RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

Industrial Gateway Router

Model: IGMG-8224D-D5G, IDS-8224D, IGAP-840D, IGR-40D

Prepared for:

ORing Industrial Networking Corp

3F., No. 542-2, Zhongzheng Road, Xindian District, New Taipei City 231, Taiwan (R.O.C)

Prepared by

Compliance Certification Services Inc.
Wugu Laboratory
No.11, Wugong 6th Rd., Wugu Dist.,
New Taipei City, Taiwan
Issued Date: January 24, 2025

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	January 24, 2025	Initial Issue	ALL	Peggy Tsai

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1 Attestation of Test Results

Applicant	ORing Industrial Networking Corp 3F., No. 542-2, Zhongzheng Road, Xindian District, New Taipei City 231, Taiwan (R.O.C)
Manufacturer	ORing Industrial Networking Corp 3F., No. 542-2, Zhongzheng Road, Xindian District, New Taipei City 231, Taiwan (R.O.C)
Model Name	IGMG-8224D-D5G, IDS-8224D, IGAP-840D, IGR-40D
Applicable Standards	FCC 47 CFR § 2.1091 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	April 3, 2024

Compliance Certification Services Inc. , tested the above equipment in accordance with the requirements set forth in the above standards. Determination of compliance is based on the results of the compliance measurement,not taking into account measurement instrumentation uncertainy.All indications of Pass/Fail in this report are opinions expressed by Compliance Certification Services Inc, 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.

Approved & Released By:

Sky Zhou
Asst. Section Manager

2 Test Specification, Methods and Procedures

The tests documented in this report were performed in accordance with FCC 47 CFR § 2.1091, the following FCC Published RF exposure KDB procedures:

- 447498 D04 Interim General RF Exposure Guidance v01
- 865664 D02 RF Exposure Reporting v01r02

3 Device Under Test (DUT) Information

3.1 DUT Description

Product	Industrial Gateway Router
Trade Name	ORing
Model No.	IGMG-8224D-D5G, IDS-8224D, IGAP-840D, IGR-40D
Model Discrepancy	Difference of the those model number (list on this report) are just for marketing purpose only
EUT Serial #	022105D00007
Software Version	V 1.0
Hardware Version	V 1.0
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	☐ Bluetooth: 2402MHz-2480MHz ☒ 802.11b/g/n HT20: 2412MHz ~ 2462 MHz ☒ 802.11n HT40: 2422MHz ~ 2452MHz ☒ 802.11a/n HT20: 5180MHz ~ 5240MHz ☒ 802.11ac VHT20: 5180MHz ~ 5240MHz ☒ 802.11n HT40: 5190MHz ~ 5230MHz ☒ 802.11ac VHT40: 5190MHz ~ 5230MHz ☒ 802.11ac VHT80: 5210MHz ☐ Others
Exposure classification	☐ Occupational/Controlled exposure ☒ General Population/Uncontrolled exposure
Antenna Specification	**Type: PCB Antenna** **WIFI 2.4G:** Chain 0: Gain: 1.99 dBi Chain 1: Gain: 1.99 dBi Direction gain: Gain: 5 dBi **5GHz (Band 1):** Chain 0: Gain: 1.70 dBi Chain 1: Gain: 1.70 dBi Direction gain: Gain: 4.71 dBi

		Antenna Gain:		
2.4GHz:	Chain 0	1.99 dBi	(Numeric gain: 1.58)	
2.4GHz:	Chain 1	1.99 dBi	(Numeric gain: 1.58)	
	Power Directional	5.00 dBi	(Numeric gain: 3.16)	Worst
		Antenna Gain:		
5GHz(Band 1)	Chain 0	1.70 dBi	(Numeric gain: 1.48)	
5GHz(Band 1)	Chain 1	1.70 dBi	(Numeric gain: 1.48)	
	Power Directional	4.71 dBi	(Numeric gain: 2.96)	Worst

Maximum Tune up power	**WIFI 2.4GHz (DTS)**		
	IEEE 802.11b_Ch0	25.00 dBm	(316.228 mW)
	IEEE 802.11b_Ch1	25.00 dBm	(316.228 mW)
	IEEE 802.11g_Ch0	18.50 dBm	(70.79 mW)
	IEEE 802.11g_Ch1	19.50 dBm	(89.13 mW)
	IEEE 802.11n HT 20 (MIMO)	20.00 dBm	(100.00 mW)
	IEEE 802.11n HT 40 (MIMO)	17.50 dBm	(56.23 mW)
	WIFI 5.2GHz (U-NII 1)		
	IEEE 802.11a_Ch0	20.00 dBm	(100.000 mW)
	IEEE 802.11a_Ch1	21.00 dBm	(125.893 mW)
	IEEE 802.11n HT 20 (MIMO)	21.50 dBm	(141.25 mW)
	IEEE 802.11n HT 40 (MIMO)	24.00 dBm	(251.19 mW)
	IEEE 802.11ac VHT 20 (MIMO)	21.50 dBm	(141.25 mW)
	IEEE 802.11ac VHT 40 (MIMO)	24.00 dBm	(251.19 mW)
	IEEE 802.11ac VHT 80 (MIMO)	17.50 dBm	(56.23 mW)

Notes:

1. For more details, please refer to the User's manual of the EUT.
2. Disclaimer: Antenna information is provided by the applicant, test results of this report are applicable to the sample EUT received.
3. Disclaimer: Variant information between/among machine type is provided by the applicant, test results of this report are applicable to the sample EUT received of main test model name.
4. The power referred the Tune up power of the test report TMWK2404001048KR and TMWK2404001049KR for RF Exposure assessment purpose.

4 Maximum Permissible Exposure

4.1 Limits for Maximum Permissible Exposure (MPE)

Table 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)	Averaging time (minutes)
(A) Limits for Occupational/Controlled Exposure				
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
300-1,500			f/300	6
1,500-100,000			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
300-1,500			f/1500	30
1,500-100,000			1.0	30

4.2 MPE Calculation Method

Calculation

Given $E = \frac{\sqrt{30 \times P \times G}}{d}$ & $S = \frac{E^2}{377}$

Where E = Field strength in Volts / meter
P = Power in Watts
G = Numeric antenna gain
d = Distance in meters
S = Power density in milliwatts / square centimeter

Combining equations and re-arranging the terms to express the distance as a function of the remaining variables yields:

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

Changing to units of mW and cm, using:

P (mW) = P (W) / 1000 and

d (cm) = d(m) / 100

Yields

$$S = \frac{30 \times (P/1000) \times G}{377 \times (d/100)^2} = 0.0796 \times \frac{P \times G}{d^2}$$ **Equation 1**

Where d = Distance in cm
P = Power in mW
G = Numeric antenna gain
S = Power density in mW / cm^2

If, Substituting the MPE safe distance using d = 20 cm into Equation 1:

$$S = 0.000199 \times P \times G$$

4.3 MPE EXEMPTION

(A) The available maximum time-averaged power is no more than 1 mW

(B) The available maximum time-averaged power or effective radiated power (ERP), whichever is greater, is less than or equal to the threshold *Pth* (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). *Pth* 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);

(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 λ/2π, 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 λ/4 or if the antenna gain is less than that of a half-wave dipole (1.64 linear value).

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.
Note: R is in meters, f is in MHz.	

4.4 Multiple RF sources

In the case of fixed RF sources operating in the same time-averaging period, or of multiple mobile or portable RF sources within a device operating in the same time averaging period, if the sum of the fractional contributions to the applicable thresholds is less than or equal to 1 as indicated in the following equation),

$$\sum_{i=1}^{a} \frac{P_i}{P_{\mathrm{th},i}} + \sum_{j=1}^{b} \frac{ERP_j}{ERP_{\mathrm{th},j}} + \sum_{k=1}^{c} \frac{Evaluated_k}{Exposure\ Limit_k} \leq 1$$

5 MPE Exemption Option B

WIFI 2.4GHz (DTS)

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11b_Ch0	2462.00	0.2	25.0	1.99	26.99	24.84	304.789	3060	Complies
IEEE 802.11b_Ch1	2462.00	0.2	25.0	1.99	26.99	24.84	304.789	3060	Complies
IEEE 802.11g_Ch0	2462.00	0.2	18.5	1.99	20.49	18.34	68.234	3060	Complies
IEEE 802.11g_Ch1	2462.00	0.2	19.5	1.99	21.49	19.34	85.901	3060	Complies
IEEE 802.11n HT 20 (MIMO)	2462.00	0.2	20.0	5.00	25.00	22.85	192.752	3060	Complies
IEEE 802.11n HT 40 (MIMO)	2452.00	0.2	17.5	5.00	22.50	20.35	108.393	3060	Complies

WIFI 5.2GHz (U-NII 1)

Mode	Frequency (MHz)	R(m)	Max Tune-up power (dBm)	G(dBi)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11a_Ch0	5240.00	0.2	20.0	1.70	21.70	19.55	90.157	3060	Complies
IEEE 802.11a_Ch1	5240.00	0.2	21.0	1.70	22.70	20.55	113.501	3060	Complies
IEEE 802.11n HT 20 (MIMO)	5240.00	0.2	21.5	4.71	26.21	24.06	254.683	3060	Complies
IEEE 802.11n HT 40 (MIMO)	5230.00	0.2	24.0	4.71	28.71	26.56	452.898	3060	Complies
IEEE 802.11ac VHT 20 (MIMO)	5240.00	0.2	21.5	4.71	26.21	24.06	254.683	3060	Complies
IEEE 802.11ac VHT 40 (MIMO)	5230.00	0.2	24.0	4.71	28.71	26.56	452.898	3060	Complies
IEEE 802.11ac VHT 80 (MIMO)	5210.00	0.2	17.5	4.71	22.21	20.06	101.391	3060	Complies

6 Facilities

All measurement facilities used to collect the measurement data are located at

☒ No.11, Wugong 6th Rd., Wugu Dist., New Taipei City, Taiwan.

--End of Test Report--