



# 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 Certification

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

**Date of Testing:**  
February 13 - 14, 2008  
**Test Site/Location:**  
PCTEST Lab, Columbia, MD, USA  
**Test Report Serial No.:**  
0801230086.ACJ

<b>FCC ID:</b>	<b>ACJ9TGCF-29DC</b>
<b>APPLICANT:</b>	<b>Panasonic Corporation of North America</b>

**Model(s):** CF-29  
**EUT Type:** Toughbook Model: CF-29  
**Max. RF Output Power:** 14.52 mW (11.62 dBm) Conducted (UNII Low Band)  
 38.28 mW (15.83 dBm) Conducted (UNII High Band)  
**Frequency Range:** 5180MHz – 5240MHz (UNII Low Band)  
 5260MHz – 5320MHz (UNII High Band)  
**FCC Classification:** Unlicensed National Information Infrastructure (UNII)  
**FCC Rule Part(s):** Part 15.407  
**Test Device Serial No.:** 5KKSAA00013

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



<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29		Page 1 of 39

# TABLE OF CONTENTS

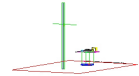
FCC PART 15.407 MEASUREMENT REPORT.....		3
1.0 INTRODUCTION.....		4
1.1 SCOPE.....		4
1.2 PCTEST TEST LOCATION.....		4
2.0 PRODUCT INFORMATION.....		5
2.1 EQUIPMENT DESCRIPTION.....		5
2.2 EMI SUPPRESSION DEVICE(S)/MODIFICATIONS.....		5
2.3 LABELING REQUIREMENTS.....		5
3.0 DESCRIPTION OF TEST.....		6
3.1 EVALUATION PROCEDURE.....		6
3.2 CONDUCTED EMISSIONS.....		6
3.3 RADIATED EMISSIONS.....		7
4.0 ANTENNA REQUIREMENTS.....		8
5.0 TEST EQUIPMENT CALIBRATION DATA.....		9
6.0 TEST RESULTS.....		10
6.1 SUMMARY.....		10
6.2 26DB BANDWIDTH MEASUREMENT.....		11
6.3 OUTPUT POWER MEASUREMENT.....		15
6.4 PEAK POWER SPECTRAL DENSITY.....		16
6.5 PEAK EXCURSION RATIO.....		20
6.6 FREQUENCY STABILITY.....		24
6.7 RADIATED SPURIOUS EMISSION MEASUREMENTS.....		26
6.8 RADIATED RESTRICTED BAND EDGE MEASUREMENTS.....		33
6.9 LINE-CONDUCTED TEST DATA.....		35
7.0 CONCLUSION.....		39

<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29		Page 2 of 39



# 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-29

**FCC ID:** ACJ9TGCF-29DC

**Test Device Serial No.:** 5KKSAA00013     Production     Pre-Production     Engineering

**FCC CLASSIFICATION:** Unlicensed National Information Infrastructure (UNII)

**DATE(S) OF TEST:** February 13 - 14, 2008



**TEST REPORT S/N:** 0801230086.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.

<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29		Page 3 of 39

# 1.0 INTRODUCTION

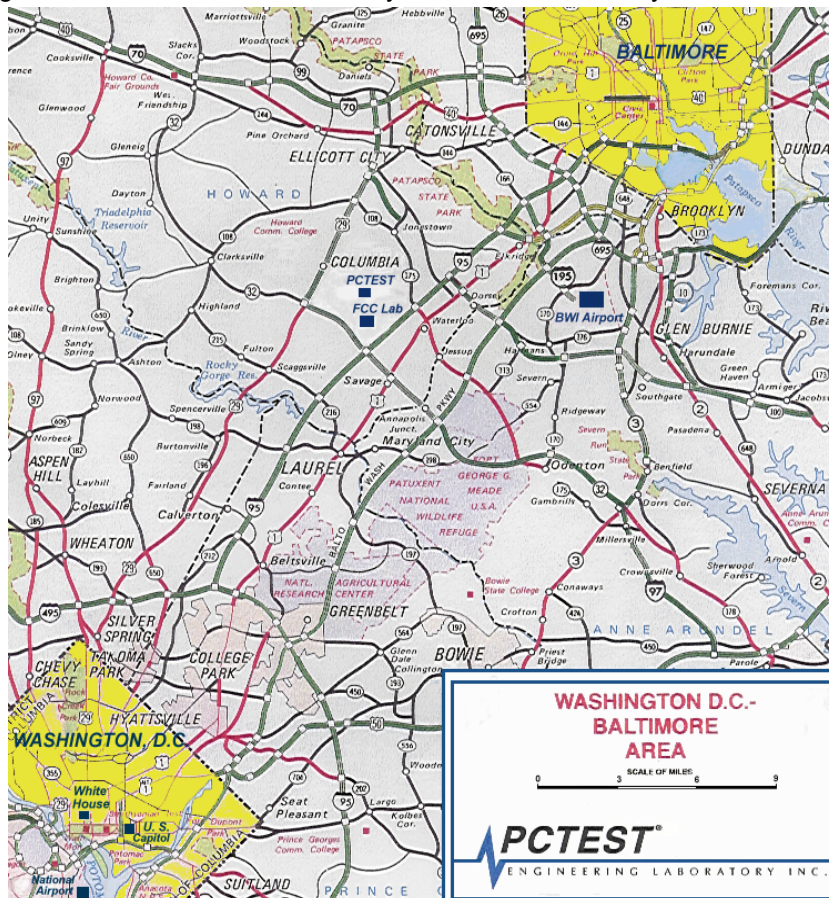
## 1.1 Scope

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 area, the Baltimore-Washington Intern'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**

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 4 of 39

## 2.0 PRODUCT INFORMATION

### 2.1 Equipment Description

The Equipment Under Test (EUT) is the **Panasonic Toughbook Model: CF-29 FCC ID: ACJ9TGCF-29DC**. The EUT consisted of the following component(s):

Manufacturer / Model	FCC ID	Description
Panasonic / Model: CF-29	ACJ9TGCF-29DC	Toughbook Model: CF-29
Novatel / Model: EU860D	NBZNRM-EU860D	GSM/EDGE/WCDMA Module
Alps / Model: UGXZ5	N/A	Bluetooth Module
Intel / Model: WM3B2915ABG	PD9WM3B2915ABG	802.11a/b/g Module

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

### 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.

<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29	Page 5 of 39	

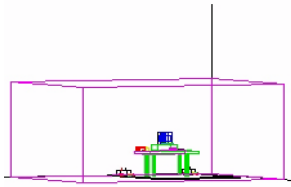
## 3.0 DESCRIPTION OF TEST

### 3.1 Evaluation Procedure

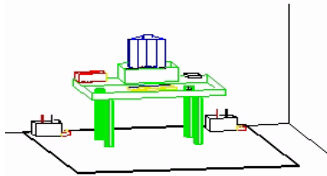
The measurement procedure described in the American National Standard for Methods of Measurement of Radio-Noise Emission from Low-Voltage Electrical and Electronic Equipment in the Range of 9kHz to 40GHz (ANSI C63.4-2003) and FCC Public Notice DA 02-2138 dated August 30, 2002 entitled "Measurement Procedure Updated for Peak Transmit Power in the Unlicensed National Information Infrastructure (U-NII) Bands" were used in the measurement of **Panasonic Toughbook Model: CF-29 FCC ID: ACJ9TGCF-29DC**.

Deviation from measurement procedure.....None.

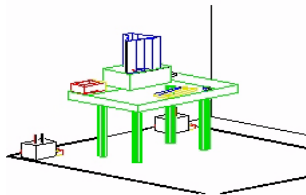
### 3.2 Conducted Emissions



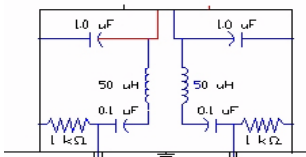
**Figure 3-1. Shielded Enclosure Line-Conducted Test Facility**



**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 (see 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.

FCC ID: ACJ9TGCF-29DC	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 6 of 39

### 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

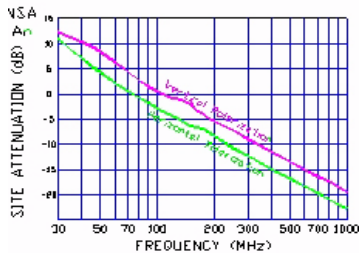


Figure 3-8. Normalized Site Attenuation Curves (H&V)

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.

FCC ID: ACJ9TGCF-29DC	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	Panasonic	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 7 of 39	

## 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-29 are **permanently attached**.
- There are no provisions for connection to an external antenna.

**Conclusion:**

The **Panasonic Toughbook Model: CF-29 FCC ID: ACJ9TGCF-29DC** unit complies with the requirement of §15.203.



**Low Band**

Ch.	Frequency (MHz)
36	5180
:	:
42	5210
:	:
48	5240

**High Band**

Ch.	Frequency (MHz)
52	5260
:	:
56	5280
:	:
64	5320

**Table 4-1. Frequency / Channel Operations**



<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29		Page 8 of 39

## 5.0 TEST EQUIPMENT CALIBRATION DATA

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

Manufacturer	Model / Equipment	Calibration Date	Cal Interval	Calibration Due	Serial No.
Agilent	E4407B ESA Spectrum Analyzer	04/29/07	Annual	04/28/08	US39210313
Agilent	N4010A Wireless Connectivity Test Set	06/11/07	Annual	06/10/08	GB46170464
EMCO	Model 3115 (1-18GHz) Horn Antenna	10/04/07	Biennial	10/03/09	9205-3874
EMCO	Model 3115 (1-18GHz) Horn Antenna	09/24/07	Biennial	09/23/09	9704-5182
Rohde & Schwarz	NRVS Power Meter	07/03/07	Biennial	07/02/09	835360/079
Rohde & Schwarz	NRV-Z53 Power Sensor	07/03/07	Biennial	07/02/09	846076/007
Agilent	E8257D (250kHz-20GHz) Signal Generator	03/08/07	Biennial	03/07/09	MY45470194
Agilent	HP 8449B (1-26.5GHz) Pre-Amplifier	12/13/07	Annual	12/12/08	3008A00985
Agilent	HP 11713A Attenuation/Switch Driver	12/13/07	Annual	12/12/08	3439A02645
Agilent	HP 8566B Opt. 462 Impulse Bandwidth	12/13/07	Annual	12/12/08	3701A22204
EMCO	Dipole Pair	09/20/06	Biennial	09/19/08	23951
SOLAR	8012-50 LISN (2)	11/08/07	Biennial	11/07/09	0310233, 0310234
-	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

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

<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29		Page 9 of 39



## 6.0 TEST RESULTS

### 6.1 Summary

Company Name: Panasonic Corporation of North America  
 FCC ID: ACJ9TGCF-29DC  
 Method/System: Unlicensed National Information Infrastructure (UNII)  
 Data Rate(s) Tested: 6, 9, 12, 18, 24, 36, 48, 54Mbps

FCC Part Section(s)	Test Description	Test Limit	Test Condition	Test Result	Reference
<b>TRANSMITTER MODE (Tx)</b>					
N/A	26 dB Bandwidth	> 500kHz	CONDUCTED	PASS	Section 6.2
15.407 (a)(1)	Maximum Conducted Output Power	< 4 + 10log <sub>10</sub> (BW) dBm (5150-5250) < 11 + 10log <sub>10</sub> (B) dBm (5250-5350)		PASS	Section 6.3
15.407 (a)(1), (5)	Peak Power Spectral Density	< 4 dBm/MHz (5150-5250) < 11dBm/MHz (5250-5350)		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	RADIATED	PASS	Section 6.6
15.407(b)(1), (6)	Undesirable Emissions	< -27 dBm/MHz EIRP (5150-5350)		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
<b>RECEIVER MODE (Rx) / DIGITAL DEVICE</b>					
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
<b>RF EXPOSURE</b>					
15.407(f), 2.1091/2.1093	MPE Test	1 mW/cm <sup>2</sup> (MPE Limit) @ 20 cm	MPE	PASS	MPE Report

**Table 6-1. Summary of Test Results**

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 10 of 39	

## 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.	Measured 26dB Bandwidth [MHz]
Band I	5180	36	16.45
	5200	40	16.45
	5240	48	16.46
Band II	5260	52	16.46
	5280	56	16.43
	5320	64	16.42

Table 6-2. Conducted Bandwidth Measurements

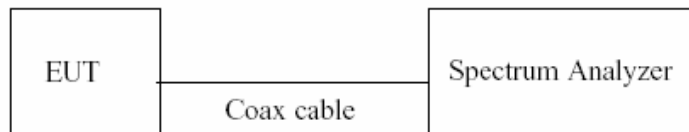


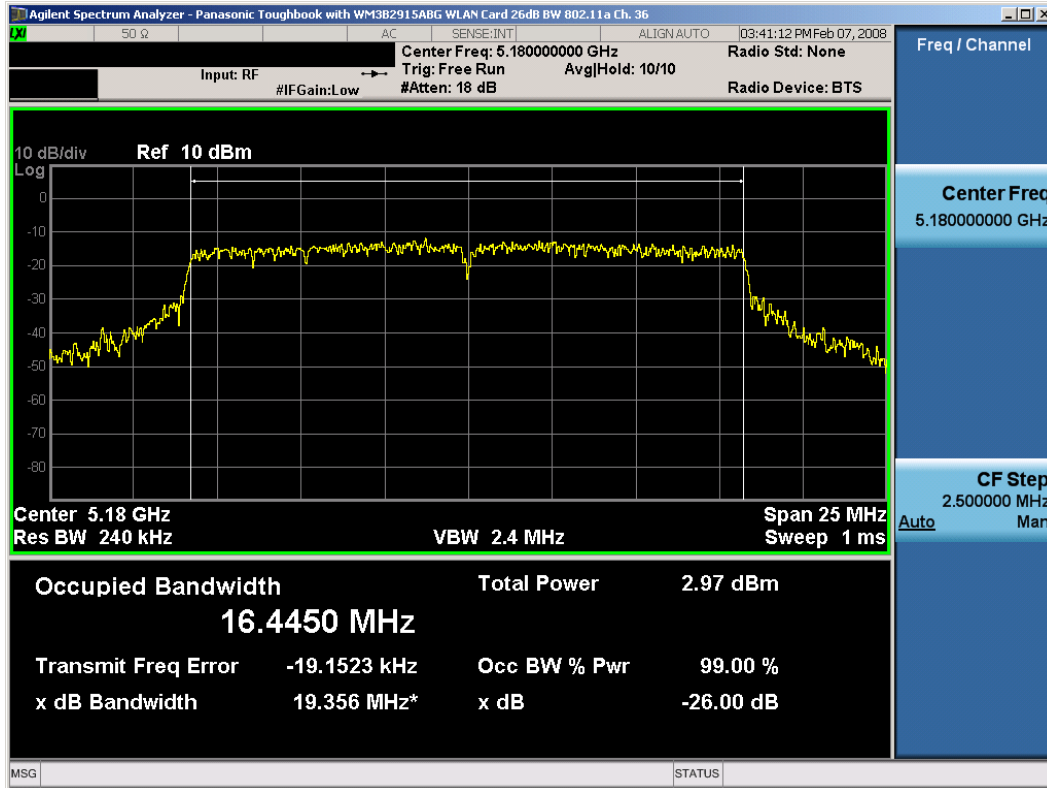
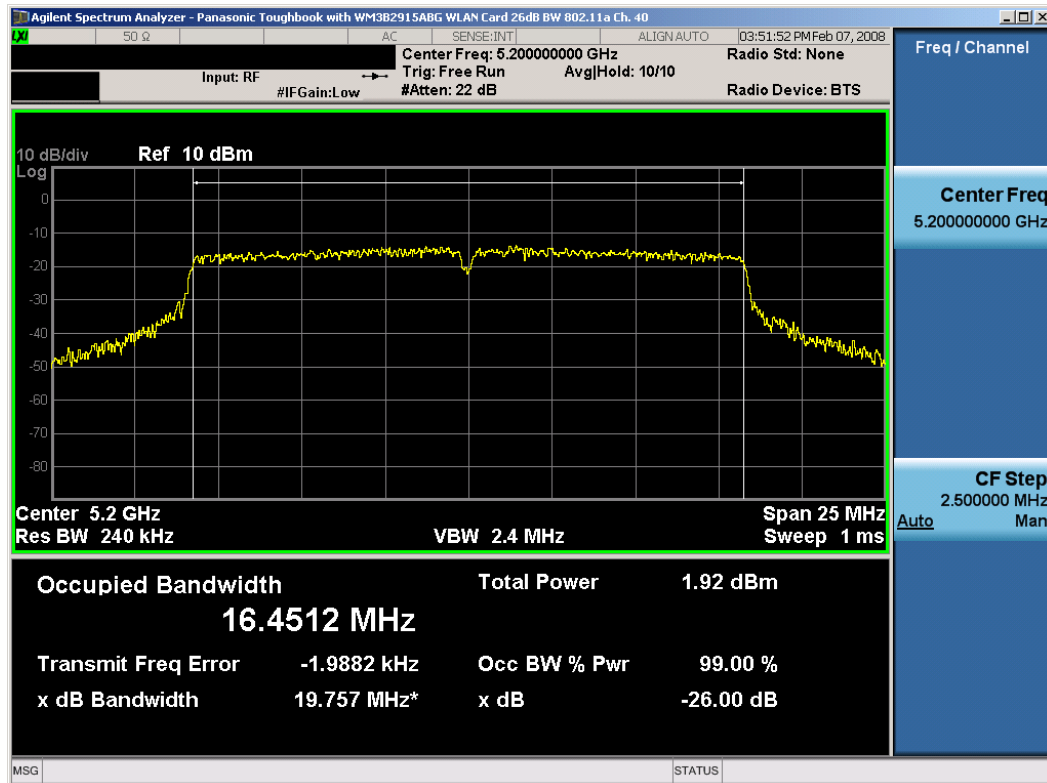


Figure 6-1. Test Instrument & Measurement Setup

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 11 of 39	

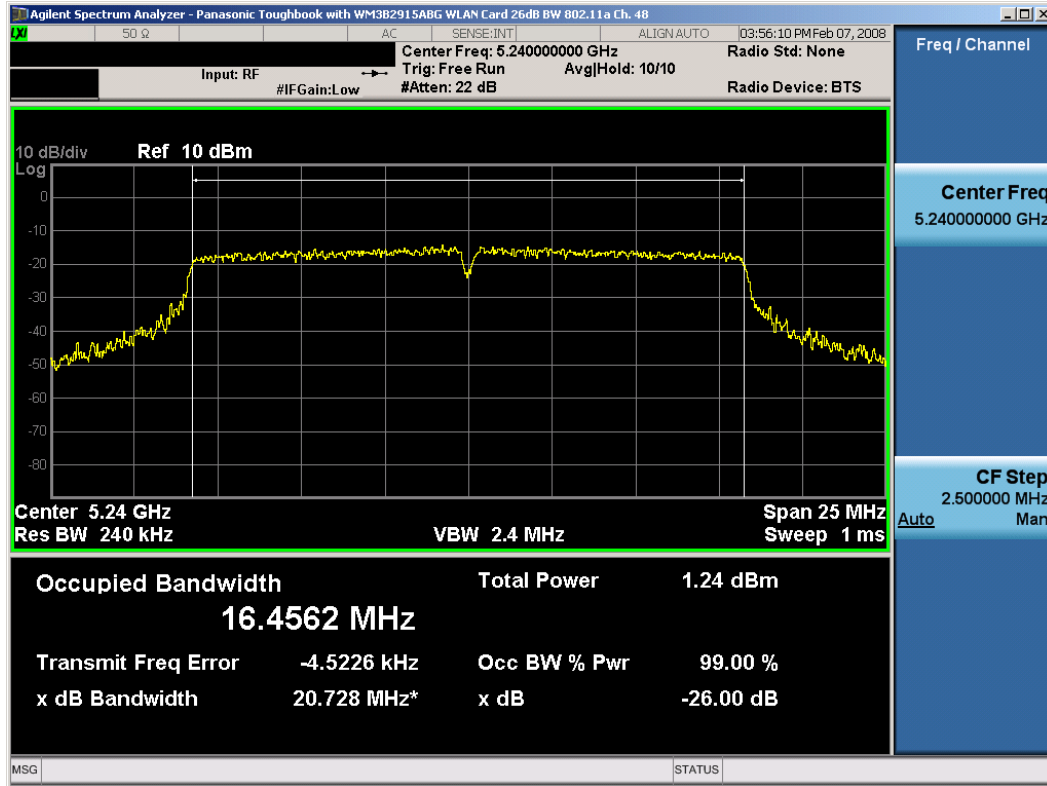


Plot 6-1. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 36)

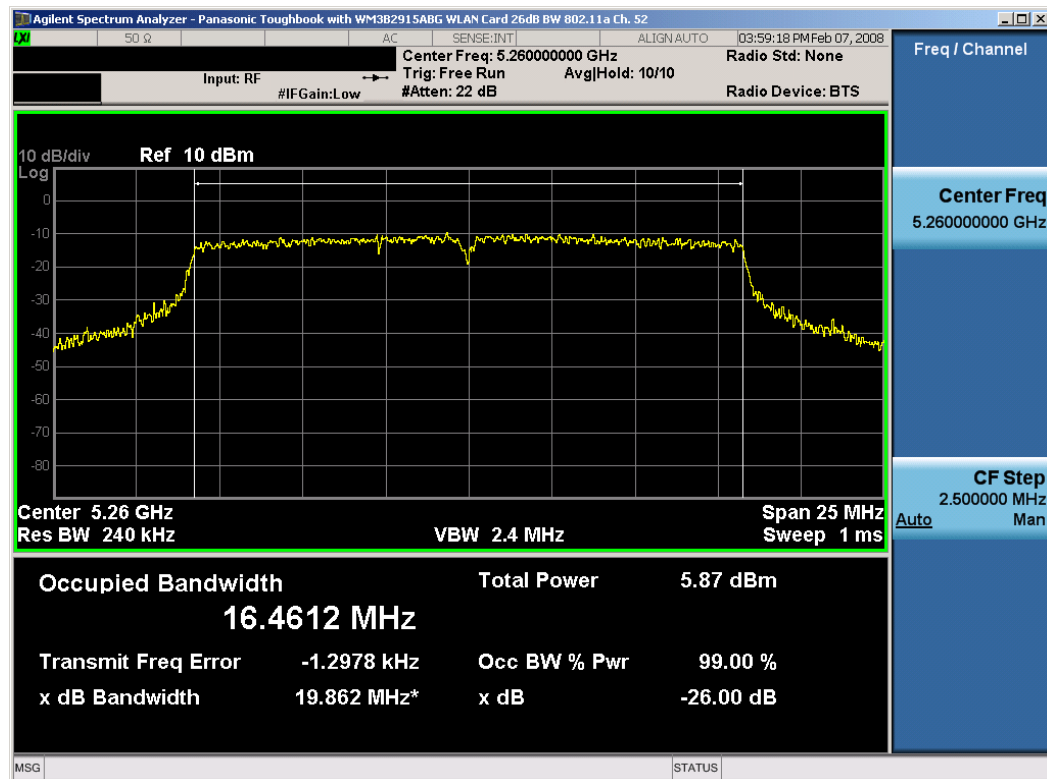


Plot 6-2. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 40)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 12 of 39

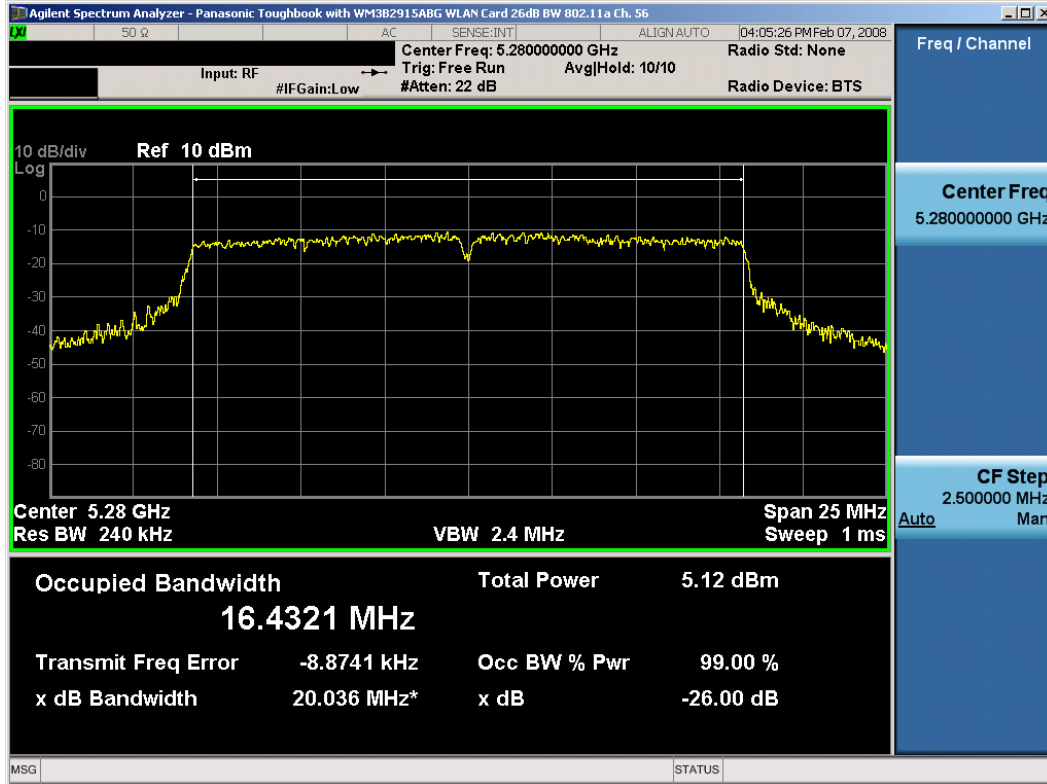


Plot 6-3. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 48)

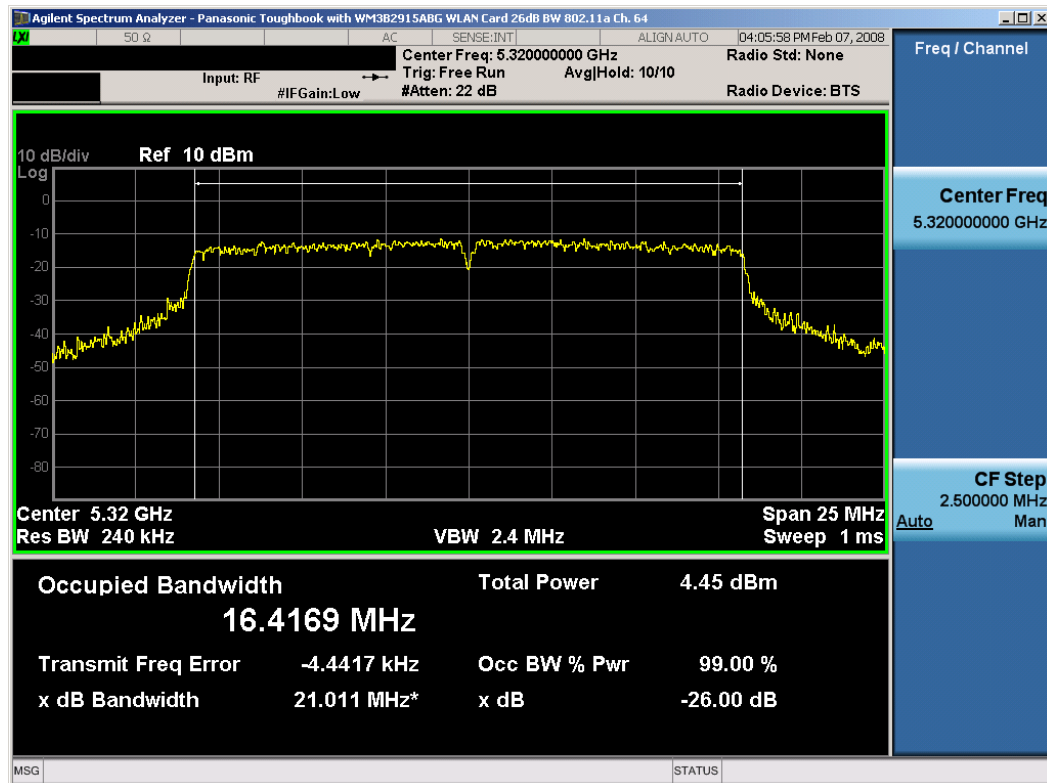


Plot 6-4. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 52)

FCC ID: ACJ9TGCF-29DC	PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	Panasonic	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 13 of 39



Plot 6-5. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 56)



Plot 6-6. 26dB Bandwidth Plot (802.11a (UNII) – Ch. 64)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 14 of 39

### 6.3 Output Power Measurement

**§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 5.15 – 5.25GHz band, the maximum permissible conducted output power is the lesser of 50mW (16.99dBm) and 4 dBm + 10log<sub>10</sub>(26dB BW). In the 5.25 – 5.35GHz band, the maximum permissible conducted output power is the lesser of 250mW (23.98dBm) and 11 dBm + 10log<sub>10</sub>(26dB BW).***

Freq [MHz]	Channel	Data Rate [Mbps]	Main Ant. Measured Power [dBm]	Aux Ant. Measured Power [dBm]
5180	36	6	11.37	11.31
		9	11.18	11.25
		12	11.15	11.08
		18	11.16	11.17
		24	10.95	10.83
		36	10.82	10.69
		48	10.86	10.78
		54	10.61	10.59
		5200	40	6
9	11.51			11.37
12	11.49			11.24
18	11.43			11.45
24	11.29			11.15
36	11.16			11.05
48	11.12			11.26
54	10.94			10.91
5240	48			6
		9	10.86	10.62
		12	10.77	10.78
		18	10.72	10.69
		24	10.64	10.61
		36	10.53	10.42
		48	10.47	10.58
		54	10.29	10.41

**Table 6-3. UNII Band I Conducted Output Power Measurements**

Freq [MHz]	Channel	Data Rate [Mbps]	Main Ant. Measured Power [dBm]	Aux Ant. Measured Power [dBm]
5260	52	6	15.64	15.21
		9	15.53	15.59
		12	15.50	15.41
		18	15.44	15.38
		24	15.35	15.22
		36	14.39	14.44
		48	14.32	14.26
		54	10.32	10.54
		5280	56	6
9	15.28			15.33
12	15.22			15.09
18	15.13			15.10
24	15.08			14.97
36	14.75			14.69
48	13.86			13.75
54	12.33			12.30
5320	64			6
		9	<b>15.83</b>	15.76
		12	15.09	15.03
		18	15.03	15.01
		24	15.00	14.93
		36	14.87	14.93
		48	13.36	14.51
		54	11.16	10.97

**Table 6-4. UNII Band II Conducted Output Power Measurements**

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 15 of 39	

## 6.4 Peak Power Spectral Density

### §15.407 (a)(1),(5)

The spectrum analyzer was connected to the antenna terminal while the EUT was operating in a continuous transmission mode at the appropriate center frequencies. **The maximum permissible peak power spectral density is 4dBm/MHz in the 5.15GHz – 5.25GHz band and 11dBm/MHz in the 5.25GHz – 5.35 GHz band.**

	Frequency [MHz]	Channel No.	Measured Power Density [dBm]	Maximum Permissible Power Density [dBm/MHz]	Margin [dB]
Band I	5180	36	0.575	4.0	-3.4
	5200	40	-0.988	4.0	-5.0
	5240	48	-0.540	4.0	-4.5
Band II	5260	52	4.138	11.0	-6.9
	5280	56	3.533	11.0	-7.5
	5320	64	2.871	11.0	-8.1

Table 6-5. Conducted Power Spectral Density Measurements

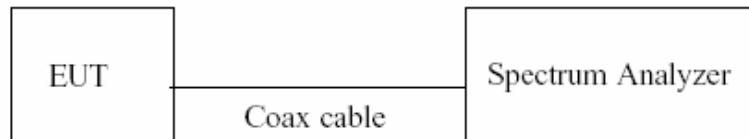


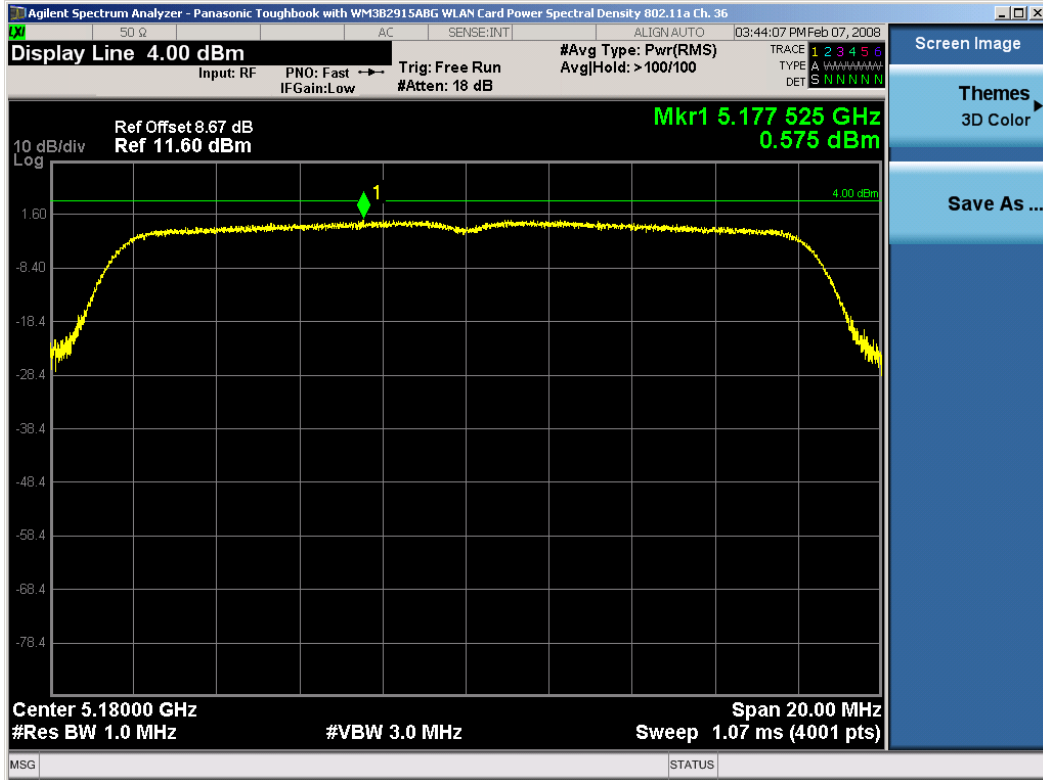
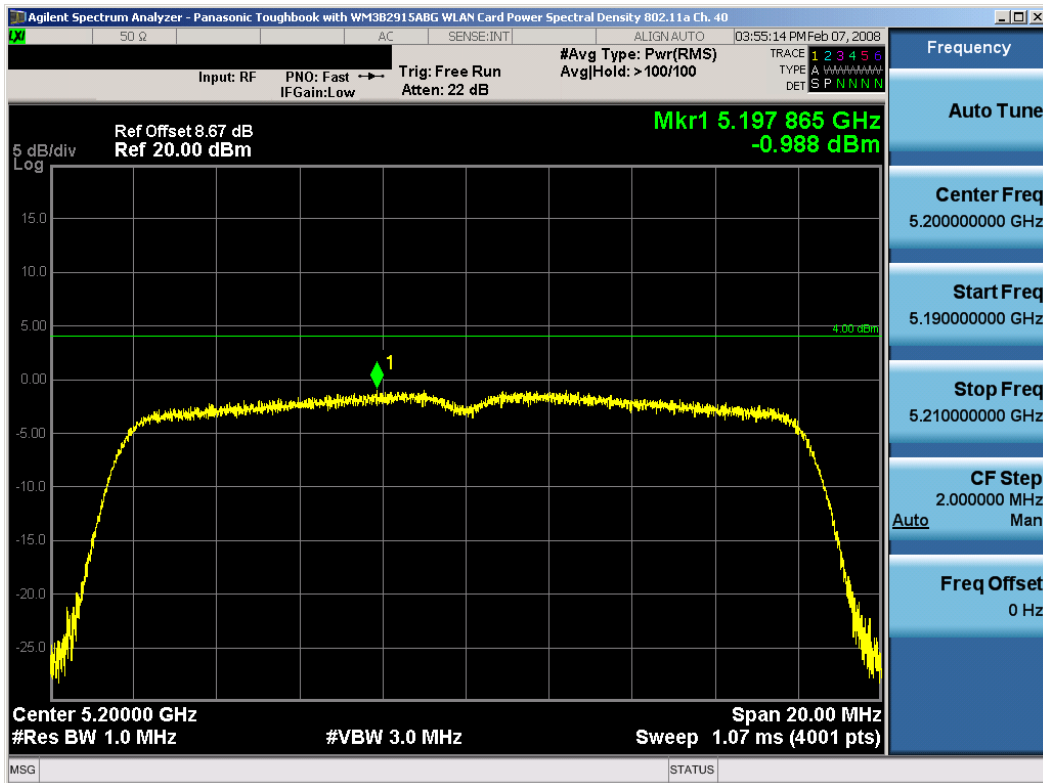


Figure 6-2. Test Instrument & Measurement Setup

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 16 of 39

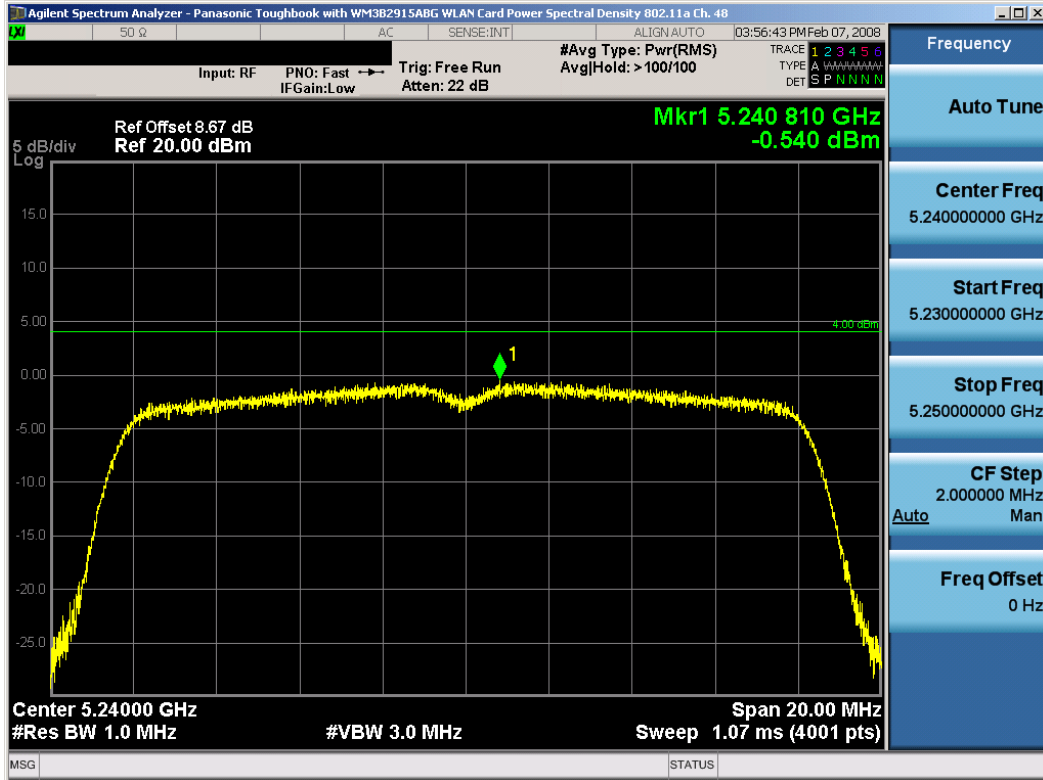


Plot 6-7. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 36)

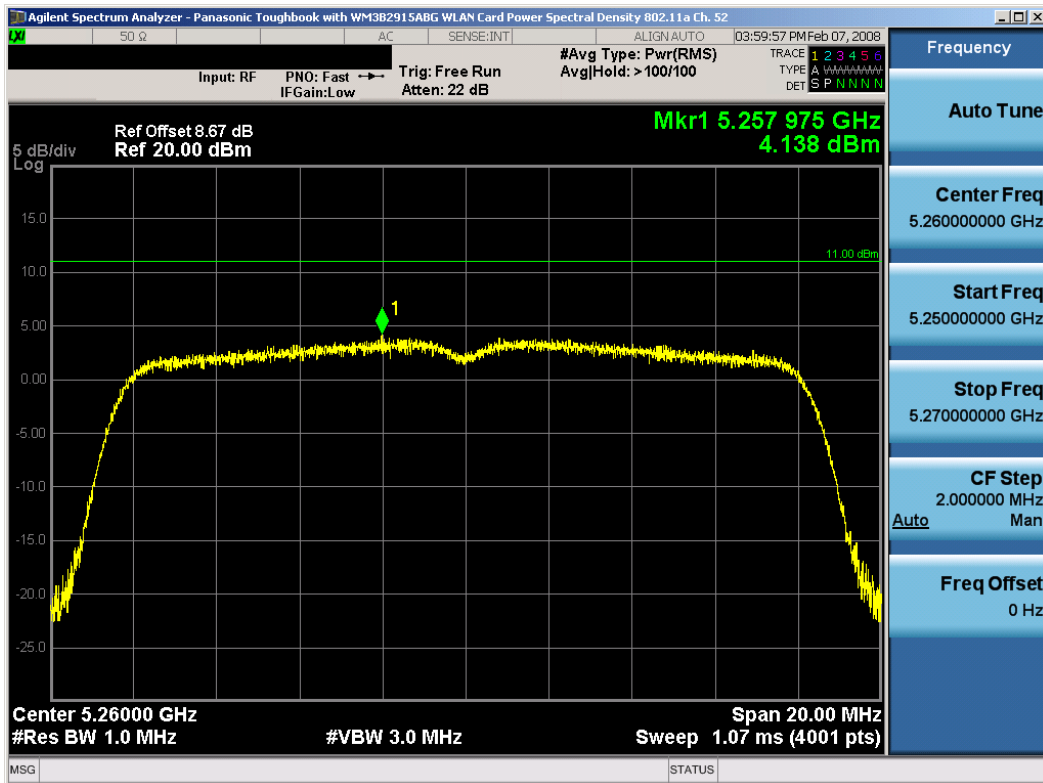


Plot 6-8. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 40)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 17 of 39

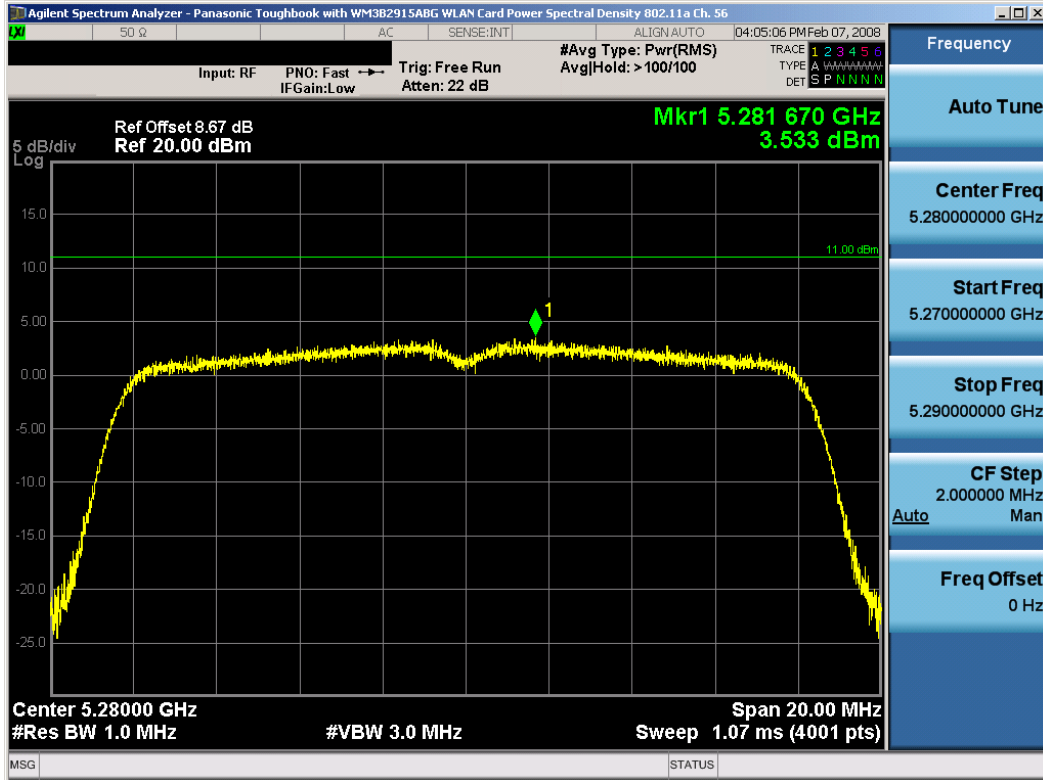


Plot 6-9. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 48)

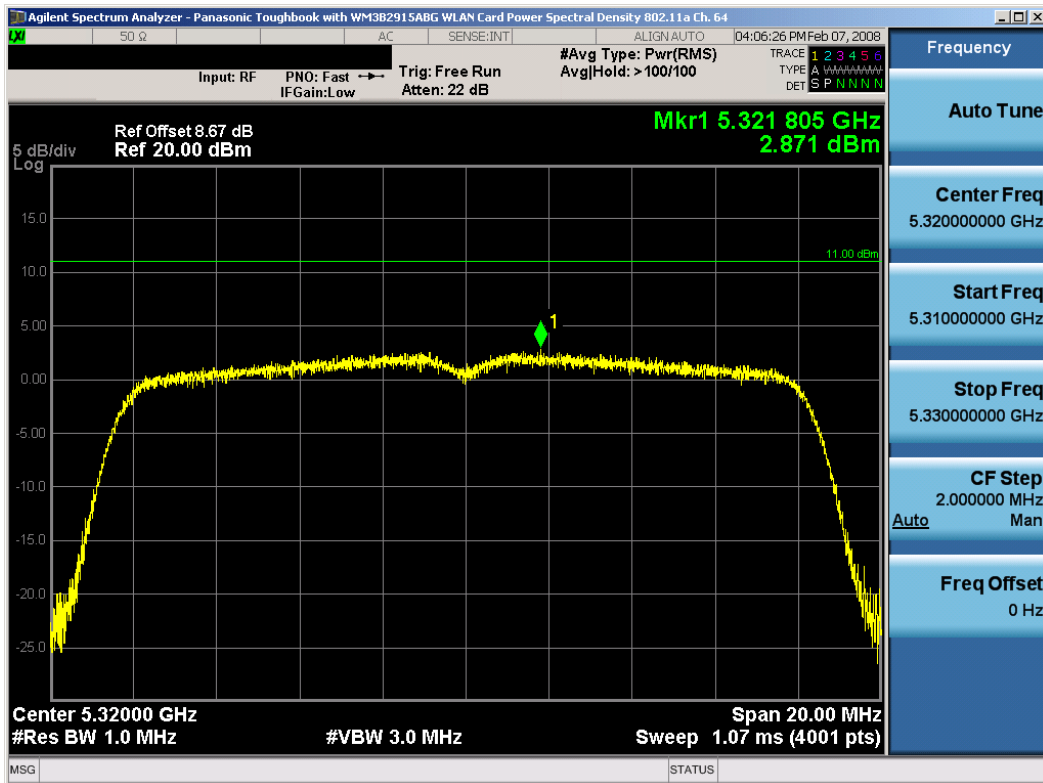


Plot 6-10. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 52)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 18 of 39



Plot 6-11. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 56)



Plot 6-12. Peak Power Spectral Density Plot (802.11a (UNII) – Ch. 64)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 19 of 39

## 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.	Measured Peak Excursion Ratio [dBm]	Maximum Permissible Peak Excursion Ratio [dBm/MHz]	Margin [dB]
Band I	5180	36	11.20	13.0	-1.8
	5200	40	11.16	13.0	-1.8
	5240	48	10.80	13.0	-2.2
Band II	5260	52	10.64	13.0	-2.4
	5280	56	10.92	13.0	-2.1
	5320	64	11.20	13.0	-1.8

Table 6-6. Conducted Peak Excursion Ratio Measurements

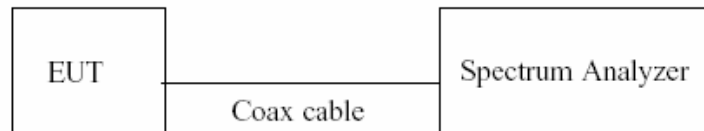


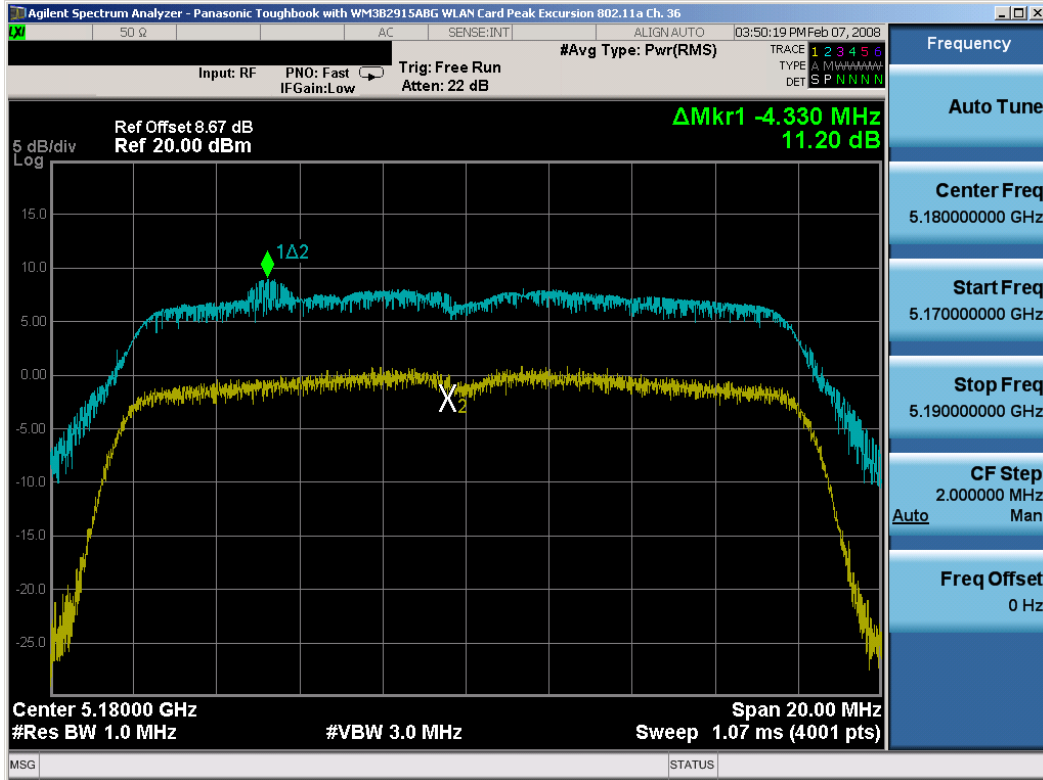
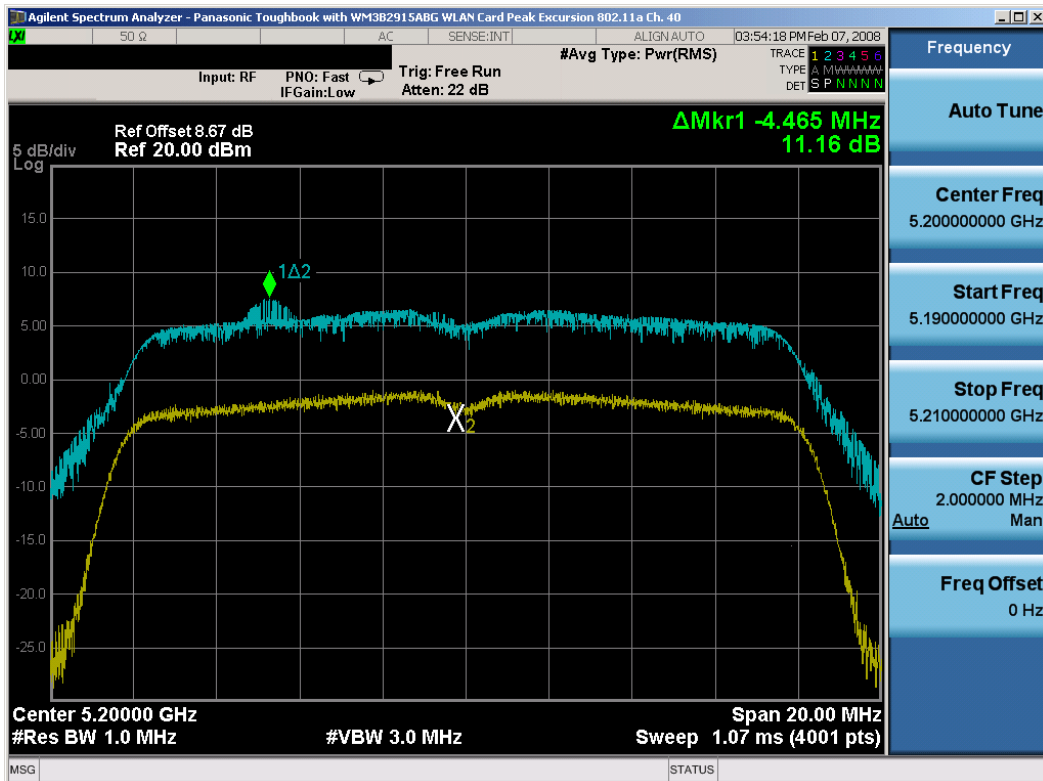


Figure 6-3. Test Instrument & Measurement Setup

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 20 of 39

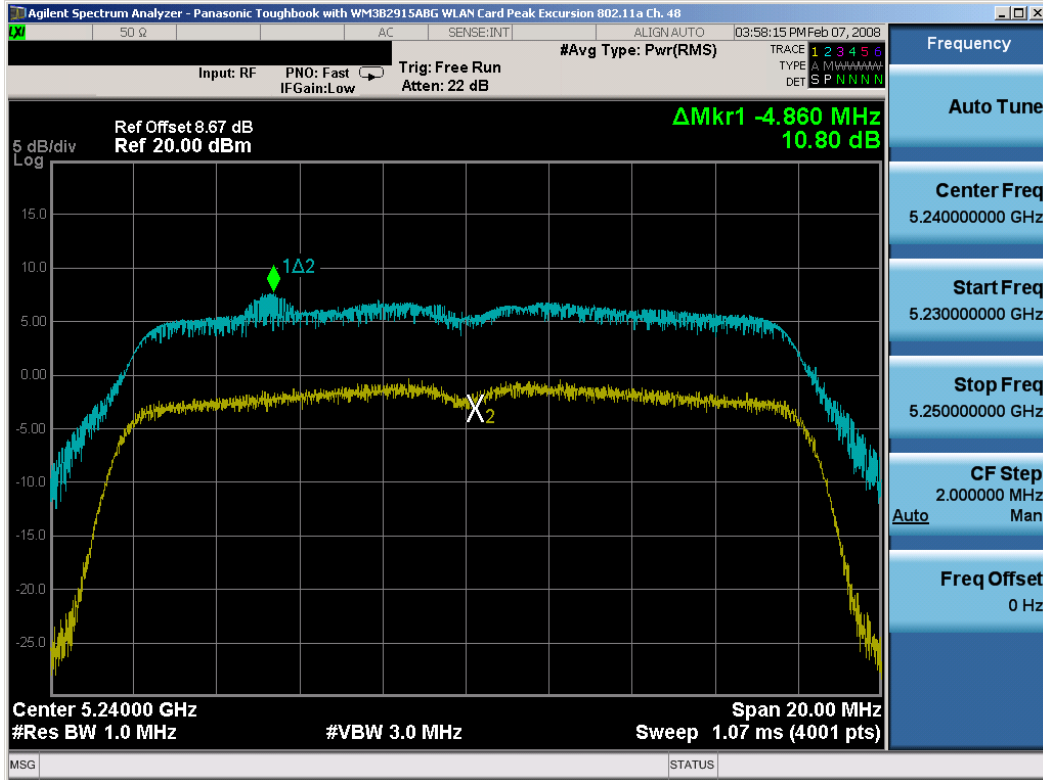


Plot 6-13. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 36)

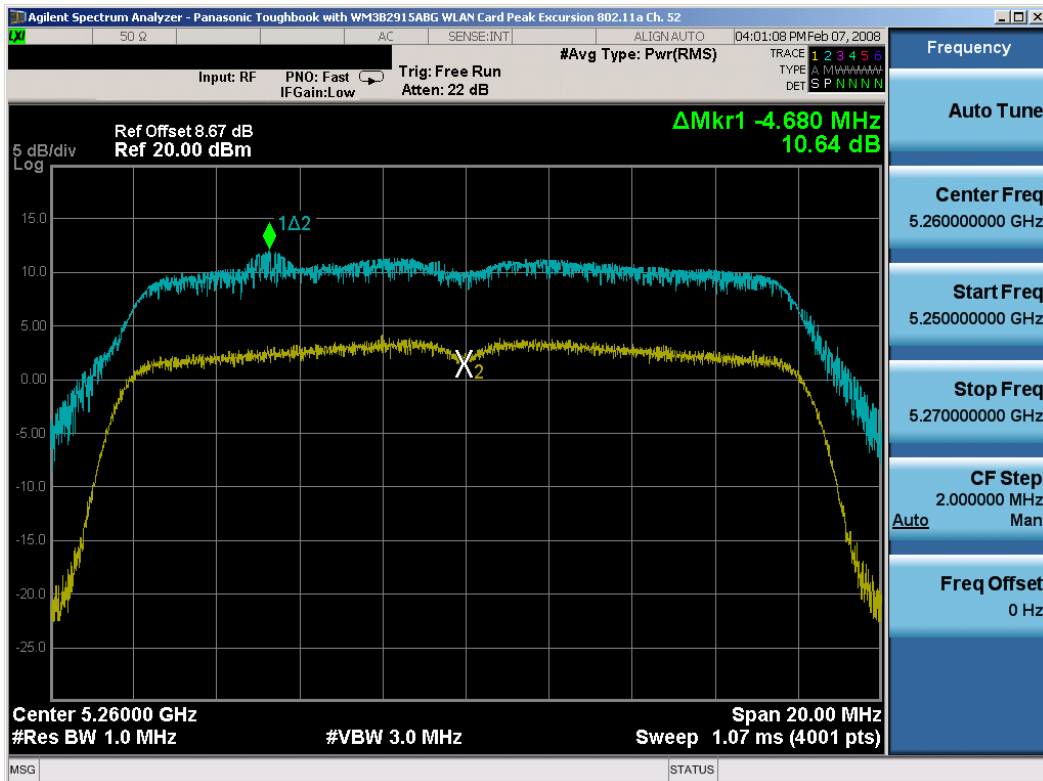


Plot 6-14. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 40)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 21 of 39



**Plot 6-15. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 48)**

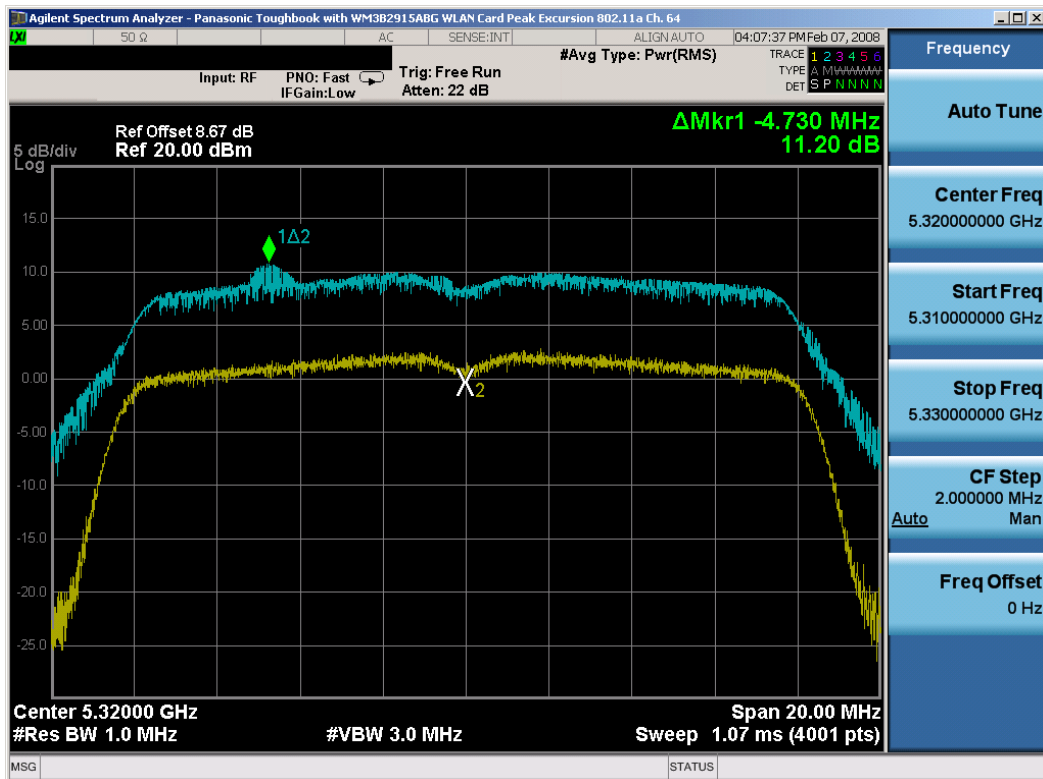


**Plot 6-16. Peak Excursion Ratio Plot (802.11a (UNII) – Ch. 52)**

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 22 of 39



Plot 6-17. Excursion Ratio Plot (802.11a (UNII) – Ch. 56)



Plot 6-18. Excursion Ratio Plot (802.11a (UNII) – Ch. 64)

FCC ID: ACJ9TGCF-29DC	<b>PCTEST</b> ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	<b>Panasonic</b>	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 23 of 39

## 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: 5,180,000,000 Hz  
 CHANNEL: 36  
 REFERENCE VOLTAGE: 10.65 VDC  
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	10.65	+ 20 (Ref)	5,260,002,010	2,010	0.000038
100 %		- 30	5,260,003,260	3,260	0.000062
100 %		- 20	5,260,005,334	5,334	0.000101
100 %		- 10	5,259,999,652	-348	-0.000007
100 %		0	5,260,000,653	653	0.000012
100 %		+ 10	5,260,007,493	7,493	0.000142
100 %		+ 20	5,260,003,384	3,384	0.000064
100 %		+ 30	5,259,998,563	-1,437	-0.000027
100 %		+ 40	5,260,008,311	8,311	0.000158
100 %		+ 50	5,260,003,373	3,373	0.000064
115 %	12.25	+ 20	5,260,005,475	5,475	0.000104
BATT. ENDPOINT	9.48	+ 20	5,259,997,407	-2,593	-0.000049

**Table 6-7. Frequency Stability Measurements for UNII Band Ch. 36**



FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 24 of 39	

**Frequency Stability (Cont'd)**  
**§15.407(g)**

OPERATING FREQUENCY: 5,260,000,000 Hz  
 CHANNEL: 52  
 REFERENCE VOLTAGE: 10.65 VDC  
 DEVIATION LIMIT: ± 0.00025 % or 2.5 ppm

VOLTAGE (%)	POWER (VDC)	TEMP (°C)	FREQUENCY (Hz)	Freq. Dev. (Hz)	Deviation (%)
100 %	10.65	+ 20 (Ref)	5,260,002,202	2,202	0.000042
100 %		- 30	5,260,003,742	3,742	0.000071
100 %		- 20	5,259,994,007	-5,993	-0.000114
100 %		- 10	5,259,997,264	-2,736	-0.000052
100 %		0	5,259,994,256	-5,744	-0.000109
100 %		+ 10	5,260,008,342	8,342	0.000159
100 %		+ 20	5,259,997,079	-2,921	-0.000056
100 %		+ 30	5,260,002,828	2,828	0.000054
100 %		+ 40	5,260,008,381	8,381	0.000159
100 %		+ 50	5,260,005,907	5,907	0.000112
115 %		12.25	+ 20	5,260,004,480	4,480
BATT. ENDPOINT	9.48	+ 20	5,259,999,596	-404	-0.000008

**Table 6-8. Frequency Stability Measurements for UNII Band Ch. 52**

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 25 of 39	

## 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 10<sup>th</sup> 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 6-9 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 6-9. Radiated Limits**

### Sample Calculation

- Field Strength Level [dBμV/m] = Analyzer Level [dBm] + 107 + AFCL [dB]

### Notes:

- AFCL = Antenna Factor [dB] + Cable Loss [dB]

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 26 of 39	

## 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: 3 Meters

Operating Frequency: 5180MHz



Channel: 36

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
10360.00	-92.24	Peak	V	48.8	63.59	68.20	-4.61
* 15540.00	-113.00	Average	V	51.6	45.58	53.98	-8.40
* 15540.00	-95.71	Peak	V	51.6	62.87	73.98	-11.11
* 20720.00	-113.57	Average	V	57.0	50.48	53.98	-3.50
* 20720.00	-96.65	Peak	V	57.0	67.40	73.98	-6.58
25900.00	-102.52	Peak	V	56.7	61.15	68.20	-7.05

**Table 6-10. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500  $\mu$ V/m (54dB $\mu$ /m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 27 of 39	

## 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: 3 Meters

Operating Frequency: 5200MHz



Channel: 40

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
10400.00	-93.59	Peak	V	48.9	62.28	68.20	-5.92
* 15600.00	-110.50	Average	V	51.7	48.16	53.98	-5.82
* 15600.00	-95.06	Peak	V	51.7	63.60	73.98	-10.38
* 20800.00	-114.43	Average	V	57.0	49.60	53.98	-4.38
* 20800.00	-97.62	Peak	V	57.0	66.41	73.98	-7.57
26000.00	-101.94	Peak	V	56.7	61.77	68.20	-6.43

**Table 6-11. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500  $\mu$ V/m (54dB $\mu$ /m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 28 of 39	

## 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: 3 Meters

Operating Frequency: 5240MHz



Channel: 48

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
10480.00	-105.81	Average	V	48.9	50.14	53.98	-3.84
10480.00	-93.09	Peak	V	48.9	62.86	73.98	-11.12
* 15720.00	-109.50	Average	V	51.8	49.33	53.98	-4.65
* 15720.00	-92.09	Peak	V	51.8	66.74	73.98	-7.24
* 20960.00	-111.47	Average	V	57.0	52.52	53.98	-1.46
* 20960.00	-99.83	Peak	V	57.0	64.16	73.98	-9.82
26200.00	-99.09	Peak	V	56.8	64.68	68.20	-3.52

**Table 6-12. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500  $\mu$ V/m (54dB $\mu$ /m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 29 of 39	

## 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: 3 Meters

Operating Frequency: 5260MHz



Channel: 52

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10520.00	-92.41	Peak	V	49.0	63.56	68.20	-4.64
* 15780.00	-107.42	Average	V	51.9	51.49	53.98	-2.49
* 15780.00	-91.68	Peak	V	51.9	67.23	73.98	-6.75
* 21040.00	-112.72	Average	V	57.0	51.27	53.98	-2.71
* 21040.00	-93.27	Peak	V	57.0	70.72	73.98	-3.26
26300.00	-101.69	Peak	V	56.8	62.12	68.20	-6.08

**Table 6-13. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 30 of 39	

## 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: 3 Meters

Operating Frequency: 5280MHz



Channel: 56

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
10560.00	-92.04	Peak	V	49.0	63.95	68.20	-4.25
* 15840.00	-108.61	Average	V	52.0	50.38	53.98	-3.60
* 15840.00	-92.88	Peak	V	52.0	66.11	73.98	-7.87
* 21120.00	-114.58	Average	V	57.0	49.40	53.98	-4.58
* 21120.00	-97.21	Peak	V	57.0	66.77	73.98	-7.21
26400.00	-100.07	Peak	V	56.8	63.77	68.20	-4.43

**Table 6-14. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 31 of 39

## 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: 3 Meters

Operating Frequency: 5320MHz



Channel: 64

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dBμV/m]	Limit [dBμV/m]	Margin [dB]
* 10640.00	-105.51	Average	V	49.0	50.51	53.98	-3.47
* 10640.00	-90.93	Peak	V	49.0	65.09	73.98	-8.89
* 15960.00	-109.31	Average	V	52.2	49.85	53.98	-4.13
* 15960.00	-90.71	Peak	V	52.2	68.45	73.98	-5.53
* 21280.00	-112.79	Average	V	57.0	51.18	53.98	-2.80
* 21280.00	-92.65	Peak	V	57.0	71.32	73.98	-2.66
26600.00	-100.01	Peak	V	56.8	63.77	68.20	-4.43

**Table 6-15. Radiated Measurements @ 3 meters**

**NOTES:**

- All harmonics that do not lie in a restricted band are subject to a peak limit of -27dBm/MHz.
- 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 6-9.
- Peak Measurements > 1GHz using RBW = VBW = 1MHz. Average Measurements > 1 GHz using RBW = 1MHz and VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500 μV/m (54dBμ/m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 32 of 39	

## 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: 3 Meters

Operating Frequency: 5180MHz



Channel: 36

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
5104.59	-104.05	Average	V	41.2	44.12	53.98	-9.86
5104.59	-93.32	Peak	V	41.2	54.85	73.98	-19.13
5124.57	-102.48	Average	V	41.2	45.76	53.98	-8.22
5124.57	-91.83	Peak	V	41.2	56.41	73.98	-17.57
5150.00	-105.70	Average	V	41.3	42.64	53.98	-11.34
5150.00	-96.77	Peak	V	41.3	51.57	73.98	-22.41

**Table 6-16. Radiated Restricted Band Measurements at 3-meters**

**NOTES:**

- 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 6-9.
- Average Measurements > 1GHz using RBW = 1MHz VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500  $\mu$ V/m (54dB $\mu$ /m) at 3 meters radiated.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 33 of 39

## Radiated Restricted Band Edge Measurements (Cont'd)

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

Mode: 802.11a

Transfer Rate: 6 Mbps

Distance of Measurements: 3 Meters

Operating Frequency: 5320MHz



Channel: 64

Frequency [MHz]	Analyzer Level [dBm]	Detector	Pol. [H/V]	AFCL [dB]	Field Strength [dB $\mu$ V/m]	Limit [dB $\mu$ V/m]	Margin [dB]
5350.00	-100.76	Average	V	42.0	48.22	53.98	-5.76
5350.00	-85.83	Peak	V	42.0	63.15	73.98	-10.83
5357.64	-101.76	Average	V	42.0	47.25	53.98	-6.73
5357.64	-89.59	Peak	V	42.0	59.42	73.98	-14.56
5387.29	-101.96	Average	V	42.1	47.17	53.98	-6.81
5387.29	-91.23	Peak	V	42.1	57.90	73.98	-16.08

**Table 6-17. Radiated Restricted Band Measurements at 3-meters**

**NOTES:**

- 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 6-9.
- Average Measurements > 1GHz using RBW = 1MHz VBW = 10Hz.
- The antenna is manipulated through typical positions, polarity and length during the tests. The EUT is manipulated through three orthogonal planes.
- The EUT is supplied with nominal AC voltage and/or a new/fully-recharged battery.
- The spectrum is measured from 9kHz to the 10<sup>th</sup> harmonic and the worst-case emissions are reported. No significant emissions were found beyond the fifth harmonic for this device.
- Levels at - 135 dBm represent the analyzer noise floor and signify that no emission was detected.
- Above 960MHz the limit is 500  $\mu$ V/m (54dB $\mu$ /m) at 3 meters radiated.

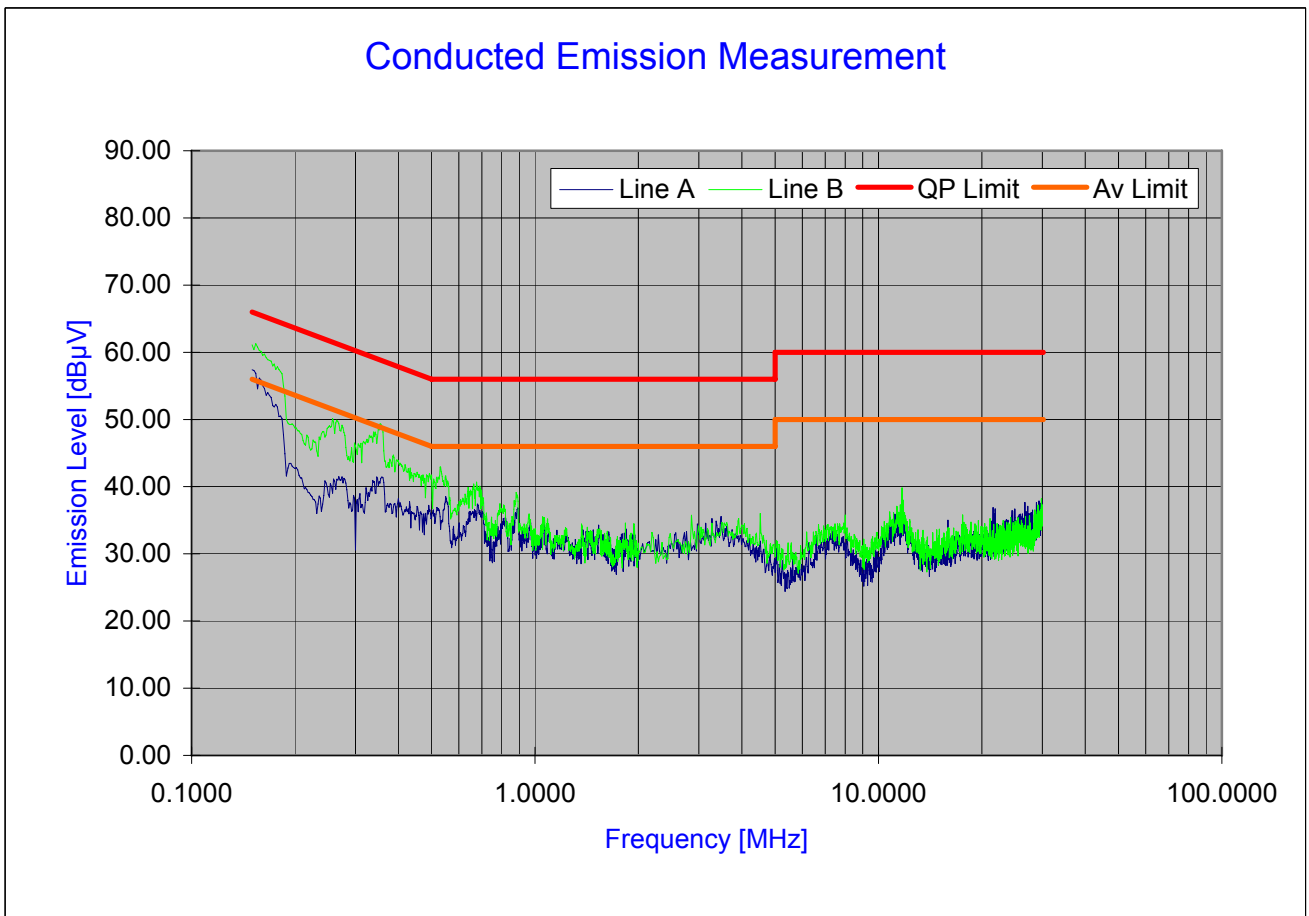
FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 34 of 39	

**6.9 Line-Conducted Test Data**  
**§15.207**

# PCTEST Engineering Laboratory Inc.

Company : Panasonic Corporation  
 Model Number : CF-29  
 FCC ID Code : ACJ9TGCF-29DC  
 Standard : FCC Part 15B class B

Power Source : AC120V/60Hz  
 Tested Date : 02/13/2008  
 Note : Tested with UNII-I Band ON





Ver. 1.1 ©PCTEST 2006.08

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

**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.

FCC ID: ACJ9TGCF-29DC	 PCTEST ENGINEERING LABORATORY, INC.	FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)	 Panasonic	Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 35 of 39	



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

No.	Line	Frequency [MHz]	Factor [dB]	QP [dBμV]	Limit [dBμV]	Margin [dB]	Average [dBμV]	Limit [dBμV]	Margin [dB]
1	A	0.150	8.20	60.69	66.00	-5.31	40.67	56.00	-15.33
2	A	0.275	7.66	38.53	60.96	-22.43	24.61	50.96	-26.35
3	A	0.354	7.53	39.20	58.88	-19.68	23.64	48.88	-25.24
4	A	0.389	7.50	33.77	58.09	-24.32	23.37	48.09	-24.72
5	A	0.415	7.48	33.60	57.54	-23.94	21.57	47.54	-25.97
6	A	0.504	7.43	32.63	56.00	-23.37	21.35	46.00	-24.65
7	A	0.505	7.43	32.65	56.00	-23.35	21.68	46.00	-24.32
8	A	0.546	7.41	34.72	56.00	-21.28	21.94	46.00	-24.06
9	A	0.678	7.38	32.93	56.00	-23.07	22.05	46.00	-23.95
10	A	0.887	7.34	32.89	56.00	-23.11	21.94	46.00	-24.06
11	B	0.150	8.20	62.51	66.00	-3.49	37.25	56.00	-18.75
12	B	0.275	7.66	46.70	60.96	-14.26	27.82	50.96	-23.14
13	B	0.309	7.56	42.15	60.00	-17.85	26.22	50.00	-23.78
14	B	0.355	7.53	46.55	58.85	-12.30	27.09	48.85	-21.76
15	B	0.391	7.50	40.43	58.04	-17.61	27.93	48.04	-20.11
16	B	0.475	7.44	35.86	56.43	-20.57	25.03	46.43	-21.40
17	B	0.549	7.41	38.62	56.00	-17.38	23.38	46.00	-22.62
18	B	0.679	7.38	36.35	56.00	-19.65	22.86	46.00	-23.14
19	B	0.681	7.38	36.55	56.00	-19.45	23.63	46.00	-22.37
20	B	0.885	7.34	35.27	56.00	-20.73	22.99	46.00	-23.01

**Table 6-18. Line Conducted Data with 802.11a (UNII-I Band)**

**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.

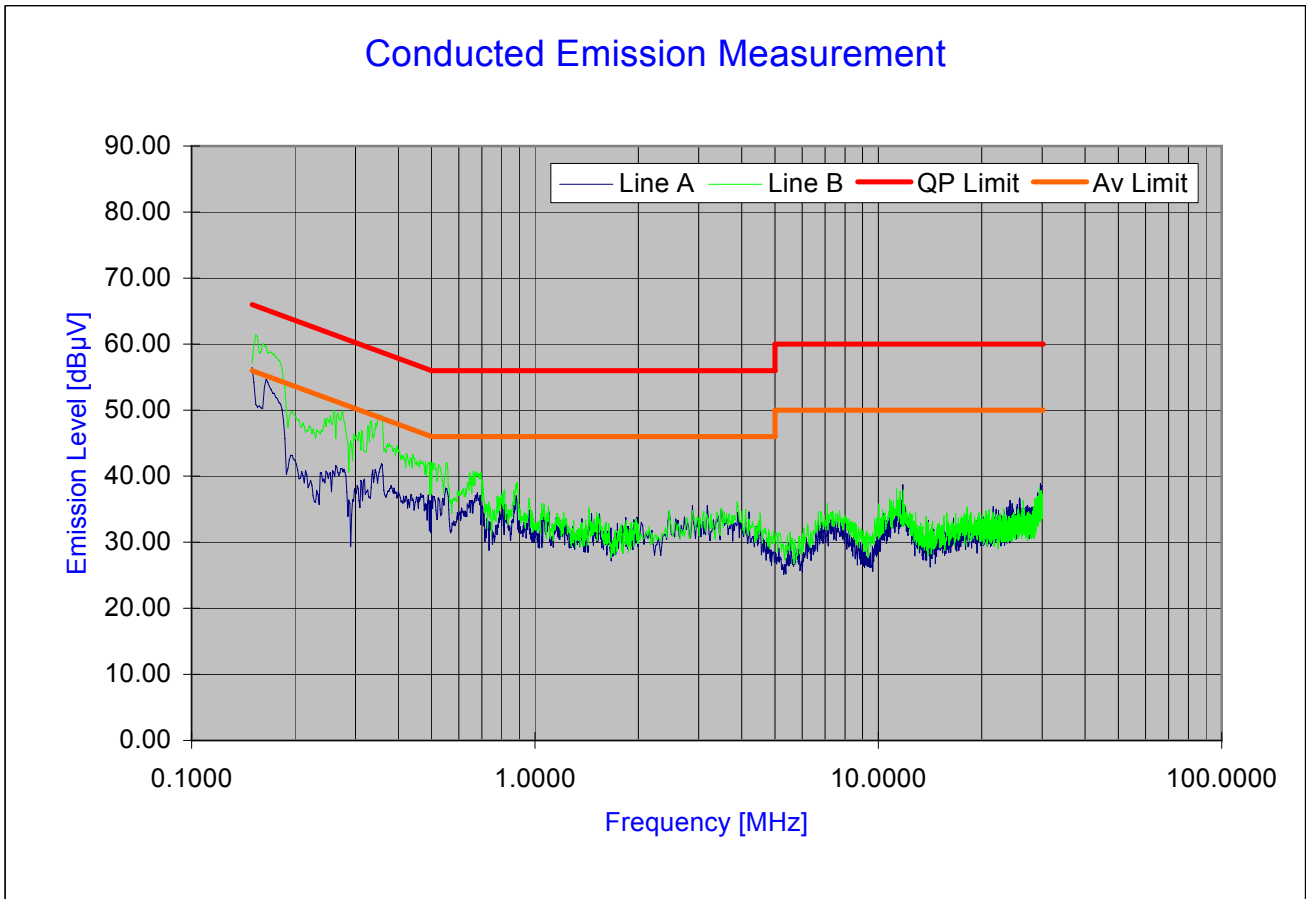
FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 36 of 39

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

# PCTEST Engineering Laboratory Inc.

Company : Panasonic Corporation  
 Model Number : CF-29  
 FCC ID Code : ACJ9TGCF-29DC  
 Standard : FCC Part 15B class B

Power Source : AC120V/60Hz  
 Tested Date : 02/13/2008  
 Note : Tested with UNII-II Band ON





Ver.1.1 ©PCTEST 2006.08

**Plot 6-20. Line Conducted Plot with 802.11a (UNII-II Band)**

**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.

FCC ID: ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29	Page 37 of 39	



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

No.	Line	Frequency [MHz]	Factor [dB]	QP [dBµV]	Limit [dBµV]	Margin [dB]	Average [dBµV]	Limit [dBµV]	Margin [dB]
1	A	0.150	8.20	60.23	66.00	-5.77	41.09	56.00	-14.91
2	A	0.152	8.20	53.30	66.00	-12.70	34.37	56.00	-21.63
3	A	0.354	7.53	39.06	58.87	-19.81	23.57	48.87	-25.30
4	A	0.378	7.51	33.32	58.33	-25.01	23.23	48.33	-25.10
5	A	0.470	7.44	30.72	56.52	-25.80	22.04	46.52	-24.48
6	A	0.514	7.42	32.75	56.00	-23.25	21.59	46.00	-24.41
7	A	0.517	7.42	32.70	56.00	-23.30	22.45	46.00	-23.55
8	A	0.552	7.41	34.76	56.00	-21.24	21.96	46.00	-24.04
9	A	0.687	7.38	33.10	56.00	-22.90	21.92	46.00	-24.08
10	A	0.884	7.34	32.92	56.00	-23.08	22.02	46.00	-23.98
11	B	0.150	8.20	62.60	66.00	-3.40	37.64	56.00	-18.36
12	B	0.273	7.67	46.87	61.02	-14.15	28.04	51.02	-22.98
13	B	0.275	7.66	46.78	61.01	-14.23	27.53	51.01	-23.48
14	B	0.274	7.66	46.72	61.00	-14.28	28.12	51.00	-22.88
15	B	0.310	7.56	42.19	59.97	-17.78	25.90	49.97	-24.07
16	B	0.353	7.53	46.62	58.89	-12.27	27.20	48.89	-21.69
17	B	0.513	7.42	37.76	56.00	-18.24	24.13	46.00	-21.87
18	B	0.553	7.41	39.54	56.00	-16.46	23.62	46.00	-22.38
19	B	0.681	7.38	36.10	56.00	-19.90	23.94	46.00	-22.06
20	B	0.884	7.34	35.05	56.00	-20.95	22.86	46.00	-23.14

**Table 6-19. Line Conducted Data with 802.11a (UNII-II Band)**


**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.

FCC ID: ACJ9TGCF-29DC		FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)		Reviewed by: Quality Manager
Test Report S/N: 0801230086.ACJ	Test Dates: February 13 - 14, 2008	EUT Type: Toughbook Model: CF-29		Page 38 of 39

## 7.0 CONCLUSION

The data collected relate only the item(s) tested and show that the **Panasonic Toughbook Model: CF-29 FCC ID: ACJ9TGCF-29DC** is in compliance with Part 15E of the FCC Rules.

<b>FCC ID:</b> ACJ9TGCF-29DC		<b>FCC Pt. 15.407 802.11a UNII MEASUREMENT REPORT (CERTIFICATION)</b>	<b>Reviewed by:</b> Quality Manager
<b>Test Report S/N:</b> 0801230086.ACJ	<b>Test Dates:</b> February 13 - 14, 2008	<b>EUT Type:</b> Toughbook Model: CF-29	Page 39 of 39