

# TEST REPORT

Applicant Name: Grandstream Networks, Inc.  
Address: 126 Brookline Ave., 3rd Floor Boston, MA 02215, USA  
Report Number: 2401T31849E-RFA  
FCC ID: YZZGRP2613W  
IC: 11964A-GRP2613W

## 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: IP Phone  
Model No.: GRP2613W  
Multiple Model(s) No.: N/A  
Trade Mark: GRANDSTREAM  
Date Received: 2024/05/28  
Issue Date: 2024/08/05

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

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

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Jimmy Xiao  
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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               | 2401T31849E-RFA | Original Report         | 2024/08/05       |

## GENERAL INFORMATION

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

|                                    |                                                                                                                                                                                                                                                                                                         |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| HVIN                               | GRP2613W                                                                                                                                                                                                                                                                                                |
| FVIN                               | 0.3.14.15                                                                                                                                                                                                                                                                                               |
| Product                            | IP Phone                                                                                                                                                                                                                                                                                                |
| Tested Model                       | GRP2613W                                                                                                                                                                                                                                                                                                |
| Multiple Model(s)                  | N/A                                                                                                                                                                                                                                                                                                     |
| Frequency Range                    | Bluetooth: 2402-2480MHz                                                                                                                                                                                                                                                                                 |
| Transmit Power                     | 12.25dBm                                                                                                                                                                                                                                                                                                |
| Modulation Technique               | Bluetooth: GFSK, $\pi/4$ -DQPSK, 8DPSK                                                                                                                                                                                                                                                                  |
| Antenna Specification <sup>#</sup> | 2.38dBi (provided by the applicant)                                                                                                                                                                                                                                                                     |
| Voltage Range                      | DC 44-57V From POE or DC 5V From Adapter                                                                                                                                                                                                                                                                |
| Sample serial number               | 2M23-1 for Conducted and Radiated Emissions Test<br>2M23-4 for RF Conducted Test (Assigned by BACL, Shenzhen)                                                                                                                                                                                           |
| Sample/EUT Status                  | Good condition                                                                                                                                                                                                                                                                                          |
| Adapter Information                | Adapter 1<br>Model: A318-050060W-US1<br>Input: 100-240V~50-60Hz, 0.15A<br>Output: DC 5.0V, 0.6A<br>Adapter 2<br>Model: DCT06W050060US-D0<br>Input: 100-240V~50/60Hz, 200mA<br>Output: DC 5.0V, 0.6A<br>Adapter 3<br>Model: GQ06-050060-ZU<br>Input: 100-240V~50/60Hz, 0.3A Max<br>Output: DC 5.0V, 0.6A |

### Objective

This test report is in accordance with Part 2-Subpart J, Part 15-Subparts A and C of the Federal Communication Commissions rules and RSS-247 Issue 3, August 2023, RSS-GEN Issue 5, Feb. 2021Amendment 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. 2021Amendment 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         |                             | ±5%                                   |
| RF output power, conducted         |                             | 0.72 dB(k=2, 95% level of confidence) |
| AC Power Lines Conducted Emissions | 9kHz-150kHz                 | 3.94dB(k=2, 95% level of confidence)  |
|                                    | 150kHz-30MHz                | 3.84dB(k=2, 95% level of confidence)  |
| Radiated Emissions                 | 9kHz - 30MHz                | 3.30dB(k=2, 95% level of confidence)  |
|                                    | 30MHz~200MHz (Horizontal)   | 4.48dB(k=2, 95% level of confidence)  |
|                                    | 30MHz~200MHz (Vertical)     | 4.55dB(k=2, 95% level of confidence)  |
|                                    | 200MHz~1000MHz (Horizontal) | 4.85dB(k=2, 95% level of confidence)  |
|                                    | 200MHz~1000MHz (Vertical)   | 5.05dB(k=2, 95% level of confidence)  |
|                                    | 1GHz - 6GHz                 | 5.35dB(k=2, 95% level of confidence)  |
|                                    | 6GHz - 18GHz                | 5.44dB(k=2, 95% level of confidence)  |
|                                    | 18GHz - 40GHz               | 5.16dB(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

Software “putty.exe<sup>#</sup>” was used and the power level is 4<sup>#</sup>. The 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    |
|--------------|-------------|-----------------------|------------------|
| BULL         | Socket      | GN-415K               | 5503290068073    |
| DELL         | PC          | Latitude E5430        | JG3NLV1          |
| NOKIA        | POE         | G0545-530-060-PSE1000 | N/A              |
| Yealink      | Earphone    | N/A                   | N/A              |
| IMAGITECH    | Router      | AX1800                | YWT0023080000064 |

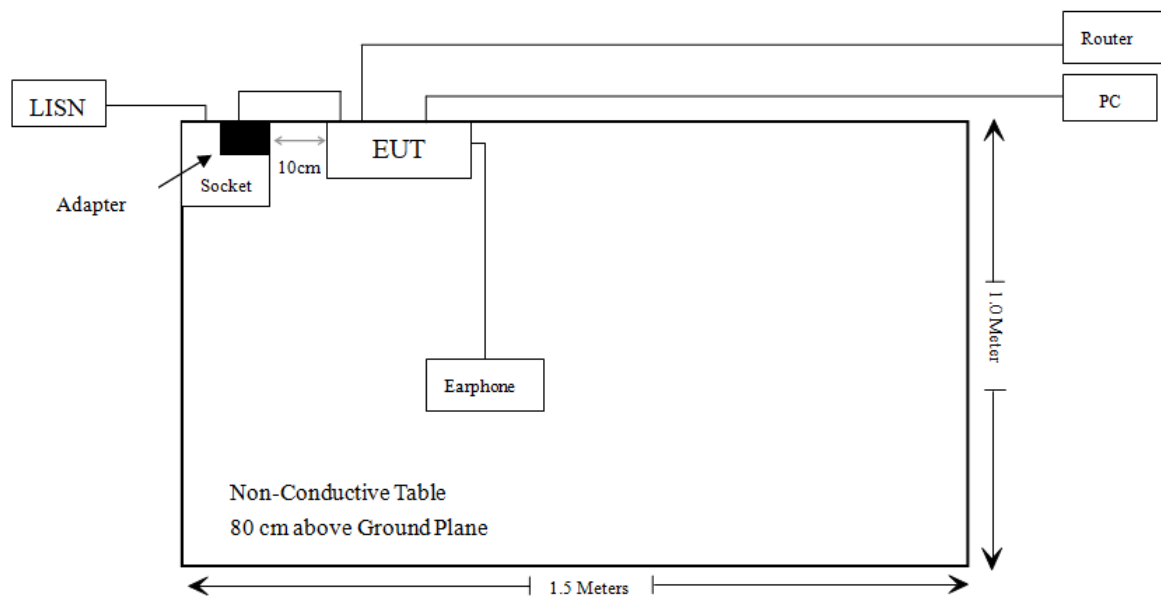
**External I/O Cable**

| Cable Description                  | Length (m) | From Port | To             |
|------------------------------------|------------|-----------|----------------|
| Un-shielded un-detachable AC cable | 1.2        | Socket    | LISN/ AC Mains |
| Un-shielded un-detachable DC cable | 1.8        | Adapter   | EUT            |
| Un-shielded detachable RJ45 cable  | 3.0        | EUT       | Router         |
| Un-shielded detachable RJ45 cable  | 3.0        | EUT       | PC             |
| Un-shielded detachable RJ11 cable  | 1.8        | EUT       | Earphone       |
| Un-shielded detachable AC cable    | 1.5        | POE       | LISN           |
| Un-shielded detachable RJ45 cable  | 1.0        | POE       | EUT            |
| Un-shielded detachable RJ45 cable  | 3.0        | POE       | IP Phone       |
| Un-shielded detachable RJ45 cable  | 10.0       | EUT       | PC             |
| Un-shielded detachable RJ45 cable  | 10.0       | EUT       | Router         |
| Un-shielded detachable RJ45 cable  | 10.0       | EUT       | POE            |

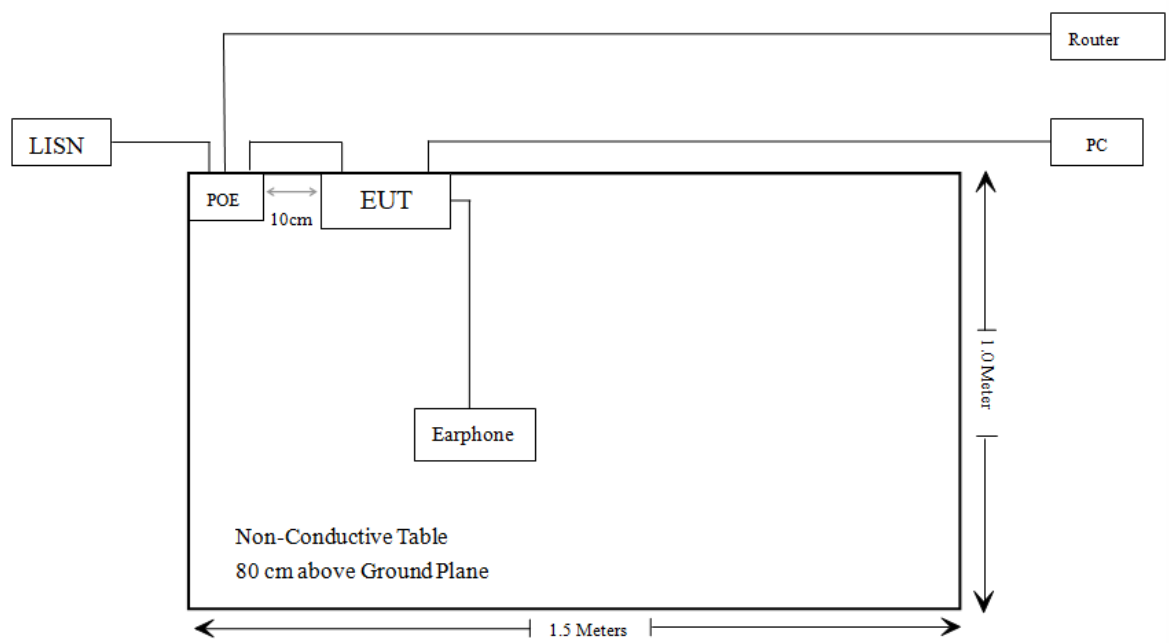
**Block Diagram of Test Setup**

For Conducted Emissions:

For Adapter:

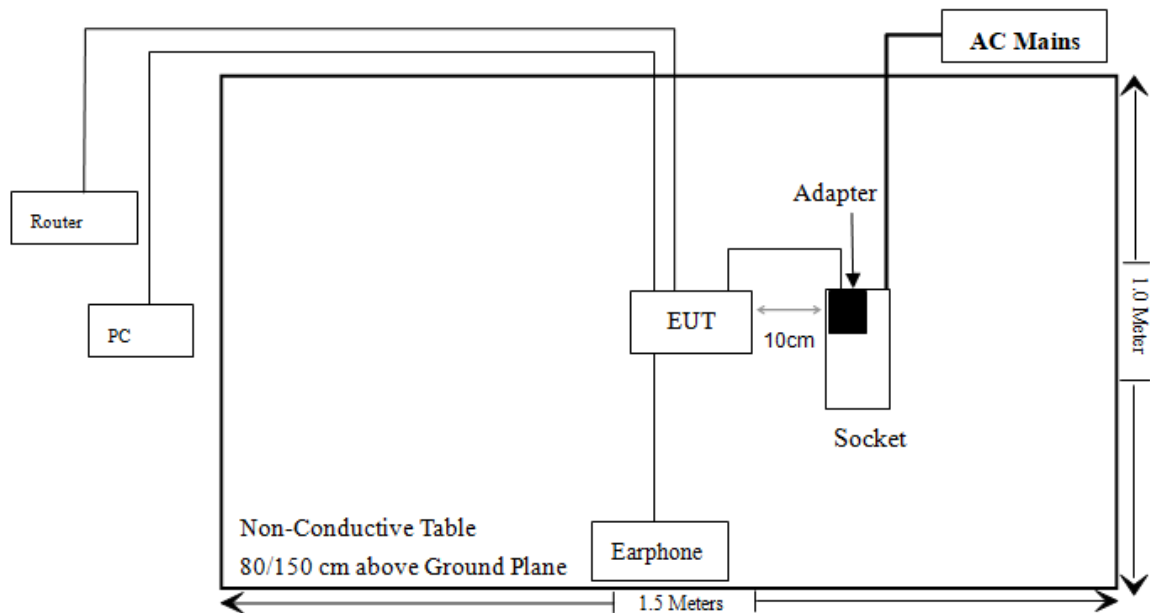


For POE:

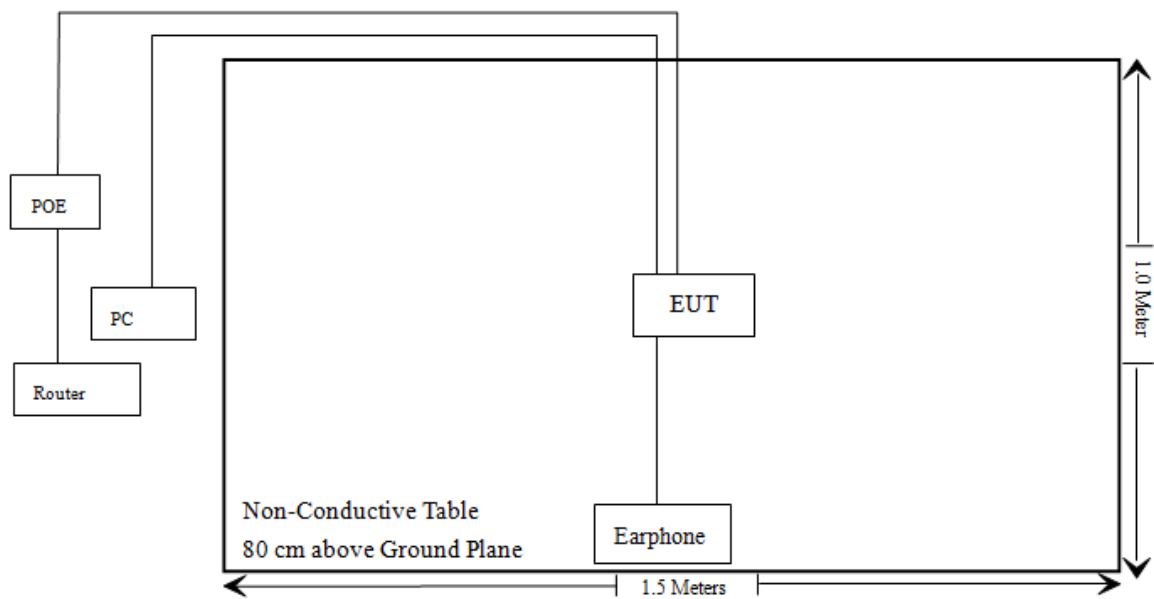


For Radiated Emissions:

For Adapter:



For POE:



**SUMMARY OF TEST RESULTS**

| <b>FCC Rules</b>                 | <b>RSS Rules</b>                | <b>Description of Test</b>                         | <b>Result</b> |
|----------------------------------|---------------------------------|----------------------------------------------------|---------------|
| FCC §1.1307(b) & 2.1091          | RSS-102 § 4                     | Maximum Permissible Exposure(MPE)& Exposure Limits | 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           |
| Audix                          | EMI Test software                 | E3                | 191218(V9)             | NCR              | NCR                  |
| Electro-Mechanics Co           | Horn Antenna                      | 3116              | 9510-2270              | 2023/09/18       | 2026/09/17           |
| UTIFLEX                        | RF Cable                          | NO. 13            | 232308-001             | 2023/08/03       | 2024/08/02           |

| Manufacturer      | Description       | Model    | Serial Number | Calibration Date | Calibration Due Date |
|-------------------|-------------------|----------|---------------|------------------|----------------------|
| RF Conducted Test |                   |          |               |                  |                      |
| Tonscend          | RF control Unit   | JS0806-2 | 19D8060154    | 2023/09/06       | 2024/09/05           |
| Rohde &Schwarz    | Spectrum Analyzer | FSV40    | 101473        | 2024/01/16       | 2025/01/15           |
| MARCONI           | 10dB Attenuator   | 6534/3   | 2942          | 2023/07/04       | 2024/07/03           |
| Unknown           | RF Cable          | 65475    | 01670515      | 2023/07/04       | 2024/07/03           |

\* **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 §1.1307(b) & 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.

#### Limits for General Population/Uncontrolled Exposure

| Limits for General Population/Uncontrolled Exposure |                               |                               |                                     |                          |
|-----------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| Frequency Range (MHz)                               | Electric Field Strength (V/m) | Magnetic Field Strength (A/m) | Power Density (mW/cm <sup>2</sup> ) | Averaging Time (Minutes) |
| 0.3-1.34                                            | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                             | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30-300                                              | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500                                            | /                             | /                             | f/1500                              | 30                       |
| 1500-100,000                                        | /                             | /                             | 1.0                                 | 30                       |

f = frequency in MHz

\* = Plane-wave equivalent power density

### Result

#### Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., mW).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For simultaneously transmit system, the calculated power density should comply with:

$$\sum_i \frac{S_i}{S_{Limit,i}} \leq 1$$

**Result****For worst case:**

| Mode       | Frequency (MHz) | Antenna Gain <sup>#</sup> |           | Tune up conducted power <sup>#</sup> |        | Evaluation Distance (cm) | Power Density (mW/cm <sup>2</sup> ) | MPE Limit (mW/cm <sup>2</sup> ) |
|------------|-----------------|---------------------------|-----------|--------------------------------------|--------|--------------------------|-------------------------------------|---------------------------------|
|            |                 | (dBi)                     | (numeric) | (dBm)                                | (mW)   |                          |                                     |                                 |
| BT         | 2402-2480       | 2.38                      | 1.73      | 12.5                                 | 17.78  | 20                       | 0.006                               | 1                               |
| BLE        | 2402-2480       | 2.38                      | 1.73      | 7.5                                  | 5.62   | 20                       | 0.002                               | 1                               |
| 2.4G Wi-Fi | 2412-2462       | 2.38                      | 1.73      | 24.5                                 | 281.84 | 20                       | 0.097                               | 1                               |
| 5.2G Wi-Fi | 5180-5240       | 4.01                      | 2.52      | 16.0                                 | 39.81  | 20                       | 0.020                               | 1                               |
| 5.3G Wi-Fi | 5260-5320       | 4.01                      | 2.52      | 16.0                                 | 39.81  | 20                       | 0.020                               | 1                               |
| 5.6G Wi-Fi | 5500-5720       | 4.01                      | 2.52      | 16.0                                 | 39.81  | 20                       | 0.020                               | 1                               |
| 5.8G Wi-Fi | 5745-5825       | 4.01                      | 2.52      | 17.5                                 | 56.23  | 20                       | 0.028                               | 1                               |

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

According to applicant, the Bluetooth and Wi-Fi can transmit at same time, the 2.4G Wi-Fi and 5G Wi-Fi cannot transmit at same time

Simultaneous transmitting consideration (worst case):

The ratio= $MPE_{Wi-Fi}/limit_{Wi-Fi} + MPE_{BT}/limit_{BT} = 0.006/1 + 0.097/1 = 0.103 < 1.0$

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

**Result: Compliant.**

## RSS-102 § 4 - EXPOSURE LIMITS

### Applicable Standard

According to RSS-102 § 4:

**Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)**

| Frequency Range (MHz)  | Electric Field (V/m rms)         | Magnetic Field (A/m rms)                        | Power Density (W/m <sup>2</sup> )  | Reference Period (minutes)      |
|------------------------|----------------------------------|-------------------------------------------------|------------------------------------|---------------------------------|
| 0.003-10 <sup>21</sup> | 83                               | 90                                              | -                                  | Instantaneous <sup>*</sup>      |
| 0.1-10                 | -                                | 0.73/ <i>f</i>                                  | -                                  | 6 <sup>**</sup>                 |
| 1.1-10                 | 87/ <i>f</i> <sup>0.5</sup>      | -                                               | -                                  | 6 <sup>**</sup>                 |
| 10-20                  | 27.46                            | 0.0728                                          | -2                                 | 6                               |
| 20-48                  | 58.07/ <i>f</i> <sup>0.25</sup>  | 0.1540/ <i>f</i> <sup>0.25</sup>                | 8.944/ <i>f</i> <sup>0.5</sup>     | 6                               |
| 48-300                 | 22.06                            | 0.05852                                         | 1.291                              | 6                               |
| 300-6000               | 3.142 <i>f</i> <sup>0.3417</sup> | 0.008335 <i>f</i> <sup>0.3417</sup>             | 0.02619 <i>f</i> <sup>0.6834</sup> | 6                               |
| 6000-15000             | 61.4                             | 0.163                                           | 10                                 | 6                               |
| 15000-150000           | 61.4                             | 0.163                                           | 10                                 | 616000/ <i>f</i> <sup>1.2</sup> |
| 150000-300000          | 0.158 <i>f</i> <sup>0.5</sup>    | 4.21 x 10 <sup>-4</sup> <i>f</i> <sup>0.5</sup> | 6.67 x 10 <sup>-5</sup> <i>f</i>   | 616000/ <i>f</i>                |

**Note:** *f* is frequency in MHz.

<sup>\*</sup> Based on nerve stimulation (NS).

<sup>\*\*</sup> Based on specific absorption rate (SAR).

### Result

#### Calculated Formulary:

Predication of MPE limit at a given distance

$$S = \frac{PG}{4\pi R^2}$$

S = power density (in appropriate units, e.g. W/m<sup>2</sup>)

P = power input to the antenna (in appropriate units, e.g., W).

G = power gain of the antenna in the direction of interest relative to an isotropic radiator, the power gain factor, is normally numeric gain.

R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

For worst case:

| Mode       | Frequency (MHz) | Antenna Gain <sup>#</sup> |           | Max Tune-up Power <sup>#</sup> |       | Evaluation Distance (m) | Power Density (W/m <sup>2</sup> ) | MPE Limit (W/m <sup>2</sup> ) |
|------------|-----------------|---------------------------|-----------|--------------------------------|-------|-------------------------|-----------------------------------|-------------------------------|
|            |                 | (dBi)                     | (numeric) | (dBm)                          | (W)   |                         |                                   |                               |
| BT         | 2402-2480       | 2.38                      | 1.73      | 12.5                           | 0.018 | 0.2                     | 0.062                             | 5.35                          |
| BLE        | 2402-2480       | 2.38                      | 1.73      | 7.5                            | 0.006 | 0.2                     | 0.021                             | 5.35                          |
| 2.4G Wi-Fi | 2412-2462       | 2.38                      | 1.73      | 24.5                           | 0.282 | 0.2                     | 0.971                             | 5.37                          |
| 5.2G Wi-Fi | 5180-5240       | 4.01                      | 2.52      | 16.0                           | 0.040 | 0.2                     | 0.201                             | 9.05                          |
| 5.3G Wi-Fi | 5260-5320       | 4.01                      | 2.52      | 16.0                           | 0.040 | 0.2                     | 0.201                             | 9.14                          |
| 5.6G Wi-Fi | 5500-5720       | 4.01                      | 2.52      | 16.0                           | 0.040 | 0.2                     | 0.201                             | 9.43                          |
| 5.8G Wi-Fi | 5745-5825       | 4.01                      | 2.52      | 17.5                           | 0.056 | 0.2                     | 0.281                             | 9.71                          |

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

According to applicant, the Bluetooth and Wi-Fi can transmit at same time, the 2.4G Wi-Fi and 5G Wi-Fi cannot transmit at same time

Simultaneous transmitting consideration (worst case):

$$\sum_i \frac{S_i}{S_{Limit,i}} = 0.062/5.35 + 0.971/5.35 = 0.193 < 1.0$$

### Result: Compliance

Note: To maintain compliance with the RF exposure guidelines, place the equipment at least 0.3 m from nearby persons.

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

### Applicable Standard

According to FCC § 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 use of a standard antenna jack or electrical connector is prohibited.

According to FCC § 15.203, 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 for Bluetooth and the maximum antenna gain<sup>#</sup> is 2.38dBi, fulfill the requirement of this section. Please refer to the EUT photos.

| Antenna Type | Antenna Gain <sup>#</sup> | Impedance | Frequency Range |
|--------------|---------------------------|-----------|-----------------|
| Dipole       | 2.38dBi                   | 50Ω       | 2.4~2.5GHz      |

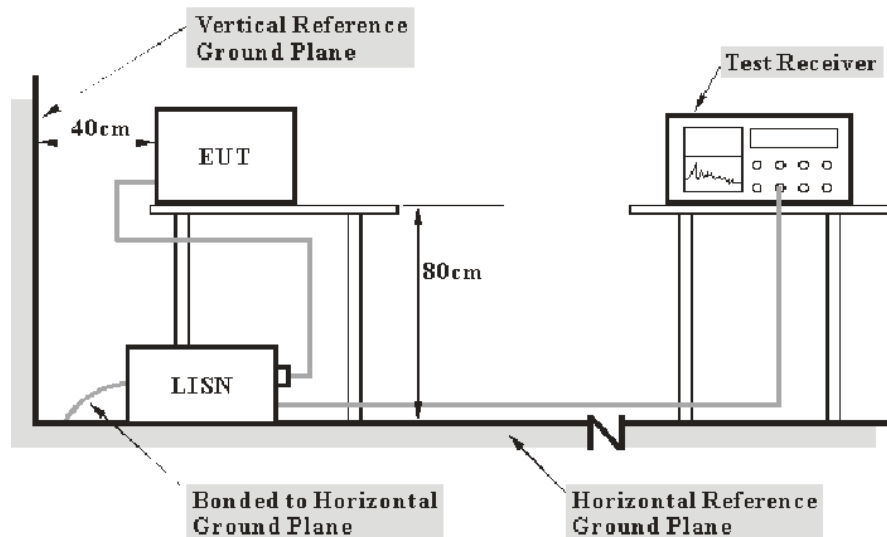
**Result: Compliant**

## 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).

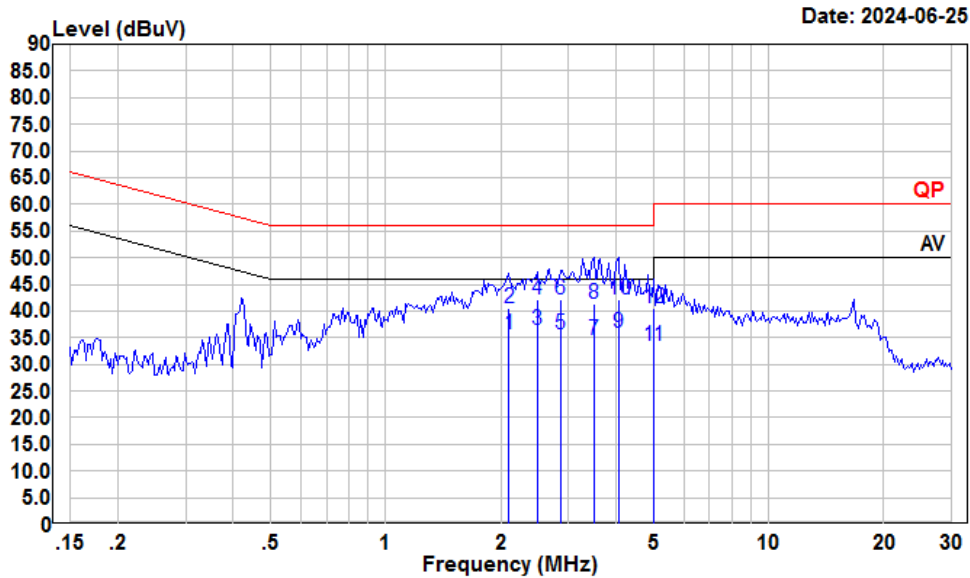
## Test Data

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 22~26 °C  |
| Relative Humidity: | 60~64 %   |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Macy Shi from 2024-06-25 to 2024-07-02.*

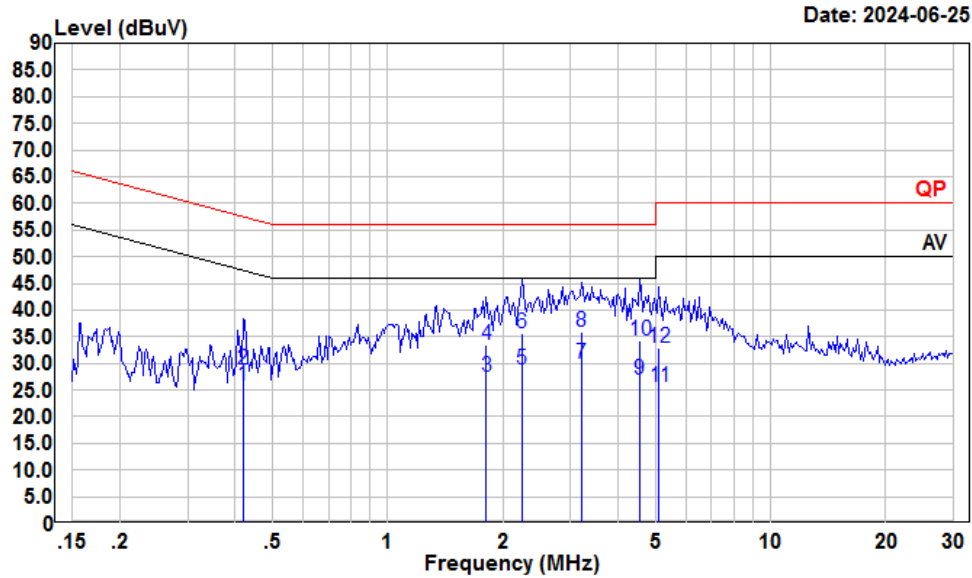
*EUT operation mode: Transmitting (maximum output power mode 8DPSK Low channel)*

*For Adapter 1***AC 120V/60 Hz, Line**

Condition: Line  
Project : 2401T31849E-RF  
tester : Macy.shi  
Note : BT

|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 2.10 | 14.90      | 35.67      | 10.58       | 10.19      | 46.00      | -10.33     | Average |
| 2  | 2.10 | 19.70      | 40.47      | 10.58       | 10.19      | 56.00      | -15.53     | QP      |
| 3  | 2.49 | 15.80      | 36.48      | 10.51       | 10.17      | 46.00      | -9.52      | Average |
| 4  | 2.49 | 21.40      | 42.08      | 10.51       | 10.17      | 56.00      | -13.92     | QP      |
| 5  | 2.85 | 14.99      | 35.62      | 10.45       | 10.18      | 46.00      | -10.38     | Average |
| 6  | 2.85 | 21.49      | 42.12      | 10.45       | 10.18      | 56.00      | -13.88     | QP      |
| 7  | 3.49 | 14.10      | 34.65      | 10.36       | 10.19      | 46.00      | -11.35     | Average |
| 8  | 3.49 | 20.80      | 41.35      | 10.36       | 10.19      | 56.00      | -14.65     | QP      |
| 9  | 4.05 | 15.49      | 36.00      | 10.30       | 10.21      | 46.00      | -10.00     | Average |
| 10 | 4.05 | 21.70      | 42.21      | 10.30       | 10.21      | 56.00      | -13.79     | QP      |
| 11 | 5.01 | 12.93      | 33.49      | 10.38       | 10.18      | 50.00      | -16.51     | Average |
| 12 | 5.01 | 19.93      | 40.49      | 10.38       | 10.18      | 60.00      | -19.51     | QP      |

## AC 120V/60 Hz, Neutral



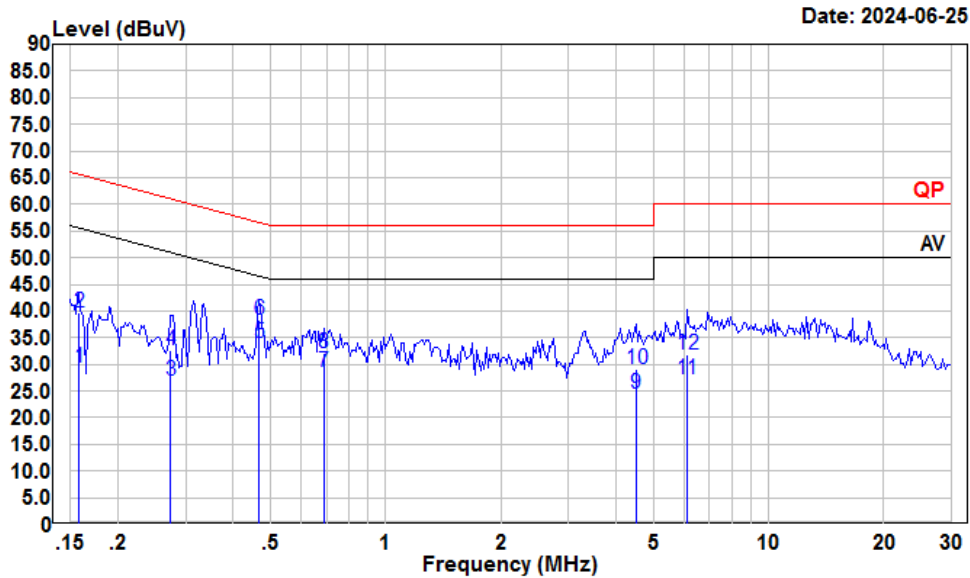
Condition: Neutral

Project : 2401T31849E-RF

tester : Macy.shi

Note : BT

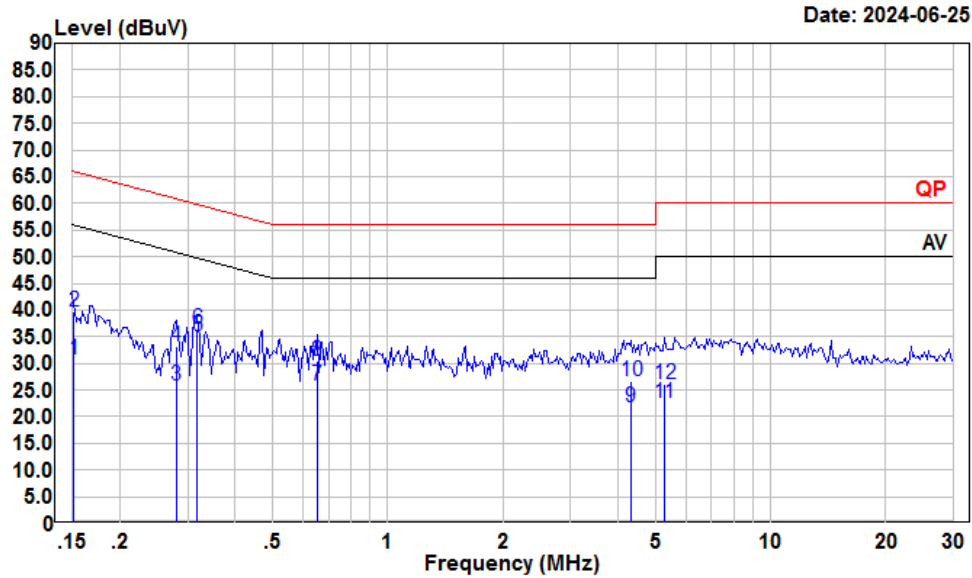
|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.42 | 5.18       | 25.93      | 10.64       | 10.11      | 47.46      | -21.53     | Average |
| 2  | 0.42 | 8.01       | 28.76      | 10.64       | 10.11      | 57.46      | -28.70     | QP      |
| 3  | 1.81 | 6.75       | 27.40      | 10.47       | 10.18      | 46.00      | -18.60     | Average |
| 4  | 1.81 | 12.94      | 33.59      | 10.47       | 10.18      | 56.00      | -22.41     | QP      |
| 5  | 2.24 | 8.33       | 28.91      | 10.40       | 10.18      | 46.00      | -17.09     | Average |
| 6  | 2.24 | 14.96      | 35.54      | 10.40       | 10.18      | 56.00      | -20.46     | QP      |
| 7  | 3.21 | 9.20       | 29.79      | 10.40       | 10.19      | 46.00      | -16.21     | Average |
| 8  | 3.21 | 15.30      | 35.89      | 10.40       | 10.19      | 56.00      | -20.11     | QP      |
| 9  | 4.55 | 6.20       | 26.86      | 10.47       | 10.19      | 46.00      | -19.14     | Average |
| 10 | 4.55 | 13.60      | 34.26      | 10.47       | 10.19      | 56.00      | -21.74     | QP      |
| 11 | 5.11 | 4.73       | 25.44      | 10.53       | 10.18      | 50.00      | -24.56     | Average |
| 12 | 5.11 | 12.21      | 32.92      | 10.53       | 10.18      | 60.00      | -27.08     | QP      |

*For Adapter 2***AC 120V/60 Hz, Line**

Condition: Line  
Project : 2401T31849E-RF  
tester : Macy.shi  
Note : BT

|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.16 | 8.40       | 29.40      | 10.88       | 10.12      | 55.56      | -26.16     | Average |
| 2  | 0.16 | 18.74      | 39.74      | 10.88       | 10.12      | 65.56      | -25.82     | QP      |
| 3  | 0.27 | 6.05       | 26.84      | 10.70       | 10.09      | 50.98      | -24.14     | Average |
| 4  | 0.27 | 11.77      | 32.56      | 10.70       | 10.09      | 60.98      | -28.42     | QP      |
| 5  | 0.47 | 13.36      | 34.01      | 10.52       | 10.13      | 46.58      | -12.57     | Average |
| 6  | 0.47 | 17.61      | 38.26      | 10.52       | 10.13      | 56.58      | -18.32     | QP      |
| 7  | 0.69 | 7.83       | 28.48      | 10.50       | 10.15      | 46.00      | -17.52     | Average |
| 8  | 0.69 | 11.49      | 32.14      | 10.50       | 10.15      | 56.00      | -23.86     | QP      |
| 9  | 4.50 | 3.97       | 24.50      | 10.34       | 10.19      | 46.00      | -21.50     | Average |
| 10 | 4.50 | 8.48       | 29.01      | 10.34       | 10.19      | 56.00      | -26.99     | QP      |
| 11 | 6.12 | 6.68       | 27.32      | 10.45       | 10.19      | 50.00      | -22.68     | Average |
| 12 | 6.12 | 11.14      | 31.78      | 10.45       | 10.19      | 60.00      | -28.22     | QP      |

## AC 120V/60 Hz, Neutral



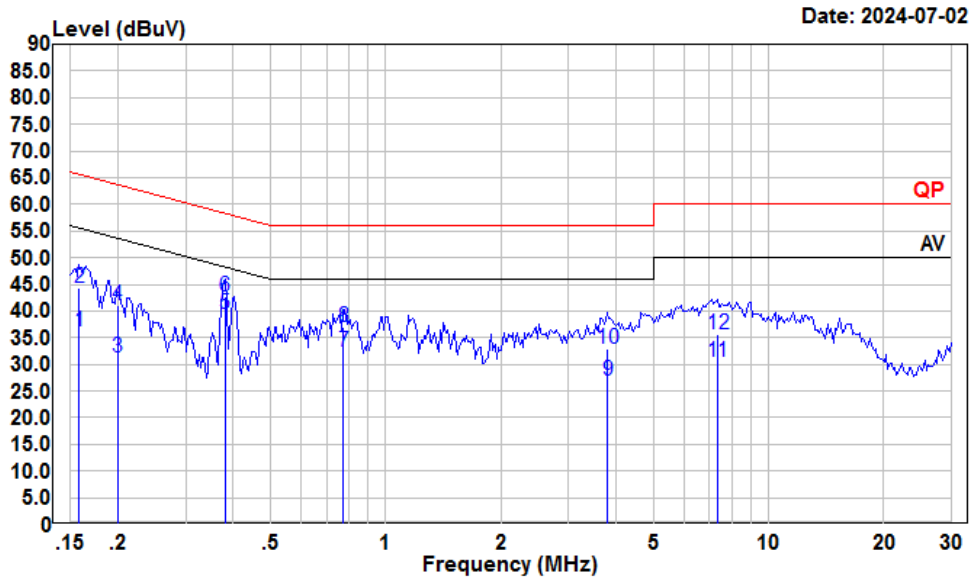
Condition: Neutral

Project : 2401T31849E-RF

tester : Macy.shi

Note : BT

|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.15 | 9.91       | 30.63      | 10.59       | 10.13      | 55.91      | -25.28     | Average |
| 2  | 0.15 | 19.05      | 39.77      | 10.59       | 10.13      | 65.91      | -26.14     | QP      |
| 3  | 0.28 | 5.32       | 25.93      | 10.51       | 10.10      | 50.81      | -24.88     | Average |
| 4  | 0.28 | 12.44      | 33.05      | 10.51       | 10.10      | 60.81      | -27.76     | QP      |
| 5  | 0.32 | 14.55      | 35.21      | 10.55       | 10.11      | 49.75      | -14.54     | Average |
| 6  | 0.32 | 15.70      | 36.36      | 10.55       | 10.11      | 59.75      | -23.39     | QP      |
| 7  | 0.65 | 4.94       | 25.78      | 10.70       | 10.14      | 46.00      | -20.22     | Average |
| 8  | 0.65 | 9.67       | 30.51      | 10.70       | 10.14      | 56.00      | -25.49     | QP      |
| 9  | 4.32 | 1.13       | 21.77      | 10.44       | 10.20      | 46.00      | -24.23     | Average |
| 10 | 4.32 | 6.01       | 26.65      | 10.44       | 10.20      | 56.00      | -29.35     | QP      |
| 11 | 5.28 | 1.79       | 22.52      | 10.55       | 10.18      | 50.00      | -27.48     | Average |
| 12 | 5.28 | 5.32       | 26.05      | 10.55       | 10.18      | 60.00      | -33.95     | QP      |

*For Adapter 3***AC 120V/60 Hz, Line**

Condition: Line

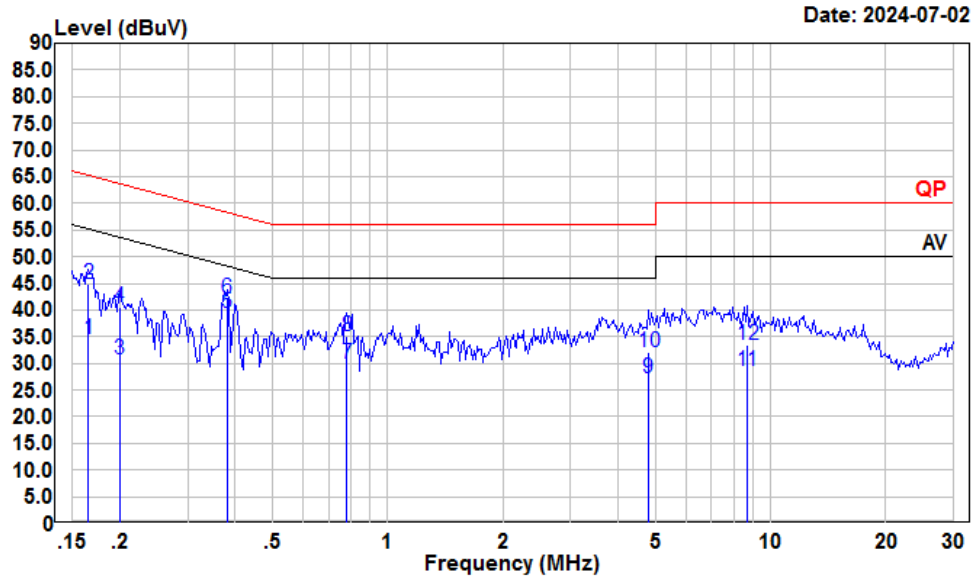
Project : 2401T31849E-RF

tester : Macy.shi

Note : BT

|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.16 | 15.06      | 36.06      | 10.88       | 10.12      | 55.56      | -19.50     | Average |
| 2  | 0.16 | 23.33      | 44.33      | 10.88       | 10.12      | 65.56      | -21.23     | QP      |
| 3  | 0.20 | 10.41      | 31.30      | 10.80       | 10.09      | 53.62      | -22.32     | Average |
| 4  | 0.20 | 20.05      | 40.94      | 10.80       | 10.09      | 63.62      | -22.68     | QP      |
| 5  | 0.38 | 18.72      | 39.42      | 10.59       | 10.11      | 48.25      | -8.83      | Average |
| 6  | 0.38 | 21.95      | 42.65      | 10.59       | 10.11      | 58.25      | -15.60     | QP      |
| 7  | 0.78 | 11.74      | 32.34      | 10.47       | 10.13      | 46.00      | -13.66     | Average |
| 8  | 0.78 | 16.31      | 36.91      | 10.47       | 10.13      | 56.00      | -19.09     | QP      |
| 9  | 3.80 | 6.38       | 26.90      | 10.32       | 10.20      | 46.00      | -19.10     | Average |
| 10 | 3.80 | 12.37      | 32.89      | 10.32       | 10.20      | 56.00      | -23.11     | QP      |
| 11 | 7.33 | 9.72       | 30.42      | 10.51       | 10.19      | 50.00      | -19.58     | Average |
| 12 | 7.33 | 15.00      | 35.70      | 10.51       | 10.19      | 60.00      | -24.30     | QP      |

## AC 120V/60 Hz, Neutral



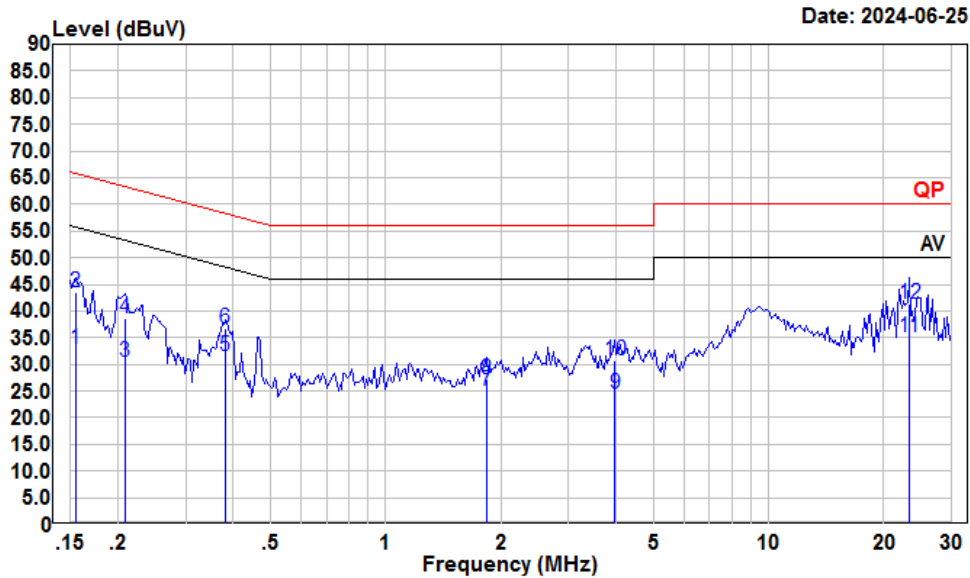
Condition: Neutral

Project : 2401T31849E-RF

tester : Macy.shi

Note : BT

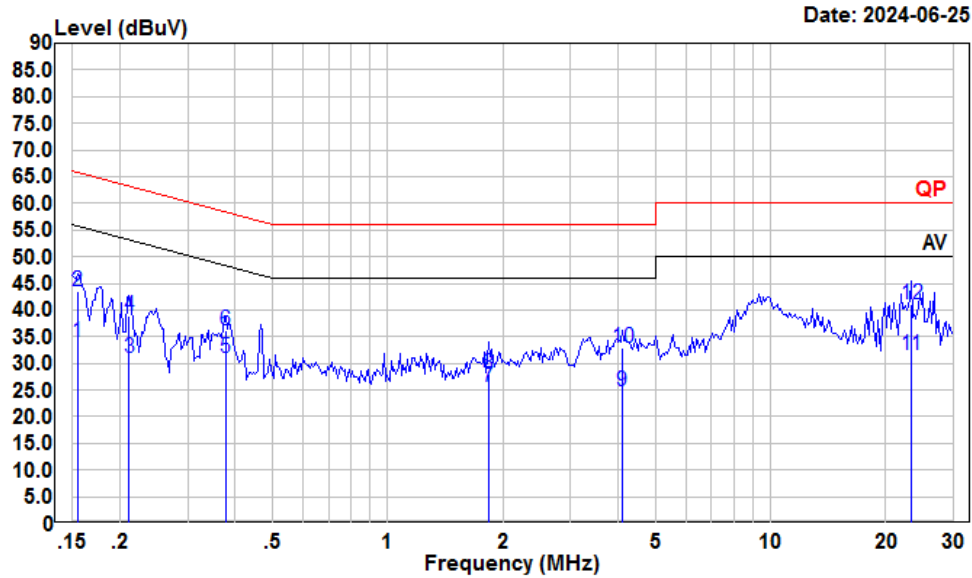
|    | Freq | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz  | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.17 | 13.98      | 34.62      | 10.53       | 10.11      | 55.21      | -20.59     | Average |
| 2  | 0.17 | 24.30      | 44.94      | 10.53       | 10.11      | 65.21      | -20.27     | QP      |
| 3  | 0.20 | 10.33      | 30.82      | 10.40       | 10.09      | 53.62      | -22.80     | Average |
| 4  | 0.20 | 19.94      | 40.43      | 10.40       | 10.09      | 63.62      | -23.19     | QP      |
| 5  | 0.38 | 18.72      | 39.44      | 10.61       | 10.11      | 48.25      | -8.81      | Average |
| 6  | 0.38 | 21.45      | 42.17      | 10.61       | 10.11      | 58.25      | -16.08     | QP      |
| 7  | 0.78 | 9.01       | 29.89      | 10.76       | 10.12      | 46.00      | -16.11     | Average |
| 8  | 0.78 | 14.13      | 35.01      | 10.76       | 10.12      | 56.00      | -20.99     | QP      |
| 9  | 4.80 | 6.48       | 27.17      | 10.50       | 10.19      | 46.00      | -18.83     | Average |
| 10 | 4.80 | 11.35      | 32.04      | 10.50       | 10.19      | 56.00      | -23.96     | QP      |
| 11 | 8.68 | 7.63       | 28.59      | 10.76       | 10.20      | 50.00      | -21.41     | Average |
| 12 | 8.68 | 12.58      | 33.54      | 10.76       | 10.20      | 60.00      | -26.46     | QP      |

*For POE***AC 120V/60 Hz, Line**

Condition: Line  
Project : 2401T31849E-RF  
tester : Macy.shi  
Note : BT

|    | Freq  | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|-------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz   | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.15  | 12.40      | 32.92      | 10.40       | 10.12      | 55.74      | -22.82     | Average |
| 2  | 0.15  | 22.87      | 43.39      | 10.40       | 10.12      | 65.74      | -22.35     | QP      |
| 3  | 0.21  | 10.06      | 30.54      | 10.39       | 10.09      | 53.27      | -22.73     | Average |
| 4  | 0.21  | 18.16      | 38.64      | 10.39       | 10.09      | 63.27      | -24.63     | QP      |
| 5  | 0.38  | 11.07      | 31.44      | 10.26       | 10.11      | 48.25      | -16.81     | Average |
| 6  | 0.38  | 16.27      | 36.64      | 10.26       | 10.11      | 58.25      | -21.61     | QP      |
| 7  | 1.83  | 4.58       | 25.10      | 10.34       | 10.18      | 46.00      | -20.90     | Average |
| 8  | 1.83  | 6.70       | 27.22      | 10.34       | 10.18      | 56.00      | -28.78     | QP      |
| 9  | 3.96  | 3.85       | 24.46      | 10.40       | 10.21      | 46.00      | -21.54     | Average |
| 10 | 3.96  | 10.08      | 30.69      | 10.40       | 10.21      | 56.00      | -25.31     | QP      |
| 11 | 23.26 | 14.28      | 35.12      | 10.66       | 10.18      | 50.00      | -14.88     | Average |
| 12 | 23.26 | 20.42      | 41.26      | 10.66       | 10.18      | 60.00      | -18.74     | QP      |

## AC 120V/60 Hz, Neutral



Condition: Neutral

Project : 2401T31849E-RF

tester : Macy.shi

Note : BT

|    | Freq  | Read Level | LISN Level | LISN Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|----|-------|------------|------------|-------------|------------|------------|------------|---------|
|    | MHz   | dBuV       | dBuV       | dB          | dB         | dBuV       | dB         |         |
| 1  | 0.15  | 13.75      | 34.11      | 10.24       | 10.12      | 55.74      | -21.63     | Average |
| 2  | 0.15  | 23.05      | 43.41      | 10.24       | 10.12      | 65.74      | -22.33     | QP      |
| 3  | 0.21  | 10.28      | 30.98      | 10.61       | 10.09      | 53.18      | -22.20     | Average |
| 4  | 0.21  | 18.21      | 38.91      | 10.61       | 10.09      | 63.18      | -24.27     | QP      |
| 5  | 0.38  | 10.23      | 31.08      | 10.74       | 10.11      | 48.34      | -17.26     | Average |
| 6  | 0.38  | 15.29      | 36.14      | 10.74       | 10.11      | 58.34      | -22.20     | QP      |
| 7  | 1.83  | 5.27       | 25.58      | 10.13       | 10.18      | 46.00      | -20.42     | Average |
| 8  | 1.83  | 7.63       | 27.94      | 10.13       | 10.18      | 56.00      | -28.06     | QP      |
| 9  | 4.09  | 4.19       | 24.80      | 10.40       | 10.21      | 46.00      | -21.20     | Average |
| 10 | 4.09  | 12.28      | 32.89      | 10.40       | 10.21      | 56.00      | -23.11     | QP      |
| 11 | 23.26 | 11.19      | 31.61      | 10.24       | 10.18      | 50.00      | -18.39     | Average |
| 12 | 23.26 | 20.74      | 41.16      | 10.24       | 10.18      | 60.00      | -18.84     | QP      |

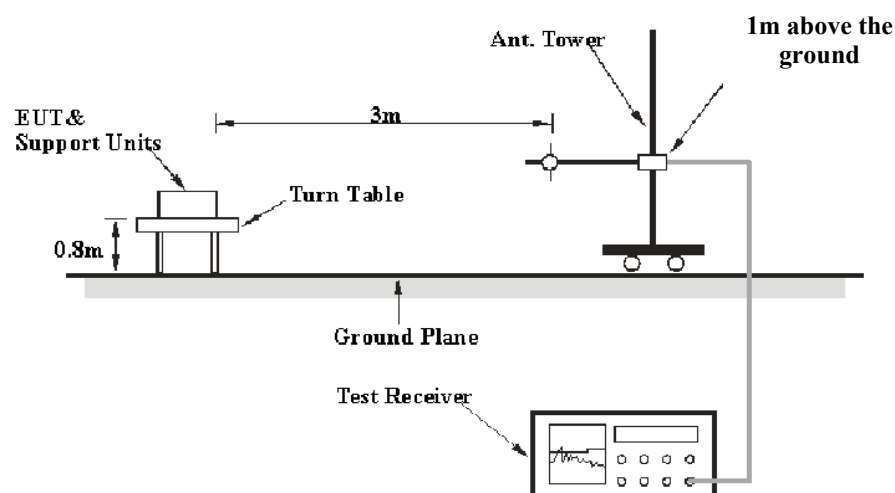
## FCC §15.209, §15.205 & §15.247(D) & RSS-247§ 5.5 - SPURIOUS EMISSIONS

### Applicable Standard

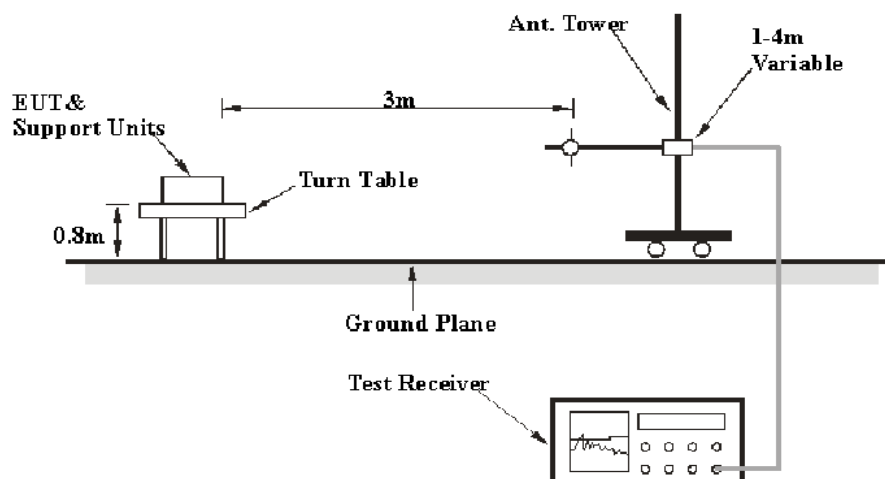
FCC §15.205; §15.209; §15.247(d); RSS-247§ 5.5; RSS-GEN § 8.10

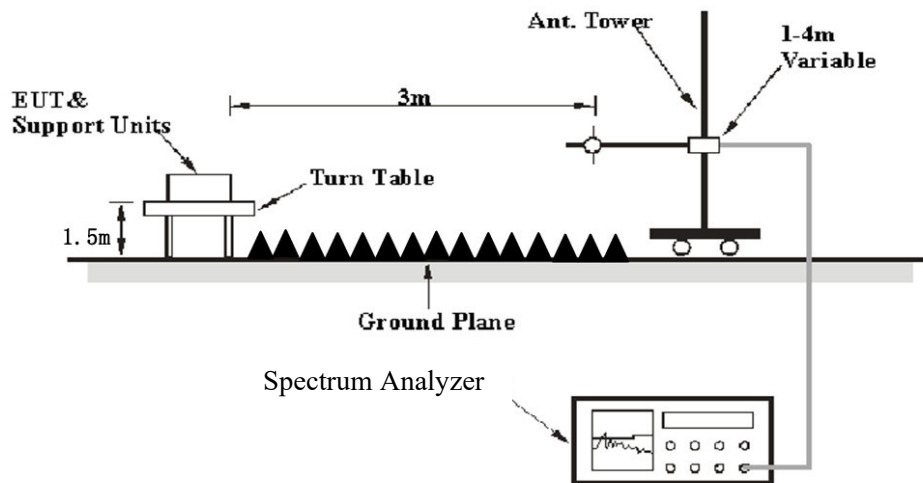
### EUT Setup

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:       | 22~25.5 °C |
| Relative Humidity: | 50~54 %    |
| ATM Pressure:      | 101.0 kPa  |

*The testing was performed by Anson Su on 2024-07-06 for below 1GHz and Zenos Qiao on 2024-06-30 for above 1GHz.*

*EUT operation mode: Transmitting*

*Note: After pre-scan in the X, Y and Z axes of orientation, the worst case of orientation were recorded.*

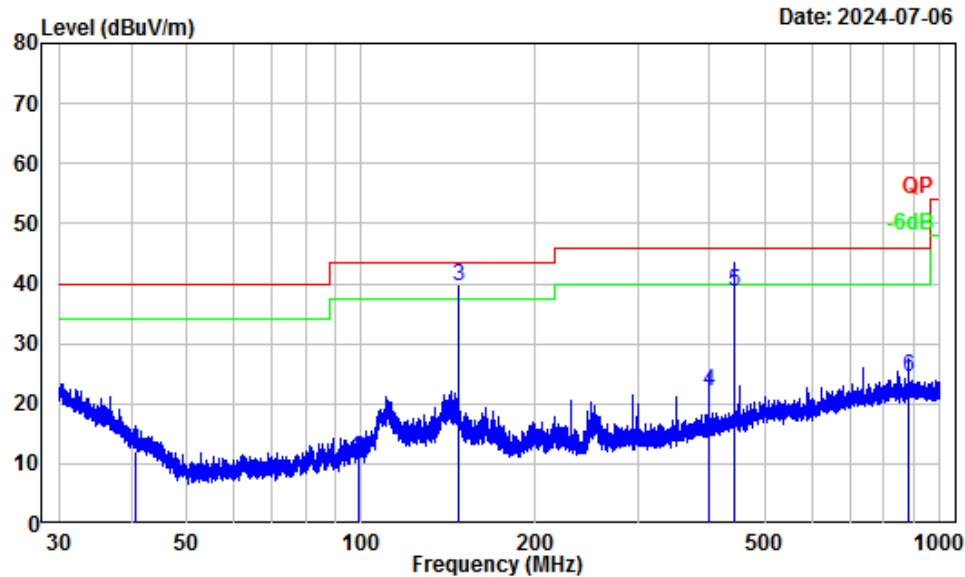
**9 kHz-30MHz:** *(Maximum output mode, EDR(8DPSK) Low Channel)*

*The amplitude of spurious emissions attenuated more than 20 dB below the limit was not recorded.*

30MHz-1GHz: (Maximum output mode, EDR(8DPSK) Low Channel)

For Adapter 1

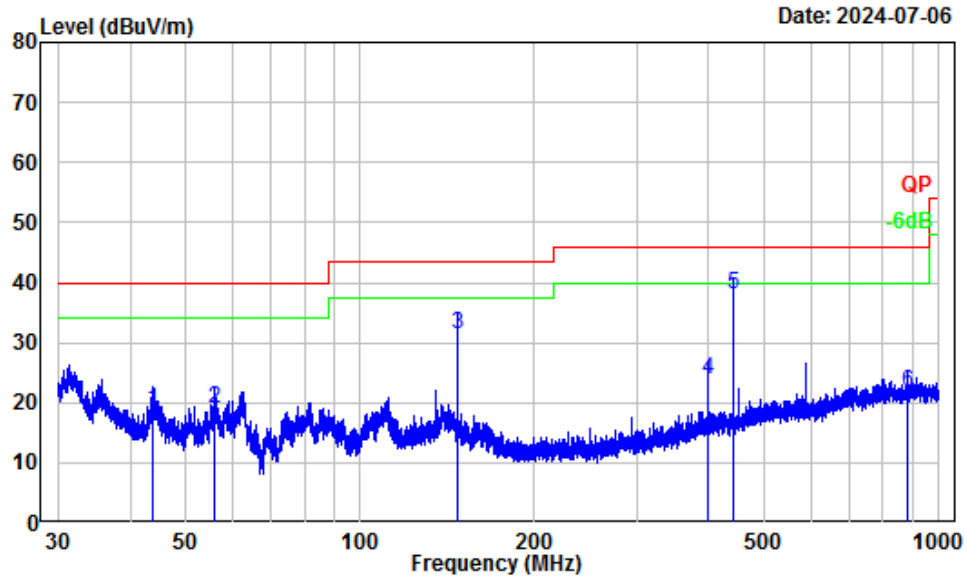
Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

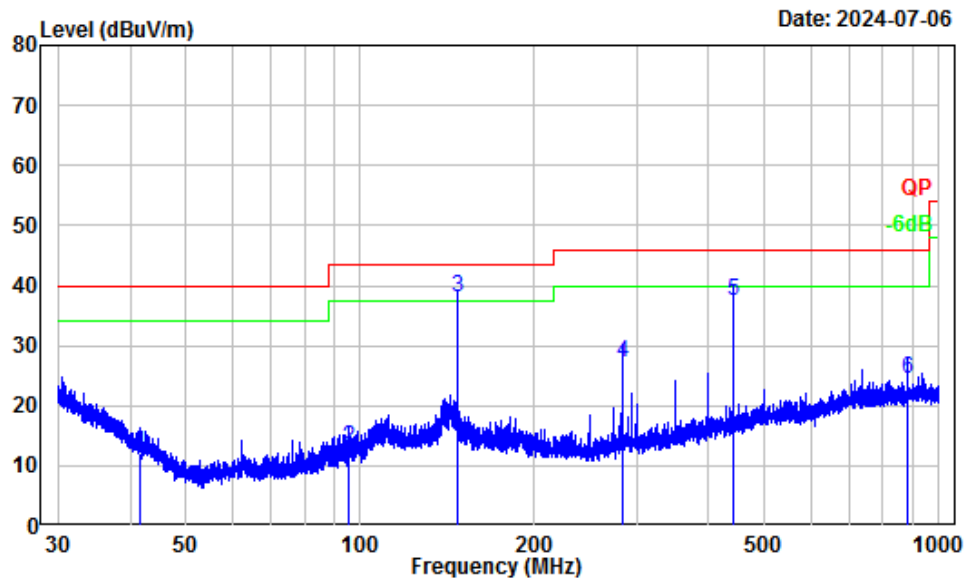
|   | Freq   | Factor | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|--------|--------|------------|--------|------------|------------|--------|
|   | MHz    | dB/m   | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 40.59  | -11.89 | 24.07      | 12.18  | 40.00      | -27.82     | QP     |
| 2 | 99.31  | -15.62 | 26.56      | 10.94  | 43.50      | -32.56     | QP     |
| 3 | 147.47 | -13.34 | 52.80      | 39.46  | 43.50      | -4.04      | QP     |
| 4 | 400.08 | -10.59 | 32.58      | 21.99  | 46.00      | -24.01     | QP     |
| 5 | 442.52 | -9.74  | 48.50      | 38.76  | 46.00      | -7.24      | QP     |
| 6 | 884.89 | -4.55  | 28.94      | 24.39  | 46.00      | -21.61     | QP     |

## Vertical



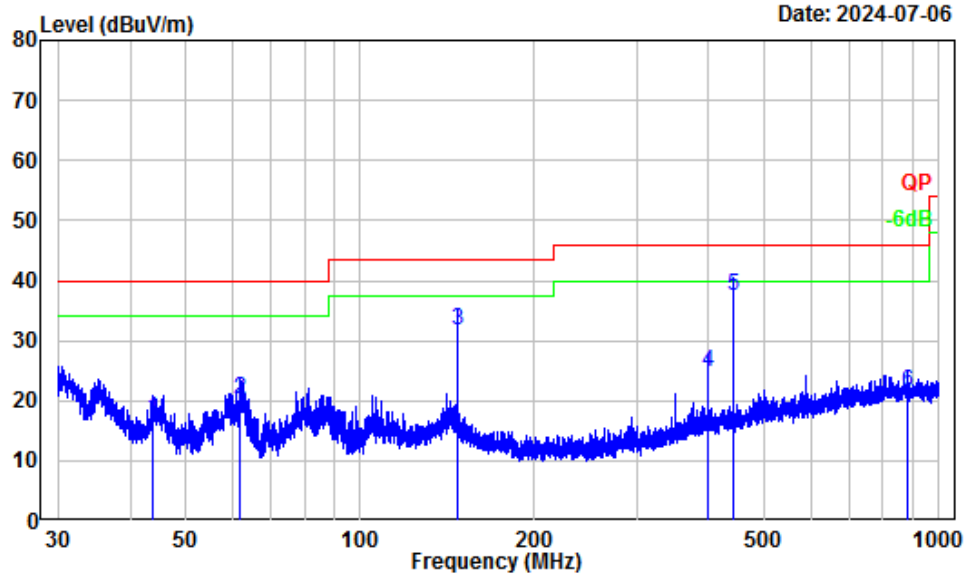
Site : Chamber A  
Condition : 3m Vertical  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

|   | Freq Factor |        | Read Level | Limit Level | Over Limit | Remark    |
|---|-------------|--------|------------|-------------|------------|-----------|
|   | MHz         | dB/m   | dBuV       | dBuV/m      | dBuV/m     | dB        |
| 1 | 43.81       | -15.17 | 33.87      | 18.70       | 40.00      | -21.30 QP |
| 2 | 55.95       | -18.76 | 37.79      | 19.03       | 40.00      | -20.97 QP |
| 3 | 147.47      | -13.72 | 45.19      | 31.47       | 43.50      | -12.03 QP |
| 4 | 400.08      | -10.79 | 34.66      | 23.87       | 46.00      | -22.13 QP |
| 5 | 442.52      | -10.20 | 48.20      | 38.00       | 46.00      | -8.00 QP  |
| 6 | 884.89      | -4.92  | 26.77      | 21.85       | 46.00      | -24.15 QP |

*For Adapter 2***Horizontal**

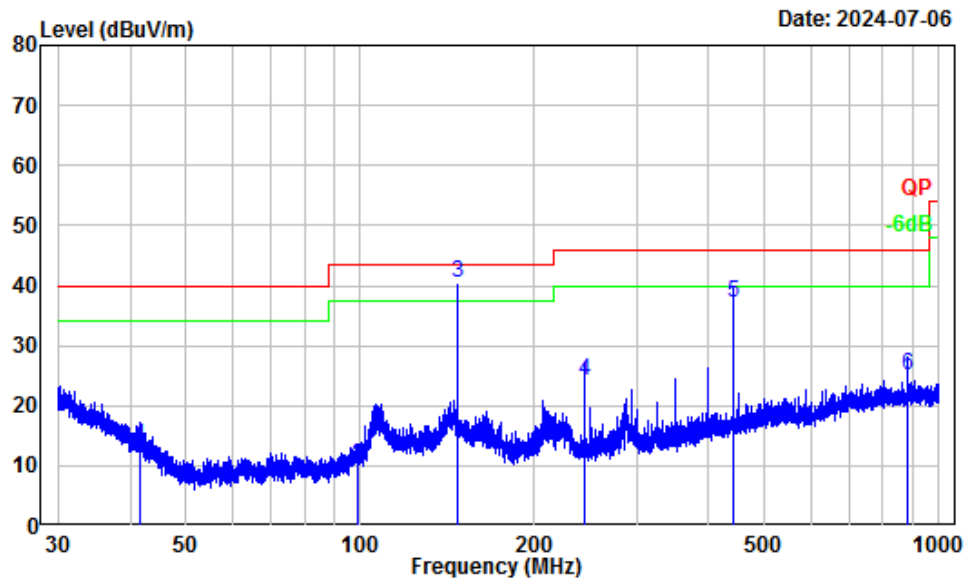
Site : Chamber A  
Condition : 3m Horizontal  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

|   | Freq Factor |        | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|-------------|--------|------------|--------|------------|------------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 41.59       | -12.53 | 24.74      | 12.21  | 40.00      | -27.79     | QP     |
| 2 | 95.76       | -16.56 | 29.63      | 13.07  | 43.50      | -30.43     | QP     |
| 3 | 147.47      | -13.34 | 51.30      | 37.96  | 43.50      | -5.54      | QP     |
| 4 | 284.35      | -13.32 | 40.41      | 27.09  | 46.00      | -18.91     | QP     |
| 5 | 442.52      | -9.74  | 47.16      | 37.42  | 46.00      | -8.58      | QP     |
| 6 | 884.89      | -4.55  | 29.11      | 24.56  | 46.00      | -21.44     | QP     |

**Vertical**

Site : Chamber A  
Condition : 3m Vertical  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

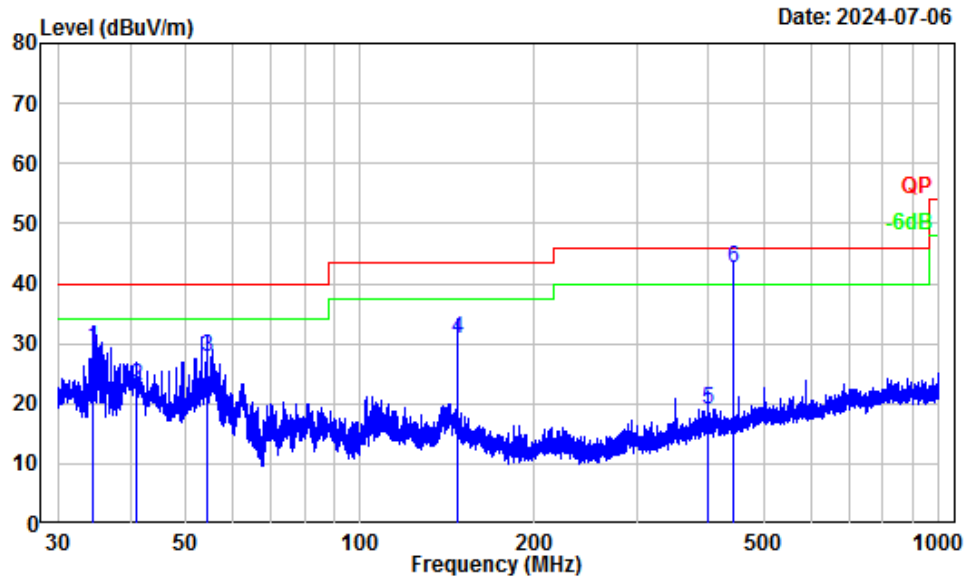
|   | Freq Factor |        | Read Level | Limit Level | Over Limit | Remark    |
|---|-------------|--------|------------|-------------|------------|-----------|
|   | MHz         | dB/m   | dBuV       | dBuV/m      | dBuV/m     | dB        |
| 1 | 43.79       | -15.16 | 32.00      | 16.84       | 40.00      | -23.16 QP |
| 2 | 62.02       | -18.82 | 38.97      | 20.15       | 40.00      | -19.85 QP |
| 3 | 147.47      | -13.72 | 45.49      | 31.77       | 43.50      | -11.73 QP |
| 4 | 400.08      | -10.79 | 35.64      | 24.85       | 46.00      | -21.15 QP |
| 5 | 442.52      | -10.20 | 47.77      | 37.57       | 46.00      | -8.43 QP  |
| 6 | 884.89      | -4.92  | 26.50      | 21.58       | 46.00      | -24.42 QP |

*For Adapter 3***Horizontal**

Site : Chamber A  
Condition : 3m Horizontal  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

|             |        | Read   |       | Limit  | Over   | Remark    |
|-------------|--------|--------|-------|--------|--------|-----------|
| Freq Factor |        | Level  | Level | Line   | Limit  |           |
|             | MHz    | dB/m   | dBuV  | dBuV/m | dBuV/m | dB        |
| 1           | 41.53  | -12.49 | 25.64 | 13.15  | 40.00  | -26.85 QP |
| 2           | 99.01  | -15.70 | 25.59 | 9.89   | 43.50  | -33.61 QP |
| 3           | 147.47 | -13.34 | 53.70 | 40.36  | 43.50  | -3.14 QP  |
| 4           | 243.80 | -14.41 | 38.48 | 24.07  | 46.00  | -21.93 QP |
| 5           | 442.52 | -9.74  | 46.78 | 37.04  | 46.00  | -8.96 QP  |
| 6           | 884.89 | -4.55  | 29.66 | 25.11  | 46.00  | -20.89 QP |

**Vertical**

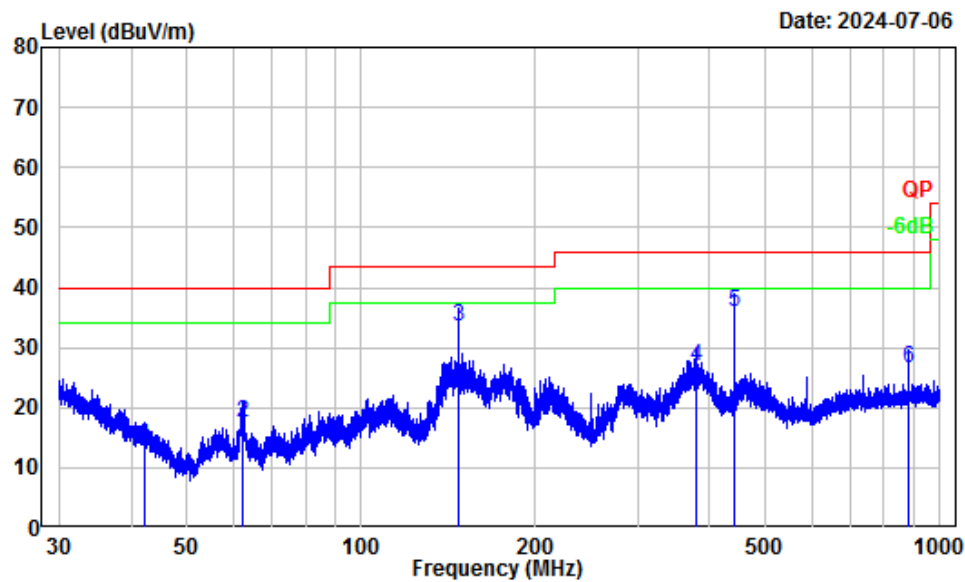


Site : Chamber A  
 Condition : 3m Vertical  
 Project Number: 2401T31849E-RF  
 Test Mode : BT  
 Tester : Anson Su

|   | Freq Factor |        | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|-------------|--------|------------|--------|------------|------------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 34.59       | -9.55  | 38.90      | 29.35  | 40.00      | -10.65     | QP     |
| 2 | 40.95       | -13.56 | 36.37      | 22.81  | 40.00      | -17.19     | QP     |
| 3 | 54.38       | -18.72 | 46.59      | 27.87  | 40.00      | -12.13     | QP     |
| 4 | 147.47      | -13.72 | 44.65      | 30.93  | 43.50      | -12.57     | QP     |
| 5 | 400.08      | -10.79 | 29.78      | 18.99  | 46.00      | -27.01     | QP     |
| 6 | 442.52      | -10.20 | 52.81      | 42.61  | 46.00      | -3.39      | QP     |

For POE

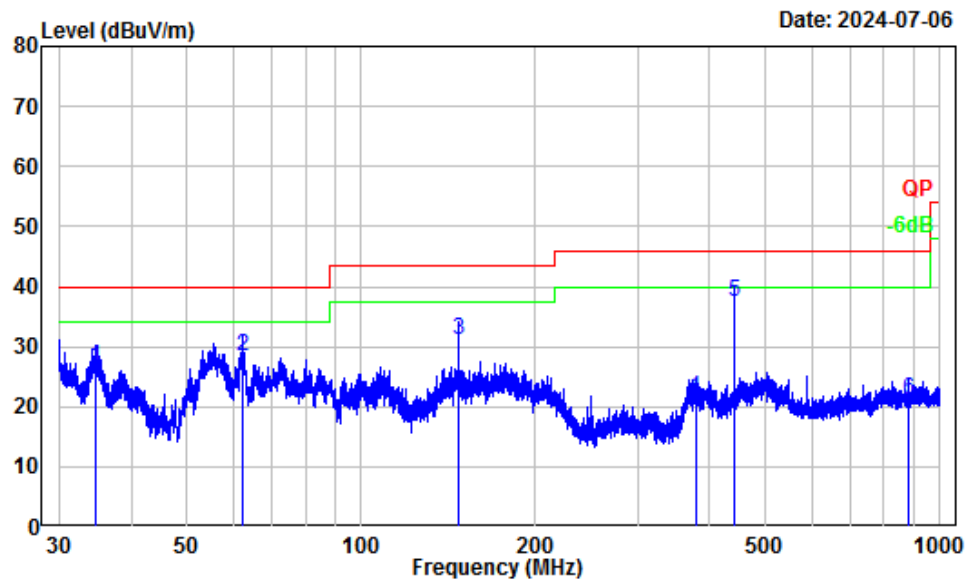
Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

|   | Freq Factor |        | Read Level | Level  | Limit Line | Over Limit | Remark |
|---|-------------|--------|------------|--------|------------|------------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m     | dB         |        |
| 1 | 42.28       | -12.97 | 26.41      | 13.44  | 40.00      | -26.56     | QP     |
| 2 | 62.16       | -17.72 | 35.29      | 17.57  | 40.00      | -22.43     | QP     |
| 3 | 147.47      | -13.34 | 46.79      | 33.45  | 43.50      | -10.05     | QP     |
| 4 | 380.08      | -11.15 | 37.91      | 26.76  | 46.00      | -19.24     | QP     |
| 5 | 442.52      | -9.74  | 45.75      | 36.01  | 46.00      | -9.99      | QP     |
| 6 | 884.89      | -4.55  | 31.15      | 26.60  | 46.00      | -19.40     | QP     |

Vertical



Site : Chamber A  
Condition : 3m Vertical  
Project Number: 2401T31849E-RF  
Test Mode : BT  
Tester : Anson Su

|   | Freq Factor |        | Read Level | Limit Level | Over Limit | Remark         |
|---|-------------|--------|------------|-------------|------------|----------------|
|   | MHz         | dB/m   | dBuV       | dBuV/m      | dBuV/m     | dB             |
| 1 | 34.65       | -9.59  | 36.11      | 26.52       | 40.00      | -13.48 Average |
| 2 | 62.21       | -18.82 | 47.12      | 28.30       | 40.00      | -11.70 QP      |
| 3 | 147.47      | -13.72 | 44.72      | 31.00       | 43.50      | -12.50 QP      |
| 4 | 377.92      | -11.45 | 32.98      | 21.53       | 46.00      | -24.47 QP      |
| 5 | 442.52      | -10.20 | 47.62      | 37.42       | 46.00      | -8.58 QP       |
| 6 | 884.89      | -4.92  | 26.18      | 21.26       | 46.00      | -24.74 QP      |

**Above 1GHz:**

| 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 |                |                  |                                    |                   |                |
| GFSK                   |                   |        |                |                  |                                    |                   |                |
| Low Channel 2402MHz    |                   |        |                |                  |                                    |                   |                |
| 2387.16                | 55.68             | PK     | H              | -2.93            | 52.75                              | 74                | -21.25         |
| 2386.69                | 55.39             | PK     | V              | -2.93            | 52.46                              | 74                | -21.54         |
| 4804.00                | 57.75             | PK     | H              | 2.42             | 60.17                              | 74                | -13.83         |
| 4804.00                | 56.88             | PK     | V              | 2.42             | 59.30                              | 74                | -14.70         |
| Middle Channel 2441MHz |                   |        |                |                  |                                    |                   |                |
| 4882.00                | 56.69             | PK     | H              | 2.58             | 59.27                              | 74                | -14.73         |
| 4882.00                | 55.72             | PK     | V              | 2.58             | 58.30                              | 74                | -15.70         |
| High Channel 2480MHz   |                   |        |                |                  |                                    |                   |                |
| 2483.58                | 55.73             | PK     | H              | -3.17            | 52.56                              | 74                | -21.44         |
| 2483.72                | 55.58             | PK     | V              | -3.17            | 52.41                              | 74                | -21.59         |
| 4960.00                | 55.54             | PK     | H              | 2.68             | 58.22                              | 74                | -15.78         |
| 4960.00                | 54.47             | PK     | V              | 2.68             | 57.15                              | 74                | -16.85         |

**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.

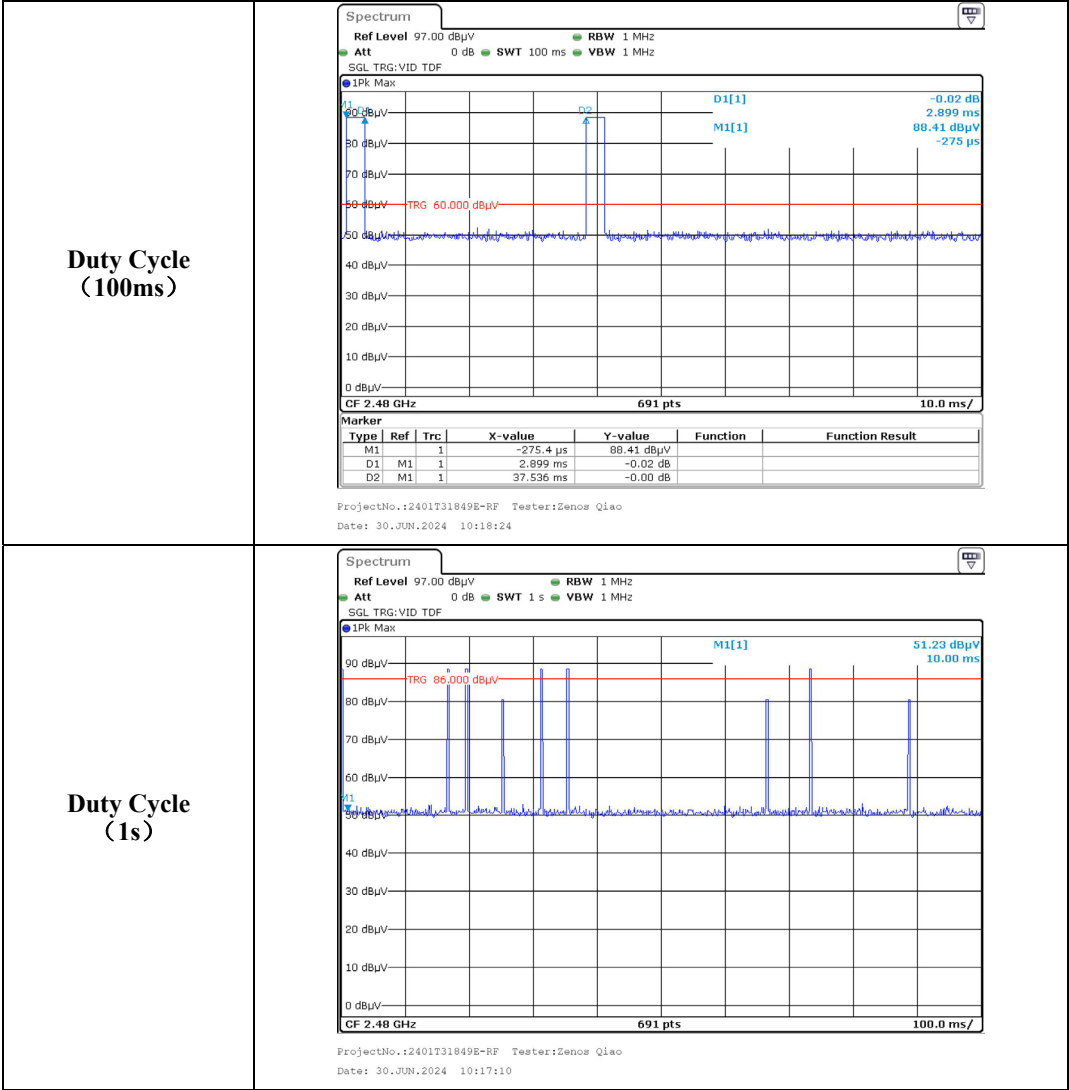
| Field Strength of Average |                               |             |                                  |                        |                |             |          |
|---------------------------|-------------------------------|-------------|----------------------------------|------------------------|----------------|-------------|----------|
| Frequency (MHz)           | Peak Measurement @3m (dBμV/m) | Polar (H/V) | Duty Cycle Corrected Factor (dB) | Average Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) | Comment  |
| Low Channel 2402MHz       |                               |             |                                  |                        |                |             |          |
| 2387.16                   | 52.75                         | H           | -24.73                           | 28.02                  | 54             | -25.98      | Bandedge |
| 2386.69                   | 52.46                         | V           | -24.73                           | 27.73                  | 54             | -26.27      | Bandedge |
| 4804.00                   | 60.17                         | H           | -24.73                           | 35.44                  | 54             | -18.56      | Harmonic |
| 4804.00                   | 59.30                         | V           | -24.73                           | 34.57                  | 54             | -19.43      | Harmonic |
| Middle Channel 2441MHz    |                               |             |                                  |                        |                |             |          |
| 4882.00                   | 59.27                         | H           | -24.73                           | 34.54                  | 54             | -19.46      | Harmonic |
| 4882.00                   | 58.30                         | V           | -24.73                           | 33.57                  | 54             | -20.43      | Harmonic |
| High Channel 2480MHz      |                               |             |                                  |                        |                |             |          |
| 2483.58                   | 52.56                         | H           | -24.73                           | 27.83                  | 54             | -26.17      | Bandedge |
| 2483.72                   | 52.41                         | V           | -24.73                           | 27.68                  | 54             | -26.32      | Bandedge |
| 4960.00                   | 58.22                         | H           | -24.73                           | 33.49                  | 54             | -20.51      | Harmonic |
| 4960.00                   | 57.15                         | V           | -24.73                           | 32.42                  | 54             | -21.58      | Harmonic |

Note: Average level= Peak level+ Duty Cycle Corrected Factor

Worst case duty cycle:

Duty Cycle =  $T_{on}/100ms = 2.899*2/100=0.05798$

Duty Cycle Corrected Factor =  $20\lg(\text{Duty Cycle}) = 20\lg 0.05798 = -24.73$



**Simultaneous transmitting consideration: (worst case as below)**

| 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 |                |                  |                                    |                   |                |
| 3DH1 2402MHz + 802.11AX40 Mode 5755MHz |                   |        |                |                  |                                    |                   |                |
| 193.30                                 | 44.46             | QP     | H              | -14.2            | 30.26                              | 43.5              | -13.24         |
| 60.25                                  | 53.36             | QP     | V              | -18.86           | 34.5                               | 40                | -5.5           |
| 4804.00                                | 49.22             | PK     | H              | 2.42             | 51.64                              | 74                | -22.36         |
| 4804.00                                | 42.24             | AV     | H              | 2.42             | 44.66                              | 54                | -9.34          |
| 4804.00                                | 48.76             | PK     | V              | 2.42             | 51.18                              | 74                | -22.82         |
| 4804.00                                | 42.41             | AV     | V              | 2.42             | 44.83                              | 54                | -9.17          |
| 11510.00                               | 56.01             | PK     | H              | 14.29            | 41.72                              | 74                | -32.28         |
| 11510.00                               | 44.8              | AV     | H              | 14.29            | 30.51                              | 54                | -23.49         |
| 11510.00                               | 56.12             | PK     | V              | 14.29            | 41.83                              | 74                | -32.17         |
| 11510.00                               | 44.34             | AV     | V              | 14.29            | 30.05                              | 54                | -23.95         |

**Note:**

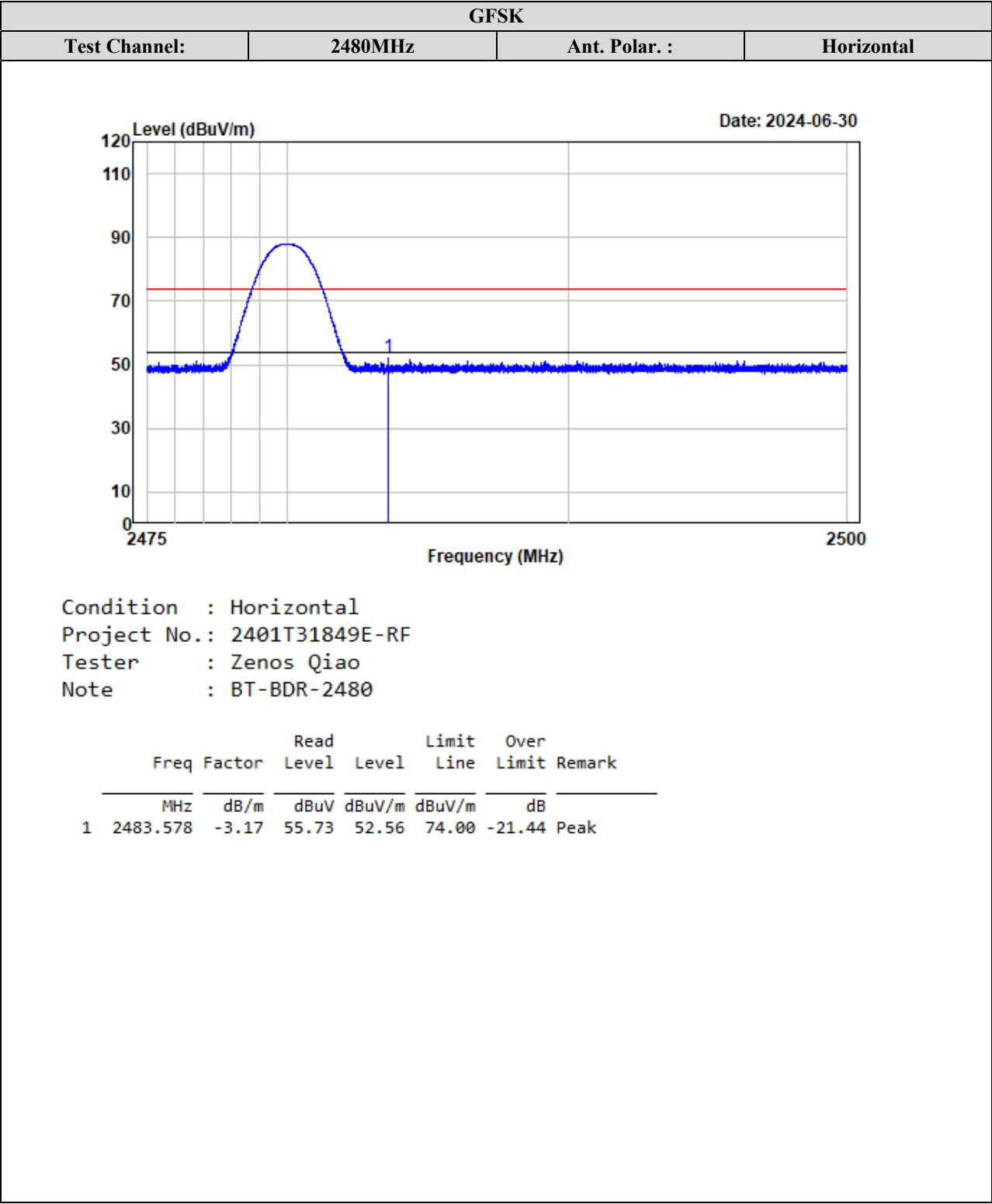
Factor = Antenna factor (RX) + Cable Loss – Amplifier Factor

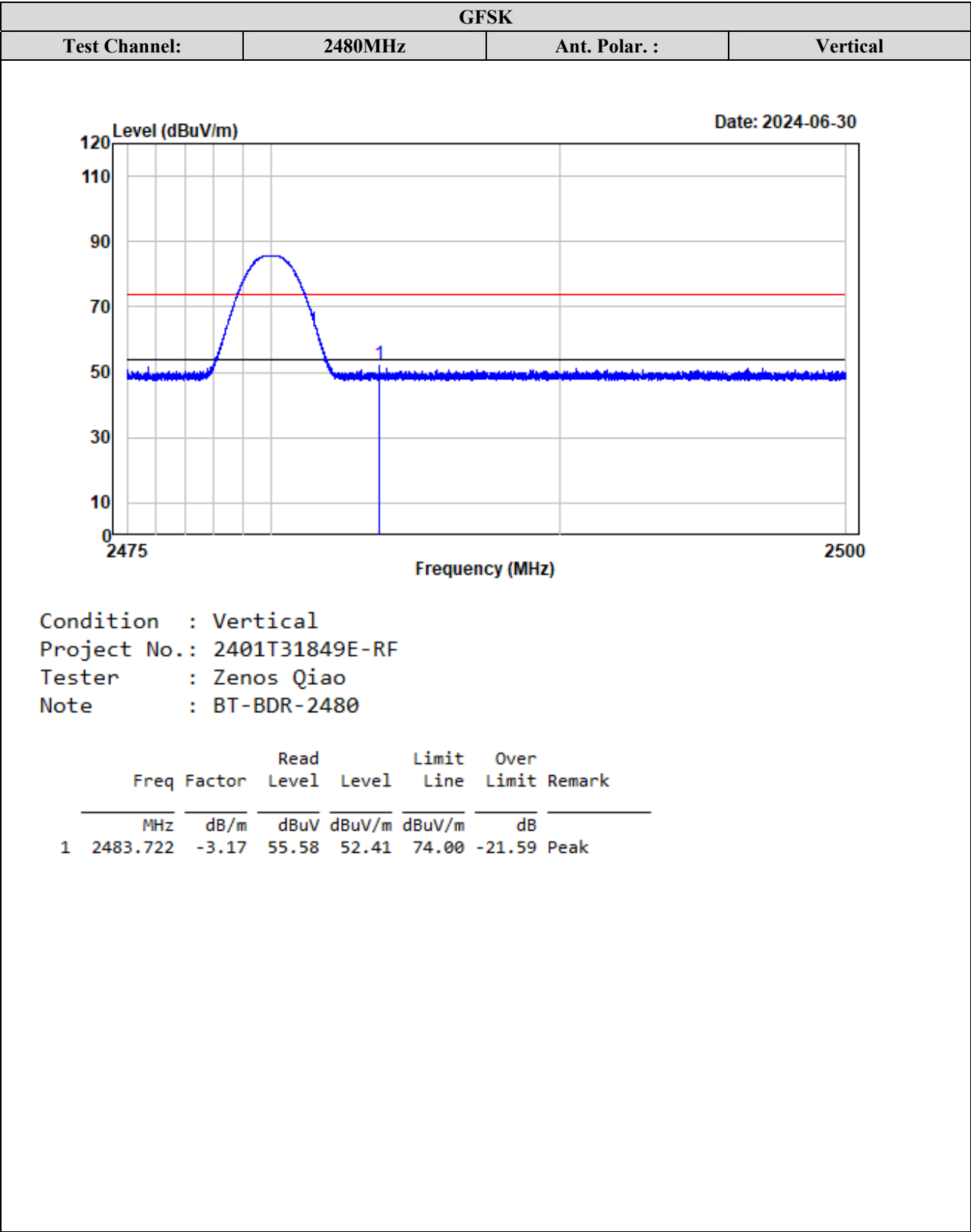
Corrected Amplitude = Factor + Reading

Margin = Corrected. Amplitude - Limit

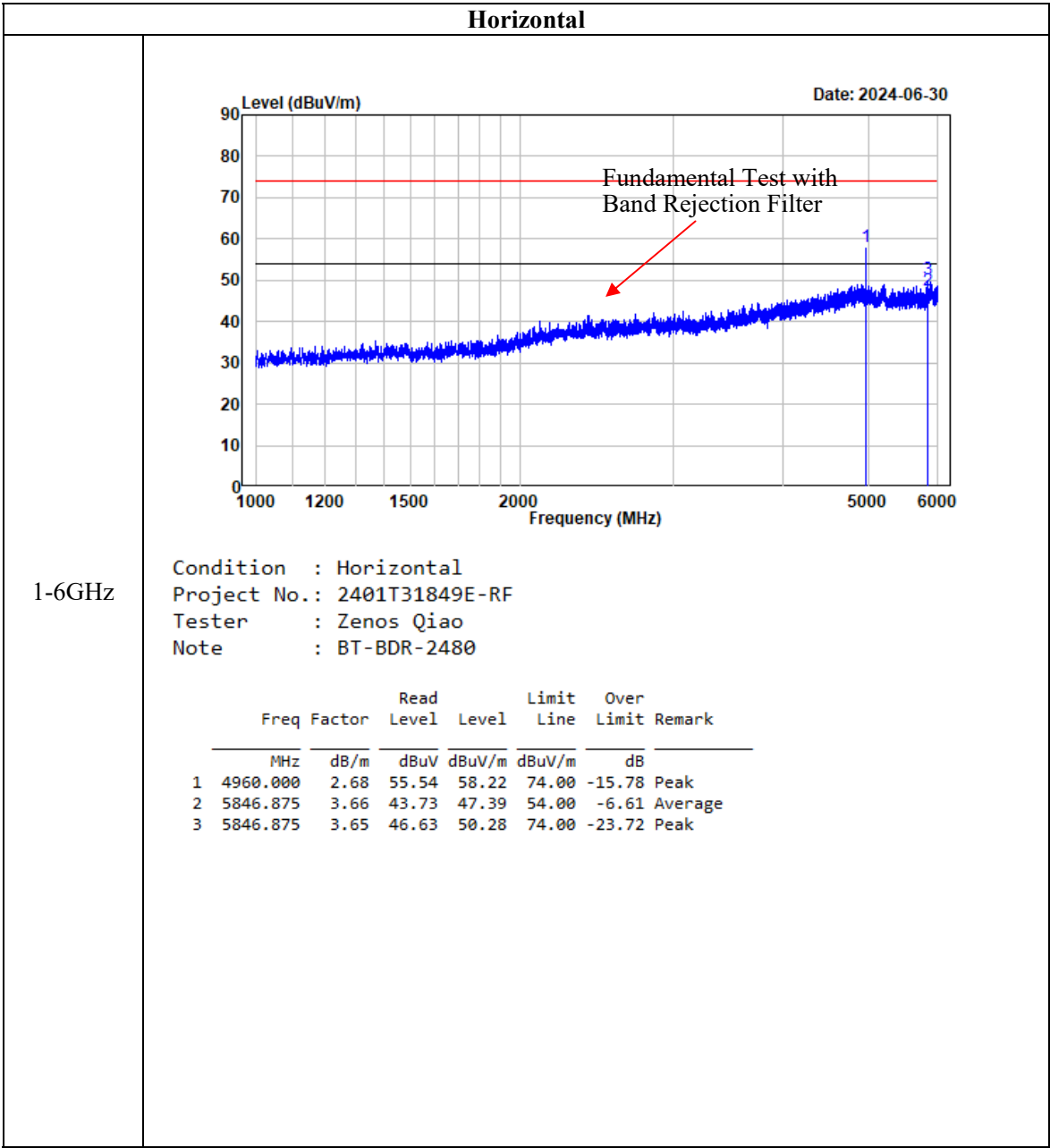
The other spurious emission which is in the noise floor level was not recorded.

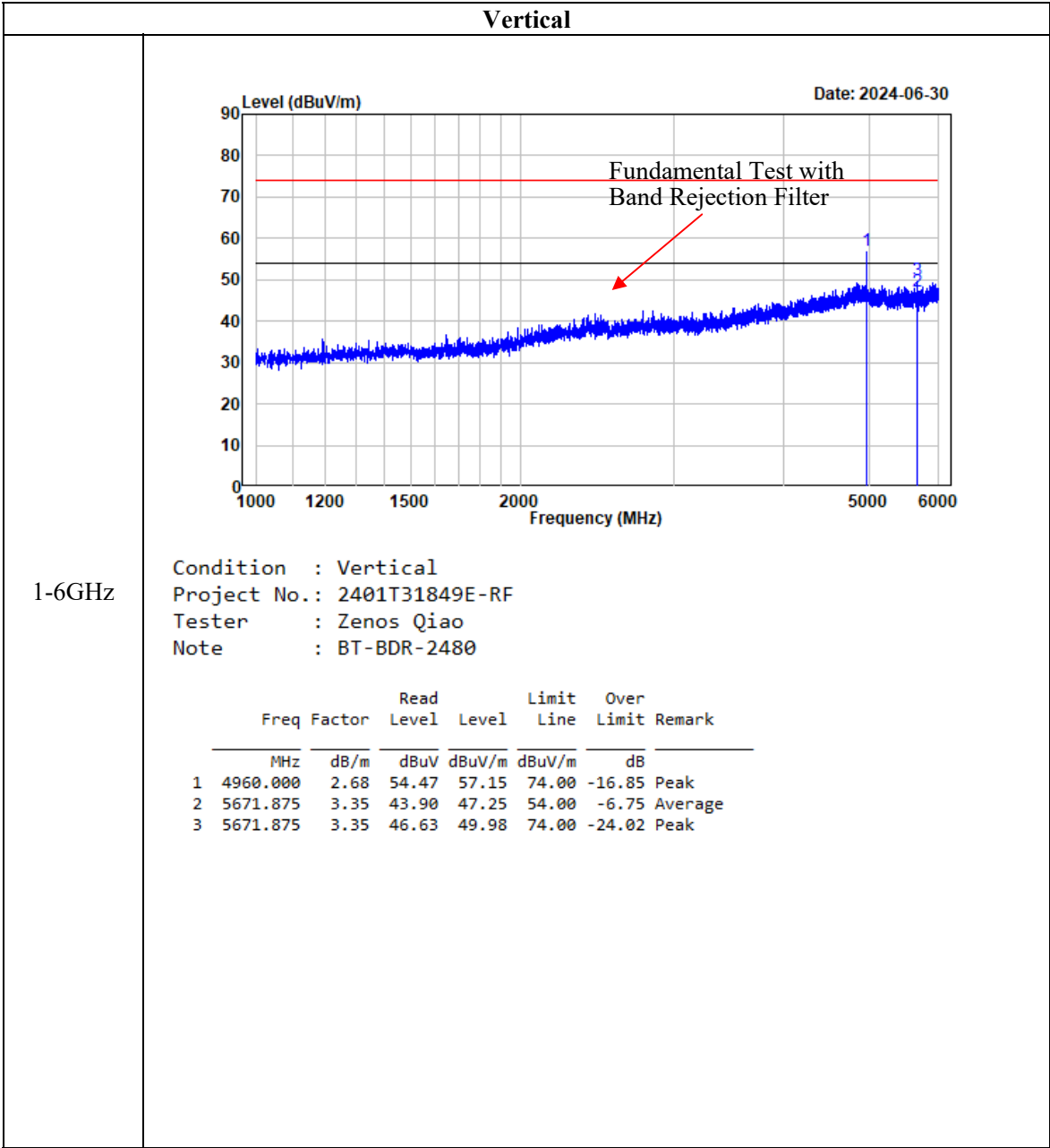
Test plots for Band Edge Measurements (Radiated):

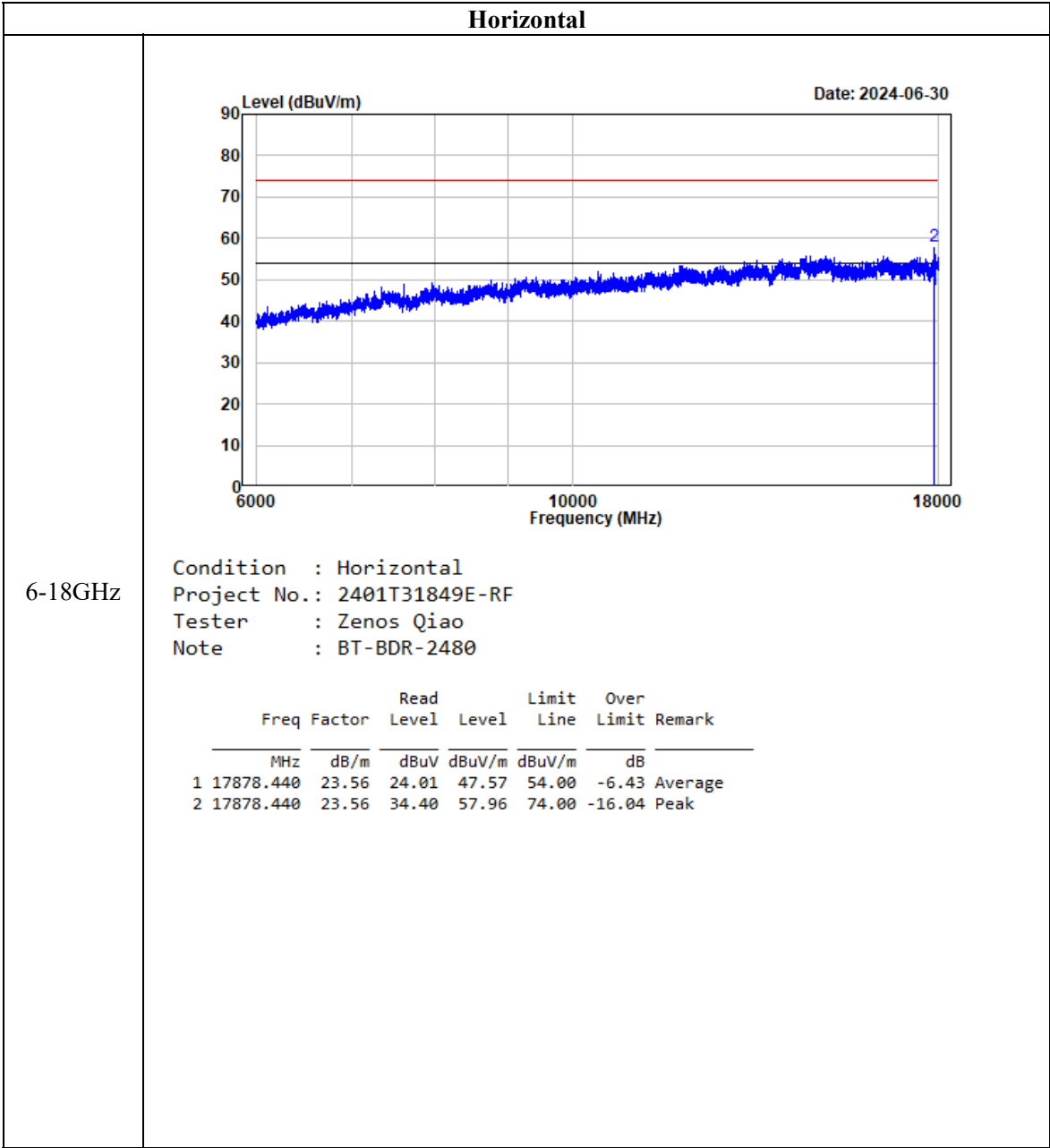


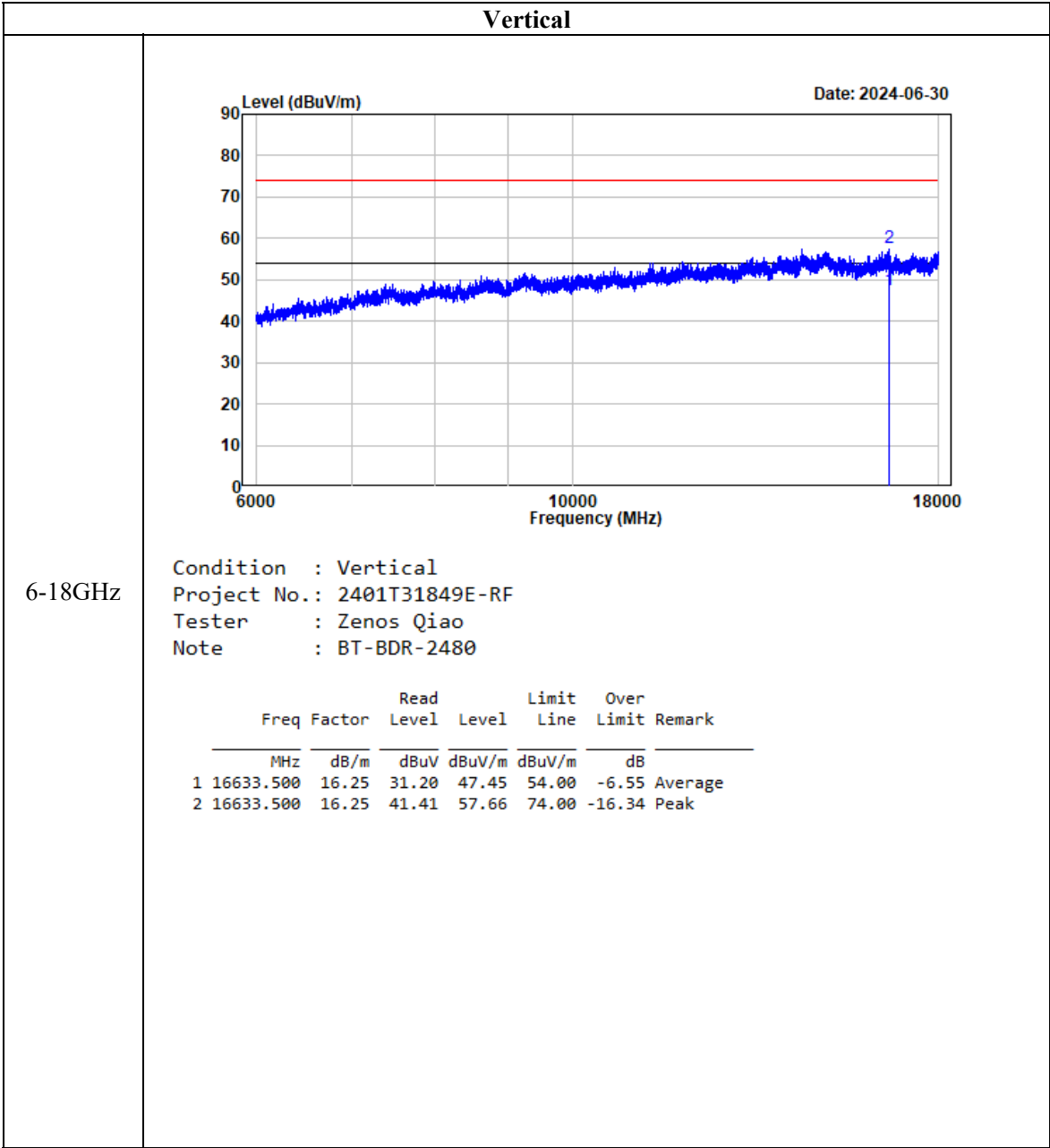


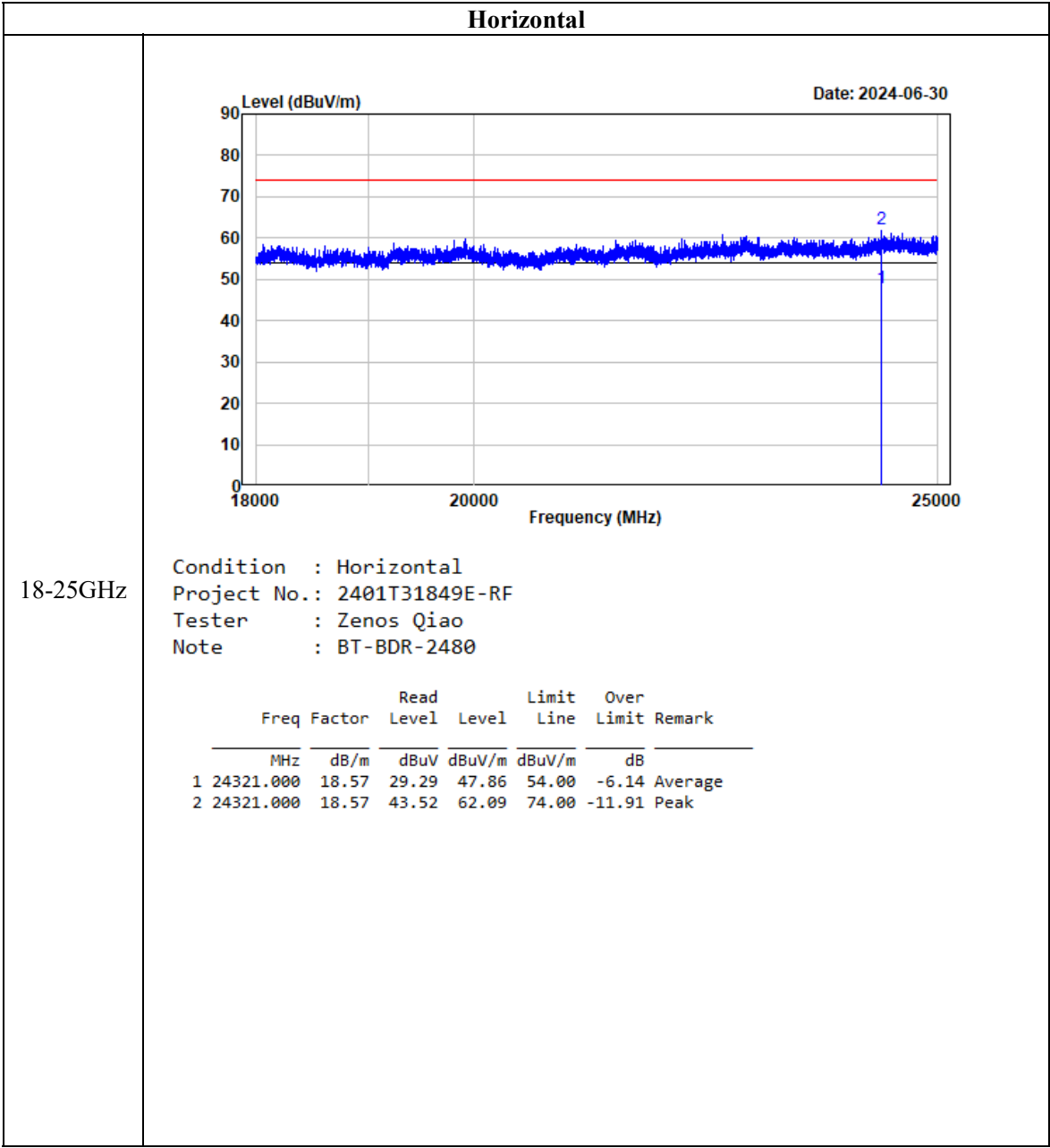
Test plots for Harmonic Measurements:

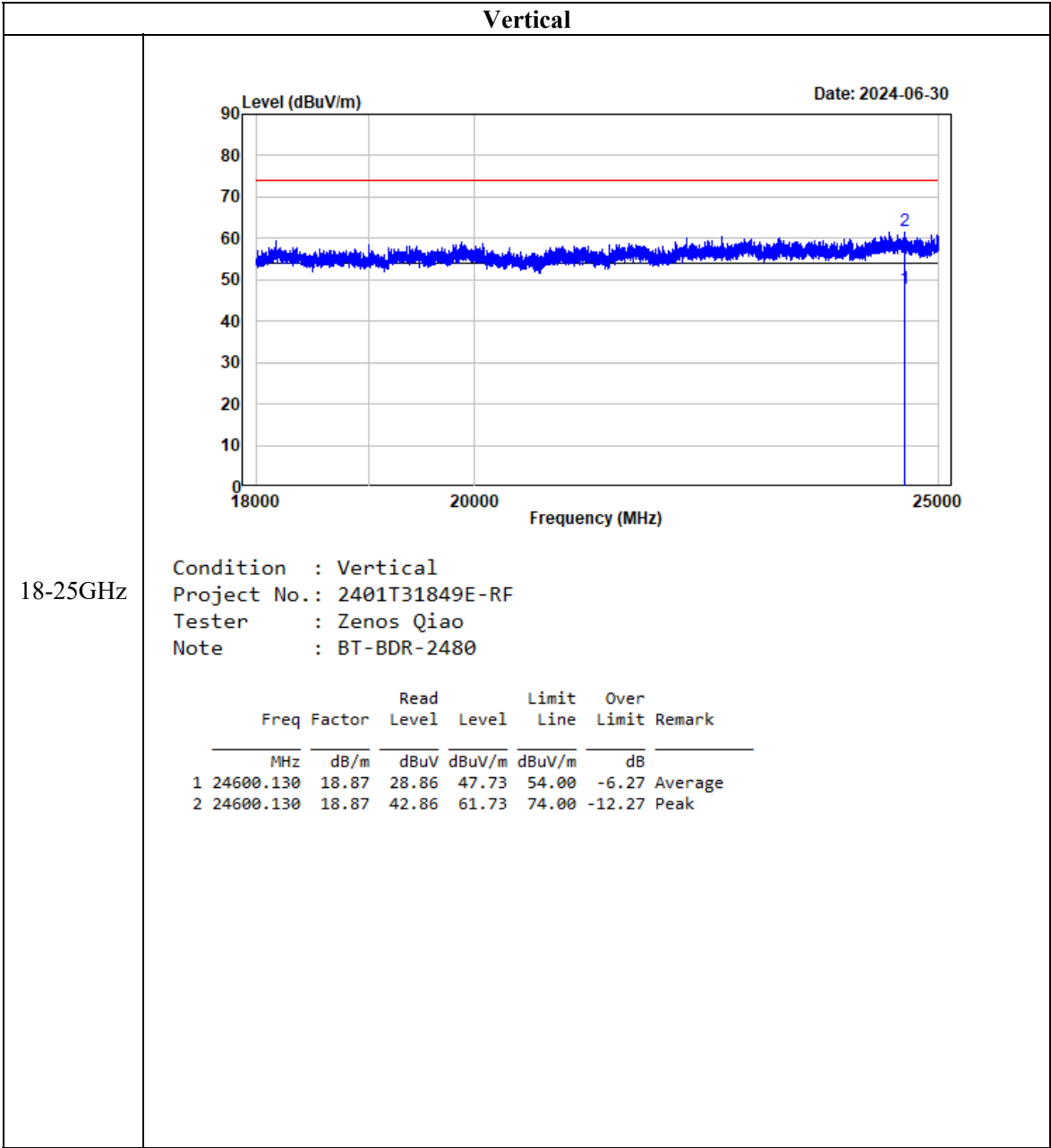












## **FCC §15.247(a) (1) & RSS-247 § 5.1 (b) - CHANNEL SEPARATION TEST**

### **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.

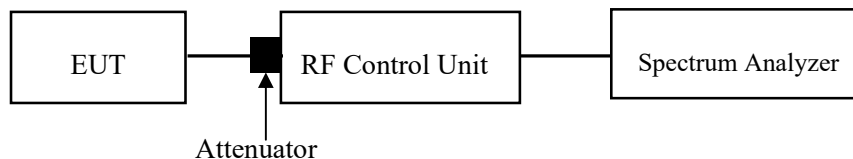
According to RSS-247 § 5.1 (b):

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

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 55 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*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**

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### **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 “20 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 20 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.

### **Test Procedure**

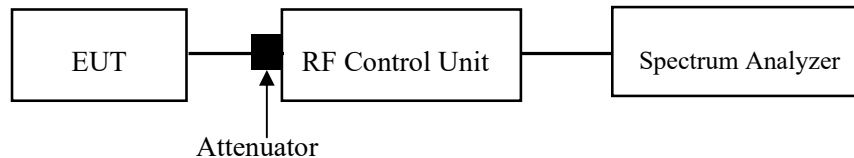
Test Method: ANSI C63.10-2013 Clause 7.8.7 & Clause 6.9.2

The following conditions shall be observed for measuring the occupied bandwidth and 20 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 / 20 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 / 20 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 Data

### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 25 °C     |
| Relative Humidity: | 55 %      |
| ATM Pressure:      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*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.

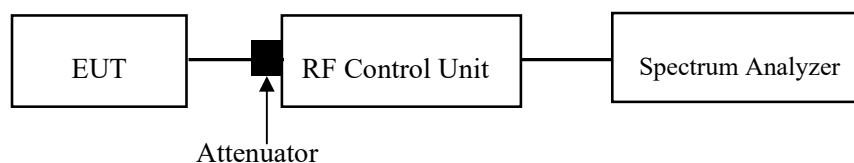
According to RSS-247 § 5.1 (d):

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.



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

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 55 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*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.

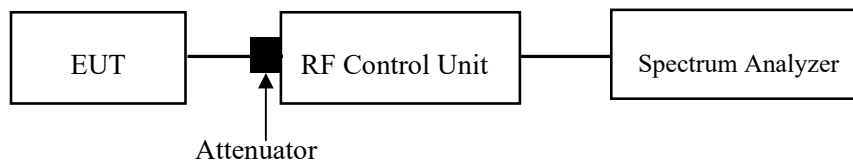
According to RSS-247 § 5.1 (d):

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



Note 1: A period time=0.4\*79=31.6(S), Result=BurstWidth\*Totalhops

Note 2: Totalhops=Hopping Number in 3.16s\*10

Note 3: Hopping Number in 3.16s=Total of highest signals in 3.16s(Second high signals were other channel)

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

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 55 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*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):

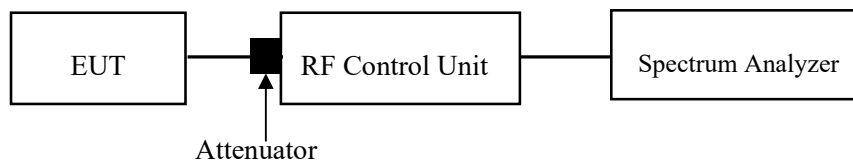
For frequency hopping systems (FHSs) operating in the band 2400-2483.5 MHz, the maximum peak conducted output power shall not exceed 1.0 W if the hopset uses 75 or more hopping channels; the maximum peak conducted output power shall not exceed 0.125 W if the hopset uses less than 75 hopping channels. 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.



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

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 25 °C     |
| <b>Relative Humidity:</b> | 55 %      |
| <b>ATM Pressure:</b>      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*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)).

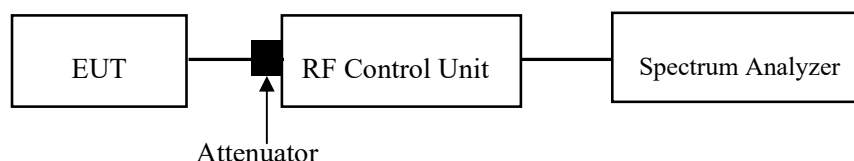
According to RSS-247 § 5.5.

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>      | 101.0 kPa |

*The testing was performed by Tom Tan on 2024-06-20.*

*EUT operation mode: Transmitting*

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

## **EUT PHOTOGRAPHS**

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Please refer to the attachment 2401T31849E-RF External photo and 2401T31849E-RF Internal photo.

## **TEST SETUP PHOTOGRAPHS**

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Please refer to the attachment 2401T31849E-RFA Test Setup photo.

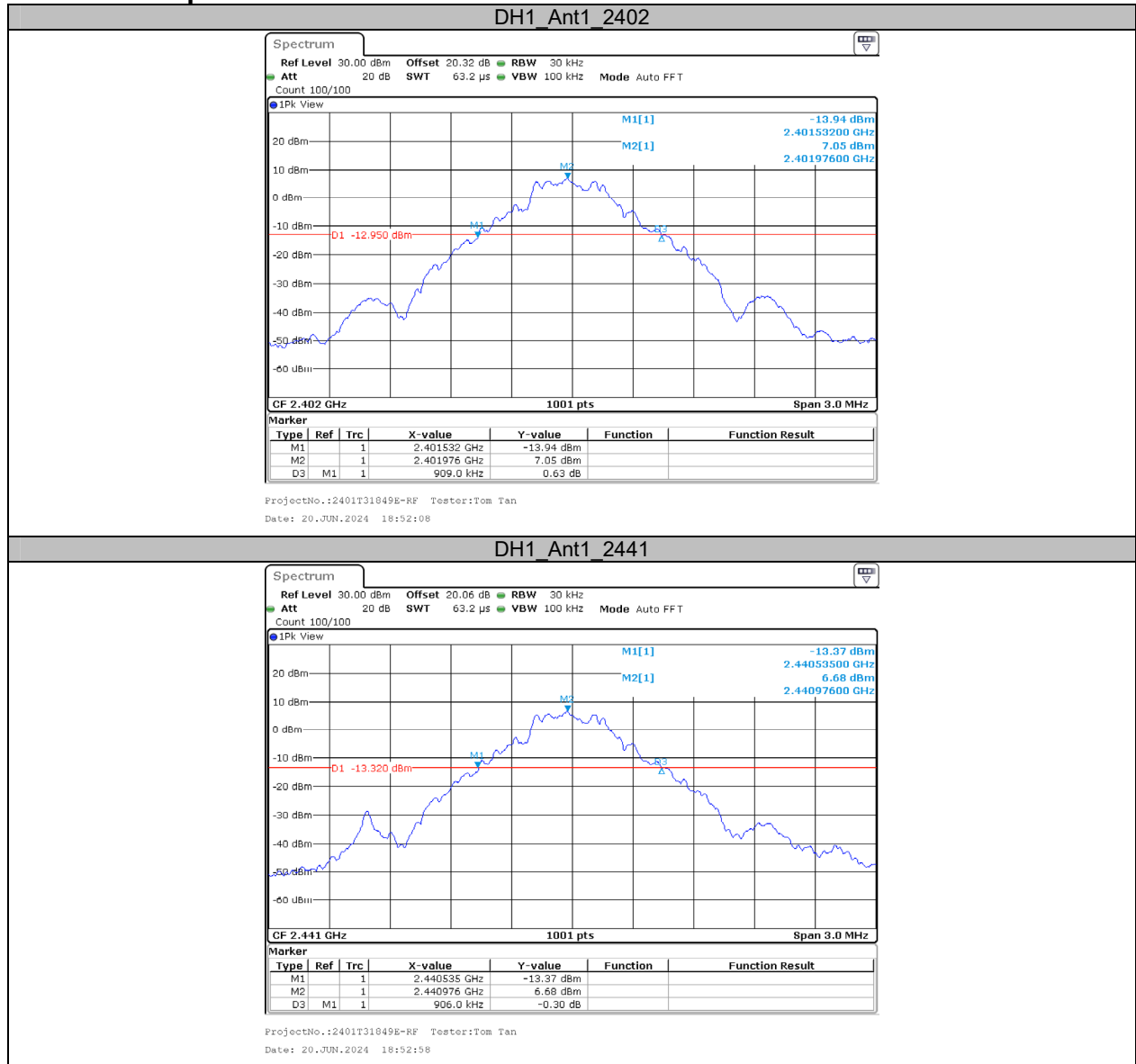
## Appendix

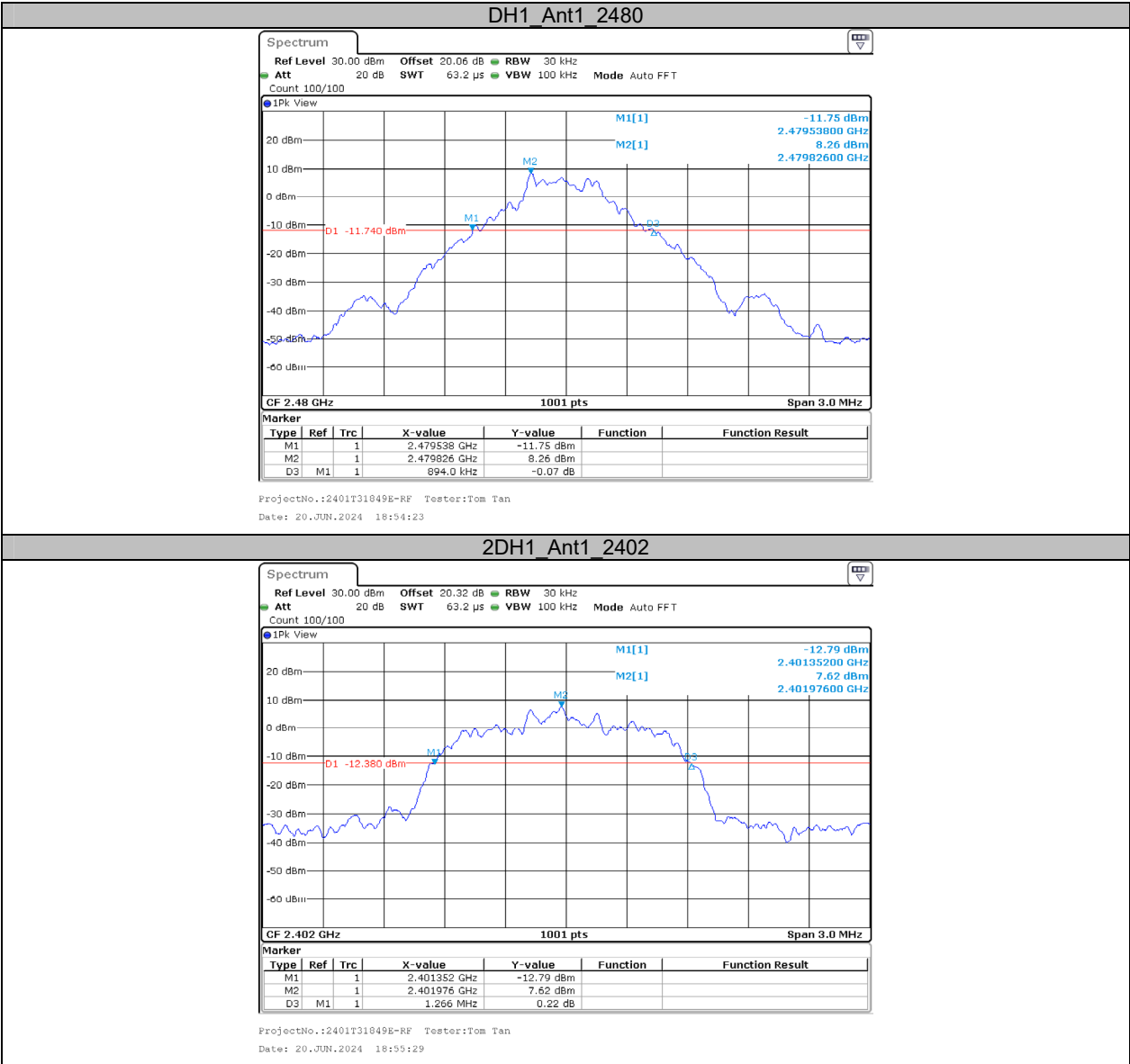
### Appendix A: 20dB Emission Bandwidth

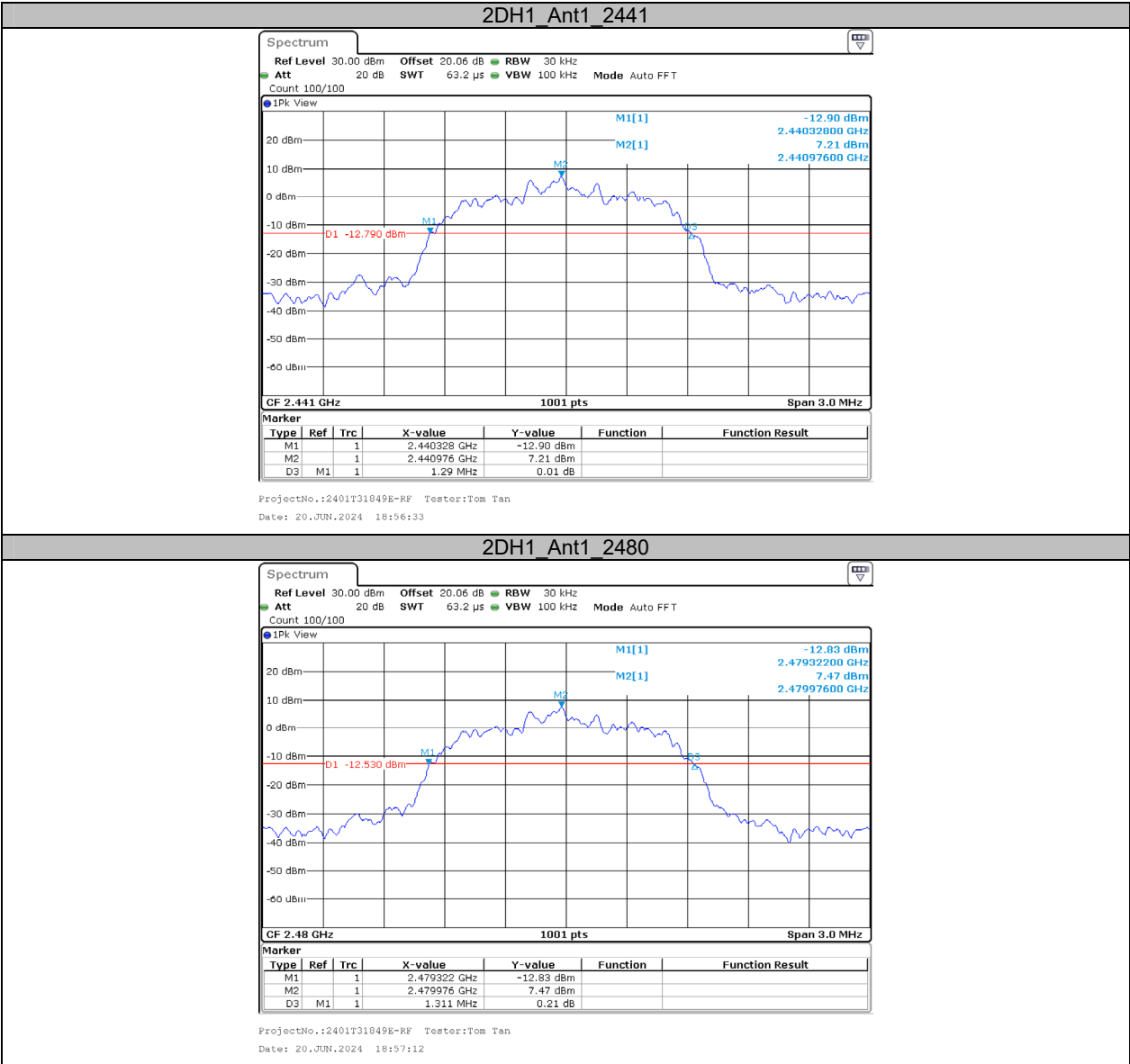
#### Test Result

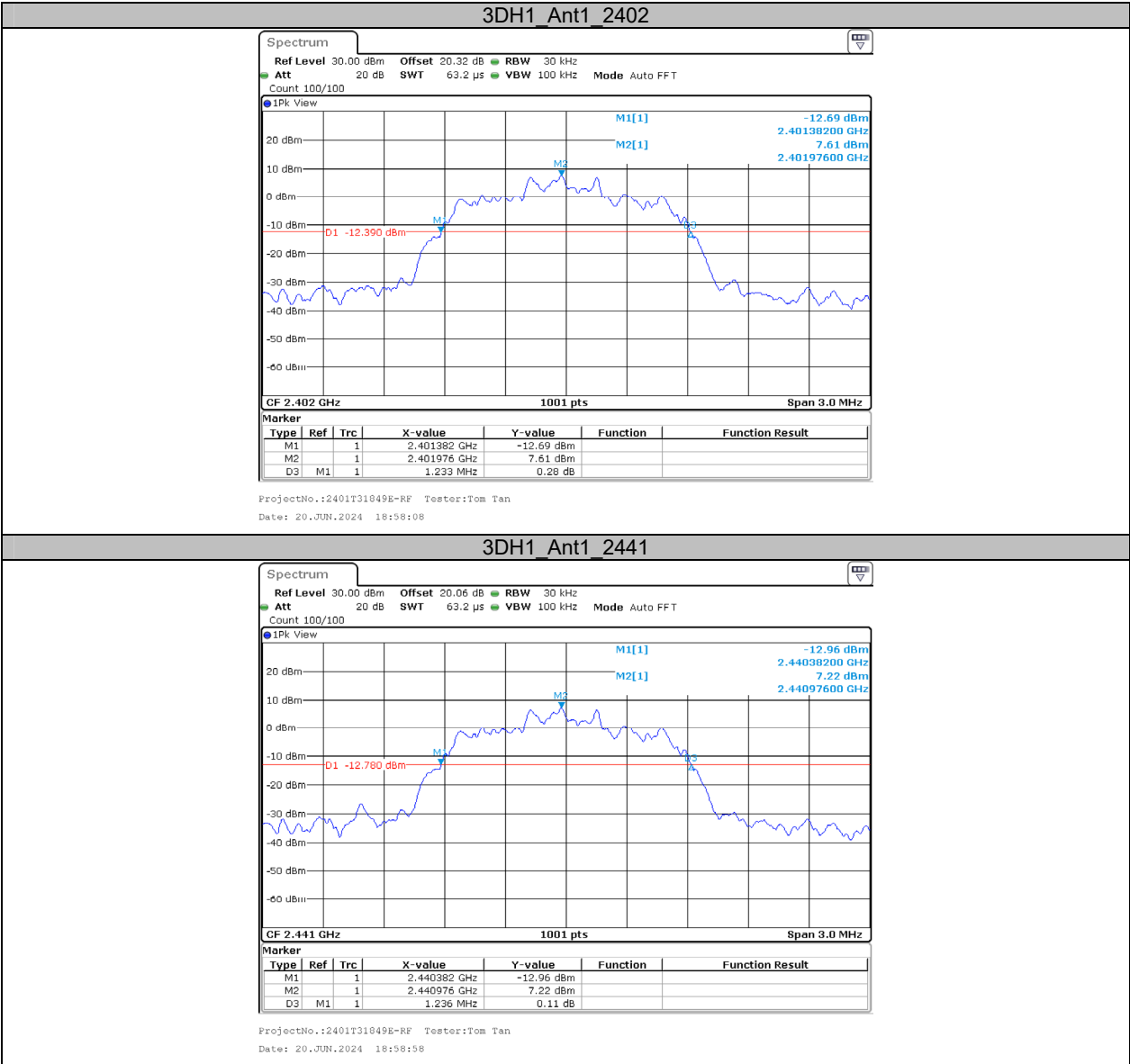
| Test Mode | Antenna | Channel | 20db EBW[MHz] | Limit[MHz] | Verdict |
|-----------|---------|---------|---------------|------------|---------|
| DH1       | Ant1    | 2402    | 0.91          | ---        | ---     |
|           |         | 2441    | 0.91          | ---        | ---     |
|           |         | 2480    | 0.89          | ---        | ---     |
| 2DH1      | Ant1    | 2402    | 1.27          | ---        | ---     |
|           |         | 2441    | 1.29          | ---        | ---     |
|           |         | 2480    | 1.31          | ---        | ---     |
| 3DH1      | Ant1    | 2402    | 1.23          | ---        | ---     |
|           |         | 2441    | 1.24          | ---        | ---     |
|           |         | 2480    | 1.24          | ---        | ---     |

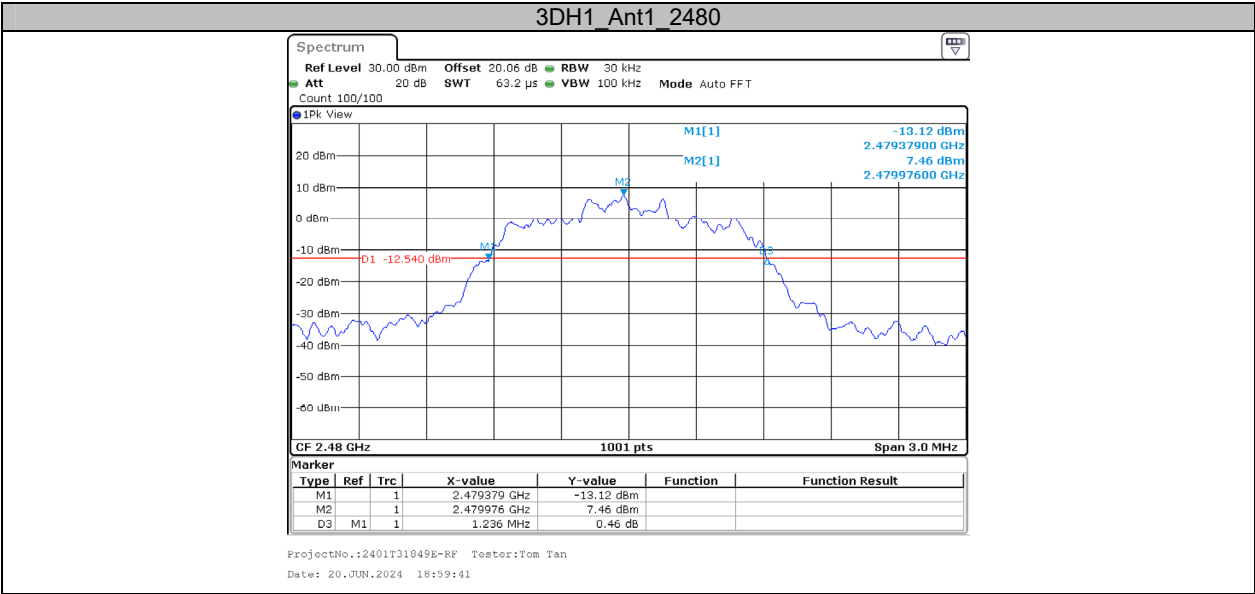
# Test Graphs









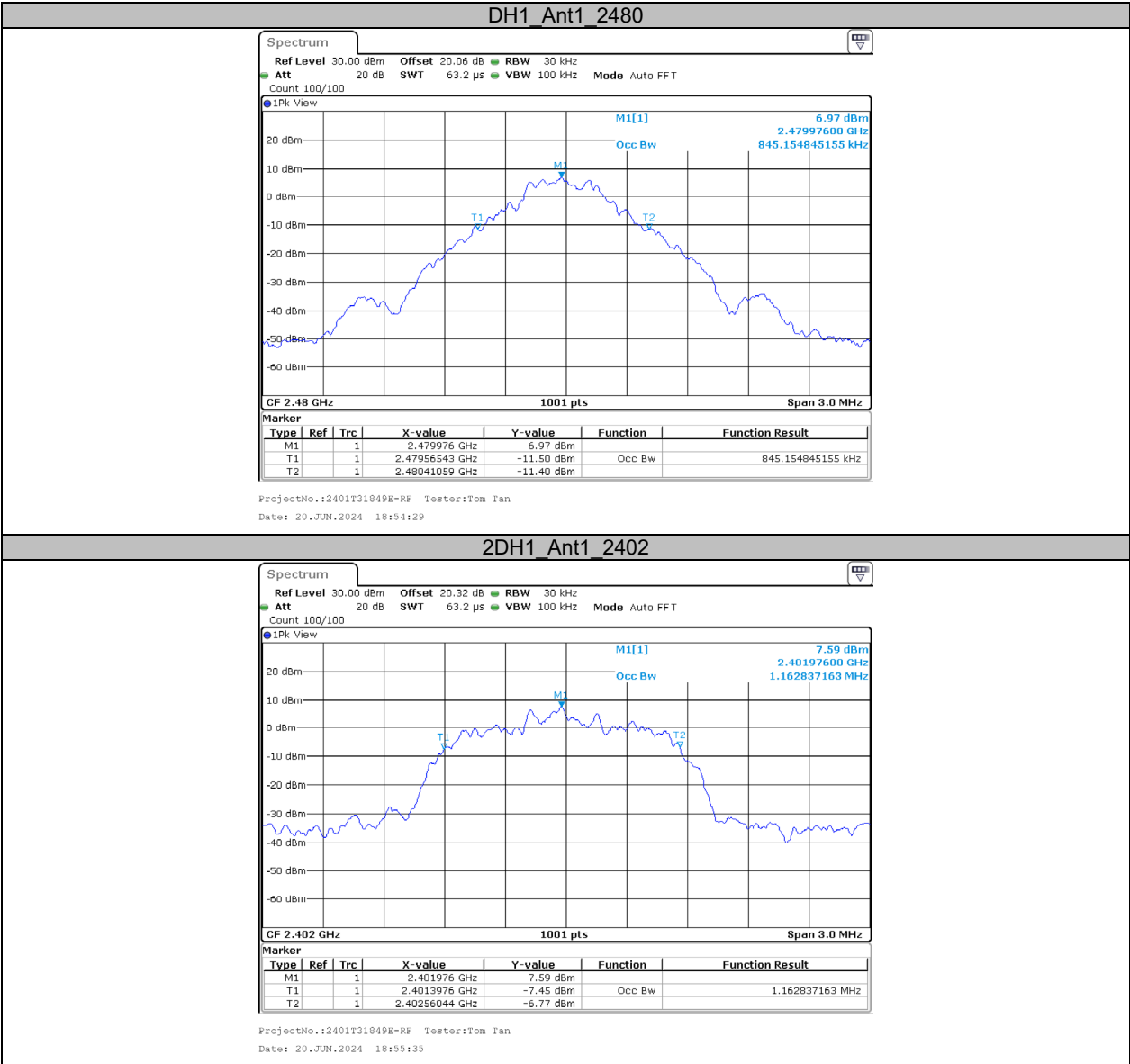


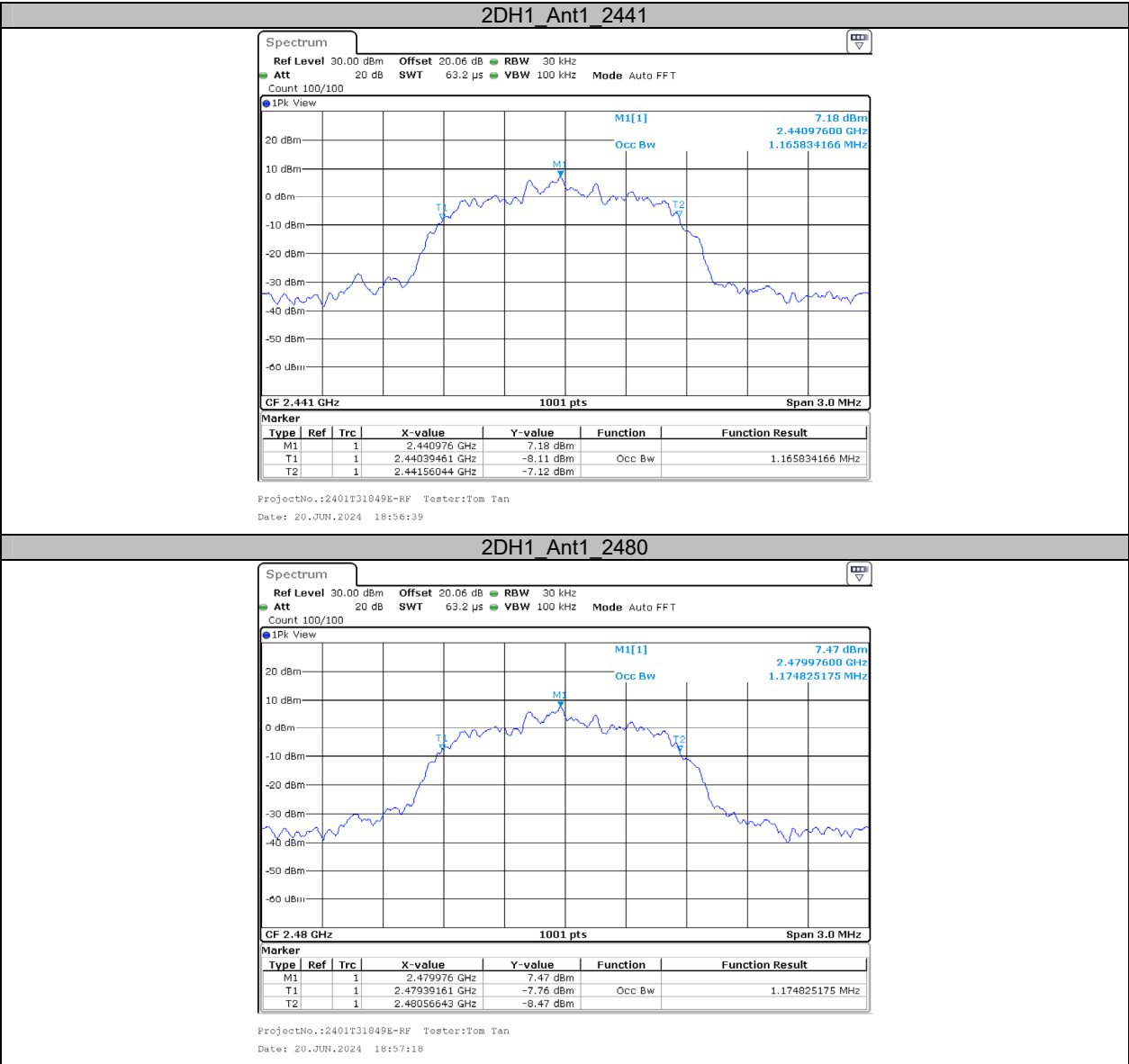
**Appendix B: Occupied Channel Bandwidth****Test Result**

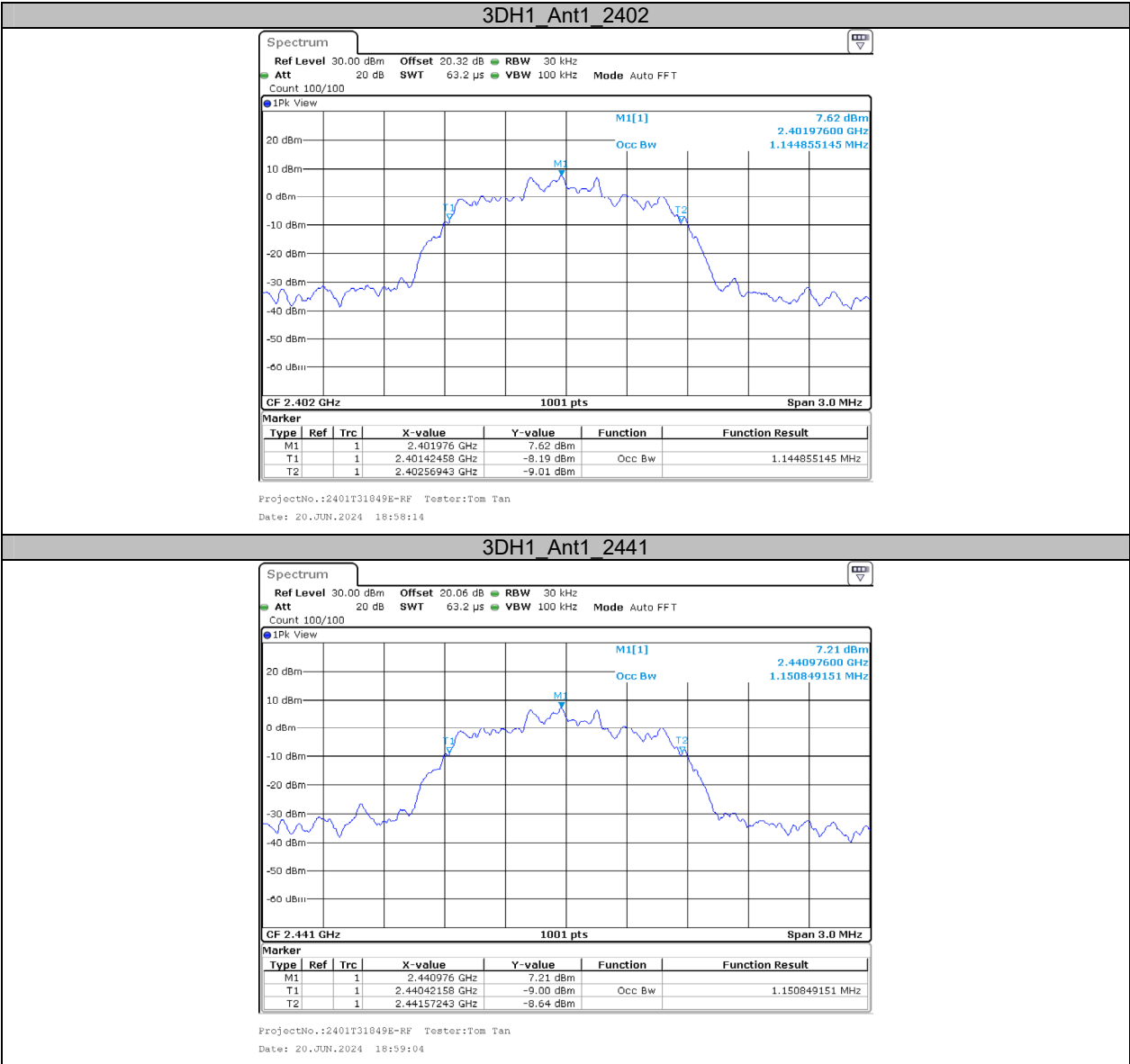
| Test Mode | Antenna | Channel | OCB [MHz] | Limit[MHz] | Verdict |
|-----------|---------|---------|-----------|------------|---------|
| DH1       | Ant1    | 2402    | 0.836     | ---        | ---     |
|           |         | 2441    | 0.845     | ---        | ---     |
|           |         | 2480    | 0.845     | ---        | ---     |
| 2DH1      | Ant1    | 2402    | 1.163     | ---        | ---     |
|           |         | 2441    | 1.166     | ---        | ---     |
|           |         | 2480    | 1.175     | ---        | ---     |
| 3DH1      | Ant1    | 2402    | 1.145     | ---        | ---     |
|           |         | 2441    | 1.151     | ---        | ---     |
|           |         | 2480    | 1.154     | ---        | ---     |

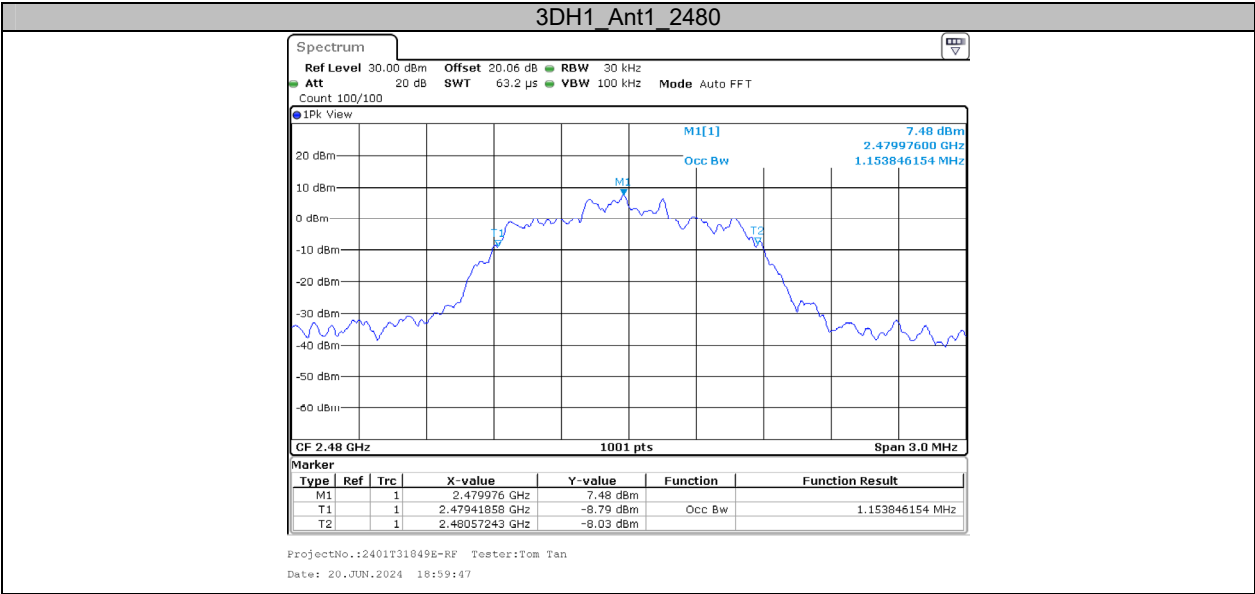
## Test Graphs







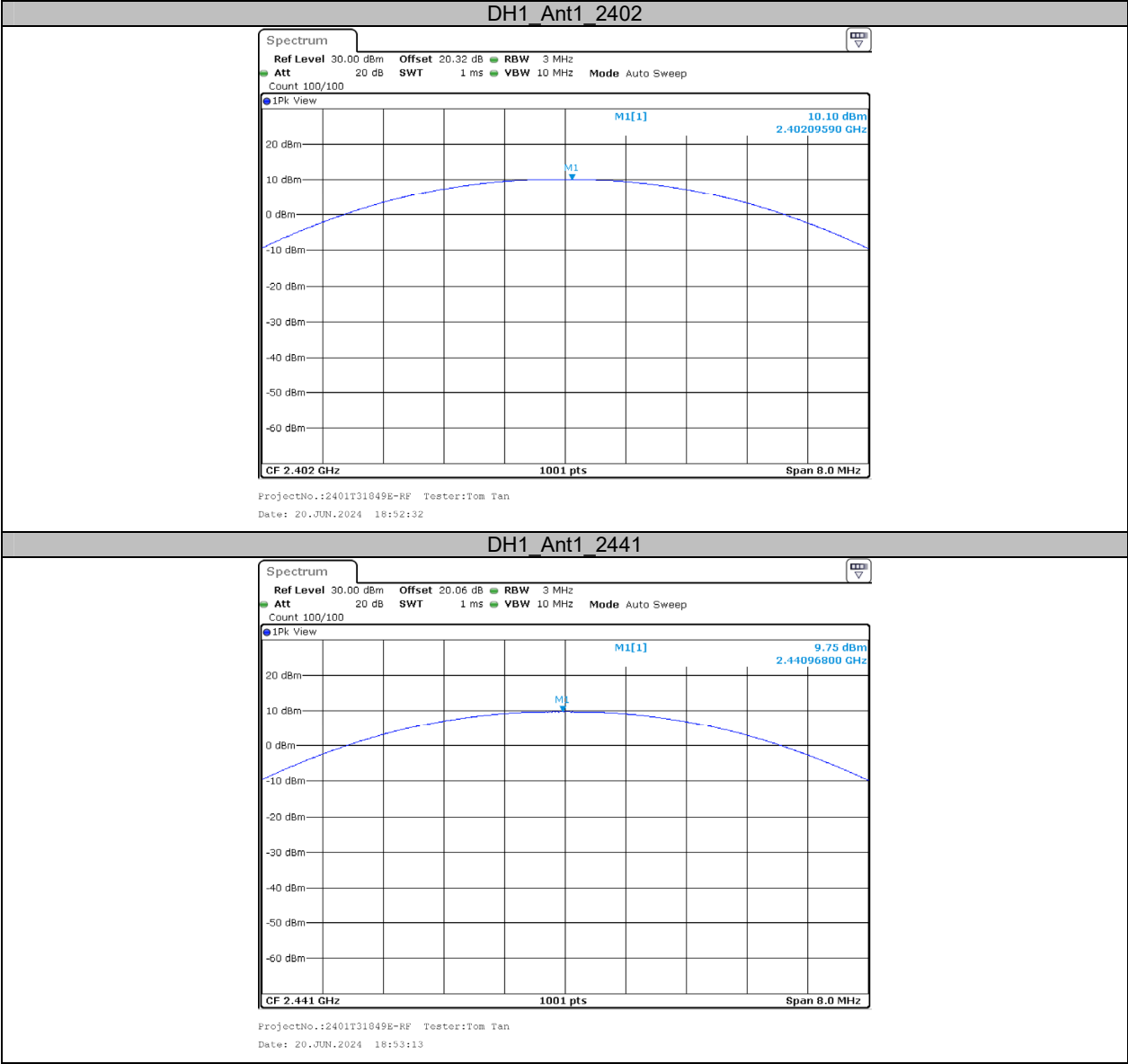


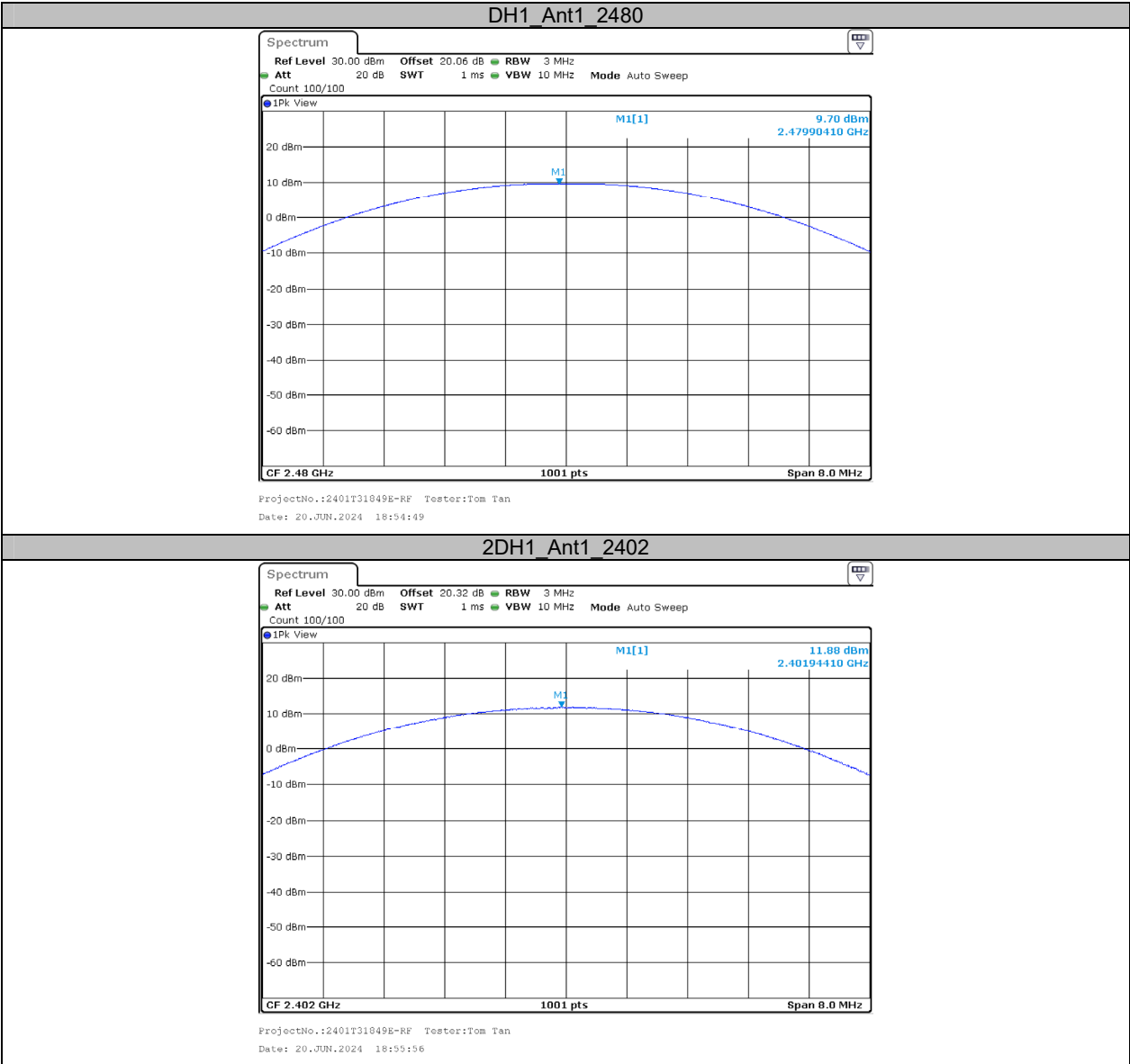


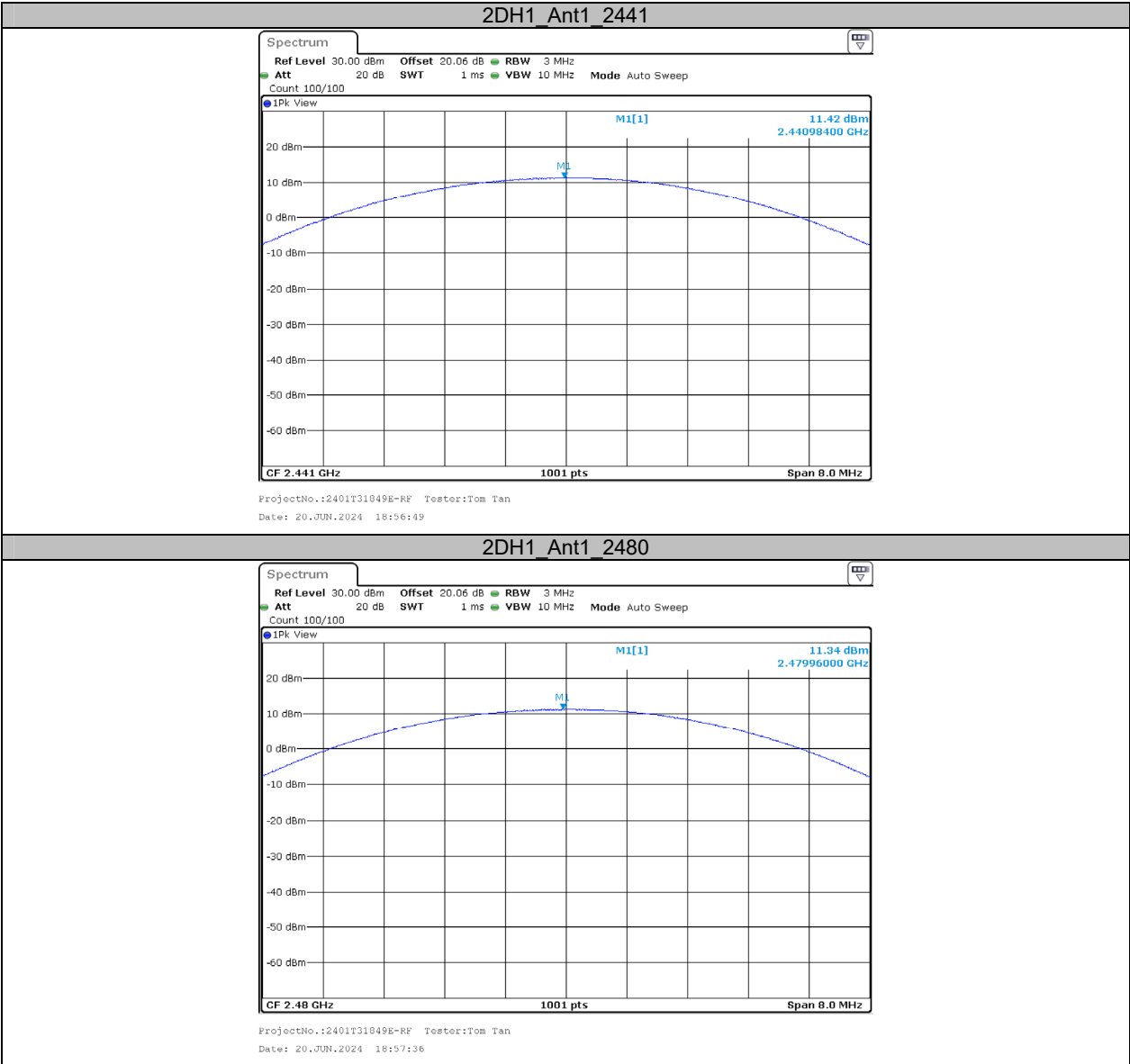
**Appendix C: Maximum conducted Peak output power****Test Result**

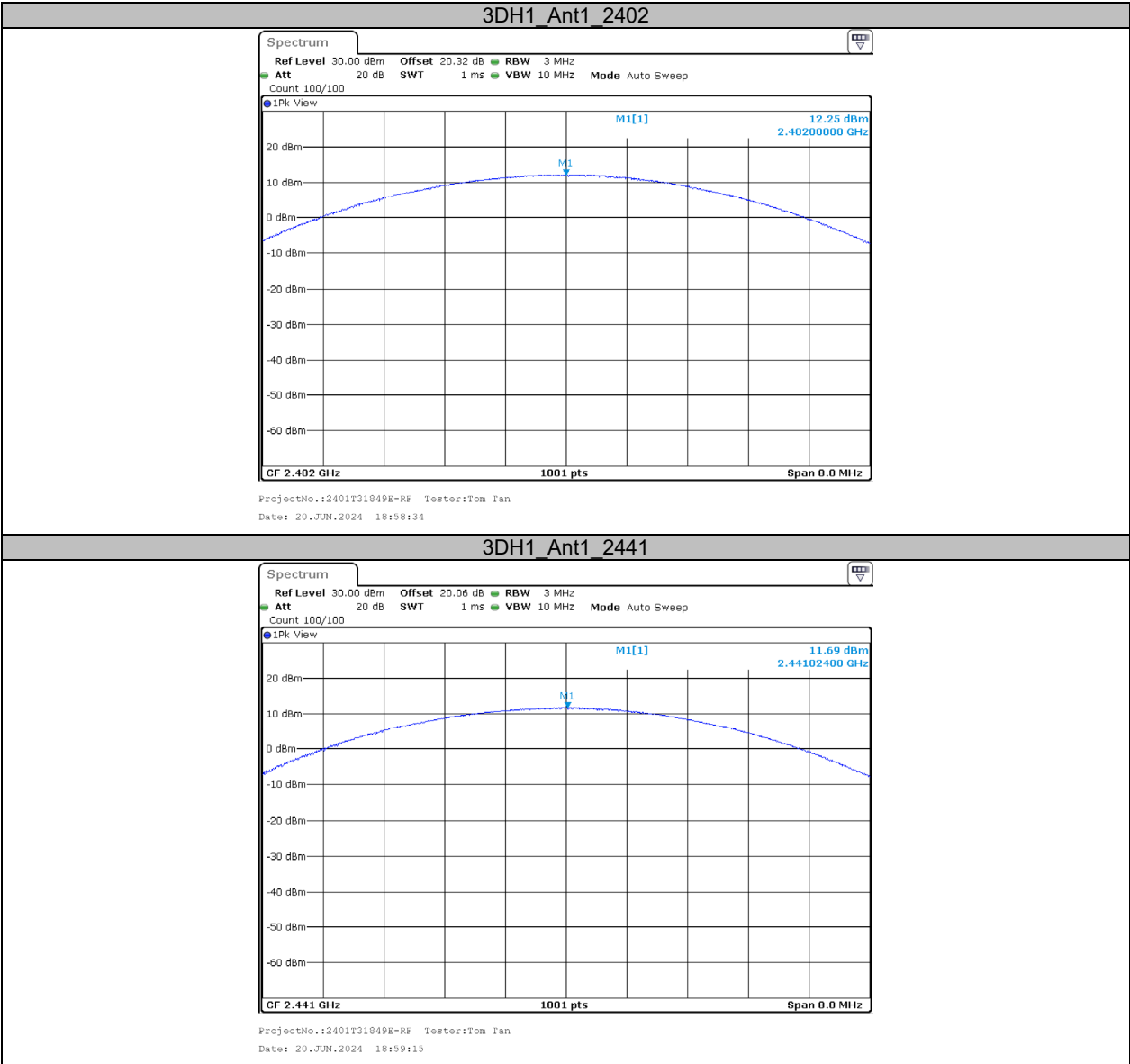
| Test Mode | Antenna | Channel | Result[dBm] | Limit[dBm] | EIRP[dBm] | EIRP<br>Limit[dBm] | Verdict |
|-----------|---------|---------|-------------|------------|-----------|--------------------|---------|
| DH1       | Ant1    | 2402    | 10.10       | ≤20.97     | 12.48     | ≤36                | PASS    |
|           |         | 2441    | 9.75        | ≤20.97     | 12.13     | ≤36                | PASS    |
|           |         | 2480    | 9.70        | ≤20.97     | 12.08     | ≤36                | PASS    |
| 2DH1      | Ant1    | 2402    | 11.88       | ≤20.97     | 14.26     | ≤36                | PASS    |
|           |         | 2441    | 11.42       | ≤20.97     | 13.80     | ≤36                | PASS    |
|           |         | 2480    | 11.34       | ≤20.97     | 13.72     | ≤36                | PASS    |
| 3DH1      | Ant1    | 2402    | 12.25       | ≤20.97     | 14.63     | ≤36                | PASS    |
|           |         | 2441    | 11.69       | ≤20.97     | 14.07     | ≤36                | PASS    |
|           |         | 2480    | 11.62       | ≤20.97     | 14.00     | ≤36                | PASS    |

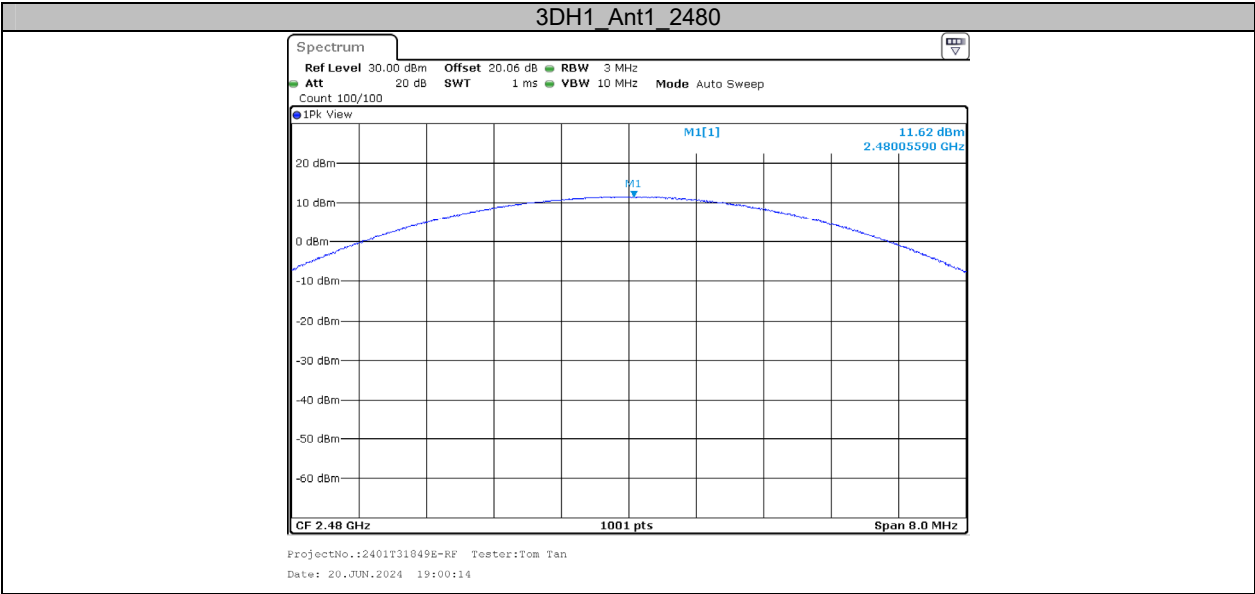
Test Graphs









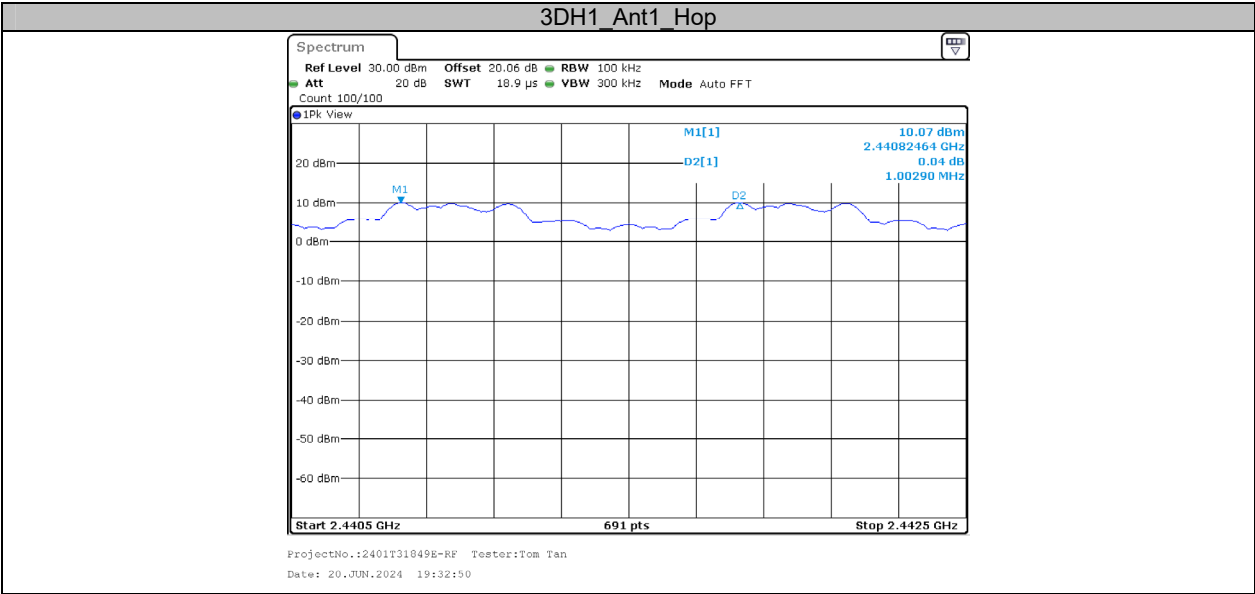


**Appendix D: Carrier frequency separation****Test Result**

| Test Mode | Antenna | Channel | Result[MHz] | Limit[MHz]   | Verdict |
|-----------|---------|---------|-------------|--------------|---------|
| DH1       | Ant1    | Hop     | 1           | $\geq 0.607$ | PASS    |
| 2DH1      | Ant1    | Hop     | 1           | $\geq 0.873$ | PASS    |
| 3DH1      | Ant1    | Hop     | 1.003       | $\geq 0.827$ | PASS    |

## Test Graphs





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

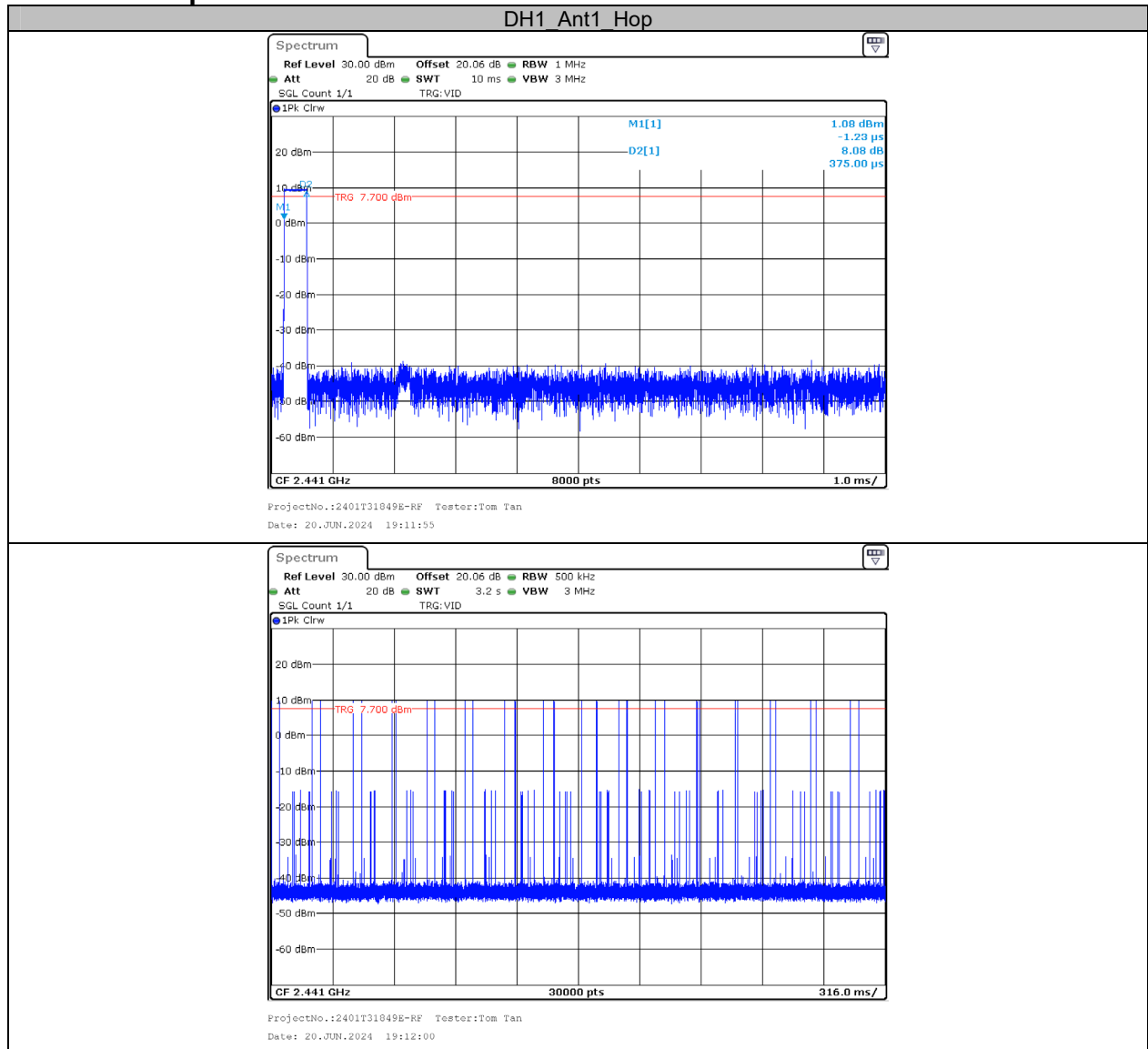
| Test Mode | Antenna | Channel | BurstWidth<br>[ms] | TotalHops<br>[Num] | Result[s] | Limit[s] | Verdict |
|-----------|---------|---------|--------------------|--------------------|-----------|----------|---------|
| DH1       | Ant1    | Hop     | 0.375              | 320                | 0.120     | ≤0.4     | PASS    |
| DH3       | Ant1    | Hop     | 1.623              | 170                | 0.276     | ≤0.4     | PASS    |
| DH5       | Ant1    | Hop     | 2.863              | 110                | 0.315     | ≤0.4     | PASS    |
| 2DH1      | Ant1    | Hop     | 0.384              | 320                | 0.123     | ≤0.4     | PASS    |
| 2DH3      | Ant1    | Hop     | 1.629              | 140                | 0.228     | ≤0.4     | PASS    |
| 2DH5      | Ant1    | Hop     | 2.870              | 120                | 0.344     | ≤0.4     | PASS    |
| 3DH1      | Ant1    | Hop     | 0.385              | 320                | 0.123     | ≤0.4     | PASS    |
| 3DH3      | Ant1    | Hop     | 1.628              | 150                | 0.244     | ≤0.4     | PASS    |
| 3DH5      | Ant1    | Hop     | 2.870              | 110                | 0.316     | ≤0.4     | PASS    |

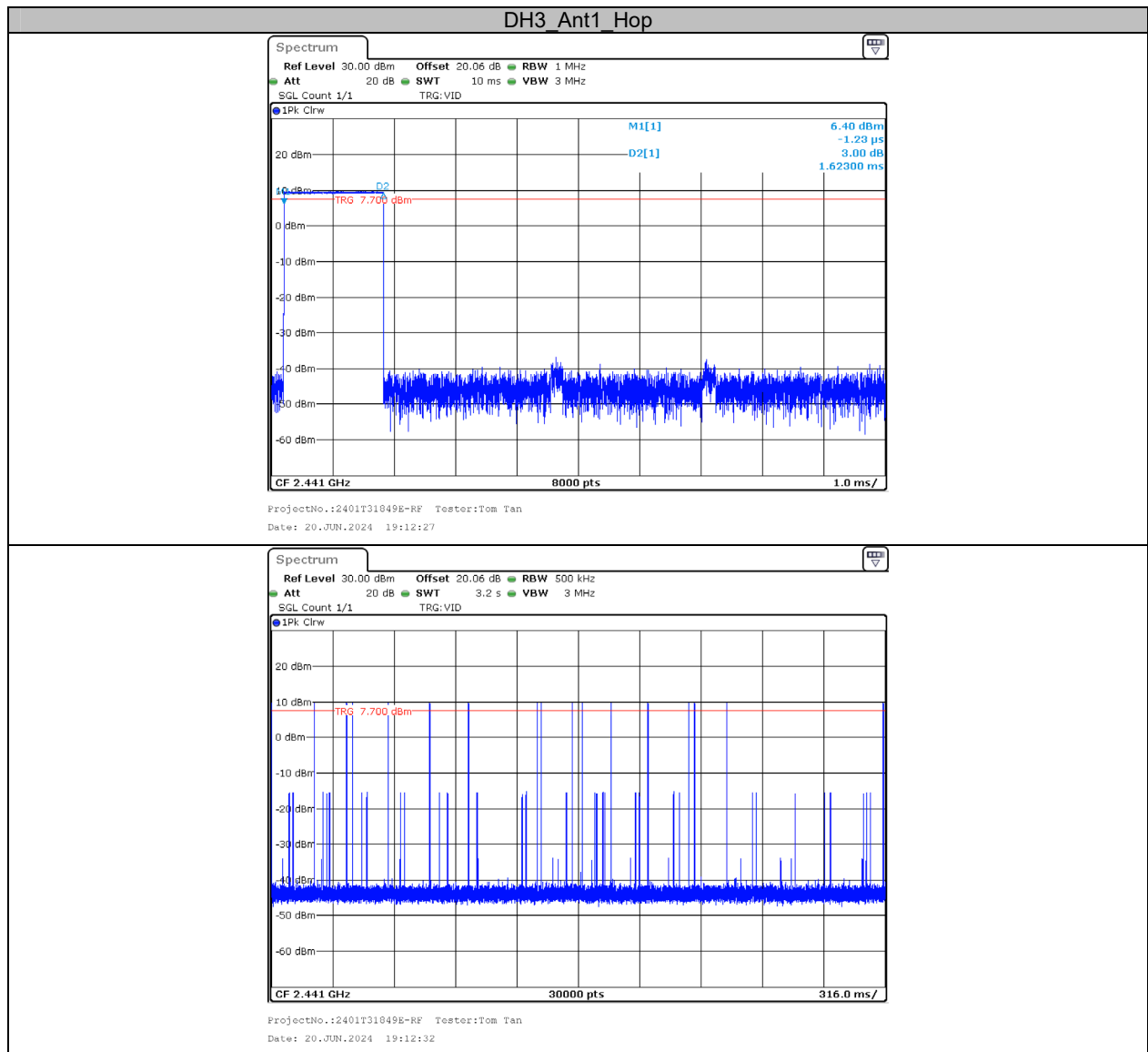
Note 1: A period time= $0.4 \times 79 = 31.6$ (S), Result=BurstWidth\*Totalhops

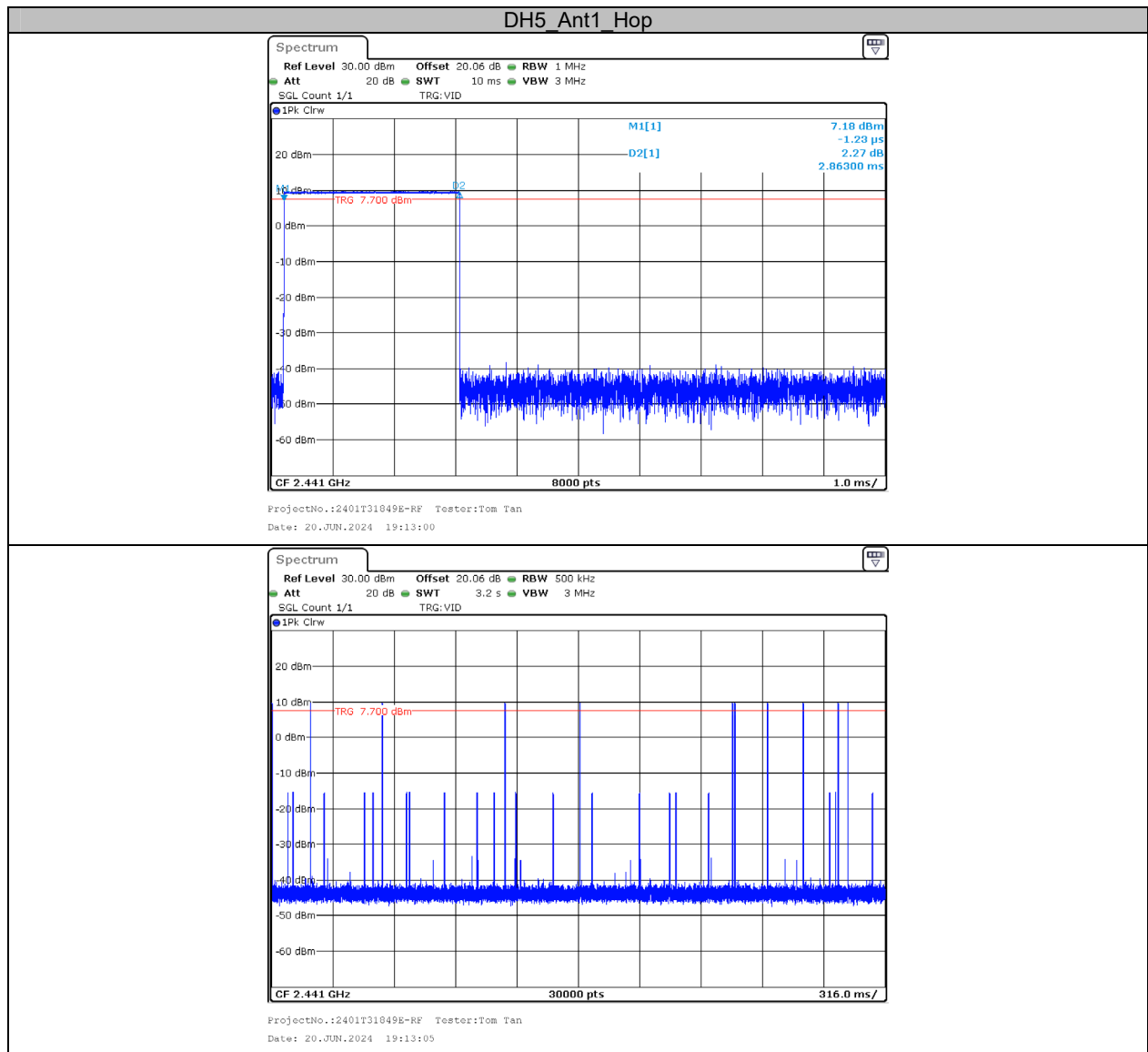
Note 2: Totalhops=Hopping Number in  $3.16s \times 10$

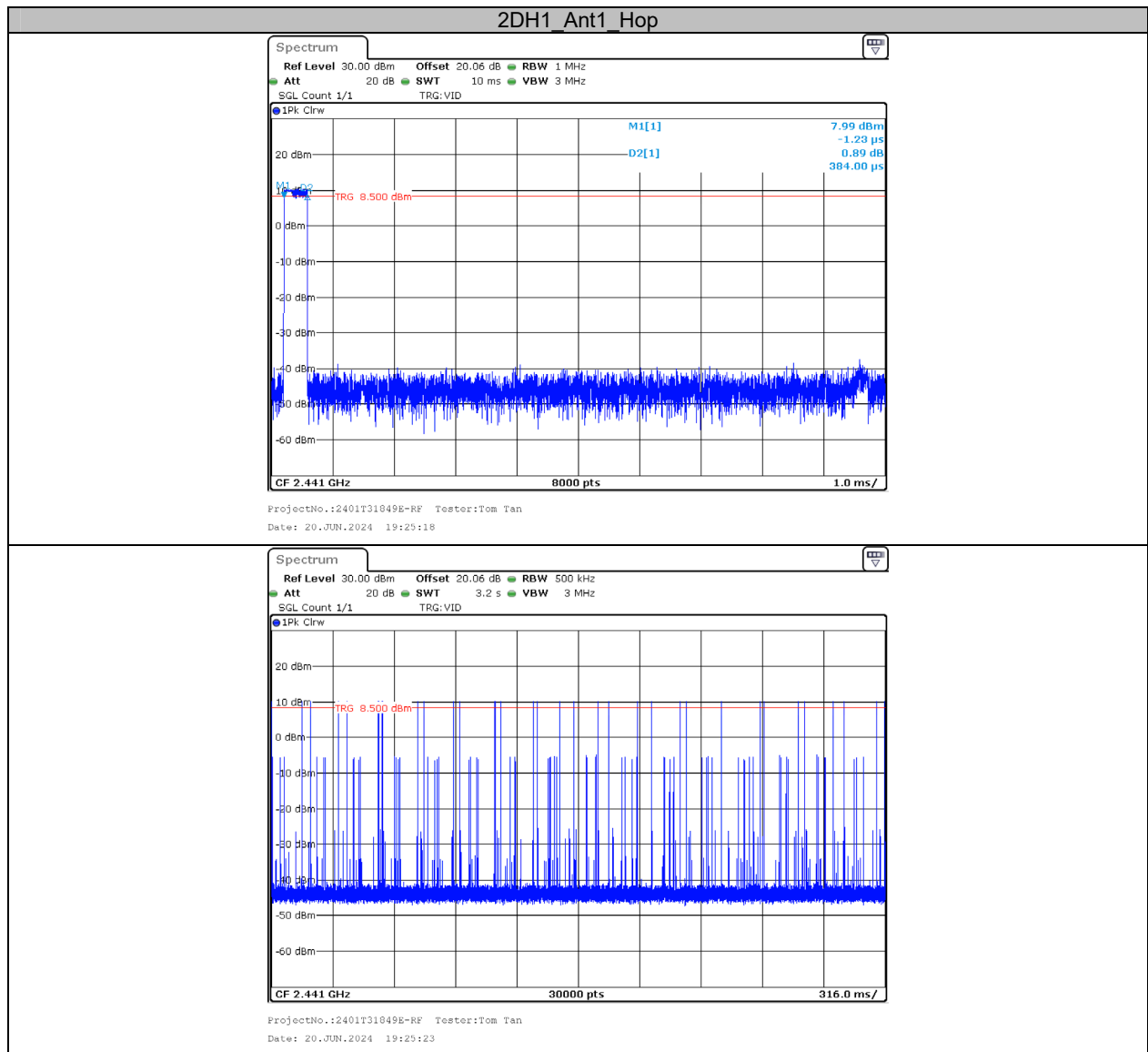
Note 3: Hopping Number in 3.16s=Total of highest signals in 3.16s(Second high signals were other channel)

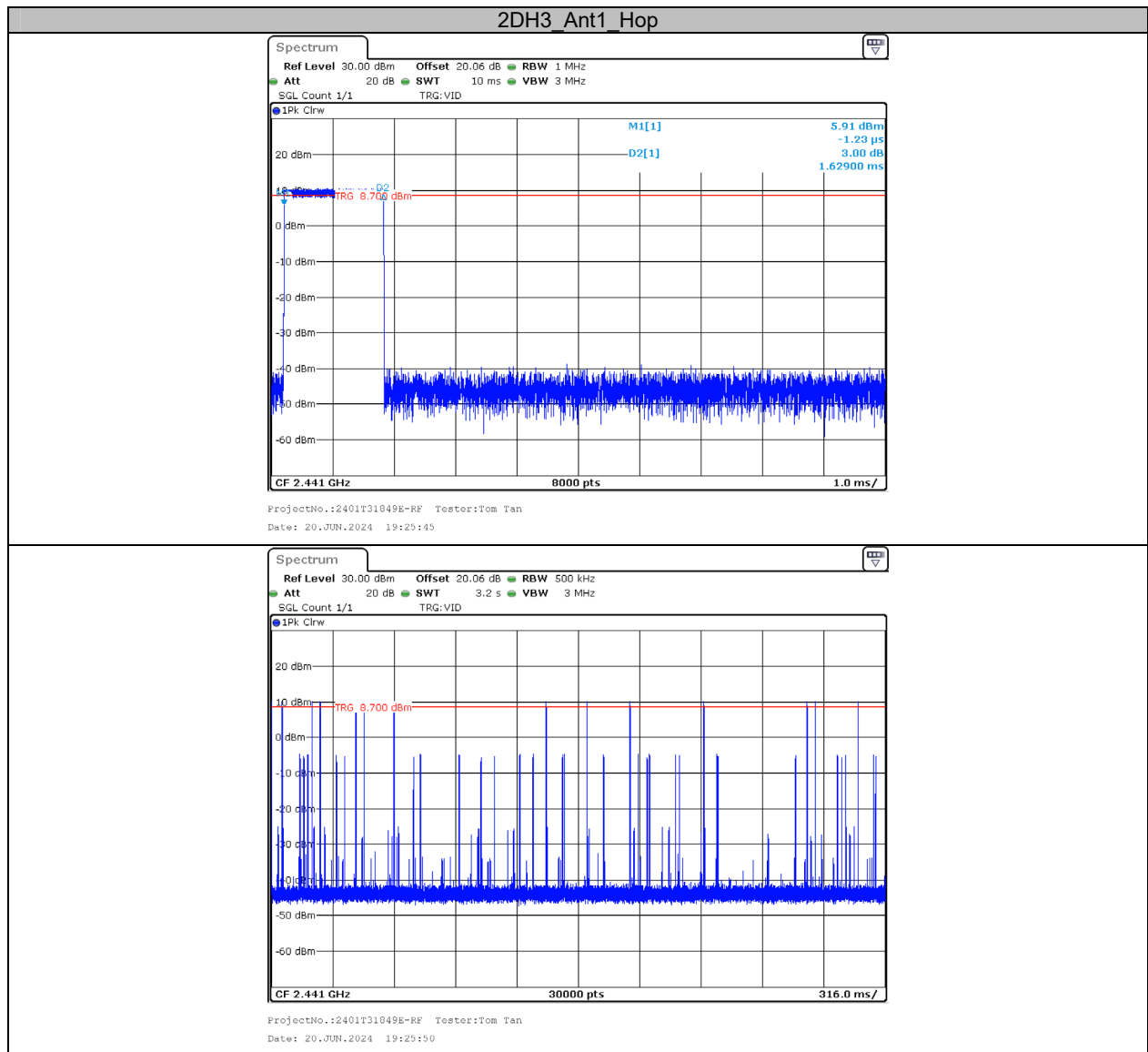
## Test Graphs

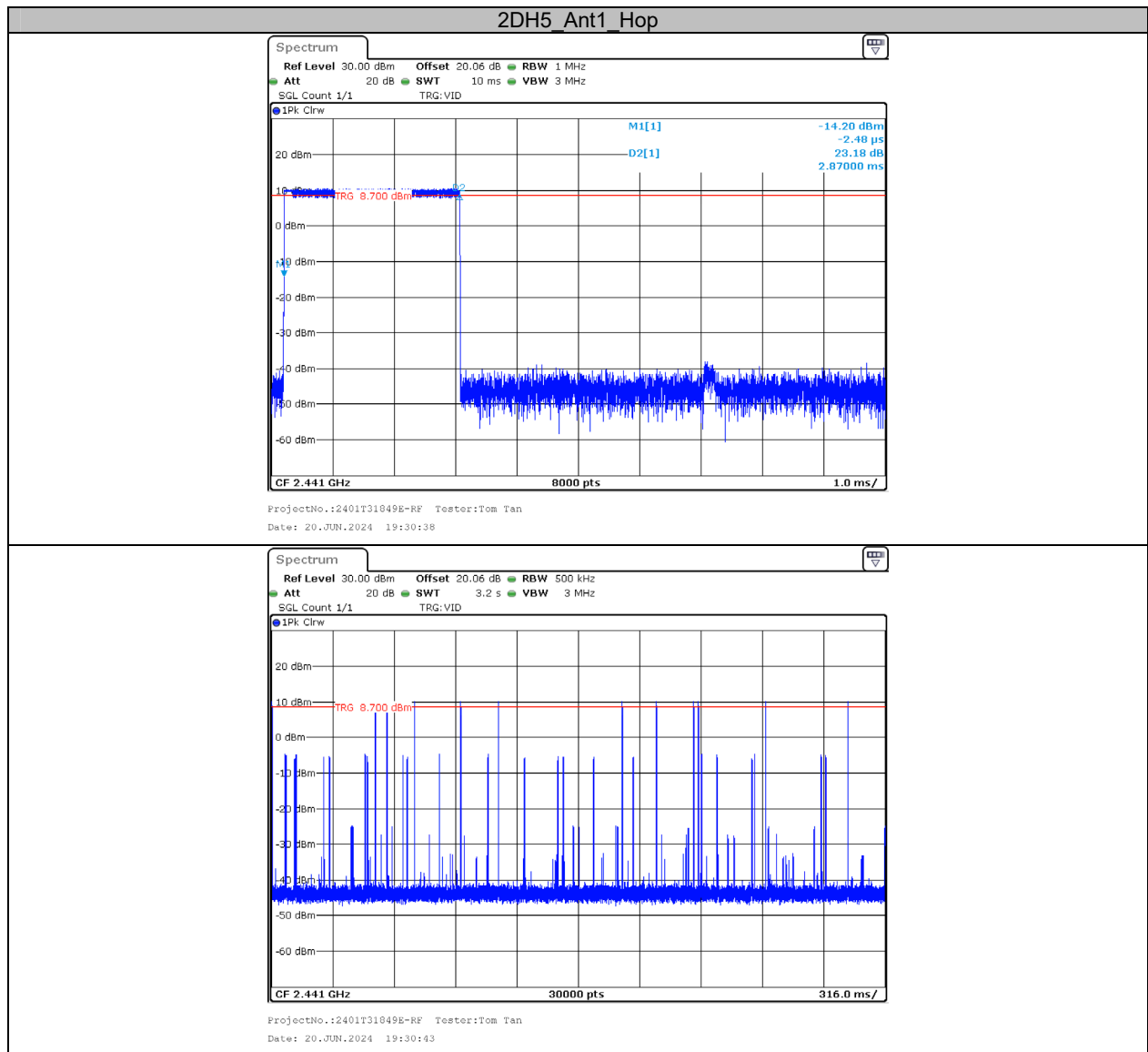


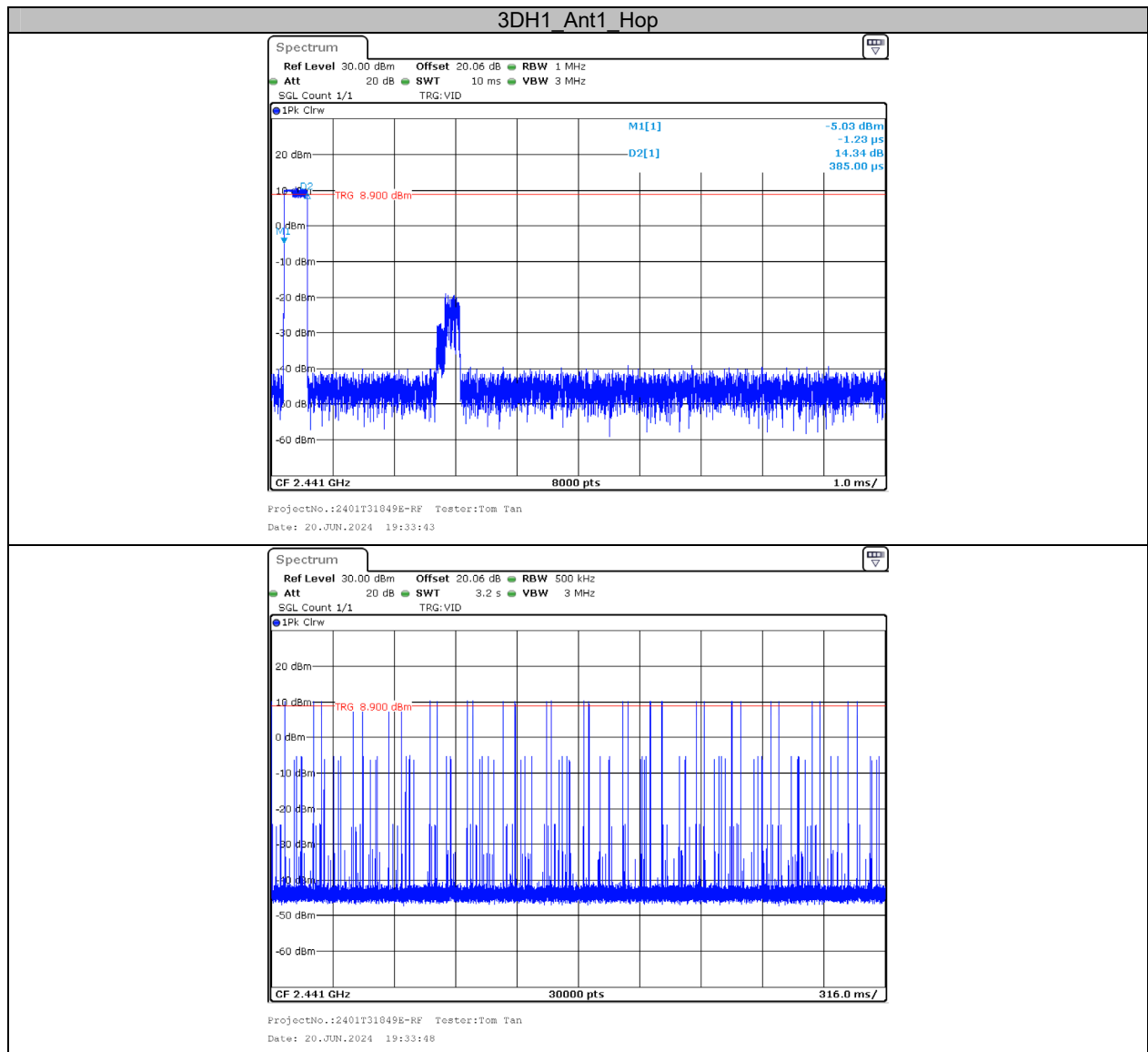


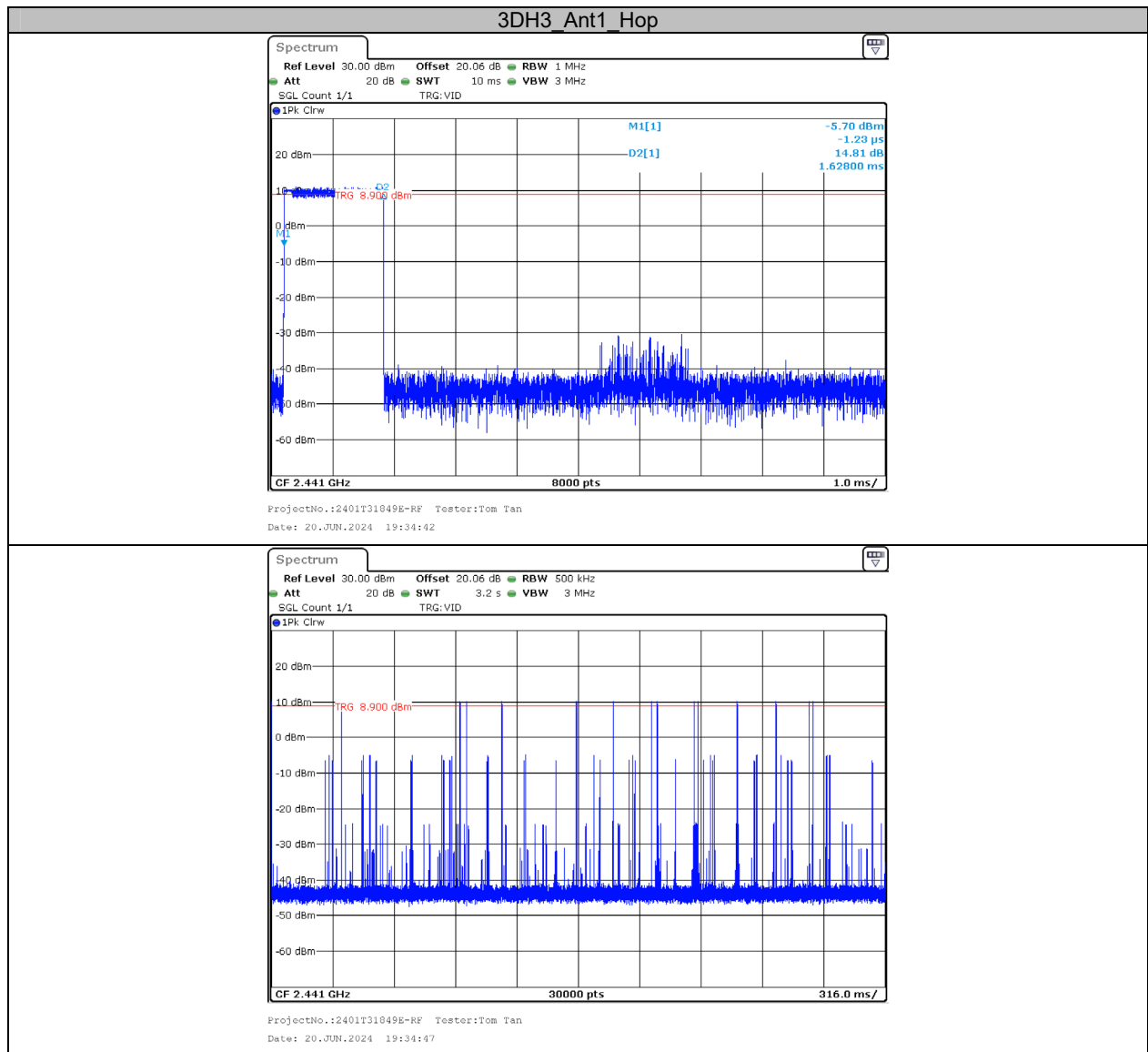


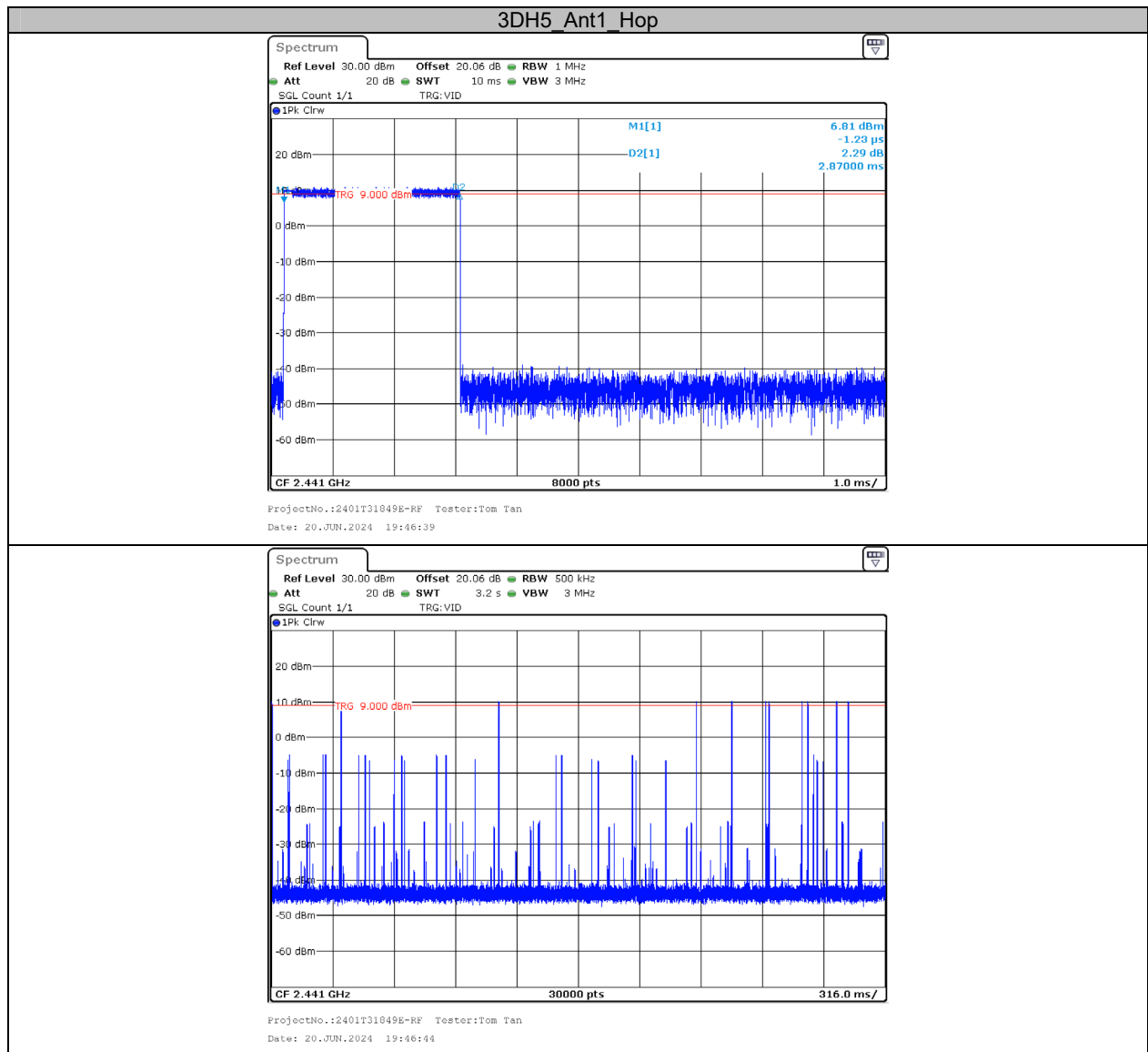








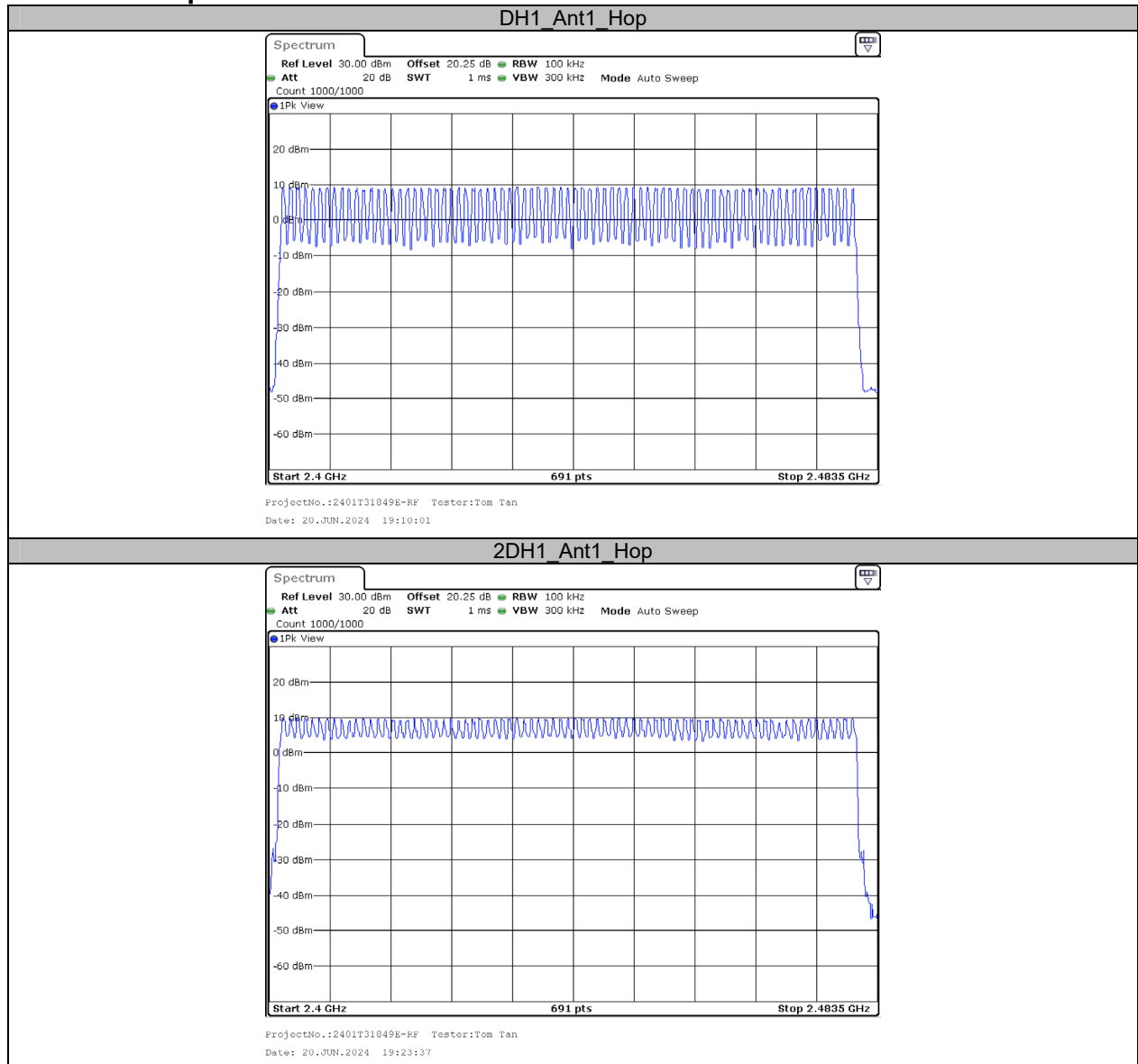


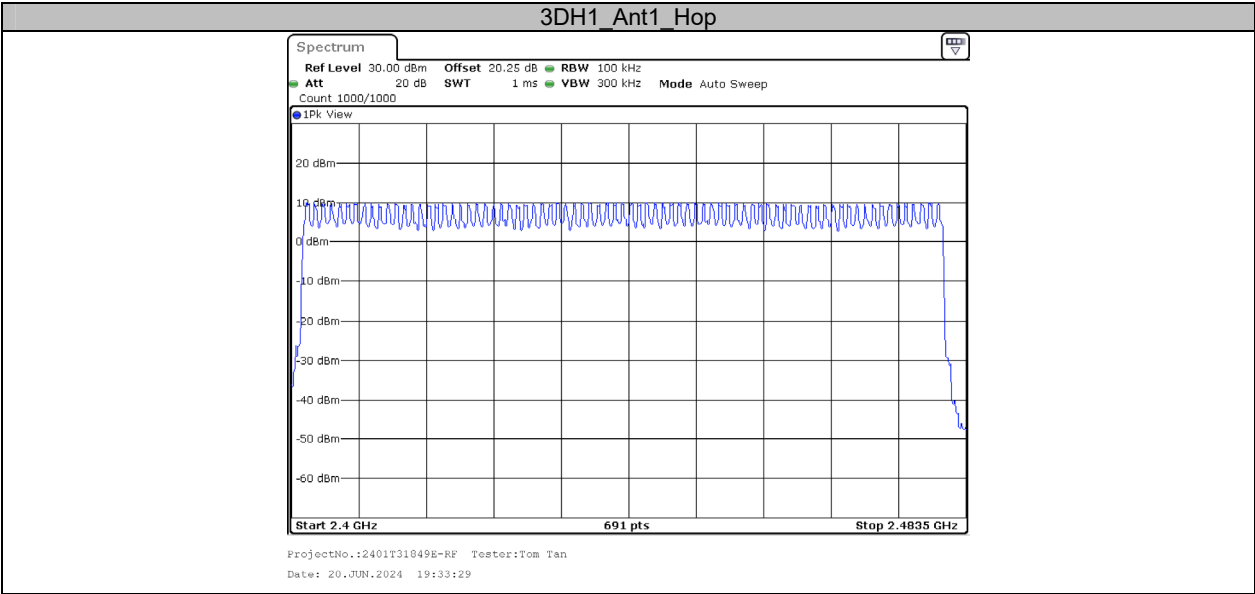


**Appendix F: Number of hopping channels****Test Result**

| 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    |

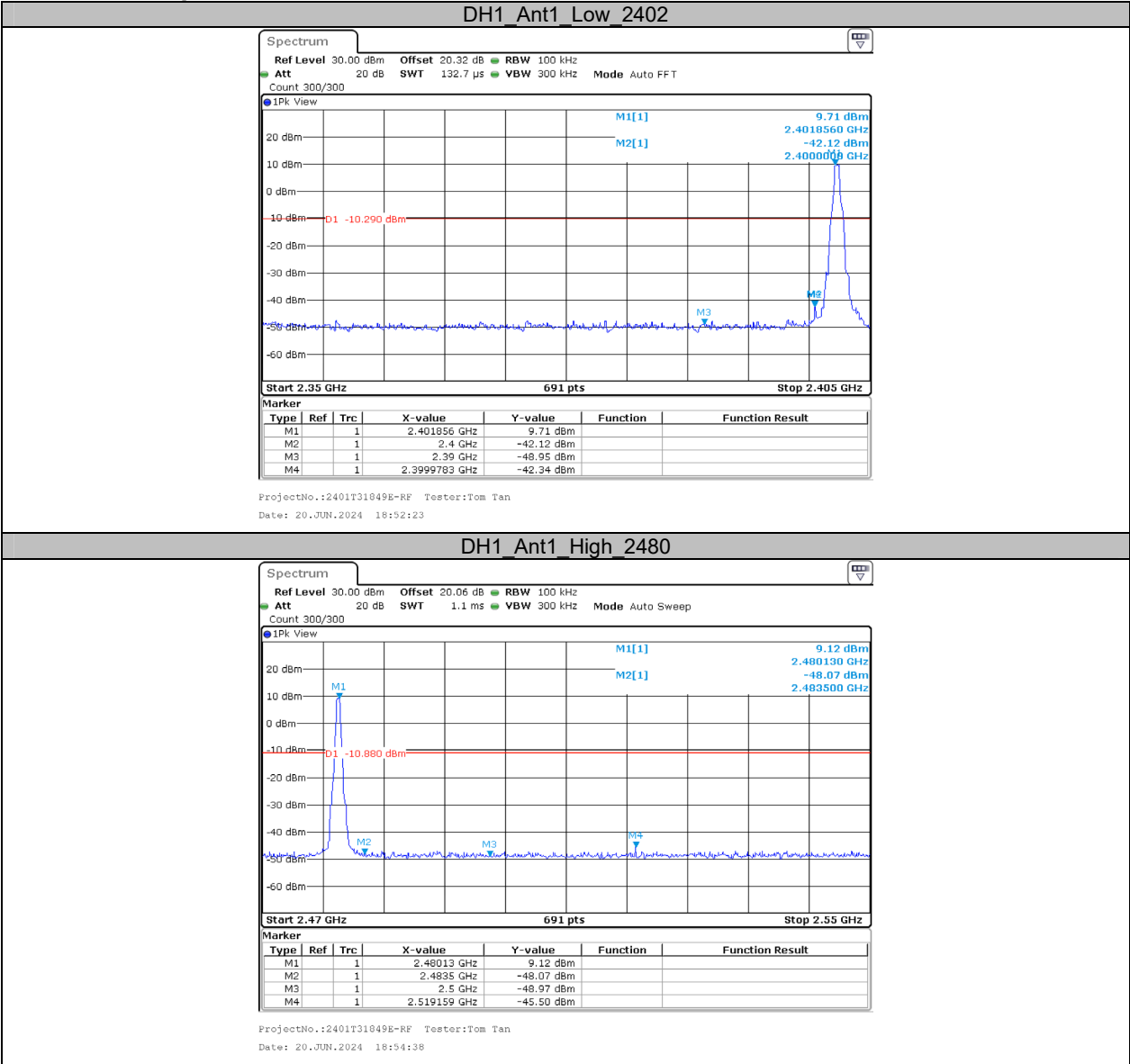
## Test Graphs



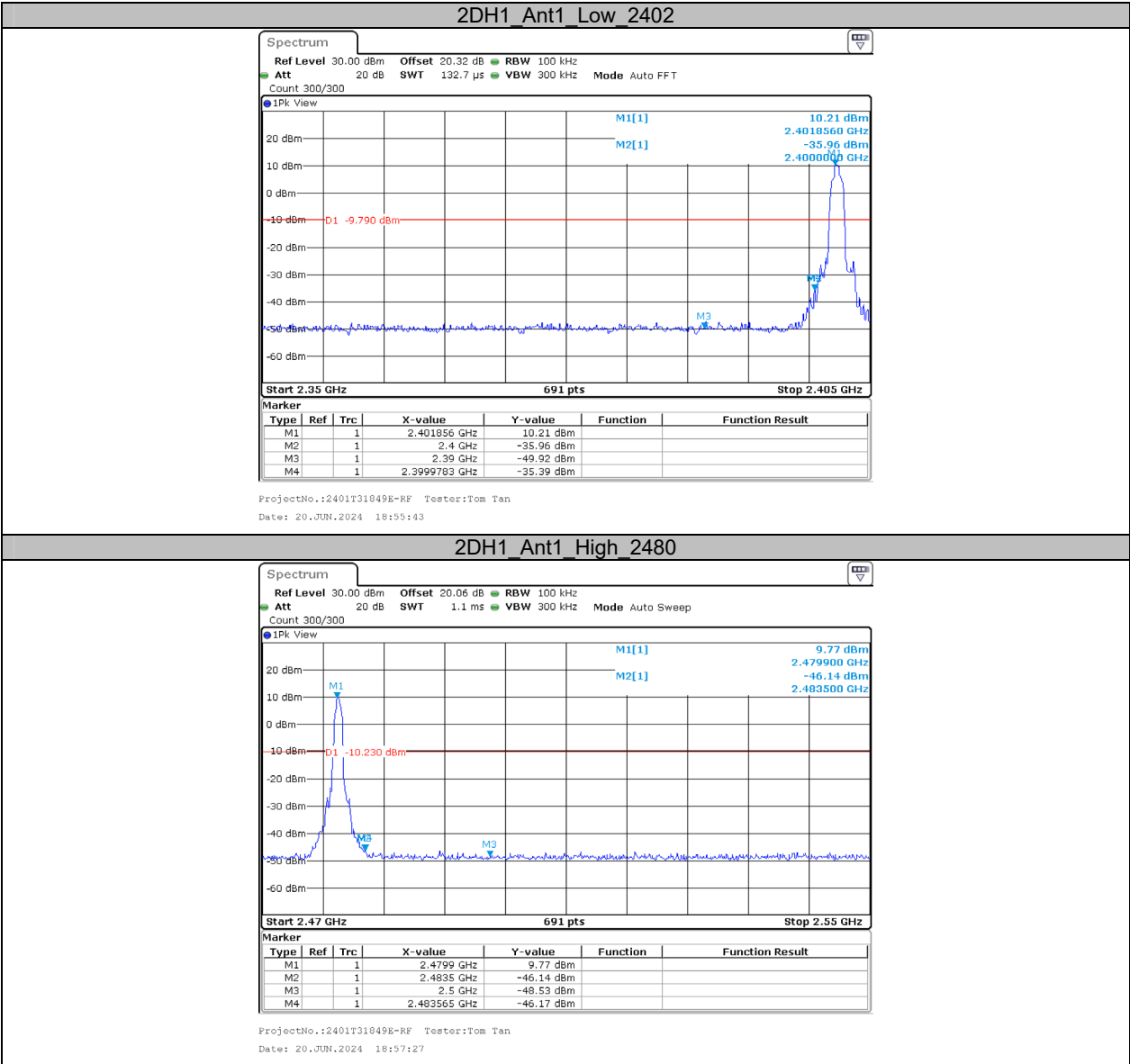


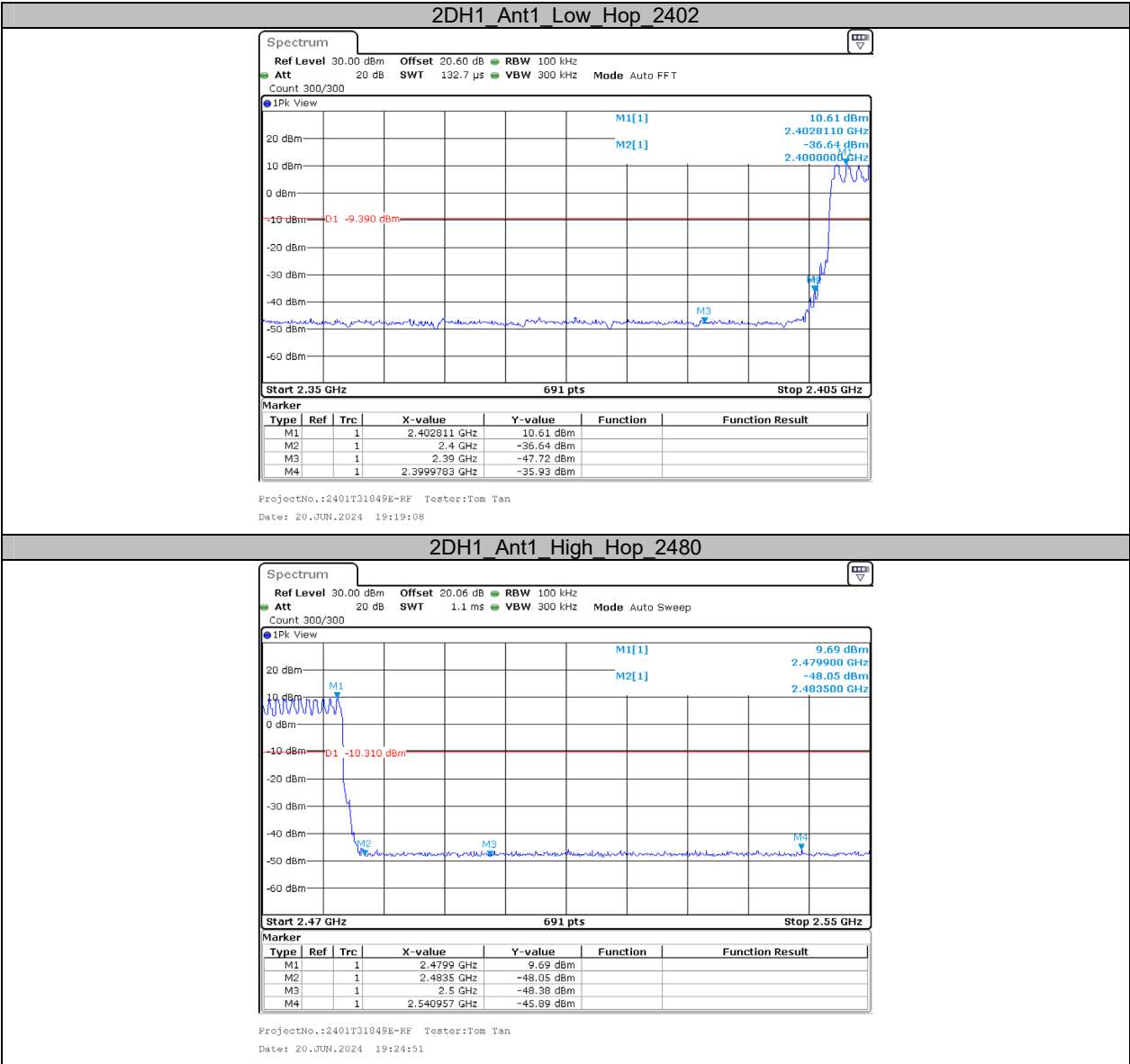
Appendix G: Band edge measurements

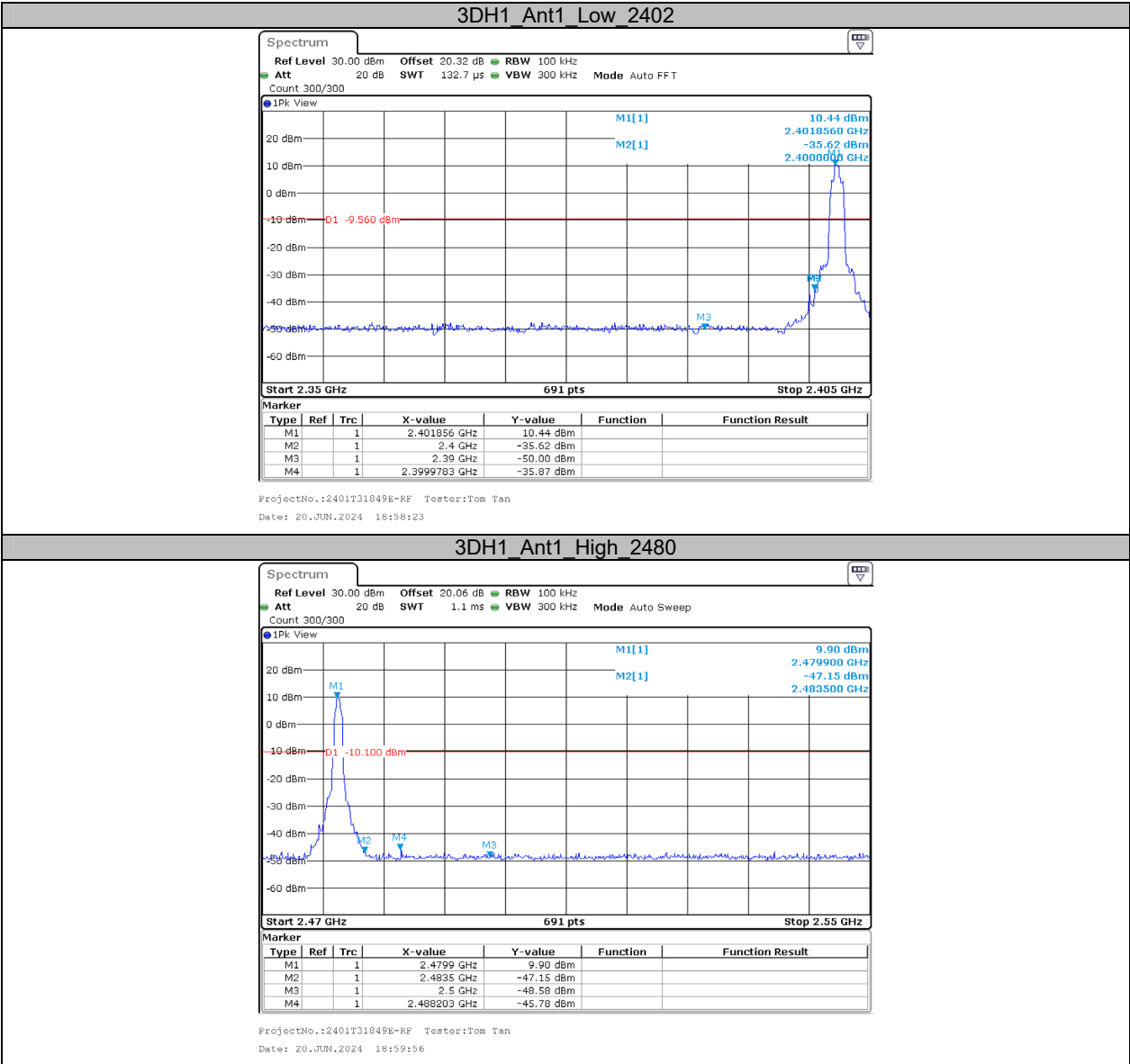
Test Graphs

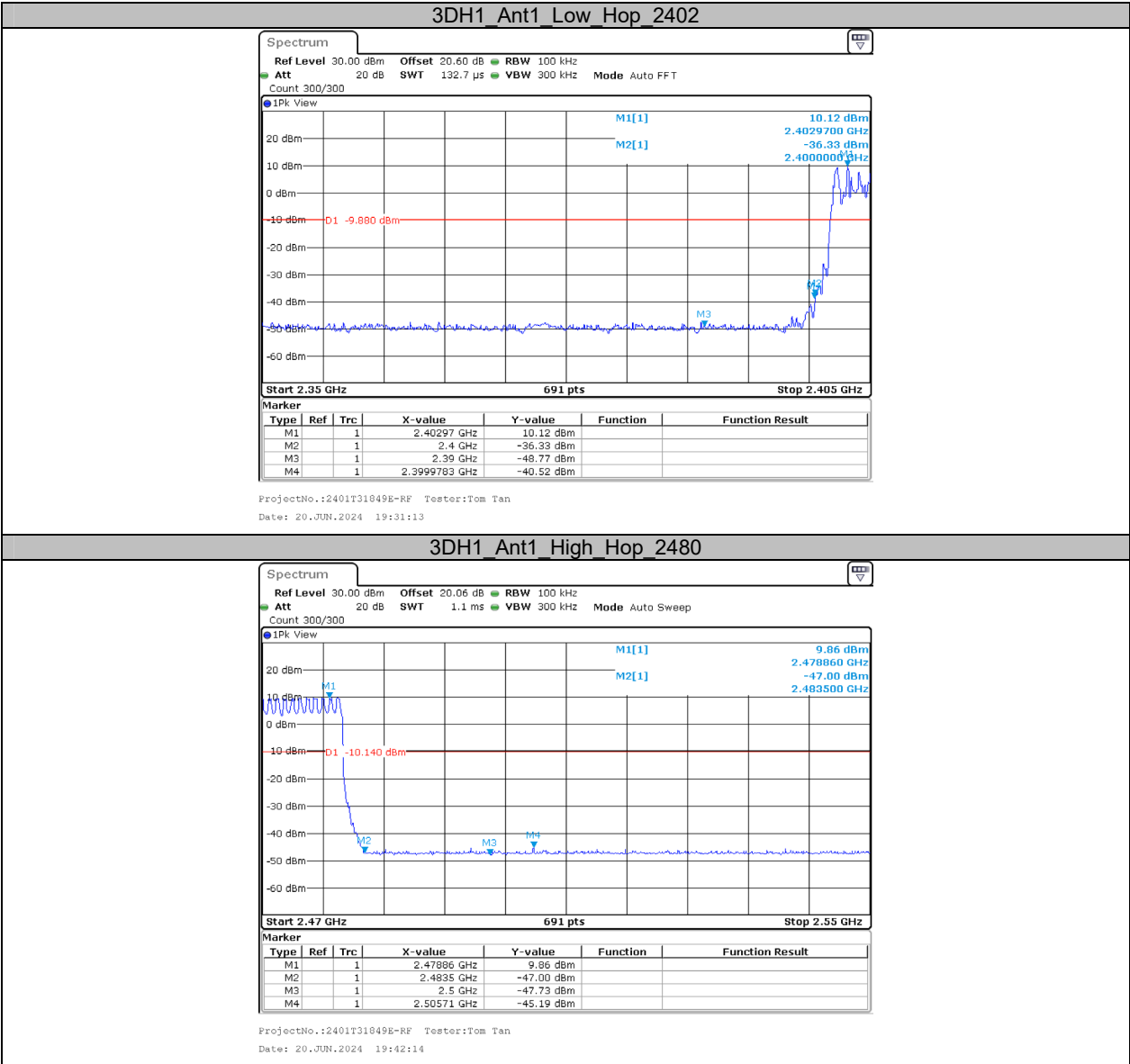












\*\*\*\*\* END OF REPORT \*\*\*\*\*