



Radio Test Report

Report No.: RJ170508C11

Test Model: CPWB-B216KKKZ

Series Model: FPWB-B925CBKZ (Refer to section 3.1 for more detail)

Received Date: May 08, 2017

Test Date: May 15, 2017 ~ May 16, 2017

Issued Date: May 19, 2017

Applicant: Hon Hai Precision Industry Co., Ltd.

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

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Release Control Record

Issue No.	Description	Date Issued
RJ170508C11	Original Release	May 19, 2017



1 Certificate of Conformity

Product: WLAN 802.11 b/g/n 1x1 AIOT Module

Brand: SHARP

Test Model: CPWB-B216KKKZ

Series Model: FPWB-B925CBKZ (Refer to section 3.1 for more detail)

Sample Status: Identical Prototype

Applicant: Hon Hai Precision Industry Co., Ltd.

Test Date: May 15, 2017 ~ May 16, 2017

Standards: ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43

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 EMC characteristics under the conditions specified in this report.

Prepared by :

Rona Chen

, Date:

May 19, 2017

Rona Chen / Specialist

Approved by :

David Huang

, Date:

May 19, 2017

David Huang / Project Engineer

2 Summary of Test Results

The EUT has been tested according to the following specifications:

WLAN 2.4 GHz

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	--	4.5	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)	4.6	Spurious Emissions of Receiver	C
--	--	3.5	Refer to All Articles for Transmitting Antenna	C
Operating Frequency 2400 to 2483.5 MHz				
--	3.7 (1)	3.2	High Frequency	C
--	3.7 (1)	3.4	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)	4.5	Antenna Power	C
--	3.6 (2)	4.5	Absolute Gain of Transmitting Antenna	C
--	3.6 (2)	4.5	Angular Width of Principal Radiation (AWPR)	C
--	3.2 (10)	--	Number of Carriers within 1 MHz Bandwidth in OFDM	C
--	3.2 (8)	4.3	Spreading Bandwidth	C
--	3.2 (9)	4.3	Spreading Factor	C
--	3.2 (11)	--	Frequency Retention Time (FH Employed)	NA
--	3.4.1(1)	4.7	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 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	491.896 Hz
Spurious Emissions	3.508 dB
Output Power Density	2.889 dB
Out of Band Radiated Power	3.93 dB
Frequency Tolerance	6805.18 Hz

2.2 Modification Record

There were no modifications required for compliance.

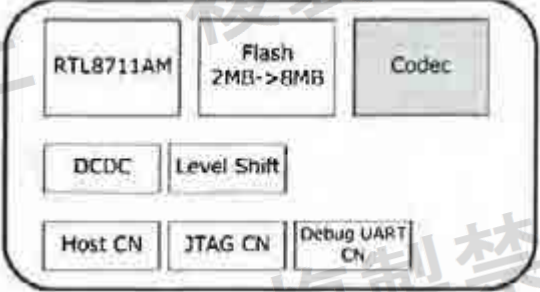
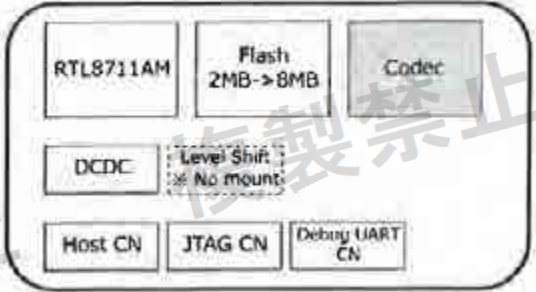
3 General Information

3.1 General Description of EUT

Product	WLAN 802.11 b/g/n 1x1 AIOT Module	
Brand	SHARP	
Test Model	CPWB-B216KKKZ	
Series Model	FPWB-B925CBKZ (Refer to Note)	
Status of EUT	Identical Prototype	
Nominal Voltage	5 Vdc (Power Supply)	
Modulation Type	CCK, DQPSK, DBPSK for DSSS 64QAM, 16QAM, QPSK, BPSK for OFDM	
Transfer Rate	802.11b: 11/5.5/2/1 Mbps 802.11g: 54/48/36/24/18/12/9/6 Mbps 802.11n: up to MCS7	
Operating Frequency	2412 ~ 2472 MHz	
Number of Channel	WLAN 2.4 GHz	802.11b/g/n (HT20): 13
Rated RF Output Power Density	Refer to Note	
Conducted RF Output Power Density	Refer to Note	
Radiated RF Output Power Density	Refer to Note	
Antenna Type	Refer to Note	

Note:

- The EUT contains two models, the differences are listed as below.

	
<p>Model: CPWB-B216KKKZ</p> <p>With Level Shift</p> <p>Operating Voltage: 5V</p>	<p>Model: FPWB-B925CBKZ</p> <p>Without Level Shift</p> <p>Operating Voltage: 3.3V</p>
<p>Difference:</p> <ul style="list-style-type: none"> * Level Shift mount or not. This part is for the level of operation interface for converting Module to Host or Host to Module. * The difference of the operating voltage depends on the demand of power supply of Host. 	

- Due to the differences of two models have no effect on any test item, only the model: CPWB-B216KKKZ is chosen for the final test.



3. The EUT provides 1 completed transmitter and 1 receiver.

Modulation Mode	Tx Function
802.11b	1TX (SISO mode)
802.11g	1TX (SISO mode)
802.11n (20MHz)	1TX (SISO mode)

4. The power table as below:

	Rated Power (mW/MHz)	Total Conducted RF Output Power Density (mW/MHz)	Radiated RF Output Power Density (mW/MHz)
2.4 GHz			
802.11b	7.00	7.00	11.09
802.11g	2.50	2.46	3.90
802.11n (HT20)	2.00	1.87	2.96

5. The antenna used in this EUT is listed as below table:

Item	Type	Gain(dBi)
Frequency		2400 ~ 2480 MHz
2.4 GHz	PCB	2.0

6. 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 Description of Test Modes

WLAN 2.4 GHz

Modes	Channel	Frquency (MHz)
802.11b/n (HT20)	1	2412
	7	2442
	13	2472

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

WLAN 2.4GHz

802.11b		802.11g	
Channel	Power Setting	Channel	Power Setting
1	37.0	1	45.0
7	37.0	7	45.0
13	39.0	13	48.0
802.11n (HT20)			
Channel	Power Setting		
1	43.0		
7	43.0		
13	46.0		

3.3 Test Conditions

Test Conditions	Voltage (Vdc)
V_{normal}	5.0
$V_{+10\%}$	5.5
$V_{-10\%}$	4.5

3.4 Assembly

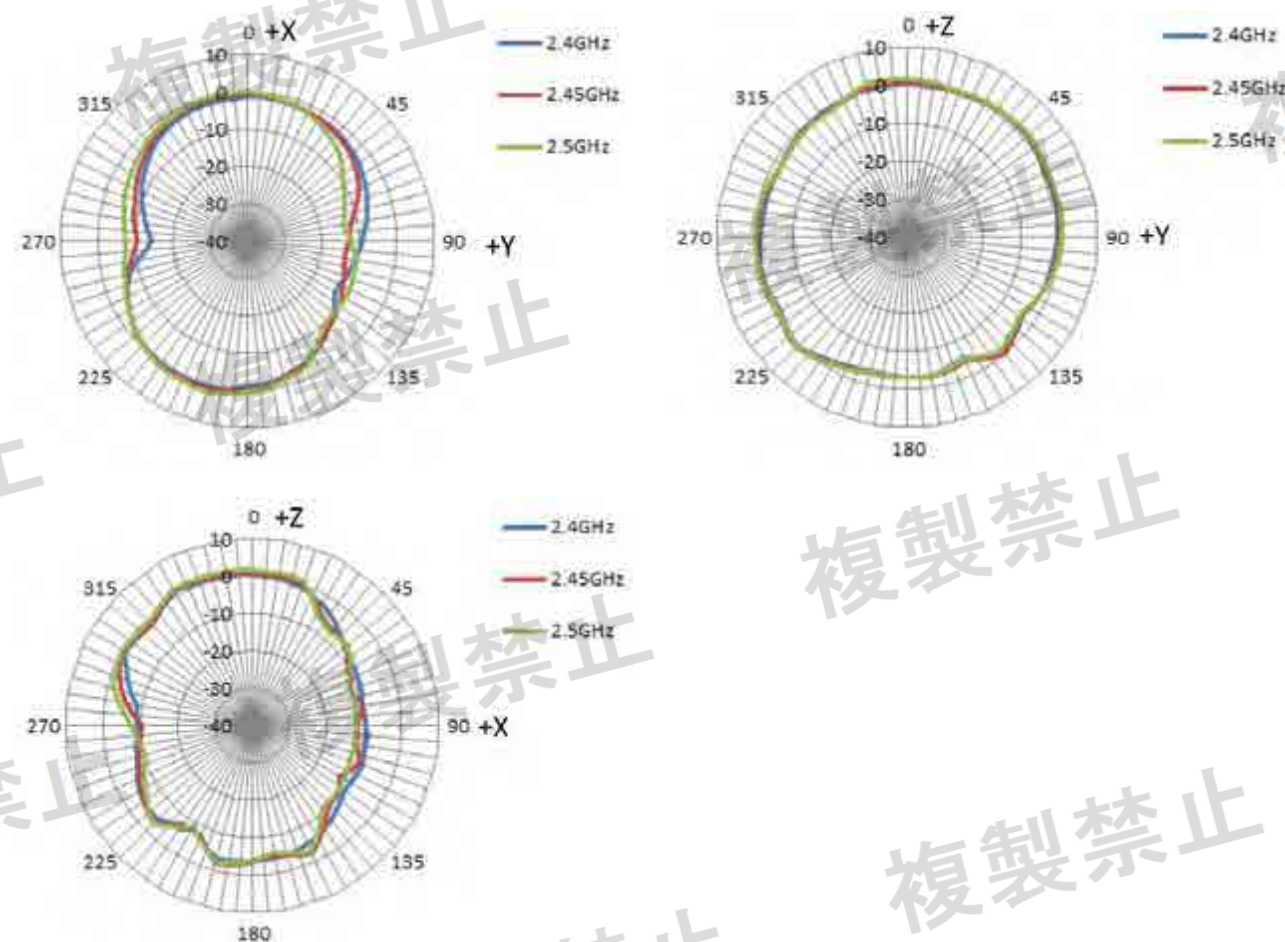
The RF areas for CPWB-B216KKKZ are covered by shielding frames.

3.5 Antenna Specifications

3.5.1 Antenna Gain

	Antenna type	Gain (dBi)
WLAN: 2.4 GHz	PCB	2.0

3.5.2 Antenna Pattern





4 Test Results (WLAN 2.4 GHz)

4.1 Frequency Tolerance Measurement

4.1.1 Limits of Frequency Tolerance Measurement

Tolerance of frequency shall be +/- 50 ppm.

4.1.2 Test Setup



4.1.3 Test Results

802.11b / 802.11g / 802.11n (HT20)

Environmental Conditions		25 deg.C, 60 % RH					
Channel	Frequency (MHz)	Voltage normal		Voltage +10%		Voltage -10%	
		Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)	Carrier Frequency (MHz)	Frequency Tolerance (ppm)
1	2412	2412.013045	5.401	2412.012885	5.342	2412.012885	5.342
7	2442	2442.013205	5.407	2442.013077	5.355	2442.012853	5.263
13	2472	2472.013365	5.407	2472.013141	5.316	2472.013077	5.290

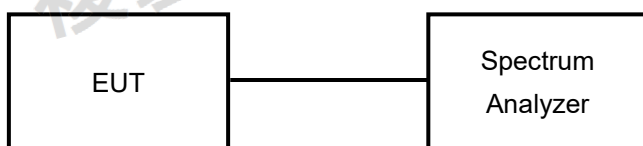


4.2 Occupied Bandwidth Measurement (99 % Power Bandwidth)

4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit	Remark
Occupied Bandwidth	< 26 MHz	802.11b, g & 802.11n (HT20)
Occupied Bandwidth	< 38 MHz	802.11n (HT40)

4.2.2 Test Setup

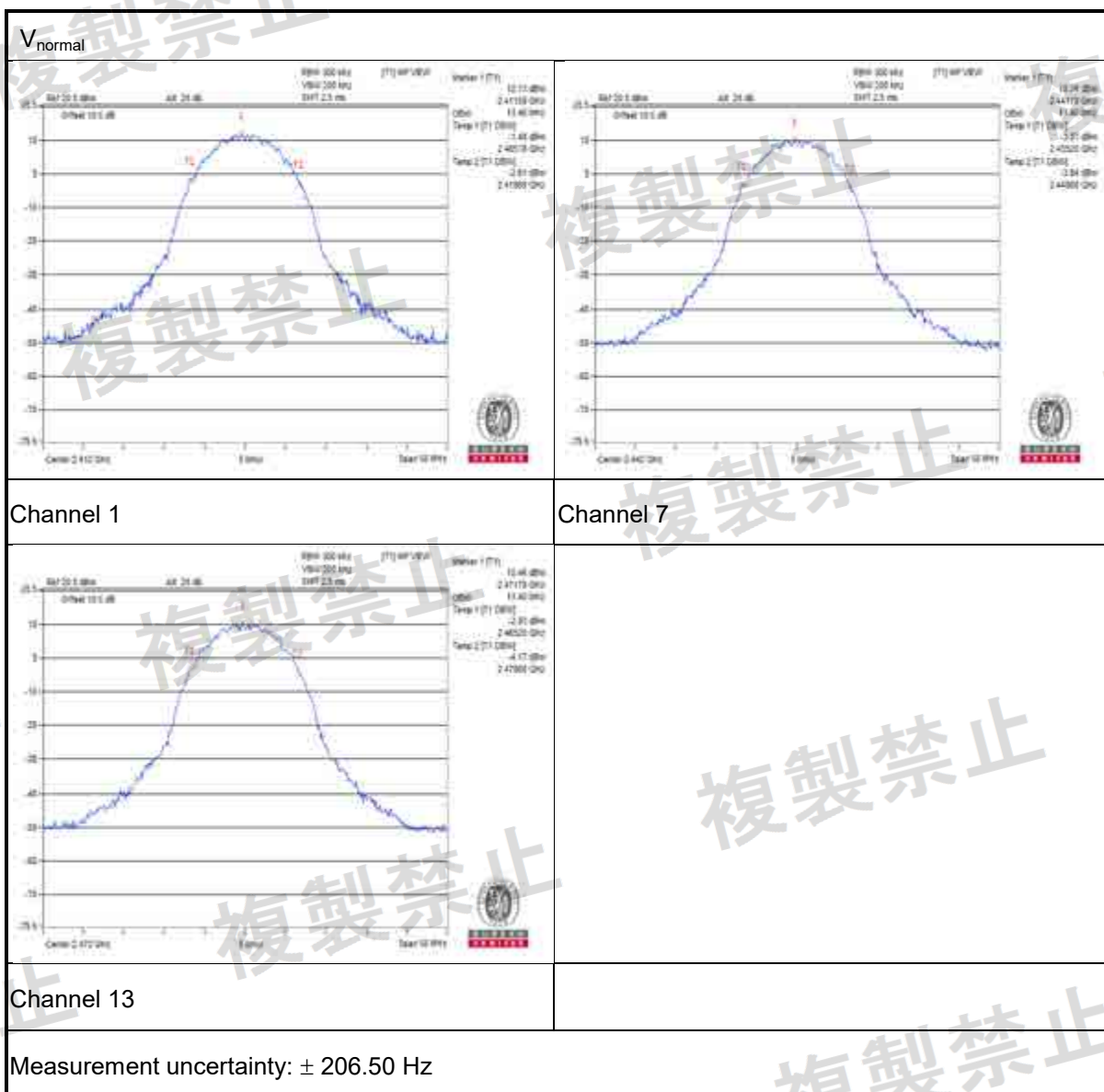


4.2.3 Test Results

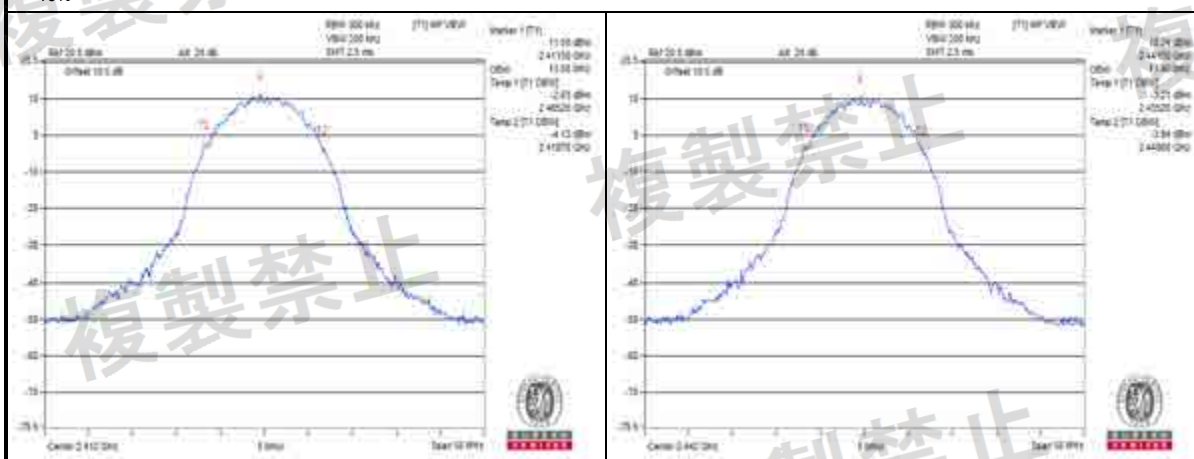
802.11b

Environmental Conditions		25 deg.C, 60 % RH		
Channel	Frequency (MHz)	V _{normal}	V _{+10%}	V _{-10%}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	13.46	13.50	13.50
7	2442	13.40	13.40	13.40
13	2472	13.40	13.40	13.40

Note: 1. For the test plots please refer to the below pages.

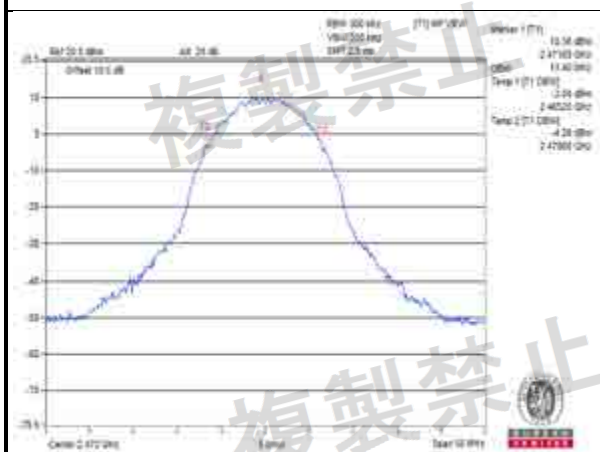


V+10%



Channel 1

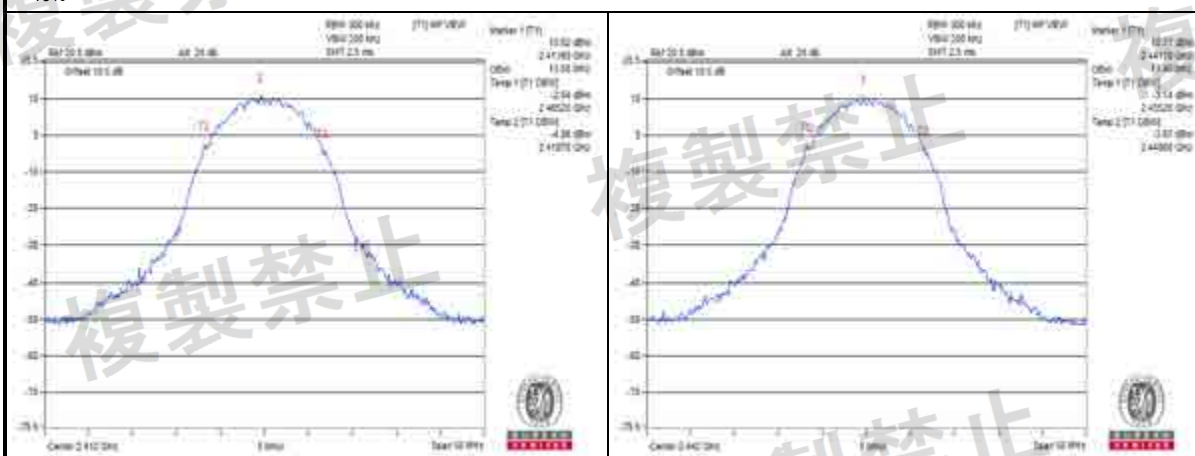
Channel 7



Channel 13

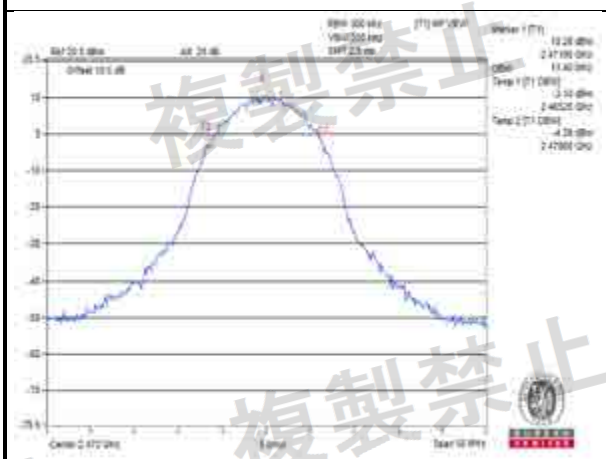
Measurement uncertainty: ± 206.50 Hz

V-10%



Channel 1

Channel 7



Channel 13

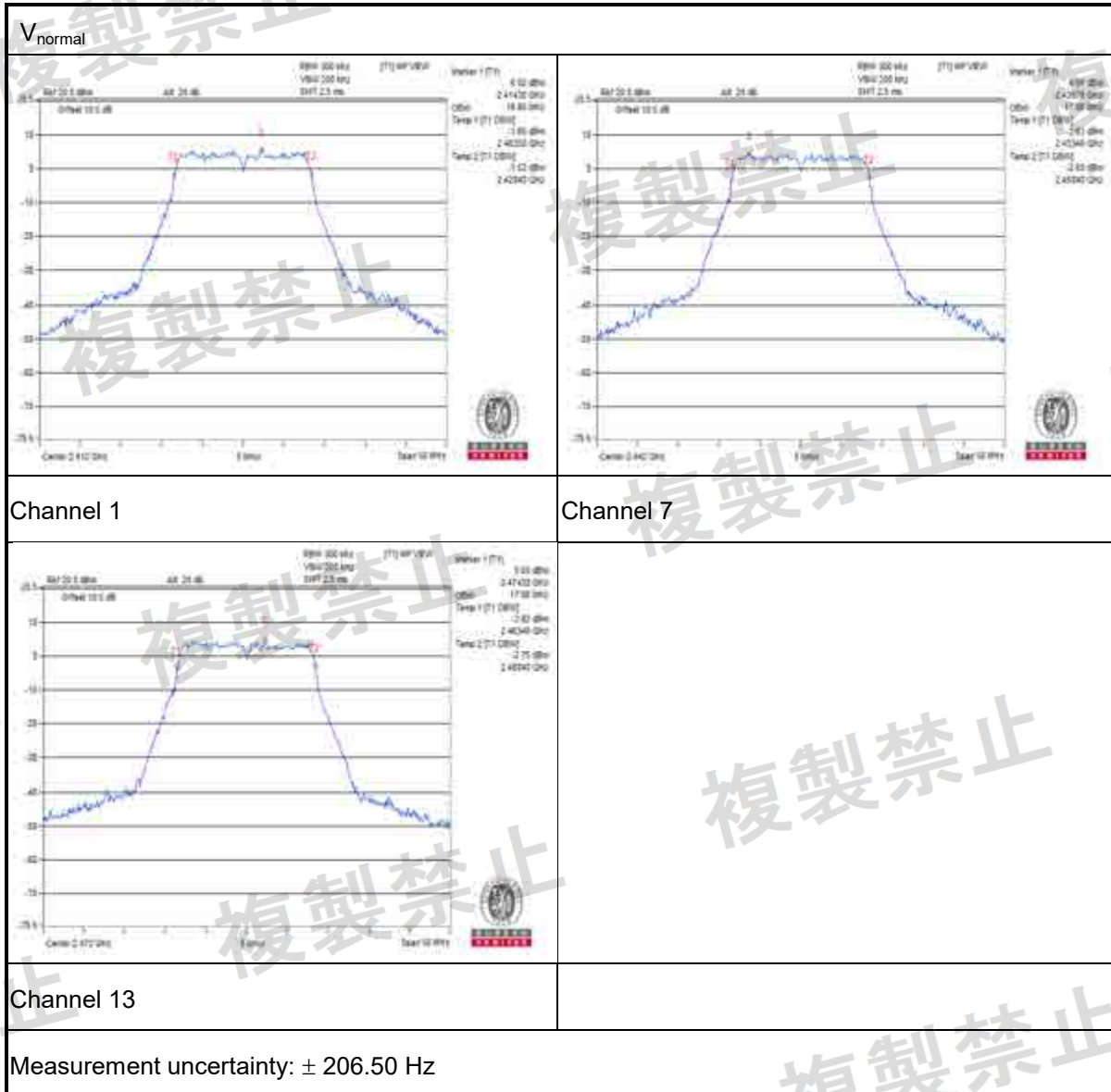
Measurement uncertainty: ± 206.50 Hz



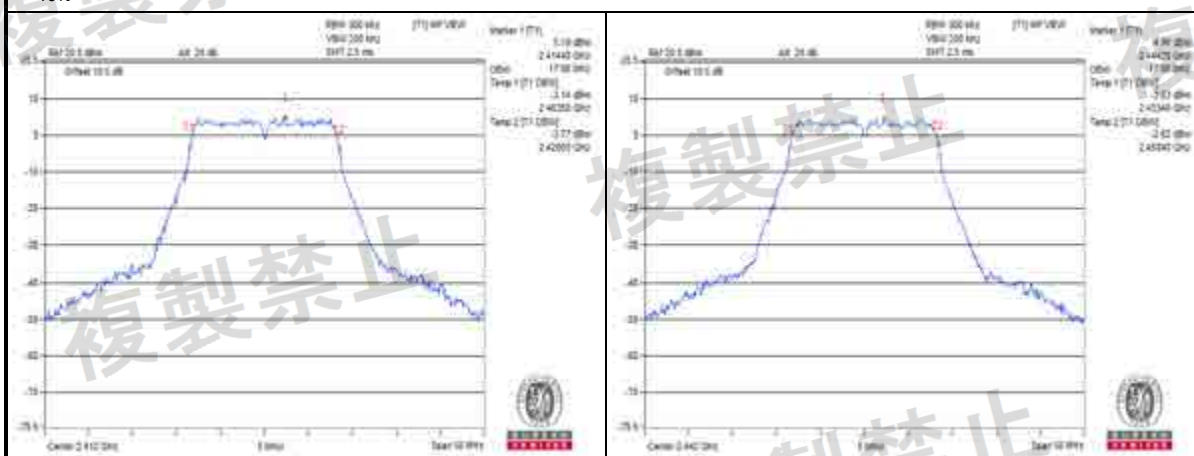
802.11g

Environmental Conditions		25 deg.C, 60 % RH		
Channel	Frequency (MHz)	V _{normal}	V _{+10%}	V _{-10%}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	16.90	17.00	17.10
7	2442	17.00	17.00	16.90
13	2472	17.00	17.00	17.00

Note: 1. For the test plots please refer to the below pages.

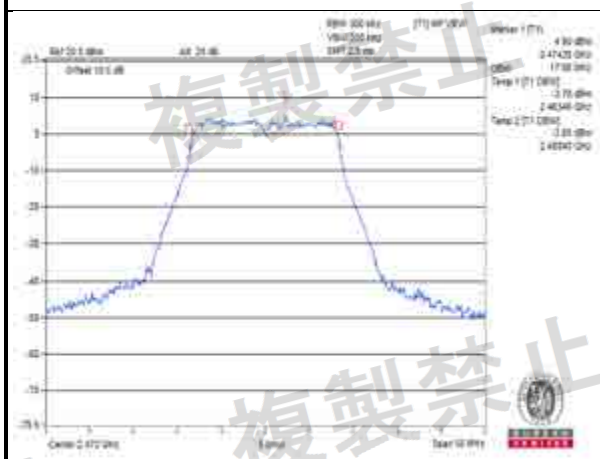


V+10%



Channel 1

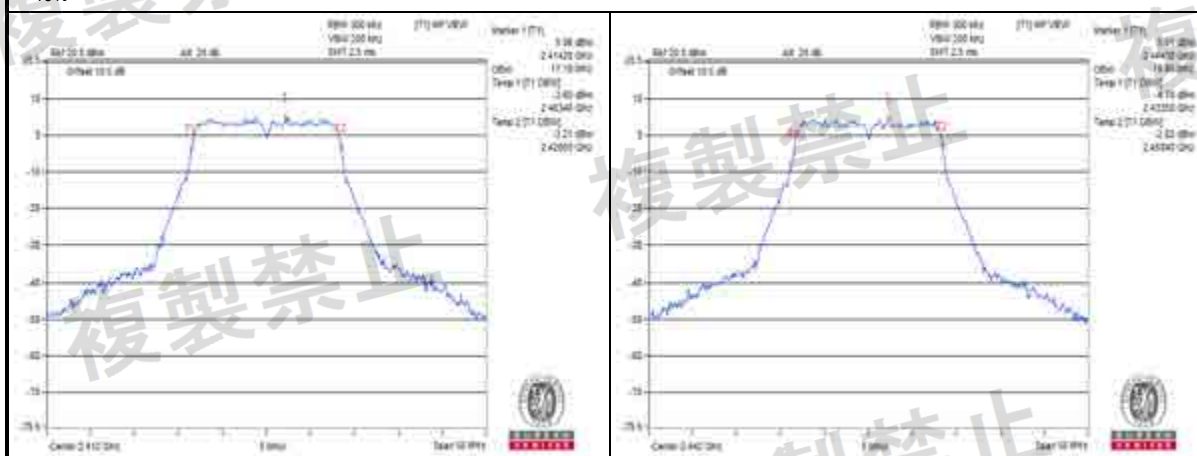
Channel 7



Channel 13

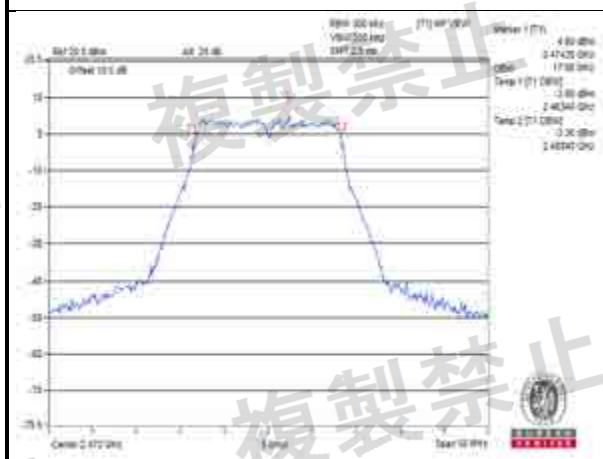
Measurement uncertainty: ± 206.50 Hz

V-10%



Channel 1

Channel 7



Channel 13

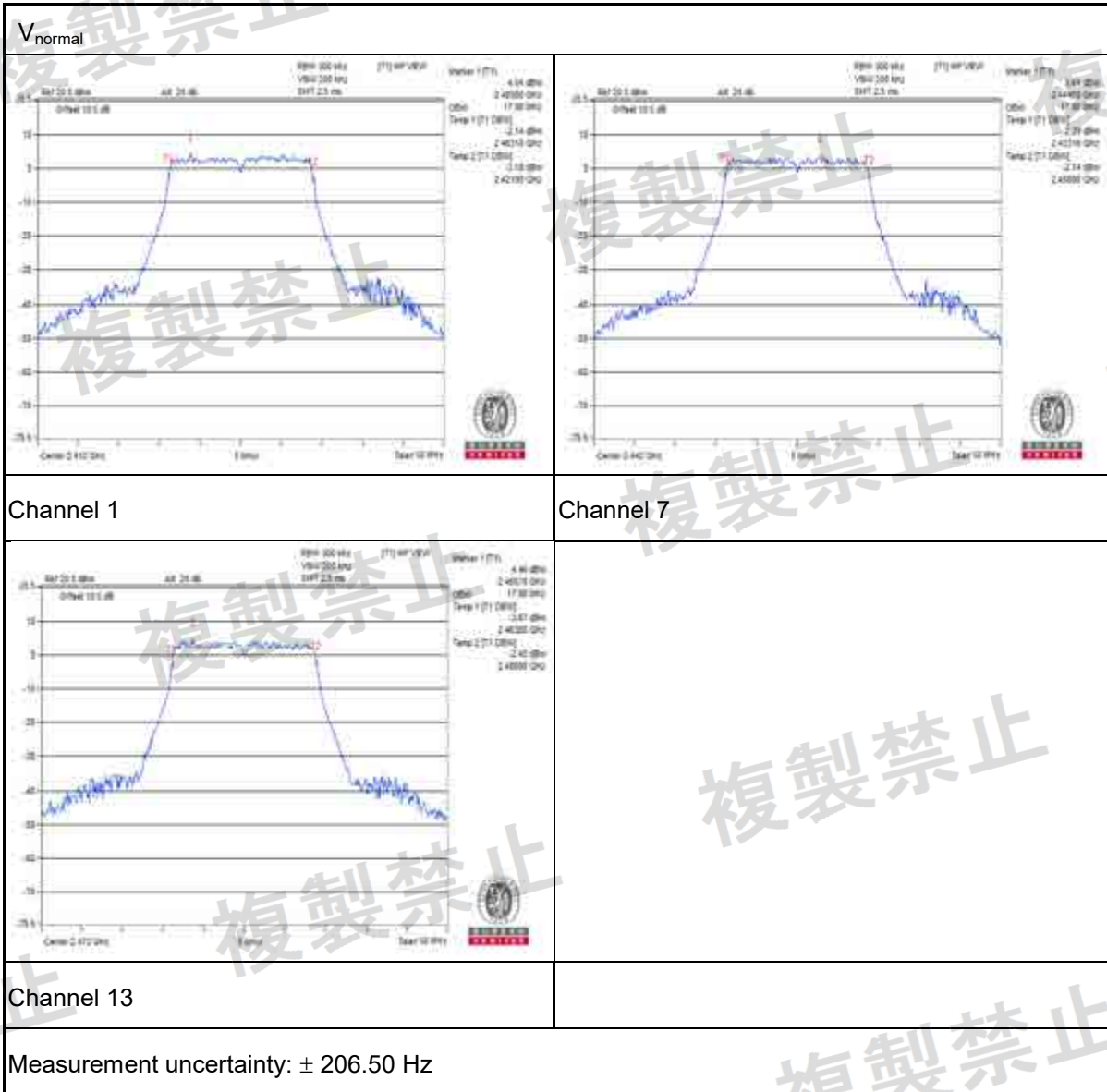
Measurement uncertainty: ± 206.50 Hz



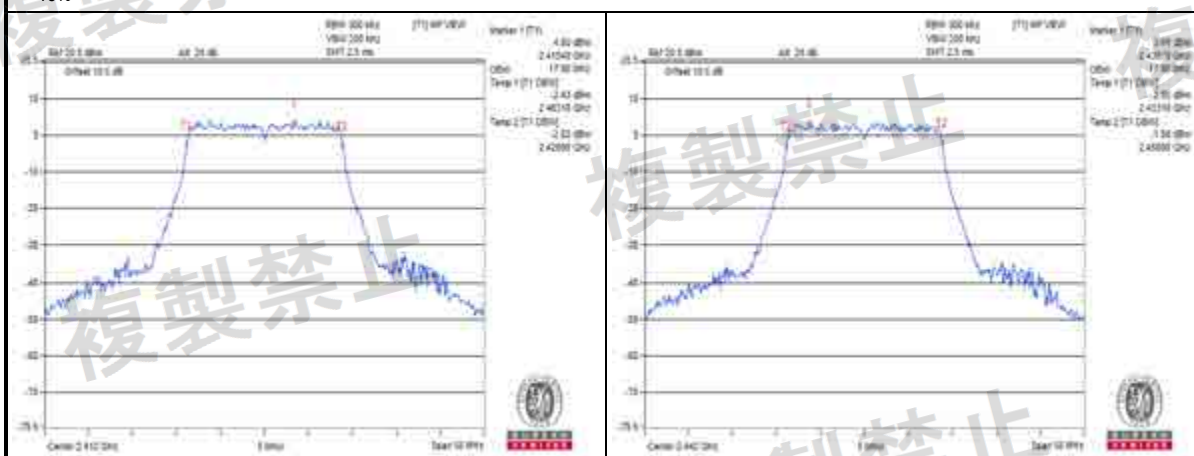
802.11n (HT20)

Environmental Conditions		25 deg.C, 60 % RH		
Channel	Frequency (MHz)	V _{normal}	V _{+10%}	V _{-10%}
		Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
1	2412	17.90	17.80	17.80
7	2442	17.80	17.80	17.90
13	2472	17.90	17.80	17.90

Note: 1. For the test plots please refer to the below pages.

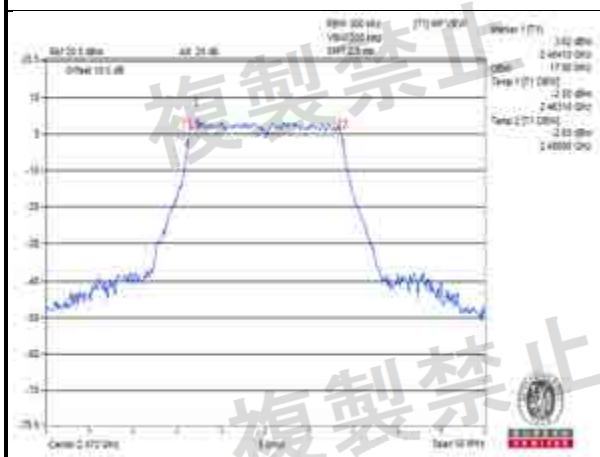


V+10%



Channel 1

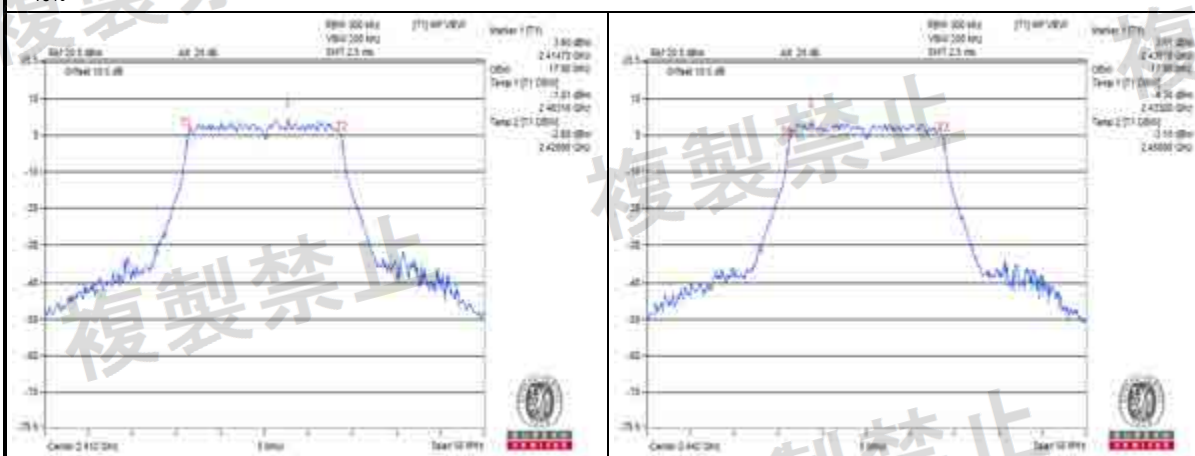
Channel 7



Channel 13

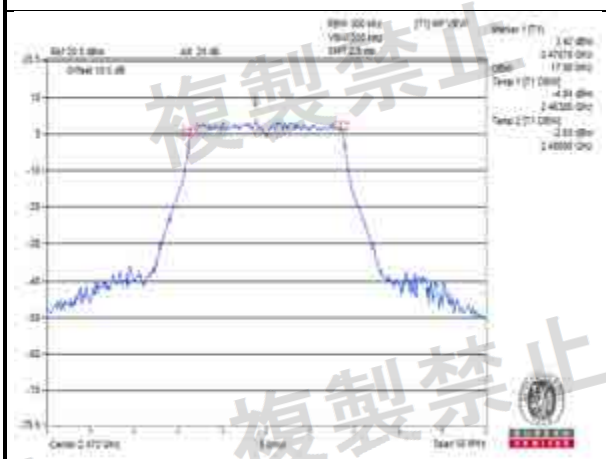
Measurement uncertainty: ± 206.50 Hz

V-10%



Channel 1

Channel 7



Channel 13

Measurement uncertainty: ± 206.50 Hz

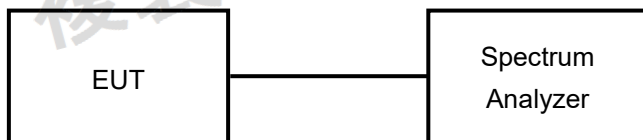


4.3 Spreading Bandwidth Measurement (90 % Power Bandwidth)

4.3.1 Limits of Spreading Bandwidth and Spreading Factor Measurement

Item	Limit	Remark
Spreading Bandwidth	≥ 500 kHz	(For DSSS, FHSS)
Spreading Factor	≥ 5	Operating Frequency 2400 to 2483.5 MHz

4.3.2 Test Setup



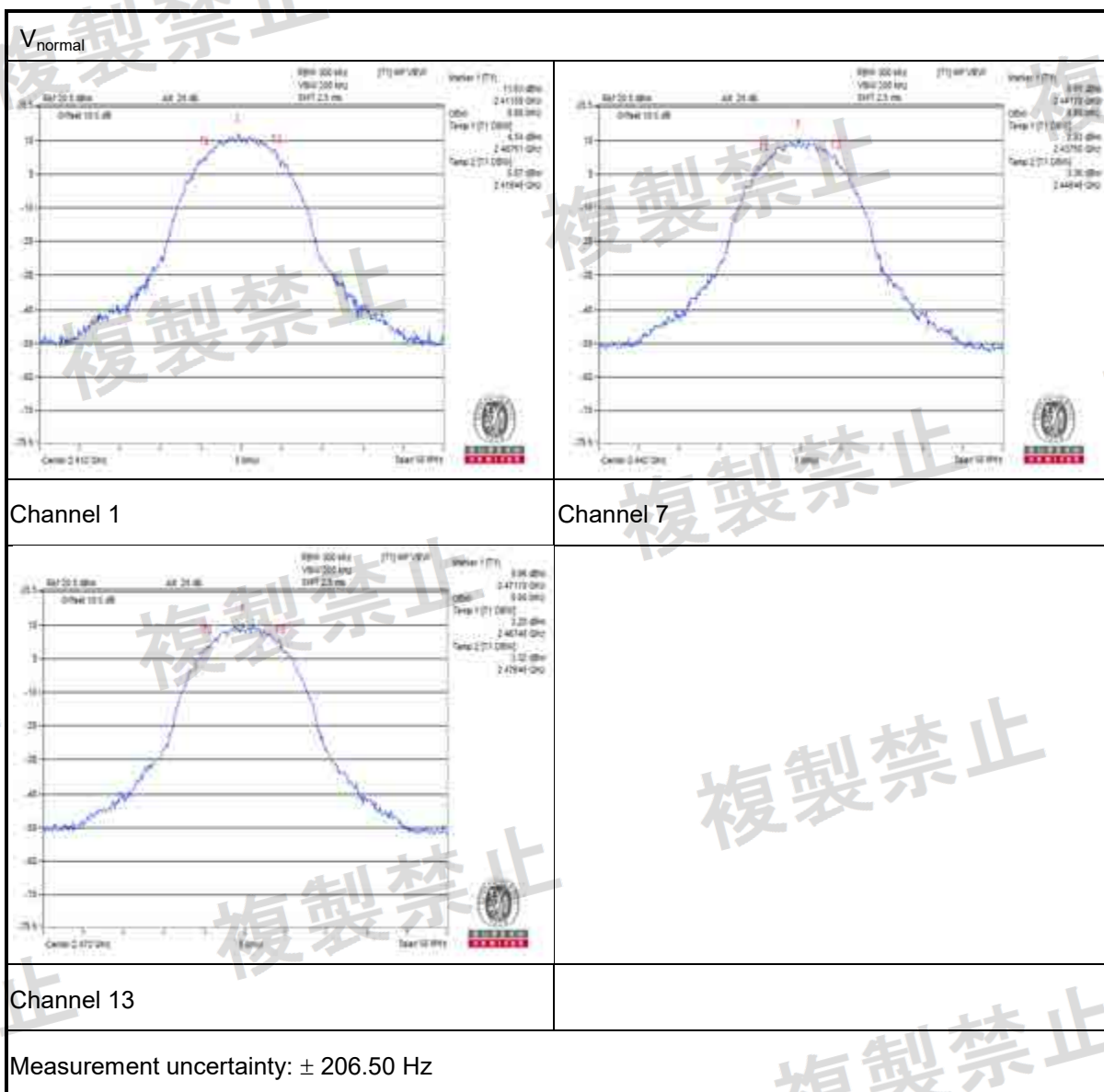
4.3.3 Test Results

802.11b

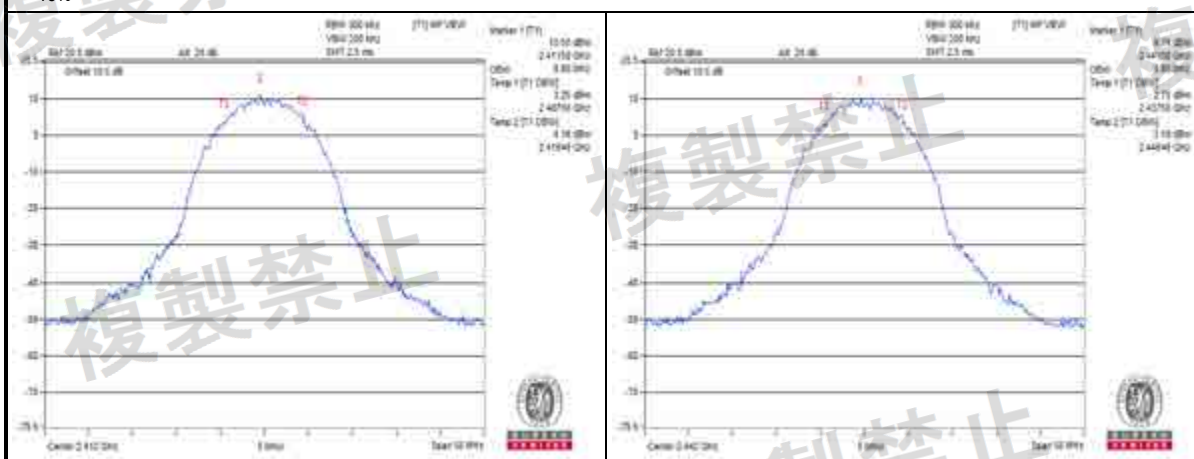
Environmental Conditions		25 deg.C, 60 % RH					
Channel	Frequency (MHz)	V_{normal}		$V_{+10\%}$		$V_{-10\%}$	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	8.89	6.465	8.90	6.473	8.90	6.473
7	2442	8.90	6.473	8.90	6.473	8.90	6.473
13	2472	9.00	6.545	8.90	6.473	8.90	6.473

Note: 1. For the test plots please refer to the below pages.

2. Spreading Factor: 90 % channel power bandwidth / 1.375.

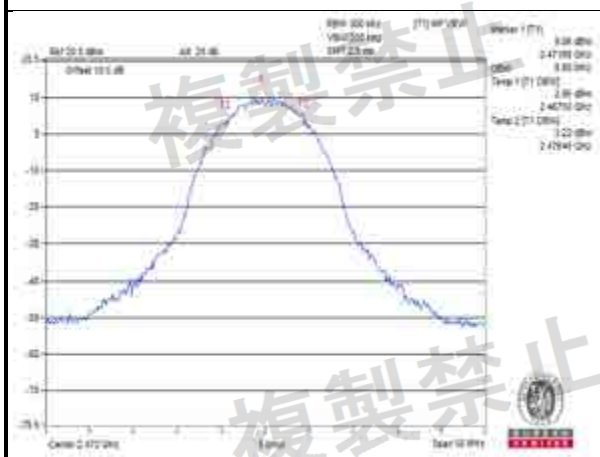


V+10%



Channel 1

Channel 7



Channel 13

Measurement uncertainty: ± 206.50 Hz

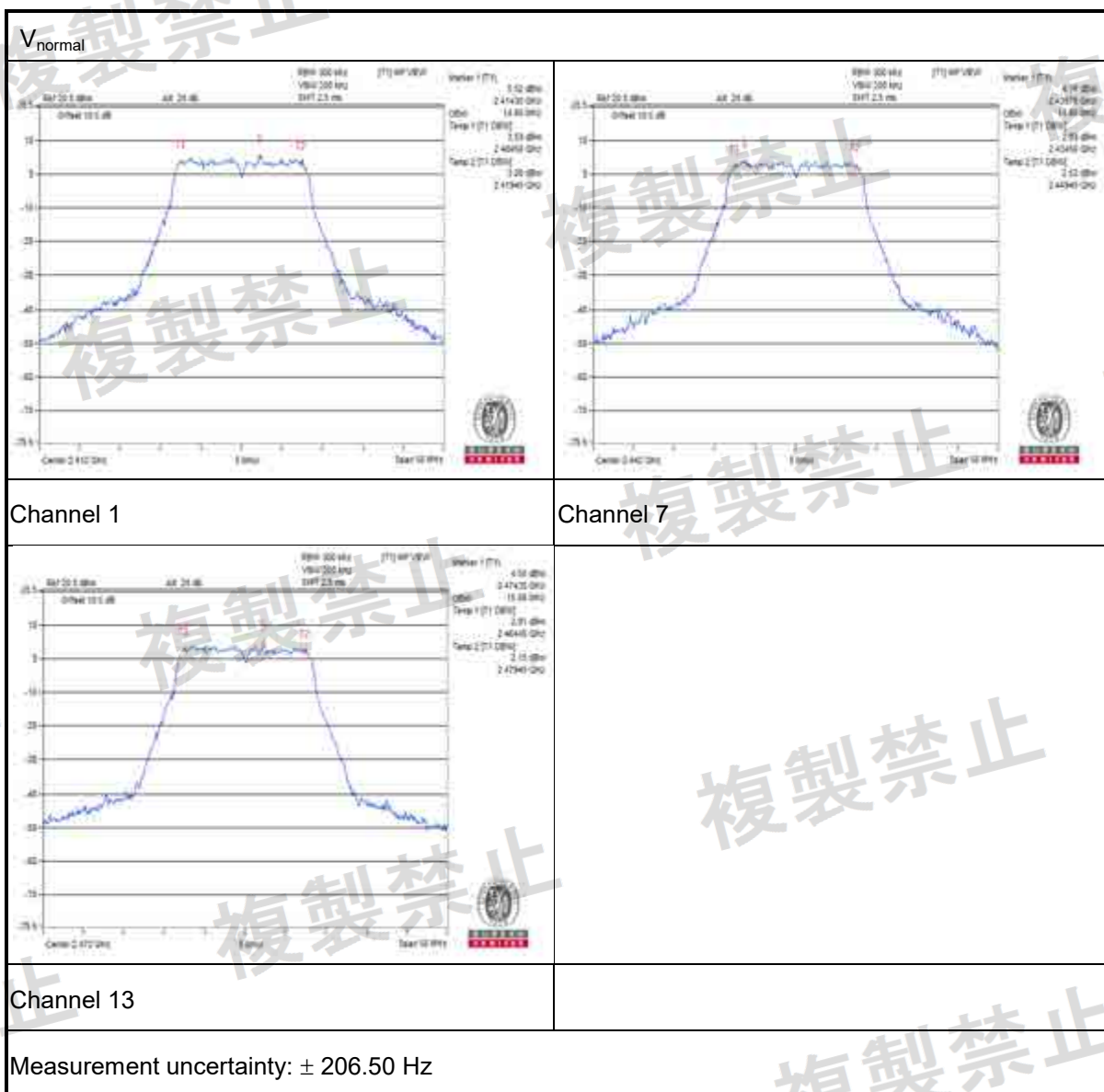


802.11g

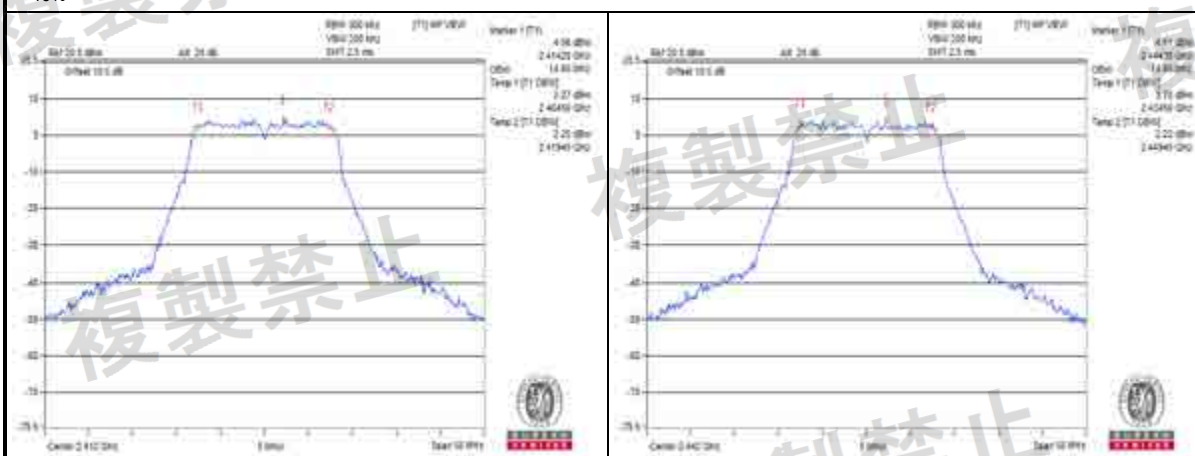
Environmental Conditions		25 deg.C, 60 % RH					
Channel	Frequency (MHz)	V _{normal}		V _{+10%}		V _{-10%}	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	14.90	9.933	15.00	10.000	14.90	9.933
7	2442	14.90	9.933	14.80	9.867	14.90	9.933
13	2472	15.00	10.000	15.00	10.000	14.90	9.933

Note: 1. For the test plots please refer to the below pages.

2. Spreading Factor: 90 % channel power bandwidth / 1.5.

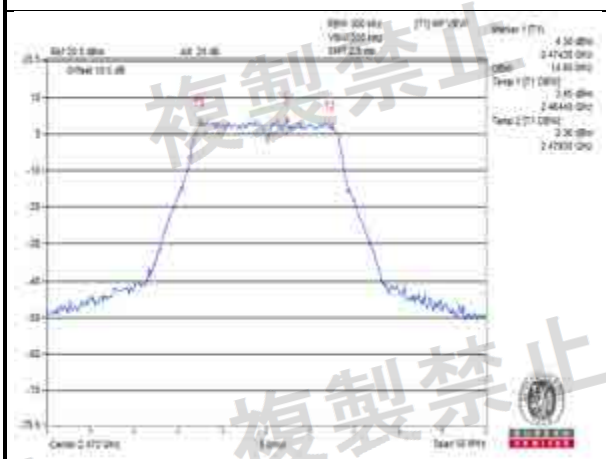


V-10%



Channel 1

Channel 7



Channel 13

Measurement uncertainty: ± 206.50 Hz

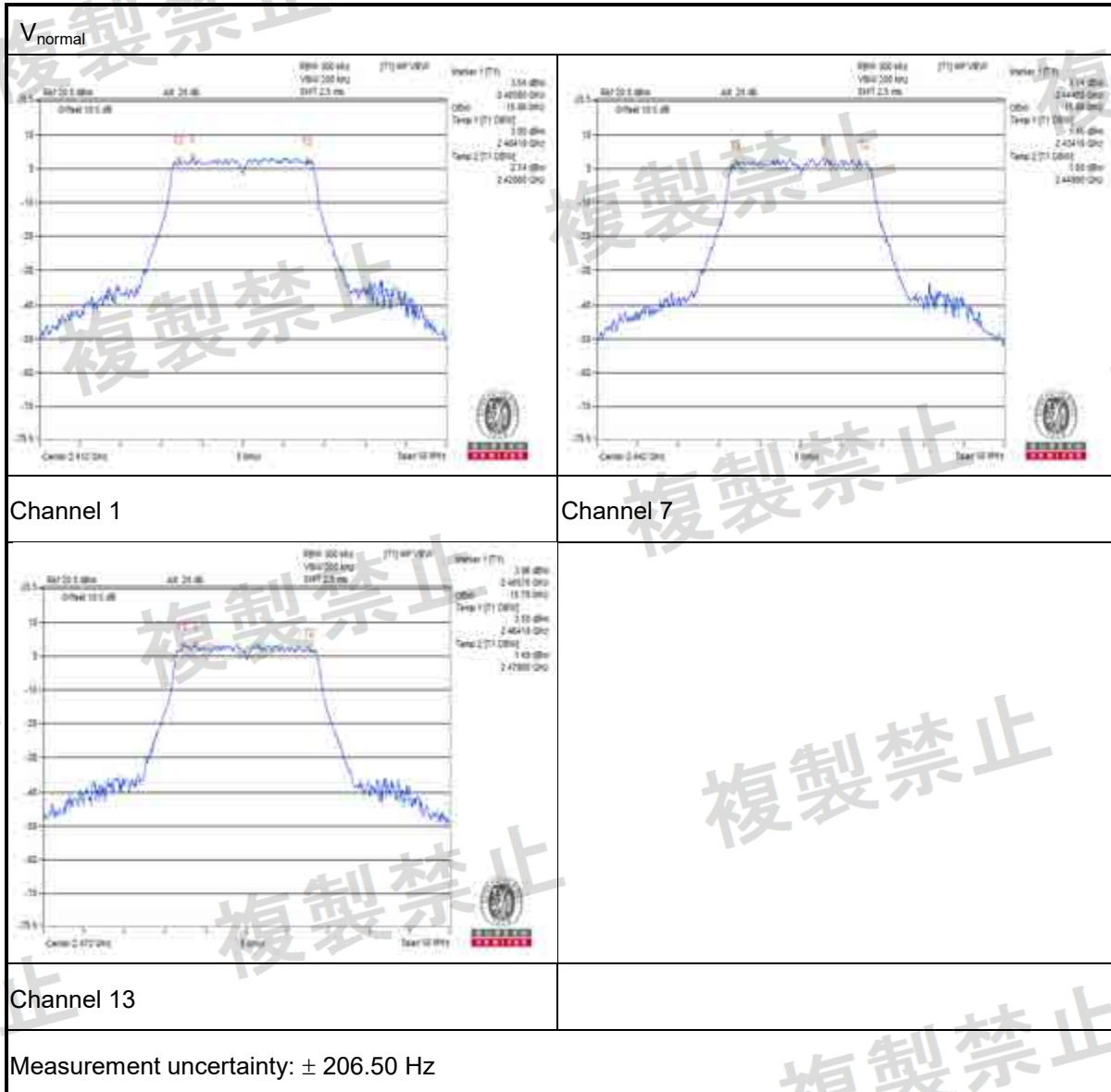


802.11n (HT20)

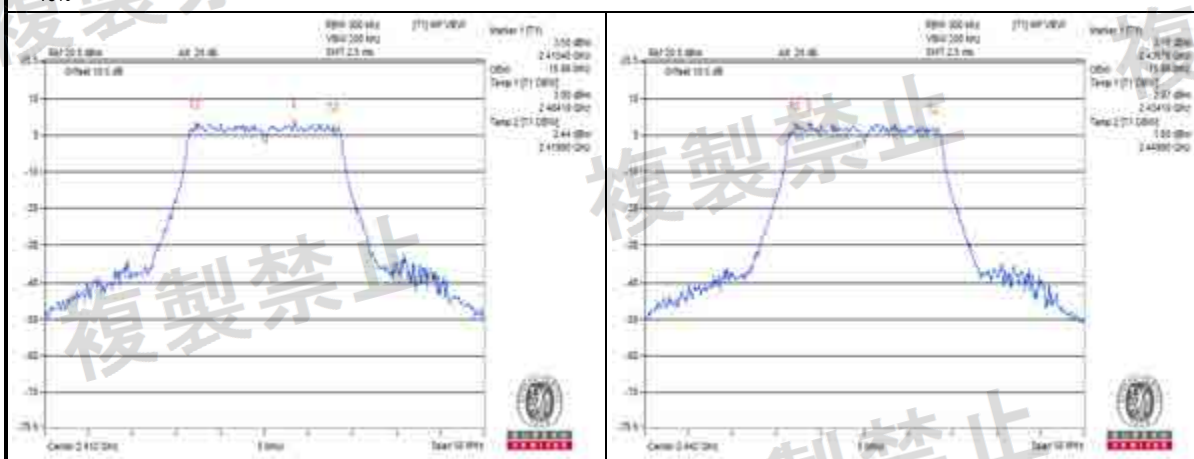
Environmental Conditions		25 deg.C, 60 % RH					
Channel	Frequency (MHz)	V _{normal}		V _{+10%}		V _{-10%}	
		Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
1	2412	15.90	10.600	15.80	10.533	15.70	10.467
7	2442	15.80	10.533	15.80	10.533	15.80	10.533
13	2472	15.70	10.467	15.90	10.600	15.90	10.600

Note: 1. For the test plots please refer to the below pages.

2. Spreading Factor: 90 % channel power bandwidth / 1.375.

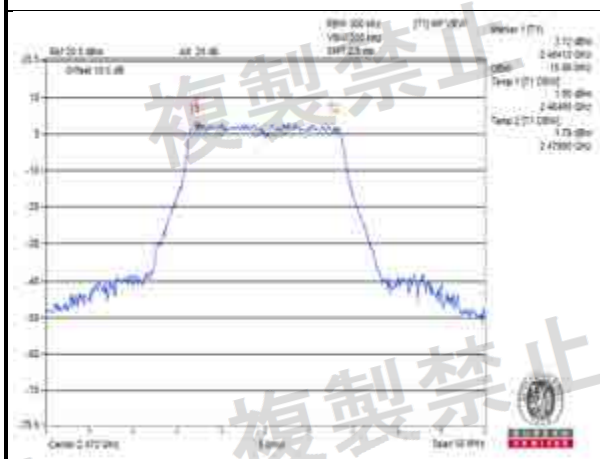


V+10%



Channel 1

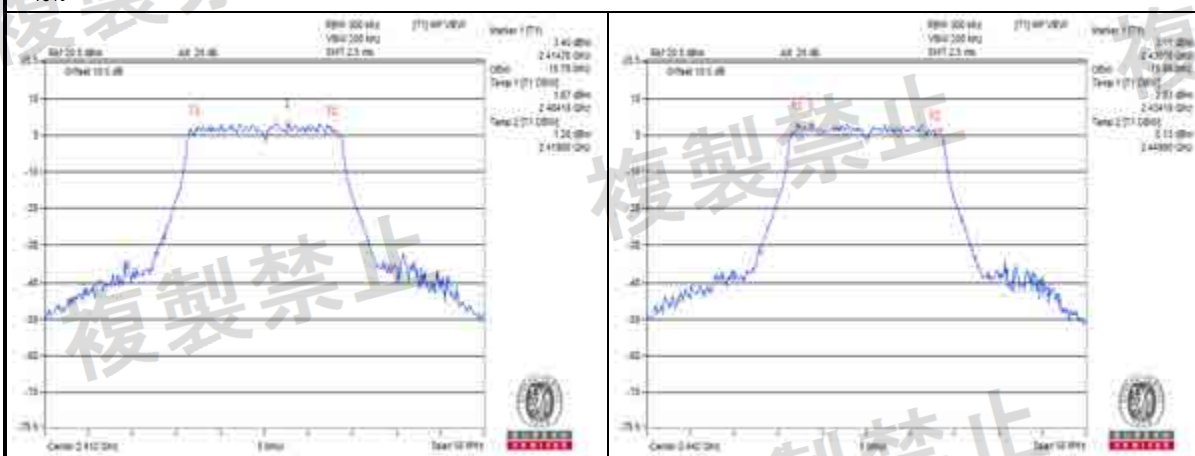
Channel 7



Channel 13

Measurement uncertainty: ± 206.50 Hz

V-10%



Channel 1

Channel 7



Channel 13

Measurement uncertainty: ± 206.50 Hz

4.4 Spurious Emissions for Transmitter Measurement

4.4.1 Limits of Spurious Emissions

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

4.4.2 Test Setup





4.4.3 Test Results

802.11b

Environmental Conditions		25 deg.C, 60 % RH					
Test Channel		Ch 1 (2412 MHz)		CH7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	97.650	0.028642uW	127.720	0.150314uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2383.180	0.050466uW	2364.110	0.036475uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.990	6.792036uW	2395.040	0.060395uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2491.840	0.072946uW	2494.810	0.033037uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2559.020	0.047753uW	2544.010	0.033497uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	98.140	0.023121uW	127.720	0.145881uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2383.530	0.077804uW	2382.490	0.036224uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.980	7.177943uW	2394.550	0.055976uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2490.260	0.06368uW	2484.470	0.049317uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2514.000	0.038726uW	2564.020	0.037068uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	98.380	0.018408uW	127.720	0.138995uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2356.130	0.050933uW	2361.340	0.035156uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.870	6.576578uW	2395.420	0.04592uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2491.950	0.065313uW	2486.980	0.0414uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2514.000	0.039084uW	2519.000	0.033574uW	2.5uW / MHz	Pass

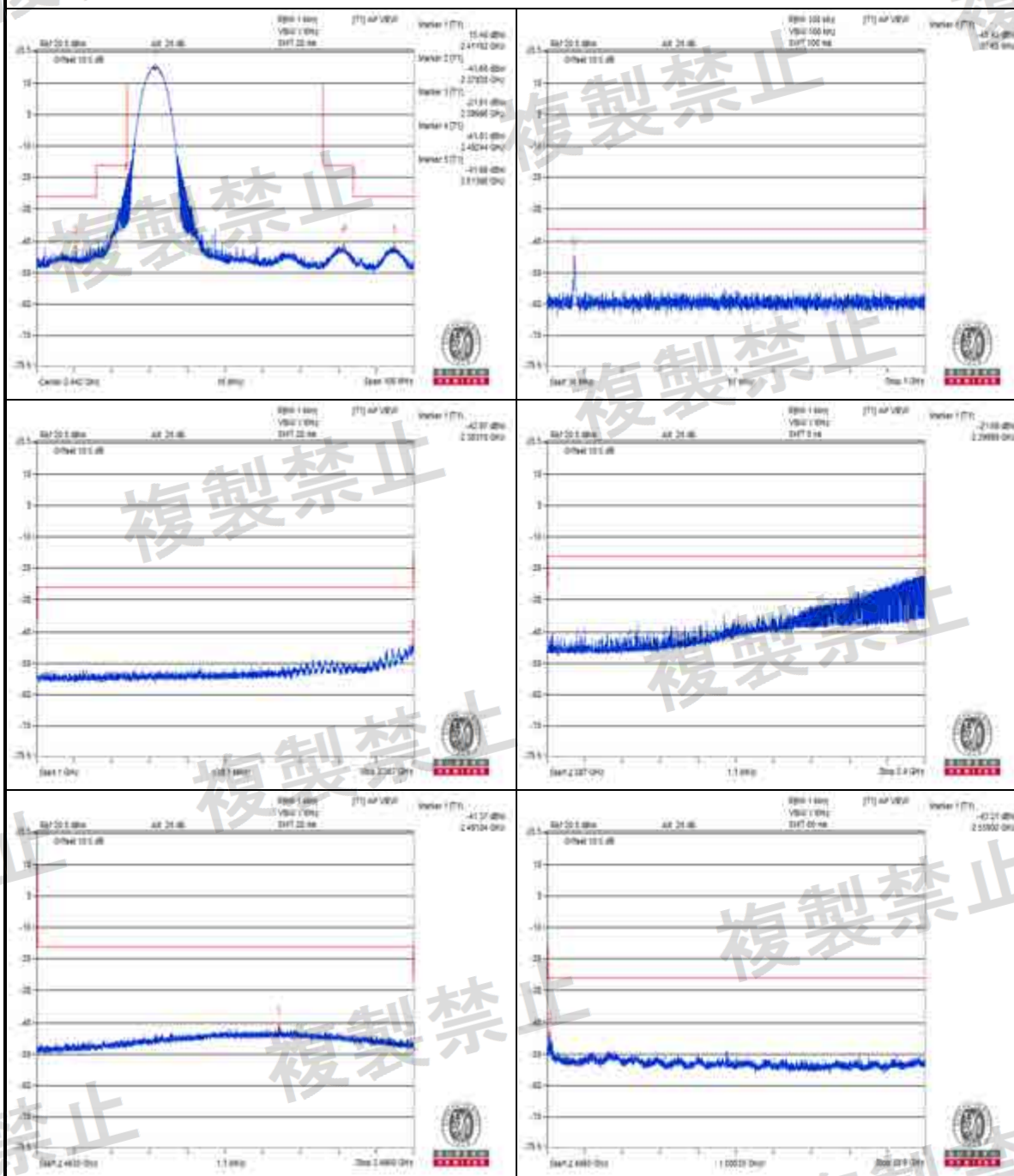


Environmental Conditions		25 deg.C, 60 % RH			
Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	157.790	0.135207uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2371.390	0.057943uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2391.740	0.063826uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.680	6.622165uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2574.020	0.035975uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	157.790	0.102094uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2370.700	0.047206uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2392.240	0.060954uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.650	6.652732uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2551.510	0.033189uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	157.550	0.023335uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2347.810	0.048978uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2393.210	0.061094uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.500	6.982324uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2549.010	0.038726uW	2.5uW / MHz	Pass

Note:

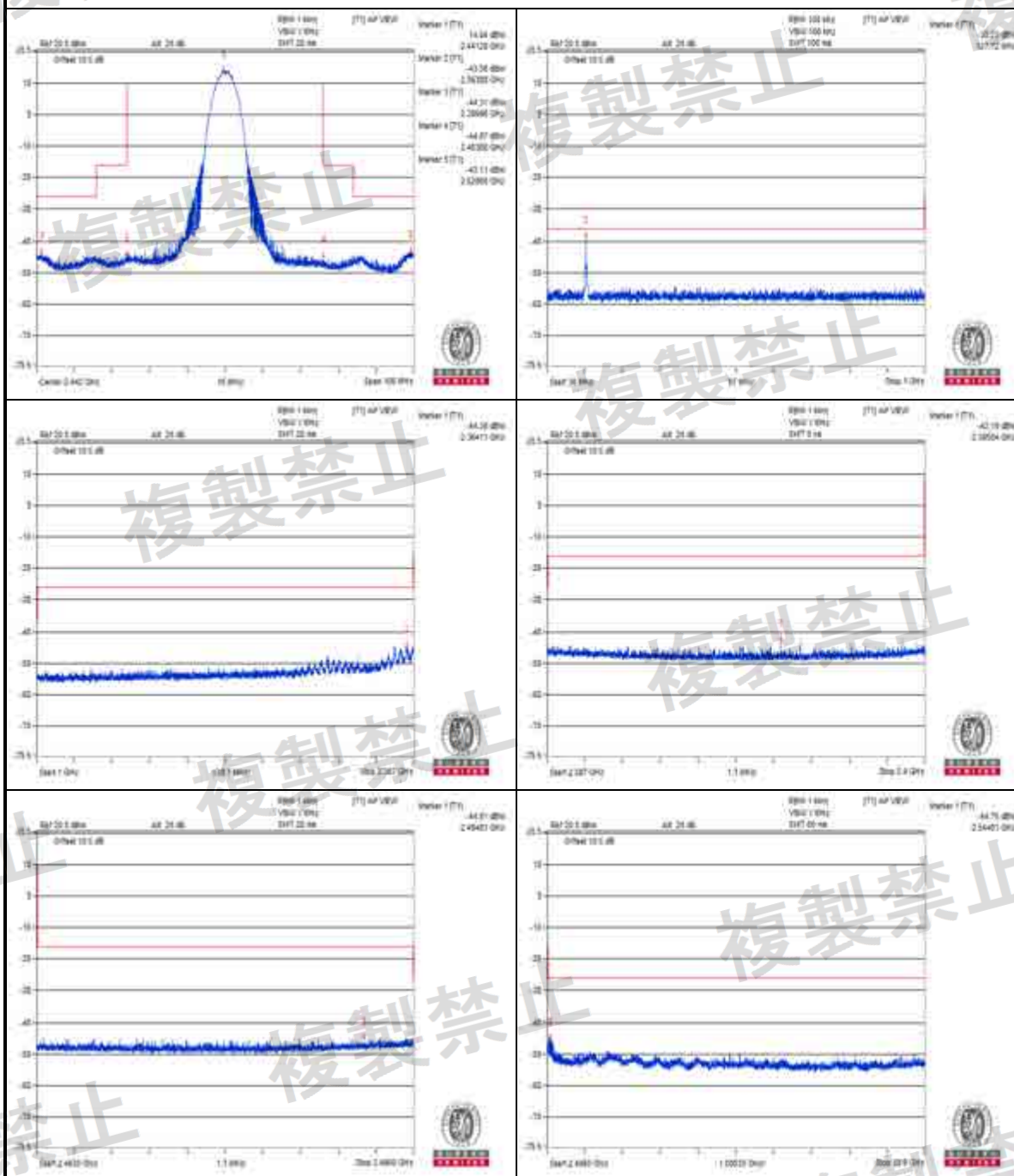
1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.

V_{normal}
Channel 1



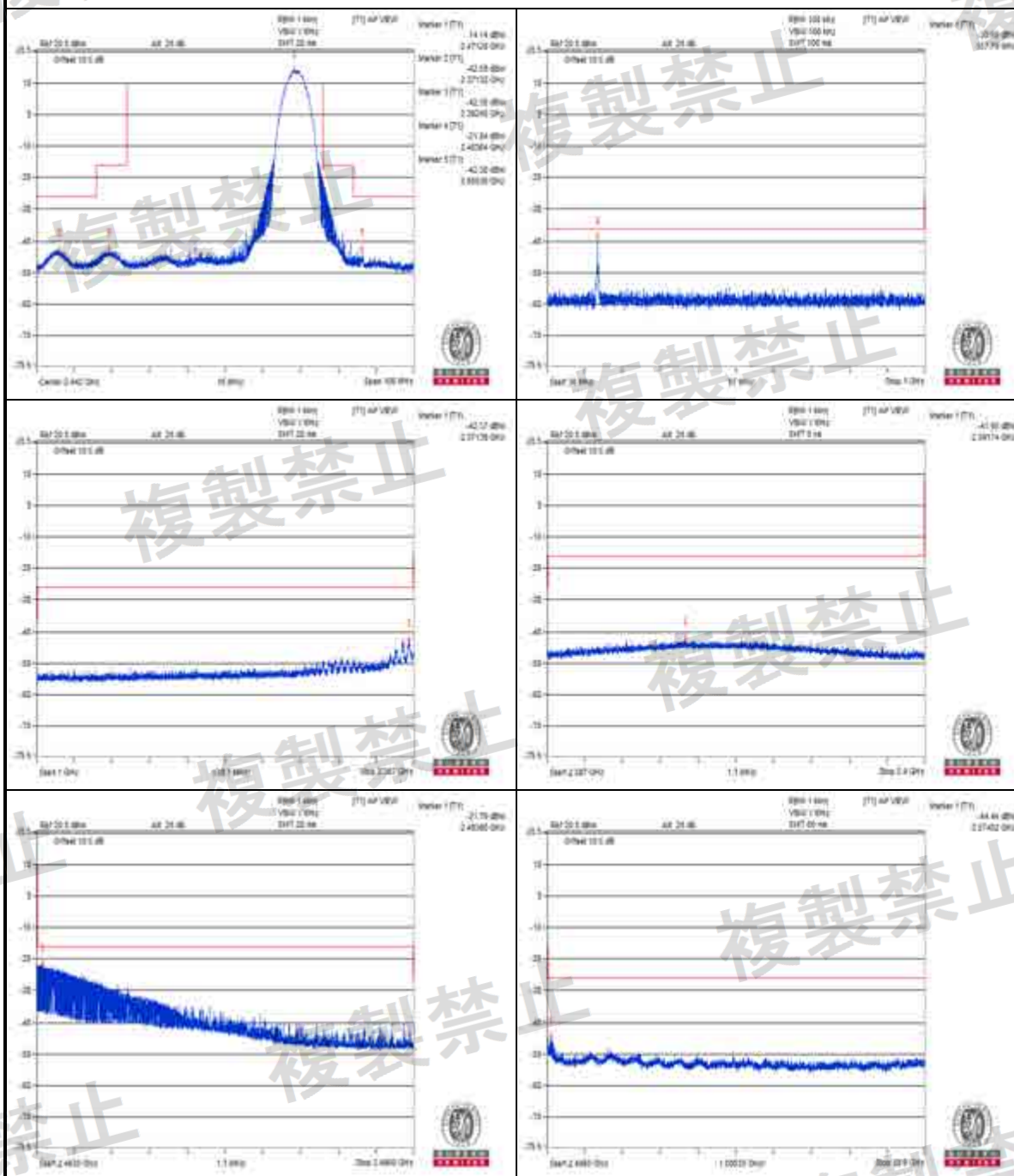
Measurement uncertainty: $\pm 3.93\text{dB}$

V_{normal}
Channel 7



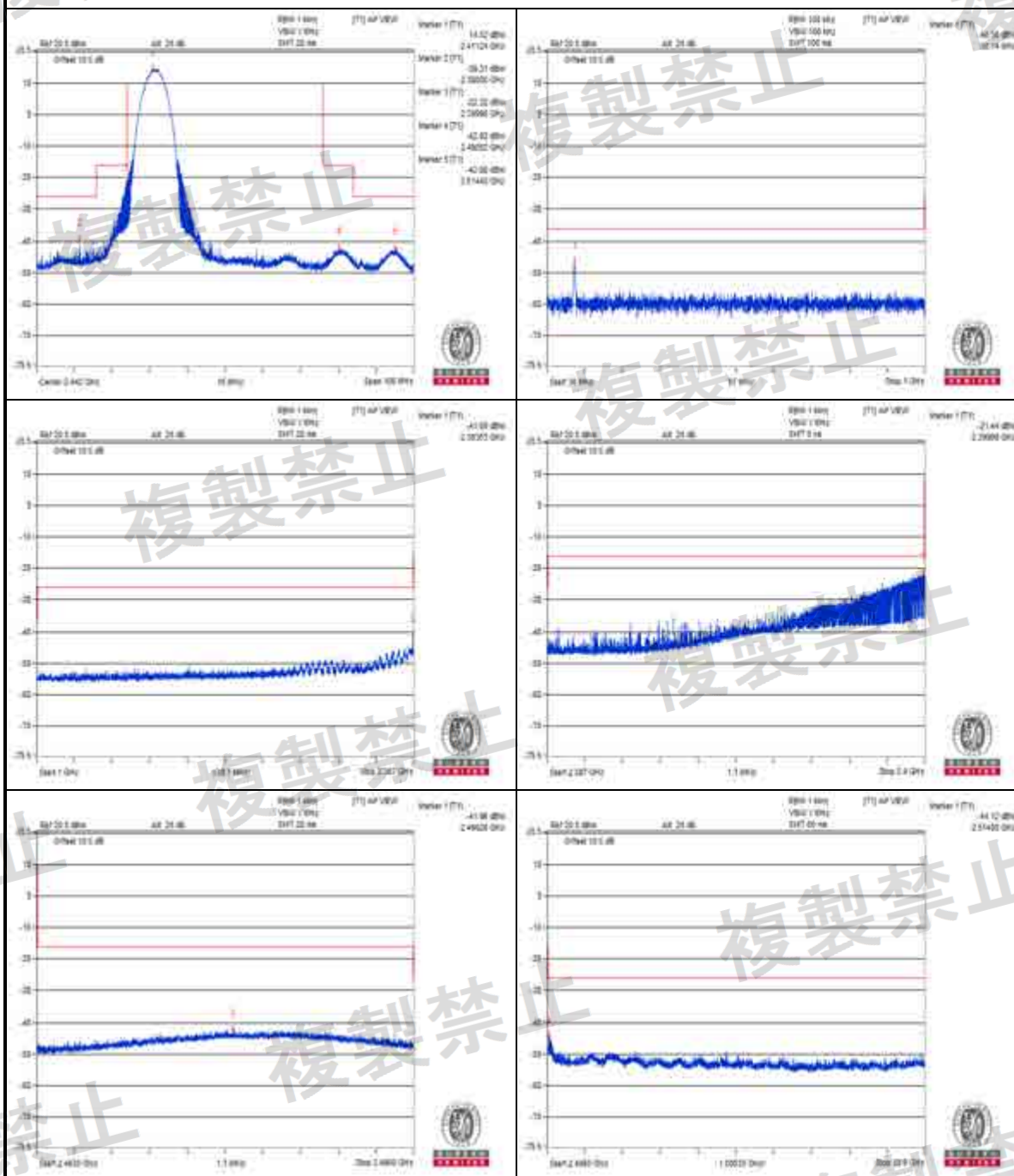
Measurement uncertainty: $\pm 3.93\text{dB}$

V_{normal}
Channel 13



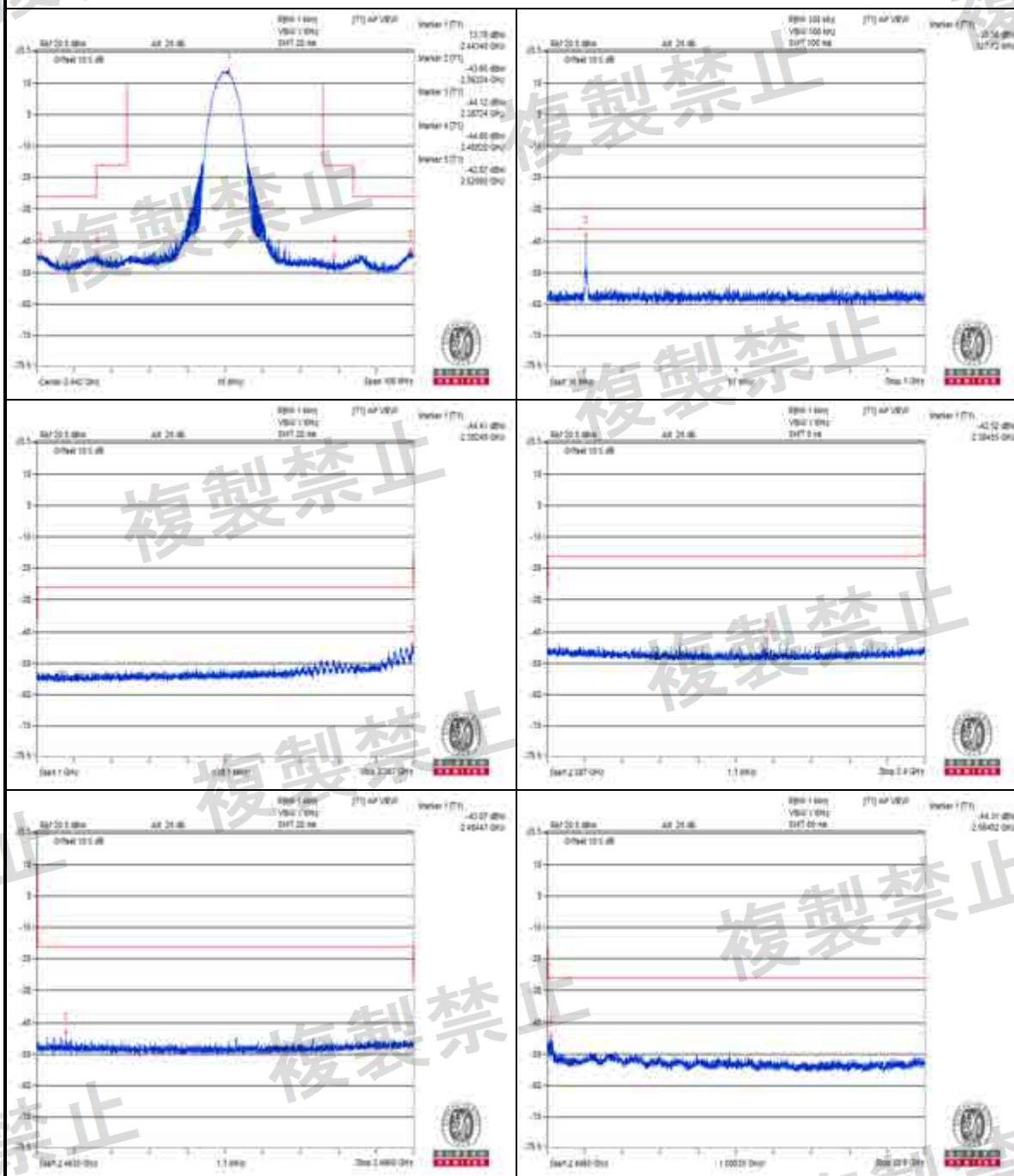
Measurement uncertainty: $\pm 3.93\text{dB}$

V=10%
Channel 1



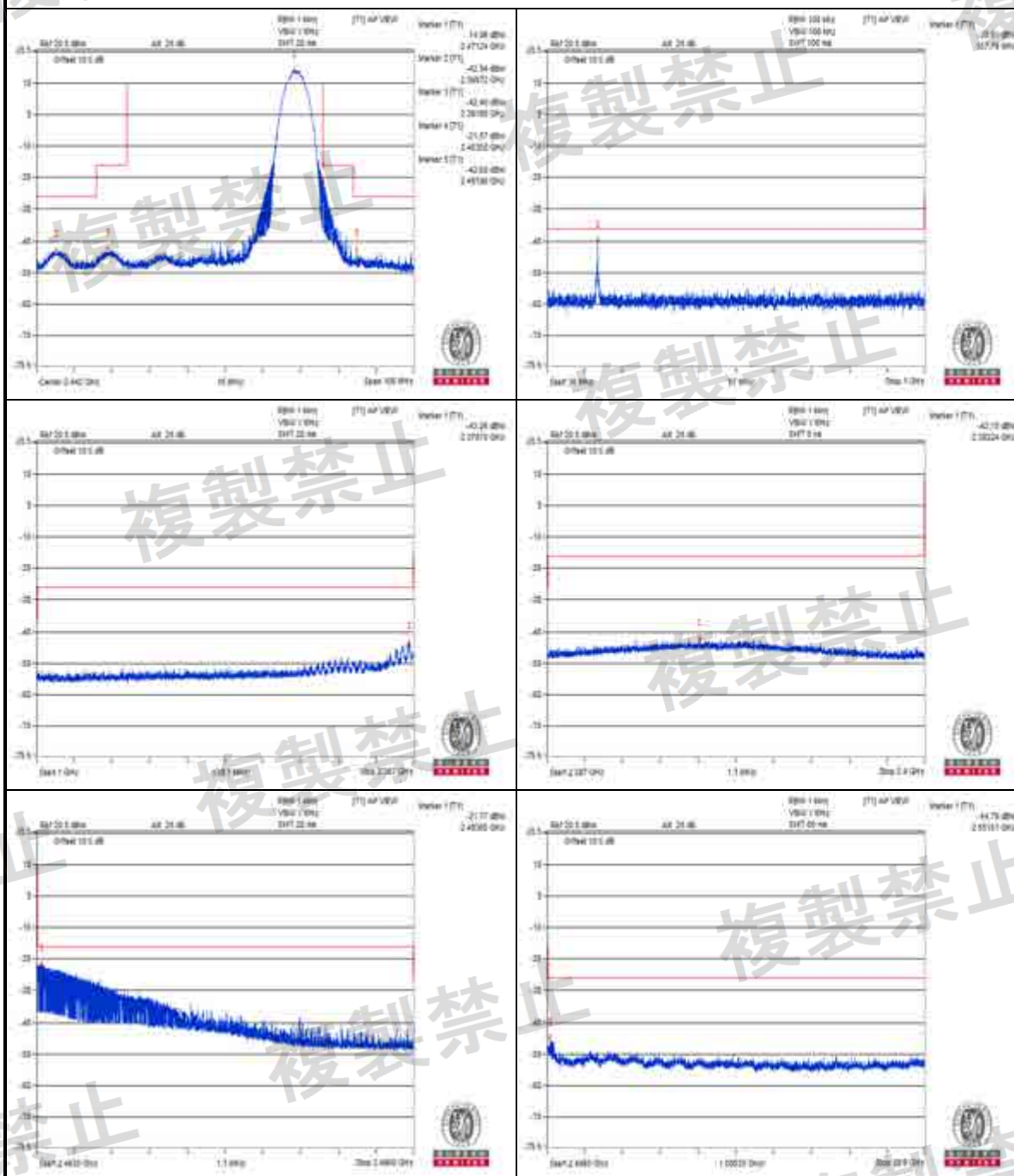
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 7



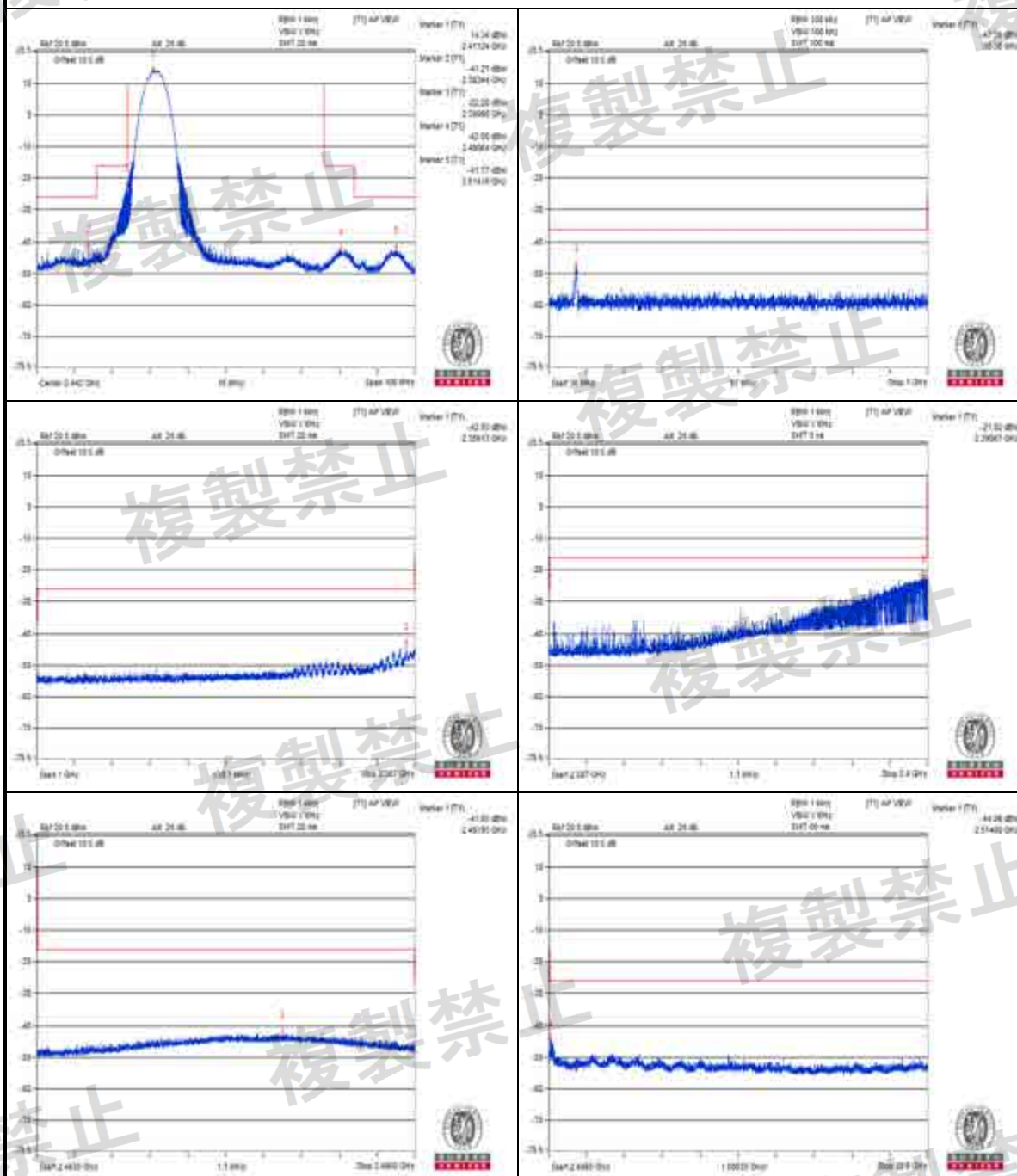
Measurement uncertainty: $\pm 3.93\text{dB}$

V=10%
Channel 13



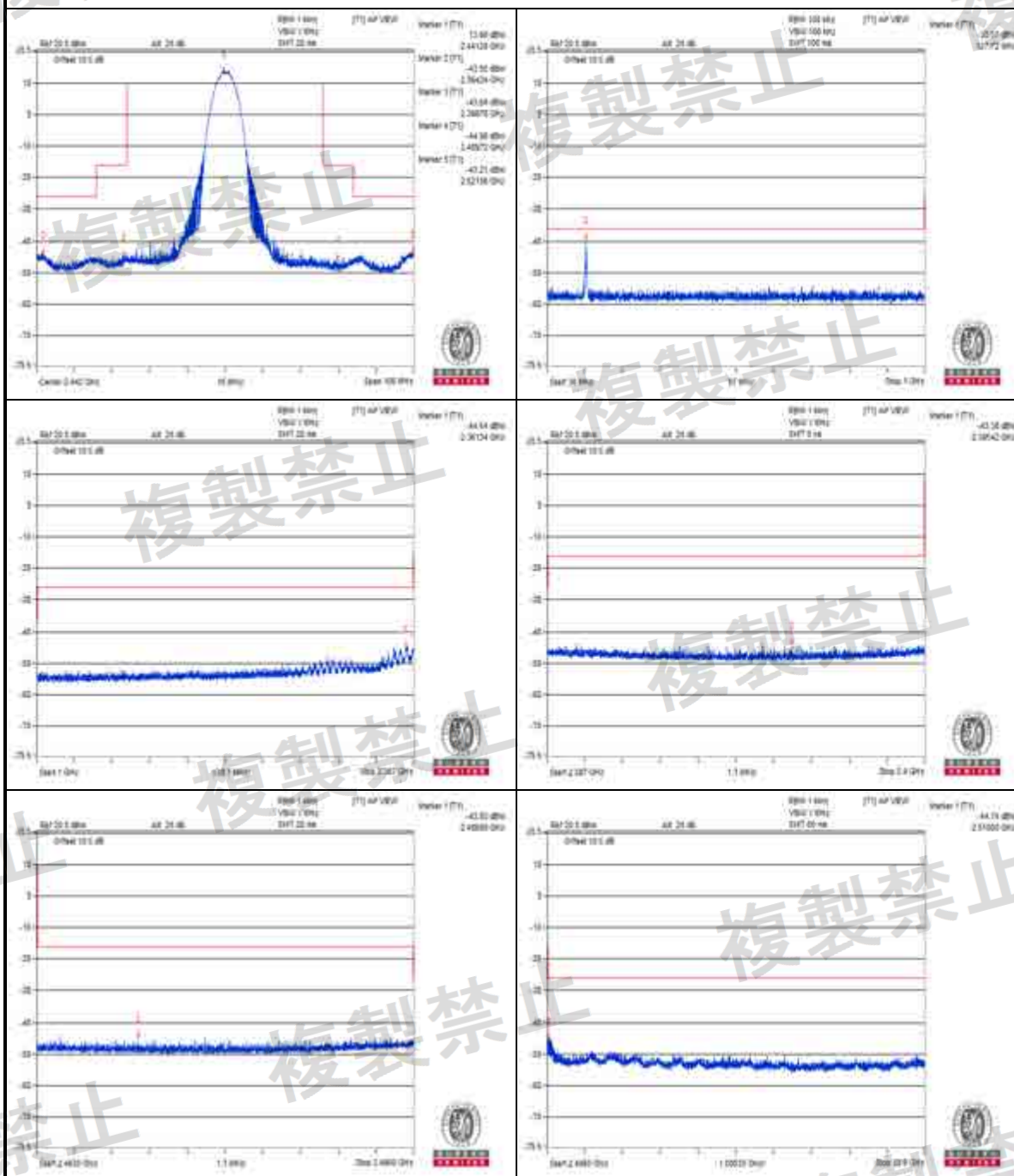
Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 1



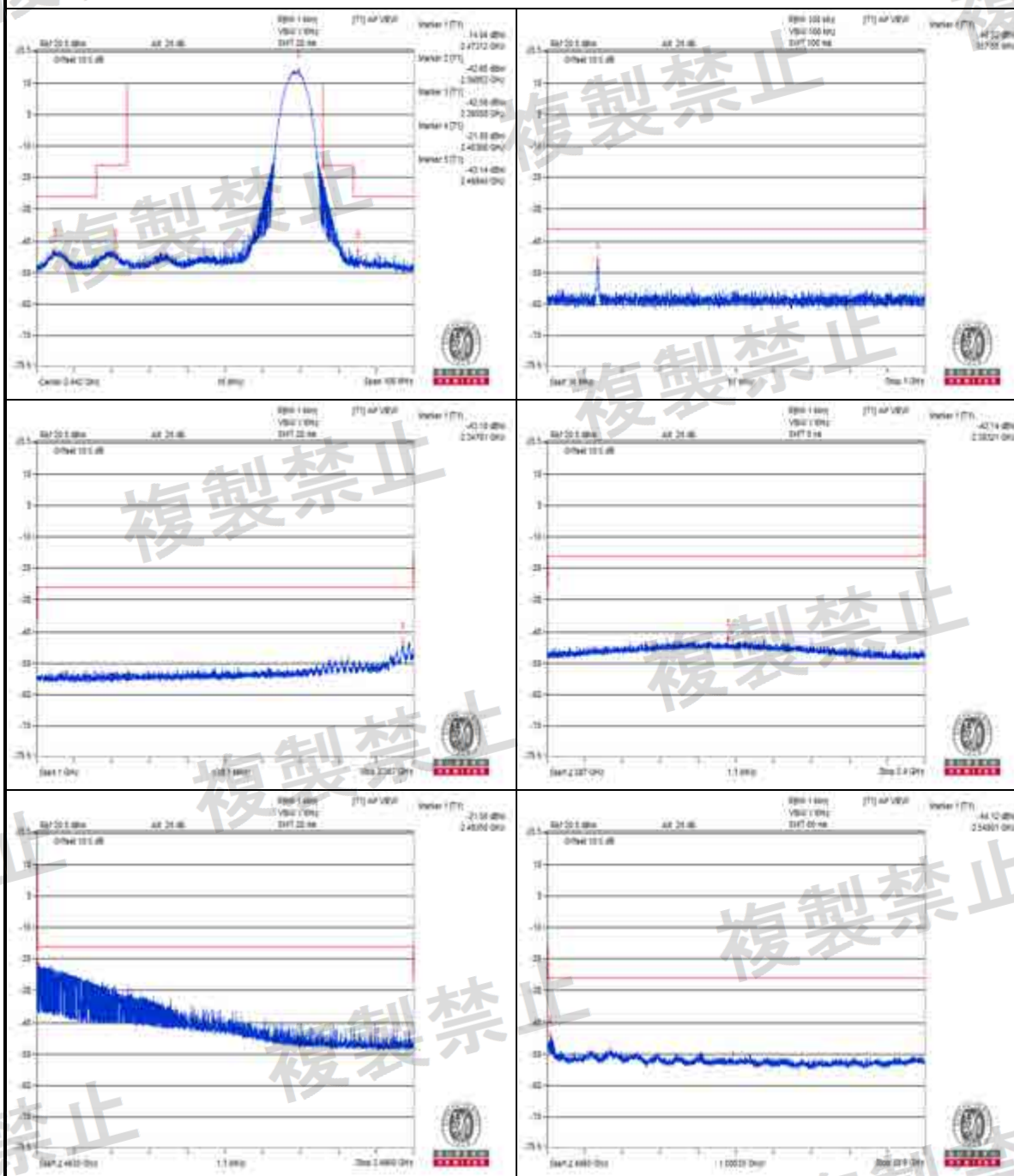
Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 7



Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 13



Measurement uncertainty: $\pm 3.93\text{dB}$



802.11g

Environmental Conditions		25 deg.C, 60 % RH					
Test Channel		Ch 1 (2412 MHz)		Ch 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	97.170	0.024547uW	126.030	0.013677uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2387.000	0.090991uW	2365.500	0.026546uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2400.000	19.186687uW	2399.660	0.039902uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2489.440	0.05781uW	2490.220	0.032961uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2536.510	0.024099uW	2511.500	0.022336uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	97.170	0.016904uW	127.240	0.020749uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2379.020	0.11324uW	2361.680	0.024266uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.960	17.060824uW	2391.790	0.033884uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2493.320	0.04256uW	2487.630	0.030761uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2539.010	0.025061uW	2524.000	0.029444uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	97.650	0.014555uW	126.030	0.014223uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2386.650	0.064417uW	2356.830	0.028379uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.980	16.86553uW	2399.940	0.039628uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2488.130	0.046345uW	2488.180	0.028379uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2529.010	0.025527uW	2559.020	0.022909uW	2.5uW / MHz	Pass

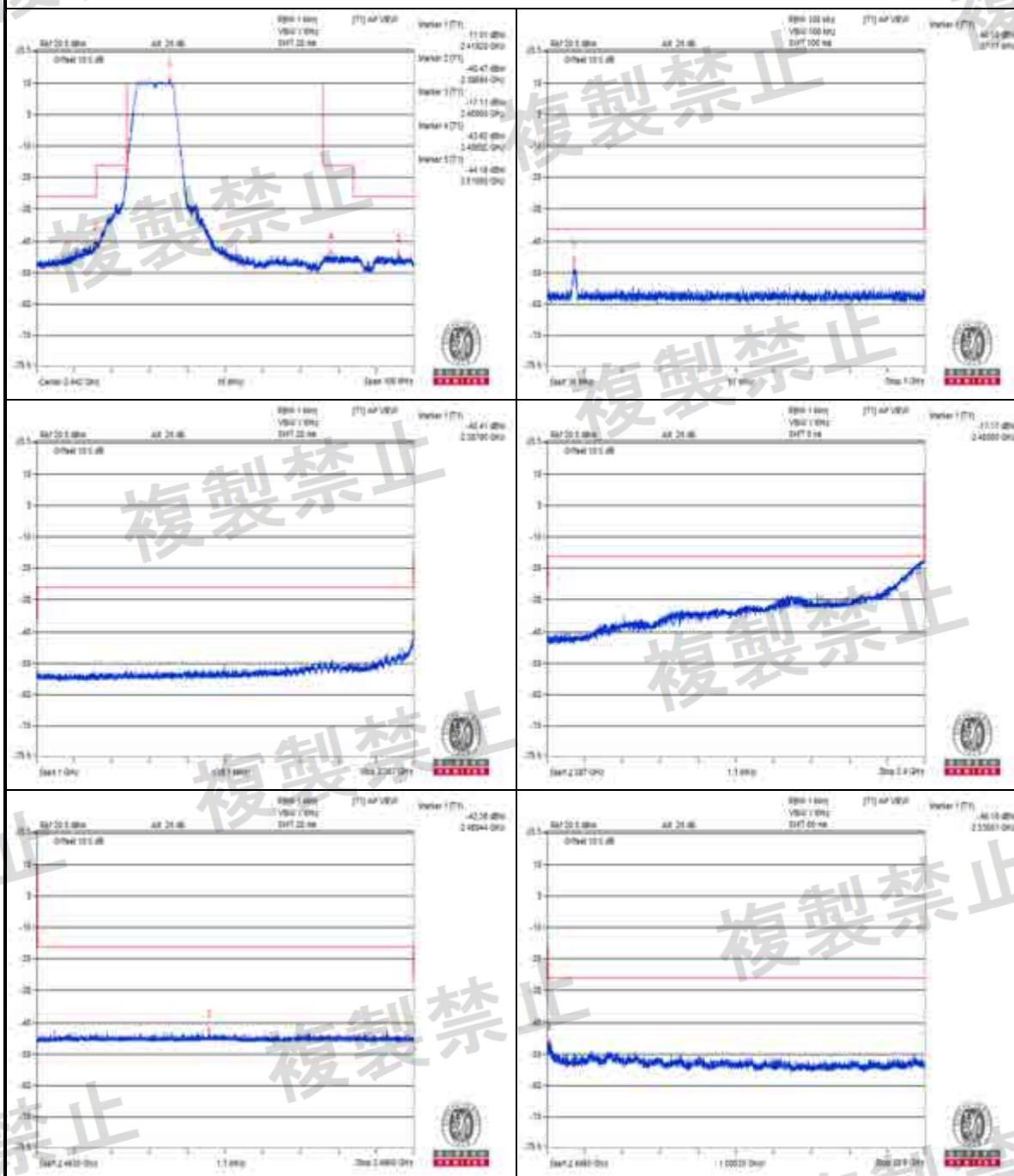


Environmental Conditions		25 deg.C, 60 % RH			
Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	157.790	0.016866uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2373.470	0.047534uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2388.350	0.065013uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.500	21.978599uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2499.000	0.041976uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	156.340	0.012618uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2375.900	0.062373uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.520	0.074302uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.500	21.28139uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2496.500	0.03062uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	157.310	0.015812uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2374.510	0.048195uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2396.680	0.066527uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.530	20.941125uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2496.500	0.048084uW	2.5uW / MHz	Pass

Note:

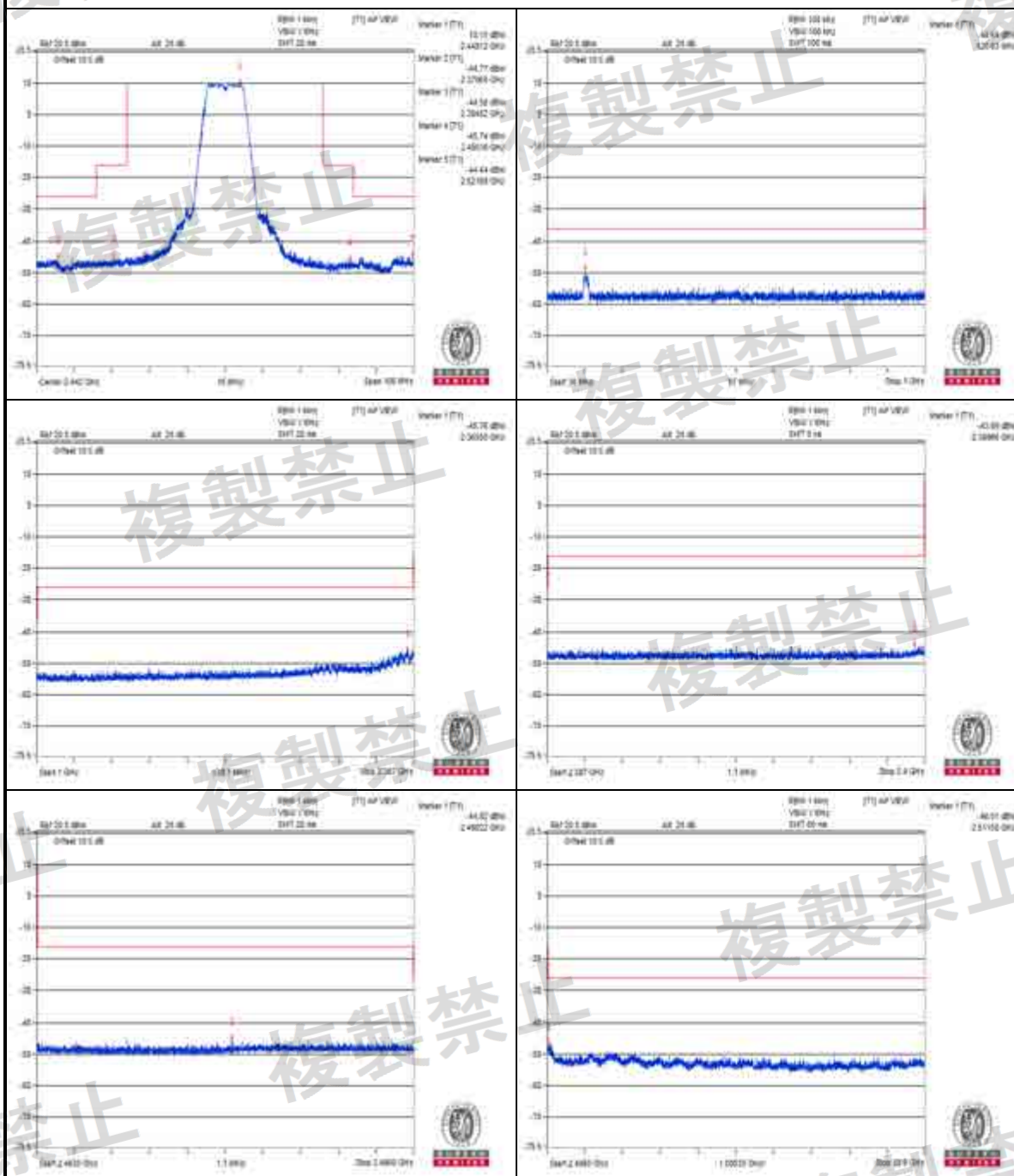
1. The worst value in each frequency range v.s. each channel has been marked by boldface.
2. The spectrum plots are attached on the following pages.

V_{normal}
Channel 1



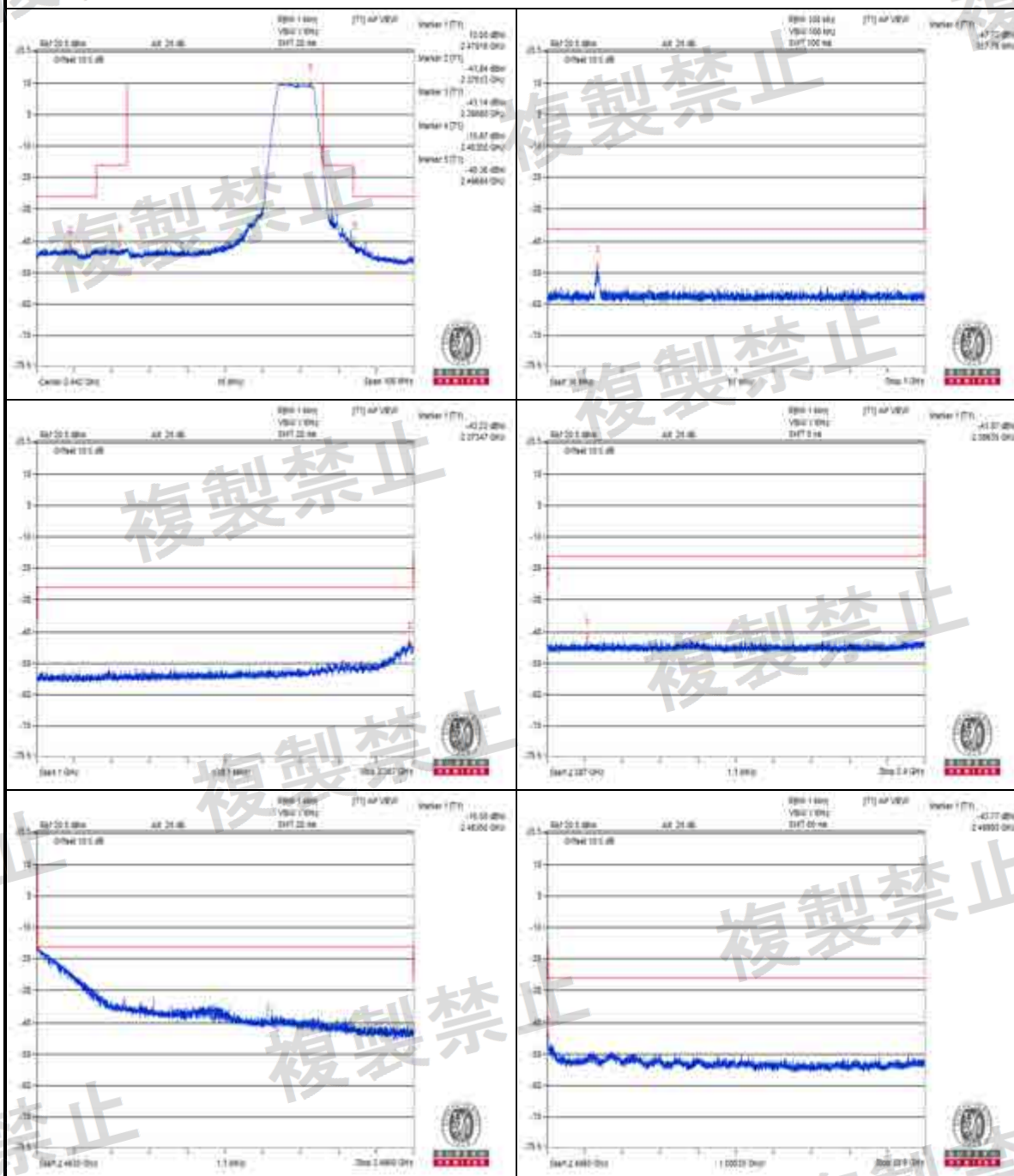
Measurement uncertainty: $\pm 3.93\text{dB}$

V_{normal}
Channel 7



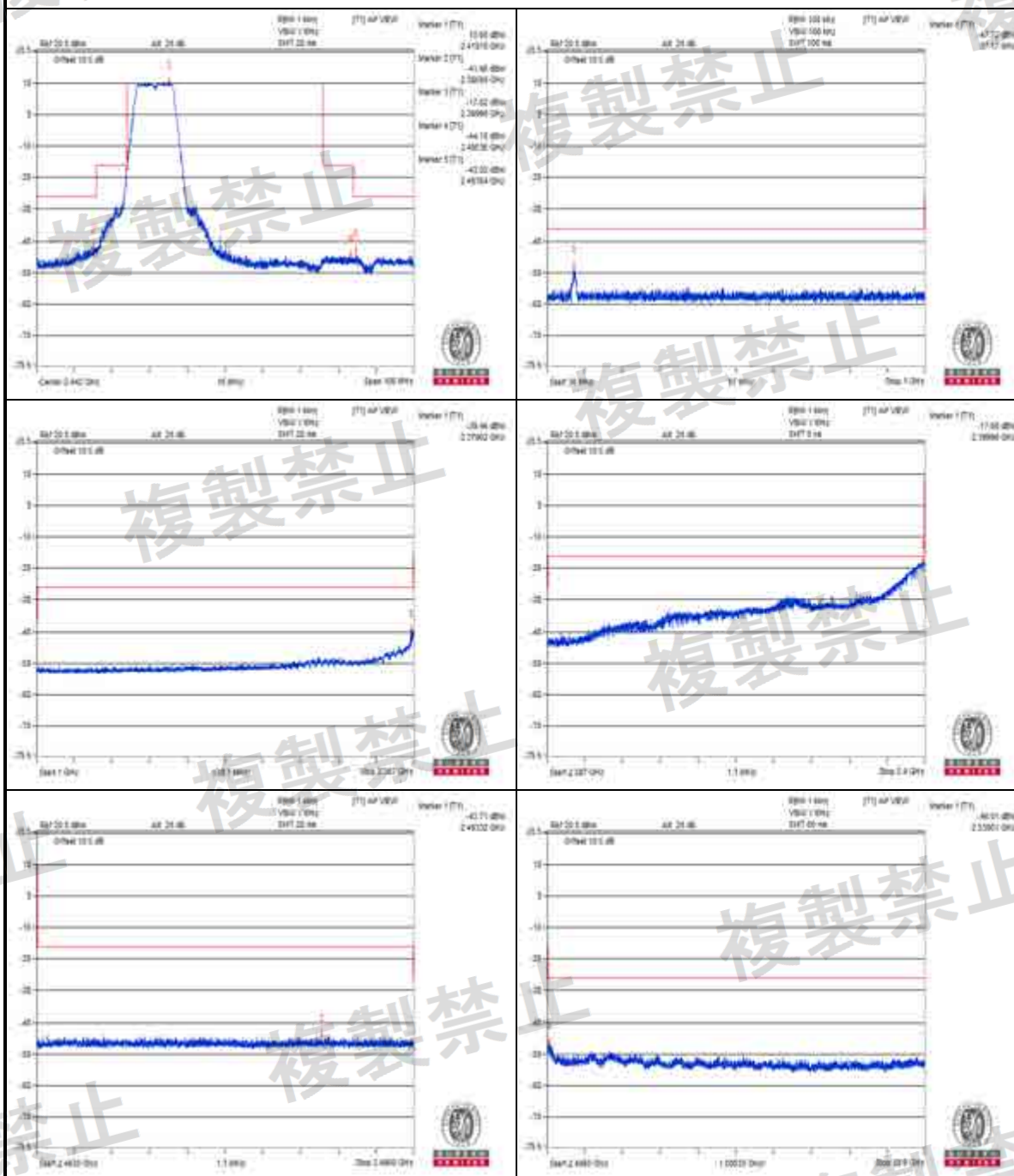
Measurement uncertainty: $\pm 3.93\text{dB}$

V_{normal}
Channel 13



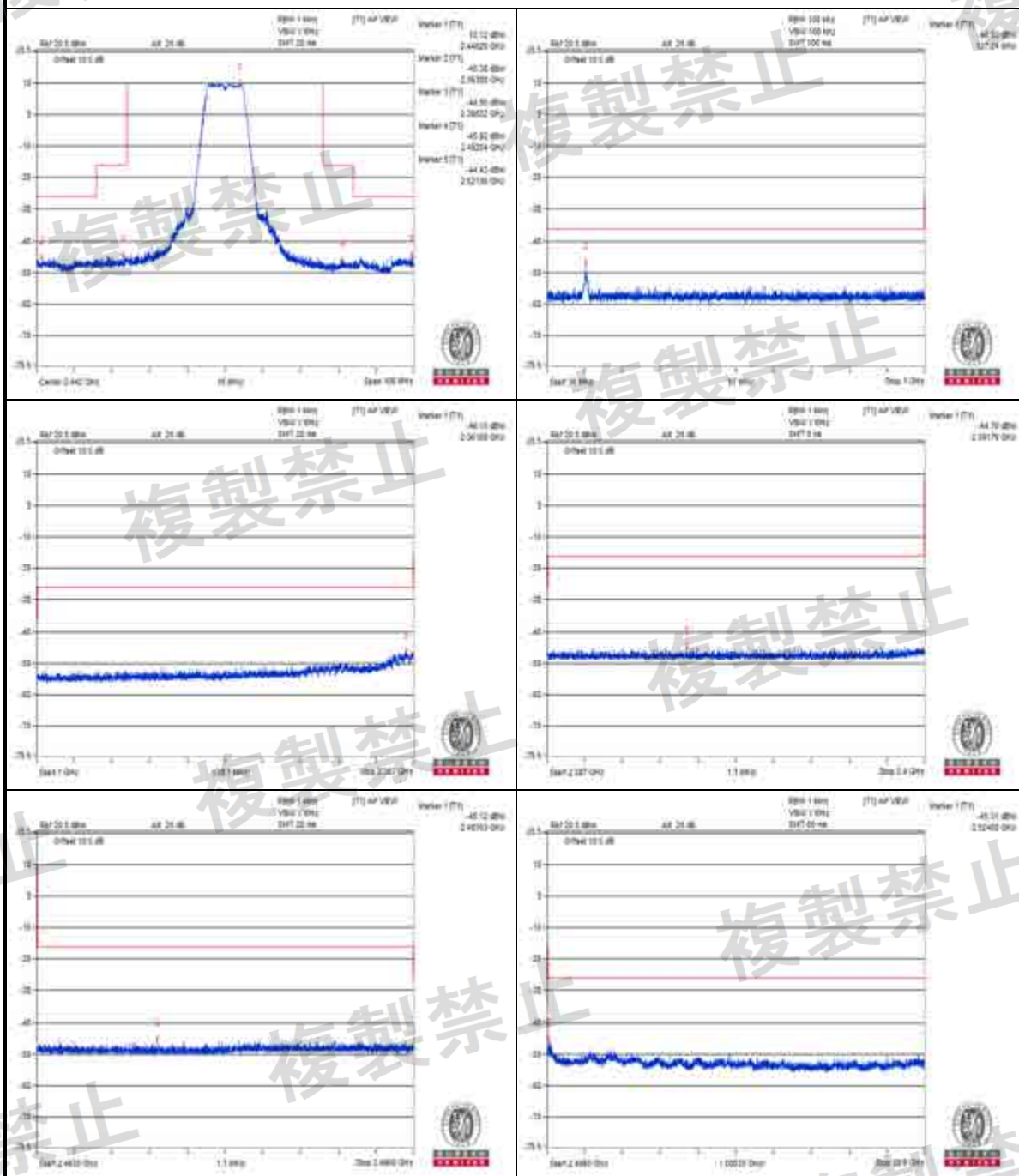
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 1



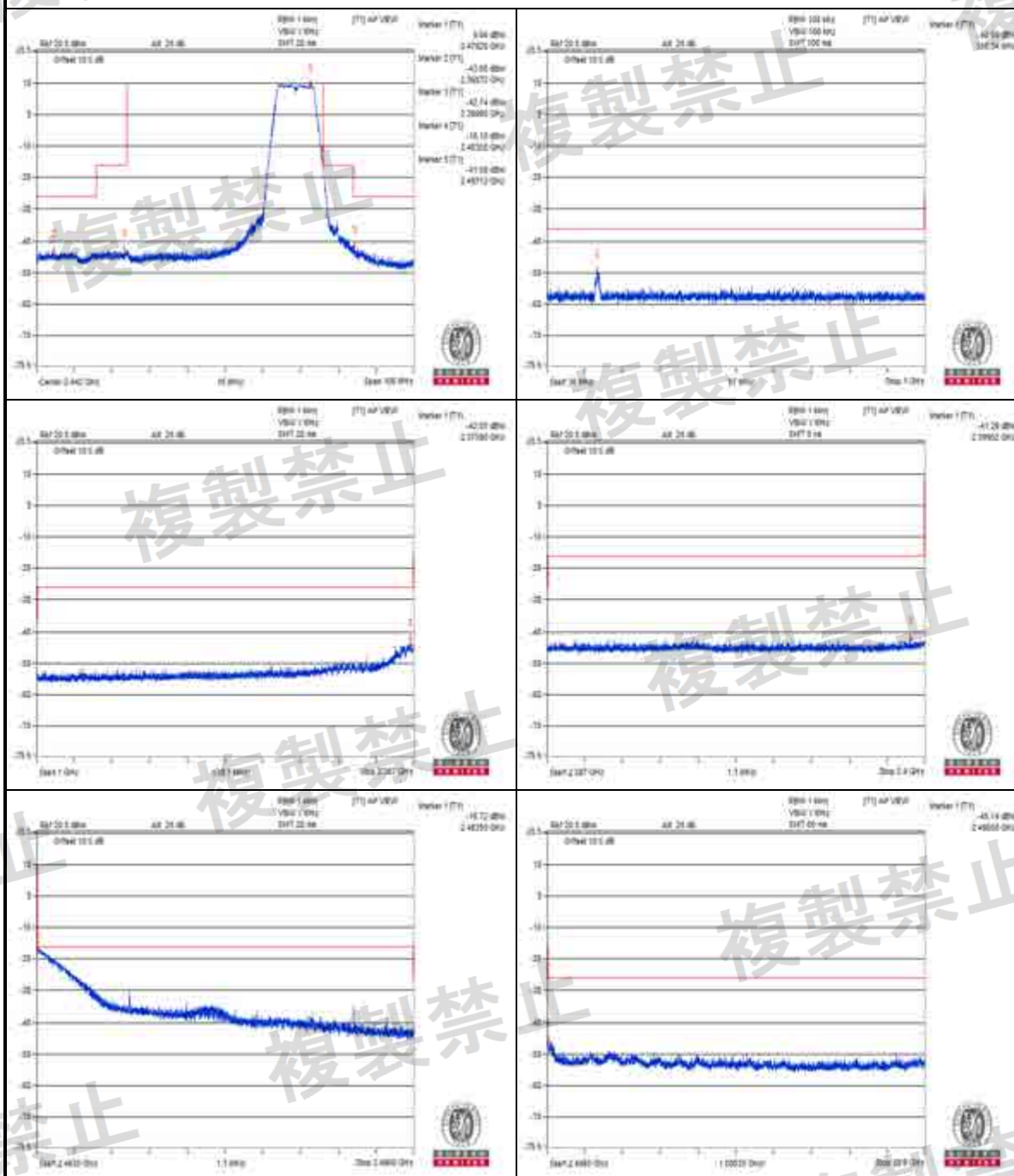
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 7



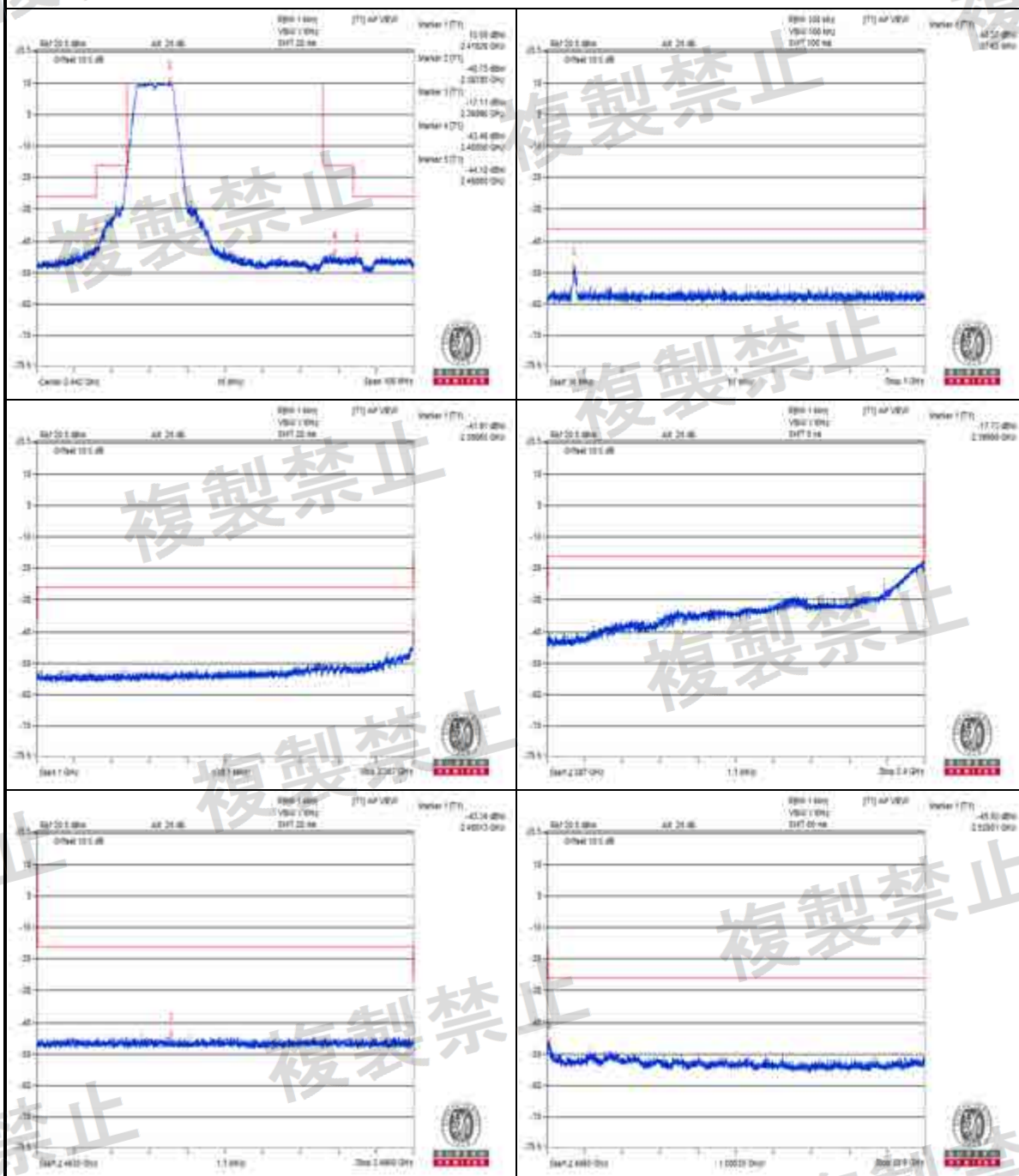
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 13



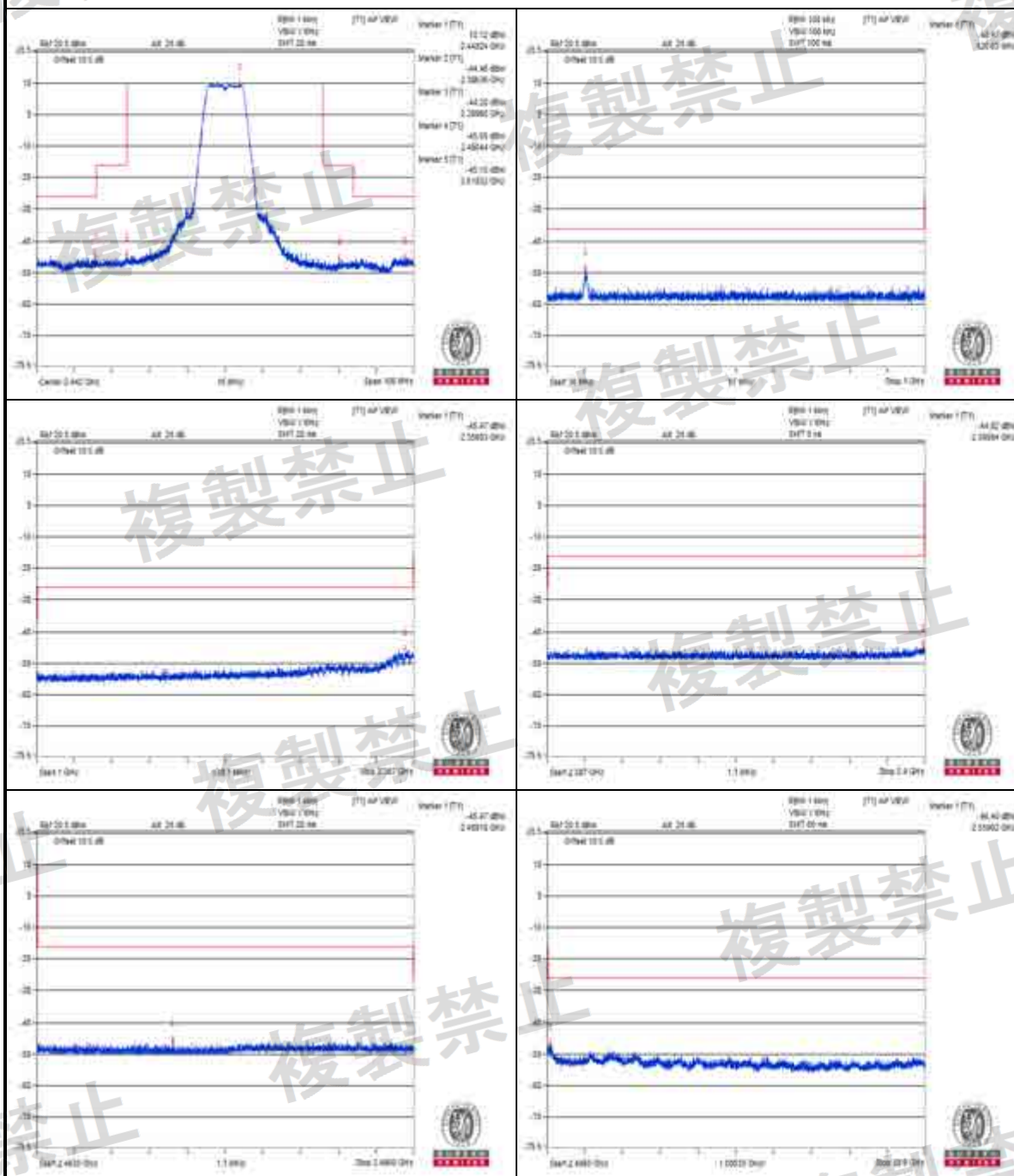
Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 1



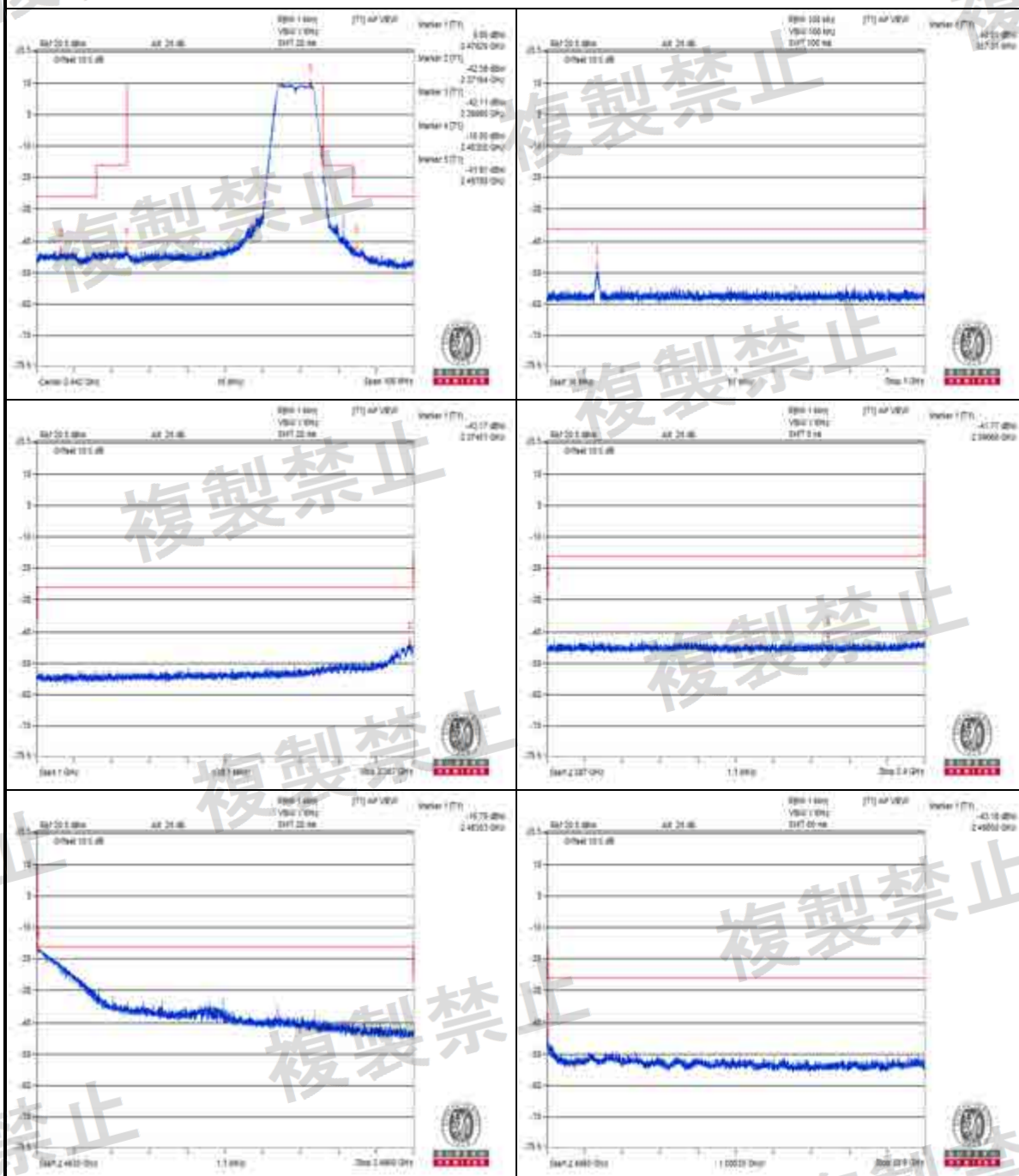
Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 7



Measurement uncertainty: $\pm 3.93\text{dB}$

V_{10%}
Channel 13



Measurement uncertainty: $\pm 3.93\text{dB}$



802.11n (HT20)

Environmental Conditions		25 deg.C, 60 % RH					
Test Channel		Ch 1 (2412 MHz)		Ch 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	98.140	0.010399uW	125.300	0.008299uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2380.410	0.070958uW	2383.870	0.025823uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.960	14.28894uW	2399.430	0.040272uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2484.850	0.039811uW	2483.550	0.044361uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2499.000	0.025235uW	2514.000	0.027861uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	95.230	0.010423uW	127.240	0.007925uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2370.000	0.071614uW	2370.700	0.023988uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2400.000	14.256076uW	2399.530	0.050933uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2493.190	0.042462uW	2484.560	0.053827uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2496.500	0.026915uW	2561.520	0.022233uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	99.350	0.009268uW	126.750	0.009183uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2384.910	0.069823uW	2345.040	0.023227uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2399.980	14.092888uW	2399.930	0.033963uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2492.910	0.040365uW	2484.110	0.052602uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2559.020	0.021928uW	2571.520	0.018707uW	2.5uW / MHz	Pass



Environmental Conditions		25 deg.C, 60 % RH			
Test Channel		Ch 13 (2472 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V _{normal}	30.0 MHz to 1000.0 MHz	156.820	0.011429uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2365.150	0.052uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2389.160	0.063826uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.500	Note 3	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2499.000	0.081283uW	2.5uW / MHz	Pass
V _{+10%}	30.0 MHz to 1000.0 MHz	156.100	0.008851uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2375.900	0.045709uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2391.640	0.055335uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.530	Note 3	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2496.500	0.039174uW	2.5uW / MHz	Pass
V _{-10%}	30.0 MHz to 1000.0 MHz	155.370	0.007145uW	0.25uW / 100kHz	Pass
	1000.0 MHz to 2387.0 MHz	2369.660	0.046989uW	2.5uW / MHz	Pass
	2387.0 MHz to 2400.0 MHz	2398.950	0.068077uW	25uW / MHz	Pass
	2483.5 MHz to 2496.5 MHz	2483.510	25.003454uW	25uW / MHz	Pass
	2496.5 MHz to 12500.0 MHz	2501.500	0.062087uW	2.5uW / MHz	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.

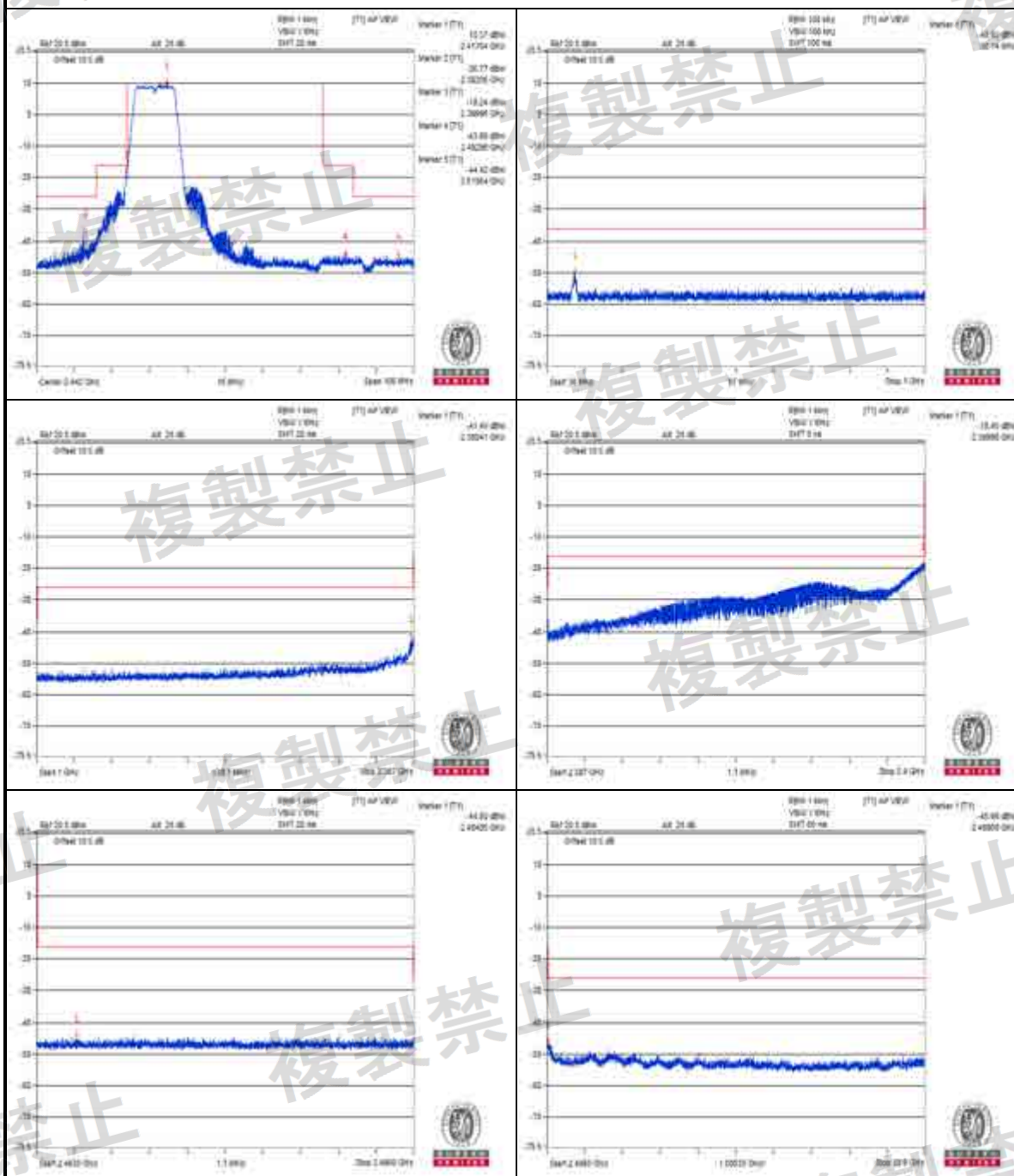


3. Take the value of total data point (501 points) and calculate the total power.

Divides total power by 501 data point to get the average value.

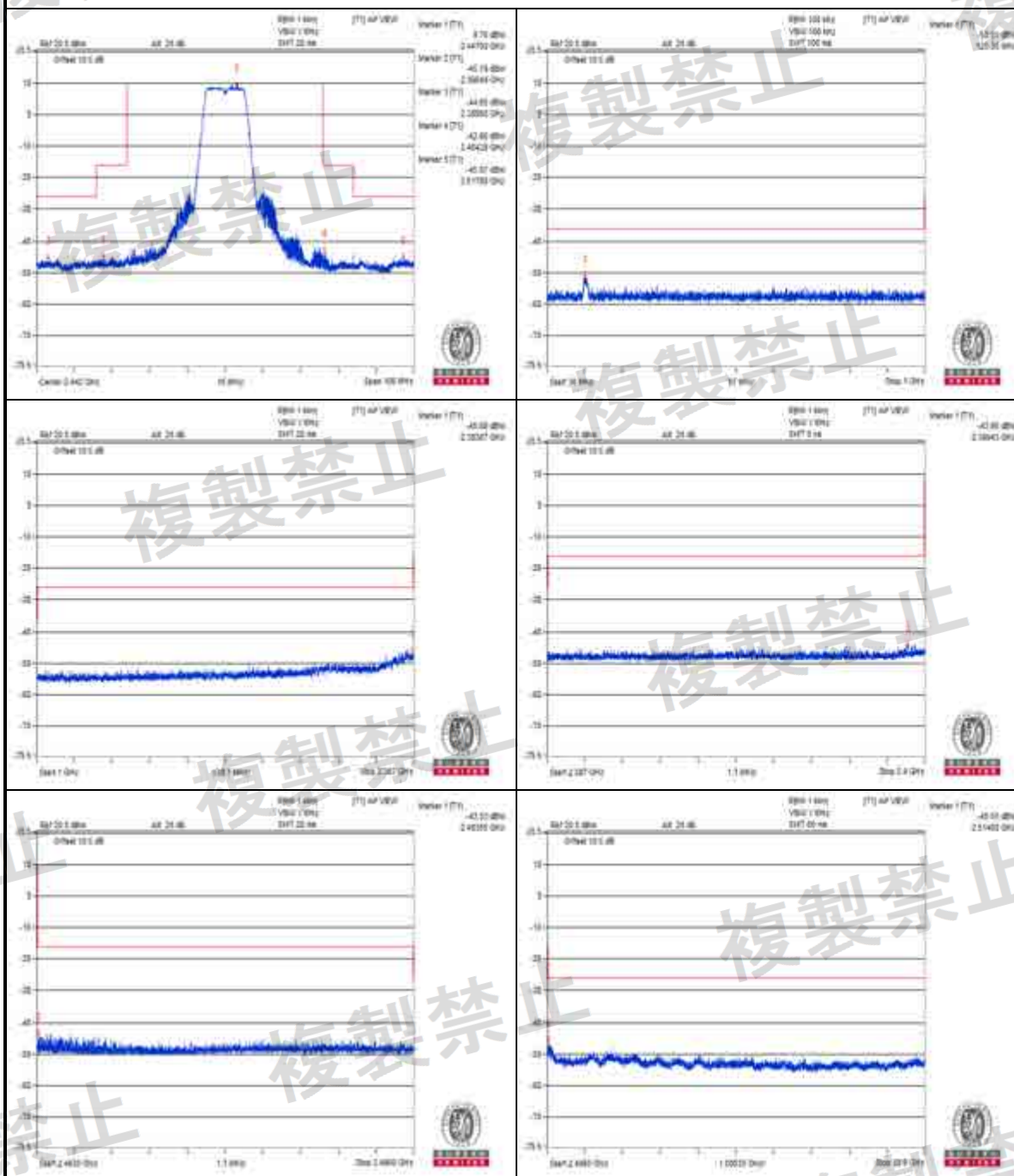
Test Condition	Max power / Zero span (dBm)	Average power (dBm)	Average power (mW)
Ch 13			
V _{normal}	-28.15	-33.229175	0.475426
V _{+10%}	-26.54	-33.255122	0.472594

V_{normal}
Channel 1



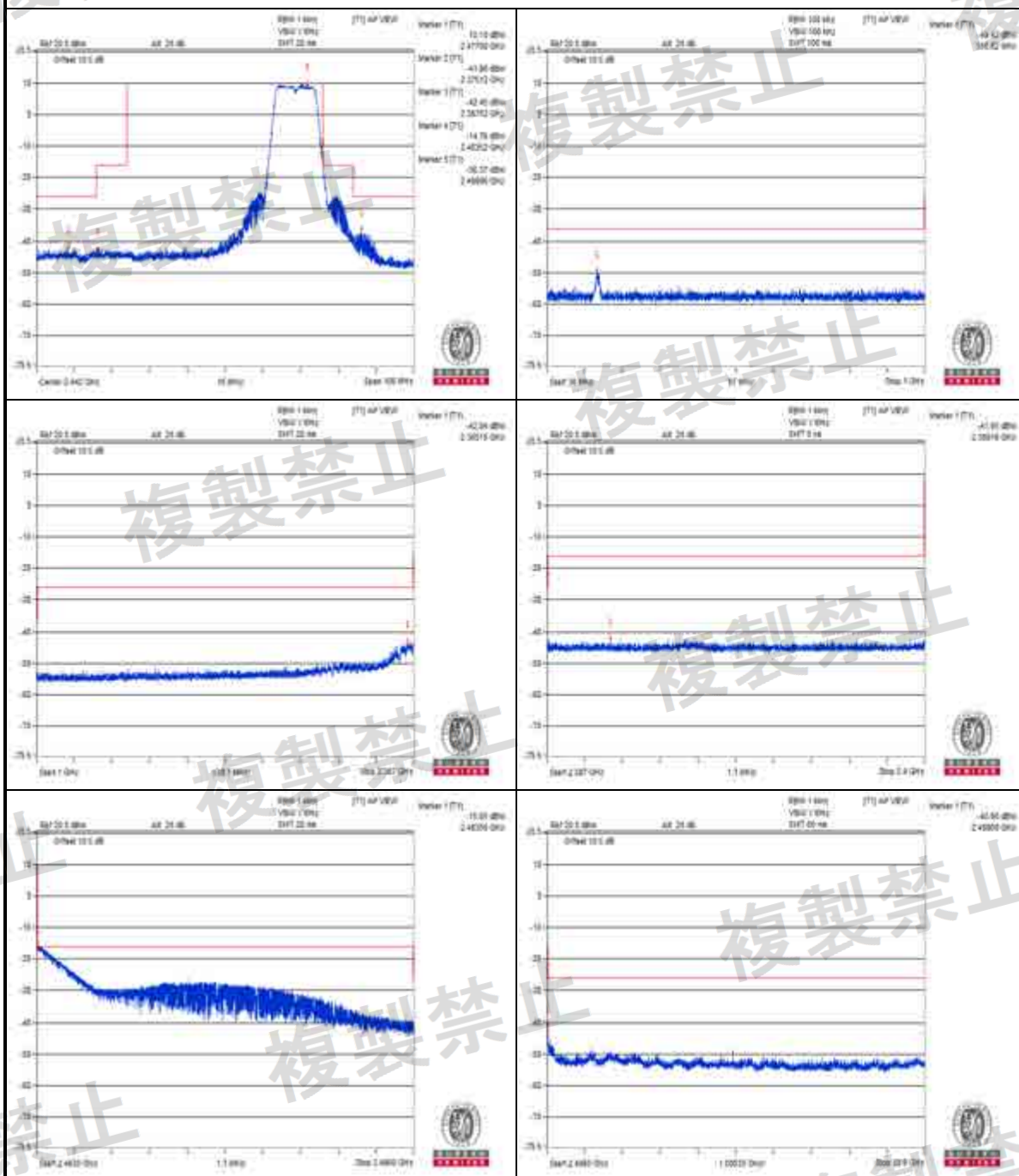
Measurement uncertainty: $\pm 3.93\text{dB}$

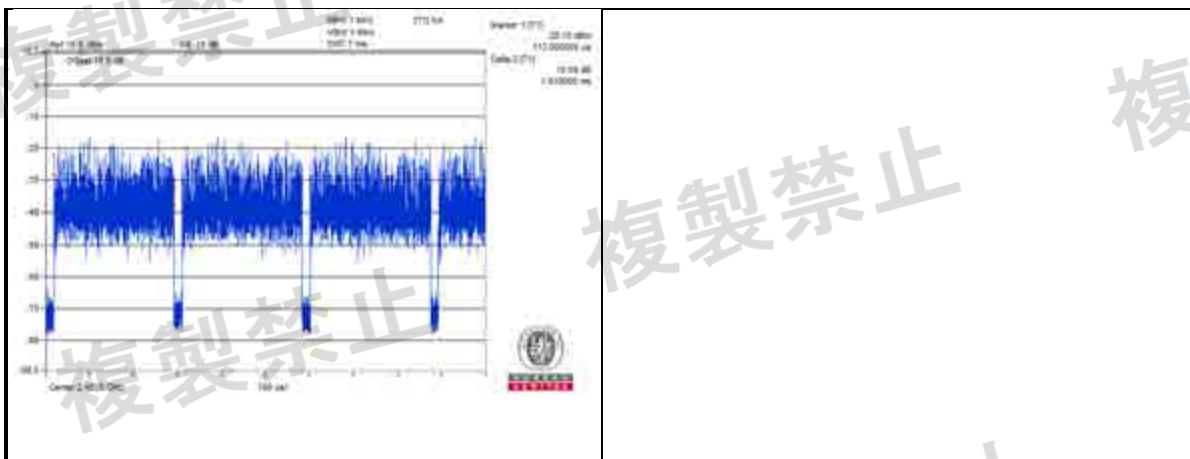
V_{normal}
Channel 7



Measurement uncertainty: $\pm 3.93\text{dB}$

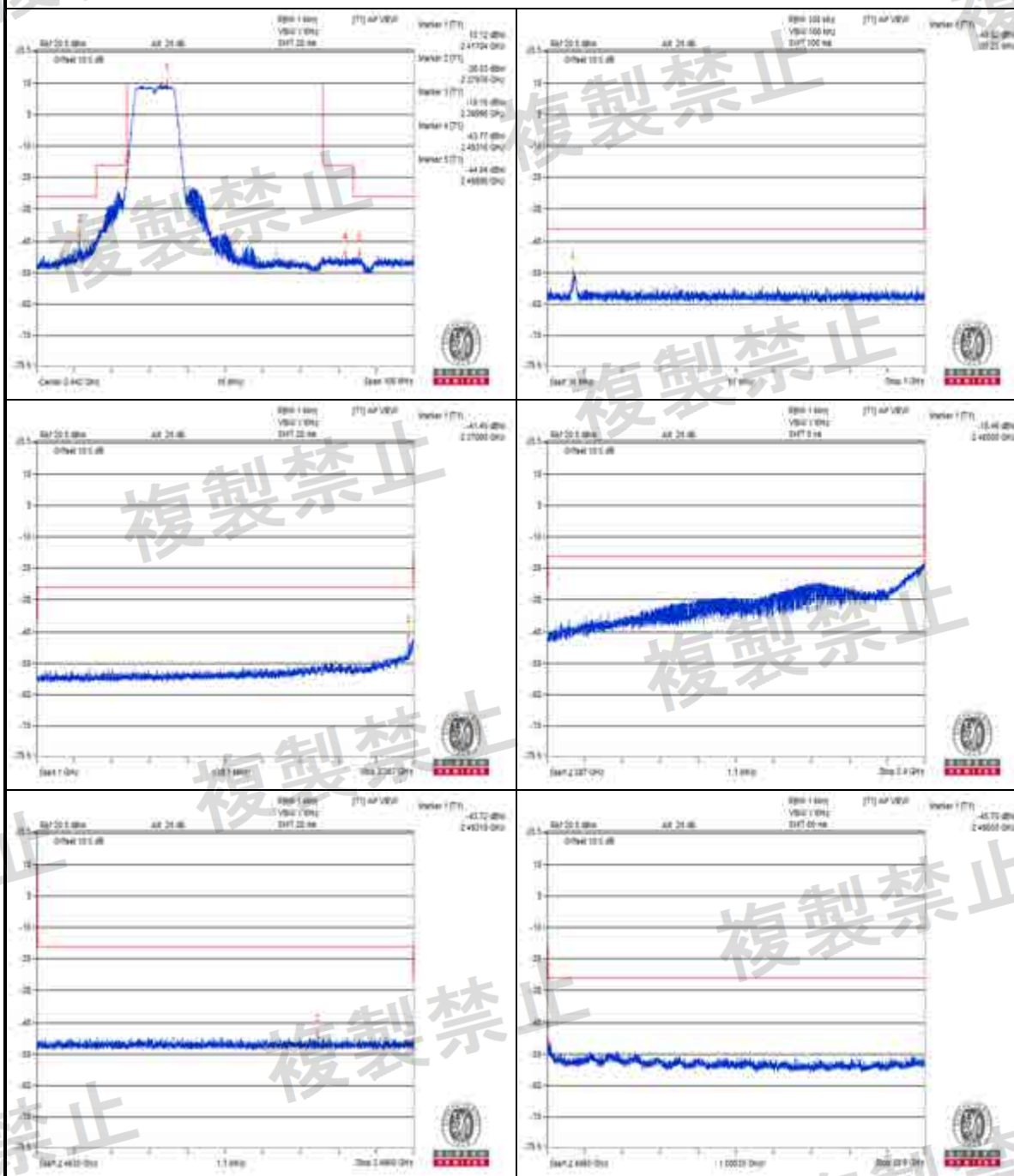
V_{normal}
Channel 13





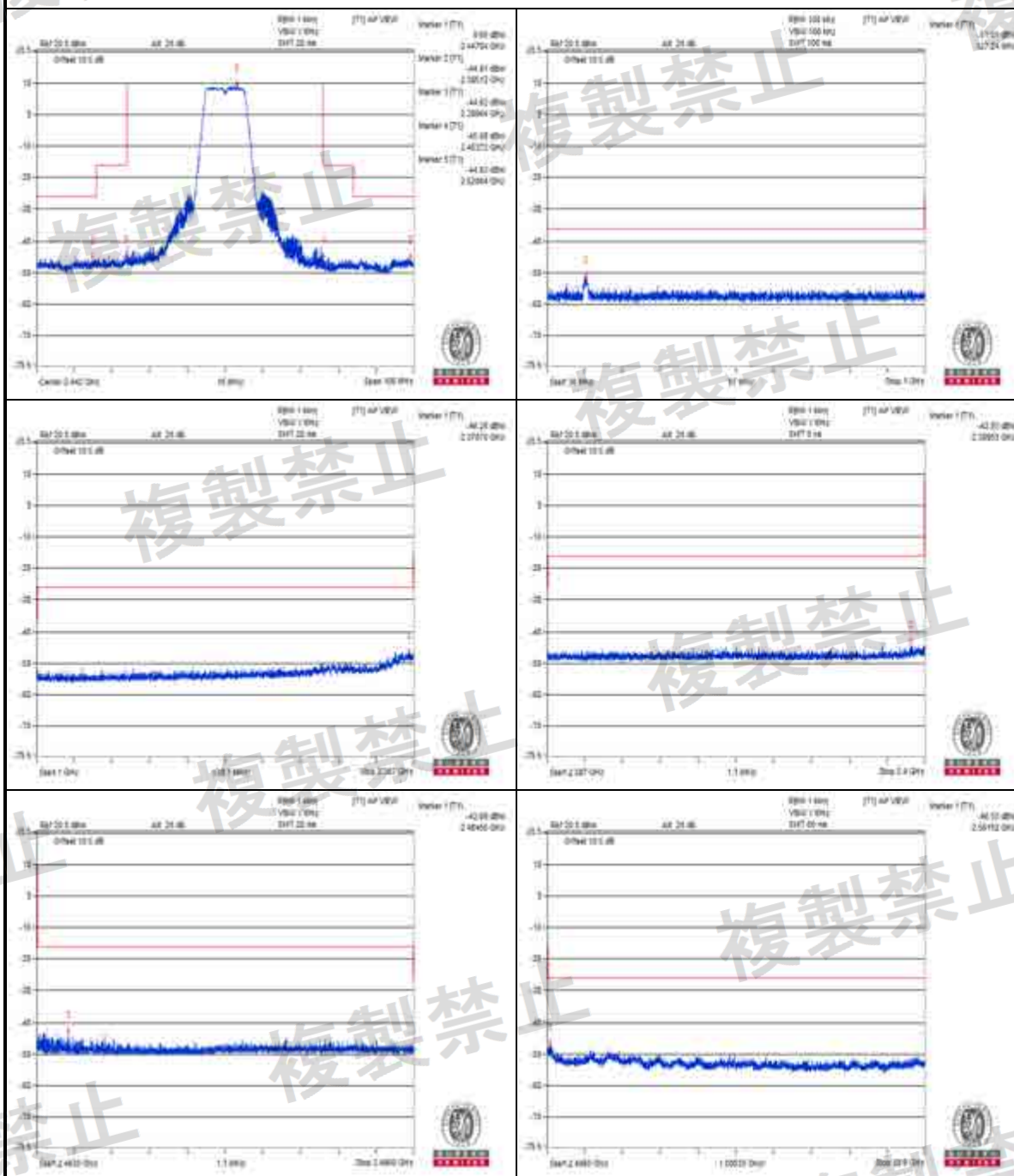
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 1



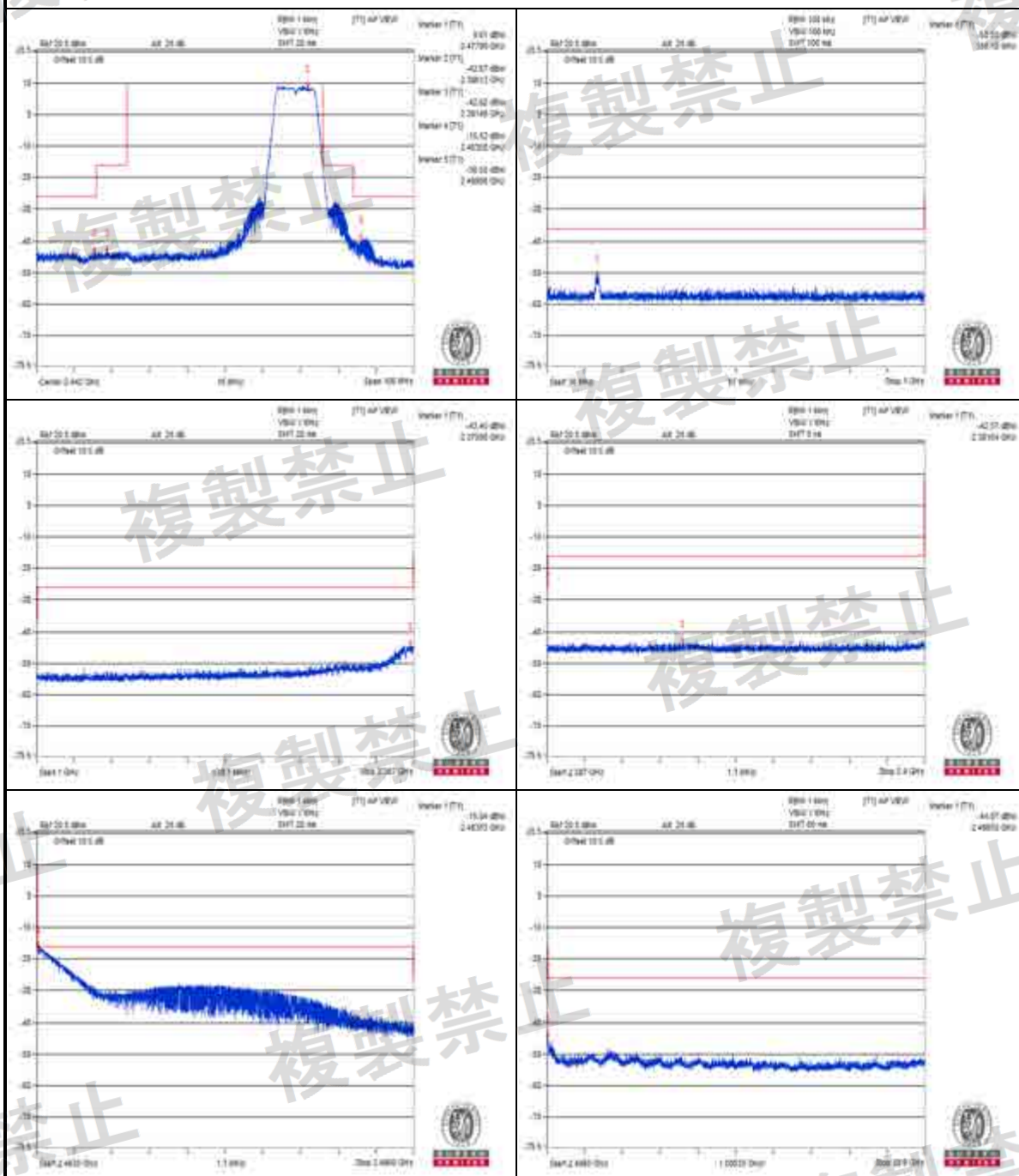
Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 7

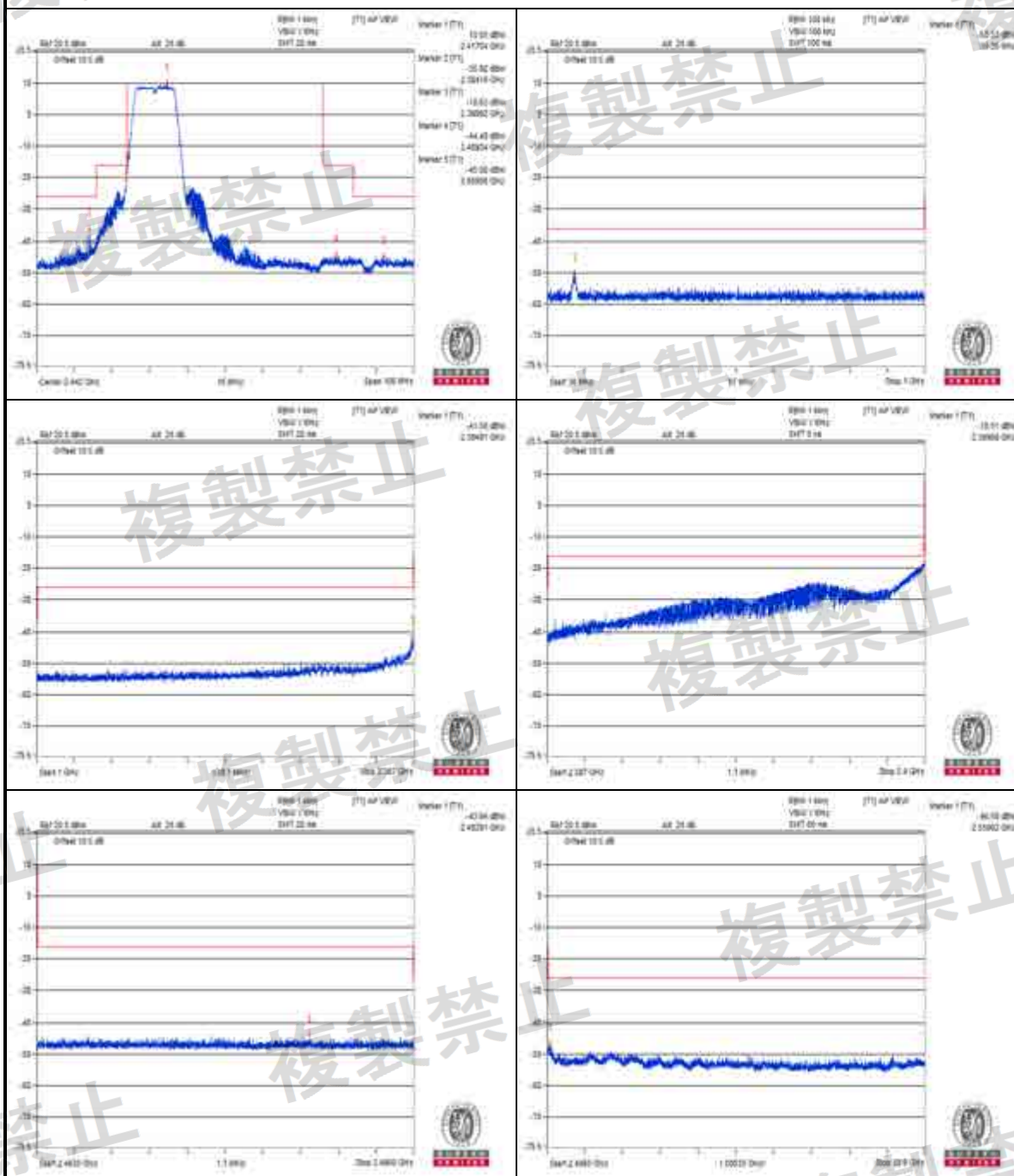


Measurement uncertainty: $\pm 3.93\text{dB}$

V+10%
Channel 13

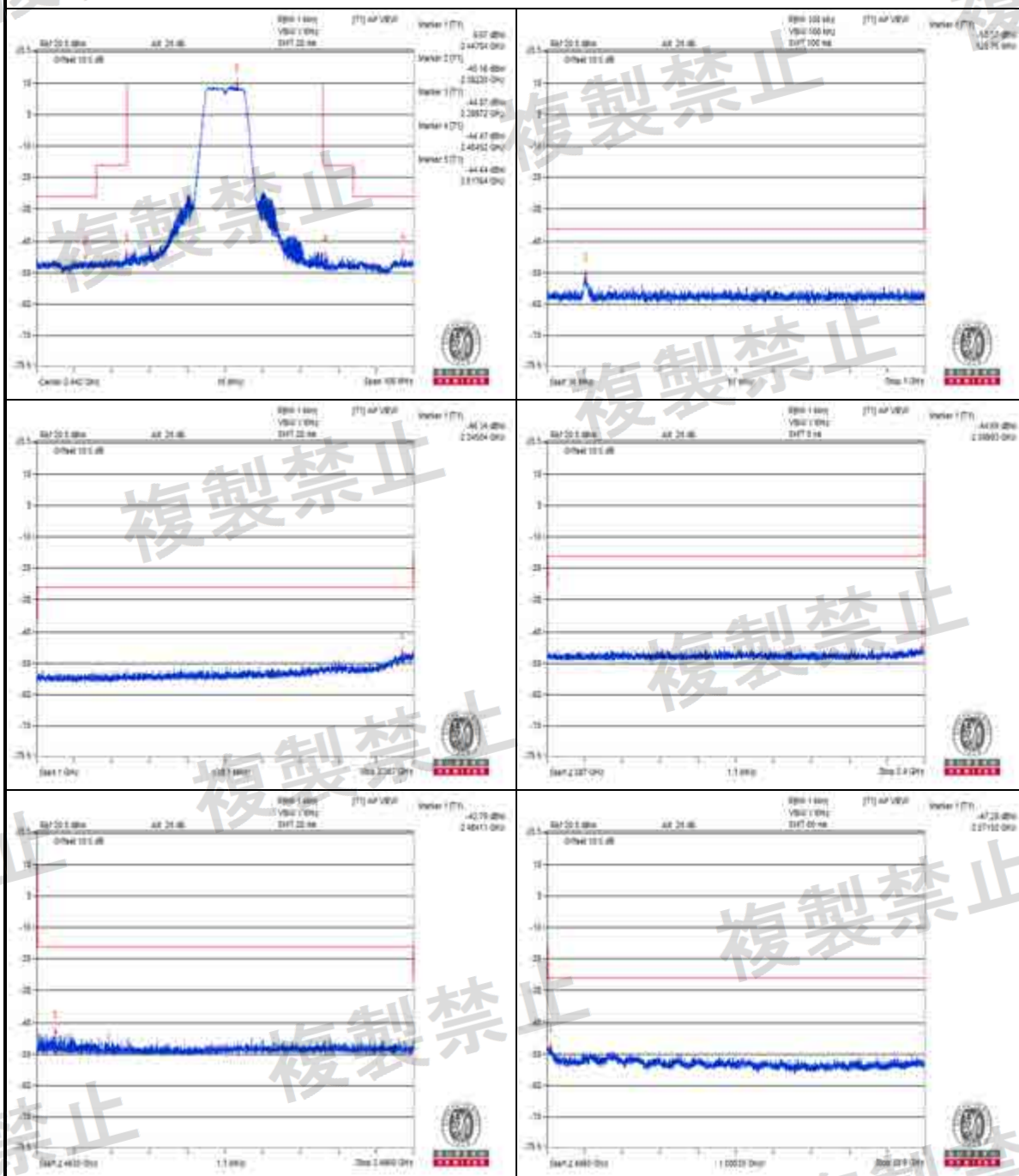


V-10%
Channel 1



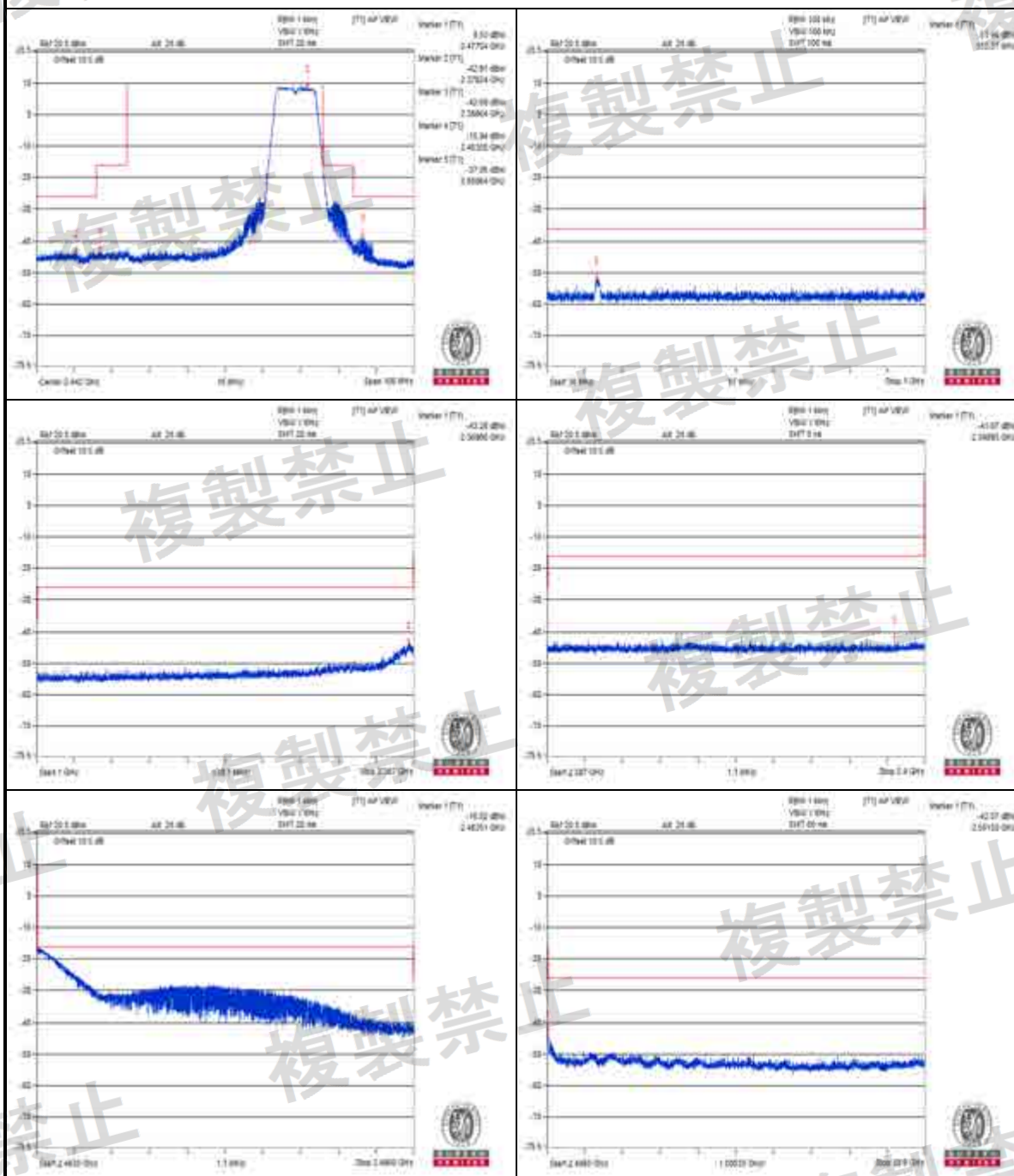
Measurement uncertainty: $\pm 3.93\text{dB}$

V-10%
Channel 7



Measurement uncertainty: $\pm 3.93\text{dB}$

V_{10%}
Channel 13



Measurement uncertainty: $\pm 3.93\text{dB}$

4.5 Antenna Power Measurement

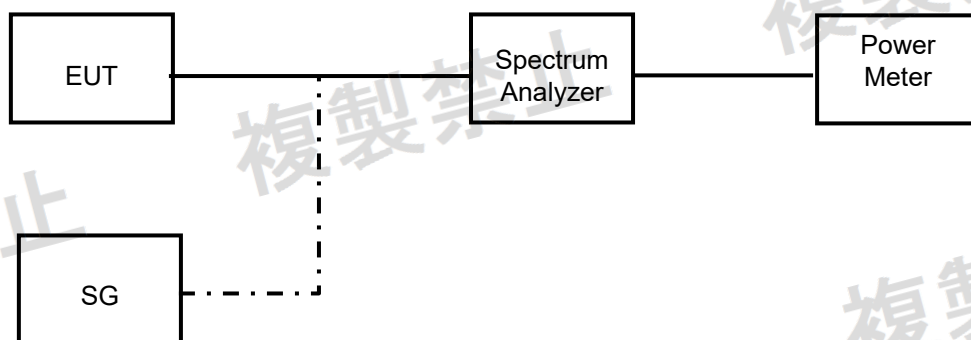
4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni-Directional Case	Directional Case
DS	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 1)	2400 – 2483.5 MHz	10mW/MHz	12.14 dBm/MHz (16.368 mW/MHz)	22.14 dBm/MHz (163.68 mW/MHz)
OFDM (Note 2)	2400 – 2483.5 MHz	5mW/MHz	9.14 dBm/MHz (8.20 mW/MHz)	19.14 dBm/MHz (82.04 mW/MHz)

Note:

1. Occupied bandwidth is less than 26 MHz
2. Occupied bandwidth is more than 26 MHz and less than 38 MHz
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).

4.5.2 Test Setup





4.5.3 Test Results

802.11b

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	7.00	6.78	6.84	10
V _{+10%}	6.97	6.73	6.78	10
V _{-10%}	6.98	6.75	6.81	10
Rated Power	7.00			
Tolerance of Antenna Power	1.4 ~ 8.4			

Note: Output power tolerance (%) = $(7.00 - 7.00) / 7.00 \times 100 = 0$ (%)

PCB antenna with 2.0 dBi gain

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	11.09	10.74	10.84	16.368
V _{+10%}	11.04	10.67	10.74	16.368
V _{-10%}	11.07	10.69	10.79	16.368

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

2. Formula: Radiated RF output power density = Conducted RF output power density + Antenna Gain.



802.11g

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	2.46	2.36	2.32	10
V _{+10%}	2.44	2.35	2.30	10
V _{-10%}	2.44	2.36	2.30	10
Rated Power	2.50			
Tolerance of Antenna Power	0.5 ~ 3.0			

Note: Output power tolerance (%) = $(2.46 - 2.50) / 2.50 \times 100 = -1.6$ (%)

PCB antenna with 2.0 dBi gain

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	3.90	3.74	3.67	16.368
V _{+10%}	3.86	3.72	3.64	16.368
V _{-10%}	3.87	3.73	3.65	16.368

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

2. Formula: Radiated RF output power density = Conducted RF output power density + Antenna Gain.



802.11n (HT20)

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Conducted RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	1.87	1.71	1.69	10
V _{+10%}	1.85	1.70	1.67	10
V _{-10%}	1.86	1.71	1.66	10
Rated Power	2.00			
Tolerance of Antenna Power	0.4 ~ 2.4			

Note: Output power tolerance (%) = $(3.50 - 2.00) / 2.00 \times 100 = 19.5$ (%)

PCB antenna with 2.0 dBi gain

Environmental Conditions	25 deg.C, 60 % RH			
Test Condition	Radiated RF Output Power Density (mW/MHz)			
	Channel 1 2412 MHz	Channel 7 2442 MHz	Channel 13 2472 MHz	Max. Limit (mW/MHz)
V _{normal}	2.96	2.72	2.67	16.368
V _{+10%}	2.93	2.70	2.65	16.368
V _{-10%}	2.94	2.70	2.64	16.368

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

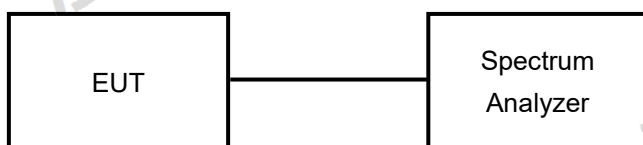
2. Formula: Radiated RF output power density = Conducted RF output power density + Antenna Gain.

4.6 Spurious Emissions for Receiver

4.6.1 Limits of Spurious Emissions for Receiver

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

4.6.2 Test Setup



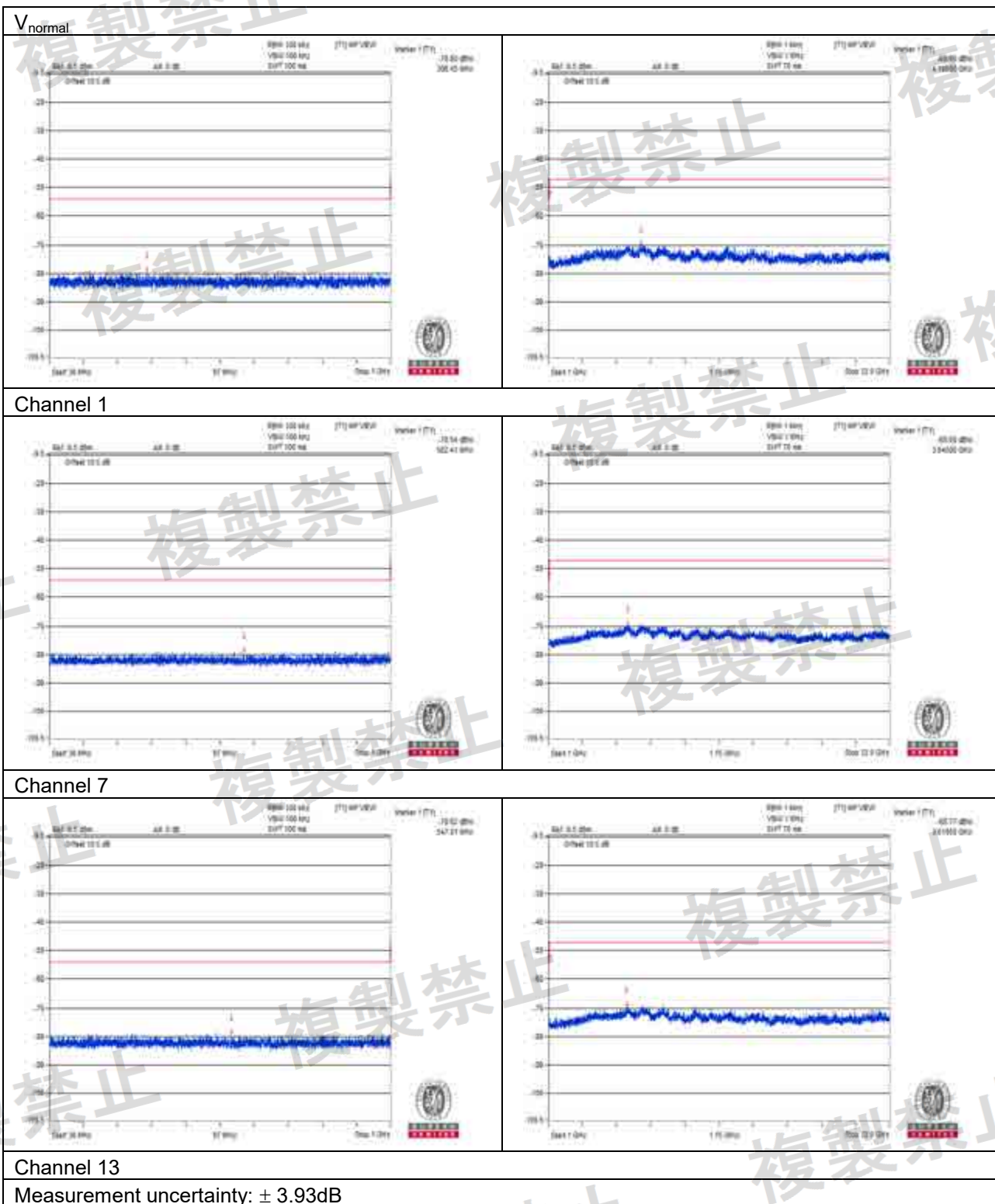
4.6.3 Test Result

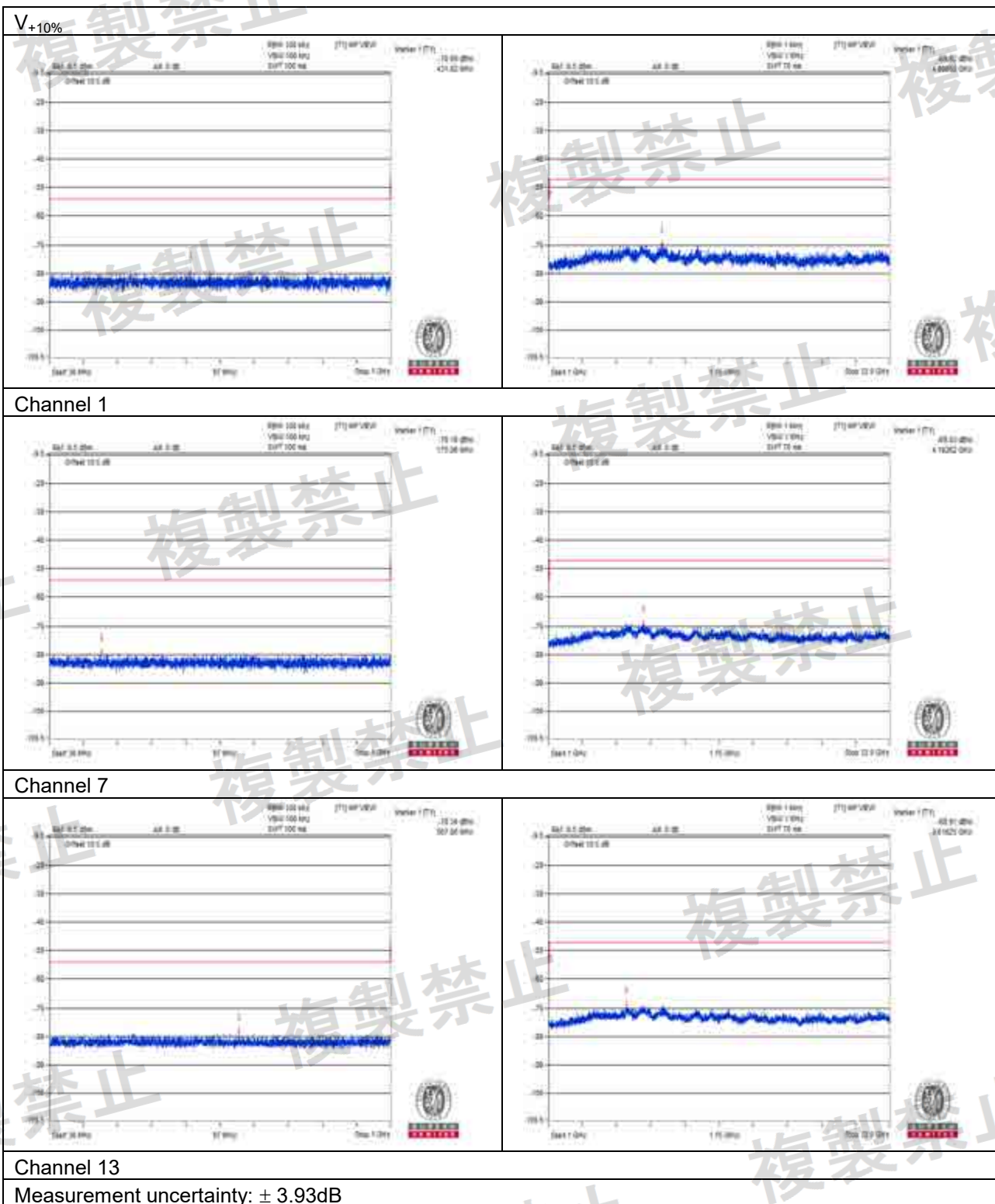
802.11b / 802.11g and 802.11n (HT20)

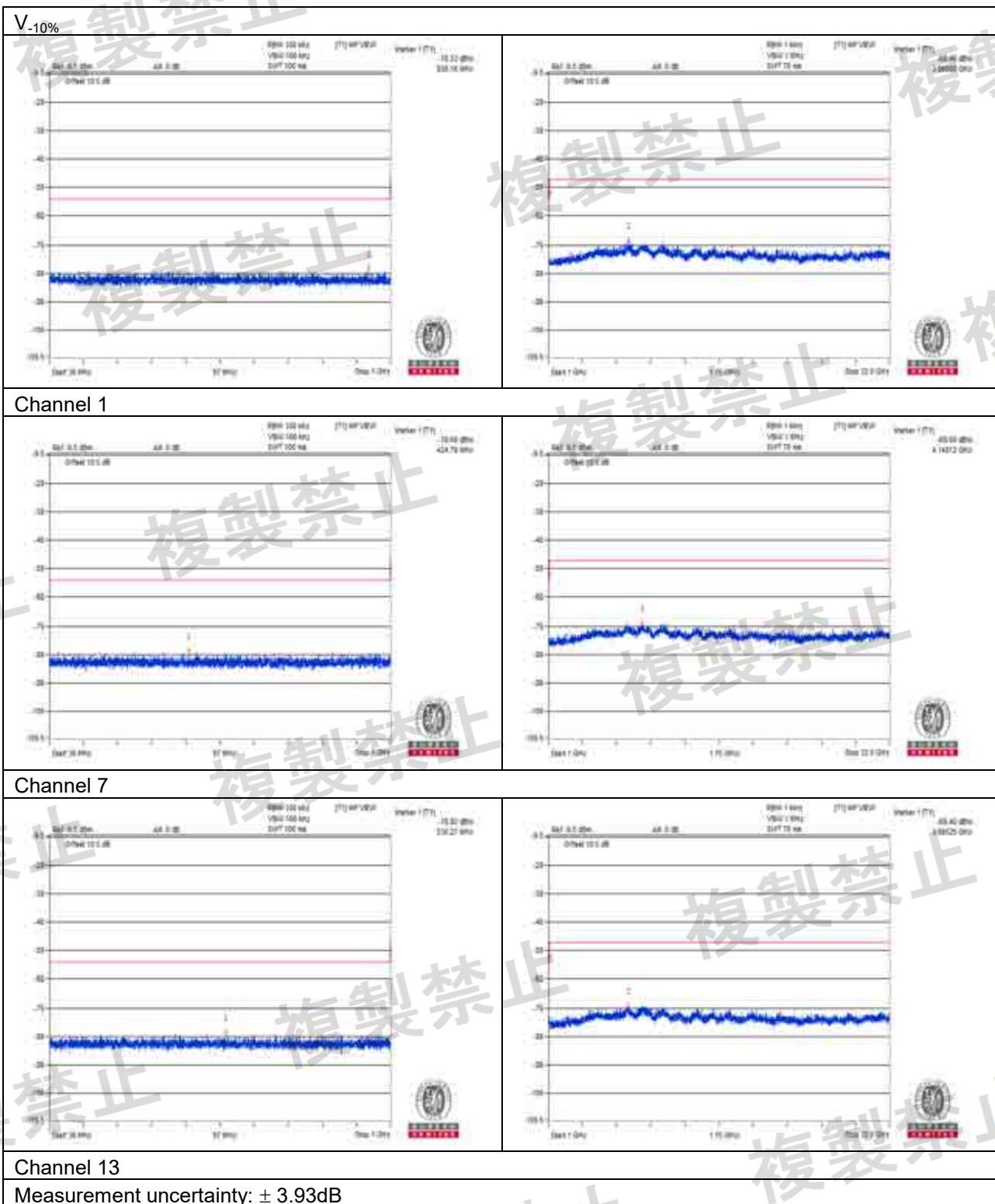
Environmental Conditions		25 deg.C, 60 % RH					
Test Channel		Channel 1 (2412 MHz)		Channel 7 (2442 MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V _{normal}	Below 1 GHz	306.450	0.013183nW	582.410	0.013996nW	4 nW	Pass
	Above 1 GHz	4105.000	0.108393nW	3645.000	0.125893nW	20 nW	Pass
V _{+10%}	Below 1 GHz	431.820	0.012618nW	175.980	0.01205nW	4 nW	Pass
	Above 1 GHz	4806.500	0.109144nW	4182.620	0.125026nW	20 nW	Pass
V _{-10%}	Below 1 GHz	938.160	0.014689nW	424.790	0.013521nW	4 nW	Pass
	Above 1 GHz	3668.000	0.142561nW	4148.120	0.125893nW	20 nW	Pass
Test Channel		Channel 13 (2472 MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measured Value			
V _{normal}	Below 1 GHz	547.010		0.01374nW		4 nW	Pass
	Above 1 GHz	3610.500		0.132739nW		20 nW	Pass
V _{+10%}	Below 1 GHz	567.860		0.014655nW		4 nW	Pass
	Above 1 GHz	3616.250		0.128529nW		20 nW	Pass
V _{-10%}	Below 1 GHz	530.270		0.013092nW		4 nW	Pass
	Above 1 GHz	3685.250		0.114815nW		20 nW	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.







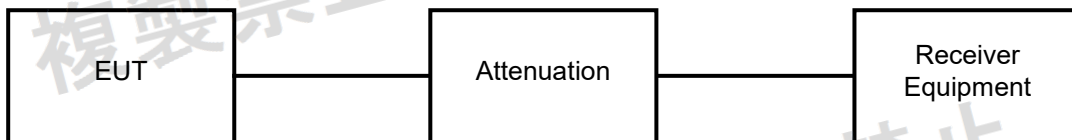


4.7 Interference Prevention Function

4.7.1 Limits of Interference Prevention Function

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

4.7.2 Test Setup



4.7.3 Test Results

Environmental Conditions	25 deg.C, 68 % RH
Link Mode	Test Result
WiFi	Pass

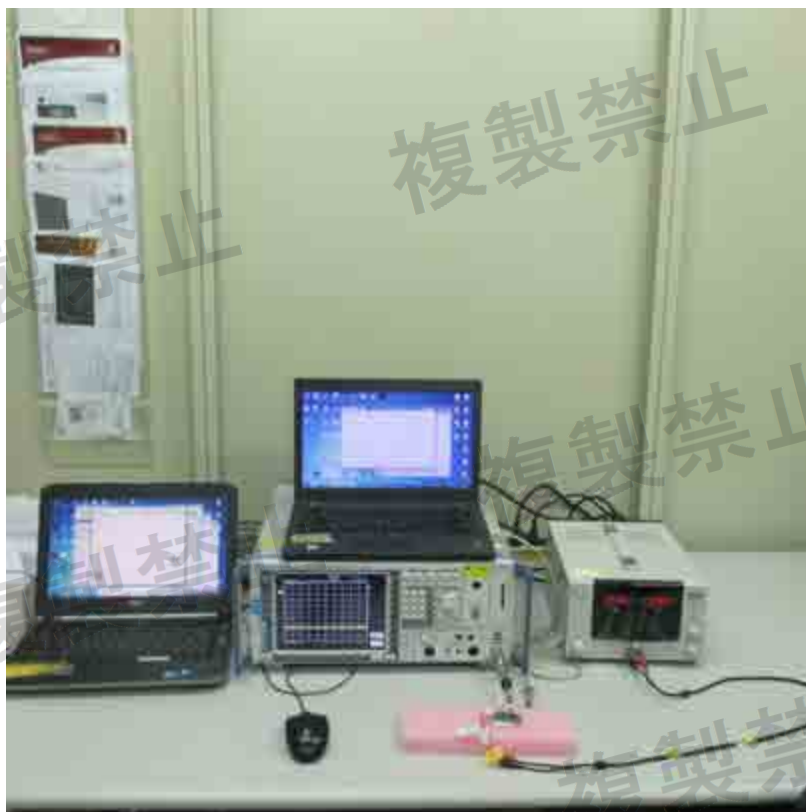
5 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Date of Calibration	Due Date of Calibration	Calibration Authority	Cal. Method
SPECTRUM ANALYZER / ROHDE & SCHWARZ	FSU43	101261	Dec. 13, 2016	Dec. 12, 2017	R&S	c)
SIGNAL GENERATOR / AGILENT	N5182B	MY53050430	Oct. 19, 2016	Oct. 18, 2017	Agilent	c)
POWER METER / ANRITSU	ML2495A	1012010	Aug. 11, 2016	Aug. 10, 2017	Agilent	c)
POWER SENSOR / ANRITSU	MA2411B	1315050	Aug. 11, 2016	Aug. 10, 2017	Agilent	c)
DC POWER SUPPLY	33010D	807748	Oct. 25, 2016	Oct. 24, 2017	ETC	c)

NOTE:

- The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.
- 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 EngineeringCenter, Intertek Japan K.K., Keysight Technologies, Inc~.
 - Correction conducted pursuant to the provisions of Article 135 or Article 144 of the MeasurementLaw (Law No. 51 of 1992)~Japan Calibration Service Syste~
 - Calibration conducted in foreign countries, which shall be equivalent to the calibration conducted bythe NICT or a designated calibration agency under Article 102-18 paragraph (1)~ TELEC EngineeringCenter, Intertek Japan K.K., Keysight Technologies, Inc~.
 - Calibration conducted by using other equipment that listed above from a) to c)

6 Photographs of the Test Configuration





Appendix - Information on 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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Email: service.adt@tw.bureauveritas.com

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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