

## Test Report

**Report No. :** CQASZ20241002229E-01  
**Applicant:** Shenzhen Kingstar Industrial Co.,Ltd.  
**Address of Applicant:** Room 211, Min Le technology Building Meiban Road, LongHua District, Shenzhen, China  
**Equipment Under Test (EUT):**  
**Product:** LIVE TWS EARBUDS WITH POWER DISPLAY  
**Model No.:** 941454  
**Test Model No.:** 941454  
**Brand Name:** N/A  
**FCC ID:** 2AO47-KS941454  
**Standards:** 47 CFR Part 15, Subpart C  
KDB558074 D01 15.247 Meas Guidance v05r02  
ANSI C63.10:2013  
**Date of Receipt:** 2024-10-18  
**Date of Test:** 2024-10-18 to 2024-10-28  
**Date of Issue:** 2024-11-21  
**Test Result :** **PASS\***

\*In the configuration tested, the EUT complied with the standards specified above.

**Tested By:** Lewis Zhou  
( Lewis Zhou )

**Reviewed By:** Timo Lei  
( Timo Lei )

**Approved By:** Alex  
( Alex Wang )



## 1 Version

### Revision History Of Report

| Report No.           | Version | Description    | Issue Date |
|----------------------|---------|----------------|------------|
| CQASZ20241002229E-01 | Rev.01  | Initial report | 2024-11-21 |

## 2 Test Summary

| Test Item                                                         | Test Requirement                         | Test method      | Result |
|-------------------------------------------------------------------|------------------------------------------|------------------|--------|
| Antenna Requirement                                               | 47 CFR Part 15.203                       | /                | PASS   |
| AC Power Line Conducted Emission                                  | 47 CFR Part 15, Subpart C Section 15.207 | ANSI C63.10-2013 | PASS   |
| Conducted Peak Output Power                                       | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| 20dB Occupied Bandwidth                                           | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Carrier Frequencies Separation                                    | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Hopping Channel Number                                            | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Dwell Time                                                        | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Pseudorandom Frequency Hopping Sequence                           | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Band-edge for RF Conducted Emissions                              | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| RF Conducted Spurious Emissions                                   | 47 CFR Part 15.247                       | ANSI C63.10-2013 | PASS   |
| Radiated Spurious emissions                                       | 47 CFR Part 15.209                       | ANSI C63.10-2013 | PASS   |
| Restricted bands around fundamental frequency (Radiated Emission) | 47 CFR Part 15.205/15.209                | ANSI C63.10-2013 | PASS   |

Remark:

The tested sample(s) and the sample information are provided by the client.

Tx: In this whole report Tx (or tx) means Transmitter.

Rx: In this whole report Rx (or rx) means Receiver.

RF: In this whole report RF means Radiated Frequency.

CH: In this whole report CH means channel.

Volt: In this whole report Volt means Voltage.

Temp: In this whole report Temp means Temperature.

Humid: In this whole report Humid means humidity.

Press: In this whole report Press means Pressure.

N/A: In this whole report not application

### 3 Contents

|                                                                        | Page      |
|------------------------------------------------------------------------|-----------|
| <b>1 VERSION .....</b>                                                 | <b>2</b>  |
| <b>2 TEST SUMMARY .....</b>                                            | <b>3</b>  |
| <b>3 CONTENTS .....</b>                                                | <b>4</b>  |
| <b>4 GENERAL INFORMATION .....</b>                                     | <b>5</b>  |
| 4.1 CLIENT INFORMATION .....                                           | 5         |
| 4.2 GENERAL DESCRIPTION OF EUT .....                                   | 5         |
| 4.3 ADDITIONAL INSTRUCTIONS .....                                      | 7         |
| 4.4 TEST ENVIRONMENT .....                                             | 8         |
| 4.5 DESCRIPTION OF SUPPORT UNITS .....                                 | 8         |
| 4.6 STATEMENT OF THE MEASUREMENT UNCERTAINTY .....                     | 9         |
| 4.7 TEST LOCATION .....                                                | 10        |
| 4.8 TEST FACILITY .....                                                | 10        |
| 4.9 ABNORMALITIES FROM STANDARD CONDITIONS .....                       | 10        |
| 4.10 OTHER INFORMATION REQUESTED BY THE CUSTOMER .....                 | 10        |
| 4.11 EQUIPMENT LIST .....                                              | 11        |
| <b>5 TEST RESULTS AND MEASUREMENT DATA .....</b>                       | <b>12</b> |
| 5.1 ANTENNA REQUIREMENT .....                                          | 12        |
| 5.2 CONDUCTED EMISSIONS .....                                          | 13        |
| 5.3 CONDUCTED PEAK OUTPUT POWER .....                                  | 17        |
| 5.4 20dB OCCUPIED BANDWIDTH .....                                      | 23        |
| 5.5 CARRIER FREQUENCIES SEPARATION .....                               | 28        |
| 5.6 HOPPING CHANNEL NUMBER .....                                       | 32        |
| 5.7 DWELL TIME .....                                                   | 35        |
| 5.8 BAND-EDGE FOR RF CONDUCTED EMISSIONS .....                         | 44        |
| 5.9 SPURIOUS RF CONDUCTED EMISSIONS .....                              | 51        |
| 5.10 OTHER REQUIREMENTS FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM ..... | 62        |
| 5.11 RADIATED SPURIOUS EMISSION & RESTRICTED BANDS .....               | 64        |
| 5.11.1 Radiated Emission below 1GHz .....                              | 67        |
| 5.11.2 Transmitter Emission above 1GHz .....                           | 69        |
| <b>6 PHOTOGRAPHS - EUT TEST SETUP .....</b>                            | <b>72</b> |
| 6.1 RADIATED EMISSION .....                                            | 72        |
| 6.2 CONDUCTED EMISSION .....                                           | 73        |
| <b>7 PHOTOGRAPHS - EUT CONSTRUCTIONAL DETAILS .....</b>                | <b>74</b> |

## 4 General Information

### 4.1 Client Information

|                          |                                                                                     |
|--------------------------|-------------------------------------------------------------------------------------|
| Applicant:               | Shenzhen Kingstar Industrial Co.,Ltd.                                               |
| Address of Applicant:    | Room 211, Min Le technology Building Meiban Road, LongHua District, Shenzhen, China |
| Manufacturer:            | Shenzhen Kingstar Industrial Co.,Ltd.                                               |
| Address of Manufacturer: | Room 211, Min Le technology Building Meiban Road, LongHua District, Shenzhen, China |
| Factory:                 | Shenzhen Kingstar Industrial Co.,Ltd.                                               |
| Address of Factory:      | Room 211, Min Le technology Building Meiban Road, LongHua District, Shenzhen, China |

### 4.2 General Description of EUT

|                           |                                                                                                                                                              |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:             | LIVE TWS EARBUDS WITH POWER DISPLAY                                                                                                                          |
| Model No.:                | 941454                                                                                                                                                       |
| Test Model No.:           | 941454                                                                                                                                                       |
| Trade Mark:               | N/A                                                                                                                                                          |
| Software Version:         | V5.3                                                                                                                                                         |
| Hardware Version:         | V5.3                                                                                                                                                         |
| Operation Frequency:      | 2402MHz~2480MHz                                                                                                                                              |
| Bluetooth Version:        | V5.3                                                                                                                                                         |
| Modulation Technique:     | Frequency Hopping Spread Spectrum(FHSS)                                                                                                                      |
| Modulation Type:          | GFSK, $\pi/4$ DQPSK, 8DPSK                                                                                                                                   |
| Transfer Rate:            | 1Mbps/2Mbps/3Mbps                                                                                                                                            |
| Number of Channel:        | 79                                                                                                                                                           |
| Hopping Channel Type:     | Adaptive Frequency Hopping systems                                                                                                                           |
| Product Type:             | <input type="checkbox"/> Mobile <input checked="" type="checkbox"/> Portable                                                                                 |
| Test Software of EUT:     | FCC_assist_1.0.2.2                                                                                                                                           |
| Antenna Type:             | Chip antenna                                                                                                                                                 |
| Antenna Gain:             | 2.6dBi                                                                                                                                                       |
| Power Supply:             | Li-ion battery DC 3.7V 30mAh, Charge by DC 5V for Charge box                                                                                                 |
| Simultaneous Transmission | <input type="checkbox"/> Simultaneous TX is supported and evaluated in this report.<br><input checked="" type="checkbox"/> Simultaneous TX is not supported. |

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

Note:

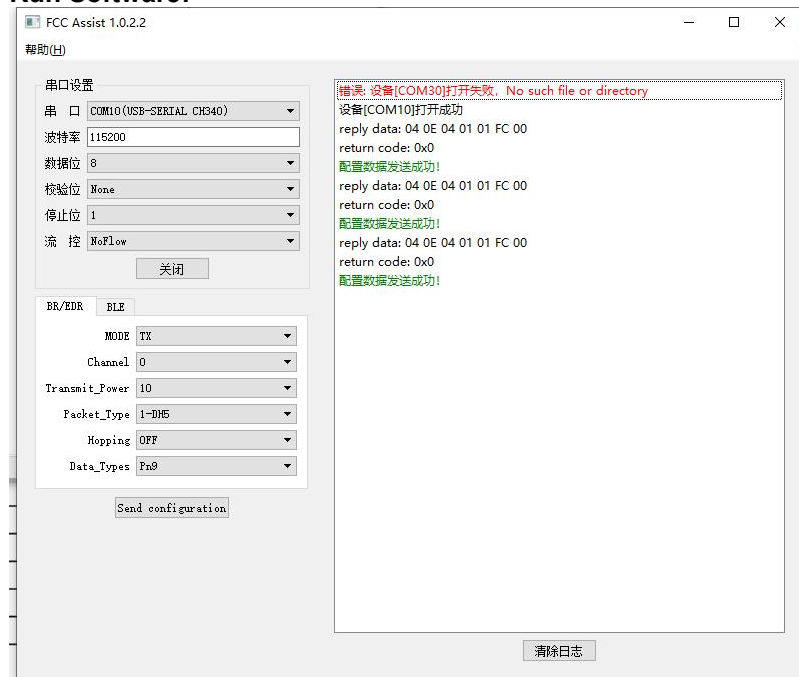
In section 15.31(m), regards to the operating frequency range over 10 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel             | Frequency |
|---------------------|-----------|
| The Lowest channel  | 2402MHz   |
| The Middle channel  | 2441MHz   |
| The Highest channel | 2480MHz   |

### 4.3 Additional Instructions

| EUT Test Software Settings:                                                                                                 |                                                                                                                                                                                        |                |
|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|
| Mode:                                                                                                                       | <input checked="" type="checkbox"/> Special software is used.<br><input type="checkbox"/> Through engineering command into the engineering mode.<br>engineering command: *##3646633##* |                |
| EUT Power level:                                                                                                            | Class 10                                                                                                                                                                               |                |
| Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT. |                                                                                                                                                                                        |                |
| Mode                                                                                                                        | Channel                                                                                                                                                                                | Frequency(MHz) |
| DH1/DH3/DH5                                                                                                                 | CH0                                                                                                                                                                                    | 2402           |
|                                                                                                                             | CH39                                                                                                                                                                                   | 2441           |
|                                                                                                                             | CH78                                                                                                                                                                                   | 2480           |
| 2DH1/2DH3/2DH5                                                                                                              | CH0                                                                                                                                                                                    | 2402           |
|                                                                                                                             | CH39                                                                                                                                                                                   | 2441           |
|                                                                                                                             | CH78                                                                                                                                                                                   | 2480           |
| 3DH1/3DH3/3DH5                                                                                                              | CH0                                                                                                                                                                                    | 2402           |
|                                                                                                                             | CH39                                                                                                                                                                                   | 2441           |
|                                                                                                                             | CH78                                                                                                                                                                                   | 2480           |

#### Run Software:



#### 4.4 Test Environment

| Operating Environment: |                                                                                                                             |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| Temperature:           | 25 °C                                                                                                                       |
| Humidity:              | 54% RH                                                                                                                      |
| Atmospheric Pressure:  | 1009mbar                                                                                                                    |
| Test Mode:             | Use test software to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT. |

#### 4.5 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No. | Remark | Supplied |
|-------------|--------------|-----------|--------|----------|
| Adapter     | MI           | /         | /      | CQA      |



#### 4.6 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd.** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for CQA laboratory is reported:

| No. | Item                               | Uncertainty        |
|-----|------------------------------------|--------------------|
| 1   | Radiated Emission (Below 1GHz)     | 5.12dB             |
| 2   | Radiated Emission (Above 1GHz)     | 4.60dB             |
| 3   | Conducted Disturbance (0.15~30MHz) | 3.34dB             |
| 4   | Radio Frequency                    | $3 \times 10^{-8}$ |
| 5   | Duty cycle                         | 0.6 %              |
| 6   | Occupied Bandwidth                 | 1.1%               |
| 7   | RF conducted power                 | 0.86dB             |
| 8   | RF power density                   | 0.74               |
| 9   | Conducted Spurious emissions       | 0.86dB             |
| 10  | Temperature test                   | 0.8℃               |
| 11  | Humidity test                      | 2.0%               |
| 12  | Supply voltages                    | 0.5 %              |
| 13  | Frequency Error                    | 5.5 Hz             |

#### 4.7 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

#### 4.8 Test Facility

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

**IC Registration No.: 22984-1**

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

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

• **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

• **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

#### 4.9 Abnormalities from Standard Conditions

None.

#### 4.10 Other Information Requested by the Customer

None.

#### 4.11 Equipment List

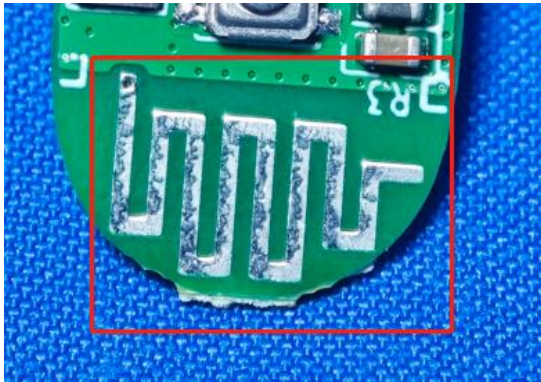
| Test Equipment             | Manufacturer | Model No.              | Instrument No. | Calibration Date | Calibration Due Date |
|----------------------------|--------------|------------------------|----------------|------------------|----------------------|
| EMI Test Receiver          | R&S          | ESR7                   | CQA-005        | 2024/9/2         | 2025/9/1             |
| Spectrum analyzer          | R&S          | FSU26                  | CQA-038        | 2024/9/2         | 2025/9/1             |
| Spectrum analyzer          | R&S          | FSU40                  | CQA-075        | 2024/9/2         | 2025/9/1             |
| Preamplifier               | MITEQ        | AFS4-00010300-18-10P-4 | CQA-035        | 2024/9/2         | 2025/9/1             |
| Preamplifier               | MITEQ        | AMF-6D-02001800-29-20P | CQA-036        | 2024/9/2         | 2025/9/1             |
| Preamplifier               | EMCI         | EMC184055SE            | CQA-089        | 2024/9/2         | 2025/9/1             |
| Loop antenna               | Schwarzbeck  | FMZB1516               | CQA-060        | 2023/9/8         | 2026/9/7             |
| Bilog Antenna              | R&S          | HL562                  | CQA-011        | 2023/11/01       | 2026/10/31           |
| Horn Antenna               | R&S          | HF906                  | CQA-012        | 2023/11/01       | 2026/10/31           |
| Horn Antenna               | Schwarzbeck  | BBHA 9170              | CQA-088        | 2023/9/7         | 2026/9/6             |
| Coaxial Cable (Above 1GHz) | CQA          | N/A                    | C007           | 2024/9/2         | 2025/9/1             |
| Coaxial Cable (Below 1GHz) | CQA          | N/A                    | C013           | 2024/9/2         | 2025/9/1             |
| Antenna Connector          | CQA          | RFC-01                 | CQA-080        | 2024/9/2         | 2025/9/1             |
| RF cable(9KHz~40GHz)       | CQA          | RF-01                  | CQA-079        | 2024/9/2         | 2025/9/1             |
| Power meter                | R&S          | NRVD                   | CQA-029        | 2024/9/2         | 2025/9/1             |
| Power divider              | MIDWEST      | PWD-2533-02-SMA-79     | CQA-067        | 2024/9/2         | 2025/9/1             |
| EMI Test Receiver          | R&S          | ESR7                   | CQA-005        | 2024/9/2         | 2025/9/1             |
| LISN                       | R&S          | ENV216                 | CQA-003        | 2024/9/2         | 2025/9/1             |
| Coaxial cable              | CQA          | N/A                    | CQA-C009       | 2024/9/2         | 2025/9/1             |
| DC power                   | KEYSIGHT     | E3631A                 | CQA-028        | 2024/9/2         | 2025/9/1             |

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

## 5 Test results and Measurement Data

### 5.1 Antenna Requirement

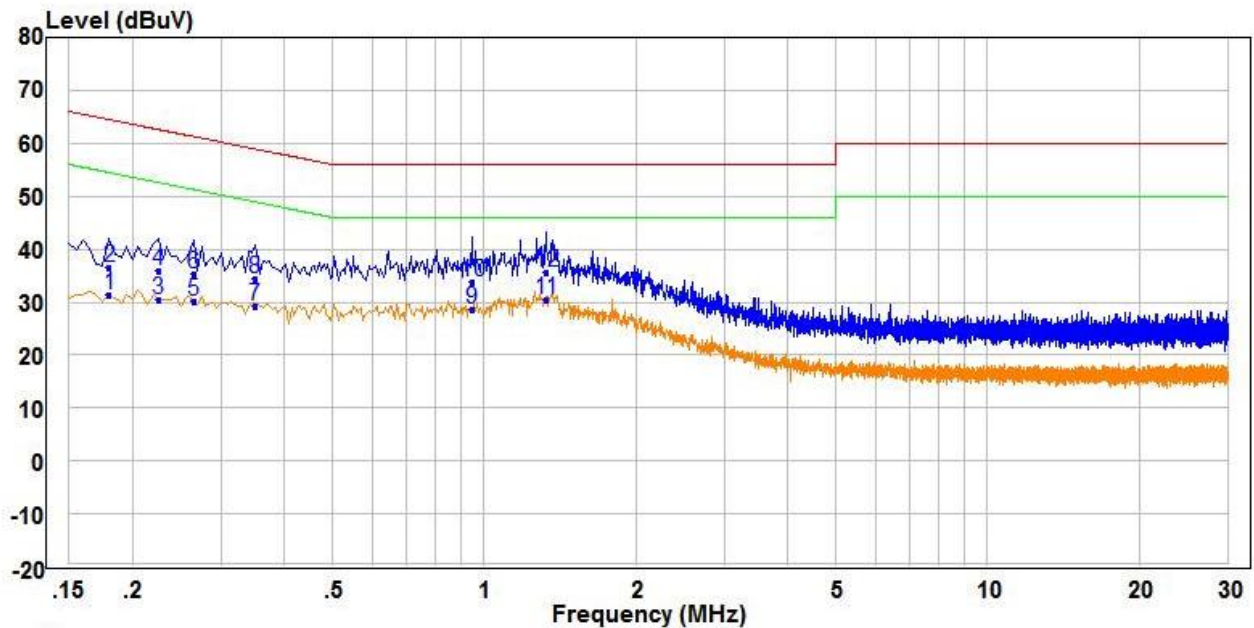
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| <b>Standard requirement:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 47 CFR Part 15C Section 15.203 /247(c)                                              |
| <p>15.203 requirement:<br/>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement:<br/>The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> |                                                                                     |
| <b>EUT Antenna:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |  |
| <p><b>The antenna is PCB antenna.</b><br/> <b>The connection/connection type between the antenna to the EUT's antenna port is: permanently attachment.</b><br/> <b>This is either permanently attachment or a unique coupling that satisfies the requirement.</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                     |



|                        |                                                                                                                                                            |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Exploratory Test Mode: | Non-hopping transmitting mode with all kind of modulation and all kind of data type at the lowest, middle, high channel.                                   |
| Final Test Mode:       | Through Pre-scan, find the DH5 of data type and GFSK modulation at the lowest channel is the worst case.<br>Only the worst case is recorded in the report. |
| Test Voltage:          | AC 120V/60Hz                                                                                                                                               |
| Test Results:          | Pass                                                                                                                                                       |

## Measurement Data

Live line:



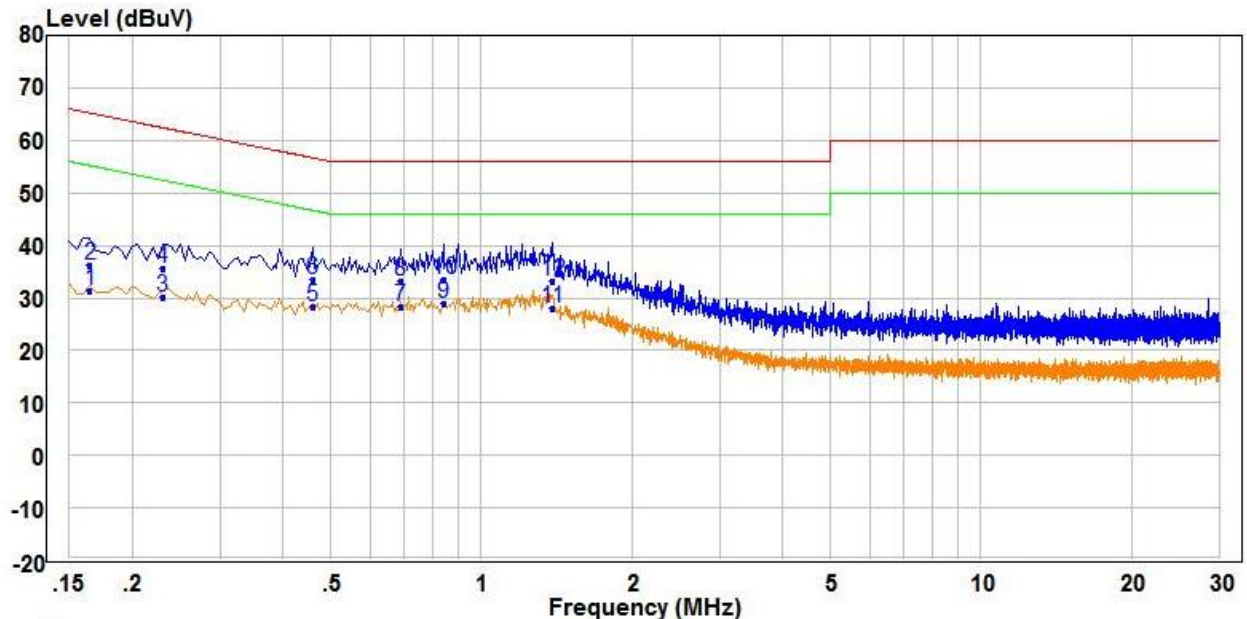
|       | Freq  | Read Level | Factor | Level | Limit Line | Over Limit | Remark  | Pol/Phase |
|-------|-------|------------|--------|-------|------------|------------|---------|-----------|
|       | MHz   | dBuV       | dB     | dBuV  | dBuV       | dB         |         |           |
| 1     | 0.180 | 21.75      | 9.64   | 31.39 | 54.49      | -23.10     | Average | Line      |
| 2     | 0.180 | 26.76      | 9.64   | 36.40 | 64.49      | -28.09     | QP      | Line      |
| 3     | 0.225 | 20.87      | 9.58   | 30.45 | 52.63      | -22.18     | Average | Line      |
| 4     | 0.225 | 26.25      | 9.58   | 35.83 | 62.63      | -26.80     | QP      | Line      |
| 5     | 0.265 | 20.64      | 9.53   | 30.17 | 51.27      | -21.10     | Average | Line      |
| 6     | 0.265 | 25.84      | 9.53   | 35.37 | 61.27      | -25.90     | QP      | Line      |
| 7     | 0.350 | 19.66      | 9.55   | 29.21 | 48.96      | -19.75     | Average | Line      |
| 8     | 0.350 | 24.96      | 9.55   | 34.51 | 58.96      | -24.45     | QP      | Line      |
| 9     | 0.945 | 19.01      | 9.74   | 28.75 | 46.00      | -17.25     | Average | Line      |
| 10    | 0.945 | 24.09      | 9.74   | 33.83 | 56.00      | -22.17     | QP      | Line      |
| 11 PP | 1.325 | 19.95      | 10.49  | 30.44 | 46.00      | -15.56     | Average | Line      |
| 12 QP | 1.325 | 25.11      | 10.49  | 35.60 | 56.00      | -20.40     | QP      | Line      |

Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.
3. If the Peak value under Average limit, the Average value is not recorded in the report.



Neutral line:

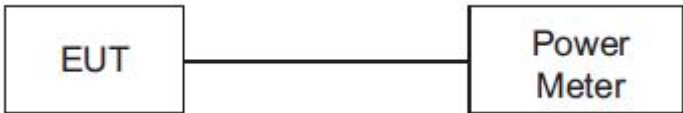
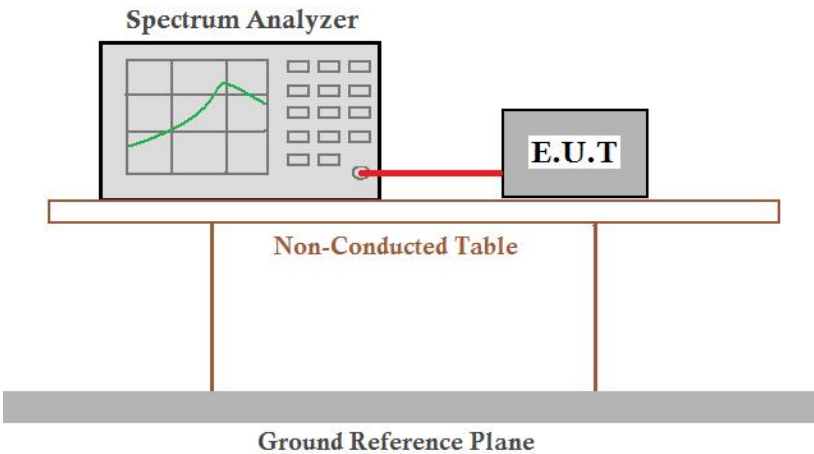


Remark:

1. The following Quasi-Peak and Average measurements were performed on the EUT:
2. Final Test Level = Receiver Reading + LISN Factor + Cable Loss.
3. If the Peak value under Average limit, the Average value is not recorded in the report.



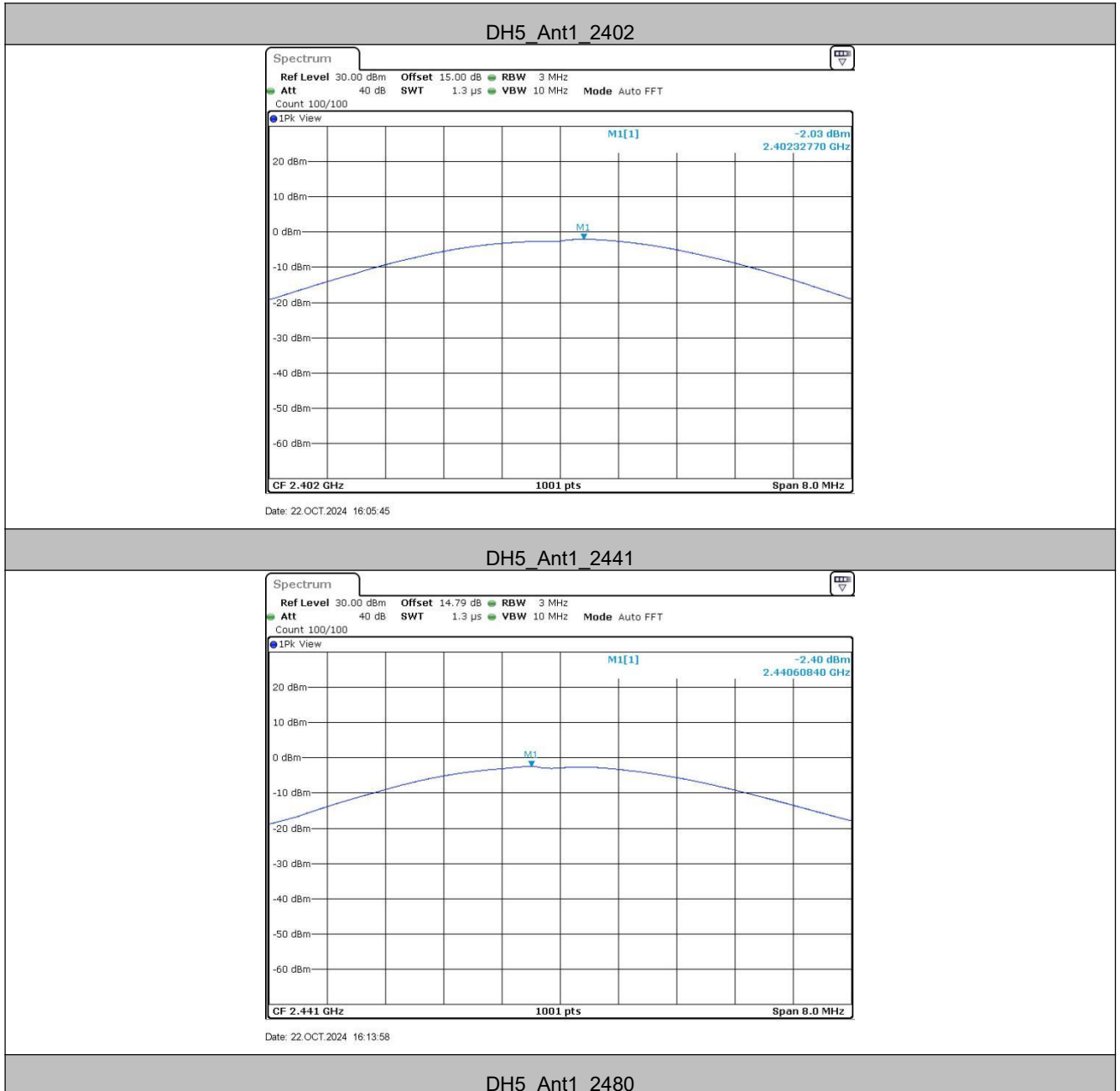
### 5.3 Conducted Peak Output Power

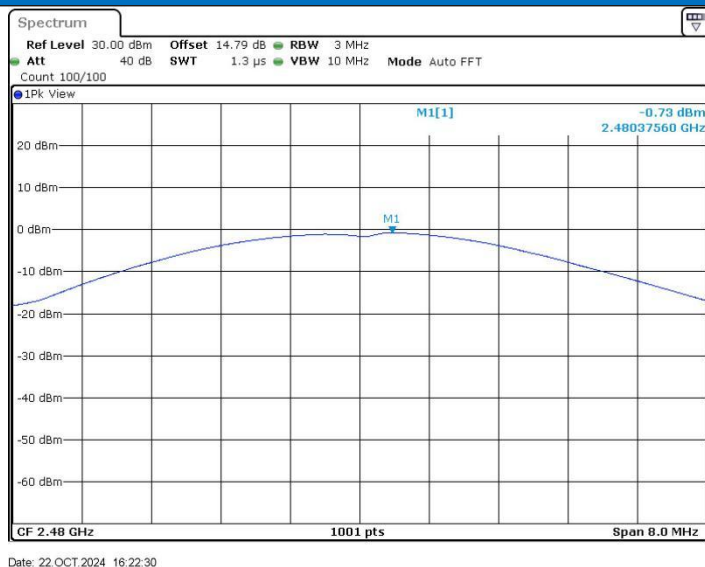
|                        |                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (b)(1)                                                                                                                                                                                                                                                                                                                   |
| Test Method:           | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                        |
| Test Setup:            | <p><b>Setup for Power meter measurement method</b></p>  <p><b>Setup for Spectrum analyser measurement method</b></p>  <p><i>Remark: Offset=Cable loss+ attenuation factor.</i></p> |
| Limit:                 | 21dBm                                                                                                                                                                                                                                                                                                                                                   |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type                                                                                                                                                                                                                                                                          |
| Final Test Mode:       | Only the worst case is recorded in the report.                                                                                                                                                                                                                                                                                                          |
| Test Results:          | Pass                                                                                                                                                                                                                                                                                                                                                    |

## Measurement Data

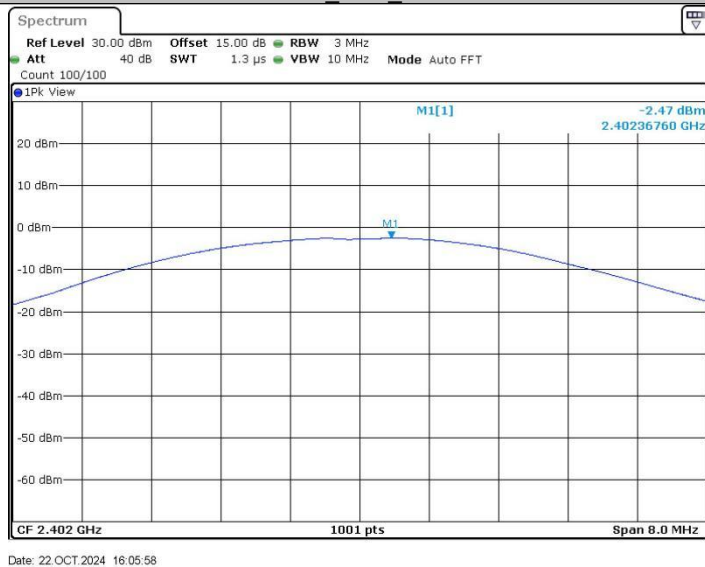
| GFSK mode          |                         |             |        |
|--------------------|-------------------------|-------------|--------|
| Test channel       | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest             | -2.03                   | 21.00       | Pass   |
| Middle             | -2.4                    | 21.00       | Pass   |
| Highest            | -0.73                   | 21.00       | Pass   |
| $\pi/4$ DQPSK mode |                         |             |        |
| Test channel       | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest             | -2.47                   | 21.00       | Pass   |
| Middle             | -2.04                   | 21.00       | Pass   |
| Highest            | -0.6                    | 21.00       | Pass   |
| 8DPSK mode         |                         |             |        |
| Test channel       | Peak Output Power (dBm) | Limit (dBm) | Result |
| Lowest             | -1.91                   | 21.00       | Pass   |
| Middle             | -2.31                   | 21.00       | Pass   |
| Highest            | -0.88                   | 21.00       | Pass   |

Test plot as follows:

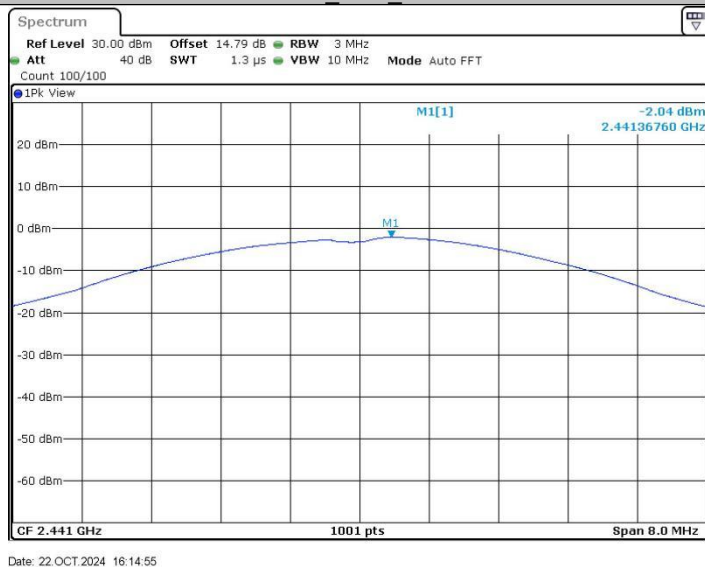




2DH5\_Ant1\_2402



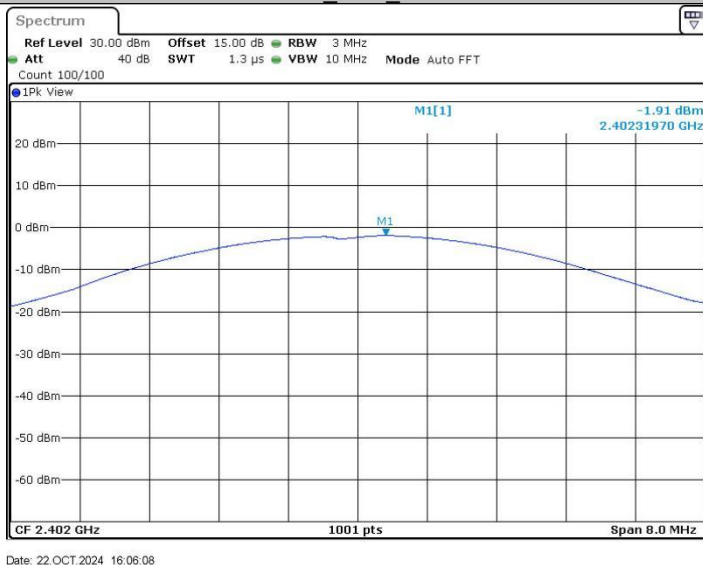
2DH5\_Ant1\_2441



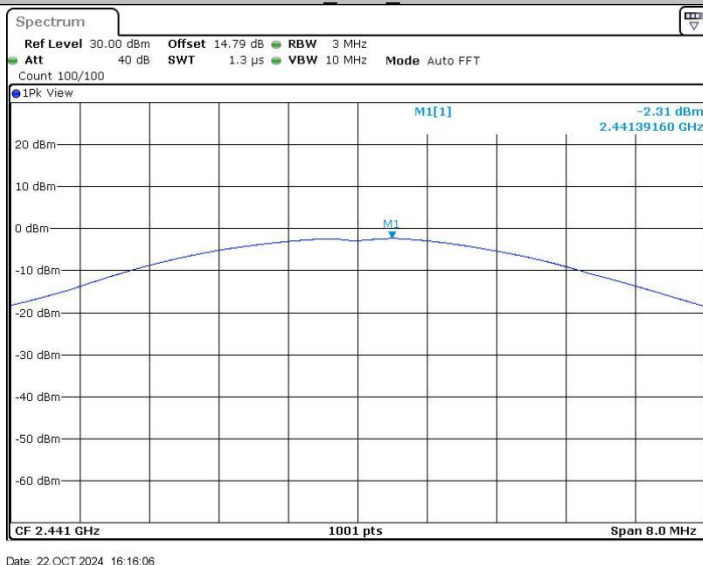
2DH5\_Ant1\_2480



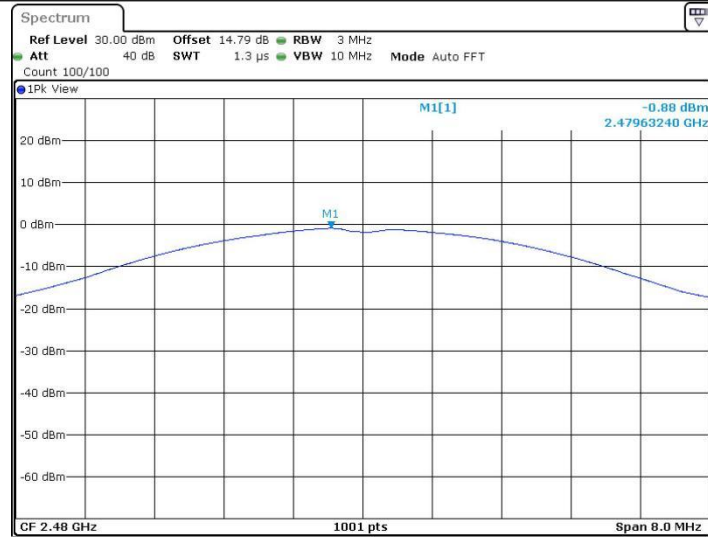
3DH5\_Ant1\_2402



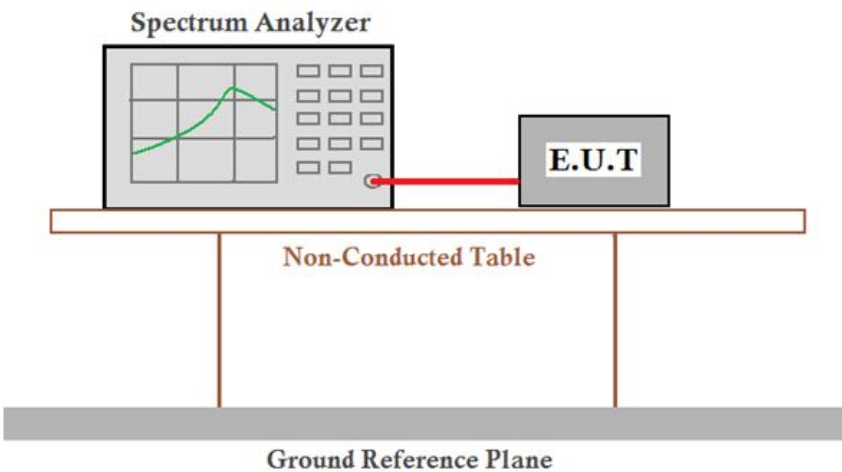
3DH5\_Ant1\_2441



3DH5\_Ant1\_2480



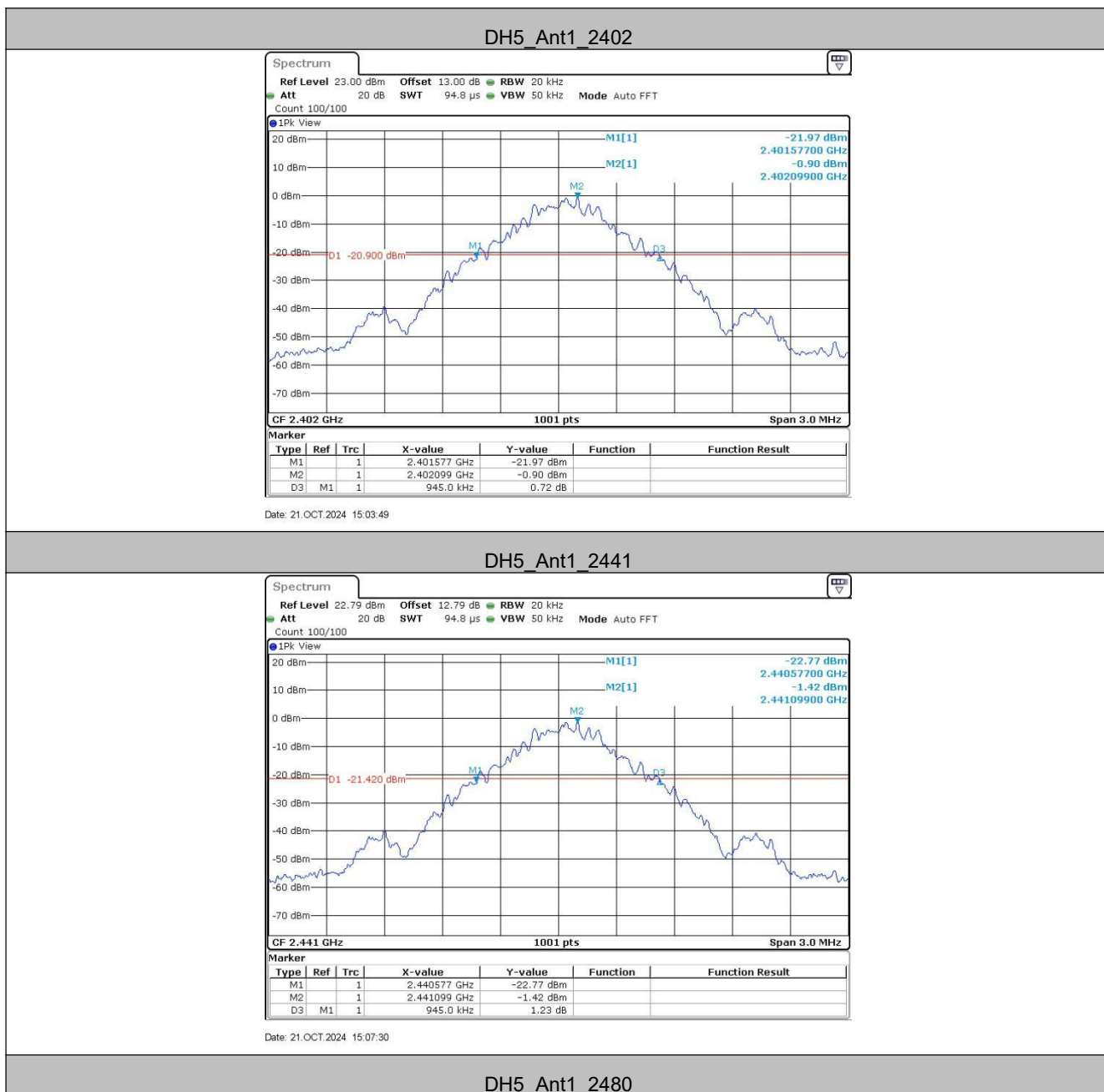
## 5.4 20dB Occupied Bandwidth

|                        |                                                                                                                                          |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (a)(1)                                                                                                    |
| Test Method:           | ANSI C63.10:2013                                                                                                                         |
| Test Setup:            |  <p>Remark: Offset=Cable loss+ attenuation factor.</p> |
| Limit:                 | NA                                                                                                                                       |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type                                                           |
| Final Test Mode:       | Only the worst case is recorded in the report.                                                                                           |
| Test Results:          | Pass                                                                                                                                     |

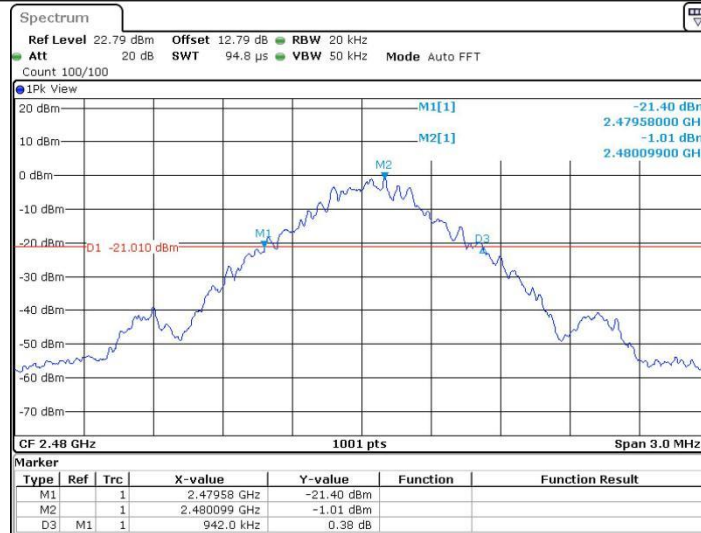
### Measurement Data

| Test channel | 20dB Occupy Bandwidth (MHz) |               |       |
|--------------|-----------------------------|---------------|-------|
|              | GFSK                        | $\pi/4$ DQPSK | 8DPSK |
| Lowest       | 0.94                        | 1.29          | 1.26  |
| Middle       | 0.94                        | 1.29          | 1.26  |
| Highest      | 0.94                        | 1.29          | 1.26  |

Test plot as follows:

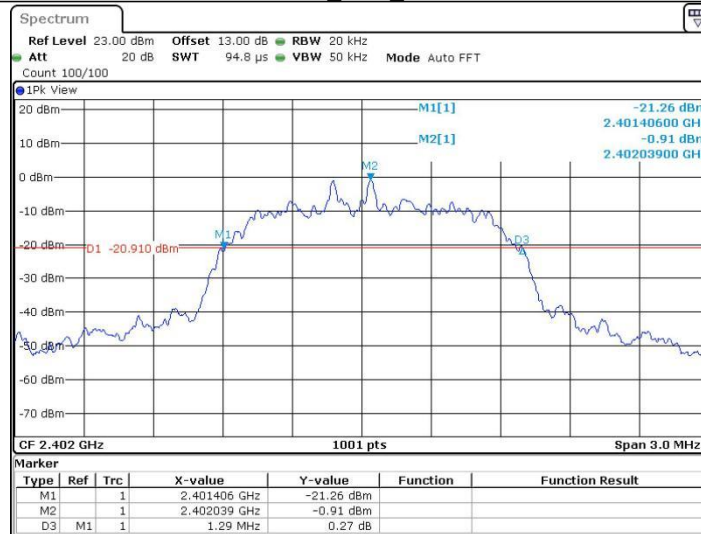






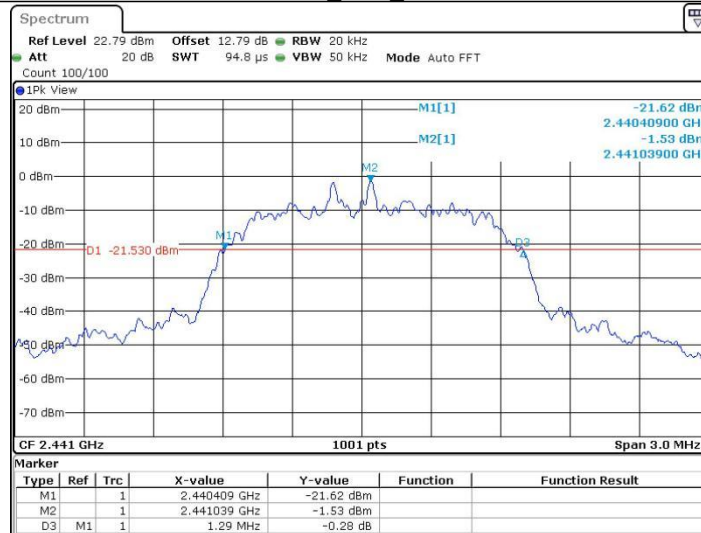
Date: 21.OCT.2024 15:09:26

### 2DH5\_Ant1\_2402



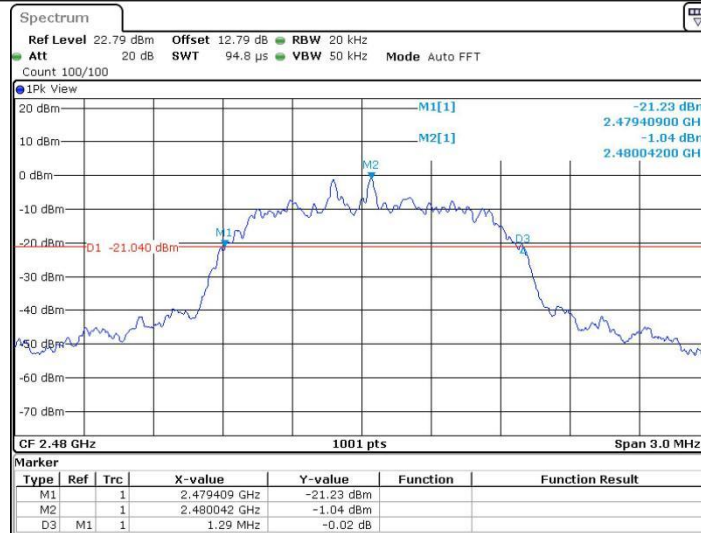
Date: 21.OCT.2024 15:12:56

### 2DH5\_Ant1\_2441



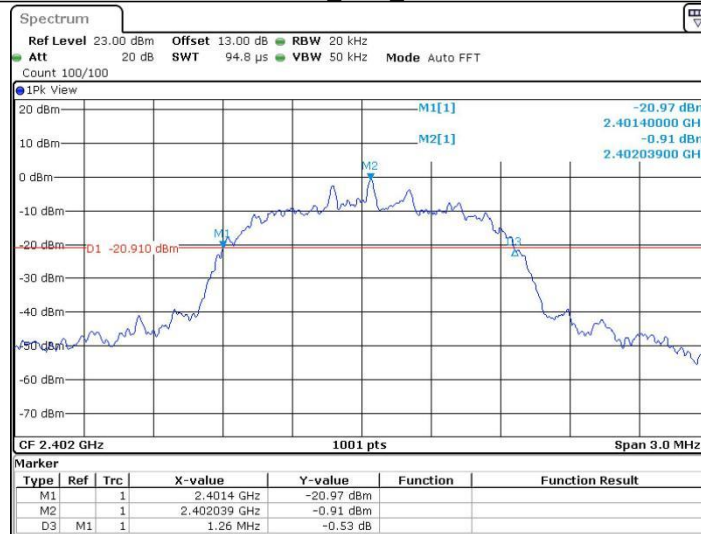
Date: 21.OCT.2024 15:16:37

### 2DH5\_Ant1\_2480



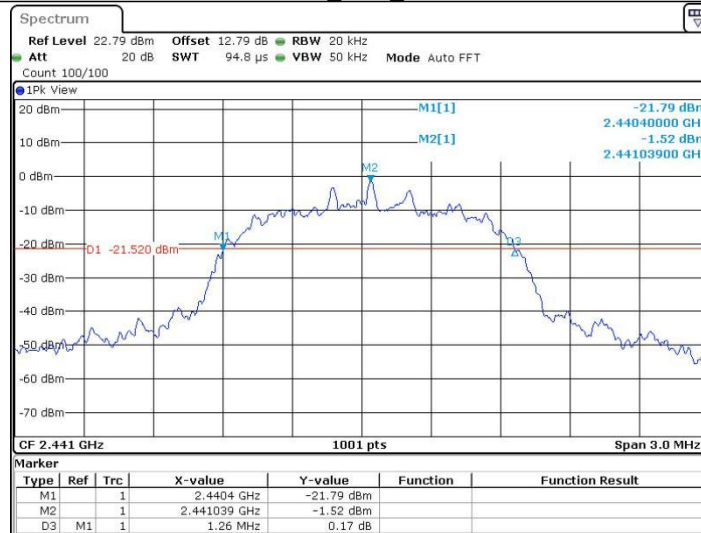
Date: 21.OCT.2024 15:20:54

### 3DH5\_Ant1\_2402



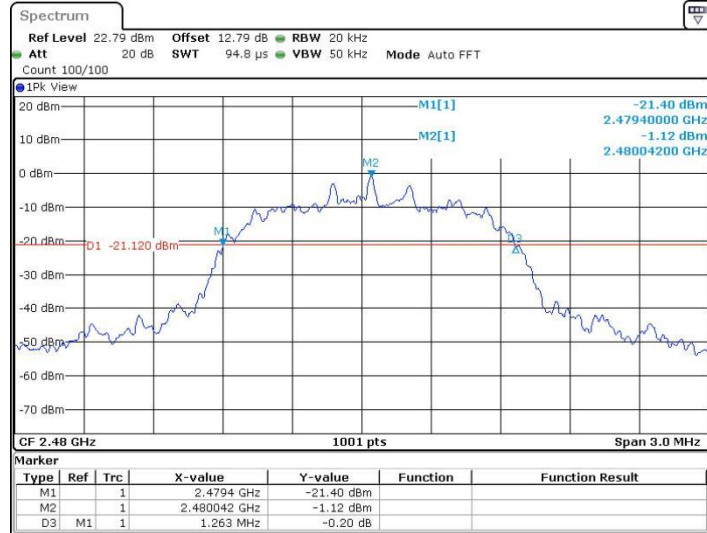
Date: 21.OCT.2024 15:23:33

### 3DH5\_Ant1\_2441



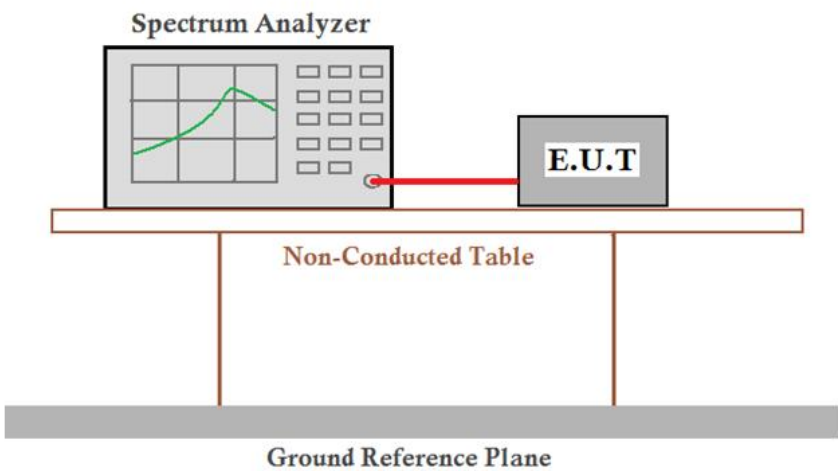
Date: 21.OCT.2024 15:26:30

### 3DH5\_Ant1\_2480



Date: 21.OCT.2024 15:27:33

## 5.5 Carrier Frequencies Separation

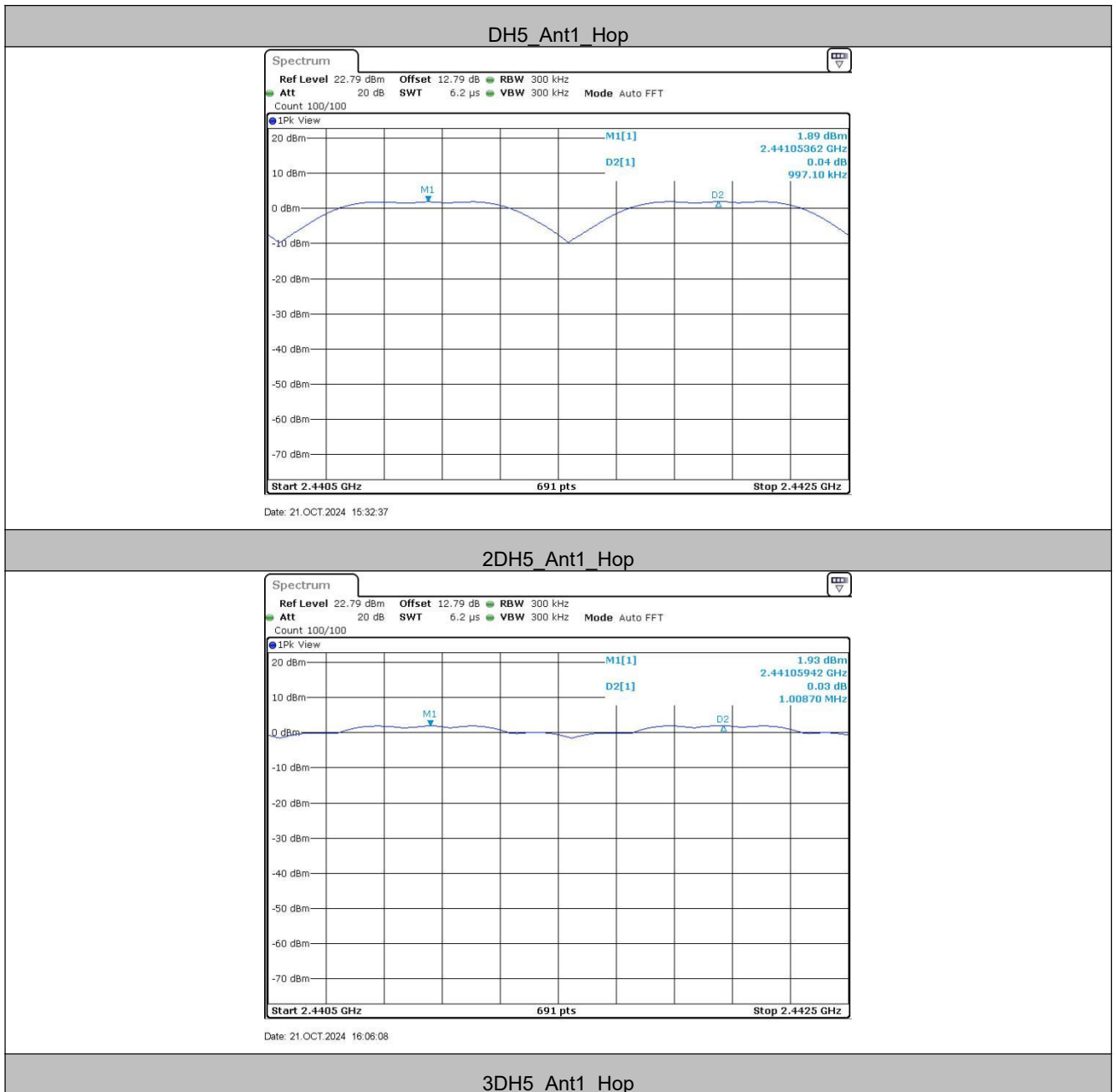
|                        |                                                                                                                                          |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (a)(1)                                                                                                    |
| Test Method:           | ANSI C63.10:2013                                                                                                                         |
| Test Setup:            |  <p>Remark: Offset=Cable loss+ attenuation factor.</p> |
| Limit:                 | 2/3 of the 20dB bandwidth                                                                                                                |
|                        | Remark: the transmission power is less than 0.125W.                                                                                      |
| Exploratory Test Mode: | Hopping transmitting with all kind of modulation and all kind of data type                                                               |
| Final Test Mode:       | Only the worst case is recorded in the report.                                                                                           |
| Test Results:          | Pass                                                                                                                                     |

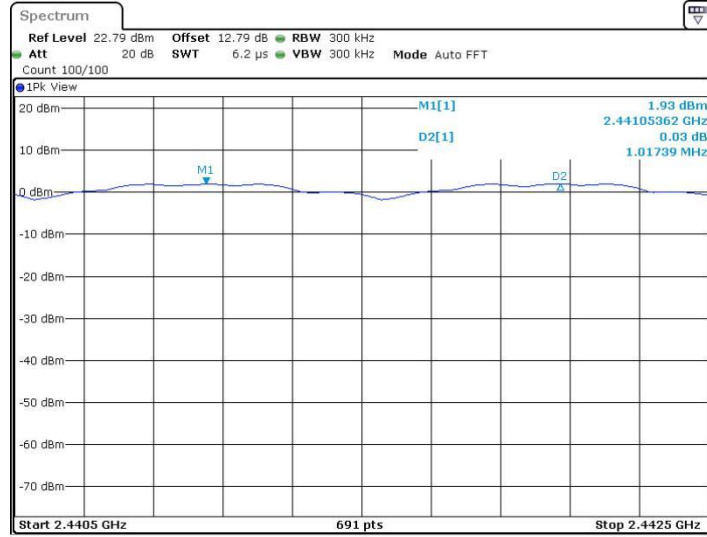
Measurement Data

| TestMode | Freq(MHz) | Result[MHz] | Limit[MHz]   | Verdict |
|----------|-----------|-------------|--------------|---------|
| DH5      | Hop       | 0.997       | $\geq 0.627$ | PASS    |
| 2DH5     | Hop       | 1.009       | $\geq 0.860$ | PASS    |
| 3DH5     | Hop       | 1.017       | $\geq 0.840$ | PASS    |

| Mode          | 20dB bandwidth (MHz)<br>(worse case) | Limit (MHz)<br>(Carrier Frequencies Separation) |
|---------------|--------------------------------------|-------------------------------------------------|
| GFSK          | 0.94                                 | $\geq 0.627$                                    |
| $\pi/4$ DQPSK | 1.29                                 | $\geq 0.860$                                    |
| 8DPSK         | 1.26                                 | $\geq 0.840$                                    |

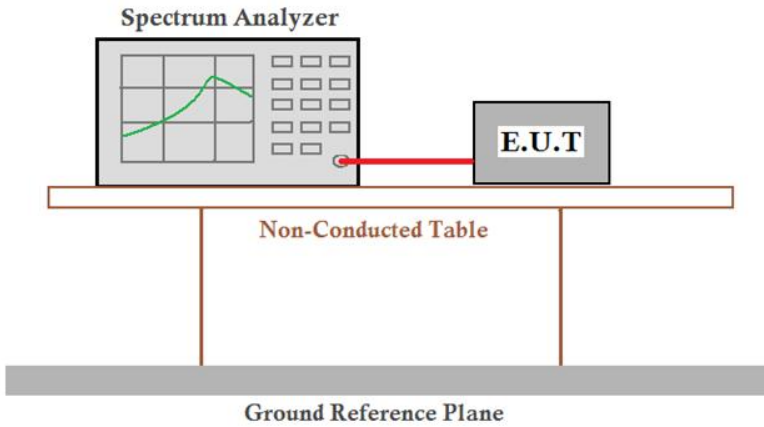
Test plot as follows:





Date: 21.OCT.2024 16:17:11

## 5.6 Hopping Channel Number

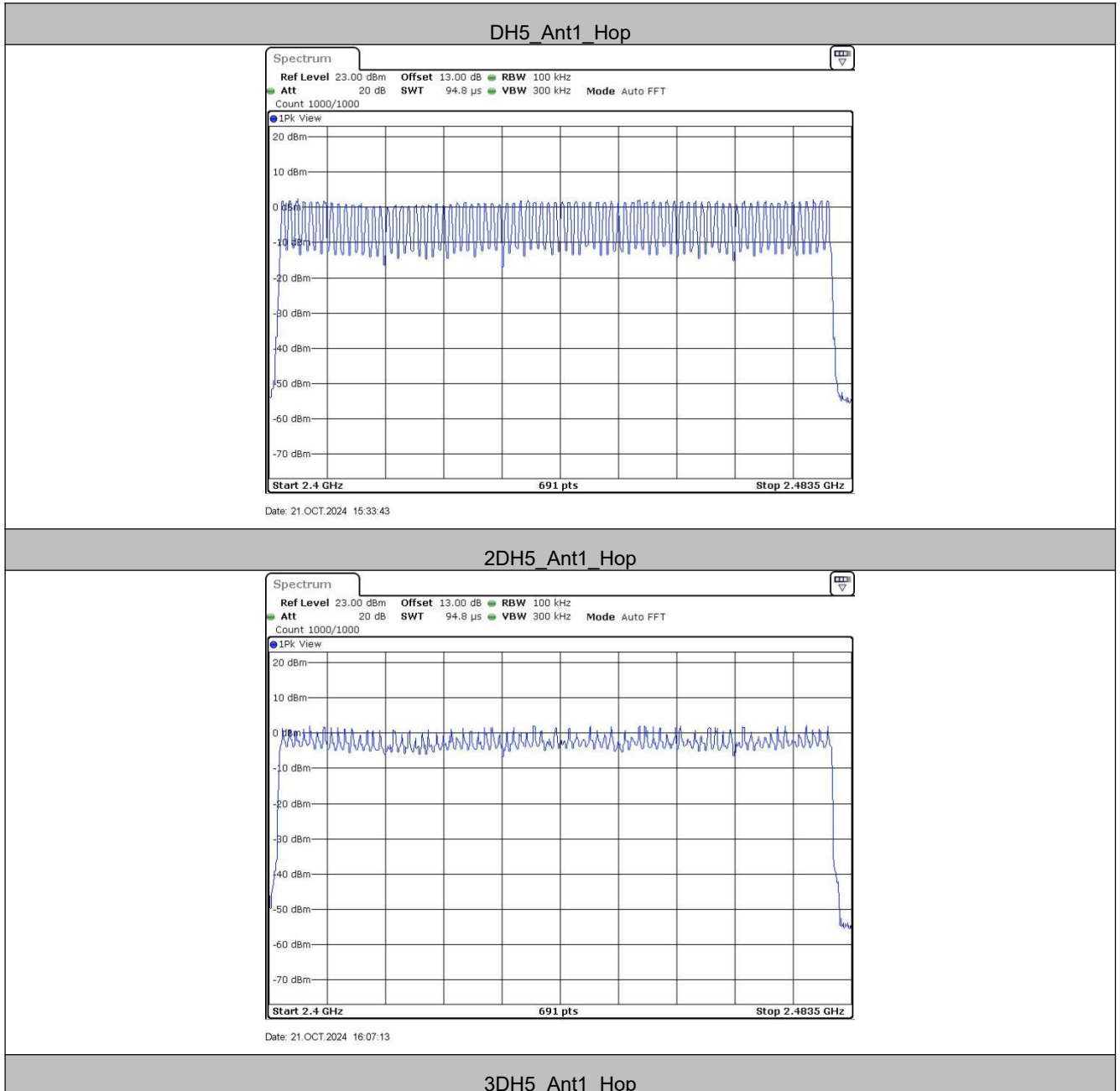
|                        |                                                                                                                                                                        |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (a)(1)                                                                                                                                  |
| Test Method:           | ANSI C63.10:2013                                                                                                                                                       |
| Test Setup:            |  <p>Remark: <math>Offset = \text{Cable loss} + \text{attenuation factor}</math>.</p> |
| Limit:                 | At least 15 channels                                                                                                                                                   |
| Exploratory Test Mode: | hopping transmitting with all kind of modulation and all kind of data type                                                                                             |
| Final Test Mode:       | Only the worst case is recorded in the report.                                                                                                                         |
| Test Results:          | Pass                                                                                                                                                                   |

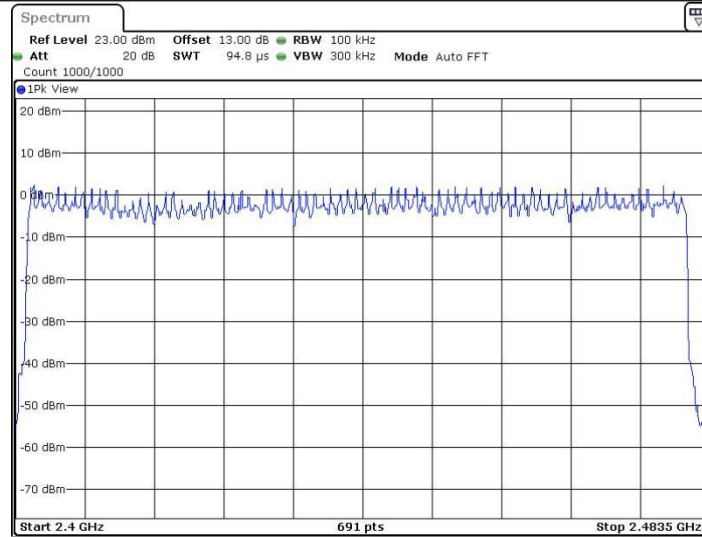
### Measurement Data

| Mode          | Hopping channel numbers | Limit     |
|---------------|-------------------------|-----------|
| GFSK          | 79                      | $\geq 15$ |
| $\pi/4$ DQPSK | 79                      | $\geq 15$ |
| 8DPSK         | 79                      | $\geq 15$ |



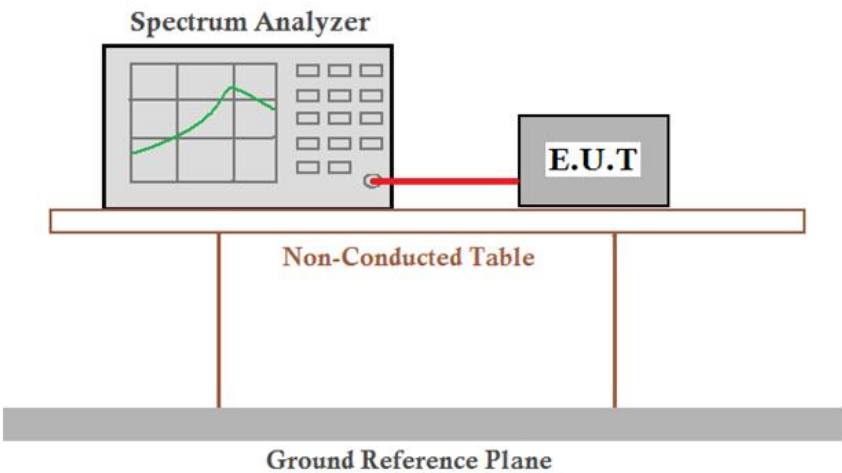
Test plot as follows:





Date: 21.OCT.2024 16:18:17

## 5.7 Dwell Time

|                   |                                                                                                                                          |
|-------------------|------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.247 (a)(1)                                                                                                    |
| Test Method:      | ANSI C63.10:2013                                                                                                                         |
| Test Setup:       |  <p>Remark: Offset=Cable loss+ attenuation factor.</p> |
| Test Mode:        | Hopping transmitting with all kind of modulation and all kind of data type.                                                              |
| Limit:            | 0.4 Second                                                                                                                               |
| Test Results:     | Pass                                                                                                                                     |

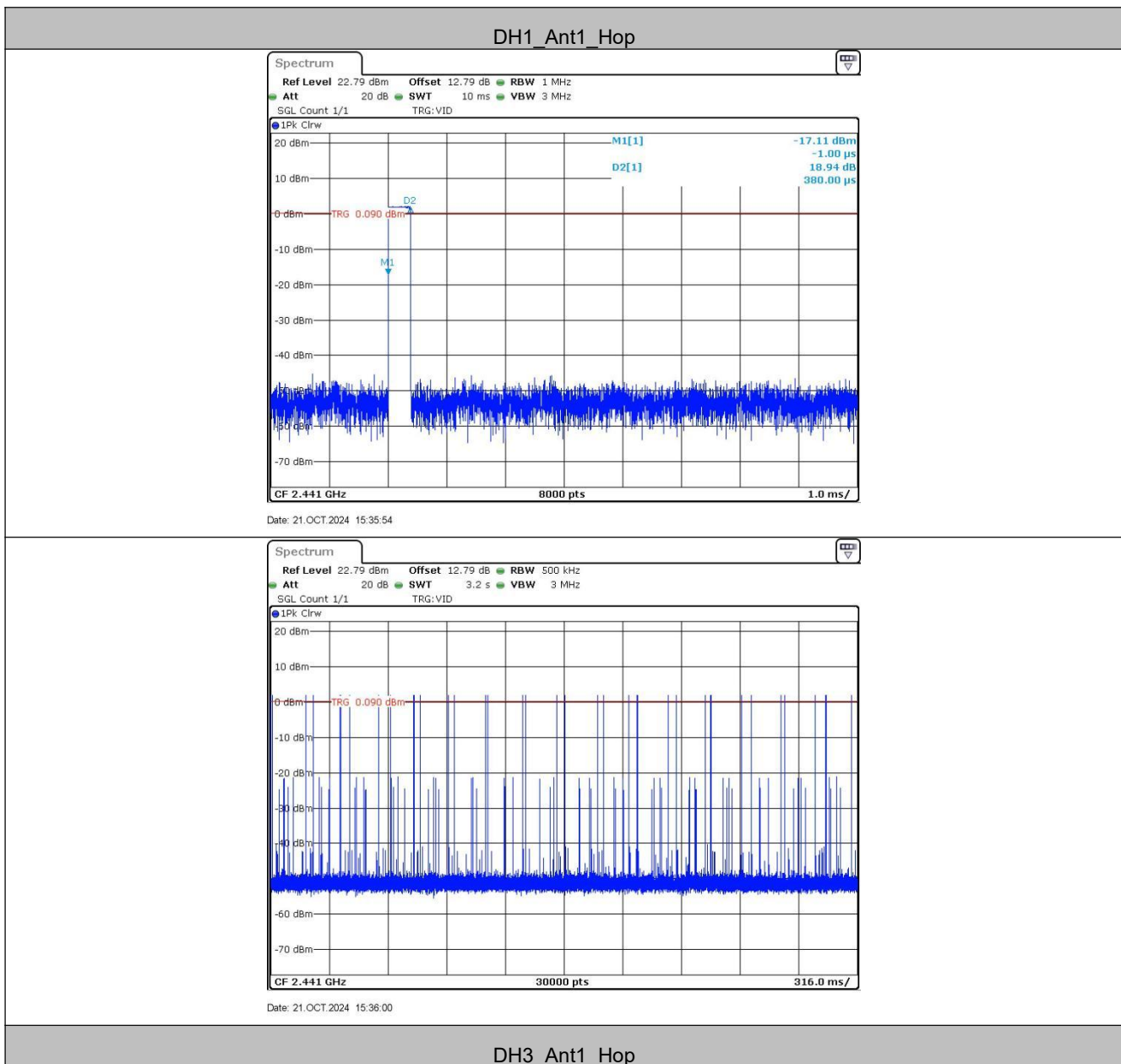
## Measurement Data

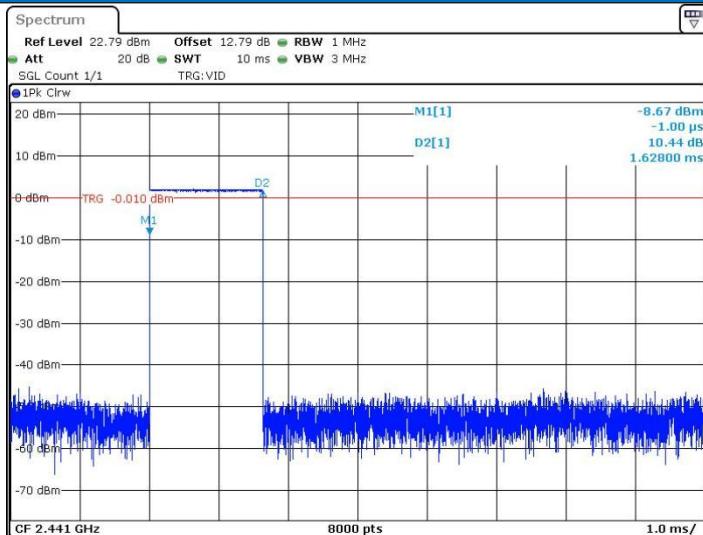
| TestMode | Freq(MHz) | BurstWidth<br>[ms] | TotalHops<br>[Num] | Result[s] | Limit[s] | Verdict |
|----------|-----------|--------------------|--------------------|-----------|----------|---------|
| DH1      | Hop       | 0.380              | 330                | 0.125     | ≤0.4     | PASS    |
| DH3      | Hop       | 1.628              | 190                | 0.309     | ≤0.4     | PASS    |
| DH5      | Hop       | 2.868              | 90                 | 0.258     | ≤0.4     | PASS    |
| 2DH1     | Hop       | 0.389              | 330                | 0.128     | ≤0.4     | PASS    |
| 2DH3     | Hop       | 1.631              | 160                | 0.261     | ≤0.4     | PASS    |
| 2DH5     | Hop       | 2.899              | 90                 | 0.261     | ≤0.4     | PASS    |
| 3DH1     | Hop       | 0.388              | 330                | 0.128     | ≤0.4     | PASS    |
| 3DH3     | Hop       | 1.631              | 180                | 0.294     | ≤0.4     | PASS    |
| 3DH5     | Hop       | 2.875              | 110                | 0.316     | ≤0.4     | PASS    |

## Remark:

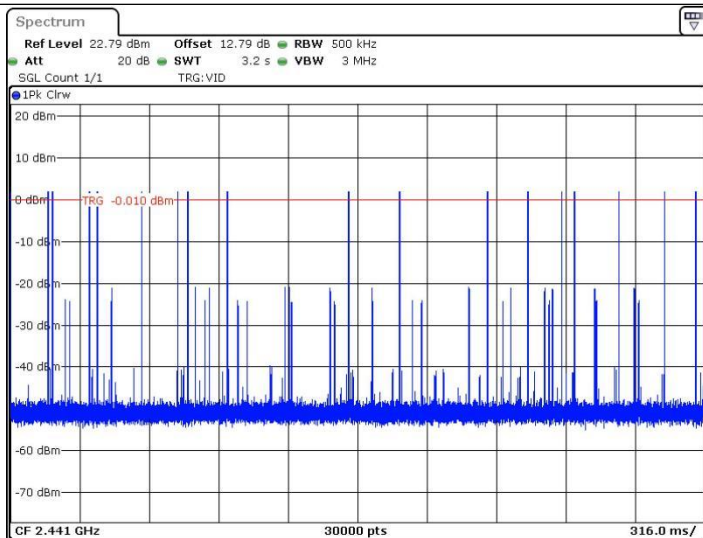
The test period:  $T = 0.4 \text{ Second/Channel} \times 79 \text{ Channel} = 31.6 \text{ s}$

Test plot as follows:



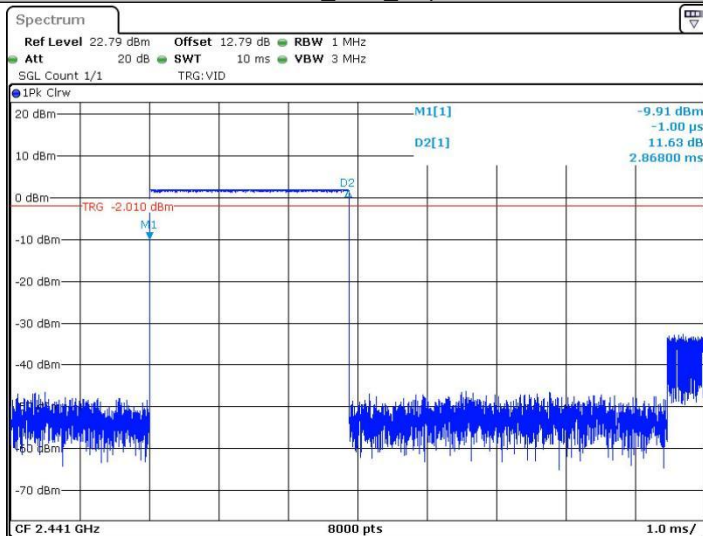


Date: 21.OCT.2024 15:38:41

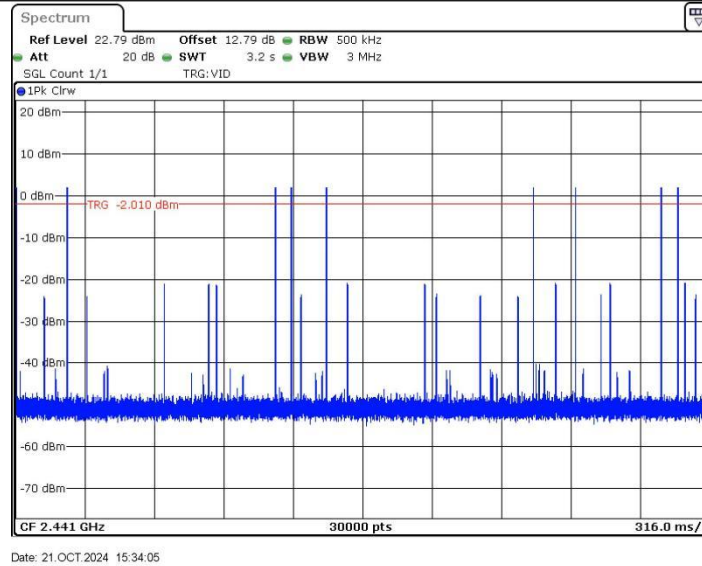


Date: 21.OCT.2024 15:38:47

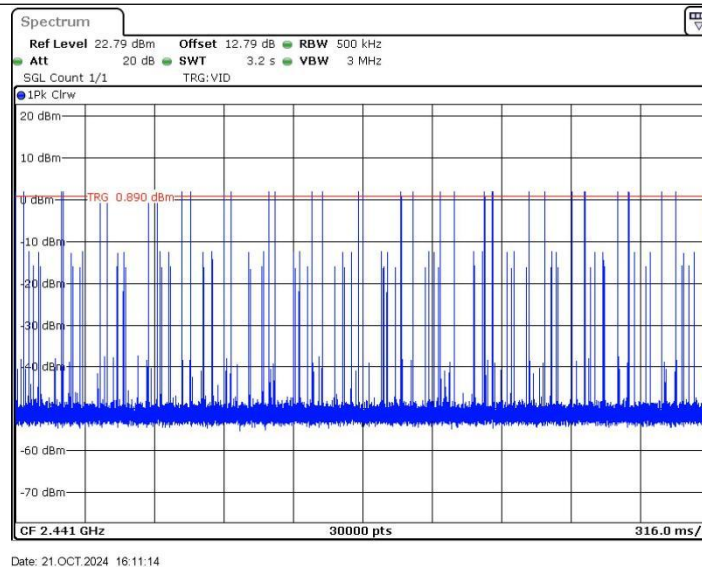
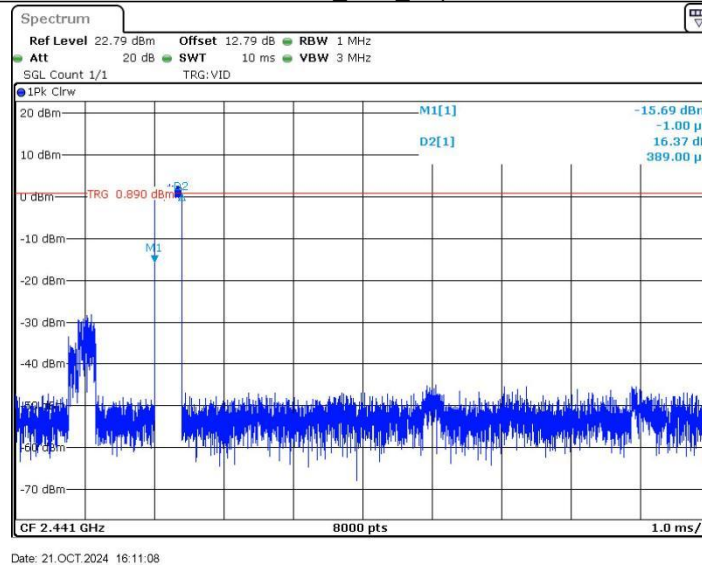
### DH5\_Ant1\_Hop



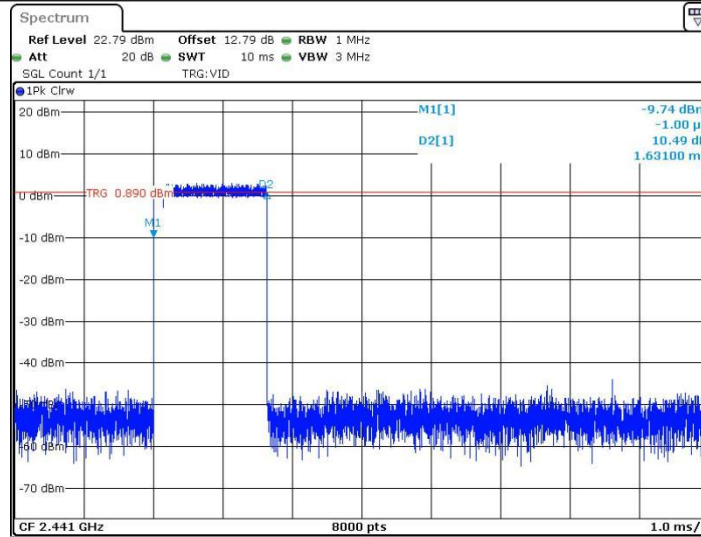
Date: 21.OCT.2024 15:34:00



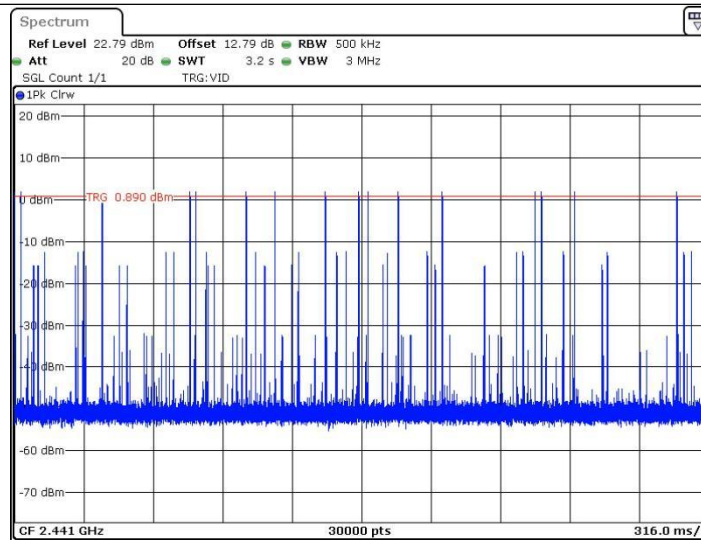
2DH1\_Ant1\_Hop



2DH3\_Ant1\_Hop

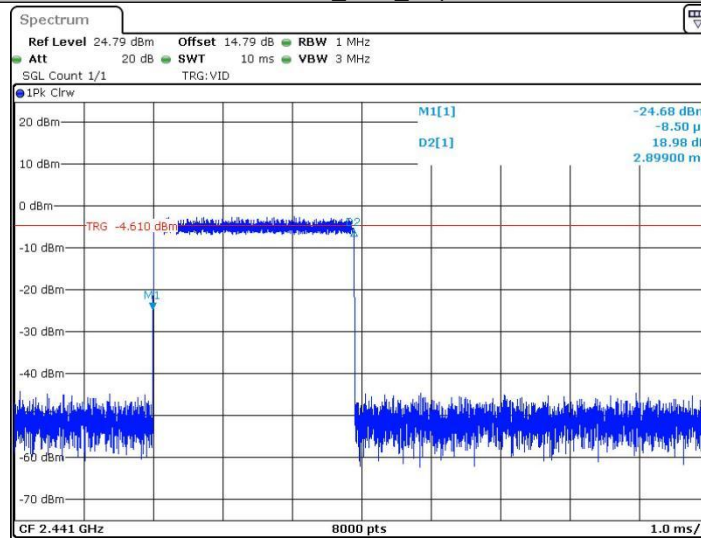


Date: 21.OCT.2024 16:11:39



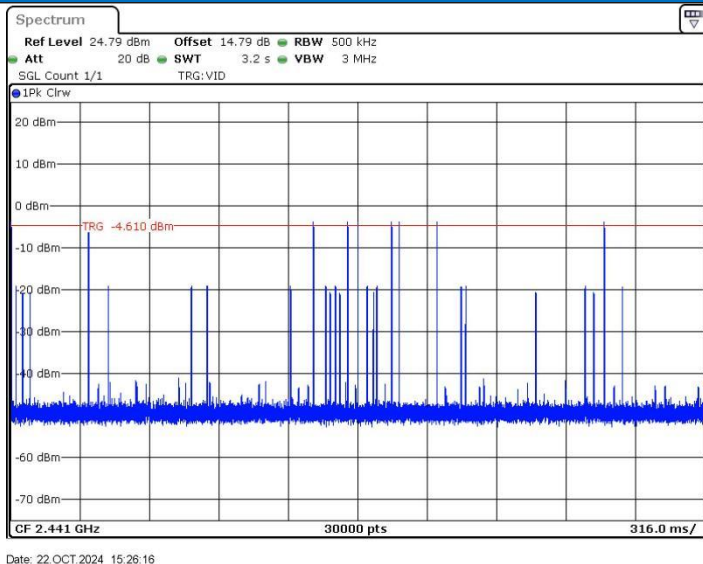
Date: 21.OCT.2024 16:11:45

### 2DH5\_Ant1\_Hop

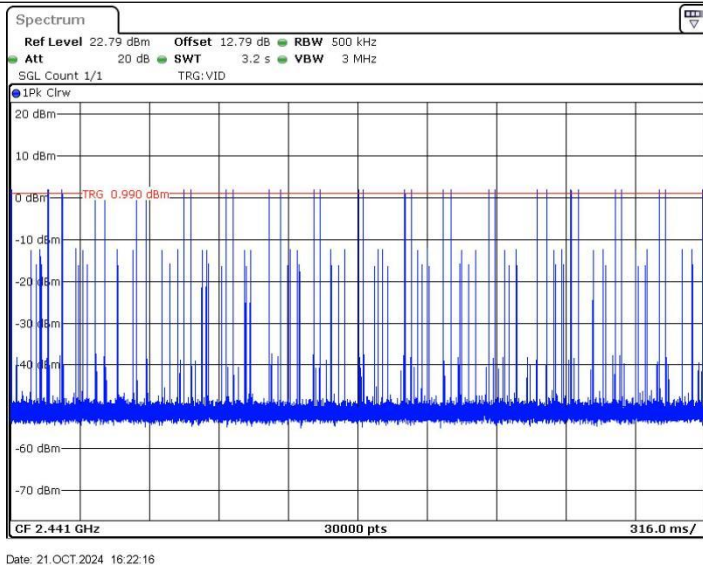
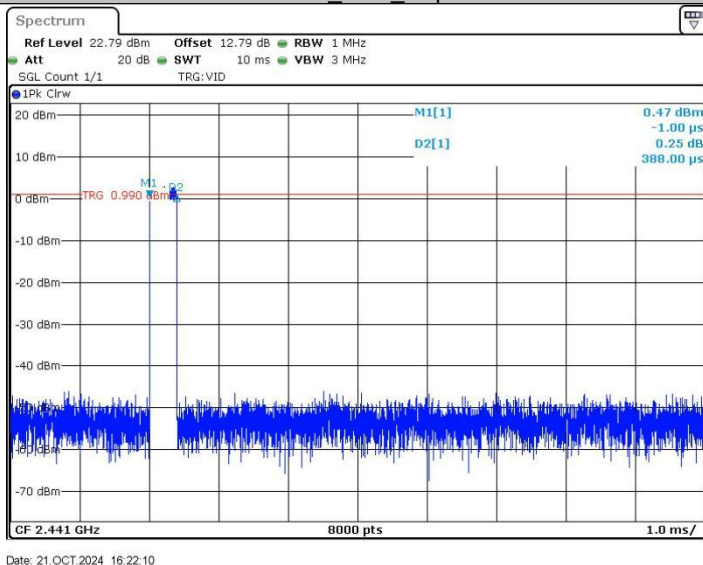


Date: 22.OCT.2024 15:26:10

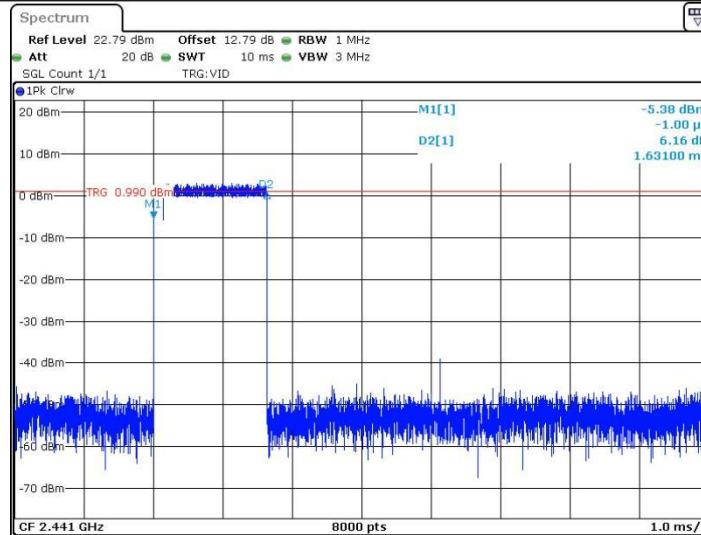




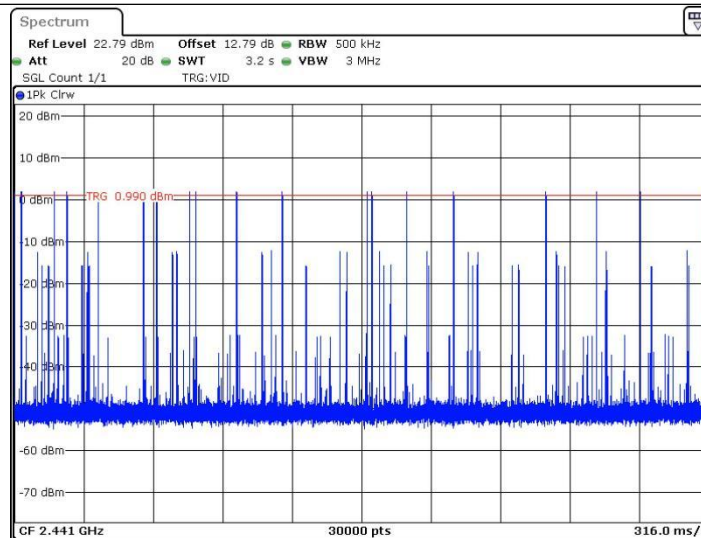
3DH1\_Ant1\_Hop



3DH3\_Ant1\_Hop

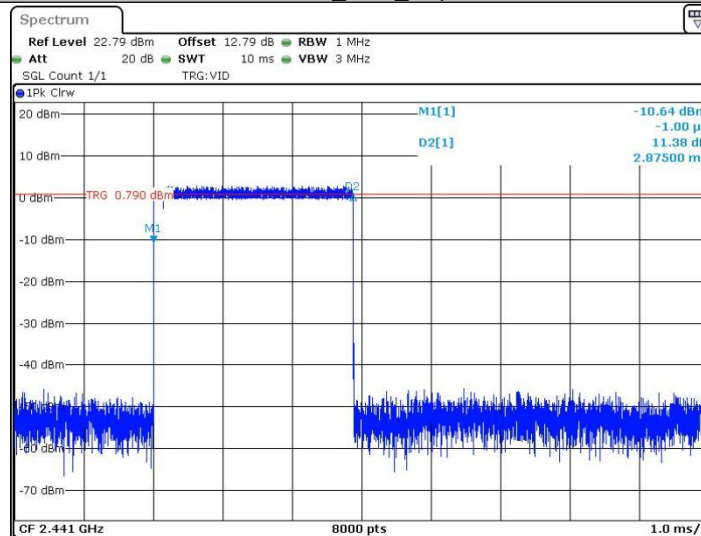


Date: 21.OCT.2024 16:23:50

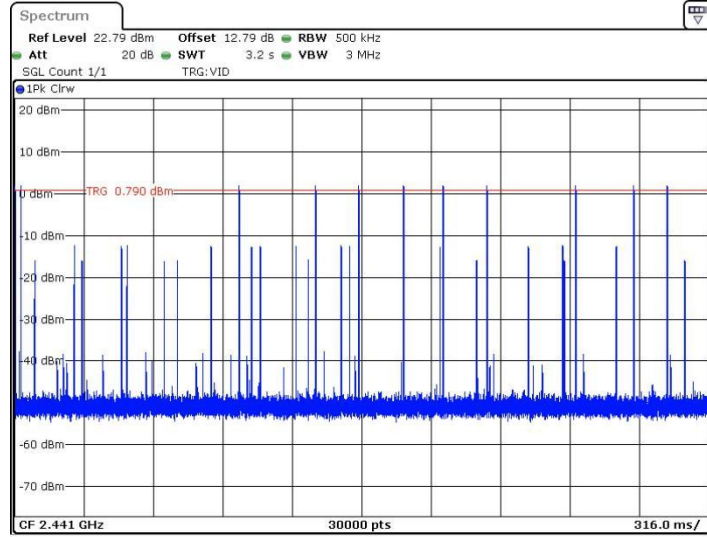


Date: 21.OCT.2024 16:23:56

### 3DH5\_Ant1\_Hop

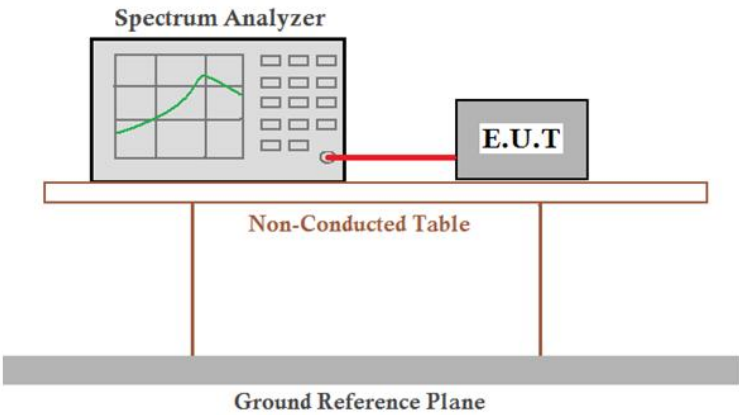


Date: 21.OCT.2024 16:18:33



Date: 21.OCT.2024 16:18:38

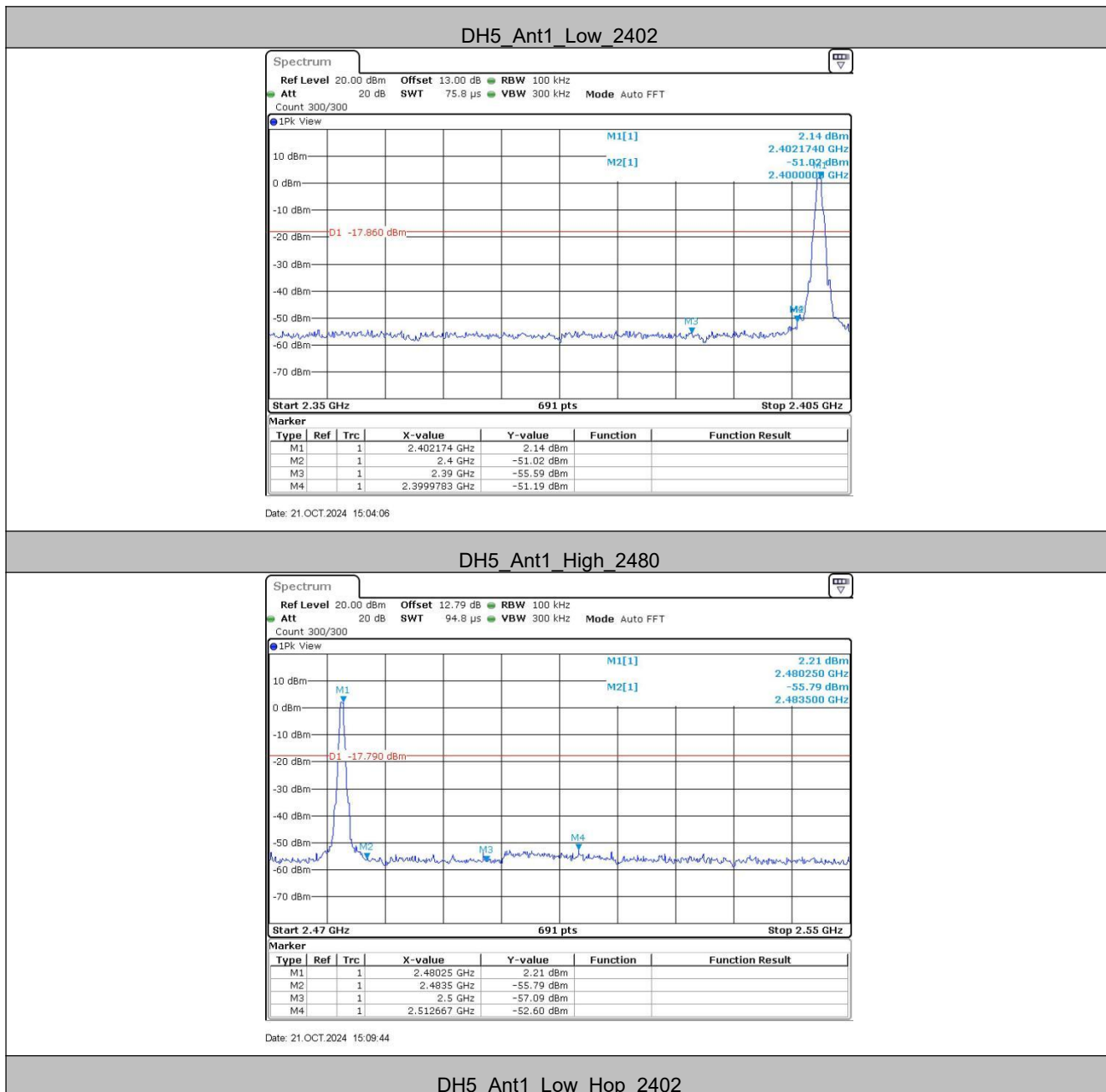
## 5.8 Band-edge for RF Conducted Emissions

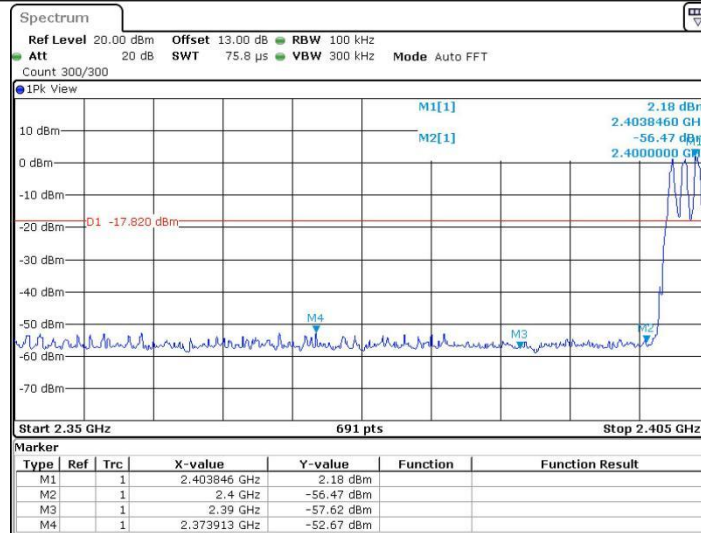
|                        |                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (d)                                                                                                                                                                                                                                                                                                                                                      |
| Test Method:           | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                        |
| Test Setup:            |  <p>Remark: <math>Offset = \text{cable loss} + \text{attenuation factor}</math>.</p>                                                                                                                                                                                                                  |
| Limit:                 | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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, based on either an RF conducted or a radiated measurement. |
| Exploratory Test Mode: | Hopping and Non-hopping transmitting with all kind of modulation and all kind of data type                                                                                                                                                                                                                                                                                              |
| Final Test Mode:       | Only the worst case is recorded in the report.                                                                                                                                                                                                                                                                                                                                          |
| Test Results:          | Pass                                                                                                                                                                                                                                                                                                                                                                                    |

Measurement Data

| TestMode | ChName | Freq(MHz) | RefLevel<br>[dBm] | Result<br>[dBm] | Limit<br>[dBm] | Verdict |
|----------|--------|-----------|-------------------|-----------------|----------------|---------|
| DH5      | Low    | 2402      | 2.14              | -51.19          | $\leq -17.86$  | PASS    |
|          | High   | 2480      | 2.21              | -52.6           | $\leq -17.79$  | PASS    |
|          | Low    | Hop_2402  | 2.18              | -52.67          | $\leq -17.82$  | PASS    |
|          | High   | Hop_2480  | 1.29              | -51.04          | $\leq -18.71$  | PASS    |
| 2DH5     | Low    | 2402      | 2.39              | -52.44          | $\leq -17.61$  | PASS    |
|          | High   | 2480      | 2.22              | -53.24          | $\leq -17.78$  | PASS    |
|          | Low    | Hop_2402  | 2.50              | -52.16          | $\leq -17.5$   | PASS    |
|          | High   | Hop_2480  | 1.89              | -52.26          | $\leq -18.11$  | PASS    |
| 3DH5     | Low    | 2402      | 2.44              | -48.44          | $\leq -17.56$  | PASS    |
|          | High   | 2480      | 2.29              | -52.12          | $\leq -17.71$  | PASS    |
|          | Low    | Hop_2402  | -0.02             | -52.98          | $\leq -20.02$  | PASS    |
|          | High   | Hop_2480  | 2.20              | -52.26          | $\leq -17.8$   | PASS    |

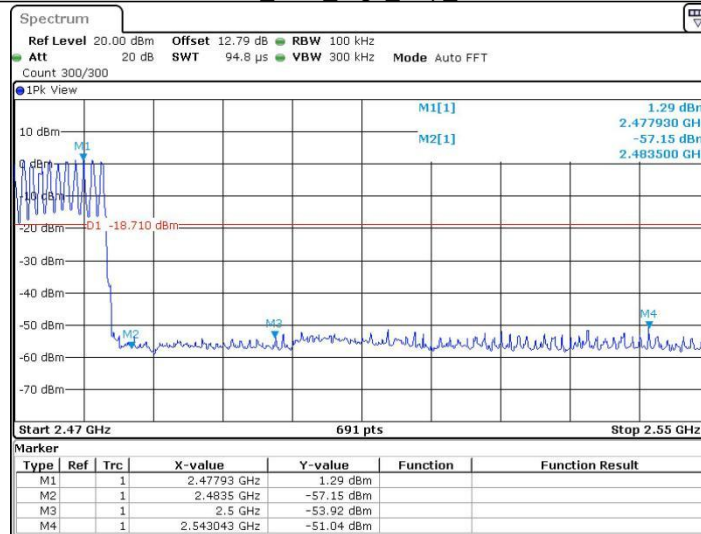
Test plot as follows:





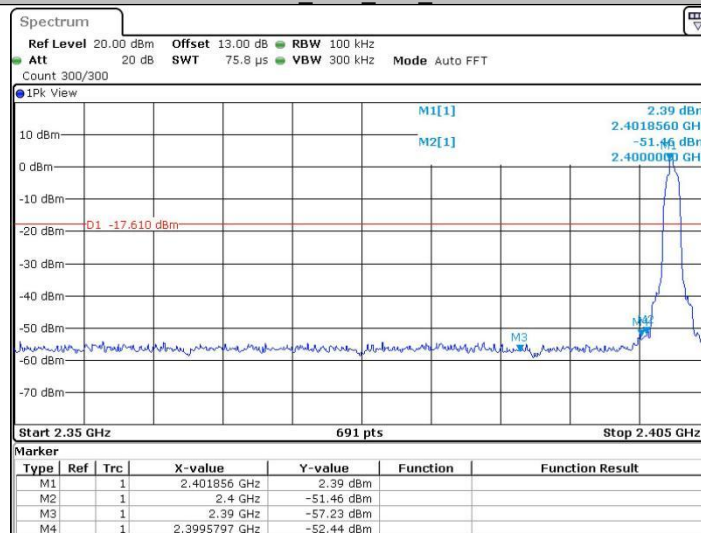
Date: 21.OCT.2024 15:30:12

### DH5\_Ant1\_High\_Hop\_2480



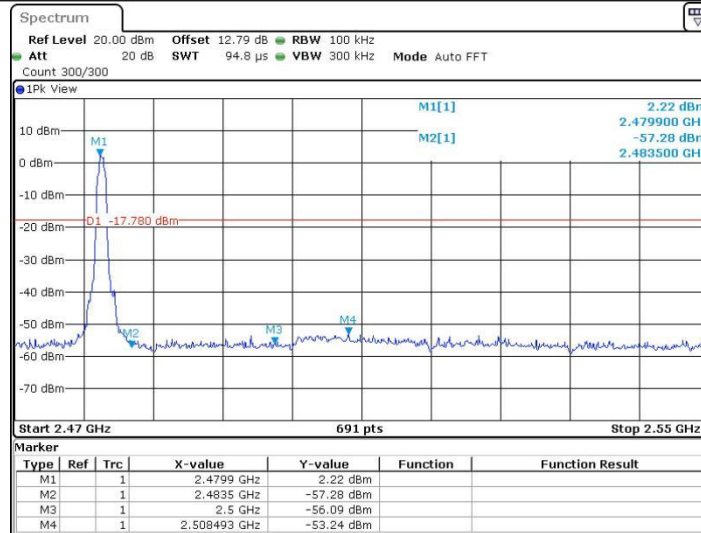
Date: 21.OCT.2024 15:43:26

### 2DH5\_Ant1\_Low\_2402



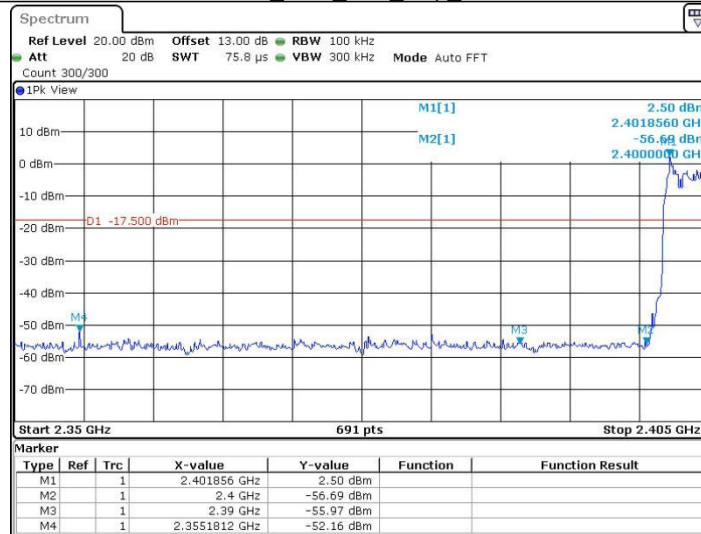
Date: 21.OCT.2024 15:13:14

### 2DH5\_Ant1\_High\_2480



Date: 21.OCT.2024 15:21:12

### 2DH5\_Ant1\_Low\_Hop\_2402



Date: 21.OCT.2024 15:46:29

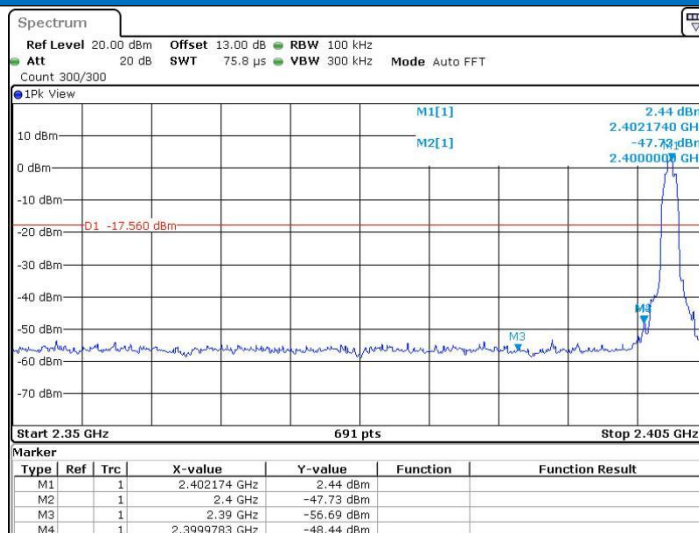
### 2DH5\_Ant1\_High\_Hop\_2480



Date: 21.OCT.2024 16:12:30

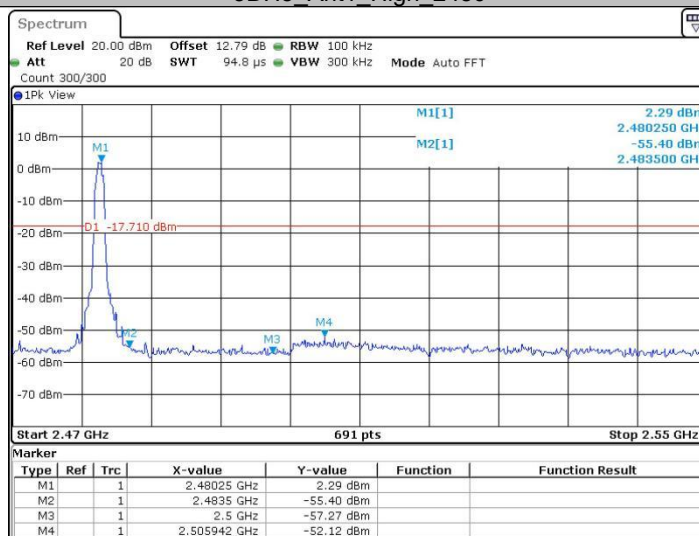
### 3DH5\_Ant1\_Low\_2402





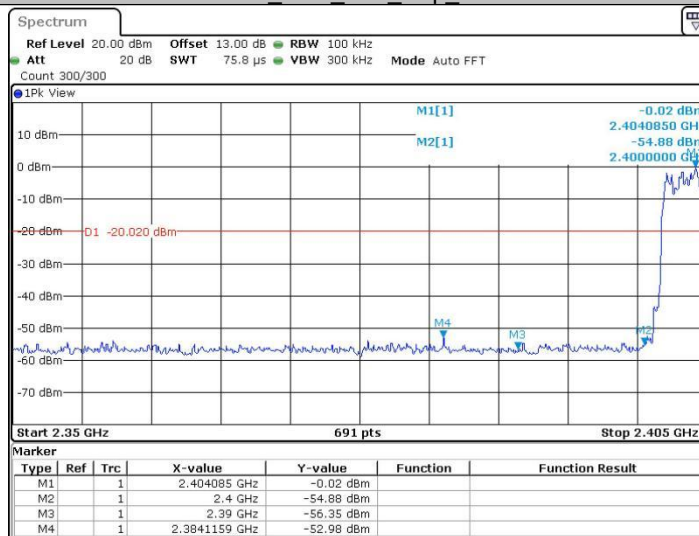
Date: 21.OCT.2024 15:23:50

### 3DH5\_Ant1\_High\_2480



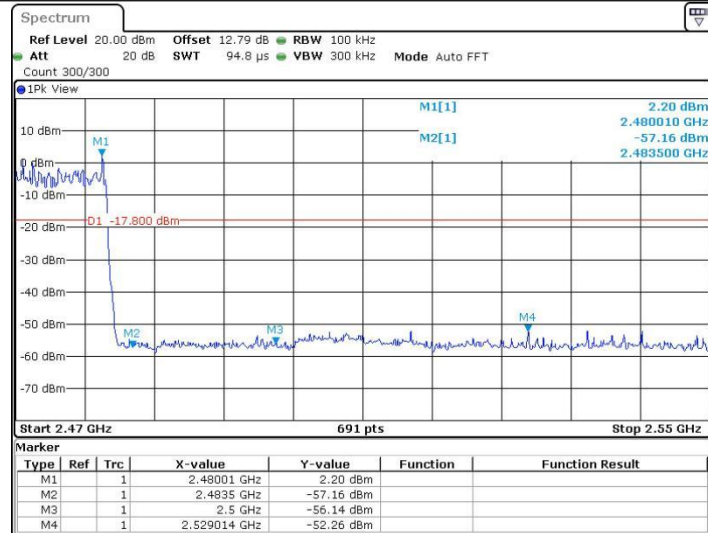
Date: 21.OCT.2024 15:27:50

### 3DH5\_Ant1\_Low\_Hop\_2402



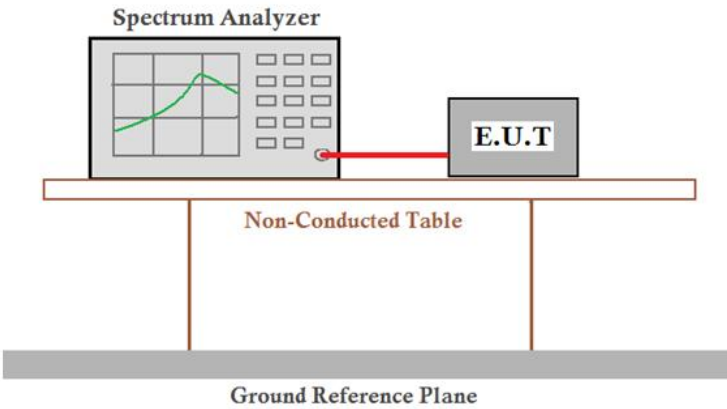
Date: 21.OCT.2024 16:13:54

### 3DH5\_Ant1\_High\_Hop\_2480



Date: 21.OCT.2024 16:24:36

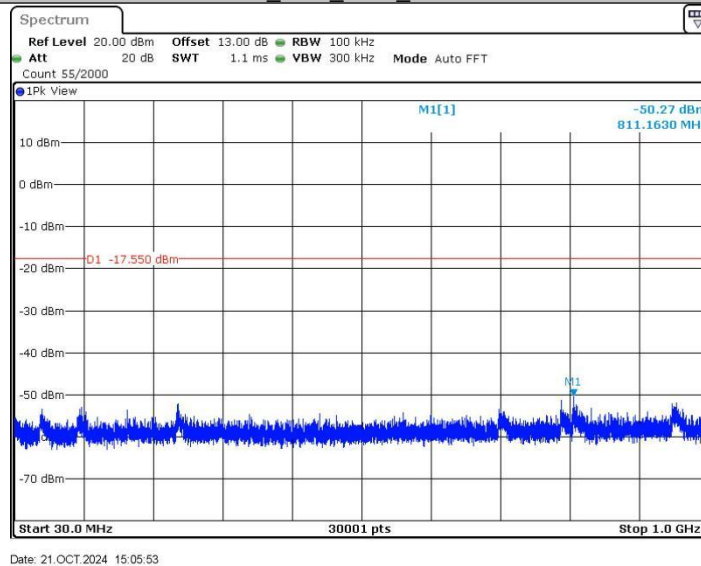
## 5.9 Spurious RF Conducted Emissions

|                        |                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement:      | 47 CFR Part 15C Section 15.247 (d)                                                                                                                                                                                                                                                                                                                                                      |
| Test Method:           | ANSI C63.10:2013                                                                                                                                                                                                                                                                                                                                                                        |
| Test Setup:            |  <p>Remark: Offset=cable loss+ attenuation factor.</p>                                                                                                                                                                                                                                                |
| Limit:                 | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum intentional radiator is 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, based on either an RF conducted or a radiated measurement. |
| Exploratory Test Mode: | Non-hopping transmitting with all kind of modulation and all kind of data type                                                                                                                                                                                                                                                                                                          |
| Final Test Mode:       | Through Pre-scan, find the DH5 of data type is the worst case of GFSK modulation type, 2-DH5 of data type is the worst case of $\pi/4$ DQPSK modulation type, 3-DH5 of data type is the worst case of 8DPSK modulation type.                                                                                                                                                            |
| Test Results:          | Pass                                                                                                                                                                                                                                                                                                                                                                                    |

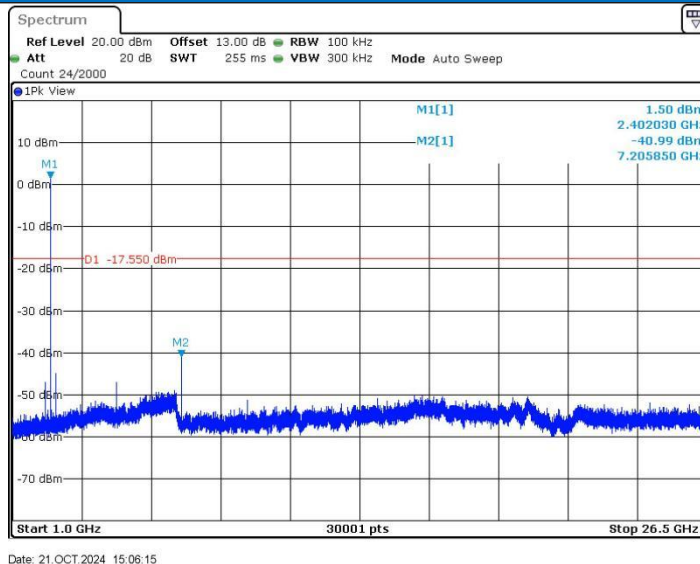
DH5\_Ant1\_2402\_0~Reference



DH5\_Ant1\_2402\_30~1000



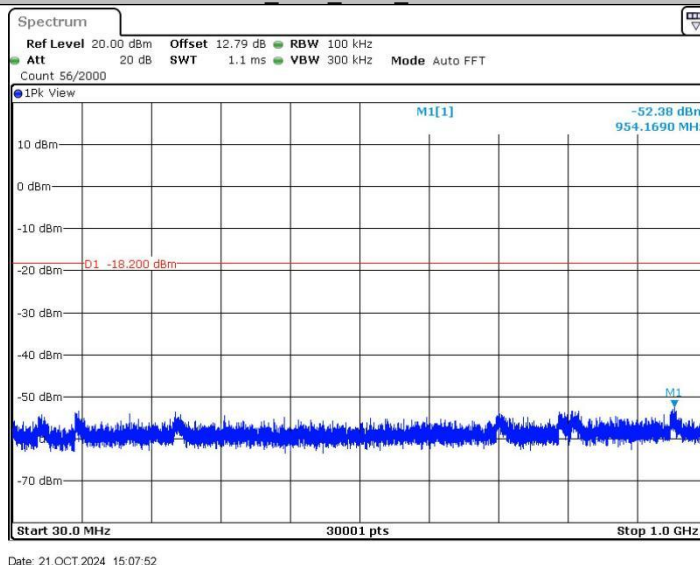
DH5\_Ant1\_2402\_1000~26500



DH5\_Ant1\_2441\_0~Reference



DH5\_Ant1\_2441\_30~1000



DH5\_Ant1\_2441\_1000~26500