JAPAN RADIO TEST REPORT

Client Information:

Applicant: YELL Co.,Ltd.

Applicant add.: 6F, Suite Shin-Okachimachi Bldg.,4-24-8, Taito, Taito-ku, Tokyo 110-0016, Japan

Product Information:

Product Name: TWS Earbuds

Model No.: YBE-190

Derivative model No.: N/A

Brand Name: N/A

Report No.: CTT2026052002R21T-01

Standards: Item 19 of Article 2 Paragraph 1

Prepared By:

Shenzhen C-link Testing & Technology Co., Ltd.

Add. : No.709, Enhai Building, No.1 Hangkong Road, Sanwei Community, Hangcheng Street, Bao 'an District, Shenzhen, Guangdong, China

Date of Receipt: May 20, 2026 Date of Test: May 20, 2026~ Jun. 02, 2026

Date of Issue: Jun. 02, 2026 Test Result: Pass

This device has been tested and found to comply with the stated standard(s) above, which is (are) applicable only to the tested sample identified in the report.

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Reviewed by: Mary Ye **Approved by:** Brown Lu

Shenzhen C-link Testing & Technology Co., Ltd. CTT *Approved*

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複製禁止

2 Test Summary

TEST	TEST REQUIREMENT	LIMIT/SEVERITY	RESULT
Antenna Requirement	Item 19 of Article 2-1	Notice 88 Appendix 43,B-1 (1)&(2)	PASS
Test frequency	Item 19 of Article 2-1	Notice 88 Appendix 43, A-3	PASS
Frequency Error	Item 19 of Article 2-1	±50 PPM or less	PASS
Occupied Bandwidth	Item 19 of Article 2-1	83.5 MHz or less	PASS
Spread-spectrum Bandwidth	Item 19 of Article 2-1	Only for reported	PASS
Antenna Power	Item 19 of Article 2-1	3 mW /MHz or less Error＋20%; 10mW Error＋20%	PASS
EIRP	Item 19 of Article 2-1	6.91dBm/MHz or less	PASS
Spurious Emission of Tx	Item 19 of Article 2-1	(1) Below 2387 MHz : -26dBm/MHz (2) 2387 to 2400 MHz : -16dBm/MHz (3) 2483.5 through 2496.5 MHz : -16dBm/MHz (4) Over 2496.5 MHz : -26dBm/MHz	PASS
Dwell Time	Item 19 of Article 2-1	less than 0.4sec	PASS
Interference prevention capability	Item 19 of Article 2-1	Notice 88 Appendix 43	PASS
RF accessibility	Item 19 of Article 2-1	Notice 88 Appendix 43	PASS
Spurious Emission of Rx	Item 19 of Article 2-1	(1) Below 1 GHz: -54dBm (2) 1GHz or higher: -47dBm	PASS
Carrier sense function	Item 19 of Article 2-1	/	N/A, Note2
Half Power Beam Angle	Item 19 of Article 2-1	/	N/A, Note3

Remark:

Note 1:EUT: In this whole report EUT means Equipment Under Test.
Tx: In this whole report Tx (or tx) means Transmitter.
Rx: In this whole report Rx (or rx) means Receiver.
RF: In this whole report RF means Radio Frequency.
Note 2: Not apply to this device of FHSS
Note3: Not apply to this device, since EIRP less than 6.91dBm/MHz

2.1 Measurement Uncertainty

The report uncertainty of measurement **y ± U**, where expended uncertainty **U** is based on a standard uncertainty Multiplied by a coverage factor of **k=2**, providing a level of confidence of approximately 95%.

No.	Item	Uncertainty
1	Frequency Error / 99% & 90% Bandwidth	± 0.85 x 10^{-7}
2	Antenna Power	± 0.70 dB
3	Spurious Emissions	± 0.80 dB
4	DC / AC Power Source	±1.4%

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3 General Information

Manufacturer:	NINGBO SINOTUO TECHNOLOGY CO., LTD.
Manufacturer Address:	Room 805, No.1 Dixintong Building, No.296 Baihe Road, High-tech Zone, Yinzhou District, Ningbo, 315100,China.
Product Name:	TWS Earbuds
Model No.:	YBE-190
Brand Name:	N/A
Derivative model No.:	N/A
Sample ID:	260520002-01
Sample(s) Quantity:	1
Operating Frequency	2402 MHz to 2480 MHz
Type of Modulation:	GFSK, (π/4)DQPSK, 8DPSK
Number of Channels	79 Channels (for FHSS)
Channel Separation:	1 MHz (for FHSS)
Dwell time	Per channel is less than 0.4s.
Antenna Type	Chip Antenna
Antenna gain:	2.78dBi
Normal antenna power:	FHSS: F1D:0.05mW/MHz, G1D: 0.05mW/MHz
Bluetooth version:	Bluetooth 6.0
Power Supply Range:	INPUT: DC5V DC 3.7V from battery
Normal Test Voltage:	The same as above
Hard Ware Version:	V1.0
Soft Ware Version:	V1.0
Model difference:	N/A

3.1 Test Location

Shenzhen C-link Testing & Technology Co., Ltd.
No.709, Enhai Building, No.1 Hangkong Road, Sanwei Community, Hangcheng Street, Bao 'an District, Shenzhen, Guangdong, China

3.2 EUT Peripheral List

No.	Equipment	Manufacturer	Model No.	Serial No.	Power cord	Signal cord
1	N/A	N/A	N/A	N/A	N/A	N/A

3.3 Test Peripheral List

No.	Equipment	Manufacturer	EMC Compliance	Model No.	Serial No.	Power cord	Signal cord
1	Computer	Lenovo	N/A	TP00076A	N/A	N/A	N/A
2	USB TO TTL	MH	N/A	MH	N/A	N/A	N/A
3	USB Line	UGREEN	N/A	USB3.0	N/A	N/A	N/A

4 Equipment Used during Test

No	Test Equipment	Manufacturer	Model No	Serial No	Cal. Date	Cal. Due Date	Cal. Lab
1	SIGNAL Analyzer	Keysight	N9020A	MY53300466	2026.01.16	2027.01.15	Guangzhou Lisai Metrology & Test Co. Ltd.
2	RF Automatic Test System	MWRFtest	MV100-RFCB	/	2026.01.16	2027.01.15	
3	Temperature and humidity recorder	Hengyang Anbiao Instrument Co., Ltd.	TH10R	17021047	2026.01.16	2027.01.15	
4	DC Source	LW	PS-305DF	210300636	2026.01.16	2027.01.15	

Remark:
(a) Calibration conducted by the National Institute of Information and Communications Technology (NICT) in Japan (hereinafter referred to as "NICT") or a designated calibration agency under Article 102-18 paragraph (1) in JRL.
(b) Correction conducted pursuant to the provisions of Article 135 or Article 144 of the Measurement Act (Act No. 51 of 1992) .

(c) Calibration conducted in countries except Japan, which shall be equivalent to the calibration conducted by the NICT or a designated calibration agency under Article 102-18 paragraph (1).
(d) Calibration, etc. conducted by using measuring instruments and other equipment listed in the right column of appended table No. 3, which shall have been given any type of calibration, etc. listed above from (a) to (C)

From JRL Article 24-2, paragraph 4, Item 2

Note：The testing equipment is calibrated using the C method.

5 Test Results

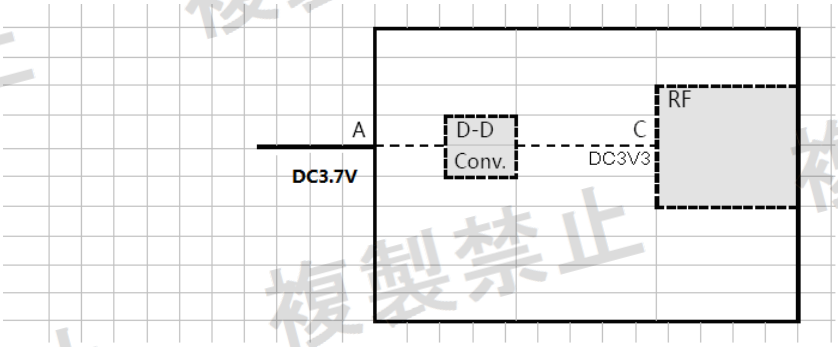
5.1 Radio Technical Requirements Specification

Tabel 1: Radio Technical Requirements Specification for 2.4 GHz band wide-band low-power data communication system (Item 19 of Article 2-1)

Items	Technical standard
Assigned frequency or designated frequency	2,400-2,483.5MHz
Communication method	One-way communication, simplex, semi-duplex, or duplex operation of digital signal transmission including spread spectrum
Tolerance of frequency ($\times 10^{-6}$)	±50
Tolerance of occupied bandwidth	FH : 83.5MHz or less FH + DS : 83.5MHz or less FH + OFDM : 83.5MHz or less OFDM : 40MHz or less Others : 26MHz or less
Antenna power	Designated value (1) FH, FH+DS , FH+OFDM: 3mW/MHz (used in the range of 2400 – 2483.5 MHz) (2) OFDM , DS other than (1) 10mW/MHz (3) Other than (1) & (2) 10mW (4) OFDM OBW 26 - 40MHz: 5mW/MHz Tolerance:+20%
Antenna gain	1) 12.14 dBi or less in principle 2) In case of directional antenna (1) FH, FH+DS or FH+OFDM using2400 – 2483.5 MHz EIRP≤ 16.91 dBm/MHz (2) OFDM or DS other than (1) EIRP≤ 22.14 dBm/MHz (3) Other than (1) and (2): 22.14 dBm or less (4) OFDM OBW 26 - 40MHz: 19.14dBm/MHz (5) Half-power angle of directional antenna (e) in case of the item 2):e ≤ 360/A (The A is 10 in maximum.)
Tolerance of spurious emission intensity	(1) Below 2387 MHz : 2.5μW/MHz (2) 2387 to 2400 MHz : 25μW/MHz (3) 2483.5 through 2496.5 MHz : 25μW/MHz (4) Over 2496.5 MHz : 2.5μW/MHz
Spreading bandwidth	Only for reported
Limit of secondary radiated emissions	(1) Below 1 GHz : 4 nW (2) 1 GHz or higher : 20 nW
Interference prevention function	Shall have the function of automatic transmission and reception of identification sign.
Structure	Shall be of the structure that the RF and modulator sections excluding antenna cannot easily be opened.
Note	DS: Direct spread FH: Frequency hopping OFDM: Orthogonal frequency division multiplexing

5.2 E.U.T. Test Conditions

Power supply: The EUT has the input voltage to the circuit of RF unit complies with output voltage limitation (±1%) against input voltage fluctuation (±10%). So, all measurements were conducted at only rated voltage DC 3.7V.



Test below:
1: The fluctuation of C point is under ±1%, when input voltage from A point to the test equipment is fluctuated by ±10%.

The measurement result of the voltage fluctuation at RF circuit when DC 3.7V +/- 10%

DC 3.7V

3.7V

4.07V

3.33V

Pre-test the EUT in all voltage mode at the DC 4.07V, DC 3.7V and DC3.33V and conducted to determine the worst-case mode, only the worst-case results (DC 3.7V) are recorded in this report.

The EUT has the input voltage to the circuit of RF unit complies with output voltage limitation (±1%) against input voltage fluctuation (±10%). So, all measurements were conducted at only rated voltage DC 3.7V.

Temperature: 5.0 -35.0 °C

Humidity: 45-85 % RH

Atmospheric Pressure: 1000 -1020 mbar

Test frequencies: If the EUT can be set to 3 of more different (carrier) frequencies in 1 allocated band, testing shall be performed using the Lowest, Middle and the Highest frequency (L, M and H). If there are 2 or fewer frequencies, testing shall be performed with the available frequencies.

EUT channels and frequencies list:

For FHSS:

Channel	Frequency (MHz)	Channel	Frequency (MHz)	Channel	Frequency (MHz)
0	2402	27	2429	54	2456
1	2403	28	2430	55	2457
2	2404	29	2431	56	2458
3	2405	30	2432	57	2459
4	2406	31	2433	58	2460
5	2407	32	2434	59	2461
6	2408	33	2435	60	2462
7	2409	34	2436	61	2463
8	2410	35	2437	62	2464
9	2411	36	2438	63	2465
10	2412	37	2439	64	2466
11	2413	38	2440	65	2467
12	2414	39	2441	66	2468
13	2415	40	2442	67	2469
14	2416	41	2443	68	2470
15	2417	42	2444	69	2471
16	2418	43	2445	70	2472
17	2419	44	2446	71	2473
18	2420	45	2447	72	2474
19	2421	46	2448	73	2475
20	2422	47	2449	74	2476
21	2423	48	2450	75	2477
22	2424	49	2451	76	2478
23	2425	50	2452	77	2479
24	2426	51	2453	78	2480
25	2427	52	2454	/	/
26	2428	53	2455	/	/

Test frequencies are the lowest channel: 0 channel(2402 MHz), middle channel: 39 channel(2441 MHz) and highest channel: 78 channel(2480 MHz)

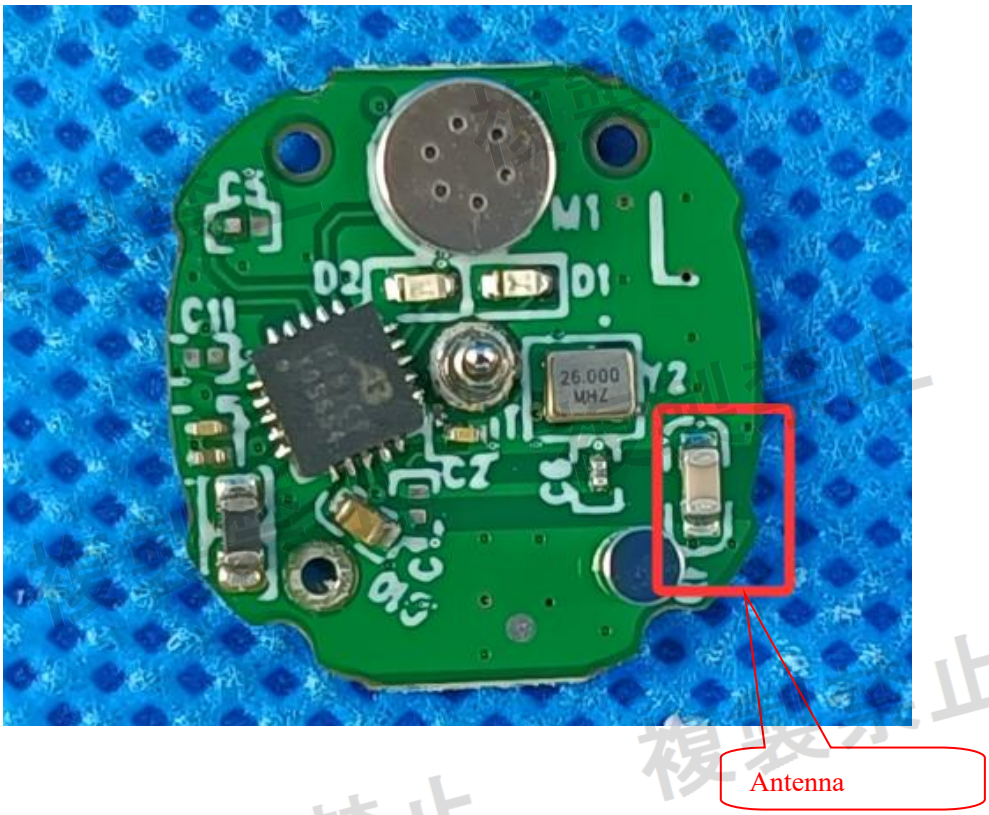
5.3 Antenna Requirement

Standard requirement

Applicable for equipment with an antenna terminal, including testing terminals) If an antenna connector is available, all relevant tests will be carried out conducted. If not, tests will be carried out in an anechoic room or with a suitable test-fixture.

EUT Antenna

The antenna is integrated on the main PCB and no consideration of replacement. The best case gain of the antenna is 2.78dBi



Result: All relevant tests will be carried out conducted.

5.4 Interference Prevention Function

LIMIT

Item	Limits
Identification code	≧48 bits

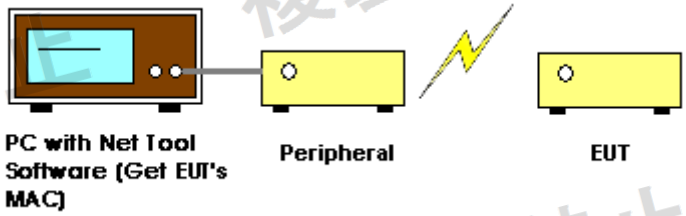
MEASURING ID CODE SOFTWARE

Item	Limits
MAC IP List	MAC Scan

TEST PROCEDURES

1. In the case that the EUT has the function of automatically transmitting the identification code:
   a. Transmit the predetermined identification codes form EUT.
   b. Check the transmitted identification codes with the demodulator.
2. In the case of receiving the identification ocde:
   a. Transmit thepredetermined identification codes form the counterpart.
   b . Check if communicationis normal.
   c. Transmit the signals other than predetermined ID codes form the counterpart.
   d. check if the EUT stops the transmission, or if it displays that idnetification codes are different from the predetermined ones.

TEST SETUP LAYOUT



TEST DEVIATION

There is no deviation with the original standard.

EUT OPERATION DURING TEST

The EUT was programmed to be in normal transmitting mode.

TEST RESULT OF RADIO INTERFERENCE PREVENTION CAPABILIT

EUT:	TWS Earbuds	Test Date:	2026/05/29
Temperature:	25^{0}C	Tested by:	Renny
Humidity:	55 % RH	Test result:	CONFORM
Atmospheric Pressure:	1013 mbar		

MAC Address: 52: 1B: 44: 01:A3: D5

5.5 Frequency Error

Test Requirement: Item 19 of Article 2-1

Tolerance of frequency: $\pm 50\times 10^{-6}$

Temperature: 23.0 °C

Humidity: 55 % RH

Atmospheric Pressure: 1013 mbar

Test Status: Test the EUT in transmitting mode without modulation.

Test Configuration:

Test Procedure:

1. Test Conditions:

   Frequency Counter or Spectrum Analyzer is used for measurement.

2. EUT conditions:

   Modulation/Spread/Hopping OFF, CW Tx

3. Spectrum Analyzer conditions:

   Frequency: Test Frequency
   Span 1MHz
   RBW 10 kHz (Modulation OFF for FHSS; Modulation ON for DSSS),
   VBW 30 kHz (Modulation OFF for FHSS; Modulation ON for DSSS),
   Sweep Time Auto
   Detector mode Positive peak
   Indication mode Max hold

Test result:
For FHSS:

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Lowest	2402.0	2402.014	2402.014	2402.014	MHz	±50 PPM or less
		+5.83	+5.83	+5.83	PPM	
Middle	2441.0	2441.014	2441.014	2441.014	MHz	
		+5.74	+5.74	+5.74	PPM	
Highest	2480.0	2480.014	2480.014	2480.014	MHz	
		+5.65	+5.65	+5.65	PPM	

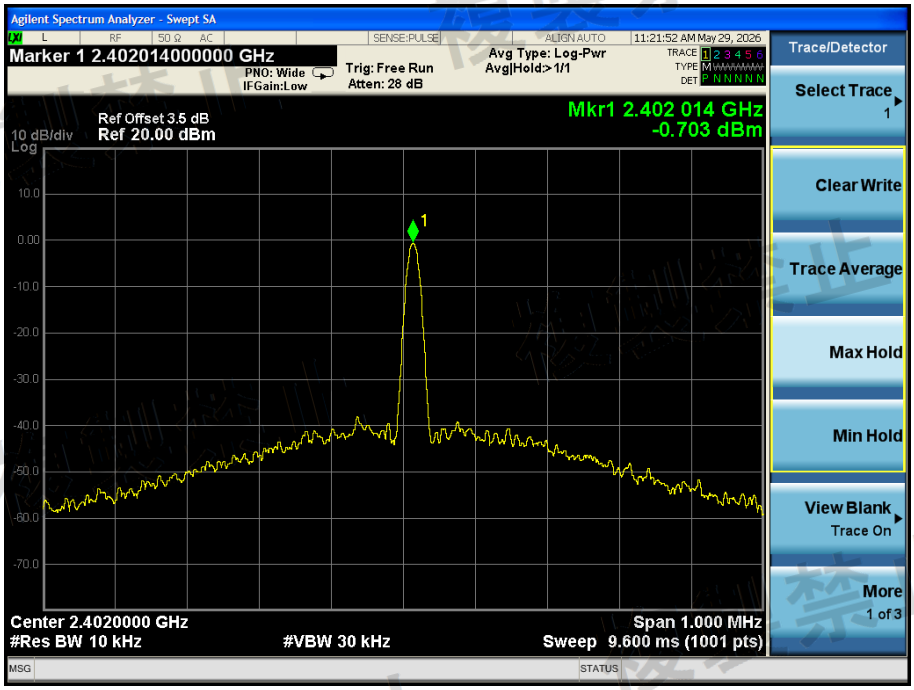
Note: The nominal frequency shall be confirmed by the applicant and test lab.

All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

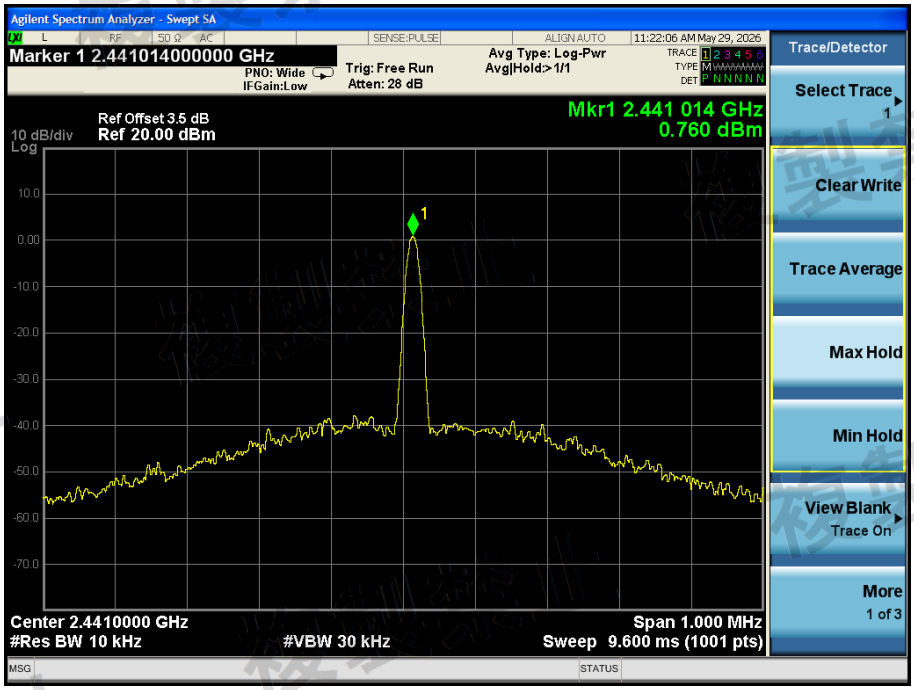
Result plot as follows:

For FHSS:

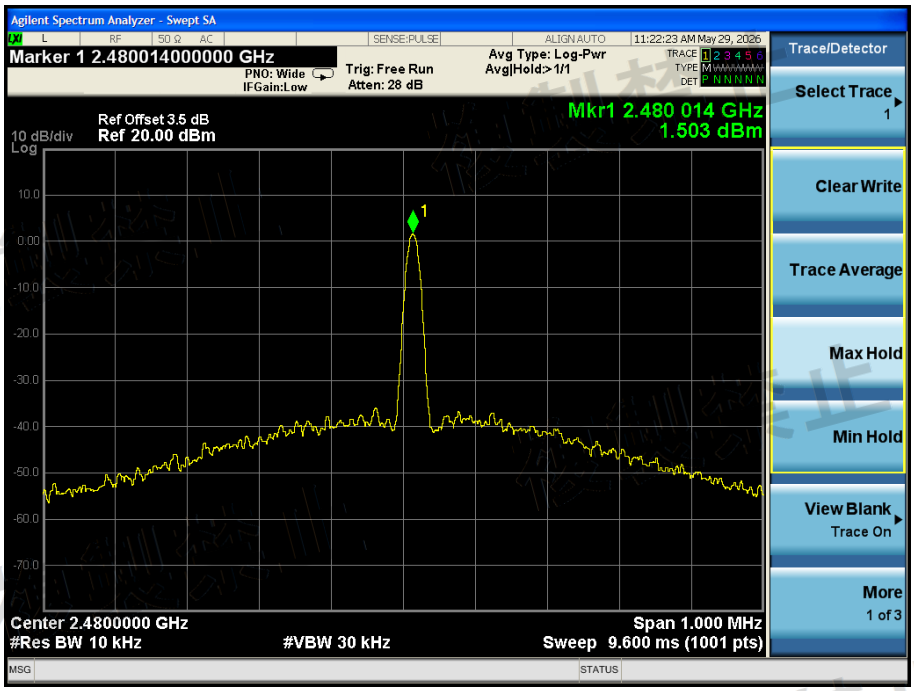
Channel 0: 2.402 GHz:



Channel 39: 2.441 GHz:



Channel 78: 2.480 GHz



Test result: The unit does meet the requirements.

5.6 Occupied Bandwidth (99%)

Test Requirement:	Item 19 of Article 2-1
	83.5MHz or less(FHSS)
Temperature:	23.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	1013 mbar
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:

Test Procedure:

1. Test Conditions:
   Spectrum Analyzer is used for measurement.
2. EUT conditions:
   Modulation/Spread/Hopping ON, PC Modulation Tx
   For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:
   Frequency: Test Frequency
   Span: 83.5 MHz(FHSS), 5MHz(DSSS)
   RBW: 1 MHz(FHSS), 300 kHz(DSSS)
   VBW: 1 MHz(FHSS), 300 kHz(DSSS)
   Sweep Time Auto
   detector mode Positive peak
   Indication mode Max hold
   OBW 99%

Test result:

For FHSS:

BR mode (GFSK):

Test channels	Test Result			Unit	Limit
	Normal Voltage	High Voltage	Low Voltage		
	3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	78.684	78.683	78.681	MHz	83.5 MHz or less

EDR mode (π/4)DQPSK

Test channels	Test Result			Unit	Limit
	Normal Voltage	High Voltage	Low Voltage		
	3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	78.726	78.724	78.724	MHz	83.5 MHz or less

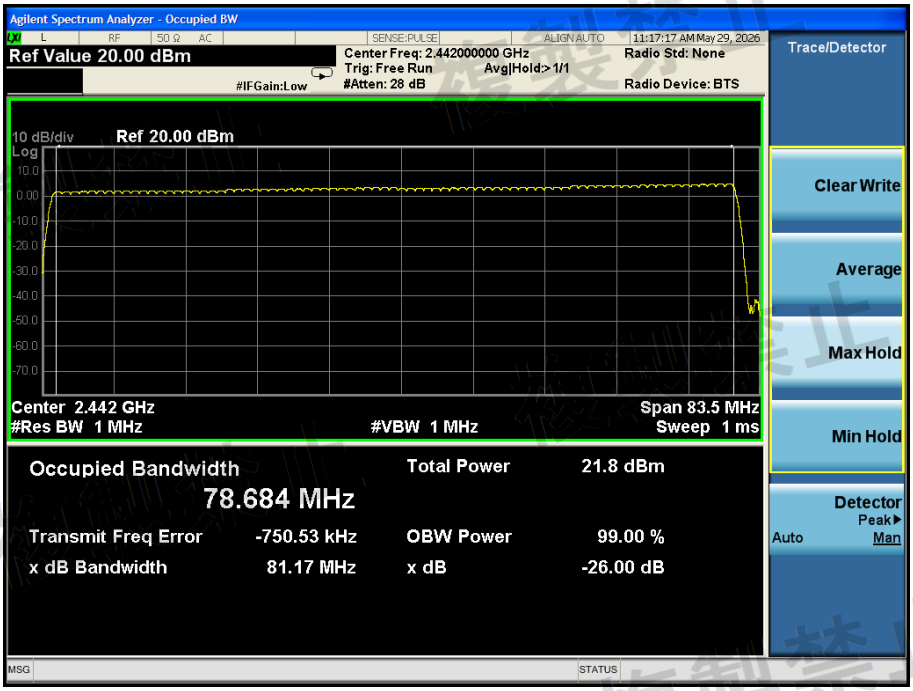
EDR mode (8DPSK):

Test channels	Test Result			Unit	Limit
	Normal Voltage	High Voltage	Low Voltage		
	3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	78.742	78.740	78.742	MHz	83.5 MHz or less

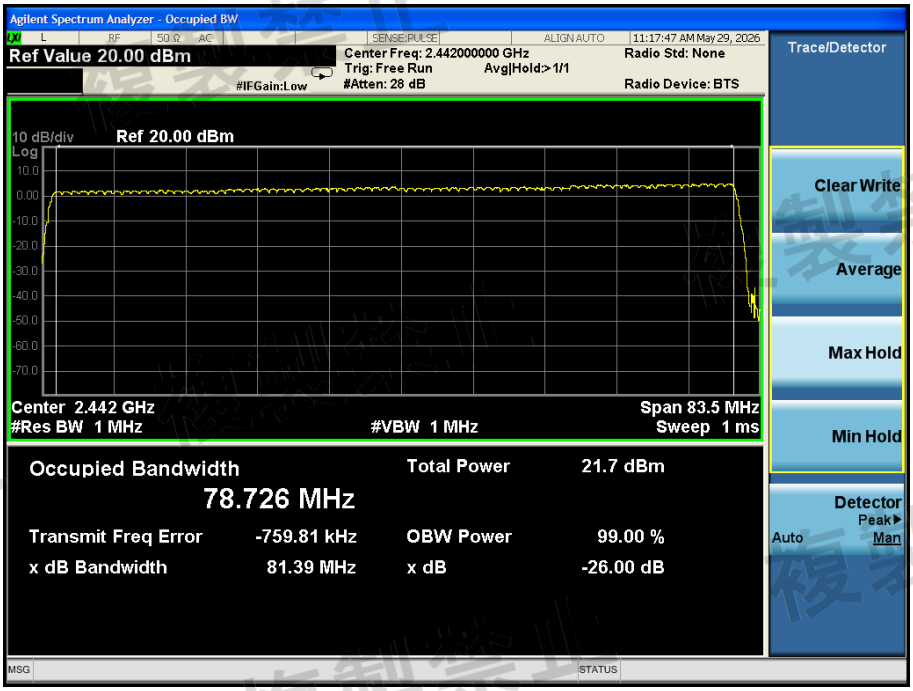
All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

Result plot as follows:

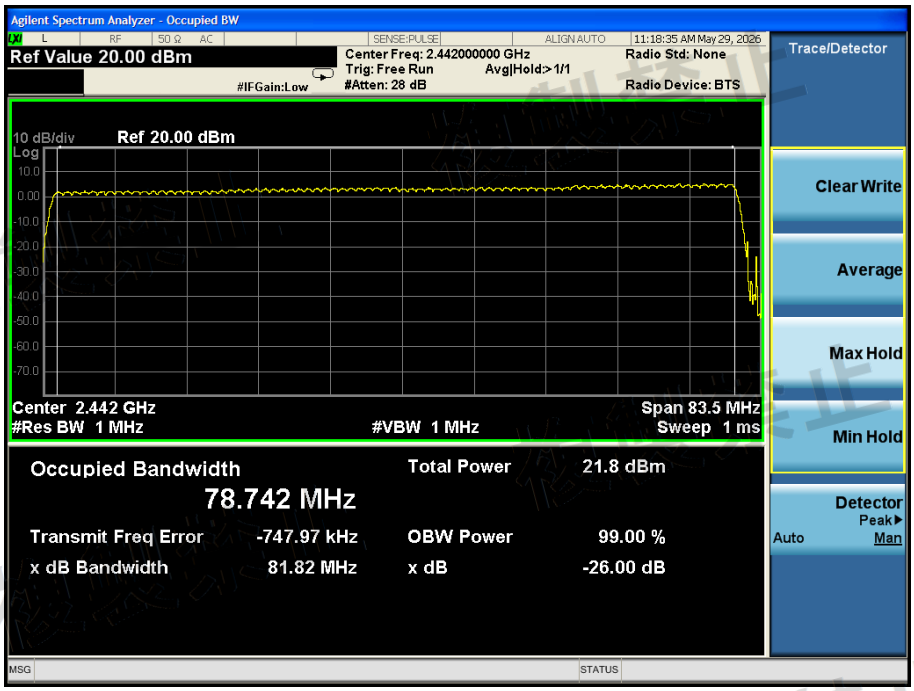
For FHSS:BDR mode (GFSK):



EDR mode (π/4)DQPSK:



EDR mode (8DPSK):



Test result: The unit does meet the requirements.

5.7 Spread Spectrum Bandwidth (90%)

Test Requirement:	Item 19 of Article 2-1
Temperature:	23.0 °C
Humidity:	55 % RH
Atmospheric Pressure:	1013 mbar
Test Status:	Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:

Test Procedure:

1. Test Conditions:

   Spectrum Analyzer is used for measurement.

2. EUT conditions:

   Modulation/Spread/Hopping ON, PC Modulation Tx

   For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.

3. Spectrum Analyzer conditions:

   Frequency: Test Frequency
   Span: 83.5 MHz(FHSS), 5MHz(DSSS)
   RBW: 1 MHz(FHSS), 300 kHz(DSSS)
   VBW: 1 MHz(FHSS), 300 kHz(DSSS)
   Sweep Time Auto
   detector mode Positive peak
   Indication mode Max hold

   OBW 90%

Test result:

For FHSS:

BDR mode (GFSK):

Test channels	Test Result			Unit
	Normal Voltage	High Voltage	Low Voltage	
	3.7V DC	4.07V DC	3.33V DC	
79 channels (2402~2480 MHz)	71.185	71.181	71.184	MHz

EDR mode (π/4)DQPSK:

Test channels	Test Result			Unit
	Normal Voltage	High Voltage	Low Voltage	
	3.7V DC	4.07V DC	3.33V DC	
79 channels (2402~2480 MHz)	71.246	71.242	71.245	MHz

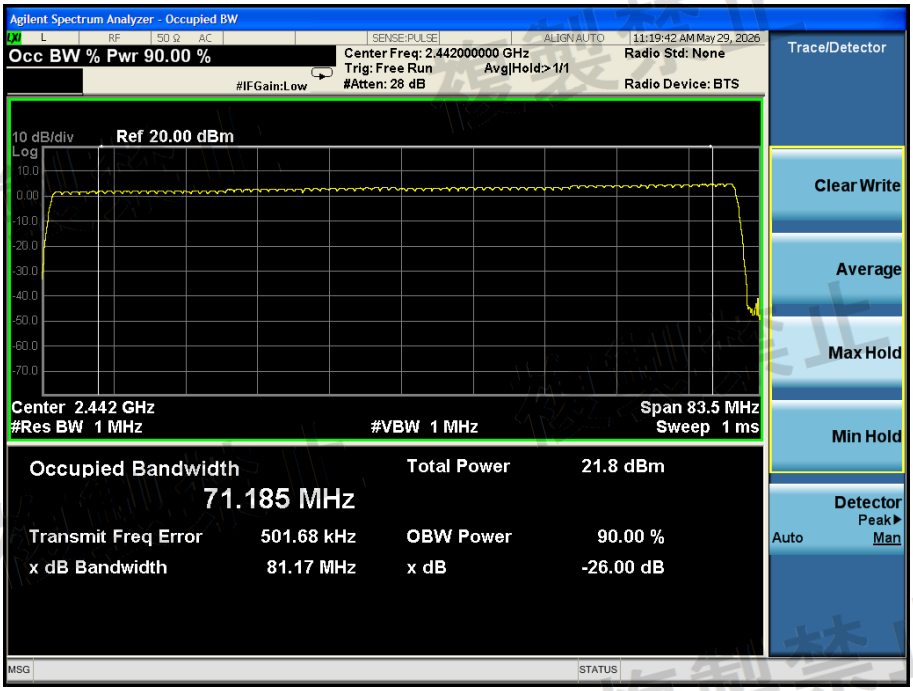
EDR mode (8DPSK):

Test channels	Test Result			Unit
	Normal Voltage	High Voltage	Low Voltage	
	3.7V DC	4.07V DC	3.33V DC	
79 channels (2402~2480 MHz)	71.158	71.152	71.155	MHz

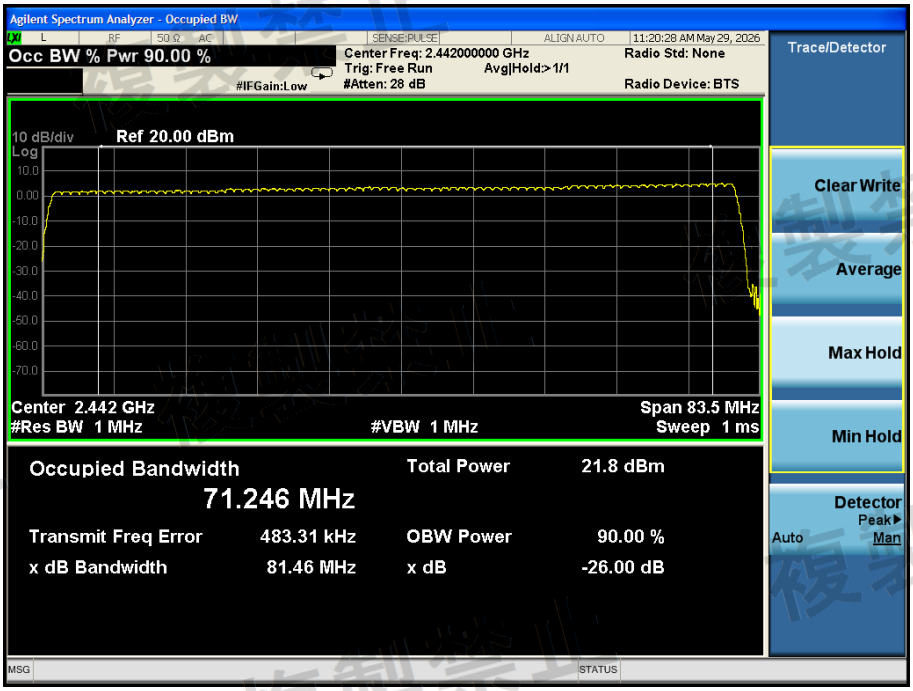
All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

Result plot as follows:

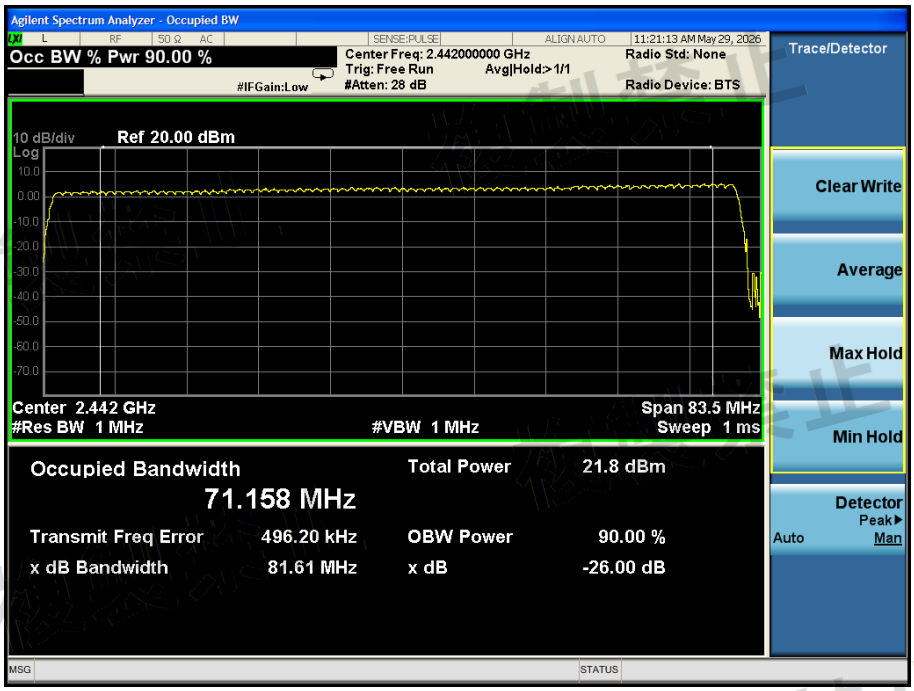
For FHSS:BDR mode (GFSK):



For FHSS: EDR mode (π/4)DQPSK:



For FHSS: EDR mode (8DPSK):



Test result: The unit does meet the requirements.

5.8 Antenna Power

Test Requirement: Item 19 of Article 2-1
3 mW/MHz or less(FHSS)

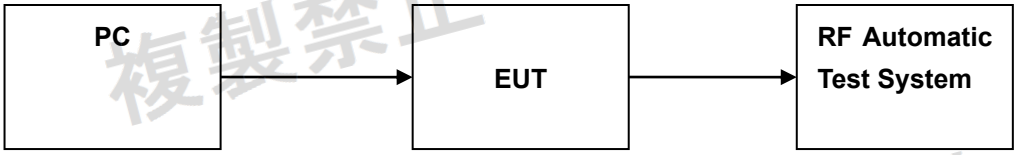
Temperature: 23.0 °C

Humidity: 55 % RH

Atmospheric Pressure: 1013 mbar

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

The EUT was directly connected to the RF Automatic Test System and antenna output port as show in the block diagram above.

Test result:

For FHSS:

Normal Voltage 3.7V DC

Frequency MHz	Total power (dBm)	Total Power (mW)	SBW MHz	Antenna Power (mW/MHz)	Rated output Power (mW/MHz)	Antenna Power (mW/MHz)	Antenna Power Tolerance(%)	
						Limit	Result	Limit
GFSK(1Mbps)								
2402-2480 DH5	4.223	2.644	71.185	0.037	0.05	3	-26.0%	＋20%
π/4/DQPSK(2Mbps)								
2402-2480 2DH5	3.954	2.485	71.246	0.035	0.05	3	-30.0%	＋20%
8DPSK (3Mbps)								
2402-2480 3DH5	4.447	2.784	71.158	0.039	0.05	3	-22.0%	＋20%

Test Frequency (MHz)	Test Result		Limit (dBm/MHz)
	Normal Voltage 3.7V DC		
	Antenna Power (dBm/MHz)	EIRP Power (dBm/MHz)	
2402-2480 DH5	-14.32	-11.54	6.91
2402-2480 2DH5	-14.56	-11.78	
2402-2480 3DH5	-14.09	-11.31	

Remark:

EIRP= Antenna Power+ Antenna Gain

Antenna Gain=2.78dBi

Antenna Power= Total power /spread bandwidth

Normal antenna power: BR&EDR: F1D:0.05mW/MHz, G1D:0.05 mW/MHz

High Voltage 4.07V DC

Frequency MHz	Total power (dBm)	Total Power (mW)	SBW MHz	Antenna Power (mW/MHz)	Rated output Power (mW/MHz)	Antenna Power (mW/MHz)	Antenna Power Tolerance(%)	
						Limit	Result	Limit
GFSK(1Mbps)								
2402-2480 DH5	4.156	2.604	71.181	0.037	0.05	3	-26.0%	＋20%
π/4/DQPSK(2Mbps)								
2402-2480 2DH5	3.911	2.461	71.242	0.035	0.05	3	-30.0%	＋20%
8DPSK (3Mbps)								
2402-2480 3DH5	4.423	2.769	71.152	0.039	0.05	3	-22.0%	＋20%

Test Frequency (MHz)	Test Result		Limit (dBm/MHz)
	Normal Voltage 3.7V DC		
	Antenna Power (dBm/MHz)	EIRP Power (dBm/MHz)	
2402-2480 DH5	-14.32	-11.54	6.91
2402-2480 2DH5	-14.56	-11.78	
2402-2480 3DH5	-14.09	-11.31	

Remark:

EIRP= Antenna Power+ Antenna Gain

Antenna Gain=2.78dBi

Antenna Power= Total power /spread bandwidth

Normal antenna power: BR&EDR: F1D:0.05mW/MHz, G1D:0.05 mW/MHz

Low Voltage 3.33V DC

Frequency MHz	Total power (dBm)	Total Power (mW)	SBW MHz	Antenna Power (mW/MHz)	Rated output Power (mW/MHz)	Antenna Power (mW/MHz)	Antenna Power Tolerance(%)	
						Limit	Result	Limit
GFSK(1Mbps)								
2402-2480 DH5	4.007	2.516	71.184	0.035	0.05	3	-30.0%	＋20%
π/4/DQPSK(2Mbps)								
2402-2480 2DH5	3.876	2.441	71.245	0.034	0.05	3	-32.0%	＋20%
8DPSK (3Mbps)								
2402-2480 3DH5	4.114	2.579	71.155	0.036	0.05	3	-28.0%	＋20%

Test Frequency (MHz)	Test Result		Limit (dBm/MHz)
	Normal Voltage 3.7V DC		
	Antenna Power (dBm/MHz)	EIRP Power (dBm/MHz)	
2402-2480 DH5	-14.56	-11.78	6.91
2402-2480 2DH5	-14.69	-11.91	
2402-2480 3DH5	-14.44	-11.66	

Remark:

EIRP= Antenna Power+ Antenna Gain

Antenna Gain=2.78dBi

Antenna Power= Total power /spread bandwidth

Normal antenna power: BR&EDR: F1D:0.05mW/MHz, G1D:0.05 mW/MHz

5.9 Spurious Emissions of Tx

Test Requirement: Item 19 of Article 2-1

(1) 30 to 1000 MHz : 2.5μW/MHz(-36dBm/100kHz)
(2) 1000 to 2387 MHz : 2.5μW/MHz(-26dBm/MHz)
(3) 2387 to 2400 MHz : 25μW/MHz(-16dBm/MHz)
(4) 2483.5 through 2496.5 MHz : 25μW/MHz(-16dBm/MHz)
(5) Over 2496.5 MHz : 2.5μW/MHz(-26dBm/MHz)

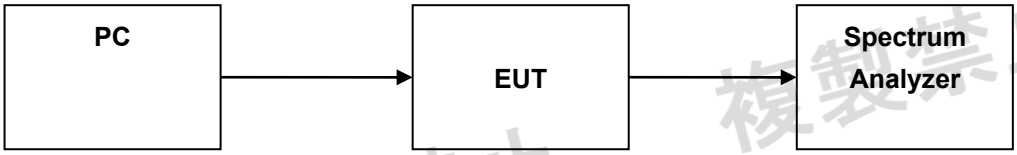
Temperature: 23.0 °C

Humidity: 55 % RH

Atmospheric Pressure: 1013 mbar

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:



Test Procedure:

1. Test Conditions:
   Spectrum Analyzer is used for measurement.
2. EUT conditions:
   Modulation/Spread/Hopping ON, , PC Modulation Tx
   For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:
   Step 1
   All spurious are measured from 30 MHz to 13 GHz by peak mode.
   Step 2
   IF the value measured by Step1 is 2 dB or less, measure in average mode.
   Test setup for Step 1:
   Frequency: 30 MHz – 1000 MHz,
   RBW 100 kHz (Below 1000 MHz), VBW 100 kHz (Below 1000 MHz)
   1000 MHz – 2400 MHz, 2483.5 MHz –13 GHz
   RBW 1 MHz (above 1000 MHz), VBW 1 MHz (above 1000 MHz)
   Sweep Time Auto
   detector mode Positive peak, Indication mode Max hold
   Test setup for Step 2:
   Frequency: Spurious Frequency
   RBW 100 kHz (Below 1000 MHz), VBW 100 kHz (Below 1000 MHz)
   RBW 1 MHz (above 1000 MHz), VBW 1 MHz (above 1000 MHz)
   Sweep Time Auto,
   Detector mode Sample, Indication mode Max hold

Test result:

BR mode (GFSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 0 (2402MHz)	869.123	-66.300	-66.112	-66.065	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	2385.99	-64.110	-64.022	-64.045		
	2399.896	-37.228	-37.084	-37.116		
	2483.947	-64.294	-64.129	-64.088		
	4804.38	-41.378	-41.056	-41.165		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 39 (2441MHz)	869.099	-65.806	-65.774	-65.654	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1870.45	-63.251	-63.112	-63.053		
	2389.189	-63.196	-63.088	-63.032		
	2493.019	-62.224	-62.096	-62.112		
	4882.37	-36.174	-36.109	-36.014		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 78 (2480MHz)	869.123	-69.493	-69.265	-69.321	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1875.82	-65.017	-65.010	-64.887		
	2398.150	-66.502	-66.176	-66.327		
	2484.786	-42.815	-42.552	-42.221		
	4960.62	-38.986	-38.743	-38.665		

EDR mode (π4)DQPSK:

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 0 (2402MHz)	869.171	-66.870	-66.240	-66.338	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1877.97	-64.129	-64.109	-64.065		
	2399.997	-33.804	-33.554	-33.421		
	2483.656	-65.181	-65.043	-65.022		
	4804.38	-46.857	-46.457	-46.667		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 39 (2441MHz)	869.123	-65.888	-65.267	-65.386	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1875.16	-66.160	-66.111	-66.104		
	288.309	-62.252	-62.066	-62.115		
	2493.377	-60.536	-60.432	-60.227		
	4882.90	-41.373	-41.321	-41.054		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 78 (2480MHz)	869.196	-64.904	-64.854	-64.666	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1873.78	-66.507	-66.443	-66.212		
	2397.665	-66.617	-66.332	-66.211		
	2483.525	-38.514	-38.098	-38.221		
	4960.36	-38.409	-38.053	-38.165		

EDR mode (8DPSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 0 (2402MHz)	869.147	-63.164	-63.009	-63.012	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	2386.55	-65.461	-65.422	-65.226		
	2399.993	-28.885	-28.564	-28.621		
	2492.887	-65.675	-65.336	-65.257		
	4804.38	-46.419	-46.116	-46.061		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 39 (2441MHz)	869.196	-68.066	-68.009	-67.556	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	2363.84	-67.665	-67.156	-67.443		
	2388.717	-62.140	-62.106	-62.021		
	2492.739	-60.477	-60.156	-60.223		
	4882.90	-42.343	-42.086	-42.225		

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Channel 78 (2480MHz)	869.147	-67.329	-67.309	-67.116	dBm/ MHz	(1)30 to 1000 MHz:-36dBm/100kHz (2)1000 to 2387 MHz:-26dBm/MHz (3)2387 to 2400 MHz :-16dBm/MHz (4)2483.5 to 2496.5 MHz : -16dBm/MHz (5)Over 2496.5 MHz: -26dBm/MHz
	1875.82	-66.270	-66.054	-66.156		
	2394.135	-67.016	-67.003	-66.668		
	2483.651	-33.184	-33.133	-33.076		
	4960.62	-38.628	-38.447	-38.267		

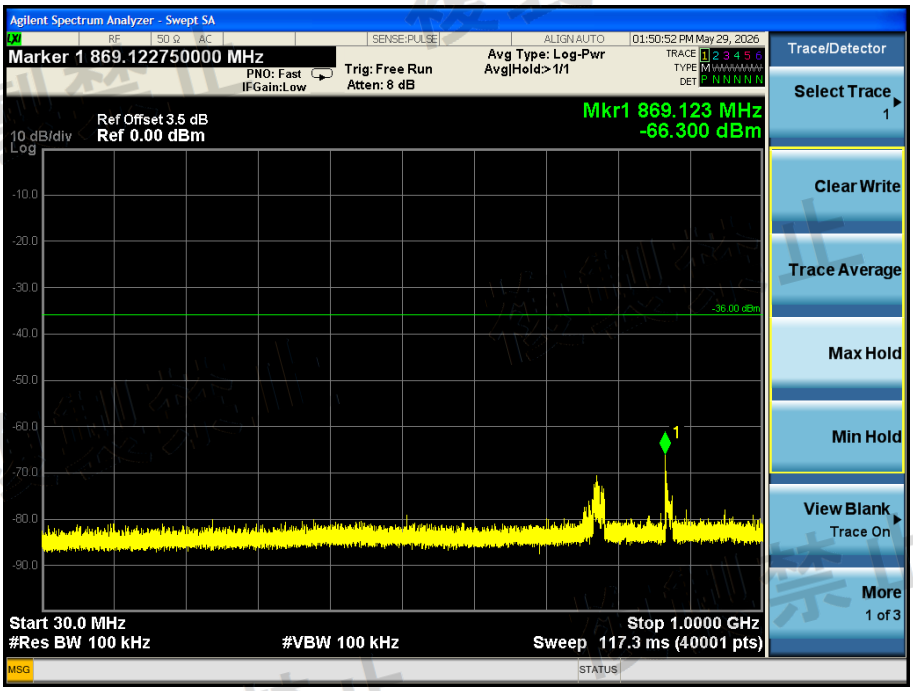
All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

Result plot as follows:

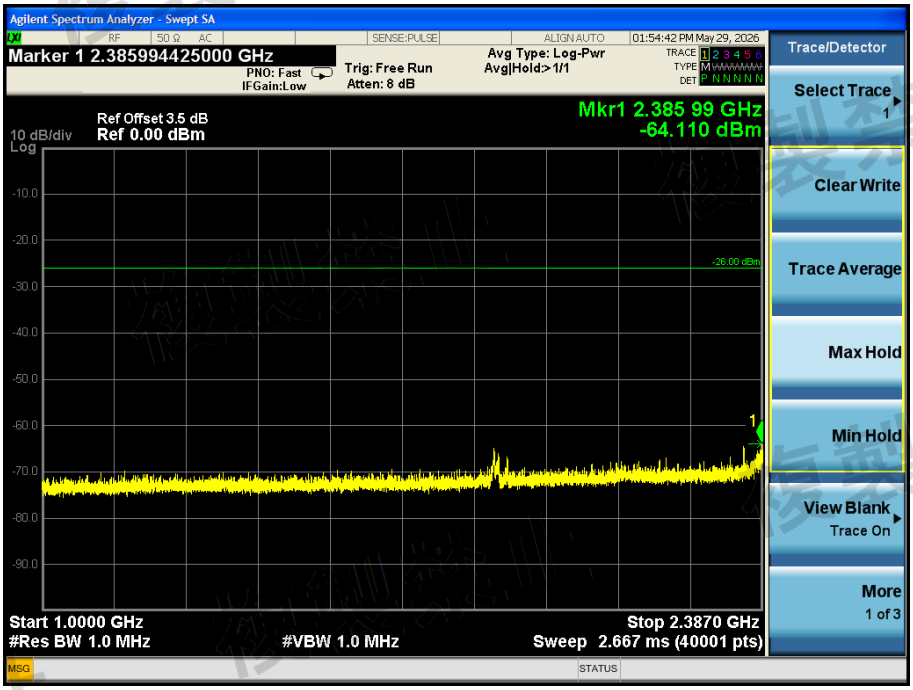
BDR mode (GFSK):

Channel 0: 2.402 GHz:

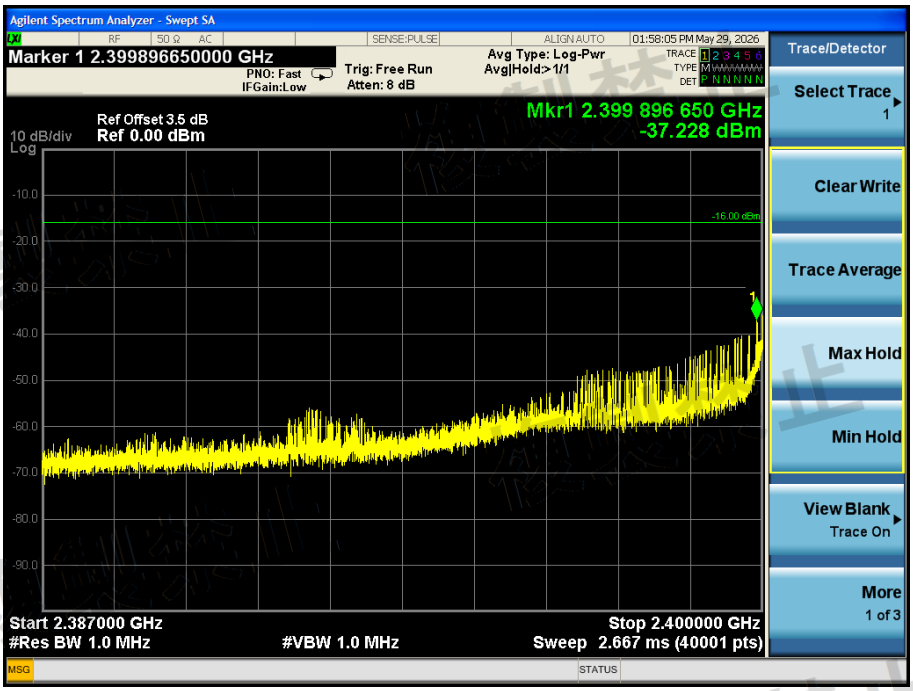
30 MHz to 1000 MHz:



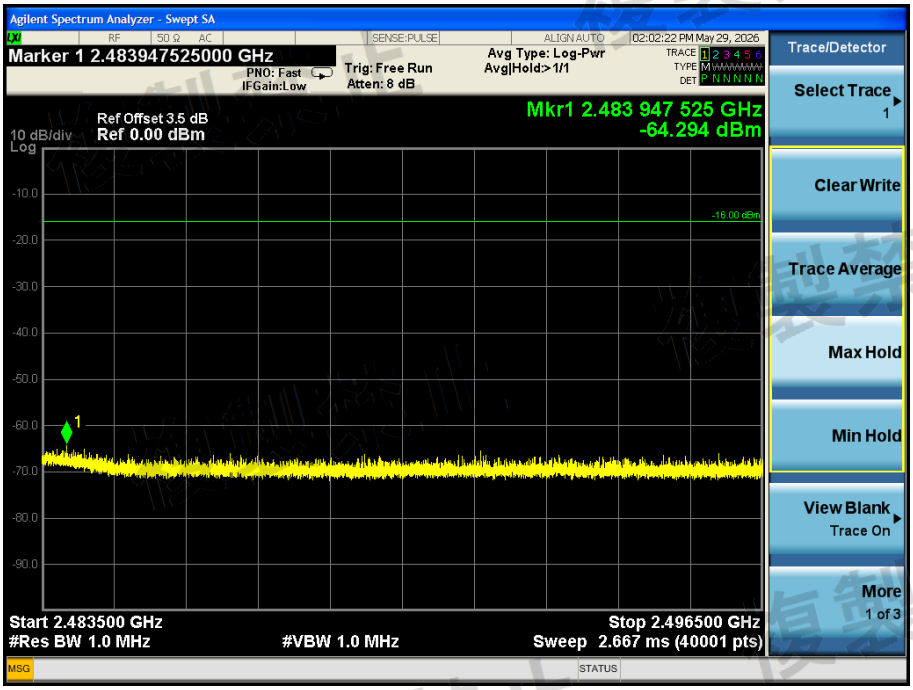
1000 MHz to 2387 MHz:



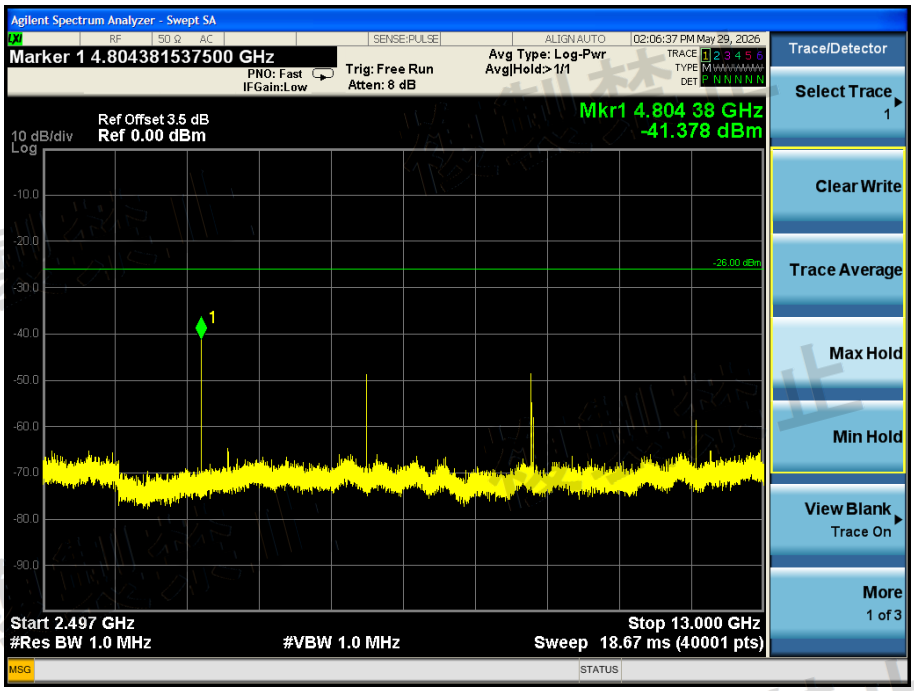
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

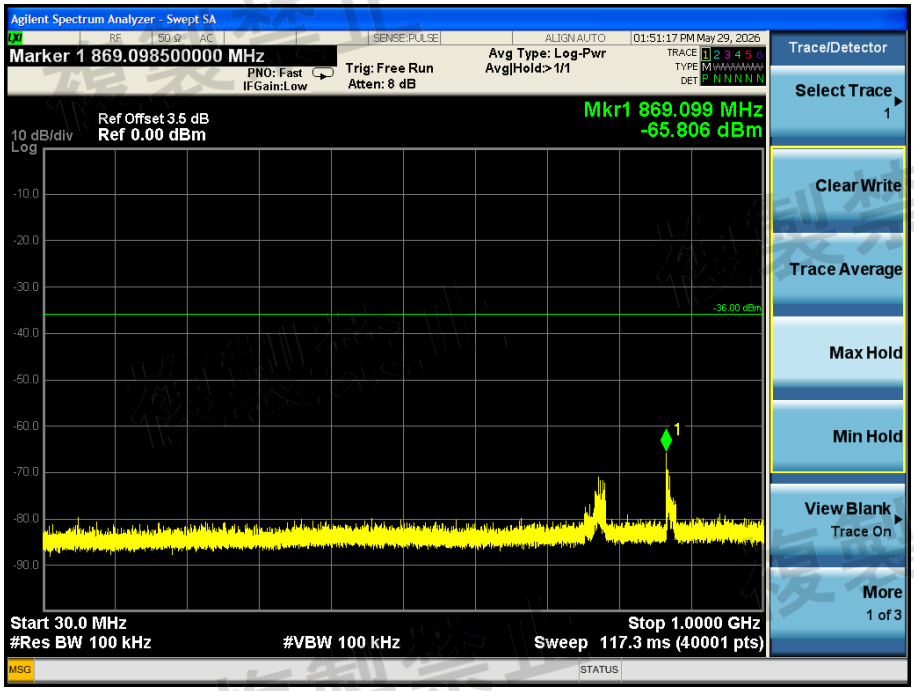


2496.5 MHz to 13 GHz:

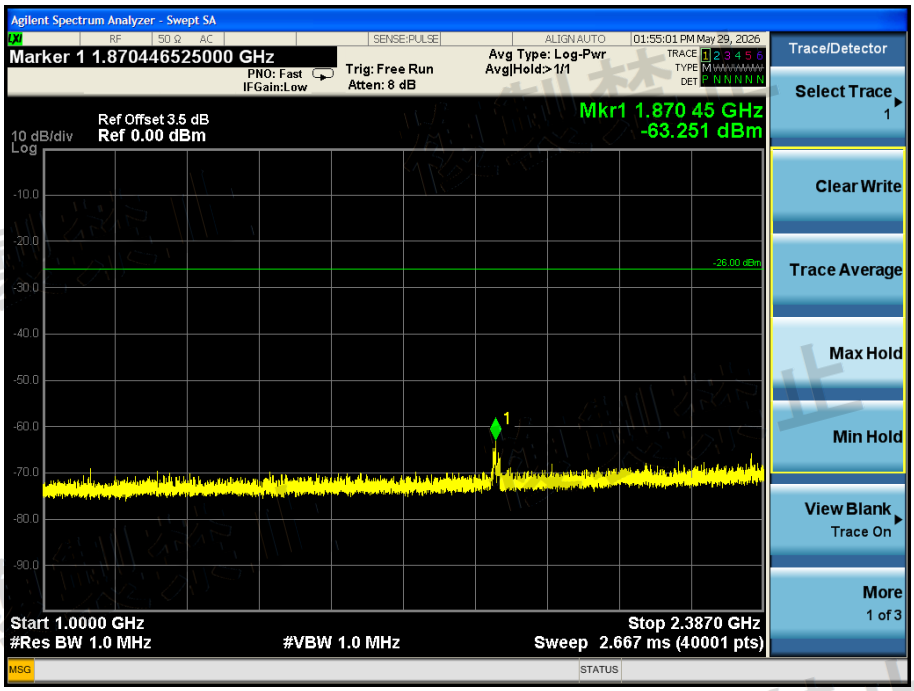


Channel 39: 2.441 GHz:

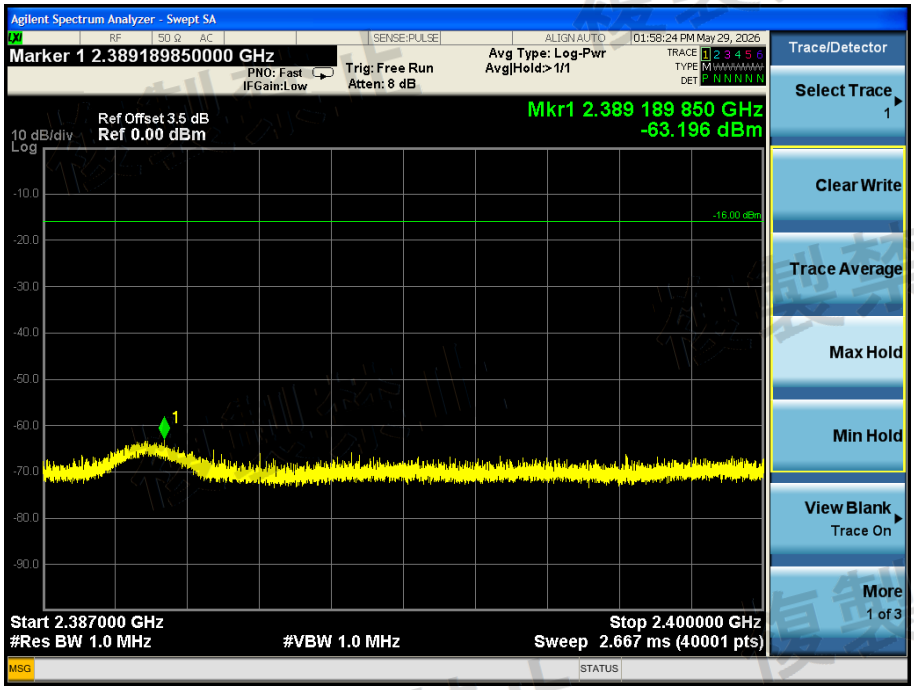
30 MHz to 1000 MHz:



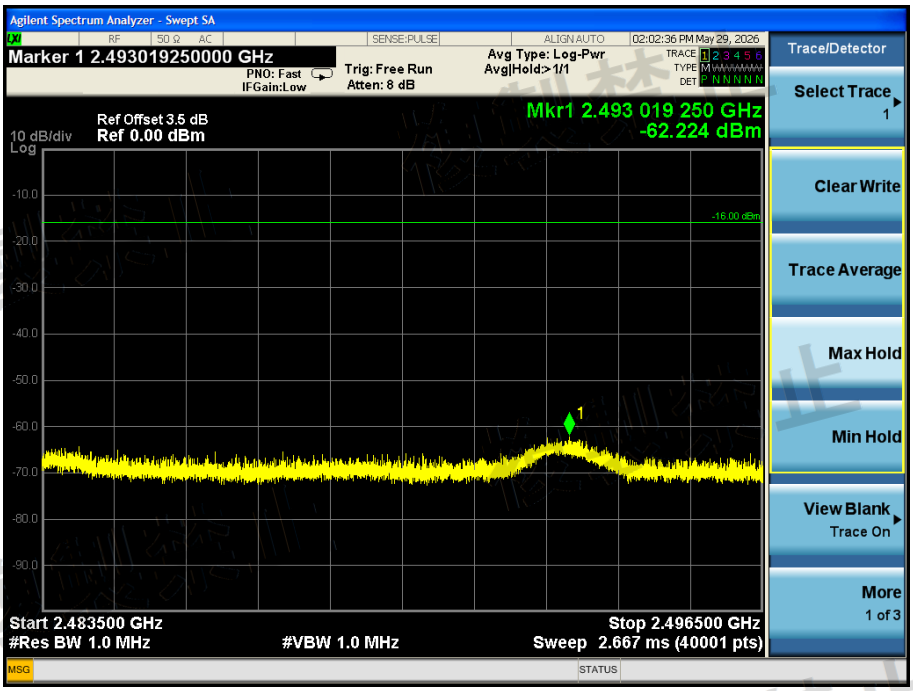
1000 MHz to 2387 MHz:



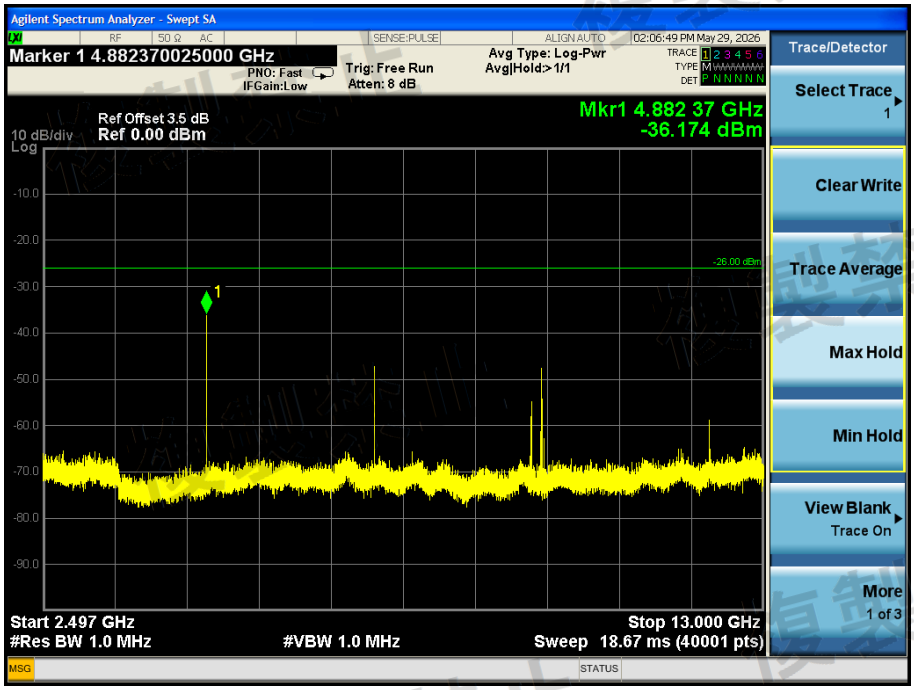
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

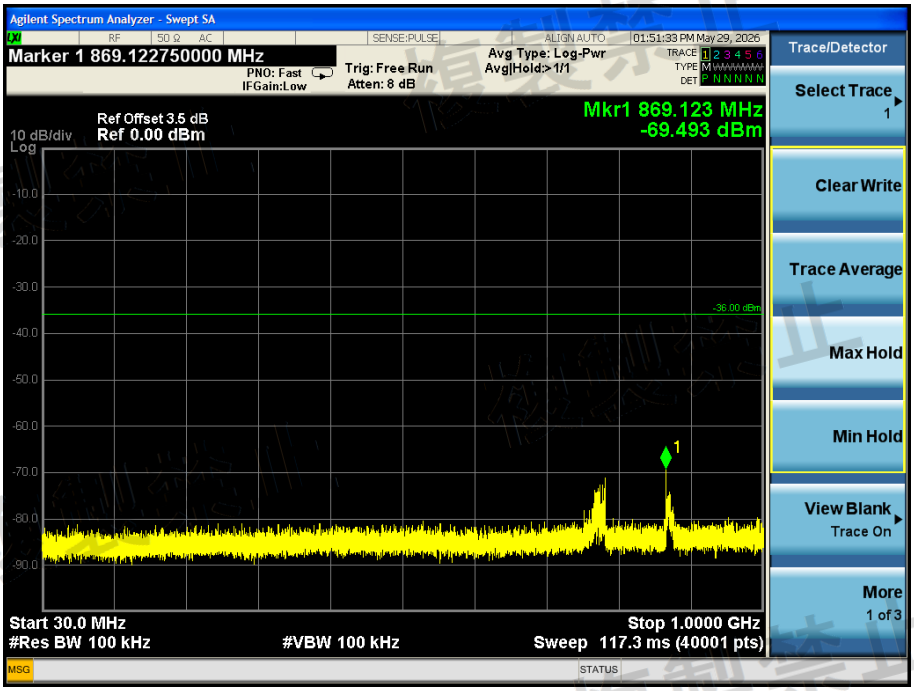


2496.5 MHz to 13 GHz:

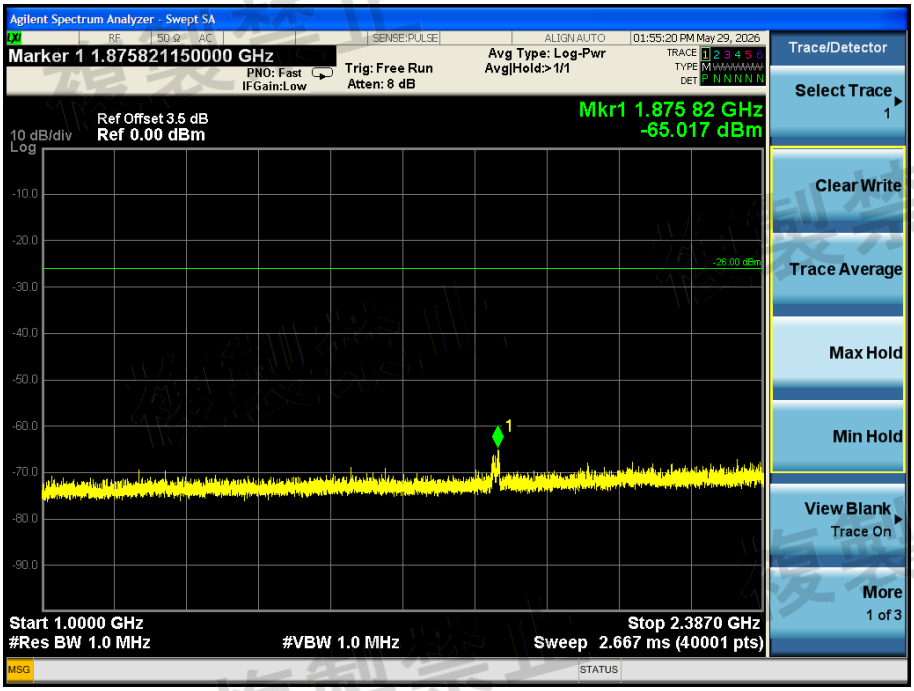


Channel 78: 2.480 GHz

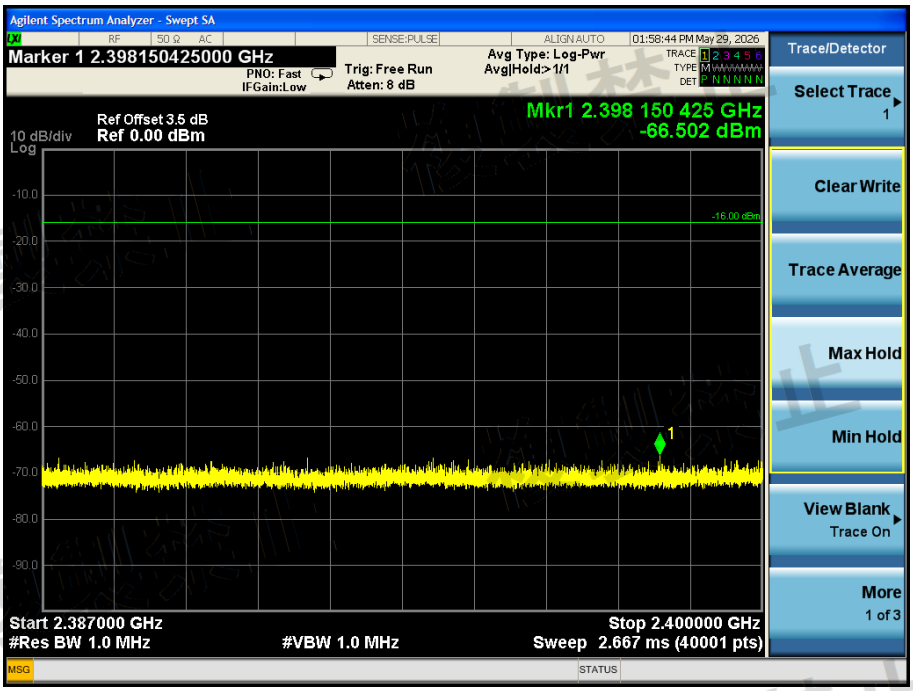
30 MHz to 1000 MHz:



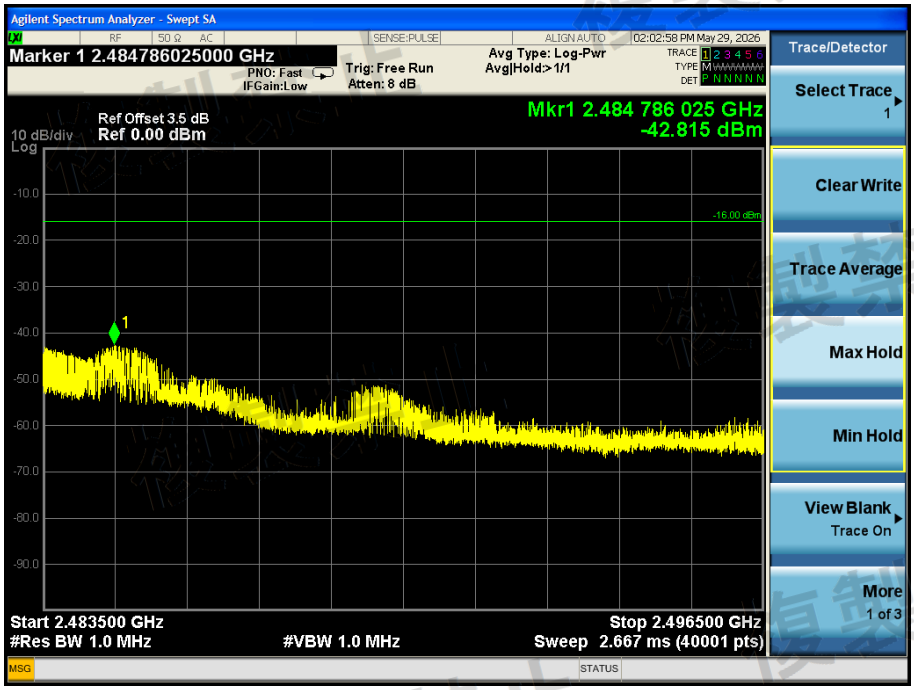
1000 MHz to 2387 MHz:



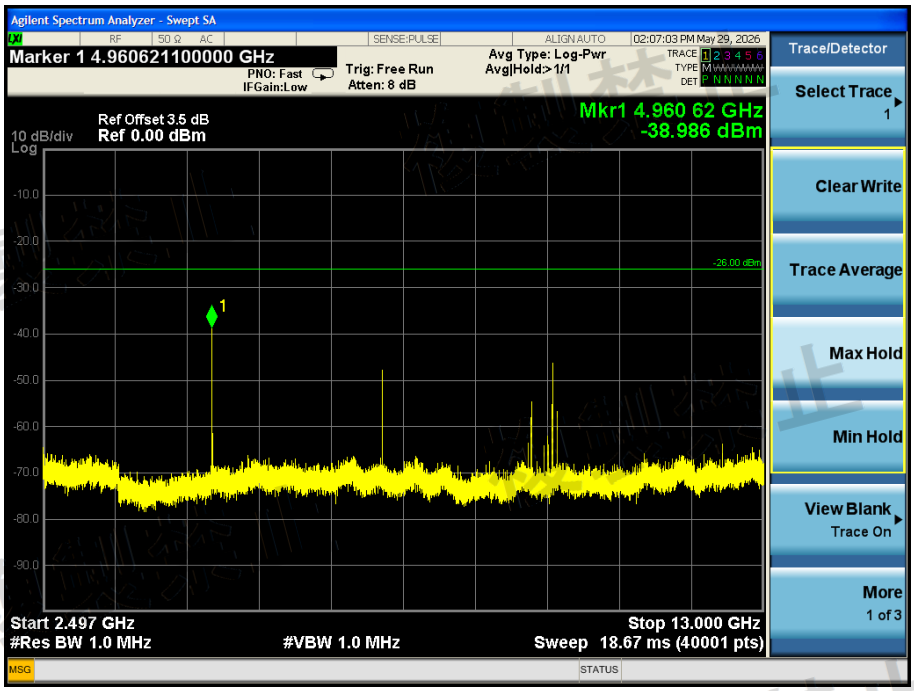
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

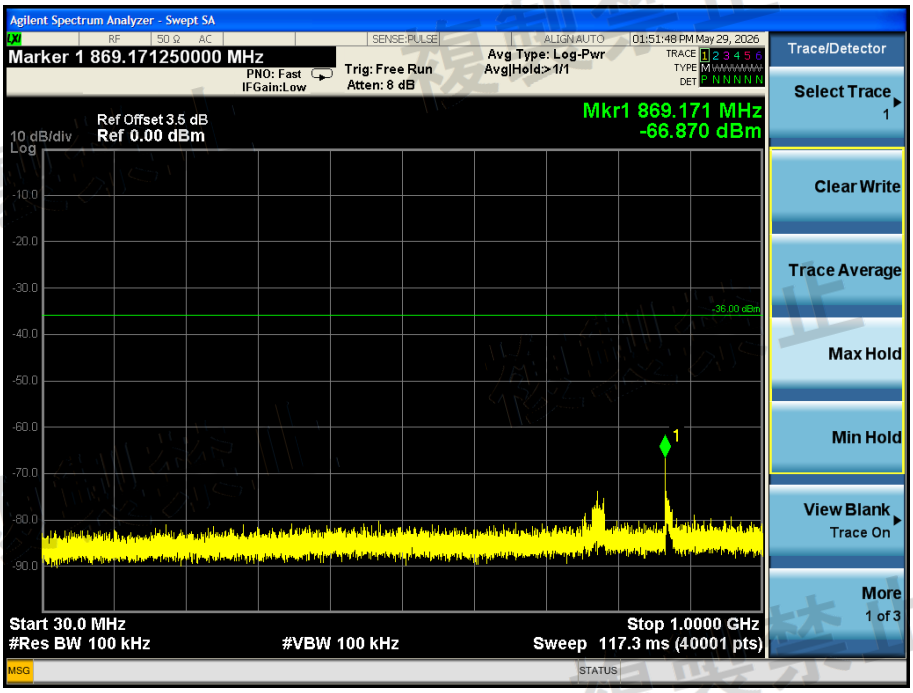


2496.5 MHz to 13 GHz:

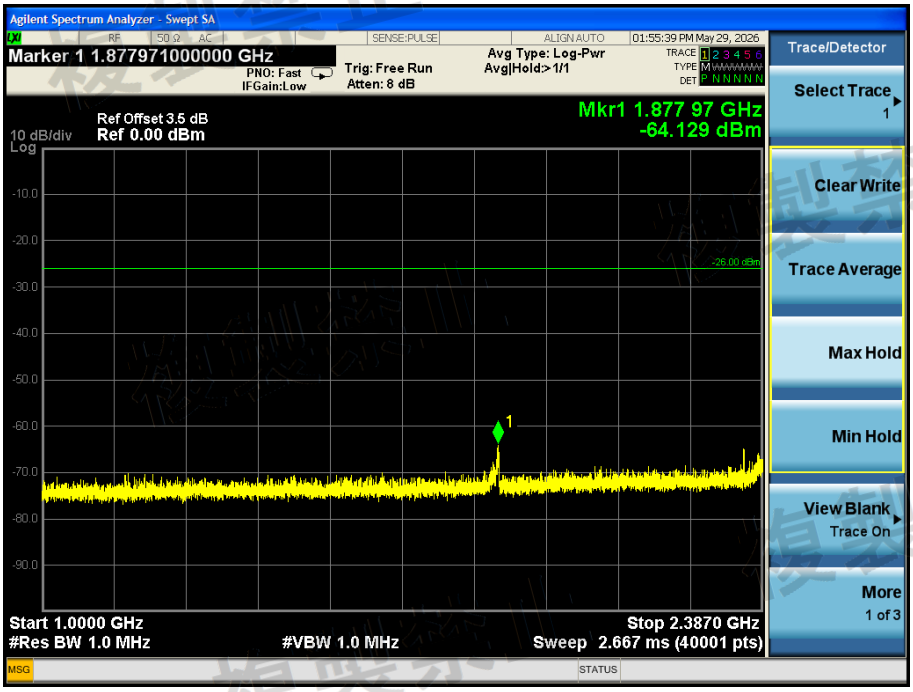


EDR mode (π4)DQPSK:

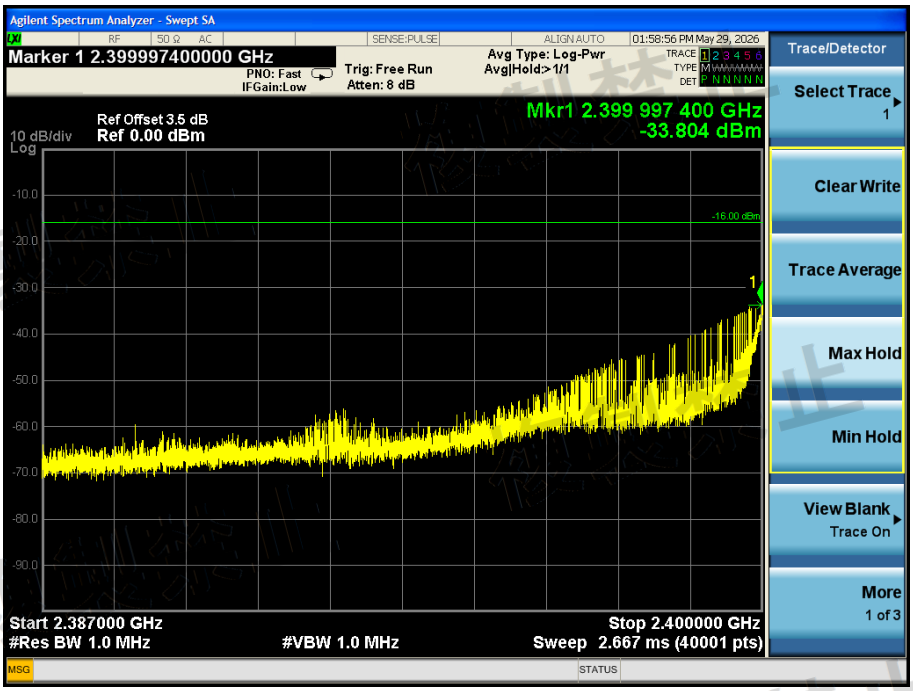
30 MHz to 1000 MHz:



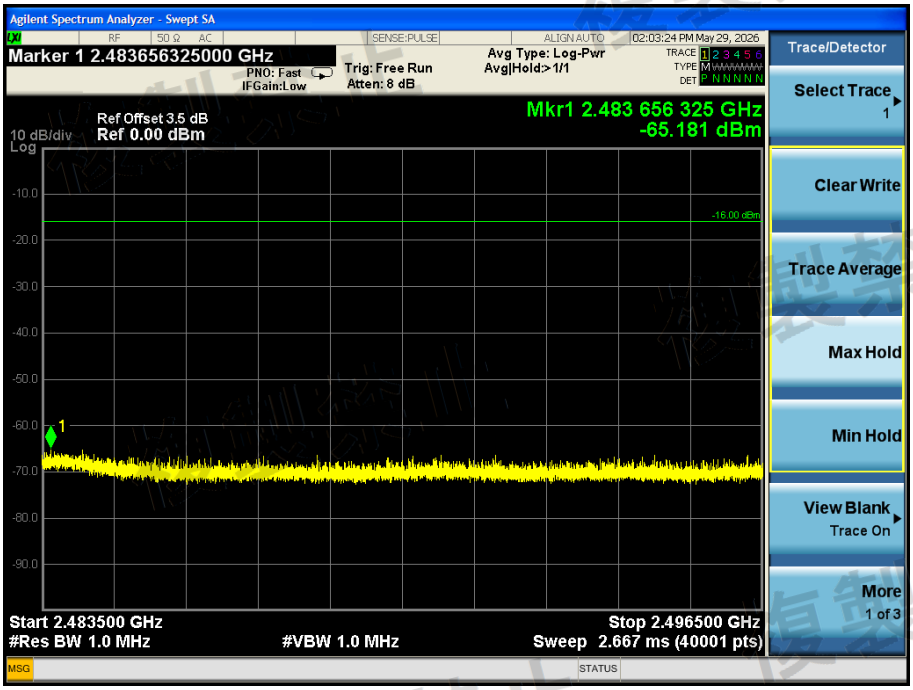
1000 MHz to 2387 MHz:



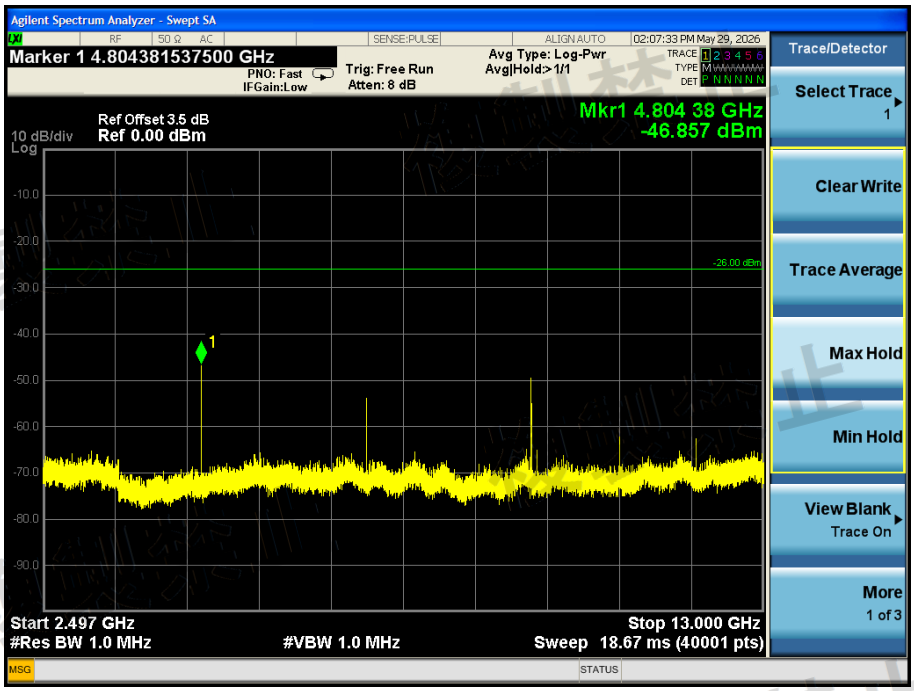
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

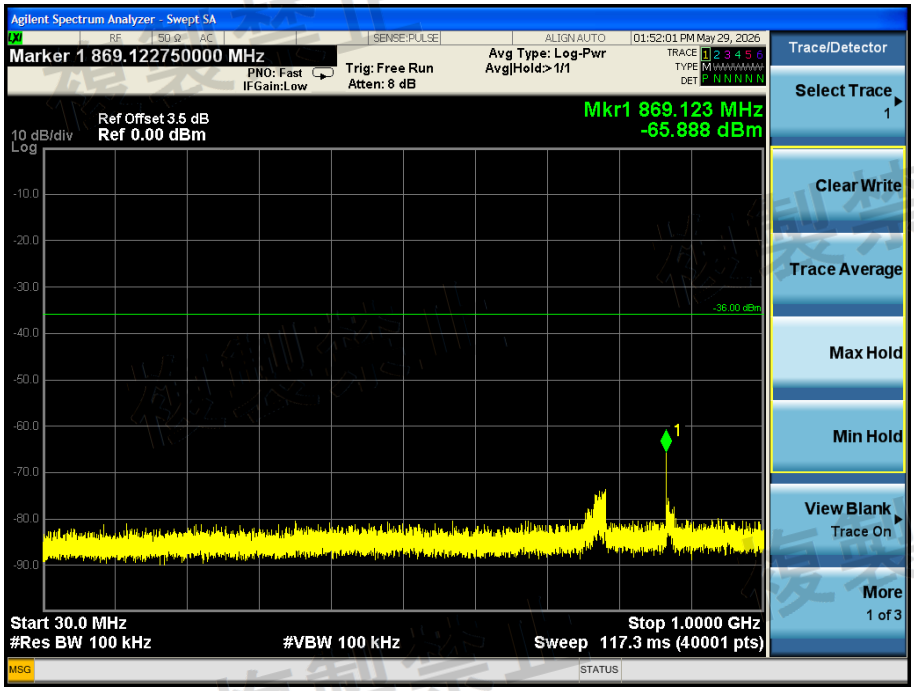


2496.5 MHz to 13 GHz:

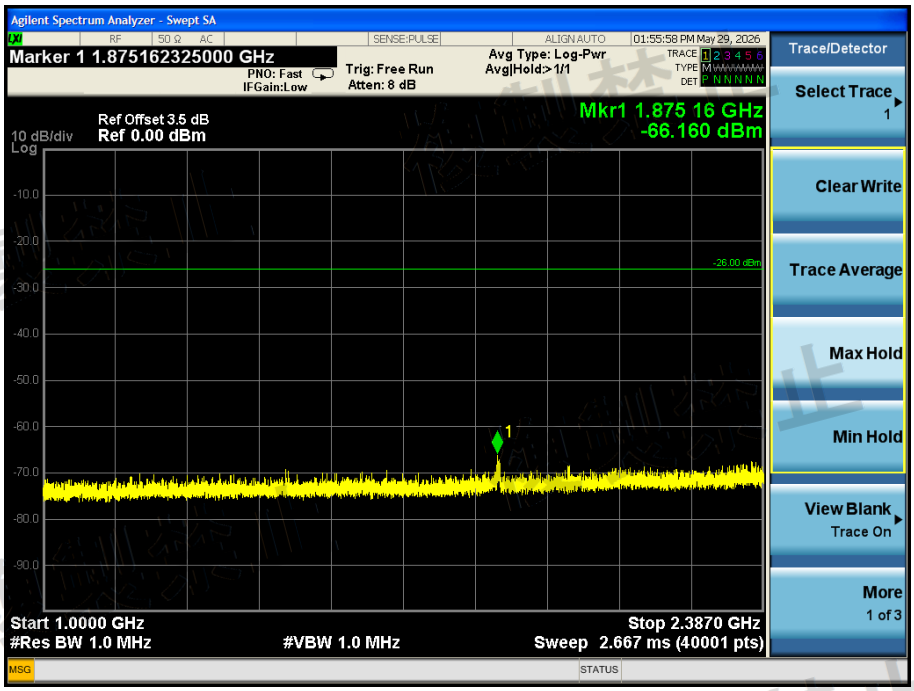


Channel 39: 2.441 GHz:

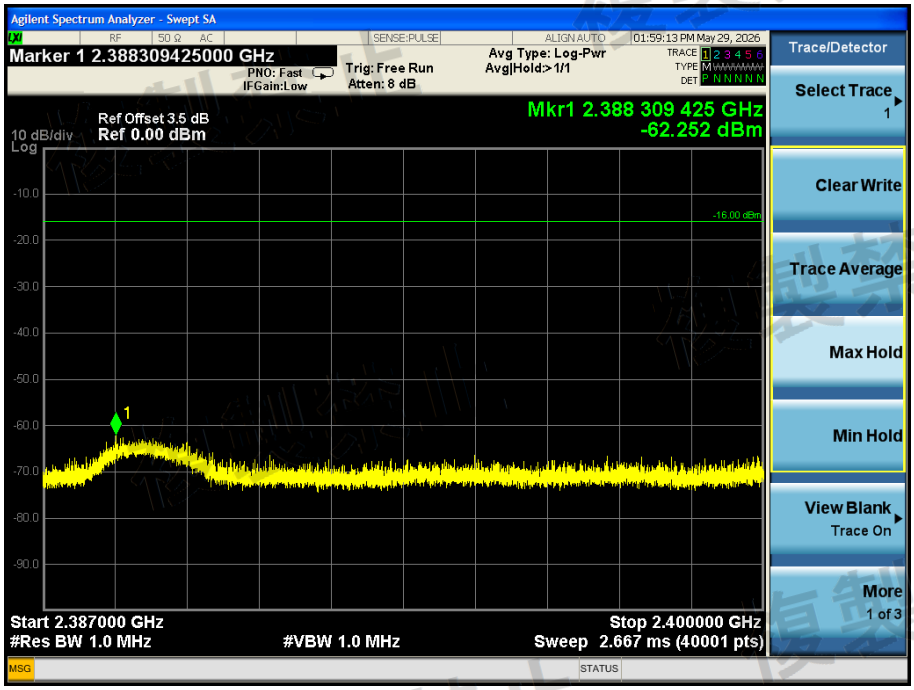
30 MHz to 1000 MHz:



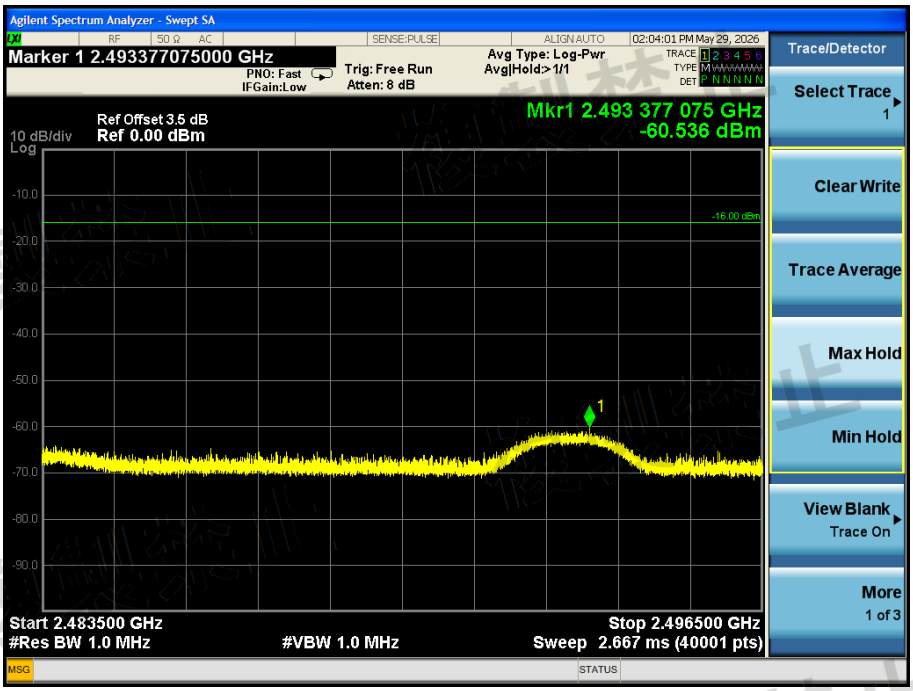
1000 MHz to 2387 MHz:



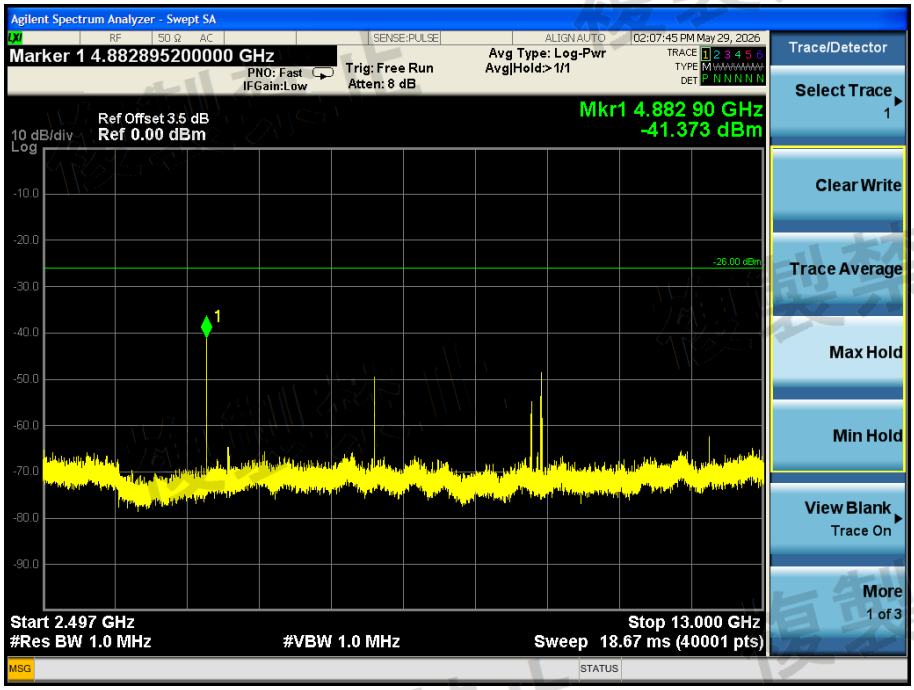
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

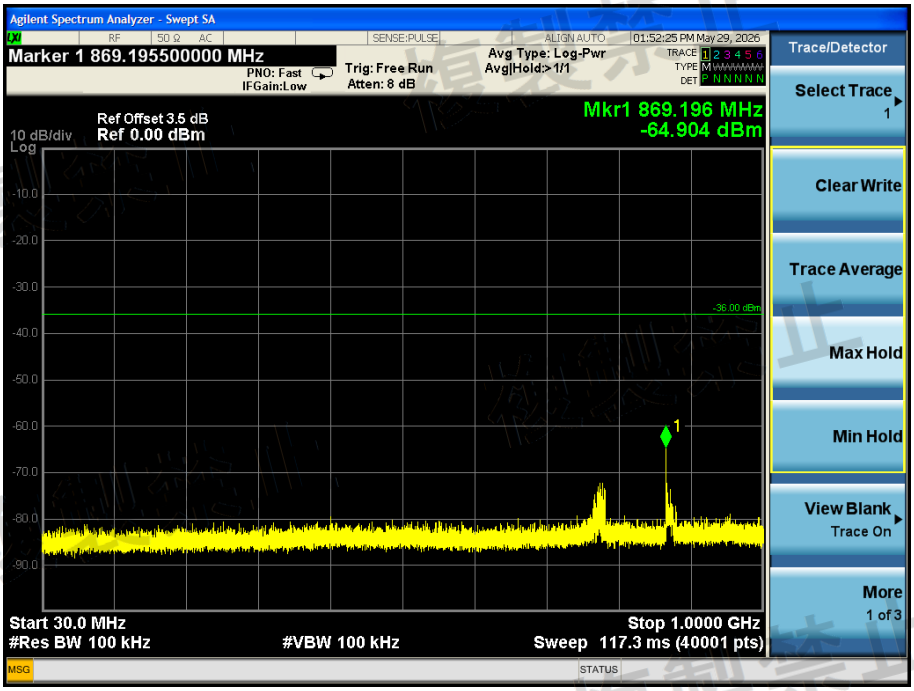


2496.5 MHz to 13 GHz:

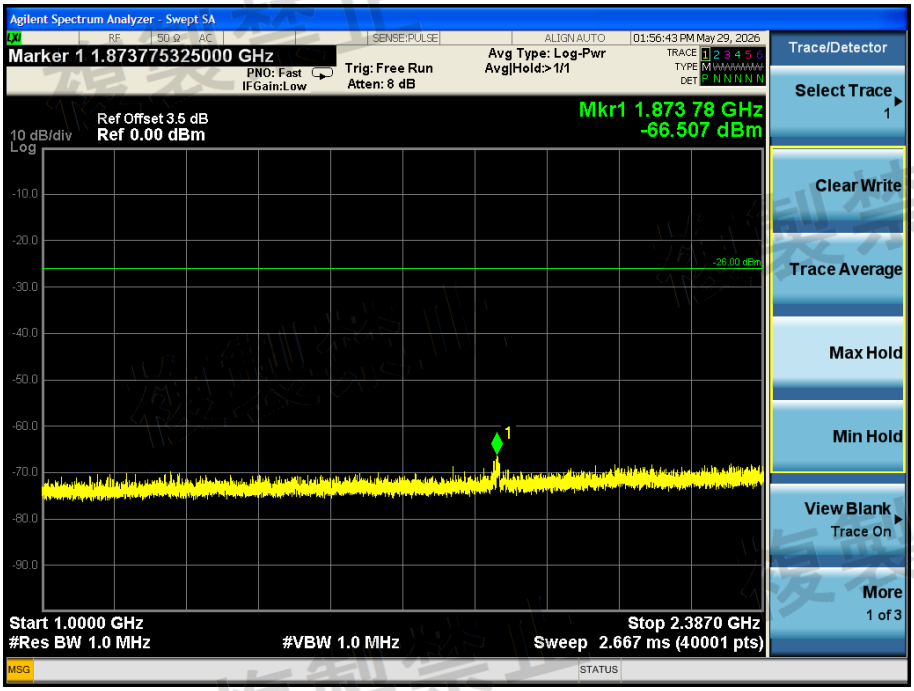


Channel 78: 2.480 GHz

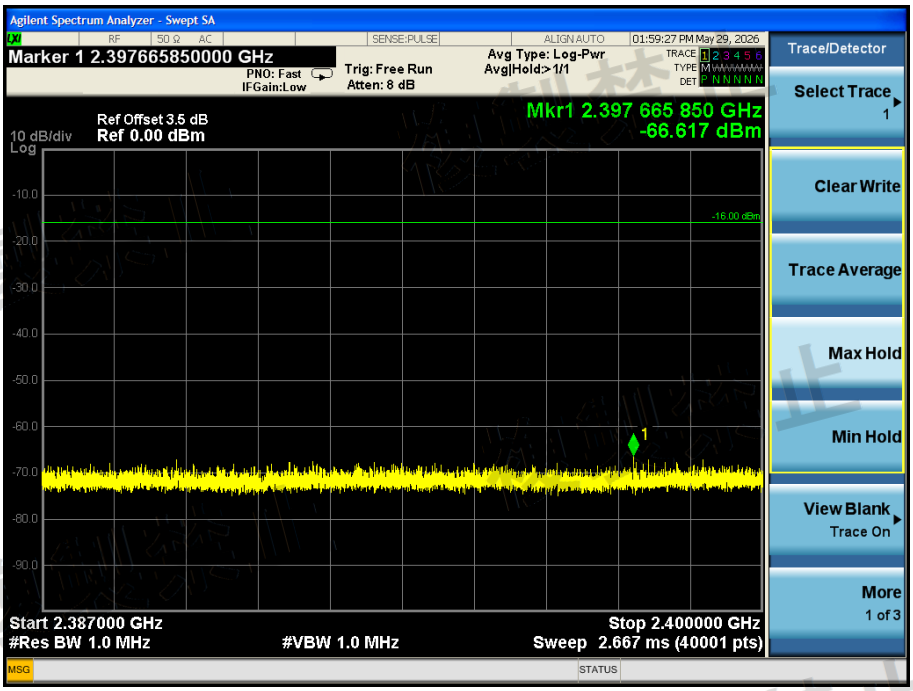
30 MHz to 1000 MHz:



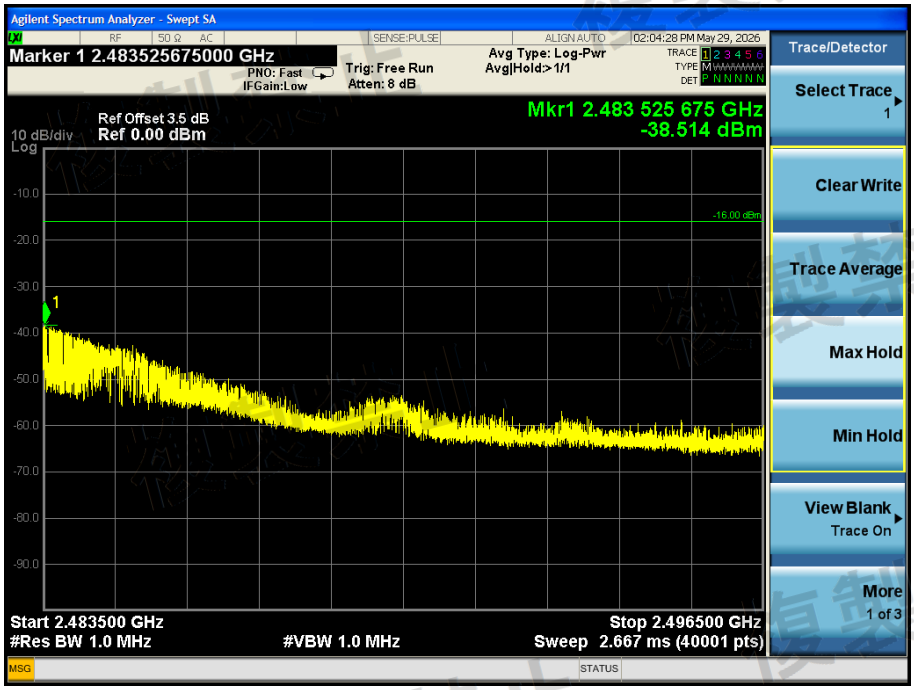
1000 MHz to 2387 MHz:



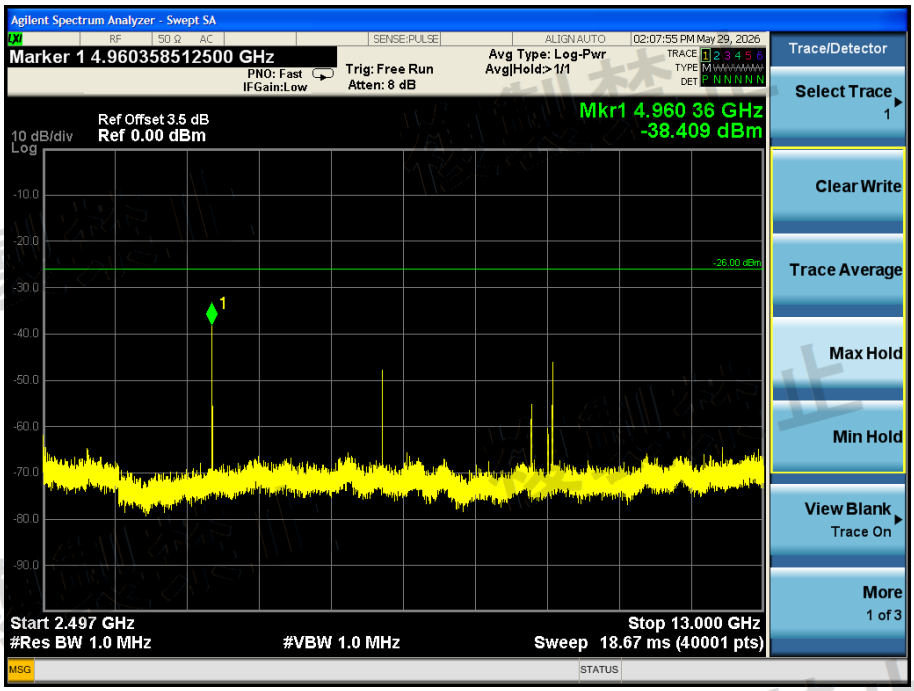
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:



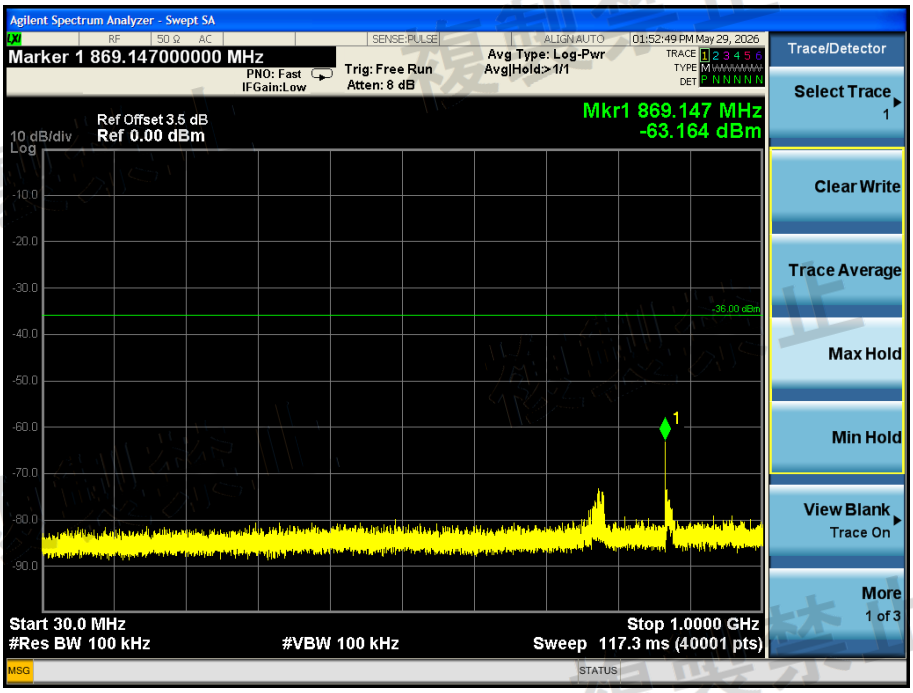
2496.5 MHz to 13 GHz:



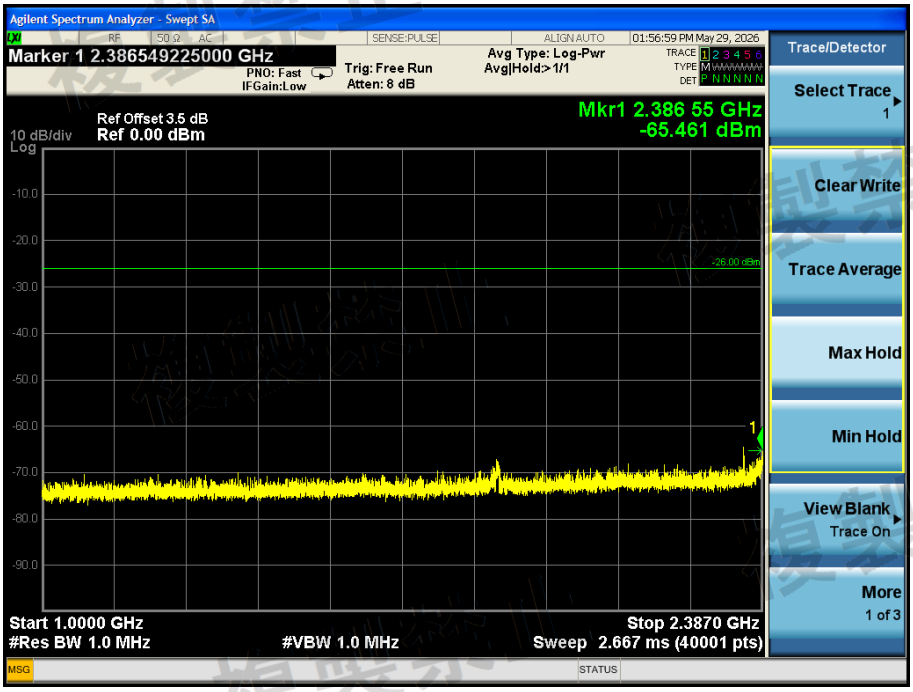
EDR mode (8DPSK):

Channel 0: 2.402 GHz

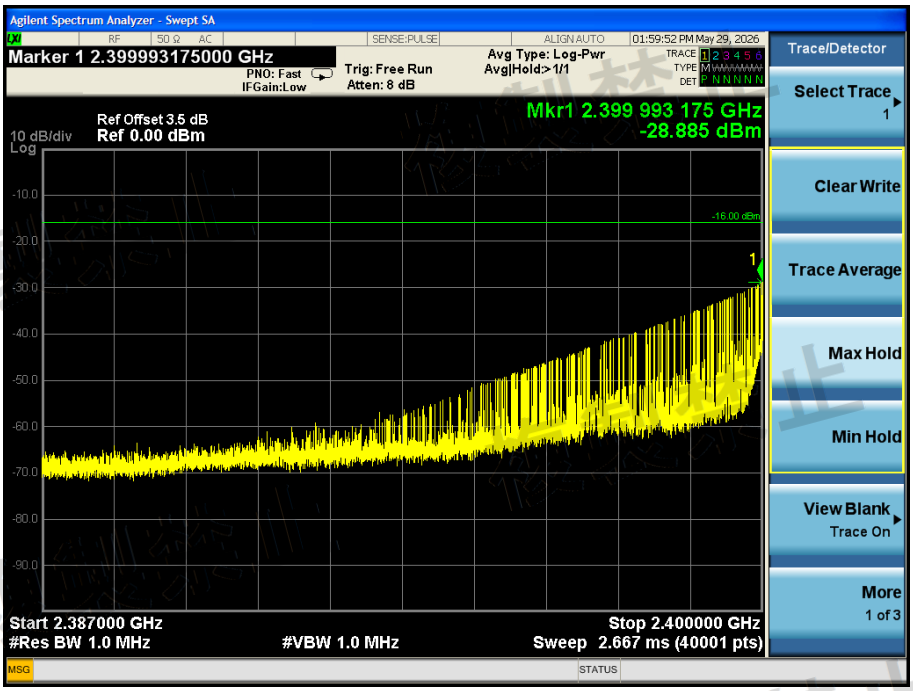
30 MHz to 1000 MHz:



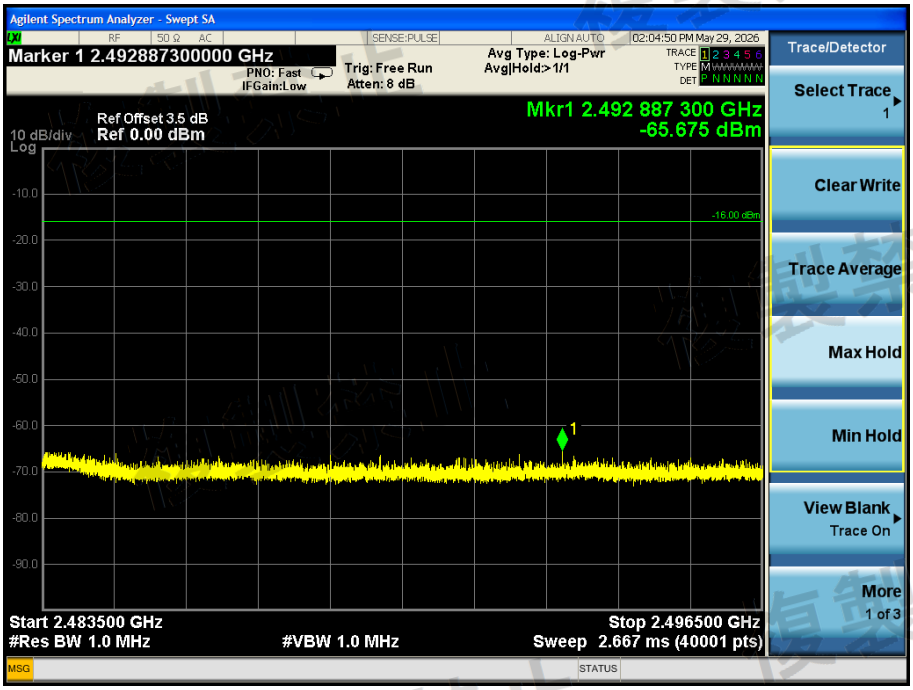
1000 MHz to 2387 MHz:



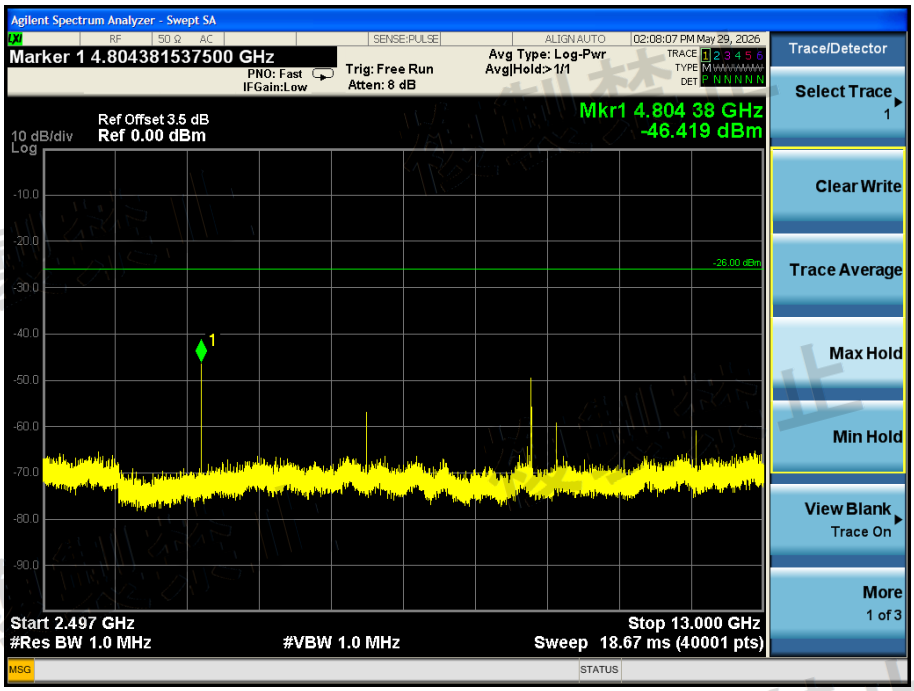
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

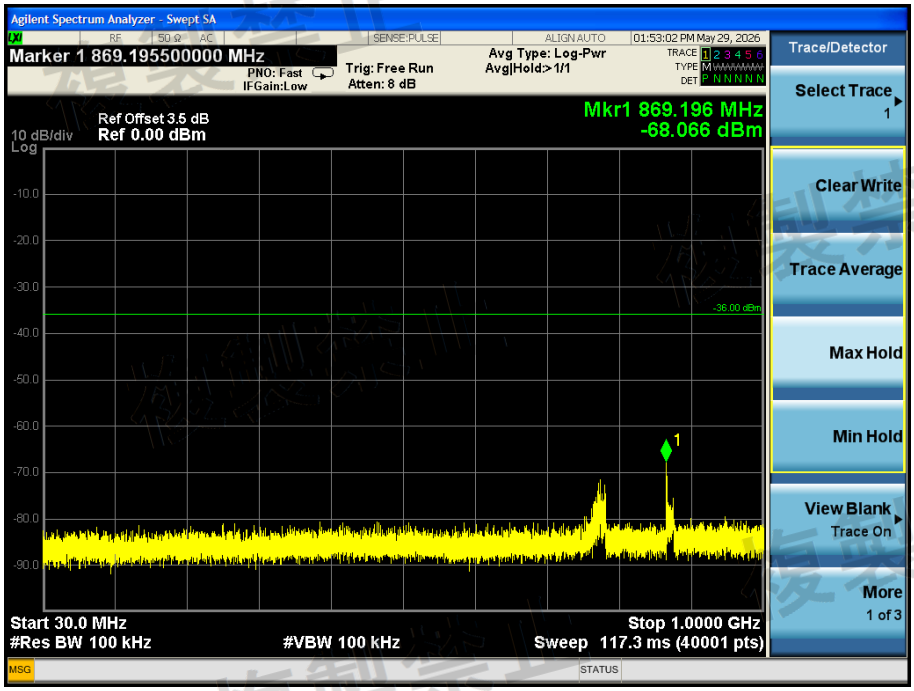


2496.5 MHz to 13 GHz:

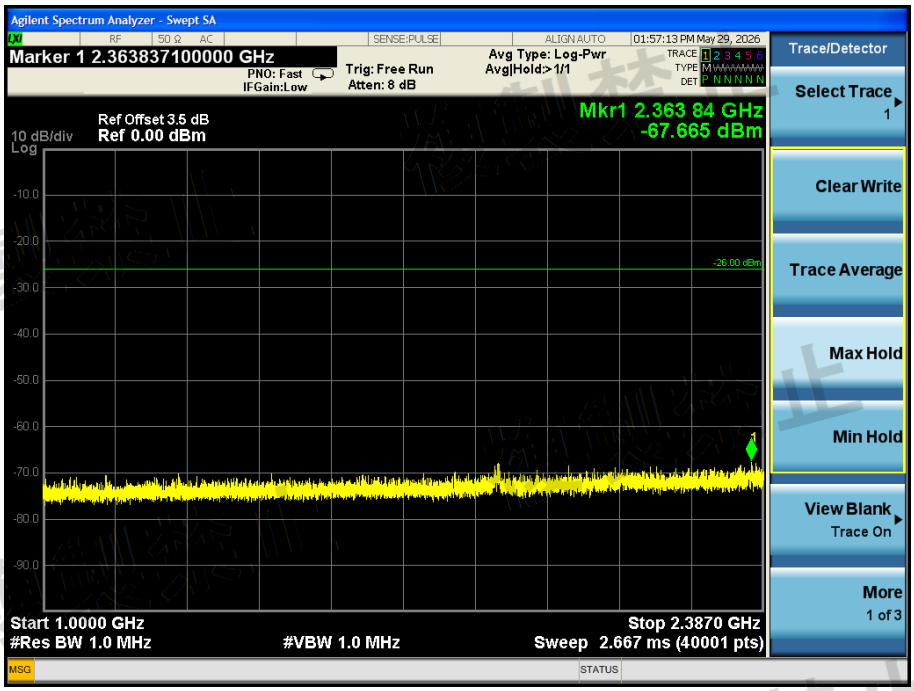


Channel 39: 2.441 GHz:

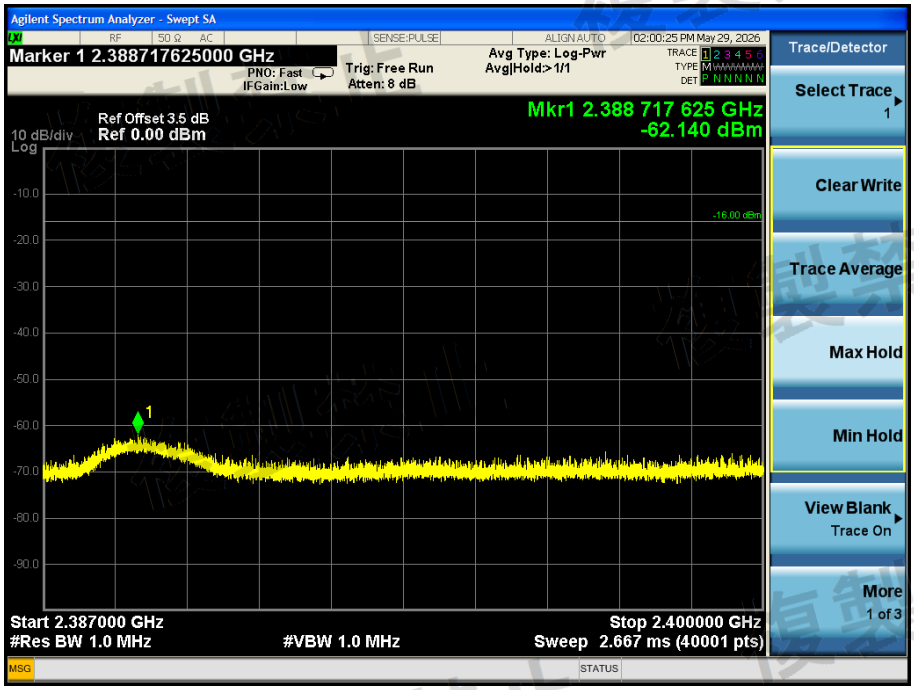
30 MHz to 1000 MHz:



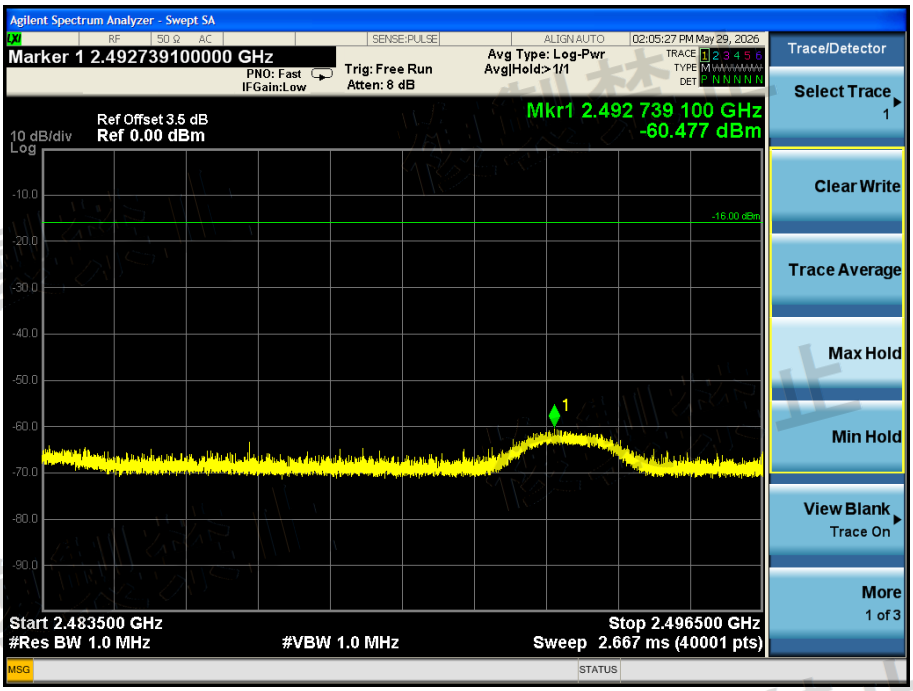
1000 MHz to 2387 MHz:



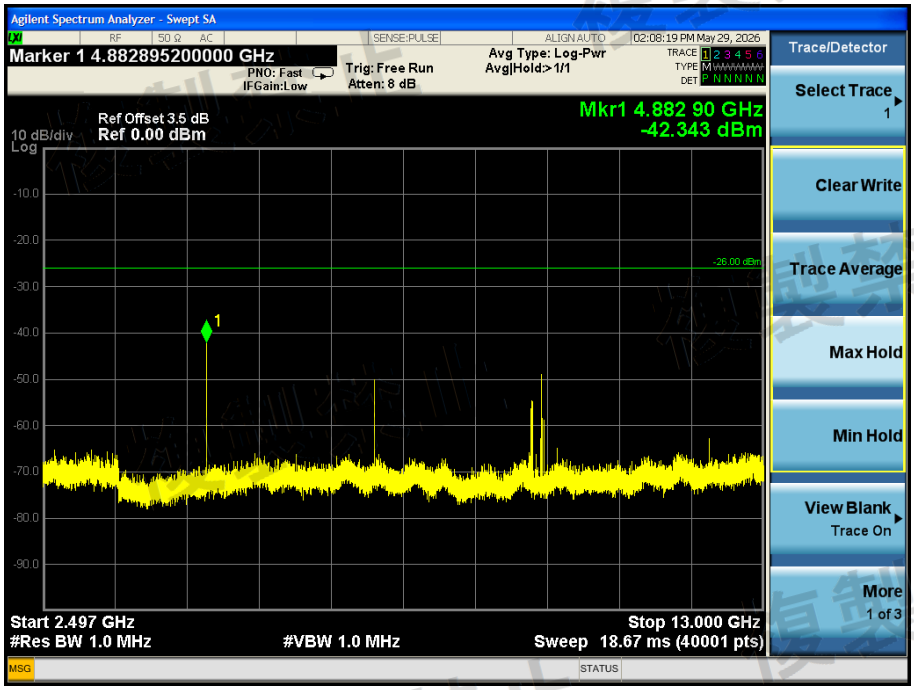
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:

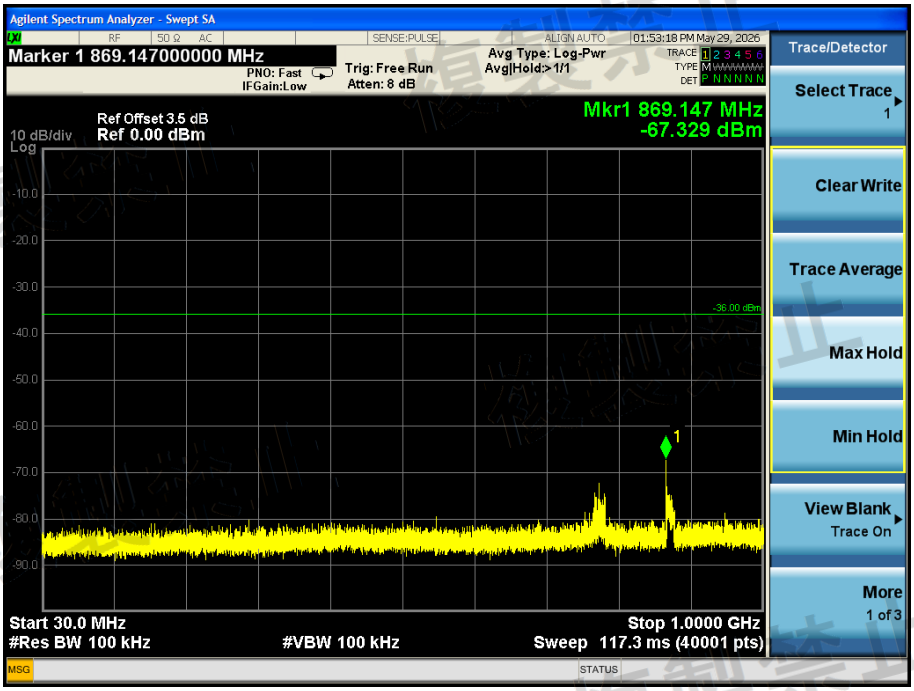


2496.5 MHz to 13 GHz:

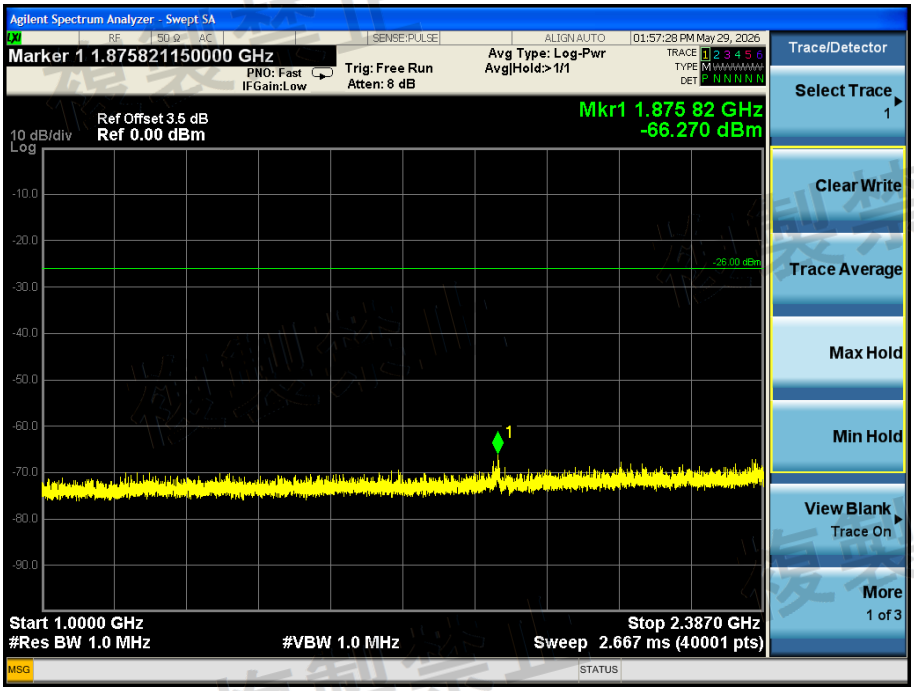


Channel 78: 2.480 GHz

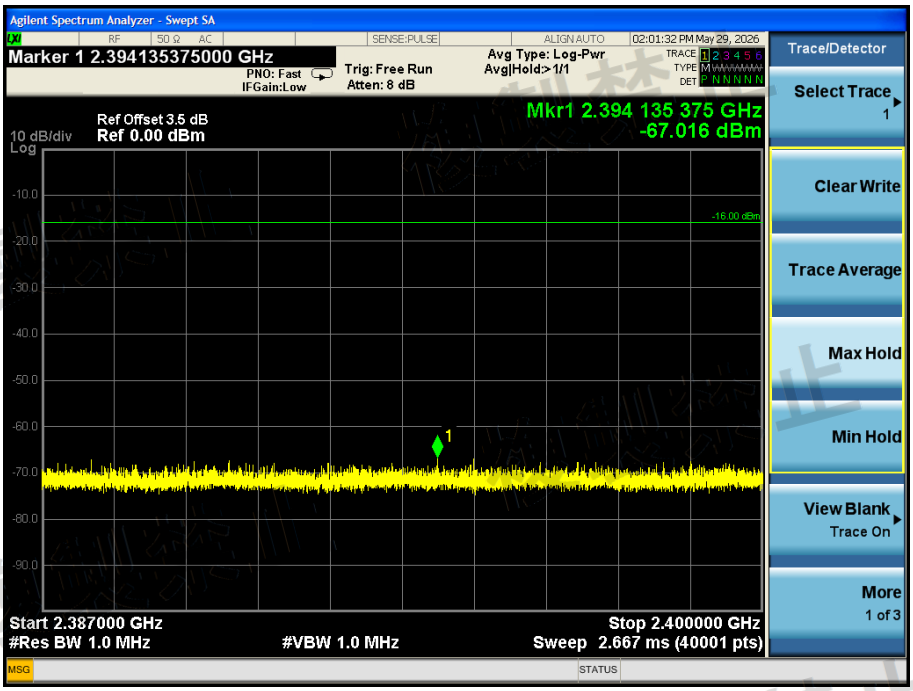
30 MHz to 1000 MHz:



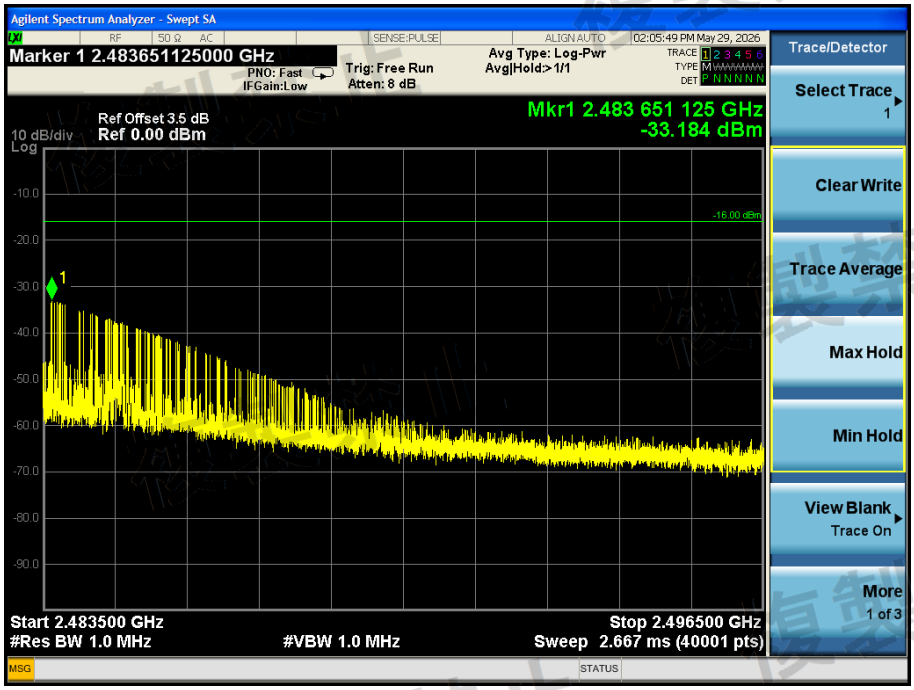
1000 MHz to 2387 MHz:



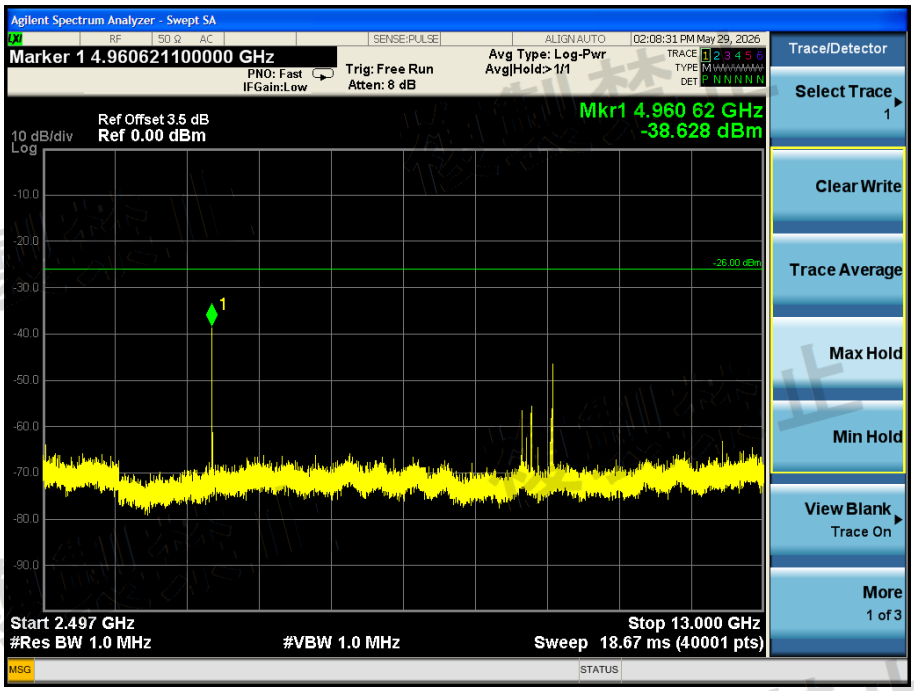
2387 MHz to 2400 MHz:



2483.5 MHz to 2496.5 MHz:



2496.5 MHz to 13 GHz:



Test result: The unit does meet the requirements.

5.10 Dwell Time

Test Requirement: Item 19 of Article 2-1

less than 0.4sec

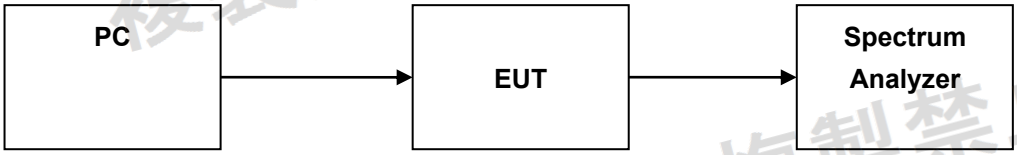
Temperature: 23.0 °C

Humidity: 55 % RH

Atmospheric Pressure: 1013 mbar

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below. Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode

Test Configuration:



Test Procedure:

1. Test Conditions:

   Spectrum Analyzer is used for measurement.

2. EUT conditions:

   Modulation/Spread/Hopping ON, Hopping frequency is fixed, Bluetooth equipment is setting DH5 mode

   For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.

3. Spectrum Analyzer conditions:

   Frequency: Test Frequency (fixed hopping frequency)
   Span 0 Hz
   RBW 1 MHz
   VBW 1 MHz
   Sweep Time EUT condition
   Trigger Video Trigger
   Measures the Transmission time of 1 burst (sec)
   Measures the Burst cycle (sec)

4. Calculation procedure :

   Dwell time = (0.4(s) x [spreading rate] x [Transmission time of 1 burst(s)]) / ([burst cycle(s)] x [No. of hopping channel])
   Note:
   * Spreading rate = [Spread bandwidth (actual measurement value)] / [Transmission rate]

Test result:

For FHSS: BDR mode (GFSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Lowest	2402.0	0.279	0.278	0.279	Sec	less than 0.4 sec
Middle	2441.0	0.278	0.278	0.278	Sec	
Highest	2480.0	0.277	0.276	0.276	Sec	

For FHSS: EDR mode (π/4)DQPSK:

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Lowest	2402.0	0.278	0.277	0.277	Sec	less than 0.4 sec
Middle	2441.0	0.277	0.277	0.277	Sec	
Highest	2480.0	0.278	0.277	0.278	Sec	

For FHSS: EDR mode (8DPSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
Lowest	2402.0	0.276	0.276	0.275	Sec	less than 0.4 sec
Middle	2441.0	0.280	0.279	0.280	Sec	
Highest	2480.0	0.276	0.276	0.276	Sec	

Remark: Calculated method: Dwell time=(0.4(s) x [spreading rate] x [Transmission time of 1 burst(s)])/([burst cycle(s)] x [No. of hopping channel])

Note: Spreading rate=[Spread bandwidth (actual measurement value)]/[Transmission rate]

Transmission rate is 1.0 Mbps for Normal mode;

Transmission rate is 1.0 Mbps for EDR mode;

Transmission rate is 1.0 Mbps for EDR mode;

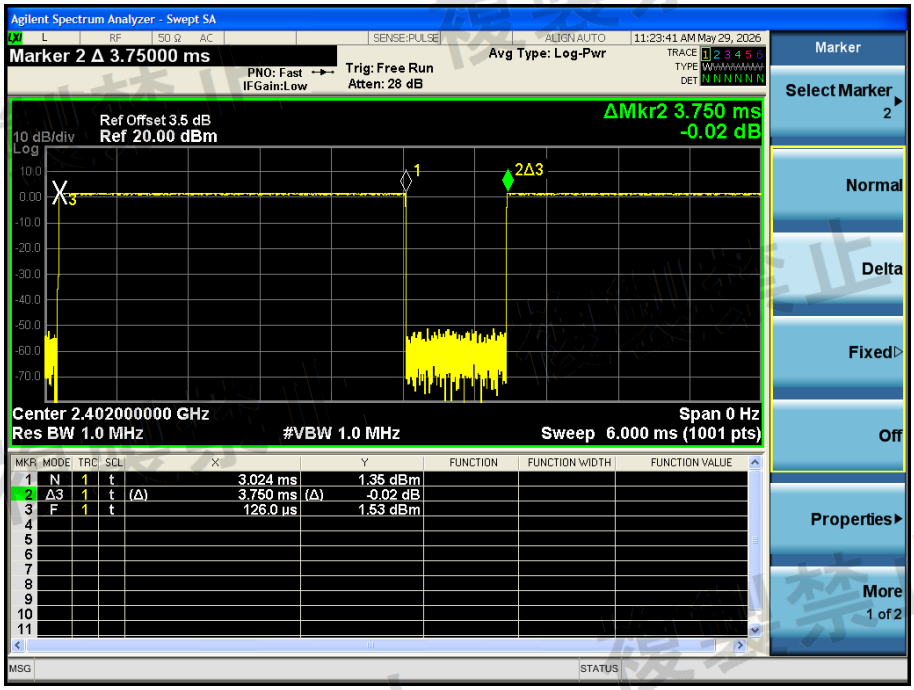
All the modes (DH1/DH3/DH5/2DH1/2DH3/2DH5/3DH1/3DH3/3DH5) have tested and recorded the worst mode(DH5/2DH5/3DH5) in the report

All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

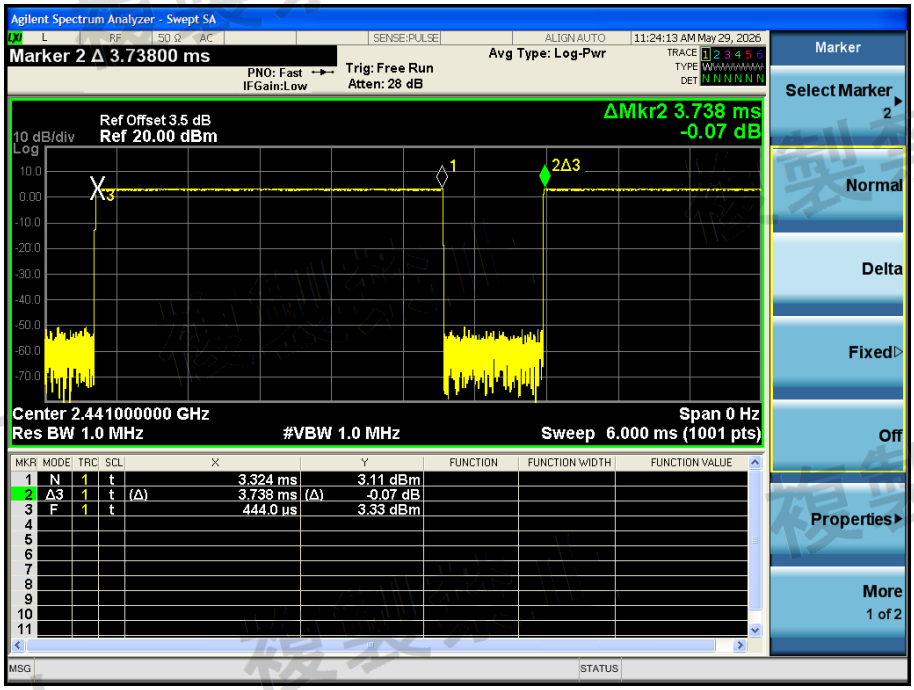
Result plot as follows:

BDR mode (GFSK):

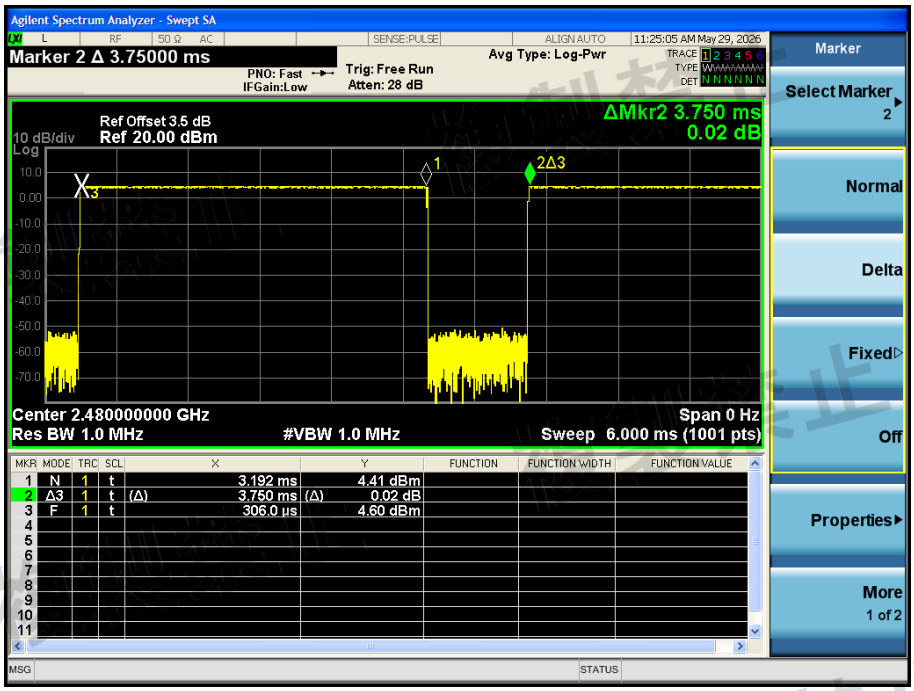
Channel 0: 2.402 GHz:



Channel 39: 2.441 GHz:

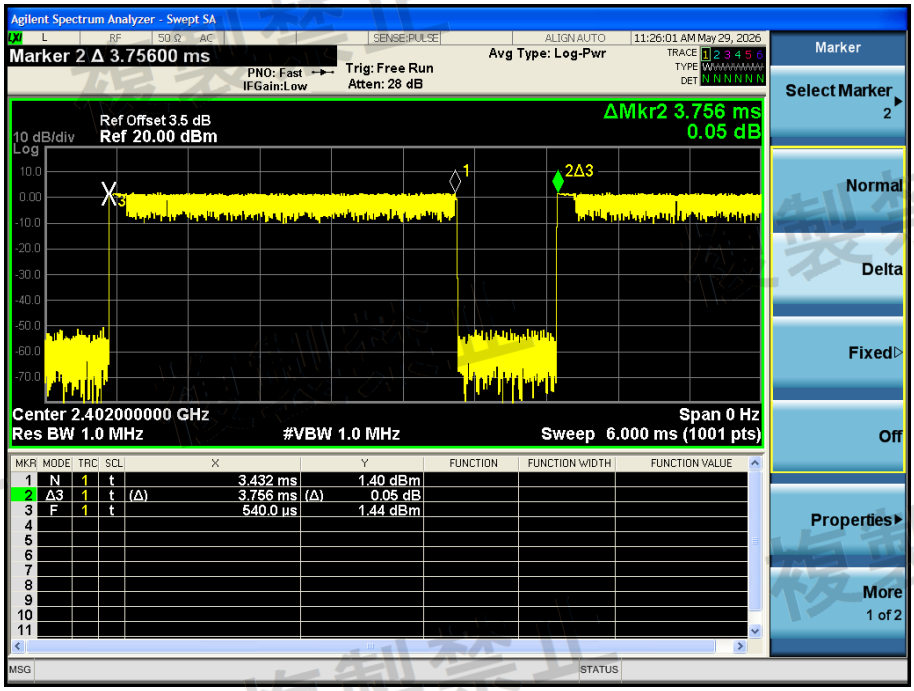


Channel 78: 2.480 GHz

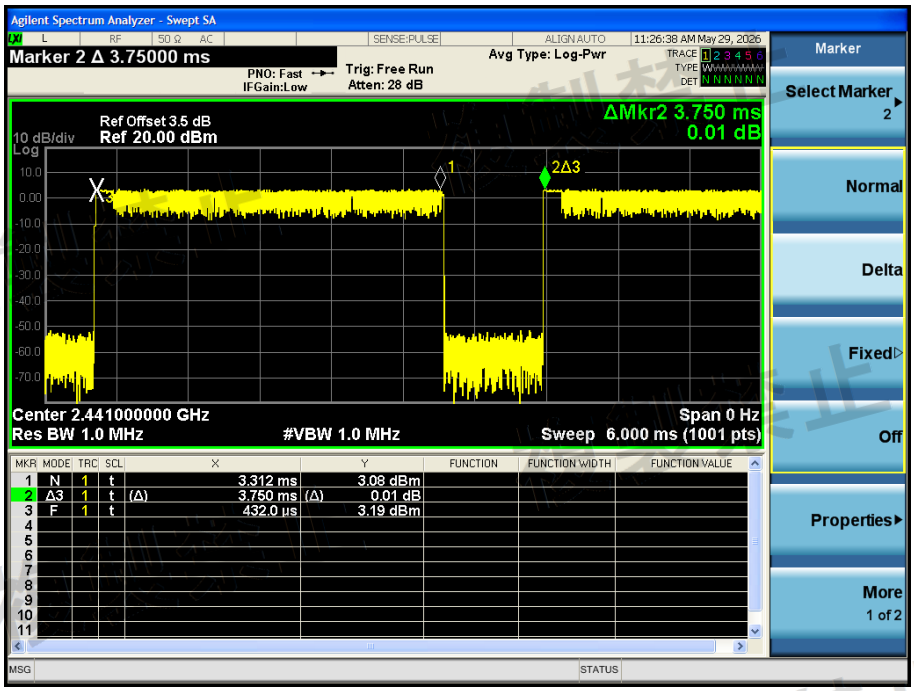


EDR mode (π/4)DQPSK:

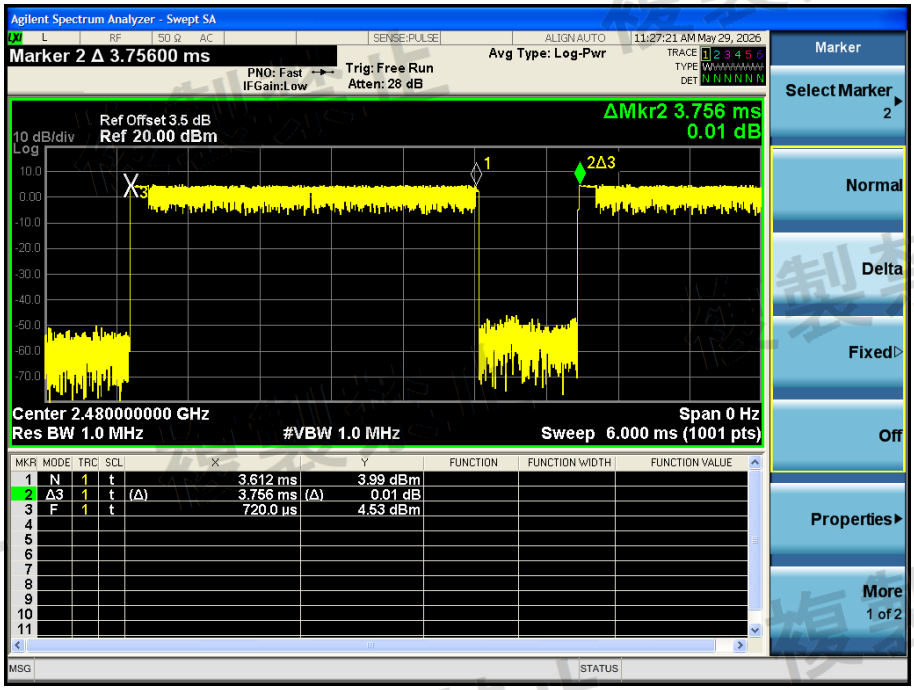
Channel 0: 2.402 GHz:



Channel 39: 2.441 GHz:

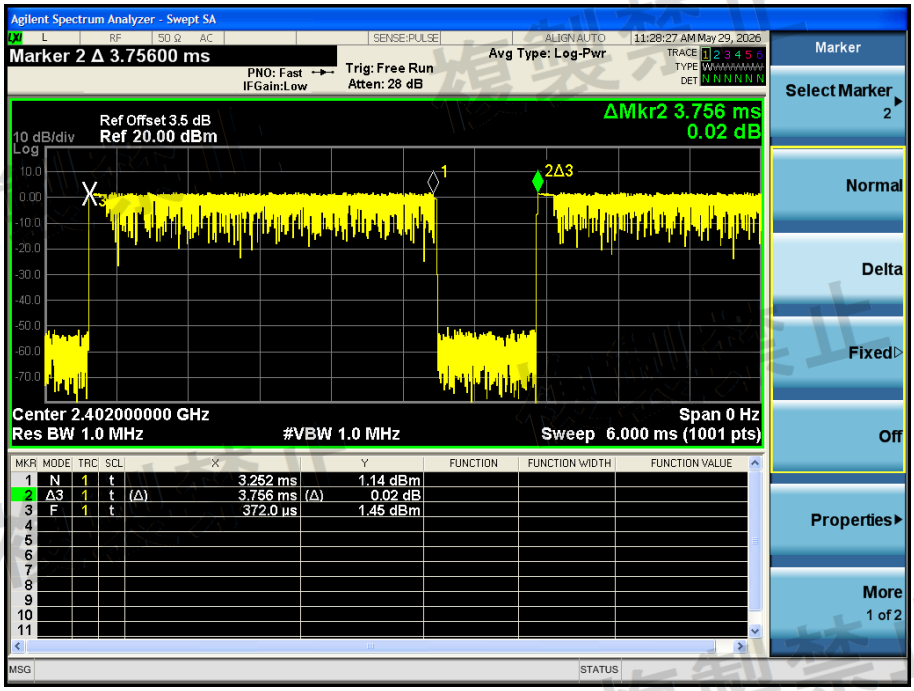


Channel 78: 2.480 GHz

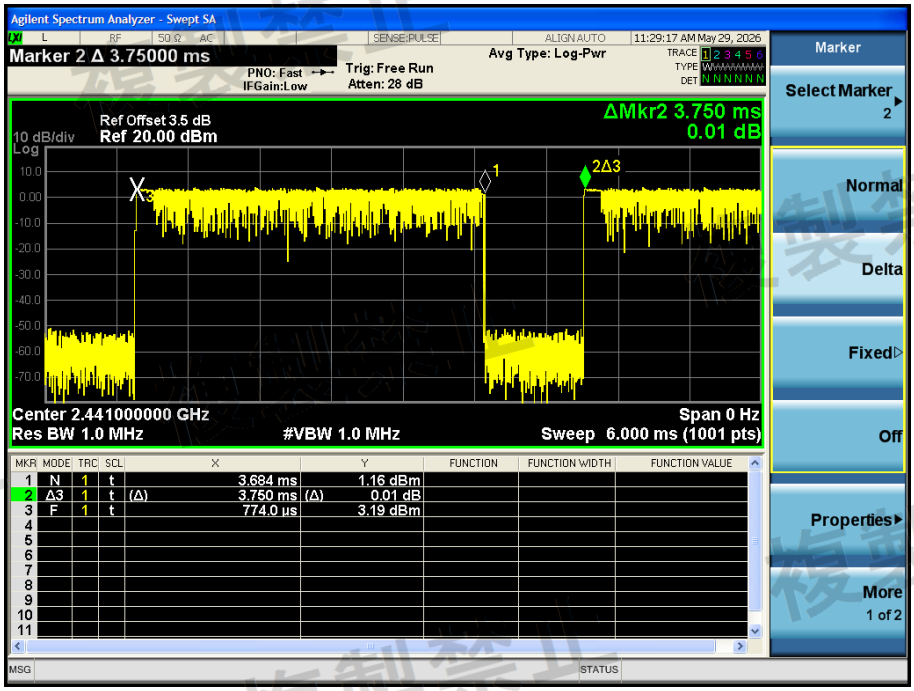


EDR mode (8DPSK):

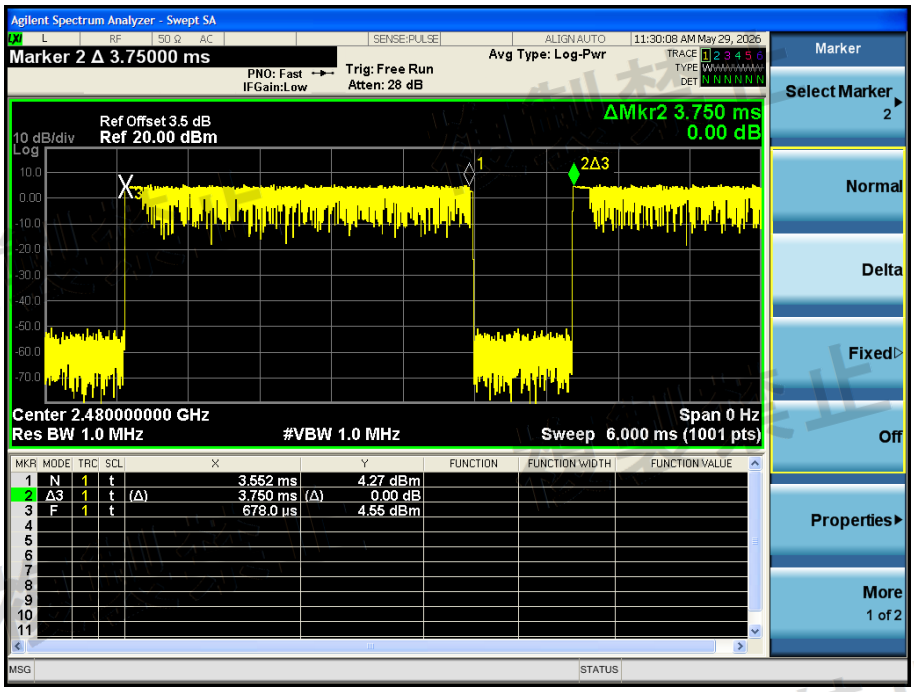
Channel 0: 2.402 GHz:



Channel 39: 2.441 GHz:



Channel 78: 2.480 GHz



Test result: The unit does meet the requirements.

5.11 Pseudorandom Frequency Hopping Sequence

Standard requirement

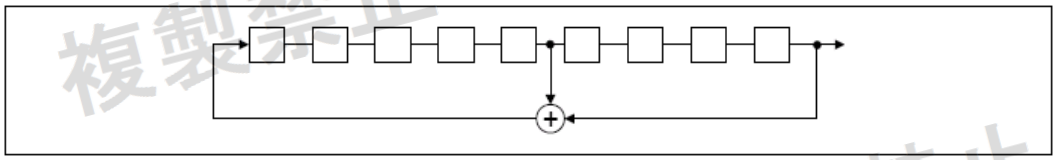
Article 2, Item (19) Notice 88 Appendix 43, 44, 45 requirement:

The EUT shall have the capability to transmit or to receive the MAC identification automatically, so that sender and receiver shall exclude other equipment.

EUT Pseudorandom Frequency Hopping Sequence

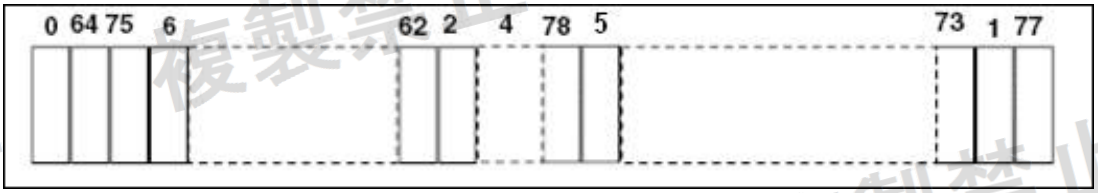
The pseudorandom sequence may be generated in a nine-stage shift register whose 5th and 9th stage outputs are added in a modulo-two addition stage. and the result is fed back to the input of the first stage. The sequence begins with the first ONE of 9 consecutive ONEs; i.e. the shift register is initialized with nine ones.

- Number of shift register stages: 9
- Length of pseudo-random sequence: 2^9 -1 = 511 bits
- Longest sequence of zeros: 8 (non-inverted signal)



Linear Feedback Shift Register for Generation of the PRBS sequence

An example of Pseudorandom Frequency Hopping Sequence as follow:



Each frequency used equally on the average by each transmitter.

The system receivers have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shift frequencies in synchronization with the transmitted signals.

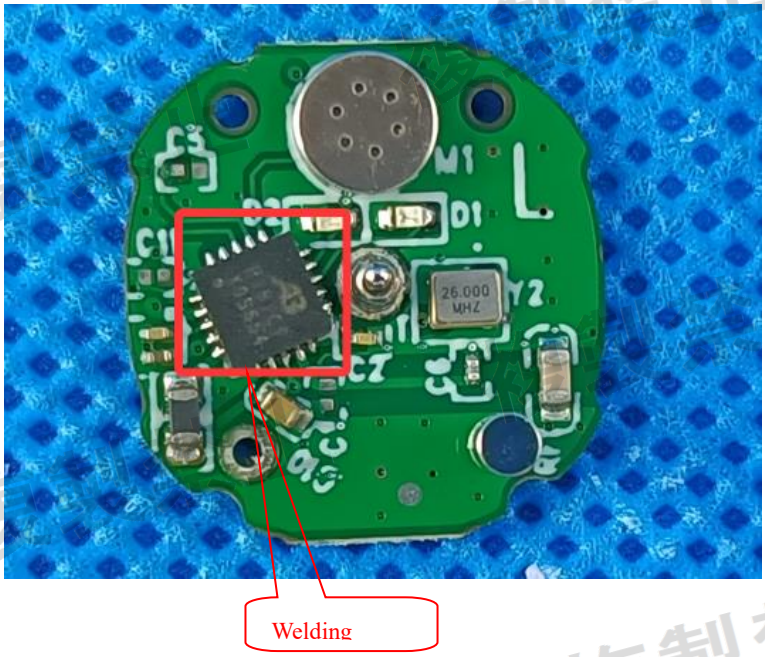
5.12 RF Accessibility

Standard requirement

Article 2, Item (19) Notice 88 Appendix 43

The EUT shall be constructed in such a way that sensitive RF parts, (like modulation and oscillator parts) cannot be reached easily by the user. These parts shall be covered by soldered metal caps or glue or by other mechanical covers. If the covers are fixed with screws, these shall be not the common type(s) like a Phillips, but special versions like Torx, so that the user cannot open the device with common tools.

The chip's pin spacing is 0.4mm and is not easy to modify, The number of pins on the chip is 20.



5.13 Spurious Emissions of Rx

Test Requirement: Item 19 of Article 2-1
(1) Below 1 GHz : 4 nW or less(-54dBm)
(2) 1 GHz and over : 20 nW or less(-47dBm)

Temperature: 23.0 °C

Humidity: 55 % RH

Atmospheric Pressure: 1013 mbar

Test Status: Pre-Scan has been conducted to determine the worst-case mode from all possible combinations between available modulations, data rates and antenna ports (if EUT with antenna diversity architecture). Following channel(s) was (were) selected for the final test as listed below.

Test Configuration:

Test Procedure:

1. Test Conditions: Spectrum Analyzer is used for measurement.
2. EUT conditions:
   Modulation/Spread/Hopping ON
   For equipment using diffusion code, set to the test diffusion code and modulate with standard coding test signal.
3. Spectrum Analyzer conditions:
   Step 1
   All spurious are measured from 30 MHz to 13 GHz by peak mode.
   Step 2
   IF the value measured by Step1 is 2 dB or less, measure in average mode.
   Test setup for Step 1:
   Frequency: 30 MHz – 2400 MHz , 2483.5 MHz –13 GHz
   RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
   VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
   Sweep Time Auto
   detector mode Positive peak
   Indication mode Max hold
   Test setup for Step 2:
   Frequency: Spurious Frequency
   Span 0 Hz
   RBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
   VBW 100 kHz (30 – 1GHz) , 1 MHz (over 1GHz)
   Sweep Time Auto
   detector mode Sample
   Indication mode Max hold

Test result:

For FHSS: BDR mode (GFSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	869.147	-69.988	-69.911	-69.934	dBm	(1) Below 1 GHz : -54dBm (2) 1 GHz to 13 GHz : -47dBm
	12851.2	-64.502	-64.446	-64.423		

For FHSS: EDR mode (π/4)DQPSK:

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	869.074	-65.126	-65.112	-65.109	dBm	(1) Below 1 GHz : -54dBm (2) 1 GHz to 13 GHz : -47dBm
	11806.6	-64.107	-64.066	-64.045		

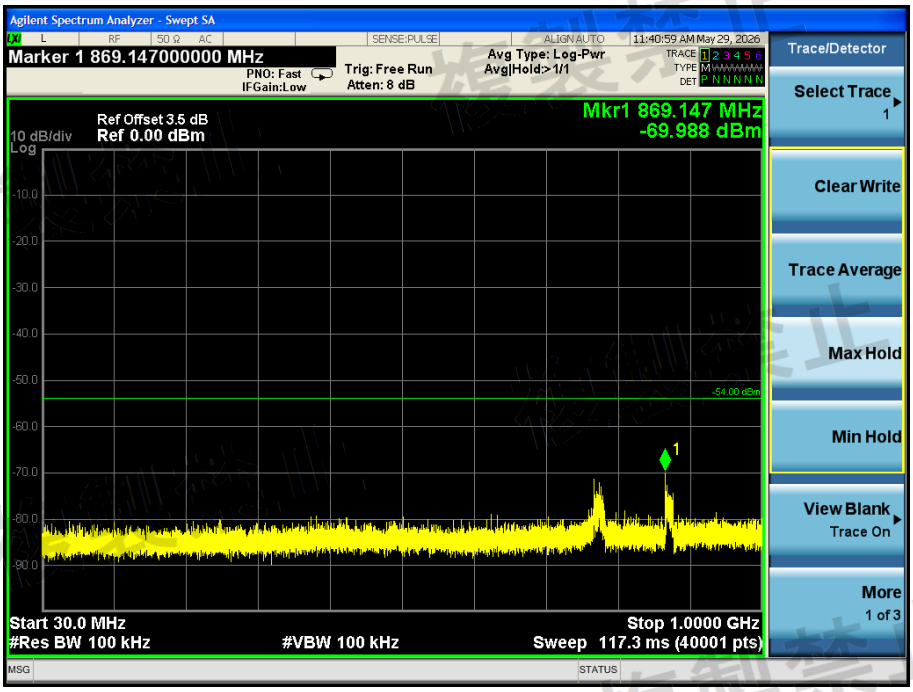
For FHSS: EDR mode (8DPSK):

Test channel	Test Frequency (MHz)	Test Result			Unit	Limit
		Normal Voltage	High Voltage	Low Voltage		
		3.7V DC	4.07V DC	3.33V DC		
79 channels (2402~2480 MHz)	869.099	-65.431	-65.244	-65.312	dBm	(1) Below 1 GHz : -54dBm (2) 1 GHz to 13 GHz : -47dBm
	2438.5	-62.619	-62.567	-62.228		

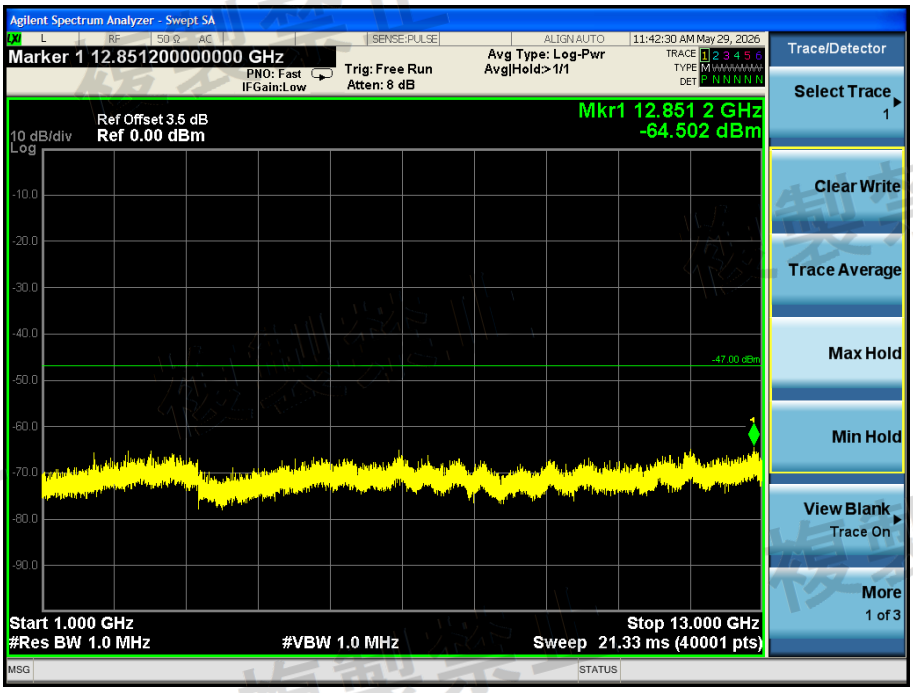
All the modes have tested and recorded, only shown 3.7V DC Plot.in the report.

For FHSS: BDR mode (GFSK):

30 MHz to 1 GHz:

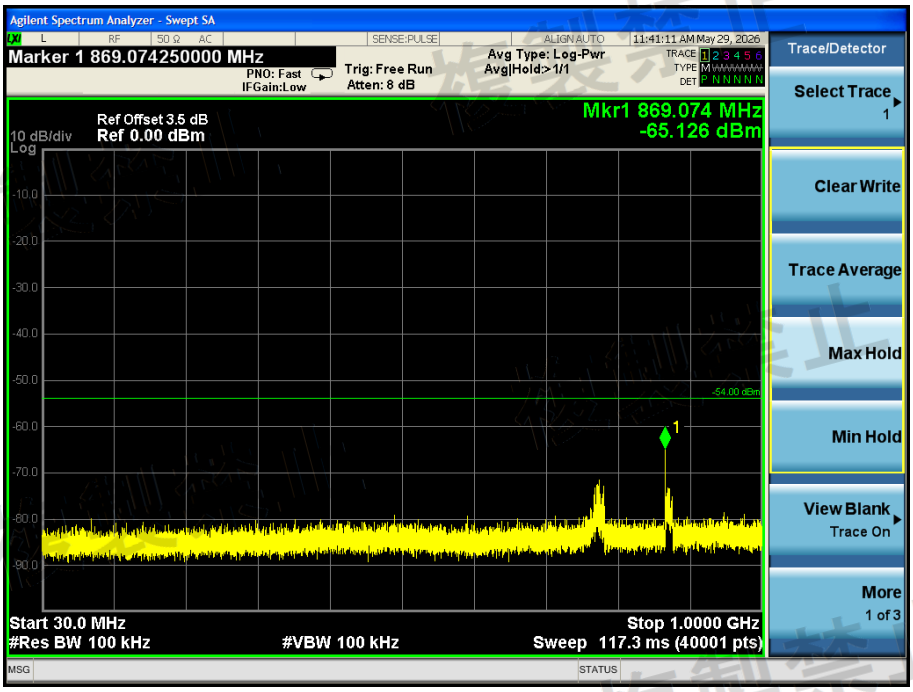


1 GHz to 13 GHz:

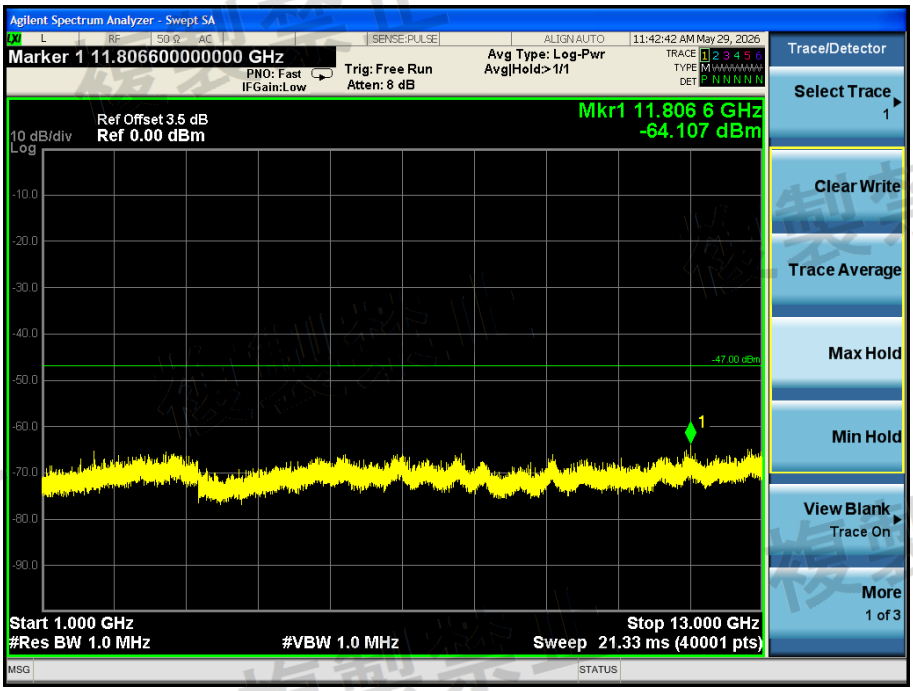


For FHSS: (π/4)DQPSK:

30 MHz to 1 GHz:

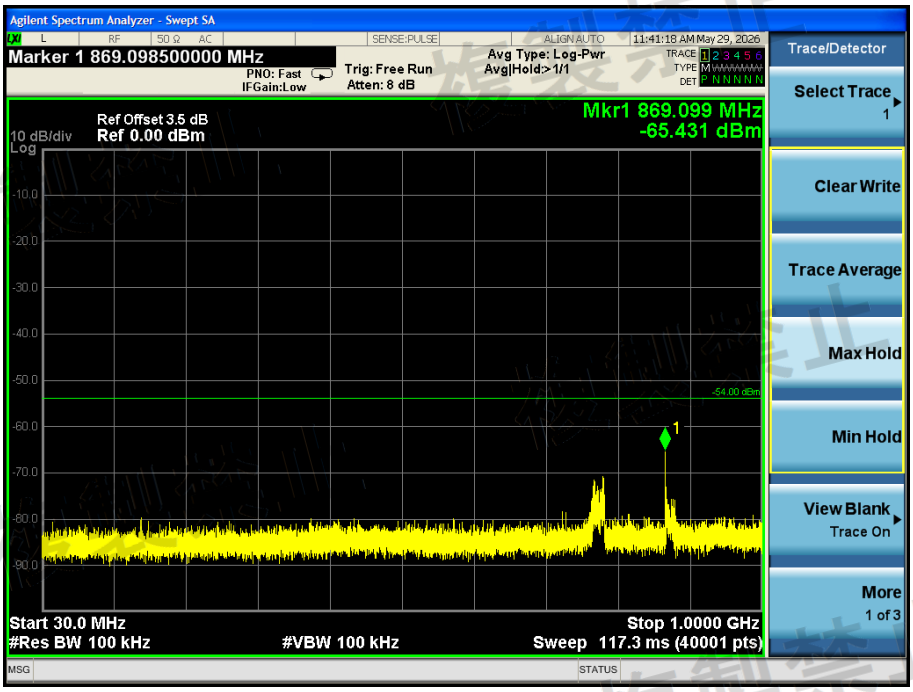


1 GHz to 13 GHz:

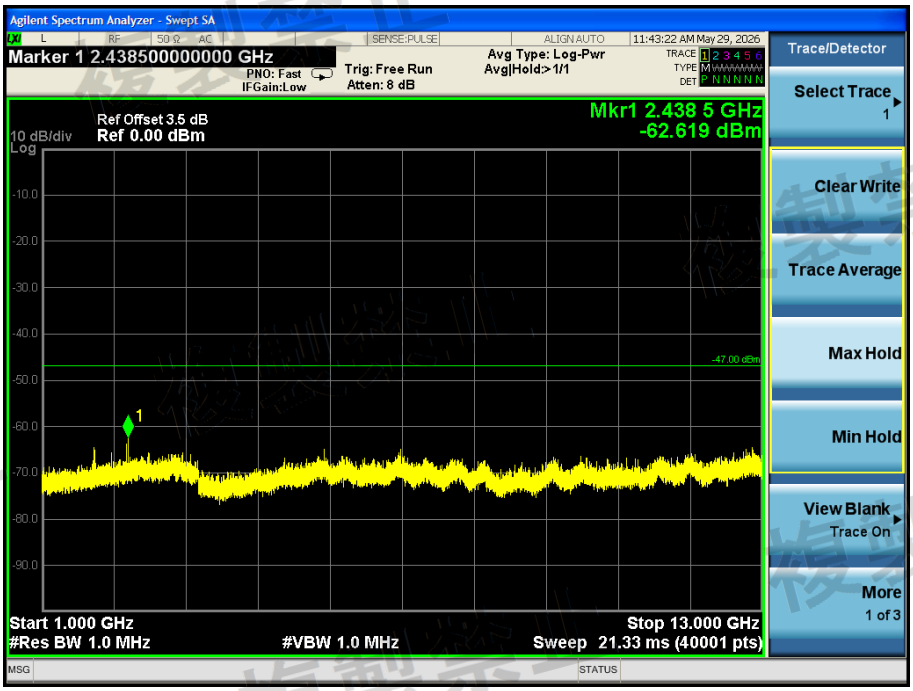


For FHSS: EDR mode (8DPSK):

30 MHz to 1 GHz:

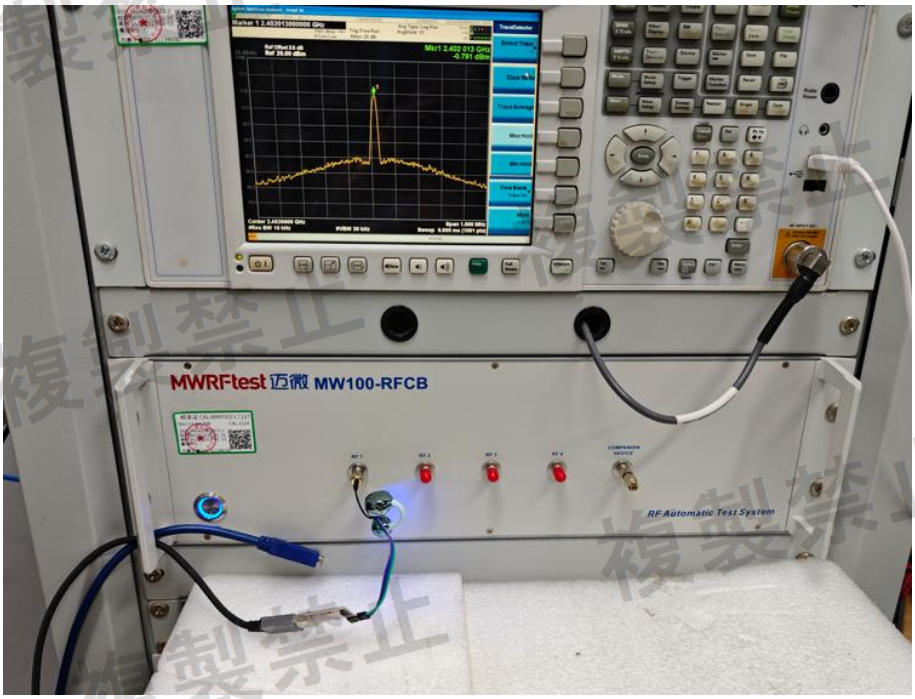


1 GHz to 13 GHz:



6 Photographs

6.1 EUT TEST PHOTO



End of report