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RF Exposure Evaluation Report

Report No.: CQASZ20240300438E-04
Applicant: Zhuhai Qiannuo Technology Co.,Ltd
Address of Applicant: floor9, building 2, No.88, Xiangshan Road, Tangjiawan Town, high tech Zone, Zhuhai, China
Equipment Under Test (EUT):
EUT Name: Wireless mechanical keyboard
Model No.: NJ98, NJ98, NJ98CP, NJ98AP
Test Model No.: NJ98
Brand Name: Keydous
FCC ID: 2A4G3-NJ98
Standards: 47 CFR Part 1.1307
47 CFR Part 2.1093
KDB447498 D04 Interim General RF Exposure Guidance v01
Date of Receipt: 2024-03-11
Date of Test: 2024-03-11 to 2024-03-23
Date of Issue: 2024-04-11
Test Result: **PASS***

*In the configuration tested, the EUT complied with the standards specified above.

Tested By: Lewis Zhou
(Lewis Zhou)

Reviewed By: Timo Lei
(Timo Lei)

Approved By: Alex
(Alex Wang)



1 Version

Revision History Of Report

Report No.	Version	Description	Issue Date
CQASZ20240300438E-04	Rev.01	Initial report	2024-04-11

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3 General Information

3.1 Client Information

Applicant:	Zhuhai Qiannuo Technology Co.,Ltd
Address of Applicant:	floor9, building 2, No.88, Xiangshan Road, Tangjiawan Town, high tech Zone, Zhuhai, China
Manufacturer:	Zhuhai Qiannuo Technology Co.,Ltd
Address of Manufacturer:	floor9, building 2, No.88, Xiangshan Road, Tangjiawan Town, high tech Zone, Zhuhai, China
Factory:	Zhuhai Qiannuo Technology Co.,Ltd
Address of Factory:	floor9, building 2, No.88, Xiangshan Road, Tangjiawan Town, high tech Zone, Zhuhai, China

3.2 General Description of EUT

Product Name:	Wireless mechanical keyboard
Model No.:	NJ98, NJ98, NJ98CP, NJ98AP
Test Model No.:	NJ98
Trade Mark:	Keydous
Software Version:	V1.1
Hardware Version:	V1.1
Power Supply:	Li-ion battery DC 3.7V 4000mAh, Charge by DC 5V for adapter
Simultaneous Transmission	<input type="checkbox"/> Simultaneous TX is supported and evaluated in this report. <input checked="" type="checkbox"/> Simultaneous TX is not supported.

3.3 General Description of BLE

Operation Frequency:	2402MHz~2480MHz
Modulation Type:	GFSK
Transfer Rate:	1Mbps/2Mbps
Number of Channel:	40
Product Type:	<input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable
Antenna Type:	PCB antenna
Antenna Gain:	1.58dBi

3.4 General Description of BT

Operation Frequency:	2402MHz~2480MHz
Modulation Type:	GFSK, $\pi/4$ DQPSK,
Transfer Rate:	1Mbps/2Mbps
Number of Channel:	79
Product Type:	<input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable
Antenna Type:	PCB antenna
Antenna Gain:	1.58dBi

3.5 General Description of 2.4G custom

Operation Frequency:	2402MHz~2479MHz
Modulation Type:	GFSK
Number of Channel:	78
Product Type:	<input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable
Antenna Type:	PCB antenna
Antenna Gain:	1.58dBi

4 RF Exposure Evaluation

4.1 SAR Evaluation for Portable condition

4.1.1 Standard Requirement

447498 D04 Interim General RF Exposure Guidance v01

3.2. SAR Test Reduction Guidance

SAR test reduction procedures [Glossary] allow using a particular set of test data as representative of other, similar, test conditions. This may be applied for data within different test positions (e.g. body, head, extremity), wireless modes (e.g. Wi-Fi, cellular), and frequency bands. This test reduction process provides for the use of test data for one specific channel, while referencing to those data for demonstrating compliance in other required channels for each test position of an exposure condition, within the operating mode of a frequency band. This is limited specifically to when the reported 1-g or 10-g SAR for the mid-band or highest output power channel meets any of the following conditions.

4.1.2 Limits

SAR-based thresholds are derived based on frequency, power, and separation distance of the RF source. The formula defines the thresholds in general for either available maximum time-averaged power or maximum time-averaged ERP, whichever is greater.

If the ERP of a device is not easily determined, such as for a portable device with a small form factor, the applicant may use the available maximum time-averaged power exclusively if the device antenna or radiating structure does not exceed an electrical length of $\lambda/4$.

As for devices with antennas of length greater than $\lambda/4$ where the gain is not well defined, but always less than that of a half-wave dipole (length $\lambda/2$), the available maximum time-averaged power generated by the device may be used in place of the maximum time-averaged ERP, where that value is not known.

The separation distance is the smallest distance from any part of the antenna or radiating structure for all persons, during operation at the applicable ERP. In the case of mobile or portable devices, the separation distance is from the outer housing of the device where it is closest to the antenna.

The SAR-based exemption formula of § 1.1307(b)(3)(i)(B), repeated here as Formula (B.2), applies for single fixed, mobile, and portable RF sources with available maximum time-averaged power or effective radiated power (ERP), whichever is greater, of less than or equal to the threshold P_{th} (mW).

This method shall only be used at separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive). P_{th} is given by Formula (B.2).

$$P_{th} \text{ (mW)} = \begin{cases} ERP_{20 \text{ cm}} (d/20 \text{ cm})^x & d \leq 20 \text{ cm} \\ ERP_{20 \text{ cm}} & 20 \text{ cm} < d \leq 40 \text{ cm} \end{cases} \quad (\text{B.2})$$

where

$$x = -\log_{10} \left(\frac{60}{ERP_{20 \text{ cm}} \sqrt{f}} \right)$$

and f is in GHz, d is the separation distance (cm), and $ERP_{20 \text{ cm}}$ is per Formula (B.1).
The example values shown in Table B.2 are for illustration only.

Table B.2—Example Power Thresholds (mW)

Frequency (MHz)	Distance (mm)									
	5	10	15	20	25	30	35	40	45	50
300	39	65	88	110	129	148	166	184	201	217
450	22	44	67	89	112	135	158	180	203	226
835	9	25	44	66	90	116	145	175	207	240
1900	3	12	26	44	66	92	122	157	195	236
2450	3	10	22	38	59	83	111	143	179	219
3600	2	8	18	32	49	71	96	125	158	195
5800	1	6	14	25	40	58	80	106	136	169

4.1.3 SAR Exclusion Evaluation Result

1) For BLE

Measurement Data

Channel	Conducted Peak Output Power (dBm)	EIRP (dBm)	ERP (dBm)	Maximum tune-up Power (mW)	Exclusion threshold (mW)
Lowest (2402MHz)	-3.93	-2.35	-4.50	0.35	3.0
Middle (2440MHz)	-3.25	-1.67	-3.82	0.41	
Highest (2480MHz)	-2.46	-0.88	-3.03	0.50	

Remark: The Max Conducted Peak Output Power data refer to report Report No.: CQASZ20240300438E-03

2) For BT

Measurement Data

Channel	Conducted Peak Output Power (dBm)	EIRP (dBm)	ERP (dBm)	Maximum tune-up Power (mW)	Exclusion threshold (mW)
Lowest (2402MHz)	1.43	3.01	0.86	1.22	3.0
Middle (2441MHz)	2.33	3.91	1.76	1.50	
Highest (2480MHz)	2.03	3.61	1.46	1.40	

Remark: The Max Conducted Peak Output Power data refer to report Report No.: CQASZ20240300438E-01

3) For 2.4G custom

$$EIRP = E_{Meas} + 20\log(d_{Meas}) - 104.7$$

where

$EIRP$ is the equivalent isotropically radiated power, in dBm
 E_{Meas} is the field strength of the emission at the measurement distance, in dB μ V/m
 d_{Meas} is the measurement distance, in m

Channel	EIRP (dBm)	ERP (dBm)	Maximum tune-up Power (mW)	Exclusion threshold (mW)
Lowest (2402MHz)	-4.17	-6.32	0.23	3.0
Middle (2440MHz)	-6.73	-8.88	0.13	
Highest (2479MHz)	-5.39	-7.54	0.18	

Remark: The Max Power data refer to report Report No.: CQASZ20240300438E-02.

*** END OF REPORT ***