



# FCC RADIO TEST REPORT

**FCC ID** : 2AEUPBHAFL031  
**Equipment** : Floodlight Cam Wired Pro  
**Brand Name** : Ring  
**Model Name** : 5B28S4  
**Applicant** : Ring LLC  
12515 Cerise Ave, Hawthorne, CA 90250 USA  
**Manufacturer** : Ring LLC  
12515 Cerise Ave, Hawthorne, CA 90250 USA  
**Standard** : FCC Part 15 Subpart C §15.247

The product was received on Feb. 09, 2021 and testing was performed from May 22, 2022 to Aug. 17, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in a

ccordance with the test procedures and has been in compliance with the applicable technical standards.

The test results in this report apply exclusively to the tested model / sample. Without written approval from Sporton International Inc. EMC & Wireless Communications Laboratory, the test report shall not be reproduced except in full.

Approved by: Louis Wu

**Sporton International Inc. EMC & Wireless Communications Laboratory**

No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)



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## History of this test report

| Report No.   | Version | Description             | Issue Date    |
|--------------|---------|-------------------------|---------------|
| FR120337-09B | 01      | Initial issue of report | Sep. 28, 2022 |
|              |         |                         |               |
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## Summary of Test Result

| Report Clause | Ref Std. Clause    | Test Items                                         | Result (PASS/FAIL) | Remark                                  |
|---------------|--------------------|----------------------------------------------------|--------------------|-----------------------------------------|
| 3.1           | 15.247(a)(2)       | 6dB Bandwidth                                      | Pass               | -                                       |
| 3.1           | 2.1049             | 99% Occupied Bandwidth                             | Reporting only     | -                                       |
| 3.2           | 15.247(b)(3)       | Power Output Measurement                           | Pass               | -                                       |
| 3.3           | 15.247(e)          | Power Spectral Density                             | Pass               | -                                       |
| 3.4           | 15.247(d)          | Conducted Band Edges                               | Pass               | -                                       |
|               |                    | Conducted Spurious Emission                        | Pass               | -                                       |
| 3.5           | 15.247(d)          | Radiated Band Edges and Radiated Spurious Emission | Pass               | 3.19 dB under the limit at 2743.500 MHz |
| 3.6           | 15.207             | AC Conducted Emission                              | Pass               | 3.30 dB under the limit at 0.499 MHz    |
| 3.7           | 15.203 & 15.247(b) | Antenna Requirement                                | Pass               | -                                       |

**Remark:** This report is prepared for FCC class II permissive change. Difference compared with the original equipment is adding Spreading Factor 8/9/10/11 by software.

### Declaration of Conformity:

- The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers. It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.
- The measurement uncertainty please refer to this report "Uncertainty of Evaluation".

### Comments and Explanations:

The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity.

**Reviewed by: Keven Cheng**

**Report Producer: Cindy Liu**



# 1 General Description

## 1.1 Product Feature of Equipment Under Test

Bluetooth-LE, Wi-Fi 2.4GHz 802.11b/g/n, Wi-Fi 5GHz 802.11a/n/ac, LoRa, and 24G Radar.

| Product Feature |                                                                                                                                         |
|-----------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| Antenna Type    | WLAN:<br><Ant. 1>: FPC Antenna<br><Ant. 2>: FPC Antenna<br>Bluetooth-LE: FPC Antenna<br>LoRa: PCB Antenna<br>24GHz Radar: Patch Antenna |

| Antenna information |                 |       |
|---------------------|-----------------|-------|
| 902 MHz ~ 928 MHz   | Peak Gain (dBi) | -0.83 |

**Remark:** The above EUT's information was declared by manufacturer. Please refer to Comments and Explanations in report summary.

## 1.2 Modification of EUT

No modifications made to the EUT during the testing.

## 1.3 Testing Location

|                    |                                                                                                                           |
|--------------------|---------------------------------------------------------------------------------------------------------------------------|
| Test Site          | Sporton International Inc. EMC & Wireless Communications Laboratory                                                       |
| Test Site Location | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City 333, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| Test Site No.      | <b>Sporton Site No.</b><br>TH02-HY, CO05-HY                                                                               |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

|                    |                                                                                                                                                  |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Site          | Sporton International Inc. Wensan Laboratory                                                                                                     |
| Test Site Location | No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist.,<br>Taoyuan City 333010, Taiwan (R.O.C.)<br>TEL: +886-3-327-0868<br>FAX: +886-3-327-0855 |
| Test Site No.      | <b>Sporton Site No.</b><br>03CH11-HY (TAF Code: 3786)                                                                                            |
| Remark             | The Radiated Spurious Emission test item subcontracted to Sporton International Inc. Wensan Laboratory                                           |

**Note:** The test site complies with ANSI C63.4 2014 requirement.

FCC designation No.: TW1190 and TW3786



## 1.4 Applicable Standards

According to the specifications declared by the manufacturer, the EUT must comply with the requirements of the following standards:

- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 15.247 Meas Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ ANSI C63.10-2013

**Remark:**

1. All the test items were validated and recorded in accordance with the standards without any modification during the testing.
2. The TAF code is not including all the FCC KDB listed without accreditation.

## 2 Test Configuration of Equipment Under Test

- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, the measured emission level of the EUT was maximized by rotating the EUT on a turntable, adjusting the orientation of the EUT and EUT antenna in three orthogonal axis (X: flat, Y: portrait, Z: landscape), and adjusting the measurement antenna orientation, following C63.10 exploratory test procedures and only the worst case emissions were reported in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

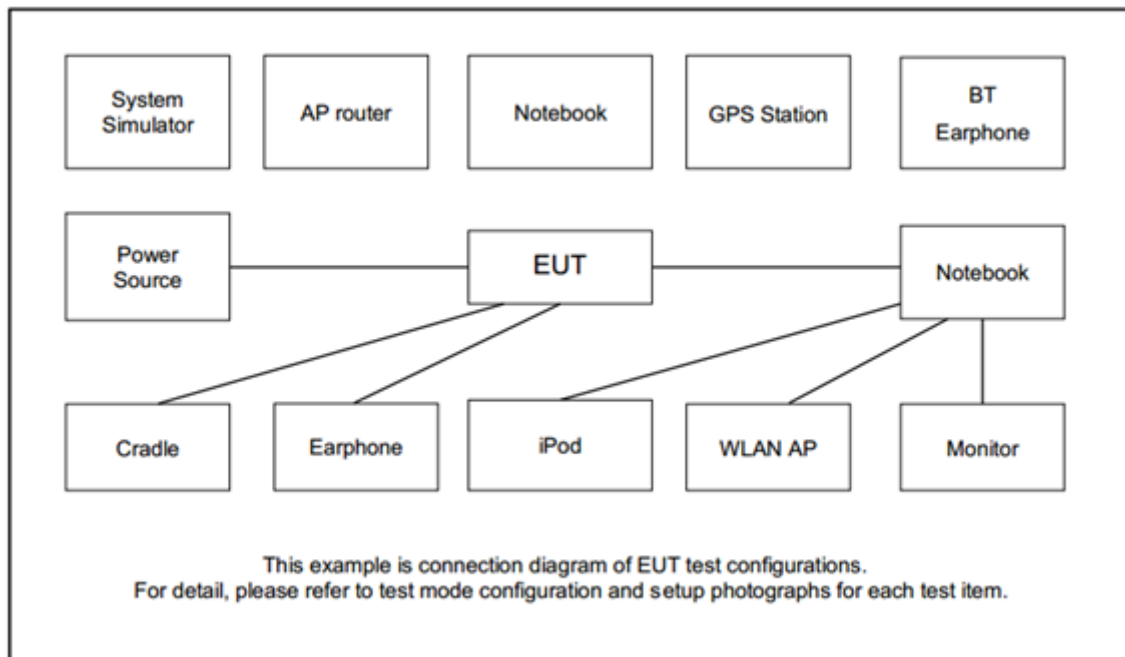
### 2.1 Carrier Frequency and Channel

| Frequency Band | Channel | Freq. (MHz) | Channel | Freq. (MHz) |
|----------------|---------|-------------|---------|-------------|
| 902 – 928 MHz  | 1       | 902.5       | 17      | 915.3       |
|                | 2       | 903.3       | 18      | 916.1       |
|                | 3       | 904.1       | 19      | 916.9       |
|                | 4       | 904.9       | 20      | 917.7       |
|                | 5       | 905.7       | 21      | 918.5       |
|                | 6       | 906.5       | 22      | 919.3       |
|                | 7       | 907.3       | 23      | 920.1       |
|                | 8       | 908.1       | 24      | 920.9       |
|                | 9       | 908.9       | 25      | 921.7       |
|                | 10      | 909.7       | 26      | 922.5       |
|                | 11      | 910.5       | 27      | 923.3       |
|                | 12      | 911.3       | 28      | 924.1       |
|                | 13      | 912.1       | 29      | 924.9       |
|                | 14      | 912.9       | 30      | 925.7       |
|                | 15      | 913.7       | 31      | 926.5       |
|                | 16      | 914.5       |         |             |

## 2.2 Test Mode

| Summary table of Test Cases      |                              |                                                                                           |
|----------------------------------|------------------------------|-------------------------------------------------------------------------------------------|
| Test Item                        | Feature                      | LoRa                                                                                      |
| <b>Conducted<br/>Test Cases</b>  | <b>LoRa 500 KHz DTS_SF8</b>  | Mode 4: CH01 Tx_902.50 MHz<br>Mode 5: CH16 Tx_914.50 MHz<br>Mode 6: CH31 Tx_926.50 MHz    |
|                                  | <b>LoRa 500 KHz DTS_SF9</b>  | Mode 7: CH01 Tx_902.50 MHz<br>Mode 8: CH16 Tx_914.50 MHz<br>Mode 9: CH31 Tx_926.50 MHz    |
|                                  | <b>LoRa 500 KHz DTS_SF10</b> | Mode 10: CH01 Tx_902.50 MHz<br>Mode 11: CH16 Tx_914.50 MHz<br>Mode 12: CH31 Tx_926.50 MHz |
|                                  | <b>LoRa 500 KHz DTS_SF11</b> | Mode 13: CH01 Tx_902.50 MHz<br>Mode 14: CH16 Tx_914.50 MHz<br>Mode 15: CH31 Tx_926.50 MHz |
| <b>Radiated<br/>Test Cases</b>   | <b>LoRa 500 KHz DTS_SF11</b> | Mode 1: CH01 Tx_902.50 MHz<br>Mode 2: CH16 Tx_914.50 MHz<br>Mode 3: CH31 Tx_926.50 MHz    |
| <b>AC Conducted<br/>Emission</b> | Mode 1: LoRa Tx              |                                                                                           |

## 2.3 Connection Diagram of Test System



## 2.4 EUT Operation Test Setup

The RF test items, utility “Tera Term Version 4.89 (SVN 6182)” was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level, data rate and the application type and for continuous transmitting signals.

## 2.5 Measurement Results Explanation Example

**For all conducted test items:**

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

Example:

The spectrum analyzer offset is derived from RF cable loss and attenuator factor.

*Offset = RF cable loss + attenuator factor.*

Following shows an offset computation example with cable loss 4.2 dB and 10 dB attenuator.

*Offset(dB) = RF cable loss(dB) + attenuator factor(dB).*

*= 4.2 + 10 = 14.2 (dB)*

### 3 Test Result

#### 3.1 6dB and 99% Bandwidth Measurement

##### 3.1.1 Limit of 6dB and 99% Bandwidth

The minimum 6 dB bandwidth shall be at least 500 kHz.

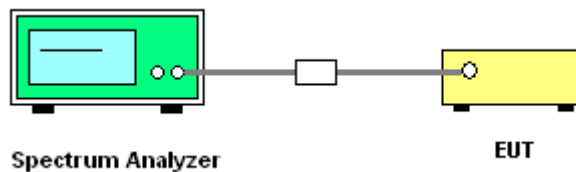
##### 3.1.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

##### 3.1.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 6.9.3 (OBW) and 11.8.1 (6dB BW).
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 100 kHz. Set the Video bandwidth (VBW) = 300 kHz. In order to make an accurate measurement. The 6 dB bandwidth must be greater than 500 kHz.
5. For 99% Bandwidth Measurement, the spectrum analyzer's resolution bandwidth (RBW) is set 1-5% of the emission bandwidth and set the Video bandwidth (VBW)  $\geq 3 * RBW$ .
6. Measure and record the results in the test report.

##### 3.1.4 Test Setup



##### 3.1.5 Test Result of 6dB and 99% Occupied Bandwidth

Please refer to Appendix A.

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

Section 15.247(b)(3) For systems using digital modulation in the 902-928 MHz, the limit for peak output power is 1 watt.

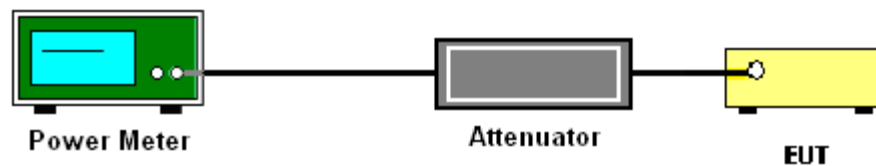
### 3.2.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

### 3.2.3 Test Procedures

1. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
2. The RF output of EUT is connected to the power meter by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Measure the conducted output power and record the results in the test report.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Average Output Power

Please refer to Appendix A.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

The peak power spectral density shall not be greater than 8 dBm in any 3 kHz band at any time interval of continuous transmission.

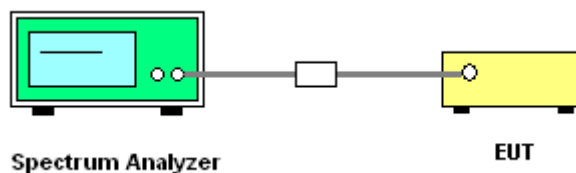
#### 3.3.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

#### 3.3.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.10.2 Method PKPSD.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Make the measurement with the spectrum analyzer's resolution bandwidth (RBW) = 3 kHz. Video bandwidth VBW = 10 kHz In order to make an accurate measurement, set the span to 1.5 times DTS Channel Bandwidth. (6dB BW)
5. Detector = peak, Sweep time = auto couple, Trace mode = max hold, Allow trace to fully stabilize. Use the peak marker function to determine the maximum power level.
6. Measure and record the results in the test report.

#### 3.3.4 Test Setup



#### 3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

### 3.4 Conducted Band Edges and Spurious Emission Measurement

#### 3.4.1 Limit of Conducted Band Edges and Spurious Emission Measurement

In any 100 kHz bandwidth outside of the authorized frequency band, the emissions which fall in the non-restricted bands shall be attenuated at least 20 dB / 30dB relative to the maximum PSD level in 100 kHz by RF conducted measurement.

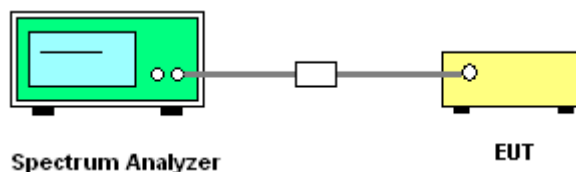
#### 3.4.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

#### 3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT is connected to the spectrum analyzer by RF cable and attenuator. The path loss is compensated to the results for each measurement.
3. Set the maximum power setting and enable the EUT to transmit continuously.
4. Set RBW = 100 kHz, VBW=300 kHz, Peak Detector. Unwanted Emissions 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 when maximum peak conducted output power procedure is used. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, the attenuation required under this paragraph shall be 30 dB instead of 20 dB per 15.247(d).
5. Measure and record the results in the test report.
6. The RF fundamental frequency should be excluded against the limit line in the operating frequency band.

#### 3.4.4 Test Setup



#### 3.4.5 Test Result of Conducted Band Edges and Spurious Emission

Please refer to Appendix A.

### 3.5 Radiated Band Edges and Spurious Emission Measurement

#### 3.5.1 Limit of Radiated band edge and Spurious Emission Measurement

In any 100 kHz bandwidth outside the intentional radiator frequency band, all harmonics/spurious must be at least 20 dB below the highest emission level within the authorized band. If the output power of this device is measured by spectrum analyzer, the attenuation under this paragraph shall be 30 dB instead of 20 dB. In addition, radiated emissions which fall in the restricted bands must also comply with the limits as below.

| Frequency<br>(MHz) | Field Strength<br>(microvolts/meter) | Measurement Distance<br>(meters) |
|--------------------|--------------------------------------|----------------------------------|
| 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                                |

#### 3.5.2 Measuring Instruments

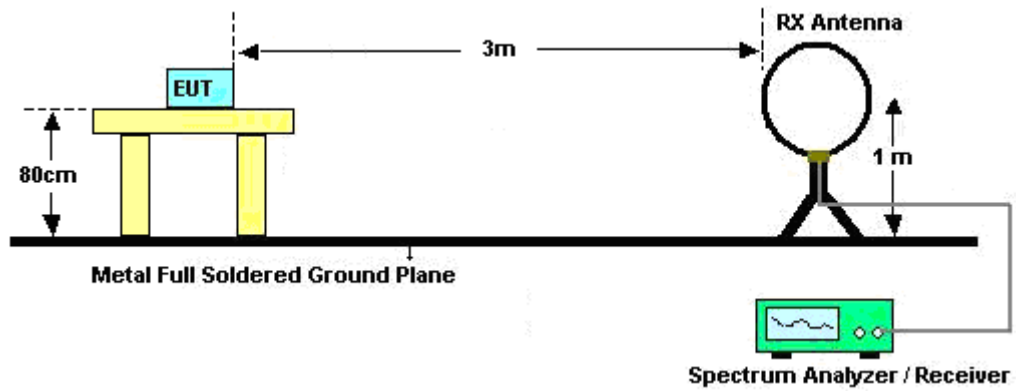
Please refer to the measuring equipment list in this test report.

### 3.5.3 Test Procedures

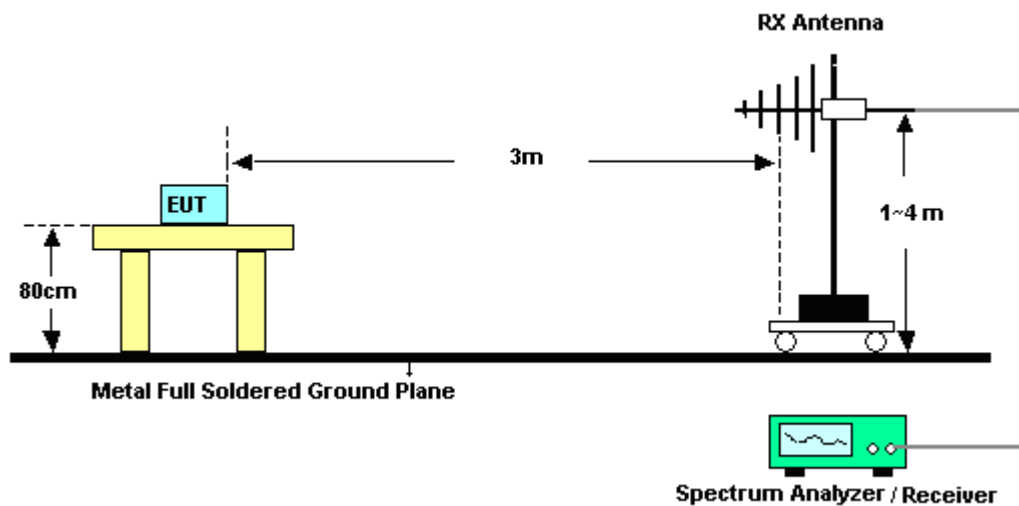
1. The testing follows the ANSI C63.10 Section 11.12.1 Radiated emission measurements.
2. The EUT is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading. A pre-amp and a high pass filter are used for the test in order to get better signal level.
3. The EUT is placed on a turntable with 0.8 meter for frequency below 1 GHz and 1.5 meter for frequency above 1 GHz respectively above ground.
4. The EUT is set 3 meters away from the receiving antenna, which is mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. Radiated testing below 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading. When there is no suspected emission found and the emission level is with at least 6 dB margin against QP limit line, the position is marked as “-”.
7. Radiated testing above 1 GHz is performed by adjusting the antenna tower from 1 m to 4 m and by rotating the turn table from 0 degree to 360 degrees to find the peak maximum hold reading for scanning all frequencies. When there is no suspected emission found and the harmonic emission level is with at least 6 dB margin against average limit line, the position is marked as “-”.
8. Use the following spectrum analyzer settings:
  - (1) Span shall wide enough to fully capture the emission being measured;
  - (2) Set RBW = 100 kHz for  $f < 1$  GHz; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
  - (3) Set RBW = 1 MHz, VBW= 3 MHz for  $f \geq 1$  GHz for peak measurement.For average measurement:
  - VBW = 10 Hz, when duty cycle is no less than 98 percent.
  - VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 3.5.4 Test Setup

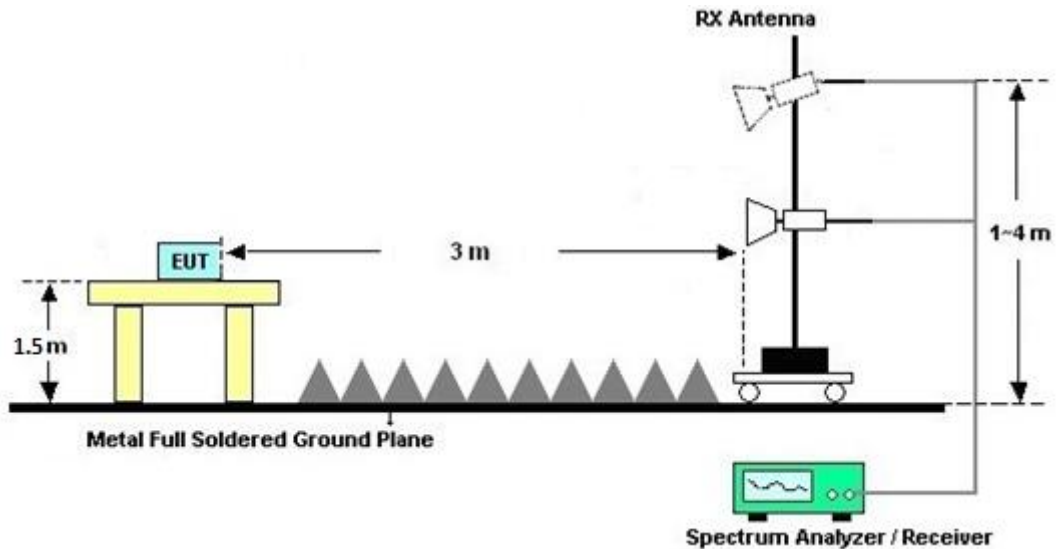
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions test above 1GHz



### 3.5.5 Test Results of Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which starts from 9 kHz to 30 MHz, is pre-scanned and the result which is 20 dB lower than the limit line is not reported.

There is adequate comparison measurement of both open-field test site and alternative test site - semi-Anechoic chamber according to 414788 D01 Radiated Test Site v01r01, and the result comes out very similar.

### 3.5.6 Test Result of Radiated Spurious at Band Edges

Please refer to Appendix C and D.

### 3.5.7 Duty Cycle

Please refer to Appendix E.

### 3.5.8 Test Result of Radiated Spurious Emission (30MHz ~ 10<sup>th</sup> Harmonic)

Please refer to Appendix C and D.

### 3.6 AC Conducted Emission Measurement

#### 3.6.1 Limit of AC Conducted Emission

For equipment 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 or frequencies within the band 150 kHz to 30 MHz shall not exceed the limits in the following table.

| Frequency of Emission<br>(MHz) | Conducted Limit (dB $\mu$ V) |           |
|--------------------------------|------------------------------|-----------|
|                                | Quasi-Peak                   | Average   |
| 0.15-0.5                       | 66 to 56*                    | 56 to 46* |
| 0.5-5                          | 56                           | 46        |
| 5-30                           | 60                           | 50        |

\*Decreases with the logarithm of the frequency.

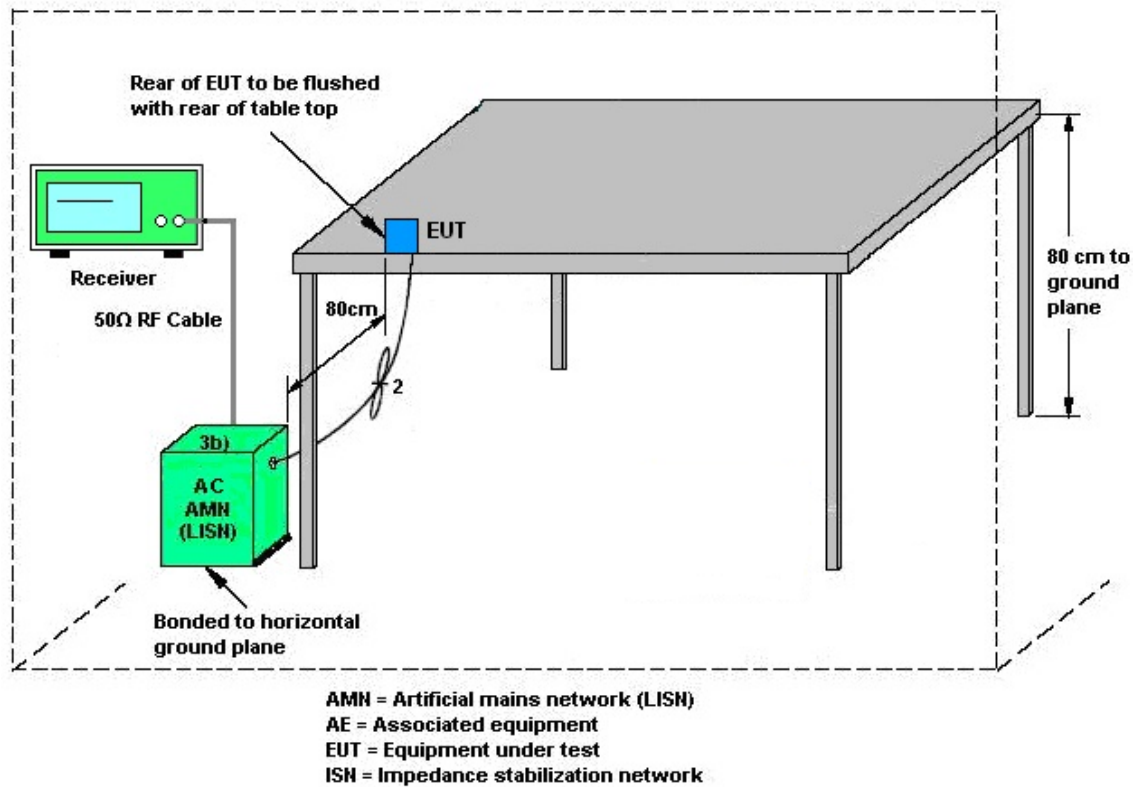
#### 3.6.2 Measuring Instruments

Please refer to the measuring equipment list in this test report.

#### 3.6.3 Test Procedures

1. The EUT is placed 0.4 meter away from the conducting wall of the shielding room, and is kept at least 80 centimeters from any other grounded conducting surface.
2. Connect EUT to the power mains through a line impedance stabilization network (LISN).
3. All the support units are connecting to the other LISN.
4. The LISN provides 50 ohm coupling impedance for the measuring instrument.
5. The FCC states that a 50 ohm, 50 microhenry LISN shall be used.
6. Both Line and Neutral shall be tested in order to find out the maximum conducted emission.
7. The frequency range from 150 kHz to 30 MHz is scanned.
8. Set the test-receiver system to Peak Detect Function and specified bandwidth (IF bandwidth = 9kHz) with Maximum Hold Mode.

### 3.6.4 Test Setup



### 3.6.5 Test Result of AC Conducted Emission

Please refer to Appendix B.



## **3.7 Antenna Requirements**

### **3.7.1 Standard Applicable**

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. 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 rule.

### **3.7.2 Antenna Anti-Replacement Construction**

An embedded-in antenna design is used.

### **3.7.3 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.



## 4 List of Measuring Equipment

| Instrument        | Brand Name        | Model No.                           | Serial No.           | Characteristics                  | Calibration Date | Test Date                       | Due Date      | Remark                   |
|-------------------|-------------------|-------------------------------------|----------------------|----------------------------------|------------------|---------------------------------|---------------|--------------------------|
| Loop Antenna      | Rohde & Schwarz   | HFH2-Z2                             | 100315               | 9 kHz~30 MHz                     | Jan. 07, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Jan. 06, 2023 | Radiation<br>(03CH11-HY) |
| Bilog Antenna     | TESEQ             | CBL 6111D &<br>N-6-06               | 35414 &<br>AT-N0602  | 30MHz~1GHz                       | Oct. 09, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Oct. 08, 2022 | Radiation<br>(03CH11-HY) |
| Horn Antenna      | SCHWARZBE<br>CK   | BBHA 9120<br>D                      | 9120D-1212           | 1GHz ~ 18GHz                     | Mar. 10, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Mar. 09, 2023 | Radiation<br>(03CH11-HY) |
| Amplifier         | SONOMA            | 310N                                | 187312               | 9kHz~1GHz                        | Dec. 10, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Dec. 09, 2022 | Radiation<br>(03CH11-HY) |
| Preamplifier      | Keysight          | 83017A                              | MY53270080           | 1GHz~26.5GHz                     | Nov. 10, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Nov. 09, 2022 | Radiation<br>(03CH11-HY) |
| Preamplifier      | Jet-Power         | JPA0118-55-<br>303                  | 171000180005<br>5007 | 1GHz~18GHz                       | Jun. 16, 2021    | May 30, 2022~<br>May 31, 2022   | Jun. 15, 2022 | Radiation<br>(03CH11-HY) |
| Preamplifier      | Jet-Power         | JPA0118-55-<br>303                  | 171000180005<br>5007 | 1GHz~18GHz                       | Jun. 15, 2022    | Aug. 16, 2022~<br>Aug. 17, 2022 | Jun. 14, 2023 | Radiation<br>(03CH11-HY) |
| Spectrum Analyzer | Keysight          | N9010A                              | MY54200486           | 10Hz~44GHz                       | Oct. 15, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Oct. 14, 2022 | Radiation<br>(03CH11-HY) |
| EMI Test Receiver | Keysight          | N9038A(MX<br>E)                     | MY55420170           | 20MHz~8.4GHz                     | Jul. 15, 2021    | May 30, 2022~<br>May 31, 2022   | Jul. 14, 2022 | Radiation<br>(03CH11-HY) |
| EMI Test Receiver | Keysight          | N9038A(MX<br>E)                     | MY54130085           | 20MHz~8.4GHz                     | Oct. 21, 2021    | Aug. 16, 2022~<br>Aug. 17, 2022 | Oct. 20, 2022 | Radiation<br>(03CH11-HY) |
| Controller        | EMEC              | EM 1000                             | N/A                  | Control Turn<br>table & Ant Mast | N/A              | May 30, 2022~<br>Aug. 17, 2022  | N/A           | Radiation<br>(03CH11-HY) |
| Antenna Mast      | EMEC              | AM-BS-4500<br>-B                    | N/A                  | 1~4m                             | N/A              | May 30, 2022~<br>Aug. 17, 2022  | N/A           | Radiation<br>(03CH11-HY) |
| Turn Table        | EMEC              | TT 2000                             | N/A                  | 0~360 Degree                     | N/A              | May 30, 2022~<br>Aug. 17, 2022  | N/A           | Radiation<br>(03CH11-HY) |
| Software          | Audix             | E3<br>6.2009-8-24                   | RK-001053            | N/A                              | N/A              | May 30, 2022~<br>Aug. 17, 2022  | N/A           | Radiation<br>(03CH11-HY) |
| RF Cable          | HUBER +<br>SUHNER | SUCOFLEX<br>102                     | MY2859/2             | 30MHz-40GHz                      | Mar. 10, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Mar. 09, 2023 | Radiation<br>(03CH11-HY) |
| RF Cable          | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | MY9837/4PE           | 9kHz-30MHz                       | Mar. 10, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Mar. 09, 2023 | Radiation<br>(03CH11-HY) |
| RF Cable          | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | MY9837/4PE           | 30MHz-18GHz                      | Mar. 10, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Mar. 09, 2023 | Radiation<br>(03CH11-HY) |
| RF Cable          | HUBER +<br>SUHNER | SUCOFLEX<br>104                     | 811852/4             | 30MHz-18GHz                      | Mar. 10, 2022    | May 30, 2022~<br>Aug. 17, 2022  | Mar. 09, 2023 | Radiation<br>(03CH11-HY) |
| Filter            | Wainwright        | WLK4-1000-<br>1530-8000-4<br>OSS    | SN11                 | 1.53G Low Pass                   | Sep. 13, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Sep. 12, 2022 | Radiation<br>(03CH11-HY) |
| Filter            | Wainwright        | WHKX12-27<br>00-3000-180<br>00-60SS | SN3                  | 3GHz High Pass<br>Filter         | Sep. 13, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Sep. 12, 2022 | Radiation<br>(03CH11-HY) |
| Filter            | Wainwright        | WHKX12-90<br>0-1000-1500<br>0-60SS  | SN12                 | 1GHz High Pass<br>Filter         | Nov. 04, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Nov. 03, 2022 | Radiation<br>(03CH11-HY) |
| Hygrometer        | TECPEL            | DTM-303B                            | TP140325             | N/A                              | Nov. 26, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Nov. 25, 2022 | Radiation<br>(03CH11-HY) |
| Hygrometer        | TECPEL            | DTM-303B                            | TP200880             | N/A                              | Sep. 30, 2021    | May 30, 2022~<br>Aug. 17, 2022  | Sep. 29, 2022 | Radiation<br>(03CH11-HY) |



| Instrument        | Brand Name      | Model No.     | Serial No. | Characteristics | Calibration Date | Test Date                  | Due Date      | Remark               |
|-------------------|-----------------|---------------|------------|-----------------|------------------|----------------------------|---------------|----------------------|
| AC Power Source   | ChainTek        | APC-1000W     | N/A        | N/A             | N/A              | Jul. 14, 2022              | N/A           | Conduction (CO05-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESR3          | 102388     | 9kHz~3.6GHz     | Dec. 01, 2021    | Jul. 14, 2022              | Nov. 30, 2022 | Conduction (CO05-HY) |
| Hygrometer        | Testo           | 608-H1        | 34913912   | N/A             | Nov. 17, 2021    | Jul. 14, 2022              | Nov. 16, 2022 | Conduction (CO05-HY) |
| LISN              | Rohde & Schwarz | ENV216        | 100080     | 9kHz~30MHz      | Dec. 03, 2021    | Jul. 14, 2022              | Dec. 02, 2022 | Conduction (CO05-HY) |
| Software          | Rohde & Schwarz | EMC32         | N/A        | N/A             | N/A              | Jul. 14, 2022              | N/A           | Conduction (CO05-HY) |
| Pulse Limiter     | SCHWARZBECK     | VTSD 9561-F N | 00691      | N/A             | Jul. 28, 2021    | Jul. 14, 2022              | Jul. 27, 2022 | Conduction (CO05-HY) |
| LISN Cable        | MVE             | RG-400        | 260260     | N/A             | Dec. 30, 2021    | Jul. 14, 2022              | Dec. 29, 2022 | Conduction (CO05-HY) |
| Hygrometer        | TECEPEL         | TR-32         | HE17XB2468 | N/A             | Mar. 18, 2022    | May 22, 2022~Jul. 31, 2022 | Mar. 17, 2023 | Conducted (TH02-HY)  |
| Signal Analyzer   | Rohde & Schwarz | FSV40         | 101564     | 10Hz~40GHz      | Aug. 30, 2021    | May 22, 2022~Jul. 31, 2022 | Aug. 29, 2022 | Conducted (TH02-HY)  |
| Power Meter       | Anritsu         | ML2495A       | 932001     | N/A             | Sep. 30, 2021    | May 22, 2022~Jul. 31, 2022 | Sep. 29, 2022 | Conducted (TH02-HY)  |
| Power Sensor      | Anritsu         | MA2411B       | 846202     | 300MHz~40GHz    | Sep. 30, 2021    | May 22, 2022~Jul. 31, 2022 | Sep. 29, 2022 | Conducted (TH02-HY)  |



## 5 Uncertainty of Evaluation

### Uncertainty of Conducted Emission Measurement (150 kHz ~ 30 MHz)

|                                                                            |        |
|----------------------------------------------------------------------------|--------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 3.1 dB |
|----------------------------------------------------------------------------|--------|

### Uncertainty of Radiated Emission Measurement (30 MHz ~ 1000 MHz)

|                                                                            |        |
|----------------------------------------------------------------------------|--------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 5.8 dB |
|----------------------------------------------------------------------------|--------|

### Uncertainty of Radiated Emission Measurement (1000 MHz ~ 18000 MHz)

|                                                                            |        |
|----------------------------------------------------------------------------|--------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 5.4 dB |
|----------------------------------------------------------------------------|--------|

### Uncertainty of Radiated Emission Measurement (18000 MHz ~ 40000 MHz)

|                                                                            |        |
|----------------------------------------------------------------------------|--------|
| Measuring Uncertainty for a Level of Confidence<br>of 95% ( $U = 2Uc(y)$ ) | 5.9 dB |
|----------------------------------------------------------------------------|--------|

**Appendix A. Test Result of Conducted Test Items**

|                |                     |                    |       |    |
|----------------|---------------------|--------------------|-------|----|
| Test Engineer: | Tommy Lee           | Temperature:       | 21~26 | °C |
| Test Date:     | 2022/5/22~2022/7/31 | Relative Humidity: | 49~56 | %  |

## &lt;LoRa 500kHz&gt;

**TEST RESULTS DATA****6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| Lora | SF8       | 1   | 1   | 902.5       | 0.537                 | 0.641        | 0.50               | Pass      |
| Lora | SF8       | 1   | 16  | 914.5       | 0.537                 | 0.637        | 0.50               | Pass      |
| Lora | SF8       | 1   | 31  | 926.5       | 0.539                 | 0.649        | 0.50               | Pass      |

**TEST RESULTS DATA****Average Power Table**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Lora | SF8       | 1   | 1   | 902.5       | 24.86                         | 30.00                       | -0.83    | 24.03            | 36.00                  | Pass       |
| Lora | SF8       | 1   | 16  | 914.5       | 24.68                         | 30.00                       | -0.83    | 23.85            | 36.00                  | Pass       |
| Lora | SF8       | 1   | 31  | 926.5       | 24.30                         | 30.00                       | -0.83    | 23.47            | 36.00                  | Pass       |

**TEST RESULTS DATA****Average Power Density**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Average PSD (dBm /3kHz) | DG (dBi) | Average PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|-------------------------|----------|-------------------------------|-----------|
| Lora | SF8       | 1   | 1   | 902.5       | 24.77                  | 5.12                    | -0.83    | 8.00                          | Pass      |
| Lora | SF8       | 1   | 16  | 914.5       | 24.50                  | 4.85                    | -0.83    | 8.00                          | Pass      |
| Lora | SF8       | 1   | 31  | 926.5       | 24.08                  | 4.52                    | -0.83    | 8.00                          | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| Lora | SF9       | 1   | 1   | 902.5       | 0.541                 | 0.645        | 0.50               | Pass      |
| Lora | SF9       | 1   | 16  | 914.5       | 0.541                 | 0.643        | 0.50               | Pass      |
| Lora | SF9       | 1   | 31  | 926.5       | 0.547                 | 0.649        | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Average Power Table**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Lora | SF9       | 1   | 1   | 902.5       | 24.85                         | 30.00                       | -0.83    | 24.02            | 36.00                  | Pass       |
| Lora | SF9       | 1   | 16  | 914.5       | 24.65                         | 30.00                       | -0.83    | 23.82            | 36.00                  | Pass       |
| Lora | SF9       | 1   | 31  | 926.5       | 24.30                         | 30.00                       | -0.83    | 23.47            | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Density**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Average PSD (dBm /3kHz) | DG (dBi) | Average PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|-------------------------|----------|-------------------------------|-----------|
| Lora | SF9       | 1   | 1   | 902.5       | 24.61                  | 5.87                    | -0.83    | 8.00                          | Pass      |
| Lora | SF9       | 1   | 16  | 914.5       | 25.29                  | 5.68                    | -0.83    | 8.00                          | Pass      |
| Lora | SF9       | 1   | 31  | 926.5       | 24.94                  | 4.99                    | -0.83    | 8.00                          | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| Lora | SF10      | 1   | 1   | 902.5       | 0.543                 | 0.649        | 0.50               | Pass      |
| Lora | SF10      | 1   | 16  | 914.5       | 0.541                 | 0.647        | 0.50               | Pass      |
| Lora | SF10      | 1   | 31  | 926.5       | 0.545                 | 0.655        | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Average Power Table**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Lora | SF10      | 1   | 1   | 902.5       | 24.84                         | 30.00                       | -0.83    | 24.01            | 36.00                  | Pass       |
| Lora | SF10      | 1   | 16  | 914.5       | 24.66                         | 30.00                       | -0.83    | 23.83            | 36.00                  | Pass       |
| Lora | SF10      | 1   | 31  | 926.5       | 24.30                         | 30.00                       | -0.83    | 23.47            | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Density**

| Mod. | Data Rate | Ntx | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Average PSD (dBm /3kHz) | DG (dBi) | Average PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|-------------------------|----------|-------------------------------|-----------|
| Lora | SF10      | 1   | 1   | 902.5       | 25.54                  | 6.92                    | -0.83    | 8.00                          | Pass      |
| Lora | SF10      | 1   | 16  | 914.5       | 25.37                  | 6.64                    | -0.83    | 8.00                          | Pass      |
| Lora | SF10      | 1   | 31  | 926.5       | 25.01                  | 6.03                    | -0.83    | 8.00                          | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

**TEST RESULTS DATA**  
**6dB and 99% Occupied Bandwidth**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | 99% Occupied BW (MHz) | 6dB BW (MHz) | 6dB BW Limit (MHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|-----------------------|--------------|--------------------|-----------|
| Lora | SF11      | 1   | 1   | 902.5       | 0.545                 | 0.649        | 0.50               | Pass      |
| Lora | SF11      | 1   | 16  | 914.5       | 0.545                 | 0.645        | 0.50               | Pass      |
| Lora | SF11      | 1   | 31  | 926.5       | 0.545                 | 0.653        | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Average Power Table**

| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Average Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Lora | SF11      | 1   | 1   | 902.5       | 24.88                         | 30.00                       | -0.83    | 24.05            | 36.00                  | Pass       |
| Lora | SF11      | 1   | 16  | 914.5       | 24.66                         | 30.00                       | -0.83    | 23.83            | 36.00                  | Pass       |
| Lora | SF11      | 1   | 31  | 926.5       | 24.30                         | 30.00                       | -0.83    | 23.47            | 36.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Density**

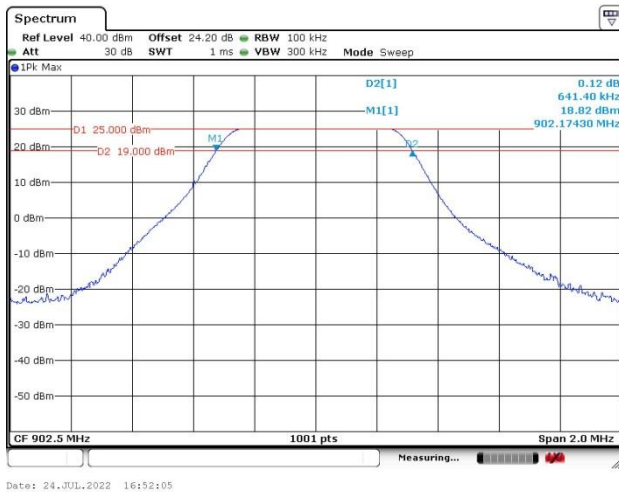
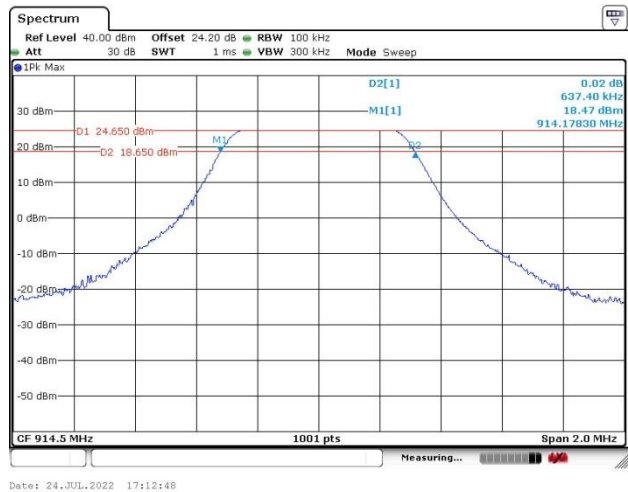
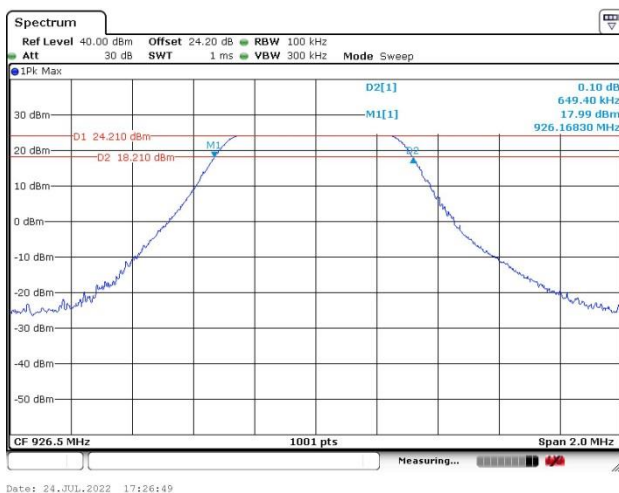
| Mod. | Data Rate | NTX | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Average PSD (dBm /3kHz) | DG (dBi) | Average PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|-------------------------|----------|-------------------------------|-----------|
| Lora | SF11      | 1   | 1   | 902.5       | 25.59                  | 6.98                    | -0.83    | 8.00                          | Pass      |
| Lora | SF11      | 1   | 16  | 914.5       | 25.38                  | 6.75                    | -0.83    | 8.00                          | Pass      |
| Lora | SF11      | 1   | 31  | 926.5       | 25.00                  | 6.16                    | -0.83    | 8.00                          | Pass      |

Note: PSD (dBm/ 100kHz) is a reference level used for Conducted Band Edges and Conducted Spurious Emission 30dBc limit.

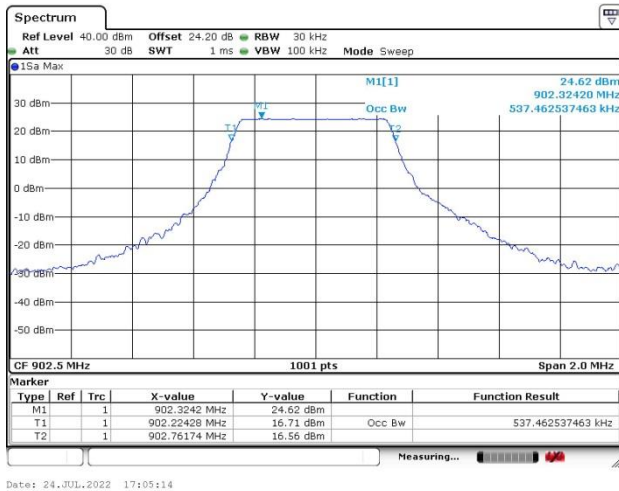
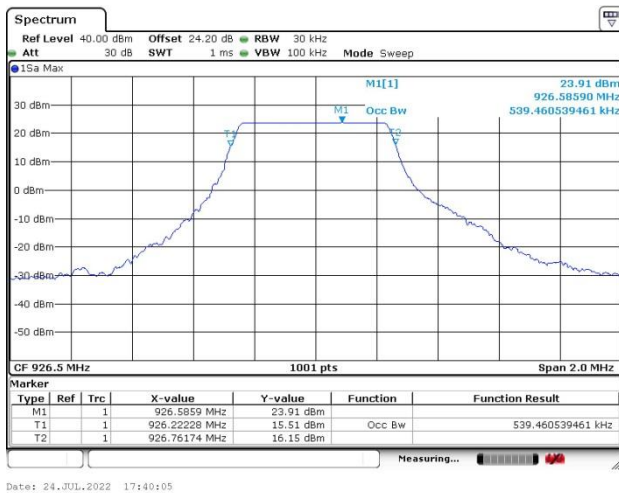


&lt;LoRa 500kHz DTS&gt;

&lt;Data Rate: SF8&gt;

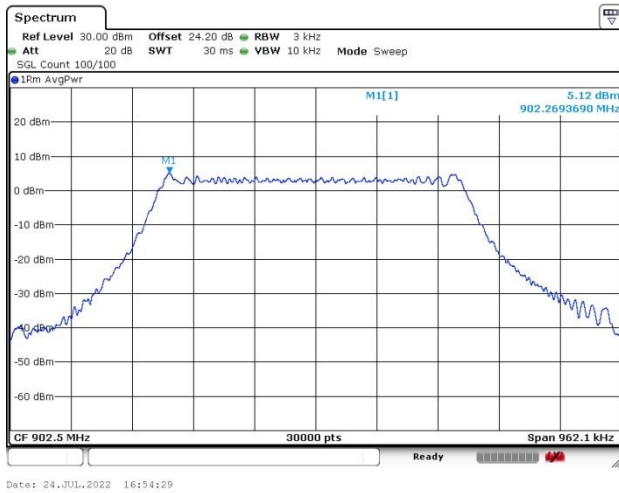
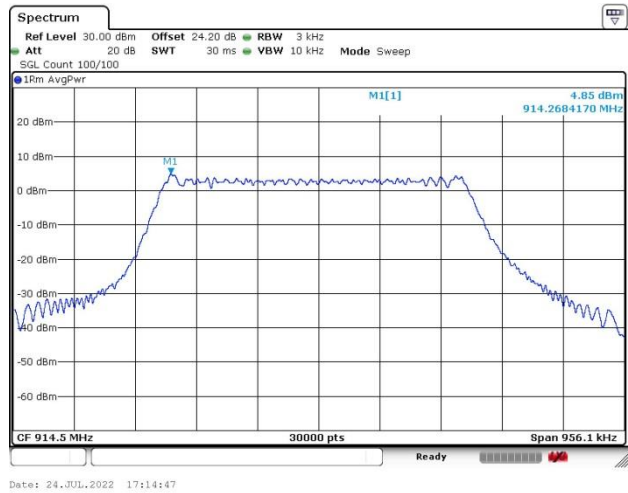
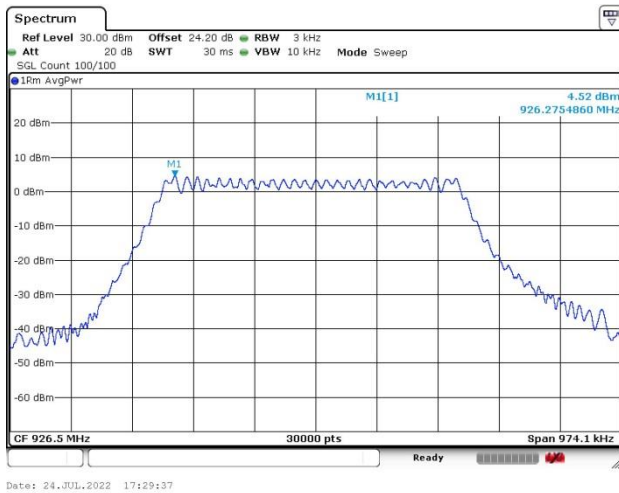
**6dB Bandwidth****Lora 500KHz SF8****6 dB Bandwidth Plot on Channel 1****6 dB Bandwidth Plot on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

**99% Occupied Bandwidth****Lora 500KHz SF8****99% Occupied Bandwidth Plot on Channel 1****99% Occupied Plot Bandwidth on Channel 16****6 dB Bandwidth Plot on Channel 31**

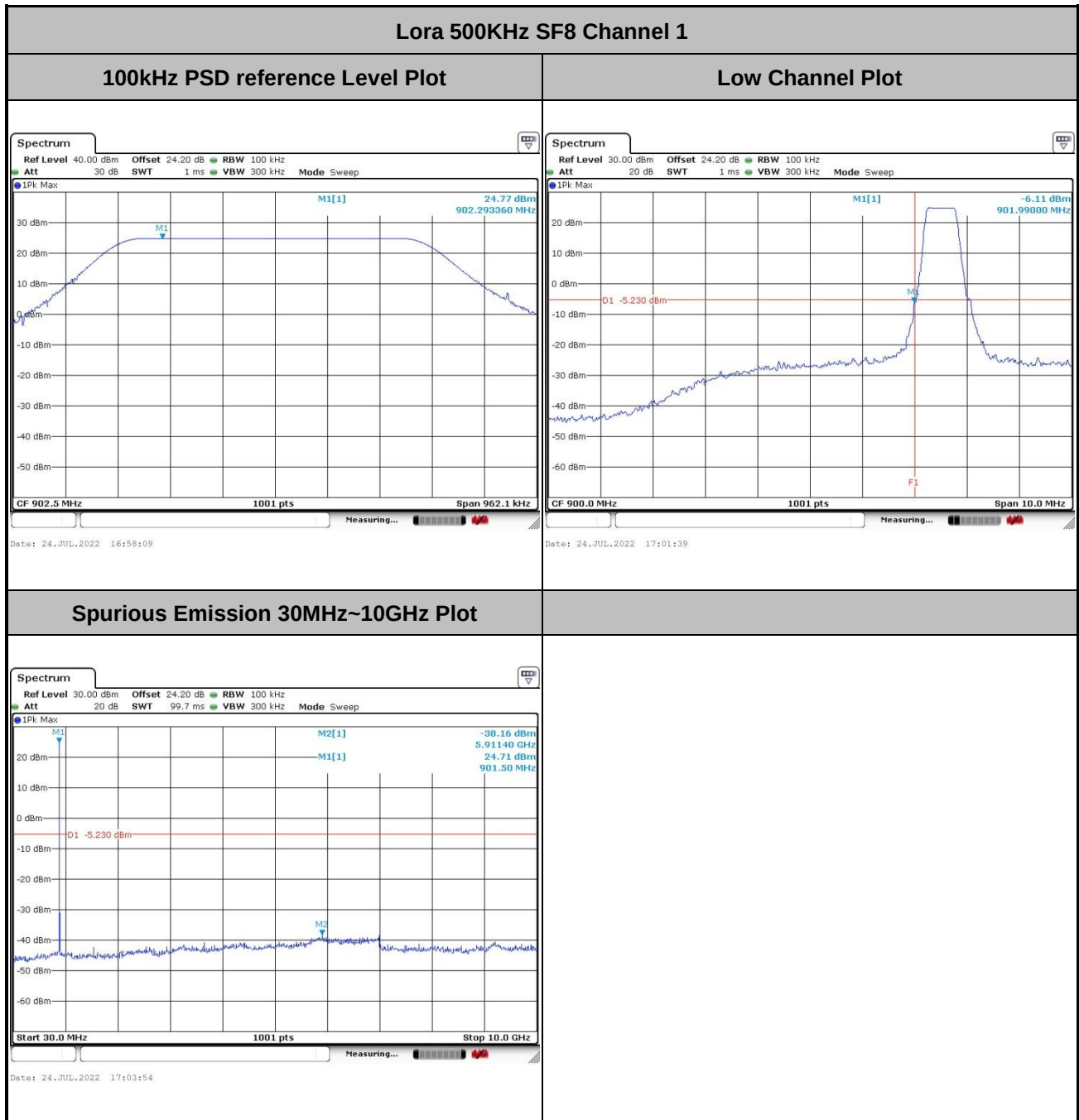
N/A

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

**Power Spectral Density (dBm/3kHz)****Lora 500KHz SF8****Power Density (dBm/3kHz) Plot Channel 1****Power Density (dBm/3kHz) Plot Channel 16****Power Density (dBm/3kHz) Plot Channel 31**

N/A

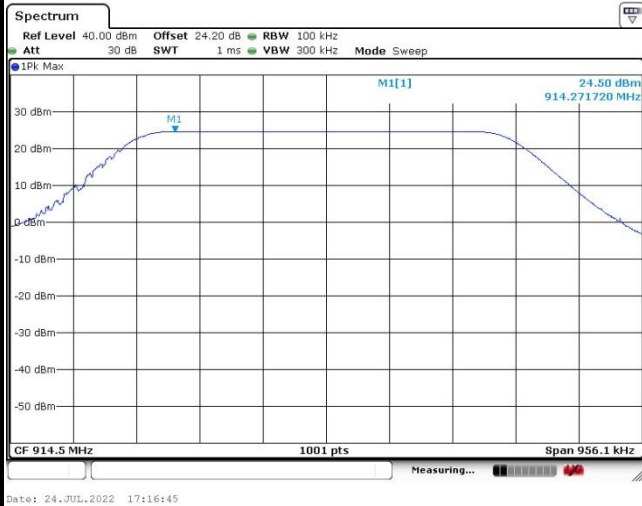
## Band Edge and Spurious Emission





Lora 500KHz SF8 Channel 16

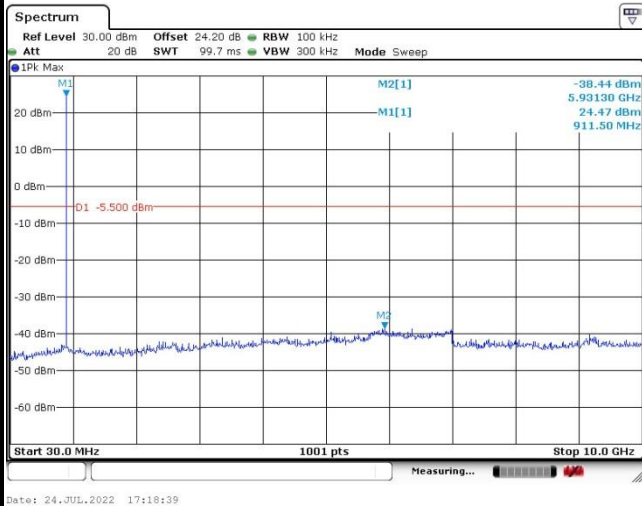
100kHz PSD reference Level Plot



Middle Channel Plot

N/A

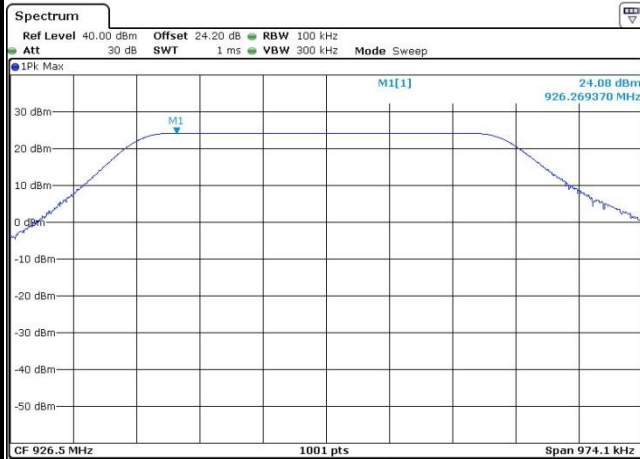
Spurious Emission 30MHz~10GHz Plot





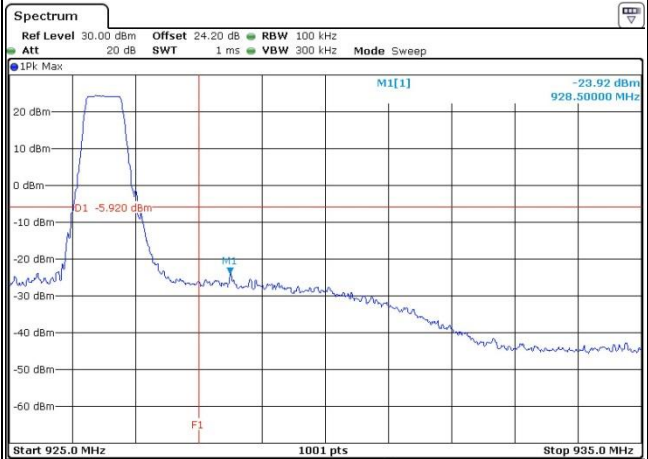
## Lora 500KHz SF8 Channel 31

## 100kHz PSD reference Level Plot



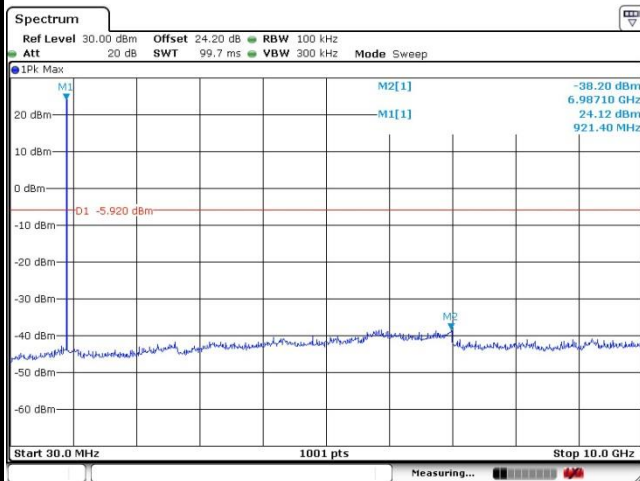
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## High Channel Plot



Date: 24.JUL.2022 17:36:00

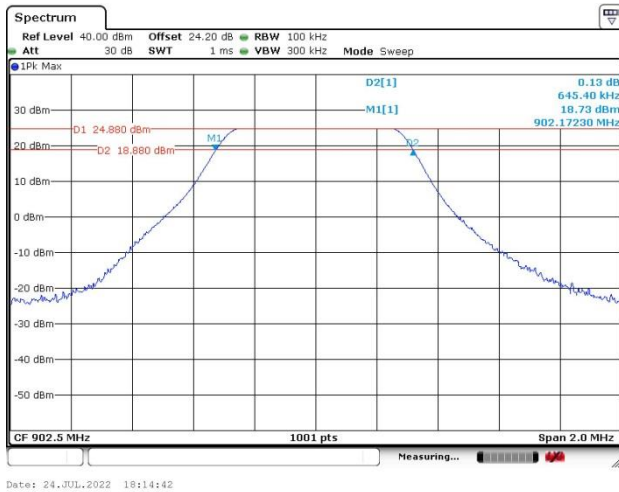
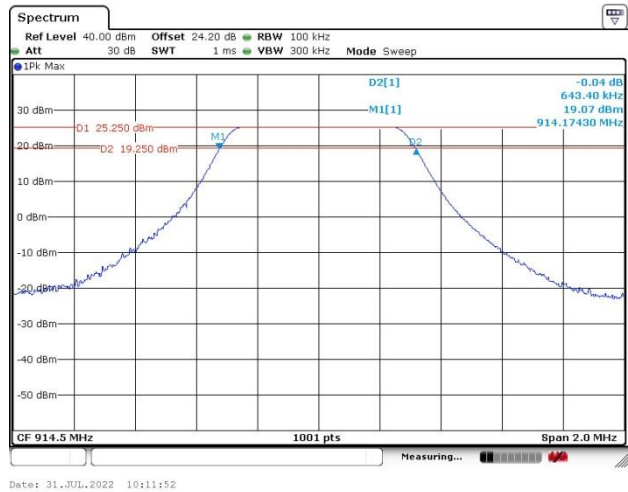
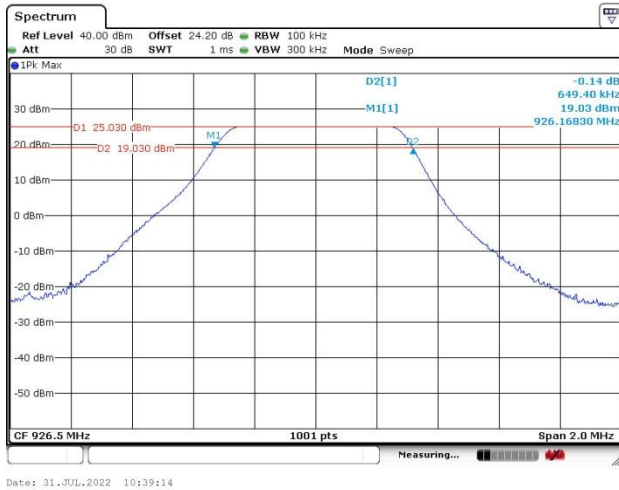
## Spurious Emission 30MHz~10GHz Plot



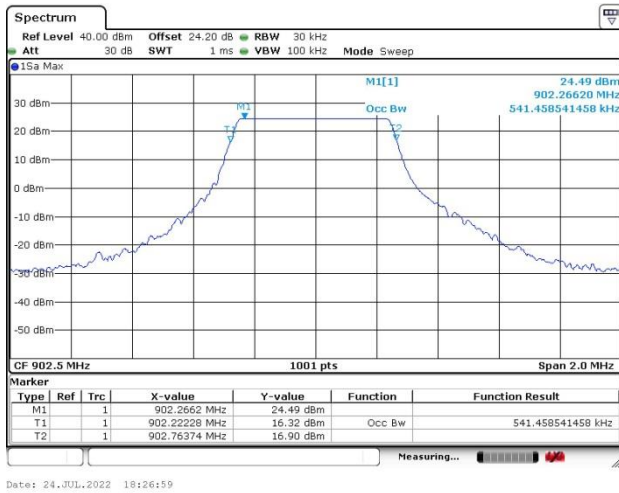
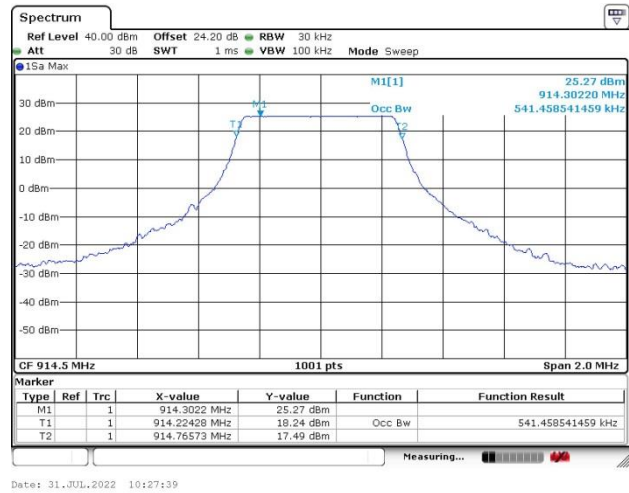
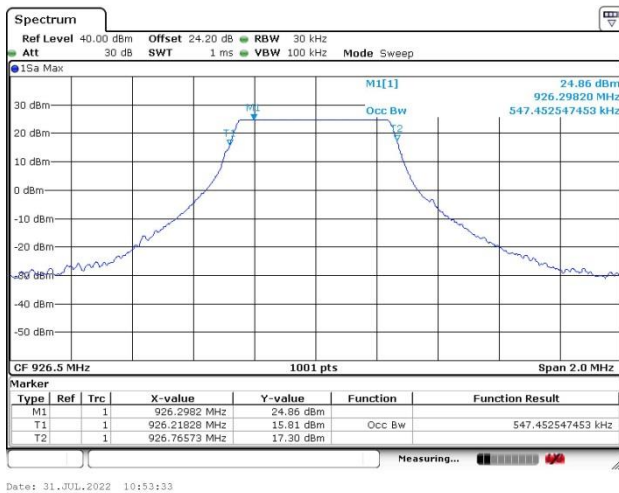
Date: 24.JUL.2022 17:38:51



&lt;Data Rate: SF9&gt;

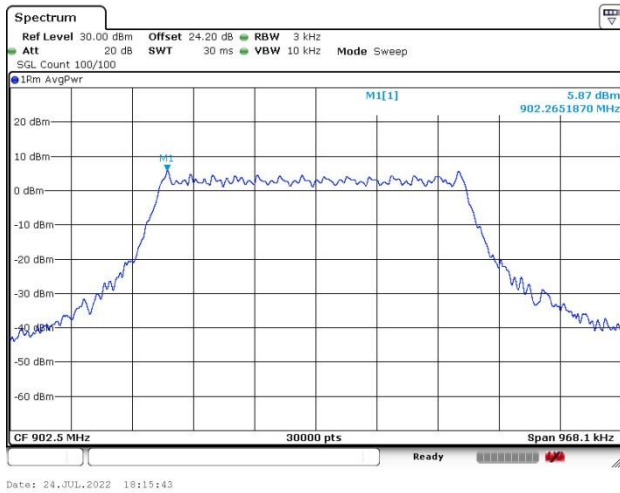
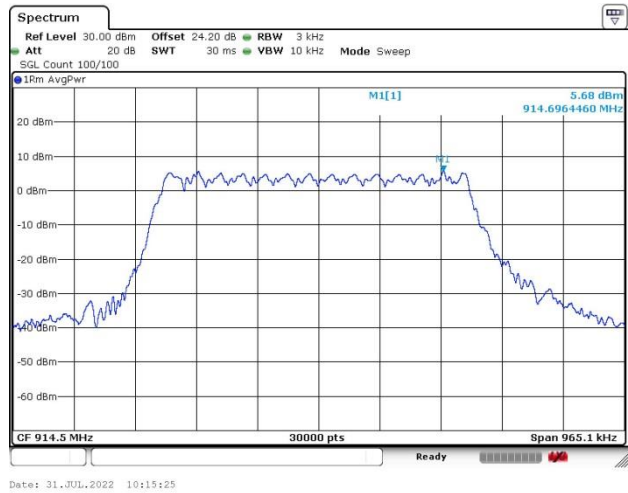
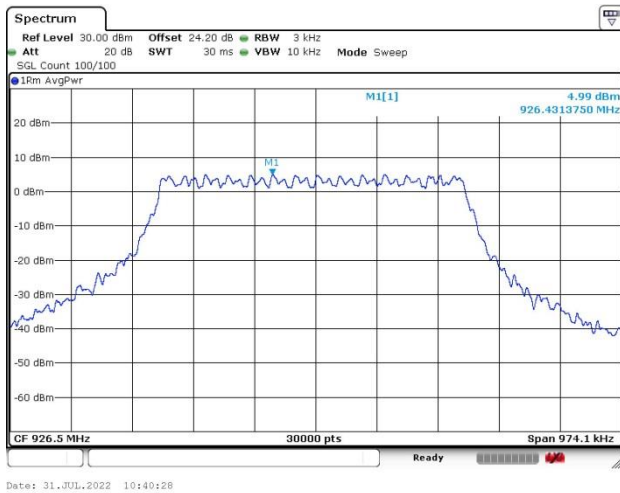
**6dB Bandwidth****Lora 500KHz SF9****6 dB Bandwidth Plot on Channel 1****6 dB Bandwidth Plot on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

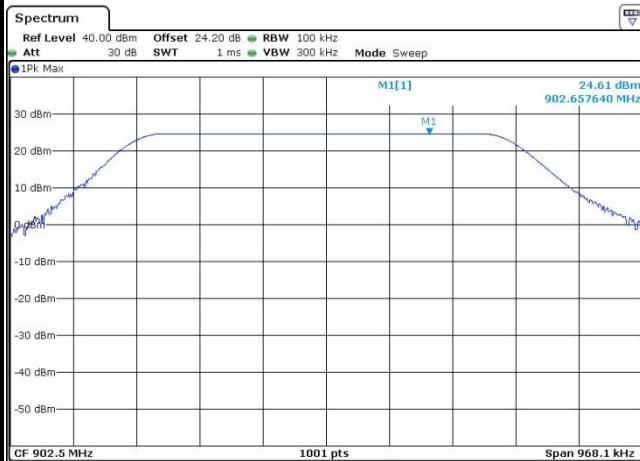
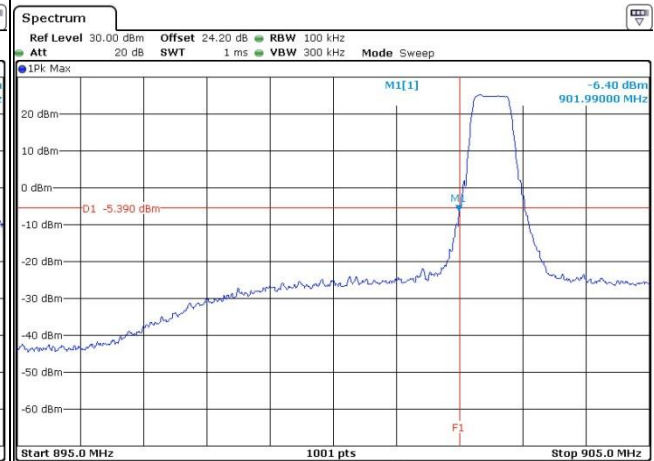
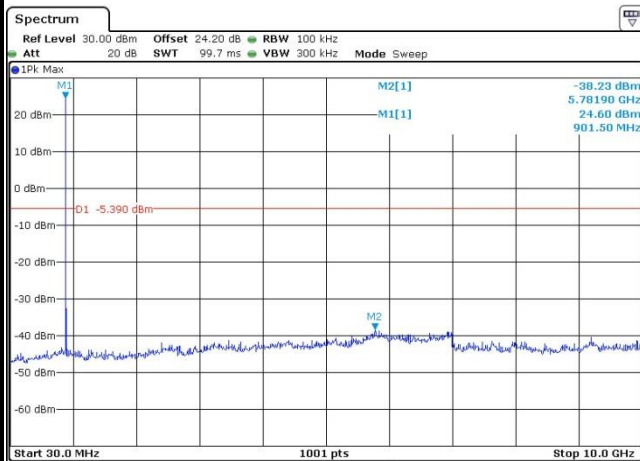
**99% Occupied Bandwidth****Lora 500KHz SF9****99% Occupied Bandwidth Plot on Channel 1****99% Occupied Plot Bandwidth on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

**Power Spectral Density (dBm/3kHz)****Lora 500KHz SF9****Power Density (dBm/3kHz) Plot Channel 1****Power Density (dBm/3kHz) Plot Channel 16****Power Density (dBm/3kHz) Plot Channel 31**

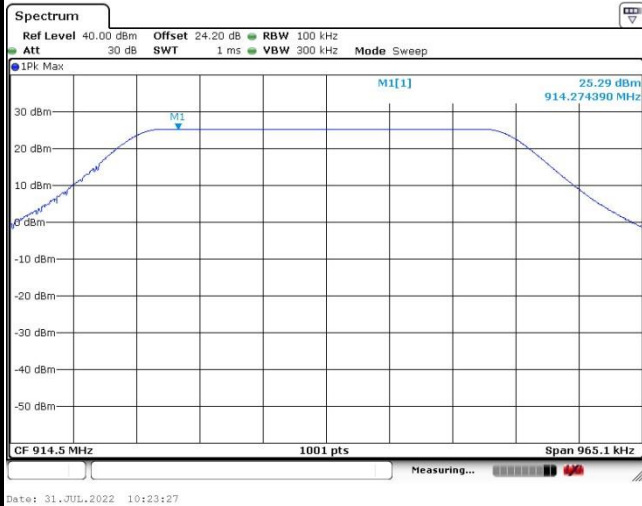
N/A

**Band Edge and Spurious Emission****Lora 500KHz SF9 Channel 1****100kHz PSD reference Level Plot****Low Channel Plot****Spurious Emission 30MHz~10GHz Plot**



Lora 500KHz SF9 Channel 16

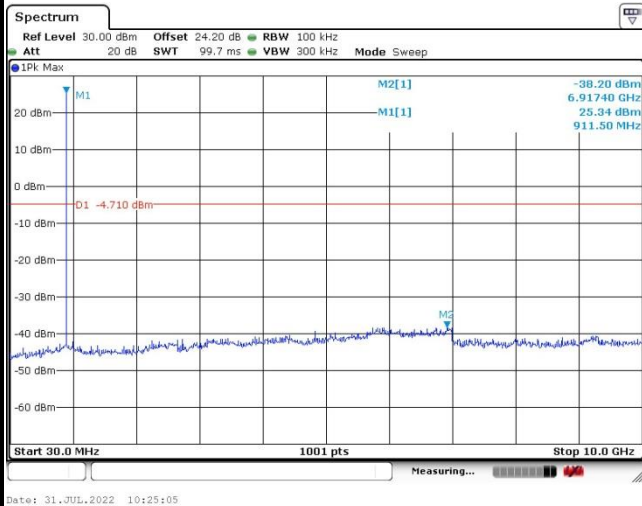
100kHz PSD reference Level Plot



Middle Channel Plot

N/A

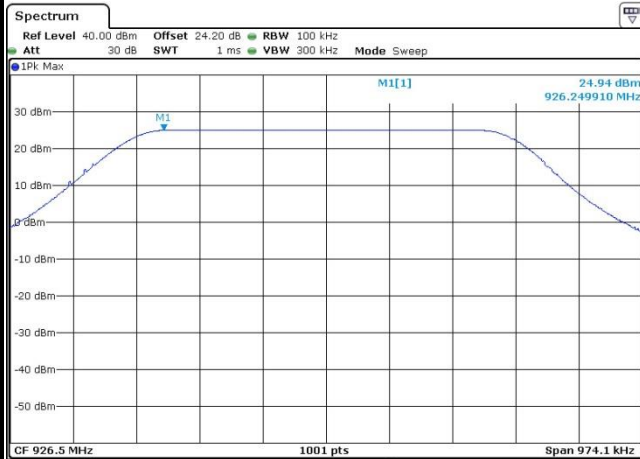
Spurious Emission 30MHz~10GHz Plot





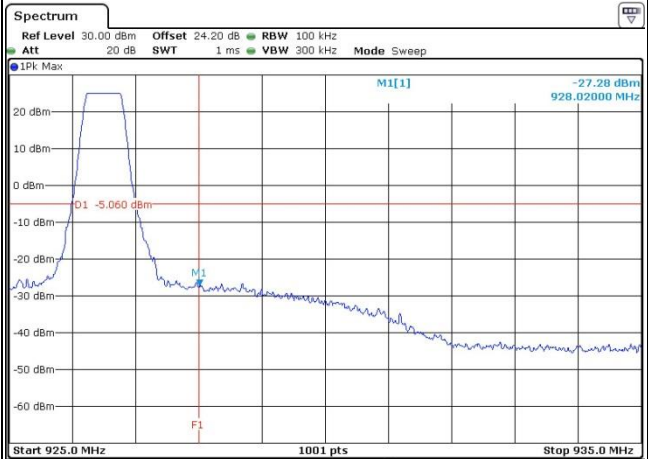
## Lora 500KHz SF9 Channel 31

## 100kHz PSD reference Level Plot



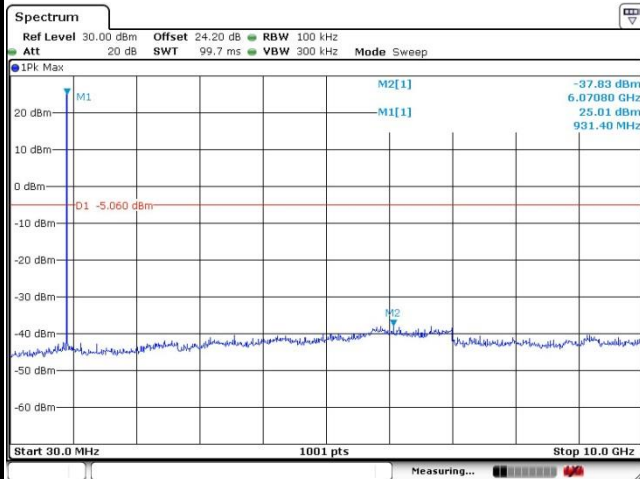
Date: 31.JUL.2022 10:46:25

## High Channel Plot



Date: 31.JUL.2022 10:49:48

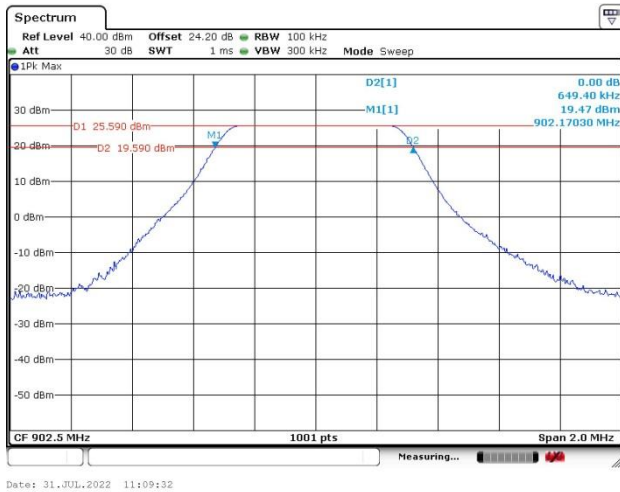
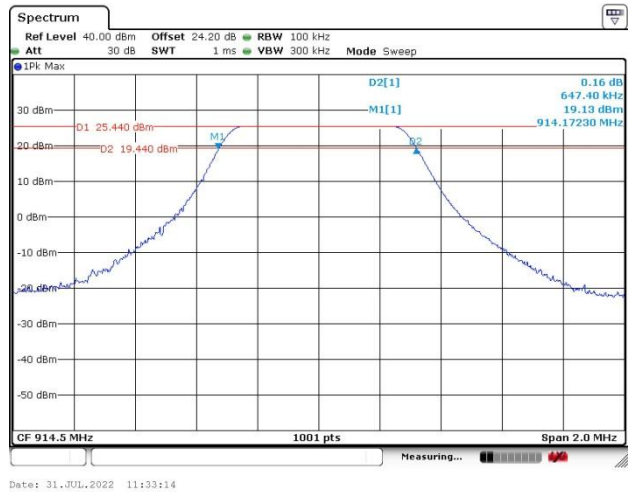
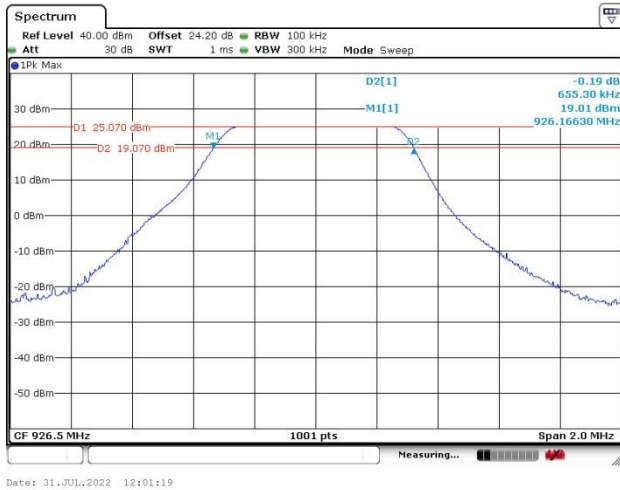
## Spurious Emission 30MHz~10GHz Plot



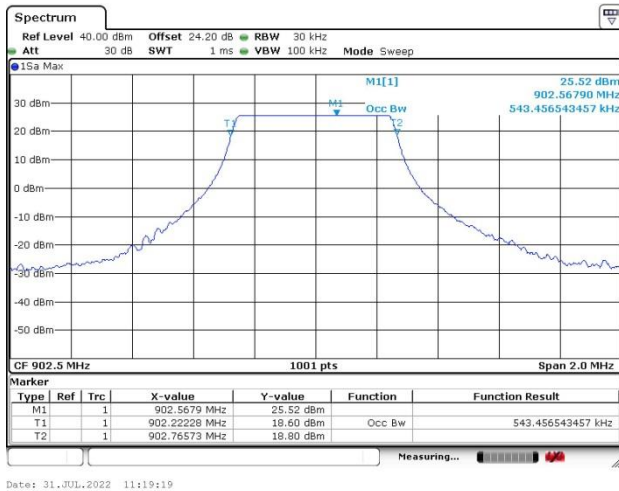
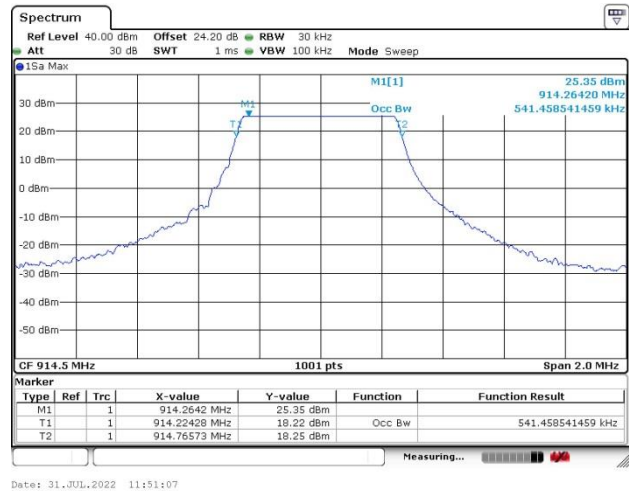
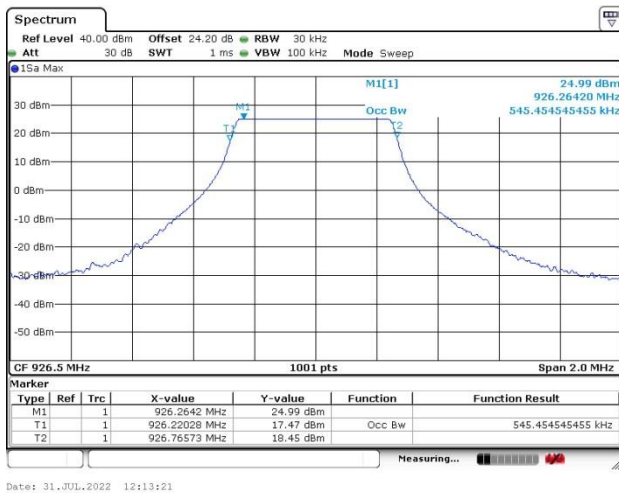
Date: 31.JUL.2022 10:51:18



&lt;Data Rate: SF10&gt;

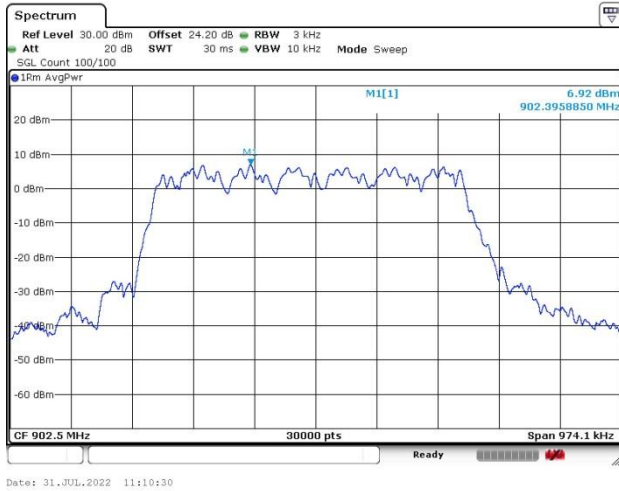
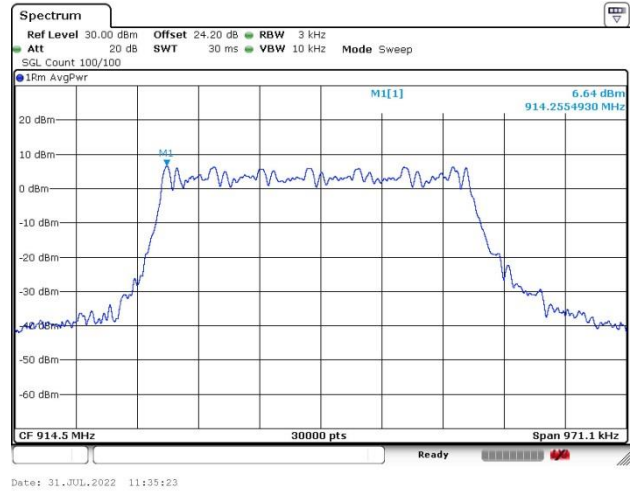
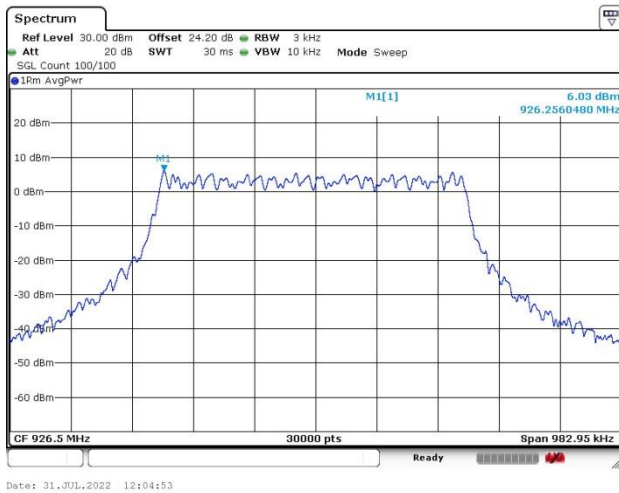
**6dB Bandwidth****Lora 500KHz SF10****6 dB Bandwidth Plot on Channel 1****6 dB Bandwidth Plot on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

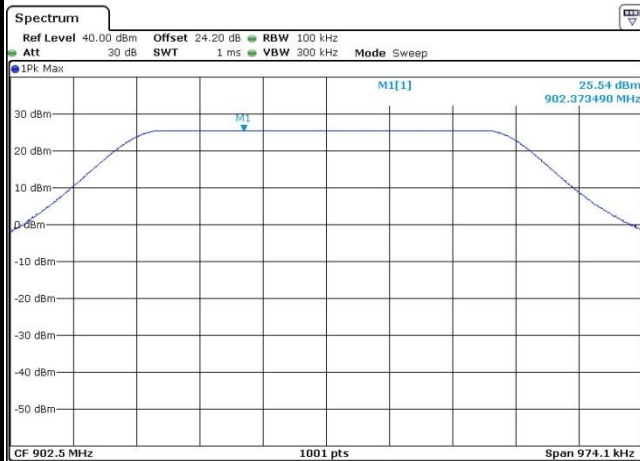
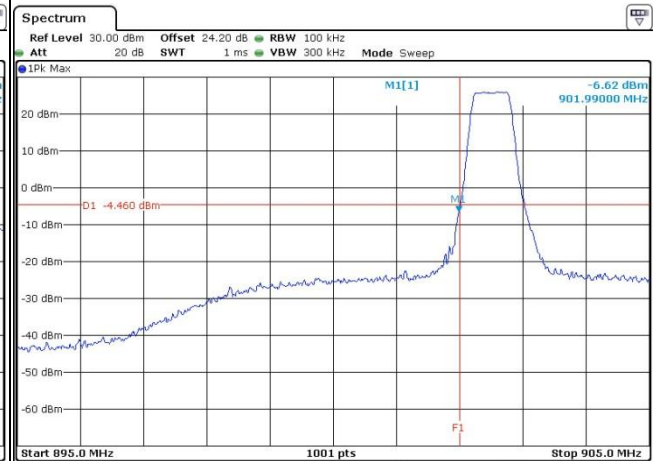
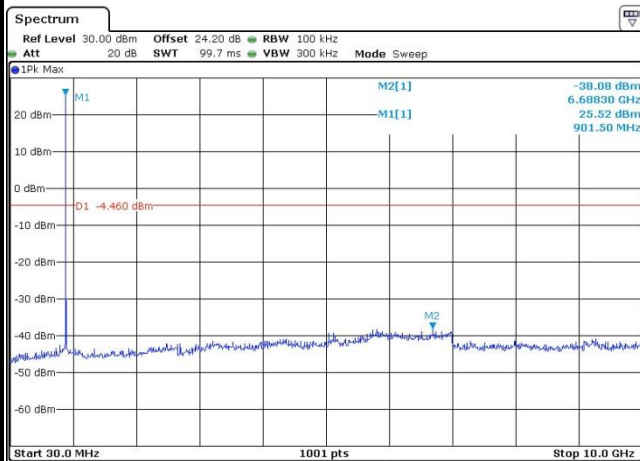
**99% Occupied Bandwidth****Lora 500KHz SF10****99% Occupied Bandwidth Plot on Channel 1****99% Occupied Plot Bandwidth on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

**Power Spectral Density (dBm/3kHz)****Lora 500KHz SF10****Power Density (dBm/3kHz) Plot Channel 1****Power Density (dBm/3kHz) Plot Channel 16****Power Density (dBm/3kHz) Plot Channel 31**

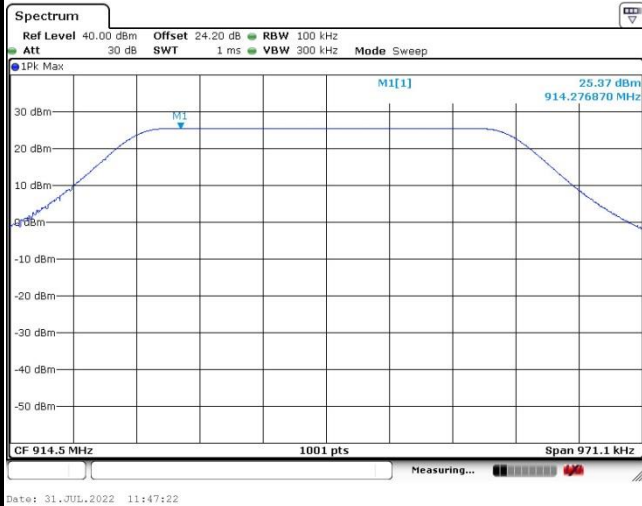
N/A

**Band Edge and Spurious Emission****Lora 500KHz SF10 Channel 1****100kHz PSD reference Level Plot****Low Channel Plot****Spurious Emission 30MHz~10GHz Plot**



Lora 500KHz SF10 Channel 16

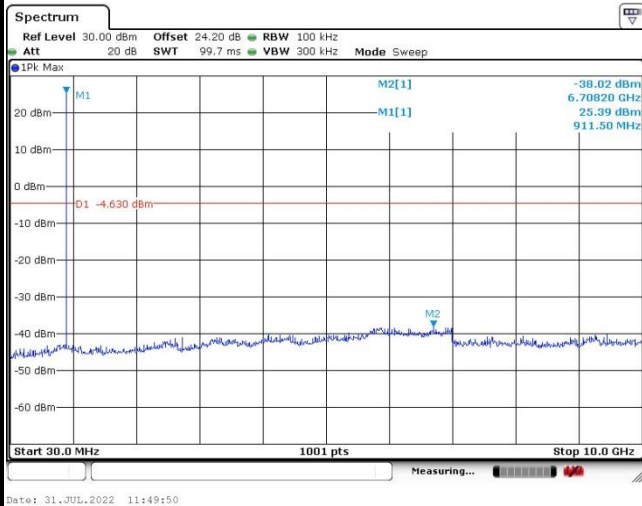
100kHz PSD reference Level Plot



Middle Channel Plot

N/A

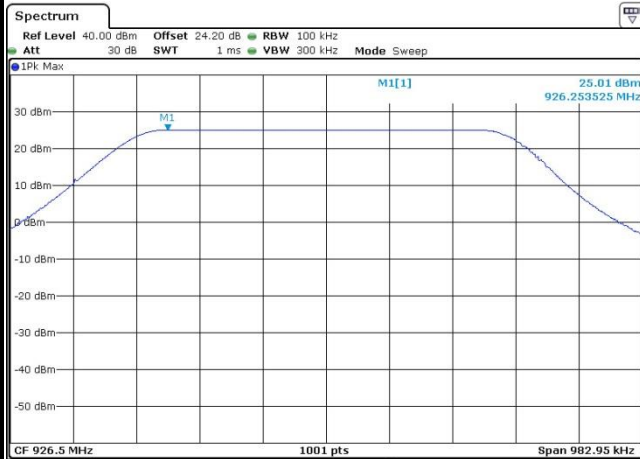
Spurious Emission 30MHz~10GHz Plot





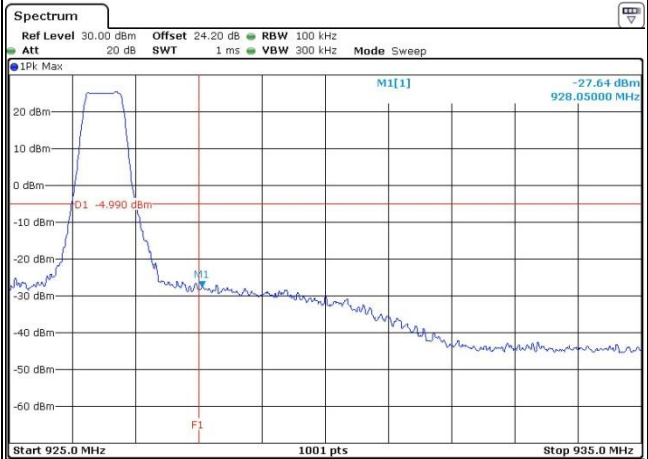
## Lora 500KHz SF10 Channel 31

## 100kHz PSD reference Level Plot



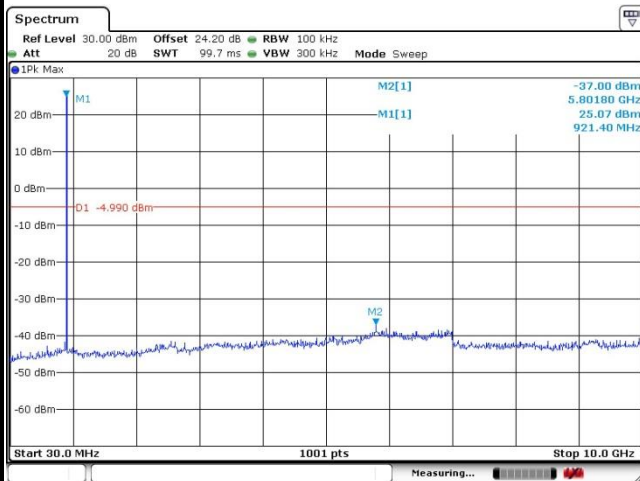
Date: 31.JUL.2022 12:08:46

## High Channel Plot



Date: 31.JUL.2022 12:10:56

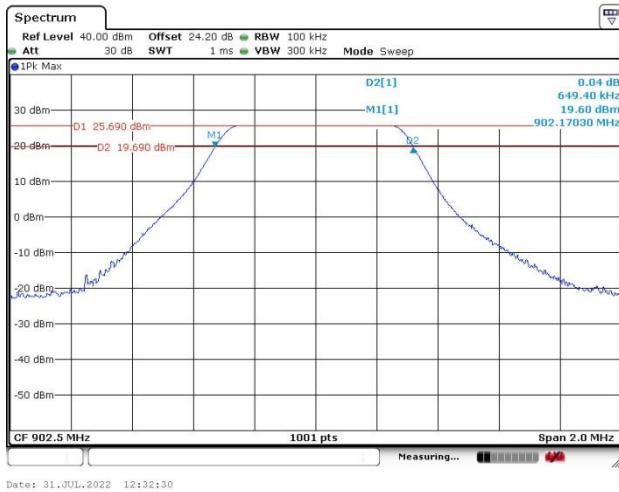
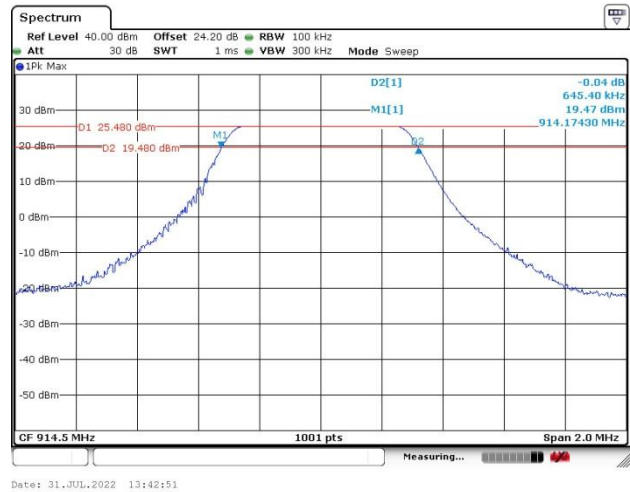
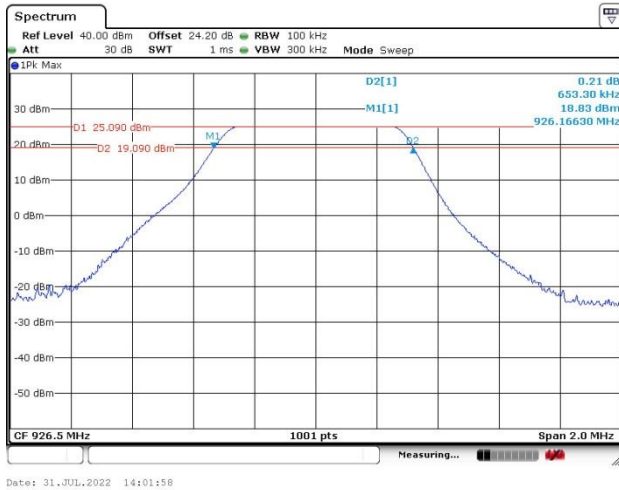
## Spurious Emission 30MHz~10GHz Plot



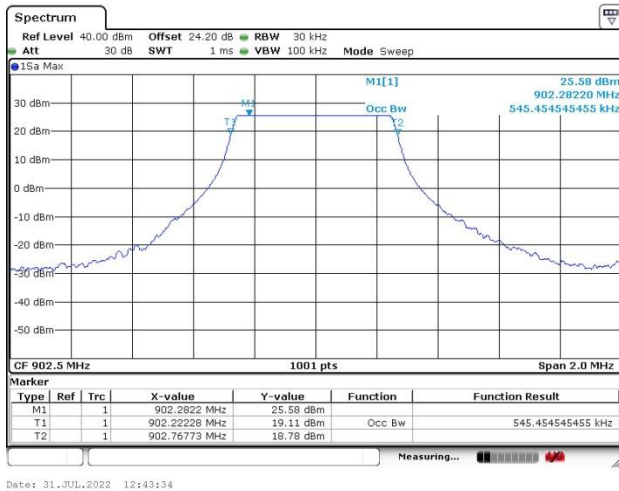
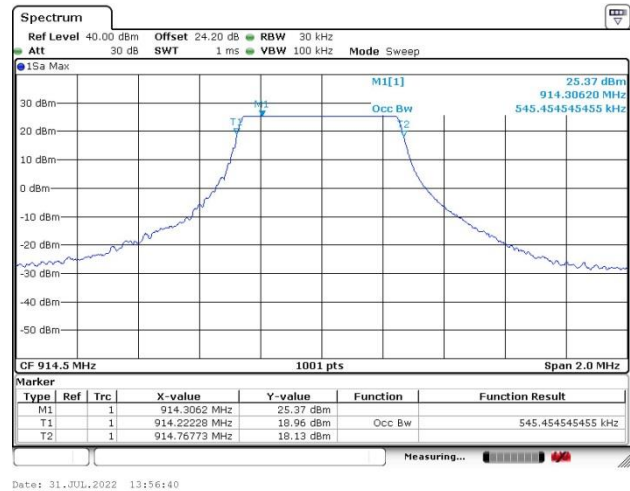
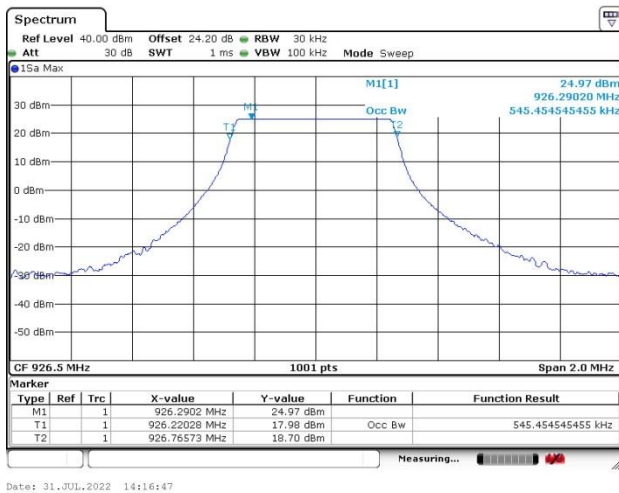
Date: 31.JUL.2022 12:12:02



&lt;Data Rate: SF11&gt;

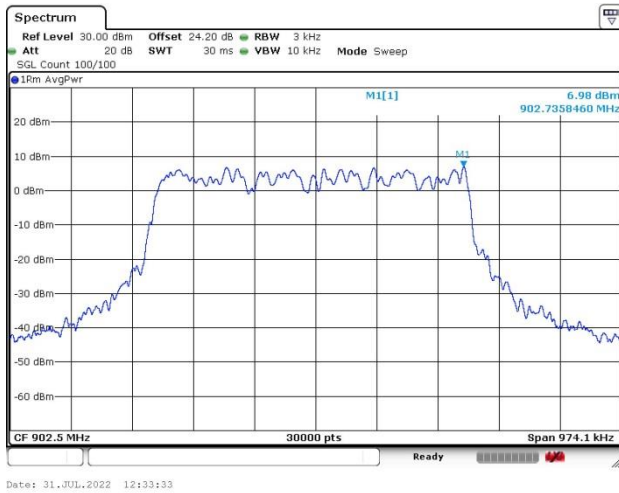
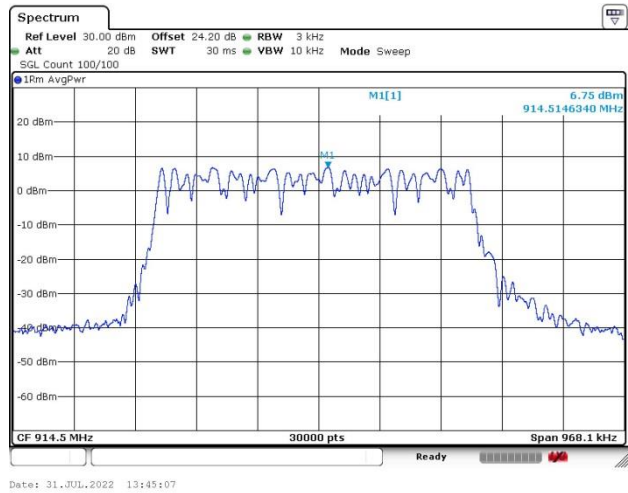
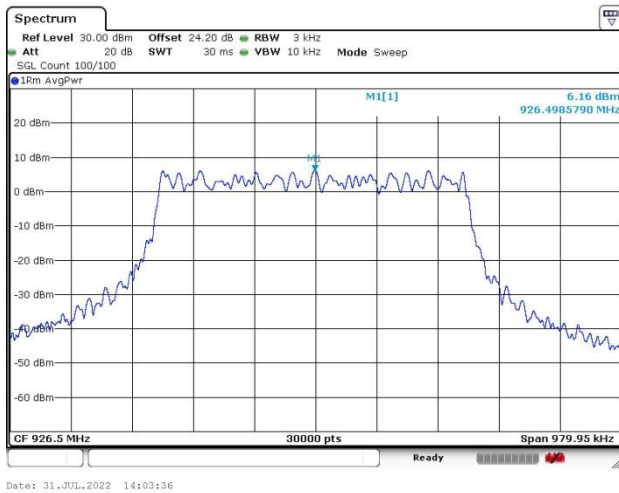
**6dB Bandwidth****Lora 500KHz SF11****6 dB Bandwidth Plot on Channel 1****6 dB Bandwidth Plot on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

**99% Occupied Bandwidth****Lora 500KHz SF11****99% Occupied Bandwidth Plot on Channel 1****99% Occupied Plot Bandwidth on Channel 16****6 dB Bandwidth Plot on Channel 31**

N/A

Note: The occupied channel bandwidth is maintained within the band of operation for all of the modulations.

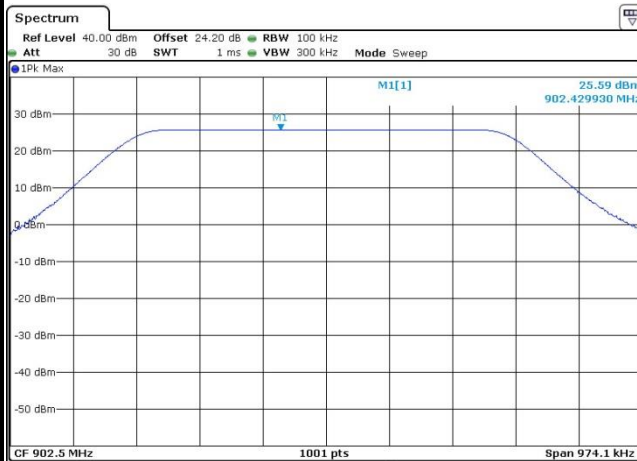
**Power Spectral Density (dBm/3kHz)****Lora 500KHz SF11****Power Density (dBm/3kHz) Plot Channel 1****Power Density (dBm/3kHz) Plot Channel 16****Power Density (dBm/3kHz) Plot Channel 31**

N/A

## Band Edge and Spurious Emission

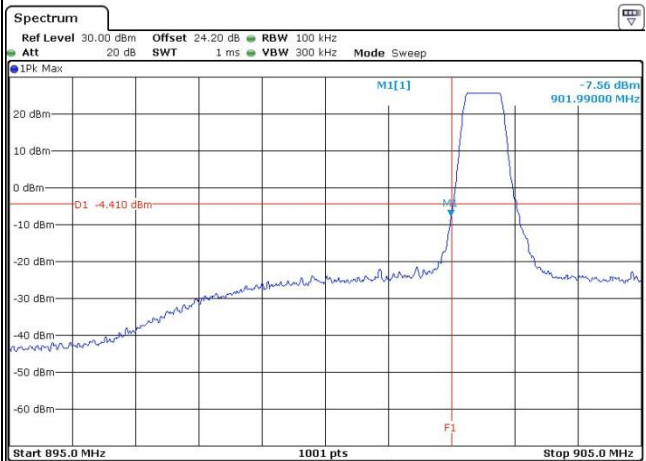
### Lora 500KHz SF11 Channel 1

#### 100kHz PSD reference Level Plot



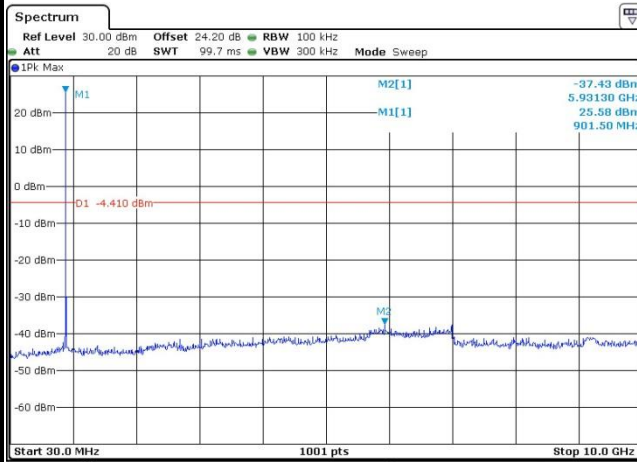
Date: 31.JUL.2022 12:38:34

#### Low Channel Plot



Date: 31.JUL.2022 12:41:09

#### Spurious Emission 30MHz~10GHz Plot

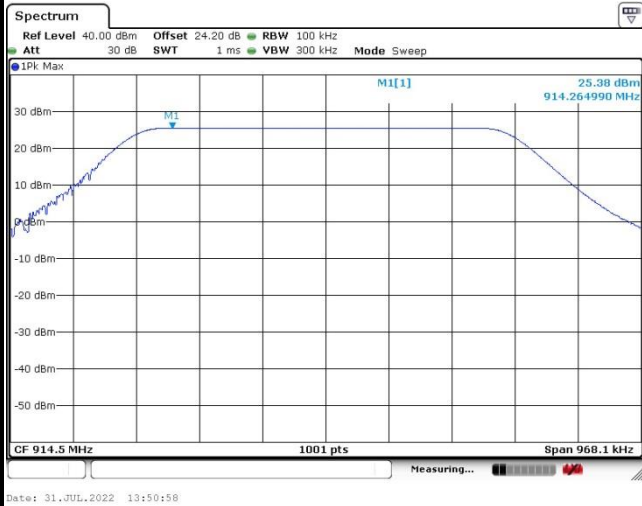


Date: 31.JUL.2022 12:42:25



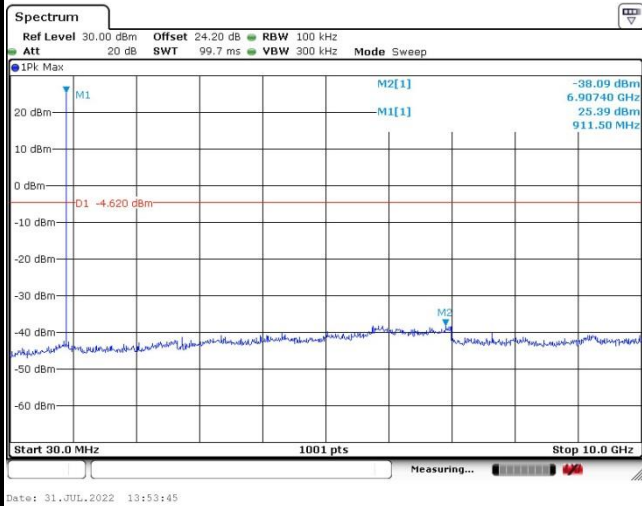
Lora 500KHz SF11 Channel 16

100kHz PSD reference Level Plot



Middle Channel Plot

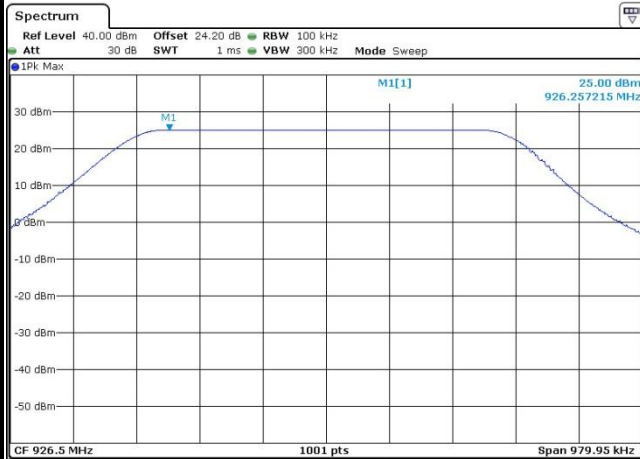
Spurious Emission 30MHz~10GHz Plot





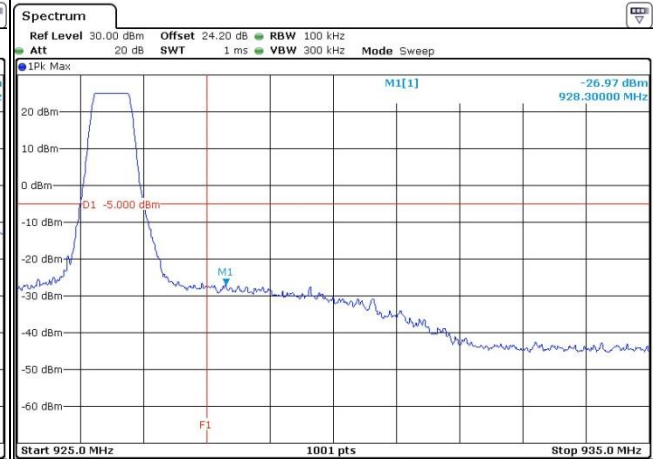
## Lora 500KHz SF11 Channel 31

## 100kHz PSD reference Level Plot



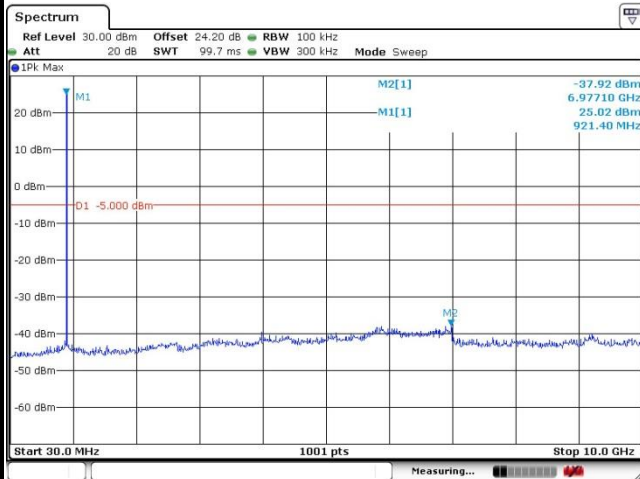
Date: 31.JUL.2022 14:10:31

## High Channel Plot



Date: 31.JUL.2022 14:12:52

## Spurious Emission 30MHz~10GHz Plot



Date: 31.JUL.2022 14:14:16



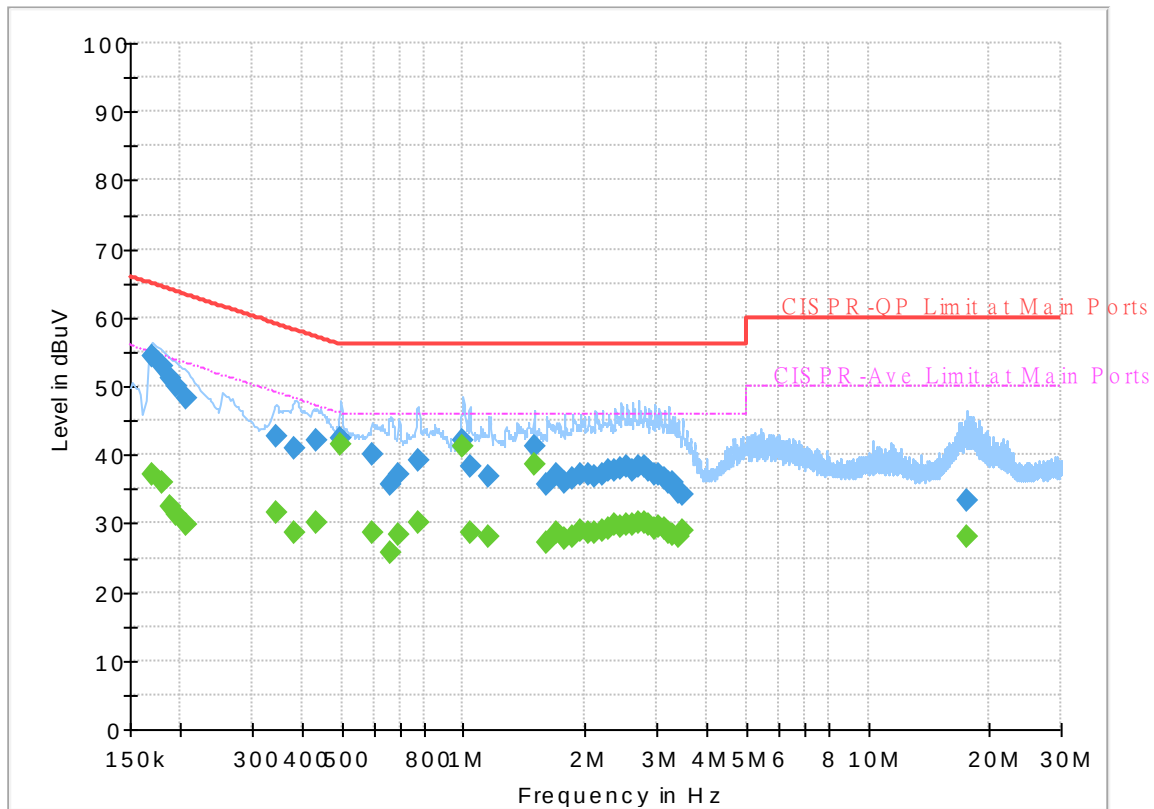
## **Appendix B. AC Conducted Emission Test Results**

|                        |         |                            |        |
|------------------------|---------|----------------------------|--------|
| <b>Test Engineer :</b> | Tom Lee | <b>Temperature :</b>       | 23~26℃ |
|                        |         | <b>Relative Humidity :</b> | 45~55% |

## EUT Information

Report NO : 120337-09  
 Test Mode : Mode 1  
 Test Voltage : 120Vac/60Hz  
 Phase : Line

Full Spectrum



## Final\_Result

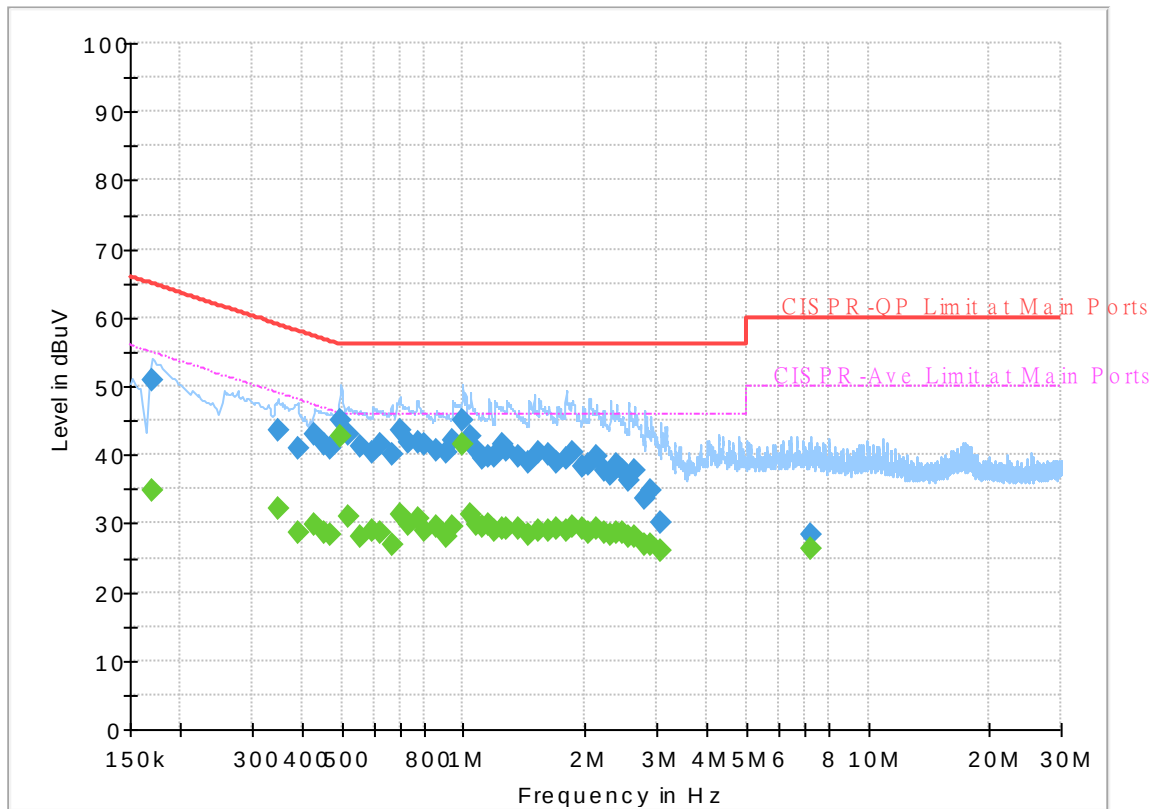
| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.170250        | ---              | 37.13           | 54.95        | 17.82       | L1   | OFF    | 19.6       |
| 0.170250        | 54.50            | ---             | 64.95        | 10.45       | L1   | OFF    | 19.6       |
| 0.179250        | ---              | 35.93           | 54.52        | 18.59       | L1   | OFF    | 19.6       |
| 0.179250        | 52.78            | ---             | 64.52        | 11.74       | L1   | OFF    | 19.6       |
| 0.188250        | ---              | 32.56           | 54.11        | 21.55       | L1   | OFF    | 19.6       |
| 0.188250        | 51.08            | ---             | 64.11        | 13.03       | L1   | OFF    | 19.6       |
| 0.195000        | ---              | 31.25           | 53.82        | 22.57       | L1   | OFF    | 19.6       |
| 0.195000        | 50.01            | ---             | 63.82        | 13.81       | L1   | OFF    | 19.6       |
| 0.206250        | ---              | 29.75           | 53.36        | 23.61       | L1   | OFF    | 19.6       |
| 0.206250        | 48.23            | ---             | 63.36        | 15.13       | L1   | OFF    | 19.6       |
| 0.343500        | ---              | 31.44           | 49.12        | 17.68       | L1   | OFF    | 19.6       |
| 0.343500        | 42.71            | ---             | 59.12        | 16.41       | L1   | OFF    | 19.6       |
| 0.384000        | ---              | 28.55           | 48.19        | 19.64       | L1   | OFF    | 19.6       |
| 0.384000        | 41.04            | ---             | 58.19        | 17.15       | L1   | OFF    | 19.6       |
| 0.431250        | ---              | 30.24           | 47.23        | 16.99       | L1   | OFF    | 19.6       |
| 0.431250        | 42.14            | ---             | 57.23        | 15.09       | L1   | OFF    | 19.6       |
| 0.496500        | ---              | 41.62           | 46.06        | 4.44        | L1   | OFF    | 19.6       |
| 0.496500        | 42.35            | ---             | 56.06        | 13.71       | L1   | OFF    | 19.6       |
| 0.595500        | ---              | 28.66           | 46.00        | 17.34       | L1   | OFF    | 19.6       |
| 0.595500        | 40.17            | ---             | 56.00        | 15.83       | L1   | OFF    | 19.6       |
| 0.663000        | ---              | 25.82           | 46.00        | 20.18       | L1   | OFF    | 19.6       |

|           |       |       |       |       |    |     |      |
|-----------|-------|-------|-------|-------|----|-----|------|
| 0.663000  | 35.73 | ---   | 56.00 | 20.27 | L1 | OFF | 19.6 |
| 0.690000  | ---   | 28.29 | 46.00 | 17.71 | L1 | OFF | 19.6 |
| 0.690000  | 37.21 | ---   | 56.00 | 18.79 | L1 | OFF | 19.6 |
| 0.773250  | ---   | 30.09 | 46.00 | 15.91 | L1 | OFF | 19.6 |
| 0.773250  | 39.29 | ---   | 56.00 | 16.71 | L1 | OFF | 19.6 |
| 0.996000  | ---   | 41.15 | 46.00 | 4.85  | L1 | OFF | 19.6 |
| 0.996000  | 42.17 | ---   | 56.00 | 13.83 | L1 | OFF | 19.6 |
| 1.038750  | ---   | 28.56 | 46.00 | 17.44 | L1 | OFF | 19.7 |
| 1.038750  | 38.32 | ---   | 56.00 | 17.68 | L1 | OFF | 19.7 |
| 1.155750  | ---   | 27.96 | 46.00 | 18.04 | L1 | OFF | 19.7 |
| 1.155750  | 36.74 | ---   | 56.00 | 19.26 | L1 | OFF | 19.7 |
| 1.495500  | ---   | 38.71 | 46.00 | 7.29  | L1 | OFF | 19.7 |
| 1.495500  | 41.20 | ---   | 56.00 | 14.80 | L1 | OFF | 19.7 |
| 1.610250  | ---   | 27.23 | 46.00 | 18.77 | L1 | OFF | 19.7 |
| 1.610250  | 35.67 | ---   | 56.00 | 20.33 | L1 | OFF | 19.7 |
| 1.695750  | ---   | 28.53 | 46.00 | 17.47 | L1 | OFF | 19.7 |
| 1.695750  | 37.17 | ---   | 56.00 | 18.83 | L1 | OFF | 19.7 |
| 1.779000  | ---   | 27.89 | 46.00 | 18.11 | L1 | OFF | 19.7 |
| 1.779000  | 36.07 | ---   | 56.00 | 19.93 | L1 | OFF | 19.7 |
| 1.860000  | ---   | 28.20 | 46.00 | 17.80 | L1 | OFF | 19.7 |
| 1.860000  | 36.53 | ---   | 56.00 | 19.47 | L1 | OFF | 19.7 |
| 1.950000  | ---   | 28.87 | 46.00 | 17.13 | L1 | OFF | 19.7 |
| 1.950000  | 37.24 | ---   | 56.00 | 18.76 | L1 | OFF | 19.7 |
| 2.031000  | ---   | 28.65 | 46.00 | 17.35 | L1 | OFF | 19.7 |
| 2.031000  | 37.16 | ---   | 56.00 | 18.84 | L1 | OFF | 19.7 |
| 2.121000  | ---   | 28.62 | 46.00 | 17.38 | L1 | OFF | 19.7 |
| 2.121000  | 36.88 | ---   | 56.00 | 19.12 | L1 | OFF | 19.7 |
| 2.204250  | ---   | 29.09 | 46.00 | 16.91 | L1 | OFF | 19.7 |
| 2.204250  | 37.24 | ---   | 56.00 | 18.76 | L1 | OFF | 19.7 |
| 2.285250  | ---   | 29.34 | 46.00 | 16.66 | L1 | OFF | 19.7 |
| 2.285250  | 37.59 | ---   | 56.00 | 18.41 | L1 | OFF | 19.7 |
| 2.368500  | ---   | 29.91 | 46.00 | 16.09 | L1 | OFF | 19.7 |
| 2.368500  | 37.60 | ---   | 56.00 | 18.40 | L1 | OFF | 19.7 |
| 2.458500  | ---   | 29.51 | 46.00 | 16.49 | L1 | OFF | 19.7 |
| 2.458500  | 37.90 | ---   | 56.00 | 18.10 | L1 | OFF | 19.7 |
| 2.539500  | ---   | 29.92 | 46.00 | 16.08 | L1 | OFF | 19.7 |
| 2.539500  | 38.32 | ---   | 56.00 | 17.68 | L1 | OFF | 19.7 |
| 2.627250  | ---   | 29.79 | 46.00 | 16.21 | L1 | OFF | 19.7 |
| 2.627250  | 37.82 | ---   | 56.00 | 18.18 | L1 | OFF | 19.7 |
| 2.710500  | ---   | 30.03 | 46.00 | 15.97 | L1 | OFF | 19.7 |
| 2.710500  | 38.25 | ---   | 56.00 | 17.75 | L1 | OFF | 19.7 |
| 2.791500  | ---   | 29.98 | 46.00 | 16.02 | L1 | OFF | 19.7 |
| 2.791500  | 38.27 | ---   | 56.00 | 17.73 | L1 | OFF | 19.7 |
| 2.881500  | ---   | 29.70 | 46.00 | 16.30 | L1 | OFF | 19.7 |
| 2.881500  | 37.60 | ---   | 56.00 | 18.40 | L1 | OFF | 19.7 |
| 2.967000  | ---   | 29.28 | 46.00 | 16.72 | L1 | OFF | 19.7 |
| 2.967000  | 36.99 | ---   | 56.00 | 19.01 | L1 | OFF | 19.7 |
| 3.050250  | ---   | 29.39 | 46.00 | 16.61 | L1 | OFF | 19.7 |
| 3.050250  | 37.27 | ---   | 56.00 | 18.73 | L1 | OFF | 19.7 |
| 3.138000  | ---   | 29.11 | 46.00 | 16.89 | L1 | OFF | 19.7 |
| 3.138000  | 36.65 | ---   | 56.00 | 19.35 | L1 | OFF | 19.7 |
| 3.225750  | ---   | 28.62 | 46.00 | 17.38 | L1 | OFF | 19.8 |
| 3.225750  | 36.07 | ---   | 56.00 | 19.93 | L1 | OFF | 19.8 |
| 3.300000  | ---   | 28.48 | 46.00 | 17.52 | L1 | OFF | 19.8 |
| 3.300000  | 36.08 | ---   | 56.00 | 19.92 | L1 | OFF | 19.8 |
| 3.392250  | ---   | 27.93 | 46.00 | 18.07 | L1 | OFF | 19.8 |
| 3.392250  | 34.58 | ---   | 56.00 | 21.42 | L1 | OFF | 19.8 |
| 3.484500  | ---   | 28.94 | 46.00 | 17.06 | L1 | OFF | 19.8 |
| 3.484500  | 34.36 | ---   | 56.00 | 21.64 | L1 | OFF | 19.8 |
| 17.616750 | ---   | 28.02 | 50.00 | 21.98 | L1 | OFF | 20.4 |
| 17.616750 | 33.20 | ---   | 60.00 | 26.80 | L1 | OFF | 20.4 |

## EUT Information

Report NO : 120337-09  
Test Mode : Mode 1  
Test Voltage : 120Vac/60Hz  
Phase : Neutral

Full Spectrum



## Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.170250        | ---              | 34.91           | 54.95        | 20.04       | N    | OFF    | 19.6       |
| 0.170250        | 50.98            | ---             | 64.95        | 13.97       | N    | OFF    | 19.6       |
| 0.348000        | ---              | 32.29           | 49.01        | 16.72       | N    | OFF    | 19.6       |
| 0.348000        | 43.59            | ---             | 59.01        | 15.42       | N    | OFF    | 19.6       |
| 0.388500        | ---              | 28.60           | 48.10        | 19.50       | N    | OFF    | 19.6       |
| 0.388500        | 40.86            | ---             | 58.10        | 17.24       | N    | OFF    | 19.6       |
| 0.429000        | ---              | 29.83           | 47.27        | 17.44       | N    | OFF    | 19.6       |
| 0.429000        | 42.86            | ---             | 57.27        | 14.41       | N    | OFF    | 19.6       |
| 0.451500        | ---              | 28.79           | 46.85        | 18.06       | N    | OFF    | 19.6       |
| 0.451500        | 41.42            | ---             | 56.85        | 15.43       | N    | OFF    | 19.6       |
| 0.469500        | ---              | 28.44           | 46.52        | 18.08       | N    | OFF    | 19.6       |
| 0.469500        | 40.90            | ---             | 56.52        | 15.62       | N    | OFF    | 19.6       |
| 0.498750        | ---              | 42.72           | 46.02        | 3.30        | N    | OFF    | 19.6       |
| 0.498750        | 45.13            | ---             | 56.02        | 10.89       | N    | OFF    | 19.6       |
| 0.519000        | ---              | 31.04           | 46.00        | 14.96       | N    | OFF    | 19.6       |
| 0.519000        | 43.13            | ---             | 56.00        | 12.87       | N    | OFF    | 19.6       |
| 0.555000        | ---              | 28.07           | 46.00        | 17.93       | N    | OFF    | 19.6       |
| 0.555000        | 41.22            | ---             | 56.00        | 14.78       | N    | OFF    | 19.6       |
| 0.597750        | ---              | 28.93           | 46.00        | 17.07       | N    | OFF    | 19.6       |
| 0.597750        | 40.42            | ---             | 56.00        | 15.58       | N    | OFF    | 19.6       |
| 0.624750        | ---              | 28.67           | 46.00        | 17.33       | N    | OFF    | 19.6       |

|          |       |       |       |       |   |     |      |
|----------|-------|-------|-------|-------|---|-----|------|
| 0.624750 | 41.64 | ---   | 56.00 | 14.36 | N | OFF | 19.6 |
| 0.665250 | ---   | 27.02 | 46.00 | 18.98 | N | OFF | 19.6 |
| 0.665250 | 40.12 | ---   | 56.00 | 15.88 | N | OFF | 19.6 |
| 0.694500 | ---   | 31.30 | 46.00 | 14.70 | N | OFF | 19.6 |
| 0.694500 | 43.44 | ---   | 56.00 | 12.56 | N | OFF | 19.6 |
| 0.728250 | ---   | 29.72 | 46.00 | 16.28 | N | OFF | 19.6 |
| 0.728250 | 41.86 | ---   | 56.00 | 14.14 | N | OFF | 19.6 |
| 0.771000 | ---   | 30.59 | 46.00 | 15.41 | N | OFF | 19.6 |
| 0.771000 | 41.89 | ---   | 56.00 | 14.11 | N | OFF | 19.6 |
| 0.802500 | ---   | 28.83 | 46.00 | 17.17 | N | OFF | 19.6 |
| 0.802500 | 41.41 | ---   | 56.00 | 14.59 | N | OFF | 19.6 |
| 0.856500 | ---   | 29.48 | 46.00 | 16.52 | N | OFF | 19.6 |
| 0.856500 | 40.50 | ---   | 56.00 | 15.50 | N | OFF | 19.6 |
| 0.910500 | ---   | 28.04 | 46.00 | 17.96 | N | OFF | 19.6 |
| 0.910500 | 40.29 | ---   | 56.00 | 15.71 | N | OFF | 19.6 |
| 0.942000 | ---   | 29.65 | 46.00 | 16.35 | N | OFF | 19.6 |
| 0.942000 | 42.05 | ---   | 56.00 | 13.95 | N | OFF | 19.6 |
| 0.996000 | ---   | 41.40 | 46.00 | 4.60  | N | OFF | 19.6 |
| 0.996000 | 45.15 | ---   | 56.00 | 10.85 | N | OFF | 19.6 |
| 1.041000 | ---   | 31.31 | 46.00 | 14.69 | N | OFF | 19.6 |
| 1.041000 | 42.70 | ---   | 56.00 | 13.30 | N | OFF | 19.6 |
| 1.079250 | ---   | 29.94 | 46.00 | 16.06 | N | OFF | 19.6 |
| 1.079250 | 40.74 | ---   | 56.00 | 15.26 | N | OFF | 19.6 |
| 1.108500 | ---   | 29.56 | 46.00 | 16.44 | N | OFF | 19.6 |
| 1.108500 | 39.45 | ---   | 56.00 | 16.55 | N | OFF | 19.6 |
| 1.158000 | ---   | 29.72 | 46.00 | 16.28 | N | OFF | 19.6 |
| 1.158000 | 39.80 | ---   | 56.00 | 16.20 | N | OFF | 19.6 |
| 1.198500 | ---   | 29.07 | 46.00 | 16.93 | N | OFF | 19.6 |
| 1.198500 | 39.68 | ---   | 56.00 | 16.32 | N | OFF | 19.6 |
| 1.243500 | ---   | 29.11 | 46.00 | 16.89 | N | OFF | 19.6 |
| 1.243500 | 41.58 | ---   | 56.00 | 14.42 | N | OFF | 19.6 |
| 1.284000 | ---   | 29.16 | 46.00 | 16.84 | N | OFF | 19.7 |
| 1.284000 | 40.62 | ---   | 56.00 | 15.38 | N | OFF | 19.7 |
| 1.365000 | ---   | 29.10 | 46.00 | 16.90 | N | OFF | 19.7 |
| 1.365000 | 39.90 | ---   | 56.00 | 16.10 | N | OFF | 19.7 |
| 1.450500 | ---   | 28.47 | 46.00 | 17.53 | N | OFF | 19.7 |
| 1.450500 | 38.77 | ---   | 56.00 | 17.23 | N | OFF | 19.7 |
| 1.536000 | ---   | 28.96 | 46.00 | 17.04 | N | OFF | 19.7 |
| 1.536000 | 40.27 | ---   | 56.00 | 15.73 | N | OFF | 19.7 |
| 1.621500 | ---   | 29.02 | 46.00 | 16.98 | N | OFF | 19.7 |
| 1.621500 | 40.15 | ---   | 56.00 | 15.85 | N | OFF | 19.7 |
| 1.707000 | ---   | 29.27 | 46.00 | 16.73 | N | OFF | 19.7 |
| 1.707000 | 38.94 | ---   | 56.00 | 17.06 | N | OFF | 19.7 |
| 1.797000 | ---   | 29.02 | 46.00 | 16.98 | N | OFF | 19.7 |
| 1.797000 | 39.37 | ---   | 56.00 | 16.63 | N | OFF | 19.7 |
| 1.864500 | ---   | 29.59 | 46.00 | 16.41 | N | OFF | 19.7 |
| 1.864500 | 40.46 | ---   | 56.00 | 15.54 | N | OFF | 19.7 |
| 1.963500 | ---   | 29.25 | 46.00 | 16.75 | N | OFF | 19.7 |
| 1.963500 | 38.37 | ---   | 56.00 | 17.63 | N | OFF | 19.7 |
| 2.049000 | ---   | 28.76 | 46.00 | 17.24 | N | OFF | 19.7 |
| 2.049000 | 38.55 | ---   | 56.00 | 17.45 | N | OFF | 19.7 |
| 2.139000 | ---   | 29.11 | 46.00 | 16.89 | N | OFF | 19.7 |
| 2.139000 | 39.66 | ---   | 56.00 | 16.34 | N | OFF | 19.7 |
| 2.222250 | ---   | 28.59 | 46.00 | 17.41 | N | OFF | 19.7 |
| 2.222250 | 37.78 | ---   | 56.00 | 18.22 | N | OFF | 19.7 |
| 2.305500 | ---   | 28.27 | 46.00 | 17.73 | N | OFF | 19.7 |
| 2.305500 | 37.13 | ---   | 56.00 | 18.87 | N | OFF | 19.7 |
| 2.395500 | ---   | 28.78 | 46.00 | 17.22 | N | OFF | 19.7 |
| 2.395500 | 38.52 | ---   | 56.00 | 17.48 | N | OFF | 19.7 |
| 2.474250 | ---   | 28.63 | 46.00 | 17.37 | N | OFF | 19.7 |
| 2.474250 | 37.69 | ---   | 56.00 | 18.31 | N | OFF | 19.7 |
| 2.559750 | ---   | 28.05 | 46.00 | 17.95 | N | OFF | 19.7 |
| 2.559750 | 36.17 | ---   | 56.00 | 19.83 | N | OFF | 19.7 |
| 2.649750 | ---   | 28.14 | 46.00 | 17.86 | N | OFF | 19.7 |
| 2.649750 | 37.61 | ---   | 56.00 | 18.39 | N | OFF | 19.7 |
| 2.816250 | ---   | 26.98 | 46.00 | 19.02 | N | OFF | 19.7 |
| 2.816250 | 33.48 | ---   | 56.00 | 22.52 | N | OFF | 19.7 |
| 2.901750 | ---   | 26.90 | 46.00 | 19.10 | N | OFF | 19.7 |
| 2.901750 | 34.75 | ---   | 56.00 | 21.25 | N | OFF | 19.7 |
| 3.075000 | ---   | 25.95 | 46.00 | 20.05 | N | OFF | 19.7 |
| 3.075000 | 30.16 | ---   | 56.00 | 25.84 | N | OFF | 19.7 |

|          |       |       |       |       |   |     |      |
|----------|-------|-------|-------|-------|---|-----|------|
| 7.192500 | ---   | 26.36 | 50.00 | 23.64 | N | OFF | 19.9 |
| 7.192500 | 28.43 | ---   | 60.00 | 31.57 | N | OFF | 19.9 |



## Appendix C. Radiated Spurious Emission

|                 |                                   |                     |             |
|-----------------|-----------------------------------|---------------------|-------------|
| Test Engineer : | Yuan Lee, Fu Chen and Troye Hsieh | Temperature :       | 20.1~21.5°C |
|                 |                                   | Relative Humidity : | 57.2~67.6%  |

## Lora 902~928MHz

## Lora DTS 500k (Band Edge @ 3m)

| Lora SF11                             | Note                                                                                                                                                                                                                                                                                                                 | Frequency<br>( MHz ) | Level<br>( dBμV/m ) | Margin<br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>( dBμV ) | Antenna<br>Factor<br>( dB/m ) | Path<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>( P/A ) | Pol.<br>( H/V ) |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| Lora<br>DTS 500k<br>CH 01<br>902.5MHz |                                                                                                                                                                                                                                                                                                                      | 30                   | 32.84               | -7.16            | 40                          | 30.1                      | 24.27                         | 10.83                  | 32.36                      | -                    | -                       | P                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 54.25                | 28.11               | -11.89           | 40                          | 37.17                     | 12.43                         | 10.99                  | 32.48                      | -                    | -                       | P                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 115.36               | 36.42               | -7.08            | 43.5                        | 40.24                     | 17.05                         | 11.53                  | 32.4                       | 281                  | 180                     | Q                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 141.55               | 31.86               | -11.64           | 43.5                        | 35.38                     | 17.17                         | 11.75                  | 32.44                      | -                    | -                       | P                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 568.35               | 36.4                | -9.6             | 46                          | 29.65                     | 25.81                         | 13.59                  | 32.65                      | -                    | -                       | P                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 743.92               | 39.79               | -6.21            | 46                          | 29.95                     | 27.83                         | 14.1                   | 32.09                      | -                    | -                       | P                       | H               |
|                                       | *                                                                                                                                                                                                                                                                                                                    | 902.5                | 120.2               | -                | -                           | 107.97                    | 28.85                         | 14.59                  | 31.21                      | 100                  | 188                     | P                       | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 41.64                | 35.16               | -4.84            | 40                          | 38.42                     | 18.37                         | 10.81                  | 32.44                      | 100                  | 355                     | Q                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 71.71                | 31.66               | -8.34            | 40                          | 40.87                     | 12.08                         | 11.15                  | 32.44                      | -                    | -                       | P                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 115.36               | 32.06               | -11.44           | 43.5                        | 35.88                     | 17.05                         | 11.53                  | 32.4                       | -                    | -                       | P                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 259.89               | 28.95               | -17.05           | 46                          | 29.25                     | 19.55                         | 12.41                  | 32.26                      | -                    | -                       | P                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 558.65               | 36.61               | -9.39            | 46                          | 29.73                     | 25.89                         | 13.56                  | 32.57                      | -                    | -                       | P                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      | 696.39               | 38.2                | -7.8             | 46                          | 30.18                     | 26.47                         | 13.93                  | 32.38                      | -                    | -                       | P                       | V               |
|                                       | *                                                                                                                                                                                                                                                                                                                    | 902.5                | 117.21              | -                | -                           | 104.98                    | 28.85                         | 14.59                  | 31.21                      | 112                  | 248                     | P                       | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | V               |
|                                       |                                                                                                                                                                                                                                                                                                                      |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         | V               |
| Remark                                | 1. No other spurious found.<br>2. All results are PASS against limit line.<br>3. Non restricted band limit is radio frequency level down 30db.<br>4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only. |                      |                     |                  |                             |                           |                               |                        |                            |                      |                         |                         |                 |

| Lora<br>SF11                          | Note                                                                                                                                                               | Frequency<br><br>( MHz ) | Level<br><br>( dBμV/m ) | Margin<br><br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>(dBμV) | Antenna<br>Factor<br>( dB/m ) | Path<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>(P/A) | Pol.<br>(H/V) |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------|----------------------|-----------------------------|-------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-----------------------|---------------|
| Lora<br>DTS 500k<br>CH 16<br>914.5MHz |                                                                                                                                                                    | 30                       | 33.54                   | -6.46                | 40                          | 30.8                    | 24.27                         | 10.83                  | 32.36                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 53.28                    | 27.65                   | -12.35               | 40                          | 36.45                   | 12.7                          | 10.98                  | 32.48                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 114.39                   | 36.36                   | -7.14                | 43.5                        | 40.31                   | 16.94                         | 11.51                  | 32.4                       | 283                  | 177                     | Q                     | H             |
|                                       |                                                                                                                                                                    | 149.31                   | 31.48                   | -12.02               | 43.5                        | 35.34                   | 16.83                         | 11.76                  | 32.45                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 583.87                   | 36.48                   | -9.52                | 46                          | 30.1                    | 25.51                         | 13.63                  | 32.76                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 695.42                   | 38.07                   | -7.93                | 46                          | 30.07                   | 26.45                         | 13.93                  | 32.38                      | -                    | -                       | P                     | H             |
|                                       | *                                                                                                                                                                  | 914.5                    | 119.08                  | -                    | -                           | 106.65                  | 28.95                         | 14.61                  | 31.13                      | 100                  | 190                     | P                     | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    | 30                       | 33.82                   | -6.18                | 40                          | 31.08                   | 24.27                         | 10.83                  | 32.36                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 41.64                    | 35.25                   | -4.75                | 40                          | 38.51                   | 18.37                         | 10.81                  | 32.44                      | 100                  | 353                     | Q                     | V             |
|                                       |                                                                                                                                                                    | 71.71                    | 31.25                   | -8.75                | 40                          | 40.46                   | 12.08                         | 11.15                  | 32.44                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 115.36                   | 32.25                   | -11.25               | 43.5                        | 36.07                   | 17.05                         | 11.53                  | 32.4                       | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 506.27                   | 35.65                   | -10.35               | 46                          | 30.65                   | 23.86                         | 13.33                  | 32.19                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 689.6                    | 37.55                   | -8.45                | 46                          | 29.64                   | 26.41                         | 13.91                  | 32.41                      | -                    | -                       | P                     | V             |
|                                       | *                                                                                                                                                                  | 914.5                    | 116.63                  | -                    | -                           | 104.2                   | 28.95                         | 14.61                  | 31.13                      | 112                  | 256                     | P                     | V             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | V             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
| Remark                                | 1. No other spurious found.                                                                                                                                        |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 2. All results are PASS against limit line.                                                                                                                        |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 3. Non restricted band limit is radio frequency level down 30db.                                                                                                   |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only. |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |

| Lora<br>SF11                          | Note                                                                                                                                                               | Frequency<br><br>( MHz ) | Level<br><br>( dBμV/m ) | Margin<br><br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>(dBμV) | Antenna<br>Factor<br>( dB/m ) | Path<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>(P/A) | Pol.<br>(H/V) |
|---------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------|----------------------|-----------------------------|-------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-----------------------|---------------|
| Lora<br>DTS 500k<br>CH 31<br>926.5MHz |                                                                                                                                                                    | 30                       | 33.67                   | -6.33                | 40                          | 30.93                   | 24.27                         | 10.83                  | 32.36                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 66.86                    | 26.98                   | -13.02               | 40                          | 36.38                   | 11.95                         | 11.1                   | 32.45                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 88.2                     | 33.67                   | -9.83                | 43.5                        | 40.69                   | 14.07                         | 11.32                  | 32.41                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 115.36                   | 35.98                   | -7.52                | 43.5                        | 39.8                    | 17.05                         | 11.53                  | 32.4                       | 283                  | 177                     | Q                     | H             |
|                                       |                                                                                                                                                                    | 540.22                   | 37.86                   | -8.14                | 46                          | 32.92                   | 23.89                         | 13.49                  | 32.44                      | -                    | -                       | P                     | H             |
|                                       |                                                                                                                                                                    | 756.53                   | 39.3                    | -6.7                 | 46                          | 29.26                   | 27.93                         | 14.13                  | 32.02                      | -                    | -                       | P                     | H             |
|                                       | *                                                                                                                                                                  | 926.5                    | 120.57                  | -                    | -                           | 107.72                  | 29.25                         | 14.65                  | 31.05                      | 150                  | 215                     | P                     | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | H             |
|                                       |                                                                                                                                                                    | 41.64                    | 35.76                   | -4.24                | 40                          | 39.02                   | 18.37                         | 10.81                  | 32.44                      | 100                  | 360                     | Q                     | V             |
|                                       |                                                                                                                                                                    | 67.83                    | 33.13                   | -6.87                | 40                          | 42.44                   | 12.03                         | 11.11                  | 32.45                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 88.2                     | 36.23                   | -7.27                | 43.5                        | 43.25                   | 14.07                         | 11.32                  | 32.41                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 116.33                   | 30.69                   | -12.81               | 43.5                        | 34.44                   | 17.12                         | 11.53                  | 32.4                       | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 702.21                   | 37.55                   | -8.45                | 46                          | 29.42                   | 26.53                         | 13.95                  | 32.35                      | -                    | -                       | P                     | V             |
|                                       |                                                                                                                                                                    | 797.27                   | 40.6                    | -5.4                 | 46                          | 30.02                   | 28.09                         | 14.26                  | 31.77                      | -                    | -                       | P                     | V             |
|                                       | *                                                                                                                                                                  | 926.5                    | 120.16                  | -                    | -                           | 107.31                  | 29.25                         | 14.65                  | 31.05                      | 150                  | 141                     | P                     | V             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       | V             |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         | V                     |               |
| Remark                                | 1. No other spurious found.                                                                                                                                        |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 2. All results are PASS against limit line.                                                                                                                        |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 3. Non restricted band limit is radio frequency level down 30db.                                                                                                   |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       | 4. The emission position marked as “-” means no suspected emission found and emission level has at least 6dB margin against limit or emission is noise floor only. |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |
|                                       |                                                                                                                                                                    |                          |                         |                      |                             |                         |                               |                        |                            |                      |                         |                       |               |



## Lora DTS 500k (Harmonic @ 3m)

| Lora SF11                             | Note | Frequency<br>( MHz ) | Level<br>( dBμV/m ) | Margin<br>( dB ) | Limit<br>Line<br>( dBμV/m ) | Read<br>Level<br>( dBμV ) | Antenna<br>Factor<br>( dB/m ) | Path<br>Loss<br>( dB ) | Preamp<br>Factor<br>( dB ) | Ant<br>Pos<br>( cm ) | Table<br>Pos<br>( deg ) | Peak<br>Avg.<br>( P/A ) | Pol.<br>( H/V ) |
|---------------------------------------|------|----------------------|---------------------|------------------|-----------------------------|---------------------------|-------------------------------|------------------------|----------------------------|----------------------|-------------------------|-------------------------|-----------------|
| Lora<br>DTS 500k<br>CH 01<br>902.5MHz |      | 2707.5               | 51.76               | -22.24           | 74                          | 48.8                      | 28.23                         | 8.63                   | 33.9                       | 266                  | 264                     | P                       | H               |
|                                       |      | 2707.5               | 50.63               | -3.37            | 54                          | 47.67                     | 28.23                         | 8.63                   | 33.9                       | 266                  | 264                     | A                       | H               |
|                                       |      | 3610                 | 38.09               | -35.91           | 74                          | 56.5                      | 29.72                         | 10.78                  | 58.91                      | -                    | -                       | P                       | H               |
|                                       |      | 4512.5               | 39.7                | -34.3            | 74                          | 54.64                     | 31.7                          | 11.08                  | 57.72                      | -                    | -                       | P                       | H               |
|                                       |      | 5415                 | 39.99               | -34.01           | 74                          | 53.32                     | 32.9                          | 12.08                  | 58.31                      | -                    | -                       | P                       | H               |
|                                       |      | 8122.5               | 42.97               | -31.03           | 74                          | 49.91                     | 37.1                          | 14.37                  | 58.41                      | -                    | -                       | P                       | H               |
|                                       |      | 9025                 | 46.25               | -27.75           | 74                          | 50.61                     | 38.05                         | 15.83                  | 58.24                      | -                    | -                       | P                       | H               |
|                                       |      | 2707.5               | 52.1                | -21.9            | 74                          | 49.14                     | 28.23                         | 8.63                   | 33.9                       | 114                  | 255                     | P                       | H               |
|                                       |      | 2707.5               | 50.06               | -3.94            | 54                          | 47.1                      | 28.23                         | 8.63                   | 33.9                       | 114                  | 255                     | A                       | H               |
|                                       |      | 3610                 | 37.65               | -36.35           | 74                          | 56.06                     | 29.72                         | 10.78                  | 58.91                      | -                    | -                       | P                       | H               |
|                                       |      | 4512.5               | 40.29               | -33.71           | 74                          | 55.23                     | 31.7                          | 11.08                  | 57.72                      | -                    | -                       | P                       | H               |
|                                       |      | 5415                 | 39.94               | -34.06           | 74                          | 53.27                     | 32.9                          | 12.08                  | 58.31                      | -                    | -                       | P                       | H               |
|                                       |      | 8122.5               | 42.94               | -31.06           | 74                          | 49.88                     | 37.1                          | 14.37                  | 58.41                      | -                    | -                       | P                       | H               |
|                                       |      | 9025                 | 45.65               | -28.35           | 74                          | 50.01                     | 38.05                         | 15.83                  | 58.24                      | -                    | -                       | P                       | H               |
| Lora<br>DTS 500k<br>CH 16<br>914.5MHz |      | 2743.5               | 52.62               | -21.38           | 74                          | 49.46                     | 28.37                         | 8.69                   | 33.9                       | 300                  | 206                     | P                       | H               |
|                                       |      | 2743.5               | 50.52               | -3.48            | 54                          | 47.36                     | 28.37                         | 8.69                   | 33.9                       | 300                  | 206                     | A                       | H               |
|                                       |      | 3658                 | 38.47               | -35.53           | 74                          | 56.6                      | 29.82                         | 10.85                  | 58.8                       | -                    | -                       | P                       | H               |
|                                       |      | 4572.5               | 39.61               | -34.39           | 74                          | 54.92                     | 31.7                          | 10.76                  | 57.77                      | -                    | -                       | P                       | H               |
|                                       |      | 7316                 | 42.66               | -31.34           | 74                          | 50.92                     | 37.04                         | 13.43                  | 58.73                      | -                    | -                       | P                       | H               |
|                                       |      | 8230.5               | 44.37               | -29.63           | 74                          | 51.1                      | 37.22                         | 14.4                   | 58.35                      | -                    | -                       | P                       | H               |
|                                       |      | 9145                 | 46.25               | -27.75           | 74                          | 50.65                     | 38.18                         | 15.83                  | 58.41                      | -                    | -                       | P                       | H               |
|                                       |      | 2743.5               | 52.63               | -21.37           | 74                          | 49.47                     | 28.37                         | 8.69                   | 33.9                       | 100                  | 211                     | P                       | V               |
|                                       |      | 2743.5               | 50.81               | -3.19            | 54                          | 47.65                     | 28.37                         | 8.69                   | 33.9                       | 100                  | 211                     | A                       | V               |
|                                       |      | 3658                 | 39.49               | -34.51           | 74                          | 57.62                     | 29.82                         | 10.85                  | 58.8                       | -                    | -                       | P                       | V               |
|                                       |      | 4572.5               | 39.89               | -34.11           | 74                          | 55.2                      | 31.7                          | 10.76                  | 57.77                      | -                    | -                       | P                       | V               |
|                                       |      | 7316                 | 41.95               | -32.05           | 74                          | 50.21                     | 37.04                         | 13.43                  | 58.73                      | -                    | -                       | P                       | V               |
|                                       |      | 8230.5               | 44.36               | -29.64           | 74                          | 51.09                     | 37.22                         | 14.4                   | 58.35                      | -                    | -                       | P                       | V               |
|                                       |      | 9145                 | 47.75               | -26.25           | 74                          | 52.15                     | 38.18                         | 15.83                  | 58.41                      | -                    | -                       | P                       | V               |



|                                                                               |                                                                                                                                                                                                                                                                                                            |        |       |        |    |       |       |       |       |     |     |   |   |
|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|-------|--------|----|-------|-------|-------|-------|-----|-----|---|---|
| <b>Lora</b><br><br><b>DTS 500k</b><br><br><b>CH 31</b><br><br><b>926.5MHz</b> |                                                                                                                                                                                                                                                                                                            | 2779.5 | 51.74 | -22.26 | 74 | 48.42 | 28.46 | 8.75  | 33.89 | 250 | 260 | P | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 2779.5 | 47.63 | -6.37  | 54 | 44.31 | 28.46 | 8.75  | 33.89 | 250 | 260 | A | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 3706   | 38.27 | -35.73 | 74 | 56.1  | 29.94 | 10.91 | 58.68 | -   | -   | P | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 4632.5 | 38.71 | -35.29 | 74 | 54.02 | 31.76 | 10.74 | 57.81 | -   | -   | P | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 7412   | 43.23 | -30.77 | 74 | 51.67 | 36.55 | 13.72 | 58.71 | -   | -   | P | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 8338.5 | 43.81 | -30.19 | 74 | 50.21 | 37.28 | 14.61 | 58.29 | -   | -   | P | H |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 2779.5 | 50.61 | -23.39 | 74 | 47.29 | 28.46 | 8.75  | 33.89 | 100 | 216 | P | V |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 2779.5 | 47.05 | -6.95  | 54 | 43.73 | 28.46 | 8.75  | 33.89 | 100 | 216 | A | V |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 3706   | 38.53 | -35.47 | 74 | 56.36 | 29.94 | 10.91 | 58.68 | -   | -   | P | V |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 4632.5 | 39.2  | -34.8  | 74 | 54.51 | 31.76 | 10.74 | 57.81 | -   | -   | P | V |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 7412   | 42.38 | -31.62 | 74 | 50.82 | 36.55 | 13.72 | 58.71 | -   | -   | P | V |
|                                                                               |                                                                                                                                                                                                                                                                                                            | 8338.5 | 44.49 | -29.51 | 74 | 50.89 | 37.28 | 14.61 | 58.29 | -   | -   | P | V |
| <b>Remark</b>                                                                 | 1. No other spurious found.<br>2. All results are PASS against Peak and Average limit line.<br>3. Non restricted band limit is radio frequency level down 30db.<br>4. The emission position marked as "-" means no suspected emission found with sufficient margin against limit line or noise floor only. |        |       |        |    |       |       |       |       |     |     |   |   |



**Note symbol**

|     |                                                                                                                                                          |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------|
| *   | <b>Fundamental Frequency</b> which can be ignored. However, the level of any unwanted emissions shall not exceed the level of the fundamental frequency. |
| !   | Test result is <b>over limit</b> line.                                                                                                                   |
| P/A | <b>Peak</b> or <b>Average</b>                                                                                                                            |
| H/V | <b>Horizontal</b> or <b>Vertical</b>                                                                                                                     |



A calculation example for radiated spurious emission is shown as below:

| LoRa                      | Note | Frequency | Level      | Margin | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                           |      |           |            |        | Line       | Level    | Factor   | Loss   | Factor | Pos    | Pos     | Avg.    |         |
|                           |      | ( MHz )   | ( dBμV/m ) | ( dB ) | ( dBμV/m ) | ( dBμV ) | ( dB/m ) | ( dB ) | ( dB ) | ( cm ) | ( deg ) | ( P/A ) | ( H/V ) |
| LoRa<br>CH 01<br>902.5MHz |      | 910       | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
|                           |      | 910       | 43.54      | -10.46 | 54         | 42.6     | 32.22    | 4.58   | 35.86  | 103    | 308     | A       | H       |

1. Path Loss(dB) = Cable loss(dB) + Filter loss(dB) + Attenuator loss(dB)

2. Level(dBμV/m) =

Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

3. Margin(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

#### For Peak Limit @ 910MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 54.51(dBμV) – 35.86 (dB)

= 55.45 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 55.45(dBμV/m) – 74(dBμV/m)

= -18.55(dB)

#### For Average Limit @ 910MHz:

1. Level(dBμV/m)

= Antenna Factor(dB/m) + Path Loss(dB) + Read Level(dBμV) - Preamp Factor(dB)

= 32.22(dB/m) + 4.58(dB) + 42.6(dBμV) – 35.86 (dB)

= 43.54 (dBμV/m)

2. Margin(dB)

= Level(dBμV/m) – Limit Line(dBμV/m)

= 43.54(dBμV/m) – 54(dBμV/m)

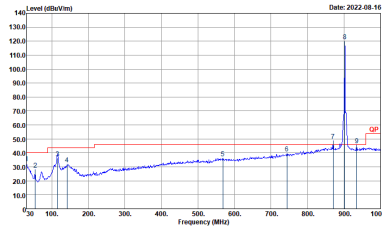
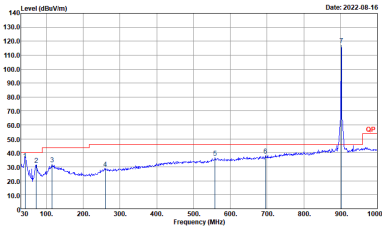
= -10.46(dB)

Both peak and average measured complies with the limit line, so test result is “PASS”.

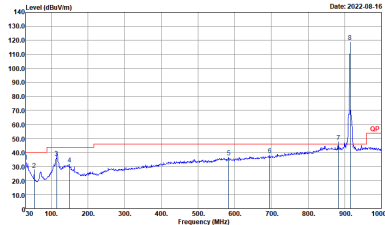
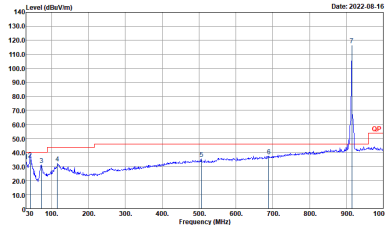
## Appendix D. Radiated Spurious Emission Plots

|                        |                                   |                            |             |
|------------------------|-----------------------------------|----------------------------|-------------|
| <b>Test Engineer :</b> | Yuan Lee, Fu Chen and Troye Hsieh | <b>Temperature :</b>       | 20.1~21.5°C |
|                        |                                   | <b>Relative Humidity :</b> | 58.1~67.6%  |

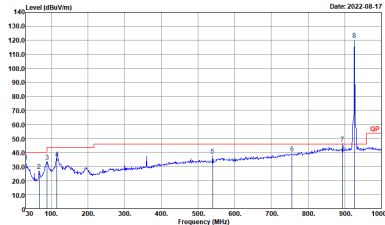
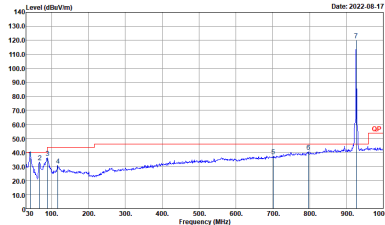
### Lora 902~928MHz Lora DTS 500k (Band Edge @ 3m)

| Lora                 | Lora 902~928MHz                                                                                                                                                                    |                                                                                                                                                                                   |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                      | Lora DTS 500k Ch01 902.5Mhz                                                                                                                                                        |                                                                                                                                                                                   |
|                      | Horizontal                                                                                                                                                                         | Vertical                                                                                                                                                                          |
| <b>QP /<br/>Peak</b> |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BE-LOG 35414-211009 HORIZONTAL<br/>Detector : Peak</p> |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BE-LOG 35414-211009 VERTICAL<br/>Detector : Peak</p> |
|                      |                                                                                                                                                                                    |                                                                                                                                                                                   |

**Remark:** The unwanted signal of mark #7.9 in Horizontal plot falls within the non-restricted band and meet the requirements of 15.247 (d).

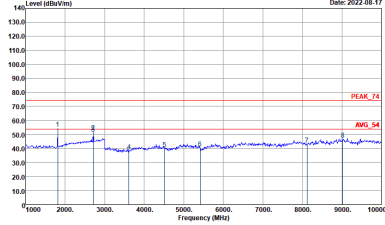
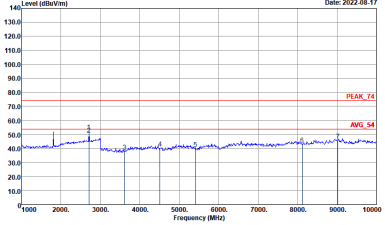
| Lora         | Lora 920~928MHz                                                                                                                                                                    |                                                                                                                                                                                   |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch16 914.5MHz                                                                                                                                                        |                                                                                                                                                                                   |
|              | Horizontal                                                                                                                                                                         | Vertical                                                                                                                                                                          |
| QP /<br>Peak |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BT-LOG 35414-211009 HORIZONTAL<br/>Detector : Peak</p> |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BT-LOG 35414-211009 VERTICAL<br/>Detector : Peak</p> |
|              |                                                                                                                                                                                    |                                                                                                                                                                                   |

**Remark:** The unwanted signal of mark #7 in Horizontal plot falls within the non-restricted band and meet the requirements of 15.247 (d).

| Lora         | Lora 902~928MHz                                                                                                                                                                    |                                                                                                                                                                                   |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch31 926.5MHz                                                                                                                                                        |                                                                                                                                                                                   |
|              | Horizontal                                                                                                                                                                         | Vertical                                                                                                                                                                          |
| Peak<br>Avg. |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BT-LOG 35414-211009 HORIZONTAL<br/>Detector : Peak</p> |  <p>Site : 03CH11-HY<br/>Condition : QP 3m BT-LOG 35414-211009 VERTICAL<br/>Detector : Peak</p> |

**Remark:** The unwanted signal of mark #7 in Horizontal plot falls within the non-restricted band and meet the requirements of 15.247 (d).

**Lora 902~928MHz**  
**Lora DTS 500k (Harmonic @ 3m)**

| Lora                           | Lora 902~928MHz                                                                                                                                                                         |                                                                                                                                                                                        |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | Lora DTS 500k Ch01 902.5Mhz                                                                                                                                                             |                                                                                                                                                                                        |
|                                | Horizontal                                                                                                                                                                              | Vertical                                                                                                                                                                               |
| <b>Peak</b><br><br><b>Avg.</b> |  <p>Site : 03CH11-HY<br/> Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL<br/> Detector : Peak</p> |  <p>Site : 03CH11-HY<br/> Condition : PEAK_74 3m 91200_1212_220310 VERTICAL<br/> Detector : Peak</p> |

**Remark:** The unwanted signal of mark #1 in Horizontal plot falls within the non-restricted band and meet the requirements of 15.247 (d).



| Lora         | Lora 902~928MHz                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch16 914.5MHz                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Horizontal                                                                                                                                                                                                                                                                                                                                                                         | Vertical                                                                                                                                                                                                                                                                                                                                                                         |
| Peak<br>Avg. | <div><p>140<br/>130.0<br/>120.0<br/>110.0<br/>100.0<br/>90.0<br/>80.0<br/>70.0<br/>60.0<br/>50.0<br/>40.0<br/>30.0<br/>20.0<br/>10.0<br/>0</p><p>Level (dBuV/m)</p><p>Date: 2022-08-17</p><p>1000 2000 3000 4000 5000 6000 7000 8000 9000 10000</p><p>Frequency (MHz)</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL<br/>Detector : Peak</p></div> | <div><p>140<br/>130.0<br/>120.0<br/>110.0<br/>100.0<br/>90.0<br/>80.0<br/>70.0<br/>60.0<br/>50.0<br/>40.0<br/>30.0<br/>20.0<br/>10.0<br/>0</p><p>Level (dBuV/m)</p><p>Date: 2022-08-17</p><p>1000 2000 3000 4000 5000 6000 7000 8000 9000 10000</p><p>Frequency (MHz)</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m 91200_1212_220310 VERTICAL<br/>Detector : Peak</p></div> |



| Lora         | Lora 902~928MHz                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch31 926.5MHz                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                  |
|              | Horizontal                                                                                                                                                                                                                                                                                                                                                                         | Vertical                                                                                                                                                                                                                                                                                                                                                                         |
| Peak<br>Avg. | <div><p>140<br/>130.0<br/>120.0<br/>110.0<br/>100.0<br/>90.0<br/>80.0<br/>70.0<br/>60.0<br/>50.0<br/>40.0<br/>30.0<br/>20.0<br/>10.0<br/>0</p><p>Level (dBuV/m)</p><p>Date: 2022-08-17</p><p>1000 2000 3000 4000 5000 6000 7000 8000 9000 10000</p><p>Frequency (MHz)</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m 91200_1212_220310 HORIZONTAL<br/>Detector : Peak</p></div> | <div><p>140<br/>130.0<br/>120.0<br/>110.0<br/>100.0<br/>90.0<br/>80.0<br/>70.0<br/>60.0<br/>50.0<br/>40.0<br/>30.0<br/>20.0<br/>10.0<br/>0</p><p>Level (dBuV/m)</p><p>Date: 2022-08-17</p><p>1000 2000 3000 4000 5000 6000 7000 8000 9000 10000</p><p>Frequency (MHz)</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m 91200_1212_220310 VERTICAL<br/>Detector : Peak</p></div> |



## Appendix E. Duty Cycle Plots

| Band               | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting |
|--------------------|---------------|-------|----------|-------------|
| LoRa (500KHz)_SF11 | 96.61         | 18500 | 0.05     | 100Hz       |

