

## Radio Test Report (BT-EDR)

**Report No.:** RJ171018E05-2 R1

**Test Model:** SP-W2M-AC1200

**Received Date:** Sep. 27, 2017

**Test Date:** Sep. 27, 2017

**Issued Date:** June 22, 2018

**Applicant:** Accton Technology Corporation

**Address:** No.1, Creation Rd. III, Science-based Industrial Park, Hsinchu, Taiwan,  
R.O.C.

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

**Lab Address:** E-2, No.1, Li Hsin 1st Road, Hsinchu Science Park, Hsinchu City 300,  
Taiwan R.O.C.



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### Release Control Record

Issue No.	Description	Date Issued
RJ171018E05-2	Original release.	Nov. 07, 2017
RJ171018E05-2 R1	Added test plots.	June 22, 2018

## 1 Certificate of Conformity

**Product:** Spark™ AC Wave2 Mini

**Brand:** IgniteNet

**Test Model:** SP-W2M-AC1200

**Sample Status:** PROTOTYPE

**Applicant:** Accton Technology Corporation

**Test Date:** Sep. 27, 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 :** Wendy Wu , **Date:** June 22, 2018  
Wendy Wu / Specialist

**Approved by :** May Chen , **Date:** June 22, 2018  
May Chen / Manager

## 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	--	4.5	Antenna power	C
--	--	--	SAR	NA
<b>Transmitting Antenna</b>				
--	--	3.5	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)	3.4	High Frequency/modulation section cannot be opened easily	C
--	3.1 (1)	3.1	Communication method	C
--	3.2 (1)a	3.1	Modulation method	C
--	3.2 (1)a	3.1	Spread spectrum method	C
--	3.2 (2)	4.5	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				



## 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	703.56 Hz
Spurious emissions	2.52 dB
Output power density	1.37 dB
Out of band radiated power	2.52 dB
Frequency Tolerance	703.56 Hz

## 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT (BT-EDR)

Product	Spark™ AC Wave2 Mini
Brand	IgniteNet
Test Model	SP-W2M-AC1200
Status of EUT	PROTOTYPE
Nominal Voltage	5Vdc from power adapter
Modulation Type	GFSK, $\pi/4$ -DQPSK, 8DPSK
Modulation Technology	FHSS
Transfer Rate	Up to 3Mbps
Operating Frequency	2402MHz ~ 2480MHz
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 section 3.5
Antenna Connector	Refer to section 3.5
Accessory Device	Adapter x1
Data Cable Supplied	USB cable x 1 (Unshielded, 1m)

Note:

1. There are WLAN, Bluetooth technology used for the EUT.
2. Simultaneously transmission condition.

Condition	Technology	
1	WLAN (2.4GHz)	Bluetooth
2	WLAN (5GHz)	Bluetooth

3. The EUT must be supplied with a power adapter as following table:

Brand	Model No.	Spec.
MASS POWER	NBS10B050200VUU	AC Input: 100-240V 50/60Hz 0.3A DC Output: 5.0V 2.0A

4. The power table as below table:

	Rated output power density (mW/MHz)	Conducted RF output power density (mW/MHz)	Radiated RF output power density (mW/MHz)
<b>Normal mode</b>			
GFSK	0.2	0.197125	0.342564
$\pi/4$ -DQPSK	0.2	0.160887	0.27959
8DPSK	0.2	0.156423	0.271832
<b>Enable AFH function</b>			
GFSK	0.8	0.773253	1.34376
$\pi/4$ -DQPSK	0.8	0.625963	1.087799
8DPSK	0.8	0.610308	1.060594

5. 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

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 (RTL819 x 3.4) provided by manufacture, the power levels during the tests were set according to the following codes:

Modulation type: GFSK		Modulation type: $\pi/4$ -DQPSK		Modulation type: 8DPSK	
Channel	Power setting	Channel	Power setting	Channel	Power setting
0	39	0	39	0	39
39	39	39	39	39	39
78	39	78	39	78	39

**NOTE 2:** The EUT was tested under following test modes, and the test data was recorded in this report:

Normal mode	Enable AFH function
GFSK	GFSK
$\pi/4$ -DQPSK	$\pi/4$ -DQPSK
8DPSK	8DPSK

\* For AFH function only tested occupied bandwidth, spreading bandwidth, Antenna power and dwell time.



### 3.3 Test Conditions

Test Conditions	Voltage (Vdc)
$V_{normal}$	5
$V_{max}$	5.5
$V_{min}$	4.5

### 3.4 Assembly

The EUT is constructed as an Spark™ AC Wave2 Mini. The housing consists of two parts, the parts was fixed together by special type screws. Separating the two parts was only possible by special tools.

### 3.5 Antenna Specifications

#### 3.5.1 Antenna Gain

WLAN				
Ant No.	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	3.9	2.4~2.4835	PCB	i-pex(MHF)
	3.9	5.15~5.85		
2	4.1	2.4~2.4835	PCB	i-pex(MHF)
	3.8	5.15~5.85		
Bluetooth				
Ant No.	Antenna Gain (dBi)	Frequency rang (GHz)	Antenna type	Connector type
1	2.4	2.4~2.4835	PCB	i-pex(MHF)

#### 3.5.2 Antenna Pattern

Please refer to the attached file (Antenna pattern).

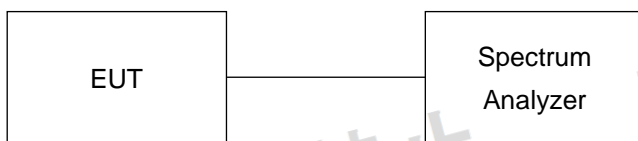
## 4 Test Results

### 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		26 deg.C, 66% RH					
Channel	Frequency (MHz)	Voltage <sub>normal</sub>		Voltage <sub>max</sub>		Voltage <sub>min</sub>	
		Carrier Frequency (MHz)	Frequency tolerance (ppm)	Carrier Frequency (MHz)	Frequency tolerance (ppm)	Carrier Frequency (MHz)	Frequency tolerance (ppm)
0	2402	2402.012240	5.095	2402.012320	5.129	2402.012240	5.095
39	2441	2441.012440	5.096	2441.012440	5.096	2441.012360	5.063
78	2480	2480.012680	5.112	2480.012520	5.048	2480.012640	5.096

## 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

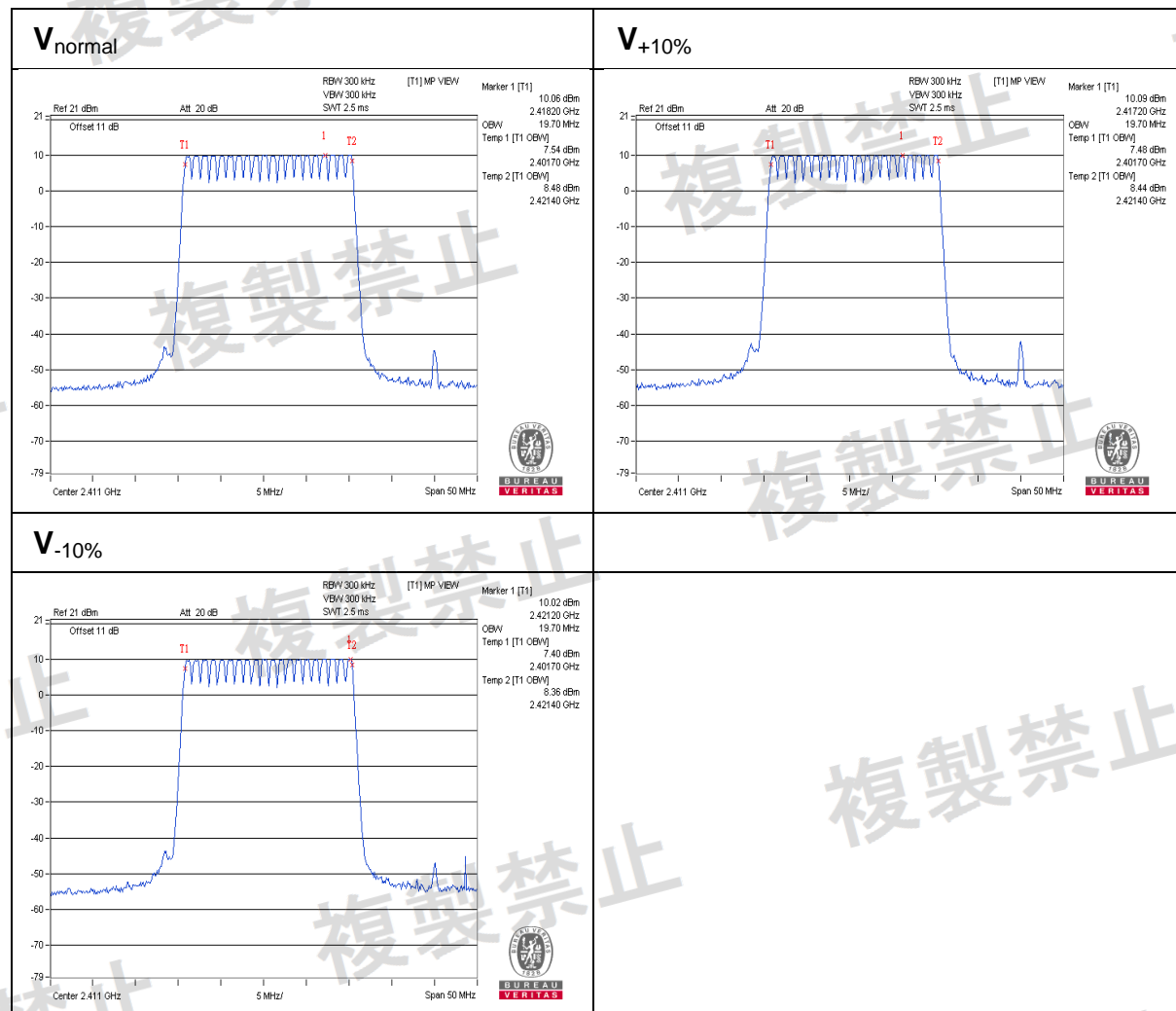
Normal Mode:

Environmental Conditions	26 deg.C, 66% RH	
V <sub>normal</sub>	V <sub>+10%</sub>	V <sub>-10%</sub>
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.20	78.40	78.20



AFH Mode:

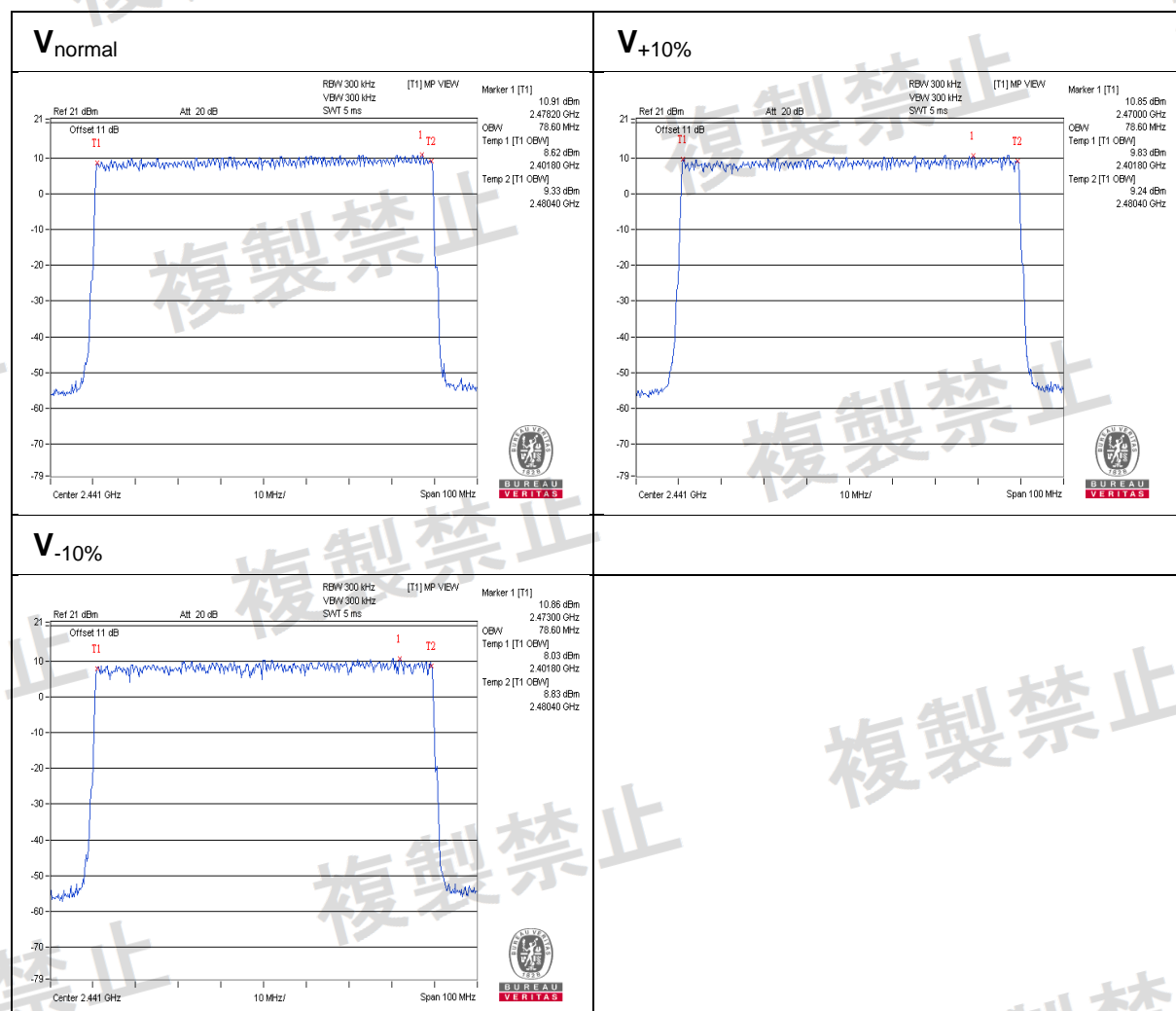
Environmental Conditions	26 deg.C, 66% RH	
$V_{normal}$	$V_{+10\%}$	$V_{-10\%}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
19.70	19.70	19.70





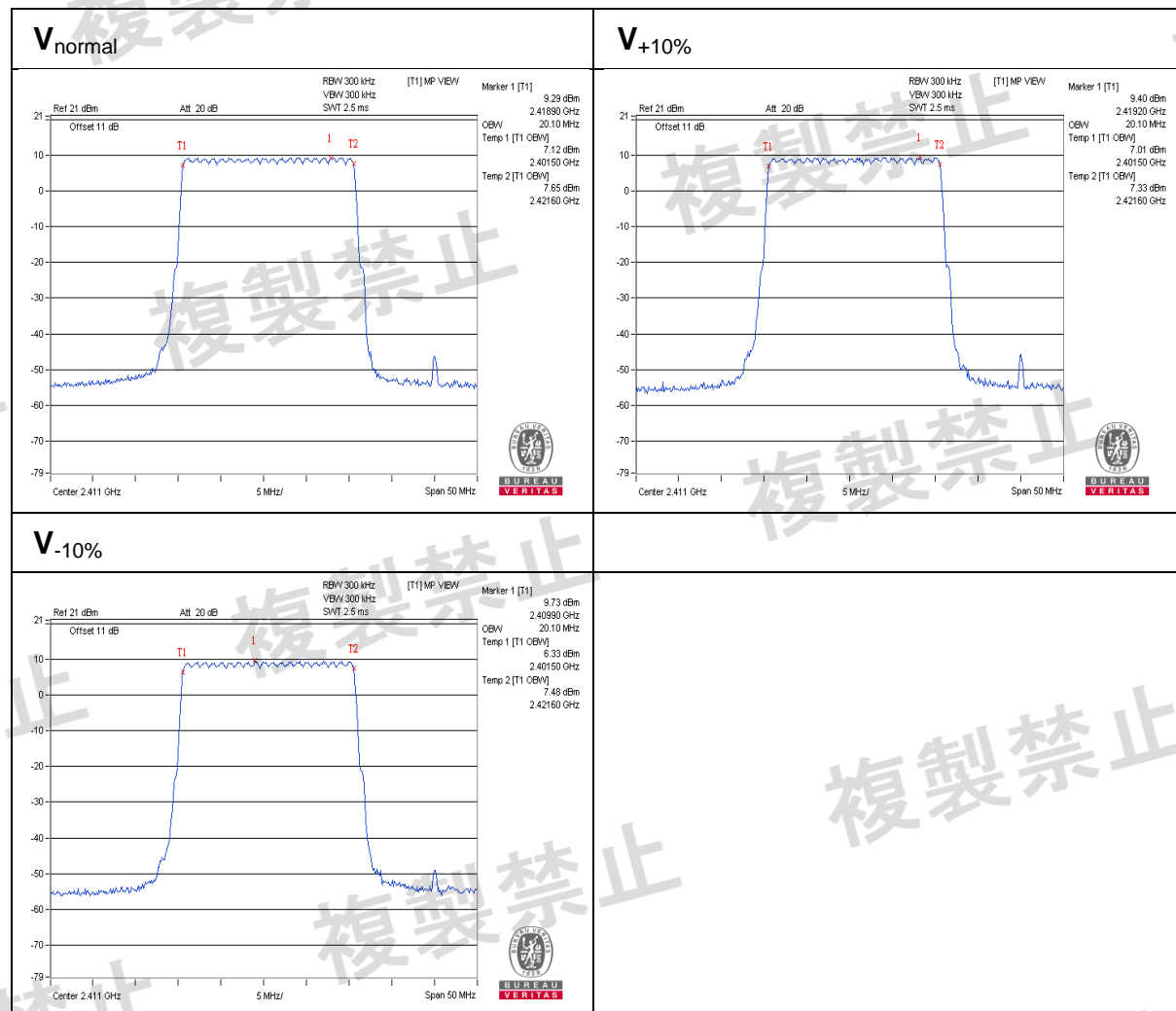
Modulation:  $\pi/4$ -DQPSK  
Normal Mode:

Environmental Conditions	26 deg.C, 66% RH	
$V_{normal}$	$V_{+10\%}$	$V_{-10\%}$
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.60	78.60	78.60



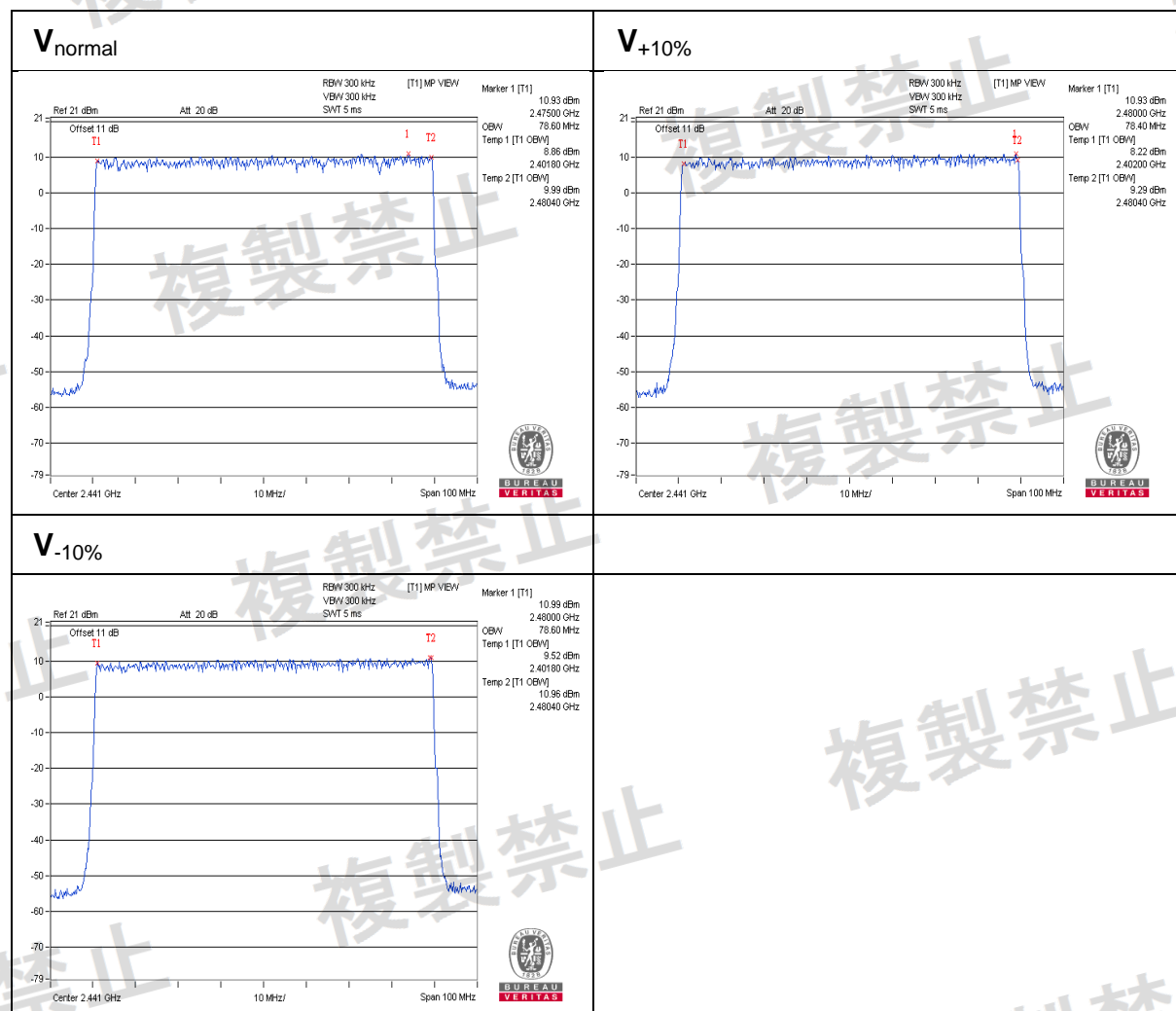
# AFH Mode:

Environmental Conditions	26 deg.C, 66% RH	
V <sub>normal</sub>	V <sub>+10%</sub>	V <sub>-10%</sub>
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
20.10	20.10	20.10



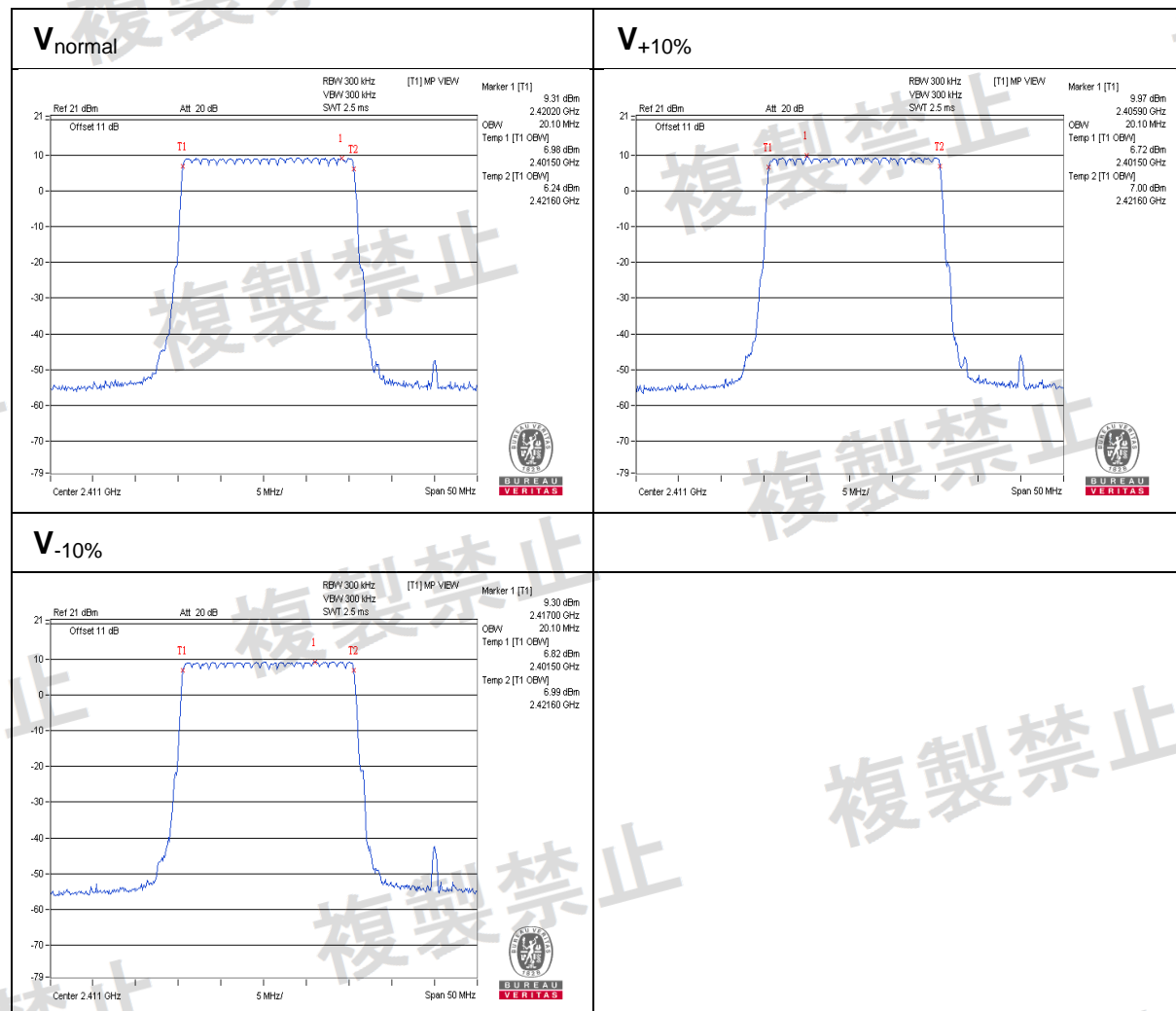
Modulation: 8DPSK  
Normal Mode:

Environmental Conditions	26 deg.C, 66% RH	
V <sub>normal</sub>	V <sub>+10%</sub>	V <sub>-10%</sub>
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
78.60	78.40	78.60



# AFH Mode:

Environmental Conditions	26 deg.C, 66% RH	
V <sub>normal</sub>	V <sub>+10%</sub>	V <sub>-10%</sub>
Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)	Occupied Bandwidth (MHz)
20.10	20.10	20.10



#### 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





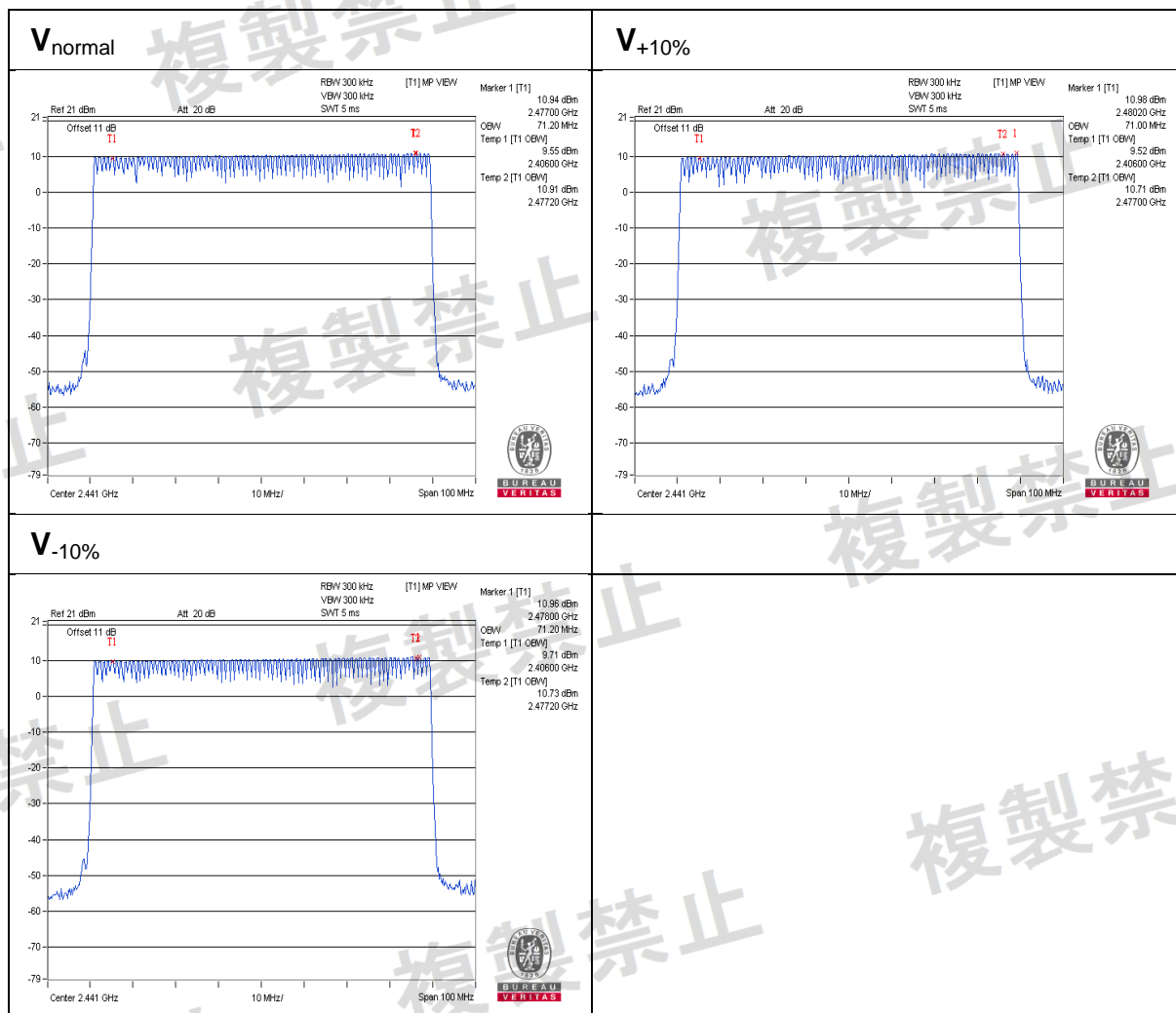
### 4.3.3 Test Results

Modulation: GFSK

Normal Mode:

Environmental Conditions		26 deg.C, 66% RH			
V <sub>normal</sub>		V <sub>+10%</sub>		V <sub>-10%</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.20	71.20	71.00	71.00	71.20	71.20

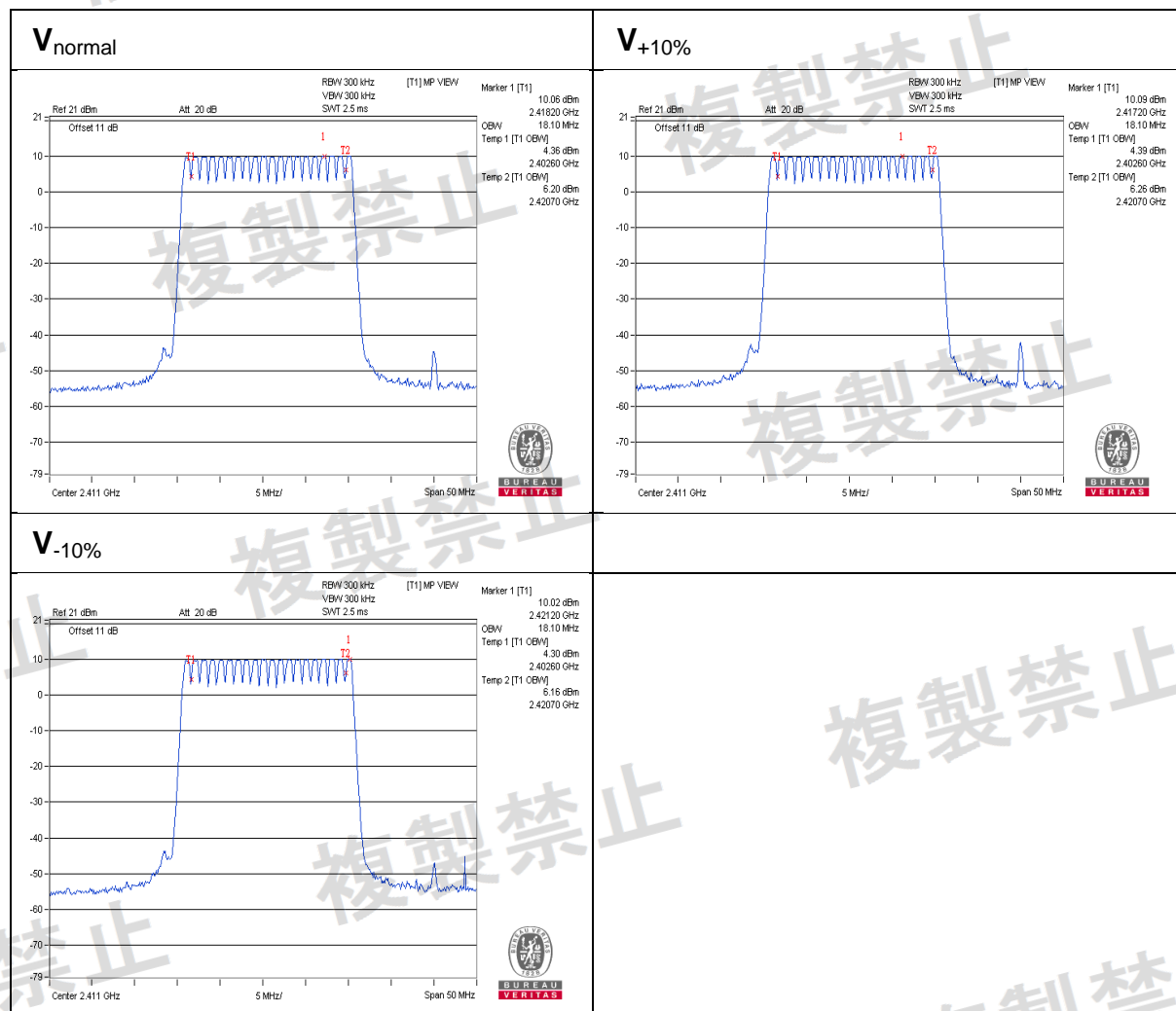
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



# AFH Mode:

Environmental Conditions		26 deg.C, 66% RH			
V <sub>normal</sub>		V <sub>+10%</sub>		V <sub>-10%</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.10	18.10	18.10	18.10	18.10	18.10

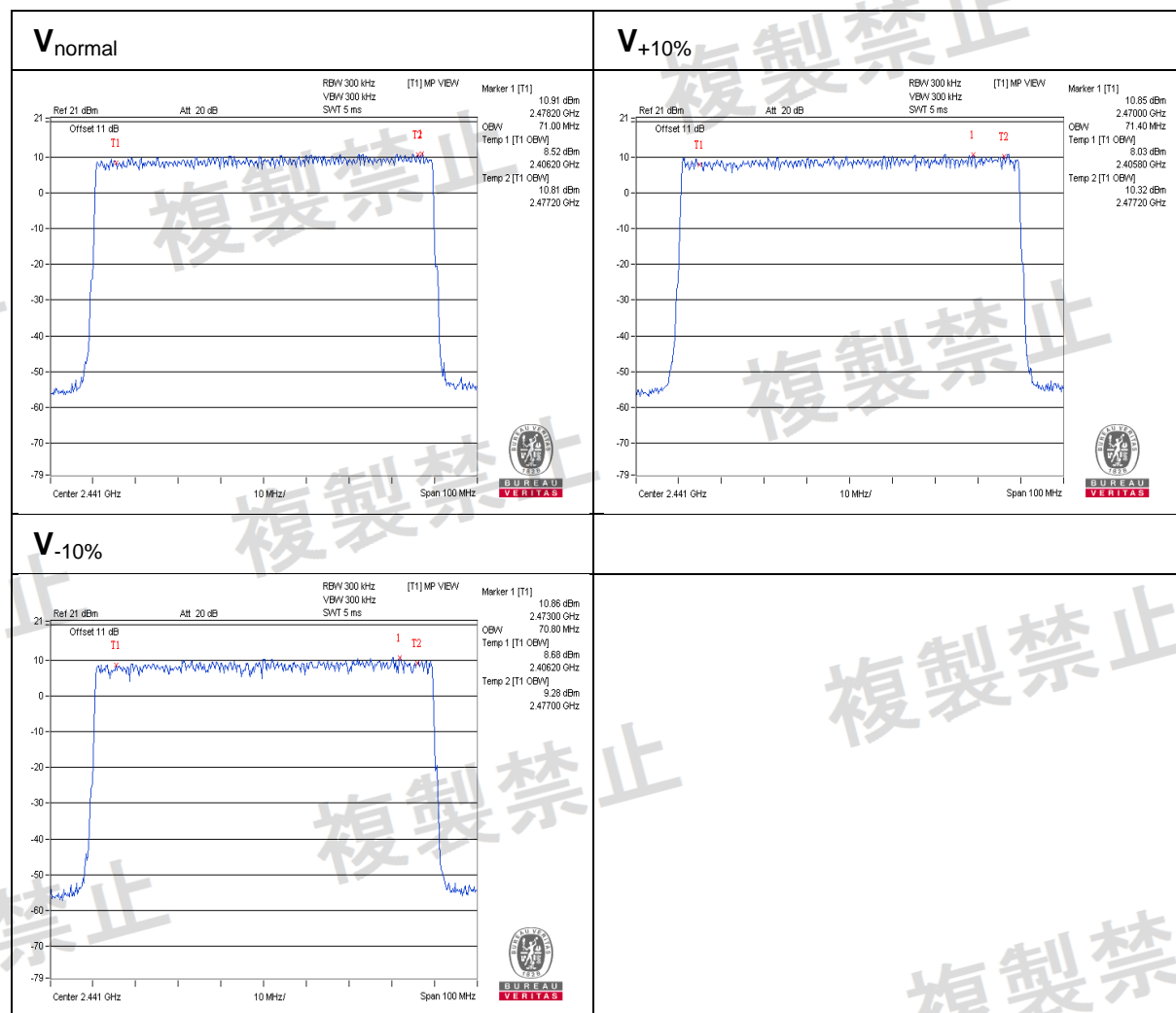
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



Modulation:  $\pi/4$ -DQPSK  
Normal Mode:

Environmental Conditions		26 deg.C, 66% RH			
$V_{normal}$		$V_{+10\%}$		$V_{-10\%}$	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.00	71.00	71.40	71.40	70.80	70.80

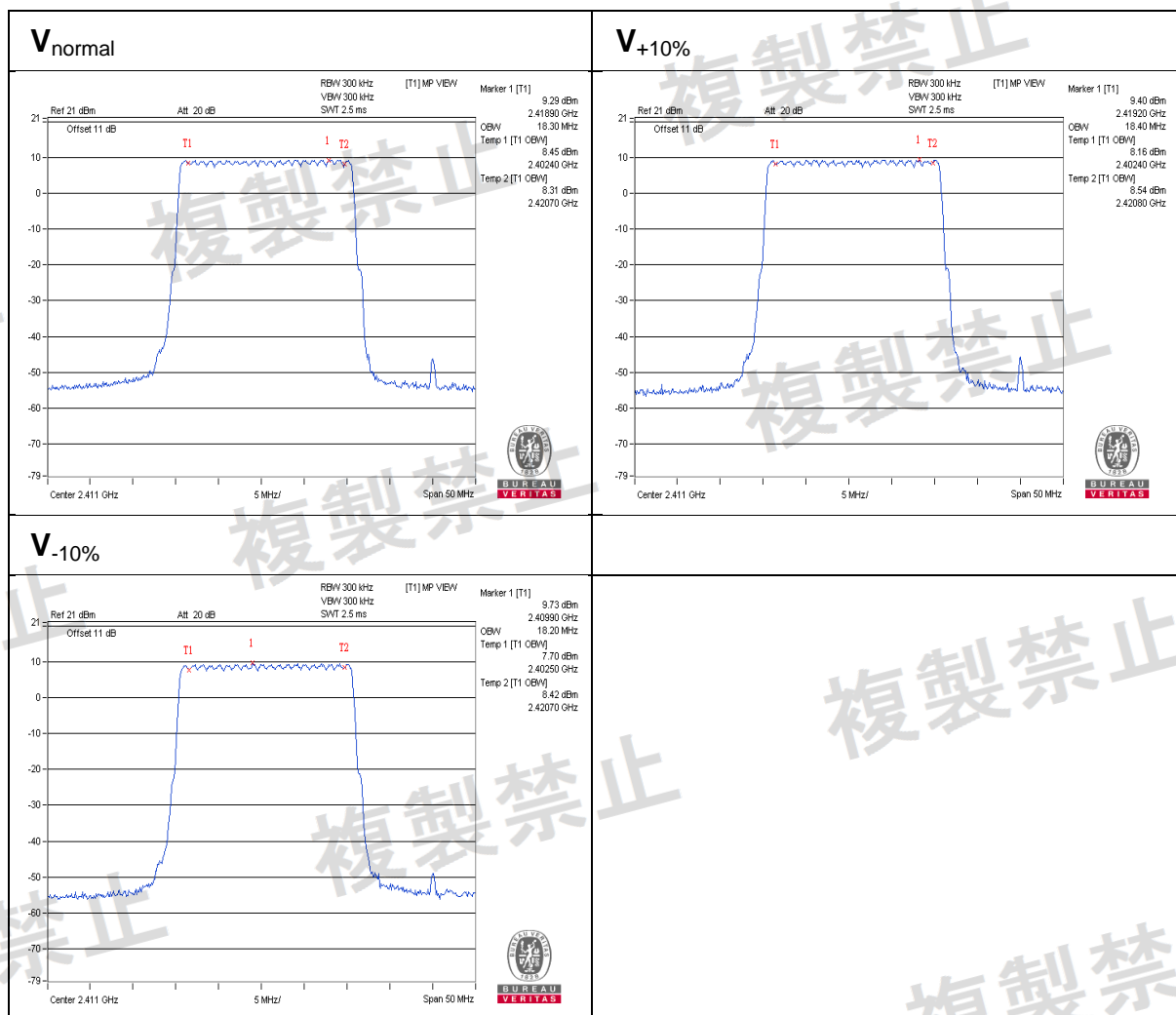
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



# AFH Mode:

Environmental Conditions		26 deg.C, 66% RH			
V <sub>normal</sub>		V <sub>+10%</sub>		V <sub>-10%</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.30	18.30	18.40	18.40	18.20	18.20

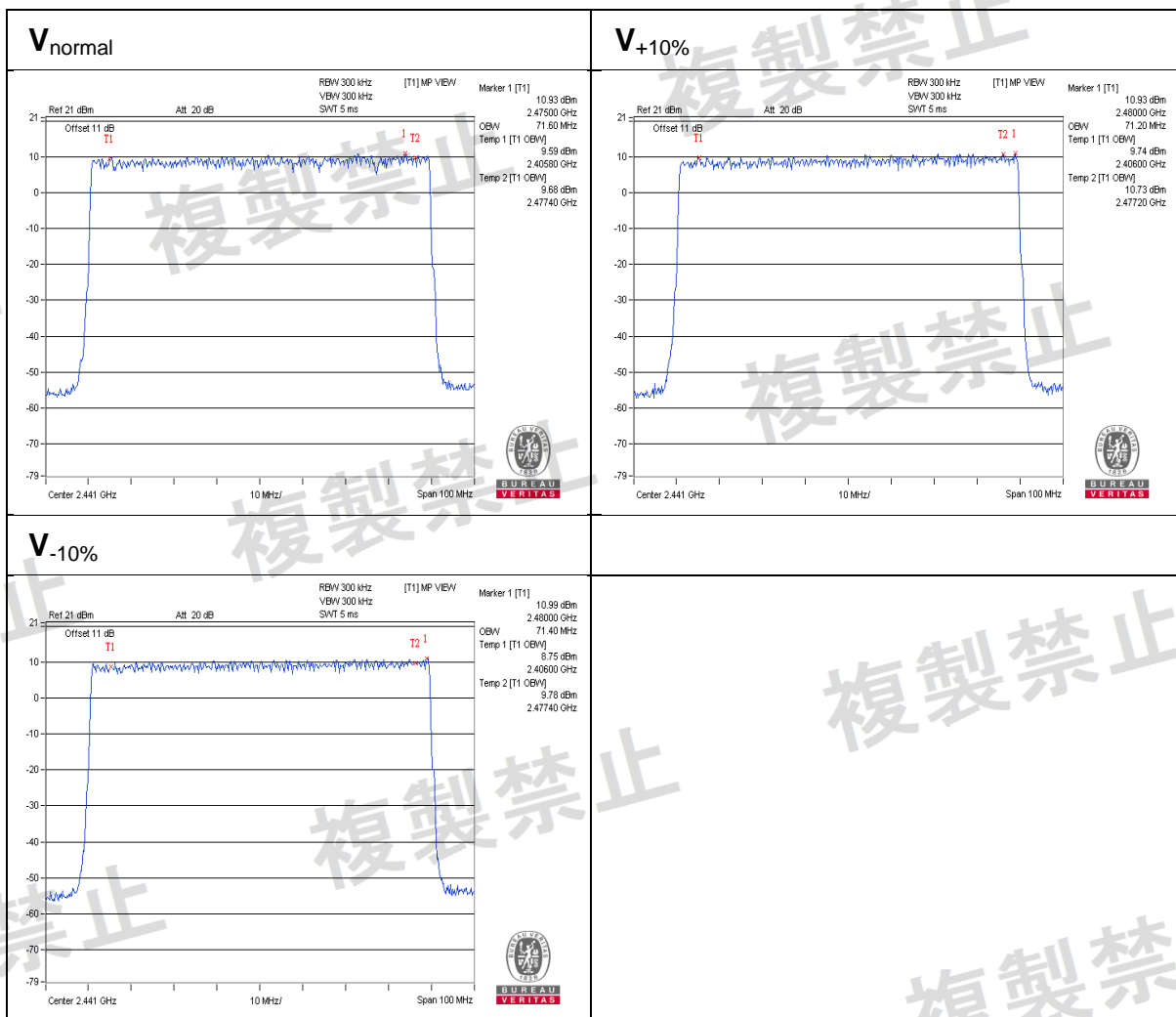
Note: 1. Spreading Factor: 90% channel power bandwidth / 1.



Modulation: 8DPSK  
Normal Mode:

Environmental Conditions		26 deg.C, 66% RH			
V <sub>normal</sub>		V <sub>+10%</sub>		V <sub>-10%</sub>	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
71.60	71.60	71.20	71.20	71.40	71.40

Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

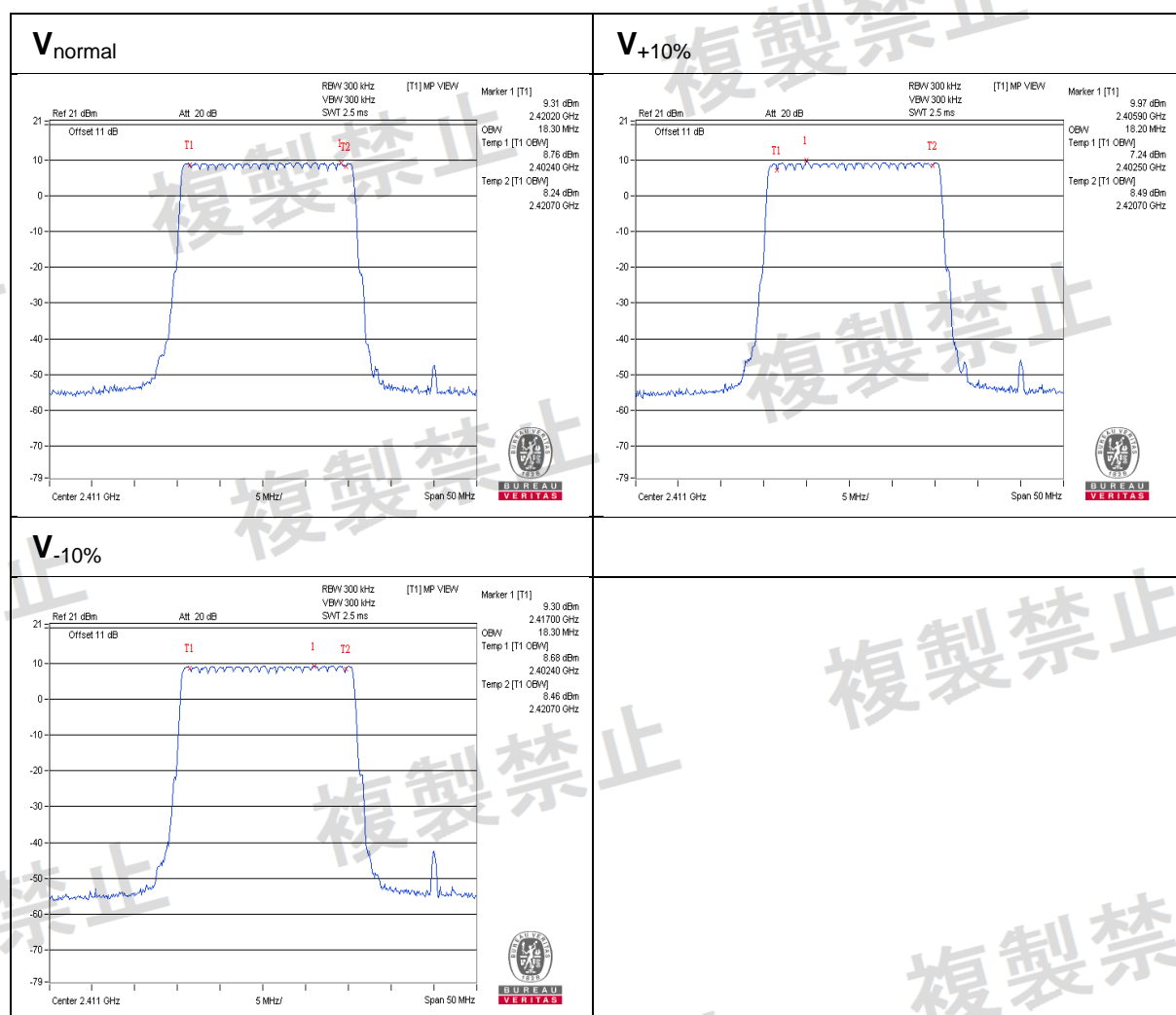




AFH Mode:

Environmental Conditions		26 deg.C, 66% RH			
$V_{normal}$		$V_{+10\%}$		$V_{-10\%}$	
Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor	Occupied Bandwidth (MHz)	Spreading Factor
18.30	18.30	18.20	18.20	18.30	18.30

Note: 1. Spreading Factor: 90% channel power bandwidth / 1.

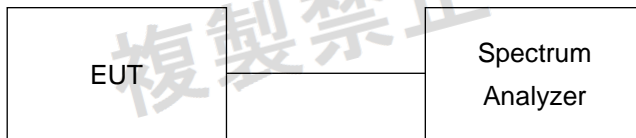


#### 4.4 Spurious Emissions for Transmitter Measurement

##### 4.4.1 Limits of Spurious Emissions

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

##### 4.4.2 Test Setup



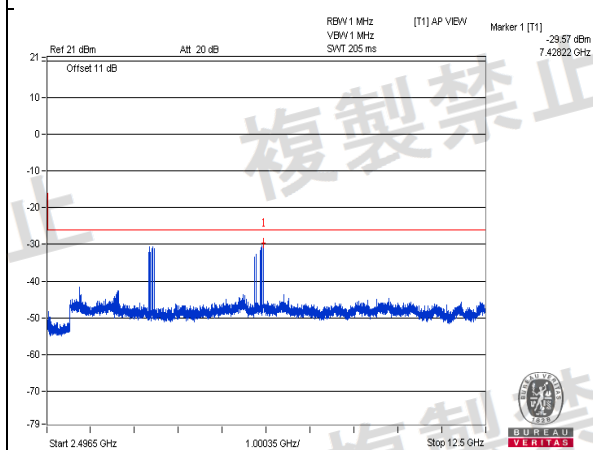
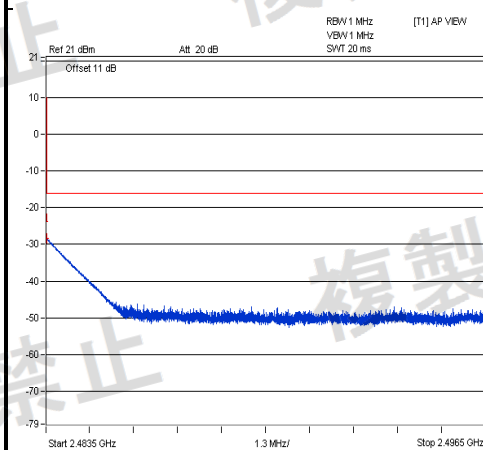
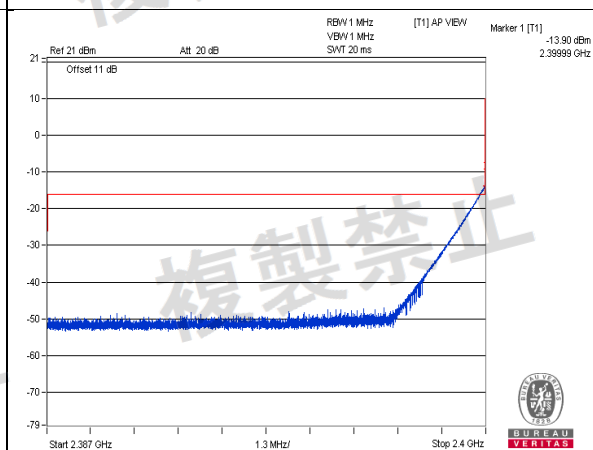
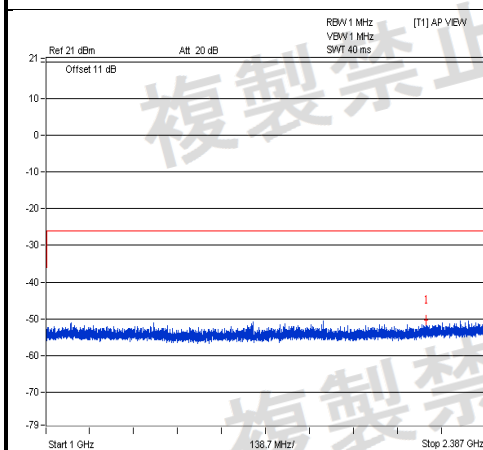
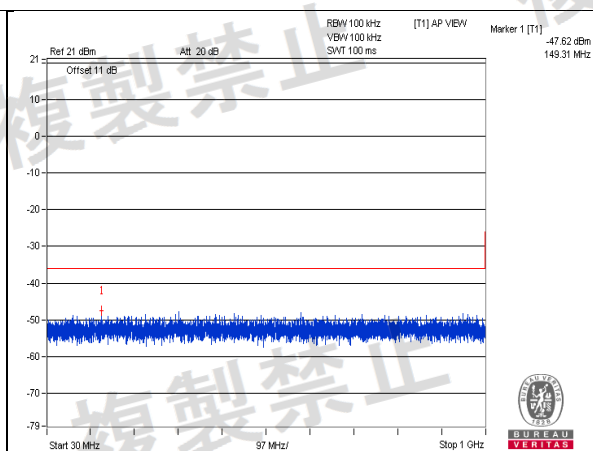
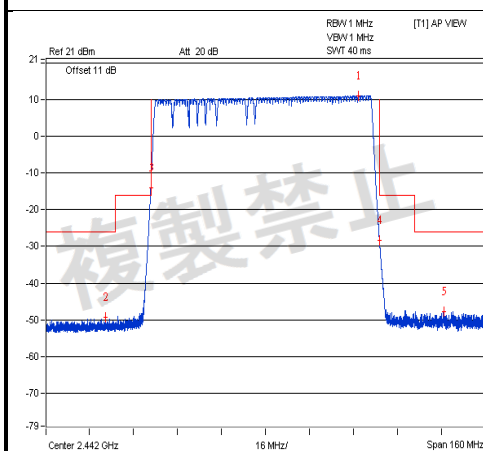
#### 4.4.3 Test Results

Modulation: GFSK

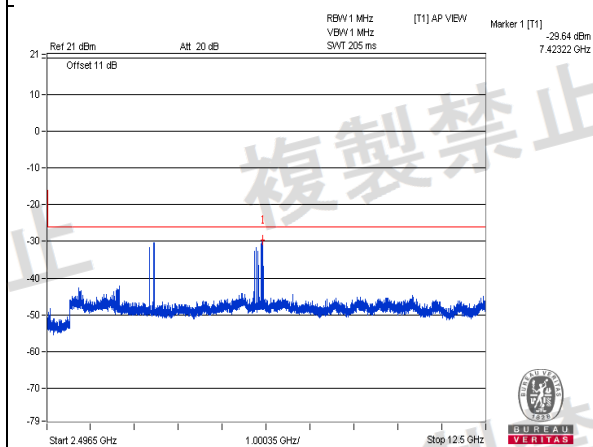
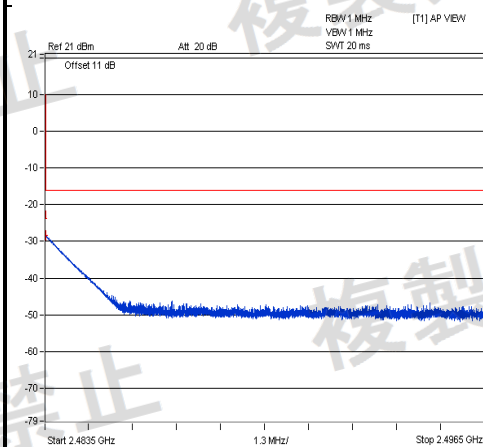
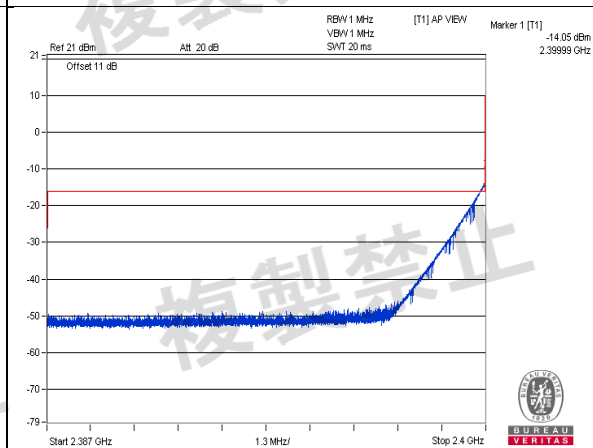
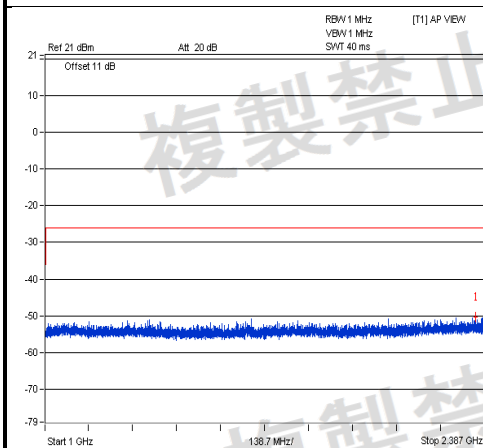
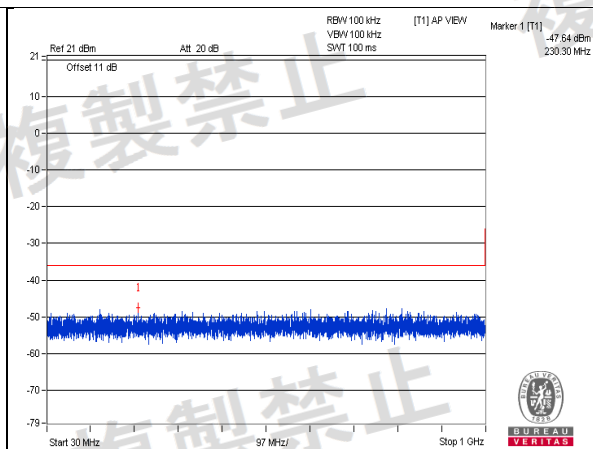
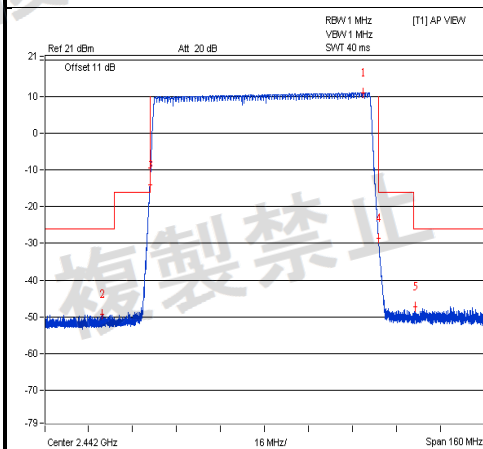
Environmental Conditions		26 deg.C, 66% RH			
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V <sub>normal</sub>	30.0MHz to 1000.0MHz	149.31	<b>0.017uW</b>	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2202	0.009uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.99	24.347uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	<b>1.462uW</b>	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7428.22	<b>1.104uW</b>	2.5 uW/MHz	PASS
V <sub>max</sub>	30.0MHz to 1000.0MHz	230.3	<b>0.017uW</b>	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2359.95	0.009uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.99	22.85uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	1.452uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7423.22	1.086uW	2.5 uW/MHz	PASS
V <sub>min</sub>	30.0MHz to 1000.0MHz	550.28	0.016uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	1603.17	<b>0.01uW</b>	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2400	<b>24.632uW</b>	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	1.396uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7436.97	1.064uW	2.5 uW/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.

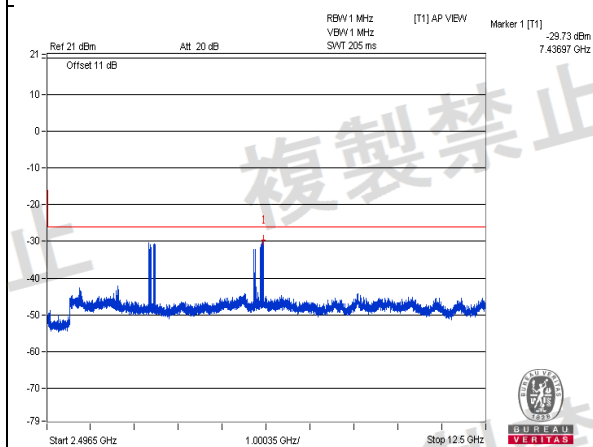
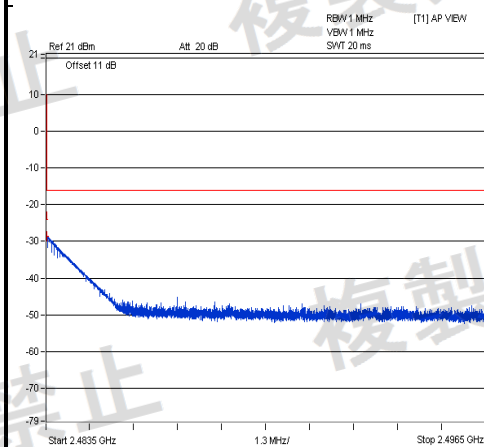
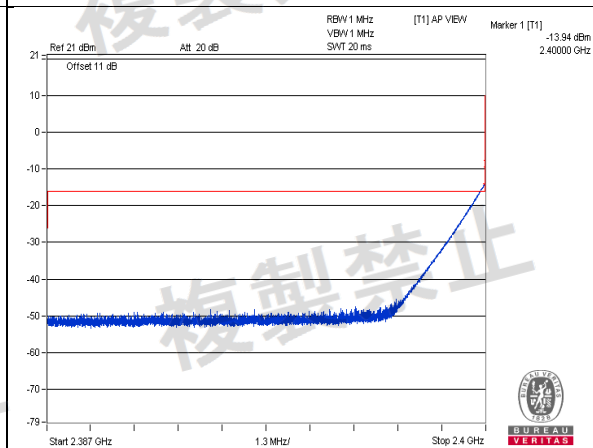
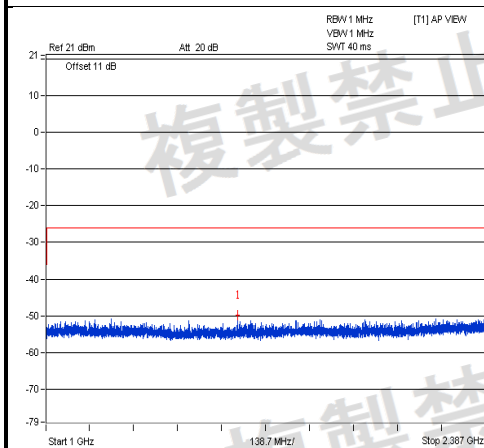
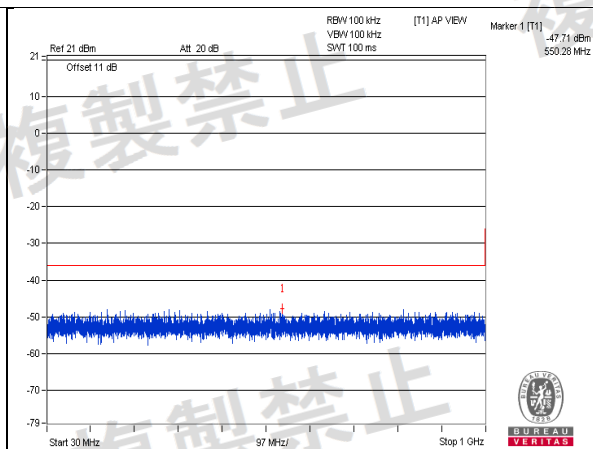
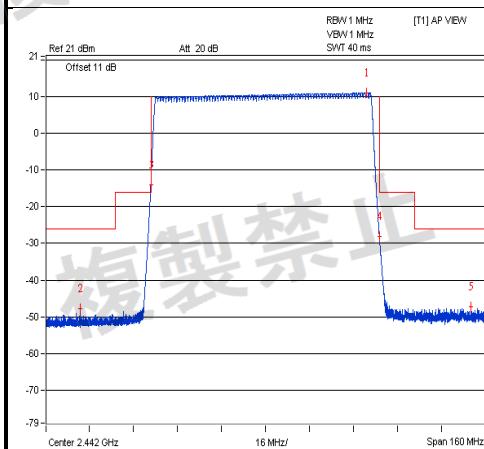
# Vnormal Channel 39



V+10%  
Channel 39



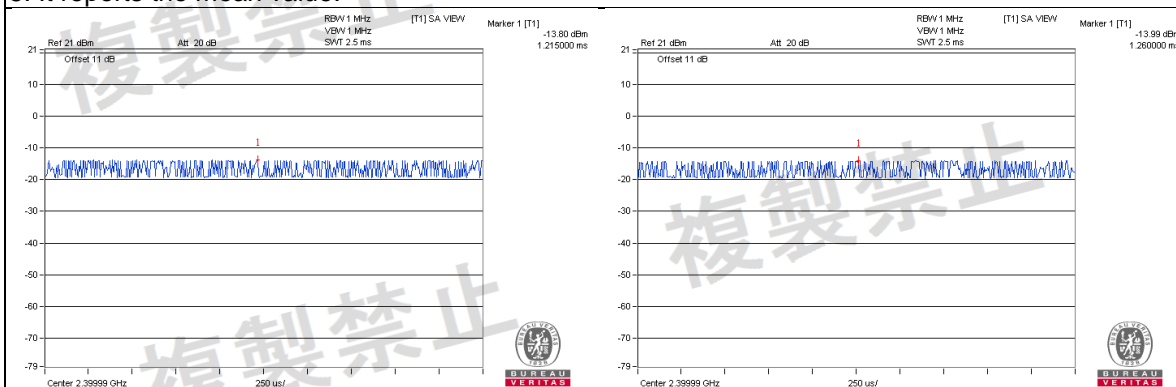
# V-10% Channel 39





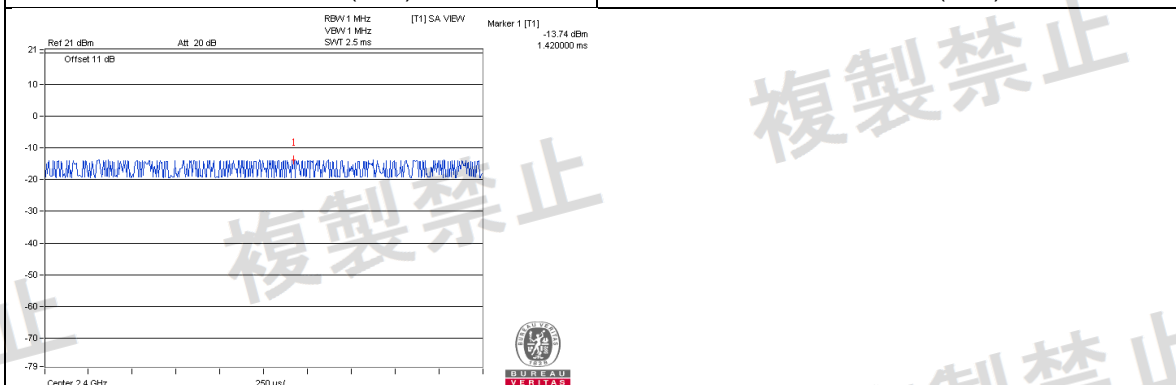
## Measuring Mode \*Zero Span

1. Set the spectrum analyzer as below and it takes in a value of all data point.
2. Regarding the all data value, it transforms the "dBm" value into "mW" value.
3. It adds the all values and calculates a grand total. Define a grand total as "P".
4. It divides "P" by sample data point (ex.501) and calculates the mean value.
5. It reports the mean value.



P= 0.024347 (mW)

P= 0.02285 (mW)



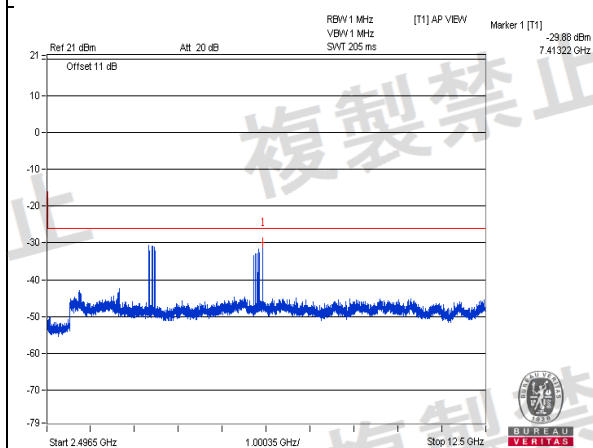
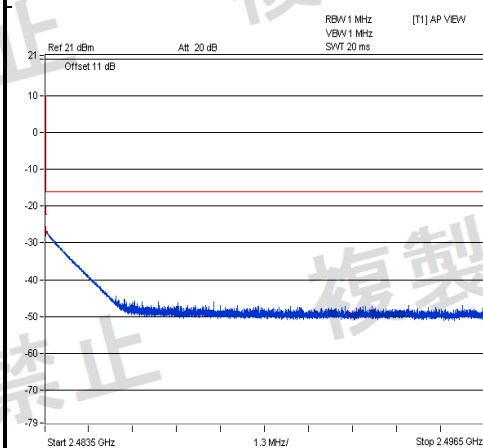
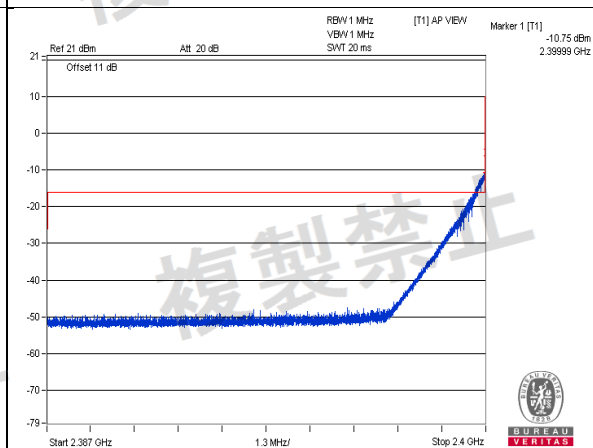
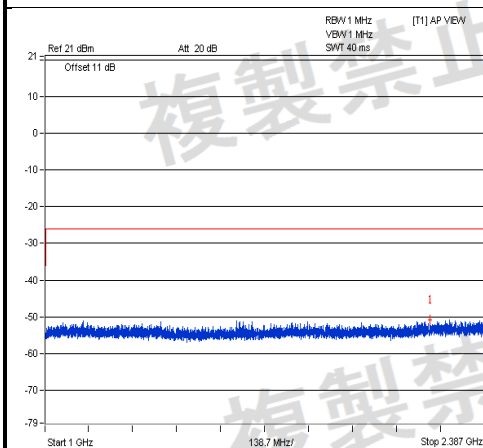
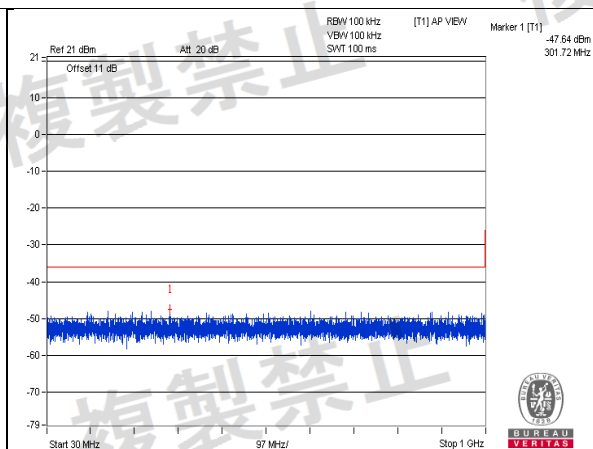
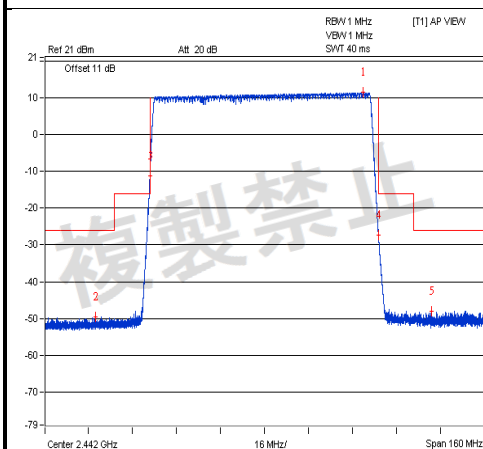
P= 0.024632 (mW)

Modulation:  $\pi/4$ -DQPSK

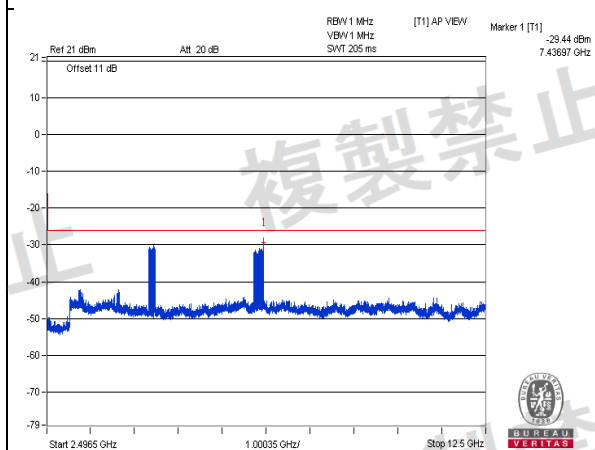
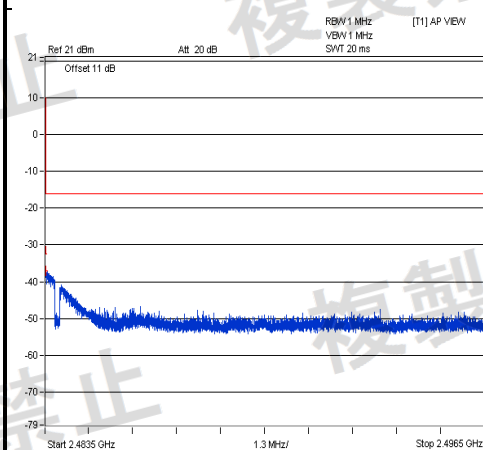
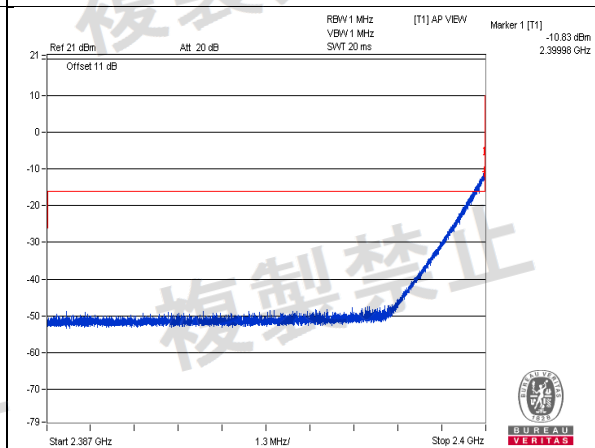
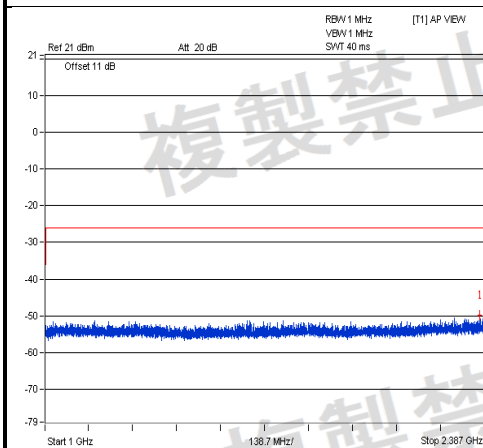
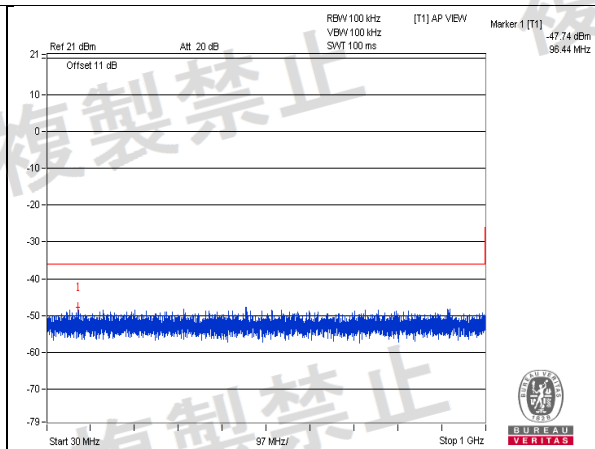
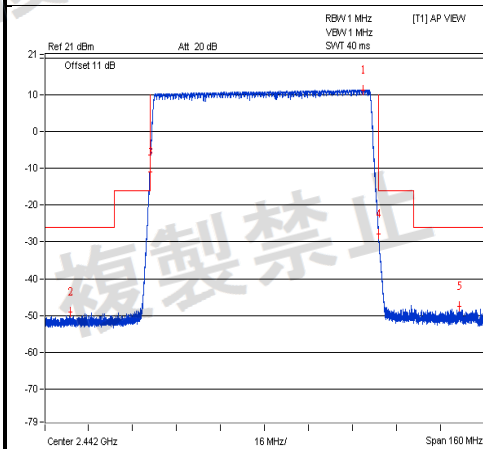
Environmental Conditions		26 deg.C, 66% RH			
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
$V_{\text{normal}}$	30.0MHz to 1000.0MHz	301.72	0.017uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2216.05	0.008uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.99	24.21uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	<b>2.023uW</b>	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7413.22	1.028uW	2.5 uW/MHz	PASS
$V_{\text{max}}$	30.0MHz to 1000.0MHz	96.44	0.016uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2374.17	<b>0.01uW</b>	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.98	24.155uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.51	0.193uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7436.97	<b>1.137uW</b>	2.5 uW/MHz	PASS
$V_{\text{min}}$	30.0MHz to 1000.0MHz	417.51	<b>0.018uW</b>	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2383.01	0.008uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.99	24.547W	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.5	1.958uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7428.22	1.044uW	2.5 uW/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.

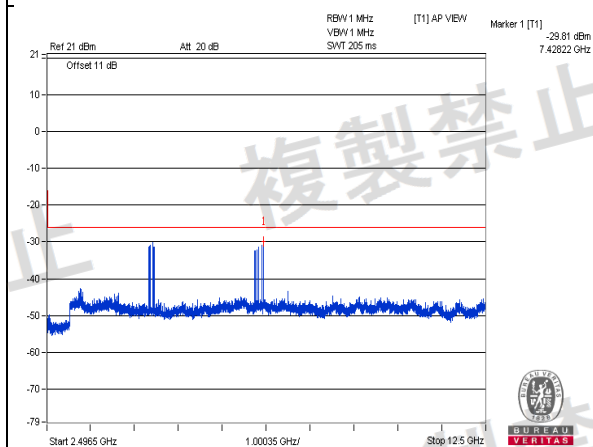
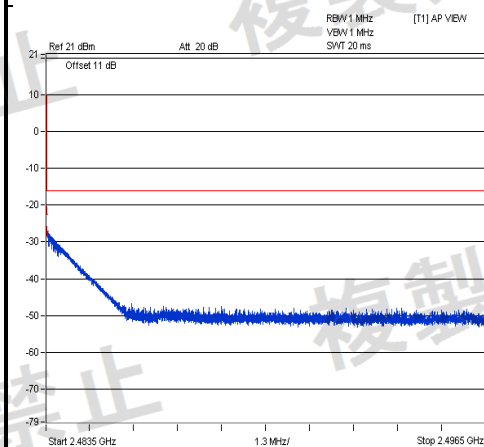
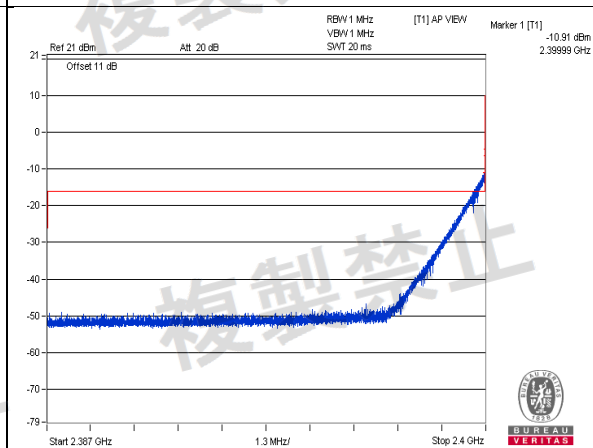
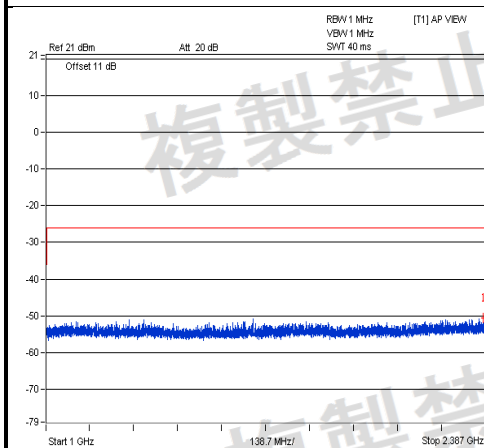
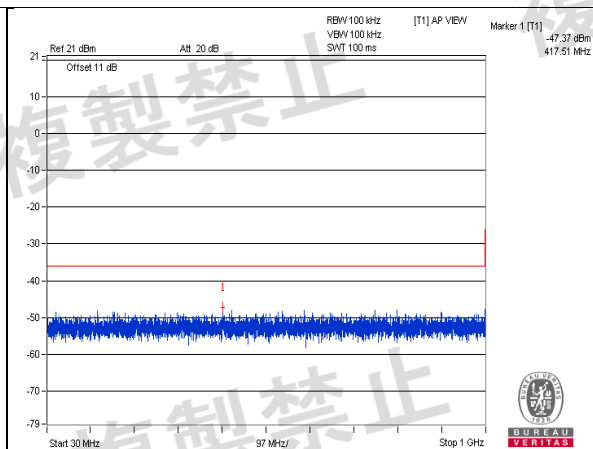
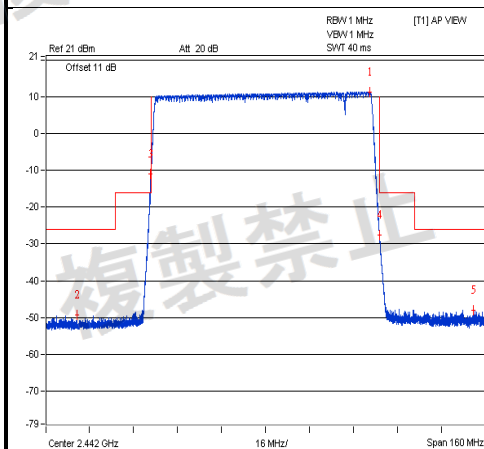
# Vnormal Channel 39



V+10%  
Channel 39



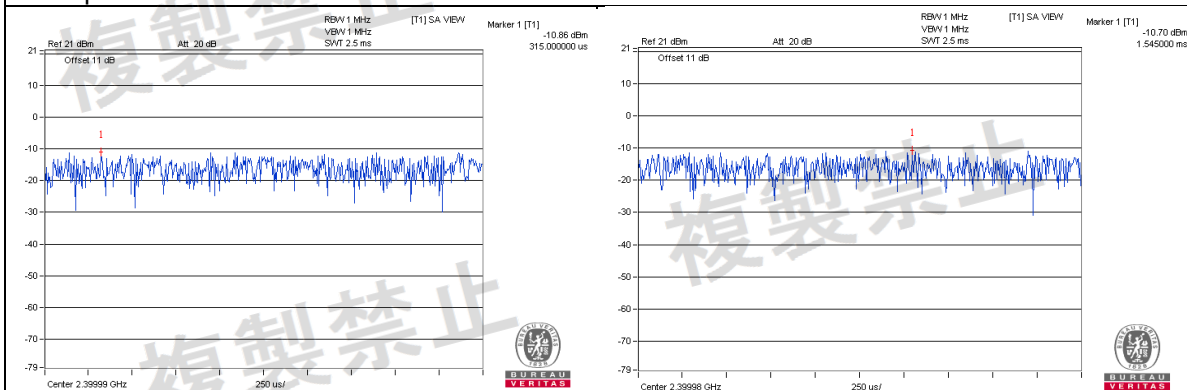
# V-10% Channel 39





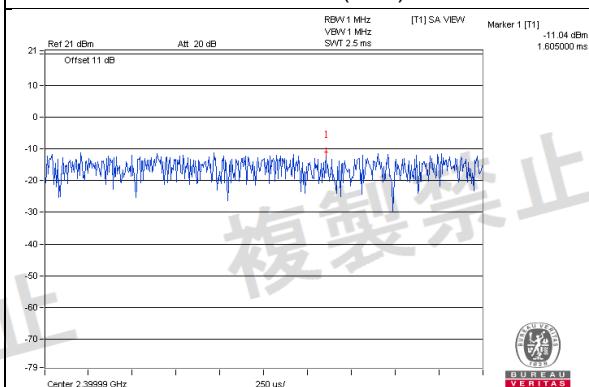
## Measuring Mode \*Zero Span

1. Set the spectrum analyzer as below and it takes in a value of all data point.
2. Regarding the all data value, it transforms the "dBm" value into "mW" value.
3. It adds the all values and calculates a grand total. Define a grand total as "P".
4. It divides "P" by sample data point (ex.501) and calculates the mean value.
5. It reports the mean value.



P= 0.02421 (mW)

P= 0.024155 (mW)



P= 0.024547 (mW)

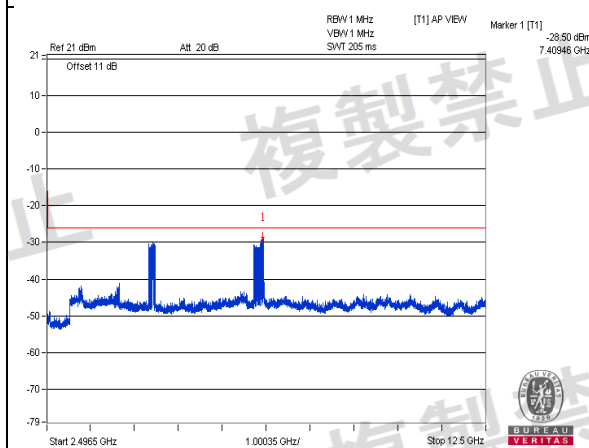
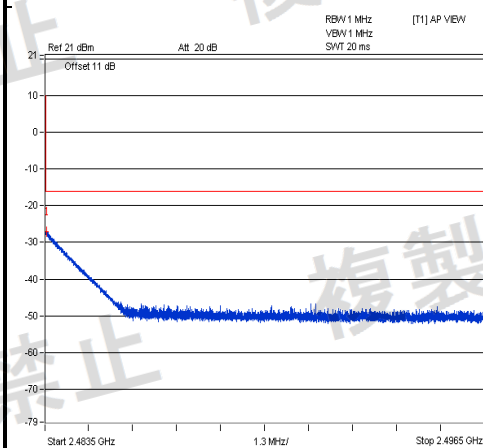
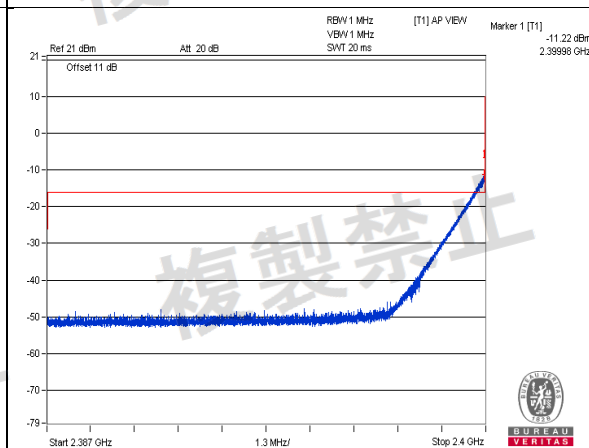
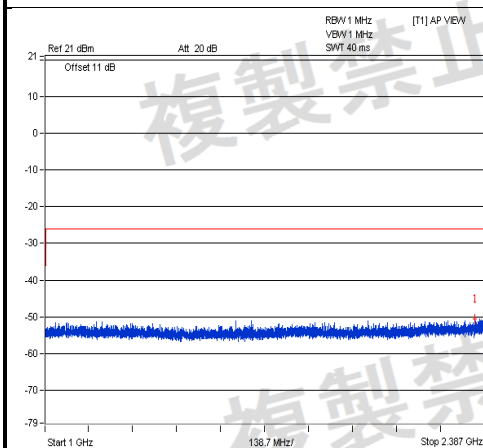
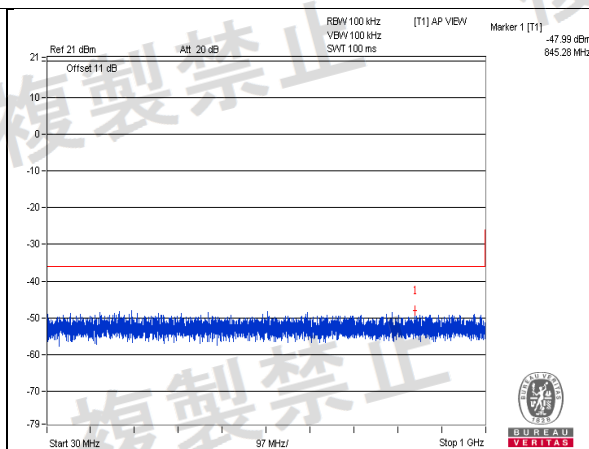
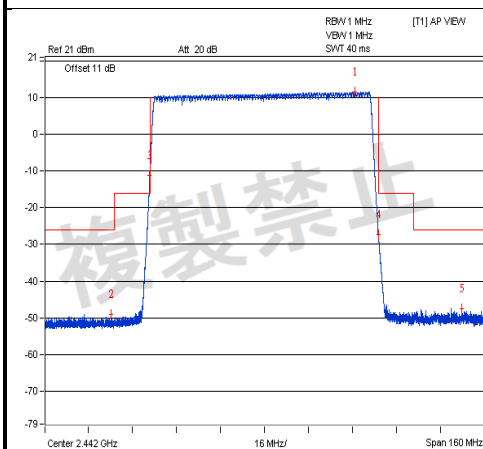


# Modulation: 8DPSK

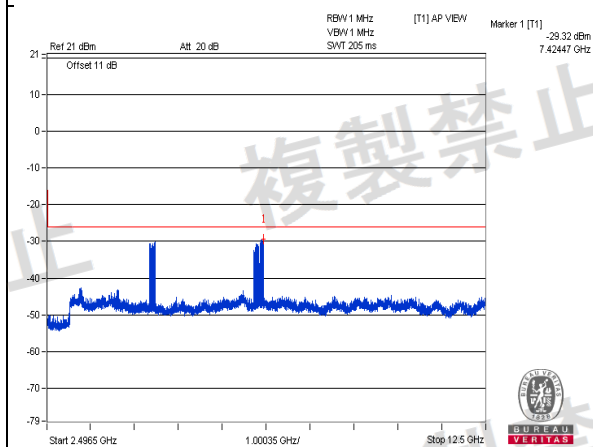
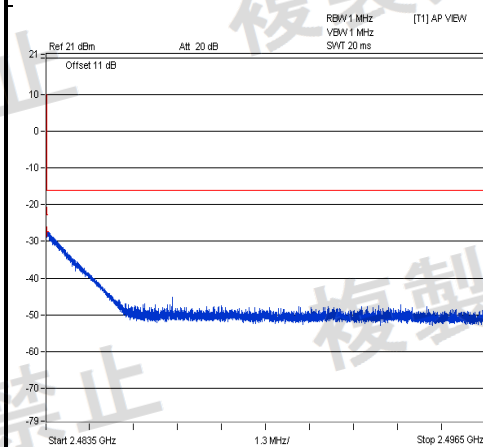
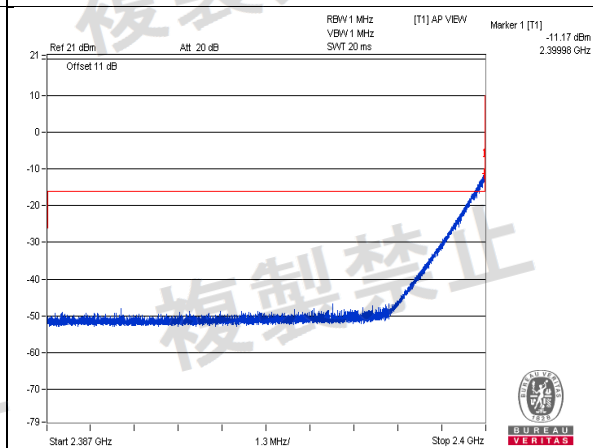
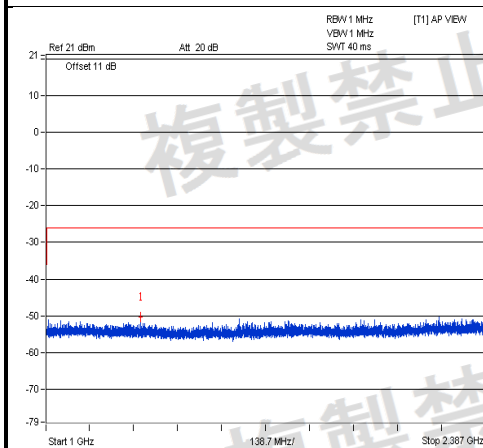
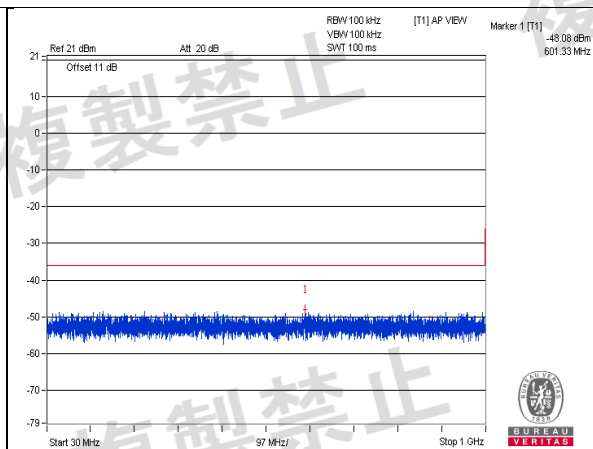
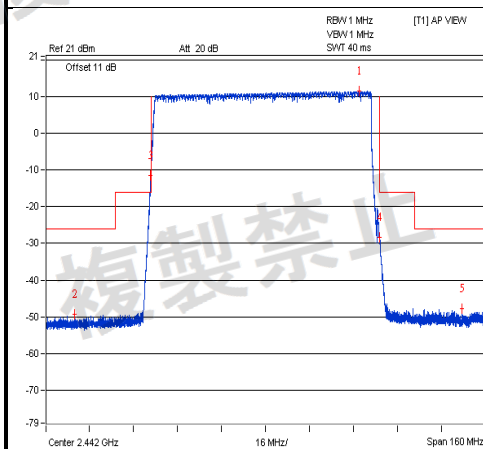
Environmental Conditions		26 deg.C, 66% RH			
Test Channel		Hopping Mode		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value		
V <sub>normal</sub>	30.0MHz to 1000.0MHz	845.28	0.015uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2358.39	0.008uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.98	23.768uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.52	1.972uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7409.46	<b>1.412uW</b>	2.5 uW/MHz	PASS
V <sub>max</sub>	30.0MHz to 1000.0MHz	601.33	0.015uW	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	1297.16	<b>0.009uW</b>	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.98	<b>24.044uW</b>	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.51	1.901uW	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7424.47	1.169uW	2.5 uW/MHz	PASS
V <sub>min</sub>	30.0MHz to 1000.0MHz	884.57	<b>0.018uW</b>	0.25 uW/100kHz	PASS
	1000.0MHz to 2387MHz	2327.7	0.008uW	2.5 uW/MHz	PASS
	2387.0MHz to 2400.0MHz	2399.99	23.768uW	25 uW/MHz	PASS
	2483.5MHz to 2496.5MHz	2483.51	<b>2.079uW</b>	25 uW/MHz	PASS
	2496.5MHz to 12500.0MHz	7398.21	1.135uW	2.5 uW/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.

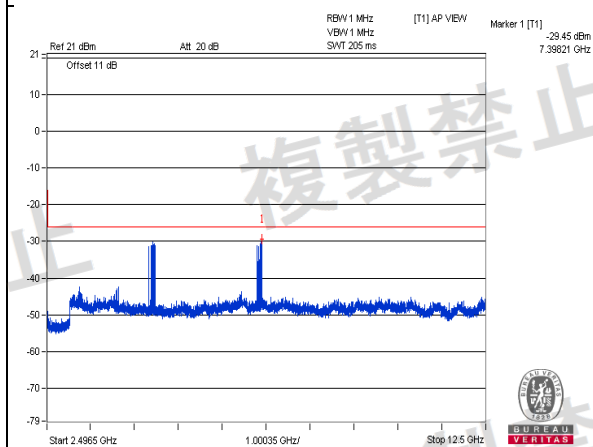
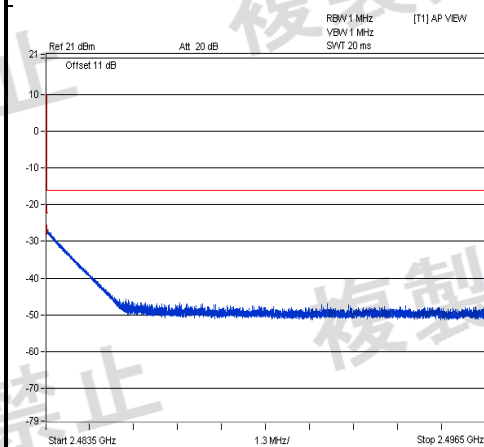
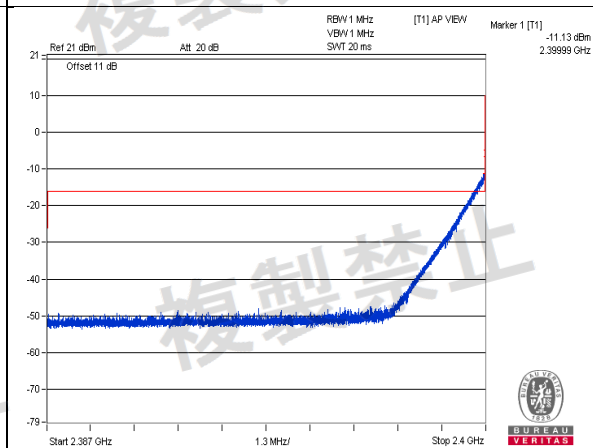
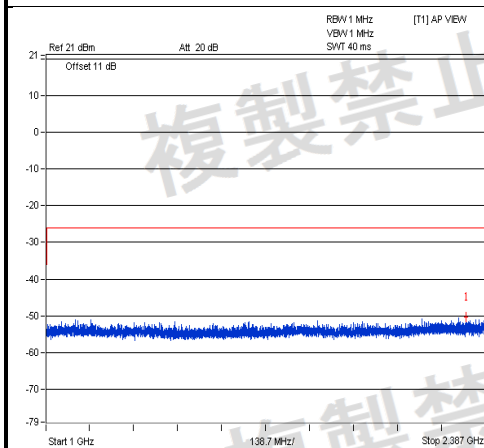
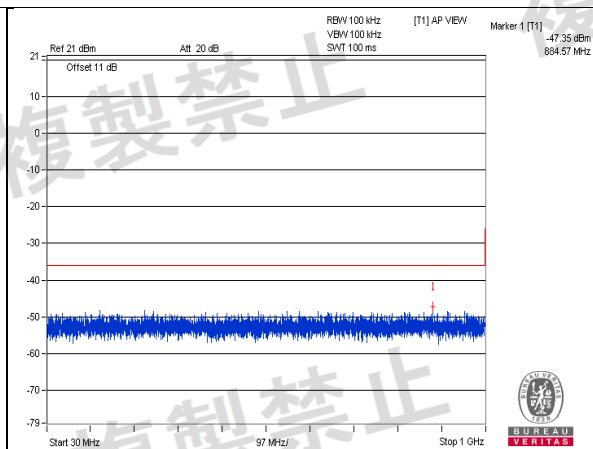
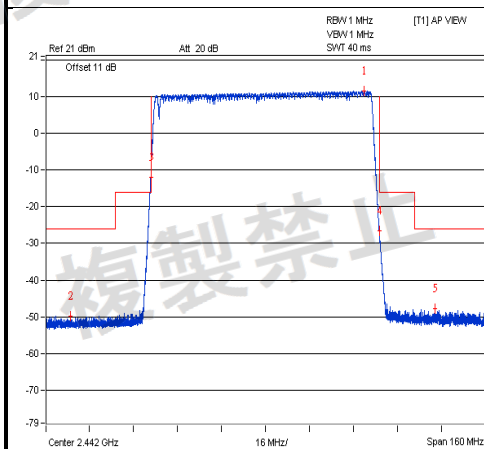
# Vnormal Channel 39



# V+10% Channel 39

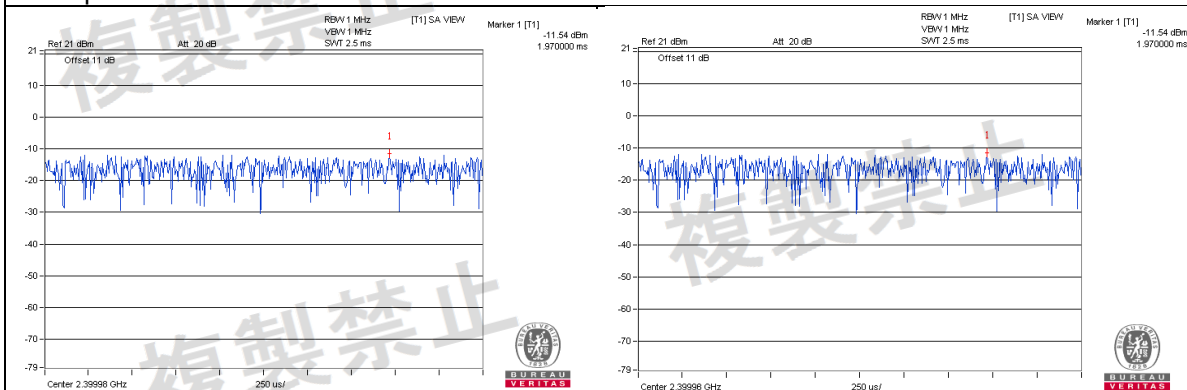


# V-10% Channel 39



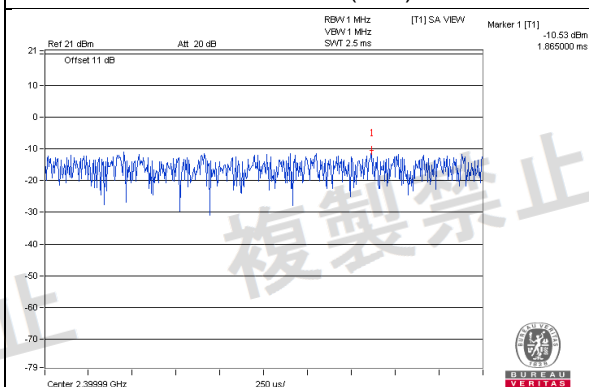
## Measuring Mode \*Zero Span

1. Set the spectrum analyzer as below and it takes in a value of all data point.
2. Regarding the all data value, it transforms the "dBm" value into "mW" value.
3. It adds the all values and calculates a grand total. Define a grand total as "P".
4. It divides "P" by sample data point (ex.501) and calculates the mean value.
5. It reports the mean value.



P= 0.023768 (mW)

P= 0.024044 (mW)



P= 0.023768 (mW)



## 4.5 Antenna Power Measurement

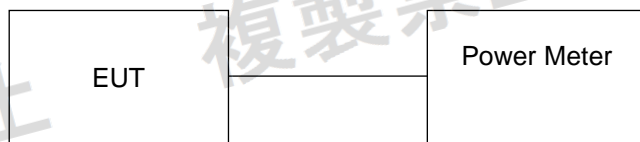
### 4.5.1 Limits of Antenna Power

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 (8.203mW/MHz)	19.14 dBm/MHz (82.03 mW/MHz)
FH	2400 – 2483.5 MHz	3 mW/MHz	6.91 dBm/MHz (4.909 mW/MHz)	16.91 dBm/MHz (49.09 mW/MHz)
Other than the above	2400 – 2483.5 MHz	10 mW	12.14 dBm (16.368 mW)	22.14 dBm (163.68 mW)

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





#### 4.5.3 Test Results

##### Normal Mode:

Environmental Conditions		26 deg.C, 66% RH		
Modulation Type	Data Rate Type	Conducted RF Output Power Density (mW/MHz)		
		V <sub>normal</sub>	V <sub>max</sub>	V <sub>min</sub>
GFSK	DH5	0.193729	0.186957	0.197125
DQPSK	2DH5	0.154277	0.160887	0.150691
8DPSK	3DH5	0.15479	0.148355	0.156423
Max. Limit (mW/MHz)		3		
Rated Power		0.2		
Tolerance of Antenna Power		0.04 ~ 0.24		

##### PCB antenna with antenna gain: 2.4dBi

Environmental Conditions		26 deg.C, 66% RH		
Modulation Type	Data Rate Type	Radiated RF Output Power Density (mW/MHz)		
		V <sub>normal</sub>	V <sub>max</sub>	V <sub>min</sub>
GFSK	DH5	0.336662	0.324894	0.342564
DQPSK	2DH5	0.268103	0.27959	0.261871
8DPSK	3DH5	0.268994	0.257811	0.271832
EIRP Max. Limit (mW/MHz)		4.909		

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 + Maximum Antenna Gain

#### AFH Mode:

Environmental Conditions		26 deg.C, 66% RH		
Modulation Type	Data Rate Type	Conducted RF Output Power Density (mW/MHz)		
		V <sub>normal</sub>	V <sub>max</sub>	V <sub>min</sub>
GFSK	DH5	0.755651	0.729338	0.773253
DQPSK	2DH5	0.601934	0.625963	0.589588
8DPSK	3DH5	0.60055	0.578827	0.610308
Max. Limit (mW/MHz)		3		
Rated Power		0.8		
Tolerance of Antenna Power		0.16 ~ 0.96		

#### PCB antenna with antenna gain: 2.4dBi

Environmental Conditions		26 deg.C, 66% RH		
Modulation Type	Data Rate Type	Radiated RF Output Power Density (mW/MHz)		
		V <sub>normal</sub>	V <sub>max</sub>	V <sub>min</sub>
GFSK	DH5	1.313171	1.267444	1.34376
DQPSK	2DH5	1.046041	1.087799	1.024587
8DPSK	3DH5	1.043636	1.005886	1.060594
EIRP Max. Limit (mW/MHz)		4.909		

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

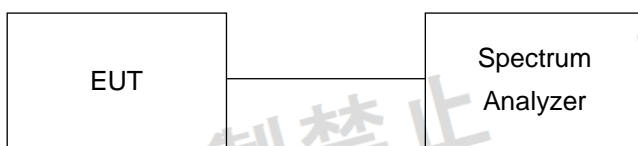
2. Formula: Radiated RF output power density = Conducted RF output power density + Maximum Antenna Gain

## 4.6 Spurious Emissions for Receiver

### 4.6.1 Limits of Spurious Emissions for Receiver

Frequencies (MHz)	Limit
Below 1GHz	$\leq 4\text{nW}/100\text{kHz}$ (-54dBm)
Above 1GHz	$\leq 20\text{nW}/\text{MHz}$ (-47dBm)

### 4.6.2 Test Setup

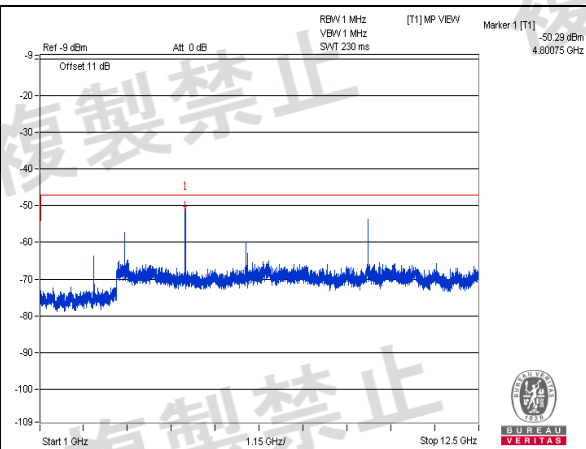
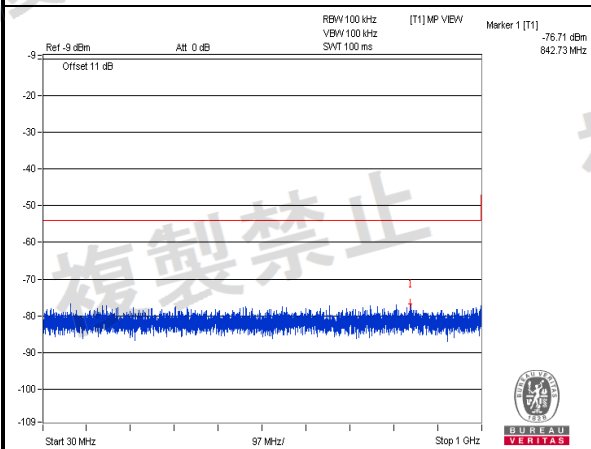


#### 4.6.3 Test Result

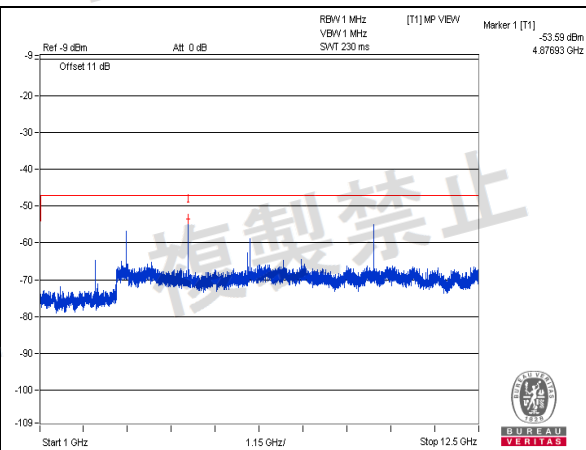
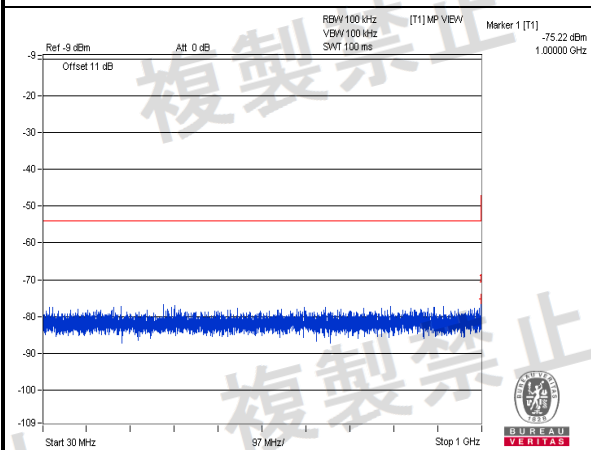
Environmental Conditions		26 deg.C, 66% RH					
Test Channel		Channel 0 (2402MHz)		Channel 39 (2441MHz)		Limit	Result
Test Condition	Frequency Range	Frequency (MHz)	Measured Value	Frequency (MHz)	Measured Value		
V <sub>normal</sub>	Below 1GHz	842.73	0.02133nW	1000	0.030061nW	4nW/100kHz	PASS
	Above 1GHz	4800.75	9.354057nW	4876.93	4.375221nW	20nW/MHz	PASS
V <sub>max</sub>	Below 1GHz	1000	0.022029nW	800.05	0.023067nW	4nW/100kHz	PASS
	Above 1GHz	4800.75	9.036495nW	4876.93	4.395416nW	20nW/MHz	PASS
V <sub>min</sub>	Below 1GHz	1000	0.027353nW	1000	0.026669nW	4nW/100kHz	PASS
	Above 1GHz	4800.75	8.830799nW	4876.93	4.120975nW	20nW/MHz	PASS
Test Channel		CH 78 (2480MHz)				Limit	Result
Test Condition	Frequency Range	Frequency (MHz) Measured Value		Measured Value			
V <sub>normal</sub>	Below 1GHz	979.99		0.030974nW		4nW/100kHz	PASS
	Above 1GHz	9915.37		3.357376nW		20nW/MHz	PASS
V <sub>max</sub>	Below 1GHz	1000		0.033806nW		4nW/100kHz	PASS
	Above 1GHz	9915.37		3.280953nW		20nW/MHz	PASS
V <sub>min</sub>	Below 1GHz	1000		0.024378nW		4nW/100kHz	PASS
	Above 1GHz	9915.37		3.10456nW		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.

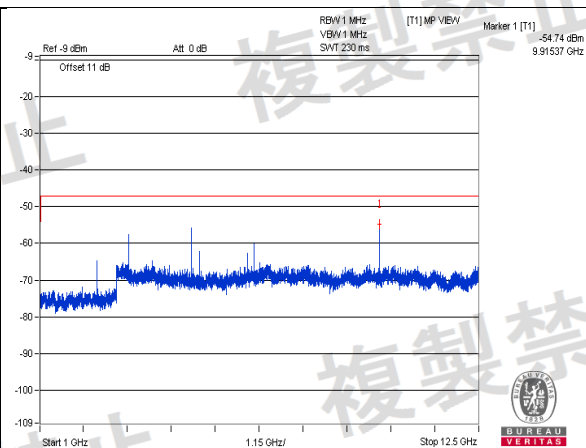
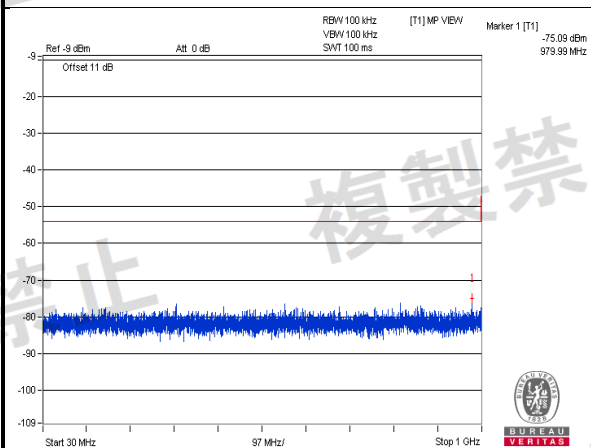
### Vnormal



### Channel 0

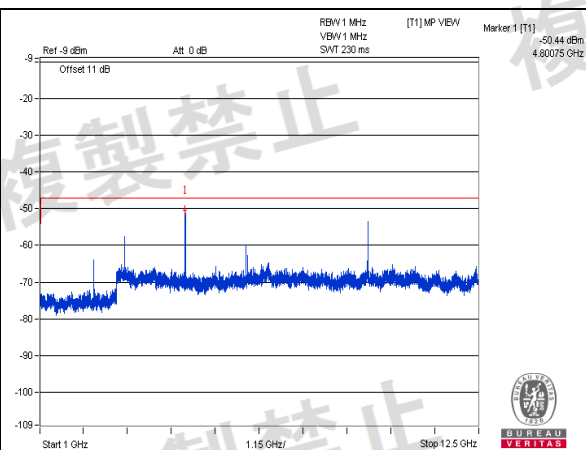
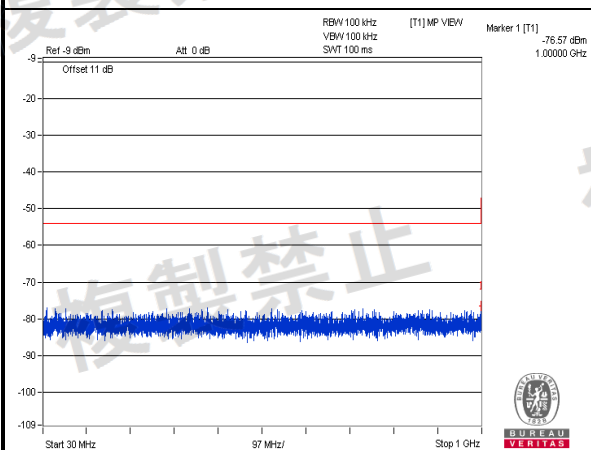


### Channel 39

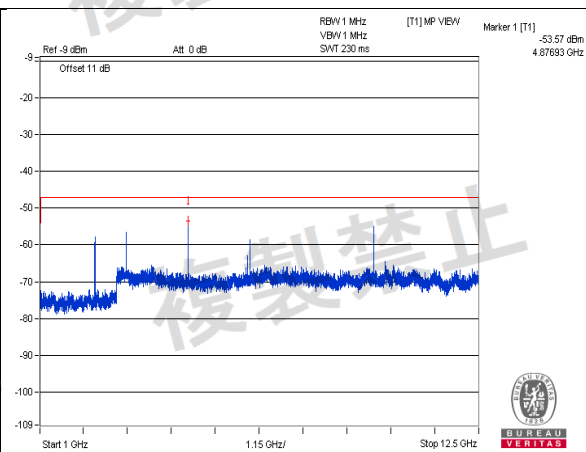
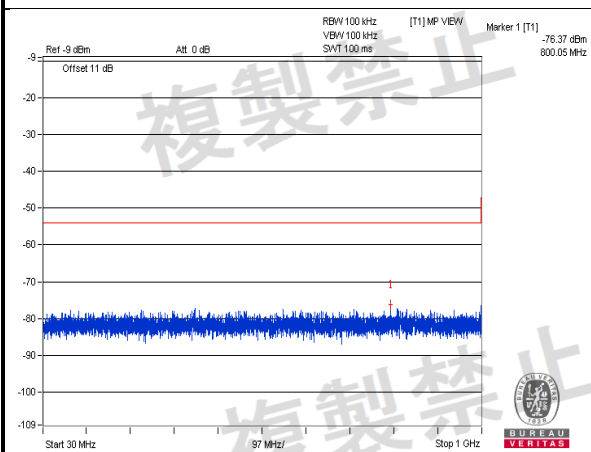


### Channel 78

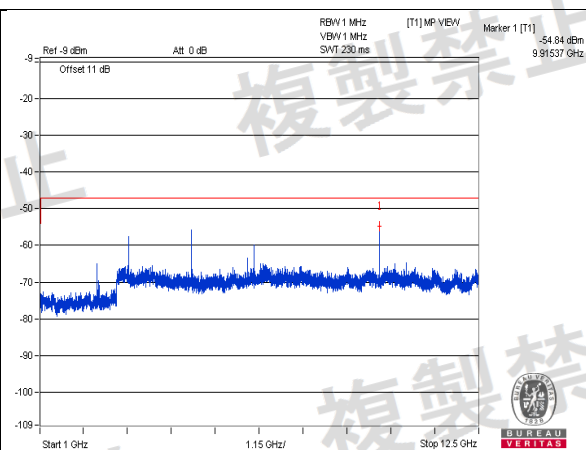
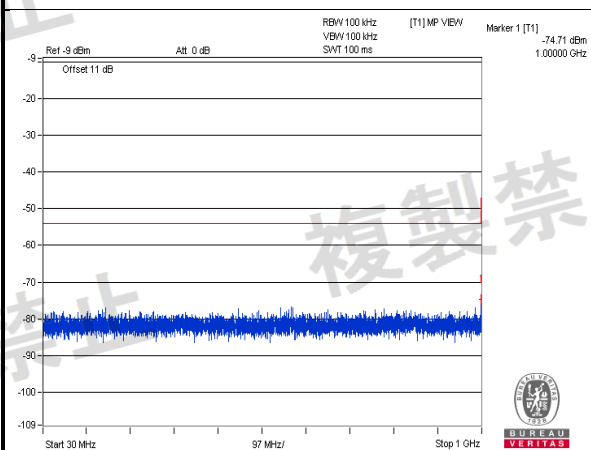
V+10%



Channel 0



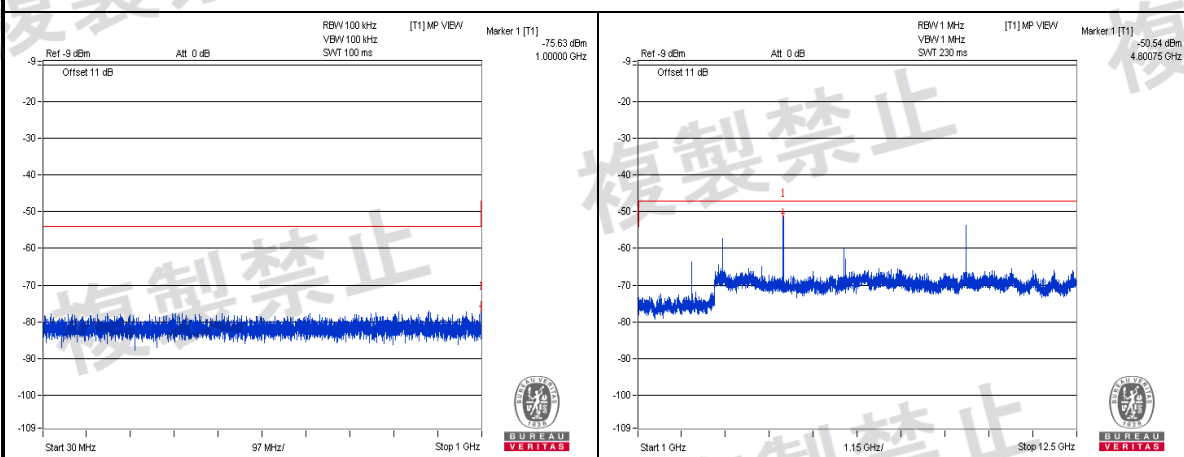
Channel 39



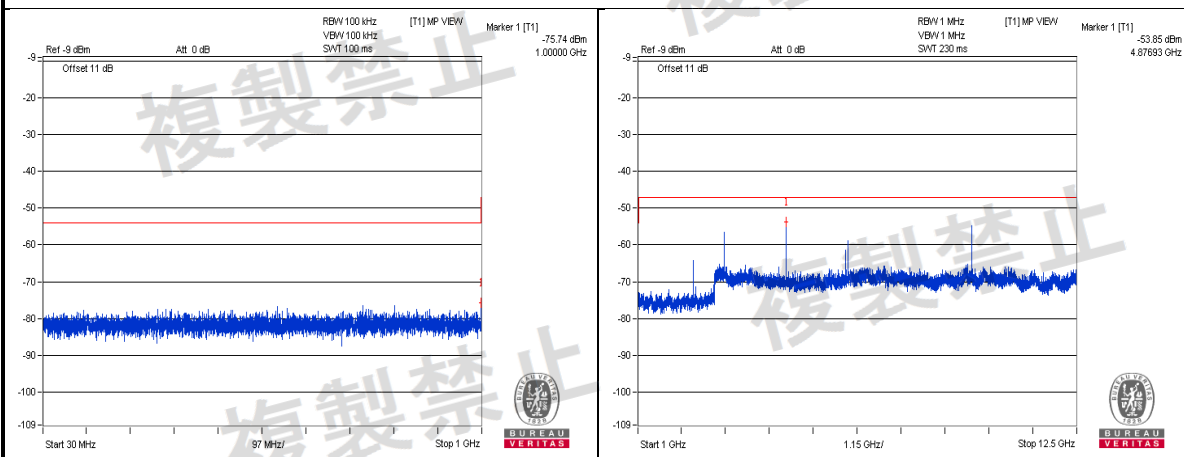
Channel 78



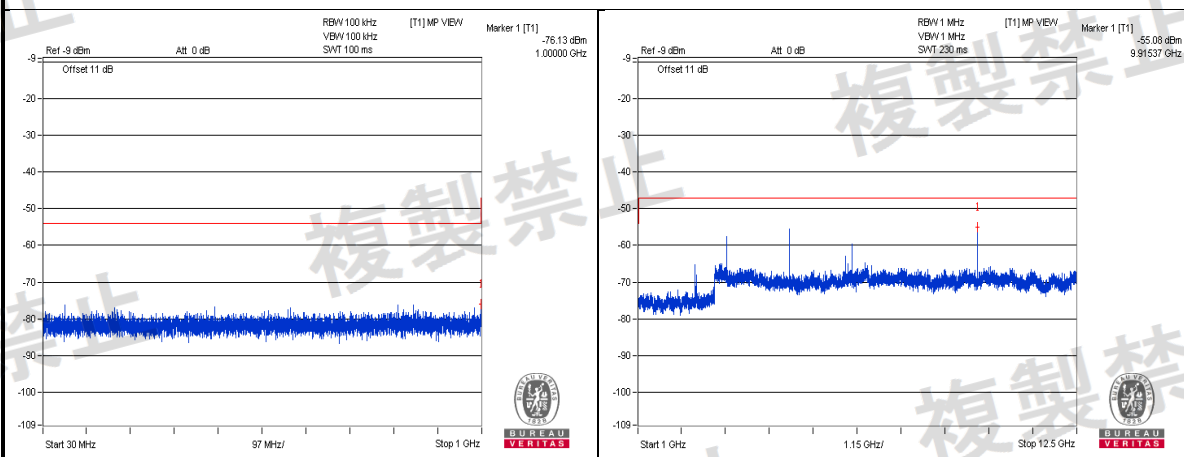
V-10%



Channel 0



Channel 39



Channel 78

#### 4.7 Dwell Time

##### 4.7.1 Limits of Dwell Time

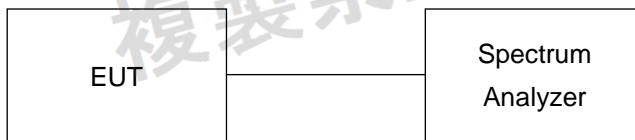
The Frequency retention time in the Frequency hopping method shall be 0.4 second or less. The total sum of the Frequency retention time in any Frequency within the time obtained by multiplying the diffusion rate by 0.4 second shall be 0.4 second or shorter.

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)
$V_{normal}$	DH1	71.20	0.360	0.142	51.120	400
	DH3	71.20	0.360	0.637	229.320	400
	DH5	71.20	0.360	0.562	202.320	400
$V_{max}$	DH1	71.00	0.359	0.134	48.106	400
	DH3	71.00	0.359	0.591	212.169	400
	DH5	71.00	0.359	0.568	203.912	400
$V_{min}$	DH1	71.20	0.360	0.134	48.240	400
	DH3	71.20	0.360	0.637	229.320	400
	DH5	71.20	0.360	0.562	202.320	400

AFH Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
$V_{normal}$	DH1	18.10	0.362	0.142	51.404	400
	DH3	18.10	0.362	0.637	230.594	400
	DH5	18.10	0.362	0.562	203.444	400
$V_{max}$	DH1	18.10	0.362	0.134	48.508	400
	DH3	18.10	0.362	0.591	213.942	400
	DH5	18.10	0.362	0.568	205.616	400
$V_{min}$	DH1	18.10	0.362	0.134	48.508	400
	DH3	18.10	0.362	0.637	230.594	400
	DH5	18.10	0.362	0.562	203.444	400

Modulation:  $\pi/4$ -DQPSK  
Normal Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
$V_{normal}$	2DH1	71.00	0.359	0.134	48.106	400
	2DH3	71.00	0.359	0.642	230.478	400
	2DH5	71.00	0.359	0.562	201.758	400
$V_{max}$	2DH1	71.40	0.361	0.134	48.374	400
	2DH3	71.40	0.361	0.642	231.762	400
	2DH5	71.40	0.361	0.562	202.882	400
$V_{min}$	2DH1	70.80	0.358	0.134	47.972	400
	2DH3	70.80	0.358	0.642	229.836	400
	2DH5	70.80	0.358	0.562	201.196	400

AFH Mode:

Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
$V_{normal}$	2DH1	18.30	0.366	0.134	49.044	400
	2DH3	18.30	0.366	0.642	234.972	400
	2DH5	18.30	0.366	0.562	205.692	400
$V_{max}$	2DH1	18.40	0.368	0.134	49.312	400
	2DH3	18.40	0.368	0.642	236.256	400
	2DH5	18.40	0.368	0.562	206.816	400
$V_{min}$	2DH1	18.20	0.364	0.134	48.776	400
	2DH3	18.20	0.364	0.642	233.688	400
	2DH5	18.20	0.364	0.562	204.568	400

**Modulation: 8DPSK**  
**Normal Mode:**

Test Condition	Mode	Spreading Rate	[Spreading Rate/79]*0.4	Duty Cycle	Result (msec)	Limit (msec)
V <sub>normal</sub>	3DH1	71.60	0.362	0.150	54.300	400
	3DH3	71.60	0.362	0.150	54.300	400
	3DH5	71.60	0.362	0.562	203.444	400
V <sub>max</sub>	3DH1	71.20	0.360	0.150	54.000	400
	3DH3	71.20	0.360	0.150	54.000	400
	3DH5	71.20	0.360	0.562	202.320	400
V <sub>min</sub>	3DH1	71.40	0.361	0.150	54.150	400
	3DH3	71.40	0.361	0.150	54.150	400
	3DH5	71.40	0.361	0.562	202.882	400

**AFH Mode:**

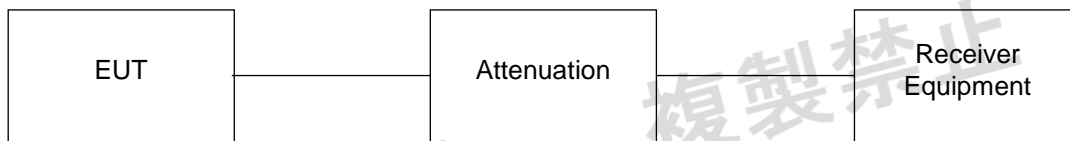
Test Condition	Mode	Spreading Rate	[Spreading Rate/20]*0.4	Duty Cycle	Result (msec)	Limit (msec)
V <sub>normal</sub>	3DH1	18.30	0.366	0.150	54.900	400
	3DH3	18.30	0.366	0.150	54.900	400
	3DH5	18.30	0.366	0.562	205.692	400
V <sub>max</sub>	3DH1	18.20	0.364	0.150	54.600	400
	3DH3	18.20	0.364	0.150	54.600	400
	3DH5	18.20	0.364	0.562	204.568	400
V <sub>min</sub>	3DH1	18.30	0.366	0.150	54.900	400
	3DH3	18.30	0.366	0.150	54.900	400
	3DH5	18.30	0.366	0.562	205.692	400

## 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	26 deg.C, 66% RH
Link Mode	Test Result
BT-EDR	Pass



## 5 Test Instruments

Description & Manufacturer	Model no.	Serial No.	Calibrated Date	Calibrated Until	Calibration Authority
Spectrum Analyzer R&S	FSV40	100964	July 1, 2017	June 30, 2018	ETC
ESG Vector signal generator Agilent	E4438C	MY45094468/005 506 602 UK6 UNJ	Nov. 25, 2016	Nov. 24, 2017	ETC
Detector Narda	4503A	0306	NA	NA	NA
Power Meter Anritsu	ML2495A	1014008	MAY 11, 2017	MAY 10, 2018	ETC
Power Sensor Anritsu	MA2411B	0917122	MAY 11, 2017	MAY 10, 2018	ETC
Digital Oscilloscope R&S	RTO1012	300053	June 28, 2017	June 27, 2018	ETC
DC Power Supply Topward	6603D	795558	NA	NA	NA
Digital Multimeter FLUKE	87III	73680266	Nov. 10, 2016	Nov. 09, 2017	ETC

**NOTE:** 1. The calibration interval of the above test instruments is 12 months and the calibrations are traceable to NML/ROC and NIST/USA.  
2. Tested Date: Sep. 27, 2017

## 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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**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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