

RF Exposure Report

FCC ID: 2BBQK-WILLENII

Applicant: Marshall Group AB

Address: Centralplan 15 111 20 Stockholm Sweden

Manufacturer: Marshall Group AB

Address: Centralplan 15 111 20 Stockholm Sweden

Product(s): PORTABLE LOUDSPEAKER

Brand: Marshall

Test Model(s): WILLEN II

Series Model(s): N/A

Test Date: Oct. 13, 2023 ~ Dec. 14, 2023

Issued Date: Jan. 22, 2024

Issued By: Hwa-Hsing (Dongguan) Testing Co., Ltd.

Address: No.101, Building N1, Yuyuan 2 Road, Yuyuan Industrial Park,
HuangJiang Town, Dongguan City, People's Republic of China

Test Firm Registration No.: 915896

Standards: FCC Part 2(Section 2.1093)
KDB 447498 D01 General RF Exposure Guidance v06
IEEE C95.1

The above equipment has been tested by **Hwa-Hsing (Dongguan) Testing Co., Ltd.**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's EMC characteristics under the conditions specified in this report.

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Ver. 1.5

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Release control record

Issue No.	Reason for change	Date Issued
23091201-SE-US-01	Original Release	Jan. 22, 2024

1 General Information**1.1 General Description of EUT**

Product	PORTABLE LOUDSPEAKER
Brand	Marshall
Sample No.	HS2310130001
Test Model(s)	WILLEN II
Series Model(s)	N/A
Status of EUT	Engineering Prototype
Power Supply Rating	DC 5V from USB or DC 3.6V from battery
Modulation Type	GFSK, $\pi/4$ DQPSK, 8DPSK for FHSS, GFSK for DTS
Transfer Rate	1/2/3Mbps
Operating Frequency	2402 ~ 2480MHz
Output Power (Average)	BLE: 3.690dBm EDR: 7.220dBm
Antenna Type	PIFA Antenna
Antenna Gain	Ant 1: 4.22dBi Gain or Ant 2: 4.18dBi Gain
Antenna Connector	I-PEX
Accessory Device	USB-C Cable: Unshielded, 80cm

Note:

1. Please refer to the EUT photo document (Reference No.: 23091201-01&02) for detailed product photo.
2. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.
3. Bluetooth can be selected with different PIFA antennas, ANT1&ANT2, the difference between the antennas is the antenna gain and the manufacturer. During the test, the antenna ANT1 with the largest gain is selected for test and recorded in the test report.

Ant. No.	Vendor	Antenna Type	Operation Frequency Range (MHz)	Gain(dBi)
1	RF link	PIFA Antenna	2.4GHz	4.22
2	SOUTH STAR	PIFA Antenna	2.4GHz	4.18

2 RF exposure limit

The corresponding SAR Exclusion Threshold condition, listed below:

- 1) The 1-g and 10-g SAR test exclusion thresholds for 100 MHz to 6 GHz at test separation distances ≤ 50 mm are determined by:

$[(\text{max. power of channel, including tune-up tolerance, mW})/(\text{min. test separation distance, mm})] \cdot [\sqrt{f(\text{GHz})}] \leq 3.0$ for 1-g SAR and ≤ 7.5 for 10-g extremity SAR, 16 where

- ☐ $f(\text{GHz})$ is the RF channel transmit frequency in GHz
- ☐ Power and distance are rounded to the nearest mW and mm before calculation
- ☐ The result is rounded to one decimal place for comparison

The test exclusions are applicable only when the minimum test separation distance is ≤ 50 mm and for transmission frequencies between 100 MHz and 6 GHz. When the minimum test separation distance is < 5 mm, the distance of 5 mm is applied to determine SAR test exclusion.

- 2) At 100 MHz to 6 GHz and for test separation distances > 50 mm, the SAR test exclusion threshold is determined according to the following:

- a) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · (f(MHz)/150)] mW, at 100MHz to 1500 MHz
- b) [Threshold at 50 mm in step 1) + (test separation distance - 50 mm) · 10] mW at > 1500 MHz and ≤ 6 GHz

- 3) At frequencies below 100 MHz, the following may be considered for SAR test exclusion.

- a) The threshold at the corresponding test separation distance at 100 MHz in step 2) is multiplied by $[1 + \log(100/f(\text{MHz}))]$ for test separation distances > 50 mm and < 200 mm.
- b) The threshold determined by the equation in a) for 50 mm and 100 MHz is multiplied by $\frac{1}{2}$ for test separation distances ≤ 50 mm.
- c) SAR measurement procedures are not established below 100 MHz. When SAR test exclusion cannot be applied, a KDB inquiry is required to determine SAR evaluation requirements for any test results to be acceptable.

3 Calculation

The antenna of this product, under normal use condition, is at less than 5mm away from the body of the user.

4 Calculation SAR test exclusion thresholds

The measured of Maximum RF Conduted Power

Mode	Frequency (MHz)	Maximum RF Power (dBm)
BT GFSK	2402-2480	7.220
BT 8DPSK	2402-2480	5.030
BLE	2402-2480	3.690

The tuned Power (declared by client)

Mode	Frequency (MHz)	Target Power (dBm)	Tolerance (dBm)	Lower Tolerance (dBm)	Upper Tolerance (dBm)
BT GFSK	2402-2480	6	± 2	4	8
BT 8DPSK	2402-2480	6	± 2	4	8
BLE	2402-2480	4	± 2	2	6

SAR Test Exclusion Thresholds

Frequency (MHz)	Maximum source-based time averaged conducted output power(dBm)	Minimum separation distance (mm)	Result of Eq. 1	Limit for 1-g SAR	Limit for 10-g extremity SAR	Verdict
2402-2480	8	5	1.987	3.0	7.5	Exempt from SAR

Conclusion: Therefore this device complies with FCC's RF radiation exposure limits for general population without SAR evaluation.

Appendix – Information on the Testing Laboratories

We, [Hwa-Hsing \(Dongguan\) Testing Co., Ltd.](#), A global provider of TESTING and CERTIFICATION services for consumer products, electronic products and wireless information technology products. Adhering to the core values “HONEST and TRUSTWORTHY, OBJECTIVE and IMPARTIALITY, RIGOROUS and AFFICIENT”, commitment to provide professional, perfect and efficient comprehensive ONE-STOP solution of TESTING and CERTIFICATION services for Manufacturers, Buyers, Traders, Brands, Retailers. Assist client to better manage risk, protect their brands, reduce costs and cut time to over 150 markets in global. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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