Report on the Radio Testing of:

BALL WIRELESS CHARGER

Model(s): HS-0335

In accordance with
47 CFR FCC Part 18C

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Add value.
Inspire trust.

Prepared for:
Kinexon Inc.
200 S Wacker Drive Suite 3100,
60606, Chicago, Illinois,
USA

COMMERCIAL-IN-CONFIDENCE

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RESPONSIBLE FOR	NAME	DATE	SIGNATURE
Approved By	Foo Kai Maun	26 Sep 2022	
Prepared By	Quek Keng Huat	23 Sep 2022	

Signatures in this approval box have checked this document in line with the requirements of TÜV SÜD PSB document control rules.

EXECUTIVE SUMMARY
A sample of this product was tested and found to be compliant with the mentioned standard(s).

TÜV SÜD PSB

ilac-MRA

Accredited Laboratory SAC-SINGLAS

LA-2007-0380-A LA-2007-0386-C
LA-2007-0381-F LA-2010-0464-D
LA-2007-0382-B LA-2018-0702-B
LA-2007-0383-G LA-2018-0703-G
LA-2007-0384-G LA-2020-0747-L
LA-2007-0385-E

The results reported herein have been performed in accordance with the terms of accreditation under the Singapore Accreditation Council. Inspections/Calibrations/Tests marked "Not SAC-SINGLAS Accredited" in this Report are not included in the SAC-SINGLAS Accreditation Schedule for our inspection body/laboratory.

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Contents

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1 Report Summary

1.1 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

Issue	Description of Change	Date of Issue
1	First Issue	26 Sep 2022

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1.2 Introduction

Applicant	:	Kinexon Inc. 200 S Wacker Drive Suite 3100, 60606, Chicago, Illinois, USA
Manufacturer	:	PCA Technology Limited 3 Ang Mo Kio Street 62 #05-01, Link@AMK Singapore 569139
Factory	:	PCA Technology Limited 3 Ang Mo Kio Street 62 #05-01, Link@AMK Singapore 569139
Model Number(s)	:	HS-0335
Serial Number(s)	:	Nil
Number of Samples Tested	:	1
Test Sample(s) Condition	:	Good
Quotation Reference	:	5668670
Test Specification/Issue/Date	:	FCC 47 CFR Part 18C
Test Sample(s) Received Date	:	05 Sep 2022
Start of Test	:	06 Sep 2022
Finish of Test	:	16 Sep 2022

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1.3 Brief Summary of Results

A brief summary of the tests carried out in accordance with specifications as shown below.

Specification Clause	Test Description	Result	Comments/Base Standard
47 CFR FCC Part 15			
18.305(b)	Conducted Emissions	Pass	FCC/OST MP-5: 1986
18.307(b)	Radiated Field Strength	Pass	FCC/OST MP-5: 1986
18.313	Maximum Permissible Exposure	Pass	KDB 680106 D01 RF Exposure Wireless Charging App v03r01

Notes

1. Nil.

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1.4 Product Information

1.4.1 Technical Description

Description	:	The Equipment Under Test(s) (EUT(s)) is a **BALL WIRELESS CHARGER.**
Microprocessor	:	NXP MC56F8006
Operating Frequency	:	110kHz – 205kHz
Clock / Oscillator Frequency	:	16MHz
Modulation	:	Amplitude-Shift Keying (ASK)
Antenna Gain	:	Not Applicable
Port / Connectors	:	1 x USB port
Rated Power	:	USB Input 5V 2A / 9V 1.2A Wireless Output 5W – 10W
Accessories	:	Nil

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1.4.2 Test Configuration and Modes of Operation

Mode(s)	Description
Maximum Wireless Power Transfer	The EUT was exercised in inductive wireless power transfer at 123kHz with a zero separation distance of 0mm (Worst Mode) between the EUT an the load.

1.5 Deviations from the Standard

Nil.

1.6 EUT Modification Record

No modifications were made.

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1.7 Test Location(s)

TÜV SÜD PSB Pte Ltd
Electrical & Electronics Centre (EEC), Product Services,
15 International Business Park
TÜV SÜD @ IBP
Singapore 609937

1.8 Test Facilities Registrations

Requirements	Registration Numbers
FCC	994109 (Test Firm Registration Number) SG0002 (Designation Number)
ISED	SGAP01 (CAB Identifier) 2932N-1 (10m Semi-Anechoic Chamber)
VCCI	R-13324 (10m ANC), G-10203 (10mANC) R-20151 (3m RF Chamber - Lab 7), G-20149 (3m RF Chamber - Lab 7) C-14933 (C.E @ CEIBP) T-12403 (Telecom Ports @ CEIBP)
BSMI	SL2-IS-E-6001R *[CNS-13803 (ISM Equipment)]* SL2-IN-E-6001R *[CNS-13438 (IT Equipment)]* SL2-R1/R2-E-6001R *[CNS-13439 (Broadcast Receivers)]* SL2-A1-E-6001R *[CNS-13783-1 (Household Appliances)]* SL2-L1-E-6001R *[CNS-14115 (Lighting Equipment)]*
SABS	SABS/A-LAB/0030/2018
ASCA	TL-86

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1.9 Supporting Equipment

Equipment Description (Including Brand Name)	Model, Serial & FCC ID Number	Cable Description (List Length, Type & Purpose)
Junvang Fast Power Adapter	M/N: B08NWV8HP1 S/N: Nil FCC ID: Nil	Nil
Kinexon Load	M/N: KNX-T2.9-1.1-3 S/N: 298109 FCC ID: Nil	Nil

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2 Test Details

2.1 Conducted Emissions

2.1.1 Test Limits

Frequency Range (MHz)	Limit Values (dBµV)	
	Quasi-peak (Q-P)	Average (AV)
0.15 - 0.5	66 – 56 *	56 – 46 *
0.5 - 5.0	56	46
5.0 - 30.0	60	50
* Decreasing linearly with the logarithm of the frequency		

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2.1.2 Test Setup

2.1.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.1.2.2 The power supply for the EUT was fed through a 50Ω/50μH EUT LISN, connected to filtered mains.

2.1.2.3 The RF OUT of the EUT LISN was connected to the EMI test receiver via a low-loss coaxial cable.

2.1.2.4 All other supporting equipment were powered separately from another LISN.

2.1.3 Test Method

2.1.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.1.3.2 A scan was made on the NEUTRAL line over the required frequency range using an EMI test receiver.

2.1.3.3 High peaks, relative to the limit line, were then selected.

2.1.3.4 The EMI test receiver was then tuned to the selected frequencies and the necessary measurements made with a receiver bandwidth setting of 9kHz. Both Quasi-peak and Average measurements were made.

2.1.3.5 The measurements were then repeated for the LIVE line.

Sample Calculation Example

At 20 MHz	Q-P limit = 60.0 dBμV
Transducer factor of LISN, pulse limiter & cable loss at 20 MHz = 11.2 dB Q-P reading obtained directly from EMI Receiver = 40.0 dBμV (Calibrated for system losses)	
Therefore, Q-P margin = 60.0 - 40.0 = 20.0	i.e. 20.0 dB below Q-P limit

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2.1.4 Test Results

Test Input Power	120V 60Hz	Temperature	24°C
Line Under Test	AC Mains	Relative Humidity	60%
Mode	Wireless Charging – Zero Separation Distance (Worst Mode)	Atmospheric Pressure	1030mbar
		Tested By	Anthony Toh
		Test Date	08 Sep 2022

Frequency (MHz)	Q-P Value (dBµV)	Q-P Limit (dBµV)	Q-P Margin (dB)	AV Value (dBµV)	AV Limit (dBµV)	AV Margin (dB)	Line
0.1501	44.6	66.0	21.4	27.0	56.0	29.0	Live
0.4270	29.1	57.3	28.2	15.7	47.3	31.6	Live
0.7741	23.9	56.0	32.1	21.1	46.0	24.9	Live
1.4196	31.3	56.0	24.7	30.5	46.0	15.5	Live
2.7096	32.9	56.0	23.1	31.2	46.0	14.8	Live
3.0956	33.9	56.0	22.1	31.1	46.0	14.9	Live

Notes

1.	All possible modes of operation were investigated from 150kHz to 30MHz. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 150kHz - 30MHz RBW: 9kHz VBW: 30kHz

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2.2 Radiated Field Strength

2.2.1 Test Limits

Equipment Type	Operating Frequency	RF Power generated by equipment (W)	Field Strength Limit (μV/m)	Field Strength Limit (dBμV/m)	Distance (m)
Any type unless otherwise specified (miscellaneous)	Any non-ISM Frequency	Below 500	15.0	23.5	300

2.2.2 Test Setup

2.2.2.1 The EUT and supporting equipment were set up in accordance with the requirements of the standard as shown in the setup photos.

2.2.2.2 The filtered power supply for the EUT and supporting equipment were tapped from the appropriate power sockets located on the turntable.

2.2.2.3 The relevant broadband antenna was set at the required test distance away from the EUT and supporting equipment boundary.

2.2.3 Test Method

2.2.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.2.3.2 A prescan was carried out to pick the worst emission frequencies from the EUT. For EUT which is a portable device, the prescan was carried out by rotating the EUT through three orthogonal axes to determine which altitude and equipment arrangement produces such emissions.

2.2.3.3 The test was carried out at the selected frequency points obtained from the pre-scan. Maximization of the emissions, was carried out by rotating the EUT, changing the antenna polarization, and adjusting the antenna height in the following manner:

a. Vertical or horizontal polarization (whichever gave the higher emission level over a full rotation of the EUT) was chosen.
b. The EUT was then rotated to the direction that gave the maximum emission.
c. Finally, the antenna height was adjusted to the height that gave the maximum emission.

2.2.3.4 The measurements were repeated for the next frequency point, until all selected frequency points were measured.

2.2.3.5 The frequency range covered was from the lowest radio frequency signal generated from the EUT, without going below 9kHz to 10th harmonics of the EUT fundamental frequency, using the loop antenna for frequency below 30MHz, Bi-log antenna for frequencies from 30MHz up to 1GHz, and the Horn antenna above 1GHz.

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Sample Calculation Example

At 30 MHz	Q-P limit = 23.5 dBμV/m
Log-periodic antenna factor & cable loss at 30 MHz = 18.5 dB Q-P reading obtained directly from EMI Receiver = 40.0 dBμV/m (Calibrated level including antenna factors & cable losses)	
Therefore, Q-P margin = 23.5 - 40.0 = 16.5	i.e. 16.5 dB below Q-P limit

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2.2.5 Test Results

Test Input Power	120V 60Hz	Temperature	24°C
Test Distance	10m	Relative Humidity	60%
Mode	Wireless Charging – Full Load (Worst Mode)	Atmospheric Pressure	1030mbar
		Tested By	Lim Kay Tak, Mohamed Aidil, Muhammad Amiruddin
		Test Date	09 Sep 2022 11 Sep 2022 13 Sep 2022

Spurious Emissions ranging from 9kHz – 30MHz *See Note 4

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)
0.0090	62.7	82.6	31.1	200	24
0.0920	47.8	82.6	43.2	200	283
0.1230	60.2	82.6	43.0	200	93
20.1240	29.8	82.6	36.7	200	202
21.3580	31.8	82.6	44.6	200	65
24.0760	24.1	82.6	45.6	200	135

Spurious Emissions ranging from 30MHz – 1GHz

Frequency (MHz)	Q-P Value (dBµV/m)	Q-P Limit (dBµV/m)	Q-P Margin (dB)	Height (cm)	Azimuth (Degrees)	Pol (H/V)
56.2240	38.2	53.0	14.8	101	345	V
69.8110	35.8	53.0	17.2	101	340	V
79.9290	35.3	53.0	17.7	300	10	V
173.9300	36.4	53.0	16.6	101	340	V
281.9220	32.8	53.0	20.2	300	328	V
994.9060	32.0	53.0	21.0	200	270	H

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Notes

1.	All possible modes of operation were investigated. Only the worst case emissions measured, using the correct CISPR detectors, are reported. All other emissions were relatively insignificant.
2.	A "positive margin" indicates a PASS as it refers to the margin present below the limit line at the particular frequency. Conversely, a "negative margin" indicates a FAIL.
3.	EMI receiver Resolution Bandwidth (RBW) and Video Bandwidth (VBW) settings: 9kHz – 150kHz RBW: 200Hz VBW: 1kHz 150kHz – 30MHz RBW: 9kHz VBW: 30kHz 30MHz - 1GHz RBW: 120kHz VBW: 1MHz
4.	The measurement was done at 10m. The specified limits were extrapolated to the test distance as specified in § 15.209 (a) based on 40dB/decade for <30MHz and 20dB/decade for >30MHz.

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2.3 Maximum Permissible Exposure (MPE)

2.3.1 Test Limits

The EUT shows compliance to the requirements of this section, which states the MPE limits for General Population / Uncontrolled Exposure are as shown below:

Frequency Range (MHz)	Electric Field Strength (V/m)	Magnetic Field Strength (A/m)	Power Density (mW/cm^2)	Average Time (min)
0.3 - 1.34	614	1.63	100 Note 2	30
1.34 - 30	824 / f	2.19 / f	180 / f^2 Note 2	30
30 - 300	27.5	0.073	0.2	30
300 - 1500	-	-	f / 1500	30
1500 - 100000	-	-	1.0	30
Notes				
1. f = frequency in MHz				
2. Plane wave equivalent power density				

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2.3.2 Test Setup

2.3.2.1 The EUT and supporting equipment were set up as shown on the setup photo.

2.3.2.2 The relevant field probe was positioned at least 20cm away from the EUT and supporting equipment boundary.

2.3.3 Test Method

2.3.3.1 The EUT was switched on and allowed to warm up to its normal operating condition.

2.3.3.2 The test was first carried out at one of the positions / sides of the EUT.

2.3.3.3 Magnetic Field Strength measurement (A/m) was made using the field meter set to the r.m.s detector and the required averaging time.

2.3.3.4 Measurements were repeated for the next position and its associate EUT operating mode, until all possible positions and modes were measured.

Sample Calculation Example

At 2400 MHz, limit = 1.0 mW/cm^2
Power density reading obtained directly from field meter = 0.3 mW/cm^2 averaged over the required 30 minutes.
Therefore, margin = 0.3 – 1.0 = -0.7 mW/cm^2 i.e. 0.7 mW/cm^2 below limit

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2.3.4 Test Results

Test Input Power	120V 60Hz	Temperature	24°C
		Relative Humidity	60%
		Atmospheric Pressure	1030mbar
		Tested By	Chang Wai Kit
		Test Date	22 Sep 2022

Sides	Measuring Distance (cm)	Measured Magnetic Field Strength (A/m)	Magnetic Field Strength Limit (A/m)	50% of Magnetic Field Strength Limit (AV/m)	Averaging Time (min)
Top	20	0.72	1.63	0.815	30
Front	15	0.27	1.63	0.815	30
Left	15	0.49	1.63	0.815	30
Right	15	0.30	1.63	0.815	30
Rear	15	0.28	1.63	0.815	30
Bottom	15	0.69	1.63	0.815	30

Notes

1.	All possible modes of operation were investigated. Only the worst case highest radiation levels were measured. Measurements were taken at the required averaging time. All other radiation levels were relatively insignificant.

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4 Test Equipment

Instrument	Model	S/No	Cal Due Date
Conducted Emissions			
Rohde & Schwarz EMI Test Receiver (9kHz - 3GHz)	ESCI	100477	11 Oct 2022
Schwarzbeck V-LISN	NNLK 8121	NNLK 8121-518	01 Apr 2023
Radiated Field Strength			
R&S EMI Test Receiver (9kHz - 26.5GHz)	ESR26	101714	01 Jul 2023
EMCO Loop Antenna (10kHz – 30MHz)	6502	134413	07 May 2023
Com-Power Preamplifier (1MHz - 1GHz)	PAM-103	441162	16 Feb 2023
Schwarzbeck Bilog Antenna (25MHz – 1GHz)	VULB9168	1430	06 Apr 2023
Maximum Permissible Exposure			
Wavecontrol EM Field Meter	SMP2	21SN1744	03 Nov 2023
Wavecontrol Probe	WP400	21WP100901	03 Nov 2023

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5 Measurement Uncertainty

All measured results are traceable to the SI units. The uncertainty of the measurement is at a confidence level of approximately 95%, with a coverage factor of 2.

Test Name	Measurement Uncertainty
Conducted Emissions at Mains Terminals	1.1dB (9kHz to 30MHz)
Radiated Emissions	10m Anechoic Chamber (Lab 4) 2.2dB (9kHz to 30MHz @ 10m) 3.1dB (30MHz to 1GHz @ 10m) 3.7dB (30MHz to 1GHz @ 3m) 4.7dB (>1GHz to 40GHz @ 3m) 3m RF Chamber (Lab7) 3.6dB (30MHz to 1GHz @ 3m) 4.7dB (>1GHz to 40GHz @ 3m)

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6 Annex A – FCC Labelling Requirment

Labelling requirements per Section 18.212

(a) Equipment authorized under Supplier's Declaration of Conformity shall include a compliance statement that contains the information set forth in § 2.1077 and a statement identical or similar to the following: “This device complies with part 18 of the FCC Rules.”

(b) The compliance information may be placed in the instruction manual, on a separate sheet, on the packaging, or electronically as permitted. There is no specific format for this information.

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Effective 26 January 2021

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End of the Test Report