EDCS#: 1297610

RF Exposure Study - Engineering Analysis per

FCC 2.1093

Industry Canada RSS-102

2.4GHz WLAN Radio 802.1 b/g
M/N : 73-15453-03
FCC ID : LDKAGORA0916
IC : 2461B-AGORA0916

Supplementary Appendix to Report EDCS# 1261389

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1.0: Attestation Statement of Compliance

The Cisco Systems 2.4GHz WLAN Radio PCIe card, 802.11 b/g
P/N: 73-15453-03 has been evaluated for Maximum Permissible Exposure in compliance with 47 Code of Federal Regulations 2.1093. The evaluation was in accordance with methodology as referenced in FCC Bulletin OET 65C (rev 01-01) by Compliance Certification Services
This report serves as the additional technical analysis of the Cisco radio modules

This study addresses the addition of an additional pair of transmitters using the data derived in the afore mentioned report # 1261389.

The limits used for this evaluation are in line with the recommendations of the World Health Organizations (WHO) International Committee on Non Ionizing Radiation Protection (ICNIRP) as well as the American National Standards Institute (ANSI) C95.1.

The limits chosen are of **General Population/Uncontrolled Exposure**. The device is pole mounted. The device is high enough that it is not accessible by the general public

This analysis also complies with the requirements stated in Industry Canada RSS-102 as well as the applicable Australian and New Zealand regulations.

Only the following case scenario was used which are:
2.4GHz WLAN Module : FCC ID: LDKAGORA0916 , IC : 2461B-AGORA0916

Output power listed is conducted. The antenna(s) used for this device must be installed to provide a separation distance of at least 20 cm from all persons. Installers must be provided with antenna installation and transmitter operating conditions for satisfying RF exposure compliance.

Based on the study this case scenario, the General Population/Uncontrolled Exposure and the minimum recommended distance is around 20cm (8 inches) from the antenna.

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2.0 EUT Description.

2.4GHz WLAN Radio PCIe card, 802.11 b/g
P/N: 73-15453-03

3.0 Methodology

All calculations were made in accordance with ANSI C95.1, and FCC OET 65C.

4.0 Technical Requirements

4.1 Single Band Operation – Limits

FCC Limits for Maximum Permissible Exposure (MPE)

(A) Limits for Occupational/Controlled Exposure

Frequency Range (MHz)	Electric Field Strength (E) (V/m)	Magnetic Field Strength (H) (A/m)	Power Density (S) (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-3.0	614	1.63	(100)*	6
3.0-30	1842/f	4.89/f	($900/f^2$)*	6
30-300	61.4	0.163	1.0	6
300-1500	--	--	f/300	6
1500-100,000	--	--	5	6

(B) Limits for General Population/Uncontrolled Exposure

Frequency	Electric Field	Magnetic Field	Power Density	Averaging Time

Range (MHz)	Strength (E) (V/m)	Strength (H) (A/m)	(S) (mW/cm^2)	$\|E\|^2$, $\|H\|^2$ or S (minutes)
0.3-1.34	614	1.63	(100)*	30
1.34-30	824/f	2.19/f	($180/f^2$)*	30
30-300	27.5	0.073	0.2	30
300-1500	--	--	f/1500	30
1500-100,000	--	--	1.0	30

f = frequency in MHz *Plane-wave equivalent power density

NOTE 1: See Section 1 for discussion of exposure categories.

NOTE 2: The averaging time for General Population/Uncontrolled exposure to fixed transmitters is not applicable for mobile and portable transmitters. See 47 CFR §§2.1091 and 2.1093 on source-based time-averaging requirements for mobile and portable transmitters.

5.0 Calculations

The Power Density (mW/cm2) is calculated as follows:

$S = PG(\text{Duty Cycle}) / 4\pi R^2$ (Equation 1)

Solve for R

$R = \text{sqrt}\left(\frac{PG(\text{duty cycle})}{4\pi S}\right)$ (Equation 2)

Where:
S = power density (in appropriate units, e.g. mW/cm2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

6.0 Results

Test Reports used in evaluation are :

2.4GHz WLAN Radio PCIe card, 802.11 b/g
M/N: 73-15453-03
WLAN report : EDCS# 1261389

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S=1mW/cm^2 maximum. The highest supported antenna gain is 3.4 dBi. Using the peak power levels recorded in the test report along with Equation 2 above, the MPE distances are calculated as follows.

Frequency (MHz)	Bit Rate (Mbps)	Power Density (mW/cm^2)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	MPE Distance (cm)	Limit (cm)	Margin (cm)
2412	1	1	13.1	3.4	**1.88**	20	18.12
2437	1	1	13.1	3.4	**1.88**	20	18.12
2462	1	1	13.0	3.4	**1.86**	20	18.14
2412	6	1	10.4	3.4	**1.37**	20	18.63
2437	6	1	12.9	3.4	**1.84**	20	18.16
2462	6	1	9.8	3.4	**1.29**	20	18.71

Note: power levels taken from EDCS - 1261389

MPE Calculations

To maintain compliance, installations will assure a separation distance of at least 20cm.

Using Equation 1, the MPE levels (s) at 20 cm are calculated as follows:

Frequency (MHz)	Bit Rate (Mbps)	MPE Distance (cm)	Peak Transmit Power (dBm)	Antenna Gain (dBi)	Power Density (mW/cm^2)	Limit (mW/cm^2)	Margin (mW/cm^2)
2412	1	20	13.1	3.4	**0.01**	1	0.99
2437	1	20	13.1	3.4	**0.01**	1	0.99
2462	1	20	13.0	3.4	**0.01**	1	0.99
2412	6	20	10.4	3.4	**0.00**	1	1.00
2437	6	20	12.9	3.4	**0.01**	1	0.99
2462	6	20	9.8	3.4	**0.00**	1	1.00

The calculation is for **General Population/Uncontrolled exposure**. The minimum distance recommended is **20cm (8 inches)**.

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References

American National Standards Institute (ANSI), "Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz," ANSI/IEEE C95.1-1992 (previously issued as IEEE C95.1-1991). Copyright 1992 by the Institute of Electrical and Electronics Engineers, Inc. (IEEE), New York, N.Y. 10017. For copies contact the IEEE: 1-800-678-4333 or 1-908-981-1393.

American National Standards Institute (ANSI), "Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields - RF and Microwave". ANSI/IEEE C95.3-1992. Copyright 1992, The Institute of Electrical and Electronics Engineers, Inc. (IEEE), New York, NY 10017. For copies contact the IEEE: 1-800-678-4333 or 1-908-981-1393.

FCC OET 65C Evaluating Compliance with FCC Guidelines for Human Exposure to RF Fields from 9KHz to 40 Ghz