



## FCC AND ISCED CERTIFICATION TEST REPORT

|                                |   |                                                                                                                                                                 |
|--------------------------------|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Applicant</b>               | : | Klein Tools, Inc.                                                                                                                                               |
| <b>Address of Applicant</b>    | : | 450 Bond Street Lincolnshire IL, 60069 USA                                                                                                                      |
| <b>Manufacturer</b>            | : | Klein Tools, Inc.                                                                                                                                               |
| <b>Address of Manufacturer</b> | : | 450 Bond Street Lincolnshire IL, 60069 USA                                                                                                                      |
| <b>Equipment under Test</b>    | : | Hardhat Bluetooth Speaker                                                                                                                                       |
| <b>Model No.</b>               | : | AEPHS1                                                                                                                                                          |
| <b>FCC ID</b>                  | : | 2AI28-AEPHS1                                                                                                                                                    |
| <b>IC</b>                      | : | 21655-AEPHS1                                                                                                                                                    |
| <b>Test Standard(s)</b>        | : | FCC Rules and Regulations Part 15 Subpart C,<br>RSS-247 Issue 3 August 2023,<br>ANSI C63.10:2013,<br>RSS-Gen Issue 5, Apr. 2018, Amendment 2<br>(February 2021) |
| <b>Report No.</b>              | : | DDT-RE24053007-1E01                                                                                                                                             |
| <b>Issue Date</b>              | : | 2024/07/19                                                                                                                                                      |
| <b>Issue By</b>                | : | Guangdong Dongdian Testing Service Co., Ltd.<br>Unit 2, Building 1, No. 17, Zongbu 2nd Road,<br>Songshan Lake Park, Dongguan, Guangdong, China,<br>523808       |

# REPORT

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## Test Report Declare

|                                |   |                                            |
|--------------------------------|---|--------------------------------------------|
| <b>Applicant</b>               | : | Klein Tools, Inc.                          |
| <b>Address of Applicant</b>    | : | 450 Bond Street Lincolnshire IL, 60069 USA |
| <b>Equipment under Test</b>    | : | Hardhat Bluetooth Speaker                  |
| <b>Model No.</b>               | : | AEPHS1                                     |
| <b>Manufacturer</b>            | : | Klein Tools, Inc.                          |
| <b>Address of Manufacturer</b> | : | 450 Bond Street Lincolnshire IL, 60069 USA |

**Test Standard Used:**

FCC Rules and Regulations Part 15 Subpart C,  
RSS-247 Issue 3 August 2023,  
ANSI C63.10:2013,  
RSS-Gen Issue 5, Apr. 2018, Amendment 2 (February 2021)

**We Declare:**

The equipment described above is tested by Guangdong 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 Guangdong Dongdian Testing Service Co., Ltd. is assumed of full responsibility for the accuracy and completeness of these tests.

|                         |                     |                      |                       |
|-------------------------|---------------------|----------------------|-----------------------|
| <b>Report No.:</b>      | DDT-RE24053007-1E01 |                      |                       |
| <b>Date of Receipt:</b> | 2024/06/17          | <b>Date of Test:</b> | 2024/06/17~2024/07/19 |

**Prepared By:****Ziqin Chen/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 Guangdong Dongdian Testing Service Co., Ltd.

Revision History

| Rev. | Revisions     | Issue Date | Revised By |
|------|---------------|------------|------------|
| ---  | Initial issue | 2024/07/19 |            |
|      |               |            |            |

## 1. Summary of Test Results

| No.                                                                                                                                              | Test Parameter                  | Clause No.                                                                                                                                            | Condition | Result |
|--------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------|
| 1                                                                                                                                                | Maximum Peak Output Power       | FCC Part 15: 15.247(b)(1), RSS-247 Issue 3 clause 5.4(b)                                                                                              | /         | Pass   |
| 2                                                                                                                                                | 20 dB Bandwidth                 | FCC Part 15: 15.247(a)(1), RSS-247 Issue 3 clause 5.1(a)                                                                                              | /         | Pass   |
| 3                                                                                                                                                | 99% Bandwidth                   | RSS-Gen Issue 5 clause 6.7                                                                                                                            | /         | Pass   |
| 4                                                                                                                                                | Carrier Frequency Separation    | FCC Part 15: 15.247(a)(1), RSS-247 Issue 3 clause 5.1(b)                                                                                              | /         | Pass   |
| 5                                                                                                                                                | Number of Hopping Channel       | FCC Part 15: 15.247(a)(1)(iii), RSS-247 Issue 3 clause 5.1(d)                                                                                         | /         | Pass   |
| 6                                                                                                                                                | Dwell Time                      | FCC Part 15: 15.247(a)(1)(iii), RSS-247 Issue 3 clause 5.1(d)                                                                                         | /         | Pass   |
| 7                                                                                                                                                | RF Conducted Spurious Emissions | FCC Part 15: 15.247(d), RSS-247 Issue 3 clause 5.5                                                                                                    | /         | Pass   |
| 8                                                                                                                                                | Radiated Emission               | FCC Part 15: 15.205, FCC Part 15: 15.209, FCC Part 15: 15.247(d), RSS-247 Issue 3 clause 5.5, RSS-Gen Issue 5 clause 8.9, RSS-Gen Issue 5 clause 8.10 | /         | Pass   |
| 9                                                                                                                                                | Band Edge Compliance            | FCC Part 15: 15.205, FCC Part 15: 15.209, FCC Part 15: 15.247(d), RSS-247 Issue 3 clause 5.5, RSS-Gen Issue 5 clause 8.9, RSS-Gen Issue 5 clause 8.10 | /         | Pass   |
| 10                                                                                                                                               | Power Line Conducted Emissions  | FCC Part 15: 15.207(a), RSS-Gen Issue 5 clause 8.8                                                                                                    | /         | Pass   |
| 11                                                                                                                                               | Antenna Requirement             | FCC Part 15: 15.203, RSS-Gen Issue 5 clause 6.8                                                                                                       | /         | Pass   |
| Note: N/A is an abbreviation for Not Applicable, and means this item is not applicable for this device or no need to test according to standard. |                                 |                                                                                                                                                       |           |        |

## 2. General Test Information

### 2.1. Description of EUT

|                            |                                                                                               |
|----------------------------|-----------------------------------------------------------------------------------------------|
| EUT Name                   | : Hardhat Bluetooth Speaker                                                                   |
| Model Number               | : AEPHS1                                                                                      |
| Difference of model number | : /                                                                                           |
| EUT Function Description   | : Please reference user manual of this device                                                 |
| Power Supply               | : Input: 5V = 1A (via type-C port)<br>Internal Li-ion Polymer battery: 3.8Vdc, 250mAh, 0.95Wh |
| Hardware Version           | : V1.3                                                                                        |
| Software Version           | : V1.0.0.7                                                                                    |

Note: This EUT support Bluetooth BR/EDR/LE, this report only for Bluetooth BR/EDR.

|                     |                               |
|---------------------|-------------------------------|
| Radio Specification | : Bluetooth BR/EDR            |
| Operation Frequency | : 2402 MHz-2480 MHz           |
| Modulation          | : GFSK, $\pi/4$ -DQPSK, 8DPSK |

|                       |                |
|-----------------------|----------------|
| Antenna information   |                |
| Antenna Type          | : Chip Antenna |
| Max Antenna Gain(dBi) | : 1.24         |

| 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 |    |      |

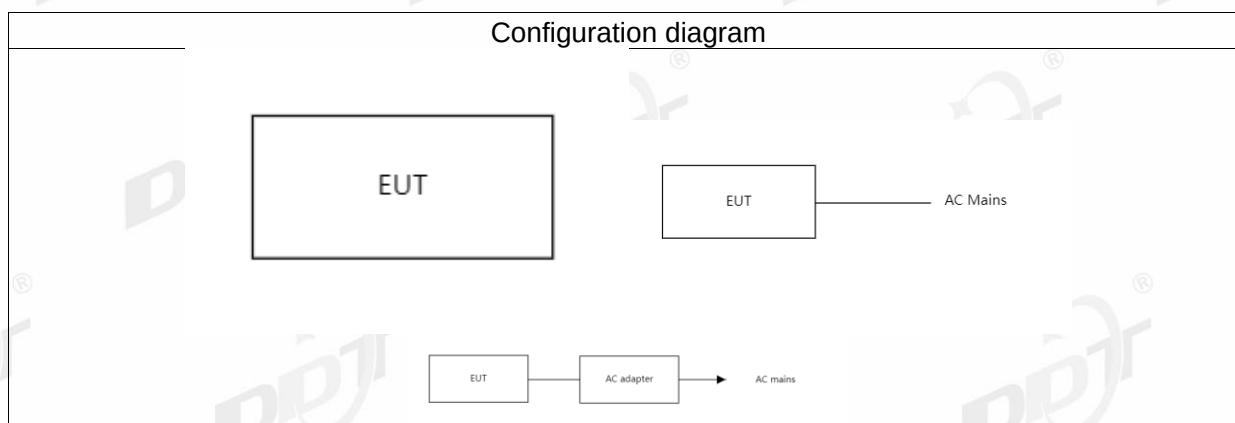
Note: The above EUT information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications or User's Manual. The above Antenna information is declared by manufacturer and for more detailed features description please refer to the manufacturer's specifications, the laboratory shall not be held responsible.

“☑” means to be chosen or applicable; “☐” means don't to be chosen or not applicable; This note applies to entire report.

## 2.2. Accessories of EUT

| Accessories | Manufacturer | Model number | Description |
|-------------|--------------|--------------|-------------|
| /           | /            | /            | /           |

## 2.3. Block diagram of EUT configuration for test



## 2.4. Decision of final test mode

According pre-test, the worst test modes were reported as below:

Test software: BK32xx RF Test\_V1.8.2.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                                                                 | 1                | CH0 to CH78 | 2402 to 2480    |
| $\pi/4$ -DQPSK hopping on Tx mode                                                       | 1                | CH0 to CH78 | 2402 to 2480    |
| 8DPSK hopping on Tx mode                                                                | 1                | CH0 to CH78 | 2402 to 2480    |
| GFSK hopping off Tx mode                                                                | 1                | CH0         | 2402            |
|                                                                                         | 1                | CH39        | 2441            |
|                                                                                         | 1                | CH78        | 2480            |
| $\pi/4$ -DQPSK hopping off Tx mode                                                      | 1                | CH0         | 2402            |
|                                                                                         | 1                | CH39        | 2441            |
|                                                                                         | 1                | CH78        | 2480            |
| 8DPSK hopping off Tx mode                                                               | 1                | CH0         | 2402            |
|                                                                                         | 1                | CH39        | 2441            |
|                                                                                         | 1                | CH78        | 2480            |
| Worst-case data rates were: GFSK mode: DH5, $\pi/4$ -DQPSK mode: 2DH5, 8DPSK mode: 3DH5 |                  |             |                 |

## 2.5. Deviations of test standard

No deviation.

## 2.6. Test environment conditions

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

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

Note: The specific temperature and humidity information of each test item refers to the temperature and humidity record in the corresponding test data.

## 2.7. Test laboratory

Guangdong Dongdian Testing Service Co., Ltd.

Add.: Unit 2, Building 1, No. 17, Zongbu 2nd Road, Songshan Lake Park, Dongguan, Guangdong, China, 523808.

Tel.: +86-0769-38826678, <http://www.dgddt.com>, Email: 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

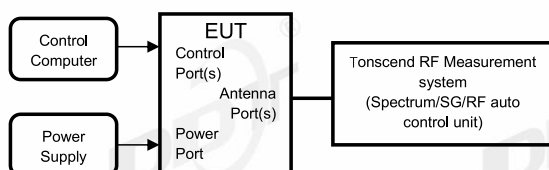
| Test Item                                                                                                                                     | Uncertainty                                                                                                                                               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

| Equipment                                     | Manufacturer | Model No.   | Serial Number | Due Date   |
|-----------------------------------------------|--------------|-------------|---------------|------------|
| ☑RF Connected Test (RF Measurement System 4#) |              |             |               |            |
| Signal &Spectrum Analyzer                     | R&S          | FSV3044     | 101173        | 2025/03/31 |
| Wideband Radio Communication Tester           | R&S          | CMW500      | 168801        | 2025/03/31 |
| MXG Vector Signal Generator                   | Agilent      | N5182A      | MY48180737    | 2025/03/31 |
| PSG Vector Signal Generator                   | Agilent      | E8267D      | US49060192    | 2024/09/05 |
| RF Control Unit                               | Tonsend      | JS0806-2    | 21I8060485    | 2025/03/31 |
| TEMP&HUMI Programmable Chamber                | ZHIXIANG     | ZXGDJS-150L | ZX170110-A    | 2025/04/22 |
| Test Software                                 | Tonscend     | JS1120-3    | Ver.3.2.22    | N/A        |

## 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.

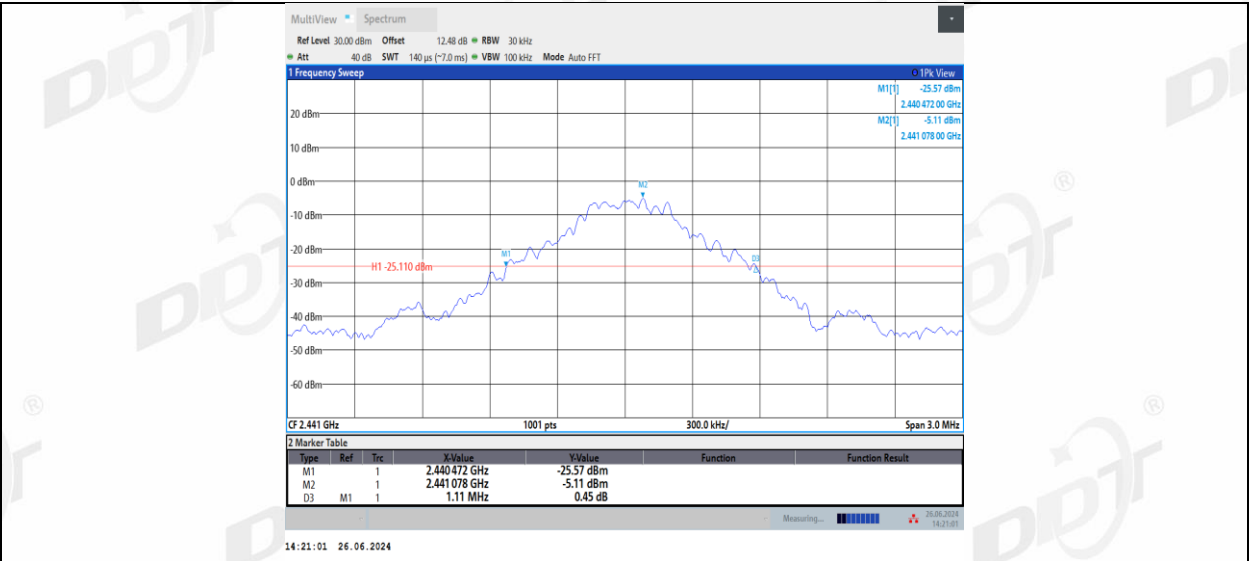
4.4. Test result

|                    |                         |                |                          |
|--------------------|-------------------------|----------------|--------------------------|
| Test Engineer:     | Zoe                     | Test Site:     | RF Measurement System 4# |
| Ambient Condition: | 25.6-26.1℃,41.8-45.3%RH | Test Date:     | 2024.06.25-2024.06.26    |
| Test Power Supply: | Battery                 | Sample Number: | S24053007-001            |

| Test Mode | Antenna    | Frequency [MHz] | 20dB EBW[MHz] |
|-----------|------------|-----------------|---------------|
| DH5       | Right side | 2402            | 1.11          |
|           | Left side  | 2402            | 1.11          |
|           | Right side | 2441            | 1.01          |
|           | Left side  | 2441            | 1.11          |
|           | Right side | 2480            | 1.11          |
|           | Left side  | 2480            | 1.11          |
| 2DH5      | Right side | 2402            | 1.32          |
|           | Left side  | 2402            | 1.35          |
|           | Right side | 2441            | 1.32          |
|           | Left side  | 2441            | 1.33          |
|           | Right side | 2480            | 1.28          |
|           | Left side  | 2480            | 1.33          |
| 3DH5      | Right side | 2402            | 1.32          |
|           | Left side  | 2402            | 1.31          |
|           | Right side | 2441            | 1.28          |
|           | Left side  | 2441            | 1.34          |
|           | Right side | 2480            | 1.30          |
|           | Left side  | 2480            | 1.28          |

4.5. Test graphs

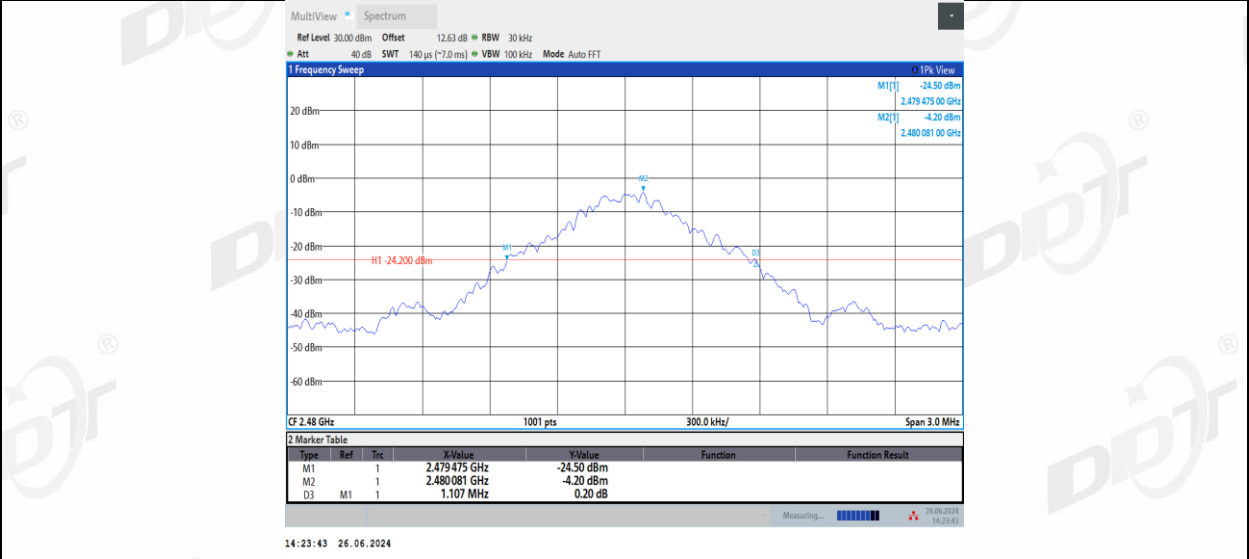




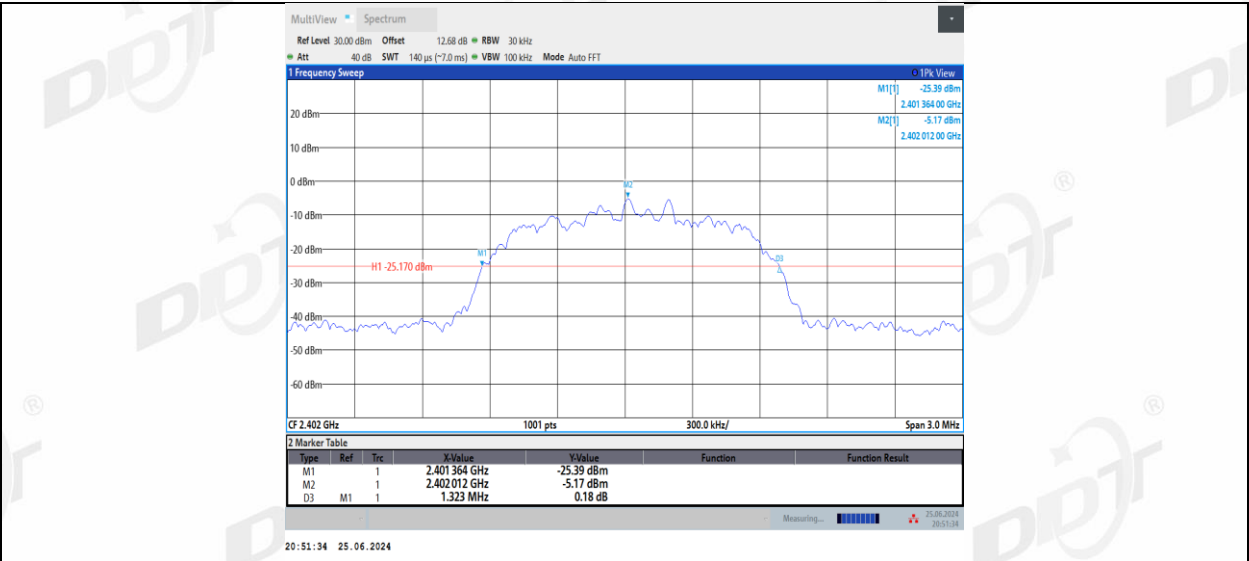
DH5\_Right side\_2480



DH5\_Left side\_2480



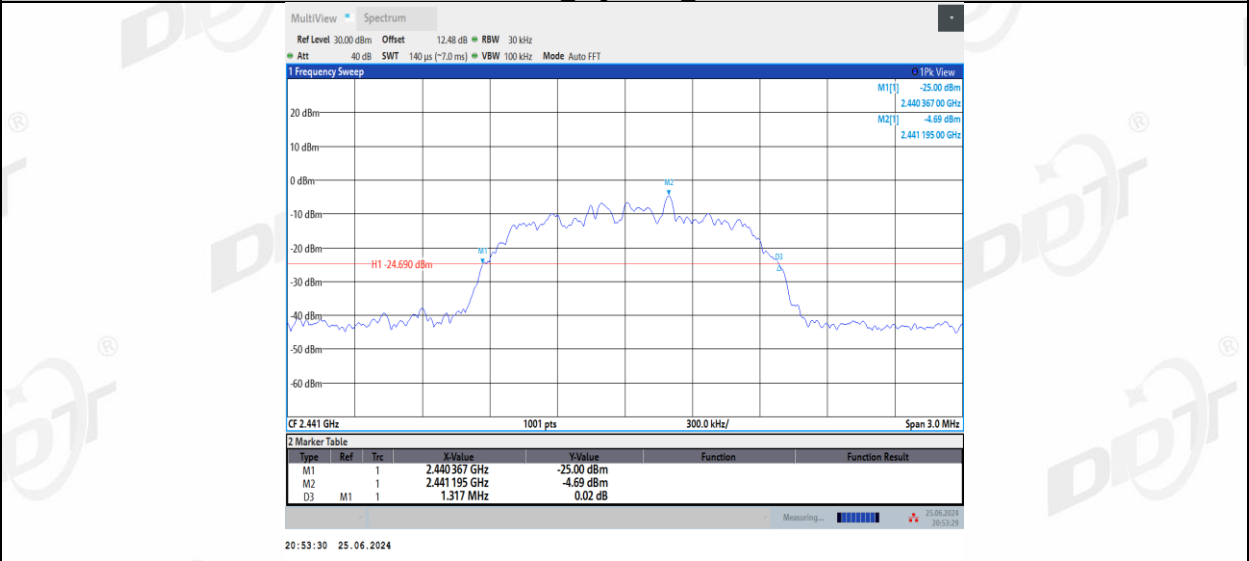
2DH5\_Right side\_2402



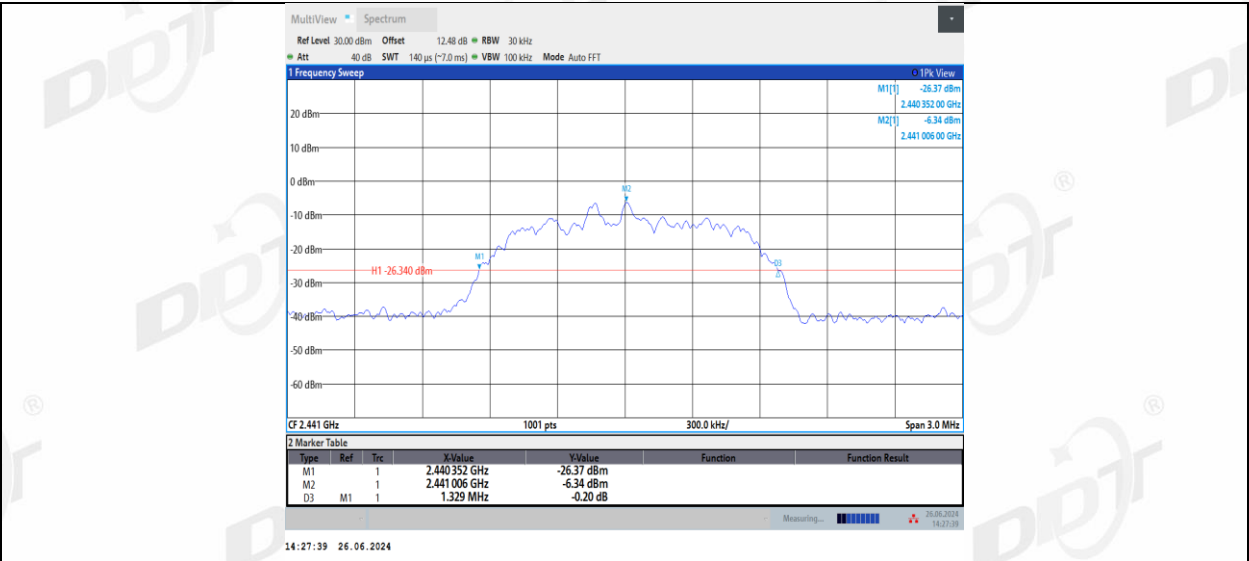
2DH5\_Left side\_2402



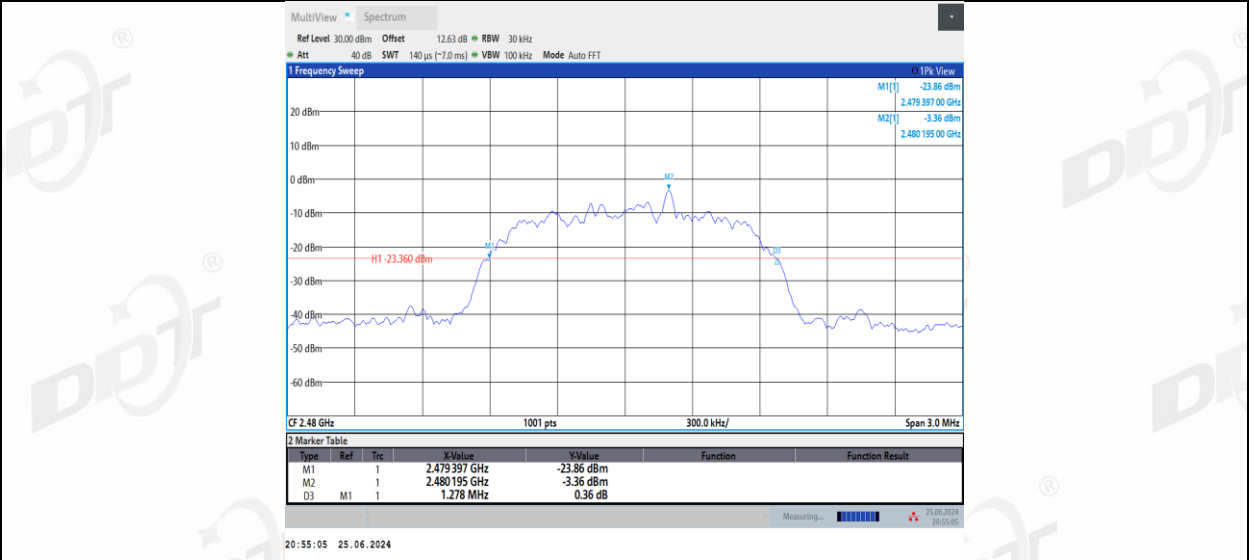
2DH5\_Right side\_2441



2DH5\_Left side\_2441



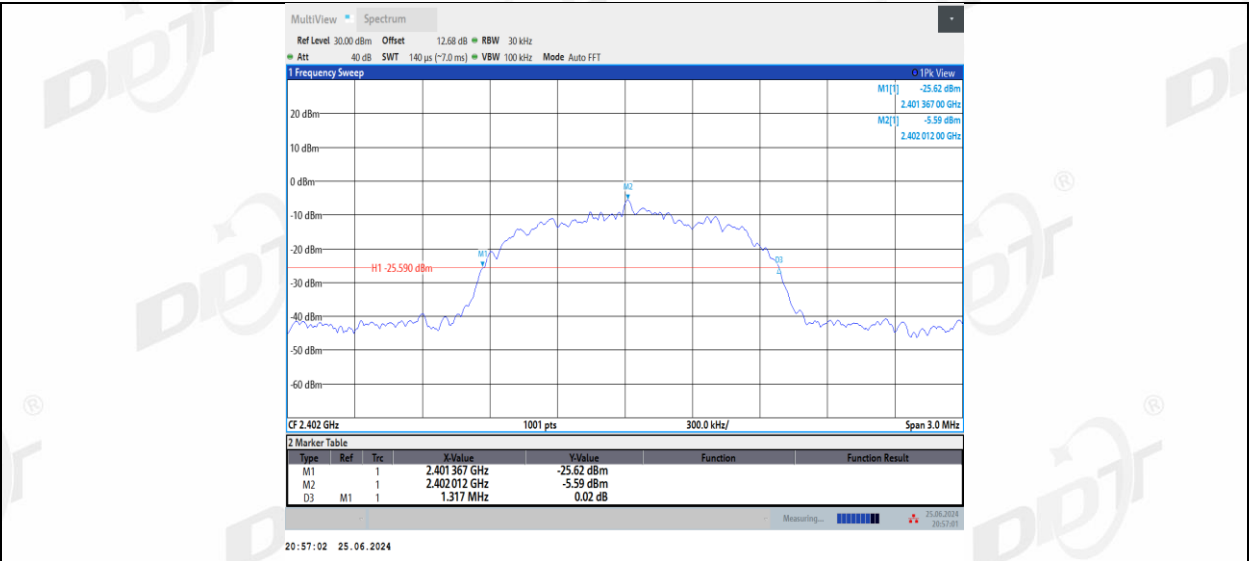
2DH5\_Right side\_2480



2DH5\_Left side\_2480



3DH5\_Right side\_2402



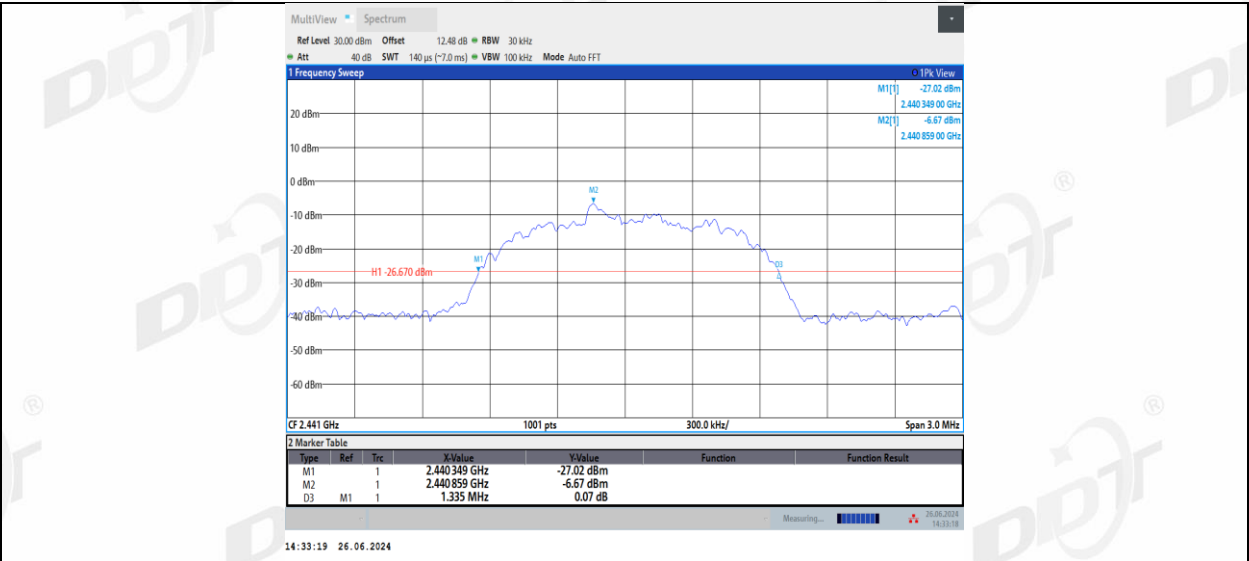
3DH5\_Left side\_2402



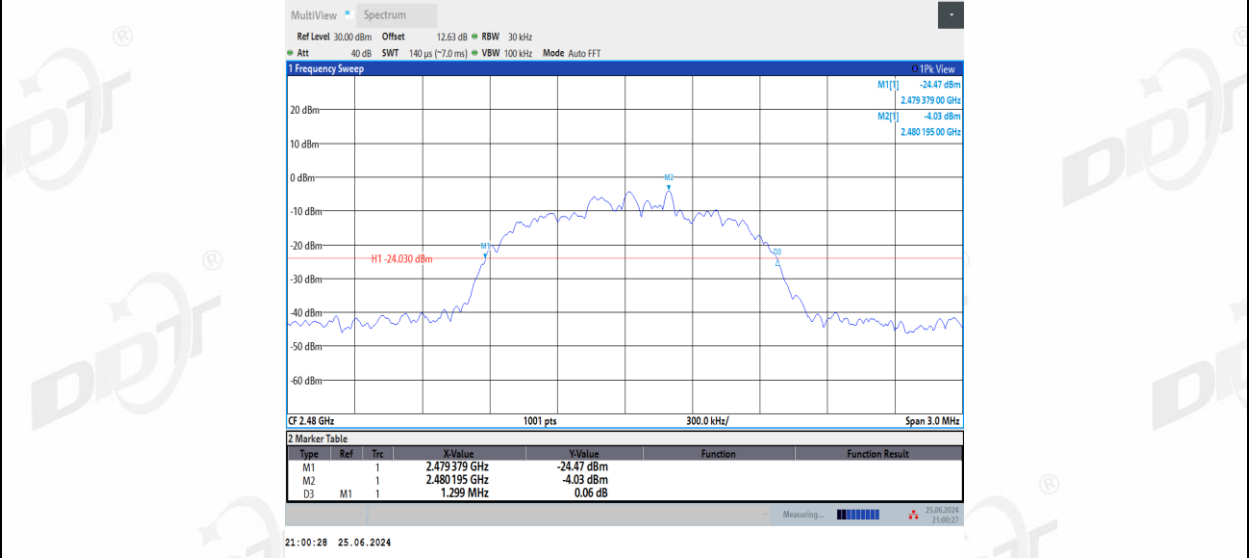
3DH5\_Right side\_2441



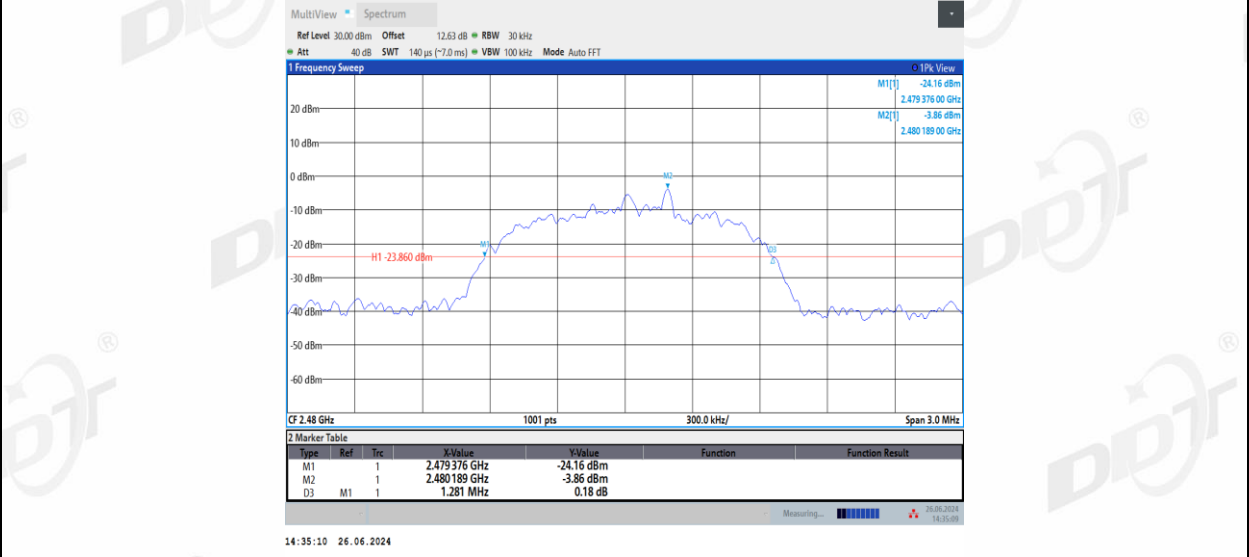
3DH5\_Left side\_2441



3DH5\_Right side\_2480

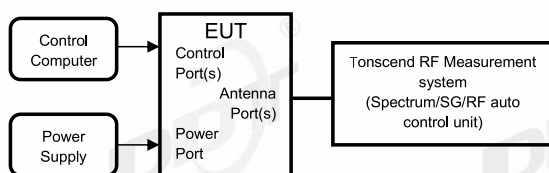


3DH5\_Left side\_2480



## 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:

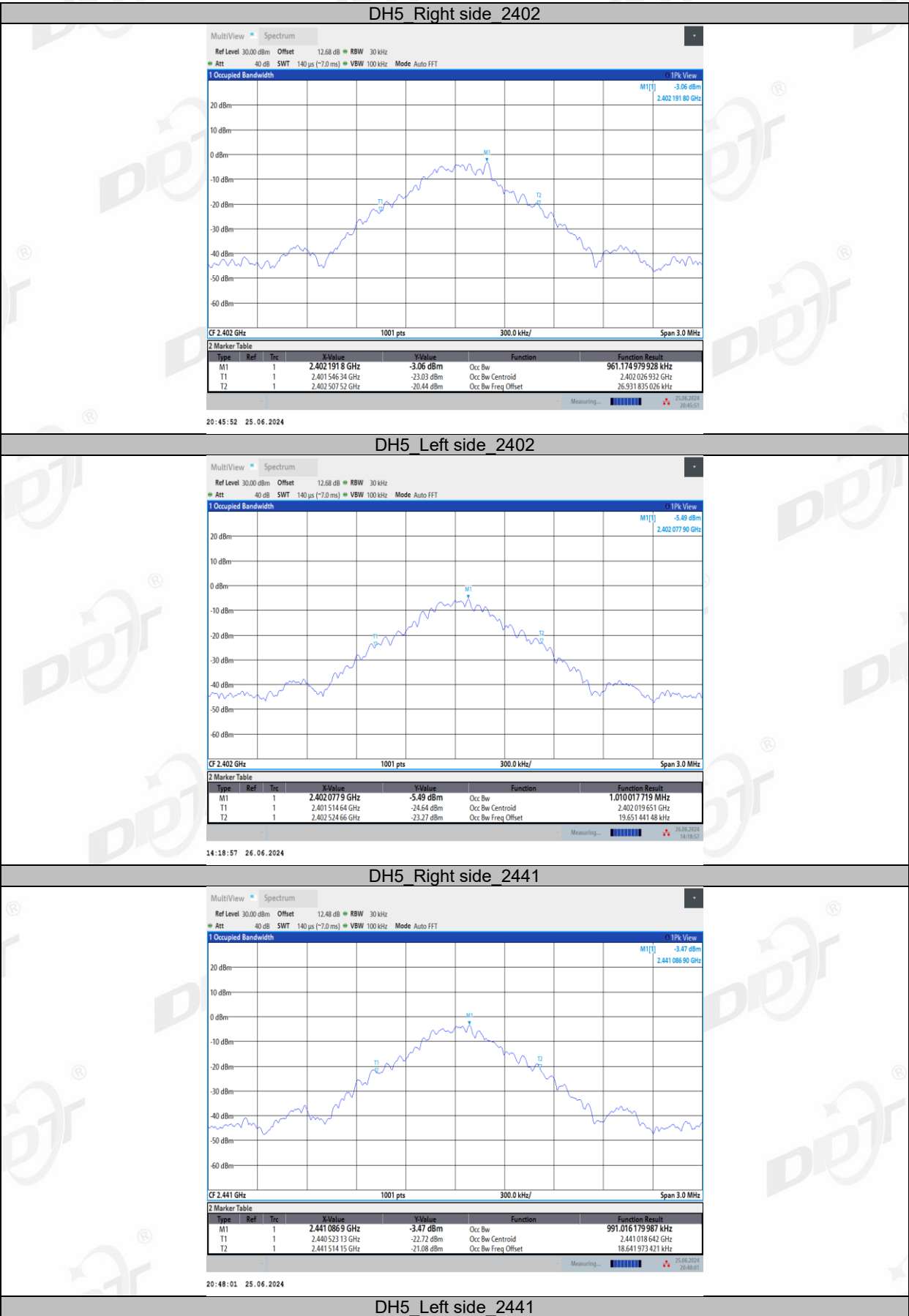
|                |                                         |
|----------------|-----------------------------------------|
| RBW:           | 1% to 5% of the OBW                     |
| VBW:           | approximately three times RBW           |
| Span:          | between 1.5 times and 5.0 times the OBW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

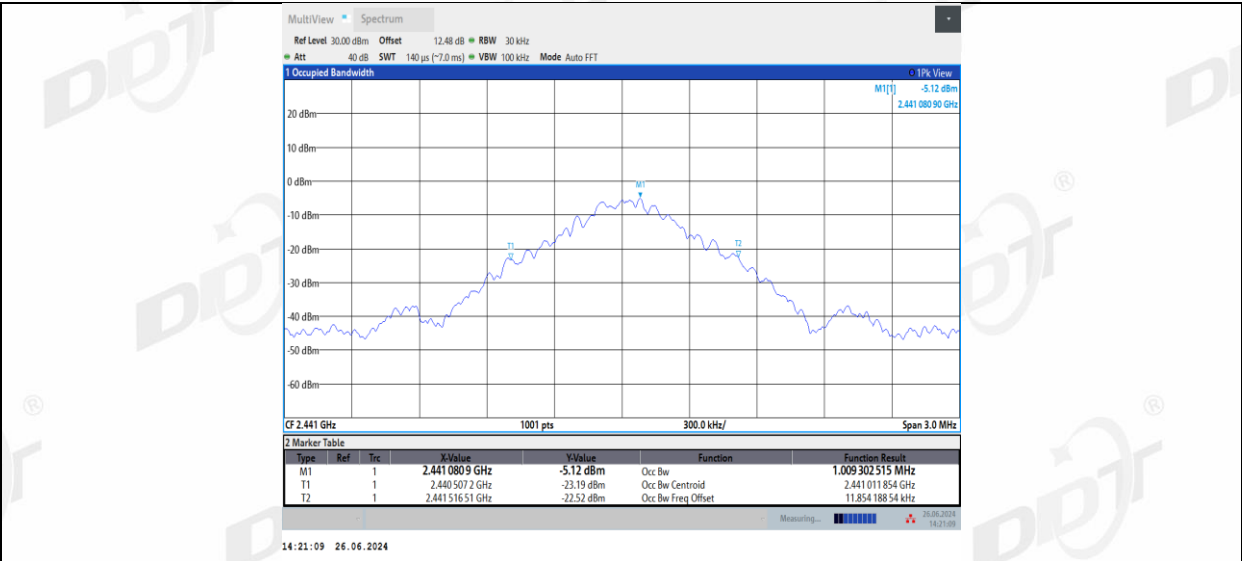
5.4. Test result

|                    |                         |                |                          |
|--------------------|-------------------------|----------------|--------------------------|
| Test Engineer:     | Zoe                     | Test Site:     | RF Measurement System 4# |
| Ambient Condition: | 25.6-26.1℃,41.8-45.3%RH | Test Date:     | 2024.06.25-2024.06.26    |
| Test Power Supply: | Battery                 | Sample Number: | S24053007-001            |

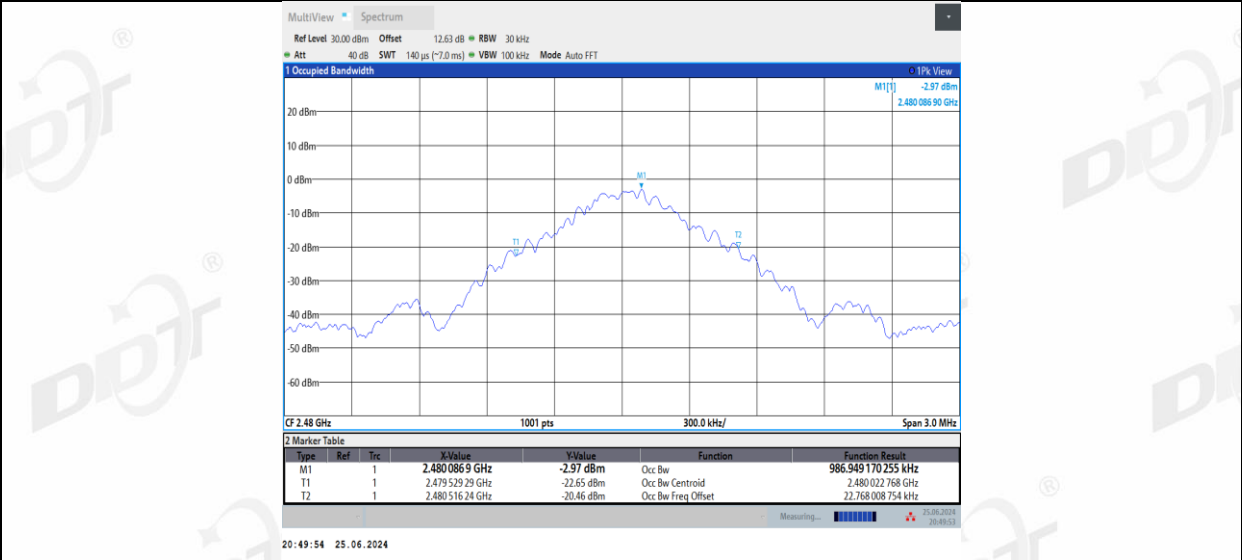
| Test Mode | Antenna    | Frequency [MHz] | OCB [MHz] | FL[MHz]   | FH[MHz]   |
|-----------|------------|-----------------|-----------|-----------|-----------|
| DH5       | Right side | 2402            | 0.961     | 2401.5463 | 2402.5075 |
|           | Left side  | 2402            | 1.01      | 2401.5146 | 2402.5247 |
|           | Right side | 2441            | 0.991     | 2440.5231 | 2441.5142 |
|           | Left side  | 2441            | 1.009     | 2440.5072 | 2441.5165 |
|           | Right side | 2480            | 0.987     | 2479.5293 | 2480.5162 |
|           | Left side  | 2480            | 1.003     | 2479.5176 | 2480.5208 |
| 2DH5      | Right side | 2402            | 1.2       | 2401.4270 | 2402.6273 |
|           | Left side  | 2402            | 1.206     | 2401.4139 | 2402.6201 |
|           | Right side | 2441            | 1.183     | 2440.4346 | 2441.6173 |
|           | Left side  | 2441            | 1.223     | 2440.4045 | 2441.6270 |
|           | Right side | 2480            | 1.193     | 2479.4303 | 2480.6230 |
|           | Left side  | 2480            | 1.212     | 2479.4124 | 2480.6248 |
| 3DH5      | Right side | 2402            | 1.187     | 2401.4337 | 2402.6205 |
|           | Left side  | 2402            | 1.213     | 2401.4057 | 2402.6187 |
|           | Right side | 2441            | 1.199     | 2440.4232 | 2441.6219 |
|           | Left side  | 2441            | 1.226     | 2440.4008 | 2441.6272 |
|           | Right side | 2480            | 1.195     | 2479.4274 | 2480.6227 |
|           | Left side  | 2480            | 1.214     | 2479.4043 | 2480.6185 |

5.5. Test graphs

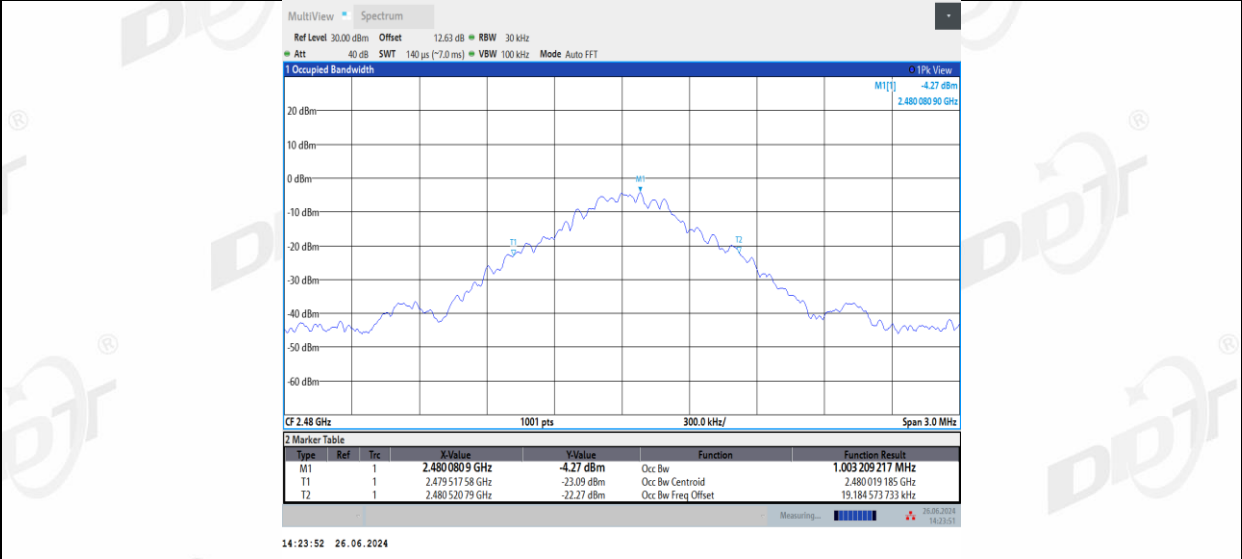




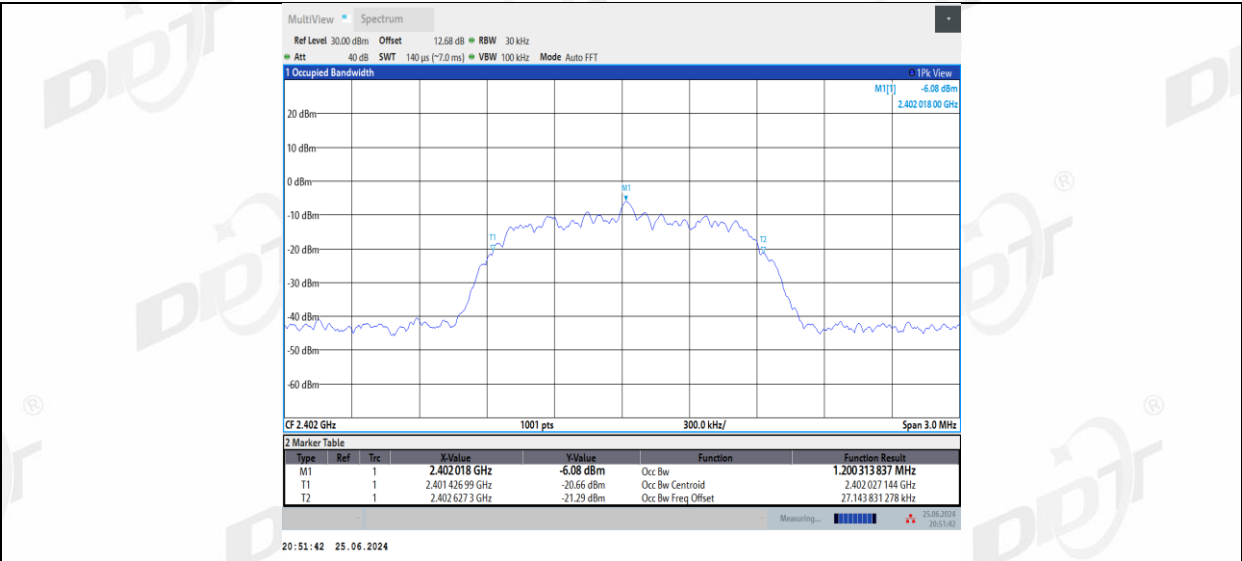
DH5\_Right side\_2480



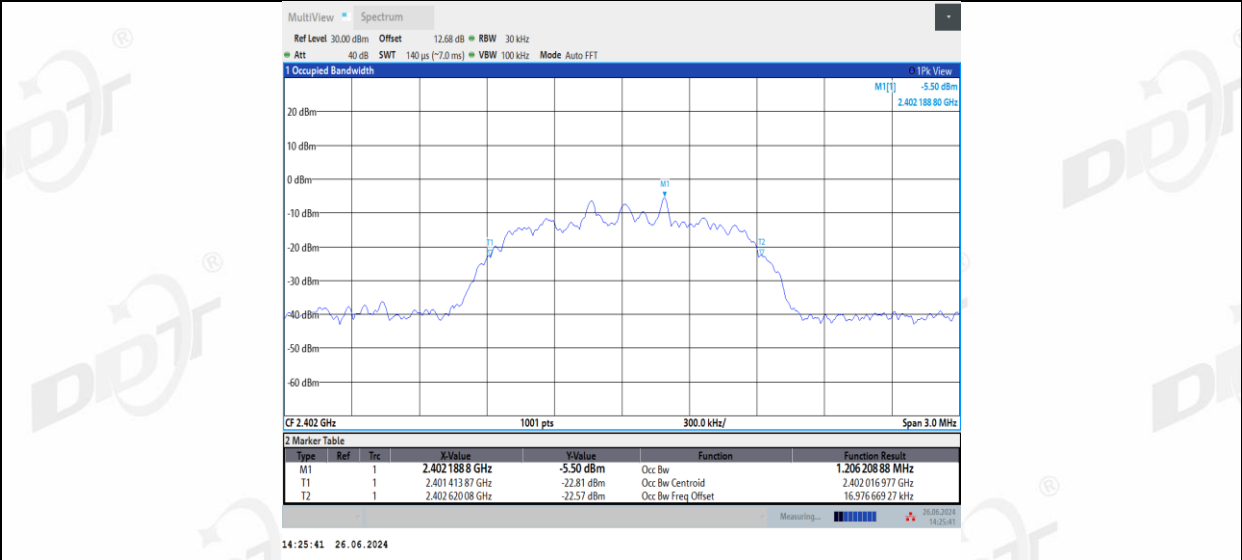
DH5\_Left side\_2480



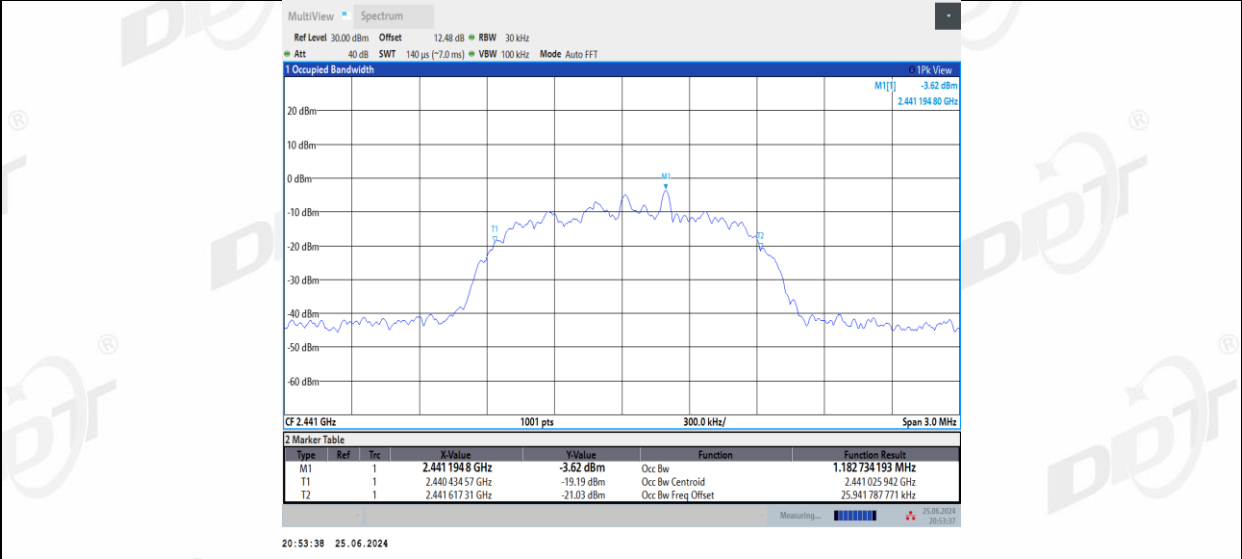
2DH5\_Right side\_2402



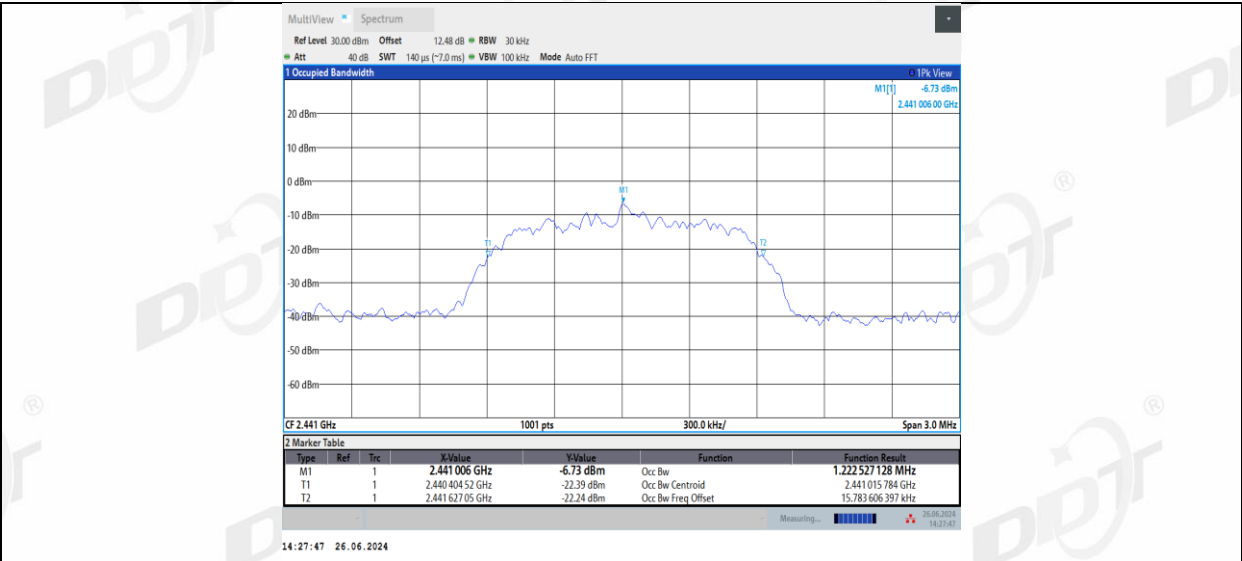
2DH5\_Left side\_2402



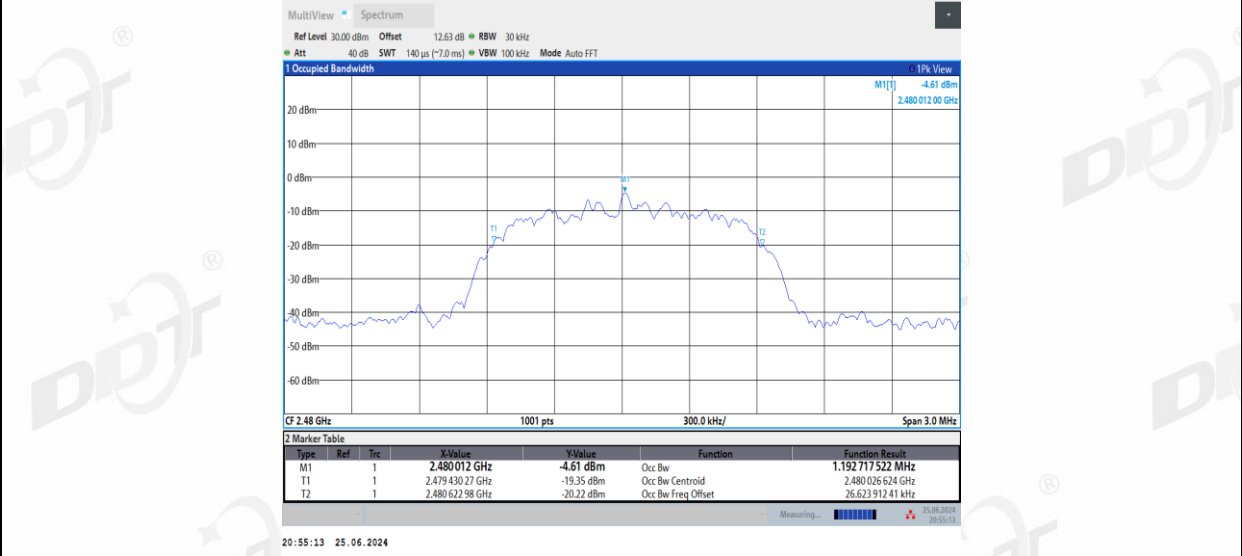
2DH5\_Right side\_2441



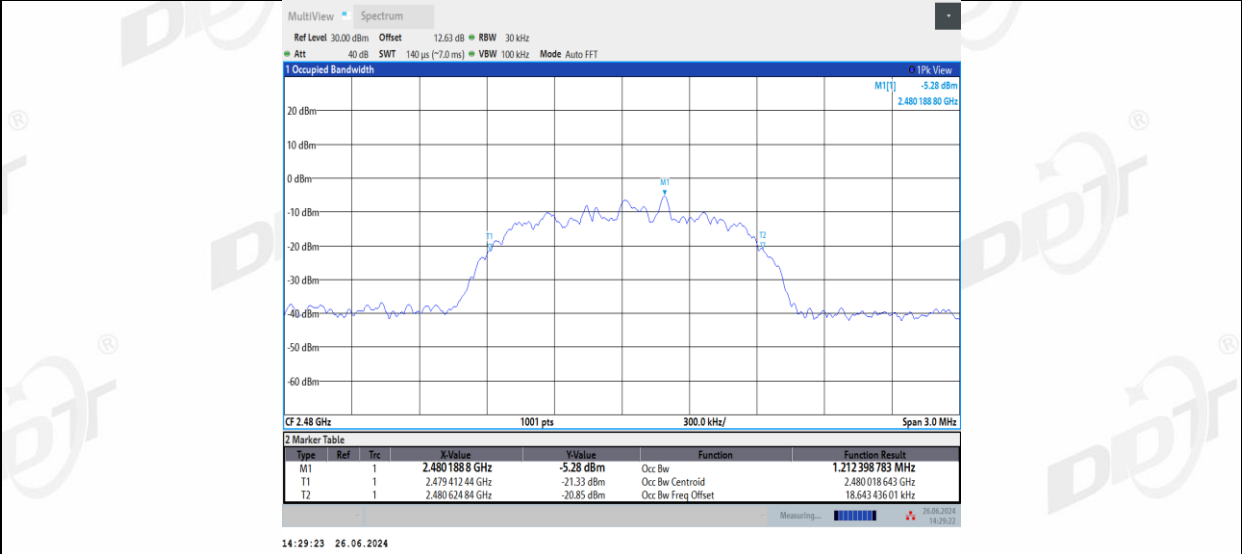
2DH5\_Left side\_2441



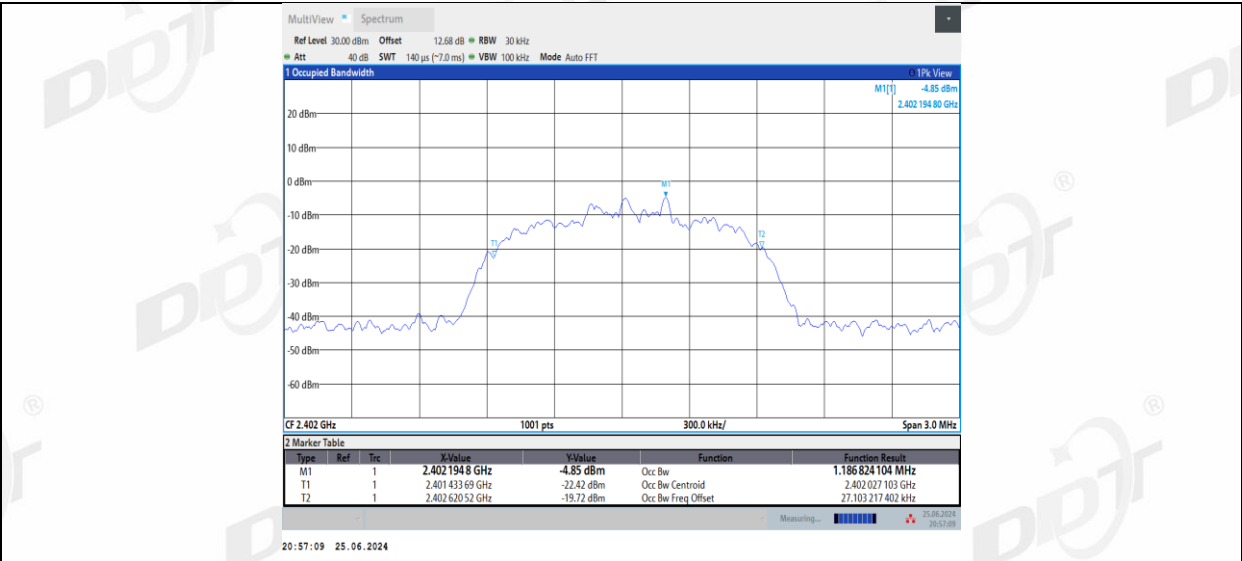
2DH5\_Right side\_2480



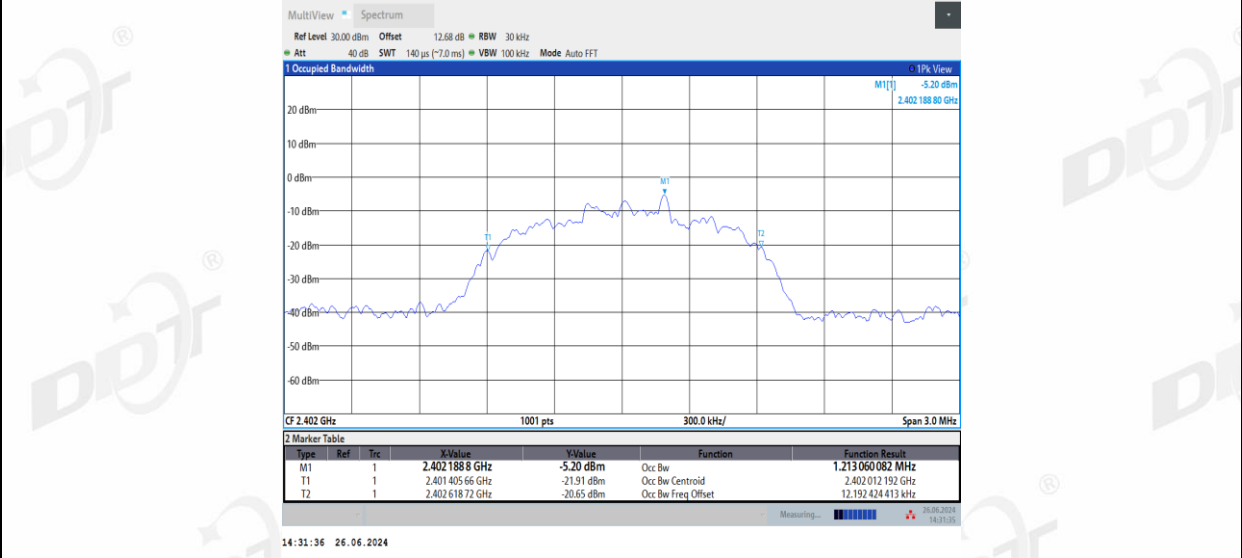
2DH5\_Left side\_2480



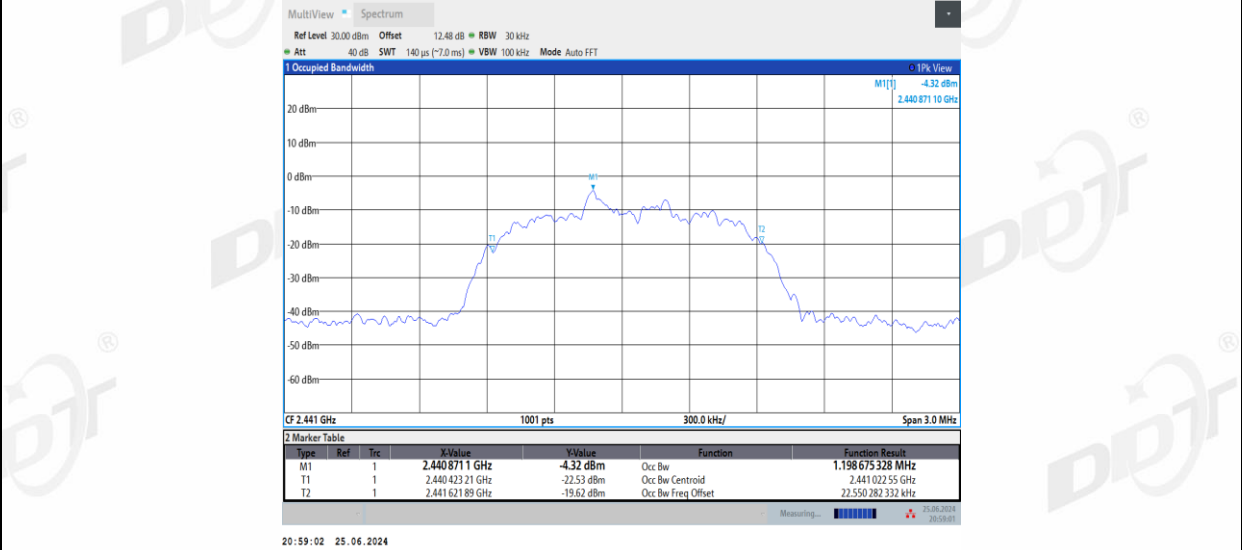
3DH5\_Right side\_2402



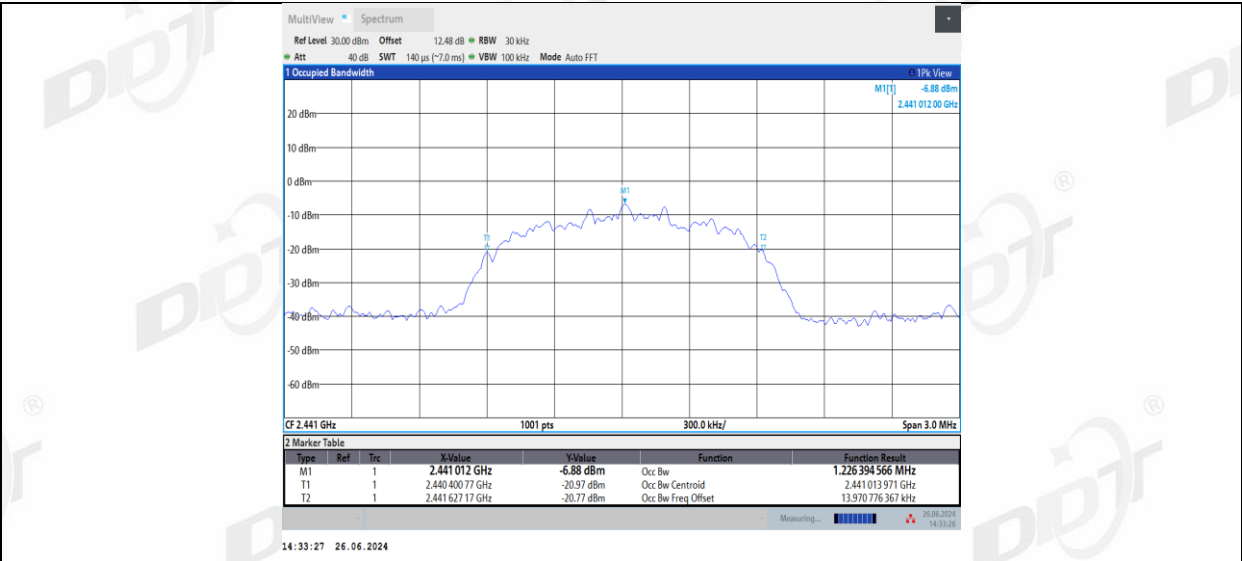
3DH5 Left side 2402



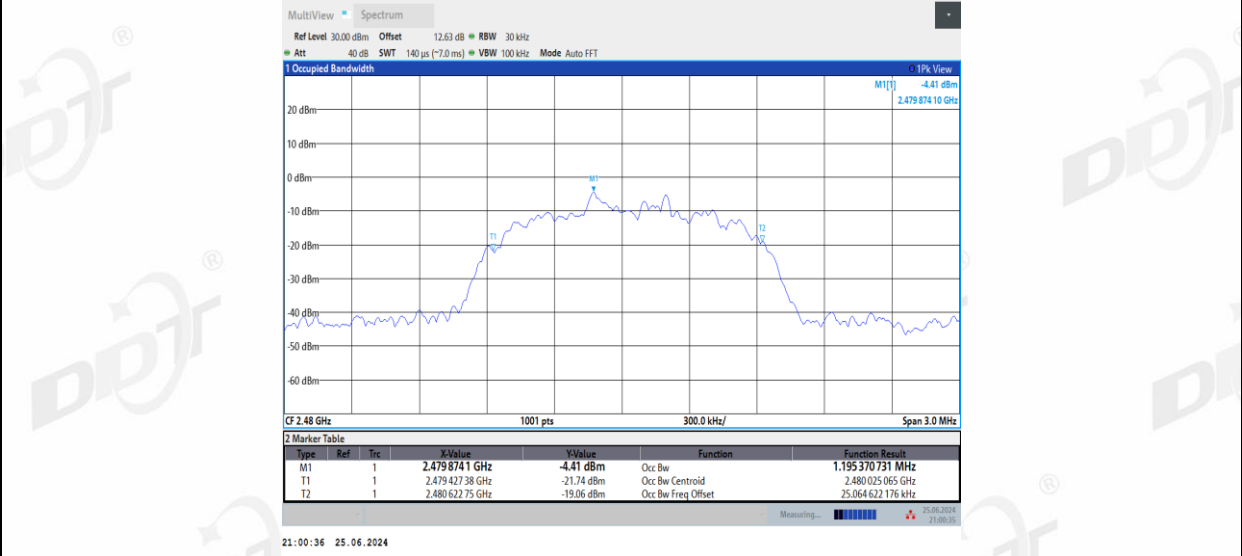
3DH5 Right side 2441



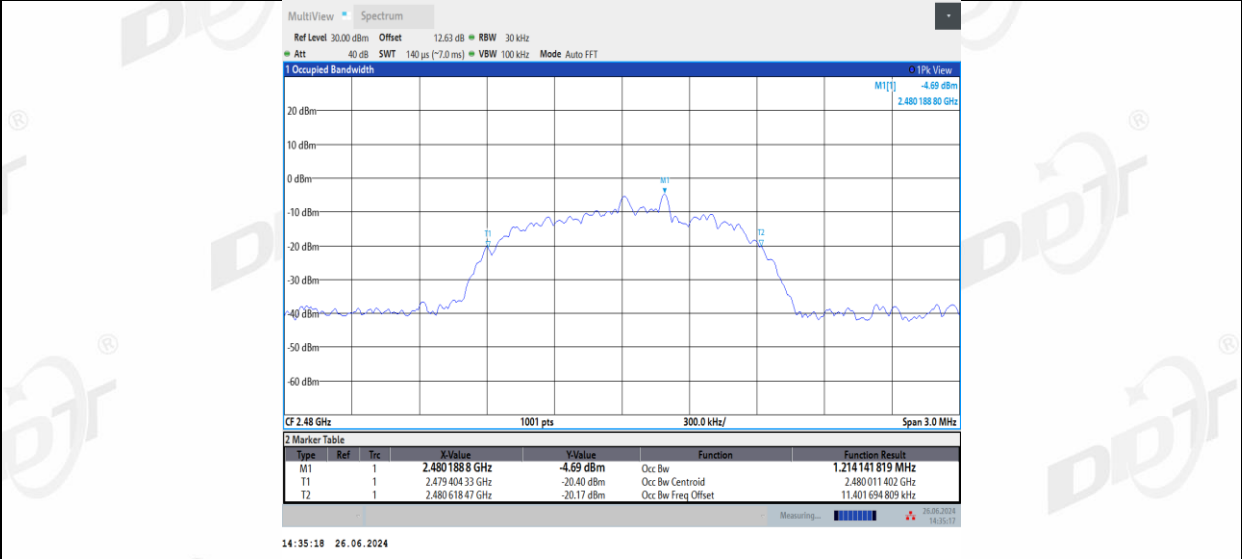
3DH5 Left side 2441



3DH5\_Right side\_2480

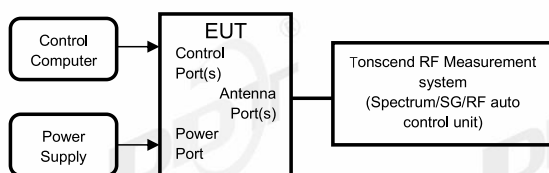


3DH5\_Left side\_2480



## 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:
 

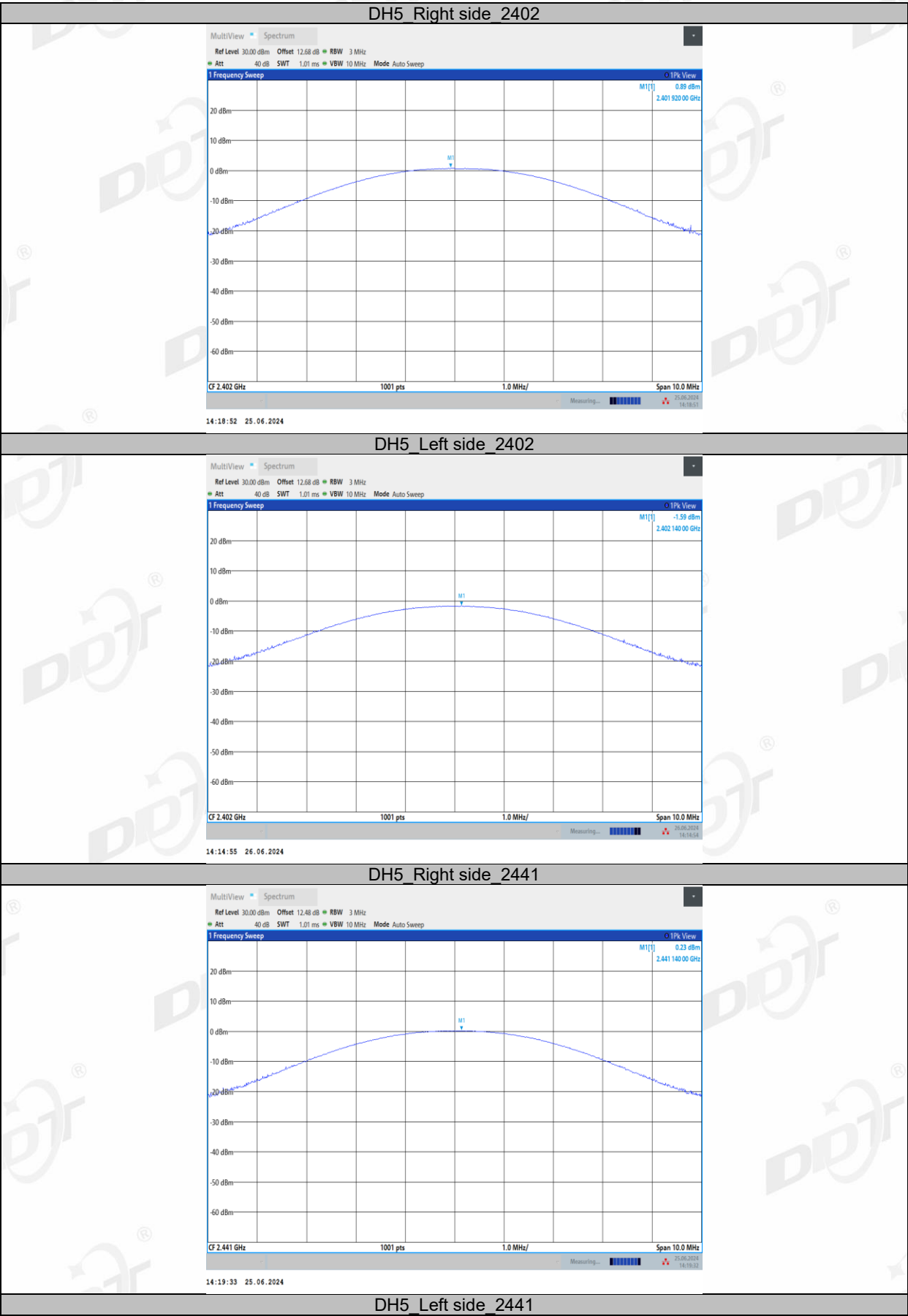
|                |                                                                              |
|----------------|------------------------------------------------------------------------------|
| RBW:           | > 20 dB bandwidth of the emission being measured.                            |
| VBW:           | $VBW \geq RBW$ .                                                             |
| 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.

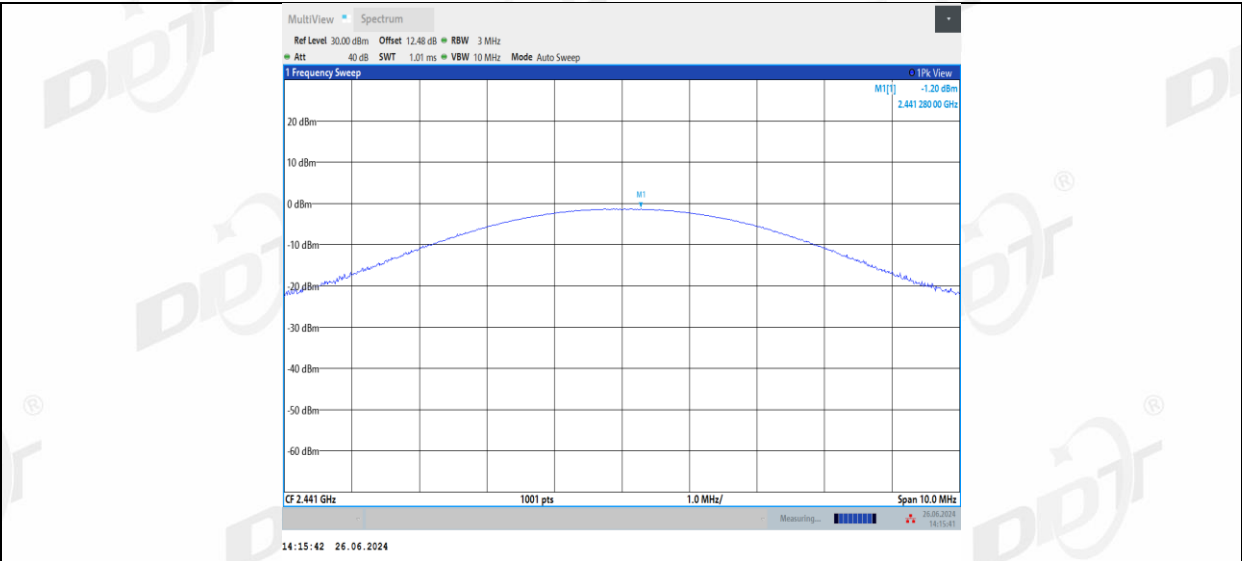
6.4. Test result

|                    |                         |                |                          |
|--------------------|-------------------------|----------------|--------------------------|
| Test Engineer:     | Zoe                     | Test Site:     | RF Measurement System 4# |
| Ambient Condition: | 25.6-26.1℃,41.8-45.3%RH | Test Date:     | 2024.06.25-2024.06.26    |
| Test Power Supply: | Battery                 | Sample Number: | S24053007-001            |

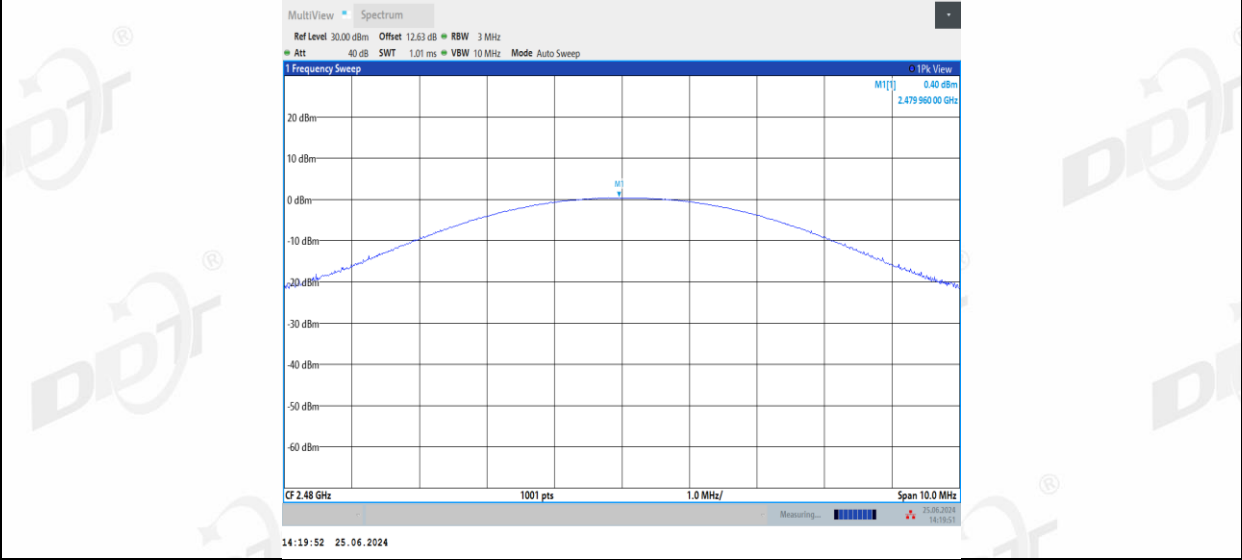
| Test Mode | Antenna    | Freque ncy [MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | EIRP[dBm] | EIRP Limit[dBm] | Verdict |
|-----------|------------|------------------|---------------------------|----------------------|-----------|-----------------|---------|
| DH5       | Right side | 2402             | 0.89                      | ≤20.97               | 2.13      | ≤30             | PASS    |
|           | Left side  | 2402             | -1.59                     | ≤20.97               | -0.35     | ≤30             | PASS    |
|           | Right side | 2441             | 0.23                      | ≤20.97               | 1.47      | ≤30             | PASS    |
|           | Left side  | 2441             | -1.20                     | ≤20.97               | 0.04      | ≤30             | PASS    |
|           | Right side | 2480             | 0.40                      | ≤20.97               | 1.64      | ≤30             | PASS    |
|           | Left side  | 2480             | -0.46                     | ≤20.97               | 0.78      | ≤30             | PASS    |
| 2DH5      | Right side | 2402             | 0.64                      | ≤20.97               | 1.88      | ≤30             | PASS    |
|           | Left side  | 2402             | -1.80                     | ≤20.97               | -0.56     | ≤30             | PASS    |
|           | Right side | 2441             | 0.06                      | ≤20.97               | 1.30      | ≤30             | PASS    |
|           | Left side  | 2441             | -1.34                     | ≤20.97               | -0.10     | ≤30             | PASS    |
|           | Right side | 2480             | 0.29                      | ≤20.97               | 1.53      | ≤30             | PASS    |
|           | Left side  | 2480             | -0.47                     | ≤20.97               | 0.77      | ≤30             | PASS    |
| 3DH5      | Right side | 2402             | 0.70                      | ≤20.97               | 1.94      | ≤30             | PASS    |
|           | Left side  | 2402             | -1.67                     | ≤20.97               | -0.43     | ≤30             | PASS    |
|           | Right side | 2441             | 0.13                      | ≤20.97               | 1.37      | ≤30             | PASS    |
|           | Left side  | 2441             | -1.27                     | ≤20.97               | -0.03     | ≤30             | PASS    |
|           | Right side | 2480             | 0.30                      | ≤20.97               | 1.54      | ≤30             | PASS    |
|           | Left side  | 2480             | -0.56                     | ≤20.97               | 0.68      | ≤30             | PASS    |

6.5.Test graphs

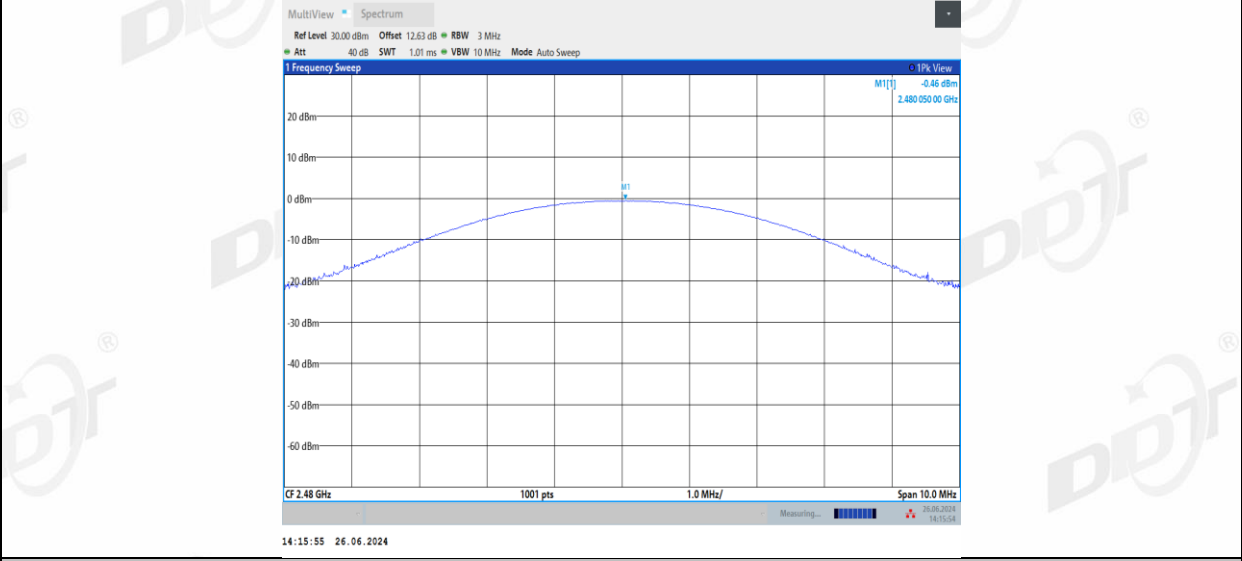




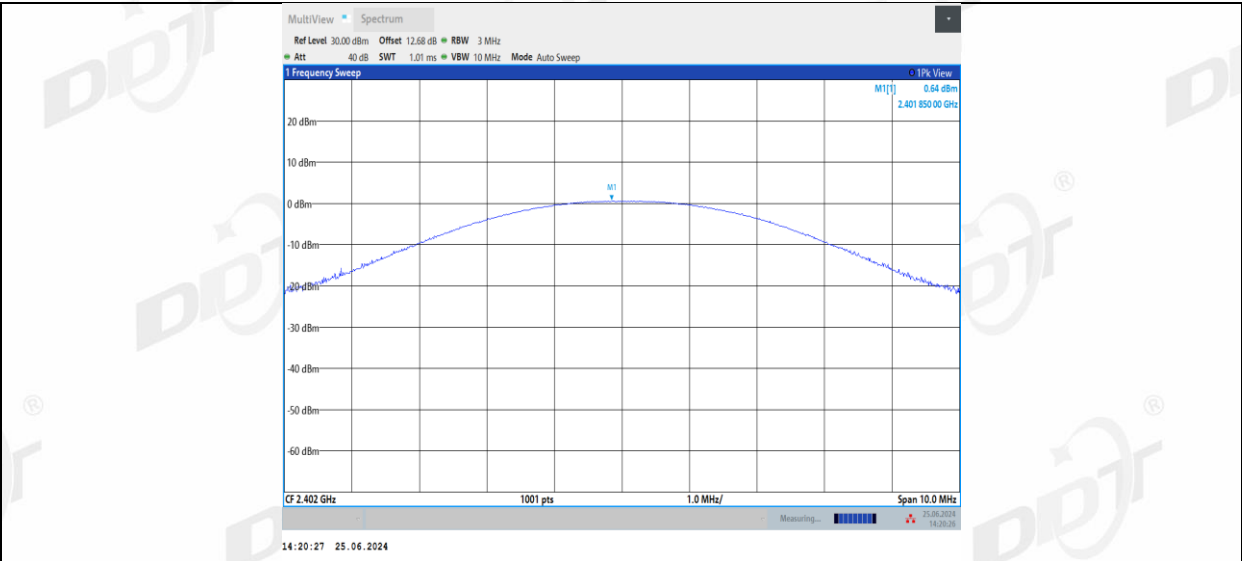
DH5\_Right side\_2480



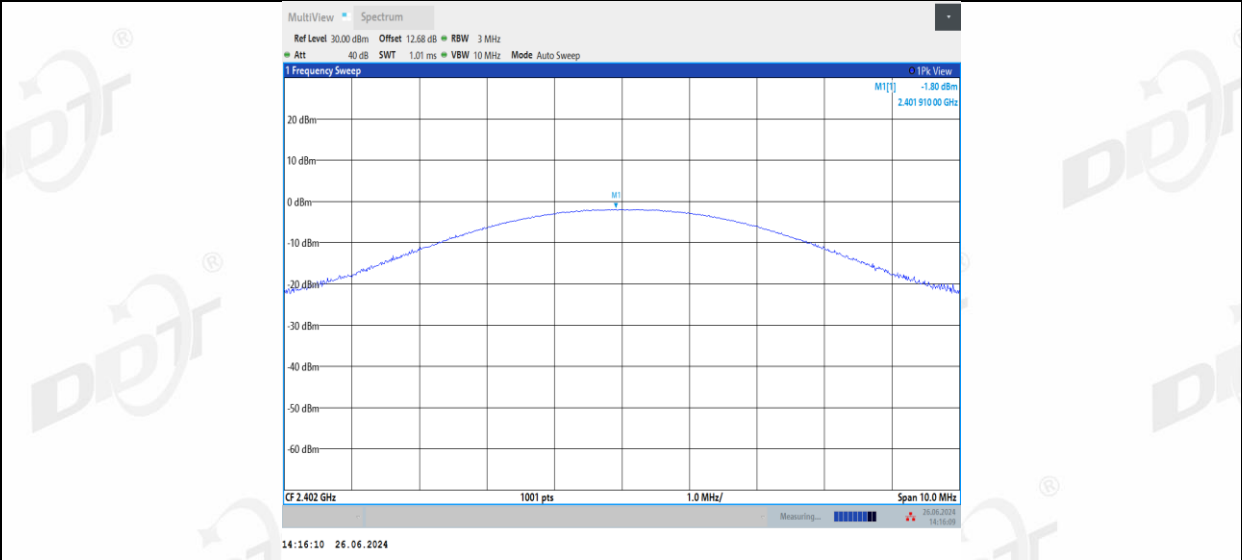
DH5\_Left side\_2480



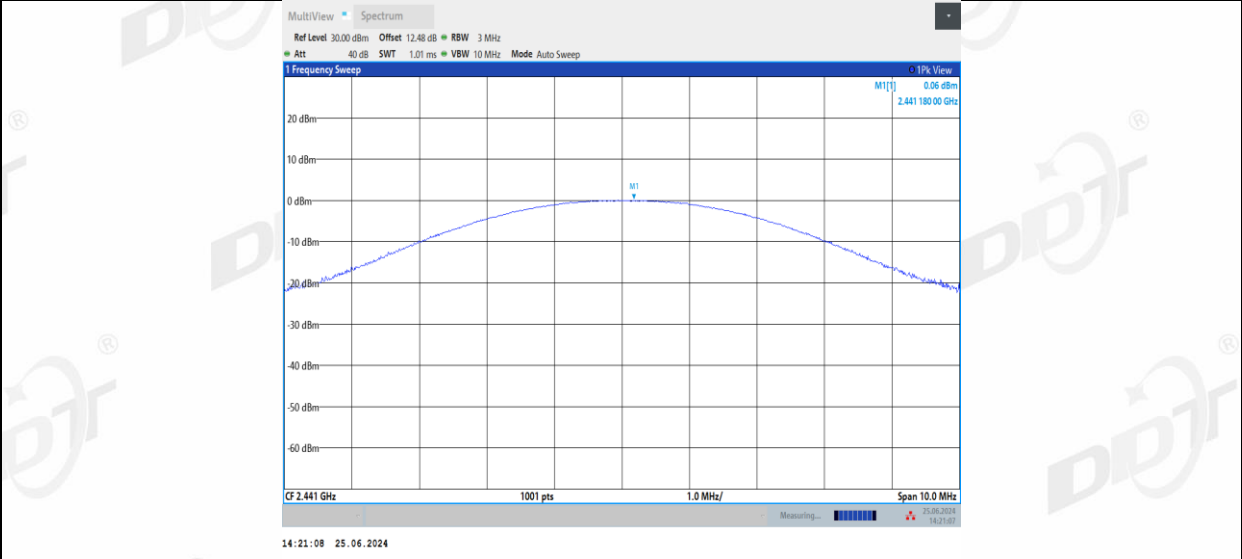
2DH5\_Right side\_2402



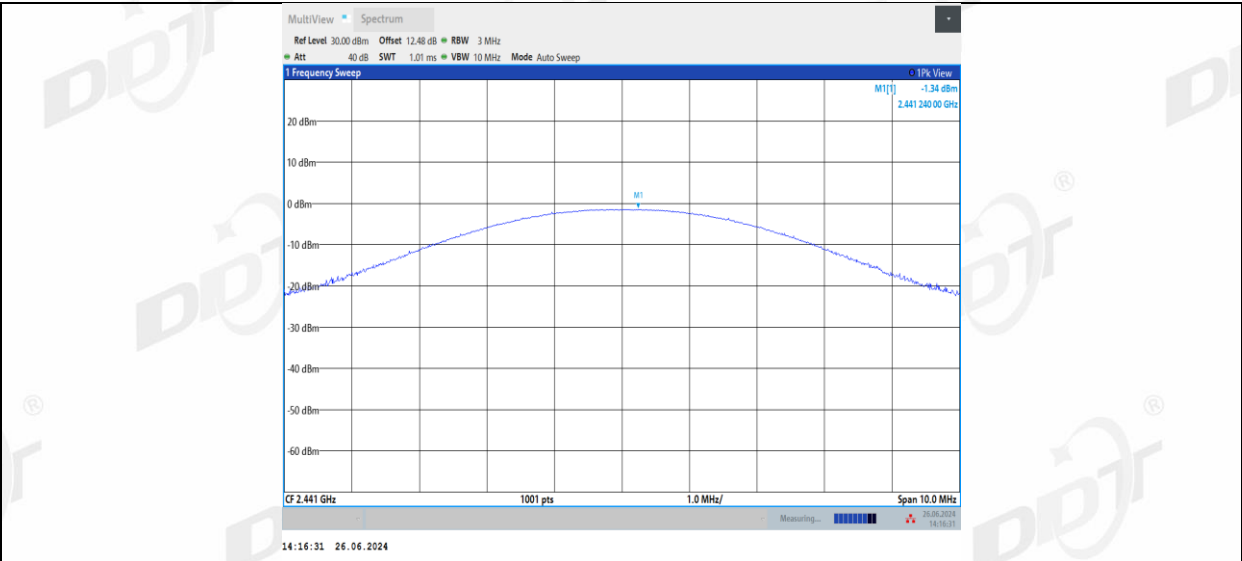
2DH5 Left side 2402



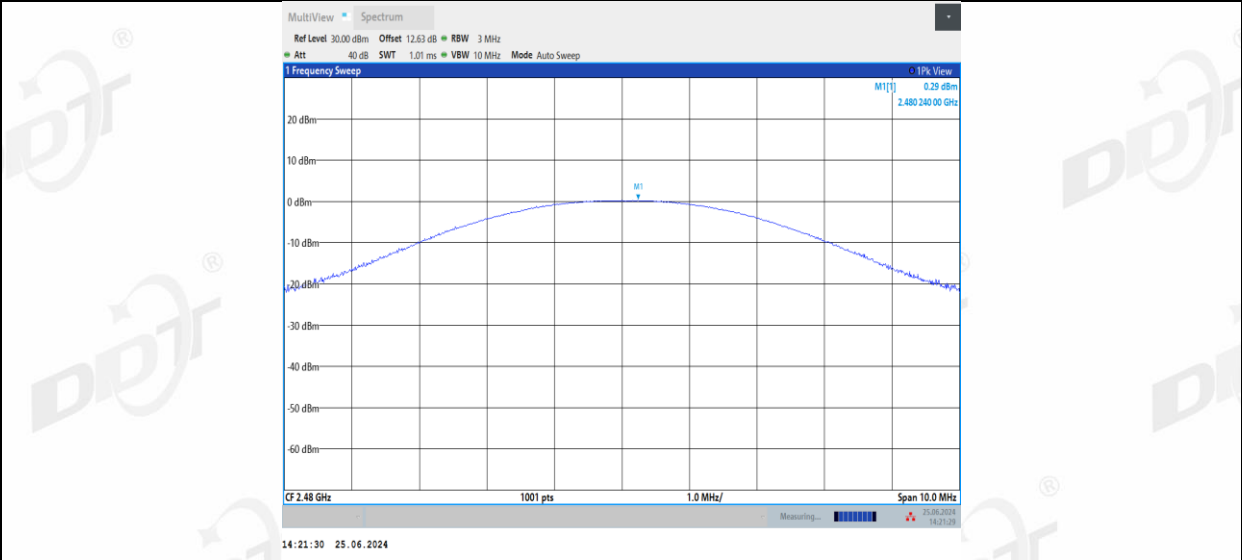
2DH5 Right side 2441



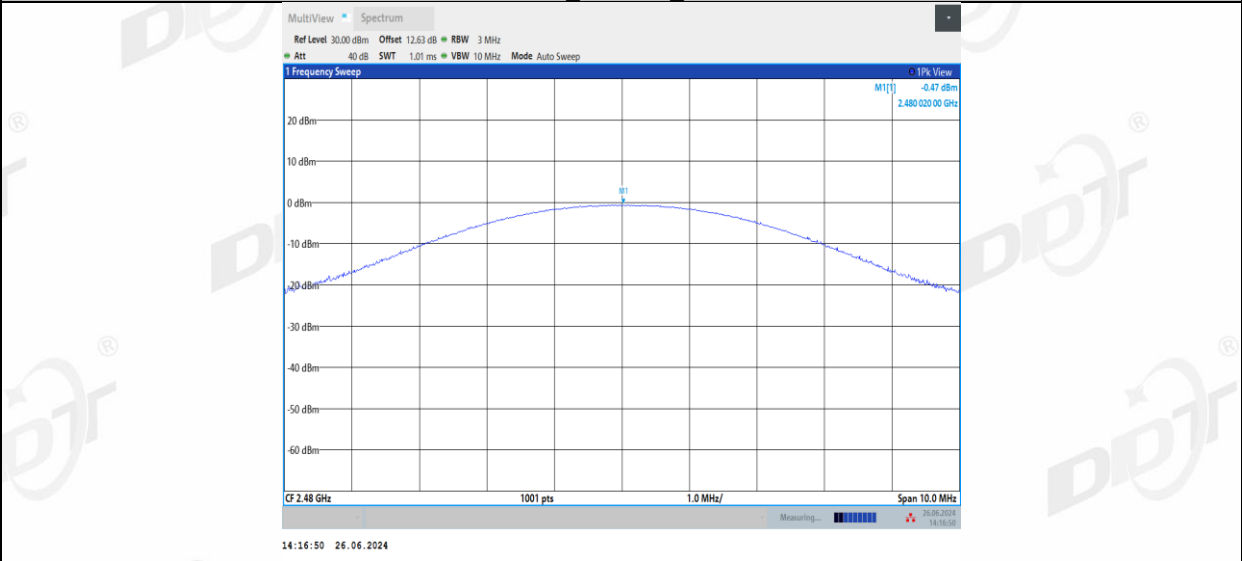
2DH5 Left side 2441



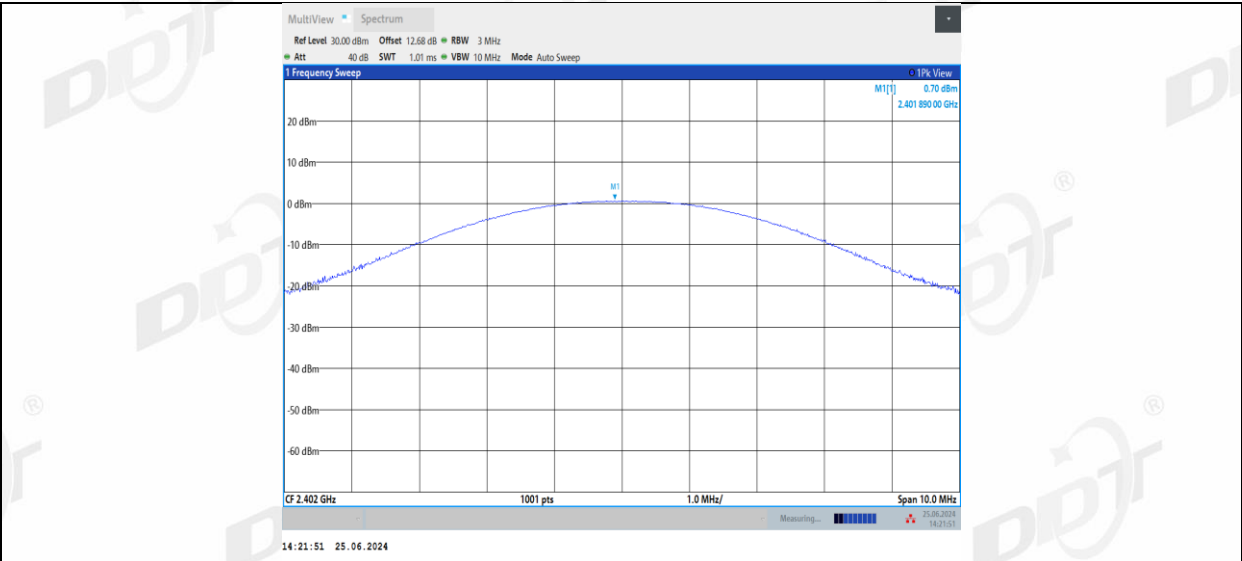
2DH5\_Right side\_2480



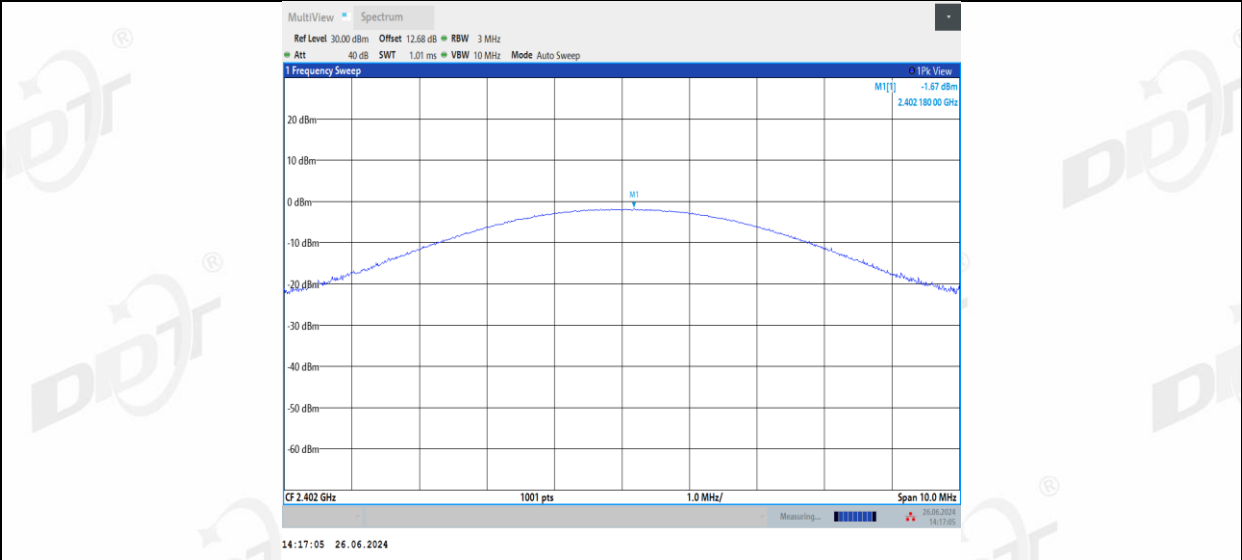
2DH5\_Left side\_2480



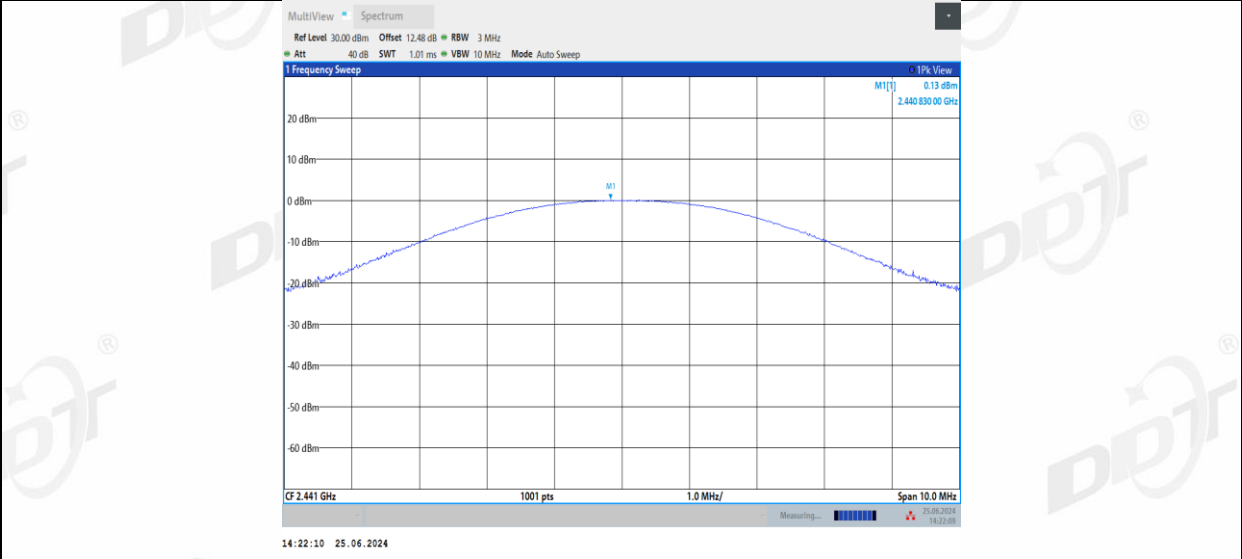
3DH5\_Right side\_2402



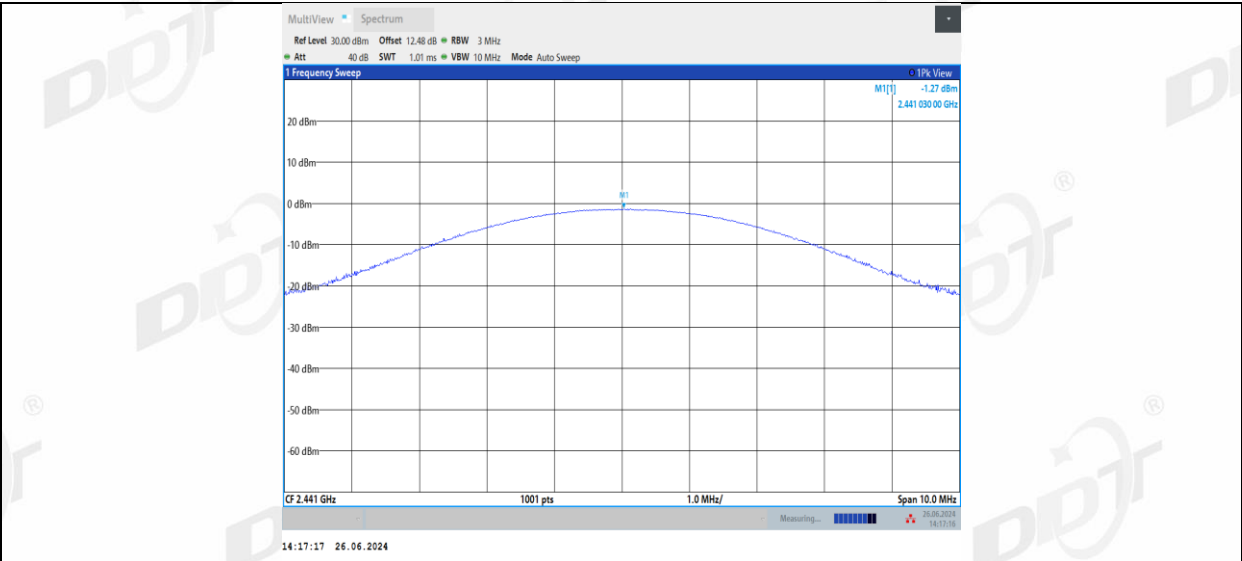
3DH5 Left side 2402



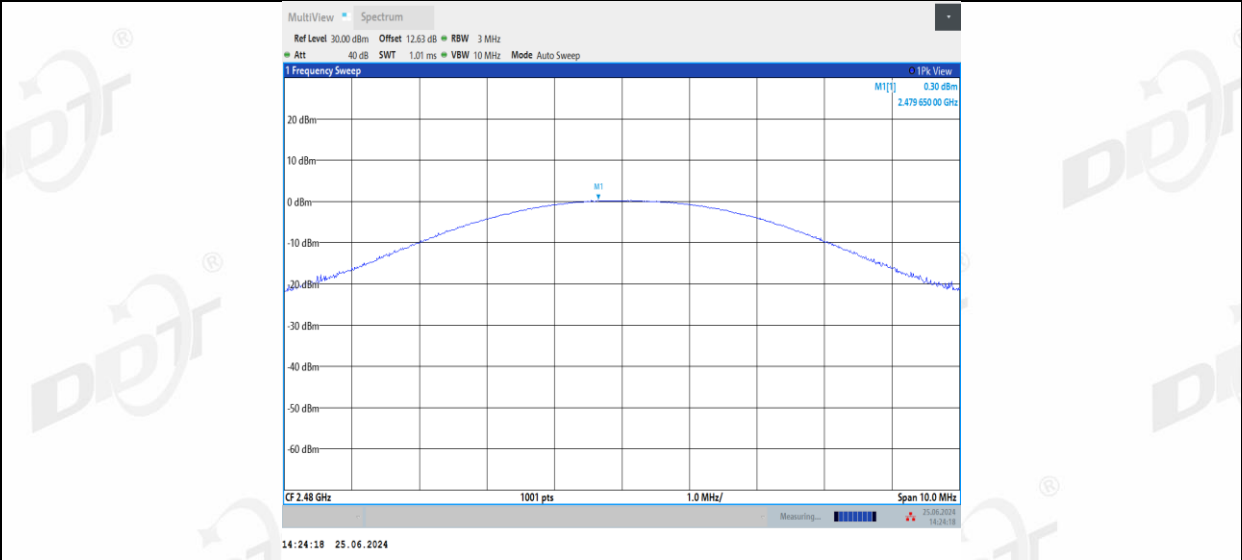
3DH5 Right side 2441



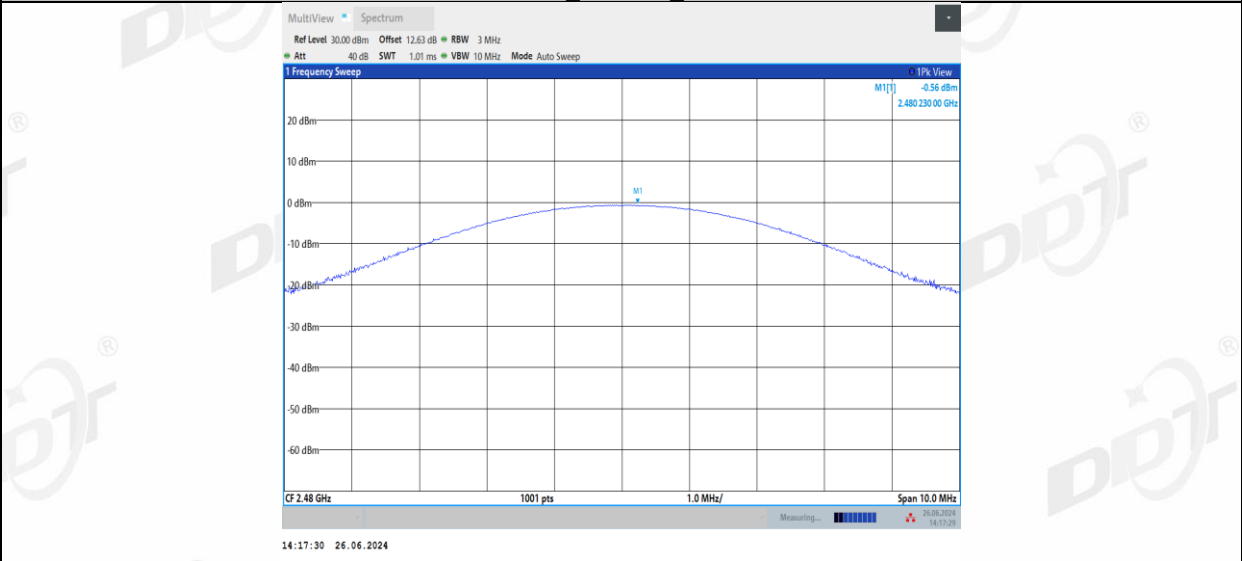
3DH5 Left side 2441



3DH5\_Right side\_2480

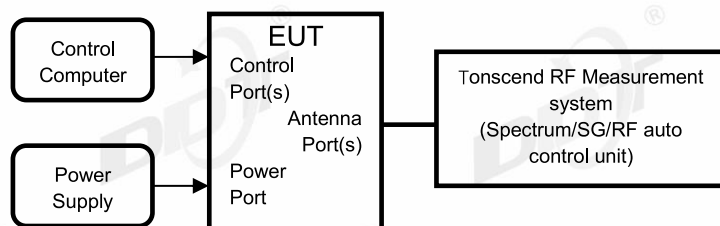


3DH5\_Left side\_2480



## 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 Engineer:     | Zoe                     | Test Site:     | RF Measurement System 4# |
| Ambient Condition: | 25.6-26.1℃,41.8-45.3%RH | Test Date:     | 2024.06.25-2024.06.26    |
| Test Power Supply: | Battery                 | Sample Number: | S24053007-001            |

| Test Mode | Antenna    | Frequency [MHz] | Result [MHz] | Limit [MHz] | Verdict |
|-----------|------------|-----------------|--------------|-------------|---------|
| DH5       | Right side | Hop             | 0.994        | ≥0.740      | PASS    |
|           | Left side  | Hop             | 0.99         | ≥0.740      | PASS    |
| 2DH5      | Right side | Hop             | 1.000        | ≥0.880      | PASS    |
|           | Left side  | Hop             | 1.006        | ≥0.880      | PASS    |
| 3DH5      | Right side | Hop             | 1.008        | ≥0.880      | PASS    |
|           | Left side  | Hop             | 1.008        | ≥0.880      | PASS    |

7.5.Test graphs

