RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

Outdoor Wi-Fi Gateway

Model: GW31-E-HW

Prepared for:

Verkada Inc

405 E. 4th Ave. San Mateo California United States 94401

Prepared by

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

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Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	April 11, 2025	Initial Issue	ALL	Peggy Tsai

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1 Attestation of Test Results

Applicant	Verkada Inc 405 E. 4th Ave. San Mateo California United States 94401
Manufacturer	Verkada Inc 405 E. 4th Ave. San Mateo California United States 94401
Model Name	GW31-E-HW
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:	March 10, 2025

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	Outdoor Wi-Fi Gateway
Trade Name	Verkada
Model No.	GW31-E-HW
Model Discrepancy	N/A
EUT Serial #	68B2701-DVT01-ANT-20
Software Version	0.1
Hardware Version	0.1
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	☒ Bluetooth: 2402MHz-2480MHz ☒ 802.11b/g/n HT20/ac VHT20/ax HE20: 2412MHz ~ 2462 MHz ☒ 802.11n HT40/ac VHT40/ax HE40: 2422MHz ~ 2452MHz ☒ 802.11a/n HT20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz ☒ 802.11ac VHT20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz ☒ 802.11ax HE20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz ☒ 802.11n HT40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz ☒ 802.11ac VHT40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz ☒ 802.11ax HE40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz ☒ 802.11ac VHT80: 5210MHz / 5775MHz ☒ 802.11ax HE80: 5210MHz / 5775MHz ☐ Others:
Exposure classification	☐ Occupational/Controlled exposure ☒ General Population/Uncontrolled exposure

Antenna Specification

Antenna-1

Type: Dipole Antenna
Brand / Model: Senao / 7102A1338000

Bluetooth: Gain: 2.38 dBi

WIFI 2.4G:
Ant 1: Gain: 2.79 dBi
Ant 2: Gain: 2.38 dBi
Direction gain: Gain: 5.6 dBi

WIFI 5G:
Band1:
Ant 1: Gain: 5.07 dBi
Ant 2: Gain: 4.96 dBi
Direction gain: Gain: 8.03 dBi

Band4:
Ant 1: Gain: 4.85 dBi
Ant 2: Gain: 5.03 dBi
Direction gain: Gain: 7.95 dBi

Bluetooth:	Antenna Gain :	2.38 dBi	(Numeric gain: 1.73)	Worst
2.4GHz:				
Ant 1:	Antenna Gain:	2.79 dBi	(Numeric gain: 1.90)	Worst
Ant 2:	Antenna Gain:	2.38 dBi	(Numeric gain: 1.73)	Worst
Direction gain:	Antenna Gain:	5.60 dBi	(Numeric gain: 3.63)	Worst
5GHz(Band 1):				
Ant 1:	Antenna Gain:	5.07 dBi	(Numeric gain: 3.21)	Worst
Ant 2:	Antenna Gain:	4.96 dBi	(Numeric gain: 3.13)	Worst
Direction gain:	Antenna Gain:	8.03 dBi	(Numeric gain: 6.35)	Worst
5GHz(Band 4):				
Ant 1:	Antenna Gain:	4.85 dBi	(Numeric gain: 3.05)	Worst
Ant 2:	Antenna Gain:	5.03 dBi	(Numeric gain: 3.18)	Worst
Direction gain:	Antenna Gain:	7.95 dBi	(Numeric gain: 6.24)	Worst

Antenna Specification	**Antenna-2** **Type:** Directional Antenna **Brand / Model:** Verkada / ACC-ANT-20 Bluetooth: Gain: 11.4 dBi WIFI 2.4G: Ant 1: Gain: 11.4 dBi Ant 2: Gain: 11.4 dBi Direction gain: Gain: 14.41 dBi WIFI 5G: Band1: Ant 1: Gain: 13.2 dBi Ant 2: Gain: 13.2 dBi Direction gain: Gain: 16.21 dBi Band4: Ant 1: Gain: 13.2 dBi Ant 2: Gain: 13.2 dBi Direction gain: Gain: 16.21 dBi **Bluetooth:** Antenna Gain : 11.40 dBi (Numeric gain: 13.80) Worst **2.4GHz:** Antenna Gain: 11.40 dBi (Numeric gain: 13.80) Worst Direction gain: 14.41 dBi (Numeric gain: 27.61) Worst **5GHz(Band 1):** Antenna Gain: 13.20 dBi (Numeric gain: 20.89) Worst Direction gain: 16.21 dBi (Numeric gain: 41.78) Worst **5GHz(Band 4):** Antenna Gain: 13.20 dBi (Numeric gain: 20.89) Worst Direction gain: 16.21 dBi (Numeric gain: 41.78) Worst

Maximum Tune up power

BLE	5.00 dBm	(3.16 mW)
2.4GHz		
IEEE 802.11b_Ch0	20.00 dBm	(100.000 mW)
IEEE 802.11b_Ch1	20.00 dBm	(100.000 mW)
IEEE 802.11g_Ch0	13.00 dBm	(19.95 mW)
IEEE 802.11g_Ch1	13.00 dBm	(19.95 mW)
IEEE 802.11n HT 20 (MIMO)	14.50 dBm	(28.18 mW)
IEEE 802.11n HT 40 (MIMO)	13.00 dBm	(19.95 mW)
IEEE 802.11ac VHT 20 (MIMO)	14.50 dBm	(28.18 mW)
IEEE 802.11ac VHT 40 (MIMO)	13.00 dBm	(19.95 mW)
IEEE 802.11ax HE 20 (MIMO)	14.50 dBm	(28.18 mW)
IEEE 802.11ax HE 40 (MIMO)	13.00 dBm	(19.95 mW)
5GHz (U-NII-1)		
IEEE 802.11a_Ch0	17.00 dBm	(50.119 mW)
IEEE 802.11a_Ch1	17.00 dBm	(50.119 mW)
IEEE 802.11n HT 20 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11n HT 40 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ac VHT 20 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ac VHT 40 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ac VHT 80 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ax HE 20 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ax HE 40 (MIMO)	17.00 dBm	(50.12 mW)
IEEE 802.11ax HE 80 (MIMO)	17.00 dBm	(50.12 mW)
5GHz (U-NII-3)		
IEEE 802.11a_Ch0	23.00 dBm	(199.53 mW)
IEEE 802.11a_Ch1	23.00 dBm	(199.53 mW)
IEEE 802.11n HT20 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11n HT40 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ac VHT20 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ac VHT40 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ac VHT80 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ax HE20 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ax HE40 (MIMO)	20.00 dBm	(100.00 mW)
IEEE 802.11ax HE80 (MIMO)	20.00 dBm	(100.00 mW)

Class II Permissive Change

1. Added new antenna. (Verkada / ACC-ANT-20)

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. The power referred the Tune up power of the test report TMWK2503001052KR, TMWK2503001053KR and TMWK2503001054KR 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

BLE

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
BLE	2402	0.2	5.0	11.40	16.40	14.25	26.607	3060	Complies

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	2412	0.2	20.0	11.40	31.40	29.25	841.395	3060	Complies
IEEE 802.11b_Ch1	2412	0.2	20.0	11.40	31.40	29.25	841.395	3060	Complies
IEEE 802.11g_Ch0	2412	0.2	13.0	11.40	24.40	22.25	167.880	3060	Complies
IEEE 802.11g_Ch1	2412	0.2	13.0	11.40	24.40	22.25	167.880	3060	Complies
IEEE 802.11n HT 20 (MIMO)	2412	0.2	14.5	14.41	28.91	26.76	474.242	3060	Complies
IEEE 802.11n HT 40 (MIMO)	2422	0.2	13.0	14.41	27.41	25.26	335.738	3060	Complies
IEEE 802.11ac VHT 20 (MIMO)	2412	0.2	14.5	14.41	28.91	26.76	474.242	3060	Complies
IEEE 802.11ac VHT 40 (MIMO)	2422	0.2	13.0	14.41	27.41	25.26	335.738	3060	Complies
IEEE 802.11ax HE 20 (MIMO)	2412	0.2	14.5	14.41	28.91	26.76	474.242	3060	Complies
IEEE 802.11ax HE 40 (MIMO)	2422	0.2	13.0	14.41	27.41	25.26	335.738	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	5180	0.2	17.0	13.20	30.20	28.05	638.263	3060	Complies
IEEE 802.11a_Ch1	5180	0.2	17.0	13.20	30.20	28.05	638.263	3060	Complies
IEEE 802.11n HT 20 (MIMO)	5180	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11n HT 40 (MIMO)	5190	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ac VHT 20 (MIMO)	5180	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ac VHT 40 (MIMO)	5190	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ac VHT 80 (MIMO)	5210	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ax HE 20 (MIMO)	5180	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ax HE 40 (MIMO)	5190	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies
IEEE 802.11ax HE 80 (MIMO)	5210	0.2	17.0	16.21	33.21	31.06	1276.439	3060	Complies

WIFI 5.8GHz (U-NII 3)

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	5745	0.2	23.0	13.20	36.20	34.05	2540.973	3060	Complies
IEEE 802.11a_Ch1	5745	0.2	23.0	13.20	36.20	34.05	2540.973	3060	Complies
IEEE 802.11n HT20 (MIMO)	5745	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11n HT40 (MIMO)	5755	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ac VHT20 (MIMO)	5745	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ac VHT40 (MIMO)	5755	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ac VHT80 (MIMO)	5775	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ax HE20 (MIMO)	5745	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ax HE40 (MIMO)	5755	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies
IEEE 802.11ax HE80 (MIMO)	5775	0.2	20.0	16.21	36.21	34.06	2546.830	3060	Complies

6 Simultaneous Transmission Analysis

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),

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

6.1 Sum of the WiFi 2.4GHz + Bluetooth

WiFi 2.4GHz +Bluetooth

Mode	Max Tune-up ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 2.4GHz	841.395	3060	0.284	≤1
Bluetooth	26.607	3060		

6.2 Sum of the WiFi 5GHz + Bluetooth

WiFi 5GHz + Bluetooth

Mode	Max Tune-up ERP(mW)	ERP Threshold(mW)	simultaneous Transmission	simultaneous Transmission Limit
WiFi 5GHz	2546.830	3060	0.841	≤1
Bluetooth	26.607	3060		

7 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--