RF Exposure Evaluation Report

FCC 47 CFR § 2.1091

for

Enkore Smart Auto Electronic Deadbolt

Model Name.: EKS-D7P1A, EKS-D791A

Prepared for:

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Prepared by

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Issue Date: September 8, 2022

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Revision History

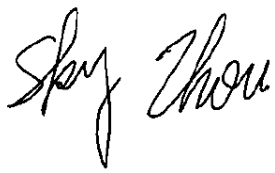
Rev.	Issue Date	Revisions	Effect Page	Revised By
00	August 22, 2022	Initial Issue	ALL	Allison Chen
01	September 2, 2022	See the following Note Rev.(01)	ALL	Allison Chen
02	September 8, 2022	See the following Note Rev.(02)	P.13-14	Allison Chen

Note:
Rev.(01)
1. Modify NFC exposure assessment purpose.
Rev.(02)
1. Modify NFC electric field strength value.

Table of Contents

1 ATTESTATION OF TEST RESULTS 4
2 TEST SPECIFICATION, METHODS AND PROCEDURES 5
3 DEVICE UNDER TEST (DUT) INFORMATION 6
3.1 DUT DESCRIPTION 6
3.2 WIRELESS TECHNOLOGIES 7
4 MAXIMUM PERMISSIBLE EXPOSURE 8
4.1 LIMITS FOR MAXIMUM PERMISSIBLE EXPOSURE (MPE) 8
4.2 MPE CALCULATION METHOD 9
4.3 MPE EXEMPTION 10
4.4 MULTIPLE RF SOURCES 11
5 RADIO FREQUENCY RADIATION MAX EXPOSURE EVALUATION 12
6 SIMULTANEOUS TRANSMISSION MPE ANALYSIS 14
6.1 SUM OF THE MPE FOR WIFI 2.4GHZ & BLE 14
7 FACILITIES 15

1 Attestation of Test Results

Applicant Name	Pamex Inc.
Model Name	EKS-D7P1A, EKS-D791A
Applicable Standards	FCC 47 CFR § 2.1091 KDB 447498 D04 FCC 47 CFR § 1.1307 FCC 47 CFR § 1.1310 Published RF exposure KDB procedures
Receive EUT Date:	July 12, 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.	

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

<table>
<tr><td>Product</td><td>Enkore Smart Auto Electronic Deadbolt</td></tr>
<tr><td>Trade Name</td><td>Pamex</td></tr>
<tr><td>Model No.</td><td>EKS-D7P1A, EKS-D791A</td></tr>
<tr><td>Model Discrepancy</td><td>Difference of the two model numbers (list on this report) are just for marketing purpose only and please see as below:
<table>
<tr><th>Model:</th><th>Electroplating material</th></tr>
<tr><td>EKS-D7P1A</td><td>nickel plating</td></tr>
<tr><td>EKS-D791A</td><td>black paint</td></tr>
</table></td></tr>
<tr><td>Hardware Version</td><td>V0.0.5</td></tr>
<tr><td>Software Version</td><td>WIFI: V0.0.15
BLE: 90.00.06</td></tr>
<tr><td>Sample Stage</td><td>Identical prototype</td></tr>
</table>

3.2 Wireless Technologies

Frequency bands	☒ Bluetooth: 2402MHz ~ 2480MHz ☒ 802.11b/g/n HT20: 2412 MHz ~ 2462 MHz ☐ 802.11n HT40: 2422 MHz ~ 2452MHz ☐ 802.11a/n HT20: 5180MHz ~ 5240MHz / 5745MHz ~ 5825MHz ☐ 802.11n HT40: 5190MHz ~ 5230MHz / 5755MHz ~ 5795MHz ☐ 802.11ac VHT80: 5210MHz / 5775MHz ☒ Others: 13.56MHz
Exposure classification	☐ Occupational/Controlled exposure (S = 5mW/cm2) ☒ General Population/Uncontrolled exposure (S=1mW/cm2)
Antenna Specification	Type: PCB antenna Bluetooth, Gain: 3.3 dBi Type: Chip antenna WIFI 2.4GHz, Gain: 1.16 dBi Bluetooth Gain : 3.30 dBi (Numeric gain: 2.14) Worst WIFI 2.4GHz Gain : 1.16 dBi (Numeric gain: 1.31) Worst 13.56MHz, Type: Loop Antenna
Maximum Measurement Average Power	BLE / 3.63 dBm / (2.307 mW) 2.4GHz IEEE 802.11b Mode: / 12.98 dBm / (19.861 mW) IEEE 802.11g Mode: / 13.90 dBm / (24.547 mW) IEEE 802.11n HT 20 Mode: / 12.53 dBm / (17.906 mW)
Maximum tune up power	BLE / 4.00 dBm / (2.512 mW) 2.4GHz IEEE 802.11b Mode: / 13.50 dBm / (22.387 mW) IEEE 802.11g Mode: / 14.50 dBm / (28.184 mW) IEEE 802.11n HT 20 Mode: / 13.00 dBm / (19.953 mW)
NFC Result Power	13.56MHz: 60.47 dBuV/m (3m)

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 TMWK2207002760KR and TMWK2207002764KR for RF Exposure assessment purpose.
4. The NFC Power referred the test report TMWK2207002765KR 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 Radio Frequency Radiation Max Exposure Evaluation

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

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

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

Bluetooth

Mode	Frequency (MHz)	Max Tune-up power (dBm)	Max Tune-up power (mW)	G (dBi)	G (num.)	D (cm)	Power Density in mW/cm2	Limit Power Density in mW/cm2
BLE	2480.00	4.00	2.51	3.30	2.14	20.0	0.001	1.000

WIFI 2.4GHz

Mode	Frequency (MHz)	Max Tune-up power (dBm)	Max Tune-up power (mW)	G (dBi)	G (num.)	D (cm)	Power Density in mW/cm2	Limit Power Density in mW/cm2
IEEE 802.11b	2462.00	13.50	22.39	1.16	1.31	20.0	0.006	1.000
IEEE 802.11g	2462.00	14.50	28.18	1.16	1.31	20.0	0.007	1.000
IEEE 802.11n HT 20	2462.00	13.00	19.95	1.16	1.31	20.0	0.005	1.000

MPE Exemption Option B

Bluetooth

Mode	Frequency (MHz)	R (m)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
BLE	2480.00	0.2	7.30	5.15	3.273	3060	Complies

WIFI 2.4GHz

Mode	Frequency (MHz)	R (m)	Max Tune-up EIRP (dBm)	Max Tune-up ERP (dBm)	Max Tune-up ERP (mW)	ERP Threshold (mW)	MPE Exemption
IEEE 802.11b	2462.00	0.2	14.66	12.51	17.824	3060	Complies
IEEE 802.11g	2462.00	0.2	15.66	13.51	22.439	3060	Complies
IEEE 802.11n HT 20	2462.00	0.2	14.16	12.01	15.885	3060	Complies

NFC

Mode	Frequency (MHz)	D(m)	Result power (dBuV/m)	Electric Field Strength (V/m)	Limit of Electric Field Strength (V/m)
NFC	13.56	0.2	60.47	0	60.77

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),

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

RF Exposure Condition	Item	Capable Transmit Configurations				
	1	DTS	+	BLE	+	NFC

6.1 Sum of the WIFI 2.4GHz & BLE & NFC

Therefore, the worst-case situation is 0.007/1+0.001/1+ 0 = 0.008, which is less than “1”.

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. (R.O.C.)

END OF REPORT