



RF EXPOSURE EVALUATION REPORT

FCC ID : UDX-60076027
Equipment : LTE & Wi-Fi Router
Brand Name : CISCO
Model Name : MX68CW-HW-NA
Applicant : Cisco Systems, Inc.
170 West Tasman Drive, San Jose, CA 95134
Standard : 47 CFR Part 2.1091

We, SPORTON INTERNATIONAL INC has been evaluated in accordance with 47 CFR Part 2.1091 for the device and pass the limit.

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Approved by: Cona Huang / Deputy Manager

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History of this test report

Report No.	Version	Description	Issued Date
FA831635	Rev. 01	Initial issue of report	Sep. 05, 2018

**1. Description of Equipment Under Test (EUT)**

Product Feature & Specification	
EUT Type	LTE & Wi-Fi Router
Brand Name	CISCO
Model Name	MX68CW-HW-NA
FCC ID	UDX-60076027
Wireless Technology and Frequency Range	GSM850: 824.2 MHz ~ 848.8 MHz GSM1900: 1850.2 MHz ~ 1909.8 MHz WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz WCDMA Band V: 826.4 MHz ~ 846.6 MHz LTE Band 2: 1850 MHz ~ 1910 MHz LTE Band 4: 1710 MHz ~ 1755 MHz LTE Band 5: 824 MHz ~ 849 MHz LTE Band 12: 699 MHz ~ 716 MHz LTE Band 13: 777 MHz ~ 787 MHz WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz
Mode	GPRS/EGPRS RMC 12.2Kbps HSDPA HSUPA DC-HSDPA LTE: QPSK, 16QAM 802.11a/b/g/n/ac HT20/HT40/VHT20/VHT40/VHT80
HW Version	R3
SW Version	Meraki Cloud Controller Router-14
EUT Stage	Identical Prototype

Remark: The above EUT's information was declared by manufacturer. Please refer to the specifications or user's manual for more detailed description.

Reviewed by: Jason Wang

Report Producer: Wan Liu

2. Maximum RF average output power among production units

<Non-beamforming mode>

Mode	Burst average power(dBm)	
	GSM 850	GSM 1900
GPRS (GMSK, 1 Tx slot)	33.5	30.5
GPRS (GMSK, 2 Tx slots)	33.5	30.5
GPRS (GMSK, 3 Tx slots)	33.5	30.5
GPRS (GMSK, 4 Tx slots)	33.5	30.5
EDGE (8PSK, 1 Tx slot)	27.5	26.5
EDGE (8PSK, 2 Tx slots)	27.5	26.5
EDGE (8PSK, 3 Tx slots)	27.5	26.5
EDGE (8PSK, 4 Tx slots)	27.5	26.5

Mode		Maximum Average power(dBm)
WCDMA	Band II	24.5
	Band IV	24.5
	Band V	24.5
LTE	Band 2	23.5
	Band 4	23.5
	Band 5	23.5
	Band 12	23.5
	Band 13	23.5

Mode		Maximum Average Power (dBm)
2.4GHz WLAN	802.11b	23.0
	802.11g	22.0
	802.11n-HT20	22.0
	802.11n-HT40	22.0
	802.11ac-VHT20	22.0
	802.11ac-VHT40	22.0
5GHz WLAN	802.11a	24.5
	802.11n-HT20	24.0
	802.11n-HT40	24.5
	802.11ac-VHT20	24.0
	802.11ac-VHT40	24.5
	802.11ac-VHT80	20.0

<Beamforming mode>

Mode		Maximum Average Power (dBm)
2.4GHz WLAN	802.11n-HT20	19.0
	802.11n-HT40	19.0
	802.11ac-VHT20	19.0
	802.11ac-VHT40	19.0
5GHz WLAN	802.11n-HT20	21.0
	802.11n-HT40	21.5
	802.11ac-VHT20	21.0
	802.11ac-VHT40	21.5
	802.11ac-VHT80	17.0



3. RF Exposure Limit Introduction

According to ANSI/IEEE C95.1-1992, the criteria listed in Table 1 shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §1.1310.

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

The MPE was calculated at 31 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

4. Radio Frequency Radiation Exposure Evaluation

4.1. Standalone Power Density Calculation

<Non-beamforming mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 31cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
GPRS 850 (1 Tx slot)	824.2	3.88	33.5	37.380	5.470	688.652	0.057	0.549	0.104
GPRS 850 (2 Tx slots)	824.2	3.88	33.5	37.380	5.470	1374.042	0.114	0.549	0.207
GPRS 850 (3 Tx slots)	824.2	3.88	33.5	37.380	5.470	2051.162	0.170	0.549	0.309
GPRS 850 (4 Tx slots)	824.2	3.88	33.5	37.380	5.470	2741.574	0.227	0.549	0.413
EGPRS 850 (1 Tx slot)	824.2	3.88	27.5	31.380	1.374	172.982	0.014	0.549	0.026
EGPRS 850 (2 Tx slots)	824.2	3.88	27.5	31.380	1.374	345.144	0.029	0.549	0.052
EGPRS 850 (3 Tx slots)	824.2	3.88	27.5	31.380	1.374	515.229	0.043	0.549	0.078
EGPRS 850 (4 Tx slots)	824.2	3.88	27.5	31.380	1.374	688.652	0.057	0.549	0.104
GPRS 1900 (1 Tx slot)	1850.2	2.90	30.5	33.400	2.188	275.423	0.023	1.000	0.023
GPRS 1900 (2 Tx slots)	1850.2	2.90	30.5	33.400	2.188	549.541	0.046	1.000	0.046
GPRS 1900 (3 Tx slots)	1850.2	2.90	30.5	33.400	2.188	820.352	0.068	1.000	0.068
GPRS 1900 (4 Tx slots)	1850.2	2.90	30.5	33.400	2.188	1096.478	0.091	1.000	0.091
EGPRS 1900 (1 Tx slot)	1850.2	2.90	26.5	29.400	0.871	109.648	0.009	1.000	0.009
EGPRS 1900 (2 Tx slots)	1850.2	2.90	26.5	29.400	0.871	218.776	0.018	1.000	0.018
EGPRS 1900 (3 Tx slots)	1850.2	2.90	26.5	29.400	0.871	326.588	0.027	1.000	0.027
EGPRS 1900 (4 Tx slots)	1850.2	2.90	26.5	29.400	0.871	436.516	0.036	1.000	0.036
WCDMA Band 2	1852.4	2.90	24.5	27.400	0.550	549.541	0.046	1.000	0.046
WCDMA Band 4	1712.4	2.90	24.5	27.400	0.550	549.541	0.046	1.000	0.046
WCDMA Band 5	826.4	3.88	24.5	28.380	0.689	688.652	0.057	0.551	0.104
LTE Band 2	1850.7	2.90	23.5	26.400	0.437	436.516	0.036	1.000	0.036
LTE Band 4	1710.7	2.90	23.5	26.400	0.437	436.516	0.036	1.000	0.036
LTE Band 5	824.7	3.88	23.5	27.380	0.547	547.016	0.045	0.550	0.082
LTE Band 12	699.7	3.88	23.5	27.380	0.547	547.016	0.045	0.466	0.097
LTE Band 13	779.5	3.88	23.5	27.380	0.547	547.016	0.045	0.520	0.087
2.4GHz WLAN	2412.0	2.63	23.00	25.630	0.366	365.595	0.030	1.000	0.030
5GHz WLAN	5180.0	5.84	24.50	30.340	1.081	1081.434	0.090	1.000	0.090

Note: For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band

<Beamforming mode>

Band	Frequency (MHz)	Antenna Gain (dBi)	Maximum Power (dBm)	Maximum EIRP (dBm)	Maximum EIRP (W)	Average EIRP (mW)	Power Density at 31cm (mW/cm ²)	Limit (mW/cm ²)	Power Density / Limit
2.4GHz WLAN	2412.0	3.90	19.00	22.900	0.195	194.984	0.016	1.000	0.016
5GHz WLAN	5180.0	8.12	21.50	29.620	0.916	916.220	0.076	1.000	0.076

Note:

- For conservativeness, the lowest frequency of each band is used to determine the MPE limit of that band.
- For this device supports Beamforming for WLAN 2.4GHz HT20/HT40/VHT20/VHT40 and WLAN 5.2GHz/5.8GHz HT20/HT40/VHT20/VHT40/VHT80; therefore, in the table above which consider maximum directional Gain 3.9dBi / 8.12dBi for WLAN2.4GHz / WLAN5GHz Beamforming mode.

**4.2. Collocated Power Density Calculation**

WWAN Power Density / Limit	WLAN Power Density / Limit	Σ (Power Density / Limit) of WWAN+WLAN
0.413	0.090	0.503

Note:

1. Σ (Power Density / Limit): This is a summation of [(power density for each transmitter/antenna included in the simultaneous transmission)/ (corresponding MPE limit)], for WWAN + WLAN.
2. Considering the WWAN module collocation with the WLAN transmitter of the EIRP performance listed in the table above, the aggregated (power density /limit) is smaller than 1, and MPE of 2 collocated transmitters is compliant

Conclusion:

According to 47 CFR §2.1091, the RF exposure analysis concludes that the RF Exposure is FCC compliant.