# TEST REPORT

| | |
|---|---|
| **Applicant:** | Seeed Technology Co., Ltd. |
| **Address:** | 9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C |
| **Equipment Type:** | Wio-E5-LE Wireless Module |
| **Model Name:** | Wio-E5-LE-HF |
| **Brand Name:** | Seeed Studio |
| **FCC ID:** | Z4T-WIO-E5-LE |
| **Test Standard:** | 47 CFR Part 15 Subpart C (refer to section 3.1) |
| **Sample Arrival Date:** | May 26, 2023 |
| **Test Date:** | May 30, 2023 - Jul. 07, 2023 |
| **Date of Issue:** | Jul. 24, 2023 |

**ISSUED BY:**

Shenzhen BALUN Technology Co., Ltd.

**Tested by:** Julie Zhu **Checked by:** Ye Hongji **Approved by:** Liao Jianming (Technical Director)

**Revision History**

| Version | Issue Date | Revisions |
|---|---|---|
| Rev. 01 | Jul. 18, 2023 | Initial Issue |
| Rev. 02 | Jul. 24, 2023 | Corrected the Frequency Range in Section 2.5. |

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# 1 GENERAL INFORMATION

## 1.1 Test Laboratory

| | |
|---|---|
| Name | Shenzhen BALUN Technology Co., Ltd. |
| Address | Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Phone Number | +86 755 6685 0100 |

## 1.2 Test Location

| | |
|---|---|
| Name | Shenzhen BALUN Technology Co., Ltd. |
| Location | ☑ Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| | ☐ 1/F, Building B, Ganghongji High-tech Intelligent Industrial Park, No. 1008, Songbai Road, Yangguang Community, Xili Sub-district, Nanshan District, Shenzhen, Guangdong Province, P. R. China |
| Accreditation Certificate | The laboratory is a testing organization accredited by FCC as a accredited testing laboratory. The designation number is CN1196. |

# 2 PRODUCT INFORMATION

## 2.1 Applicant Information

| | |
|---|---|
| Applicant | Seeed Technology Co., Ltd. |
| Address | 9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C |

## 2.2 Manufacturer Information

| | |
|---|---|
| Manufacturer | Seeed Technology Co., Ltd. |
| Address | 9F, G3 Building, TCL International E City, Zhongshanyuan Road, Nanshan District, Shenzhen, Guangdong Province, P.R.C |

## 2.3 Factory Information

| | |
|---|---|
| Factory | N/A |
| Address | N/A |

## 2.4 General Description for Equipment under Test (EUT)

| | |
|---|---|
| EUT Name | Wio-E5-LE Wireless Module |
| Model Name Under Test | Wio-E5-LE-HF |
| Series Model Name | N/A |
| Description of Model name differentiation | N/A |
| Hardware Version | v2.0 |
| Software Version | v4.0.11 |
| Dimensions (Approx.) | N/A |
| Weight (Approx.) | N/A |

## 2.5 Technical Information

| | |
|---|---|
| Network and Wireless connectivity | LoRa |

The requirement for the following technical information of the EUT was tested in this report:

| | |
|---|---|
| Modulation Technology | Frequency hopping system |
| Modulation Type | LoRa |
| Product Type | ☒ Mobile<br>☐ Portable<br>☐ Fix Location |
| Frequency Range | The frequency range used is 902.3 MHz to 914.9 MHz. |
| Frequency Bandwidth | 125 kHz |
| Number of channel | 64 |
| Tested Channel | 1 (902.3 MHz), 32 (908.5 MHz), 64 (914.9 MHz) |
| Antenna Type | Dipole Antenna |
| Antenna Gain | 2.4 dBi |
| Antenna System(MIMO Smart Antenna) | N/A |

All channel was listed on the following table:

| Channel number | Freq. (MHz) | Channel number | Freq. (MHz) | Channel number | Freq. (MHz) | Channel number | Freq. (MHz) |
|---|---|---|---|---|---|---|---|
| **1** | **902.3** | 17 | 905.5 | 33 | 908.7 | 49 | 911.9 |
| 2 | 902.5 | 18 | 905.7 | 34 | 908.9 | 50 | 912.1 |
| 3 | 902.7 | 19 | 905.9 | 35 | 909.1 | 51 | 912.3 |
| 4 | 902.9 | 20 | 906.1 | 36 | 909.3 | 52 | 912.5 |
| 5 | 903.1 | 21 | 906.3 | 37 | 909.5 | 53 | 912.7 |
| 6 | 903.3 | 22 | 906.5 | 38 | 909.7 | 54 | 912.9 |
| 7 | 903.5 | 23 | 906.7 | 39 | 909.9 | 55 | 913.1 |
| 8 | 903.7 | 24 | 906.9 | 40 | 910.1 | 56 | 913.3 |
| 9 | 903.9 | 25 | 907.1 | 41 | 910.3 | 57 | 913.5 |
| 10 | 904.1 | 26 | 907.3 | 42 | 910.5 | 58 | 913.7 |
| 11 | 904.3 | 27 | 907.5 | 43 | 910.7 | 59 | 913.9 |
| 12 | 904.5 | 28 | 907.7 | 44 | 910.9 | 60 | 914.1 |
| 13 | 904.7 | 29 | 907.9 | 45 | 911.1 | 61 | 914.3 |
| 14 | 904.9 | 30 | 908.1 | 46 | 911.3 | 62 | 914.5 |
| 15 | 905.1 | 31 | 908.3 | 47 | 911.5 | 63 | 914.7 |
| 16 | 905.3 | **32** | **908.5** | 48 | 911.7 | **64** | **914.9** |

# 3 SUMMARY OF TEST RESULTS

## 3.1 Test Standards

| No. | Identity | Document Title |
|---|---|---|
| 1 | 47 CFR Part 15, Subpart C | Intentional radiators of radio frequency equipment |
| 2 | KDB Publication 558074 D01v05r02 | GUIDANCE FOR COMPLIANCE MEASUREMENTS ON DIGITAL TRANSMISSION SYSTEM, FREQUENCY HOPPING SPREAD SPECTRUM SYSTEM, AND HYBRID SYSTEM DEVICES OPERATING UNDER SECTION 15.247 OF THE FCC RULES |
| 3 | ANSI C63.10-2013 | American National Standard for Testing Unlicensed Wireless Devices |

## 3.2 Test Verdict

| No. | Description | FCC Part No. | Modulation Technology | Channel | Test Result | Verdict |
|---|---|---|---|---|---|---|
| 1 | Antenna Requirement | 15.203 | N/A | N/A | -- | Pass[Note] |
| 2 | Number of Hopping Frequencies | 15.247(a) | Frequency hopping system | Hopping Mode | ANNEX A.1 | Pass |
| 3 | Peak Output Power | 15.247(b) | Frequency hopping system | Low/Middle/High | ANNEX A.2 | Pass |
| 4 | Occupied Bandwidth | 15.247(a) | Frequency hopping system | Low/Middle/High | ANNEX A.3 | Pass |
| 5 | Carrier Frequency Separation | 15.247(a) | Frequency hopping system | Hopping Mode | ANNEX A.4 | Pass |
| 6 | Time of Occupancy (Dwell time) | 15.247(a) | Frequency hopping system | Hopping Mode | ANNEX A.5 | Pass |
| 7 | Conducted Spurious Emission & Authorized-band band-edge | 15.247(d) | Frequency hopping system | Low/Middle/High, Hopping Mode | ANNEX A.6 | Pass |
| 8 | Conducted Emission | 15.207 | Frequency hopping system | Low/Middle/High | ANNEX A.7 | Pass |
| 9 | Radiated Spurious Emission | 15.209 15.247(d) | Frequency hopping system | Low/Middle/High | ANNEX A.8 | Pass |
| 10 | Band Edge(Restricted-band band-edge) | 15.209 15.247(d) | Frequency hopping system | Low/High | ANNEX A.9 | Pass |
| Note: Please refer to section 5.1 | | | | | | |

# 4 GENERAL TEST CONFIGURATIONS

## 4.1 Test Environments

During the measurement, the normal environmental conditions were within the listed ranges:

| | | |
|---|---|---|
| Relative Humidity | 40% to 61% | |
| Atmospheric Pressure | 100 kPa to 102 kPa | |
| Temperature | NT (Normal Temperature) | +22.3℃ to +25.1℃ |
| Working Voltage of the EUT | NV (Normal Voltage) | 3.3 V |

## 4.2 Test Equipment List

| Description | Manufacturer | Model | Serial No. | Cal. Date | Cal. Due |
|---|---|---|---|---|---|
| Spectrum Analyzer | KEYSIGHT | N9020A | MY50330200 | 2023.05.16 | 2024.05.15 |
| Spectrum Analyzer | ROHDE&SCHWARZ | FSV-40 | 101544 | 2022.12.28 | 2023.12.27 |
| Spectrum Analyzer | KEYSIGHT | N9020A | MY52510065 | 2022.09.06 | 2023.09.05 |
| Test Antenna-Bi-Log | SCHWARZBECK | VULB 9163 | 01415 | 2021.03.08 | 2024.03.07 |
| Test Antenna-Horn | SCHWARZBECK | BBHA 9120D | 01631 | 2022.02.03 | 2025.02.02 |
| Test Antenna-Horn | A-INFO | LB-180400KF | J211060273 | 2021.07.02 | 2024.07.01 |
| Anechoic Chamber | RAINFORD | 9m*6m*6m | 144 | 2022.02.19 | 2024.09.03 |
| EMI Receiver | ROHDE&SCHWARZ | ESRP | 101036 | 2022.09.09 | 2023.09.08 |
| Test Antenna-Bi-Log | SCHWARZBECK | VULB 9168 | 00883 | 2022.04.01 | 2025.03.31 |
| Test Antenna-Loop | SCHWARZBECK | FMZB 1519 | 1519-037 | 2021.04.16 | 2024.04.15 |
| Anechoic Chamber | EMC Electronic Co., Ltd | 20.10*11.60 *7.35m | 130 | 2021.08.15 | 2024.08.14 |
| EMI Receiver | KEYSIGHT | N9010B | MY57110309 | 2022.09.09 | 2023.09.08 |
| LISN | SCHWARZBECK | NSLK 8127 | 8127-687 | 2023.05.16 | 2024.05.15 |
| Shielded Enclosure | YiHeng Electronic Co., Ltd | 3.5m*3.1m* 2.8m | 112 | 2022.02.19 | 2025.02.18 |
| Amplifier | COM-MV | LSCX_LNA1 -12G-01 | 180602 | 2020.09.08 | 2023.09.07 |
| Amplifier | COM-MV | XKu_LNA7-18G-01 | 180601 | 2020.09.08 | 2023.09.07 |
| Amplifier | COM-MV | KA_LNA18-40G-01 | 18050001 | 2020.09.08 | 2023.09.07 |
| Amplifier | COM-MV | ZT30-1000M | B2017119082 | 2022.12.07 | 2023.12.06 |

## 4.3 Measurement Uncertainty

The following measurement uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2.

This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

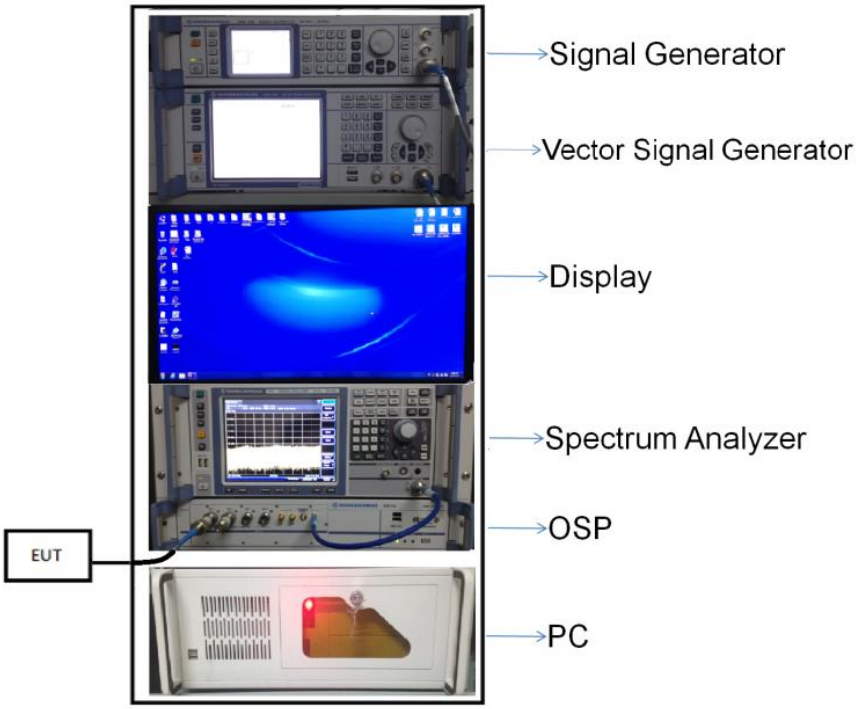
| Parameters | Uncertainty |
|---|---|
| Occupied Channel Bandwidth | 2.8% |
| RF output power, conducted | 1.28 dB |
| Power Spectral Density, conducted | 1.30 dB |
| Unwanted Emissions, conducted | 1.84 dB |
| All emissions, radiated | 5.36 dB |
| Temperature | 0.8 °C |
| Humidity | 4 % |

## 4.4 Description of Test Setup

### 4.4.1 For Antenna Port Test

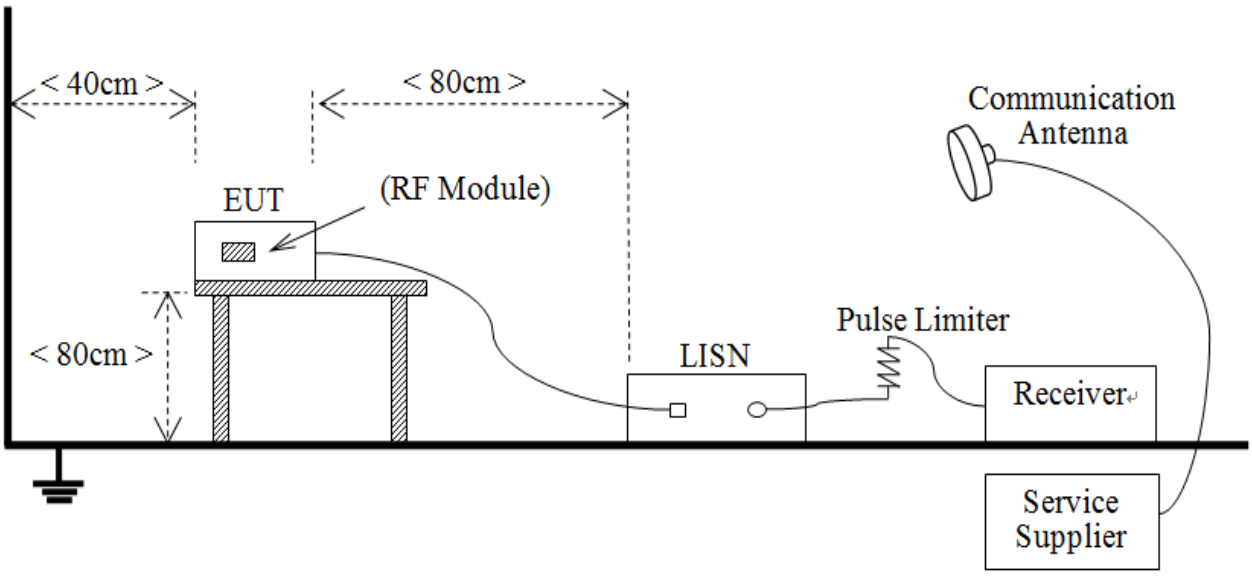
Conducted value (dBm) = Measurement value (dBm) + cable loss (dB)

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:
Conducted value (dBm) = 10 dBm + 0.5 dB = 10.5 dBm



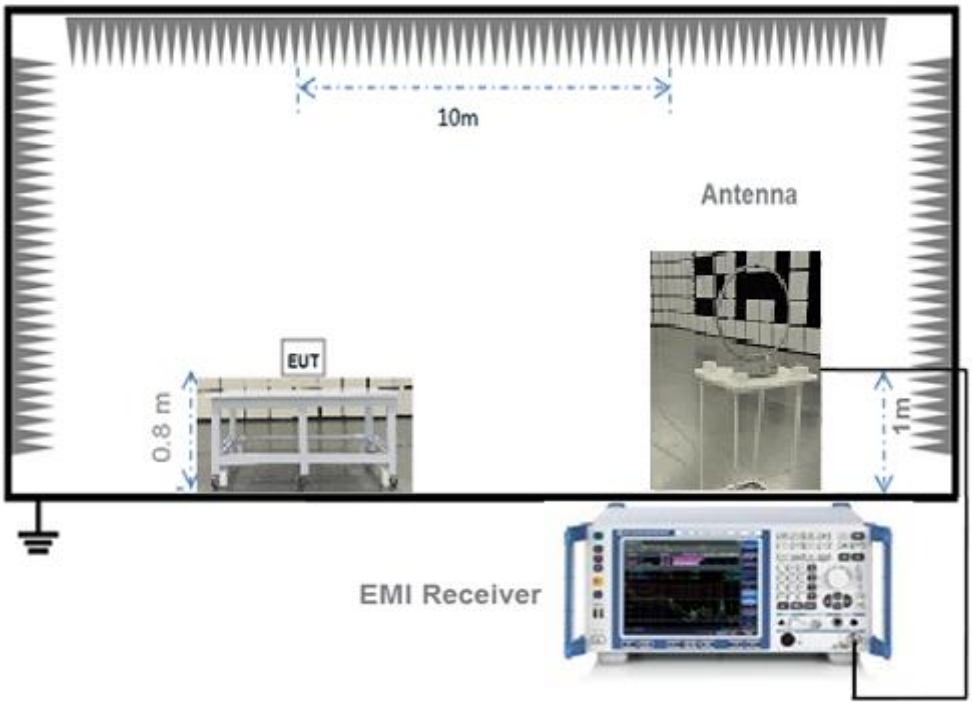

**(Diagram 1)**

### 4.4.2 For AC Power Supply Port Test



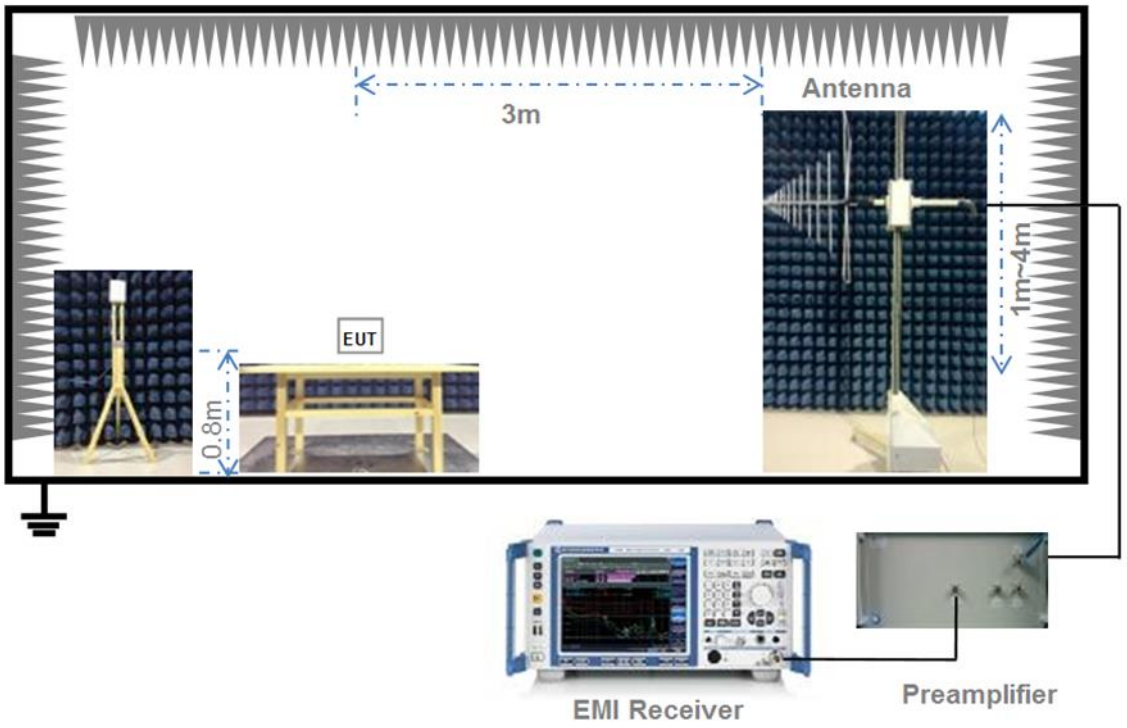

**(Diagram 2)**

### 4.4.3 For Radiated Test (Below 30 MHz)



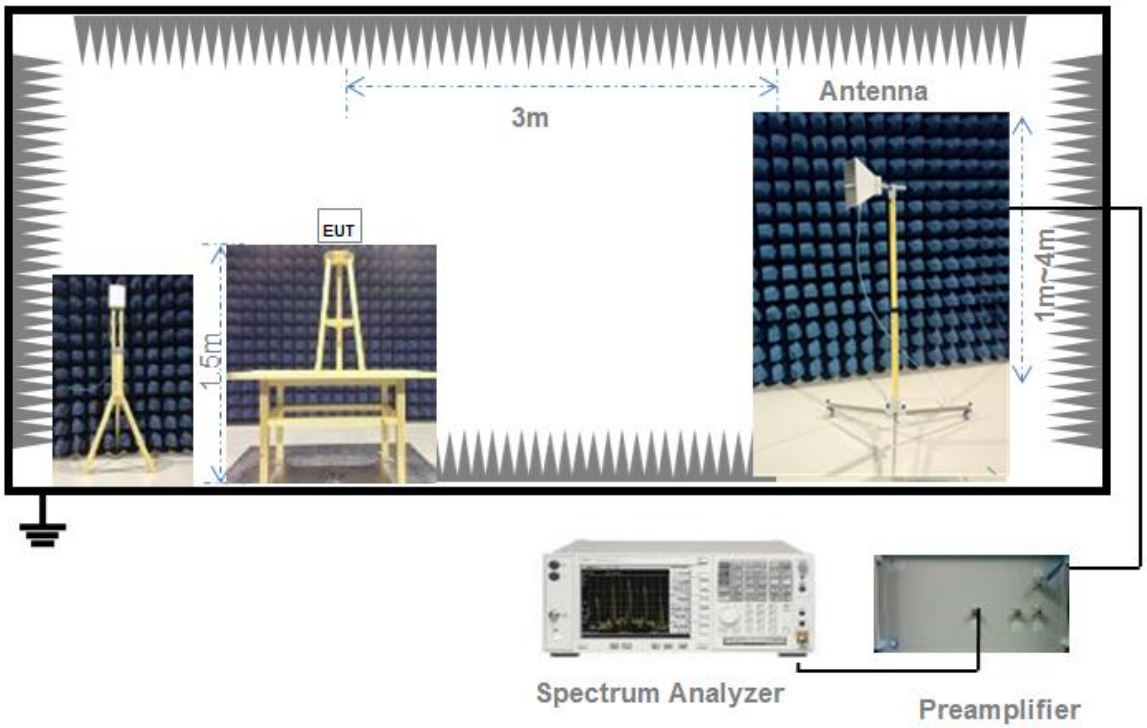

**(Diagram 3)**

### 4.4.4 For Radiated Test (30 MHz-1 GHz)




**(Diagram 4)**

### 4.4.5 For Radiated Test (Above 1 GHz)




**(Diagram 5)**

## 4.5 Measurement Results Explanation Example

### 4.5.1 For conducted test items:

The offset level is set in the spectrum analyzer to compensate the RF cable loss and attenuator between EUT conducted output port and spectrum analyzer. With the offset compensation, the spectrum analyzer reading level is exactly the EUT RF output level.
The spectrum analyzer offset is derived from RF cable loss and attenuator factor.
Offset = RF cable loss + attenuator factor.

# 5 TEST ITEMS

## 5.1 Antenna Requirements

### 5.1.1 Relevant Standards

FCC §15.203

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section. The manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited. This requirement does not apply to carrier current devices or to devices operated under the provisions of § 15.211, § 15.213, § 15.217, § 15.219, or § 15.221. Further, this requirement does not apply to intentional radiators that must be professionally installed, such as perimeter protection systems and some field disturbance sensors, or to other intentional radiators which, in accordance with § 15.31(d), must be measured at the installation site. However, the installer shall be responsible for ensuring that the proper antenna is employed so that the limits in this part are not exceeded.

If directional gain of transmitting antennas is greater than 6 dBi, the power shall be reduced by the same level in dB comparing to gain minus 6 dBi. For the fixed point-to-point operation, the power shall be reduced by one dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the FCC rule.

### 5.1.2 Antenna Anti-Replacement Construction

The Antenna Anti-Replacement as following method:

| Protected Method | Description |
|---|---|
| The antenna is embedded in the product | The antenna is welded on the mainboard, can’t be replaced by the consumer |

| Reference Documents | Item |
|---|---|
| Photo | Please refer to the EUT Photo documents. |

### 5.1.3 Antenna Gain

The antenna peak gain of EUT is less than 6 dBi. Therefore, it is not necessary to reduce maximum peak output power limit.

## 5.2 Number of Hopping Frequencies

### 5.2.1 Limit

FCC §15.247(a)

For FHSs in the band 902-928 MHz: if the 20 dB bandwidth of the hopping channel is less than 250 kHz, the system shall use at least 50 hopping channels and the average time of occupancy on any channel 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 channels and the average time of occupancy on any channel shall not be greater than 0.4 seconds within a 10-second period. The maximum 20 dB bandwidth of the hopping channel shall be 500 kHz.

### 5.2.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.2.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = the frequency band of operation

RBW ≥ 1% of the span

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize

### 5.2.4 Test Result

Please refer to ANNEX A.1.

## 5.3 Peak Output Power

### 5.3.1 Test Limit

FCC § 15.247(b)

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.

### 5.3.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.3.3 Test Procedure

The Module operates at hopping-off test mode. The lowest, middle and highest channels are selected to perform testing to verify the conducted RF output peak power of the Module.

Use the following spectrum analyzer settings:

Span = approximately 5 times the 20 dB bandwidth, centered on a hopping channel

RBW > the 20 dB bandwidth of the emission being measured

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize.

### 5.3.4 Test Result

Please refer to ANNEX A.2.

## 5.4 Occupied Bandwidth

### 5.4.1 Limit

FCC §15.247(a)

### 5.4.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.4.3 Test Procedure

Use the following spectrum analyzer settings:

Span = approximately 2 to 3 times the 20 dB bandwidth, centered on a hopping channel

RBW = in the range of 1% to 5% of the OBW

VBW ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

The EUT should be transmitting at its maximum data rate, Allow the trace to stabilize.

### 5.4.4 Test Result

Please refer to ANNEX A.3.

## 5.5 Carrier Frequency Separation

### 5.5.1 Limit

FCC §15.247(a)

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.

### 5.5.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.5.3 Test Procedure

The EUT must have its hopping function enabled. Use the following spectrum analyzer settings:

Span = wide enough to capture the peaks of two adjacent channels

Resolution (or IF) Bandwidth (RBW) ≥ 1% of the span

Video (or Average) Bandwidth (VBW) ≥ RBW

Sweep = auto

Detector function = peak

Trace = max hold

Allow the trace to stabilize. Use the marker-delta function to determine the separation between the peaks of the adjacent channels.

### 5.5.4 Test Result

Please refer to ANNEX A.4.

## 5.6 Time of Occupancy (Dwell time)

### 5.6.1 Limit

FCC §15.247(a)

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.

### 5.6.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.6.3 Test Procedure

The lowest, middle and highest channels are selected to perform testing to record the dwell time of each occupation measured in this channel, which is called Pulse Time here.

### 5.6.4 Test Result

Please refer to ANNEX A.5

## 5.7 Conducted Spurious Emission & Authorized-band band-edge

### 5.7.1 Limit

FCC §15.247(d)

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement.

### 5.7.2 Test Setup

See section 4.4.1 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.7.3 Test Procedure

Use the following spectrum analyzer settings:

Span = wide enough to capture the peak level of the in-band emission and all spurious emissions (e.g., harmonics) from the lowest frequency generated in the EUT up through the 10th harmonic. Typically, several plots are required to cover this entire span.
RBW = 100 kHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
Allow the trace to stabilize

### 5.7.4 Test Result

Please refer to ANNEX A.6 and A.7

## 5.8 Conducted Emission

### 5.8.1 Limit

FCC §15.207

For an intentional radiator that is designed to be connected to the public utility (AC) power line, the radio frequency voltage that is conducted back onto the AC power line on any frequency within the band 150 kHz to 30 MHz shall not exceed the limits in the following table, as measured using a 50μH/50Ω line impedance stabilization network (LISN).

| Frequency range (MHz) | Conducted Limit (dBμV) | |
|---|---|---|
| | Quai-peak | Average |
| 0.15 - 0.50 | 66 to 56 | 56 to 46 |
| 0.50 - 5 | 56 | 46 |
| 0.50 - 30 | 60 | 50 |

### 5.8.2 Test Setup

See section 4.4.2 for test setup description for the AC power supply port. The photo of test setup please refer to ANNEX B.

### 5.8.3 Test Procedure

The maximum conducted interference is searched using Peak (PK), if the emission levels more than the AV and QP limits, and that have narrow margins from the AV and QP limits will be re-measured with AV and QP detectors. Tests for both L phase and N phase lines of the power mains connected to the EUT are performed. Refer to recorded points and plots below.
Devices subject to Part 15 must be tested for all available U.S. voltages and frequencies (such as a nominal 120 VAC, 50/60 Hz and 240 VAC, 50/60 Hz) for which the device is capable of operation. A device rated for 50/60 Hz operation need not be tested at both frequencies provided the radiated and line conducted emissions are the same at both frequencies.

### 5.8.4 Test Result

Please refer to ANNEX A.7.

## 5.9 Radiated Spurious Emission

### 5.9.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

According to FCC section 15.209 (a), except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field Strength (μV/m) | Measurement Distance (m) |
|---|---|---|
| 0.009 - 0.490 | 902/F(kHz) | 300 |
| 0.490 - 1.705 | 9020/F(kHz) | 30 |
| 1.705 - 30.0 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note:

1. Field Strength (dBμV/m) = 20*log[Field Strength (μV/m)].
2. In the emission tables above, the tighter limit applies at the band edges.
3. For Above 1000 MHz, the emission limit in this paragraph is based on measurement instrumentation employing an average detector, measurement using instrumentation with a peak detector function, corresponding to 20dB above the maximum permitted average limit.
4. For above 1000 MHz, limit field strength of harmonics: 54dBuV/m@3m (AV) and 74dBuV/m@3m (PK).

### 5.9.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.9.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold
For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

### 5.9.4 Test Result

Please refer to ANNEX A.8.

## 5.10 Band Edge (Restricted-band band-edge)

### 5.10.1 Limit

FCC §15.209&15.247(d)

Radiated emission outside the frequency band attenuation below the general limits specified in FCC section 15.209(a) is not required. In addition, radiated emissions which fall in the restricted bands, as defined in FCC section 15.205(a), must also comply with the radiated emission limits specified in FCC section 15.209(a).

### 5.10.2 Test Setup

See section 4.4.3 to 4.4.5 for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.10.3 Test Procedure

The measurement frequency range is from 9 kHz to the 10th harmonic of the fundamental frequency. The Turn Table is actuated to turn from 0° to 360°, and both horizontal and vertical polarizations of the Test Antenna are used to find the maximum radiated power. Mid channels on all channel bandwidth verified. Only the worst RB size/offset presented.

The power of the EUT transmitting frequency should be ignored.

All Spurious Emission tests were performed in X, Y, Z axis direction. And only the worst axis test condition was recorded in this test report.

Use the following spectrum analyzer settings:

Span = wide enough to fully capture the emission being measured
RBW = 1 MHz for f ≥ 1 GHz, 100 kHz for f < 1 GHz
VBW ≥ RBW
Sweep = auto
Detector function = peak
Trace = max hold

For measurement below 1GHz, If the emission level of the EUT measured by the peak detector is 3 dB lower than the applicable limit, the peak emission level will be reported, Otherwise, the emission measurement will be repeated using the quasi-peak detector and reported.

### 5.10.4 Test Result

Please refer to ANNEX A.9.

# ANNEX A TEST RESULT

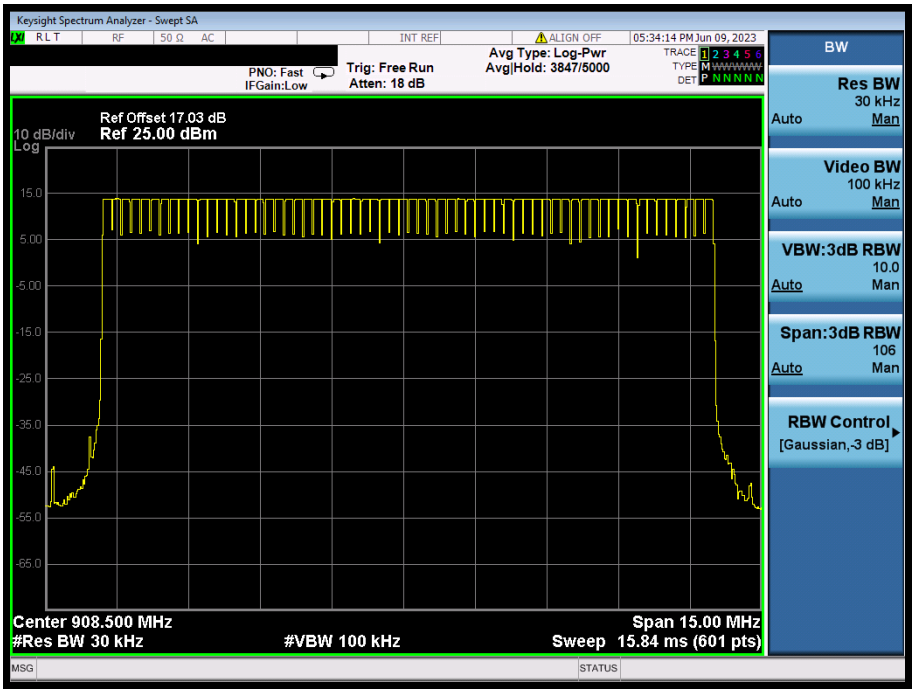
## A.1 Number of Hopping Frequency

Test Data

| Test Mode | Frequency Block (MHz) | Measured Channel Numbers | Min. Limit | Verdict |
|---|---|---|---|---|
| LoRa | 902-928 | 64 | 50 | Pass |

Test Plots

LoRa



## A.2 Peak Output Power

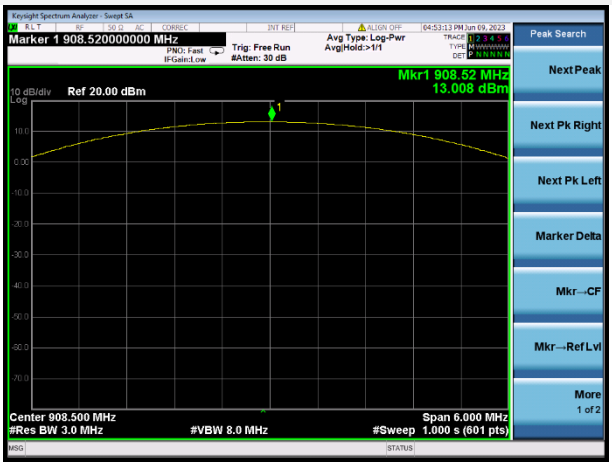
Test Data

| Channel | Measured Output Peak Power | | Limit | | Verdict |
|---|---|---|---|---|---|
| | LoRa | | dBm | mW | |
| | dBm | mW | | | |
| Low | 13.02 | 20.04 | 30 | 1000 | Pass |
| Middle | 13.01 | 19.99 | | | Pass |
| High | 12.95 | 19.71 | | | Pass |

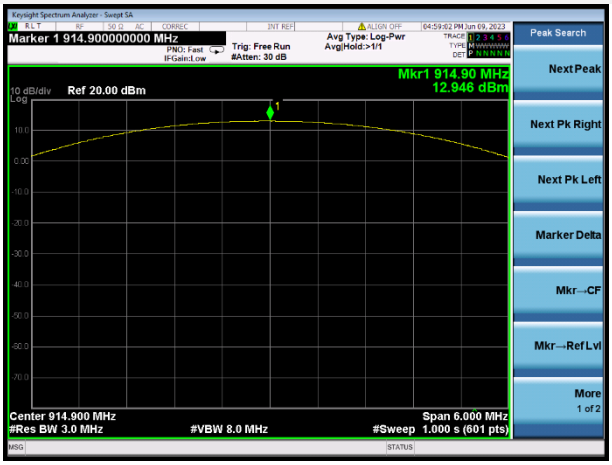
Test Plots

LOW CHANNEL

MIDDLE CHANNEL




HIGH CHANNEL



## A.3 20 dB and 99% bandwidth

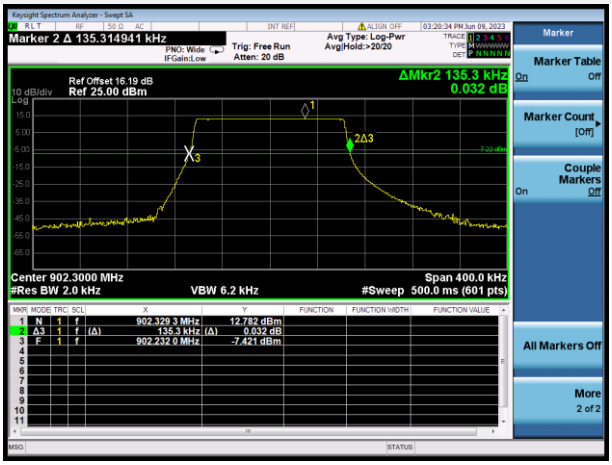
Test Data

| LoRa | | | | |
|---|---|---|---|---|
| Channel | 20 dB Bandwidth (MHz) | 99% Bandwidth (MHz) | Limit (MHz) | Verdict |
| Low | 0.135300 | 0.125440 | 0.25 | Pass |
| Middle | 0.135300 | 0.125350 | 0.25 | Pass |
| High | 0.135400 | 0.125260 | 0.25 | Pass |

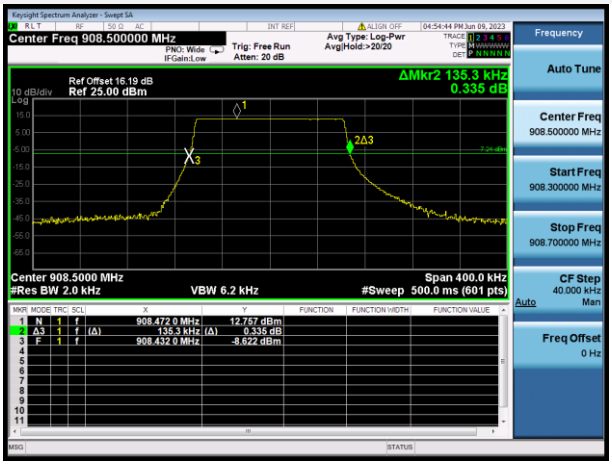
Test Plots

20 dB Bandwidth

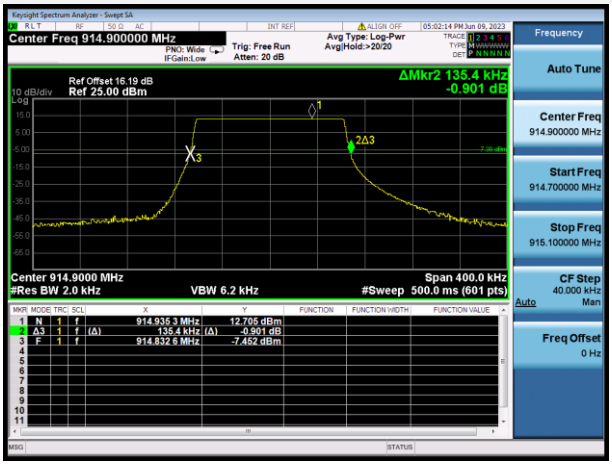
LOW CHANNEL




MIDDLE CHANNEL

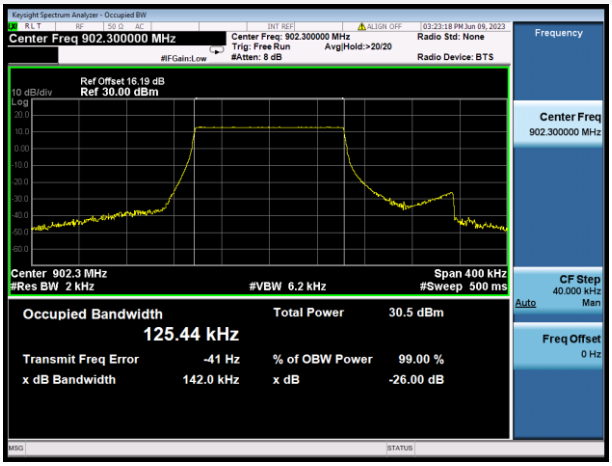



HIGH CHANNEL

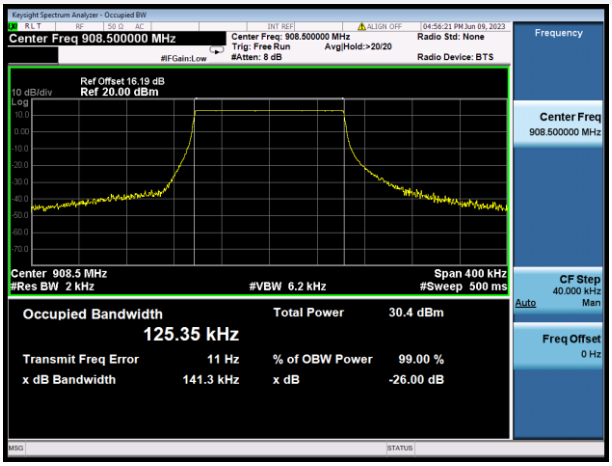


## 99% Bandwidth

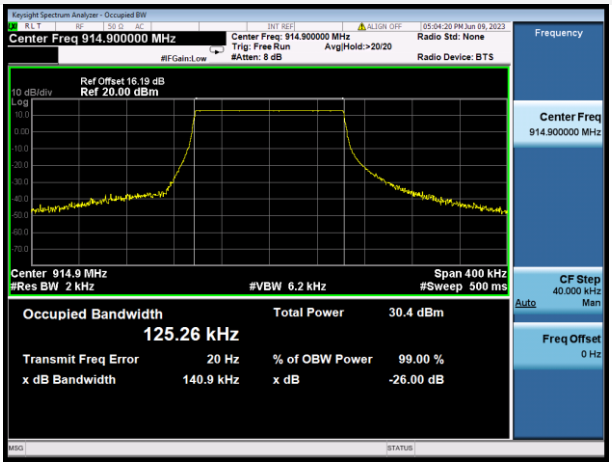
### LOW CHANNEL




### MIDDLE CHANNEL




### HIGH CHANNEL



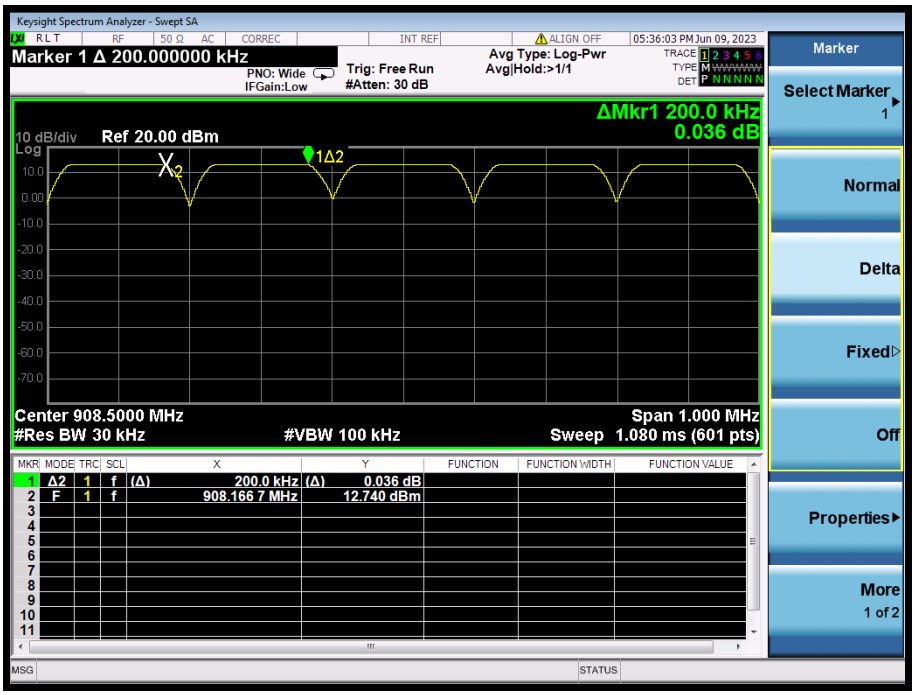
## A.4 Hopping Frequency Separation

Test Data

| Mode | Frequency separation (MHz) | Max 20 dB Bandwidth (MHz) | Verdict |
|---|---|---|---|
| LoRa | 0.200 | 0.135 | Pass |

Test Plots

LoRa

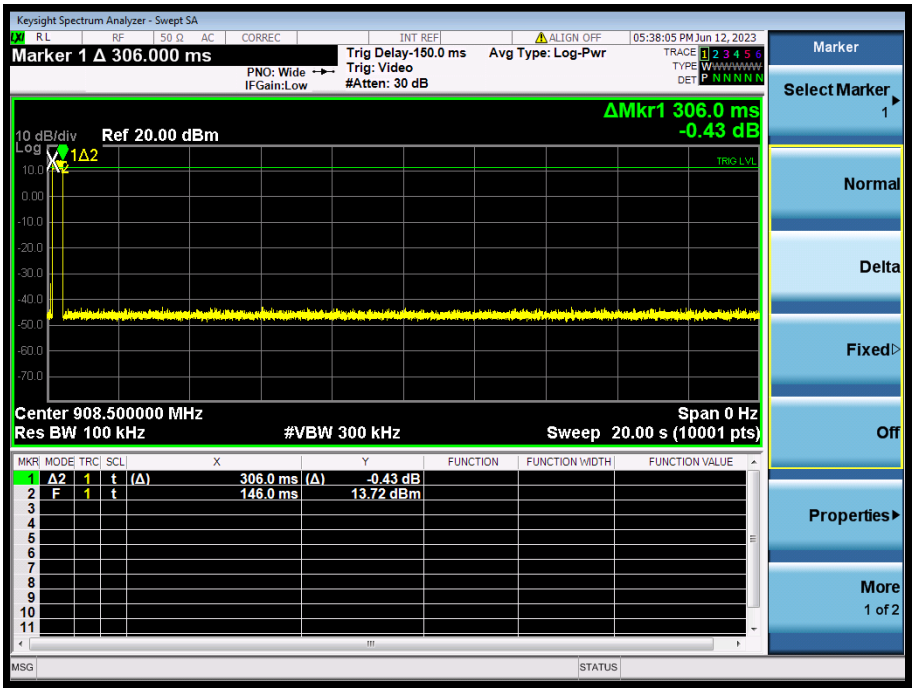


## A.5 Average Time of Occupancy

Test Data

| LoRa | | |
|---|---|---|
| Total of Dwell (ms) | Limit (sec) | Verdict |
| 306.0 | 0.4 | Pass |

LoRa



## A.6 Conducted Spurious Emissions & Authorized-band band-edge

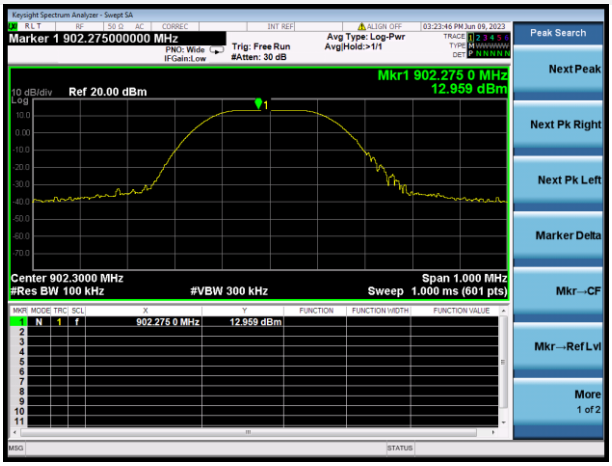
Test Data

| LoRa | | | | |
|---|---|---|---|---|
| Channel | Measured Max. Out of Band Emission (dBm) | Limit (dBm) | | Verdict |
| | | Carrier Level | Calculated 20 dBc Limit | |
| Low | -24.91 | 12.96 | -7.04 | Pass |
| Middle | -25.63 | 12.94 | -7.06 | Pass |
| High | -24.85 | 12.89 | -7.11 | Pass |

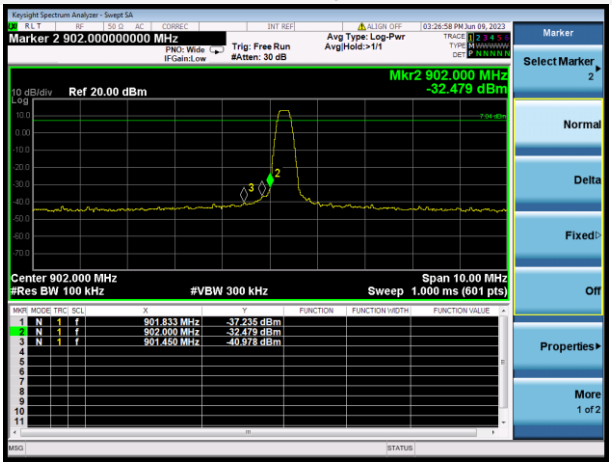
| LoRa | | | | |
|---|---|---|---|---|
| Mode | Measured Max. Out of Band Emission (dBm) | Limit (dBm) | | Verdict |
| | | Carrier Level | Calculated 20 dBc Limit | |
| Hopping | -24.16 | 13.10 | -6.90 | Pass |

## Test Plots

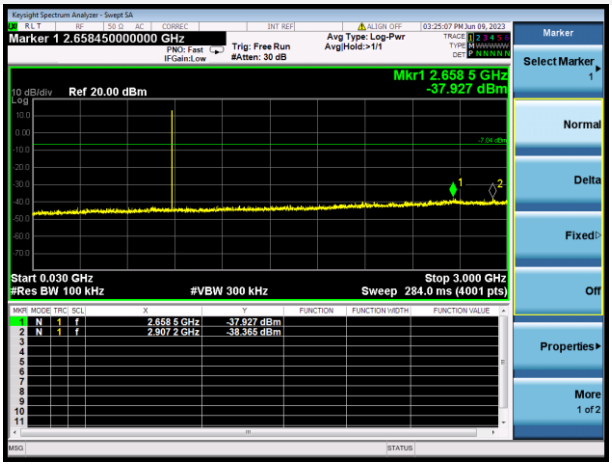
### LOW CHANNEL, CARRIER LEVEL



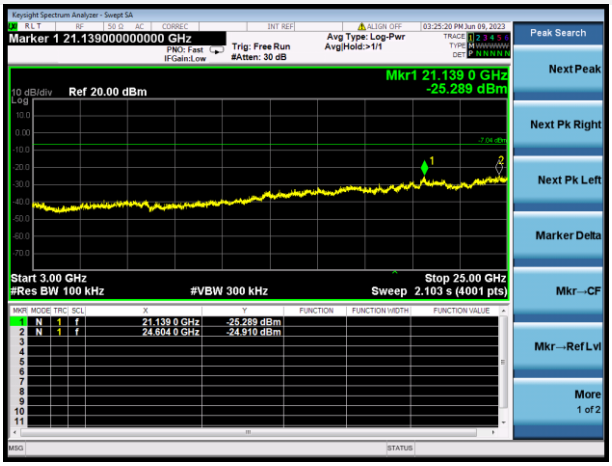

### LOW CHANNEL, Band Edge



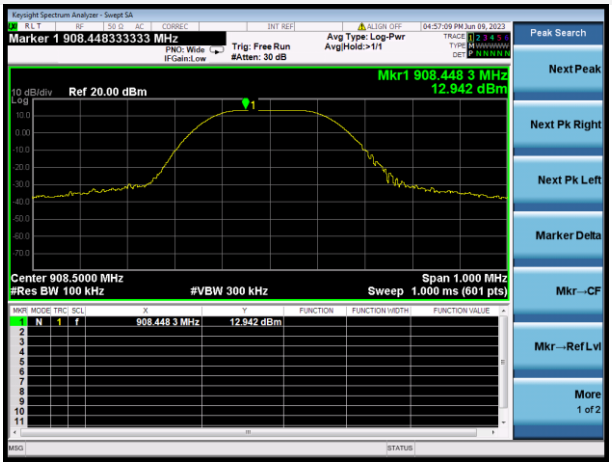

### LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



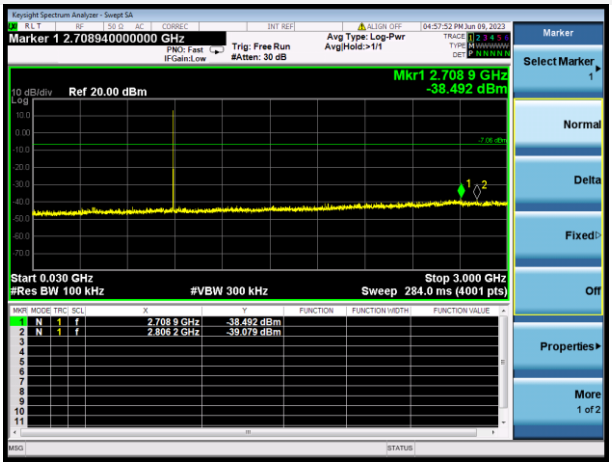

### LOW CHANNEL, SPURIOUS 3 GHz ~ 25 GHz



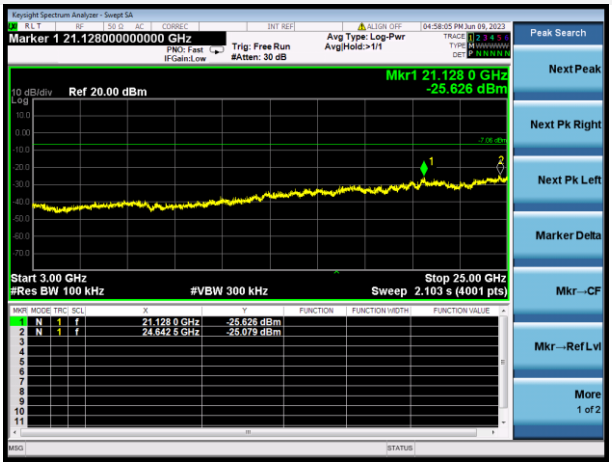

### MIDDLE CHANNEL, CARRIER LEVEL



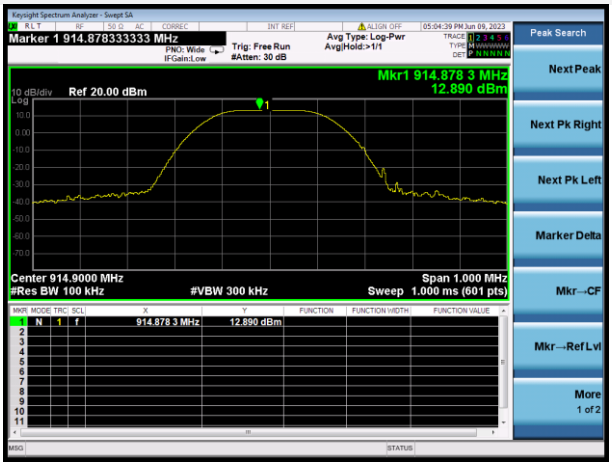
MIDDLE CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



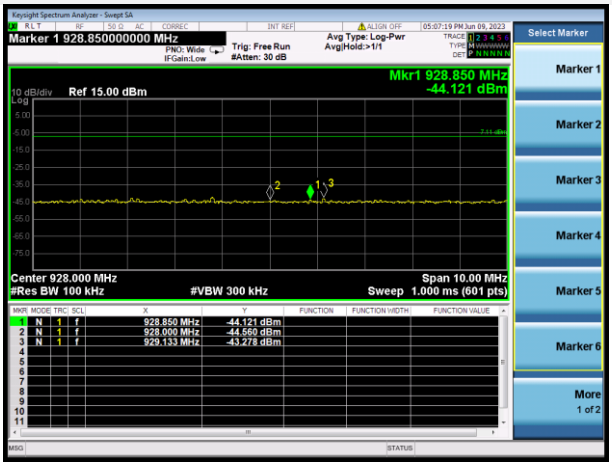

MIDDLE CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



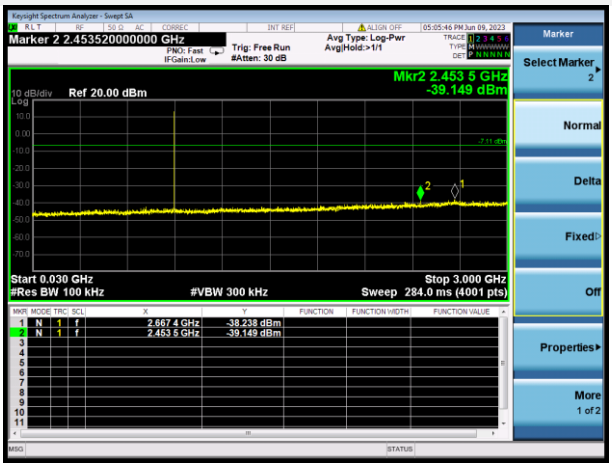

HIGH CHANNEL, CARRIER LEVEL



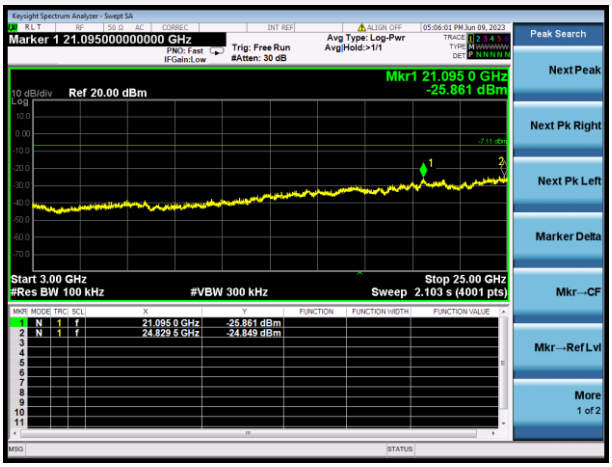

HIGH CHANNEL , BAND EDGE



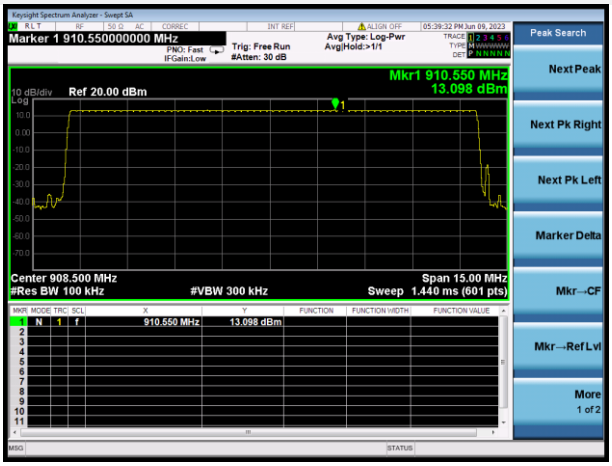

HIGH CHANNEL , SPURIOUS 30 MHz ~ 3 GHz



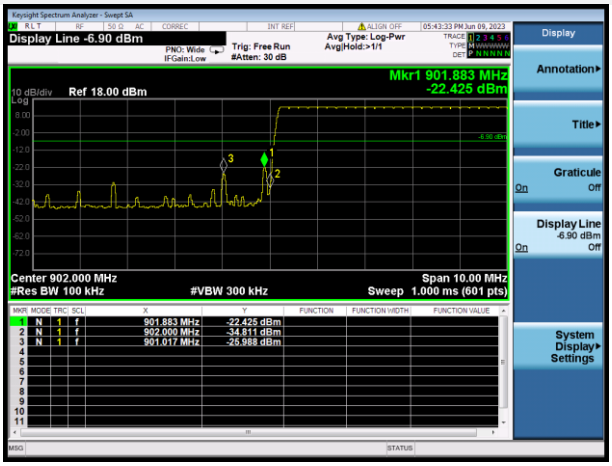

HIGH CHANNEL , SPURIOUS 3 GHz ~ 25 GHz



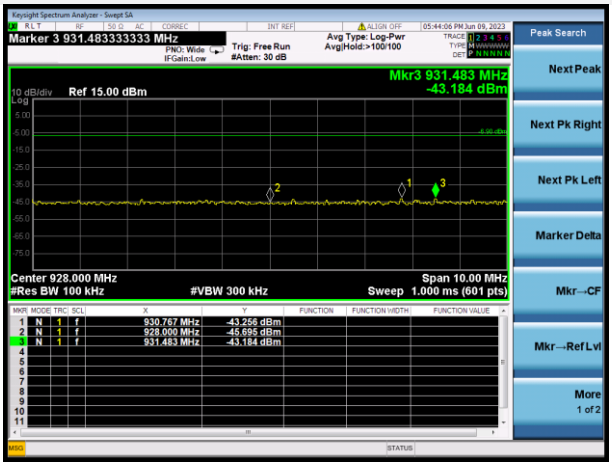
## HOPPING, CARRIER LEVEL



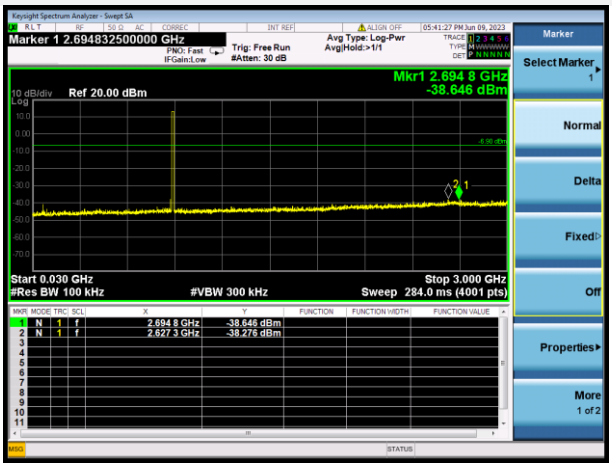

## HOPPING BAND EDGE (LOW)



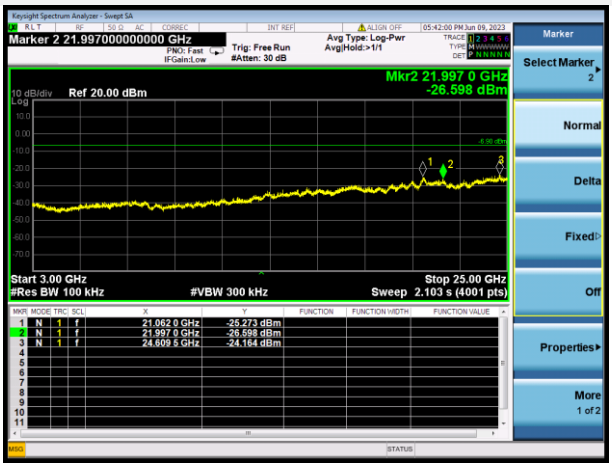

## HOPPING BAND EDGE (HIGH)




## HOPPING Mode, SPURIOUS 30 MHz ~ 3 GHz




## Hopping Mode, SPURIOUS 3 GHz ~ 25 GHz



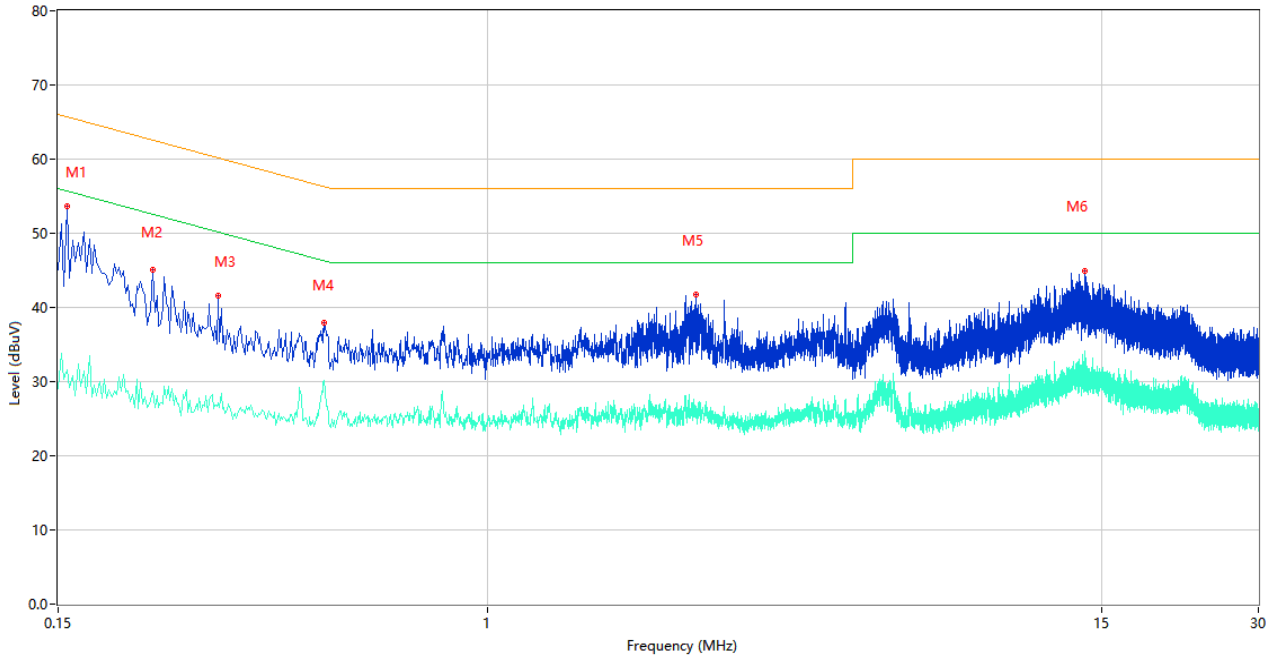
## A.7 Conducted Emissions

Note [1]: The EUT is working in the Normal link mode. All modes have been tested and normal link mode is worst.

Note [2]: Results (dBuV) = Original reading level of Spectrum Analyzer (dBuV) + Factor (dB)

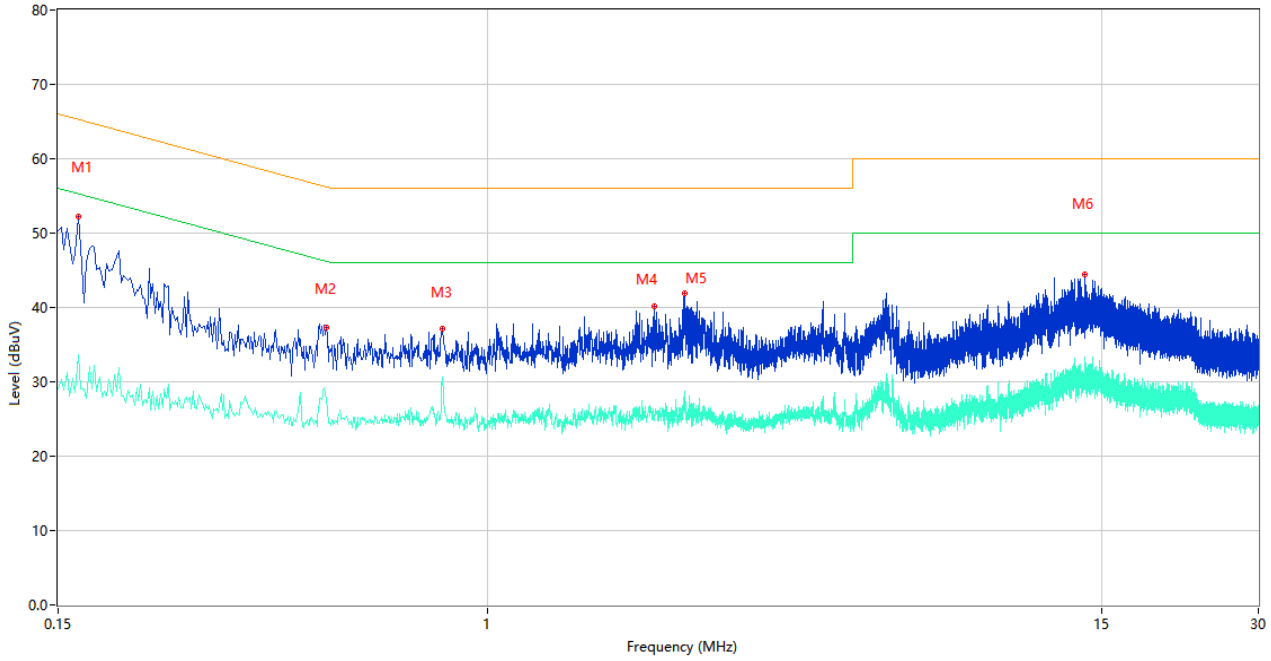
Test Data and Plots

PHASE L




| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line | Verdict |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.156 | 53.64 | 9.78 | 65.67 | 12.03 | Peak | L | Pass |
| 1** | 0.156 | 31.58 | 9.78 | 55.67 | 24.09 | AV | L | Pass |
| 2 | 0.228 | 45.11 | 9.77 | 62.52 | 17.41 | Peak | L | Pass |
| 2** | 0.228 | 28.74 | 9.77 | 52.52 | 23.78 | AV | L | Pass |
| 3 | 0.304 | 41.55 | 9.84 | 60.13 | 18.58 | Peak | L | Pass |
| 3** | 0.304 | 27.06 | 9.84 | 50.13 | 23.07 | AV | L | Pass |
| 4 | 0.486 | 37.98 | 10.00 | 56.24 | 18.26 | Peak | L | Pass |
| 4** | 0.486 | 30.17 | 10.00 | 46.24 | 16.07 | AV | L | Pass |
| 5 | 2.502 | 41.70 | 10.16 | 56.00 | 14.30 | Peak | L | Pass |
| 5** | 2.502 | 26.66 | 10.16 | 46.00 | 19.34 | AV | L | Pass |
| 6 | 13.968 | 44.86 | 10.41 | 60.00 | 15.14 | Peak | L | Pass |
| 6** | 13.968 | 31.83 | 10.41 | 50.00 | 18.17 | AV | L | Pass |

PHASE N




| No. | Frequency (MHz) | Results (dBuV) | Factor (dB) | Limit (dBuV) | Margin (dB) | Detector | Line | Verdict |
|---|---|---|---|---|---|---|---|---|
| 1 | 0.164 | 52.17 | 9.78 | 65.26 | 13.09 | Peak | N | Pass |
| 1** | 0.164 | 33.68 | 9.78 | 55.26 | 21.58 | AV | N | Pass |
| 2 | 0.490 | 37.36 | 9.99 | 56.17 | 18.81 | Peak | N | Pass |
| 2** | 0.490 | 27.69 | 9.99 | 46.17 | 18.48 | AV | N | Pass |
| 3 | 0.820 | 37.09 | 10.57 | 56.00 | 18.91 | Peak | N | Pass |
| 3** | 0.820 | 30.43 | 10.57 | 46.00 | 15.57 | AV | N | Pass |
| 4 | 2.082 | 40.21 | 10.09 | 56.00 | 15.79 | Peak | N | Pass |
| 4** | 2.082 | 25.43 | 10.09 | 46.00 | 20.57 | AV | N | Pass |
| 5 | 2.382 | 41.95 | 10.21 | 56.00 | 14.05 | Peak | N | Pass |
| 5** | 2.382 | 28.25 | 10.21 | 46.00 | 17.75 | AV | N | Pass |
| 6 | 13.950 | 44.50 | 10.47 | 60.00 | 15.50 | Peak | N | Pass |
| 6** | 13.950 | 32.56 | 10.47 | 50.00 | 17.44 | AV | N | Pass |

## A.8 Radiated Spurious Emission

Note [1]: The symbol of "--" in the table which means not application.

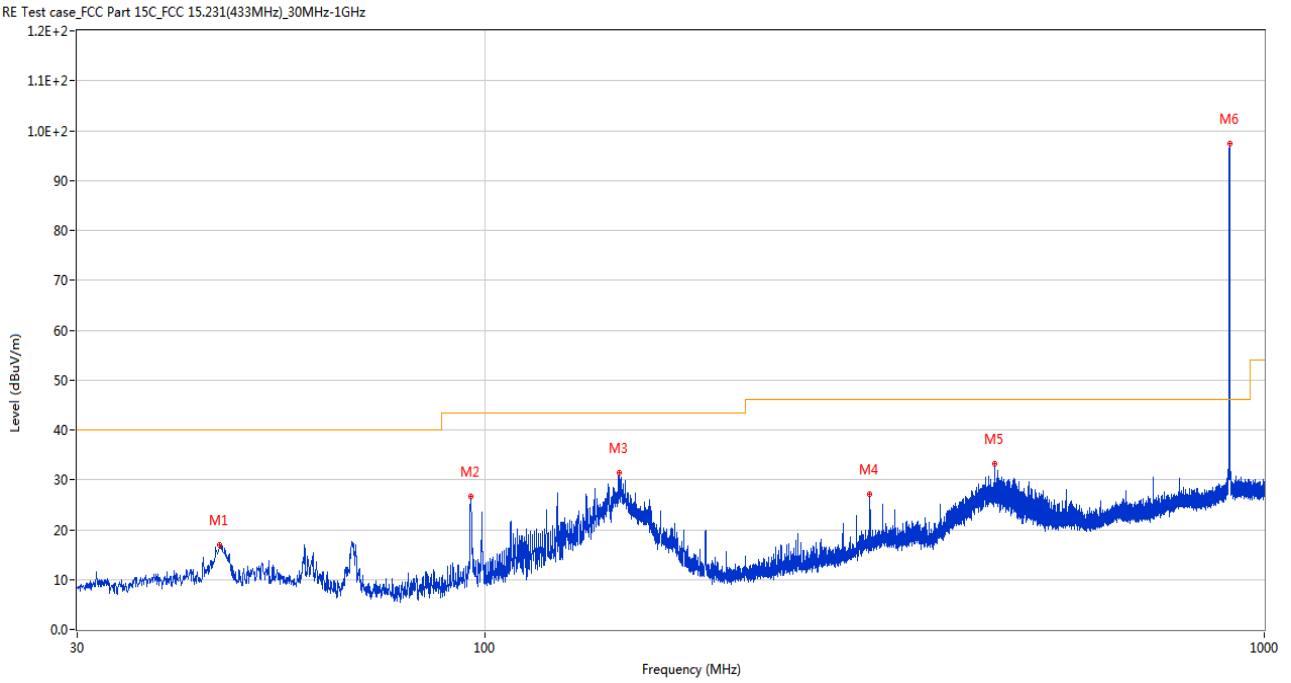
Note [2]: For the test data above 1 GHz, according the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.

Note [3]: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note [4]: The marked spikes near 900 MHz with circle should be ignored because they are Fundamental signal.

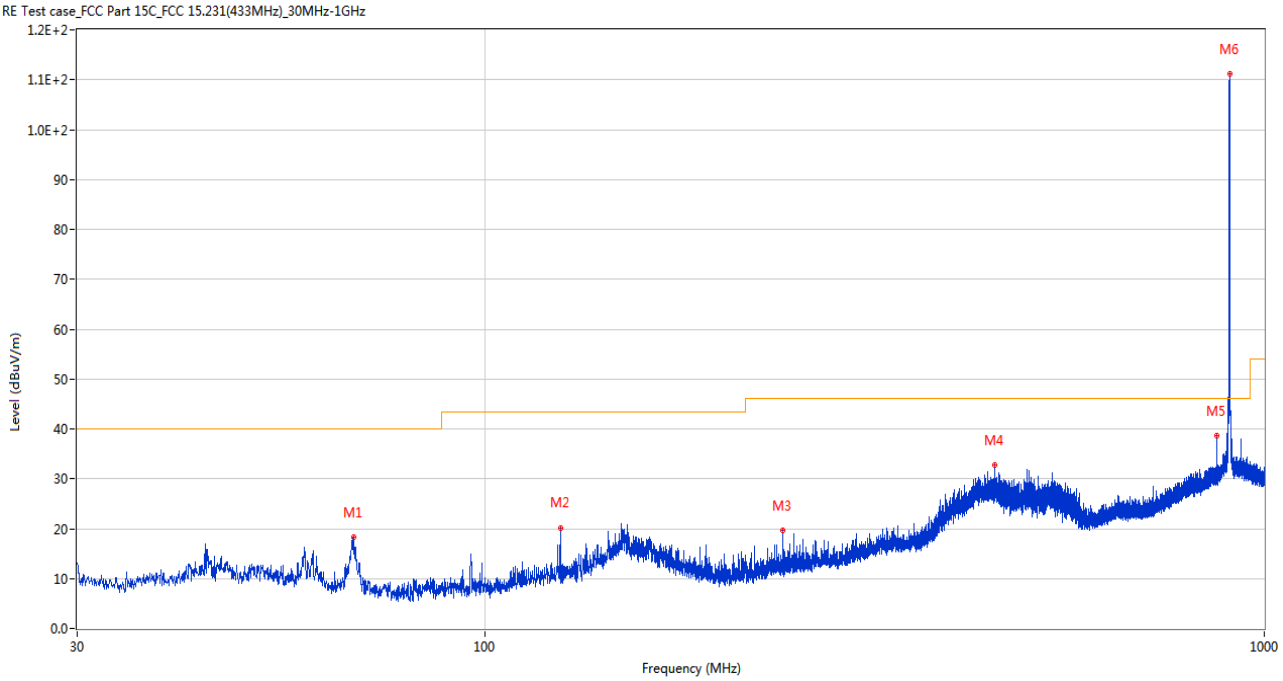
Test Data and Plots

LOW CHANNEL, 30 MHz to 1 GHz, ANT H



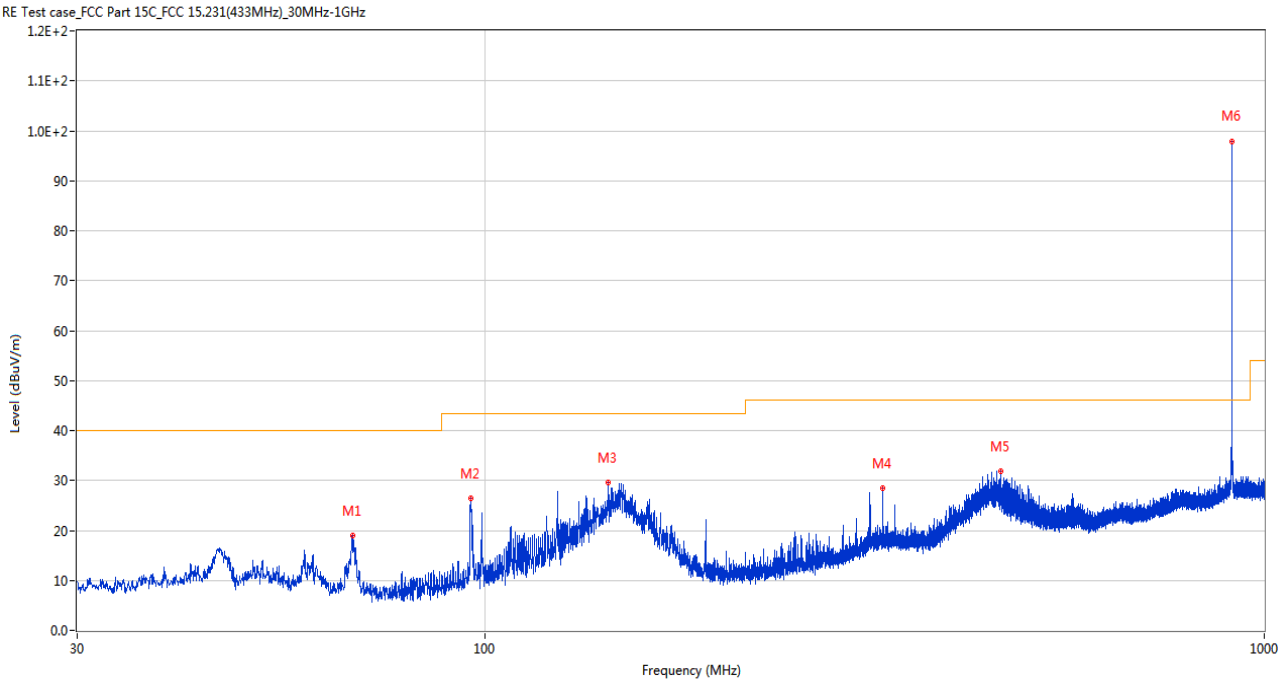

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.714 | 16.99 | -26.19 | 40.0 | 23.01 | Peak | 330.00 | 200 | Horizontal | Pass |
| 2 | 96.008 | 26.69 | -29.08 | 43.5 | 16.81 | Peak | 32.00 | 150 | Horizontal | Pass |
| 3 | 148.680 | 31.46 | -24.41 | 43.5 | 12.04 | Peak | 237.00 | 300 | Horizontal | Pass |
| 4 | 311.930 | 27.01 | -23.40 | 46.0 | 18.99 | Peak | 99.00 | 200 | Horizontal | Pass |
| 5 | 451.174 | 33.15 | -19.18 | 46.0 | 12.85 | Peak | 186.00 | 150 | Horizontal | Pass |
| 6 | 902.321 | 97.33 | -7.59 | 46.0 | -51.33 | Peak | 223.00 | 150 | Horizontal | N/A |

## LOW CHANNEL, 30 MHz to 1 GHz, ANT V



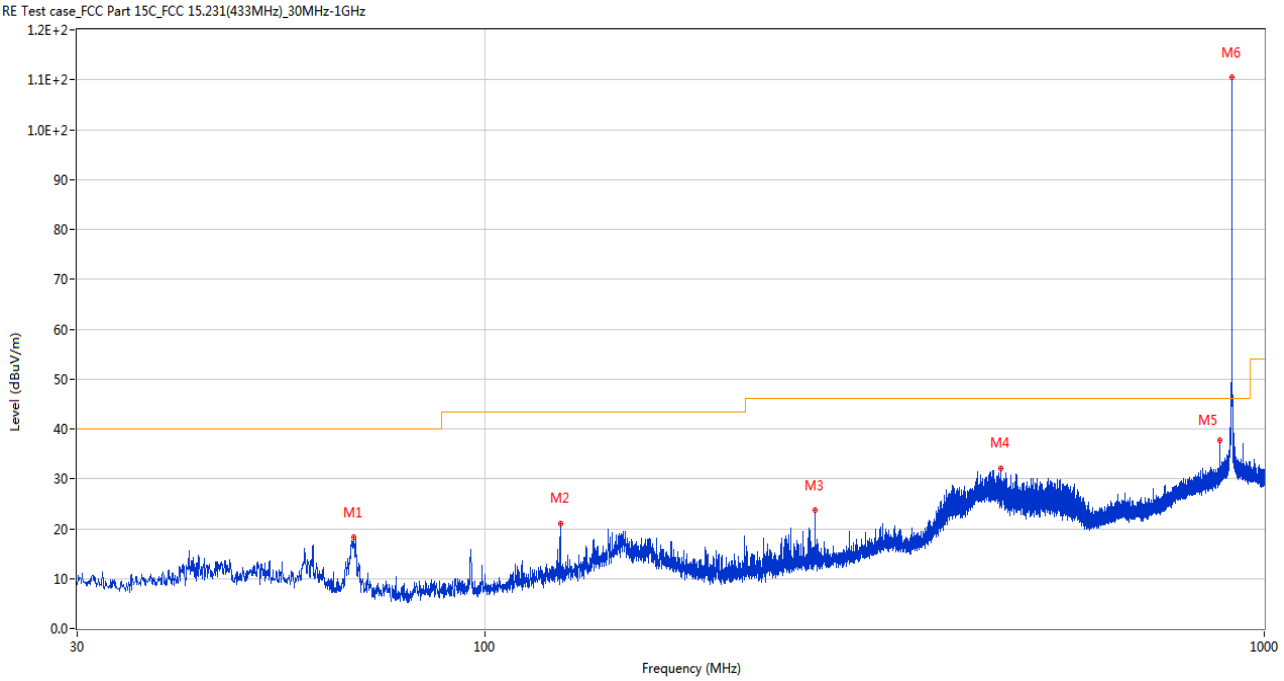

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67.830 | 18.32 | -28.03 | 40.0 | 21.68 | Peak | 209.00 | 300 | Vertical | Pass |
| 2 | 125.011 | 20.21 | -26.17 | 43.5 | 23.29 | Peak | 43.00 | 150 | Vertical | Pass |
| 3 | 240.926 | 19.64 | -25.89 | 46.0 | 26.36 | Peak | 182.00 | 200 | Vertical | Pass |
| 4 | 450.786 | 32.76 | -19.15 | 46.0 | 13.24 | Peak | 86.00 | 150 | Vertical | Pass |
| 5 | 870.311 | 38.60 | -9.02 | 46.0 | 7.40 | Peak | 101.00 | 150 | Vertical | Pass |
| 6 | 902.321 | 111.26 | -7.59 | 46.0 | -65.26 | Peak | 107.00 | 150 | Vertical | N/A |

## MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT H



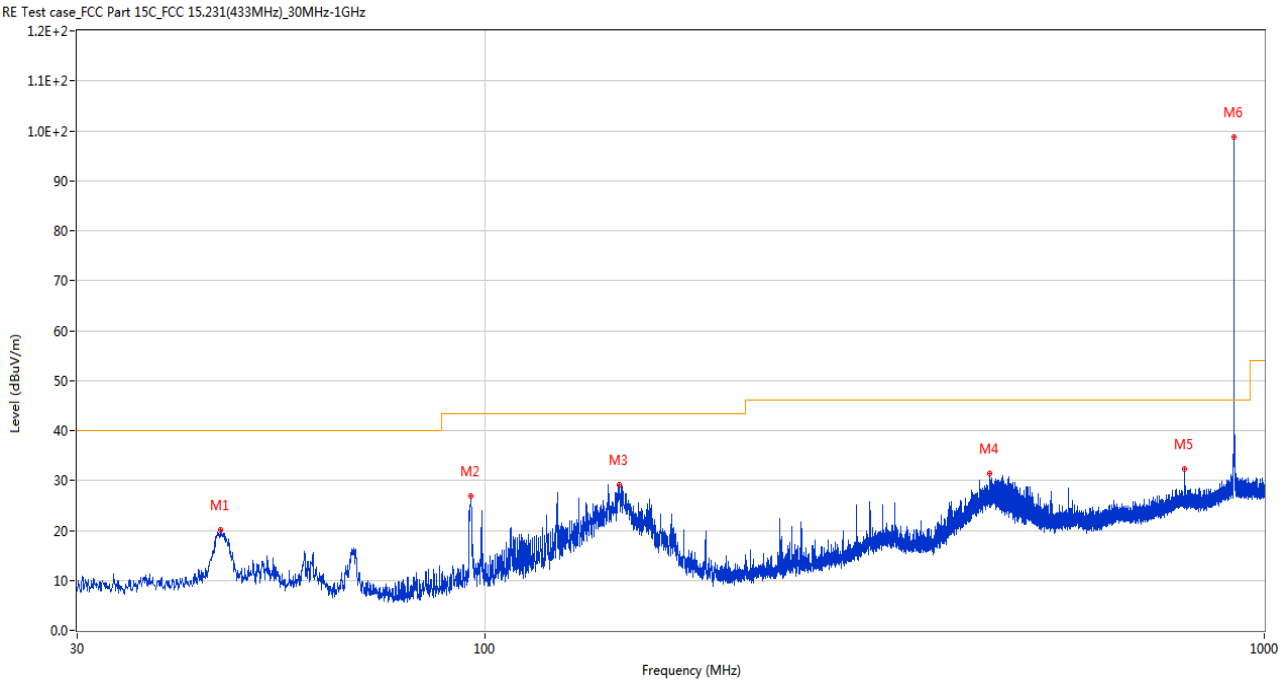

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67.636 | 18.98 | -28.01 | 40.0 | 21.02 | Peak | 338.00 | 150 | Horizontal | Pass |
| 2 | 96.057 | 26.47 | -29.08 | 43.5 | 17.03 | Peak | 58.00 | 100 | Horizontal | Pass |
| 3 | 144.120 | 29.64 | -24.81 | 43.5 | 13.86 | Peak | 52.00 | 150 | Horizontal | Pass |
| 4 | 324.056 | 28.53 | -23.03 | 46.0 | 17.47 | Peak | 242.00 | 150 | Horizontal | Pass |
| 5 | 458.983 | 31.86 | -19.19 | 46.0 | 14.14 | Peak | 159.00 | 200 | Horizontal | Pass |
| 6 | 908.529 | 97.96 | -7.61 | 46.0 | -51.96 | Peak | 221.00 | 150 | Horizontal | N/A |

## MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT V



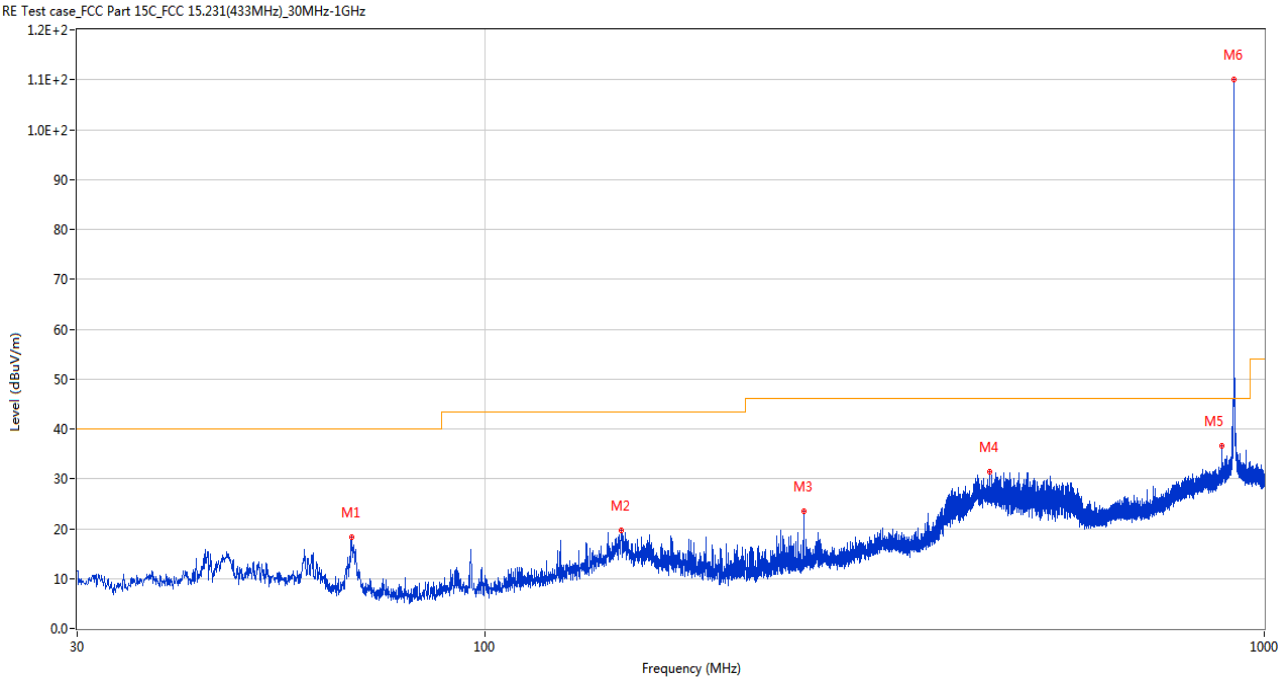

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67.879 | 18.30 | -28.03 | 40.0 | 21.70 | Peak | 0.00 | 150 | Vertical | Pass |
| 2 | 125.011 | 21.11 | -26.17 | 43.5 | 22.39 | Peak | 224.00 | 200 | Vertical | Pass |
| 3 | 265.565 | 23.79 | -25.15 | 46.0 | 22.21 | Peak | 53.00 | 150 | Vertical | Pass |
| 4 | 459.128 | 32.20 | -19.19 | 46.0 | 13.80 | Peak | 60.00 | 100 | Vertical | Pass |
| 5 | 876.567 | 37.76 | -8.70 | 46.0 | 8.24 | Peak | 249.00 | 150 | Vertical | Pass |
| 6 | 908.432 | 110.43 | -7.61 | 46.0 | -64.43 | Peak | 107.00 | 150 | Vertical | N/A |

## HIGH CHANNEL, 30 MHz to 1 GHz, ANT H



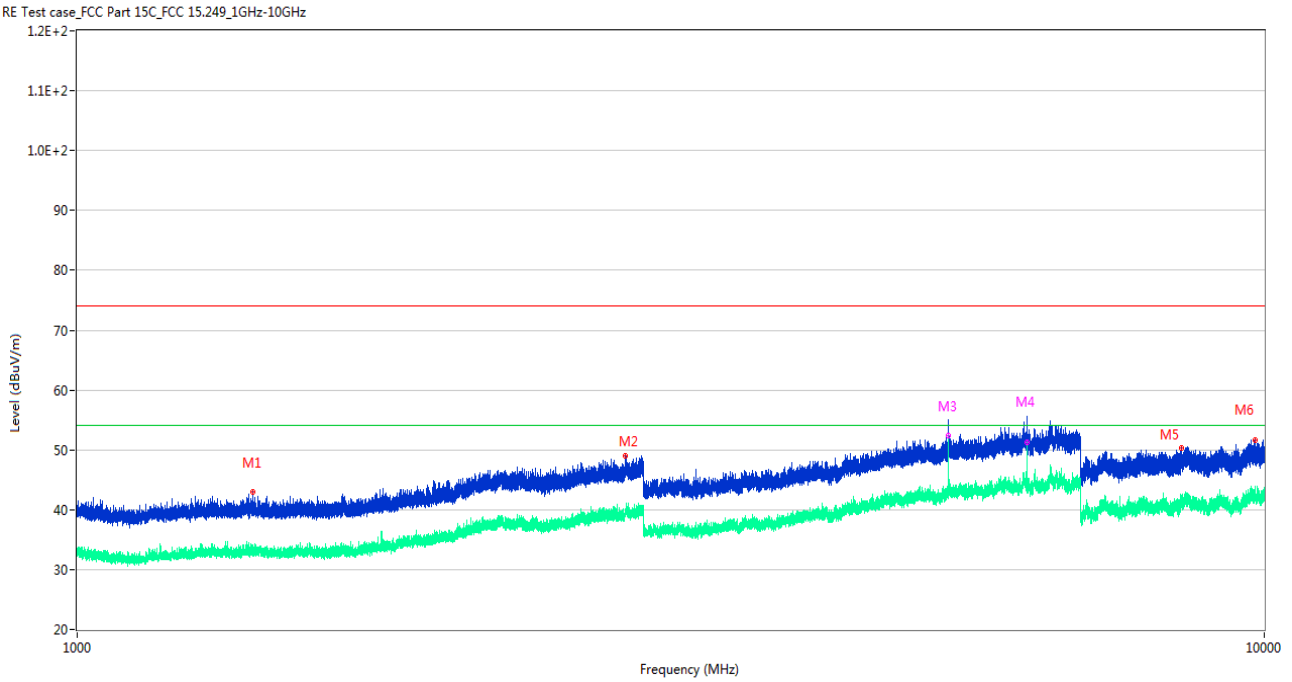

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.859 | 20.19 | -26.19 | 40.0 | 19.81 | Peak | 170.00 | 200 | Horizontal | Pass |
| 2 | 96.008 | 26.83 | -29.08 | 43.5 | 16.67 | Peak | 237.00 | 150 | Horizontal | Pass |
| 3 | 148.680 | 29.20 | -24.41 | 43.5 | 14.30 | Peak | 229.00 | 100 | Horizontal | Pass |
| 4 | 443.948 | 31.44 | -19.61 | 46.0 | 14.56 | Peak | 170.00 | 150 | Horizontal | Pass |
| 5 | 790.092 | 32.38 | -9.84 | 46.0 | 13.62 | Peak | 103.00 | 100 | Horizontal | Pass |
| 6 | 914.882 | 98.68 | -7.83 | 46.0 | -52.68 | Peak | 221.00 | 150 | Horizontal | N/A |

## HIGH CHANNEL, 30 MHz to 1 GHz, ANT V



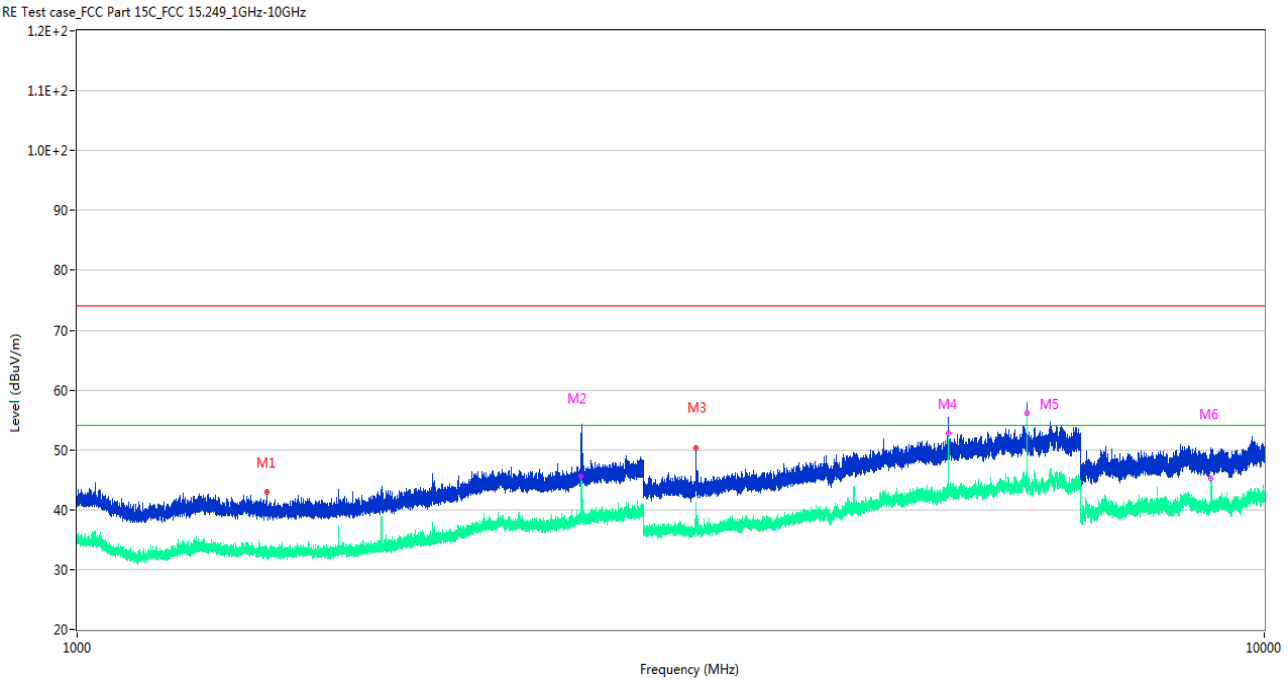

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 67.442 | 18.21 | -28.00 | 40.0 | 21.79 | Peak | 58.00 | 300 | Vertical | Pass |
| 2 | 149.747 | 19.71 | -24.33 | 43.5 | 23.79 | Peak | 183.00 | 150 | Vertical | Pass |
| 3 | 256.592 | 23.54 | -25.59 | 46.0 | 22.46 | Peak | 104.00 | 100 | Vertical | Pass |
| 4 | 444.093 | 31.40 | -19.60 | 46.0 | 14.60 | Peak | 78.00 | 150 | Vertical | Pass |
| 5 | 882.969 | 36.66 | -8.56 | 46.0 | 9.34 | Peak | 100.00 | 150 | Vertical | Pass |
| 6 | 914.931 | 109.99 | -7.83 | 46.0 | -63.99 | Peak | 104.00 | 150 | Vertical | N/A |

## LOW CHANNEL 1 GHz to 10 GHz, ANT H



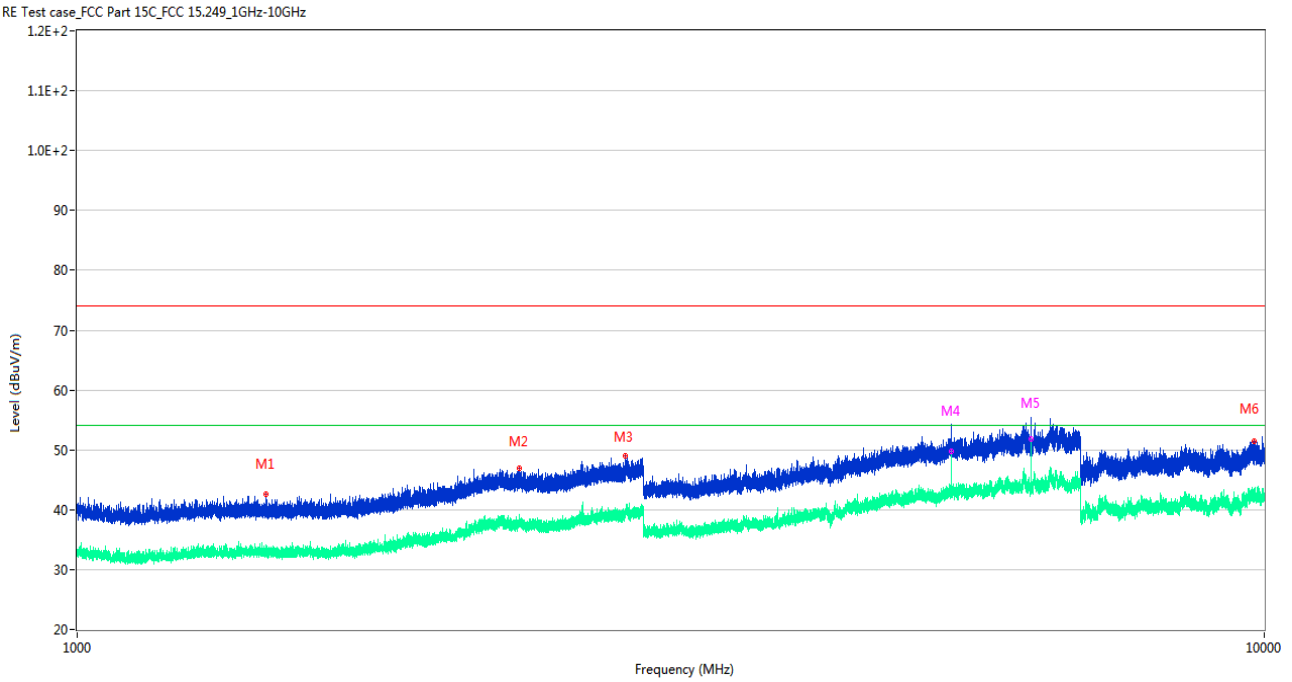

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1406.100 | 42.93 | -13.28 | 74.0 | 31.07 | Peak | 47.00 | 150 | Horizontal | Pass |
| 1** | 1406.100 | 32.33 | -13.28 | 54.0 | 21.67 | AV | 47.00 | 150 | Horizontal | Pass |
| 2 | 2895.700 | 49.09 | -4.67 | 74.0 | 24.91 | Peak | 3.00 | 150 | Horizontal | Pass |
| 2** | 2895.700 | 39.48 | -4.67 | 54.0 | 14.52 | AV | 3.00 | 150 | Horizontal | Pass |
| 3 | 5414.000 | 54.22 | -2.40 | 74.0 | 19.78 | Peak | 197.00 | 150 | Horizontal | Pass |
| 3** | 5414.000 | 52.36 | -2.40 | 54.0 | 1.64 | AV | 197.00 | 150 | Horizontal | Pass |
| 4 | 6316.000 | 53.79 | -1.28 | 74.0 | 20.21 | Peak | 0.00 | 150 | Horizontal | Pass |
| 4** | 6316.000 | 51.25 | -1.28 | 54.0 | 2.75 | AV | 0.00 | 150 | Horizontal | N/A |
| 5 | 8524.000 | 50.28 | -1.70 | 74.0 | 23.72 | Peak | 0.00 | 150 | Horizontal | Pass |
| 5** | 8524.000 | 40.67 | -1.70 | 54.0 | 13.33 | AV | 0.00 | 150 | Horizontal | Pass |
| 6 | 9816.401 | 51.68 | -0.01 | 74.0 | 22.32 | Peak | 311.00 | 150 | Horizontal | Pass |
| 6** | 9816.401 | 43.50 | -0.01 | 54.0 | 10.50 | AV | 311.00 | 150 | Horizontal | Pass |

## LOW CHANNEL 1 GHz to 10 GHz, ANT V



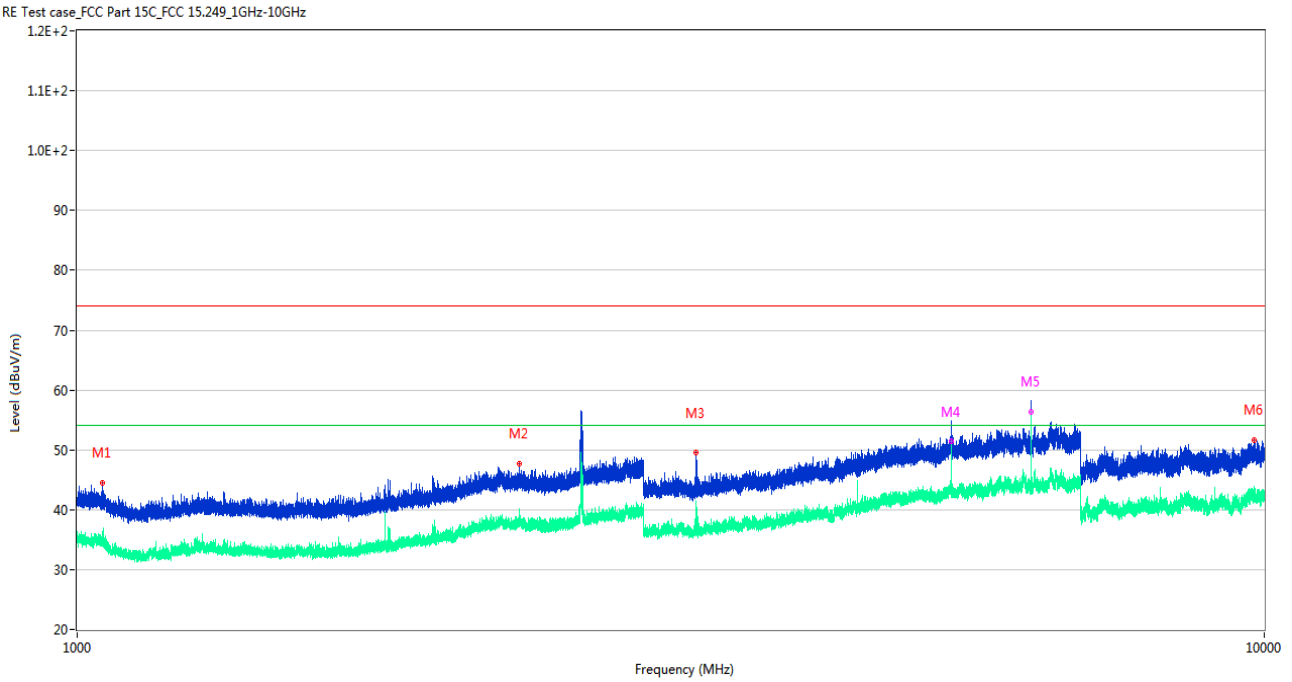

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1445.700 | 42.91 | -13.70 | 74.0 | 31.09 | Peak | 294.00 | 150 | Vertical | Pass |
| 1** | 1445.700 | 32.36 | -13.70 | 54.0 | 21.64 | AV | 294.00 | 150 | Vertical | Pass |
| 2 | 2657.000 | 52.64 | -7.07 | 74.0 | 21.36 | Peak | 187.00 | 150 | Vertical | Pass |
| 2** | 2657.000 | 45.66 | -7.07 | 54.0 | 8.34 | AV | 187.00 | 150 | Vertical | Pass |
| 3 | 3321.200 | 50.40 | -8.31 | 74.0 | 23.60 | Peak | 201.00 | 150 | Vertical | Pass |
| 3** | 3321.200 | 37.22 | -8.31 | 54.0 | 16.78 | AV | 201.00 | 150 | Vertical | Pass |
| 4 | 5413.800 | 55.45 | -2.40 | 74.0 | 18.55 | Peak | 355.00 | 150 | Vertical | Pass |
| 4** | 5413.800 | 52.71 | -2.40 | 54.0 | 1.29 | AV | 355.00 | 150 | Vertical | Pass |
| 5 | 6316.200 | 57.34 | -1.31 | 74.0 | 16.66 | Peak | 222.00 | 150 | Vertical | Pass |
| 5** | 6316.200 | 56.23 | -1.31 | 54.0 | -2.23 | AV | 222.00 | 150 | Vertical | N/A |
| 6 | 9022.900 | 49.54 | -0.58 | 74.0 | 24.46 | Peak | 104.00 | 150 | Vertical | Pass |
| 6** | 9022.900 | 45.15 | -0.58 | 54.0 | 8.85 | AV | 104.00 | 150 | Vertical | Pass |

## MIDDLE CHANNEL 1 GHz to 10 GHz, ANT H



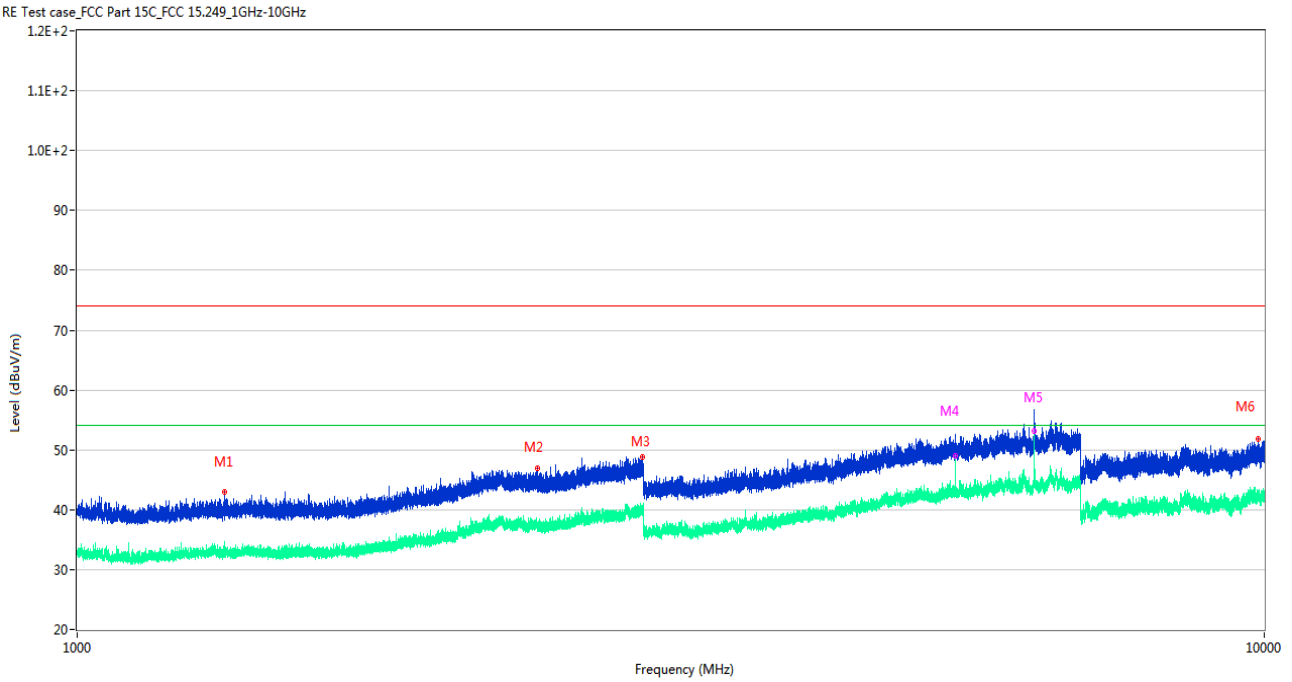

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1441.600 | 42.62 | -13.53 | 74.0 | 31.38 | Peak | 300.00 | 300 | Horizontal | Pass |
| 1** | 1441.600 | 32.53 | -13.53 | 54.0 | 21.47 | AV | 300.00 | 300 | Horizontal | Pass |
| 2 | 2357.000 | 46.91 | -7.69 | 74.0 | 27.09 | Peak | 267.00 | 200 | Horizontal | Pass |
| 2** | 2357.000 | 37.73 | -7.69 | 54.0 | 16.27 | AV | 267.00 | 200 | Horizontal | Pass |
| 3 | 2896.700 | 49.01 | -4.44 | 74.0 | 24.99 | Peak | 213.00 | 200 | Horizontal | Pass |
| 3** | 2896.700 | 39.32 | -4.44 | 54.0 | 14.68 | AV | 213.00 | 200 | Horizontal | Pass |
| 4 | 5451.000 | 52.76 | -2.03 | 74.0 | 21.24 | Peak | 202.00 | 150 | Horizontal | Pass |
| 4** | 5451.000 | 49.74 | -2.03 | 54.0 | 4.26 | AV | 202.00 | 150 | Horizontal | Pass |
| 5 | 6359.400 | 55.13 | -2.13 | 74.0 | 18.87 | Peak | 225.00 | 150 | Horizontal | Pass |
| 5** | 6359.400 | 51.84 | -2.13 | 54.0 | 2.16 | AV | 225.00 | 150 | Horizontal | N/A |
| 6 | 9810.700 | 51.48 | -0.02 | 74.0 | 22.52 | Peak | 205.00 | 300 | Horizontal | Pass |
| 6** | 9810.700 | 43.06 | -0.02 | 54.0 | 10.94 | AV | 205.00 | 300 | Horizontal | Pass |

## MIDDLE CHANNEL 1 GHz to 10 GHz, ANT V



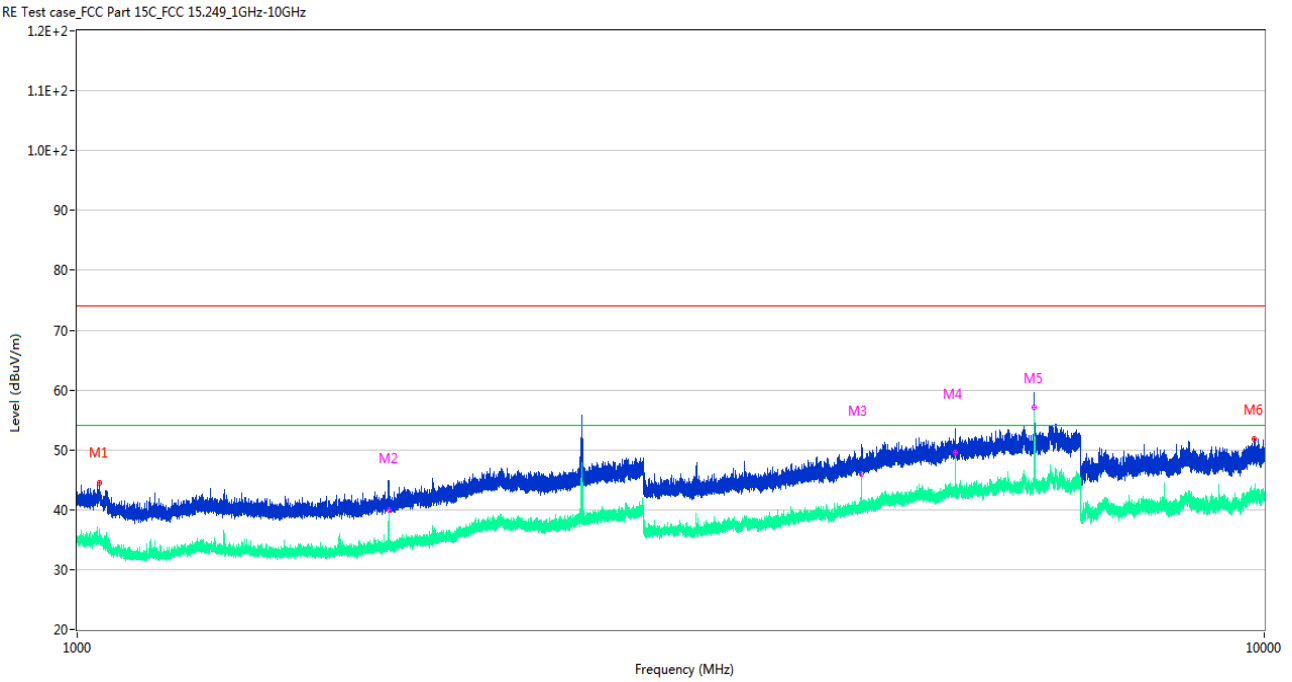

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1050.100 | 44.52 | -13.84 | 74.0 | 29.48 | Peak | 34.00 | 300 | Vertical | Pass |
| 1** | 1050.100 | 34.26 | -13.84 | 54.0 | 19.74 | AV | 34.00 | 300 | Vertical | Pass |
| 2 | 2358.000 | 47.73 | -7.83 | 74.0 | 26.27 | Peak | 175.00 | 400 | Vertical | Pass |
| 2** | 2358.000 | 40.06 | -7.83 | 54.0 | 13.94 | AV | 175.00 | 400 | Vertical | Pass |
| 3 | 3318.000 | 49.64 | -8.07 | 74.0 | 24.36 | Peak | 184.00 | 150 | Vertical | Pass |
| 3** | 3318.000 | 37.46 | -8.07 | 54.0 | 16.54 | AV | 184.00 | 150 | Vertical | Pass |
| 4 | 5450.800 | 54.84 | -2.02 | 74.0 | 19.16 | Peak | 0.00 | 150 | Vertical | Pass |
| 4** | 5450.800 | 51.39 | -2.02 | 54.0 | 2.61 | AV | 0.00 | 150 | Vertical | Pass |
| 5 | 6359.200 | 58.28 | -2.12 | 74.0 | 15.72 | Peak | 229.00 | 150 | Vertical | Pass |
| 5** | 6359.200 | 56.41 | -2.12 | 54.0 | -2.41 | AV | 229.00 | 150 | Vertical | N/A |
| 6 | 9814.450 | 51.63 | -0.03 | 74.0 | 22.37 | Peak | 180.00 | 300 | Vertical | Pass |
| 6** | 9814.450 | 42.25 | -0.03 | 54.0 | 11.75 | AV | 180.00 | 300 | Vertical | Pass |

## HIGH CHANNEL 1 GHz to 10 GHz, ANT H




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1329.900 | 43.04 | -13.39 | 74.0 | 30.96 | Peak | 110.00 | 200 | Horizontal | Pass |
| 1** | 1329.900 | 32.13 | -13.39 | 54.0 | 21.87 | AV | 110.00 | 200 | Horizontal | Pass |
| 2 | 2442.300 | 47.01 | -8.84 | 74.0 | 26.99 | Peak | 146.00 | 300 | Horizontal | Pass |
| 2** | 2442.300 | 37.23 | -8.84 | 54.0 | 16.77 | AV | 146.00 | 300 | Horizontal | Pass |
| 3 | 2994.200 | 48.84 | -4.87 | 74.0 | 25.16 | Peak | 360.00 | 200 | Horizontal | Pass |
| 3** | 2994.200 | 40.00 | -4.87 | 54.0 | 14.00 | AV | 360.00 | 200 | Horizontal | Pass |
| 4 | 5489.200 | 52.42 | -2.46 | 74.0 | 21.58 | Peak | 179.00 | 150 | Horizontal | Pass |
| 4** | 5489.200 | 49.02 | -2.46 | 54.0 | 4.98 | AV | 179.00 | 150 | Horizontal | Pass |
| 5 | 6404.600 | 56.33 | 0.24 | 74.0 | 17.67 | Peak | 288.00 | 150 | Horizontal | Pass |
| 5** | 6404.600 | 53.11 | 0.24 | 54.0 | 0.89 | AV | 288.00 | 150 | Horizontal | N/A |
| 6 | 9873.849 | 51.75 | -0.83 | 74.0 | 22.25 | Peak | 226.00 | 400 | Horizontal | Pass |
| 6** | 9873.849 | 42.54 | -0.83 | 54.0 | 11.46 | AV | 226.00 | 400 | Horizontal | Pass |

## HIGH CHANNEL 1 GHz to 10 GHz, ANT V



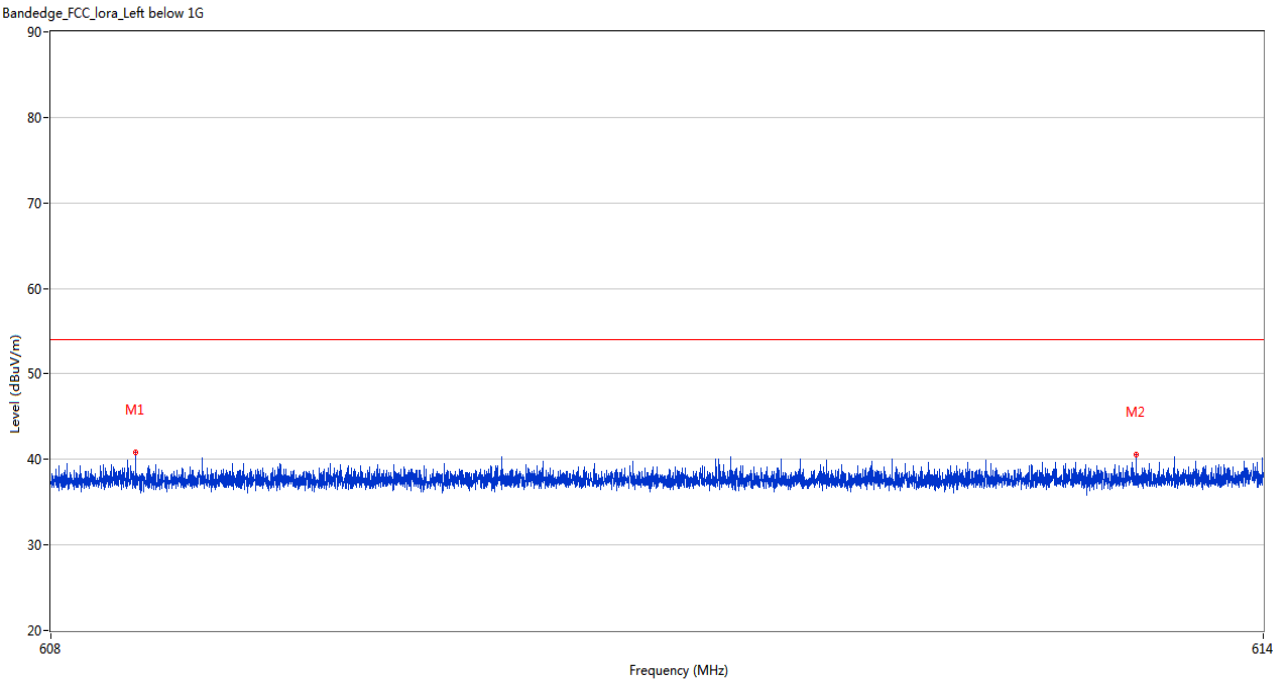

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1044.300 | 44.51 | -13.36 | 74.0 | 29.49 | Peak | 44.00 | 300 | Vertical | Pass |
| 1** | 1044.300 | 34.71 | -13.36 | 54.0 | 19.29 | AV | 44.00 | 300 | Vertical | Pass |
| 2 | 1830.100 | 43.83 | -12.55 | 74.0 | 30.17 | Peak | 97.00 | 150 | Vertical | Pass |
| 2** | 1830.100 | 39.87 | -12.55 | 54.0 | 14.13 | AV | 97.00 | 150 | Vertical | Pass |
| 3 | 4574.800 | 49.82 | -4.27 | 74.0 | 24.18 | Peak | 62.00 | 150 | Vertical | Pass |
| 3** | 4574.800 | 45.94 | -4.27 | 54.0 | 8.06 | AV | 62.00 | 150 | Vertical | Pass |
| 4 | 5489.600 | 53.05 | -2.45 | 74.0 | 20.95 | Peak | 84.00 | 150 | Vertical | Pass |
| 4** | 5489.600 | 49.66 | -2.45 | 54.0 | 4.34 | AV | 84.00 | 150 | Vertical | Pass |
| 5 | 6404.200 | 59.08 | 0.20 | 74.0 | 14.92 | Peak | 211.00 | 150 | Vertical | Pass |
| 5** | 6404.200 | 57.02 | 0.20 | 54.0 | -3.02 | AV | 211.00 | 150 | Vertical | N/A |
| 6 | 9814.300 | 51.81 | -0.03 | 74.0 | 22.19 | Peak | 360.00 | 200 | Vertical | Pass |
| 6** | 9814.300 | 42.76 | -0.03 | 54.0 | 11.24 | AV | 360.00 | 200 | Vertical | Pass |

## A.9 Band Edge (Restricted-band band-edge)

Note [1]: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.
Note [2]: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.
Note [3]: According the ANSI C63.10-2013, where limits are specified for both average and peak (or quasi-peak) detector functions, if the peak (or quasi-peak) measured value complies with the average limit, it is unnecessary to perform an average measurement.
Note [4]: The Level (dBuV/m) has been corrected by factor.

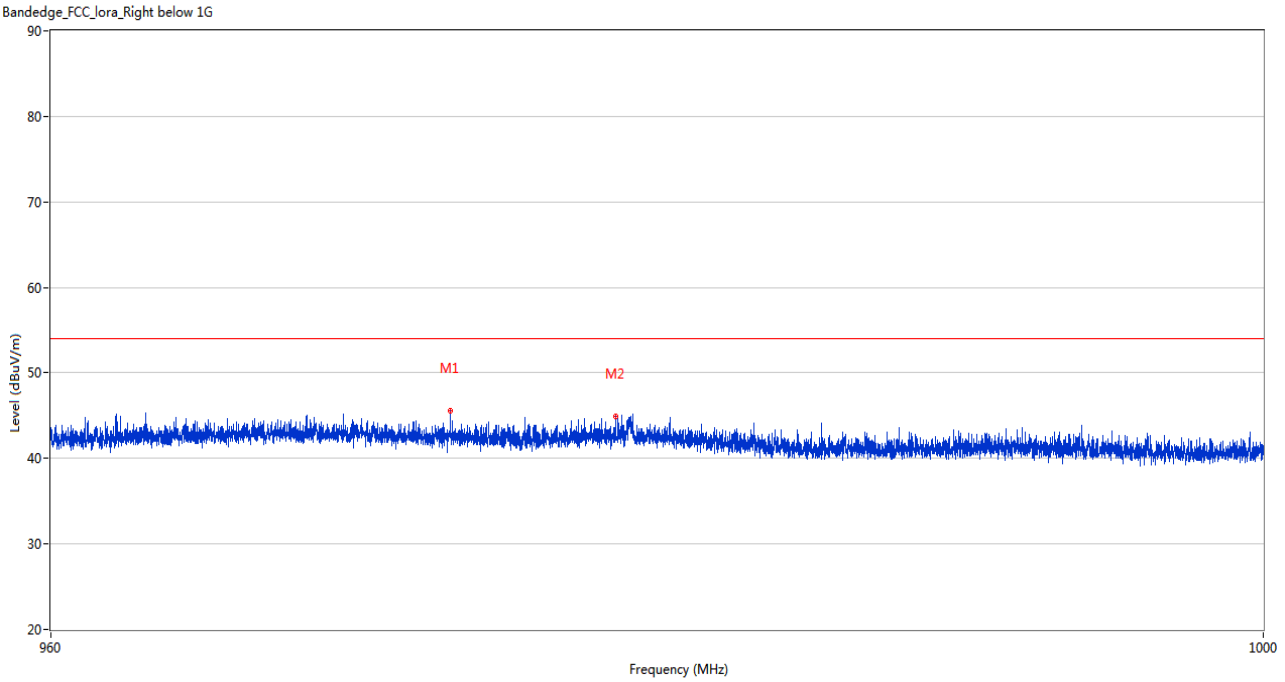
Test Data and Plots

LOW CHANNEL



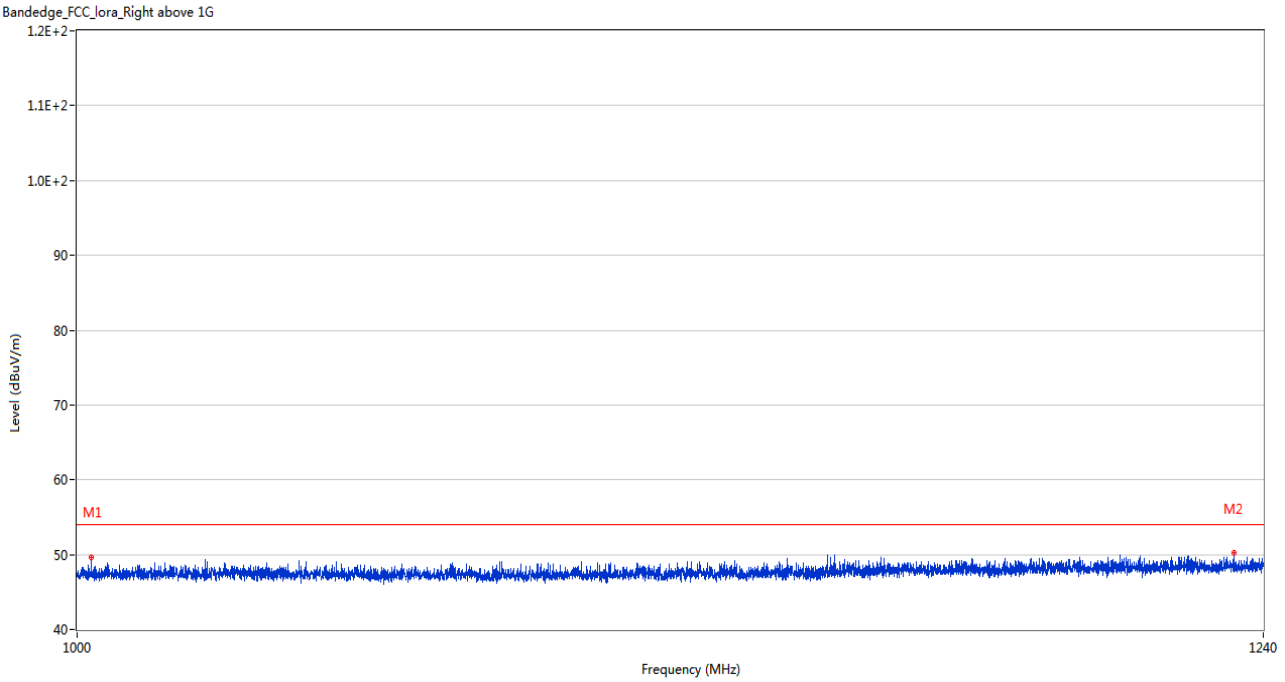

| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 608.418 | 40.89 | 3.00 | 54.0 | 13.11 | Peak | 106.00 | 150 | Vertical | Pass |
| 2 | 613.369 | 40.51 | 3.19 | 54.0 | 13.49 | Peak | 41.00 | 200 | Vertical | Pass |

## HIGH CHANNEL




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 973.000 | 45.55 | -3.29 | 54.0 | 8.45 | Peak | 199.00 | 150 | Vertical | Pass |
| 2 | 978.440 | 44.87 | -3.43 | 54.0 | 9.13 | Peak | 212.00 | 150 | Vertical | Pass |

## HIGH CHANNEL




| No. | Frequency (MHz) | Results (dBuV/m) | Factor (dB) | Limit (dBuV/m) | Margin (dB) | Detector | Table (Degree) | Height (cm) | Antenna | Verdict |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1002.560 | 49.60 | -6.18 | 54.0 | 4.40 | Peak | 350.00 | 150 | Vertical | Pass |
| 2 | 1233.440 | 50.19 | -5.62 | 54.0 | 3.81 | Peak | 75.00 | 150 | Vertical | Pass |

# ANNEX B TEST SETUP PHOTOS

Please refer the document “BL-SZ2351174-AR.PDF”.

# ANNEX C EUT EXTERNAL PHOTOS

Please refer the document “BL-SZ2351174-AW.PDF”.

# ANNEX D EUT INTERNAL PHOTOS

Please refer the document “BL-SZ2351174-AI.PDF”.

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--END OF REPORT--