

# 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  
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**ISSUED BY:**

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<b>Revision History</b>		
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	<input checked="" type="checkbox"/> Block B, 1/F, Baisha Science and Technology Park, Shahe Xi Road, Nanshan District, Shenzhen, Guangdong Province, P. R. China
	<input type="checkbox"/> 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
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The requirement for the following technical information of the EUT was tested in this report:

Modulation Technology	LoRa
Modulation Type	GFSK
Product Type	<input checked="" type="checkbox"/> Mobile <input type="checkbox"/> Portable <input type="checkbox"/> Fix Location
Frequency Range	The frequency range used is 903 MHz to 914.2 MHz.
Frequency Bandwidth	500 kHz
Number of Channel	8
Tested Channel	65 (903 MHz), 68 (907.8 MHz), 72 (914.2 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	Frequency (MHz)	Channel Number	Frequency (MHz)
<b>65</b>	<b>903.0</b>	69	909.4
66	904.6	70	911.0
67	906.2	71	912.6
<b>68</b>	<b>907.8</b>	<b>72</b>	<b>914.2</b>

### 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.	Channel	Verdict
1	Antenna Requirement	15.203	--	Pass <sup>Note</sup>
2	Output Power	15.247(b)	ANNEX A.1	Pass
3	Occupied Bandwidth	15.247(a)	ANNEX A.2	Pass
4	Conducted Spurious Emission	15.247(d)	ANNEX A.3	Pass
5	Band Edge(Authorized-band band-edge)	15.247(d)	ANNEX A.4	Pass
6	Conducted Emission	15.207	ANNEX A.5	Pass
7	Radiated Spurious Emission	15.209 15.247(d)	ANNEX A.6	Pass
8	Band Edge(Restricted-band band-edge)	15.209 15.247(d)	ANNEX A.7	Pass
9	Power spectral density (PSD)	15.247(e)	ANNEX A.8	Pass

Note: The EUT has a permanently and irreplaceable attached antenna, which complies with the requirement FCC 15.203.

## 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°C to +25.1°C
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	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 %

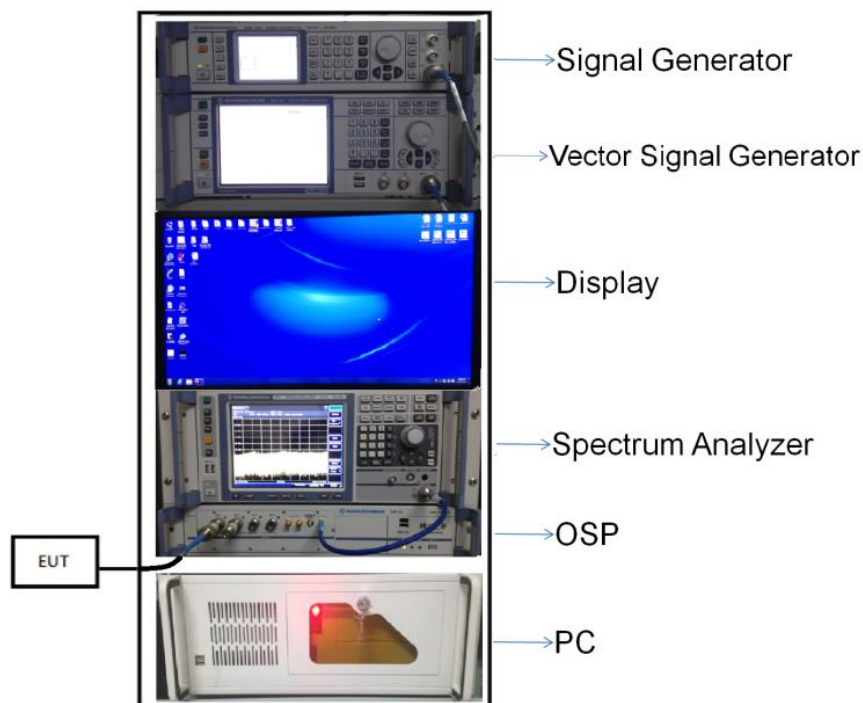
### 4.4 Description of Test Setup

#### 4.4.1 For Antenna Port Test

$$\text{Conducted value (dBm)} = \text{Measurement value (dBm)} + \text{cable loss (dB)}$$

For example: the measurement value is 10 dBm and the cable 0.5dBm used, then the final result of EUT:

$$\text{Conducted value (dBm)} = 10 \text{ dBm} + 0.5 \text{ dB} = 10.5 \text{ dBm}$$



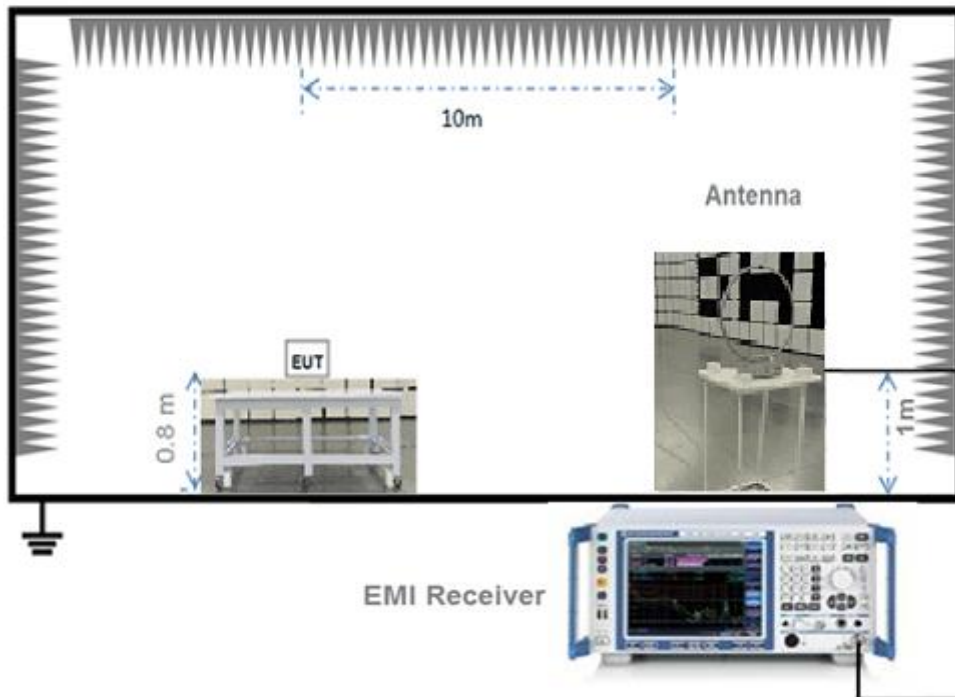
(Diagram 1)

4.4.2 For AC Power Supply Port Test



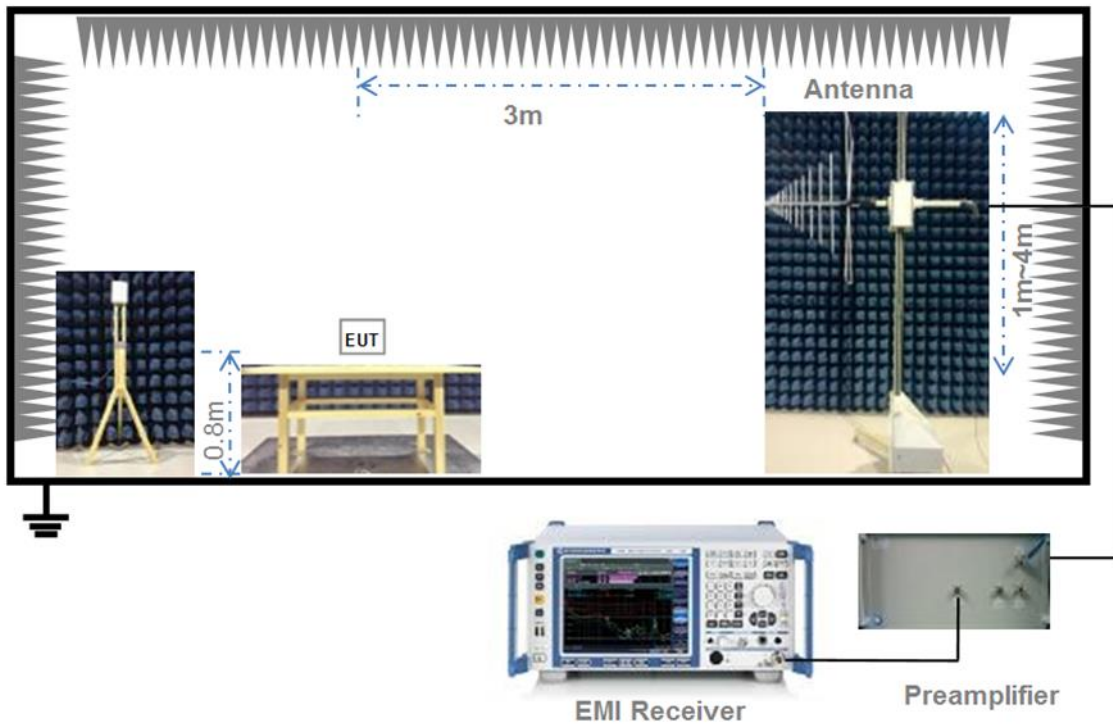
(Diagram 2)

4.4.3 For Radiated Test (Below 30 MHz)



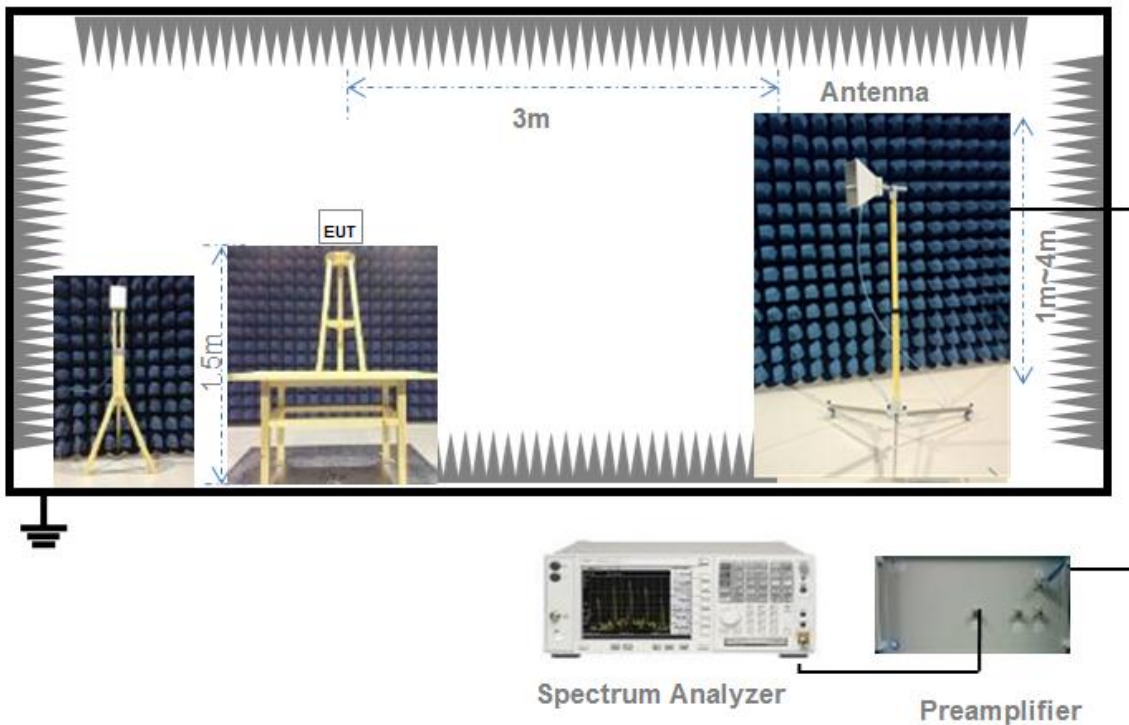
(Diagram 3)

#### 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.

### 4.5.2 For radiated band edges and spurious emission test:

$$E = \text{EIRP} - 20\log D + 104.8$$

where:

E = electric field strength in dB $\mu$ V/m,

EIRP = equivalent isotropic radiated power in dBm

D = specified measurement distance in meters.

EIRP = Measure Conducted output power Value (dBm) + Maximum transmit antenna gain (dBi) + the appropriate maximum ground reflection factor (dB)

## 5 TEST ITEMS

### 5.1 Antenna Requirements

#### 5.1.1 Relevant Standards

FCC §15.203 & 15.247(b)

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.	An embedded-in antenna design is used.

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 Output Power

### 5.2.1 Test Limit

#### FCC § 15.247(b)

For systems using digital modulation in the 902-928 MHz, 2400-2483.5 MHz, and 5725-5850 MHz bands: 1 Watt. As an alternative to a peak power measurement, compliance with the one Watt limit can be based on a measurement of the maximum conducted output power. Maximum Conducted Output Power is defined as the total transmit power delivered to all antennas and antenna elements averaged across all symbols in the signaling alphabet when the transmitter is operating at its maximum power control level. Power must be summed across all antennas and antenna elements.

### 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

#### a) Maximum peak conducted output power

This procedure shall be used when the measurement instrument has available a resolution bandwidth that is greater than the DTS bandwidth.

Set the RBW  $\geq$  DTS bandwidth.

Set VBW  $\geq$  3 x RBW.

Set span  $\geq$  3 x RBW

Sweep time = auto couple.

Detector = peak.

Trace mode = max hold.

Allow trace to fully stabilize.

Use peak marker function to determine the peak amplitude level.

#### b) Measurements of duty cycle

The zero-span mode on a spectrum analyzer or EMI receiver if the response time and spacing between bins on the sweep are sufficient to permit accurate measurements of the on and off times of the transmitted signal.

Set the center frequency of the instrument to the center frequency of the transmission.

Set RBW  $\geq$  OBW if possible; otherwise, set RBW to the largest available value.

Set VBW  $\geq$  RBW. Set detector = peak or average.

The zero-span measurement method shall not be used unless both RBW and VBW are  $> 50/T$  and the number of sweep points across duration T exceeds 100. (For example, if VBW and/or RBW are limited to 3 MHz, then the zero-span method of measuring duty cycle shall not be used if  $T \leq 16.7$  microseconds.)

#### 5.2.4 Test Result

Please refer to ANNEX A.1.

## 5.3 Occupied Bandwidth

### 5.3.1 Limit

FCC §15.247(a)

Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. In order to make an accurate measurement, set the span greater than RBW. The 6 dB bandwidth must be greater than 500 kHz.

### 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

Use the following spectrum analyzer settings:

Set RBW = 100 kHz.

Set the video bandwidth (VBW)  $\geq 3$  RBW.

Detector = Peak.

Trace mode = max hold.

Sweep = auto couple.

Allow the trace to stabilize.

Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 5.3.4 Test Result

Please refer to ANNEX A.2.



## 5.4 Conducted Spurious Emission

### 5.4.1 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.

### 5.4.2 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

The DTS rules specify that in any 100 kHz bandwidth outside of the authorized frequency band, the power shall be attenuated according to the following conditions:

- a) If the maximum peak conducted output power procedure was used to demonstrate compliance as described in 9.1, then the peak output power measured in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 20 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 20 dBc).
- b) If maximum conducted (average) output power was used to demonstrate compliance as described in 9.2, then the peak power in any 100 kHz bandwidth outside of the authorized frequency band shall be attenuated by at least 30 dB relative to the maximum in-band peak PSD level in 100 kHz (i.e., 30 dBc).
- c) In either case, attenuation to levels below the 15.209 general radiated emissions limits is not required.

The following procedures shall be used to demonstrate compliance to these limits. Note that these procedures can be used in either an antenna-port conducted or radiated test set-up. Radiated tests must conform to the test site requirements and utilize maximization procedures defined herein.

Reference level measurement:

Establish a reference level by using the following procedure:

Set instrument center frequency to DTS channel center frequency.

Set the span to  $\geq 1.5$  times the DTS bandwidth.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum PSD level.

Emission level measurement:

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.

Set the RBW = 100 kHz.

Set the VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level.

Ensure that the amplitude of all unwanted emissions outside of the authorized frequency band (excluding restricted frequency bands) are attenuated by at least the minimum requirements specified in 11.1 a) or 11.1 b). Report the three highest emissions relative to the limit.

#### 5.4.4 Test Result

Please refer to ANNEX A.3.

## 5.5 Band Edge (Authorized-band band-edge)

### 5.5.1 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.

### 5.5.2 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 following procedures may be used to determine the peak or average field strength or power of an unwanted emission that is within 2 MHz of the authorized band edge. If a peak detector is utilized, use the procedure described in 13.2.1. Use the procedure described in 13.2.2 when using an average detector and the EUT can be configured to transmit continuously (i.e., duty cycle  $\geq 98\%$ ). Use the procedure described in 13.2.3 when using an average detector and the EUT cannot be configured to transmit continuously but the duty cycle is constant (i.e., duty cycle variations are less than  $\pm 2$  percent). Use the procedure described in 13.2.4 when using an average detector for those cases where the EUT cannot be configured to transmit continuously and the duty cycle is not constant (duty cycle variations equal or exceed 2 percent).

When using a peak detector to measure unwanted emissions at or near the band edge (within 2 MHz of the authorized band), the following integration procedure can be used.

Set instrument center frequency to the frequency of the emission to be measured (must be within 2 MHz of the authorized band edge).

Set span to 2 MHz

RBW = 100 kHz.

VBW  $\geq 3 \times$  RBW.

Detector = peak.

Sweep time = auto.

Trace mode = max hold.

Allow sweep to continue until the trace stabilizes (required measurement time may increase for low duty cycle applications)

Compute the power by integrating the spectrum over 1 MHz using the analyzer's band power measurement function with band limits set equal to the emission frequency (femission)  $\pm 0.5$  MHz. If the instrument does not have a band power function, then sum the amplitude levels (in power units) at 100 kHz intervals extending across the 1 MHz spectrum defined by femission  $\pm 0.5$  MHz.

#### 5.5.4 Test Result

Please refer to ANNEX A.4.

## 5.6 Conducted Emission

### 5.6.1 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 50 $\mu$ H/50 $\Omega$  line impedance stabilization network (LISN).

Frequency range (MHz)	Conducted Limit (dB $\mu$ V)	
	Quai-peak	Average
0.15 - 0.50	66 to 56	56 to 46
0.50 - 5	56	46
0.50 - 30	60	50

### 5.6.2 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.

### 5.6.3 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.

### 5.6.4 Test Result

Please refer to ANNEX A.5.

## 5.7 Radiated Spurious Emission

### 5.7.1 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 ( $\mu\text{V}/\text{m}$ )	Measurement Distance (m)
0.009 - 0.490	2400/F(kHz)	300
0.490 - 1.705	24000/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 (dB $\mu\text{V}/\text{m}$ ) = 20\*log[Field Strength ( $\mu\text{V}/\text{m}$ )].
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).

### 5.7.2 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.

### 5.7.3 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  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  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.

#### 5.7.4 Test Result

Please refer to ANNEX A.6.

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

### 5.8.1 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).

### 5.8.2 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.

### 5.8.3 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  $f \geq 1$  GHz, 100 kHz for  $f < 1$  GHz

VBW  $\geq$  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.

For transmitters operating above 1 GHz repeat the measurement with an average detector.

### 5.8.4 Test Result

Please refer to ANNEX A.7.



## 5.9 Power Spectral density (PSD)

### 5.9.1 Limit

#### FCC §15.247(e)

The same method of determining the conducted output power shall be used to determine the power spectral density. If a peak output power is measured, then a peak power spectral density measurement is required. If an average output power is measured, then an average power spectral density measurement should be used.

The transmitter power spectral density conducted from the transmitter to the antenna shall not be greater than 8 dBm in any 3 kHz band during any time interval of continuous transmission. This power spectral density shall be determined in accordance with the provisions of Section 5.4(4), (i.e. the power spectral density shall be determined using the same method as is used to determine the conducted output power).

### 5.9.2 Test Setup

See section 4.4.1 (Diagram 1) for test setup description for the antenna port. The photo of test setup please refer to ANNEX B.

### 5.9.3 Test Procedure

Set analyzer center frequency to DTS channel center frequency.

Set the span to 1.5 times the DTS bandwidth.

Set the RBW to:  $3 \text{ kHz} \leq \text{RBW} \leq 100 \text{ kHz}$ .

Set the VBW  $\geq 3 \text{ RBW}$ .

Detector = peak.

Sweep time = auto couple.

Trace mode = max hold.

Allow trace to fully stabilize.

Use the peak marker function to determine the maximum amplitude level within the RBW.

If measured value exceeds limit, reduce RBW (no less than 3 kHz) and repeat.

### 5.9.4 Test Result

Please refer to ANNEX A.8.

# ANNEX A TEST RESULT

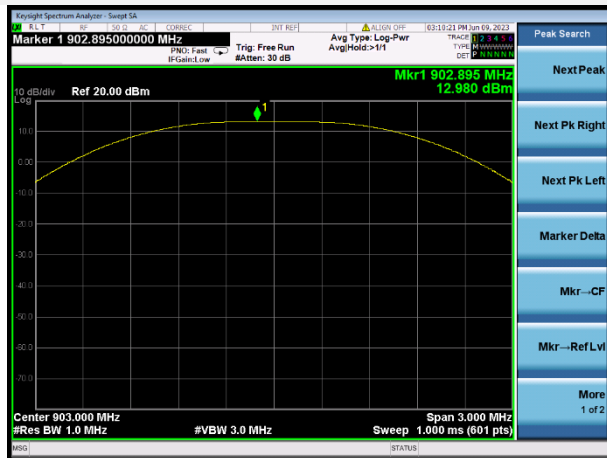
## A.1 Output Power

### Peak Power Test Data

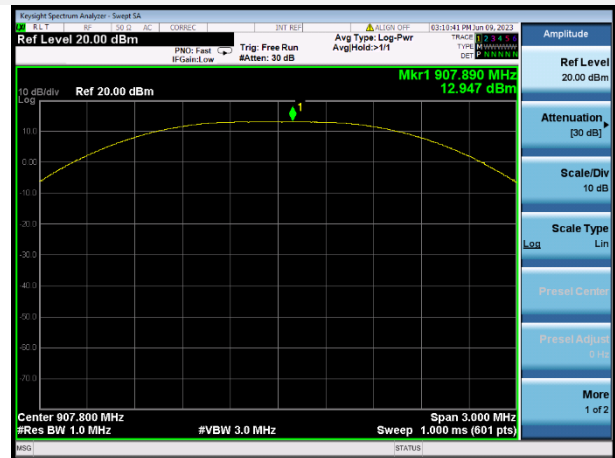
Channel	Measured Output Peak Power		Limit		Verdict
	LoRa		dBm	mW	
	dBm	mW			
Low	12.98	19.86	30	1000	Pass
Middle	12.95	19.71			Pass
High	12.91	19.53			Pass

### Test Plots

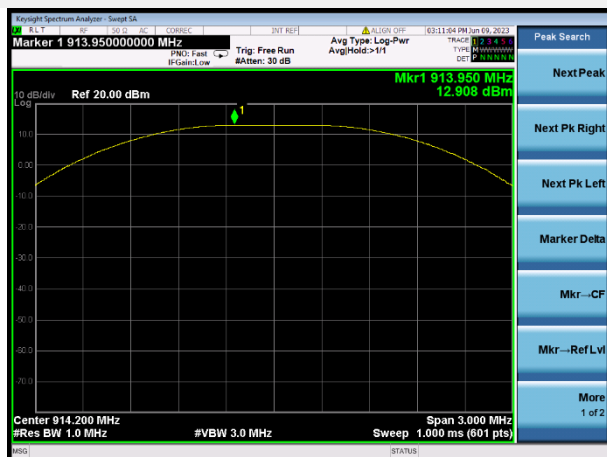
#### LOW CHANNEL



#### MIDDLE CHANNEL



#### HIGH CHANNEL



## A.2 Occupied Bandwidth

### Test Data

Test Mode	LoRa		
Channel	6 dB Bandwidth (MHz)	99% Bandwidth (MHz)	6 dB Bandwidth Limits (MHz)
Low Channel	0.650000	0.524030	≥0.5
Middle Channel	0.650000	0.523280	≥0.5
High Channel	0.650000	0.524060	≥0.5

### Test Plots

#### 6 dB Bandwidth

##### LOW CHANNEL



##### MIDDLE CHANNEL

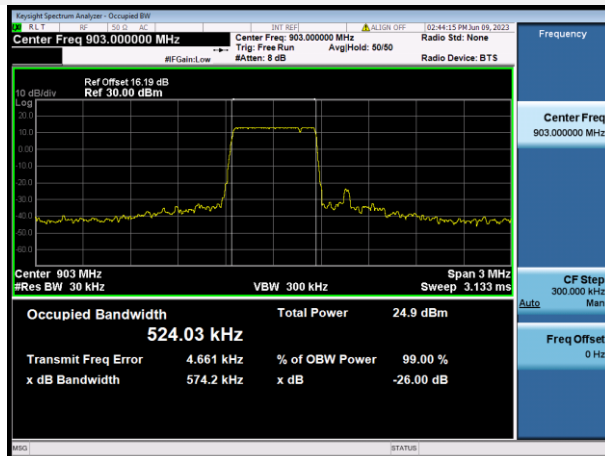


##### HIGH CHANNEL

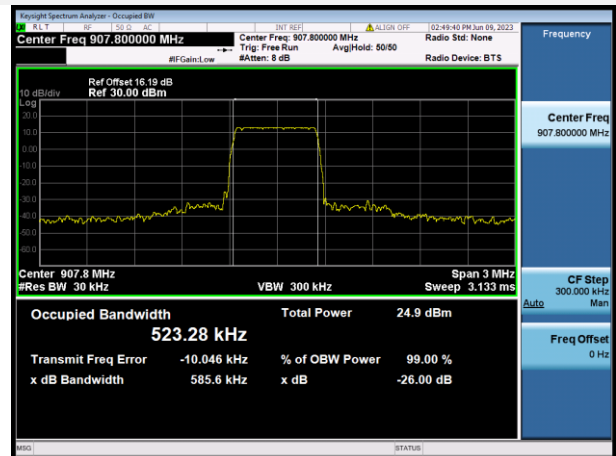


99% Bandwidth

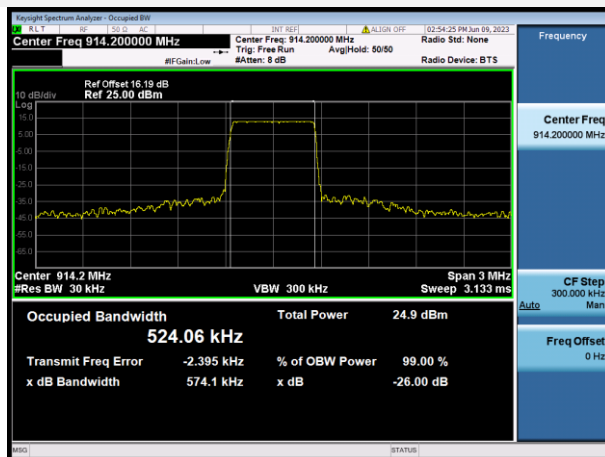
LOW CHANNEL



MIDDLE CHANNEL



HIGH CHANNEL



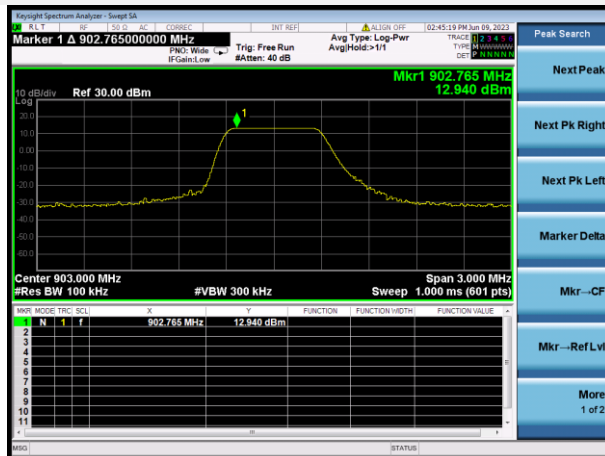
### A.3 Conducted Spurious Emissions

#### Test Data

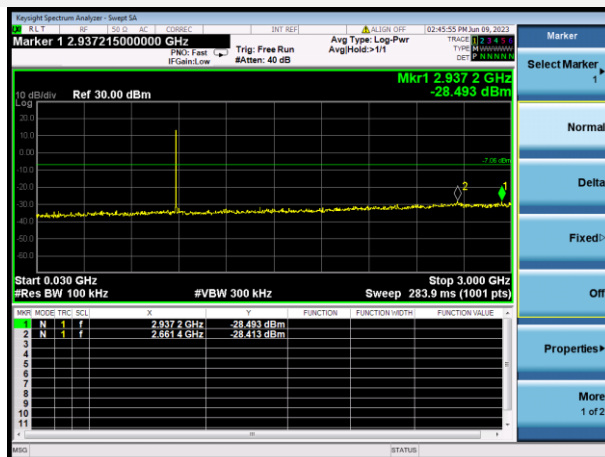
LoRa				
Channel	Measured Max. Out of Band Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low	-15.37	12.94	-7.06	Pass
Middle	-23.81	12.94	-7.06	Pass
High	-24.72	12.88	-7.12	Pass

Test Plots

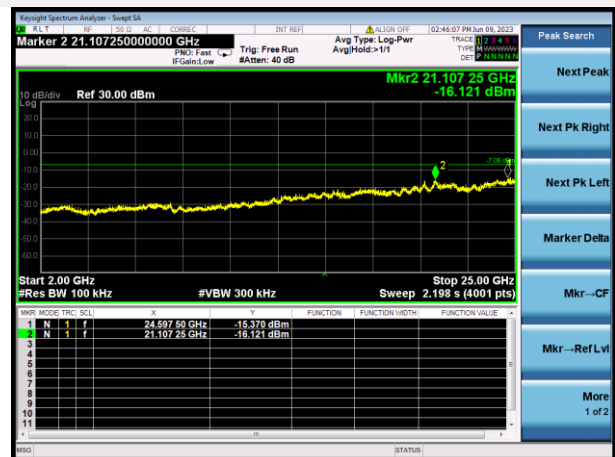
LOW CHANNEL, CARRIER LEVEL



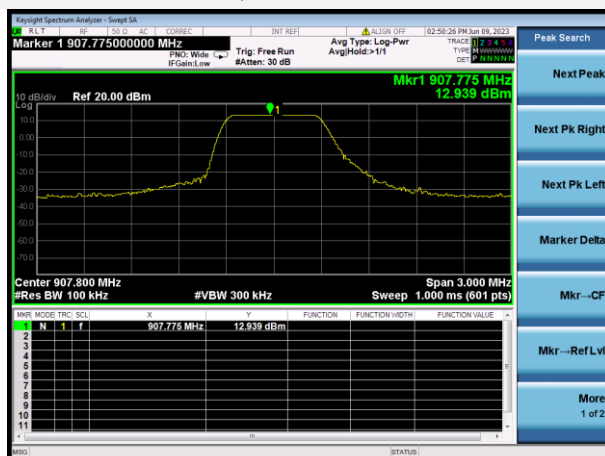
LOW CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



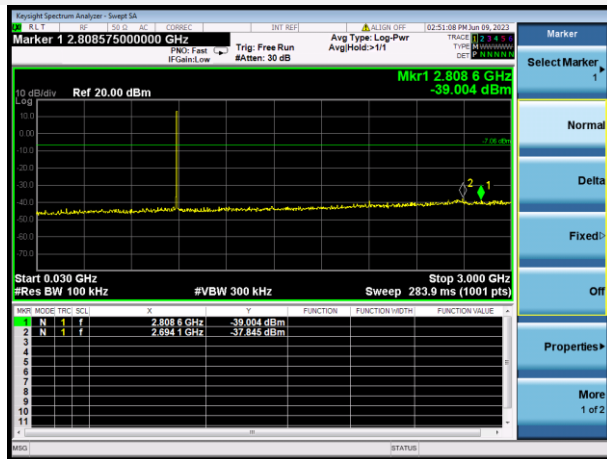
LOW CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



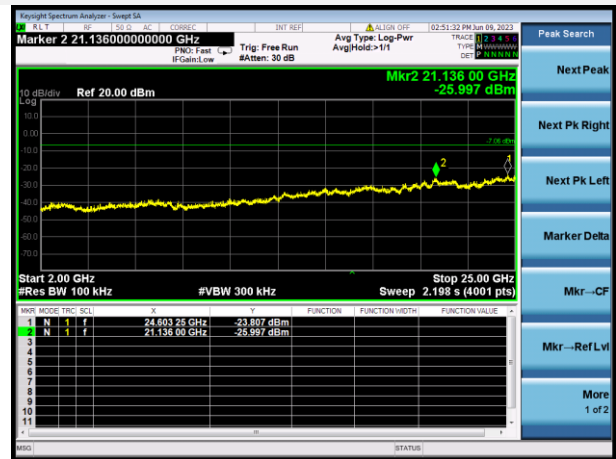
MIDDLE CHANNEL, CARRIER LEVEL



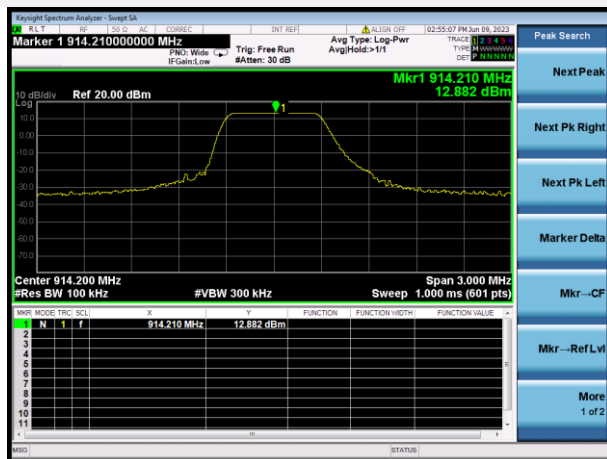
MIDDLE CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



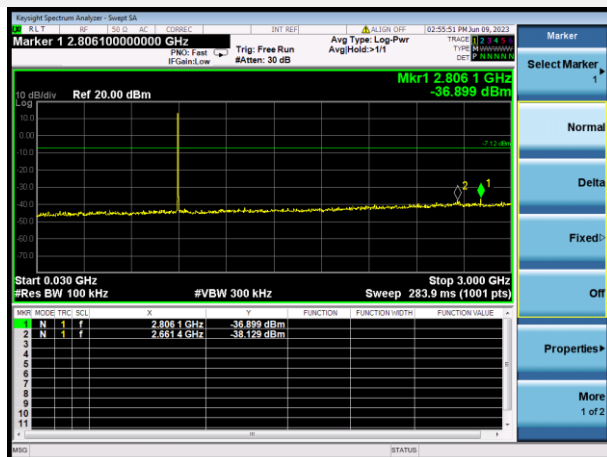
MIDDLE CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



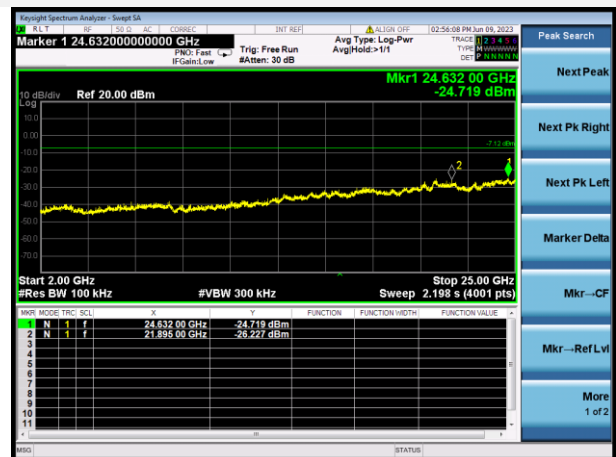
HIGH CHANNEL, CARRIER LEVEL



HIGH CHANNEL, SPURIOUS 30 MHz ~ 3 GHz



HIGH CHANNEL, SPURIOUS 2 GHz ~ 25 GHz



## A.4 Band Edge (Authorized-band band-edge)

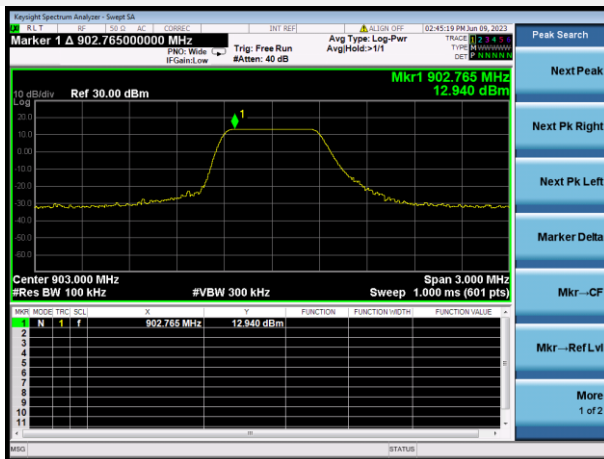
Note: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

### Test Data

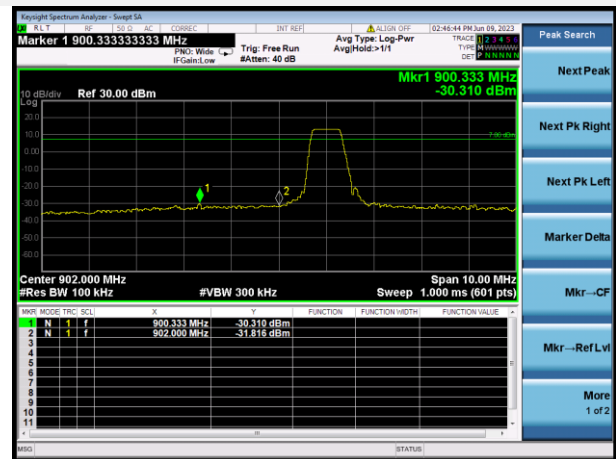
LoRa				
Channel	Measured Max. Band Edge Emission (dBm)	Limit (dBm)		Verdict
		Carrier Level	Calculated 20 dBc Limit	
Low Channel	-30.31	12.94	-7.06	Pass
High Channel	-49.00	12.88	-7.12	Pass

### Test Plots

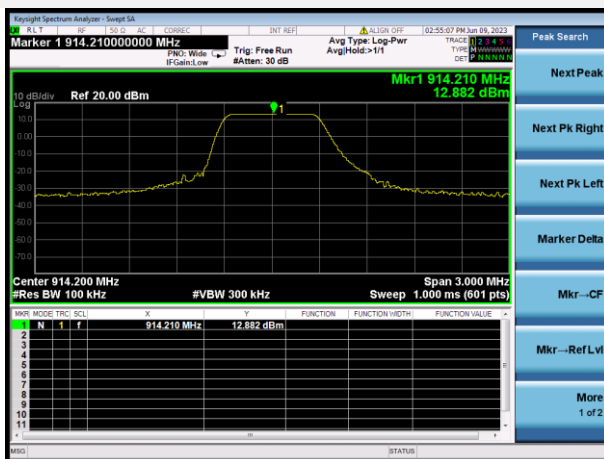
LOW CHANNEL, CARRIER LEVEL



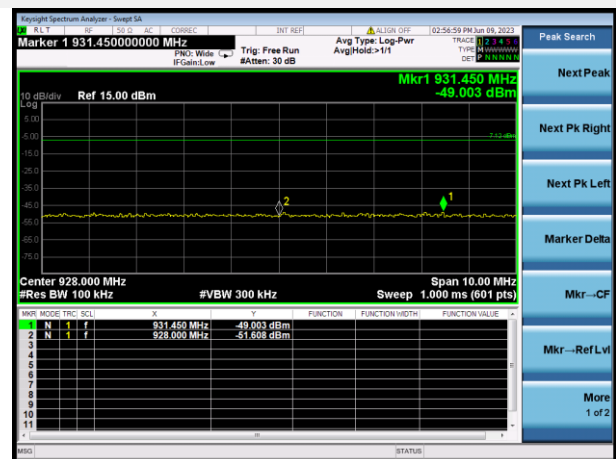
LOW CHANNEL, BAND EDGE



HIGH CHANNEL, CARRIER LEVEL



HIGH CHANNEL, BAND EDGE





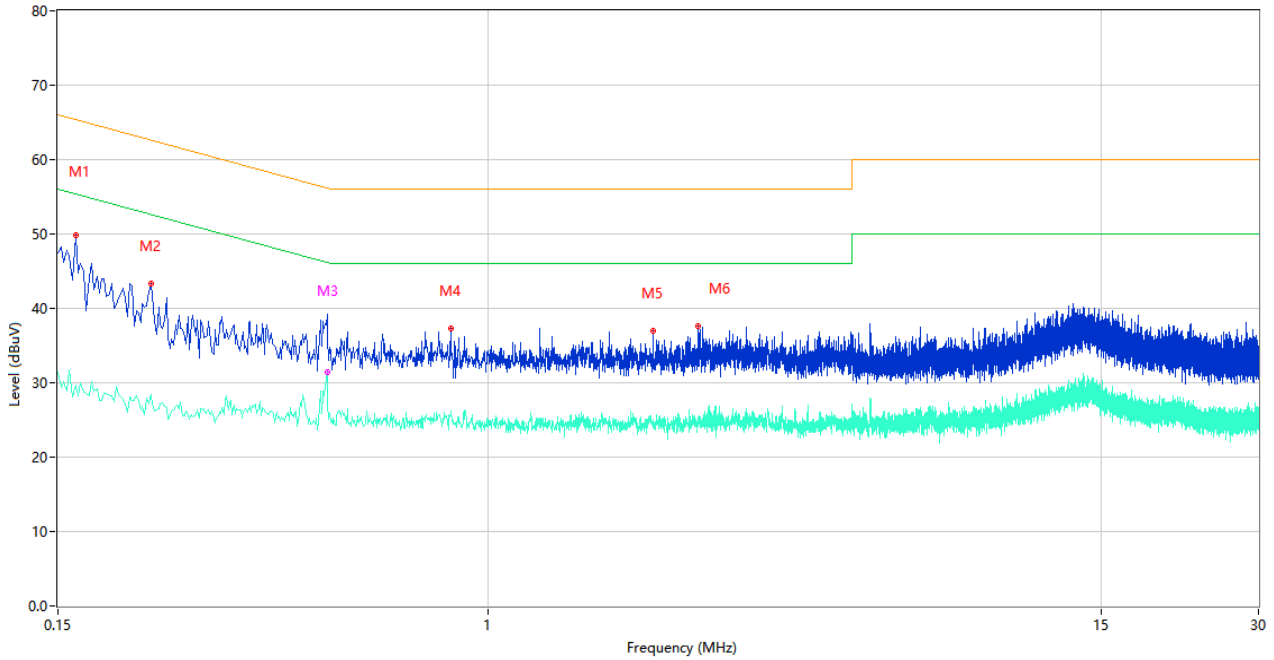
## A.5 Conducted Emissions

Note 1: The EUT is working in the Normal link mode.

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

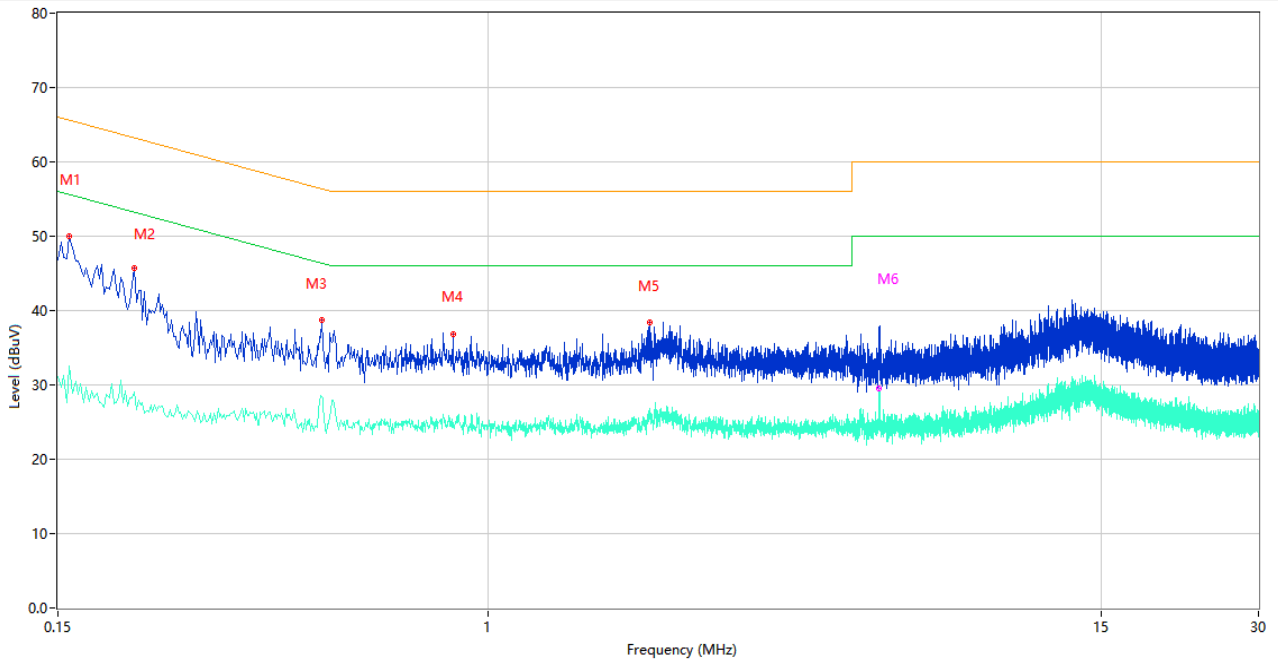
### Test Data and Plots

#### PHASE L



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.162	49.80	9.78	65.36	15.56	Peak	L	Pass
1**	0.162	29.64	9.78	55.36	25.72	AV	L	Pass
2	0.226	43.35	9.77	62.60	19.25	Peak	L	Pass
2**	0.226	28.42	9.77	52.60	24.18	AV	L	Pass
3	0.492	39.26	9.99	56.13	16.87	Peak	L	Pass
3**	0.492	31.36	9.99	46.13	14.77	AV	L	Pass
4	0.848	37.33	10.62	56.00	18.67	Peak	L	Pass
4**	0.848	25.68	10.62	46.00	20.32	AV	L	Pass
5	2.072	37.00	10.21	56.00	19.00	Peak	L	Pass
5**	2.072	25.00	10.21	46.00	21.00	AV	L	Pass
6	2.528	37.67	10.12	56.00	18.33	Peak	L	Pass
6**	2.528	24.97	10.12	46.00	21.03	AV	L	Pass

PHASE N



No.	Frequency (MHz)	Results (dBuV)	Factor (dB)	Limit (dBuV)	Margin (dB)	Detector	Line	Verdict
1	0.158	50.06	9.78	65.57	15.51	Peak	N	Pass
1**	0.158	32.52	9.78	55.57	23.05	AV	N	Pass
2	0.210	45.77	9.77	63.21	17.44	Peak	N	Pass
2**	0.210	29.05	9.77	53.21	24.16	AV	N	Pass
3	0.480	38.79	10.00	56.34	17.55	Peak	N	Pass
3**	0.480	28.45	10.00	46.34	17.89	AV	N	Pass
4	0.858	36.84	10.54	56.00	19.16	Peak	N	Pass
4**	0.858	24.86	10.54	46.00	21.14	AV	N	Pass
5	2.044	38.38	10.48	56.00	17.62	Peak	N	Pass
5**	2.044	26.90	10.48	46.00	19.10	AV	N	Pass
6	5.630	37.29	10.42	60.00	22.71	Peak	N	Pass
6**	5.630	29.55	10.42	50.00	20.45	AV	N	Pass

## A.6 Radiated Spurious Emission

Note <sup>1</sup>: The symbol of "--" in the table which means not application.

Note <sup>2</sup>: For the test data above 1 GHz, according to the ANSI C63.4-2014, 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.

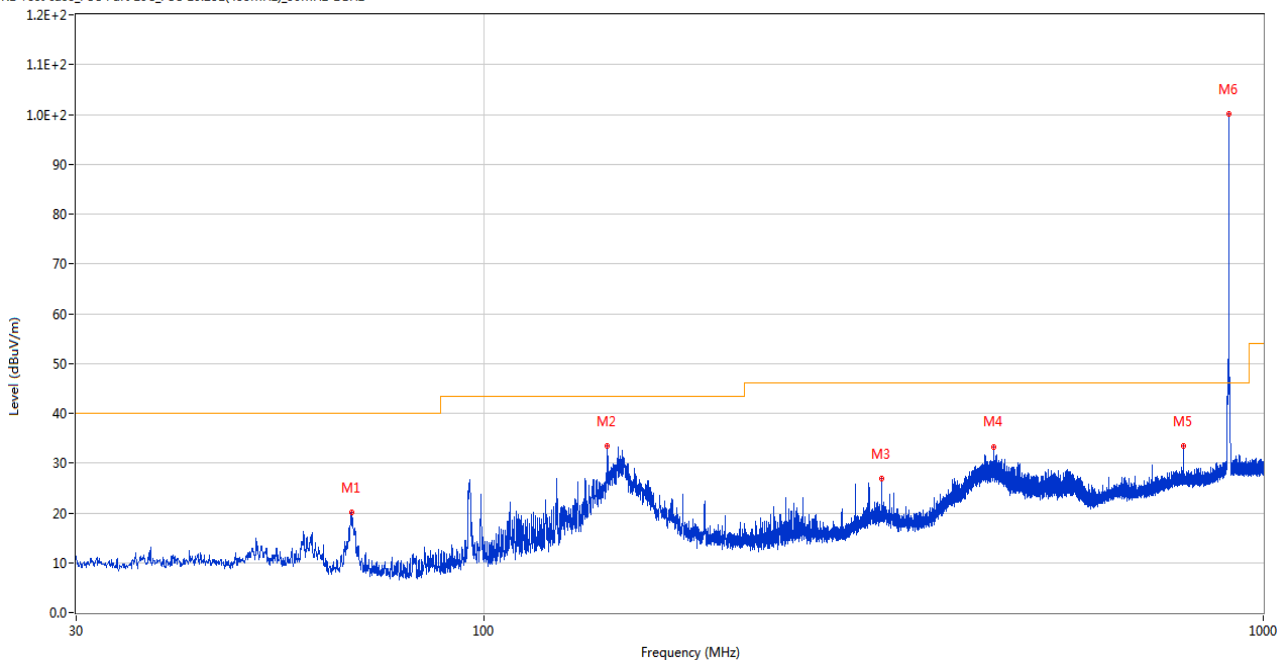
Note <sup>3</sup>: The low frequency, which started from 9 kHz to 30 MHz, was pre-scanned and the result which was 20 dB lower than the limit line per 15.31(o) was not reported.

Note <sup>4</sup>: 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

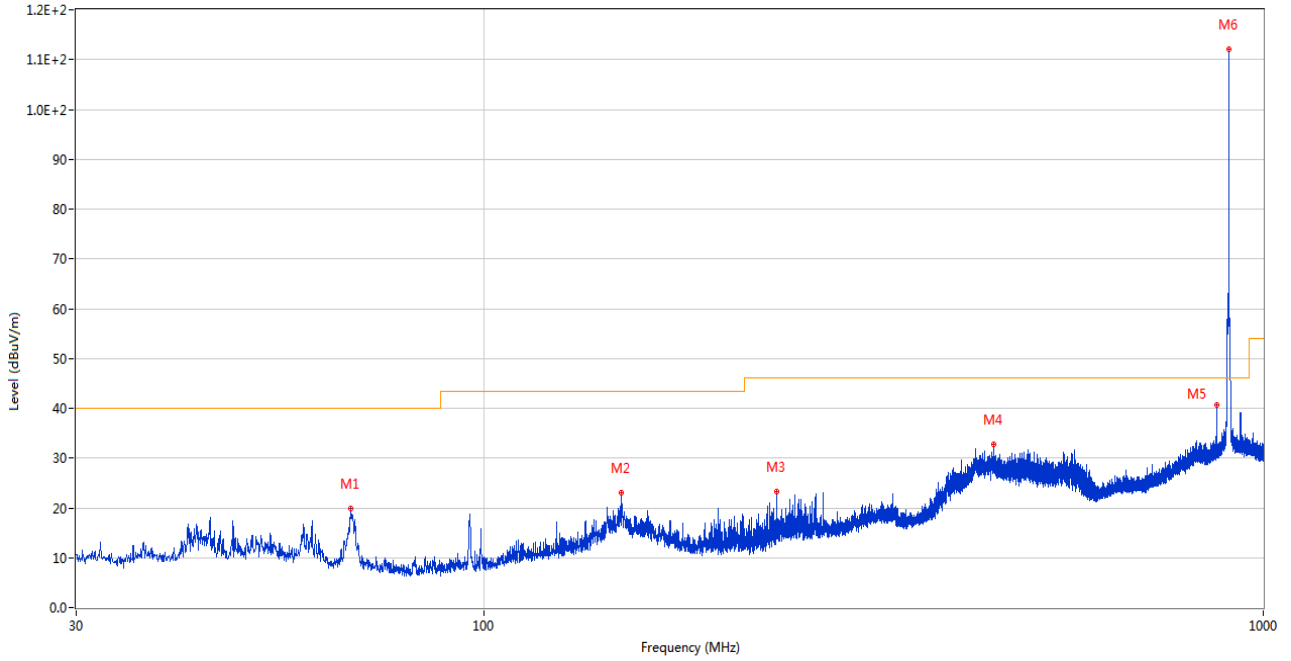
RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	67.636	20.05	-28.01	40.0	19.95	Peak	0.00	300	Horizontal	Pass
2	144.120	33.38	-24.81	43.5	10.12	Peak	235.00	100	Horizontal	Pass
3	323.910	26.81	-23.03	46.0	19.19	Peak	88.00	150	Horizontal	Pass
4	451.465	33.31	-19.20	46.0	12.69	Peak	179.00	150	Horizontal	Pass
5	789.073	33.39	-9.86	46.0	12.61	Peak	113.00	150	Horizontal	Pass
6	903.049	100.10	-7.47	46.0	-54.10	Peak	254.00	100	Horizontal	N/A

LOW CHANNEL, 30 MHz to 1 GHz, ANT V

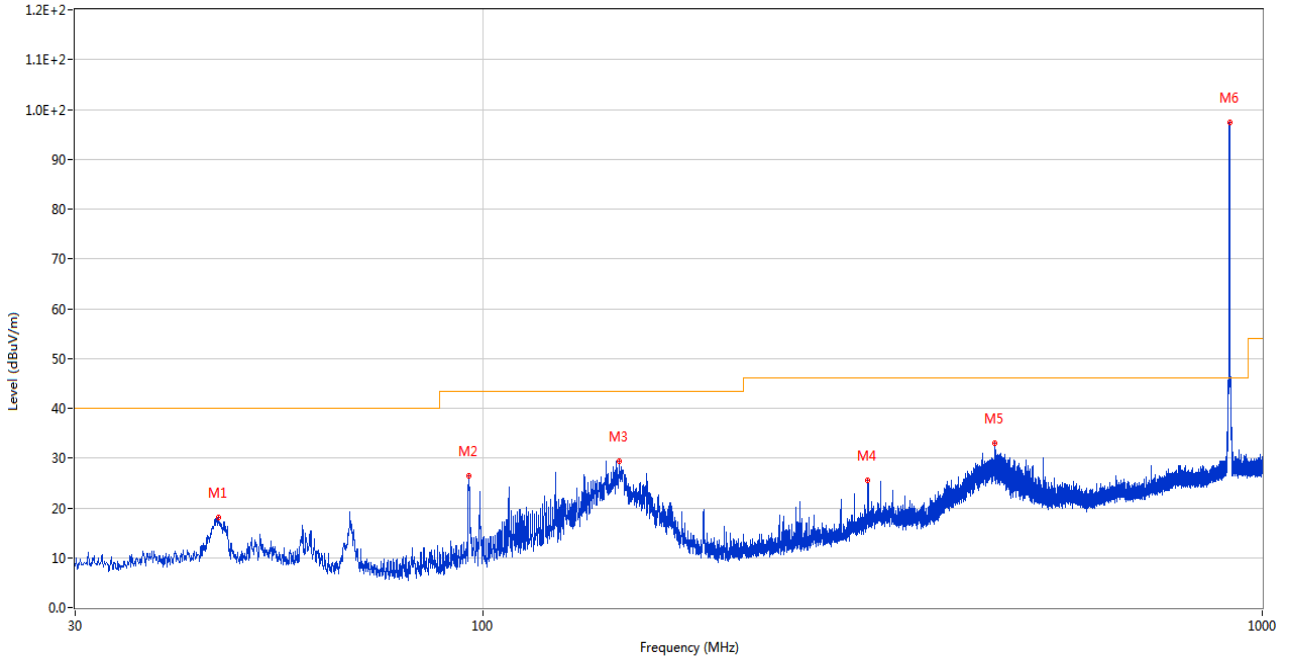
RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	67.539	19.84	-28.00	40.0	20.16	Peak	200.00	200	Vertical	Pass
2	150.135	23.08	-24.32	43.5	20.42	Peak	167.00	150	Vertical	Pass
3	237.628	23.36	-25.94	46.0	22.64	Peak	202.00	100	Vertical	Pass
4	451.465	32.73	-19.20	46.0	13.27	Peak	131.00	150	Vertical	Pass
5	870.942	40.59	-8.88	46.0	5.41	Peak	101.00	150	Vertical	Pass
6	903.194	112.07	-7.45	46.0	-66.07	Peak	104.00	200	Vertical	N/A

MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT H

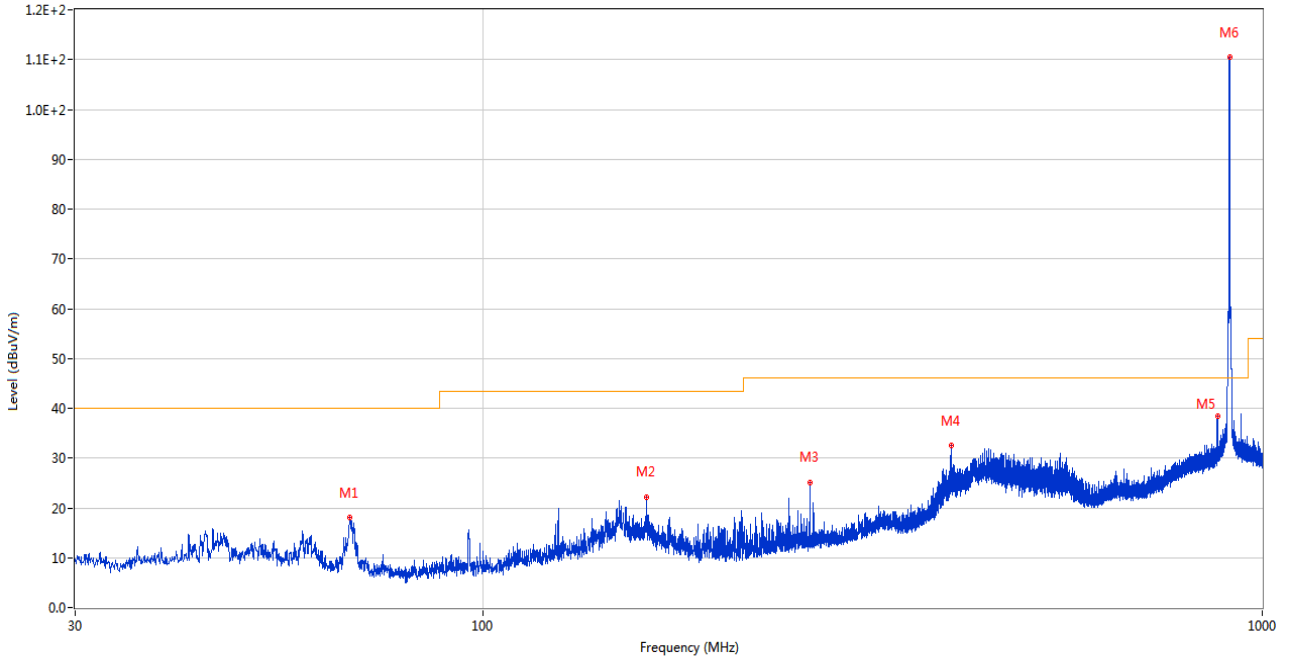
RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	45.763	18.12	-26.19	40.0	21.88	Peak	330.00	200	Horizontal	Pass
2	96.057	26.41	-29.08	43.5	17.09	Peak	258.00	150	Horizontal	Pass
3	149.601	29.42	-24.33	43.5	14.08	Peak	217.00	200	Horizontal	Pass
4	312.027	25.47	-23.40	46.0	20.53	Peak	89.00	150	Horizontal	Pass
5	453.842	32.91	-19.32	46.0	13.09	Peak	190.00	150	Horizontal	Pass
6	907.850	97.40	-7.60	46.0	-51.40	Peak	220.00	100	Horizontal	N/A

MIDDLE CHANNEL, 30 MHz to 1 GHz, ANT V

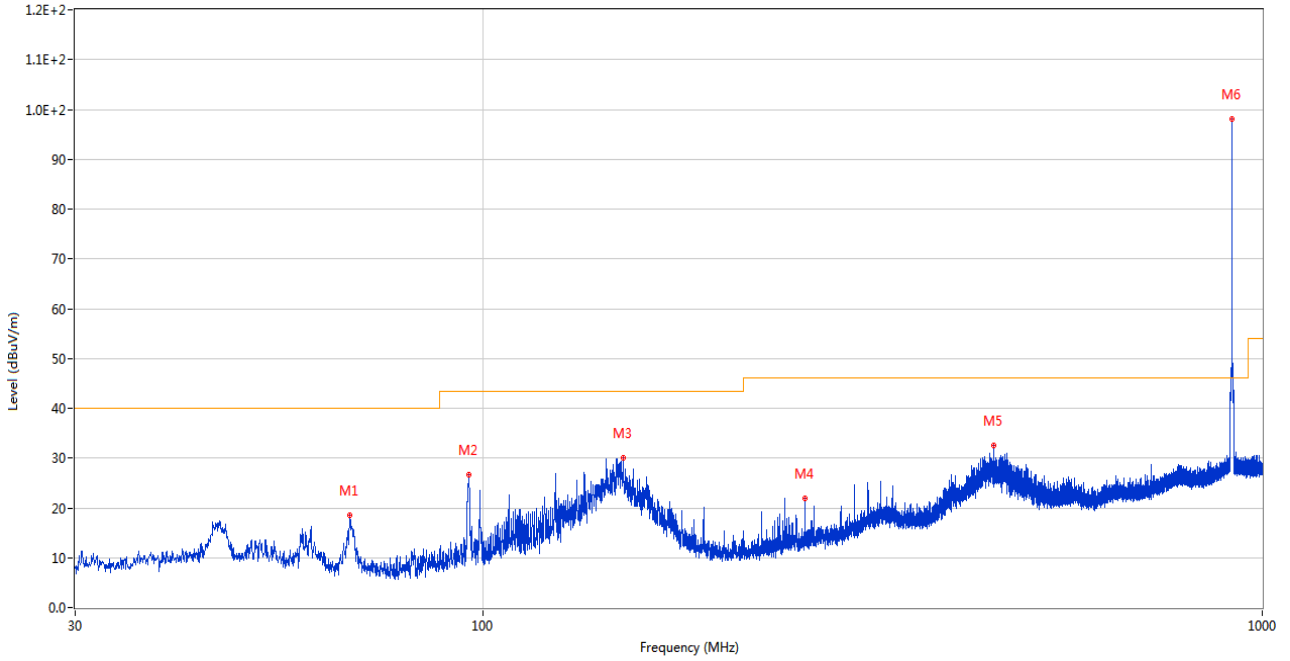
RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	67.588	18.07	-28.01	40.0	21.93	Peak	66.00	150	Vertical	Pass
2	162.066	22.24	-24.44	43.5	21.26	Peak	135.00	100	Vertical	Pass
3	262.800	25.18	-25.41	46.0	20.82	Peak	78.00	150	Vertical	Pass
4	399.522	32.52	-21.21	46.0	13.48	Peak	220.00	150	Vertical	Pass
5	875.937	38.35	-8.73	46.0	7.65	Peak	238.00	200	Vertical	Pass
6	907.705	110.55	-7.60	46.0	-64.55	Peak	107.00	200	Vertical	N/A

HIGH CHANNEL, 30 MHz to 1 GHz, ANT H

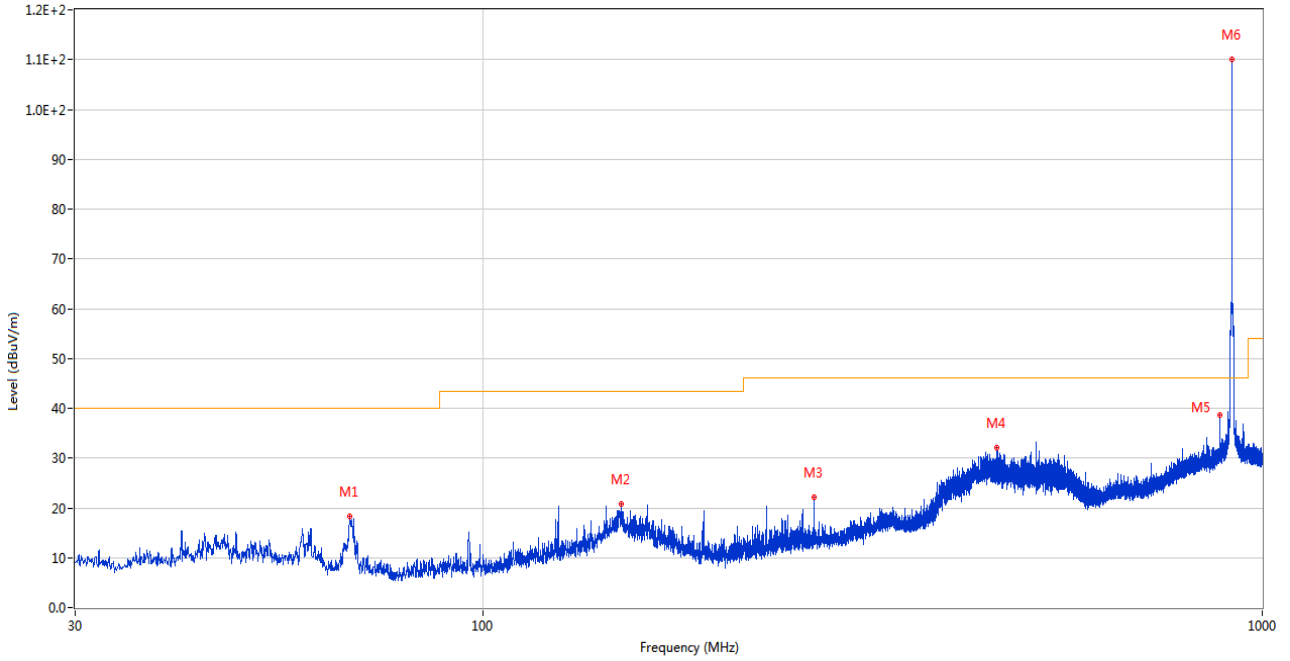
RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	67.588	18.61	-28.01	40.0	21.39	Peak	34.00	150	Horizontal	Pass
2	96.057	26.75	-29.08	43.5	16.75	Peak	231.00	200	Horizontal	Pass
3	151.444	30.07	-24.34	43.5	13.43	Peak	68.00	150	Horizontal	Pass
4	259.065	21.89	-25.40	46.0	24.11	Peak	143.00	150	Horizontal	Pass
5	452.920	32.54	-19.33	46.0	13.46	Peak	172.00	300	Horizontal	Pass
6	914.204	98.04	-7.81	46.0	-52.04	Peak	223.00	150	Horizontal	N/A

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

RE Test case\_FCC Part 15C\_FCC 15.231(433MHz)\_30MHz-1GHz

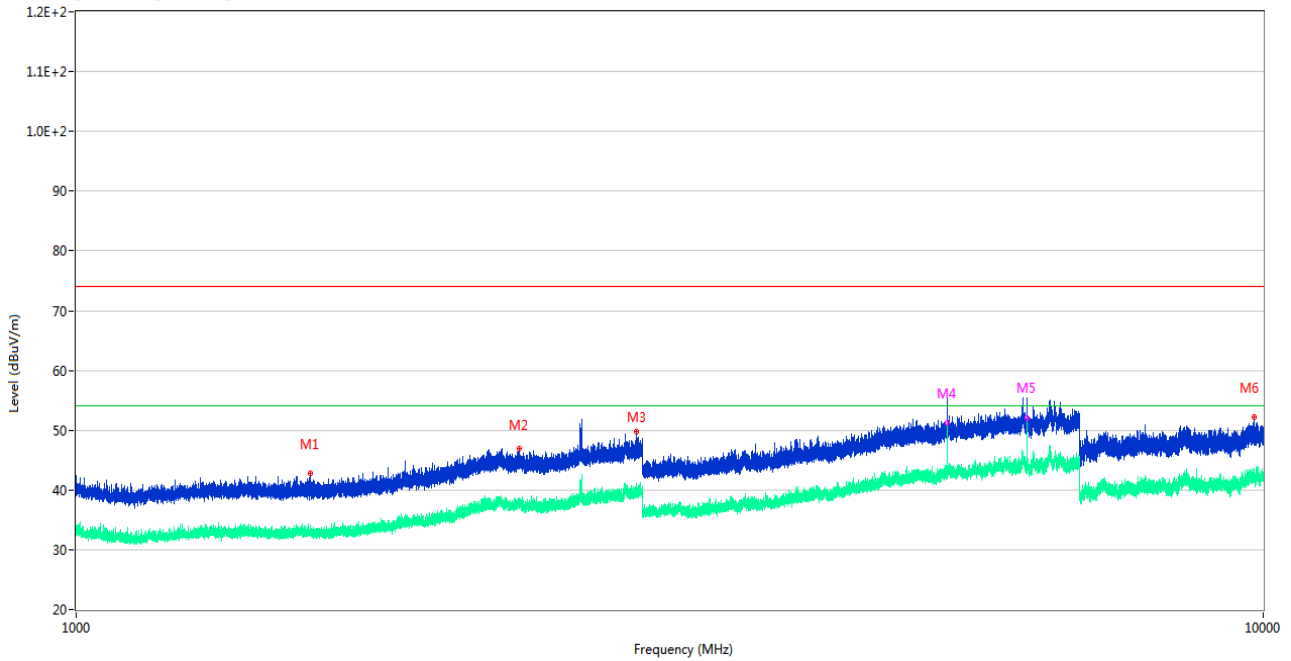


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	67.539	18.23	-28.00	40.0	21.77	Peak	336.00	200	Vertical	Pass
2	150.668	20.75	-24.33	43.5	22.75	Peak	148.00	150	Vertical	Pass
3	266.098	22.07	-25.10	46.0	23.93	Peak	46.00	150	Vertical	Pass
4	455.927	32.02	-19.24	46.0	13.98	Peak	52.00	300	Vertical	Pass
5	882.388	38.75	-8.63	46.0	7.25	Peak	233.00	150	Vertical	Pass
6	914.349	110.00	-7.82	46.0	-64.00	Peak	104.00	150	Vertical	N/A



LOW CHANNEL 1 GHz to 10 GHz, ANT H

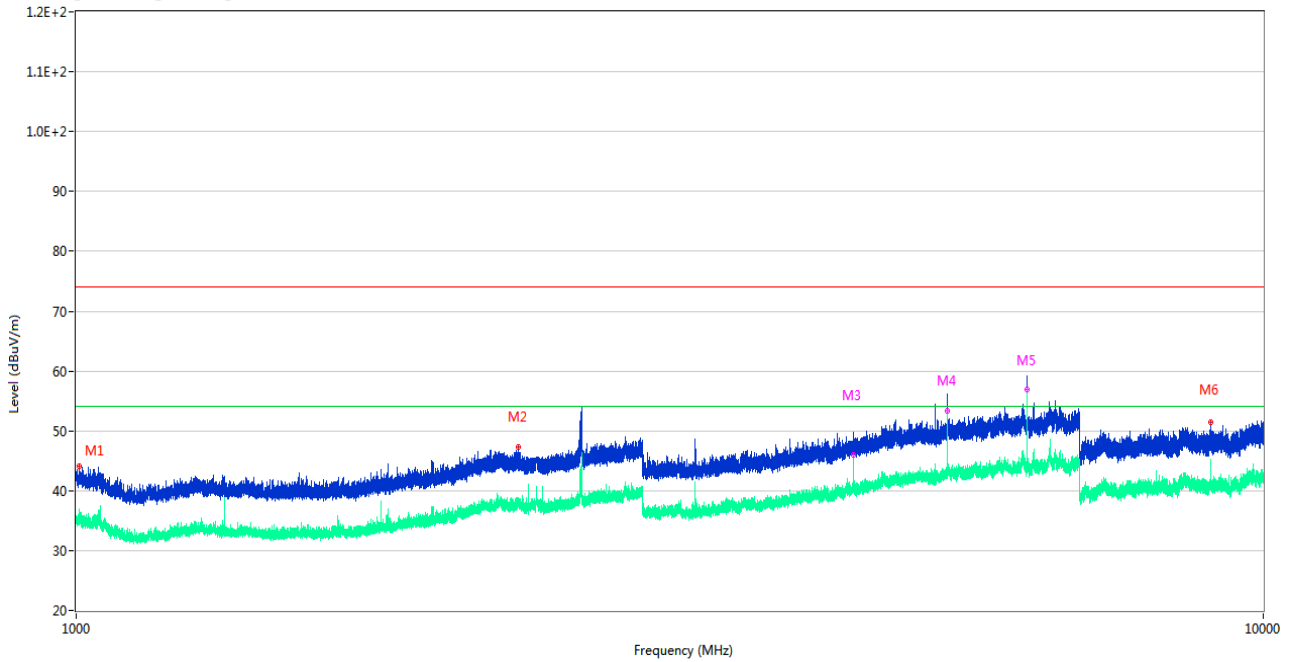
RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1573.500	42.72	-13.60	74.0	31.28	Peak	46.00	100	Horizontal	Pass
1**	1573.500	32.83	-13.60	54.0	21.17	AV	46.00	100	Horizontal	Pass
2	2361.000	46.92	-8.14	74.0	27.08	Peak	38.00	100	Horizontal	Pass
2**	2361.000	37.77	-8.14	54.0	16.23	AV	38.00	100	Horizontal	Pass
3	2966.700	49.70	-5.39	74.0	24.30	Peak	159.00	150	Horizontal	Pass
3**	2966.700	39.56	-5.39	54.0	14.44	AV	159.00	150	Horizontal	Pass
4	5418.200	53.68	-2.34	74.0	20.32	Peak	192.00	150	Horizontal	Pass
4**	5418.200	51.23	-2.34	54.0	2.77	AV	192.00	150	Horizontal	Pass
5	6322.400	55.00	-1.42	74.0	19.00	Peak	280.00	150	Horizontal	Pass
5**	6322.400	52.05	-1.42	54.0	1.95	AV	280.00	150	Horizontal	N/A
6	9821.200	52.21	-0.01	74.0	21.79	Peak	309.00	300	Horizontal	Pass
6**	9821.200	43.07	-0.01	54.0	10.93	AV	309.00	300	Horizontal	Pass

LOW CHANNEL 1 GHz to 10 GHz, ANT V

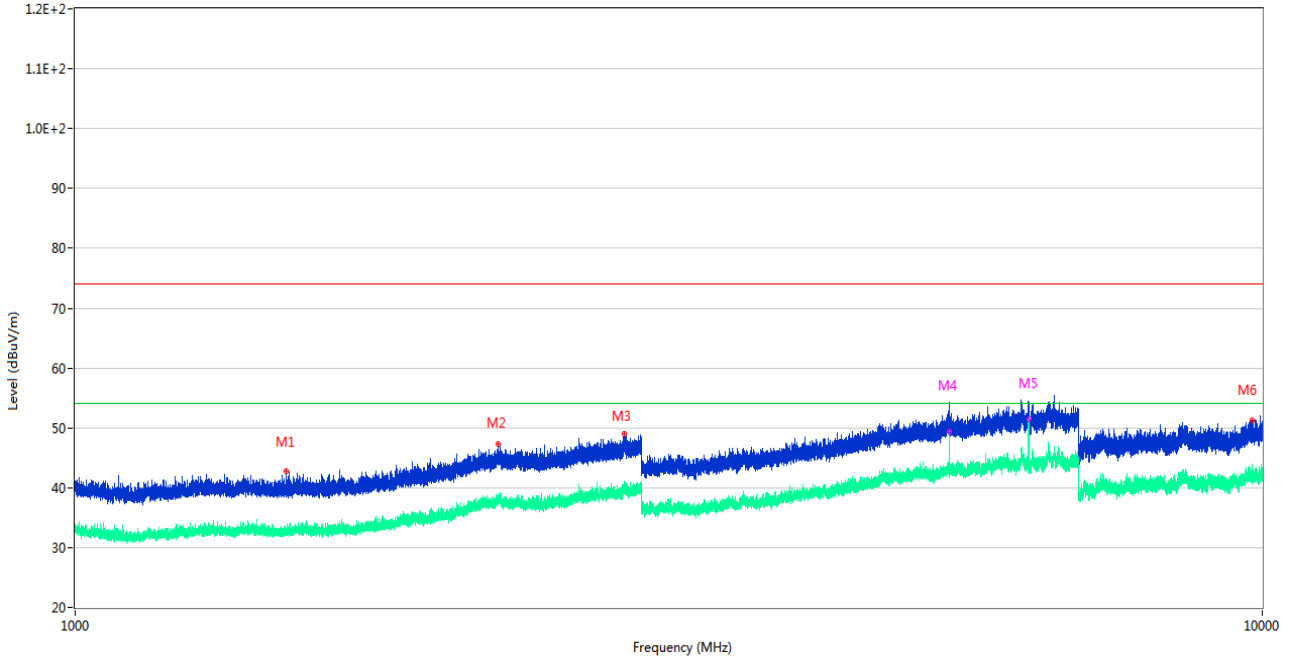
RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1006.200	44.07	-12.94	74.0	29.93	Peak	21.00	200	Vertical	Pass
1**	1006.200	34.43	-12.94	54.0	19.57	AV	21.00	200	Vertical	Pass
2	2357.600	47.29	-7.78	74.0	26.71	Peak	80.00	150	Vertical	Pass
2**	2357.600	37.77	-7.78	54.0	16.23	AV	80.00	150	Vertical	Pass
3	4515.200	49.76	-3.47	74.0	24.24	Peak	71.00	150	Vertical	Pass
3**	4515.200	46.05	-3.47	54.0	7.95	AV	71.00	150	Vertical	Pass
4	5419.600	55.69	-2.32	74.0	18.31	Peak	0.00	150	Vertical	Pass
4**	5419.600	53.36	-2.32	54.0	0.64	AV	0.00	150	Vertical	Pass
5	6322.600	57.54	-1.39	74.0	16.46	Peak	240.00	150	Vertical	Pass
5**	6322.600	56.86	-1.39	54.0	-2.86	AV	240.00	150	Vertical	N/A
6	9027.700	51.50	-0.72	74.0	22.50	Peak	48.00	150	Vertical	Pass
6**	9027.700	44.61	-0.72	54.0	9.39	AV	48.00	150	Vertical	Pass

MIDDLE CHANNEL 1 GHz to 10 GHz, ANT H

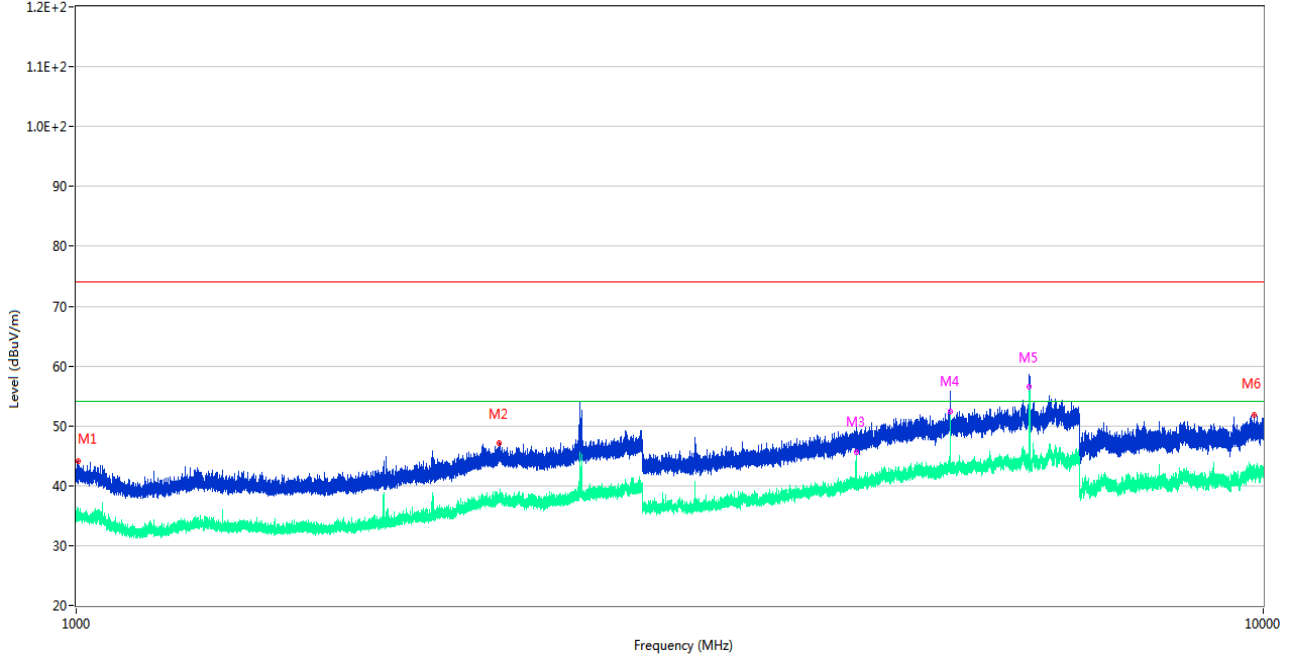
RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1504.800	42.70	-13.90	74.0	31.30	Peak	246.00	400	Horizontal	Pass
1**	1504.800	32.44	-13.90	54.0	21.56	AV	246.00	400	Horizontal	Pass
2	2272.000	47.22	-7.48	74.0	26.78	Peak	295.00	100	Horizontal	Pass
2**	2272.000	38.25	-7.48	54.0	15.75	AV	295.00	100	Horizontal	Pass
3	2903.500	49.09	-3.44	74.0	24.91	Peak	265.00	200	Horizontal	Pass
3**	2903.500	40.01	-3.44	54.0	13.99	AV	265.00	200	Horizontal	Pass
4	5448.000	52.79	-2.07	74.0	21.21	Peak	193.00	150	Horizontal	Pass
4**	5448.000	49.44	-2.07	54.0	4.56	AV	193.00	150	Horizontal	Pass
5	6355.800	53.75	-2.22	74.0	20.25	Peak	66.00	150	Horizontal	Pass
5**	6355.800	51.46	-2.22	54.0	2.54	AV	66.00	150	Horizontal	N/A
6	9806.500	51.35	-0.08	74.0	22.65	Peak	360.00	200	Horizontal	Pass
6**	9806.500	42.08	-0.08	54.0	11.92	AV	360.00	200	Horizontal	Pass

MIDDLE CHANNEL 1 GHz to 10 GHz, ANT V

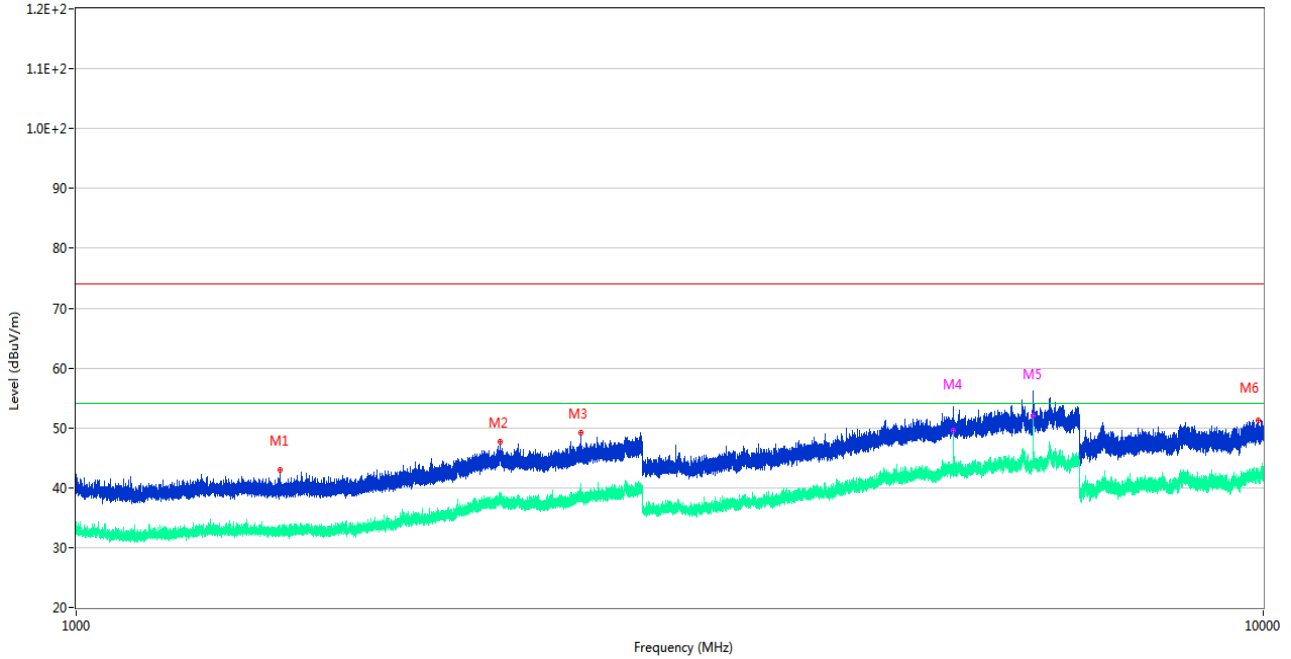
RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1003.800	44.09	-12.62	74.0	29.91	Peak	84.00	300	Vertical	Pass
1**	1003.800	34.88	-12.62	54.0	19.12	AV	84.00	300	Vertical	Pass
2	2270.400	47.07	-7.50	74.0	26.93	Peak	54.00	400	Vertical	Pass
2**	2270.400	37.99	-7.50	54.0	16.01	AV	54.00	400	Vertical	Pass
3	4540.400	48.11	-4.35	74.0	25.89	Peak	272.00	150	Vertical	Pass
3**	4540.400	45.67	-4.35	54.0	8.33	AV	272.00	150	Vertical	Pass
4	5446.000	54.54	-1.89	74.0	19.46	Peak	360.00	150	Vertical	Pass
4**	5446.000	52.40	-1.89	54.0	1.60	AV	360.00	150	Vertical	Pass
5	6355.400	57.70	-2.21	74.0	16.30	Peak	49.00	150	Vertical	Pass
5**	6355.400	56.49	-2.21	54.0	-2.49	AV	49.00	150	Vertical	N/A
6	9816.700	51.74	-0.01	74.0	22.26	Peak	25.00	400	Vertical	Pass
6**	9816.700	41.66	-0.01	54.0	12.34	AV	25.00	400	Vertical	Pass

HIGH CHANNEL 1 GHz to 10 GHz, ANT H

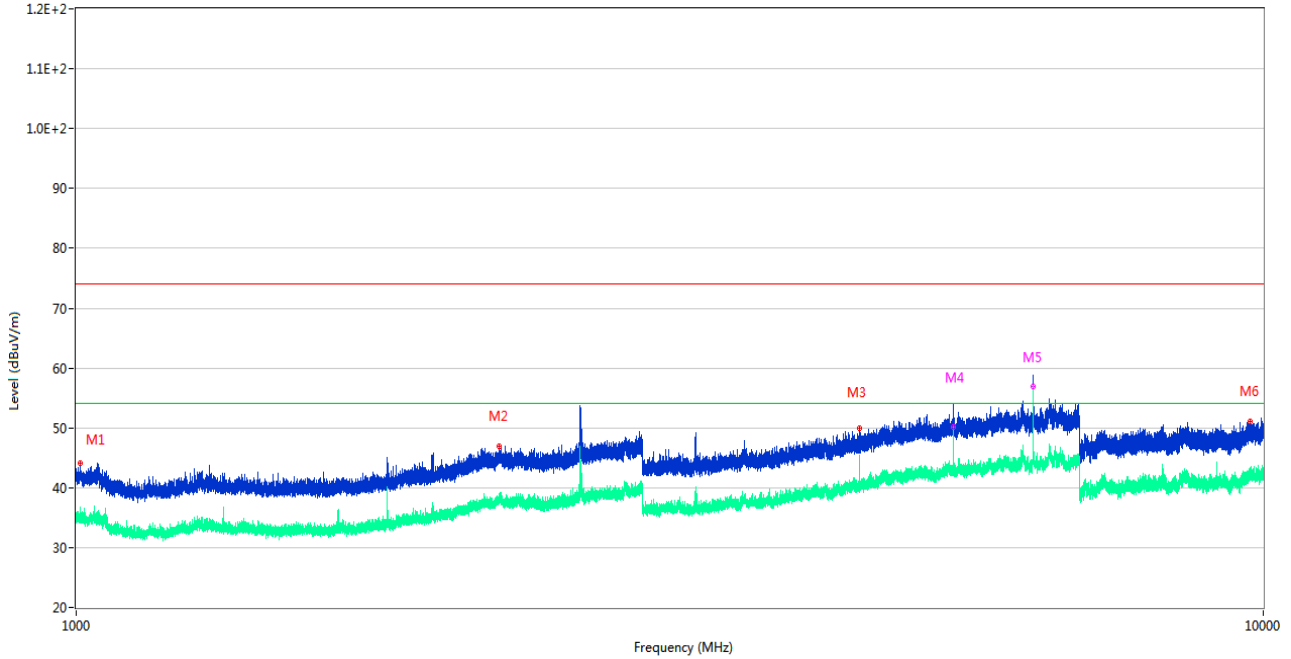
RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1485.500	42.91	-14.03	74.0	31.09	Peak	205.00	200	Horizontal	Pass
1**	1485.500	32.42	-14.03	54.0	21.58	AV	205.00	200	Horizontal	Pass
2	2274.200	47.60	-7.33	74.0	26.40	Peak	14.00	200	Horizontal	Pass
2**	2274.200	37.54	-7.33	54.0	16.46	AV	14.00	200	Horizontal	Pass
3	2663.300	49.25	-7.16	74.0	24.75	Peak	89.00	150	Horizontal	Pass
3**	2663.300	37.69	-7.16	54.0	16.31	AV	89.00	150	Horizontal	Pass
4	5484.000	52.96	-2.44	74.0	21.04	Peak	217.00	150	Horizontal	Pass
4**	5484.000	49.58	-2.44	54.0	4.42	AV	217.00	150	Horizontal	Pass
5	6400.800	54.39	-0.08	74.0	19.61	Peak	285.00	150	Horizontal	Pass
5**	6400.800	52.03	-0.08	54.0	1.97	AV	285.00	150	Horizontal	N/A
6	9907.750	51.22	-0.93	74.0	22.78	Peak	190.00	100	Horizontal	Pass
6**	9907.750	42.29	-0.93	54.0	11.71	AV	190.00	100	Horizontal	Pass

HIGH CHANNEL 1 GHz to 10 GHz, ANT V

RE Test case\_FCC Part 15C\_FCC 15.249\_1GHz-10GHz



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1008.300	44.12	-12.99	74.0	29.88	Peak	82.00	200	Vertical	Pass
1**	1008.300	36.56	-12.99	54.0	17.44	AV	82.00	200	Vertical	Pass
2	2269.500	46.94	-7.52	74.0	27.06	Peak	219.00	300	Vertical	Pass
2**	2269.500	38.01	-7.52	54.0	15.99	AV	219.00	300	Vertical	Pass
3	4571.600	49.93	-4.34	74.0	24.07	Peak	288.00	150	Vertical	Pass
3**	4571.600	44.84	-4.34	54.0	9.16	AV	288.00	150	Vertical	Pass
4	5484.400	52.98	-2.45	74.0	21.02	Peak	343.00	150	Vertical	Pass
4**	5484.400	50.06	-2.45	54.0	3.94	AV	343.00	150	Vertical	Pass
5	6400.800	58.09	-0.08	74.0	15.91	Peak	208.00	150	Vertical	Pass
5**	6400.800	56.83	-0.08	54.0	-2.83	AV	208.00	150	Vertical	N/A
6	9748.300	51.15	-0.46	74.0	22.85	Peak	238.00	100	Vertical	Pass
6**	9748.300	42.63	-0.46	54.0	11.37	AV	238.00	100	Vertical	Pass

## A.7 Band Edge (Restricted-band band-edge)

Note <sup>1</sup>: The lowest and highest channels are tested to verify the band edge emissions. Please refer to the following the plots for emissions values.

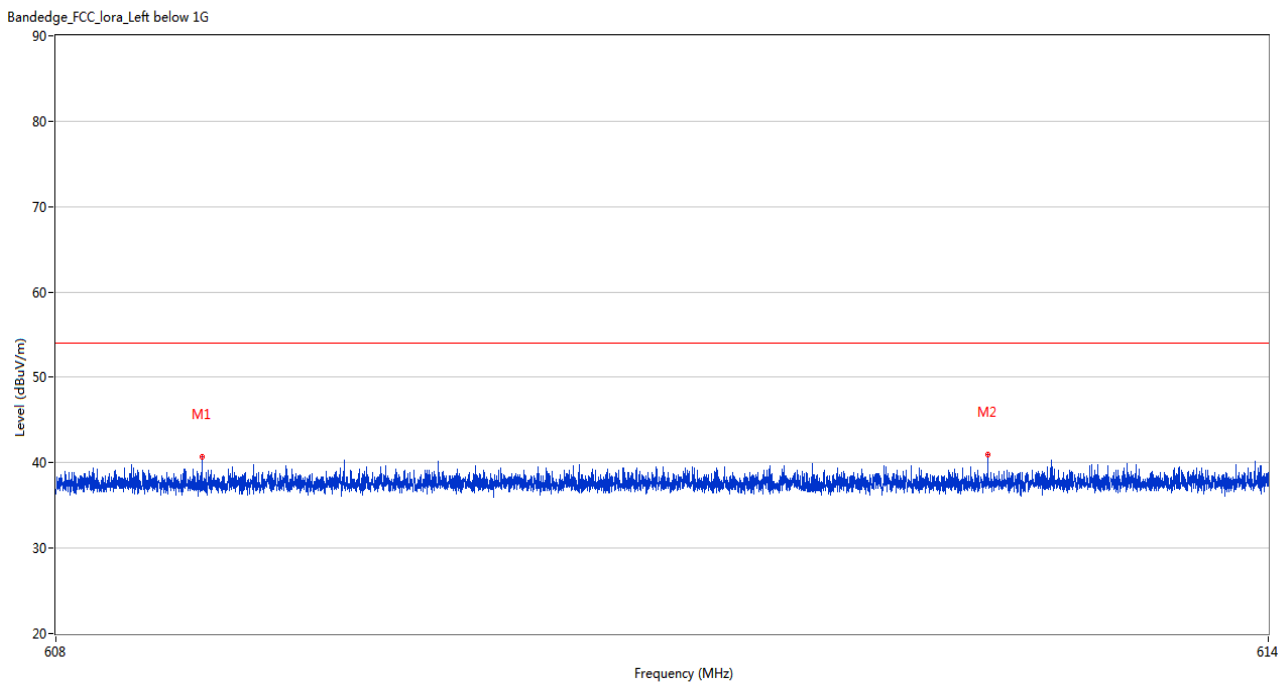
Note <sup>2</sup>: The test data all are tested in the vertical and horizontal antenna which the trace is max hold. So these plots have shown the worst case.

Note <sup>3</sup>: 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 <sup>4</sup>: The Level (dBuV/m) has been corrected by factor.

### Test Data and Plots

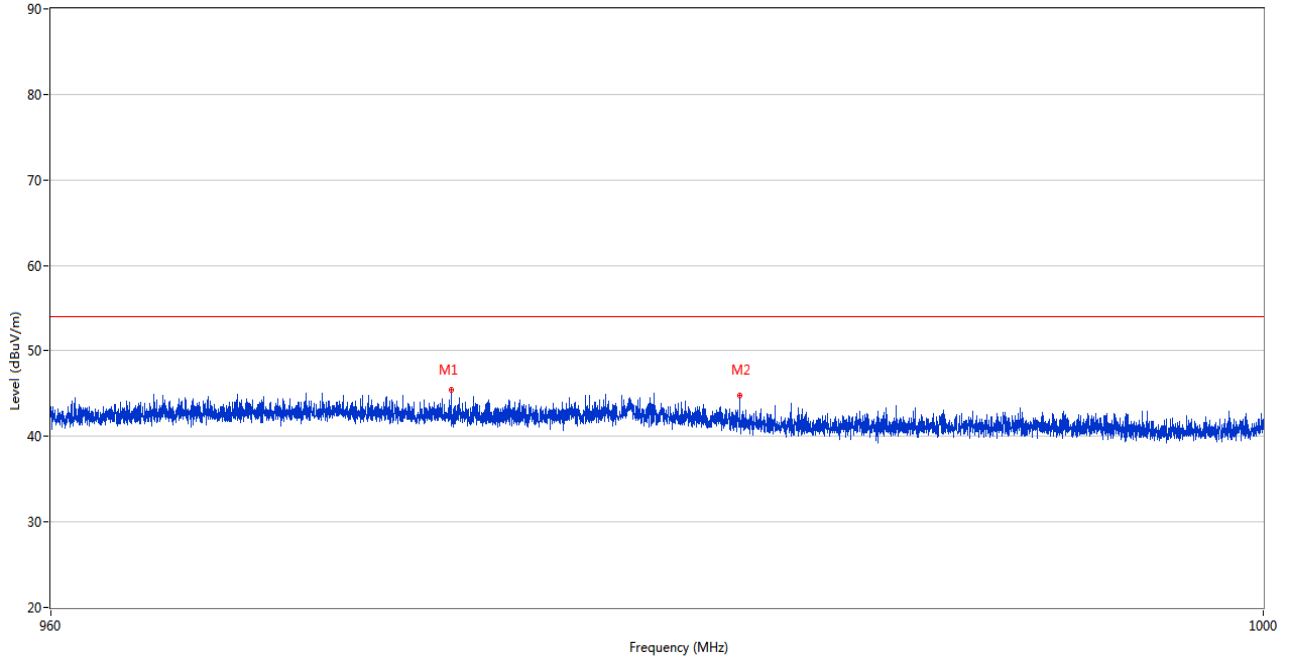
#### LOW CHANNEL



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	608.719	40.65	3.01	54.0	13.35	Peak	29.00	100	Vertical	Pass
2	612.607	40.93	3.12	54.0	13.07	Peak	80.00	150	Vertical	Pass

**HIGH CHANNEL**

Bandedge\_FCC\_lora\_Right below 1G

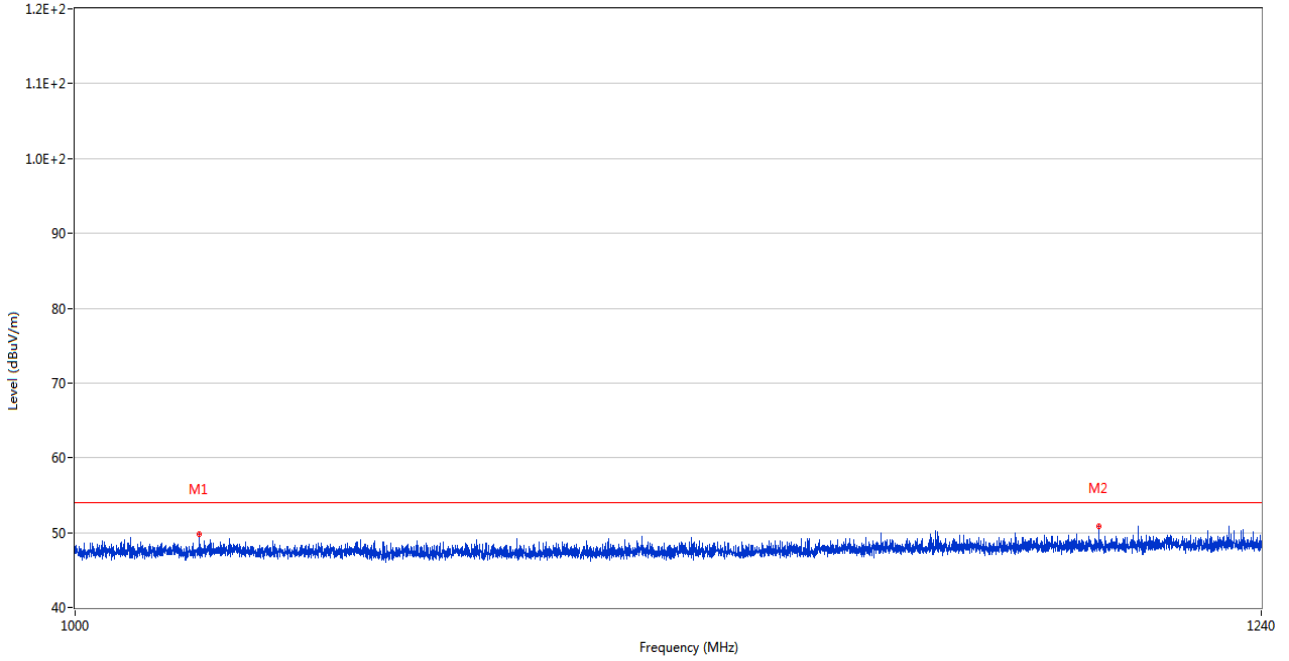


No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	973.040	45.50	-3.29	54.0	8.50	Peak	275.00	200	Vertical	Pass
2	982.527	44.73	-3.52	54.0	9.27	Peak	283.00	150	Vertical	Pass



**HIGH CHANNEL**

Bandedge\_FCC\_lora\_Right above 1G



No.	Frequency (MHz)	Results (dBuV/m)	Factor (dB)	Limit (dBuV/m)	Margin (dB)	Detector	Table (Degree)	Height (cm)	Antenna	Verdict
1	1022.840	49.78	-6.16	54.0	4.22	Peak	28.00	150	Vertical	Pass
2	1203.960	50.92	-6.02	54.0	3.08	Peak	270.00	150	Vertical	Pass

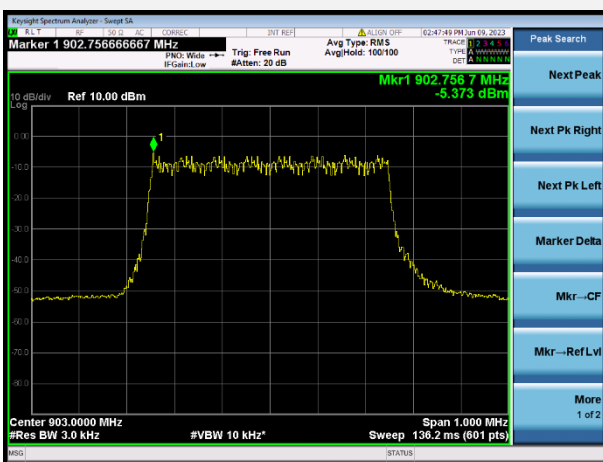
## A.8 Power Spectral Density (PSD)

### Test Data

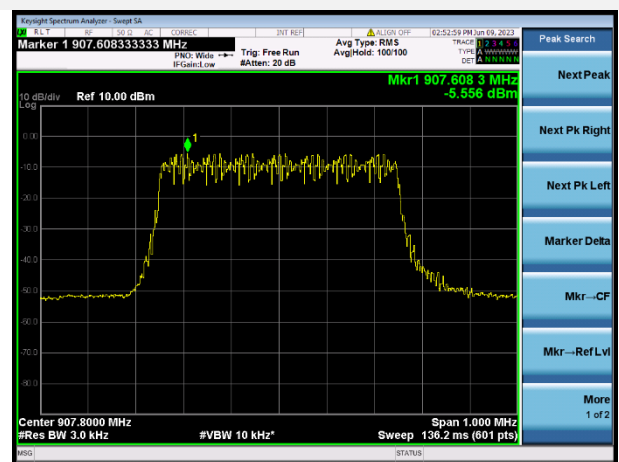
LoRa			
Channel	Spectral power density (dBm/3kHz)	Limit (dBm/3kHz)	Verdict
Low Channel	-5.37	8	Pass
Middle Channel	-5.56	8	Pass
High Channel	-5.82	8	Pass

### Test Plots

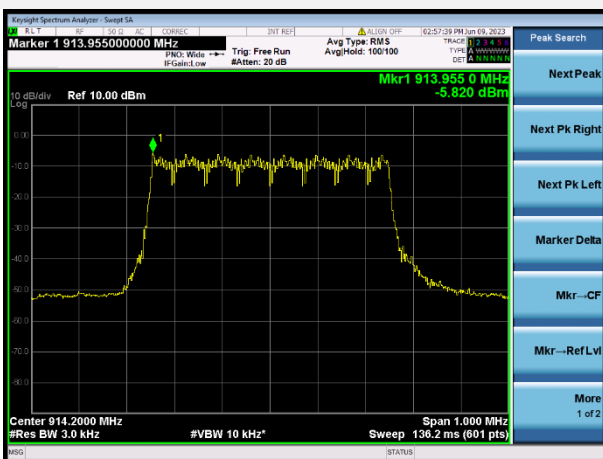
#### LOW CHANNEL



#### MIDDLE CHANNEL



#### HIGH CHANNEL



## **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--