

# TEST REPORT

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TONG, KL, HONG KONG  
Report Number: 2401X94796E-RFB  
FCC ID: 2BK5Y-JD-668BT  
IC: 33056-JD668BT

## Test Standard (s)

FCC PART 15.247; RSS-GEN ISSUE 5, FEBRUARY 2021 AMENDMENT 2;  
RSS-247 ISSUE 3, AUGUST 2023

## Sample Description

Product Type: Thermal Label Printer  
Model No.: JD-668BT  
Multiple Model(s) No.: JD-668Pro  
Trade Mark: N/A  
Date Received: 2024/09/18  
Issue Date: 2024/11/18

|              |       |
|--------------|-------|
| Test Result: | Pass▲ |
|--------------|-------|

▲ In the configuration tested, the EUT complied with the standards above.

## Prepared and Checked By:

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Ekko Wu  
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## Approved By:

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Jimmy Xiao  
EMC Manager

Note: The information marked # is provided by the applicant, the laboratory is not responsible for its authenticity and this information can affect the validity of the result in the test report. Customer model name, addresses, names, trademarks etc. are included.

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DOCUMENT REVISION HISTORY

| Revision Number | Report Number   | Description of Revision | Date of Revision |
|-----------------|-----------------|-------------------------|------------------|
| 0               | 2401X94796E-RFB | Original Report         | 2024/11/18       |

## GENERAL INFORMATION

### Product Description for Equipment under Test (EUT)

|                                                                                                                                                                                                                    |                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| HVIN                                                                                                                                                                                                               | JD-668BT, JD-668Pro                                                                                           |
| FVIN                                                                                                                                                                                                               | N/A                                                                                                           |
| Product                                                                                                                                                                                                            | Thermal Label Printer                                                                                         |
| Tested Model                                                                                                                                                                                                       | JD-668BT                                                                                                      |
| Multiple Model(s)                                                                                                                                                                                                  | JD-668Pro                                                                                                     |
| Frequency Range                                                                                                                                                                                                    | Bluetooth: 2402-2480MHz                                                                                       |
| Transmit Power                                                                                                                                                                                                     | 1.63dBm                                                                                                       |
| Modulation Technique                                                                                                                                                                                               | Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK                                                                        |
| Antenna Specification <sup>#</sup>                                                                                                                                                                                 | -4.73dBi (provided by the applicant)                                                                          |
| Voltage Range                                                                                                                                                                                                      | DC 24V from adapter                                                                                           |
| Sample serial number                                                                                                                                                                                               | 2RMG-2 for Conducted and Radiated Emissions Test<br>2RMG-1 for RF Conducted Test (Assigned by BACL, Shenzhen) |
| Sample/EUT Status                                                                                                                                                                                                  | Good condition                                                                                                |
| Adapter Information                                                                                                                                                                                                | Model: GMB36-240150-1D<br>Input: AC 100-240V, 50/60Hz, 1.5A<br>Output: DC 24.0V, 1.5A, 36.0W                  |
| Note: The Multiple models are electrically identical with the test model except for model name and Color. Please refer to the declaration letter <sup>#</sup> for more detail, which was provided by manufacturer. |                                                                                                               |

### Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules, section 15.203, 15.205, 15.207, 15.209, 15.247 rules and RSS-247 Issue 3, August 2023, RSS-GEN Issue 5, Feb. 2021 Amendment 2 of the Innovation, Science and Economic Development Canada rules.

### Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices and RSS-247 Issue 3, August 2023, RSS-GEN Issue 5, Feb. 2021 Amendment 2 of the Innovation, Science and Economic Development Canada rules.

All emissions measurement was performed at Bay Area Compliance Laboratories Corp. (Shenzhen). The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

Each test item follows test standards and with no deviation.

## Measurement Uncertainty

| Parameter                          |                             | Uncertainty                            |
|------------------------------------|-----------------------------|----------------------------------------|
| Occupied Channel Bandwidth         |                             | 109.2kHz(k=2, 95% level of confidence) |
| RF output power, conducted         |                             | 0.86dB(k=2, 95% level of confidence)   |
| AC Power Lines Conducted Emissions | 9kHz-150kHz                 | 3.63dB(k=2, 95% level of confidence)   |
|                                    | 150kHz-30MHz                | 3.66dB(k=2, 95% level of confidence)   |
| Radiated Emissions                 | 0.009MHz~30MHz              | 3.60dB(k=2, 95% level of confidence)   |
|                                    | 30MHz~200MHz (Horizontal)   | 5.32dB(k=2, 95% level of confidence)   |
|                                    | 30MHz~200MHz (Vertical)     | 5.43dB(k=2, 95% level of confidence)   |
|                                    | 200MHz~1000MHz (Horizontal) | 5.77dB(k=2, 95% level of confidence)   |
|                                    | 200MHz~1000MHz (Vertical)   | 5.73dB(k=2, 95% level of confidence)   |
|                                    | 1GHz - 6GHz                 | 5.34dB(k=2, 95% level of confidence)   |
|                                    | 6GHz - 18GHz                | 5.40dB(k=2, 95% level of confidence)   |
|                                    | 18GHz - 40GHz               | 5.64dB(k=2, 95% level of confidence)   |
| Temperature                        |                             | ±1°C                                   |
| Humidity                           |                             | ±1%                                    |
| Supply voltages                    |                             | ±0.4%                                  |

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The Test site used by Bay Area Compliance Laboratories Corp. (Shenzhen) to collect test data is located on the 5F(B-West) , 6F, 7F, the 3rd Phase of Wan Li Industrial Building D, Shihua Rd, FuTian Free Trade Zone, Shenzhen, China.

The lab has been recognized as the FCC accredited lab under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No. : 715558, the FCC Designation No. : CN5045.

The lab has been recognized by Innovation, Science and Economic Development Canada to test to Canadian radio equipment requirements, the CAB identifier: CN0023.

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing in an engineering mode.

| Channel | Frequency (MHz) | Channel | Frequency (MHz) |
|---------|-----------------|---------|-----------------|
| 0       | 2402            | 40      | 2442            |
| 1       | 2403            | 41      | 2443            |
| 2       | 2404            | 42      | 2444            |
| ...     | ...             | ...     | ...             |
| ...     | ...             | ...     | ...             |
| 36      | 2438            | 75      | 2477            |
| 37      | 2439            | 76      | 2478            |
| 38      | 2440            | 77      | 2479            |
| 39      | 2441            | 78      | 2480            |

EUT was tested with Channel 0, 39 and 78.

### EUT Exercise Software

“BR BlueletSuite\_V6\_0.exe”<sup>#</sup> software was used to test and power level is 7<sup>#</sup>. The software and power level was provided by the applicant.

### Special Accessories

No special accessory.

### Equipment Modifications

No modification was made to the EUT tested.

### Support Equipment List and Details

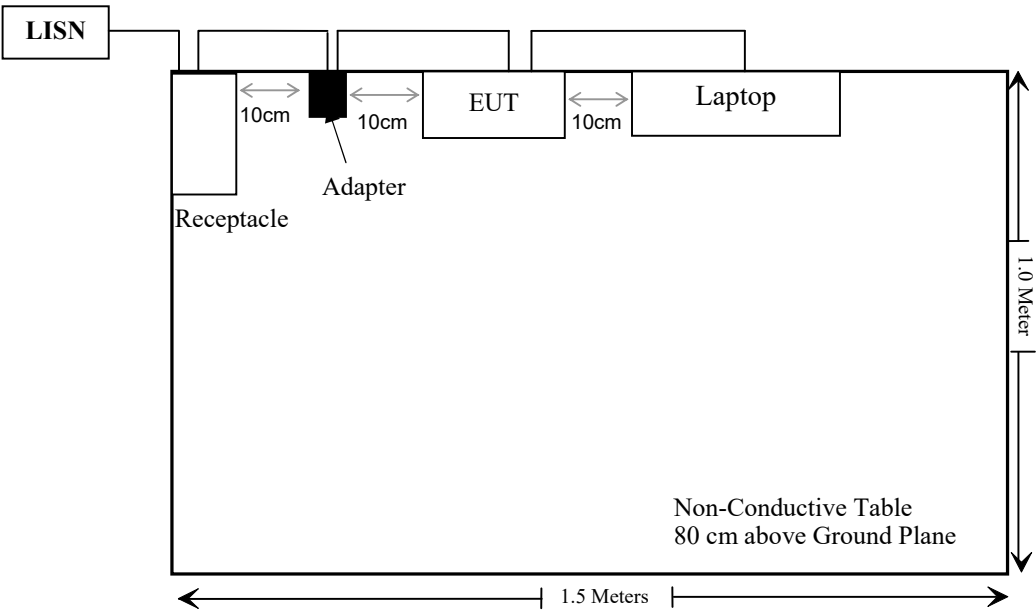
| Manufacturer | Description | Model           | Serial Number |
|--------------|-------------|-----------------|---------------|
| GVE          | Adapter     | GMB36-240150-1D | A7453271587   |
| GREATWALL    | Laptop      | NF50AL          | Unknown       |

External I/O Cable

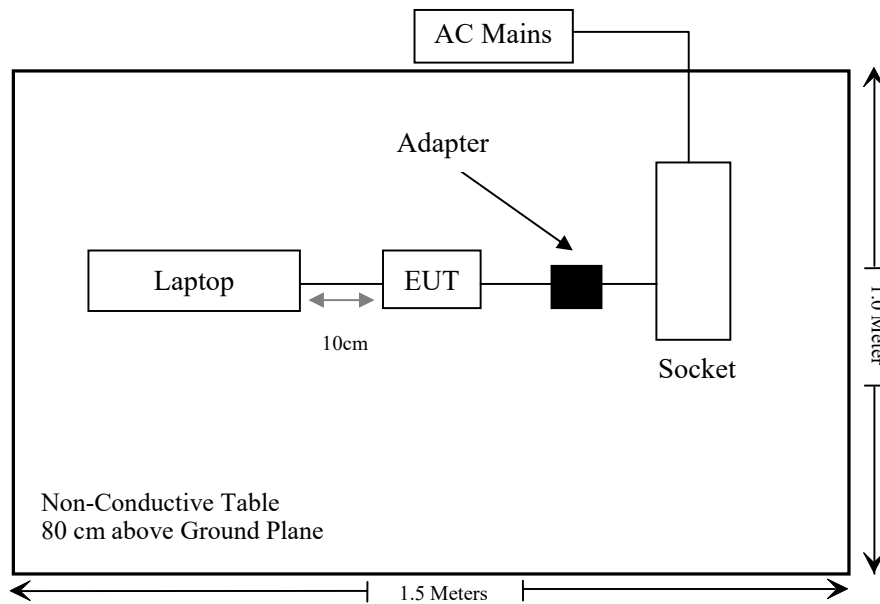
| Cable Description                   | Length (m) | From/Port | To      |
|-------------------------------------|------------|-----------|---------|
| Un-shielding Un-detachable DC Cable | 1.0        | EUT       | Adapter |
| Un-shielding Detachable USB Cable   | 1.0        | EUT       | Laptop  |

Block Diagram of Test Setup

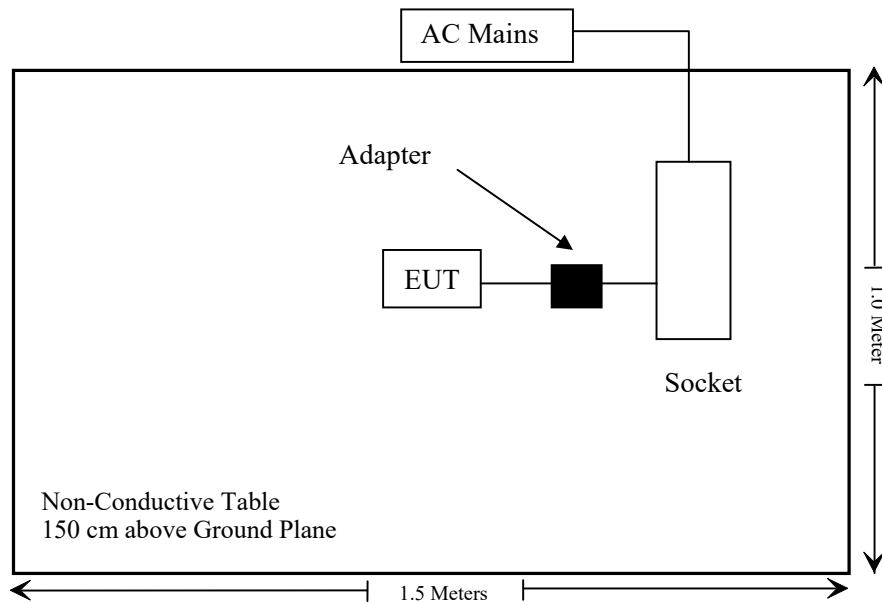
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



**SUMMARY OF TEST RESULTS**

| <b>FCC Rules</b>                 | <b>RSS Rules</b>                | <b>Description of Test</b>                                                                            | <b>Result</b> |
|----------------------------------|---------------------------------|-------------------------------------------------------------------------------------------------------|---------------|
| §2.1091                          | RSS-102 § 2.5.2                 | Maximum Permissible Exposure (MPE) & Exemption Limits for Routine Evaluation – RF Exposure Evaluation | Compliant     |
| FCC §15.203                      | RSS-Gen §6.8                    | Antenna Requirement                                                                                   | Compliant     |
| FCC §15.207(a)                   | RSS-Gen §8.8                    | AC Line Conducted Emissions                                                                           | Compliant     |
| FCC §15.205, §15.209, §15.247(d) | RSS-247 § 5.5, RSS-GEN § 8.10   | Radiated Emissions                                                                                    | Compliant     |
| FCC §15.247(a)(1)                | RSS-247 § 5.1(a), RSS-GEN § 6.7 | 20 dB Emission Bandwidth & 99% Occupied Bandwidth                                                     | Compliant     |
| FCC §15.247(a)(1)                | RSS-247 § 5.1 (b)               | Channel Separation Test                                                                               | Compliant     |
| FCC §15.247(a)(1)(iii)           | RSS-247 § 5.1 (d)               | Time of Occupancy (Dwell Time)                                                                        | Compliant     |
| FCC §15.247(a)(1)(iii)           | RSS-247 § 5.1 (d)               | Quantity of hopping channel Test                                                                      | Compliant     |
| FCC §15.247(b)(1)                | RSS-247 § 5.1(b) & § 5.4(b)     | Peak Output Power Measurement                                                                         | Compliant     |
| FCC §15.247(d)                   | RSS-247 § 5.5                   | Band edges                                                                                            | Compliant     |

**TEST EQUIPMENT LIST**

| Manufacturer                   | Description                       | Model             | Serial Number          | Calibration Date | Calibration Due Date |
|--------------------------------|-----------------------------------|-------------------|------------------------|------------------|----------------------|
| <b>Conducted Emission Test</b> |                                   |                   |                        |                  |                      |
| Rohde & Schwarz                | EMI Test Receiver                 | ESCI              | 101120                 | 2024/01/16       | 2025/01/15           |
| Rohde & Schwarz                | LISN                              | ENV216            | 101613                 | 2024/01/16       | 2025/01/15           |
| Rohde & Schwarz                | Transient Limiter                 | ESH3Z2            | DE25985                | 2024/05/21       | 2025/05/20           |
| Unknown                        | CE Cable                          | Unknown           | UF A210B-1-0720-504504 | 2024/05/21       | 2025/05/20           |
| Audix                          | EMI Test software                 | E3                | 191218(V9)             | NCR              | NCR                  |
| <b>Radiated Emission Test</b>  |                                   |                   |                        |                  |                      |
| Rohde & Schwarz                | EMI Test Receiver                 | ESR3              | 102455                 | 2024/01/16       | 2025/01/15           |
| Sonoma instrument              | Pre-amplifier                     | 310 N             | 186238                 | 2024/05/21       | 2025/05/20           |
| Sunol Sciences                 | Broadband Antenna                 | JB1               | A040904-1              | 2023/07/20       | 2026/07/19           |
| Unknown                        | Cable                             | Chamber A Cable 1 | N/A                    | 2024/06/18       | 2025/06/17           |
| Unknown                        | Cable                             | XH500C            | J-10M-A                | 2024/06/18       | 2025/06/17           |
| BACL                           | Active Loop Antenna               | 1313-1A           | 4031911                | 2024/05/14       | 2027/05/13           |
| Unknown                        | Cable                             | 2Y194             | 0735                   | 2024/05/21       | 2025/05/20           |
| Unknown                        | Cable                             | PNG214            | 1354                   | 2024/05/21       | 2025/05/20           |
| Audix                          | EMI Test software                 | E3                | 19821b(V9)             | NCR              | NCR                  |
| Rohde & Schwarz                | Spectrum Analyzer                 | FSV40             | 101605                 | 2024/03/27       | 2025/03/26           |
| COM-POWER                      | Pre-amplifier                     | PA-122            | 181919                 | 2024/06/18       | 2025/06/17           |
| Schwarzbeck                    | Horn Antenna                      | BBHA9120D(1201)   | 1143                   | 2023/07/26       | 2026/07/25           |
| Unknown                        | RF Cable                          | KMSE              | 735                    | 2024/06/18       | 2025/06/17           |
| Unknown                        | RF Cable                          | UFA147            | 219661                 | 2024/06/18       | 2025/06/17           |
| Unknown                        | RF Cable                          | XH750A-N          | J-10M                  | 2024/06/18       | 2025/06/17           |
| JD                             | Multiplex Switch Test Control Set | DT7220FSU         | DQ77926                | 2024/06/18       | 2025/06/17           |
| Rohde & Schwarz                | Spectrum Analyzer                 | FSV40             | 101605                 | 2024/03/27       | 2025/03/26           |
| A.H.System                     | Pre-amplifier                     | PAM-1840VH        | 190                    | 2024/06/18       | 2025/06/17           |
| Electro-Mechanics Co           | Horn Antenna                      | 3116              | 9510-2270              | 2023/09/18       | 2026/09/17           |
| UTIFLEX                        | RF Cable                          | NO. 13            | 232308-001             | 2024/06/18       | 2025/06/17           |
| Audix                          | EMI Test software                 | E3                | 191218(V9)             | NCR              | NCR                  |

| Manufacturer      | Description       | Model    | Serial Number | Calibration Date | Calibration Due Date |
|-------------------|-------------------|----------|---------------|------------------|----------------------|
| RF Conducted Test |                   |          |               |                  |                      |
| Tonscend          | RF control Unit   | JS0806-2 | 19D8060154    | 2024/08/06       | 2025/08/05           |
| Unknown           | RF Cable          | 65475    | 01670515      | 2024/06/27       | 2025/06/26           |
| Rohde & Schwarz   | Spectrum Analyzer | FSV40    | 101473        | 2024/01/16       | 2025/01/15           |
| Unknown           | 10dB Attenuator   | Unknown  | F-03-EM190    | 2024/06/27       | 2025/06/26           |

\* **Statement of Traceability:** Bay Area Compliance Laboratories Corp. (Shenzhen) attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

## FCC §15.247 (i) & §1.1307 (b) (3) & §2.1091- MAXIMUM PERMISSIBLE EXPOSURE (MPE)

### Applicable Standard

According to subpart 15.247 (i) and subpart 2.1091 systems operating under the provisions of this section shall be operated in a manner that ensures the public is not exposed to RF energy level in excess of the communication guidelines.

According to KDB 447498 D04 Interim General RF Exposure Guidance

MPE-Based Exemption:

General frequency and separation-distance dependent MPE-based effective radiated power(ERP) thresholds are in Table B.1 [Table 1 of § 1.1307(b)(3)(i)(C)] to support an exemption from further evaluation from 300 kHz through 100 GHz.

Table 1 to § 1.1307(b)(3)(i)(C) - Single RF Sources Subject to Routine Environmental Evaluation

| RF Source frequency (MHz) | Threshold ERP (watts) |
|---------------------------|-----------------------|
| 0.3-1.34                  | $1,920 R^2$ .         |
| 1.34-30                   | $3,450 R^2/f^2$ .     |
| 30-300                    | $3.83 R^2$ .          |
| 300-1,500                 | $0.0128 R^2f$ .       |
| 1,500-100,000             | $19.2R^2$ .           |

R is the minimum separation distance in meters

f = frequency in MHz

### Result

| Mode      | Frequency (MHz) | Tune up conducted power <sup>#</sup> | Antenna Gain <sup>#</sup> |       | ERP   |        | Evaluation Distance (m) | ERP Limit (W) |
|-----------|-----------------|--------------------------------------|---------------------------|-------|-------|--------|-------------------------|---------------|
|           |                 | (dBm)                                | (dBi)                     | (dBd) | (dBm) | (W)    |                         |               |
| Bluetooth | 2402-2480       | 2.0                                  | -4.73                     | -6.88 | -4.88 | 0.0003 | 0.2                     | 0.768         |

Note: The tune up conducted power and antenna gain was declared by the applicant.

To maintain compliance with the FCC's RF exposure guidelines, place the equipment at least 20cm from nearby persons.

**Result: Compliant.**

## **RSS-102 § 2.5.2 - EXEMPTION LIMITS FOR ROUTINE EVALUATION-RF EXPOSURE EVALUATION**

### **Applicable Standard**

According to RSS-102 Issue 5 § (2.5.2):

RF exposure evaluation is required if the separation distance between the user and/or bystander and the device's radiating element is greater than 20 cm, except when the device operates as follows:

- below 20 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 1 W (adjusted for tune-up tolerance);
- at or above 20 MHz and below 48 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $4.49/f^{0.5}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 48 MHz and below 300 MHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 0.6 W (adjusted for tune-up tolerance);
- at or above 300 MHz and below 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than  $1.31 \times 10^{-2} f^{0.6834}$  W (adjusted for tune-up tolerance), where  $f$  is in MHz;
- at or above 6 GHz and the source-based, time-averaged maximum e.i.r.p. of the device is equal to or less than 5 W (adjusted for tune-up tolerance). In these cases, the information contained in the RF exposure technical brief may be limited to information that demonstrates how the e.i.r.p. was derived.

### **Result**

#### **Calculated Data:**

The max tune-up conducted output power is 2.0dBm, antenna gain is -4.73dBi.

Time-averaged maximum e.i.r.p. of the device is 2.0dBm -4.73dBi = -2.73dBm = 0.0005 W

The worst case is  $f = 2402$  MHz:

The limit is  $1.31 \times 10^{-2} f^{0.6834}$  W = 2.68W

$0.0005\text{W} < 2.68\text{W}$

**So the RF Exposure evaluation can be exempted.**

## **FCC §15.203 & RSS-GEN §6.8 - ANTENNA REQUIREMENT**

### **Applicable Standard**

According to § 15.203, an intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the user of a standard antenna jack or electrical connector is prohibited.

Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

The structure and application of the EUT were analyzed to determine compliance with section §15.203 of the rules. §15.203 state that the subject device must meet the following criteria:

- a. Antenna must be permanently attached to the unit.
- b. Antenna must use a unique type of connector to attach to the EUT.
- c. Unit must be professionally installed, and installer shall be responsible for verifying that the correct antenna is employed with the unit.

And according to FCC 47 CFR section 15.247 (b), if the transmitting antennas of directional gain greater than 6dBi are used, the power shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

The applicant for equipment certification shall provide a list of all antenna types that may be used with the transmitter, where applicable (i.e. for transmitters with detachable antenna), indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna. The test report shall demonstrate the compliance of the transmitter with the limit for maximum equivalent isotropically radiated power (e.i.r.p.) specified in the applicable RSS, when the transmitter is equipped with any antenna type, selected from this list.

For expediting the testing, measurements may be performed using only the antenna with highest gain of each combination of transmitter and antenna type, with the transmitter output power set at the maximum level. However, the transmitter shall comply with the applicable requirements under all operational conditions and when in combination with any type of antenna from the list provided in the test report (and in the notice to be included in the user manual, provided below).

When measurements at the antenna port are used to determine the RF output power, the effective gain of the device's antenna shall be stated, based on a measurement or on data from the antenna's manufacturer.

The test report shall state the RF power, output power setting and spurious emission measurements with each antenna type that is used with the transmitter being tested.

For licence-exempt equipment with detachable antennas, the user manual shall also contain the following notice in a conspicuous location:

This radio transmitter [enter the device's ISED certification number] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device. Immediately following the above notice, the manufacturer shall provide a list of all antenna types which can be used with the transmitter, indicating the maximum permissible antenna gain (in dBi) and the required impedance for each antenna type.

### Antenna Connector Construction

The EUT has one internal antenna arrangement which was permanently attached and the maximum antenna gain<sup>#</sup> is -4.73dBi, fulfill the requirement of this section. Please refer to the EUT photos.

| Antenna Type | Antenna Gain <sup>#</sup> | Impedance | Frequency Range |
|--------------|---------------------------|-----------|-----------------|
| PCB          | -4.73dBi                  | 50Ω       | 2.4~2.4835GHz   |

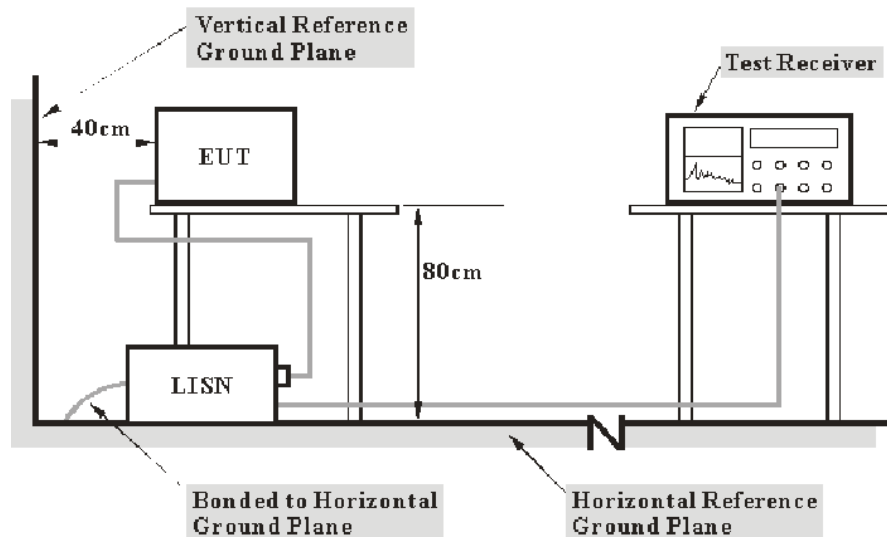
**Result: Compliant**

## FCC §15.207 (a) & RSS-GEN § 8.8 - AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC §15.207(a), RSS-GEN § 8.8

### EUT Setup



Note: 1. Support units were connected to second LISN.  
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The measurement procedure of EUT setup is according with ANSI C63.10-2013. The related limit was specified in FCC Part 15.207 & RSS-Gen.

The spacing between the peripherals was 10 cm.

### EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range  | IF B/W |
|------------------|--------|
| 150 kHz – 30 MHz | 9 kHz  |

### Test Procedure

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

## Factor & Over Limit Calculation

The factor is calculated by adding LISN VDF (Voltage Division Factor) and Cable Loss. The basic equation is as follows:

$$\text{Factor} = \text{LISN VDF} + \text{Cable Loss}$$

The “**Over limit**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over limit of -7 dB means the emission is 7 dB below the limit. The equation for calculation is as follows:

$$\begin{aligned}\text{Over Limit} &= \text{Level} - \text{Limit} \\ \text{Level} &= \text{Read Level} + \text{Factor}\end{aligned}$$

Note: The term "cable loss" refers to the combination of a cable and a 10dB transient limiter (attenuator).

## Test Data

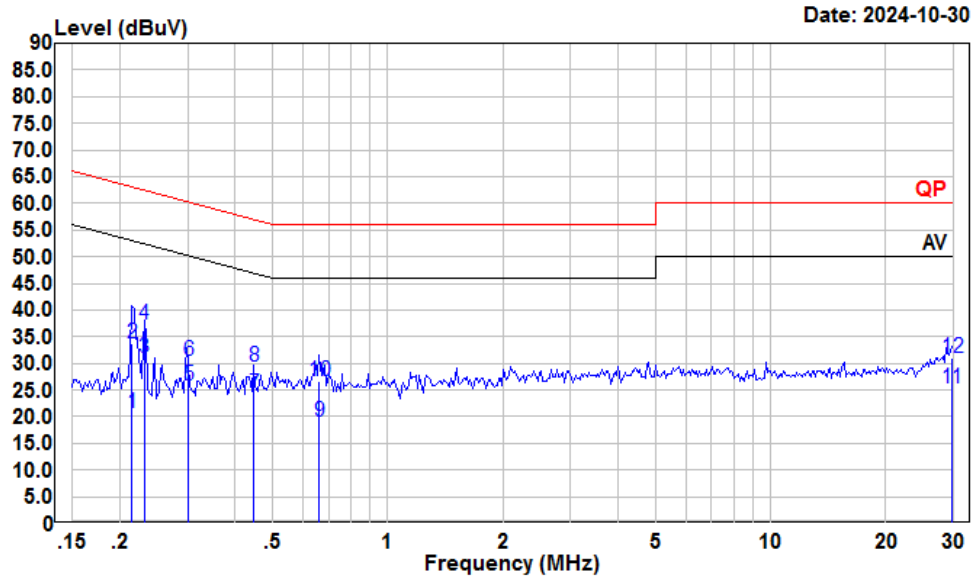
### Environmental Conditions

|                    |         |
|--------------------|---------|
| Temperature:       | 26 °C   |
| Relative Humidity: | 57 %    |
| ATM Pressure:      | 101 kPa |

*The testing was performed by Macy Shi on 2024-10-30.*

*EUT operation mode: Transmitting (Maximum output power: 8DPSK High Channel)*

## AC 120V/60 Hz, Line



Condition: Line

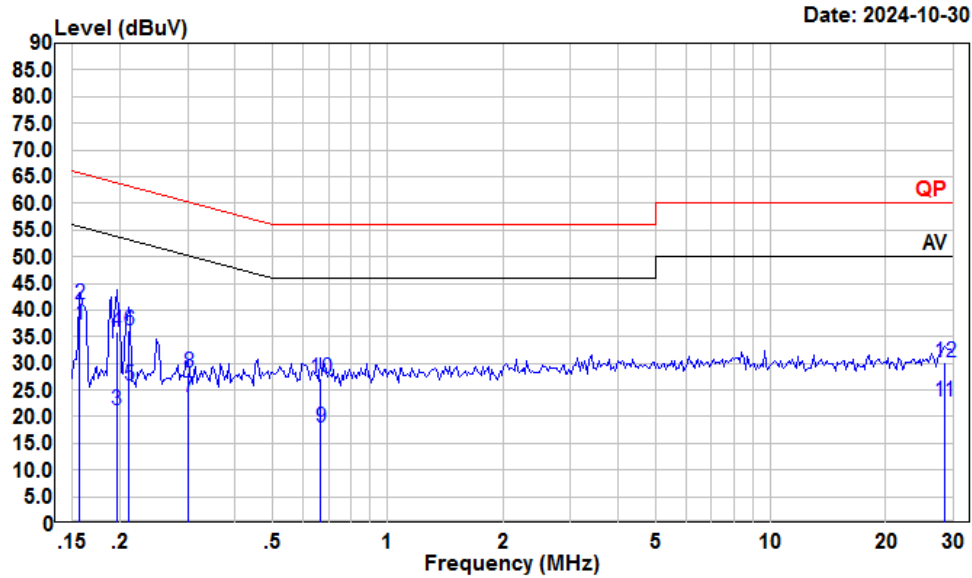
Project : 2401X94796E-RF

tester : Macy.shi

Note : BT Transmitting

|    | Freq   | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|--------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz    | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.215  | -0.19      | 20.68      | 10.78       | 10.09      | 53.01      | -32.33     | Average |
| 2  | 0.215  | 12.97      | 33.84      | 10.78       | 10.09      | 63.01      | -29.17     | QP      |
| 3  | 0.232  | 10.22      | 31.05      | 10.75       | 10.08      | 52.39      | -21.34     | Average |
| 4  | 0.232  | 16.40      | 37.23      | 10.75       | 10.08      | 62.39      | -25.16     | QP      |
| 5  | 0.302  | 5.05       | 25.83      | 10.67       | 10.11      | 50.19      | -24.36     | Average |
| 6  | 0.302  | 9.81       | 30.59      | 10.67       | 10.11      | 60.19      | -29.60     | QP      |
| 7  | 0.447  | 3.65       | 24.31      | 10.54       | 10.12      | 46.93      | -22.62     | Average |
| 8  | 0.447  | 8.62       | 29.28      | 10.54       | 10.12      | 56.93      | -27.65     | QP      |
| 9  | 0.661  | -1.55      | 19.09      | 10.50       | 10.14      | 46.00      | -26.91     | Average |
| 10 | 0.661  | 6.10       | 26.74      | 10.50       | 10.14      | 56.00      | -29.26     | QP      |
| 11 | 29.684 | 4.55       | 25.28      | 10.51       | 10.22      | 50.00      | -24.72     | Average |
| 12 | 29.684 | 10.23      | 30.96      | 10.51       | 10.22      | 60.00      | -29.04     | QP      |

## AC 120V/60 Hz, Neutral



Condition: Neutral

Project : 2401X94796E-RF

tester : Macy.shi

Note : BT Transmitting

|    | Freq   | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|--------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz    | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.156  | 16.50      | 37.19      | 10.57       | 10.12      | 55.65      | -18.46     | Average |
| 2  | 0.156  | 20.36      | 41.05      | 10.57       | 10.12      | 65.65      | -24.60     | QP      |
| 3  | 0.195  | 0.83       | 21.34      | 10.42       | 10.09      | 53.80      | -32.46     | Average |
| 4  | 0.195  | 15.36      | 35.87      | 10.42       | 10.09      | 63.80      | -27.93     | QP      |
| 5  | 0.211  | 5.39       | 25.90      | 10.42       | 10.09      | 53.18      | -27.28     | Average |
| 6  | 0.211  | 15.61      | 36.12      | 10.42       | 10.09      | 63.18      | -27.06     | QP      |
| 7  | 0.302  | 2.97       | 23.61      | 10.53       | 10.11      | 50.19      | -26.58     | Average |
| 8  | 0.302  | 7.55       | 28.19      | 10.53       | 10.11      | 60.19      | -32.00     | QP      |
| 9  | 0.668  | -2.79      | 18.05      | 10.70       | 10.14      | 46.00      | -27.95     | Average |
| 10 | 0.668  | 6.32       | 27.16      | 10.70       | 10.14      | 56.00      | -28.84     | QP      |
| 11 | 28.452 | 2.05       | 22.79      | 10.53       | 10.21      | 50.00      | -27.21     | Average |
| 12 | 28.452 | 9.39       | 30.13      | 10.53       | 10.21      | 60.00      | -29.87     | QP      |

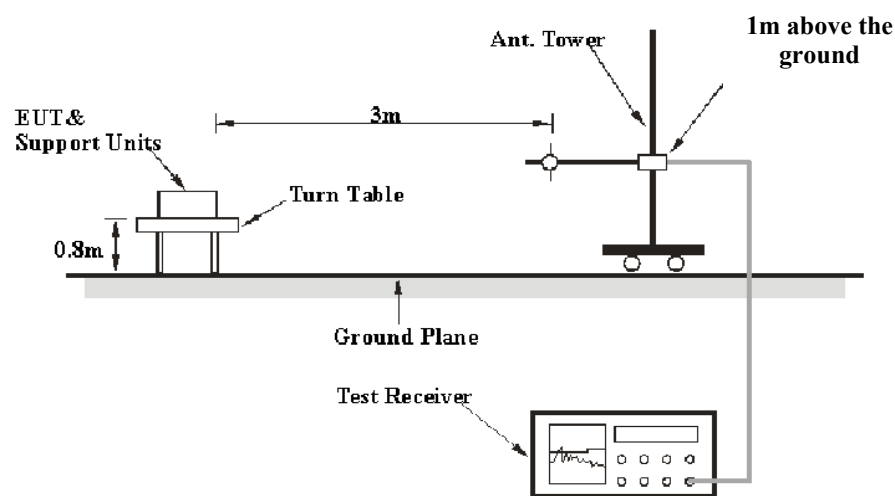
## FCC §15.209, §15.205 & §15.247(D) & RSS-247§ 5.5 - SPURIOUS EMISSIONS

### Applicable Standard

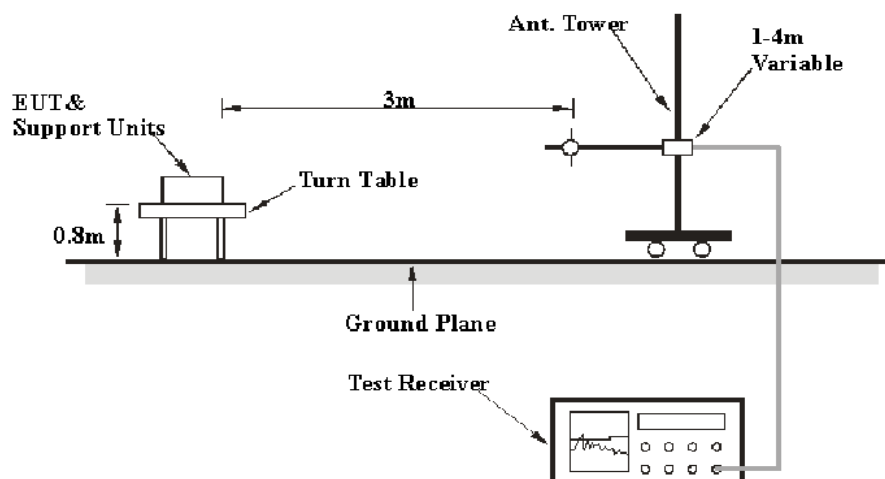
FCC §15.205; §15.209; §15.247(d); RSS-247§ 5.5; RSS-GEN § 8.10

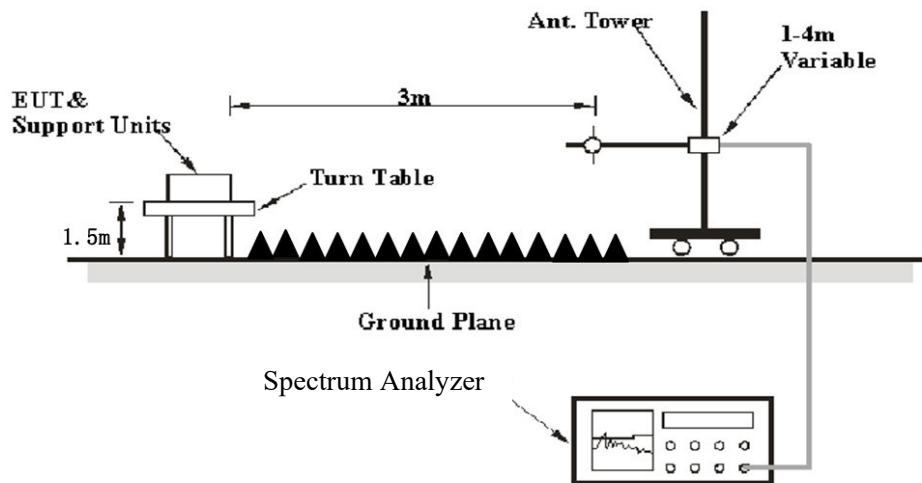
### EUT Setup

9 kHz-30MHz:



30MHz-1GHz:



**Above 1GHz:**

The radiated emission performed in the 3 meters, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209, FCC 15.247, RSS-247, RSS-Gen limits.

**EMI Test Receiver & Spectrum Analyzer Setup**

The EMI test receiver & Spectrum Analyzer Setup were set with the following configurations:

| Frequency Range   | RBW                                                           | Video B/W | IF B/W  | Measurement |
|-------------------|---------------------------------------------------------------|-----------|---------|-------------|
| 9 kHz – 150 kHz   | /                                                             | /         | 200 Hz  | QP          |
|                   | 300 Hz                                                        | 1 kHz     | /       | PK          |
| 150 kHz – 30 MHz  | /                                                             | /         | 9 kHz   | QP          |
|                   | 10 kHz                                                        | 30 kHz    | /       | PK          |
| 30 MHz – 1000 MHz | /                                                             | /         | 120 kHz | QP          |
|                   | 100 kHz                                                       | 300 kHz   | /       | PK          |
| Above 1 GHz       | Harmonics & Band Edge                                         |           |         |             |
|                   | 1MHz                                                          | 3 MHz     | /       | PK          |
|                   | Average Emission Level=Peak Emission Level+20*log(Duty cycle) |           |         |             |
|                   | Other Emissions                                               |           |         |             |
|                   | 1MHz                                                          | 3 MHz     | /       | PK          |
|                   | 1MHz                                                          | ≥10 Hz    | /       | Average     |

For Duty cycle measurement:

Use the duty cycle factor correction factor method per 15.35(c).

Duty cycle=On time/100milliseconds, On time= $N_1 \cdot L_1 + N_2 \cdot L_2 + \dots + N_{n-1} \cdot L_{n-1} + N_n \cdot L_n$ ,

Where  $N_1$  is number of type 1 pulses,  $L_1$  is length of type 1 pulse, etc.

## Test Procedure

Maximizing procedure was performed on the highest emissions to ensure that the EUT complied with all installation combinations.

All final data was recorded in Quasi-peak detection mode except for the frequency bands 9–90 kHz, 110–490 kHz and above 1000 MHz, average detection modes for frequency bands 9–90 kHz and 110–490 kHz, peak and average detection modes for frequencies above 1 GHz.

For 9 kHz-30MHz, the report shall list the six emissions with the smallest margin relative to the limit, for each of the three antenna orientations (parallel, perpendicular, and ground-parallel) unless the margin is greater than 20 dB.

If the maximized peak measured value complies with under the QP/Average limit more than 6dB, then it is unnecessary to perform an QP/Average measurement.

All emissions under the average limit and under the noise floor have not recorded in the report.

## Factor & Over Limit/Margin Calculation

The Factor is calculated by adding the Antenna Factor and Cable Loss, and subtracting the Amplifier Gain. The basic equation is as follows:

$$\text{Factor} = \text{Antenna Factor} + \text{Cable Loss} - \text{Amplifier Gain}$$

The “**Over Limit/Margin**” column of the following data tables indicates the degree of compliance with the applicable limit. For example, an Over Limit/margin of -7dB means the emission is 7dB below the limit. The equation for calculation is as follows:

$$\begin{aligned}\text{Over Limit/Margin} &= \text{Level} / \text{Corrected Amplitude} - \text{Limit} \\ \text{Level} / \text{Corrected Amplitude} &= \text{Read Level} + \text{Factor}\end{aligned}$$

## Test Data

### Environmental Conditions

|                    |            |
|--------------------|------------|
| Temperature:       | 23~25.1 °C |
| Relative Humidity: | 44~50%     |
| ATM Pressure:      | 101 kPa    |

*The testing was performed by Carl Zhu on 2024-11-04 for below 1GHz and Karl Xu and Dylan Yang on 2024-11-04 for above 1GHz.*

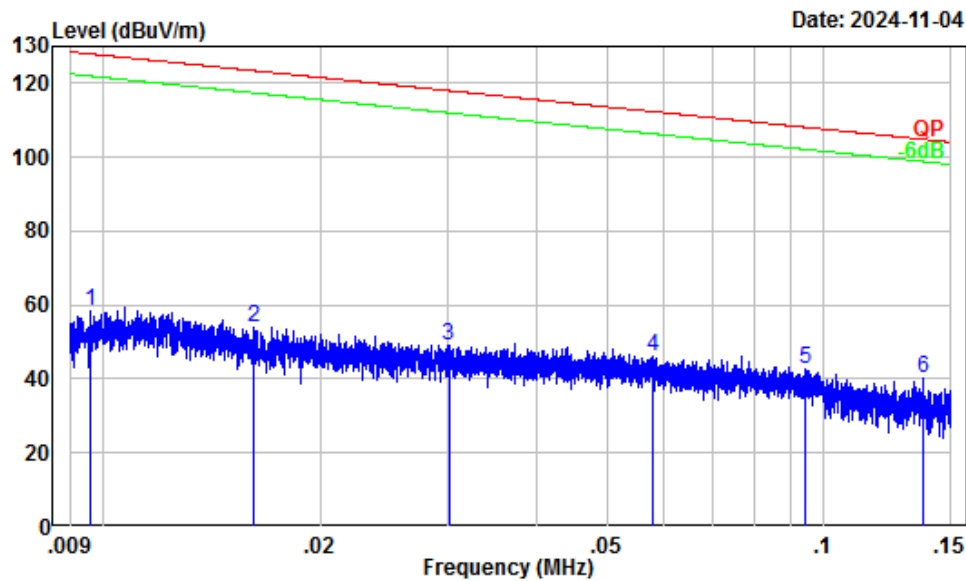
*EUT operation mode: Transmitting*

*Note: The spurious emission from 9 kHz-30MHz of IC RSS-247 standard, the unit of final result on the test plots are dBμV/m, so the limit should be added by 51,5 dB from dBμA/m to dBμV/m.*

9 kHz-30MHz: ((Maximum output power: 8DPSK High Channel))

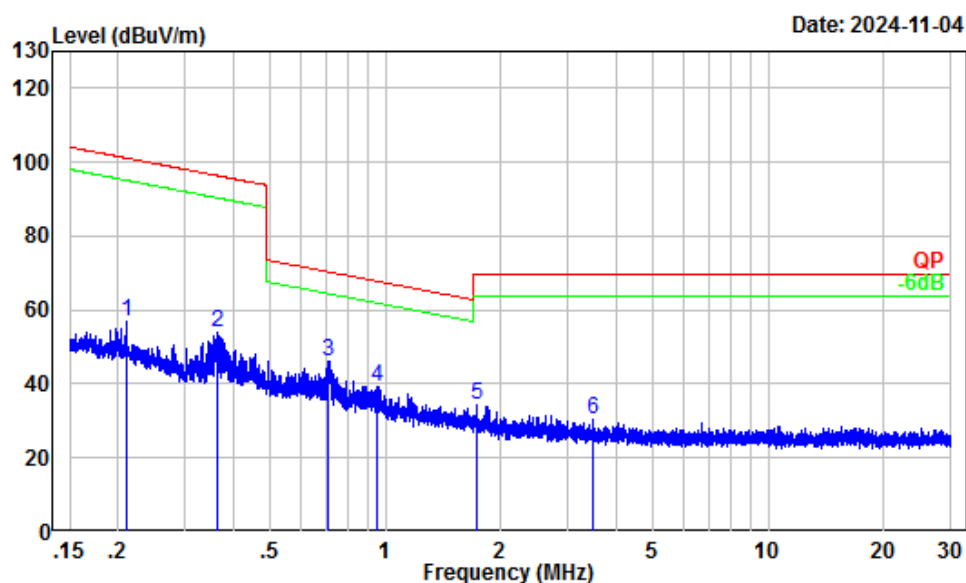
Note: When the test result of peak was less than the limit of QP/Average more than 6dB, just peak value were recorded.

Parallel (worst case)



Site : Chamber A  
Condition : 3m  
Project Number: 2401X94796E-RF  
Test Mode : Transmitting  
Tester : Carl Zhu

|   | Freq | Factor | Read<br>Level | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|------|--------|---------------|--------|---------------|---------------|--------|
|   | MHz  | dB/m   | dBuV          | dBuV/m | dBuV/m        | dB            |        |
| 1 | 0.01 | 32.37  | 26.07         | 58.44  | 127.93        | -69.49        | Peak   |
| 2 | 0.02 | 31.12  | 22.75         | 53.87  | 123.40        | -69.53        | Peak   |
| 3 | 0.03 | 28.48  | 20.74         | 49.22  | 118.01        | -68.79        | Peak   |
| 4 | 0.06 | 25.61  | 20.48         | 46.09  | 112.35        | -66.26        | Peak   |
| 5 | 0.09 | 22.42  | 20.20         | 42.62  | 108.14        | -65.52        | Peak   |
| 6 | 0.14 | 19.79  | 20.58         | 40.37  | 104.84        | -64.47        | Peak   |

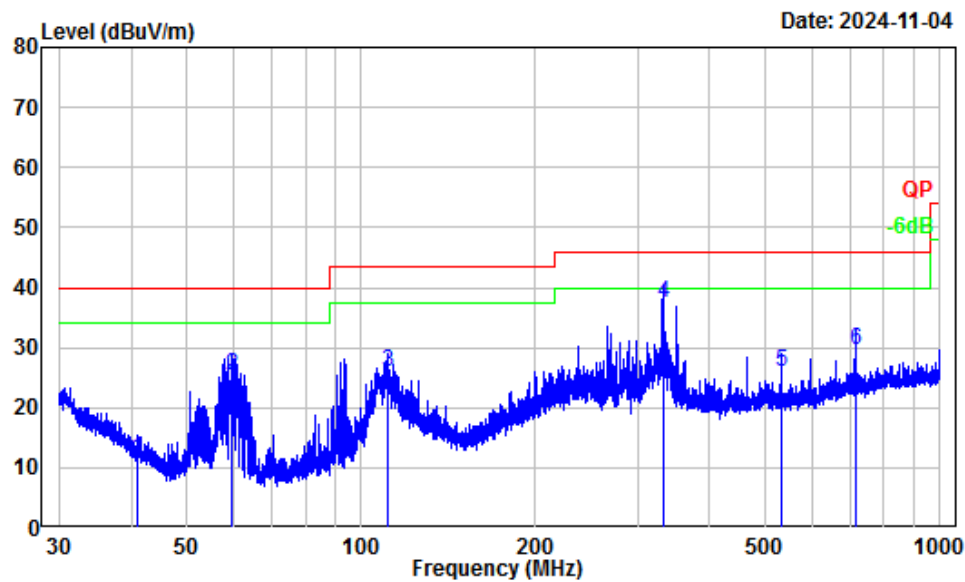


Site : Chamber A  
Condition : 3m  
Project Number: 2401X94796E-RF  
Test Mode : Transmitting  
Tester : Carl Zhu

|   | Freq | Factor | Read<br>Level | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|------|--------|---------------|--------|---------------|---------------|--------|
|   | MHz  | dB/m   | dBuV          | dBuV/m | dBuV/m        | dB            |        |
| 1 | 0.21 | 15.49  | 41.45         | 56.94  | 101.15        | -44.21        | Peak   |
| 2 | 0.37 | 8.95   | 44.82         | 53.77  | 96.34         | -42.57        | Peak   |
| 3 | 0.71 | 3.78   | 42.50         | 46.28  | 70.48         | -24.20        | Peak   |
| 4 | 0.95 | 1.55   | 37.65         | 39.20  | 67.90         | -28.70        | Peak   |
| 5 | 1.74 | -0.87  | 35.43         | 34.56  | 69.54         | -34.98        | Peak   |
| 6 | 3.47 | -2.41  | 32.83         | 30.42  | 69.54         | -39.12        | Peak   |

30MHz-1GHz: (Maximum output power: 8DPSK High Channel)

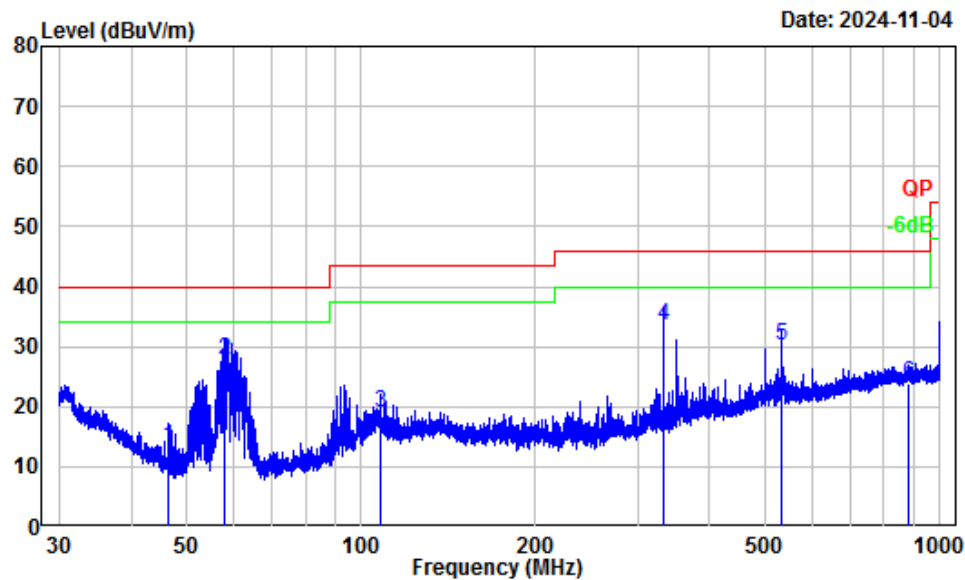
Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number: 2401X94796E-RF  
Test Mode : Transmitting  
Tester : Carl Zhu

|   | Freq Factor |        | Read Level | Level  | Limit  | Over   | Remark |
|---|-------------|--------|------------|--------|--------|--------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m | Limit  |        |
| 1 | 41.01       | -13.08 | 24.43      | 11.35  | 40.00  | -28.65 | QP     |
| 2 | 59.62       | -18.16 | 43.47      | 25.31  | 40.00  | -14.69 | QP     |
| 3 | 111.05      | -12.87 | 38.75      | 25.88  | 43.50  | -17.62 | QP     |
| 4 | 332.81      | -10.59 | 48.00      | 37.41  | 46.00  | -8.59  | QP     |
| 5 | 531.73      | -5.77  | 31.79      | 26.02  | 46.00  | -19.98 | QP     |
| 6 | 714.49      | -3.32  | 33.05      | 29.73  | 46.00  | -16.27 | QP     |

Vertical



Site : Chamber A  
Condition : 3m Vertical  
Project Number: 2401X94796E-RF  
Test Mode : Transmitting  
Tester : Carl Zhu

|   | Freq Factor |        | Read Level | Level  | Limit  | Over Limit | Remark |
|---|-------------|--------|------------|--------|--------|------------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m | dB         |        |
| 1 | 46.48       | -16.70 | 30.02      | 13.32  | 40.00  | -26.68     | QP     |
| 2 | 58.20       | -18.22 | 45.86      | 27.64  | 40.00  | -12.36     | QP     |
| 3 | 108.27      | -13.55 | 32.48      | 18.93  | 43.50  | -24.57     | QP     |
| 4 | 332.37      | -10.60 | 44.05      | 33.45  | 46.00  | -12.55     | QP     |
| 5 | 532.43      | -5.75  | 35.80      | 30.05  | 46.00  | -15.95     | QP     |
| 6 | 885.67      | -1.42  | 25.13      | 23.71  | 46.00  | -22.29     | QP     |

**Above 1GHz:** (Maximum output power: 8DPSK)

| Frequency<br>(MHz) | Receiver          |        | Polar<br>(H/V) | Factor<br>(dB/m) | Corrected<br>Amplitude<br>(dBμV/m) | Limit<br>(dBμV/m) | Margin<br>(dB) |
|--------------------|-------------------|--------|----------------|------------------|------------------------------------|-------------------|----------------|
|                    | Reading<br>(dBμV) | PK/Ave |                |                  |                                    |                   |                |
| Low Channel        |                   |        |                |                  |                                    |                   |                |
| 4804.00            | 45.45             | PK     | H              | 2.42             | 47.87                              | 74                | -26.13         |
| 4804.00            | 46.03             | PK     | V              | 2.42             | 48.45                              | 74                | -25.55         |
| Middle Channel     |                   |        |                |                  |                                    |                   |                |
| 4882.00            | 45.39             | PK     | H              | 2.58             | 47.97                              | 74                | -26.03         |
| 4882.00            | 45.22             | PK     | V              | 2.58             | 47.80                              | 74                | -26.20         |
| High Channel       |                   |        |                |                  |                                    |                   |                |
| 4960.00            | 46.17             | PK     | H              | 2.68             | 48.85                              | 74                | -25.15         |
| 4960.00            | 45.44             | PK     | V              | 2.68             | 48.12                              | 74                | -25.88         |

**Note:**

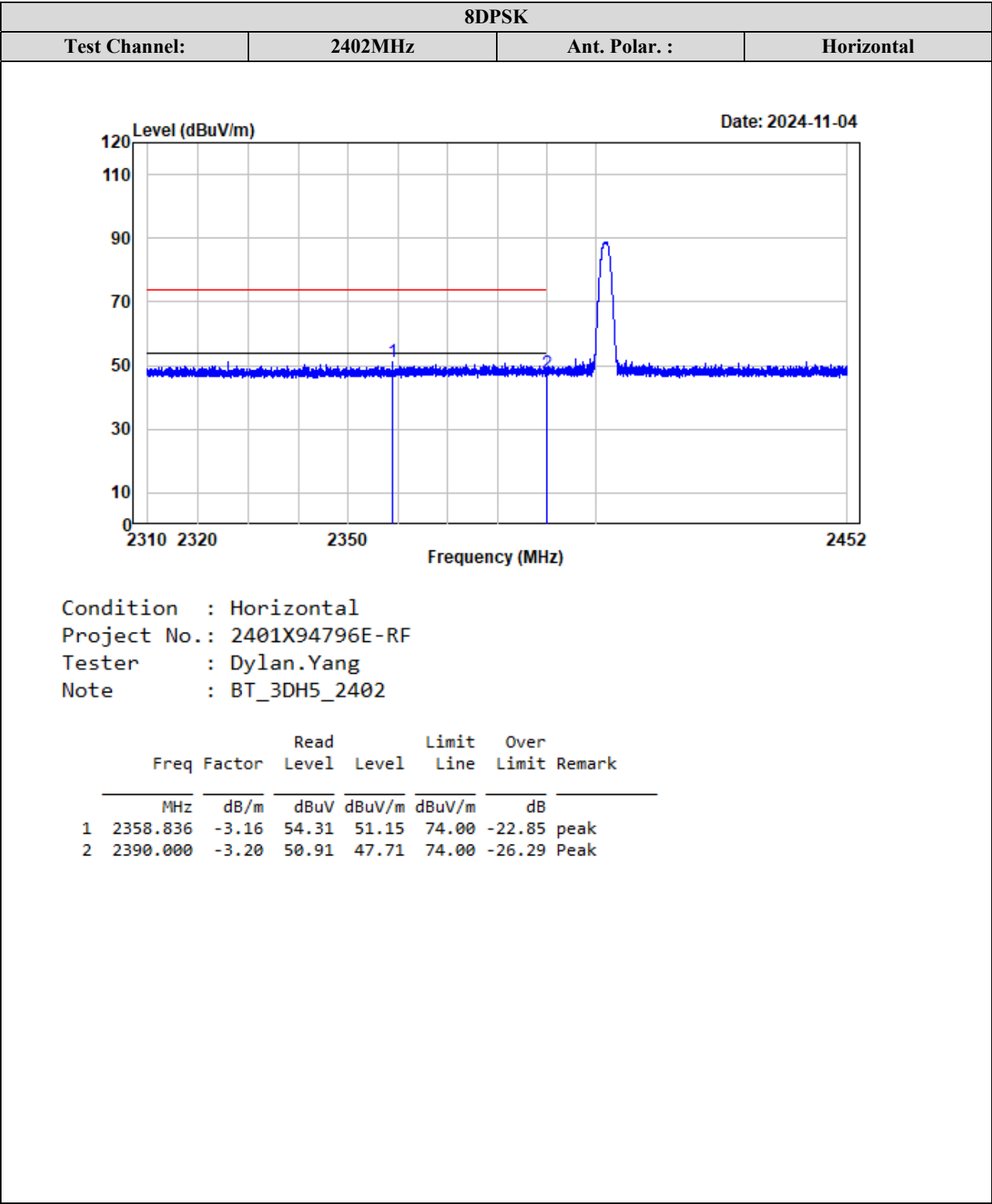
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

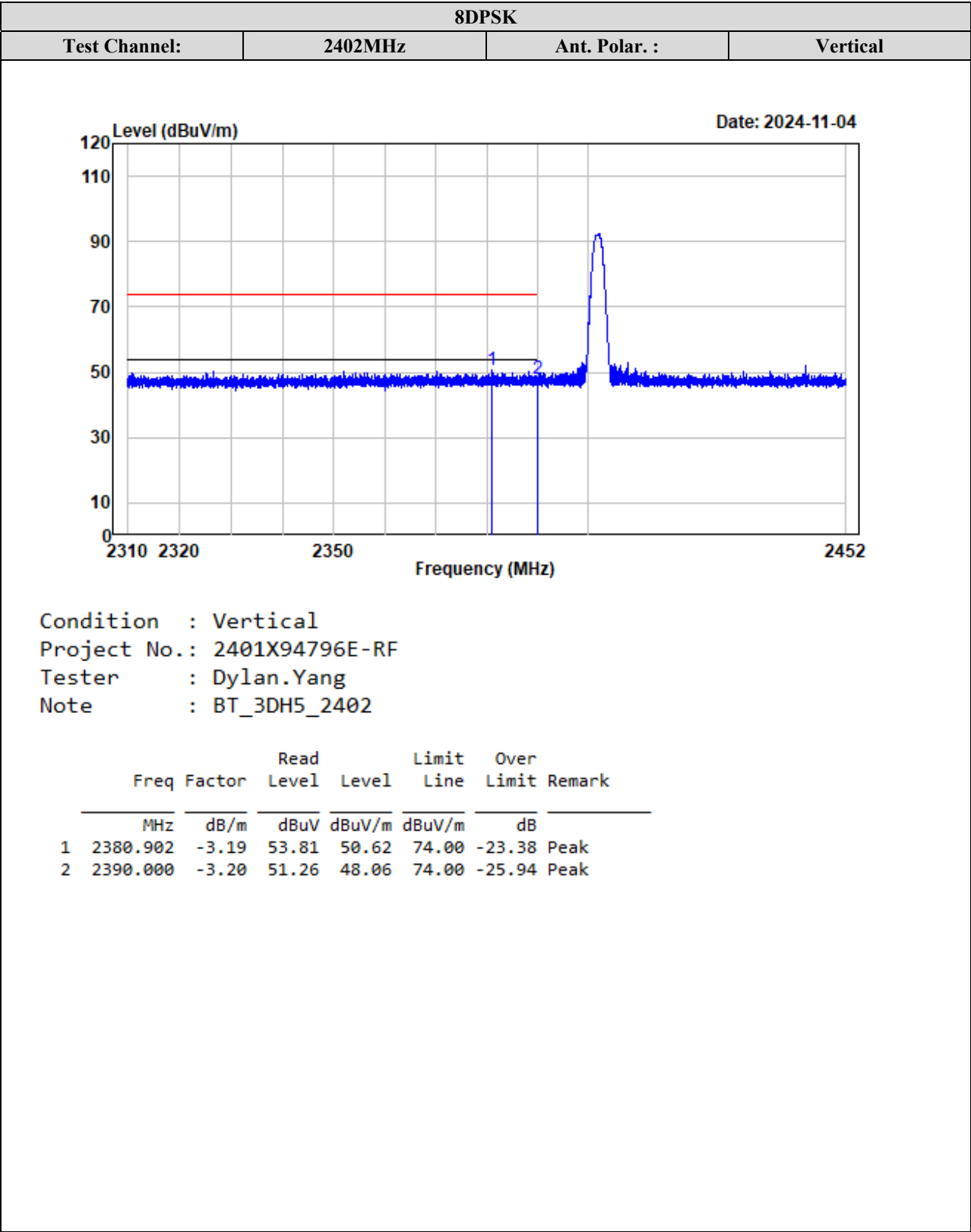
Corrected Amplitude = Factor + Reading

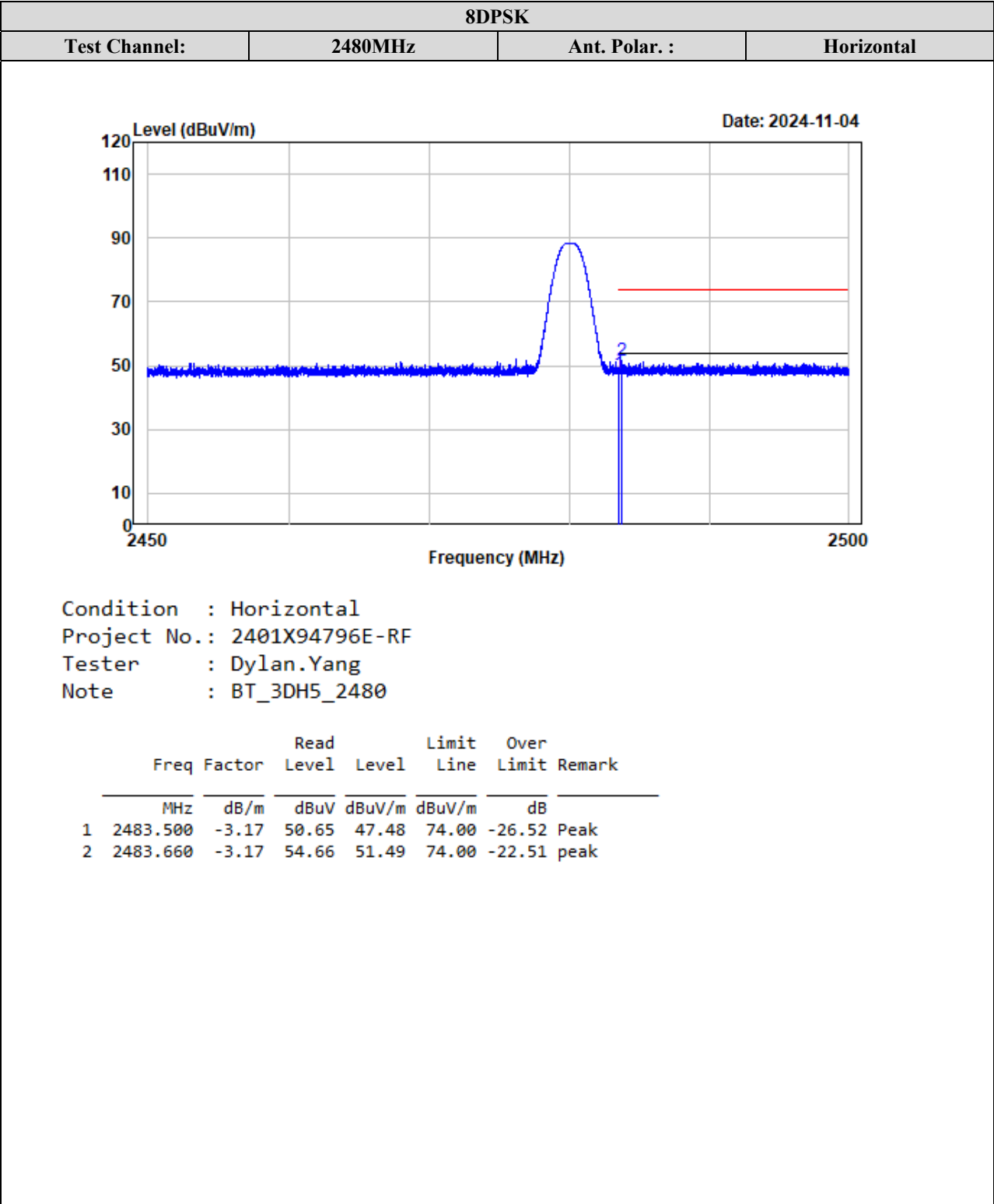
Margin = Corrected. Amplitude - Limit

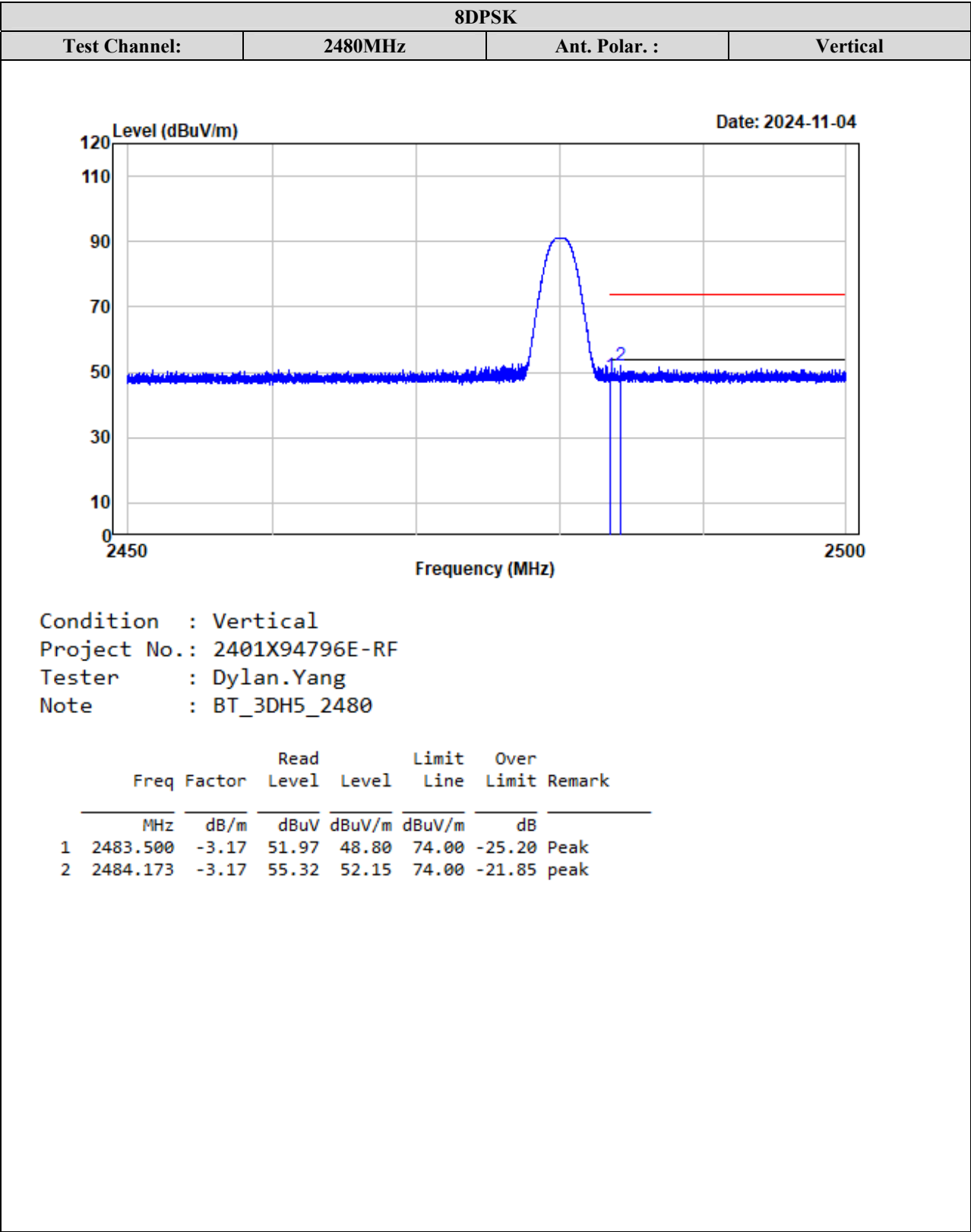
The other spurious emission which is in the noise floor level was not recorded.

Test plots for Band Edge Measurements (Radiated):

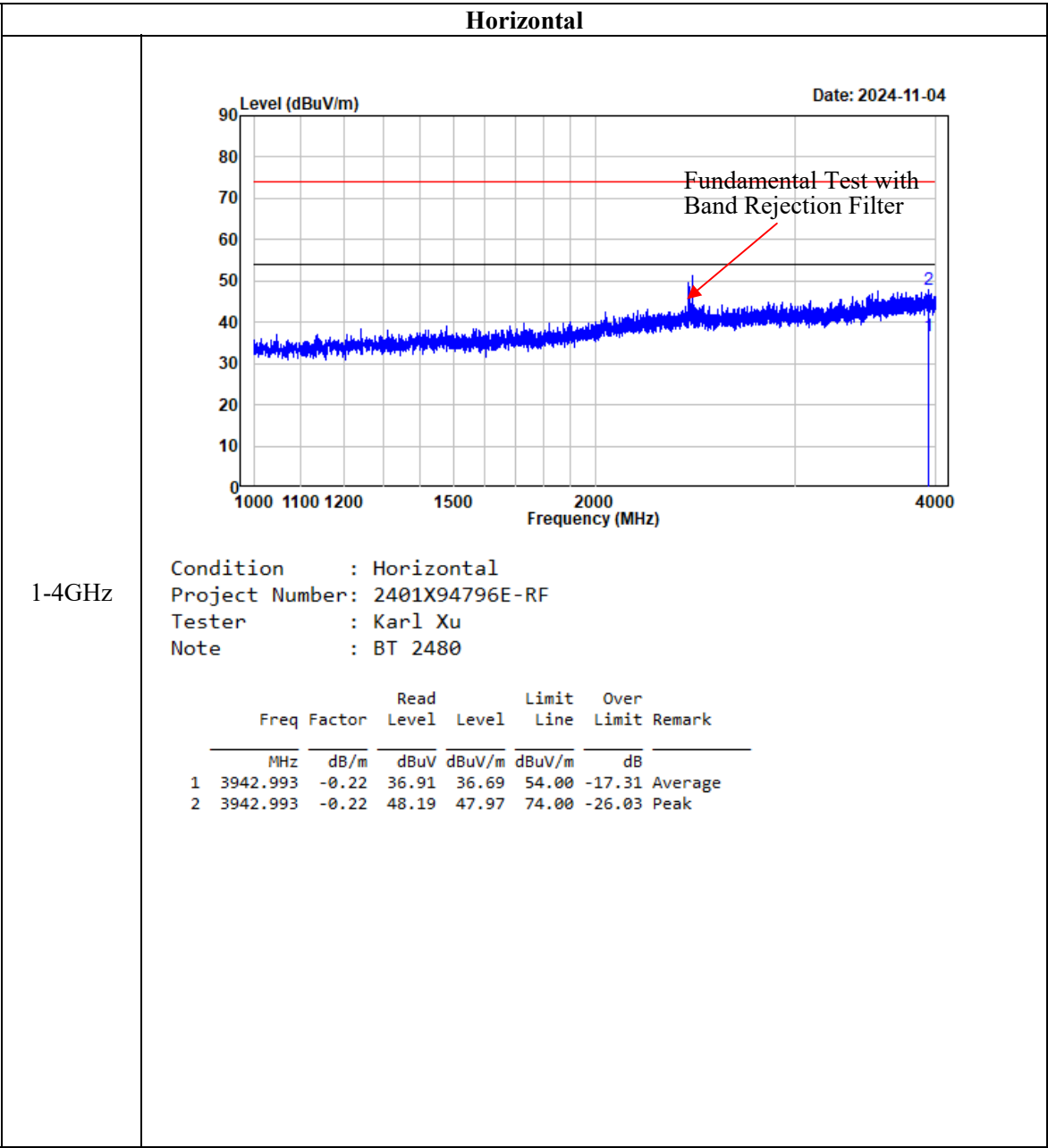




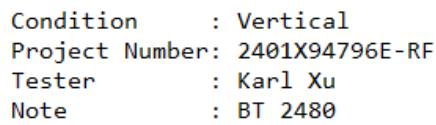




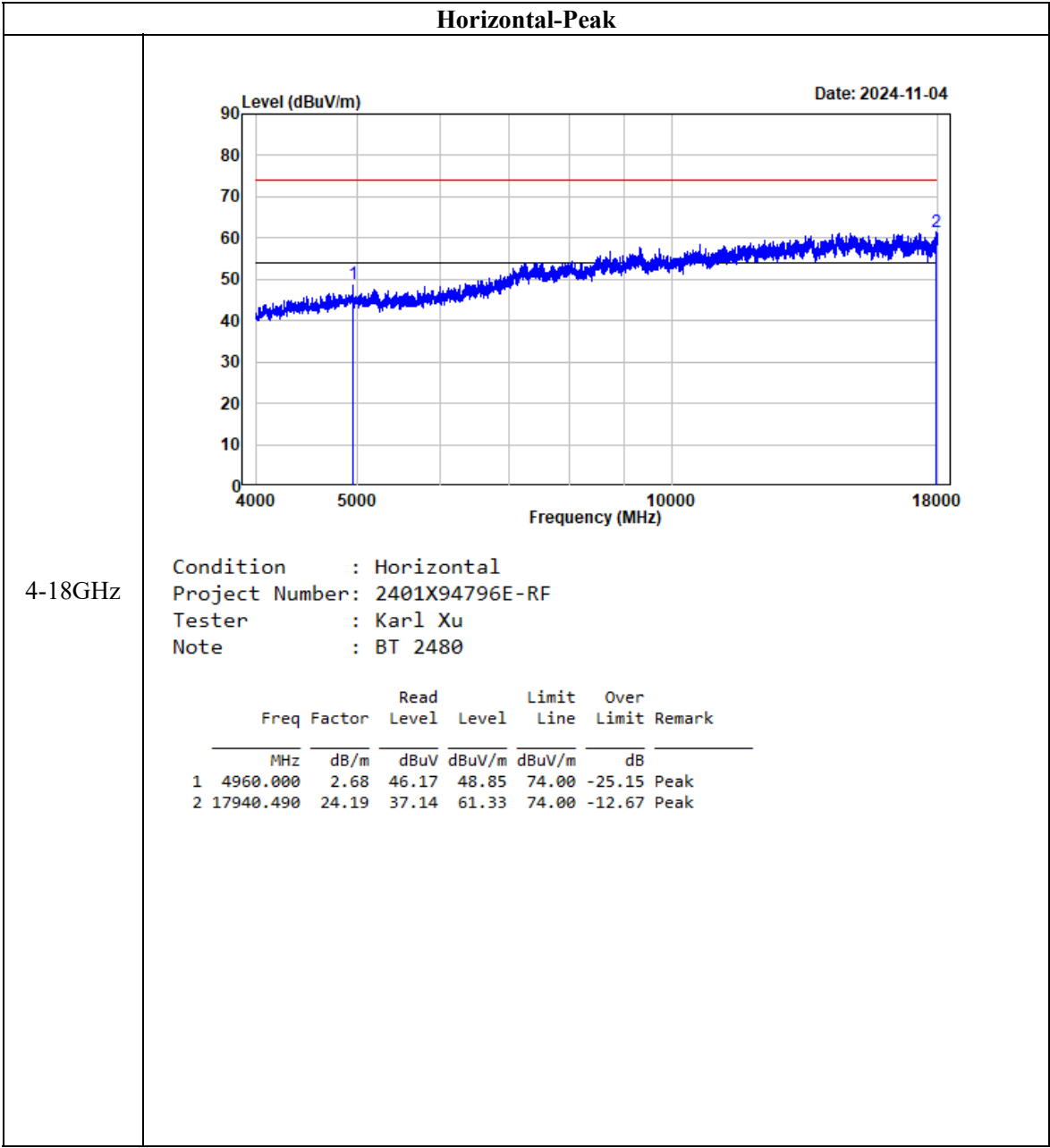
Listed with the worst harmonic margin test plot:

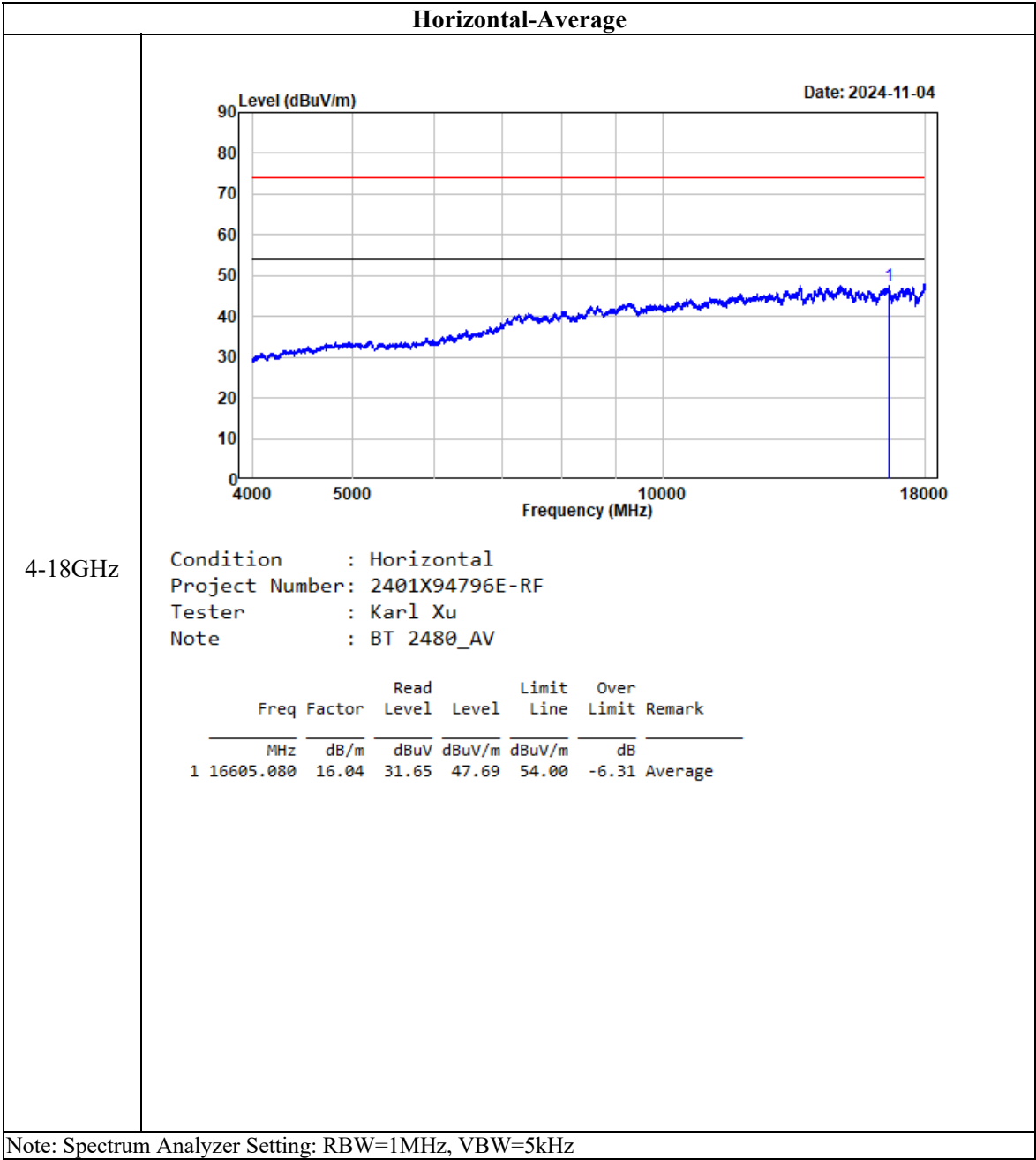


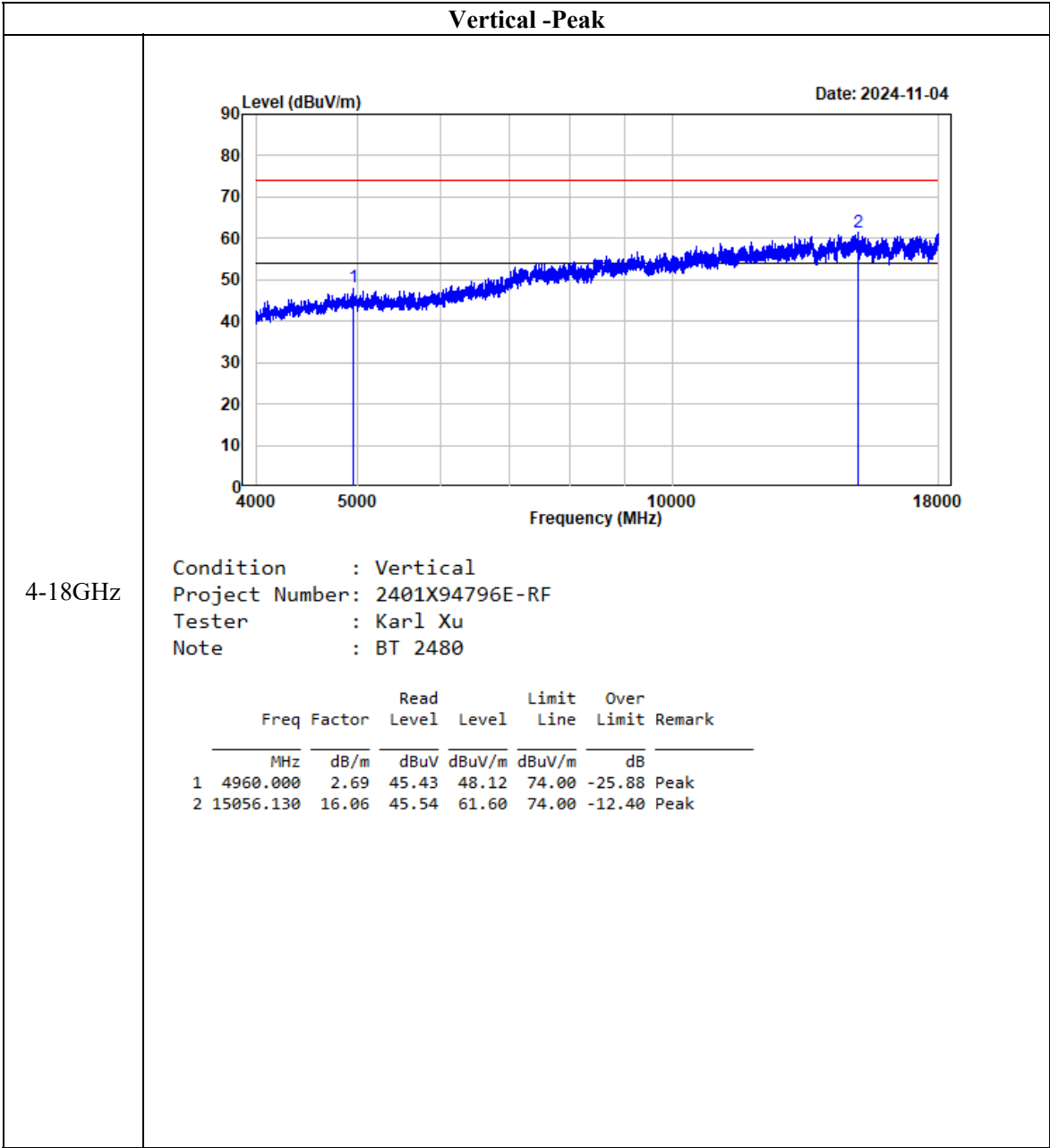
## 1-4GHz

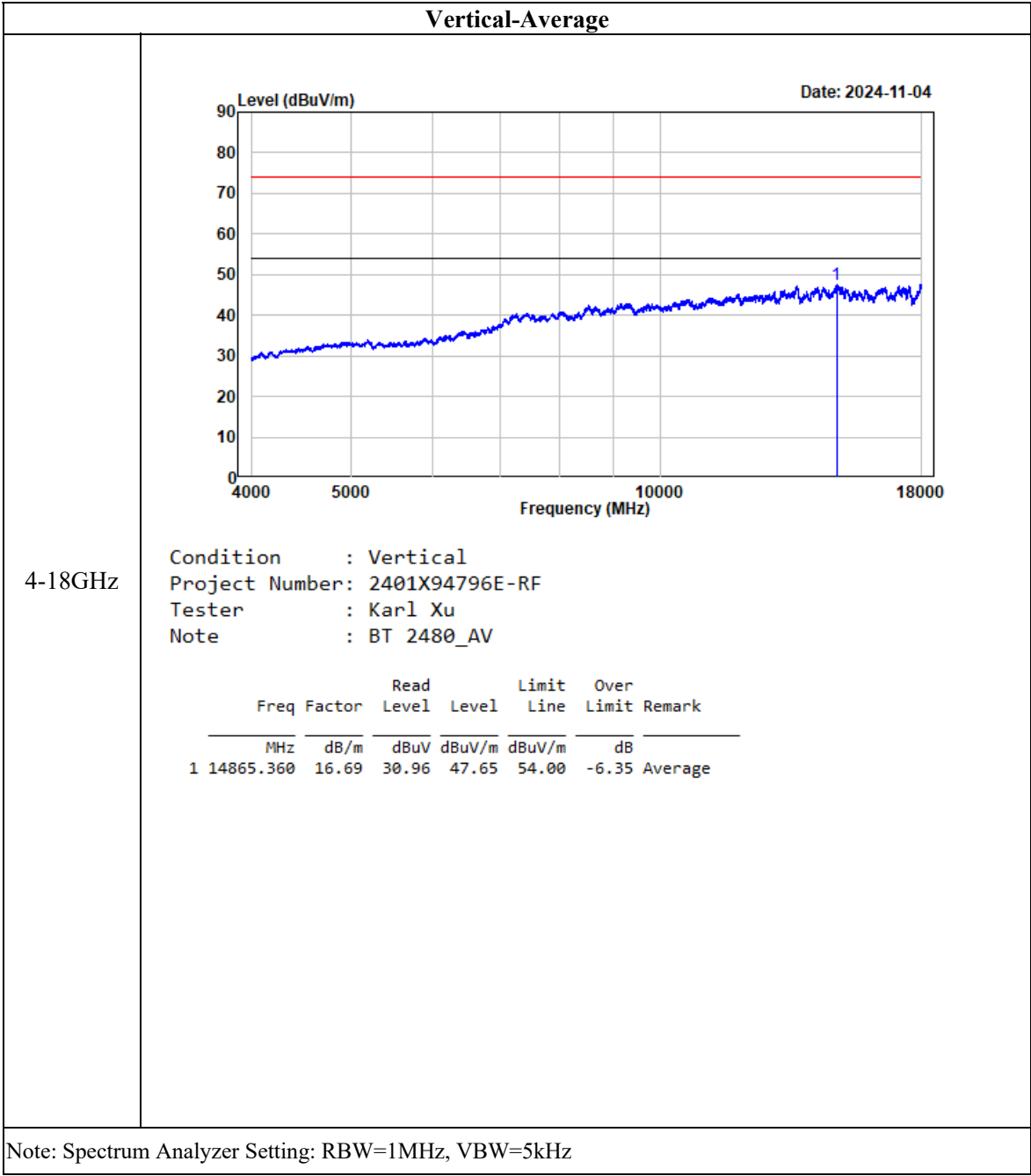


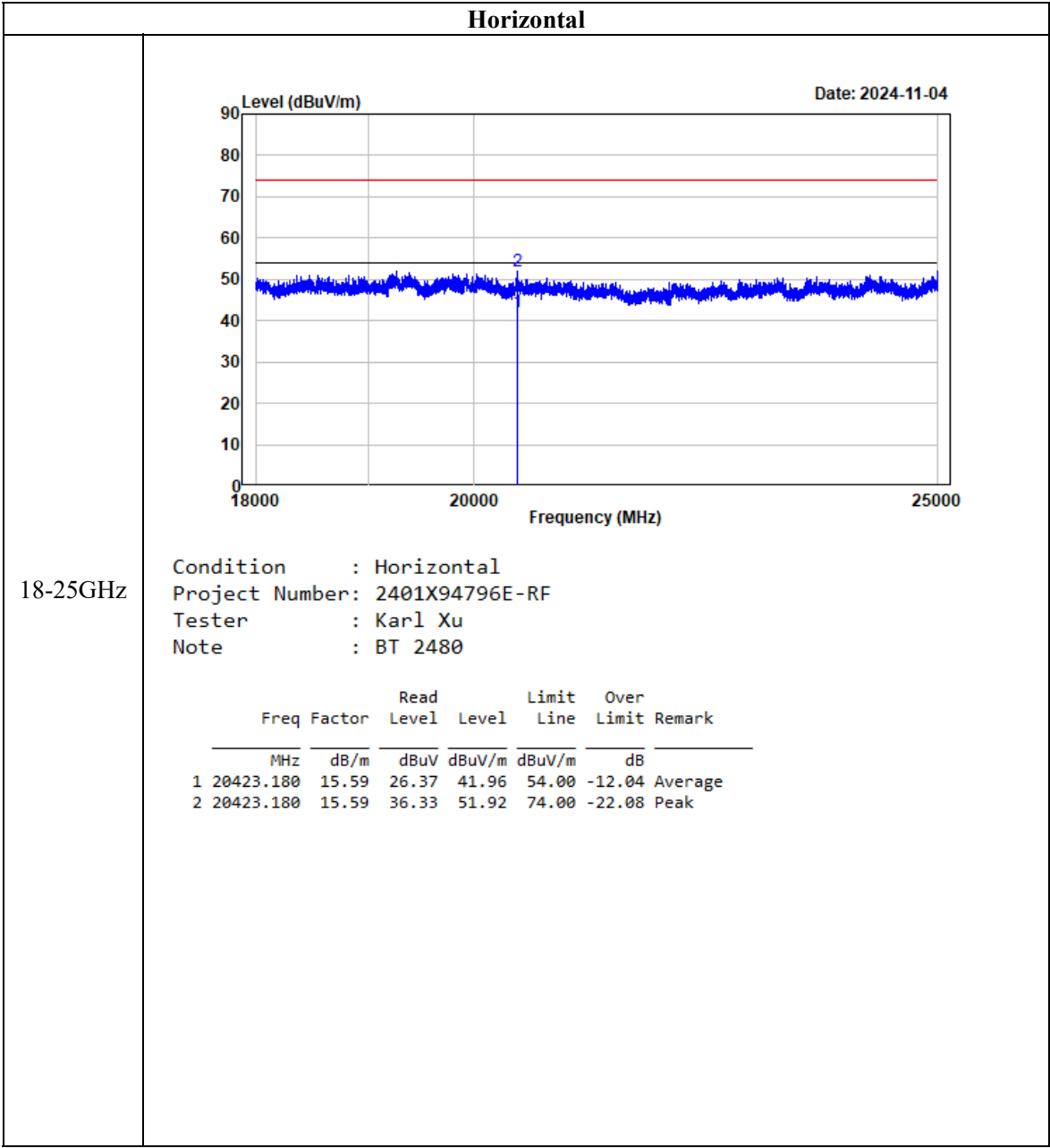
|   | Freq     | Factor | Read Level | Level  | Limit Line | Over Limit | Remark  |
|---|----------|--------|------------|--------|------------|------------|---------|
|   | MHz      | dB/m   | dBuV       | dBuV/m | dBuV/m     | dB         |         |
| 1 | 3851.106 | -0.78  | 36.58      | 35.80  | 54.00      | -18.20     | Average |
| 2 | 3851.106 | -0.78  | 48.19      | 47.41  | 74.00      | -26.59     | Peak    |

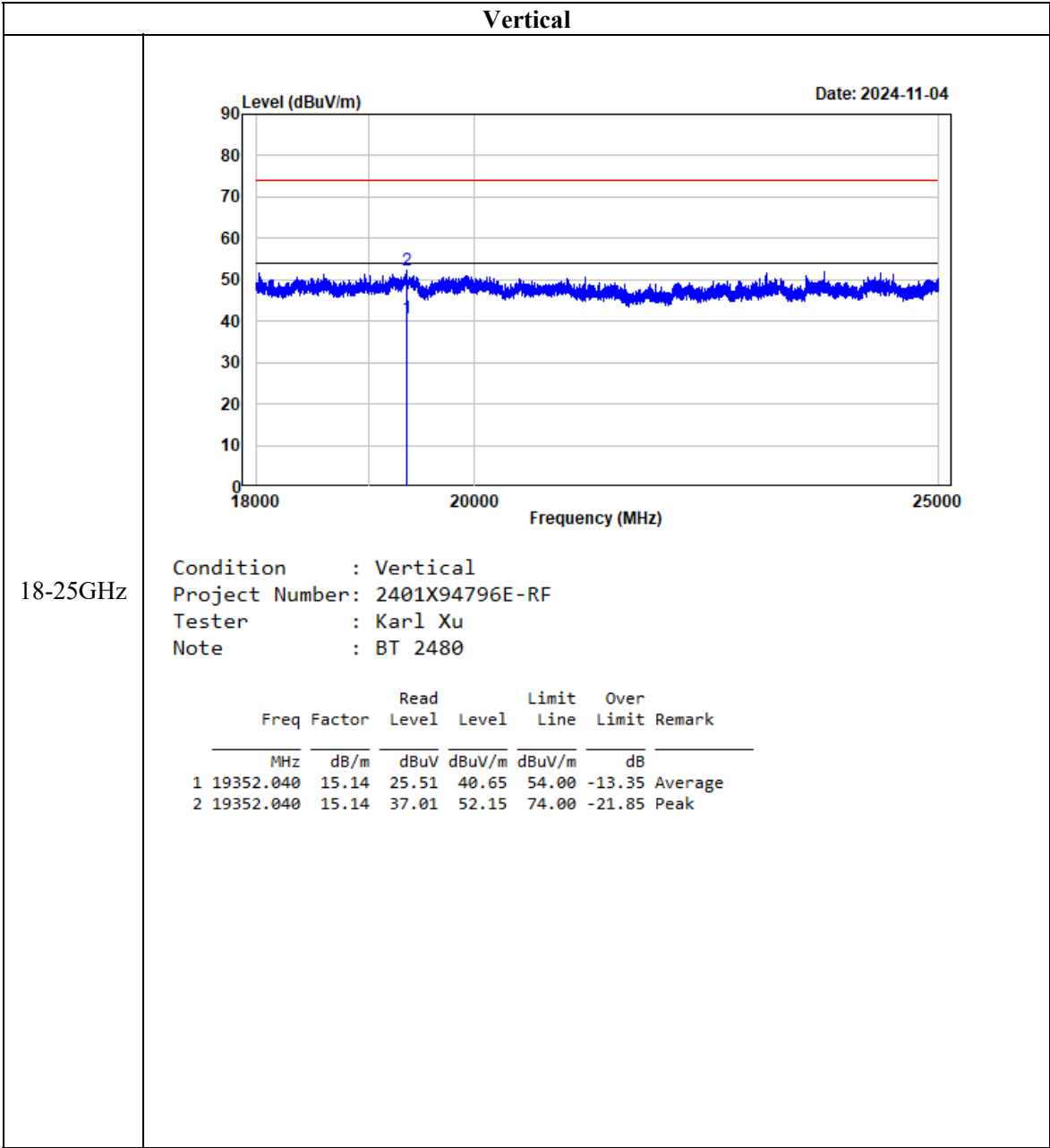












## **FCC §15.247(a) (1) & RSS-247 § 5.1 (b) - CHANNEL SEPARATION TEST**

### **Applicable Standard**

According to FCC §15.247(a) (1):

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. The system shall hop to channel frequencies that are selected at the system hopping rate from a pseudo randomly ordered list of hopping frequencies. Each frequency must be used equally on the average by each transmitter. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

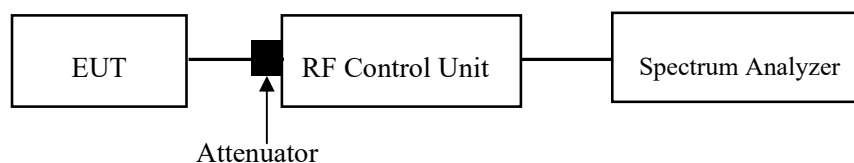
According to RSS-247 § 5.1 (b):

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W. The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.

### **Test Procedure**

Test Method: ANSI C63.10-2013 Clause 7.8.2

1. Set the EUT in transmitting mode, max hold the channel.
2. Set the adjacent channel of the EUT and max hold another trace.
3. Measure the channel separation.



**Test Data****Environmental Conditions**

|                           |         |
|---------------------------|---------|
| <b>Temperature:</b>       | 25 °C   |
| <b>Relative Humidity:</b> | 55 %    |
| <b>ATM Pressure:</b>      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## **FCC §15.247(a) (1) & RSS-247 § 5.1 (a), RSS-GEN § 6.7 - 20 dB EMISSION BANDWIDTH & 99% OCCUPIED BANDWIDTH**

### **Applicable Standard**

According to FCC §15.247(a) (1):

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.

According to RSS-247 § 5.1 (a), RSS-GEN § 6.7:

The occupied bandwidth or the “99% emission bandwidth” is defined as the frequency range between two points, one above and the other below the carrier frequency, within which 99% of the total transmitted power of the fundamental transmitted emission is contained. The occupied bandwidth shall be reported for all equipment in addition to the specified bandwidth required in the applicable RSSs.

In some cases, the “x dB bandwidth” is required, which is defined as the frequency range between two points, one at the lowest frequency below and one at the highest frequency above the carrier frequency, at which the maximum power level of the transmitted emission is attenuated x dB below the maximum in-band power level of the modulated signal, where the two points are on the outskirts of the in-band emission.

The following conditions shall be observed for measuring the occupied bandwidth and x dB bandwidth:

- The transmitter shall be operated at its maximum carrier power measured under normal test conditions.
- The span of the spectrum analyzer shall be set large enough to capture all products of the modulation process, including the emission skirts, around the carrier frequency, but small enough to avoid having other emissions (e.g. on adjacent channels) within the span.
- The detector of the spectrum analyzer shall be set to “Sample”. However, a peak, or peak hold, may be used in place of the sampling detector since this usually produces a wider bandwidth than the actual bandwidth (worst-case measurement). Use of a peak hold (or “Max Hold”) may be necessary to determine the occupied / x dB bandwidth if the device is not transmitting continuously.
- The resolution bandwidth (RBW) shall be in the range of 1% to 5% of the actual occupied / x dB bandwidth and the video bandwidth (VBW) shall not be smaller than three times the RBW value. Video averaging is not permitted.

Note: It may be necessary to repeat the measurement a few times until the RBW and VBW are in compliance with the above requirement.

For the 99% emission bandwidth, the trace data points are recovered and directly summed in linear power level terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached, and that frequency recorded. The process is repeated for the highest frequency data points (starting at the highest frequency, at the right side of the span, and going down in frequency). This frequency is then recorded. The difference between the two recorded frequencies is the occupied bandwidth (or the 99% emission bandwidth).

## Test Procedure

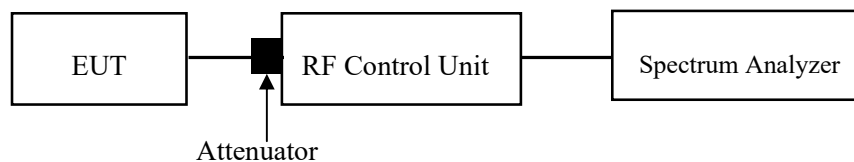
Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2 & RSS-Gen §6.7

The following conditions shall be observed for measuring the occupied bandwidth and 20 dB bandwidth:

- a. The spectrum analyzer center frequency is set to the nominal EUT channel center frequency. The span range for the EMI receiver or spectrum analyzer shall be between two times and five times the OBW.
- b) The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.
- c) Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (OBW/RBW)]$  below the reference level.
- d) Steps a) through c) might require iteration to adjust within the specified tolerances.
- e) The dynamic range of the instrument at the selected RBW shall be more than 10 dB below the target “-xx dB down” requirement; that is, if the requirement calls for measuring the -20 dB OBW, the instrument noise floor at the selected RBW shall be at least 30 dB below the reference value.
- f) Set detection mode to peak and trace mode to max hold.
- g) Determine the reference value: Set the EUT to transmit an un-modulated carrier or modulated signal, as applicable. Allow the trace to stabilize. Set the spectrum analyzer marker to the highest level of the displayed trace (this is the reference value).
- h) Determine the “-xx dB down amplitude” using  $[(\text{reference value}) - xx]$ . Alternatively, this calculation may be made by using the marker-delta function of the instrument.
- i) If the reference value is determined by an un-modulated carrier, then turn the EUT modulation on, and either clear the existing trace or start a new trace on the spectrum analyzer and allow the new trace to stabilize. Otherwise, the trace from step g) shall be used for step j).
- j) Place two markers, one at the lowest frequency and the other at the highest frequency of the envelope of the spectral display, such that each marker is at or slightly below the “- xx” dB down amplitude determined in step h). If a marker is below this “-xx dB down amplitude” value, then it shall be as close as possible to this value. The occupied bandwidth is the frequency difference between the two markers. Alternatively, set a marker at the lowest frequency of the envelope of the spectral display, such that the marker is at or slightly below the “- xx dB down amplitude” determined in step h). Reset the marker-delta function and move the marker to the other side of the emission until the delta marker amplitude is at the same level as the reference marker amplitude. The marker-delta frequency reading at this point is the specified emission bandwidth.
- k) The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data may be reported in addition to the plot(s).

The occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Procedure as below

- The instrument center frequency is set to the nominal EUT channel center frequency. The frequency span for the spectrum analyzer shall be between 1.5 times and 5.0 times the OBW.
- The nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW, and VBW shall be approximately three times the RBW (for RSS rules, VBW shall not be smaller than three times the RBW, unless otherwise specified by the applicable requirement).
- Set the reference level of the instrument as required, keeping the signal from exceeding the maximum input mixer level for linear operation. In general, the peak of the spectral envelope shall be more than  $[10 \log (OBW/RBW)]$  below the reference level.
- Step a) through step c) might require iteration to adjust within the specified range.
- Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.
- Use the 99% power bandwidth function of the instrument (if available) and report the measured bandwidth.
- If the instrument does not have a 99% power bandwidth function, then the trace data points are recovered and directly summed in linear power terms. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% power bandwidth is the difference between these two frequencies.
- The occupied bandwidth shall be reported by providing plot(s) of the measuring instrument display; the plot axes and the scale units per division shall be clearly labeled. Tabular data maybe reported in addition to the plot(s).



## Test Data

### Environmental Conditions

|                    |         |
|--------------------|---------|
| Temperature:       | 25 °C   |
| Relative Humidity: | 55 %    |
| ATM Pressure:      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - QUANTITY OF HOPPING CHANNEL TEST

### Applicable Standard

According to FCC §15.247(a) (1) (iii):

Frequency hopping systems in the 2400–2483.5 MHz band shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

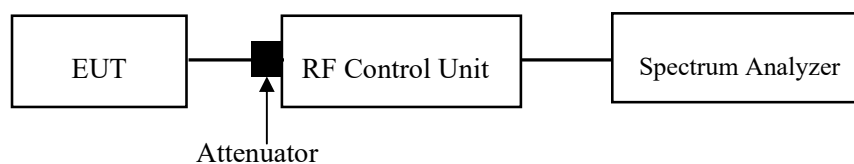
According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSS) operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

### Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.3

1. Check the calibration of the measuring instrument (SA) using either an internal calibrator or a known signal from an external generator.
2. Set the EUT in hopping mode from first channel to last.
3. By using the max-hold function record the quantity of the channel.



Note: Limit=20 dB bandwidth\*2/3

**Test Data****Environmental Conditions**

|                           |         |
|---------------------------|---------|
| <b>Temperature:</b>       | 25 °C   |
| <b>Relative Humidity:</b> | 55 %    |
| <b>ATM Pressure:</b>      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## **FCC §15.247(a) (1) (iii) & RSS-247 § 5.1 (d) - TIME OF OCCUPANCY (DWELL TIME)**

### **Applicable Standard**

According to FCC §15.247(a) (1) (iii):

Frequency hopping systems in the 2400-2483.5 MHz shall use at least 15 channels. 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. Frequency hopping systems may avoid or suppress transmissions on a particular hopping frequency provided that a minimum of 15 channels are used.

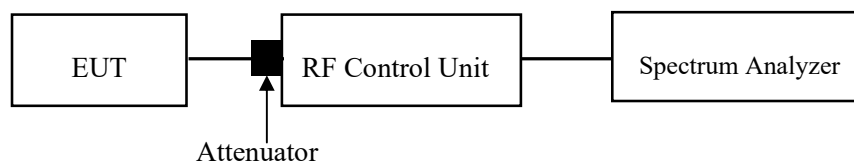
According to RSS-247 § 5.1 (d):

Frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz shall use at least 15 hopping channels. 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. Transmissions on particular hopping frequencies may be avoided or suppressed provided that at least 15 hopping channels are used.

### **Test Procedure**

Test Method: ANSI C63.10-2013 Clause 7.8.4

1. The EUT was worked in channel hopping.
2. Set the RBW to: 1MHz.
3. Set the VBW  $\geq 3 \times$  RBW.
4. Set the span to 0Hz.
5. Detector = peak.
6. Sweep time = auto couple.
7. Trace mode = max hold.
8. Allow trace to fully stabilize.
9. Recorded the time of single pulses



**Test Data****Environmental Conditions**

|                           |         |
|---------------------------|---------|
| <b>Temperature:</b>       | 25.6 °C |
| <b>Relative Humidity:</b> | 55.6 %  |
| <b>ATM Pressure:</b>      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## FCC §15.247(b) (1) & RSS-247§ 5.1(b) &§ 5.4(b) - PEAK OUTPUT POWER MEASUREMENT

### Applicable Standard

According to FCC §15.247(b) (1):

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. And for all other frequency hopping systems in the 2400–2483.5 MHz band: 0.125 watts.

According to RSS-247§ 5.1(b) &§ 5.4(b):

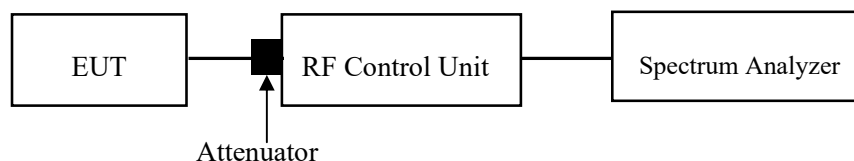
For frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. The e.i.r.p. shall not exceed 4 W (see Section 5.4(e) for exceptions).

Frequency hopping systems (FHSs) 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, FHSs operating in the band 2400-2483.5 MHz 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 that the systems operate with an output power no greater than 0.125 W.

### Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.5

1. Place the EUT on a bench and set in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to one test equipment.
3. Add a correction factor to the display.



Note: A short RF cable with low cable loss connected to the EUT antenna port, which was provided by lab, the cable loss was added with offset into test equipment, the total offset consists of attenuator and RF cable.

**Test Data****Environmental Conditions**

|                           |         |
|---------------------------|---------|
| <b>Temperature:</b>       | 25 °C   |
| <b>Relative Humidity:</b> | 55 %    |
| <b>ATM Pressure:</b>      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## FCC §15.247(d) & RSS-247 § 5.5 - BAND EDGES TESTING

### Applicable Standard

According to FCC §15.247(d).

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated 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, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)).

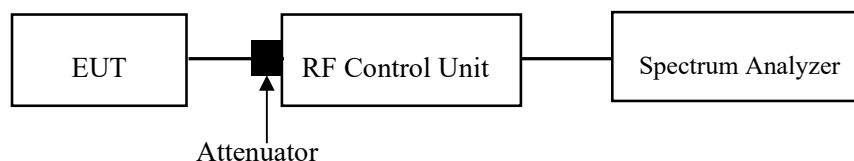
According to RSS-247 § 5.5.

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated device is operating, the RF power that is produced 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, provided that the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of root-mean-square averaging over a time interval, as permitted under Section 5.4(e), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength limits specified in RSS-Gen is not required.

### Test Procedure

Test Method: ANSI C63.10-2013 Clause 7.8.6 & Clause 6.10

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Remove the antenna from the EUT and then connect to a low loss RF cable from the antenna port to a EMI test receiver, then turn on the EUT and make it operate in transmitting mode. Then set it to Low Channel and High Channel within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 100 kHz with a convenient frequency span including 100 kHz bandwidth from band edge.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.



**Test Data****Environmental Conditions**

|                           |         |
|---------------------------|---------|
| <b>Temperature:</b>       | 25 °C   |
| <b>Relative Humidity:</b> | 55 %    |
| <b>ATM Pressure:</b>      | 101 kPa |

*The testing was performed by Navilite Cai on 2024-10-30.*

*EUT operation mode: Transmitting*

***Test Result: Compliant. Please refer to the Appendix.***

## **EUT PHOTOGRAPHS**

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Please refer to the attachment 2401X94796E-RF External photo and 2401X94796E-RF Internal photo.

## **TEST SETUP PHOTOGRAPHS**

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Please refer to the attachment 2401X94796E-RF Test Setup photo.

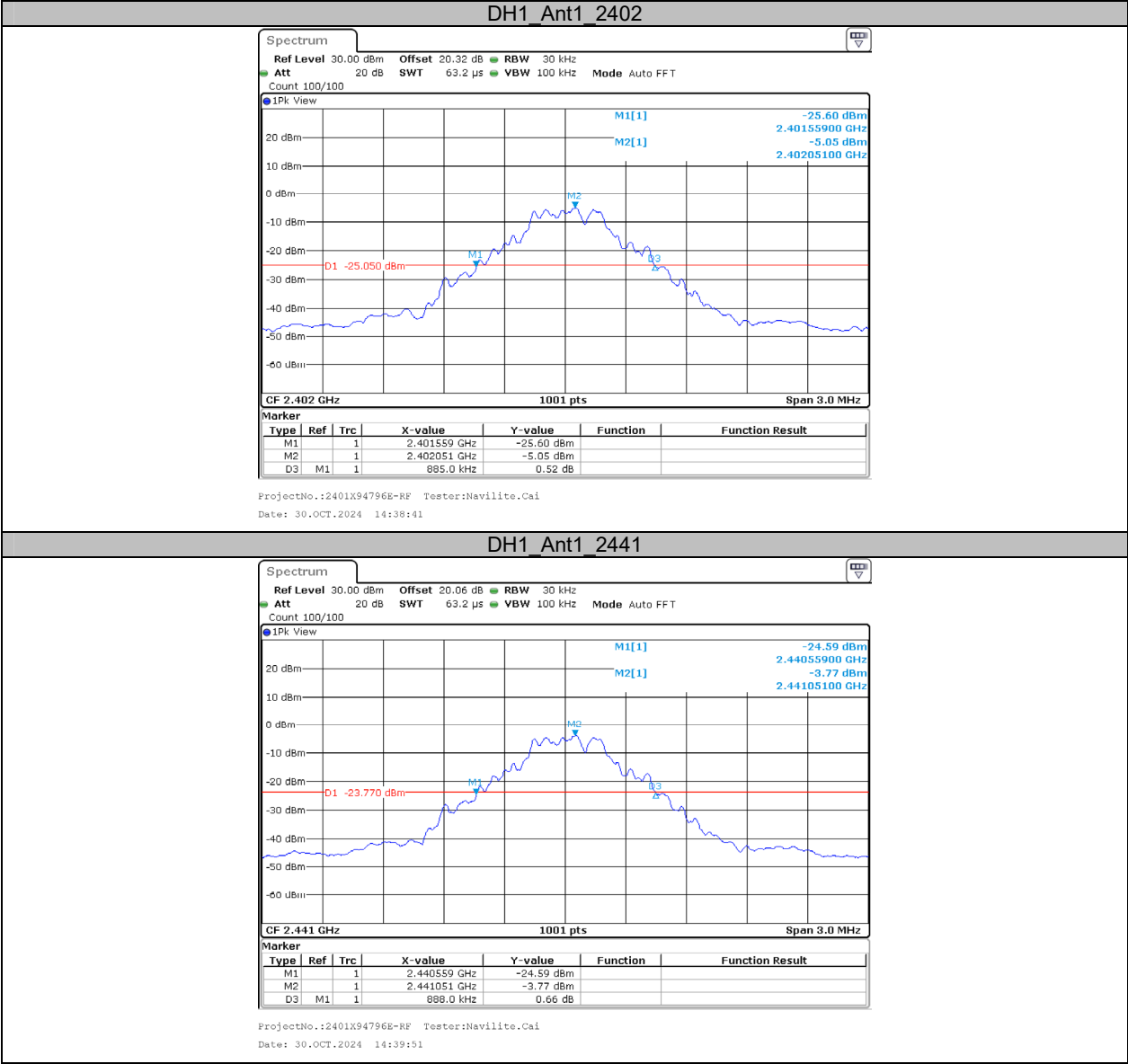
## APPENDIX

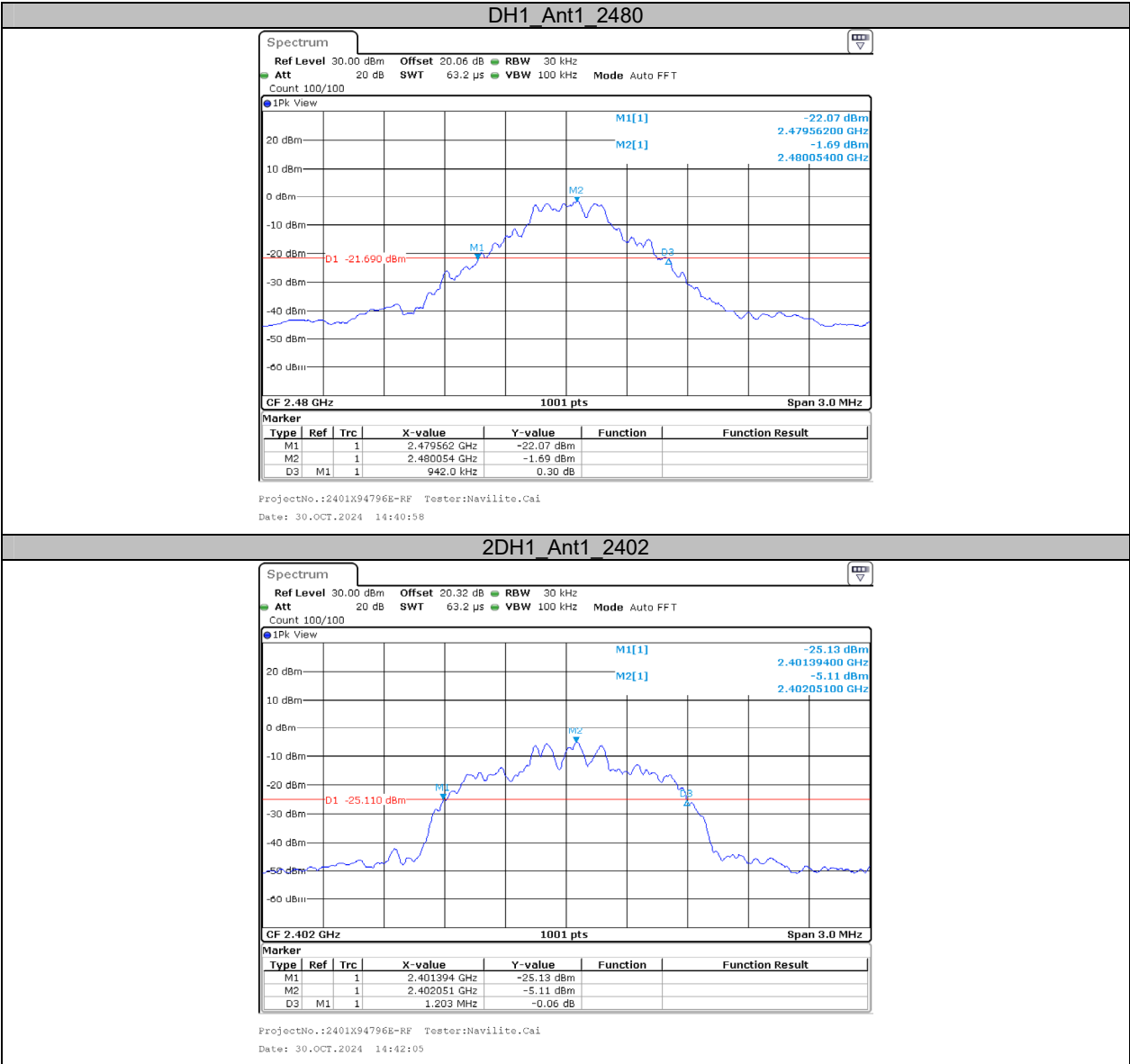
### Appendix A: 20dB Emission Bandwidth

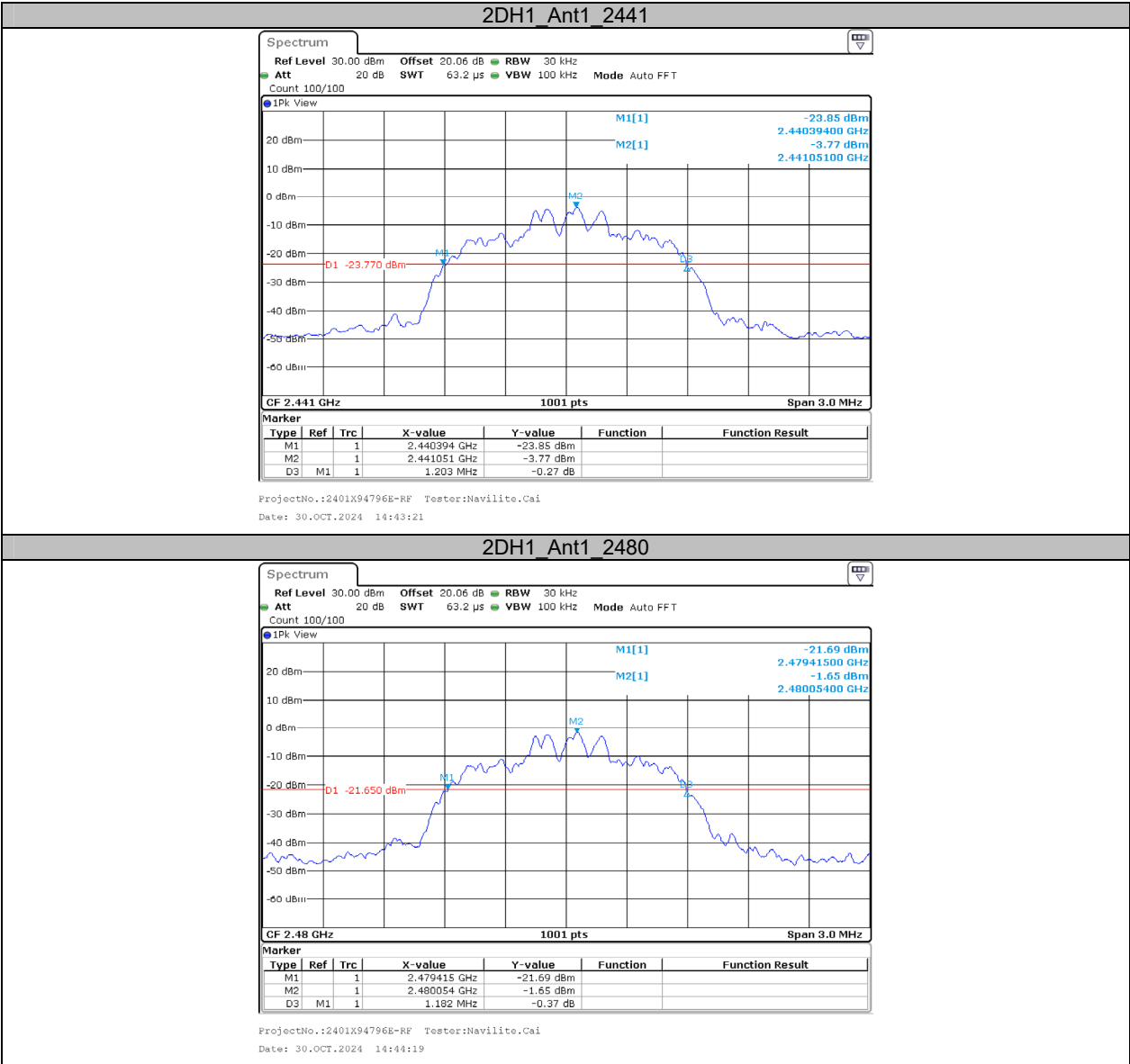
#### Test Result

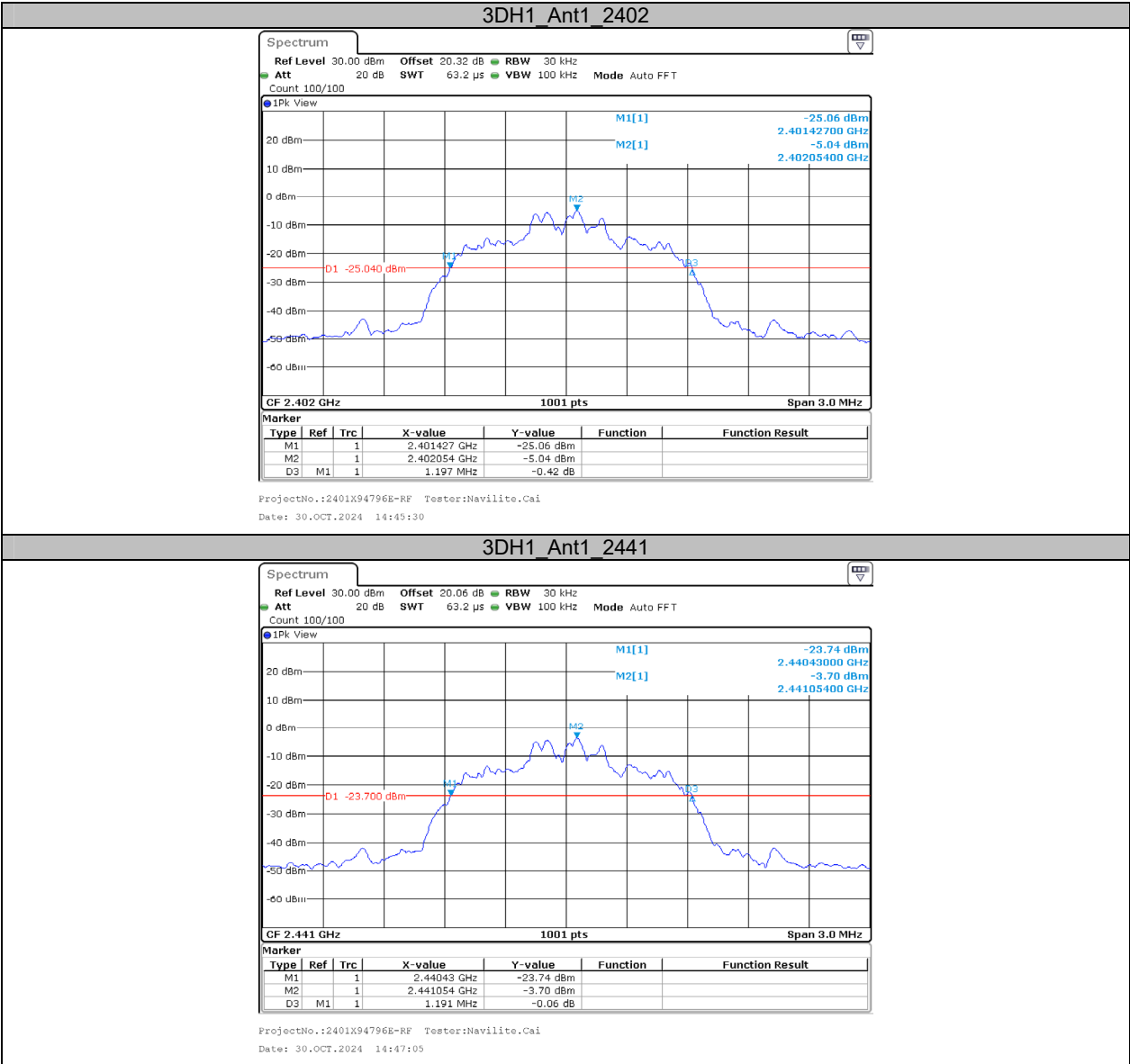
| Test Mode | Antenna | Channel | 20db EBW[MHz] | Limit[MHz] | Verdict |
|-----------|---------|---------|---------------|------------|---------|
| DH1       | Ant1    | 2402    | 0.88          | ---        | ---     |
|           |         | 2441    | 0.89          | ---        | ---     |
|           |         | 2480    | 0.94          | ---        | ---     |
| 2DH1      | Ant1    | 2402    | 1.20          | ---        | ---     |
|           |         | 2441    | 1.20          | ---        | ---     |
|           |         | 2480    | 1.18          | ---        | ---     |
| 3DH1      | Ant1    | 2402    | 1.20          | ---        | ---     |
|           |         | 2441    | 1.19          | ---        | ---     |
|           |         | 2480    | 1.19          | ---        | ---     |

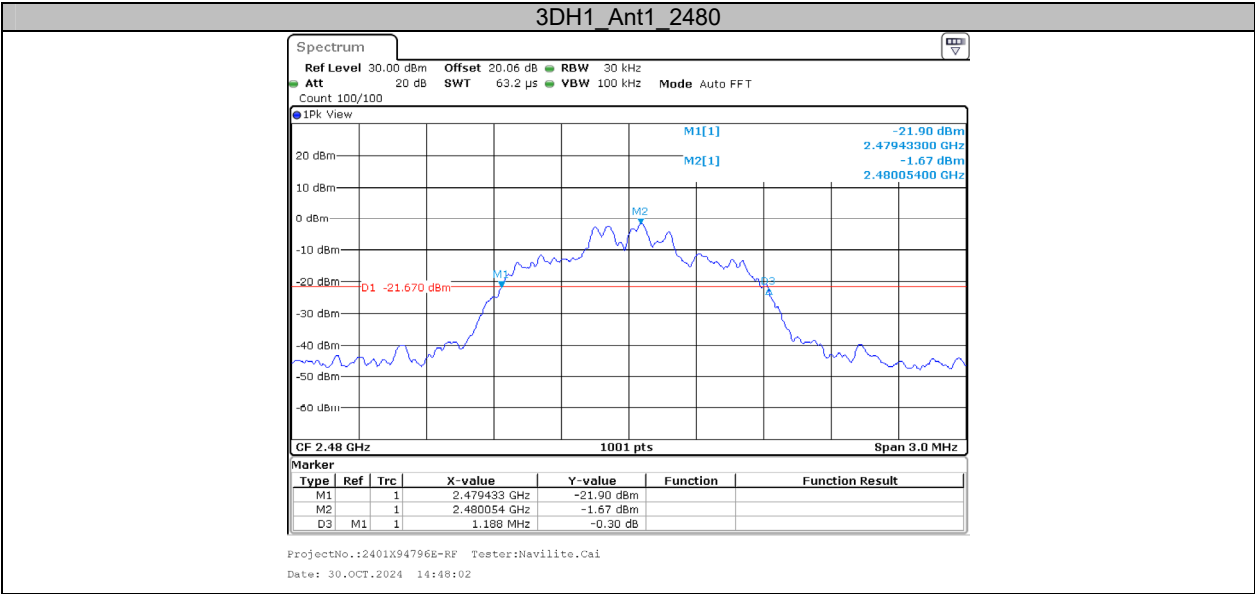
Test Graphs







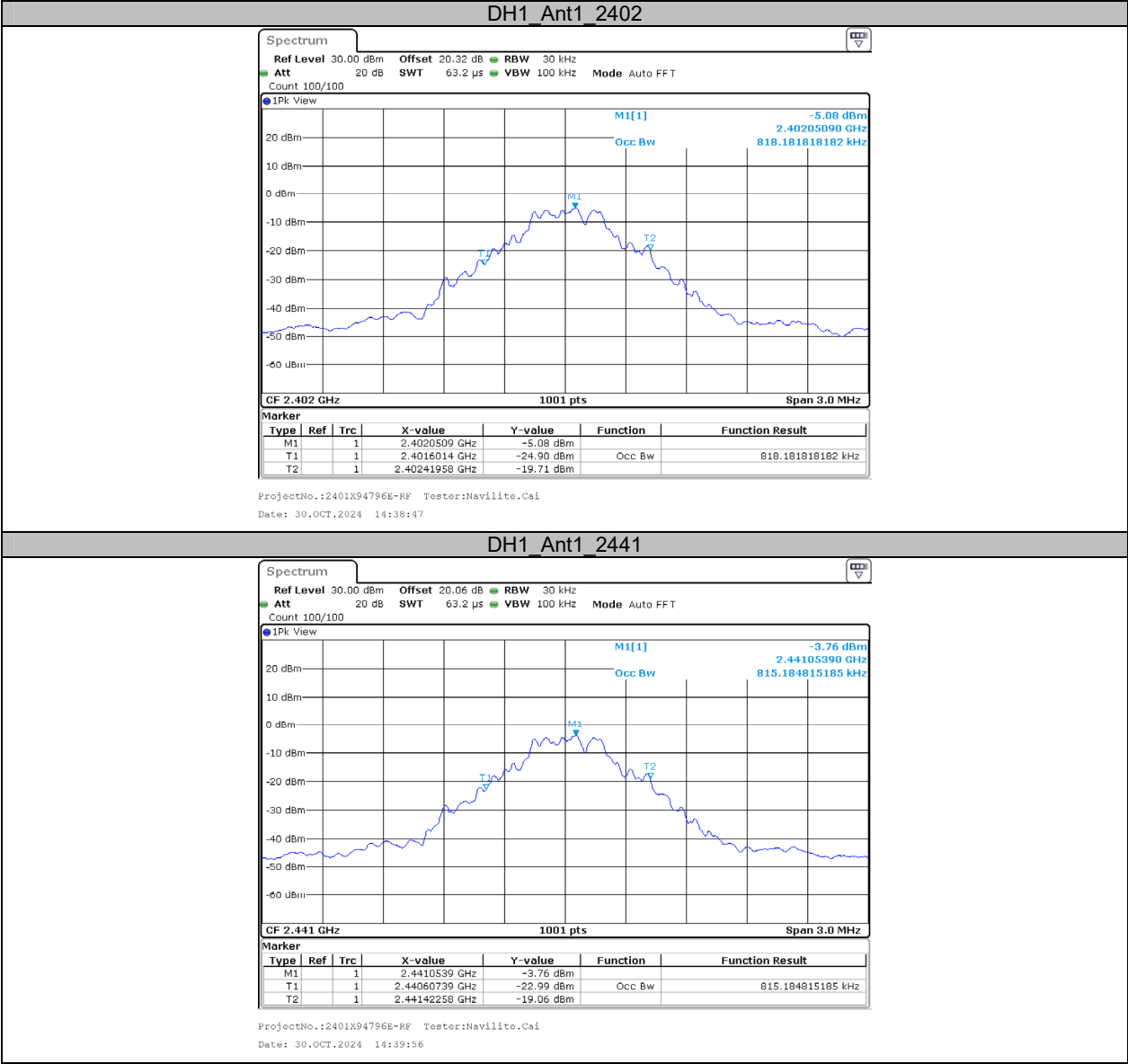


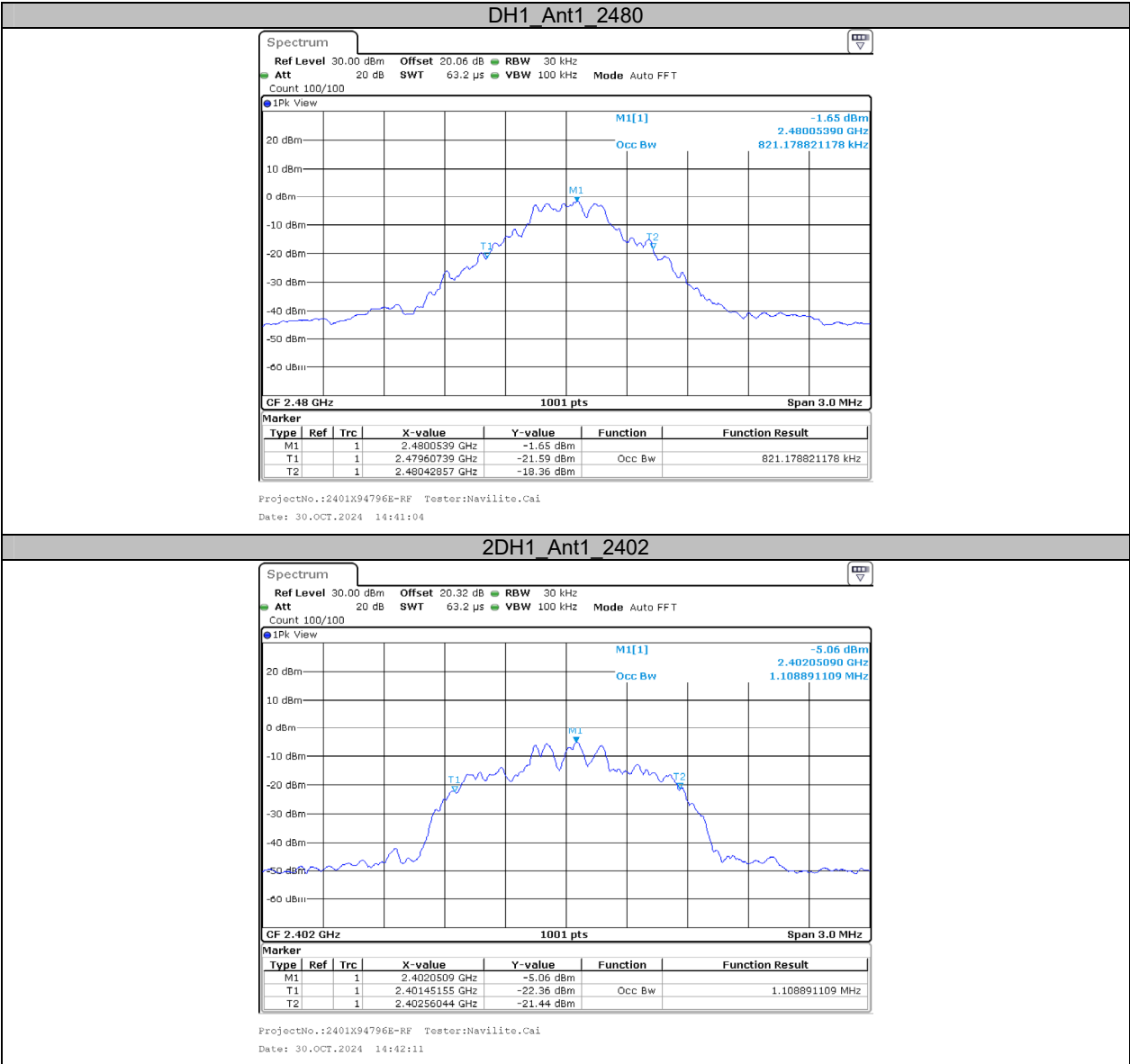


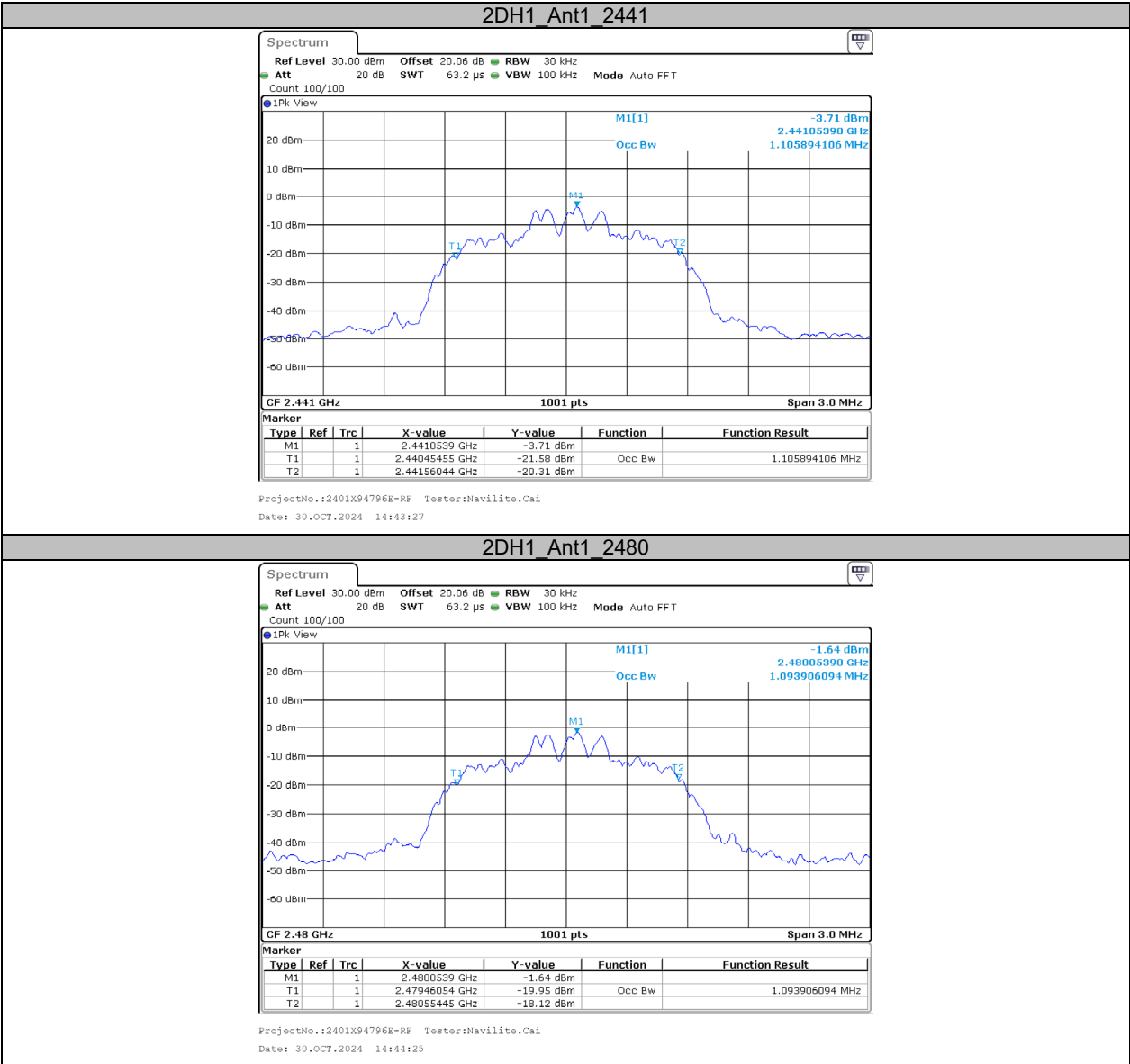
**Appendix B: Occupied Channel Bandwidth****Test Result**

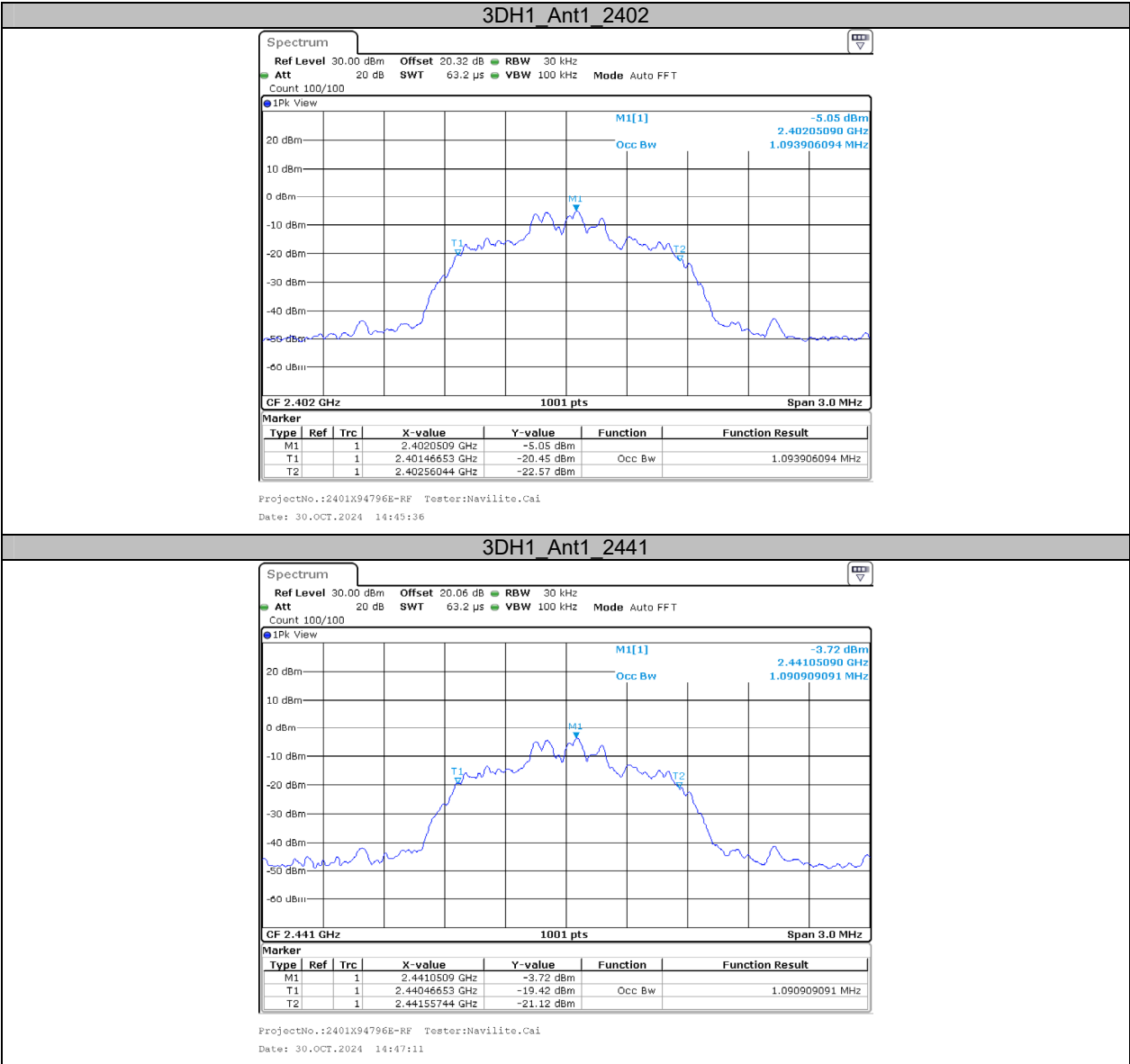
| Test Mode | Antenna | Channel | OCB [MHz] | Limit[MHz] | Verdict |
|-----------|---------|---------|-----------|------------|---------|
| DH1       | Ant1    | 2402    | 0.818     | ---        | ---     |
|           |         | 2441    | 0.815     | ---        | ---     |
|           |         | 2480    | 0.821     | ---        | ---     |
| 2DH1      | Ant1    | 2402    | 1.109     | ---        | ---     |
|           |         | 2441    | 1.106     | ---        | ---     |
|           |         | 2480    | 1.094     | ---        | ---     |
| 3DH1      | Ant1    | 2402    | 1.094     | ---        | ---     |
|           |         | 2441    | 1.091     | ---        | ---     |
|           |         | 2480    | 1.085     | ---        | ---     |

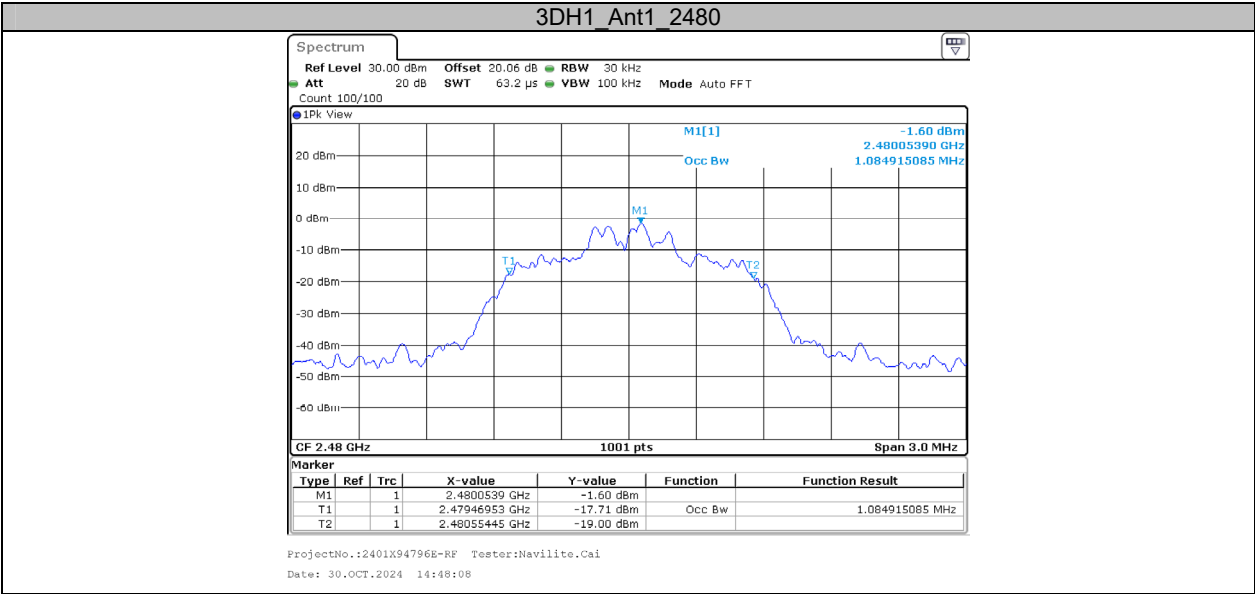
Test Graphs









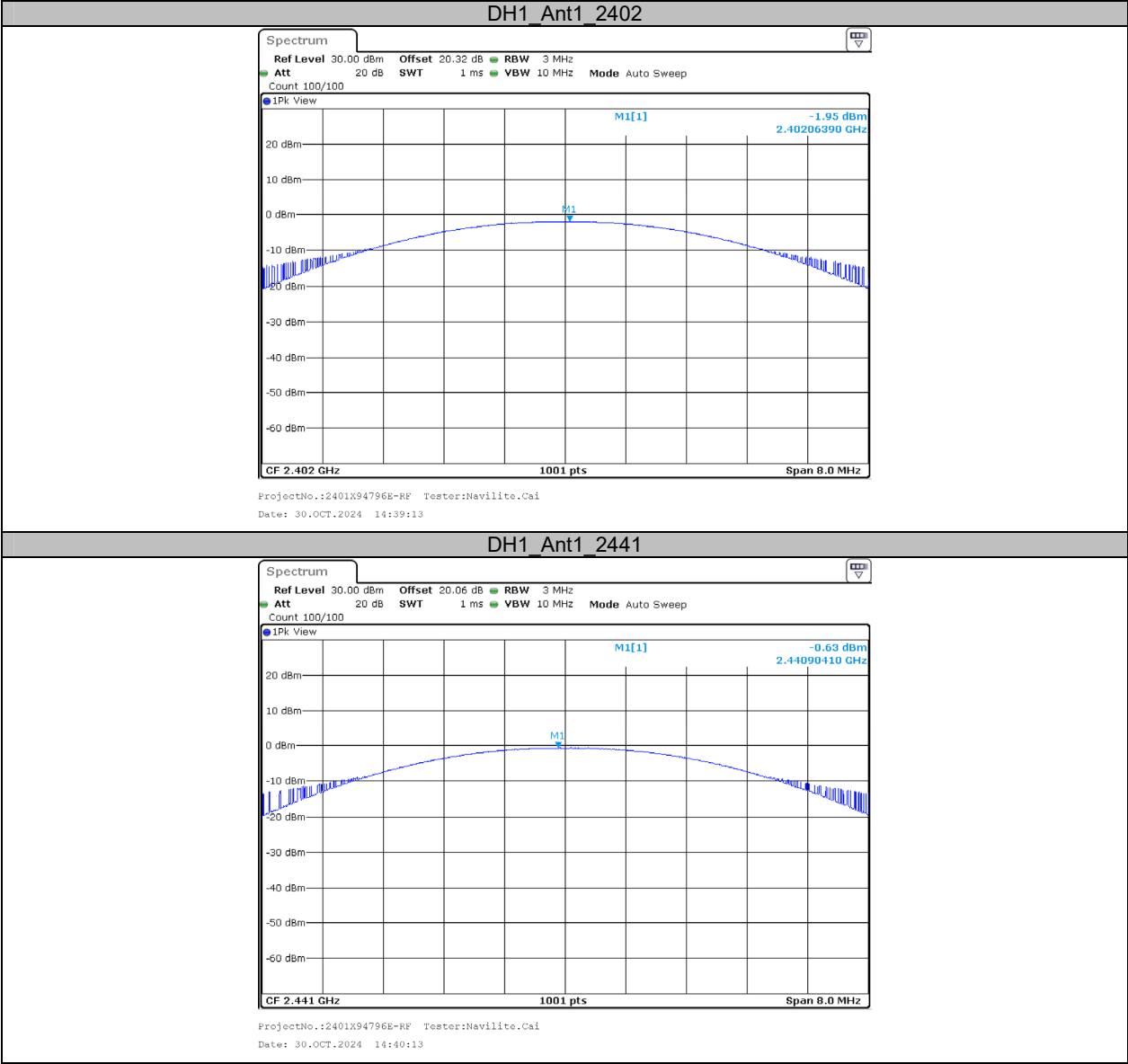


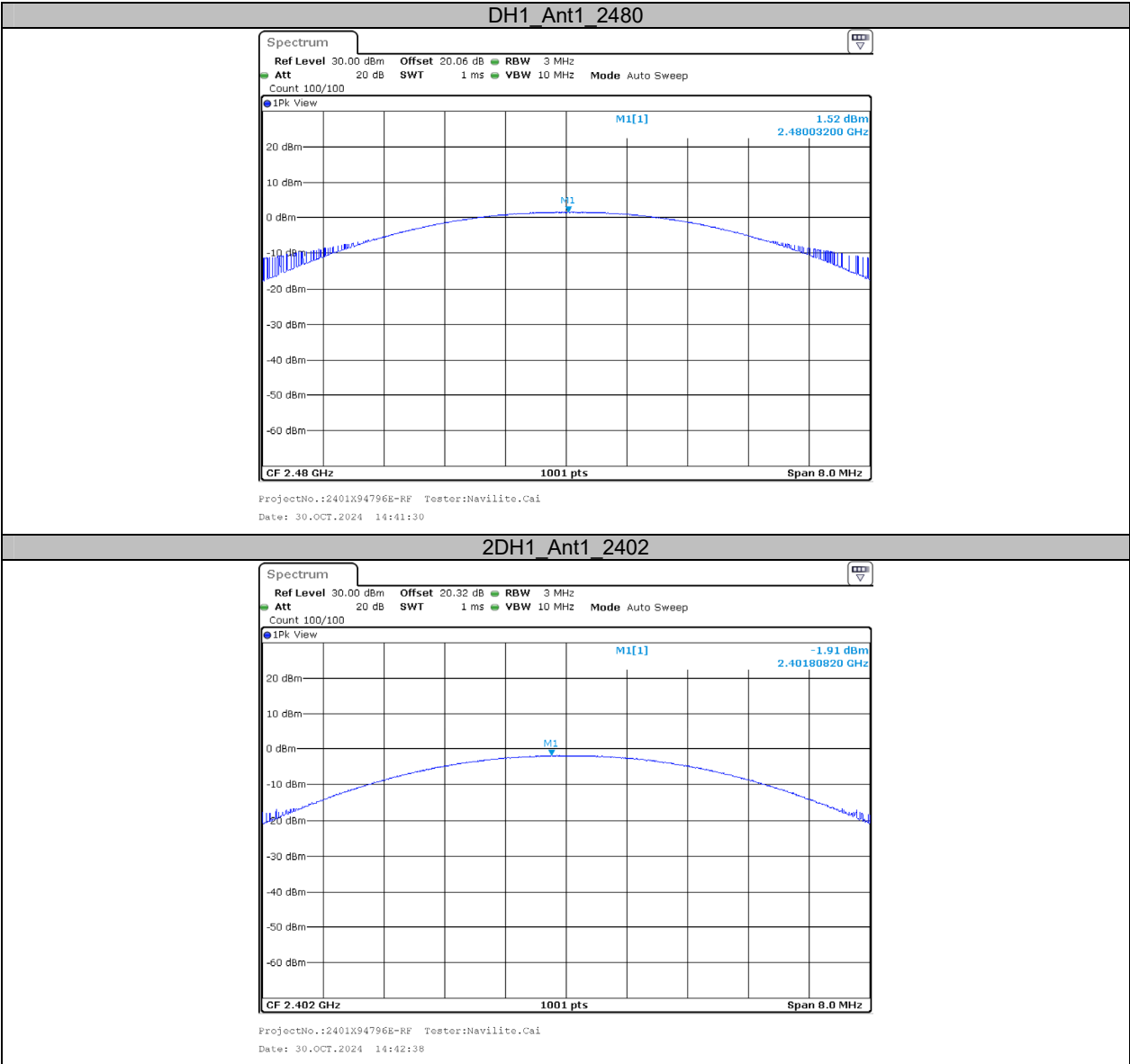
**Appendix C: Maximum Conducted Peak Output Power****Test Result**

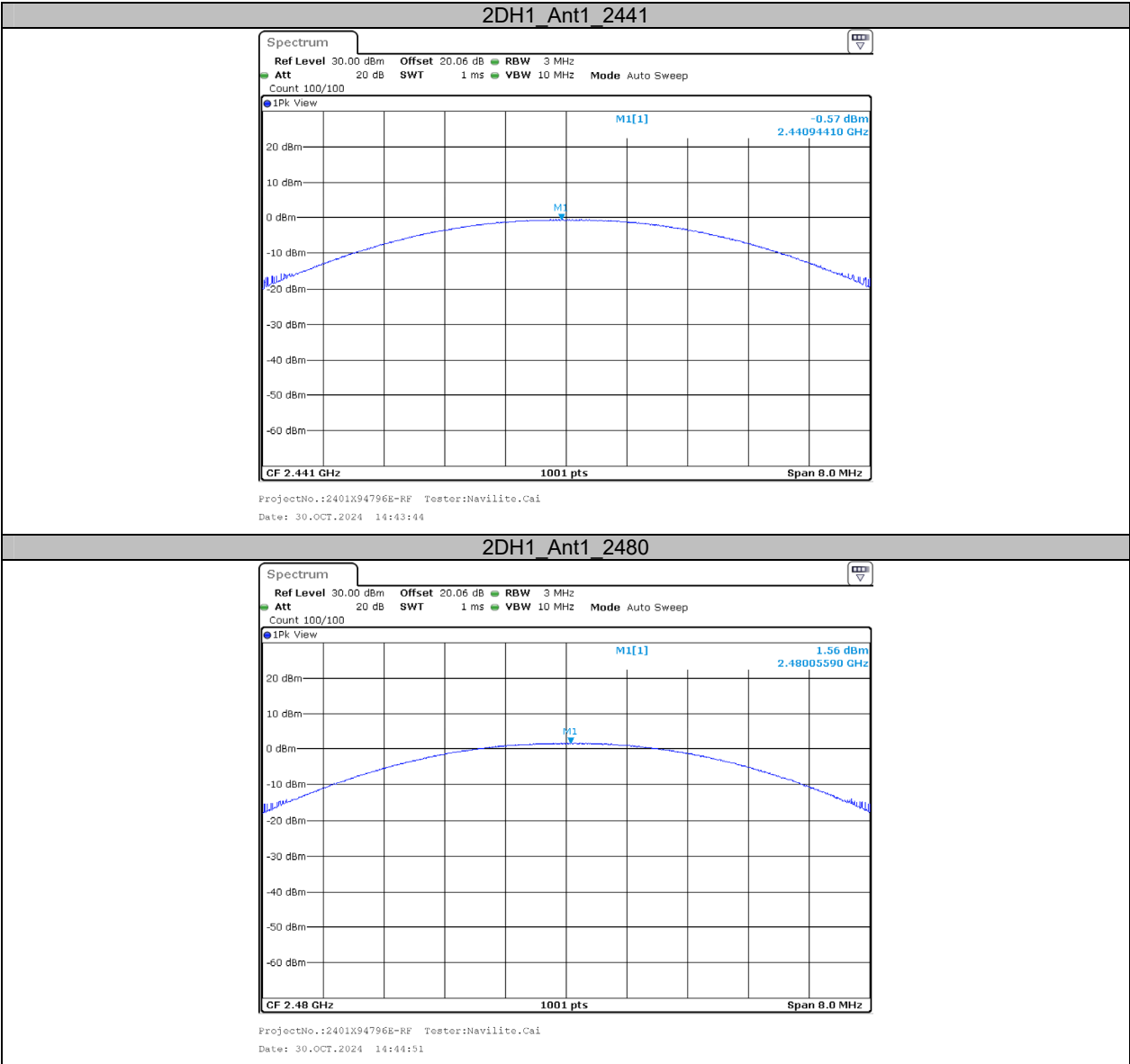
| Test Mode | Antenna | Channel | Result[dBm] | Limit[dBm] | Verdict |
|-----------|---------|---------|-------------|------------|---------|
| DH1       | Ant1    | 2402    | -1.95       | ≤20.97     | PASS    |
|           |         | 2441    | -0.63       | ≤20.97     | PASS    |
|           |         | 2480    | 1.52        | ≤20.97     | PASS    |
| 2DH1      | Ant1    | 2402    | -1.91       | ≤20.97     | PASS    |
|           |         | 2441    | -0.57       | ≤20.97     | PASS    |
|           |         | 2480    | 1.56        | ≤20.97     | PASS    |
| 3DH1      | Ant1    | 2402    | -1.89       | ≤20.97     | PASS    |
|           |         | 2441    | -0.60       | ≤20.97     | PASS    |
|           |         | 2480    | 1.63        | ≤20.97     | PASS    |

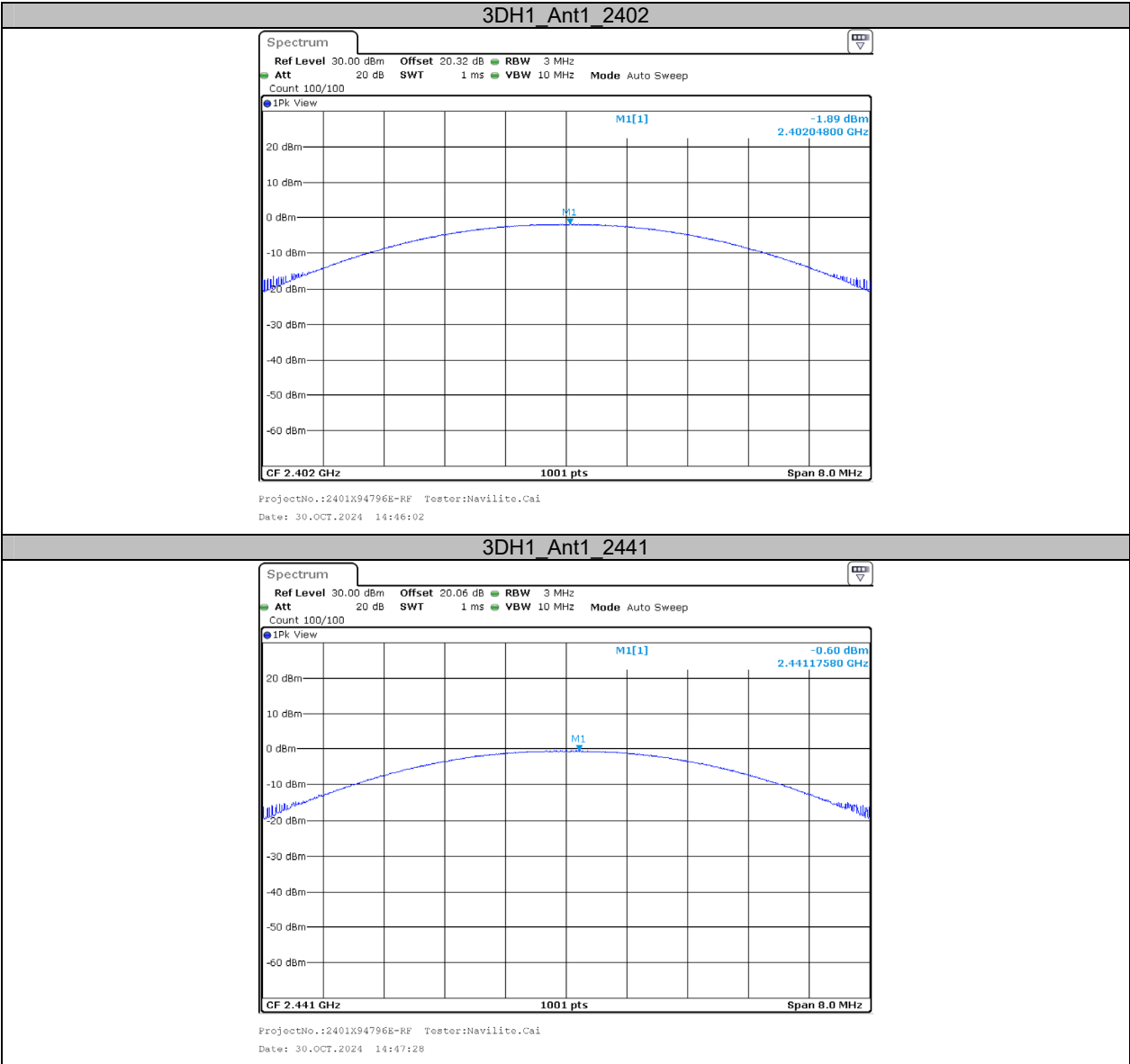
Note: the antenna gain is -4.73dBi, so the maximum EIRP is 1.63dBm-4.73dBi=-3.10dBm which is less than 36dBm. So it meets the ISED EIRP limit.

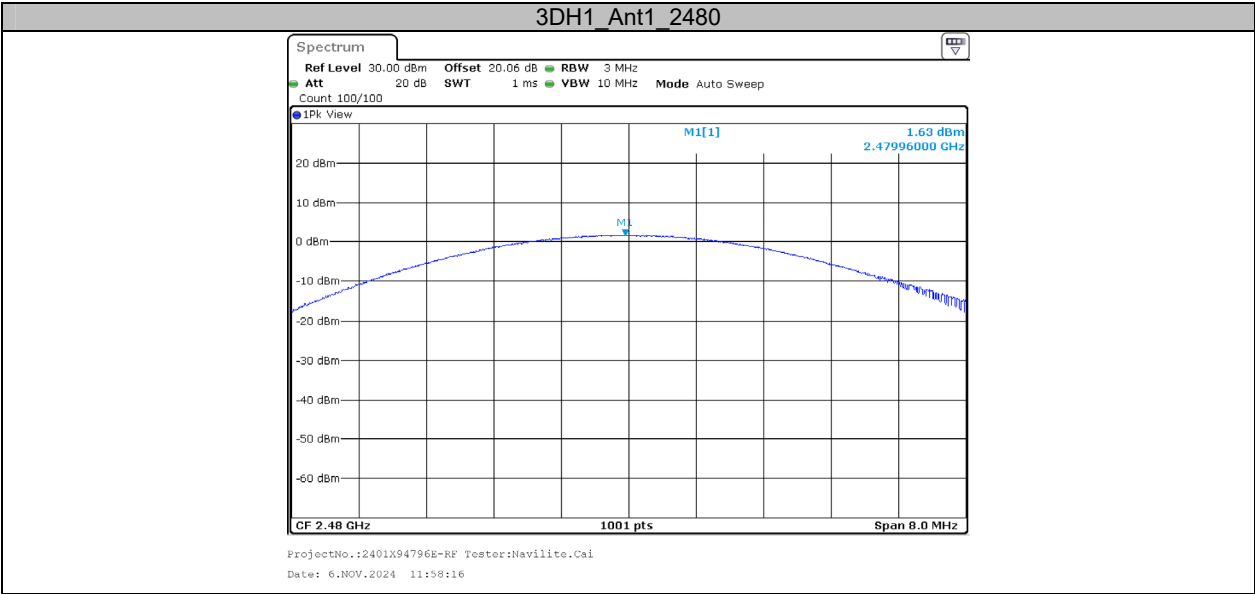
Test Graphs











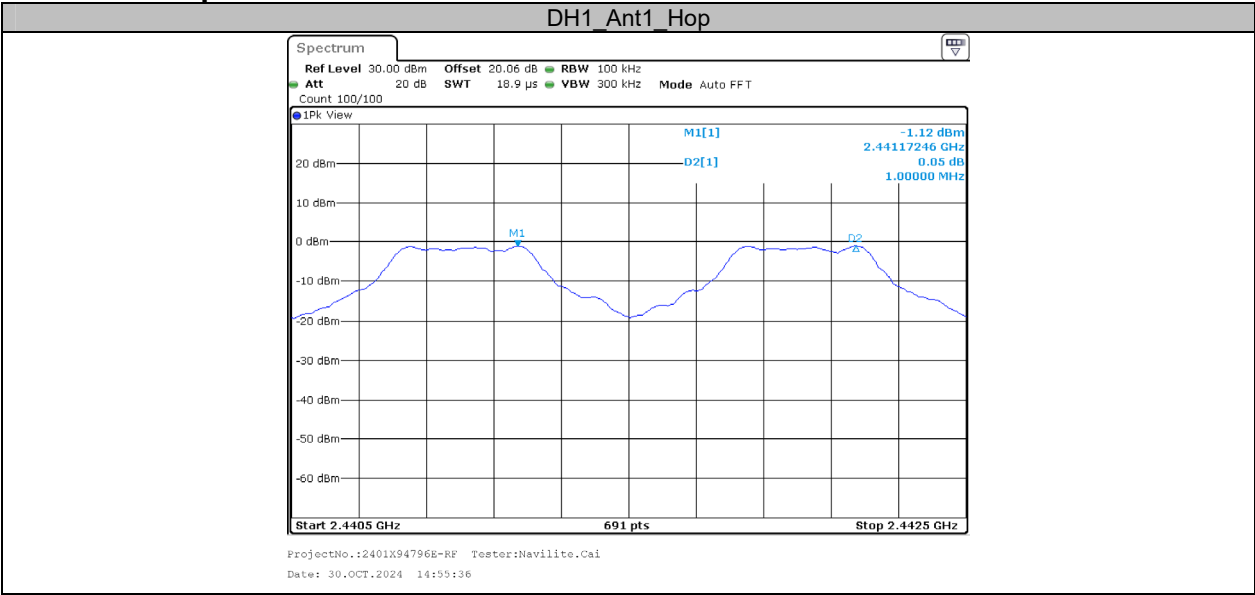
Appendix D: Carrier Frequency Separation

Test Result

| Test Mode | Antenna | Channel | Result[MHz] | Limit[MHz] | Verdict |
|-----------|---------|---------|-------------|------------|---------|
| DH1       | Ant1    | Hop     | 1.000       | ≥0.800     | PASS    |

Note: Only GFSK (DH1) mode result is reported since EDR ( $\pi/4$  DQPSK, 8DPSK) has the exact same channel plan.

Test Graphs



**Appendix E: Time of Occupancy****Test Result**

| Test Mode | Antenna | Channel | BurstWidth<br>[ms] | Result[s] | Limit[s] | Verdict |
|-----------|---------|---------|--------------------|-----------|----------|---------|
| DH1       | Ant1    | Hop     | 0.378              | 0.121     | ≤0.4     | PASS    |
| DH3       | Ant1    | Hop     | 1.626              | 0.260     | ≤0.4     | PASS    |
| DH5       | Ant1    | Hop     | 2.865              | 0.306     | ≤0.4     | PASS    |
| 2DH1      | Ant1    | Hop     | 0.593              | 0.190     | ≤0.4     | PASS    |
| 2DH3      | Ant1    | Hop     | 1.631              | 0.261     | ≤0.4     | PASS    |
| 2DH5      | Ant1    | Hop     | 2.872              | 0.306     | ≤0.4     | PASS    |
| 3DH1      | Ant1    | Hop     | 0.388              | 0.124     | ≤0.4     | PASS    |
| 3DH3      | Ant1    | Hop     | 1.630              | 0.261     | ≤0.4     | PASS    |
| 3DH5      | Ant1    | Hop     | 2.873              | 0.306     | ≤0.4     | PASS    |

Note:

DH1: Dwell time=Pulse time(ms)×(1600/2/79)×31.6s

DH3: Dwell time=Pulse time(ms)×(1600/4/79)×31.6s

DH5: Dwell time=Pulse time(ms)×(1600/6/79)×31.6s

2DH1: Dwell time=Pulse time(ms)×(1600/2/79)×31.6s

2DH3: Dwell time=Pulse time(ms)×(1600/4/79)×31.6s

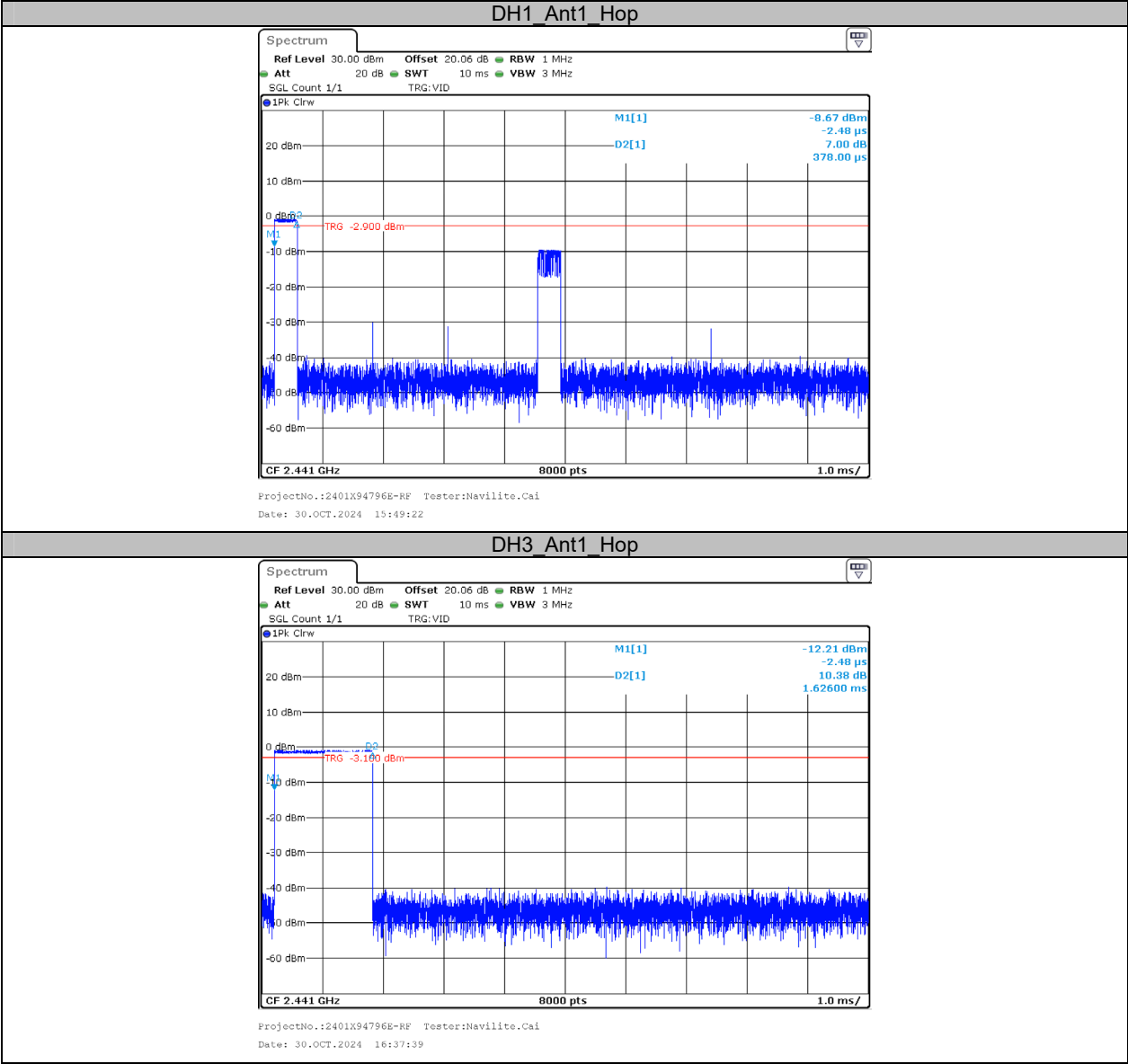
2DH5: Dwell time=Pulse time(ms)×(1600/6/79)×31.6s

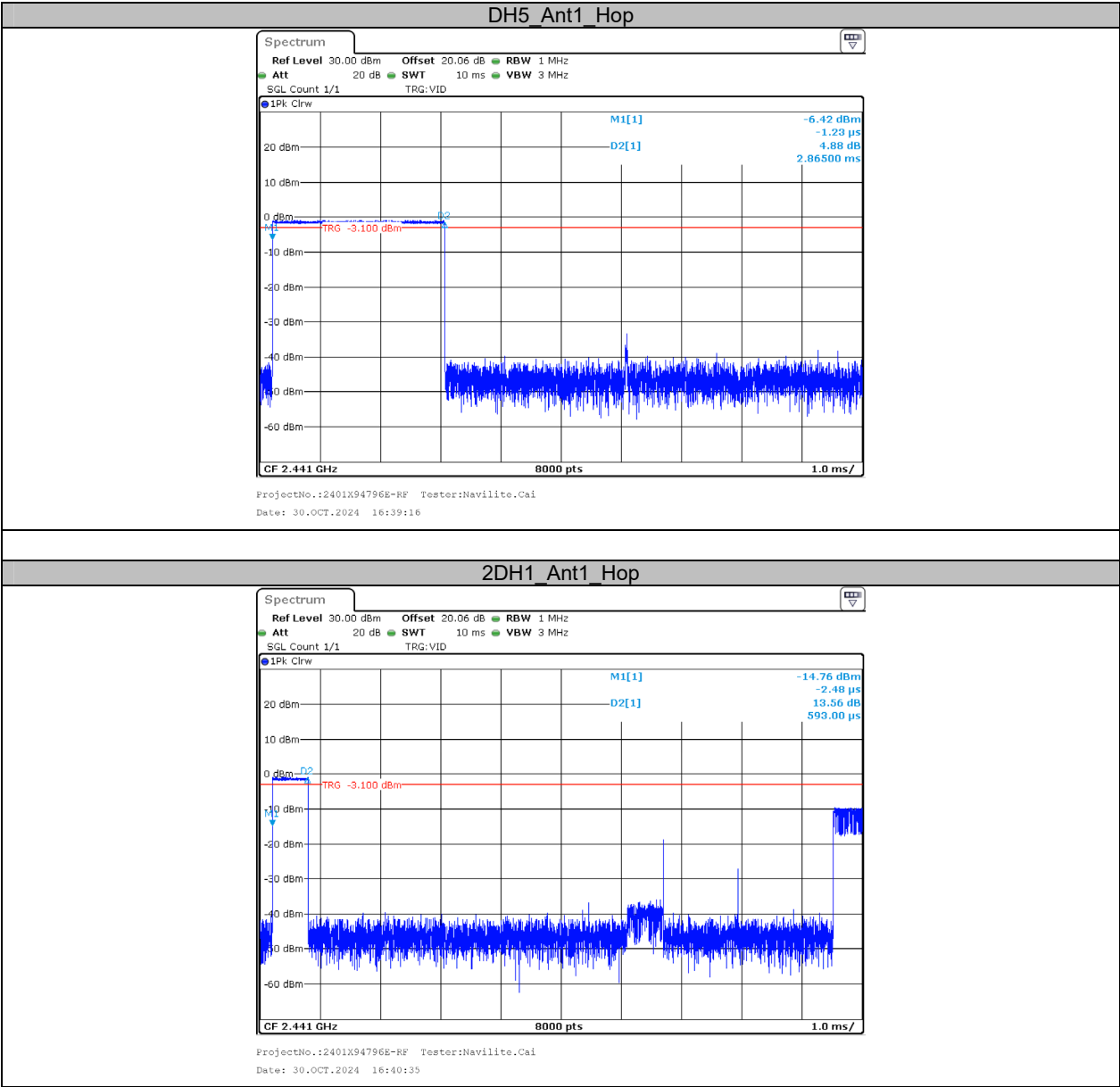
3DH1: Dwell time=Pulse time(ms)×(1600/2/79)×31.6s

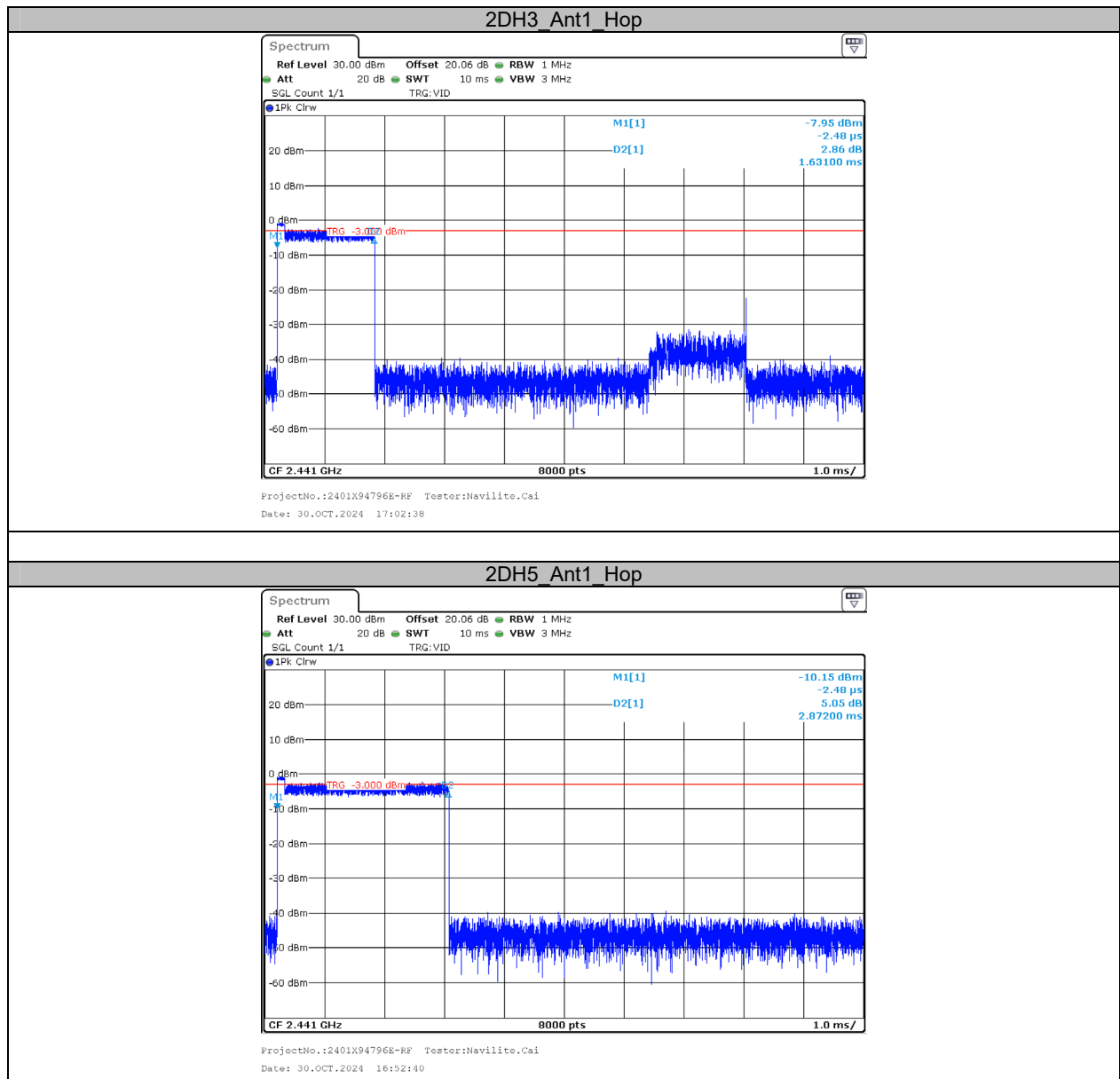
3DH3: Dwell time=Pulse time(ms)×(1600/4/79)×31.6s

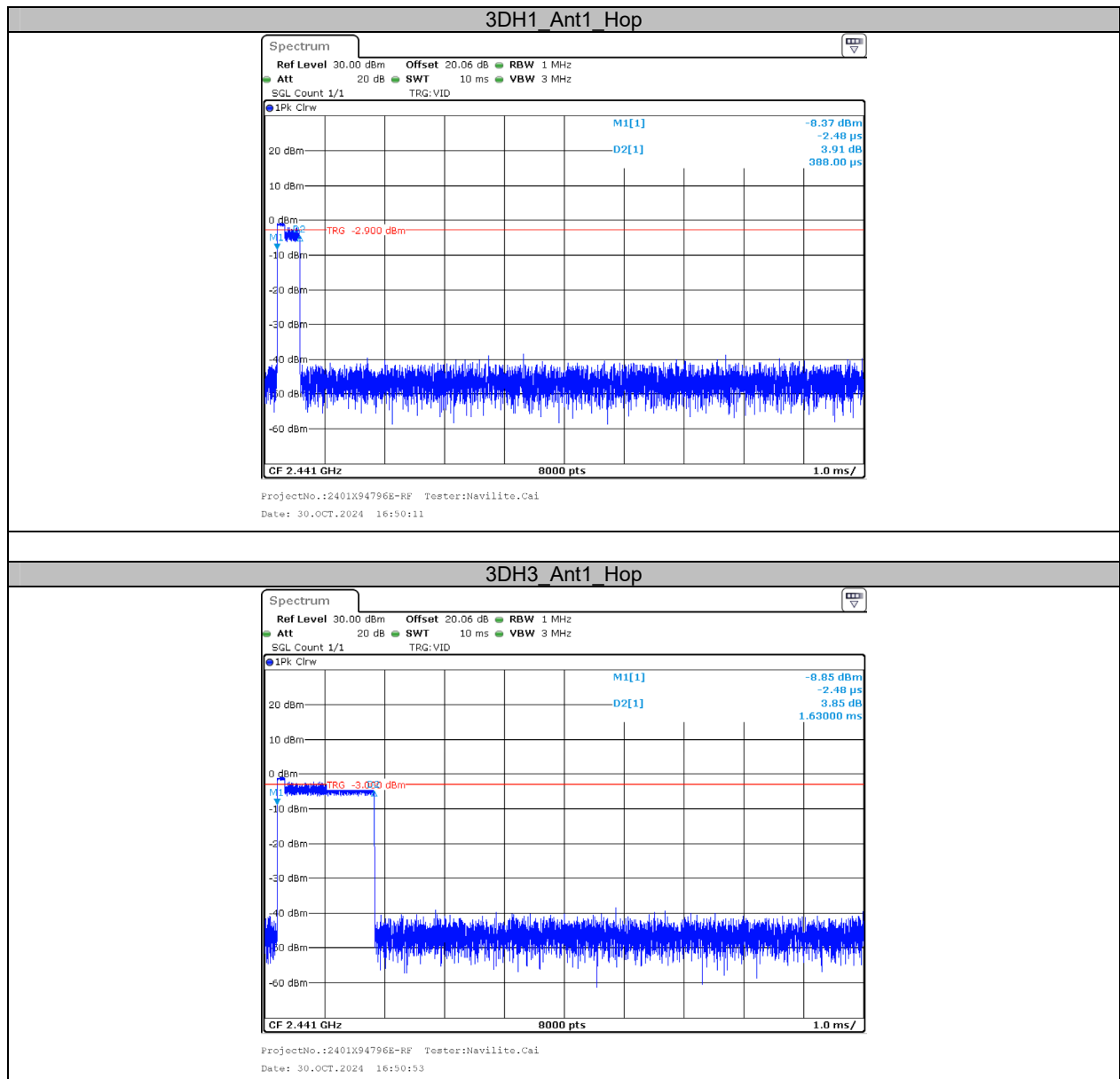
3DH5: Dwell time=Pulse time(ms)×(1600/6/79)×31.6s

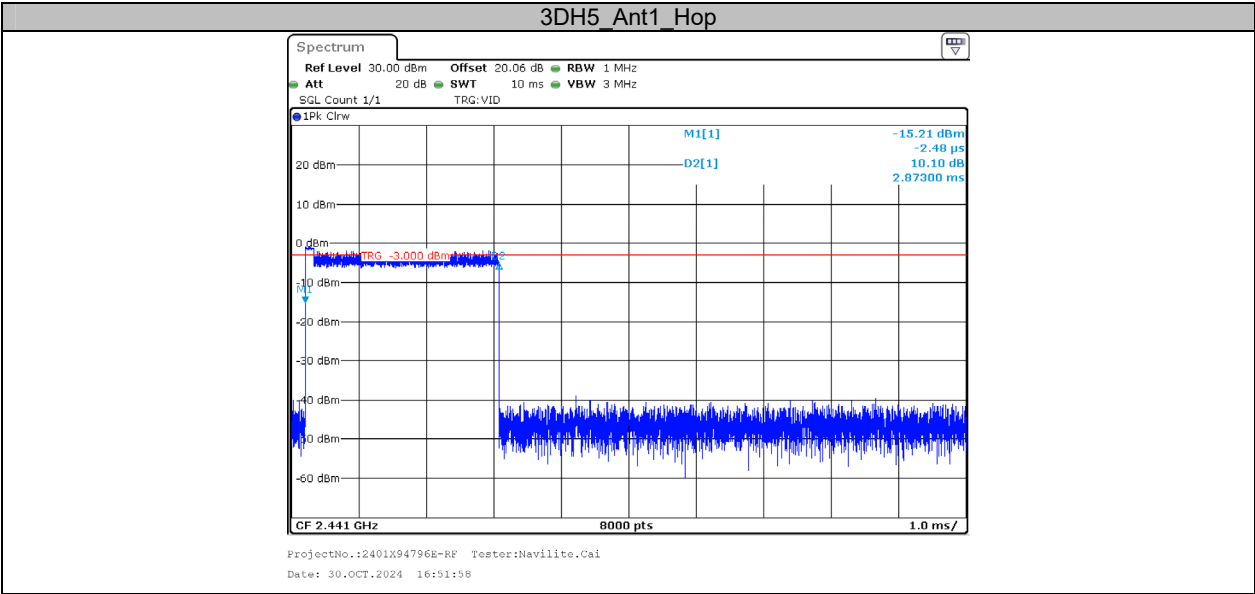
Test Graphs









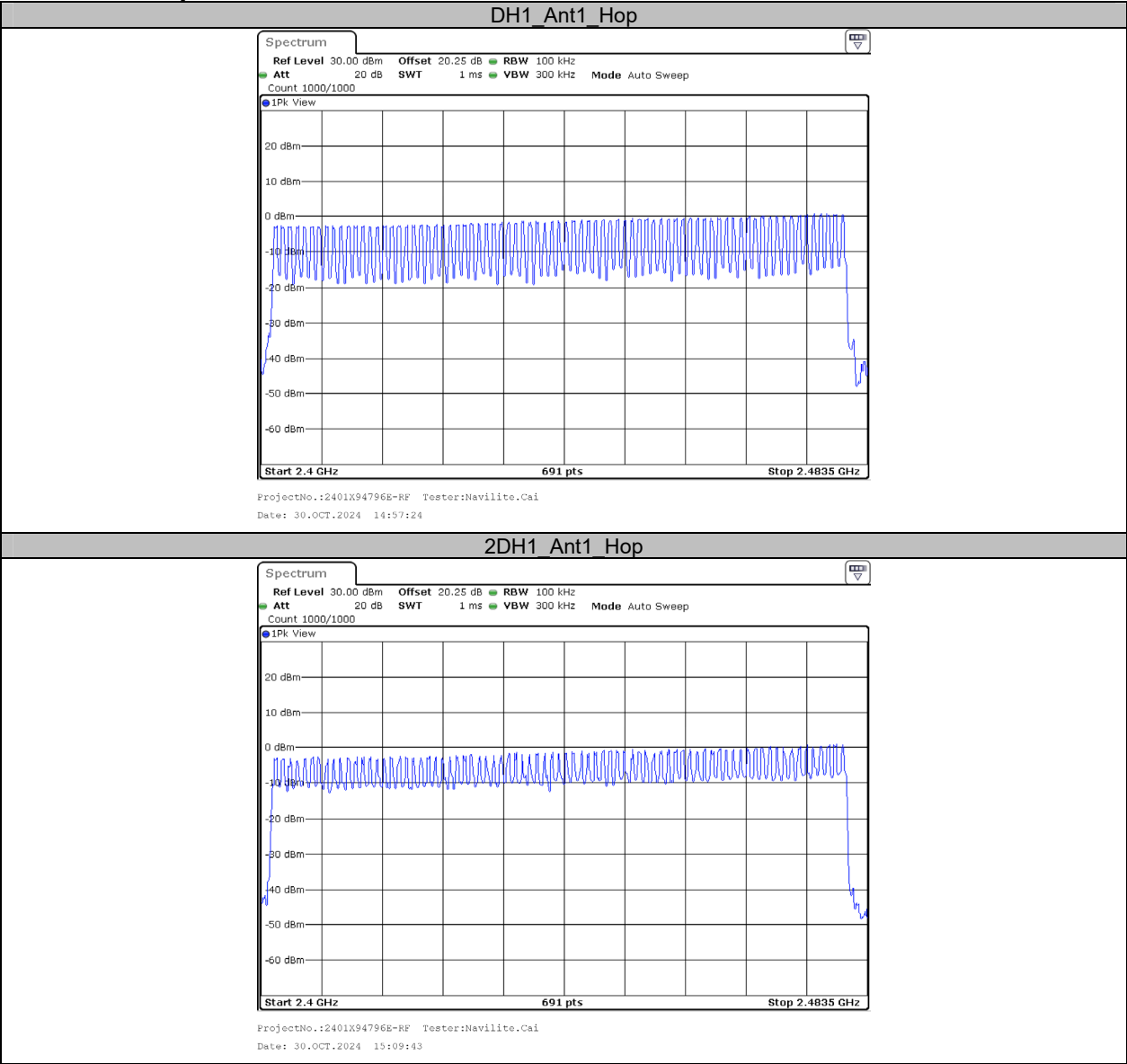


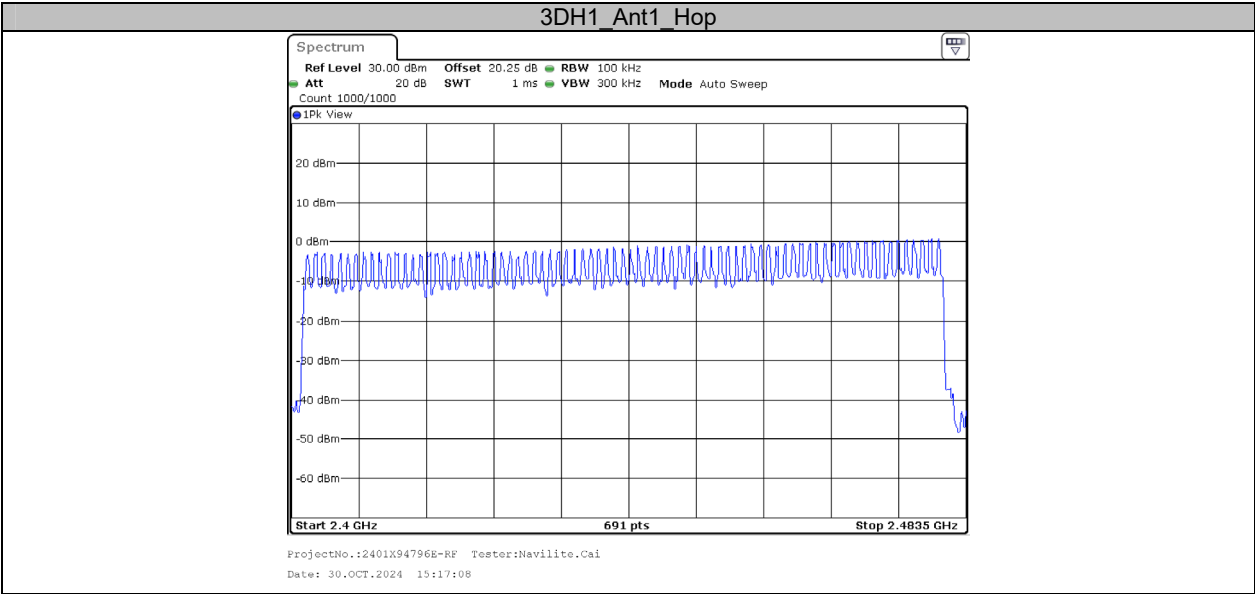
Appendix F: Number Of Hopping Channels

Test Result

| Test Mode | Antenna | Channel | Result[Num] | Limit[Num] | Verdict |
|-----------|---------|---------|-------------|------------|---------|
| DH1       | Ant1    | Hop     | 79          | ≥15        | PASS    |
| 2DH1      | Ant1    | Hop     | 79          | ≥15        | PASS    |
| 3DH1      | Ant1    | Hop     | 79          | ≥15        | PASS    |

Test Graphs





## Appendix G: Band Edge Measurements

## Test Graphs

