

# RF Exposure Evaluation - Maximum Permissible Exposure (MPE)

#### 1. Introduction

This document attempts to prove the safety of radiation generated by RF devices to the human body. The limit for Maximum Permissible Exposure (MPE), specified in FCC 1.1210, is listed below. The power generated by this product is measured by a power meter. Through use of the Friis transmission formula and the maximum gain of the antenna, the distance from the product at which compliance with the MPE limit is achieved may be calculated. Alternatively, near field measurements may be performed to demonstrate compliance at a specific measurement distance.

Near field probe: Wandel & Goltermann EMR-20.

### 2. RF Exposure Limit

According to FCC 1.1310: 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).

#### LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE)

Frequency	Electric Field	Magnetic Field	Power Density	Average Time					
Range (MHz)	Strength (V/m)	Strength (A/m)	$(mW/cm^2)$	(Minutes)					
	(A) Limits For Occupational / Control Exposures								
30-300	61.4	.163	1.0	6					
300-1500	•••	•••	F/300	6					
1500-100,000	•••	•••	5	6					
	(B) Limits For Gene	eral Population / Un	controlled Exposure	)					
30-300	27.5	.073	.2	30					
300-1500	•••	•••	F/1500	30					
1500-100,000	•••	•••	1.0	30					

F = Frequency in MHz

#### 3. Friis Formula

Friis transmission formula:  $Pd = (P_{out}*G) / (4pr^2)$ 

Where:

 $Pd = power density in mW/cm^2 (MPE limit)$ 

 $P_{out}$  = output power to antenna in mW

G = gain of antenna in linear scale

p = 3.1416

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

Ref.: David K. Cheng, Field and Wave Electromagnetics, Second Edition, Page 640, Eq. (11.133)

PCTEST MPE REPORT	PCTEST	FCC CERTIFICATION REPORT	Panasonic	REVIEWED BY: QUALITY MANAGER
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## 4. EUT Operating Condition

Software provided by the client enabled the EUT to transmit and receive data at lowest, middle, and highest channels individually.

## 5. Climate Condition

The temperature and relative humidity:  $22^{\circ}C$  and 78% RH

## 6. Measurement Results

Frequency	Level	Measurement	Front	Rear	Right	Left	Limit
(MHz)	(dBm)	Distance	MPE	MPE	MPE	MPE	
			reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
824.20	31.47	20cm	.110	.109	.071	.077	.537
2412	23.32						

Frequency (MHz)	Level (dBm)	Measurement Distance	Front MPE	Rear MPE	Right MPE	Left MPE	Limit
(IVII IZ)	(dDIII)	Distance	reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
836.60	31.73	20cm	.111	.103	.073	.090	.543
2441	12.1						

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Frequency	Level	Measurement	Front	Rear	Right	Left	Limit
(MHz)	(dBm)	Distance	MPE	MPE	MPE	MPE	
			reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
849.8	31.58	20cm	.105	.111	.063	.070	.547
2462	23.65						

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Frequency	Level	Measurement	Front	Rear	Right	Left	Limit
(MHz)	(dBm)	Distance	MPE	MPE	MPE	MPE	
			reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
1850.2	30.93	20cm	.093	.090	.056	.063	1.00
2412	23.32						

Frequency	Level	Measurement	Front	Rear	Right	Left	Limit
(MHz)	(dBm)	Distance	MPE	MPE	MPE	MPE	
			reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
1880	31.25	20cm	.091	.081	.050	.054	1.00
2437	23.67						

Frequency	Level	Measurement	Front	Rear	Right	Left	Limit
(MHz)	(dBm)	Distance	MPE	MPE	MPE	MPE	
			reading	reading	reading	reading	
			mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	mW/cm <sup>2</sup>	
1909.80	31.12	20cm	.101	.095	.072	.051	1.00
2462	23.65						

1. Data taken with all transmitters operating simultaneously

## 7. Conclusion

The device meets the mobile 20cm separation distance as specified in Section 2.1091 of the FCC Rules. An appropriate RF exposure compliance statement will be placed in the user's manual.

\* All data was taken with WLAN Channel 6 with 1 Mbps transmitting at full power.

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