

# TEST REPORT

Applicant Name: Huaibei Makera Technology Co., Ltd  
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Economic Development Zone, Suixi County, Huaibei City,  
Anhui Province, China  
Report Number: 2401Z66868E-RF-00B  
FCC ID: 2A8Z8-CA1

## Test Standard (s)

FCC PART 15.249

## Sample Description

Product Type: CARVERA AIR Desktop CNC Machine  
Model No.: CA1  
Multiple Model(s) No.: N/A  
Trade Mark: N/A  
Date Received: 2024-11-06  
Issue Date: 2025-01-25

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

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

## Prepared and Checked By:

*Jack Zeng*

Jack Zeng  
RF Engineer

## Approved By:

*Nancy Wang*

Nancy Wang  
RF Supervisor

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               | 2401Z66868E-RF-00B | Original Report         | 2025-01-25       |

## GENERAL INFORMATION

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

|                                    |                                                  |
|------------------------------------|--------------------------------------------------|
| Product                            | CARVERA AIR Desktop CNC Machine                  |
| Tested Model                       | CA1                                              |
| Multiple Model(s)                  | N/A                                              |
| Frequency Range                    | 2405-2480MHz                                     |
| Maximum E-field strength           | 81.60dBuV/m@3m                                   |
| Modulation Technique               | O-QPSK                                           |
| Antenna Specification <sup>#</sup> | 3dBi (provided by the applicant)                 |
| Voltage Range                      | AC 120V/60Hz                                     |
| Sample serial number               | 2UG3-1 for Conducted and Radiated Emissions Test |
| Sample/EUT Status                  | Good condition                                   |
| Adapter Information                | N/A                                              |

### Objective

This test report is in accordance with Part 2-Subpart J, and Part 15-Subparts A and C of the Federal Communication Commissions rules.

The tests were performed in order to determine compliance with FCC Part 15, Subpart C, and section 15.203, 15.205, 15.207, 15.209 and 15.249 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.

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

Each test item follows test standards and with no deviation.

## Measurement Uncertainty

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

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

## Test Facility

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

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

## SYSTEM TEST CONFIGURATION

### Description of Test Configuration

The system was configured for testing by manufacturer.

### Frequency Channel List:

| Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) | Channel No. | Frequency (MHz) |
|-------------|-----------------|-------------|-----------------|-------------|-----------------|-------------|-----------------|
| 1           | 2405            | 5           | 2425            | 9           | 2445            | 13          | 2465            |
| 2           | 2410            | 6           | 2430            | 10          | 2450            | 14          | 2470            |
| 3           | 2415            | 7           | 2435            | 11          | 2455            | 15          | 2475            |
| 4           | 2420            | 8           | 2440            | 12          | 2460            | 16          | 2480            |

Note: Test on Channel 1, 8 and 16.

### EUT Exercise Software

“Carvera controller” exercise software was used and the power level is “Default<sup>#</sup>”. The software and power level was provided by the applicant.

### Equipment Modifications

No modifications were made to the unit tested.

### Support Equipment List and Details

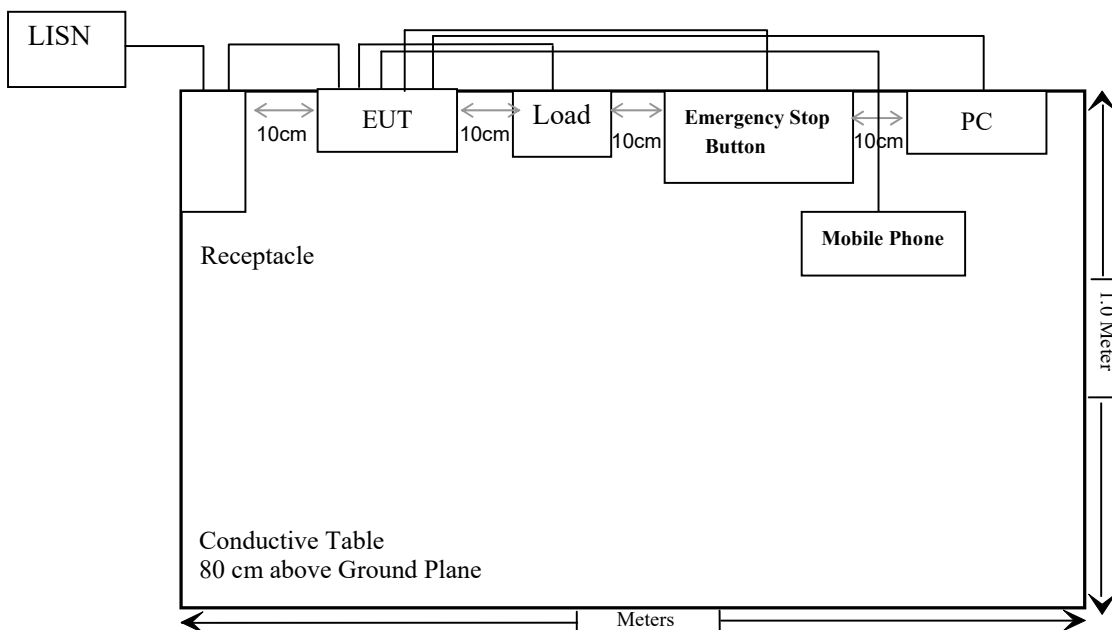
| Manufacturer | Description           | Model   | Serial Number |
|--------------|-----------------------|---------|---------------|
| iKU          | Smartphone            | X9      | 12345ab       |
| GREATWALL    | PC                    | NF50AL  | 2457EF36      |
| Unknown      | Load                  | Unknown | Unknown       |
| Unknown      | Emergency Stop Button | Unknown | Unknown       |

## Support Cable Descriptions

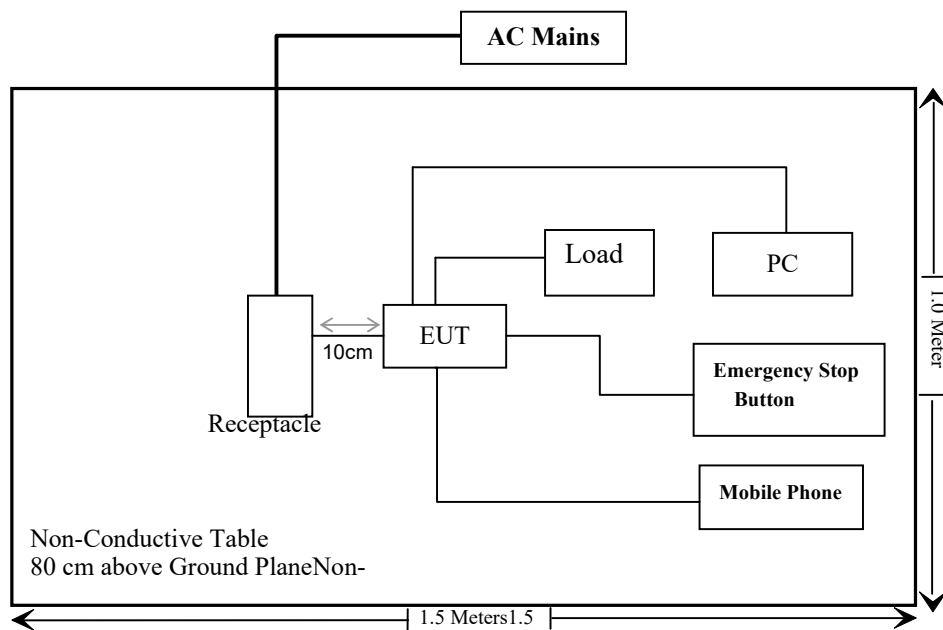
| Cable Description                  | Length (m) | From/Port | To                    |
|------------------------------------|------------|-----------|-----------------------|
| Unshielded un-detachable AC cable  | 1.2        | EUT       | Mains                 |
| Unshielded un-detachable USB cable | 1.0        | EUT       | PC                    |
| Unshielded un-detachable USB cable | 1.0        | EUT       | Smartphone            |
| Unshielded un-detachable DC cable  | 1.0        | EUT       | Load                  |
| Unshielded un-detachable DC cable  | 1.0        | EUT       | Emergency Stop Button |

### Block Diagram of Test Setup

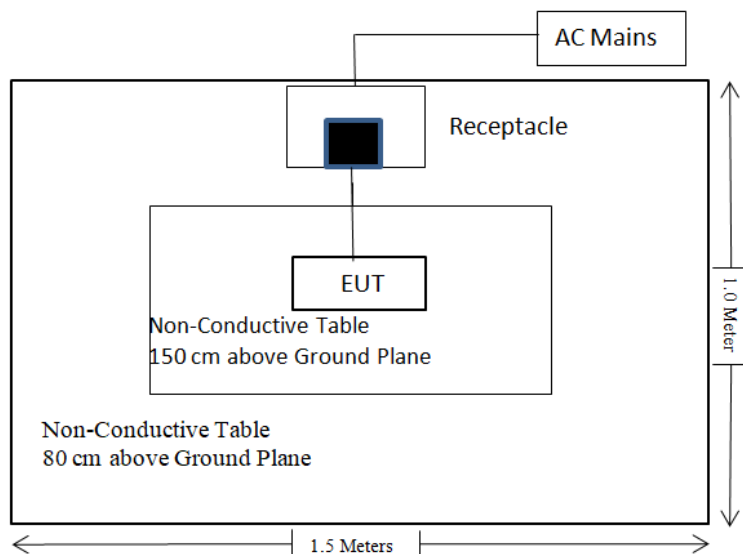
For Conducted Emissions:



For Radiated Emissions below 1GHz:



For Radiated Emissions above 1GHz:



**SUMMARY OF TEST RESULTS**

| FCC Rules                   | Description of Test                          | Result    |
|-----------------------------|----------------------------------------------|-----------|
| §1.1307 (b) (3) & §2.1091   | Maximum Permissible Exposure(MPE)            | Compliant |
| §15.203                     | Antenna Requirement                          | Compliant |
| §15.207(a)                  | Conduction Emissions                         | Compliant |
| 15.205, §15.209, §15.249(d) | Radiated Emissions& Outside of Band Emission | Compliant |
| §15.215 (c)                 | 20 dB Bandwidth                              | 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                 | 2024/12/04       | 2025/12/03           |
| Rohde & Schwarz                | LISN                              | ENV216            | 101613                 | 2024/12/04       | 2025/12/03           |
| 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                 | 2024/12/04       | 2025/12/03           |
| 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                   | 2024/12/04       | 2025/12/03           |
| Unknown                        | Cable                             | PNG214            | 1354                   | 2024/12/04       | 2025/12/03           |
| Audix                          | EMI Test software                 | E3                | 19821b(V9)             | NCR              | NCR                  |
| Rohde & Schwarz                | Spectrum Analyzer                 | FSV40             | 101605                 | 2024/03/27       | 2025/03/26           |
| A.H.System                     | Preamplifier                      | PAM-0118P         | 489                    | 2024/11/15       | 2025/11/14           |
| Schwarzbeck                    | Horn Antenna                      | BBHA9120D(1201)   | 1143                   | 2023/07/26       | 2026/07/25           |
| Unknown                        | RF Cable                          | KMSE              | 735                    | 2024/12/06       | 2025/12/05           |
| Unknown                        | RF Cable                          | UFA147            | 219661                 | 2024/12/06       | 2025/12/05           |
| Unknown                        | RF Cable                          | XH750A-N          | J-10M                  | 2024/12/06       | 2025/12/05           |
| JD                             | Filter Switch Unit                | DT7220FSU         | DS79906                | 2024/09/09       | 2025/09/08           |
| JD                             | Multiplex Switch Test Control Set | DT7220SCU         | DS79903                | 2024/09/09       | 2025/09/08           |
| A.H.System                     | Pre-amplifier                     | PAM-1840VH        | 190                    | 2024/06/18       | 2025/06/17           |
| Electro-Mechanics Co           | Horn Antenna                      | 3116              | 9510-2270              | 2023/09/18       | 2026/09/17           |
| UTIFLEX                        | RF Cable                          | NO. 13            | 232308-001             | 2024/12/18       | 2025/12/17           |
| Audix                          | EMI Test software                 | E3                | 191218(V9)             | NCR              | NCR                  |

\* **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).

## RF EXPOSURE EVALUATION

### MAXIMUM PERMISSIBLE EXPOSURE (MPE)

#### Applicable Standard

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

According to KDB 447498 D04 Interim General RF Exposure Guidance v01.

MPE-Based Exemption:

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

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

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

R is the minimum separation distance in meters

f = frequency in MHz

#### Result

| Mode       | Frequency (MHz) | EIRP (dBm) | Tune Up EIRP (dBm) | Tune Up ERP (dBm) | Tune Up ERP (mW) | Evaluation Distance (m) | ERP Limit (mW) |
|------------|-----------------|------------|--------------------|-------------------|------------------|-------------------------|----------------|
| 2.4G Radio | 2405-2480       | -13.6      | -13.0              | -15.15            | 0.03             | 0.2                     | 768            |

Note 1: The maximum E-Field is 81.60dBuV/m @ 3m, so the EIRP = (81.6-95.2)dBm=-13.6dBm

Note 2: The tune up EIRP was declared by the applicant.

Note 3: ERP=EIRP-2.15

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

**Result: Compliant**

## **FCC§15.203 - 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.

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

### **Antenna Connector Construction**

The EUT has one internal antenna which was permanently attached and the antenna gain<sup>#</sup> is 3dBi, fulfill the requirement of this section. Please refer to the EUT photos.

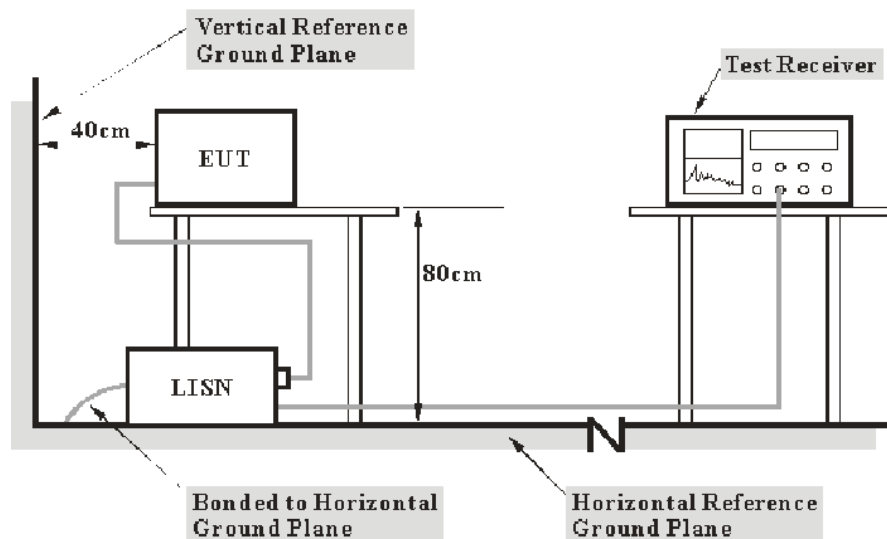
**Result: Compliant.**

## FCC §15.207 (a) - AC LINE CONDUCTED EMISSIONS

### Applicable Standard

FCC §15.207(a)

### 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.

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

During the conducted emission test, the adapter was connected to the outlet of the LISN.

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

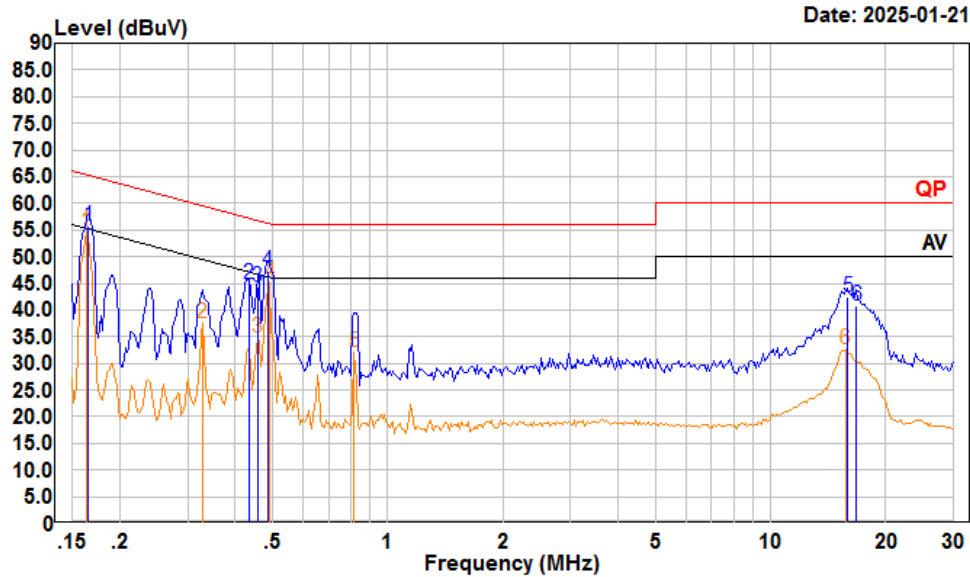
### Environmental Conditions

|                    |           |
|--------------------|-----------|
| Temperature:       | 23.9 °C   |
| Relative Humidity: | 38 %      |
| ATM Pressure:      | 101.1 kPa |

*The testing was performed by Macy Shi on 2025-01-21.*

*EUT operation mode: Transmitting (Worst case is low channel)*

## AC 120V/60 Hz, Line



Trace: 1

Condition: Line

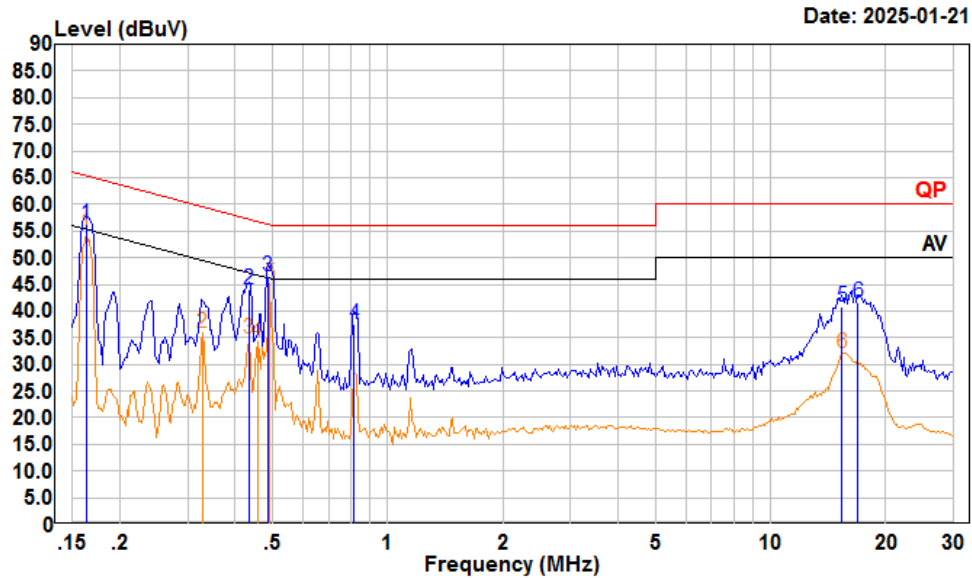
Project : 2401Z66868E-RF

tester : Macy.shi Note:Transmitting

Setting : RBW:9kHz VBW:Auto SWT:Auto

|   |        | Read  |       | LISN   | Cable | Limit | Over   |         |
|---|--------|-------|-------|--------|-------|-------|--------|---------|
|   | Freq   | Level | Level | Factor | Loss  | Line  | Limit  | Remark  |
|   | MHz    | dBuV  | dBuV  | dB     | dB    | dBuV  | dB     |         |
| 1 | 0.165  | 34.40 | 55.74 | 11.23  | 10.11 | 65.21 | -9.47  | QP      |
| 2 | 0.433  | 23.70 | 44.86 | 11.05  | 10.11 | 57.20 | -12.34 | QP      |
| 3 | 0.456  | 23.30 | 44.45 | 11.03  | 10.12 | 56.76 | -12.31 | QP      |
| 4 | 0.486  | 26.10 | 47.24 | 11.01  | 10.13 | 56.23 | -8.99  | QP      |
| 5 | 15.885 | 21.10 | 42.41 | 11.10  | 10.21 | 60.00 | -17.59 | QP      |
| 6 | 16.750 | 19.60 | 40.90 | 11.10  | 10.20 | 60.00 | -19.10 | QP      |
|   | Freq   | Read  |       | LISN   | Cable | Limit | Over   |         |
|   | MHz    | Level | Level | Factor | Loss  | Line  | Limit  | Remark  |
|   | MHz    | dBuV  | dBuV  | dB     | dB    | dBuV  | dB     |         |
| 1 | 0.163  | 33.31 | 54.65 | 11.23  | 10.11 | 55.30 | -0.65  | Average |
| 2 | 0.329  | 16.17 | 37.43 | 11.14  | 10.12 | 49.49 | -12.06 | Average |
| 3 | 0.456  | 13.76 | 34.91 | 11.03  | 10.12 | 46.76 | -11.85 | Average |
| 4 | 0.491  | 24.07 | 45.22 | 11.01  | 10.14 | 46.14 | -0.92  | Average |
| 5 | 0.817  | 10.73 | 31.99 | 11.14  | 10.12 | 46.00 | -14.01 | Average |
| 6 | 15.718 | 11.23 | 32.54 | 11.10  | 10.21 | 50.00 | -17.46 | Average |

## AC 120V/60 Hz, Neutral



Trace: 1

Condition: Neutral

Project : 2401Z66868E-RF

tester : Macy.shi Note:Transmitting

Setting : RBW:9kHz VBW:Auto SWT:Auto

|   | Freq   | Read Level | LISN Level | Cable Factor | Cable Loss | Limit Line | Over Limit | Remark |
|---|--------|------------|------------|--------------|------------|------------|------------|--------|
|   | MHz    | dBuV       | dBuV       | dB           | dB         | dBuV       | dB         |        |
| 1 | 0.163  | 36.10      | 56.42      | 10.21        | 10.11      | 65.30      | -8.88      | QP     |
| 2 | 0.433  | 23.71      | 44.01      | 10.19        | 10.11      | 57.20      | -13.19     | QP     |
| 3 | 0.486  | 26.30      | 46.55      | 10.12        | 10.13      | 56.23      | -9.68      | QP     |
| 4 | 0.817  | 16.99      | 37.44      | 10.33        | 10.12      | 56.00      | -18.56     | QP     |
| 5 | 15.388 | 20.69      | 40.74      | 9.83         | 10.22      | 60.00      | -19.26     | QP     |
| 6 | 16.928 | 21.50      | 41.63      | 9.93         | 10.20      | 60.00      | -18.37     | QP     |

|   | Freq   | Read Level | LISN Level | Cable Factor | Cable Loss | Limit Line | Over Limit | Remark  |
|---|--------|------------|------------|--------------|------------|------------|------------|---------|
|   | MHz    | dBuV       | dBuV       | dB           | dB         | dBuV       | dB         |         |
| 1 | 0.163  | 34.43      | 54.75      | 10.21        | 10.11      | 55.30      | -0.55      | Average |
| 2 | 0.329  | 15.33      | 35.82      | 10.37        | 10.12      | 49.49      | -13.67     | Average |
| 3 | 0.433  | 14.45      | 34.75      | 10.19        | 10.11      | 47.20      | -12.45     | Average |
| 4 | 0.456  | 14.09      | 34.37      | 10.16        | 10.12      | 46.76      | -12.39     | Average |
| 5 | 0.491  | 24.94      | 45.19      | 10.11        | 10.14      | 46.14      | -0.95      | Average |
| 6 | 15.388 | 12.11      | 32.16      | 9.83         | 10.22      | 50.00      | -17.84     | Average |

## FCC§15.205, §15.209 & §15.249(d) - RADIATED EMISSIONS

### Applicable Standard

As per FCC§15.249 (a), except as provided in paragraph (b) of this section, the field strength of emissions from intentional radiators operated within these frequency bands shall comply with the following:

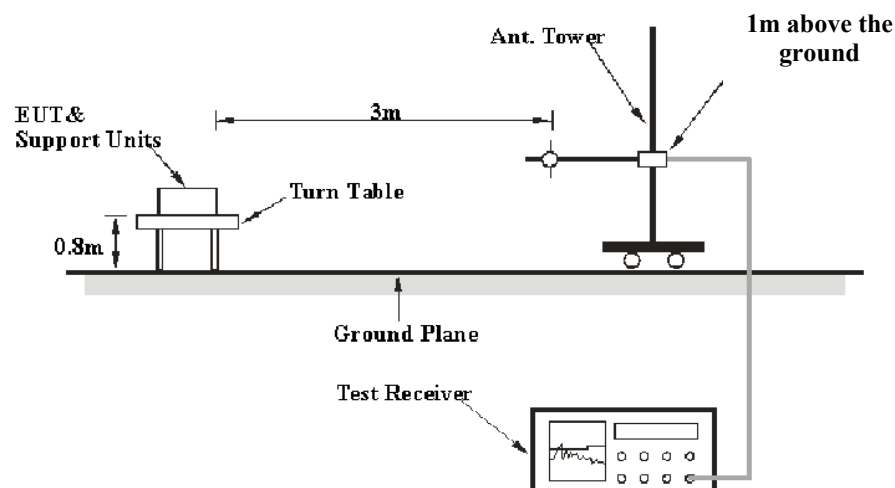
| Fundamental frequency | Field strength of fundamental (millivolts/meter) | Field strength of harmonics (microvolts/meter) |
|-----------------------|--------------------------------------------------|------------------------------------------------|
| 902–928 MHz           | 50                                               | 500                                            |
| 2400–2483.5 MHz       | 50                                               | 500                                            |
| 5725–5875 MHz         | 50                                               | 500                                            |
| 24.0–24.25 GHz        | 250                                              | 2500                                           |

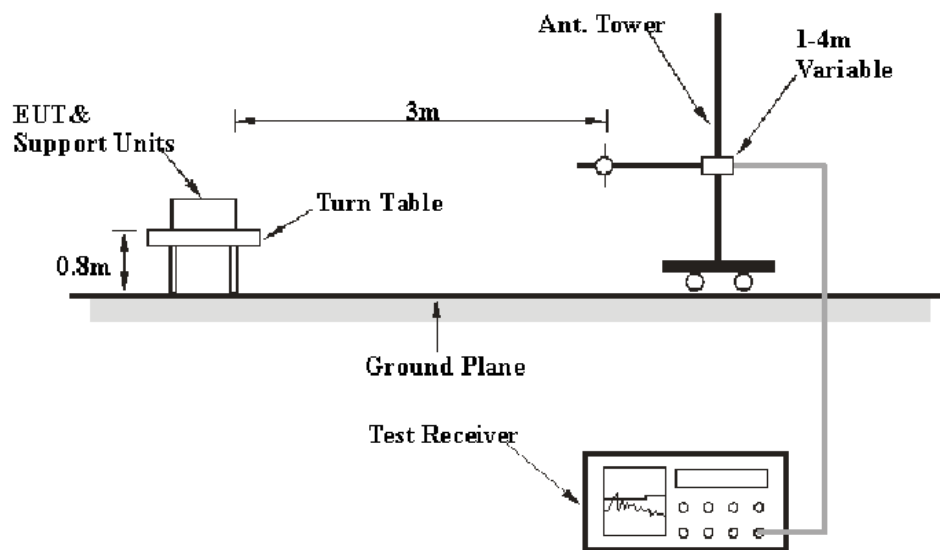
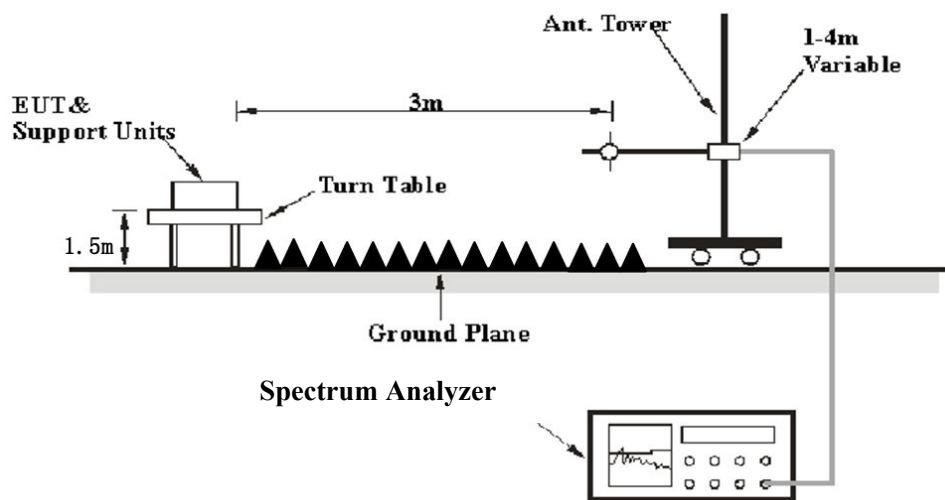
As per FCC§15.249 (c), Field strength limits are specified at a distance of 3 meters.

As per FCC§15.249 (d), Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in §15.209, whichever is the lesser attenuation.

### EUT Setup

9 kHz-30MHz:



**30MHz-1GHz:****Above 1GHz:**

The radiated emission and out of band emission tests were performed in the 3 meters chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC 15.209/15.205 and FCC 15.249 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          |

1-25GHz:

Pre-scan

| Measurement | RBW  | Video B/W |
|-------------|------|-----------|
| PK          | 1MHz | 3 MHz     |
| AV          | 1MHz | 1 kHz     |

Final measurement for emission identified during pre-scan

| Measurement | RBW  | Video B/W |
|-------------|------|-----------|
| PK          | 1MHz | 3 MHz     |
| AV          | 1MHz | 10 Hz     |

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.

## Test Procedure

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

The EUT is set 3 meter away from the testing antenna, which is varied from 1-4 meter, and the EUT is placed on a turntable, which is 0.8 meter above ground plane for below 1GHz or 1.5 meter for above 1GHz, the table shall be rotated for 360 degrees to find out the highest emission. The receiving antenna should be changed the polarization both of horizontal and vertical.

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.

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:

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

## Test Data

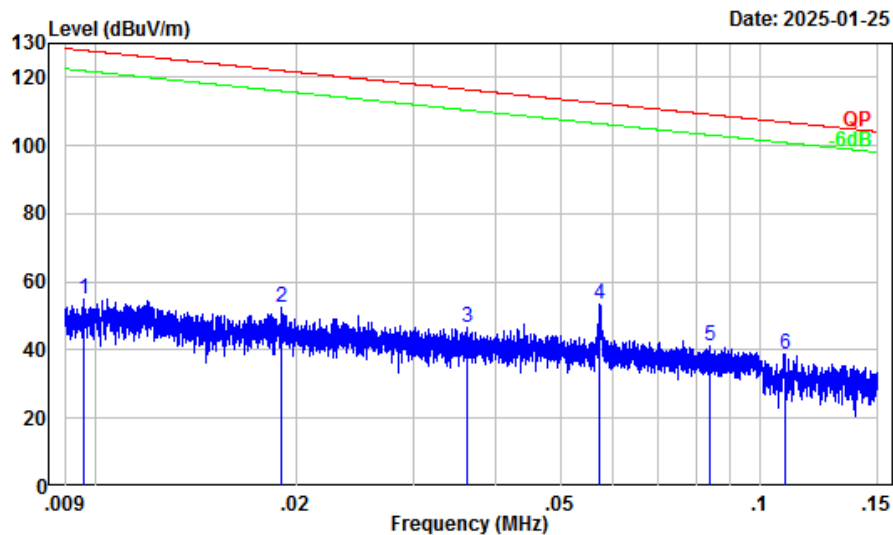
### Environmental Conditions

|                    |                 |
|--------------------|-----------------|
| Temperature:       | 24.1~24.2 °C    |
| Relative Humidity: | 40~50.1 %       |
| ATM Pressure:      | 101.3~101.4 kPa |

*The testing was performed by Jack Liu on 2025-01-25 for below 1GHz and Visen Wu from 2024-12-30 to 2025-01-23 for above 1GHz.*

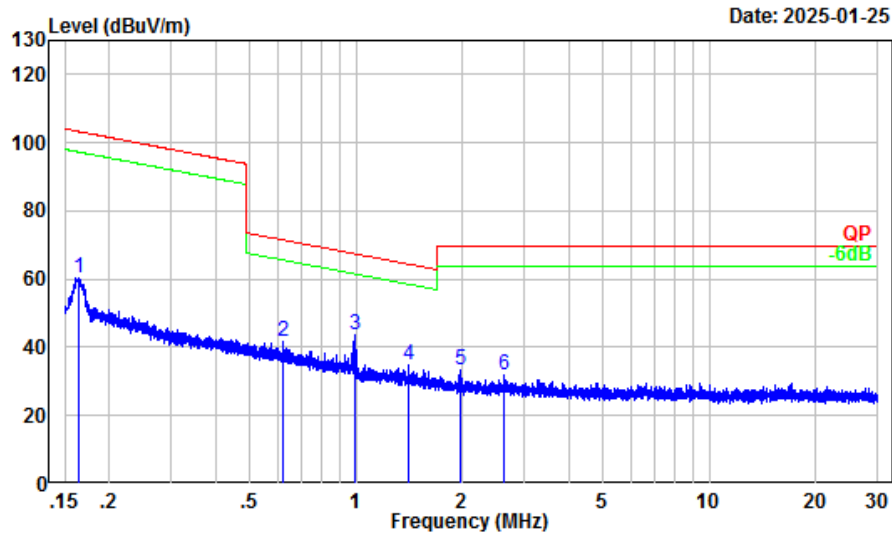
*EUT operation mode: Transmitting*

9 kHz-30MHz: (Low channel in the Parallel was worst case)



Site : Chamber A  
Condition : 3m  
Project Number : 2401Z66868E-RF  
Test Mode : Transmitting  
Detector: Peak RBW/VBW: 0.3/1kHz  
Tester : Jack Liu

|   | Freq | Factor | Read<br>Level | Level  | Limit<br>Line | Over<br>Limit | Remark |
|---|------|--------|---------------|--------|---------------|---------------|--------|
|   | MHz  | dB/m   | dBuV          | dBuV/m | dBuV/m        | dB            |        |
| 1 | 0.01 | 32.37  | 22.40         | 54.77  | 127.94        | -73.17        | Peak   |
| 2 | 0.02 | 30.57  | 21.88         | 52.45  | 121.99        | -69.54        | Peak   |
| 3 | 0.04 | 27.85  | 18.87         | 46.72  | 116.42        | -69.70        | Peak   |
| 4 | 0.06 | 25.66  | 27.92         | 53.58  | 112.43        | -58.85        | Peak   |
| 5 | 0.08 | 23.13  | 18.07         | 41.20  | 109.13        | -67.93        | Peak   |
| 6 | 0.11 | 21.46  | 17.31         | 38.77  | 106.85        | -68.08        | Peak   |

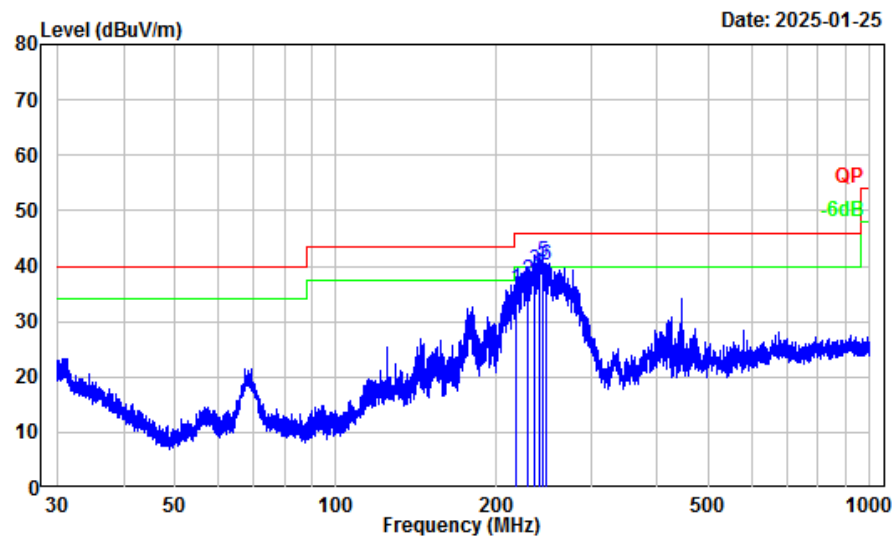


Site : Chamber A  
Condition : 3m  
Project Number : 2401Z66868E-RF  
Test Mode : Transmitting  
Detector: Peak RBW/VBW: 10/30kHz  
Tester : Jack Liu

|   | Freq | Factor | Read<br>Level | Limit<br>Level | Over<br>Line | Over<br>Limit | Remark |
|---|------|--------|---------------|----------------|--------------|---------------|--------|
|   | MHz  | dB/m   | dBuV          | dBuV/m         | dBuV/m       | dB            |        |
| 1 | 0.16 | 18.20  | 42.32         | 60.52          | 103.28       | -42.76        | Peak   |
| 2 | 0.62 | 4.90   | 36.81         | 41.71          | 71.69        | -29.98        | Peak   |
| 3 | 0.99 | 1.28   | 42.27         | 43.55          | 67.56        | -24.01        | Peak   |
| 4 | 1.41 | 0.05   | 34.76         | 34.81          | 64.41        | -29.60        | Peak   |
| 5 | 1.98 | -1.55  | 34.88         | 33.33          | 69.54        | -36.21        | Peak   |
| 6 | 2.63 | -1.95  | 33.87         | 31.92          | 69.54        | -37.62        | Peak   |

30MHz-1GHz (worst case at Low channel)

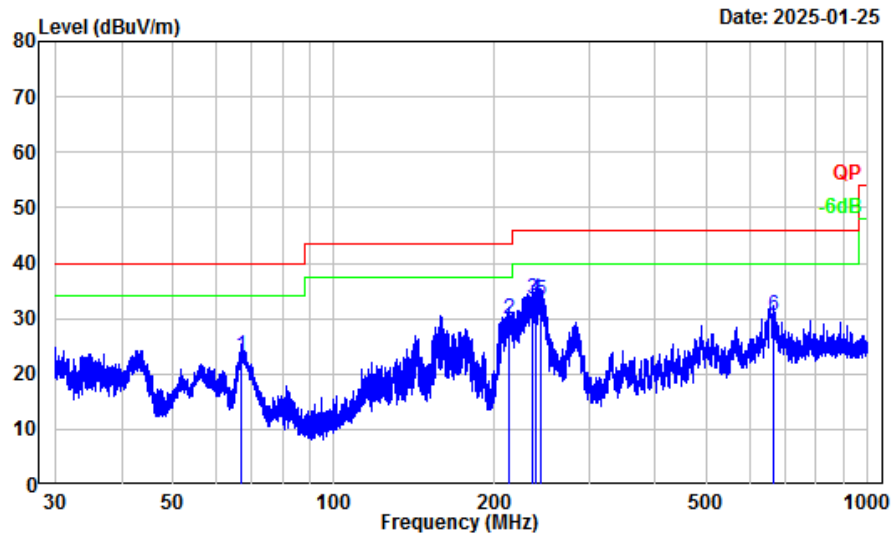
Horizontal



Site : Chamber A  
Condition : 3m Horizontal  
Project Number : 2401Z66868E-RF  
Test Mode : Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Jack Liu

|   | Freq Factor |        | Read Level |        | Limit  | Over   | Remark |
|---|-------------|--------|------------|--------|--------|--------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m | dB     |        |
| 1 | 217.83      | -14.20 | 50.10      | 35.90  | 46.00  | -10.10 | QP     |
| 2 | 229.09      | -13.90 | 51.20      | 37.30  | 46.00  | -8.70  | QP     |
| 3 | 234.68      | -13.56 | 52.70      | 39.14  | 46.00  | -6.86  | QP     |
| 4 | 239.78      | -13.33 | 52.10      | 38.77  | 46.00  | -7.23  | QP     |
| 5 | 243.38      | -13.24 | 53.90      | 40.66  | 46.00  | -5.34  | QP     |
| 6 | 248.44      | -13.13 | 53.30      | 40.17  | 46.00  | -5.83  | QP     |

## Vertical



Site : Chamber A  
Condition : 3m Vertical  
Project Number : 2401Z66868E-RF  
Test Mode : Transmitting  
Detector: Peak RBW/VBW: 100/300kHz  
Tester : Jack Liu

|   | Freq Factor |        | Read  | Limit  | Over   | Remark    |
|---|-------------|--------|-------|--------|--------|-----------|
|   | MHz         | dB/m   | Level | Level  | Line   |           |
|   |             |        | dBuV  | dBuV/m | dBuV/m | dB        |
| 1 | 66.97       | -17.88 | 41.26 | 23.38  | 40.00  | -16.62 QP |
| 2 | 213.20      | -14.14 | 44.05 | 29.91  | 43.50  | -13.59 QP |
| 3 | 236.13      | -13.49 | 46.92 | 33.43  | 46.00  | -12.57 QP |
| 4 | 239.36      | -13.35 | 46.74 | 33.39  | 46.00  | -12.61 QP |
| 5 | 243.91      | -13.24 | 46.54 | 33.30  | 46.00  | -12.70 QP |
| 6 | 665.51      | -3.87  | 34.26 | 30.39  | 46.00  | -15.61 QP |

**Above 1GHz:**

| Frequency (MHz) | Reading (dBμV) | PK/AV | Polar (H/V) | Factor (dB/m) | Absolute Level (dBμV/m) | Limit (dBμV/m) | Margin (dB) |
|-----------------|----------------|-------|-------------|---------------|-------------------------|----------------|-------------|
| Low Channel     |                |       |             |               |                         |                |             |
| 2405.00         | 92.60          | PK    | H           | -11.00        | 81.60                   | 114            | -32.40      |
| 2405.00         | 87.01          | PK    | V           | -11.00        | 76.01                   | 114            | -37.99      |
| 4810.00         | 52.08          | PK    | H           | -7.79         | 44.29                   | 74             | -29.71      |
| 4810.00         | 52.36          | PK    | V           | -7.79         | 44.57                   | 74             | -29.43      |
| Middle Channel  |                |       |             |               |                         |                |             |
| 2440.00         | 90.53          | PK    | H           | -10.93        | 79.60                   | 114            | -34.40      |
| 2440.00         | 85.47          | PK    | V           | -10.93        | 74.54                   | 114            | -39.46      |
| 4880.00         | 52.36          | PK    | H           | -7.59         | 44.77                   | 74             | -29.23      |
| 4880.00         | 54.48          | PK    | V           | -7.59         | 46.89                   | 74             | -27.11      |
| High Channel    |                |       |             |               |                         |                |             |
| 2480.00         | 86.09          | PK    | H           | -10.97        | 75.12                   | 114            | -38.88      |
| 2480.00         | 81.70          | PK    | V           | -10.97        | 70.73                   | 114            | -43.27      |
| 4960.00         | 52.59          | PK    | H           | -7.56         | 45.03                   | 74             | -28.97      |
| 4960.00         | 54.03          | PK    | V           | -7.56         | 46.47                   | 74             | -27.53      |

**Note:**

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

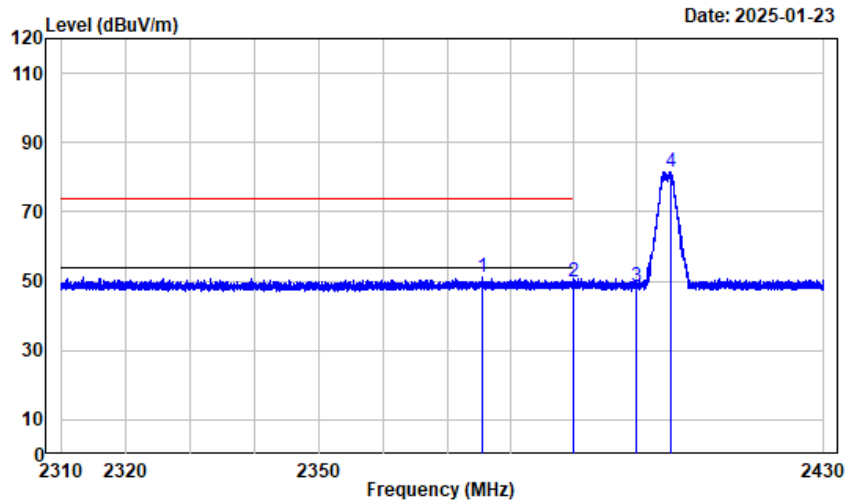
Absolute Level (Corrected Amplitude) = Factor + Reading

Margin = Absolute Level - Limit

The other spurious emission which is 20dB to the limit or in noise floor level was not recorded. The peak emission was less than the average emission limit, so the Average emission was not tested.

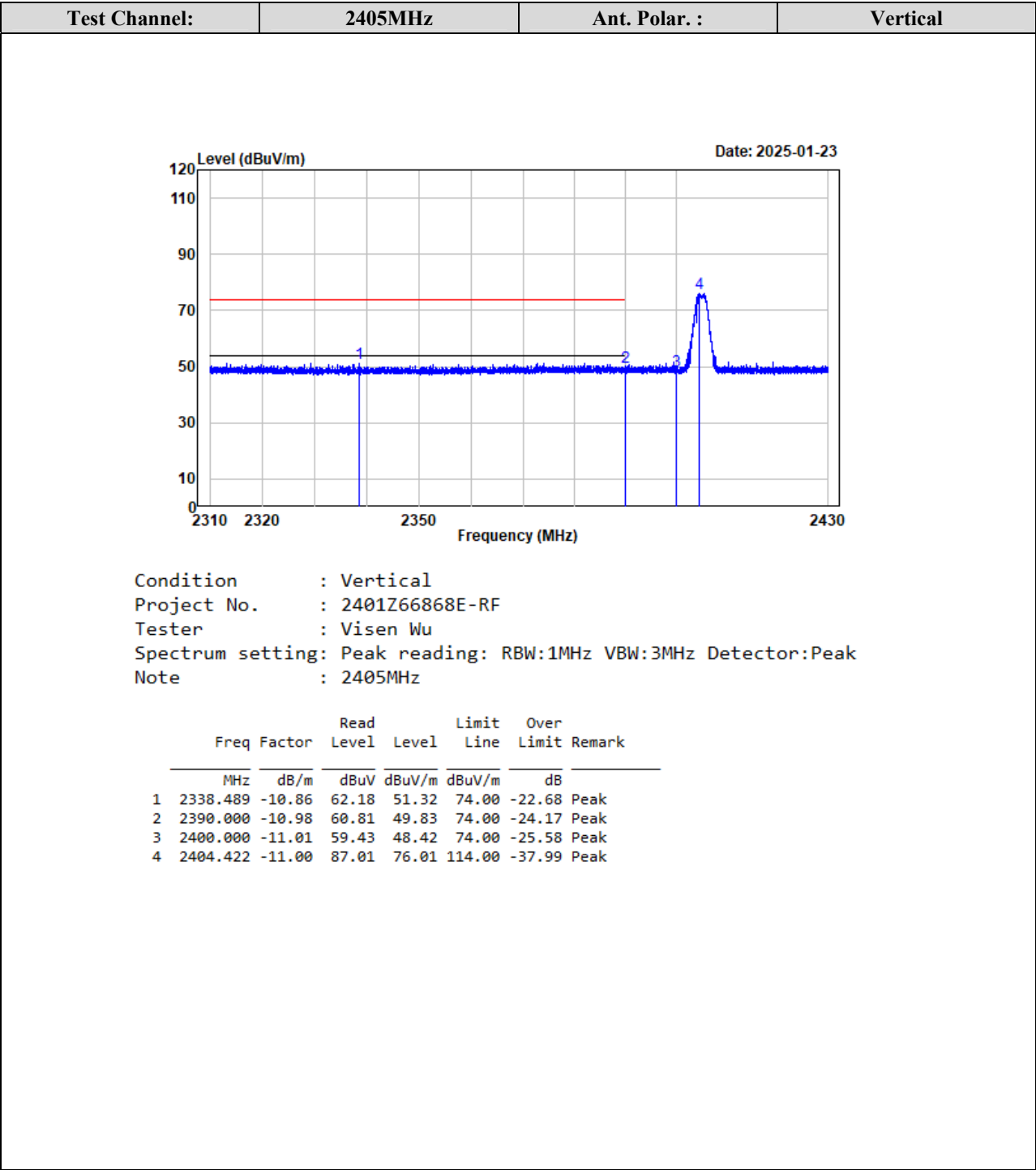
## Test plots for Band Edge Measurements (Radiated):

|               |         |               |            |
|---------------|---------|---------------|------------|
| Test Channel: | 2405MHz | Ant. Polar. : | Horizontal |
|---------------|---------|---------------|------------|



Condition : Horizontal  
Project No. : 2401Z66868E-RF  
Tester : Visen Wu  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : 2405MHz

| Freq Factor |          | Read Level | Level  | Limit Line | Over Limit | Remark      |
|-------------|----------|------------|--------|------------|------------|-------------|
| MHz         | dB/m     | dBuV       | dBuV/m | dBuV/m     | dB         |             |
| 1           | 2375.438 | -10.95     | 62.19  | 51.24      | 74.00      | -22.76 Peak |
| 2           | 2390.000 | -10.98     | 60.60  | 49.62      | 74.00      | -24.38 Peak |
| 3           | 2400.000 | -11.01     | 59.57  | 48.56      | 74.00      | -25.44 Peak |
| 4           | 2405.442 | -11.00     | 92.60  | 81.60      | 114.00     | -32.40 Peak |

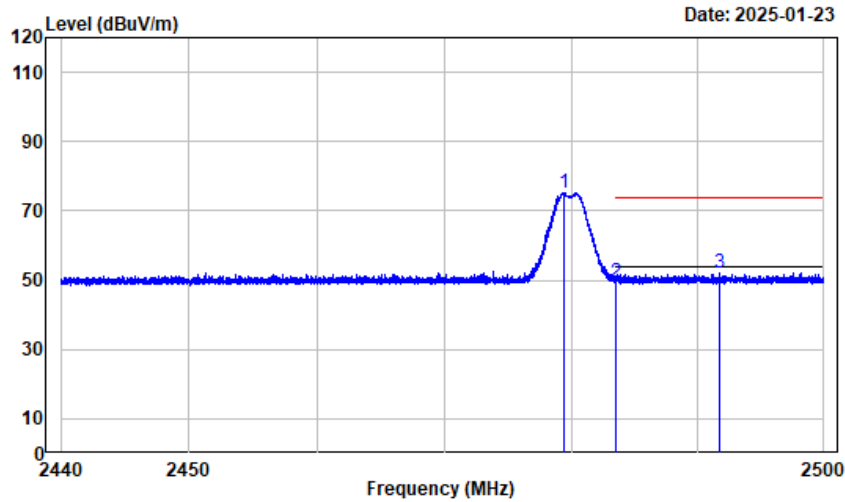


Test Channel:

2480MHz

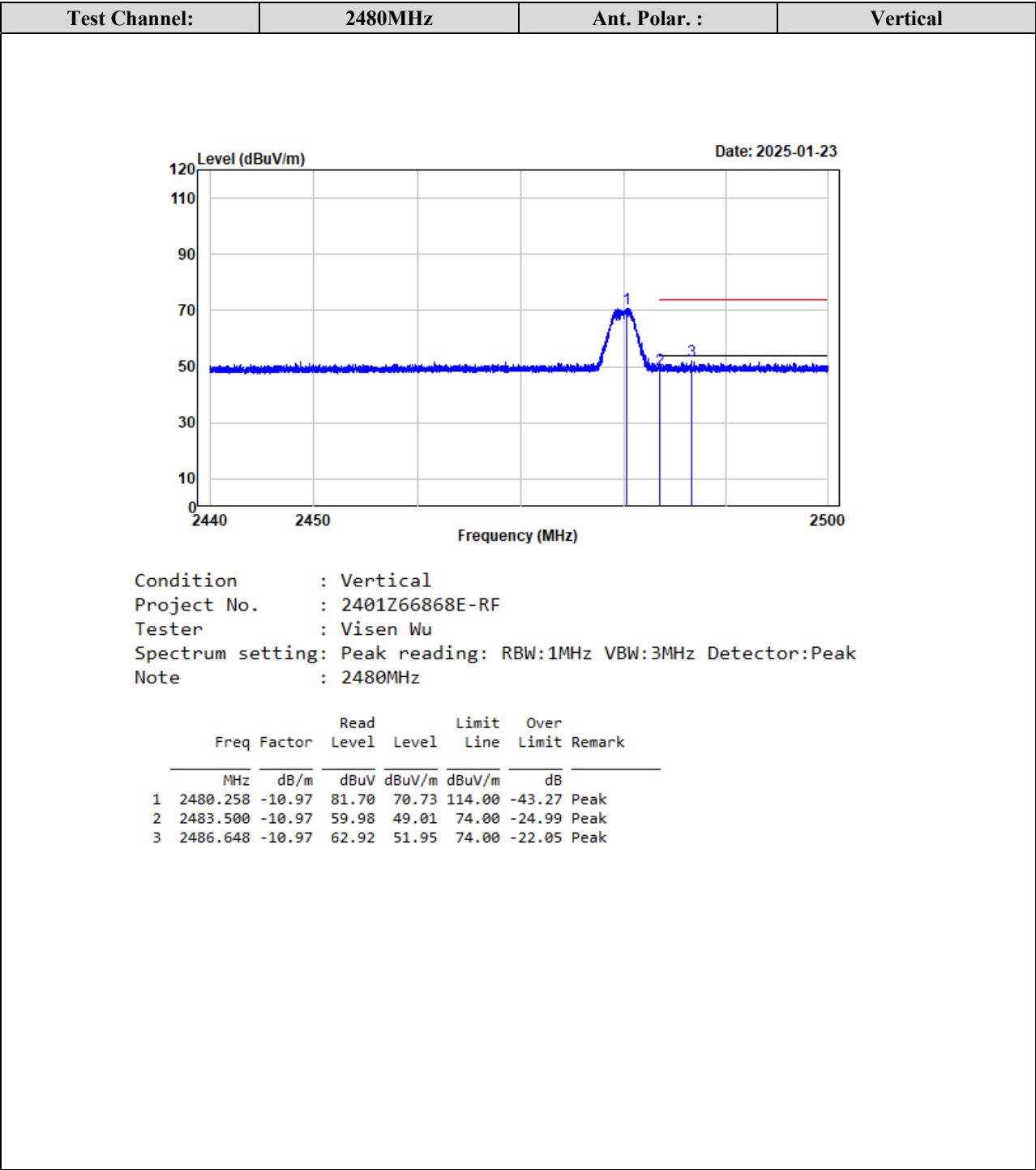
Ant. Polar. :

Horizontal

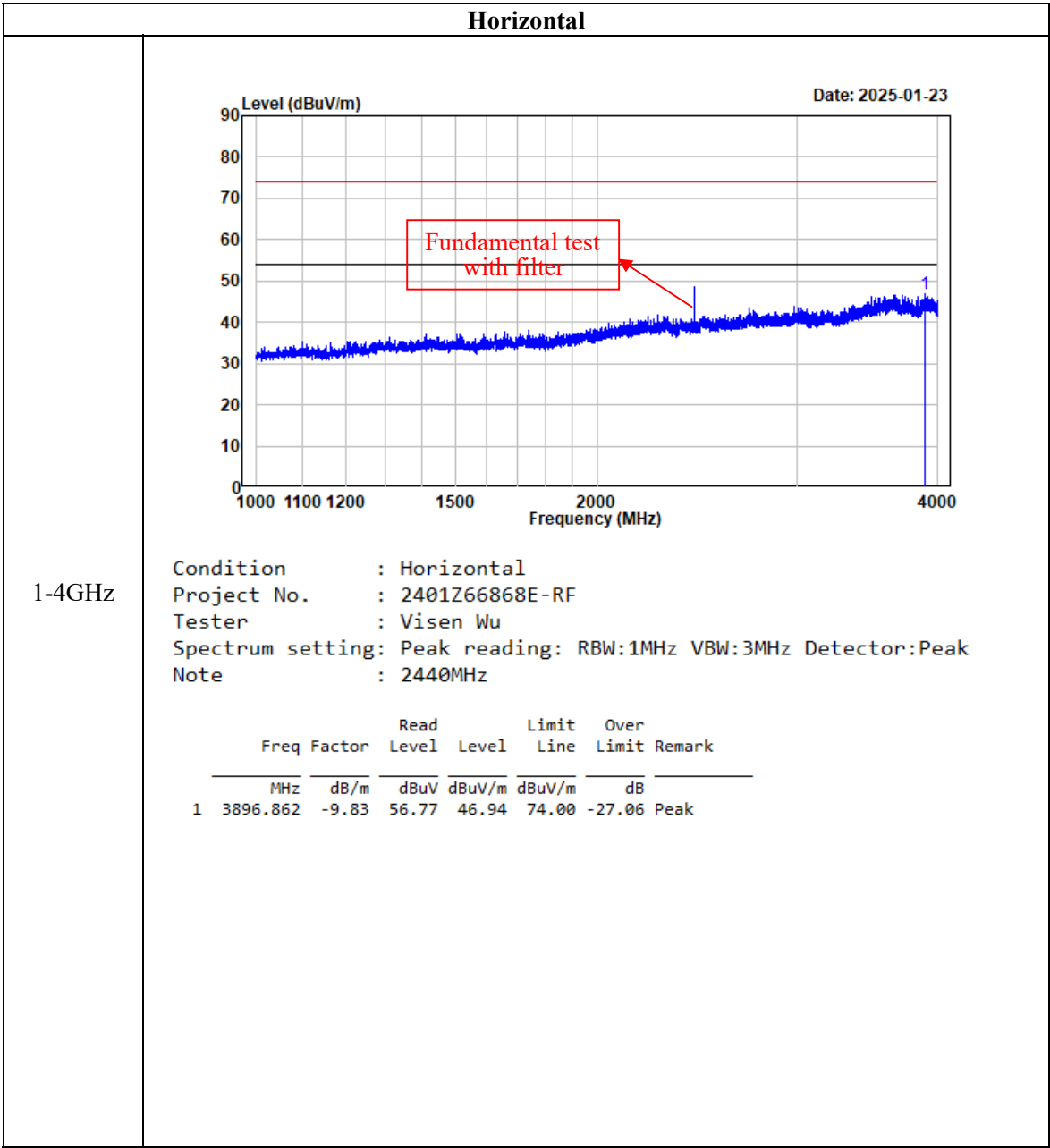


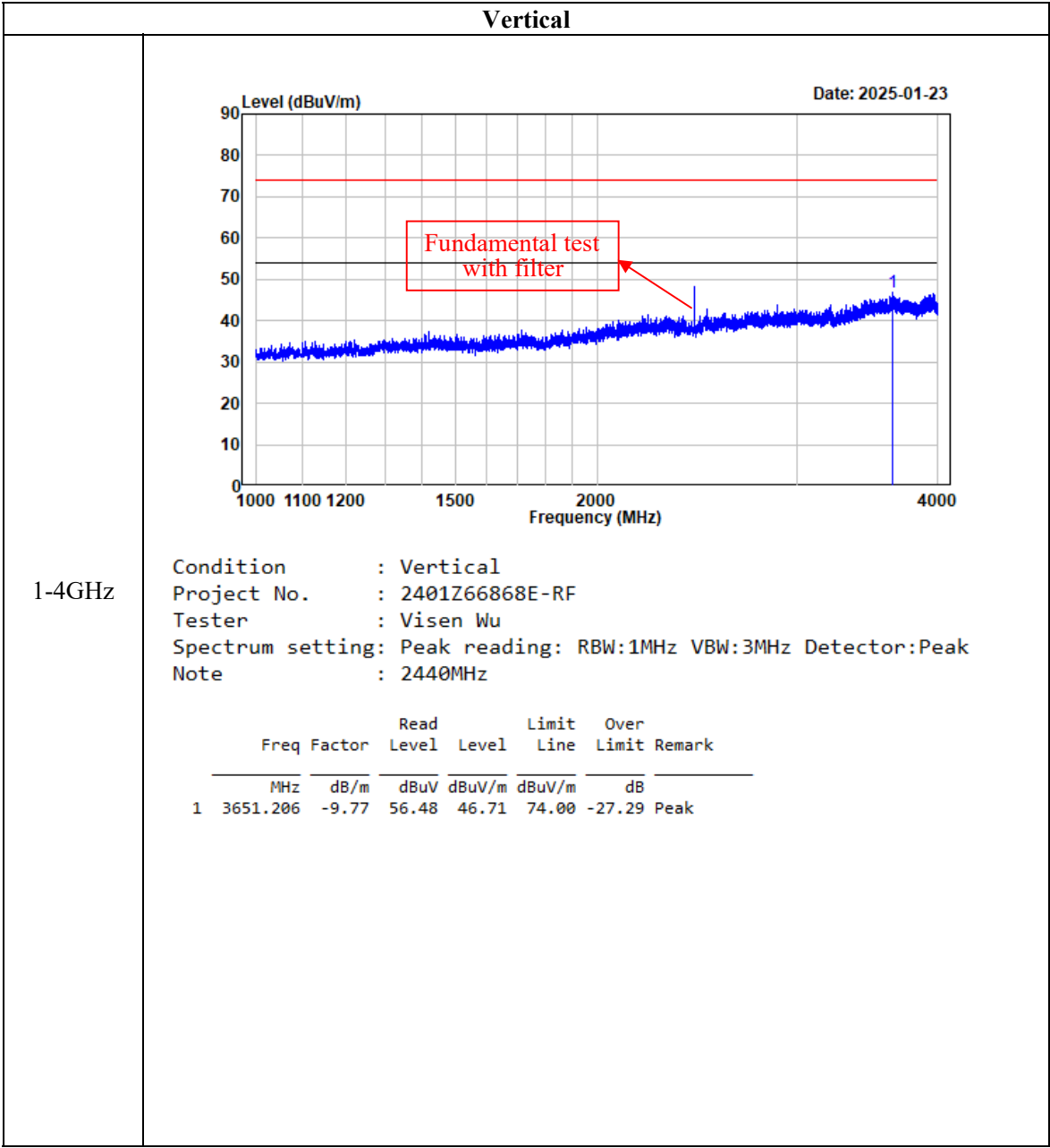
Condition : Horizontal  
Project No. : 2401Z66868E-RF  
Tester : Visen Wu  
Spectrum setting: Peak reading: RBW:1MHz VBW:3MHz Detector:Peak  
Note : 2480MHz

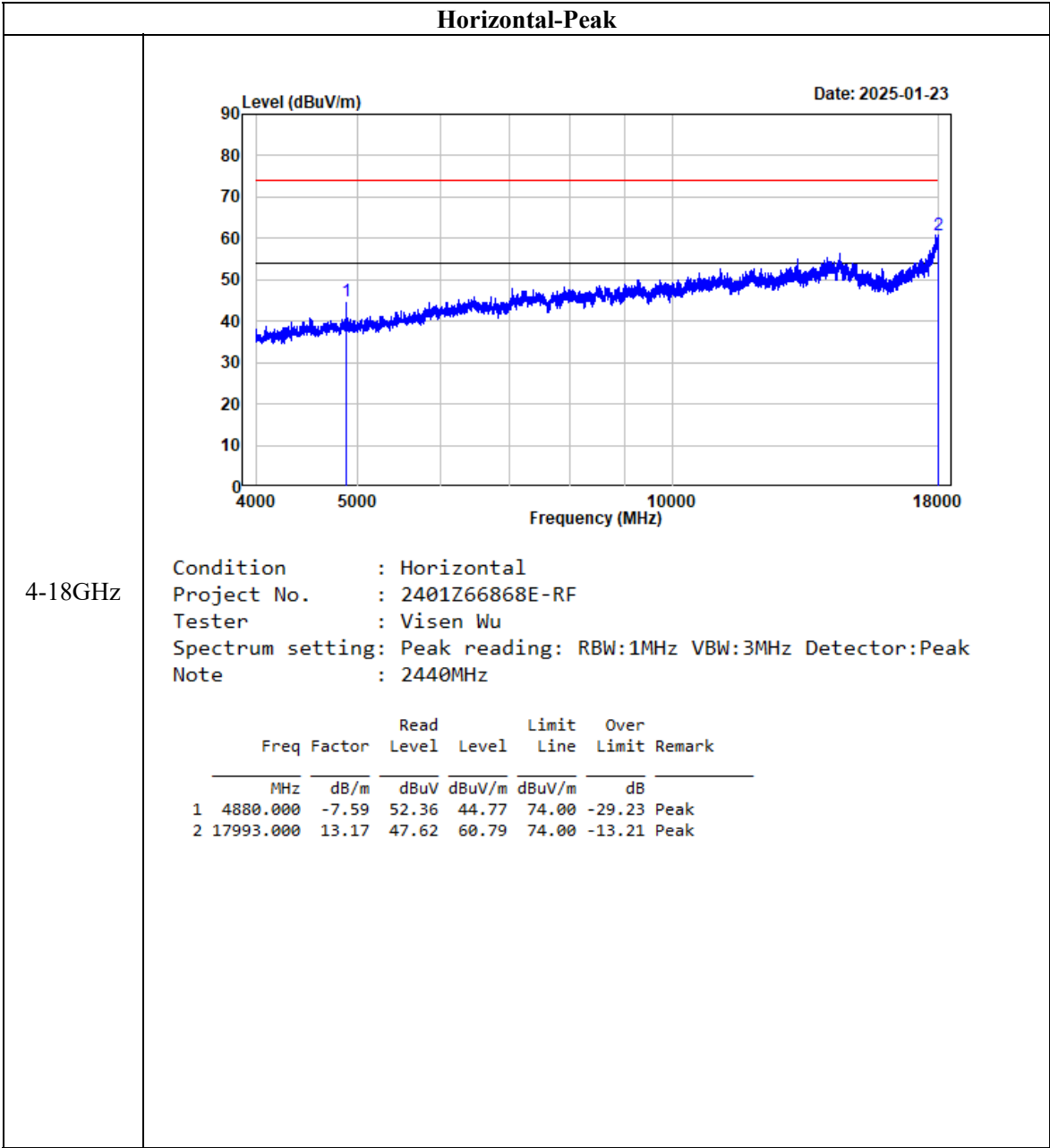
|   | Freq Factor |        | Read Level |        | Limit  | Over   | Remark |
|---|-------------|--------|------------|--------|--------|--------|--------|
|   | MHz         | dB/m   | dBuV       | dBuV/m | dBuV/m | dB     |        |
| 1 | 2479.455    | -10.97 | 86.09      | 75.12  | 114.00 | -38.88 | Peak   |
| 2 | 2483.500    | -10.97 | 60.42      | 49.45  | 74.00  | -24.55 | Peak   |
| 3 | 2491.711    | -10.98 | 62.95      | 51.97  | 74.00  | -22.03 | Peak   |

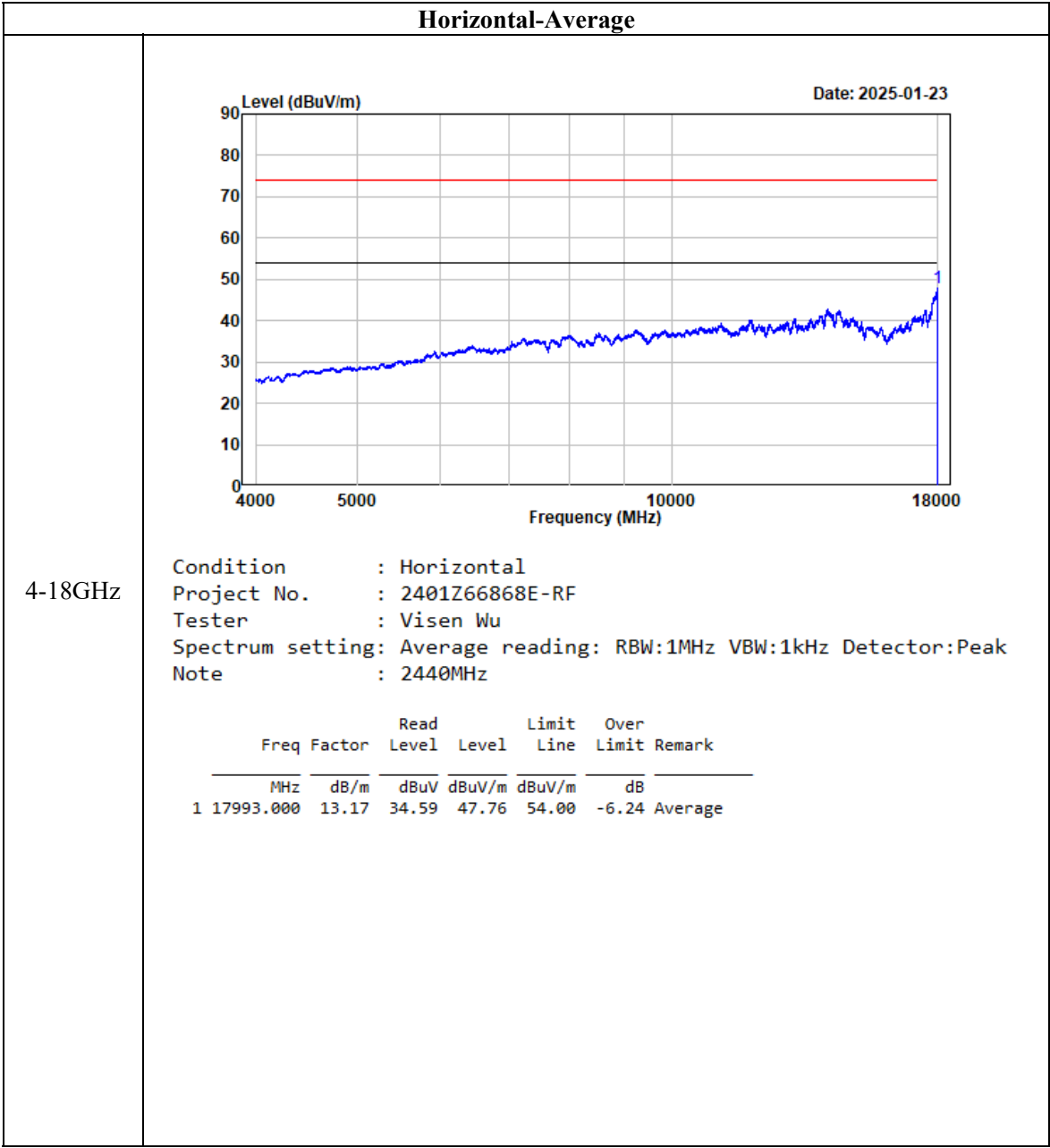


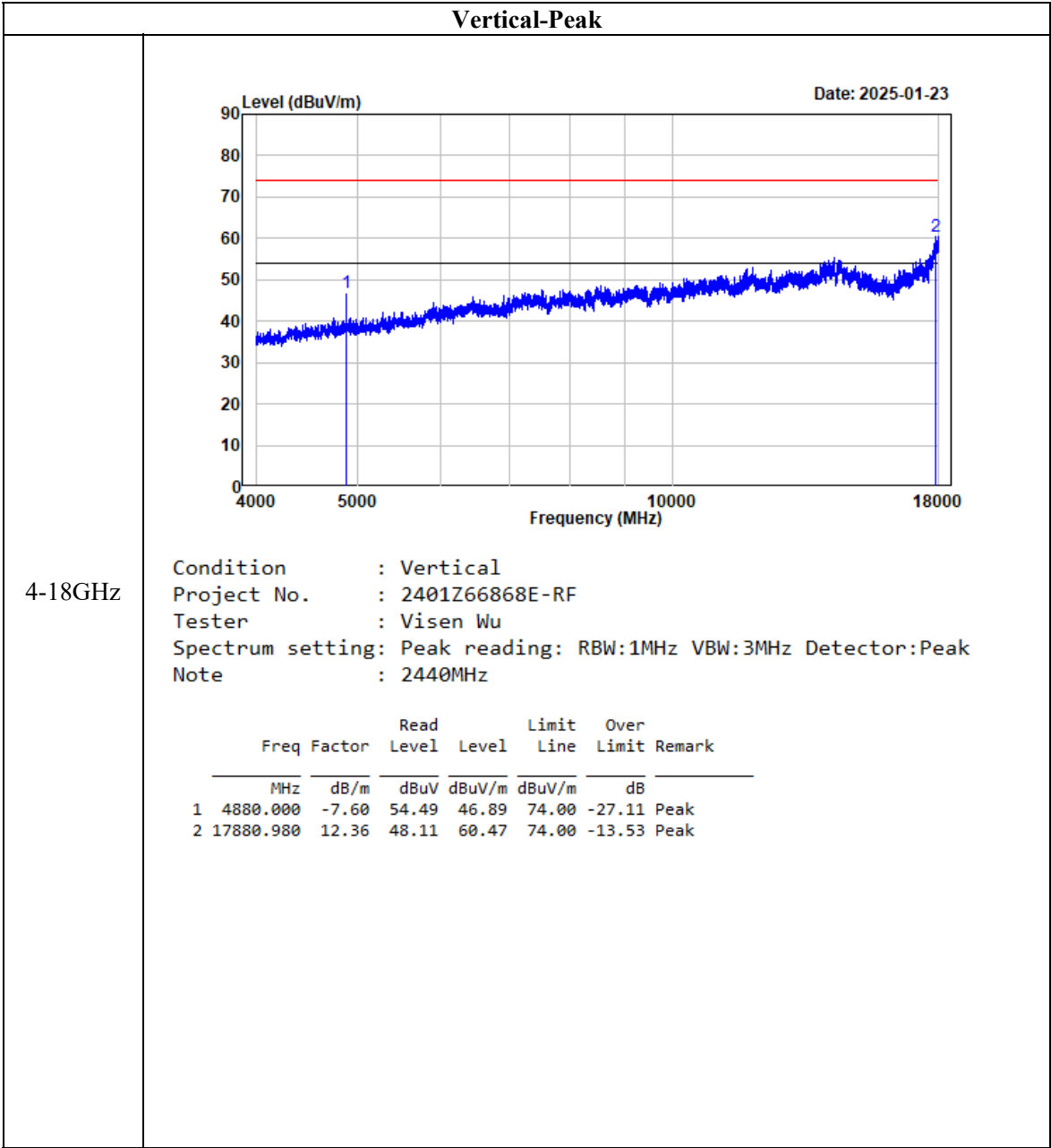
Listed with the worst harmonic margin test plot:

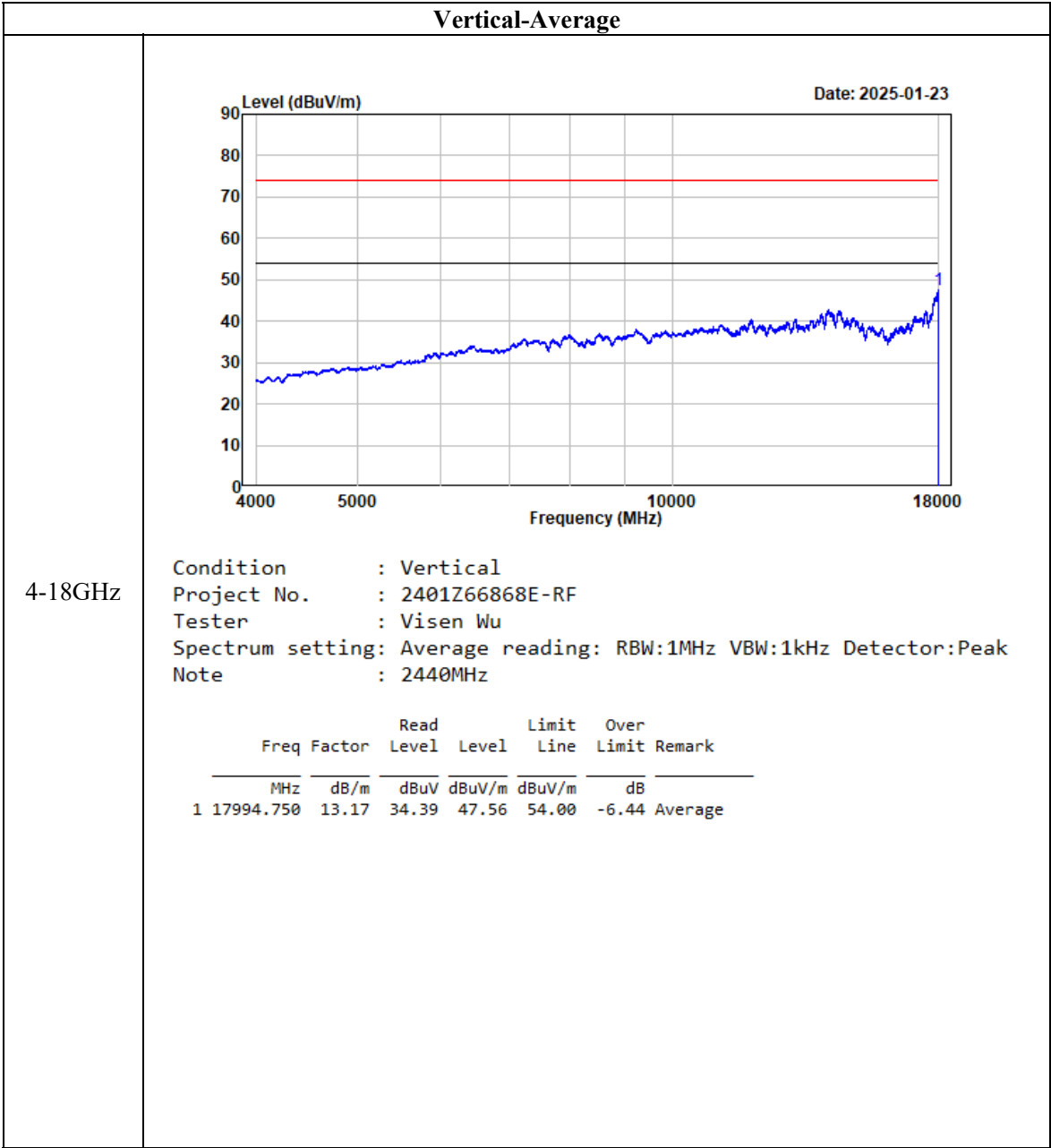


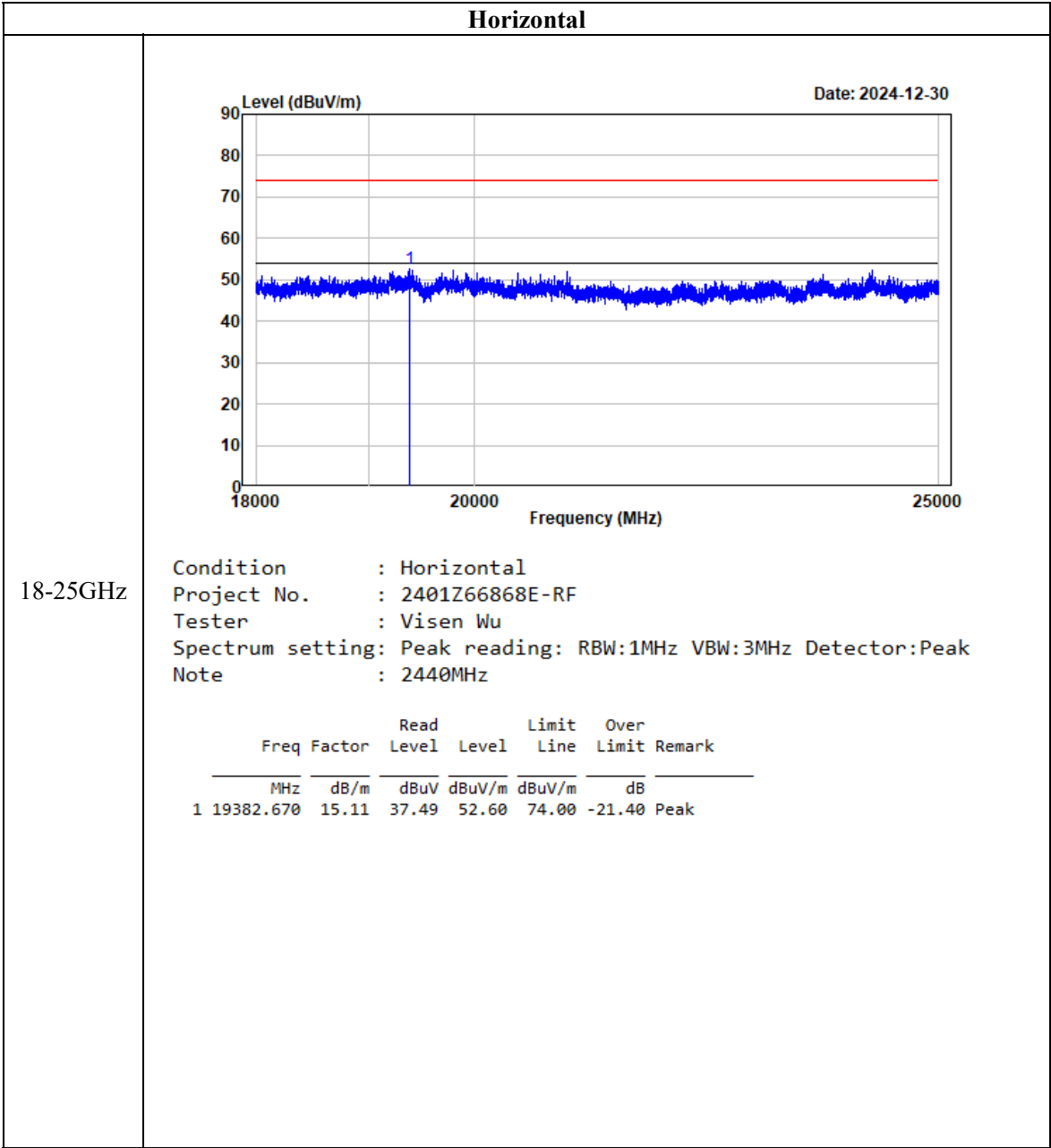


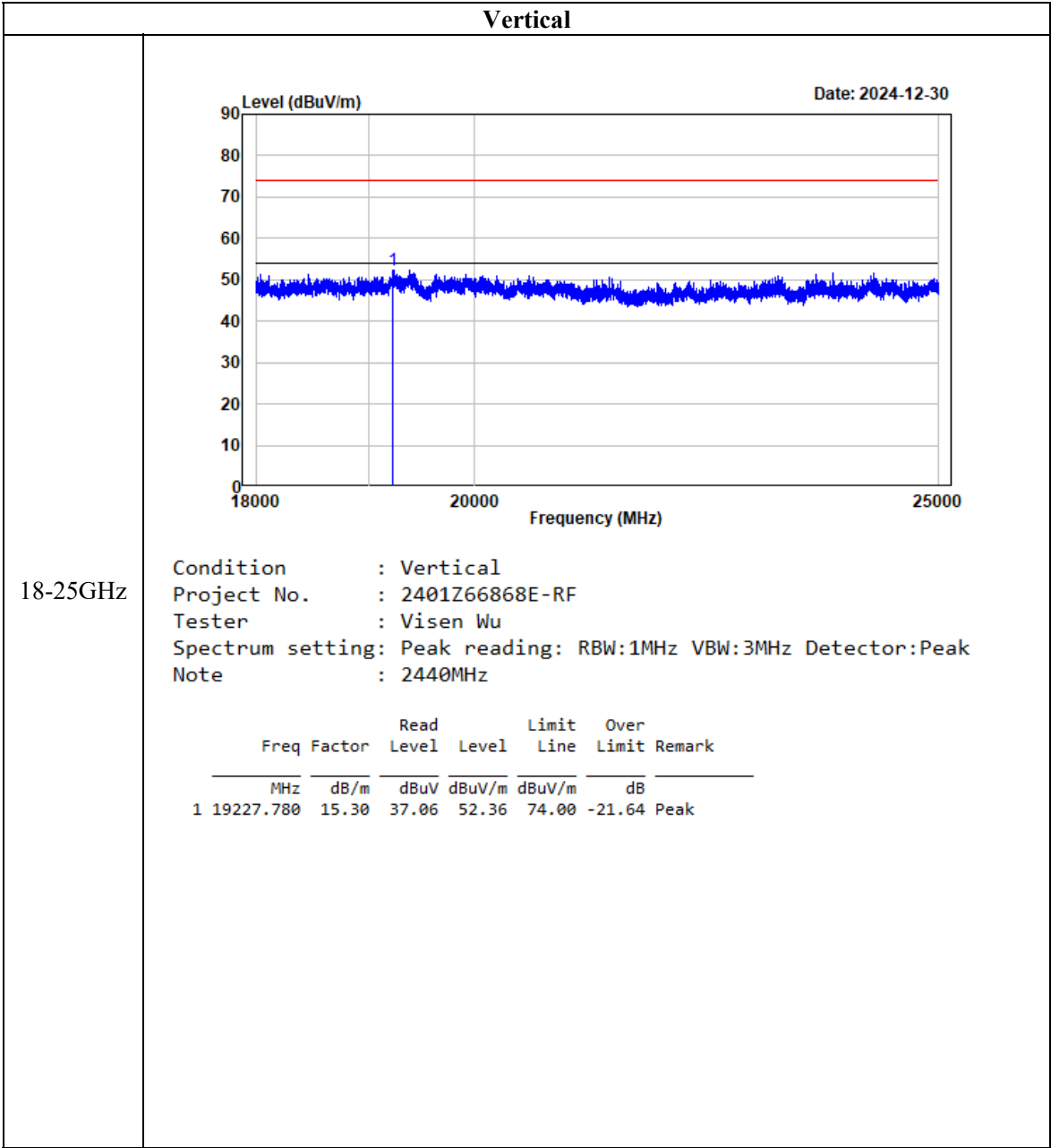












## FCC§15.215(c) - 20dB EMISSION BANDWIDTH

### Applicable Standard

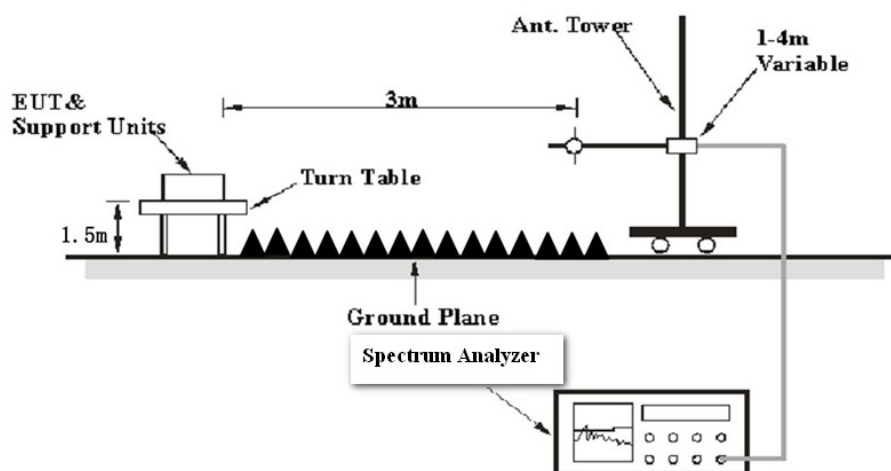
Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

### 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 nominal IF filter bandwidth (3 dB RBW) shall be in the range of 1% to 5% of the OBW/ 20dB bandwidth and video bandwidth (VBW) shall be approximately three times RBW, unless otherwise specified by the applicable requirement.



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

|                           |           |
|---------------------------|-----------|
| <b>Temperature:</b>       | 24.2 °C   |
| <b>Relative Humidity:</b> | 50.1 %    |
| <b>ATM Pressure:</b>      | 101.3 kPa |

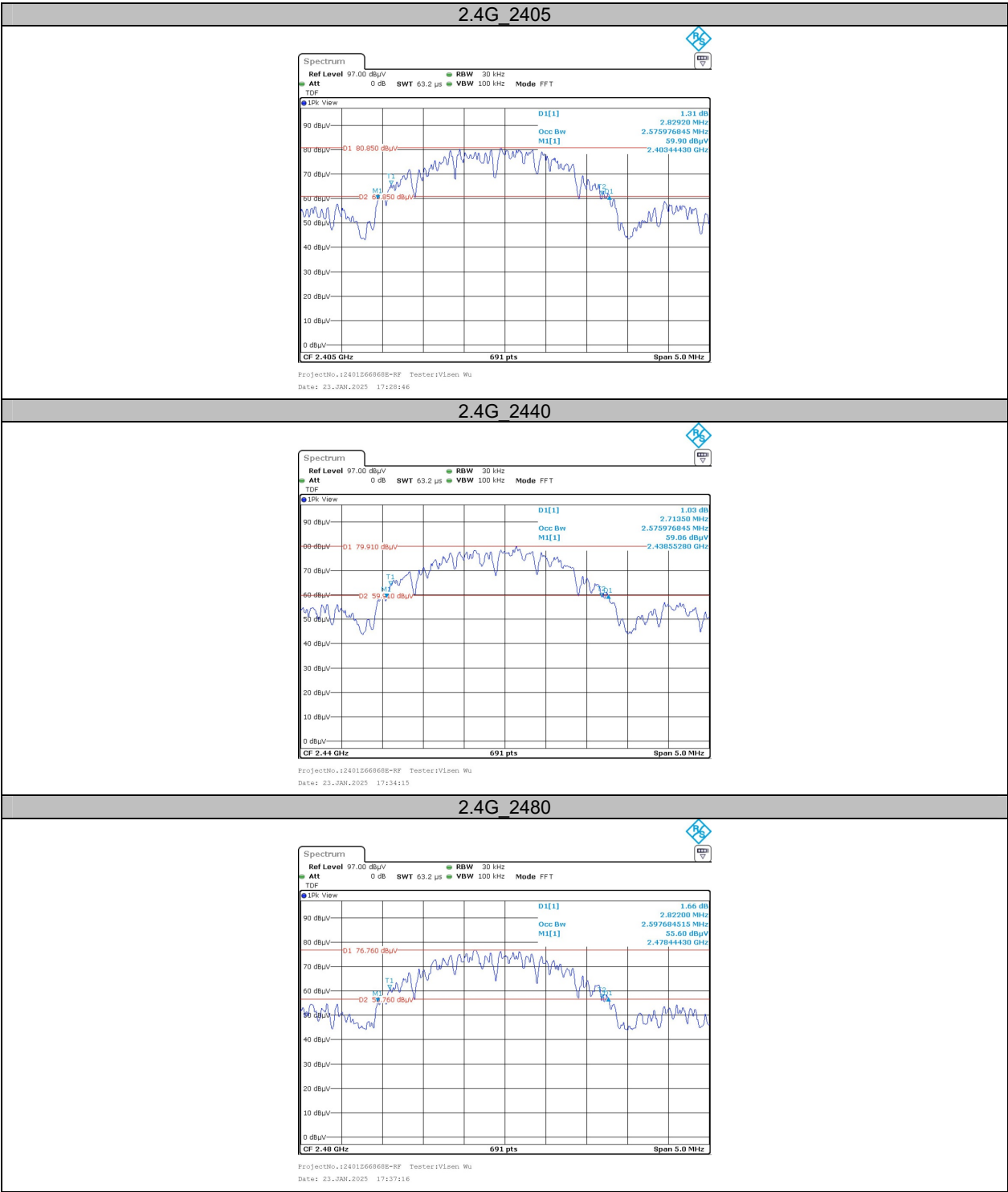
*The testing was performed by Visen Wu on 2025-01-23.*

*EUT operation mode: Transmitting*

*Please refer to the following table and plots.*

| Frequency[MHz] | 20dB EBW[MHz] |
|----------------|---------------|
| 2405           | 2.829         |
| 2440           | 2.714         |
| 2480           | 2.822         |

Test Graphs



## **EUT PHOTOGRAPHS**

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Please refer to the attachment 2401Z66868E-RF External photo and 2401Z66868E-RF Internal photo.

## **TEST SETUP PHOTOGRAPHS**

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Please refer to the attachment 2401Z66868E-RF Test Setup photo.

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