10	5,600,006,495	6,495	0.000116
100 %		0	5,600,011,096	11,096	0.000198
100 %		+ 10	5,600,014,185	14,185	0.000253
100 %		+ 20	5,600,012,319	12,319	0.000220
100 %		+ 30	5,599,994,449	-5,551	-0.000099
100 %		+ 40	5,599,985,786	-14,214	-0.000254
100 %		+ 50	5,600,008,548	8,548	0.000153
115 %	12.77	+ 20	5,600,011,209	11,209	0.000200
BATT. ENDPOINT	9.85	+ 20	5,600,001,854	1,854	0.000033

Table 6-7. Frequency Stability Measurements for UNII Band III Ch. 120

6.7 Radiated Spurious Emission Measurements

§15.407(b)(1), (6), §15.205, §15.209

The EUT was tested from 9kHz and up to the 10th harmonic of the fundamental frequency of the transmitter using CISPR quasi peak detector below 1GHZ. Above 1 GHz, peak measurements were taken using RBW = VBW = 1MHz and linearly polarized horn antennas. All out of band emissions appearing in a restricted band as specified in Section 15.205 of the Title 47 CFR must not exceed the limits shown in Table 6-8 per Section 15.209.

Frequency	Field Strength [μV/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 6-8. Radiated Limits

Sample Calculation

- Field Strength Level $_{[dB\mu V/m]}$ = Analyzer Level $_{[dBm]}$ + 107 + AFCL $_{[dB]}$

Notes:

- AFCL = Antenna Factor $_{[dB]}$ + Cable Loss $_{[dB]}$

Radiated Spurious Emission Measurements (Cont'd)

§15.407(b)(1) and (2), §15.205 & §15.209

Mode: 802.11a

Transfer Rate: 6 Mbps

Distance of Measurements: 1 Meter

Operating Frequency: 5500MHz

Channel: 100

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Distance Correction Factor [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
*	11000.00	-94.06	Average	V	49.16	-9.54	52.56	53.98	-1.42
*	11000.00	-76.86	Peak	V	49.16	-9.54	69.76	73.98	-4.22
	16500.00	-86.84	Peak	V	52.09	-9.54	62.70	68.20	-5.50
	22000.00	-125.00	Peak	V	56.81	-9.54	38.81	68.20	-29.39
	27500.00	-125.00	Peak	V	56.44	-9.54	38.44	68.20	-29.76

Table 6-9. Radiated Measurements @ 1 meter

NOTES:

1. All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.

2. This unit was tested with all possible data rate and transmission mode combinations and the highest power is reported with the unit transmitting at 6 Mbps.

3. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-8.

4. Peak Measurements > 1GHz using RBW = VBW = 1MHz.

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

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

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

8. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.

9. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

Radiated Spurious Emission Measurements (Cont'd)

§15.407(b)(1) and (2), §15.205 & §15.209

Mode: 802.11a

Transfer Rate: 6 Mbps

Distance of Measurements: 1 Meter

Operating Frequency: 5600MHz

Channel: 120

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Distance Correction Factor [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
*	11200.00	-94.03	Average	V	49.47	-9.54	52.90	53.98	-1.08
*	11200.00	-78.08	Peak	V	49.47	-9.54	68.85	73.98	-5.13
	16800.00	-84.61	Peak	V	53.69	-9.54	66.54	68.20	-1.66
*	22400.00	-103.45	Average	V	56.92	-9.54	50.93	53.98	-3.05
*	22400.00	-85.35	Peak	V	56.92	-9.54	69.03	73.98	-4.95
	28000.00	-125.00	Peak	V	56.20	-9.54	38.20	68.20	-30.00

Table 6-10. Radiated Measurements @ 1 meter

NOTES:

1. All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.

2. This unit was tested with all possible data rate and transmission mode combinations and the highest power is reported with the unit transmitting at 6 Mbps.

3. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-8.

4. Peak Measurements > 1GHz using RBW = VBW = 1MHz.

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

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

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

8. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.

9. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

Radiated Spurious Emission Measurements (Cont'd)

§15.407(b)(1) and (2), §15.205 & §15.209

Mode: 802.11a

Transfer Rate: 6 Mbps

Distance of Measurements: 1 Meter

Operating Frequency: 5700MHz

Channel: 140

	Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Distance Correction Factor [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
*	11400.00	-94.60	Average	V	49.78	-9.54	52.64	53.98	-1.34
*	11400.00	-77.85	Peak	V	49.78	-9.54	69.39	73.98	-4.59
	17100.00	-86.01	Peak	V	55.56	-9.54	67.01	68.20	-1.19
*	22800.00	-102.93	Average	V	56.74	-9.54	51.28	53.98	-2.70
*	22800.00	-87.23	Peak	V	56.74	-9.54	66.98	73.98	-7.00
	28500.00	-125.00	Peak	V	55.61	-9.54	37.61	68.20	-30.59

Table 6-11. Radiated Measurements @ 1 meter

NOTES:

1. All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.

2. This unit was tested with all possible data rate and transmission mode combinations and the highest power is reported with the unit transmitting at 6 Mbps.

3. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-8.

4. Peak Measurements > 1GHz using RBW = VBW = 1MHz.

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

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

7. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

8. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.

9. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

6.8 Radiated Restricted Band Edge Measurements

§15.407(b)(1) and (2), §15.205 & §15.209

Mode: 802.11a

Transfer Rate: 6 Mbps

Distance of Measurements: 1 Meter

Operating Frequency: 5500MHz

Channel: 100

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Distance Correction Factor [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
5354.00	-94.98	Average	V	41.99	-9.54	44.47	53.98	-9.51
5354.00	-85.03	Peak	V	41.99	-9.54	54.42	73.98	-19.56
5413.80	-95.55	Average	V	42.17	-9.54	44.08	53.98	-9.90
5413.80	-84.55	Peak	V	42.17	-9.54	55.08	73.98	-18.90
5460.00	-95.77	Average	V	42.32	-9.54	44.00	53.98	-9.98
5460.00	-85.82	Peak	V	42.32	-9.54	53.95	73.98	-20.03

Table 6-12. Radiated Restricted Band Measurements at 1-meter

NOTES:

1. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-8.

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

3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.

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

5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.

7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

Radiated Restricted Band Edge Measurements (Cont'd)

§15.407(b)(1) and (2), §15.205 & §15.209

Mode: 802.11n

Transfer Rate: 13.5/15 Mbps

Distance of Measurements: 1 Meter

Operating Frequency: 5510MHz

Channel: 102

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Distance Correction Factor [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
5353.00	-96.88	Average	V	41.98	-9.54	42.56	53.98	-11.42
5353.00	-83.63	Peak	V	41.98	-9.54	55.81	73.98	-18.17
5450.10	-95.08	Average	V	42.28	-9.54	44.67	53.98	-9.31
5450.10	-78.58	Peak	V	42.28	-9.54	61.17	73.98	-12.81
5460.00	-92.82	Average	V	42.32	-9.54	46.95	53.98	-7.03
5460.00	-79.37	Peak	V	42.32	-9.54	60.40	73.98	-13.58

Table 6-13. Radiated Restricted Band Measurements at 1-meter

NOTES:

1. All emissions that lie in the restricted bands (denoted by a * next to the frequency) specified in §15.205 are below the limit shown in Table 6-8.

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

3. The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.

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

5. The spectrum is measured from 9kHz to the 10th harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.

6. Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.

7. Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

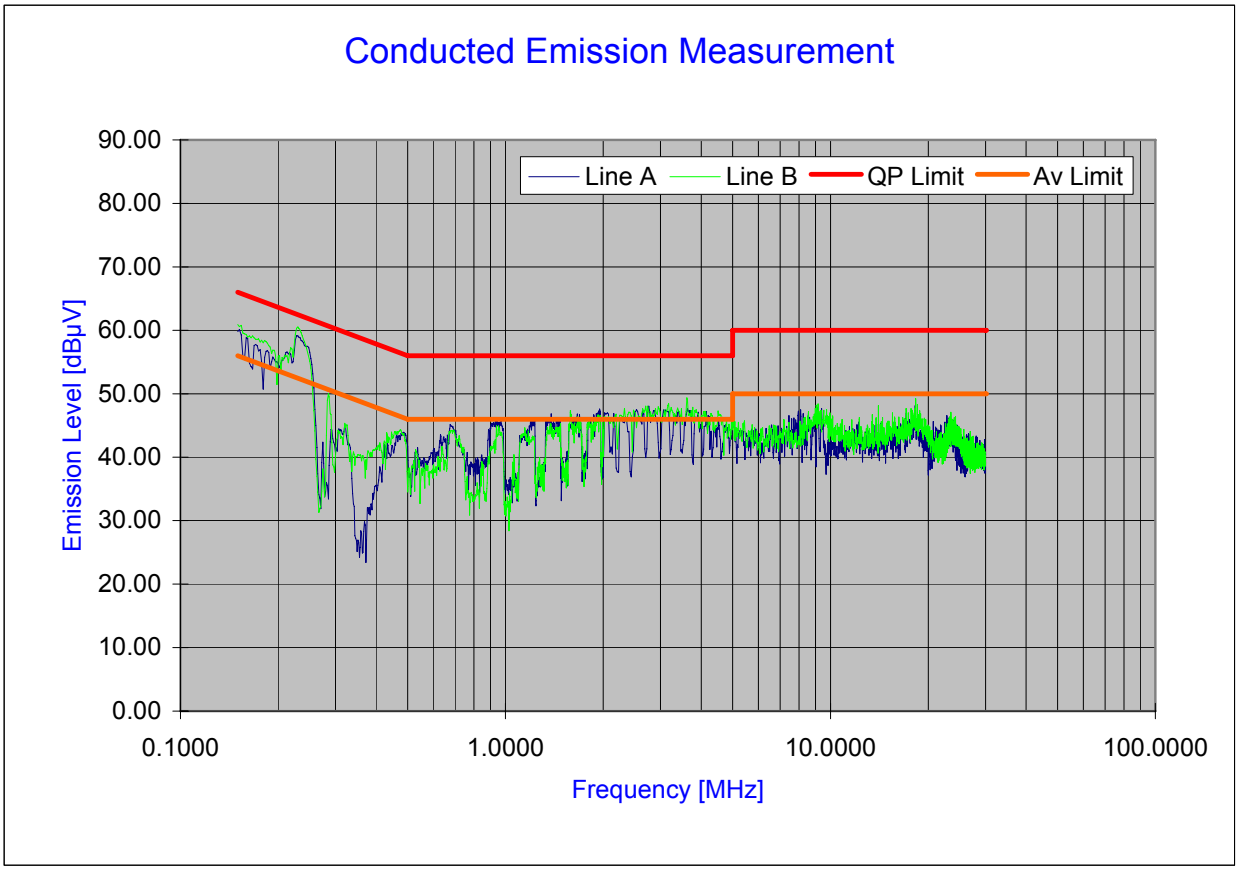
6.9 Line-Conducted Test Data

§15.207

PCTEST Engineering Laboratory Inc.

Company : Panasonic Corporation
Model Number : CF-52
FCC ID Code : ACJ9TGCF-523
Standard : FCC Part 15C, 15.207

Power Source : AC120V/60Hz
Tested Date : 07/29/2008
Note : Tested with 802.11a UNII Band 3 ON



Ver.1.1 ©PCTEST 2006.08

Plot 6-19. Line Conducted Plot with 802.11a (UNII Band III)

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 Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot made using a peak detector.
5. Deviations to the Specifications: None.

Line-Conducted Test Data (Cont'd)

§15.207

No.	Line	Frequency	Factor	QP	Limit	Margin	Average	Limit	Margin
		[MHz]	[dB]	[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	A	0.150	8.20	54.63	66.00	-11.37	35.31	56.00	-20.69
2	A	0.151	8.20	54.74	66.00	-11.26	36.06	56.00	-19.94
3	A	0.152	8.18	53.98	65.87	-11.89	34.13	55.87	-21.74
4	A	0.168	8.10	51.00	65.08	-14.08	30.27	55.08	-24.81
5	A	0.228	7.83	58.13	62.53	-4.40	39.62	52.53	-12.91
6	A	1.946	7.39	42.59	56.00	-13.41	24.42	46.00	-21.58
7	A	2.483	7.42	45.11	56.00	-10.89	28.45	46.00	-17.55
8	A	2.714	7.43	44.10	56.00	-11.90	28.56	46.00	-17.44
9	A	3.145	7.45	44.54	56.00	-11.46	27.93	46.00	-18.07
10	A	3.616	7.47	43.25	56.00	-12.75	31.32	46.00	-14.68
11	B	0.150	8.20	57.60	66.00	-8.40	36.00	56.00	-20.00
12	B	0.229	7.82	58.79	62.49	-3.70	46.88	52.49	-5.61
13	B	1.591	7.36	43.19	56.00	-12.81	32.29	46.00	-13.71
14	B	1.928	7.39	42.51	56.00	-13.49	24.36	46.00	-21.64
15	B	1.991	7.39	36.40	56.00	-19.60	23.69	46.00	-22.31
16	B	2.257	7.41	43.81	56.00	-12.19	28.22	46.00	-17.78
17	B	2.718	7.43	44.36	56.00	-11.64	28.23	46.00	-17.77
18	B	3.612	7.47	44.44	56.00	-11.56	31.90	46.00	-14.10
19	B	4.521	7.50	42.75	56.00	-13.25	30.26	46.00	-15.74
20	B	4.958	7.51	41.22	56.00	-14.78	30.15	46.00	-15.85

Table 6-14. Line Conducted Data with 802.11a (UNII Band III)

Notes:

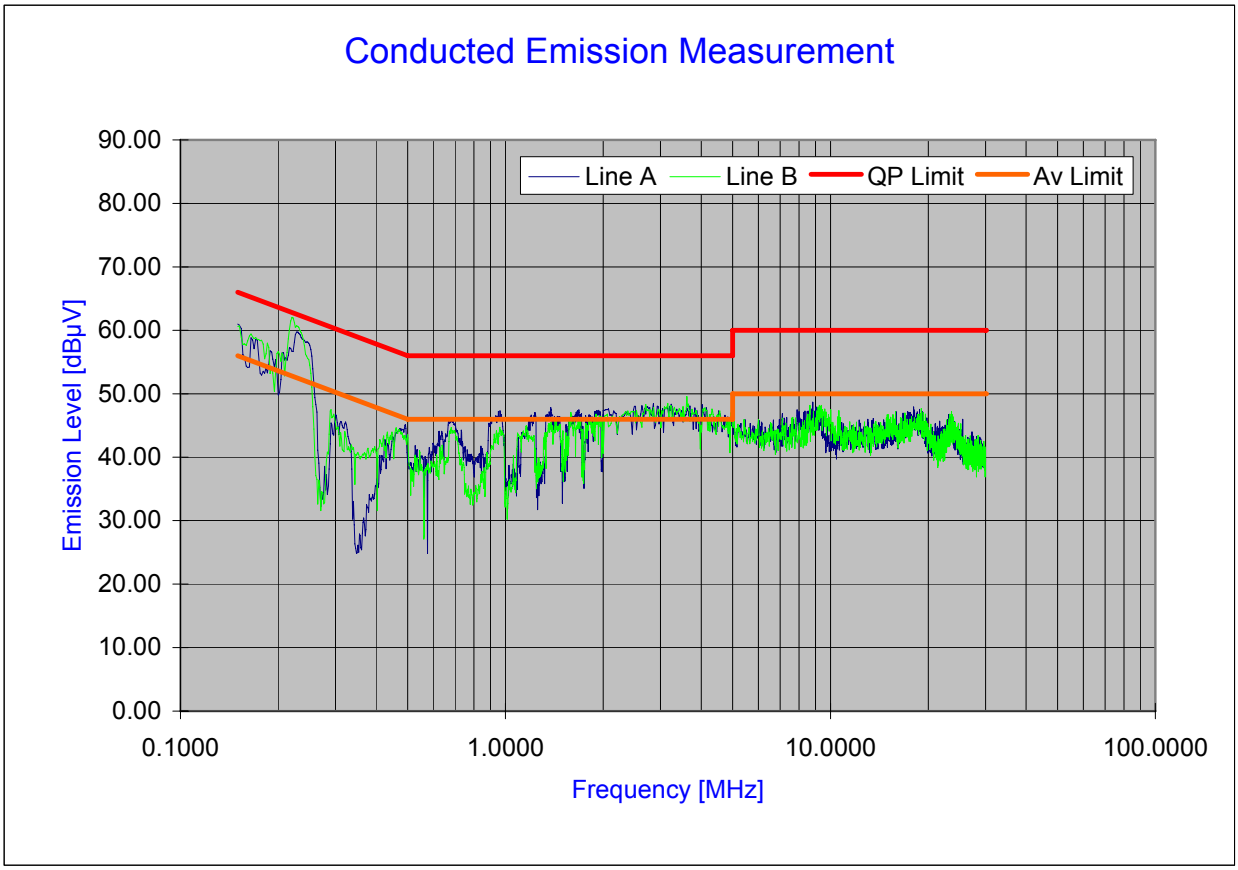
1. All Modes of operation were investigated and the worst-case emissions are reported.
2. The limit for Class B device(s) from 150kHz to 30MHz are specified in Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot made using a peak detector.
5. Deviations to the Specifications: None.

Line-Conducted Test Data (Cont'd)
§15.207

PCTEST Engineering Laboratory Inc.

Company : Panasonic Corporation
Model Number : CF-52
FCC ID Code : ACJ9TGCF-523
Standard : FCC Part 15C, 15.207

Power Source : AC120V/60Hz
Tested Date : 07/29/2008
Note : Tested with 802.11n UNII Band 3 ON



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Plot 6-20. Line Conducted Plot with 802.11n (UNII Band III)

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 Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot made using a peak detector.
5. Deviations to the Specifications: None.

Line-Conducted Test Data (Cont'd)

§15.207

No.	Line	Frequency	Factor	QP	Limit	Margin	Average	Limit	Margin
		[MHz]	[dB]	[dBµV]	[dBµV]	[dB]	[dBµV]	[dBµV]	[dB]
1	A	0.150	8.20	54.89	66.00	-11.11	36.02	56.00	-19.98
2	A	0.152	8.19	53.85	65.87	-12.02	34.36	55.87	-21.51
3	A	0.198	7.94	49.82	63.72	-13.90	30.26	53.72	-23.46
4	A	0.228	7.83	58.10	62.53	-4.43	39.78	52.53	-12.75
5	A	1.368	7.34	44.66	56.00	-11.34	28.33	46.00	-17.67
6	A	2.498	7.42	45.45	56.00	-10.55	28.55	46.00	-17.45
7	A	2.695	7.43	43.24	56.00	-12.76	26.67	46.00	-19.33
8	A	2.872	7.44	43.37	56.00	-12.63	27.27	46.00	-18.73
9	A	2.948	7.44	44.47	56.00	-11.53	27.36	46.00	-18.64
10	A	3.157	7.45	44.90	56.00	-11.10	27.86	46.00	-18.14
11	B	0.150	8.20	57.32	65.99	-8.67	35.83	55.99	-20.16
12	B	0.153	8.20	57.29	65.99	-8.70	36.29	55.99	-19.70
13	B	0.226	7.84	58.70	62.61	-3.91	37.70	52.61	-14.91
14	B	1.590	7.36	43.12	56.00	-12.88	32.54	46.00	-13.46
15	B	3.169	7.45	45.32	56.00	-10.68	31.59	46.00	-14.41
16	B	3.178	7.45	45.32	56.00	-10.68	31.34	46.00	-14.66
17	B	3.615	7.47	43.03	56.00	-12.97	30.94	46.00	-15.06
18	B	4.095	7.48	43.77	56.00	-12.23	30.95	46.00	-15.05
19	B	4.316	7.49	42.86	56.00	-13.14	30.74	46.00	-15.26
20	B	4.542	7.50	42.77	56.00	-13.23	30.50	46.00	-15.50

Table 6-15. Line Conducted Data with 802.11n (UNII Band III)

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 Section 15.207 of the Title 47 CFR.
3. Line A = Phase; Line B = Neutral
4. Traces shown in plot made using a peak detector.
5. Deviations to the Specifications: None.

7.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Panasonic Toughbook Model: CF-52 FCC ID: ACJ9TGCF-523** is in compliance with Part 15E of the FCC Rules.