

# FCC CERTIFICATION TEST REPORT

## FOR

|                             |   |   |
|-----------------------------|---|---|
| <b>Applicant</b>            | : | ASA Electronics Shenzhen Limited  |
| <b>Address</b>              | : | Room 503, 5/F., Unit A, Skyworth Building, Gaoxin Avenue.1.S., Nanshan District, Shen Zhen, China |
| <b>Equipment under Test</b> | : | AM/FM/WX/USB/BT/AUX IN Radio  |
| <b>Model No.</b>            | : | XMH100, RMXMH100  |
| <b>Trade Mark</b>           | : | N/A   |
| <b>FCC ID</b>               | : | 2AHU2-XMH100  |
| <b>Manufacturer</b>         | : | ASA Electronics, LLC.   |
| <b>Address</b>              | : | 2602 Marina Drive Elkhart, IN 46514 USA   |

**Issued By: Dongguan Dongdian Testing Service Co., Ltd.**

**Add.:** No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park,  
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# REPORT

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## Test Report Declare

|                             |   |   |
|-----------------------------|---|---|
| <b>Applicant</b>            | : | ASA Electronics Shenzhen Limited  |
| <b>Address</b>              | : | Room 503, 5/F., Unit A, Skyworth Building, Gaoxin Avenue.1.S., Nanshan District, Shen Zhen, China |
| <b>Equipment under Test</b> | : | AM/FM/WX/USB/BT/AUX IN Radio  |
| <b>Model No.</b>            | : | XMH100, RMXMH100  |
| <b>Trade Mark</b>           | : | N/A   |
| <b>Manufacturer</b>         | : | ASA Electronics, LLC.   |
| <b>Address</b>              | : | 2602 Marina Drive Elkhart, IN 46514 USA   |

### Test Standard Used:

FCC Rules and Regulations Part 15 Subpart C

### Test Procedure Used:

ANSI C63.10:2013

### We Declare:

The equipment described above is tested by Dongguan Dongdian Testing Service Co., Ltd. and in the configuration tested the equipment complied with the standards specified above. The test results are contained in this test report and Dongguan Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

**After test and evaluation, our opinion is that the equipment provided for test compliance with the requirement of the above FCC standards.**

|                         |                    |                      |                               |
|-------------------------|--------------------|----------------------|-------------------------------|
| <b>Report No.:</b>      | DDT-R23021423-2E01 |                      |                               |
| <b>Date of Receipt:</b> | Feb. 15, 2023      | <b>Date of Test:</b> | Feb. 15, 2023 ~ Mar. 31, 2023 |

**Prepared By:**

*Johnny Wang*

**Johnny Wang/Engineer**

**Approved By:**



**Damon Hu/EMC Manager**

Note: This report applies to above tested sample only. This report shall not be reproduced in parts without written approval of Dongguan Dongdian Testing Service Co., Ltd.

### Revision History

| Rev. | Revisions     | Issue Date    | Revised By |
|------|---------------|---------------|------------|
| ---  | Initial issue | Mar. 31, 2023 |            |
|      |               |               |            |

## 1. Summary of Test Results

| Description of Test Item        | Standard   | Verdict |
|---------------------------------|--|---------|
| Maximum Peak Output Power       | FCC Part 15: 15.247(b)(1)  | Pass    |
| 20 dB Bandwidth & 99% Bandwidth | FCC Part 15: 15.247(a)(1)  | Pass    |
| Carrier Frequency Separation    | FCC Part 15: 15.247(a)(1)  | Pass    |
| Number of Hopping Channel       | FCC Part 15: 15.247(a)(1)(iii)                                       | Pass    |
| Dwell Time                      | FCC Part 15: 15.247(a)(1)(iii)                                       | Pass    |
| RF Conducted Spurious Emissions | FCC Part 15: 15.247(d)   | Pass    |
| Radiated Emission               | FCC Part 15: 15.205<br>FCC Part 15: 15.209<br>FCC Part 15: 15.247(d) | Pass    |
| Band Edge Compliance            | FCC Part 15: 15.205<br>FCC Part 15: 15.209<br>FCC Part 15: 15.247(d) | Pass    |
| Power Line Conducted Emissions  | FCC Part 15: 15.207(a)   | N/A     |
| Antenna Requirement             | FCC Part 15: 15.203  | Pass    |

Note: N/A is an abbreviation for Not Applicable and means this test item is not applicable for this device according to the technology characteristic of device.

## 2. General Test Information

### 2.1. Description of EUT

|                           |   |
|---------------------------|---|
| EUT* Name                 | : AM/FM/WX/USB/BT/AUX IN Radio  |
| Model Number              | : XMH100, RMXMH100  |
| Difference of models      | : Above models are identical in schematic and structure, only the name is different for all the models, therefore the test performed on the model XMH100. |
| EUT* Function Description | : Please reference user manual of this device   |
| Power Supply              | : DC 12V  |
| Radio Specification       | : Bluetooth V5.0  |
| Operation Frequency       | : 2402 MHz - 2480 MHz   |
| Modulation                | : GFSK, $\pi/4$ -DQPSK, 8DPSK   |
| Data Rate                 | : 1 Mbps, 2 Mbps, 3 Mbps  |
| Antenna                   | : PCB antenna, maximum PK gain: -0.62 dBi   |
| Sample Number             | : S23021423-02  |

Note: EUT is the ab. of equipment under test.

| Channel information |                 |         |                 |         |                 |
|---------------------|-----------------|---------|-----------------|---------|-----------------|
| 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            |         |                 |



## 2.2. Accessories of EUT

| Description of Accessories | Manufacturer | Model number | Description | Remark |
|----------------------------|--------------|--------------|-------------|--------|
| N/A                        | N/A          | N/A          | N/A         | N/A    |

## 2.3. Assistant equipment used for test

| Assistant equipment | Manufacturer | Model number | EMC Compliance | SN  |
|---------------------|--------------|--------------|----------------|-----|
| N/A                 | N/A          | N/A          | N/A            | N/A |

## 2.4. Block diagram of EUT configuration for test



Test software: FrequencyTool\_v0.3.2.exe

The test software was used to control EUT work in Continuous Tx mode, and select test channel, wireless mode as below table.

The pathloss of external cable: 0.5 dB (According to the manufacturer's claims)

| Tested mode, channel, information  |                  |             |                 |
|------------------------------------|------------------|-------------|-----------------|
| Mode                               | Setting Tx Power | Channel     | Frequency (MHz) |
| GFSK hopping on Tx mode            | 4                | CH0 to CH78 | 2402 to 2480    |
| $\pi/4$ -DQPSK hopping on Tx mode  | 4                | CH0 to CH78 | 2402 to 2480    |
| 8DPSK hopping on Tx mode           | 4                | CH0 to CH78 | 2402 to 2480    |
| GFSK hopping off Tx mode           | 4                | CH0         | 2402            |
|                                    | 4                | CH39        | 2441            |
|                                    | 4                | CH78        | 2480            |
| $\pi/4$ -DQPSK hopping off Tx mode | 4                | CH0         | 2402            |
|                                    | 4                | CH39        | 2441            |
|                                    | 4                | CH78        | 2480            |
| 8DPSK hopping off Tx mode          | 4                | CH0         | 2402            |
|                                    | 4                | CH39        | 2441            |
|                                    | 4                | CH78        | 2480            |

## 2.5. Deviations of test standard

No deviation.

## 2.6. Test environment conditions

|                    |                   |
|--------------------|-------------------|
| Temperature range: | +15°C to +35 °C   |
| Humidity range:    | 20% to 75%        |
| Pressure range:    | 86 kPa to 106 kPa |

## 2.7. Test laboratory

Dongguan Dongdian Testing Service Co., Ltd.

Add.: No. 17, Zongbu Road 2, Songshan Lake Sci&Tech, Industry Park, Dongguan City, Guangdong Province, China, 523808.

Tel.: +86-0769-38826678, <http://www.dgddt.com>, Email: [ddt@dgddt.com](mailto:ddt@dgddt.com).

CNAS Accreditation No. L6451; A2LA Accreditation Number: 3870.01

FCC Designation Number: CN1182, Test Firm Registration Number: 540522

Innovation, Science and Economic Development Canada Site Registration Number: 10288A

Conformity Assessment Body identifier: CN0048

VCCI facility registration number: C-20087, T-20088, R-20123, R-20155, G-20118

## 2.8. Measurement uncertainty

| Test Item  | Uncertainty                                    |
|--|--|
| Bandwidth  | 1.1%   |
| Peak Output Power (Conducted) (Spectrum analyzer)        | 0.86 dB (10 MHz ≤ f < 3.6 GHz);                |
|  | 1.38 dB (3.6 GHz ≤ f < 8 GHz)                  |
| Peak Output Power (Conducted) (Power Sensor)             | 0.74 dB  |
| Power Spectral Density                                   | 0.74 dB (10 MHz ≤ f < 3.6 GHz);                |
|  | 1.38 dB (3.6 GHz ≤ f < 8 GHz)                  |
| Frequencies Stability                                    | 6.7 × 10 <sup>-8</sup> (Antenna couple method) |
|  | 5.5 × 10 <sup>-8</sup> (Conducted method)      |
| Conducted spurious emissions                             | 0.86 dB (10 MHz ≤ f < 3.6 GHz);                |
|  | 1.40 dB (3.6 GHz ≤ f < 8 GHz)                  |
|  | 1.66 dB (8 GHz ≤ f < 26.5 GHz)                 |
| Uncertainty for radio frequency (RBW < 20 kHz)           | 3×10 <sup>-8</sup>                             |
| Temperature  | 0.4 °C   |
| Humidity   | 2 %  |
| Uncertainty for Radiation Emission test (9 kHz – 30 MHz) | 3.44 dB  |
| Uncertainty for Radiation Emission test (30 MHz - 1 GHz) | 4.70 dB (Antenna Polarize: V)                  |
|  | 4.84 dB (Antenna Polarize: H)                  |
| Uncertainty for Radiation Emission test (1 GHz - 40 GHz) | 4.10 dB (1 - 6 GHz)                            |
|  | 4.40 dB (6 GHz - 18 GHz)                       |
|  | 3.54 dB (18 GHz - 26 GHz)                      |
|  | 4.30 dB (26 GHz - 40 GHz)                      |
| Uncertainty for Power line conduction emission test      | 3.34dB (150KHz-30MHz)                          |
|  | 3.72dB (9KHz-150KHz)                           |

Note: This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

### 3. Equipment Used During Test

| Equipment   | Manufacturer    | Model No.   | Serial No.        | Last Cal.     | Cal. Interval |
|---|-----------------|---|-------------------|---------------|---------------|
| <b>☑RF Connected Test (Tonscend RF Measurement System 3#)</b> |                 |   |                   |               |               |
| Signal & Spectrum analyzer                                    | R&S             | FSV40   | 101407            | Jul. 21, 2022 | 1 Year        |
| Wideband Radio Communication tester                           | R&S             | CMW500  | 117491            | May 18, 2022  | 1 Year        |
| Vector Signal Generator                                       | Agilent         | N5182A  | MY19060405        | May 18, 2022  | 1 Year        |
| Vector Signal Generator                                       | Agilent         | N5182A  | MY48180912        | May 18, 2022  | 1 Year        |
| RF Control Unit   | Tonscend        | JS0806-2  | 20C8060230        | May 18, 2022  | 1 Year        |
| Temp&Humi Programmable  | ZHIXIANG        | ZXGDJS-150L   | ZX170110-A        | May 26, 2022  | 1 Year        |
| Test Software   | JS Tonscend     | JS1120-3  | Ver.3.2.22        | N/A           | N/A           |
| <b>☑Radiation 3#chamber</b>                                   |                 |   |                   |               |               |
| EMI Test Receiver   | R&S             | ESU26   | 100472            | May 19, 2022  | 1 Year        |
| Spectrum analyzer   | Agilent         | E4447A  | MY50180031        | May 17, 2022  | 1 Year        |
| Active Loop antenna   | Schwarzbeck     | FMZB-1519   | 1519-038          | Sep. 29, 2022 | 1 Year        |
| Trilog Broadband Antenna                                      | Schwarzbeck     | VULB 9163   | 01429             | Jul. 22, 2022 | 1 Year        |
| Double Ridged Horn Antenna                                    | Schwarzbeck     | BBHA9120 D  | 02468             | Sep. 29, 2022 | 1 Year        |
| Broad Band Horn Antenna                                       | Schwarzbeck     | BBHA 9170   | 790               | May 06, 2022  | 1 Year        |
| Pre-amplifier   | COM-POWER       | PAM-118A  | 18040084          | Aug.17, 2022  | 1 Year        |
| Pre-amplifier   | COM-POWER       | PAM-840A  | 461369            | Apr. 11, 2022 | 1 Year        |
| RE Cable  | N/A             | W23.02 CP1-X2 + W23.09 AP1-X8+ JCT26S-NJ-NJ-1.5M+ JCT26S-NJ-NJ-1.5M | 4.5M+8M+1.5M+1.5M | Aug.17, 2022  | 1 Year        |
| RF Cable  | Yuhu Technology | JCTB810-NJ-NJ-9M  | 21123964          | May. 19, 2022 | 1 Year        |
| RF Cable  | Yuhu Technology | ZT26S-SMAJ-SMAJ-1M  | 21073466          | Aug.17, 2022  | 1 Year        |
| Test software   | Tonscend        | JS32-RE   | V 5.0.0.1         | N/A           | N/A           |
| Test software   | Audix           | E3  | V 6.1.1.1         | N/A           | N/A           |
| <b>☐Power Line Conducted Emissions Test 1#</b>                |                 |   |                   |               |               |
| Test Receiver   | R&S             | ESCI  | 100551            | Aug. 26, 2022 | 1 Year        |
| LISN 1  | R&S             | ENV216  | 101109            | Aug. 26, 2022 | 1 Year        |
| LISN 2  | R&S             | ESH2-Z5   | 100309            | Aug. 26, 2022 | 1 Year        |
| Pulse Limiter   | R&S             | ESH3-Z2   | 101242            | Aug. 26, 2022 | 1 Year        |
| CE Cable 1  | HUBSER          | N/A   | W10.01            | Aug. 26, 2022 | 1 Year        |
| Test Receiver   | R&S             | ESCI  | 100551            | Aug. 26, 2022 | 1 Year        |

## 4. 20 dB Bandwidth

### 4.1. Block diagram of test setup



### 4.2. Limits

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 4.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 6.9.2.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously
- (4) Use the following spectrum analyzer settings for the 20 dB bandwidth measurement:
 

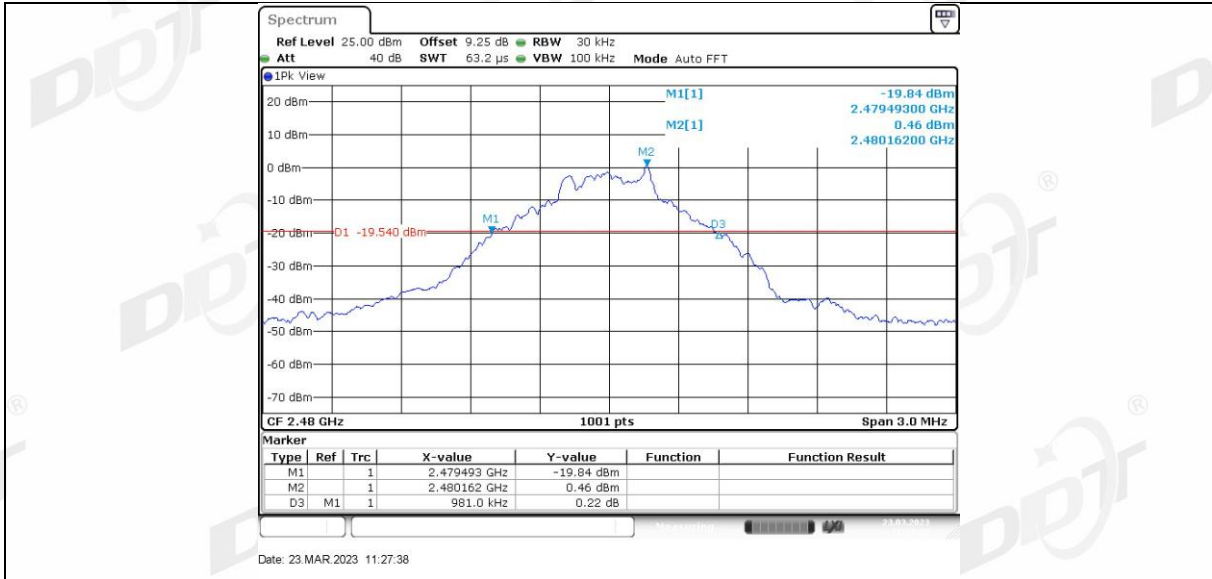
|                |                                     |
|----------------|-------------------------------------|
| RBW:           | 1% to 5% of the OBW                 |
| VBW:           | approximately three times RBW       |
| Span:          | between 2 times and 5 times the OBW |
| Detector Mode: | Peak                                |
| Sweep time:    | Auto                                |
| Trace mode:    | Max hold                            |
- (5) Measure and record the results in the report.

### 4.4. test result

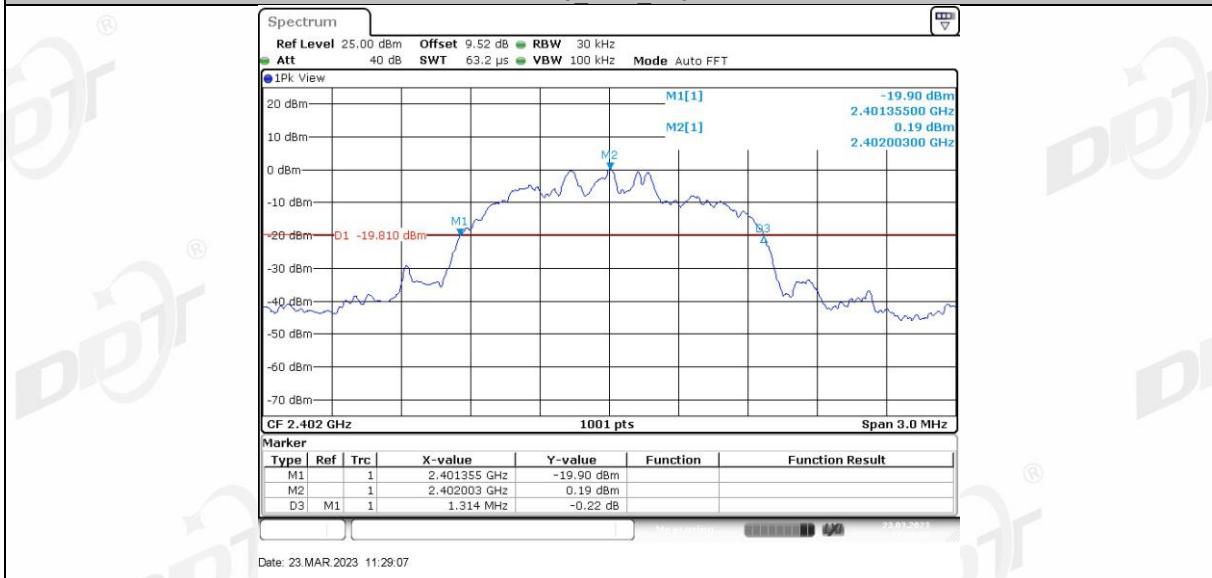
| Test Mode | Antenna | Frequency [MHz] | 20dB EBW[MHz] |
|-----------|---------|-----------------|---------------|
| DH5       | Ant1    | 2402            | 0.98          |
|           |         | 2441            | 0.99          |
|           |         | 2480            | 0.98          |
| 2DH5      | Ant1    | 2402            | 1.31          |
|           |         | 2441            | 1.31          |
|           |         | 2480            | 1.31          |
| 3DH5      | Ant1    | 2402            | 1.30          |
|           |         | 2441            | 1.30          |
|           |         | 2480            | 1.30          |

### 4.5. Test graphs

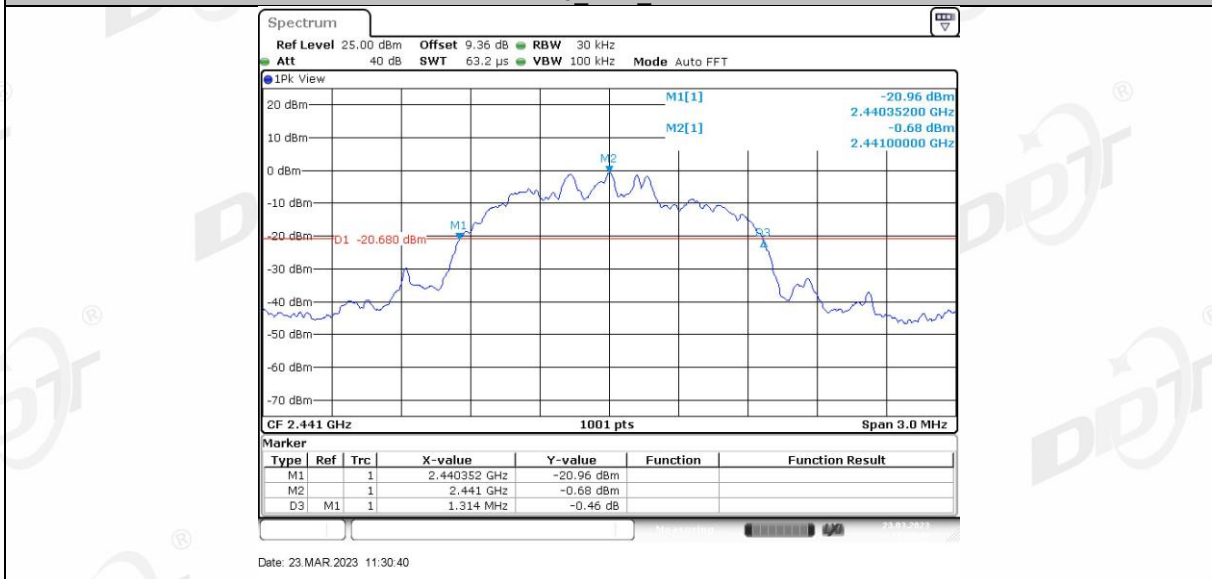




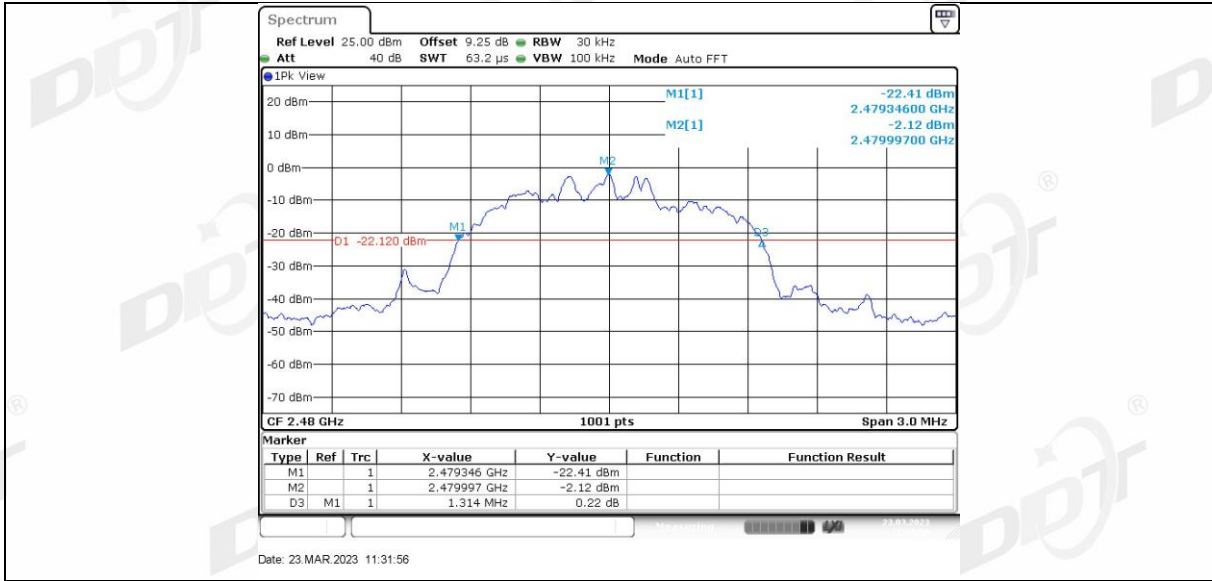
2DH5 Ant1\_2402



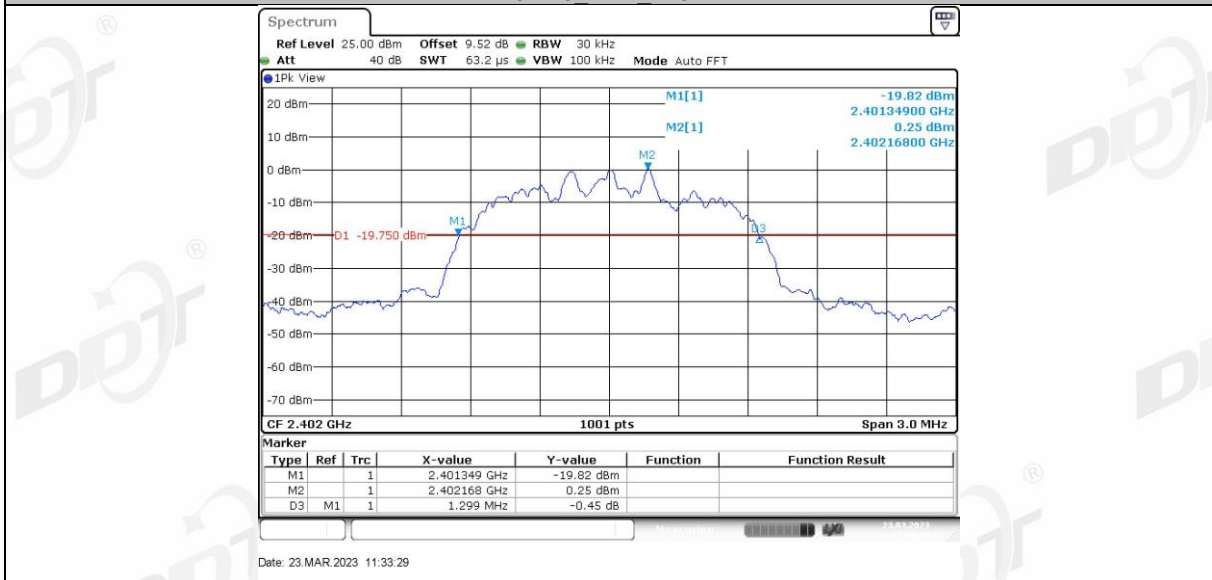
2DH5 Ant1\_2441



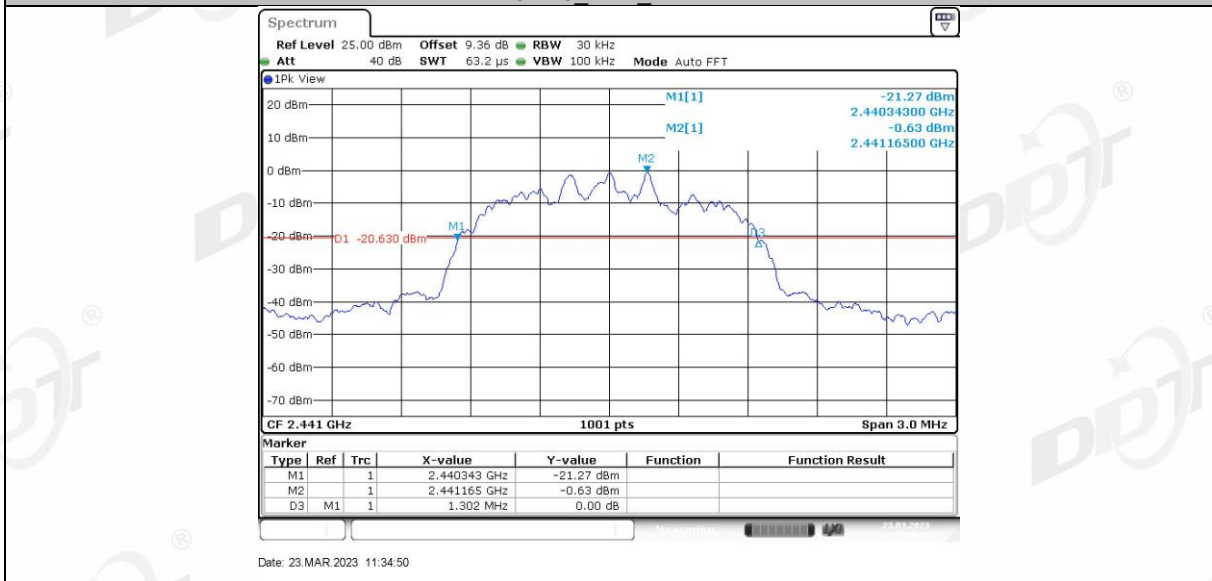
2DH5 Ant1\_2480



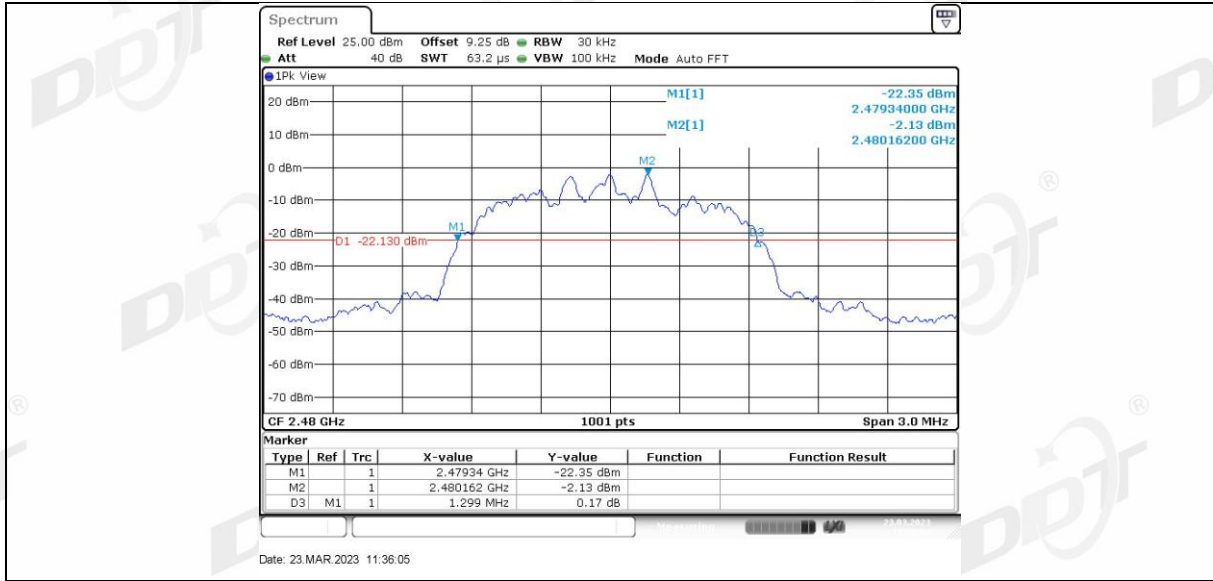
3DH5 Ant1\_2402



3DH5 Ant1\_2441



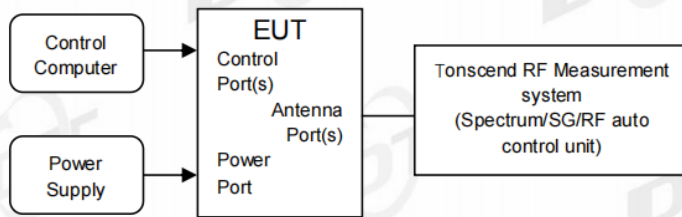
3DH5 Ant1\_2480





## 5. 99% Bandwidth

### 5.1. Block diagram of test setup



### 5.2. Limits

Just for Report.

### 5.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 6.9.3.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously
- (4) Use the following spectrum analyzer settings for the 99% bandwidth measurement:
 

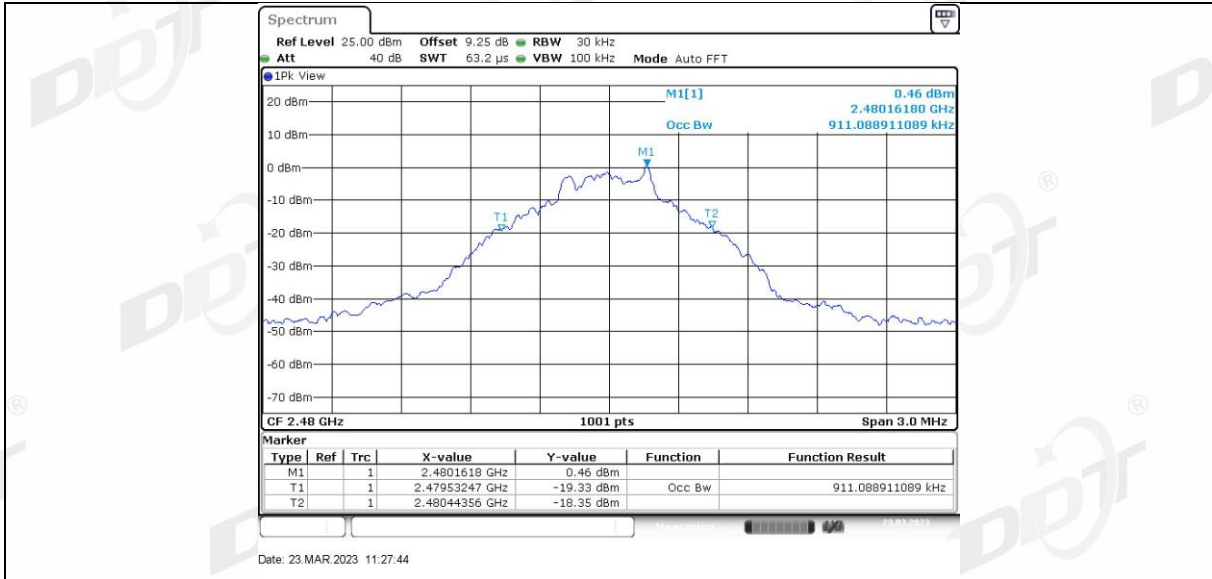
|                |   |
|----------------|---|
| RBW:           | 1% to 5% of the OBW                     |
| VBW:           | approximately three times RBW           |
| Span:          | between 1.5 times and 5.0 times the OBW |
| Detector Mode: | Peak                                    |
| Sweep time:    | Auto                                    |
| Trace mode:    | Max hold                                |
- (5) Measure and record the results in the report.

### 5.4. Test Result

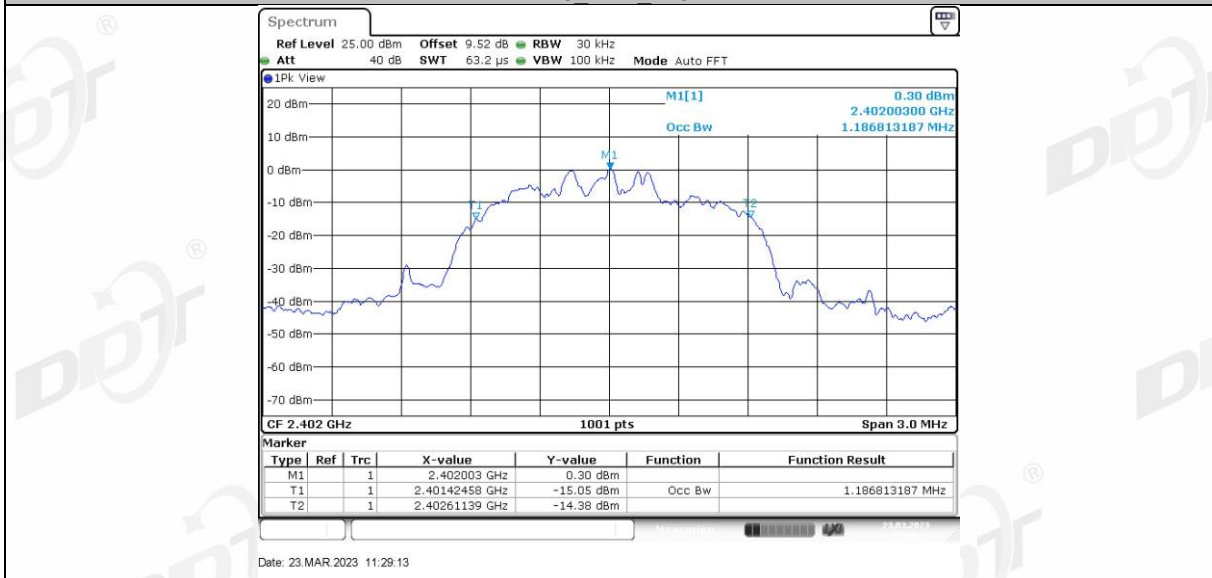
| Test Mode | Antenna | Frequency [MHz] | OCB [MHz] | FL[MHz]   | FH[MHz]   |
|-----------|---------|-----------------|-----------|-----------|-----------|
| DH5       | Ant1    | 2402            | 0.908     | 2401.5415 | 2402.4496 |
|           |         | 2441            | 0.908     | 2440.5385 | 2441.4466 |
|           |         | 2480            | 0.911     | 2479.5325 | 2480.4436 |
| 2DH5      | Ant1    | 2402            | 1.187     | 2401.4246 | 2402.6114 |
|           |         | 2441            | 1.187     | 2440.4186 | 2441.6054 |
|           |         | 2480            | 1.187     | 2479.4156 | 2480.6024 |
| 3DH5      | Ant1    | 2402            | 1.181     | 2401.4246 | 2402.6054 |
|           |         | 2441            | 1.181     | 2440.4186 | 2441.5994 |
|           |         | 2480            | 1.181     | 2479.4156 | 2480.5964 |

### 5.5. Test Graphs

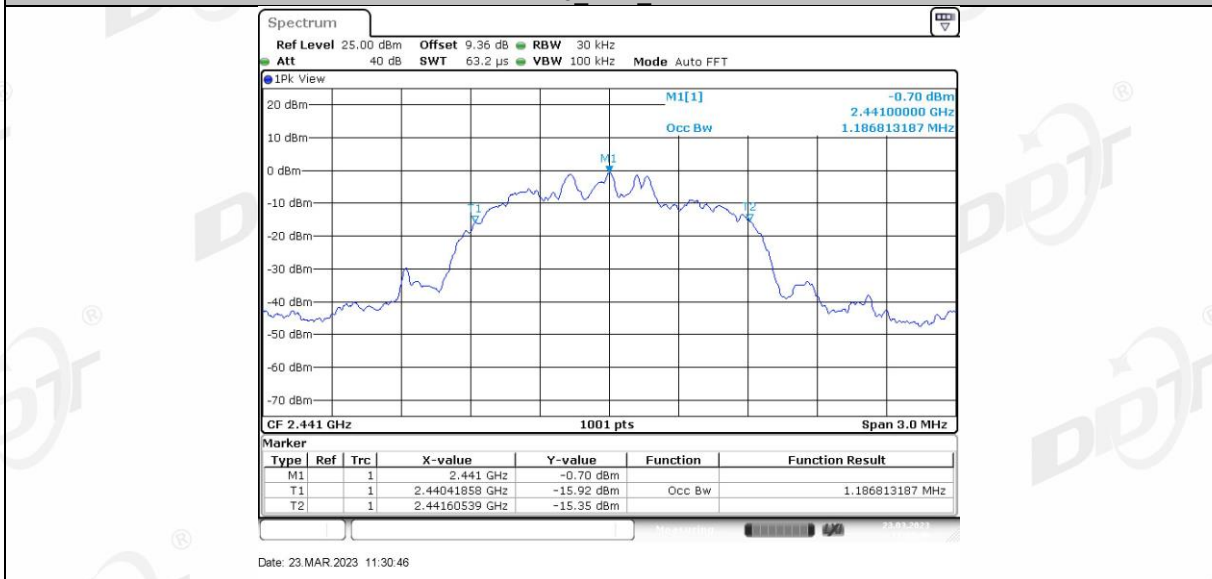




2DH5 Ant1\_2402



2DH5 Ant1\_2441



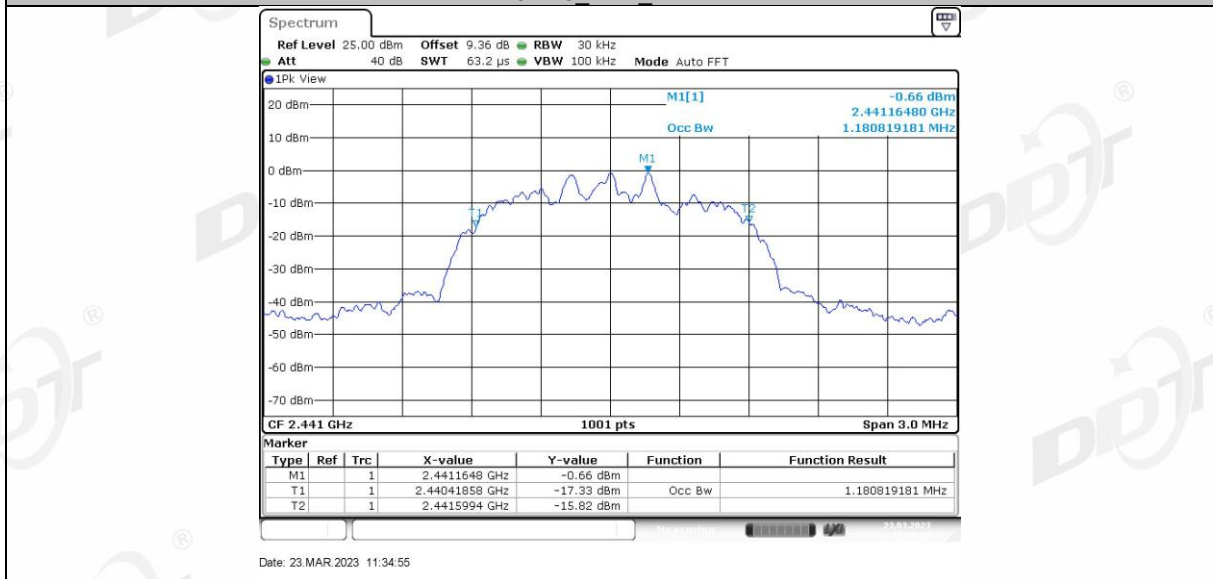
2DH5 Ant1\_2480



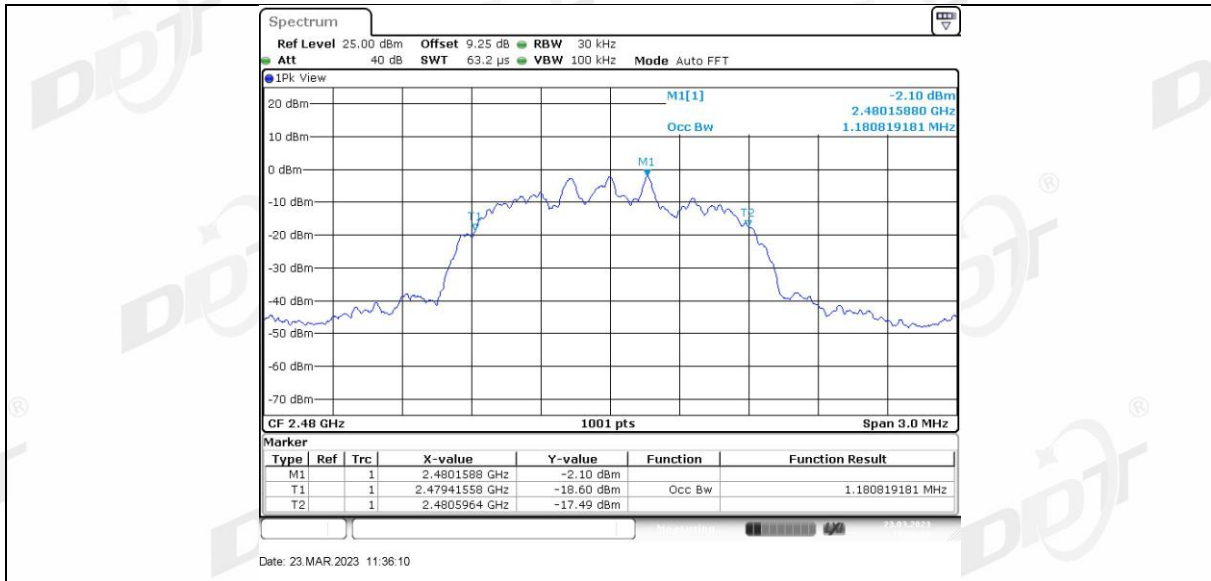
3DH5 Ant1\_2402



3DH5 Ant1\_2441

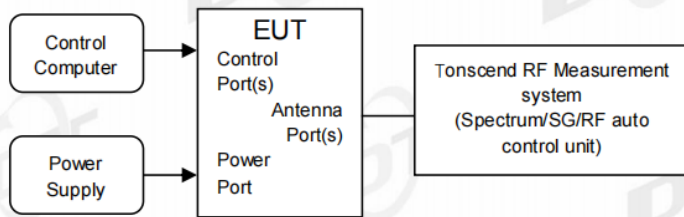


3DH5 Ant1\_2480



## 6. Maximum Peak Output Power

### 6.1. Block diagram of test setup



### 6.2. Limits

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 non-overlapping hopping channels, and all frequency hopping systems in the 5725-5850 MHz band: 1 watt. For all other frequency hopping systems in the 2400-2483.5 MHz band: 0.125 watts, the e.i.r.p shall not exceed 4W.

### 6.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 7.8.5.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for the maximum peak output power measurement:
 

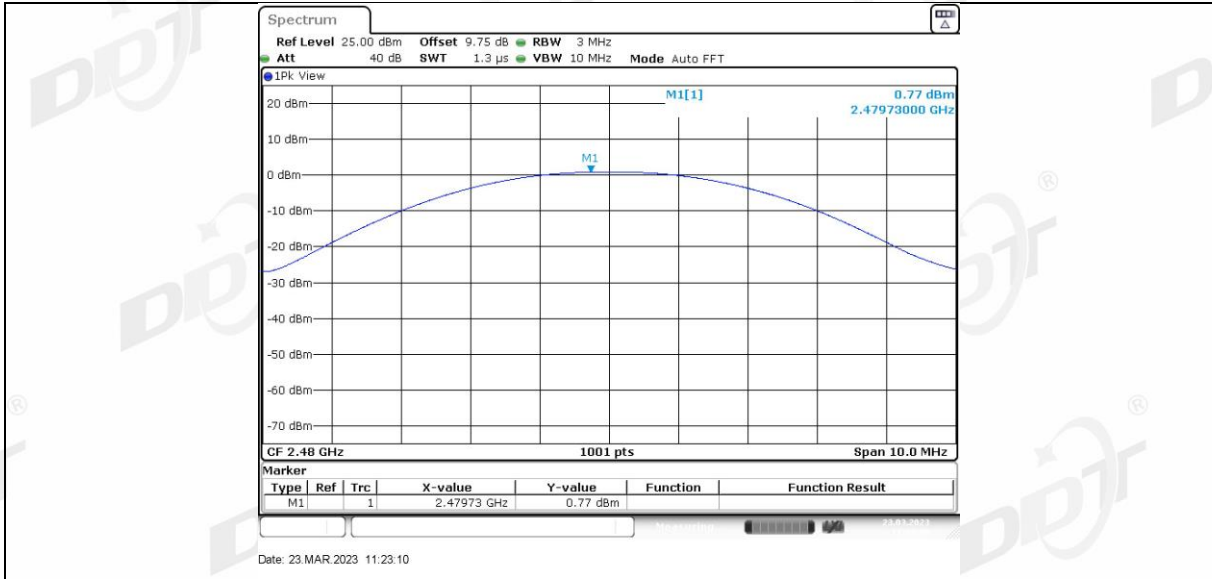
|                |  |
|----------------|--|
| RBW:           | > 20 dB bandwidth of the emission being measured.                            |
| VBW:           | $VBW \geq RBW$ .   |
| Span:          | Approximately five times the 20 dB bandwidth, centered on a hopping channel. |
| Detector Mode: | Peak   |
| Sweep time:    | Auto   |
| Trace mode:    | Max hold   |
- (5) Use the marker-to-peak function to set the marker to the peak of the emission and record the results in the report.

### 6.4. Test Result Peak

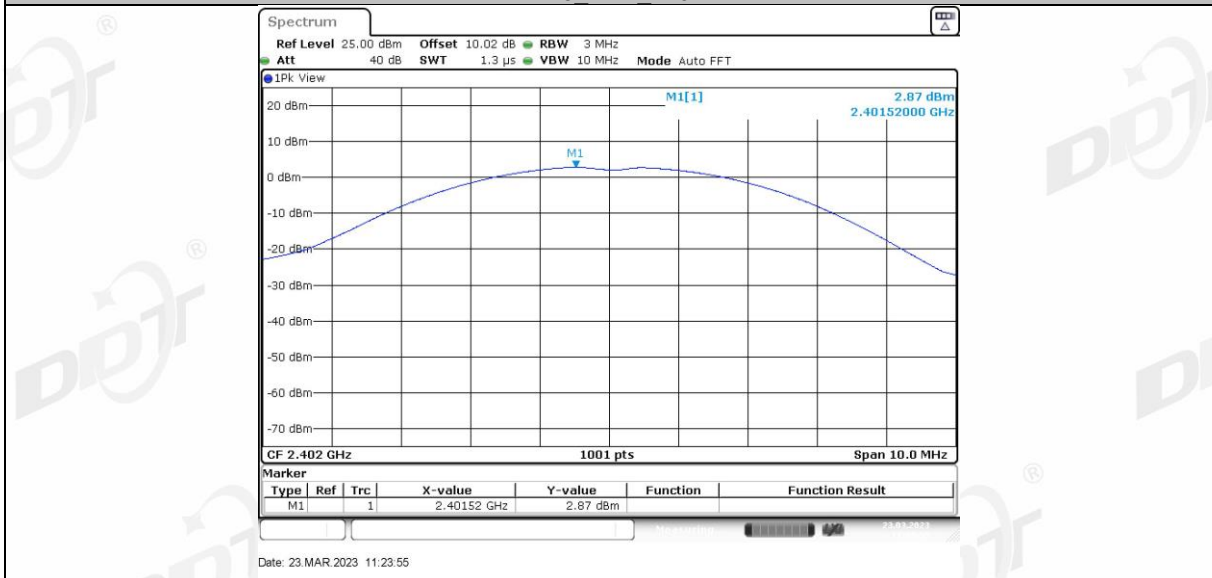
| Test Mode | Antenna | Frequency [MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | EIRP[dBm] | EIRP Limit[dBm] | Verdict |
|-----------|---------|-----------------|---------------------------|----------------------|-----------|-----------------|---------|
| DH5       | Ant1    | 2402            | <b>2.99</b>               | ≤20.97               | 2.37      | ≤36             | PASS    |
|           |         | 2441            | 2.56                      | ≤20.97               | 1.94      | ≤36             | PASS    |
|           |         | 2480            | 0.77                      | ≤20.97               | 0.15      | ≤36             | PASS    |
| 2DH5      | Ant1    | 2402            | 2.87                      | ≤20.97               | 2.25      | ≤36             | PASS    |
|           |         | 2441            | 2.34                      | ≤20.97               | 1.72      | ≤36             | PASS    |
|           |         | 2480            | 0.59                      | ≤20.97               | -0.03     | ≤36             | PASS    |
| 3DH5      | Ant1    | 2402            | 2.74                      | ≤20.97               | 2.12      | ≤36             | PASS    |
|           |         | 2441            | 2.32                      | ≤20.97               | 1.70      | ≤36             | PASS    |
|           |         | 2480            | 0.44                      | ≤20.97               | -0.18     | ≤36             | PASS    |

### 6.5. Test graphs

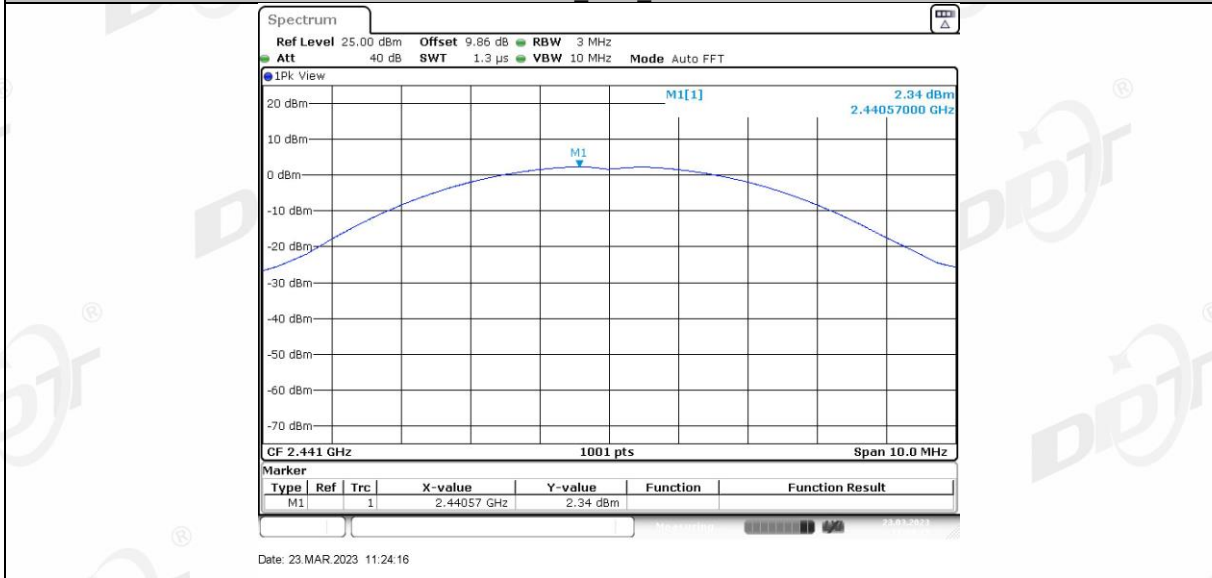




2DH5 Ant1\_2402

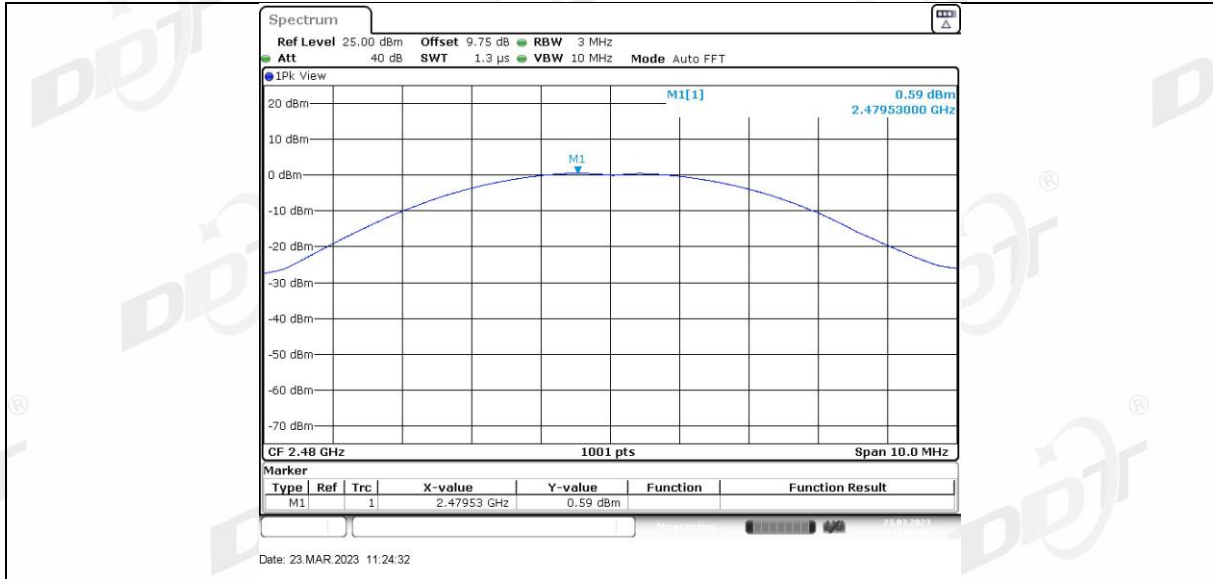


2DH5 Ant1\_2441

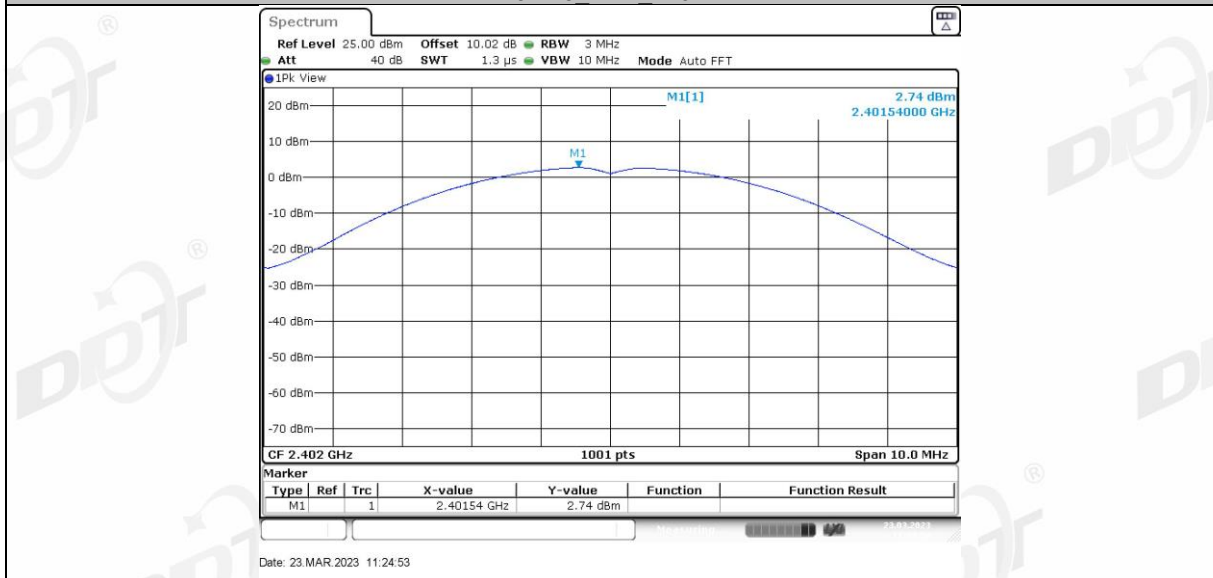


2DH5 Ant1\_2480

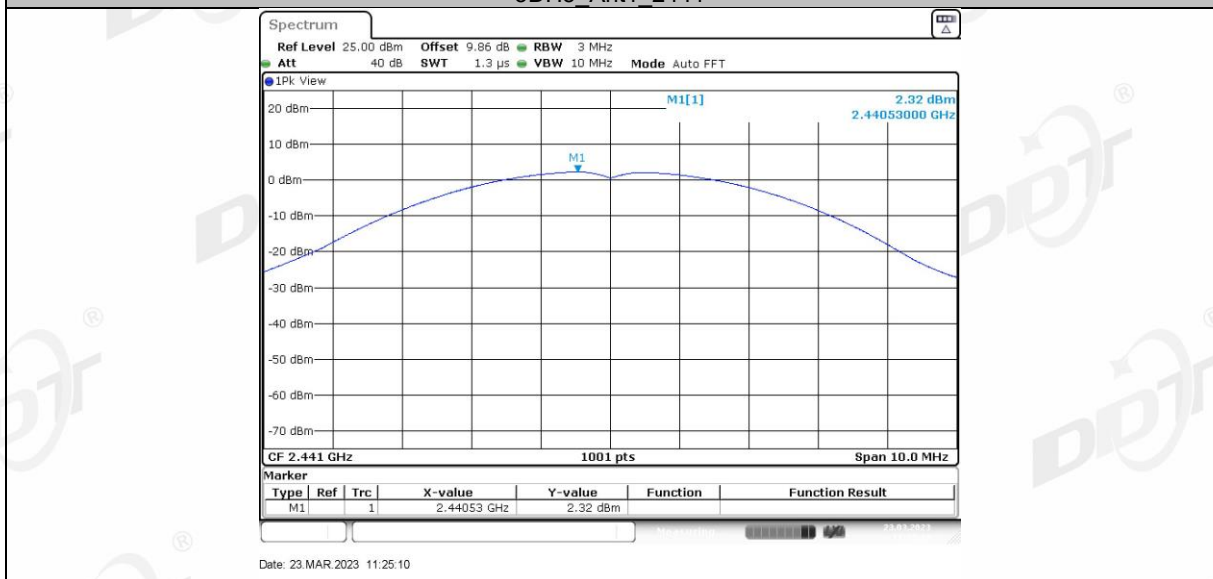




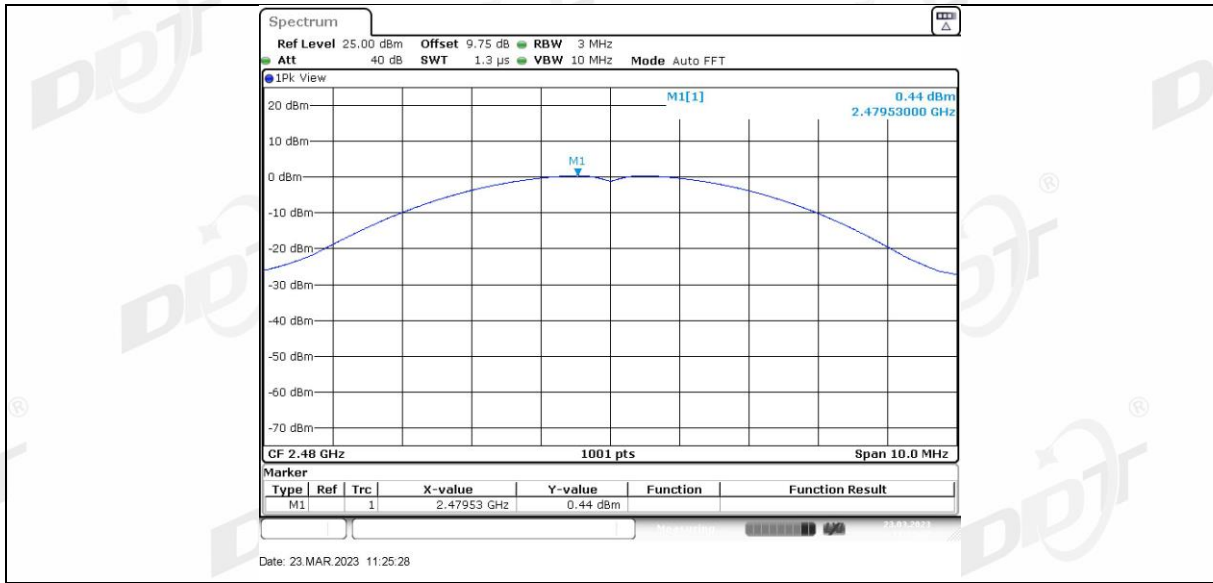
3DH5 Ant1\_2402



3DH5 Ant1\_2441

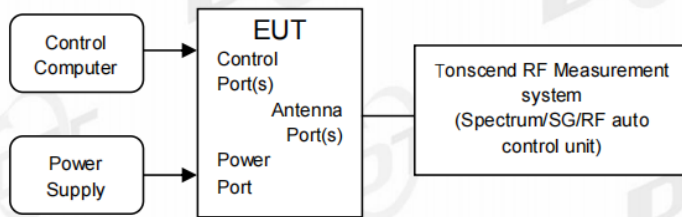


3DH5 Ant1\_2480



## 7. Carrier Frequency Separation

### 7.1. Block diagram of test setup



### 7.2. Limits

Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater. Alternatively, frequency hopping systems operating in the 2400-2483.5 MHz band may have hopping channel carrier frequencies that are separated by 25 kHz or two-thirds of the 20 dB bandwidth of the hopping channel, whichever is greater, provided the systems operate with an output power no greater than 125 mW.

### 7.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 7.8.2.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for the maximum peak output power measurement:
 

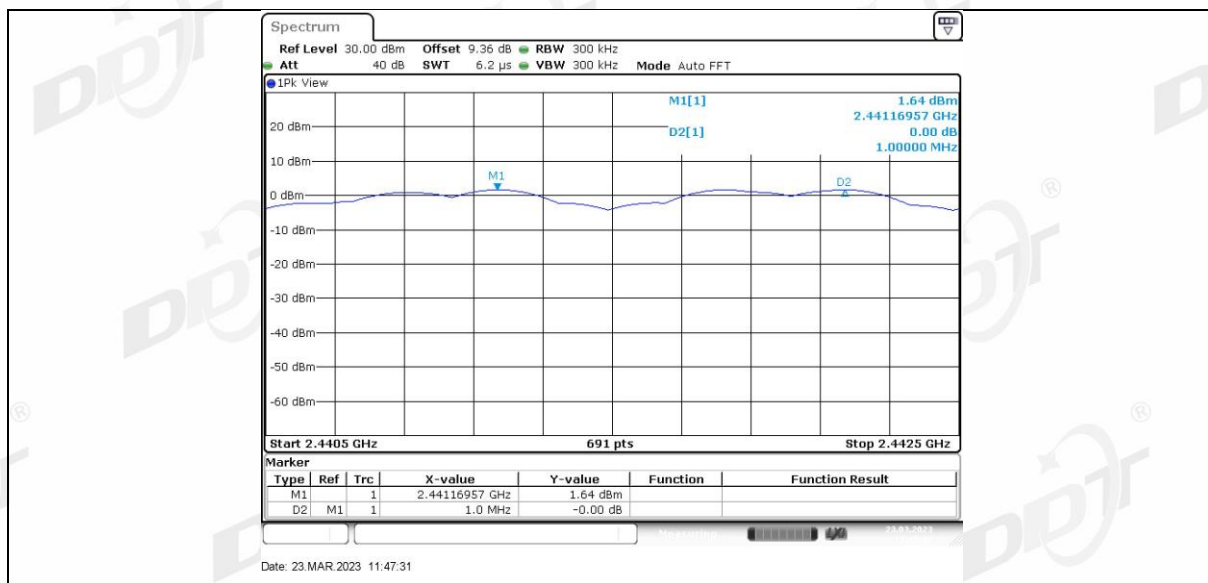
|                |  |
|----------------|--|
| RBW:           | approximately 30% of the channel spacing                   |
| VBW:           | $VBW \geq RBW$ .   |
| Span:          | Wide enough to capture the peaks of two adjacent channels. |
| Detector Mode: | Peak   |
| Sweep time:    | Auto   |
| Trace mode:    | Max hold   |
- (5) Use the marker-delta function to determine the separation between the peaks of the adjacent channels and record the results in the report.

### 7.4. Test result

| Test Mode | Antenna | Frequency [MHz] | Result [MHz] | Limit [MHz] | Verdict |
|-----------|---------|-----------------|--------------|-------------|---------|
| DH5       | Ant1    | Hop             | 1.000        | ≥0.653      | PASS    |
| 2DH5      | Ant1    | Hop             | 1.003        | ≥0.873      | PASS    |
| 3DH5      | Ant1    | Hop             | 1.000        | ≥0.867      | PASS    |

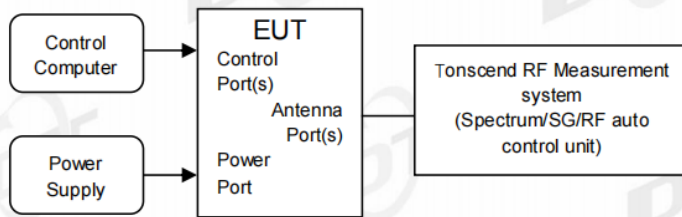
### 7.5. Test graphs





## 8. Dwell Time

### 8.1. Block diagram of test setup



### 8.2. Limits

The average time of occupancy on any channel shall not be greater than 0.4 seconds within a period of 0.4 seconds multiplied by the number of hopping channels employed.

### 8.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 7.8.4.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

|                |   |
|----------------|---|
| RBW:           | $\leq$ channel spacing and where possible RBW should be set $\gg 1 / T$ |
| VBW:           | $VBW \geq RBW$ .  |
| Span:          | Zero span, centered on a hopping channel.                               |
| Detector Mode: | Peak  |
| Sweep time:    | Auto  |
| Trace mode:    | Max hold  |

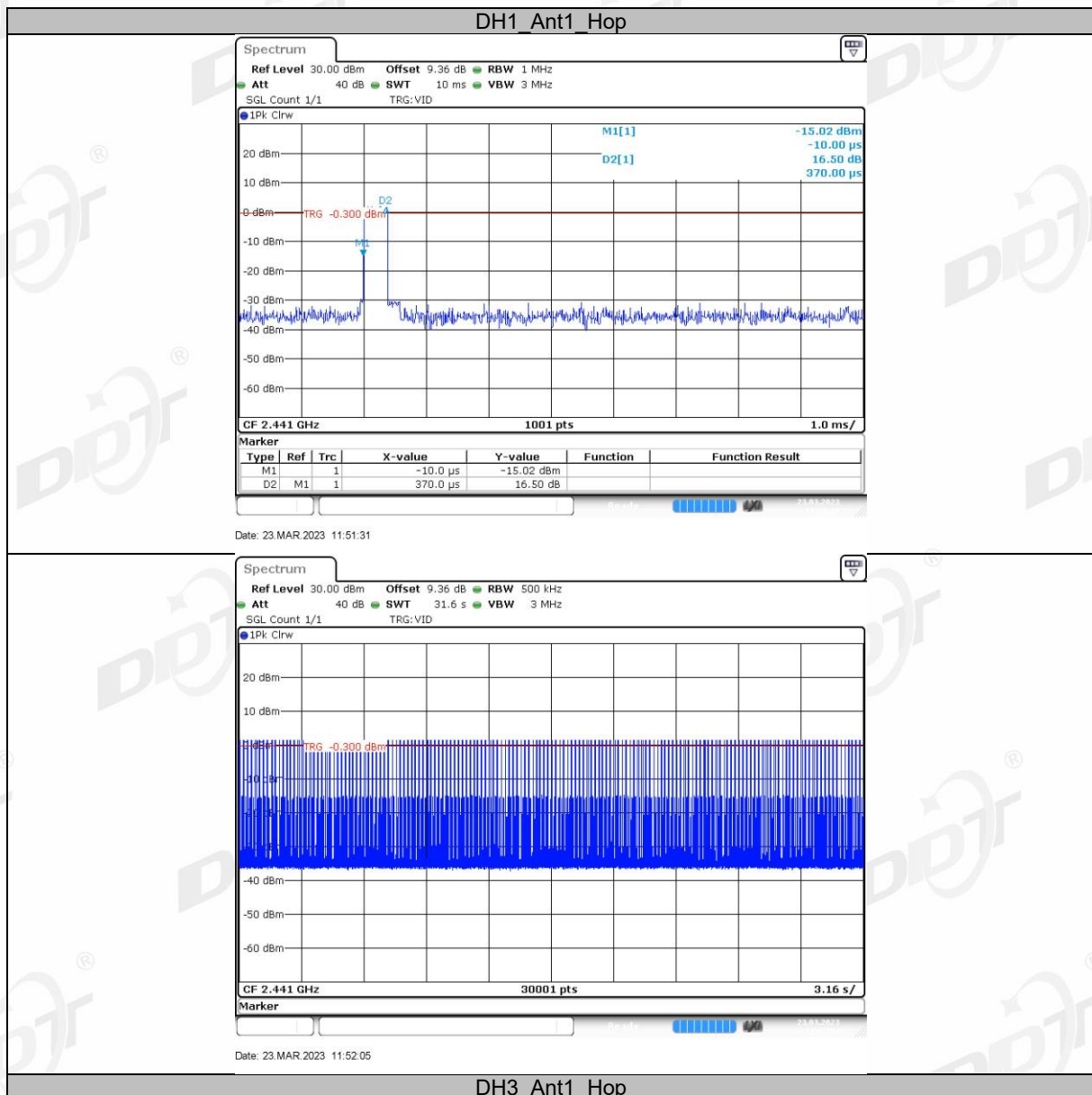
Measure and record the results in the report.

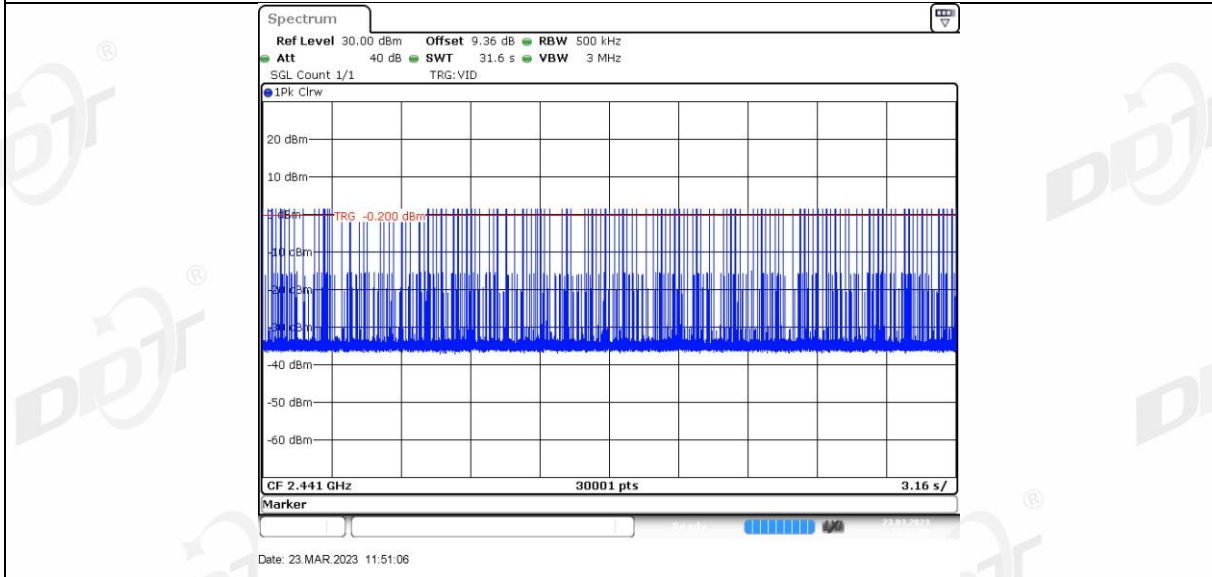
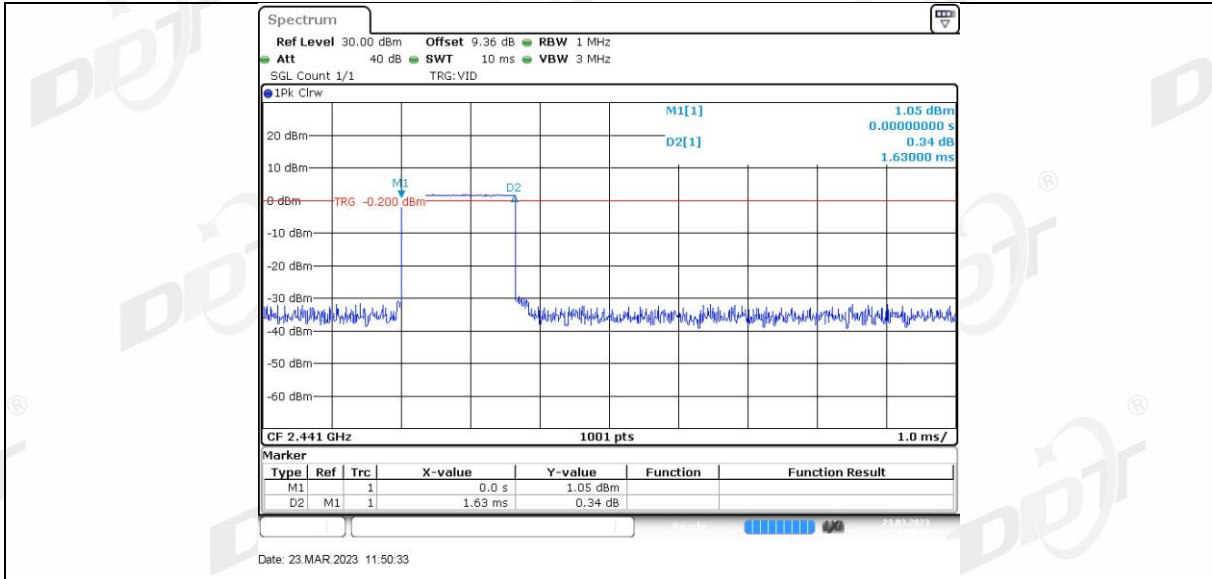
- (5) The test period:  $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$
- (6) Measure the hopping number and on time of each pulse with spectrum analyzer in zero span set, and calculate dwell time with formula Dwell time = total hops \* pulse's on time.

### 8.4. Test result

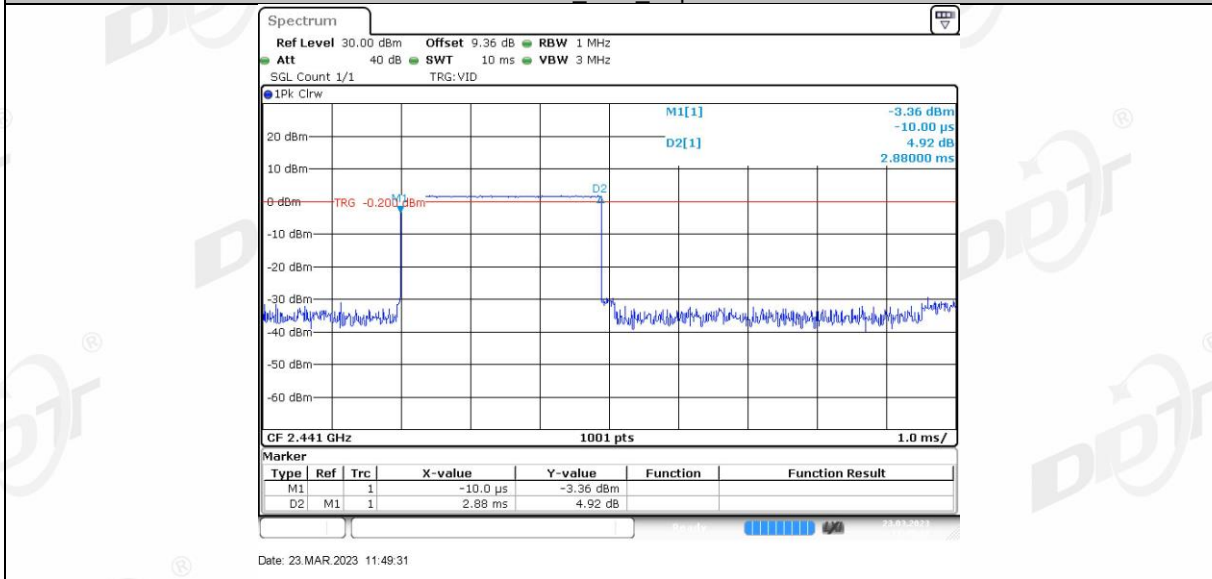
| Test Mode | Antenna | Frequency [MHz] | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|-----------|---------|-----------------|-----------------|-----------------|-----------|----------|---------|
| DH1       | Ant1    | Hop             | 0.37            | 312             | 0.115     | ≤0.4     | PASS    |
| DH3       | Ant1    | Hop             | 1.63            | 173             | 0.282     | ≤0.4     | PASS    |
| DH5       | Ant1    | Hop             | 2.88            | 103             | 0.297     | ≤0.4     | PASS    |
| 2DH1      | Ant1    | Hop             | 0.37            | 311             | 0.115     | ≤0.4     | PASS    |
| 2DH3      | Ant1    | Hop             | 1.63            | 172             | 0.280     | ≤0.4     | PASS    |
| 2DH5      | Ant1    | Hop             | 2.87            | 107             | 0.307     | ≤0.4     | PASS    |
| 3DH1      | Ant1    | Hop             | 0.37            | 312             | 0.115     | ≤0.4     | PASS    |
| 3DH3      | Ant1    | Hop             | 1.62            | 173             | 0.280     | ≤0.4     | PASS    |
| 3DH5      | Ant1    | Hop             | 2.87            | 104             | 0.298     | ≤0.4     | PASS    |

### 8.5. Test graphs

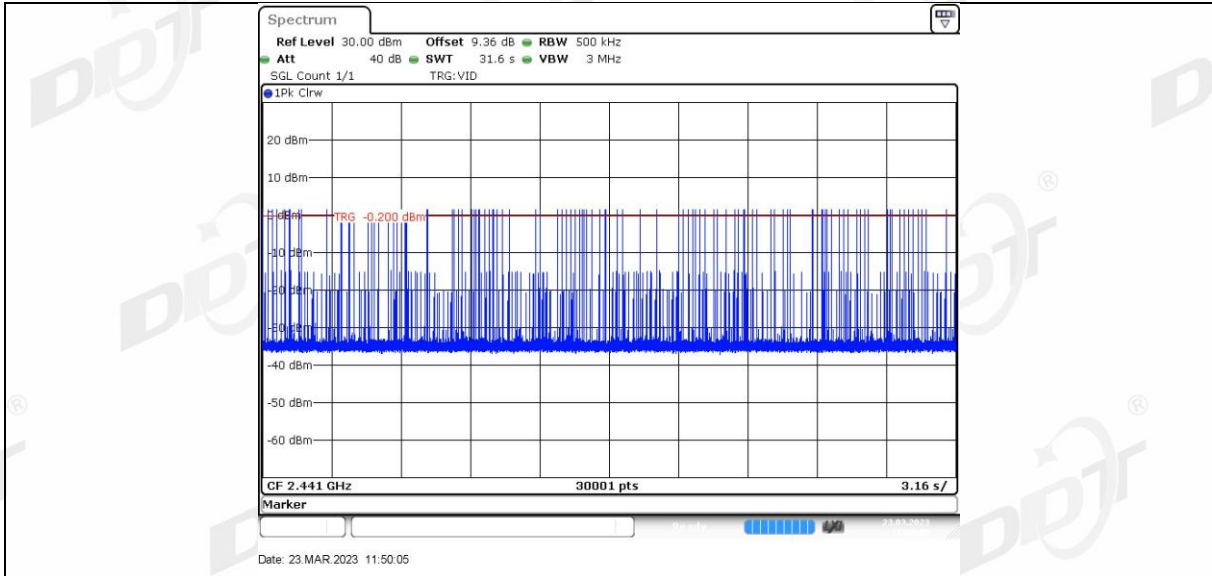




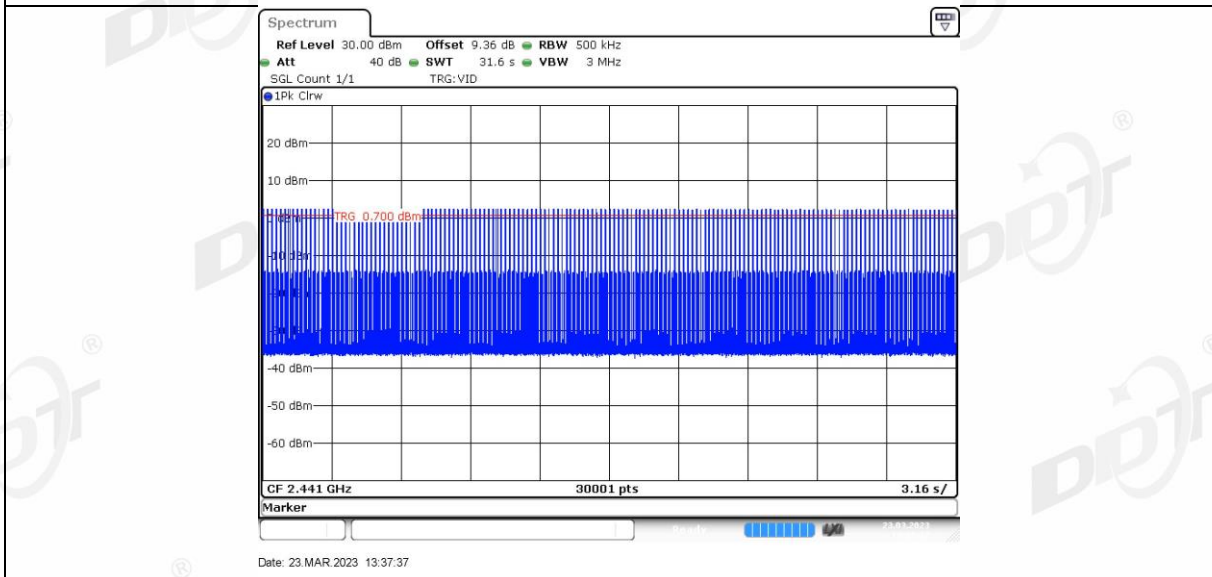
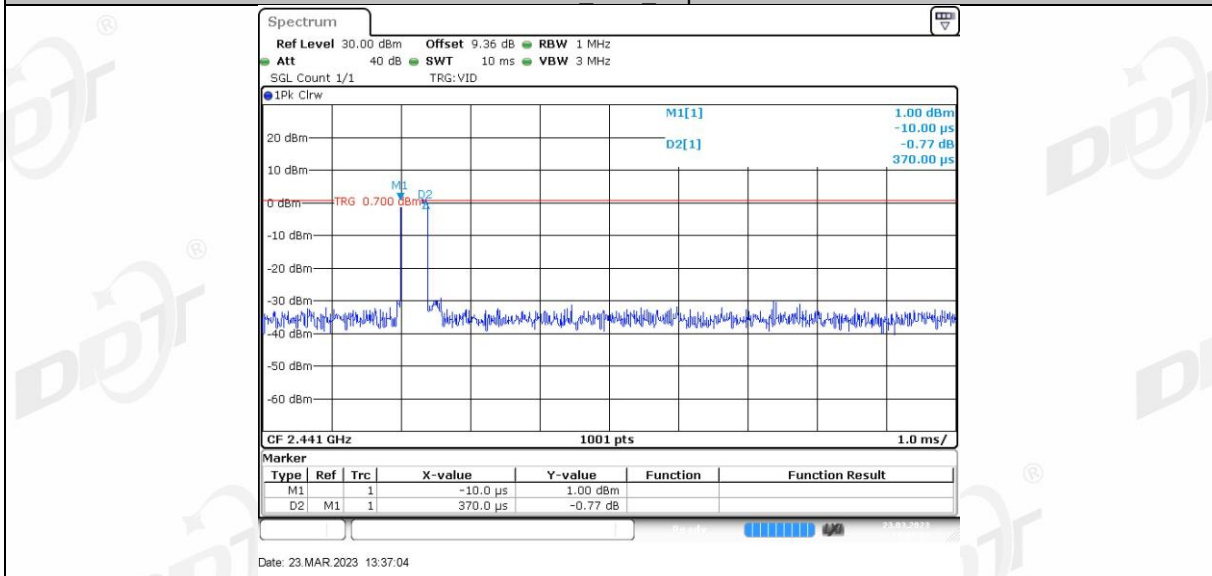
DH5\_Ant1\_Hop



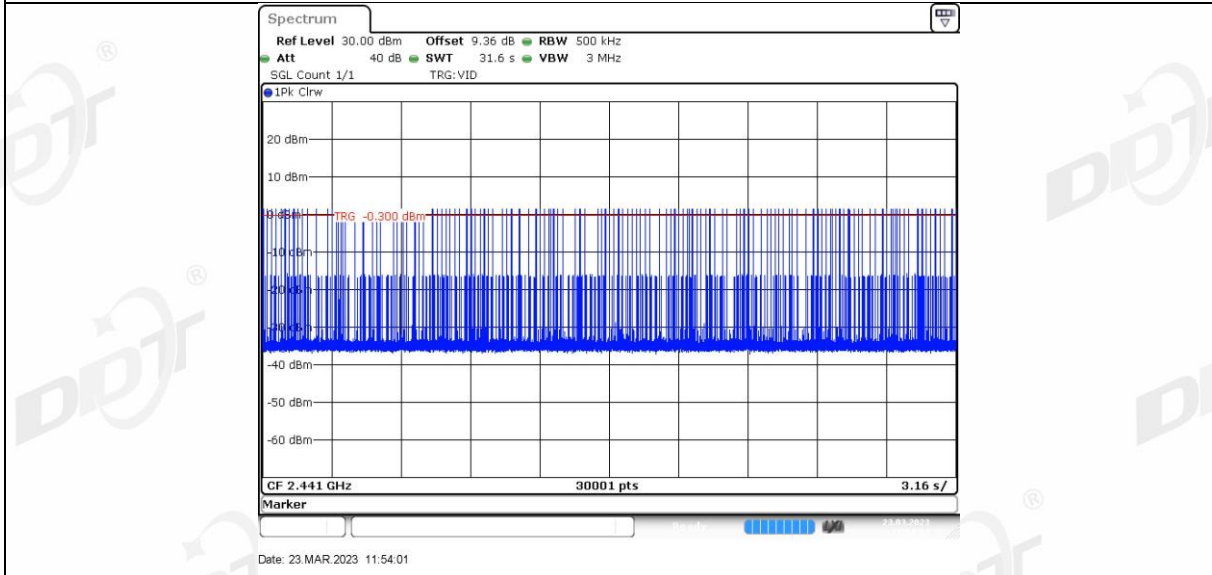
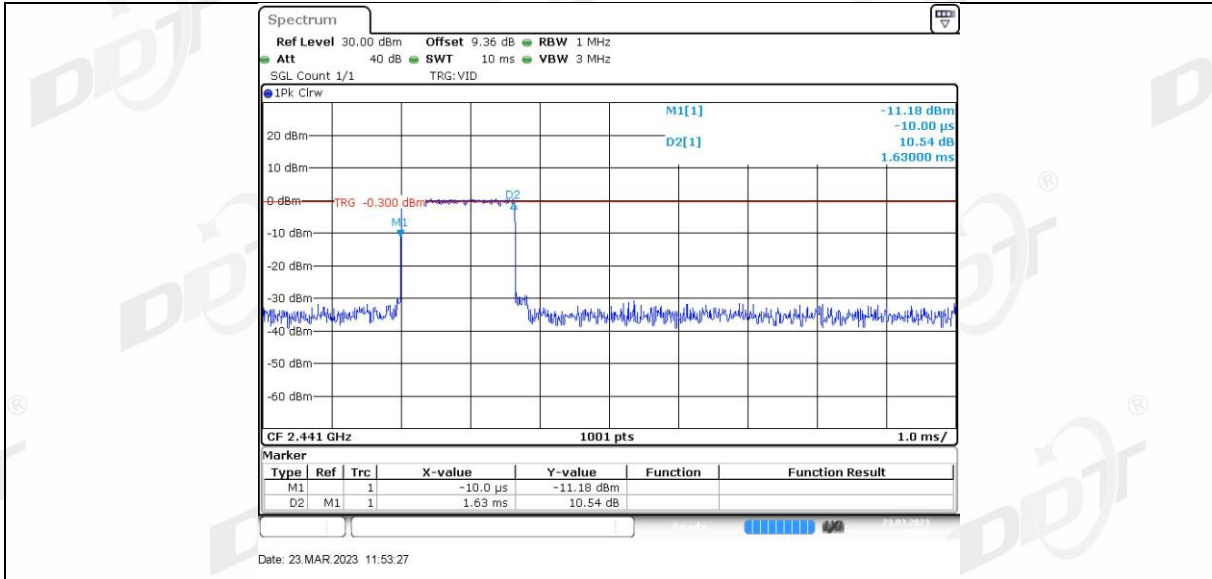




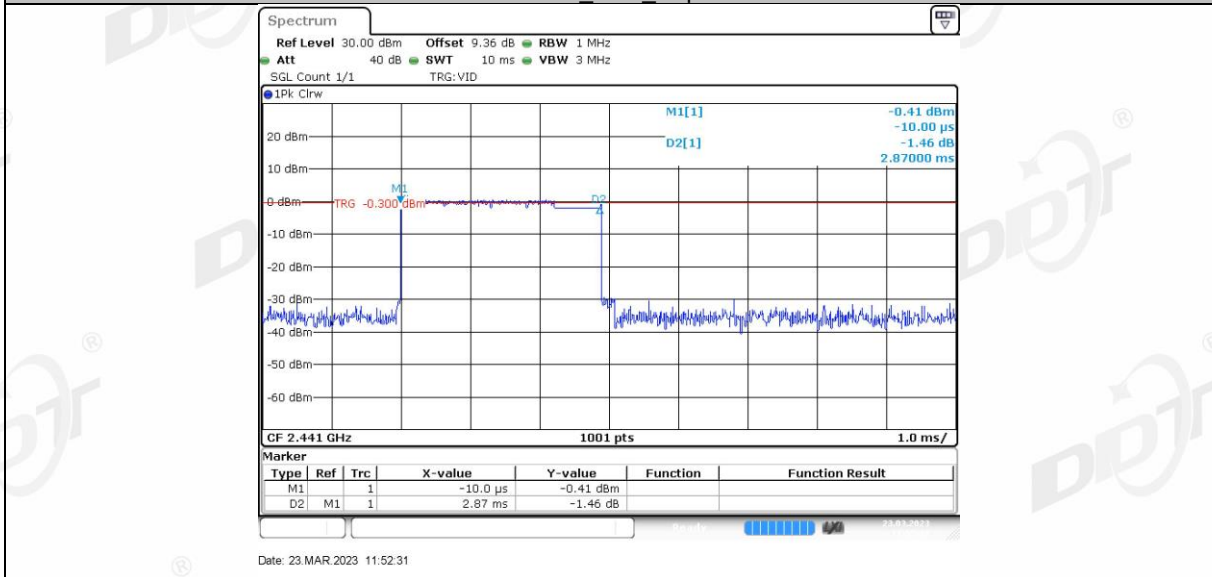
2DH1 Ant1 Hop

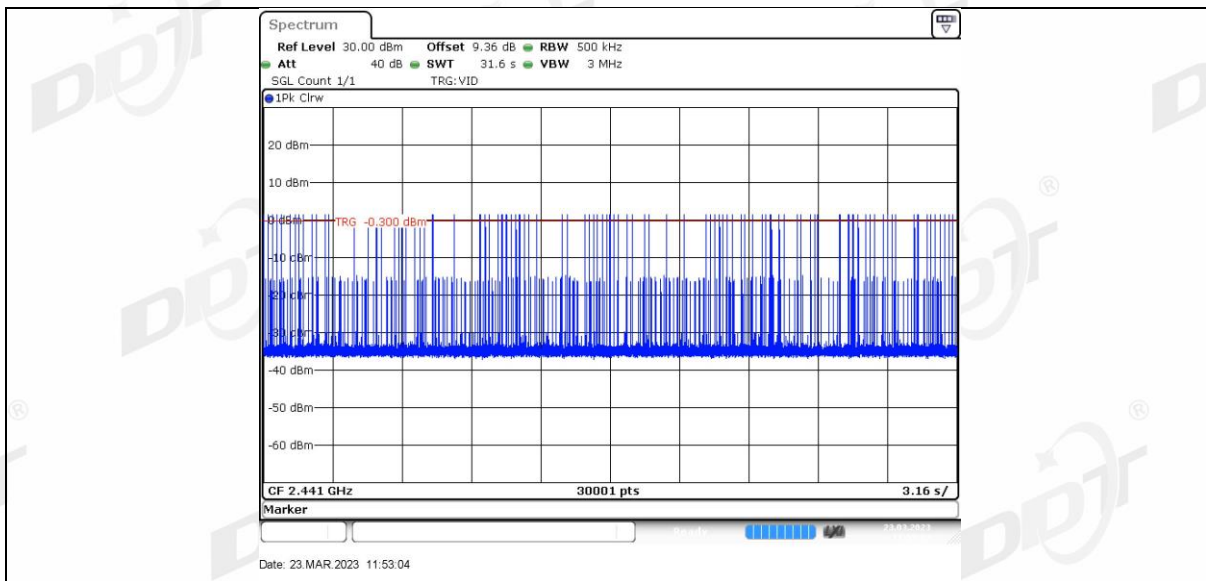


2DH3 Ant1 Hop

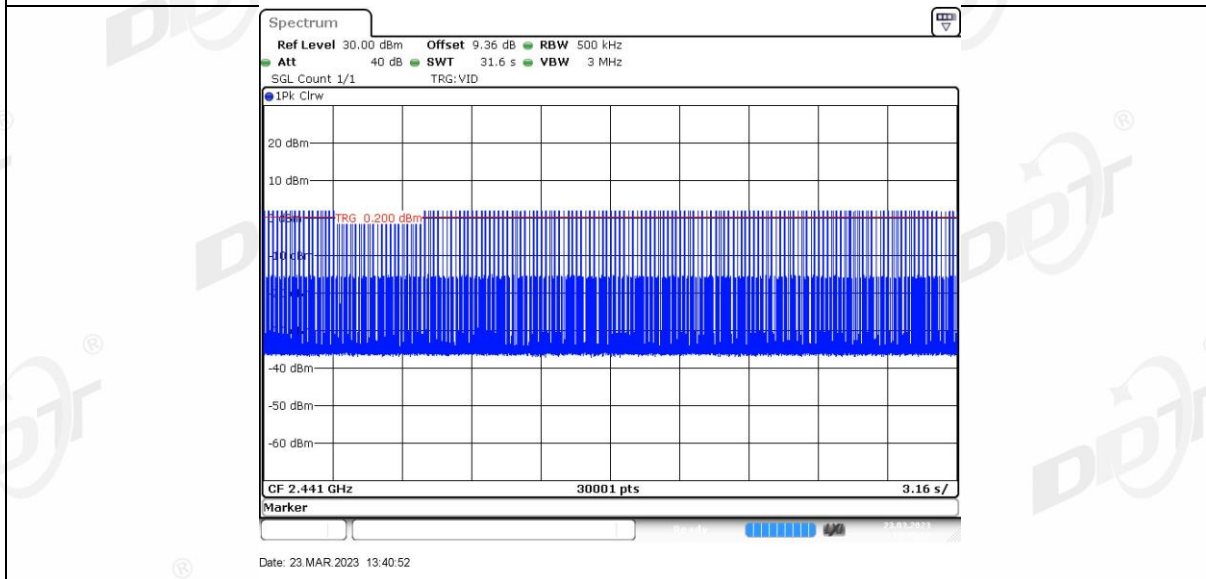
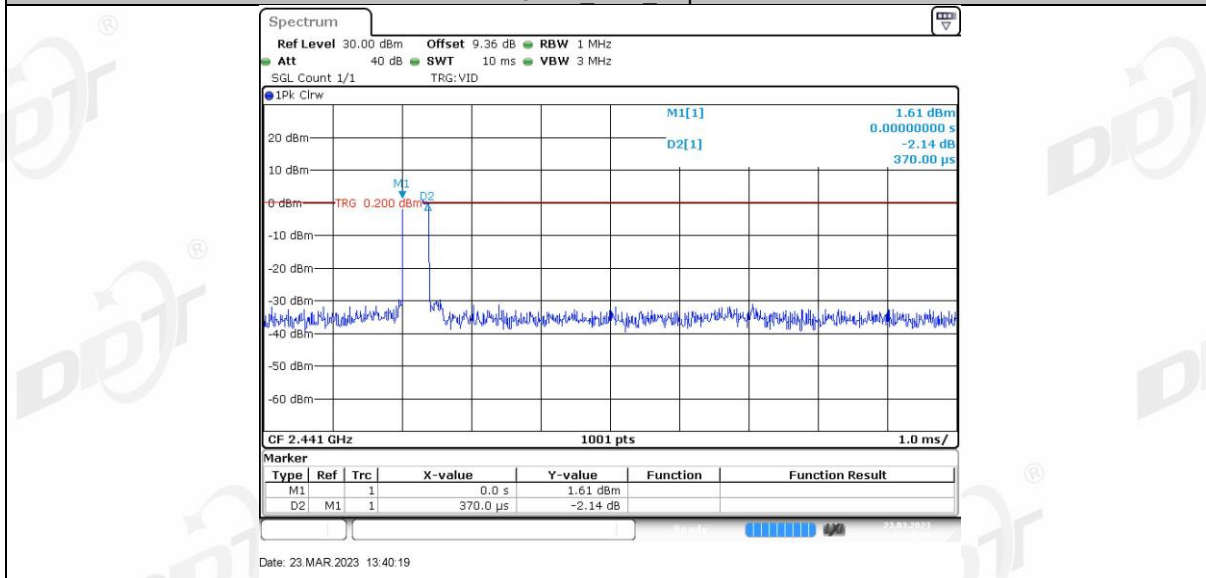


2DH5\_Ant1\_Hop

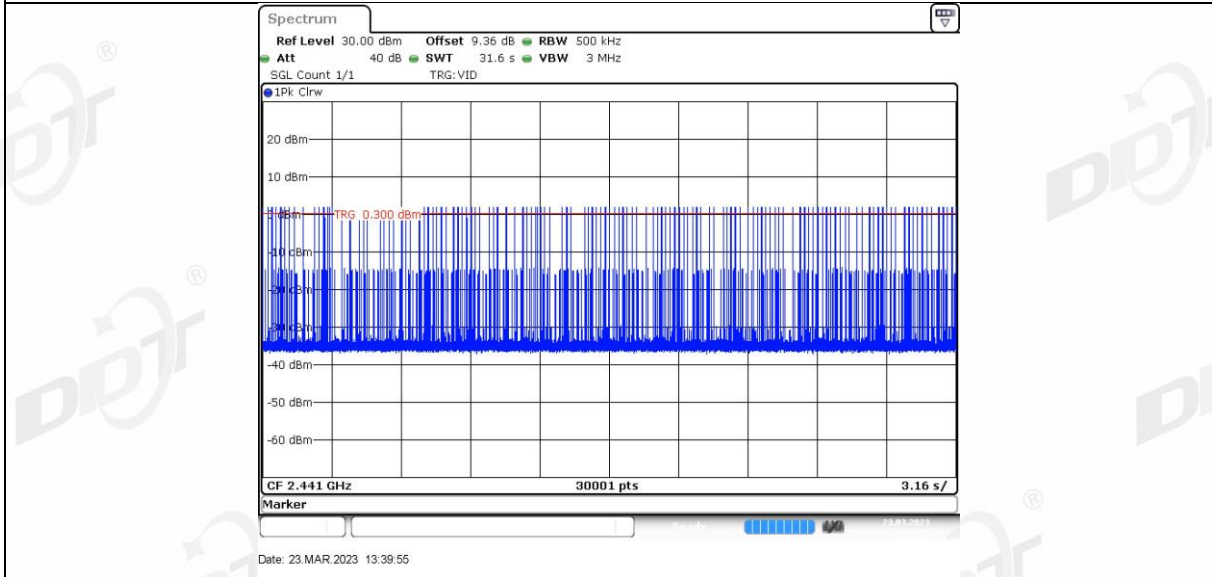
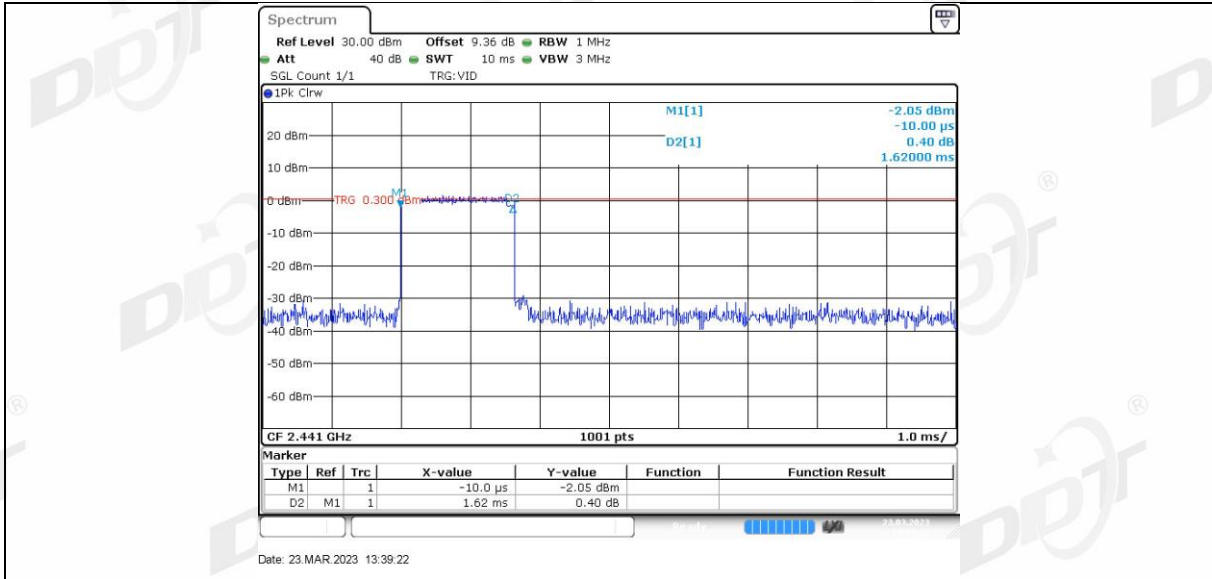




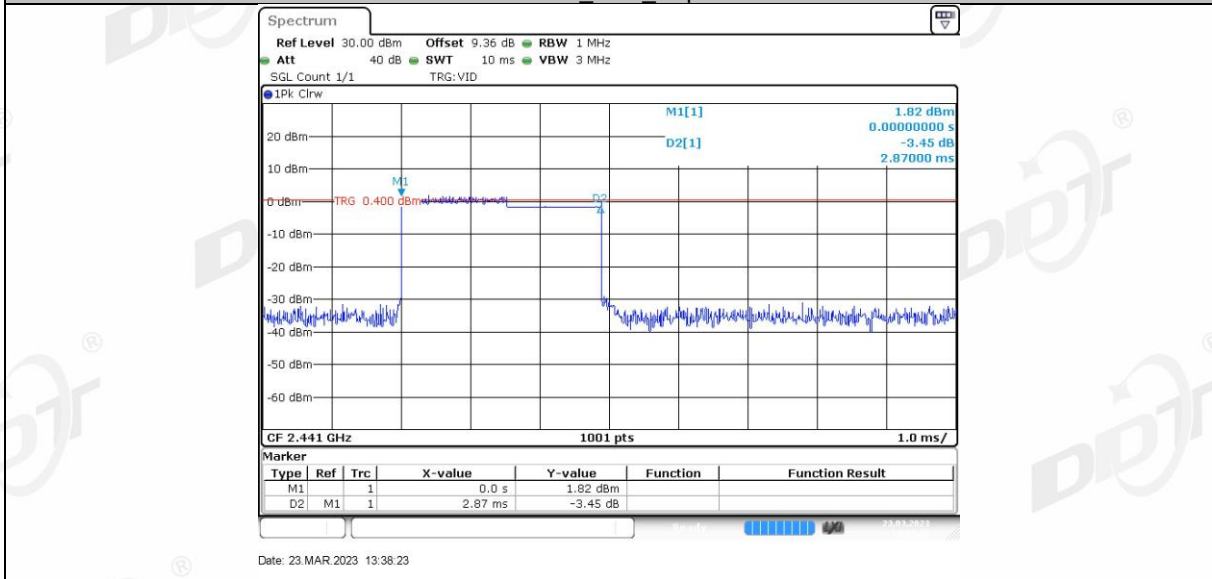
3DH1 Ant1 Hop

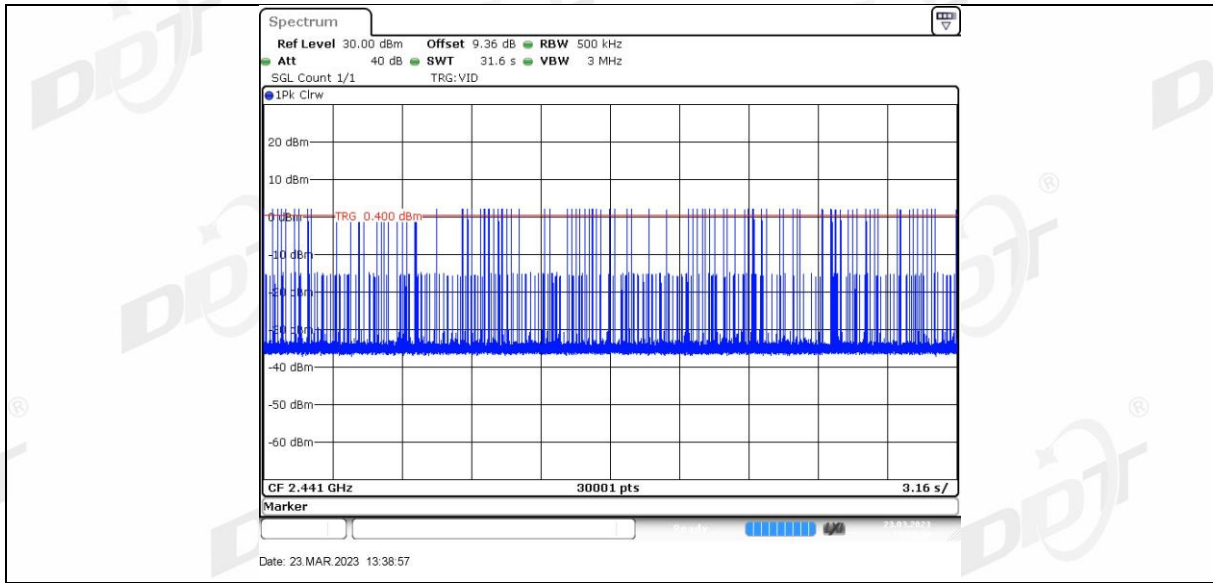


3DH3 Ant1 Hop



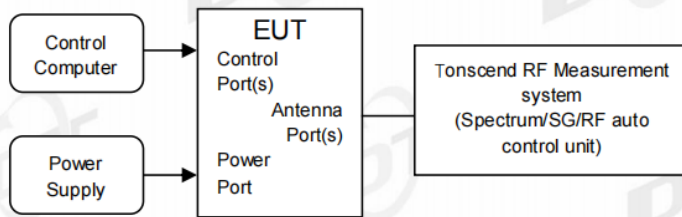
3DH5\_Ant1\_Hop





## 9. Number of Hopping Channel

### 9.1. Block diagram of test setup



### 9.2. Limits

Frequency hopping systems in the 2400-2483.5 MHz band shall use at least 15 channels.

### 9.3. Test procedure

- (1) The test according to ANSI C63.10-2013 clause 7.8.3.
- (2) Connect EUT's antenna output to spectrum analyzer by RF cable, the path loss was compensated to the results.
- (3) Set the EUT as maximum power setting and enable the EUT transmit continuously.
- (4) Use the following spectrum analyzer settings for the maximum peak output power measurement:

|                |   |
|----------------|---|
| RBW:           | RBW to less than 30% of the channel spacing or the 20 dB bandwidth, whichever is smaller. |
| VBW:           | VBW $\geq$ RBW.   |
| Span:          | The frequency band of operation   |
| Detector Mode: | Peak  |
| Sweep time:    | Auto  |
| Trace mode:    | Max hold  |

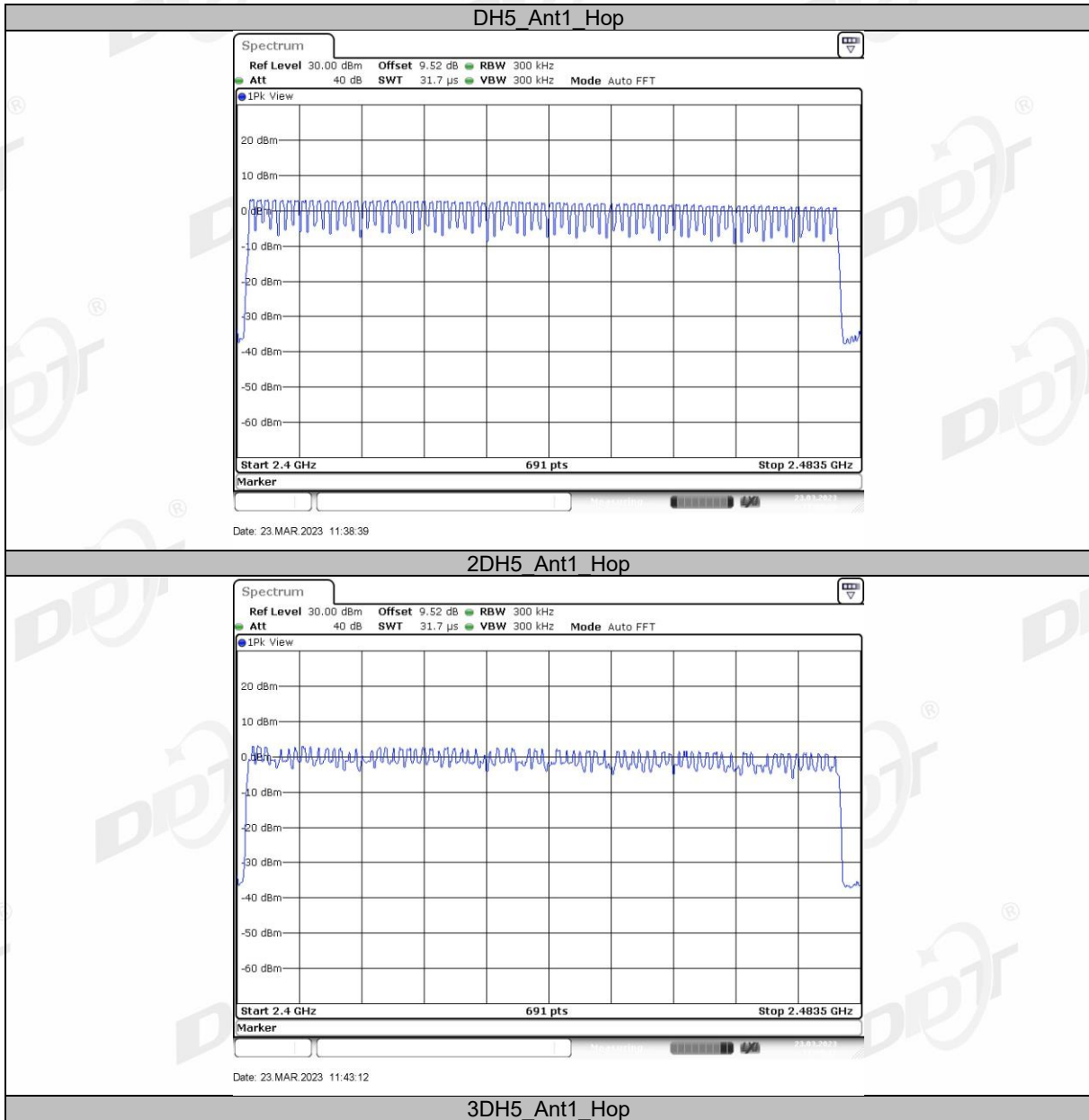
Measure and record the results in the report.

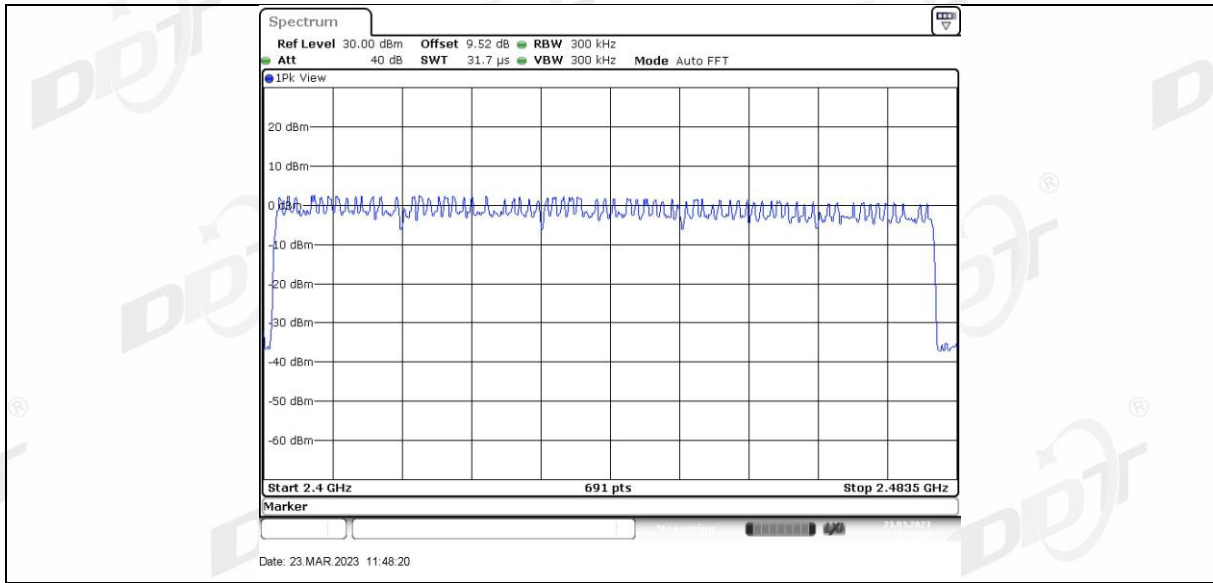
- (5) Measure the hopping number and record the results in the report.

### 9.4. Test result

| Test Mode | Antenna | Frequency [MHz] | Result [Num] | Limit [Num] | Verdict |
|-----------|---------|-----------------|--------------|-------------|---------|
| DH5       | Ant1    | Hop             | 79           | ≥15         | PASS    |
| 2DH5      | Ant1    | Hop             | 79           | ≥15         | PASS    |
| 3DH5      | Ant1    | Hop             | 79           | ≥15         | PASS    |

### 9.5. Test graphs

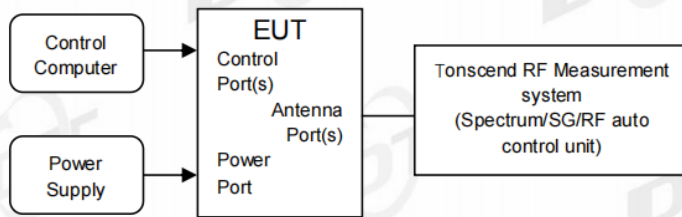






## 10. Band Edge Compliance (Conducted Method)

### 10.1. Block diagram of test setup



### 10.2. Limit

All restriction band should comply with 15.209, other emission should be at least 20dB below the fundamental.

### 10.3. Test procedure

(1) Connect EUT's antenna output to spectrum analyzer by RF cable.

(2) Establish a reference level by using the following procedure:

|                |  |
|----------------|--|
| RBW:           | 100 kHz                                  |
| VBW:           | 300 kHz                                  |
| Span           | Encompass frequency range to be measured |
| Detector Mode: | Peak                                     |
| Sweep time:    | Auto                                     |
| Trace mode     | Max hold                                 |

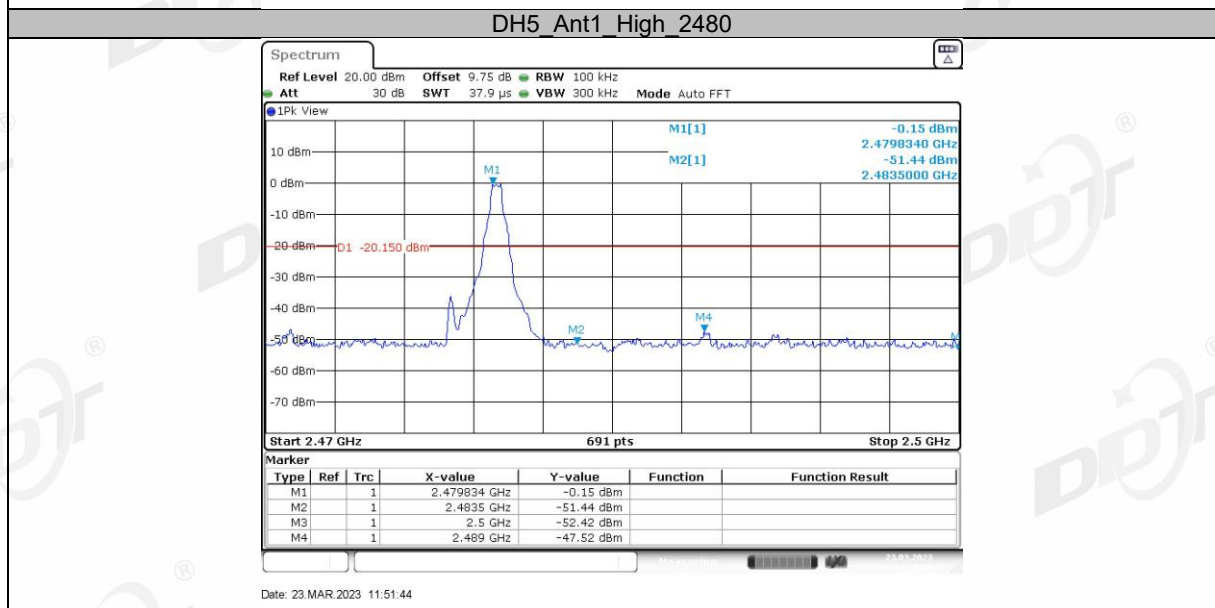
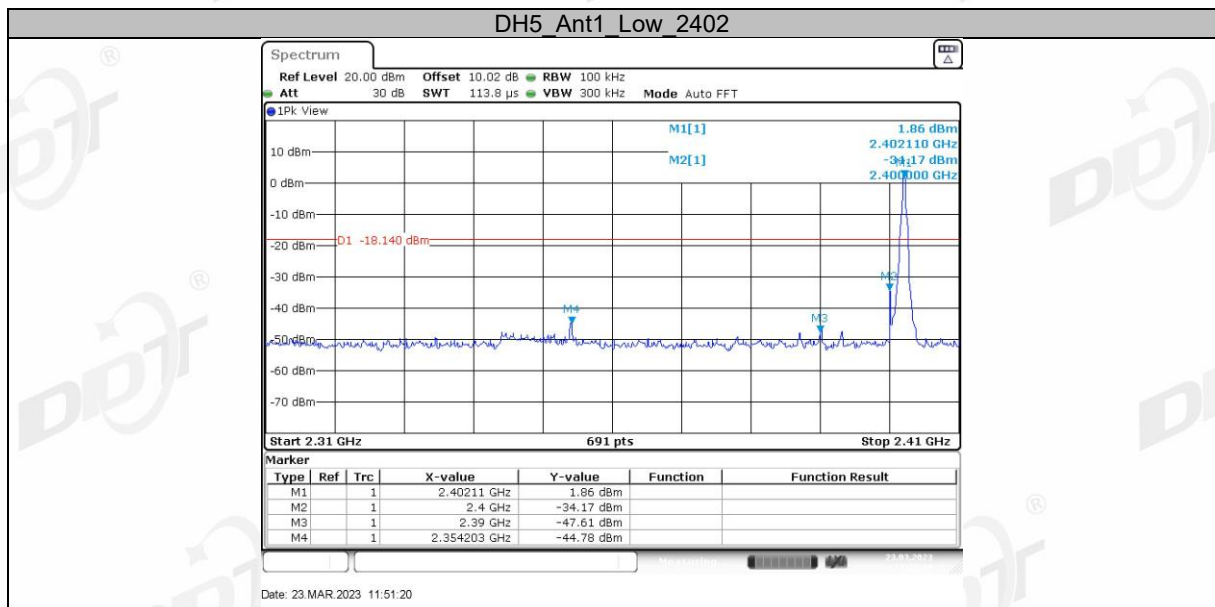
(3) Allow the trace to stabilize, use the peak marker function to determine the maximum peak power level to establish the reference level.

(4) Then mark the maximum amplitude of all unwanted emissions outside of the authorized frequency band.

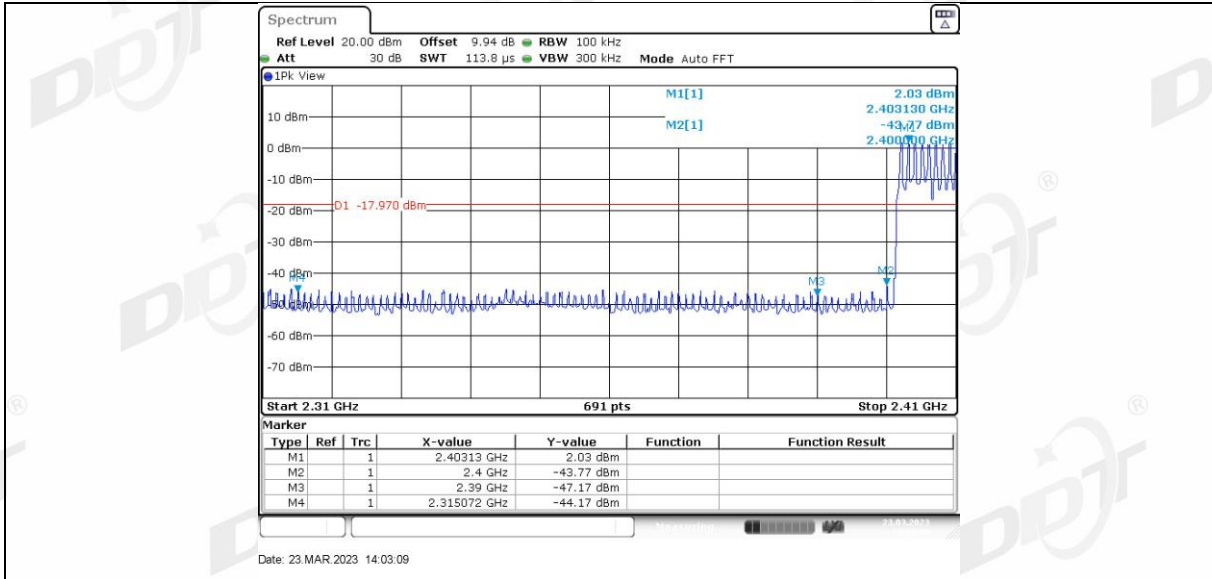
10.4. Test result

| Mode           | Freq. (MHz)      | Verdict |
|----------------|------------------|---------|
| GFSK           | Hopping off 2402 | Pass    |
|                | Hopping off 2480 | Pass    |
|                | Hopping on       | Pass    |
| $\pi/4$ -DQPSK | Hopping off 2402 | Pass    |
|                | Hopping off 2480 | Pass    |
|                | Hopping on       | Pass    |
| 8DPSK          | Hopping off 2402 | Pass    |
|                | Hopping off 2480 | Pass    |
|                | Hopping on       | Pass    |

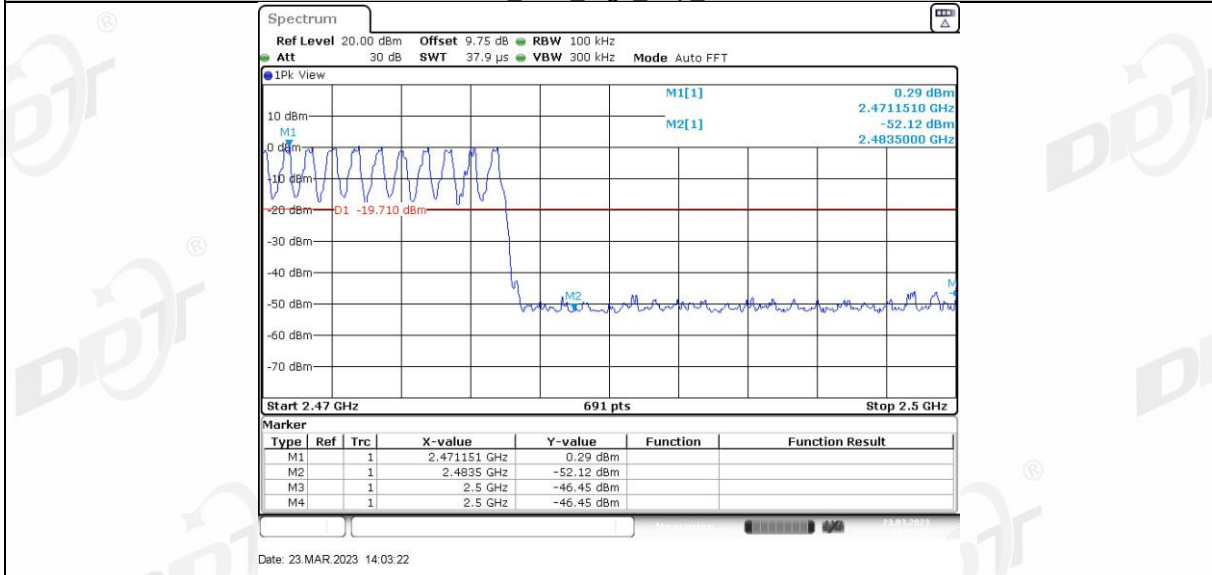
10.5. Test graphs



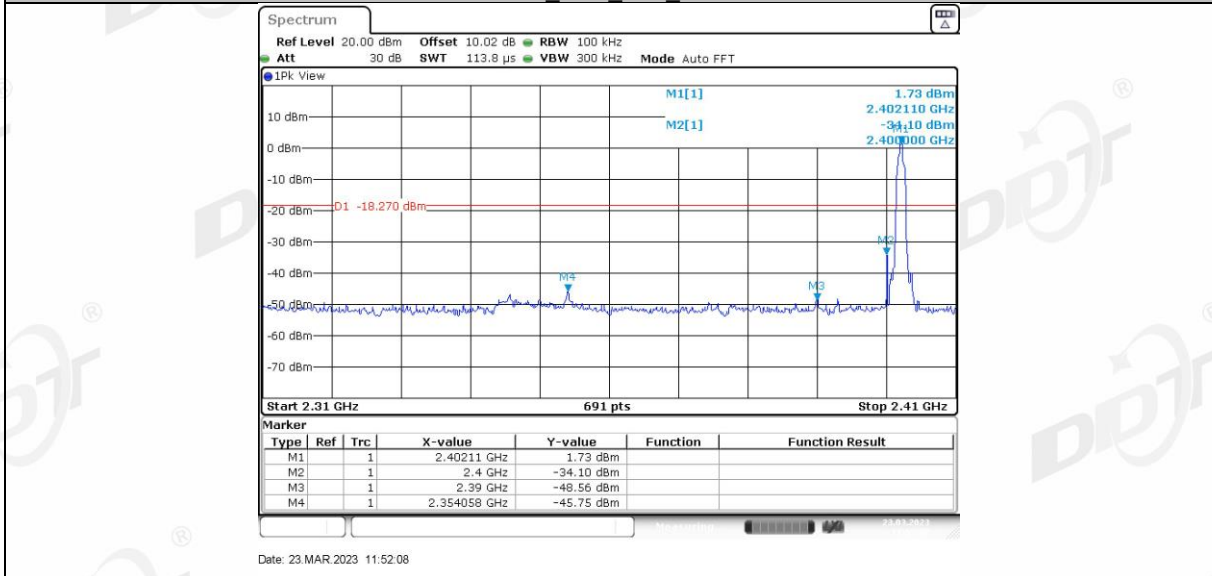
DH5\_Ant1\_Low\_Hop\_2402



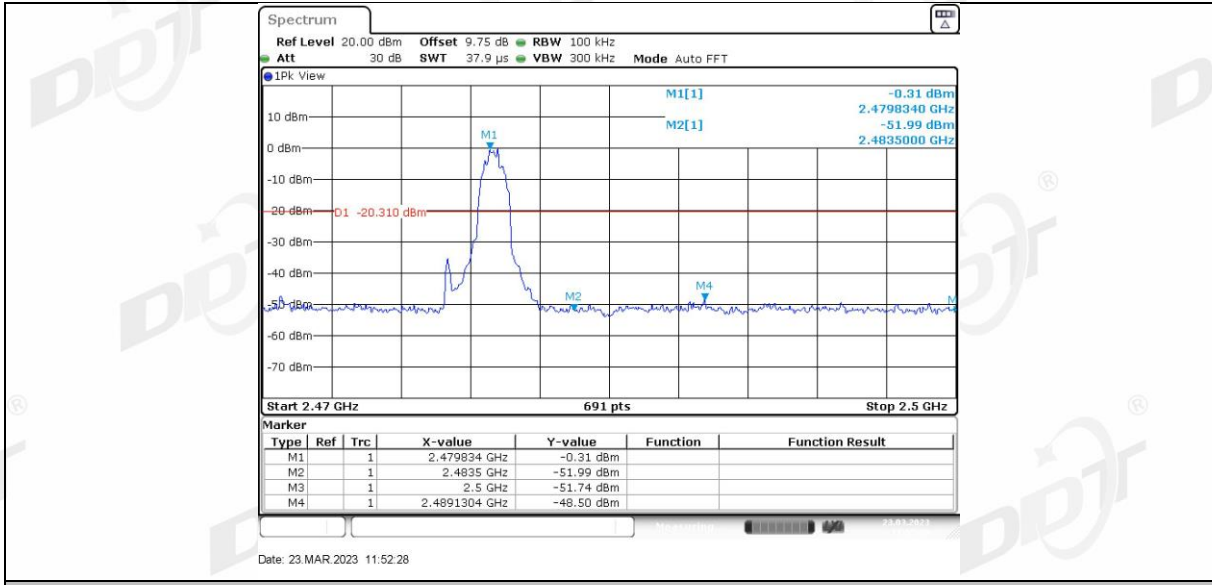
DH5 Ant1 High Hop 2480



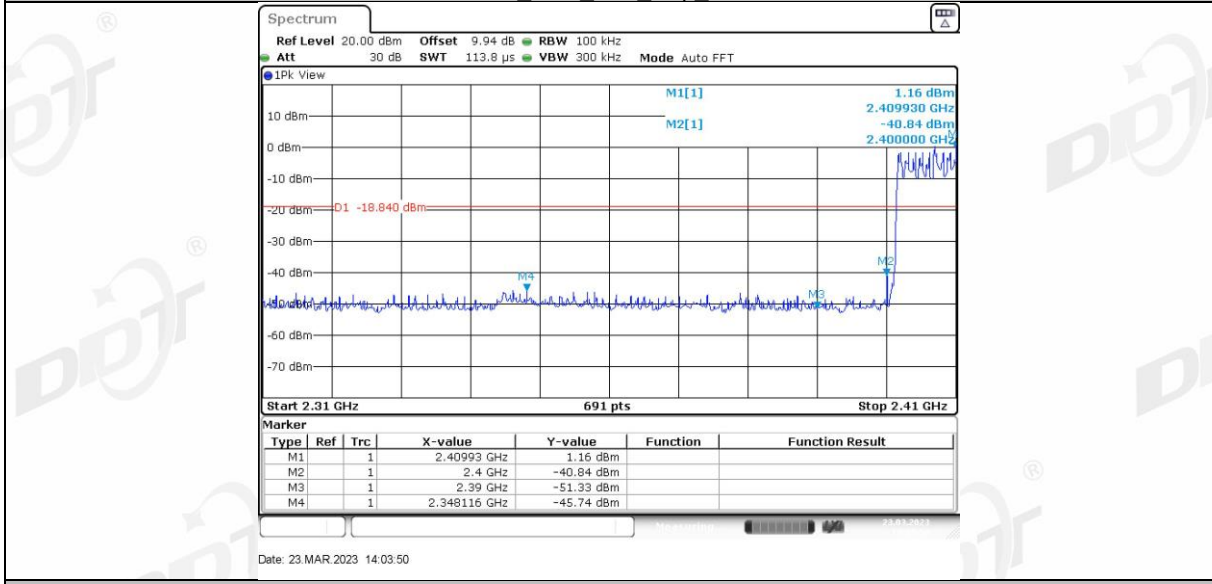
2DH5 Ant1 Low 2402



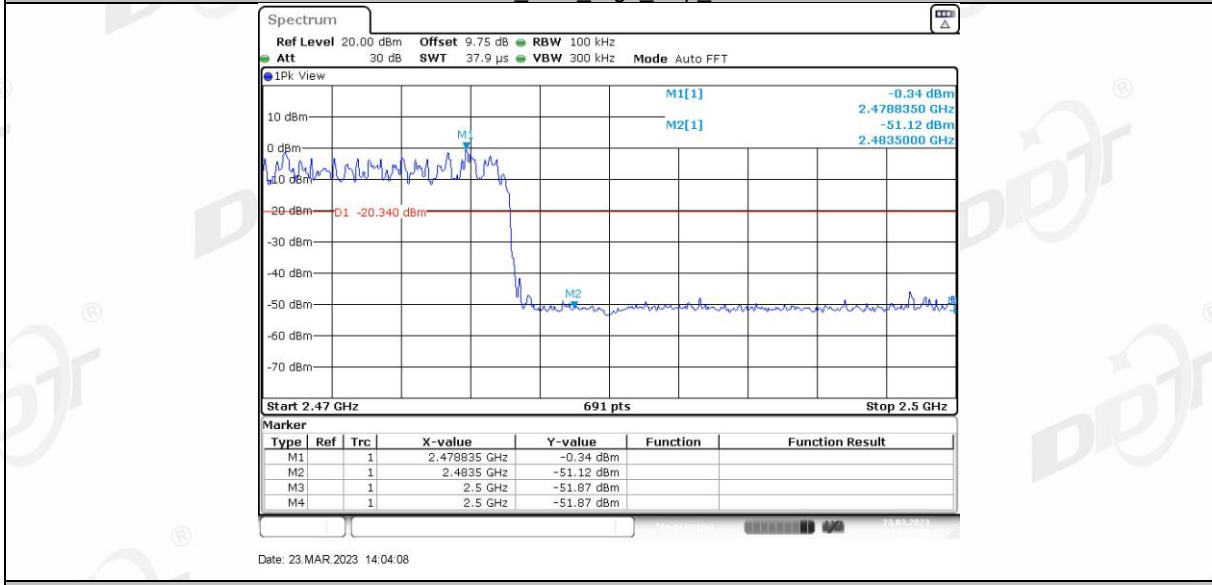
2DH5 Ant1 High 2480



2DH5 Ant1 Low Hop 2402



2DH5 Ant1 High Hop 2480



3DH5 Ant1 Low 2402

