



PCTEST ENGINEERING LABORATORY, INC.

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



RF EXPOSURE EVALUATION (MAXIMUM PERMISSIBLE EXPOSURE)

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

Date of Testing:
February 11, 2008
Test Site/Location:
PCTEST Lab, Columbia, MD, USA
Test Report Serial No.:
0801230090.ACJ

FCC ID:	ACJ9TGCF-29DC
APPLICANT:	Panasonic Corporation of North America

EUT Type: Toughbook Model: CF-29
FCC Rule Part(s): FCC Part 1 (§1.1310) and Part 2 (§2.1091)
FCC Classification: PCS Licensed Transmitter (PCB)
Test Procedure: OET Bulletin 65

The device bearing the FCC Identifier specified above has been shown to comply with the applicable technical standards as indicated in the measurement report and has been tested in accordance with the measurement procedures specified in FCC OET Bulletin 65 (See Test Report). These measurements were performed with no deviation from the standards.

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

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


Randy Ortanez
President







FCC ID: ACJ9TGCF-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 1 of 8

TABLE OF CONTENTS

1.0	RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE).....	3
1.1	INTRODUCTION	3
1.2	EUT DESCRIPTION	3
1.3	MPE REQUIREMENTS OVERVIEW	4
1.4	PROCEDURE	5
1.5	SUMMARY OF RESULTS	7
2.0	CONCLUSION.....	8

FCC ID: ACJ9TGCF-29DC	 <small>ENGINEERING LABORATORY, INC.</small>	MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 2 of 8

1.0 RF EXPOSURE EVALUATION – MAXIMUM PERMISSIBLE EXPOSURE (MPE)

1.1 Introduction

This document is prepared on behalf of Panasonic Corporation of North America to show compliance with the RF Exposure requirements as required in §1.1310 of the FCC Rules and Regulations and Health Code 6 of Industry Canada.

The limit for Maximum Permissible Exposure (MPE), specified in FCC §1.1310, is listed in Table 1-1. According to FCC §1.1310 and RSS-102: the criteria listed in the following table shall be used to evaluate the environmental impact of human exposure to radio-frequency (RF) radiation as specified in §1.1307(b).

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm ²)	Average Time (Minutes)
(A) Limits For Occupational / Control Exposures (f = frequency)				
30-300	61.4	0.163	1.0	6
300-1500	...	...	f/300	6
1500-100,000	...	...	5.0	6
(B) Limits For General Population / Uncontrolled Exposure (f = frequency)				
30-300	27.5	0.073	0.2	30
300-1500	...	...	f/1500	30
1500-100,000	...	...	1.0	30



Table 1-1. Limits for Maximum Permissible Exposure (MPE)

1.2 EUT Description

The Panasonic Model: CF-29 is a Toughbook containing Novatel HSDPA, Intel PRO/Wireless WLAN, and Alps Bluetooth modules. For this MPE evaluation the device is set to transmit from the antenna of each transmitter and the RF exposure of each transmitter is evaluated individually. A 5dBi external antenna (Model: NMO5E2400BKTNC) is used for the WLAN card in the MPE evaluation of the Panasonic Toughbook while it is docked in a vehicle mount.

EUT:

Model: CF-29
 Grantee: Panasonic Corporation of North America
 FCC ID: ACJ9TGCF-29DC
 Internal Antenna Gains: 2.86dBi (Used with WLAN Module / Model: WM3B2915ABG)
 1.47dBi (Used with Bluetooth Module / Model: UGXZ5)
 2.15dBi (Used with Novatel Wireless Module / Model: EU860D)
 External Antenna Gain: 5dBi (Used with Vehicle Mount Model: CFWEB291)

FCC ID: ACJ9TGCF-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29	Page 3 of 8	



1.3 MPE Requirements Overview



Three different categories of transmitters are defined by the FCC in OET Bulletin 65. These categories are fixed installation, mobile, and portable and are defined as follows:

- **Fixed Installations:** fixed location means that the device, including its antenna, is physically secured at a permanent location and is not able to be easily moved to another location. Additionally, distance to humans from the antenna is maintained to at least 2 meters.
- **Mobile Devices:** a mobile device is defined as a transmitting device designed to be used in other than fixed locations and to be generally used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structures and the body of the user or nearby persons. Transmitters designed to be used by consumers or workers that can be easily re-located, such as a wireless modem operating in a laptop computer, are considered mobile devices if they meet the 20 centimeter separation requirement. The FCC rules for evaluating mobile devices for RF compliance are found in 47 CFR §2.1091.
- **Portable Devices:** a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user. Portable device requirements are found in Section 2.1093 of the FCC's Rules (47 CFR§2.1093).

The FCC also categorizes the use of the device as based upon the user's awareness and ability to exercise control over his or her exposure. The two categories defined are Occupational/ Controlled Exposure and General Population/Uncontrolled Exposure. These two categories are defined as follows:

- **Occupational/Controlled Exposure:** In general, occupational/controlled exposure limits are applicable to situations in which persons are exposed as a consequence of their employment, who have been made fully aware of the potential for exposure and can exercise control over their exposure. This exposure category is also applicable when the exposure is of a transient nature due to incidental passage through a location where the exposure levels may be higher than the general population/uncontrolled limits, but the exposed person is fully aware of the potential for exposure and can exercise control over his or her exposure by leaving the area or by some other appropriate means. Awareness of the potential for RF exposure in a workplace or similar environment can be provided through specific training as part of a RF safety program. If appropriate, warning signs and labels can also be used to establish such awareness by providing prominent information on the risk of potential exposure and instructions on methods to minimize such exposure risks.
- **General Population/Uncontrolled Exposure:** The general population / uncontrolled exposure limits are applicable to situations in which the general public may be exposed or in which persons who are exposed as a consequence of their employment may not be made fully aware of the potential for exposure or cannot exercise control over their exposure. Members of the general public would come under this category when exposure is not employment-related; for example, in the case of a wireless transmitter that exposes persons in its vicinity. Warning labels placed on low-power consumer devices such as cellular telephones are not considered sufficient to allow the device to be considered under the occupational/controlled category, and the general population/uncontrolled exposure limits apply to these devices.

The Panasonic Toughbook Model: CF-29 FCC ID: ACJ9TGCF-29DC is evaluated to the Mobile Device requirements and is considered a device to be used by the General Population/Uncontrolled Exposure.

FCC ID: ACJ9TGCF-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 4 of 8



1.4 Procedure

The procedure used to determine the RF power density was based upon a calculation for determining compliance with the MPE requirements.

The power generated by each transmitter used in this product was initially measured by a power meter and the powers were recorded. Through use of the Friis transmission formula and knowledge of the maximum antenna gain to be used, the power density level is calculated at a distance of 20cm.

The antenna gains of each antenna to be used with the different available transmitters were used to calculate the MPE in all relevant bands of operation.

Friis Transmission Formula

$$\text{Friis transmission formula: } P_d = (P_{\text{out}} * G) / (4\pi r^2)$$

Where,

P_d = Power Density (mW/cm²)

π = 3.1416

P_{out} = output power to antenna (mW)

r = distance between observation point and center of the radiator (cm)

G = gain of antenna in linear scale

Calculated MPE

The highest RF power measured in each band along with the maximum antenna gain was used to determine the maximum theoretical power density in that band. The power density limit for General Population/Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1.



There is no co-location between the electric fields of any two transmitters therefore following power densities are calculated for each individual transmitter by frequency at 20cm spacing:

Frequency	848.8 MHz	
Limit	0.566 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	32.31 dBm	1702.16 mW
TX Ant Gain (dBi), G =	2.15 dBi	
Power Density (S) =	0.556 mW/cm ²	(at 20cm)
Minimum Distance =	19.8 cm	

Table 1-2. Calculated MPE Data for Cellular Band

Frequency:	1880 MHz	
Limit:	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	29.16 dBm	824.14 mW
TX Ant Gain (dBi), G =	2.15 dBi	
Power Density (S) =	0.2690 mW/cm ²	(at 20cm)
Minimum Distance =	10.4 cm	

Table 1-3. Calculated MPE Data for PCS Band

FCC ID: ACJ9TGCF-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 5 of 8



Frequency	2437 MHz	
Limit	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	17.59 dBm	57.41 mW
TX Ant Gain (dB), G =	2.86 dBi	
Power Density (S) =	0.022 mW/cm ²	(at 20cm)
Minimum Distance =	3.0 cm	

Table 1-4. Calculated MPE Data for 2.4GHz Band

Frequency	5320 MHz	
Limit	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	15.76 dBm	37.67 mW
TX Ant Gain (dB), G =	2.86 dBi	
Power Density (S) =	0.014 mW/cm ²	(at 20cm)
Minimum Distance =	2.4 cm	

Table 1-5. Calculated MPE Data for 5GHz (UNII) Band

Frequency	5825 MHz	
Limit	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	14.78 dBm	30.06 mW
TX Ant Gain (dB), G =	2.86 dBi	
Power Density (S) =	0.012 mW/cm ²	(at 20cm)
Minimum Distance =	2.1 cm	

Table 1-6. Calculated MPE Data for 5GHz (802.11a) Band

Calculated MPE For Car Mounter

The highest conducted RF power measured in each band was used to determine the RF exposure from this device while docked in the vehicle mount. In the Cellular band, the highest permissible theoretical antenna gain that yields a power density equal to the limit is found. In the PCS band, the highest theoretical antenna gain is found by determining what antenna gain yields an EIRP of 2 Watts. In the 2.4GHz band, the supplied 5dBi antenna is used for power density evaluation. The power density limit for General Population/Uncontrolled Exposure at each frequency is determined based on the information in Table 1-1.

Frequency	848.8 MHz	
Limit	0.566 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	32.31 dBm	1702.16 mW
TX Ant Gain (dB), G =	2.23 dBi	
Power Density (S) =	0.566 mW/cm ²	(at 20cm)
Minimum Distance =	20.0 cm	

Table 1-7. Calculated MPE Data for Cellular Band with Car Mount

FCC ID: ACJ9TGCF-29DC	PCTEST ENGINEERING LABORATORY, INC.	MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT	Panasonic	Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 6 of 8

Frequency	1880 MHz	
Limit	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	29.16 dBm	824.14 mW
TX Ant Gain (dB), G =	3.84 dBi	
Power Density (S) =	0.397 mW/cm ²	(at 20cm)
Minimum Distance =	12.6 cm	

Table 1-8. Calculated MPE Data for PCS Band with Car Mount



Frequency	2437 MHz	
Limit	1.000 mW/cm ²	
Distance (cm), R =	20 cm	
Power (dBm), P =	17.62 dBm	57.81 mW
TX Ant Gain (dB), G =	5 dBi	
Power Density (S) =	0.036 mW/cm ²	(at 20cm)
Minimum Distance =	3.8 cm	

Table 1-9. Calculated MPE Data for 2.4GHz Band with Car Mount and External Antenna

1.5 Summary of Results



	Frequency Band [MHz]	Maximum Antenna Gain [dBi]	MPE at 20cm (mW/cm ²)	Test Result
MPE for Standalone Configuration	824.2 – 848.8	2.15	0.556	PASS
	1850.2 – 1909.8	2.15	0.2690	PASS
	2412 – 2462	2.86 (802.11b)	0.022	PASS
	5180 – 5320	2.86 (802.11a - UNII)	0.014	PASS
	5745 – 5825	2.86 (802.11a)	0.012	PASS
MPE for Car Mount Configuration	824.2 – 848.8	2.23	0.566	PASS
	1850.2 – 1909.8	3.84	0.397	PASS
	2412 – 2462	5.0	0.036	PASS

Table 1-10. Maximum Permissible Exposure Summary Table

FCC ID: ACJ9TGCF-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29		Page 7 of 8

2.0 CONCLUSION

The device meets the mobile RF exposure limit at a 20cm separation distance as specified in §2.1091 of the FCC Rules and Regulations and Health Code 6 of Industry Canada. An appropriate RF exposure compliance statement will be placed in the user's manual.

FCC ID: ACJ9TGC-29DC		MAXIMUM PERMISSIBLE EXPOSURE (MPE) DATA REPORT		Reviewed by: Quality Manager
Test Report S/N: 0801230090.ACJ	Test Dates: February 11, 2008	EUT Type: Toughbook Model: CF-29	Page 8 of 8	