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Lexmark International, Inc. MPE REPORT

SCOPE OF WORK

MPE CALCULATION
ON THE LEX-M08-001 WIRELESS PRINT SERVER

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TEST REPORT

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Product Name: Wireless Print Server

Model: LEX-M08-001

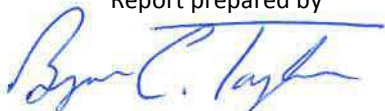
FCC Standards: FCC Part 1.1310 Limits for Maximum Permissible Exposure (MPE)

Industry Canada Standards: RSS-102 Issue 5

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MPE Calculation

§ 1.1310: The criteria listed in table 1 shall be used to evaluate the environmental impact of human exposure to radiofrequency (RF) radiation as specified in §1.1307(b), except in the case of portable devices which shall be evaluated according to the provisions of §2.1093 of this chapter.

Part 1.1310 Limits for Maximum Permissible Exposure (MPE)

Frequency range (MHz)	Electric field strength (V/m)	Magnetic field strength (A/m)	Power density (mW/cm ²)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposures				
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				
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 TO TABLE 1: Occupational/controlled limits apply in situations in which persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

NOTE 2 TO TABLE 1: General population/uncontrolled exposures apply in situations in which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

**RSS-102 Issue 5 Exposure Limits:****Table 4: RF Field Strength Limits for Devices Used by the General Public
(Uncontrolled Environment)**

Frequency Range (MHz)	Electric Field (V/m rms)	Magnetic Field (A/m rms)	Power Density (W/m ²)	Reference Period (minutes)
0.003-10 ²¹	83	90	-	Instantaneous*
0.1-10	-	0.73/ <i>f</i>	-	6**
1.1-10	87/ <i>f</i> ^{0.5}	-	-	6**
10-20	27.46	0.0728	2	6
20-48	58.07/ <i>f</i> ^{0.25}	0.1540/ <i>f</i> ^{0.25}	8.944/ <i>f</i> ^{0.5}	6
48-300	22.06	0.05852	1.291	6
300-6000	3.142 <i>f</i> ^{0.3417}	0.008335 <i>f</i> ^{0.3417}	0.02619 <i>f</i> ^{0.6834}	6
6000-15000	61.4	0.163	10	6
15000-150000	61.4	0.163	10	616000/ <i>f</i> ^{1.2}
150000-300000	0.158 <i>f</i> ^{0.5}	4.21 x 10 ⁻⁴ <i>f</i> ^{0.5}	6.67 x 10 ⁻⁵ <i>f</i>	616000/ <i>f</i> ^{1.2}
Note: <i>f</i> is frequency in MHz. *Based on nerve stimulation (NS). ** Based on specific absorption rate (SAR).				

1.1 Test Procedure

An MPE evaluation for was performed in order to show that the device was compliant with §2.1091. The maximum power density was calculated for each transmitter at a separation distance of 20cm. The calculation was performed using the maximum gain from the internal and external antennas declared by the manufacturer.

For each transmitter the maximum RF exposure at a 20 cm distance using the formula:

$$ConductedPower_{mW} = 10^{ConductedPower(dBm)/10}$$

$$PowerDensity = \frac{ConductedPower_{mW} \times Ant.Gain}{4\pi \times (20_{cm})^2}$$



1.2 Results:

802.11b (Internal Antenna)		Value	Unit	Comments
Frequency	2412 MHz			
Distance	20 cm			
Maximum Scaled Power	19.89 dBm			Measured conducted power
TX Antenna Gain	2.8 dBi			Internal Antenna
Source Based Duty Cycle	100 %			Percent of time transmitter is active
EIRP	22.69 dBm			Maximum Scaled Power x Antenna Gain
Source Based Output Power	22.69 dBm			EIRP x Duty Cycle
Power Density @ Distance	0.0370 mW/cm ²			(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit	1.0000 mW/cm ²			1. x f0
Maximum Permissible Antenna Gain	17.12 dBi			((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)
802.11b (External Antenna)		Value	Unit	Comments
Frequency	2412 MHz			
Distance	20 cm			
Maximum Scaled Power	19.89 dBm			Measured conducted power
TX Antenna Gain	2.5 dBi			External Antenna
Source Based Duty Cycle	100 %			Percent of time transmitter is active
EIRP	22.39 dBm			Maximum Scaled Power x Antenna Gain
Source Based Output Power	22.39 dBm			EIRP x Duty Cycle
Power Density @ Distance	0.0345 mW/cm ²			(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit	1.0000 mW/cm ²			1. x f0
Maximum Permissible Antenna Gain	17.12 dBi			((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)

802.11g (Internal Antenna)		Value	Unit	Comments
Frequency	2412 MHz			
Distance	20 cm			
Maximum Scaled Power	24.11 dBm			Measured conducted power
TX Antenna Gain	2.8 dBi			Internal Antenna
Source Based Duty Cycle	100 %			Percent of time transmitter is active
EIRP	26.91 dBm			Maximum Scaled Power x Antenna Gain
Source Based Output Power	26.91 dBm			EIRP x Duty Cycle
Power Density @ Distance	0.0977 mW/cm ²			(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit	1.0000 mW/cm ²			1. x f0
Maximum Permissible Antenna Gain	12.90 dBi			((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)
802.11g (External Antenna)		Value	Unit	Comments
Frequency	2412 MHz			
Distance	20 cm			
Maximum Scaled Power	24.11 dBm			Measured conducted power
TX Antenna Gain	2.5 dBi			External Antenna
Source Based Duty Cycle	100 %			Percent of time transmitter is active
EIRP	26.61 dBm			Maximum Scaled Power x Antenna Gain
Source Based Output Power	26.61 dBm			EIRP x Duty Cycle
Power Density @ Distance	0.0911 mW/cm ²			(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit	1.0000 mW/cm ²			1. x f0
Maximum Permissible Antenna Gain	12.90 dBi			((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)



802.11n (Internal Antenna)		Value	Unit	Comments
Frequency		2412	MHz	
Distance		20	cm	
Maximum Scaled Power		23.62	dBm	Measured conducted power
TX Antenna Gain		2.8	dBi	Internal Antenna
Source Based Duty Cycle		100	%	Percent of time transmitter is active
EIRP		26.42	dBm	Maximum Scaled Power x Antenna Gain
Source Based Output Power		26.42	dBm	EIRP x Duty Cycle
Power Density @ Distance		0.0872	mW/cm ²	(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit		1.0000	mW/cm ²	1. x f0
Maximum Permissible Antenna Gain		13.39	dBi	((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)
802.11n (External Antenna)		Value	Unit	Comments
Frequency		2412	MHz	
Distance		20	cm	
Maximum Scaled Power		23.62	dBm	Measured conducted power
TX Antenna Gain		2.5	dBi	External Antenna
Source Based Duty Cycle		100	%	Percent of time transmitter is active
EIRP		26.12	dBm	Maximum Scaled Power x Antenna Gain
Source Based Output Power		26.12	dBm	EIRP x Duty Cycle
Power Density @ Distance		0.0814	mW/cm ²	(Source Based Output Power, mW) / (4 π x (distance, cm) ²)
FCC Limit		1.0000	mW/cm ²	1. x f0
Maximum Permissible Antenna Gain		13.39	dBi	((Limit, mW/cm ²) x 4 π x (distance, cm) ²) / ((Maximum Scaled Power, mW) x Source Based Duty Cycle)

The calculated maximum power density at 20cm distance is less than the limit for general population / uncontrolled exposure.