

## FCC - TEST REPORT

Report Number : **709502409685-00B** Date of Issue: December 23, 2024

Model : CMD-03, CM-45

Product Type : Tubular motor

Applicant : Coulisse B.V.

Address : Vonderweg 48, 7468 DC Enter, THE NETHERLANDS

Manufacturer : Coulisse B.V.

Address : Vonderweg 48, 7468 DC Enter, THE NETHERLANDS

Test Result : ☒ **Positive** ☐ **Negative**

Total pages including  
Appendices : 44



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## 2 Report Modification Record

Alterations and additions to this report will be issued to the holders of each copy in the form of a complete document.

| Issue            | Description of Change | Date of Issue |
|------------------|-----------------------|---------------|
| 709502409685-00B | First Issue           | 12/23/2024    |

## 3 Details about the Test Laboratory

### Test Site 1

Company name: TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch  
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Shanghai 201108,  
P.R. China

Telephone: +86 21 6141 0123

Fax: +86 21 6140 8600

FCC Registration No.: 820234

FCC Designation Number: CN1183

ISED CAB identifier CN0101

IC Registration No.: 31668

#### 4 Description of the Equipment under Test

Product: Tubular motor

Model no.: CMD-03, CM-45

FCC ID: ZY4CMD03B1

Options and accessories: NA

Rating: Input USB-C 5V

RF Transmission Frequency: 433.92MHz  
2402~2480 MHz (BLE5.0)

No. of Operated Channel:

| Bluetooth Low Energy |          |    |          |    |          |    |          |
|----------------------|----------|----|----------|----|----------|----|----------|
| Ch                   | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) | Ch | Fre(MHz) |
| 0                    | 2402     | 10 | 2422     | 20 | 2442     | 30 | 2462     |
| 1                    | 2404     | 11 | 2424     | 21 | 2444     | 31 | 2464     |
| 2                    | 2406     | 12 | 2426     | 22 | 2446     | 32 | 2466     |
| 3                    | 2408     | 13 | 2428     | 23 | 2448     | 33 | 2468     |
| 4                    | 2410     | 14 | 2430     | 24 | 2450     | 34 | 2470     |
| 5                    | 2412     | 15 | 2432     | 25 | 2452     | 35 | 2472     |
| 6                    | 2414     | 16 | 2434     | 26 | 2454     | 36 | 2474     |
| 7                    | 2416     | 17 | 2436     | 27 | 2456     | 37 | 2476     |
| 8                    | 2418     | 18 | 2438     | 28 | 2458     | 38 | 2478     |
| 9                    | 2420     | 19 | 2440     | 29 | 2460     | 39 | 2480     |

Modulation: 2.4GHz BLE: GFSK; 433.92MHz: 2GFSK

Hardware Version: B1

Software Version: B1

Antenna Type: 2.4GHz BLE: Line antenna; 433.92MHz: Line antenna

Antenna Gain: 2.4GHz BLE:2.2 dBi;

Description of the EUT: The Equipment Under Test (EUT) is a Tubular motor which supports 433.92MHz transceiver and support 2.4GHz BLE. We tested it and listed the worst data in this report.

Test sample no.: SHA-866063-2 (RF Radiated and Conducted)

The sample's mentioned in this report is/are submitted/ supplied/ manufactured by client. The laboratory therefore assumes no responsibility for accuracy of information on the brand name, model number, origin of manufacture, consignment or any information supplied.



**5 Summary of Test Standards**

| Test Standards                             |                                                                        |
|--------------------------------------------|------------------------------------------------------------------------|
| FCC Part 15 Subpart C<br>10-1-2023 Edition | PART 15 - RADIO FREQUENCY DEVICES<br>Subpart C - Intentional Radiators |

All the test methods were according to KDB 558074 D01 15.247 Meas Guidance v05r02 Measurement Guidance and ANSI C63.10-2020.

## 6 Summary of Test Results

| Technical Requirements         |                                             |            |           |                                     |                          |                                     |
|--------------------------------|---------------------------------------------|------------|-----------|-------------------------------------|--------------------------|-------------------------------------|
| FCC Part 15 Subpart C          |                                             |            |           |                                     |                          |                                     |
| Test Condition                 |                                             | Pages      | Test Site | Test Result                         |                          |                                     |
|                                |                                             |            |           | Pass                                | Fail                     | N/A                                 |
| §15.207                        | Conducted emission AC power port            | 12-16      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247 (b) (3)                | Conducted peak output power                 | 17-18      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(a)(1)                  | 20dB bandwidth and 99% Occupied Bandwidth   | ---        | ---       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)                  | Carrier frequency separation                | ---        | ---       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii)             | Number of hopping frequencies               | ---        | ---       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(1)(iii)             | Dwell Time - Average Time of Occupancy      | ---        | ---       | <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> |
| §15.247(a)(2)                  | 6dB bandwidth                               | 19-20      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(e)                     | Power spectral density                      | 21-22      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(e)                     | Spurious RF conducted emissions             | 23-26      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(d)                     | Band edge                                   | 27-29      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.247(d) & §15.209 & §15.205 | Spurious radiated emissions for transmitter | 30-40      | Site 1    | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |
| §15.203                        | Antenna requirement                         | See note 1 |           | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            |

Remark 1: N/A – Not Applicable.

Note 1: The EUT uses line antenna, which gain is 2.2dBi for 2.4GHz BLE.

In accordance to §15.203, It is considered sufficiently to comply with the provisions of this section.



## 7 General Remarks

### Remarks

This submittal(s) (test report) is intended for FCC ID: ZY4CMD03B1 complies with Section 15.207, 15.209, 15.247 of the FCC Part 15, Subpart C rules.

According to client's declaration, schematics, PCB layout, critical components and mechanical construction of the two models are the same. Differences between two models are the model name and outside view. Model CMD-03 was chosen to perform the full test items.

This report is only for the 2.4GHz BLE.

### SUMMARY:

All tests according to the regulations cited on page 5 were

■ - Performed

□ - **Not** Performed

The Equipment under Test

■ - **Fulfills** the general approval requirements.

□ - **Does not** fulfill the general approval requirements.

Sample Received Date: November 30, 2024

Testing Start Date: December 2, 2024

Testing End Date: December 18, 2024

-TÜV SÜD Certification and Testing (China) Co., Ltd. Shanghai Branch

Reviewed by:

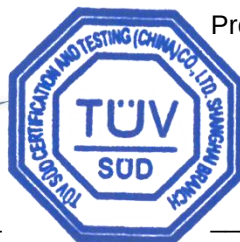
Hui TONG  
Review Engineer

Prepared by:

Jiaxi XU  
Project Engineer

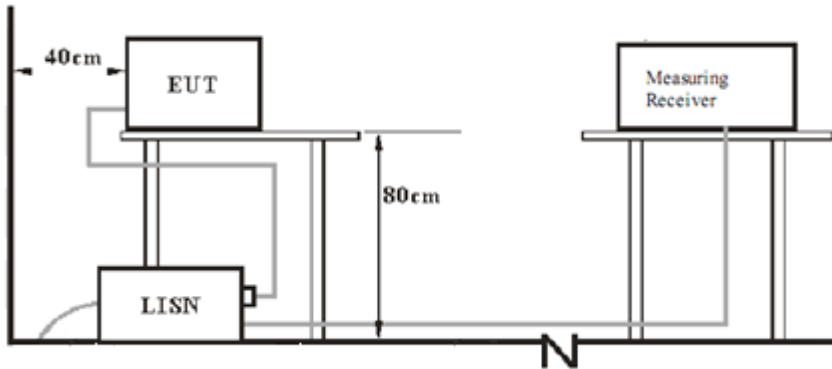
Tested by:

Chengjie GUO  
Test Engineer



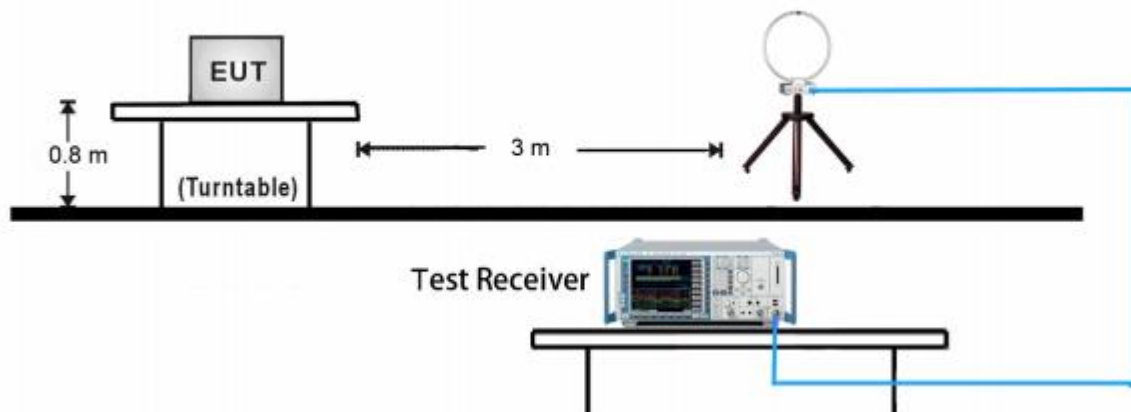
## 8 Test Setups

### 8.1 AC Power Line Conducted Emission test setups

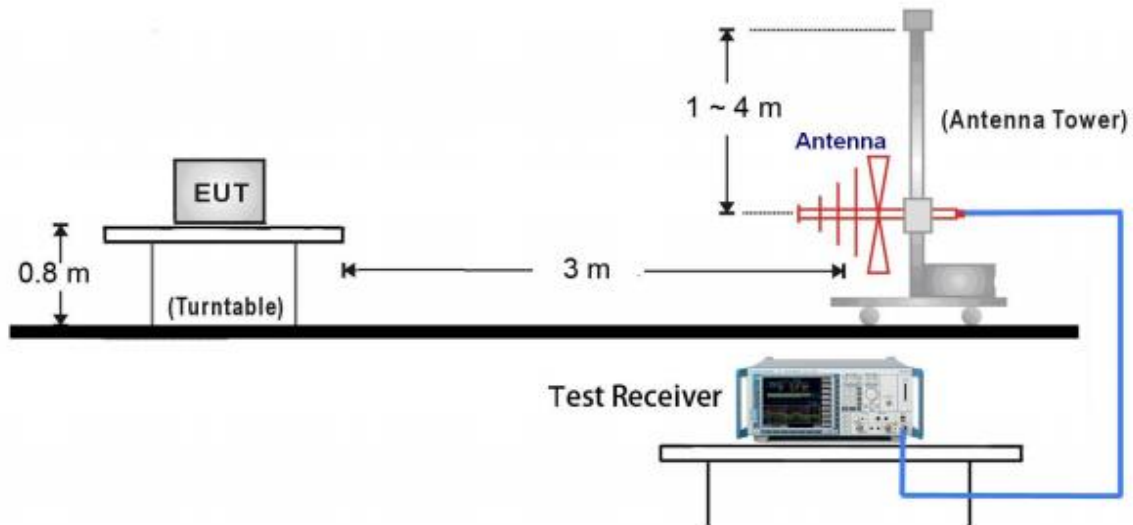


### 8.2 Radiated test setups

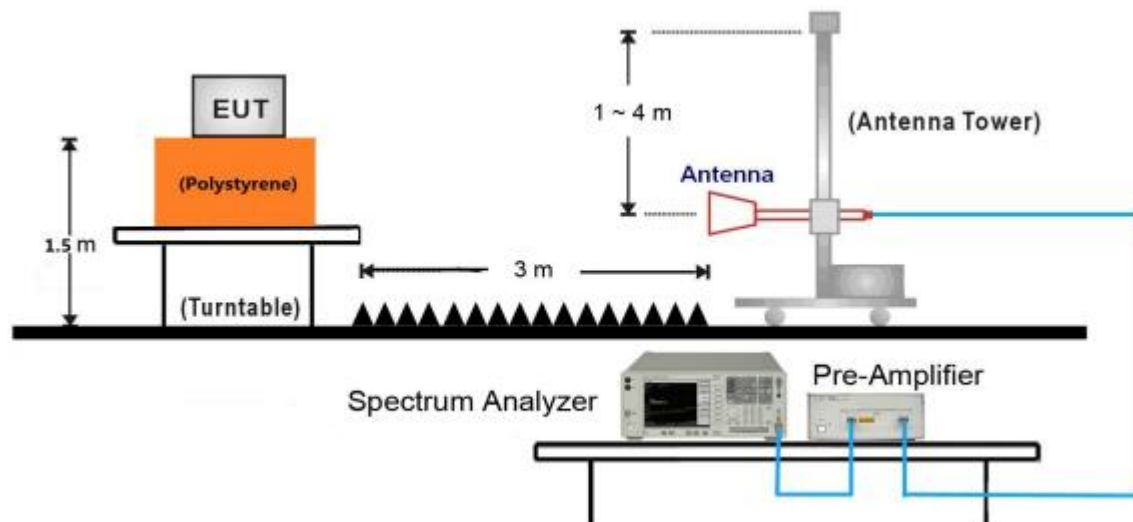
#### 9kHz ~ 30MHz Test Setup:



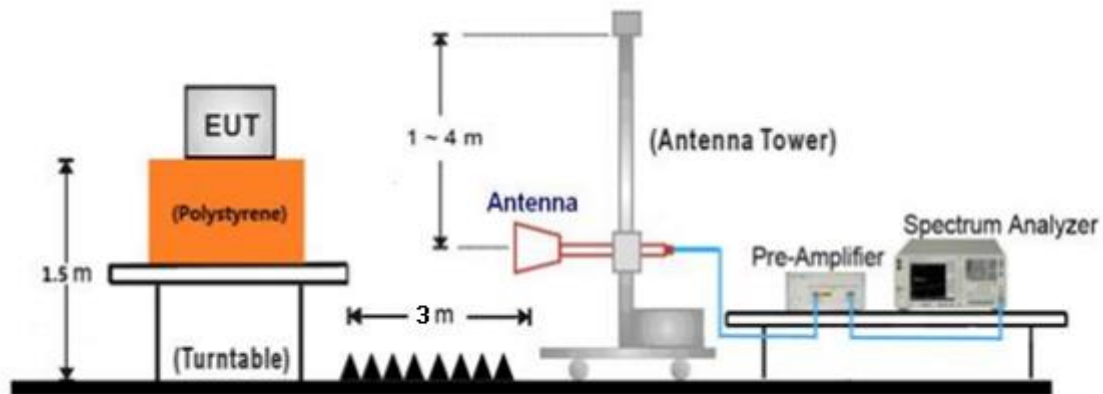
### 30MHz ~ 1GHz Test Setup:



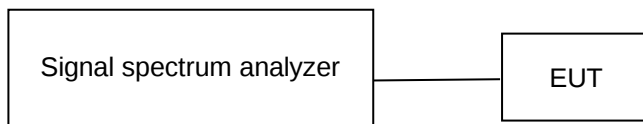
### 1GHz ~ 18GHz Test Setup:



### 18GHz ~ 25GHz Test Setup:



### 8.3 Conducted RF test setups



## 9 Systems test configuration

Auxiliary Equipment Used during Test:

| DESCRIPTION   | MANUFACTURER | MODEL NO.(SHIELD) | S/N(LENGTH)     |
|---------------|--------------|-------------------|-----------------|
| Notebook      | Lenovo       | E470              | PF-OU5TS7 17/09 |
| AC/DC adapter | MLF          | MLF-A260502000UU  | --              |

Test software: BlueNRG GUI v4.0.0, which used to control the EUT in continues transmitting mode.

The system was configured to channel 0, 19, and 39 for the test.

Test Mode Applicability and Tested Channel Detail:

| Mode         | Tested Channel | Data Rate (Mbps) | Modulation | Power level setting |
|--------------|----------------|------------------|------------|---------------------|
| Bluetooth LE | 0              | 1                | GFSK       | 10                  |
|              | 19             | 1                | GFSK       | 10                  |
|              | 39             | 1                | GFSK       | 10                  |

Non-hopping mode: The system was configured to operate at a signal channel transmitting. The test software allows the configuration and operation at the worst-case duty and the highest transmit power.

## 10 Technical Requirement

### 10.1 Conducted Emission

#### Test Method

1. The EUT was placed on a table, which is 0.8m above ground plane
2. The power line of the EUT is connected to the AC mains through a Artificial Mains Network (A.M.N.).
3. Maximum procedure was performed to ensure EUT compliance
4. A EMI test receiver is used to test the emissions from both sides of AC line

#### Limit

According to §15.207, conducted emissions limit as below:

| Frequency<br>MHz | QP Limit<br>dB $\mu$ V | AV Limit<br>dB $\mu$ V |
|------------------|------------------------|------------------------|
| 0.150-0.500      | 66-56*                 | 56-46*                 |
| 0.500-5          | 56                     | 46                     |
| 5-30             | 60                     | 50                     |

Decreasing linearly with logarithm of the frequency

## Conducted Emission

# 150k-30MHz Conducted Emission Test

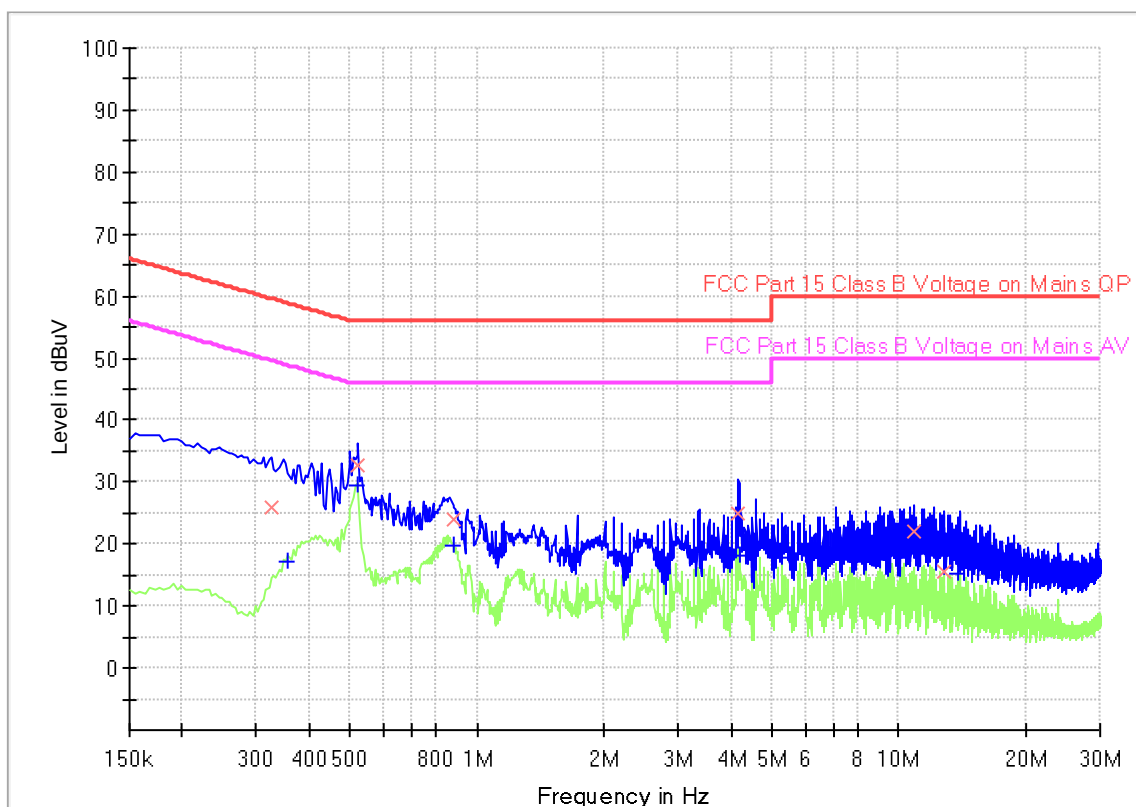
## EUT Information

EUT Name: Tubular motor  
 Model: CMD-03  
 Client: Coulisse B.V  
 Op Cond: Power on and charging mode, TX at 2402MHz  
 Operator: Guo Chengjie  
 Test Spec: FCC part 15.207(a)  
 Comment: Phase L  
 Sample No: SHA-866063-2

## Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN  
 Receiver: [ESR 3]  
 Level Unit: dBuV

| Subrange         | Step Size | Detectors | IF BW  | Meas. Time | Preamplifier |
|------------------|-----------|-----------|--------|------------|--------------|
| 9 kHz - 150 kHz  | 100 Hz    | PK+       | 200 Hz | 0.02 s     | 0 dB         |
| 150 kHz - 30 MHz | 4.5 kHz   | PK+; AVG  | 9 kHz  | 0.01 s     | 0 dB         |





## Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.325500        | 26.07            | ---             | 59.57        | 33.50       | 1000.0          | 9.000           | L1   | 19.5       |
| 0.357000        | ---              | 17.26           | 48.80        | 31.54       | 1000.0          | 9.000           | L1   | 19.5       |
| 0.519000        | ---              | 29.31           | 46.00        | 16.69       | 1000.0          | 9.000           | L1   | 19.5       |
| 0.523500        | 32.77            | ---             | 56.00        | 23.23       | 1000.0          | 9.000           | L1   | 19.5       |
| 0.879000        | ---              | 19.91           | 46.00        | 26.09       | 1000.0          | 9.000           | L1   | 19.5       |
| 0.879000        | 23.86            | ---             | 56.00        | 32.14       | 1000.0          | 9.000           | L1   | 19.5       |
| 4.173000        | 25.05            | ---             | 56.00        | 30.95       | 1000.0          | 9.000           | L1   | 19.6       |
| 4.177500        | ---              | 18.25           | 46.00        | 27.75       | 1000.0          | 9.000           | L1   | 19.6       |
| 5.271000        | ---              | 17.75           | 50.00        | 32.25       | 1000.0          | 9.000           | L1   | 19.6       |
| 10.833000       | 22.10            | ---             | 60.00        | 37.90       | 1000.0          | 9.000           | L1   | 19.8       |
| 12.732000       | 15.59            | ---             | 60.00        | 44.41       | 1000.0          | 9.000           | L1   | 19.8       |
| 13.803000       | ---              | 15.32           | 50.00        | 34.68       | 1000.0          | 9.000           | L1   | 19.8       |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

# 150k-30MHz Conducted Emission Test

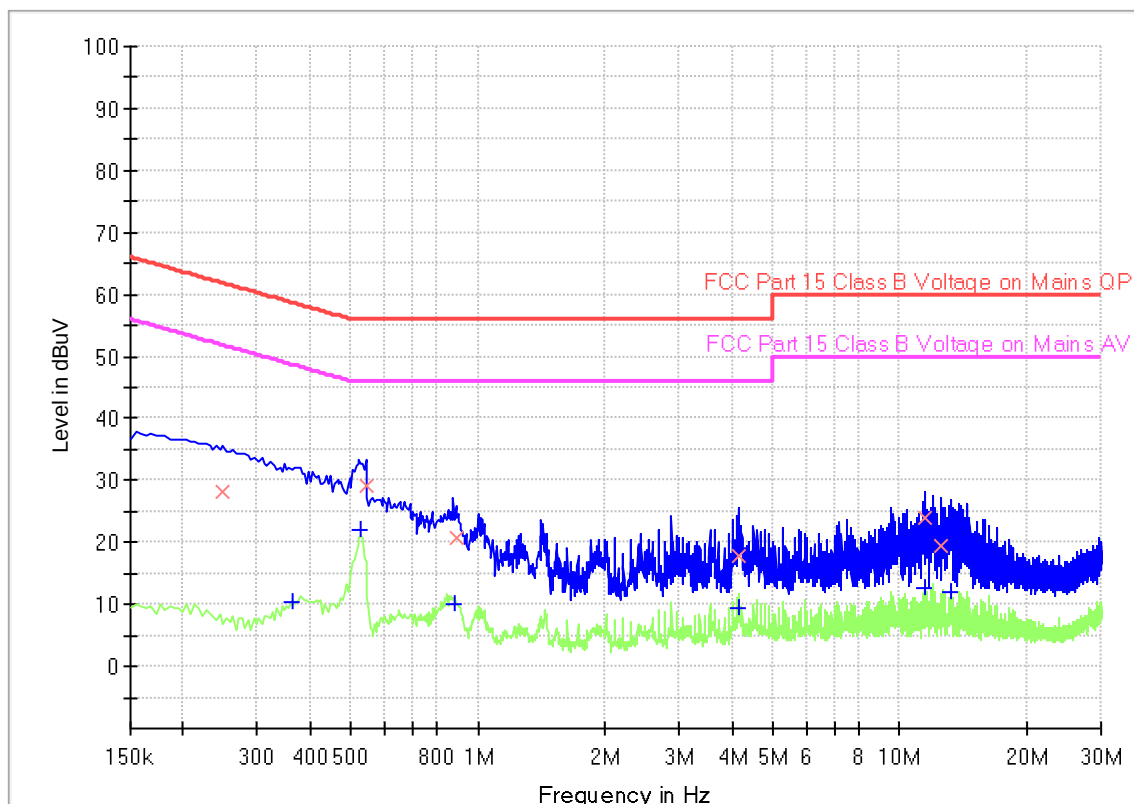
## EUT Information

EUT Name: Tubular motor  
 Model: CMD-03  
 Client: Coulisse B.V  
 Op Cond: Power on and charging mode, TX at 2402MHz  
 Operator: Guo Chengjie  
 Test Spec: FCC part 15.207(a)  
 Comment: Phase N  
 Sample No: SHA-866063-2

## Scan Setup: Voltage with 2-Line-LISN pre [EMI conducted]

Hardware Setup: Voltage with 2-Line-LISN  
 Receiver: [ESR 3]  
 Level Unit: dBuV

| Subrange         | Step Size | Detectors | IF BW  | Meas. Time | Preamp |
|------------------|-----------|-----------|--------|------------|--------|
| 9 kHz - 150 kHz  | 100 Hz    | PK+       | 200 Hz | 0.02 s     | 0 dB   |
| 150 kHz - 30 MHz | 4.5 kHz   | PK+; AVG  | 9 kHz  | 0.01 s     | 0 dB   |





## Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Line | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|-----------------|-----------------|------|------------|
| 0.249000        | 28.13            | ---             | 61.79        | 33.66       | 1000.0          | 9.000           | N    | 19.4       |
| 0.361500        | ---              | 10.35           | 48.69        | 38.34       | 1000.0          | 9.000           | N    | 19.4       |
| 0.528000        | ---              | 22.05           | 46.00        | 23.95       | 1000.0          | 9.000           | N    | 19.5       |
| 0.541500        | 29.16            | ---             | 56.00        | 26.84       | 1000.0          | 9.000           | N    | 19.5       |
| 0.883500        | ---              | 10.21           | 46.00        | 35.79       | 1000.0          | 9.000           | N    | 19.5       |
| 0.888000        | 20.80            | ---             | 56.00        | 35.20       | 1000.0          | 9.000           | N    | 19.5       |
| 4.150500        | 17.94            | ---             | 56.00        | 38.06       | 1000.0          | 9.000           | N    | 19.6       |
| 4.150500        | ---              | 9.36            | 46.00        | 36.64       | 1000.0          | 9.000           | N    | 19.6       |
| 11.503500       | 23.85            | ---             | 60.00        | 36.15       | 1000.0          | 9.000           | N    | 19.8       |
| 11.503500       | ---              | 12.79           | 50.00        | 37.21       | 1000.0          | 9.000           | N    | 19.8       |
| 12.552000       | 19.49            | ---             | 60.00        | 40.51       | 1000.0          | 9.000           | N    | 19.8       |
| 13.227000       | ---              | 12.10           | 50.00        | 37.90       | 1000.0          | 9.000           | N    | 19.8       |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + LISN Factor (dB) + 10dB Attenuator

## 10.2 Conducted peak output power

### Test Method

1. Use the following spectrum analyzer settings:  
RBW > the 6 dB bandwidth of the emission being measured, VBW $\geq$ 3RBW, Span $\geq$ 3RBW  
Sweep = auto, Detector function = peak, Trace = max hold.
2. Add a correction factor to the display.
3. Allow the trace to stabilize. Use the marker-to-peak function to set the marker to the peak of the emission. The indicated level is the peak output power.

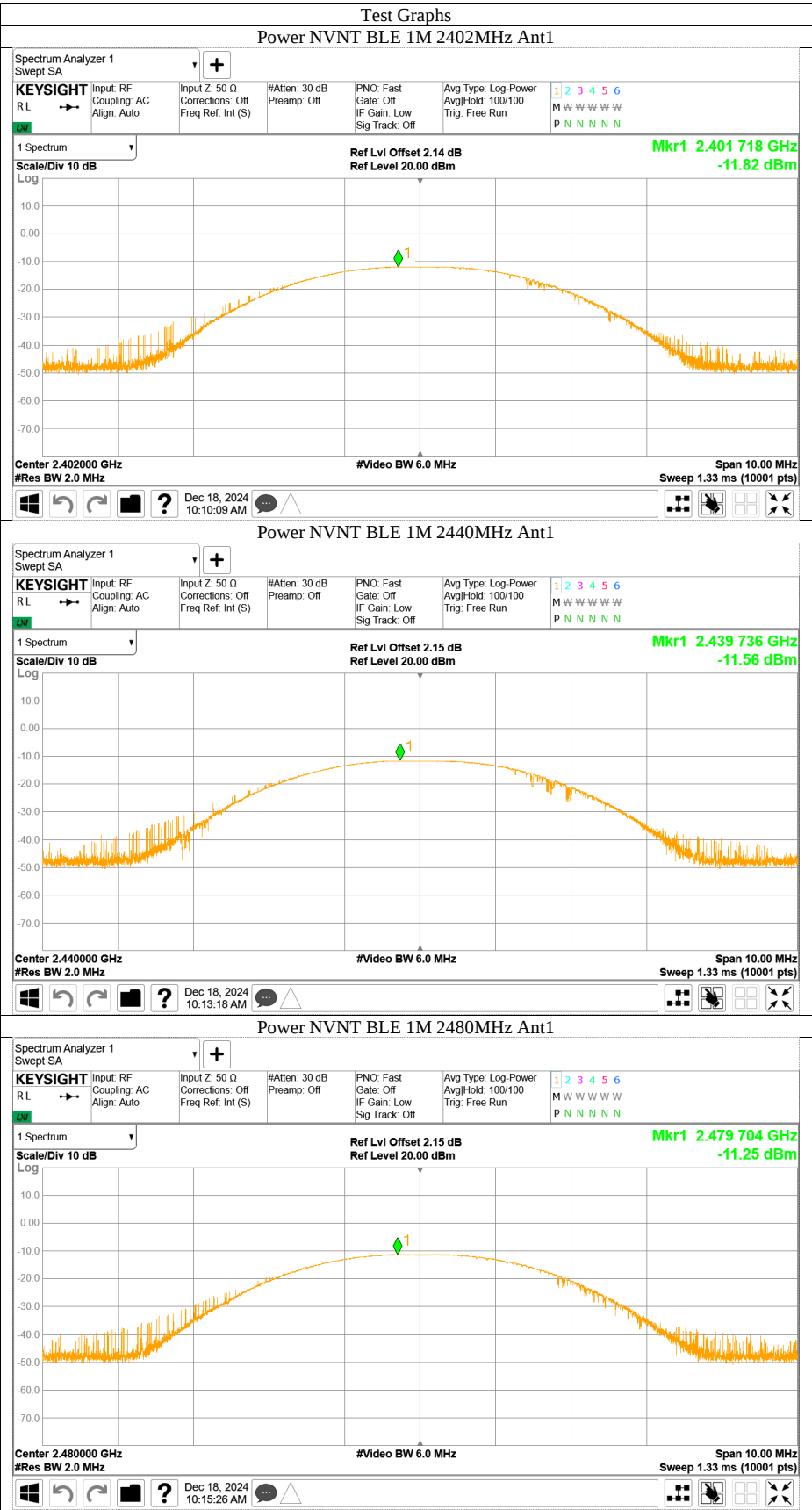
### Limits

According to §15.247 (b) (3), conducted peak output power limit as below:

| Frequency Range<br>MHz | Limit<br>W | Limit<br>dBm |
|------------------------|------------|--------------|
| 2400-2483.5            | $\leq 1$   | $\leq 30$    |

Test result as below table

| Data transmission rate: 1Mbps |                                       |        |
|-------------------------------|---------------------------------------|--------|
| Frequency<br>MHz              | Conducted Peak Output<br>Power<br>dBm | Result |
| Low channel 2402MHz           | -11.82                                | Pass   |
| Middle channel 2440MHz        | -11.56                                | Pass   |
| High channel 2480MHz          | -11.25                                | Pass   |





**10.36dB bandwidth**

**Test Method**

- 1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
- 2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
- 3. Use the following spectrum analyzer settings:  
RBW=100KHz, VBW≥3RBW, Sweep = auto, Detector function = peak, Trace = max hold
- 4. Use the automatic bandwidth measurement capability of an instrument, use the X dB bandwidth mode with X set to 6 dB.
- 5. Allow the trace to stabilize, record the 6 dB Bandwidth value.

**Limit**

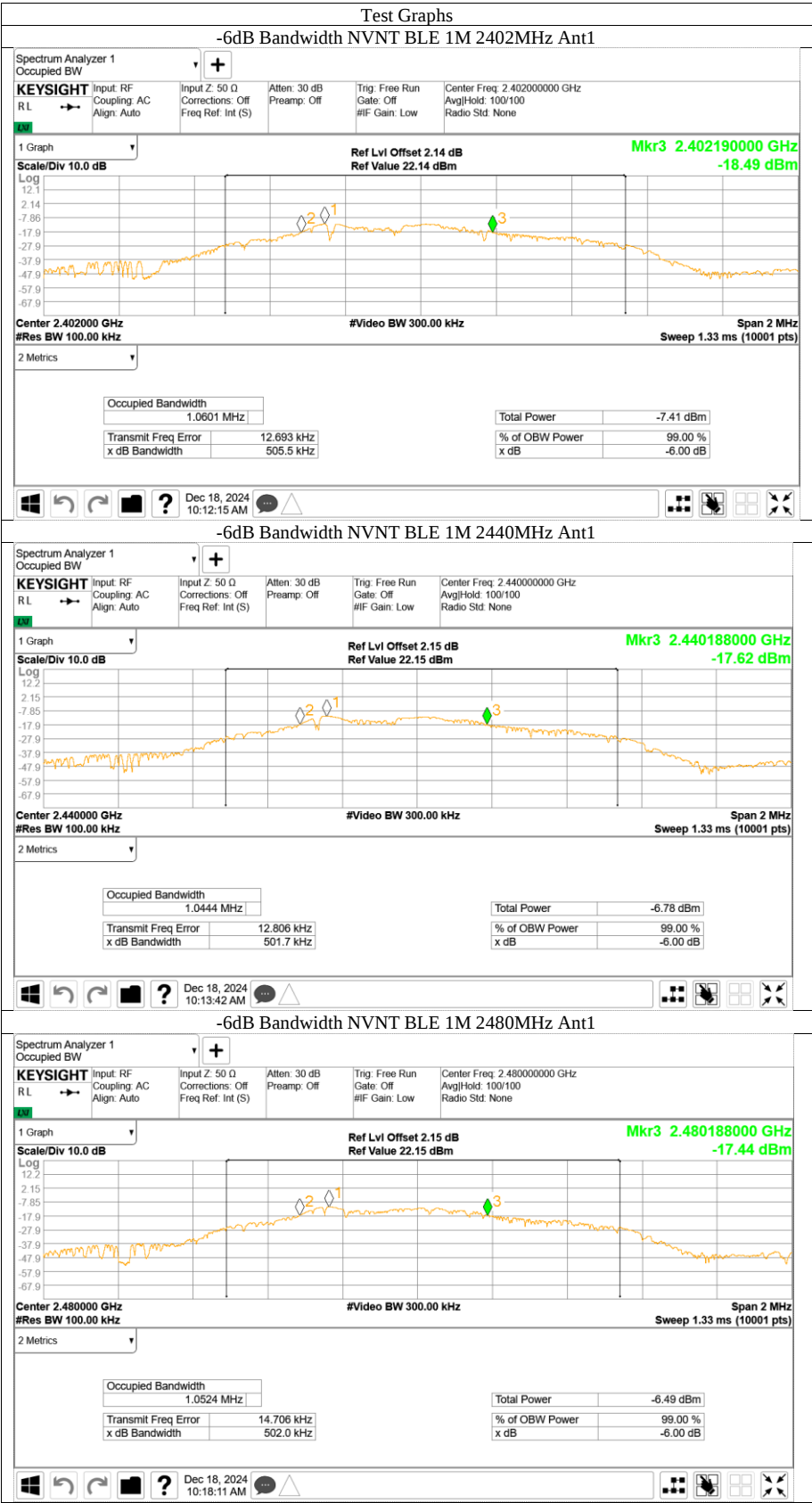
| Limit [kHz] |
|-------------|
| ≥500        |

**Test result**

| Frequency<br>MHz       | 6dB bandwidth<br>kHz | Result |
|------------------------|----------------------|--------|
| Top channel 2402MHz    | 0.505                | Pass   |
| Middle channel 2440MHz | 0.502                | Pass   |
| Bottom channel 2480MHz | 0.502                | Pass   |



6dB Bandwidth



## 10.4 Power spectral density

### Test Method

This procedure shall be used if maximum peak conducted output power was used to demonstrate compliance:

1. The RF output of EUT was connected to the spectrum analyzer. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:
4. Set analyzer center frequency to DTS channel center frequency. RBW=3kHz, VBW $\geq$ 3RBW, Span=1.5 times DTS bandwidth, Detector=Peak, Sweep=auto, Trace= max hold.
5. Allow trace to fully stabilize, use the peak marker function to determine the maximum amplitude level within the RBW.
6. Repeat above procedures until other frequencies measured were completed.

### Limit

Limit [dBm/3kHz]

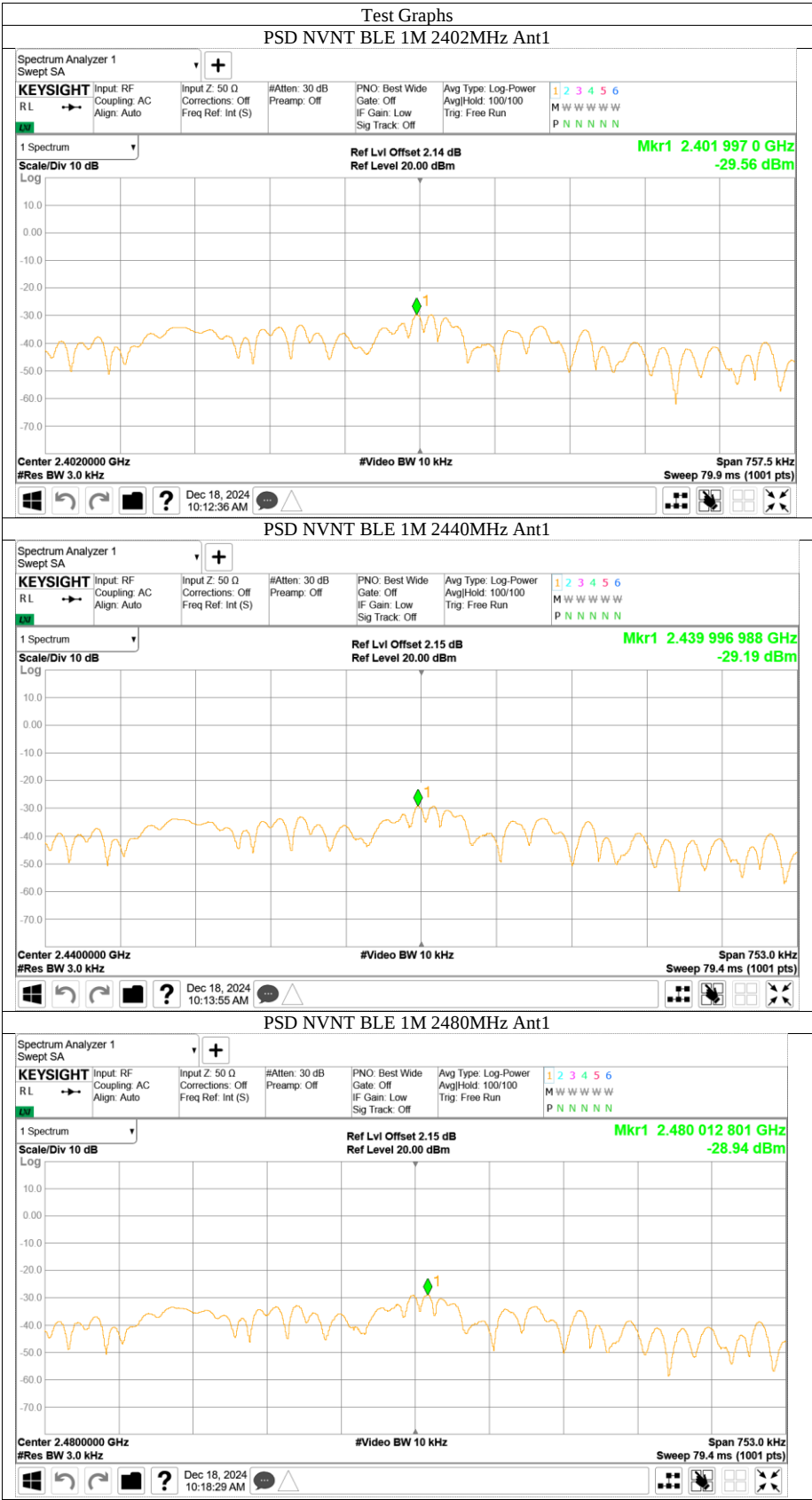
$\leq 8$

### Test result

| Data transmission rate | Frequency              | Power spectral density | Result |
|------------------------|------------------------|------------------------|--------|
| 1Mbps                  | MHz                    | dBm/3kHz               |        |
|                        | Top channel 2402MHz    | -29.57                 | Pass   |
|                        | Middle channel 2440MHz | -29.19                 | Pass   |
|                        | Bottom channel 2480MHz | -28.94                 | Pass   |



Power spectral density



## 10.5 Spurious RF conducted emissions

### Test Method

1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10<sup>th</sup> harmonic. Typically, several plots are required to cover this entire span.  
RBW = 100 kHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize. Set the marker on the peak of any spurious emission recorded.
5. The level displayed must comply with the limit specified in this Section. Submit these plots.
6. Repeat above procedures until all frequencies measured were complete.

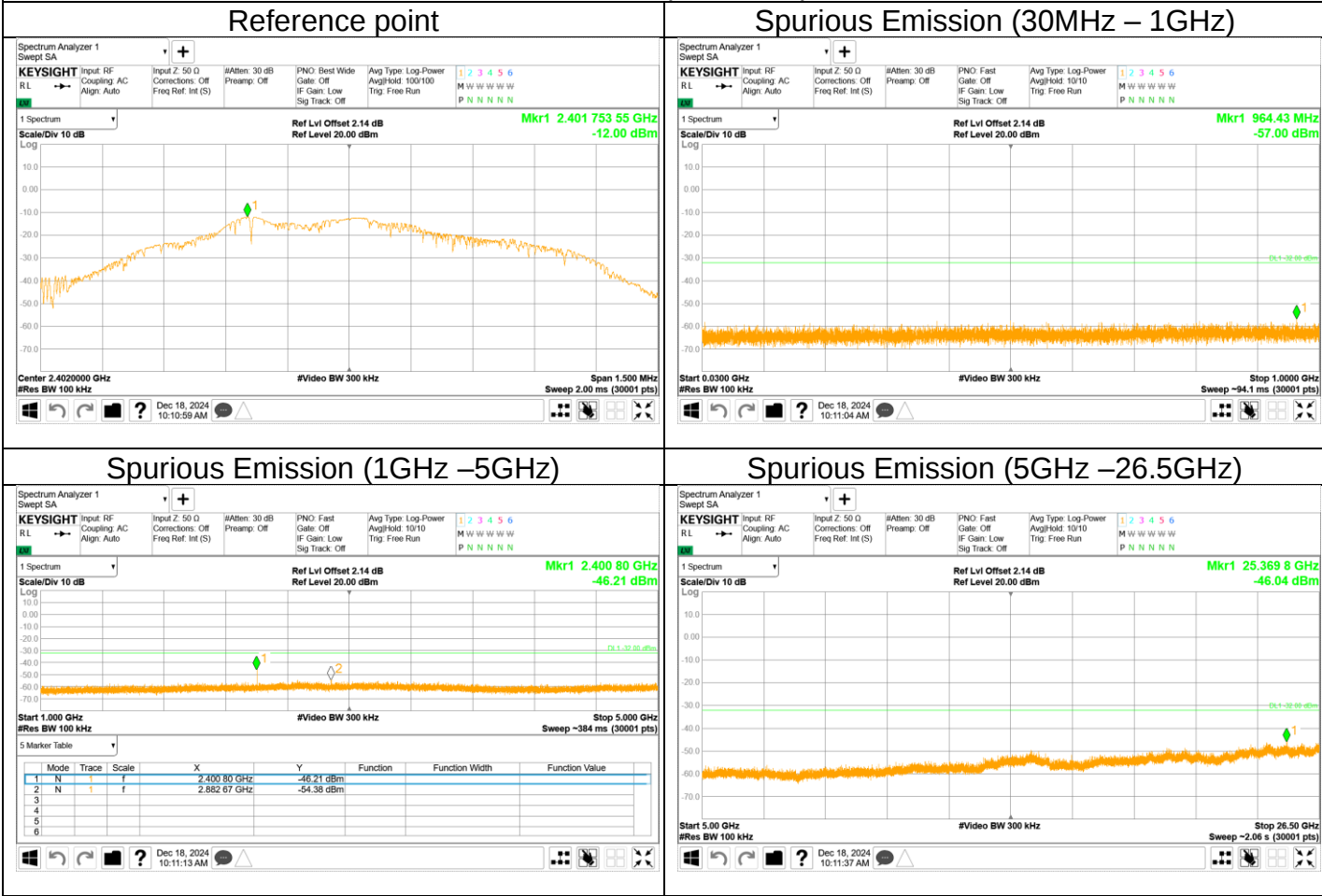
### Limit

| Frequency Range<br>MHz | Limit (dBc) |
|------------------------|-------------|
| 30-25000               | -20         |



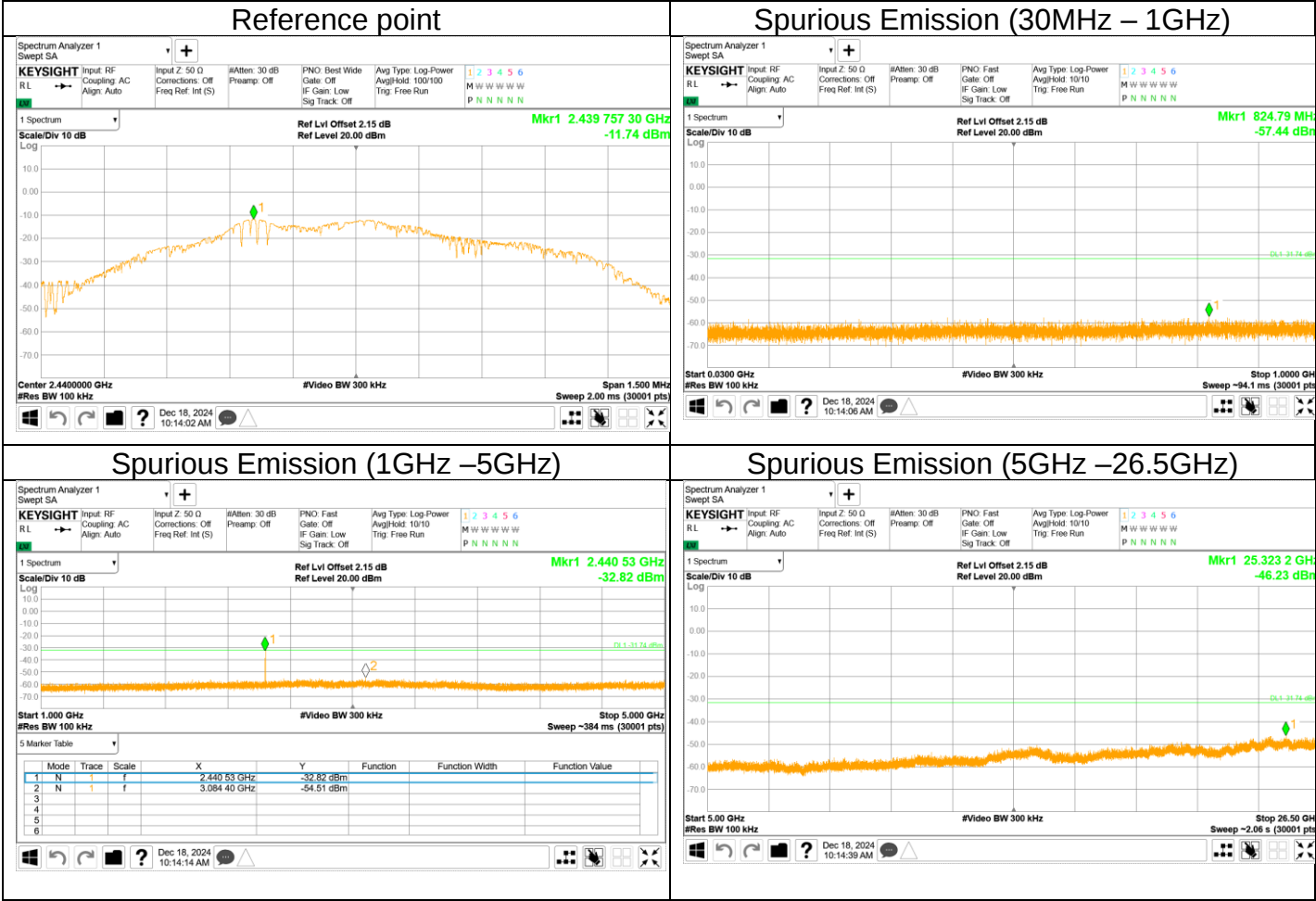
Spurious RF conducted emissions

Out-of-Band Emissions  
Channel 0 (2402MHz)



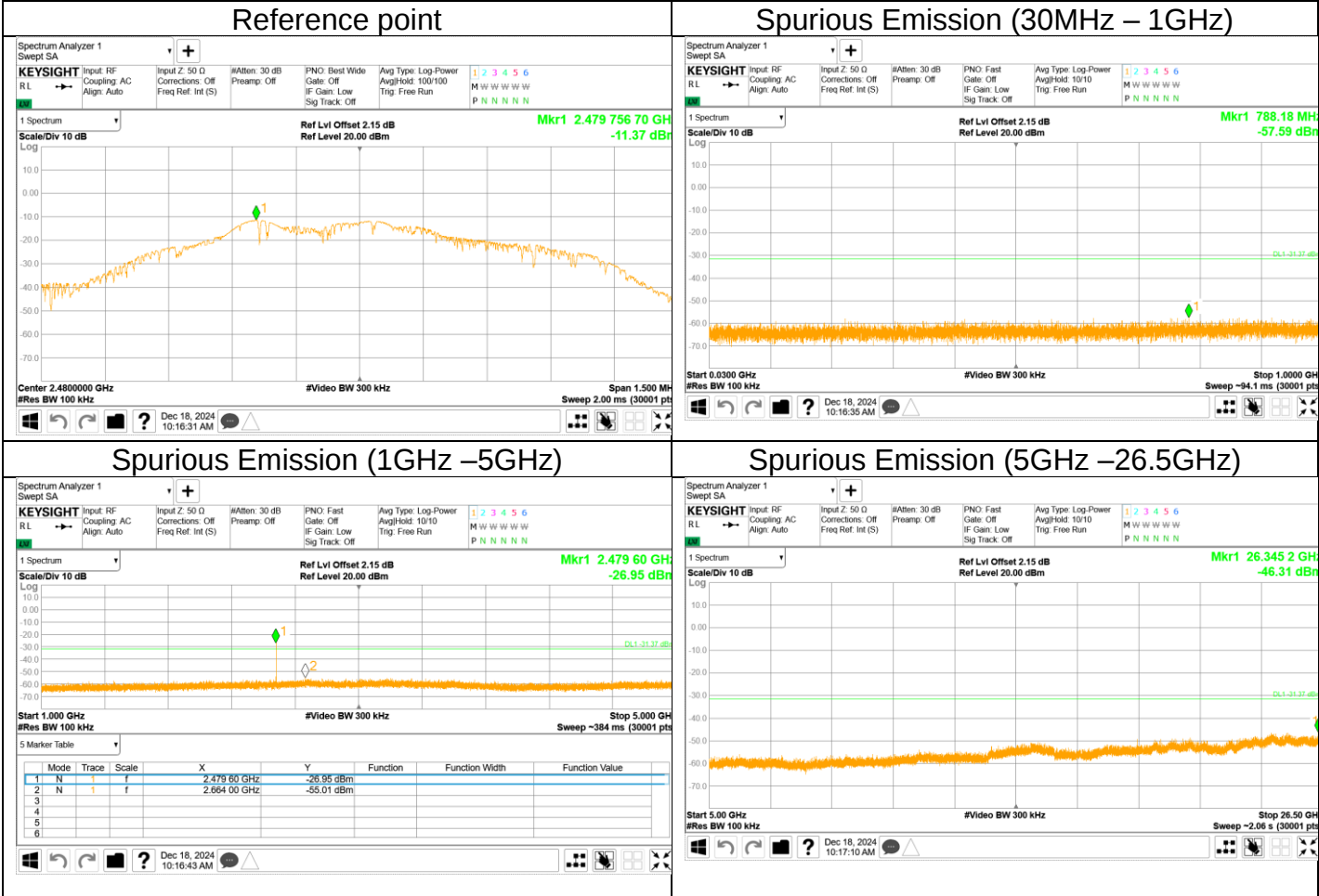


Out-of-Band Emissions  
Channel 19 (2440MHz)





Out-of-Band Emissions  
Channel 39 (2480MHz)



## 10.6 Band edge

### Test Method

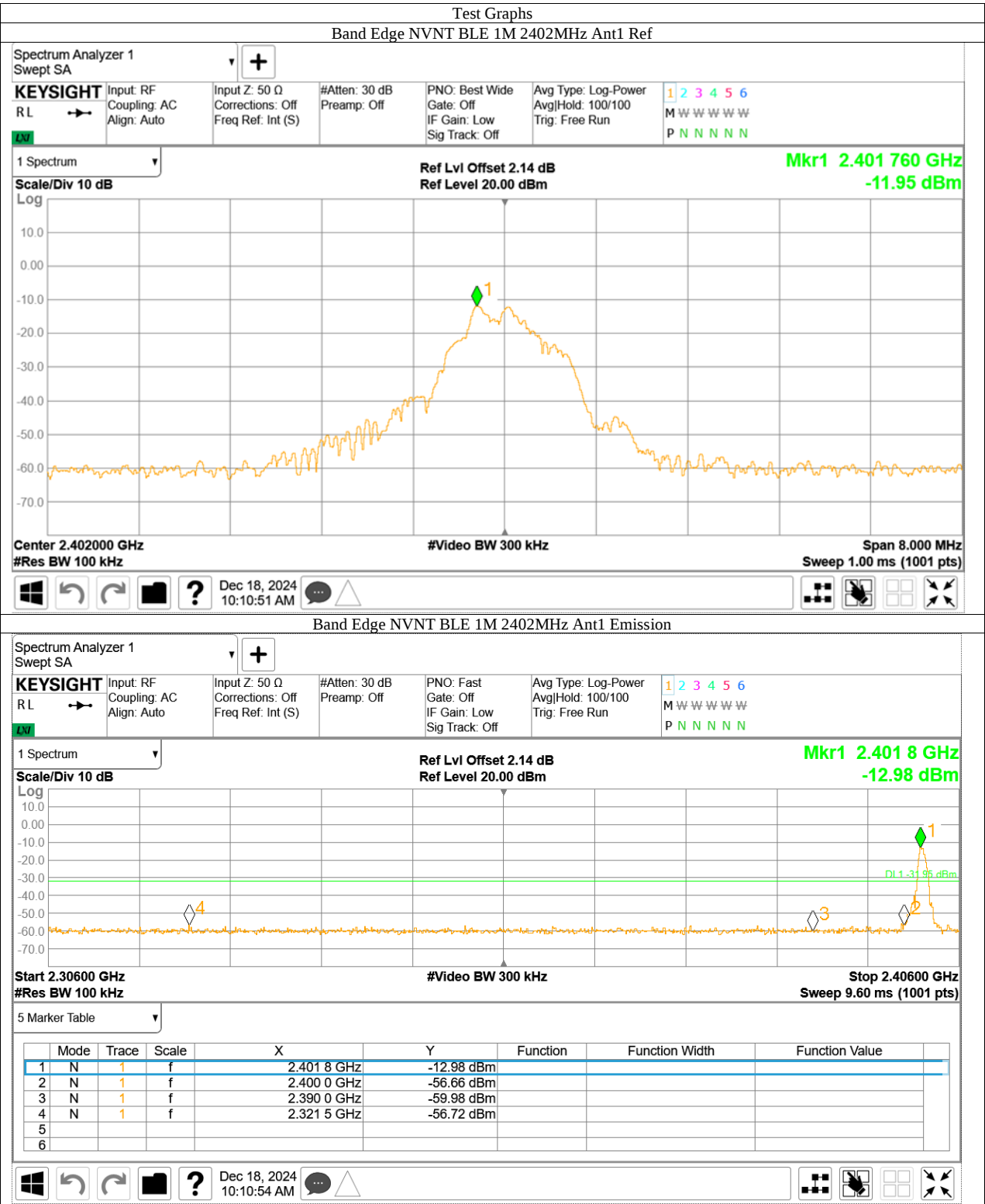
1. The RF output of EUT was connected to the spectrum analyzer by RF cable. The path loss was compensated to the results for each measurement.
2. Set to the maximum power setting, the instrument center frequency is set to the nominal EUT channel center frequency enable the EUT transmit continuously.
3. Use the following spectrum analyzer settings:  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz, VBW $\geq$ 3RBW, Sweep = auto, Detector function = peak, Trace = max hold
4. Allow the trace to stabilize, use the peak and delta measurement to record the result.
5. The level displayed must comply with the limit specified in this Section.
6. Repeat above procedures until all frequencies measured were complete and submit all the plots.

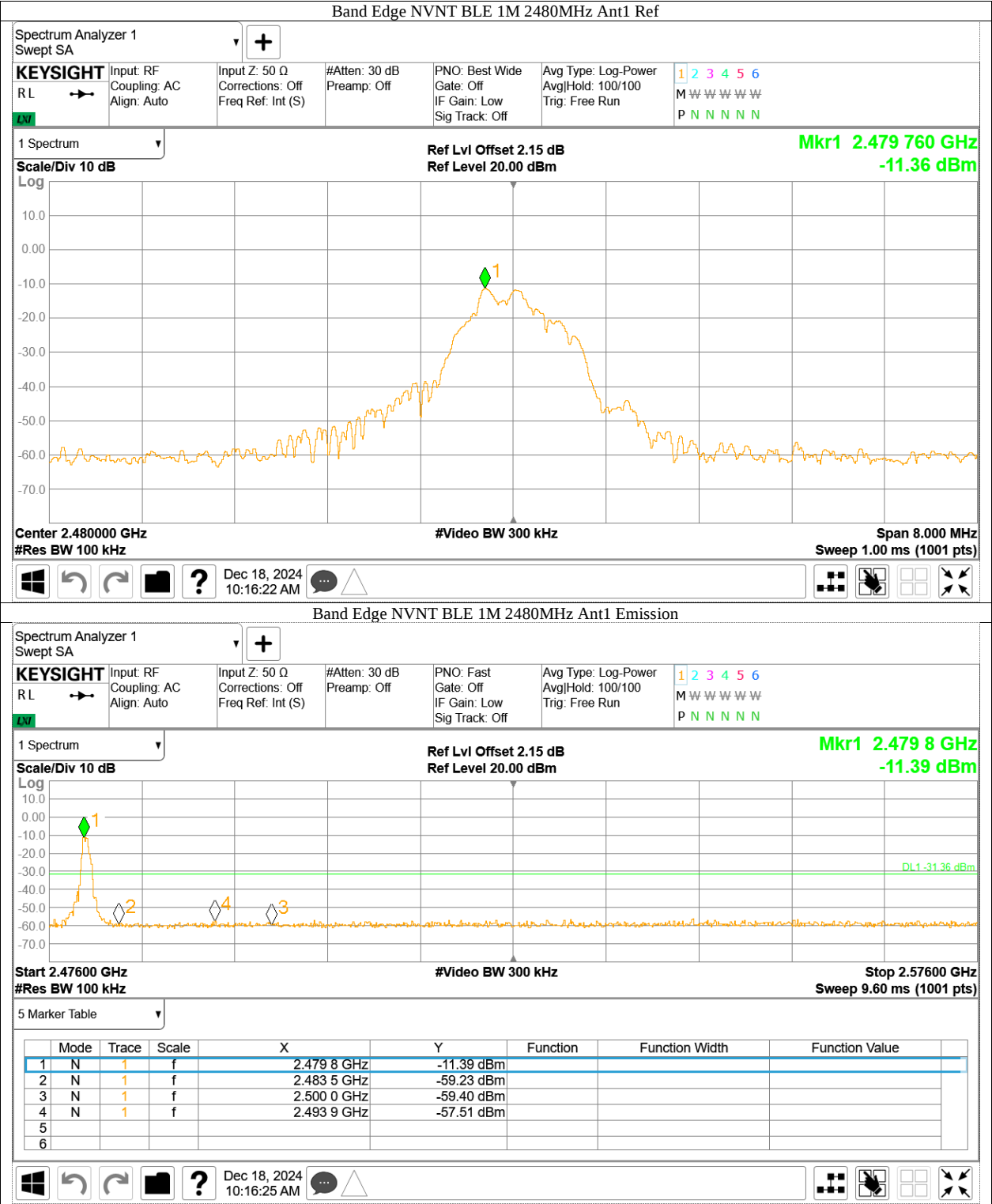
### Limit

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 RMS averaging over a time interval, as permitted under § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB.



Test result





## 10.7 Spurious radiated emissions for transmitter

### Test Method

1. The EUT was placed on a turn table which is 1.5m above ground plane for above 1GHz and 0.8m above ground for below 1GHz at 3 meter chamber room for test. The table was rotated 360 degrees to determine the position of the highest radiation.
2. The EUT was set 3 meters away from the interference – receiving antenna, which was mounted on the top of a variable – height antenna tower.
3. The height of antenna is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
4. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
5. Use the following spectrum analyzer settings According to C63.10
  - 1) Procedure for Unwanted Emissions Measurements Below 1000 MHz  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 100 kHz to 120kHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.
  - 2) For Peak unwanted emissions Above 1GHz:  
Span = wide enough to capture the peak level of the in-band emission and all spurious  
RBW = 1MHz, VBW ≥ RBW for peak measurement, Sweep = auto, Detector function = peak, Trace = max hold.  
Procedures for average unwanted emissions measurements above 1GHz
    - a) RBW = 1MHz.
    - b)  $VBW \setminus [3 \times RBW]$ .
    - c) Detector = AV (power averaging), if  $[span / (\# \text{ of points in sweep})] \setminus RBW / 2$ . Satisfying this condition can require increasing the number of points in the sweep or reducing the span. If the condition is not satisfied, then the detector mode shall be set to peak.
    - d) Averaging type = power (i.e., AV) (As an alternative, the detector and averaging type may be set for linear voltage averaging. Some instruments require linear display mode to use linear voltage averaging. Log or dB averaging shall not be used.)
    - e) Sweep time = auto.
    - f) Perform a trace average of at least 100 traces if the transmission is continuous. If the transmission is not continuous, then the number of traces shall be increased by a factor of  $1 / D$ , where  $D$  is the duty cycle. For example, with 50% duty cycle, at least 200 traces shall be averaged. (If a specific emission is demonstrated to be continuous—i.e., 100% duty cycle—then rather than turning ON and OFF with the transmit cycle, at least 100 traces shall be averaged.)
    - g) If tests are performed with the EUT transmitting at a duty cycle less than 98%, then a correction factor shall be added to the measurement results prior to comparing with the emission limit, to compute the emission level that would have been measured had the test been performed at 100% duty cycle. The correction factor is computed as follows:
      - 1) If power averaging (AV) mode was used in the preceding step e), then the correction factor is  $[10 \log (1 / D)]$ , where  $D$  is the duty cycle. For example, if the transmit duty cycle was 50%, then 3 dB shall be added to the measured emission levels.

2) If linear voltage averaging mode was used in the preceding step e), then the correction factor is  $[20 \log (1 / D)]$ , where D is the duty cycle. For example, if the transmit duty cycle was 50%, then 6 dB shall be added to the measured emission levels.

3) If a specific emission is demonstrated to be continuous (100% duty cycle) rather than turning ON and OFF with the transmit cycle, then no duty cycle correction is required for that emission (AV) at frequency above 1GHz.

## Limit

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 AV averaging over a time interval, as permitted under § 15.247(b)(3), the attenuation required shall be 30 dB instead of 20 dB. Attenuation below the general field strength 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).

| Frequency<br>MHz | Field Strength<br>uV/m | Measured Distance<br>Meters |
|------------------|------------------------|-----------------------------|
| 0.009~0.490      | 2400/F (kHz)           | 300                         |
| 0.490~1.705      | 24000/F (kHz)          | 30                          |
| 1.705~30         | 30                     | 30                          |

| Frequency<br>MHz | Field Strength<br>uV/m | Field Strength<br>dBuV/m | Detector |
|------------------|------------------------|--------------------------|----------|
| 30-88            | 100                    | 40                       | QP       |
| 88-216           | 150                    | 43.5                     | QP       |
| 216-960          | 200                    | 46                       | QP       |
| 960-1000         | 500                    | 54                       | QP       |
| Above 1000       | 500                    | 54                       | AV       |
| Above 1000       | 5000                   | 74                       | PK       |

## Spurious radiated emissions for transmitter

According to C63.10, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement, so AV emission value did not show in below table if the peak value complies with average limit.

Data of measurement within frequency range 9kHz-30MHz and 18-25GHz is the noise floor or attenuated more than 20dB below the permissible limits or the field strength is too small to be measured, so test data does not present in this report.



Test result

The worst case of Radiated Emission below 1GHz: Only the worst case listed as below.

30-1000MHz Radiated Emission

EUT Information

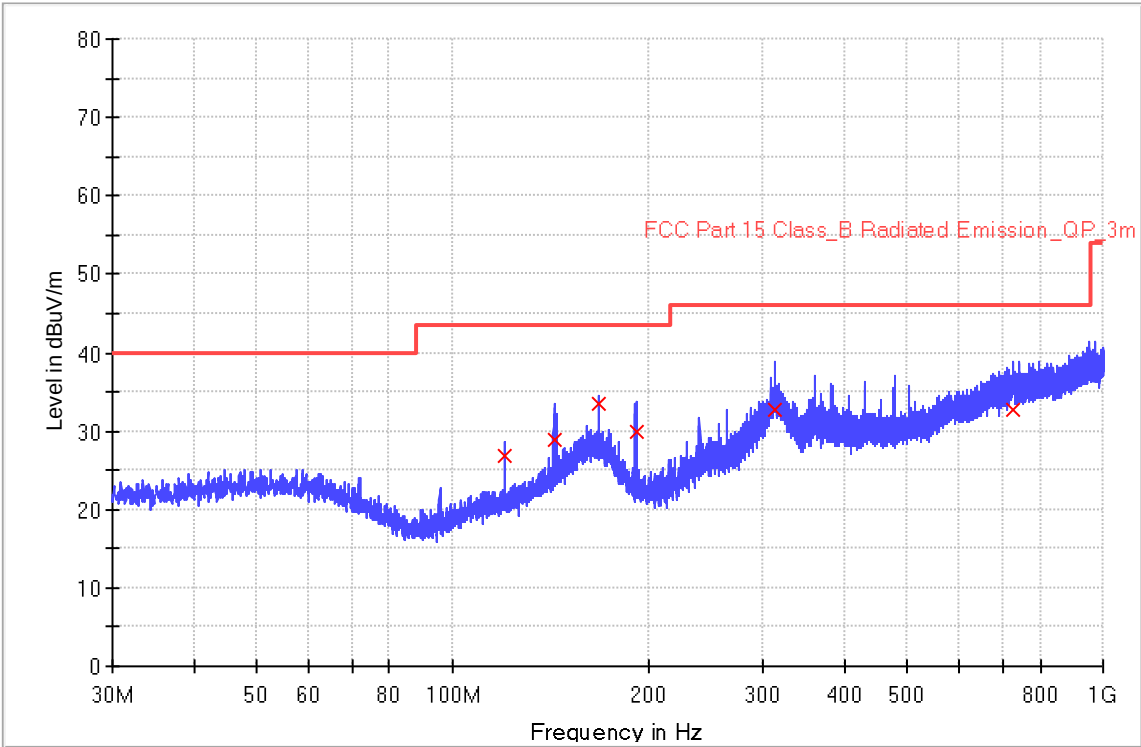
EUT Name: Tubular motor  
Model: CMD-03  
Client: Coulisse B.V  
Op Cond: Power on and TX at 2402MHz  
Operator: Guo Chengjie  
Test Spec: FCC part 15.209(a)  
Comment: Horizontal  
Sample No: SHA-866063-2

Sweep Setup: RE\_VULB9168\_pre\_Cont\_30-1000 [EMI radiated]

Hardware Setup: RE\_VULB9168  
Receiver: [ESR 3]  
Level Unit: dBuV/m

| Subrange       | Step Size | Detectors | Bandwidth | Sweep Time | Preamp |
|----------------|-----------|-----------|-----------|------------|--------|
| 30 MHz - 1 GHz | 48.5 kHz  | PK+       | 120 kHz   | 0.2 s      | 20 dB  |

RE\_VULB9168\_pre\_Cont\_30-1000





## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - QPK (dB) |
|-----------------|--------------------|-----------------|-----------------|-------------|-----|---------------|--------------|-------------------|
| 119.960000      | 26.8               | 1000.0          | 120.000         | 150.0       | H   | 249.0         | 18.4         | 16.7              |
| 143.920000      | 28.9               | 1000.0          | 120.000         | 146.0       | H   | 326.0         | 20.8         | 14.6              |
| 168.000000      | 33.4               | 1000.0          | 120.000         | 186.0       | H   | 53.0          | 20.5         | 10.1              |
| 191.520000      | 29.8               | 1000.0          | 120.000         | 168.0       | H   | 248.0         | 18.5         | 13.7              |
| 312.040000      | 32.7               | 1000.0          | 120.000         | 146.0       | H   | 157.0         | 22.1         | 13.3              |
| 727.400000      | 32.7               | 1000.0          | 120.000         | 185.0       | H   | 46.0          | 31.7         | 13.4              |

(continuation of the "Limit and Margin" table from column 16 ...)

| Frequency (MHz) | Limit - QPK (dBuV/m) | Comment |
|-----------------|----------------------|---------|
| 119.960000      | 43.5                 |         |
| 143.920000      | 43.5                 |         |
| 168.000000      | 43.5                 |         |
| 191.520000      | 43.5                 |         |
| 312.040000      | 46.0                 |         |
| 727.400000      | 46.0                 |         |

Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)



# 30-1000MHz Radiated Emission

## EUT Information

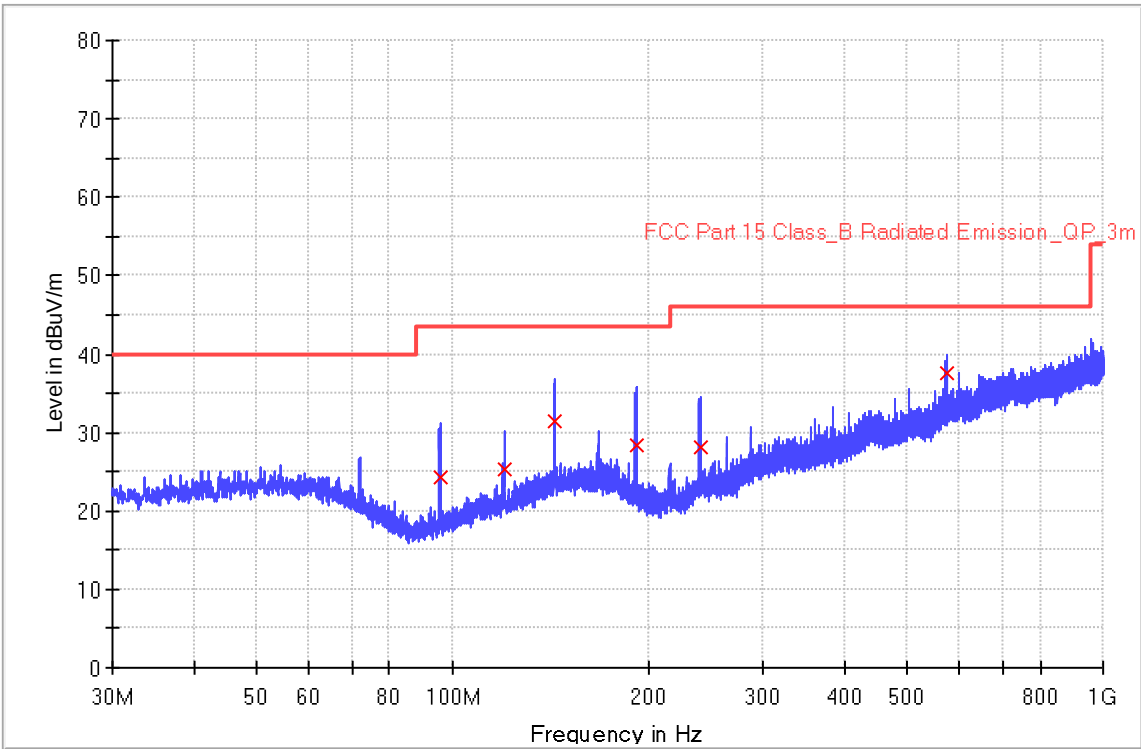
EUT Name: Tubular motor  
Model: CM-05  
Client: Coulisse B.V  
Op Cond: Power on and TX at 2402MHz  
Operator: Guo Chengjie  
Test Spec: FCC part 15.209(a)  
Comment: Vertical  
Sample No: SHA-866063-2

## Sweep Setup: RE\_VULB9168\_pre\_Cont\_30-1000 [EMI radiated]

Hardware Setup: RE\_VULB9168  
Receiver: [ESR 3]  
Level Unit: dBuV/m

| Subrange       | Step Size | Detectors | Bandwidth | Sweep Time | Preamplifier |
|----------------|-----------|-----------|-----------|------------|--------------|
| 30 MHz - 1 GHz | 48.5 kHz  | PK+       | 120 kHz   | 0.2 s      | 20 dB        |

RE\_VULB9168\_pre\_Cont\_30-1000





## Limit and Margin

| Frequency (MHz) | QuasiPeak (dBuV/m) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - QPK (dB) |
|-----------------|--------------------|-----------------|-----------------|-------------|-----|---------------|--------------|-------------------|
| 95.680000       | 24.2               | 1000.0          | 120.000         | 154.0       | V   | 157.0         | 15.9         | 19.3              |
| 119.960000      | 25.4               | 1000.0          | 120.000         | 176.0       | V   | 162.0         | 18.4         | 18.1              |
| 143.520000      | 31.5               | 1000.0          | 120.000         | 153.0       | V   | 175.0         | 20.8         | 12.0              |
| 191.400000      | 28.4               | 1000.0          | 120.000         | 221.0       | V   | 186.0         | 18.5         | 15.2              |
| 240.240000      | 28.1               | 1000.0          | 120.000         | 249.0       | V   | 225.0         | 19.7         | 17.9              |
| 575.400000      | 37.5               | 1000.0          | 120.000         | 130.0       | V   | 44.0          | 28.8         | 8.5               |

(continuation of the "Limit and Margin" table from column 16 ...)

| Frequency (MHz) | Limit - QPK (dBuV/m) | Comment |
|-----------------|----------------------|---------|
| 95.680000       | 43.5                 |         |
| 119.960000      | 43.5                 |         |
| 143.520000      | 43.5                 |         |
| 191.400000      | 43.5                 |         |
| 240.240000      | 46.0                 |         |
| 575.400000      | 46.0                 |         |

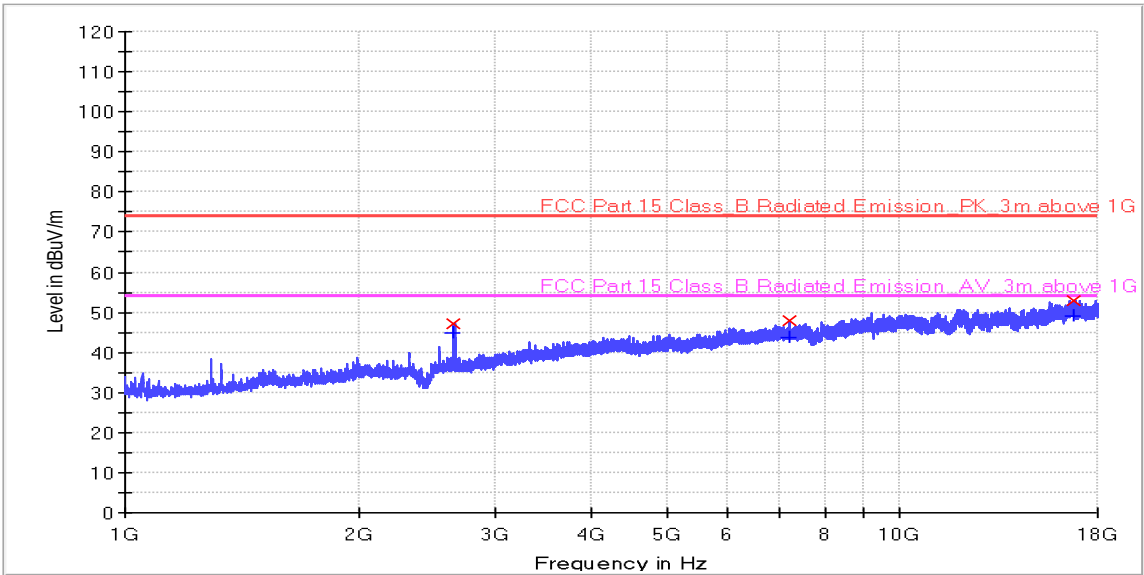
Note 1: Measure Level (dBuV/m) = Reading Level (dBuV) + Factor (dB)

Factor (dB) = Cable Loss (dB) + Antenna Factor (dB/m)



Radiated Emission 1-18 GHz  
Frequency:2402MHz at 1Mbps

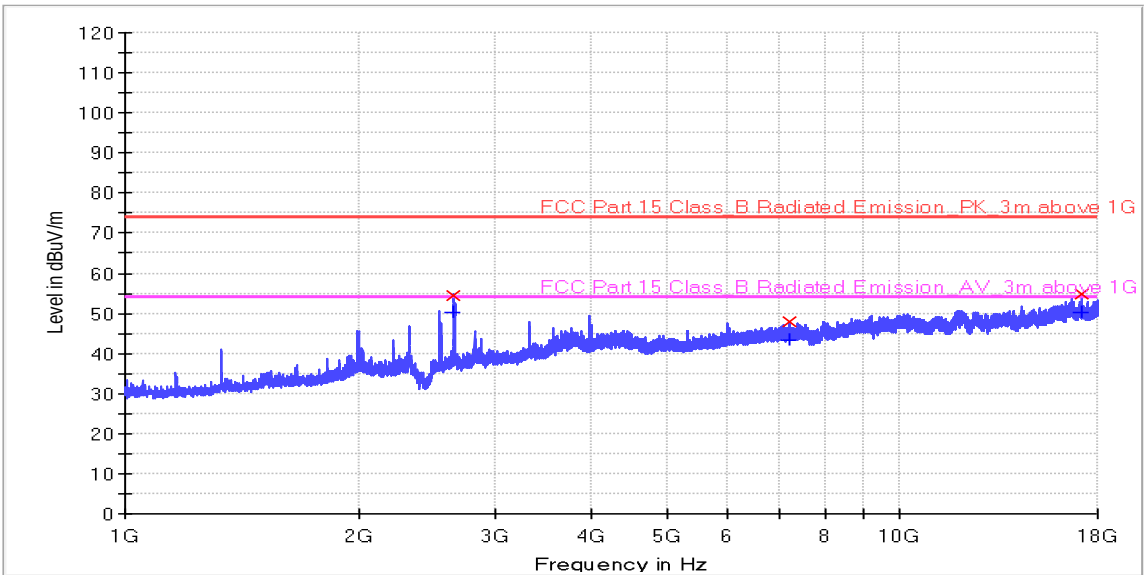
RE\_HF907\_BRF\_Pre



Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2654.200000     | 47.0             | 44.8        | 1000.000        | 253.0       | H   | 254.0         | -9.6         | 27.0         | 74.0        | 9.2         | 54.0       |
| 7206.000000     | 47.8             | 43.7        | 1000.000        | 215.0       | H   | 325.0         | -0.5         | 26.2         | 74.0        | 10.3        | 54.0       |
| 16711.600000    | 52.9             | 48.9        | 1000.000        | 145.0       | H   | 145.0         | 7.2          | 21.1         | 74.0        | 5.1         | 54.0       |

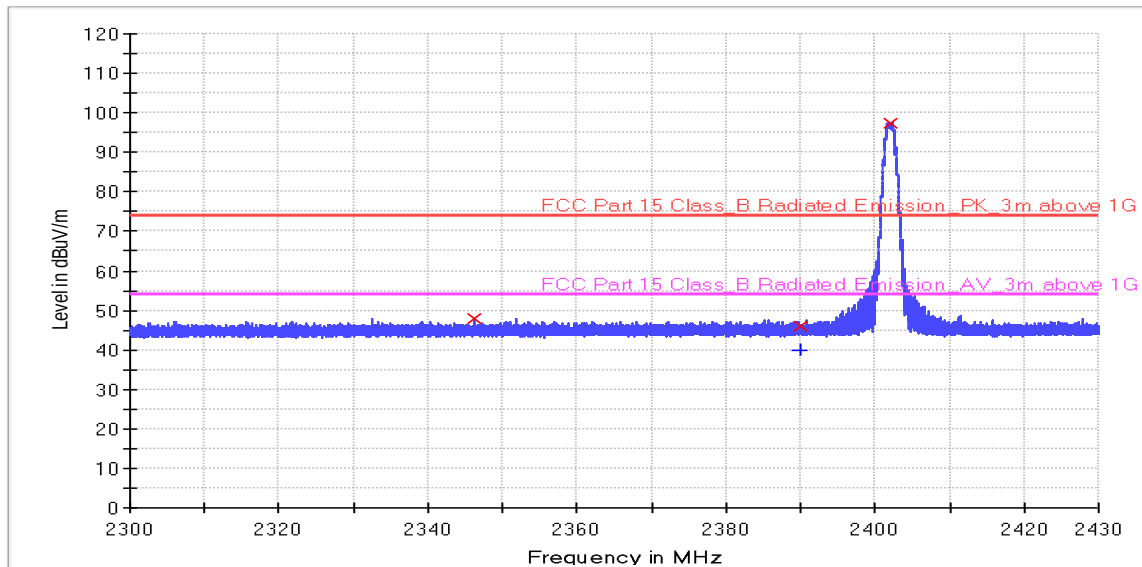
RE\_HF907\_BRF\_Pre



Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2656.000000     | 54.4             | 50.3        | 1000.000        | 241.0       | V   | 152.0         | -9.6         | 19.6         | 74.0        | 3.7         | 54.0       |
| 7205.500000     | 47.9             | 43.3        | 1000.000        | 145.0       | V   | 145.0         | 0.8          | 26.1         | 74.0        | 10.7        | 54.0       |
| 17147.800000    | 54.9             | 50.2        | 1000.000        | 147.0       | V   | 175.0         | 7.3          | 19.1         | 74.0        | 3.8         | 54.0       |

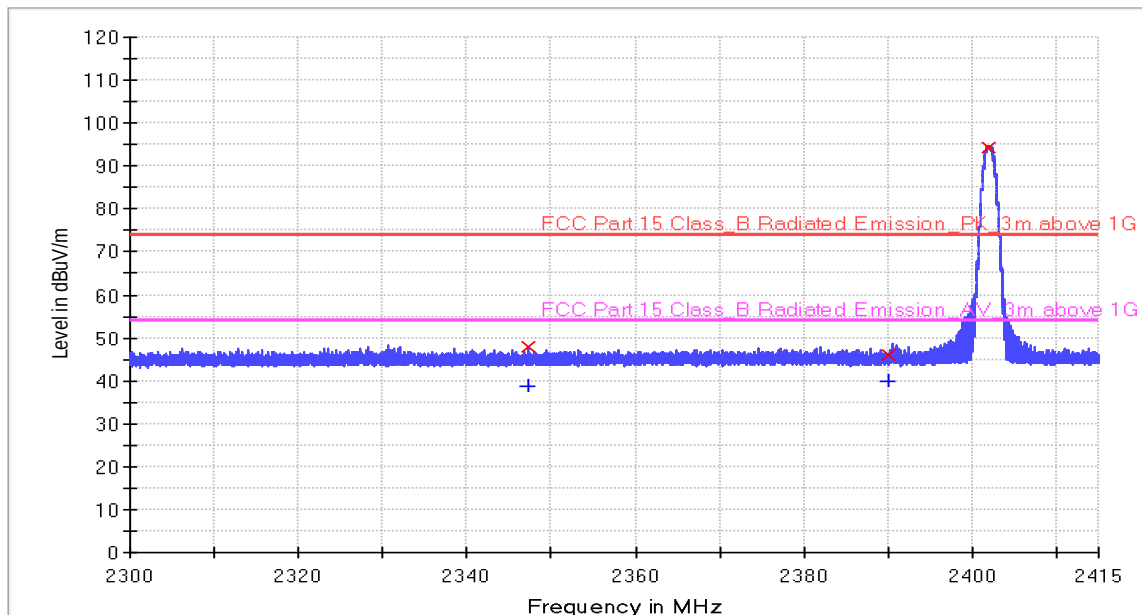
RE\_HF907\_BRF\_Pre



### Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ (dB) | Limit - PK+ (dBuV/) | Margin - AV (dB) | Limit - AV (dBuV/) |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|-------------------|---------------------|------------------|--------------------|
| 2346.312500     | 47.8             | ---         | 1000.000        | 223.0       | H   | 123.0         | -1.0         | 26.2              | 74.0                | ---              | ---                |
| 2390.000000     | 46.0             | 39.8        | 1000.000        | 210.0       | H   | 186.0         | -0.8         | 28.0              | 74.0                | 14.3             | 54.0               |

RE\_HF907\_BRF\_Pre

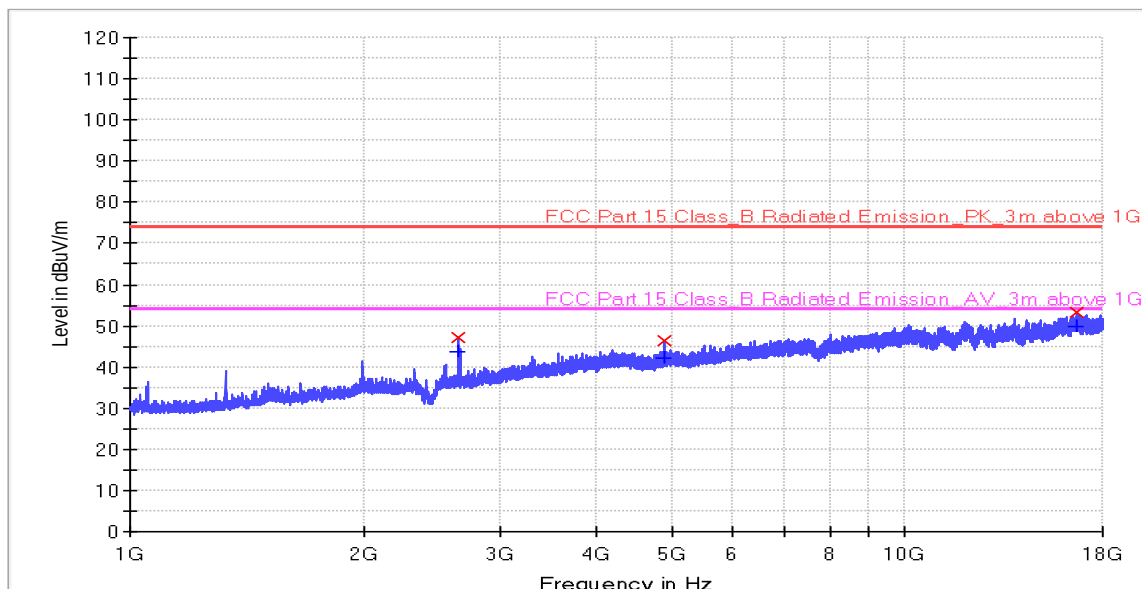


### Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ (dB) | Limit - PK+ (dBuV/) | Margin - AV (dB) | Limit - AV (dBuV/) |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|-------------------|---------------------|------------------|--------------------|
| 2347.198000     | 48.0             | 38.6        | 1000.000        | 192.0       | V   | 115.0         | -1.0         | 26.0              | 74.0                | 15.4             | 54.0               |
| 2390.000000     | 46.1             | 39.7        | 1000.000        | 241.0       | V   | 176.0         | -0.8         | 27.9              | 74.0                | 14.3             | 54.0               |

## Frequency: 2440MHz at 1Mbps

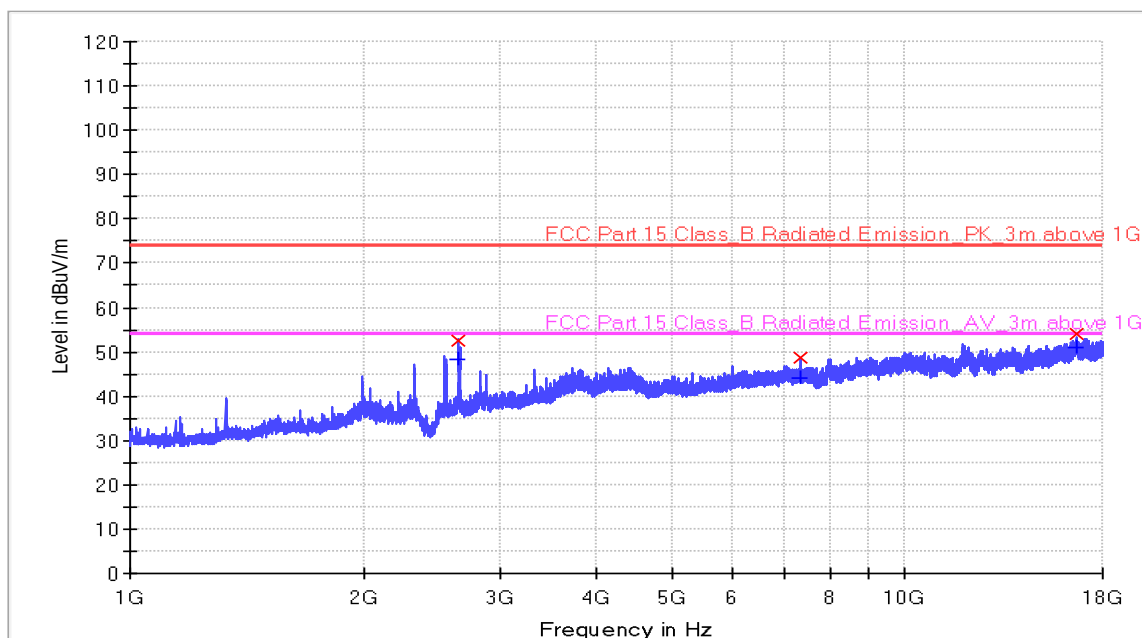
RE\_HF907\_BRF\_Pre



## Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2654.200000     | 47.2             | 43.8        | 1000.000        | 245.0       | H   | 142.0         | -9.6         | 26.8         | 74.0        | 10.3        | 54.0       |
| 4880.200000     | 46.3             | 42.1        | 1000.000        | 113.0       | H   | 175.0         | -2.4         | 27.7         | 74.0        | 11.9        | 54.0       |
| 16655.500000    | 53.4             | 49.9        | 1000.000        | 175.0       | H   | 143.0         | 7.1          | 20.6         | 74.0        | 4.1         | 54.0       |

RE\_HF907\_BRF\_Pre



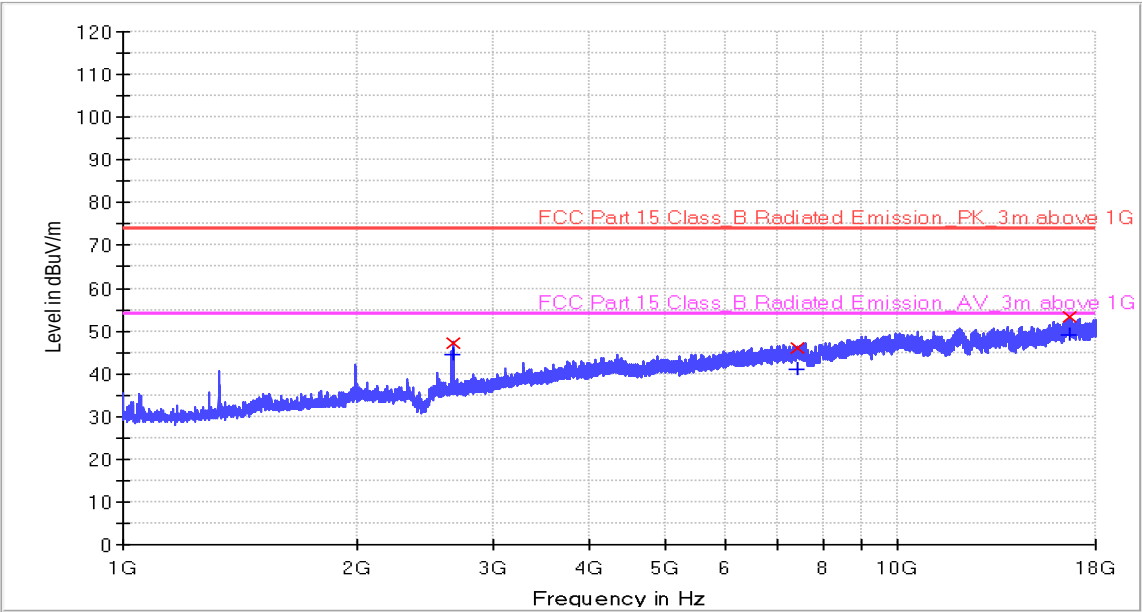
## Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2656.000000     | 52.4             | 48.5        | 1000.000        | 175.0       | V   | 175.0         | -9.6         | 21.6         | 74.0        | 5.5         | 54.0       |
| 7319.200000     | 48.5             | 44.1        | 1000.000        | 147.0       | V   | 225.0         | 0.8          | 25.5         | 74.0        | 9.9         | 54.0       |
| 16665.400000    | 54.0             | 51.0        | 1000.000        | 198.0       | V   | 124.0         | 7.1          | 20.1         | 74.0        | 3.0         | 54.0       |



Frequency:2480MHz at 1Mbps

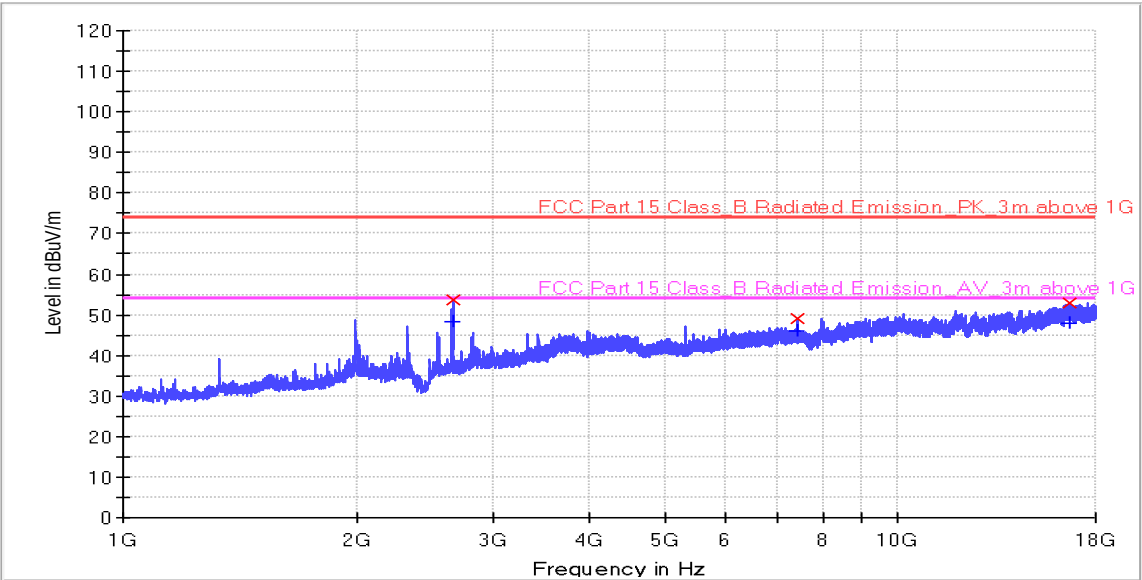
RE\_HF907\_BRF\_Pre



Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2665.900000     | 47.3             | 44.4        | 1000.000        | 178.0       | H   | 177.0         | -9.6         | 26.7         | 74.0        | 9.6         | 54.0       |
| 7440.000000     | 45.9             | 41.1        | 1000.000        | 198.0       | H   | 174.0         | 1.1          | 28.1         | 74.0        | 13.0        | 54.0       |
| 16655.500000    | 53.2             | 49.0        | 1000.000        | 177.0       | H   | 145.0         | 7.1          | 20.8         | 74.0        | 5.0         | 54.0       |

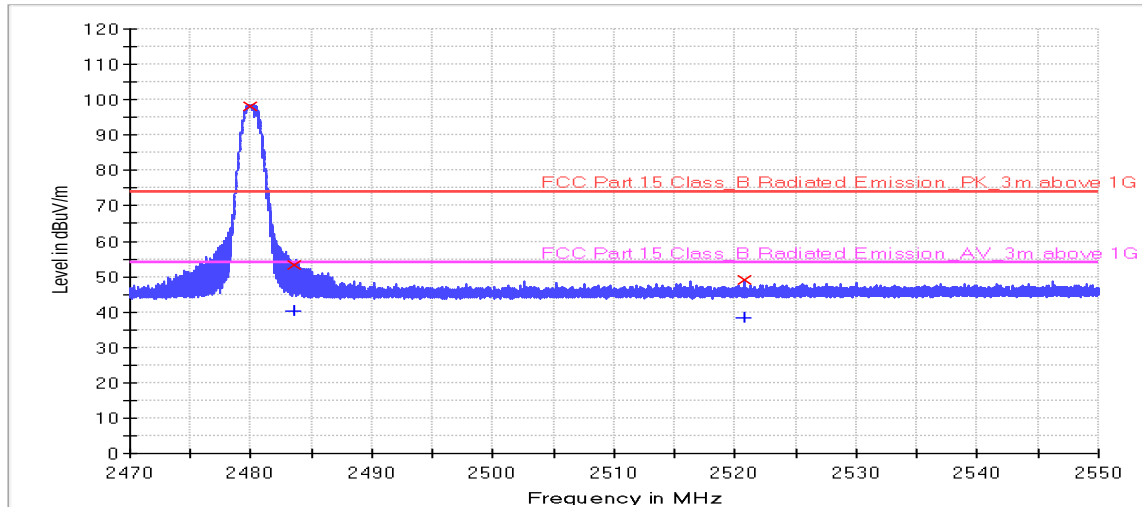
RE\_HF907\_BRF\_Pre



Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ | Limit - PK+ | Margin - AV | Limit - AV |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|--------------|-------------|-------------|------------|
| 2663.200000     | 53.6             | 48.3        | 1000.000        | 175.0       | V   | 147.0         | -9.6         | 20.5         | 74.0        | 5.7         | 54.0       |
| 7439.200000     | 49.1             | 45.9        | 1000.000        | 254.0       | V   | 174.0         | 0.8          | 24.9         | 74.0        | 8.1         | 54.0       |
| 16687.300000    | 52.9             | 48.0        | 1000.000        | 178.0       | V   | 174.0         | 7.2          | 21.1         | 74.0        | 6.0         | 54.0       |

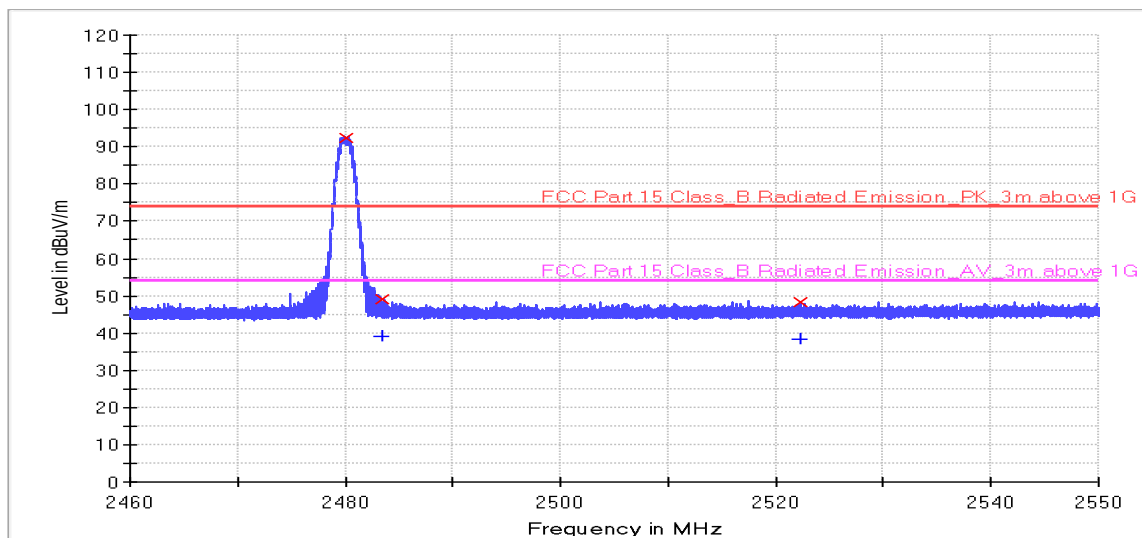
RE\_HF907\_BRF\_Pre



### Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ (dB) | Limit - PK+ (dBuV/) | Margin - AV (dB) | Limit - AV (dBuV/) |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|-------------------|---------------------|------------------|--------------------|
| 2483.500000     | 53.4             | 40.3        | 1000.000        | 101.0       | H   | 168.0         | -0.3         | 20.6              | 74.0                | 13.7             | 54.0               |
| 2520.768000     | 49.0             | 38.4        | 1000.000        | 279.0       | H   | 197.0         | -0.1         | 25.0              | 74.0                | 15.7             | 54.0               |

RE\_HF907\_BRF\_Pre



### Limit and Margin

| Frequency (MHz) | MaxPeak (dBuV/m) | AV (dBuV/m) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Margin - PK+ (dB) | Limit - PK+ (dBuV/) | Margin - AV (dB) | Limit - AV (dBuV/) |
|-----------------|------------------|-------------|-----------------|-------------|-----|---------------|--------------|-------------------|---------------------|------------------|--------------------|
| 2483.500000     | 49.0             | 39.2        | 1000.000        | 219.0       | V   | 139.0         | -0.3         | 25.0              | 74.0                | 14.8             | 54.0               |
| 2522.328000     | 48.3             | 38.4        | 1000.000        | 102.0       | V   | 175.0         | -0.1         | 25.7              | 74.0                | 15.6             | 54.0               |

Remark:

- (1) Emission level= Original Receiver Reading + Correct Factor
- (2) Correct Factor = Antenna Factor + Cable Loss -Amplifier gain
- (3) Margin = limit – Corrected Reading

## 11 Test Equipment List

List of Test Instruments  
Test Site1

|    | DESCRIPTION                          | MANUFACTURER    | MODEL NO.  | SERIAL NO. | CAL. DATE | CAL. DUE DATE |
|----|--------------------------------------|-----------------|------------|------------|-----------|---------------|
| C  | Signal spectrum analyzer             | Agilent         | N9020B     | MY59050168 | 2024-2-19 | 2025-2-18     |
| RE | EMI Test Receiver                    | Rohde & Schwarz | ESR3       | 101906     | 2024-8-1  | 2025-7-31     |
|    | Signal Analyzer                      | Rohde & Schwarz | FSV40      | 101091     | 2024-8-1  | 2025-7-31     |
|    | Trilog Super Broadband Test Antenna  | Schwarzbeck     | VULB 9168  | 961        | 2024-8-30 | 2025-8-29     |
|    | Double-ridged waveguide horn antenna | Rohde & Schwarz | HF907      | 102868     | 2024-4-14 | 2025-4-13     |
|    | Pre-amplifier                        | Shenzhen HzEMC  | HPA-081843 | HYP A23026 | 2024-4-16 | 2025-4-15     |
|    | Loop antenna                         | Rohde & Schwarz | HFH2-Z2    | 100443     | 2024-6-26 | 2025-6-25     |
|    | Double Ridged Horn Antenna           | ETS-Lindgren    | 3116C      | 00246076   | 2023-7-7  | 2026-7-6      |
|    | 3m Semi-anechoic chamber             | TDK             | 9X6X6      | ----       | 2024-5-8  | 2027-5-7      |
| CE | EMI Test Receiver                    | Rohde & Schwarz | ESR3       | 101907     | 2024-8-1  | 2025-7-31     |
|    | LISN                                 | Rohde & Schwarz | ENV216     | 101924     | 2024-8-1  | 2025-7-31     |

| Measurement Software Information |          |                 |           |
|----------------------------------|----------|-----------------|-----------|
| Test Item                        | Software | Manufacturer    | Version   |
| C                                | MTS 8310 | MWRFTtest       | 3.0.0.0   |
| RE                               | EMC 32   | Rohde & Schwarz | V10.50.40 |
| CE                               | EMC 32   | Rohde & Schwarz | V9.15.03  |

### C - Conducted RF tests

- Conducted peak output power
- 6dB bandwidth and 99% Occupied Bandwidth
- Power spectral density
- Spurious RF conducted emissions
- Band edge



12 System Measurement Uncertainty

For a 95% confidence level, the measurement expanded uncertainties for defined systems, in accordance with the recommendations of ISO 17025 were:

| Items                                    | Extended Uncertainty                                                                                                                |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------|
| Conducted Disturbance at Mains Terminals | 150kHz to 30MHz, LISN, 3.16dB                                                                                                       |
| Radiated Disturbance                     | 9kHz to 30MHz, 3.52dB<br>30MHz to 1GHz, 5.03dB (Horizontal)<br>5.12dB (Vertical)<br>1GHz to 18GHz, 5.49dB<br>18GHz to 40GHz, 5.63dB |
| RF Conducted Measurement                 | Power related: 1.16dB<br>Frequency related: 6.00×10 <sup>-8</sup>                                                                   |

Measurement Uncertainty Decision Rule:

Determination of conformity with the specification limits is based on the decision rule according to IEC Guide 115: 2023, clause 4.3.3.



## 13 Photographs of Test Set-ups

Refer to the < Test Setup photos >.



## 14 Photographs of EUT

Refer to the < External Photos > & < Internal Photos >.

-----End of Test Report-----