



Measurement and Test Report

According to

MIC Public Notice 88:2004

For

Shenzhen Aukey E-Business Co.,Ltd.

Room 102 Bld P09 ,Huanan International Printing Paper Packing Logistics

Zone, No.1 Huanan Rd, Pinghu Town, Longgang District ,Shenzhen City,

Guangdong Province 51800, China

Test Standards: Item 19 of Article 2 Paragraph 1

Product Description: Bluetooth Earbuds

Tested Model: EP-B80

Report No.: WTX19X02008272W

Tested Date: 2019-02-20 to 2019-02-26

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Tested By: Mike Shi / Engineer

Reviewed By: Silin Chen / EMC Manager

Approved & Authorized By: Jandy so / PSQ Manager

Prepared By:

Shenzhen SEM Test Technology Co., Ltd.

1/F, Building A, Hongwei Industrial Park, Liuxian 2nd Road,

Bao'an District, Shenzhen, P.R.C (518101)

Tel.: +86-755-33663308 Fax: +86-755-33663309 Website: www.semtest.com.cn

Note: This test report is limited to the above client company and the product model only. It may not be duplicated without prior permitted by Shenzhen SEM Test Technology Co., Ltd.

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Version:	Issue date	Revisions Content
initial	2019-02-26	initial Issue
Rev.1		
Rev.2		

1. GENERAL INFORMATION

1.1 Product Description for Equipment Under Test (EUT)

Client Information

Applicant: Shenzhen Aukey E-Business Co.,Ltd.
Address of applicant: Room 102 Bld P09 ,Huanan International Printing Paper Packing Logistics Zone, No.1 Huanan Rd, Pinghu Town, Longgang District ,Shenzhen City, Guangdong Province 51800, China

Manufacturer: Shenzhen Aukey E-Business Co.,Ltd.
Address of manufacturer: Room 102 Bld P09 ,Huanan International Printing Paper Packing Logistics Zone, No.1 Huanan Rd, Pinghu Town, Longgang District ,Shenzhen City, Guangdong Province 51800, China

General Description of EUT	
Product Name:	Bluetooth Earbuds
Brand Name:	Aukey
Model No.:	EP-B80
Adding Model(s):	EP-T16S, EP-T10, EP-B32S, EP-T18, EP-B33NC, EP-B33, EP-A60, EP-A33, EP-B90
Rated Voltage:	Battery:DC3.7V
Battery Capacity:	60mAh*2
Power Adapter:	/
<i>Note: The test data is gathered from a production sample, provided by the manufacturer. The appearance of others models listed in the report is different from main-test model EP-B80, but the circuit and the electronic construction do not change, declared by the manufacturer.</i>	

Technical Characteristics of EUT	
Bluetooth	
Bluetooth Version:	Bluetooth V5.0 (Only BR/EDR)
Frequency Range:	2402~2480MHz
Max.RF Rated Output	0.04mw/MHz
Type of Modulation:	GFSK, Pi/4 DQPSK, 8DPSK
Data Rate:	1Mbps, 2Mbps, 3Mbps
Quantity of Channels	79
Channel Separation:	1MHz
Type of Antenna:	PCB Antenna
Antenna Gain:	-0.3dBi

➤ Center Frequency of Each of Channel:

BDR/EDR	
Channel	Frequency (MHz)
00	2402
01	2403
⋮	⋮
39	2441
⋮	⋮
77	2479
78	2480

1.2 Test Standards

The tests were performed according to following standards:

Art. 49.20" and MIC public notice 88:2004 or relevant ARIB STD-T66 or relevant AIR STD and MIC Public Notice 127.

The objective is to determine compliance with Item 19 of Article 2 Paragraph 1 of the MIC rules for 2.4GHz band wide-band low-power data communication system. Item 2 of Article 6.

Maintenance of compliance is the responsibility of the manufacturer. Any modification of the product, which result in lowering the emission, should be checked to ensure compliance has been maintained.

1.3 Test Methodology

All measurements contained in this report were conducted with test method for radio equipment specified in MIC public notice 88:2004 for certification.

1.4 Test Facility

FCC – Registration No.: 125990

Shenzhen SEM Test Technology Co., Ltd. Laboratory has been recognized to perform compliance testing on equipment subject to the Commissions Declaration Of Conformity (DOC). The Designation Number is CN5010, and Test Firm Registration Number is 125990.

Industry Canada (IC) Registration No.: 11464A

The 3m Semi-anechoic chamber of Shenzhen SEM Test Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 11464A.

1.5 EUT Setup and Test Mode

The EUT was operated in the engineering mode to fix the Tx/Rx frequency that was for the purpose of the measurements. All testing shall be performed under maximum output power condition, and to measure its highest possible emissions level, more detailed description as follows:

Test Mode List		
Test Mode	Description	Remark
TM1	Low Channel	2402MHz
TM2	Middle Channel	2441MHz
TM3	High Channel	2480MHz
TM4	Hopping	2402-2480MHz

Modulation Configure			
Modulation	Packet	Packet Type	Packet Size
GFSK	DH1	4	27
	DH3	11	183
	DH5	15	339
Pi/4 DQPSK	2DH1	20	54
	2DH3	26	367
	2DH5	30	679
8DPSK	3DH1	24	83
	3DH3	27	552
	3DH5	31	1021
Note: The Bluetooth has been tested on the modulation of GFSK, (Pi/4)DQPSK and 8DPSK, all modulation modes complied with the requirements and record the worst case.			

Special Cable List and Details			
Cable Description	Length (m)	Shielded/Unshielded	With / Without Ferrite
/	/	/	/

Auxiliary Equipment List and Details			
Description	Manufacturer	Model	Serial Number
/	/	/	/

1.6 Test Conditions

Supply Voltage					
	EUT supply power V	module input power V	Rated module power V	Tolerance (%)	
Normal	3.7	3.3	3.3		
+10%	3.5	3.3	3.3		0
-10%	4.2	3.3	3.3		0
Others					
Temperature (°C)		23			
Relative humidity		56 %.			
ATM Pressure:		1019 mbar			
Note 1: When the input voltage is reduced or increased by 10%, the regulator voltage changes of less than 1%. So the following test items are conducted in the normal voltage.					

1.7 Measurement Uncertainty

Measurement uncertainty		
Parameter	Conditions	Uncertainty
RF Output Power	9kHz-6GHz	$\pm 0.42\text{dB}$
Frequency Tolerance	9kHz-6GHz	$\pm 1 \times 10^{-7}$
Occupied Bandwidth	9kHz-6GHz	$\pm 3\%$
Dwell Time	9kHz-6GHz	$\pm 1\%$
Transmitter Spurious Emissions	9kHz-25GHz	$\pm 2.76\text{dB}$
Receiver Spurious Emissions	9kHz-25GHz	$\pm 2.76\text{dB}$

1.8 Test Equipment List and Details

Description	Manufacturer	Model	Serial Number	Cal Date	Due Date
Attenuator	ATTEN	ATS100-4-20	/	2018-05-22	2019-05-21
Spectrum Analyzer	Agilent	E4407B	MY41440400	2018-05-22	2019-05-21
Spectrum Analyzer	R&S	FSP	836079/035	2018-05-22	2019-05-21
EMI Test Receiver	R&S	ESVB	825471/005	2018-05-22	2019-05-21
Pre-amplifier	Agilent	8447F	3113A06717	2018-05-22	2019-05-21
Pre-amplifier	Compliance Direction	PAP-0118	24002	2018-05-22	2019-05-21
Trilog Broadband Antenna	SCHWARZBECK	VULB9163	9163-333	2017-06-08	2020-06-07
Horn Antenna	ETS	3117	00086197	2017-06-08	2020-06-07
Loop Antenna	SCHWARZECK	HFRA 5165	9365	2017-06-08	2020-06-07

1.9 Calibration Information

Calibration lab: CHINA CEPREI LABORATORY

Calibrated by: Liu Peng

2. SUMMARY OF TEST RESULTS

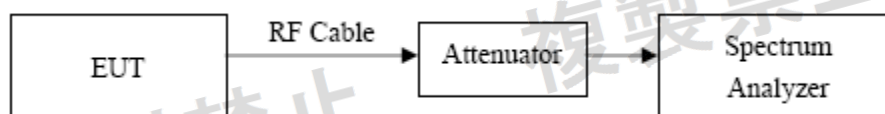
MIC RULES	DESCRIPTION OF TEST	RESULT
Item 19	RF Output Power	Compliant
Item 19	Frequency Tolerance	Compliant
Item 19	Occupied Bandwidth /Spreading Bandwidth/Spread Factor	Compliant
Item 19	Holding time of hopping frequency	Compliant
Item 19	Transmitter Spurious Emissions	Compliant
Item 19	Receiver Spurious Emissions	Compliant
Item 19	Interference Prevention Function	Compliant
Item 19	Carrier Sending Function	N/A

3. RF OUTPUT POWER

3.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1, The antenna power of a transmitting equipment (with a frequency band of 2,427 -2,470.75 MHz, for spread spectrum systems using FH systems, hybrid systems of DS and FH, or hybrid systems of FH and OFDM) shall be such that the mean power within a bandwidth of 1 MHz is 3 mW or less in the case of modulation using a standard coding test signal with the same transmission rate as that of the modulation signal., and the maximum permit tolerance is +20% or -80%.

3.2 Test Setup Block Diagram



3.3 Test Procedure

For FHSS

Spectrum Analyzer conditions (Search Frequency of Peak Power)

Frequency: Test Frequency

Span 2 Times of Signal Occupied bandwidth

RBW 1MHz

VBW 3MHz

Sweep Time Auto (In case of Burst, at least 1 burst per sample)

Detector mode Positive peak

Indication mode Max hold

Spectrum Analyzer conditions (Measure of Antenna Power)

Frequency: Frequency of Peak Power

Span 0Hz

RBW 1MHz

VBW 1MHz

Sweep Time Auto (In case of Burst, at least 1 burst per sample)

For DSSS

(a) A measurement instrument with an integrated 1MHz power bandwidth function may be used to automate the test process.

(b) Connect the EUT to the RF input of the spectrum analyzer via a 50ohm attenuator.

(c) Set the RBW = 1MHz, VBW = 1MHz, center of frequency = operating frequency, Sweep = Auto.

(d) 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided emission is repetitive in nature.

3.4 Summary of Test Results/Plots

➤ RF Output Power:

Mode	Test Channel	Average Burst power (dBm)	Average Burst power (mW)	SBW (MHz)	Antenna Power (mW/MHz)	Antenna Power Limit (mW/MHz)	Result
GFSK	Low	2.46	1.76	70.1301	0.0251	3	Pass
	Middle	4.44	2.78	70.1301	0.0396	3	Pass
	High	3.71	2.35	70.1301	0.0335	3	Pass
Pi/4 DQPSK	Low	1.62	1.45	70.4393	0.0206	3	Pass
	Middle	2.78	1.90	70.4393	0.0270	3	Pass
	High	2.41	1.74	70.4393	0.0247	3	Pass
8DPSK	Low	1.55	1.43	70.4859	0.0203	3	Pass
	Middle	3.23	2.10	70.4859	0.0298	3	Pass
	High	2.44	1.75	70.4859	0.0248	3	Pass

All the BDR/EDR EIRP is less than 6.911dBm and BLE less than 12.14dBm, so the half-power beam width is not necessary.

➤ RF Output Power Tolerance

Mode	Test Channel	Antenna Power (mW/MHz)	Rated Output Power (mW/MHz)	Tolerance (%)	Limit (%)	Result
GFSK	Low	0.0251	0.0400	-36.25	+20% to -80%	Pass
	Middle	0.0396	0.0400	-1.00	+20% to -80%	Pass
	High	0.0335	0.0400	-16.25	+20% to -80%	Pass
Pi/4 DQPSK	Low	0.0206	0.0400	-48.50	+20% to -80%	Pass
	Middle	0.0270	0.0400	-32.50	+20% to -80%	Pass
	High	0.0247	0.0400	-38.25	+20% to -80%	Pass
8DPSK	Low	0.0203	0.0400	-49.25	+20% to -80%	Pass
	Middle	0.0298	0.0400	-25.50	+20% to -80%	Pass
	High	0.0248	0.0400	-38.00	+20% to -80%	Pass

Note: Tolerance = (Output Power – Rated Output Power) / Rated Output Power * 100%

Mode:	GFSK
Low	 <p>Agilent R T</p> <p>Ch Freq 2.402 GHz Trig VidIF</p> <p>Burst Power</p> <p>Center 2.40200000 GHz</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Samp Log 10 dB/Offset 1 dB</p> <p>-1.8 ms 2.2 ms</p> <p>Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Output Power (Measured Burst Width) 2.46 dBm</p> <p>Amplitude Threshold -30.00 dB</p> <p>Current Data Output Pwr Max Pt Min Pt</p> <p>Full Burst Width: 399.0 μs 2.46 dBm 2.83 dBm 0.44 dBm</p> <p>Freq/Channel</p> <p>Center Freq 2.40200000 GHz</p> <p>Start Freq 2.40200000 GHz</p> <p>Stop Freq 2.40200000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
Middle	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig VidIF</p> <p>Burst Power</p> <p>Center 2.44100000 GHz</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Samp Log 10 dB/Offset 1 dB</p> <p>0 s 4 ms</p> <p>Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Output Power (Measured Burst Width) 4.44 dBm</p> <p>Amplitude Threshold -30.00 dB</p> <p>Current Data Output Pwr Max Pt Min Pt</p> <p>Full Burst Width: 399.0 μs 4.44 dBm 4.79 dBm 2.69 dBm</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.44100000 GHz</p> <p>Stop Freq 2.44100000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
High	 <p>Agilent R T</p> <p>Ch Freq 2.48 GHz Trig VidIF</p> <p>Burst Power</p> <p>Center 2.48000000 GHz</p> <p>Ref 10 dBm Atten 20 dB</p> <p>#Samp Log 10 dB/Offset 1 dB</p> <p>0 s 4 ms</p> <p>Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Output Power (Measured Burst Width) 3.71 dBm</p> <p>Amplitude Threshold -30.00 dB</p> <p>Current Data Output Pwr Max Pt Min Pt</p> <p>Full Burst Width: 399.0 μs 3.71 dBm 4.08 dBm 2.05 dBm</p> <p>Freq/Channel</p> <p>Center Freq 2.48000000 GHz</p> <p>Start Freq 2.48000000 GHz</p> <p>Stop Freq 2.48000000 GHz</p> <p>CF Step 1.00000000 MHz Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

Mode:	Pi/4 DQPSK
Low	
Middle	
High	

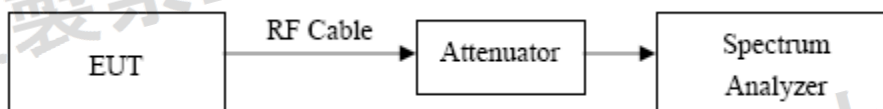


4. FREQUENCY TOLERANCE

4.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1, the maximum permit tolerance of frequency is 50ppm.

4.2 Test Setup Block Diagram



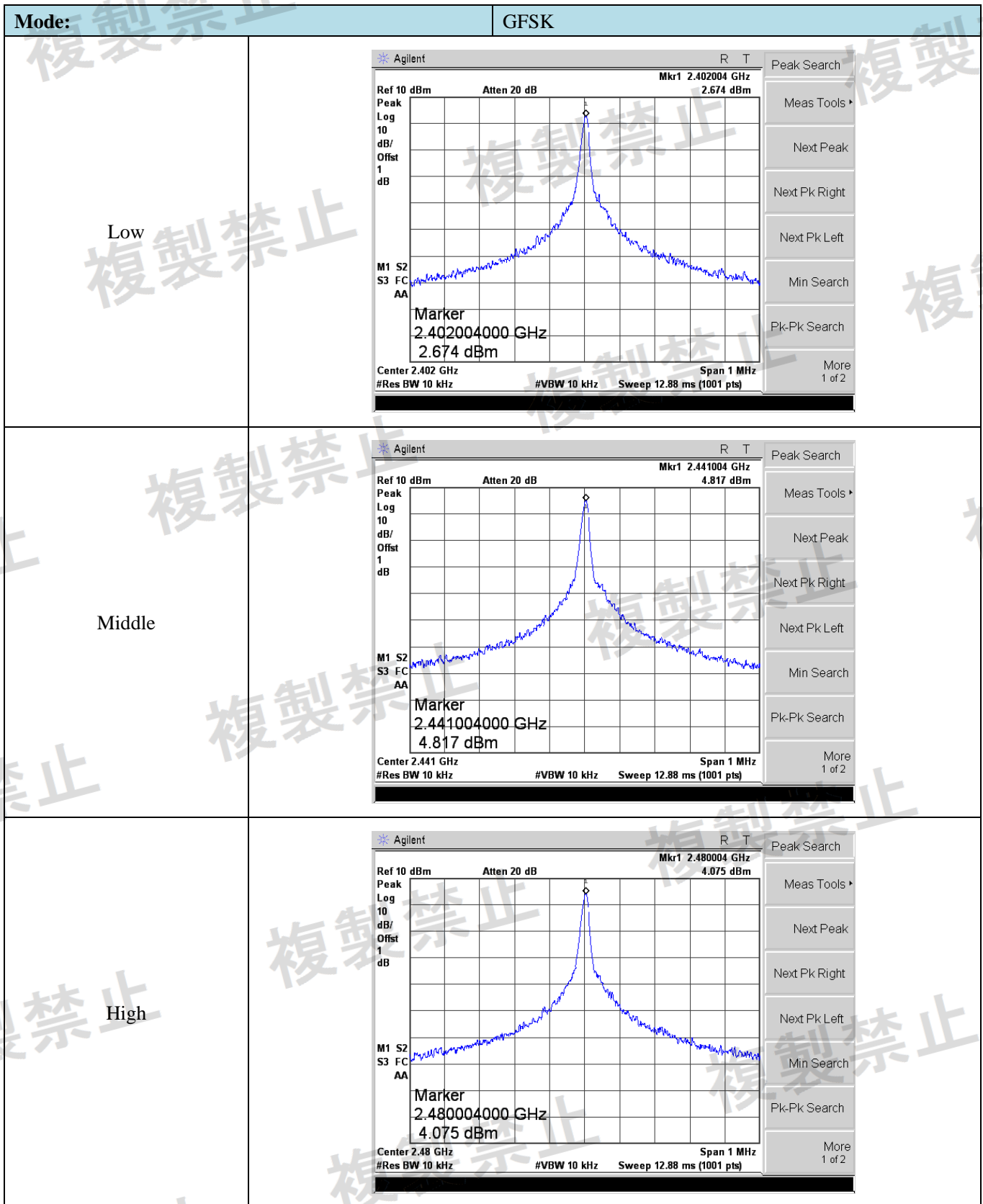
4.3 Test Procedure

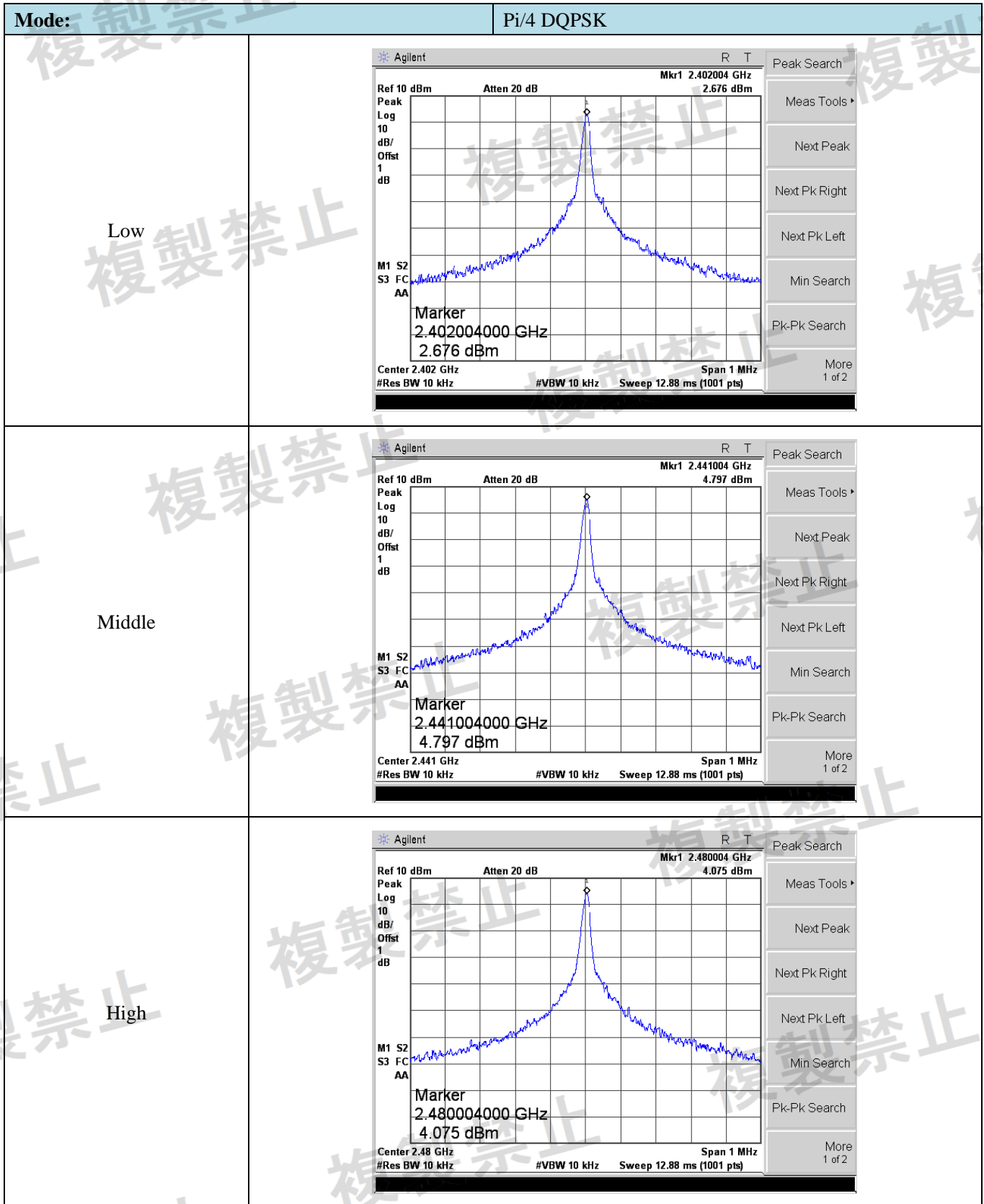
1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW, VBW=10KHz, Span = 1MHz.
- 4 'Maximum Hold' mode may be used to accumulate the measurement result over several scans provided emission is repetitive in nature.
5. Repeat above procedures until all frequency measured was complete.

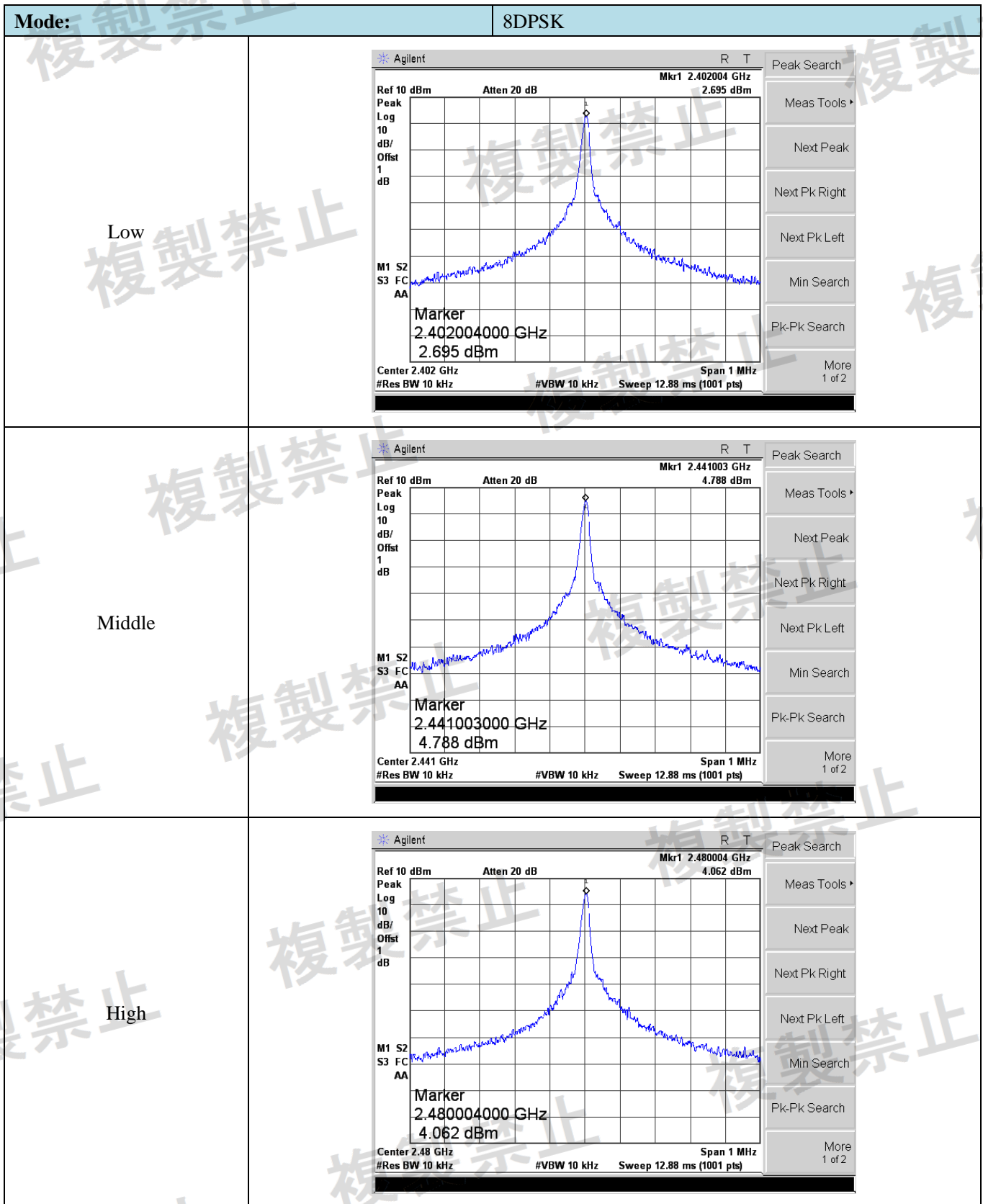
4.4 Summary of Test Results/Plots

Mode	Test Frequency (MHz)	Reading Value (MHz)	Tolerance (ppm)	Limit (ppm)	Result
GFSK	2402	2402.004	1.67	± 50	Pass
	2441	2441.004	1.64	± 50	Pass
	2480	2480.004	1.61	± 50	Pass
Pi/4 DQPSK	2402	2402.004	1.67	± 50	Pass
	2441	2441.004	1.64	± 50	Pass
	2480	2480.004	1.61	± 50	Pass
8DPSK	2402	2402.004	1.67	± 50	Pass
	2441	2441.003	1.23	± 50	Pass
	2480	2480.004	1.61	± 50	Pass

➤ Please refer to the test plots





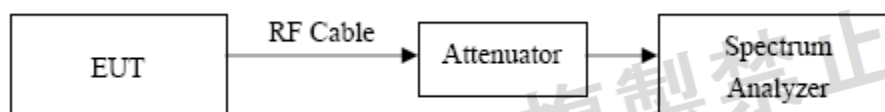


5. OCCUPIED BANDWIDTH/SPREAD BANDWIDTH/SPREAD FACTOR

5.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1. For FHSS the occupied bandwidth shall not exceed 83.5MHz, the spreading bandwidth no less than 500kHz, and the operating frequency range lies within the band 2400MHz to 2483.5 MHz.

5.2 Test Setup Block Diagram



5.3 Test Procedure

(1) Set up the spectrum analyzer as the follows:

Center frequency: Test frequency

Sweep bandwidth: 120MHz

Resoluble bandwidth: 1MHz

Video bandwidth: 1MHz

Sweep time: Auto

Sampling points: More than 400 points

Sweep mode : Continuous sweeping

Detection mode: Positive peak

Display mode: Maximum holding

(2) Repeat the sweeping till no change was observed on the display and enter all values of data point to the computer as array variable.

(3) About all data, convert dB value to antilogarithm of electric power dimension.

(4) Add up the electric power of all data and record it as “Sum total of electric power”.

(5) Adding up data in order from the lowest frequency to upper frequencies, look for a limit point where the value reaches to 0.5% (5% in case of diffusion bandwidth) of “Sum total of electric power”. Convert the limit point to frequency and record as “Lowest limit frequency”.

(6) Adding up data in order from the highest frequency to lower frequencies, look for a limit point where the value reaches to 0.5% (5% in case of diffusion bandwidth) of “Sum total of electric power”. Convert the limit point to frequency and record as “Highest limit frequency”.

(7) Repeat above procedures until all frequency measured was complete.

5.4 Summary of Test Results/Plots

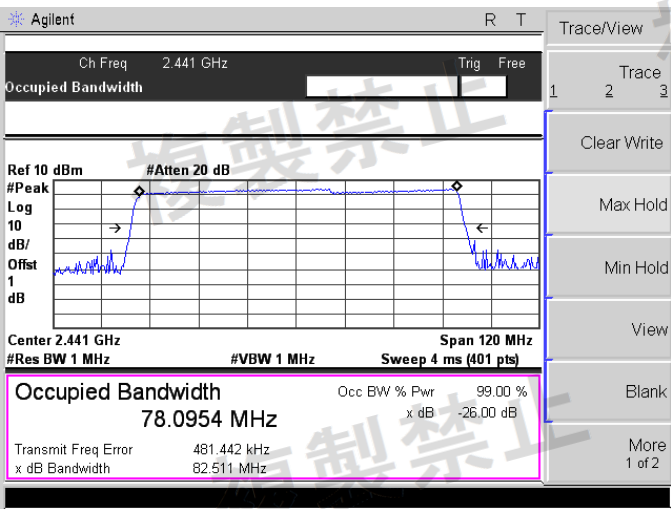
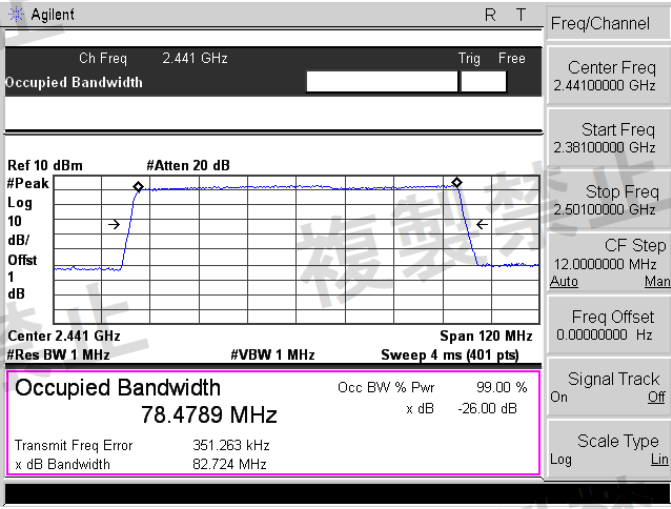
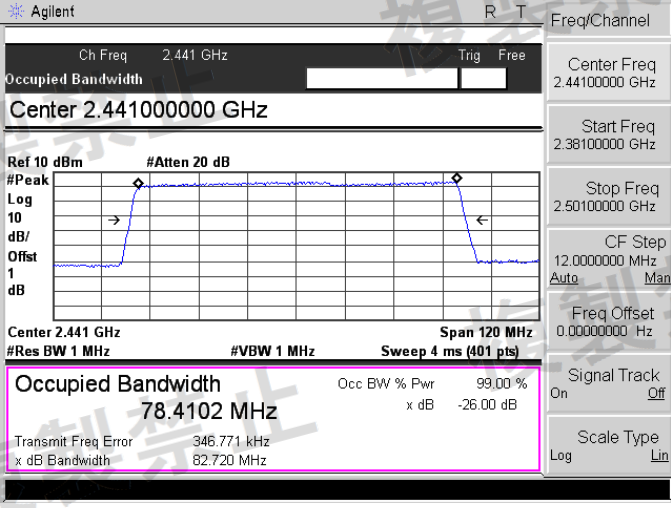
Mode	Channel	99% Emission bandwidth		90% Emission bandwidth		Result
		Reading Value (MHz)	Limit (MHz)	Reading Value (MHz)	Limit (MHz)	
GFSK	Hopping	78.0954	<83.5	70.1301	≥0.5	Pass
Pi/4 DQPSK	Hopping	78.4789	<83.5	70.4393	≥0.5	Pass
8DPSK	Hopping	78.4102	<83.5	70.4859	≥0.5	Pass

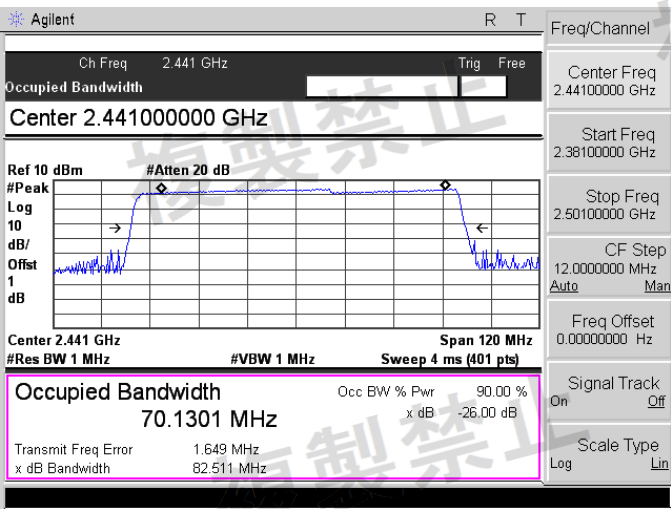
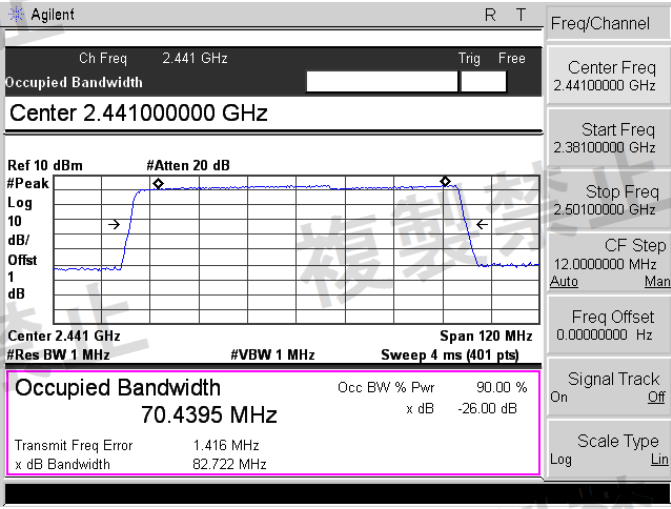
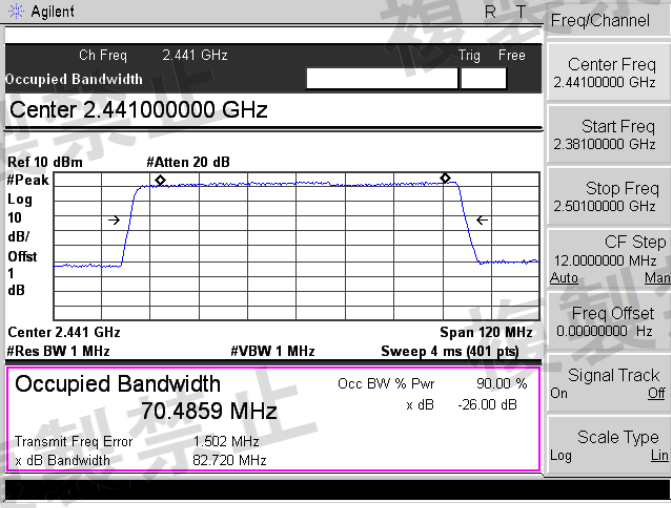
➤ Spread Factor

Test mode	Diffusion Bandwidth	Modulation Data Rate (M)	Spread Factor	Limit	Result
GFSK	70.1301	1	70.1301	≥5	Pass
Pi/4 DQPSK	70.4393	1.7	41.4349	≥5	Pass
8DPSK	70.4859	2.7	26.1059	≥5	Pass

Spread Factor= Diffusion Bandwidth/ Modulation Data Rate

➤ Please refer to the following test plots

99% Emission bandwidth	
GFSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth</p> <p>78.0954 MHz</p> <p>Occ BW % Pwr 99.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 481.442 kHz</p> <p>x dB Bandwidth 82.511 MHz</p> <p>Trace/View</p> <p>1 Trace 2 3</p> <p>Clear Write</p> <p>Max Hold</p> <p>Min Hold</p> <p>View</p> <p>Blank</p> <p>More 1 of 2</p>
Pi/4 DQPSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth</p> <p>78.4789 MHz</p> <p>Occ BW % Pwr 99.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 351.263 kHz</p> <p>x dB Bandwidth 82.724 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.38100000 GHz</p> <p>Stop Freq 2.50100000 GHz</p> <p>CF Step 12.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
8DPSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.441000000 GHz</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth</p> <p>78.4102 MHz</p> <p>Occ BW % Pwr 99.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 346.771 kHz</p> <p>x dB Bandwidth 82.720 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.38100000 GHz</p> <p>Stop Freq 2.50100000 GHz</p> <p>CF Step 12.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.00000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

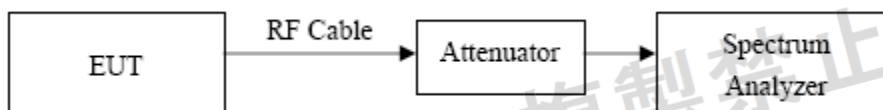
90% Emission bandwidth	
GFSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.441000000 GHz</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 70.1301 MHz</p> <p>Occ BW % Pwr 90.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 1.649 MHz</p> <p>x dB Bandwidth 82.511 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.38100000 GHz</p> <p>Stop Freq 2.50100000 GHz</p> <p>CF Step 12.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
Pi/4 DQPSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.441000000 GHz</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 70.4395 MHz</p> <p>Occ BW % Pwr 90.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 1.416 MHz</p> <p>x dB Bandwidth 82.722 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.38100000 GHz</p> <p>Stop Freq 2.50100000 GHz</p> <p>CF Step 12.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>
8DPSK-Hopping	 <p>Agilent R T</p> <p>Ch Freq 2.441 GHz Trig Free</p> <p>Occupied Bandwidth</p> <p>Center 2.441000000 GHz</p> <p>Ref 10 dBm #Peak Log 10 dB/Offst 1 dB</p> <p>#Atten 20 dB</p> <p>Center 2.441 GHz Span 120 MHz</p> <p>#Res BW 1 MHz #VBW 1 MHz Sweep 4 ms (401 pts)</p> <p>Occupied Bandwidth 70.4859 MHz</p> <p>Occ BW % Pwr 90.00 %</p> <p>x dB -26.00 dB</p> <p>Transmit Freq Error 1.502 MHz</p> <p>x dB Bandwidth 82.720 MHz</p> <p>Freq/Channel</p> <p>Center Freq 2.44100000 GHz</p> <p>Start Freq 2.38100000 GHz</p> <p>Stop Freq 2.50100000 GHz</p> <p>CF Step 12.0000000 MHz</p> <p>Auto Man</p> <p>Freq Offset 0.0000000 Hz</p> <p>Signal Track On Off</p> <p>Scale Type Log Lin</p>

6. HOLDING TIME OF HOPPING FREQUENCY

6.1 Standard Application

According to Item 19 of Article 2 Paragraph 1. The Holding Time shall not exceed 0.4sec or less , The Total Sum of Holding Time at arbitrary Frequencies Within the Time Multiplied 0.4 sec By the Spreading Ratio Shall be 0.4sec or Less.

6.2 Test Setup Block Diagram



6.3 Test procedure

1. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
2. Set center frequency of spectrum analyzer = operating frequency.
3. Set the spectrum analyzer as RBW,VBW=1MHz, Span = 0Hz
4. Recode the quantity of pulse in a test period.
5. Set the spectrum analyzer as RBW,VBW=1MHz, Span = 0Hz
6. Mark the time slot length.
7. Repeat above procedures until all frequency measured was complete.

6.4 Summary of Test Results/Plots

The dwell time within a test period second period in data mode is independent from the packet type (packet length). The calculation for a test period is a follows:

Dwell time = (0.4(s) x spreading rate x sending time of 1 burst(s)) / (burst cycle(s) x No. of hopping channel)

* Spreading rate = Spread bandwidth (actual measurement value) / Transmission rate

Modulation	Test Channel	Packet	Duty (%)	Dwell Time (ms)	Limit (ms)
GFSK	Low	DH5	76.7	272.4	<400
	Middle	DH5	76.7	272.4	<400
	High	DH5	77.3	274.5	<400
Pi/4 DQPSK	Low	DH5	77.3	137.8	<400
	Middle	DH5	77.3	137.8	<400
	High	DH5	76.7	136.8	<400
8DPSK	Low	DH5	76.7	91.2	<400
	Middle	DH5	76.7	91.2	<400
	High	DH5	76.7	91.2	<400

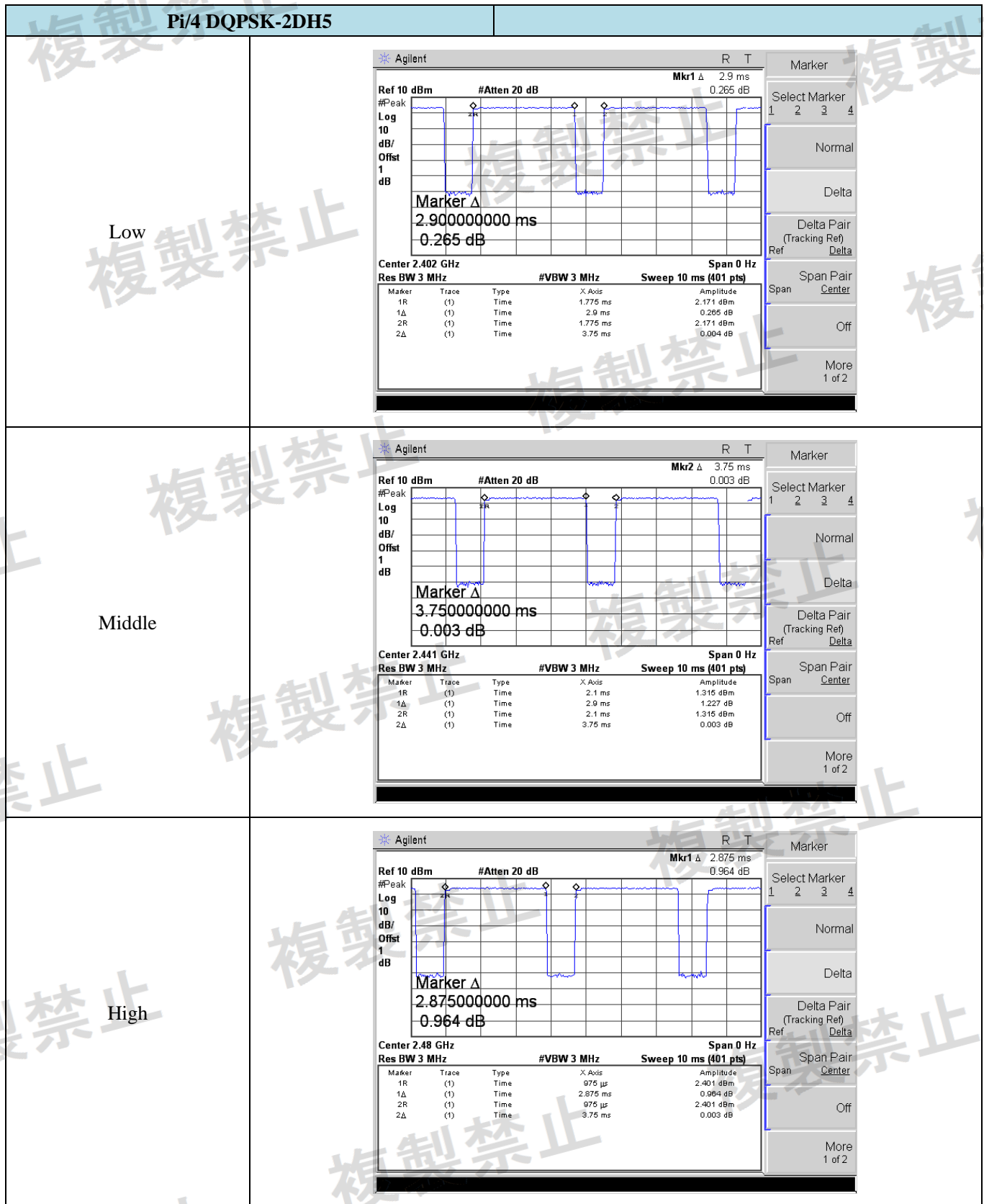
Test mode	Diffusion Bandwidth	Modulation Data Rate (M)	Process gain
GFSK	70.1301	1	70.1301
Pi/4 DQPSK	70.4393	2	35.21965
8DPSK	70.4859	3	23.4953

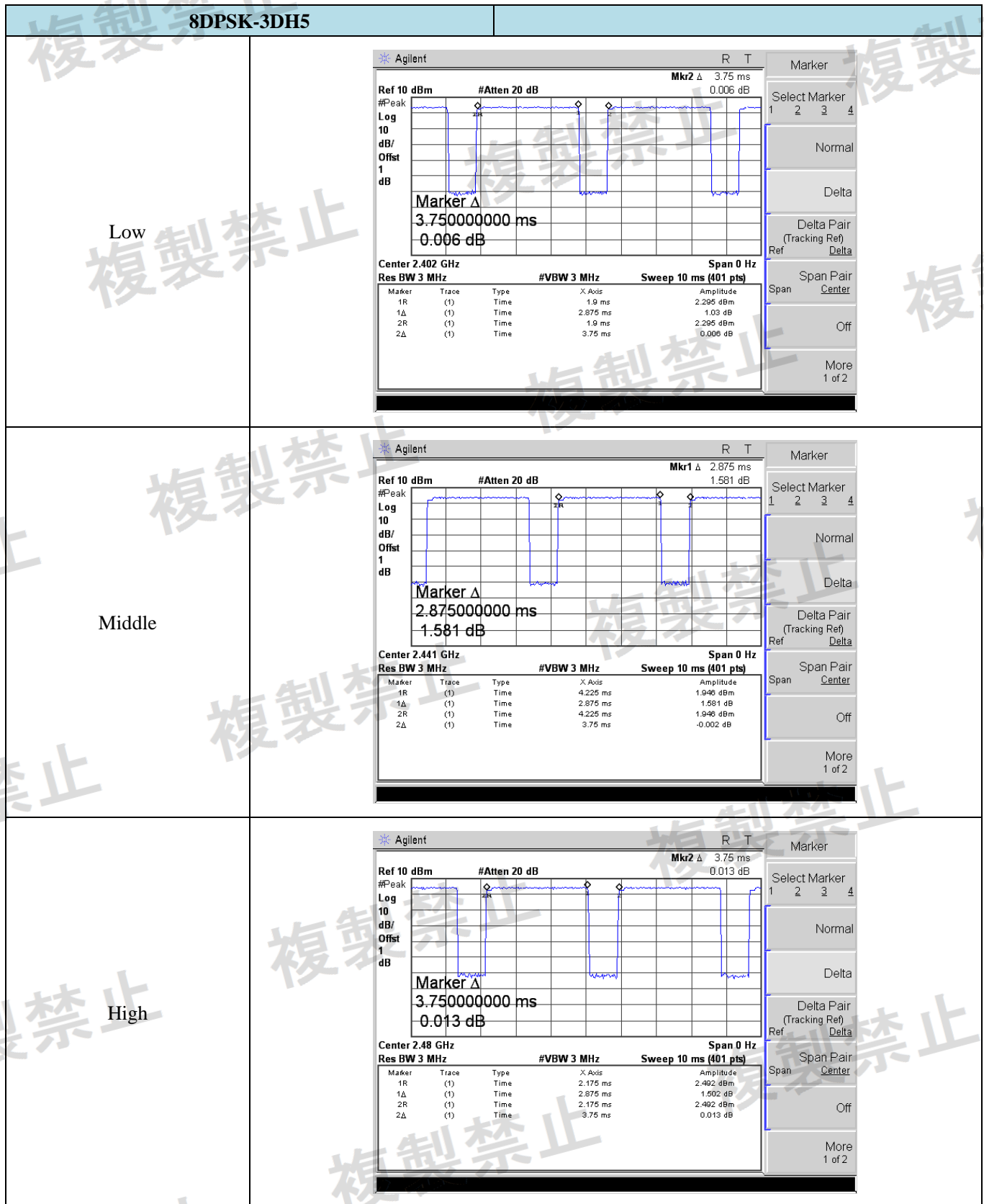
GFSK dwell time (s)=70.1301/79*duty cycle*0.4

Pi/4 DQPSK dwell time (s)=(70.4393/2)/79*duty cycle*0.4

8DPSK dwell time (s)=(70.4859/3)/79*duty cycle*0.4







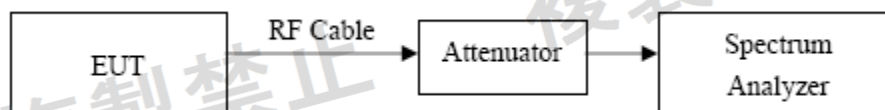
7. TRANSMITTER SPURIOUS EMISSIONS

7.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1. The transmitter spurious emissions shall not exceed the following limit:

- (1) Below 2387MHz : 2.5 μ W/MHz
- (2) 2387 to 2400MHz : 25 μ W/MHz
- (3) 2483.5 through 2496.5MHz : 25 μ W/MHz
- (4) Over 2496.5MHz : 2.5 μ W/MHz

7.2 Test Setup Block Diagram



7.3 Test Procedure

- (1) In case of conducted measurements, the radio device shall be connected to the measuring equipment via a suitable attenuator.
- (2) The measurement equipment shall be set for peak hold mode of operation.
- (3) the transmitter shall be operated at the highest output power, or, in the case of equipment able to operate at more than one power level, at the lowest and highest output powers;
- (4) The resolution bandwidth shall be set to 100kHz from 10MHz to 1GHz, the resolution bandwidth shall be set to 1MHz above 1GHz, and the sweep time shall be set to auto mode, to ensure all major modulation products are captured.
- (5) When the searched result is less than the specified limit, the maximum one shall be recorded, when the result is more than the specified limit, all measured values shall be recorded.
- (5) This measurement shall be repeated with the transmitter in standby mode where applicable.
- (6) Repeat above procedures until all frequency measured was complete.

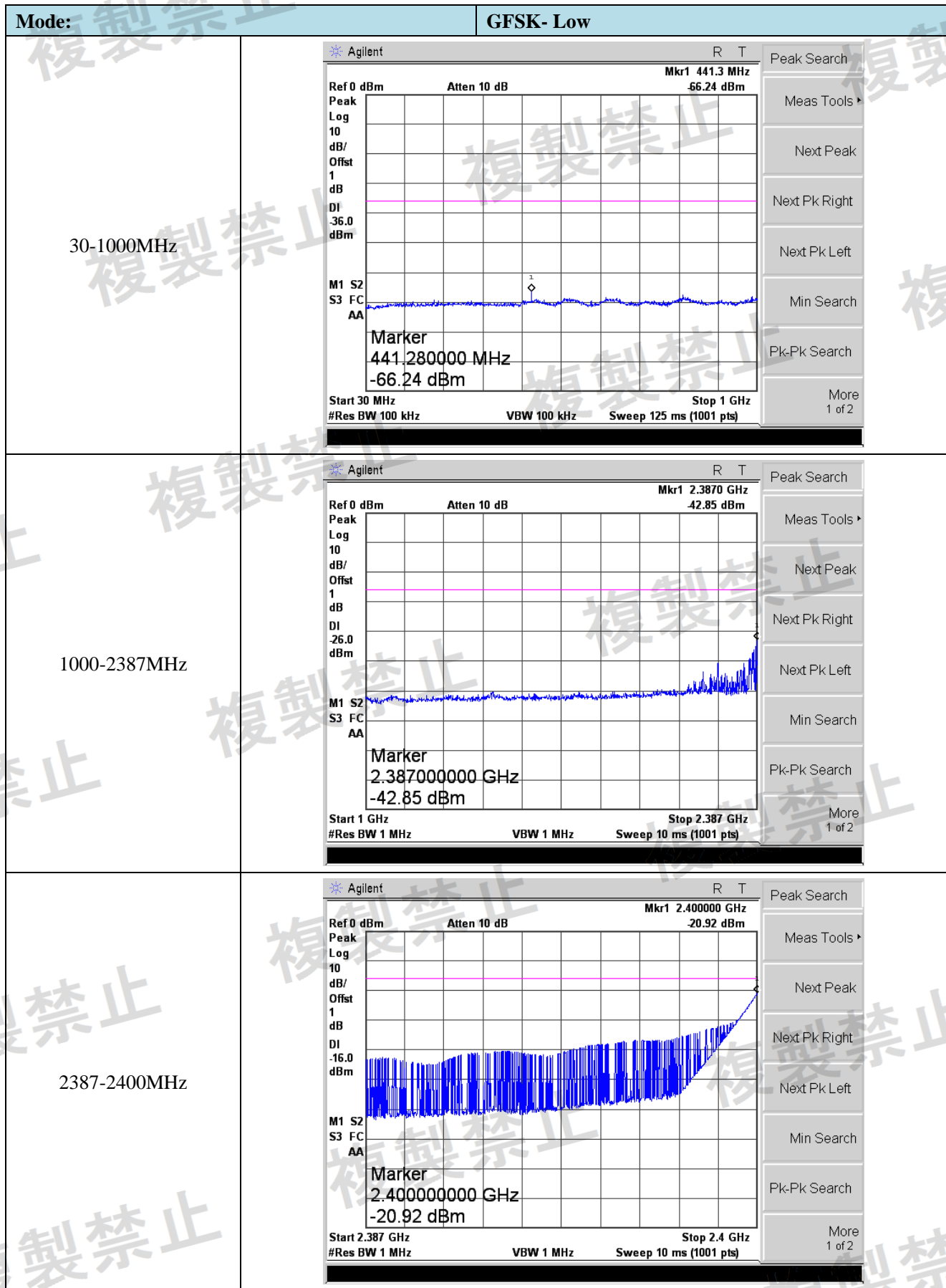
7.4 Summary of Test Results/Plots

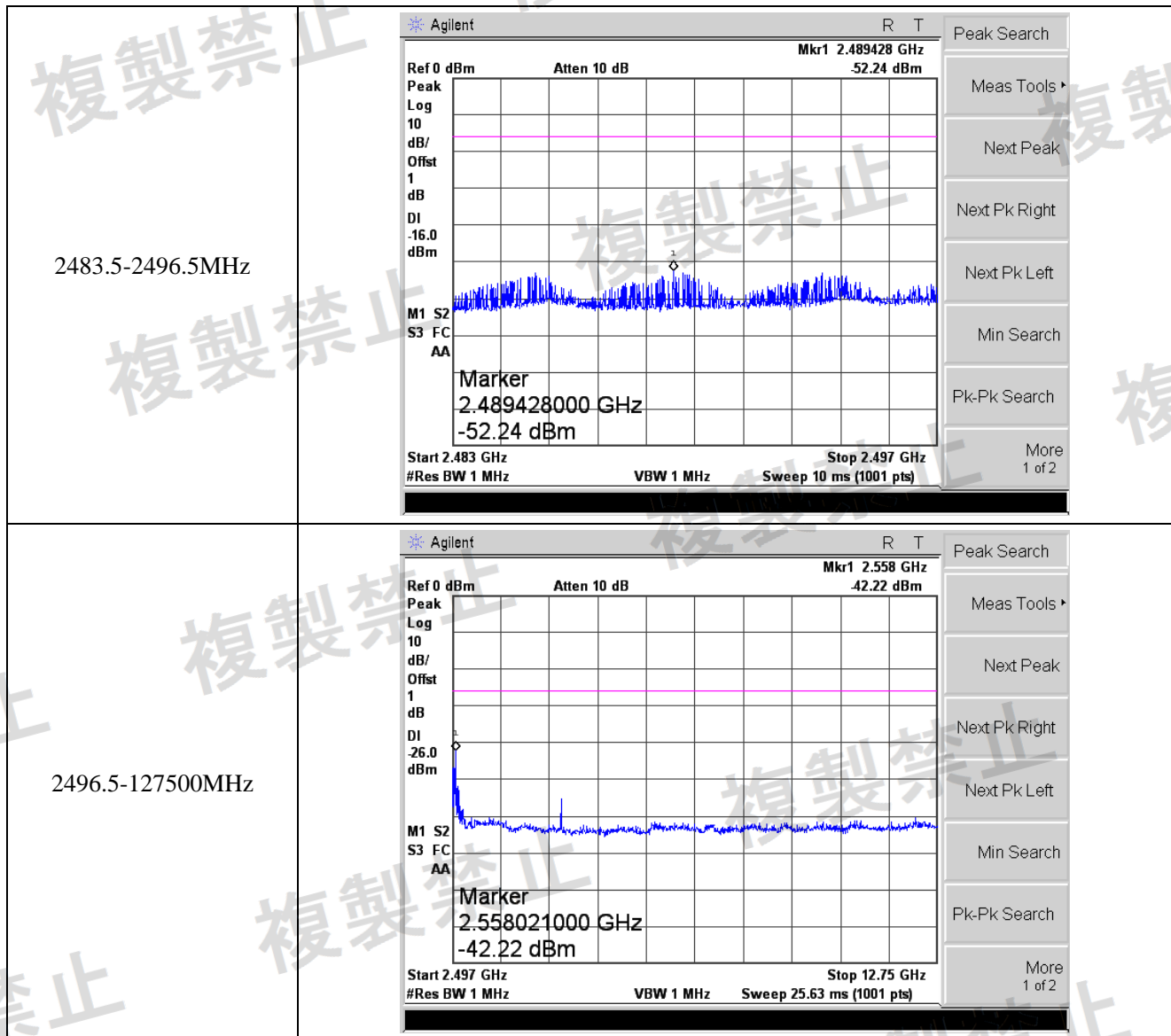
➤ For BDR, EDR Worst case at GFSK mode

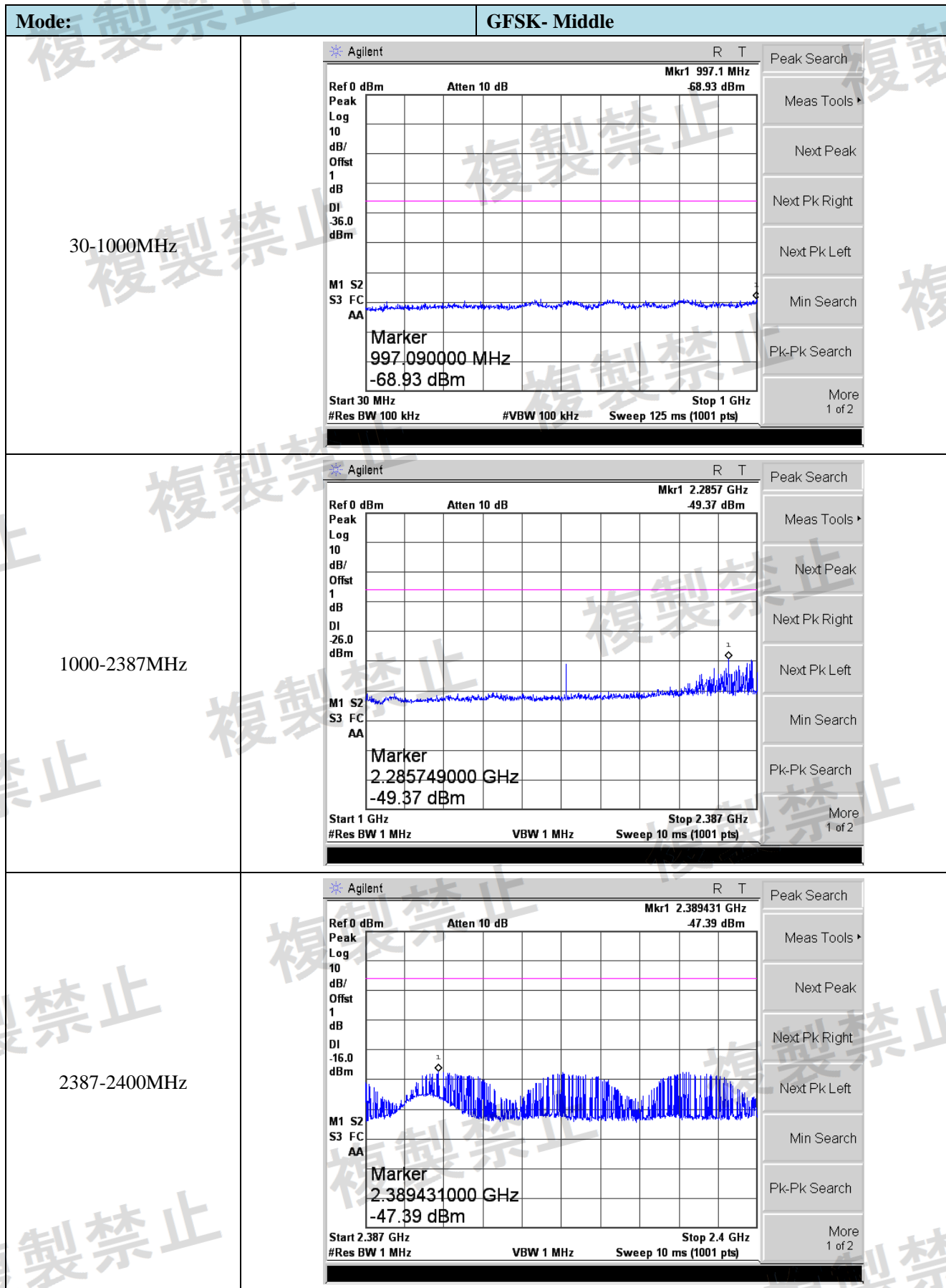
Mode	Channel	Frequency Range (MHz)	Test Value (dBm)	Limit (dBm)	Result
GFSK	Low	30-1000	-66.24	-36	Pass
		1000-2387	-42.85	-26	Pass
		2387-2400	-20.92	-16	Pass
		2483.5-2496.5	-52.24	-16	Pass
		2496.5-127500	-42.22	-26	Pass
	Middle	30-1000	-68.93	-36	Pass
		1000-2387	-49.37	-26	Pass
		2387-2400	-47.39	-16	Pass
		2483.5-2496.5	-47.77	-16	Pass
		2496.5-127500	-44.84	-26	Pass
	High	30-1000	-68.38	-36	Pass
		1000-2387	-49.65	-26	Pass
		2387-2400	-50.87	-16	Pass
		2483.5-2496.5	-31.73	-16	Pass
		2496.5-127500	-45.38	-26	Pass

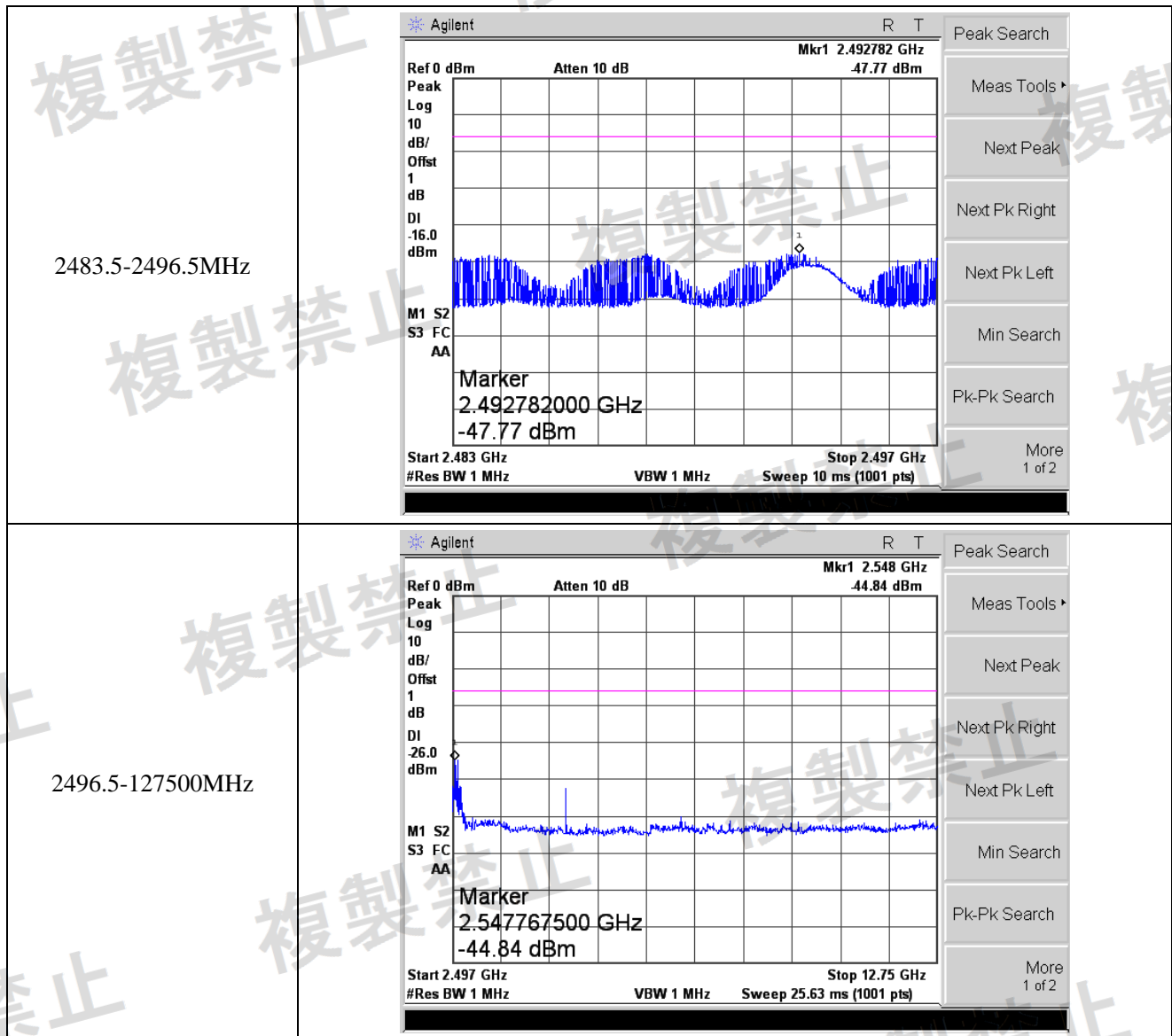
2.5 μ W/MHz=-26dBm/MHz, 25 μ W/MHz=-16dBm/MHz 2.5 μ W/MHz=-36dBm/100kHz,

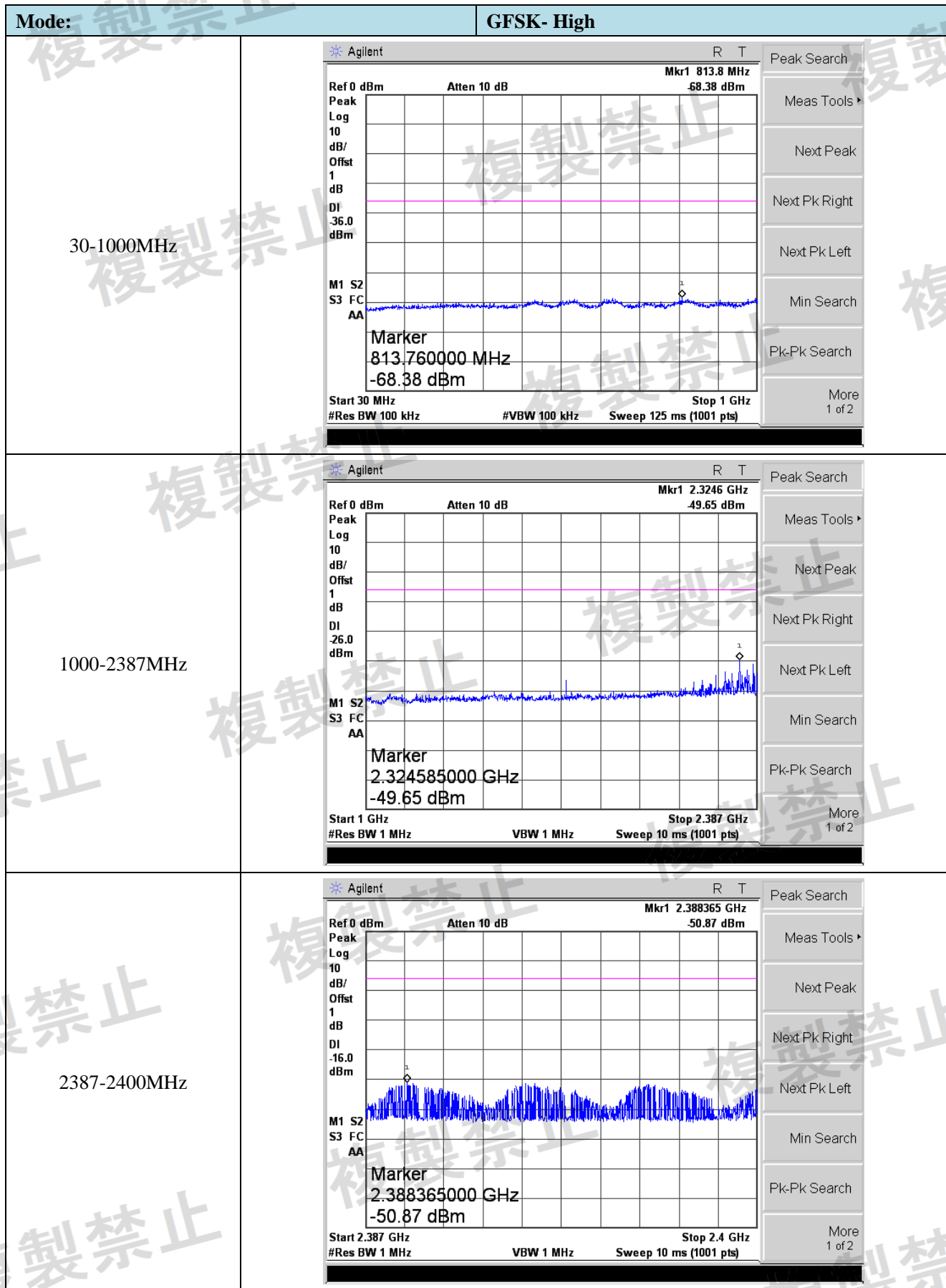
➤ Please refer to the following test plots

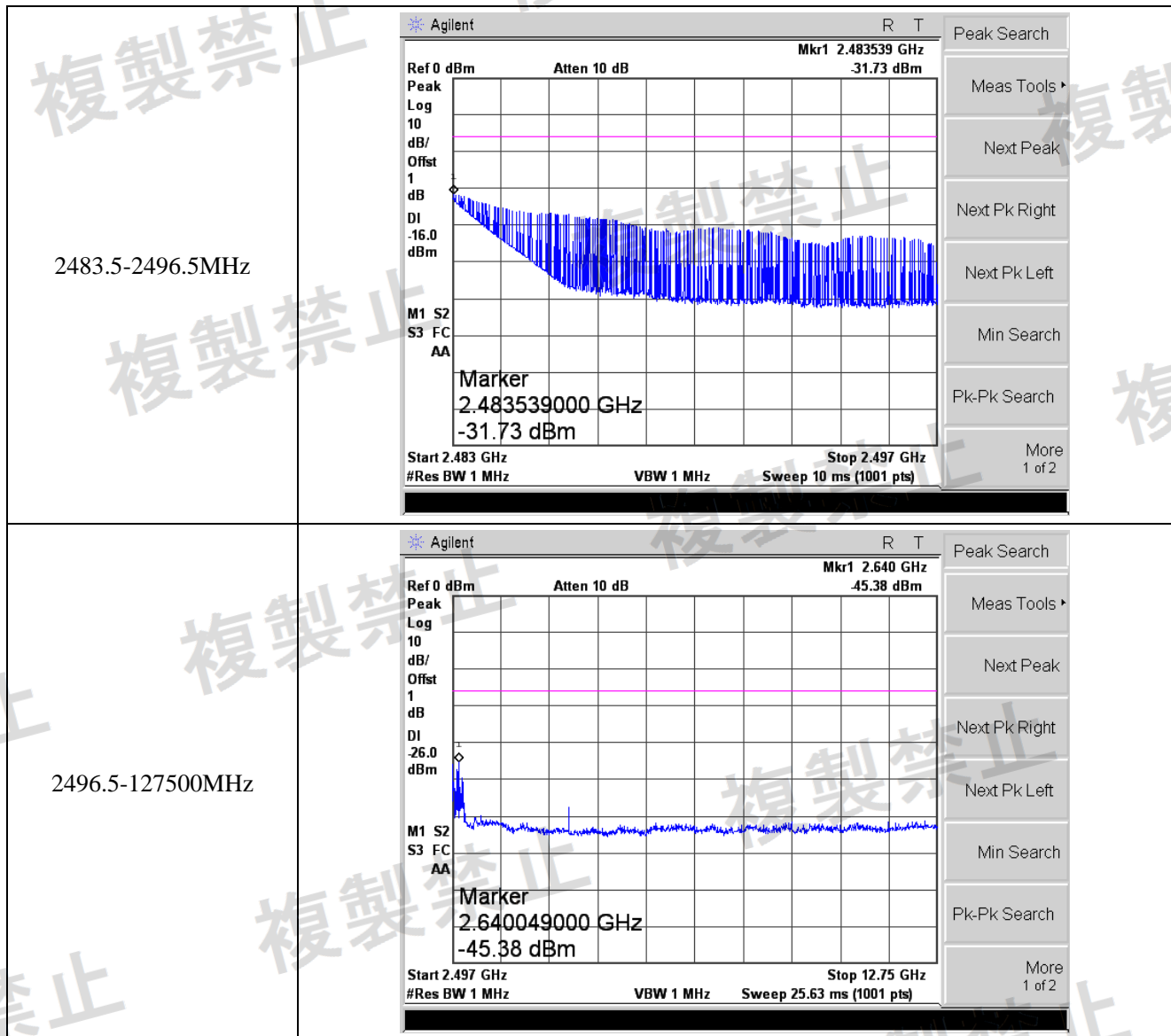












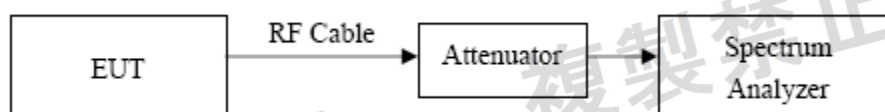
8. RECEIVER SPURIOUS EMISSIONS

8.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1. The receiver spurious emissions shall not exceed the following limit:

- (1) Below 1GHz : 4nW/100kHz
- (2) 1GHz or higher : 20nW/MHz

8.2 Test Setup Block Diagram



8.3 Test Procedure

- (1) A spectrumIn case of conducted measurements, the radio device shall be connected to the measuring equipment via a suitable attenuator.
- (2) The measurement equipment shall be set for peak hold mode of operation.
- (3) the transmitter shall be operated at the receiving mode.
- (4) The resolution bandwidth shall be set to 100kHz from 10MHz to 1GHz, the resolution bandwidth shall be set to 1MHz above 1GHz , and the sweep time shall be set to auto mode, to ensure all major modulation products are captured.
- (5) When the searched result is less than the specified limit, the maximum one shall be recorded, when the result is more than the specified limit, all measured values shall be recorded.
- (5) This measurement shall be repeated with the transmitter in standby mode where applicable.
- (6) Repeat above procedures until all frequency measured was complete.

8.4 Summary of Test Results/Plots

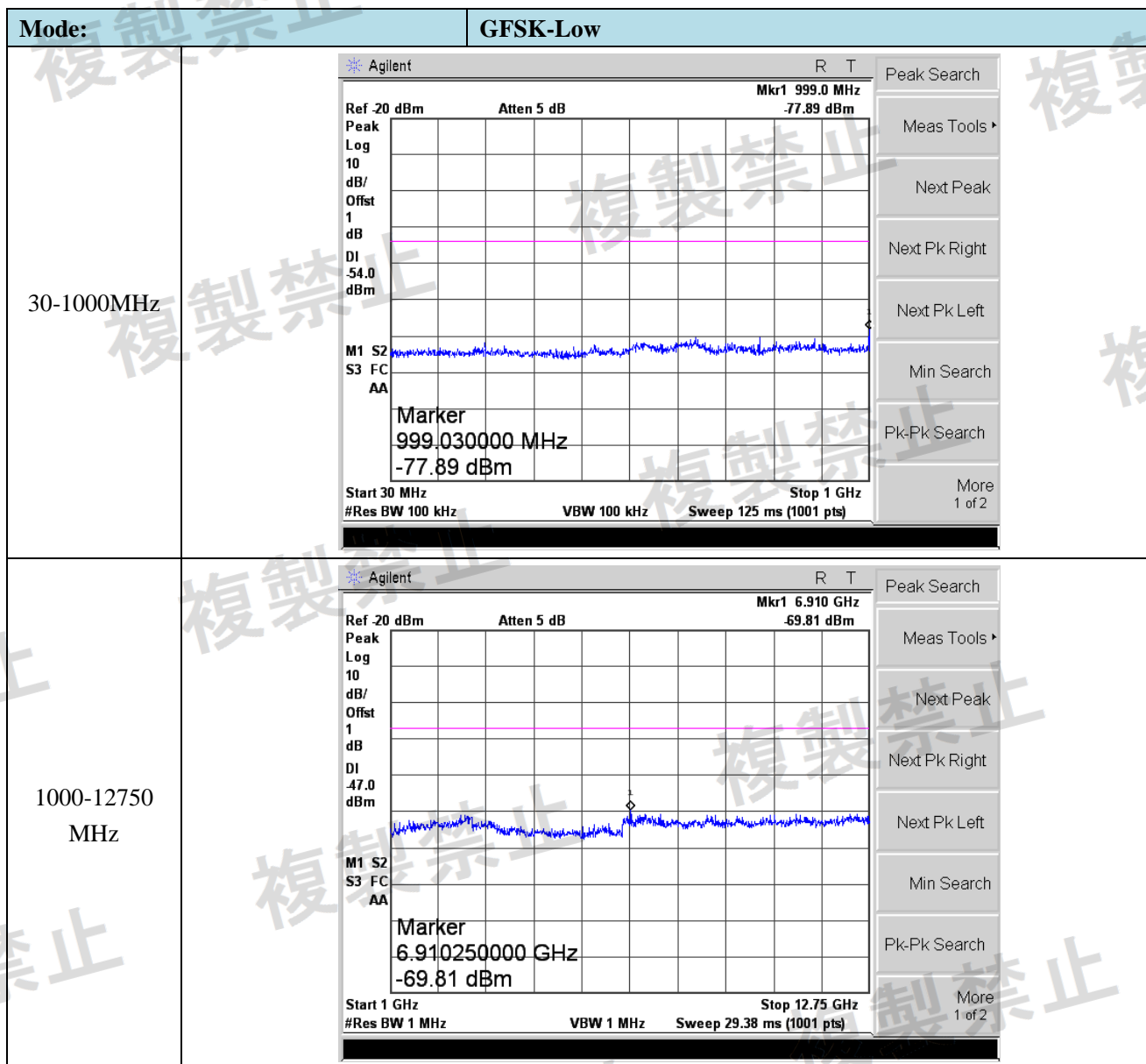
➤ For BDR, EDR Worst case at GFSK mode

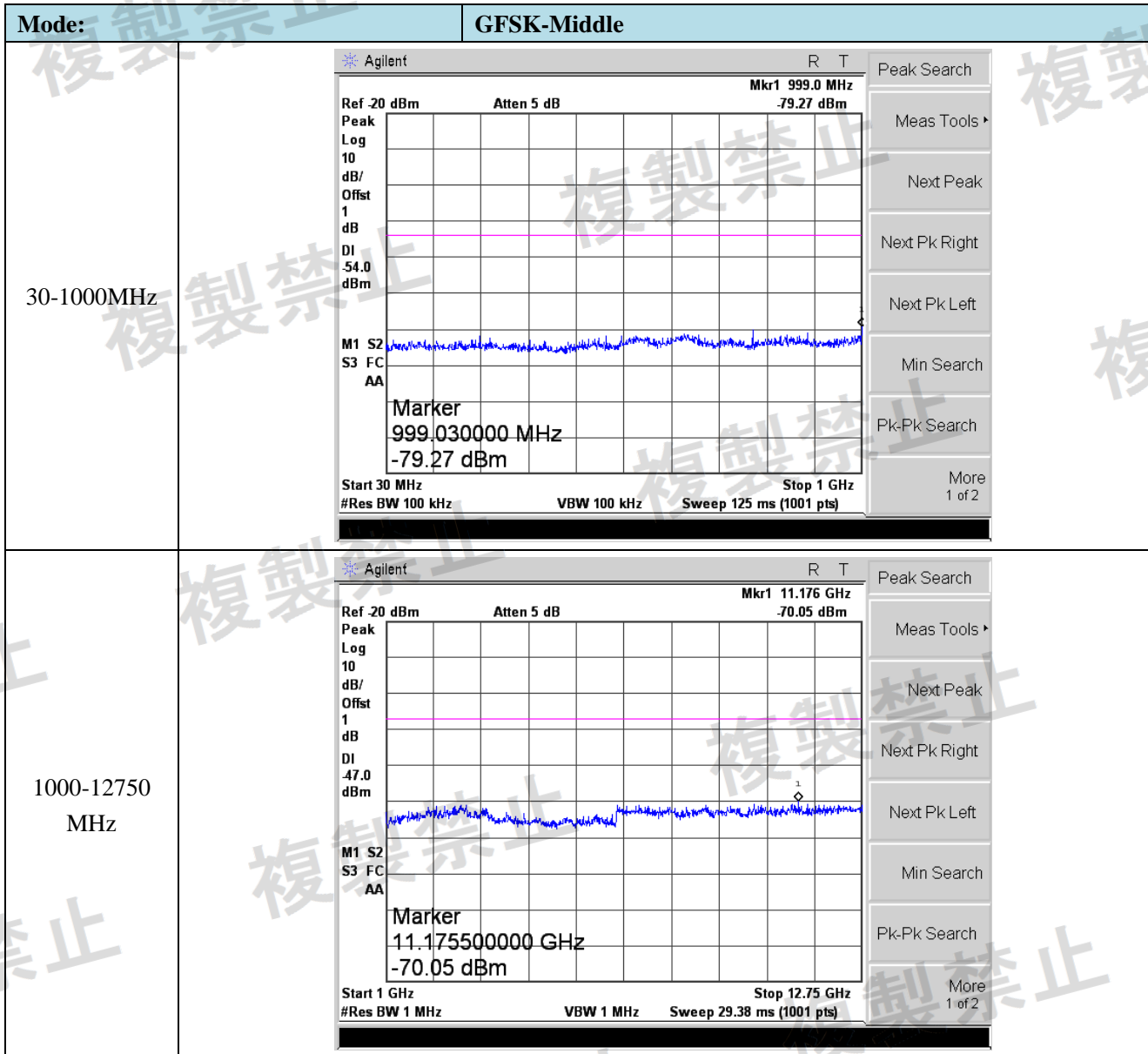
Mode	Channel	Frequency Range (MHz)	Test Value (dBm)	Limit (dBm)	Result
GFSK	Low	30-1000	-77.89	-54	Pass
		1000-12750	-69.81	-47	Pass
	Middle	30-1000	-79.27	-54	Pass
		1000-12750	-70.05	-47	Pass
	High	30-1000	-78.65	-54	Pass
		1000-12750	-69.92	-47	Pass

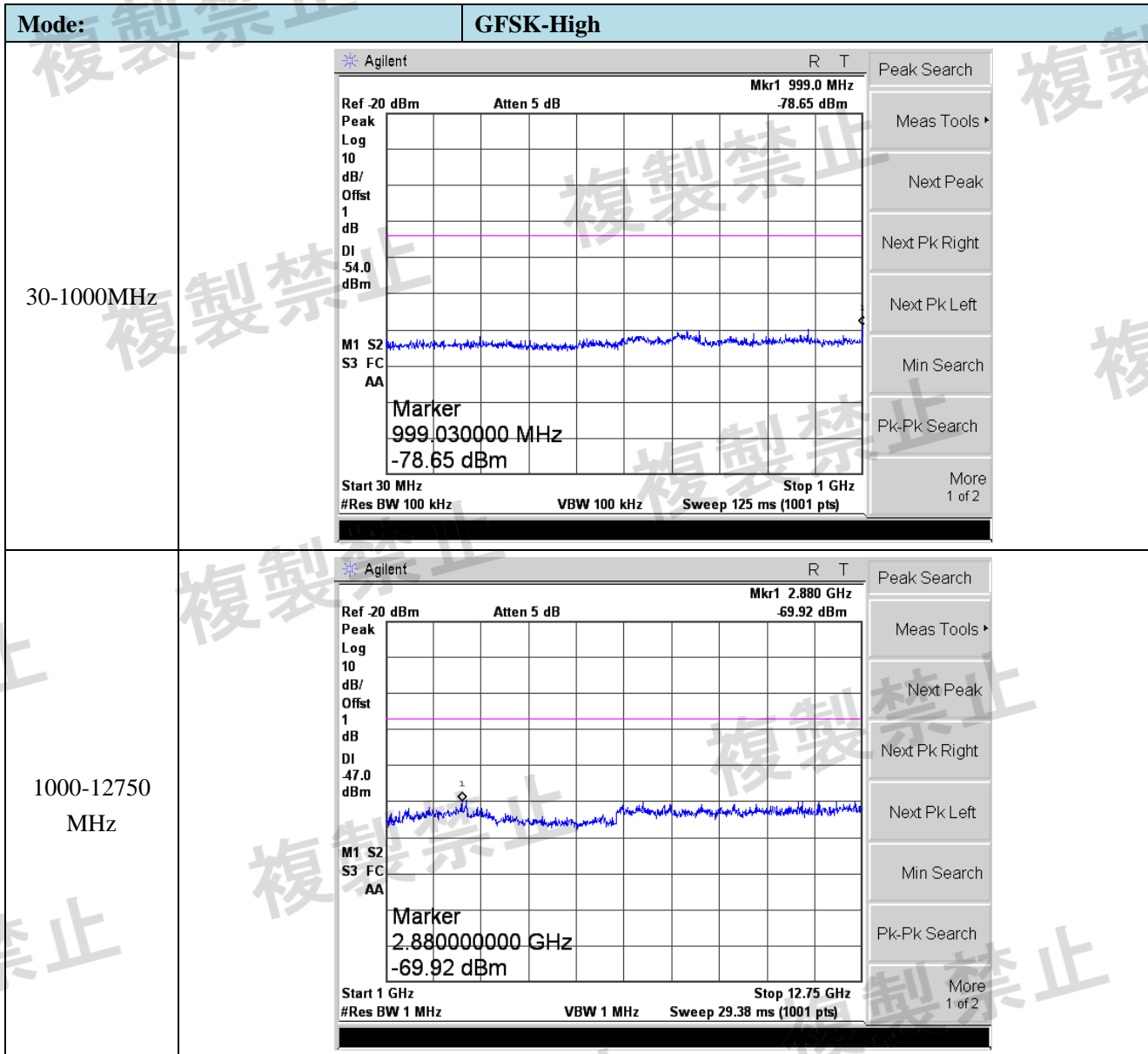
4nW/100kHz=-54dBm/100kHz

20nW/MHz=-47dBm/MHz

➤ Please refer to the following test plots





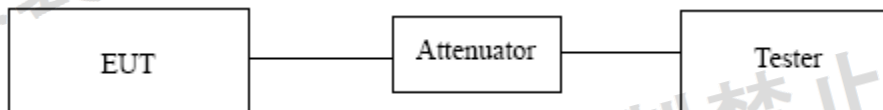


9. INTERFERENCE PREVENTION FUNCTION

9.1 Standard Applicable

According to Item 19 of Article 2 Paragraph 1. The device shall have the function of automatic transmission or reception of identification code.

9.2 Test Setup Block Diagram



9.3 Test Procedure

1. Set the EUT in the usual operation condition
2. The radio equipment with automatic transmitting function of identification code
 - A. Transmit the assigned identification code from the radio equipment.
 - B. Confirm the identification code received by the demodulator.
3. The radio equipment with automatic receiving function of identification code
 - A. Transmit the assigned identification code from the opposite equipment.
 - B. Confirm that the usual communication is available.
 - C. Transmit the identification code distinct from the assigned one from the opposite equipment.
 - D. Confirm that the radio equipment is stopped or an indication is displayed as the identification code is different.
4. The identification function shall be recorded.

9.4 Summary of Test Results/Plots

Test Item	Test Result
Transmitting Function of Identification Code	>48 bits
Receiving Function of Identification Code	>48 bits

***** END OF REPORT *****