TEST REPORT

Applicant:	3M Construction & Home Improvement Markets Division
Address:	3M Center,Building 251-01-E-19,St,Paul,MN55144-1000 U.S.A
Equipment Type:	WorkTunes Connect + AM/FM Hearing Protector
Model Name:	90542
Brand Name:	N/A
FCC ID:	2AFHL-90542
Test Standard:	47 CFR Part 2.1093 KDB 447498 D04
Test Date:	May 31, 2022 - Jun. 09, 2022
Date of Issue:	Jul. 21, 2022

ISSUED BY:

Shenzhen BALUN Technology Co., Ltd.

Tested by: Julie Zhu **Checked by:** Zong Liyao **Approved by:** Wei Yanquan (Chief Engineer)

Revision History

Version	Issue Date	Revisions Content
Rev. 01	Jul. 21, 2022	Initial Issue

TABLE OF CONTENTS

1 GENERAL INFORMATION 3

1.1 Identification of the Testing Laboratory 3

1.2 Identification of the Responsible Testing Location 3

2 PRODUCT INFORMATION 4

2.1 Applicant Information 4

2.2 Manufacturer Information 4

2.3 Factory Information 4

2.4 General Description for Equipment under Test (EUT) 4

2.5 Ancillary Equipment 4

2.6 Technical Information 5

3 SUMMARY OF TEST RESULT 6

3.1 Test Standards 6

4 DEVICE CATEGORY AND LEVELS LIMITS 7

5 ASSESSMENT RESULT 9

5.1 Output Power 9

5.2 Conclusion 9

1 GENERAL INFORMATION

1.1 Identification of the Testing Laboratory

Company Name	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China
Phone Number	+86 755 6685 0100

1.2 Identification of the Responsible Testing Location

Test Location	Shenzhen BALUN Technology Co., Ltd.
Address	Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China
Accreditation Certificate	The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196.
Description	All measurement facilities used to collect the measurement data are located at Block B, 1/F, Baisha Science and Technology Park, Shahe West Road, Nanshan District, ShenZhen, GuangDong Province, China

2 PRODUCT INFORMATION

2.1 Applicant Information

Applicant	3M Construction & Home Improvement Markets Division
Address	3M Center,Building 251-01-E-19,St,Paul,MN55144-1000 U.S.A

2.2 Manufacturer Information

Manufacturer	3M Construction & Home Improvement Markets Division
Address	3M Center,Building 251-01-E-19,St,Paul,MN55144-1000 U.S.A

2.3 Factory Information

Factory	OSM HUIZHOU LIMITED
Address	A02, Taixiang Road, High-tech Industrial Park, Sandong Town, Huicheng District Huizhou,Guangdong Province, P.R.C. China

2.4 General Description for Equipment under Test (EUT)

EUT Name	WorkTunes Connect + AM/FM Hearing Protector
Model Name Under Test	90542
Series Model Name	N/A
Description of Model name differentiation	N/A
Hardware Version	A109_RB_R1.1A_220511
Software Version	C888WP-II_0_2_0_20220425_24355
Dimensions (Approx.)	N/A
Weight (Approx.)	N/A

2.5 Ancillary Equipment

Note: Not applicable.

2.6 Technical Information

Network and Wireless connectivity	Bluetooth, AM, FM

The requirement for the following technical information of the EUT was tested in this report:

Operating Mode	Bluetooth	
Frequency Range	Bluetooth	2400 ~ 2483.5 MHz
Antenna Type	Bluetooth	PCB
Exposure Category	General Population/Uncontrolled Exposure	
EUT Stage	Portable Device	

3 SUMMARY OF TEST RESULT

3.1 Test Standards

No.	Identity	Document Title
1	47 CFR Part 2.1093	Radiofrequency radiation exposure evaluation: portable devices
2	KDB 447498 D04	KDB 447498 D04 Interim General RF Exposure Guidance v01

4 DEVICE CATEGORY AND LEVELS LIMITS

Portable Derives:

CFR Title 47 §2.1093(b)

(b) For purposes of this section, a portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is/are within 20 centimeters of the body of the user.

FCC KDB 447498 Derives:

According with FCC KDB 447498 D04, Appendix B, The SAR-based exemption formula 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 Pth (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). The following table shows the power threshold from 5mm to 50mm.

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

Note:

1. Maximum power is the source-based time-average power and represents the maximum RF output power including tune-up tolerance among production units
2. Per KDB 447498 D04, for larger devices, the test separation distance of adjacent edge configuration is determined by the closest separation between the antenna and the user.
3. Per KDB 447498 D04, standalone SAR test exclusion threshold is applied; If the distance of the antenna to the user is < 5mm, 5mm is used to determine SAR exclusion threshold
4. Per KDB 447498 D04, for separation distances from 0.5 cm to 40 cm and at frequencies from 0.3 GHz to 6 GHz (inclusive), the threshold Pth (mW) is given by Following:

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

where

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

a. f(GHz) is the RF channel transmit frequency in GHz
b. d is the separation distance (cm), The result is rounded to one decimal place for comparison
c. ERP_{20cm} are determined by:

$$ERP_{20cm}(mW) = f(x) = \begin{cases} 2040f & 0.3GHz \le f < 1.5GHz \\ 3060 & 1.5GHz \le f \le 6GHz \end{cases}$$

5 ASSESSMENT RESULT

5.1 Output Power

Bluetooth			
Mode	BR+EDR		
	GFSK	π/4-DQPSK	8-DPSK
Peak Power (dBm)	**3.93**	3.92	3.91
Antenna Gain（dBi）	0		
EIRP	**3.93**	3.92	3.91
Note: This report listed the worst case peak power value, please refer to RF test report for more details.			

Bluetooth			
Mode	GFSK (BLE)		
	Low Channel	Middle Channel	High Channel
Peak Power (dBm)	**1.97**	2.01	0.77
Antenna Gain（dBi）	0		
EIRP	**1.97**	2.01	0.77
Note: This report listed the worst case power value, please refer to RF test report for more details.			

5.2 Tune-up power

Mode	EIRP Range (dBm)	ERP Range (dBm)
Bluetooth	0.50. - 4.00	(1.85) – (2.65)
Note: ERP= EIRP -2.15dB		

5.3 RF Exposure Evaluation Result

Mode	Distance (mm)	Calculation Frequency (MHz)	Tune-up limit power (dBm)	Tune-up limit power (mW)	Threshold Value(mW)	Verdict
Bluetooth	5	2480	4.00	2.51	2.72	Compliance

5.4 Conclusion

This EUT is deemed to comply with the reference level limits, therefore the basic restrictions are compliant with human exposure limits.

Statement

1. The laboratory guarantees the scientificity, accuracy and impartiality of the test, and is responsible for all the information in the report, except the information provided by the customer. The customer is responsible for the impact of the information provided on the validity of the results.
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--END OF REPORT--