



## Radio Test Report (Bluetooth EDR)

**Report No.:** RJ190426C18A-1

**Test Model:** EPD-132

**Series Model:** EPD-092, EPD092, EPD132 (Refer to item 3.1 for the more details)

**Received Date:** May 17, 2019

**Test Date:** May 26 ~ May 28, 2019

**Issued Date:** Aug. 29, 2019

**Applicant:** ADVANTECH CO., LTD

**Address:** No. 1, Alley 20, Lane 26, Rueiguang Rd, Neihu District, Taipei, Taiwan 114

**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 (R.O.C)

**Test Location:** No.19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City 33383, TAIWAN (R.O.C.)



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### Release Control Record

Issue No.	Description	Date Issued
RJ190426C18A-1	Original release	Aug. 29, 2019



## 1 Certificate of Conformity

**Product:** WIRELESS Epaper CONTROL BOARD

**Brand:** Advantech

**Test Model:** EPD-132

**Series Model:** EPD-092, EPD092, EPD132 (Refer to item 3.1 for the more details)

**Sample Status:** Engineering sample

**Applicant:** ADVANTECH CO., LTD

**Test Date:** May 26 ~ May 28, 2019

**Standards:** ARIB STD-T66 (V3.7), MIC notice 88 Appendix 43  
Article 2 Paragraph 1 of 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 :** Pettie Chen, **Date:** Aug. 29, 2019  
Pettie Chen / Senior Specialist

**Approved by :** Bruce Chen, **Date:** Aug. 29, 2019  
Bruce Chen / Senior Project Engineer



## 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)
<b>General Provisions</b>				
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
<b>Transmitting Equipment</b>				
F	3.2 (2)	4.5	Antenna power	C
--	--	--	SAR	NA
<b>Transmitting Antenna</b>				
--	--	3.4	Type, configuration, etc. of transmitting antenna	C
--	--	3.5	Direction pattern of transmitting antenna	C
<b>Receiving Equipment</b>				
G	3.3 (1)	4.6	Spurious emissions of receiver	C
--	--	3.5	Refer to all articles for transmitting antenna	C
<b>Operating Frequency 2400 to 2483.5MHz</b>				
--	3.7 (1)a	3.4	Radio 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)	4.5	Antenna power	C
--	3.6 (2)	4.5	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)	4.3	Spreading bandwidth	C
--	3.2 (9)	4.3	Spreading factor	C
--	3.2 (11)	4.7	Frequency retention time (FH employed)	C
--	3.4.1(1)	4.8	Interference Prevention Function	C
--	3.4.1(3)	--	Carrier Sense Capability	NA
Note: C = Conform NC = Not Conform NT = Not Tested NA = Not Applicable				

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





## 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	491.896Hz
Spurious emissions	3.508dB
Output power density	2.889dB
Out of band radiated power	3.93dB
Frequency Tolerance	6805.18Hz

## 2.2 Modification Record

There were no modifications required for compliance.



### 3 General Information

#### 3.1 General Description of EUT

Product	WIRELESS Epaper CONTROL BOARD
Brand	Advantech
Test Model	EPD-132
Series Model	EPD-092, EPD092, EPD132
Model Difference	Refer to Note
Status of EUT	Engineering sample
Nominal Voltage	5Vdc (Host)
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	1/2/3Mbps
Operating Frequency	2402.0MHz ~ 2480.0MHz
Number of Channel	79
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
Antenna Connector	Refer to note
Accessory Device	Refer to note
Data Cable Supplied	Refer to note

Note:

1. All models are listed as below.

Product Name	Model	Difference
WIRELESS Epaper CONTROL BOARD	EPD-092	Marketing purpose
	EPD092	
	EPD-132	
	EPD132	

Model: EPD-092 and EPD092 are electrically identical, different model names are for marketing purpose.

Model: EPD-132 and EPD132 are electrically identical, different model names are for marketing purpose.

Model: EPD-132 is chosen for the final tests.



2. The following antennas were provided to the EUT.

For EUT Model: EPD-092, EPD092:

Ant. No.	Type	P/N	Connector	Gain (dBi)			
1	Dipole	AN2450-92K01BRS	SMA Male Reverse	5.03			
2	Dipole	AN2450-5511BRS	SMA Male Reverse	2.89			
3	Dipole	RFDPA131000SBLB808	Reverse SMA Plug	Freq. (MHz)	ZX Plane	ZY Plane	XY Plane
				2400	2.17	1.01	0.65
				2450	2.57	2.11	1.07
				2500	2.92	1.79	0.82
4	Monopole	AJMQ1J-B0009	I-PEX I	3.61			

For EUT Model: EPD-132, EPD132:

Ant. No.	Type	P/N	Connector	Gain (dBi)			
1	Dipole	AN2450-92K01BRS	SMA Male Reverse	5.03			
2	Dipole	AN2450-5511BRS	SMA Male Reverse	2.89			
3	Dipole	RFDPA131000SBLB808	Reverse SMA Plug	Freq. (MHz)	ZX Plane	ZY Plane	XY Plane
				2400	2.17	1.01	0.65
				2450	2.57	2.11	1.07
				2500	2.92	1.79	0.82
4	Monopole	AJMQ1J-B0007	I-PEX I	1.51			

\*Antenna 1 with maximum gain was chosen for the final tests.

3. The following Accessories for the EUT. (Optional)

Type	Length
RF SMA cable	L=150mm
Antenna magnetic base	L=100mm
FPC Cable 10P-0.5mm for DCU2.0	7.9cm
Micro USB cable	60cm
daughter board with Switch and LED	-

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)
Normal mode	0.04	0.034432	0.109638
AFH mode	0.2	0.135434	0.431249





### 3.2 Description of Test Modes

79 channels are provided for BT-EDR mode:

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	78	2480
19	2421	39	2441	59	2461		

**NOTE 1:** By means of test software (CMD) provided by manufacture, the power levels during the tests were set according to the following codes:

**NOTE 2:** Pre-Scan has been conducted to determine the worst-case mode from packet type; we found the DH5 was the worst case, and chosen for final test. Following test items were selected for the final test as listed below.

Test Items
Spurious emissions
Power density (Antenna power)
Occupied / spreading bandwidth

#### Bluetooth EDR

Modulation type	Power setting
GFSK	Default
$\pi/4$ -DQPSK	Default
8DPSK	Default



### 3.3 Test Conditions

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

### 3.4 Assembly

The RF circuit was covered by metal shielding case, and the metal shielding case won't be easy to be opened.

### 3.5 Antenna Specifications

#### 3.5.1 Antenna Gain

For EUT Model: EPD-092, EPD092:

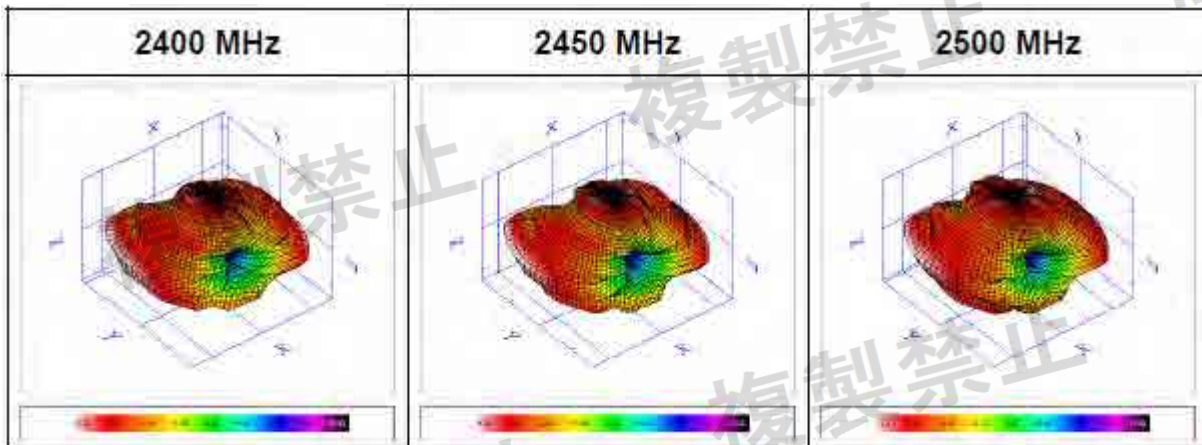
Ant. No.	Type	P/N	Connector	Gain (dBi)			
1	Dipole	AN2450-92K01BRS	SMA Male Reverse	5.03			
2	Dipole	AN2450-5511BRS	SMA Male Reverse	2.89			
3	Dipole	RFDPA131000SBLB808	Reverse SMA Plug	Freq. (MHz)	ZX Plane	ZY Plane	XY Plane
				2400	2.17	1.01	0.65
				2450	2.57	2.11	1.07
				2500	2.92	1.79	0.82
4	Monopole	AJMQ1J-B0009	I-PEX I	3.61			

For EUT Model: EPD-132, EPD132:

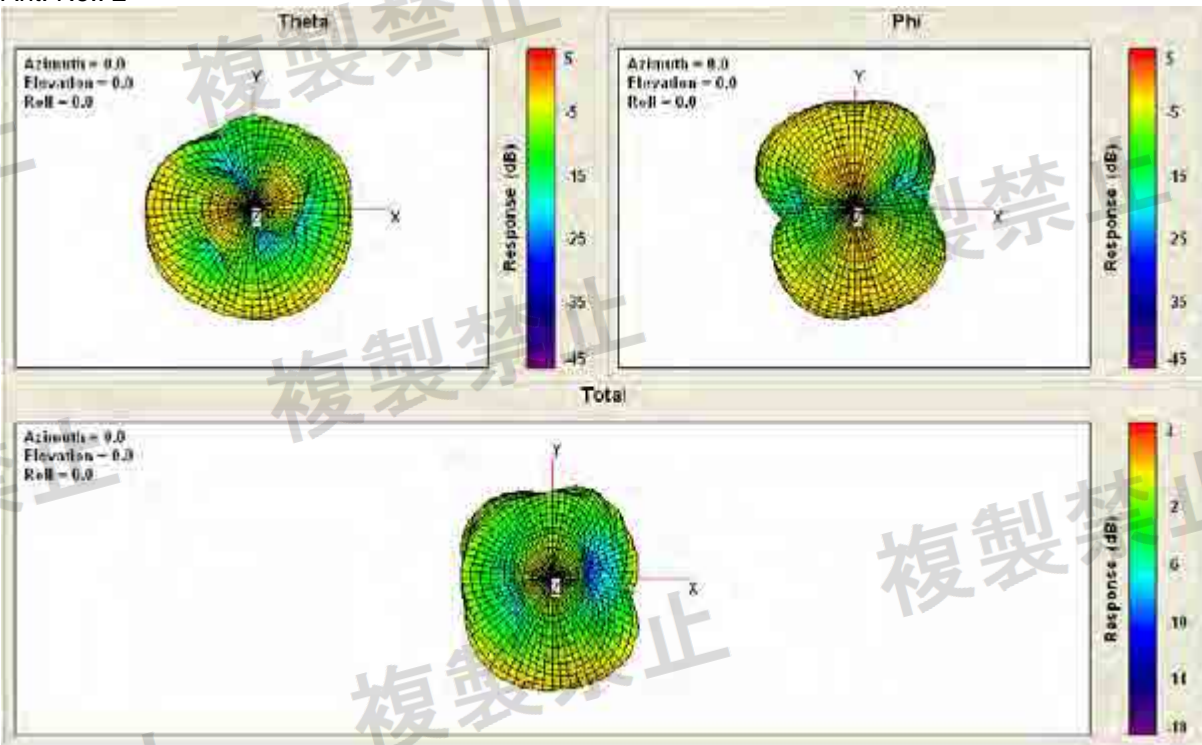
Ant. No.	Type	P/N	Connector	Gain (dBi)			
1	Dipole	AN2450-92K01BRS	SMA Male Reverse	5.03			
2	Dipole	AN2450-5511BRS	SMA Male Reverse	2.89			
3	Dipole	RFDPA131000SBLB808	Reverse SMA Plug	Freq. (MHz)	ZX Plane	ZY Plane	XY Plane
				2400	2.17	1.01	0.65
				2450	2.57	2.11	1.07
				2500	2.92	1.79	0.82
4	Monopole	AJMQ1J-B0007	I-PEX I	1.51			

### 3.5.2 Antenna Pattern

Ant. No.: 1



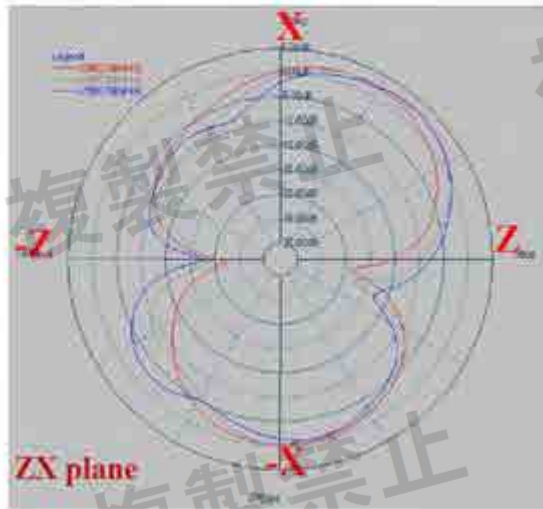
Ant. No.: 2





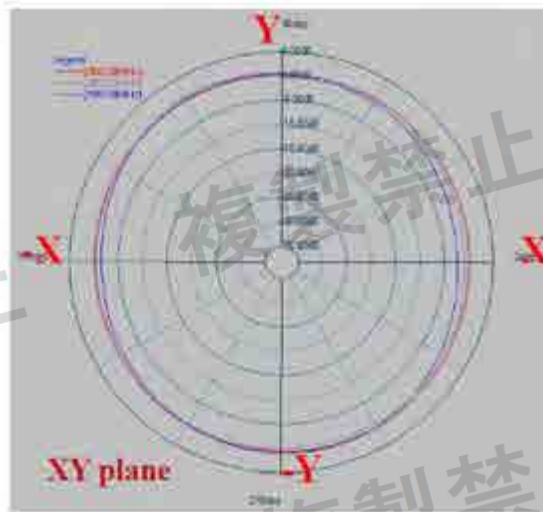
Ant. No.: 3  
Phi=0.00deg

Gain, dB



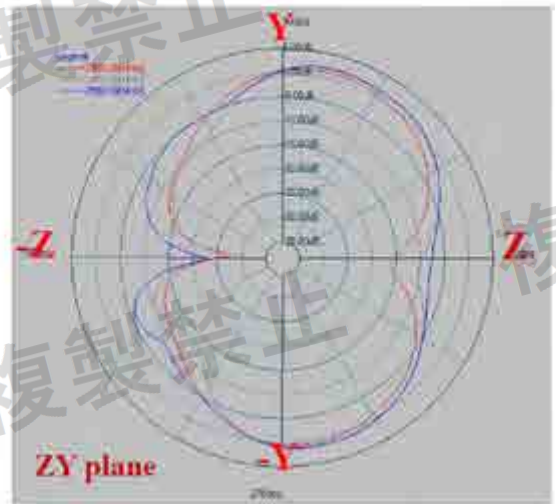
Theta=90.00deg

Gain, dB



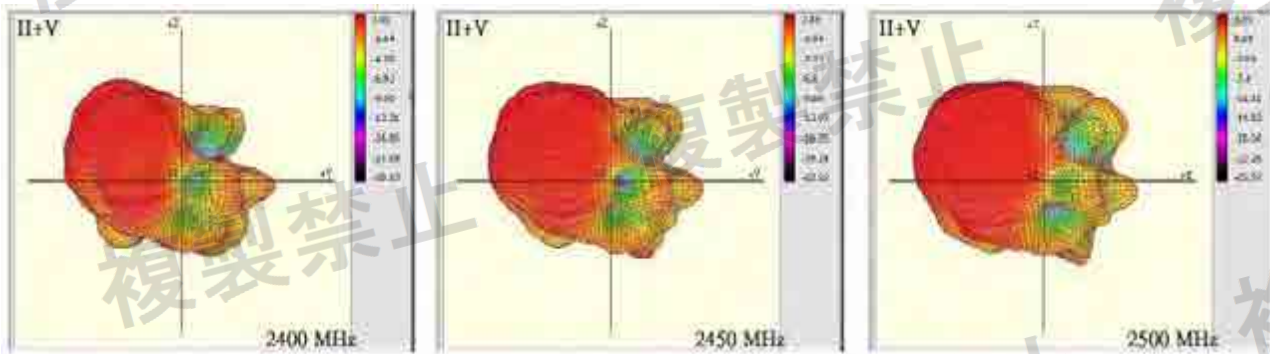
Phi=90.00deg

Gain, dB

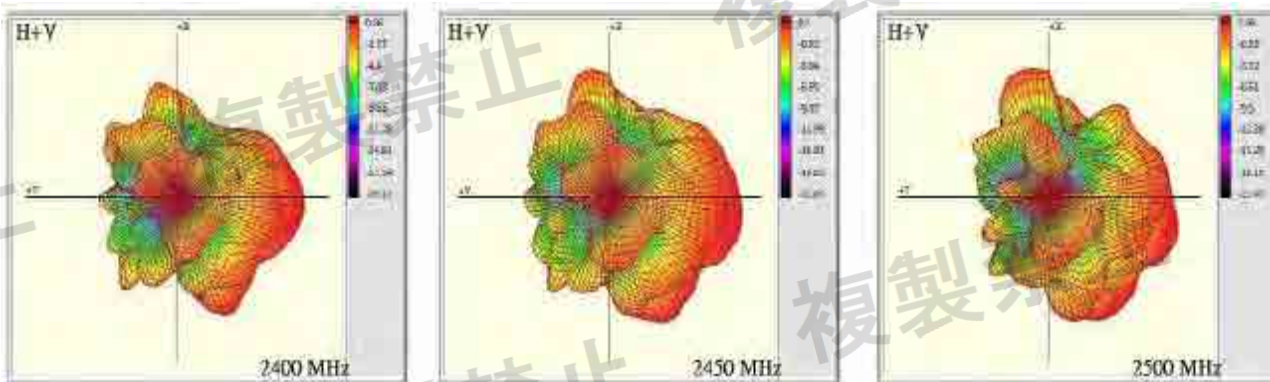




For EUT Model: EPD-092, EPD092  
Ant. No.: 4



For EUT Model: EPD-132, EPD132:  
Ant. No.: 4







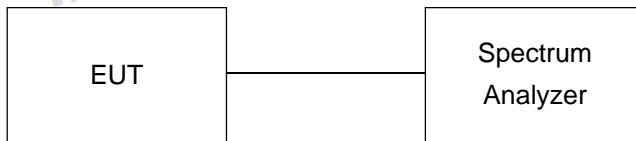
## 4 Test Results

### 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

Modulation: GFSK

Environmental Conditions		20 deg.C, 70% 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	2402.007600	3.164	2402.007600	3.164	2402.007600	3.164
39	2441	2441.012000	4.916	2441.012000	4.916	2441.012000	4.916
78	2480	2480.016800	6.774	2480.016800	6.774	2480.016800	6.774

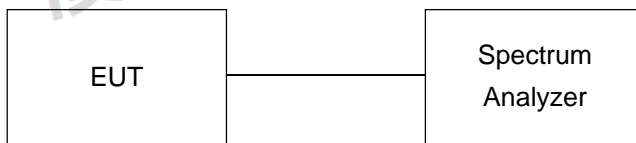


## 4.2 Occupied Bandwidth Measurement (99% power bandwidth)

### 4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	<83.5 MHz

### 4.2.2 Test Setup





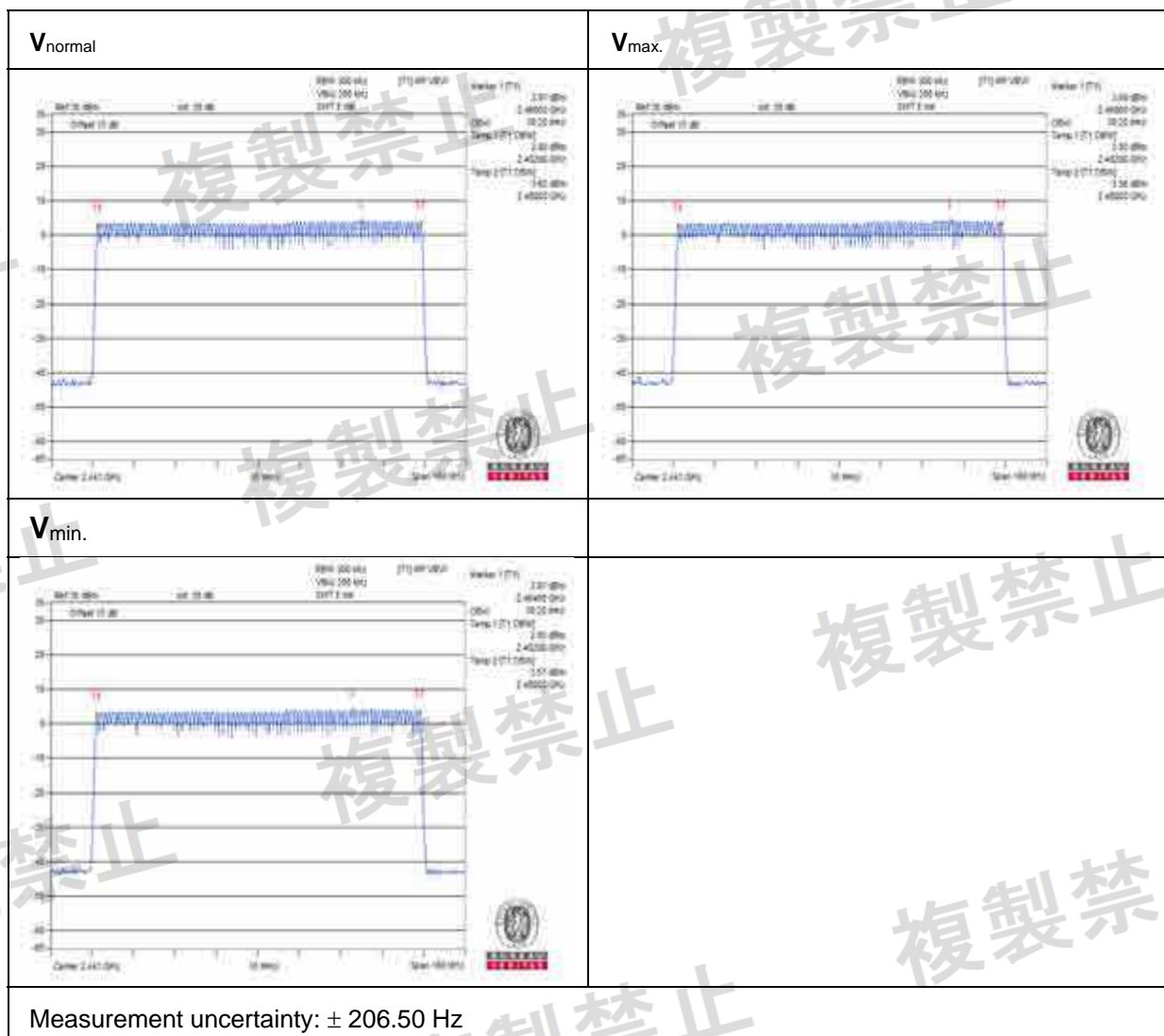
#### 4.2.3 Test Results

**Modulation: GFSK**

**NORMAL MODE**

Environmental Conditions	20 deg.C, 70% RH	
Voltage normal	Voltage max.	Voltage min.
Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
78.20	78.20	78.20
Measurement uncertainty	$\pm 206.50$ Hz	

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



# AFH MODE

Environmental Conditions	20 deg.C, 70% RH	
Voltage <sub>normal</sub>	Voltage <sub>max.</sub>	Voltage <sub>min.</sub>
Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
19.70	19.70	19.70
Measurement uncertainty	± 206.50 Hz	

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



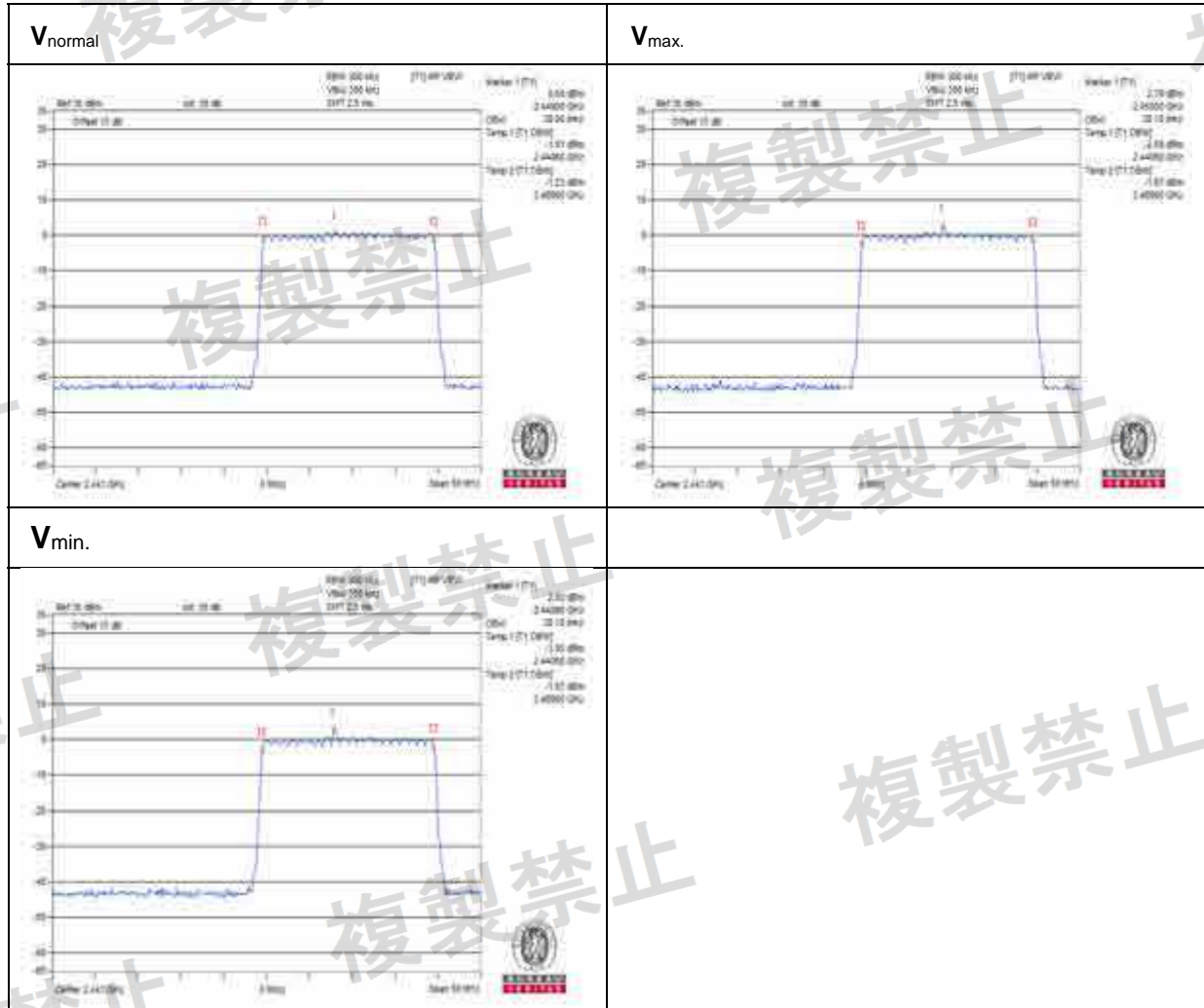




# AFH MODE

Environmental Conditions	20 deg.C, 70% RH	
Voltage <sub>normal</sub>	Voltage <sub>max.</sub>	Voltage <sub>min.</sub>
Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
20.00	20.10	20.10
Measurement uncertainty	± 206.50 Hz	

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



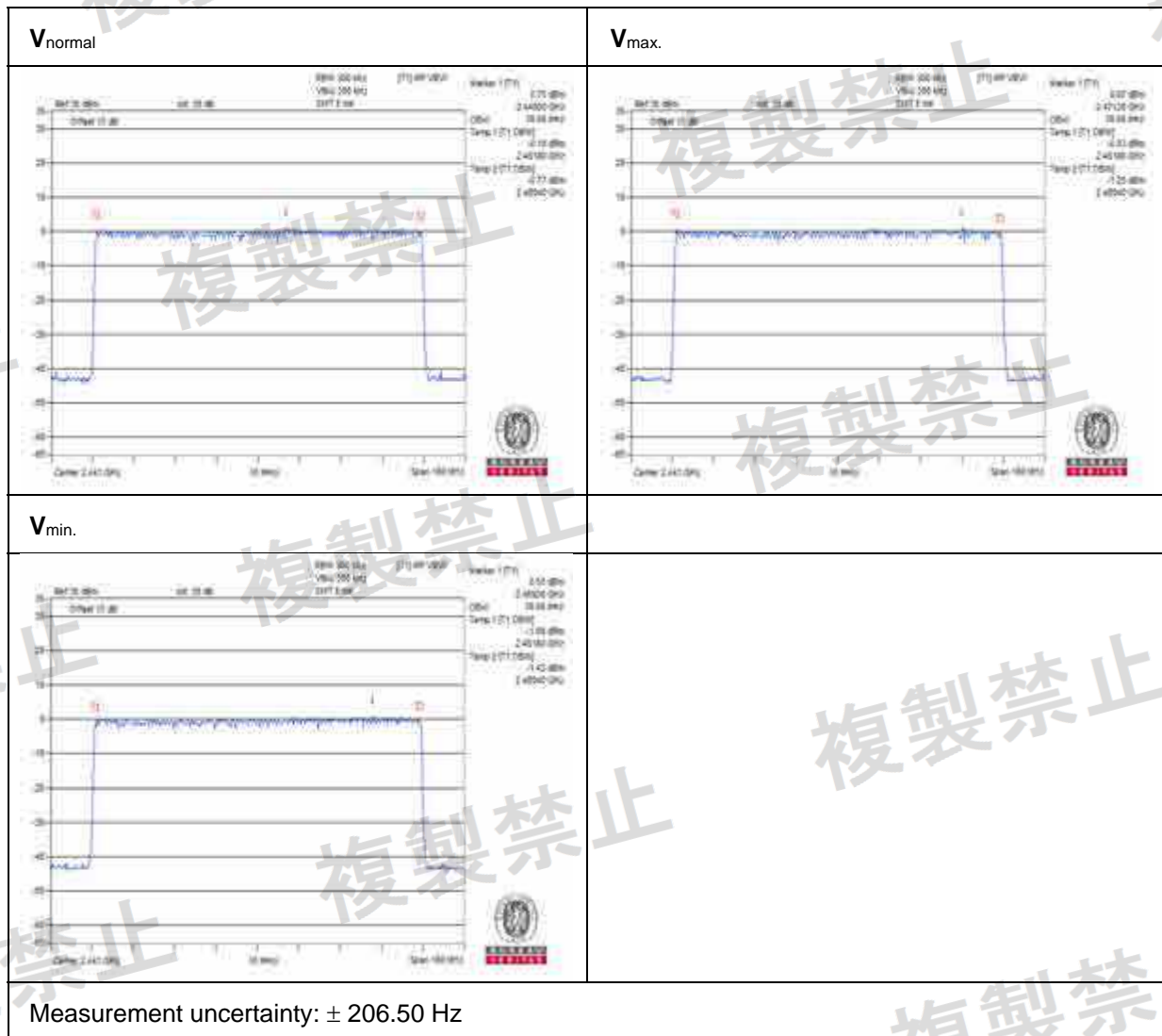
Measurement uncertainty:  $\pm 206.50$  Hz



**Modulation: 8DPSK**  
**NORMAL MODE**

Environmental Conditions	20 deg.C, 70% RH	
Voltage normal	Voltage max.	Voltage min.
Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
78.60	78.60	78.60
Measurement uncertainty	$\pm 206.50$ Hz	

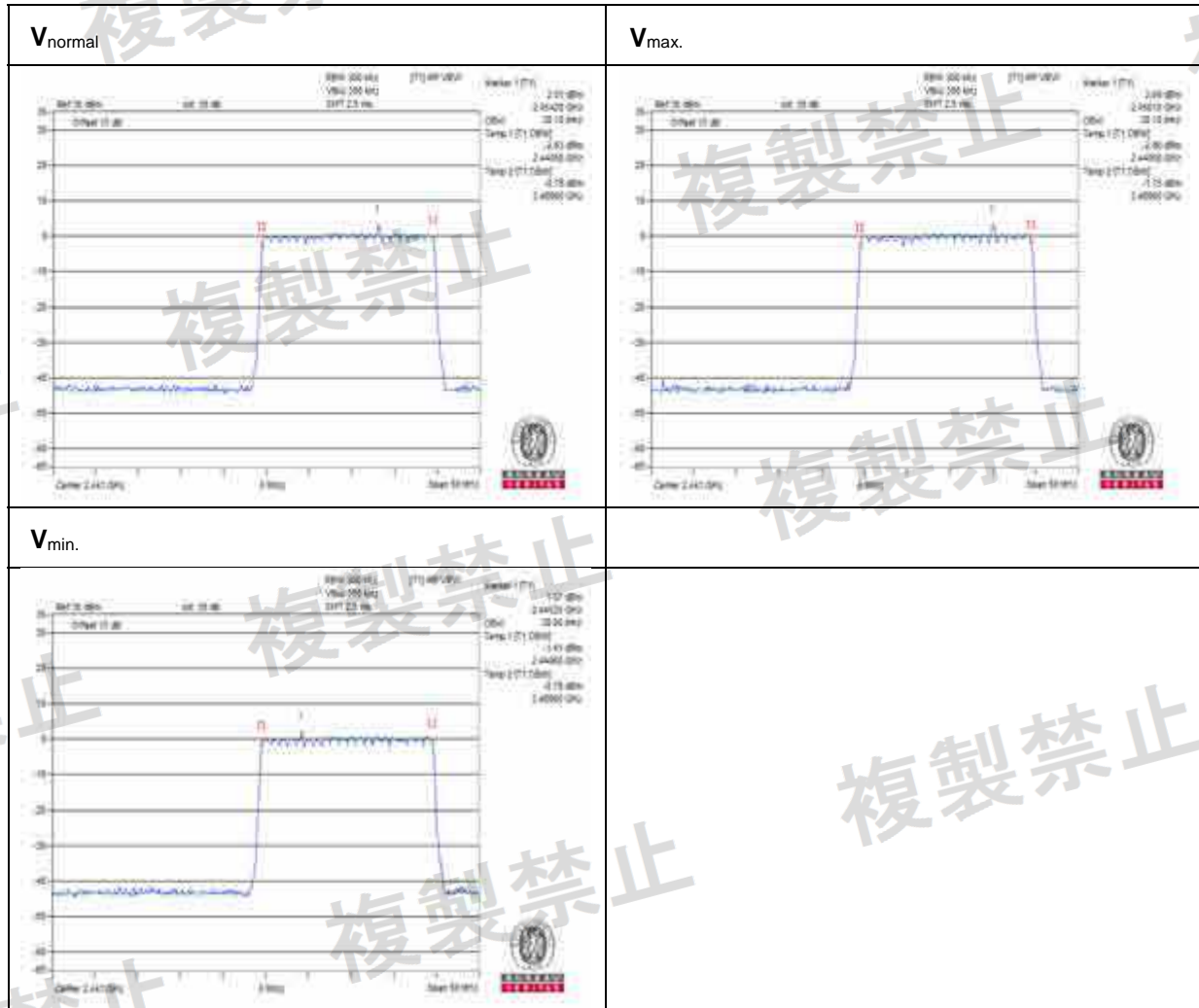
**NOTE:** For the test plots please refer to the below.



# AFH MODE

Environmental Conditions	20 deg.C, 70% RH	
Voltage <sub>normal</sub>	Voltage <sub>max.</sub>	Voltage <sub>min.</sub>
Occupied bandwidth (MHz)	Occupied bandwidth (MHz)	Occupied bandwidth (MHz)
20.10	20.10	20.00
Measurement uncertainty	± 206.50 Hz	

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



Measurement uncertainty:  $\pm 206.50$  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	$\geq 500\text{kHz}$	(For DSSS, FHSS)
Spreading Factor	$\geq 5$	Operating frequency 2400 to 2483.5MHz

##### 4.3.2 Test Setup





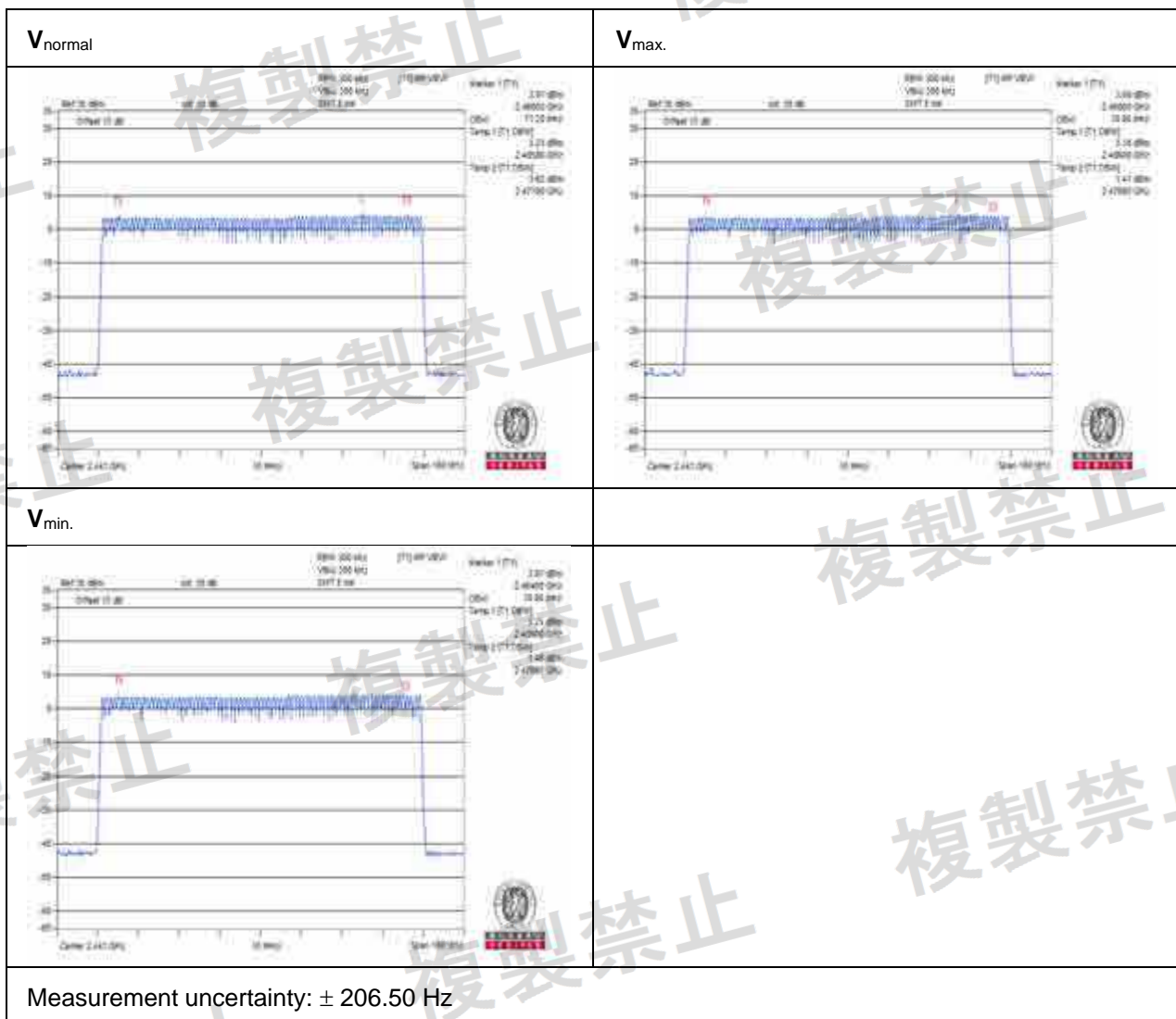
#### 4.3.3 Test Results

Modulation: GFSK

NORMAL MODE

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.20	71.20	70.80	70.80	70.80	70.80
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below.







# AFH MODE

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.00	18.00	18.00	18.00	18.00	18.00
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below

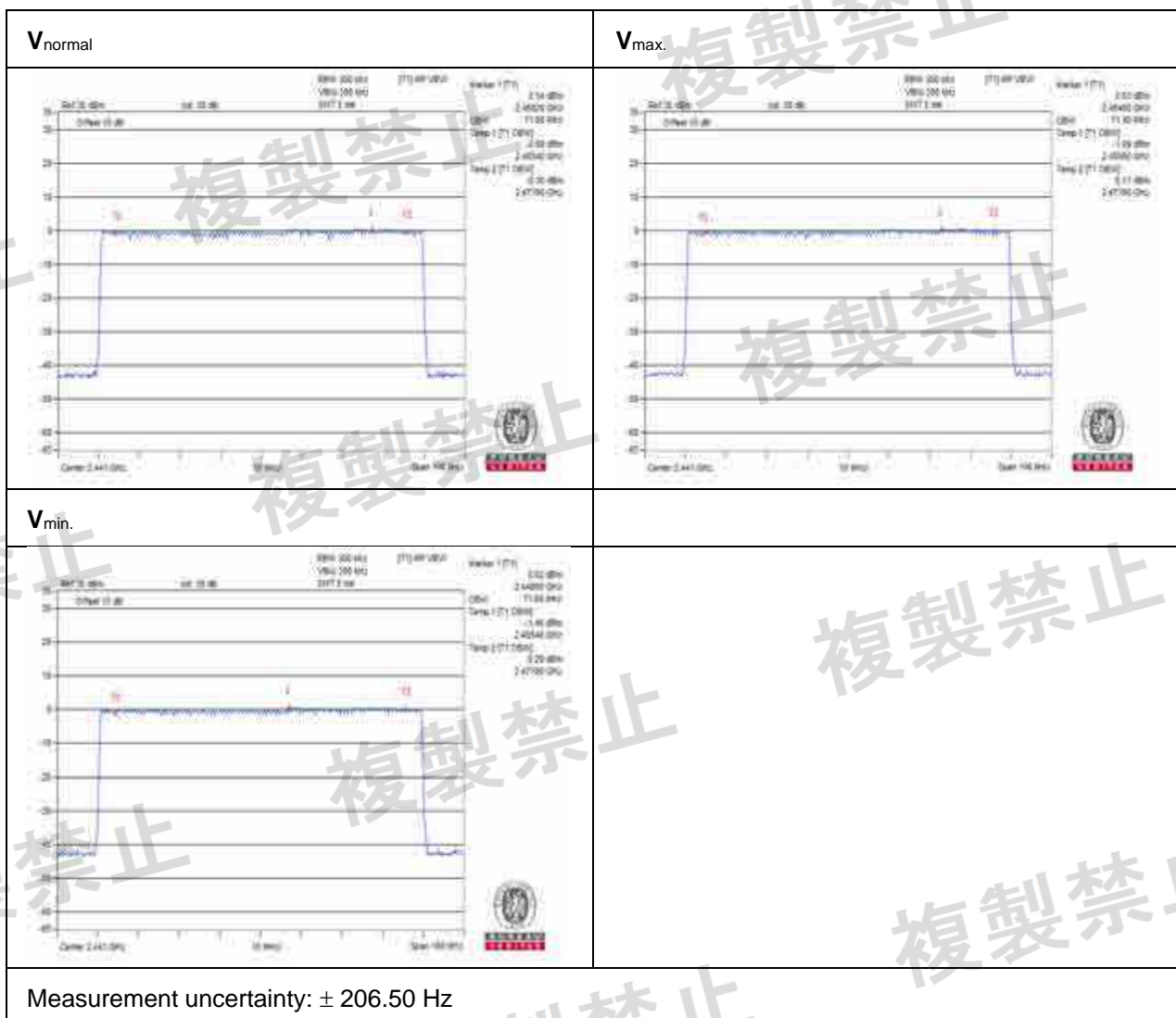




Modulation:  $\pi/4$ -DQPSK  
NORMAL MODE

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.60	71.60	71.40	71.40	71.60	71.60
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below.

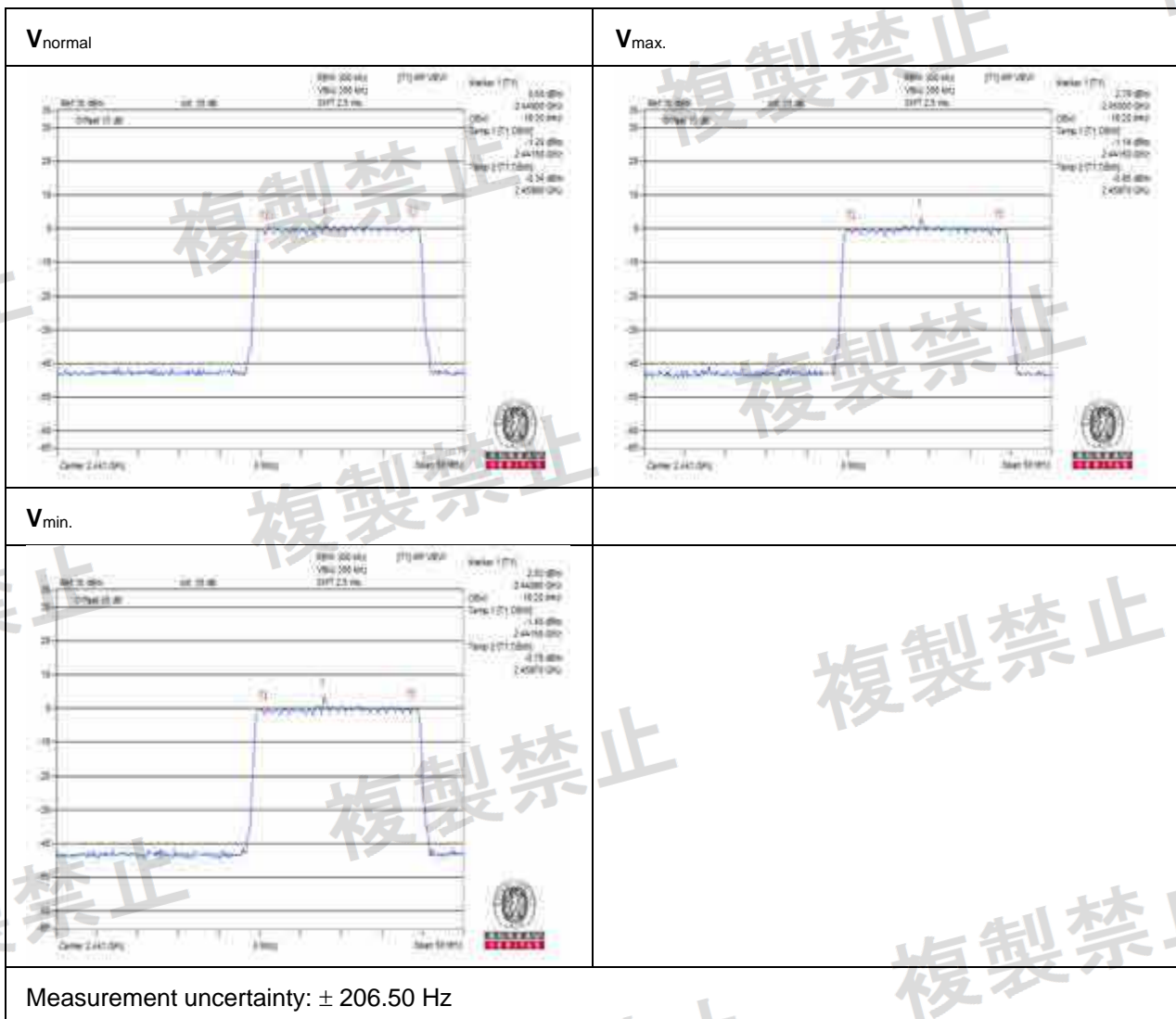




# AFH MODE

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.30	18.30	18.20	18.20	18.20	18.20
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below.

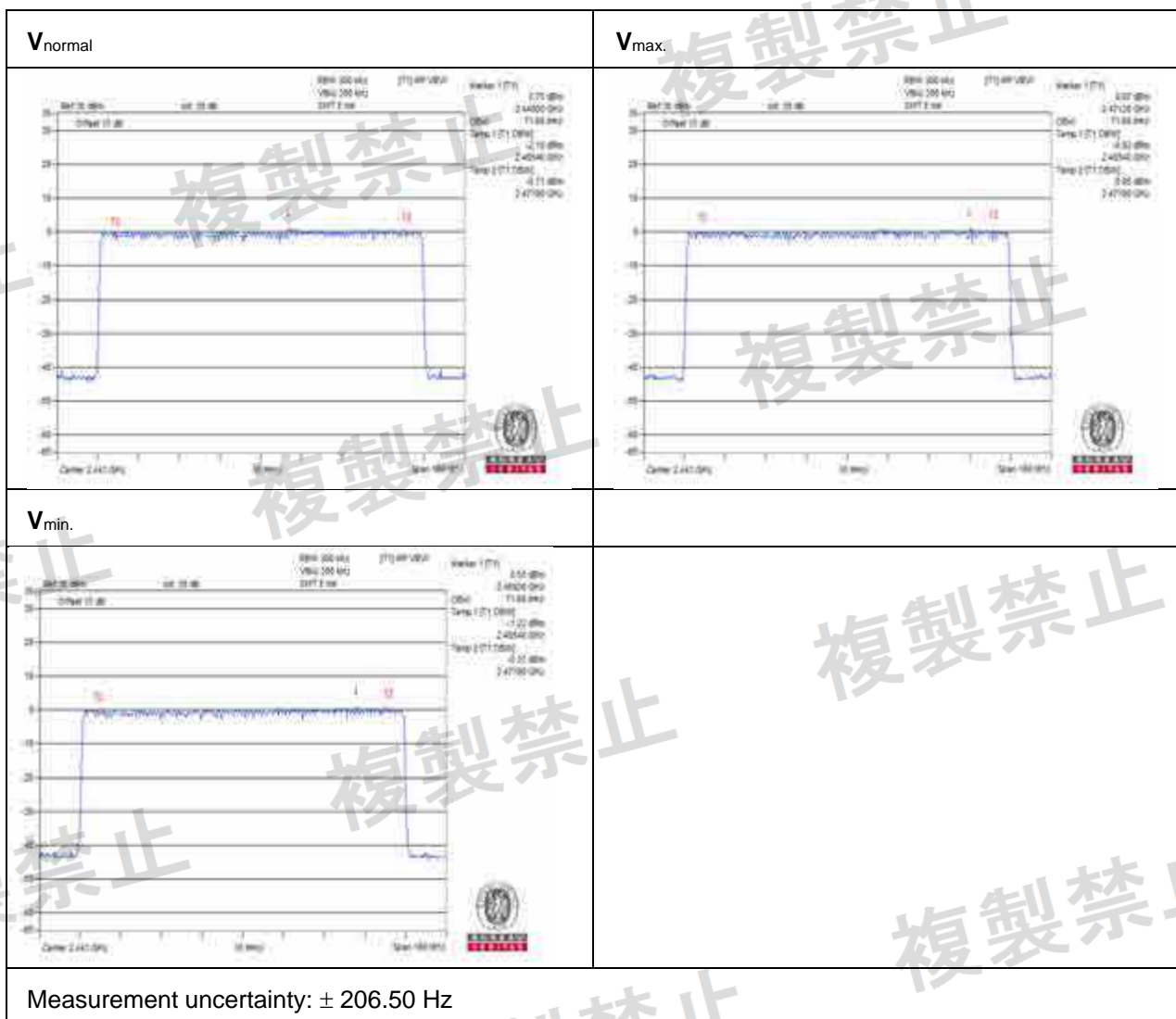




**Modulation: 8DPSK**  
**NORMAL MODE**

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
71.60	71.60	71.60	71.60	71.60	71.60
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below.





# AFH MODE

Environmental Conditions		20 deg.C, 70% RH			
Voltage normal		Voltage max.		Voltage min.	
Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor	Occupied bandwidth (MHz)	Spreading factor
18.20	18.20	18.30	18.30	18.30	18.30
Measurement uncertainty		$\pm 206.50$ Hz			

**NOTE:** 1. Spreading Factor: 90% channel power bandwidth / 1.  
2. For the test plots please refer to the below.





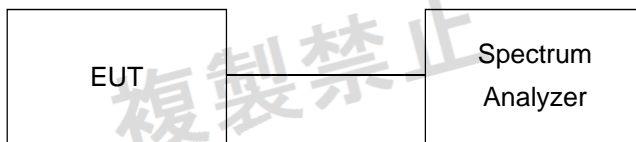


#### 4.4 Spurious Emissions for Transmitter Measurement

##### 4.4.1 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	$\leq 2.5 \text{ uW/MHz}$

##### 4.4.2 Test Setup





#### 4.4.3 Test Results

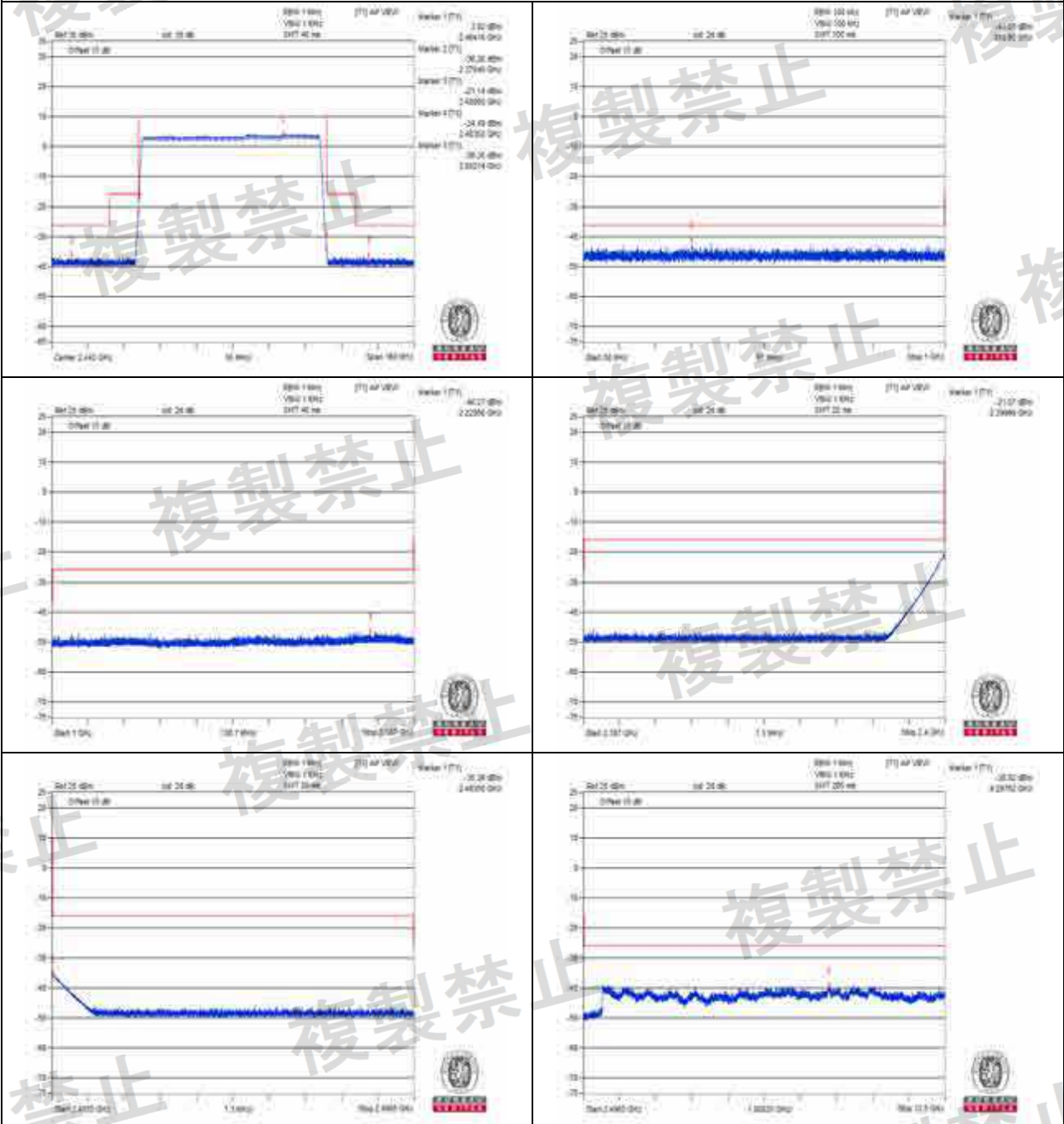
Hopping Mode

Modulation: GFSK

Environmental Conditions		20 deg.C, 70% RH			
Test Condition	Frequency Range	Frequency (MHz)	Measure. Value(uW)	Limit	Result
V <sub>normal</sub>	30.0MHz to 1000.0MHz	319.900	<b>0.078uW</b>	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2220.560	0.023uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	7.816uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	<b>0.289uW</b>	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	9297.620	0.131uW	2.5uW/MHz	PASS
V <sub>max.</sub>	30.0MHz to 1000.0MHz	899.480	0.049uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2299.790	0.022uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	7.673uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	0.285uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3014.180	0.156uW	2.5uW/MHz	PASS
V <sub>min.</sub>	30.0MHz to 1000.0MHz	390.470	0.053uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2281.240	<b>0.027uW</b>	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2400.000	<b>8.035uW</b>	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	0.284uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	9297.620	<b>0.187uW</b>	2.5uW/MHz	PASS

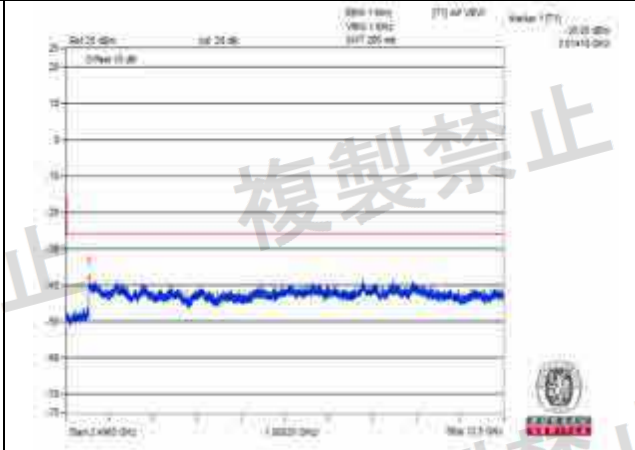
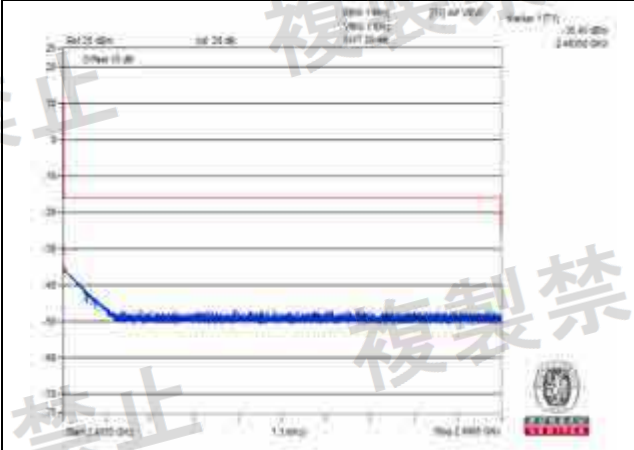
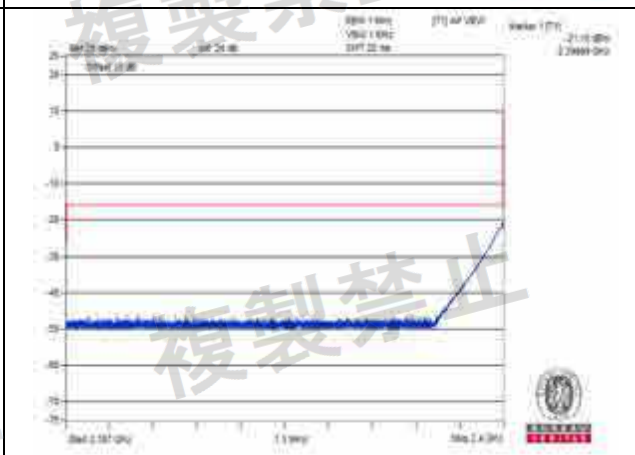
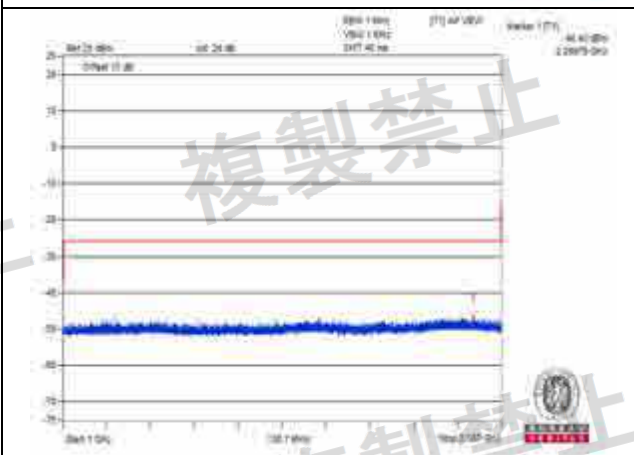
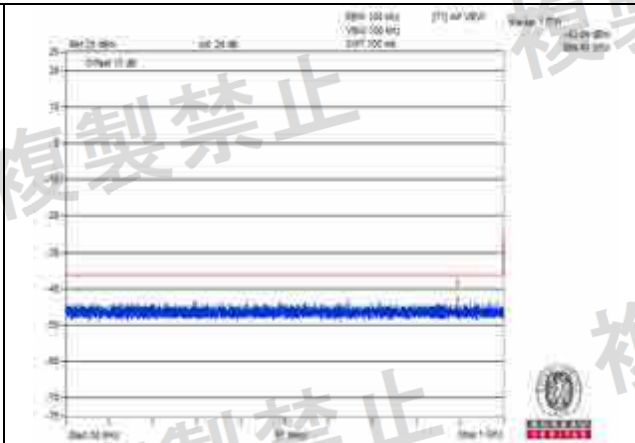
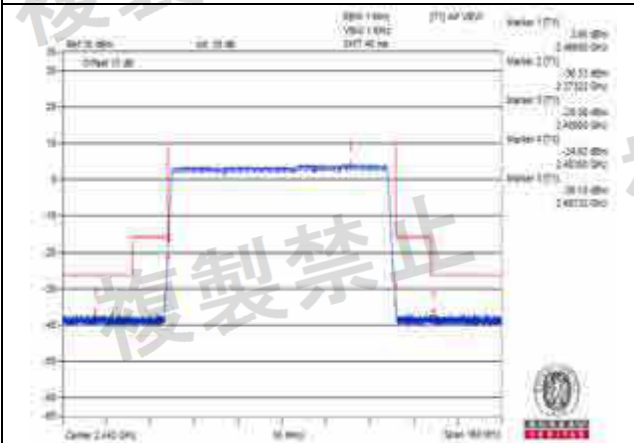
**NOTE:** 1. The worst value in each frequency range v.s. each channel has been marked by boldface.  
2. The spectrum plots are attached on the following pages.

V<sub>normal</sub>



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

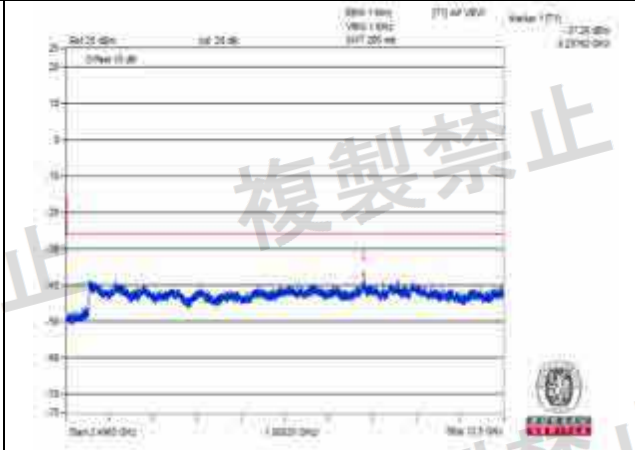
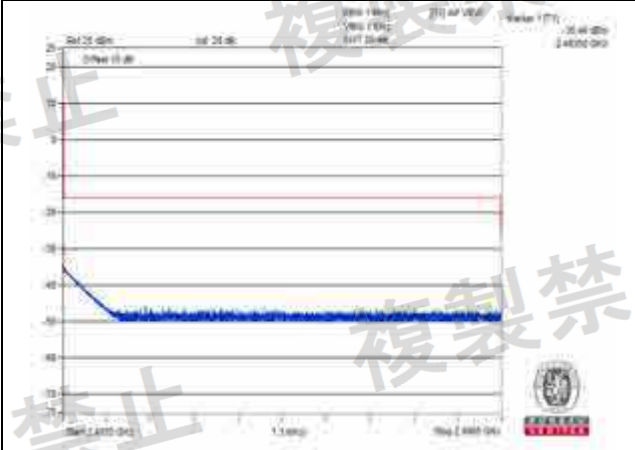
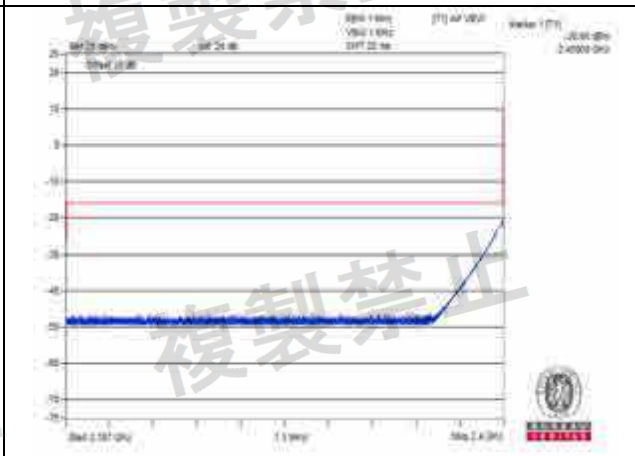
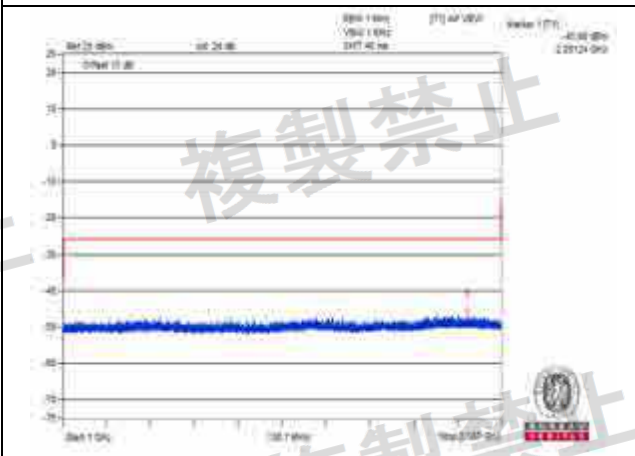
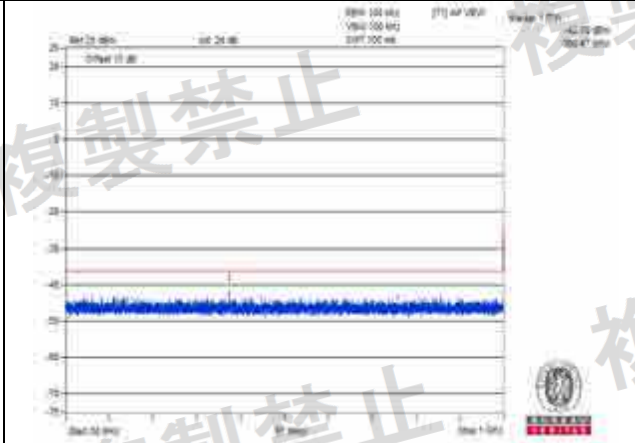
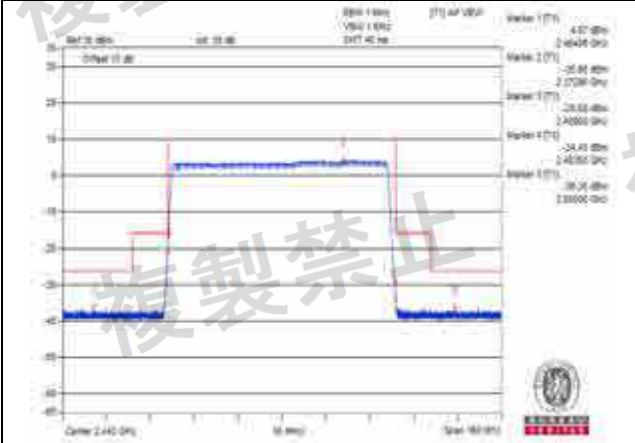
V<sub>max</sub>



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



V<sub>min</sub>



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



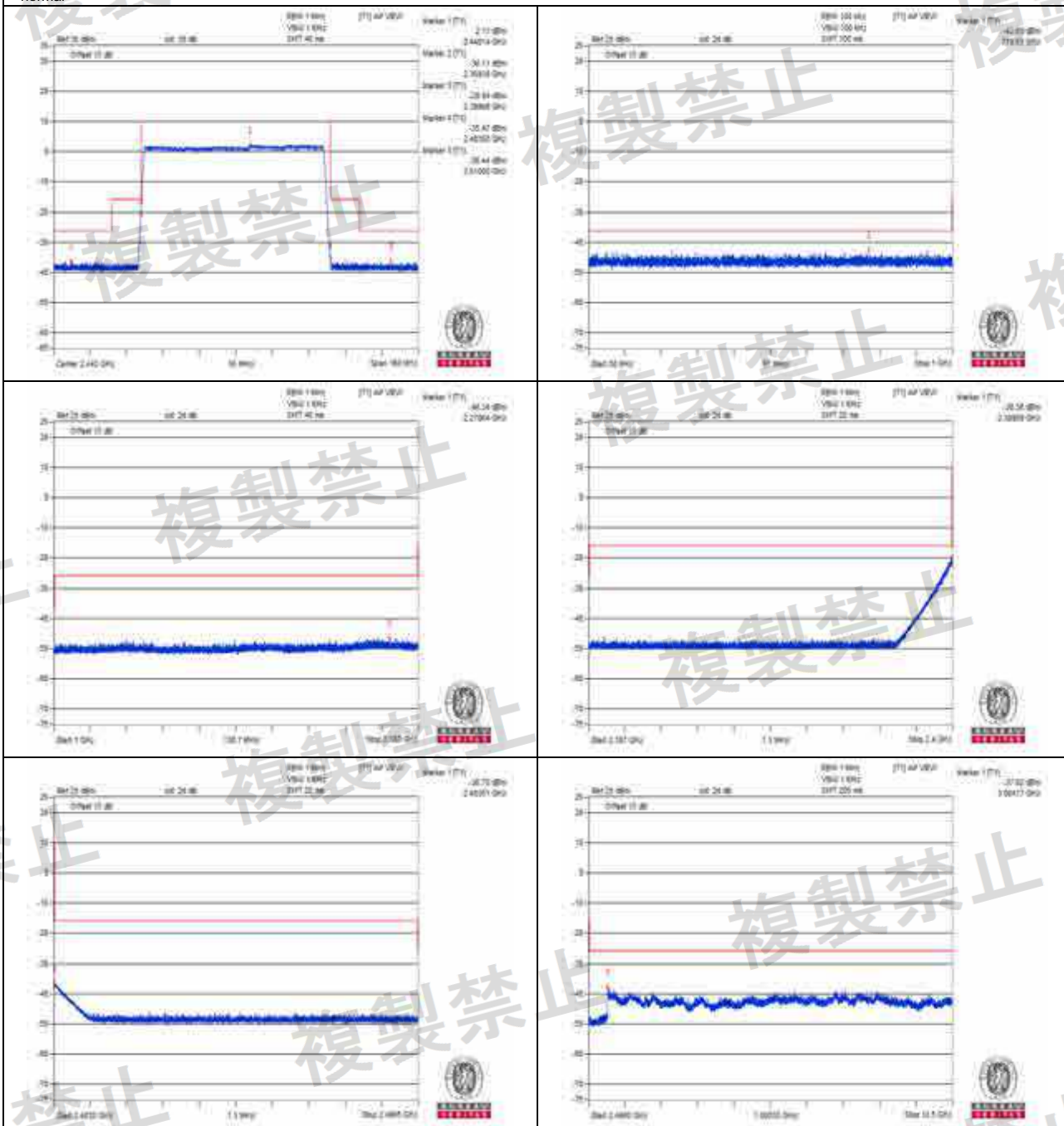


Modulation:  $\pi/4$ -DQPSK

Environmental Conditions		20 deg.C, 70% RH			
Test Condition	Frequency Range	Frequency (MHz)	Measure. Value(uW)	Limit	Result
V <sub>normal</sub>	30.0MHz to 1000.0MHz	778.590	0.054uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2278.640	0.023uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	9.204uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.510	0.213uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3004.170	0.172uW	2.5uW/MHz	PASS
V <sub>max.</sub>	30.0MHz to 1000.0MHz	583.020	0.064uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2272.910	<b>0.025uW</b>	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	9.015uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	<b>0.232uW</b>	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3016.680	0.154uW	2.5uW/MHz	PASS
V <sub>min.</sub>	30.0MHz to 1000.0MHz	948.590	<b>0.072uW</b>	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2225.410	0.023uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	<b>9.885uW</b>	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	0.228uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3021.680	<b>0.175uW</b>	2.5uW/MHz	PASS

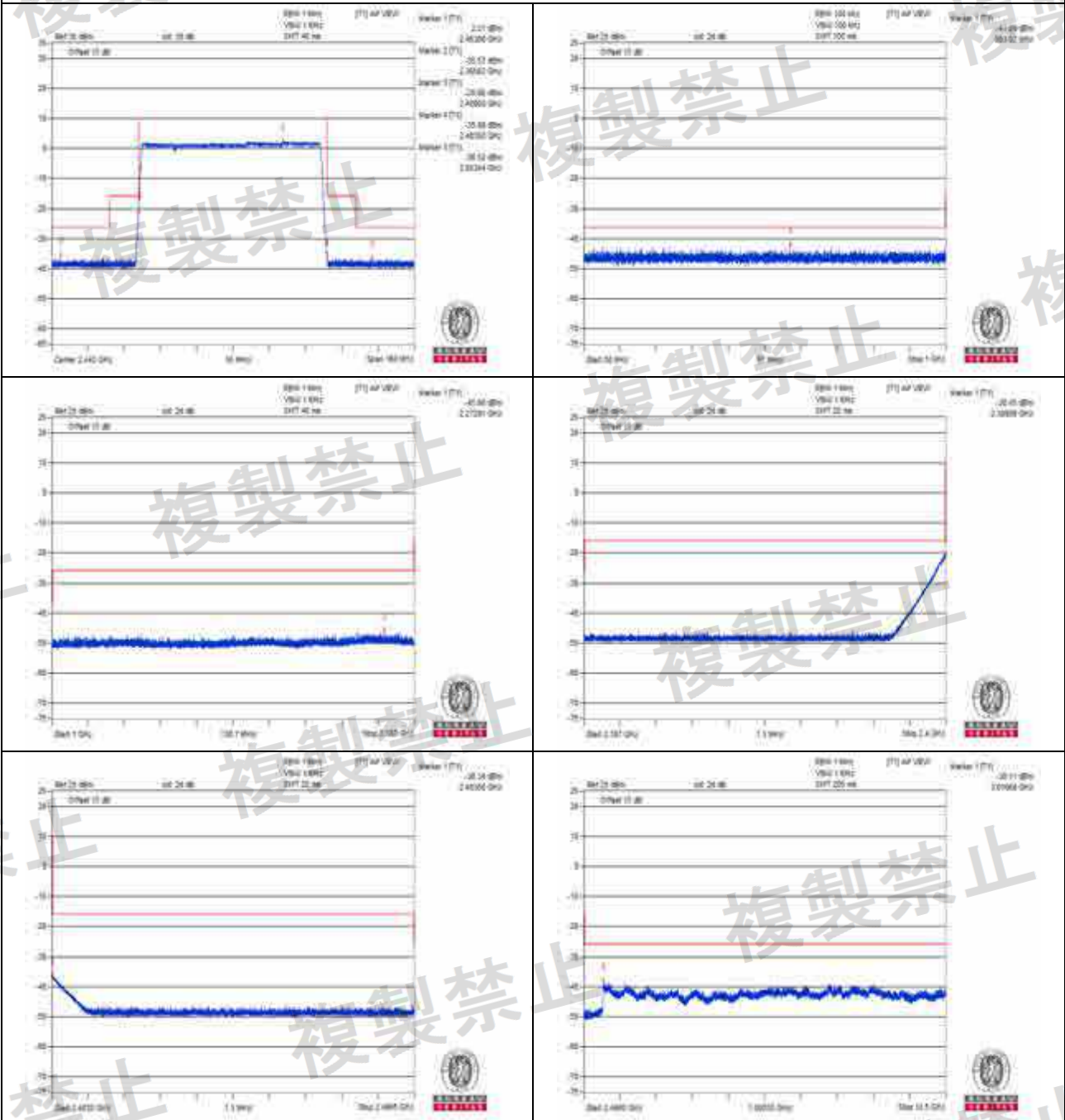
**NOTE:** 1. The worst value in each frequency range v.s. each channel has been marked by boldface.  
2. The spectrum plots are attached on the following pages.

V<sub>normal</sub>



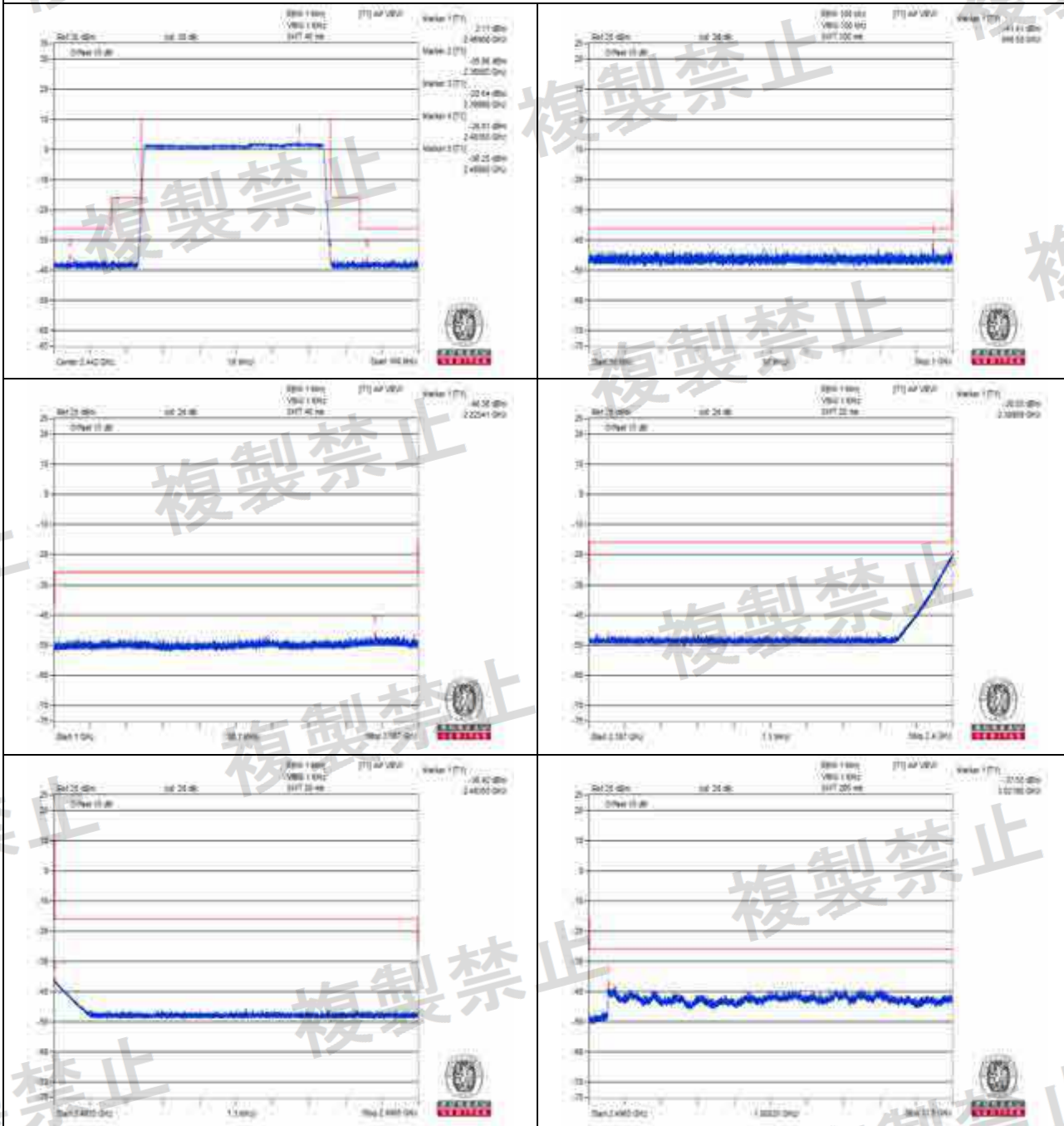
Measurement uncertainty:  $\pm 3.93\text{dB}$

V<sub>max</sub>



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

V<sub>min</sub>



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





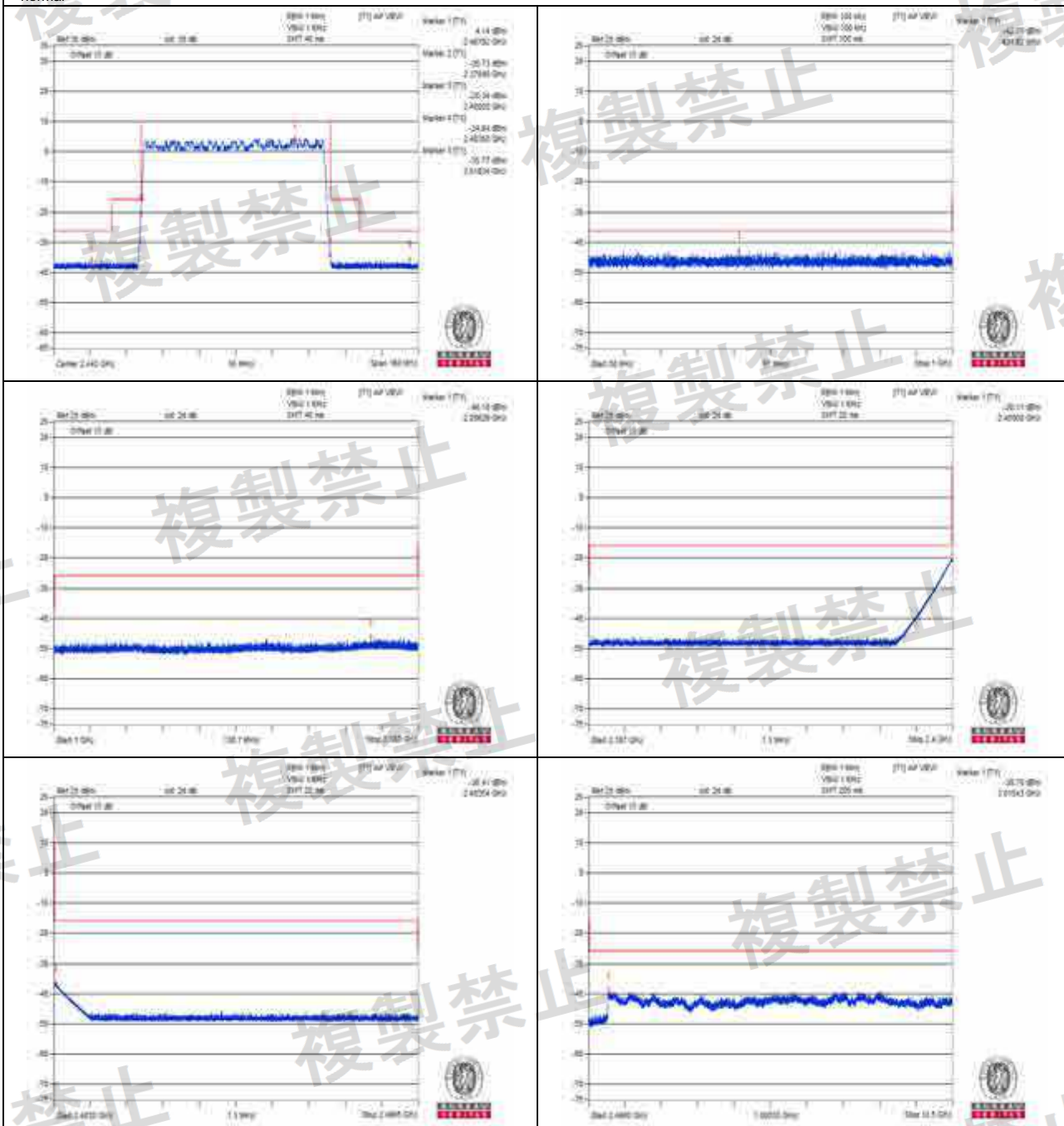
### Modulation: 8DPSK

Environmental Conditions		20 deg.C, 70% RH			
Test Condition	Frequency Range	Frequency (MHz)	Measure. Value(uW)	Limit	Result
V <sub>normal</sub>	30.0MHz to 1000.0MHz	431.820	0.052uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2209.290	0.024uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2400.000	<b>9.749uW</b>	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.540	<b>0.228uW</b>	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3015.430	0.134uW	2.5uW/MHz	PASS
V <sub>max.</sub>	30.0MHz to 1000.0MHz	699.900	<b>0.057uW</b>	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2223.680	<b>0.026uW</b>	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	9.375uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	0.227uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3170.480	<b>0.146uW</b>	2.5uW/MHz	PASS
V <sub>min.</sub>	30.0MHz to 1000.0MHz	56.910	0.056uW	0.25uW/100kHz	PASS
	1000.0MHz to 2387MHz	2305.510	0.022uW	2.5uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.990	9.015uW	25uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.500	0.22uW	25uW/MHz	PASS
	2496.5MHz to 12500.0MHz	3170.480	0.138uW	2.5uW/MHz	PASS

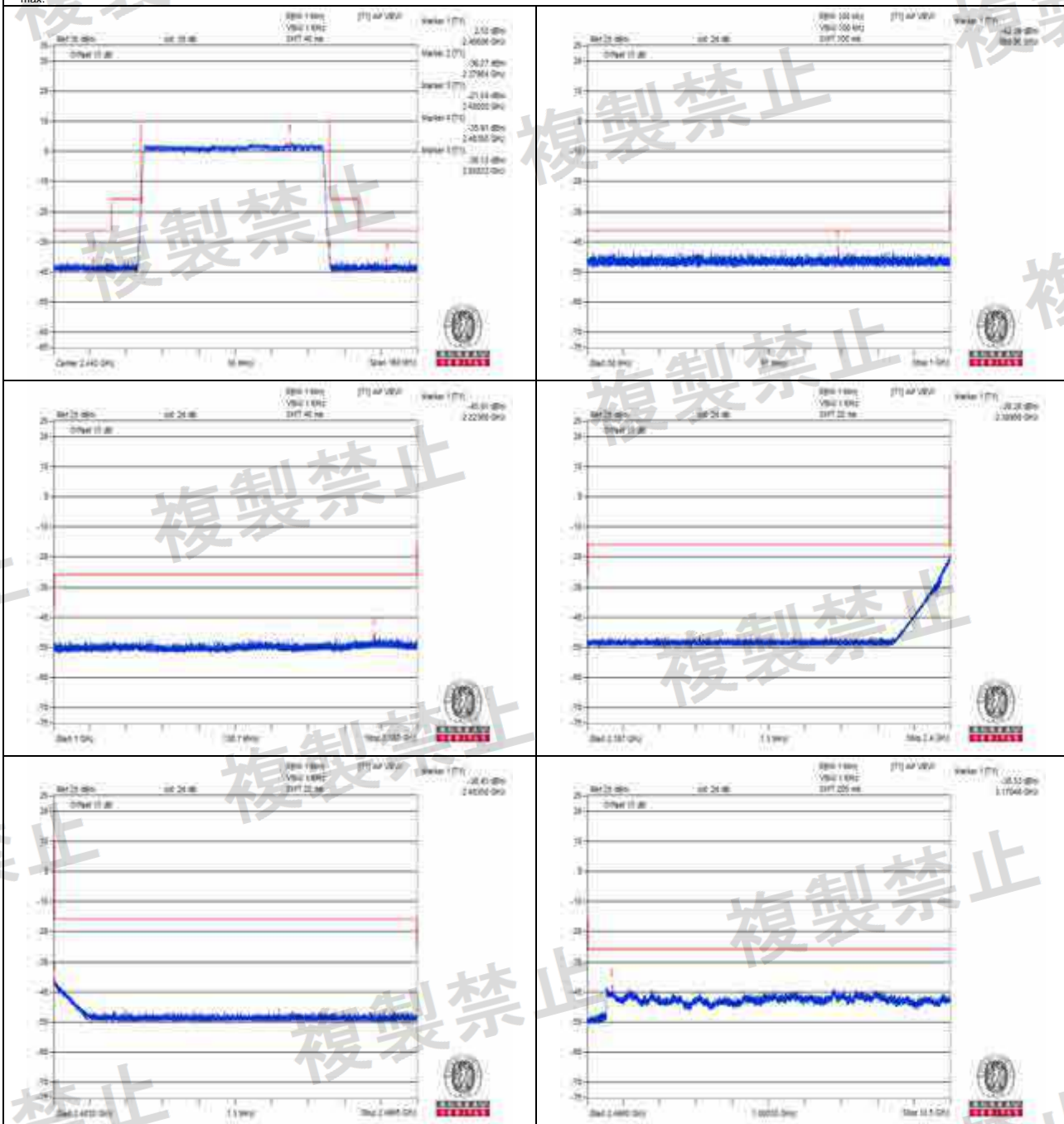
- NOTE:** 1. The worst value in each frequency range v.s. each channel has been marked by boldface.  
2. The spectrum plots are attached on the following pages.



V<sub>normal</sub>

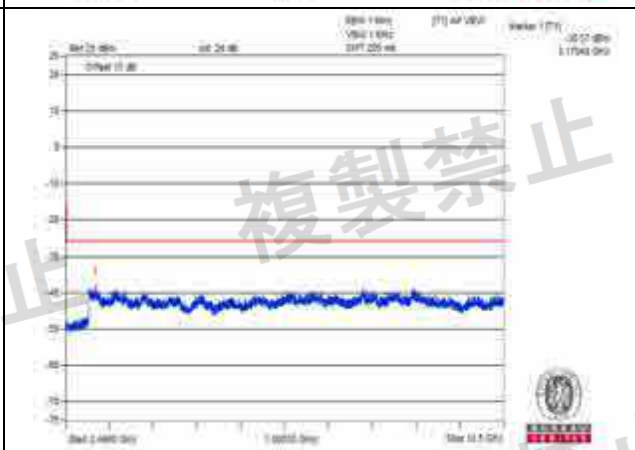
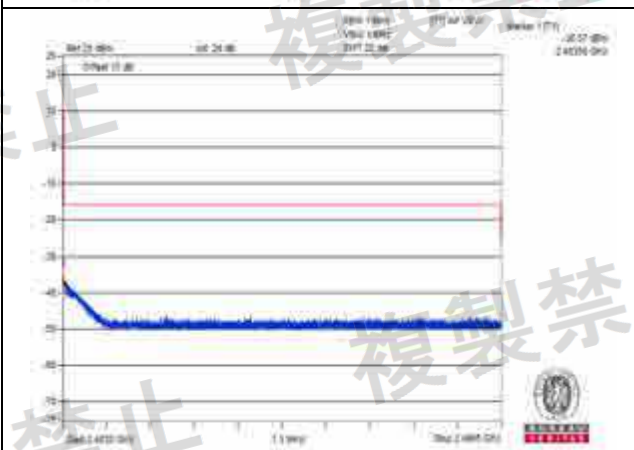
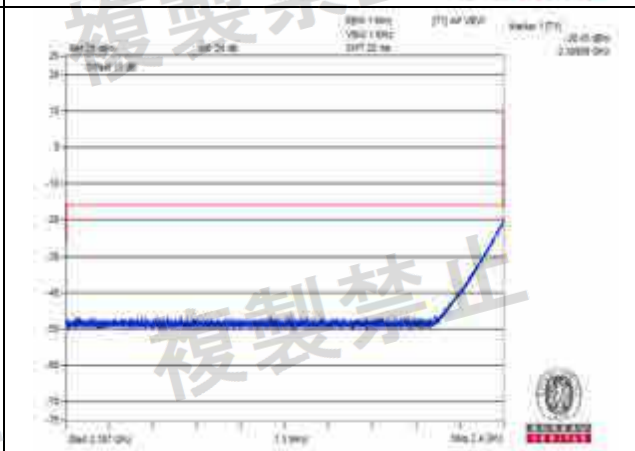
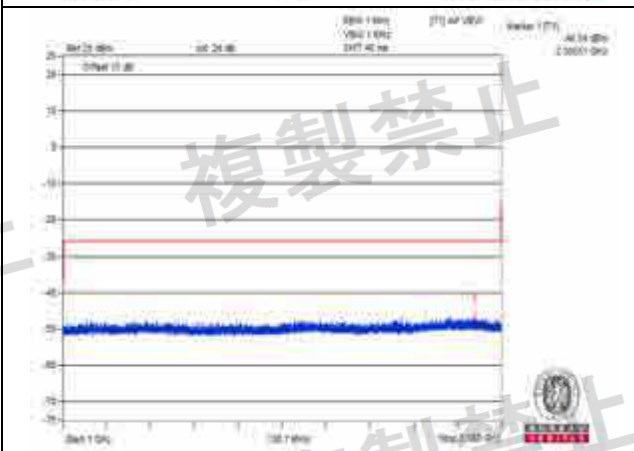
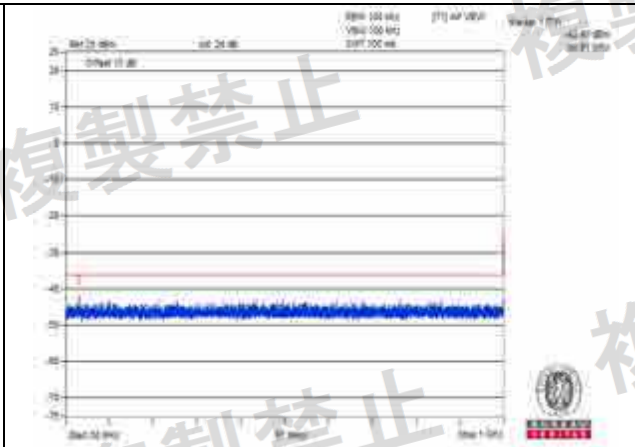
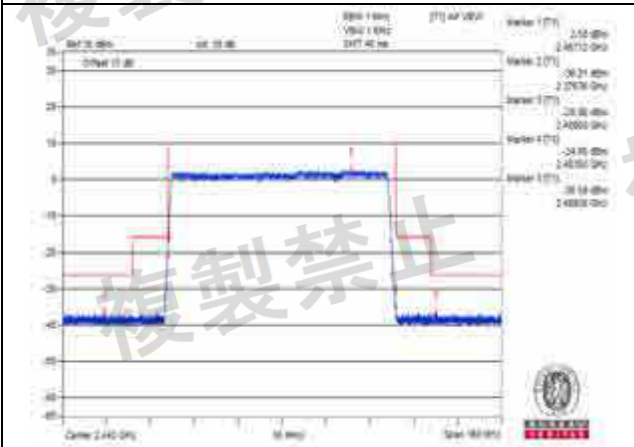


Measurement uncertainty:  $\pm 3.93\text{dB}$

$V_{\max}$ 

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

V<sub>min</sub>



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



## 4.5 Antenna Power Measurement

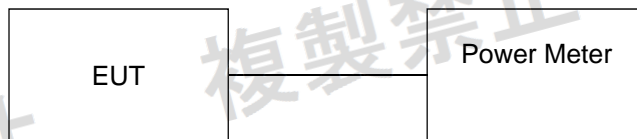
### 4.5.1 Limits of Antenna Power

Modulation System	Frequency Band Used	Antenna Power (Max.)	EIRP (Max.)	
			Omni-Directional Case	Directional Case
DS	2400 – 2483.5 MHz	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 (8.20mW/MHz)	19.14 dBm/MHz (82.03 mW/MHz)
FH	2400 – 2483.5 MHz	3 mW/MHz	6.91 dBm/MHz (4.9 mW/MHz)	16.91 dBm/MHz (49.09 mW/MHz)

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).

### 4.5.2 Test Setup



Output Power Density (mW/MHz) = Total Output Power (mW) / Spread Bandwidth (MHz)  
Average power sensor was used to perform output power measurement, trigger and gating function of wide band power meter is enabled to measure max output power of TX on burst. Duty factor is not added to measured value.





#### 4.5.3 Test Results

##### NORMAL MODE

Environmental Conditions		25 deg.C, 68% RH			
Modulation Type	Data Rate Type	Conducted RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		5Vdc	5.5Vdc	4.5Vdc	
GFSK	DH5	0.033455	0.032656	<b>0.034432</b>	3
$\pi/4$ -DQPSK	2DH5	0.016034	0.016723	0.015707	3
8DPSK	3DH5	0.016034	0.015456	0.016296	3
Rated power		0.04mW/MHz			
Tolerance of antenna power		0.008mW/MHz ~ 0.048mW/MHz			

##### Dipole antenna with 5.03dBi gain

Environmental Conditions		25 deg.C, 68% RH			
Modulation Type	Data Rate Type	Radiated RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		5Vdc	5.5Vdc	4.5Vdc	
GFSK	DH5	0.106527	0.103983	<b>0.109638</b>	4.909
$\pi/4$ -DQPSK	2DH5	0.051055	0.053249	0.050014	4.909
8DPSK	3DH5	0.051055	0.049215	0.051890	4.909

Note: The value of radiated RF output densities are "calculated" values.





#### AFH MODE

Environmental Conditions		25 deg.C, 68% RH			
Modulation Type	Data Rate Type	Conducted RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		5Vdc	5.5Vdc	4.5Vdc	
GFSK	DH5	0.132333	0.128448	<b>0.135434</b>	3
$\pi/4$ -DQPSK	2DH5	0.062732	0.065604	0.061791	3
8DPSK	3DH5	0.063077	0.060471	0.063760	3
Rated power		0.2mW/MHz			
Tolerance of antenna power		0.04mW/MHz ~ 0.24mW/MHz			

#### Dipole antenna with 5.03dBi gain

Environmental Conditions		25 deg.C, 68% RH			
Modulation Type	Data Rate Type	Radiated RF Output Power Density (mW/MHz)			
		Normal Voltage	Max. Voltage	Min. Voltage	Max. Limit (mW/MHz)
		5Vdc	5.5Vdc	4.5Vdc	
GFSK	DH5	0.421374	0.409004	<b>0.431249</b>	4.909
$\pi/4$ -DQPSK	2DH5	0.199751	0.208896	0.196755	4.909
8DPSK	3DH5	0.200850	0.192552	0.203024	4.909

Note: The value of radiated RF output densities are "calculated" values.



#### 4.6 Spurious Emissions for Receiver

##### 4.6.1 Limits of Spurious Emissions for Receiver

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

##### 4.6.2 Test Setup





#### 4.6.3 Test Result

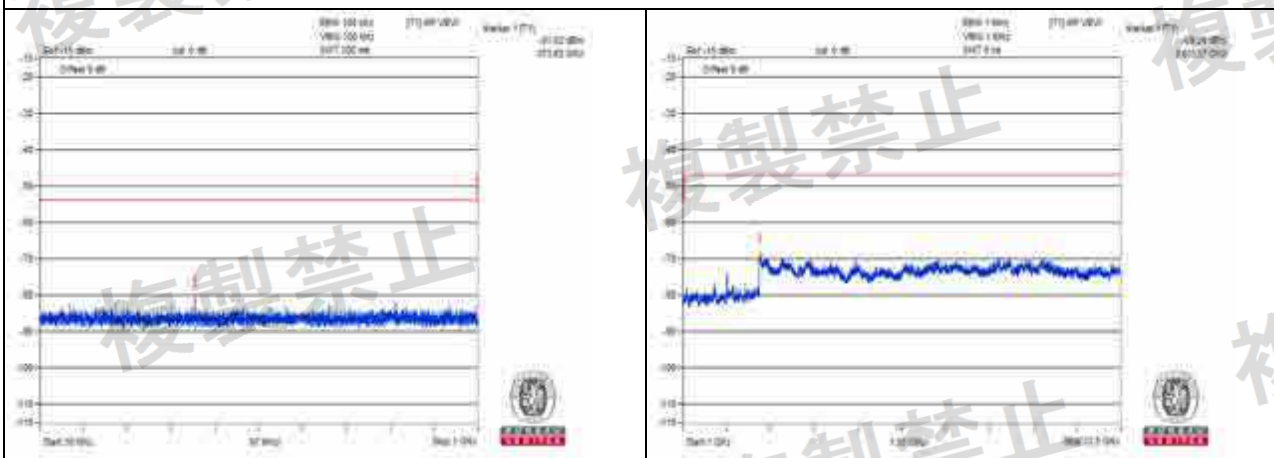
##### Modulation: GFSK

Test Channel		CH0 (2402MHz)		CH39 (2441MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measure. Value (nW)	Frequency (MHz)	Measure. Value (nW)		
V <sub>normal</sub>	below 1GHz	373.620	0.006887nW	178.160	0.005321nW	4nW/100kHz	PASS
	above 1GHz	3015.370	0.119124nW	3024.000	0.119399nW	20nW/MHz	PASS
V <sub>max.</sub>	below 1GHz	183.500	0.007145nW	820.790	0.007311nW	4nW/100kHz	PASS
	above 1GHz	3015.370	0.152405nW	7681.500	0.125026nW	20nW/MHz	PASS
V <sub>min.</sub>	below 1GHz	479.590	0.006368nW	877.530	0.006871nW	4nW/100kHz	PASS
	above 1GHz	3032.620	0.121339nW	3029.750	0.126765nW	20nW/MHz	PASS
Test Channel		CH78 (2480MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz)		Measure. Value (nW)			
V <sub>normal</sub>	below 1GHz	804.060		0.00811nW		4nW/100kHz	PASS
	above 1GHz	9415.120		0.118577nW		20nW/MHz	PASS
V <sub>max.</sub>	below 1GHz	823.940		0.006427nW		4nW/100kHz	PASS
	above 1GHz	3001.000		0.125026nW		20nW/MHz	PASS
V <sub>min.</sub>	below 1GHz	357.860		0.007079nW		4nW/100kHz	PASS
	above 1GHz	3208.000		0.133352nW		20nW/MHz	PASS

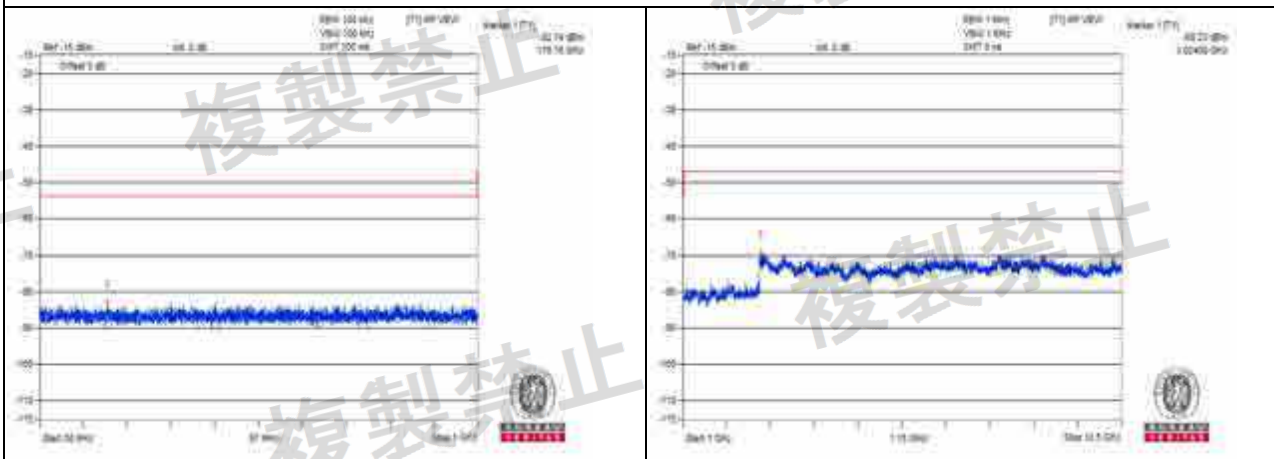
**NOTE:** 1. The worst value in each frequency range v.s. each channel has been marked by boldface.  
2. The spectrum plots are attached on the following pages.



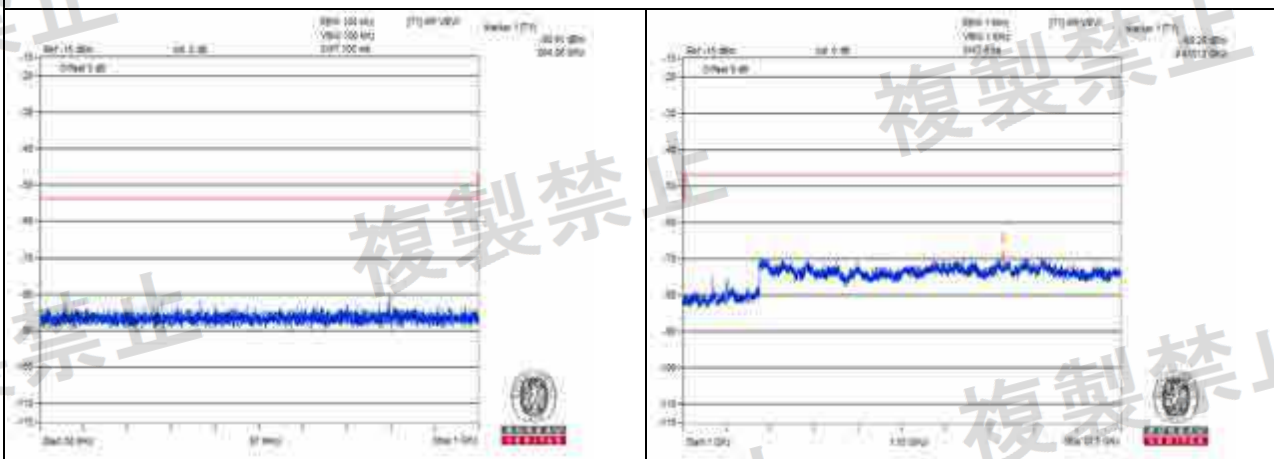
V<sub>normal</sub>



Channel 0



Channel 39

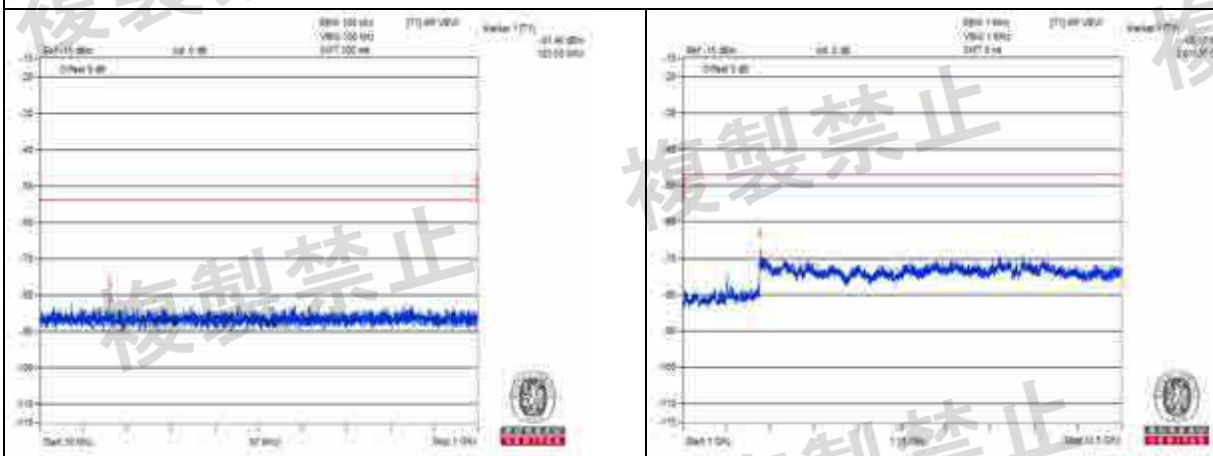


Channel 78

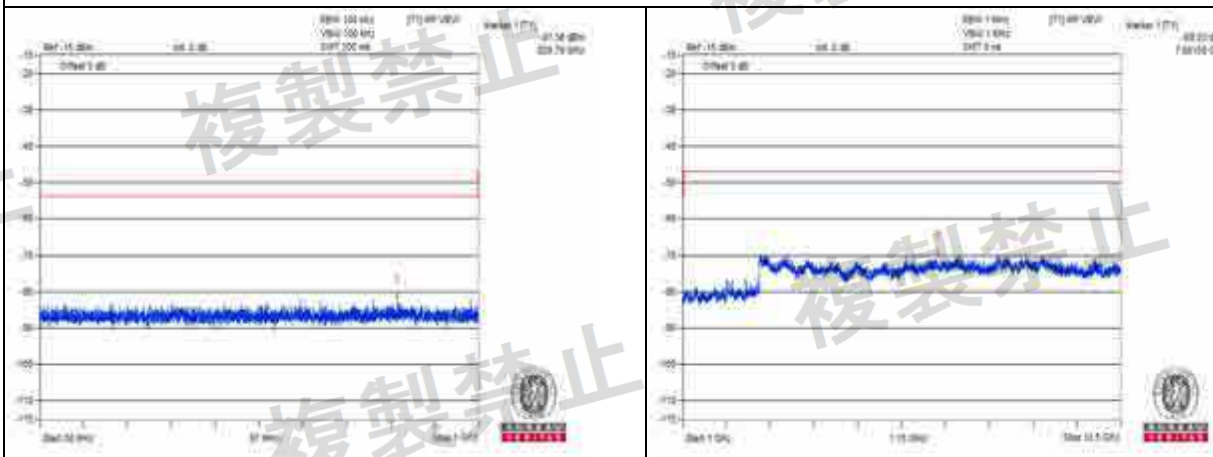
Measurement uncertainty:  $\pm 3.93\text{dB}$



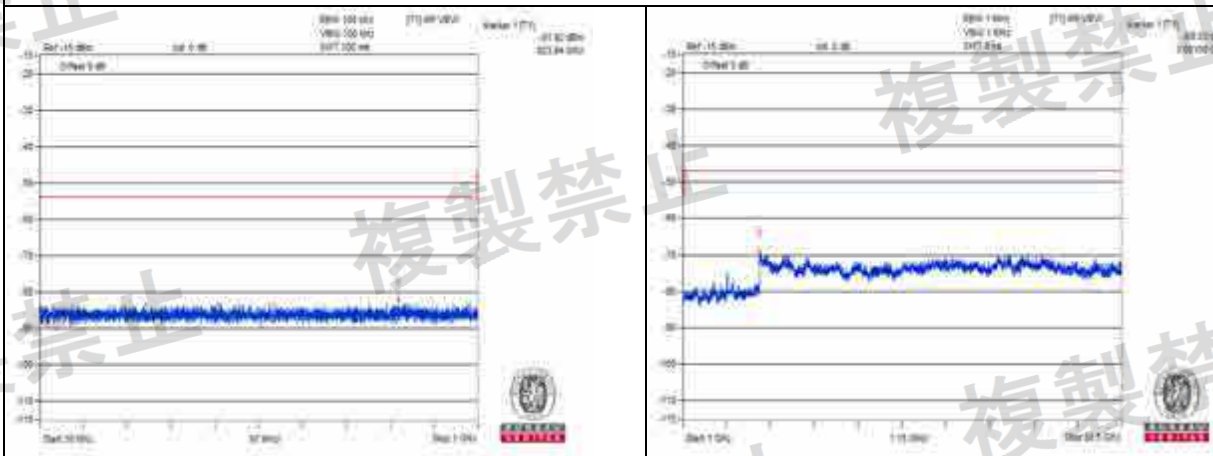
Vmax.



Channel 0



Channel 39

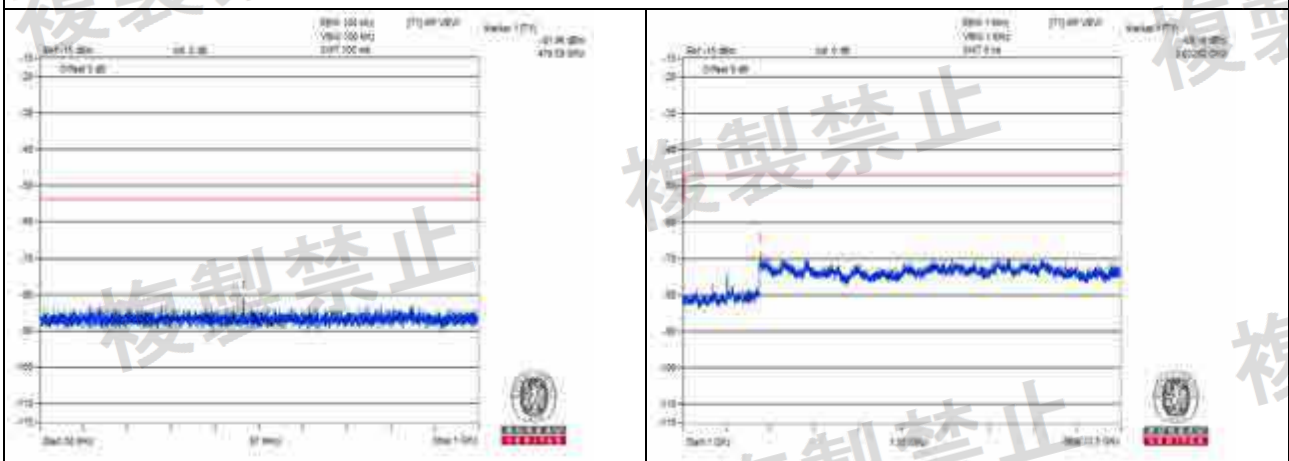


Channel 78

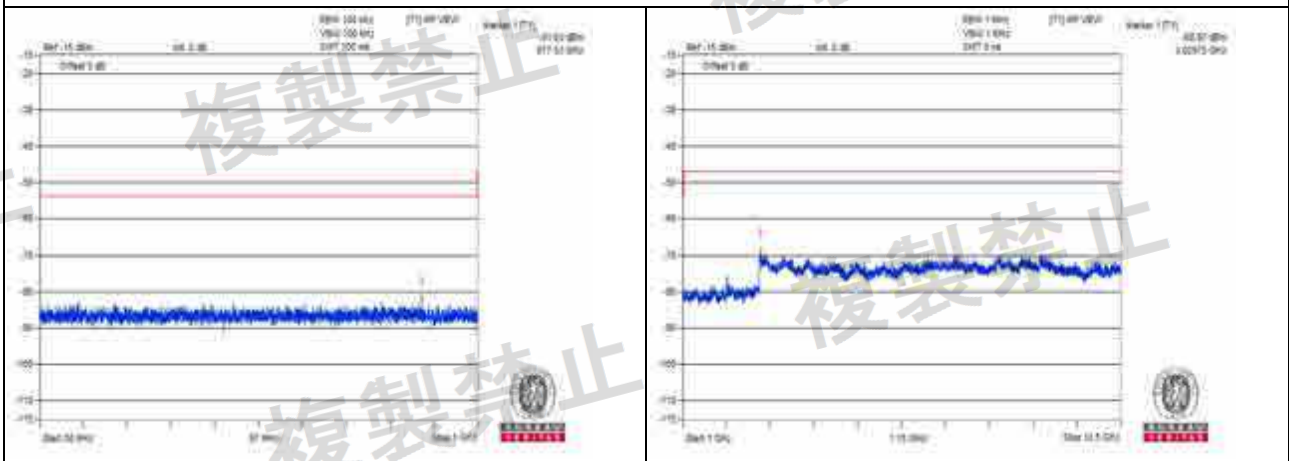
Measurement uncertainty:  $\pm 3.93\text{dB}$



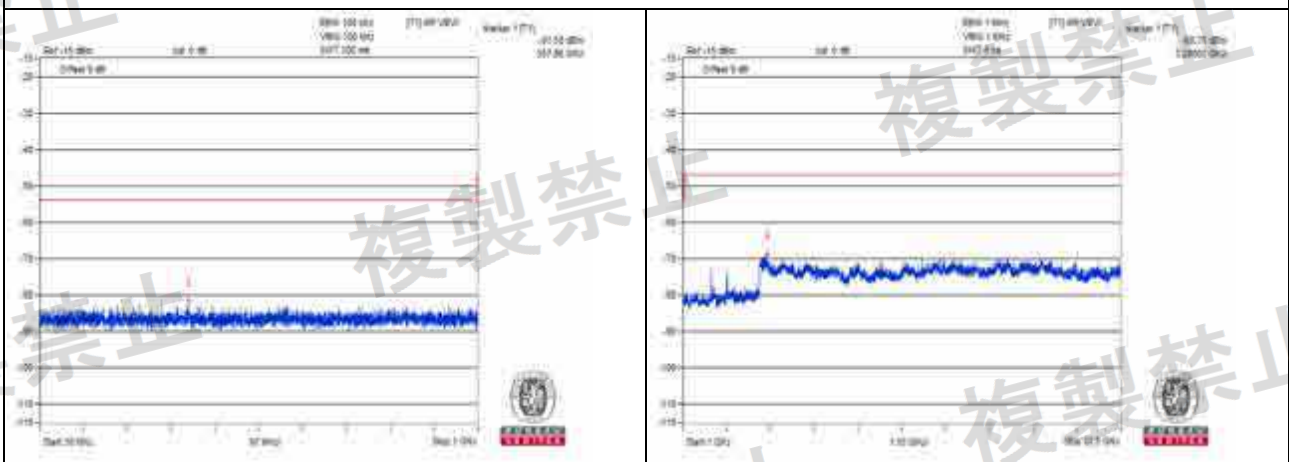
Vmin.



Channel 0



Channel 39



Channel 78

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



#### 4.7 Dwell Time

##### 4.7.1 Limits of Dwell Time

The frequency retention time in the frequency hopping method shall be 0.4 second or less. The total sum of the frequency retention time in any frequency within the time obtained by multiplying the diffusion rate by 0.4 second shall be 0.4 second or shorter.

Formula:

**(Normal mode)** dwell time = [diffusion rate/ 79] x duty-cycle x 0.4 seconds

**(AFH mode)** dwell time = [diffusion rate/20] x duty-cycle x 0.4 sec

##### 4.7.2 Test Setup





#### 4.7.3 Test Result

Modulation: GFSK

NORMAL MODE

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	DH1	71.20	0.360	0.299	107.640	400
	DH3	71.20	0.360	0.650	234.000	400
	DH5	71.20	0.360	0.761	273.960	400
Normal Voltage max.	DH1	70.80	0.358	0.299	107.042	400
	DH3	70.80	0.358	0.650	232.700	400
	DH5	70.80	0.358	0.761	272.438	400
Normal Voltage min.	DH1	70.80	0.358	0.312	111.696	400
	DH3	70.80	0.358	0.650	232.700	400
	DH5	70.80	0.358	0.761	272.438	400

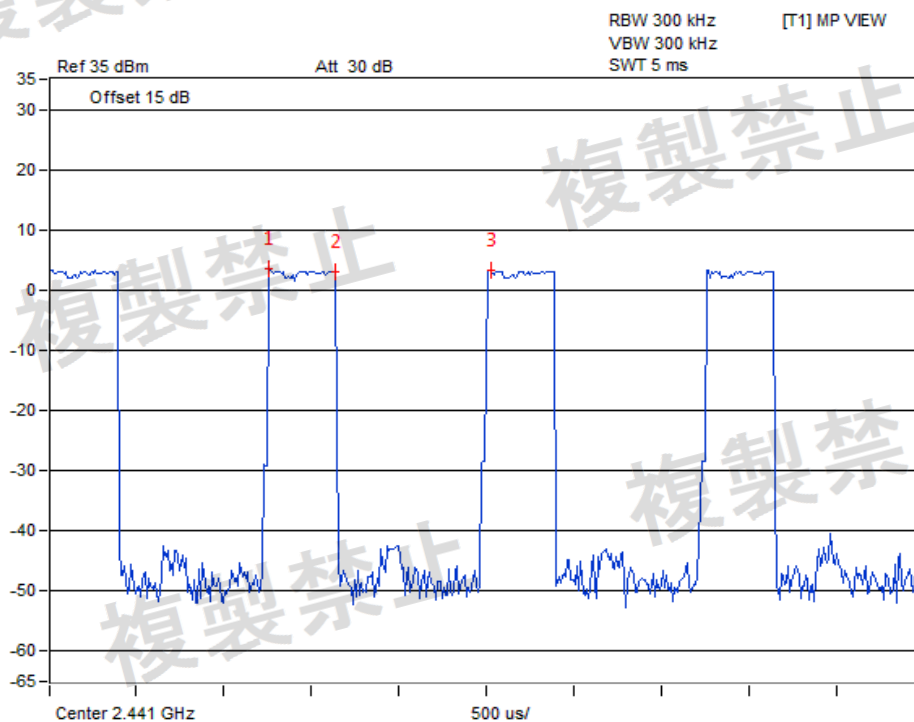
AFH MODE

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	DH1	18.00	0.360	0.299	107.640	400
	DH3	18.00	0.360	0.650	234.000	400
	DH5	18.00	0.360	0.761	273.960	400
Normal Voltage max.	DH1	18.00	0.360	0.299	107.640	400
	DH3	18.00	0.360	0.650	234.000	400
	DH5	18.00	0.360	0.761	273.960	400
Normal Voltage min.	DH1	18.00	0.360	0.312	112.320	400
	DH3	18.00	0.360	0.650	234.000	400
	DH5	18.00	0.360	0.761	273.960	400

Test plots of the transmitting time slot are shown on next 6 pages.



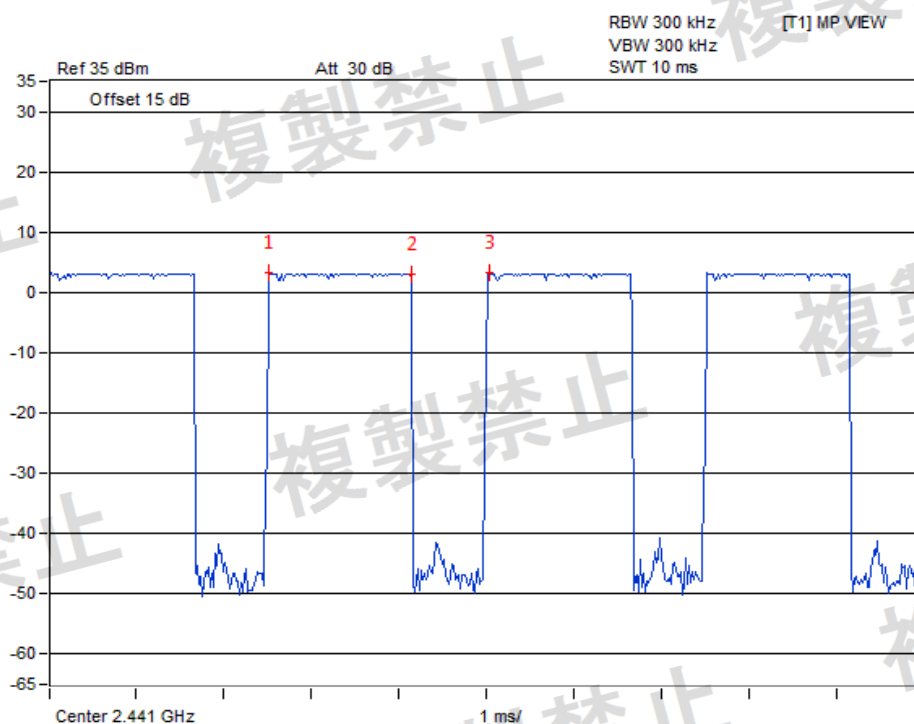
V<sub>normal</sub>



Marker 1 [T1] 3.43 dBm  
1.250000 ms  
Delta 2 [T1] 0.44 dB  
380.000000 us  
Delta 3 [T1] 0.27 dB  
1.270000 ms



DH1



Marker 1 [T1] 3.38 dBm  
2.500000 ms  
Delta 2 [T1] 0.39 dB  
1.640000 ms  
Delta 3 [T1] 0.01 dB  
2.520000 ms

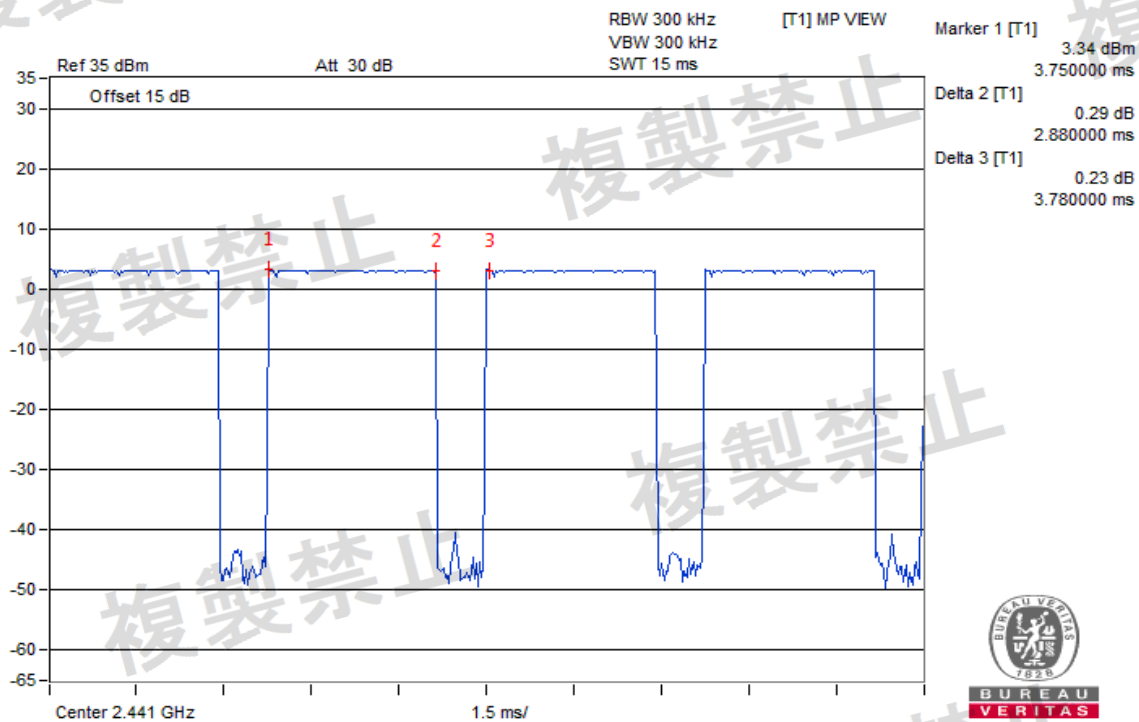


DH3

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



V<sub>normal</sub>



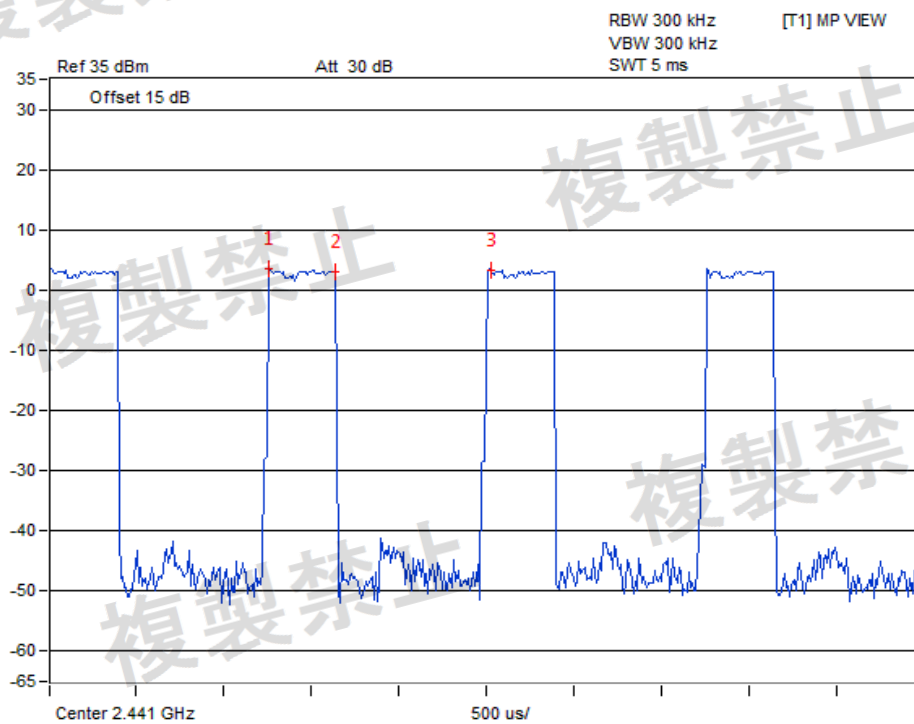
DH5

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





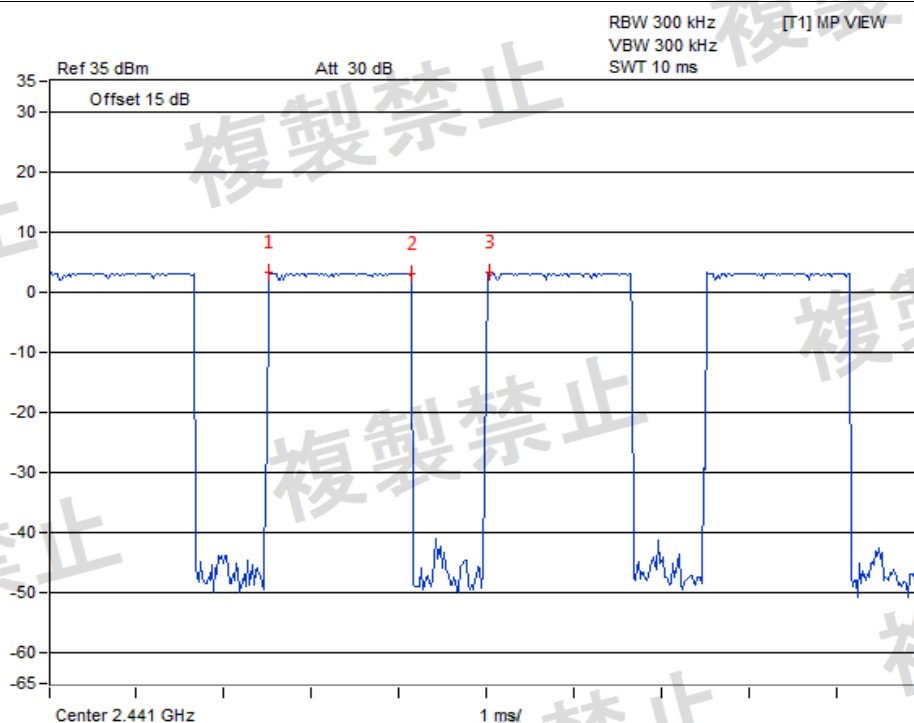
V<sub>max</sub>.



Marker 1 [T1] 3.42 dBm  
1.250000 ms  
Delta 2 [T1] 0.40 dB  
380.000000 us  
Delta 3 [T1] 0.25 dB  
1.270000 ms



DH1



Marker 1 [T1] 3.38 dBm  
2.500000 ms  
Delta 2 [T1] 0.36 dB  
1.640000 ms  
Delta 3 [T1] 0.03 dB  
2.520000 ms

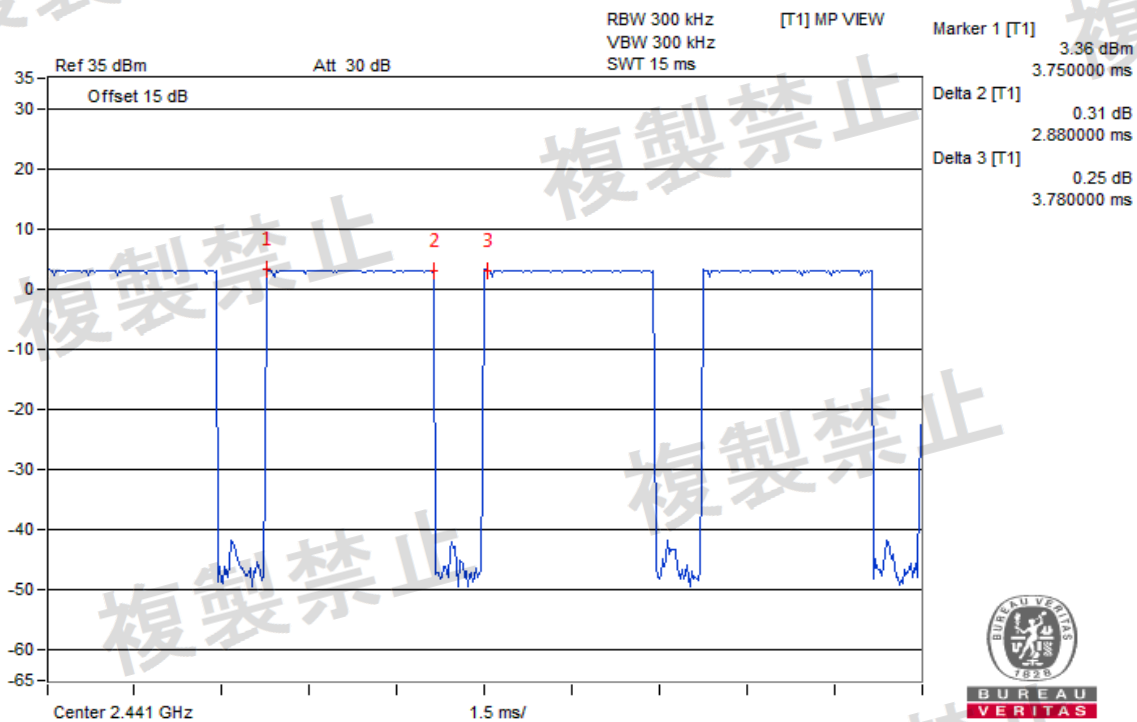


DH3

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



V<sub>max</sub>.

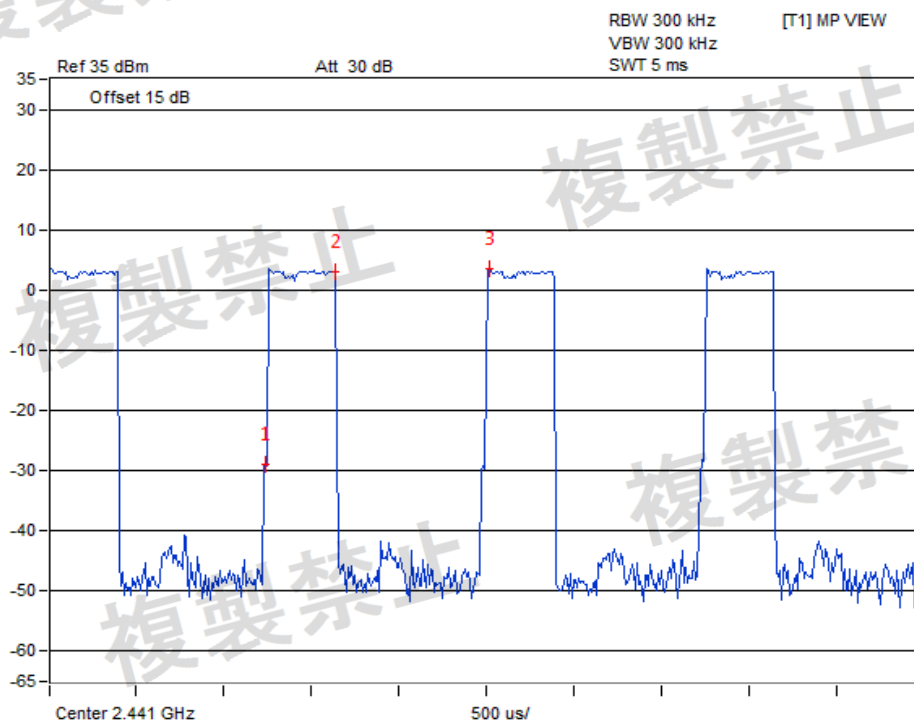


DH5

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



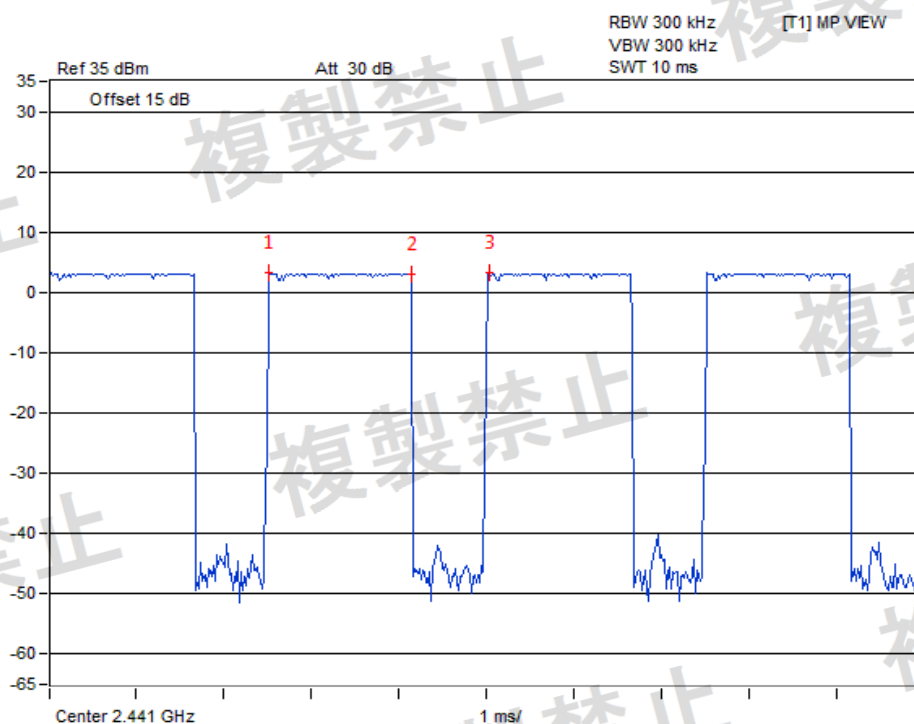
V<sub>min</sub>.



Marker 1 [T1]  
-28.98 dBm  
1.230000 ms  
Delta 2 [T1]  
32.03 dB  
400.000000 us  
Delta 3 [T1]  
32.42 dB  
1.280000 ms



DH1



Marker 1 [T1]  
3.38 dBm  
2.500000 ms  
Delta 2 [T1]  
0.37 dB  
1.640000 ms  
Delta 3 [T1]  
0.04 dB  
2.520000 ms

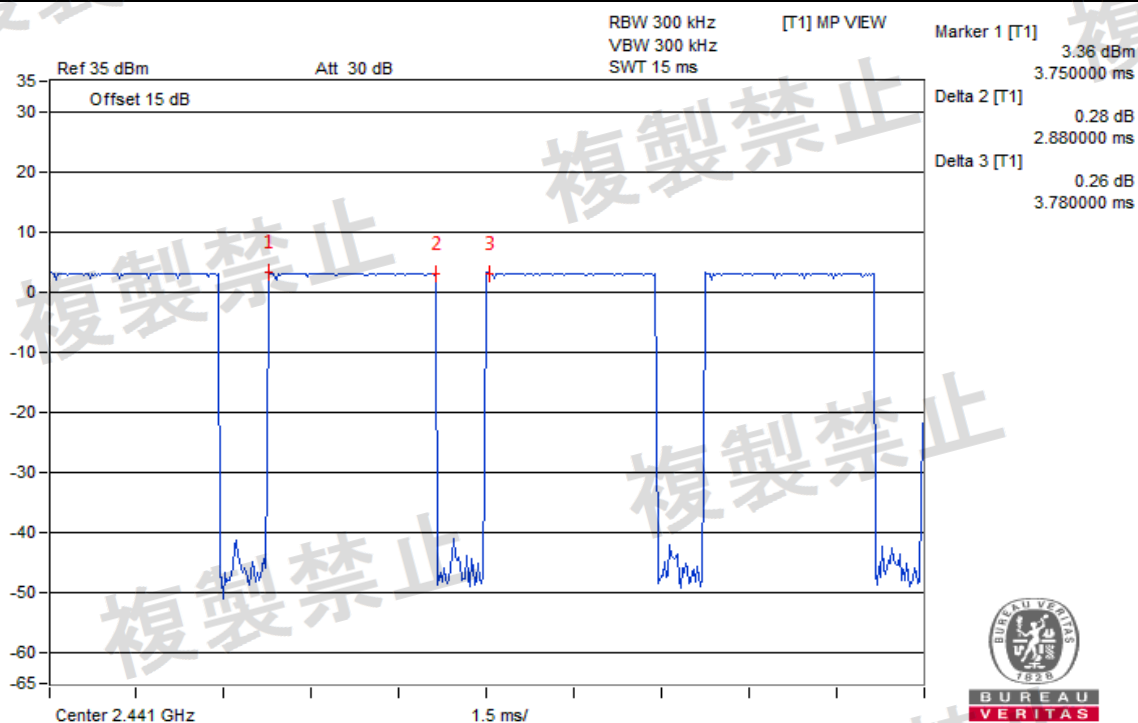


DH3

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



V<sub>min</sub>.



DH5

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



Modulation:  $\pi/4$ -DQPSK

**NORMAL MODE**

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	2DH1	71.60	0.362	0.301	108.962	400
	2DH3	71.60	0.362	0.642	232.404	400
	2DH5	71.60	0.362	0.752	272.224	400
Normal Voltage max.	2DH1	71.40	0.361	0.301	108.661	400
	2DH3	71.40	0.361	0.650	234.650	400
	2DH5	71.40	0.361	0.752	271.472	400
Normal Voltage min.	2DH1	71.60	0.362	0.312	112.944	400
	2DH3	71.60	0.362	0.650	235.300	400
	2DH5	71.60	0.362	0.761	275.482	400

**AFH MODE**

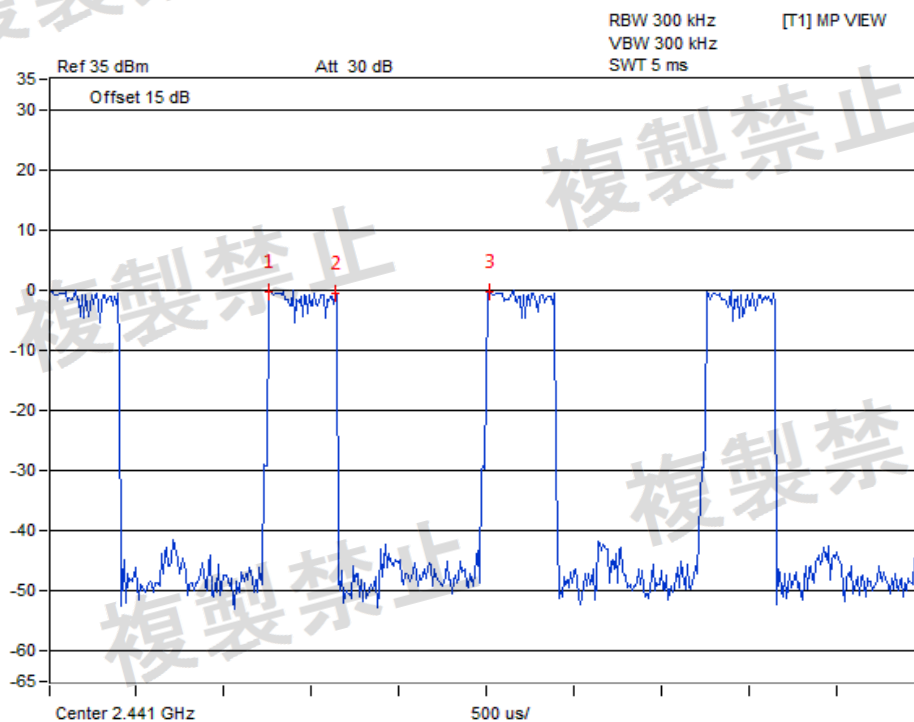
Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	2DH1	18.30	0.366	0.301	110.166	400
	2DH3	18.30	0.366	0.642	234.972	400
	2DH5	18.30	0.366	0.752	275.232	400
Normal Voltage max.	2DH1	18.20	0.364	0.301	109.564	400
	2DH3	18.20	0.364	0.650	236.600	400
	2DH5	18.20	0.364	0.752	273.728	400
Normal Voltage min.	2DH1	18.20	0.364	0.312	113.568	400
	2DH3	18.20	0.364	0.650	236.600	400
	2DH5	18.20	0.364	0.761	277.004	400

Test plots of the transmitting time slot are shown on next 6 pages.





V<sub>normal</sub>



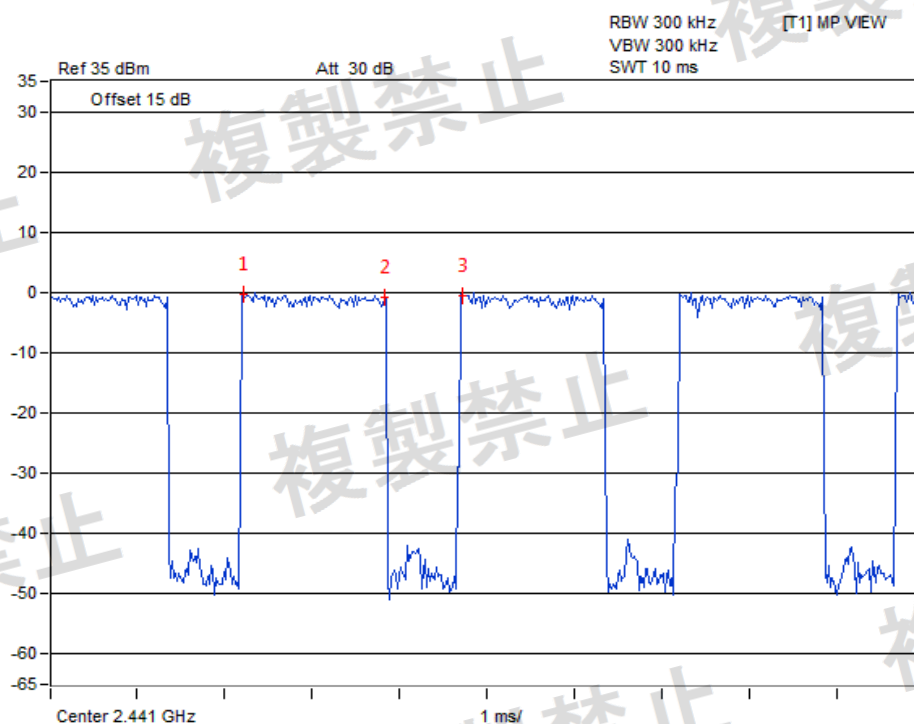
Marker 1 [T1]  
-0.20 dBm  
1.250000 ms

Delta 2 [T1]  
0.29 dB  
380.000000 us

Delta 3 [T1]  
0.01 dB  
1.260000 ms



2DH1



Marker 1 [T1]  
-0.26 dBm  
2.200000 ms

Delta 2 [T1]  
0.67 dB  
1.620000 ms

Delta 3 [T1]  
0.21 dB  
2.520000 ms

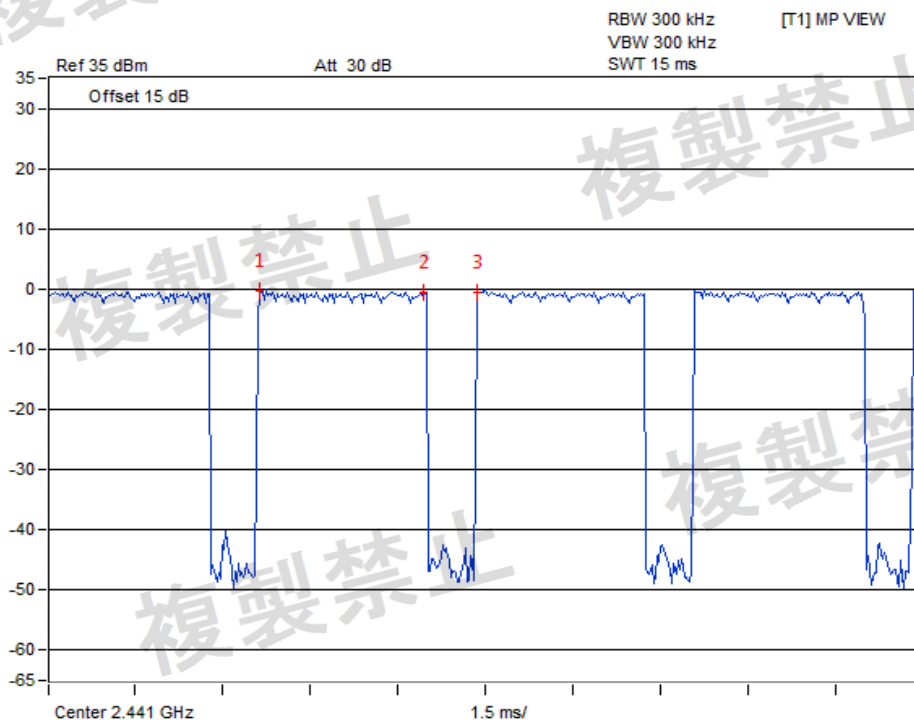


2DH3

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



V<sub>normal</sub>



Marker 1 [T1]      -0.32 dBm  
3.600000 ms

Delta 2 [T1]      0.27 dB  
2.820000 ms

Delta 3 [T1]      0.27 dB  
3.750000 ms

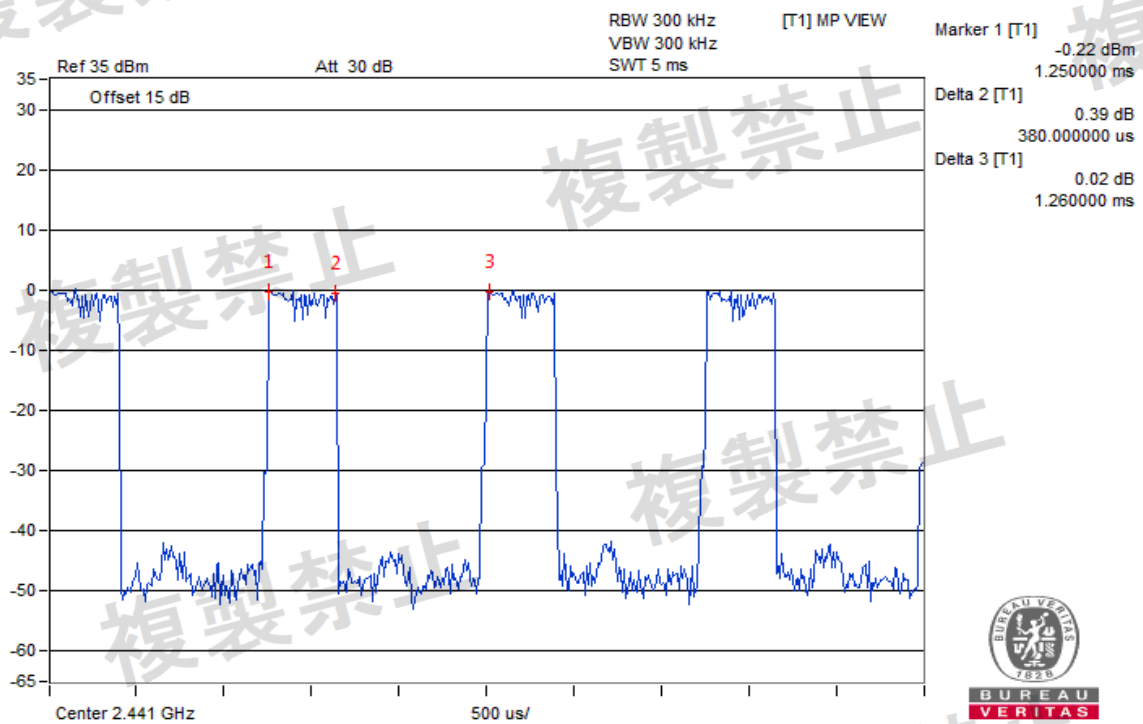


2DH5

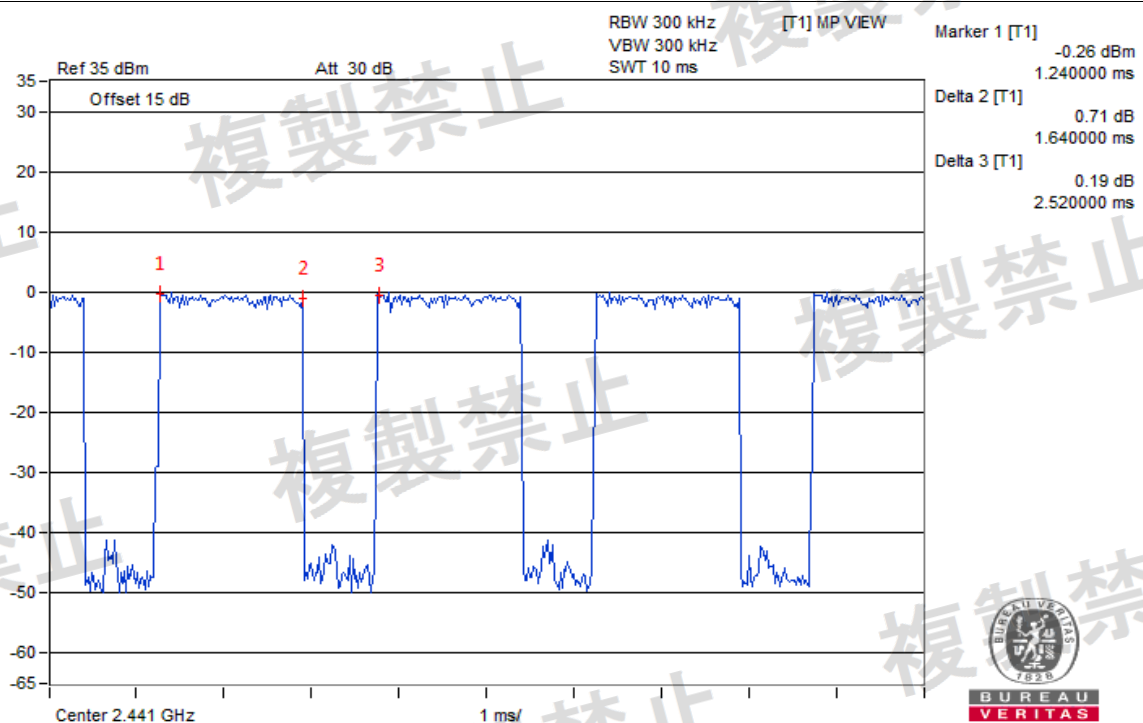
Measurement uncertainty:  $\pm 3.93\text{dB}$



V<sub>max</sub>.



2DH1

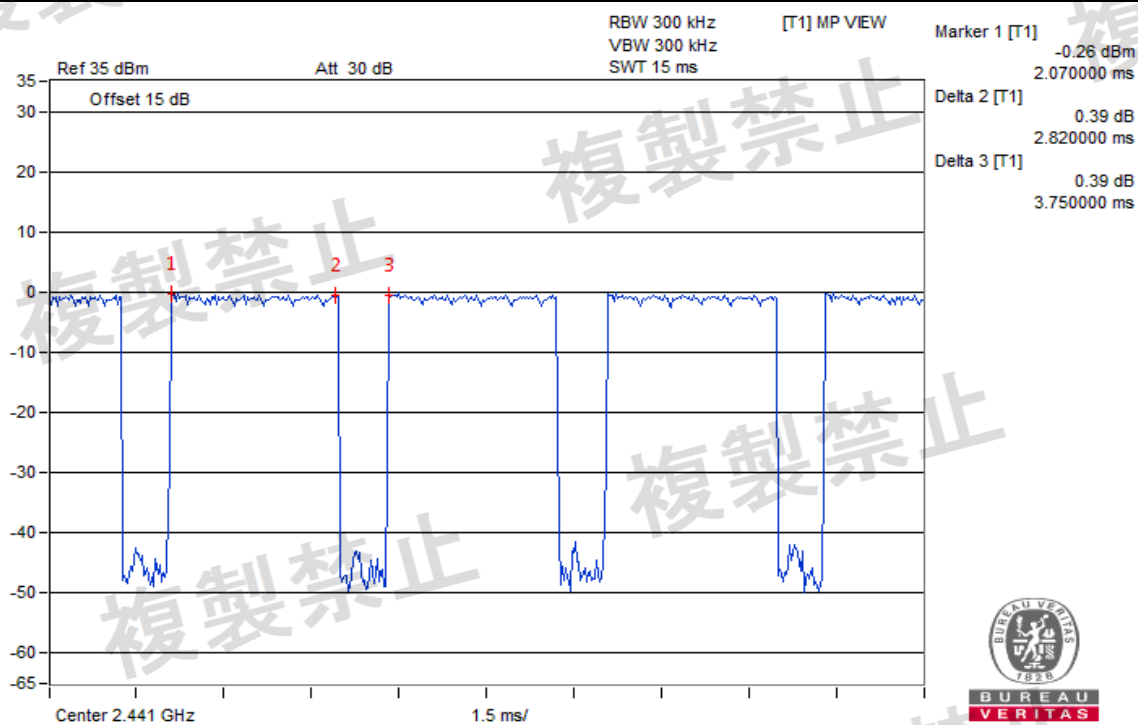


2DH3

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



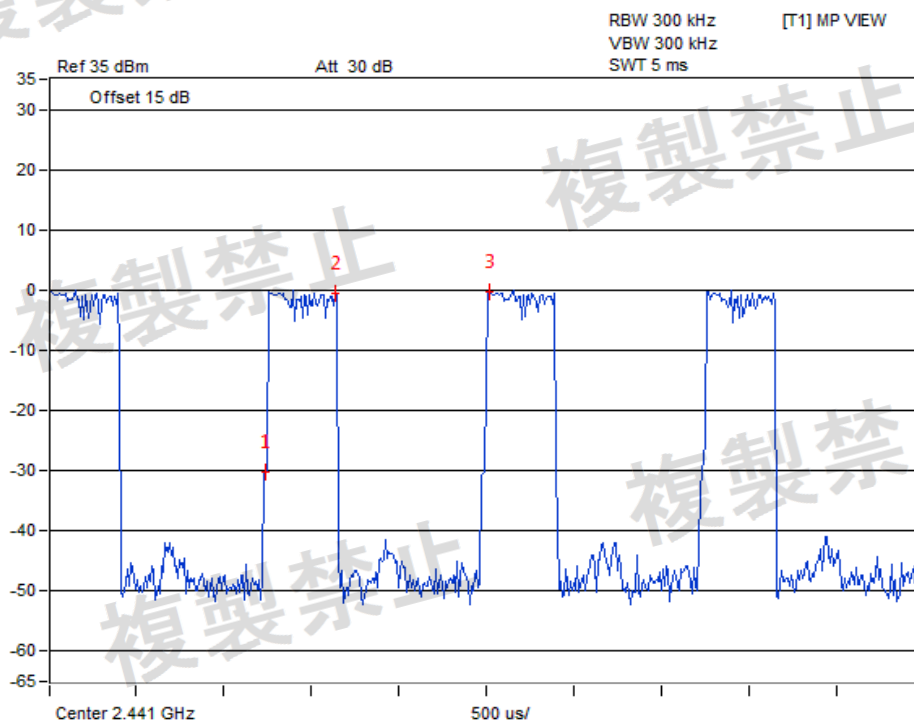
V<sub>max</sub>.



2DH5

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

V<sub>min</sub>.



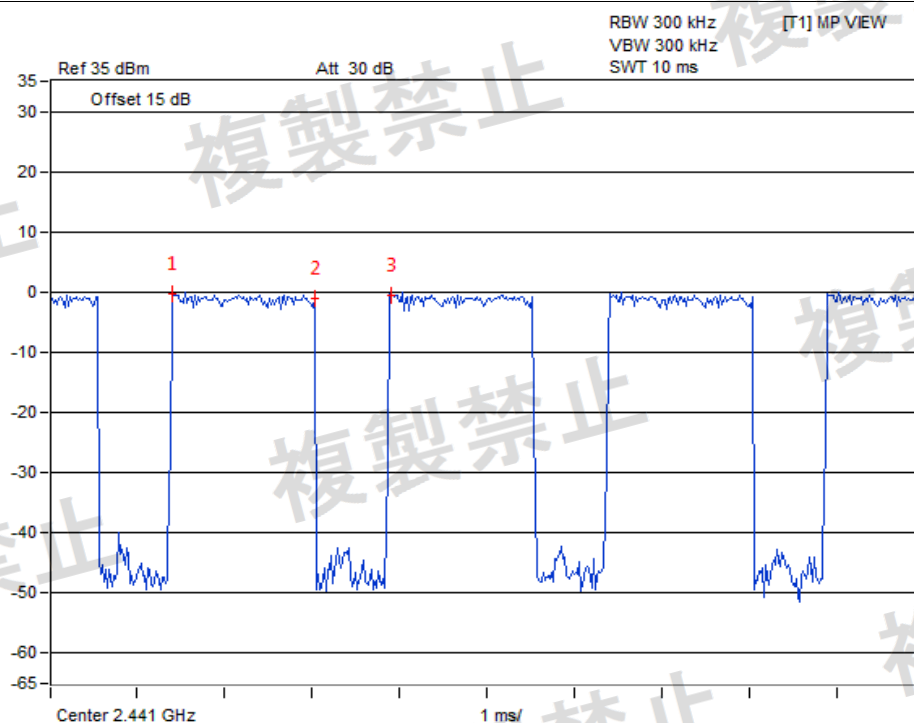
Marker 1 [T1]  
-30.17 dBm  
1.230000 ms

Delta 2 [T1]  
29.63 dB  
400.000000 us

Delta 3 [T1]  
29.94 dB  
1.280000 ms



2DH1



Marker 1 [T1]  
-0.28 dBm  
1.380000 ms

Delta 2 [T1]  
0.70 dB  
1.640000 ms

Delta 3 [T1]  
0.18 dB  
2.520000 ms



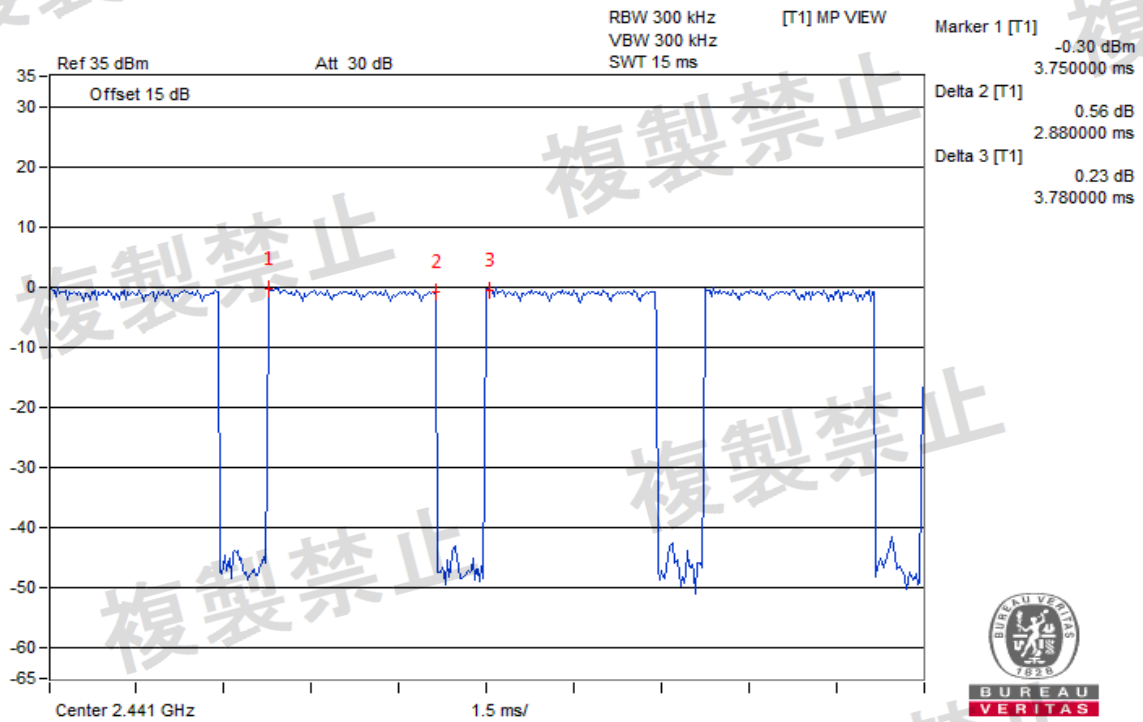
2DH3

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





V<sub>min</sub>.



2DH5

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



## Modulation: 8DPSK

### NORMAL MODE

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	3DH1	71.60	0.362	0.293	106.066	400
	3DH3	71.60	0.362	0.650	235.300	400
	3DH5	71.60	0.362	0.769	278.378	400
Normal Voltage max.	3DH1	71.60	0.362	0.312	112.944	400
	3DH3	71.60	0.362	0.650	235.300	400
	3DH5	71.60	0.362	0.768	278.016	400
Normal Voltage min.	3DH1	71.60	0.362	0.312	112.944	400
	3DH3	71.60	0.362	0.650	235.300	400
	3DH5	71.60	0.362	0.768	278.016	400

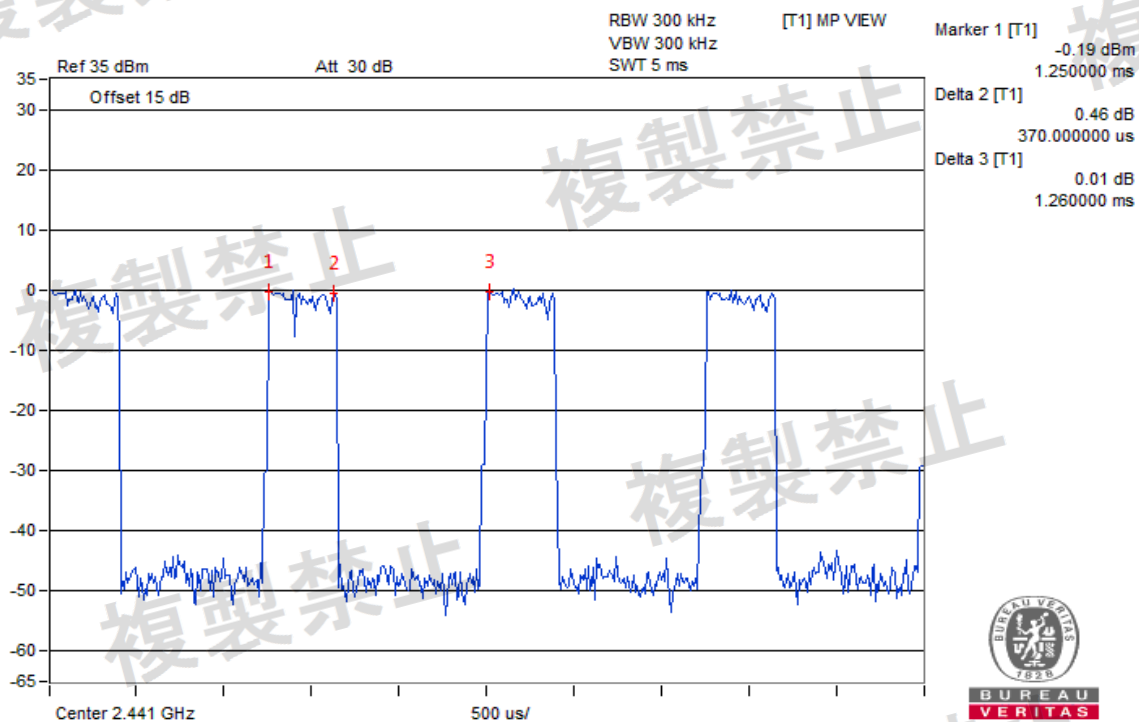
### AFH MODE

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
Normal Voltage	3DH1	18.20	0.364	0.293	106.652	400
	3DH3	18.20	0.364	0.650	236.600	400
	3DH5	18.20	0.364	0.769	279.916	400
Normal Voltage max.	3DH1	18.30	0.366	0.312	114.192	400
	3DH3	18.30	0.366	0.650	237.900	400
	3DH5	18.30	0.366	0.768	281.088	400
Normal Voltage min.	3DH1	18.30	0.366	0.312	114.192	400
	3DH3	18.30	0.366	0.650	237.900	400
	3DH5	18.30	0.366	0.768	281.088	400

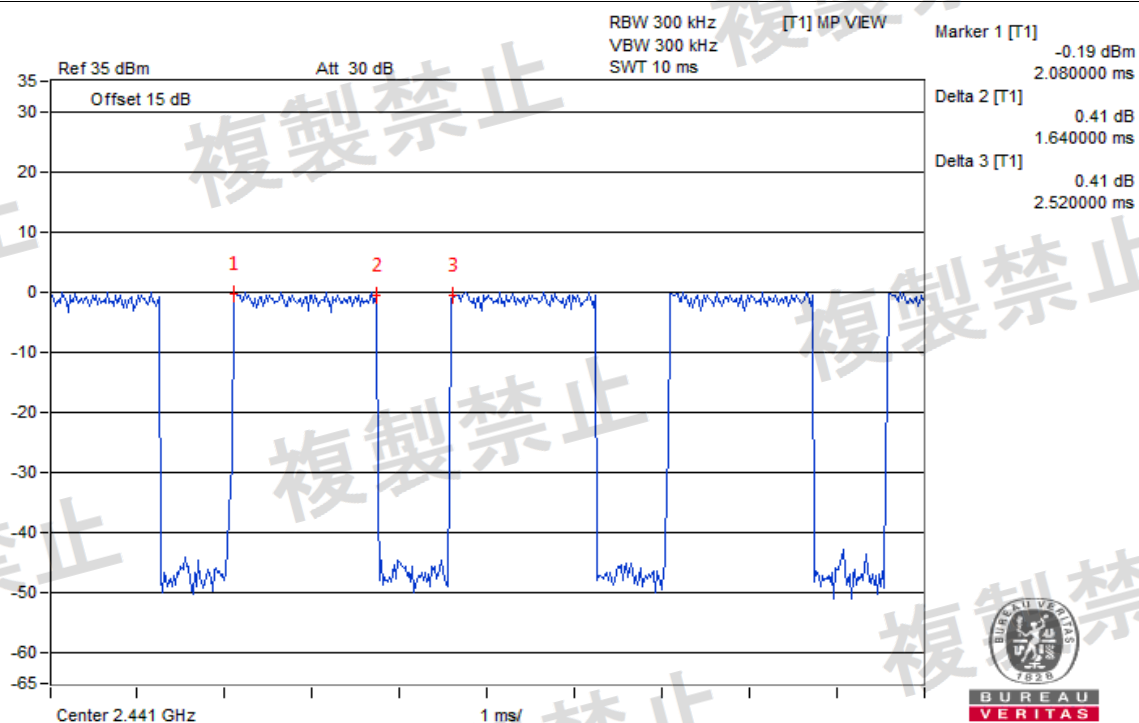
Test plots of the transmitting time slot are shown on next 6 pages.



V<sub>normal</sub>



3DH1

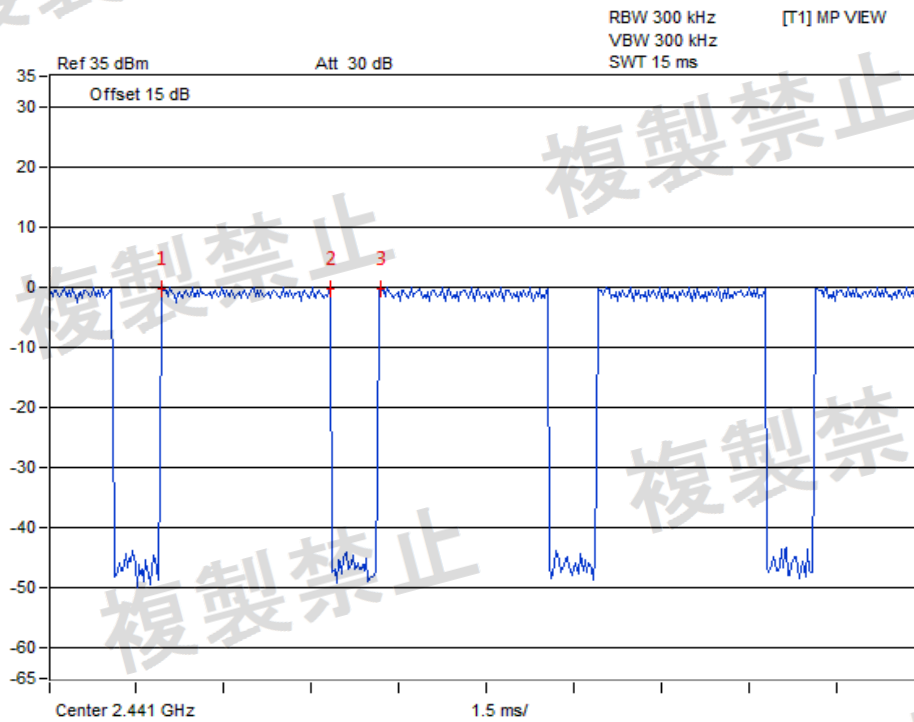


3DH3

Measurement uncertainty:  $\pm 3.93$  dB



V<sub>normal</sub>



Marker 1 [T1]      -0.22 dBm  
1.890000 ms  
Delta 2 [T1]      0.05 dB  
2.910000 ms  
Delta 3 [T1]      0.05 dB  
3.780000 ms

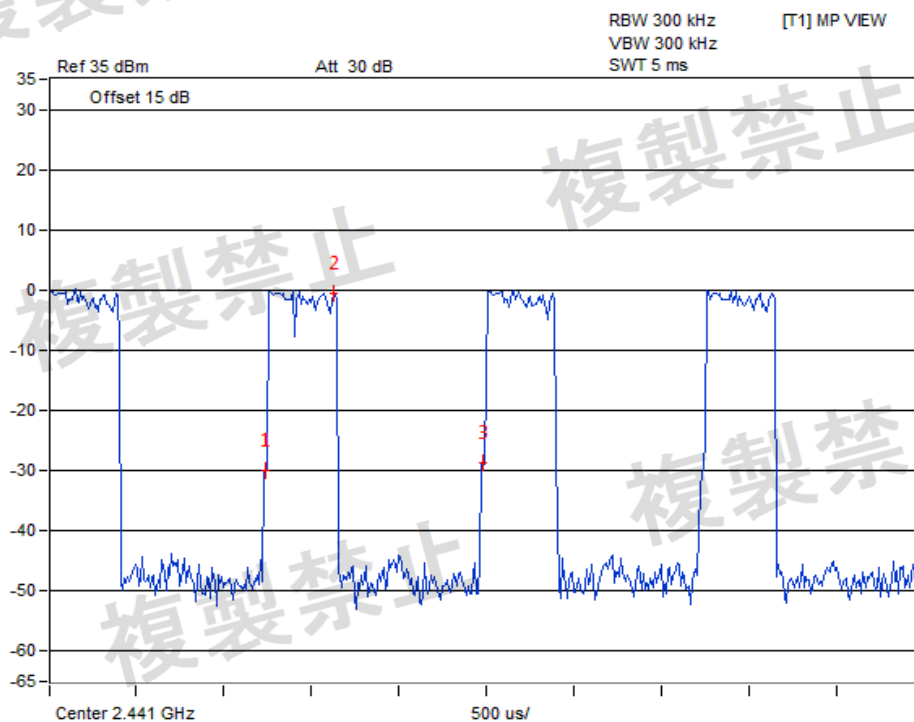


3DH5

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



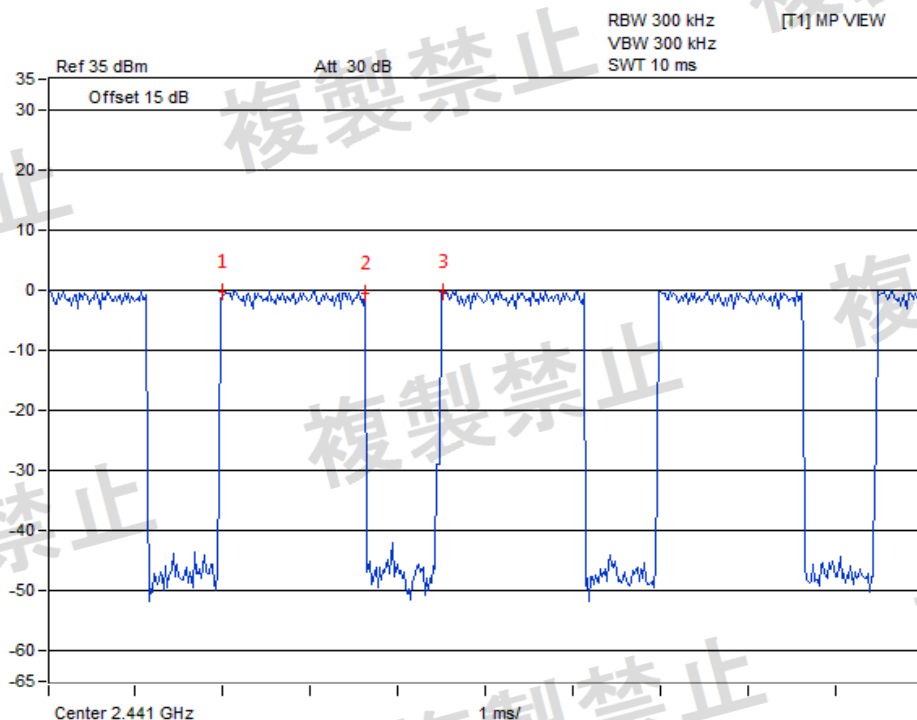
V<sub>max</sub>.



Marker 1 [T1]  
-29.93 dBm  
1.230000 ms  
Delta 2 [T1]  
29.32 dB  
390.000000 us  
Delta 3 [T1]  
1.25 dB  
1.250000 ms



3DH1



Marker 1 [T1]  
-0.21 dBm  
1.980000 ms  
Delta 2 [T1]  
0.42 dB  
1.640000 ms  
Delta 3 [T1]  
0.19 dB  
2.520000 ms



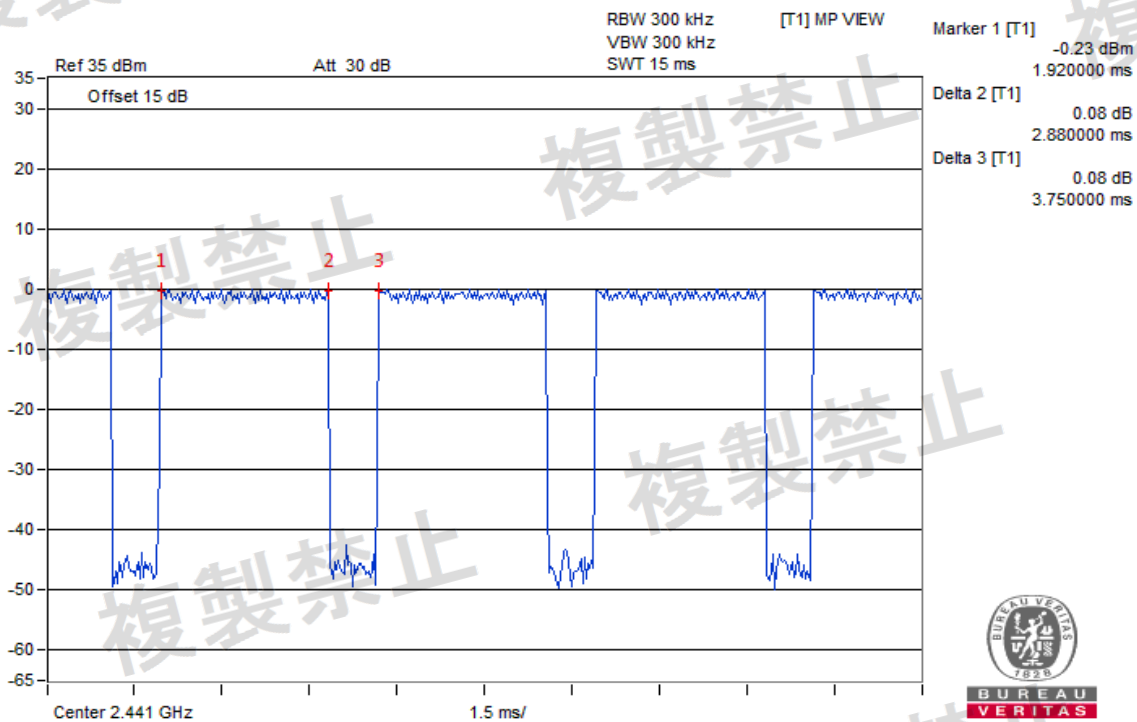
3DH3

Measurement uncertainty:  $\pm 3.93$  dB





V<sub>max</sub>.

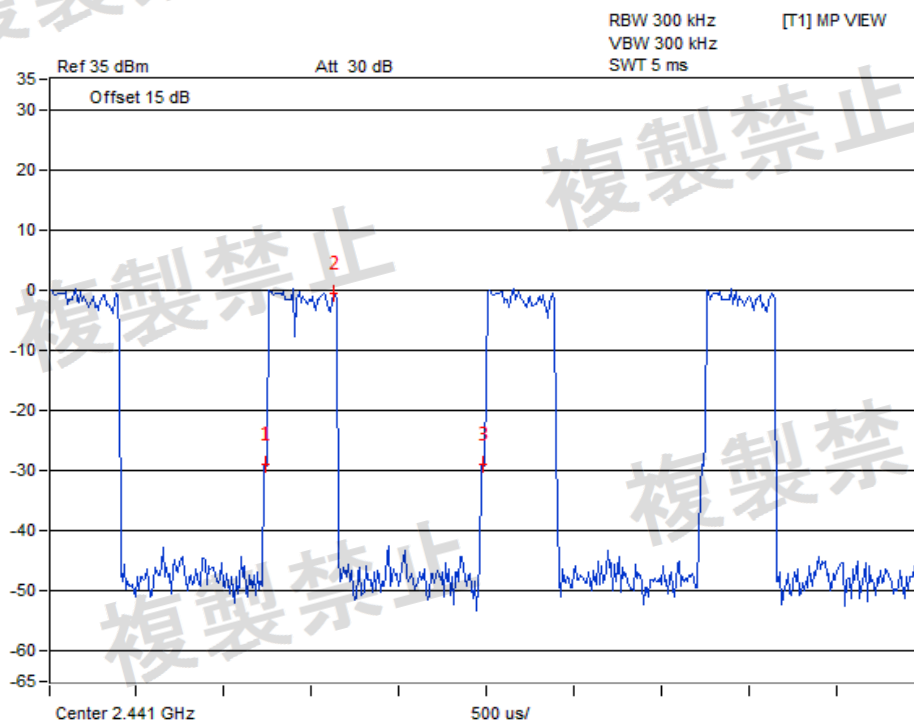


3DH5

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



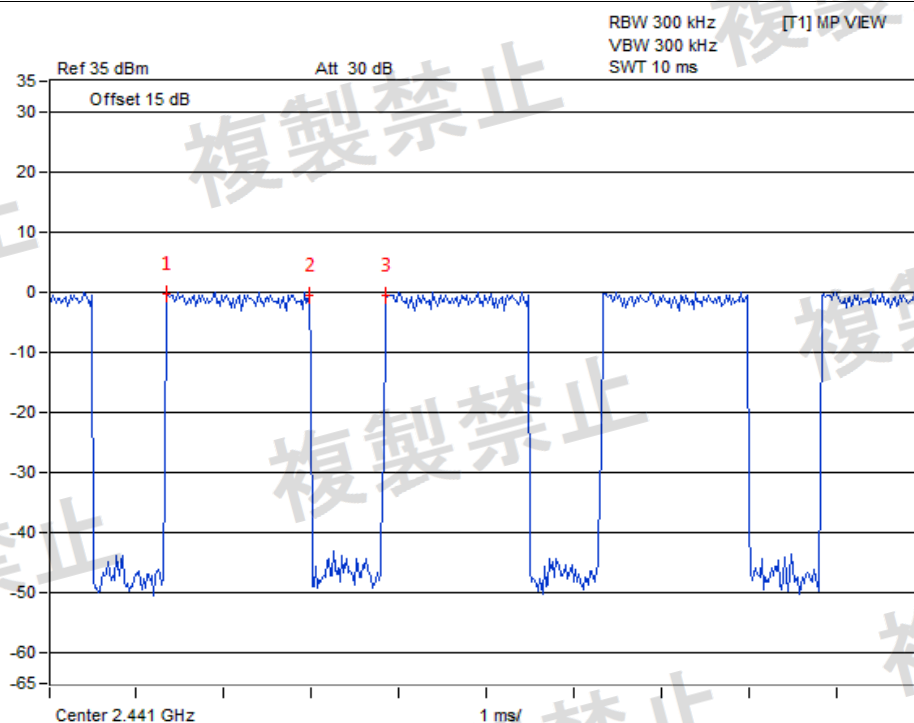
V<sub>min</sub>.



Marker 1 [T1]  
-29.04 dBm  
1.230000 ms  
Delta 2 [T1]  
28.48 dB  
390.000000 us  
Delta 3 [T1]  
0.00 dB  
1.250000 ms



3DH1



Marker 1 [T1]  
-0.22 dBm  
1.320000 ms  
Delta 2 [T1]  
0.39 dB  
1.640000 ms  
Delta 3 [T1]  
0.39 dB  
2.520000 ms

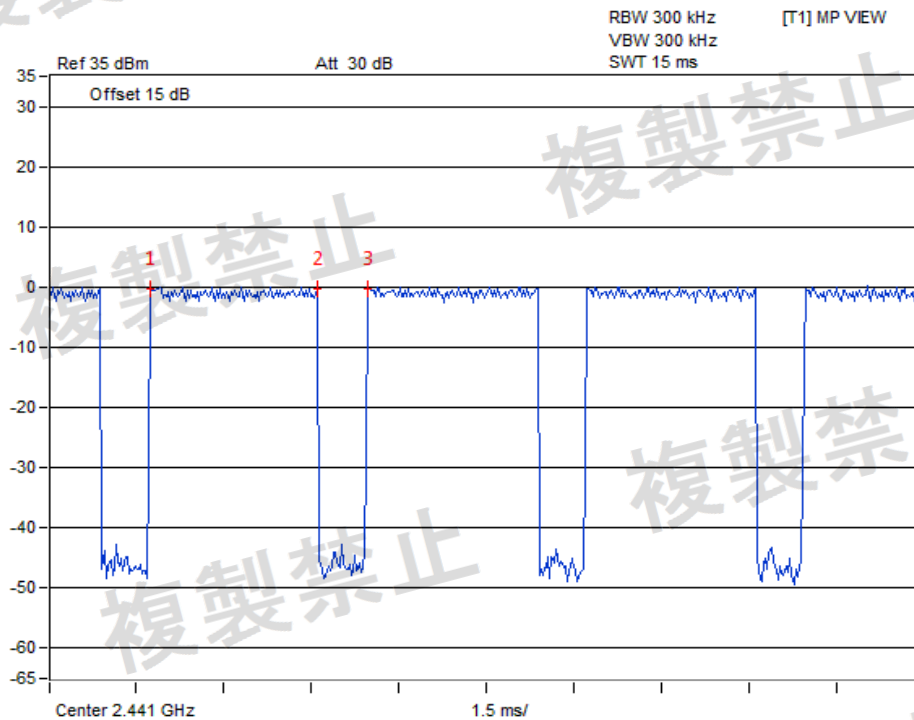


3DH3

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



V<sub>min</sub>.



Marker 1 [T1]      -0.22 dBm  
1.710000 ms  
Delta 2 [T1]      0.08 dB  
2.880000 ms  
Delta 3 [T1]      0.08 dB  
3.750000 ms



BUREAU  
VERITAS

3DH5

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

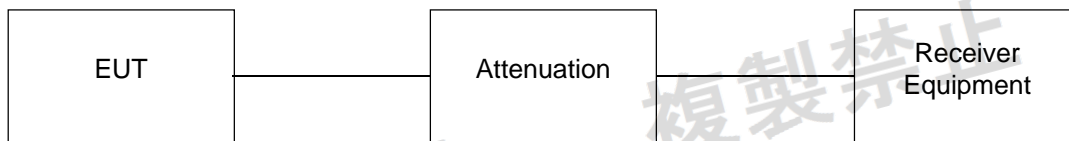


#### 4.8 Interference Prevention Function

##### 4.8.1 Limits of Interference Prevention Function

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

##### 4.8.2 Test Setup



##### 4.8.3 Test Results

Environmental Conditions	25 deg.C, 68% RH
Link Mode	Test Result
Bluetooth	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	FSP40	100040	Sep. 25, 2018	Sep. 24, 2019	Electronics Testing Center, Taiwan	c)
Signal Generator / Anritsu	E4438C	MY49071692	Oct. 15, 2018	Oct. 14, 2019	Electronics Testing Center, Taiwan	c)
Power Meter / Anritsu	ML2495A	1232003	Dec. 25, 2018	Dec. 24, 2019	Electronics Testing Center, Taiwan	c)
Power Sensor / Anritsu	MA2411B	1207333	Dec. 25, 2018	Dec. 24, 2019	Electronics Testing Center, Taiwan	c)
DC Power Supply / Keysight	U8002A	MY56330015	NA	NA	NA	d)
True RMS Clamp Meter / Fluke	325	31130711WS	May 21, 2019	May 20, 2020	Electronics Testing Center Taiwan	c)
Bluetooth Tester / Rohde & Schwarz	CBT	100946	Aug. 07, 2018	Aug. 06, 2019	Electronics Testing Center Taiwan	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)~ TELEC EngineeringCenter, Intertek Japan K.K., Keysight Technologies, Inc~.

b) : Correction conducted pursuant to the provisions of Article 135 or Article 144 of the MeasurementLaw (Law No. 51 of 1992)~Japan Calibration Service Syste~

c) : 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~.

d) : Calibration conducted by using other equipment that listed above from a) to c)



## 6 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](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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