

Radio Test Report

Report No.: RJBEBU-WTW-P22120823-1

Product: Gaming Keyboard

Brand: ALIENWARE, DELL

Test Model: AW920K

Received Date: 2022/12/28

Test Date: 2023/1/10

Issued Date: 2023/1/30

Applicant: Chicony Electronics Co., Ltd.

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

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



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Release Control Record

Issue No.	Description	Date Issued
RJBEBU-WTW-P22120823-1	Original release.	2023/1/30

1 Certificate of Conformity

Product: Gaming Keyboard

Brand: ALIENWARE, DELL

Test Model: AW920K

Sample Status: Engineering sample


Applicant: Chicony Electronics Co., Ltd.

Test Date: 2023/1/10

Standards: ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43
Certification Ordinance Article 2-1-19

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 :


Jessica Cheng / Senior Specialist

, **Date:**

2023/1/30

Approved by :


Jeremy Lin / Project Engineer

, **Date:**

2023/1/30

2 Summary of Test Results

The EUT has been tested according to the following specifications:

Notice 88 Appendix 43 Reference	ARIB STD- T66 Ref.	Report Reference	Parameter	Test Results (Note)
General Provisions				
C	3.2 (4)	4.1	Frequency tolerance	C
D	3.2 (7)	4.2	Occupied bandwidth	C
E	3.2 (6)	4.4	Spurious emissions	C
Transmitting Equipment				
F	3.2 (2)	4.4	Antenna power	C
--	--	--	SAR	NA
Transmitting Antenna				
--	--	3.5	Type, configuration, etc. of transmitting antenna	C
--	--	3.5	Direction pattern of transmitting antenna	C
Receiving Equipment				
G	3.3 (1)	4.5	Spurious emissions of receiver	C
--	--	3.5	Refer to all articles for transmitting antenna	C
Operating Frequency 2400 to 2483.5MHz				
--	3.7 (1)	3.4	High Frequency/modulation section cannot be opened easily	C
--	3.1 (1)	3.1	Communication method	C
--	3.2 (1)a	3.1	Modulation method	C
--	3.2 (1)a	3.1	Spread spectrum method	NA
--	3.2 (2)	4.4	Antenna power	C
--	3.6 (2)	4.4	Absolute gain of transmitting antenna	C
--	3.6 (2)	4.4	Angular width of principal radiation (AWPR)	NA
--	3.2 (10)	--	Number of carriers within 1 MHz bandwidth in OFDM	NA
--	3.2 (8)	--	Diffusion bandwidth	NA
--	3.2 (9)	--	Spreading factor	NA
--	3.2 (11)	--	Frequency retention time (FH employed)	NA
--	3.4.1(1)	4.6	Interference Prevention Function	C
--	3.4.1(3)	--	Carrier Sense Capability	NA

Note:

1. C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable
2. Determining compliance based on the results of the compliance measurement, not taking into account measurement instrumentation uncertainty.

2.1 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until	Calibration Authority	Cal. Method
MIMO Power measurement Test set (4X4) KEYSIGHT	U2021XA	U2021XA_001	2022/6/13	2023/6/12	ETC	c)
Spectrum Analyzer R&S	FSV40	101042	2022/9/5	2023/9/4	ETC	c)
Spectrum Analyzer KEYSIGHT	N9030A	MY54490260	2022/7/14	2023/7/13	ETC	c)
Peak Power meter Anritsu	ML2495A	0842014	2022/4/27	2023/4/26	ETC	c)
Peak Power meter Anritsu	ML2495A	0842014	2022/4/27	2023/4/26	ETC	c)
MXG Vector Signal Generator KEYSIGHT	N5182B	MY53052658	2022/5/9	2023/5/8	ETC	c)
Voltage Meter FLUKE	179	89610322	2022/10/3	2023/10/2	ETC	c)
Programmable DC Power Supply (IDRC)	DSP80-180WE	701217	2022/3/3	2023/3/2	ETC	c)

NOTE: Calibration Method

- a) : Calibration conducted by the National Institute of Information and Communications Technology(NICT) or a designated calibration agency under Article 102-18 paragraph (1) of the Radio Law.
- b) : Calibration conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Law (Law No. 51 of 1992) Japan Calibration Service System.
- 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 other equipment that listed above from a) to c)

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 (\pm)
Occupied Bandwidth	960 Hz
Spurious emissions	2.7 dB
Output power density	1.2 dB
Out of band radiated power	3.2 dB
Frequency Tolerance	97.75 Hz

2.3 Modification Record

There were no modifications required for compliance.

3 General Information

3.1 General Description of EUT

Product	Gaming Keyboard
Brand	ALIENWARE, DELL
Test Model	AW920K
Status of EUT	Engineering sample
Nominal Voltage	3.8Vdc from battery or 5Vdc from host equipment
Modulation Type	GFSK
Operating Frequency	2402MHz ~ 2480MHz
Number of Channel	79
Assembly	The EUT is constructed as a Keyboard. 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.

Note:

1. The EUT uses following accessories.

Shielded USB Cable 2.0m	
Extender	
Brand	Model
ALIENWARE	771-02227L-A01
Dongle	
Brand	Model
ALIENWARE, DELL	UD2402c

2. There are Bluetooth and GFSK technology used for the EUT.
3. Bluetooth and GFSK technology can not transmit at same time.
4. The above EUT information is declared by manufacturer and for more detailed features description, please refer to the manufacturer's specifications or User's Manual.

3.2 Output Power Description of EUT

Modulation Type	Rated power (mW)	Total Conducted RF output power (mW)	Radiated RF output power (mW)
GFSK	3	2.065	7.815

3.3 Antenna Description of EUT

1. The antenna information is listed as below.

Gain (dBi)	Antenna Type	Connector Type
5.78	Monopole	N/A

* Detail antenna specification please refer to antenna datasheet and/or antenna measurement report.

2. Antenna Pattern:

Please refer to the attached file (Antenna pattern).

3.4 Description of Test Modes

79 channels are provided to this EUT:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	20	2422	40	2442	60	2462
1	2403	21	2423	41	2443	61	2463
2	2404	22	2424	42	2444	62	2464
3	2405	23	2425	43	2445	63	2465
4	2406	24	2426	44	2446	64	2466
5	2407	25	2427	45	2447	65	2467
6	2408	26	2428	46	2448	66	2468
7	2409	27	2429	47	2449	67	2469
8	2410	28	2430	48	2450	68	2470
9	2411	29	2431	49	2451	69	2471
10	2412	30	2432	50	2452	70	2472
11	2413	31	2433	51	2453	71	2473
12	2414	32	2434	52	2454	72	2474
13	2415	33	2435	53	2455	73	2475
14	2416	34	2436	54	2456	74	2476
15	2417	35	2437	55	2457	75	2477
16	2418	36	2438	56	2458	76	2478
17	2419	37	2439	57	2459	77	2479
18	2420	38	2440	58	2460	78	2480
19	2421	39	2441	59	2461		

Note: The channels which were indicated in bold type of the above channel list were selected as representative test channel. Therefore only the data of the test channels were recorded in this report.

By means of test software provided by manufacture, the power levels during the tests were set according to the following codes:

Channel	Power setting
0	0
38	0
78	0

3.5 Test Conditions

Test Conditions		Voltage (Vdc)
V_{normal}	-	5
$V_{\text{max.}}$	+10%	5.5
$V_{\text{min.}}$	-10%	4.5

Test modes are presented in the report as below:

Test Item	Environmental Conditions
Frequency Tolerance	25 deg.C, 76% RH
Occupied Bandwidth	25 deg.C, 76% RH
Spurious Emissions for Transmitter	25 deg.C, 76% RH
Antenna Power	25 deg.C, 76% RH
Spurious Emissions for Receiver	25 deg.C, 76% RH
Interference Prevention Function	25 deg.C, 76% RH

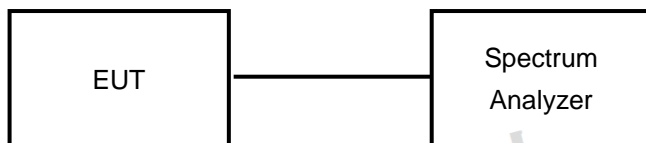
4 Test Results

4.1 Frequency Tolerance Measurement

4.1.1 Limits of Frequency Tolerance Measurement

Tolerance of frequency shall be +/- 50ppm

4.1.2 Test Setup



4.1.3 Test Results

Channel	Frequency (MHz)	V _{normal}		V _{max.}		V _{min.}	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2401.986404	-5.660	2401.986372	-5.673	2401.986279	-5.712
38	2440	2439.986067	-5.710	2439.986087	-5.702	2439.986133	-5.683
78	2480	2479.985872	-5.696	2479.985923	-5.676	2479.985827	-5.714

4.2 Occupied Bandwidth Measurement (99% power bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	<26MHz

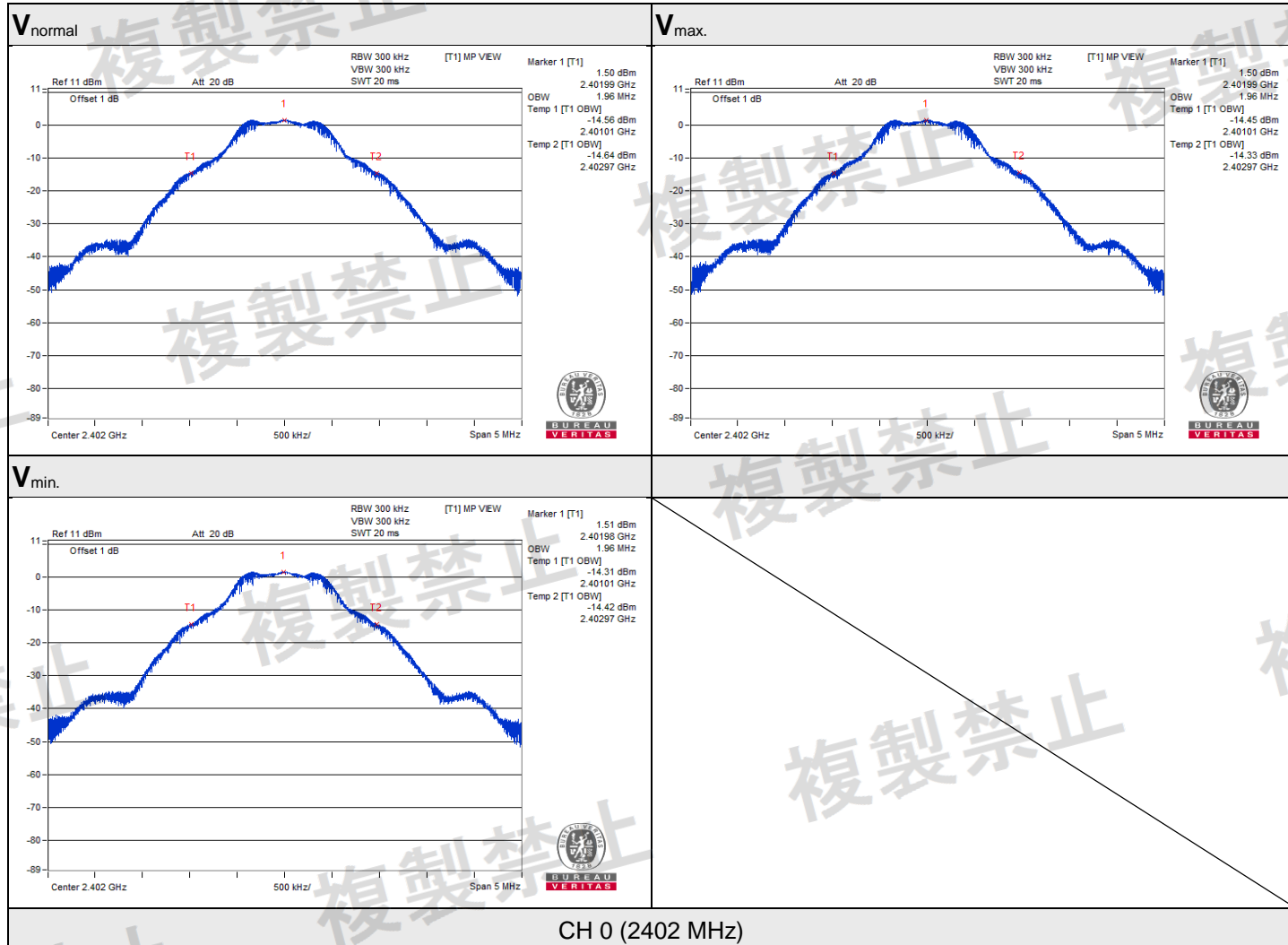
4.2.2 Test Setup



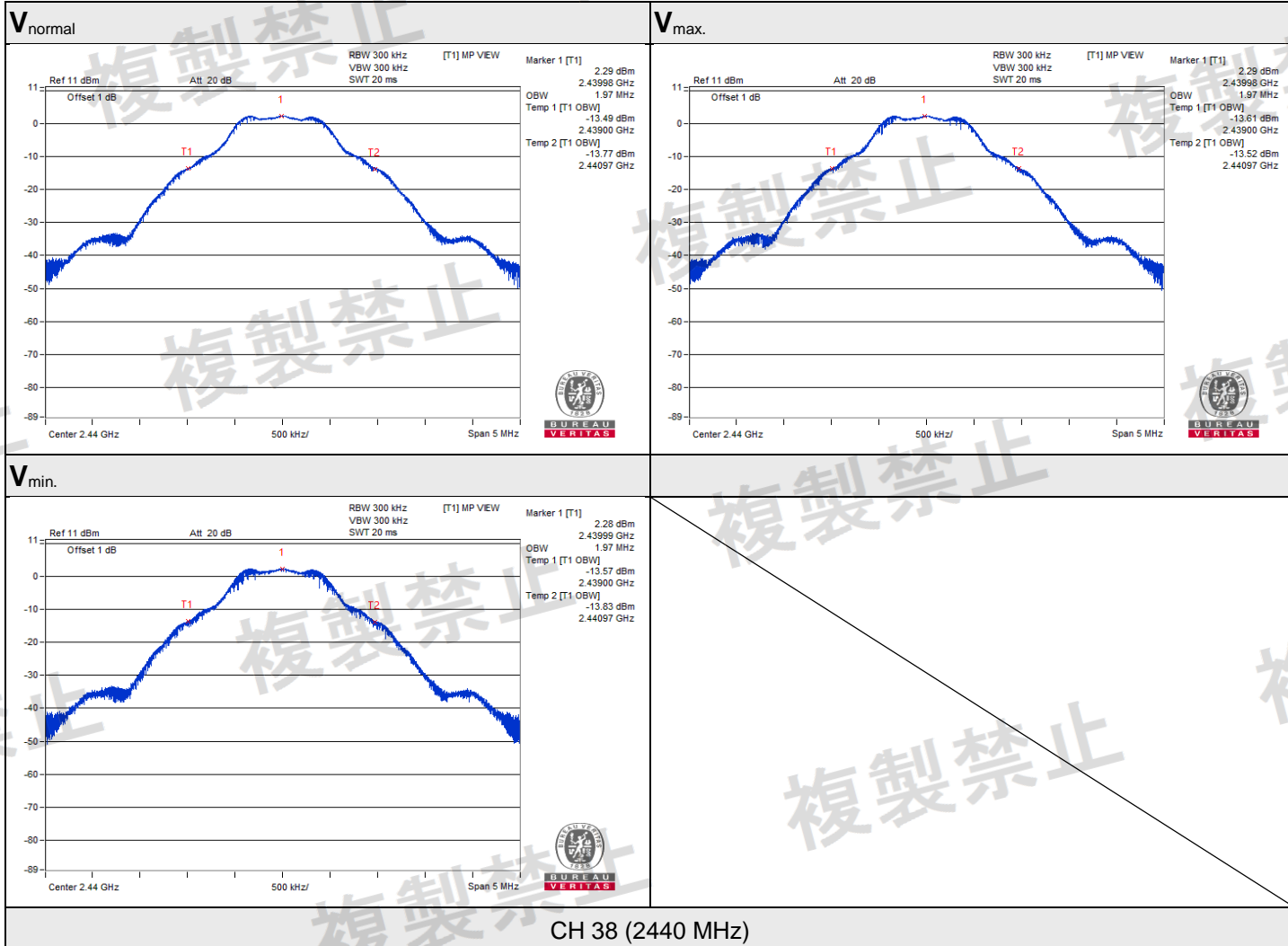
4.2.3 Test Results

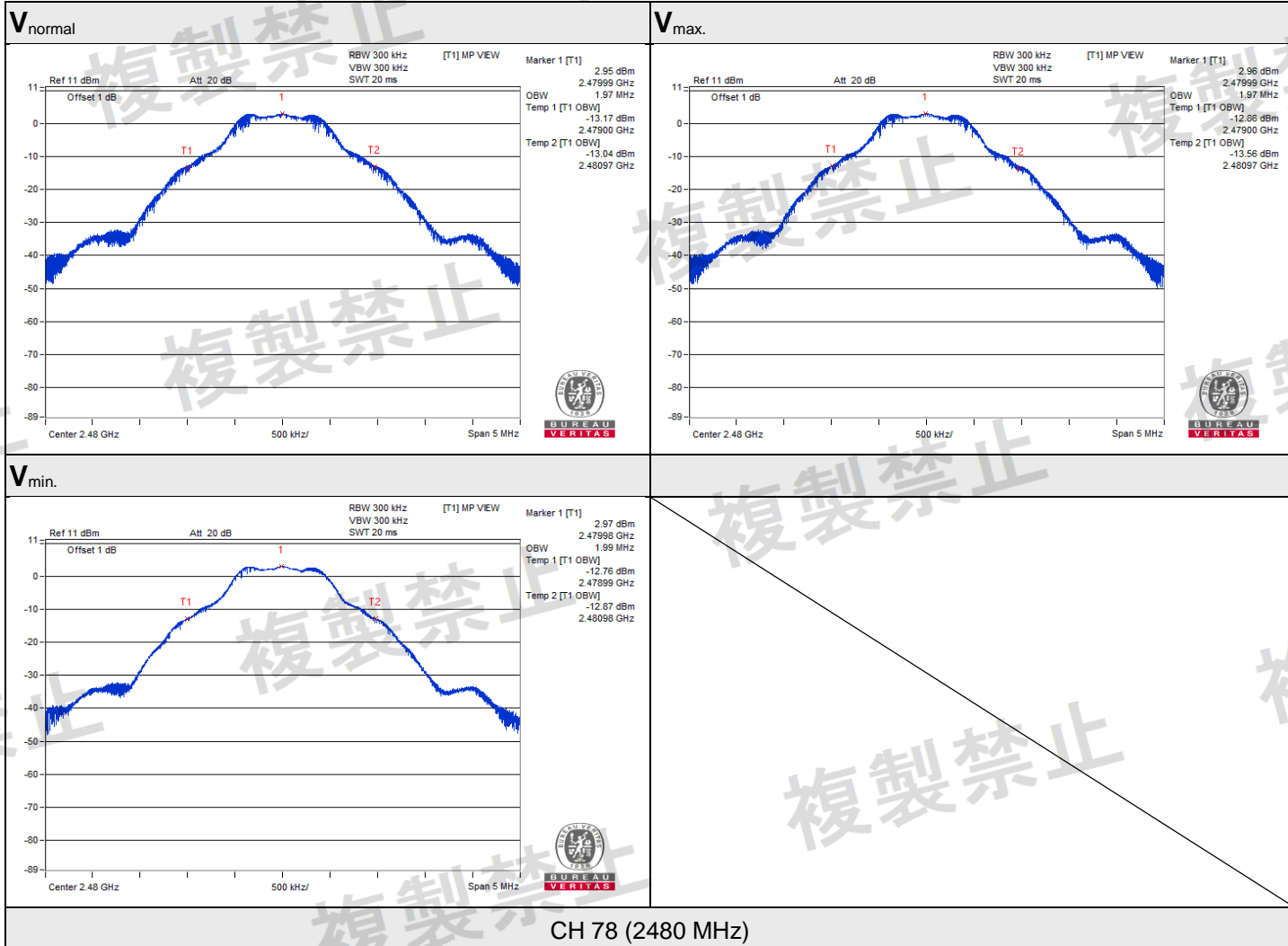
Channel	Frequency (MHz)	V_{normal}	$V_{\text{max.}}$	$V_{\text{min.}}$
		Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
0	2402	1.96	1.96	1.96
38	2440	1.97	1.97	1.97
78	2480	1.97	1.97	1.99

NOTE: For the test plots please refer to the below pages.



CH 0 (2402 MHz)



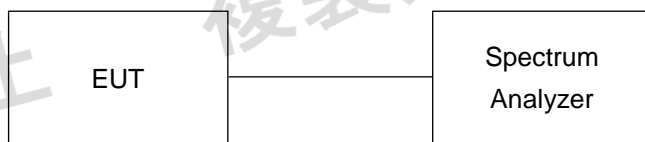


4.3 Spurious Emissions for Transmitter Measurement

4.3.1 Limits of Spurious Emissions

Frequencies (MHz)	Limit
Operating frequency 2400 to 2483.5MHz	
30.0MHz to 1000.0MHz	$\leq 0.25 \text{ uW/100kHz}$
1000.0MHz to 2387MHz	$\leq 2.5 \text{ uW/MHz}$
2387.0MHz to 2400.0MHz	$\leq 25 \text{ uW/MHz}$
2483.5MHz to 2496.5MHz	$\leq 25 \text{ uW/MHz}$
2496.5MHz to 12500.0MHz	$\leq 2.5 \text{ uW/MHz}$

4.3.2 Test Setup

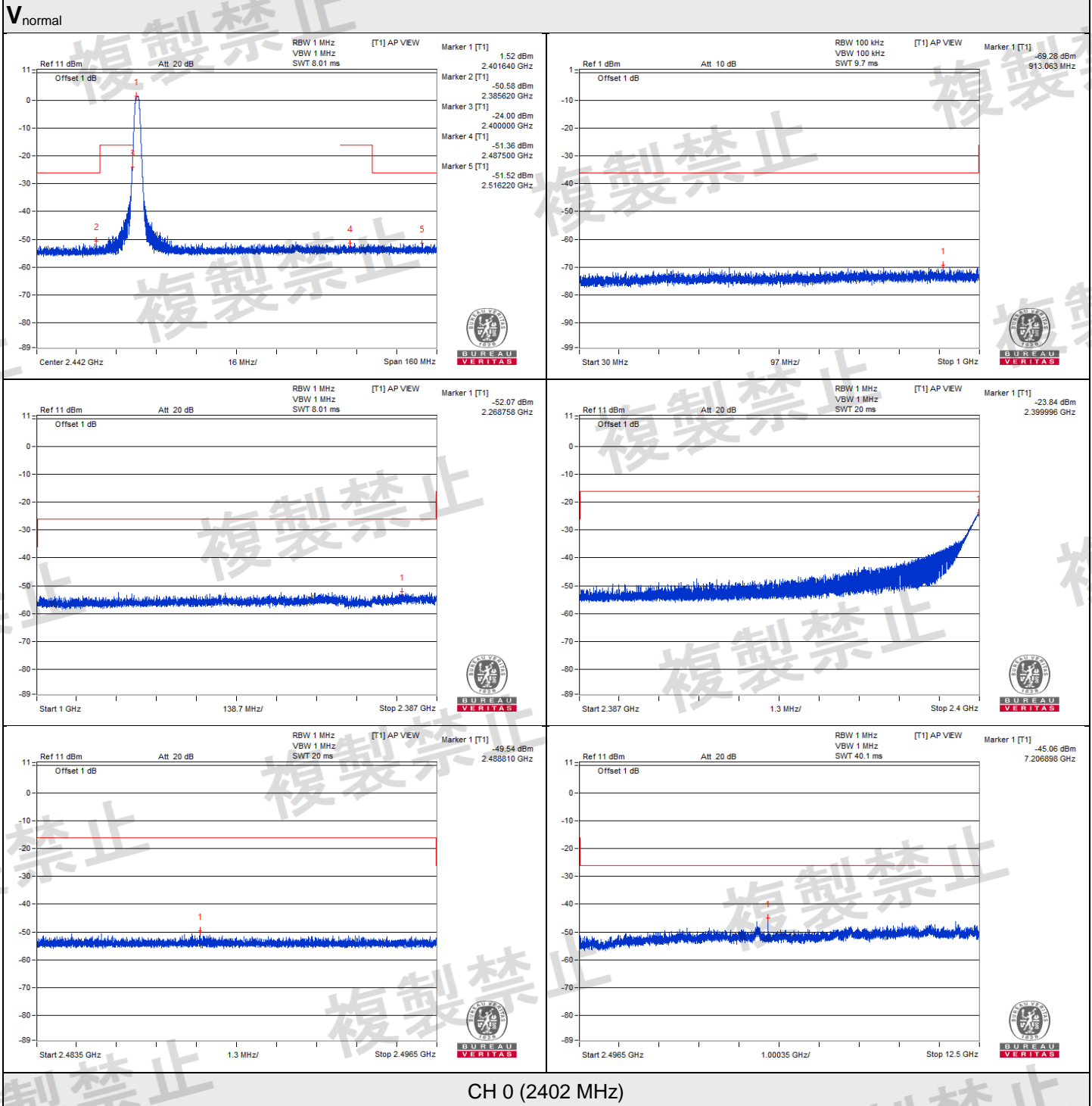


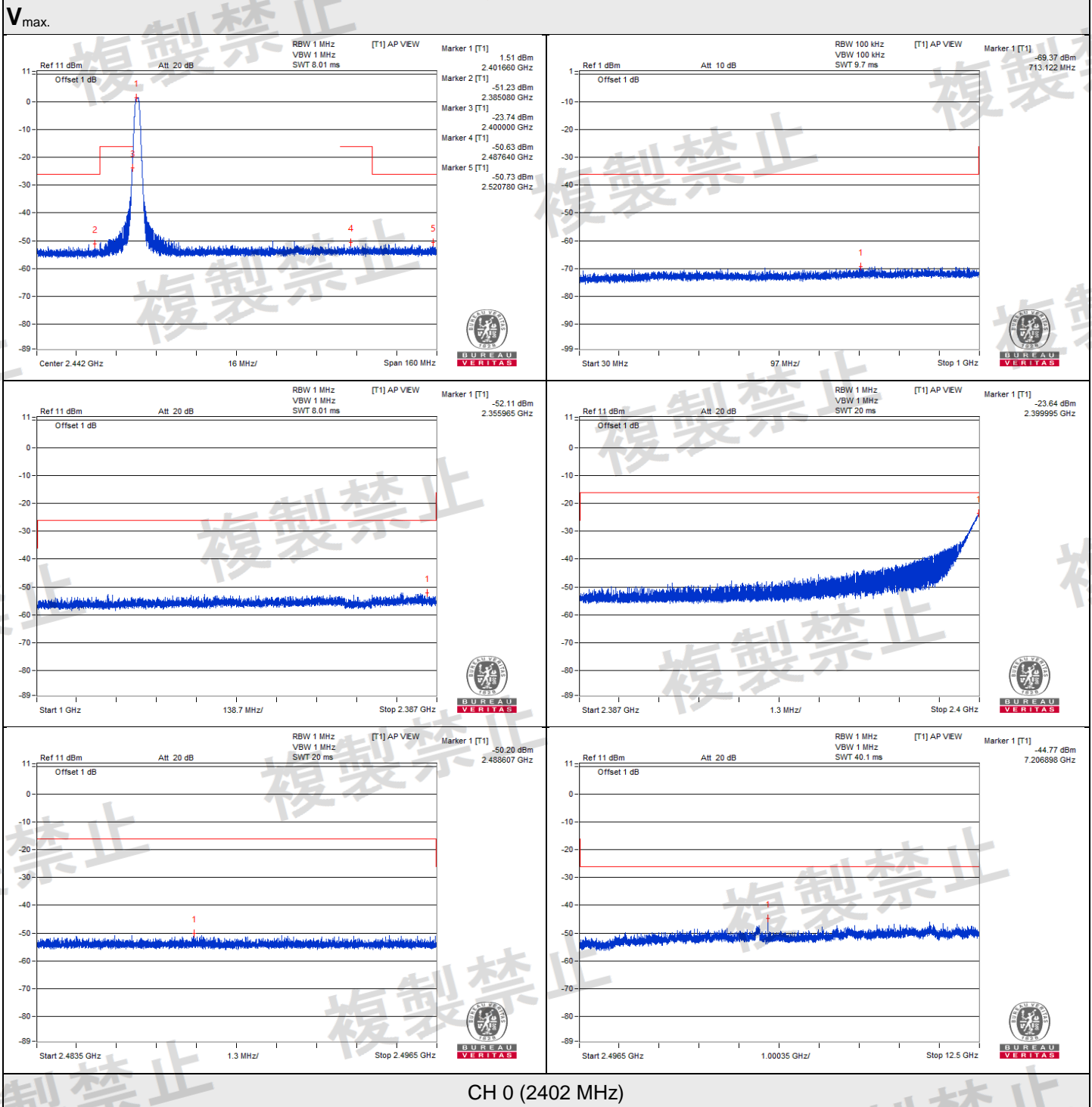
4.3.3 Test Results

TEST CHANNEL		CH 0 (2402 MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASUREMENT VALUE(uW)	LIMIT	RESULT
V_{normal}	30MHz to 1000MHz	913.063	0.000118	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2268.758	0.006209	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2399.996	4.130475	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2488.810	0.011117	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	7206.898	0.031189	2.5 uW/MHz	PASS
V_{max.}	30MHz to 1000MHz	713.122	0.000116	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2355.965	0.006152	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2399.995	4.325138	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2488.607	0.00955	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	7206.898	0.033343	2.5 uW/MHz	PASS
V_{min.}	30MHz to 1000MHz	704.877	0.000142	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2318.343	0.006252	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2400.000	4.355119	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2493.079	0.007907	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	7205.647	0.045499	2.5 uW/MHz	PASS
TEST CHANNEL		CH 38 (2440 MHz)			
V_{normal}	30MHz to 1000MHz	779.082	0.0001	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2297.885	0.006653	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2396.815	0.007674	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2490.849	0.007907	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	10696.869	0.023174	2.5 uW/MHz	PASS
V_{max.}	30MHz to 1000MHz	719.185	0.000128	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2352.151	0.006934	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2398.708	0.006577	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2491.306	0.010765	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	10691.867	0.020941	2.5 uW/MHz	PASS
V_{min.}	30MHz to 1000MHz	952.591	0.000117	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2324.238	0.006237	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2389.284	0.006637	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2485.908	0.010641	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	11352.098	0.024434	2.5 uW/MHz	PASS

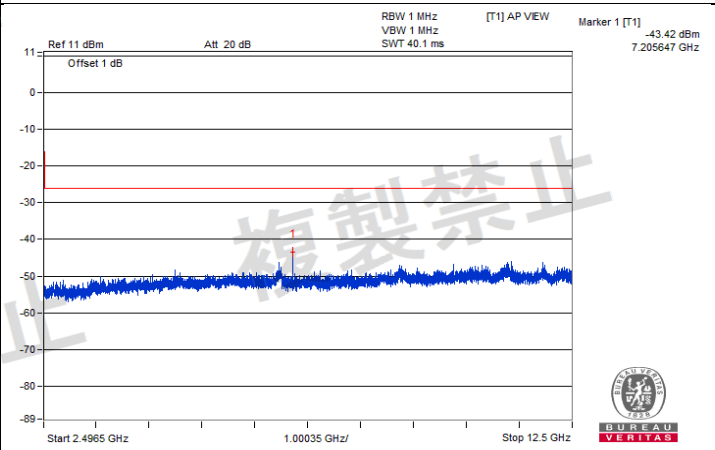
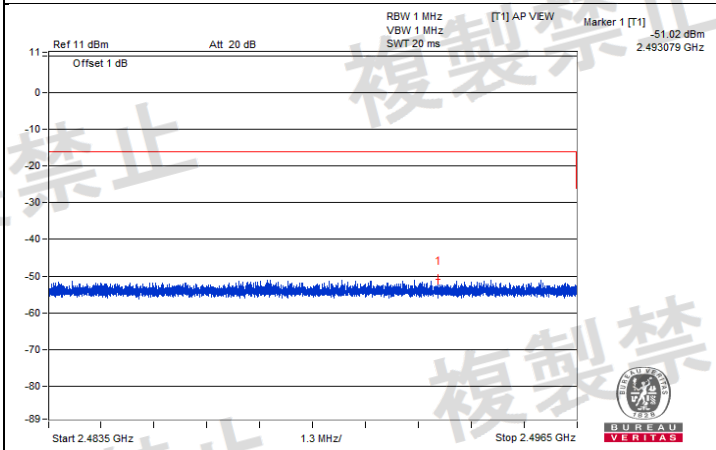
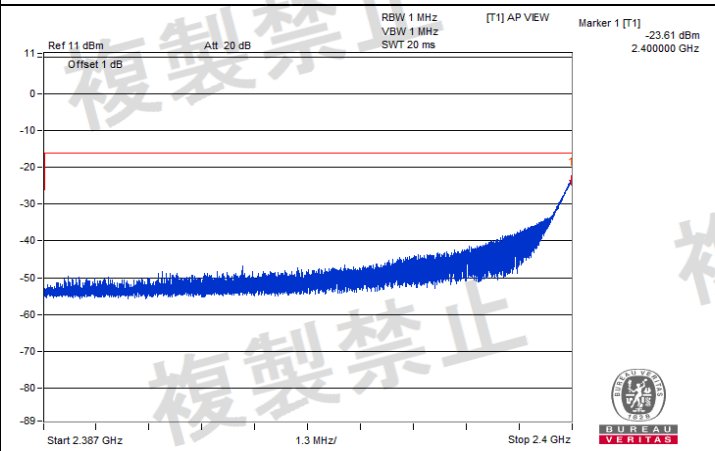
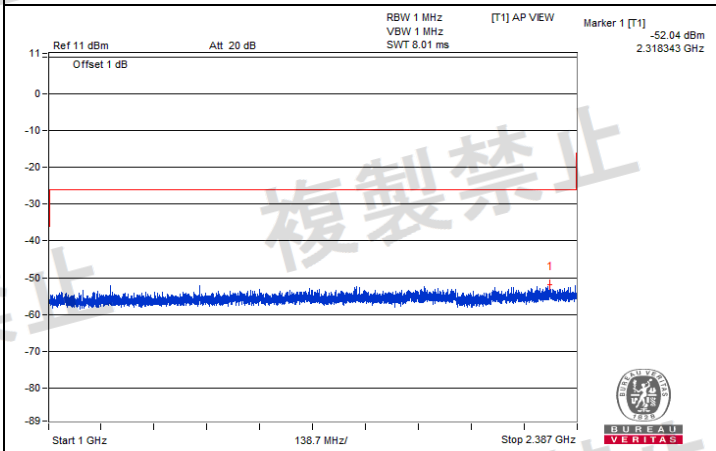
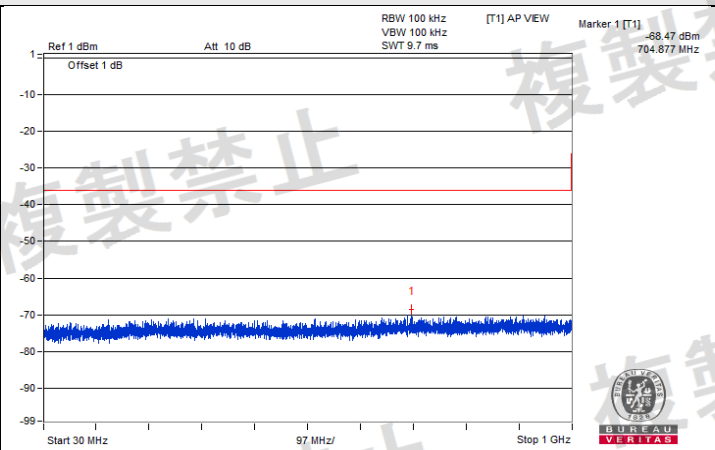
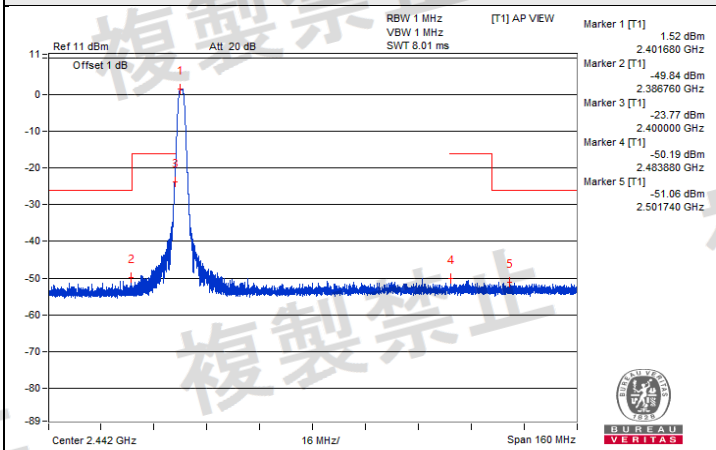
TEST CHANNEL		CH 78 (2480 MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASUREMENT VALUE(uW)	LIMIT	RESULT
V_{normal}	30MHz to 1000MHz	706.817	0.000126	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	2313.835	0.006546	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2393.669	0.007674	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.511	0.25704	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	10835.667	0.020654	2.5 uW/MHz	PASS
V_{max.}	30MHz to 1000MHz	876.931	0.000109	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	1988.064	0.007396	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2389.309	0.008128	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.517	0.258821	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	11280.823	0.021928	2.5 uW/MHz	PASS
V_{min.}	30MHz to 1000MHz	702.937	0.000115	0.25 uW/100kHz	PASS
	1000MHz to 2387MHz	1799.778	0.006486	2.5 uW/MHz	PASS
	2387MHz to 2400MHz	2390.661	0.007603	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.582	0.263027	25 uW/MHz	PASS
	2496.5MHz to 12500MHz	10898.189	0.021677	2.5 uW/MHz	PASS

NOTE: 1. The spectrum plots are attached on the following pages.

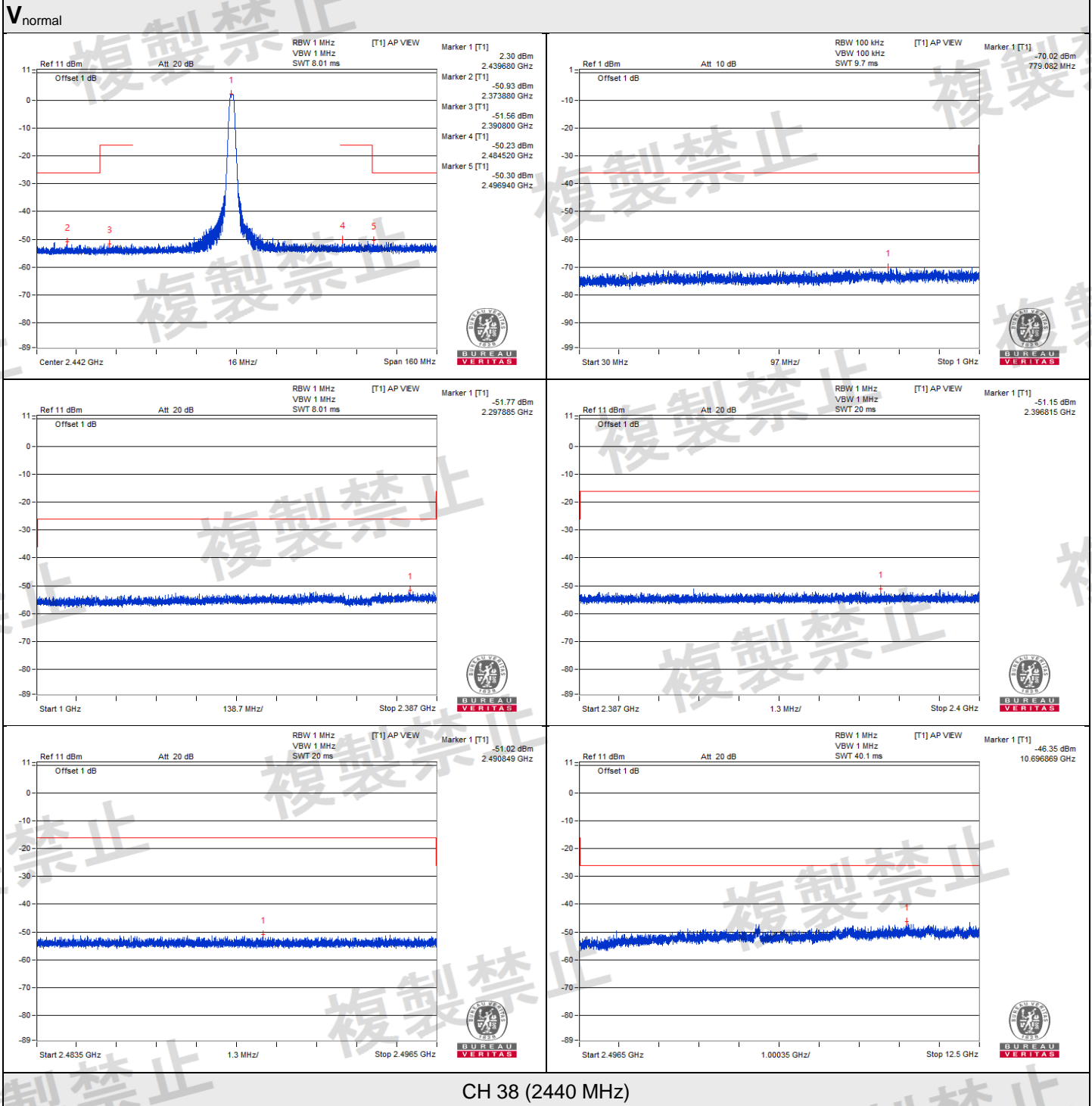


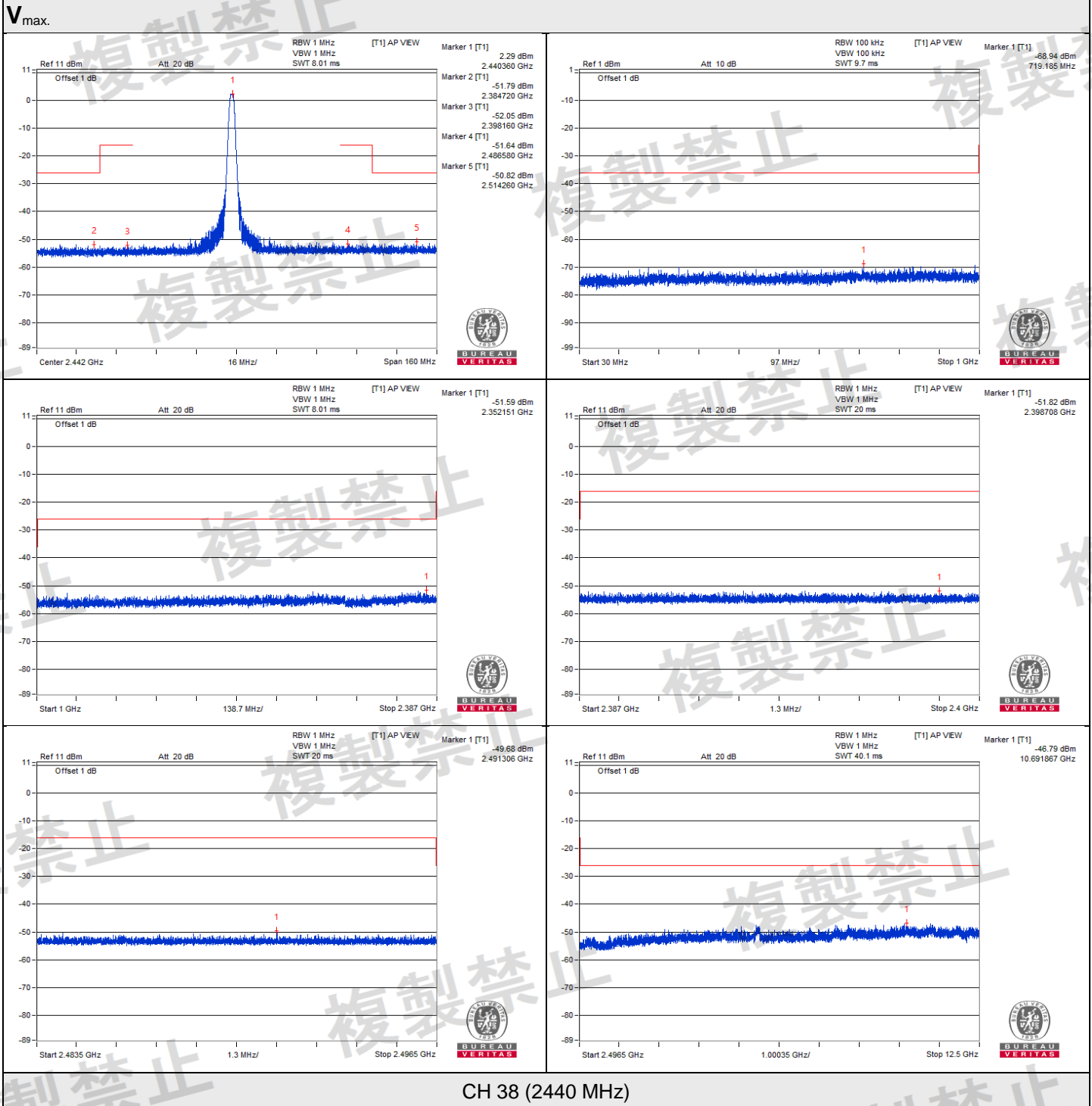


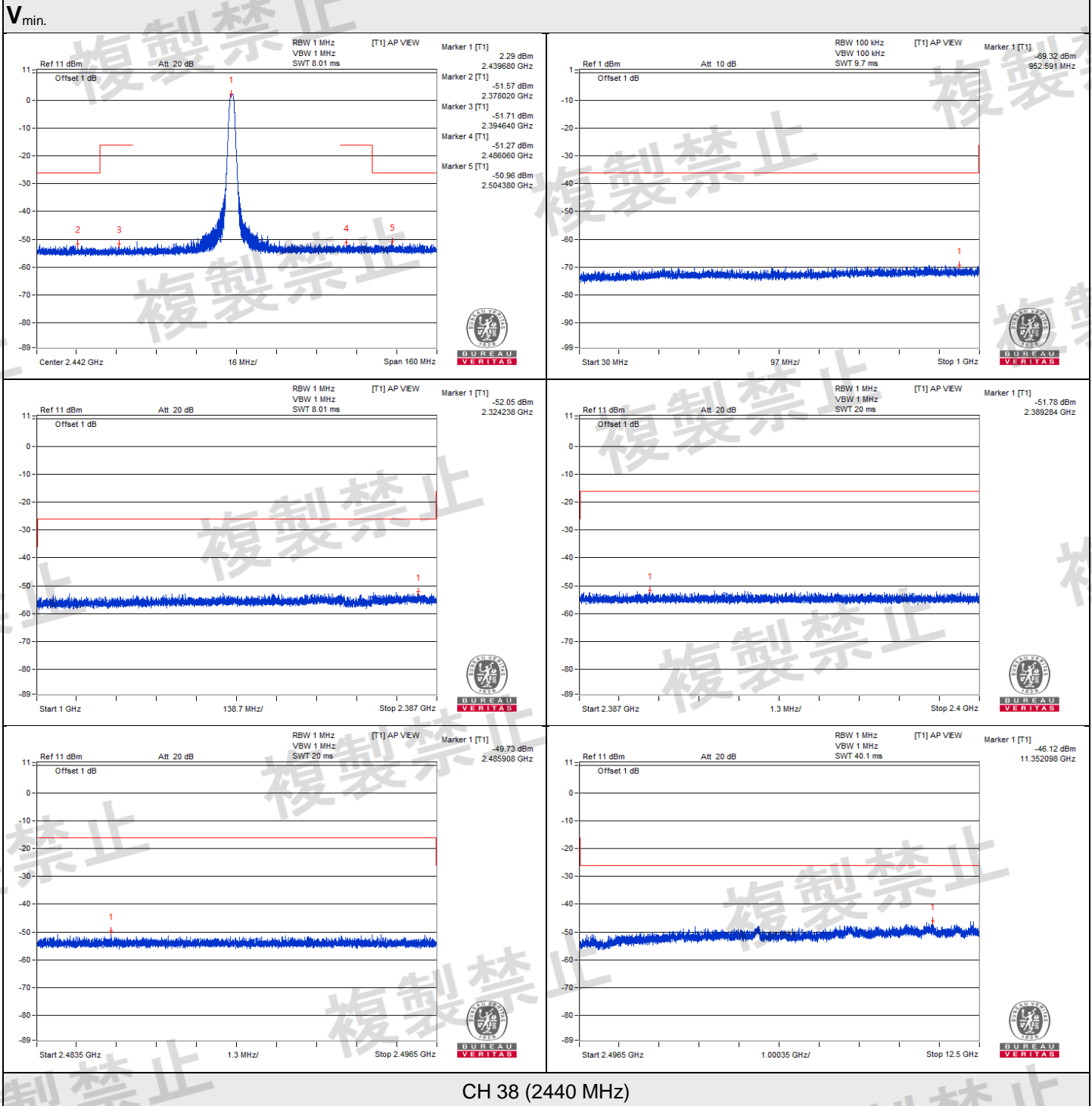
V_{min}.



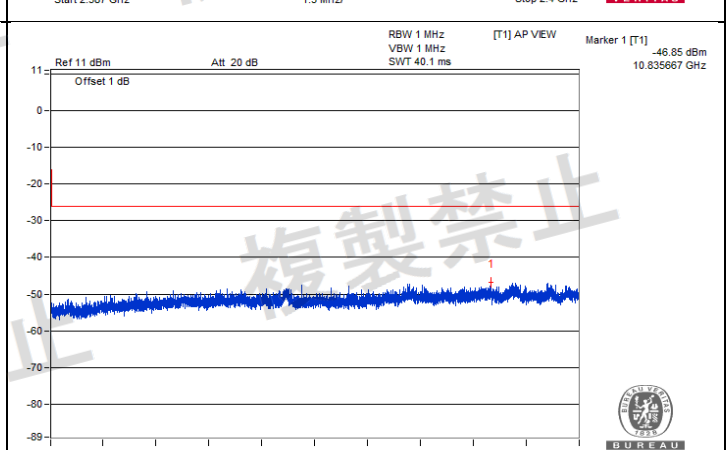
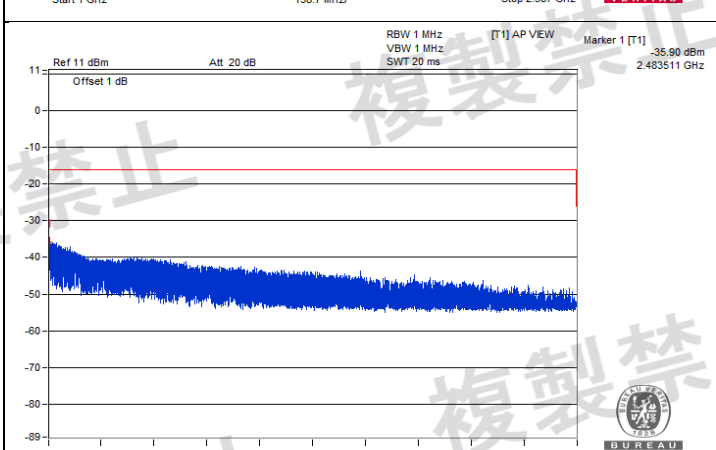
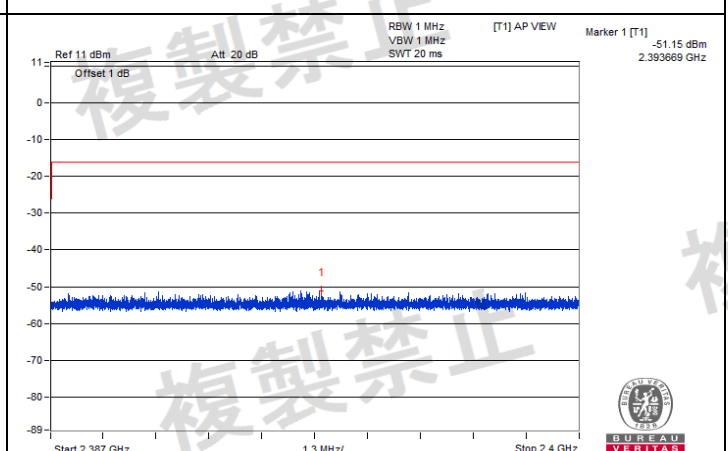
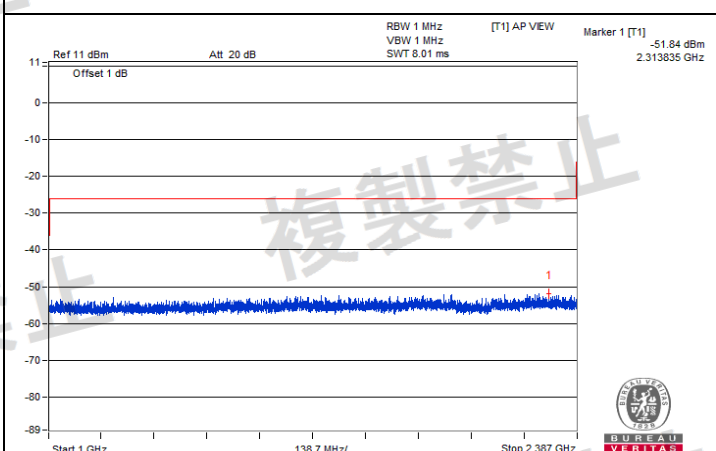
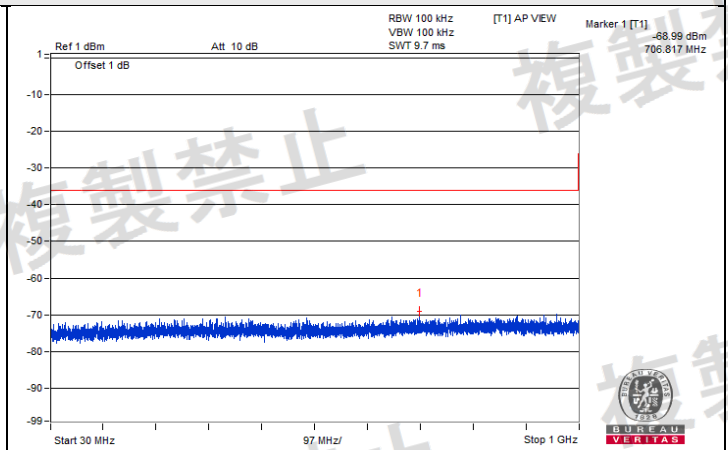
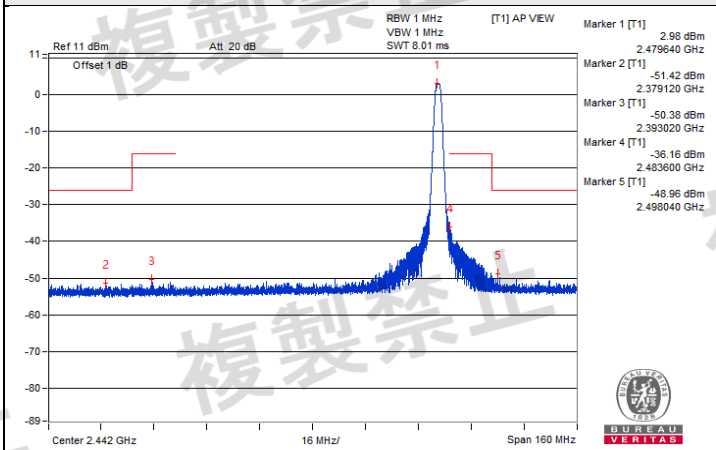
CH 0 (2402 MHz)



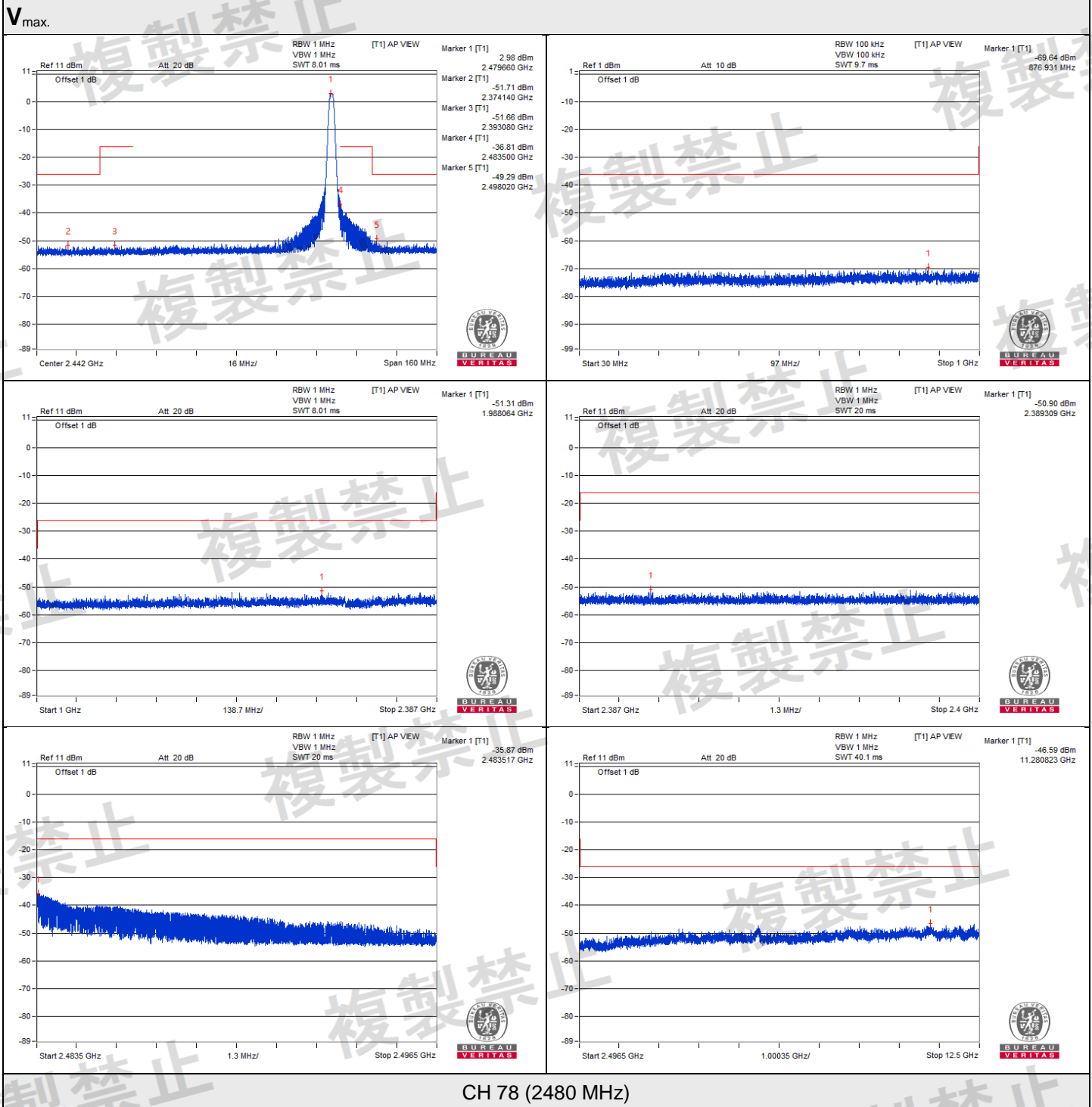




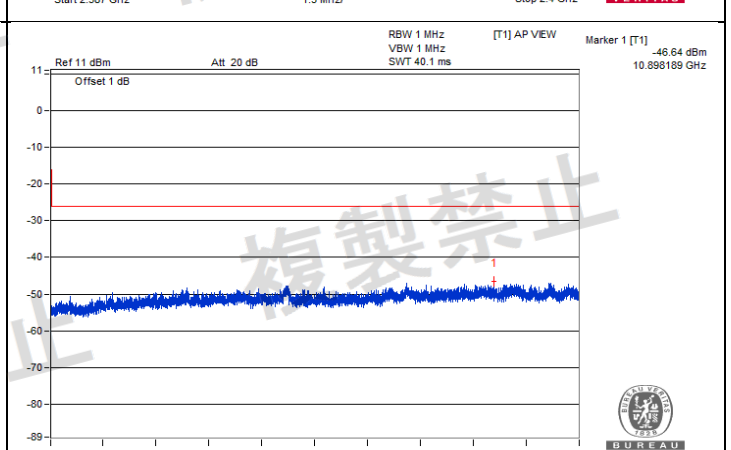
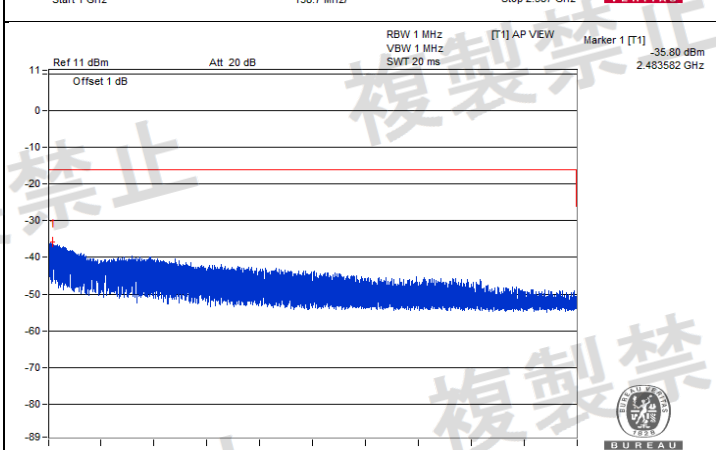
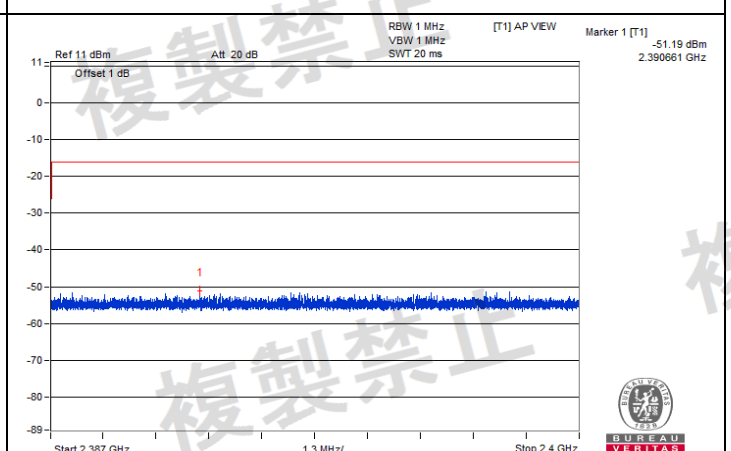
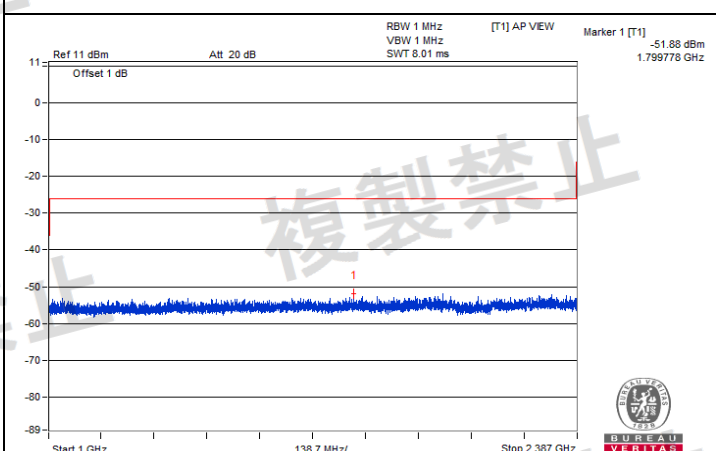
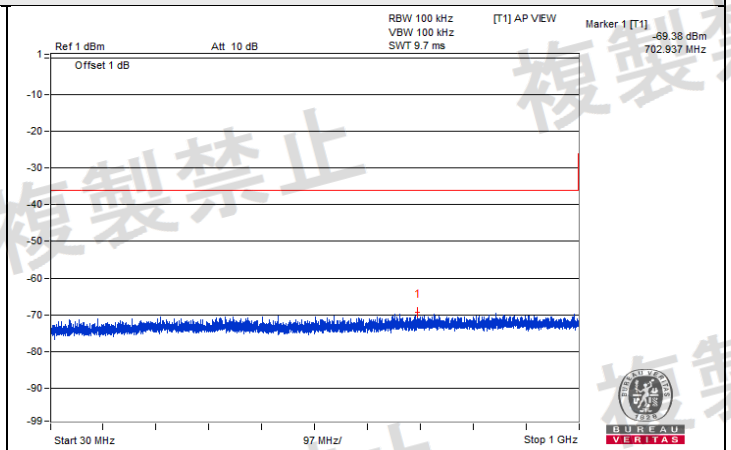
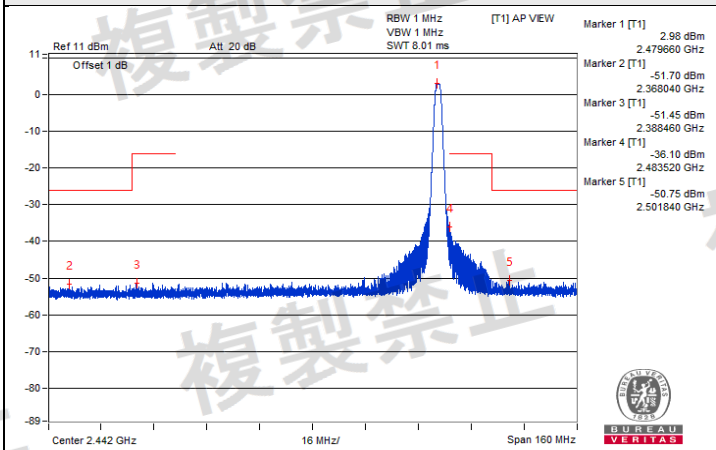
V_{normal}



CH 78 (2480 MHz)



V_{min}.



CH 78 (2480 MHz)

4.4 Antenna Power Measurement

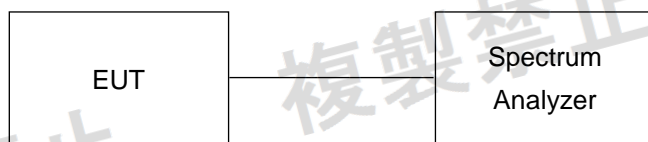
4.4.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP Limit (Note 3)
DS	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz ~ 22.14 dBm/MHz (16.368 mW/MHz ~ 163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz ~ 22.14 dBm/MHz (16.368 mW/MHz ~ 163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5mW/MHz	9.13 dBm/MHz ~ 19.13 dBm/MHz (8.185 mW/MHz ~ 81.846 mW/MHz)
Other than the above	2400 – 2483.5 MHz	10mW	12.14 dBm ~ 22.14 dBm (16.368 mW ~ 163.68 mW)

Note:

1. Occupied bandwidth is less than 26MHz
2. Occupied bandwidth is more than 26MHz and less than 40MHz
3. EIRP limit is variable by the ALIENWARE, DELLBA, the ALIENWARE, DELLBA (half-power beam width) of the antenna shall be $360/A$ degrees or less, where $A = \text{EIRP}/(2.14 \text{ dBi} + \text{"Antenna Power (limit)})$.
4. Tolerance of antenna power shall be +20% (upper value) and -80% (lower value).

4.4.2 Test Setup



4.4.3 Test Results

Voltage	Channel Number	Frequency (MHz)	Conducted RF Output Power (mW)	Radiated RF Output Power (mW)
V_{normal}	0	2402	1.622	6.138
	38	2440	1.866	7.062
	78	2480	2.037	7.709
V_{max.}	0	2402	1.626	6.153
	38	2440	1.811	6.854
	78	2480	2.065	7.815
V_{min.}	0	2402	1.667	6.309
	38	2440	1.919	7.262
	78	2480	1.945	7.361
Max. Limit (mW)			10	-
Rated Power (mW)			3	-
Tolerance of Antenna Power (mW)			0.6 ~ 3.6	-
Max. EIRP Limit (mW)			-	16.368

Note: 1. Antenna gain is 5.78 dBi.

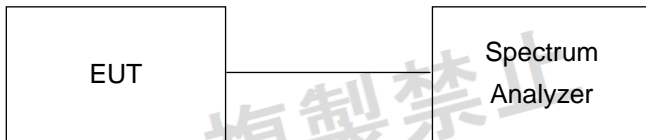
- The radiated RF output power is a “calculated” value derived from the conducted value.
- Formula: Radiated RF output power = Conducted RF output power + Antenna gain

4.5 Spurious Emissions for Receiver

4.5.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	$\leq 4\text{nW}$ (-54dBm)
Above 1GHz	$\leq 20\text{nW}$ (-47dBm)

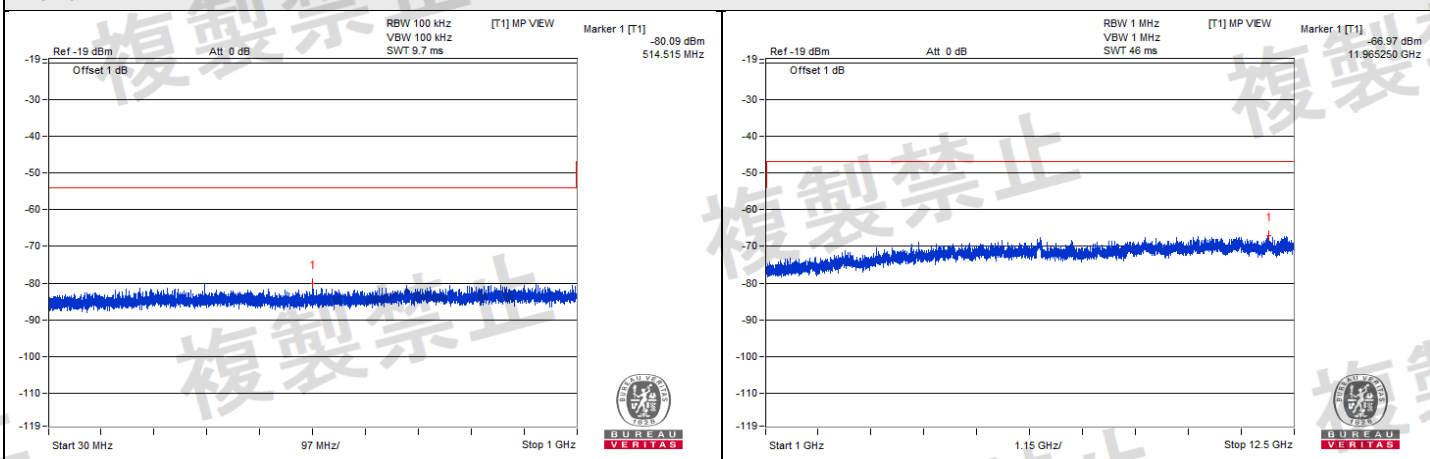
4.5.2 Test Setup



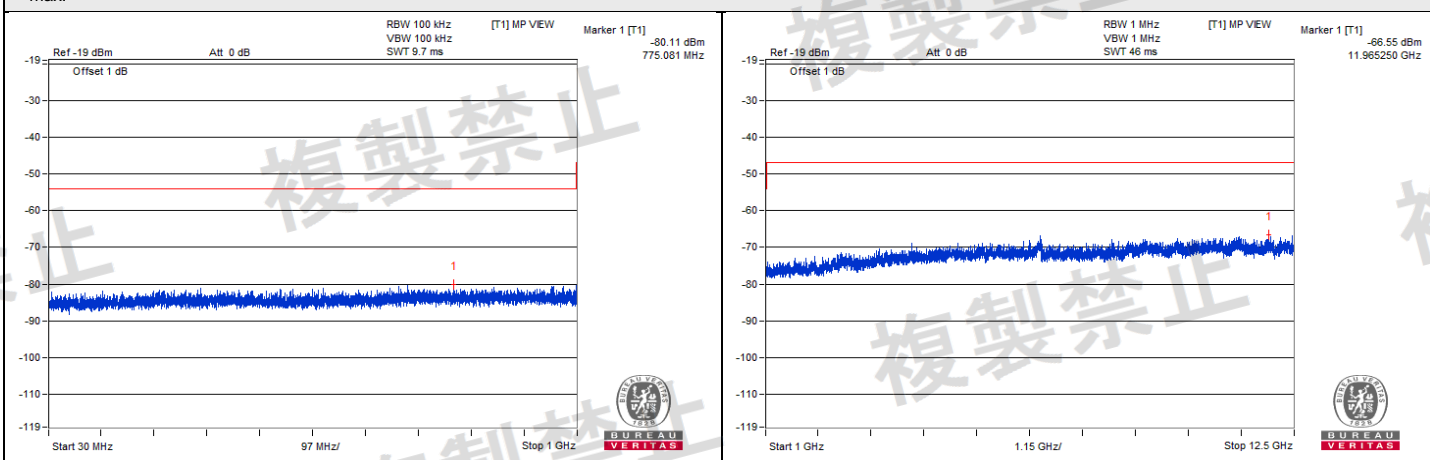
4.5.3 Test Result

TEST CHANNEL		CH 0 (2402 MHz)			
TEST CONDITION	FREQUENCY RANGE(MHz)	FREQUENCY (MHz)	MEASUREMENT VALUE(nW)	LIMIT (nW)	RESULT
V_{normal}	30.0 to 1000.0	514.515	0.009795	4nW	PASS
	1000.0 to 12500.0	11965.250	0.200909	20nW	PASS
$V_{max.}$	30.0 to 1000.0	775.081	0.00975	4nW	PASS
	1000.0 to 12500.0	11965.250	0.221309	20nW	PASS
$V_{min.}$	30.0 to 1000.0	774.838	0.009863	4nW	PASS
	1000.0 to 12500.0	10724.687	0.207491	20nW	PASS
TEST CHANNEL		CH 38 (2440 MHz)			
V_{normal}	30.0 to 1000.0	961.685	0.011169	4nW	PASS
	1000.0 to 12500.0	11383.062	0.232274	20nW	PASS
$V_{max.}$	30.0 to 1000.0	820.186	0.012853	4nW	PASS
	1000.0 to 12500.0	11249.375	0.22182	20nW	PASS
$V_{min.}$	30.0 to 1000.0	846.012	0.010839	4nW	PASS
	1000.0 to 12500.0	11960.937	0.234423	20nW	PASS
TEST CHANNEL		CH 78 (2480 MHz)			
V_{normal}	30.0 to 1000.0	983.267	0.01052	4nW	PASS
	1000.0 to 12500.0	11338.500	0.244343	20nW	PASS
$V_{max.}$	30.0 to 1000.0	842.981	0.011298	4nW	PASS
	1000.0 to 12500.0	10708.875	0.240991	20nW	PASS
$V_{min.}$	30.0 to 1000.0	868.322	0.011858	4nW	PASS
	1000.0 to 12500.0	10619.750	0.260016	20nW	PASS

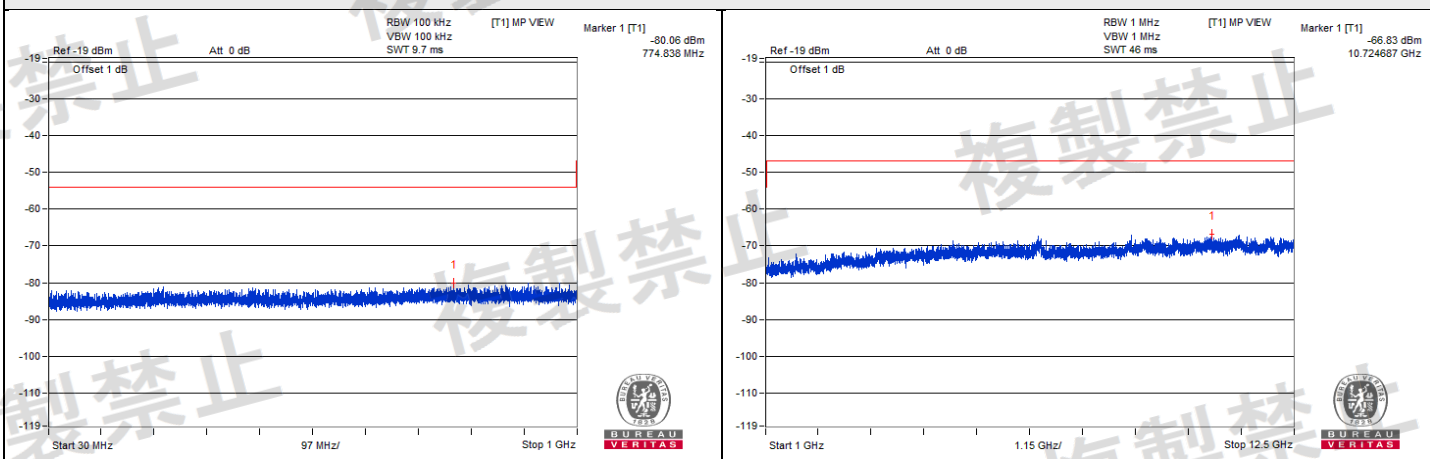
V_{normal}



V_{max.}

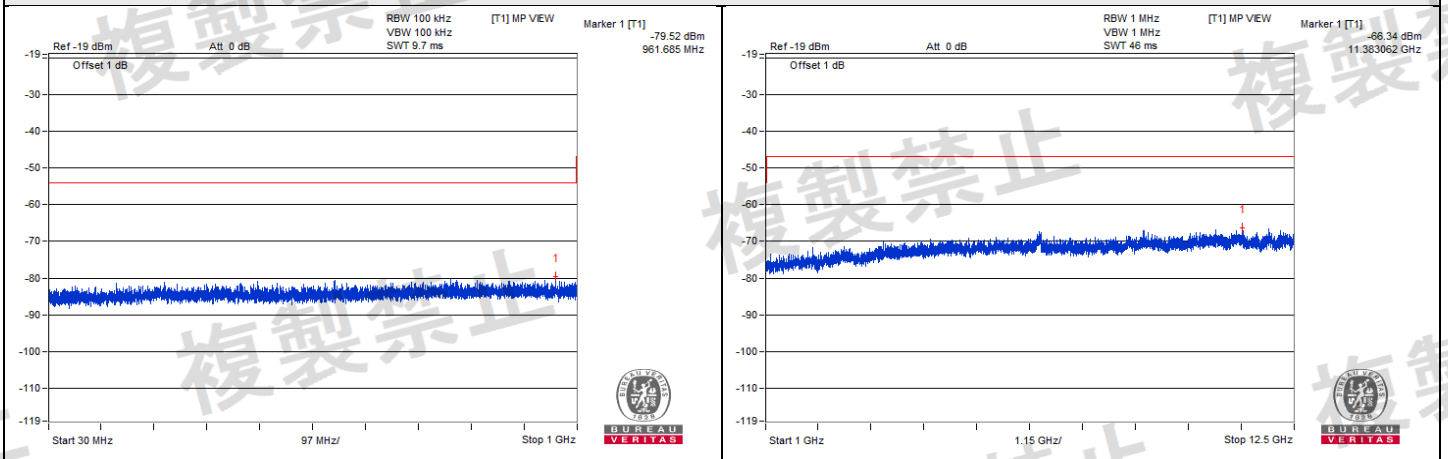


V_{min.}

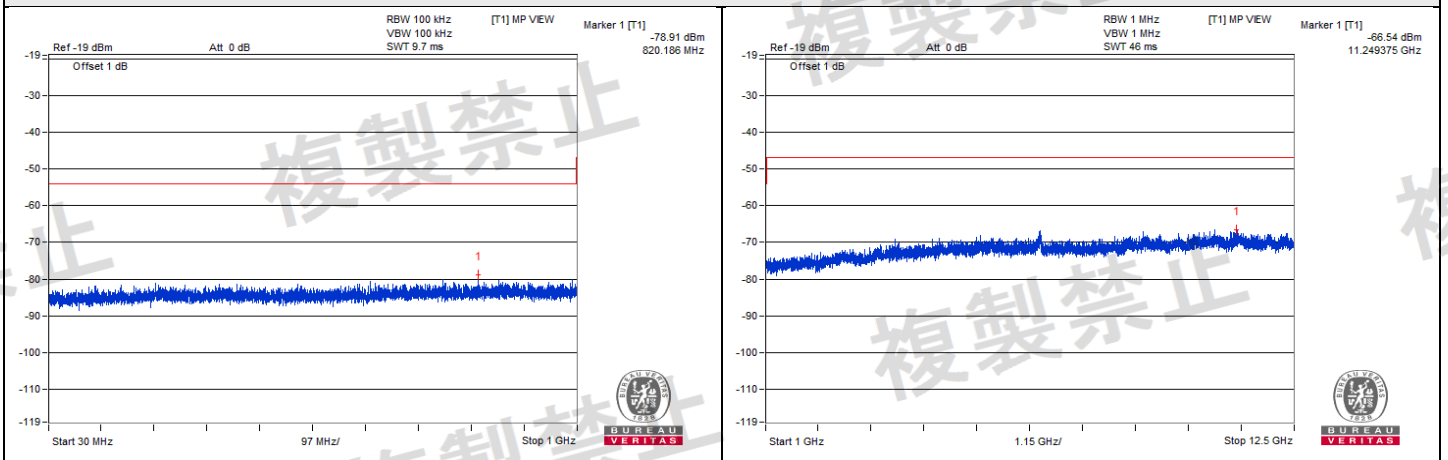


CH 0 (2402 MHz)

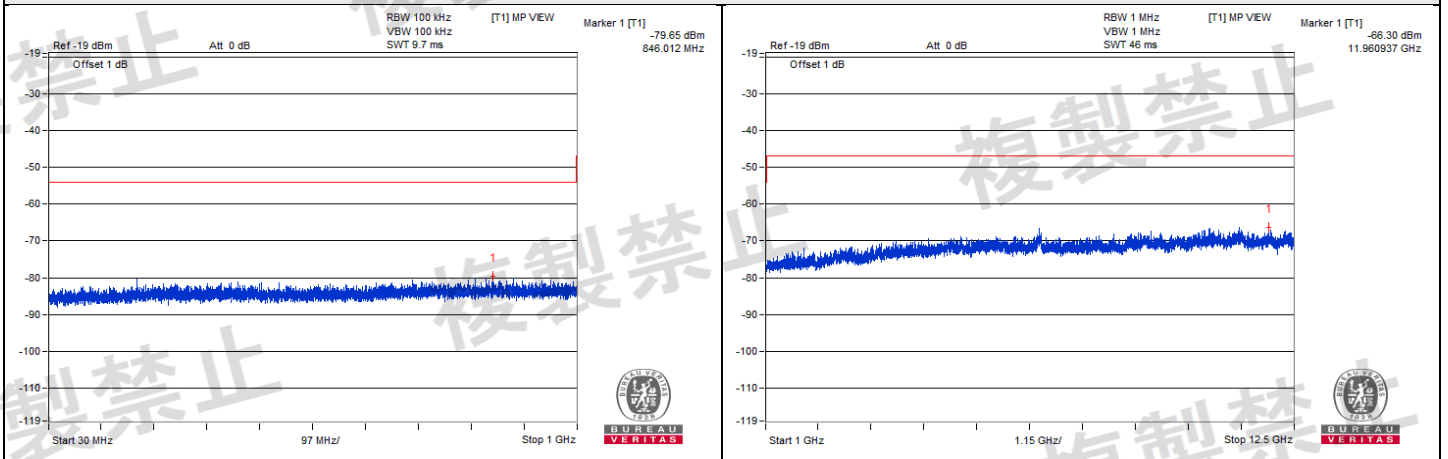
V_{normal}



V_{max.}

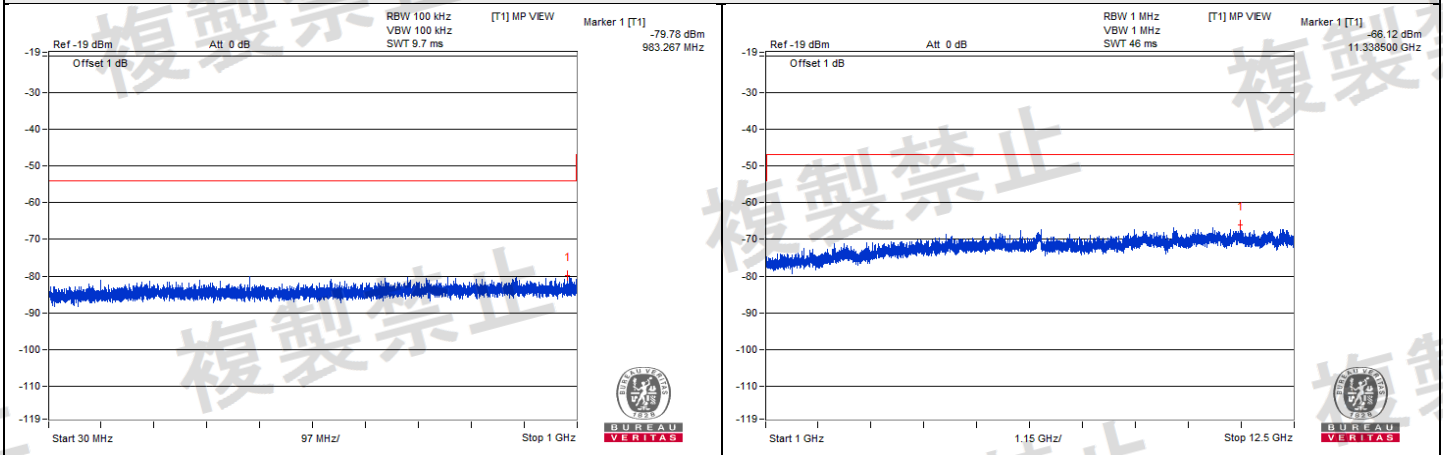


V_{min.}

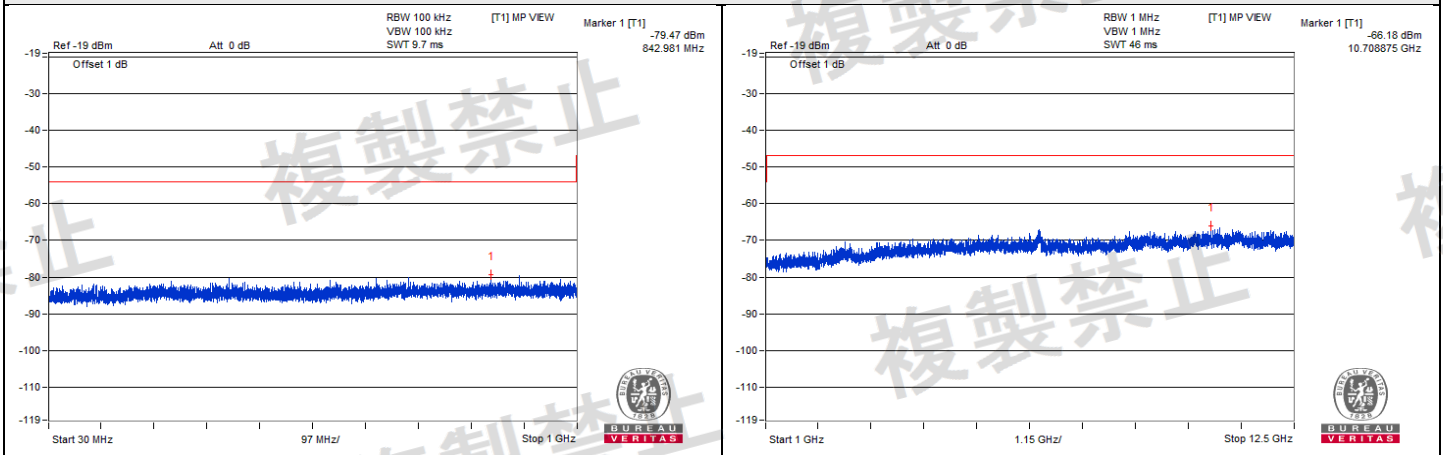


CH 38 (2440 MHz)

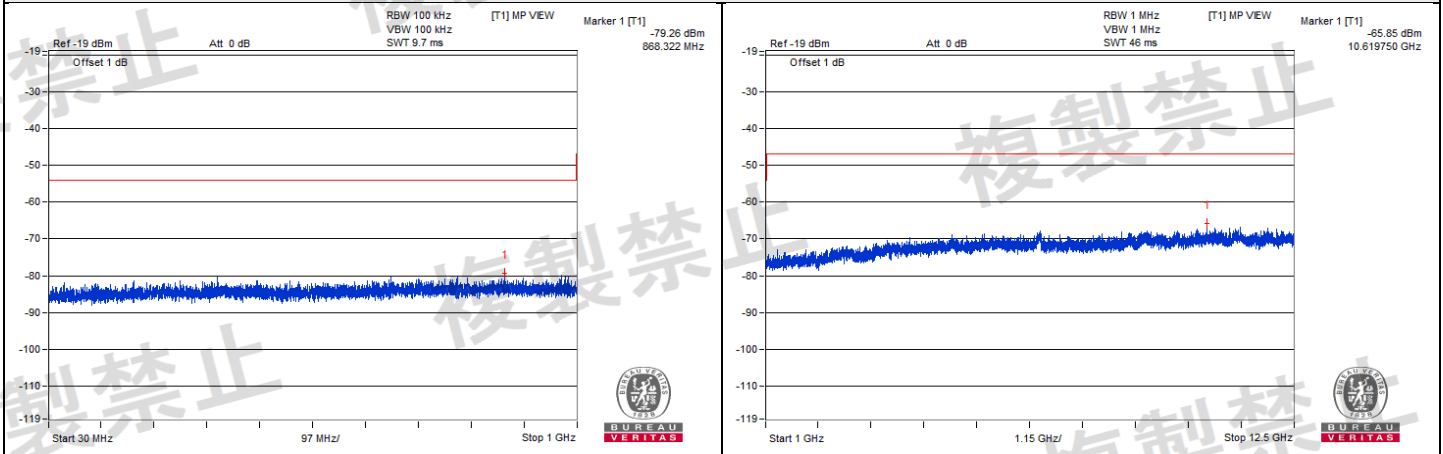
V_{normal}



V_{max}



V_{min}



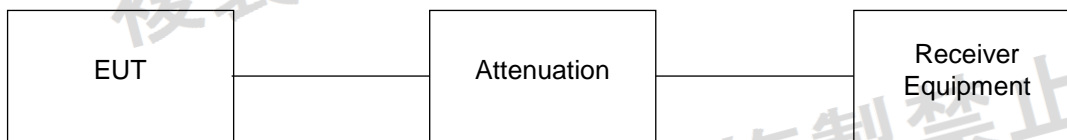
CH 78 (2480 MHz)

4.6 Interference Prevention Function

4.6.1 Limits of Interference Prevention Function

Radio equipment used mainly on the same premises and automatically transmits or receives identification code.

4.6.2 Test Setup



4.6.3 Test Results

Link Mode	Test Result
Normal	Pass

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 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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Web Site: <http://ee.bureauveritas.com.tw>

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

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