



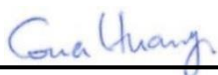
# RF EXPOSURE EVALUATION REPORT

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.

The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any agency of government.

The results in this variant report apply exclusively to the tested model / sample. Without written approval of SPORTON INTERNATIONAL INC. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.



Approved by: Cona Huang / Deputy Manager

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## **Table of Contents**

|                                                                        |          |
|------------------------------------------------------------------------|----------|
| <b>1. DESCRIPTION OF EQUIPMENT UNDER TEST (EUT) .....</b>              | <b>4</b> |
| <b>2. MAXIMUM RF AVERAGE OUTPUT POWER AMONG PRODUCTION UNITS .....</b> | <b>5</b> |
| <b>3. RF EXPOSURE LIMIT INTRODUCTION .....</b>                         | <b>7</b> |
| <b>4. RADIO FREQUENCY RADIATION EXPOSURE EVALUATION .....</b>          | <b>8</b> |
| 4.1. Standalone Power Density Calculation .....                        | 8        |
| 4.2. Collocated Power Density Calculation.....                         | 9        |



## History of this test report

| Report No. | Version | Description             | Issued Date   |
|------------|---------|-------------------------|---------------|
| FA831635   | Rev. 01 | Initial issue of report | Sep. 05, 2018 |
|            |         |                         |               |
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**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<br>GSM1900: 1850.2 MHz ~ 1909.8 MHz<br>WCDMA Band II: 1852.4 MHz ~ 1907.6 MHz<br>WCDMA Band IV: 1712.4 MHz ~ 1752.6 MHz<br>WCDMA Band V: 826.4 MHz ~ 846.6 MHz<br>LTE Band 2: 1850 MHz ~ 1910 MHz<br>LTE Band 4: 1710 MHz ~ 1755 MHz<br>LTE Band 5: 824 MHz ~ 849 MHz<br>LTE Band 12: 699 MHz ~ 716 MHz<br>LTE Band 13: 777 MHz ~ 787 MHz<br>WLAN 2.4GHz Band: 2412 MHz ~ 2462 MHz<br>WLAN 5.2GHz Band: 5180 MHz ~ 5240 MHz<br>WLAN 5.8GHz Band: 5745 MHz ~ 5825 MHz |
| Mode                                    | GPRS/EGPRS<br>RMC 12.2Kbps<br>HSDPA<br>HSUPA<br>DC-HSDPA<br>LTE: QPSK, 16QAM<br>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<br>WLAN | 802.11n-HT20   | 19.0                        |
|                | 802.11n-HT40   | 19.0                        |
|                | 802.11ac-VHT20 | 19.0                        |
|                | 802.11ac-VHT40 | 19.0                        |
| 5GHz<br>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 <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1500                                                       |                               |                               | f/300                               | 6                        |
| 1500-100,000                                                   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 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 <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | 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 <sup>2</sup> ) | Limit (mW/cm <sup>2</sup> ) | 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<br>Power Density / Limit | WLAN<br>Power Density / Limit | $\Sigma$ (Power Density / Limit)<br>of<br>WWAN+WLAN |
|-------------------------------|-------------------------------|-----------------------------------------------------|
| 0.413                         | 0.090                         | 0.503                                               |

**Note:**

1.  $\Sigma$  (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.