

## 2.4GHz Wideband Low Power Data Communication System Test Report

Product Name	Gaming Mouse
Model No.	P508

Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan

Date of Receipt	Jan. 30, 2019
Issued Date	Apr. 24, 2019
Report No.	1910347R-RFJPP24V00
Report Version	V1.0

The test results relate only to the samples tested.

The test results shown in the test report are traceable to the national/international standard through the calibration report of the equipment and evaluated measurement uncertainty herein.

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## Test Report

Issued Date : Apr. 24, 2019

Report No. : 1910347R-RFJPP24V00



Product Name	Gaming Mouse
Applicant	ASUSTeK COMPUTER INC.
Address	4F, No. 150, Li-Te Rd., Peitou, Taipei, Taiwan
Manufacturer	ASUSTeK COMPUTER INC.
Model No.	P508
EUT Rated Voltage	DC 3V by Battery
EUT Test Voltage	DC 3V by Battery
Trade Name	ASUS
Test Method	Public notice of MIC No.88 test method of specified radio equipment (January 26, 2004) Annex43. Article 2 paragraph 1 item 19
Test Result	Complied

Documented By

:

Jinn Chen

( Senior Adm. Specialist / Jinn Chen )

Tested By

:

Droll Yang

( Assistant Engineer / Droll Yang )

Approved By

:



( Director / Vincent Lin )

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## 1. GENERAL INFORMATION

### 1.1. EUT Description

Product Name	Gaming Mouse
Trade Name	ASUS
Model No.	P508
SERIAL NUMBER	None
Frequency Range	2402-2480MHz
Number of Channels	V4.0: 40CH
Type of Modulation	V4.0: GFSK (1Mbps)
Antenna Type	Multilayer Chip Antenna
Antenna Gain	Refer to the table "Antenna List"
Channel Control	Auto
Declared Output Power	0.05 mW

#### Antenna List

No.	Manufacturer	Part No.	Antenna Type	Peak Gain
1	GainForce Technology	690800003300	Multilayer Chip Antenna	0.5dBi for 2.4 GHz

## Center Frequency of Each Channel: (For V4.0)

Channel	Frequency	Channel	Frequency	Channel	Frequency	Channel	Frequency
Channel 00:	2402 MHz	Channel 10:	2422 MHz	Channel 20:	2442 MHz	Channel 30:	2462 MHz
Channel 01:	2404 MHz	Channel 11:	2424 MHz	Channel 21:	2444 MHz	Channel 31:	2464 MHz
Channel 02:	2406 MHz	Channel 12:	2426 MHz	Channel 22:	2446 MHz	Channel 32:	2466 MHz
Channel 03:	2408 MHz	Channel 13:	2428 MHz	Channel 23:	2448 MHz	Channel 33:	2468 MHz
Channel 04:	2410 MHz	Channel 14:	2430 MHz	Channel 24:	2450 MHz	Channel 34:	2470 MHz
Channel 05:	2412MHz	Channel 15:	2432 MHz	Channel 25:	2452 MHz	Channel 35:	2472 MHz
Channel 06:	2414 MHz	Channel 16:	2434 MHz	Channel 26:	2454 MHz	Channel 36:	2474 MHz
Channel 07:	2416 MHz	Channel 17:	2436 MHz	Channel 27:	2456 MHz	Channel 37:	2476 MHz
Channel 08:	2418 MHz	Channel 18:	2438 MHz	Channel 28:	2458 MHz	Channel 38:	2478 MHz
Channel 09:	2420 MHz	Channel 19:	2440 MHz	Channel 29:	2460 MHz	Channel 39:	2480 MHz

## Note:

1. The EUT is a Gaming Mouse with built-in Bluetooth V4.0 transceiver.
2. DEKRA has verified the construction and function in typical operation. All the test modes were carried out with the EUT in normal operation, which was shown in this test report and defined as:

Test Mode	Mode 1: Transmit - BLE
	Mode 2: Receive - BLE



## 1.2. Operation Description

The EUT is a Gaming Mouse with built-in Bluetooth V4.0 transceiver. The number of the channels is 40 in Bluetooth V4.0 mode. This device is GFSK(1Mbps) of transmitting speed and modulation. The antenna is multilayer chip antenna and provides diversity function to improve the receiving function. Frequency hopping spread spectrum systems are not required to employ all available hopping channels during each transmission. The transmitter is presented with a continuous data stream. In addition, a system employing short transmission bursts must comply with the definition of a frequency hopping system and must distribute its 40 channels.

### 1.3. EUT Exercise Software

- (1) Press the test button.
- (2) Configure the test mode and the test channel.
- (3) Start the continuous Transmit.
- (4) Verify that the EUT works properly.

### 1.4. Parament of test software setting

The RF output power selection is for the setting of RF output power expected by the customer and is going to be fixed on the firmware of the final end product.

#### BLE mode

Test Software	N/A		
Frequency	2402MHz	2440MHz	2480MHz
BLE(GFSK)	default	default	default

### 1.5. Test Conditions

Voltage Test Item	Test Voltage	Voltage meter reading value (RF Chip U1 pin 48)
Nominal Voltage	DC 3V	1.9V DC
Highest Voltage	DC 3.3V	1.9V DC
Lowest Voltage	DC 2.7V	1.9V DC

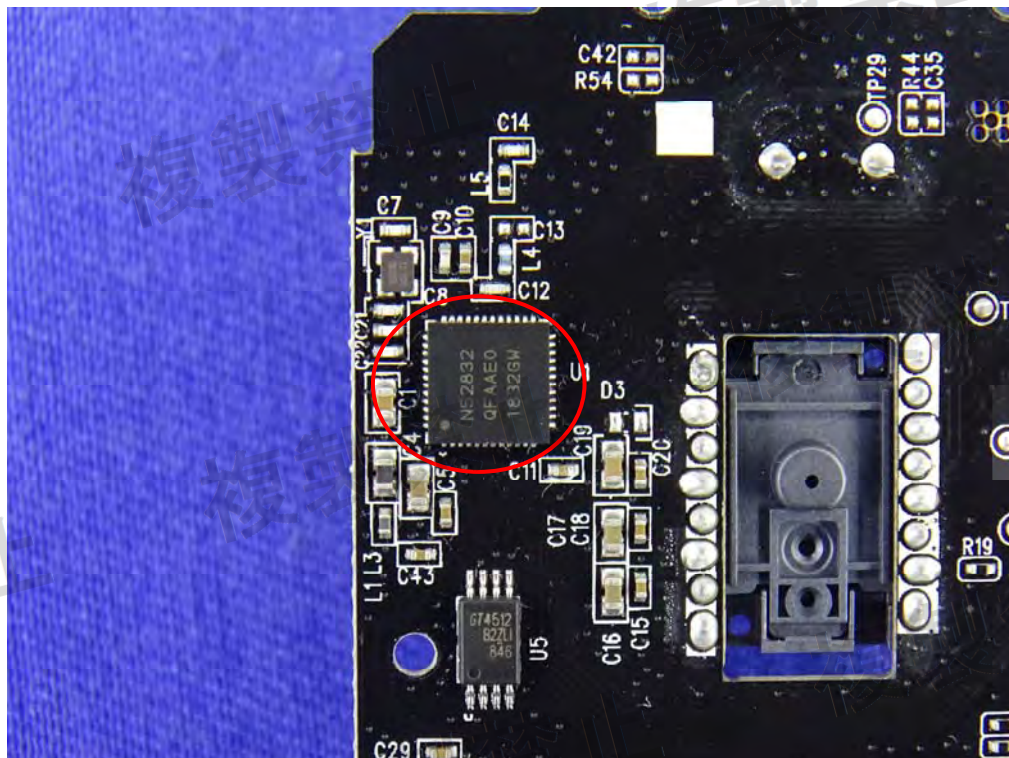
Note:

1. The Voltage supply for RF Chip U67 pin 19 is 1.9V DC.
2. The internal supply gives a fluctuation value less than 1 % (**Around 0% from max. to min.**)

Temperature	25 °C
Relative Humidity	55 %

### 1.6. RF and IF section must be tamper requirement

Requirement	Comments	Result
RF, IF and Modulation section must be tamper	<input type="checkbox"/> Use Special Screw <input type="checkbox"/> Metal Shielding is Soldered (Please see Attachment: EUT Detailed Photographs) <input type="checkbox"/> Use Ball Grid Array (BGA)	--
	<input checked="" type="checkbox"/> RF module/Chip pin >10 <input checked="" type="checkbox"/> RF module/Chip pins distance <1.5mm (Please see mechanism photograph)	Complete





### 1.7. Test Facility

Ambient conditions in the laboratory:

Items	Required (JIS Z8703)	Actual
Temperature (°C)	5-35	18-28
Humidity (%RH)	45 - 85%	50-65
Barometric pressure (mbar)	860-1060	950-1000

The related certificate for our laboratories about the test site and management system can be downloaded from DEKRA Testing and Certification Co., Ltd. Web Site:

<http://www.dekra.com.tw/english/about/certificates.aspx?bval=5>

The address and introduction of DEKRA Testing and Certification Co., Ltd. laboratories can be founded in our Web site: [http://www.dekra.com.tw/index\\_en.aspx](http://www.dekra.com.tw/index_en.aspx)

Site Name: DEKRA Testing and Certification Co., Ltd.

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New Taipei City 24457, Taiwan.

TEL: 886-2-2602-7968 / FAX : 866-2-2602-3286

E-Mail : [info.tw@dekra.com](mailto:info.tw@dekra.com)

## 1.8. List of Test Item and Equipment

### For Conducted measurements /ASR4

	Equipment	Manufacturer	Model No.	Serial No.	Calibrated	Cal. Method	Cali. Data	Due. Data
X	Spectrum Analyzer	R&S	FSV30	103464	ETC	*(c)	2019.01.25	2020.01.24
X	Power Meter	Anritsu	ML2496A	1548003	ETC	*(c)	2018.12.19	2019.12.18
X	Power Sensor	Anritsu	MA2411B	1531024	ETC	*(c)	2018.12.19	2019.12.18
X	Power Sensor	Anritsu	MA2411B	1531025	ETC	*(c)	2018.12.19	2019.12.18
	Bluetooth Tester	R&S	CBT	101238	ETC	*(c)	2019.01.21	2020.01.20

Note:

1. All equipments are calibrated every one year.
2. The test instruments marked with "X" are used to measure the final test results.
3. Test Software version : DEKRA Conduction Test System V9.0.1
4.
  - a) Calibration conducted by the National Institute of Information and Communications Technology(NICT) (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1)
  - b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992)
  - c) Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted by the NICT or a designated agency under Article 102-18 paragraph (1).
  - d) Calibration conducted by using other equipment that listed above from a) to c).

## 2. Output Power and Output Power Tolerance

### 2.1. Test Setup



### 2.2. Limits

10mW (10dBm)

### 2.3. Test Procedure

Output power is measured using the power meter and record the value.

### 2.4. Uncertainty

$\pm 0.86$  dB

## 2.5. Test Result of Output Power and Output Power Tolerance

Product : Gaming Mouse  
Test Item : Output Power  
Test Date : 2019/04/12  
Test Mode : Mode 1: Transmit - BLE

Maximum Antenna Gain= 0.5 dBi				
Frequency (MHz)	Real Value (dBm)	Limit (dBm)	Real Value (EIRP) (dBm)	Limit (EIRP) (dBm)
2402	-13.73	10	-13.23	12.14
2440	-13.78	10	-13.28	12.14
2480	-13.92	10	-13.42	12.14

Real Value (EIRP) = Real Value + Antenna Gain

Test Result	PASS
-------------	------

Product : Gaming Mouse  
Test Item : Output Power Tolerance  
Test Date : 2019/04/12  
Test Mode : Mode 1: Transmit - BLE

Frequency (MHz)	Declared Output Power (mW)	Output Power (mW)	Tolerance (%)	Limit (%)
2402	0.050	0.042	-15.27	+20% to -80%
2440	0.050	0.042	-16.24	+20% to -80%
2480	0.050	0.041	-18.90	+20% to -80%

Note: Deviation = (Output Power - Declared Output Power) / Declared Output Power \* 100%

Test Result	PASS
-------------	------



### 3. Occupied Bandwidth

#### 3.1. Test Setup



#### 3.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) A measurement instrument with an integrated 99% power bandwidth function may be used to automate the test process.
- (c) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slow, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (d) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

#### 3.3. Limits

$\leq 26$  MHz for DSSS&OFDM,  $\leq 83.5$  MHz for FHSS,  
 $\leq 38$  MHz for OFDM(Wide-band)

#### 3.4. Uncertainty

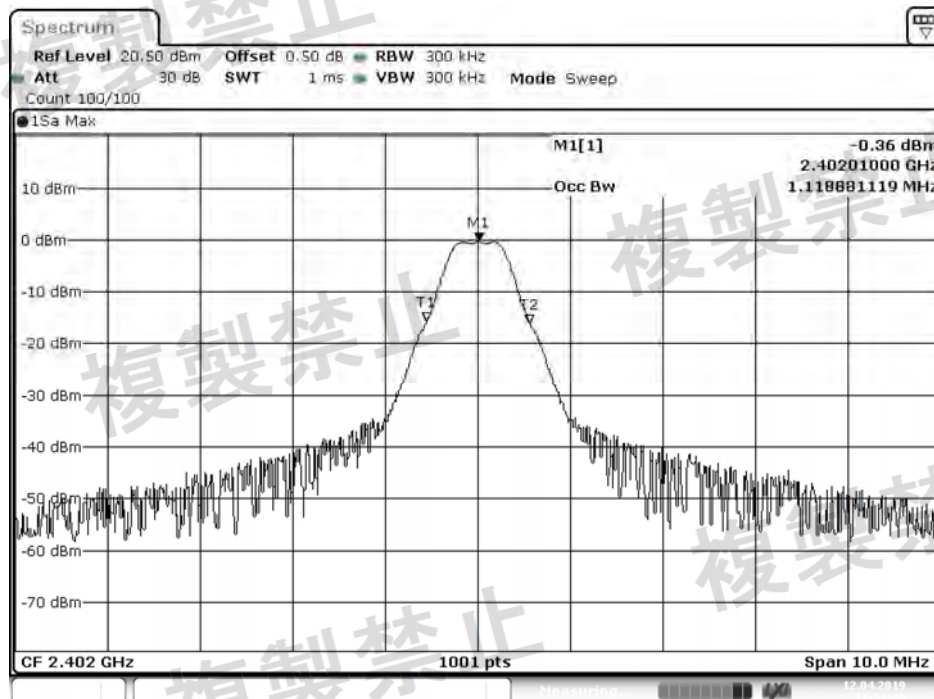
$\pm 279.2$ Hz

### 3.5. Test Result of Occupied Bandwidth

Product : Gaming Mouse  
 Test Item : Occupied Bandwidth  
 Test Mode : Mode 1: Transmit - BLE

Frequency (MHz)	Reading Value (MHz)	Limit (MHz)
2402	1.119	$\leq 26$
2440	1.119	$\leq 26$
2480	1.119	$\leq 26$

2402MHz



Date: 12.APR.2019 13:51:47

**Spectrum**

Ref Level 20.50 dBm Offset 0.50 dB RBW 300 kHz  
 Att 30 dB SWT 1 ms VBW 300 kHz Mode Sweep

Count 100/100

● 1Sa Max

M1[1]  
 Occ Bw  
 M1  
 T1  
 T2

-0.65 dBm  
 2.44017000 GHz  
 1.118881119 MHz

CF 2.44 GHz 1001 pts Span 10.0 MHz

**Spectrum**  
 Ref Level 20.50 dBm Offset 0.50 dB RBW 300 kHz  
 Att 30 dB SWT 1 ms VBW 300 kHz Mode Sweep  
 Count 100/100  
 1Sa Max

M1[1]  
 -0.96 dBm  
 2.48000000 GHz  
 1.118881119 MHz

Occ Bw

M1  
 T1  
 T2

CF 2.48 GHz 1001 pts Span 10.0 MHz

# PASS

#### 4. Frequency Tolerance

##### 4.1. Test Setup



##### 4.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slow, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

##### 4.3. Limits

$\leq 50$  ppm

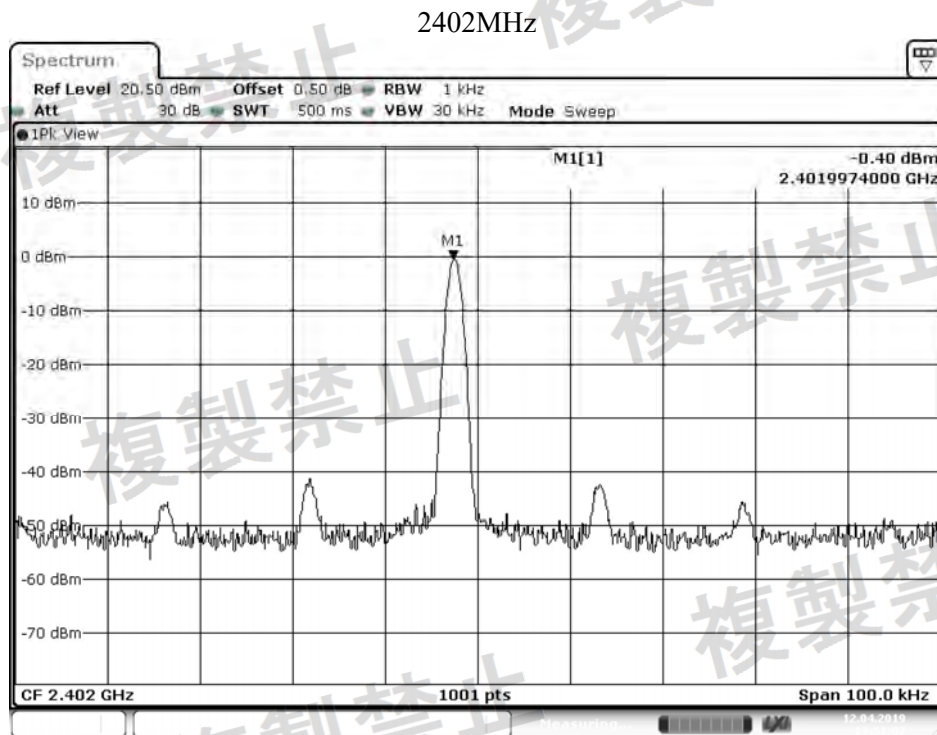
##### 4.4. Uncertainty

$\pm 279.2\text{Hz}$

#### 4.5. Test Result of Frequency Tolerance

Product : Gaming Mouse  
 Test Item : Frequency Tolerance  
 Test Mode : Mode 1: Transmit - BLE

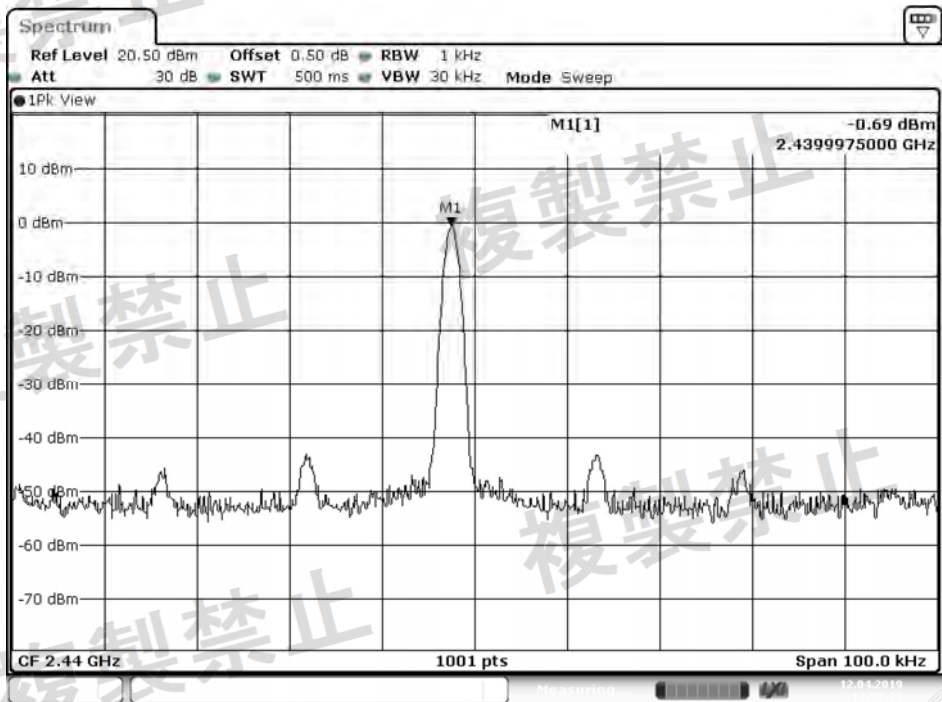
Frequency (MHz)	Reading Value (MHz)	Tolerance (ppm)	Limit (ppm)
2402	2401.99	-4.16320	$\leq 50$
2440	2439.99	-4.09836	$\leq 50$
2480	2479.99	-4.03226	$\leq 50$



Date: 12.APR.2019 13:51:07

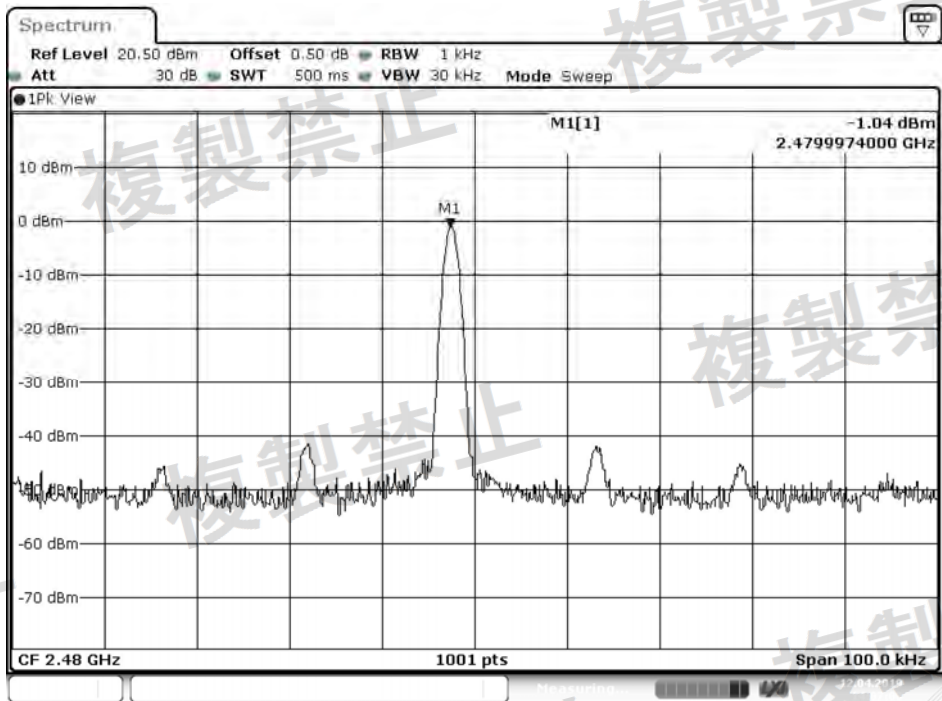


2440MHz



Date: 12.APR.2019 13:58:39

2480MHz



Date: 12.APR.2019 14:07:00

Test Result

PASS

## 5. Transmitter Spurious Emissions

### 5.1. Test Setup



### 5.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slow, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

### 5.3. Limits

- $\leq 2.5\mu\text{W}$  for 30 – 2387 MHz
- $\leq 25\mu\text{W}$  for 2387 – 2400 MHz
- $\leq 25\mu\text{W}$  for 2483.5 – 2496.5 MHz
- $\leq 2.5\mu\text{W}$  for 2496.5 – 12750 MHz

### 5.4. Uncertainty

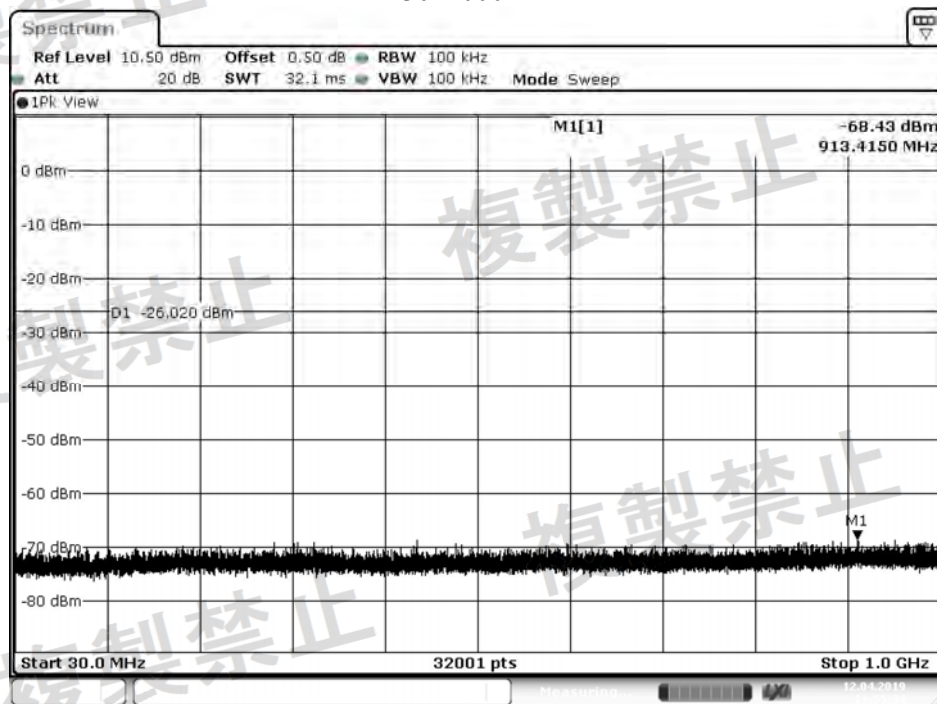
$\pm 1.23\text{dB}$

### 5.5. Test Result of Transmitter Spurious Emissions

Product : Gaming Mouse  
Test Item : Transmitter Spurious Emissions  
Test Mode : Mode 1: Transmit - BLE 2402MHz

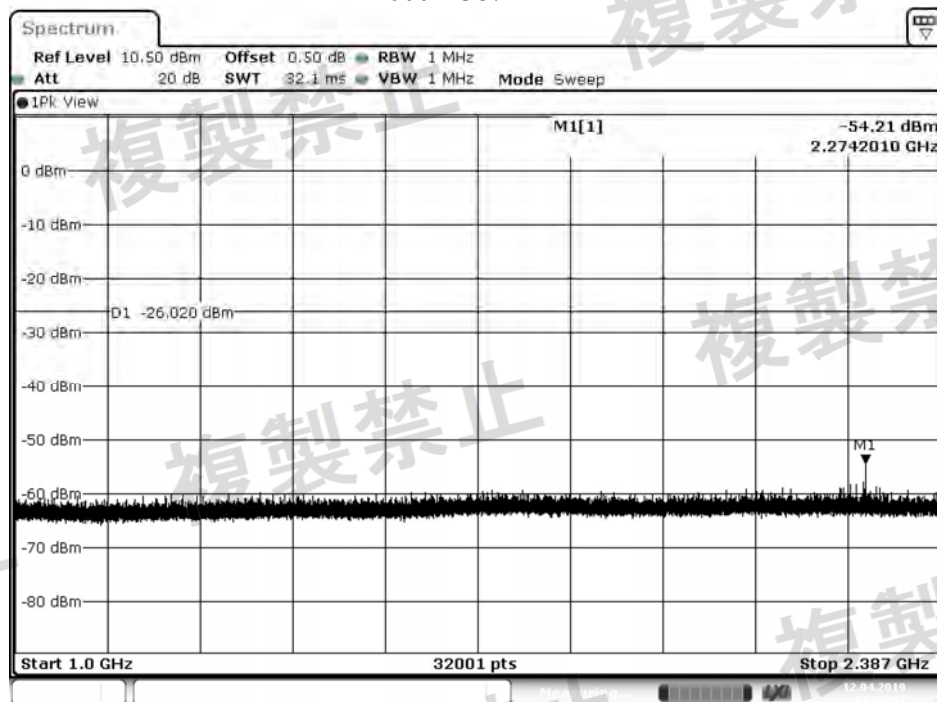
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-68.43	-26 (2.5uW)
1000 – 2387	-54.21	-26 (2.5uW)
2387 – 2400	-29.54	-16 (25uW)
2483.5 – 2496.5	-55.41	-16 (25uW)
2496.5 – 8000	-49.49	-26 (2.5uW)
8000 – 12750	-57.01	-26 (2.5uW)

30–1000MHz



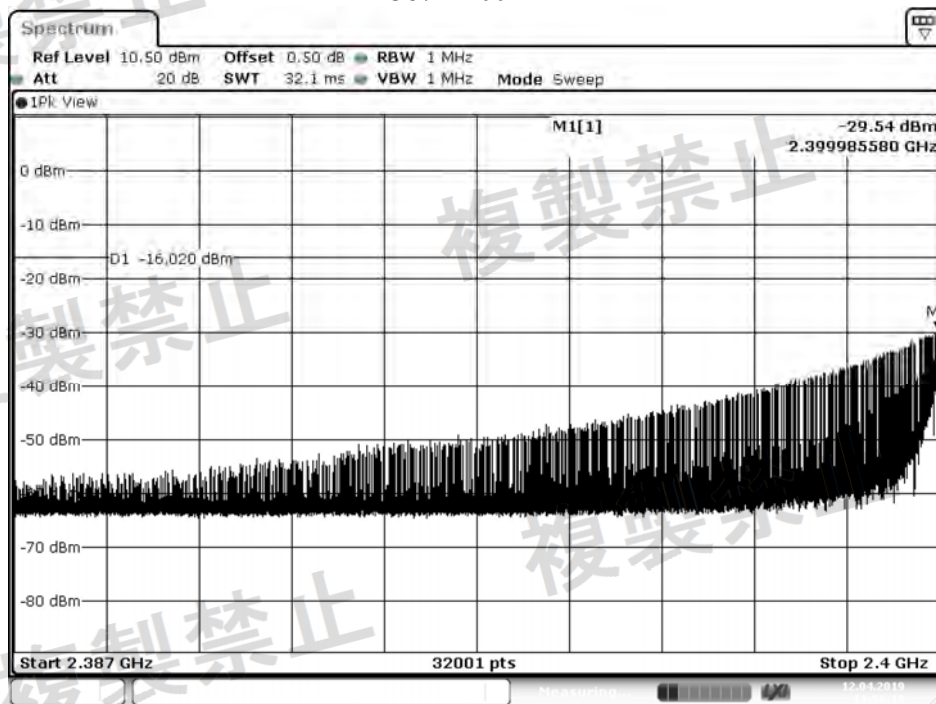
Date: 12.APR.2019 13:55:35

1000–2387MHz



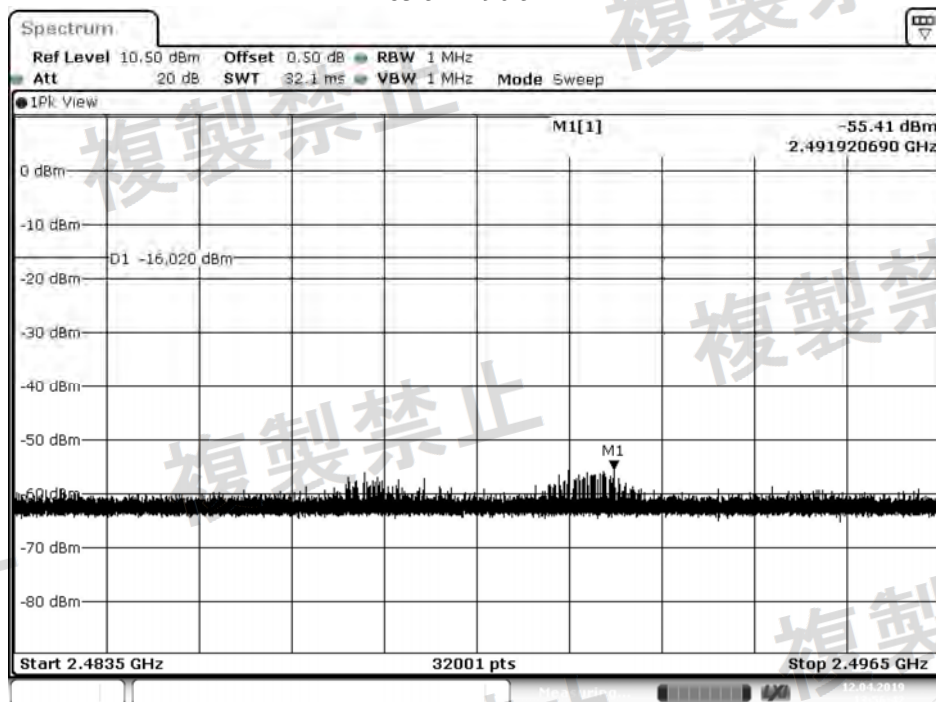
Date: 12.APR.2019 13:55:57

2387–2400 MHz



Date: 12.APR.2019 13:56:20

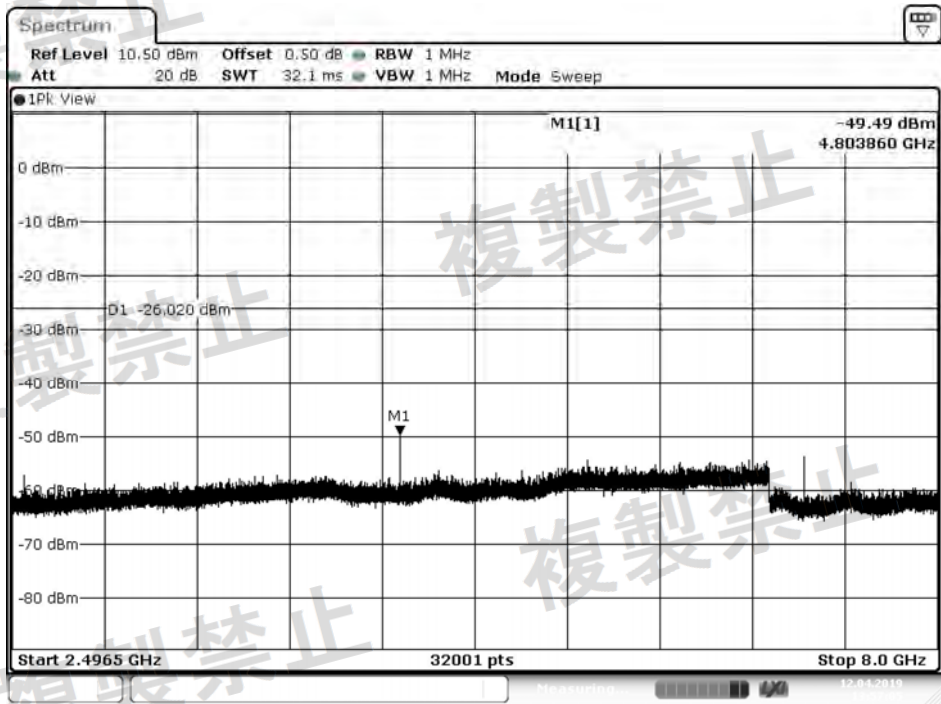
2483.5–2496.5MHz



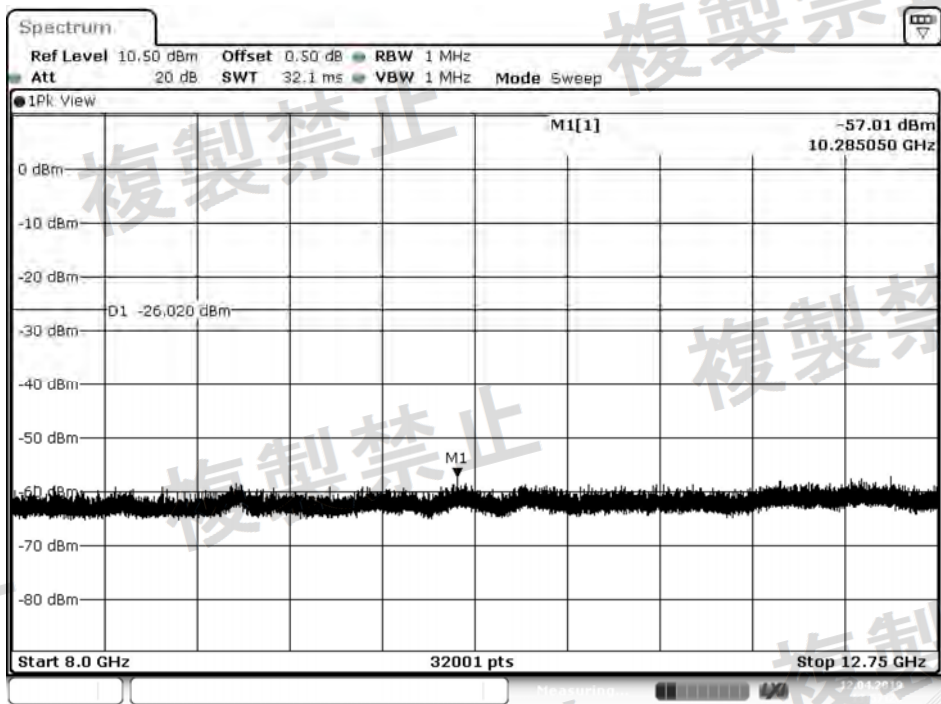
Date: 12.APR.2019 13:56:42



2496.5–8000MHz



8000–12750MHz



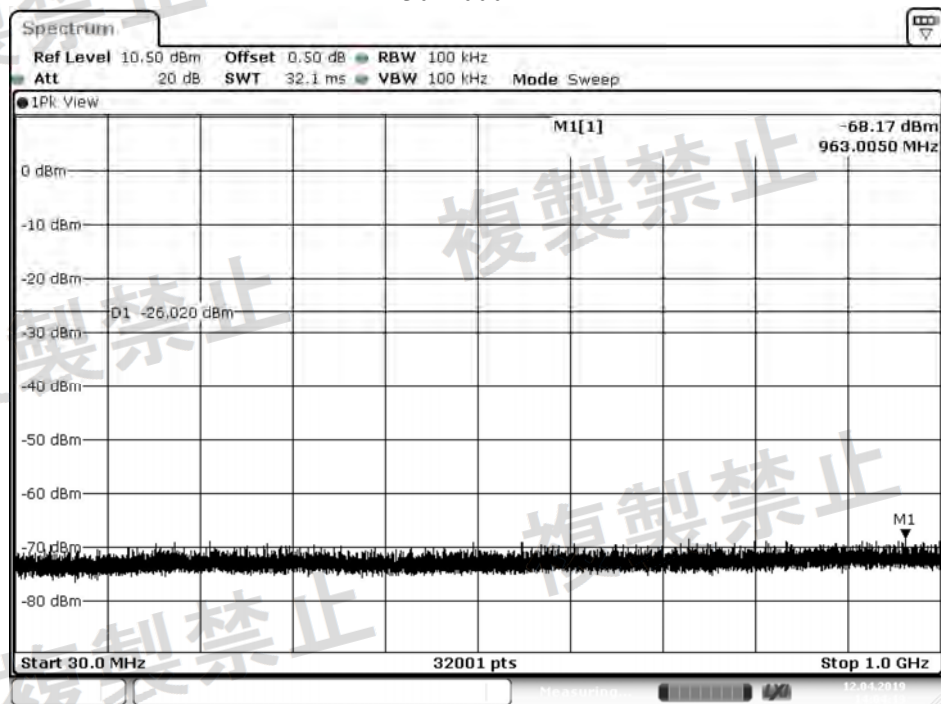
Test Result

PASS

Product : Gaming Mouse  
Test Item : Transmitter Spurious Emissions  
Test Mode : Mode 1: Transmit - BLE 2440MHz

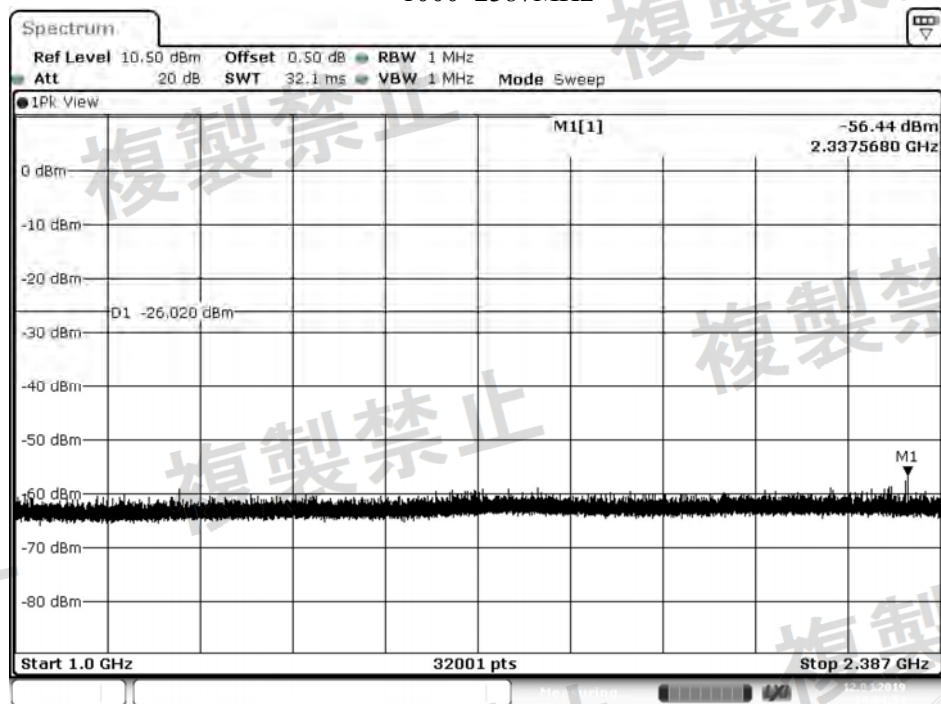
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-68.17	-26 (2.5uW)
1000 – 2387	-56.44	-26 (2.5uW)
2387 – 2400	-58.36	-16 (25uW)
2483.5 – 2496.5	-57.37	-16 (25uW)
2496.5 – 8000	-52.07	-26 (2.5uW)
8000 – 12750	-57.30	-26 (2.5uW)

30–1000MHz



Date: 12.APR.2019 14:04:13

1000–2387MHz



Date: 12.APR.2019 14:04:35

**Spectrum**

Ref Level 10.50 dBm Offset 0.50 dB RBW 1 MHz  
 Att 20 dB SWT 32.1 ms VBW 1 MHz Mode Sweep

● 1Pk View

M1[1] -58.36 dBm 2.388654000 GHz

D1 -16.020 dBm

M1

Start 2.387 GHz 32001 pts Stop 2.4 GHz

Measured: 12/12/2015

Spectrum

Ref Level 10.50 dBm Offset 0.50 dB RBW 1 MHz  
Att 20 dB SWT 32.1 ms VBW 1 MHz Mode Sweep

● 1Pk View

M1[1] -57.37 dBm  
2.491202060 GHz

D1 -16.020 dBm

M1

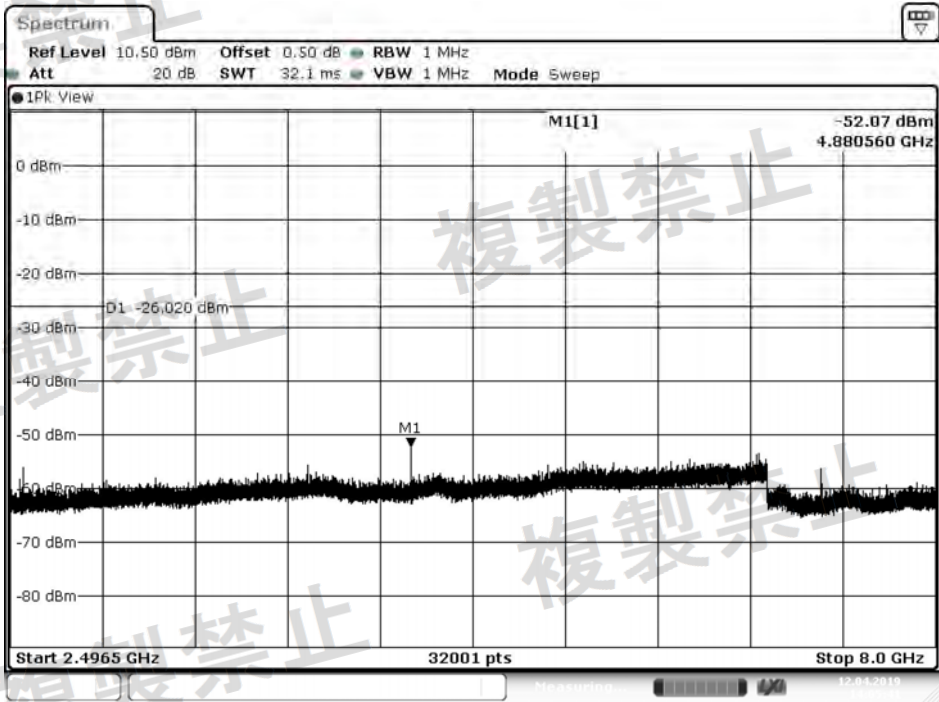
Start 2.4835 GHz 32001 pts Stop 2.4965 GHz

Measuring

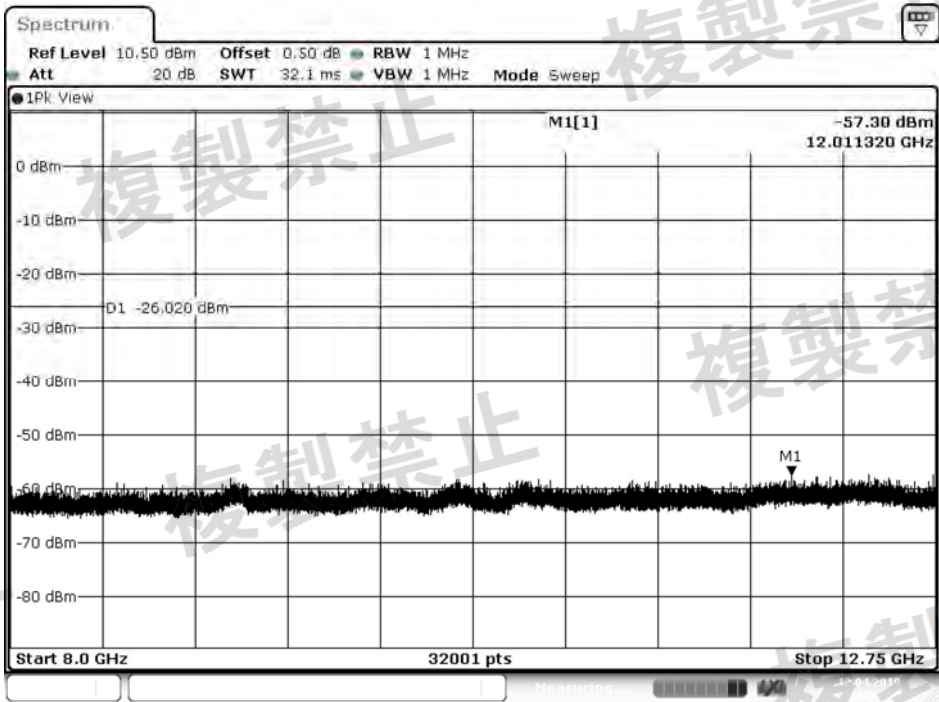
Page: 27 of 56



2496.5–8000MHz



8000–12750MHz



Test Result

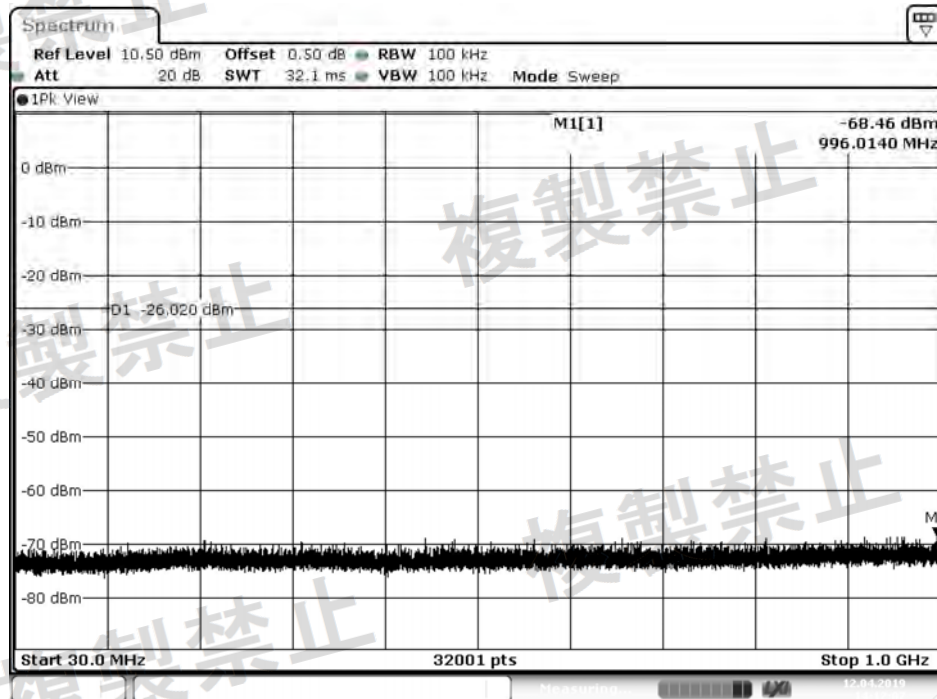
PASS



Product : Gaming Mouse  
Test Item : Transmitter Spurious Emissions  
Test Mode : Mode 1: Transmit - BLE 2480MHz

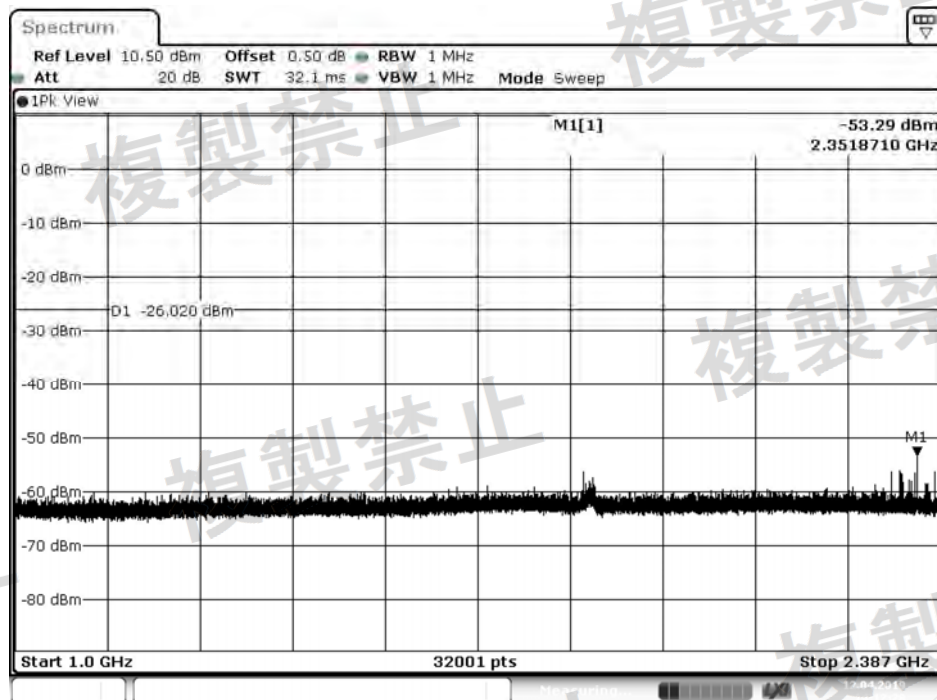
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-68.46	-26 (2.5uW)
1000 - 2387	-53.29	-26 (2.5uW)
2387 - 2400	-55.47	-16 (25uW)
2483.5 - 2496.5	-35.87	-16 (25uW)
2496.5 - 8000	-53.35	-26 (2.5uW)
8000 - 12750	-57.21	-26 (2.5uW)

30–1000MHz



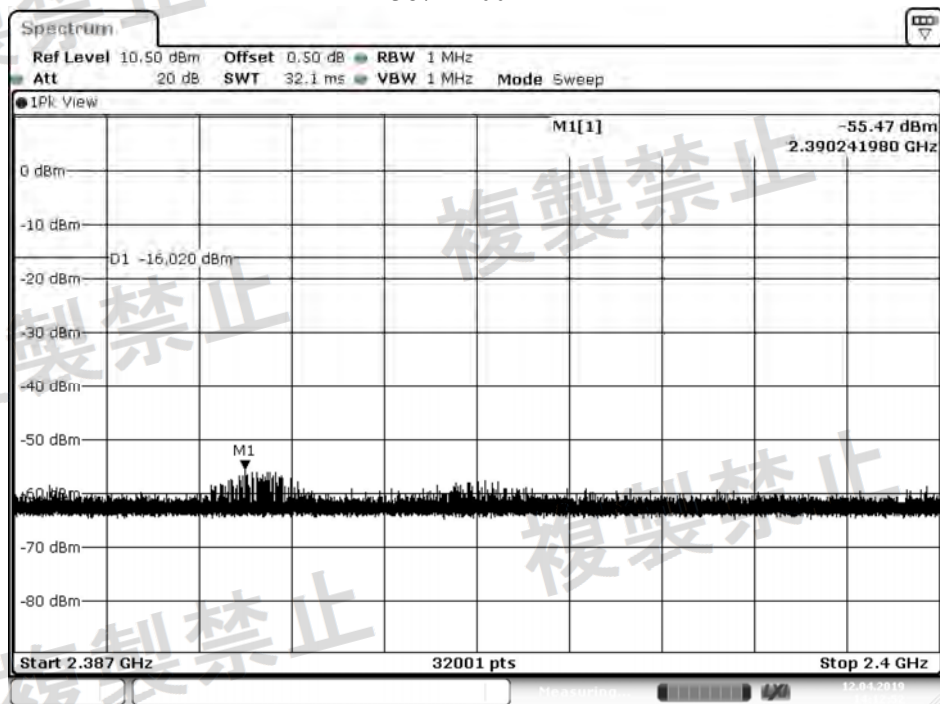
Date: 12 APR 2019 14:12:07

1000–2387MHz



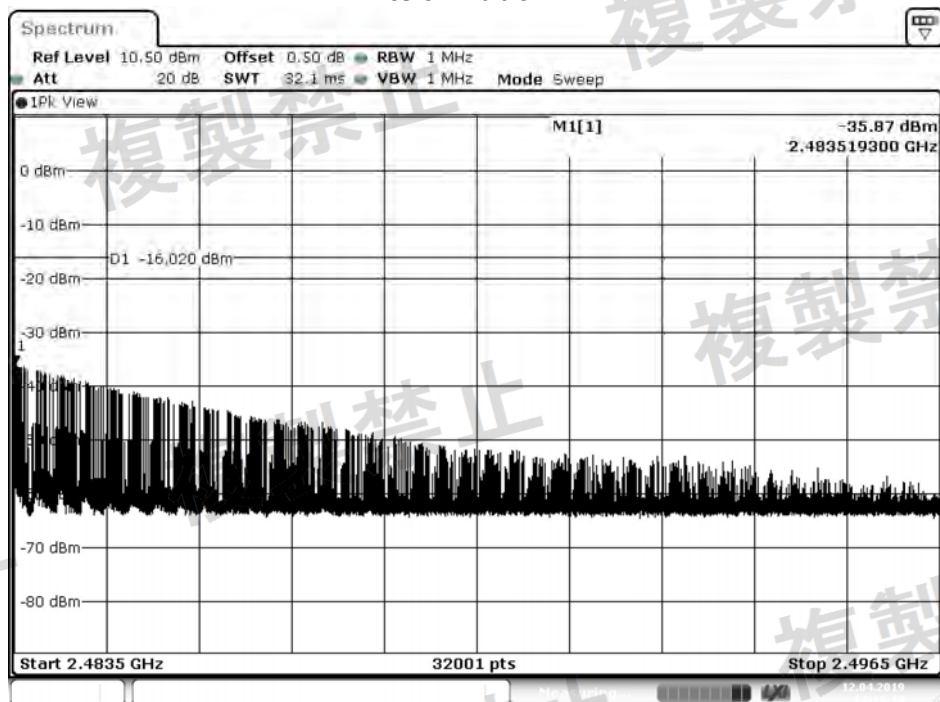
Date: 12 APR 2019 14:12:29

2387–2400 MHz



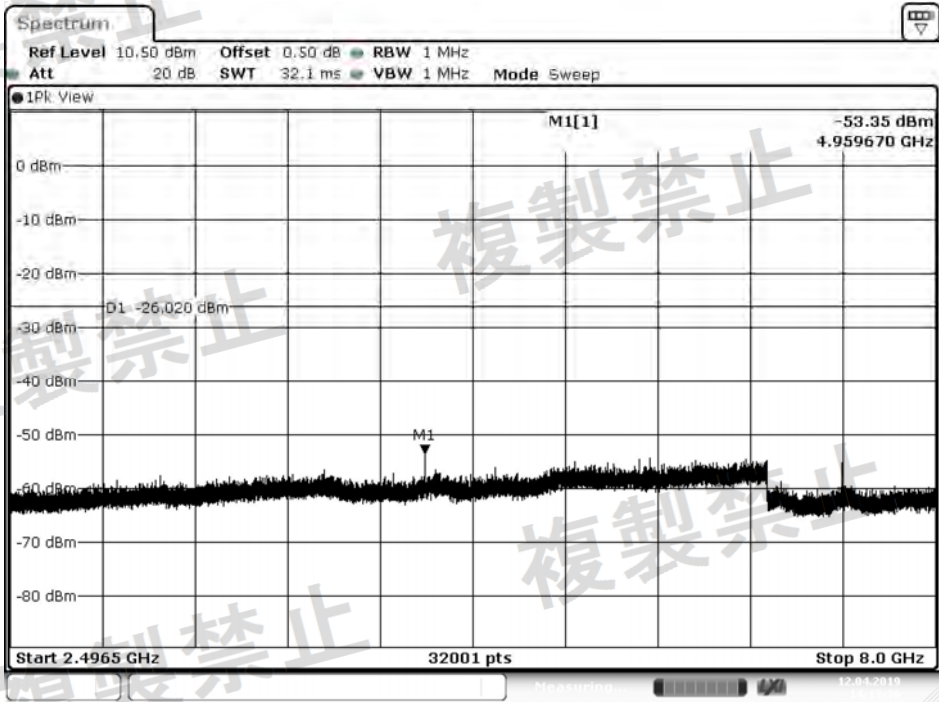
Date: 12.APR.2019 14:12:52

2483.5–2496.5MHz

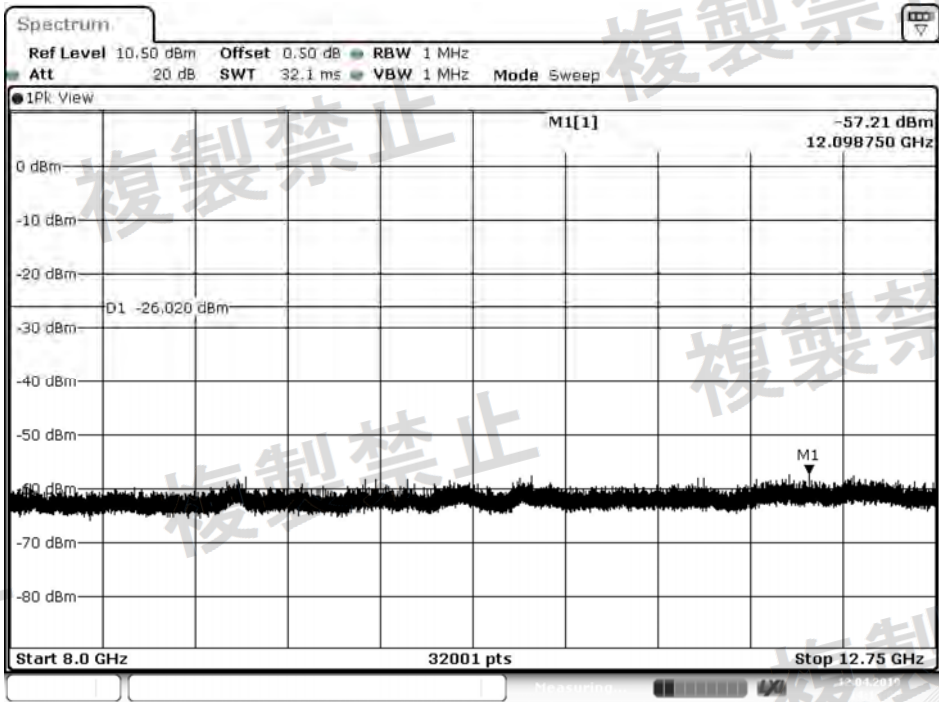


Date: 12.APR.2019 14:13:14

2496.5–8000MHz



8000–12750MHz



Test Result

PASS

## 6. Receiver Suprious Emissions

### 6.1. Test Setup



### 6.2. Test Procedure

A spectrum analyzer or similar device shall be used to observe a sample of the modulated transmitter's radio frequency power output.

- (a) A positive peak detector function must be used.
- (b) The measurement instrument bandwidth and span must be set sufficiently with, and, the scan time set sufficiently slow, to ensure all major modulation products are captured. Note that the measurement bandwidth should also be set sufficiently narrow to avoid adding significant error to the test result.
- (c) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided the emission is repetitive in nature.

### 6.3. Limits

$\leq 4\text{nW}$  for 30 – 1000 MHz

$\leq 20\text{nW}$  for 1000 – 3000 MHz

$\leq 20\text{nW}$  for 3000 – 12750 MHz

### 6.4. Uncertainty

$\pm 1.23\text{dB}$

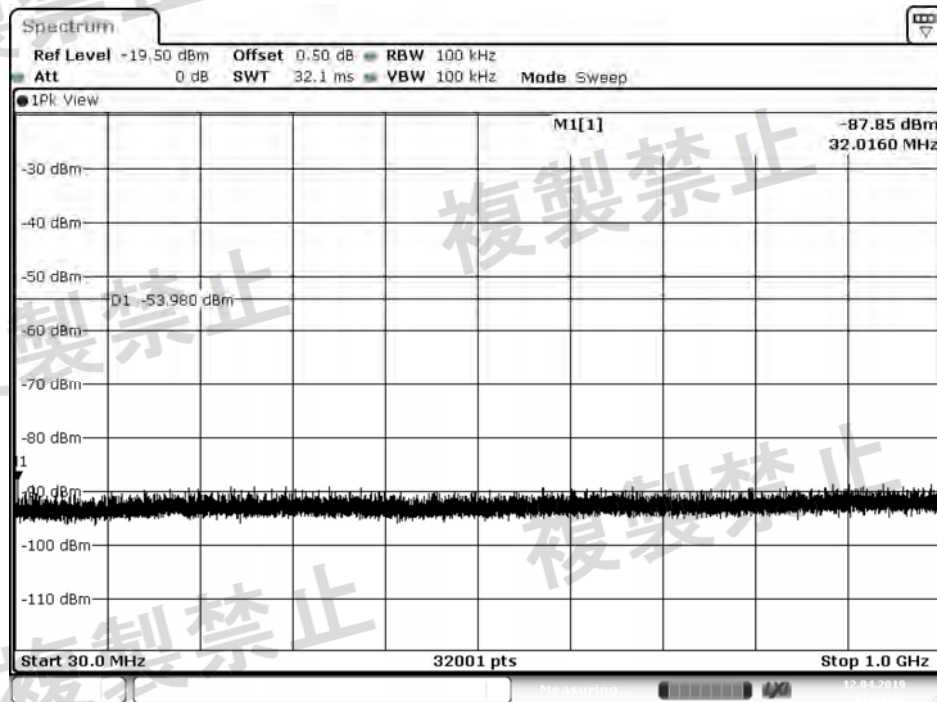


## 6.5. Test Result of Receiver Spurious Emissions

Product : Gaming Mouse  
Test Item : Receiver Spurious Emissions  
Test Mode : Mode 2: Receive - BLE 2402MHz

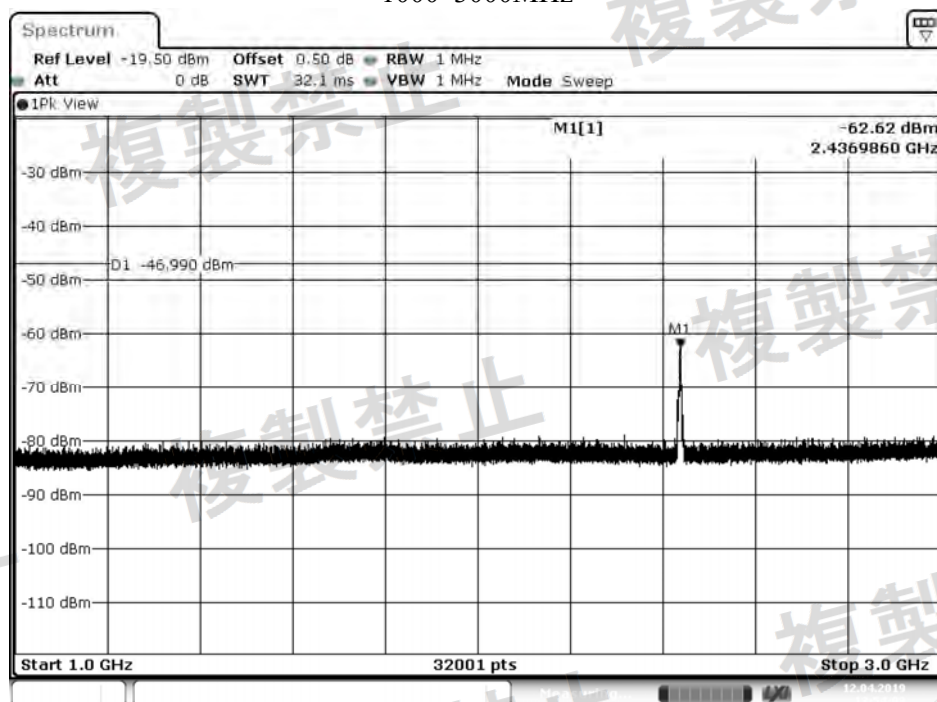
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-87.85	-54 (4nW)
1000 – 3000	-62.62	-47 (20nW)
3000 – 8000	-65.24	-47 (20nW)
8000 – 12750	-77.72	-47 (20nW)

30–1000MHz



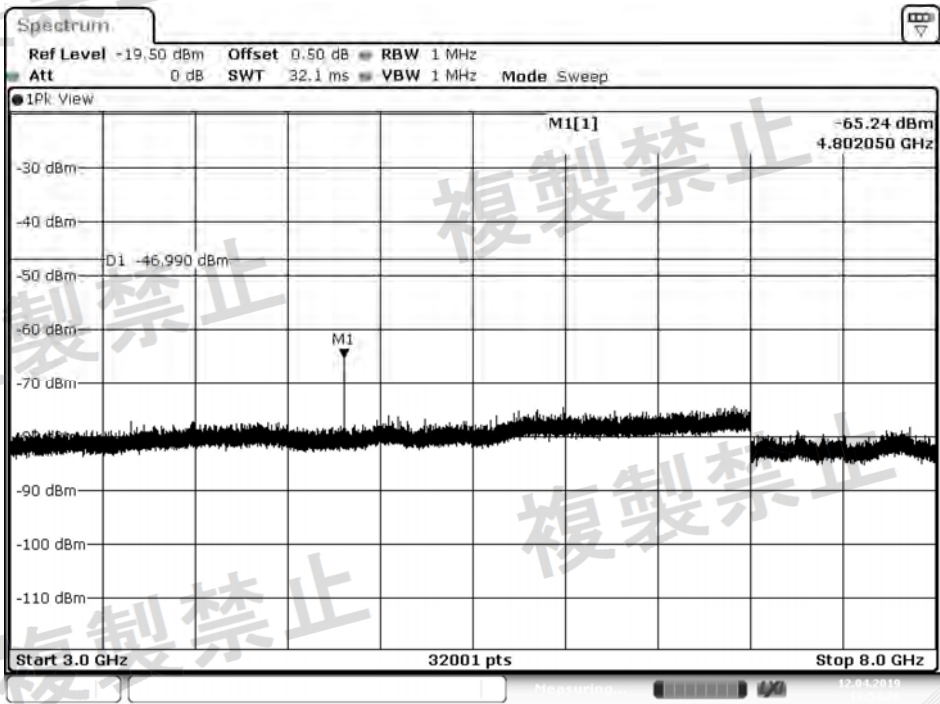
Date: 12.APR.2019 13:53:42

1000–3000MHz



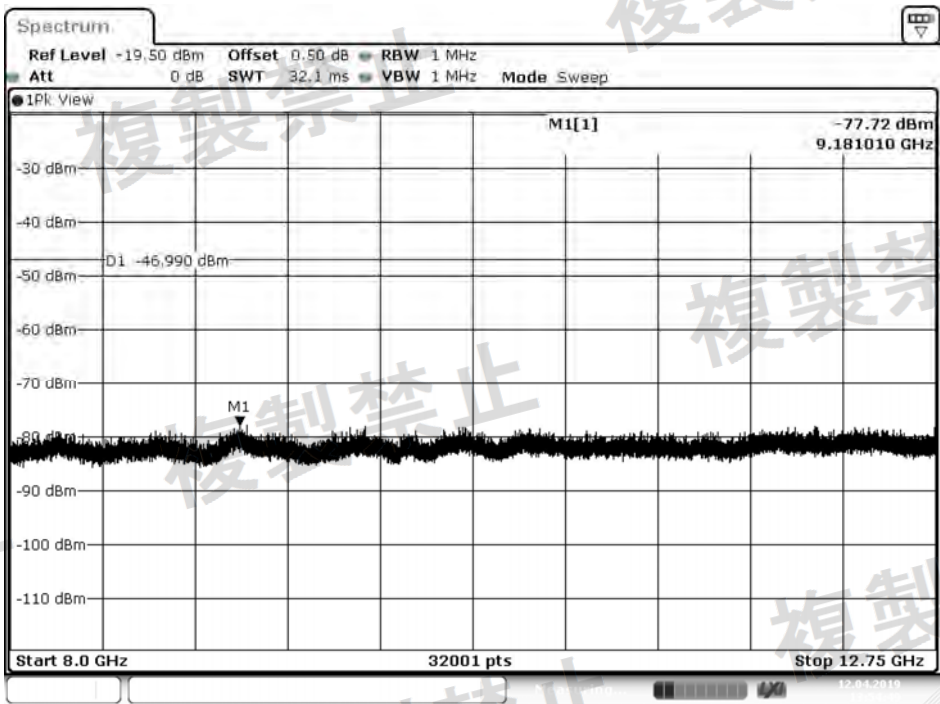
Date: 12.APR.2019 13:54:04

3000–8000MHz



Date: 12.APR.2019 13:54:27

8000–12750MHz



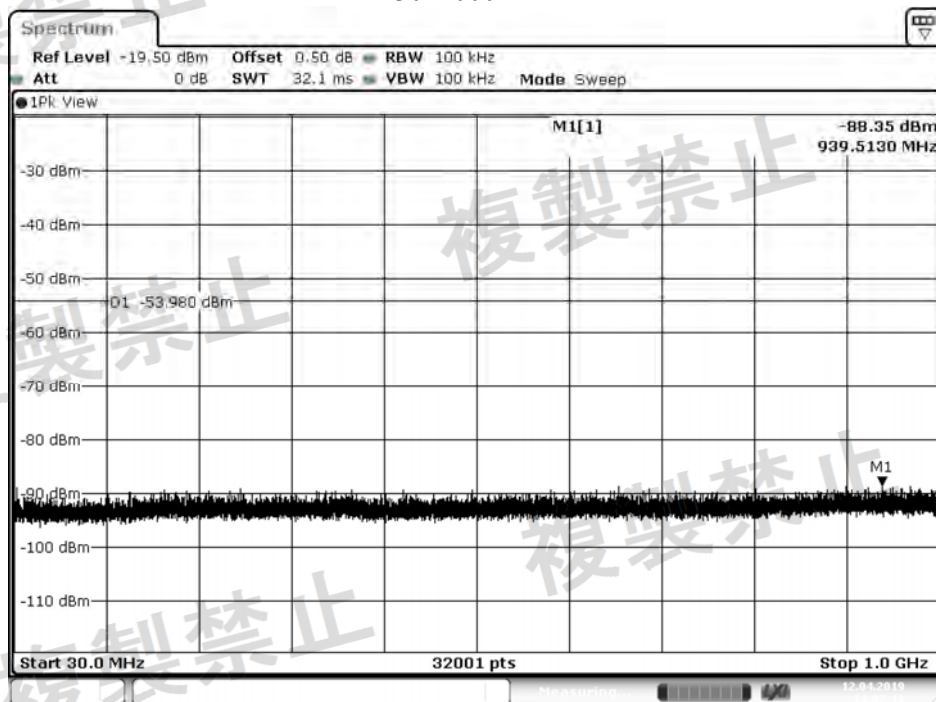
Date: 12.APR.2019 13:54:49

Test Result	PASS
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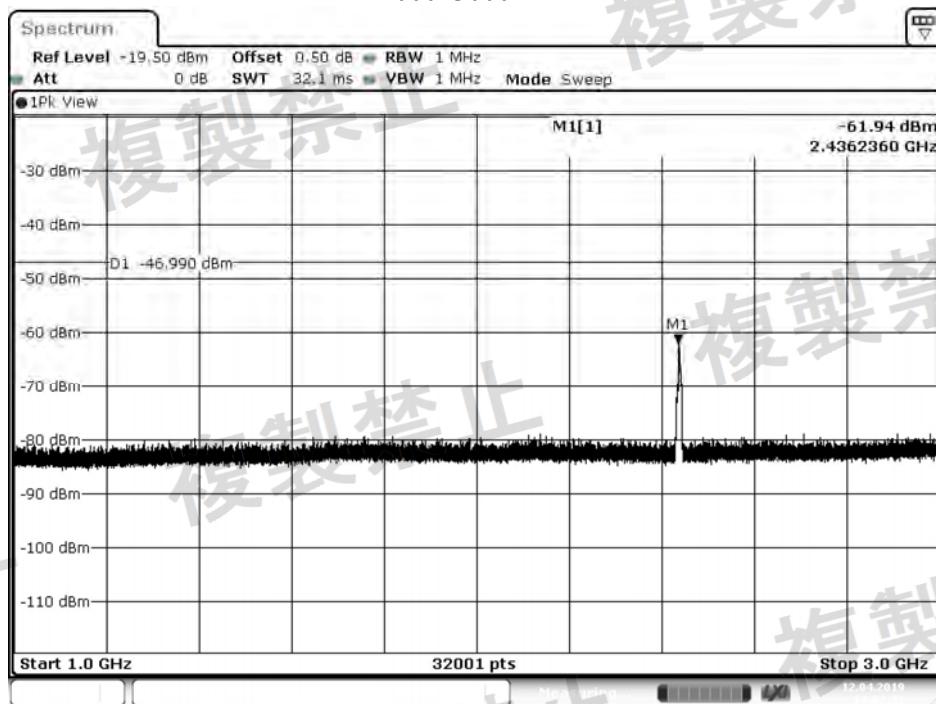
Product : Gaming Mouse  
Test Item : Receiver Spurious Emissions  
Test Mode : Mode 2: Receive - BLE 2440MHz

Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-88.35	-54 (4nW)
1000 - 3000	-61.94	-47 (20nW)
3000 - 8000	-68.23	-47 (20nW)
8000 - 12750	-76.58	-47 (20nW)

30–1000MHz

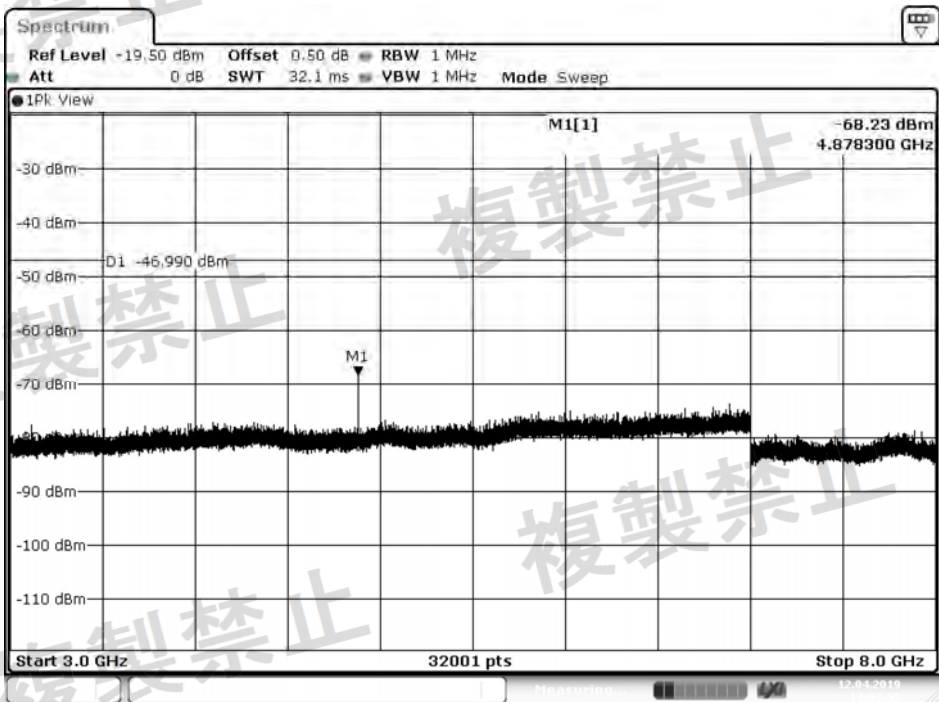


1000–3000MHz



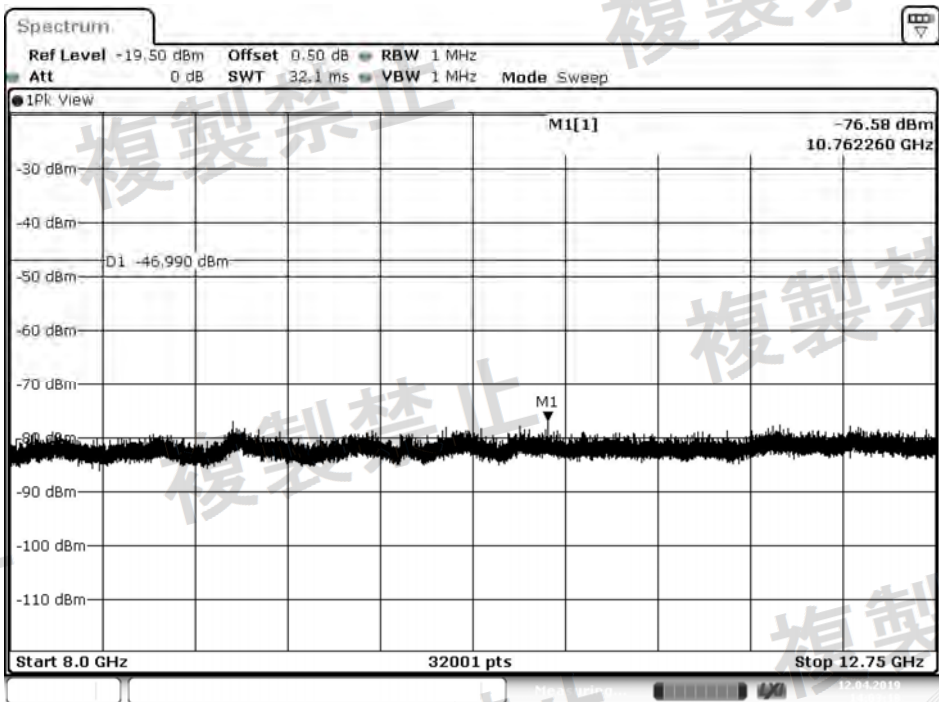


3000–8000MHz



Date: 12.APR.2019 14:02:56

8000–12750MHz



Date: 12.APR.2019 14:03:18

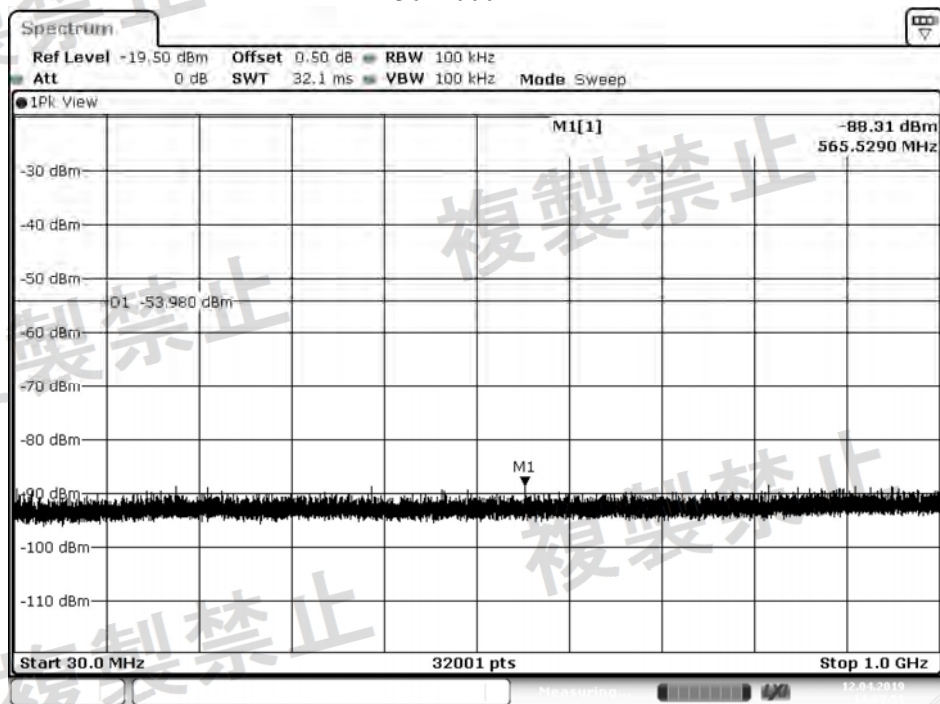
Test Result

PASS

Product : Gaming Mouse  
Test Item : Receiver Spurious Emissions  
Test Mode : Mode 2: Receive - BLE 2480MHz

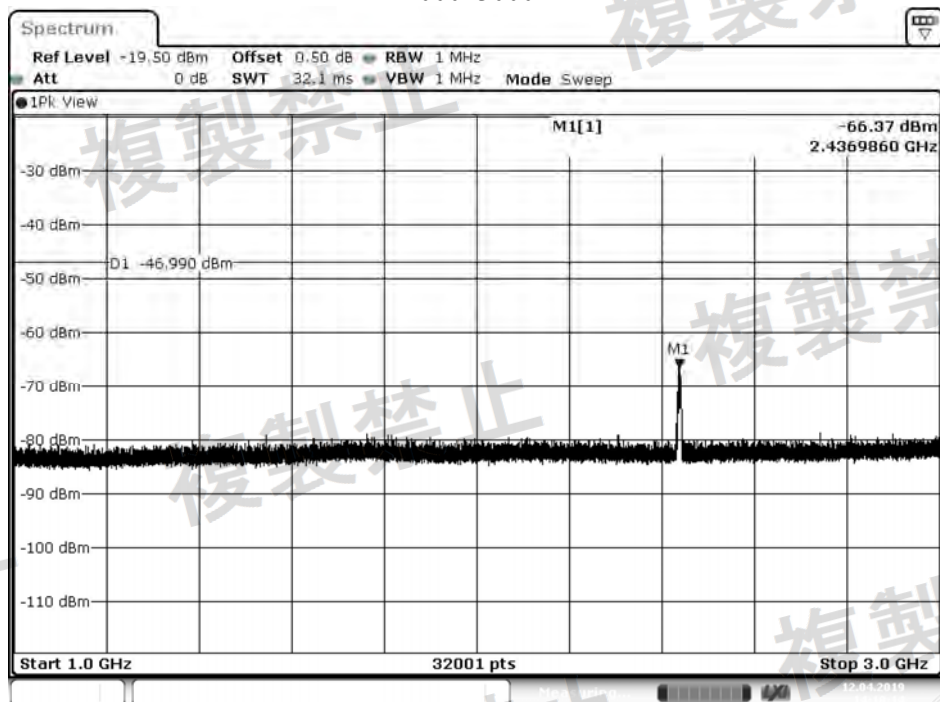
Frequency Range (MHz)	Reading Value (dBm)	Limit (dBm)
30 - 1000	-88.31	-54 (4nW)
1000 - 3000	-66.37	-47 (20nW)
3000 - 8000	-68.45	-47 (20nW)
8000 - 12750	-77.71	-47 (20nW)

30–1000MHz



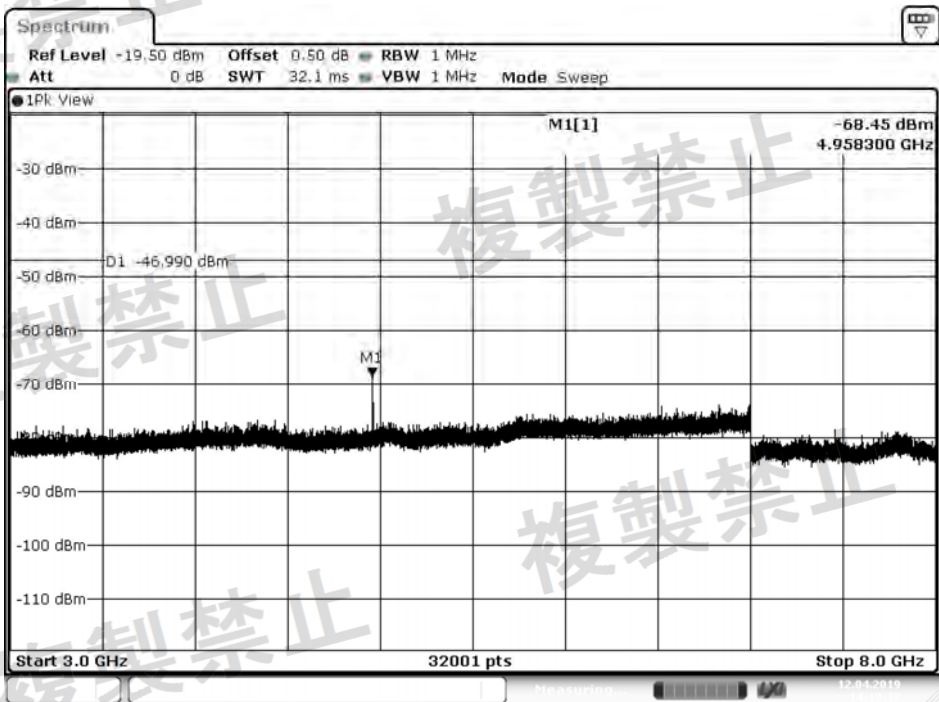
Date: 12.APR.2019 14:09:52

1000–3000MHz



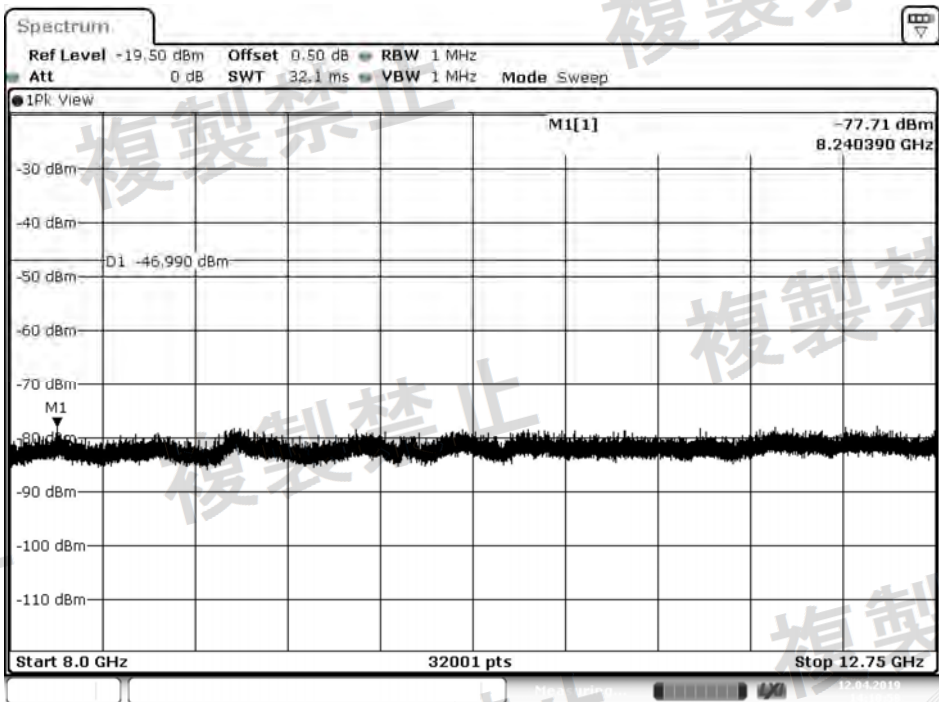
Date: 12.APR.2019 14:10:14

3000–8000MHz



Date: 12.APR.2019 14:10:37

8000–12750MHz



Date: 12.APR.2019 14:10:59

Test Result

PASS

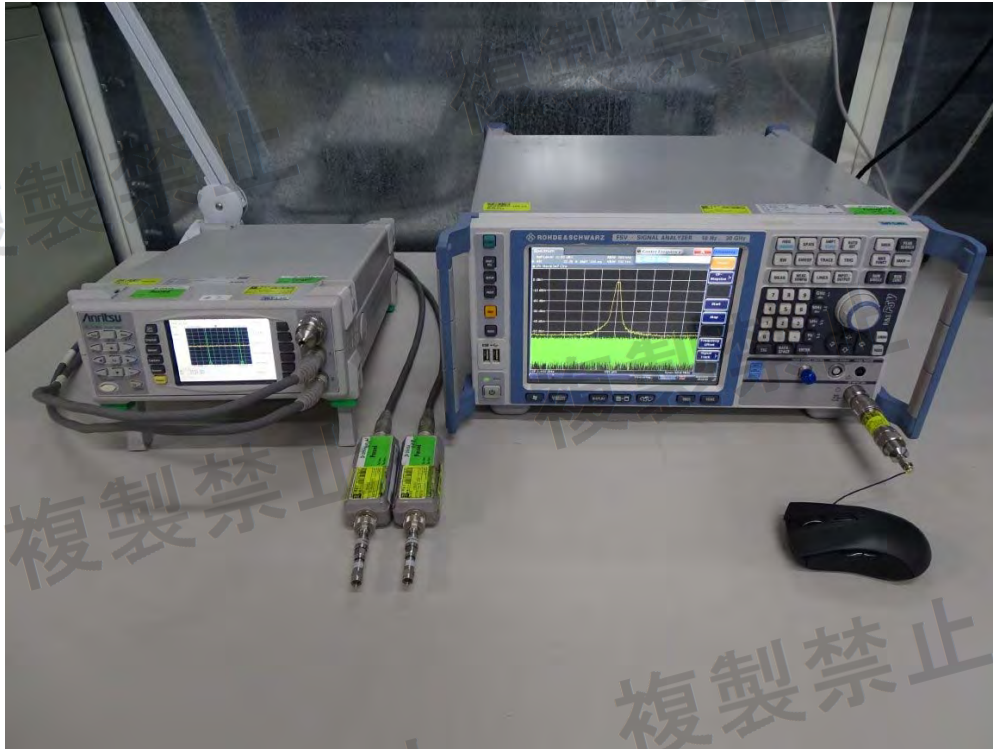
**7. EMI Reduction Method During Compliance Testing**

No modification was made during testing.



**Attachment**

- EUT Test Photographs
  - Spectrum Measurement



## Power Meter Measurement

