



# FCC RF Test Report

## (FHSS)

**Applicant:** Hangzhou Roombanker Technology Co., Ltd.

**Address of Applicant:** A#801 Wantong center, Hangzhou, China

### Equipment Under Test (EUT)

**Product Name:** Multi Protocol Host Gateway

**Model No.:** DSGW-291, DSGW-291-X (X:1~18)

**FCC ID:** 2AUXBDSGW-291

**Applicable Standards:** FCC CFR Title 47 Part 15C (§15.247)

**Date of Sample Receipt:** 27 Feb., 2023

**Date of Test:** 28 Feb., to 26 May, 2023

**Date of Report Issued:** 26 Jul., 2023

**Test Result:** PASS

**Tested by:**

June Li

**Date:**

26 Jul., 2023

**Reviewed by:**

Project Engineer

**Date:**

26 Jul., 2023

**Approved by:**

Manager

**Date:**

26 Jul., 2023

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in above the application standard version. Test results reported herein relate only to the item(s) tested.

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## 1 Version

| Version No. | Date          | Description          |
|-------------|---------------|----------------------|
| 00          | 29 May, 2023  | Original             |
| 01          | 20 Jul., 2023 | 1. Updated page 7&17 |
| 02          | 26 Jul., 2023 | 1. Updated page 7&17 |
|             |               |                      |
|             |               |                      |
|             |               |                      |

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### 3 General Information

#### 3.1 Client Information

|               |                                          |
|---------------|------------------------------------------|
| Applicant:    | Hangzhou Roombanker Technology Co., Ltd. |
| Address:      | A#801 Wantong center, Hangzhou, China    |
| Manufacturer: | Hangzhou Roombanker Technology Co., Ltd. |
| Address:      | A#801 Wantong center, Hangzhou, China    |

#### 3.2 General Description of E.U.T.

|                        |                                                                                                                                                                         |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Product Name:          | Multi Protocol Host Gateway                                                                                                                                             |
| Model No.:             | DSGW-291, DSGW-291-X (X:1~18)                                                                                                                                           |
| Operation Frequency:   | 902 MHz - 915 MHz                                                                                                                                                       |
| Number of Channel:     | 64                                                                                                                                                                      |
| Modulation Technology: | LoRa (hybrid system)                                                                                                                                                    |
| Antenna Type:          | External Antenna                                                                                                                                                        |
| Antenna Gain:          | 0.77dBi (declare by applicant)                                                                                                                                          |
| Power Supply:          | DC 12V, 3A                                                                                                                                                              |
| Test Sample Condition: | The test samples were provided in good working order with no visible defects.                                                                                           |
| Remark:                | DSGW-291, DSGW-291-X (X:1~18) were identical inside, the electrical circuit design, layout, components used and internal wiring, with only difference being model name. |

### 3.3 Test Mode and Test Environment

| Test Modes:                                                                                                                                                                                      |                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|
| Non-hopping mode:                                                                                                                                                                                | Keep the EUT in continuous transmitting mode. |
| Hopping mode:                                                                                                                                                                                    | Keep the EUT in hopping mode.                 |
| <b>Remark:</b> For spurious emission of below 1GHz, pre-scan lowest, middle and highest channel, found lowest channel was worse case mode. The report only reflects the test data of worst mode. |                                               |
| Operating Environment:                                                                                                                                                                           |                                               |
| Temperature:                                                                                                                                                                                     | 15°C ~ 35°C                                   |
| Humidity:                                                                                                                                                                                        | 20 % ~ 75 % RH                                |
| Atmospheric Pressure:                                                                                                                                                                            | 1008 mbar                                     |

### 3.4 Description of Test Auxiliary Equipment

|                                                 |
|-------------------------------------------------|
| The EUT has been tested as an independent unit. |
|-------------------------------------------------|

### 3.5 Measurement Uncertainty

| Parameter                                                                                                                                                                                                                                                                                                            | Expanded Uncertainty<br>(Confidence of 95%(U = 2Uc(y))) |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| Radiated Emission (30MHz ~ 1GHz) (3m SAC)                                                                                                                                                                                                                                                                            | 3.8 dB                                                  |
| Radiated Emission (1GHz ~ 18GHz) (3m SAC)                                                                                                                                                                                                                                                                            | 3.6 dB                                                  |
| Radiated Emission (18GHz ~ 40GHz) (3m SAC)                                                                                                                                                                                                                                                                           | 5.34 dB                                                 |
| <b>Note:</b> All the measurement uncertainty value were shown with a coverage k=2 to indicate 95% level of confidence. The measurement data show herein meets or exceeds the CISPR measurement uncertainty values specified in CISPR 16-4-2 and can be compared directly to specified limit to determine compliance. |                                                         |

### 3.6 Additions to, Deviations, or Exclusions From the Method

|    |
|----|
| No |
|----|

### 3.7 Laboratory Facility

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>The test facility is recognized, certified, or accredited by the following organizations:</p> <ul style="list-style-type: none"> <li>● <b>FCC - Designation No.: CN1211</b><br/>JianYan Testing Group Shenzhen Co., Ltd. has been accredited as a testing laboratory by FCC(Federal Communications Commission). The test firm Registration No. is 727551.</li> <li>● <b>ISED – CAB identifier.: CN0021</b><br/>The 3m Semi-anechoic chamber and 10m Semi-anechoic chamber of JianYan Testing Group Shenzhen Co., Ltd. has been Registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing with Registration No.: 10106A-1.</li> <li>● <b>CNAS - Registration No.: CNAS L15527</b><br/>JianYan Testing Group Shenzhen Co., Ltd. is accredited to ISO/IEC 17025:2017 General Requirements for the Competence of Testing and Calibration laboratories for the competence of testing. The Registration No. is CNAS L15527.</li> <li>● <b>A2LA - Registration No.: 4346.01</b><br/>This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017 General requirements for the competence of testing and calibration laboratories. The test scope can be found as below link: <a href="https://portal.a2la.org/scopepdf/4346-01.pdf">https://portal.a2la.org/scopepdf/4346-01.pdf</a></li> </ul> |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 3.8 Laboratory Location

|                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>JianYan Testing Group Shenzhen Co., Ltd.<br/>Address: No.101, Building 8, Innovation Wisdom Port, No.155 Hongtian Road, Huangpu Community, Xinqiao Street, Bao'an District, Shenzhen, Guangdong, People's Republic of China.<br/>Tel: +86-755-23118282, Fax: +86-755-23116366<br/>Email: info-JYTee@lets.com, Website: <a href="http://jyt.lets.com">http://jyt.lets.com</a></p> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

### 3.9 Test Instruments List

| Radiated Emission(3m SAC):    |                 |                 |                    |                      |                          |
|-------------------------------|-----------------|-----------------|--------------------|----------------------|--------------------------|
| Test Equipment                | Manufacturer    | Model No.       | Manage No.         | Cal. Date (mm-dd-yy) | Cal. Due date (mm-dd-yy) |
| 3m SAC                        | ETS             | 9m*6m*6m        | WXJ001-1           | 04-14-2021           | 04-13-2024               |
| Loop Antenna                  | Schwarzbeck     | FMZB 1519 B     | WXJ002-4           | 02-09-2023           | 02-08-2024               |
| BiConiLog Antenna             | Schwarzbeck     | VULB9163        | WXJ002             | 02-09-2023           | 02-08-2024               |
| Horn Antenna                  | Schwarzbeck     | BBHA9120D       | WXJ002-2           | 02-09-2023           | 02-08-2024               |
| Horn Antenna                  | Schwarzbeck     | BBHA9170        | WXJ002-5           | 01-09-2023           | 01-08-2024               |
| Pre-amplifier (30MHz ~ 1GHz)  | Schwarzbeck     | BBV9743B        | WXJ001-2           | 01-10-2023           | 01-09-2024               |
| Pre-amplifier (1GHz ~ 18GHz)  | SKET            | LNPA_0118G-50   | WXJ001-3           | 01-10-2023           | 01-09-2024               |
| Pre-amplifier (18GHz ~ 40GHz) | RF System       | TRLA-180400G45B | WXJ002-7           | 01-11-2023           | 01-10-2024               |
| EMI Test Receiver             | Rohde & Schwarz | ESRP7           | WXJ003-1           | 01-11-2023           | 01-10-2024               |
| Spectrum Analyzer             | Rohde & Schwarz | FSP 30          | WXJ004             | 01-10-2023           | 01-09-2024               |
| Spectrum Analyzer             | KEYSIGHT        | N9010B          | WXJ004-2           | 10-17-2022           | 10-16-2023               |
| Coaxial Cable (30MHz ~ 1GHz)  | JYTSZ           | JYT3M-1G-NN-8M  | WXG001-4           | 01-18-2023           | 01-17-2024               |
| Coaxial Cable (1GHz ~ 18GHz)  | JYTSZ           | JYT3M-18G-NN-8M | WXG001-5           | 01-18-2023           | 01-17-2024               |
| Coaxial Cable (18GHz ~ 40GHz) | JYTSZ           | JYT3M-40G-SS-8M | WXG001-7           | 01-18-2023           | 01-17-2024               |
| Band Reject Filter Group      | Tonscend        | JS0806-F        | WXJ089             | N/A                  |                          |
| Test Software                 | Tonscend        | TS+             | Version: 3.0.0.1   |                      |                          |
| EMI Test Software             | AUDIX           | E3              | Version: 6.110919b |                      |                          |

| Conducted Method: |                 |           |            |                      |                          |
|-------------------|-----------------|-----------|------------|----------------------|--------------------------|
| Test Equipment    | Manufacturer    | Model No. | Manage No. | Cal. Date (mm-dd-yy) | Cal. Due date (mm-dd-yy) |
| Spectrum Analyzer | Rohde & Schwarz | FSP 30    | WXJ004     | 01-10-2023           | 01-09-2024               |
| EMI Test Receiver | Rohde & Schwarz | ESCI3     | WXJ003     | 01-10-2023           | 01-09-2024               |
| Spectrum Analyzer | Keysight        | N9010B    | WXJ004-3   | 10-17-2022           | 10-16-2023               |
| DC Power Supply   | Keysight        | E3642A    | WXJ025-2   | 10-27-2021           | 10-26-2022               |

## 4 Measurement Setup and Procedure

### 4.1 Test Channel

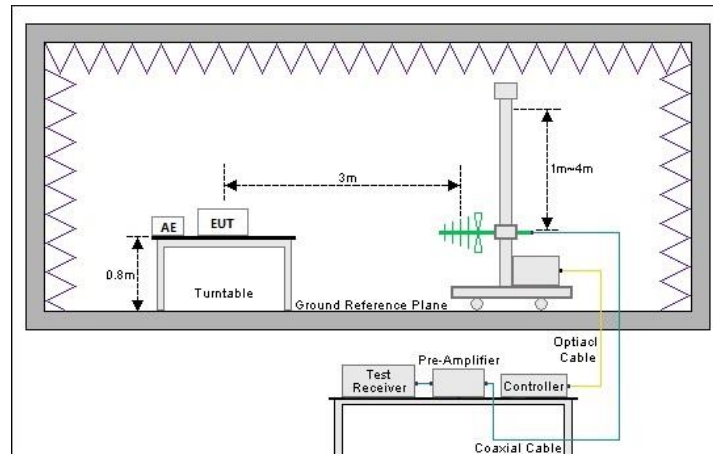
According to ANSI C63.10-2013 chapter 5.6.1 Table 4 requirement, select lowest channel, middle channel, and highest channel in the frequency range in which device operates for testing. The detailed frequency points are as follows:

| Lowest channel |                 | Middle channel |                 | Highest channel |                 |
|----------------|-----------------|----------------|-----------------|-----------------|-----------------|
| Channel No.    | Frequency (MHz) | Channel No.    | Frequency (MHz) | Channel No.     | Frequency (MHz) |
| <b>1</b>       | <b>902.3</b>    | <b>32</b>      | <b>908.5</b>    | 63              | 914.7           |
| 2              | 902.5           | 33             | 908.7           | <b>64</b>       | <b>914.9</b>    |
| 3              | 902.7           | 34             | 908.9           | /               |                 |
| 4              | 902.9           | 35             | 909.1           |                 |                 |
| 5              | 903.1           | 36             | 909.3           |                 |                 |
| 6              | 903.3           | 37             | 909.5           |                 |                 |
| 7              | 903.5           | 38             | 909.7           |                 |                 |
| 8              | 903.7           | 39             | 909.9           |                 |                 |
| 9              | 903.9           | 40             | 910.1           |                 |                 |
| 10             | 904.1           | 41             | 910.3           |                 |                 |
| 11             | 904.3           | 42             | 910.5           |                 |                 |
| 12             | 904.5           | 43             | 910.7           |                 |                 |
| 13             | 904.7           | 44             | 910.9           |                 |                 |
| 14             | 904.9           | 45             | 911.1           |                 |                 |
| 15             | 905.1           | 46             | 911.3           |                 |                 |
| 16             | 905.3           | 47             | 911.5           |                 |                 |
| 17             | 905.5           | 48             | 911.7           |                 |                 |
| 18             | 905.7           | 49             | 911.9           |                 |                 |
| 19             | 905.9           | 50             | 912.1           |                 |                 |
| 20             | 906.1           | 51             | 912.3           |                 |                 |
| 21             | 906.3           | 52             | 912.5           |                 |                 |
| 22             | 906.5           | 53             | 912.7           |                 |                 |
| 23             | 906.7           | 54             | 912.9           |                 |                 |
| 24             | 906.9           | 55             | 913.1           |                 |                 |
| 25             | 907.1           | 56             | 913.3           |                 |                 |
| 26             | 907.3           | 57             | 913.5           |                 |                 |
| 27             | 907.5           | 58             | 913.7           |                 |                 |
| 28             | 907.7           | 59             | 913.9           |                 |                 |
| 29             | 907.9           | 60             | 914.1           |                 |                 |
| 30             | 908.1           | 61             | 914.3           |                 |                 |
| 31             | 908.3           | 62             | 914.5           |                 |                 |

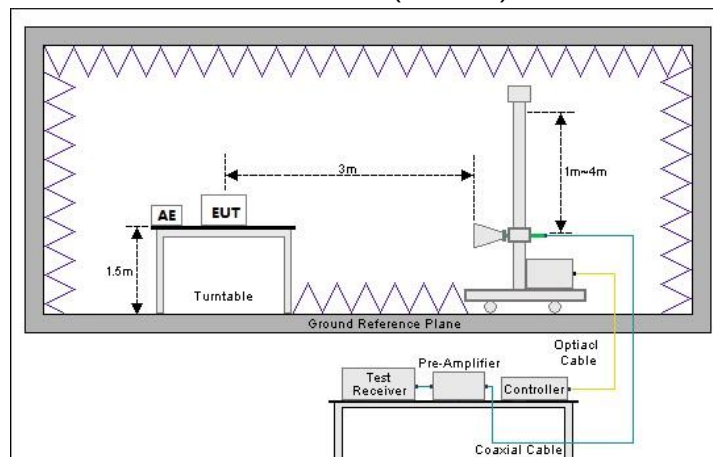
## 4.2 Test Setup

### 1) Radiated emission measurement:

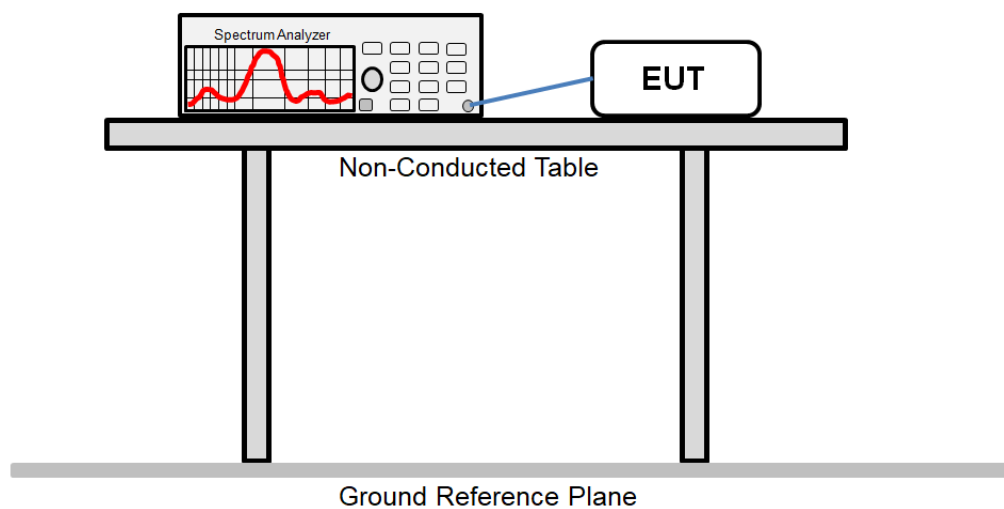
Below 1GHz (3m SAC)



Above 1GHz (3m SAC)



### 2) Conducted test method



### 4.3 Test Procedure

| Test method           | Test step                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|-----------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Radiated emission     | <p><b>For below 1GHz:</b></p> <ol style="list-style-type: none"> <li>The EUT was placed on the tabletop of a rotating table 0.8 m the ground at a 3 m semi anechoic chamber. The measurement distance from the EUT to the receiving antenna is 3 m.</li> <li>EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.</li> <li>Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.</li> </ol> <p><b>For above 1GHz:</b></p> <ol style="list-style-type: none"> <li>The EUT was placed on the tabletop of a rotating table 1.5 m the ground at a 3 m fully anechoic room. The measurement distance from the EUT to the receiving antenna is 3 m.</li> <li>EUT works in each mode of operation that needs to be tested, and having the EUT continuously working, respectively on 3 axis (X, Y &amp; Z) and considered typical configuration to obtain worst position. The highest signal levels relative to the limit shall be determined by rotating the EUT from 0° to 360° and with varying the measurement antenna height between 1 m and 4 m in vertical and horizontal polarizations.</li> <li>Open the test software to control the test antenna and test turntable. Perform the test, save the test results, and export the test data.</li> </ol> |
| Conducted test method | <ol style="list-style-type: none"> <li>The antenna port of EUT was connected to the test port of the test system through an RF cable.</li> <li>The EUT is keeping in continuous transmission mode and tested in all modulation modes.</li> <li>Open the test software, prepare a test plan, and control the system through the software. After the test is completed, the test report is exported through the test software.</li> </ol>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

## 5 Test Results

### 5.1 Summary

#### 5.1.1 Clause and data summary

| Test items                                                                                                                                                                                                                                                   | Standard clause                                                | Test data       | Result |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------|-----------------|--------|
| Antenna Requirement                                                                                                                                                                                                                                          | 15.203<br>15.247 (b)(4)                                        | See Section 5.2 | Pass   |
| AC Power Line Conducted Emission                                                                                                                                                                                                                             | 15.207                                                         | N/A             | N/A    |
| Conducted Output Power                                                                                                                                                                                                                                       | 15.247 (b)(2)                                                  | See Section 5.3 | Pass   |
| 20dB Occupied Bandwidth                                                                                                                                                                                                                                      | 15.247 (a)(1)(i)                                               | See Section 5.4 | Pass   |
| Carrier Frequencies Separation                                                                                                                                                                                                                               | 15.247 (a)(1)                                                  | See Section 5.5 | Pass   |
| Hopping Channel Number                                                                                                                                                                                                                                       | 5.247 (a)(1)(i)                                                | See Section 5.6 | Pass   |
| Dwell Time                                                                                                                                                                                                                                                   | 15.247 (a)(1)(i)                                               | See Section 5.7 | Pass   |
| Spurious Emission                                                                                                                                                                                                                                            | 15.205<br>15.209<br>15.247 (d)                                 | See Section 5.8 | Pass   |
| <b>Remark:</b><br>1. Pass: The EUT complies with the essential requirements in the standard.<br>2. N/A: Not Applicable.<br>3. The cable insertion loss used by "RF Output Power" and other conduction measurement items is 0.5dB (provided by the customer). |                                                                |                 |        |
| <b>Test Method:</b>                                                                                                                                                                                                                                          | ANSI C63.10-2013<br>KDB 558074 D01 15.247 Meas Guidance v05r02 |                 |        |

### 5.1.2 Test Limit

| Test items                                                              | Limit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
|-------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|--|----------|------|-------|---------|------|------|------------|----------|------|------|------------|-----------|------|------|------------|------------|------|------|------------|-----------|---------------------|--|---------|-------|-------------|------|------|
| Conducted Output Power                                                  | For frequency hopping systems operating in the 902-928 MHz band: 1 watt for systems employing at least 50 hopping channels; and, 0.25 watts for systems employing less than 50 hopping channels, but at least 25 hopping channels, as permitted under paragraph (a)(1)(i) of this section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| 20dB Occupied Bandwidth<br><br>Hopping Channel Number<br><br>Dwell Time | For frequency hopping systems operating in the 902-928 MHz band: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 20 second period; if the 20 dB bandwidth of the hopping channel is 250 kHz or greater, the system shall use at least 25 hopping frequencies and the average time of occupancy on any frequency shall not be greater than 0.4 seconds within a 10 second period. The maximum allowed 20 dB bandwidth of the hopping channel is 500 kHz.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| Carrier Frequencies Separation                                          | Frequency hopping systems shall have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| Spurious Emission                                                       | <p>In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a) (see §15.205(c)):</p> <table><tr><th rowspan="2">Frequency (MHz)</th><th colspan="2">Limit (dBµV/m)</th><th rowspan="2">Detector</th></tr><tr><th>@ 3m</th><th>@ 10m</th></tr><tr><td>30 – 88</td><td>40.0</td><td>30.0</td><td>Quasi-peak</td></tr><tr><td>88 – 216</td><td>43.5</td><td>33.5</td><td>Quasi-peak</td></tr><tr><td>216 – 960</td><td>46.0</td><td>36.0</td><td>Quasi-peak</td></tr><tr><td>960 – 1000</td><td>54.0</td><td>44.0</td><td>Quasi-peak</td></tr></table> <p><b>Note:</b> The more stringent limit applies at transition frequencies.</p> <table><tr><th rowspan="2">Frequency</th><th colspan="2">Limit (dBµV/m) @ 3m</th></tr><tr><th>Average</th><th>Peake</th></tr><tr><td>Above 1 GHz</td><td>54.0</td><td>74.0</td></tr></table> <p><b>Note:</b> The measurement bandwidth shall be 1 MHz or greater.</p> | Frequency (MHz) | Limit (dBµV/m) |  | Detector | @ 3m | @ 10m | 30 – 88 | 40.0 | 30.0 | Quasi-peak | 88 – 216 | 43.5 | 33.5 | Quasi-peak | 216 – 960 | 46.0 | 36.0 | Quasi-peak | 960 – 1000 | 54.0 | 44.0 | Quasi-peak | Frequency | Limit (dBµV/m) @ 3m |  | Average | Peake | Above 1 GHz | 54.0 | 74.0 |
| Frequency (MHz)                                                         | Limit (dBµV/m)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Detector       |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
|                                                                         | @ 3m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | @ 10m           |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| 30 – 88                                                                 | 40.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 30.0            | Quasi-peak     |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| 88 – 216                                                                | 43.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 33.5            | Quasi-peak     |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| 216 – 960                                                               | 46.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 36.0            | Quasi-peak     |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| 960 – 1000                                                              | 54.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 44.0            | Quasi-peak     |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| Frequency                                                               | Limit (dBµV/m) @ 3m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
|                                                                         | Average                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Peake           |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |
| Above 1 GHz                                                             | 54.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 74.0            |                |  |          |      |       |         |      |      |            |          |      |      |            |           |      |      |            |            |      |      |            |           |                     |  |         |       |             |      |      |

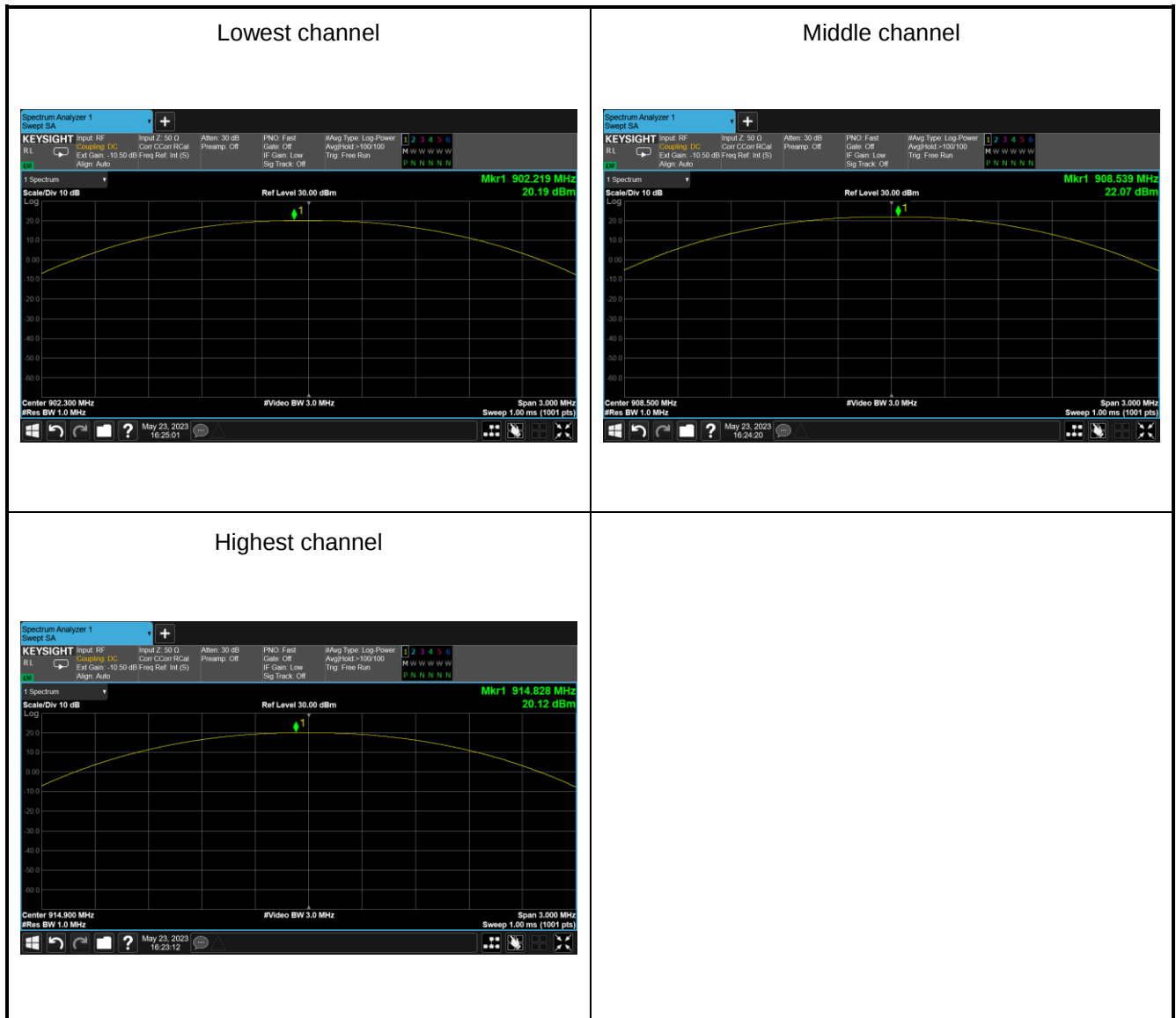
## 5.2 Antenna Requirement

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                       |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|
| <b>Standard requirement:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | FCC Part 15 C Section 15.203 & 247(b) |
| <p>15.203 requirement:<br/>An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> <p>15.247(b) (4) requirement:<br/>(4) The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.</p> |                                       |
| <b>E.U.T Antenna:</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                       |
| <p>The EUT antenna is an external antenna which permanently attached, and the best case gain of the antenna is 0.77 dBi. See product internal photos for details.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                       |

### 5.3 Conducted Output Power

| Test channel    | Maximum Output Power (dBm) | Limit (dBm) | Result |
|-----------------|----------------------------|-------------|--------|
| Lowest channel  | 20.19                      | 30.00       | Pass   |
| Middle channel  | 22.07                      | 30.00       | Pass   |
| Highest channel | 20.12                      | 30.00       | Pass   |

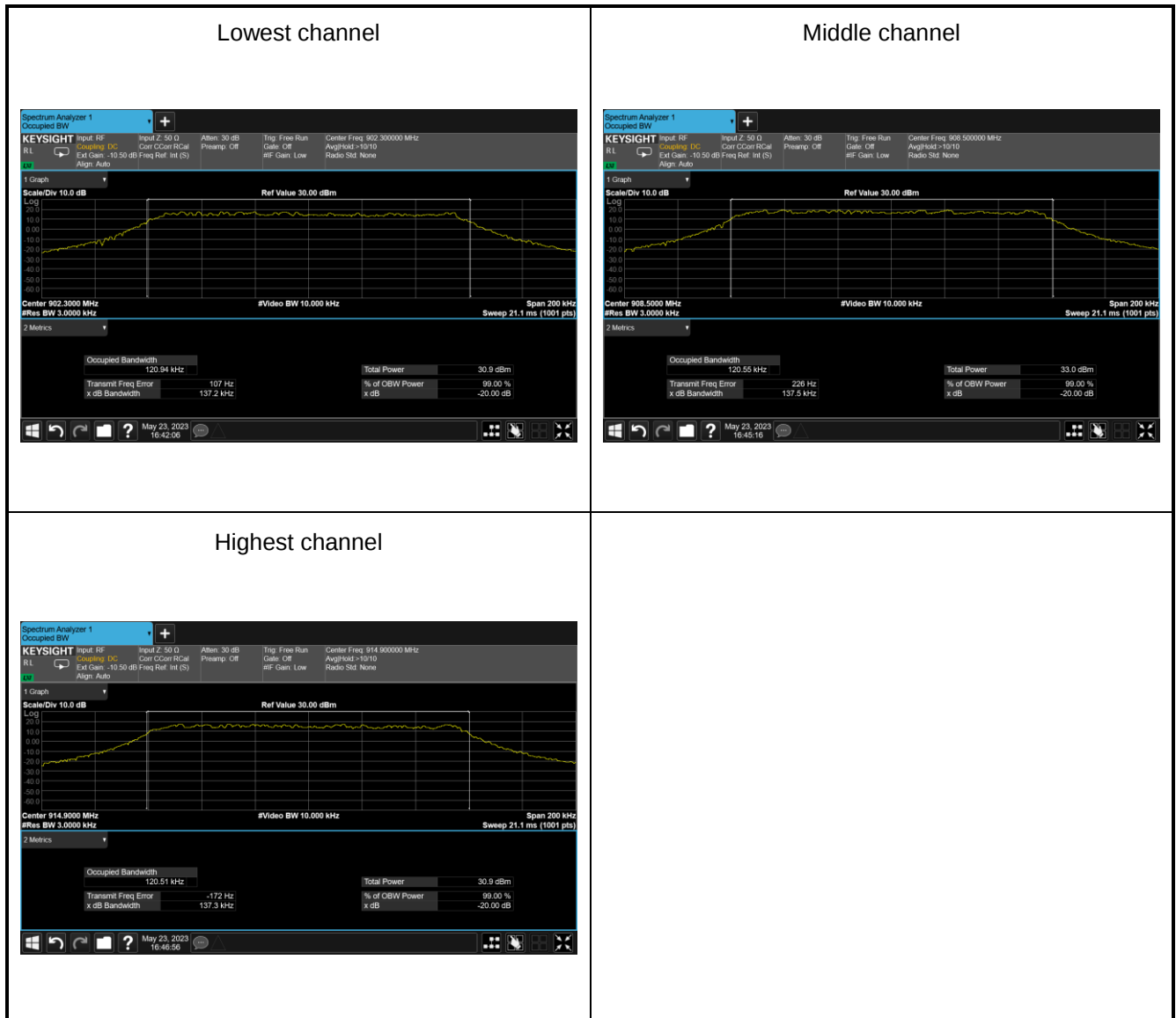
Test plot as follows:



## 5.4 20dB Occupied Bandwidth

| Test channel    | 20dB Occupy Bandwidth (kHz) |
|-----------------|-----------------------------|
| Lowest channel  | 137.2                       |
| Middle channel  | 137.5                       |
| Highest channel | 137.3                       |

Test plot as follows:



## 5.5 Carrier Frequencies Separation

| Test channel    | Carrier Frequencies Separation (kHz) | Limit (kHz) | Result |
|-----------------|--------------------------------------|-------------|--------|
| Lowest channel  | 209.5                                | 137.2       | Pass   |
| Middle channel  | 200.0                                | 137.5       | Pass   |
| Highest channel | 201.0                                | 137.3       | Pass   |

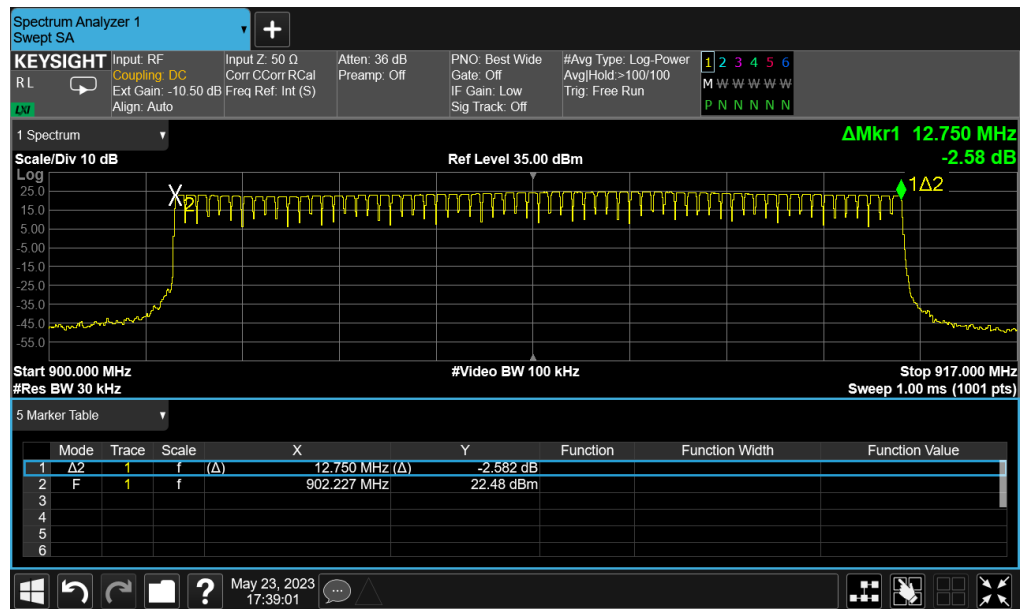
Test plot as follows:



## 5.6 Hopping Channel Number

| Hopping channel numbers | Limit            | Result |
|-------------------------|------------------|--------|
| 64                      | $N_{ch} \geq 50$ | Pass   |

**Test plot as follows:**



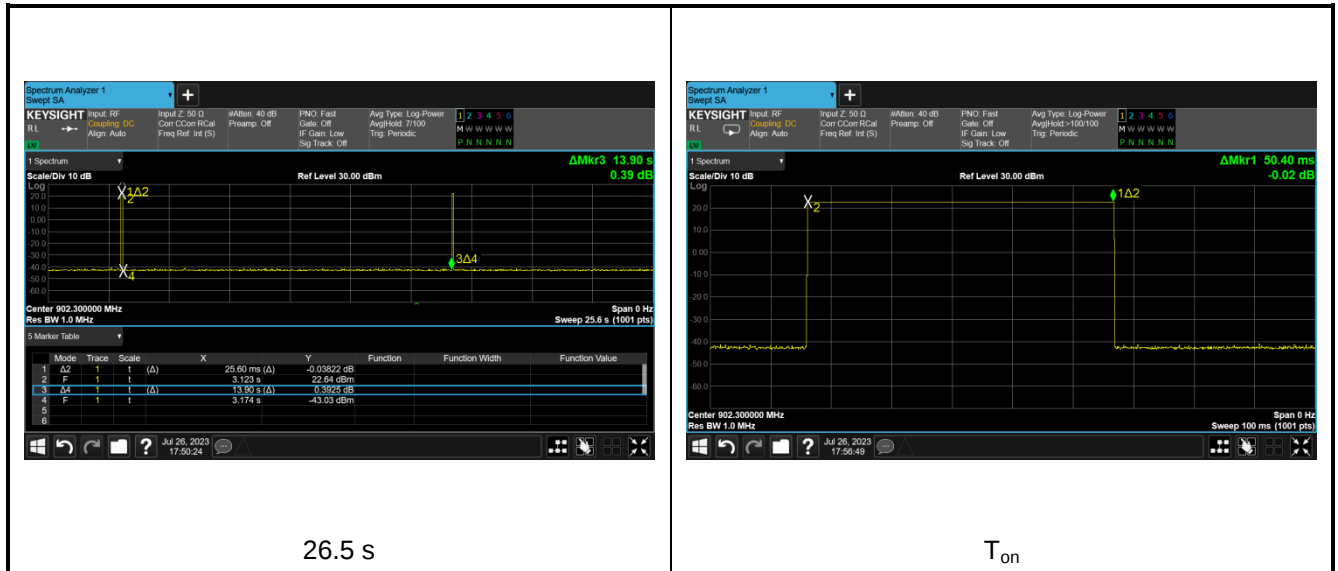
## 5.7 Dwell Time

| $T_{on}$<br>(s) | Hopping numbers | Dwell time<br>(s) | Limit<br>(s) | Result |
|-----------------|-----------------|-------------------|--------------|--------|
| 0.0504          | 2               | 0.1008            | 0.4          | Pass   |

**Note:**

- $T_{on}$  is time per hop.
- Dwell time =  $T_{on} * \text{Hopping numbers}$ .

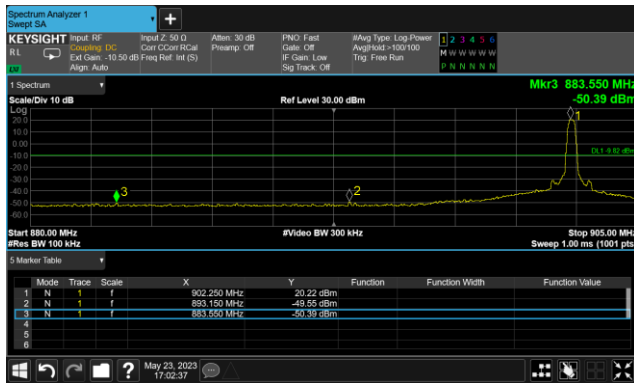
Test plot as follows:



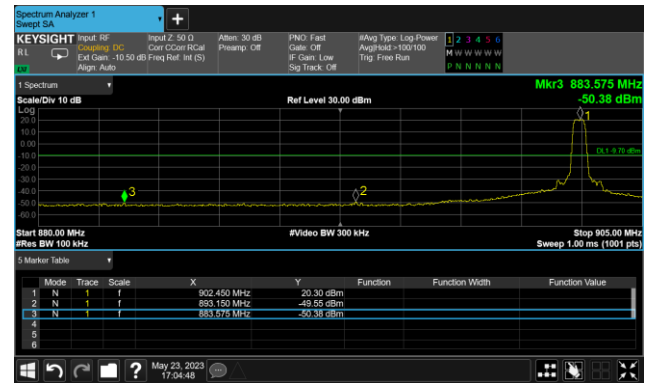
## 5.8 Spurious Emission

### 5.8.1 Band-edge Emission

Lowest Channel

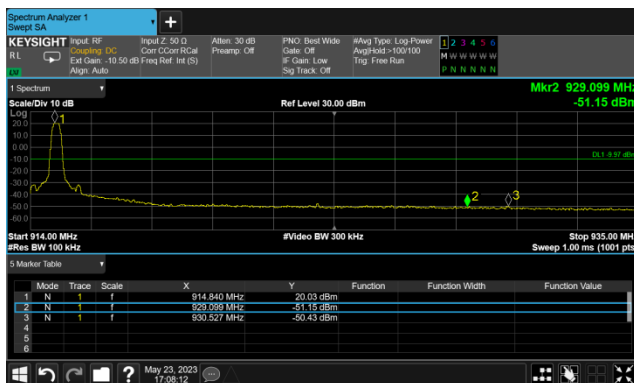


No-hopping mode

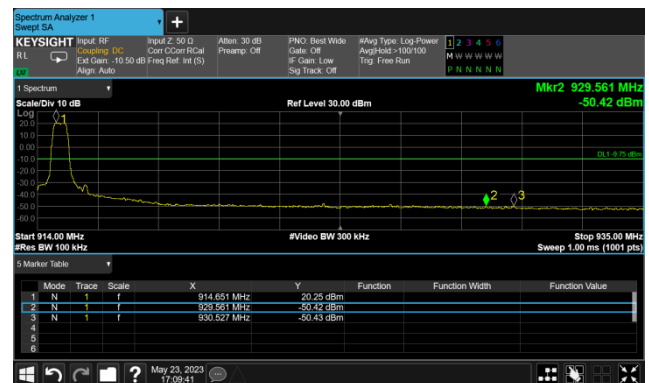


Hopping mode

Highest Channel



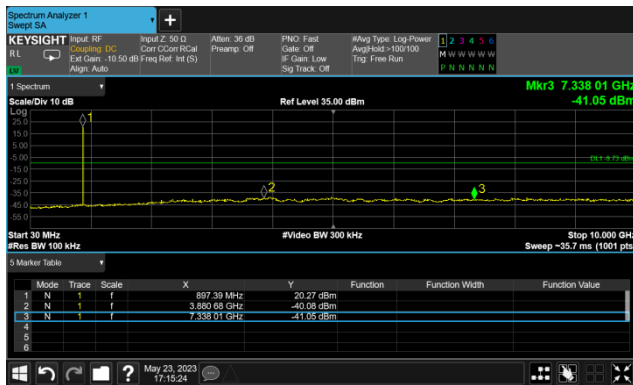
No-hopping mode



Hopping mode

## 5.8.2 Conducted Spurious Emission

Lowest channel



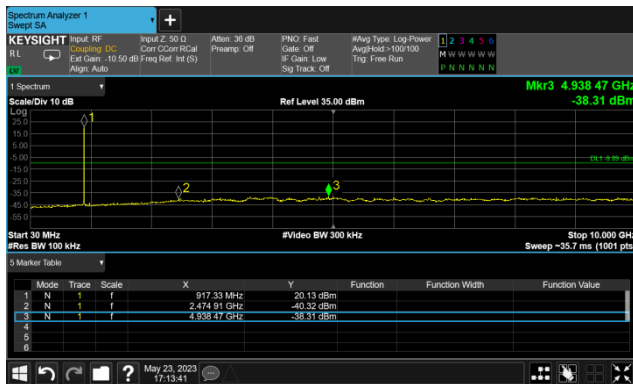
30MHz~10GHz

Middle channel



30MHz~10GHz

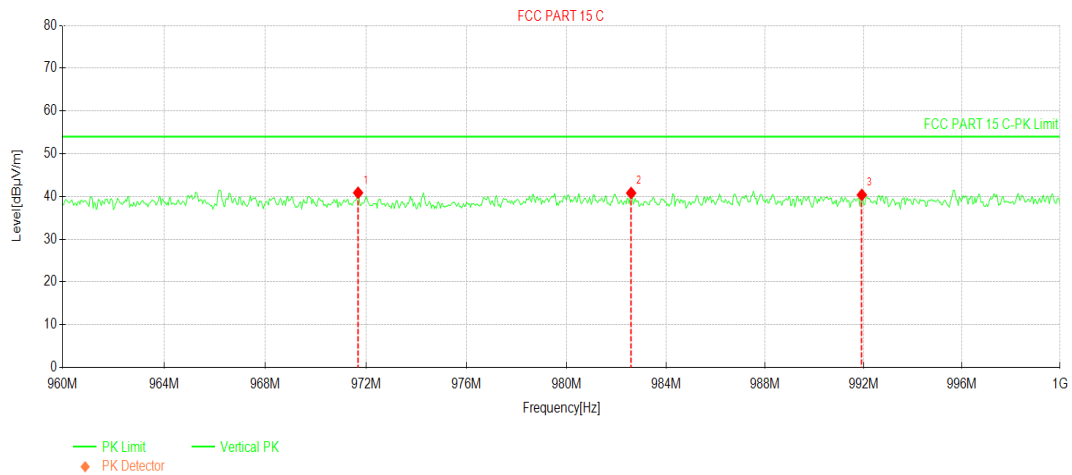
Highest channel



30MHz~10GHz

### 5.8.3 Emissions in Restricted Frequency Bands

|               |                             |                |                     |
|---------------|-----------------------------|----------------|---------------------|
| Product Name: | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:      | June                        | Test mode:     | Tx mode             |
| Test Channel: | Lowest channel              | Polarization:  | Vertical            |
| Test Voltage: | DC 12V                      |                |                     |



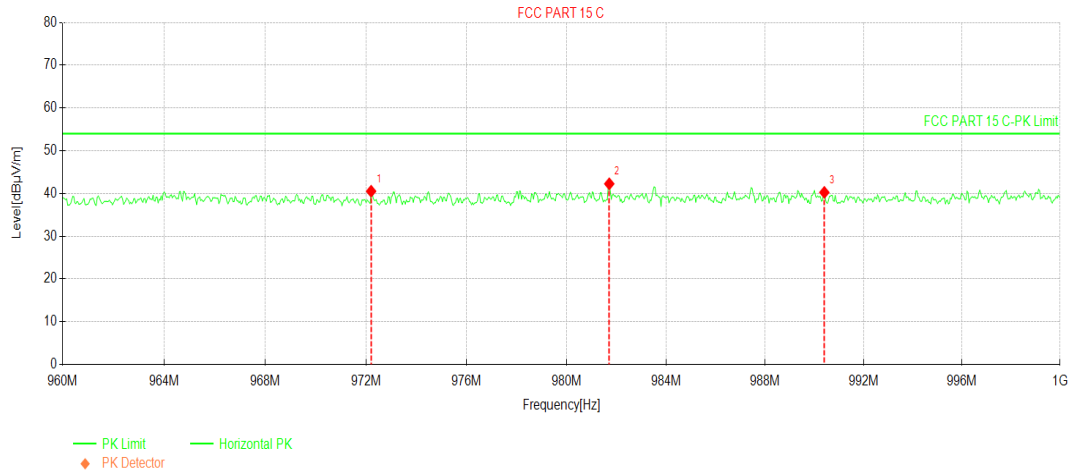
#### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|----------|
| 1   | 971.680     | 15.04            | 40.85          | 25.81       | 54.00          | 13.15       | PK    | Vertical |
| 2   | 982.600     | 14.78            | 40.79          | 26.01       | 54.00          | 13.21       | PK    | Vertical |
| 3   | 991.920     | 14.14            | 40.35          | 26.21       | 54.00          | 13.65       | PK    | Vertical |

#### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

|               |                             |                |                     |
|---------------|-----------------------------|----------------|---------------------|
| Product Name: | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:      | June                        | Test mode:     | Tx mode             |
| Test Channel: | Lowest channel              | Polarization:  | Horizontal          |
| Test Voltage: | DC 12V                      |                |                     |



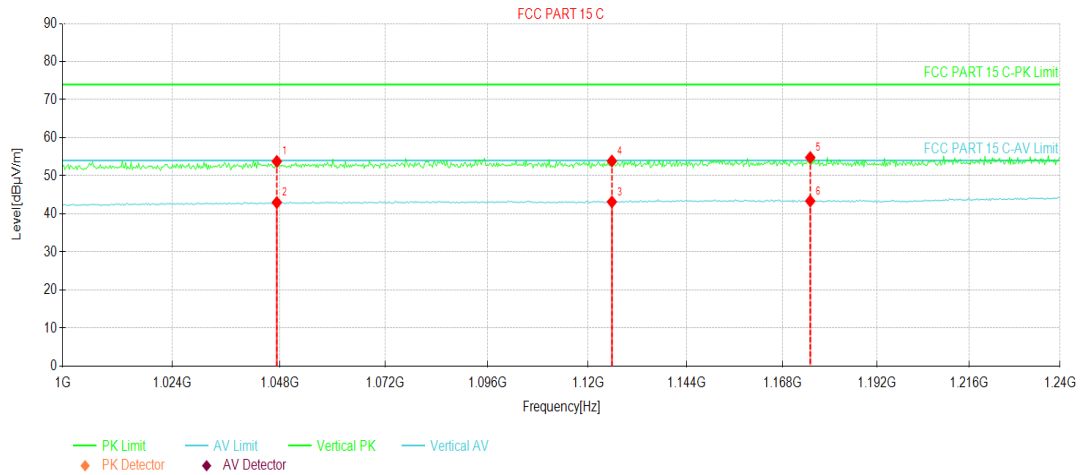
#### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|------------|
| 1   | 972.200     | 14.69            | 40.51          | 25.82       | 54.00          | 13.49       | PK    | Horizontal |
| 2   | 981.720     | 16.26            | 42.25          | 25.99       | 54.00          | 11.75       | PK    | Horizontal |
| 3   | 990.400     | 14.03            | 40.24          | 26.21       | 54.00          | 13.76       | PK    | Horizontal |

#### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

|               |                             |                |                     |
|---------------|-----------------------------|----------------|---------------------|
| Product Name: | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:      | June                        | Test mode:     | Tx mode             |
| Test Channel: | Highest channel             | Polarization:  | Vertical            |
| Test Voltage: | DC 12V                      |                |                     |



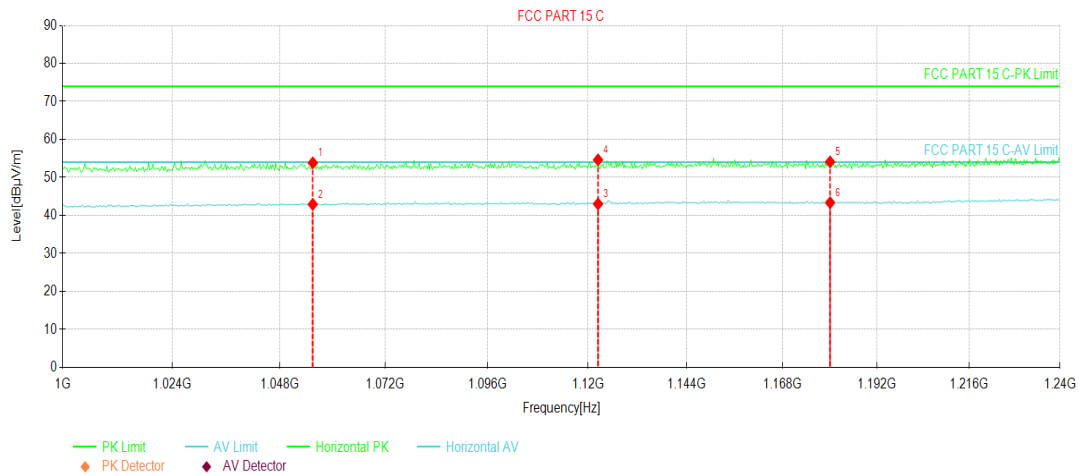
#### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|----------|
| 1   | 1047.28     | 24.14            | 53.78          | 29.64       | 74.00          | 20.22       | PK    | Vertical |
| 2   | 1047.28     | 13.34            | 42.98          | 29.64       | 54.00          | 11.02       | AV    | Vertical |
| 3   | 1125.76     | 12.91            | 43.14          | 30.23       | 54.00          | 10.86       | AV    | Vertical |
| 4   | 1125.76     | 23.64            | 53.87          | 30.23       | 74.00          | 20.13       | PK    | Vertical |
| 5   | 1174.96     | 24.52            | 54.80          | 30.28       | 74.00          | 19.20       | PK    | Vertical |
| 6   | 1174.96     | 13.09            | 43.37          | 30.28       | 54.00          | 10.63       | AV    | Vertical |

#### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

|               |                             |                |                     |
|---------------|-----------------------------|----------------|---------------------|
| Product Name: | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:      | June                        | Test mode:     | Tx mode             |
| Test Channel: | Highest channel             | Polarization:  | Horizontal          |
| Test Voltage: | DC 12V                      |                |                     |



#### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|------------|
| 1   | 1055.44     | 24.13            | 53.82          | 29.69       | 74.00          | 20.18       | PK    | Horizontal |
| 2   | 1055.44     | 13.23            | 42.92          | 29.69       | 54.00          | 11.08       | AV    | Horizontal |
| 3   | 1122.40     | 12.83            | 43.03          | 30.20       | 54.00          | 10.97       | AV    | Horizontal |
| 4   | 1122.40     | 24.43            | 54.63          | 30.20       | 74.00          | 19.37       | PK    | Horizontal |
| 5   | 1180.00     | 23.85            | 54.09          | 30.24       | 74.00          | 19.91       | PK    | Horizontal |
| 6   | 1180.00     | 13.12            | 43.36          | 30.24       | 54.00          | 10.64       | AV    | Horizontal |

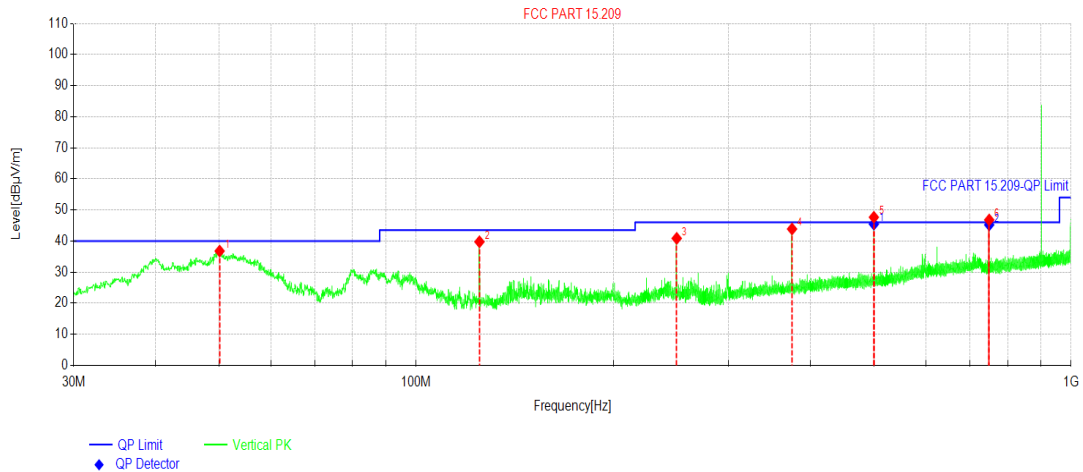
#### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

## 5.8.4 Emissions in Non-restricted Frequency Bands

Below 1GHz:

|                 |                             |                |                     |
|-----------------|-----------------------------|----------------|---------------------|
| Product Name:   | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:        | June                        | Test mode:     | Tx mode             |
| Test Frequency: | 30 MHz ~ 1 GHz              | Polarization:  | Vertical            |
| Test Voltage:   | DC 12V                      |                |                     |



### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|----------|
| 1   | 50.1275     | 49.41            | 36.79          | -12.62      | 40.00          | 3.21        | PK    | Vertical |
| 2   | 124.963     | 57.32            | 39.77          | -17.55      | 43.50          | 3.73        | PK    | Vertical |
| 3   | 249.996     | 54.35            | 40.86          | -13.49      | 46.00          | 5.14        | PK    | Vertical |
| 4   | 374.980     | 54.67            | 43.89          | -10.78      | 46.00          | 2.11        | PK    | Vertical |
| 5   | 499.965     | 56.62            | 47.66          | -8.96       | 46.00          | -1.66       | PK    | Vertical |
| 6   | 749.982     | 50.74            | 46.80          | -3.94       | 46.00          | -0.80       | PK    | Vertical |

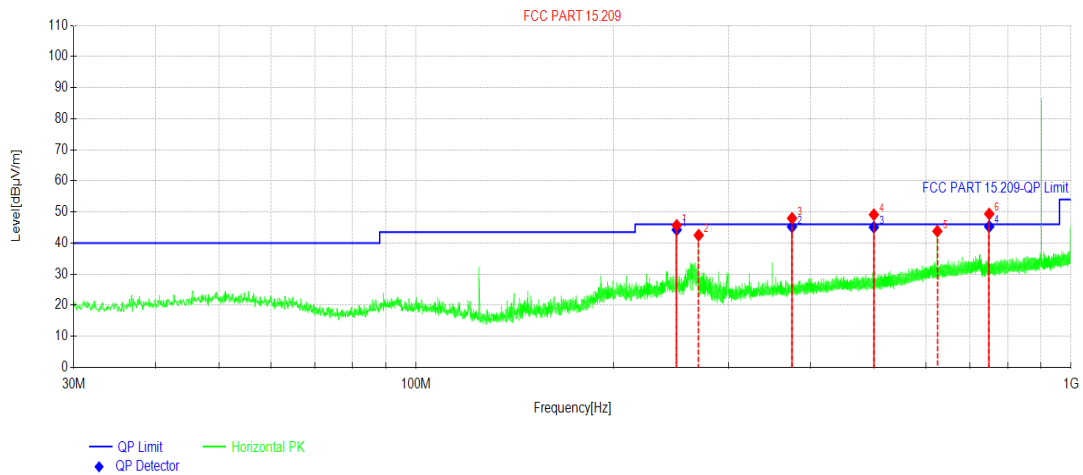
### Final Data List

| NO. | Freq. [MHz] | Factor [dB] | QP Value [dBμV/m] | QP Limit [dBμV/m] | QP Margin [dB] | QP Reading [dBμV/m] | Angle [°] | Verdict |
|-----|-------------|-------------|-------------------|-------------------|----------------|---------------------|-----------|---------|
| 1   | 499.965     | -8.96       | 45.45             | 46.00             | 0.55           | 54.41               | 204       | PASS    |
| 2   | 749.982     | -3.94       | 45.22             | 46.00             | 0.78           | 49.16               | 204       | PASS    |

### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

|                 |                             |                |                     |
|-----------------|-----------------------------|----------------|---------------------|
| Product Name:   | Multi Protocol Host Gateway | Product Model: | DSGW-291-X (X:1~18) |
| Test By:        | June                        | Test mode:     | Tx mode             |
| Test Frequency: | 30 MHz ~ 1 GHz              | Polarization:  | Horizontal          |
| Test Voltage:   | DC 12V                      |                |                     |



#### Suspected Data List

| NO. | Freq. [MHz] | Reading [dBμV/m] | Level [dBμV/m] | Factor [dB] | Limit [dBμV/m] | Margin [dB] | Trace | Polarity   |
|-----|-------------|------------------|----------------|-------------|----------------|-------------|-------|------------|
| 1   | 249.996     | 59.20            | 45.71          | -13.49      | 46.00          | 0.29        | PK    | Horizontal |
| 2   | 270.026     | 55.91            | 42.53          | -13.38      | 46.00          | 3.47        | PK    | Horizontal |
| 3   | 374.980     | 58.73            | 47.95          | -10.78      | 46.00          | -1.95       | PK    | Horizontal |
| 4   | 499.965     | 58.09            | 49.13          | -8.96       | 46.00          | -3.13       | PK    | Horizontal |
| 5   | 624.998     | 50.03            | 43.81          | -6.22       | 46.00          | 2.19        | PK    | Horizontal |
| 6   | 749.934     | 53.31            | 49.37          | -3.94       | 46.00          | -3.37       | PK    | Horizontal |

#### Final Data List

| NO. | Freq. [MHz] | Factor [dB] | QP Value [dBμV/m] | QP Limit [dBμV/m] | QP Margin [dB] | QP Reading [dBμV/m] | Angle [°] | Verdict |
|-----|-------------|-------------|-------------------|-------------------|----------------|---------------------|-----------|---------|
| 1   | 249.996     | -13.49      | 44.27             | 46.00             | 1.73           | 57.76               | 166       | PASS    |
| 2   | 374.980     | -10.78      | 45.23             | 46.00             | 0.77           | 56.01               | 217       | PASS    |
| 3   | 499.965     | -8.96       | 45.08             | 46.00             | 0.92           | 54.04               | 23        | PASS    |
| 4   | 749.934     | -3.94       | 45.31             | 46.00             | 0.69           | 49.25               | 125       | PASS    |

#### Remark:

1. Level = Reading + FactorAntenna Factor + Cable Loss – Preamplifier Factor).

**Above 1GHz:**

| Lowest channel                  |                   |            |                |                |             |              |
|---------------------------------|-------------------|------------|----------------|----------------|-------------|--------------|
| Peak Value                      |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1804.60                         | 62.99             | -9.60      | 53.39          | 74.00          | 20.61       | Vertical     |
| 1804.60                         | 57.77             | -9.60      | 48.17          | 74.00          | 25.83       | Horizontal   |
| Average Value                   |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1804.60                         | 56.28             | -9.60      | 46.68          | 54.00          | 7.32        | Vertical     |
| 1804.60                         | 50.84             | -9.60      | 41.24          | 54.00          | 12.76       | Horizontal   |
| Middle channel                  |                   |            |                |                |             |              |
| Peak Value                      |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1817.00                         | 62.92             | -9.04      | 53.88          | 74.00          | 20.12       | Vertical     |
| 1817.00                         | 57.54             | -9.04      | 48.50          | 74.00          | 25.50       | Horizontal   |
| Average Value                   |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1817.00                         | 55.84             | -9.04      | 46.80          | 54.00          | 7.20        | Vertical     |
| 1817.00                         | 50.59             | -9.04      | 41.55          | 54.00          | 12.45       | Horizontal   |
| Highest channel                 |                   |            |                |                |             |              |
| Peak Value                      |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1829.80                         | 62.91             | -8.45      | 54.46          | 74.00          | 19.54       | Vertical     |
| 1829.80                         | 57.30             | -8.45      | 48.85          | 74.00          | 25.15       | Horizontal   |
| Average Value                   |                   |            |                |                |             |              |
| Frequency (MHz)                 | Read Level (dBuV) | Factor(dB) | Level (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Polarization |
| 1829.80                         | 55.53             | -8.45      | 47.08          | 54.00          | 6.92        | Vertical     |
| 1829.80                         | 50.80             | -8.45      | 42.35          | 54.00          | 11.65       | Horizontal   |
| <b>Remark:</b>                  |                   |            |                |                |             |              |
| 1. Level = Read level + Factor. |                   |            |                |                |             |              |

-----End of report-----