

# TEST REPORT

**Product Name** : TWS Bluetooth earphones  
**Brand Mark** : N/A  
**Model No.** : In2011, In2011L  
**FCC ID** : RDR-IN2011L  
**Report Number** : BLA-EMC-202005-A54-02  
**Date of Sample Receipt** : 2020/5/22  
**Date of Test** : 2020/5/22 to 2020/5/29  
**Date of Issue** : 2020/5/29  
**Test Standard** : 47 CFR Part 15, Subpart C 15.247  
**Test Result** : Pass

Prepared for:

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2020/5/29



**REPORT REVISE RECORD**

<b>Version No.</b>	<b>Date</b>	<b>Description</b>
00	2020/5/29	Original

BlueAsia

## TABLE OF CONTENTS

<b>1</b>	<b>TEST SUMMARY .....</b>	<b>6</b>
<b>2</b>	<b>GENERAL INFORMATION .....</b>	<b>7</b>
<b>3</b>	<b>GENERAL DESCRIPTION OF E.U.T. ....</b>	<b>7</b>
<b>4</b>	<b>TEST ENVIRONMENT .....</b>	<b>8</b>
<b>5</b>	<b>TEST MODE .....</b>	<b>8</b>
<b>6</b>	<b>MEASUREMENT UNCERTAINTY .....</b>	<b>8</b>
<b>7</b>	<b>DESCRIPTION OF SUPPORT UNIT.....</b>	<b>9</b>
<b>8</b>	<b>LABORATORY LOCATION.....</b>	<b>9</b>
<b>9</b>	<b>TEST INSTRUMENTS LIST .....</b>	<b>10</b>
<b>1</b>	<b>RADIATED SPURIOUS EMISSIONS.....</b>	<b>14</b>
1.1	LIMITS .....	14
1.2	BLOCK DIAGRAM OF TEST SETUP .....	15
1.3	PROCEDURE .....	15
1.4	TEST DATA .....	17
<b>2</b>	<b>RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS.....</b>	<b>22</b>
2.1	LIMITS .....	22
2.2	BLOCK DIAGRAM OF TEST SETUP .....	23
2.3	PROCEDURE .....	23
2.4	TEST DATA .....	25
<b>3</b>	<b>CONDUCTED SPURIOUS EMISSIONS .....</b>	<b>26</b>
3.1	LIMITS .....	26
3.2	BLOCK DIAGRAM OF TEST SETUP .....	26
3.3	TEST DATA .....	27
<b>4</b>	<b>CONDUCTED BAND EDGES MEASUREMENT.....</b>	<b>28</b>
4.1	LIMITS .....	28
4.2	BLOCK DIAGRAM OF TEST SETUP .....	28
4.3	TEST DATA .....	29
<b>5</b>	<b>DWELL TIME.....</b>	<b>30</b>
5.1	LIMITS .....	30
5.2	BLOCK DIAGRAM OF TEST SETUP .....	30

5.3	TEST DATA .....	31
<b>6</b>	<b>HOPPING CHANNEL NUMBER .....</b>	<b>32</b>
6.1	LIMITS .....	32
6.2	BLOCK DIAGRAM OF TEST SETUP .....	32
6.3	TEST DATA .....	32
<b>7</b>	<b>CARRIER FREQUENCIES SEPARATION .....</b>	<b>33</b>
7.1	LIMITS .....	33
7.2	BLOCK DIAGRAM OF TEST SETUP .....	33
7.3	TEST DATA .....	33
<b>8</b>	<b>20DB BANDWIDTH.....</b>	<b>34</b>
8.1	BLOCK DIAGRAM OF TEST SETUP .....	34
8.2	TEST DATA .....	34
<b>9</b>	<b>CONDUCTED PEAK OUTPUT POWER .....</b>	<b>35</b>
9.1	LIMITS .....	35
9.2	BLOCK DIAGRAM OF TEST SETUP .....	35
9.3	TEST DATA .....	36
<b>10</b>	<b>ANTENNA REQUIREMENT .....</b>	<b>37</b>
10.1	CONCLUSION .....	37
<b>11</b>	<b>CONDUCTED EMISSIONS AT AC POWER LINE (150KHZ-30MHZ).....</b>	<b>38</b>
11.1	LIMITS .....	38
11.2	BLOCK DIAGRAM OF TEST SETUP .....	38
11.3	PROCEDURE .....	38
11.4	TEST DATA.....	40
<b>12</b>	<b>APPENDIX.....</b>	<b>42</b>
12.1	APPENDIX : 20DB EMISSION BANDWIDTH .....	42
	<i>Test Result</i> .....	42
	<i>Test Graphs</i> .....	43
12.2	APPENDIX : MAXIMUM CONDUCTED OUTPUT POWER .....	46
	<i>Test Result</i> .....	46
	<i>Test Graphs</i> .....	47
12.3	APPENDIX : CARRIER FREQUENCY SEPARATION .....	50
	<i>Test Result</i> .....	50

<i>Test Graphs</i> .....	50
12.4    APPENDIX : TIME OF OCCUPANCY .....	52
<i>Test Result</i> .....	52
<i>Test Graphs</i> .....	53
12.5    APPENDIX : NUMBER OF HOPPING CHANNELS .....	56
<i>Test Result</i> .....	56
<i>Test Graphs</i> .....	57
12.6    APPENDIX : BAND EDGE MEASUREMENTS .....	59
<i>Test Result</i> .....	59
<i>Test Graphs</i> .....	60
12.7    APPENDIX : CONDUCTED SPURIOUS EMISSION.....	66
<i>Test Result</i> .....	66
<i>Test Graphs</i> .....	67
<b>APPENDIX A: PHOTOGRAPHS OF TEST SETUP .....</b>	<b>76</b>
<b>APPENDIX B: PHOTOGRAPHS OF EUT .....</b>	<b>78</b>

## 1 TEST SUMMARY

Test item	Test Requirement	Test Method	Class/Severity	Result
Radiated Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.4,6.5,6.6	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Radiated Emissions which fall in the restricted bands	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.10.5	47 CFR Part 15, Subpart C 15.209 & 15.247(d)	Pass
Conducted Spurious Emissions	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.8	47 CFR Part 15, Subpart C 15.247(d)	Pass
Conducted Band Edges Measurement	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.6	47 CFR Part 15, Subpart C 15.247(d)	Pass
Dwell Time	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.4	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Hopping Channel Number	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.3	47 CFR Part 15, Subpart C 15.247a(1)(iii)	Pass
Carrier Frequencies Separation	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.2	47 CFR Part 15, Subpart C 15.247a(1)	Pass
20Db Bandwidth	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.9	47 CFR Part 15, Subpart C 15.215	Pass
Conducted Peak Output Power	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 7.8.5	47 CFR Part 15, Subpart C 15.247(b)(1)	Pass
Antenna Requirement	47 CFR Part 15, Subpart C 15.247	N/A	47 CFR Part 15, Subpart C 15.203 & 15.247©	Pass
Conducted Emissions at AC Power Line (150kHz-30MHz)	47 CFR Part 15, Subpart C 15.247	ANSI C63.10 (2013) Section 6.2	47 CFR Part 15, Subpart C 15.207	Pass

## 2 GENERAL INFORMATION

<b>Applicant</b>	Dongguan Hele Electronics Co.,Ltd
<b>Address</b>	Dalingya Industrial Zone,Daojiao Town,Dongguan City,Guangdong,China
<b>Manufacturer</b>	Dongguan Hele Electronics Co.,Ltd
<b>Address</b>	Dalingya Industrial Zone,Daojiao Town,Dongguan City,Guangdong,China
<b>Factory</b>	N/A
<b>Address</b>	N/A
<b>Product Name</b>	TWS Bluetooth earphones
<b>Test Model No.</b>	In2011L

## 3 GENERAL DESCRIPTION OF E.U.T.

<b>Hardware Version</b>	N/A
<b>Software Version</b>	N/A
<b>Operation Frequency:</b>	2402~2480MHz
<b>Modulation Type:</b>	GFSK, pi/4DQPSK, 8DPSK
<b>Channel Spacing:</b>	1MHz
<b>Number of Channels:</b>	79
<b>Antenna Type:</b>	chip antenna
<b>Antenna Gain:</b>	2.5 dBi

#### 4 TEST ENVIRONMENT

Environment	Temperature	Voltage
Normal	+25°C	3.7Vdc

#### 5 TEST MODE

TEST MODE	TEST MODE DESCRIPTION
Transmitting mode	Keep the EUT in continuously transmitting mode with modulation. (hopping or no hopping mode all have been tested, only non hopping mode is reported for RE)
<p><i>Remark: During the test, the test voltage was tuned from 85% to 115% of the nominal rated supply voltage, and found that the worst case was under the nominal rated supply condition. So the report just shows that condition's data.</i></p> <p><i>Full battery is used during all test except ac conducted emission, DH1, DH3, DH5 all have been tested, during the test, GFSK, Pi/4QPSK, 8-DPSK modulation were all pre-scanned only worse case is reported.</i></p>	

#### 6 MEASUREMENT UNCERTAINTY

Parameter	Expanded Uncertainty (Confidence of 95%)
Radiated Emission	±4.34dB
Radiated Emission	±4.24dB
Radiated Emission	±4.68dB
AC Power Line Conducted Emission	±3.45dB

Parameter	Expanded Uncertainty (Confidence of 95%)
Occupied Channel Bandwidth	±5 %
RF output power, conducted	±1.5 dB
Power Spectral Density, conducted	±3.0 dB
Unwanted Emissions, conducted	±3.0 dB
Temperature	±3 °C
Supply voltages	±3 %
Time	±5 %
Radiated Emission (30MHz ~ 1000MHz)	±4.35 dB
Radiated Emission (1GHz ~ 18GHz)	±4.44 dB



## 7 DESCRIPTION OF SUPPORT UNIT

Device Type	Manufacturer	Model Name	Serial No.	Remark
PC	HASEE	K610D	N/A	N/A

## 8 LABORATORY LOCATION

All tests were performed at:  
BlueAsia of Technical Services(Shenzhen) Co., Ltd.  
IOT Test Centre of BlueAsia  
No. 448 Bulong Road, Bantian Street, Longgang District, Shenzhen, China  
Telephone: TEL: +86-755-28682673 FAX: +86-755-28682673  
No tests were sub-contracted.

## 9 TEST INSTRUMENTS LIST

Test Equipment Of Radiated Spurious Emissions					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	5/8/2018	5/7/2021
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2020
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2020
Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2019	2/13/2022
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

Test Equipment Of Radiated Emissions which fall in the restricted bands					
Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Chamber	SKET	966	N/A	5/8/2018	5/7/2021
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Receiver	R&S	ESR7	101199	4/20/2020	4/19/2021
broadband Antenna	Schwarzbeck	VULB9168	00836 P:00227	7/14/2018	7/13/2020
Horn Antenna	Schwarzbeck	9120D	01892 P:00331	7/14/2018	7/13/2020

Amplifier	SKET	LNPA-0118-45	N/A	7/4/2019	7/3/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A
Loop antenna	SCHNARZBECK	FMZB1519B	00102	2/14/2019	2/13/2022
Controller	SKET	N/A	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-02	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-03	N/A	N/A	N/A
Coaxial Cable	BlueAsia	BLA-XC-01	N/A	N/A	N/A

**Test Equipment Of Conducted Spurious Emissions**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Conducted Band Edges Measurement**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Dwell Time**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020

Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Hopping Channel Number**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Carrier Frequencies Separation**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of 20dB Bandwidth**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Conducted Peak Output Power**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Spectrum	R&S	FSP40	100817	7/4/2019	7/3/2020
Spectrum	Agilent	N9020A	MY49100060	12/17/2019	12/16/2020
Signal Generator	Agilent	N5182A	MY49060650	12/17/2019	12/16/2020
Signal Generator	Agilent	E8257D	MY44320250	4/20/2020	4/19/2021

**Test Equipment Of Antenna Requirement**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
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**Test Equipment Of Conducted Emissions at AC Power Line (150kHz-30MHz)**

Equipment	Manufacturer	Model	S/N	Cal.Date	Cal.Due
Shield room	SKET	833	N/A	6/10/2018	6/9/2021
Receiver	R&S	ESPI3	101082	4/20/2020	4/19/2021
LISN	R&S	ENV216	3560.6550.15	7/4/2019	7/3/2020
LISN	AT	AT166-2	AKK1806000003	12/17/2019	12/16/2020
EMI software	EZ	EZ-EMC	N/A	N/A	N/A

## 1 RADIATED SPURIOUS EMISSIONS

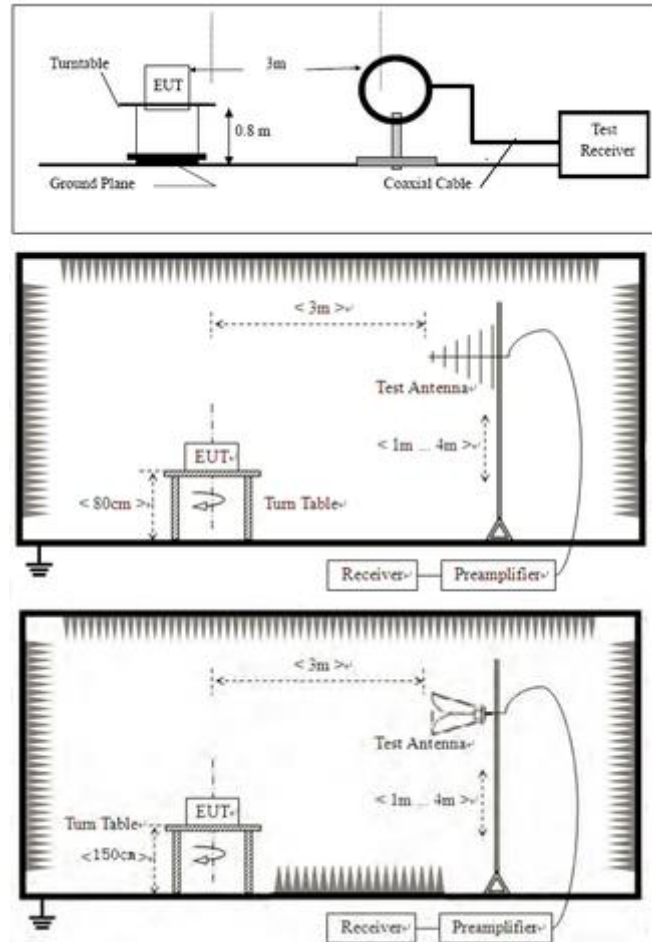
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.4,6.5,6.6
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Ben
<b>Temperature</b>	25°C
<b>Humidity</b>	55%

### 1.1 LIMITS

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 1.2 BLOCK DIAGRAM OF TEST SETUP



## 1.3 PROCEDURE

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:  
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor + Preamplifier Factor
- 3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.



### 1.4 TEST DATA

During the test, pre-scan the GFSK, Pi/4QPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

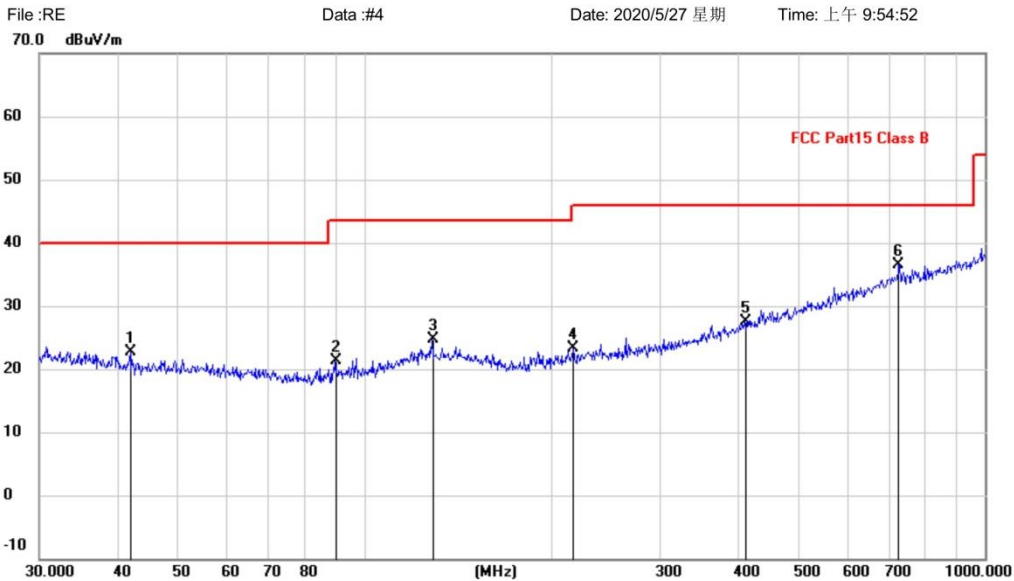
[TestMode: TX]						
Test channel:lowest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	58.64	2.38	61.02	74	-12.98	Vertical
7206.00	60.93	2.17	63.1	74	-10.9	Vertical
9608.00	58.8	2.06	60.86	74	-13.14	Vertical
12010.00	*			74		Vertical
14412.00	*			74		Vertical
4804.00	59.34	2.38	61.72	74	-12.28	Horizontal
7206.00	59.53	2.17	61.7	74	-12.3	Horizontal
9608.00	58.82	2.06	60.88	74	-13.12	Horizontal
12010.00	*			74		Horizontal
14412.00	*			74		Horizontal
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4804.00	41.65	2.38	44.03	54	-9.97	Vertical
7206.00	40.02	2.17	42.19	54	-11.81	Vertical
9608.00	41.26	2.06	43.32	54	-10.68	Vertical
12010.00	*			54		Vertical
14412.00	*			54		Vertical
4804.00	39.33	2.38	41.71	54	-12.29	Horizontal
7206.00	40.41	2.17	42.58	54	-11.42	Horizontal
9608.00	39.86	2.06	41.92	54	-12.08	Horizontal
12010.00	*			54		Horizontal
14412.00	*			54		Horizontal

Test channel:Middle						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	58.68	0.17	58.85	74	-15.15	Vertical
7323.00	60.56	1.43	61.99	74	-12.01	Vertical
9764.00	59.68	1.26	60.94	74	-13.06	Vertical
12205.00	*			74		Vertical
14646.00	*			74		Vertical
4882.00	60.71	0.17	60.88	74	-13.12	Horizontal
7323.00	59.69	1.43	61.12	74	-12.88	Horizontal
9764.00	59.88	1.26	61.14	74	-12.86	Horizontal
12205.00	*			74		Horizontal
14646.00	*			74		Horizontal
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4882.00	38.13	0.17	38.3	54	-15.7	Vertical
7323.00	39.78	1.43	41.21	54	-12.79	Vertical
9764.00	39.07	1.26	40.33	54	-13.67	Vertical
12205.00	*			54		Vertical
14646.00	*			54		Vertical
4882.00	40.69	0.17	40.86	54	-13.14	Horizontal
7323.00	38.42	1.43	39.85	54	-14.15	Horizontal
9764.00	39.72	1.26	40.98	54	-13.02	Horizontal
12205.00	*			54		Horizontal
14646.00	*			54		Horizontal

Test channel: Highest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	59.51	1.04	60.55	74	-13.45	Vertical
7440.00	58.2	2.59	60.79	74	-13.21	Vertical
9920.00	61.38	2.74	64.12	74	-9.88	Vertical
12400.00	*			74		Vertical
14880.00	*			74		Vertical
4960.00	61.88	1.04	62.92	74	-11.08	Horizontal
7440.00	60.78	2.59	63.37	74	-10.63	Horizontal
9920.00	58.58	2.74	61.32	74	-12.68	Horizontal
12400.00	*			74		Horizontal
14880.00	*			74		Horizontal
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
4960.00	41.44	1.04	42.48	54	-11.52	Vertical
7440.00	41.7	2.59	44.29	54	-9.71	Vertical
9920.00	41.99	2.74	44.73	54	-9.27	Vertical
12400.00	*			54		Vertical
14880.00	*			54		Vertical
4960.00	38.45	1.04	39.49	54	-14.51	Horizontal
7440.00	41.44	2.59	44.03	54	-9.97	Horizontal
9920.00	38.23	2.74	40.97	54	-13.03	Horizontal
12400.00	*			54		Horizontal
14880.00	*			54		Horizontal
<b>Test Result: Pass</b>						

[TestMode: TX]; [Polarity: Horizontal]

**Radiated Emission Measurement**



Site	Polarization: <b>Horizontal</b>	Temperature:
Limit: FCC Part15 Class B	Power:	Humidity: %
EUT: TWS Bluetooth earphones	Distance:	
M/N: In2011		
Mode: BT mode		
Note:		

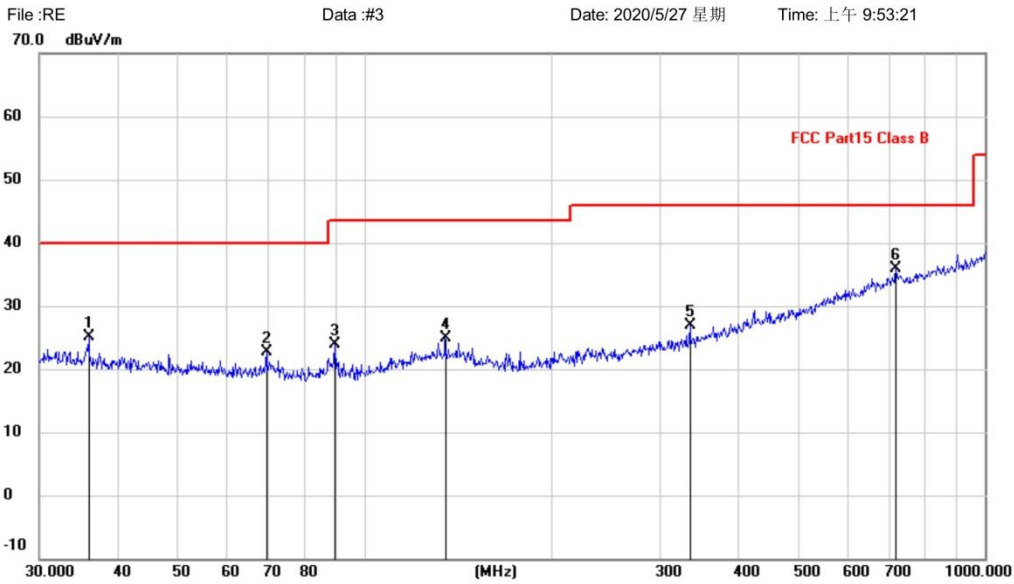
No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		42.0066	-1.62	24.33	22.71	40.00	-17.29	QP		
2		89.9047	1.72	19.58	21.30	43.50	-22.20	QP		
3		128.5630	1.76	22.95	24.71	43.50	-18.79	QP		
4		217.5443	1.97	21.38	23.35	46.00	-22.65	QP		
5		410.3825	0.23	27.24	27.47	46.00	-18.53	QP		
6	*	726.8052	3.40	33.15	36.55	46.00	-9.45	QP		

\*:Maximum data    x:Over limit    !:over margin      <Reference Only

**Test Result: Pass**

[TestMode: TX]; [Polarity: Vertical]

**Radiated Emission Measurement**



Site	Polarization: <b>Vertical</b>	Temperature:
Limit: FCC Part15 Class B	Power:	Humidity: %
EUT: TWS Bluetooth earphones	Distance:	
M/N: In2011		
Mode: BT mode		
Note:		

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Antenna Height	Table Degree	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	cm	degree	Comment
1		36.0007	1.78	23.41	25.19	40.00	-14.81	QP		
2		69.6005	1.37	21.27	22.64	40.00	-17.36	QP		
3		89.5899	4.34	19.56	23.90	43.50	-19.60	QP		
4		135.0319	1.75	23.15	24.90	43.50	-18.60	QP		
5		334.8589	1.97	24.93	26.90	46.00	-19.10	QP		
6	*	719.1995	2.94	33.02	35.96	46.00	-10.04	QP		

\*:Maximum data    x:Over limit    !:over margin

⟨Reference Only

**Test Result: Pass**

## 2 RADIATED EMISSIONS WHICH FALL IN THE RESTRICTED BANDS

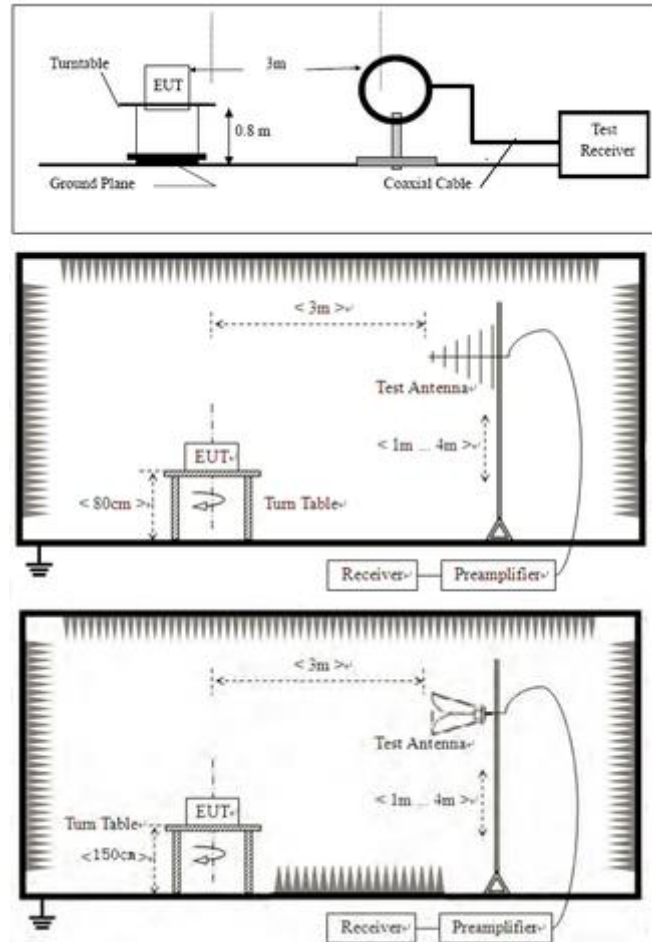
<b>Test Standard</b>	47 CFR Part 15, Subpart C 15.247
<b>Test Method</b>	ANSI C63.10 (2013) Section 6.10.5
<b>Test Mode (Pre-Scan)</b>	TX
<b>Test Mode (Final Test)</b>	TX
<b>Tester</b>	Ben
<b>Temperature</b>	25°C
<b>Humidity</b>	55%

### 2.1 LIMITS

<b>Frequency(MHz)</b>	<b>Field strength(microvolts/meter)</b>	<b>Measurement distance(meters)</b>
0.009-0.490	2400/F(kHz)	300
0.490-1.705	24000/F(kHz)	30
1.705-30.0	30	30
30-88	100	3
88-216	150	3
216-960	200	3
Above 960	500	3

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

## 2.2 BLOCK DIAGRAM OF TEST SETUP



## 2.3 PROCEDURE

- For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
- For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
- The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.

- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1:  $Level = Read\ Level + Cable\ Loss + Antenna\ Factor - Preamp\ Factor$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

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## 2.4 TEST DATA

During the test, pre-scan the GFSK, Pi/4QPSK, 8-DPSK modulation, and found the GFSK modulation which it is worse case.

[TestMode: TX]						
Test channel:lowest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	45.84	-4.2	41.64	74	-32.36	Horizontal
2390	46.19	-3.88	42.31	74	-31.69	Horizontal
2310	46.66	-4.49	42.17	74	-31.83	Vertical
2390	53.36	-4.21	49.15	74	-24.85	Vertical
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2310	34.49	-4.2	30.29	54	-23.71	Horizontal
2390	35.62	-3.88	31.74	54	-22.26	Horizontal
2310	35.55	-4.49	31.06	54	-22.94	Vertical
2390	39.89	-4.21	35.68	54	-18.32	Vertical
Test channel:Highest						
Peak value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	46.82	-3.38	43.44	74	-30.56	Horizontal
2500	44.55	-3.3	41.25	74	-32.75	Horizontal
2483.5	47.87	-3.77	44.1	74	-29.9	Vertical
2500	56.07	-3.7	52.37	74	-21.63	Vertical
Average value:						
Frequency (MHz)	Read Level (dBuV)	Correct factor(dB/m)	Level (dBuV/m)	Limit Line (dBuV/m)	Over Limit (dB)	Polarization
2483.5	34.11	-3.38	30.73	54	-23.27	Horizontal
2500	32.91	-3.3	29.61	54	-24.39	Horizontal
2483.5	35.32	-3.77	31.55	54	-22.45	Vertical
2500	42.39	-3.7	38.69	54	-15.31	Vertical

**Test Result: Pass**

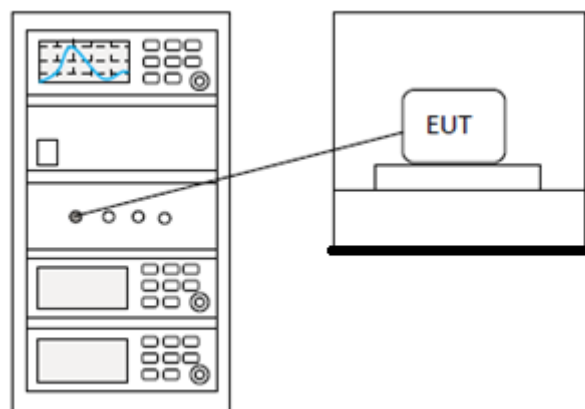
### 3 CONDUCTED SPURIOUS EMISSIONS

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.8
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	55%

#### 3.1 LIMITS

<b>Limit:</b>	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
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#### 3.2 BLOCK DIAGRAM OF TEST SETUP



### 3.3 TEST DATA

**Pass: Please Refer To Appendix: For Details**

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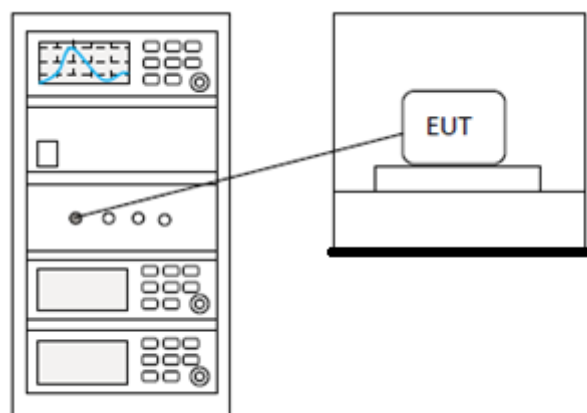
#### 4 CONDUCTED BAND EDGES MEASUREMENT

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.6
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	55%

##### 4.1 LIMITS

<b>Limit:</b>	In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).
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##### 4.2 BLOCK DIAGRAM OF TEST SETUP



### 4.3 TEST DATA

**Pass: Please Refer To Appendix: For Details**

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## 5 DWELL TIME

Test Standard	47 CFR Part 15, Subpart C 15.247
Test Method	ANSI C63.10 (2013) Section 7.8.4
Test Mode (Pre-Scan)	TX
Test Mode (Final Test)	TX
Tester	Ben
Temperature	25°C
Humidity	55%

### 5.1 LIMITS

Frequency(MHz)	Limit
902-928	0.4S within a 20S period(20dB bandwidth<250kHz)
	0.4S within a 10S period(20dB bandwidth≥250kHz)
2400-2483.5	0.4S within a period of 0.4Smultiplied by the number of hopping channels
5725-5850	0.4S within a 30S period

### 5.2 BLOCK DIAGRAM OF TEST SETUP

