RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

BX21 Wireless Relay

Model Name.: BX21-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.
Issue Date: November 10, 2022

Note: This document may be altered or revised by Compliance Certification Services Inc. personnel only, and shall be noted in the revision section of the document. The client should not use it to claim product endorsement by TAF, NIST or any government agencies. The test results in the report only apply to the tested sample.

Compliance Certification Services Inc.
程智科技股份有限公司   No.11, Wugong 6th Rd., Wugu Dist., New Taipei City , Taiwan /新北市五股區五工六路 11 號
t:(886-2) 2299-9720 **f**:(886-2) 2299-9721 www.sgs.com.tw

Member of the SGS Group

Revision History

Rev.	Issue Date	Revisions	Effect Page	Revised By
00	November 10, 2022	Initial Issue	ALL	Doris Chu

Table of Contents

1 Attestation of Test Results

Applicant Name	Verkada Inc
Model Name	BX21-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:	October 19, 2022
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 Compliance Certification Services Inc.	

Report No.:   TMWK2210004217KS

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:

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

3 Device Under Test (DUT) Information

3.1 DUT Description

Product	BX21 Wireless Relay
Trade Name	Verkada
Model No.	BX21-HW
Model Discrepancy	N/A
Hardware Version	Rev.0
Software Version	Rev.0
Sample Stage	Identical prototype

3.2 Wireless Technologies

Frequency bands	☐ Bluetooth 5.0: 2402MHz-2480MHz ☐ 802.11b/g, 802.11n HT20: 2412MHz ~ 2462 MHz ☐ 802.11n HT40/ac (VHT40)/ax (HE40): 2422MHz ~ 2452MHz ☐ 802.11a/n HT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720MHz / 5745MHz ~ 5825MHz ☐ 802.11ac VHT20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720MHz / 5745MHz ~ 5825MHz ☐ 802.11ax HE20: 5180MHz ~ 5240MHz / 5260MHz ~ 5320MHz / 5500MHz ~ 5720 MHz / 5745MHz ~ 5825MHz ☐ 802.11n HT40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☐ 802.11ac VHT 40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☐ 802.11ax HE40: 5190MHz ~ 5230MHz / 5270MHz ~ 5310MHz / 5510MHz ~ 5710MHz / 5755MHz ~ 5795MHz ☐ 802.11ac VHT80: 5210MHz / 5290MHz / 5530MHz ~ 5690 MHz / 5775MHz ☐ 802.11ax HE80: 5210MHz / 5290MHz / 5530MHz ~ 5690 MHz / 5775MHz ☒ Others (915.0MHz ~915.7MHz)
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2)
Antenna Specification	**WLAN ANTENNA** Direction Gain: -0.72 dBi (Numeric gain: 0.85) Worst

Maximum Measurement Average Power	915MHz	18.51 dBm	(70.958 mW)
	915.35MHz	18.31 dBm	(67.764 mW)
	915.7MHz	17.81 dBm	(60.395 mW)

Maximum tune up power	915MHz	19.50 dBm	(89.125 mW)
	915.35MHz	18.50 dBm	(70.795 mW)
	915.7MHz	18.50 dBm	(70.795 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. The tune up power referred the AVG power of the test report TMTN2210001429NR for RF Exposure assessment purpose.

Report No.: TMWK2210004217KS

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

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

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

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 X P X 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:

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

Where

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

and

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

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	$0.0128\ R^2 f$.
1,500-100,000	$19.2 R^2$.
Note: R is in meters, f is in MHz.	

Report No.: TMWK2210004217KS

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),

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

Report No.: TMWK2210004217KS

5 MPE Exemption Option B

Mode	Frequency (MHz)	R(m)	Max Tune-up power(dBm)	Max Tune-up power(mW)	Max Tune-up EIRP(dBm)	Max Tune-up ERP(dBm)	Max Tune-up ERP(mW)	ERP Threshold(mW)	MPE Exemption
915MHz	915.00	0.2	19.50	89.13	18.78	16.63	46.026	1867	Complies
915.35MHz	915.35	0.2	18.50	70.79	17.78	15.63	36.559	1867	Complies
915.7MHz	915.70	0.2	18.50	70.79	17.78	15.63	36.559	1868	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),

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

N/A

Report No.:   TMWK2210004217KS

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 REPORT