

JAPAN RADIO TEST REPORT

Client Information:

Applicant: DLT TECH KOREA CO.,LTD
Applicant add.: 26-1, Hongyureung-ro 212beon-gil, Namyangju-si, Gyeonggi-do, Republic of Korea

Product Information:

Product Name: Wireless mouse
Model No.: PTWM-02
Series Model: N/A
Brand Name: N/A

Standards: Item 19 of Article 2 Paragraph 1
MIC Notice No.88 Appendix No. 43

Prepared By:

Guangdong Asia Hongke Test Technology Limited

B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Date of Receipt: May 21, 2024

Date of Test: May 21, 2024~ Jun. 24, 2024

Date of Issue: Jun. 24, 2024

Test Result: Pass

This device has been tested and found to comply with the stated standard(s) above, which is (are) applicable only to the tested sample identified in the report.

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Reviewed by:

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2 Test Summary

TEST	TEST REQUIREMENT	LIMIT/SEVERITY	RESULT
Antenna Requirement	MIC Notice No.88 Appendix No. 43	Notice 88 Appendix 43,B-1 (1)&(2)	PASS
Test frequency	MIC Notice No.88 Appendix No. 43	Notice 88 Appendix 43, A-3	PASS
Frequency Error	MIC Notice No.88 Appendix No. 43	±50 PPM or less	PASS
Occupied Bandwidth	MIC Notice No.88 Appendix No. 43	83.5 MHz or less	PASS
Antenna Power	MIC Notice No.88 Appendix No. 43	3 mW /MHz or less Error + 20%; 10mW Error + 20%	PASS
Spurious Emission of Tx	MIC Notice No.88 Appendix No. 43	(1) Below 2387 MHz : -26dBm (2) 2387 to 2400 MHz : -16dBm (3) 2483.5 through 2496.5 MHz : -16dBm (4) Over 2496.5 MHz : -26dBm	PASS
Dwell Time	MIC Notice No.88 Appendix No. 43	less than 0.4sec	N/A
Interference prevention capability	MIC Notice No.88 Appendix No. 43	Notice 88 Appendix 43, 44, 45	PASS
RF accessibility	MIC Notice No.88 Appendix No. 43	Notice 88 Appendix 43, 44, 45	PASS
Spurious Emission of Rx	MIC Notice No.88 Appendix No. 43	(1) Below 1 GHz: -54dBm (2) 1GHz or higher: -47dBm	PASS

Remark:

EUT: In this whole report EUT means Equipment Under Test.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radio Frequency.

2.1 Measurement Uncertainty

The report uncertainty of measurement $y \pm U$, where expended uncertainty U is based on a standard uncertainty Multiplied by a coverage factor of $k=2$, providing a level of confidence of approximately 95%.

No.	Item	Uncertainty
1	Frequency Error / 99% & 90% Bandwidth	$\pm 0.85 \times 10^{-7}$
2	Antenna Power	± 0.70 dB
3	Spurious Emissions	± 0.80 dB
4	DC / AC Power Source	$\pm 1.4\%$

3 Test Facility

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

FCC-Registration No.: 251906 Designation Number: CN1376

Guangdong Asia Hongke Test Technology Limited has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

IC —Registration No.: 31737 CAB identifier: CN0165

The 3m Semi-anechoic chamber of Guangdong Asia Hongke Test Technology Limited has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 31737

A2LA-Lab Cert. No.: 7133.01

Guangdong Asia Hongke Test Technology Limited has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

3.1 Deviation from standard

None

3.2 Abnormalities from standard conditions

None

3.3 Test Location

Guangdong Asia Hongke Test Technology Limited

Address: B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street, Bao'an District, Shenzhen, Guangdong, China

Tel.: +86 0755-230967639 Fax.: +86 0755-230967639

4 General Information

Manufacturer:	DLT TECH KOREA CO.,LTD
Manufacturer Address:	26-1, Hongyureung-ro 212beon-gil, Namyangju-si, Gyeonggi-do, Republic of Korea
Product Name:	Wireless mouse
Model No.:	PTWM-02
Brand Name:	N/A
Series Model:	N/A
Operating Frequency	2402MHz to 2479 MHz
Type of Modulation:	GFSK
Number of Channels	16 Channels
Channel Separation:	1 MHz
Antenna Type	PCB Antenna
Antenna gain:	2.34dBi
Power Supply Range:	Mouse:DC1.5V from battery Dongle:DC5V
Normal Test Voltage:	The same as above
Hard Ware Version:	V1.0
Soft Ware Version:	V1.0
Model difference:	N/A

4.1 Test Location

All tests were performed at:

Guangdong Asia Hongke Test Technology Limited
B1/F, Building 11, Junfeng Industrial Park, Chongqing Road, Heping Community, Fuhai Street,
Bao'an District, Shenzhen, Guangdong, China

Tel.: +86 0755-230967639

Fax.: +86 0755-230967639

4.2 EUT Peripheral List

No.	Equipment	Manufacturer	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A

4.3 Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A	N/A

5 Equipment Used during Test

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date	Cal. Lab
1	Spectrum Analyzer	R&S	FSV40	101470	2023.09.08	2024.09.07	Guangzhou Lisai
2	Spectrum Analyzer	Keysight	N9020A	MY51280643	2023.09.08	2024.09.07	Guangzhou Lisai
3	Pro.Temp&Humi .chamber	MENTEK	MHP-150-1C	MAA08112501	2023.09.08	2024.09.07	Guangzhou Lisai
4	RF Automatic Test system	MW	MW100-RFCB	21033016	N/A	N/A	Guangzhou Lisai
5	Signal Generator	Agilent	N5182A	MY50143009	2023.09.08	2024.09.07	Guangzhou Lisai
6	Wideband Radio communication tester	R&S	CMW500	1201.0002K50	2023.09.08	2024.09.07	Guangzhou Lisai
7	DC power supply	ZHAOXIN	RXN-305D-2	28070002559	2023.09.08	2024.09.07	Guangzhou Lisai
8	Digital Phosphor Oscilloscope	Tektronix	TDS3012	B021220	2023.09.08	2024.09.07	Guangzhou Lisai

Note:

1. Calibration by the calibration agencies listed in the table correspond to paragraph 4 (ii) (c) of Article 24-2 in the Radio Law.
2. The above equipment is calibrated by Guangzhou Lishai Measurement and Testing Co., LTD

6 Test Results

6.1 Radio Technical Requirements Specification

Tabel 1: Radio Technical Requirements Specification for 2.4 GHz band wide-band low-power data communication system (Item 19 of Article 2-1)

Items	Technical standard
Assigned frequency or designated frequency	2,400-2,483.5MHz
Communication method	One-way communication, simplex, semi-duplex, or duplex operation of digital signal transmission including spread spectrum
Tolerance of frequency ($\times 10^{-6}$)	± 50 ppm
Tolerance of occupied bandwidth	FH : 83.5MHz or less FH + DS : 83.5MHz or less FH + OFDM : 83.5MHz or less OFDM(802.11n(HT40)) : 26-40MHz Others OFDM: 26MHz or less DSSS: 26MHz or less
Antenna power	Designated value (1) FH, FH+DS , FH+OFDM: 3mW/MHz (used in the range of 2427 - 2479.75 MHz) (2) OFDM , DS other than (1) 10mW/MHz (3) Other than (1) & (2) 10mW (4) OFDM OBW 26 - 40MHz: 5mW/MHz Tolerance:+20%
Antenna gain	1) 12.14 dBi or less in principle 2) In case of directional antenna (1) FH, FH+DS or FH+OFDM using 2427-2479.75 MHz EIRP \leq 16.91 dBm/MHz (2) OFDM or DS other than (1) EIRP \leq 22.14 dBm/MHz (3) Other than (1) and (2): 22.14 dBm or less (4) OFDM OBW 26 - 40MHz: 19.14dBm/MHz (5) Half-power angle of directional antenna (e) in case of the item 2): $e \leq 360/A$ (The A is 10 in maximum.)
Tolerance of spurious emission intensity	(1) Below 2387 MHz : 2.5 μ W (2) 2387 to 2400 MHz : 25 μ W (3) 2483.5 through 2496.5 MHz : 25 μ W (4) Over 2496.5 MHz : 2.5 μ W
Spreading bandwidth	DS,FH,FH+DS,FH+OFDM : 500kHz or more
Spreading rate of spectrum	For DS system;(Spreading bandwidth) / (Frequency corresponding to transmission rate) ≥ 5
Limit of secondary radiated emissions	(1) Below 1 GHz : 4 nW (2) 1 GHz or higher : 20 nW
Interference prevention function	Shall have the function of automatic transmission and reception of identification sign.
Structure	Shall be of the structure that the RF and modulator sections excluding antenna cannot easily be opened.
Note	DS: Direct spread FH: Frequency hopping OFDM: Orthogonal frequency division multiplexing

6.2 E.U.T. Test Conditions

Power supply:	<p>The input voltage of the EUT RF unit circuit does not meet the output voltage limitation ($\pm 1\%$) and is limited by the input voltage fluctuation ($\pm 10\%$).</p> <p>Pre-test the EUT in all voltage mode at the DC 1.65V, DC 1.5V and DC 1.35V and conducted to determine the worst-case mode, only the worst-case results (DC 1.5V) are recorded in this report.</p>
Temperature:	23.55 °C
Humidity:	52.36 % RH
Atmospheric Pressure:	1000 -1010 mbar
Test frequencies:	<p>If the EUT can be set to 3 of more different (carrier) frequencies in 1 allocated band, testing shall be performed using the Lowest, Middle and the Highest frequency (L, M and H). If there are 2 or fewer frequencies, testing shall be performed with the available frequencies.</p>
Parameters of test software setting	<p>During testing channel & power controlling software provided by the manufacturer was used to control the operating channel as well as the output power level.</p>

Test software Version	FCC_test_tool		
Frequency	2402 MHz	2437 MHz	2479 MHz
Parameters	Default	Default	Default

EUT channels and frequencies list:

For DSSS:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
1	2402	11	2456		
2	2408	12	2460		
3	2417	13	2468		
4	2419	14	2474		
5	2421	15	2478		
6	2423	16	2479		
7	2428				
8	2437				
9	2446				
10	2451				

Test frequencies are the lowest channel: 1 channel(2402 MHz) and highest channel: 16 channel(2479 MHz)

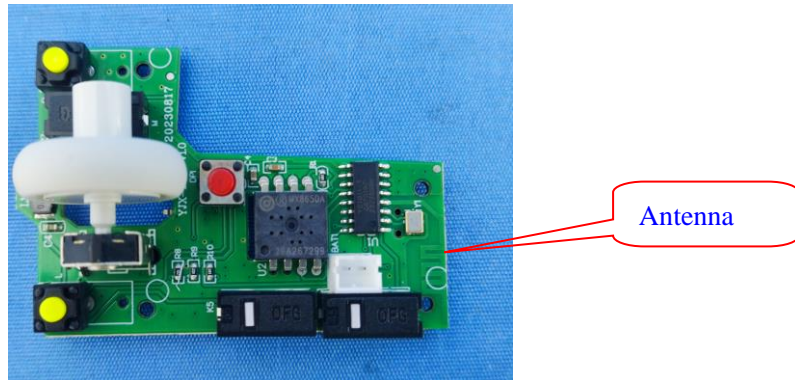
6.3 Antenna Requirement

Standard requirement

Applicable for equipment with an antenna terminal, including testing terminals) If an antenna connector is available, all relevant tests will be carried out conducted. If not, tests will be carried out in an anechoic room or with a suitable test-fixture.

EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the main antenna is 2.34dBi.



Result: All relevant tests will be carried out conducted.

6.4 Interference Prevention Function

The device consists of the Integrated antenna and 2.4 GHz module; Component module also can use the protocol function to protect interference come from outside.

Test Procedure:

The measuring method was according to MIC Notice No.88 Appendix No.43.

- A. Transmit the assigned identification code from the radio equipment.
- B. Confirm the identification code received by the demodulator.

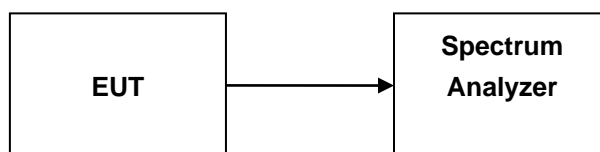
Note: Radio interference prevention capability was conformed.



Test result: The unit does meet the requirements.

6.5 Frequency Error

Test Requirement:	Item 19 of Article 2-1
	Tolerance of frequency: $\pm 50 \times 10^{-6}$
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Test the EUT in transmitting mode without modulation.
Test Configuration:	



Test Procedure:

1. Test Conditions:
Frequency Counter or Spectrum Analyzer is used for measurement.
2. EUT conditions:
EUT have transmitted continuous maximum power
3. Spectrum Analyzer conditions:
Frequency: Test Frequency
Span 4MHz
RBW 100 kHz (Modulation OFF for FHSS; Modulation ON for DSSS),
VBW 100 kHz (Modulation OFF for FHSS; Modulation ON for DSSS),
Sweep Time Auto
Detector mode Positive peak
Indication mode Max hold

Test result:

Please refer to Appendix B

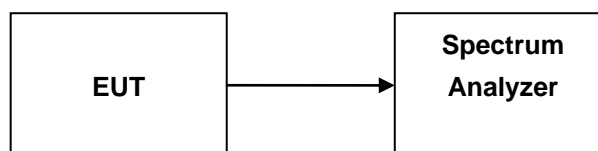
Note: The nominal frequency shall be confirmed by the applicant and test lab.

Note: The nominal frequency shall be confirmed by the applicant and test lab.

6.6 Occupied Bandwidth (99%)

Test Requirement:	Item 19 of Article 2-1 83.5MHz or less(FHSS) 26 MHz or less(others)
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Test Conditions:
Spectrum Analyzer is used for measurement.
2. EUT conditions:
EUT have transmitted continuous maximum power
3. Spectrum Analyzer conditions:
Frequency: Test Frequency
Span: 6 MHz(FHSS), 3MHz(DSSS)
RBW: 300kHz(FHSS), 300 kHz(DSSS)
VBW: 300k Hz(FHSS), 300 kHz(DSSS)
Sweep Time Auto
detector mode Positive peak
Indication mode Max hold
OBW 99%

Test result:

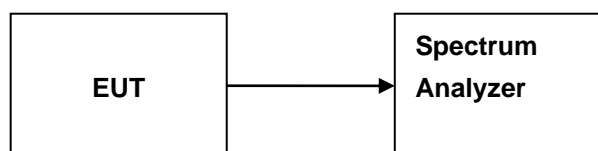
Please refer to Appendix B

Test result: The unit does meet the requirements.

6.7 Antenna Power

Test Requirement:	Item 19 of Article 2-1 3mW/MHz or less(FHSS) 10mW and less(DSSS)
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Test Conditions:

Power meter or Spectrum Analyzer is used for measurement.

2. EUT conditions:

EUT have transmitted continuous maximum power

3. Spectrum Analyzer conditions:

Frequency: Test Frequency

Span: 2 MHz(for DSSS)

RBW: 1 MHz

VBW: 1 MHz

Sweep Time Auto

detector mode Positive peak

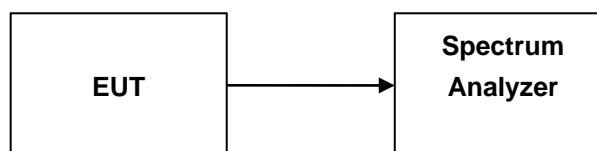
Indication mode Max hold

Test result:

Please refer to Appendix B

6.8 Spurious Emissions of Tx

Test Requirement:	Item 19 of Article 2-1 (1) Below 2387 MHz : 2.5 μ W/MHz (2) 2387 to 2400 MHz : 25 μ W/MHz (3) 2483.5 through 2496.5 MHz : 25 μ W/MHz (4) Over 2496.5 MHz : 2.5 μ W/MHz
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test Configuration:	



Test Procedure:

1. Test Conditions:
Spectrum Analyzer is used for measurement.
2. EUT conditions:
EUT have transmitted continuous maximum power
3. Spectrum Analyzer conditions:
Step 1
All spurious are measured from 30 MHz to 13 GHz by peak mode.
Step 2
IF the value measured by Step1 is 2 Db or less, measure in average mode.
Test setup for Step 1:
Frequency: 30 MHz – 1000 MHz,
RBW 100 kHz (Below 1000 MHz), VBW 100 kHz (Below 1000 MHz)
1000 MHz – 2400 MHz, 2483.5 MHz –13 GHz
RBW 1 MHz (above 1000 MHz), VBW 1 MHz (above 1000 MHz)
Sweep Time Auto
detector mode Positive peak, Indication mode Max hold
Test setup for Step 2:
Frequency: Spurious Frequency
RBW 100 kHz (Below 1000 MHz), VBW 100 kHz (Below 1000 MHz)
RBW 1 MHz (above 1000 MHz), VBW 1 MHz (above 1000 MHz)
Sweep Time Auto,
Detector mode Sample, Indication mode Max hold

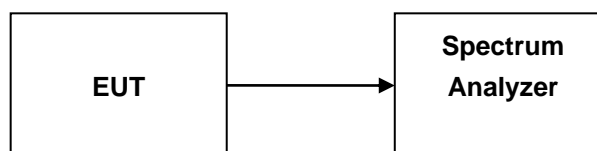
Test result:

Please refer to Appendix B

6.9 Dwell Time

Test Requirement:	Item 19 of Article 2-1 less than 0.4sec
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode

Test Configuration:



Test Procedure:

- Test Conditions:
Spectrum Analyzer is used for measurement.
- EUT conditions:
EUT have transmitted continuous maximum power
- Spectrum Analyzer conditions:
Frequency: Test Frequency (fixed hopping frequency)
Span 0 Hz
RBW 1 MHz
VBW 1 MHz
Sweep Time EUT condition
Trigger Video Trigger
Measures the Transmission time of 1 burst (sec)
Measures the Burst cycle (sec)
- Calculation procedure :
Dwell time = $(0.4(s) \times [\text{spreading rate}] \times [\text{Transmission time of 1 burst}(s)]) / ([\text{burst cycle}(s)] \times [\text{No. of hopping channel}])$
Note:
* Spreading rate = $[\text{Spread bandwidth (actual measurement value)}] / [\text{Transmission rate}]$

Test result:

N/A

6.10 RF Accessibility

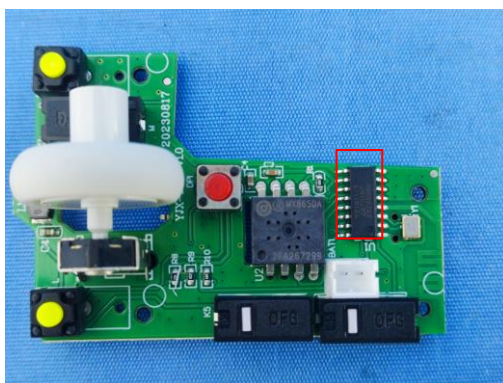
Standard requirement

Article 2, Item (19) Notice 88 Appendix 43, 44, 45

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

The Product cannot be manipulated since it is a highly integrated design in IC and has no accessible adjustable components. It is not easily changed by users. Please refer to following for photo for details.

TX

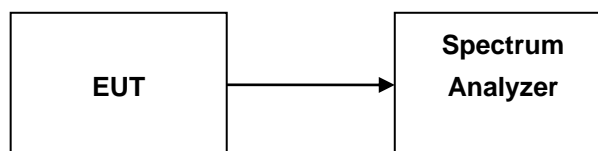


RX



6.11 Spurious Emissions of Rx

Test Requirement:	Item 19 of Article 2-1 (1) Below 1 GHz : 4 nW or less (2) 1 GHz and over : 20 nW or less
Temperature:	23.0 °C
Humidity:	55 % RH
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.
Test Configuration:	



Test Procedure:

1. Test Conditions: Spectrum Analyzer is used for measurement.
2. EUT conditions:
EUT have transmitted continuous maximum power
3. Spectrum Analyzer conditions:
 - Step 1
All spurious are measured from 30 MHz to 13 GHz by peak mode.
 - Step 2
IF the value measured by Step1 is 2 dB or less, measure in average mode.

Test setup for Step 1:

Frequency: 30 MHz – 1000 MHz , 1GHz –13 GHz
 RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
 VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
 Sweep Time Auto
 detector mode Positive peak
 Indication mode Max hold

Test setup for Step 2:

Frequency: Spurious Frequency
 Span 0 Hz
 RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
 VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
 Sweep Time Auto
 detector mode Sample
 Indication mode Max hold

Test result:

Please refer to Appendix B

Test result: The unit does meet the requirements.

7 Photographs

7.1 EUT Constructional Details

Refer to *Appendix EUT Photo*.

****End of report****