**Report No.:**DDT-RE23051020-1E01

**Issued Date:** May 25, 2023

# FCC CERTIFICATION TEST REPORT

## FOR

| | | |
|---|---|---|
| **Applicant** | : | Shenzhen Qinggu Technology Co., Ltd |
| **Address** | : | A1313, Building1, Great Wall Building No.2 Baihua 4th Rd Yuanling Str, Futian DIST, Shenzhen, China |
| **Equipment under Test** | : | LED Lamp |
| **Model No.** | : | SUNLAMP-P |
| **Trade Mark** | : | N/A |
| **FCC ID** | : | 2BBFF-LAMP-00X |
| **Manufacturer** | : | Shenzhen Qinggu Technology Co., Ltd |
| **Address** | : | A1313, Building1, Great Wall Building No.2 Baihua 4th Rd Yuanling Str, Futian DIST, Shenzhen, China |


**Issued By: 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, **E-mail:** ddt@dgddt.com, http://www.dgddt.com


REPORT

# Table of Contents


Test report declares....4
1. Summary of Test Results.... 7
2. General Test Information .... 8
2.1. Description of EUT .... 8
2.2. Accessories of EUT.... 9
2.3. Assistant equipment used for test.... 9
2.4. Block diagram of EUT configuration for test .... 9
2.5. Deviations of test standard.... 9
2.6. Test environment conditions .... 10
2.7. Test laboratory .... 10
2.8. Measurement uncertainty.... 10
3. Equipment Used During Test.... 11
4. 20 dB Bandwidth .... 13
4.1. Block diagram of test setup.... 13
4.2. Limits .... 13
4.3. Test procedure .... 13
4.4. test result.... 13
4.5. Test graphs .... 14
5. Maximum Peak Output Power .... 16
5.1. Block diagram of test setup.... 16
5.2. Limits .... 16
5.3. Test procedure .... 16
5.4. Test Result Peak.... 16
5.5. Test graphs .... 17
6. Carrier Frequency Separation.... 19
6.1. Block diagram of test setup.... 19
6.2. Limits .... 19
6.3. Test procedure .... 19
6.4. Test result.... 19
6.5. Test graphs .... 20
7. Dwell Time.... 21
7.1. Block diagram of test setup.... 21
7.2. Limits .... 21
7.3. Test procedure .... 21
7.4. Test result.... 21
7.5. Test graphs .... 22
8. Number of Hopping Channel .... 26

8.1. Block diagram of test setup ..... 26
8.2. Limits ..... 26
8.3. Test procedure ..... 26
8.4. Test result ..... 26
8.5. Test graphs ..... 27
9. Band Edge Compliance (Conducted Method) ..... 28
9.1. Block diagram of test setup ..... 28
9.2. Limit ..... 28
9.3. Test procedure ..... 28
9.4. Test result ..... 28
9.5. Test graphs ..... 29
10. RF Conducted Spurious Emissions ..... 32
10.1. Block diagram of test setup ..... 32
10.2. Limits ..... 32
10.3. Test procedure ..... 32
10.4. Test result ..... 33
10.5. Test graphs ..... 33
11. Duty cycle ..... 40
11.1. Block diagram of test setup ..... 40
11.2. Limit ..... 40
11.3. Test procedure ..... 40
11.4. Test result ..... 40
11.5. Test graphs ..... 41
12. Radiated Emission ..... 43
12.1. Block diagram of test setup ..... 43
12.2. Limit ..... 44
12.3. Test Procedure ..... 45
12.4. Test result ..... 47
13. Band Edge Compliance (Radiated Method) ..... 56
13.1. Block diagram of test setup ..... 56
13.2. Limit ..... 56
13.3. Test Procedure ..... 56
13.4. Test result ..... 56
14. Power Line Conducted Emission ..... 65
14.1. Block diagram of test setup ..... 65
14.2. Power line conducted emission limits ..... 65
14.3. Test procedure ..... 65
14.4. Test result ..... 66

15. Antenna Requirements ..... 69
15.1. Limit ..... 69
15.2. Result ..... 69
16. Photos of the EUT ..... 70

# Test Report Declare

| | | |
|---|---|---|
| **Applicant** | : | Shenzhen Qinggu Technology Co., Ltd |
| **Address** | : | A1313, Building1, Great Wall Building No.2 Baihua 4th Rd Yuanling Str, Futian DIST, Shenzhen, China |
| **Equipment under Test** | : | LED Lamp |
| **Model No.** | : | SUNLAMP-P |
| **Trade Mark** | : | N/A |
| **Manufacturer** | : | Shenzhen Qinggu Technology Co., Ltd |
| **Address** | : | A1313, Building1, Great Wall Building No.2 Baihua 4th Rd Yuanling Str, Futian DIST, Shenzhen, China |

**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.**

| | | | |
|---|---|---|---|
| **Report No.:** | DDT-RE23051020-1E01 | | |
| **Date of Receipt:** | May 12, 2023 | **Date of Test:** | May 12, 2023 ~ May 25, 2023 |

***Prepared By:***

Bobo Chen

***Bobo Chen/Engineer***

***Approved By:***

DONGGUAN DONGDIAN TESTING SERVICE CO., LTD. APPROVED

Damon Hu

***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 | May 25, 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 | 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) | Pass |
| Antenna Requirement | FCC Part 15: 15.203 | Pass |

# 2. General Test Information

## 2.1. Description of EUT

| | | |
|---|---|---|
| EUT Name | : | LED Lamp |
| Model Number | : | SUNLAMP-P |
| EUT Function Description | : | Please reference user manual of this device |
| Power Supply | : | DC 5V from external USB cable |
| Radio Specification | : | Bluetooth V5.1 |
| Operation Frequency | : | 2402 MHz - 2480 MHz |
| Modulation | : | GFSK, π/4-DQPSK |
| Data Rate | : | 1 Mbps, 2 Mbps |
| Antenna | : | PCB antenna, maximum PK gain: -6.93 dBi |
| Sample Number | : | S23051020-01 for conductive,<br>S23051020-02 for radiation |

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 | SN | EMC Compliance |
|---|---|---|---|---|
| Adapter | SAMSUNG | EP-TA200 | N/A | Input: 100-240~, 50/60Hz, 0.5A; Output: 9V/1.67A or 5V/2A |

## 2.4. Block diagram of EUT configuration for test

AC main — Adapter — EUT

Test software: FCC_assist_1.0.2.2.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 | 10 | CH0 to CH78 | 2402 to 2480 |
| π/4-DQPSK hopping on Tx mode | 10 | CH0 to CH78 | 2402 to 2480 |
| GFSK hopping off Tx mode | 10 | CH0 | 2402 |
| | 10 | CH39 | 2441 |
| | 10 | CH78 | 2480 |
| π/4-DQPSK hopping off Tx mode | 10 | CH0 | 2402 |
| | 10 | CH39 | 2441 |
| | 10 | CH78 | 2480 |

## 2.5. Deviations of test standard

No deviation.

## 2.6. Test environment conditions

| | |
|---|---|
| Temperature range: | +15℃ to +35 ℃ |
| Humidity range: | 20% to 75% |
| Pressure range: | 86 kPa to106 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.

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 x $10^{-8}$ (Antenna couple method) |
| | 5.5 x $10^{-8}$ (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) | $3\times10^{-8}$ |
| Temperature | 0.4 ℃ |
| 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. | |

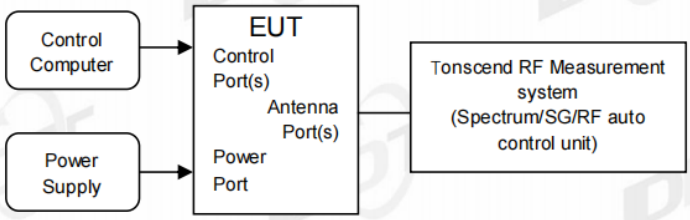
# 3. Equipment Used During Test

| Equipment | Manufacturer | Model No. | Serial No. | Last Cal. | Cal. Interval |
|---|---|---|---|---|---|
| **☒RF Connected Test (Tonscend RF Measurement System 3#)** | | | | | |
| Signal &Spectrum analyzer | R&S | FSV40 | 101407 | Jul. 21, 2022 | 1 Year |
| Wideband Radio Communication tester | R&S | CMW500 | 117491 | Apr. 27, 2023 | 1 Year |
| EXG Analog Signal Generator | KEYSIGHT | N5173B | MY62153058 | Aug. 26, 2022 | 1 Year |
| Vector Signal Generator | Agilent | N5182A | MY48180912 | Apr. 23, 2023 | 1 Year |
| RF Control Unit | Tonscend | JS0806-2 | 20C8060230 | Apr. 27, 2023 | 1 Year |
| Temp&Humi Programmable | ZHIXIANG | ZXGDJS-150L | ZX170110-A | May 26, 2022<br>May 15, 2023 | 1 Year |
| Test Software | JS Tonscend | JS1120-3 | Ver.3.2.22 | N/A | N/A |
| **☒Radiation 3#chamber** | | | | | |
| EMI Test Receiver | R&S | ESU26 | 100472 | Apr. 23, 2023 | 1 Year |
| Spectrum analyzer | Agilent | E4447A | MY50180031 | Apr. 23, 2023 | 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 | Apr. 26, 2023 | 1 Year |
| Pre-amplifier | COM-POWER | PAM-118A | 18040084 | Aug.17, 2022 | 1 Year |
| Pre-amplifier | COM-POWER | PAM-840A | 461369 | Apr. 27, 2023 | 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 | Apr. 21, 2023 | 1 Year |
| RF Cable | Yuhu Technology | JCTB810-NJ-NJ-9M+ ZT26S-SMAJ-SMAJ-1M | 21123964 | Apr. 23, 2023 | 1 Year |
| Micro-Tronics filters | REBES | BRM50702 | G555 | N/A | N/A |
| Micro-Tronics filters | REBES | BRM50716 | G392 | N/A | N/A |
| High Pass filter | XB | XBLBQ-GTA67 | 210820-2-3 | N/A | N/A |
| 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 |
| **☒Power Line Conducted Emissions Test 3#** | | | | | |
| Test Receiver | R&S | ESCI | 101028 | Aug. 26, 2022 | 1 Year |
| LISN 1 | R&S | ENV216 | 101725 | Aug. 26, 2022 | 1 Year |
| LISN 2 | R&S | ENV216 | 101726 | Aug. 26, 2022 | 1 Year |

| | | | | | |
|---|---|---|---|---|---|
| LISN 3 | SCHWARZBECK | NSLK 8163 | 00017 | Aug. 26, 2022 | 1 Year |
| Pulse Limiter | SCHWARZBECK | VTSD 9561 | 102766 | Aug. 26, 2022 | 1 Year |
| CE Cable 3 | HUBSER | Z806-NJ-NJ-6M | 21070275 | Aug. 26, 2022 | 1 Year |
| Test software | Audix | E3 | V 6.11111b | N/A | 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 |

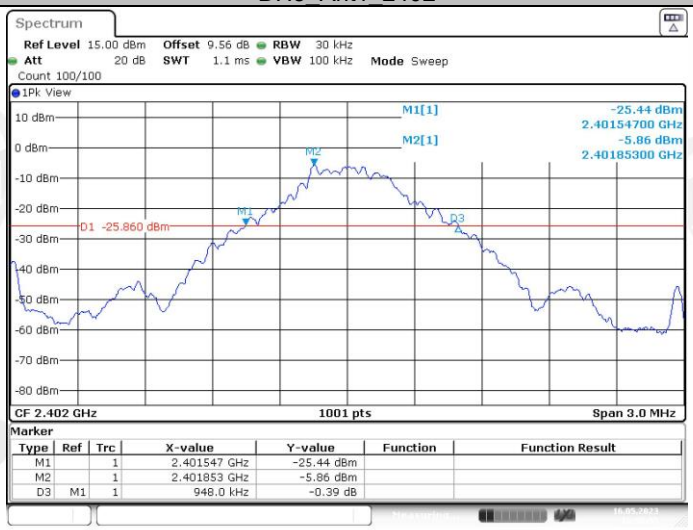
(5) Measure and record the results in the report.

## 4.4. test result

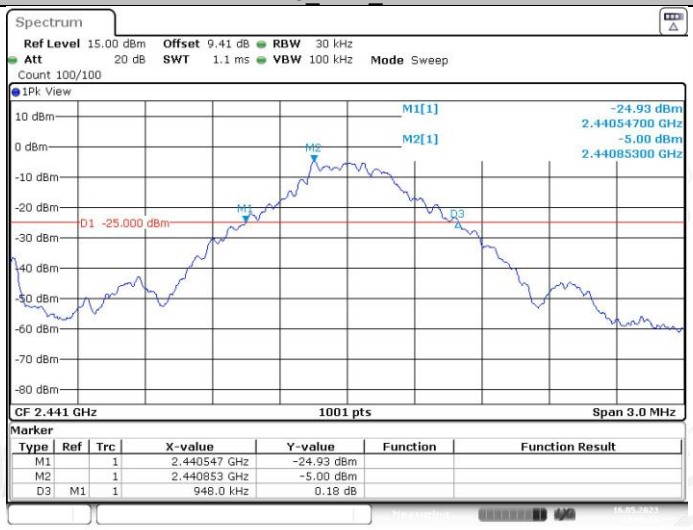
| Test Mode | Antenna | Frequency [MHz] | 20dB EBW[MHz] |
|---|---|---|---|
| DH5 | Ant1 | 2402 | 0.95 |
| | | 2441 | 0.95 |
| | | 2480 | 0.94 |
| 2DH5 | Ant1 | 2402 | 1.28 |
| | | 2441 | 1.28 |
| | | 2480 | 1.28 |

## 4.5. Test graphs

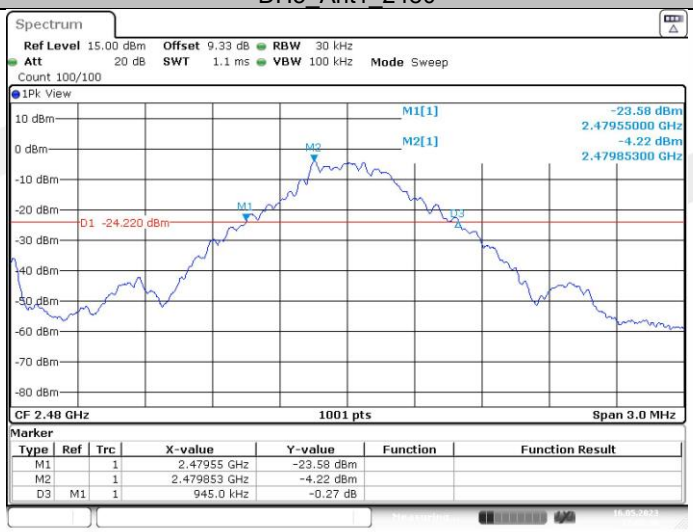
DH5_Ant1_2402



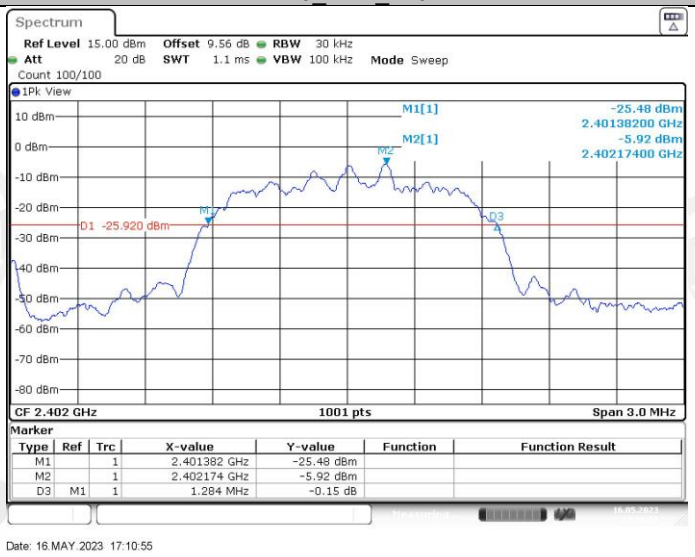

DH5_Ant1_2441



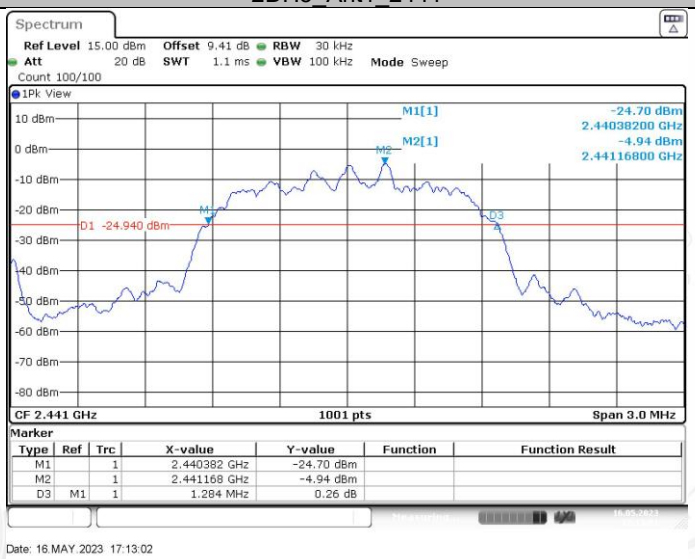

DH5_Ant1_2480



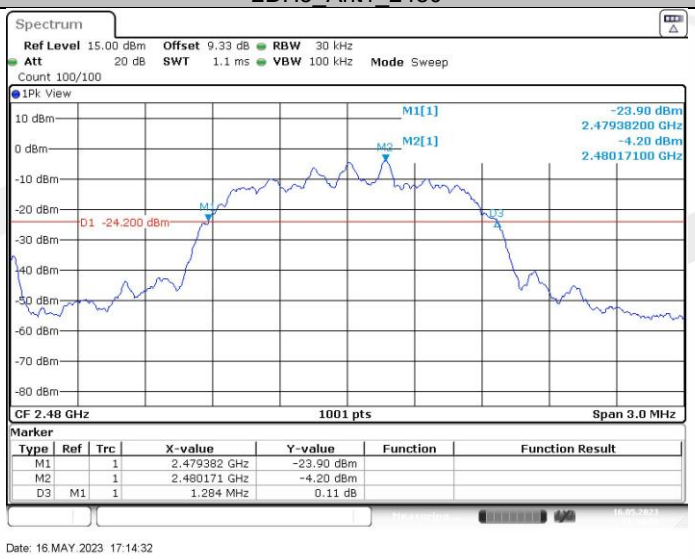
2DH5_Ant1_2402




2DH5_Ant1_2441

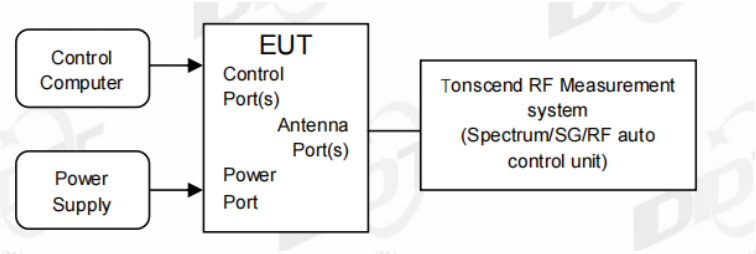



2DH5_Ant1_2480



# 5. Maximum Peak Output Power

## 5.1. Block diagram of test setup




## 5.2. 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.

## 5.3. 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 ⩾ RBW. |
| Span: | Approximately five times the 20 dB bandwidth, centered on a hopping channel. |
| Detector Mode: | Peak |
| Sweep time: | Auto |
| Trace mode: | Max hold |

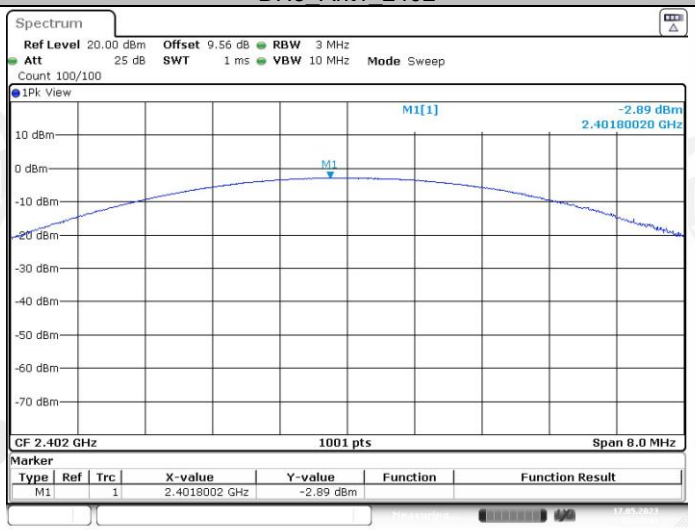
(5) Use the marker-to-peak function to set the marker to the peak of the emission and record the results in the report.

## 5.4. Test Result Peak

| Test Mode | Antenna | Frequency [MHz] | Conducted Peak Power[dBm] | Conducted Limit[dBm] | EIRP[dBm] | EIRP Limit[dBm] | Verdict |
|---|---|---|---|---|---|---|---|
| DH5 | Ant1 | 2402 | -2.89 | ≤20.97 | -9.82 | ≤36 | PASS |
| | | 2441 | -2.16 | ≤20.97 | -9.09 | ≤36 | PASS |
| | | 2480 | -1.39 | ≤20.97 | -8.32 | ≤36 | PASS |
| 2DH5 | Ant1 | 2402 | -2.03 | ≤20.97 | -8.96 | ≤36 | PASS |
| | | 2441 | -1.35 | ≤20.97 | -8.28 | ≤36 | PASS |
| | | 2480 | -0.60 | ≤20.97 | -7.53 | ≤36 | PASS |

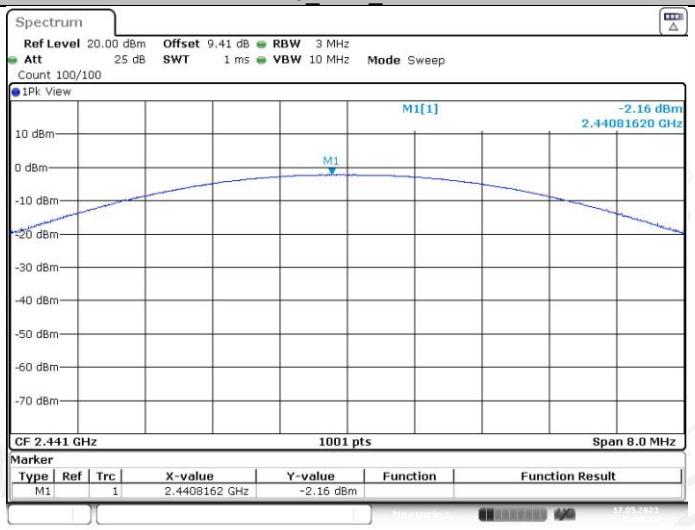
## 5.5. Test graphs

DH5_Ant1_2402



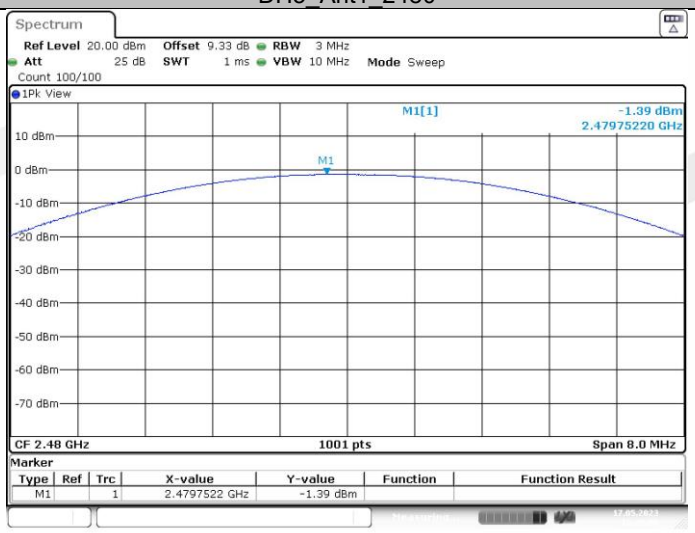

Date: 17.MAY.2023 16:18:44

DH5_Ant1_2441



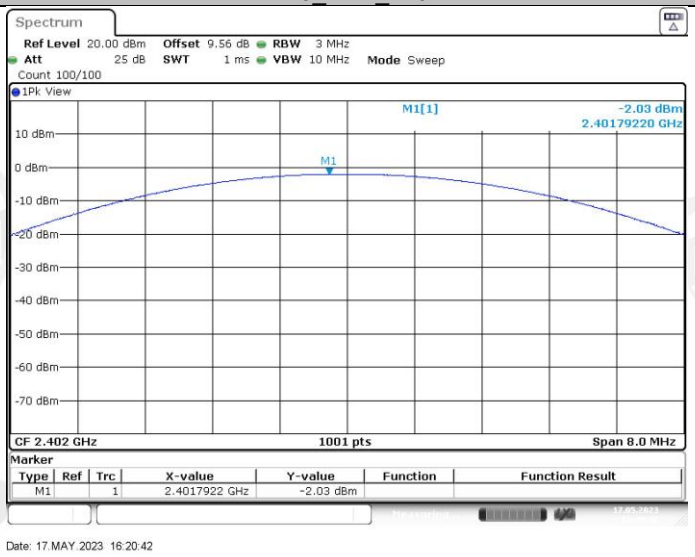

Date: 17.MAY.2023 16:19:27

DH5_Ant1_2480

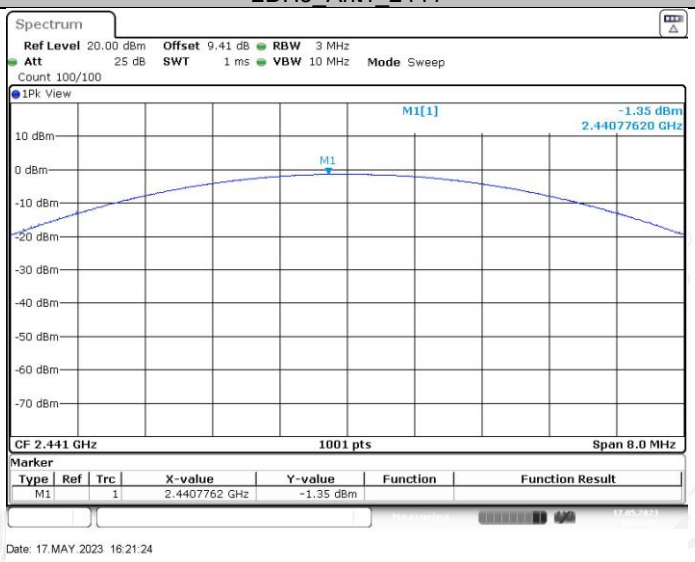



Date: 17.MAY.2023 16:20:08

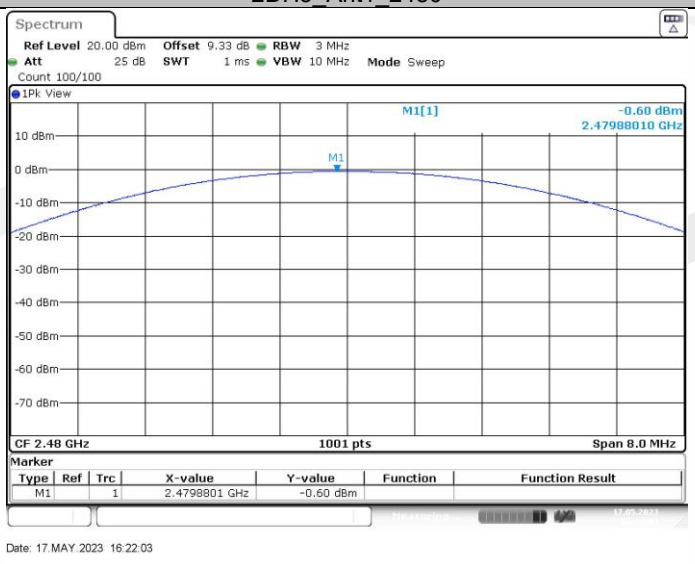
2DH5_Ant1_2402




2DH5_Ant1_2441

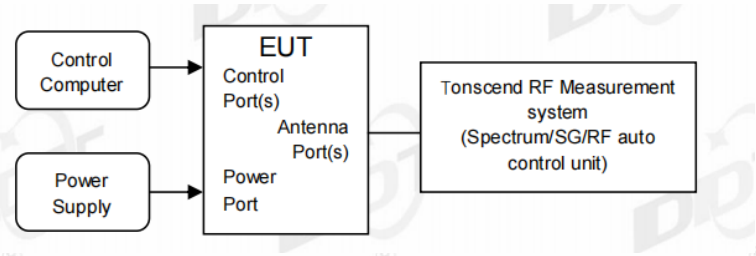



2DH5_Ant1_2480



# 6. Carrier Frequency Separation

## 6.1. Block diagram of test setup




## 6.2. 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.

## 6.3. 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 ⩾ RBW. |
| Span: | Wide enough to capture the peaks of two adjacent channels. |
| Detector Mode: | Peak |
| Sweep time: | Auto |
| Trace mode: | Max hold |

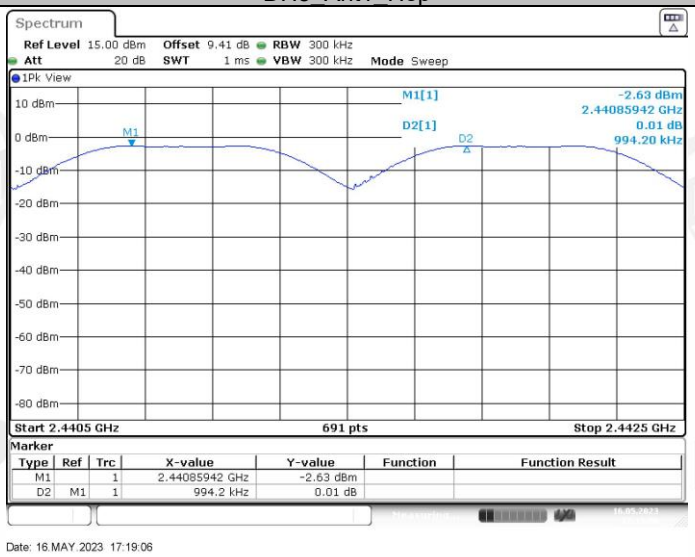
(5) Use the marker-delta function to determine the separation between the peaks of the adjacent channels and record the results in the report.

## 6.4. Test result

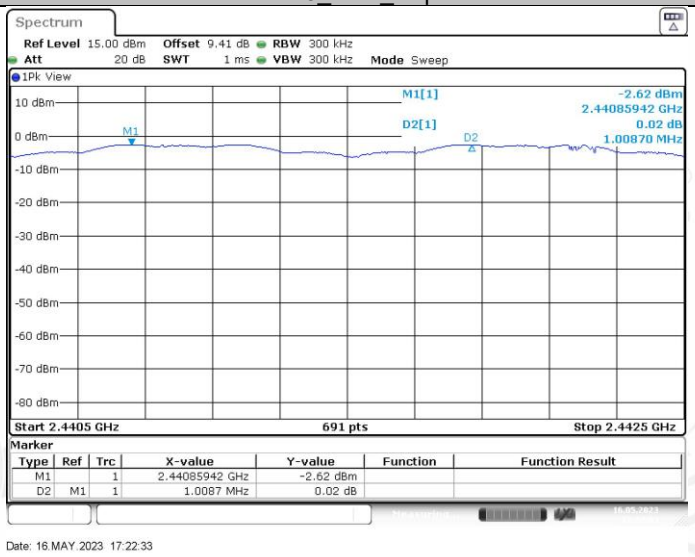
| Test Mode | Antenna | Frequency [MHz] | Result [MHz] | Limit [MHz] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 0.994 | ≥0.950 | PASS |
| 2DH5 | Ant1 | Hop | 1.009 | ≥0.853 | PASS |

## 6.5. Test graphs

DH5_Ant1_Hop

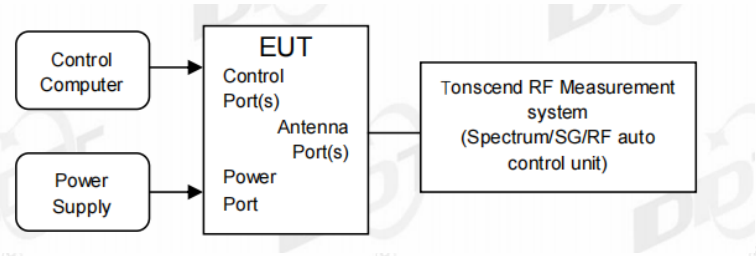



2DH5_Ant1_Hop



# 7. Dwell Time

## 7.1. Block diagram of test setup




## 7.2. 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.

## 7.3. 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: | ≤ channel spacing and where possible RBW should be set >>1 / T |
| VBW: | VBW ≥ RBW. |
| Span: | Zero span, centered on a hopping channel. |
| Detector Mode: | Peak |
| Sweep time: | Auto |
| Trace mode: | Clear Write. |

Measure and record the results in the report.

(5) The test period: T= 0.4 Second/Channel x 79 Channel = 31.6 s

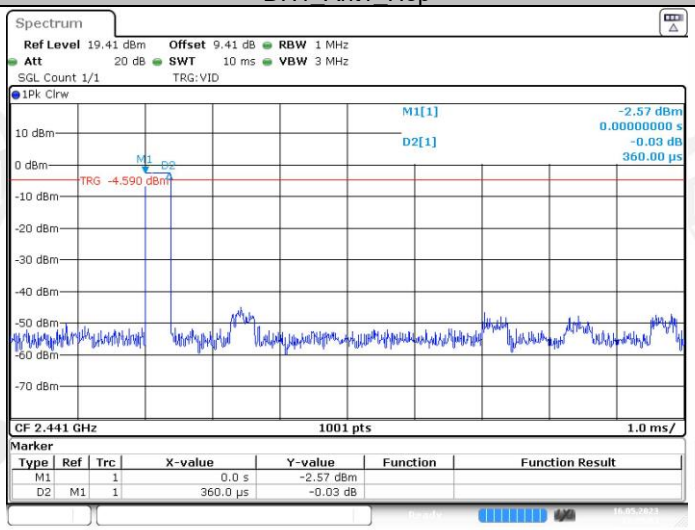
(6) Measure the hopping number and on time of each pulse with spectrum analyzer in zero span set, and calculate dwell time with formula Dwell time = total hops *pulse's on time.

## 7.4. Test result

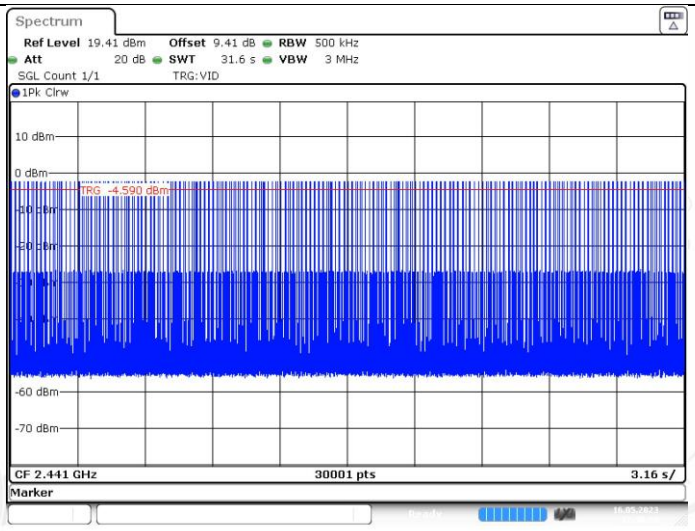
| Test Mode | Antenna | Frequency [MHz] | BurstWidth [ms] | TotalHops [Num] | Result[s] | Limit[s] | Verdict |
|---|---|---|---|---|---|---|---|
| DH1 | Ant1 | Hop | 0.360 | 317 | 0.114 | ≤0.4 | PASS |
| DH3 | Ant1 | Hop | 1.610 | 162 | 0.261 | ≤0.4 | PASS |
| DH5 | Ant1 | Hop | 2.860 | 105 | 0.3 | ≤0.4 | PASS |
| 2DH1 | Ant1 | Hop | 0.370 | 320 | 0.118 | ≤0.4 | PASS |
| 2DH3 | Ant1 | Hop | 1.620 | 168 | 0.272 | ≤0.4 | PASS |
| 2DH5 | Ant1 | Hop | 2.870 | 105 | 0.301 | ≤0.4 | PASS |

## 7.5. Test graphs

DH1_Ant1_Hop

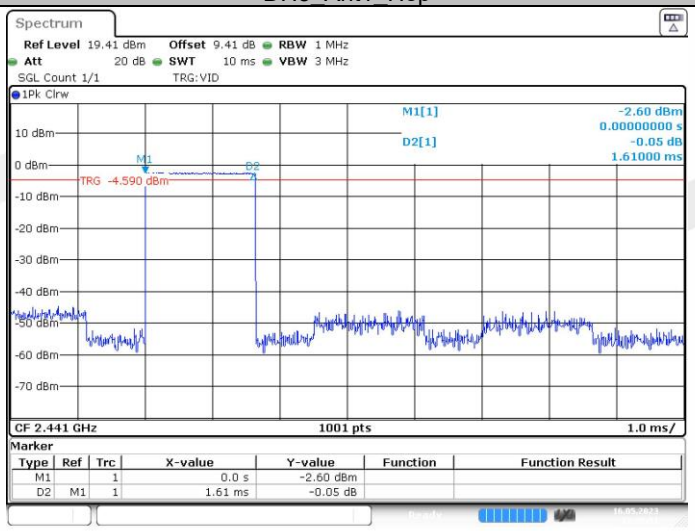



Date: 16.MAY.2023 17:29:53

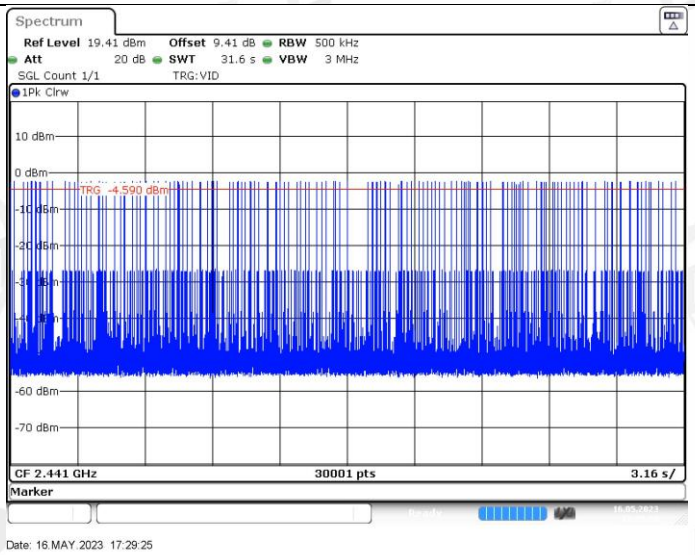



Date: 16.MAY.2023 17:30:27

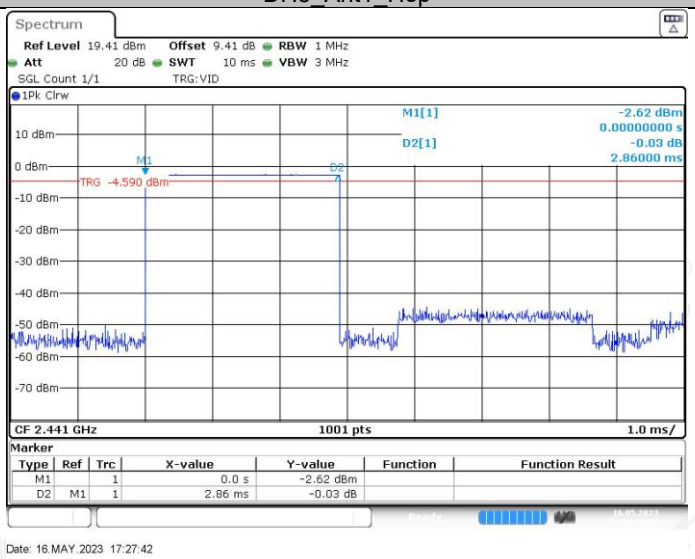
DH3_Ant1_Hop

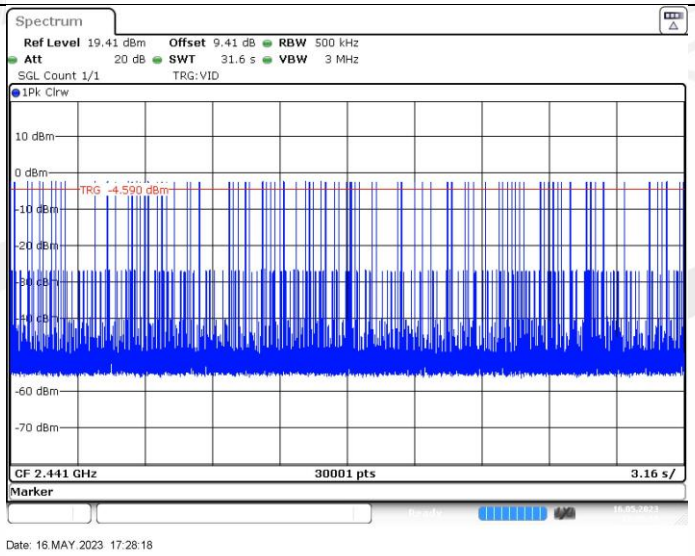



Date: 16.MAY.2023 17:28:51

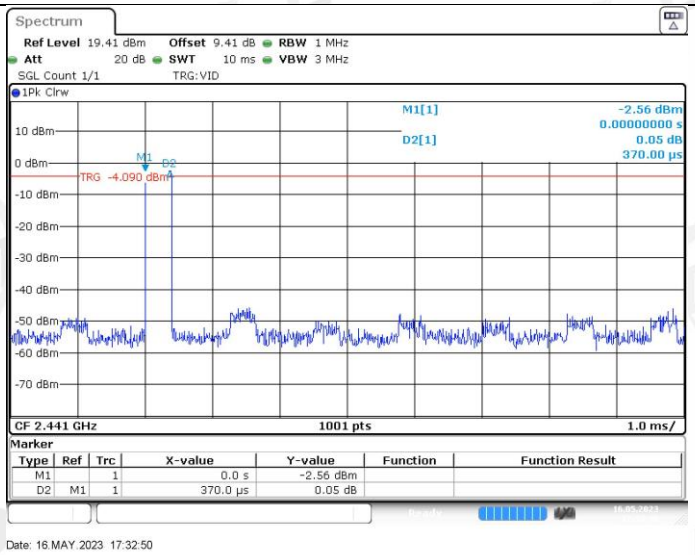


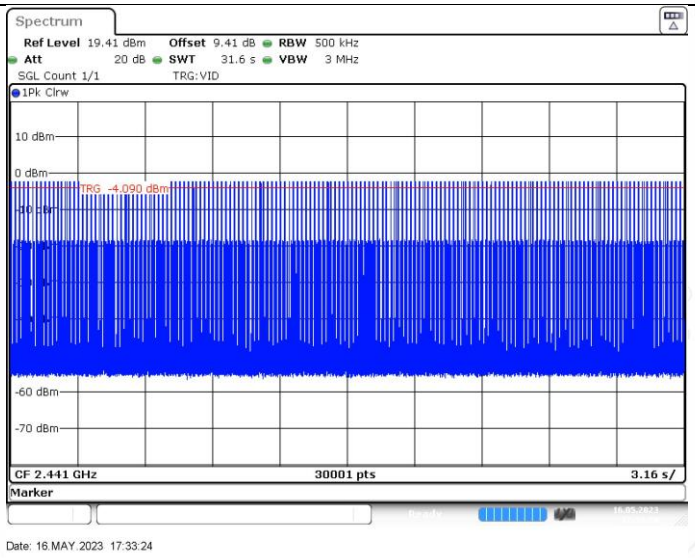

DH5_Ant1_Hop



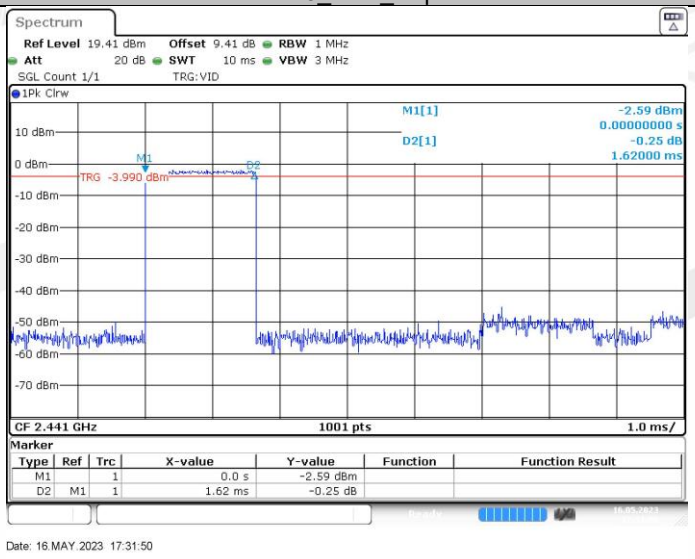



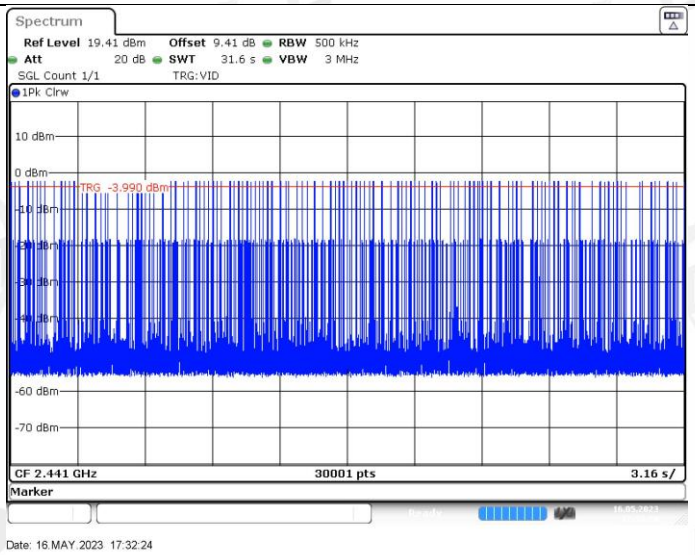

2DH1_Ant1_Hop



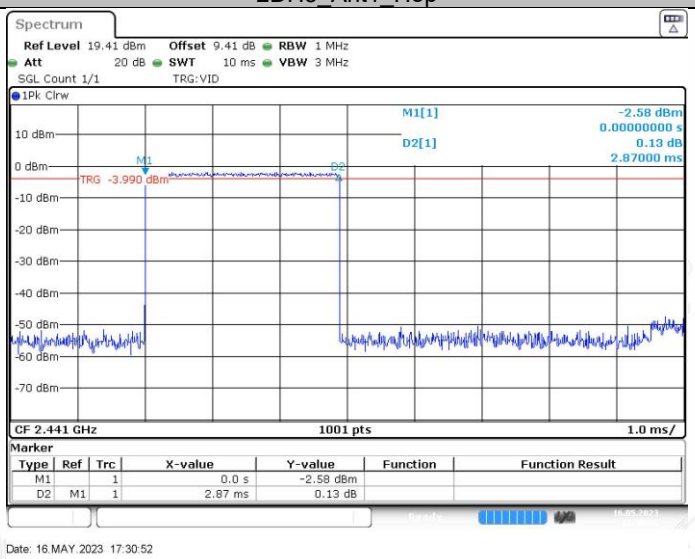



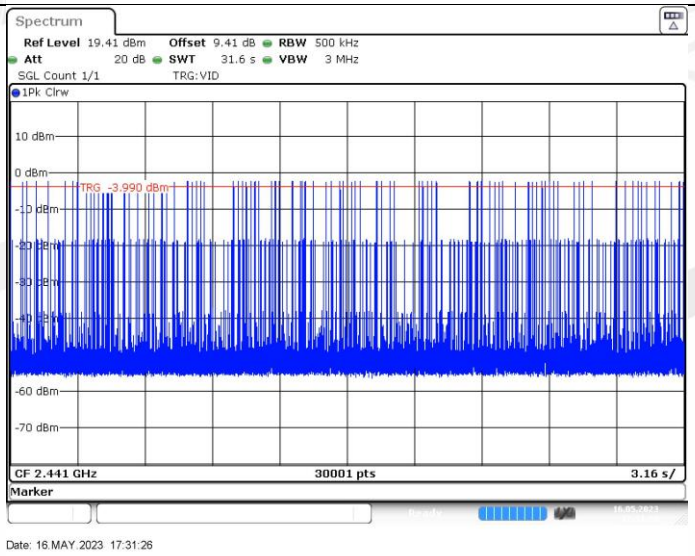

2DH3_Ant1_Hop





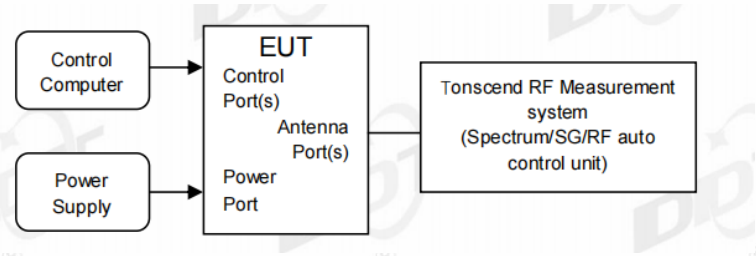

2DH5_Ant1_Hop



# 8. Number of Hopping Channel

## 8.1. Block diagram of test setup




## 8.2. Limits

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

## 8.3. 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 ≥ 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.

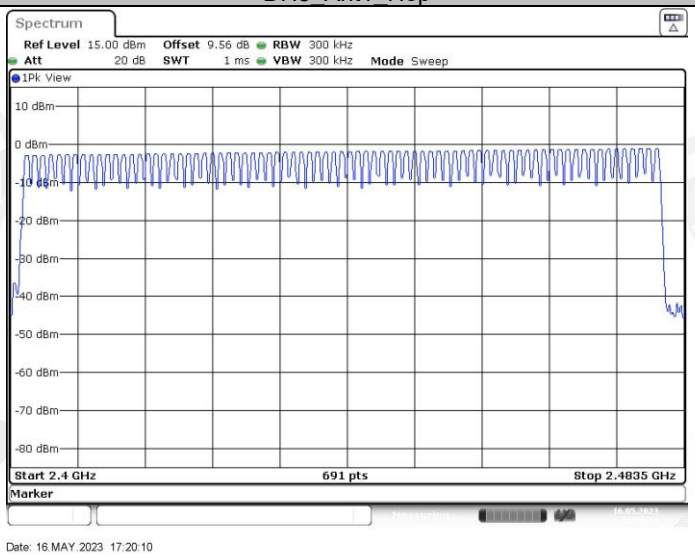
(5) Measure the hopping number and record the results in the report.

## 8.4. Test result

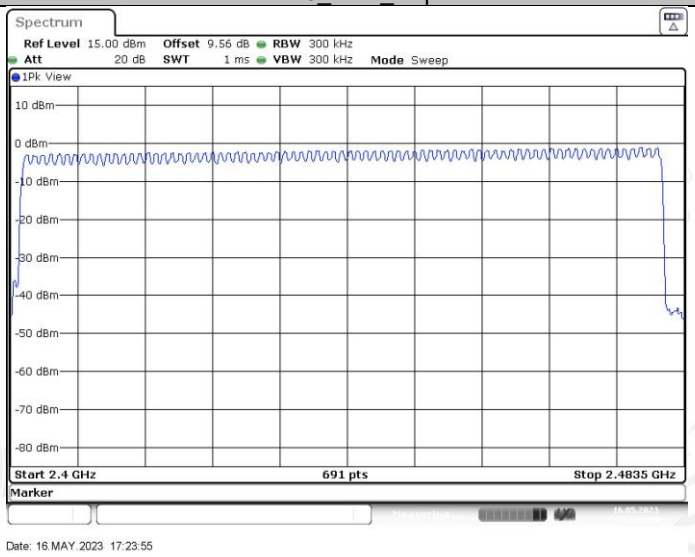
| Test Mode | Antenna | Frequency [MHz] | Result [Num] | Limit [Num] | Verdict |
|---|---|---|---|---|---|
| DH5 | Ant1 | Hop | 79 | ≥15 | PASS |
| 2DH5 | Ant1 | Hop | 79 | ≥15 | PASS |

## 8.5. Test graphs

DH5_Ant1_Hop

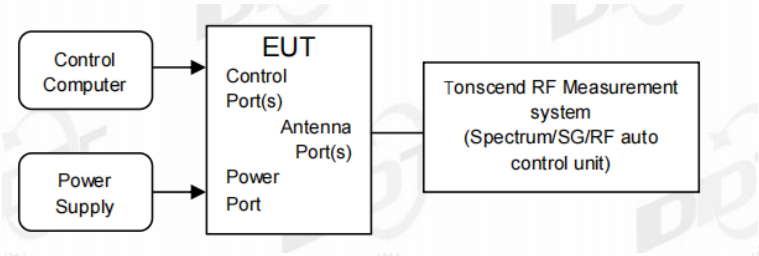



2DH5_Ant1_Hop



# 9. Band Edge Compliance (Conducted Method)

## 9.1. Block diagram of test setup




## 9.2. Limit

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

## 9.3. 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.

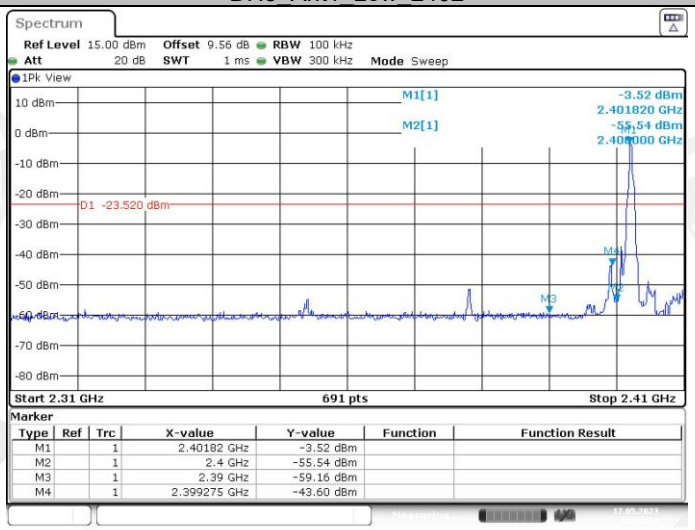
(4) Then mark the maximum amplitude of all unwanted emissions outside of the authorized frequency band.

## 9.4. Test result

| Mode | Freq. (MHz) | Verdict |
|---|---|---|
| GFSK | Hopping off 2402 | Pass |
| | Hopping off 2480 | Pass |
| | Hopping on | Pass |
| π/4-DQPSK | Hopping off 2402 | Pass |
| | Hopping off 2480 | Pass |
| | Hopping on | Pass |

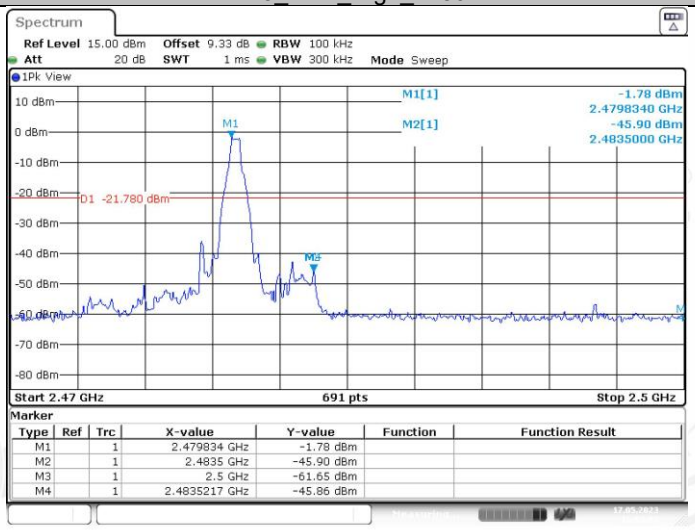
## 9.5. Test graphs

DH5_Ant1_Low_2402



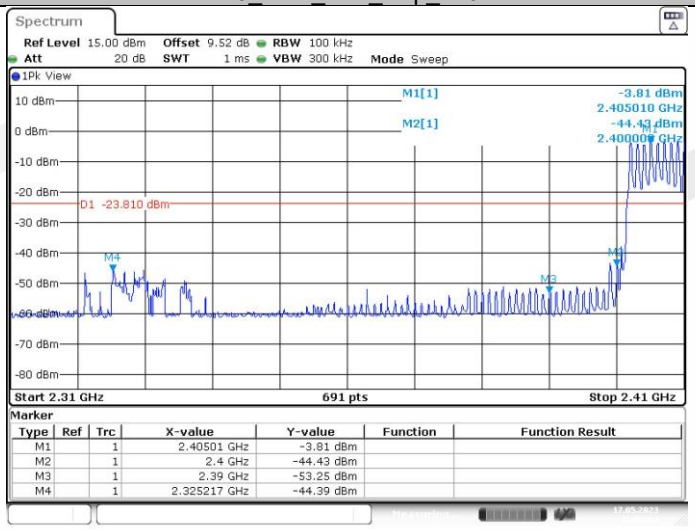

Date: 17.MAY.2023 16:01:16

DH5_Ant1_High_2480



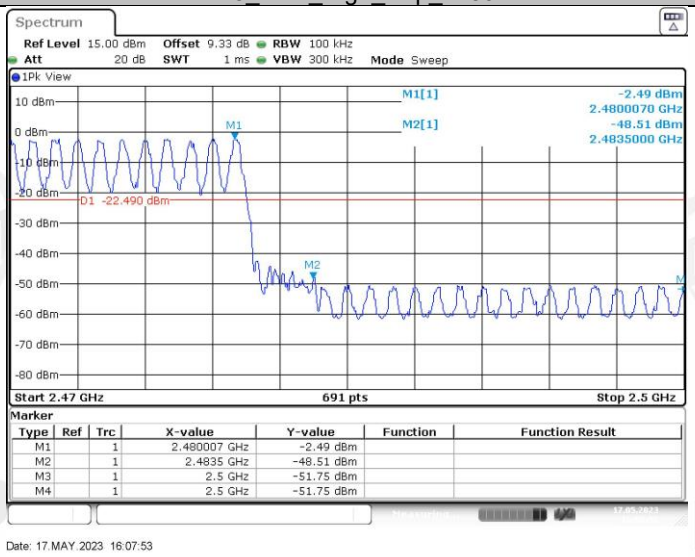

Date: 17.MAY.2023 16:02:58

DH5_Ant1_Low_Hop_2402

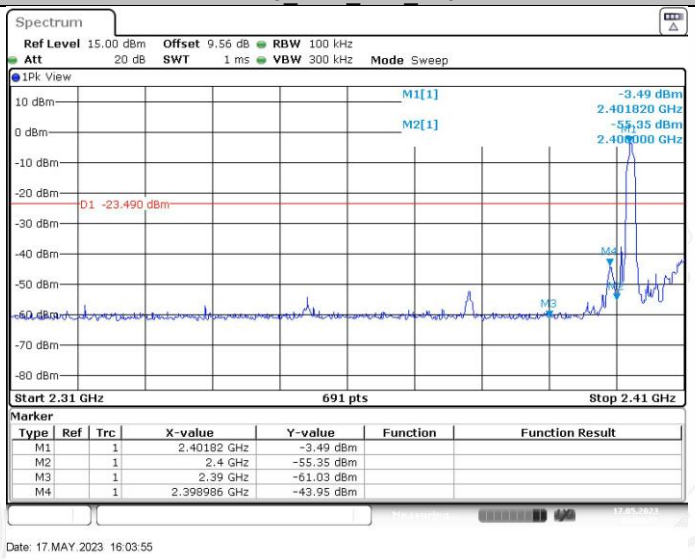



Date: 17.MAY.2023 16:07:33

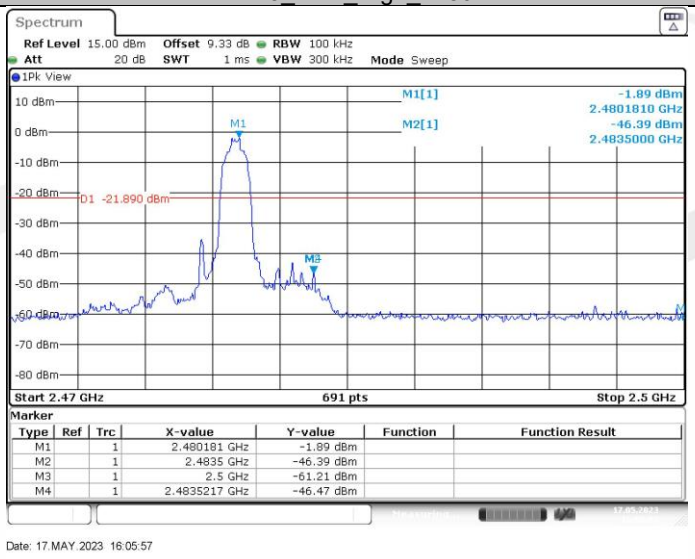
DH5_Ant1_High_Hop_2480



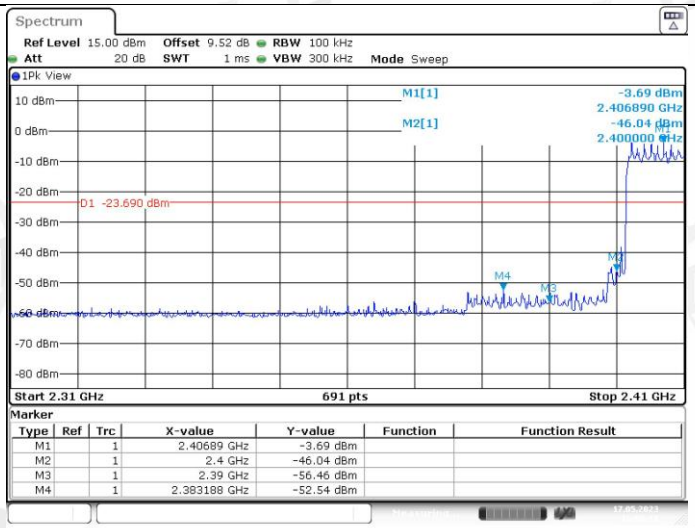

2DH5_Ant1_Low_2402



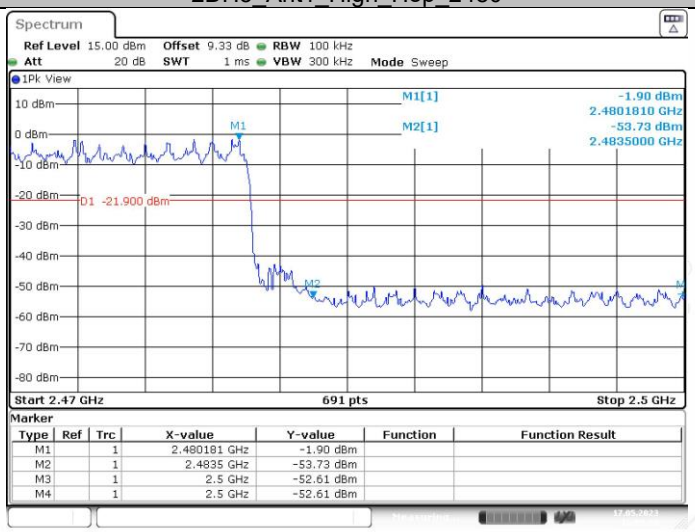

2DH5_Ant1_High_2480




2DH5_Ant1_Low_Hop_2402

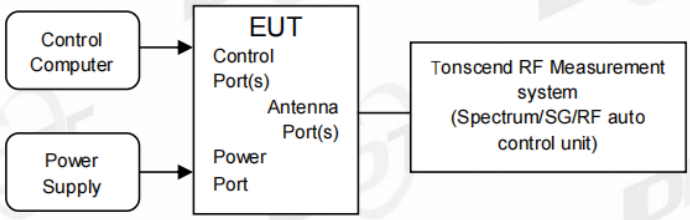



2DH5_Ant1_High_Hop_2480



# 10. RF Conducted Spurious Emissions

## 10.1. Block diagram of test setup




## 10.2. Limits

In any 100 kHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator in operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.

## 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:

| | |
|---|---|
| Center frequency | Test frequency |
| RBW: | 100 kHz |
| VBW: | 300 kHz |
| Span | Wide enough to capture the peak level of the in-band emission |
| 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) Set the spectrum analyzer as follows:

| | |
|---|---|
| RBW: | 100 kHz |
| VBW: | 300 kHz |
| Span | Encompass frequency range to be measured |
| Number of measurement points | ≥span/RBW |
| Detector Mode: | Peak |
| Sweep time: | Auto |
| Trace mode | Max hold |

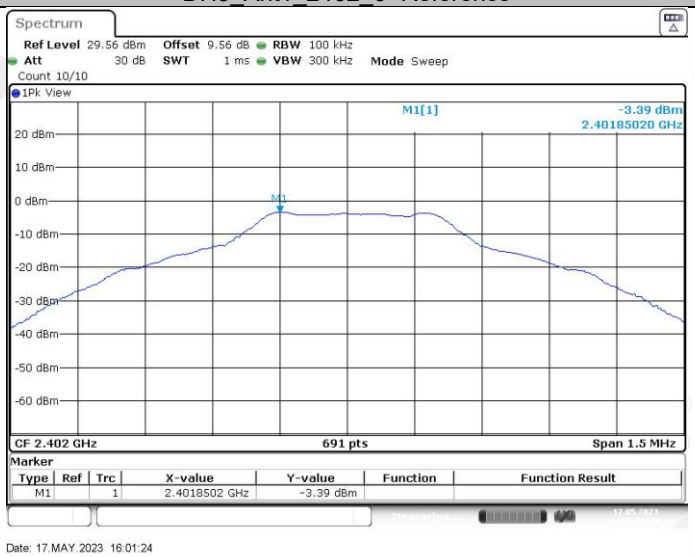
Allow the trace to stabilize, use the peak marker function to determine the maximum amplitude of all unwanted emissions outside of the authorized frequency band

## 10.4. Test result

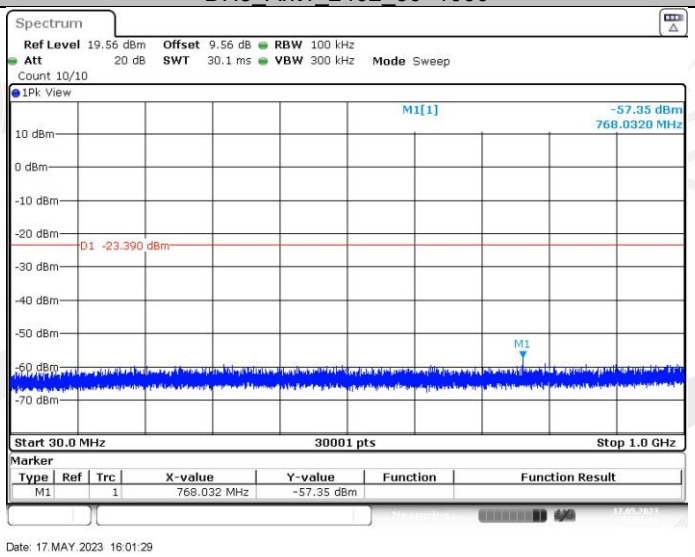
| Mode | Freq. (MHz) | Verdict |
|---|---|---|
| GFSK | Hopping off 2402 | Pass |
| | Hopping off 2441 | Pass |
| | Hopping off 2480 | Pass |
| π/4-DQPSK | Hopping off 2402 | Pass |
| | Hopping off 2441 | Pass |
| | Hopping off 2480 | Pass |

## 10.5. Test graphs

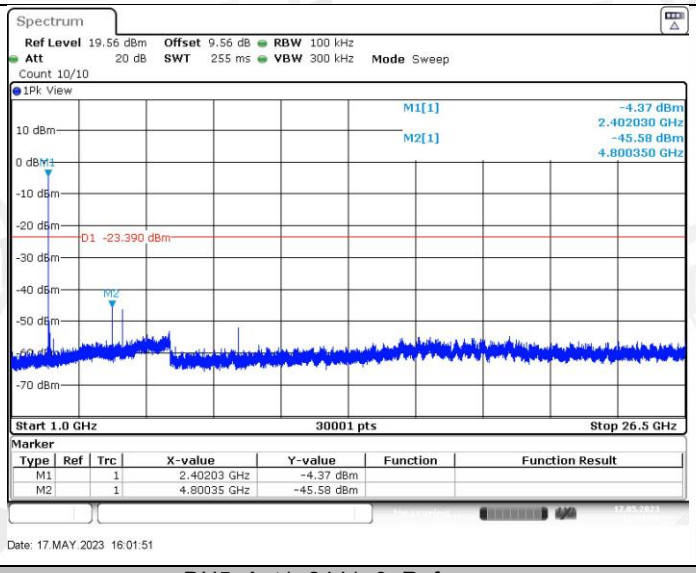
DH5_Ant1_2402_0~Reference



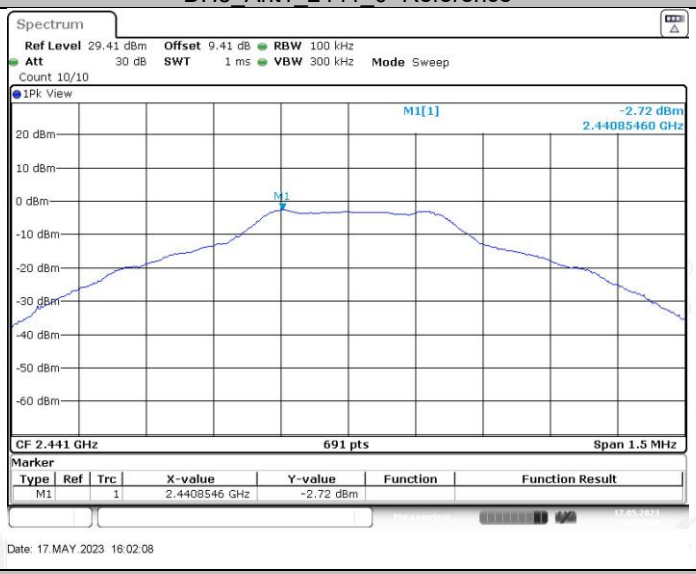

DH5_Ant1_2402_30~1000



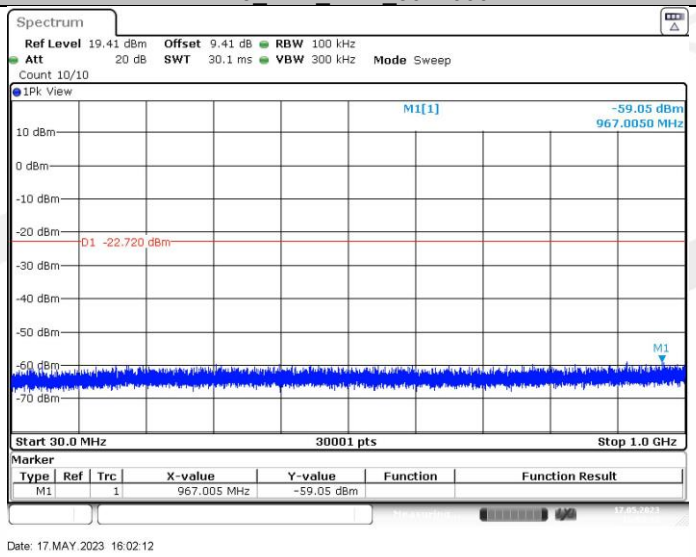

DH5_Ant1_2402_1000~26500



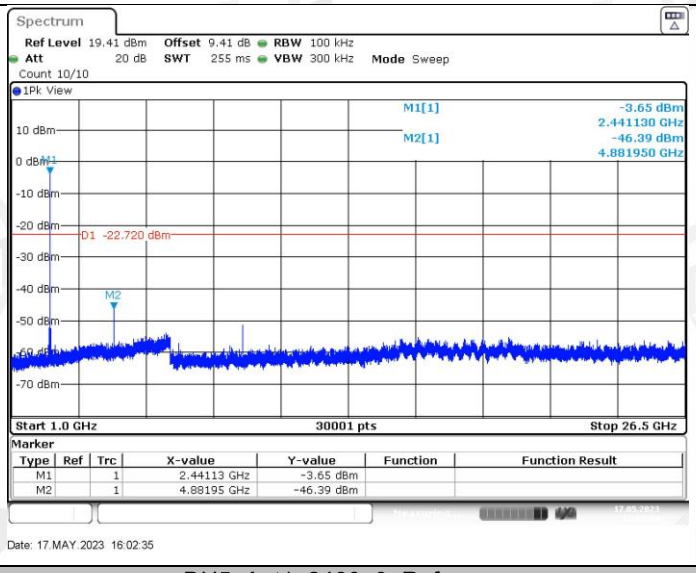

DH5_Ant1_2441_0~Reference



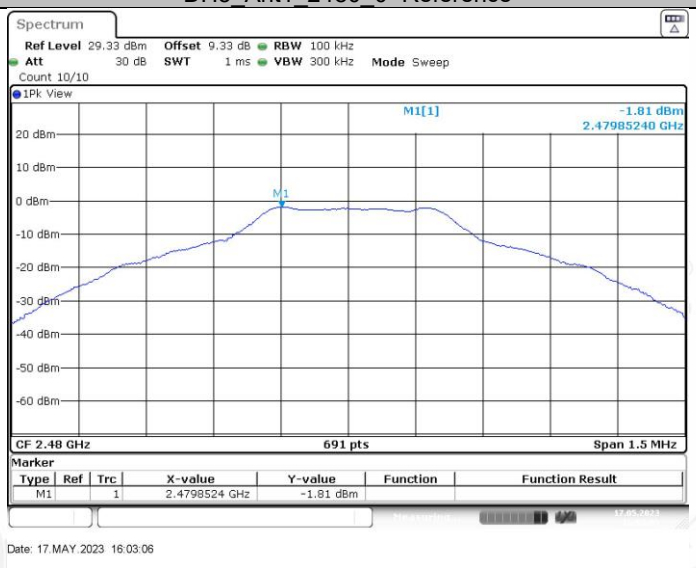

DH5_Ant1_2441_30~1000



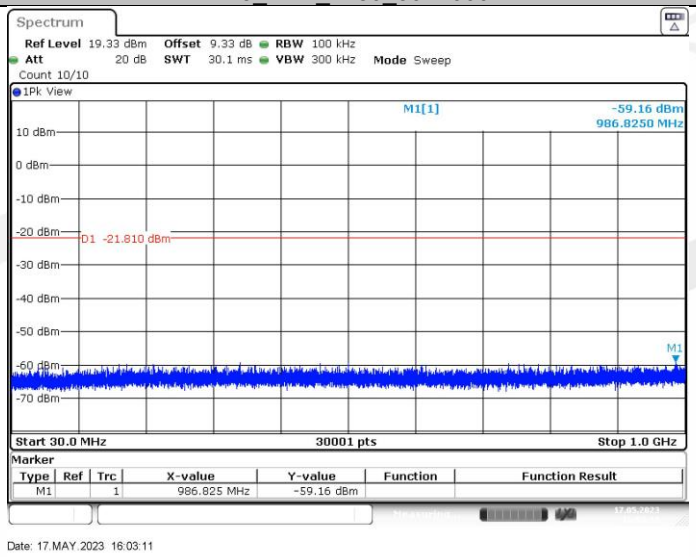

DH5_Ant1_2441_1000~26500




DH5_Ant1_2480_0~Reference




DH5_Ant1_2480_30~1000




DH5_Ant1_2480_1000~26500