



Radio Test Report

Report No.: RJ190708D10

Test Model: HSA-P009K

Received Date: Jul. 8, 2019

Test Date: Jul. 22, 2019

Issued Date: Jul. 24, 2019

Applicant: PRIMAX ELECTRONICS LTD.

Address: No. 669, Ruey Kuang Road, Neihu, Taipei, Taiwan, R.O.C.

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

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Release Control Record

Issue No.	Description	Date Issued
RJ190708D10	Original release.	Jul. 24, 2019



1 Certificate of Conformity

Product: HP Ecosystem Wireless Keyboard

Brand: hp

Test Model: HSA-P009K

Sample Status: Engineering sample

Applicant: PRIMAX ELECTRONICS LTD.

Test Date: Jul. 22, 2019

Standards: ARIB STD-T66 (V3.7),
MIC No.88(2004) Test method of specified radio equipments
Annex no. 43 Article 2 paragraph 1 item (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 :

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Date: Jul. 24, 2019

Approved by :

Rex Lai
Rex Lai / Associate Technical Manager

Date: Jul. 24, 2019



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)	4.3	Spurious emissions	C
Transmitting Equipment				
F	--	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	C
--	3.2 (2)	4.4	Antenna power	C
--	3.6 (2)	4.4	Absolute gain of transmitting antenna	C
--	3.6 (2)	--	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: C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable				



2.1 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until	Calibration Authority
ROHDE & SCHWARZ Spectrum Analyzer	FSV40	101042	Sep. 27, 2018	Sep. 26, 2019	ETC
ROHDE & SCHWARZ Signal Generator	SMR 40	100231	Jul. 1, 2019	Jun. 30, 2020	ETC
Anritsu Power Sensor	MA2411B	0738404	Apr. 16, 2019	Apr. 15, 2020	ETC
Anritsu Power Meter	ML2495A	0842014	Apr. 16, 2019	Apr. 15, 2020	ETC
KEYSIGHT MIMO Powermeasurement Test set	U2021XA	U2021XA-001	Jun. 11, 2019	Jun. 10, 2020	ETC
KEYSIGHT Spectrum Analyzer	N9030A	MY54490260	Aug. 3, 2018	Aug. 2, 2019	ETC
KEYSIGHT MXG Vector Signal Generator	N5182B	MY53052658	May 20, 2019	May 19, 2020	ETC

NOTE: The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.

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	206.50 Hz
Spurious emissions	3.93 dB
Output power density	1.11 dB
Out of band radiated power	3.93 dB
Frequency Tolerance	603.76 Hz

2.3 Modification Record

There were no modifications required for compliance.



3 General Information

3.1 General Description of EUT

Product	HP Ecosystem Wireless Keyboard
Brand	hp
Test Model	HSA-P009K
Status of EUT	Engineering sample
Nominal Voltage	3.0Vdc from batteries
Modulation Type	GFSK
Operating Frequency	2402MHz ~ 2479MHz
Number of Channel	78
Rated RF Output Power	3mW
Conducted RF Output Power	2.296mW
Radiated RF Output Power	4.487mW
Antenna Type	Printed antenna with 2.91 dBi gain
Antenna Connector	N/A
Accessory Device	N/A
Data Cable Supplied	N/A

Note: The above EUT information is declared by manufacturer and for more detailed features description, please refers to the manufacturer's specifications or user's manual.



3.2 Description of Test Modes

78 channels are provided to this EUT:

CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (MHz)	CHANNEL	FREQ. (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		
19	2421	39	2441	59	2461		

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

Channel	Power setting
0	0
39	0
77	0



3.3 Test Conditions

Test Conditions		Voltage (Vdc)
V_{normal}	-	3.0
$V_{max.}$	+10%	3.3 (Note)
$V_{min.}$	-10%	2.7 (Note)

Note: After checking the fluctuation of input voltage to the circuit of the radio part (excluding the power supply) of the equipment to be tested, the fluctuation less than $\pm 1\%$ when input voltage from an external supply into the equipment fluctuates $\pm 10\%$, therefore, the test is carried out only at the normal voltage.

3.4 Assembly

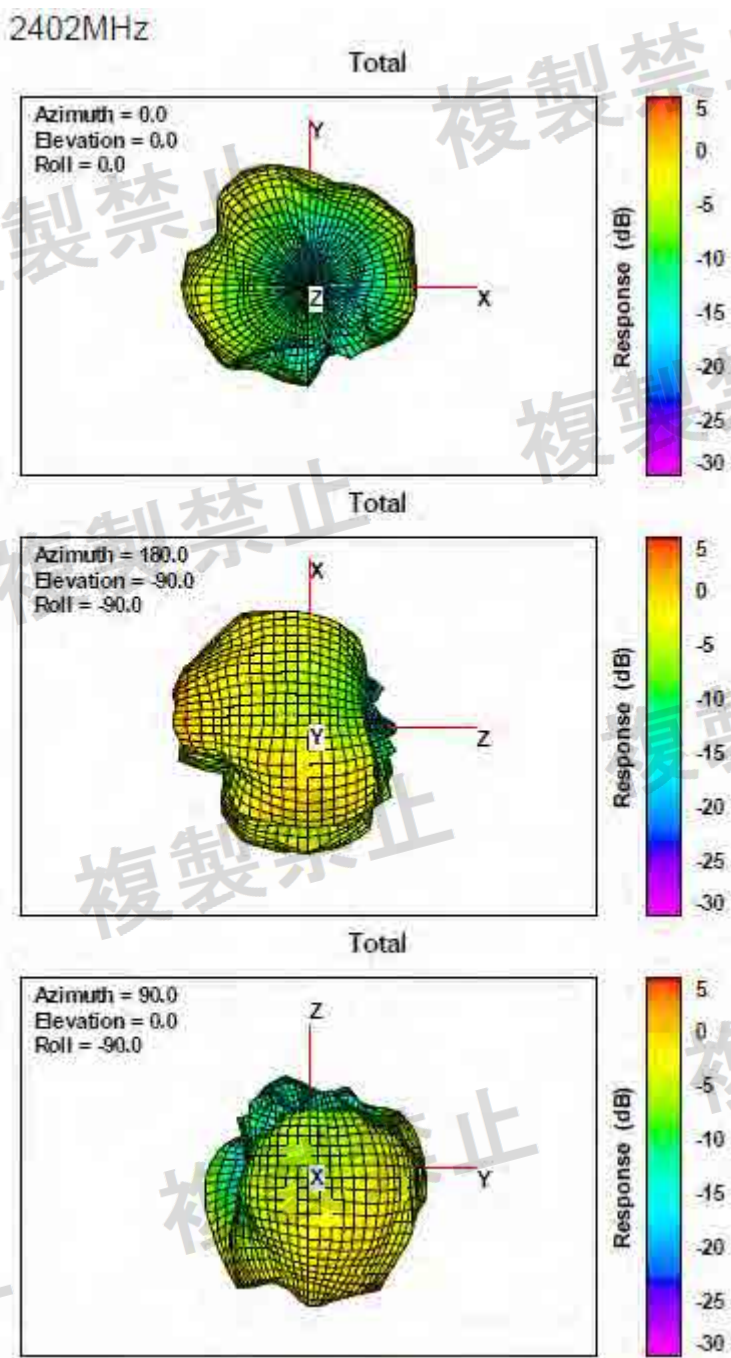
The housing consists of two plastic parts, affirmed together by means of deforming. Separating the two parts (i.e. operating of the housing) was only possible by means of brute force.

3.5 Antenna Specifications

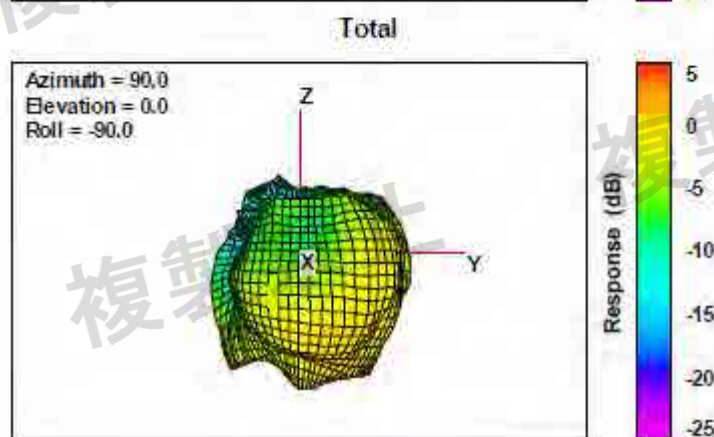
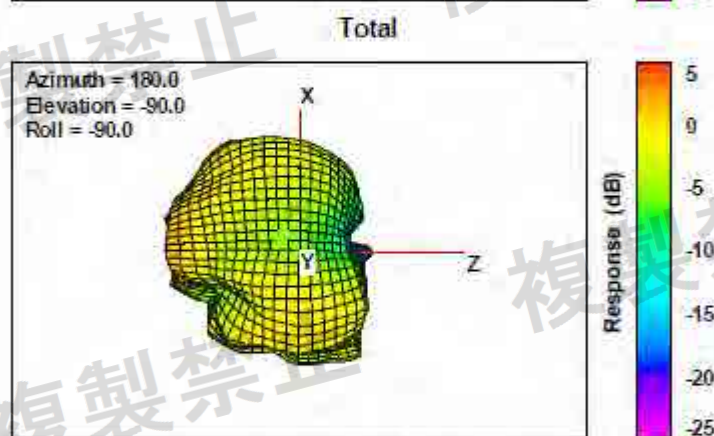
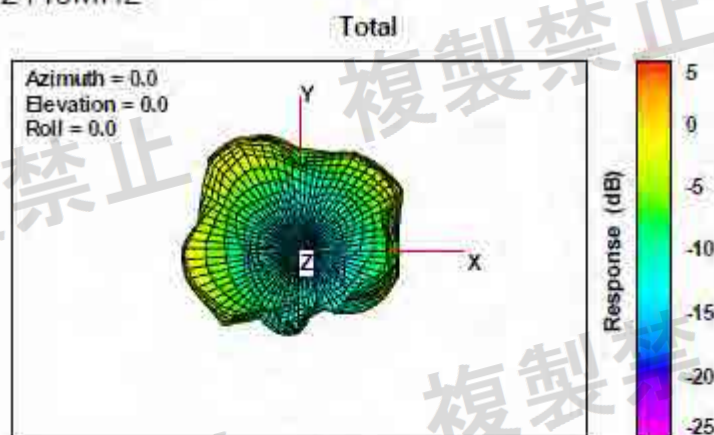
3.5.1 Antenna Gain

Antenna Type	Max. Gain (dBi)
Printed antenna	2.91

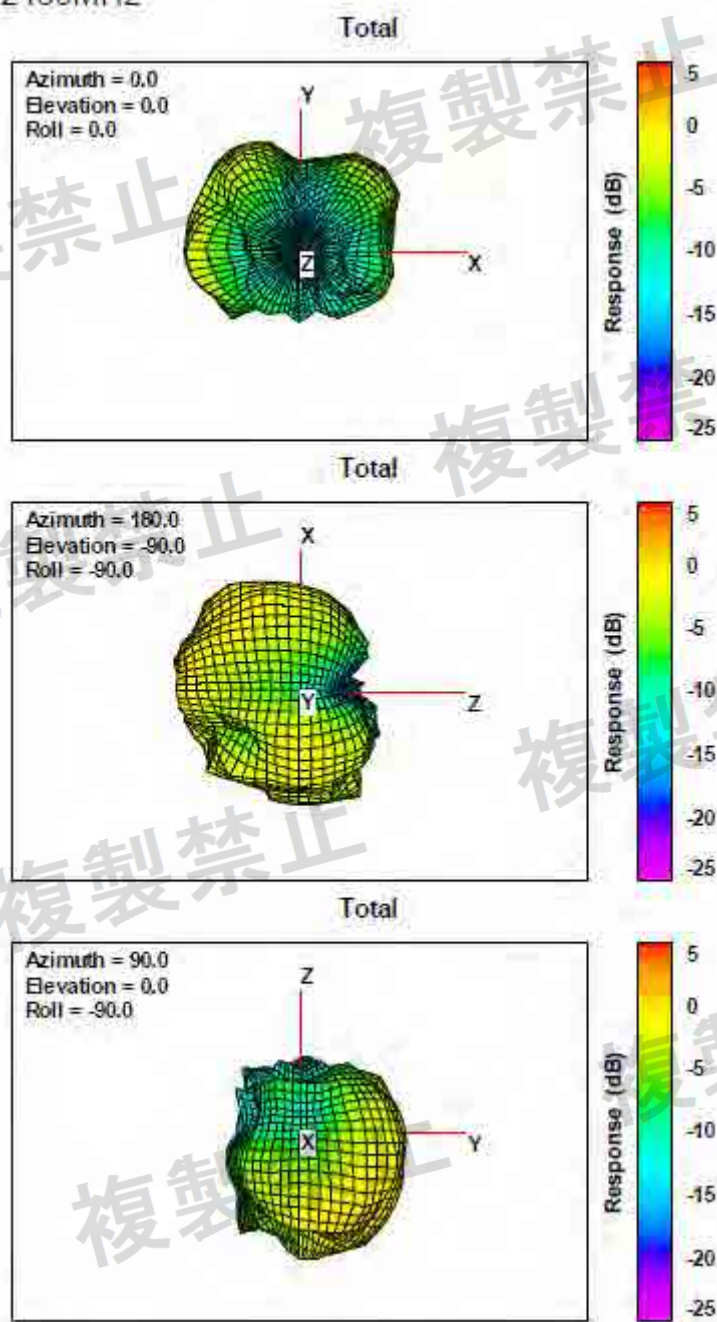
3.5.2 Antenna Pattern



2440MHz



2480MHz





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

Environmental Conditions		25 deg.C, 76% RH					
Channel	Frequency (MHz)	Voltage _{normal}		Voltage _{max.}		Voltage _{min.}	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
0	2402	2402.011250	4.683	2402.011300	4.704	2402.011200	4.662
39	2441	2441.011450	4.690	2441.011450	4.690	2441.011400	4.670
77	2479	2479.011500	4.638	2479.011600	4.679	2479.011500	4.638

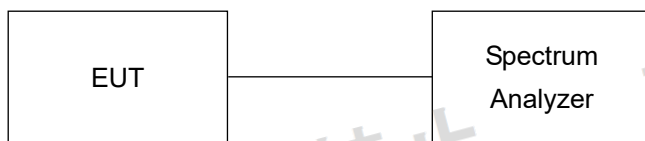


4.2 Occupied Bandwidth Measurement (99% power bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	<26MHz

4.2.2 Test Setup

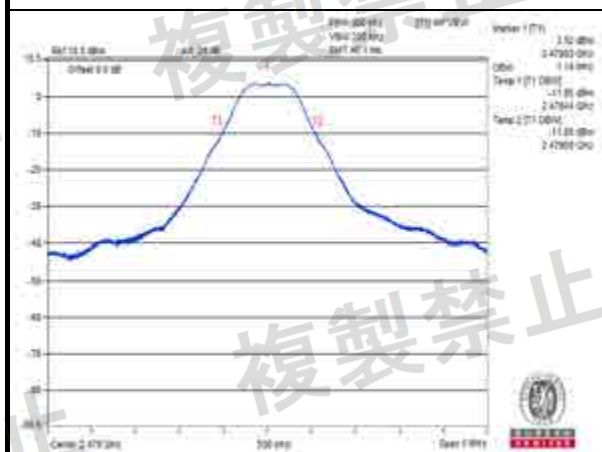
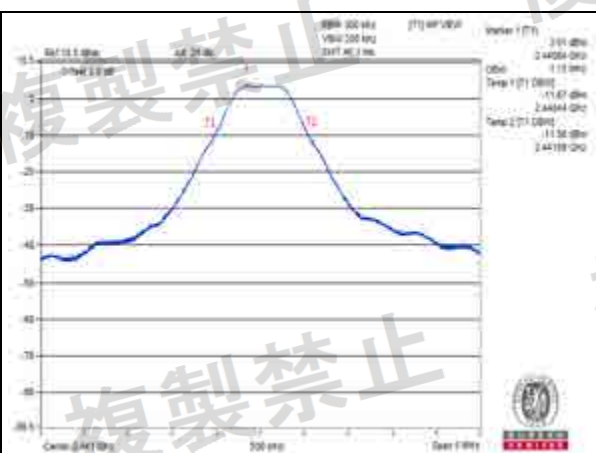
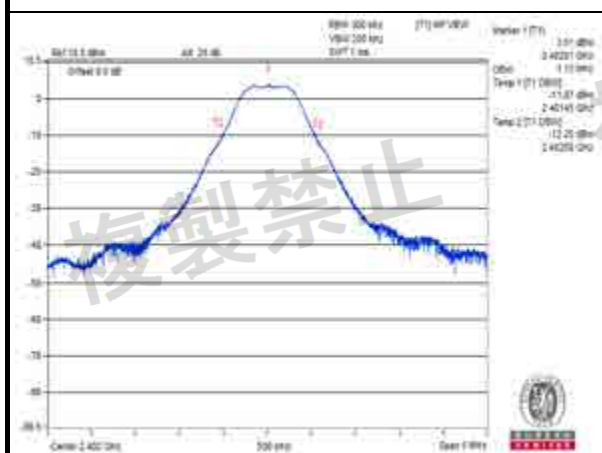


4.2.3 Test Results

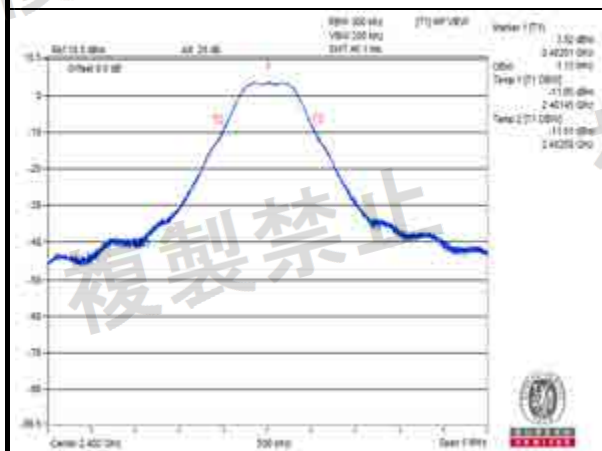
Environmental Conditions		25 deg.C, 76% RH		
Channel	Frequency (MHz)	V _{normal}	V _{max.}	V _{min.}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
0	2402	1.13	1.13	1.15
39	2441	1.15	1.15	1.15
77	2479	1.14	1.13	1.15

Note: For the test plots please refer to the below pages

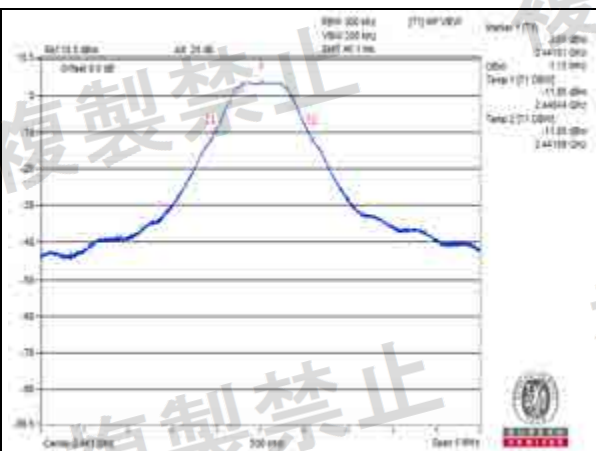
V normal



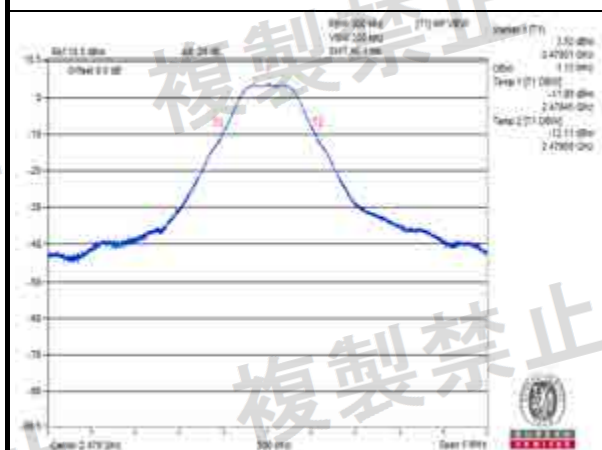
V_{max}.



Channel 0

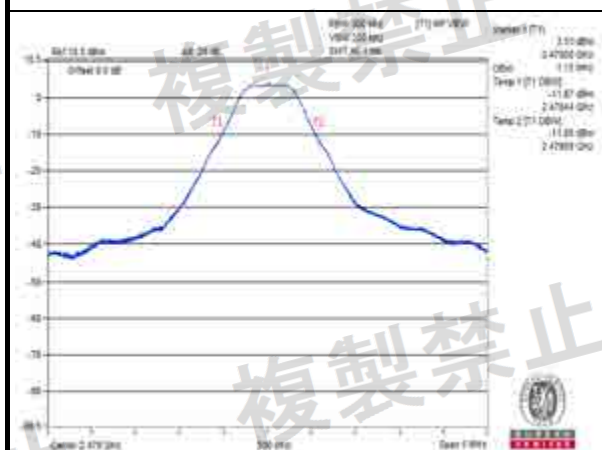
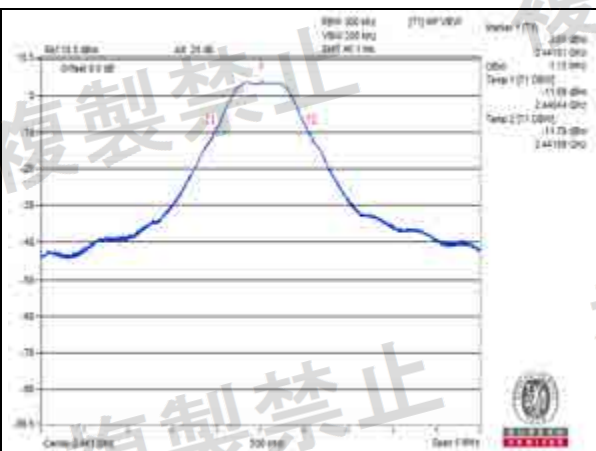
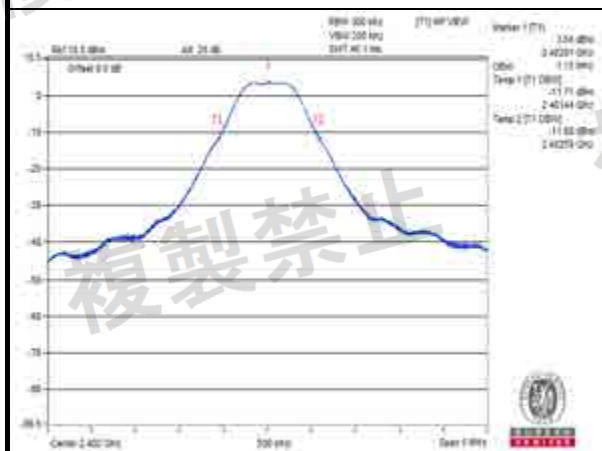


Channel 39



Channel 77

V_{min}.



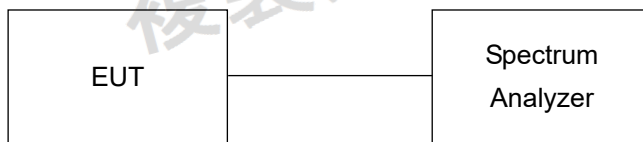


4.3 Spurious Emissions for Transmitter Measurement

4.3.1 Limits of Spurious Emissions

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

4.3.2 Test Setup





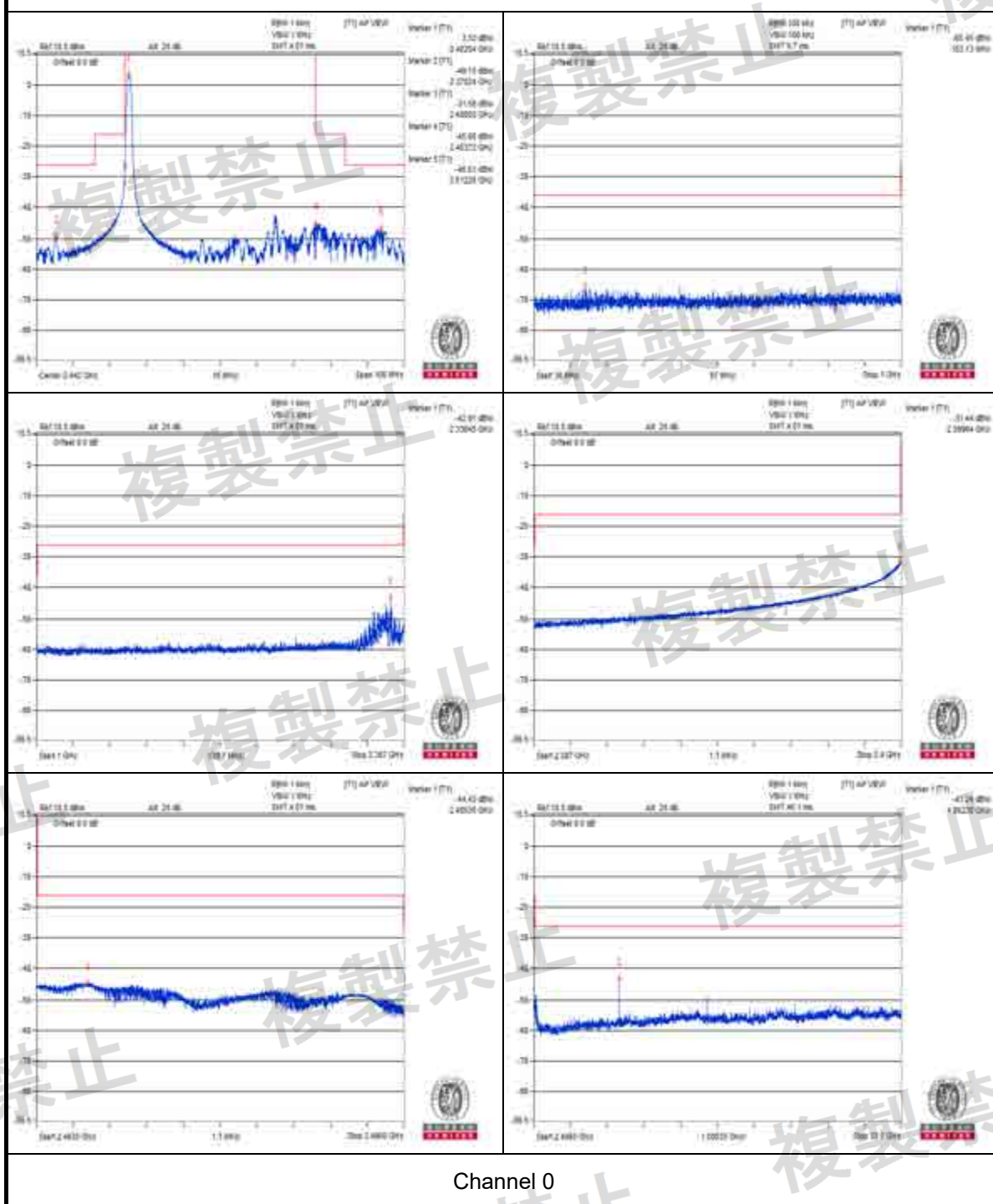
4.3.3 Test Results

Environmental Conditions		25 deg.C, 76% RH							
Test Channel		CH 0 (2402MHz)		CH 39 (2441MHz)		CH 77 (2479MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0MHz to 1000.0MHz	163.130	0.000285uW	172.830	0.000513uW	172.590	0.000355uW	0.25uW	Pass
	1000.0MHz to 2387MHz	2338.450	0.051168uW	2376.940	0.077446uW	2351.280	0.04529uW	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.940	0.717794uW	2395.510	0.015959uW	2395.400	0.046666uW	25uW	Pass
	2483.5MHz to 2496.5MHz	2485.300	0.036058uW	2487.860	0.015668uW	2483.500	0.066222uW	25uW	Pass
	2496.5MHz to 12500.0MHz	4802.300	0.047424uW	2566.520	0.029854uW	2541.510	0.049888uW	2.5uW	Pass
V _{max.}	30.0MHz to 1000.0MHz	191.990	0.000413uW	143.970	0.000292uW	143.970	0.000393uW	0.25uW	Pass
	1000.0MHz to 2387MHz	2338.450	0.061235uW	2377.290	0.074473uW	2351.280	0.047098uW	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2400.000	0.703072uW	2394.680	0.017219uW	2395.890	0.044875uW	25uW	Pass
	2483.5MHz to 2496.5MHz	2485.180	0.038194uW	2487.670	0.015276uW	2483.510	0.063826uW	25uW	Pass
	2496.5MHz to 12500.0MHz	4804.800	0.038994uW	4882.330	0.024889uW	2554.020	0.018072uW	2.5uW	Pass
V _{min.}	30.0MHz to 1000.0MHz	147.120	0.000334uW	172.830	0.000385uW	163.130	0.000405uW	0.25uW	Pass
	1000.0MHz to 2387MHz	2338.450	0.070307uW	2377.630	0.073451uW	2350.930	0.052119uW	2.5uW	Pass
	2387.0MHz to 2400.0MHz	2399.990	0.770903uW	2394.660	0.017947uW	2395.430	0.044668uW	25uW	Pass
	2483.5MHz to 2496.5MHz	2485.060	0.038548uW	2487.260	0.014655uW	2483.550	0.078705uW	25uW	Pass
	2496.5MHz to 12500.0MHz	4802.300	0.05236uW	2521.500	0.019275uW	2554.020	0.017498uW	2.5uW	Pass

- Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.



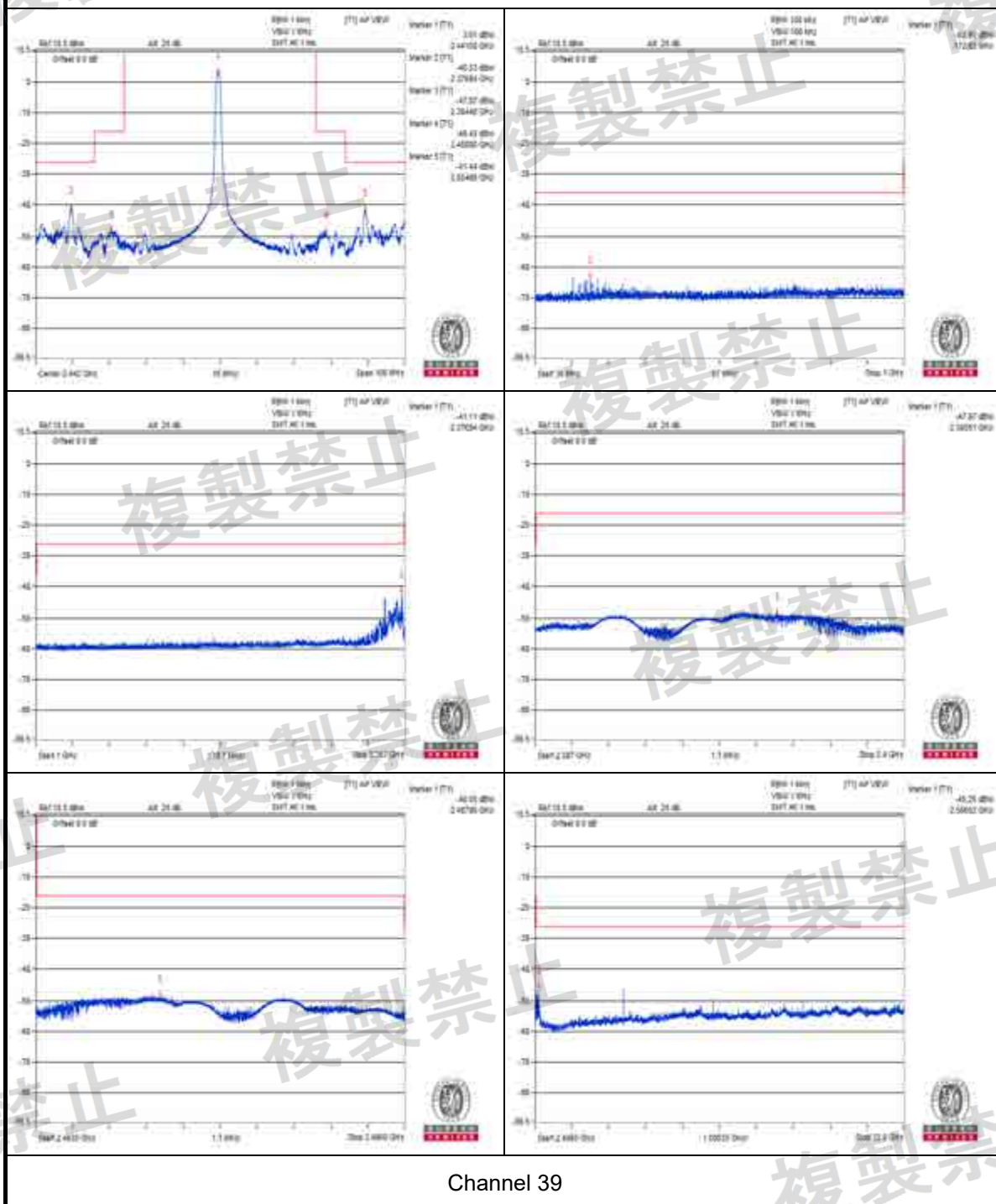
Vnormal



Channel 0

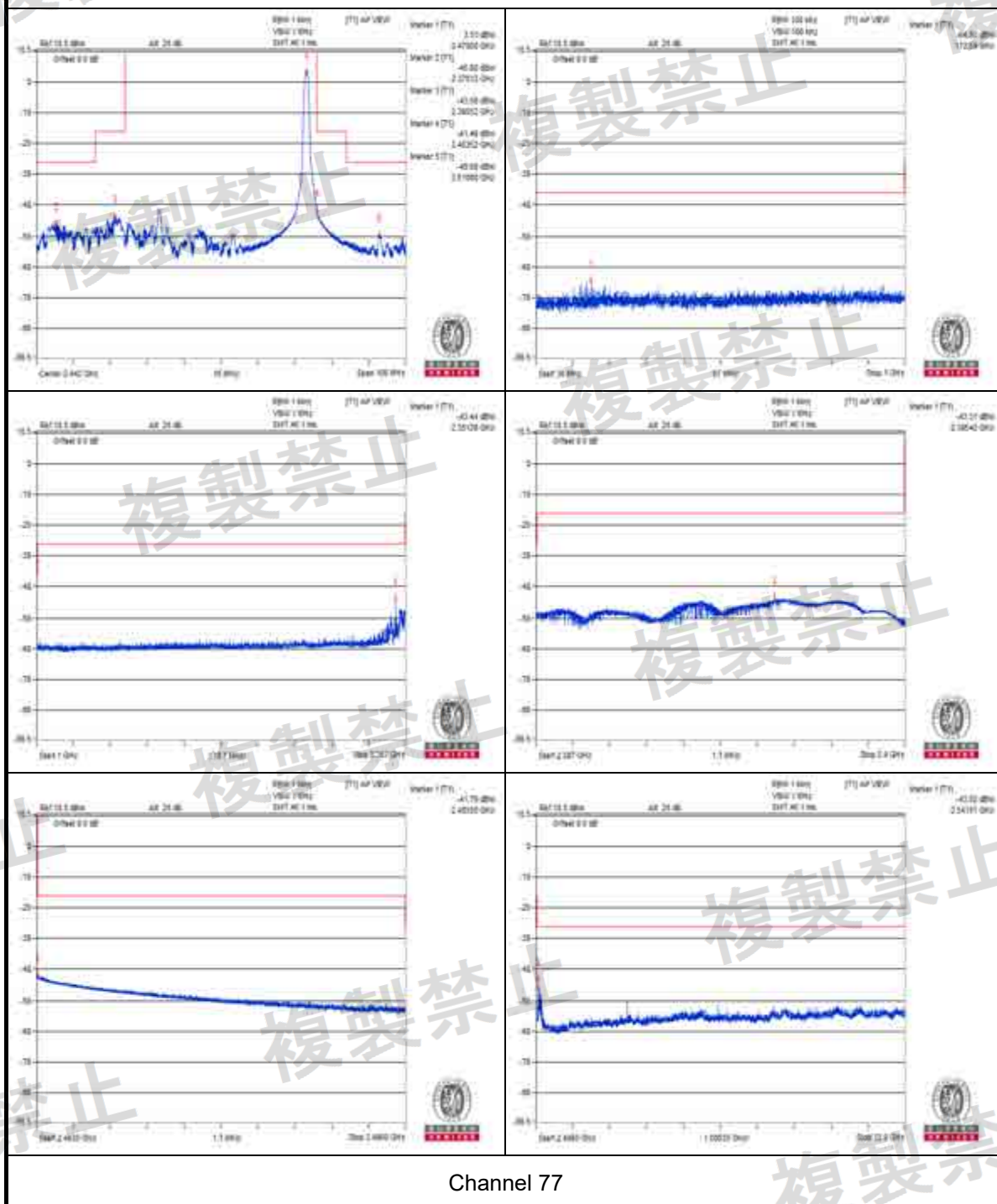


Vnormal

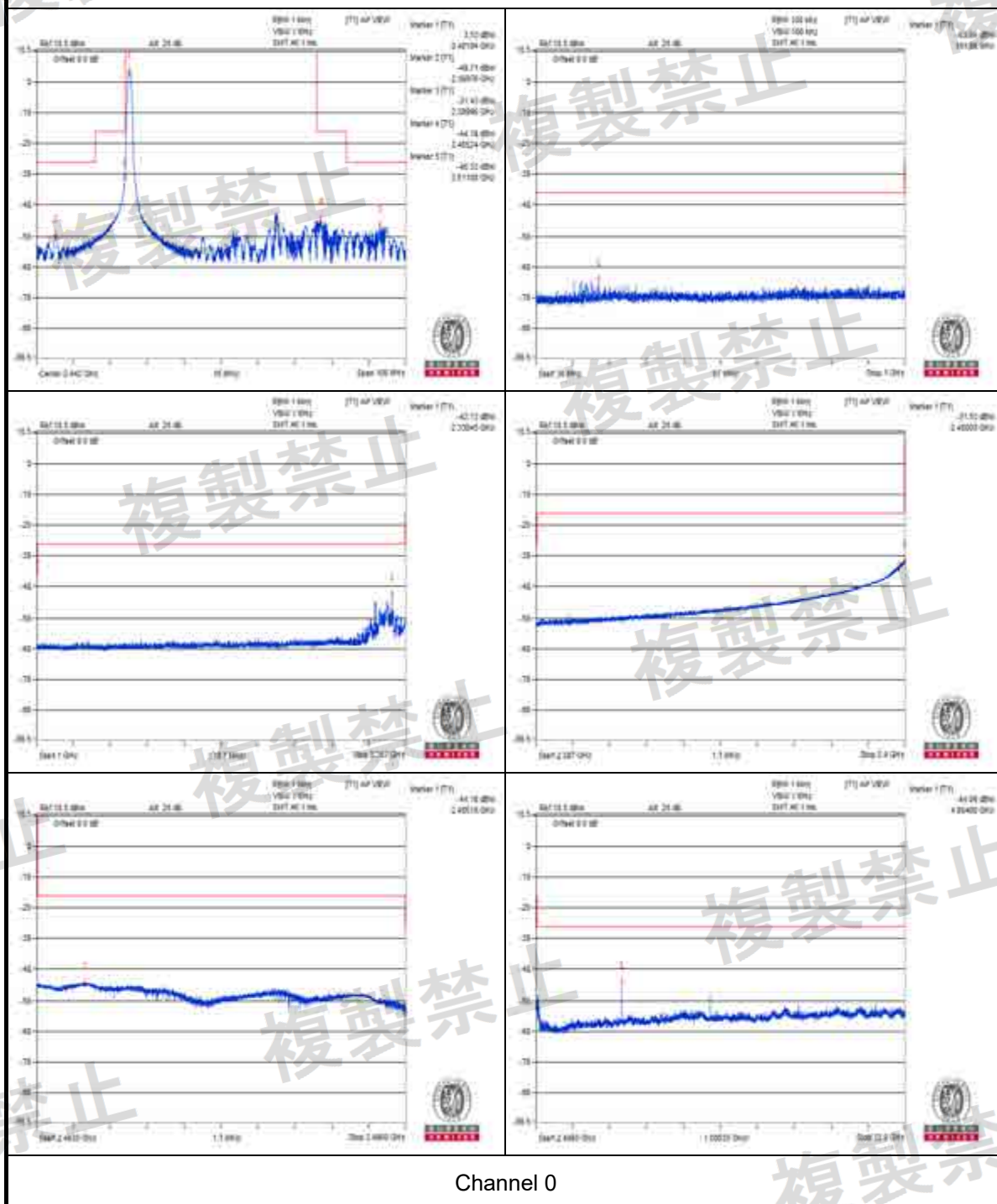




Vnormal

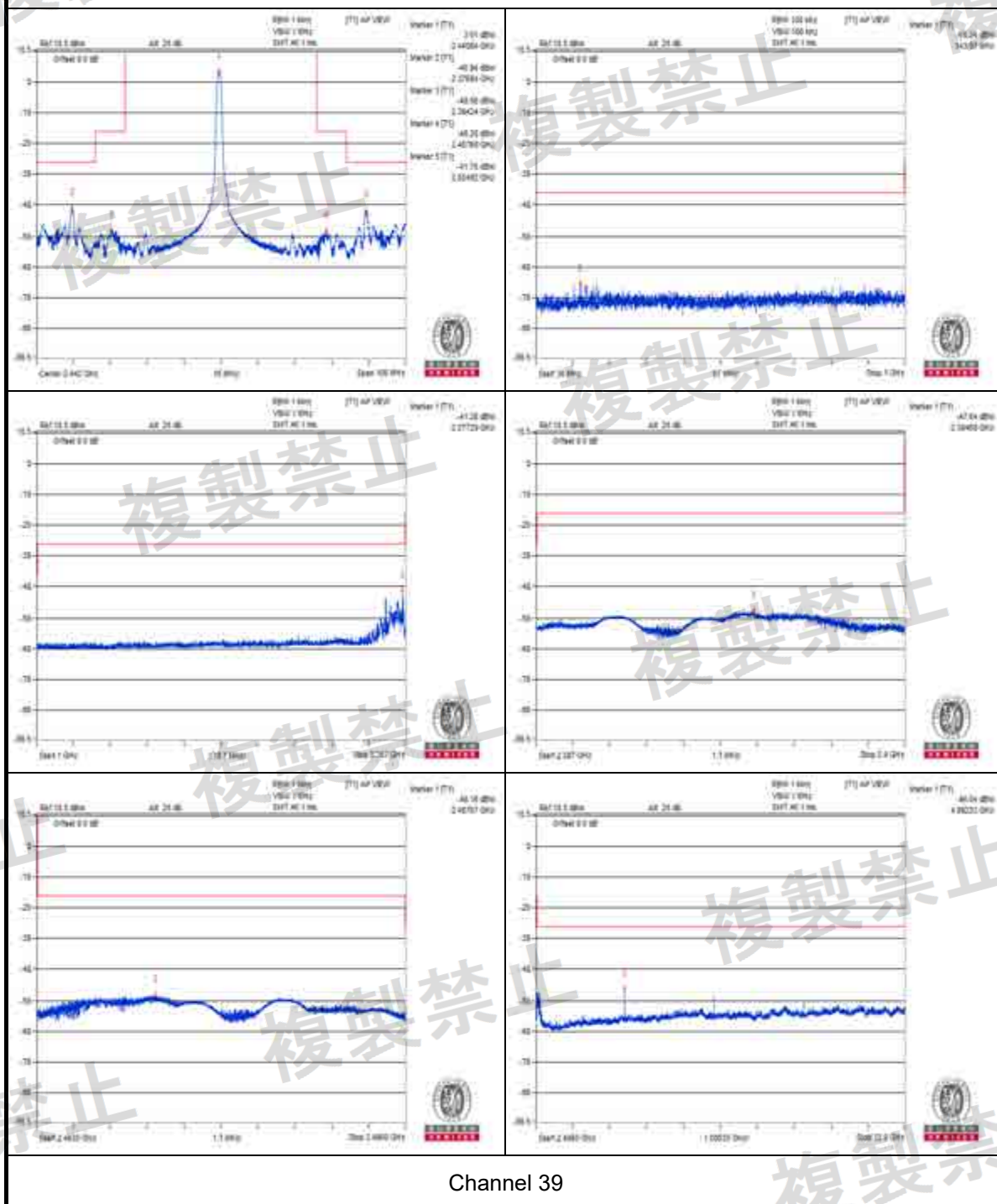


V_{max}.



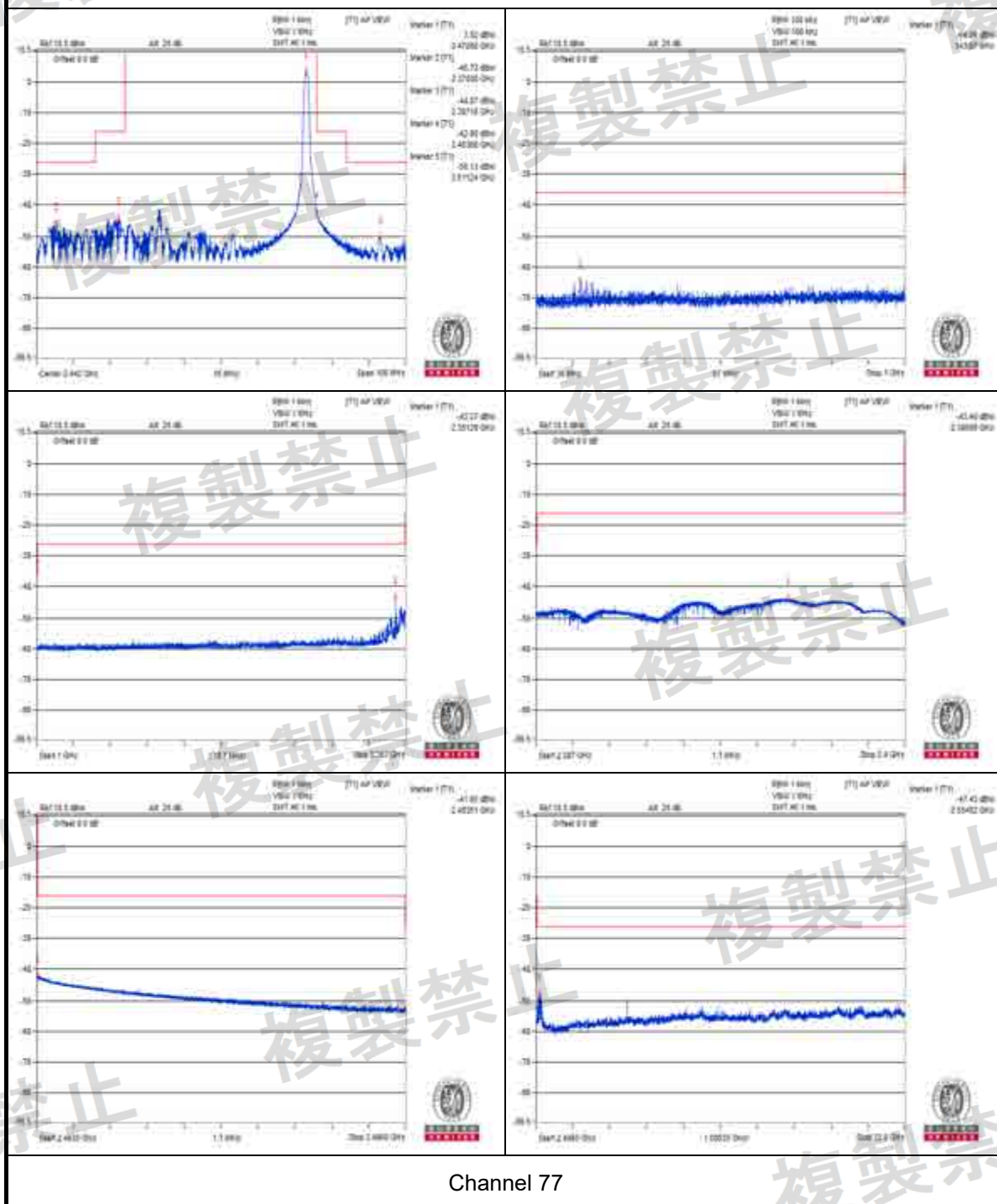


V_{max}.

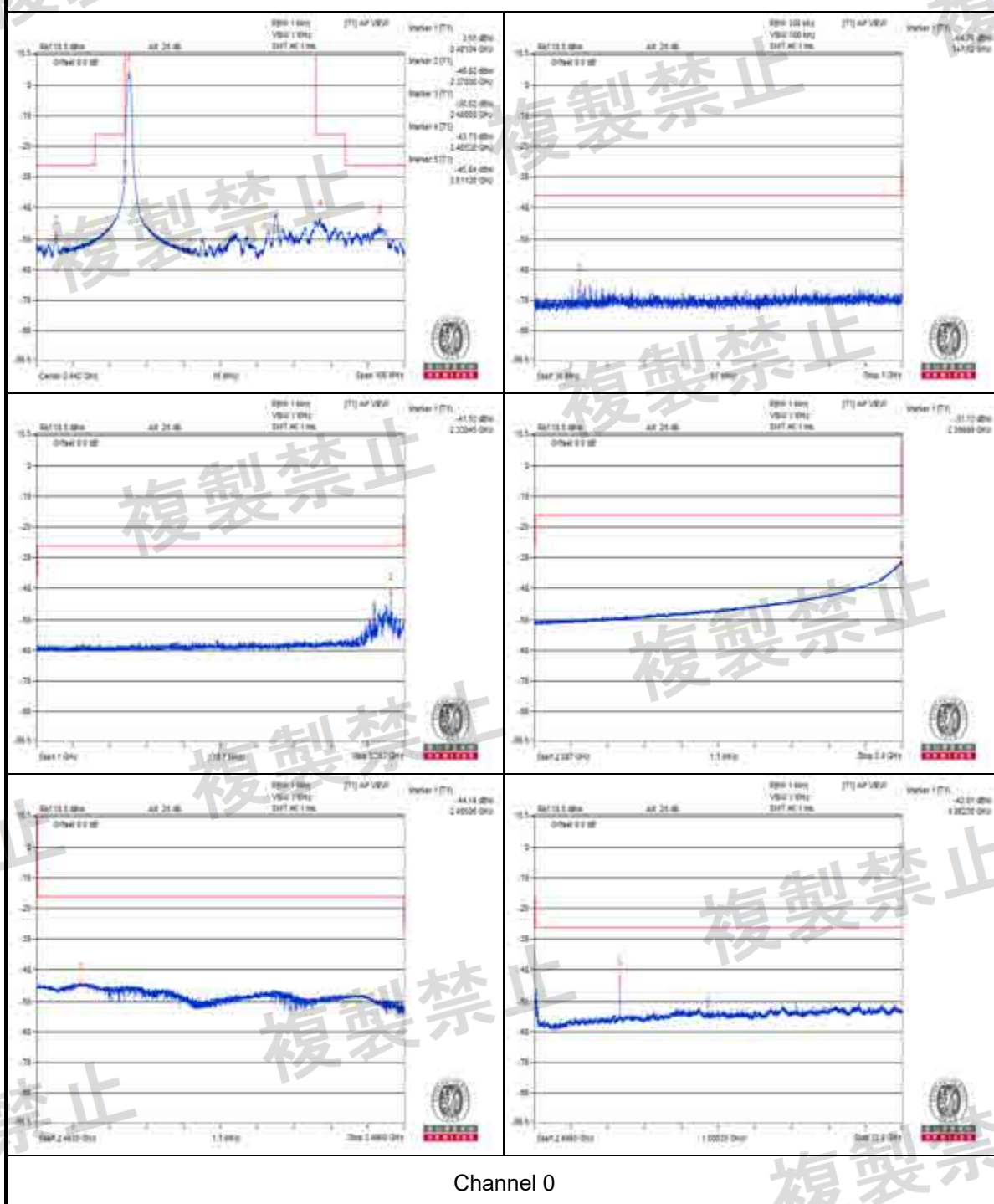




V_{max}.

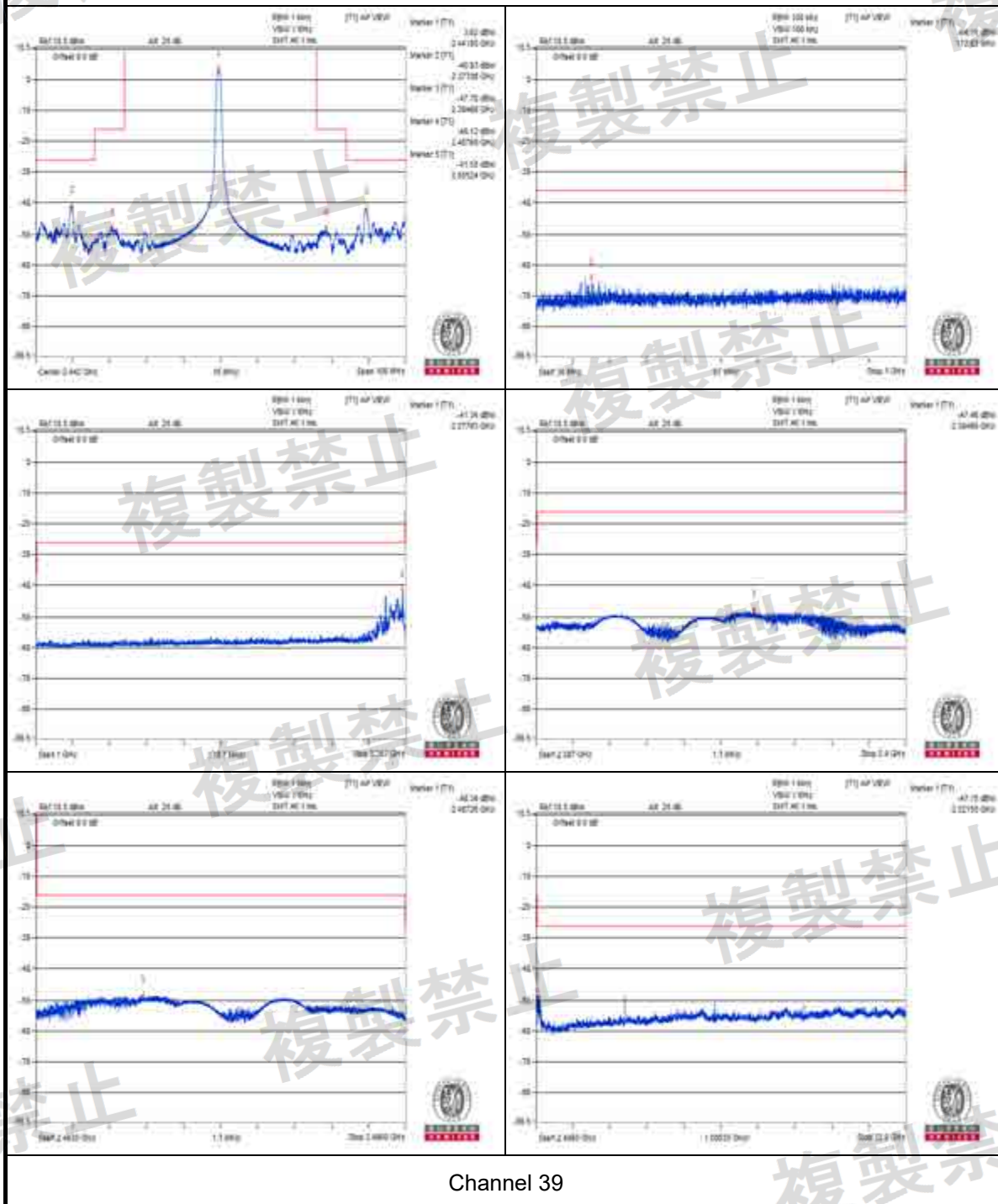


V_{min}.

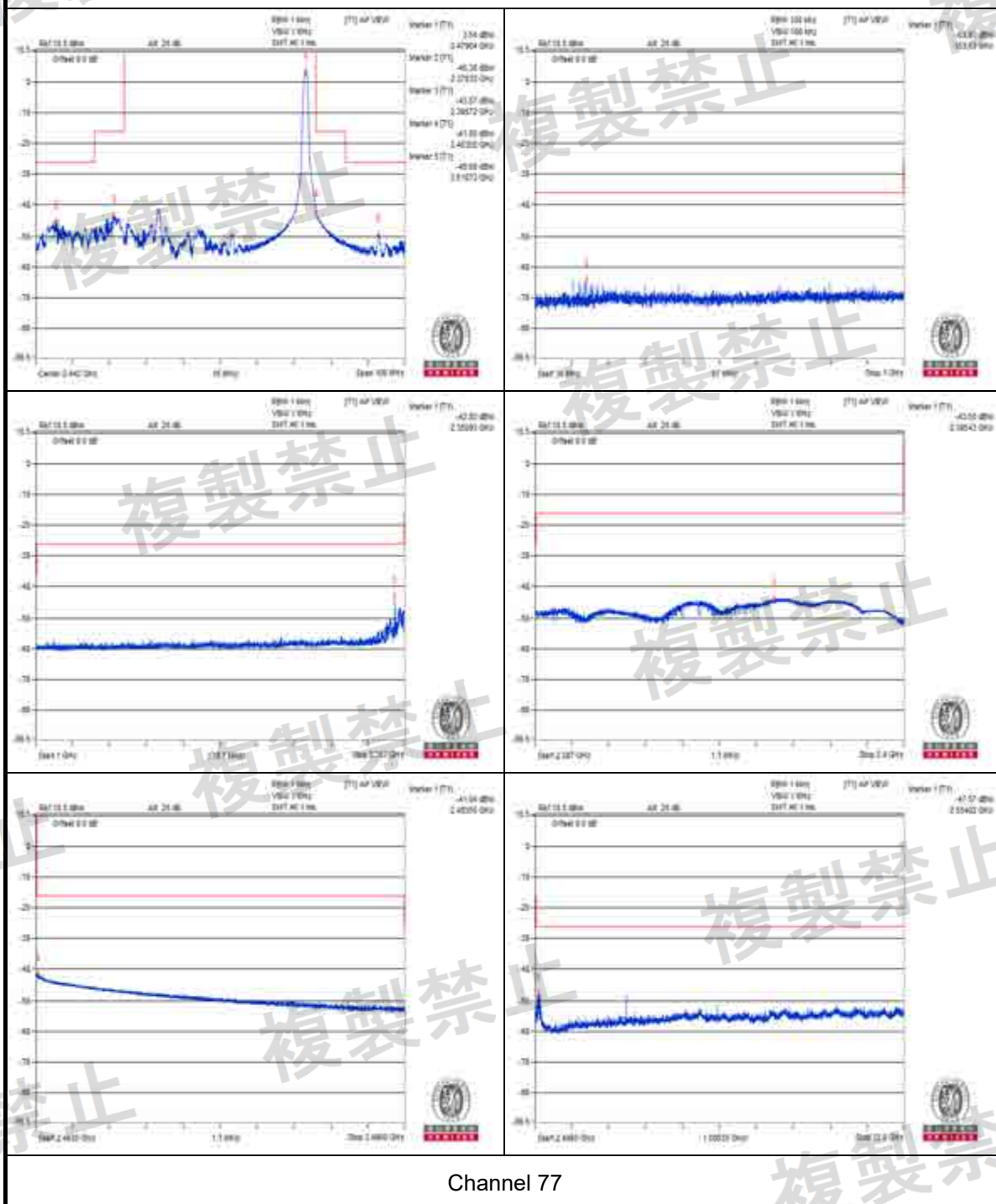




V_{min}.



V_{min}.





4.4 Antenna Power Measurement

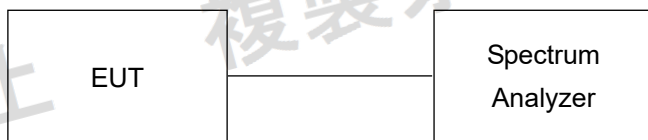
4.4.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni-Directional Case	Directional Case
DS	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10 mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5 mW/MHz	9.14 dBm/MHz (8.20 mW/MHz)	19.14 dBm/MHz (82.03 mW/MHz)
Other than the above	2400 – 2483.5 MHz	10 mW	12.14 dBm	22.14 dBm

Note:

1. Occupied bandwidth is less than 26MHz
2. Occupied bandwidth is more than 26MHz and less than 38MHz
3. The half-power beam width for directional antenna shall be $360/A$ degrees or less, where A is a ratio which causes the EIRP concerned to exceed the omnidirectional EIRP upper 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

Environmental Conditions		25 deg.C, 76% RH			
Channel Number	Frequency (MHz)	Conducted RF Output Power (mW)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		3.0Vdc	3.3Vdc	2.7Vdc	
0	2402	2.223	2.193	2.163	10
39	2441	2.218	2.128	2.296	10
77	2479	2.173	2.168	2.193	10
Rated power		3			
Tolerance of antenna power		0.6 ~ 3.6			
Measurement uncertainty		± 1.11dB			

Printed antenna with antenna gain: 2.91dBi

Environmental Conditions		25 deg.C, 76% RH			
Channel Number	Frequency (MHz)	Radiated RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		3.0Vdc	3.3Vdc	2.7Vdc	
0	2402	4.344	4.286	4.227	16.368
39	2441	4.335	4.159	4.487	16.368
77	2479	4.247	4.237	4.286	16.368
Measurement uncertainty		± 1.11dB			

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

2. 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





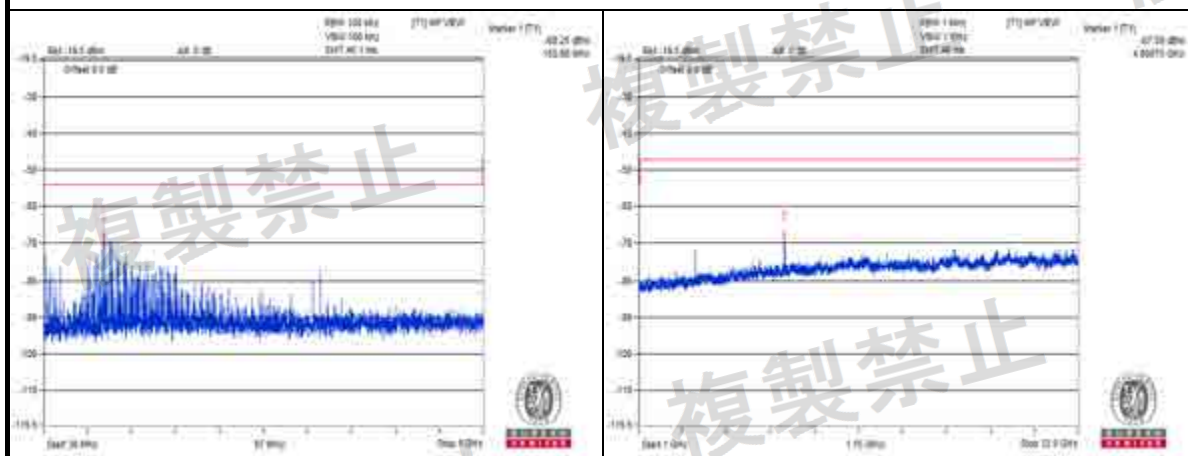
4.5.3 Test Result

Environmental Conditions		25 deg.C, 76% RH							
Test Channel		CH 0 (2402MHz)		CH 39 (2441MHz)		CH 77 (2479MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V_{normal}	Below 1GHz	159.980	0.149624nW	159.980	0.149624nW	159.980	0.145881nW	4nW	Pass
	Above 1GHz	4800.750	0.174181nW	4878.370	0.174582nW	4956.000	0.11298nW	20nW	Pass
$V_{max.}$	Below 1GHz	159.980	0.152055nW	159.980	0.150314nW	159.980	0.147231nW	4nW	Pass
	Above 1GHz	4800.750	0.142889nW	4878.370	0.179887nW	5295.250	0.114815nW	20nW	Pass
$V_{min.}$	Below 1GHz	159.980	0.148252nW	159.980	0.151356nW	159.980	0.149624nW	4nW	Pass
	Above 1GHz	4800.750	0.16788nW	4878.370	0.194536nW	4956.000	0.122744nW	20nW	Pass

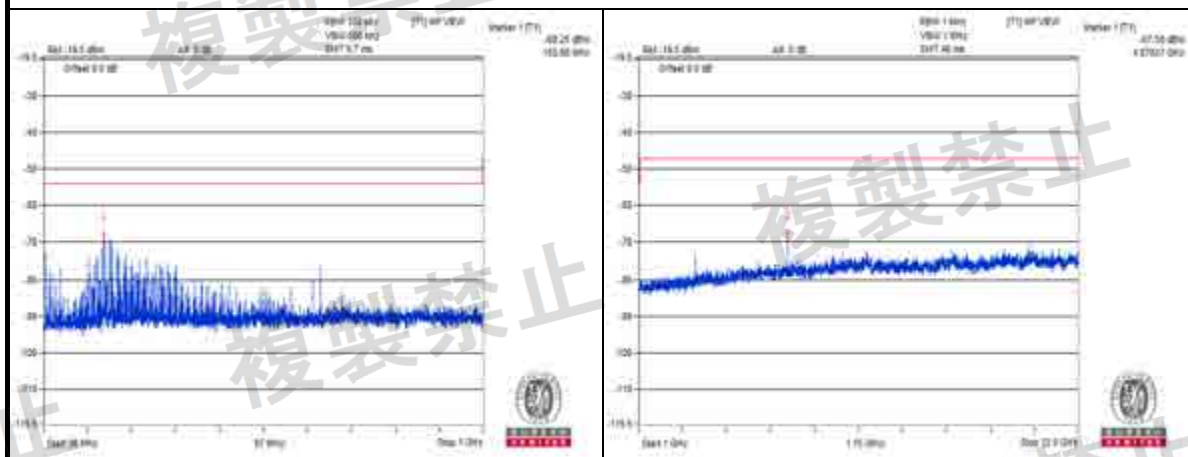
- Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.



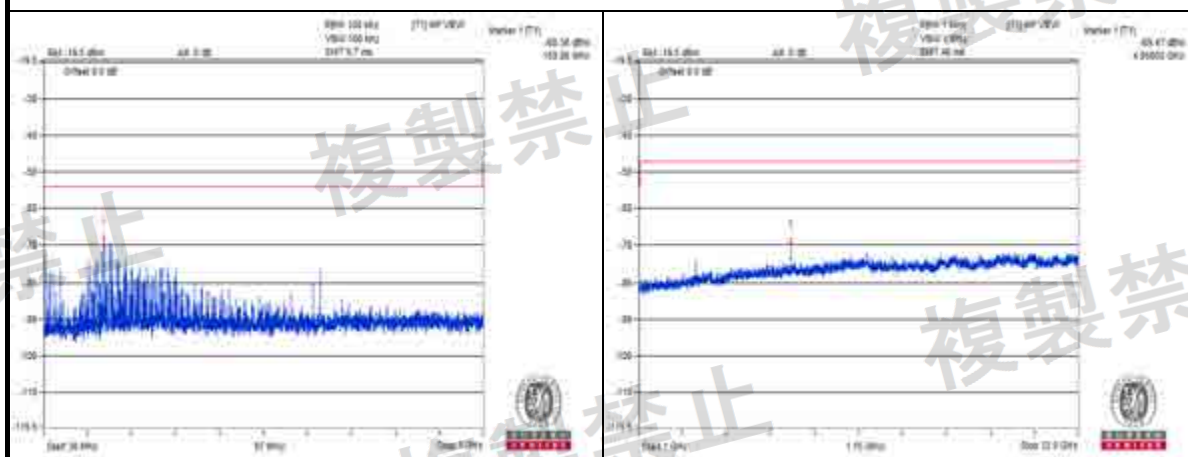
V_{normal}



Channel 0

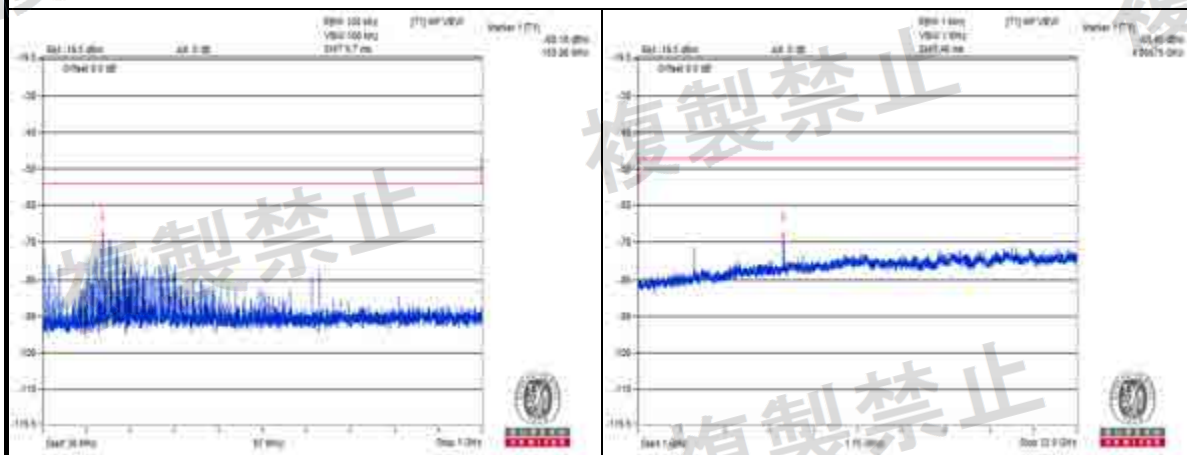


Channel 39

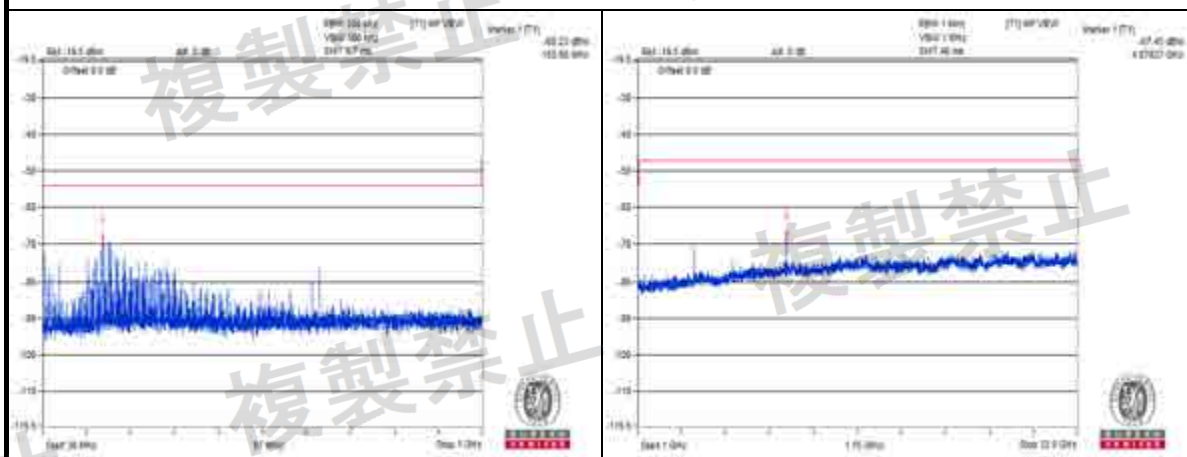


Channel 77

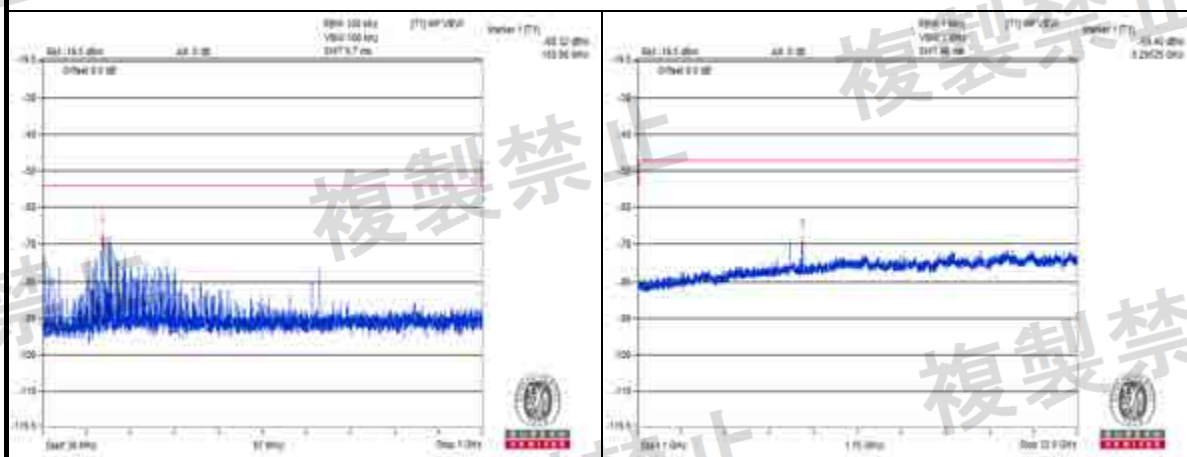
V_{max}.



Channel 0

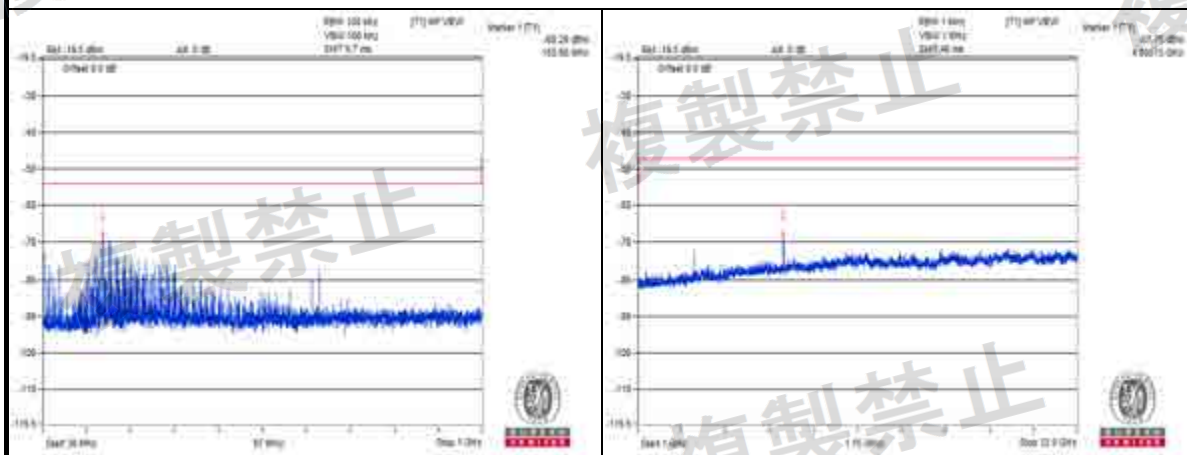


Channel 39

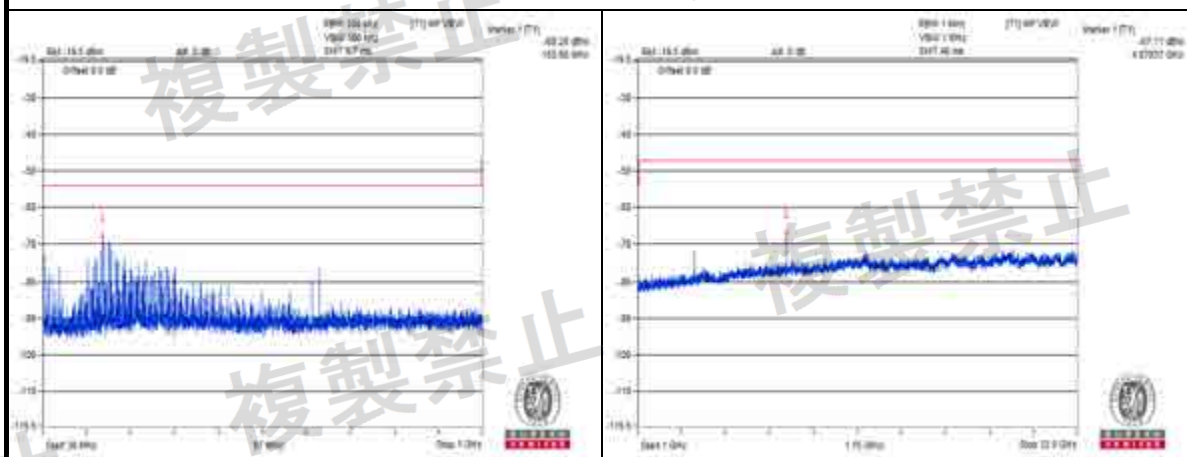


Channel 77

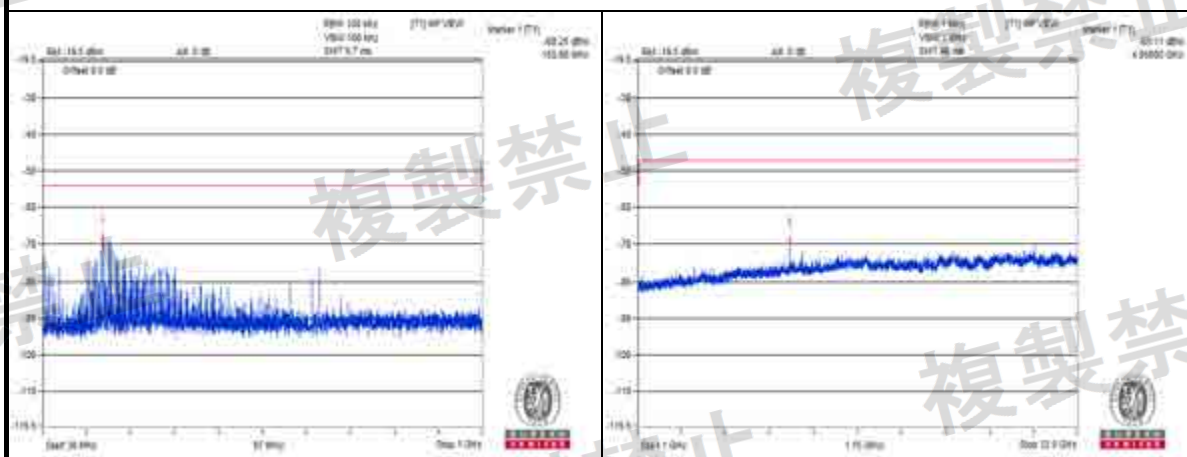
V_{min}.



Channel 0



Channel 39



Channel 77

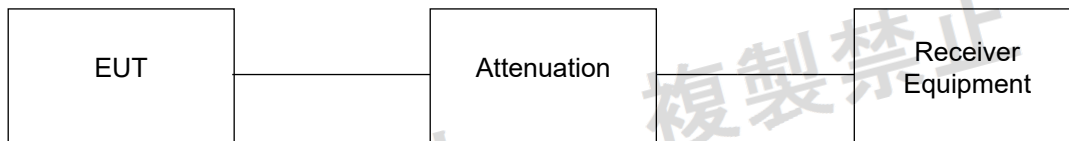


4.6 Interference Prevention Function

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

Environmental Conditions	25 deg.C, 76% RH
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: 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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