

RF Exposure Report

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FCC ID: UDX-60094011

Test Model: MR86-HW

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Table of Contents

| | |
|---|----------|
| Release Control Record | 3 |
| 1 Certificate of Conformity | 4 |
| 2 RF Exposure | 5 |
| 2.1 Limits for Maximum Permissible Exposure (MPE) | 5 |
| 2.2 MPE Calculation Formula | 5 |
| 2.3 Classification | 5 |
| 2.4 Antenna Gain | 6 |
| 2.5 Calculation Result of Maximum Conducted Power | 7 |

Release Control Record

| Issue No. | Description | Date Issued |
|-----------------------|-------------------|-------------|
| MFBCKS-WTW-P21030823A | Original release. | 2022/11/3 |

2 RF Exposure

2.1 Limits for Maximum Permissible Exposure (MPE)

| Frequency Range (MHz) | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm ²) | Average Time (minutes) |
|---|-------------------------------|-------------------------------|-------------------------------------|------------------------|
| 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

2.2 MPE Calculation Formula

$$Pd = (Pout * G) / (4 * \pi * r^2)$$

where

Pd = power density in mW/cm²

Pout = output power to antenna in mW

G = gain of antenna in linear scale

Pi = 3.1416

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

2.3 Classification

For Antenna Model: AIR-ANT2513P4M-N

The antenna of this product, under normal use condition, is at least 54cm away from the body of the user. So, this device is classified as **Mobile Device**.

For Antenna Model: MA-ANT-20

The antenna of this product, under normal use condition, is at least 39cm away from the body of the user. So, this device is classified as **Mobile Device**.

For Antenna Model: MA-ANT-25

The antenna of this product, under normal use condition, is at least 40cm away from the body of the user. So, this device is classified as **Mobile Device**.

For Antenna Model: MA-ANT-27

The antenna of this product, under normal use condition, is at least 53cm away from the body of the user. So, this device is classified as **Mobile Device**.

2.4 Antenna Gain

| WLAN 2.4GHz + WLAN 5GHz | | | | | | | |
|-------------------------|------------------------|-------|------------------|--------------------|-----------------------|--|----------------|
| Antenna set | Chain No. | Brand | Model | Antenna Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type |
| 1 | Chain 0/1 Chain 2/3 | Cisco | AIR-ANT2513P4M-N | 13 | 2.4~2.4835 | Dual-Band Polarization Diverse Patch Array | N type(F) |
| | | | | 13 | 5.15~5.85 | | |
| 2 | Chain 0/1 Chain 2/3 | Cisco | MA-ANT-20 | 4 | 2.4~2.4835 | omni-directional | |
| | | | | 7 | 5.15~5.85 | | |
| 3 | Chain 0/1 Chain 2/3 | Cisco | MA-ANT-25 | 8 | 2.4~2.4835 | Patch Array | |
| | | | | 6.5 | 5.15~5.85 | | |
| 4 | Chain 0/1 Chain 2/3 | Cisco | MA-ANT-27 | 9 | 2.4~2.4835 | Sector | |
| | | | | 12 | 5.15~5.85 | | |
| Scanning Radio | | | | | | | |
| - | - | Brand | Model | Antenna Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type |
| - | - | WNC | MR86-HW | 4 | 2.4~2.4835 | PIFA | I-PEX |
| | | | | 6.63 | 5.15~5.85 | | |
| Bluetooth | | | | | | | |
| - | - | Brand | Model | Antenna Gain (dBi) | Frequency Range (GHz) | Antenna Type | Connector Type |
| - | - | WNC | MR86-HW | 4.13 | 2.4~2.4835 | PIFA | I-PEX |

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2.5 Calculation Result of Maximum Conducted Power

All data (except Bluetooth) was copied from the original test report (Report No.: SA191023E01D R1, FCC ID: UDX-60094010)

WLAN Antenna Model: AIR-ANT2513P4M-N

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| WLAN 2.4GHz | 2437 | 198.326 | 19.02 | 54 | 0.43190 | 1 |
| WLAN 5GHz U-NII-1 | 5200 | 6.013 | 19.02 | 54 | 0.01309 | 1 |
| WLAN 5GHz (U-NII-2A) | 5290 | 49.113 | 19.02 | 54 | 0.10695 | 1 |
| WLAN 5GHz (U-NII-2C) | 5610 | 49.555 | 19.02 | 54 | 0.10792 | 1 |
| WLAN 5GHz U-NII-3 | 5745 | 196.2 | 19.02 | 54 | 0.42727 | 1 |
| Bluetooth | 2402 | 86.497 | 4.13 | 54 | 0.00611 | 1 |

NOTE:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- 2.4GHz: Directional gain = 13dBi + 10log(4) = 19.02dBi
 5GHz (U-NII-1): Directional gain = 13dBi + 10log(4) = 19.02dBi
 5GHz (U-NII-2A): Directional gain = 13dBi + 10log(4) = 19.02dBi
 5GHz (U-NII-2C): Directional gain = 13dBi + 10log(4) = 19.02dBi
 5GHz (U-NII-3): Directional gain = 13dBi + 10log(4) = 19.02dBi

Conclusion:

The formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$WLAN\ 2.4GHz + WLAN\ 5GHz + Bluetooth = 0.43190 / 1 + 0.42727 / 1 + 0.00611 / 1 = 0.86528$$

Therefore the maximum calculations of above situations are less than the "1" limit.

WLAN Antenna Model: MA-ANT-20

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| WLAN 2.4GHz | 2437 | 577.777 | 10.02 | 39 | 0.30368 | 1 |
| WLAN 5GHz U-NII-1 | 5180 | 24.06 | 13.02 | 39 | 0.02523 | 1 |
| WLAN 5GHz (U-NII-2A) | 5290 | 191.391 | 13.02 | 39 | 0.20072 | 1 |
| WLAN 5GHz (U-NII-2C) | 5610 | 192.472 | 13.02 | 39 | 0.20185 | 1 |
| WLAN 5GHz U-NII-3 | 5795 | 529.361 | 13.02 | 39 | 0.55515 | 1 |
| Bluetooth | 2402 | 86.497 | 4.13 | 39 | 0.01171 | 1 |

NOTE:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- 2.4GHz: Directional gain = 4dBi + 10log(4) = 10.02dBi
 5GHz (U-NII-1): Directional gain = 7dBi + 10log(4) = 13.02dBi
 5GHz (U-NII-2A): Directional gain = 7dBi + 10log(4) = 13.02dBi
 5GHz (U-NII-2C): Directional gain = 7dBi + 10log(4) = 13.02dBi
 5GHz (U-NII-3): Directional gain = 7dBi + 10log(4) = 13.02dBi

Conclusion:

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz+ Bluetooth = 0.30368 / 1 + 0.55515 / 1 + 0.01171/1 = 0.87054

Therefore the maximum calculations of above situations are less than the "1" limit.

WLAN Antenna Model: MA-ANT-25

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| WLAN 2.4GHz | 2437 | 470.66 | 14.02 | 40 | 0.59071 | 1 |
| WLAN 5GHz U-NII-1 | 5190 | 27.236 | 12.52 | 40 | 0.02420 | 1 |
| WLAN 5GHz (U-NII-2A) | 5290 | 155.307 | 12.52 | 40 | 0.13799 | 1 |
| WLAN 5GHz (U-NII-2C) | 5690 | 215.436 | 12.52 | 40 | 0.19142 | 1 |
| WLAN 5GHz U-NII-3 | 5775 | 335.941 | 12.52 | 40 | 0.29849 | 1 |
| Bluetooth | 2402 | 86.497 | 4.13 | 40 | 0.01113 | 1 |

NOTE:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- 2.4GHz: Directional gain = 8dBi + 10log(4) = 14.02dBi
 5GHz (U-NII-1): Directional gain = 6.5dBi + 10log(4) = 12.52dBi
 5GHz (U-NII-2A): Directional gain = 6.5dBi + 10log(4) = 12.52dBi
 5GHz (U-NII-2C): Directional gain = 6.5dBi + 10log(4) = 12.52dBi
 5GHz (U-NII-3): Directional gain = 6.5dBi + 10log(4) = 12.52dBi

Conclusion:

The formula of calculated the MPE is:

$$CPD1 / LPD1 + CPD2 / LPD2 + \dots \text{etc.} < 1$$

CPD = Calculation power density

LPD = Limit of power density

$$\text{WLAN 2.4GHz} + \text{WLAN 5GHz} + \text{Bluetooth} = 0.59071 / 1 + 0.29849 / 1 + 0.01113 / 1 = 0.90033$$

Therefore the maximum calculations of above situations are less than the "1" limit.

WLAN Antenna Model: MA-ANT-27

| Operation Mode | Evaluation Frequency (MHz) | Max Power (mW) | Antenna Gain (dBi) | Distance (cm) | Power Density (mW/cm ²) | Limit (mW/cm ²) |
|----------------------|----------------------------|----------------|--------------------|---------------|-------------------------------------|-----------------------------|
| WLAN 2.4GHz | 2437 | 495.227 | 15.02 | 53 | 0.44570 | 1 |
| WLAN 5GHz U-NII-1 | 5180 | 7.59 | 18.02 | 53 | 0.01363 | 1 |
| WLAN 5GHz (U-NII-2A) | 5290 | 62.054 | 18.02 | 53 | 0.11143 | 1 |
| WLAN 5GHz (U-NII-2C) | 5610 | 62.592 | 18.02 | 53 | 0.1124 | 1 |
| WLAN 5GHz U-NII-3 | 5745 | 247.721 | 18.02 | 53 | 0.44484 | 1 |
| Bluetooth | 2402 | 86.497 | 4.13 | 53 | 0.00634 | 1 |

NOTE:

- Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.
- 2.4GHz: Directional gain = 9dBi + 10log(4) = 15.02dBi
 5GHz U-NII-1: Directional gain = 12dBi + 10log(4) = 18.02dBi
 5GHz (U-NII-2A): Directional gain = 12dBi + 10log(4) = 18.02dBi
 5GHz (U-NII-2C): Directional gain = 12dBi + 10log(4) = 18.02dBi
 5GHz U-NII-3: Directional gain = 12dBi + 10log(4) = 18.02dBi

Conclusion:

The formula of calculated the MPE is:

CPD1 / LPD1 + CPD2 / LPD2 +etc. < 1

CPD = Calculation power density

LPD = Limit of power density

WLAN 2.4GHz + WLAN 5GHz+ Bluetooth = 0.44570 / 1 + 0.44484 / 1 + 0.00634 / 1 = 0.89688

Therefore the maximum calculations of above situations are less than the "1" limit.

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