

# TEST REPORT

**Report No.** .....: **2021-90032-2**

**FCC ID**.....: **2A343HD7131**

**Applicant**.....: **Shenzhen Huadai Technoloy Co., Ltd**

**Address**.....: Rm., 3506-1, 35/F, Block A, Rongde International Plaza, Baokang Road, Yuanshan, Longgang District, Shenzhen, China

**Manufacturer**.....: Shenzhen Huadai Technoloy Co., Ltd

**Address**.....: Rm., 3506-1, 35/F, Block A, Rongde International Plaza, Baokang Road, Yuanshan, Longgang District, Shenzhen, China

**Product Name**.....: **Smart Watch**

**Trade Mark**.....: HUADAI

**Model/Type reference**.....: HD7

**Listed Model(s)** .....: HD1, HD6, HD8, HD9 , HD26, HD36, HD88, HD89

**Standard**.....: **FCC 15.247**

**Date of receipt of test sample**....: November 24, 2021

**Date of testing**.....: November 24, 2021~January 06, 2022

**Date of issue**.....: January 06, 2022

**Test Result**.....: **Pass**

Compiled by:		
( Printed name + Signature )	Chen Zhijun	
Supervised by:		
( Printed name + Signature )	Liu Canhui	
Approved by:		
( Printed name + Signature )	Wang Weixiong	

**Testing Laboratory Name**.....: **KSIGN Testing Co., Ltd.**

**Address**.....: Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China

This test report may be duplicated completely for legal use with the approval of the applicant. It should not be reproduced except in full, without the written approval of our laboratory. The client should not use it to claim product endorsement by KSIGN. The test results in the report only apply to the tested sample. The test report shall be invalid without all the signatures of testing engineers, reviewer and approver. Any objections must be raised to KSIGN within 15 days since the date when the report is received. It will not be taken into consideration beyond this limit. The test report merely correspond to the test sample.

**TABLE OF CONTENTS****Page**

<b>1. TEST SUMMARY.....</b>	<b>3</b>
1.1. TEST STANDARDS.....	3
1.2. REPORT VERSION.....	3
1.3. TEST DESCRIPTION.....	4
1.4. TEST FACILITY.....	5
1.5. MEASUREMENT UNCERTAINTY.....	6
1.6. ENVIRONMENTAL CONDITIONS.....	6
<b>2. GENERAL INFORMATION.....</b>	<b>7</b>
2.1. GENERAL DESCRIPTION OF EUT.....	7
2.2. OPERATION STATE.....	8
2.3. MEASUREMENT INSTRUMENTS LIST.....	9
2.4. TEST SOFTWARE.....	10
<b>3. TEST ITEM AND RESULTS.....</b>	<b>11</b>
3.1. ANTENNA REQUIREMENT.....	11
3.2. PEAK OUTPUT POWER.....	12
3.3. 20DB BANDWIDTH.....	19
3.4. CARRIER FREQUENCIES SEPARATION.....	32
3.5. NUMBER OF HOPPING CHANNEL.....	35
3.6. DWELL TIME.....	37
3.7. BAND EDGE AND SPURIOUS EMISSION (CONDUCTED).....	43
3.8. BAND EDGE EMISSIONS(RADIATED).....	50
3.9. RADIATED SPURIOUS EMISSIONS.....	59
3.10. CONDUCTED EMISSION.....	70
3.11. PSEUDORANDOM FREQUENCY HOPPING SEQUENCE.....	73
<b>4. EUT TEST PHOTOS.....</b>	<b>74</b>
<b>5. PHOTOGRAPHS OF EUT CONSTRUCTIONAL.....</b>	<b>76</b>

## 1. TEST SUMMARY

### 1.1. Test Standards

The tests were performed according to following standards:

**FCC Rules Part 15.247:** Operation within the bands of 902-928MHz, 2400-2483.5MHz, and 5725-5850MHz.

**KDB 558074 D01** : The measurement guidance provided herein is applicable only to Digital Transmission System (DTS) devices operating in the 902-928 MHz. 2400-2483.5 MHz and/or 5725-5850 MHz bands under §15.247 of the FCC rules (Title 47 of the Code of Federal Regulations).

**ANSI C63.10-2020:** American National Standard for Testing Unlicensed Wireless Devices.

### 1.2. Report version

Revised No.	Date of issue	Description
01	January 06, 2022	Original

### 1.3. Test Description

FCC Part 15 Subpart C(15.247)			
Test Item	Standard Section	Result	Test Engineer
	FCC		
Antenna Requirement	15.203	Pass	Chen Zhijun
Conducted Emission	15.207	Pass	Chen Zhijun
Restricted Bands	15.205	Pass	Chen Zhijun
Hopping Channel Separation	15.247(a)(1)	Pass	Chen Zhijun
Dwell Time	15.247(a)(1)	Pass	Chen Zhijun
Peak Output Power	15.247(b)(1)	Pass	Chen Zhijun
Number of Hopping Frequency	15.247 (a)(1)	Pass	Chen Zhijun
Band Edge Emissions	15.247(d)	Pass	Chen Zhijun
Radiated Spurious Emission	15.247(c)&15.209	Pass	Chen Zhijun
99% Occupied Bandwidth & 20dB Bandwidth	15.247(a)(1)	Pass	Chen Zhijun
Pseudorandom Frequency Hopping Sequence	15.247 (a)(1)	Pass	Chen Zhijun

Note:

The measurement uncertainty is not included in the test result.

## 1.4. Test Facility

### Address of the report laboratory

**KSIGN Testing Co., Ltd.**

Building 5, No. 316, Jianghong South Road Binjiang District, Hangzhou 310052, China

### Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

#### **CNAS-Lab Code: L0461**

KSIGN Testing Co., Ltd. Has been assessed and proved to be in Compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2017 General Requirements) for the Competence of Testing and Calibration Laboratories.

#### **A2LA-Lab Cert. No.: 4749.01**

KSIGN Testing Co., Ltd. EMC Laboratory has been accredited by A2LA for technical competence In the field of electrical testing, and proved to be in compliance with ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

#### **IC Registration No.: CN0036**

The 3m alternate test site of KSIGN Testing Co., Ltd. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: CN0096

#### **FCC-Registration No.: CN1254**

KSIGN Testing Co., Ltd. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files.

## 1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM); Uncertainties in the measurement of mobile radio equipment characteristics; Part 2" and is documented in the KSIGN(Guangdong) Testing Co., Ltd. system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device. Below is the best measurement capability for KSIGN(Guangdong) Testing Co., Ltd.

Test Items	Measurement Uncertainty	Notes
Transmitter power conducted	0.42 dB	(1)
Transmitter power Radiated	2.14 dB	(1)
Conducted spurious emissions 9kHz~40GHz	1.60 dB	(1)
Radiated spurious emissions 9kHz~40GHz	2.20 dB	(1)
Conducted Emissions 9kHz~30MHz	3.20 dB	(1)
Radiated Emissions 30~1000MHz	4.70 dB	(1)
Radiated Emissions 1~18GHz	5.00 dB	(1)
Radiated Emissions 18~40GHz	5.54 dB	(1)
Occupied Bandwidth	2.80 dB	(1)

**Note (1):** This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=1.96$ .

## 1.6. Environmental conditions

During the measurement the environmental conditions were within the listed ranges:

Temperature:	15~35°C
Relative Humidity:	30~60 %
Air Pressure:	950~1050mba

## 2. GENERAL INFORMATION

### 2.1. General Description of EUT

Test Sample Number:	1-1-1(Normal Sample),1-1-2(Engineering Sample )
Product Name:	Smart Watch
Trademark:	HUADAI
Model/Type reference:	HD7
Listed Model(s):	HD1, HD6, HD8, HD9 , HD26, HD36, HD88, HD89
Model Difference:	All models have the same circuit and RF module, except for the different appearance shape and color.
Power supply:	Input: DC 5V/1A
Power supply(Battery):	DC 3.8V, 205mAh, 0.779Wh
Hardware version:	T36BV1.0
Software version:	V1.0.0
<b>Bluetooth</b>	
Modulation:	GFSK(DH5), $\pi/4$ -DQPSK(2DH5), 8DPSK(3DH5)
Operation frequency:	2402MHz~2480MHz
Max Peak Output Power:	DH5: -1.65dBm 2DH5: -1.19dBm 3DH5: -0.76dBm
Channel number:	79
Channel separation:	1MHz
Antenna type:	Cable Antenna
Antenna gain:	-1dBi

## 2.2. Operation state

Operation Frequency List: The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing. BT EDR, 79 channels are provided to the EUT. Channels 00/39/78 were selected for testing.

Operation Frequency List:

Channel	Frequency (MHz)
<b>00</b>	<b>2402</b>
01	2403
⋮	⋮
38	2440
<b>39</b>	<b>2441</b>
40	2442
⋮	⋮
77	2479
<b>78</b>	<b>2480</b>

Note: The display in gray were the channel selected for testing.

Test mode

NO.	TEST MODE DESCRIPTION
1	Low channel GFSK
2	Middle channel GFSK
3	High channel GFSK
4	Low channel $\pi/4$ -DQPSK
5	Middle channel $\pi/4$ -DQPSK
6	High channel $\pi/4$ -DQPSK
7	Low channel 8DPSK
8	Middle channel 8DPSK
9	High channel 8DPSK
10	Hopping mode GFSK
11	Hopping mode $\pi/4$ -DQPSK
12	Hopping mode 8DPSK

Note:

1. Only the result of the worst case was recorded in the report, if no other cases.
2. The test software is the Blue Test 3 which can set the EUT into the individual test modes.



## 2.3. Measurement Instruments List

Tonscend JS0806-2 Test system					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
1	Spectrum Analyzer	R&S	FSV40-N	101798	04/07/2022
2	Vector Signal Generator	Agilent	N5182A	MY50142520	04/07/2022
3	Analog Signal Generator	HP	83752A	3344A00337	04/07/2022
4	Power Sensor	Agilent	E9304A	MY50390009	04/07/2022
5	Power Sensor	Agilent	E9300A	MY41498315	04/07/2022
6	Wideband Radio Communication Tester	R&S	CMW500	157282	04/07/2022
7	Climate Chamber	Angul	AGNH80L	1903042120	04/07/2022
8	Dual Output DC Power Supply	Agilent	E3646A	MY40009992	04/07/2022
9	RF Control Unit	Tonscend	JS0806-2	/	04/07/2022

Transmitter spurious emissions & Receiver spurious emissions					
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Cal. Until
1	EMI Test Receiver	R&S	ESR	102525	04/07/2022
2	High Pass Filter	Chengdu E-Microwave	OHF-3-18-S	0E01901038	03/27/2022
3	High Pass Filter	Chengdu E-Microwave	OHF-6.5-18-S	0E01901039	03/27/2022
4	Spectrum Analyzer	HP	8593E	3831U02087	04/07/2022
5	Ultra-Broadband logarithmic period Antenna	Schwarzbeck	VULB 9163	01230	03/29/2023
6	Loop Antenna	Beijin ZHINAN	ZN30900C	18050	03/25/2022
7	Spectrum Analyzer	R&S	FSV40-N	101798	04/07/2022
8	Horn Antenna	Schwarzbeck	BBHA 9120 D	2023	03/29/2023
9	Pre-Amplifier	Schwarzbeck	BBV 9745	9745#129	04/07/2022
10	Pre-Amplifier	EMCI	EMC051835SE	980662	04/07/2022
11	Pre-Amplifier	Schwarzbeck	BBV-9721	57	04/07/2022
12	Horn Antenna	Schwarzbeck	BBHA 9170	00939	03/29/2022

Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated until
1	LISN	R&S	ENV432	1326.6105.02	03/27/2022
2	EMI Test Receiver	R&S	ESR	102524	04/07/2022
3	Manual RF Switch	JS TOYO	/	MSW-01/002	04/07/2022

Note:

1)The Cal. Interval was one year.

2)The cable loss has calculated in test result which connection between each test instruments.

## 2.4. Test Software

Software name	Model	Version
Conducted emission Measurement Software	EZ-EMC	EMC-Con 3A1.1
Radiated emission Measurement Software	EZ-EMC	FA-03A.2.RE
Bluetooth and WIFI Test System	JS1120-3	2.5.77.0418

### 3. TEST ITEM AND RESULTS

#### 3.1. Antenna requirement

##### Requirement

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.203:**

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

##### **FCC CFR Title 47 Part 15 Subpart C Section 15.247(c) (1)(i):**

(i) Systems operating in the 2400~2483.5 MHz band that is used exclusively for fixed. Point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum conducted output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6dBi.

##### Test Result

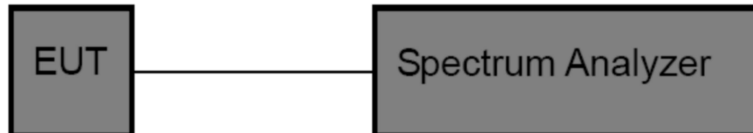
The directional gain of the antenna less than 6dBi, please refer to the EUT internal photographs antenna photo.

## 3.2. Peak Output Power

### Limit

Test Item	Limit	Frequency Range(MHz)
Peak Output Power	Hopping Channels>75 Power<1W(30dBm) Other <125mW(21dBm)	2400~2483.5

### Test Configuration



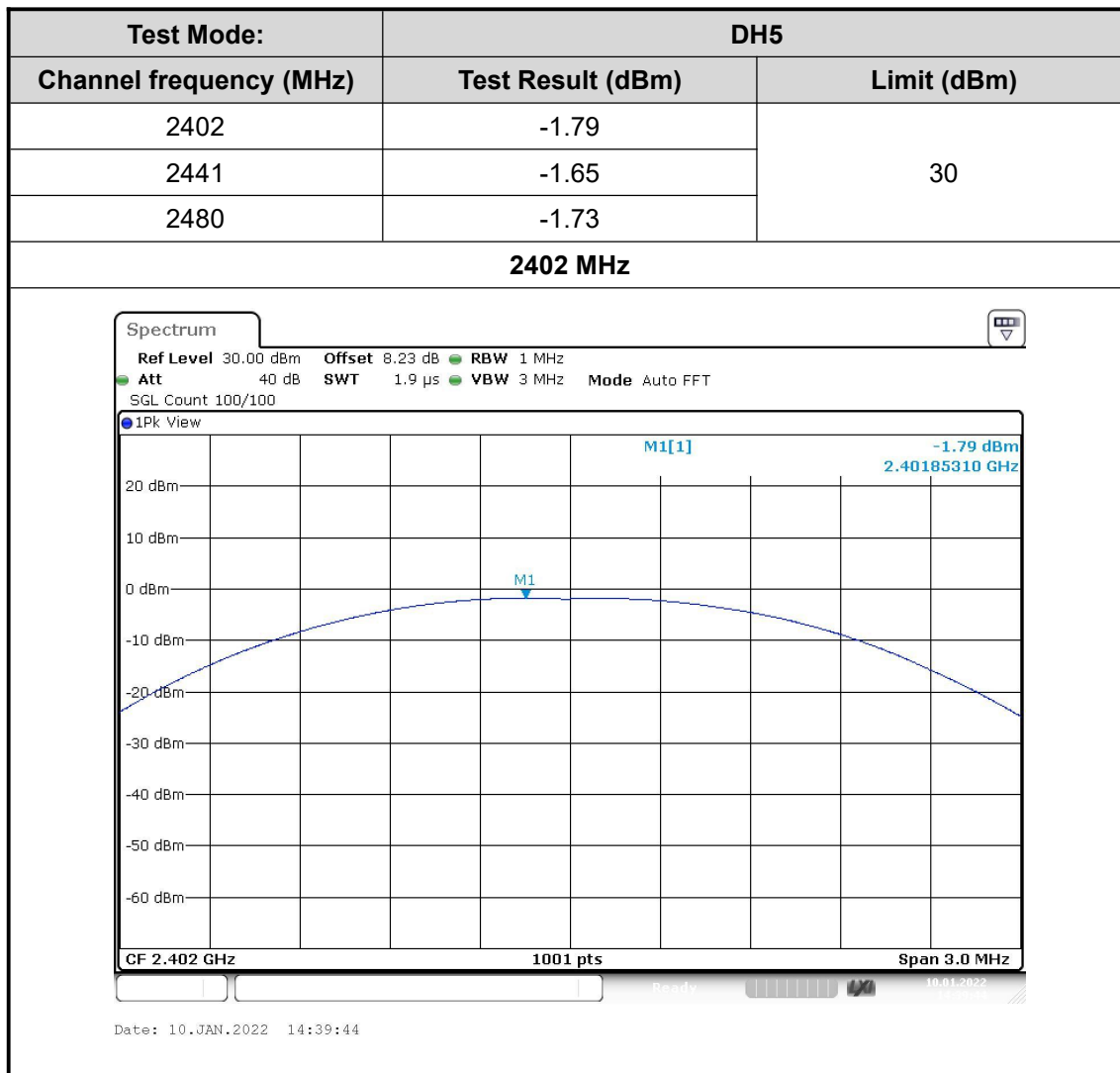
### Test Procedure

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.
2. Spectrum Setting:  
Peak Detector: RBW=1 MHz, VBW=3 MHz for bandwidth less than 1MHz.  
RBW=3 MHz, VBW=10 MHz for bandwidth more than 1MHz.

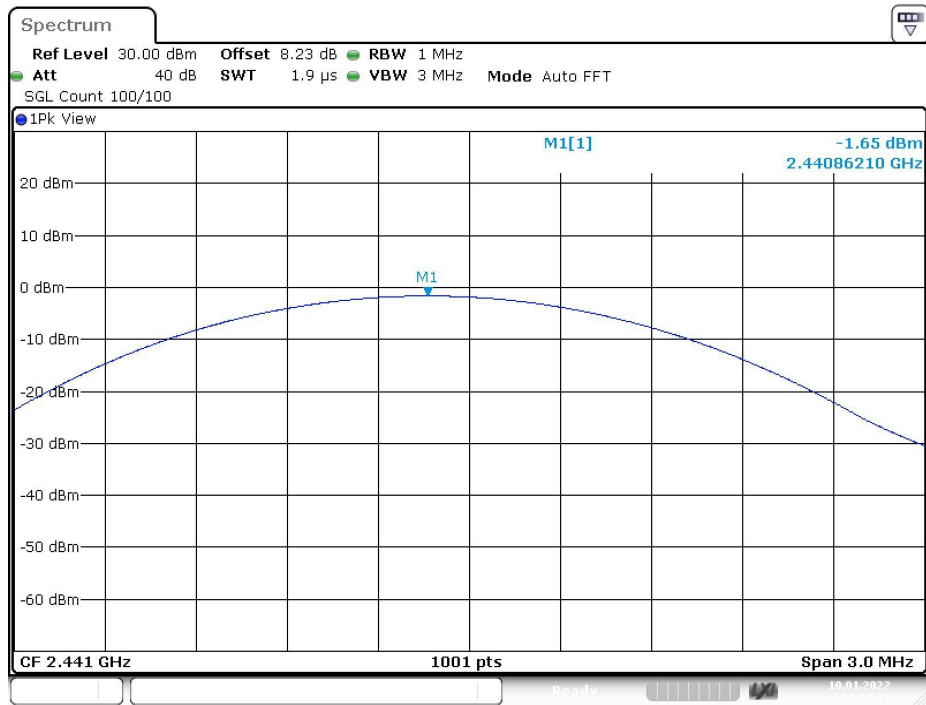
### Test Mode

Please refer to the clause 2.2

## Test Result

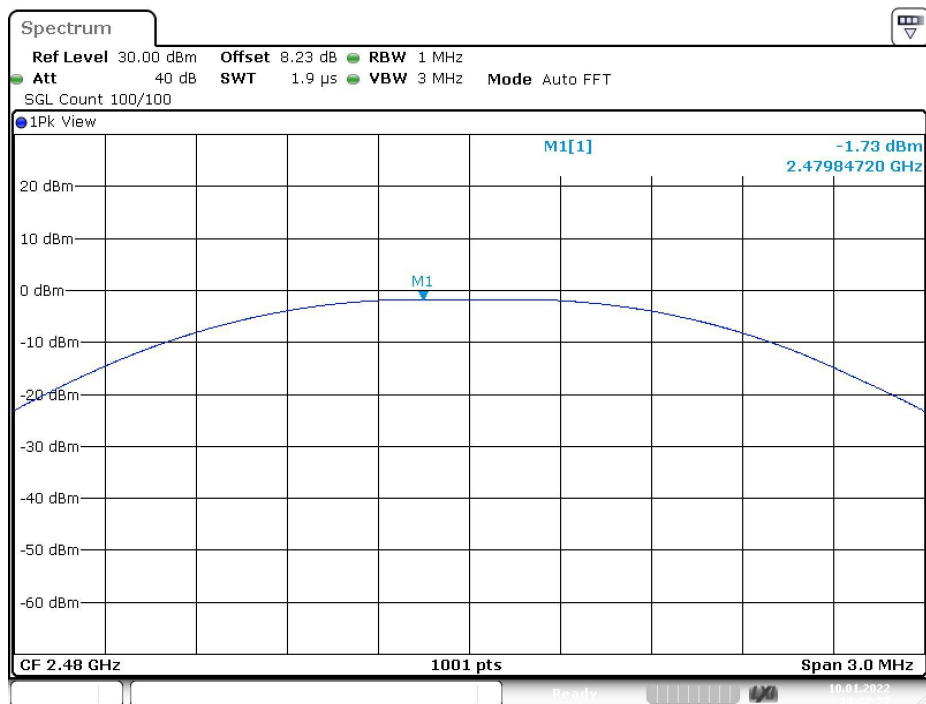


### 2441 MHz

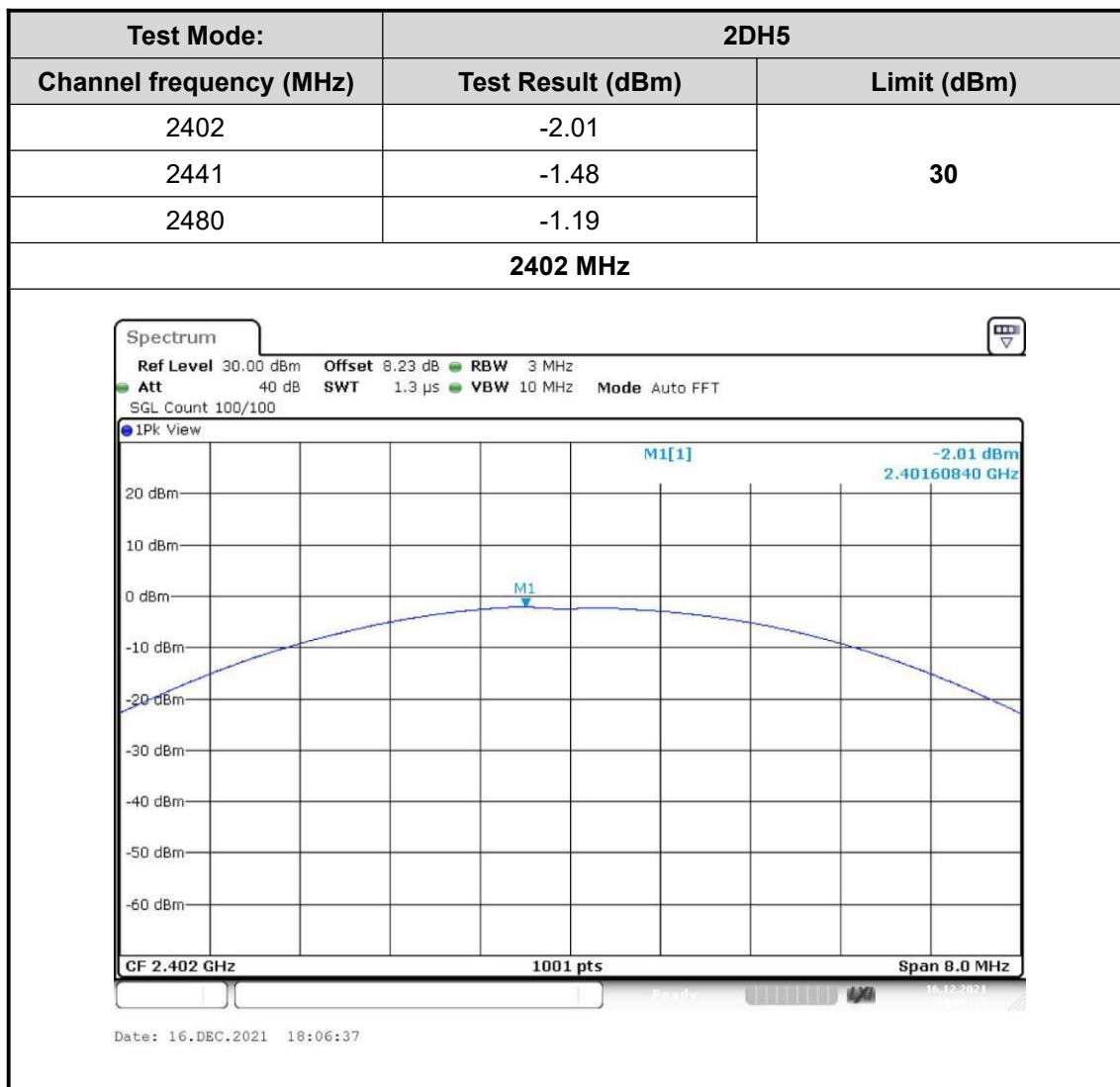


Date: 10.JAN.2022 14:42:13

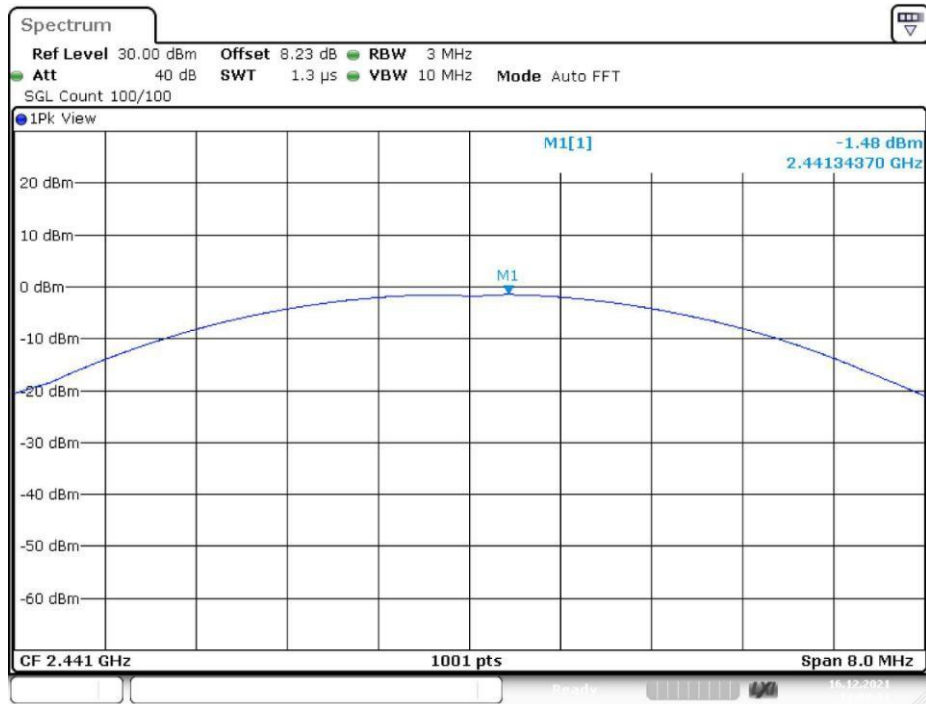
### 2480 MHz



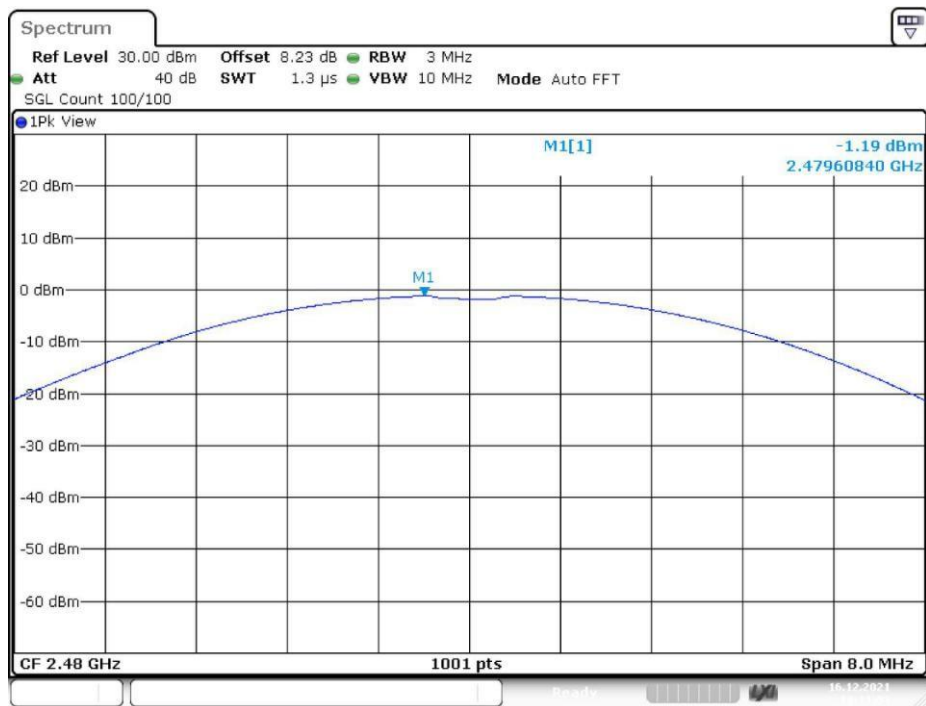
Date: 10.JAN.2022 14:42:28



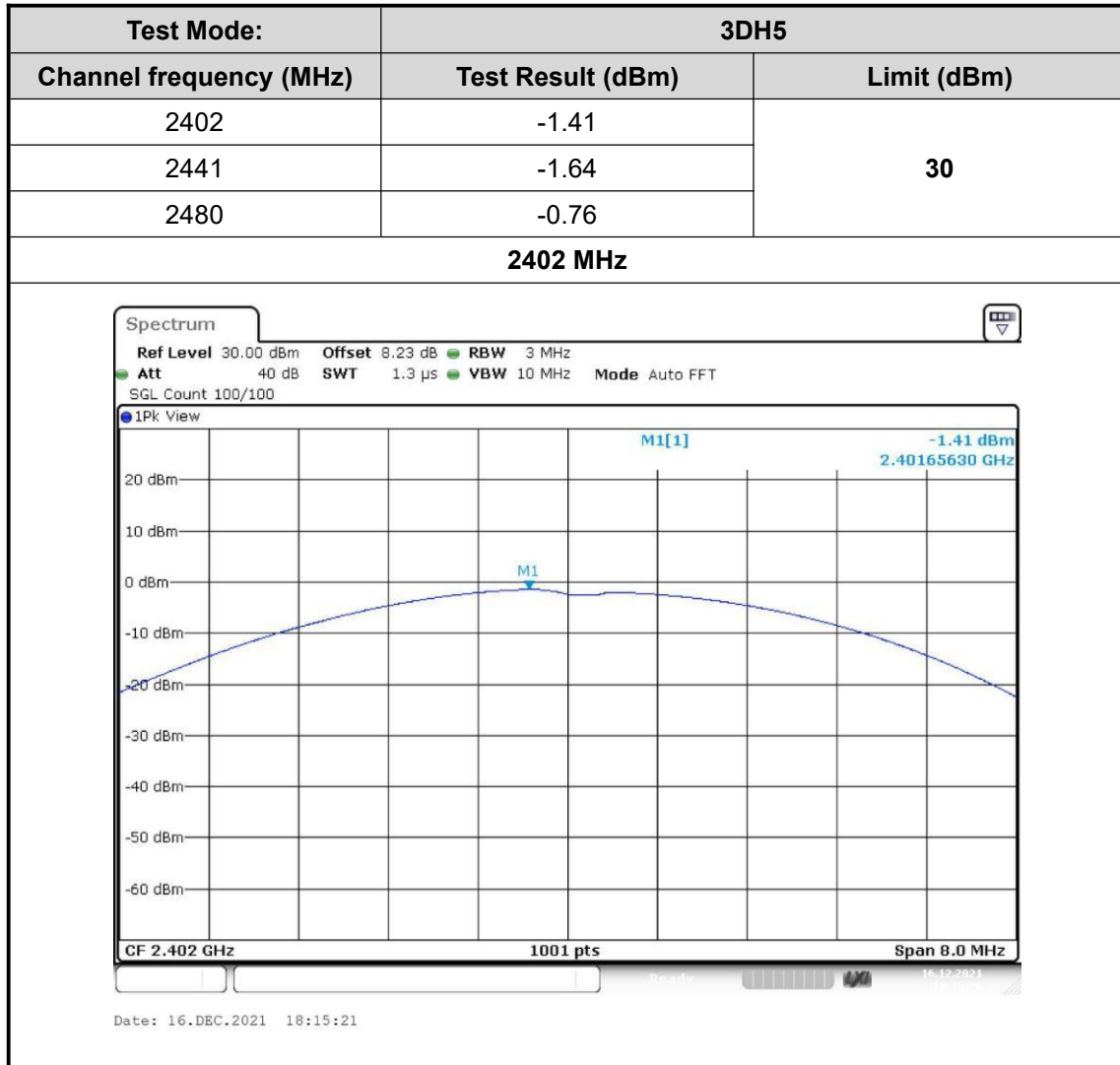
### 2441 MHz



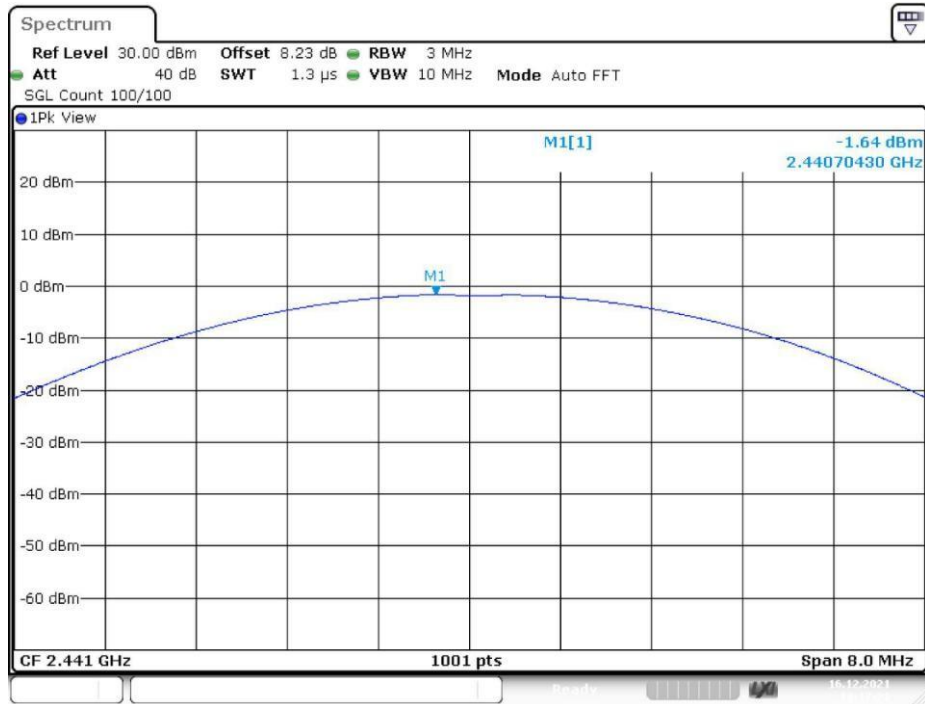
### 2480 MHz



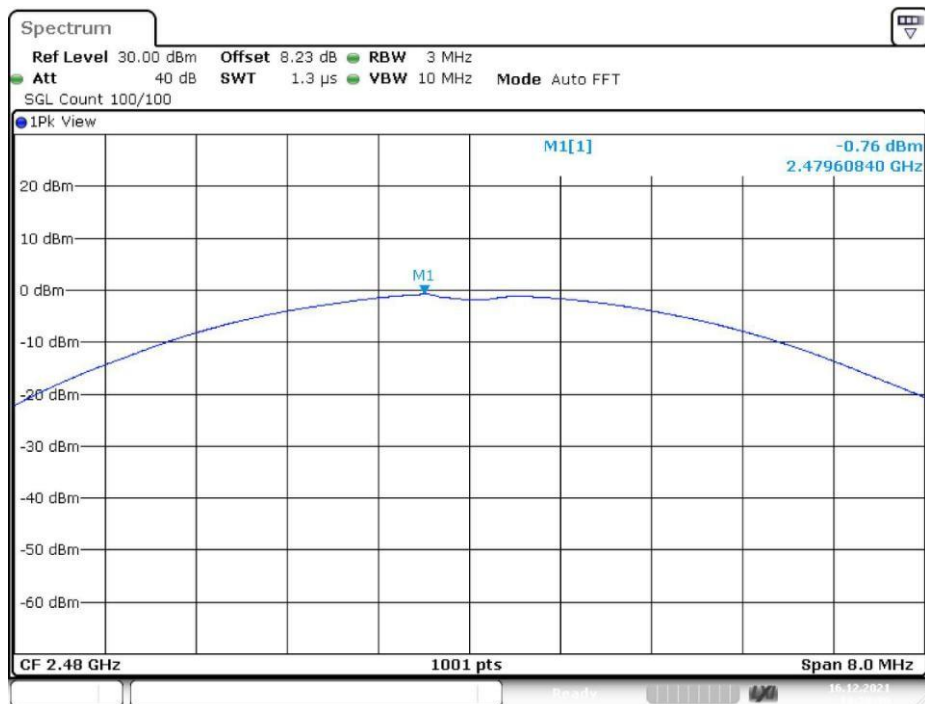




### 2441 MHz



### 2480 MHz

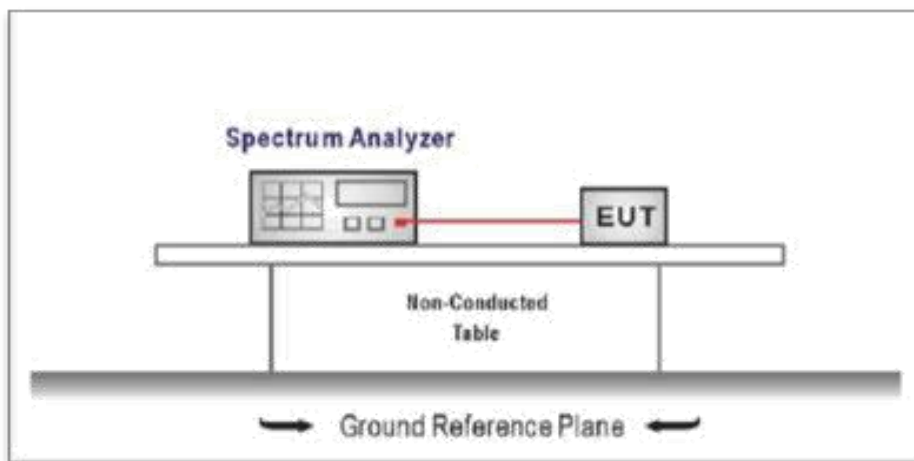


### 3.3. 20dB Bandwidth

#### Limit

Test Item	Limit	Frequency Range(MHz)
Bandwidth	N/A	2400~2483.5

#### Test Configuration



#### Test Procedure

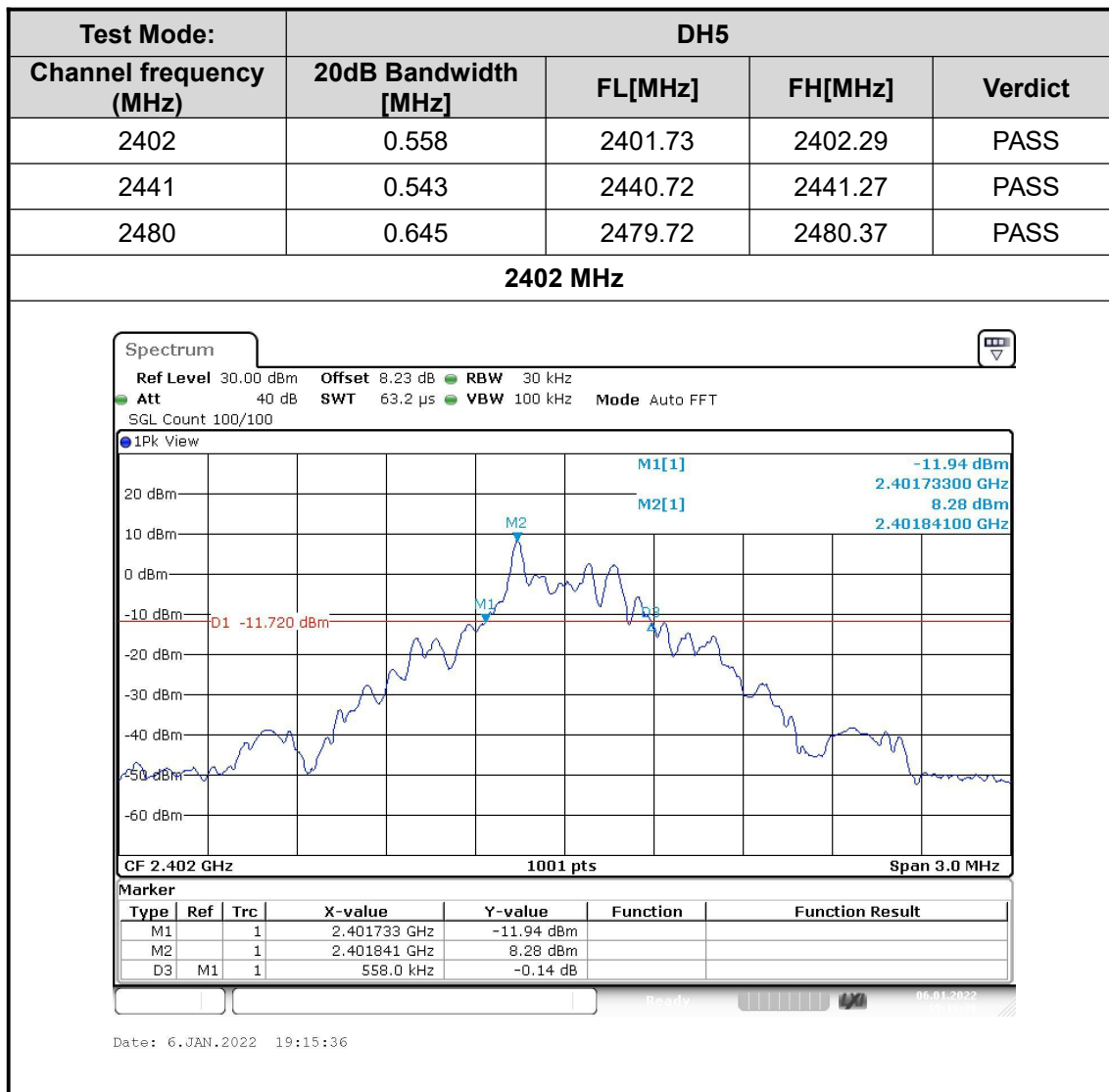
1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.
2. Spectrum Setting:
  - (1) Set RBW = 30 kHz.
  - (2) Set the video bandwidth (VBW)  $\geq 3 \times \text{RBW}$ .
  - (3) Detector = Peak.
  - (4) Trace mode = Max hold.
  - (5) Sweep = Auto couple.

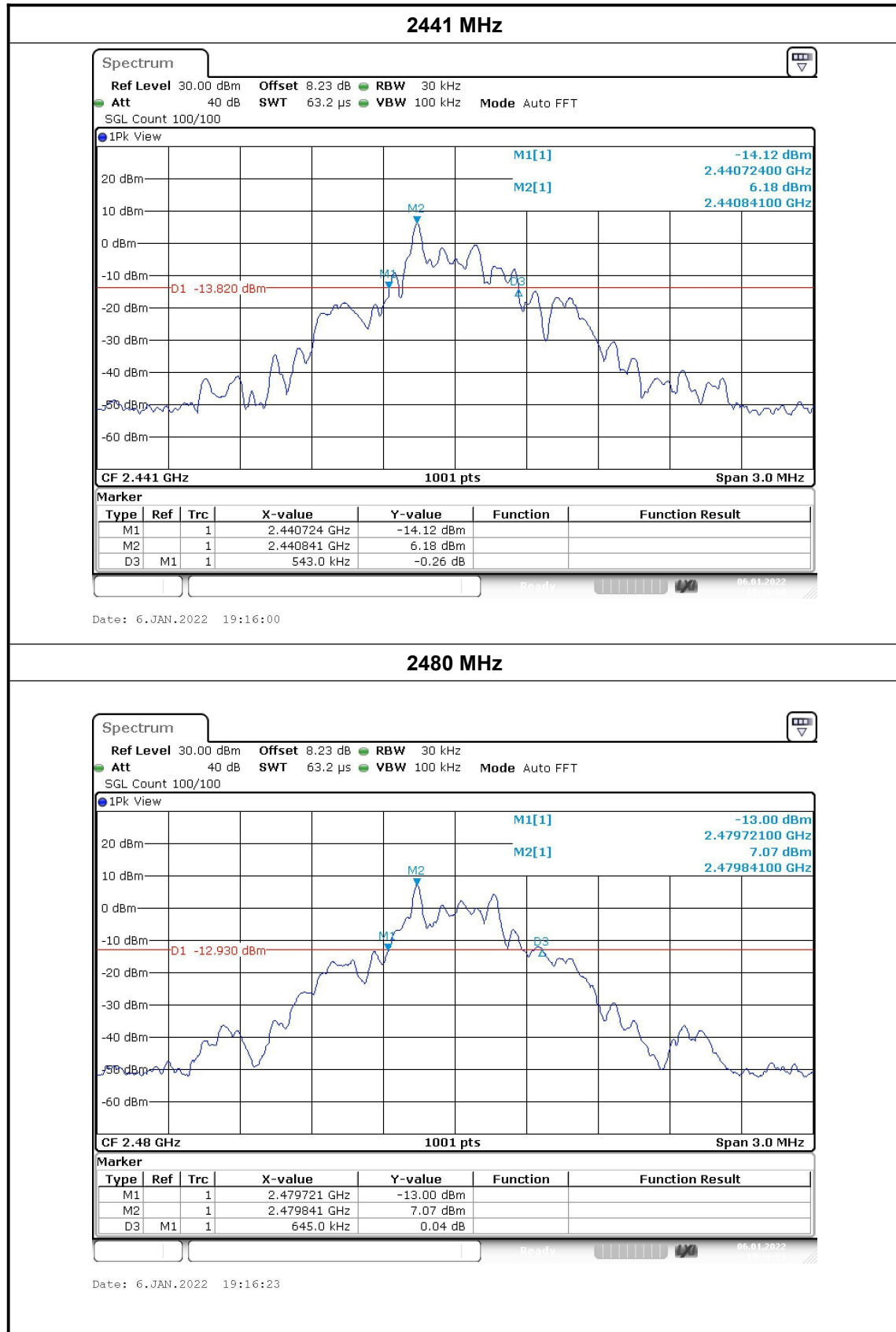
NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

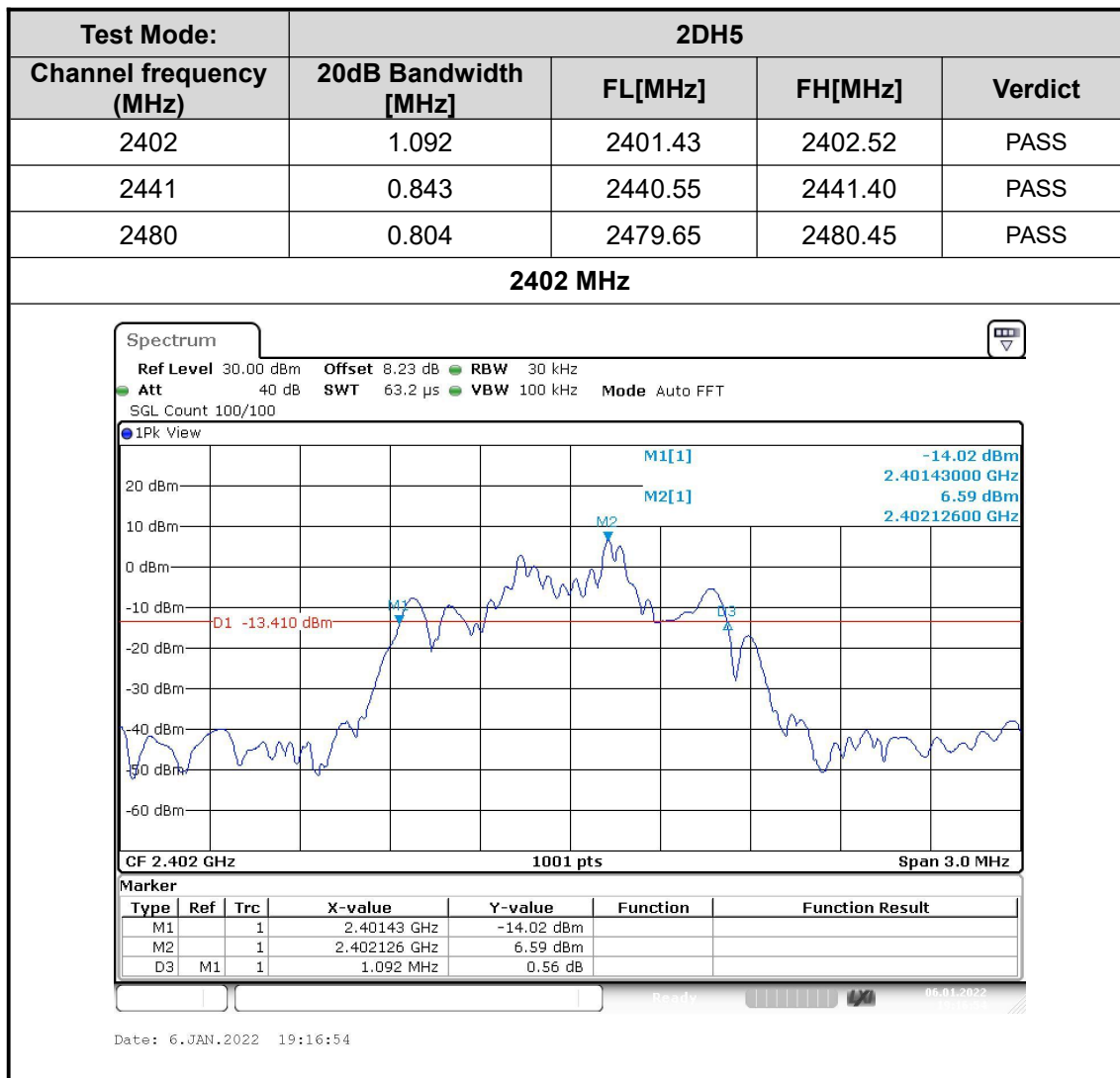
#### Test Mode

Please refer to the clause 2.2.

## Test Results





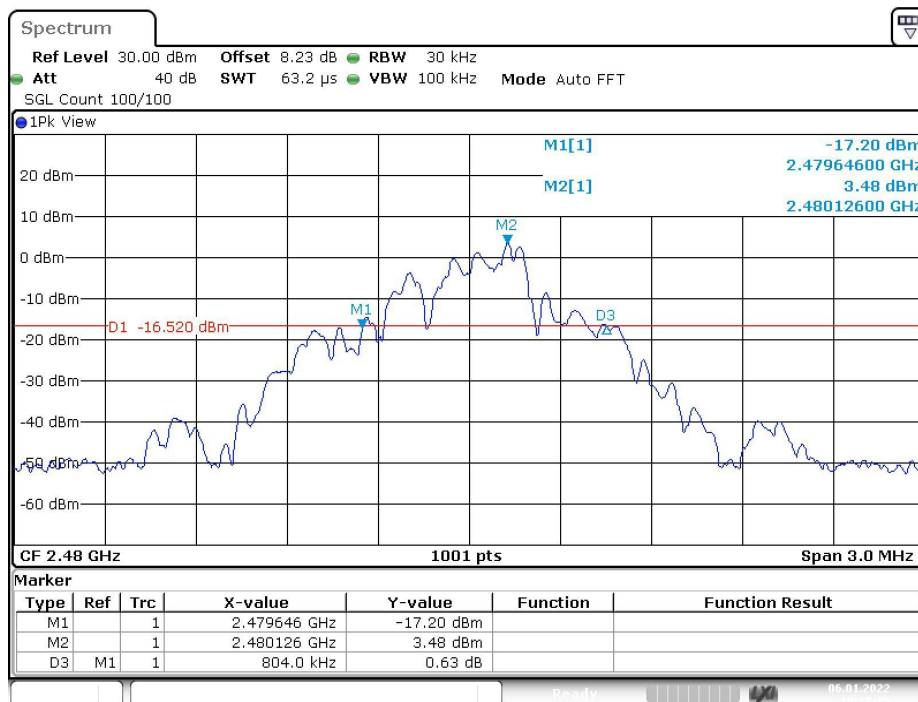


### 2441 MHz

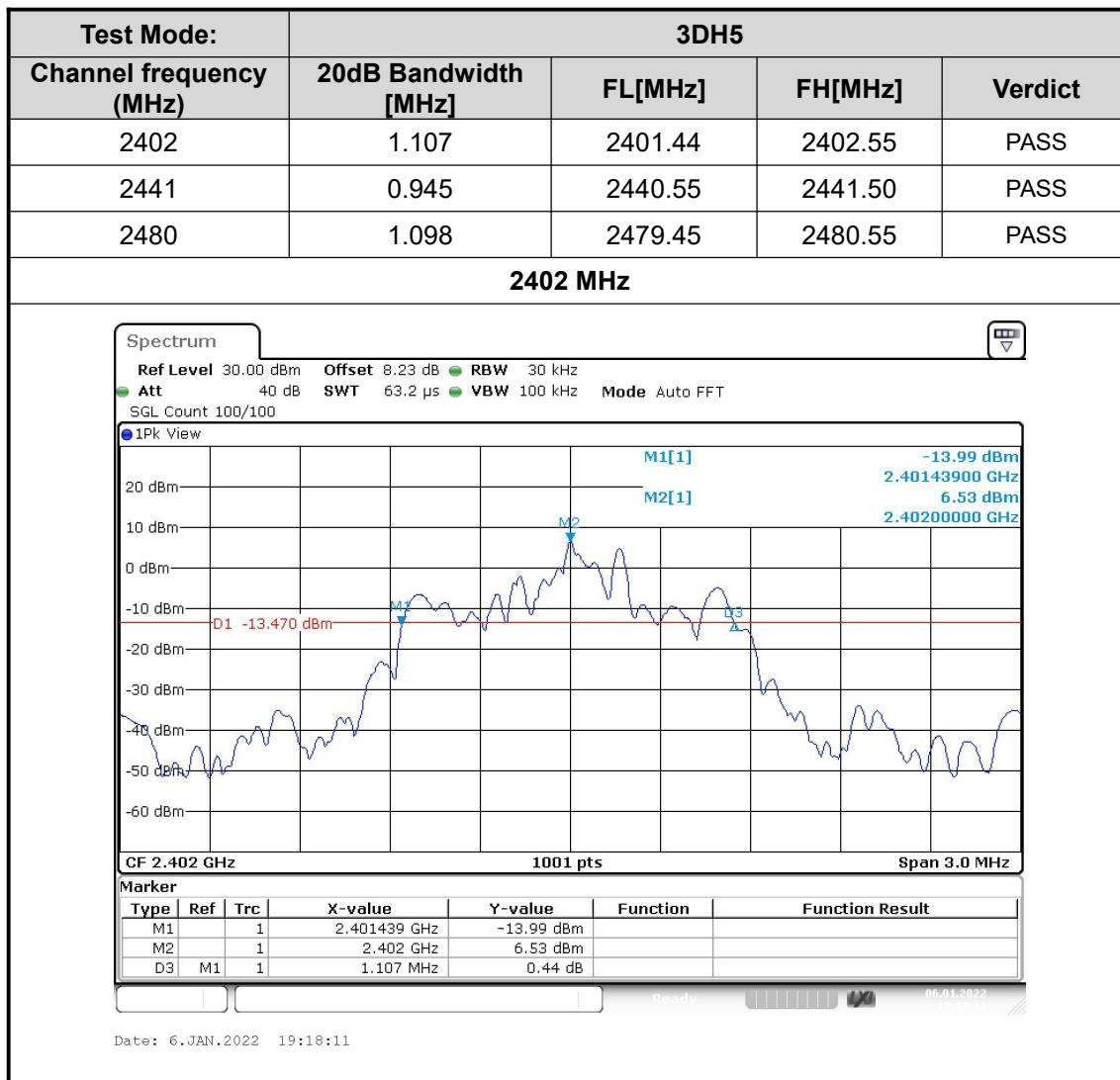


Date: 6.JAN.2022 19:17:15

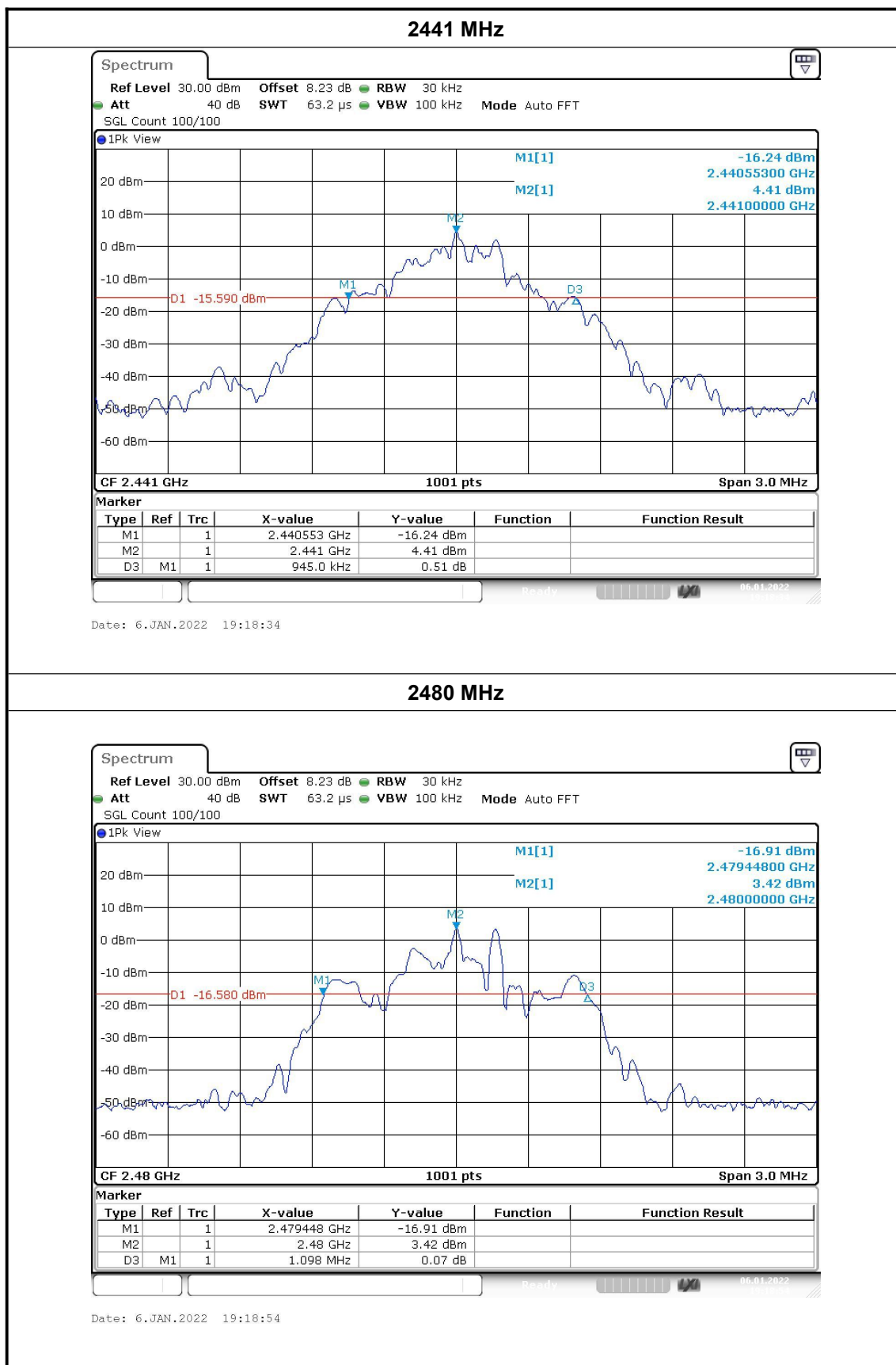
### 2480 MHz

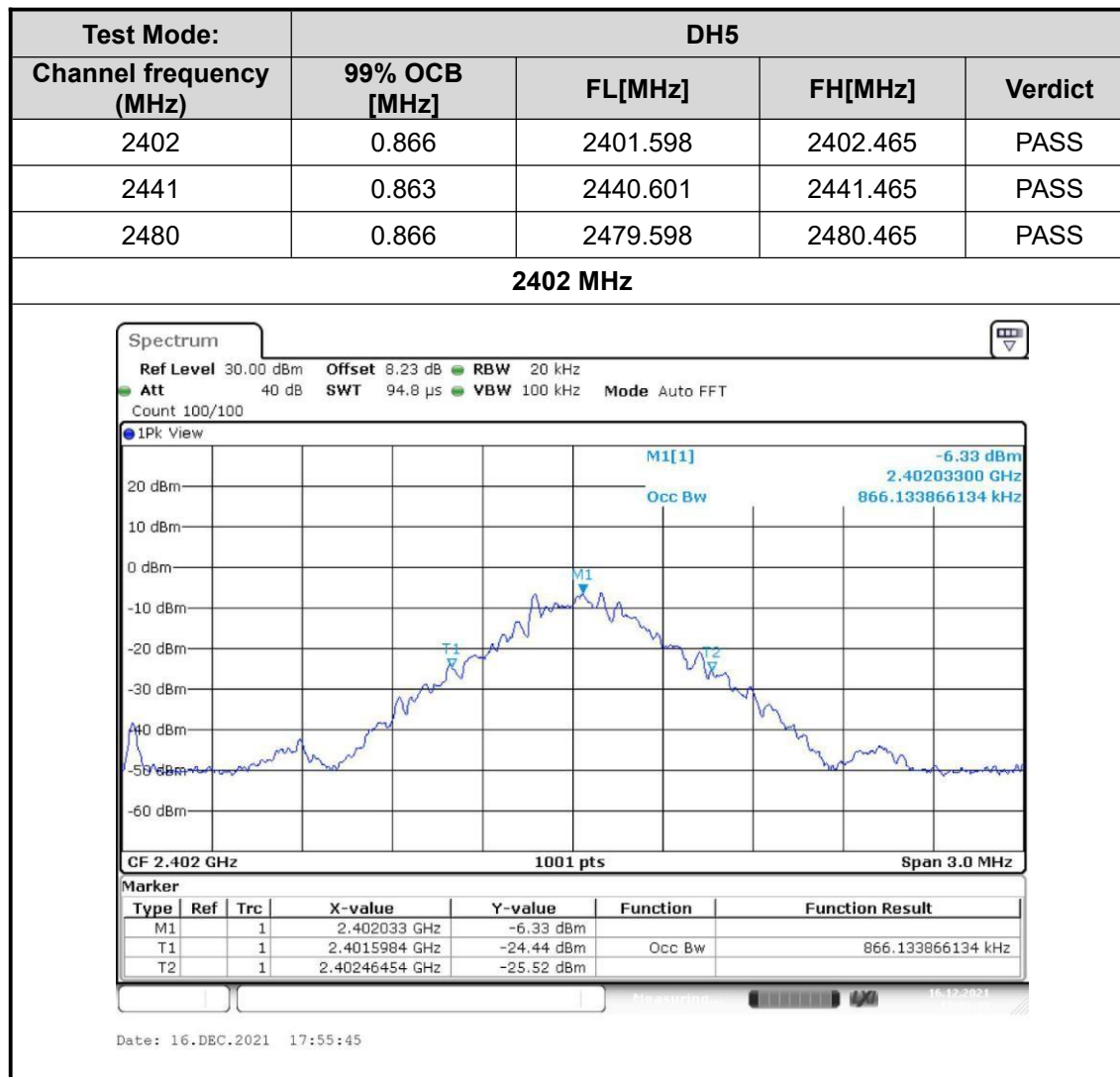


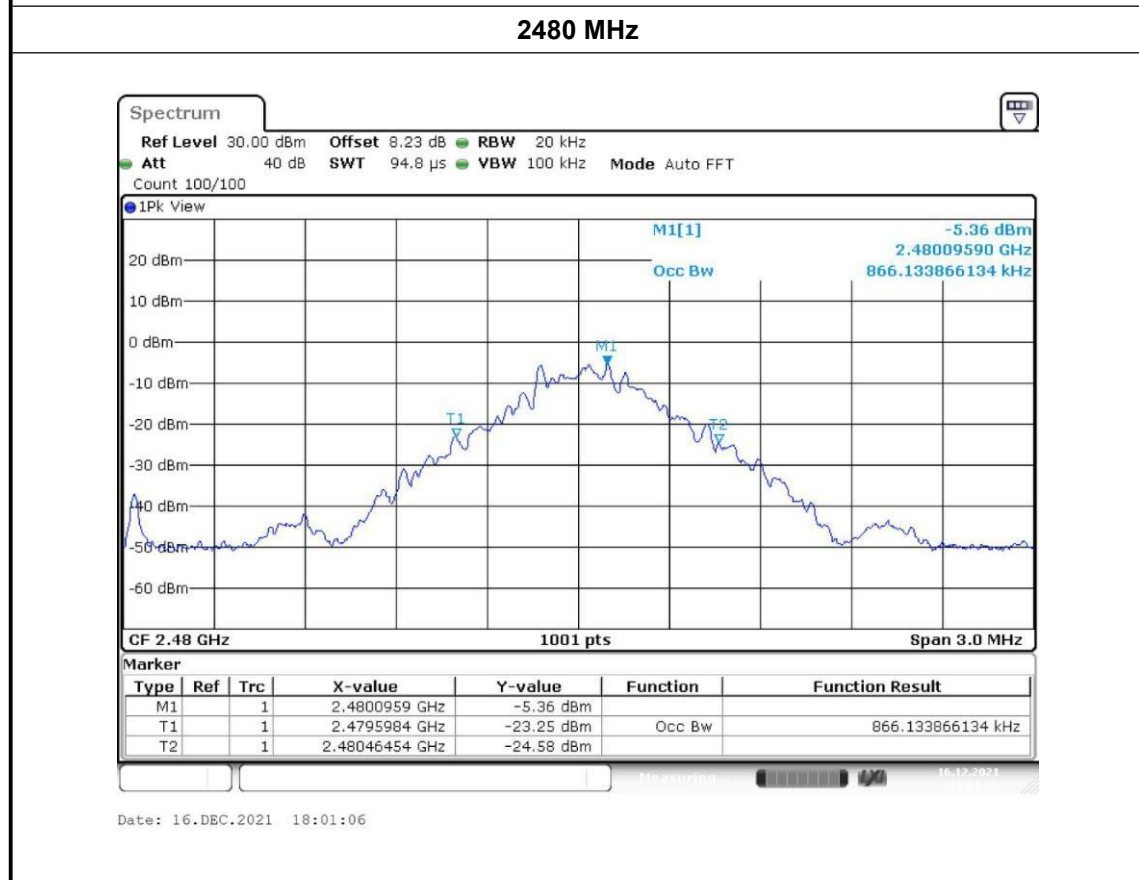
Date: 6.JAN.2022 19:17:35

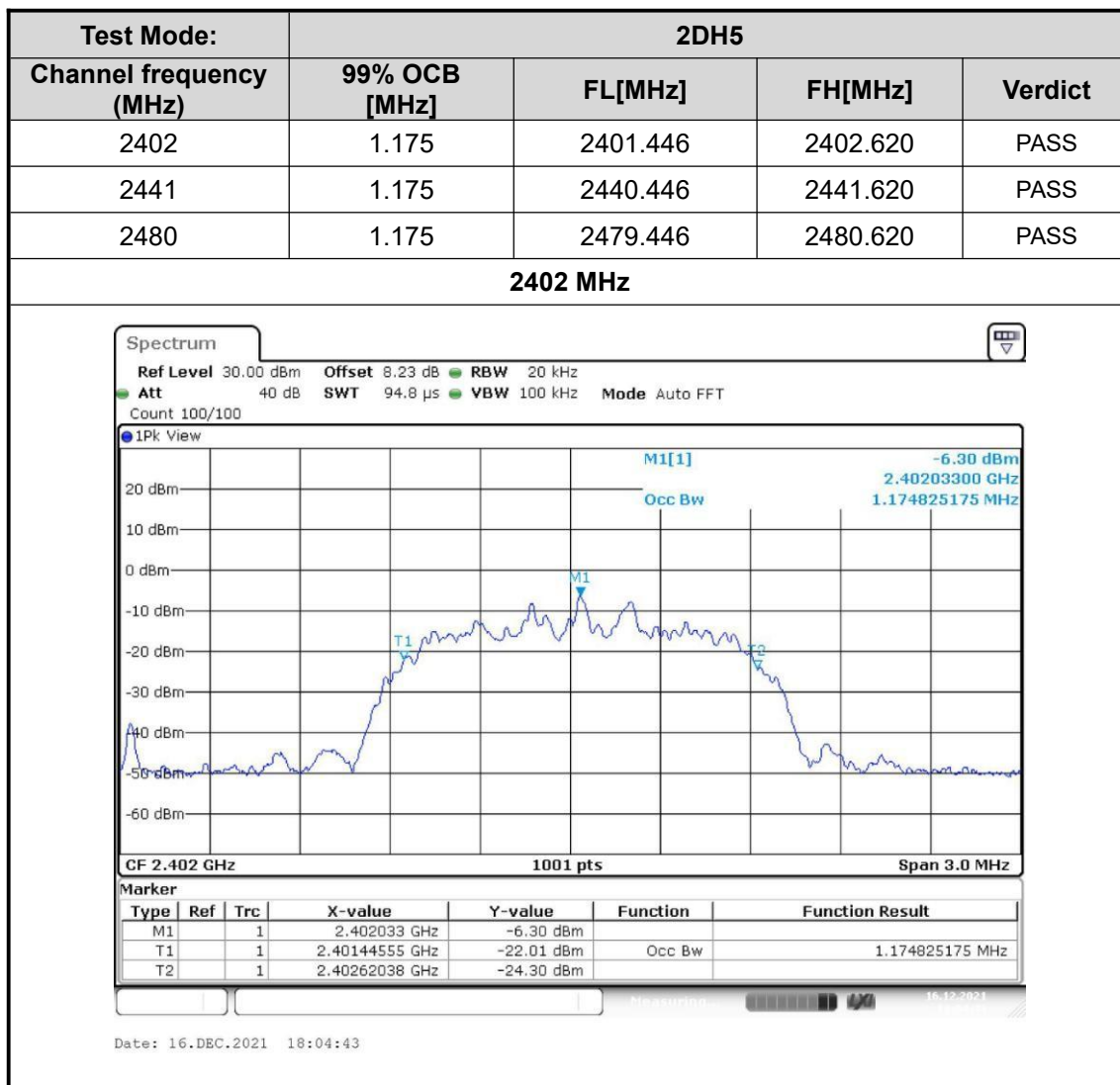


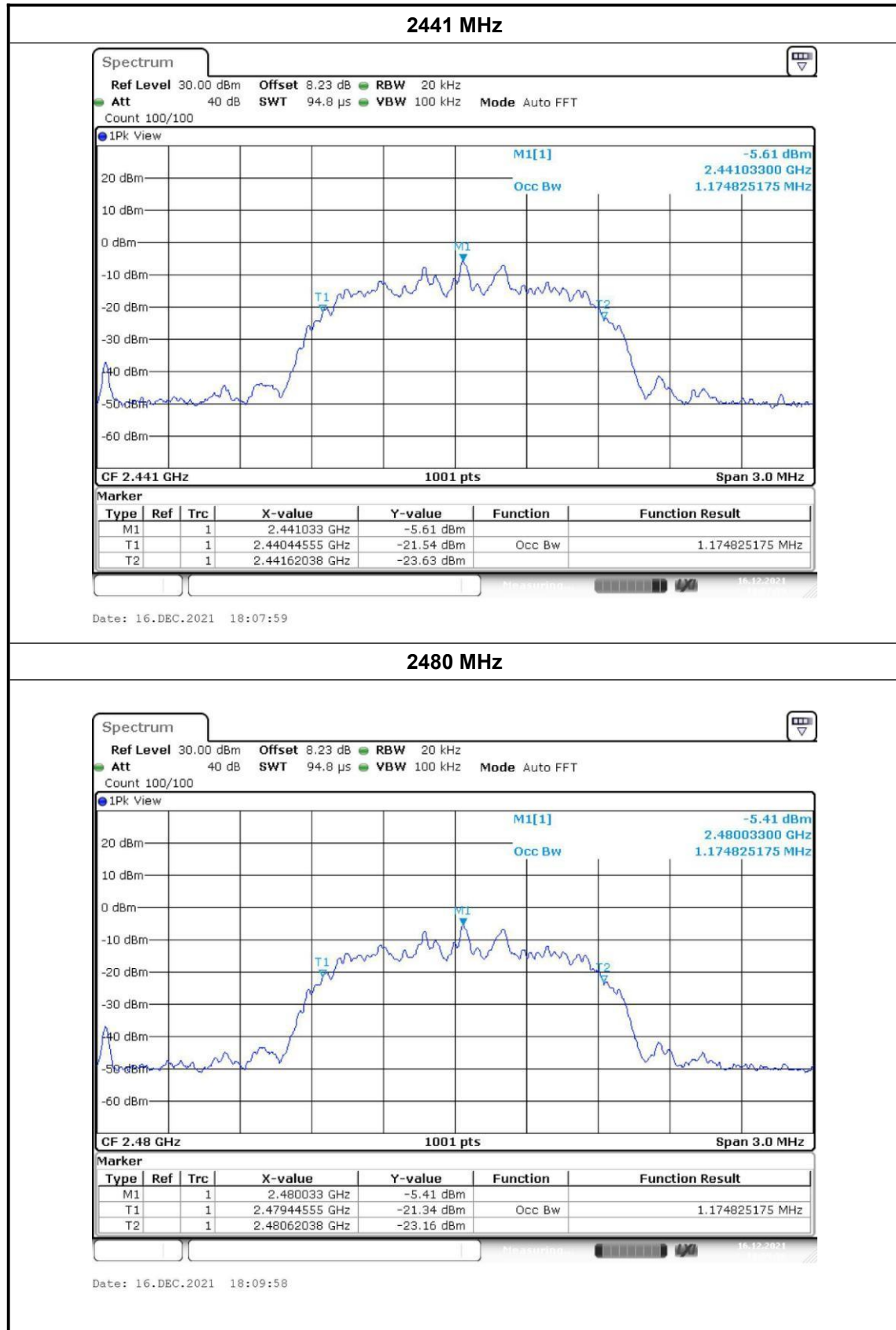


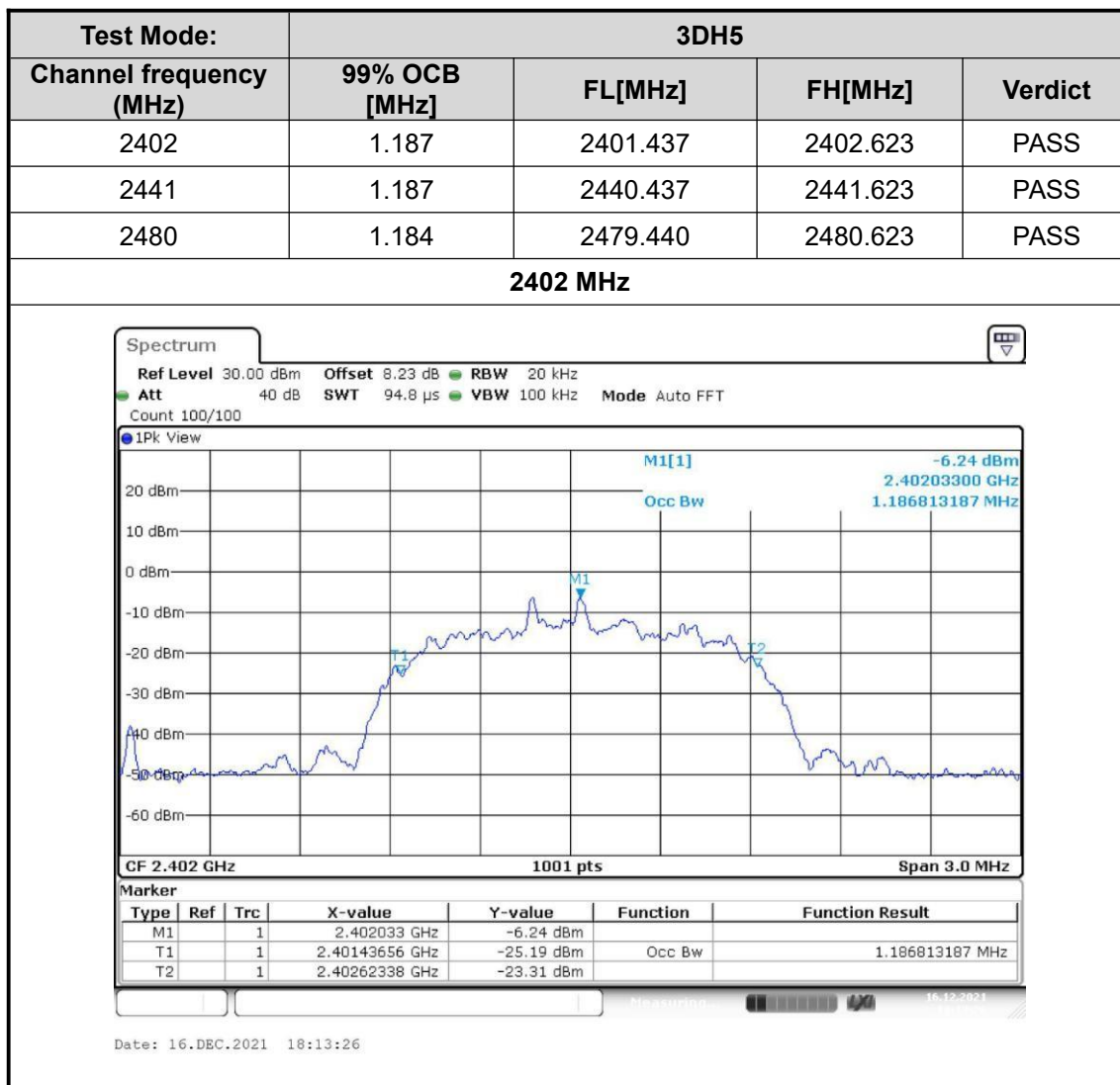


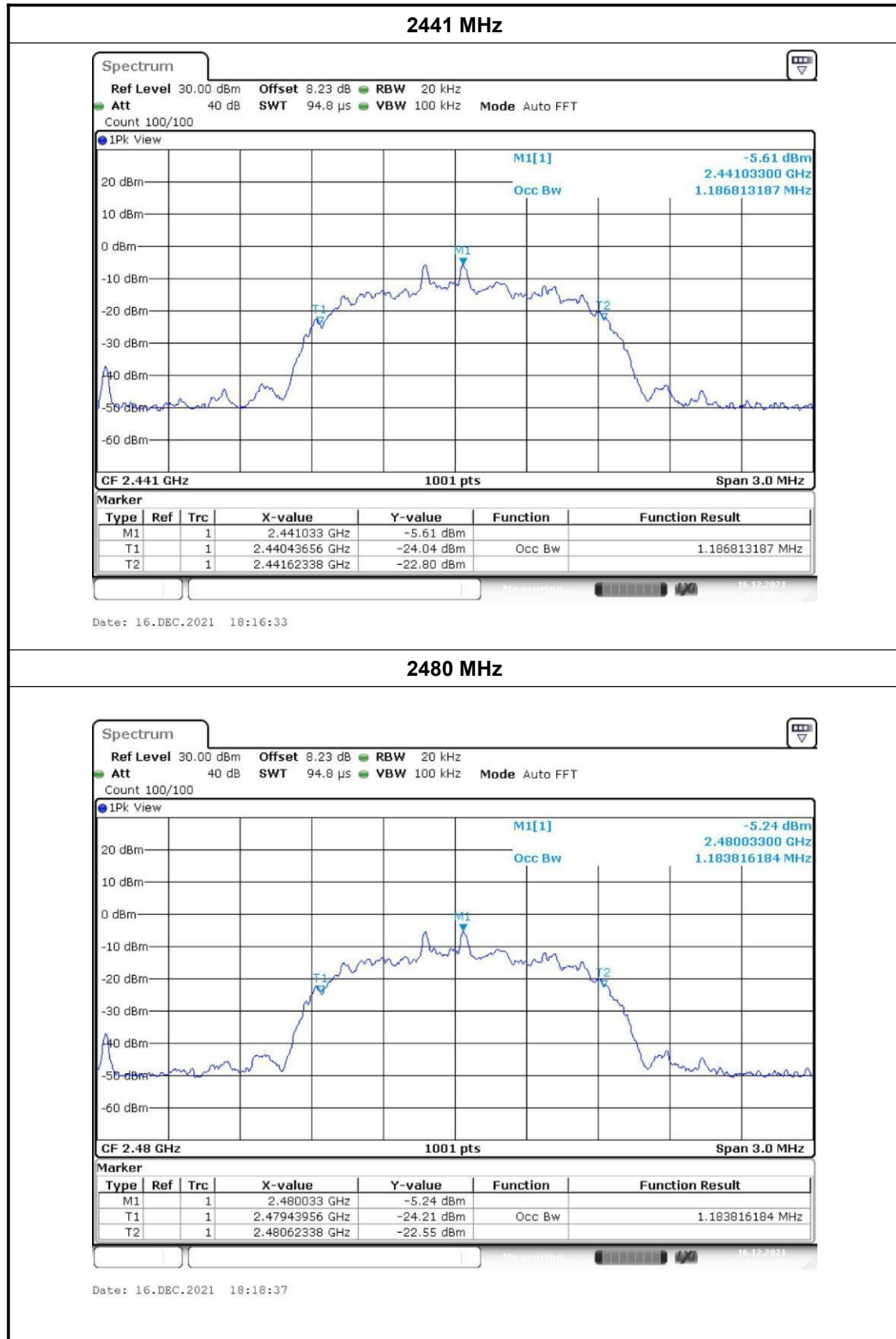














### 3.4. Carrier Frequencies Separation

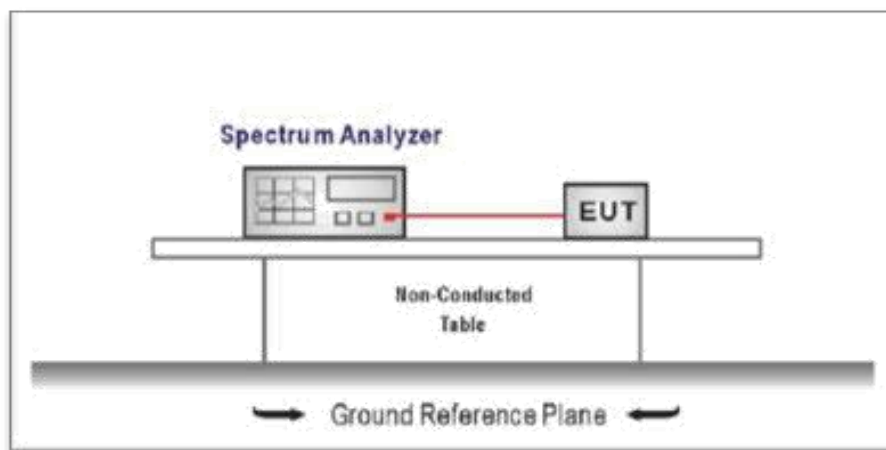
#### LIMIT

FCC CFR Title 47 Part 15 Subpart C Section 15.247 (a)(1):

frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25kHz or the  $\frac{2}{3} \times 20\text{dB}$  bandwidth of the hopping channel, whichever is greater.

Test Item	Limit	Frequency Range(MHz)
Channel Separation	>25KHz or >two-thirds of the 20 dB bandwidth Which is greater	2400~2483.5

#### Test Configuration



#### Test Procedure

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.

2. Spectrum Setting:

- (1) Set RBW = 100 kHz.
- (2) Set the video bandwidth (VBW)  $\geq 3$  RBW.
- (3) Detector = Peak.
- (4) Trace mode = Max hold.
- (5) Sweep = Auto couple.

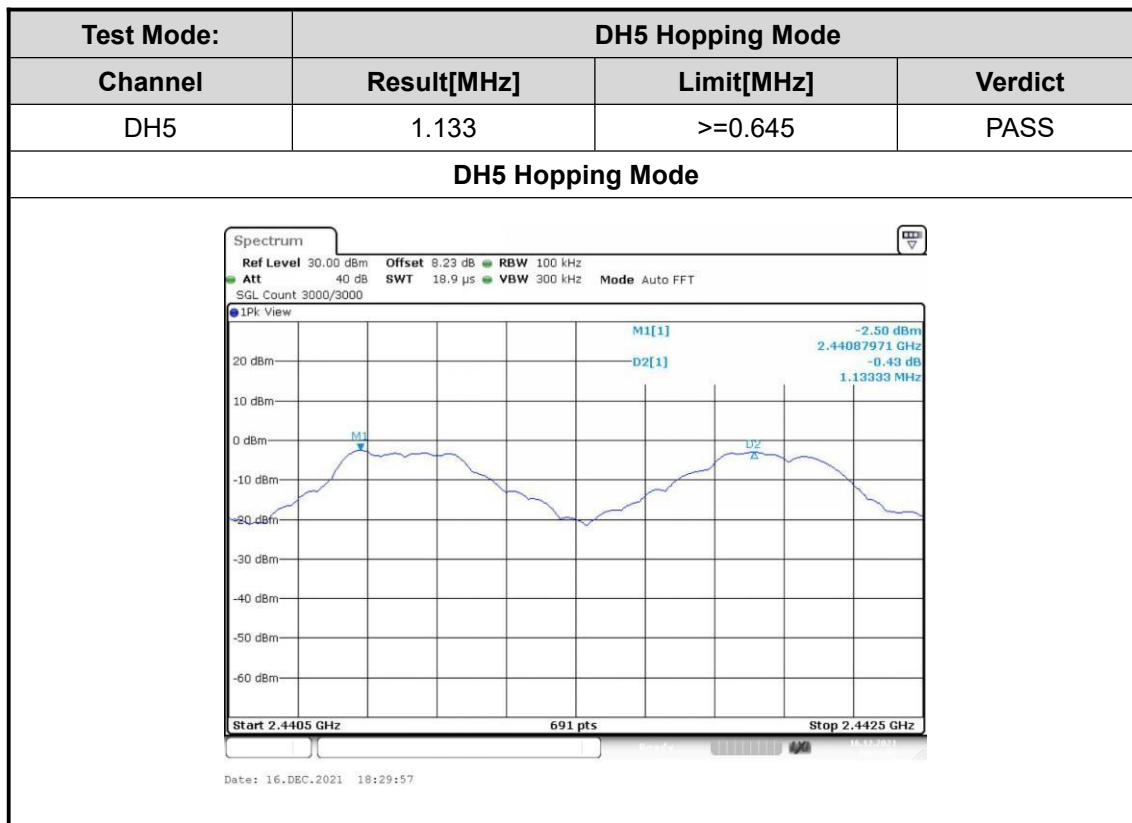
NOTE: The EUT was set to continuously transmitting in each mode and low, Middle and high channel for the test.

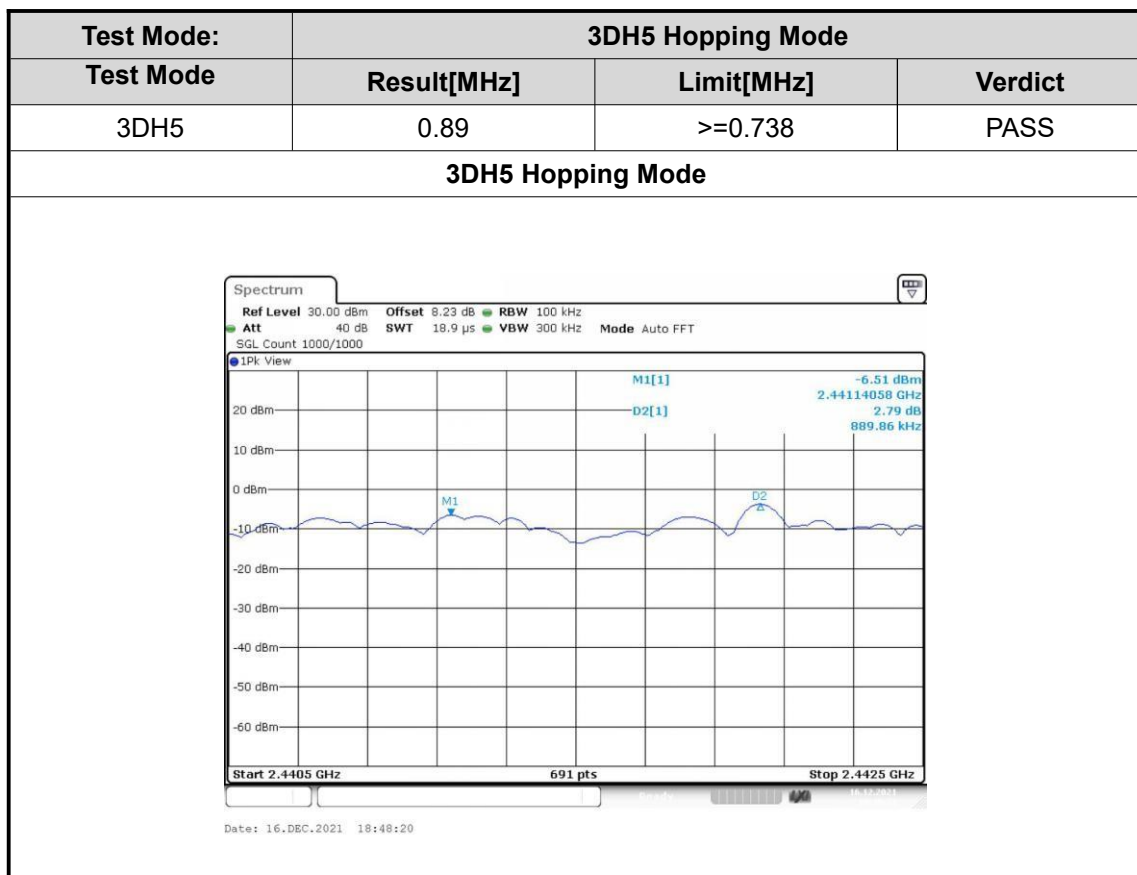
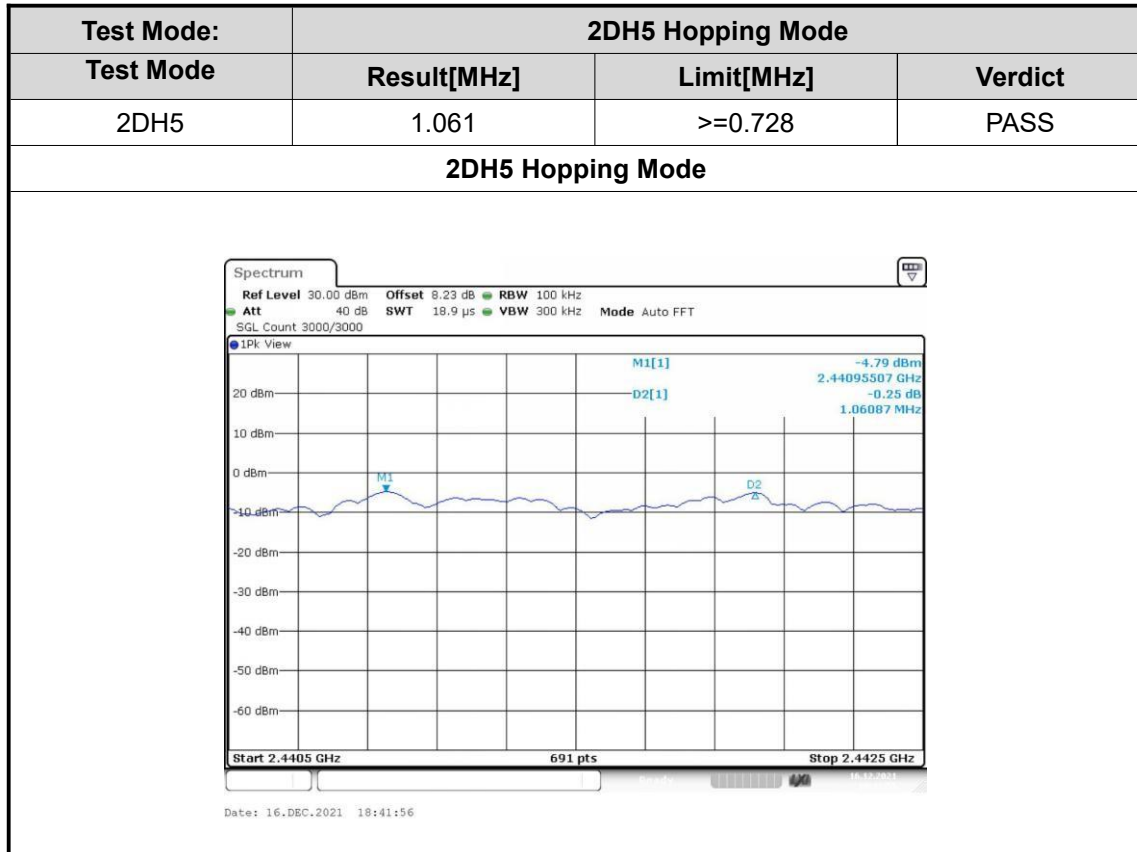
#### Test Mode

Please refer to the clause 2.2.



## Test Results



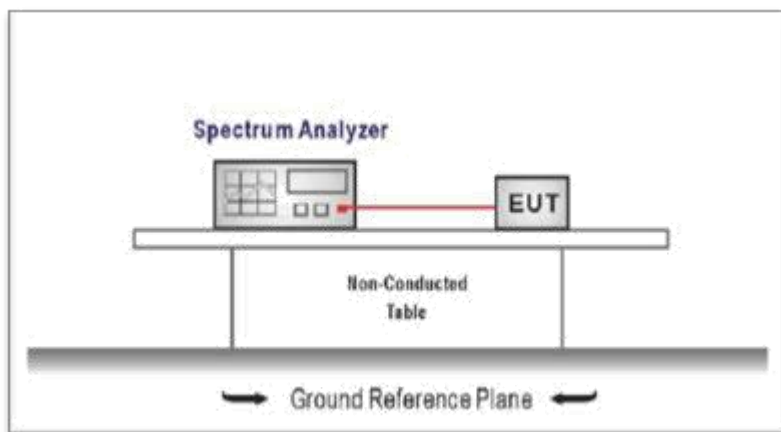


### 3.5. Number of Hopping Channel

#### Limit

Section	Test Item	Limit
15.247	Number of Hopping Channel	>15

#### Test Configuration



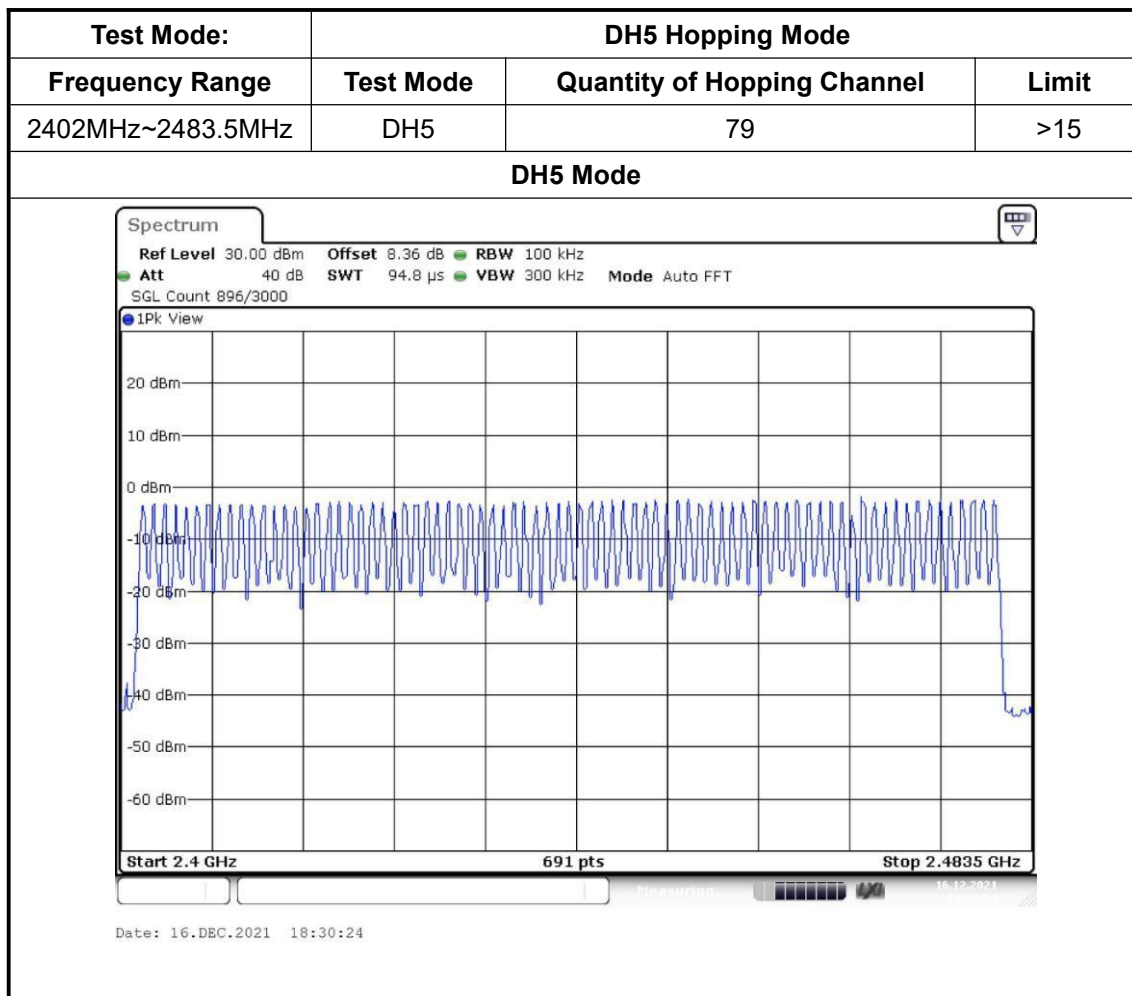
#### Test Procedure

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.
2. Spectrum Setting:
  - (1) Peak Detector: RBW=100 kHz, VBW $\geq$ RBW, Sweep time= Auto.

#### Test Mode

Please refer to the clause 2.2.

## Test Result



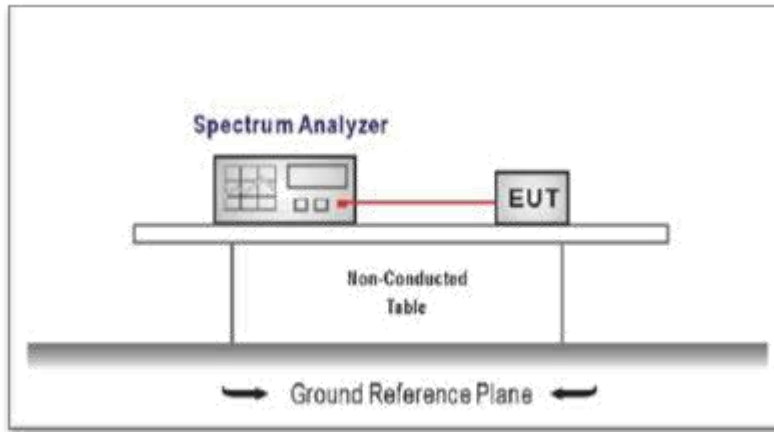
Note: The GFSK ( DH5 ) modulation is the worst case and recorded in the report.

### 3.6. Dwell Time

#### Limit

Section	Test Item	Limit
15.247(a)(1)	Average Time of Occupancy	0.4 sec

#### Test Configuration



#### Test Procedure

1. Connect EUT RF output port to the Spectrum Analyzer through an RF attenuator.
2. Spectrum Setting:
  - (1) Spectrum Setting:  $RBW=1\text{MHz}$ ,  $VBW \geq RBW$ .
  - (2) Use video trigger with the trigger level set to enable triggering only on full pulses.
  - (3) Sweep Time is more than once pulse time.
  - (4) Set the center frequency on any frequency would be measure and set the frequency span to zero.
  - (5) Measure the maximum time duration of one single pulse.
  - (6) Set the EUT for packet transmitting.

#### Test Mode

Please refer to the clause 2.2

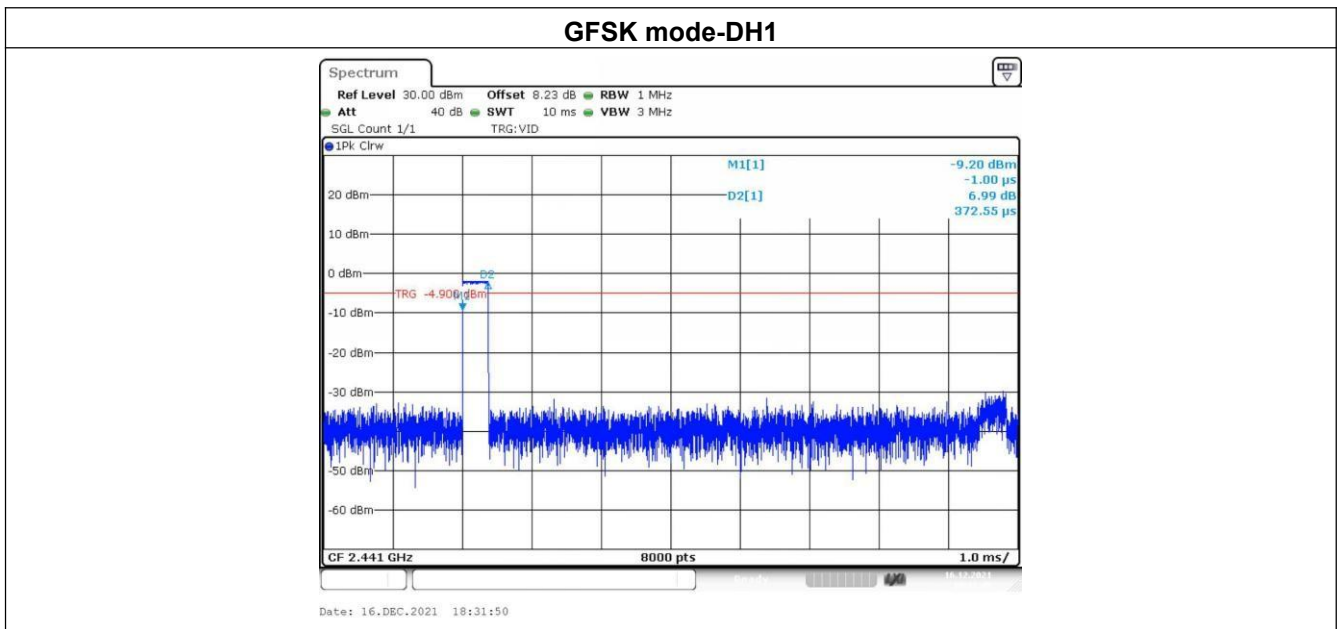
## Test Result

Mode	Data Packet	Frequency (MHz)	Pulse Duration (ms)	Dwell Time (ms)	Limit(s)	Conclusion
GFSK	DH1	2441	0.37	118.40	<0.4	Pass
	DH3	2441	1.62	259.20	<0.4	Pass
	DH5	2441	2.86	305.07	<0.4	Pass
$\pi/4$ DQPSK	2DH1	2441	0.38	121.60	<0.4	Pass
	2DH3	2441	1.63	260.80	<0.4	Pass
	2DH5	2441	2.87	306.13	<0.4	Pass
8DPSK	3DH1	2441	0.38	121.60	<0.4	Pass
	3DH3	2441	1.63	260.80	<0.4	Pass
	3DH5	2441	2.87	306.13	<0.4	Pass

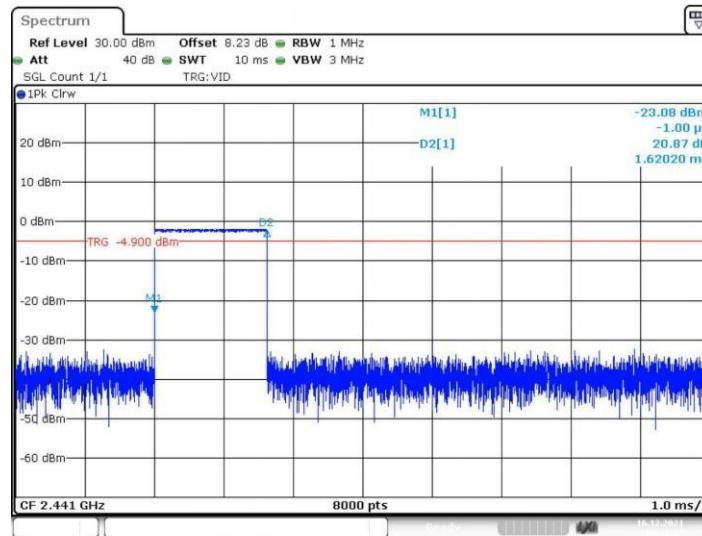
Note:

- A period time = 0.4 (s) \* 79 = 31.6(s)
- DH1 time slot = Pulse Duration \* (1600/(2\*79)) \* A period time  
DH3 time slot = Pulse Duration \* (1600/(4\*79)) \* A period time  
DH5 time slot = Pulse Duration \* (1600/(6\*79)) \* A period time
- For GFSK,  $\pi/4$ -DQPSK and 8DPSK: The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

## Test plots

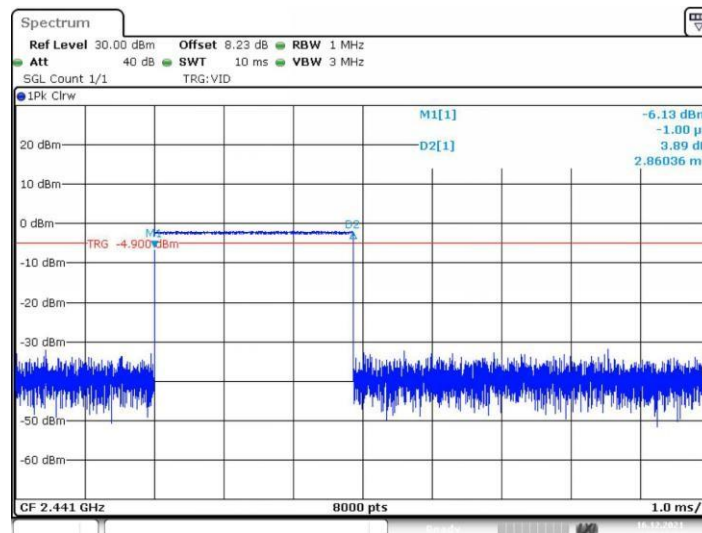


### GFSK mode-DH3



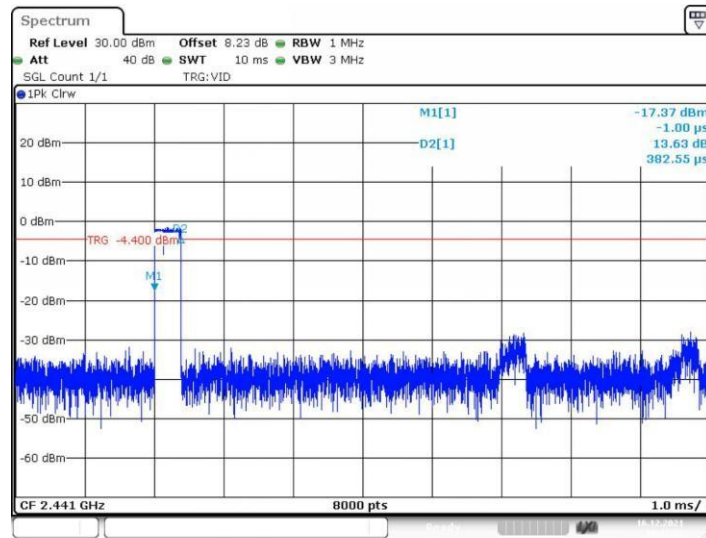
Date: 16.DEC.2021 18:32:28

### GFSK mode-DH5



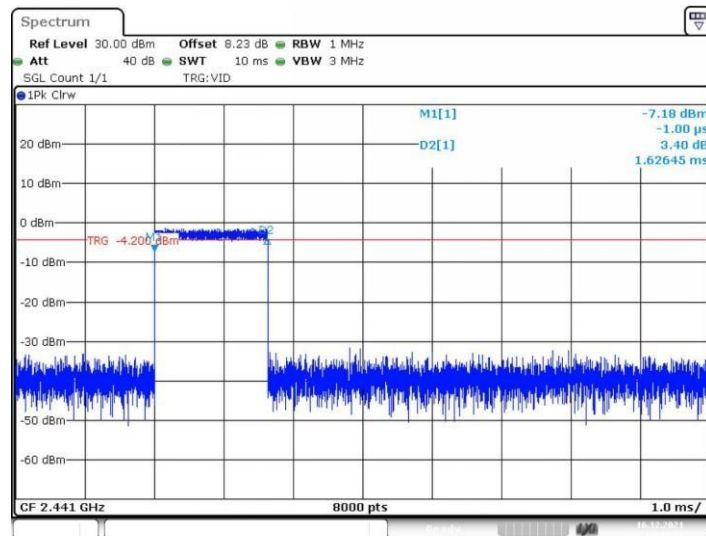
Date: 16.DEC.2021 18:31:14

### $\pi/4$ -DQPSK mode-2DH1



Date: 16.DEC.2021 18:42:52

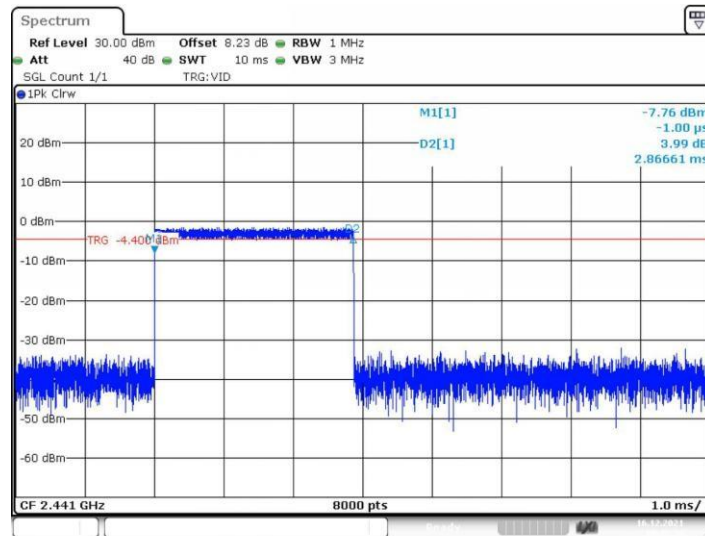
### $\pi/4$ -DQPSK mode-2DH3



Date: 16.DEC.2021 18:43:30

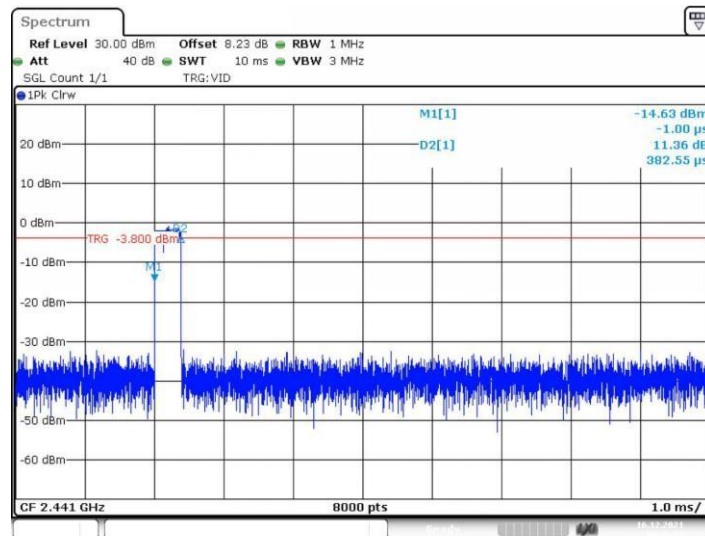


### $\pi/4$ -DQPSK mode-2DH5



Date: 16.DEC.2021 18:42:13

### 8DPSK mode-3DH1



Date: 16.DEC.2021 18:49:33