

## Radio Test Report

**Report No.:** RJBCNI-WTW-P21123593

**Test Model:** GMR™ 122X xHD2

**Received Date:** Dec. 30, 2021

**Test Date:** Apr. 19 ~ Apr. 26, 2022

**Issued Date:** May 06, 2022

**Applicant:** GARMIN CORP.

**Address:** No. 68, Zhangshu 2nd Road, Xizhi Dist., New Taipei City 221, Taiwan

**Issued By:** Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch  
Lin Kou Laboratories

**Lab Address:** No. 47-2, 14th Ling, Chia Pau Vil., Lin Kou Dist., New Taipei City, Taiwan

**Test Location:** No. 70, Wenming Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)

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### Release Control Record

Issue No.	Description	Date Issued
RJBCNI-WTW-P21123593	Original release	May 06, 2022

## 1 Certificate of Conformity

**Product:** Marine Radar Scanner

**Brand:** GARMIN

**Test Model:** GMR™ 122X xHD2

**Sample Status:** Engineering sample

**Applicant:** GARMIN CORP.

**Test Date:** Apr. 19 ~ Apr. 26, 2022

**Standards:** Article 2-1-28-3

**Reference Test Guidance:** Notice 88 Appendix 58

The above equipment has been tested by **Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch**, and found compliance with the requirement of the above standards. The test record, data evaluation & Equipment Under Test (EUT) configurations represented herein are true and accurate accounts of the measurements of the sample's RF characteristics under the conditions specified in this report.

**Prepared by :** Billy Chien, **Date:** May 06, 2022  
Polly Chien / Specialist

**Approved by :** Jeremy Lin, **Date:** May 06, 2022  
Jeremy Lin / Project Engineer

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

Certification Ordinance: Article 2 Paragraph 1 of item 28-3				
Notice 88 Appendix 58	Ordinance Regulation radio equipment	Report Reference	Parameter	Test Results (Note)
<b>General Provisions</b>				
Section 4	Article 5	4.1	Frequency tolerance	C
Appendix 58 2rd	Article 15.3	4.1	Vibration test	C
Appendix 58 3rd	Article 15.1 and 15.2	4.1	Temperature and humidity test	C
Appendix 58 4rd	Article 48.1	4.2	Occupied bandwidth	C
	Article 7	4.3	Spurious emissions	C
<b>Transmitting Equipment</b>				
Appendix 58 6rd	--	4.5	Antenna power	C
--	--	--	SAR	NA
<b>Transmitting Antenna</b>				
--	--	3.5	Type, configuration, etc. of transmitting antenna	C
--	--	3.5	Antenna Gain	--
--	--	3.5	Refer to all articles for transmitting antenna	C
<b>Receiving Equipment</b>				
14	--	4.5	Spurious emissions of receiver	C
<b>Operating Frequency 24.05 to 24.25GHz</b>				
--	--	3.4	High frequency / modulation section cannot be opened easily	C
--	Article 48.1	3.1	Modulation method	C
--	--	3.1	Operating Frequency	C
Appendix 58 5rd	Article 14	4.4	Tolerance of Antenna Power	C
Note:				
1. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.				
2. C = Conform      NC = Not Conform      NT = Not Tested      NA = Not Applicable				



## 2.1 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration	Calibration Authority	Cal. Method
Spectrum Analyzer R&S	FSV40	100979	Mar. 13, 2022	Mar. 12, 2023	Electronics Testing Center, Taiwan	c)
Software	ADT_Radiated_V7.6.15.9.5	NA	NA	NA	NA	NA
Power meter Anritsu	ML2495A	1145013	Jun. 15, 2021	Jun. 14, 2022	Electronics Testing Center, Taiwan	c)
Power sensor Anritsu	MA2411B	1126085	Jun. 15, 2021	Jun. 14, 2022	Electronics Testing Center, Taiwan	c)
DC Power Supply Jin Yih	EX60-60	ODA-02-0923-19318	NA	NA	NA	d)
PXA Signal Analyzer KEYSIGHT	N9030B	MY57140938	Mar. 15, 2022	Mar. 14, 2023	Electronics Testing Center, Taiwan	c)
Vibration System Vibration Source	VS-100	6293	Jan. 14, 2022	Jan. 13, 2023	Vibration Source	d)
Temperature & Humidity Chamber TERCY	HRM-120RF	931022	Jan. 03, 2022	Jan. 02, 2023	Electronics Testing Center, Taiwan	c)

Note:

### 1. Calibration Method

- Calibration conducted by the National Institute of Information and Communications Technology ~ NICT ~ or a designated calibration agency under Article 102-18 paragraph (1) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
  - Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) ~ Japan Calibration Service System ~.
  - 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) ~ TELEC Engineering Center, Intertek Japan K.K., Keysight Technologies, Inc ~.
  - Calibration conducted by using other equipment that listed above from a) to c)
- The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
  - The power supply no evaluation calibration, which used the digital multimeter to verify before each testing.

## 2.2 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in TR 100 028-1.

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

Parameter	Uncertainty
Occupied Bandwidth	491.896Hz
Spurious emissions	2.208dB
Output power density	2.889dB
Out of band radiated power	3.93dB
Frequency Tolerance	6805.18Hz

Note: Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

## 2.3 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	Marine Radar Scanner
Brand	GARMIN
Test Model	GMR™ 122X xHD2
Status of EUT	Engineering sample
Nominal Voltage	10-32Vdc (Marine Radar Scanner) 36Vdc (Voltage Converter)
Modulation Type	P0N
Operating Frequency	9385MHz
Rated RF Output Power Density	9794.899854W
Conducted RF Output Power Density	9794.899854W
Radiated RF Output Power Density	6776415.07610W
Antenna Type	Refer to note
Antenna Connector	Refer to note
Accessory Device	Cable Grommet, Voltage Converter (Brand: GARMIN)
Cable Supplied	15m non-shielded power cable without core 15m non-shielded network cable without core

Note:

1. There is 9GHz radar technology used for the EUT.
2. The following antennas were provided to the EUT.

No.	Type	Connector	Antenna Model	Gain (dBi)
1	Waveguide slotted array antenna	WR90 Waveguide	Antenna (4ft) - GMR xHD2	25.6
2	Waveguide slotted array antenna	WR90 Waveguide	Antenna (6ft) - GMR xHD2	28.4

\* Ant. 2 is max. gain and for chosen final test.

\* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.



### 3.2 Description of Test Modes

1 channel is provided in EUT for test:

Channel	Freq. (MHz)
1	9385MHz

### 3.3 Test Conditions

Test Conditions	Voltage (Vdc)
Vnormal	36.0
Vmax.	39.6
Vmin.	32.4

Test Item	Environmental Conditions	Test Engineer
Frequency Tolerance	-25 ~ 35 deg.C, 60 ~ 95% RH	Ted Chang
Occupied Bandwidth (99% power bandwidth)	25 deg.C, 60 % RH	Ted Chang
Spurious Emissions for Transmitter	25 deg.C, 60 % RH	Ted Chang
Antenna Power Tolerance	25 deg.C, 60 % RH	Ted Chang

### 3.4 Assembly

The EUT used a kind of particular screw, which could not operated by a tool bought in the market. Only means of brute force will be able to open.

### 3.5 Antenna Specifications

#### 3.5.1 Antenna Gain

No.	Type	Connector	Antenna Model	Gain (dBi)
1	Waveguide slotted array antenna	WR90 Waveguide	Antenna (4ft) - GMR xHD2	25.6
2	Waveguide slotted array antenna	WR90 Waveguide	Antenna (6ft) - GMR xHD2	28.4

\* The above Antenna information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

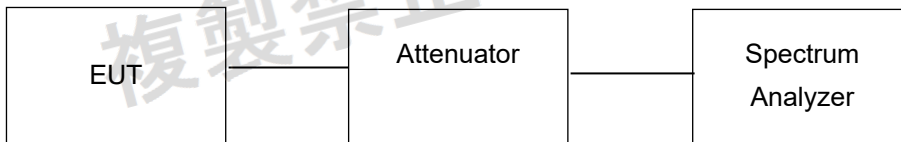
## 4 Test Results

### 4.1 Frequency Tolerance Measurement

#### 4.1.1 Limits of Frequency Tolerance Measurement

Tolerance of frequency shall be within operating frequency.

#### 4.1.2 Test Setup



#### 4.1.3 Test Results

##### Normal Condition

Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band
1	9385	9382.80	9320 ~ 9430	9382.15	9320 ~ 9430	9381.55	9320 ~ 9430

##### After the Vibration Test

Environmental Conditions		25 deg.C, 60% RH					
Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band
1	9385	9381.55	9320 ~ 9430	9380.60	9320 ~ 9430	9380.75	9320 ~ 9430

##### While the High Temperature Test

Environmental Conditions		60 deg.C, 60% RH					
Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band
1	9385	9380.65	9320 ~ 9430	9380.70	9320 ~ 9430	9380.75	9320 ~ 9430

##### While the Low Temperature Test

Environmental Conditions		-20 deg.C, 60% RH					
Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band
1	9385	9380.60	9320 ~ 9430	9382.90	9320 ~ 9430	9382.15	9320 ~ 9430

##### While the High Humidity Test

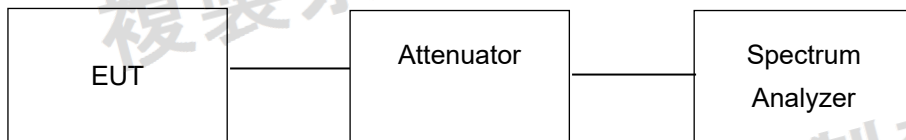
Environmental Conditions		35 deg.C, 95% RH					
Channel	Frequency (MHz)	V <sub>normal</sub>		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band	Carrier frequency (MHz)	Designated frequency band
1	9385	9380.75	9320 ~ 9430	9382.15	9320 ~ 9430	9381.55	9320 ~ 9430

## 4.2 Occupied Bandwidth Measurement (99% power bandwidth)

### 4.2.1 Limits of Occupied Bandwidth Measurement

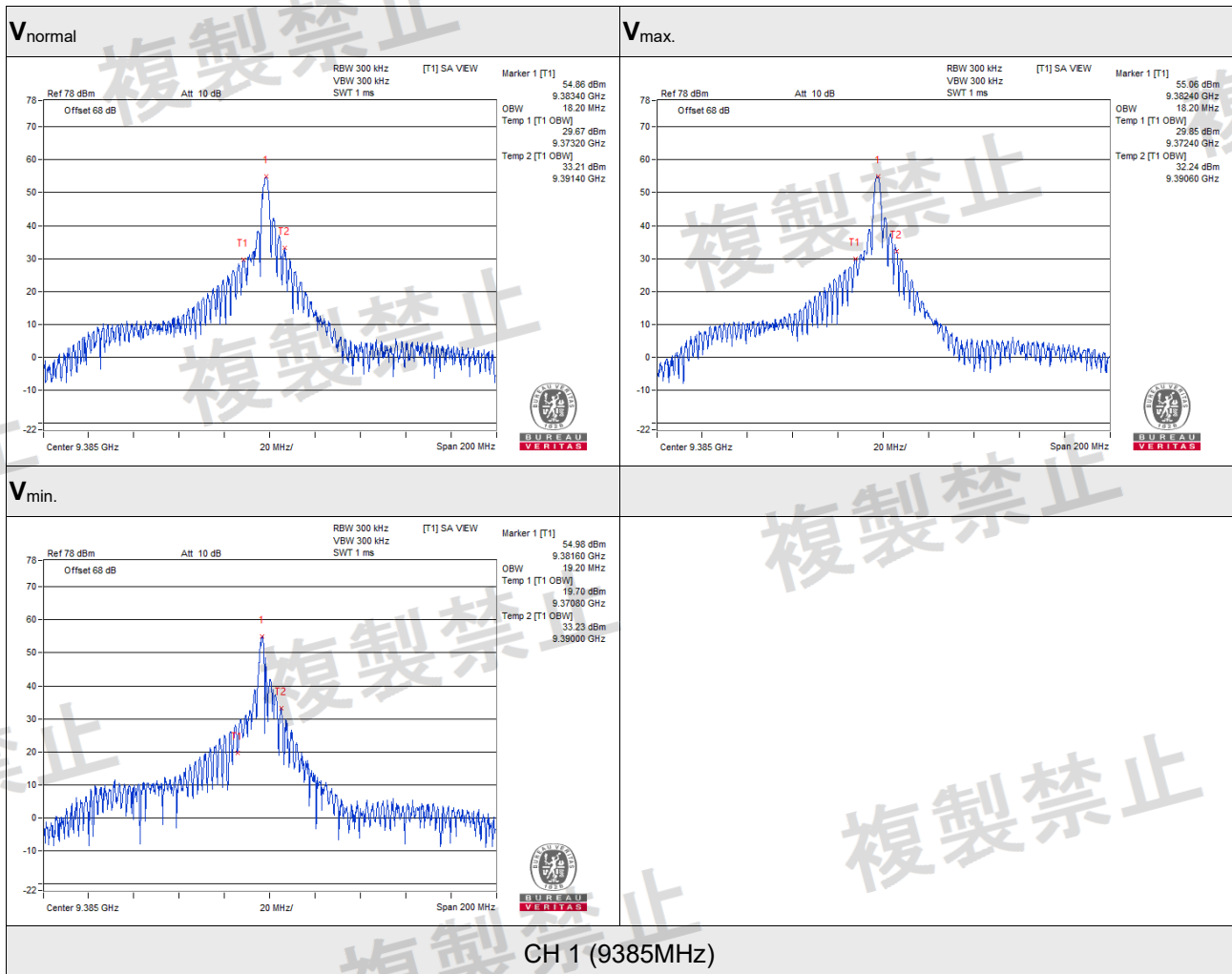
Occupied bandwidth Limit
110 MHz

### 4.2.2 Test Setup



#### 4.2.3 Test Results

Channel	Frequency (MHz)	V <sub>normal</sub>	V <sub>max.</sub>	V <sub>min.</sub>
		Occupied Bandwidth (MHz)		
1	9385	18.20	18.20	19.20



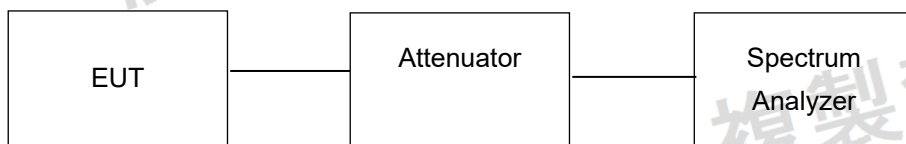


### 4.3 Spurious Emissions for Transmitter Measurement

#### 4.3.1 Limits of Spurious Emissions

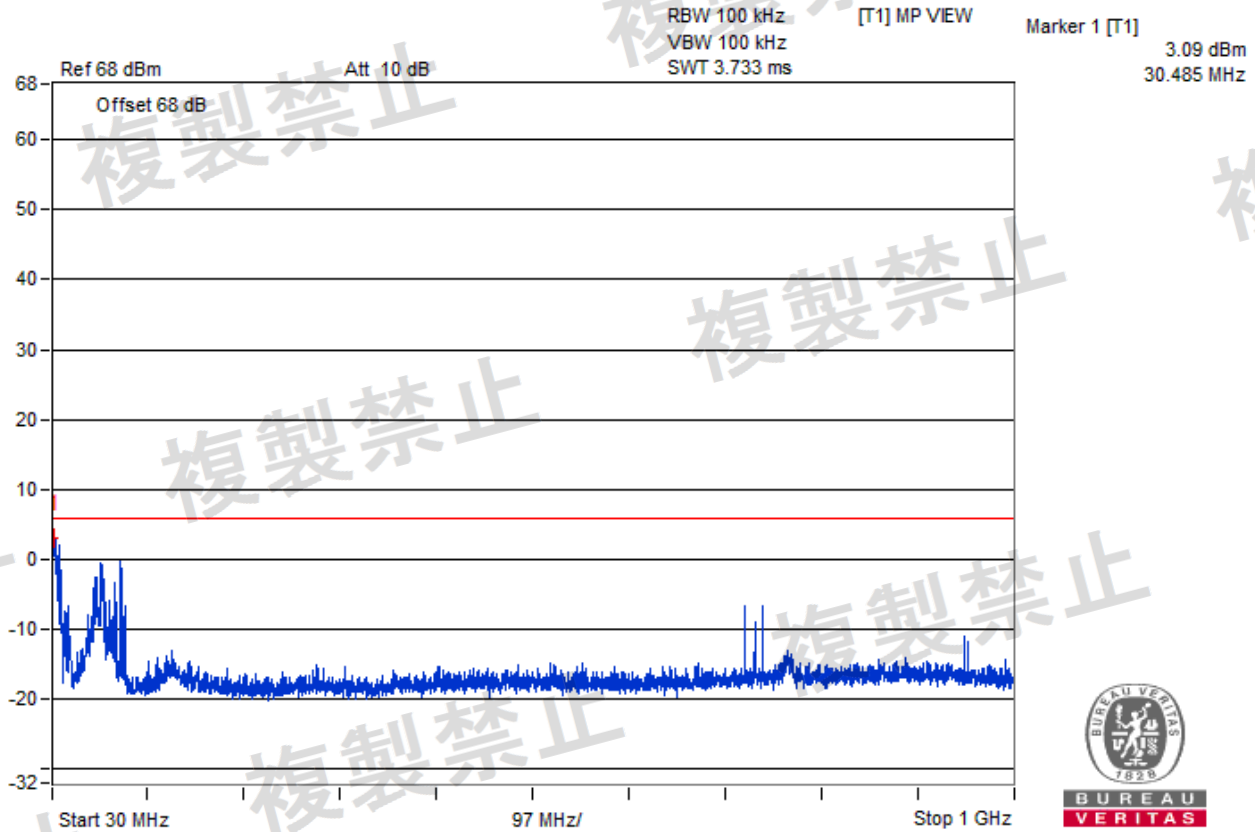
Limit	
Spurious Emission Strength / Out-band area	-40 dBc(Average)
Unwanted Emission Strength / Spurious area	Antenna Power over 50W : -60dBc (Peak) Antenna Power 50W or less : 50us or less

#### 4.3.2 Test Setup



#### 4.3.3 Test Results

<b>Spruious Emission Frequency Range</b>	30MHz ~ 1GHz	<b>Test Condition</b>	V <sub>normal</sub>
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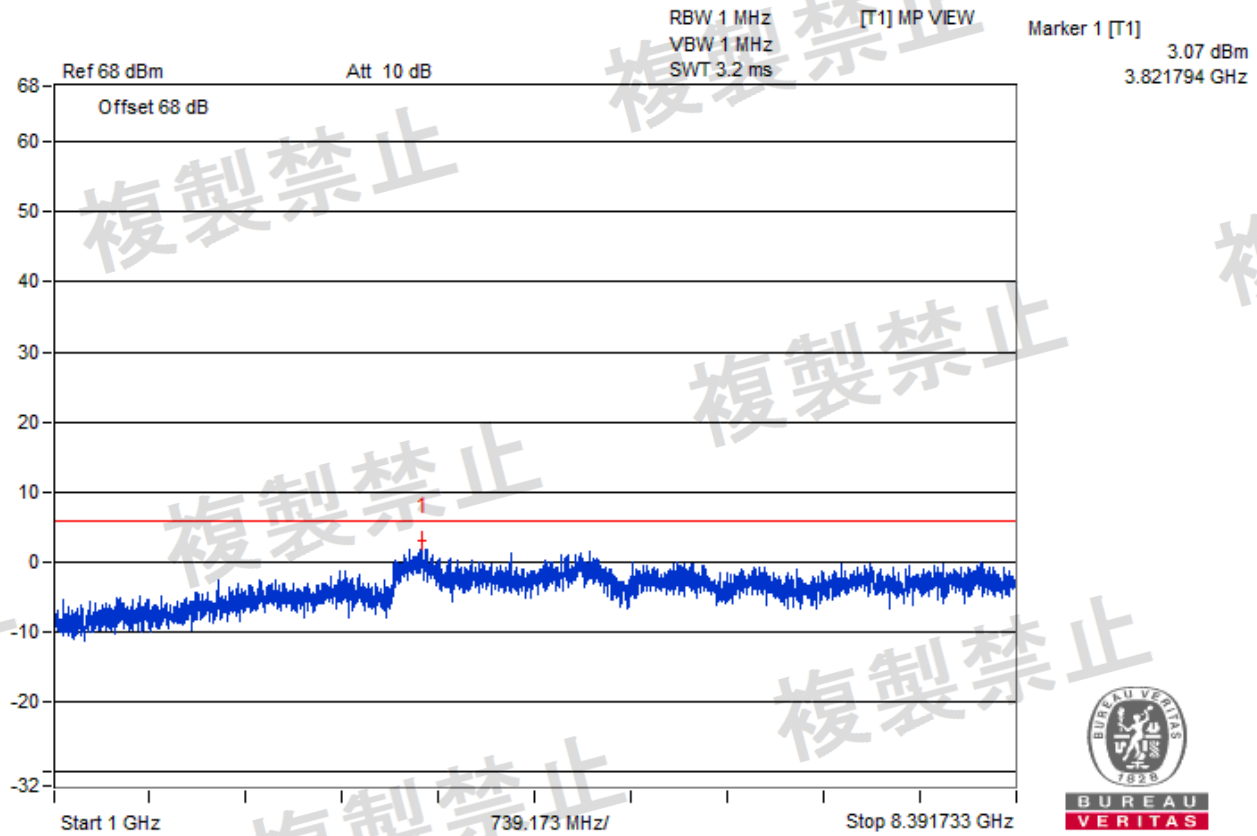


**Spruious Emission  
Frequency Range**

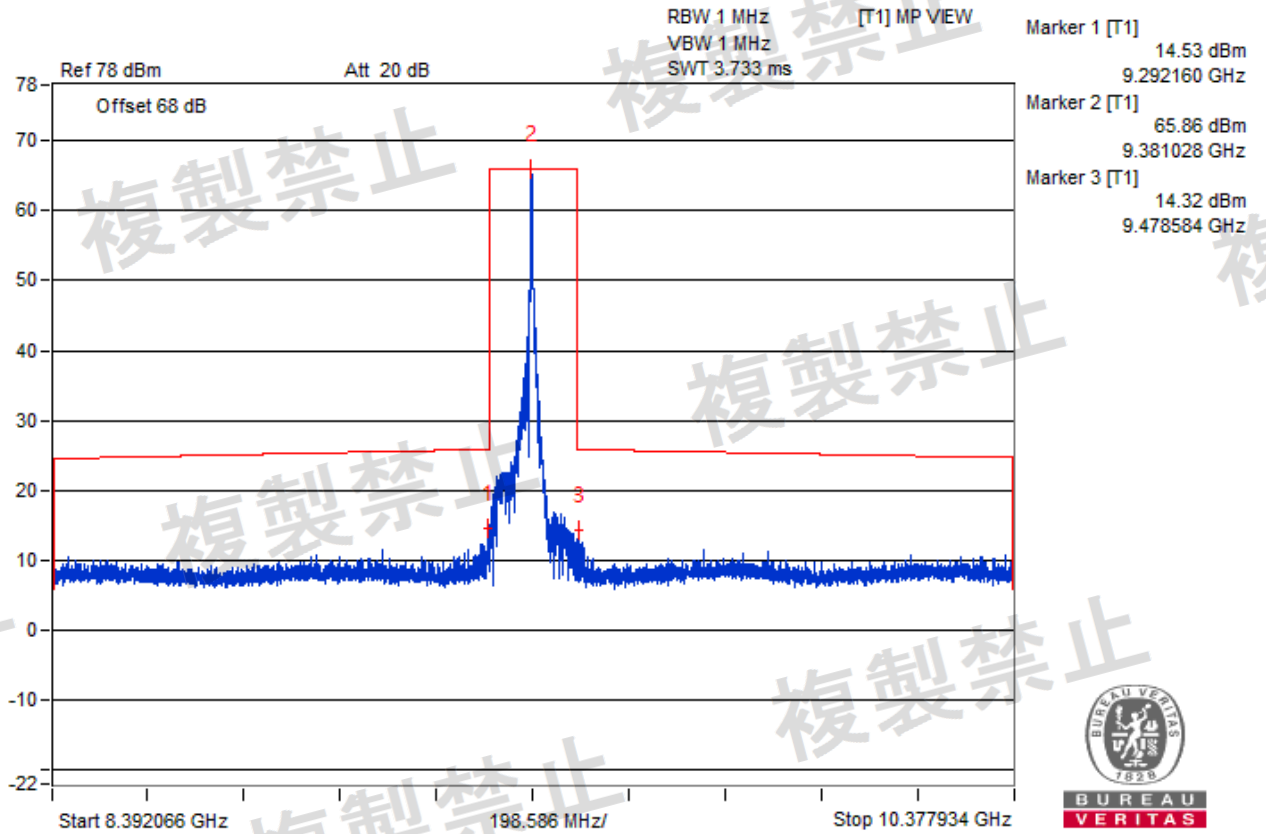
1GHz ~ 8.391733GHz

**Test Condition**

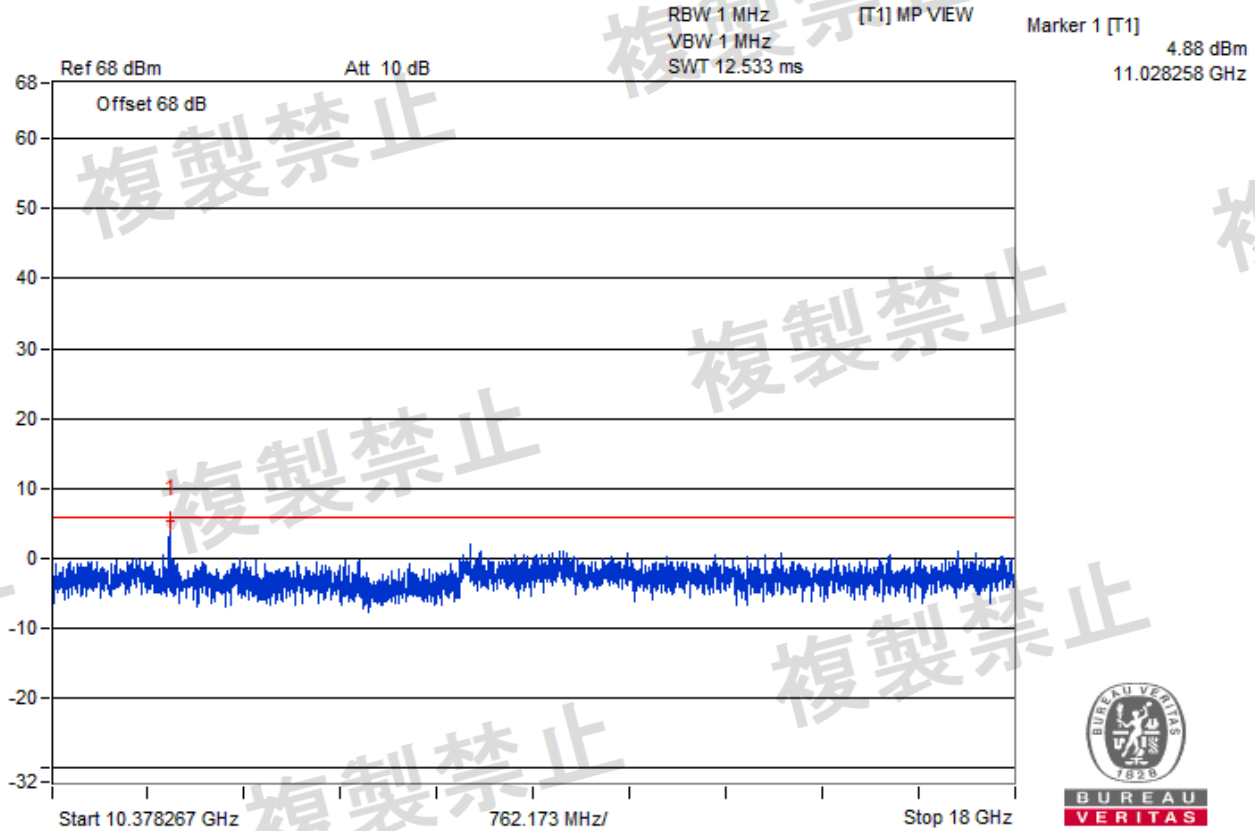
V<sub>normal</sub>



<b>Spruous Emission Frequency Range</b>	8.392066GHz ~ 10.377934GHz	<b>Test Condition</b>	V <sub>normal</sub>
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Spruious Emission Frequency Range	10.378267GHz ~ 18GHz	Test Condition	V <sub>normal</sub>
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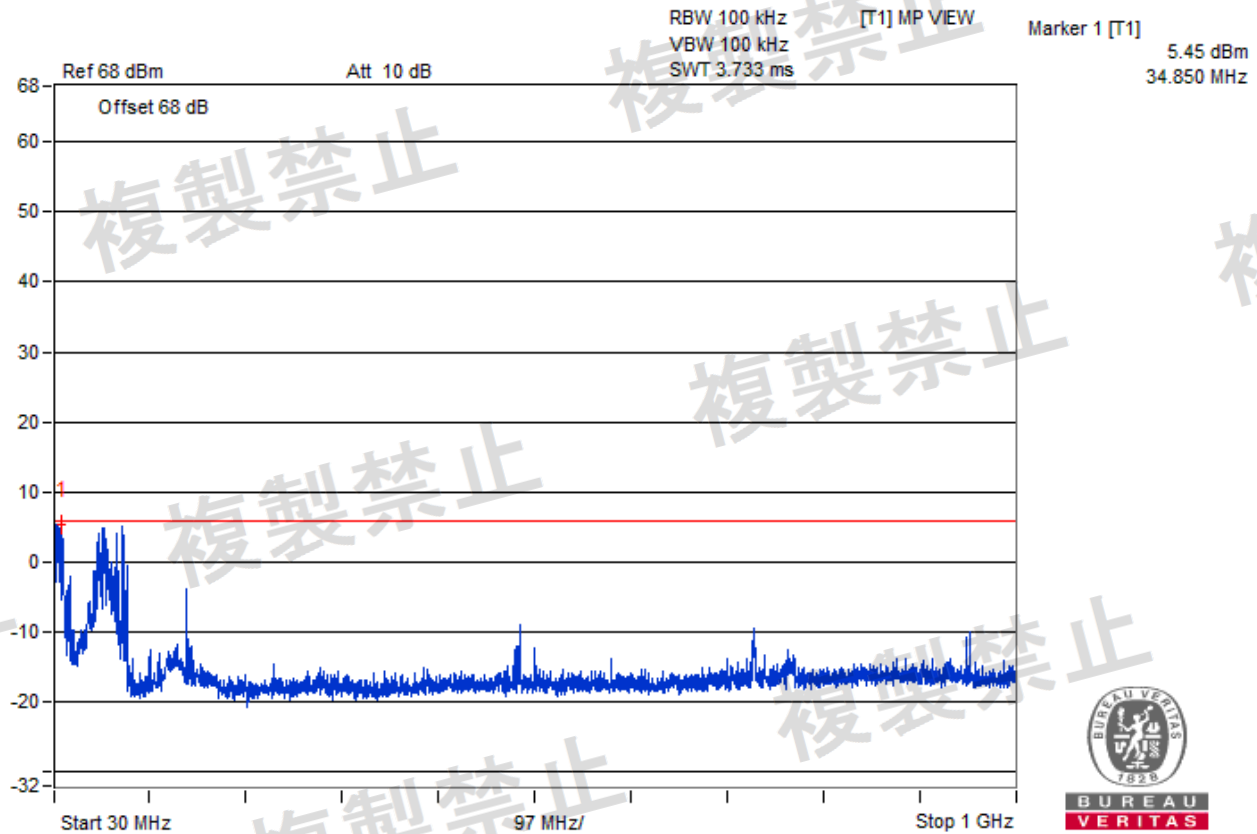


**Spruious Emission  
Frequency Range**

30MHz ~ 1GHz

**Test Condition**

$V_{max}$

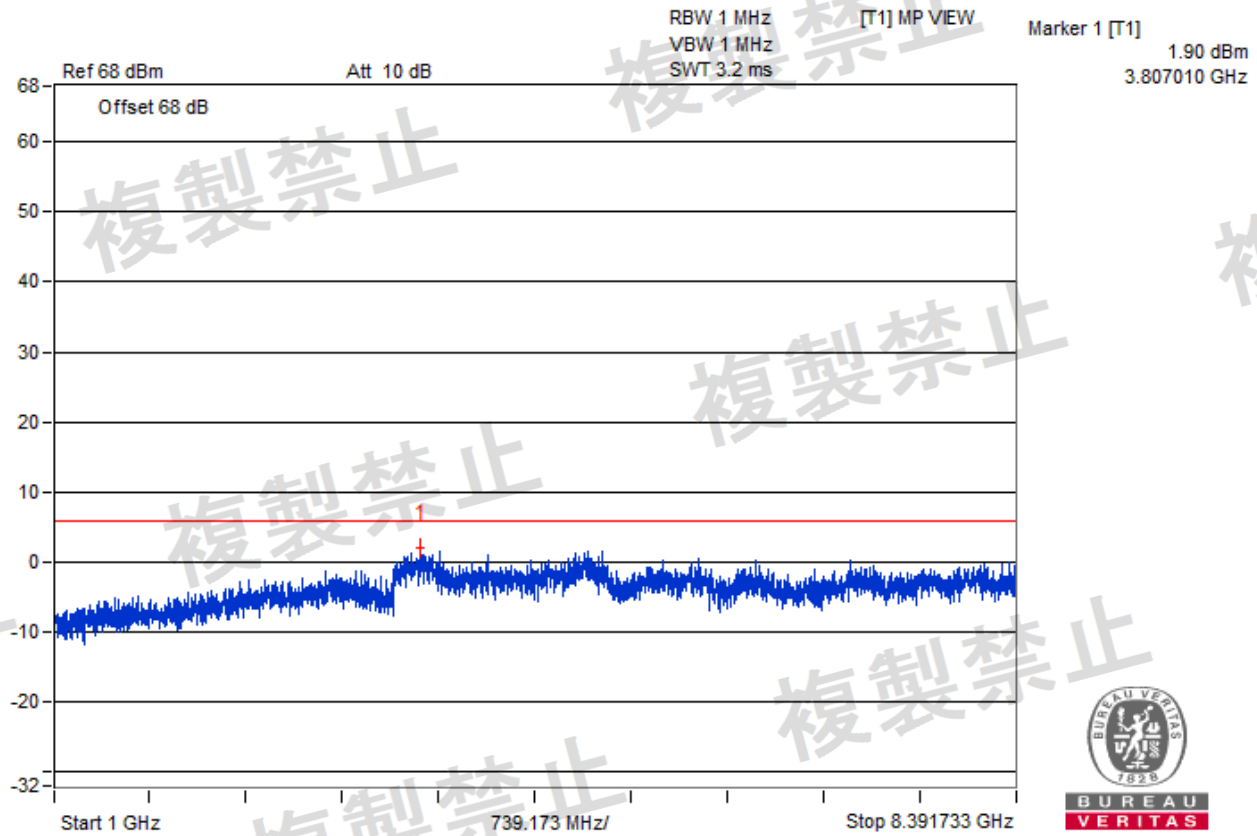


**Spruious Emission  
Frequency Range**

1GHz ~ 8.391733GHz

**Test Condition**

$V_{max}$

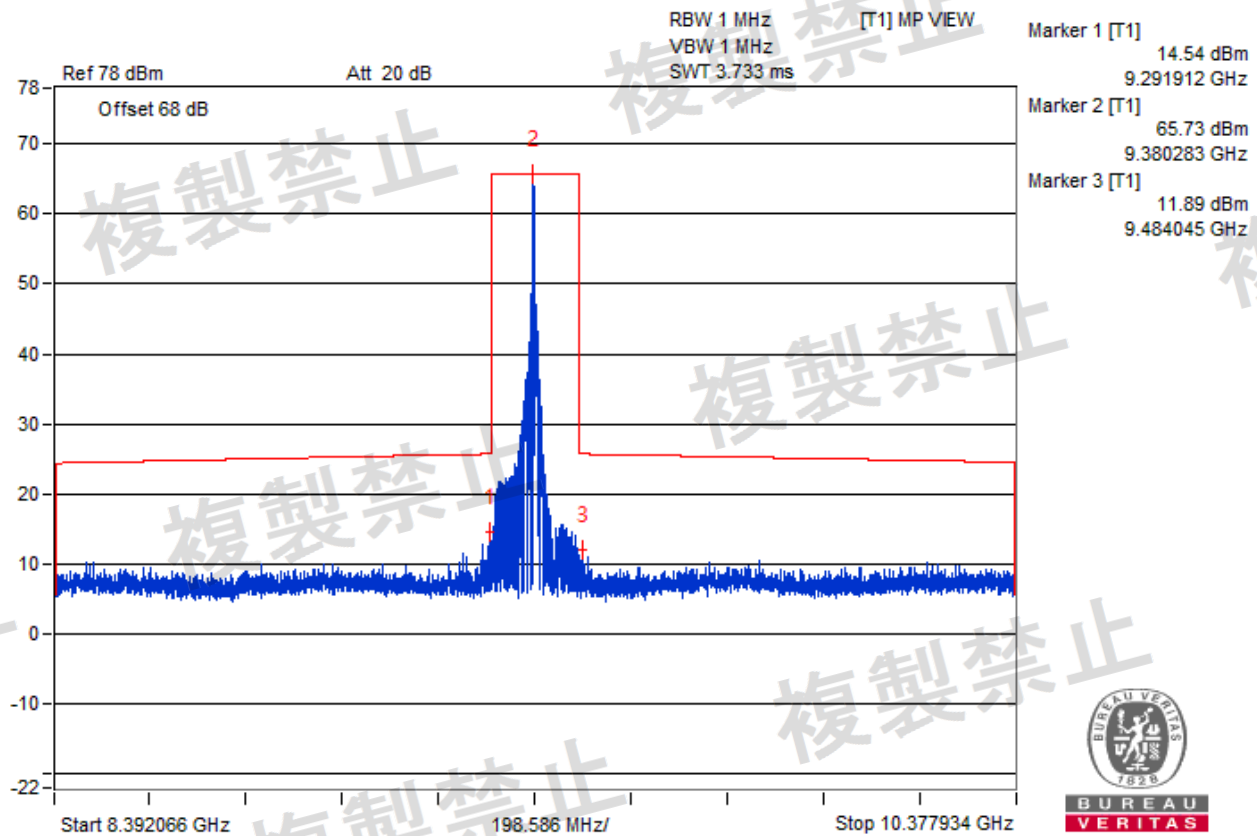


**Spruious Emission  
Frequency Range**

8.392066GHz ~ 10.377934GHz

**Test Condition**

$V_{max}$

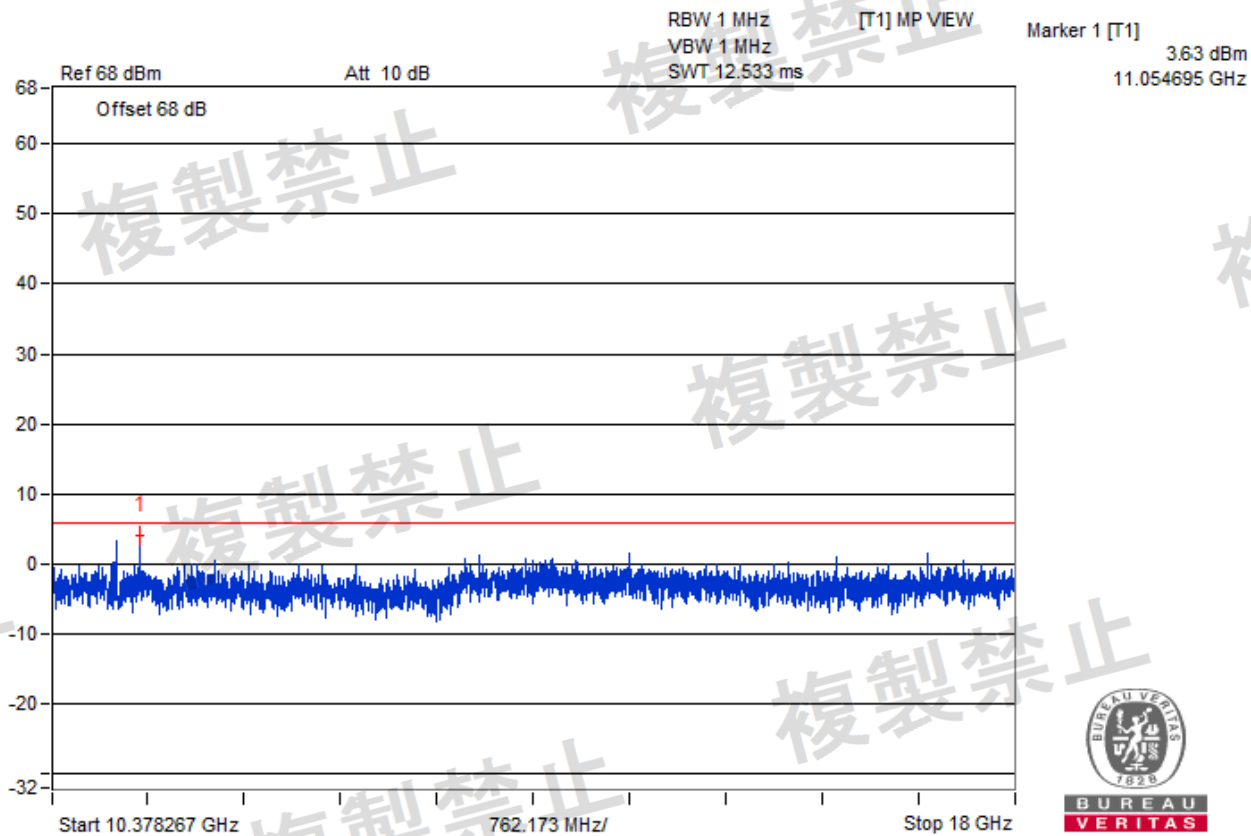


**Spruious Emission  
Frequency Range**

10.378267GHz ~ 18GHz

**Test Condition**

V<sub>max</sub>

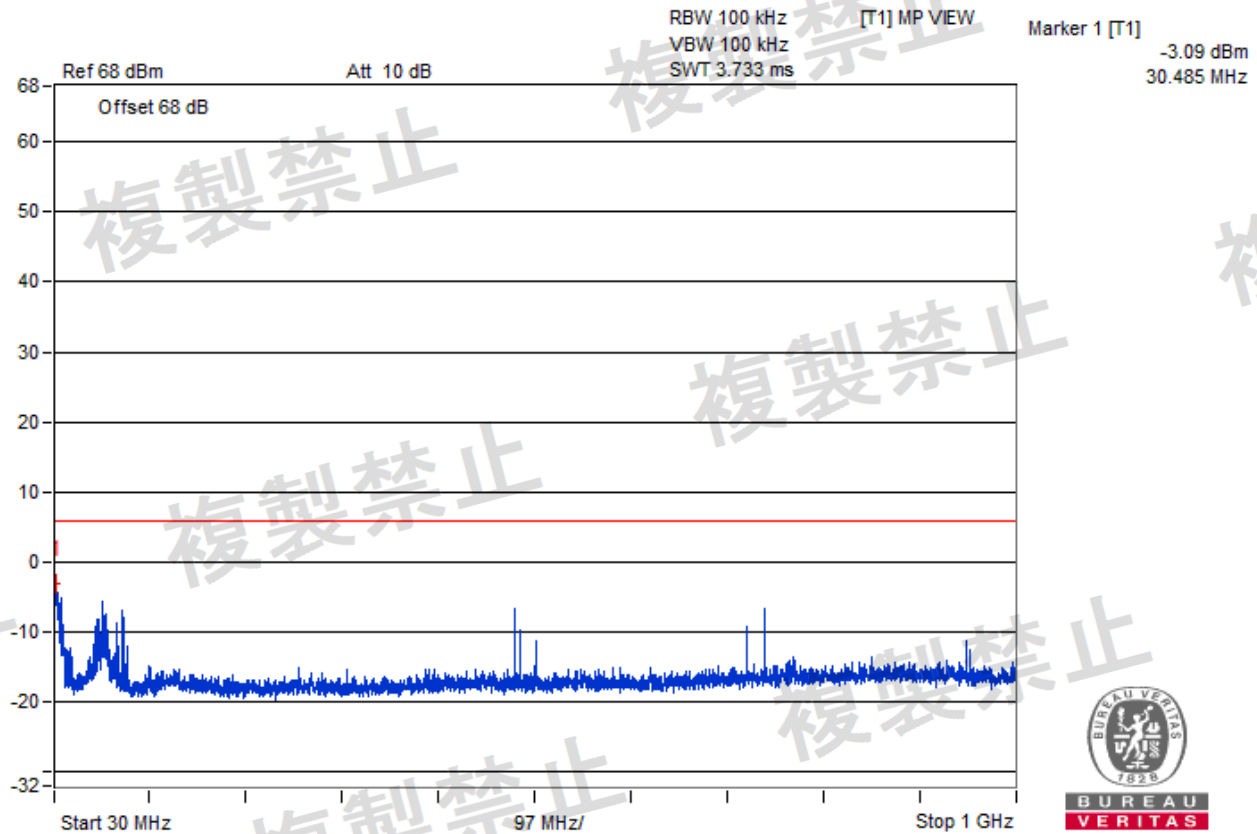


**Spruious Emission  
Frequency Range**

30MHz ~ 1GHz

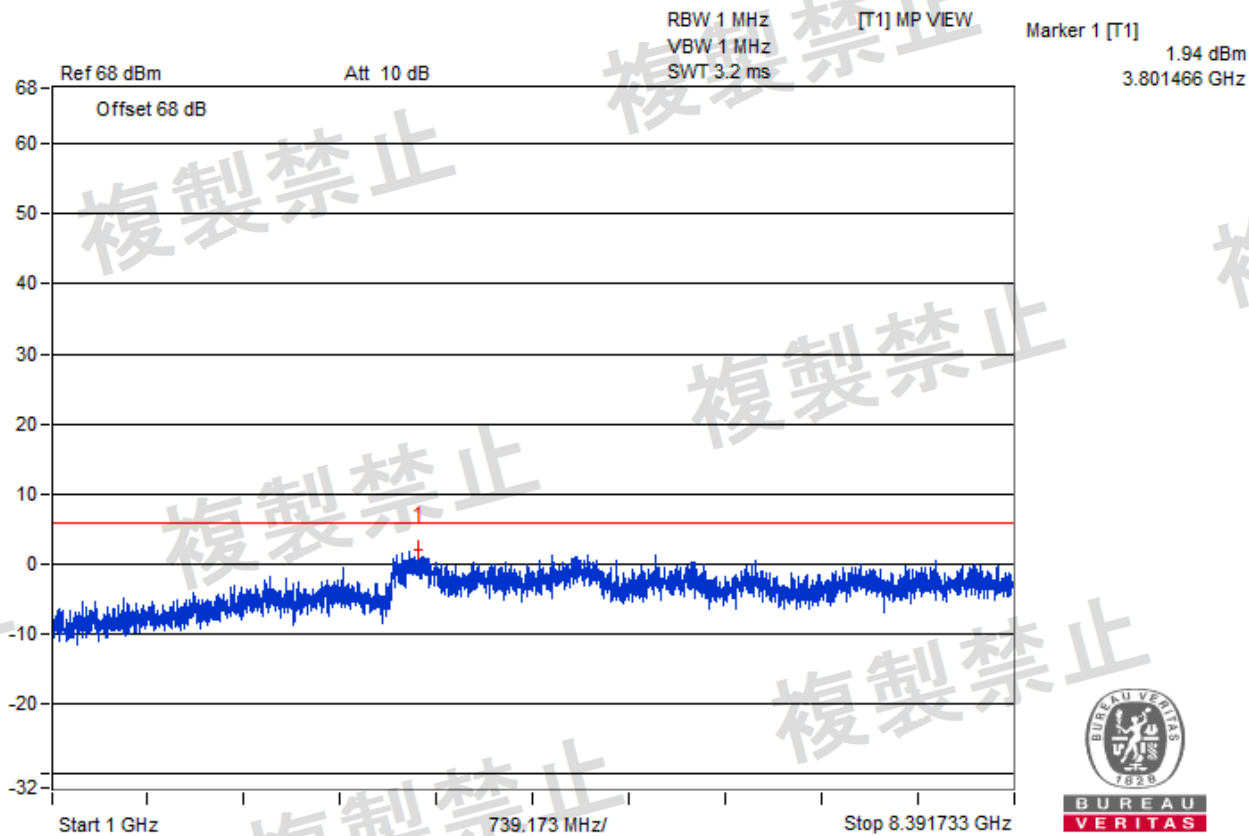
**Test Condition**

V<sub>min</sub>

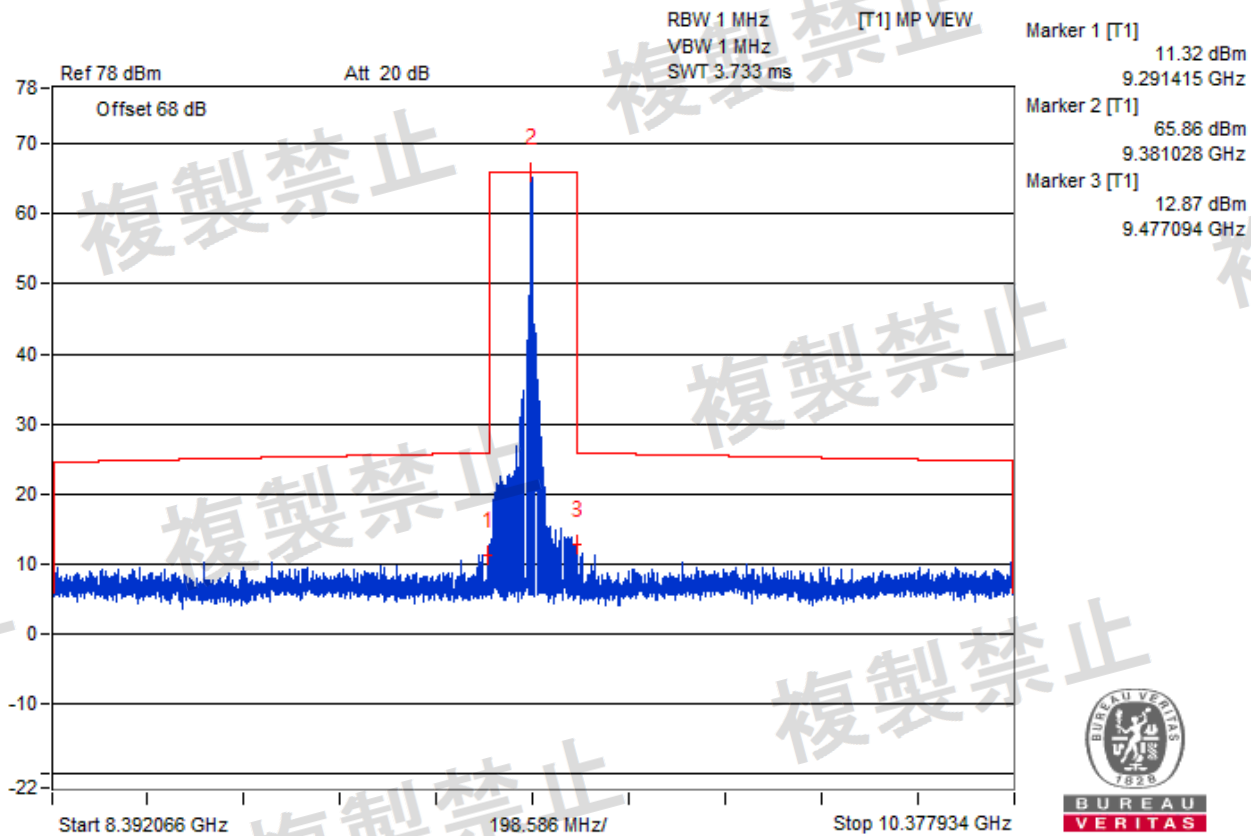




Spruious Emission Frequency Range	1GHz ~ 8.391733GHz	Test Condition	V <sub>min</sub>
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Spruious Emission Frequency Range	8.392066GHz ~ 10.377934GHz	Test Condition	V <sub>min</sub>
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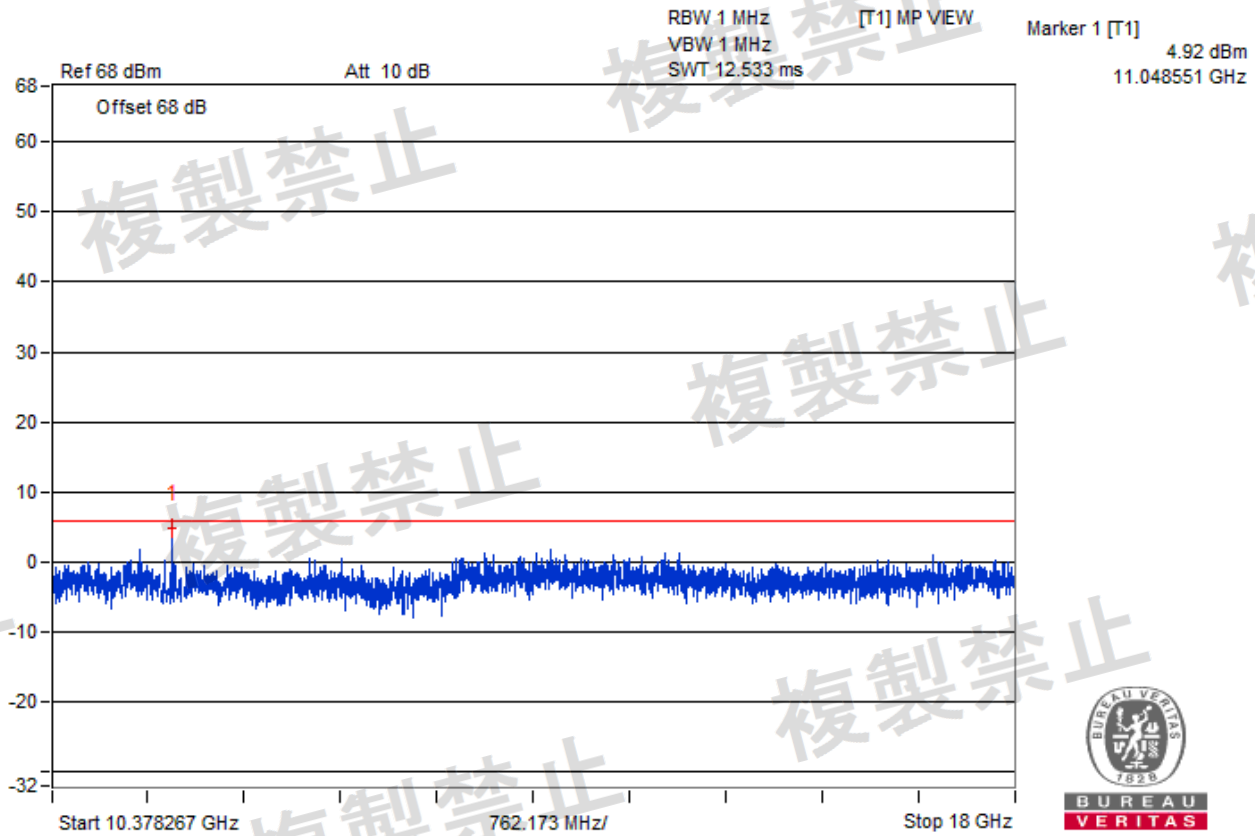


**Spruious Emission  
Frequency Range**

10.378267GHz ~ 18GHz

**Test Condition**

V<sub>min</sub>



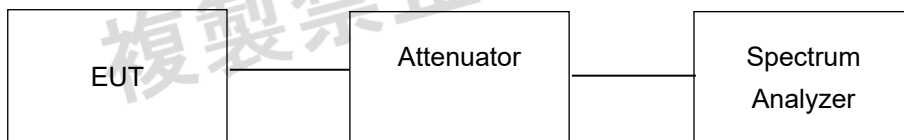
#### 4.4 Antenna Power Tolerance Measurement

##### 4.4.1 Limits of Antenna Power Tolerance

Antenna Power: Its power is 12kW declared by the manufacturer.

Tolerance of antenna power shall be +50% (upper value) and -50% (lower value).

##### 4.4.2 Test Setup



##### 4.4.3 Test Results

Channel Number	Frequency (MHz)	Conducted RF Output Power (W)		
		V <sub>normal</sub>	V <sub>max.</sub>	V <sub>min.</sub>
1	9385	9616.122784	9794.899854	9527.961640
Max. Limit (W)		N/A		
Rated Power		9794.899854		
Tolerance of Antenna Power		4897.449927~14692.349781		

##### Waveguide slotted array antenna with 28.4dBi gain

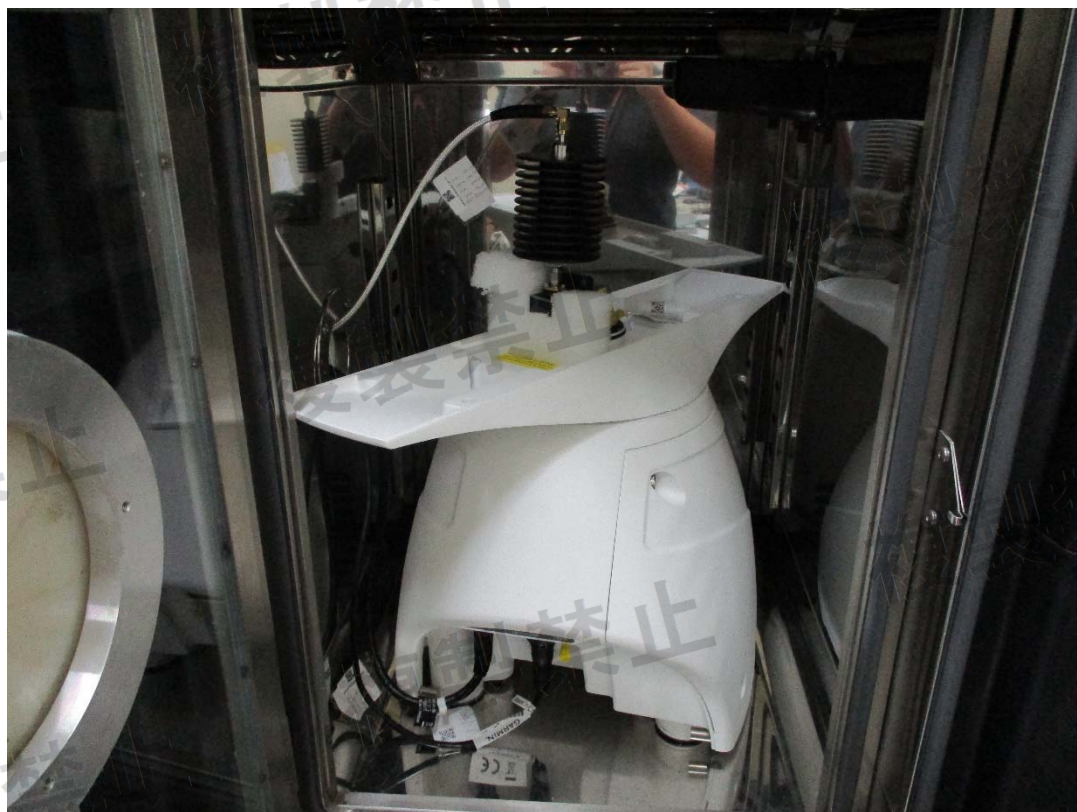
Channel Number	Frequency (MHz)	Radiated RF Output Power (W)		
		V <sub>normal</sub>	V <sub>max.</sub>	V <sub>min.</sub>
1	9385	6652731.562018	6776415.076107	6591738.952444

Note: 1. The conducted RF output power is a “calculated” value derived from the radiated value.

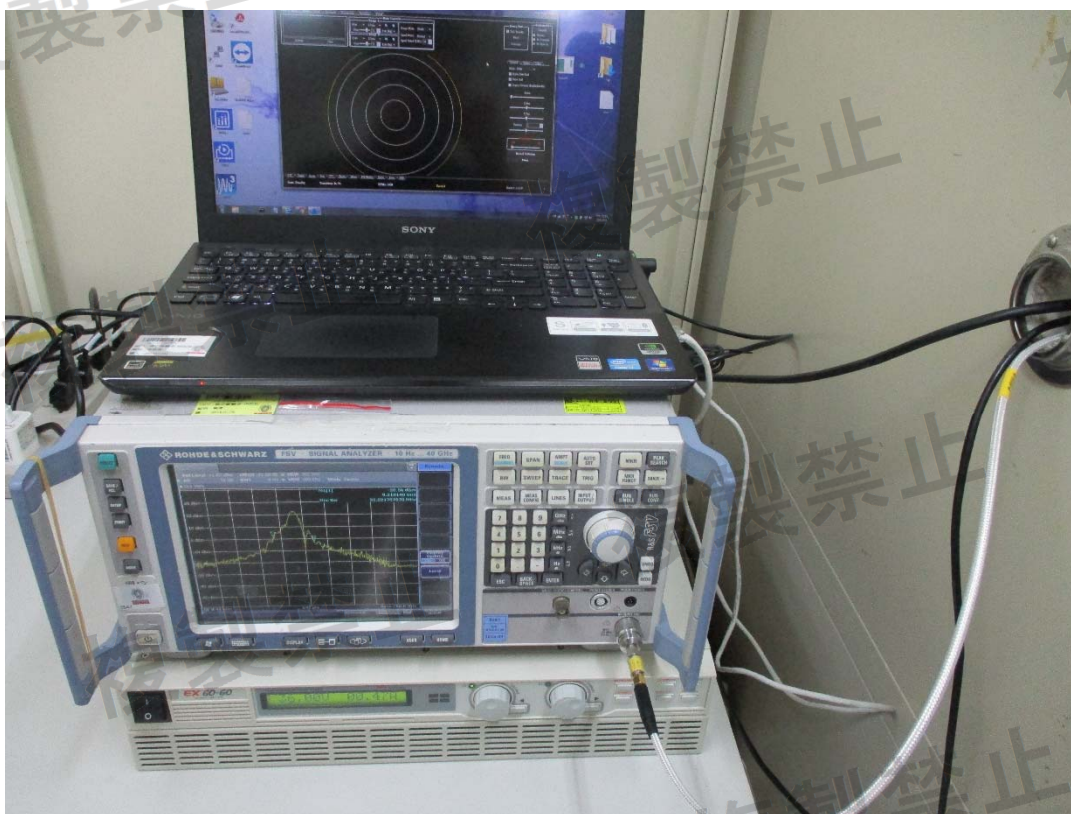
2. Formula: Conducted RF output power = Radiated RF output power - Maximum Antenna Gain.



## 5 Photographs of the Test Configuration







## Appendix - Information of the Testing Laboratories

We, Bureau Veritas Consumer Products Services (H.K.) Ltd., Taoyuan Branch, were founded in 1988 to provide our best service in EMC, Radio, Telecom and Safety consultation. Our laboratories are FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

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### Hsin Chu EMC/RF/Telecom Lab

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Fax: 886-3-6668323

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Web Site: [www.bureauveritas-adt.com](http://www.bureauveritas-adt.com)

The address and road map of all our labs can be found in our web site also.

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