Prüfbericht - Produkte
Test Report - Products

TÜVRheinland®

Prüfbericht-Nr.: *Test report no.:*	**CN25EHD9 001**	**Auftrags-Nr.:** *Order no.:*	168538399	Seite 1 von 24 *Page 1 of 24*
Kunden-Referenz-Nr.: *Client reference no.:*	N/A	**Auftragsdatum:** *Order date:*	2025-06-09	
Auftraggeber: *Client:*	Robert Bosch LLC 15000 Haggerty Plymouth MI 48170			
Prüfgegenstand: *Test item:*	Perfectly Keyless Master			
Bezeichnung / Typ-Nr.: *Identification / Type no.:*	PKM2.0			
Auftrags-Inhalt: *Order content:*	Test Report			
Prüfgrundlage: *Test specification:*	Article 2 Section 1 Item 19			

Wareneingangsdatum: *Date of sample receipt:*	2025-06-09	Refer to photo document
Prüfmuster-Nr.: *Test sample no:*	A004026257-006~10	
Prüfzeitraum: *Testing period:*	2025-06-19 - 2025-08-10	
Ort der Prüfung: *Place of testing:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüflaboratorium: *Testing laboratory:*	TÜV Rheinland (Shenzhen) Co., Ltd.	
Prüfergebnis*: *Test result*:*	Pass	

geprüft von: tested by:	x Bell Hu Signed by: Bell Hu	**genehmigt von:** *authorized by:*	X Jonathan Li Signed by: Jonathan Li
Datum: *Date:* 2026-02-09		**Ausstellungsdatum:** *Issue date:* 2026-02-09	
Stellung / Position:	Sachverständige(r)/Expert	**Stellung** / Position:	Sachverständige(r)/Expert

Sonstiges / *Other:*

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: *Test item complete and undamaged*

* Legende:	P(ass) = entspricht o.g. Prüfgrundlage(n)	F(ail) = entspricht nicht o.g. Prüfgrundlage(n)	N/A = nicht anwendbar	N/T = nicht getestet
** Legend:*	*P(ass) = passed a.m. test specification(s)*	*F(ail) = failed a.m. test specification(s)*	*N/A = not applicable*	*N/T = not tested*

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
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Anmerkungen
Remarks

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1 General Remarks

1.1 Complementary Materials

All attachments are integral parts of this test report. This applies especially to the following appendix:

Appendix A: Test result of Bluetooth Low Energy;

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2 Test Sites

2.1 Test Facilities

TÜV Rheinland (Shenzhen) Co., Ltd.
2-3F, 101 & 102, No.2, Nuclear Power Industrial Park, Fuming Community, Fucheng Street, Longhua District, Shenzhen 518000, China

CNAS Registration No.: L3080

2.2 List of Test and Measurement Instruments

Table 1: List of Test and Measurement Equipment

Equipment	Manufacturer	Model	Serial No.	Cal. Date	Cal. until	Calibration Body	Calibration Method*
Signal Analyzer	R&S	FSV 40	101441	2024-09-26	2025-09-25	GRGTEST	c
Power Meter	R&S	NRP2	107105	2024-10-31	2025-10-30	GRGTEST	c
Power Sensor	R&S	NRP-Z81	105677	2024-09-26	2025-09-25	GRGTEST	c
DC Power Supply	KIKUSUI	PAN35-5A	YM002997	2025-02-22	2026-02-21	GRGTEST	c
Digital Multi Meter	FLUKE	F15B	44350844WS	2025-02-24	2026-02-23	GRGTEST	c

Calibration Method:
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 listed in the right column of Table No. 3 attached hereto, which shall have been given any of calibration, etc. listed above from a) to c)

2.3 Uncertainty of Measurement

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

Table 2: Measurement Uncertainty

Parameter	Uncertainty
Occupied Bandwidth	± 2.08 %
Spurious emissions	± 3.68 dB
Output power density	± 0.99 dB
Antenna Power	± 0.99 dB
Frequency Tolerance	0.104 ppm

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3 General Product Information

3.1 Product Function and Intended Use

The product is Perfectly Keyless anchor which supports Bluetooth low energy and UWB wireless technology.

For details refer to the User Manual, Technical Description and Circuit Diagram.

3.2 Ratings and System Details

Table 3: Technical Specification of EUT

General Information of EUT	**Description**
Kind of Equipment:	Perfectly Keyless Master
Type Designation:	PKM2.0
MIC ID:	201-260110
Operating Voltage:	DC12.5V
Operating Temperature Range:	-40 ~+85℃
Hardware release No.:	0202
Software release No.:	14.06.09
Technical Specification of Bluetooth Low Energy	
Characteristic	**Description**
Frequency Range:	2402 MHz to 2480 MHz
Type of Modulation:	GFSK
Channel Number:	40 channels
Data Rate:	1Mbps, 500kbps
Channel Separation:	2 MHz
Antenna Type:	Integral Antenna
Antenna Gain:	2.8 dBi (Provided by the Client)
rated RF output power:	Please refer to Note 1
Conducted RF output power:	Please refer to Note 1
EIRP output power:	Please refer to Note 1

Note: The correctness of all data provided by customer in the test report is ensured and responsible of the customer. Any misjudgment of the test results caused by the use of incorrect data provided by customer shall be borne by the customer.

Note 1: The power table as below table:

Bluetooth LE			
Test mode	**Rated power (mW)**	**Conducted power(mW)**	**EIRP power (mW)**
Bluetooth LE, 1Mbps	5	1.91	3.64
Bluetooth LE, 500kbps	5	1.92	3.66

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Table 4: RF Channel and Frequency of Bluetooth LE

RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)	RF Channel	Frequency (MHz)
0	**2402**	10	2422	20	2442	30	2462
1	2404	11	2424	21	2444	31	2464
2	2406	12	2426	22	2446	32	2466
3	2408	13	2428	23	2448	33	2468
4	2410	14	2430	24	2450	34	2470
5	2412	15	2432	25	2452	35	2472
6	2414	16	2434	26	2454	36	2474
7	2416	17	2436	27	2456	37	2476
8	2418	18	2438	28	2458	38	2478
9	2420	**19**	**2440**	29	2460	**39**	**2480**

Test frequencies are lowest channel: 2402 MHz, middle channel: 2440 MHz and highest channel: 2480 MHz

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3.3 Antenna Specifications

3.3.1 Antenna Gain

Ant. Type	Connector Type	Highest Peak Gain (dBi) 2.4GHz ~ 2.5GHz
Integral Antenna	N/A	2.8 dBi

3.3.2 Antenna Pattern

Please refer to the attached file (Antenna report).

3.4 Noise Generating and Noise Suppressing Parts

For details refer to the Circuit Diagram.

3.5 Submitted Documents

- Application Form
- Operation Description
- User Manual
- Rating Label

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4 Test Set-up and Operation Modes

4.1 Principle of Configuration Selection

Emission: The equipment under test (EUT) was configured to measure its highest possible radiation level. The test modes were adapted accordingly in reference to the instructions for use.

Radio Spectrum: The equipment under test (EUT) was configured at its highest power output in order to measure its highest possible radiation and conducted level. The test modes were adapted accordingly in reference to the instructions for use.

4.2 Test Operation and Test Software

Test operation refers to test setup in chapter 5 and chapter 6.

The RF circuits are located inside of the EUT, also it won't be easy to open and require special tools. Frequency Band, channels and modulation parameters are fixed inside the module. They cannot be edited or modified by end-user.

Table 5: Test Conditions

Test conditions	Unit
Voltage $_{normal}$	3.3V dc
Voltage $_{max}$	3.3V dc
Voltage $_{min}$	3.3V dc
Temperature	24.6 deg.C
Humidity	57 %

Note: During the input supply voltage to the EUT from the external power source is varied by +/- 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 +/-1%. Exempt extremely high and low supply voltage condition test, EUT only operated in normal voltage to test all regulations.

4.3 Special Accessories and Auxiliary Equipment

Table 6: List of Accessories and Auxiliary Equipment

Description	Manufacturer	Model	S/N
Laptop	Lenovo	T480	PF-16A6N8

4.4 Countermeasures to Achieve EMC Compliance

The test sample which has been tested contained the noise suppression parts as described in the Technical Construction File (TCF).

No additional measures were employed to achieve compliance.

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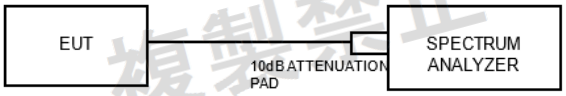
5 Test Results

5.1 Frequency Tolerance Measurement

5.1.1 Limits of Frequency Tolerance Measurement

Tolerance of frequency shall be +/- 50ppm

5.1.2 Test Setup



5.1.3 Condition of Measuring Instrument

(1) As a frequency meter, use a frequency counter or spectrum analyzer (with a synthesizer type local oscillator).
(2) The measurement accuracy of the frequency meter shall be 1/10 or less of the allowable value specified in the Equipment Regulations.
(3) When measuring burst waves, set the gate open time to the time that allows the entire burst section to be measured.

5.1.4 Condition of Test Equipment

(1) Set the test frequency and transmit.
(2) Stop modulation and continuously transmit non-modulated waves. However, if modulation is stopped and continuous transmission of unmodulated waves cannot be performed, continuous burst transmission of unmodulated waves or a modulation state that produces a characteristic frequency spectrum whose frequency can be measured by a spectrum analyzer is used.

5.1.5 Measurement procedure

(1) In the case of unmodulated waves (continuous or continuous burst), measure directly with a frequency meter.
(2) In the case of burst waves, measure for the time period when sufficient accuracy is obtained, calculate the average value, and use it as the measured value.
(3) If the test mode produces a characteristic frequency spectrum, measure the frequency of that spectrum with a spectrum analyzer.

5.1.6 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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5.2 Occupied Bandwidth Measurement (99% Power Bandwidth)

5.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit	Remark
Occupied bandwidth	shall be 83.5MHz or less	FHSS
Occupied bandwidth	<26MHz	For 20M
Occupied bandwidth	<40MHz	For 40M

5.2.2 Test Setup

5.2.3 Measuring Instrument Conditions

Set the spectrum analyzer as follows.
Center frequency: Test frequency
Sweep frequency width From about 2 times to about 3.5 times the allowable value specified in the equipment regulations
Resolution bandwidth: 3% or less of the allowable value specified in the equipment regulations
Video bandwidth: Same as resolution bandwidth
Input level : The level at which the carrier wave level can be measured without being affected by the noise level of the spectrum analyzer.
Sweep time: Minimum time for guaranteed measurement accuracy
(In the case of burst waves, when more than 1 burst per sample)

Sweep mode: Continuous sweep
Detection mode: Positive peak (Note)
Display mode: Max hold (Note)

Note: For OFDM and other than burst waves, the following shall apply.
Average processing times 10 times or more
Detection mode sample

5.2.4 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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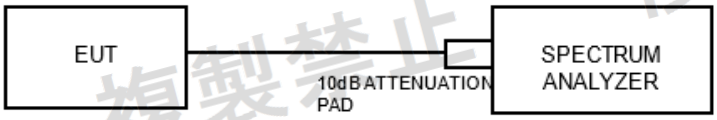
5.3 Spreading Bandwidth Measurement (90% Power Bandwidth)

5.3.1 Limits of Spreading Bandwidth and Spreading Factor

Item	Limit	Remark
Spreading Bandwidth	≧500kHz	(For DSSS, FHSS)
Spreading Factor	≧5	Operating frequency 2400 to 2483MHz
	≧10	Operating frequency 2471 to 2497MHz

5.3.2 Test Setup



5.3.3 Measuring Instrument Conditions

Set the spectrum analyzer as follows.
Center frequency: Test frequency
Sweep frequency width From about 2 times to about 3.5 times the allowable value specified in the equipment regulations
Resolution bandwidth: 3% or less of the allowable value specified in the equipment regulations
Video bandwidth: Same as resolution bandwidth
Input level: The level at which the carrier wave level can be measured without being affected by the noise level of the spectrum analyzer.
Sweep time: Minimum time for guaranteed measurement accuracy
(In the case of burst waves, when more than 1 burst per sample)

Sweep mode: Continuous sweep
Detection mode: Positive peak (Note)
Display mode: Max hold (Note)

Note: For OFDM and other than burst waves, the following shall apply.
Average processing times 10 times or more
Detection mode sample

5.3.4 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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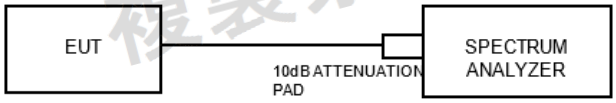
5.4 Spurious Emissions for Transmitter Measurement

5.4.1 Limits of Spurious Emissions

Frequencies (MHz)	Limit
Operating frequency 2400 to 2483.5MHz	
30.0MHz to 2387MHz	≦ 2.5uW/MHz
2387.0MHz to 2400.0MHz	≦ 25uW/MHz
2483.5MHz to 2496.5MHz	≦ 25uW/MHz
2496.5MHz to 12500.0MHz	≦ 2.5uW/MHz

5.4.2 Test Setup



5.4.3 Conditions of The Measuring Instrument.

(1) The spectrum analyzer when searching for **unwanted emissions** is set as follows.

Sweep frequency width: 30MHz to 26GHz (Note)
Resolution bandwidth: 1MHz
Video bandwidth: Same as resolution bandwidth
Y-axis scale: 10dB/Div
Input level: Maximum dynamic range value
Sweep time: The minimum time for which measurement accuracy is guaranteed (in the case of burst waves, it can be longer than the time obtained by "(sweep frequency width (MHz)/resolution Bandwidth (MHz)) × burst period (s)" .) It can be longer than the time required
Number of data points: 400 or more data points
Sweep mode: Single sweep
Detection mode: positive peak

(2) Set the spectrum analyzer as follows when measuring unwanted emission amplitude.

Center frequency: Unwanted emission frequency (searched frequency)
Sweep frequency width: 0Hz
Resolution bandwidth: 1MHz
Video bandwidth: Same as resolution bandwidth
Y-axis scale: 10dB/Div
Input level Maximum dynamic range value
Sweep time; The minimum time for which the measurement accuracy is guaranteed (in the case of burst waves, the duration of one burst or more)
Number of data points: 400 or more data points
Sweep mode: Single sweep
Detection mode: sample

5.4.4 Others

(1) In 2(2), the detection mode of the spectrum analyzer at the time of amplitude measurement can use RMS (referred to as the true value of power) instead of sampling.
(2) In (1), if the burst time rate (Note) of unwanted emission is obtained for each unwanted emission frequency, the sweep frequency width can be set to about 10 MHz in (2).

Note: Burst time rate = time during which radio waves are emitted/burst period

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5.4.5 Conditions of the measuring instrument

(1) Use a carrier suppression filter as necessary.

(2) The settings of the spectrum analyzer when searching for spurious are as follows.
Sweep frequency width: Search for spurious from the lowest possible frequency to three times or more of the carrier frequency.
Resolution bandwidth:100 kHz below 1 GHz, 1 MHz above 1 GHz
Video bandwidth: Same as resolution bandwidth
Y-axis scale: 10dB/Div
Input level: Maximum dynamic range value
Sweep time: Minimum time for guaranteed measurement accuracy
Number of data points: 400 or more data points
Sweep mode: Single sweep
Detection mode: positive peak

(3) Set the spectrum analyzer for spurious measurement as follows.
Center frequency: Searched spurious frequency
Sweep frequency: 0Hz
Resolution bandwidth:10 kHz below 30 MHz, 100 kHz between 30 MHz and 1 GHz, 1 MHz above 1 GHz
Video bandwidth: Same as resolution bandwidth
Y-axis scale: 10dB/Div
Input level: Set the amplitude of the carrier wave near the maximum in the linear region of the mixer.
Sweep time: Minimum time for guaranteed measurement accuracy
Number of data points: 400 or more data points
Sweep mode: Single sweep
Detection mode: sample

Spurious Emission
(1) Set the spectrum analyzer as follows when searching.
Sweep frequency width: 30MHz to 5 times the carrier frequency
Resolution bandwidth: 100 kHz for frequencies below 1 GHz, 1 MHz for frequencies above 1 GHz
Video bandwidth: Same as resolution bandwidth
Sweep time: Minimum time for guaranteed measurement accuracy
Sweep mode: Single sweep
Detection mode : positive peak
(2) Set the spectrum analyzer for secondary emission measurement as follows.
Center frequency: Secondary emission frequency
Sweep frequency width: 0Hz
Resolution bandwidth: 100 kHz for frequencies below 1 GHz, 1 MHz for frequencies above 1 GHz
Video bandwidth: Same as resolution bandwidth
Sweep time: Minimum time for guaranteed measurement accuracy
Sweep mode: Single sweep
Detection mode: sample

5.4.6 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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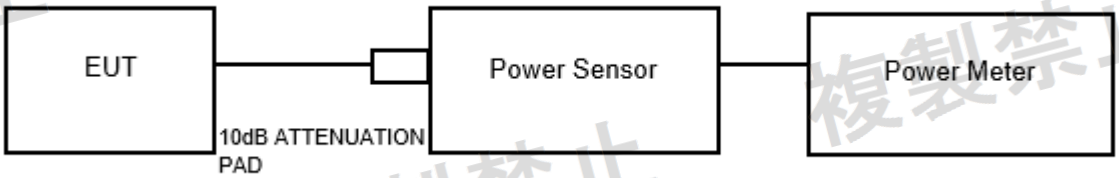
5.5 Antenna Power Measurement

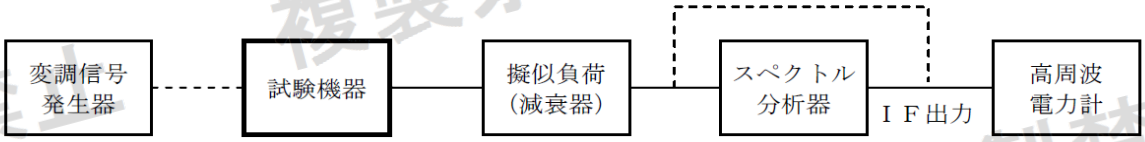
5.5.1 Limits of Antenna Power

Modulation system	Frequency band used	Antenna power (max.)	EIRP (max)	
			Omni-directional case	Directional case
FHSS	2,400 – 2,4835 MHz	3mW/MHz	--	--
DS.OFDM (Narrow-Band)	2,400 – 2,4835 MHz	10mW/MHz	12.14 dBm/MHz (16.367 mW/MHz)	22.14 dBm/MHz (163.682 mW/MHz)
OFDM (Wide-Band)	2,400 – 2,4835 MHz	5mW/MHz	9.13dBm/MHz (8.185mW/MHz)	19.13dBm/MHz (81.846mW/MHz)
DTS	2,400 – 2,4835 MHz	10mW	12.14 dBm 16.367 mW	22.14 dBm 163.682 mW

Tolerance of antenna power shall be +20% (upper value)
According article 49.20 f(2)The angular width of the principal radiation in the horizontal and vertical planes of the transmitting antenna shall not exceed the value obtained by the following expression. 360/A degree
A represents the value determined by dividing an equivalent isotropically radiated power by the value obtained by applying an antenna power with the mean power of 10 mW to the transmitting antenna with its absolute gain being 2.14 dB, and shall be 1 when it is lower than 1.

5.5.2 Test Setup





Note: A high-frequency power meter is directly connected to the output of a dummy load (attenuator) when measuring the total power of a system other than the orthogonal frequency division multiplexing system or the spread spectrum system using direct spreading.

5.5.3 Condition of Measuring Instrument

(1) Measure the equivalent noise bandwidth at the resolution bandwidth of 1 MHz of the spectrum analyzer, correct the bandwidth to the 1 MHz equivalent bandwidth, and read the displayed value. However, when the spread bandwidth is 1 MHz or less, correction shall be performed only when "spread bandwidth (MHz)/equivalent noise bandwidth (MHz)" exceeds 1.
(2) The attenuation of the dummy load (attenuator) shall be the value that gives the optimum operating input level to the spectrum analyzer.
(3) Set the spectrum analyzer as follows when searching for the frequency that gives the maximum antenna power.

Center frequency:	Test frequency
Sweep frequency width:	About twice the occupied frequency bandwidth
Resolution bandwidth:	1MHz
Video bandwidth:	About three times the resolution bandwidth
Sweep time:	Minimum time for guaranteed measurement accuracy

(In the case of burst waves, the time at which one or more bursts are included per sample)

Trigger condition:	Free run
Sweep mode:	Continuous sweep
Detection mode:	positive peak
Display mode:	Max hold

(4) Set the spectrum analyzer as follows when measuring the antenna power.

Center frequency The frequency that gives the maximum power (searched frequency)

Sweep frequency width:	0Hz
Resolution bandwidth:	1MHz
Video bandwidth :	Same as resolution bandwidth
Sweep mode:	Continuous sweep

5.5.4 Condition of Test Equipment

(1) Set to the test frequency and enter the continuous transmission state or continuous burst transmission state.
(2) If a spread code is used, set it to the test spread code and modulate it with the standard coded test signal.
(3) If the orthogonal frequency division multiplexing system is used, it shall be in a burst transmission state and in a modulation state in which the proportion of time in which the number of subcarriers is the smallest is maximized. At this time, it is performed within a range that can occur continuously in the actual operation. However, when the modulation cannot be set, it can be performed in continuous burst transmission state or continuous transmission state.

5.5.5 Measurement Procedure

(1) Those using frequency hopping method (including DSSS or composite method with OFDM)

a. Confirming in the submitted document that the frequency hopping intervals in the frequency distribution of frequency hopping are equal intervals of 1 MHz or less, and that the probability of occurrence at each hopping frequency is uniform, and that the probability of occurrence at each hopping frequency is uniform. If it is, it is implemented by the following method.

(a) Connect a high frequency power meter to the output of the dummy load (attenuator) and measure the total power.

(b) Divide the total power by the spreading bandwidth to calculate the average power per 1 MHz.

(c) Antenna power shall be as follows.

A Value of (b) for continuous wave

B For burst wave Average power in burst is calculated from the value of (b) and the transmission time rate.

b. If the frequency distribution of frequency hopping or the probability of occurrence at each hopping frequency is not uniform, set the spectrum analyzer as in 2(3) to search for the frequency that gives the maximum antenna power, and then perform spectrum analysis. Set the device as in 2(4), and measure the antenna power at the frequency that gives the maximum power.

(2) In the case of those using OFDM or DSSS

a. Set the spectrum analyzer as in 2(3).

b. After repeating the sweep until no change is observed in the display, measure the frequency at which the power per 1 MHz gives the maximum value.

c. Set the spectrum analyzer as in 2(4).

d. Connect the high frequency power meter to the IF output terminal of the spectrum analyzer.

e. Antenna power shall be as follows.

(a) For continuous wave: The value corrected by 2(1) from the indication of the high-frequency power meter

(b) Burst wave: Calculated average power in a burst from values corrected in the same way as for continuous waves and the transmission time rate

f. In the case of using the orthogonal frequency division multiplexing system, when there are multiple subcarrier modulation systems, measure the antenna power at each time and take the largest value as the measured value.

(3) In the case of items using other methods

(a) Connect a high-frequency power meter to the output of the dummy load (attenuator) and measure the total power.

(b) Antenna power shall be as follows.

a. Value of a for continuous wave

b. Burst wave The average power in the burst is calculated from the value of (a) and the transmission time rate.

5.5.6 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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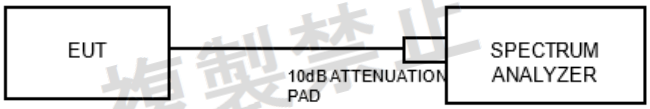
5.6 Spurious Emissions for Receiver

5.6.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	≦4nW (-54dBm)
Above 1GHz	≦20nW (-47dBm)

5.6.2 Test Setup



5.6.3 Measurement Procedure

(1) Set the spectrum analyzer as follows when searching.
Sweep frequency width: 30MHz to 5 times the carrier frequency
Resolution bandwidth: 100 kHz for frequencies below 1 GHz, 1 MHz for frequencies above 1 GHz
Video bandwidth: Same as resolution bandwidth
Sweep time: Minimum time for guaranteed measurement accuracy
Sweep mode: Single sweep
Detection mode: positive peak
(2) Set the spectrum analyzer for secondary emission measurement as follows.
Center frequency: Secondary emission frequency
Sweep frequency width: 0Hz
Resolution bandwidth: 100 kHz for frequencies below 1 GHz, 1 MHz for frequencies above 1 GHz
Video bandwidth: Same as resolution bandwidth
Sweep time: Minimum time for guaranteed measurement accuracy
Sweep mode: Single sweep
Detection mode: sample

5.6.4 Test Results

Result **PASS**

For the measurement records, refer to the appendix A.

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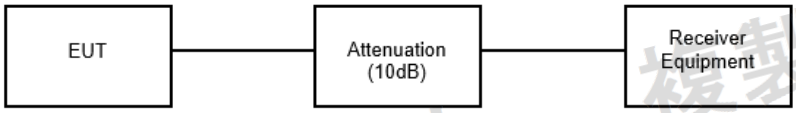
5.7 Interference Prevention Function

5.7.1 Limits of Interference Prevention Function

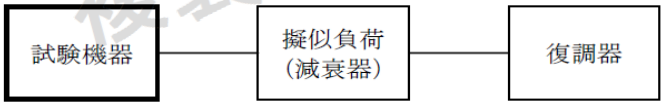
N/A

5.7.2 Test Setup

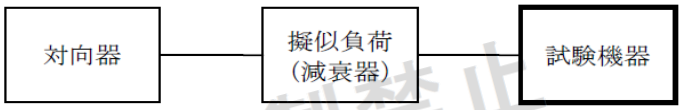


Measurement system diagram

(1) When sending an identification code



(2) When receiving an identification code



5.7.3 Condition of Measuring Instrument

(1) The demodulator shall be able to demodulate the transmission signal sent by EUT and display the content of the identification code.
(2) The counterpart device shall be capable of transmitting the same identification code as the transmission signal transmitted by EUT.
(3) Condition of test equipment
Normal use condition.

5.7.4 Measurement procedure

(1) When EUT has a function to automatically transmit an identification code
 a) Transmit the identification code specified in the Equipment Regulations from the test equipment.
 b) Check the identification code sent by the demodulator.
(2) When the test equipment has a function to automatically receive the identification code
 a) Transmit the identification code specified in the Equipment Regulations from the counterpart device.
 b) Confirm that communication is performed with the EUT using the dedicated jig.
 c) Transmit a code different from the identification code specified in the Equipment Regulations from the counterpart device.
 d) Confirm that EUT stops transmission or displays that the identification code is different.

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5.7.5 How to describe test results

(1) When EUT has a function to automatically transmit an identification code
If the code stipulated in the equipment rule and the demodulated code are the same, it is described as "passed", and if they are different, it is described as "failed".

(2) When the test equipment has a function to automatically receive the identification code
If the received code is the code stipulated in the equipment regulations, normal reception is performed, and if the code is different from the code stipulated in the equipment regulations, a message indicating that the code is different is displayed. “No” shall be entered in other case.

5.7.6 Test Results

Link Mode	Test Result
Bluetooth LE	PASS

For the measurement records, refer to the appendix A.

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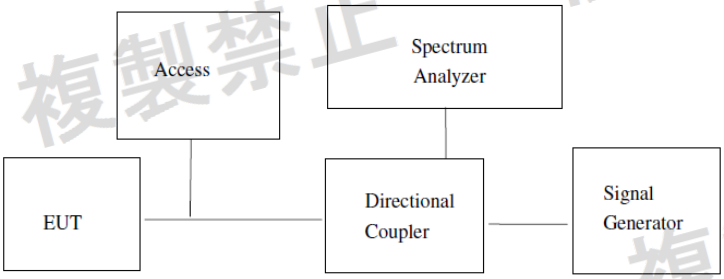
5.8 Carrier Sensing

5.8.1 Test Setup



5.8.2 Measurement procedure

(a) Link EUT and Access Point to Directional Coupler input port.
(b) Link Signal Generator and Spectrum Analyzer to test port and output port in the Directional Coupler separately.
(c) A positive Peak Detector function in Spectrum Analyzer must be used.
(d) Set the Span to Zero.
Press the Signal Generator on and it will output the Carrier Signal. When the Link breaks off, wait a minute and press the Signal Generator off. After a while, reset the Link and done the test.

5.8.3 Test Results

Result **N/A**

Not required for BLE.

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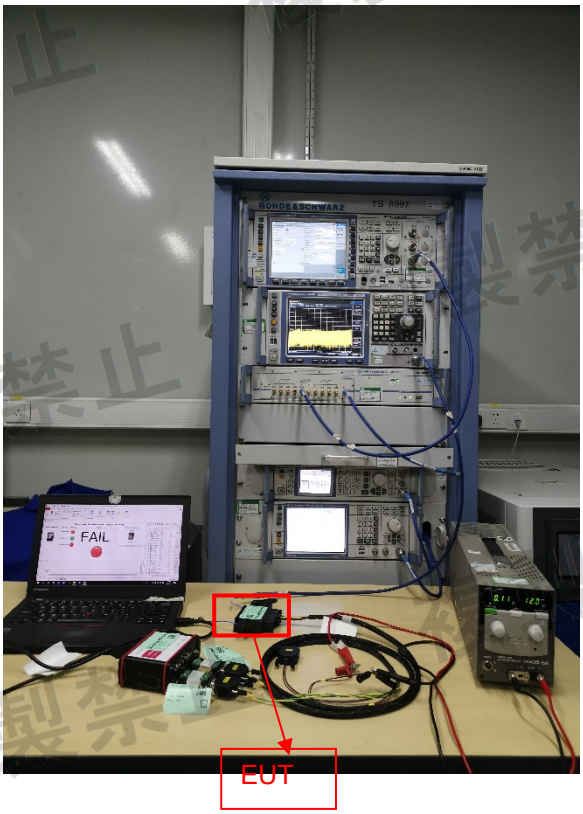
6 Photographs of the Test Set-Up

Photograph 1: Set-up for Radio Spectrum Testing



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Appendix A: Test Results of Bluetooth Low Energy

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Appendix A.1: Test Results of Frequency Tolerance

Test Result

TestCondition	Mode	Freq(MHz)	Result[ppm]	Limit[ppm]	Verdict
NTNV	1Mbps	2402	-7.24	±50	PASS
		2440	-7.13	±50	PASS
		2480	-7.01	±50	PASS

TestCondition	Antenna	Freq(MHz)	Result[ppm]	Limit[ppm]	Verdict
NTNV	500kbps	2402	-10.86	±50	PASS
		2440	-10.69	±50	PASS
		2480	-10.52	±50	PASS

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Appendix A.2: Test Results of Antenna Power

Test Result

Antenna Power							
Test Condition	Test Mode	Antenna	Freq (MHz)	Result(dBm)	Result(mW)	Limit(mW)	Verdict
NTNV	BLE_1M	Ant1	2402	2.62	1.83	≤10	PASS
			2440	2.81	1.91	≤10	PASS
			2480	0.87	1.22	≤10	PASS
	BLE_500k	Ant1	2402	2.63	1.83	≤10	PASS
			2440	2.84	1.92	≤10	PASS
			2480	0.89	1.23	≤10	PASS

Tolerance								
Test Condition	Test Mode	Antenna	Freq (MHz)	Power (mW)	RatedPower (mW)	Result (%)	Limit (%)	Verdict
NTNV	BLE_1M	Ant1	2402	1.83	5	-63.44	+20	PASS
			2440	**1.91**	5	-61.80	+20	PASS
			2480	1.22	5	-75.56	+20	PASS
	BLE_500k	Ant1	2402	1.83	5	-63.35	+20	PASS
			2440	**1.92**	5	-61.54	+20	PASS
			2480	1.23	5	-75.45	+20	PASS

EIRP							
Test Condition	Test Mode	Antenna	Freq (MHz)	Power (dBm)	EIRP(dBm)	Limit(dBm)	Verdict
NTNV	BLE_1M	Ant1	2402	2.62	5.42	≤12.14	PASS
			2440	2.81	5.61	≤12.14	PASS
			2480	0.87	3.67	≤12.14	PASS
	BLE_500k	Ant1	2402	2.63	5.43	≤12.14	PASS
			2440	2.84	5.64	≤12.14	PASS
			2480	0.89	3.69	≤12.14	PASS

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Appendix A.3: Test Results of Occupied Channel Bandwidth (99%)

Test Result

TestCondition	TestMode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	2402	1.322	≤26	PASS
			2440	1.252	≤26	PASS
			2480	1.287	≤26	PASS
	BLE_500k	Ant1	2402	1.270	≤26	PASS
			2440	1.270	≤26	PASS
			2480	1.304	≤26	PASS

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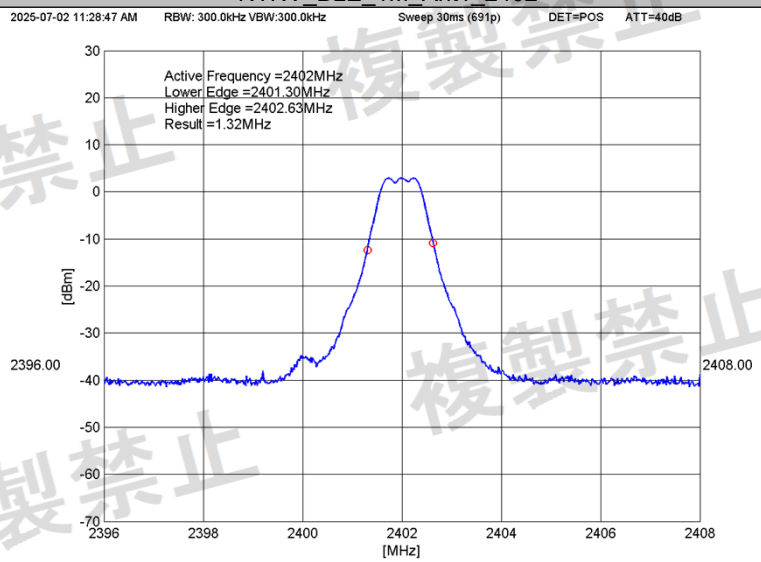
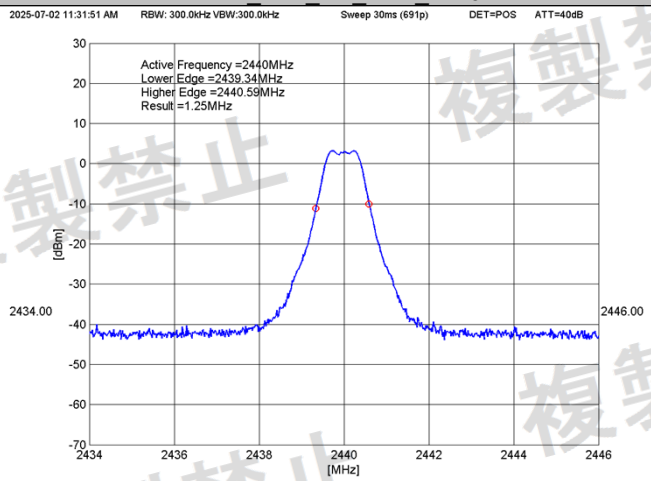
Test Graphs

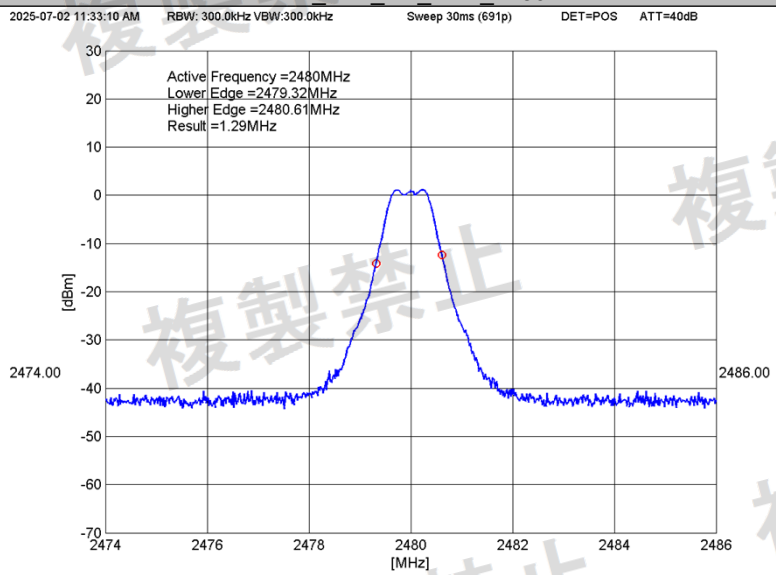
NTNV_BLE_1M_Ant1_2402



NTNV_BLE_1M_Ant1_2440



NTNV_BLE_1M_Ant1_2480



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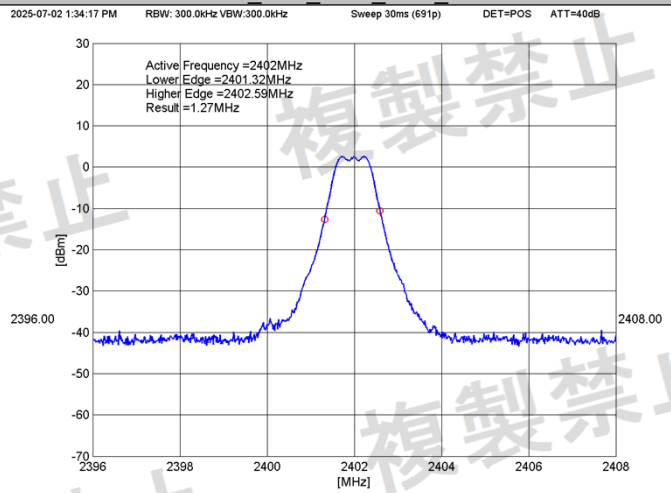
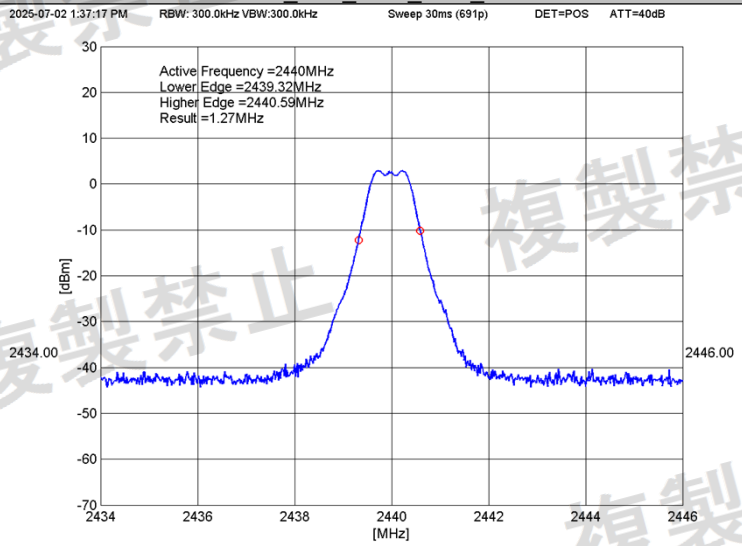
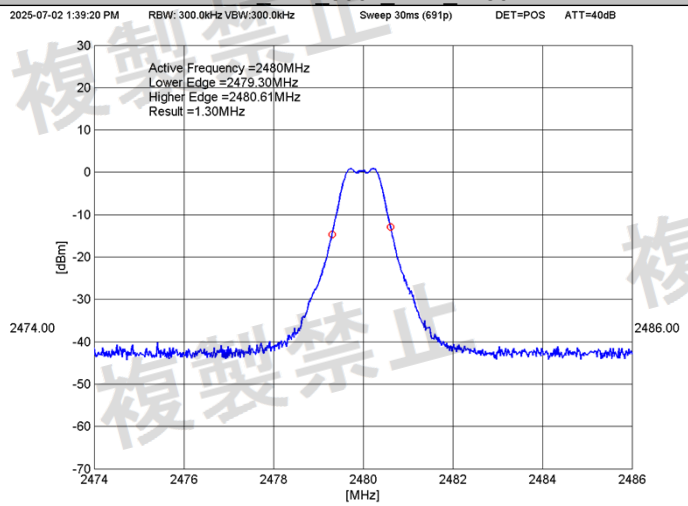
NTNV_BLE_500k_Ant1_2402



NTNV_BLE_500k_Ant1_2440



NTNV_BLE_500k_Ant1_2480



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Appendix A.4: Test Results of Spread Bandwidth (90%)

Test Result

TestCondition	TestMode	Antenna	Freq(MHz)	Result [MHz]	Limit [MHz]	Verdict
NTNV	BLE_1M	Ant1	2402	0.87	≥0.5	PASS
			2440	0.83	≥0.5	PASS
			2480	0.83	≥0.5	PASS
	BLE_500k	Ant1	2402	0.85	≥0.5	PASS
			2440	0.85	≥0.5	PASS
			2480	0.85	≥0.5	PASS

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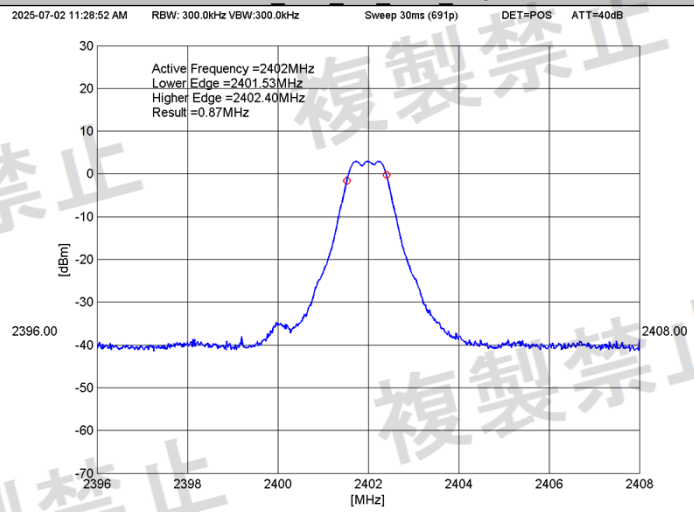
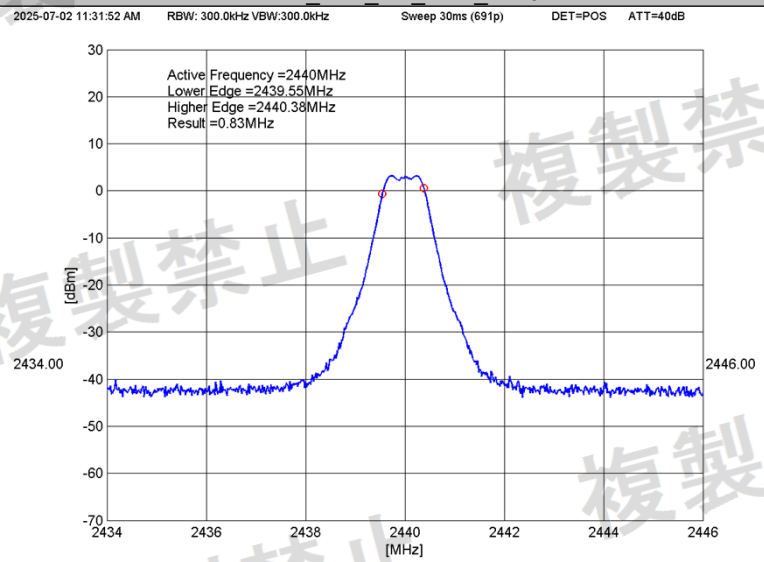
Test Graphs

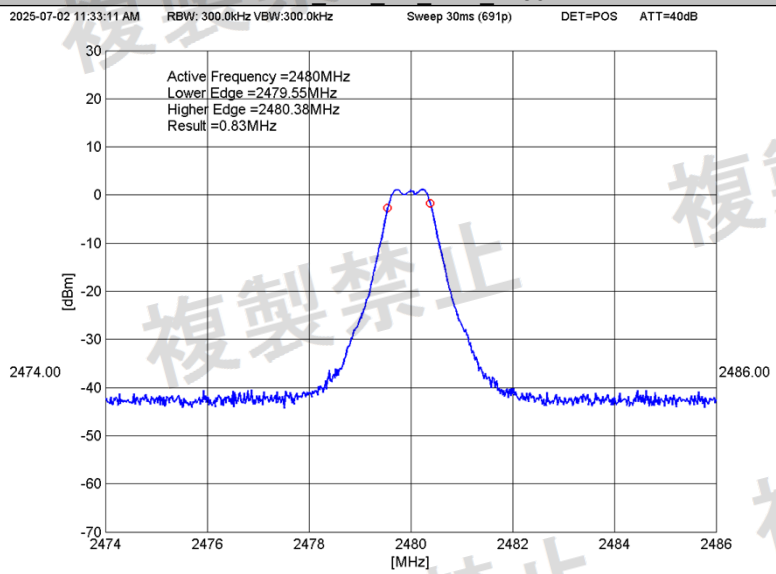
NTNV_BLE_1M_Ant1_2402



NTNV_BLE_1M_Ant1_2440



NTNV_BLE_1M_Ant1_2480



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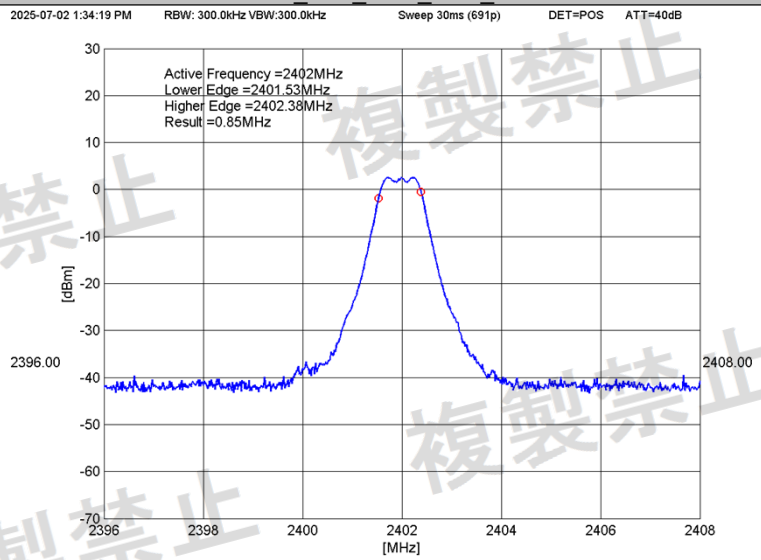
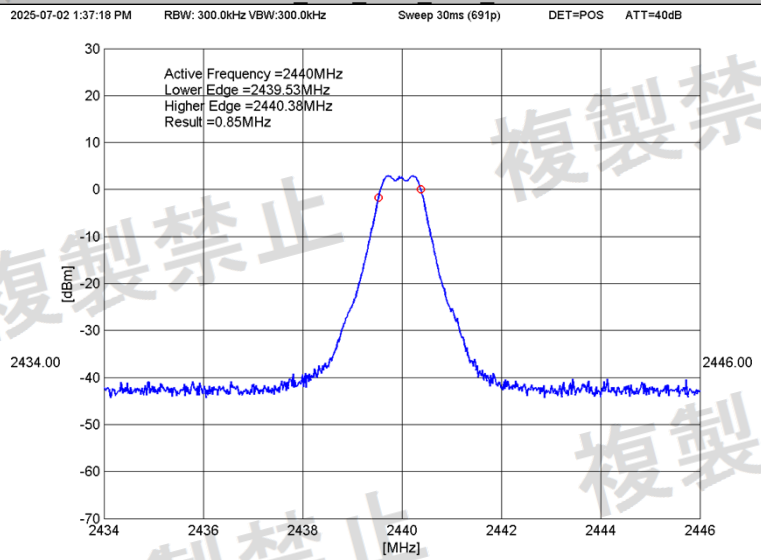
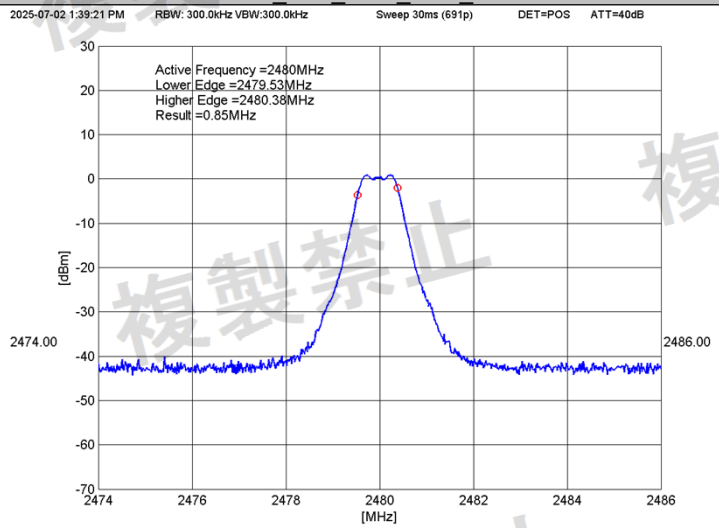
NTNV_BLE_500k_Ant1_2402



NTNV_BLE_500k_Ant1_2440



NTNV_BLE_500k_Ant1_2480



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Appendix A.5: Test Results of Spurious Emissions for Transmitter

Test Result

TestCondition	Test Mode	Antenna	Freq (MHz)	Freq.Range [MHz]	Freq. [MHz]	Result [μW]	Limit [μW]	Verdict
NTNV	BLE_1M	Ant1	2402	30~2387	2317.55	0.003	≤2.5	PASS
				2387~2400	2399.99	1.38	≤25	PASS
				2483.5~2496.5	2487.33	0.005	≤25	PASS
				2496.5~12500	9607.23	0.018	≤2.5	PASS
			2440	30~2387	1930.98	0.003	≤2.5	PASS
				2387~2400	2391.58	0.01	≤25	PASS
				2483.5~2496.5	2487.74	0.010	≤25	PASS
				2496.5~12500	4879.82	0.017	≤2.5	PASS
			2480	30~2387	942.59	0.003	≤2.5	PASS
				2387~2400	2388.86	0.004	≤25	PASS
				2483.5~2496.5	2483.96	0.014	≤25	PASS
				2496.5~12500	9918.90	0.018	≤2.5	PASS
	BLE_500k	Ant1	2402	30~2387	2367.78	0.003	≤2.5	PASS
				2387~2400	2400.00	1.35	≤25	PASS
				2483.5~2496.5	2488.03	0.005	≤25	PASS
				2496.5~12500	9607.23	0.016	≤2.5	PASS
			2440	30~2387	2187.73	0.003	≤2.5	PASS
				2387~2400	2392.33	0.01	≤25	PASS
				2483.5~2496.5	2487.98	0.009	≤25	PASS
				2496.5~12500	9760.37	0.014	≤2.5	PASS
			2480	30~2387	1562.53	0.003	≤2.5	PASS
				2387~2400	2388.65	0.004	≤25	PASS
				2483.5~2496.5	2483.53	0.015	≤25	PASS
				2496.5~12500	5246.90	0.026	≤2.5	PASS

Note: The values in μW listed above tables were converted from values in dBm in below plots.

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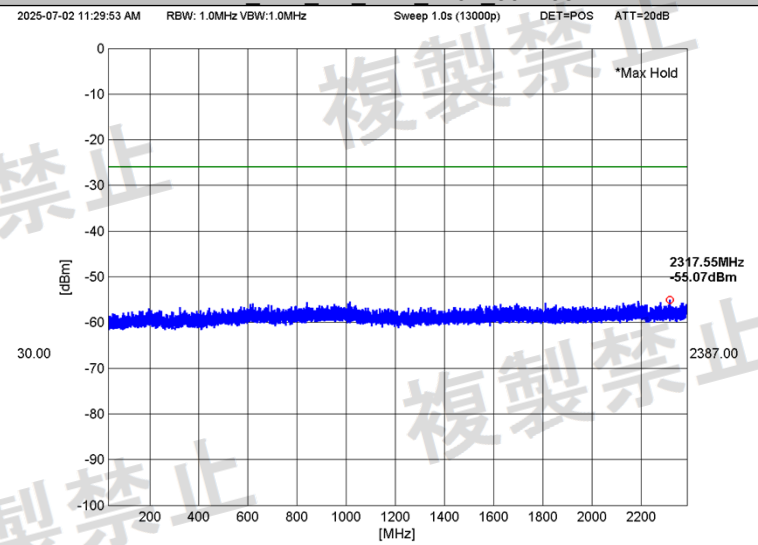
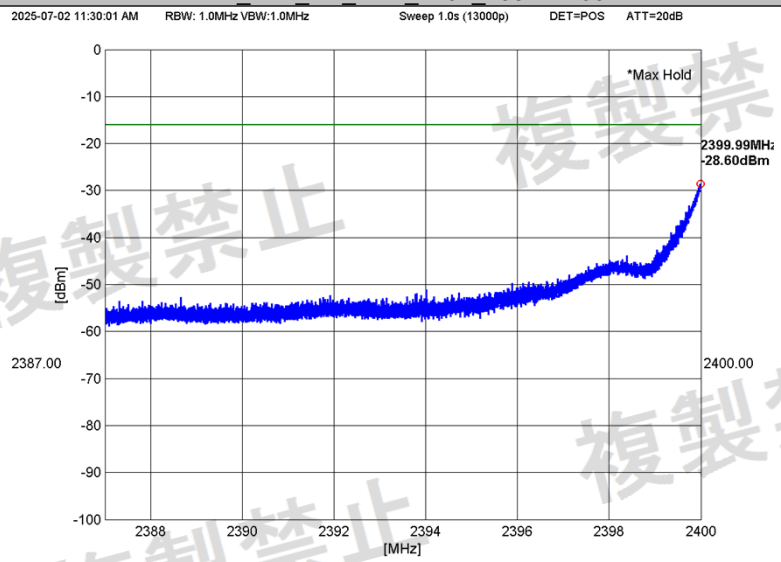
Test Graphs

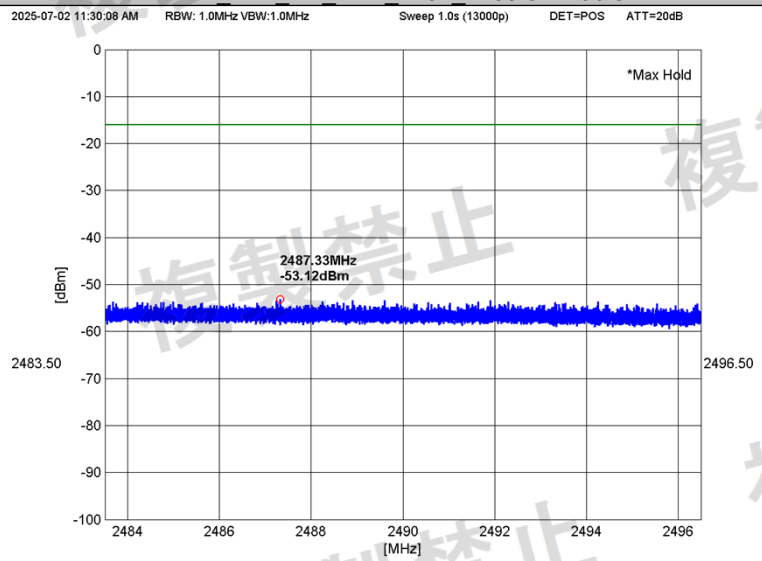
NTNV_BLE_1M_Ant1_2402_30~2387



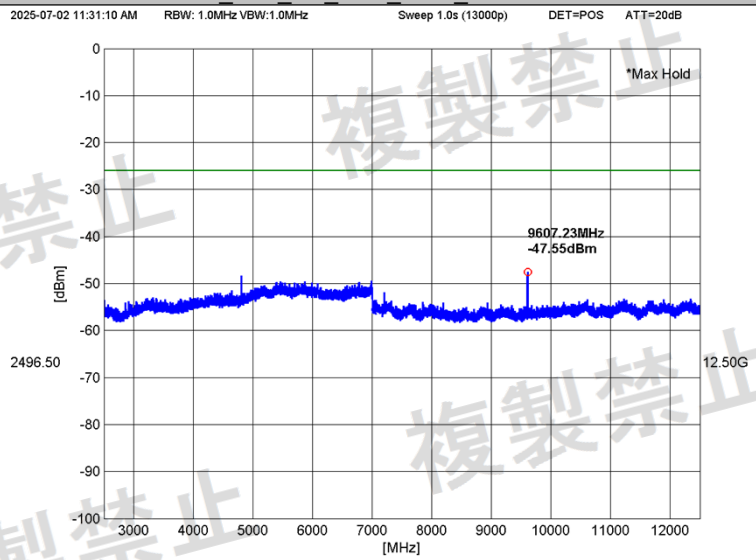
NTNV_BLE_1M_Ant1_2402_2387~2400



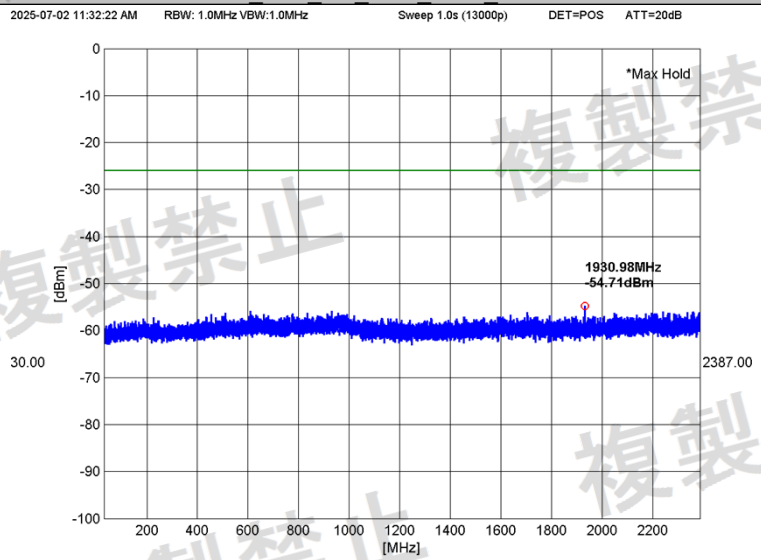
NTNV_BLE_1M_Ant1_2402_2483.5~2496.5



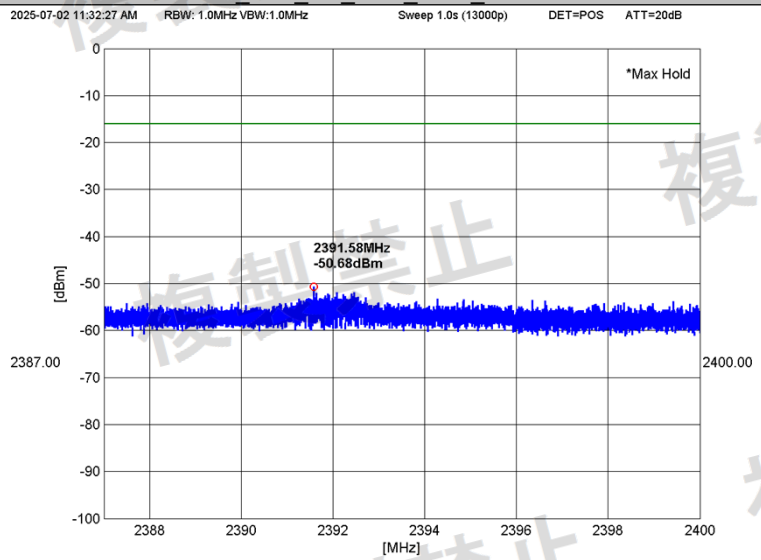
NTNV_BLE_1M_Ant1_2402_2496.5~12500



NTNV_BLE_1M_Ant1_2440_30~2387

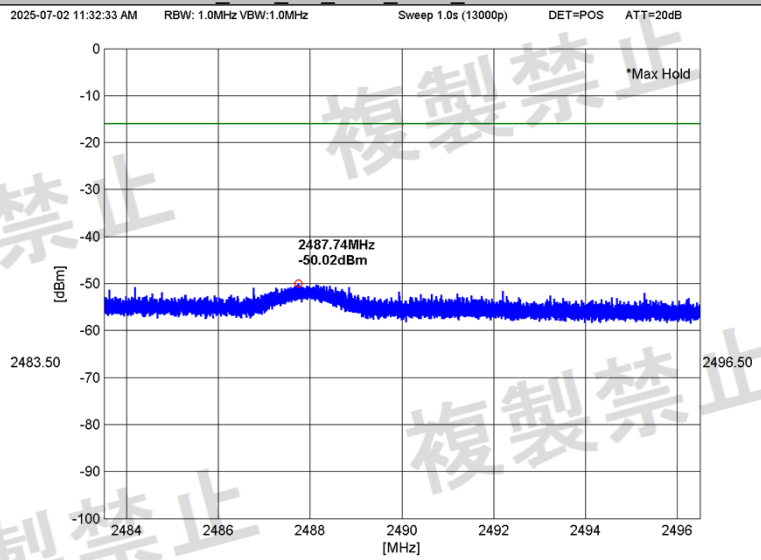


NTNV_BLE_1M_Ant1_2440_2387~2400

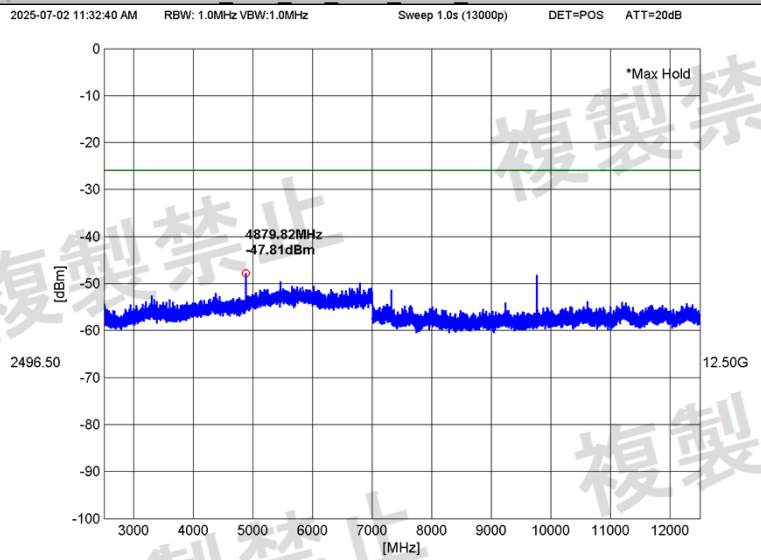


複製禁止

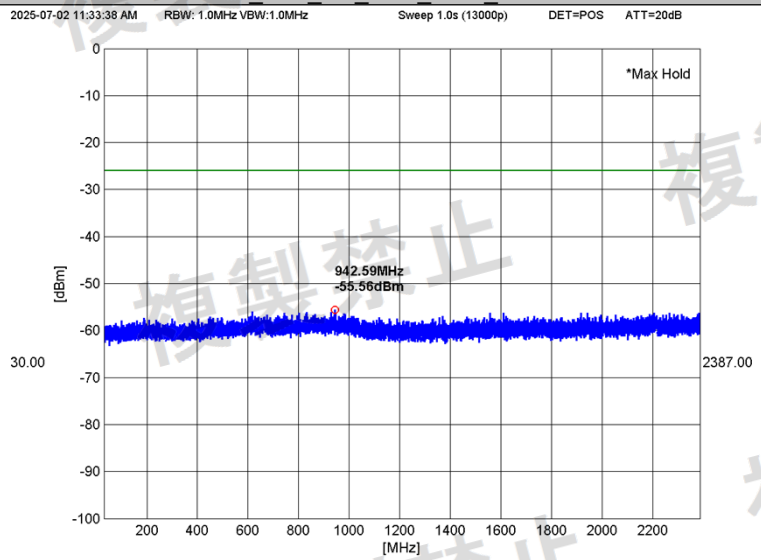
NTNV_BLE_1M_Ant1_2440_2483.5~2496.5



NTNV_BLE_1M_Ant1_2440_2496.5~12500

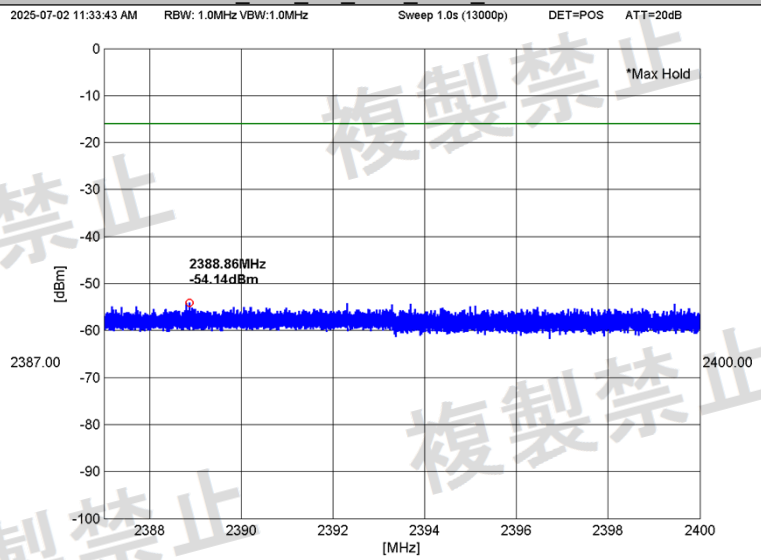


NTNV_BLE_1M_Ant1_2480_30~2387

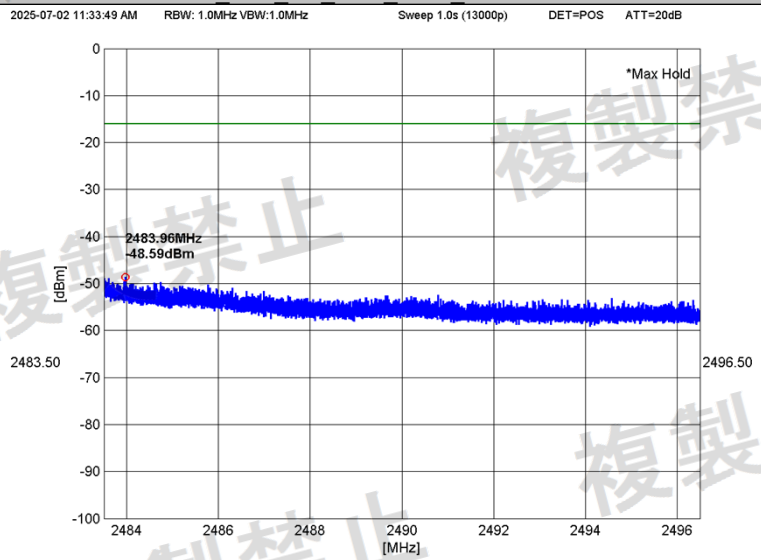


複製禁止

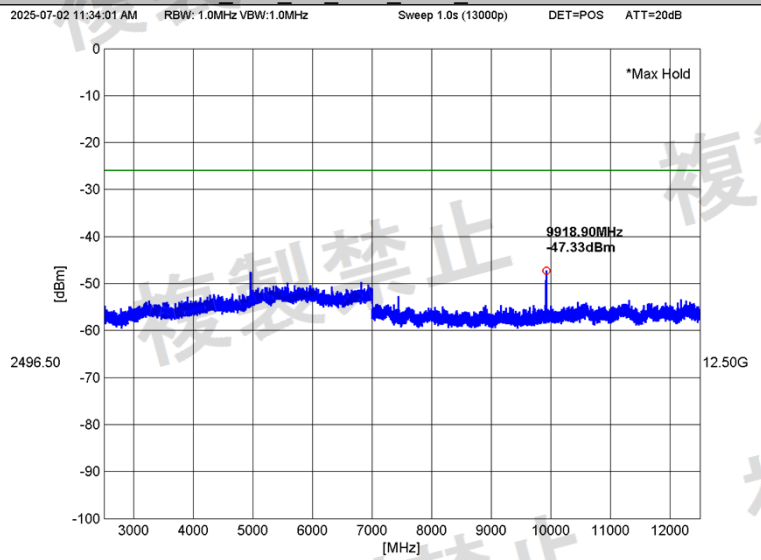
NTNV_BLE_1M_Ant1_2480_2387~2400



NTNV_BLE_1M_Ant1_2480_2483.5~2496.5

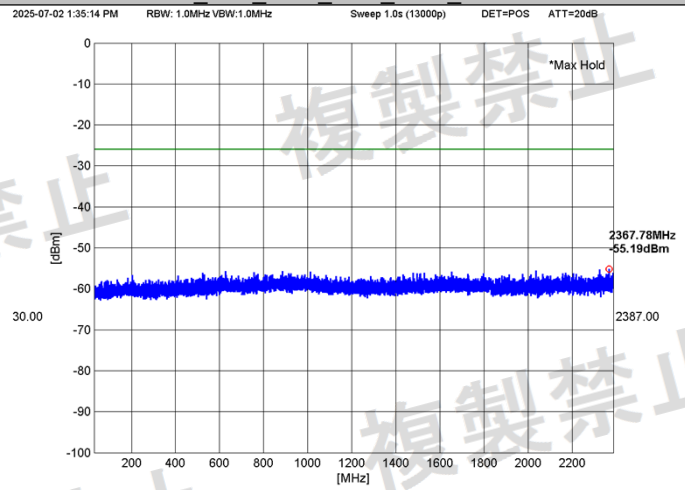


NTNV_BLE_1M_Ant1_2480_2496.5~12500

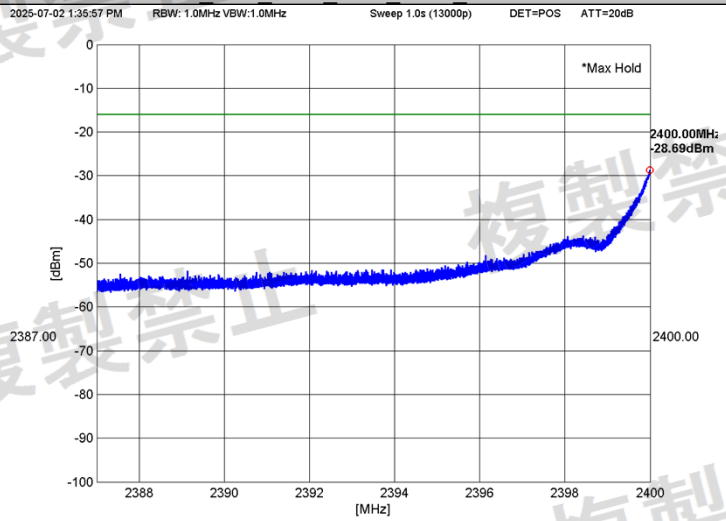


複製禁止

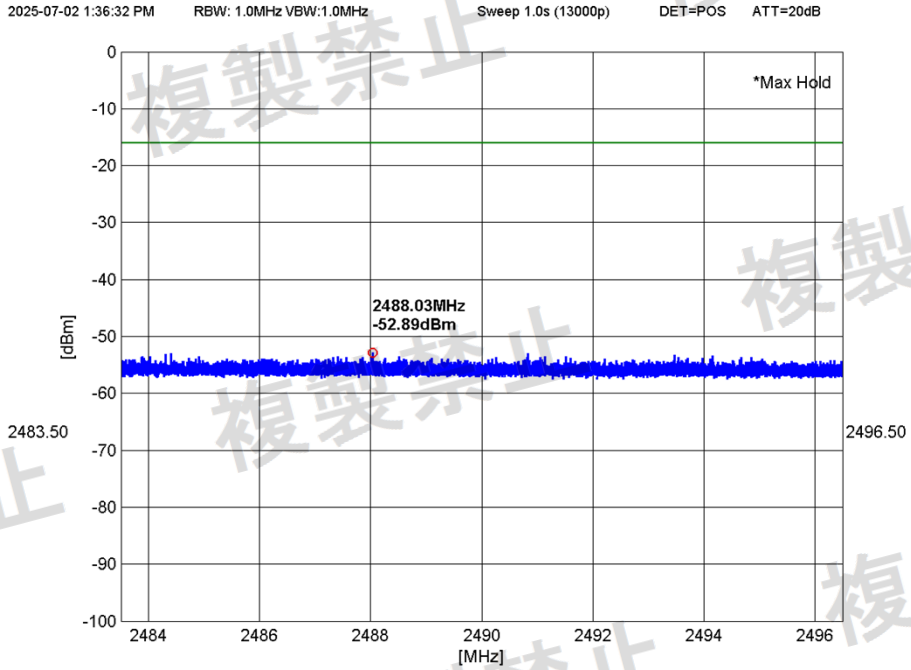
NTNV_BLE_500k_Ant1_2402_30~2387



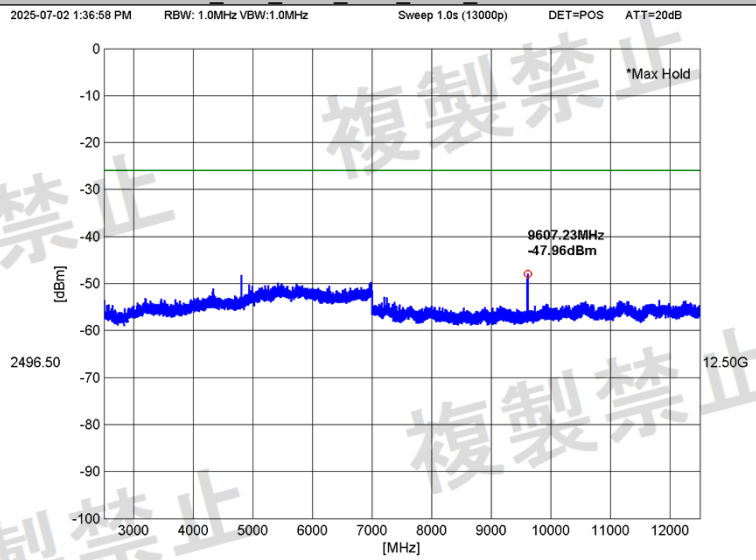
NTNV_BLE_500k_Ant1_2402_2387~2400



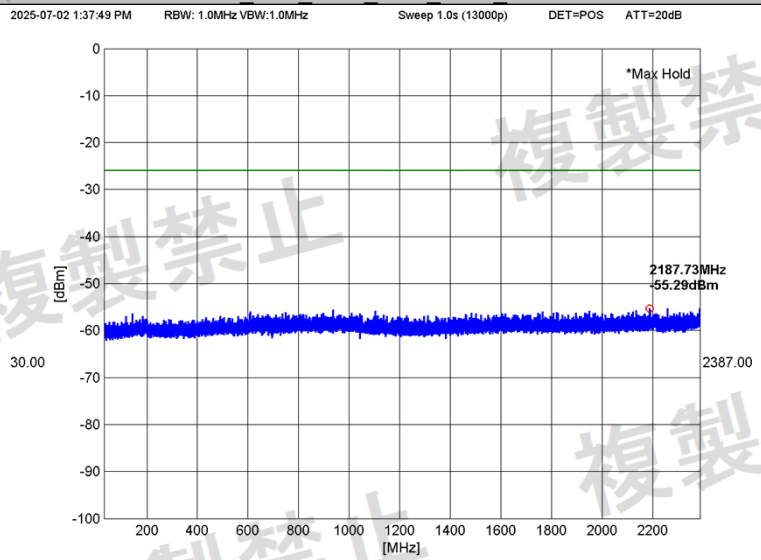
NTNV_BLE_500k_Ant1_2402_2483.5~2496.5



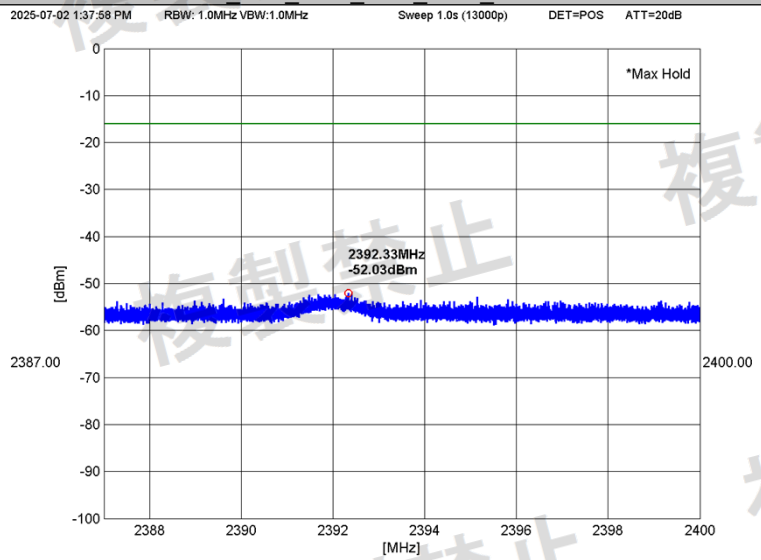
NTNV_BLE_500k_Ant1_2402_2496.5~12500



NTNV_BLE_500k_Ant1_2440_30~2387

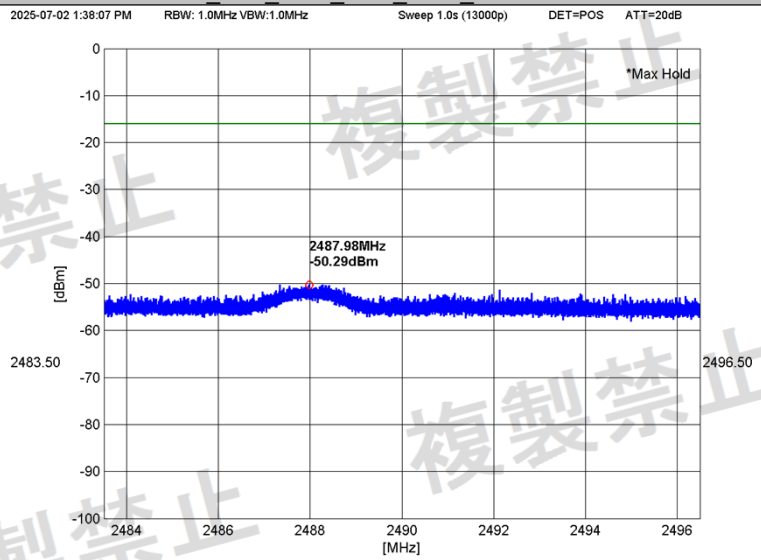


NTNV_BLE_500k_Ant1_2440_2387~2400

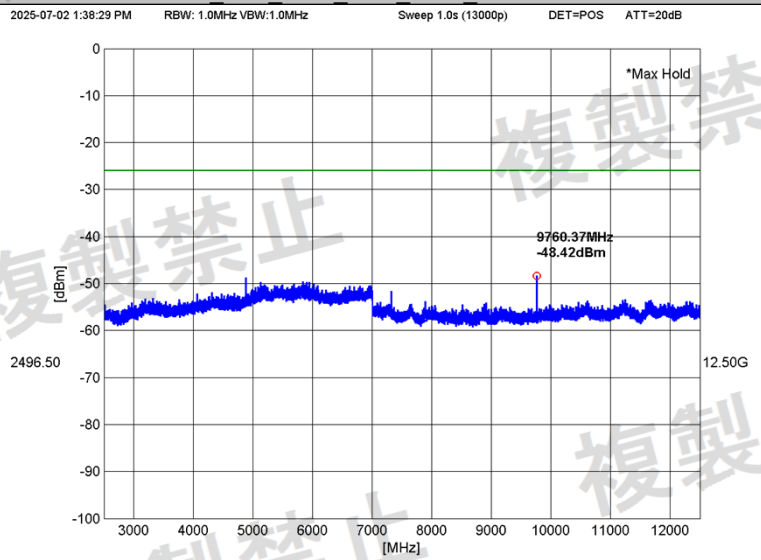


複製禁止

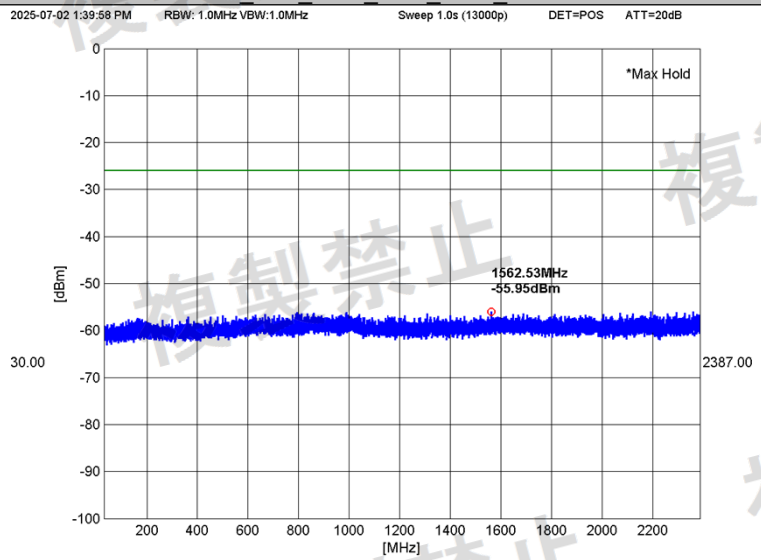
NTNV_BLE_500k_Ant1_2440_2483.5~2496.5



NTNV_BLE_500k_Ant1_2440_2496.5~12500

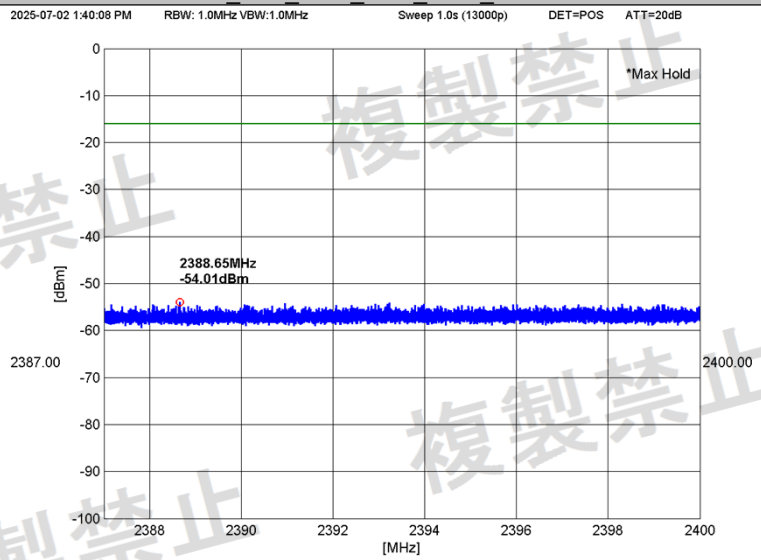


NTNV_BLE_500k_Ant1_2480_30~2387

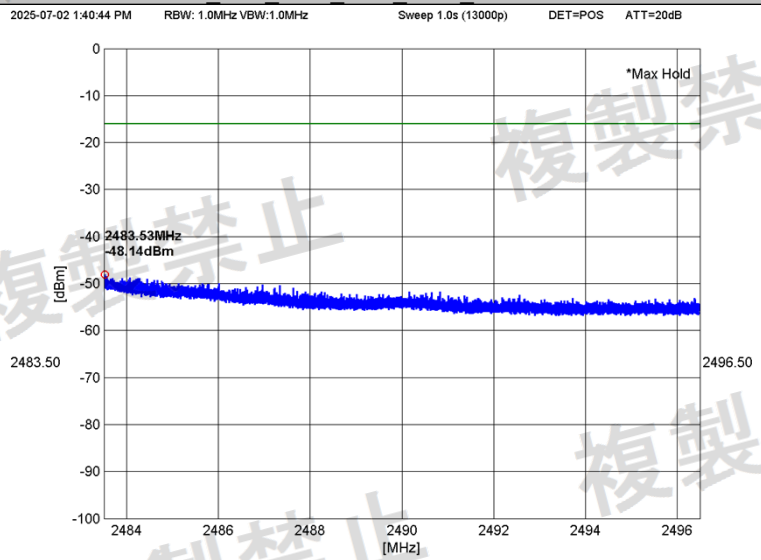


複製禁止

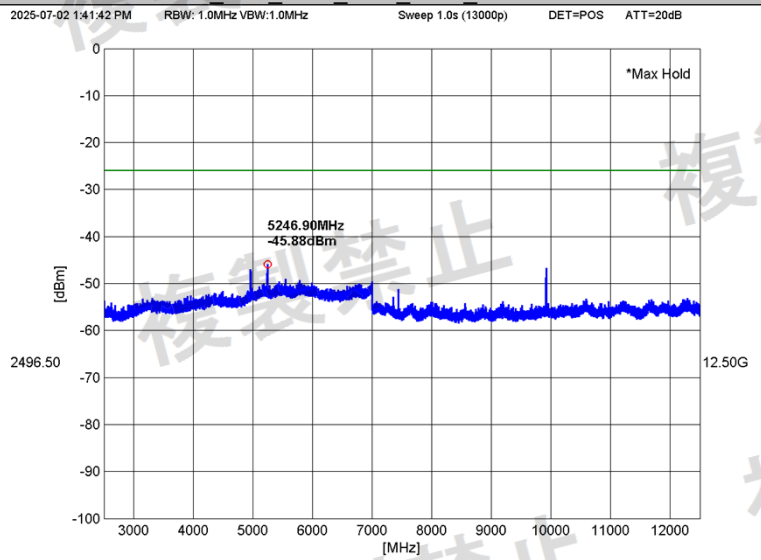
NTNV_BLE_500k_Ant1_2480_2387~2400



NTNV_BLE_500k_Ant1_2480_2483.5~2496.5



NTNV_BLE_500k_Ant1_2480_2496.5~12500



複製禁止

Appendix A.6: Test Results of Spurious Emissions for Receiver

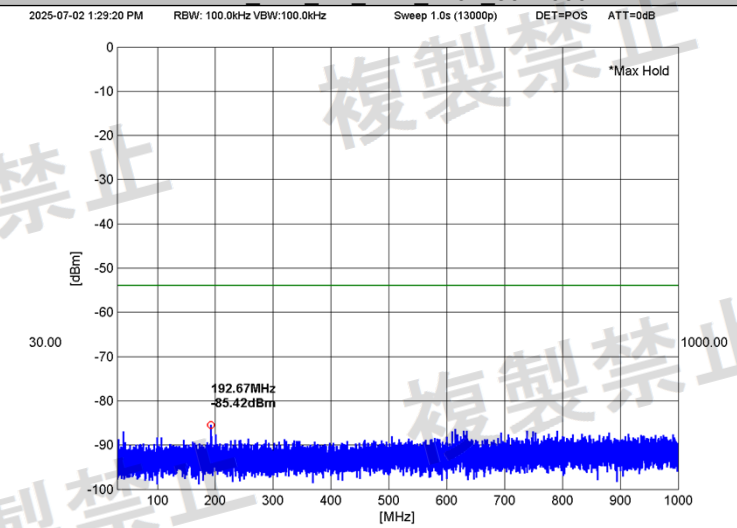
Test Result

Test Condition	Test Mode	Antenna	Freq (MHz)	Freq.Range [MHz]	Freq. [MHz]	Result [nW]	Limit [nW]	Verdict
NTNV	BLE_1M	Ant1	2402	30~1000	192.67	0.003	≤4	PASS
				1000~12500	6950.38	0.10	≤20	PASS
			2440	30~1000	846.50	0.003	≤4	PASS
				1000~12500	5566.74	0.10	≤20	PASS
			2480	30~1000	831.73	0.002	≤4	PASS
				1000~12500	6037.39	0.10	≤20	PASS
	BLE_500k	Ant1	2402	30~1000	892.17	0.012	≤4	PASS
				1000~12500	6953.03	0.10	≤20	PASS
			2440	30~1000	894.41	0.008	≤4	PASS
				1000~12500	5533.12	0.10	≤20	PASS
			2480	30~1000	948.44	0.003	≤4	PASS
				1000~12500	5745.44	0.10	≤20	PASS

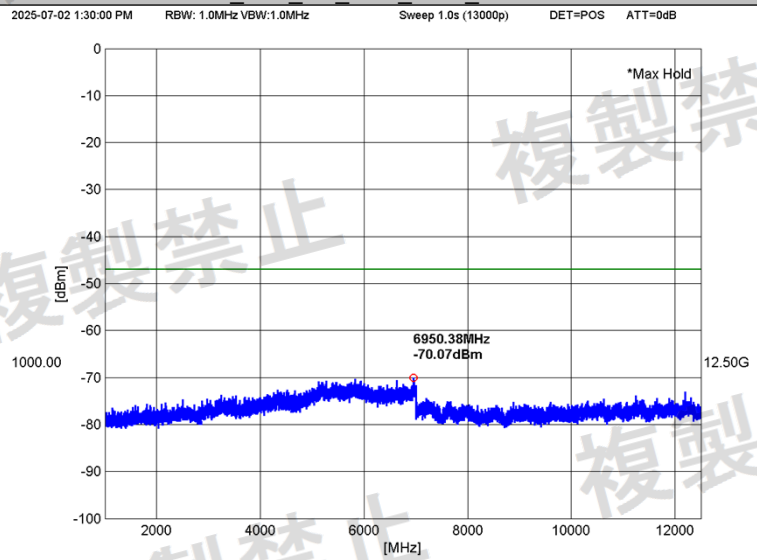
複製禁止

Test Graphs

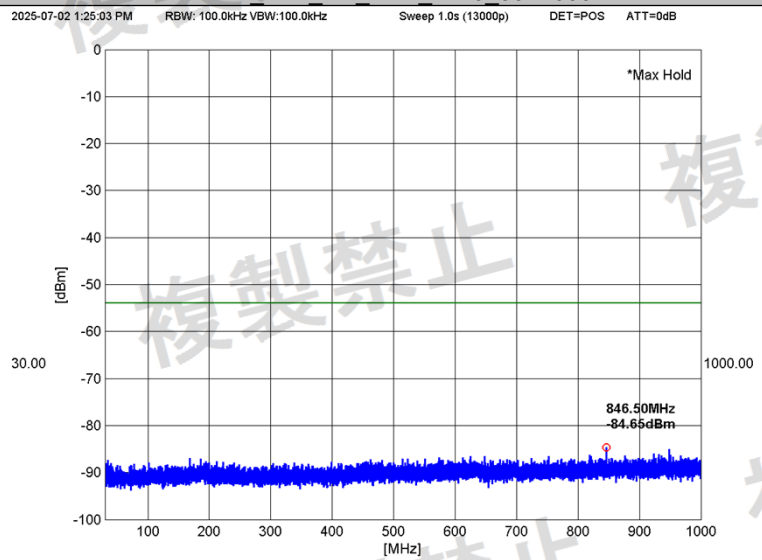
NTNV_BLE_1M_Ant1_2402_30~1000



NTNV_BLE_1M_Ant1_2402_1000~12500

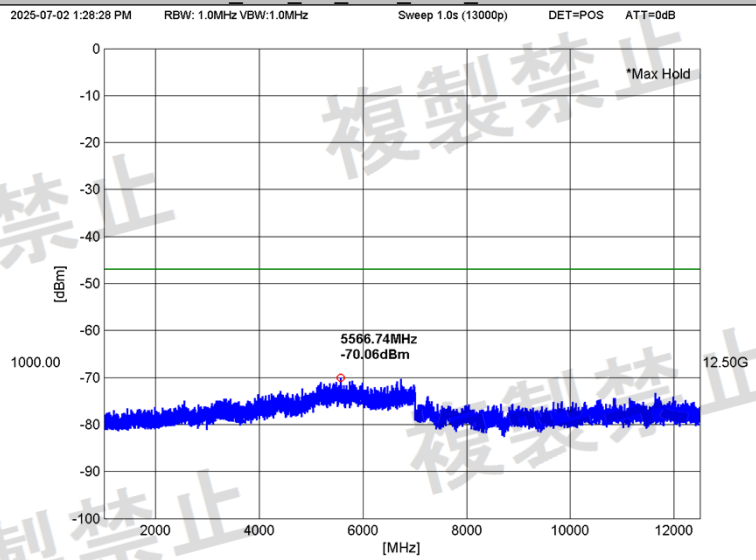


NTNV_BLE_1M_Ant1_2440_30~1000

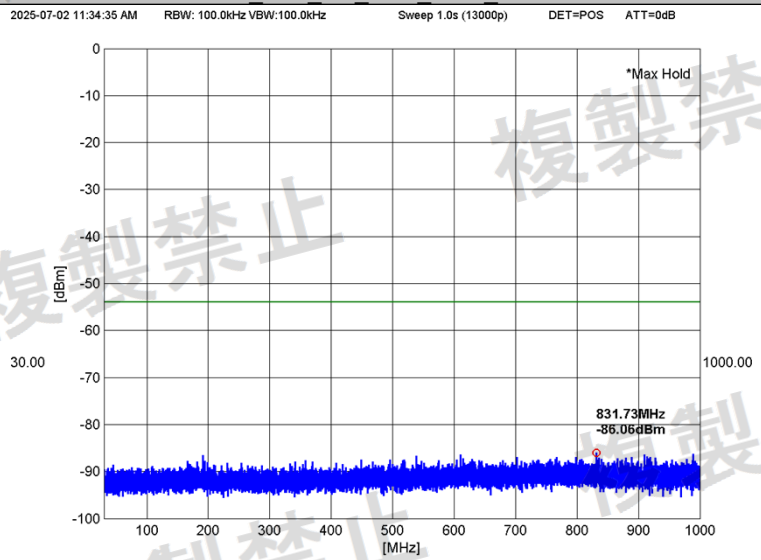


複製禁止

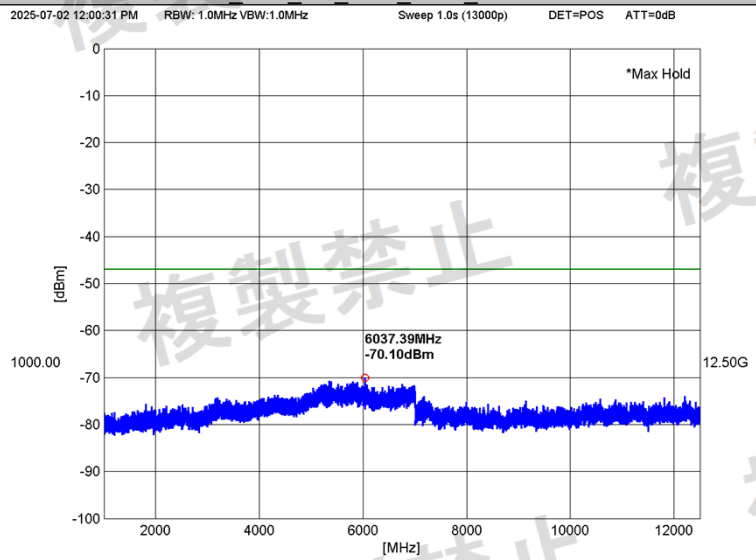
NTNV_BLE_1M_Ant1_2440_1000~12500



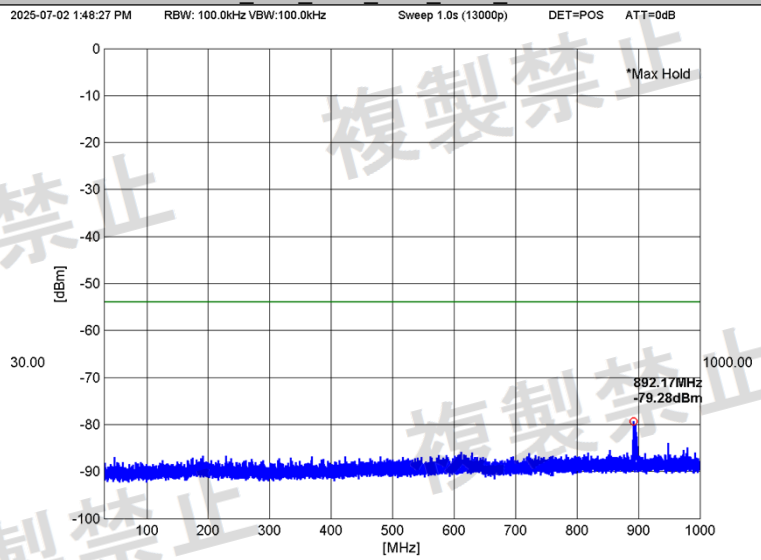
NTNV_BLE_1M_Ant1_2480_30~1000



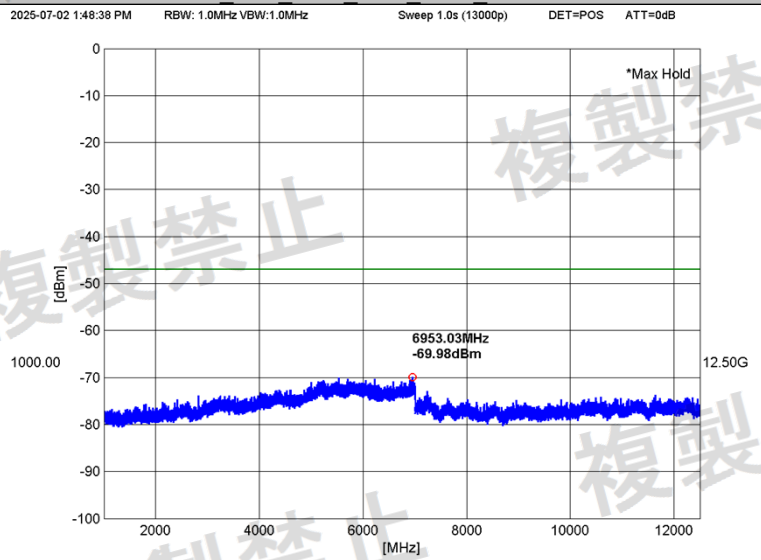
NTNV_BLE_1M_Ant1_2480_1000~12500



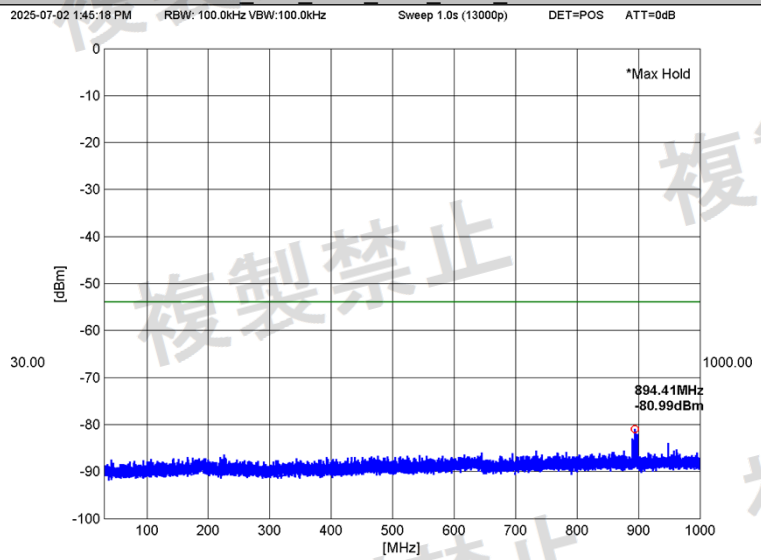
NTNV_BLE_500k_Ant1_2402_30~1000



NTNV_BLE_500k_Ant1_2402_1000~12500

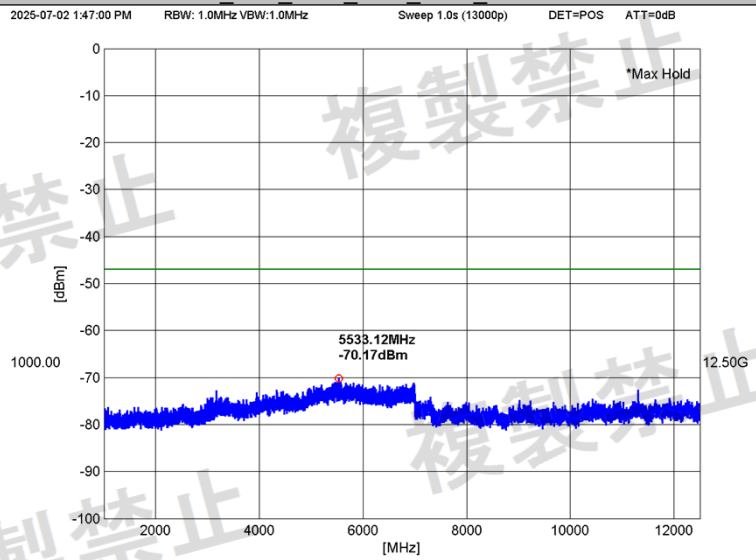


NTNV_BLE_500k_Ant1_2440_30~1000

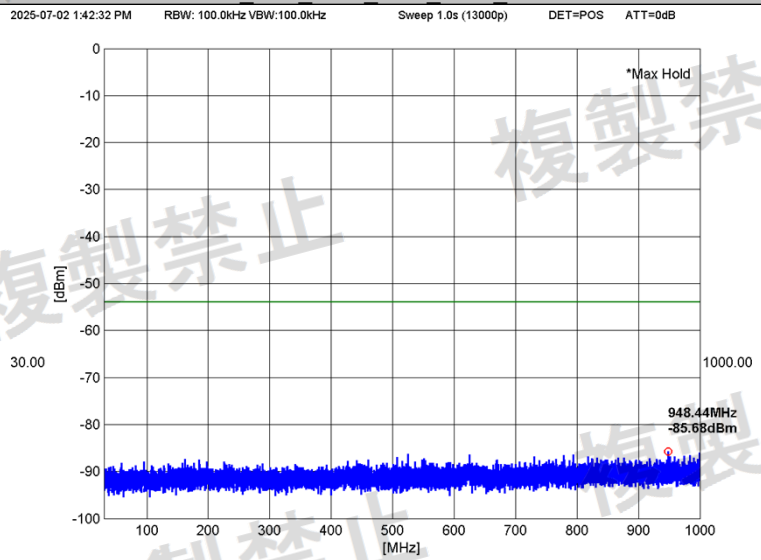


複製禁止

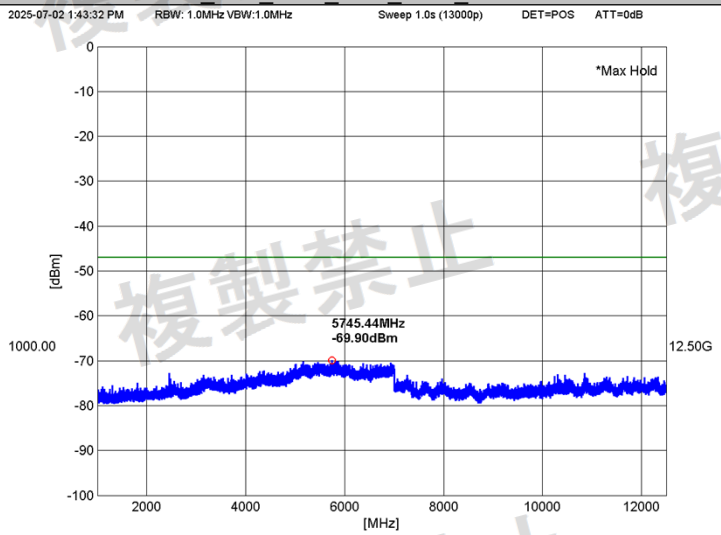
NTNV_BLE_500k_Ant1_2440_1000~12500



NTNV_BLE_500k_Ant1_2480_30~1000



NTNV_BLE_500k_Ant1_2480_1000~12500



複製禁止

Appendix A.7: Test Results of Interference Prevention Function

Limits:	≥48 bits	Measuring	MAC Scan
Mac address:	≥48 bits	Test result:	Conform

複製禁止