FCC REPORT

Applicant: BITWAVE PTE LTD

Address of Applicant: Ascendas Building, 53 Serangoon North Ave 4, #05-06

Equipment Under Test (EUT)

Product Name: Bluetooth Helmet Communicator

Model No.: MOTION HDX-V

Trade mark: UCLEAR DIGITAL

FCC ID: NMC-MHDX

Applicable standards: FCC CFR Title 47 Part 15 Subpart B

Date of sample receipt: 17 Nov., 2021

Date of Test: 18 Nov., 2021 to 06 Sep., 2022

Date of report issued: 07 Sep., 2022

Test Result: PASS *

* In the configuration tested, the EUT complied with the standards specified above.

Authorized Signature:

Bruce Zhang
Laboratory Manager

2 Version

Version No.	Date	Description
00	*07 Sep., 2022*	*Original*

Tested by: Mike.ou ***Date:*** *07 Sep., 2022*

Test Engineer

Reviewed by: Winner Zhang ***Date:*** *07 Sep., 2022*

Project Engineer

3 Contents

Page

4 Test Summary

Test Item	Section in CFR 47	Result
Conducted Emission	Part 15.107	Pass
Radiated Emission	Part 15.109	Pass
Remark: *1. Pass: The EUT complies with the essential requirements in the standard.*		
Test Method:	*ANSI C63.4:2014*	

5 General Information

5.1 Client Information

Applicant:	BITWAVE PTE LTD
Address:	Ascendas Building, 53 Serangoon North Ave 4, #05-06
Manufacturer:	Bitwave Pte Ltd
Address:	Ascendas Building, 53 Serangoon North Ave 4, #05-06 Singapore 555852

5.2 General Description of E.U.T.

Product Name:	Bluetooth Helmet Communicator
Model No.:	MOTION HDX-V
Power supply:	Rechargeable Li-ion Battery DC3.7V, 650mAh
Test Sample Condition:	The test samples were provided in good working order with no visible defects.

5.3 Test Mode and test samples plans

Operating mode	Detail description
Charging & Working mode	Keep the EUT in Charging & Working mode(Worst case)
Charging mode	Keep the EUT in Charging mode
The sample was placed 0.8m above the ground plane of 3m chamber. Measurements in both horizontal and vertical polarities were performed. During the test, each emission was maximized by: having the EUT continuously working, investigated all operating modes, rotated about all 3 axis (X, Y & Z) and considered typical configuration to obtain worst position, manipulating interconnecting cables, rotating the turntable, varying antenna height from 1m to 4m in both horizontal and vertical polarizations. The emissions worst-case are shown in Test Results of the following pages.	

5.4 Measurement Uncertainty

Parameter	Expanded Uncertainty (Confidence of 95%)
Conducted Emission (9kHz ~ 150KHz) for V-AMN	3.11 dB
Conducted Emission (150kHz ~ 30MHz) for V-AMN	2.62 dB
Radiated Emission (9kHz ~ 30MHz electric field) for 3m SAC	3.13 dB
Radiated Emission (9kHz ~ 30MHz magnetic field) for 3m SAC	3.13 dB
Radiated Emission (30MHz ~ 1GHz) for 3m SAC	4.45 dB
Radiated Emission (1GHz ~ 18GHz) for 3m SAC	5.34 dB
Radiated Emission (18GHz ~ 40GHz) for 3m SAC	5.34 dB
Radiated Emission (30MHz ~ 1GHz) for 10m SAC	4.32 dB

5.5 Description of Support Units

Manufacturer	Description	Model	S/N	FCC ID/DoC
Lenovo	Laptop	ThinkPad T14 Gen 1	SL10Z47277	DoC
HUAWEI	Adapter	HW-050200C02	HS952E2KBS103C1	/

5.6 Related Submittal(s) / Grant (s)

This is an original grant, no related submittals and grants.

5.7 Description of Cable Used

Cable Type	Description	Length	From	To
Detached USB Cable	Shielding	1.0m	EUT	PC/Adapter

5.8 Additions to, deviations, or exclusions from the method

No

5.9 Laboratory Facility

The test facility is recognized, certified, or accredited by the following organizations:

- **FCC - Designation No.: CN1211**

JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.

- **ISED – CAB identifier.: CN0021**

The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.

- **CNAS - Registration No.: CNAS L15527**

JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.

- **A2LA - Registration No.: 4346.01**

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: https://portal.a2la.org/scopepdf/4346-01.pdf

5.10 Laboratory Location

JianYan Testing Group Shenzhen Co., Ltd.
Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.
Tel: +86-755-23118282, Fax: +86-755-23116366
Email: info-JYTee@lets.com, Website: http://jyt.lets.com

5.11 Test Instruments list

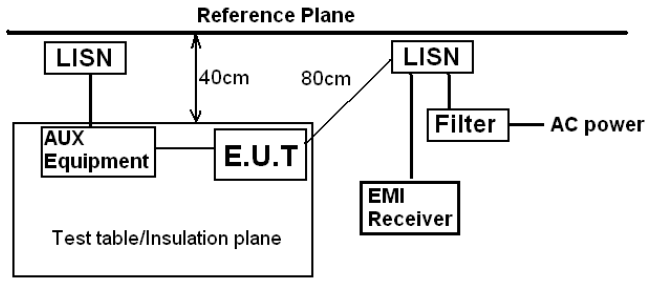
Radiated Emission(3m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
3m SAC	ETS	9m*6m*6m	WXJ001-1	04-14-2021	04-13-2024
BiConiLog Antenna	Schwarzbeck	VULB9163	WXJ002	03-10-2021	03-09-2022
				03-08-2022	03-07-2023
Horn Antenna	Schwarzbeck	BBHA9120D	WXJ002-2	03-10-2021	03-09-2022
				03-08-2022	03-07-2023
Pre-amplifier (30MHz ~ 1GHz)	Schwarzbeck	BBV9743B	WXJ001-2	03-07-2021	03-06-2022
				01-20-2022	01-19-2023
Pre-amplifier (1GHz ~ 18GHz)	SKET	LNPA_0118G-50	WXJ001-3	03-07-2021	03-06-2022
				01-20-2022	01-19-2023
EMI Test Receiver	Rohde & Schwarz	ESRP7	WXJ003-1	03-09-2021	03-08-2022
				03-05-2022	03-04-2023
Spectrum Analyzer	Rohde & Schwarz	FSP 30	WXJ004	03-03-2021	03-02-2022
				01-20-2022	01-19-2023
Coaxial Cable (30MHz ~ 1GHz)	JYTSZ	JYT3M-1G-NN-8M	WXG001-4	03-07-2021	03-06-2022
				01-20-2022	01-19-2023
Coaxial Cable (1GHz ~ 18GHz)	JYTSZ	JYT3M-18G-NN-8M	WXG001-5	03-07-2021	03-06-2022
				01-20-2022	01-19-2023
Band Reject Filter Group	Tonscend	JS0806-F	WXJ089	N/A	
Test Software	Tonscend	TS+	Version: 3.0.0.1		

Radiated Emission(10m SAC):					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
10m SAC	ETS	RFSD-100-F/A	WXJ090	04-28-2021	04-27-2024
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-1	04-02-2021	04-01-2022
				04-01-2022	03-31-2023
BiConiLog Antenna	SCHWARZBECK	VULB 9168	WXJ090-2	04-02-2021	04-01-2022
				03-31-2022	03-30-2023
EMI Test Receiver	R&S	ESR 3	WXJ090-3	04-08-2021	04-07-2022
				03-30-2022	03-29-2023
EMI Test Receiver	R&S	ESR 3	WXJ090-4	04-08-2021	04-07-2022
				03-30-2022	03-29-2023
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-6	04-06-2021	04-05-2022
				01-20-2022	01-19-2023
Low Pre-amplifier	Bost	LNA 0920N	WXJ090-7	04-06-2021	04-05-2022
				01-20-2022	01-19-2023
Cable	Bost	JYT10M-1G-NN-10M	WXG002-7	04-02-2021	04-01-2022
				01-20-2022	01-19-2023
Cable	Bost	JYT10M-1G-NN-10M	WXG002-8	04-02-2021	04-01-2022
				01-20-2022	01-19-2023
Test Software	R&S	EMC32	Version: 10.50.40		

Conducted Emission:					
Test Equipment	**Manufacturer**	**Model No.**	**Manage No.**	**Cal. Date (mm-dd-yy)**	**Cal. Due date (mm-dd-yy)**
EMI Test Receiver	Rohde & Schwarz	ESR3	WXJ003-2	03-03-2021	03-02-2022
				10-21-2021	10-20-2022
LISN	Schwarzbeck	NSLK 8127	QCJ001-13	04-06-2021	04-05-2022
				02-24-2022	02-23-2023
LISN	Rohde & Schwarz	ESH3-Z5	WXJ005-1	04-06-2021	04-05-2022
				03-30-2022	03-29-2023
LISN Coaxial Cable (9kHz ~ 30MHz)	JYTSZ	JYTCE-1G-NN-2M	WXG003-1	04-06-2021	04-05-2022
				02-24-2022	02-23-2023
RF Switch	TOP PRECISION	RSU0301	WXG003	N/A	
Test Software	AUDIX	E3	Version: 6.110919b		

6 Test results and Measurement Data

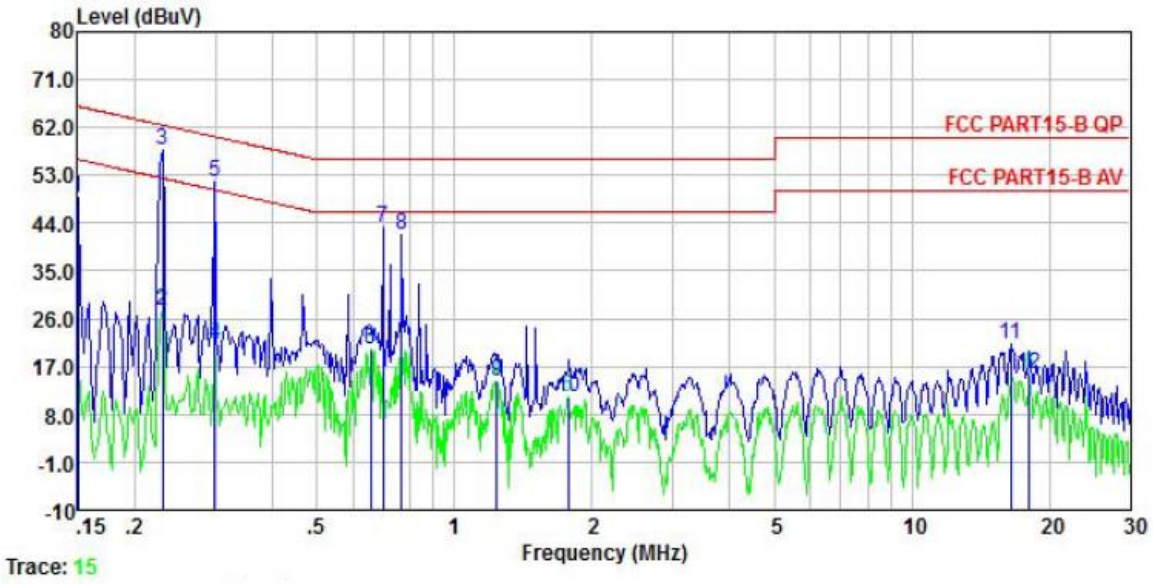
6.1 Conducted Emission

<table>
<tr><td>Test Requirement:</td><td colspan="3">FCC Part 15 B Section 15.107</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="3">150kHz to 30MHz</td></tr>
<tr><td>Class / Severity:</td><td colspan="3">Class B</td></tr>
<tr><td>Receiver setup:</td><td colspan="3">RBW=9kHz, VBW=30kHz</td></tr>
<tr><td rowspan="5">Limit:</td><td rowspan="2">Frequency range (MHz)</td><td colspan="2">Limit (dBµV)</td></tr>
<tr><td>Quasi-peak</td><td>Average</td></tr>
<tr><td>0.15-0.5</td><td>66 to 56*</td><td>56 to 46*</td></tr>
<tr><td>0.5-5</td><td>56</td><td>46</td></tr>
<tr><td>0.5-30</td><td>60</td><td>50</td></tr>
<tr><td colspan="3">* Decreases with the logarithm of the frequency.</td></tr>
<tr><td>Test setup:</td><td colspan="3"> 

Remark:
E.U.T: Equipment Under Test
LISN: Line Impedence Stabilization Network
Test table height=0.8m</td></tr>
<tr><td>Test procedure</td><td colspan="3">1. The E.U.T and simulators are connected to the main power through a line impedance stabilization network(L.I.S.N.). The provide a 50ohm/50uH coupling impedance for the measuring equipment.
2. The peripheral devices are also connected to the main power through a LISN that provides a 50ohm/50uH coupling impedance with 50ohm termination. (Please refers to the block diagram of the test setup and photographs).
3. Both sides of A.C. line are checked for maximum conducted interference. In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.4(latest version) on conducted measurement.</td></tr>
<tr><td>Test Instruments:</td><td colspan="3">Refer to section 5.11 for details</td></tr>
<tr><td>Test mode:</td><td colspan="3">Refer to section 5.3 for details</td></tr>
<tr><td>Test results:</td><td colspan="3">Pass</td></tr>
</table>

Measurement data:

Product name:	Bluetooth Helmet Communicator	Product model:	MOTION HDX-V
Test by:	Mike	Test mode:	Charging & Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Line
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 23.2℃ Huni: 40%

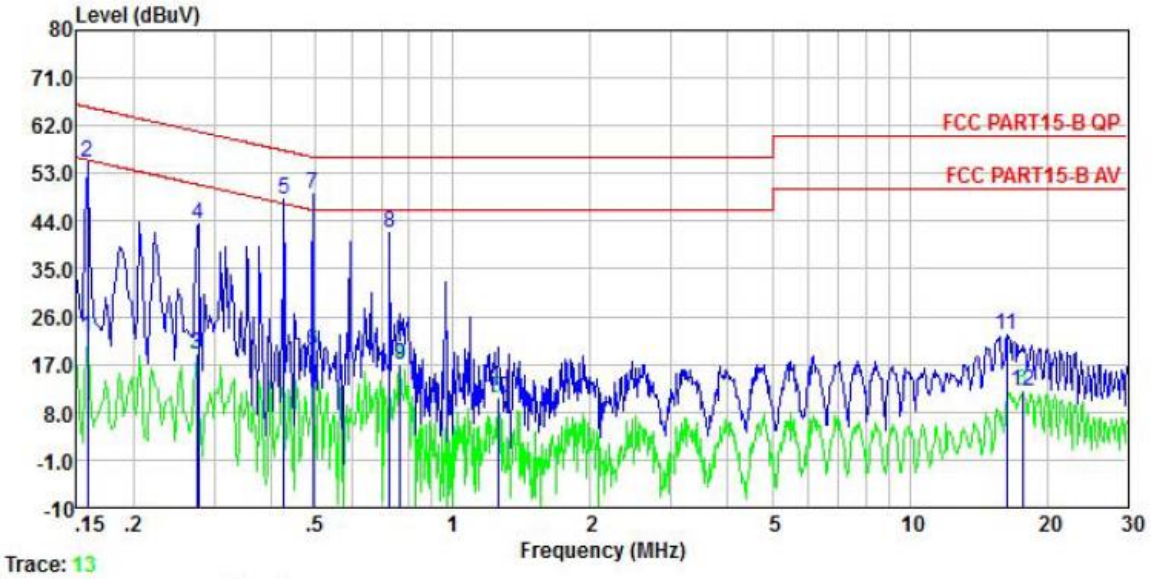


	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.150	48.77	0.04	0.01	48.83	66.00	-17.17	QP
2	0.230	27.43	0.05	0.02	27.50	52.44	-24.94	Average
3	0.230	57.80	0.05	0.02	57.87	62.44	-4.57	QP
4	0.299	21.11	0.06	0.03	21.21	50.28	-29.07	Average
5	0.299	51.53	0.06	0.03	51.63	60.28	-8.65	QP
6	0.654	20.17	0.07	0.03	20.31	46.00	-25.69	Average
7	0.697	42.98	0.07	0.03	43.12	56.00	-12.88	QP
8	0.767	41.64	0.07	0.03	41.79	56.00	-14.21	QP
9	1.236	13.94	0.07	0.10	14.22	46.00	-31.78	Average
10	1.772	10.82	0.08	0.18	11.23	46.00	-34.77	Average
11	16.486	18.60	0.31	0.16	21.28	60.00	-38.72	QP
12	18.039	13.89	0.32	0.15	15.66	50.00	-34.34	Average

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Aux Factor + Cable Loss.*

Product name:	Bluetooth Helmet Communicator	Product model:	MOTION HDX-V
Test by:	Mike	Test mode:	Charging & Working mode
Test frequency:	150 kHz ~ 30 MHz	Phase:	Neutral
Test voltage:	AC 120 V/60 Hz	Environment:	Temp: 23.2℃ Huni: 40%

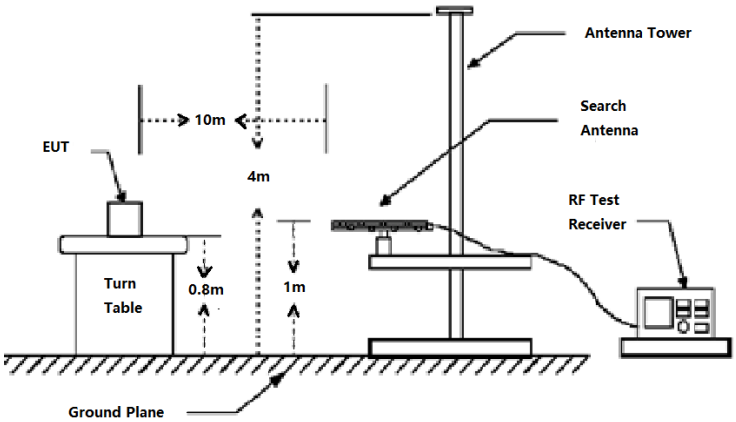


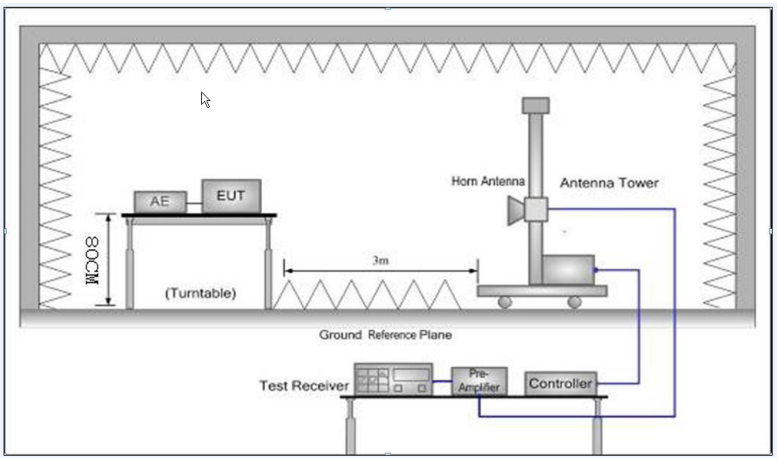
	Freq	Read Level	LISN Factor	Cable Loss	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB	dB	dBuV	dBuV	dB	
1	0.158	22.03	0.06	0.01	22.11	55.56	-33.45	Average
2	0.158	55.14	0.06	0.01	55.22	65.56	-10.34	QP
3	0.274	18.69	0.05	0.02	18.77	50.98	-32.21	Average
4	0.277	43.22	0.05	0.02	43.30	60.90	-17.60	QP
5	0.426	48.02	0.04	0.03	48.06	57.33	-9.27	QP
6	0.494	19.54	0.04	0.03	19.64	46.10	-26.46	Average
7	0.494	49.00	0.04	0.03	49.10	56.10	-7.00	QP
8	0.727	41.51	0.06	0.03	41.64	56.00	-14.36	QP
9	0.767	16.90	0.06	0.03	17.04	46.00	-28.96	Average
10	1.255	10.47	0.06	0.10	10.74	46.00	-35.26	Average
11	16.312	19.72	0.29	0.16	22.46	60.00	-37.54	QP
12	17.661	9.86	0.30	0.15	11.78	50.00	-38.22	Average

Notes:

1. *An initial pre-scan was performed on the line and neutral lines with peak detector.*
2. *Quasi-Peak and Average measurement were performed at the frequencies with maximized peak emission.*
3. *Final Level =Receiver Read level + LISN Factor + Aux Factor + Cable Loss.*

6.2 Radiated Emission

<table>
<tr><td>Test Requirement:</td><td colspan="5">FCC Part 15 B Section 15.109</td></tr>
<tr><td>Test Frequency Range:</td><td colspan="5">30MHz to 6000MHz</td></tr>
<tr><td>Test site:</td><td colspan="5">Measurement Distance: 3m or 10m (Semi-Anechoic Chamber)</td></tr>
<tr><td rowspan="5">Receiver setup:</td><td>Frequency</td><td>Detector</td><td>RBW</td><td>VBW</td><td>Remark</td></tr>
<tr><td>30MHz-1GHz</td><td>Quasi-peak</td><td>120kHz</td><td>300kHz</td><td>Quasi-peak Value</td></tr>
<tr><td rowspan="2">Above 1GHz</td><td>Peak</td><td>1MHz</td><td>3MHz</td><td>Peak Value</td></tr>
<tr><td>RMS</td><td>1MHz</td><td>3MHz</td><td>Average Value</td></tr>
<tr><td></td><td colspan="3"></td></tr>
<tr><td rowspan="10">Limit:</td><td colspan="2">Frequency</td><td colspan="2">Limit (dBuV/m @10m)</td><td>Remark</td></tr>
<tr><td colspan="2">30MHz-88MHz</td><td colspan="2">30.0</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">88MHz-216MHz</td><td colspan="2">33.5</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">216MHz-960MHz</td><td colspan="2">36.0</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">960MHz-1GHz</td><td colspan="2">44.0</td><td>Quasi-peak Value</td></tr>
<tr><td colspan="2">Frequency</td><td colspan="2">Limit (dBuV/m @3m)</td><td>Remark</td></tr>
<tr><td colspan="2" rowspan="2">Above 1GHz</td><td colspan="2">54.0</td><td>Average Value</td></tr>
<tr><td colspan="2">74.0</td><td>Peak Value</td></tr>
<tr><td colspan="3"></td></tr>
<tr><td colspan="3"></td></tr>
<tr><td>Test setup:</td><td colspan="5">Below 1GHz
 

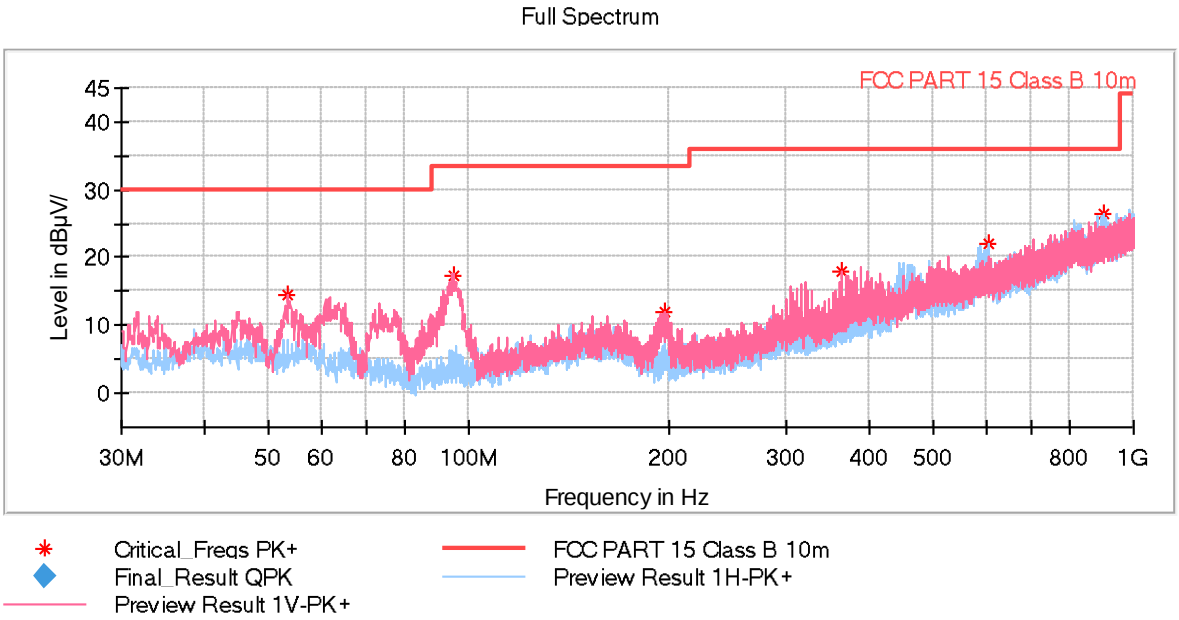
Above 1GHz
 
</td></tr>
<tr><td>Test Procedure:</td><td colspan="5">1. The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 10 meter chamber (below 1GHz)or 3 meter chamber(above 1GHz). The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 10 meters(below 1GHz) or 3 meters(above 1GHz) away from the interference-receiving antenna, which was mounted on</td></tr>
</table>

	the top of a variable-height antenna tower. 3. 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. 4. 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 and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading. 5. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode. 6. 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.
Test Instruments:	Refer to section 5.11 for details
Test mode:	Refer to section 5.3 for details
Test results:	Passed
Remark:	All of the observed value above 6GHz ware the niose floor , which were no recorded

Measurement Data:

Below 1GHz:

Product Name:	Bluetooth Helmet Communicator	**Product Model:**	MOTION HDX-V
Test By:	Mike	**Test mode:**	Charging & Working mode
Test Frequency:	30 MHz ~ 1 GHz	**Polarization:**	Vertical & Horizontal
Test Voltage:	AC 120/60Hz	**Environment:**	Temp:21.5℃ Huni: 54%



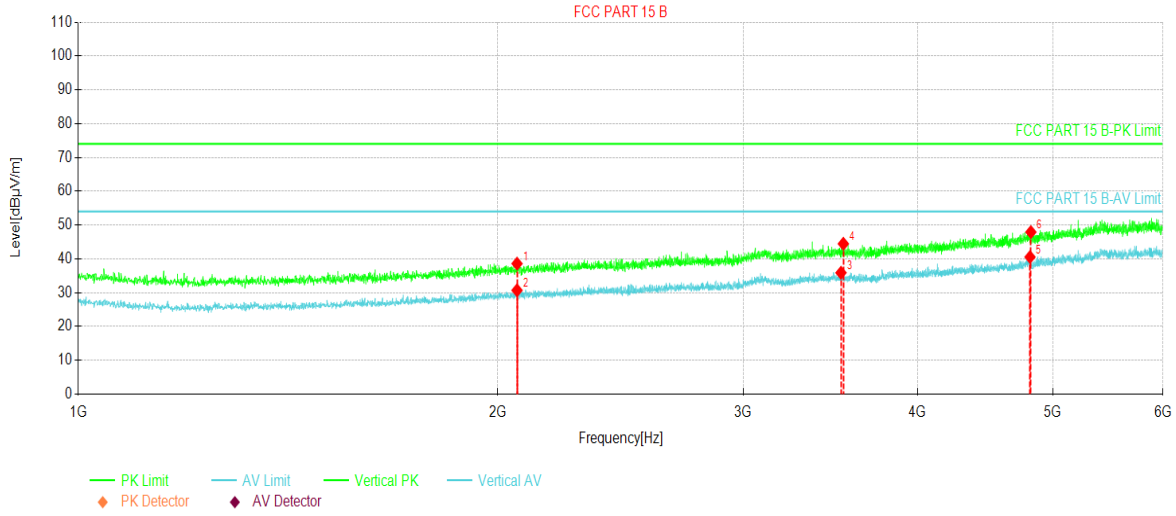
Frequency (MHz)	MaxPeak (dB µ V/m)	Limit (dB µ V/m)	Margin (dB)	Height (cm)	Pol	Azimuth (deg)	Corr. (dB/m)
53.377000	14.48	30.00	15.52	100.0	V	182.0	-16.2
94.602000	17.47	33.50	16.03	100.0	V	213.0	-19.5
197.761500	11.86	33.50	21.64	100.0	V	199.0	-17.9
363.971000	17.97	36.00	18.03	100.0	V	323.0	-13.3
603.803500	21.89	36.00	14.11	100.0	H	218.0	-7.6
901.157000	26.54	36.00	9.46	100.0	H	246.0	-1.9

Remark:

1. *Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss – Preamplifier Factor).*
2. *The emission levels of other frequencies are lower than the limit 20dB and not show in test report.*

Above 1GHz:

Product Name:	Bluetooth Helmet Communicator	**Product Model:**	MOTION HDX-V
Test By:	Mike	**Test mode:**	Charging & Working mode
Test Frequency:	1 GHz ~ 6 GHz	**Polarization:**	Vertical
Test Voltage:	AC 120/60Hz	**Environment:**	Temp: 22.2℃ Huni: 55%

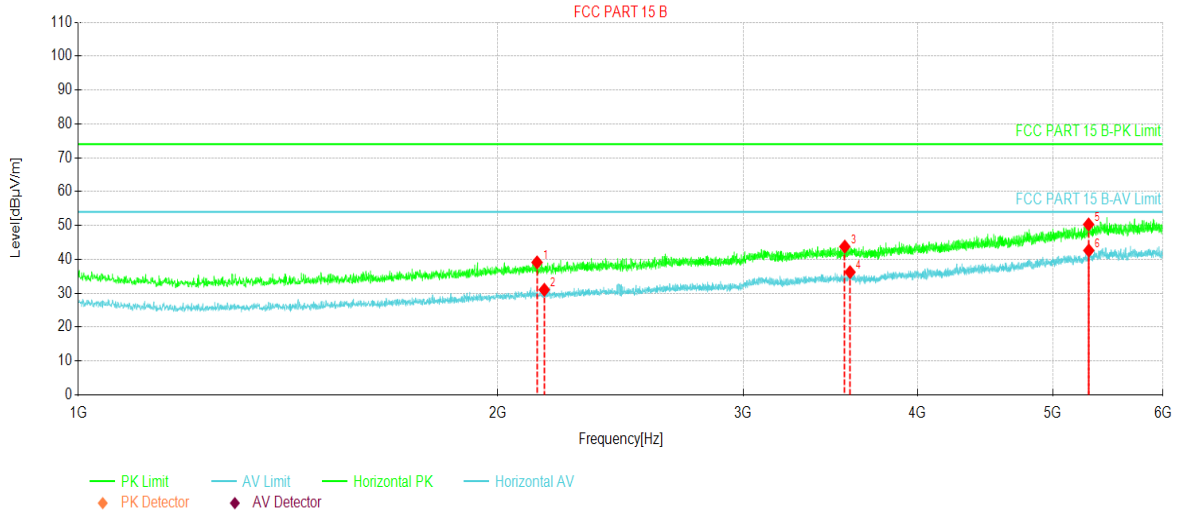


NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	2064.37	58.48	38.59	-19.89	74.00	35.41	PK	Vertical
2	2064.37	50.60	30.71	-19.89	54.00	23.29	AV	Vertical
3	3525.00	50.76	35.90	-14.86	54.00	18.10	AV	Vertical
4	3538.75	59.33	44.46	-14.87	74.00	29.54	PK	Vertical
5	4816.87	49.69	40.54	-9.15	54.00	13.46	AV	Vertical
6	4823.75	57.05	47.92	-9.13	74.00	26.08	PK	Vertical

Remark:

1. *Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss – Preamplifier Factor).*
2. *The emission levels of other frequencies are lower than the limit 20dB and not show in test report.*

Product Name:	Bluetooth Helmet Communicator	Product Model:	MOTION HDX-V
Test By:	Mike	Test mode:	Charging & Working mode
Test Frequency:	1 GHz ~ 6 GHz	Polarization:	Horizontal
Test Voltage:	AC 120/60Hz	Environment:	Temp: 22.2℃ Huni: 55%



NO.	Freq. [MHz]	Reading [dBµV/m]	Level [dBµV/m]	Factor [dB]	Limit [dBµV/m]	Margin [dB]	Trace	Polarity
1	2133.75	58.80	39.10	-19.70	74.00	34.90	PK	Horizontal
2	2159.37	50.67	31.02	-19.65	54.00	22.98	AV	Horizontal
3	3547.50	58.63	43.76	-14.87	74.00	30.24	PK	Horizontal
4	3578.12	51.13	36.24	-14.89	54.00	17.76	AV	Horizontal
5	5306.25	56.91	50.30	-6.61	74.00	23.70	PK	Horizontal
6	5308.12	49.22	42.63	-6.59	54.00	11.37	AV	Horizontal

Remark:

1. *Final Level = Receiver Read level + Factor.(Antenna Factor + Cable Loss – Preamplifier Factor).*
2. *The emission levels of other frequencies are lower than the limit 20dB and not show in test report.*