EMC TEST REPORT

Applicant	Roobuck Pty Ltd
FCC ID	2BDKT4EWB
Product	WiFi/BLE Cordless Cap lamp; Intrinsically Safe WiFi/BLE Cordless Cap lamp
Brand	Roobuck
Model	RN4E-WB; KC4E-WB-Ex; KH4E-WB-Ex
Report No.	R2309A1021-E1V1
Issue Date	January 26, 2024

TA Technology (Shanghai) Co., Ltd. tested the above equipment in accordance with the requirements in **FCC Code CFR47 Part15B (2022)/ ANSI C63.4-2014**. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Liu Wei

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Version	Revision Description	Issue Date
Rev.0	Initial issue of report.	January 9, 2024
Rev.1	Update information.	January 26, 2024
Note: This revised report (Report No.: R2309A1021-E1V1) supersedes and replaces the previously issued report (Report No.: R2309A1021-E1). Please discard or destroy the previously issued report and dispose of it accordingly.		

Summary of measurement results

Number	Test Case	Clause in FCC Rules	Conclusion
1	Radiated Emission	FCC Part15.109, ANSI C63.4-2014	PASS
2	Conducted Emission	FCC Part15.107, ANSI C63.4-2014	NA
Date of Testing: November 1, 2023 ~ November 28, 2023 Date of Sample Received: September 22, 2023			
Note: NA = Not Applicable. 1. All indications of Pass/Fail in this report are opinions expressed by TA Technology (Shanghai) Co., Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only.			

1 Test Laboratory

1.1 Notes of the Test Report

This report shall not be reproduced in full or partial, without the written approval of **TA Technology (Shanghai) Co., Ltd.** The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. Measurement Uncertainties were not taken into account and are published for informational purposes only. This report is written to support regulatory compliance of the applicable standards stated above.

1.2 Test Facility

FCC (Designation number: CN1179, Test Firm Registration Number: 446626)

TA Technology (Shanghai) Co., Ltd. has been listed on the US Federal Communications Commission list of test facilities recognized to perform measurements.

A2LA (Certificate Number: 3857.01)

TA Technology (Shanghai) Co., Ltd. has been listed by American Association for Laboratory Accreditation to perform measurement.

1.3 Testing Location

Company:	TA Technology (Shanghai) Co., Ltd.
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2 General Description of Equipment Under Test

2.1 Applicant and Manufacturer Information

Applicant	Roobuck Pty Ltd
Applicant address	6/20 West Street, Brookvale, NSW, Australia, 2100
Manufacturer	Roobuck Pty Ltd
Manufacturer address	6/20 West Street, Brookvale, NSW, Australia, 2100

2.2 General Information

EUT Description			
Device Type	Portable Device		
Model	RN4E-WB; KC4E-WB-Ex; KH4E-WB-Ex		
Lab internal SN	R2309A1021/S01		
HW Version	V1.1		
SW Version	V1.1		
Power Rating	DC 3.6V from battery.		
Connecting I/O Port(s)	Please refer to the User's Manual.		
Antenna Type	PCB Antenna		
Frequency	Band	Tx (MHz)	Rx (MHz)
	Bluetooth LE	2400 ~ 2483.5	2400 ~ 2483.5
	Wi-Fi 2.4G	2400 ~ 2483.5	2400 ~ 2483.5
	NFC	/	13.56
	RFID	/	915 ~ 921
EUT Accessory			
Battery	Manufacturer: Panasonic Model: NCR18500A DC 3.6V, 4000mAh		
Auxiliary Test Equipment			
PC	PC Manufacturer: Dell Model: Latitude 3301 (SN : 1Q6DJW2)		
Note: 1. The EUT is sent from the applicant to TA and the information of the EUT is declared by the applicant. 2. The customer claims that RN4E-WB, KC4E-WB-Ex and KH4E-WB-Ex are only different in model, and the others are the same. This report only records RN4E-WB test data.			

Product	WiFi/BLE Cordless Cap lamp	Intrinsically Safe WiFi/BLE Cordless Cap lamp	Intrinsically Safe WiFi/BLE Cordless Cap lamp
Model	RN4E-WB	KC4E-WB-Ex	KH4E-WB-Ex
Note: These differences are only because they are for different markets.			

2.3 Applied Standards

According to the specifications of the manufacturer, it must comply with the requirements of the following standards:

Test standards
FCC Code CFR47 Part15B (2022)
ANSI C63.4-2014

2.4 Test Mode

Test Mode	
Mode 1	BATTERY POWERED + EUT+NFC/ RFID/Bluetooth LE/ WLAN Receiver
Mode 2	BATTERY POWERED + EUT+ NFC/RFID/ Bluetooth LE / WLAN STANDBY

Test Type	Test Mode	Worst Mode
Radiated Emission	Mode 1, 2	Mode 1
Conducted Emission	/	/
During the test, the preliminary test was performed in all modes, the test data of the worst-case condition was recorded in this report.		

3 Test Case Results

3.1 Radiated Emission

Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	30% ~ 60%

Methods of Measurement

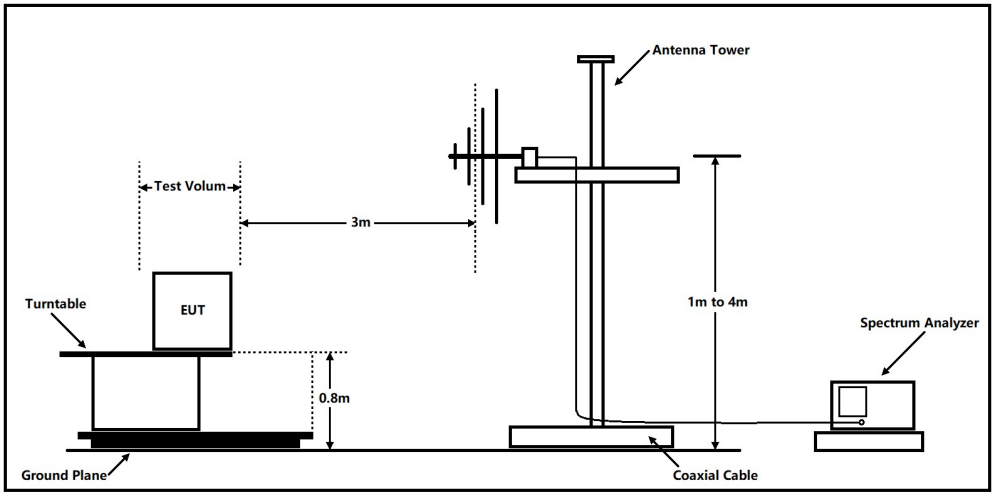
The EUT is placed on a non-metallic table 0.8m above the horizontal metal reference ground plane. The distance between EUT and receive antenna should be 3 meters. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier. During the test, the height of receive antenna shall be moved from 1 to 4 meters, and the antenna shall be performed under horizontal and vertical polarization. The turn table shall be rotated from 0 to 360 degrees for detecting the maximum of radiated signal level.
The data of cable loss and antenna factor has been calibrated in full testing frequency range before the testing. During the test, the EUT is worked at maximum output power.
Set the spectrum analyzer in the following:

Below 1GHz:
RBW=100 kHz / VBW=300 kHz / Sweep=AUTO
Above 1GHz:
(a) PEAK Detector: RBW=1MHz / VBW=3MHz/ Sweep=AUTO
(b) AVERAGE Detector: RBW=1MHz / VBW=3MHz / Sweep=AUTO

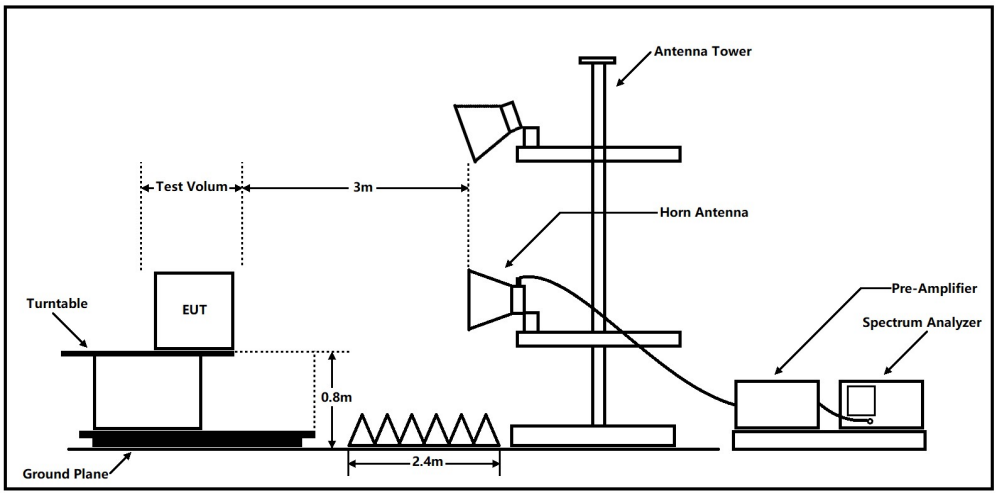
The radiated emission was measured in the following position: EUT stand-up position (Z axis), lie-down position (X, Y axis). The worst emission was found in lie-down position (X axis) and the worst case was recorded.

Test Setup

Below 1GHz



Above 1GHz



Note: Area side: 2.4mX3.6m

Antenna Tower meets ANSI C63.4 requirements for measurements above 1 GHz by keeping the antenna aimed at the EUT during the antenna's ascent/ descent along the antenna mast.

Limits

Class B

Frequency (MHz)	Field Strength (dBμV/m)	Detector
30 -88	40.0	Quasi-peak
88-216	43.5	Quasi-peak
216 – 960	46.0	Quasi-peak
960-1000	54.0	Quasi-peak
1000-5th harmonic of the highest frequency or 40GHz, which is lower	54 74	Average Peak

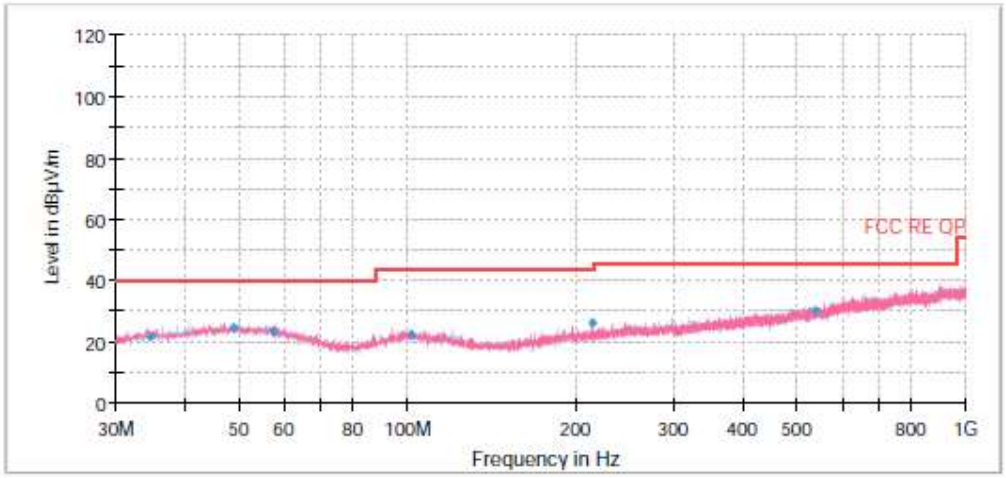
Frequency range of radiated measurements

Highest frequency generated or used in the device or on which the device operates or tunes (MHz)	Upper frequency of measurement range (MHz)
Below 1.705	30
1.705-108	1000
108-500	2000
500-1000	5000
Above 1000	5th harmonic of the highest frequency or 40 GHz, whichever is lower.

Test Results

Sweep the whole frequency band through the range from 30MHz to the 5th harmonic of the carrier.

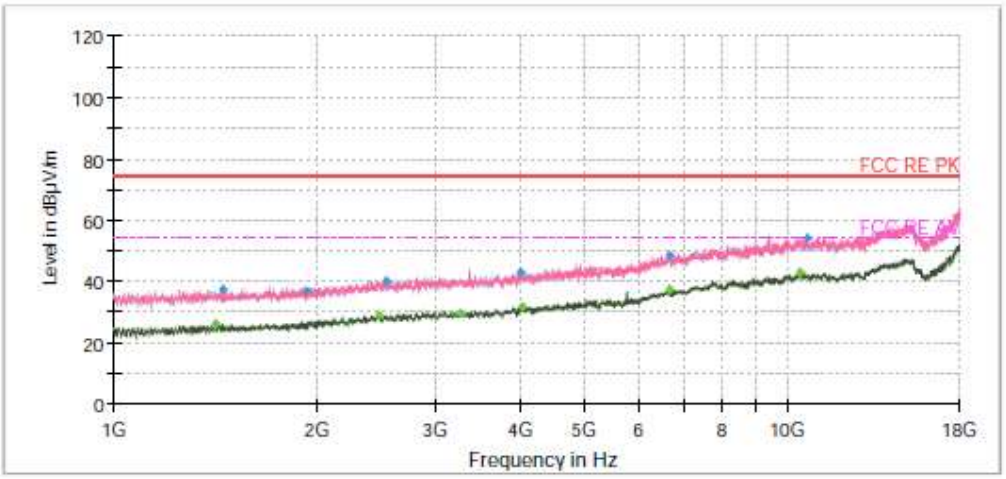
The following graphs display the maximum values of horizontal and vertical by software.
For above 1GHz, Blue trace uses the peak detection, Green trace uses the average detection.



Radiated Emission from 30MHz to 1GHz

Frequency (MHz)	Quasi-Peak (dBµV/m)	Limit (dBµV/m)	Margin (dB)	Height (cm)	Polarization	Azimuth (deg)	Correct Factor (dB)
34.60	21.95	40.00	18.05	112.0	H	152.00	18
48.64	24.35	40.00	15.65	122.0	H	0.00	20
57.53	23.46	40.00	16.54	207.0	H	330.00	20
101.58	22.12	43.50	21.38	182.0	H	298.00	19
214.50	26.50	43.50	17.00	213.0	V	1.00	18
535.77	30.03	46.00	15.97	177.0	H	18.00	26

Remark: 1. Correction Factor = Antenna factor + Insertion loss(cable loss+amplifier gain)
2. Margin = Limit – Quasi-Peak



Radiated Emission from 1GHz to 18GHz

Frequency (MHz)	MaxPeak (dBµV/m)	Average (dBµV/m)	Limit (dB µ V/m)	Margin (dB)	Meas. Time (ms)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
1416.50	---	26.26	54.00	27.74	500.00	115.0	H	204.00	-19
1450.50	37.66	---	74.00	36.34	500.00	102.0	V	50.00	-19
1930.75	36.75	---	74.00	37.25	500.00	200.0	H	0.00	-18
2466.25	---	28.97	54.00	25.03	500.00	119.0	H	103.00	-16
2532.13	40.32	---	74.00	33.68	500.00	138.0	V	77.00	-16
3261.00	---	29.32	54.00	24.68	500.00	199.0	H	340.00	-14
4017.50	42.98	---	74.00	31.02	500.00	114.0	H	309.00	-11
4026.00	---	31.93	54.00	22.07	500.00	200.0	V	119.00	-11
6656.75	---	37.17	54.00	16.83	500.00	101.0	H	161.00	-3
6663.13	48.68	---	74.00	25.32	500.00	101.0	V	333.00	-3
10426.50	---	42.90	54.00	11.10	500.00	199.0	V	251.00	2
10687.88	54.06	---	74.00	19.94	500.00	187.0	V	3.00	1

Remark: 1. Correction Factor = Antenna factor + Insertion loss (cable loss + amplifier gain)
2. Peak Margin = Limit –MAX Peak/ Average

3.2 Conducted Emission

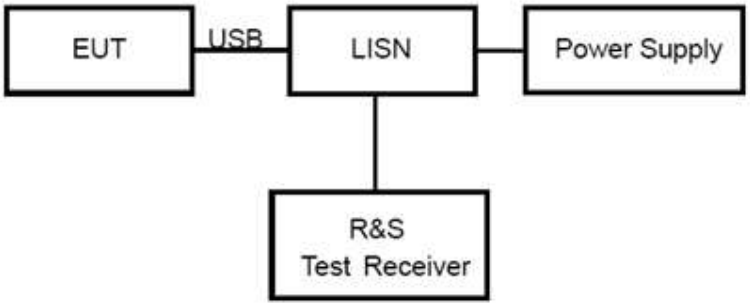
Ambient Condition

Temperature	Relative humidity
15°C ~ 35°C	30% ~ 60%

Methods of Measurement

The EUT is placed on a non-metallic table of 80cm height above the horizontal metal reference ground plane. During the test, the EUT was operating in its typical mode. The test method is according to ANSI C63.4-2014. Connect the AC power line of the EUT to the L.I.S.N. Use EMI receiver to detect the average and Quasi-peak value. RBW is set to 9 kHz, VBW is set to 30kHz. The measurement result should include both L line and N line.

Test Setup



Limits

Frequency (MHz)	Class A (dBµV)		Class B (dBµV)	
	Quasi-peak	Average	Quasi-peak	Average
0.15 - 0.5	79	66	66 to 56 *	56 to 46*
0.5 - 5	73	60	56	46
5 - 30	73	60	60	50
*: Decreases with the logarithm of the frequency.				

Test Results

The equipment doesn't connect to public network, therefore this requirement does not apply.

4 Uncertainty Measurement

Case	Uncertainty	Factor k
Radiated Emission 30MHz – 200MHz	4.17 dB	1.96
Radiated Emission 200MHz – 1GHz	4.84 dB	1.96
Radiated Emission 1GHz – 18GHz	4.35 dB	1.96

5 Main Test Instruments

Name of Equipment	Manufacturer	Type/Model	Serial Number	Calibration Date	Expiration Time
Radiated Emission					
EMI Test Receiver	R&S	ESCI3	100948	2023-05-12	2024-05-11
Signal Analyzer	R&S	FSV40	101298	2023-05-12	2024-05-11
TRILOG Broadband Antenna	SCHWARZBECK	VULB 9163	01111	2022-10-25	2025-10-24
Horn Antenna	SCHWARZBECK	BBHA 9120D	430	2021-07-26	2024-07-25
Amplifier	MWPA.CN	MWLA-010200G40	YQ2103039B01	2023-05-12	2024-05-11
Software	R&S	EMC32	9.26.01	/	/

ANNEX A: The EUT Appearance

The EUT Appearance are submitted separately.

ANNEX B: Test Setup Photos

The Test Setup Photos are submitted separately.

******** END OF REPORT ********