



# RADIO EXPOSURE TEST REPORT

**FCC ID** : TLZ-XM549

**Equipment** : IEEE 802.11 1X1 a/b/g/n/ac/ax Wireless LAN +  
Bluetooth 5.3 + 802.15.4 Tri-radio 12 x 12 LGA Module

**Brand Name** : AzureWave

**Model Name** : AW-XM549 , AW-XM549-I , AW-XM553 , AW-XM553-I

**Applicant** : AzureWave Technologies, Inc.  
8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei  
City , Taiwan 231

**Manufacturer** : AzureWave Technologies, Inc.  
8F., No.94, Baozhong Rd. , Xindian Dist., New Taipei  
City , Taiwan 231

**Standard** : 47 CFR Part 2.1091

The product was received on Dec. 16, 2022, and testing was started from Dec. 16, 2022 and completed on Dec. 26, 2025. We, Sporton International Inc. Hsinchu Laboratory, would like to declare that the tested sample has been evaluated in accordance with the procedures given in 47 CFR Part 2.1091 and shown compliance with the applicable technical standards.

The test results in this variant report apply exclusively to the tested model / sample. Without written approval of Sporton International Inc. Hsinchu Laboratory, the test report shall not be reproduced except in full.

Approved by: Sam Chen

**Sporton International Inc. Hsinchu Laboratory**

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### Photographs of EUT v01



## History of this test report

[illegible]



## Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items          | Result (PASS/FAIL) | Remark |
|---------------|-----------------|---------------------|--------------------|--------|
| 2             | -               | Exposure evaluation | PASS               | -      |

**Conformity Assessment Condition:**

1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented against the regulation limits or in accordance with the requirements stipulated by the applicant/manufacture who shall bear all the risks of non-compliance that may potentially occur if measurement uncertainty is taken into account.
2. The measurement uncertainty please refer to each test result in the chapter "Measurement Uncertainty".

**Disclaimer:**

The product specifications of the EUT presented in the test report that may affect the test assessments are declared by the manufacturer who shall take full responsibility for the authenticity.

Reviewed by: Sam Chen

Report Producer: Vicky Huang



# 1 General Description

## 1.1 EUT General Information

| RF General Information |                                                  |                                                  |                                                                                                                                                                                                |
|------------------------|--------------------------------------------------|--------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Evaluation Mode        | Frequency Range (MHz)                            | Operating Frequency (MHz)                        | Modulation Type                                                                                                                                                                                |
| 2.4GHz WLAN            | 2400-2483.5                                      | 2412-2462                                        | 802.11b: DSSS (DBPSK, DQPSK, CCK)<br>802.11g/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)<br>VHT: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)<br>802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM) |
| 5GHz WLAN              | 5150-5250<br>5250-5350<br>5470-5725<br>5725-5850 | 5180-5240<br>5260-5320<br>5500-5720<br>5745-5825 | 802.11a/n: OFDM (BPSK, QPSK, 16QAM, 64QAM)<br>802.11ac: OFDM (BPSK, QPSK, 16QAM, 64QAM, 256QAM)<br>802.11ax: OFDMA (BPSK, QPSK, 16QAM, 64QAM, 256QAM, 1024QAM)                                 |
| Bluetooth              | 2400-2483.5                                      | 2402-2480                                        | BR / EDR: FHSS (GFSK / $\pi/4$ -DQPSK / 8DPSK)<br>LE: GFSK                                                                                                                                     |
| IEEE802.15.4           | 2400-2483.5                                      | 2405-2480                                        | O-QPSK                                                                                                                                                                                         |

## 1.2 Antenna Information

| Ant. | Port | Brand       | Model Name        | Antenna Type   | Connector | Gain (dBi) |
|------|------|-------------|-------------------|----------------|-----------|------------|
| 1    | 1    | MAG. LAYERS | MSA-4008-25GC1-A2 | PIFA Antenna   | I-PEX     | Note1      |
| 2    | 1    | CEL         | 0032-02-07-00-001 | PIFA Antenna   | N/A       |            |
| 3    | 1    | Taoglas     | FXP830.54.0250C   | Dipole Antenna | I-PEX     |            |
| 4    | 1    | Taoglas     | GW20.54.0400A.km  | Dipole Antenna | I-PEX     |            |
| 5    | 1    | Taoglas     | GW20.54.0180A.km  | Dipole Antenna | I-PEX     |            |

Note1:

| Ant. | Gain (dBi)                   |           |
|------|------------------------------|-----------|
|      | WLAN 2.4GHz/Bluetooth/Thread | WLAN 5GHz |
| 1    | 2.98                         | 5.16      |
| 2    | 1.30                         | 4.30      |
| Ant. | WLAN 2.4GHz/Bluetooth        | WLAN 5GHz |
| 3    | 3.1                          | 6.08      |
| 4    | 2.33                         | 1.73      |
| 5    | 2.47                         | 2.62      |

Note 2: The above information was declared by manufacturer.

Note 3: The EUT has two types of antennas. Only the highest gain antenna from each type was selected for testing. Thus, Antenna 1 and Antenna 3 were selected to perform the test.

**For WLAN 2.4GHz function>**

**For IEEE 802.11b/g/n/VHT/ax (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

**<For WLAN 5GHz function>**

**For IEEE 802.11a/n/ac/ax (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

**<For Bluetooth function> (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

**<For Thread function> (1TX/1RX):**

Only Port 1 can be used as transmitting/receiving antenna.

### 1.3 Table for Multiple Listing

The model names in the following table are all refer to the identical product.

| Model Name | Description                                                                      |
|------------|----------------------------------------------------------------------------------|
| AW-XM549   | All the models are identical, the difference model served as marketing strategy. |
| AW-XM549-I |                                                                                  |
| AW-XM553   |                                                                                  |
| AW-XM553-I |                                                                                  |

Note 1: From the above models, model: AW-XM549 was selected as representative model for the test and its data was recorded in this report.

Note 2: The above information was declared by manufacturer.

### 1.4 Table for EUT Information

| EUT | Hardware Version | Description                                                                                      |
|-----|------------------|--------------------------------------------------------------------------------------------------|
| 1   | 01H              | The difference between 01H and 02H is the layout of DC-DC power.<br>All RF layouts are the same. |
| 2   | 02H              |                                                                                                  |

Note: The above information was declared by manufacturer.

### 1.5 Table for Permissive Change

This product is an extension of original one reported under Sporton project number: FA2O0715

Below is the table for the change of the product with respect to the original one.

| Modifications                                                                                                                                              | Performance Checking |
|------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Add three sets of dipole antennas of a different type from the original application, with both higher and lower gain only for WLAN and Bluetooth function. | MPE                  |

Note: Other test results are based on original test report.

### 1.6 Accessories

N/A



## 1.7 Applicable Standards

According to the specifications of the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ 47 CFR Part 2.1091
- ♦ KDB 447498 D04 Interim General RF Exposure Guidance v01

The following reference test guidance is not within the scope of accreditation of TAF.

- ♦ 47 CFR Part 1.1307
- ♦ 47 CFR Part 1.1310

## 1.8 Testing Location

| Testing Location Information                              |                                                                                    |
|-----------------------------------------------------------|------------------------------------------------------------------------------------|
| Test Lab. : Sporton International Inc. Hsinchu Laboratory |                                                                                    |
| Hsinchu                                                   | ADD: No.8, Ln. 724, Bo'ai St., Zhubei City, Hsinchu County 302010, Taiwan (R.O.C.) |
| (TAF: 3787)                                               | TEL: 886-3-656-9065      FAX: 886-3-656-9085                                       |
|                                                           | Test site Designation No. TW3787 with FCC.                                         |
|                                                           | Conformity Assessment Body Identifier (CABID) TW3787 with ISCED.                   |

Note: The tested sample of the Antenna 3~5 test item was received on Jul. 25, 2025



## 2 Maximum Permissible Exposure

### 2.1 Limit of Maximum Permissible Exposure

(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 <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 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) Limits for General Population / Uncontrolled Exposure

| Frequency Range (MHz) | Electric Field Strength (E) (V/m) | Magnetic Field Strength (H) (A/m) | Power Density (S) (mW/ cm <sup>2</sup> ) | Averaging Time  E  <sup>2</sup> , H  <sup>2</sup> or S (minutes) |
|-----------------------|-----------------------------------|-----------------------------------|------------------------------------------|------------------------------------------------------------------|
| 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                                                              |

Note: f = frequency in MHz ; \*Plane-wave equivalent power density

### 2.2 MPE Calculation Method

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$E \text{ (V/m)} = \frac{\sqrt{30 \times P \times G}}{d} \quad \text{Power Density: } Pd \text{ (W/m}^2\text{)} = \frac{E^2}{377}$$

**E** = Electric field (V/m)

**P** = RF output power (W)

**G** = EUT Antenna numeric gain (numeric)

**d** = Separation distance between radiator and human body (m)

The formula can be changed to

$$Pd = \frac{30 \times P \times G}{377 \times d^2}$$



## 2.3 MPE Exemption

Option (A): 1.1307(b)(3)(i)(A): Available maximum time-averaged power is < 1 mW

Option (B): 1.1307(b)(3)(i)(B): Device operates between 300 MHz and 6 GHz and the maximum time-averaged power or effective radiated power (ERP), whichever is greater, <= Pth.

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases}$$

Where

$$x = -\log_{10} \left( \frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right) \text{ and } f \text{ is in GHz;}$$

and

$$ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases}$$

$d$  = the separation distance (cm);

Option (C): 1.1307(b)(3)(i)(C): ERP is below a threshold calculated based on the distance

$R$  between the person and the antenna / radiating structure, where  $R > \lambda / 2 \pi$ .

| Single RF Sources Subject to Routine Environmental Evaluation |                       |
|---------------------------------------------------------------|-----------------------|
| RF Source frequency (MHz)                                     | Threshold ERP (watts) |
| 0.3-1.34                                                      | $1,920 R^2$ .         |
| 1.34-30                                                       | $3,450 R^2/f^2$ .     |
| 30-300                                                        | $3.83 R^2$ .          |
| 300-1,500                                                     | $0.0128 R^2 f$ .      |
| 1,500-100,000                                                 | $19.2 R^2$ .          |
| Note: $R$ is in meters, $f$ is in MHz.                        |                       |



## 2.4 Calculated Result and Limit

Exposure Environment: General Population / Uncontrolled Exposure

For Antenna 1:

| Mode       | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) | Option | TL EIRP (dBm) | TL Ratio |
|------------|----------|-------------|------------|----------------|--------------------|---------------|-------------------------|-------------------------------|--------|---------------|----------|
| 2.4G;D1D   | 2.98     | 20.58       | 23.56      | 0.50           | 24.06              | 20            | 0.05067                 | 1.00000                       | B      | 37.006        | 0.0507   |
| 5.2G;D1D   | 5.16     | 20.99       | 26.15      | 0.50           | 26.65              | 20            | 0.09199                 | 1.00000                       | B      | 37.006        | 0.0920   |
| 5.3G;D1D   | 5.16     | 20.04       | 25.20      | 0.50           | 25.70              | 20            | 0.07391                 | 1.00000                       | B      | 37.006        | 0.0739   |
| 5.6G;D1D   | 5.16     | 20.78       | 25.94      | 0.50           | 26.44              | 20            | 0.08764                 | 1.00000                       | B      | 37.006        | 0.0876   |
| 5.8G;D1D   | 5.16     | 21.33       | 26.49      | 0.50           | 26.99              | 20            | 0.09948                 | 1.00000                       | B      | 37.006        | 0.0995   |
| 2.4G;BT-BR | 2.98     | 11.03       | 14.01      | 0.50           | 14.51              | 20            | 0.00562                 | 1.00000                       | B      | 37.006        | 0.0056   |
| 2.4G;BT-LE | 2.98     | 11.03       | 14.01      | 0.50           | 14.51              | 20            | 0.00562                 | 1.00000                       | B      | 37.006        | 0.0056   |
| 802.15.4   | 2.98     | 6.53        | 9.51       | 0.50           | 10.01              | 20            | 0.00199                 | 1.00000                       | B      | 37.006        | 0.0020   |

For Antenna 3:

| Mode       | DG (dBi) | Power (dBm) | EIRP (dBm) | Tolerance (dB) | Tune-up EIRP (dBm) | Distance (cm) | S (mW/cm <sup>2</sup> ) | S Limit (mW/cm <sup>2</sup> ) | Option | TL EIRP (dBm) | TL Ratio |
|------------|----------|-------------|------------|----------------|--------------------|---------------|-------------------------|-------------------------------|--------|---------------|----------|
| 2.4G;D1D   | 3.10     | 20.58       | 23.68      | 0.50           | 24.18              | 20            | 0.0522                  | 1.00000                       | B      | 37.006        | 0.0522   |
| 5.2G;D1D   | 6.08     | 20.99       | 27.07      | 0.50           | 27.57              | 20            | 0.1139                  | 1.00000                       | B      | 37.006        | 0.1139   |
| 5.3G;D1D   | 6.08     | 20.04       | 26.12      | 0.50           | 26.62              | 20            | 0.0915                  | 1.00000                       | B      | 37.006        | 0.0915   |
| 5.6G;D1D   | 6.08     | 20.78       | 26.86      | 0.50           | 27.36              | 20            | 0.1085                  | 1.00000                       | B      | 37.006        | 0.1085   |
| 5.8G;D1D   | 6.08     | 21.33       | 27.41      | 0.50           | 27.91              | 20            | 0.1232                  | 1.00000                       | B      | 37.006        | 0.1232   |
| 2.4G;BT-BR | 3.10     | 11.03       | 14.13      | 0.50           | 14.63              | 20            | 0.0058                  | 1.00000                       | B      | 37.006        | 0.0058   |
| 2.4G;BT-LE | 3.10     | 11.03       | 14.13      | 0.50           | 14.63              | 20            | 0.0058                  | 1.00000                       | B      | 37.006        | 0.0058   |

Note: The above antenna gain was declared by manufacturer.

————THE END————