



## Radio Test Report

**Report No.:** RJ190520C05A

**Test Model:** WISE-2410B

**Series Model:** WISE-2410Bxxxxxxxxxxxx (where "X" maybe any alphanumeric character, blank or "-" ) (refer to item 3.1 for more details)

**Received Date:** Jul. 29, 2019

**Test Date:** Oct. 28 ~ Nov. 08, 2019

**Issued Date:** Nov. 12, 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

**Test Location:** No. 19, Hwa Ya 2nd Rd., Wen Hwa Vil., Kwei Shan Dist., Taoyuan City  
33383, Taiwan



This report is for your exclusive use. Any copying or replication of this report to or for any other person or entity, or use of our name or trademark, is permitted only with our prior written permission. This report sets forth our findings solely with respect to the test samples identified herein. The results set forth in this report are not indicative or representative of the quality or characteristics of the lot from which a test sample was taken or any similar or identical product specifically and expressly noted. Our report includes all of the tests requested by you and the results thereof based upon the information that you provided to us. You have 60 days from date of issuance of this report to notify us of any material error or omission caused by our negligence, provided, however, that such notice shall be in writing and shall specifically address the issue you wish to raise. A failure to raise such issue within the prescribed time shall constitute your unqualified acceptance of the completeness of this report, the tests conducted and the correctness of the report contents. Unless specific mention, the uncertainty of measurement has been explicitly taken into account to declare the compliance or non-compliance to the specification. The report must not be used by the client to claim product certification, approval, or endorsement by TAF or any government agencies.

## Table of Contents

Release Control Record .....	3
1 Certificate of Conformity .....	4
2 Summary of Test Results .....	5
2.1 Measurement Uncertainty .....	6
2.2 Modification Record .....	6
3 General Information .....	7
3.1 General Description of EUT .....	7
3.2 Description of Test Modes .....	8
3.3 Test Conditions .....	8
3.4 Antenna Specifications .....	9
3.4.1 Antenna Gain .....	9
3.4.2 Antenna Pattern .....	9
4 Test Results .....	11
4.1 Frequency Tolerance Measurement .....	11
4.1.1 Limits of Frequency Tolerance Measurement .....	11
4.1.2 Test Setup .....	11
4.1.3 Test Results .....	11
4.2 Occupied Bandwidth Measurement (99% power bandwidth) .....	12
4.2.1 Limits of Occupied Bandwidth Measurement .....	12
4.2.2 Test Setup .....	12
4.2.3 Test Results .....	12
4.3 Spurious Emissions for Transmitter Measurement .....	16
4.3.1 Limits of Spurious Emissions .....	16
4.3.2 Test Setup .....	16
4.3.3 Test Results .....	17
4.4 Adjacent Channel Leakage Power .....	38
4.4.1 Limits of Adjacent Channel Leakage Power .....	38
4.4.2 Test Results .....	39
4.5 Antenna Power Measurement .....	49
4.5.1 Limits of Antenna Power .....	49
4.5.2 Test Setup .....	49
4.5.3 Test Results .....	50
4.6 Spurious Emissions for Receiver .....	51
4.6.1 Limits of Spurious Emissions for Receiver .....	51
4.6.2 Test Setup .....	51
4.6.3 Test Result .....	52
4.7 Transmission Time Control .....	63
4.7.1 Limits of Transmission Time Control .....	63
4.7.2 Test Setup .....	63
4.7.3 Test Results .....	64
4.8 Carrier Sense .....	68
4.8.1 Limits of Carrier Sense .....	68
4.8.2 Test Setup .....	68
4.8.3 Test Results .....	69
4.9 Interference Prevention Function .....	72
4.9.1 Limits of Interference Prevention Function .....	72
4.9.2 Test Setup .....	72
4.9.3 Test Results .....	72
5 Test Instruments .....	73
6 Photographs of the Test Configuration .....	74
Appendix - Information of the Testing Laboratories .....	75



Release Control Record

Issue No.	Description	Date Issued
RJ190520C05A	Original release	Nov. 12, 2019



## 1 Certificate of Conformity

**Product:** WISE-2410B LoRa board

**Brand:** Advanech

**Test Model:** WISE-2410B

**Series Model:** WISE-2410Bxxxxxxxxxx (where "X" maybe any alphanumeric character, blank or "-")  
(refer to item 3.1 for more details)

**Sample Status:** Engineering sample

**Applicant:** ADVANTECH CO., LTD

**Test Date:** Oct. 28 ~ Nov. 08, 2019

**Standards:** ARIB STD-T108

Article 2 Clause I Item 8

Measurement was conducted by the temporary test method which submitted to the Minister for Internal Affairs and Communications based on the Ordinance Concerning Technical Regulations Conformity Certification etc. of Specified Radio Equipment in Annex 1, the Ministry of Internal Affairs and Communication notification in Article 88, Paragraph 2.

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 :**

  
Polly Chien / Specialist

**Date:**

Nov. 12, 2019

**Approved by :**

  
Bruce Chen / Senior Project Engineer

**Date:**

Nov. 12, 2019

## 2 Summary of Test Results

The EUT has been tested according to the following specifications:

Notice 88 Reference	ARIB STD-T108 REF. (Part 2)	REPORT REFERENCE	PARAMETER	TEST RESULTS (NOTE)
<b>GENERAL PROVISIONS</b>				
Appendix 22 3rd	3.2.4	4.1	Frequency tolerance	C
Appendix 22 3rd	3.2.6	4.2	Occupied bandwidth	C
Appendix 1	3.2.8	4.3	Spurious emissions	C
<b>TRANSMITTING EQUIPMENT</b>				
Appendix 22 3rd	3.2.1	4.5	Antenna power	C
-	-	-	SAR	NA
<b>TRANSMITTING ANTENNA</b>				
-	-	3.4	Type, configuration, etc. of transmitting antenna	C
-	-	3.4	Direction pattern of transmitting antenna	C
<b>RECEIVING EQUIPMENT</b>				
Appendix 22 3rd	3.3	4.6	Spurious emissions of receiver	C
-	-	3.4	Refer to all articles for transmitting antenna	C
<b>OPERATING FREQUENCY 920MHz-BAND</b>				
-	3.5	-	High frequency/modulation section cannot be opened easily	C
-	3.1.1	3.1	Communication method	C
-	3.2.5	3.1	Modulation method	C
-	3.7	4.5	Absolute gain of transmitting antenna	C
Appendix 22 3rd	3.4.1	4.7	Transmission time control equipment	C
Appendix 22 3rd	3.2.7	4.4	Adjacent channel leakage power	C
Appendix 22 3rd	3.4.2	4.8	Carrier Sense Capability	C
Appendix 22 3rd	3.4.3	-	Skipping carrier sense in a response	NA
-	3.4.4	4.9	Interference Prevention Function	C
<b>NOTE:</b> 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	1620.33Hz
Spurious emissions	2.52dB
Output power density	1.37dB
Adjacent Channel Leakage Power	0.71 dB
Out of band radiated power	2.52 dB
Frequency Tolerance	1620.33Hz
Transmission Time	2.23ms

## 2.2 Modification Record

There were no modifications required for compliance.

### 3 General Information

#### 3.1 General Description of EUT

Product	WISE-2410B LoRa board
Brand	Advantech
Test Model	WISE-2410B
Series Model	WISE-2410Bxxxxxxxxxxxx (where "X" maybe any alphanumeric character, blank or "-" )
Status of EUT	Engineering sample
Nominal Voltage	3.6Vdc (from host equipment)
Modulation Type	Chirp spread spectrum (CSS) technology
Operating Frequency	920.6~923.4MHz
Number of Channel	11
Rated RF Output Power	15.02mW
Conducted RF Output Power	12.540mW
Radiated RF Output Power	14.250dBm
Antenna Type	Refer to Note
Antenna Connector	Refer to Note
Accessory Device	NA
Data Cable Supplied	NA

Note:

1. The following models are provided to this EUT. The model WISE-2410B was chosen for final test.

Brand	Model	Description
Advantech	WISE-2410B	The serious difference is for market request. (where "X" maybe any alphanumeric character, blank or "-" )
	WISE-2410Bxxxxxxxxxxxx	

2. The EUT uses following antennas.

No	Antenna Type	Antenna Connector	Antenna Gain (dBi)
1	Chip	SMA(F)	1
2	Dipole	SMA Plug	1.71

3. 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

11 channels are provided to this EUT:

Channel	Freq. (MHz)
1	920.6
2	920.8
3	921.0
4	921.2
5	921.4
6	921.6
7	921.8
8	922.0
9	922.2
10	923.2
11	923.4

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

Channel	Power setting
1	12.00
5	12.00
11	12.00

### 3.3 Test Conditions

Test Conditions	Voltage (Vdc)
$V_{normal}$	3.60
$V_{max.}$	3.96
$V_{mix.}$	3.24



### 3.4 Antenna Specifications

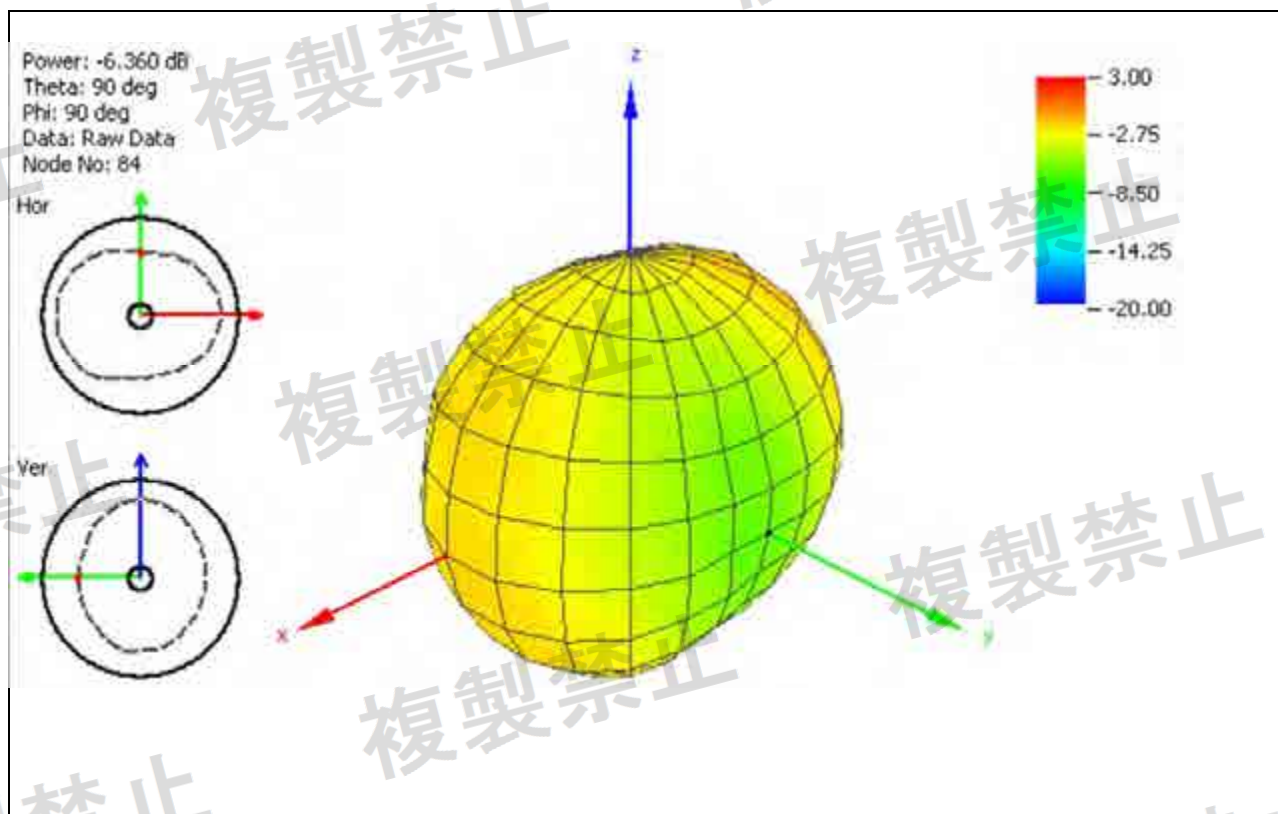
#### 3.4.1 Antenna Gain

The antenna provided to the EUT, please refer to the following table:

No	Antenna Type	Antenna Connector	Antenna Gain (dBi)
1	Chip	SMA(F)	1
2	Dipole	SMA Plug	1.71

#### 3.4.2 Antenna Pattern

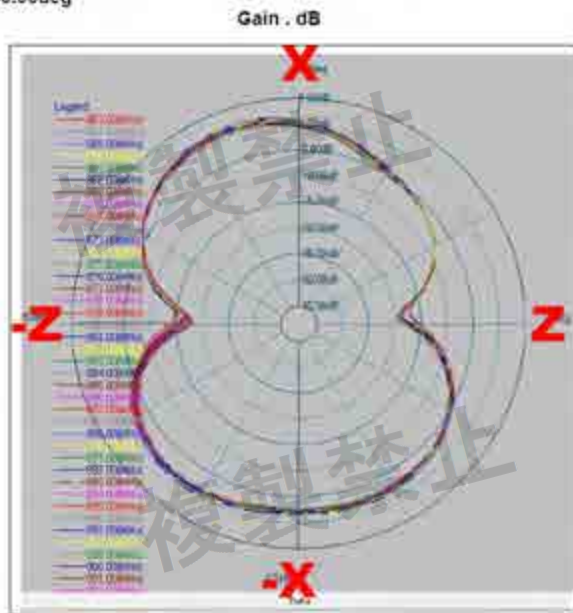
Antenna 1



# Antenna 2

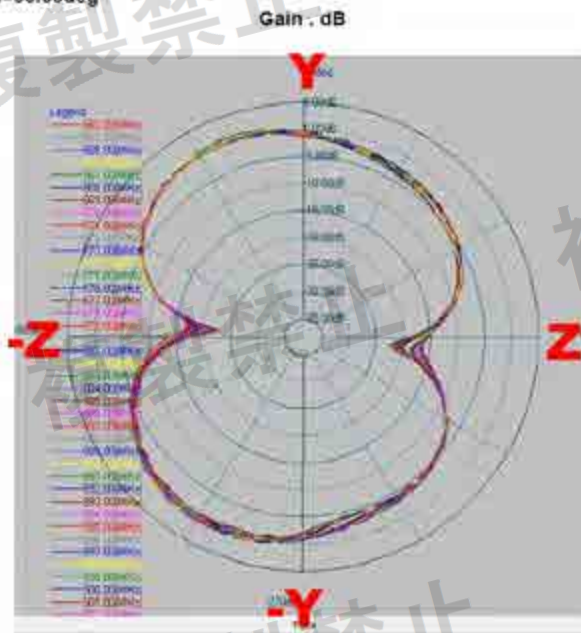
## X-Z Plane

Phi=0.00deg



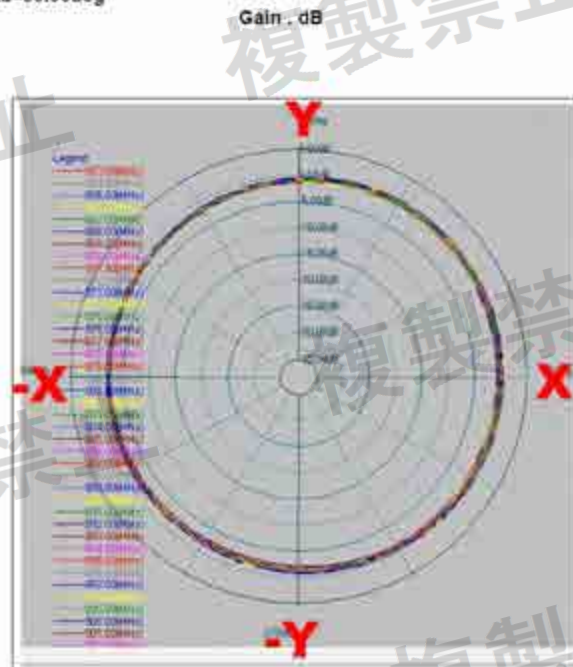
## Y-Z Plane

Phi=90.00deg



## X-Y Plane

Theta=90.00deg



## 4 Test Results

### 4.1 Frequency Tolerance Measurement

#### 4.1.1 Limits of Frequency Tolerance Measurement

It shall be within  $20 \times 10^{-6}$

#### 4.1.2 Test Setup



#### 4.1.3 Test Results

Environmental Conditions		24 deg.C, 70% RH					
Channel	Frequency (MHz)	Voltage normal		V <sub>max.</sub>		V <sub>min.</sub>	
		Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)	Carrier frequency (MHz)	Frequency tolerance (ppm)
1	920.6	920.600300	0.325	920.600600	0.651	920.602000	2.17
5	921.4	921.400400	0.434	921.400400	0.434	921.400400	0.434
11	923.4	923.400000	0.000	923.400200	0.216	923.400400	0.433

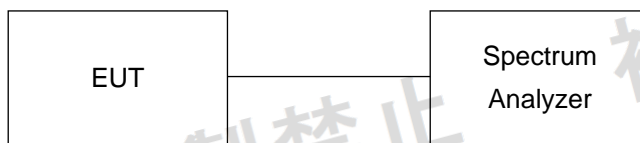
## 4.2 Occupied Bandwidth Measurement (99% power bandwidth)

### 4.2.1 Limits of Occupied Bandwidth Measurement

Item	Limit
Occupied bandwidth	(200 x n) kHz

Notes: 1. For center frequency is from 928.15 MHz to 929.65 MHz, it shall be (100 x n) kHz or less  
2. **n = 1** (n is a number of unit radio channels constituting the radio channel and is an integer from 1 to 5.)

### 4.2.2 Test Setup

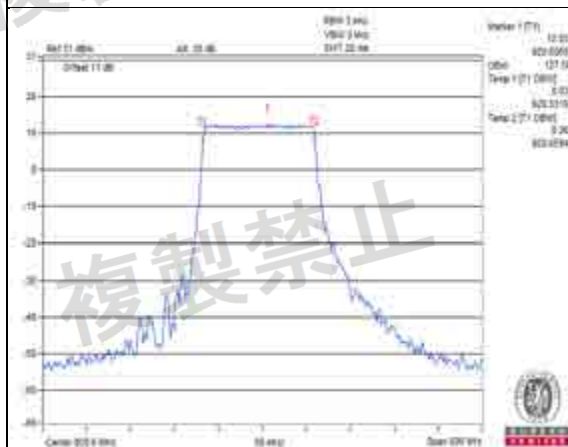


### 4.2.3 Test Results

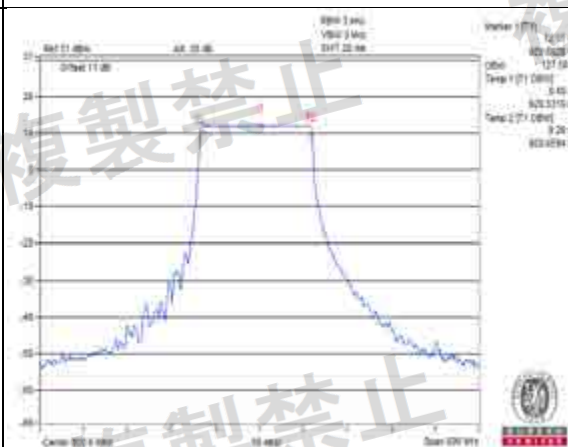
Environmental Conditions		24 deg.C, 70% RH		
Channel	Frequency (MHz)	V <sub>normal</sub>	V <sub>max.</sub>	V <sub>min.</sub>
		Occupied Bandwidth (kHz)	Occupied Bandwidth (kHz)	Occupied Bandwidth (kHz)
1	920.6	127.50	127.50	127.50
5	921.4	127.50	127.50	126.10
11	923.4	127.50	127.50	126.80

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

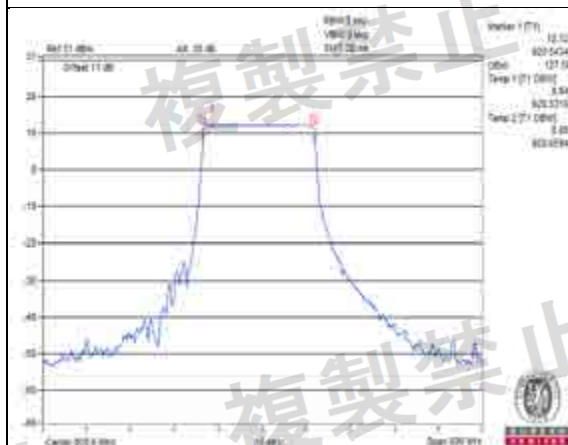
V<sub>normal</sub>



V<sub>max</sub>



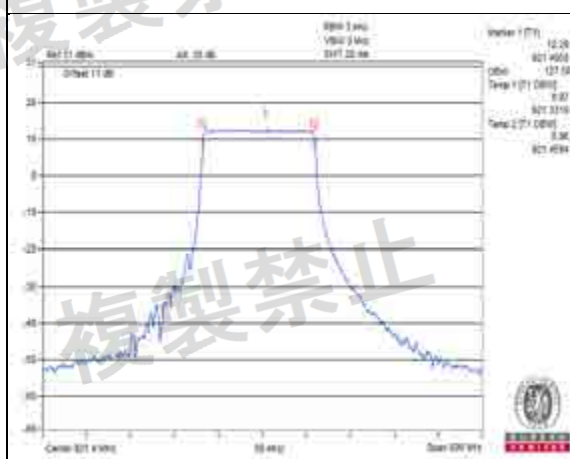
V<sub>min</sub>



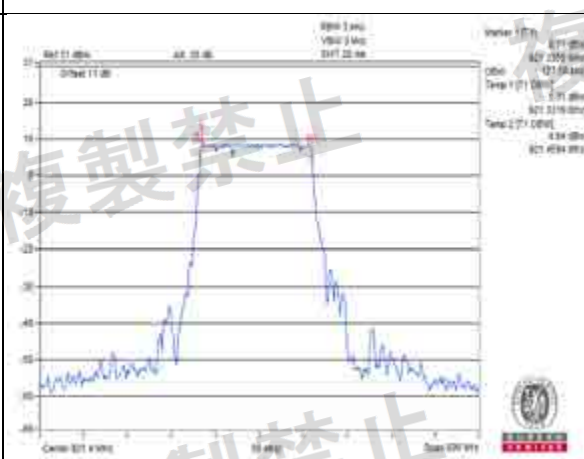
CH 1 (920.6MHz)



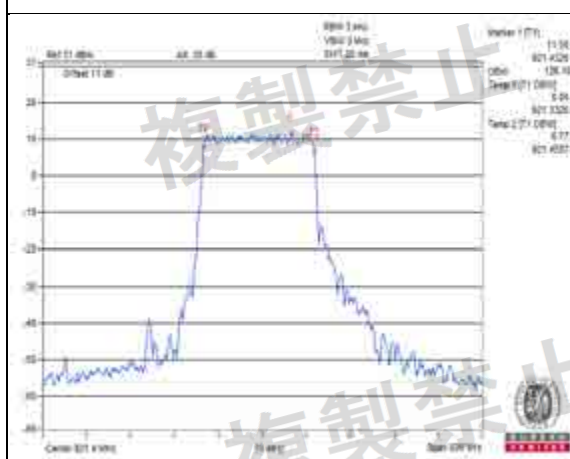
V<sub>normal</sub>



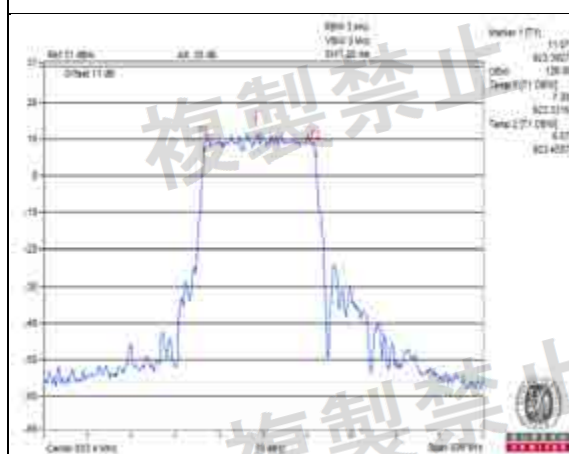
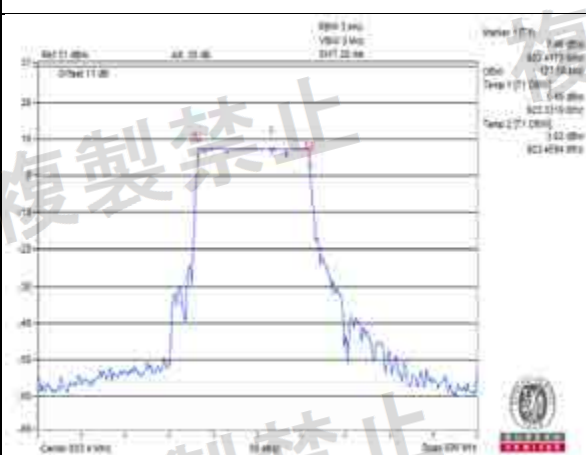
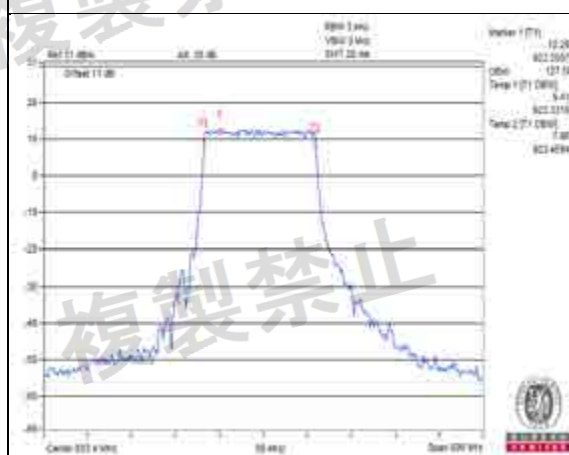
V<sub>max</sub>



V<sub>min</sub>



CH 5 (921.4MHz)



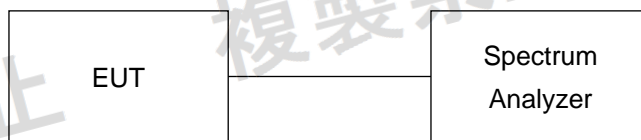
CH 11 (923.4MHz)

### 4.3 Spurious Emissions for Transmitter Measurement

#### 4.3.1 Limits of Spurious Emissions

Frequency band	Limit (dBm)	RBW
$f \leq 710 \text{ MHz}$	-36	100kHz
$710 \text{ MHz} < f \leq 900 \text{ MHz}$	-55	1MHz
$900 \text{ MHz} < f \leq 915 \text{ MHz}$	-55	100kHz
$915 \text{ MHz} < f \leq 930 \text{ MHz}^*$ (Except for $ f-f_c  \leq (200+100 \times n) \text{ kHz}$ if bandwidth of unit radio channel is 200 kHz, except for $ f-f_c  \leq (100+50 \times n) \text{ kHz}$ if bandwidth of unit radio channel is 100 kHz. Except for $ f-f_c  \leq (100+100 \times n) \text{ kHz}$ If frequency band is $915.9 \text{ MHz} \leq f \leq 916.9 \text{ MHz}$ and $920.5 \text{ MHz} \leq$ $922.3 \text{ MHz}$ . Where n is a number of unit radio channels constituting the radio channel and is an integer from 1 to 5)	-36	100kHz
$930 \text{ MHz} < f \leq 1000 \text{ MHz}$	-55	100kHz
$1000 \text{ MHz} < f \leq 1,215 \text{ MHz}$	-45	1MHz
$1,215 \text{ MHz} < f$	-30	1MHz

#### 4.3.2 Test Setup



### 4.3.3 Test Results

TEST CHANNEL		920.6MHz		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE		
Vnormal	30MHz to 710MHz	459.68000	<b>-57.444473</b>	-36.00	PASS
	710MHz to 900MHz	885.13000	<b>-55.157050</b>	-55.00	PASS
	900MHz to 915MHz	913.21000	-63.496517	-55.00	PASS
	915MHz to CF-300kHz	920.18000	<b>-36.727772</b>	-36.00	PASS
	CF+300kHz to 930MHz	920.90000	<b>-38.496620</b>	-36.00	PASS
	930MHz to 1000MHz	939.63000	<b>-57.411442</b>	-55.00	PASS
	1000MHz to 1215MHz	1023.99000	-56.207306	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	<b>-47.075520</b>	-30.00	PASS
Vmax.	30MHz to 710MHz	615.39000	-57.789207	-36.00	PASS
	710MHz to 900MHz	821.52000	-55.803135	-55.00	PASS
	900MHz to 915MHz	914.56000	-63.197689	-55.00	PASS
	915MHz to CF-300kHz	920.30000	-38.822273	-36.00	PASS
	CF+300kHz to 930MHz	920.90000	-39.197960	-36.00	PASS
	930MHz to 1000MHz	939.73000	-57.433552	-55.00	PASS
	1000MHz to 1215MHz	1061.69000	-56.595230	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	-47.160004	-30.00	PASS
Vmin.	30MHz to 710MHz	234.00000	-57.533649	-36.00	PASS
	710MHz to 900MHz	888.71000	-55.030000	-55.00	PASS
	900MHz to 915MHz	911.60000	<b>-62.777542</b>	-55.00	PASS
	915MHz to CF-300kHz	920.30000	-40.461227	-36.00	PASS
	CF+300kHz to 930MHz	920.90000	-38.515102	-36.00	PASS
	930MHz to 1000MHz	939.63000	-57.603428	-55.00	PASS
	1000MHz to 1215MHz	1159.22000	<b>-55.372002</b>	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	-47.208763	-30.00	PASS

TEST CHANNEL		921.4MHz		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE		
Vnormal	30MHz to 710MHz	135.44000	<b>-56.989933</b>	-36.00	PASS
	710MHz to 900MHz	900.00000	-56.445377	-55.00	PASS
	900MHz to 915MHz	913.86000	<b>-63.334415</b>	-55.00	PASS
	915MHz to CF-300kHz	921.10000	-39.483650	-36.00	PASS
	CF+300kHz to 930MHz	921.71000	<b>-39.514992</b>	-36.00	PASS
	930MHz to 1000MHz	940.44000	-57.564278	-55.00	PASS
	1000MHz to 1215MHz	1078.21000	<b>-55.936230</b>	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	-47.434498	-30.00	PASS
Vmax.	30MHz to 710MHz	299.04000	-57.374191	-36.00	PASS
	710MHz to 900MHz	768.10000	<b>-55.843605</b>	-55.00	PASS
	900MHz to 915MHz	913.39000	-63.751480	-55.00	PASS
	915MHz to CF-300kHz	921.10000	<b>-38.264111</b>	-36.00	PASS
	CF+300kHz to 930MHz	921.70000	-39.719330	-36.00	PASS
	930MHz to 1000MHz	940.34000	-57.793636	-55.00	PASS
	1000MHz to 1215MHz	1007.47000	-56.078892	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	<b>-46.848713</b>	-30.00	PASS
Vmin.	30MHz to 710MHz	697.18000	-57.355026	-36.00	PASS
	710MHz to 900MHz	713.02000	-56.105526	-55.00	PASS
	900MHz to 915MHz	914.95000	-63.637741	-55.00	PASS
	915MHz to CF-300kHz	921.06000	-40.002762	-36.00	PASS
	CF+300kHz to 930MHz	921.70000	-40.051323	-36.00	PASS
	930MHz to 1000MHz	940.34000	<b>-57.143620</b>	-55.00	PASS
	1000MHz to 1215MHz	1106.25000	-56.551735	-45.00	PASS
	1215MHz to 5000MHz	1840.34000	-47.001625	-30.00	PASS

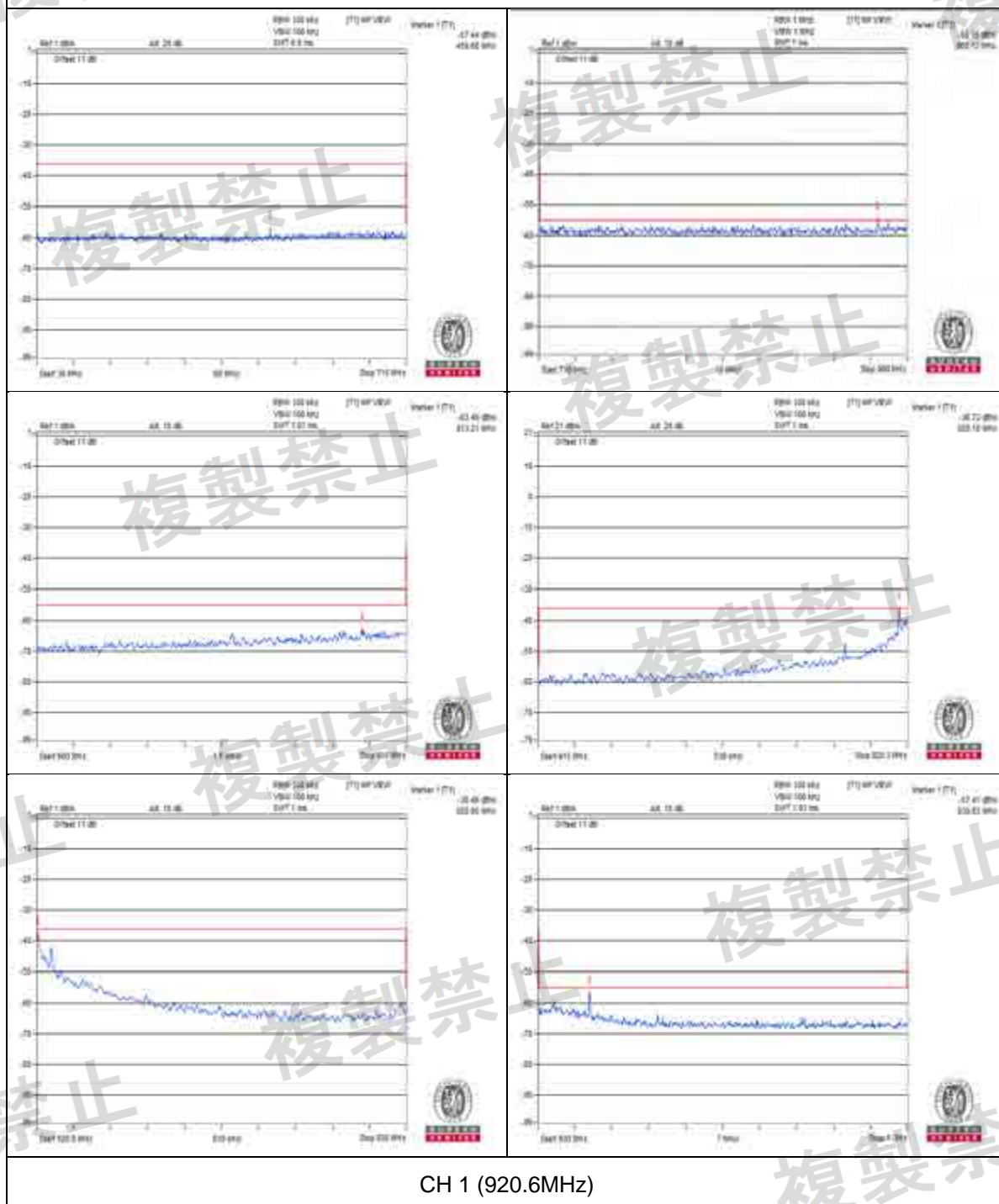


TEST CHANNEL		923.4MHz		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE		
Vnormal	30MHz to 710MHz	640.02000	-57.803448	-36.00	PASS
	710MHz to 900MHz	718.53000	<b>-55.447613</b>	-55.00	PASS
	900MHz to 915MHz	914.45000	-64.462357	-55.00	PASS
	915MHz to CF-300kHz	923.10000	-40.58437	-36.00	PASS
	CF+300kHz to 930MHz	923.74000	<b>-36.080407</b>	-36.00	PASS
	930MHz to 1000MHz	942.37000	<b>-56.757118</b>	-55.00	PASS
	1000MHz to 1215MHz	1056.71000	-56.083782	-45.00	PASS
	1215MHz to 5000MHz	1845.83000	<b>-46.882877</b>	-30.00	PASS
Vmax.	30MHz to 710MHz	165.01000	-57.366165	-36.00	PASS
	710MHz to 900MHz	825.37000	-55.825195	-55.00	PASS
	900MHz to 915MHz	912.47000	<b>-64.353424</b>	-55.00	PASS
	915MHz to CF-300kHz	923.10000	-40.026848	-36.00	PASS
	CF+300kHz to 930MHz	923.70000	-36.0812	-36.00	PASS
	930MHz to 1000MHz	942.37000	-57.847927	-55.00	PASS
	1000MHz to 1215MHz	1113.42000	<b>-55.952591</b>	-45.00	PASS
	1215MHz to 5000MHz	1845.83000	-47.047436	-30.00	PASS
Vmin.	30MHz to 710MHz	330.57000	<b>-57.202419</b>	-36.00	PASS
	710MHz to 900MHz	898.07000	-56.271133	-55.00	PASS
	900MHz to 915MHz	914.39000	-64.355446	-55.00	PASS
	915MHz to CF-300kHz	923.07000	<b>-39.604263</b>	-36.00	PASS
	CF+300kHz to 930MHz	923.70000	-39.667606	-36.00	PASS
	930MHz to 1000MHz	942.37000	-56.989662	-55.00	PASS
	1000MHz to 1215MHz	1133.36000	-56.270111	-45.00	PASS
	1215MHz to 5000MHz	1845.83000	-47.177628	-30.00	PASS

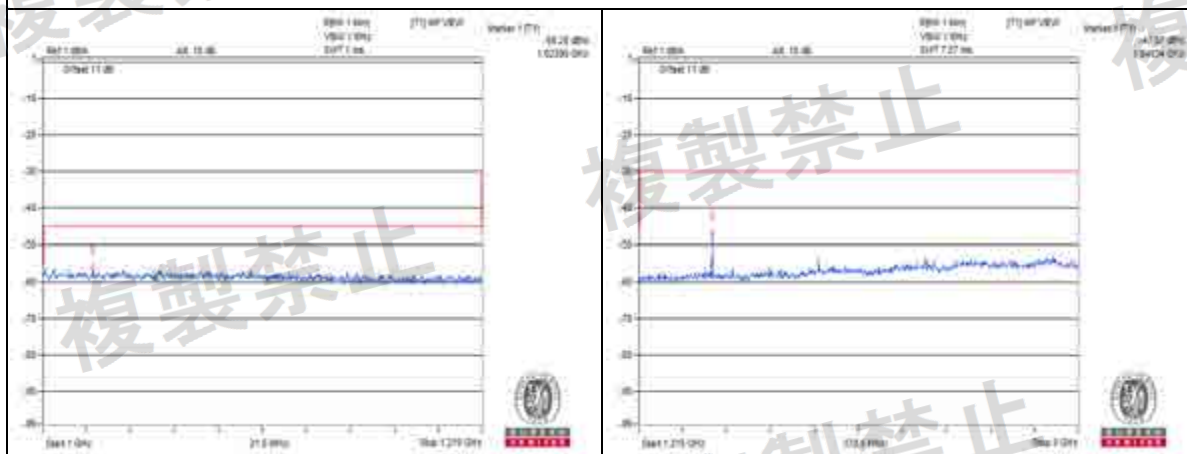
Note: 1. The worst value in each frequency range v.s. each channel has been marked by boldface.

2. The spectrum plots are attached on the following pages.

Vnormal

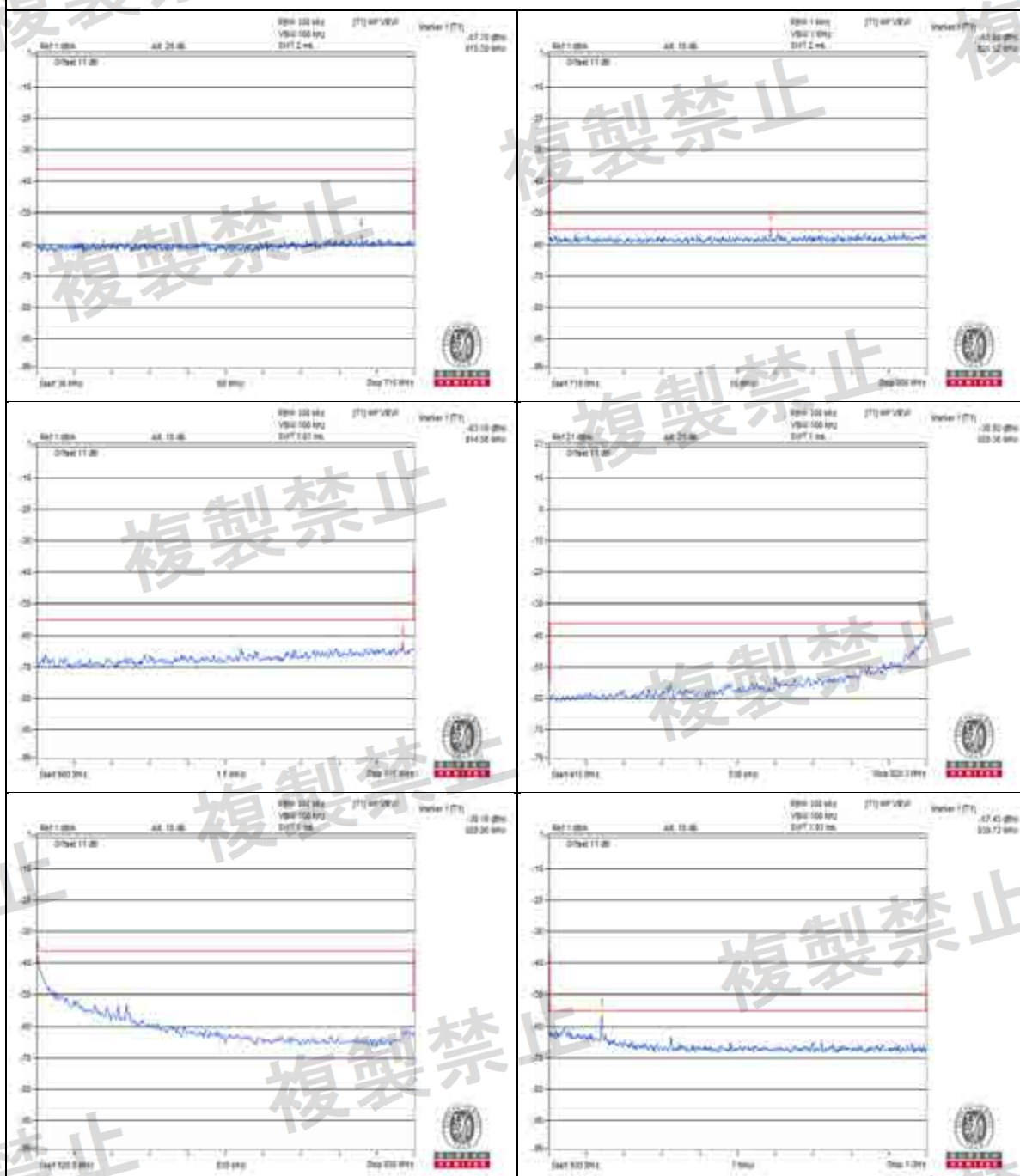


V<sub>normal</sub>

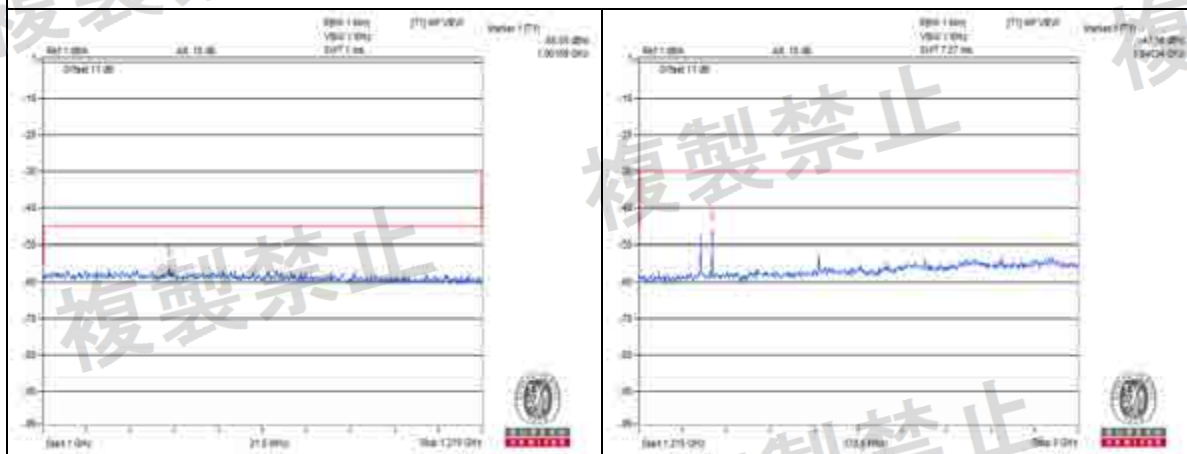


CH 1 (920.6MHz)

V<sub>max</sub>.



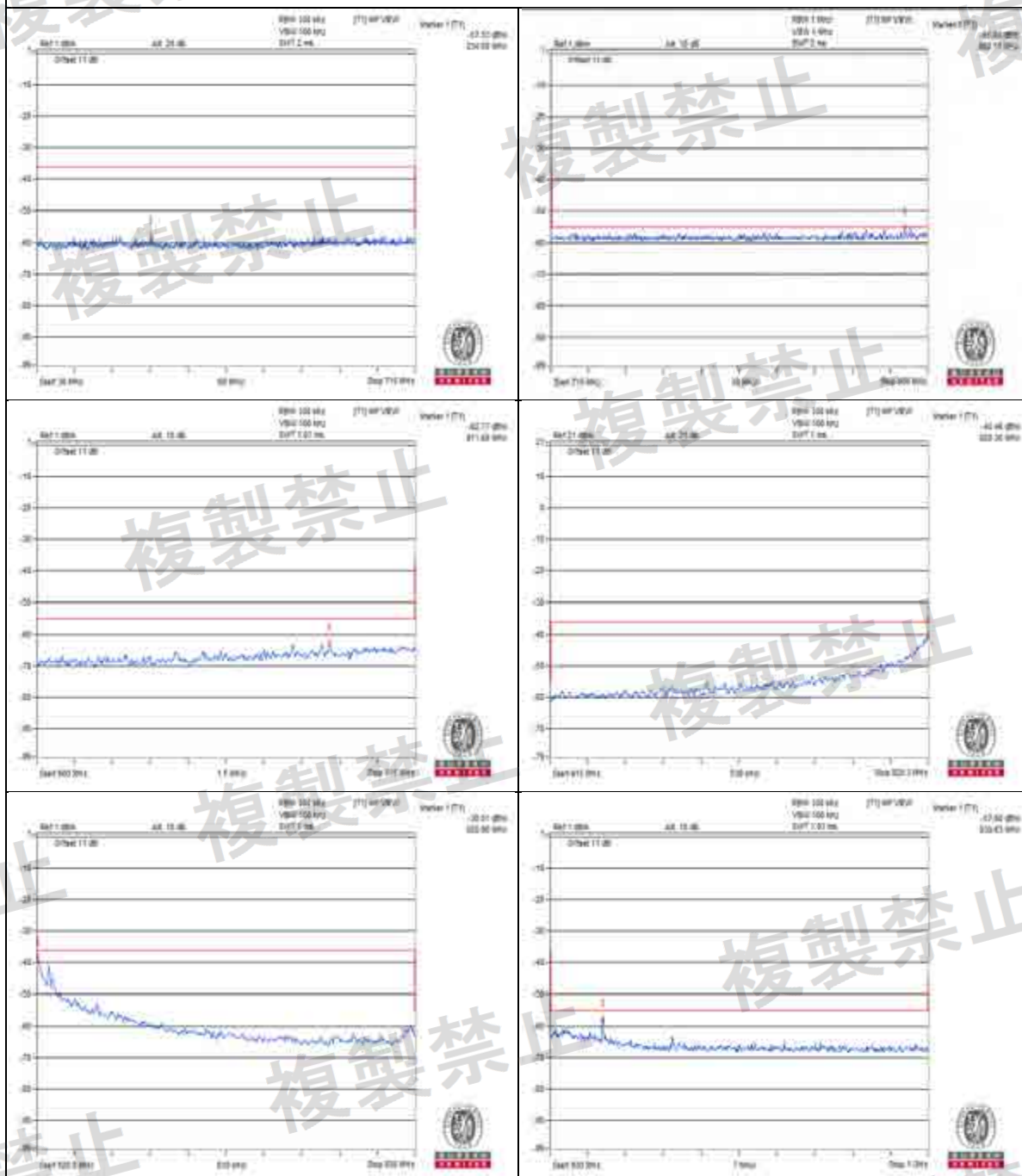
V<sub>max</sub>.



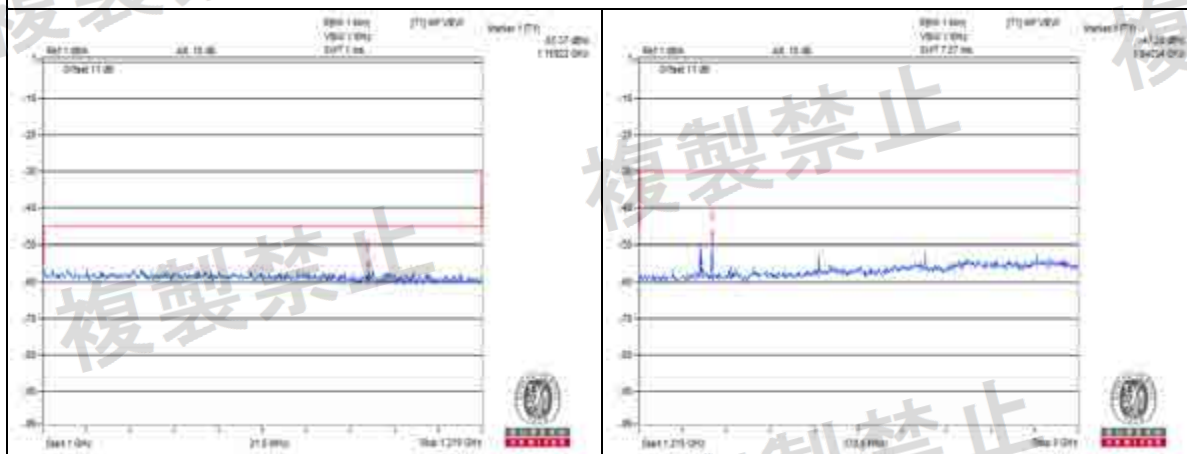
CH 1 (920.6MHz)



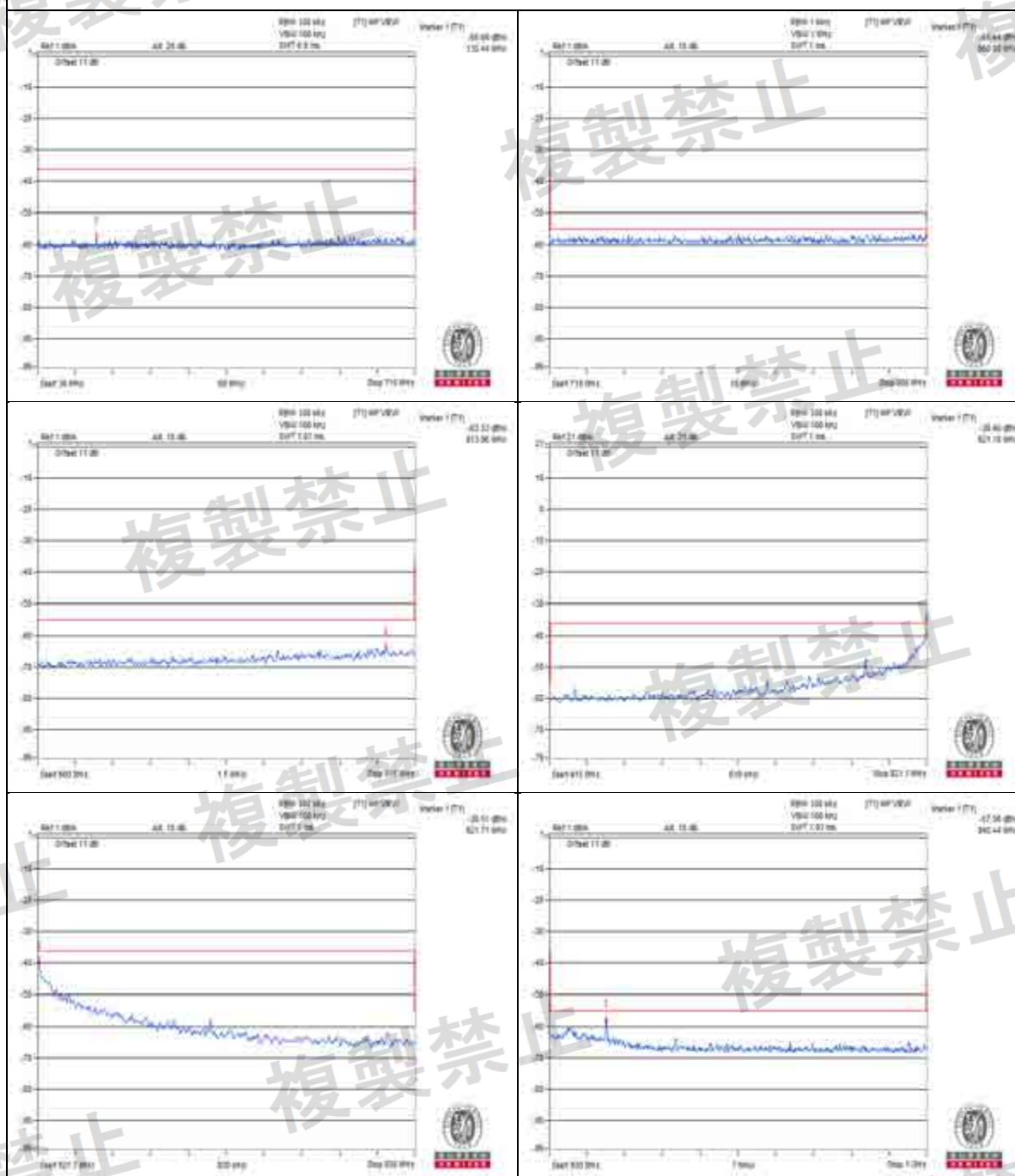
V<sub>min</sub>.



V<sub>min</sub>.

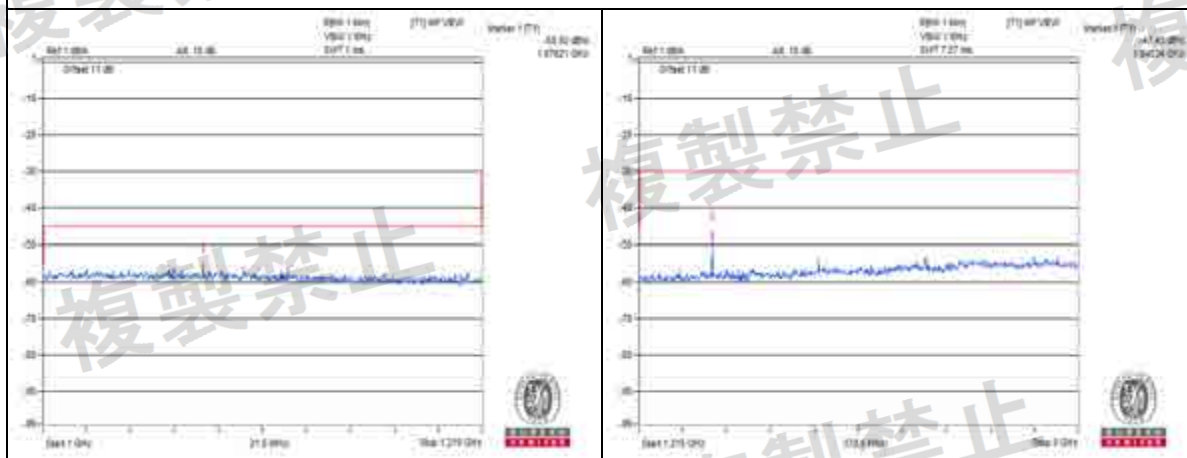


CH 1 (920.6MHz)



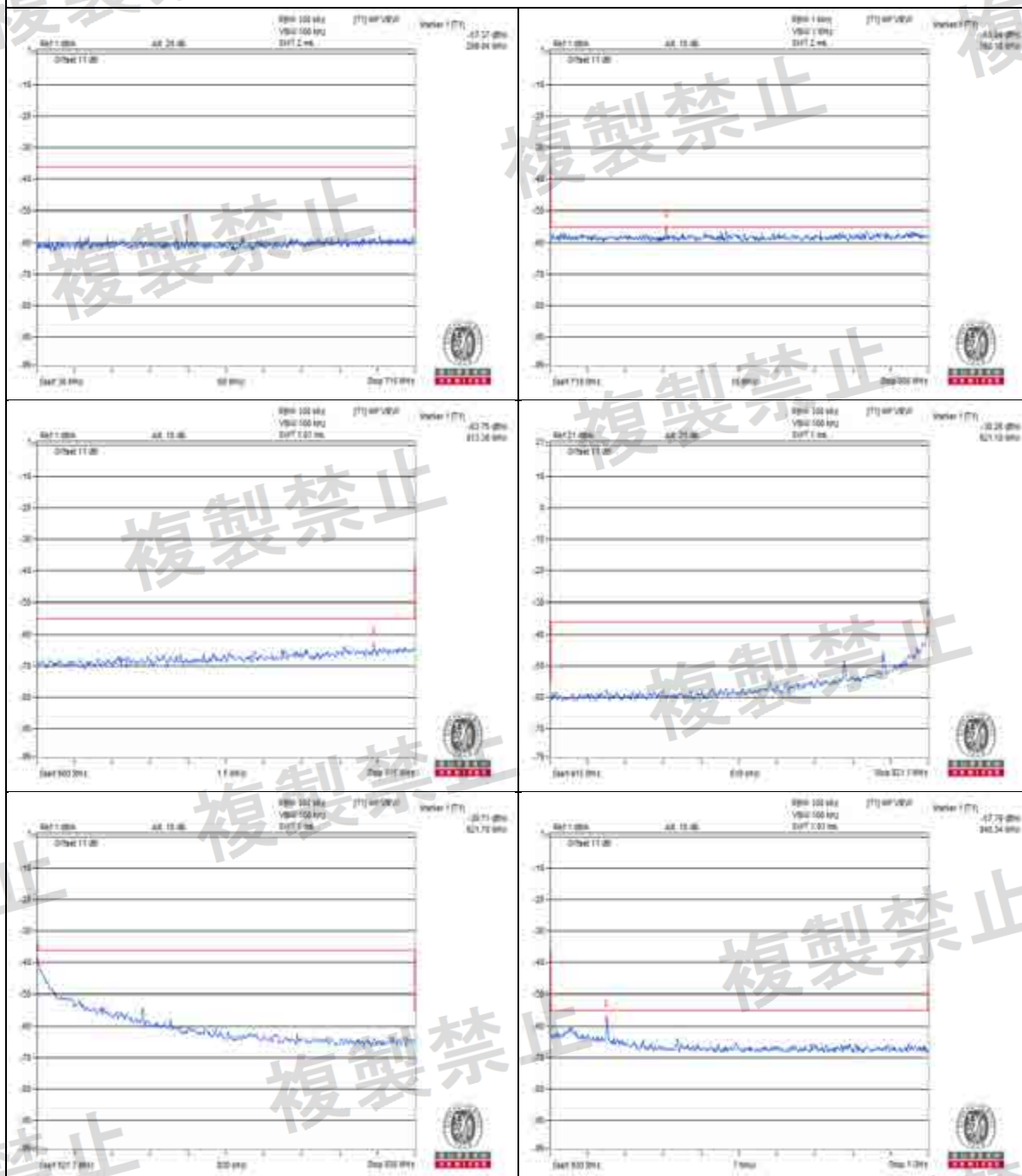
CH 5 (921.4MHz)

V<sub>normal</sub>



CH 5 (921.4MHz)

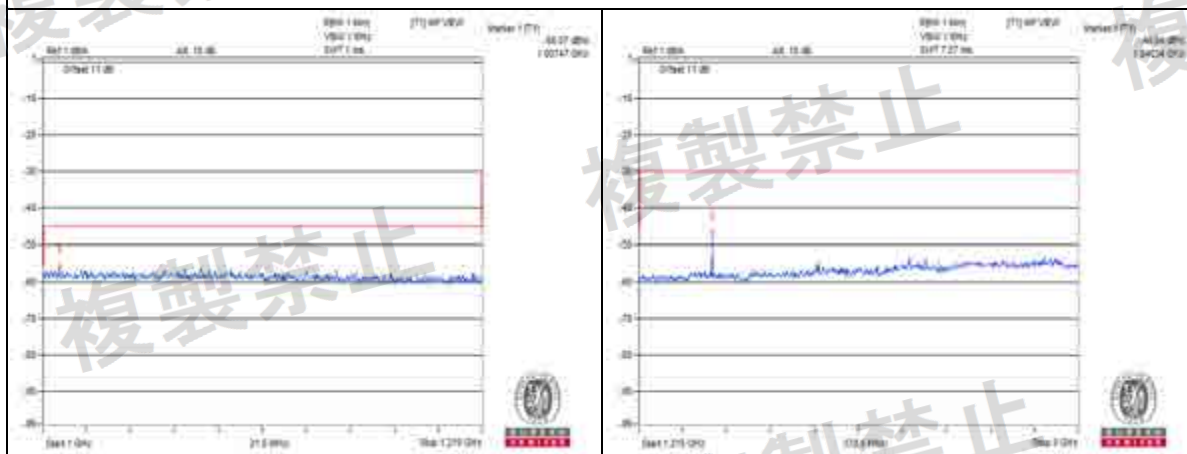
V<sub>max</sub>.



CH 5 (921.4MHz)



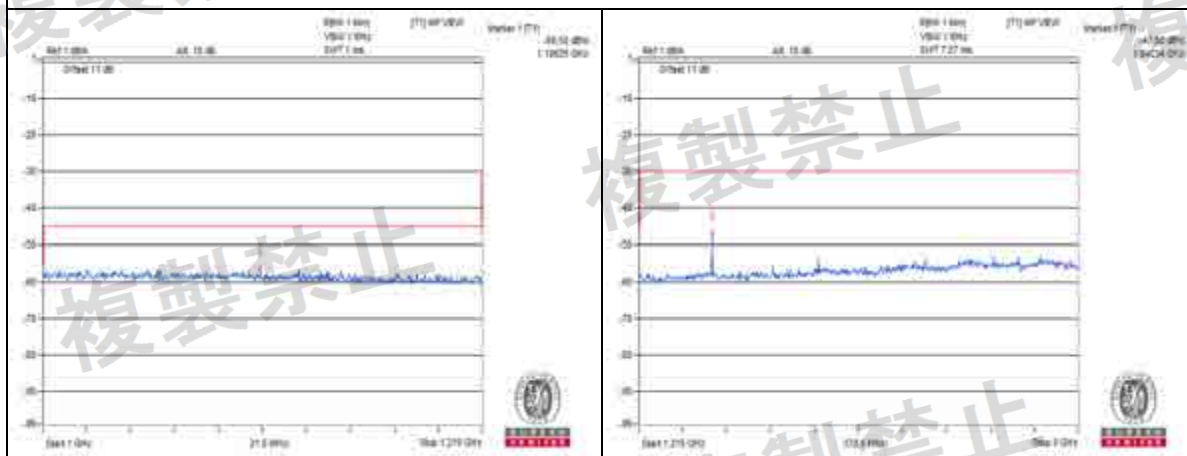
V<sub>max</sub>.



CH 5 (921.4MHz)

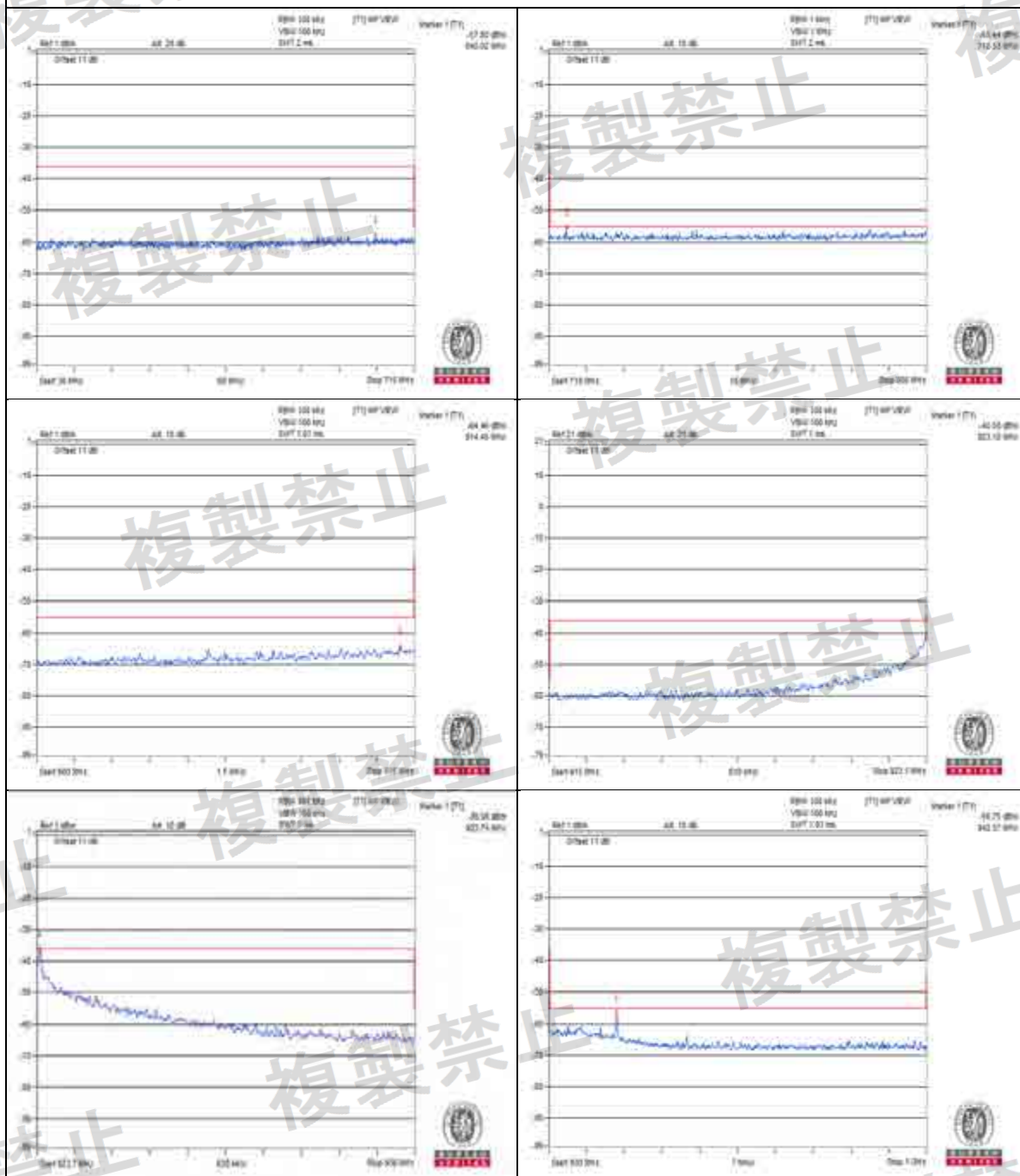


V<sub>min</sub>.



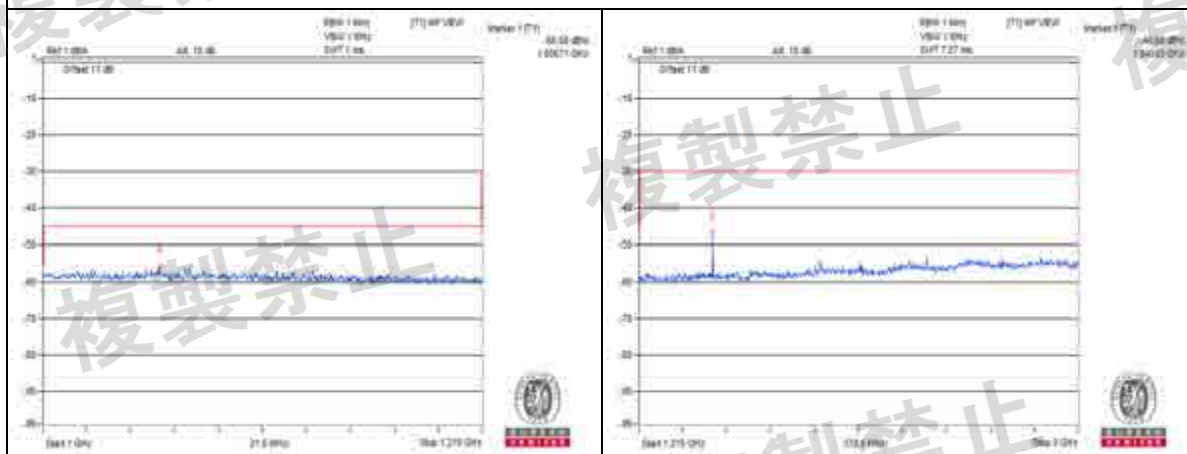
CH 5 (921.4MHz)

V<sub>normal</sub>



CH 11 (923.4MHz)

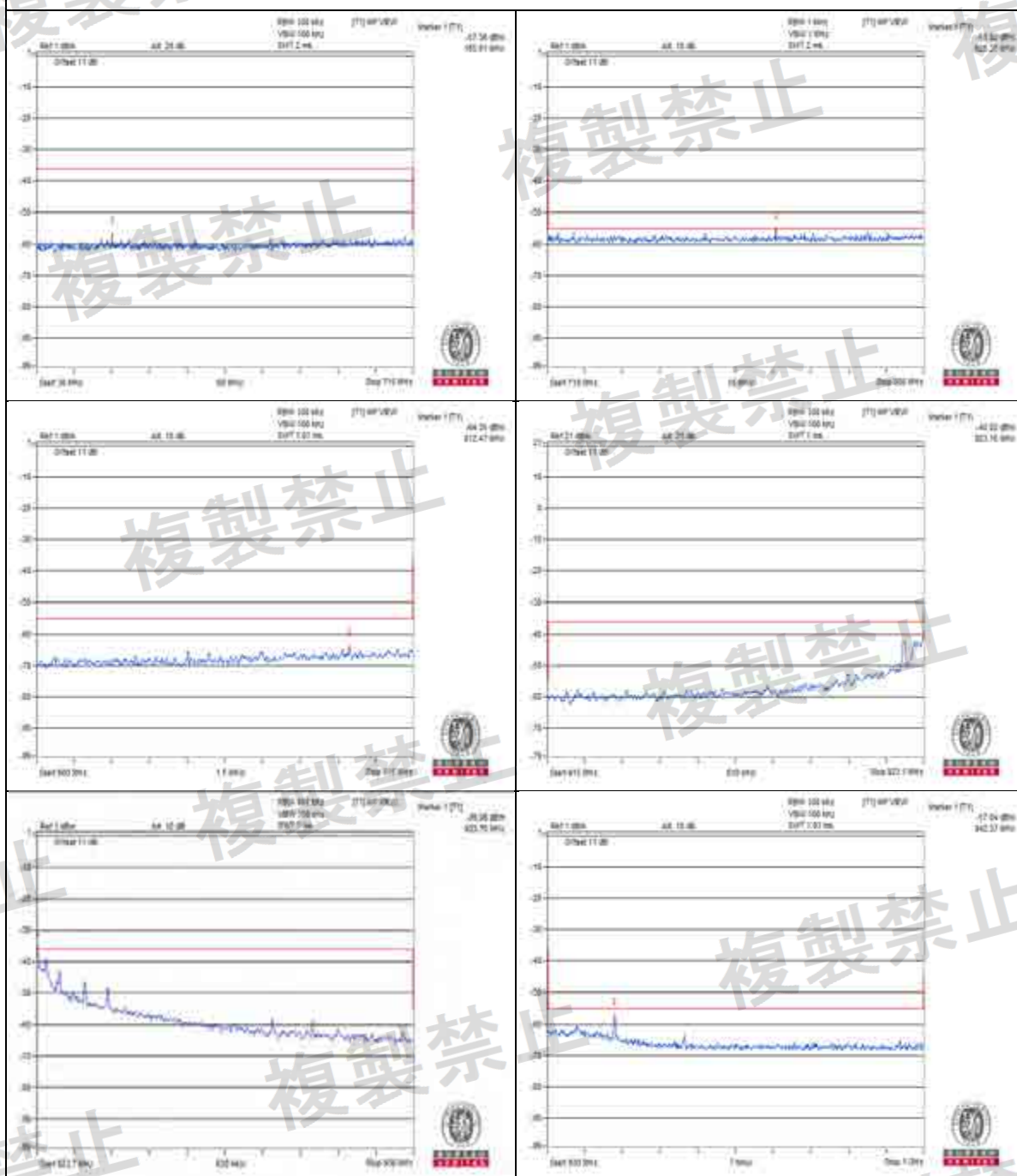
V<sub>normal</sub>



CH 11 (923.4MHz)

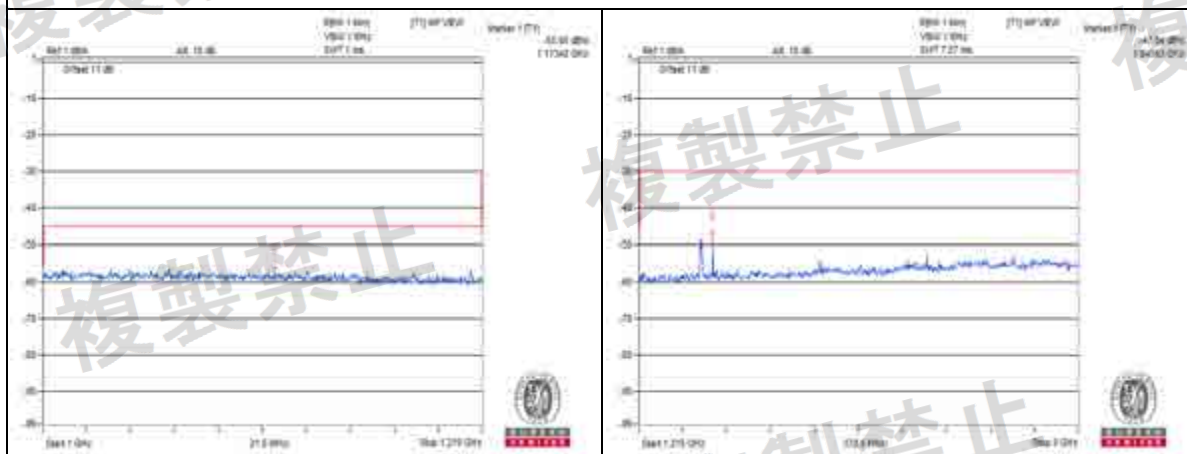


V<sub>max</sub>.



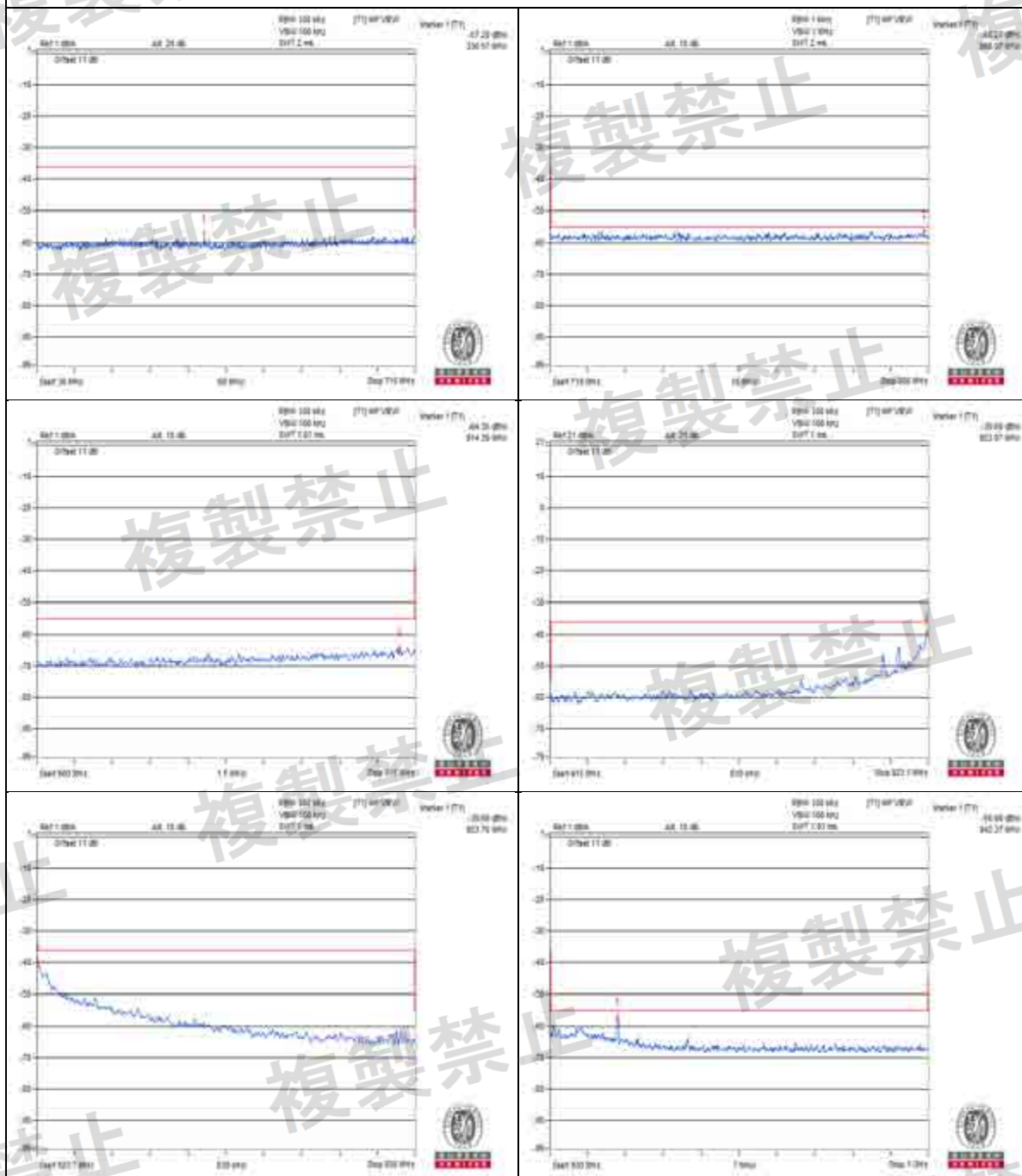
CH 11 (923.4MHz)

V<sub>max</sub>.



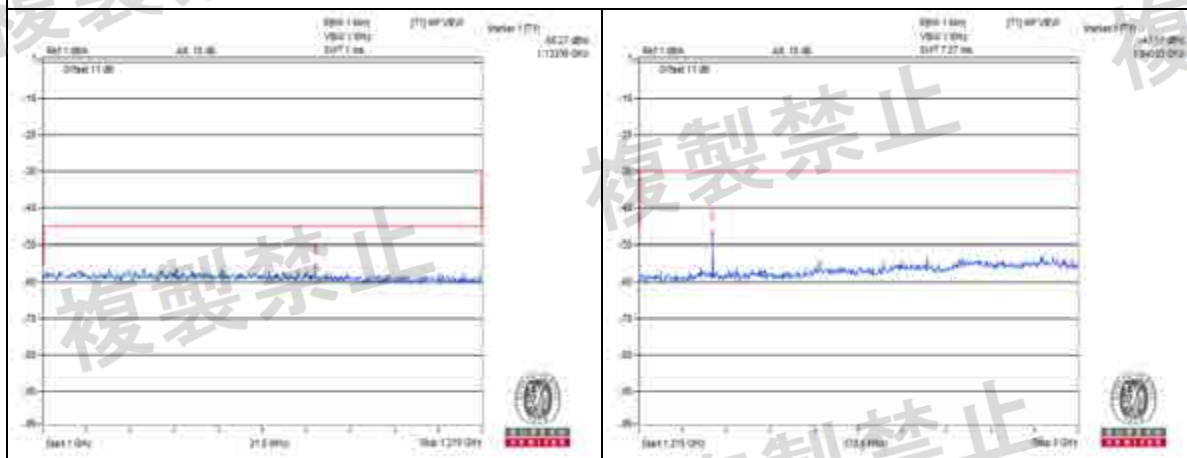
CH 11 (923.4MHz)

V<sub>min</sub>.



CH 11 (923.4MHz)

V<sub>min</sub>.



#### 4.4 Adjacent Channel Leakage Power

##### 4.4.1 Limits of Adjacent Channel Leakage Power

Frequency Band (MHz) 915.9MHz TO 916.9MHz	Limit
At the edge of a Radio channel	-20dBm
In unit radio channel Adjacent to a radio channel	-26dBm

Frequency Band (MHz) 920.5MHz TO 922.3MHz	Limit
At the edge of a Radio channel	-7dBm
In unit radio channel Adjacent to a radio channel	-15dBm or less (*)

\* If antenna power is reduced by 1mW or less, each adjacent channel leakage power is 26dBm or less.

Frequency Band (MHz) 922.3MHz TO 928.1MHz (Antenna power is 1mW or less)	Limit
In unit radio channel Adjacent to a radio channel	-26dBm or less

Frequency Band (MHz) 922.3MHz TO 928.1MHz (Antenna power is more than 1mW and 20mW or less.)	Limit
In unit radio channel Adjacent to a radio channel	-15dBm or less

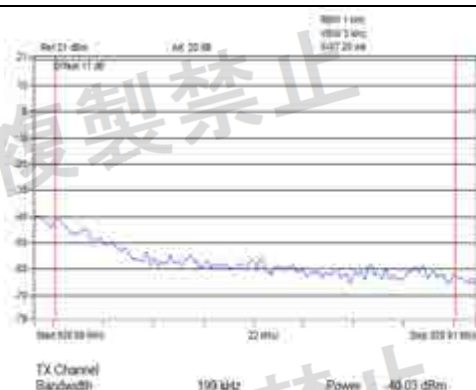
Frequency Band (MHz) 928.1MHz TO 929.7MHz	Limit
In unit radio channel Adjacent to a radio channel	-26dBm or less



#### 4.4.2 Test Results

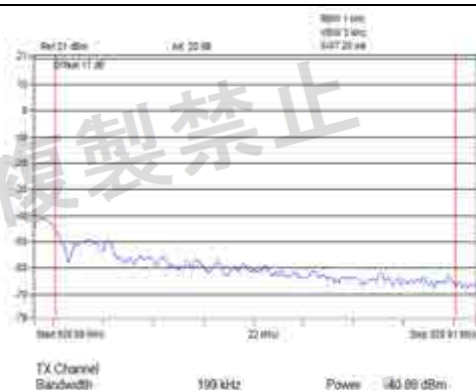
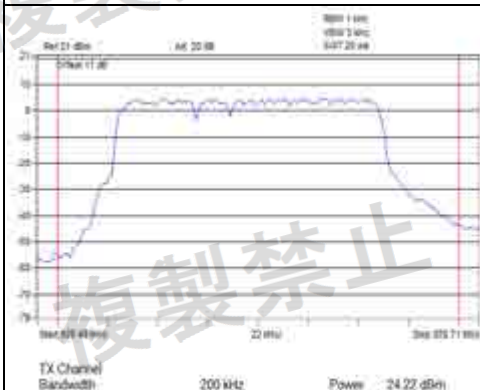
ENVIRONMENTAL CONDITIONS		24 deg.C, 70% RH			
VOLTAGE	FREQUENCY (MHz)	920.6MHz	921.4MHz	923.4MHz	MAX. LIMIT (dBm)
V <sub>nom</sub>	Mean Power of carrier (dBm)	27.33	27.57	23.59	-
	Mean Power +0.2 MHz distance of carrier (dBm)	-40.03	-29.31	-38.69	-15
	Mean Power -0.2 MHz distance of carrier (dBm)	-36.89	-39.34	-37.30	-15
V <sub>max.</sub>	Mean Power of carrier (dBm)	24.22	23.78	23.25	-
	Mean Power +0.2 MHz distance of carrier (dBm)	-40.89	-41.80	-35.21	-15
	Mean Power -0.2 MHz distance of carrier (dBm)	-37.05	-36.38	-41.15	-15
V <sub>min.</sub>	Mean Power of carrier (dBm)	27.71	26.51	26.17	-
	Mean Power +0.2 MHz distance of carrier (dBm)	-39.18	-39.70	-35.43	-15
	Mean Power -0.2 MHz distance of carrier (dBm)	-38.49	-39.66	-41.50	-15

V<sub>normal</sub>



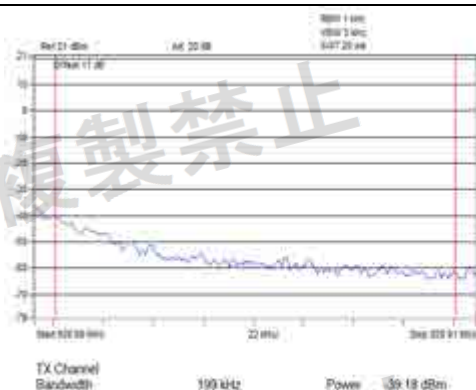
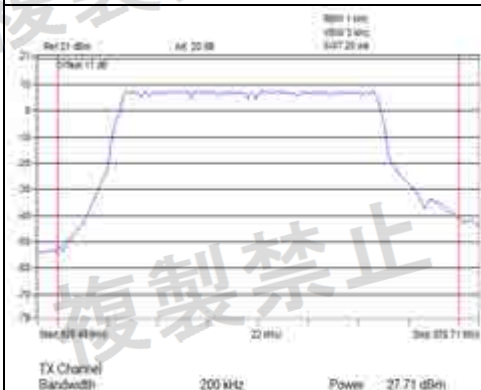
CH 1 (920.6MHz)

V<sub>max</sub>.



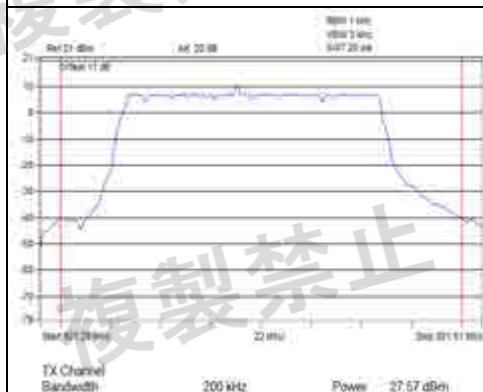
CH 1 (920.6MHz)

V<sub>min</sub>.



CH 1 (920.6MHz)

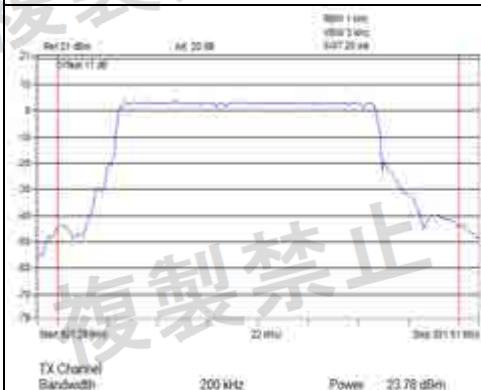
V<sub>normal</sub>



CH 5 (921.4MHz)

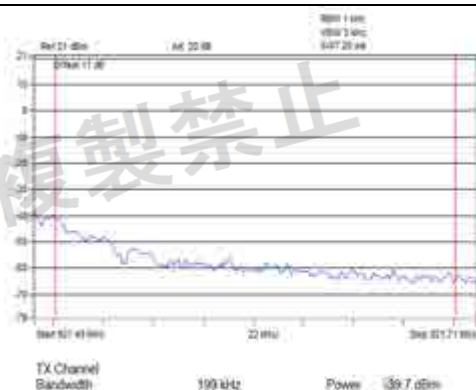
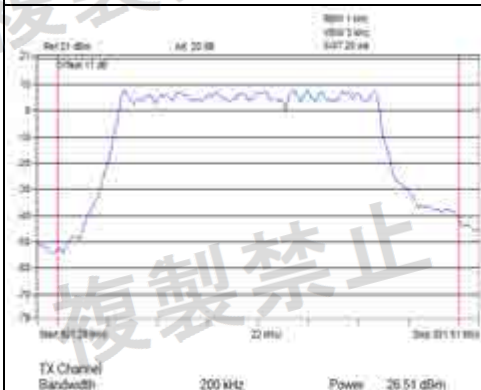


V<sub>max</sub>.



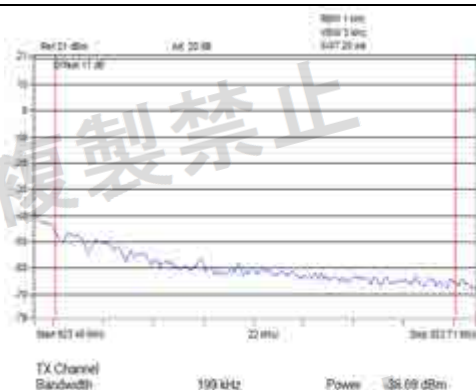
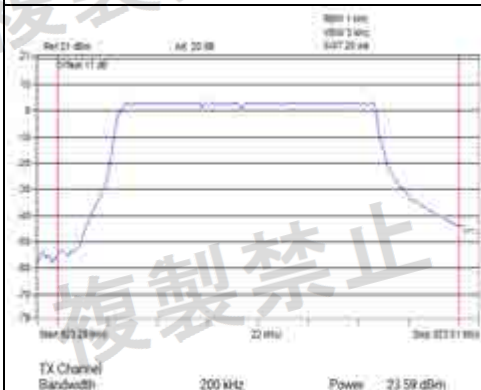
CH 5 (921.4MHz)

V<sub>min</sub>.



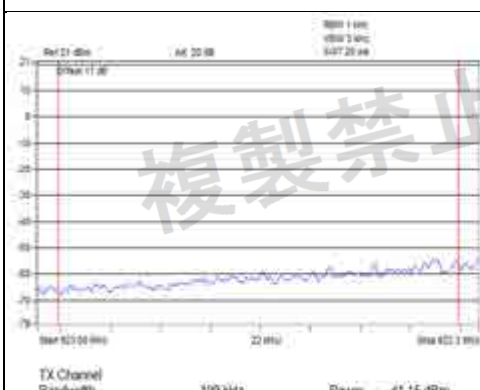
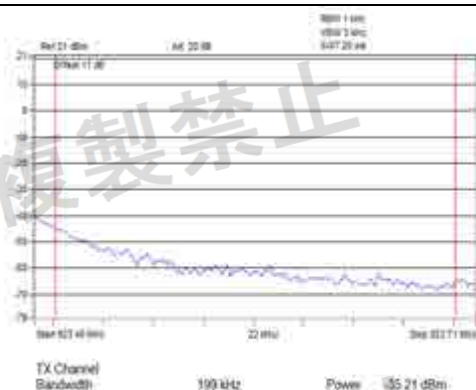
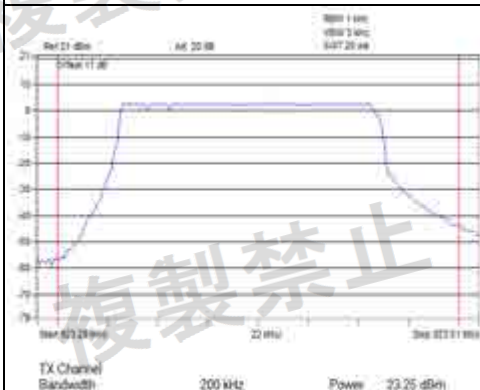
CH 5 (921.4MHz)

V<sub>normal</sub>



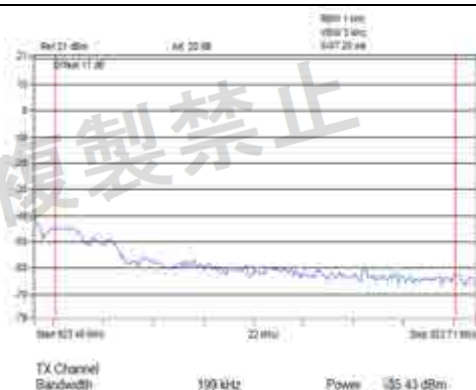
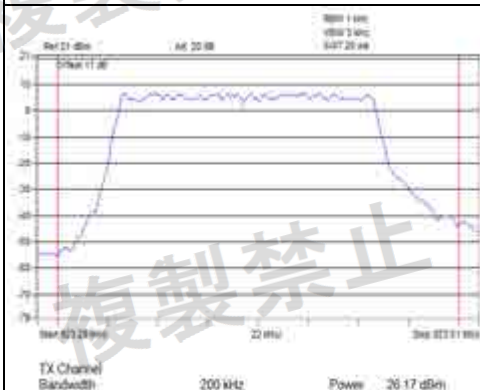
CH 11 (923.4MHz)

V<sub>max</sub>.



CH 11 (923.4MHz)

V<sub>min</sub>.



CH 11 (923.4MHz)



## 4.5 Antenna Power Measurement

### 4.5.1 Limits of Antenna Power

Application	Antenna Power	Applied CH number	Unit CH bandwidth	CH used in a bundle
	1mW or less	1-5	200kHz	1~5 ch
		62-77	100kHz	1~5 ch
V	20mW or less	1-38	200kHz	1~5 ch
V		33-11	200kHz	1ch
				2ch
				3~5ch

Tolerance of antenna power shall be +20% (upper value) and -80% (lower value).

### 4.5.2 Test Setup



#### 4.5.3 Test Results

ENVIRONMENTAL CONDITIONS	24 deg.C, 70% RH			
TEST CONDITION	Conducted RF output power (mW)			
	CHANNEL 1 920.6MHz	CHANNEL 5 921.4Hz	CHANNEL 11 923.4MHz	Max. Limit (mW)
V <sub>normal</sub>	12.240	12.370	12.530	20
V <sub>max.</sub>	12.250	12.370	<b>12.540</b>	20
V <sub>min.</sub>	12.230	12.360	12.530	20
RATED POWER	15.02			
TOLERANCE OF ANTENNA POWER	3.00 ~ 18.02			

#### Dipole antenna with 1.71dBi gain

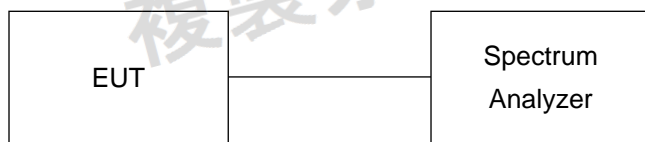
ENVIRONMENTAL CONDITIONS	26 DEG.C, 64% RH			
TEST CONDITION	Radiated RF Output Power Density (dBm)			
	CHANNEL 1 920.6MHz	CHANNEL 5 921.4Hz	CHANNEL 11 923.4MHz	Max. Limit (dBm)
V <sub>normal</sub>	13.950	14.080	14.240	16
V <sub>max.</sub>	13.960	14.080	<b>14.250</b>	16
V <sub>min.</sub>	13.940	14.070	14.240	16

#### 4.6 Spurious Emissions for Receiver

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

FREQUENCY BAND	LIMIT (dBm)	RBW
$f \leq 710 \text{ MHz}$	-54	100kHz
$710 \text{ MHz} < f \leq 900 \text{ MHz}$	-55	1MHz
$900 \text{ MHz} < f \leq 915 \text{ MHz}$	-55	100kHz
$915 \text{ MHz} < f \leq 930 \text{ MHz}$	-54	100kHz
$930 \text{ MHz} < f \leq 1000 \text{ MHz}$	-55	100kHz
$1000 \text{ MHz} < f$	-47	1MHz

##### 4.6.2 Test Setup



#### 4.6.3 Test Result

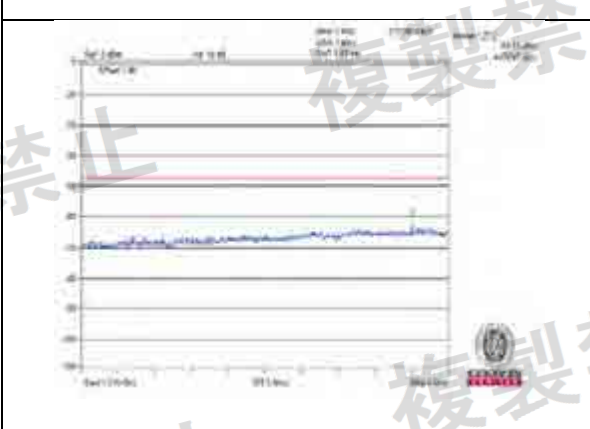
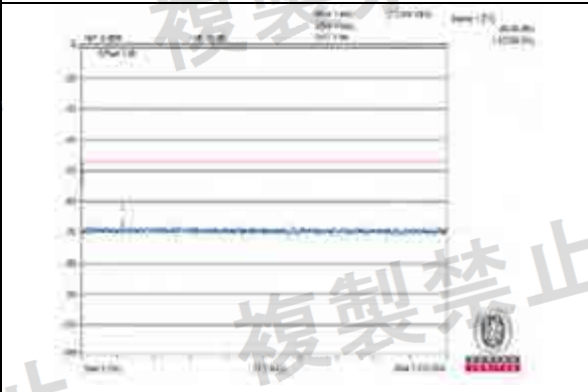
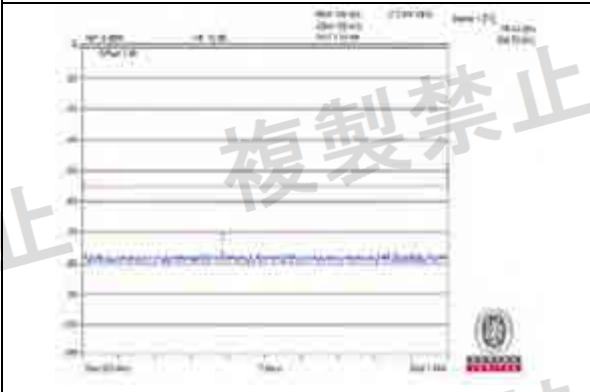
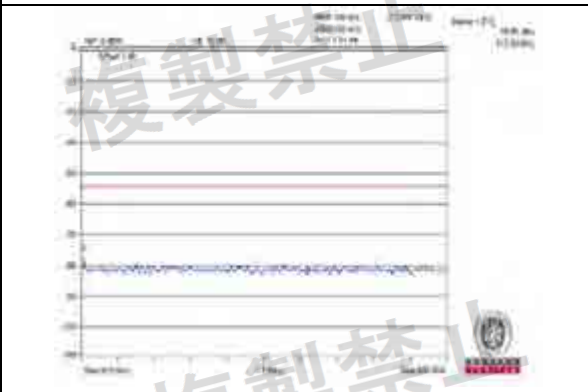
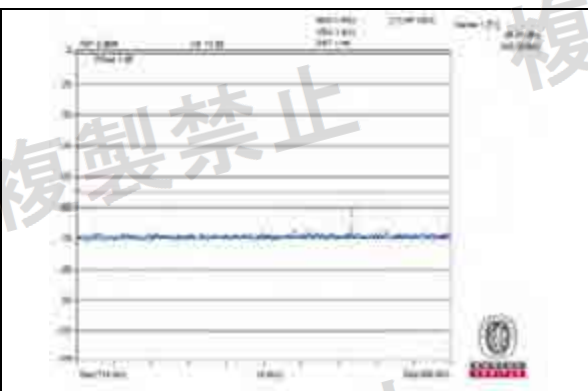
TEST CHANNEL		920.6MHz		921.4MHz		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQ. (MHz)	MEASURE. VALUE (dBm)	FREQ. (MHz)	MEASURE. VALUE (dBm)		
Vnormal	30MHz to 710MHz	652.840	-77.00	672.550	-76.93	-54/100kHz	PASS
	710MHz to 900MHz	849.880	<b>-66.62</b>	871.630	<b>-66.67</b>	-55/MHz	PASS
	900MHz to 915MHz	914.230	-78.00	909.910	-78.15	-55/100kHz	PASS
	915MHz to 930MHz	915.080	-78.80	923.860	<b>-77.79</b>	-54/100kHz	PASS
	930MHz to 1000MHz	956.780	-76.44	991.680	-75.68	-55/100kHz	PASS
	1000MHz to 1215MHz	1023.990	<b>-66.86</b>	1077.270	<b>-66.58</b>	-47/MHz	PASS
	1215MHz to 5000MHz	4632.470	-63.55	3974.210	<b>-62.10</b>	-47/MHz	PASS
Vmax.	30MHz to 710MHz	582.860	-77.48	683.390	<b>-76.87</b>	-54/100kHz	PASS
	710MHz to 900MHz	881.000	-67.09	826.200	-67.14	-55/MHz	PASS
	900MHz to 915MHz	912.040	-78.77	900.150	<b>-78.00</b>	-55/100kHz	PASS
	915MHz to 930MHz	925.280	-78.34	922.470	-79.02	-54/100kHz	PASS
	930MHz to 1000MHz	938.110	-76.12	944.200	-76.29	-55/100kHz	PASS
	1000MHz to 1215MHz	1000.620	-67.25	1081.010	-67.20	-47/MHz	PASS
	1215MHz to 5000MHz	4906.740	<b>-62.97</b>	4040.030	-62.86	-47/MHz	PASS
Vmin.	30MHz to 710MHz	670.570	<b>-76.99</b>	571.040	-77.28	-54/100kHz	PASS
	710MHz to 900MHz	846.300	-67.11	890.080	-66.85	-55/MHz	PASS
	900MHz to 915MHz	902.950	<b>-77.88</b>	905.860	-78.28	-55/100kHz	PASS
	915MHz to 930MHz	921.860	<b>-77.22</b>	925.760	-78.04	-54/100kHz	PASS
	930MHz to 1000MHz	953.730	<b>-75.73</b>	961.750	<b>-75.67</b>	-55/100kHz	PASS
	1000MHz to 1215MHz	1012.770	-67.14	1081.630	-66.87	-47/MHz	PASS
	1215MHz to 5000MHz	3990.660	-63.64	1752.570	-62.60	-47/MHz	PASS

TEST CHANNEL		923.4MHz		LIMIT	RESULT
TEST CONDITION	FREQUENCY RANGE	FREQUENCY (MHz)	MEASURE. VALUE		
Vnormal	30MHz to 710MHz	553.300	<b>-76.09</b>	-54/100kHz	PASS
	710MHz to 900MHz	810.230	-67.33	-55/MHz	PASS
	900MHz to 915MHz	900.650	<b>-78.12</b>	-55/100kHz	PASS
	915MHz to 930MHz	923.840	-78.55	-54/100kHz	PASS
	930MHz to 1000MHz	951.910	-76.31	-55/100kHz	PASS
	1000MHz to 1215MHz	1032.090	<b>-67.02</b>	-47/MHz	PASS
	1215MHz to 5000MHz	1752.570	<b>-58.43</b>	-47/MHz	PASS
Vmax.	30MHz to 710MHz	679.440	-77.24	-54/100kHz	PASS
	710MHz to 900MHz	891.460	<b>-66.74</b>	-55/MHz	PASS
	900MHz to 915MHz	900.860	-78.70	-55/100kHz	PASS
	915MHz to 930MHz	916.820	<b>-77.50</b>	-54/100kHz	PASS
	930MHz to 1000MHz	979.810	-76.34	-55/100kHz	PASS
	1000MHz to 1215MHz	1184.150	-67.02	-47/MHz	PASS
	1215MHz to 5000MHz	1752.570	-58.95	-47/MHz	PASS
Vmin.	30MHz to 710MHz	704.080	-77.41	-54/100kHz	PASS
	710MHz to 900MHz	749.370	-66.84	-55/MHz	PASS
	900MHz to 915MHz	906.390	-79.02	-55/100kHz	PASS
	915MHz to 930MHz	929.230	-78.39	-54/100kHz	PASS
	930MHz to 1000MHz	967.530	<b>-76.28</b>	-55/100kHz	PASS
	1000MHz to 1215MHz	1126.190	-67.11	-47/MHz	PASS
	1215MHz to 5000MHz	1747.090	-61.32	-47/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.

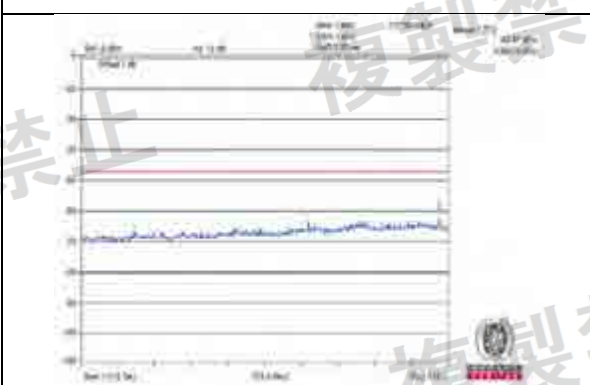
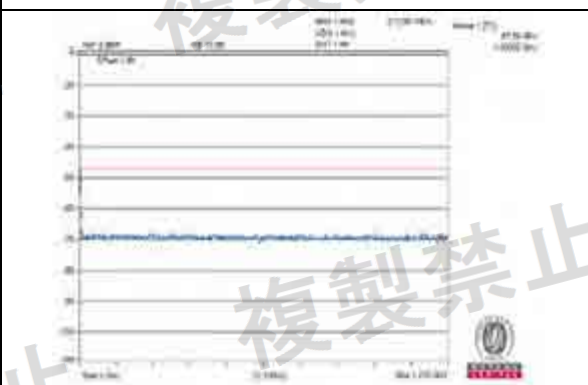
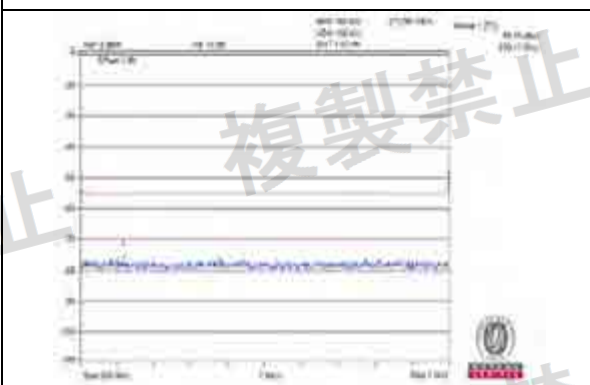
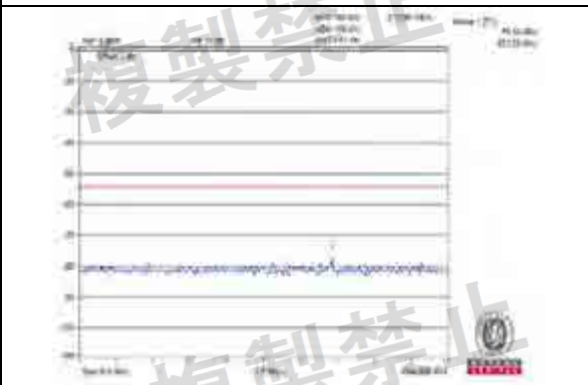
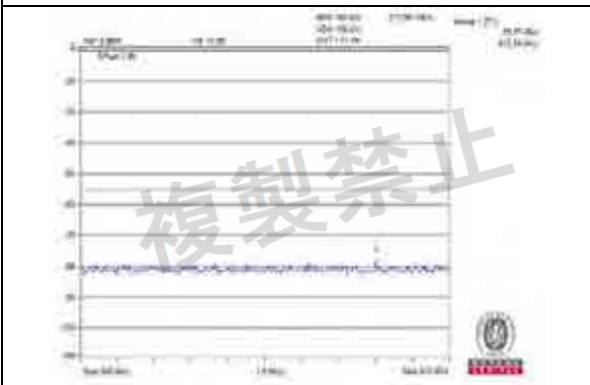
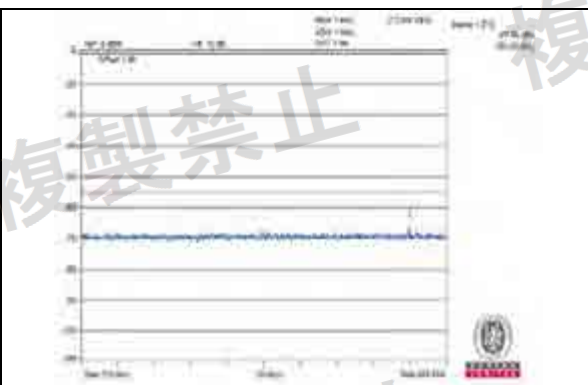
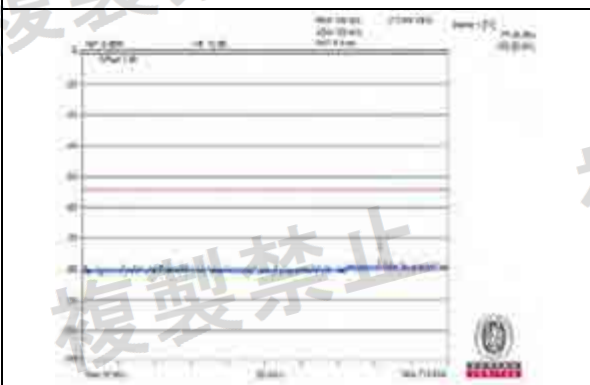


Vnormal



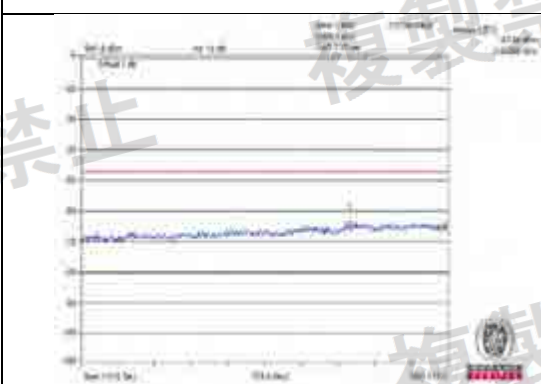
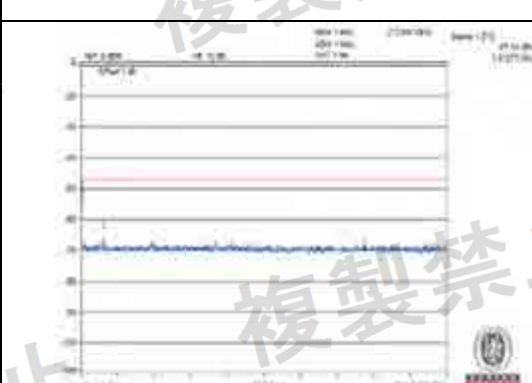
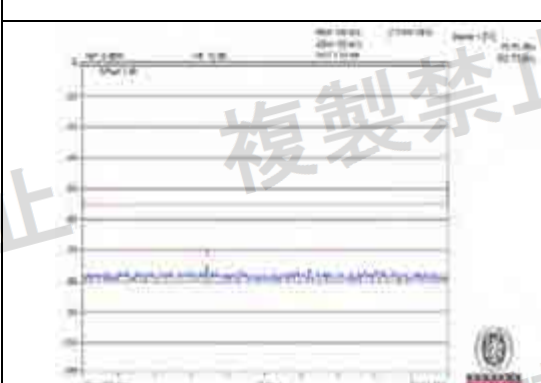
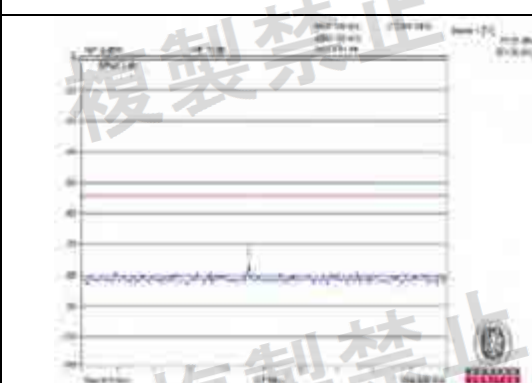
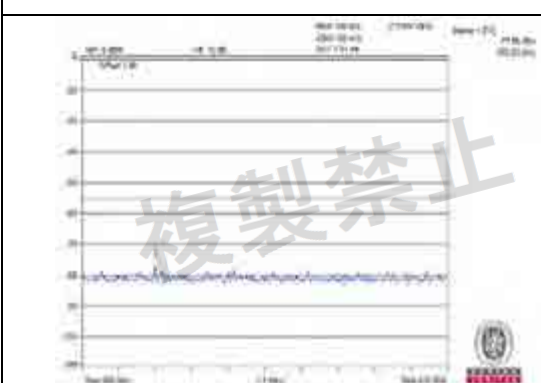
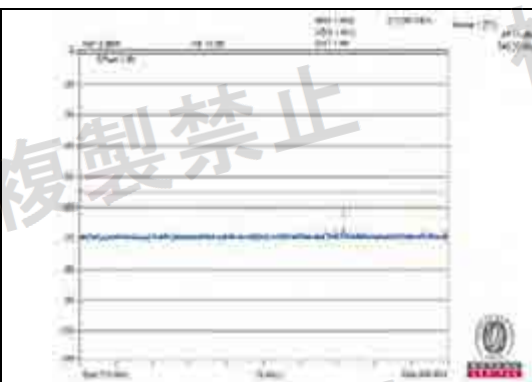
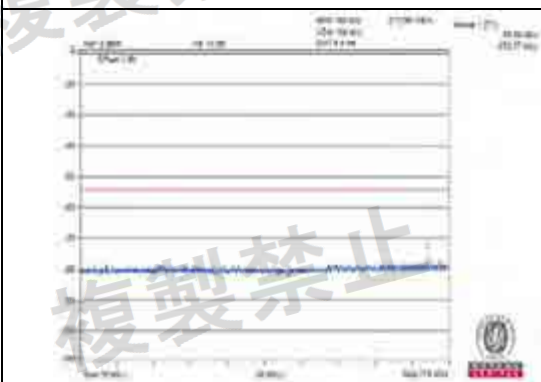
920.6MHz

Vmax.



920.6MHz

V<sub>min</sub>.



920.6MHz

V<sub>normal</sub>



Vmax.



921.4MHz



Vmin.



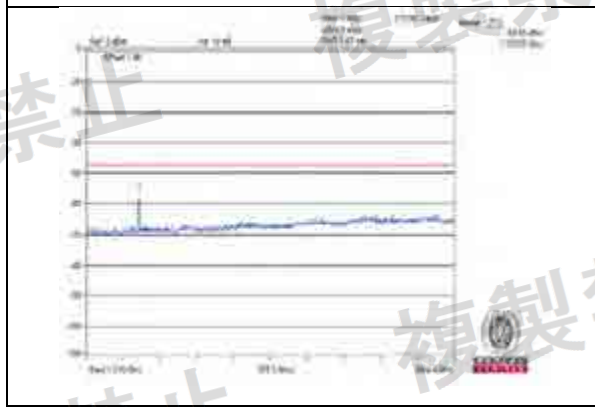
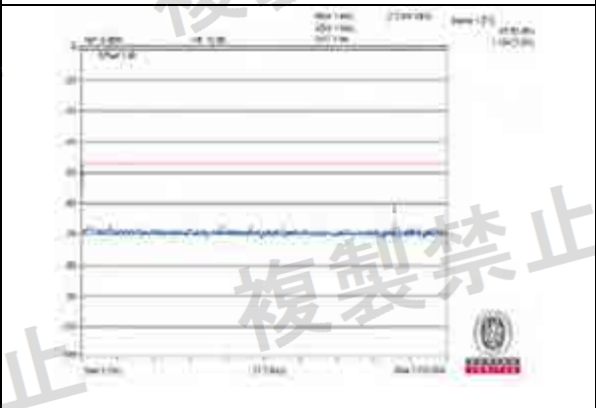
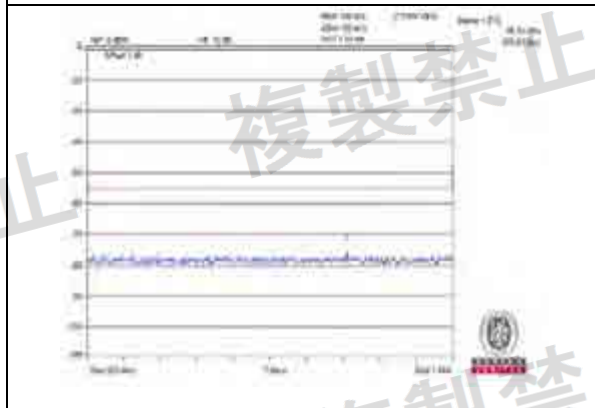
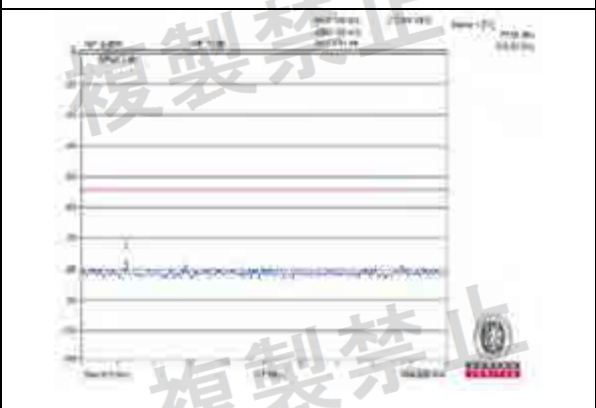
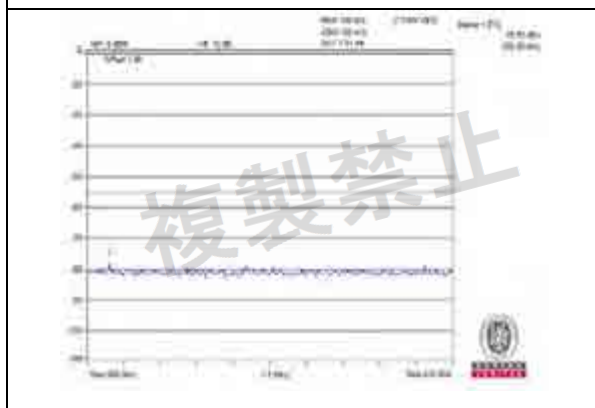
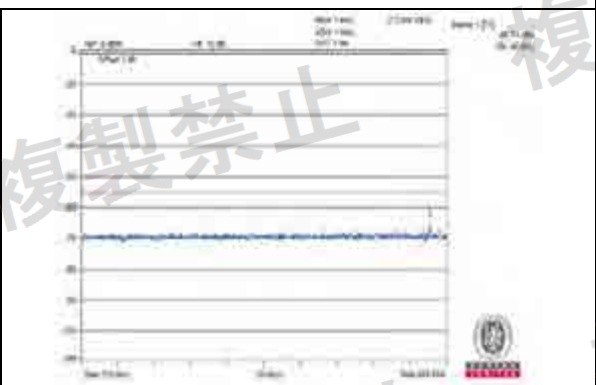
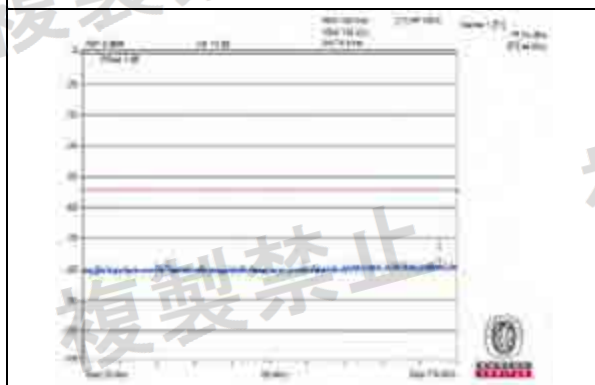
921.4MHz

V<sub>normal</sub>



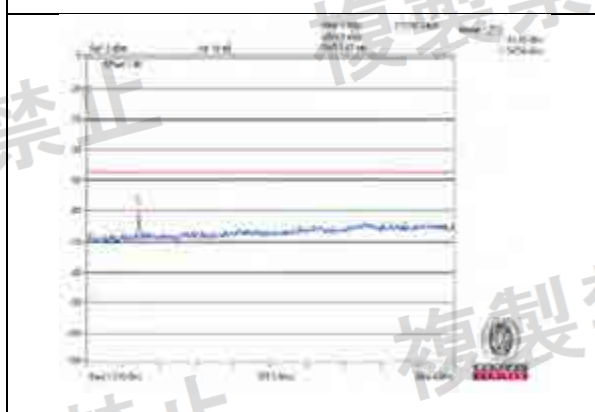
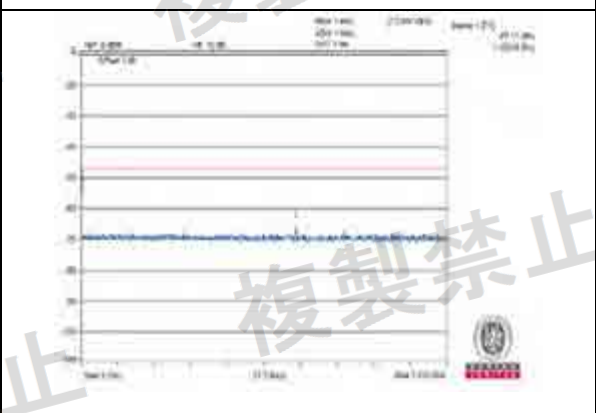
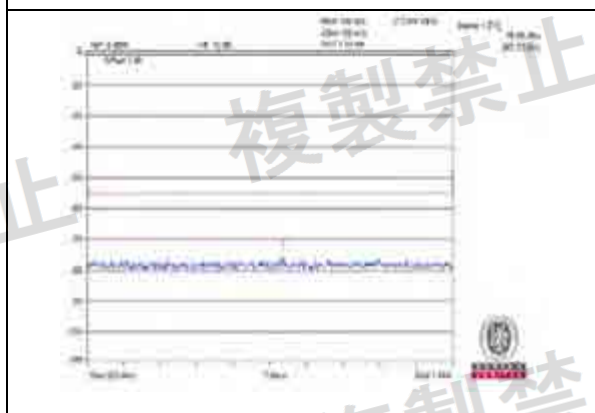
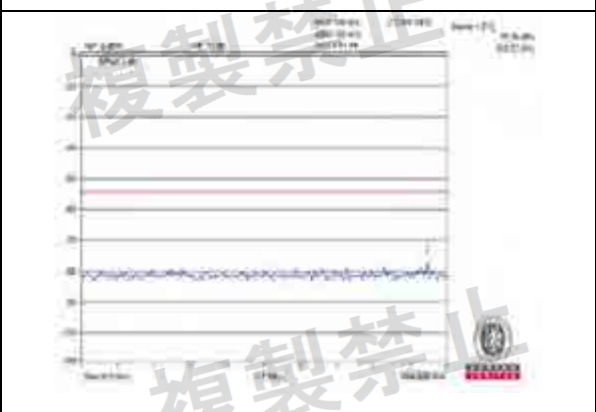
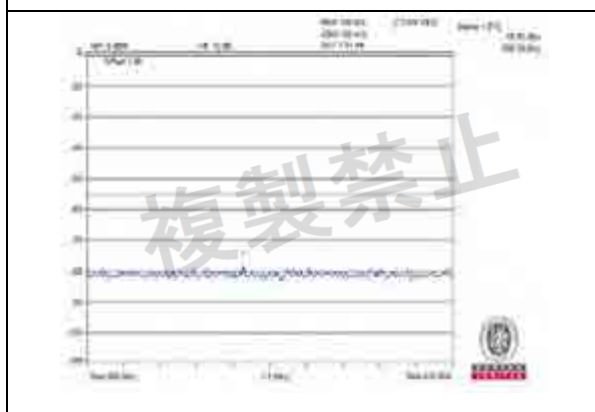
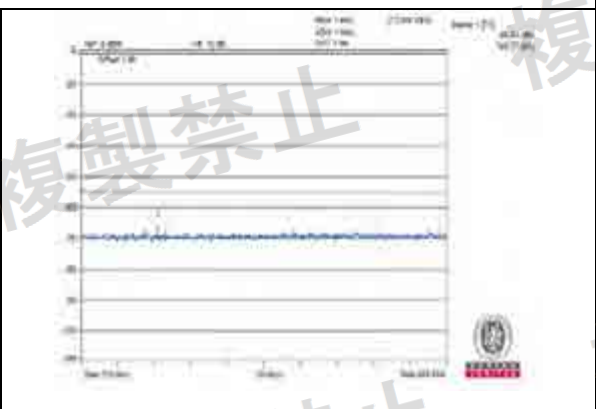
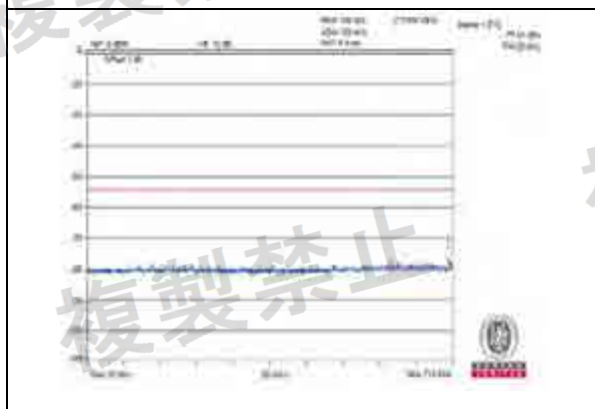
923.4MHz

V<sub>max</sub>.



923.4MHz

V min.



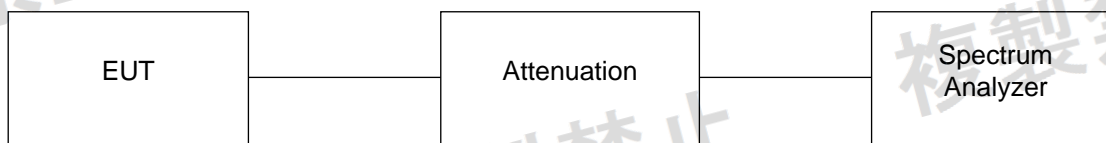
923.4MHz

## 4.7 Transmission Time Control

### 4.7.1 Limits of Transmission Time Control

Application	Antenna Power	Applied CH number	Unit CH bandwidth	CH used in a bundle	Sending duration	Pause duration	The sum of emission time per arbitrary one hour
	1mW or less	1-5	200kHz	1~5 ch	100ms or less	100ms	3.6sec or less
		62-77	100kHz	1~5 ch	50ms or less	50ms	None
V	20mW or less	1-38	200kHz	1~5 ch	4s	50ms	None
V		33-11	200kHz	1ch	More than 200ms, and 400ms or less	Ten times or more of the former sending time	360sec or less
					More than 6ms, and 200ms or less	2ms	
					6ms or less	None	
				2ch	More than 3ms, and 200ms or less	2ms	
					3ms or less	None	
				3~5ch	More than 2ms, and 100ms or less	2ms	
					2ms or less	None	

### 4.7.2 Test Setup



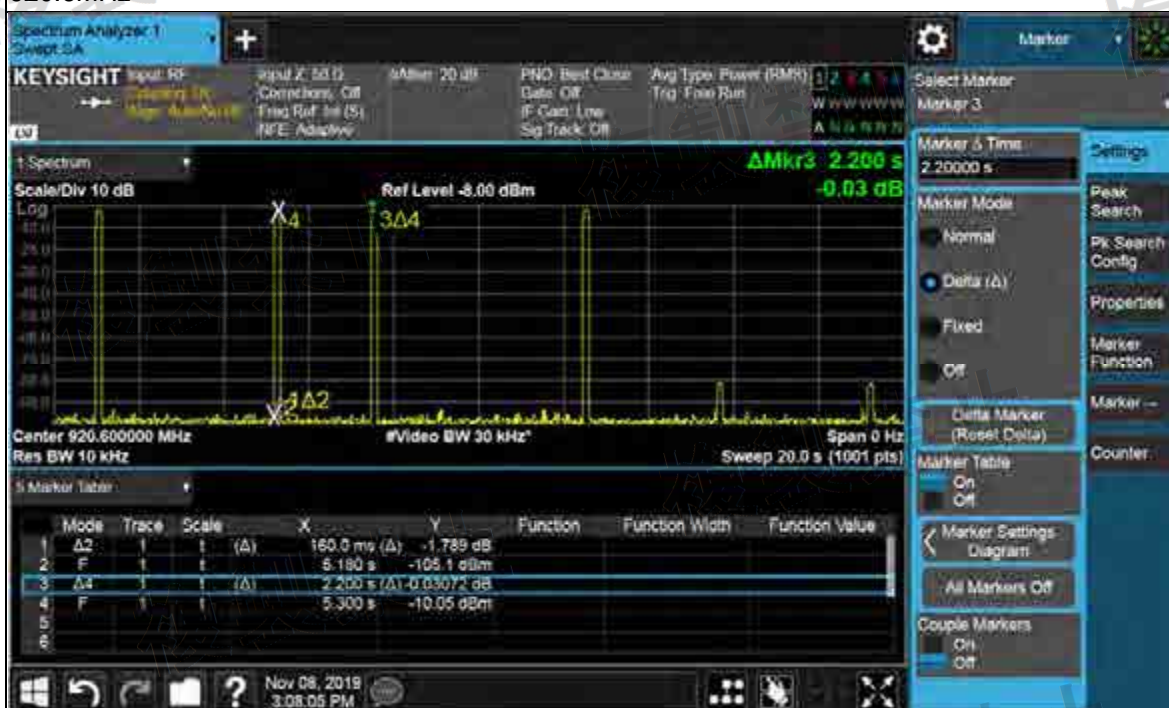


#### 4.7.3 Test Results

Transmission Time Control				
Frequency (MHz)	Sending Duration		Pause Duration	
	Test Result (ms)	Limit	Test Result (s)	Limit
920.6	160	More than 200ms, and 400ms or less	2.200	Ten times or more of the former sending time
921.4	160		3.180	
923.4	160		3.400	

Frequency (MHz)	The sum of emission time per arbitrary one hour	
	Test Result (s)	Limit
920.6	115.2	360sec or less
921.4	144.0	360sec or less
923.4	172.8	360sec or less

920.6MHz



Emission time in 20 sec :160 ms\*4=640 ms

1 hour (3600 sec) = 640 ms\*(3600/20)= 115200ms =115.2 sec

921.4MHz



Emission time in 20 sec : 160 ms\*5=800 ms

1 hour (3600 sec) = 800 ms\*(3600/20)= 144000ms= 144.0 sec

923.4MHz



Emission time in 20 sec:  $160 \text{ ms} \times 6 = 960 \text{ ms}$

1 hour (3600 sec) =  $960 \text{ ms} \times (3600/20) = 1728000 \text{ ms} = 172.8 \text{ sec}$

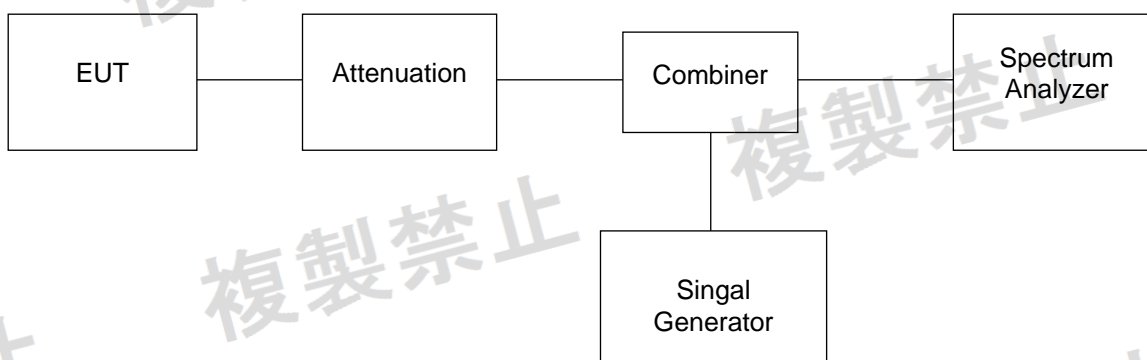


## 4.8 Carrier Sense

### 4.8.1 Limits of Carrier Sense

Application	Antenna Power	Applied CH number	Unit CH bandwidth	CH used in a bundle	Carrier sense time
	1mW or less	1-5	200kHz	1~5 ch	None
		62-77	100kHz	1~5 ch	
V	20mW or less	1-38	200kHz	1~5 ch	5ms or more
V		33-11	200kHz	1ch	128us or more
				2ch	
				3~5ch	

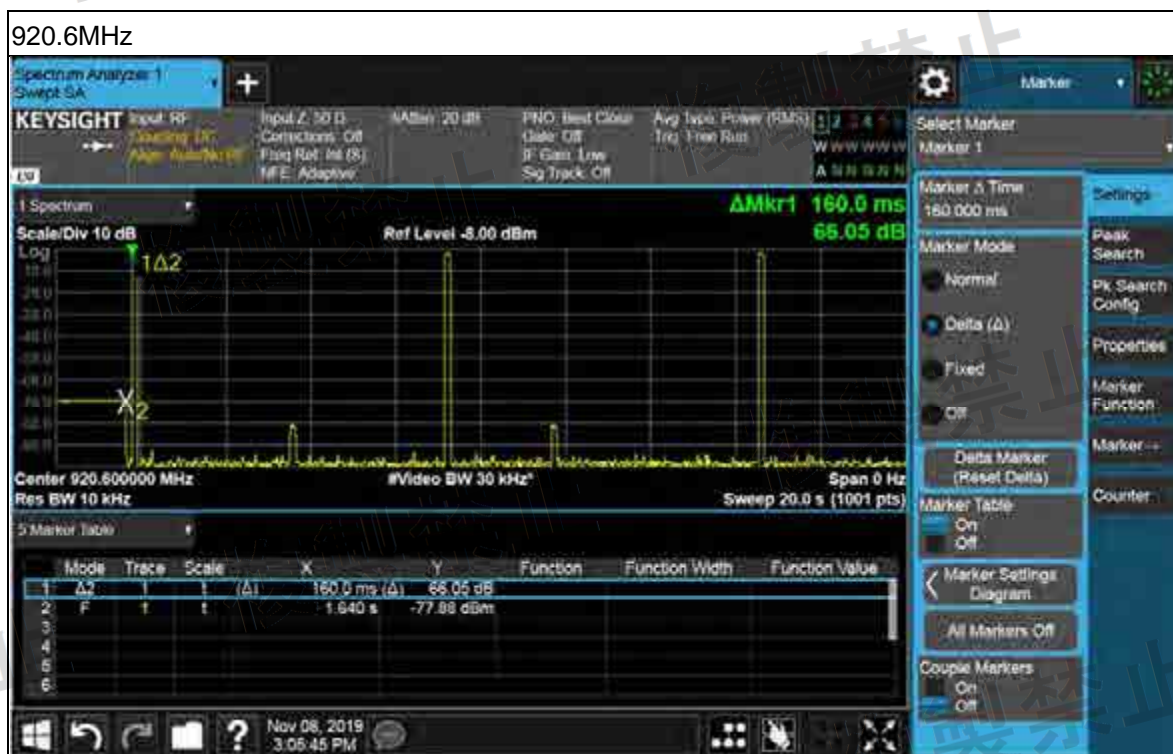
### 4.8.2 Test Setup





#### 4.8.3 Test Results

Frequency (MHz)	Carrier Sense	
	Carrier Sense Level (dBm)	Result
920.6	-80	Pass
921.4	-80	Pass
923.4	-80	Pass



921.4MHz



923.4MHz

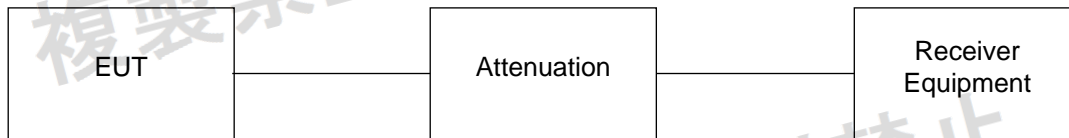


#### 4.9 Interference Prevention Function

##### 4.9.1 Limits of Interference Prevention Function

The radio equipment shall automatically transmit/receive identification codes.

##### 4.9.2 Test Setup



##### 4.9.3 Test Results

Environmental Conditions	24 deg.C, 70% RH
Link Mode	Test Result
Normal	Pass



## 5 Test Instruments

Description & Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated Until	Calibration Authority	Calibration Method
Spectrum Analyzer / Rohde & Schwarz	FSV40	100979	Mar. 18, 2019	Mar. 17, 2020	Electronics Testing Center, Taiwan	c)
Spectrum Analyzer / Rohde & Schwarz	FSV40	101516	Mar. 18, 2019	Mar. 17, 2020	Electronics Testing Center, Taiwan	c)
Signal Generator / Agilent	E4438C	MY49071692	Oct. 21, 2019	Oct. 20, 2020	Electronics Testing Center, Taiwan	c)
Power Meter / Anritsu	ML2495A	1145013	May 28, 2019	May 27, 2020	Electronics Testing Center, Taiwan	c)
Power Sensor / Anritsu	MA2411B	1207334	Dec. 25, 2108	Dec. 24, 2019	Electronics Testing Center, Taiwan	c)
Power Splitter/ Agilent	11667B	11628	NA	NA	BV CPS E&E	c)
Power Splitter/ Agilent	11667B	52805	NA	NA	BV CPS E&E	c)
Standard Temperature And Humidity Chamber/ Terchy	MHU-225AU	920842	May 31, 2019	May 30, 2020	Electronics Testing Center, Taiwan	c)
DC Block	MCL	15542	NA	NA	BV CPS E&E	c)
RF Cable	Junflon	MWX221	NA	NA	BV CPS E&E	c)

- 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. 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 System~
  - 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 FCC recognized accredited test firms and accredited and approved according to ISO/IEC 17025.

If you have any comments, please feel free to contact us at the following:

### Lin Kou EMC/RF Lab

Tel: 886-2-26052180

Fax: 886-2-2605191

### Hsin Chu EMC/RF/Telecom Lab

Tel: 886-3-6668565

Fax: 886-3-6668323

### Hwa Ya EMC/RF/Safety Lab

Tel: 886-3-3183232

Fax: 886-3-3270892

Email: [service.adt@tw.bureauveritas.com](mailto:service.adt@tw.bureauveritas.com)

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.

--- END ---