Maximum Permissible Exposure Report

Product	:	Wi-Fi 7 AIW-173 module
Model Name	:	AIW-173BQ-GI1
Series Model	:	AIW-173LQ-GI1, AIW-173LQ-GI2, AIW-173BQ-GI2, AIW-173HQ-GI1, AIW-173HQ-GI2
FCC ID	:	M82-AIW-173
Test Regulation	:	47 CFR FCC Part 2.1091
Received Date	:	2024/9/18
Test Date	:	2024/09/19 ~ 2025/02/10
Issued Date	:	2025/4/16
Applicant	:	Advantech Co Ltd No. 1, Alley 20, Lane 26, Rueiguang Road Neihu District, Taipei, Taiwan 114
Issued By	:	Underwriters Laboratories Taiwan Co., Ltd. Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan

Testing Laboratory
3398

The results reported herein have been performed in accordance with the laboratory's terms of accreditation. This report shall not be reproduced except in full without the written approval of the Laboratory. The results in this report are responsible of the test sample(s) provided by the client only and are not to be used to indicate applicability to other similar products.

REVISION HISTORY

Original Test Report No.: 4791471150-US-R6-V0

Revision	Test report No.	Date	Page revised	Contents
Original	4791471150-US-R6-V0	2025/4/16	-	Initial issue

Table of Contents

1. Attestation of Test Results

APPLICANT:	Advantech Co Ltd No. 1, Alley 20, Lane 26, Rueiguang Road Neihu District, Taipei, Taiwan 114
MANUFACTURER:	Advantech Co Ltd No. 1, Alley 20, Lane 26, Rueiguang Road Neihu District, Taipei, Taiwan 114
EUT DESCRIPTION:	Wi-Fi 7 AIW-173 module
BRAND:	ADVANTECH
MODEL:	AIW-173BQ-GI1
SERIES MODEL:	AIW-173LQ-GI1, AIW-173LQ-GI2, AIW-173BQ-GI2, AIW-173HQ-GI1, AIW-173HQ-GI2
SAMPLE STAGE:	Design Verification Test Sample

APPLICABLE STANDARDS	
STANDARD	**Test Results**
47 CFR FCC Part 2.1091	PASS

Underwriters Laboratories Taiwan Co., Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by Underwriters Laboratories Taiwan Co., Ltd. based on interpretations and/or observations of test results. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by Underwriters Laboratories Taiwan Co., Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by Underwriters Laboratories Taiwan Co., Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by NVLAP, NIST, any agency of the Federal Government, or any agency of any government.

Prepared By:

Sally Lu Date : 2025/4/16
Project Handler

Approved and Authorized By:

Eric Lee Date : 2025/4/16
Senior Laboratory Engineer

2. Test Methodology and Reference Procedures

The tests documented in this report were performed in accordance with KDB 447498 D04 Interim General RF Exposure Guidance v01.

3. Facilities and Accreditation

Test Location	Underwriters Laboratories Taiwan Co., Ltd.
Address	Building A, B and E, No. 372-7, Sec. 4, Zhongxing Rd., Zhudong Township, Hsinchu County, Taiwan
Accreditation Certificate	Underwriters Laboratories Taiwan Co., Ltd. is accredited by TAF, Laboratory Code 3398.

4. Equipment Under Test

4.1. Description of EUT

Product	Wi-Fi 7 AIW-173 module
Brand Name	ADVANTECH
Model Name	AIW-173BQ-GI1
Series Model	AIW-173LQ-GI1, AIW-173LQ-GI2, AIW-173BQ-GI2, AIW-173HQ-GI1, AIW-173HQ-GI2
Normal Voltage	3.3Vdc

Operating Frequency	BT EDR: 2402MHz ~ 2480MHz BT LE: 2402MHz ~ 2480MHz 2.4GHz WiFi: 2412MHz ~ 2462MHz 5GHz WiFi: 5180 ~ 5240MHz, 5260 ~ 5320MHz, 5500 ~ 5720MHz, 5745 ~ 5825MHz 6GHz WiFi: 5935 ~ 6425MHz, 6435 ~ 6515MHz, 6535 ~ 6855MHz, 6875 ~ 7115MHz
Sample ID	Conducted Test:7620396
	Radiated Test:7620396

Note:
1. The models difference table as below:

Model	**Different**	
	Type	**Bluetooth Interface**
AIW-173LQ-GI1	LGA Module	Bluetooth USB control
AIW-173LQ-GI2		Bluetooth UART control
AIW-173BQ-GI1	M.2 type PCB board + LGA Module	Bluetooth USB control
AIW-173BQ-GI2		Bluetooth UART control
AIW-173HQ-GI1	PCIE type PCB board + LGA Module	Bluetooth USB control
AIW-173HQ-GI2		Bluetooth UART control

Remark:
1. There are no circuit or layout differences in the LGA Module part across the three types.
2. AIW-173LQ-GI1 and AIW-173LQ-GI2 have identical electrical characteristics.
3. AIW-173BQ-GI1 and AIW-173BQ-GI2 have identical electrical characteristics.
4. AIW-173HQ-GI1 and AIW-173HQ-GI2 have identical electrical characteristics.

2. For this report measurement uncertainty, statement of conformity, determining compliance, it is necessary to refer to the original measurement report of EUT.

3. The above EUT information is declared by manufacturer and for more detailed features description, please refer the manufacturer's or user's manual, the laboratory shall not be held responsible.

4.2. Description of Available Antennas

Ant. No.	Transmitter Circuit	Brand Name	Model Name	Maximum Gain (dBi)	Ant. Type	Connector Type
1	Chain0+1	Advantech	AIW-512-C (1751000460-01)	2.87 dBi : 2400 ~ 2500 MHz 3.11 dBi : 5150 ~ 5850 MHz 3.22 dBi : 5925 ~ 7125 MHz	Dipole	RP-SMA Male
2	Chain0+1	Advantech	AIW-512-I (1751000651-01)	2.87 dBi : 2400 ~ 2500 MHz 3.11 dBi : 5150 ~ 5850 MHz 3.22 dBi : 5925 ~ 7125 MHz	Dipole	RP-SMA Male
3	Chain0+1	Advantech	1751000642-01	1.61 dBi : 2400 ~ 2500 MHz 3.68 dBi : 5150 ~ 5850 MHz 4.06 dBi : 5925 ~ 7125 MHz	Dipole	RP-SMA Male
4	Chain0+1	Advantech	AIW-511 (1751000342-01)	2.28 dBi : 2400 ~ 2500 MHz 2.64 dBi : 5150 ~ 5850 MHz 3.28 dBi : 5925 ~ 7125 MHz	Dipole	RP-SMA Male
5	Chain0+1	Advantech	AIW-513 (1751000717-01)	1.48 dBi : 2400 ~ 2500 MHz 3.58 dBi : 5150 ~ 5850 MHz 4.04 dBi : 5925 ~ 7125 MHz	Dipole	RP-SMA Male
6	Chain0+1	Advantech	AIW-514	ANT0: 2.59 dBi @ 2400 – 2500 MHz 3.58 dBi @ 5150 – 5850 MHz 3.94 dBi @ 5925 – 7125 MHz ANT1: 2.60 dBi @ 2400 – 2500 MHz 3.51 dBi @ 5150 – 5850 MHz 3.91 dBi @ 5925 – 7125 MHz	Dipole	RP-SMA-Male

Note: The above antenna information was provided from customer and for more detailed features description, please refer the manufacturer's specification or user's manual, the laboratory shall not be held responsible.

5. Requirement

Limits for General Population/Uncontrolled Exposure

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^2)**	**Averaging Time |E|2, |H|2 or S (minutes)**
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
Note 1: f = frequency in MHz, * means Plane-wave equivalent power density				
Note 2: 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 cannot exercise control over their exposure.				

Power Density (S) is calculated by the following formula:

$S=(P*G)/4\pi R^2$

where: S = power density (in appropriate units, e.g. mW/cm^2)
P = power input to the antenna (in appropriate units, e.g., mW)
G = power gain of the antenna in the direction of interest relative to an isotropic radiator R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

6. General RF Exposure Test Exemption

The corresponding Exclusion Threshold condition, listed below:

1) Blanket Exempt: Following 47 CFR 1.1307(b)(3)(i)(A), the available maximum time-averaged power is no more than 1 mW.

2) SAR Exempt: Following 47 CFR 1.1307(b)(3)(i)(B), the available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold P_{th} (mW) described in the following formula. This method shall only be used at separation distances (cm) from 0.5 centimeters to 40 centimeters and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by:

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

Where

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

and

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

d = the separation distance (cm);

3) MPE Exempt: Following 47 CFR 1.1307(b)(3)(i)(C), using Table 1 and the minimum separation distance (R in meters) from the body of a nearby person for the frequency (f in MHz) at which the source operates, the ERP (watts) is no more than the calculated value prescribed for that frequency. For the exemption in Table 1 to apply, R must be at least $\lambda/2\pi$, where λ is the free-space operating wavelength in meters. If the ERP of a single RF source is not easily obtained, then the available maximum time-averaged power may be used in lieu of ERP if the physical dimensions of the radiating structure(s) do not exceed the electrical length of $\lambda/4$ or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

Table 1 to § 1.1307(b)(3)(i)(C) - 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^2f.
1,500-100,000	19.2R^2.

7. Radio Frequency Radiation Exposure Evaluation

(1) General RF Exposure Test Exemption

Option	Evaluation Method	Clause
☐	Blanket Exempt	47 CFR 1.1307(b)(3)(i)(A)
☐	SAR Exempt	47 CFR 1.1307(b)(3)(i)(B)
☒	MPE Exempt	47 CFR 1.1307(b)(3)(i)(C)

Bluetooth EDR

Evaluation Frequency	λ/2π	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2402 ~ 2480	0.0199	0.225	13.15	0.021	0.972

Note:
1. λ(m) = $3*10^8$ (m/s) / frequency (Hz)
2. Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
3. Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)}$ / 1000
4. Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = 19.2 R^2

Bluetooth LE

Evaluation Frequency	λ/2π	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2402 ~ 2480	0.0199	0.225	13.85	0.024	0.972

Note:
1. λ(m) = $3*10^8$ (m/s) / frequency (Hz)
2. Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
3. Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)}$ / 1000
4. Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = 19.2 R^2

WLAN 2.4GHz

Evaluation Frequency	λ/2π	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
2412 ~ 2462	0.0198	0.225	26.79	0.478	0.972

Note:
1. λ(m) = $3*10^8$ (m/s) / frequency (Hz)
2. Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
3. Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)}$ / 1000
4. Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = 19.2 R^2

WLAN 5GHz

Evaluation Frequency	λ/2π	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
5180 ~ 5240	0.0092	0.225	26.39	0.436	0.972
5260 ~ 5320	0.0091	0.225	26.23	0.42	0.972
5500 ~ 5720	0.0087	0.225	26.16	0.413	0.972
5745 ~ 5825	0.0083	0.225	25.74	0.375	0.972

Note:

1. $\lambda(m) = 3*10^8$ (m/s) / frequency (Hz)
2. Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
3. Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)}$ / 1000
4. Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = 19.2 R^2

WLAN 6GHz

Evaluation Frequency	λ/2π	R	Max. ERP	Max. ERP	Threshold ERP
(MHz)	(m)	(m)	(dBm)	(W)	(W)
5935 ~ 6415	0.0078	0.225	19.57	0.091	0.972
6435 ~ 6515	0.0074	0.225	19.65	0.092	0.972
6535 ~ 6855	0.0073	0.225	19.69	0.093	0.972
6878 ~ 7115	0.0071	0.225	19.68	0.093	0.972

Note:

1. $\lambda(m) = 3*10^8$ (m/s) / frequency (Hz)
2. Max. ERP (dBm) = Max. Average power (dBm) + Antenna Gain (dBi) -2.15
3. Max. ERP (W) = $10^{(\text{Max. ERP (dBm)} / 10)}$ / 1000
4. Threshold ERP (W) (RF Source Frequency 1500 – 100000 MHz) = 19.2 R^2

(2) Simultaneously transmission condition:

Condition	Technology		
1	BT	WLAN (2.4GHz)	-
2	BT	WLAN (5GHz)	-
3	BT	WLAN (6GHz)	-
4	WLAN (2.4GHz)	WLAN (5GHz)	-
5	WLAN (2.4GHz)	WLAN (6GHz)	-
6	BT	WLAN (2.4GHz)	WLAN (5GHz)
7	BT	WLAN (2.4GHz)	WLAN (6GHz)

Condition 1	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
BT LE	0.225	0.024	0.972	0.516	≦1
WLAN (2.4GHz)	0.225	0.478	0.972		

Condition 2	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
BT LE	0.225	0.024	0.972	0.473	≦1
WLAN (5GHz)	0.225	0.436	0.972		

Condition 3	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
BT LE	0.225	0.024	0.972	0.120	≦1
WLAN (6GHz)	0.225	0.093	0.972		

Condition 4	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
WLAN (2.4GHz)	0.225	0.478	0.972	0.940	≦1
WLAN (5GHz)	0.225	0.436	0.972		

Condition 5	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
WLAN (2.4GHz)	0.225	0.478	0.972	0.587	≦1
WLAN (6GHz)	0.225	0.093	0.972		

Condition 6	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
BT LE	0.225	0.024	0.972	0.965	≦1
WLAN (2.4GHz)	0.225	0.478	0.972		
WLAN (5GHz)	0.225	0.436	0.972		

Condition 7	R	Max. ERP	Threshold ERP	Transmit Simultaneously	Transmit Simultaneously Limit
	(m)	(W)	(W)		
BT LE	0.225	0.024	0.972	0.612	≦1
WLAN (2.4GHz)	0.225	0.478	0.972		
WLAN (6GHz)	0.225	0.093	0.972		

END OF REPORT