

Test Report

Verified code: 902551

Report No.: E20230512370501-7

Customer: Wuxi Auto-Link World Information Technology Co., Ltd.

Address: No. 8, Huayun road, Wuxi city, Jiangsu Province, P.R.China

Sample Name: BYD Di5.0F

Sample Model: MTCA05

Receive Sample Date: May.16,2023

Test Date: May.19,2023 ~ Jun.06,2023

Reference Document: CFR 47, FCC Part 2.1091 Radio frequency radiation exposure evaluation: mobile devices.

Test Result: Pass

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GRG METROLOGY & TEST GROUP CO., LTD.

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REPORT ISSUED HISTORY

Report Version	Report No.	Description	Compile Date
1.0	E20230512370501-7	Original Issue	2023-06-09

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1. GENERAL DESCRIPTION OF EUT**1.1 APPLICANT**

Name: Wuxi Auto-Link World Information Technology Co., Ltd.
Address: No. 8, Huayun road, Wuxi city, Jiangsu Province, P.R.China

1.2 MANUFACTURER

Name: Wuxi Auto-Link World Information Technology Co., Ltd.
Address: No. 8, Huayun road, Wuxi city, Jiangsu Province, P.R.China

1.3 Factory

Name: Wuxi Auto-Link World Information Technology Co., Ltd.
Address: No. 8, Huayun road, Wuxi city, Jiangsu Province, P.R.China

1.4 BASIC DESCRIPTION OF EQUIPMENT UNDER TEST

Product Name: BYD Di5.0F
Model No.: MTCA05
Adding Model: /
Trade Name: 
FCC ID: 2BBDI20003502MTCA05
Power Supply: DC 12.0V
Frequency Range: 2402MHz-2480MHz for BT/BLE
2412MHz-2462MHz for 802.11b/g/n HT20/ax HE20
2422MHz-2452MHz: 802.11n HT40/ax HE40
U-NII-1: 5180 MHz~5240 MHz
U-NII-2A: 5260 MHz~5320 MHz
U-NII-2C: 5500 MHz~5700 MHz
U-NII-3: 5745 MHz~5825 MHz
Transmit Power: Reference Section 4 Table 2
Modulation type: BT/BLE:
GFSK / π /4-DQPSK/8DPSK
2.4G wifi:
DSSS for 802.11b mode;
OFDM for 802.11g/n mode;
OFDM, OFDMA for 802.11ax mode;
5G wifi:
OFDM, OFDMA.
Antenna Specification: Reference Section 4 Table 1
Temperature Range: -30~+70°C

Hardware Version: 0.0.6

Software Version: 4.00.3

Sample No: E20230512370501-0001, E20230512370501-0002

Note: The EUT antenna gain is provided by the applicant. This report is made solely on the basis of such data and/or information. We accept no responsibility for the authenticity and completeness of the above data and information and the validity of the results and/or conclusions.

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2. LABORATORY AND ACCREDITATIONS

2.1. LABORATORY

The tests & measurements refer to this report were performed by Shenzhen EMC Laboratory of GRG METROLOGY & TEST GROUP CO., LTD.

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2.2. ACCREDITATIONS

Our laboratories are accredited and approved by the following approval agencies according to ISO/IEC 17025.

USA A2LA(Certificate #2861.01)

The measuring facility of laboratories has been authorized or registered by the following approval agencies.

Canada ISED (Company Number: 24897, CAB identifier:CN0069)

USA FCC (Registration Number: 759402, Designation Number:CN1198)

Copies of granted accreditation certificates are available for downloading from our web site, <http://www.grgtest.com>

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3. LIMITS FOR GENERAL POPULATION/UNCONTROLLED EXPOSURE

According to the KDB 447498 D04 Interim General RF Exposure Guidance v01, General frequency and separation-distance dependent MPE-based effective radiated power (ERP) thresholds are in Table 4.1 to support an exemption from further evaluation from 300 kHz through 100 GHz.

TABLE 4.1—THRESHOLDS FOR SINGLE RF SOURCES SUBJECT TO ROUTINE ENVIRONMENTAL EVALUATION

RF Source Frequency			Minimum Distance			Threshold ERP
f_L MHz		f_H MHz	$\lambda_L / 2\pi$		$\lambda_H / 2\pi$	W
0.3	–	1.34	159 m	–	35.6 m	1,920 R ²
1.34	–	30	35.6 m	–	1.6 m	3,450 R ² /f ²
30	–	300	1.6 m	–	159 mm	3.83 R ²
300	–	1,500	159 mm	–	31.8 mm	0.0128 R ² f
1,500	–	100,000	31.8 mm	–	0.5 mm	19.2R ²
Subscripts L and H are low and high; λ is wavelength. From § 1.1307(b)(3)(i)(C), modified by adding Minimum Distance columns.						

For mobile devices that are not exempt per Table 4.1 at distances from 20 cm to 40 cm and in 0.3 GHz to 6 GHz, evaluation of compliance with the exposure limits in §1.1310 is necessary if the ERP of the device is greater than $ERP_{20\text{cm}}$ in Formula (4.1).

$$P_{\text{th}} \text{ (mW)} = ERP_{20 \text{ cm}} \text{ (mW)} = \begin{cases} 2040f & 0.3 \text{ GHz} \leq f < 1.5 \text{ GHz} \\ 3060 & 1.5 \text{ GHz} \leq f \leq 6 \text{ GHz} \end{cases} \quad (4.1)$$

In accordance with KDB447498D04 Either SAR-based or MPE-based exemption may be considered for test exemption for fixed, mobile, or portable device exposure conditions; therefore, the contributions from each exemption in conjunction with the measured SAR (Evaluated_k term) shall be used to determine exemption for simultaneous transmission according to Formula

$$\text{MPE Ratio} = \sum_{j=1}^b \frac{ERP_j}{ERP_{\text{th},j}} < 1$$

ERP_j: the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j.

ERP_{th,j}: exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.

the sum of the ratios of the applicable terms for SAR-based, MPE-based and measured SAR or MPE shall be less than 1, to determine simultaneous transmission exposure compliance.

4. CALCULATION METHOD

Predication of MPE limit at a given distance

$EIRP(dBm) = \text{Maximum Tune-up Output power (dBm)} + \text{Maximum antenna gain (dBi)}$

$ERP(dBm) = EIRP(dBm) - 2.15$

R= minimum distance to the center of radiation of the antenna

From the EUT RF output power, the minimum mobile separation distance, d=20cm, as well as the maximum gain of the used as following information, the RF power ERP can be obtained.

Table 1 Antenna Specification

Frequency Band	Antenna type	Internal Identification	Maximum antenna gain
BT/BLE	PCB antenna	Antenna 1	3.16 dBi
2.4G wifi	PCB antenna	Antenna 1	3.16 dBi
		Antenna 2	3.16 dBi
5G wifi U-NII-1	PCB antenna	Antenna 1	1.63 dBi
		Antenna 2	1.63 dBi
5G wifi U-NII-2A		Antenna 1	1.17 dBi
		Antenna 2	1.17 dBi
5G wifi U-NII-2C		Antenna 1	1.83 dBi
		Antenna 2	1.83 dBi
5G wifi U-NII-3		Antenna 1	1.89 dBi
		Antenna 2	1.89 dBi

Table 2 Transmit Power

Frequency Band	Test mode	Maximum Output Power (dBm)	Tune-up Output Power Range (dBm)
2.4G wifi	BT/BLE	-3.14	-3.0 ± 1.0
	802.11b	15.75	15.0 ± 1.0
	802.11g	20.22	20.0 ± 1.0
	802.11n HT20	21.37	20.5 ± 1.0
	802.11ax HE20	21.88	21.0 ± 1.0
	802.11n HT40	21.05	20.5 ± 1.0
	802.11ax HE40	21.48	20.5 ± 1.0
5G wifi U-NII-1	802.11a	12.83	12.0 ± 1.0
	802.11n HT20	14.46	13.5 ± 1.0
	802.11ac VHT20	13.83	13.0 ± 1.0
	802.11ax HE20	12.95	12.0 ± 1.0
	802.11n HT40	14.10	13.5 ± 1.0
	802.11ac VHT40	13.72	13.0 ± 1.0
	802.11ax HE40	11.99	11.0 ± 1.0
	802.11ac VHT80	13.37	12.5 ± 1.0
	802.11ax HE80	11.94	11.0 ± 1.0

5G wifi U-NII-2A	802.11a	12.95	12.0±1.0
	802.11n HT20	14.81	14.0±1.0
	802.11ac VHT20	14.02	13.5±1.0
	802.11ax HE20	13.00	12.5±1.0
	802.11n HT40	14.42	13.5±1.0
	802.11ac VHT40	13.47	12.5±1.0
	802.11ax HE40	12.36	11.5±1.0
	802.11ac VHT80	13.29	12.5±1.0
	802.11ax HE80	12.01	11.5±1.0
5G wifi U-NII-2C	802.11a	13.08	12.5±1.0
	802.11n HT20	14.60	14.0±1.0
	802.11ac VHT20	14.01	13.5±1.0
	802.11ax HE20	12.86	12.0±1.0
	802.11n HT40	14.15	13.5±1.0
	802.11ac VHT40	13.41	12.5±1.0
	802.11ax HE40	12.29	11.5±1.0
	802.11ac VHT80	13.60	13.0±1.0
	802.11ax HE80	11.87	11.0±1.0
5G wifi U-NII-3	802.11a	10.89	10.0±1.0
	802.11n HT20	11.86	11.0±1.0
	802.11n HT40	10.89	10.0±1.0
	802.11ac VHT20	10.67	10.0±1.0
	802.11ac VHT40	11.31	10.5±1.0
	802.11ac VHT80	11.02	10.5±1.0
	802.11ax HE20	10.95	10.0±1.0
	802.11ax HE40	10.73	10.0±1.0
	802.11ax HE80	10.79	10.0±1.0

Note:

1. The maximum output Power of BT/BLE wifi were refer to the module report. (Report No.: E20230512370501-1& E20230512370501-2).
2. The maximum output Power of 2.4G wifi were refer to the module report. (Report No.: E20230512370501-3).
3. The maximum output Power of 5G wifi were refer to the module report. (Report No.: E20230512370501-4)

5. ESTIMATION RESULT

5.1 MEASUREMENT RESULTS

STANDALONE MPE

Mode	Frequency (MHz)	Maximum Tune-up Output power (dBm)	Antenna Gain (dBi)	Maximum Tune-up EIRP (dBm)	Maximum Tune-up ERP (dBm)	Maximum Tune-up ERP (mW)	Threshold ERP (mW)
BT/BLE	2402-2480	-2.00	3.16	1.16	-0.99	0.80	3060
2.4G WIFI	2412-2462	22.00	3.16	25.16	23.01	199.99	3060
5G wifi U-NII-1	5150-5250	14.50	1.63	16.13	13.98	25.00	3060
5G wifi U-NII-2A	5250-5350	15.00	1.17	16.17	14.02	25.23	3060
5G wifi U-NII-2C	5470-5725	15.00	1.83	16.83	14.68	29.38	3060
5G wifi U-NII-3	5725-5850	12.00	1.89	13.89	11.74	14.93	3060

Remark:

1. RF Exposure use distance is 20cm from manufacturer declaration of user manual.
- 2 ERP=EIRP-2.15

For Simultaneous transmission:

- $\sum \text{MPE ratios} = \text{MPE ratio}(\text{BT}) + \text{MPE ratio}(2.4\text{G wifi})$
 $\sum \text{MPE ratios} = \text{MPE ratio}(\text{BT}) + \text{MPE ratio}(5\text{G wifi-U-NII-1});$
 $\sum \text{MPE ratios} = \text{MPE ratio}(\text{BT}) + \text{MPE ratio}(5\text{G wifi-U-NII-2A});$
 $\sum \text{MPE ratios} = \text{MPE ratio}(\text{BT}) + \text{MPE ratio}(5\text{G wifi-U-NII-2C});$
 $\sum \text{MPE ratios} = \text{MPE ratio}(\text{BT}) + \text{MPE ratio}(5\text{G wifi-U-NII-3});$

Maximum Simultaneous transmission MPE Ratio for WLAN(2.4G wifi)

Maximum MPE ratio (BT)	Maximum MPE ratio (2.4G wifi)	$\sum \text{MPE ratios}$	Limit	Results
0.00026	0.06536	0.06562	1.000	Pass

Maximum Simultaneous transmission MPE Ratio for RLAN(5G wifi)

Maximum MPE ratio (BT)	Maximum MPE ratio (5G wifi)	$\sum \text{MPE ratios}$	Limit	Results
0.00026	0.00960	0.00986	1.000	Pass

Note:

1. The bluetooth and wifi support simultaneous, 2.4G wifi and 5G wifi no support simultaneous.
2. ERP_j : the available maximum time-averaged power or the ERP, whichever is greater, of fixed, mobile, or portable RF source j.
3. $\text{ERP}_{\text{th},j}$: exemption threshold ERP for fixed, mobile, or portable RF source j, at a distance of at least $\lambda/2\pi$, according to the applicable § 1.1307(b)(3)(i)(C) Table 1 formula at the location in question.
4. Maximum MPE Ratio (BT) = Maximum Tune-up ERP / Threshold ERP = $0.80\text{mW}/3060\text{mW} = 0.00026$;
5. Maximum MPE Ratio (2.4G wifi) = Maximum Tune-up ERP / Threshold ERP = $199.99\text{mW}/3060\text{mW} = 0.06536$;
Maximum MPE Ratio (5G wifi) = Maximum Tune-up ERP(5G wifi U-NII-2C) / Threshold ERP = $29.38\text{mW}/3060\text{mW} = 0.0096$;

6. $\sum \text{MPE ratios} = \text{Maximum MPE Ratio (BT)} + \text{Maximum MPE Ratio (2.4G wifi)} + \text{Maximum MPE Ratio (5G wifi)}$
 $= 0.00026 + 0.06536 + 0.00960 = 0.07522 < 1.$
7. The result is pass.

6. CONCLUSION

The measurement results comply with the FCC Limit per 47 CFR 2.1091 for the uncontrolled RF Exposure of mobile device.

----- End of Report -----