Shenzhen Toby Technology Co., Ltd.

RF Exposure Evaluation
FCC ID: 2AXQX-4001340

1. Client Information

Applicant	:	Marpac, LLC
Address	:	2015 Capital Drive, Wilmington, NC 28405
Manufacturer	:	Shen zhen Hi-FiD Electronics Tech Co., Ltd
Address	:	4F~ 5F B7 & 3F B17, Hengfeng Industrial Town, Zhoushi Road, Bao'an District, Shenzhen City, China. 518126.

2. General Description of EUT

EUT Name	:	Rohm Voyager, Rohm+	
Model(s)	:	4001340, 4001341	
Model Difference	:	All these models are identical in the same PCB, layout and electrical circuit, the only difference is appearance colors.	
Product Description	:	Operation Frequency:	Bluetooth LE 5.0:2402MHz~2480MHz Bluetooth 5.0:2402MHz~2480MHz
		Number of Channel:	Bluetooth:79 channels Bluetooth LE:40 channels
		Antenna Gain:	-0.58dBi PCB Antenna
		Modulation Type:	GFSK π/4-DQPSK 8-DPSK
		Bit Rate of Transmitter:	1/2/3Mbps
Power Rating	:	Input: DC 5V/1A DC 3.7V by 1200mAh Li-ion battery	
Software Version	:	----	
Hardware Version	:	----	
Connecting I/O Port(S)	:	Please refer to the User's Manual	
Remark: The antenna gain provided by the applicant, the adapter and verified for the RF conduction test and adapter provided by TOBY test lab.			

Note: More test information about the EUT please refer the RF Test Report.

TB-RF-074-1.0

The RF Exposure Evaluation for FCC:

SAR Test Exclusion Calculations

FCC: According to 447498 D04 Interim General RF Exposure Guidance v01.

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).

$$P_{th}\ (mW) = \begin{cases} ERP_{20\ cm}(d/20\ cm)^x & d \le 20\ cm \\ ERP_{20\ cm} & 20\ cm < d \le 40\ cm \end{cases}$$

where

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

and f is in GHz, d is the separation distance (cm), and ERP_{20cm} 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

1. Calculation:

Test separation: 5mm					
Bluetooth (GFSK)					
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mW)**	**Limit P_{th}(mW)**
2402	-0.416	0±1	1	1.259	3
2441	-0.44	0±1	1	1.259	3
2480	-2.027	-2±1	-1	0.794	3
Bluetooth (π /4-DQPSK)					
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mW)**	**Limit P_{th}(mW)**
2402	0.366	0±1	1	1.259	3
2441	0.336	0±1	1	1.259	3
2480	-1.186	-1±1	0	1.000	3
Bluetooth (8-DPSK)					
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mW)**	**Limit P_{th}(mW)**
2402	0.858	1±1	2	1.585	3
2441	0.788	1±1	2	1.585	3
2480	0.816	1±1	2	1.585	3
Bluetooth LE 1Mbps					
Frequency (GHz)	**Conducted Power (dBm)**	**Turn-up Power Tolerance (dB)**	**Max power of tune up tolerance (dBm)**	**Max power of tune up tolerance (mW)**	**Limit P_{th}(mW)**
2402	-0.537	-1±1	0	1.000	3
2440	-0.555	-1±1	0	1.000	3
2480	-0.517	-1±1	0	1.000	3

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 D04, No SAR is required.

Conclusion:

The measurement results comply with the FCC Limit per 47 CFR 2.1093 for the uncontrolled RF Exposure and SAR Exclusion Threshold per KDB 447498 v06.

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