



**中认信通**

CHINA CERTIFICATION ICT CO., LTD (DONGGUAN)

## JAPAN MIC TEST REPORT

**Applicant:** Raspberry Pi Ltd.

**Address:** Maurice Wilkes Building, Cowley Road, Cambridge, CB4 0DS, UK

**Product Name:** Raspberry Pi 5

**Model Number:** Raspberry Pi 5

**Standard(s):** Radio Law of Japan item 19 of Article 2 Paragraph 1

The above device has been tested and found compliant with the requirement of the relative standards by China Certification ICT Co., Ltd (Dongguan)

**Report Number:** CR231059171-07A

**Date Of Issue:** 2023/11/22

**Reviewed By:** Calvin Chen

**Title:** RF Engineer

**Approved By:** Sun Zhong

**Title:** Manager

**Test Laboratory:** China Certification ICT Co., Ltd (Dongguan)  
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Guangdong, China  
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**Test Facility**

The Test site used by China Certification ICT Co., Ltd (Dongguan) to collect test data is located on the No. 113, Pingkang Road, Dalang Town, Dongguan, Guangdong, China.

**Declarations**

China Certification ICT Co., Ltd (Dongguan) is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with a triangle symbol “▲”. Customer model name, addresses, names, trademarks etc. are not considered data.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested.

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DOCUMENT REVISION HISTORY

Revision Number	Report Number	Description of Revision	Date of Revision
1.0	CR231059171-07A	Original Report	2023/11/22

## 1. GENERAL INFORMATION

### 1.1 Product Description for Equipment under Test (EUT)

<b>EUT Name:</b>	Raspberry Pi 5
<b>Trade Name:</b>	Raspberry Pi
<b>EUT Model:</b>	Raspberry Pi 5
<b>Frequency Range:</b>	2402-2480 MHz
<b>Nominal RF Output Power (Conducted):</b>	1.7mW
<b>Number of TX Chain(s):</b>	1
<b>Number of RX Chain(s):</b>	1
<b>Antenna Gain (dBi)▲:</b>	3.5
<b>Modulation Type:</b>	GFSK
<b>Rated Input Voltage:</b>	DC 5V from Adapter
<b>Serial Number:</b>	2C4L-6
<b>EUT Received Date:</b>	2023/10/15
<b>EUT Received Status:</b>	Good

### Operation Frequency Detail:

Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2442
1	2404	...	...
...	...	...	...
...	...	...	...
...	...	38	2478
19	2440	39	2480
The test frequencies were performed the test as below:			
Test Channel		Frequency (MHz)	
Lowest		2402	
Middle		2440	
Highest		2480	

### Accessory Information:

Accessory Description	Manufacturer	Model	Parameters
/	/	/	/



## 1.2 Description of Test Configuration

### 1.2.1 EUT Operation Condition

EUT Operation Mode:	The system was configured for testing in Engineering Mode, which was provided by the manufacturer.		
Equipment Modifications:	No		
EUT Exercise Software:	cmd.exe		
The software was provided by manufacturer. The maximum power was configured as below, that was provided by the manufacturer▲:			
Test Modes	Power Level Setting		
	Lowest	Middle	Highest
BLE 1Mbps	default	default	default

### 1.2.2 Power Supply Voltage Fluctuation

Fluctuation	DC Input Voltage (V <sub>DC</sub> )	RF Part DC Output Voltage (V <sub>DC</sub> )	Variation (%)
Normal Voltage	5.0	3.34	---
Low Voltage -10% of Normal Voltage	4.5	3.32	-0.60
High Voltage +10% of Normal Voltage	5.5	3.34	0.00

**Note:**

1. Voltage Variation (%) = (Measured Voltage at High or Low Voltage - Measured Voltage at Normal Voltage) / Measured Voltage at Normal Voltage \* 100
2. The Voltage for the Radio Part fluctuation is verified at the power input PIN of the RF circuit.

During the input supply voltage to the EUT from the external power source is varied by  $\pm 10\%$ , if output voltage had been confirmed that the fluctuation of power supply to the RF circuit of EUT (excluding power source) is equal to or less than  $\pm 1\%$ . Exempt extremely high and low supply voltage condition tests, EUT only operated in **Normal Voltage (NV)** to test all regulations.

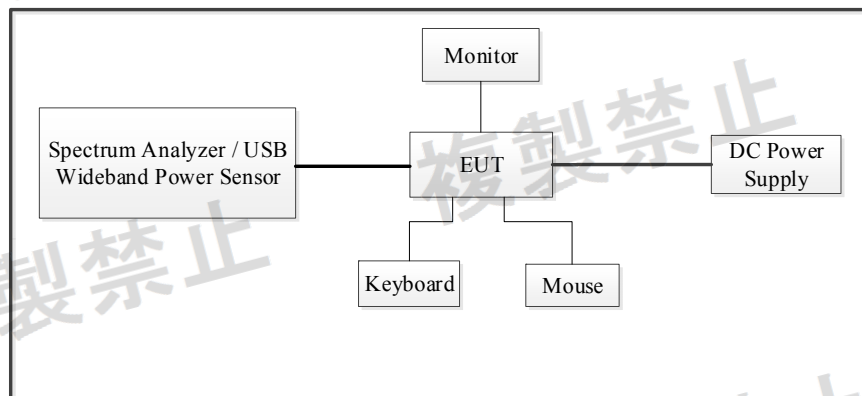
### 1.2.3 Support Equipment List and Details

Manufacturer	Description	Model	Serial Number
PHILIPS	Monitor	24PFF5595/T3	XM2A2124000343
Raspberry Pi	Keyboard	RPI-KYB	Unknown
Raspberry Pi	Mouse	RPI-MOUSE	Unknown
ZHAOXIN	DC Power Supply	RXN-6010D	21R6010D0912386

### 1.2.4 Support Cable List and Details

Cable Description	Shielding Type	Ferrite Core	Length (m)	From Port	To
Detachable Power Cable	No	No	1.2	DC Power Supply	EUT
Keyboard Cable	No	No	0.8	Keyboard	EUT
Mouse Cable	No	No	0.8	Mouse	EUT
HDMI Cable	No	No	0.8	Monitor	EUT
Coaxial Cable	No	No	0.1	Spectrum Analyzer / USB Wideband Power Sensor	EUT

### 1.2.5 Block Diagram of Test Setup



### 1.3 Measurement Uncertainty

Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty. The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval.

Parameter	Measurement Uncertainty
Frequency Error	$\pm 0,5$ ppm
Occupied bandwidth and spreading bandwidth	$\pm 5$ %
RF output power, conducted	$\pm 0.61$ dB
Unwanted Emissions (TX&RX), conducted	$\pm 2.47$ dB
Temperature	$\pm 1$ °C
Humidity	$\pm 5$ %
DC and low frequency voltages	$\pm 0.4$ %
Duty Cycle	1 %



## 2. SUMMARY OF TEST RESULTS

MIC Notice No.88 Appendix No.43 Article 2, Paragraph 1, Item 19 Rules Section	Description of Test	Result
3	Frequency Error	Compliant
4	Occupied Bandwidth	Compliant
5	Transmitter Spurious Emission and Unwanted Emission Intensity	Compliant
6	Antenna Output Power and Output Power Tolerance	Compliant
7	Receiver Spurious Emission and Unwanted Emission Intensity	Compliant
8	Carrier sense capability (1)	Not Applicable*
9	Carrier sense capability (2)	Not Applicable**
10	Transmission Antenna Gain	Not Applicable***
11	Transmission Radiation Angle Width	Not Applicable***
12	Interference Prevention Function	Compliant
13	Frequency Hopping Dwell Time	Not Applicable****
Note 1	Construction Protection Confirmation	Compliant

**Note:**

*Not Applicable\*:* Only required for OBW between 26MHz and 40MHz with OFDM modulation type.

*Not Applicable\*\*:* Only required for outdoor use radio control of model airplanes.

*Not Applicable\*\*\*:* This item not applicable when the EIRP less than the limit.

*Not Applicable\*\*\*\*:* Testing is only required for FHSS system devices.

### 3. REQUIREMENTS AND TEST PROCEDURES

#### 3.1 Frequency Error

##### 3.1.1 Limit

Within  $\pm 50\text{ppm}$ .

##### 3.1.2 Test Procedure

Set the EUT to the measurement frequency without modulation.

Setting of SA is following as: Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode:

Positive peak / Trace mode: MAX Hold.

Record the peak spot frequency.

If the EUT can't set at un-modulation mode, measure the 10dBc center frequency.

#### 3.2 Occupied Bandwidth and Spreading Bandwidth

##### 3.2.1 Limit

- Occupied bandwidth:  $\leq 26\text{ MHz}$

##### 3.2.2 Test Procedure

1. Setting of SA is following as: RB: 30 kHz/VB: 30 kHz / Sweep time: Auto / Sweep Mode: Continuous sweep / Detect mode: Positive peak / Trace mode: Max hold
2. EUT have transmitted the maximum modulation signal and fixed channelize. SA set to 99% of occupied bandwidth to measure occupied bandwidth.

### 3.3 Transmitter Spurious Emission Strength and Unwanted Emission Intensity

#### 3.3.1 Limit

- $30\text{MHz} \leq f < 2387\text{MHz}$ :  $\leq 2.5\mu\text{W}/\text{MHz}$
- $2387\text{MHz} \leq f \leq 2400\text{MHz}$ :  $\leq 25\mu\text{W}/\text{MHz}$ ;
- $2483.5\text{MHz} < f \leq 2496.5\text{MHz}$ :  $\leq 25\mu\text{W}/\text{MHz}$
- $2496.5\text{MHz} < f \leq 12500\text{MHz}$ :  $\leq 2.5\mu\text{W}/\text{MHz}$

#### 3.3.2 Test Procedure

❖ Conditions of Application Equipment (EUT)

- The modulation state shall be in continuously transmitting mode.

❖ Spectrum Analyzer Conditions

- Setting of SA start 30MHz and stop frequency 1000MHz, RB:100kHz/VB:100kHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $0.25\mu\text{W}/100\text{kHz}$ .
- Setting of SA start 1000MHz and stop frequency 2387MHz, RB:1MHz/VB:1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $2.5\mu\text{W}/\text{MHz}$ .
- Setting of SA start 2387MHz and stop frequency 2400MHz, RB:1MHz/VB:1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $25\mu\text{W}/\text{MHz}$ .
- Setting of SA start 2483.5MHz and stop frequency 2496.5MHz, RB:1MHz/VB:1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $25\mu\text{W}/\text{MHz}$ .
- Setting of SA start 2496.5MHz and stop frequency 12500MHz, RB:1MHz/VB:1MHz, Sweep time: Auto. Sweep mode: continuous sweep .Detect mode: Positive peak/Trace mode: max hold. Then to mark peak. reading value + cable loss shall be less than  $2.5\mu\text{W}/\text{MHz}$ .

If above test over the limit, the below test procedure should be used:

Step 1:

Center the frequency which was want to investigate, search the peak frequency.

Step 2:

Center frequency: Searched Frequency

Span: 0Hz

RBW: 1MHz(Above 1GHz), VBW: Same as RBW.

Sweep time: Auto(Minimum time to ensure measurement accuracy. \*In case of burst wave, one burst shall be included per data point) Data points: 400 points or more. Sweep mode: Single Sweep.

Detection Mode: Sample

### 3.4 Antenna Output Power and Antenna Power Tolerance

#### 3.4.1 Limit

Antenna output power:

- $\leq 10 \text{ mW}$
- The Output Power Tolerance must be within  $+20\% \sim -80\%$ .
- $\text{EIRP} \leq 12.14\text{dBm}$  (other from 2400-2483.5 MHz)

#### 3.4.2 Test Procedure

Set the EUT Frequency to measure

Detector: Average

### 3.5 Receiver Spurious Emission and Unwanted Emission Intensity

#### 3.5.1 Limit

- $\leq 4 \text{ nW}$  ( $30 \text{ MHz} \leq f \leq 1000 \text{ MHz}$ )
- $\leq 20 \text{ nW}$  ( $1 \text{ GHz} \leq f \leq 12.5 \text{ GHz}$ )

#### 3.5.2 Test Procedure

❖ Conditions of Application Equipment (EUT)

- The modulation state shall be “continuous receiving mode”.

❖ Spectrum Analyzer Conditions

- Start Frequency: Start Frequency of frequency range to measure (30MHz to 1GHz)
- Stop Frequency: Stop Frequency of frequency range to measure (1GHz to 12.5GHz)
- Span: AUTO (Measurement Range)
- RBW: 100 kHz, VBW: 100 kHz for Frequency  $< 1 \text{ GHz}$
- RBW: 1MHz, VBW: 1MHz for Frequency  $> 1 \text{ GHz}$
- Sweep time: AUTO or more
- Sweep mode: Auto Sweep
- Detection: Positive Peak
- Reference Level: Enough level for maximum dynamic range

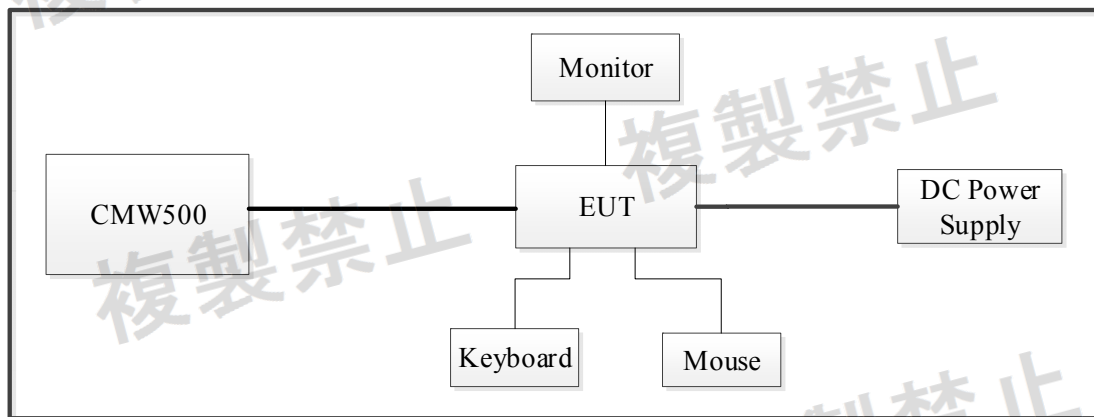
### 3.6 Interference Prevention Function

#### 3.6.1 Requirement

The EUT shall have the interference prevention capability to transmit or to receive the identification automatically, so that sender and receiver shall exclude other equipment.

#### 3.6.2 Test Procedure

Measurement System Diagram:



In the case that the EUT has the function of automatically transmitting the identification code:

1. Transmit the predetermined identification codes from EUT
2. Check the transmitted identification codes with the demodulator.

In the case of receiving the identification codes:

1. Transmit the predetermined identification codes from the counterpart.
2. Check if communication is normal
3. Transmit the signal other than predetermined ID codes from the counterpart.
4. Check if the EUT stops the transmission, or if it displays that identification codes are different from the predetermined ones.

#### 3.6.3 Measurement Result

**Result: Compliant.**



### 3.7 Note 1 - Construction Protection Confirmation

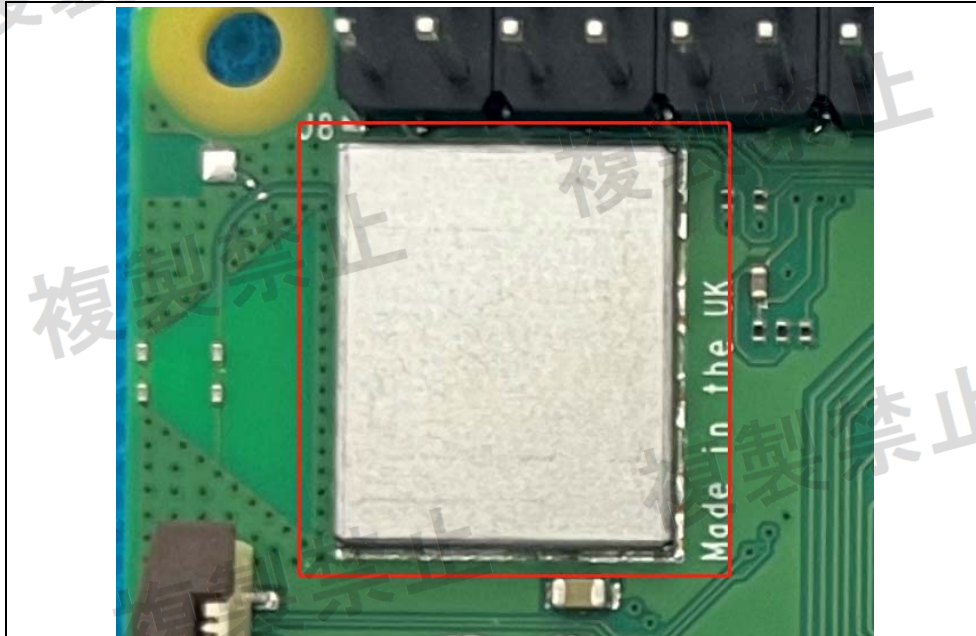
#### 3.7.1 Limit

The high-frequency section and modulation section of the radio equipment except for the antenna system shall not be capable of being opened easily.

#### 3.7.2 Confirmation Method

The RF and Modulation components are covered with shielding case and this shielding case can't be opened easily.

#### 3.7.3 The Photos of Construction Protection





4. TEST DATA AND RESULTS

4.1 Test Environmental Conditions & Test Equipment List and Details

Test Date:		2023/11/3			
Tester:		LingLing Li			
Environmental Conditions:					
Temperature: (°C)	25.1	Relative Humidity: (%)	59	ATM Pressure: (kPa)	100.5

Manufacturer	Description	Model	Serial Number	Calibration Date	Calibration Due Date	Calibration Agency	Calibration Method <sup>Note</sup>
Agilent	USB Wideband Power Sensor	U2021XA	MY50000432	2023/3/31	2024/3/30	CCIC	C
R&S	Wideband Radio Communication Tester	CMW500	143458	2023/3/31	2024/3/30	CCIC	C
R&S	Spectrum Analyzer	FSU26	100147	2023/3/31	2024/3/30	CCIC	C
UNI-T	Multimeter	UT39A+	C210582554	2023/9/29	2024/9/28	CCIC	C

\* Statement of Traceability: China Certification ICT Co., Ltd (Dongguan) attests that all calibrations have been performed, traceable to National Primary Standards and International System of Units (SI).

- Note:
- 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 calibration agency under Article 102-18 paragraph (1).
  - D. Calibration conducted by using measuring instruments and other equipment which shall have been given any of calibration, etc. listed above from a) to c)

## 4.2 Frequency Error

**Test Result:** Compliant

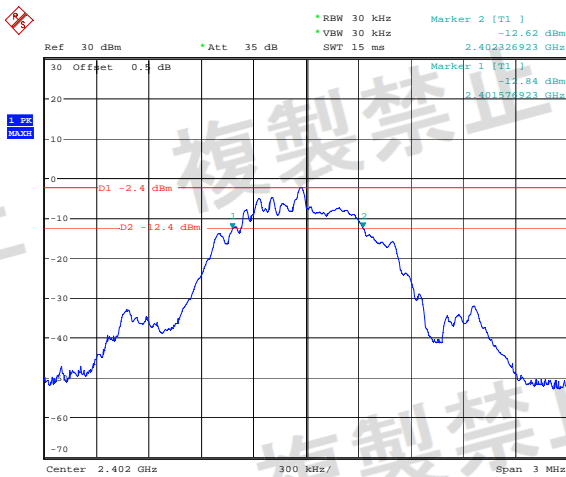
*Test Mode: Transmitting*

Test Condition	Mode	Channel	F <sub>c</sub> (MHz)	F <sub>L</sub> (MHz)	F <sub>H</sub> (MHz)	F <sub>0</sub> (MHz)	Result (ppm)	Limit (ppm)
NV	BLE 1Mbps	Low	2402	2401.576923	2402.326923	2401.952	-20.02	± 50
		Middle	2440	2439.586538	2440.331731	2439.959	-16.75	
		High	2480	2479.586538	2480.336538	2479.962	-15.51	

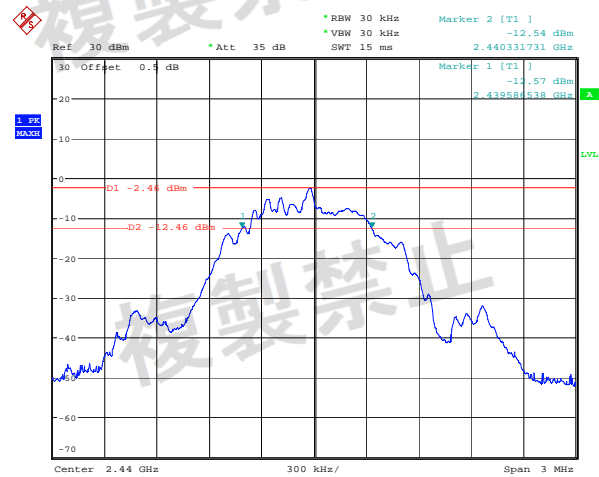
**Note:**  $f_c$  is declaring of channel frequency. Then the frequency error formula is  $(F_0 - F_c)/F_c \times 10^6$  ppm, where  $F_0 = (F_L + F_H)/2$ .

Please refer to the plots for normal voltage test:

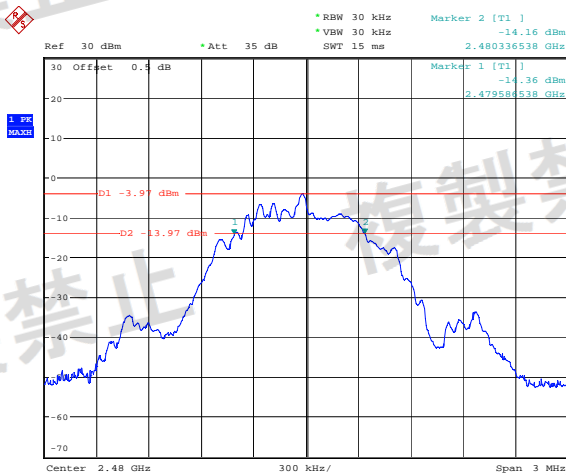
**2402MHz**



**2440MHz**



**2480MHz**



### 4.3 Occupied Bandwidth

**Test Result: Compliant**

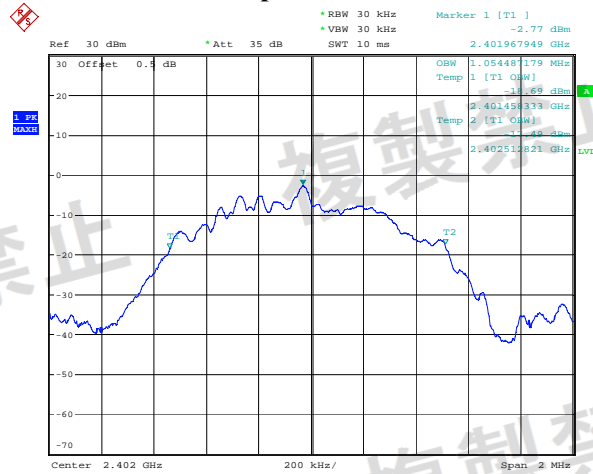
*Test Mode: Transmitting*

Test Condition	Occupied bandwidth (MHz)				
	Mode	Low Channel	Middle Channel	High Channel	Limit
NV	BLE 1Mbps	1.054	1.054	1.051	$\leq 26$

Please refer to the below plots for normal voltage test:

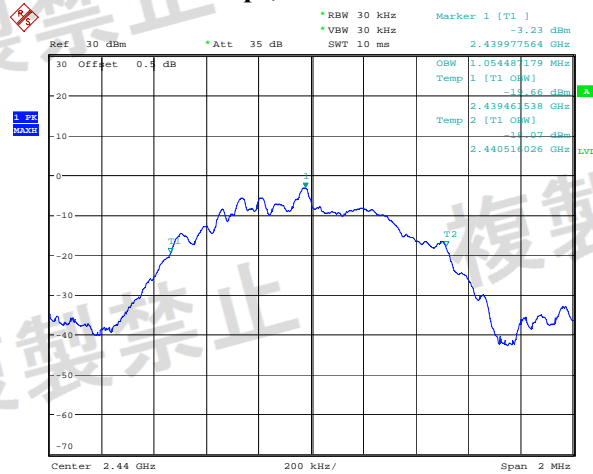
## Occupied Bandwidth:

## BLE 1Mbps, Low Channel



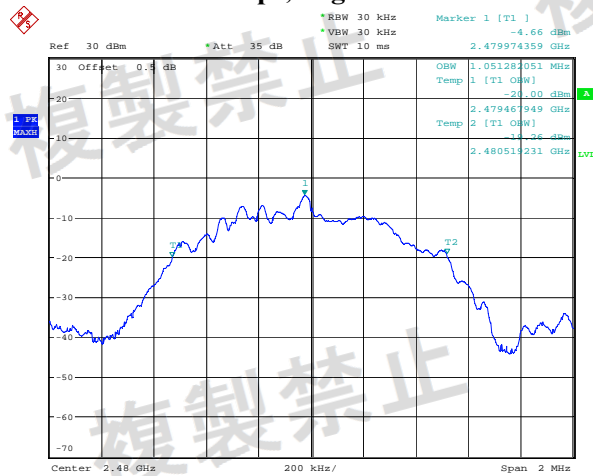
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## BLE 1Mbps, Middle Channel



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Date: 3.NOV.2023 08:07:11

## BLE 1Mbps, High Channel



Comment: ProjectNo.:CR231059171-RF Tester:LingLing Li  
Date: 3.NOV.2023 08:10:06

#### 4.4 Transmitter Spurious Emission Strength and Unwanted Emission Intensity

**Test Result: Compliant**

*Test Mode: Transmitting*

Test Condition	Mode	Test Band (RBW)	Result (dBm/RBW)			Limit (dBm/RBW)	Limit (μW/RBW)
			Low Channel	Middle Channel	High Channel		
NV	BLE 1Mpbs	Band I (100kHz)	-55.09	-46.05	-51.80	-36	0.25
		Band II (1MHz)	-44.65	-44.67	-44.54	-26	2.5
		Band III (1MHz)	-22.16	-43.99	-43.31	-16	25
		Band IV (1MHz)	-42.98	-43.65	-42.47	-16	25
		Band V (1MHz)	-27.90	-28.59	-26.93	-26	2.5

*Note:*

*Band I: 30MHz~1000MHz*

*Band II: 1000MHz~2387MHz*

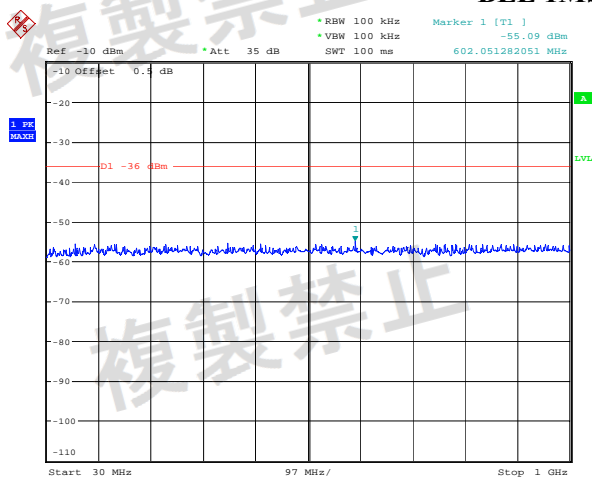
*Band III: 2387MHz~2400MHz*

*Band IV: 2483.5MHz~2496.5MHz*

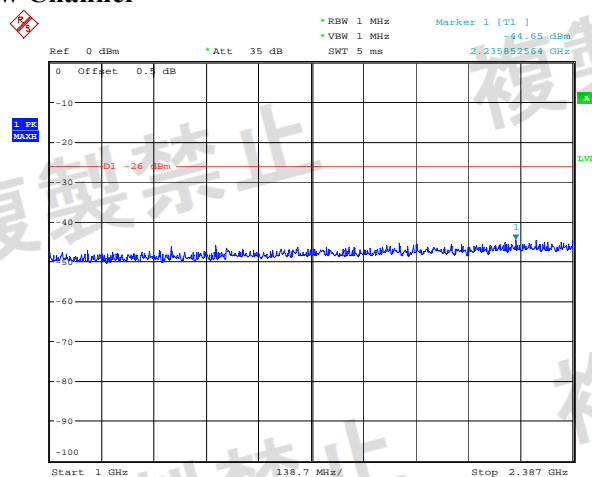
*Band V: 2496.5MHz~12500MHz*

Please refer to the below plots for normal voltage test.

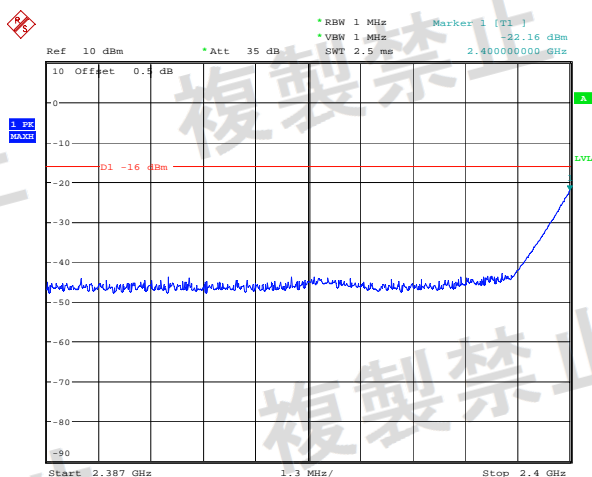
### BLE 1Mbps Low Channel



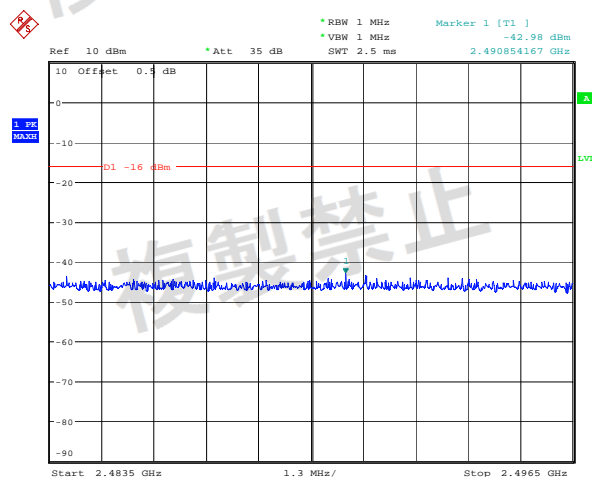
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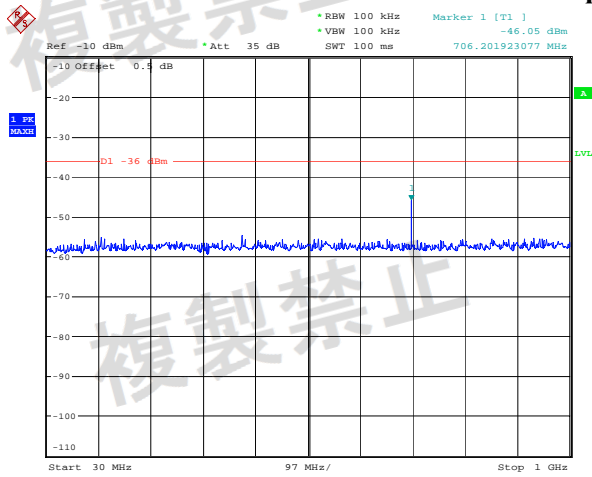
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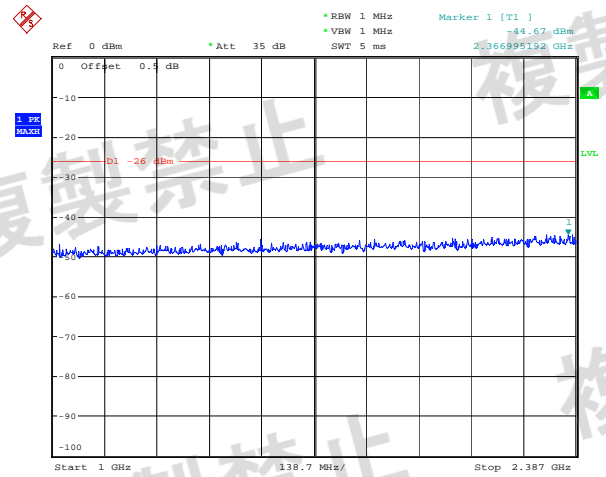
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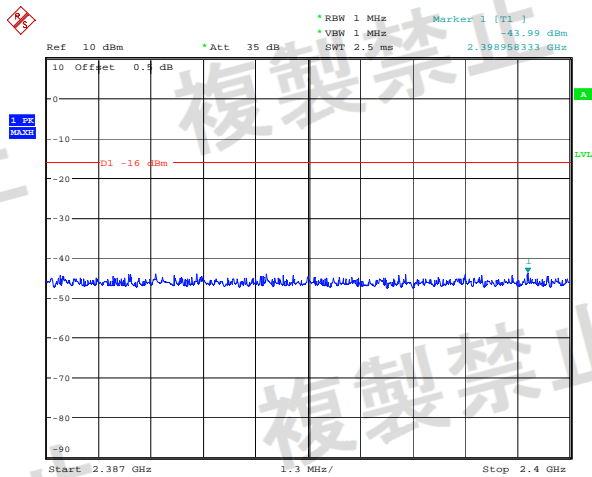
## BLE 1Mbps Middle Channel



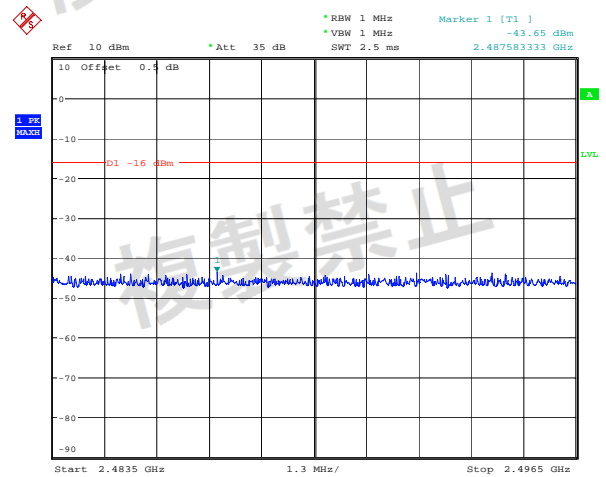
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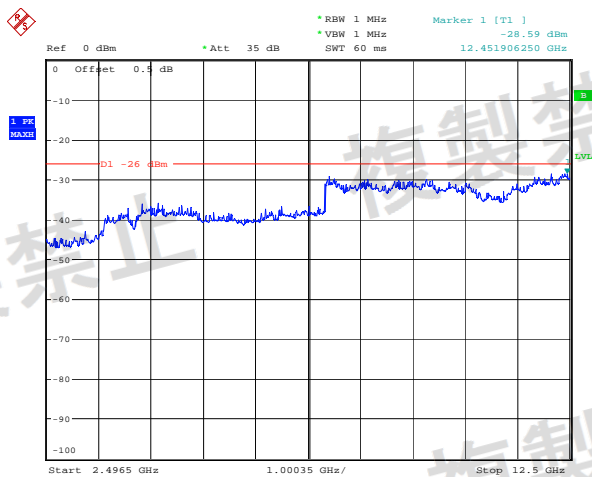
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Date: 3.NOV.2023 08:06:28

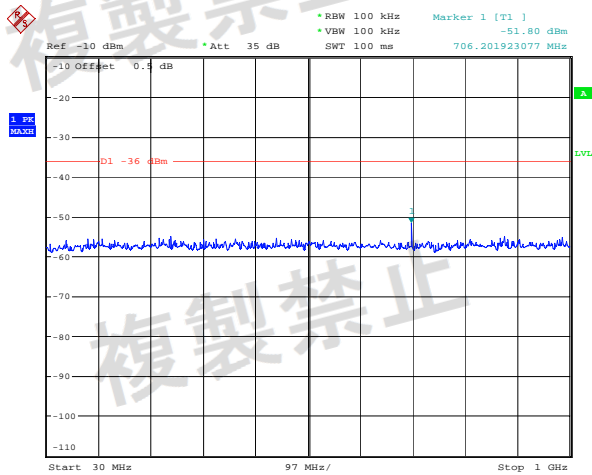


Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:06:40

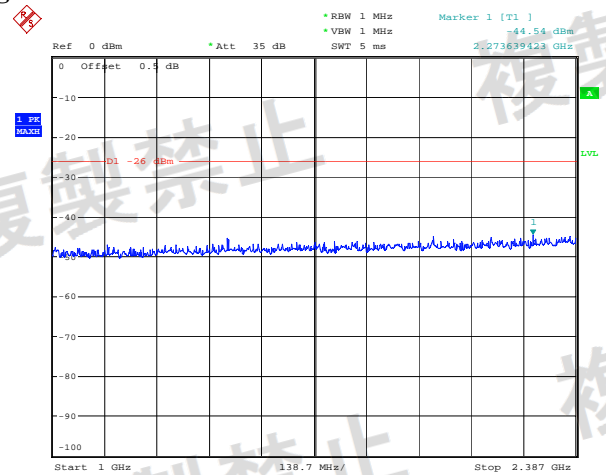


Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 14:20:04

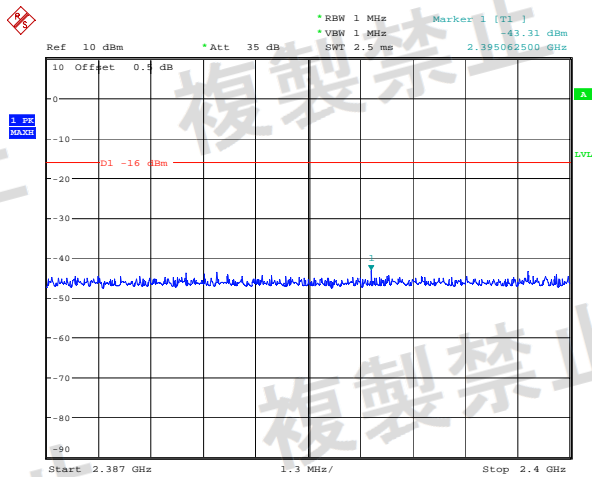
## BLE 1Mbps High Channel



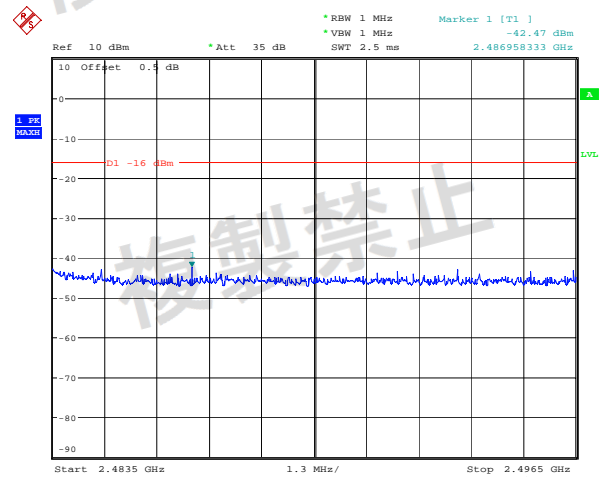
Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:08:52



Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:09:04



Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:09:20



Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:09:35



Comment: ProjectNo.:CR231059171-RP Tester:LingLing Li  
Date: 3.NOV.2023 08:09:48

#### 4.5 Antenna Output Power and Antenna Power Tolerance

**Test Result: Compliant**

*Test Mode: Transmitting*

##### Duty Cycle and Declared Power:

Mode	Ton (ms)	Ton+Toff (ms)	Duty Cycle (%)
BLE 1Mbps	0.409	0.625	65.44

Mode	Antenna Gain (dBi)	Declared Power (mW)
BLE 1Mbps	3.5	1.70

##### Output power

Test Condition	Mode	Channel	Conducted Power (dBm)	Antenna Output Power (mW)		Antenna Output Tolerance (%)		EIRP (dBm)	
				Result	Limit	Result	Limit	Result	Limit
NV	BLE 1Mbps	Low	0.39	1.672	≤ 10	-1.65	-80~+20	5.73	≤ 12.14
		Middle	-0.04	1.514		-10.94		5.30	
		High	-1.48	1.087		-36.06		3.86	

*Note:*

1. Antenna Output Power Tolerance = (Antenna Output power - Declared Power)/Declared Power\*100%

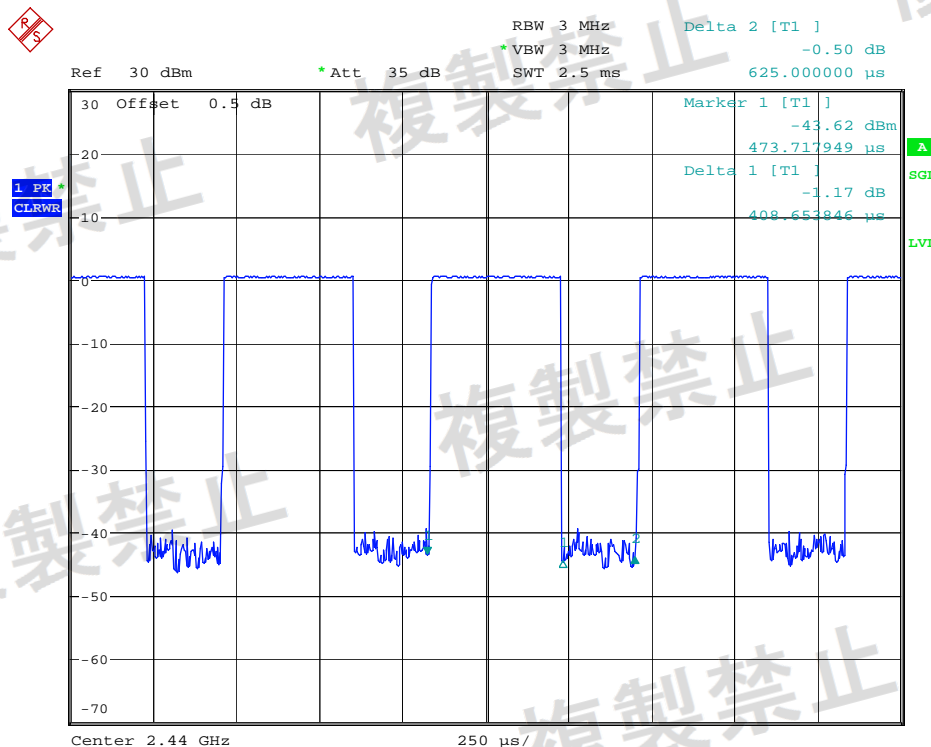
2. Antenna output power (mW) = Conducted power(mW)/Duty cycle =  $(10^{(Conducted\ power(dBm)/10)})/Duty\ cycle$

3. EIRP (dBm) =  $10 * \log(Antenna\ output\ power\ (mW)) + Antenna\ Gain$

Duty Cycle:

2440MHz

BLE 1Mbps



Comment: ProjectNo.:CR231059171-RF Tester:LingLing Li  
Date: 3.NOV.2023 13:38:08

#### 4.6 Receiver Spurious Emission and Unwanted Emission Intensity

**Test Result: Compliant**, please see the below tables and plots

*Test Mode: Receiving*

Test Condition	Mode	Test Band (RBW)	Result (dBm)			Limit (dBm)	Limit (nW)
			Low Channel	Middle Channel	High Channel		
NV	BLE 1Mbps	Band I (100kHz)	-75.92	-77.20	-76.45	-54	4
		Band II (1MHz)	-63.17	-62.99	-63.10	-47	20

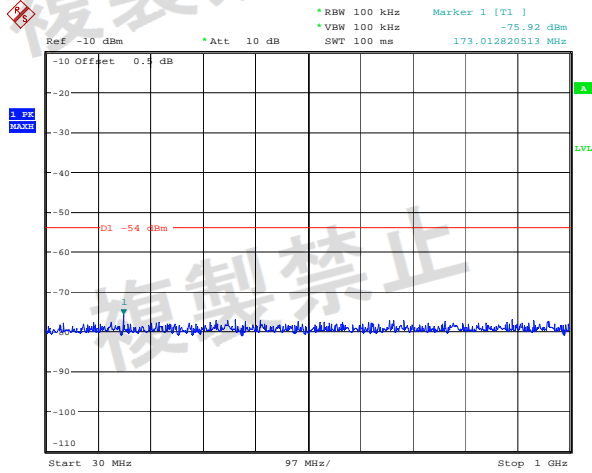
*Note:*

*Band I: 30MHz ~ 1000MHz*

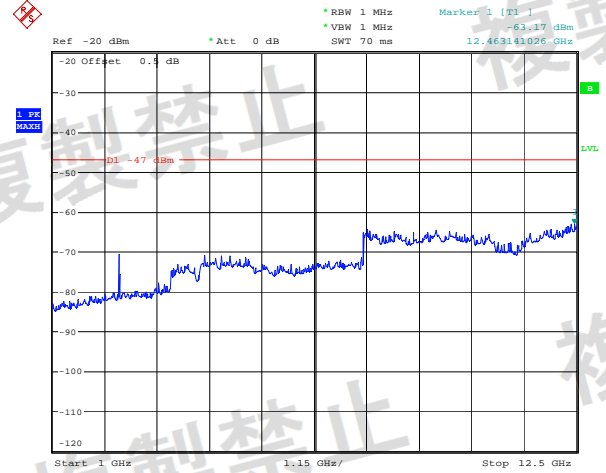
*Band II: 1000MHz ~ 12500MHz*

Please refer to the below plots for normal voltage test.

## BLE 1Mbps, Low Channel

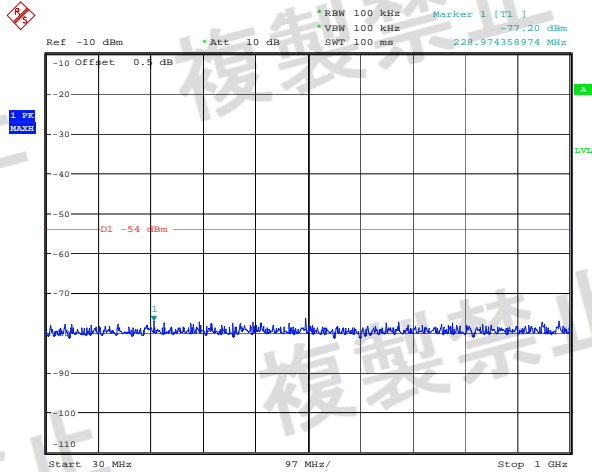


Comment: ProjectNo.:CR231059171-RF Tester:LingLing Li  
Date: 3.NOV.2023 14:28:37

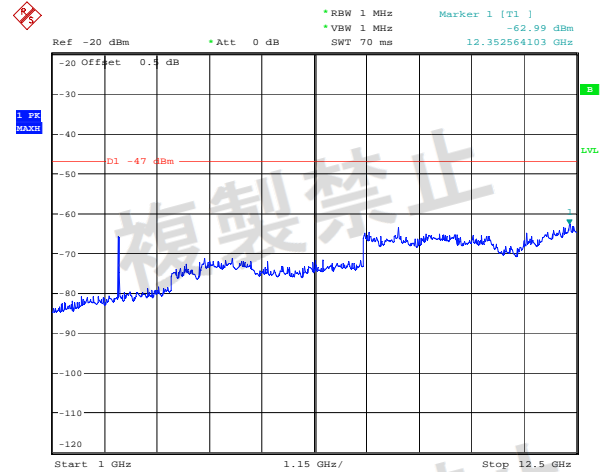


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## BLE 1Mbps, Middle Channel

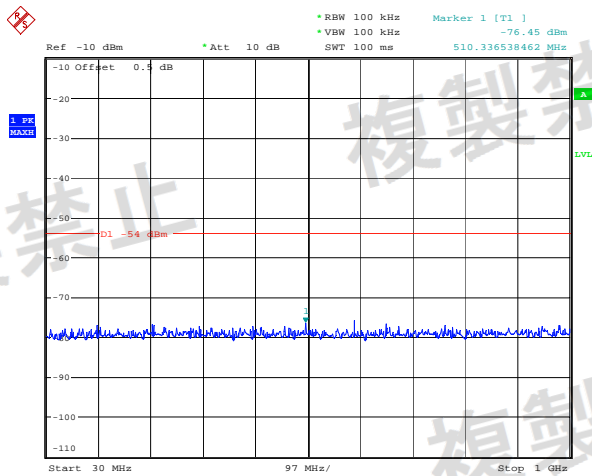


Comment: ProjectNo.:CR231059171-RF Tester:LingLing Li  
Date: 3.NOV.2023 14:28:42

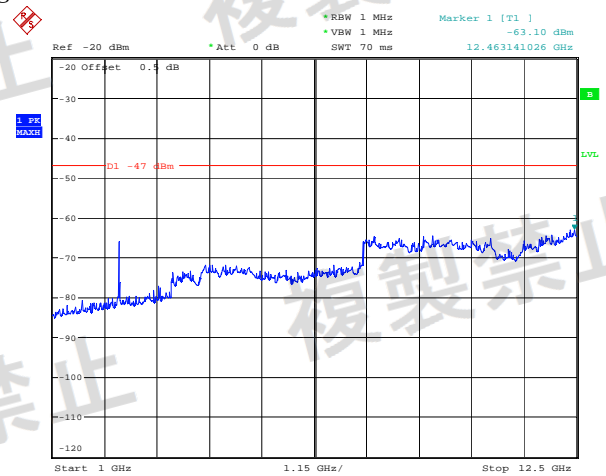


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## BLE 1Mbps, High Channel



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Comment: ProjectNo.:CR231059171-RF Tester:LingLing Li  
Date: 3.NOV.2023 14:31:13



## 5. EUT PHOTOGRAPHS

Please refer to the attachment CR231059171-EP EUT PHOTOGRAPHS.

## 6. TEST SETUP PHOTOGRAPHS

Please refer to the attachment CR231059171-07A-TSP TEST SETUP PHOTOGRAPHS.

\*\*\*\*\* END OF REPORT \*\*\*\*\*