

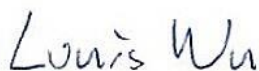


# NCC RADIO TEST REPORT

**Equipment** : Floodlight Cam Wired Pro  
**Brand Name** : Ring  
**Model Name** : 5B28S4  
**Applicant** : 環安智控股份有限公司  
台北市內湖區堤頂大道二段 179 號 4 樓  
**Manufacturer** : Ring LLC  
1523 26th St Santa Monica, CA 90404 USA  
**Standard** : NCC LP0002 (2020-07-01)

The product was received on Feb. 09, 2021 and testing was started from Mar. 17, 2021 and completed on May 13, 2021. We, Sporton International Inc. Wensan Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures NCC LP0002 (2020-07-01) 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 of Sporton International Inc. Wensan Laboratory, the test report shall not be reproduced except in full.



Approved by: Louis Wu

**Sporton International Inc. Wensan Laboratory**

No.58, Aly. 75, Ln. 564, Wenhua 3rd, Rd., Guishan Dist., Taoyuan City 333010, Taiwan (R.O.C.)



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## History of this test report

| Report No. | Version | Description                                   | Issued Date   |
|------------|---------|-----------------------------------------------|---------------|
| TR120337E  | 01      | Initial issue of report                       | Jun. 10, 2021 |
| TR120337E  | 02      | Revise maximum power density limit in Annex B | Jun. 18, 2021 |
|            |         |                                               |               |
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|            |         |                                               |               |

## Summary of Test Result

| Report Clause | Ref Std. Clause                     | Test Items                                         | Result (PASS/FAIL) | Remark                                   |
|---------------|-------------------------------------|----------------------------------------------------|--------------------|------------------------------------------|
| 3.1           | LP0002<br>5.8.1.5 (2)(A)            | 6dB Bandwidth                                      | Pass               | -                                        |
| 3.1           | -                                   | 99% Occupied Bandwidth                             | Reporting only     | -                                        |
| 3.2           | LP0002<br>5.8.1.2 (1)(B)            | Power Output Measurement                           | Pass               | -                                        |
| 3.3           | LP0002<br>5.8.1.5 (2)(B)            | Power Spectral Density                             | Pass               | -                                        |
| 3.4           | LP0002<br>5.8.1.4                   | Conducted Band Edges and Spurious Emission         | Pass               | -                                        |
| 3.5           | LP0002<br>5.8.1.4                   | Radiated Band Edges and Radiated Spurious Emission | Pass               | Under limit<br>5.14 dB at<br>117.300 MHz |
| 3.6           | LP0002<br>3.3                       | AC Conducted Emission                              | Pass               | Under limit<br>13.23 dB at<br>0.184 MHz  |
| 3.7           | LP0002<br>3.2<br>5.8.1.3<br>5.8.1.4 | Antenna Requirement                                | Pass               | -                                        |
| Annex A       | LP0002<br>3.9                       | Receiver Radiated Emission                         | Pass               | Please refer to Annex A                  |
| Annex B       | LP0002<br>3.2<br>6.20.2             | Maximum Power Density                              | Pass               | -                                        |

**Declaration of Conformity:**

The test results with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.

**Comments and Explanations:**

The declared of product specification for EUT presented in the report are provided by the manufacturer, and the manufacturer takes all the responsibilities for the accuracy of product specification.

**Reviewed by: Keven Cheng**  
**Report Producer: Dara Chiu**

# 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 Specification subjective to this standard |                       |
|---------------------------------------------------|-----------------------|
| <b>Tx/Rx Frequency Range</b>                      | 920.9 MHz ~ 924.1 MHz |
| <b>Modulation</b>                                 | Lora                  |

| Antenna Information |                   |                           |                  |             |
|---------------------|-------------------|---------------------------|------------------|-------------|
| <b>Antenna</b>      | <b>Brand Name</b> | INPAQ TECHNOLOGY CO., LTD | <b>Peak Gain</b> | -1.38 dBi   |
|                     | <b>Model Name</b> | RFPCA604400NNRB002        | <b>Type</b>      | PCB antenna |

**Remark:**

1. The detail internal, external and transmit antenna photo please refer to Sporton report no.: EP120337.
2. 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 are made to the EUT during all test items.

## 1.3 Testing Location

|                           |                                                                                                                                                  |
|---------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Test Site</b>          | Sporton International Inc. Wensan Laboratory                                                                                                     |
| <b>Test Site Location</b> | 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 |
| <b>Test Site No.</b>      | <b>Sporton Site No.</b>                                                                                                                          |
|                           | 03CH11-HY, CO07-HY, TH05-HY                                                                                                                      |

FCC designation No.: TW3786



## 1.4 Applicable Standards

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

- ♦ NCC LP0002 (2020-07-01)
- ♦ FCC Part 15 Subpart C §15.247
- ♦ FCC KDB Publication No. 558074 D01 DTS Meas. Guidance v05r02
- ♦ FCC KDB 414788 D01 Radiated Test Site v01r01.
- ♦ ANSI C63.10-2013

**Remark:**

1. All test items were verified and recorded according to the standards and without any deviation during the test.
2. The TAF code is not including all the FCC KDB listed without accreditation.

## 2 Test Configuration of Equipment Under Test

### 2.1 Carrier Frequency and Channel

| Frequency Band | Channel | Freq. (MHz) |
|----------------|---------|-------------|
| 920.9-924.1MHz | 24      | 920.9       |
|                | 25      | 921.7       |
|                | 26      | 922.5       |
|                | 27      | 923.3       |
|                | 28      | 924.1       |

### 2.2 Test Mode

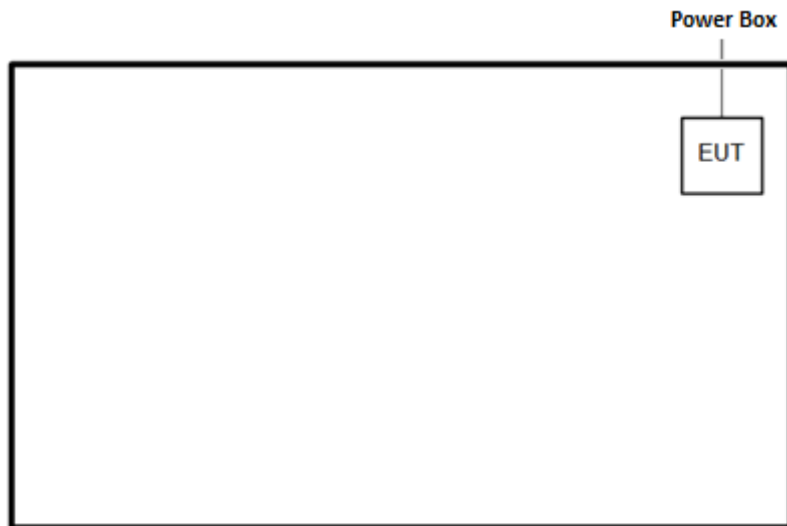
- a. The EUT has been associated with peripherals and configuration operated in a manner tended to maximize its emission characteristics in a typical application. Frequency range investigated: conduction emission (150 kHz to 30 MHz), radiation emission (9 kHz to the 10th harmonic of the highest fundamental frequency or to 40 GHz, whichever is lower). For radiated measurement, pre-scanned in two Degree (0 and 90). The worst cases (Ant. Degree 0) were recorded in this report.
- b. AC power line Conducted Emission was tested under maximum output power.

The following summary table is showing all test modes to demonstrate in compliance with the standard.

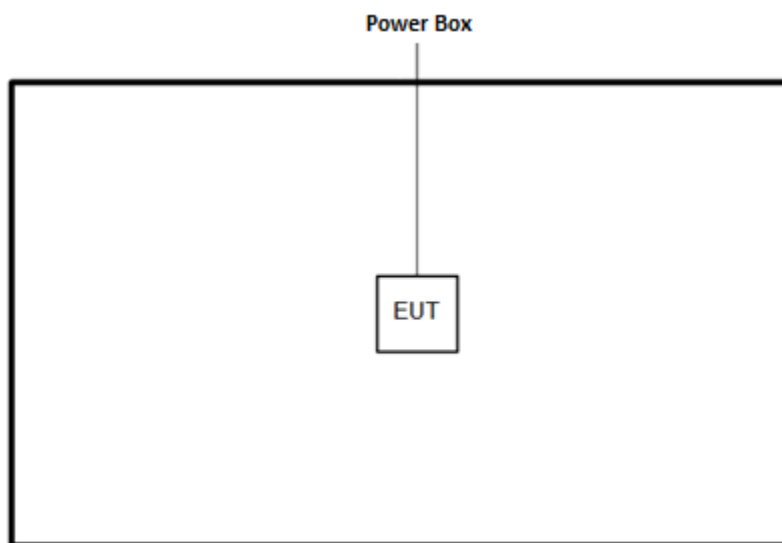
| Summary table of Test Cases                                                                                                                                               |                                                   |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| Test Item                                                                                                                                                                 | LoRa 500KHz DTS                                   |
| <b>Conducted Test Cases</b>                                                                                                                                               | Mode 1: LoRa 500KHz DTS Tx CH24_920.9 MHz         |
|                                                                                                                                                                           | Mode 2: LoRa 500KHz DTS Tx CH28_924.1 MHz         |
| <b>Radiated Test Cases</b>                                                                                                                                                | Mode 1: LoRa 500KHz DTS Tx CH24_920.9 MHz         |
|                                                                                                                                                                           | Mode 2: LoRa 500KHz DTS Tx CH28_924.1 MHz         |
| <b>AC Conducted Emission</b>                                                                                                                                              | Mode 1: WLAN (2.4GHz) Tx + Bluetooth Tx + Lora Tx |
| For radiation spurious emission, after the test voltage (120Vac/60Hz and 110Vac/60Hz) is verified by lab, the test data can conform to the test requirements of NCC rule. |                                                   |

## 2.3 Connection Diagram of Test System

<AC Conducted Emission Mode>



<LoRa Tx Mode>



## 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 10dB attenuator.

$$\begin{aligned}\text{Offset(dB)} &= \text{RF cable loss(dB)} + \text{attenuator factor(dB)} \\ &= 4.2 + 10 = 14.2 \text{ (dB)}\end{aligned}$$

### 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.

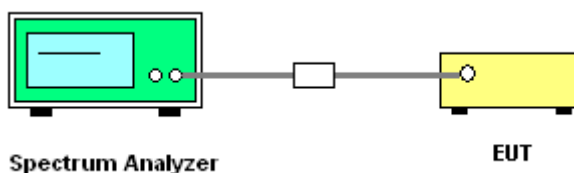
##### 3.1.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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.

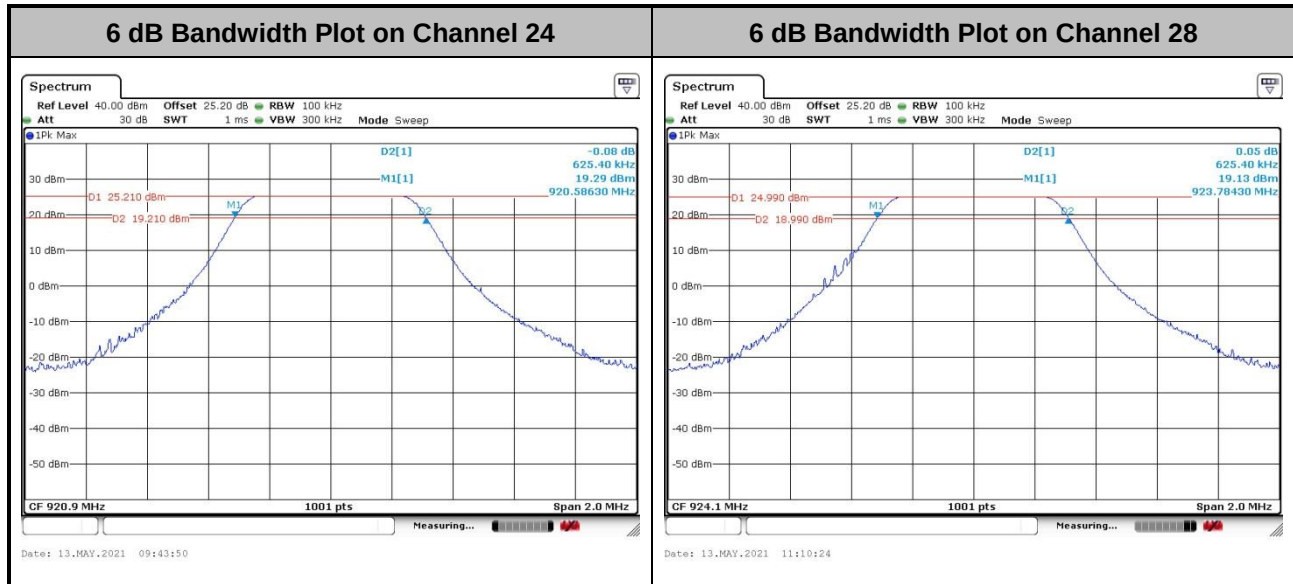
##### 3.1.4 Test Setup





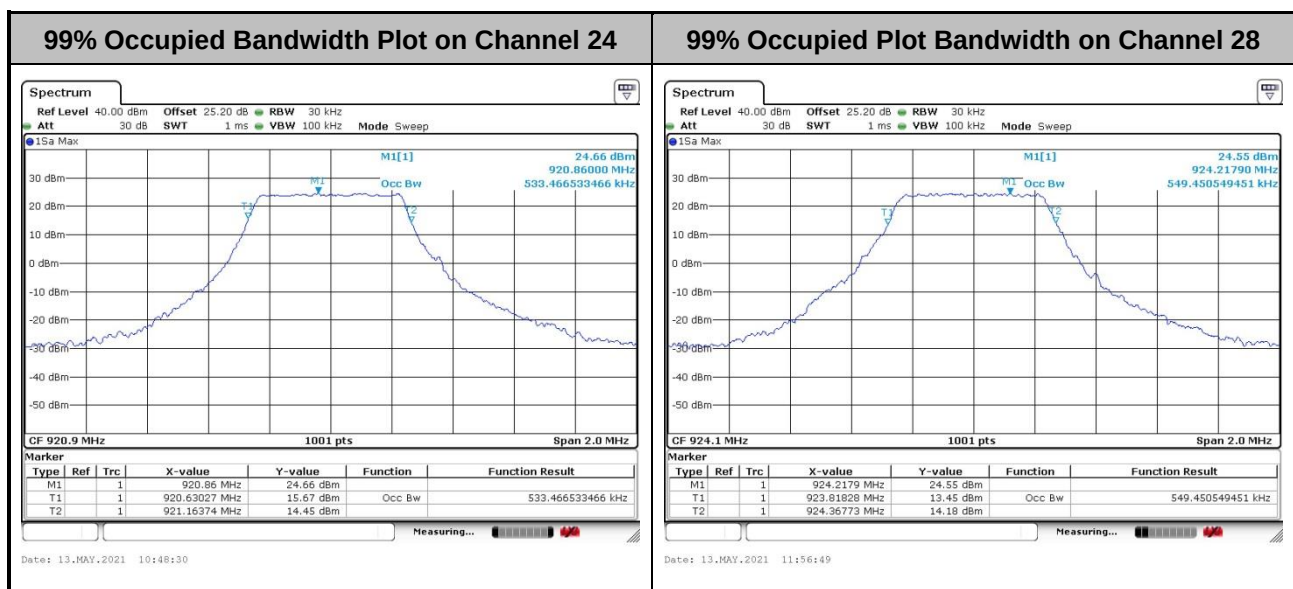
### 3.1.5 Test Result of 6dB

Please refer to Appendix A.



### 3.1.6 Test Result of 99% Occupied Bandwidth

Please refer to Appendix A.



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

## 3.2 Output Power Measurement

### 3.2.1 Limit of Output Power

For systems using digital modulation in the 920 ~ 925 MHz, the limit for output power is 27dBm. If transmitting antenna with directional gain greater than 6dBi is used, the output power from the intentional radiator shall be reduced below the above stated value by the amount in dB that the directional gain of the antenna exceeds 6 dBi. 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

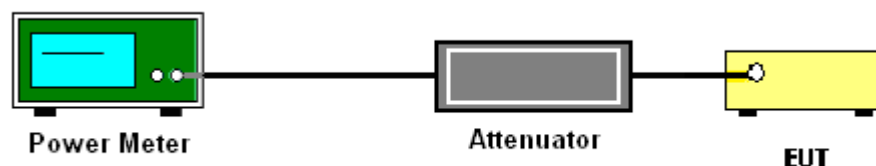
### 3.2.2 Measuring Instruments

See list of measuring equipment of this test report.

### 3.2.3 Test Procedures

1. For Peak Power, the testing follows ANSI C63.10 Section 11.9.1.3 PKPM1
2. For Average Power, the testing follows ANSI C63.10 Section 11.9.2.3.2 Method AVGPM-G
3. The RF output of EUT was connected to the power meter by RF cable and attenuator.
4. The path loss was compensated to the results for each measurement.
5. Set to the maximum power setting and enable the EUT transmit continuously.
6. Measure the conducted output power and record the results in the test report.

### 3.2.4 Test Setup



### 3.2.5 Test Result of Peak Output Power

Please refer to Appendix A.

### 3.2.6 Test Result of Average Output Power (Reporting Only)

Please refer to Appendix A.

### 3.3 Power Spectral Density Measurement

#### 3.3.1 Limit of Power Spectral Density

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

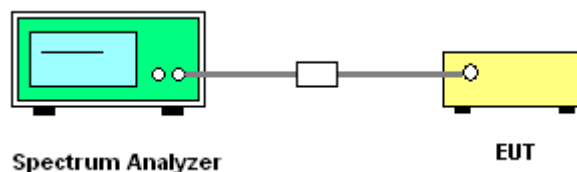
#### 3.3.2 Measuring Instruments

See list of measuring equipment of 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 was connected to the spectrum analyzer by RF cable and attenuator. The path loss was compensated to the results for each measurement.
3. Set to the maximum power setting and enable the EUT 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 = RMS, Sweep time = auto couple, Trace mode = Average, 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.
7. The Measured power density (dBm)/ 100kHz is a reference level and used as 30dBc down limit line for Conducted Band Edges and Conducted Spurious Emission.

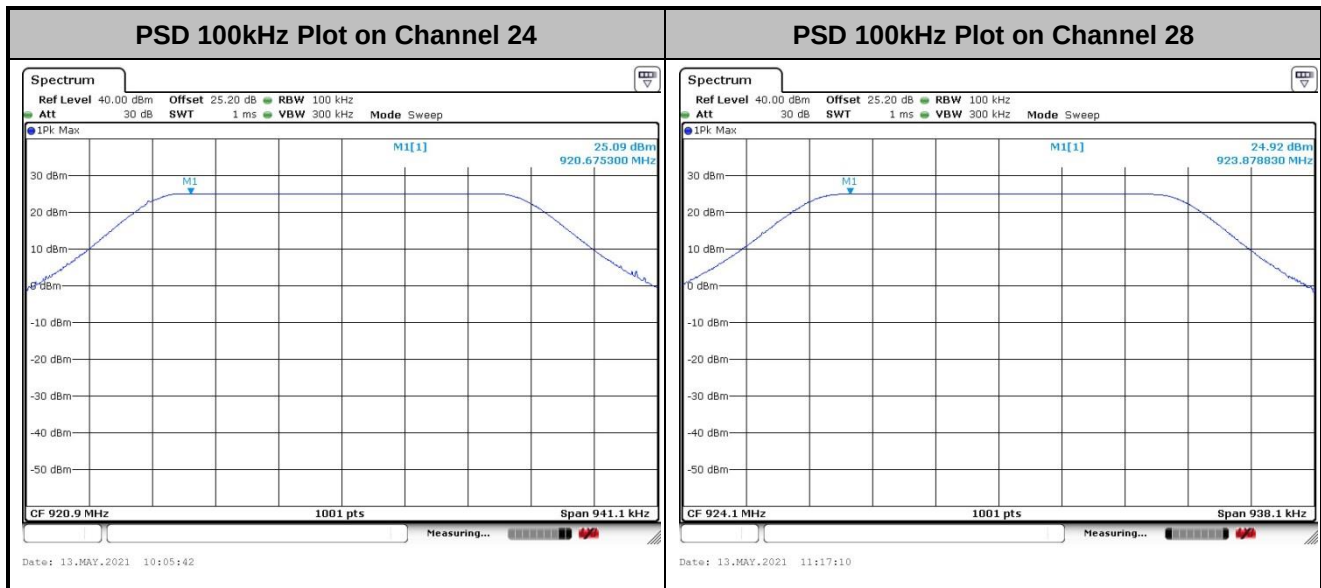
#### 3.3.4 Test Setup



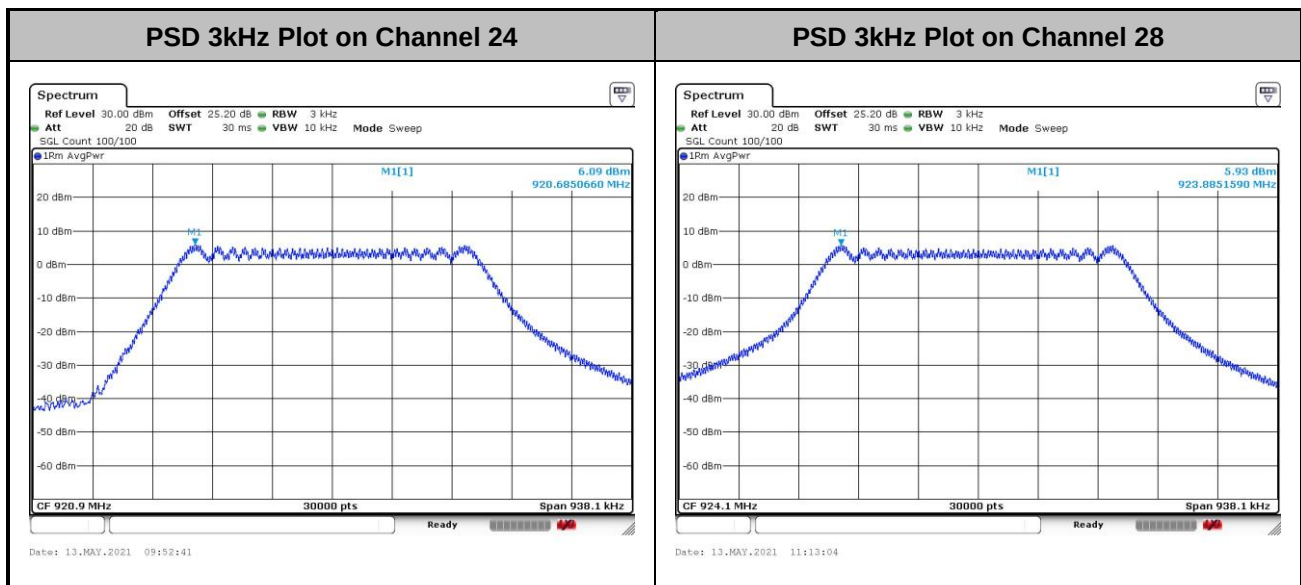
#### 3.3.5 Test Result of Power Spectral Density

Please refer to Appendix A.

### 3.3.6 Test Result of Power Spectral Density Plots (100kHz)



### 3.3.7 Test Result of Power Spectral Density Plots (3kHz)



## 3.4 Conducted Band Edges and Spurious Emission Measurement

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

All harmonics/spurious must be at least 20 dB down from the highest emission level within the authorized band.

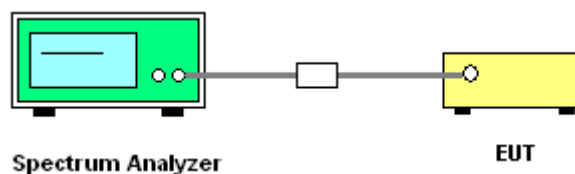
### 3.4.2 Measuring Instruments

See list of measuring equipment of this test report.

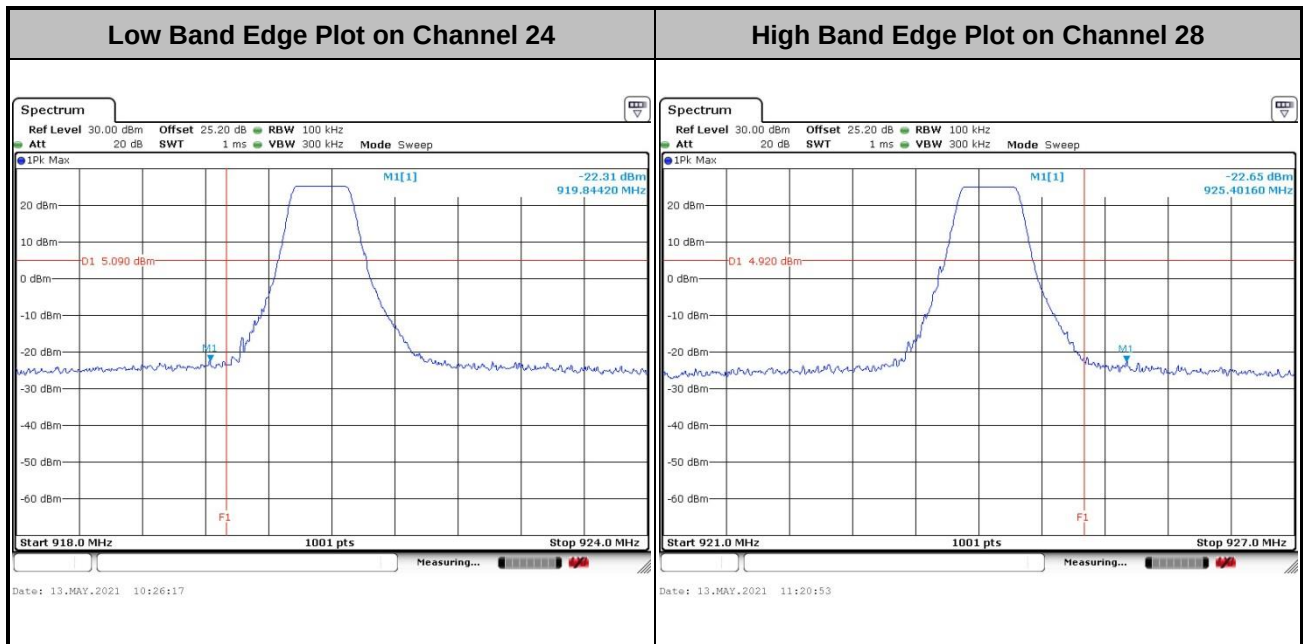
### 3.4.3 Test Procedures

1. The testing follows the ANSI C63.10 Section 11.11.3 Emission level measurement.
2. The RF output of EUT was connected to the spectrum analyzer by RF cable and attenuator. The path loss was 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.
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.

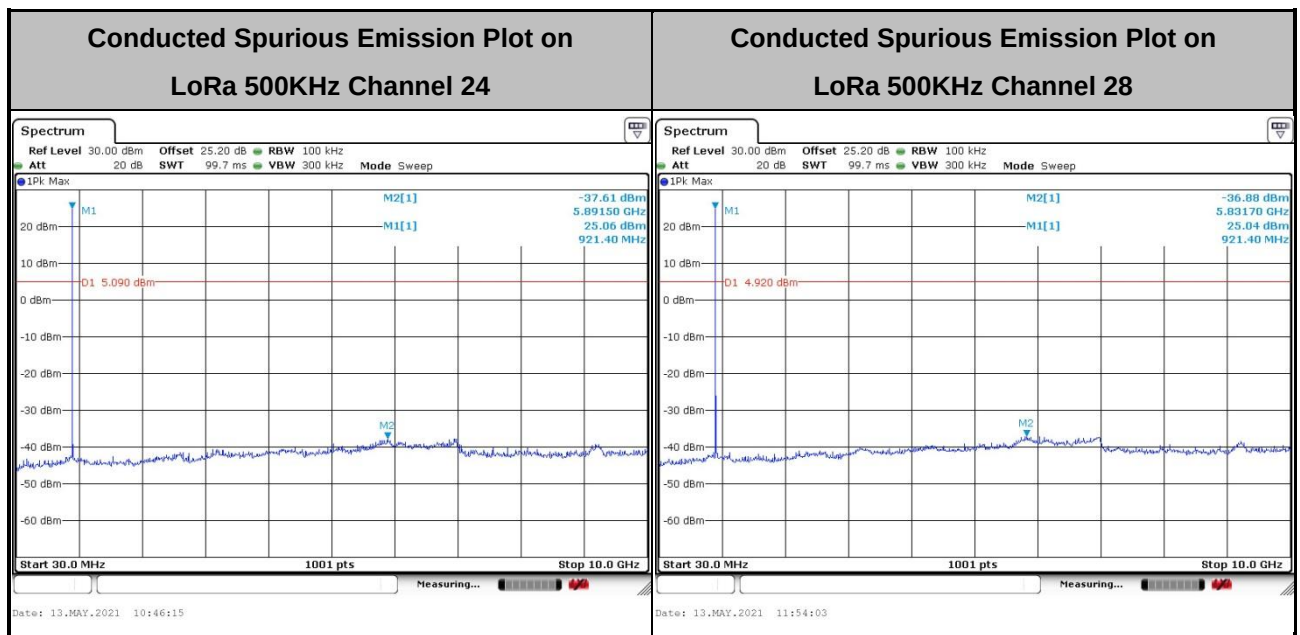
### 3.4.4 Test Setup



### 3.4.5 Test Result of Conducted Band Edges Plots



### 3.4.6 Test Result of Conducted Spurious Emission Plots



### 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 was 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 NCC LP0002 section 3.6 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

See list of measuring equipment of 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 was 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 was placed on a turntable with 0.8 meter for frequency below 1GHz and 1.5 meter for frequency above 1GHz respectively above ground.
4. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
5. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level
6. For testing below 1GHz, if the emission level of the EUT in peak mode was 3 dB lower than the limit specified, then peak values of EUT will be reported, otherwise, the emissions will be repeated one by one using the CISPR quasi-peak method and reported.
7. For testing above 1GHz, the emission level of the EUT in peak mode was 20dB lower than average limit (that means the emission level in average mode also complies with the limit in average mode), then peak values of EUT will be reported, otherwise, the emissions will be measured in average mode again and reported.

8. Use the following spectrum analyzer settings:

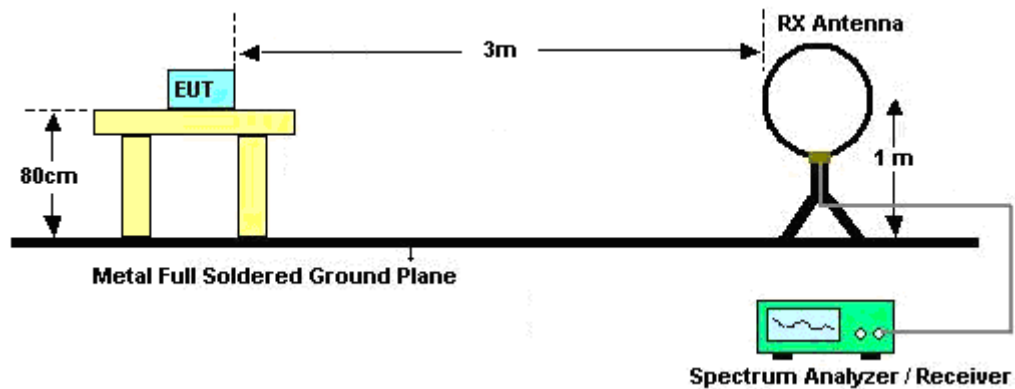
- (1) Span shall wide enough to fully capture the emission being measured;
- (2) Set RBW=100 kHz for  $f < 1$  GHz; VBW  $\geq$  RBW; Sweep = auto; Detector function = peak; Trace = max hold;
- (3) Set RBW = 1 MHz, VBW= 3MHz for  $f \geq 1$  GHz for peak measurement.

For average measurement:

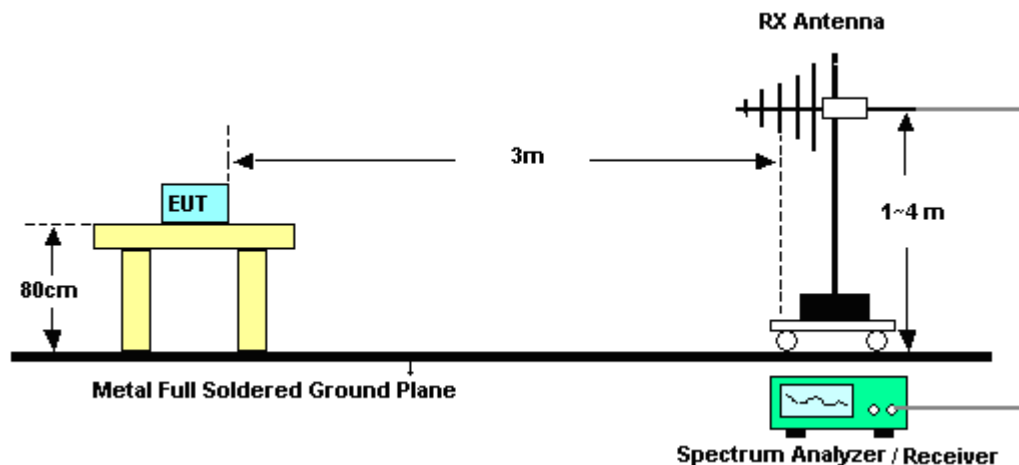
- VBW = 10 Hz, when duty cycle is no less than 98 percent.
- VBW  $\geq 1/T$ , when duty cycle is less than 98 percent where T is the minimum transmission duration over which the transmitter is on and is transmitting at its maximum power control level for the tested mode of operation.

### 3.5.4 Test Setup

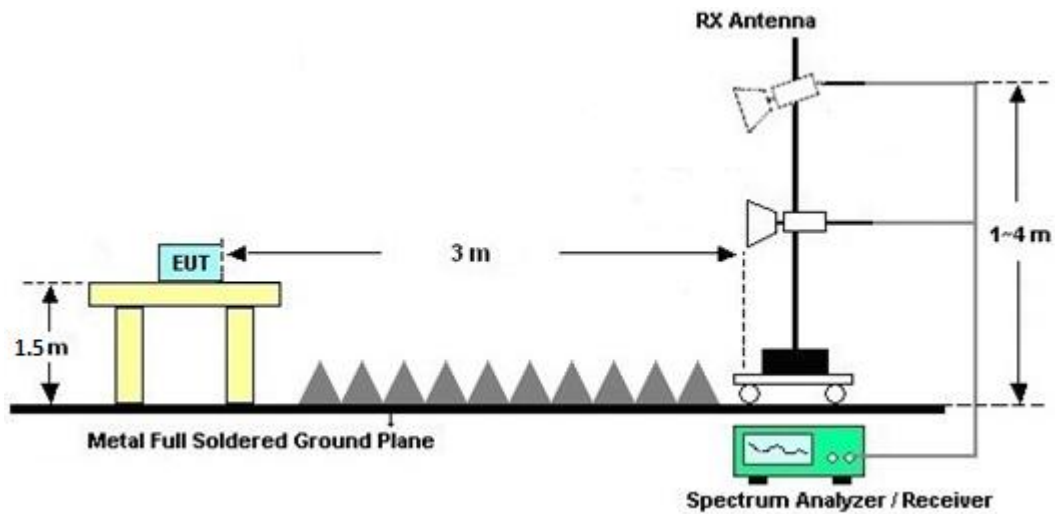
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz



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

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 6.13 was 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 came 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.

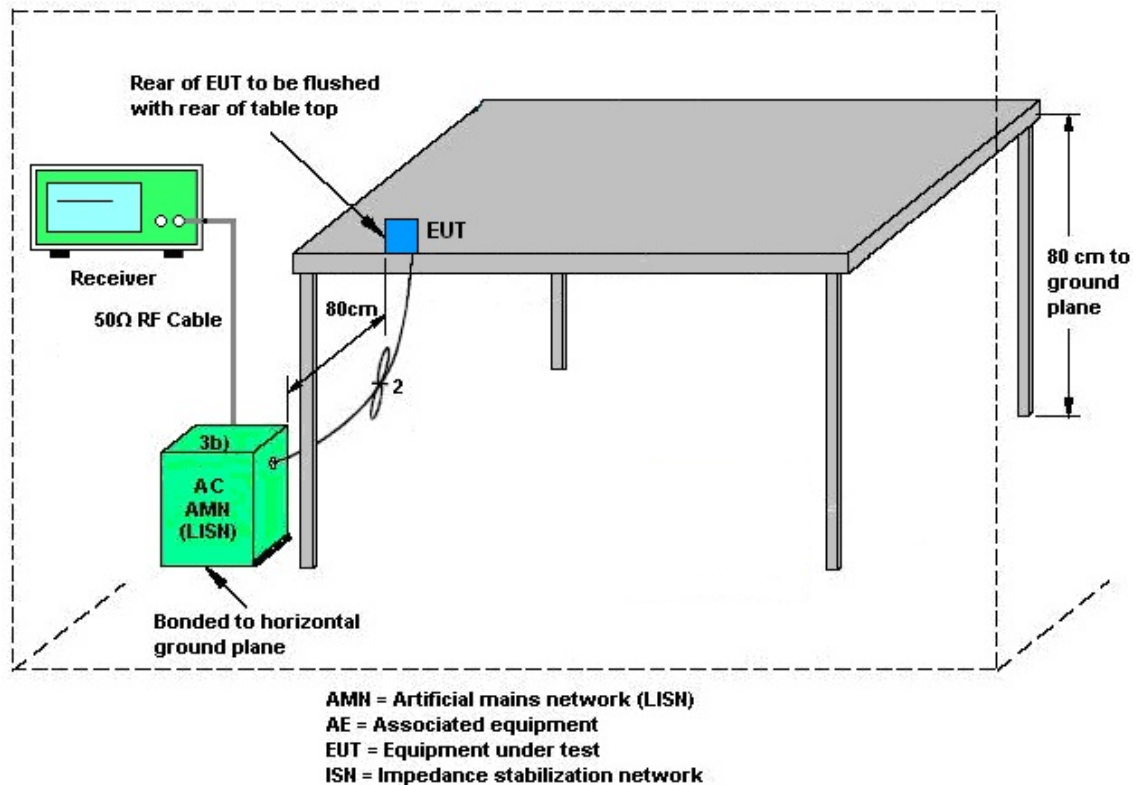
#### 3.6.2 Measuring Instruments

See list of measuring equipment of this test report.

#### 3.6.3 Test Procedures

1. The EUT was placed 0.4 meter from the conducting wall of the shielding room, and it was 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 should be used.
6. Both sides of AC line were checked for maximum conducted interference.
7. The frequency range from 150 kHz to 30 MHz was searched.
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 6dBi, the power shall be reduced by the same level in dB comparing to gain minus 6dBi. 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 LP0002 Section 3.2, Section 4.10.1.3, and Section 4.10.1.4

### **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                |
|--------------------|-----------------|------------------------------------|------------------|-----------------------|------------------|---------------------------------|---------------|-----------------------|
| AC Power Source    | ACPOWER         | AFC-11003G                         | F317040033       | N/A                   | N/A              | Mar. 22, 2021                   | N/A           | Conduction (CO07-HY)  |
| Software           | Rohde & Schwarz | EMC32 V10.30                       | N/A              | N/A                   | N/A              | Mar. 22, 2021                   | N/A           | Conduction (CO07-HY)  |
| Pulse Limiter      | SCHWARZBECK     | VTSD 9561-F N                      | 9561-F N00373    | 9kHz-200MHz           | Nov. 02, 2020    | Mar. 22, 2021                   | Nov. 01, 2021 | Conduction (CO07-HY)  |
| RF Cable           | HUBER + SUHNER  | RG 214/U                           | 1358175          | 9kHz~30MHz            | N/A              | Mar. 22, 2021                   | N/A           | Conduction (CO07-HY)  |
| Two-Line V-Network | TESEQ           | NNB 51                             | 45051            | N/A                   | Feb. 01, 2021    | Mar. 22, 2021                   | Jan. 31, 2022 | Conduction (CO07-HY)  |
| EMI Test Receiver  | Rohde & Schwarz | ESR3                               | 102317           | 9kHz~3.6GHz           | Sep. 11, 2020    | Mar. 22, 2021                   | Sep. 10, 2021 | Conduction (CO07-HY)  |
| Loop Antenna       | Rohde & Schwarz | HFH2-Z2                            | 100488           | 9 kHz~30 MHz          | Jul. 14, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Jul. 13, 2021 | Radiation (03CH11-HY) |
| Bilog Antenna      | TESEQ           | CBL 6111D & N-6-06                 | 35414 & AT-N0602 | 30MHz~1GHz            | Oct. 11, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Oct. 10, 2021 | Radiation (03CH11-HY) |
| Horn Antenna       | SCHWARZBECK     | BBHA 9120 D                        | 9120D-1326       | 1GHz ~ 18GHz          | Nov. 03, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Nov. 02, 2021 | Radiation (03CH11-HY) |
| Amplifier          | SONOMA          | 310N                               | 187312           | 9kHz~1GHz             | Dec. 02, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Dec. 01, 2021 | Radiation (03CH11-HY) |
| Preamplifier       | Keysight        | 83017A                             | MY53270080       | 1GHz~26.5GHz          | Nov. 12, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Nov. 11, 2021 | Radiation (03CH11-HY) |
| Preamplifier       | EMEC            | EM1G18G                            | 060812           | 1GHz~18GHz            | Oct. 27, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Oct. 26, 2021 | Radiation (03CH11-HY) |
| Spectrum Analyzer  | Keysight        | N9010A                             | MY54200486       | 10Hz~44GHz            | Oct. 23, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Oct. 22, 2021 | Radiation (03CH11-HY) |
| EMI Test Receiver  | Keysight        | N9038A(MXE)                        | MY55420170       | 20MHz~8.4GHz          | May 21, 2020     | Mar. 17, 2021~<br>Mar. 30, 2021 | May 20, 2021  | Radiation (03CH11-HY) |
| Antenna Mast       | EMEC            | AM-BS-4500-B                       | N/A              | 1~4m                  | N/A              | Mar. 17, 2021~<br>Mar. 30, 2021 | N/A           | Radiation (03CH11-HY) |
| Turn Table         | EMEC            | TT 2000                            | N/A              | 0~360 Degree          | N/A              | Mar. 17, 2021~<br>Mar. 30, 2021 | N/A           | Radiation (03CH11-HY) |
| Software           | Audix           | E3<br>6.2009-8-24                  | RK-001053        | N/A                   | N/A              | Mar. 17, 2021~<br>Mar. 30, 2021 | N/A           | Radiation (03CH11-HY) |
| RF Cable           | HUBER + SUHNER  | SUCOFLEX 104                       | MY9837/4PE       | 9kHz-30MHz            | Mar. 11, 2021    | Mar. 17, 2021~<br>Mar. 30, 2021 | Mar. 10, 2022 | Radiation (03CH11-HY) |
| RF Cable           | HUBER + SUHNER  | SUCOFLEX 102                       | MY2859/2         | 30MHz-40GHz           | Mar. 11, 2021    | Mar. 17, 2021~<br>Mar. 30, 2021 | Mar. 10, 2022 | Radiation (03CH11-HY) |
| RF Cable           | HUBER + SUHNER  | SUCOFLEX 104                       | MY9837/4PE       | 30M-18G               | Mar. 11, 2021    | Mar. 17, 2021~<br>Mar. 30, 2021 | Mar. 10, 2022 | Radiation (03CH11-HY) |
| RF Cable           | HUBER + SUHNER  | SUCOFLEX 102                       | MY4274/2         | 30MHz-40GHz           | Mar. 11, 2021    | Mar. 17, 2021~<br>Mar. 30, 2021 | Mar. 10, 2022 | Radiation (03CH11-HY) |
| Filter             | Wainwright      | WLK4-1000-15<br>30-8000-40SS       | SN11             | 1.53G Low Pass        | Sep. 14, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Sep. 13, 2021 | Radiation (03CH11-HY) |
| Filter             | Wainwright      | WHKX12-935-<br>1000-15000-40<br>ST | SN1              | 1GHz High Pass Filter | Apr. 30, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Apr. 29, 2021 | Radiation (03CH11-HY) |
| Hygrometer         | TECEP           | DTM-303B                           | TP140325         | N/A                   | Nov. 18, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Nov. 17, 2021 | Radiation (03CH11-HY) |
| Hygrometer         | TECEP           | DTM-303B                           | TP200880         | QA-3-031              | Oct. 22, 2020    | Mar. 17, 2021~<br>Mar. 30, 2021 | Oct. 21, 2021 | Radiation (03CH11-HY) |



| Instrument               | Brand Name      | Model No. | Serial No. | Characteristics  | Calibration Date | Test Date                      | Due Date      | Remark                 |
|--------------------------|-----------------|-----------|------------|------------------|------------------|--------------------------------|---------------|------------------------|
| Hygrometer               | TECPEL          | TR-32     | HE17XB2468 | N/A              | Mar. 09, 2021    | May 12, 2020 ~<br>May 13, 2020 | Mar. 08, 2022 | Conducted<br>(TH05-HY) |
| Signal Analyzer          | Rohde & Schwarz | FSV40     | 101566     | 10Hz ~ 40GHz     | Jul. 22, 2020    | May 12, 2020 ~<br>May 13, 2020 | Jul. 21, 2021 | Conducted<br>(TH05-HY) |
| Power Meter              | Anritsu         | ML2495A   | 1218006    | N/A              | Oct. 18, 2020    | May 12, 2020 ~<br>May 13, 2020 | Oct. 17, 2021 | Conducted<br>(TH05-HY) |
| Power Sensor             | Anritsu         | MA2411B   | 1207363    | 300MHz~<br>40GHz | Oct. 18, 2020    | May 12, 2020 ~<br>May 13, 2020 | Oct. 17, 2021 | Conducted<br>(TH05-HY) |
| Switch Box &<br>RF Cable | Burgeon         | ETF058    | EC1300484  | N/A              | Nov. 19, 2020    | May 12, 2020 ~<br>May 13, 2020 | Nov. 18, 2021 | Conducted<br>(TH05-HY) |

## 5 Uncertainty of Evaluation

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

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 2.3 |
|-------------------------------------------------------------------------|-----|

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

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 4.4 |
|-------------------------------------------------------------------------|-----|

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

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 5.2 |
|-------------------------------------------------------------------------|-----|

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

|                                                                         |     |
|-------------------------------------------------------------------------|-----|
| Measuring Uncertainty for a Level of Confidence of 95% ( $U = 2Uc(y)$ ) | 5.1 |
|-------------------------------------------------------------------------|-----|

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

|                |                     |                    |           |    |
|----------------|---------------------|--------------------|-----------|----|
| Test Engineer: | Tommy Lee           | Temperature:       | 23.2~23.7 | °C |
| Test Date:     | 2021/5/12~2021/5/13 | Relative Humidity: | 51.2~52   | %  |

**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 | SF7       | 1   | 24  | 920.9       | 0.533                 | 0.625        | 0.50               | Pass      |
| Lora | SF7       | 1   | 28  | 924.1       | 0.549                 | 0.625        | 0.50               | Pass      |

**TEST RESULTS DATA**  
**Peak Power Table**

| Mod. | Data Rate | NTx | CH. | Freq. (MHz) | Peak Conducted Power (dBm) | Conducted Power Limit (dBm) | DG (dBi) | EIRP Power (dBm) | EIRP Power Limit (dBm) | Pass /Fail |
|------|-----------|-----|-----|-------------|----------------------------|-----------------------------|----------|------------------|------------------------|------------|
| Lora | SF11      | 1   | 24  | 920.9       | 25.47                      | 27.00                       | -1.38    | 24.09            | 33.00                  | Pass       |
| Lora | SF11      | 1   | 28  | 924.1       | 25.44                      | 27.00                       | -1.38    | 24.06            | 33.00                  | Pass       |

**TEST RESULTS DATA**  
**Average Power Table**  
**(Reporting Only)**

| 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 | Setting |
|------|-----------|-----|-----|-------------|-------------------------------|-----------------------------|----------|------------------|------------------------|------------|---------|
| Lora | SF7       | 1   | 24  | 920.9       | 25.42                         | 27.00                       | -1.38    | 24.04            | 33.00                  | Pass       | 20      |
| Lora | SF7       | 1   | 28  | 924.1       | 25.40                         | 27.00                       | -1.38    | 24.02            | 33.00                  | Pass       | 20      |

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

| Mod. | Data Rate | NTx | CH. | Freq. (MHz) | Peak PSD (dBm /100kHz) | Average PSD (dBm /3kHz) | DG (dBi) | Peak PSD Limit (dBm /3kHz) | Pass/Fail |
|------|-----------|-----|-----|-------------|------------------------|-------------------------|----------|----------------------------|-----------|
| Lora | SF7       | 1   | 24  | 920.9       | 25.09                  | 6.09                    | -1.38    | 8.00                       | Pass      |
| Lora | SF7       | 1   | 28  | 924.1       | 24.92                  | 5.93                    | -1.38    | 8.00                       | Pass      |

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



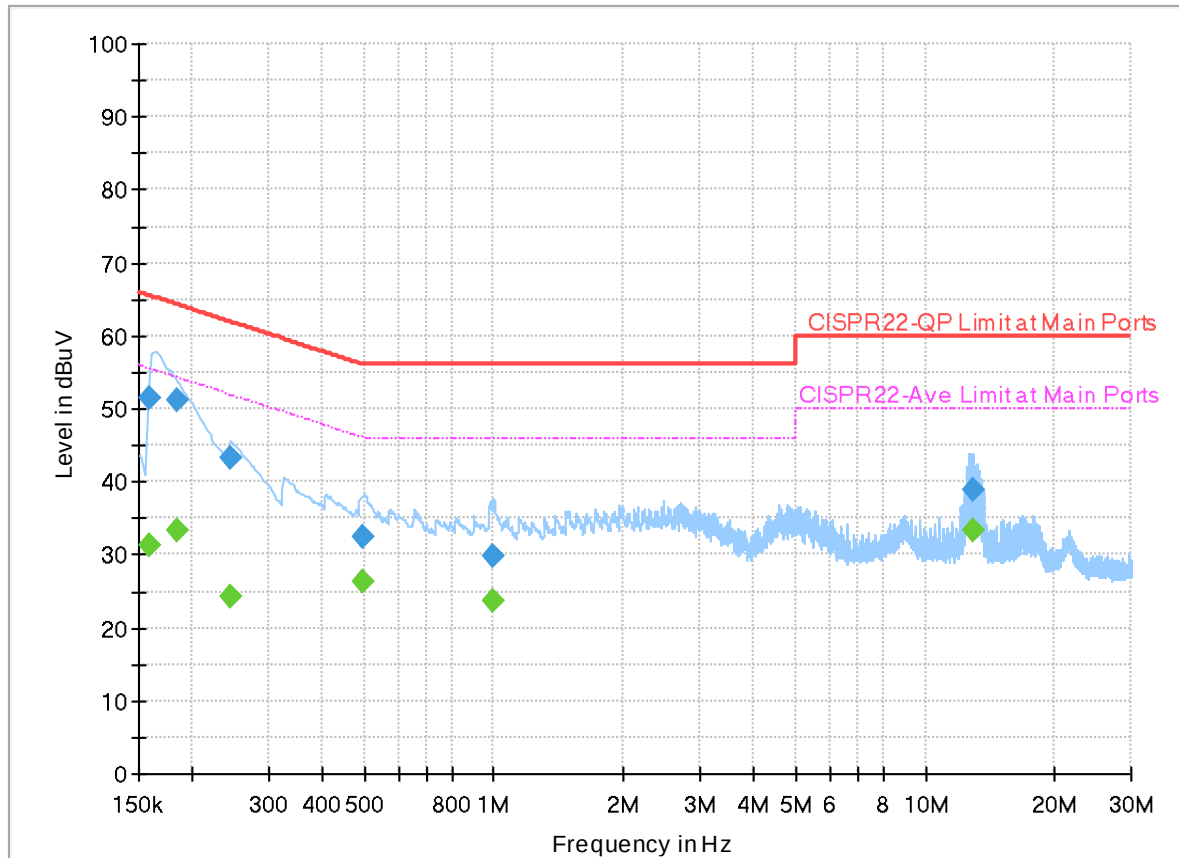
## **Appendix B. AC Conducted Emission Test Results**

|                        |           |                            |        |
|------------------------|-----------|----------------------------|--------|
| <b>Test Engineer :</b> | Eric Jeng | <b>Temperature :</b>       | 23~26℃ |
|                        |           | <b>Relative Humidity :</b> | 40~50% |

## EUT Information

Report NO : 120337  
 Test Mode : Mode 1  
 Test Voltage : 110Vac/60Hz  
 Phase : Line

Full Spectrum



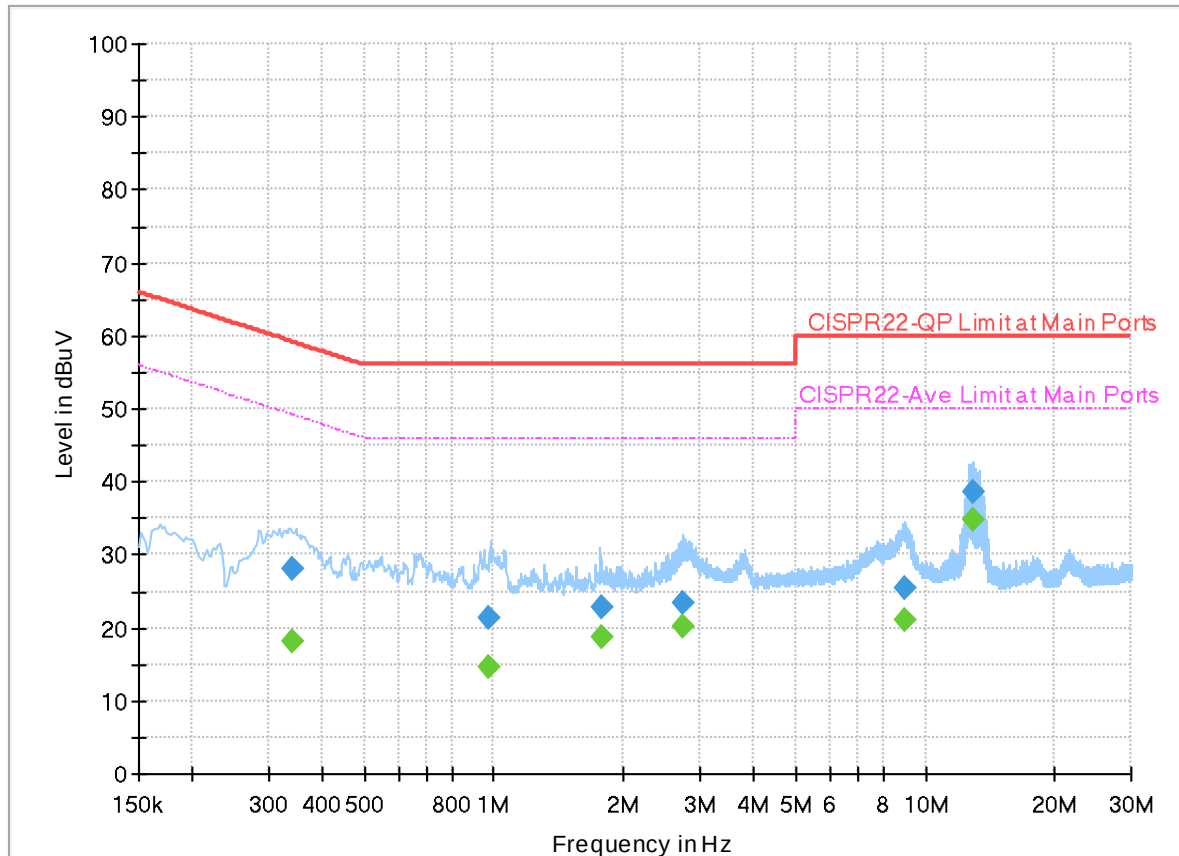
## Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.159000        | ---              | 31.28           | 55.52        | 24.24       | L1   | OFF    | 20.0       |
| 0.159000        | 51.44            | ---             | 65.52        | 14.08       | L1   | OFF    | 20.0       |
| 0.183750        | ---              | 33.29           | 54.31        | 21.02       | L1   | OFF    | 20.0       |
| 0.183750        | 51.08            | ---             | 64.31        | 13.23       | L1   | OFF    | 20.0       |
| 0.244590        | ---              | 24.24           | 51.94        | 27.70       | L1   | OFF    | 20.0       |
| 0.244590        | 43.38            | ---             | 61.94        | 18.56       | L1   | OFF    | 20.0       |
| 0.498300        | ---              | 26.23           | 46.03        | 19.80       | L1   | OFF    | 20.0       |
| 0.498300        | 32.38            | ---             | 56.03        | 23.65       | L1   | OFF    | 20.0       |
| 0.997260        | ---              | 23.79           | 46.00        | 22.21       | L1   | OFF    | 20.0       |
| 0.997260        | 29.96            | ---             | 56.00        | 26.04       | L1   | OFF    | 20.0       |
| 12.862500       | ---              | 33.30           | 50.00        | 16.70       | L1   | OFF    | 20.2       |
| 12.862500       | 38.98            | ---             | 60.00        | 21.02       | L1   | OFF    | 20.2       |

## EUT Information

Report NO : 120337  
 Test Mode : Mode 1  
 Test Voltage : 110Vac/60Hz  
 Phase : Neutral

Full Spectrum



## Final Result

| Frequency (MHz) | QuasiPeak (dBuV) | CAverage (dBuV) | Limit (dBuV) | Margin (dB) | Line | Filter | Corr. (dB) |
|-----------------|------------------|-----------------|--------------|-------------|------|--------|------------|
| 0.339000        | ---              | 18.19           | 49.23        | 31.04       | N    | OFF    | 20.0       |
| 0.339000        | 28.07            | ---             | 59.23        | 31.16       | N    | OFF    | 20.0       |
| 0.975750        | ---              | 14.63           | 46.00        | 31.37       | N    | OFF    | 20.0       |
| 0.975750        | 21.22            | ---             | 56.00        | 34.78       | N    | OFF    | 20.0       |
| 1.768290        | ---              | 18.67           | 46.00        | 27.33       | N    | OFF    | 20.0       |
| 1.768290        | 22.77            | ---             | 56.00        | 33.23       | N    | OFF    | 20.0       |
| 2.744250        | ---              | 20.22           | 46.00        | 25.78       | N    | OFF    | 20.1       |
| 2.744250        | 23.26            | ---             | 56.00        | 32.74       | N    | OFF    | 20.1       |
| 8.925270        | ---              | 21.11           | 50.00        | 28.89       | N    | OFF    | 20.1       |
| 8.925270        | 25.41            | ---             | 60.00        | 34.59       | N    | OFF    | 20.1       |
| 12.963480       | ---              | 34.70           | 50.00        | 15.30       | N    | OFF    | 20.2       |
| 12.963480       | 38.69            | ---             | 60.00        | 21.31       | N    | OFF    | 20.2       |



## Appendix C. Radiated Spurious Emission

|                 |                                      |                     |               |
|-----------------|--------------------------------------|---------------------|---------------|
| Test Engineer : | Bill Chang, Fu Chen, and Troye Hsieh | Temperature :       | 18.2 ~ 21.5°C |
|                 |                                      | Relative Humidity : | 50.2 ~ 69.3%  |

### Lora 920~925MHz

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

| Lora                                  | Note                                                                                                                                          | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                                       |                                                                                                                                               |           |            | Limit  | 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>DTS 500k<br>CH 24<br>920.9MHz |                                                                                                                                               | 117.3     | 38.36      | -5.14  | 43.5       | 42.18    | 17.21    | 11.48  | 32.51  | 268    | 346     | QP      | H       |
|                                       |                                                                                                                                               | 185.2     | 30.85      | -12.65 | 43.5       | 36.66    | 14.71    | 12.01  | 32.53  | -      | -       | P       | H       |
|                                       |                                                                                                                                               | 541.19    | 34.55      | -11.45 | 46         | 29.35    | 24.29    | 13.39  | 32.48  | -      | -       | P       | H       |
|                                       |                                                                                                                                               | 763.32    | 40.71      | -5.29  | 46         | 30.43    | 28.12    | 14.05  | 31.89  | -      | -       | P       | H       |
|                                       |                                                                                                                                               | 889.42    | 47.17      | -53.73 | 100.9      | 34.79    | 29.16    | 14.46  | 31.24  | -      | -       | P       | H       |
|                                       | *                                                                                                                                             | 920.9     | 120.9      | -      | -          | 108.05   | 29.36    | 14.55  | 31.06  | 150    | 21      | P       | H       |
|                                       |                                                                                                                                               | 952.47    | 45.16      | -55.74 | 100.9      | 30.61    | 30.79    | 14.62  | 30.86  | -      | -       | P       | H       |
|                                       |                                                                                                                                               |           |            |        |            |          |          |        |        |        |         |         | H       |
|                                       |                                                                                                                                               |           |            |        |            |          |          |        |        |        |         |         | H       |
|                                       |                                                                                                                                               | 42.61     | 32.91      | -7.09  | 40         | 36.68    | 17.84    | 10.9   | 32.51  | 100    | 356     | QP      | V       |
|                                       |                                                                                                                                               | 54.25     | 27.03      | -12.97 | 40         | 36.2     | 12.35    | 11.03  | 32.55  | 100    | 352     | QP      | V       |
|                                       |                                                                                                                                               | 418.97    | 33.02      | -12.98 | 46         | 29.28    | 22.64    | 12.95  | 31.85  | -      | -       | P       | V       |
|                                       |                                                                                                                                               | 705.12    | 38.33      | -7.67  | 46         | 30.21    | 26.61    | 13.86  | 32.35  | -      | -       | P       | V       |
|                                       |                                                                                                                                               | 888.45    | 47.66      | -51.77 | 99.43      | 35.29    | 29.16    | 14.46  | 31.25  | -      | -       | P       | V       |
|                                       | *                                                                                                                                             | 920.9     | 119.43     | -      | -          | 106.58   | 29.36    | 14.55  | 31.06  | 105    | 112     | P       | V       |
|                                       |                                                                                                                                               | 952.47    | 46.81      | -52.62 | 99.43      | 32.26    | 30.79    | 14.62  | 30.86  | -      | -       | P       | 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 20db |           |            |        |            |          |          |        |        |        |         |         |         |

[illegible]



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

| Lora                                  | Note                                                                                                                                          | Frequency<br>( MHz ) | Level<br>( dBμV/m ) | Over<br>Limit<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 24<br>920.9MHz |                                                                                                                                               | 2762.7               | 46.18               | -27.82                  | 74                          | 76.43                     | 28.05                         | 8.72                   | 67.02                      | 100                  | 0                       | P                       | H               |
|                                       |                                                                                                                                               | 3683.6               | 35.98               | -38.02                  | 74                          | 63.64                     | 29.07                         | 9.69                   | 66.42                      | 100                  | 0                       | P                       | H               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                               | 2762.7               | 45.29               | -28.71                  | 74                          | 75.54                     | 28.05                         | 8.72                   | 67.02                      | 100                  | 0                       | P                       | V               |
|                                       |                                                                                                                                               | 3683.6               | 34.97               | -39.03                  | 74                          | 62.63                     | 29.07                         | 9.69                   | 66.42                      | 100                  | 0                       | P                       | V               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | V               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | V               |
| Lora<br>DTS 500k<br>CH 28<br>924.1MHz |                                                                                                                                               | 2772.3               | 40.41               | -33.59                  | 74                          | 70.61                     | 28.09                         | 8.73                   | 67.02                      | 100                  | 0                       | P                       | H               |
|                                       |                                                                                                                                               | 3696.4               | 35.74               | -38.26                  | 74                          | 63.38                     | 29.09                         | 9.7                    | 66.43                      | 100                  | 0                       | P                       | H               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                               |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         | H               |
|                                       |                                                                                                                                               | 2772.3               | 42.07               | -31.93                  | 74                          | 72.27                     | 28.09                         | 8.73                   | 67.02                      | 100                  | 0                       | P                       | V               |
|                                       |                                                                                                                                               | 3696.4               | 35.92               | -38.08                  | 74                          | 63.56                     | 29.09                         | 9.7                    | 66.43                      | 100                  | 0                       | P                       | 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 20db |                      |                     |                         |                             |                           |                               |                        |                            |                      |                         |                         |                 |



**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>P</b> eak or <b>A</b> verage                                                                                                                          |
| H/V | <b>H</b> orizontal or <b>V</b> ertical                                                                                                                   |

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

| Lora                     | Note | Frequency | Level      | Over   | Limit      | Read     | Antenna  | Path   | Preamp | Ant    | Table   | Peak    | Pol.    |
|--------------------------|------|-----------|------------|--------|------------|----------|----------|--------|--------|--------|---------|---------|---------|
|                          |      |           |            | Limit  | 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 00<br>2402MHz |      | 2390      | 55.45      | -18.55 | 74         | 54.51    | 32.22    | 4.58   | 35.86  | 103    | 308     | P       | H       |
|                          |      | 2390      | 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. Over Limit(dB) = Level(dBμV/m) – Limit Line(dBμV/m)

**For Peak Limit @ 2390MHz:**

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. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 55.45(dBμV/m) – 74(dBμV/m)  
= -18.55(dB)

**For Average Limit @ 2390MHz:**

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. Over Limit(dB)  
= Level(dBμV/m) – Limit Line(dBμV/m)  
= 43.54(dBμV/m) – 54(dBμV/m)  
= -10.46(dB)

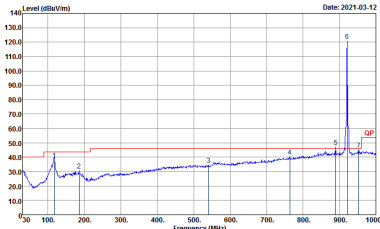
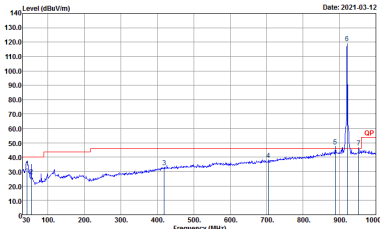
**Both peak and average measured complies with the limit line, so test result is “PASS”.**

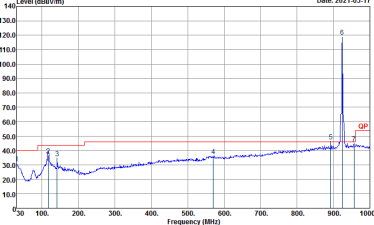
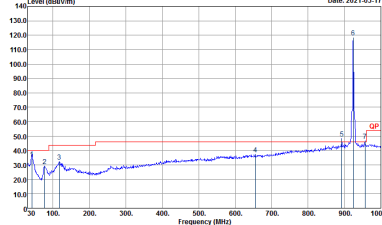
## Appendix D. Radiated Spurious Emission Plots

|                 |                                      |                     |               |
|-----------------|--------------------------------------|---------------------|---------------|
| Test Engineer : | Bill Chang, Fu Chen, and Troye Hsieh | Temperature :       | 18.2 ~ 21.5°C |
|                 |                                      | Relative Humidity : | 50.2 ~ 69.3%  |

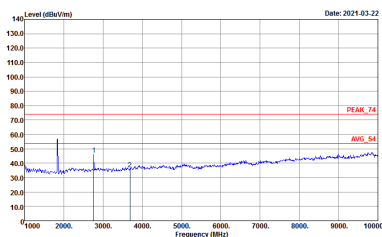
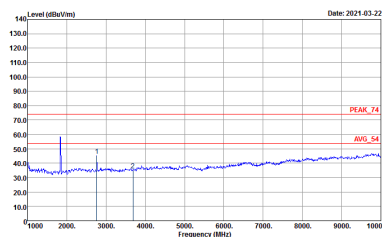
### Lora 920~925MHz

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

| Lora         | Lora 920~925MHz                                                                                                                                                                                                                   |                                                                                                                                                                                                                                  |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch24 920.9Mhz                                                                                                                                                                                                       |                                                                                                                                                                                                                                  |
|              | Horizontal                                                                                                                                                                                                                        | Vertical                                                                                                                                                                                                                         |
| QP /<br>Peak |  <p>Site : 03CHI1-HY<br/>Condition : QP 3m BE-LOG 6111D-LF_ETC HORIZONTAL<br/>Detector : Peak<br/>Project : 120337<br/>Setting : 10<br/>SF7</p> |  <p>Site : 03CHI1-HY<br/>Condition : QP 3m BE-LOG 6111D-LF_ETC VERTICAL<br/>Detector : Peak<br/>Project : 120337<br/>Setting : 10<br/>SF7</p> |

| Lora         | Lora 920~925MHz                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                      |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch28 924.1MHz                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                      |
|              | Horizontal                                                                                                                                                                                                                                                                                                                                            | Vertical                                                                                                                                                                                                                                                                                                                                             |
| QP /<br>Peak |  <p>           Date: 2021-03-17<br/>           Site : 03CH11-HY<br/>           Condition : QP 3m BE-LO6 6111D-LF_ETC HORIZONTAL<br/>           Detector : Peak<br/>           Project : 120337<br/>           Setting : 10<br/>           Setting : SF7         </p> |  <p>           Date: 2021-03-17<br/>           Site : 03CH11-HY<br/>           Condition : QP 3m BE-LO6 6111D-LF_ETC VERTICAL<br/>           Detector : Peak<br/>           Project : 120337<br/>           Setting : 10<br/>           Setting : SF7         </p> |
|              |                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                      |

**Lora 920~925MHz**
**Lora DTS 500k (Harmonic @ 3m)**

| Lora                           | Lora 920~925MHz                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                             |
|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | Lora DTS 500k Ch24 920.9Mhz                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                             |
|                                | Horizontal                                                                                                                                                                                                                                                                                                                   | Vertical                                                                                                                                                                                                                                                                                                                    |
| <b>Peak</b><br><br><b>Avg.</b> |  <p>           Site : 03CH11-49Y<br/>           Condition : PEAK_74 3m HORN 91200-4F_1326 HORIZONTAL<br/>           Detector : Peak<br/>           Project : 120337<br/>           Setting : 10<br/>                     : SF7         </p> |  <p>           Site : 03CH11-49Y<br/>           Condition : PEAK_74 3m HORN 91200-4F_1326 VERTICAL<br/>           Detector : Peak<br/>           Project : 120337<br/>           Setting : 10<br/>                     : SF7         </p> |



| Lora         | Lora 920~925MHz                                                                                                                                                                                           |                                                                                                                                                                                                         |
|--------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|              | Lora DTS 500k Ch28 924.1MHz                                                                                                                                                                               |                                                                                                                                                                                                         |
|              | Horizontal                                                                                                                                                                                                | Vertical                                                                                                                                                                                                |
| Peak<br>Avg. | <div><p>Level (dBuV/m)</p><p>Date: 2021-03-22</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m HORN 91200-HF_1326 HORIZONTAL<br/>Detector : Peak<br/>Project : 120337<br/>Setting : 10<br/>SF7</p></div> | <div><p>Level (dBuV/m)</p><p>Date: 2021-03-22</p><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m HORN 91200-HF_1326 VERTICAL<br/>Detector : Peak<br/>Project : 120337<br/>Setting : 10<br/>SF7</p></div> |

## Annex. A Receiver Radiated Emission Measurement

### A.1 Limit of Receiver Radiated Emission

| 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                                |

### A.2 Measuring Instruments

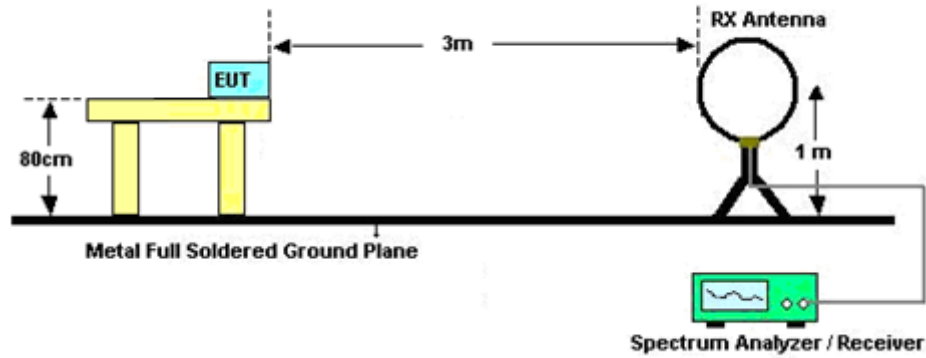
See list of measuring equipment of this test report.

### A.3 Test Procedures

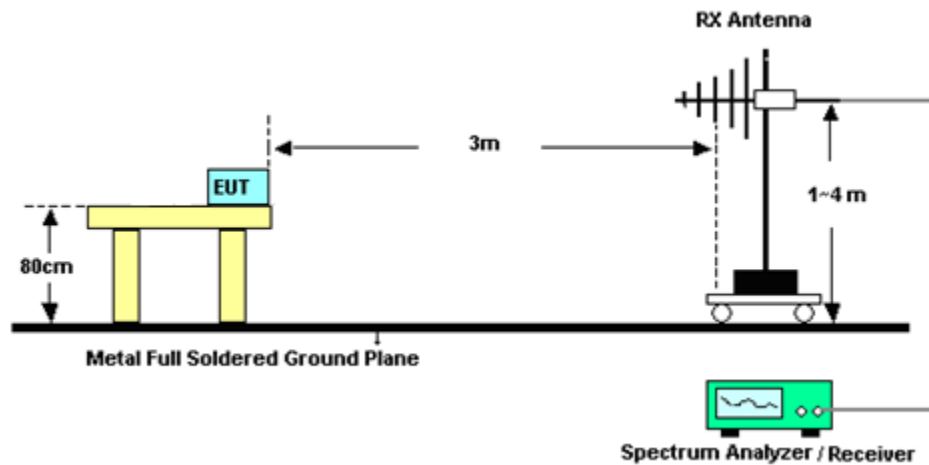
1. The EUT was placed on a turntable with 0.8 meter above ground.
2. The EUT was set 3 meters from the interference receiving antenna, which was mounted on the top of a variable height antenna tower.
3. The table was rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is a Bi-Log antenna and its height is adjusted between one to four meters above ground to find the maximum value of the field strength for both horizontal polarization and vertical polarization of the antenna.
5. For each suspected emission, the EUT was 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.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120kHz/VBW=300kHz for frequency below 1GHz; RBW=1MHz VBW=3MHz (Peak), RBW=1MHz/VBW=10Hz (Average) for frequency above 1GHz).
7. If the emission level of the EUT in peak mode was 3 dB lower than the limit specified, peak values of EUT will be reported. Otherwise, the emission will be repeated by using the quasi-peak method and reported.
8. Emission level (dBμV/m) = 20 log Emission level (μV/m)
9. Corrected Reading: Antenna Factor + Cable Loss + Read Level - Preamp Factor = Level

## A.4 Test Setup

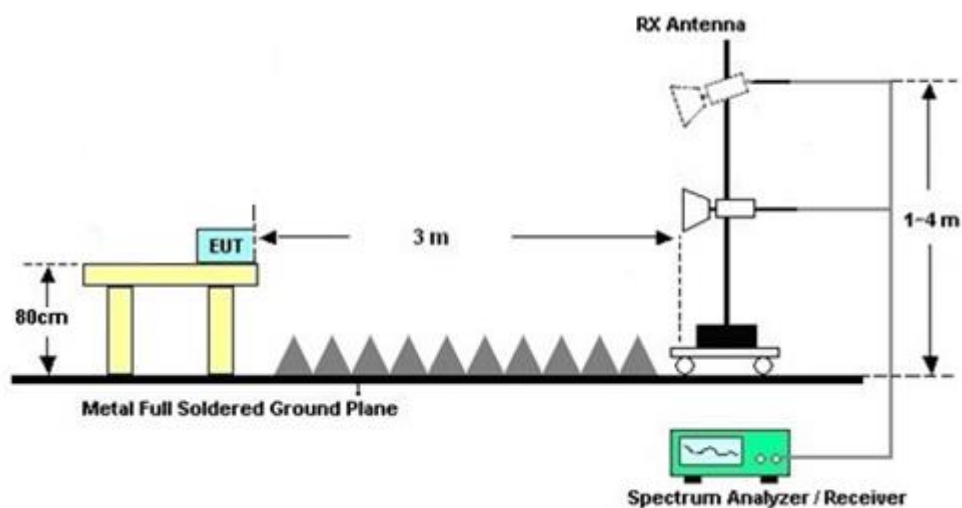
For radiated emissions below 30MHz



For radiated emissions from 30MHz to 1GHz



For radiated emissions above 1GHz

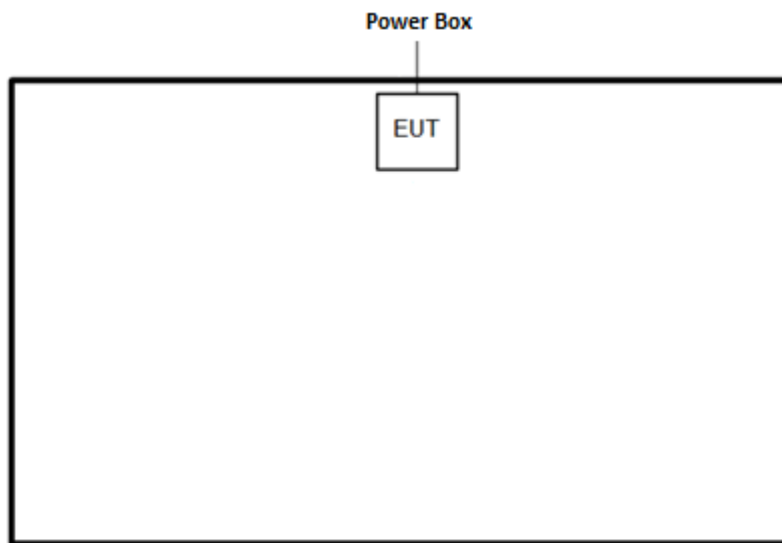


### A.5 Test Result of Receiver Radiated Spurious Emissions (9kHz ~ 30MHz)

The low frequency, which started from 9 kHz to 30MHz, was pre-scanned and the result which was 20dB lower than the limit line per NCC LP0002 section 6.13 was 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 came out very similar.

### A.6 Connection Diagram of Test System

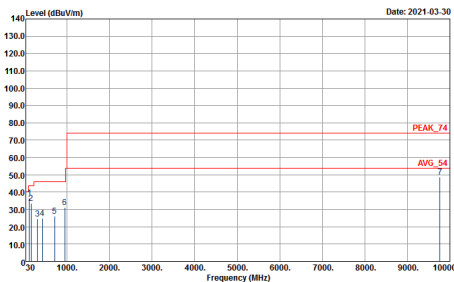
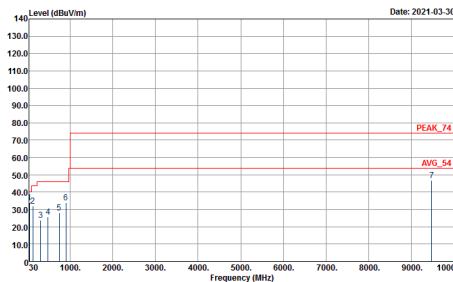


### A.7 EUT Operation Test Setup

The Lora test items, utility "Tera Term Version 4.95" was installed in Notebook which was programmed in order to make the EUT get into the engineering modes to provide channel selection, power level (power setting: default), data rate (default) and the application type and for continuous receiving signals.

A.8 Test Result of Receiver Radiated Spurious Emission (30MHz ~ 5<sup>th</sup> Harmonic)

|                 |                                      |                     |               |
|-----------------|--------------------------------------|---------------------|---------------|
| Test Engineer : | Bill Chang, Fu Chen, and Troye Hsieh | Temperature :       | 18.2 ~ 21.5°C |
|                 |                                      | Relative Humidity : | 50.2 ~ 69.3%  |
| Frequency       | 45.700 MHz                           | Margin :            | Under 5.97 dB |
| Test Mode       | LoRa (DTS) Idle                      |                     |               |

|              | Idle Mode                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |              |             |             |        |        |        |        |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |      |       |             |       |        |       |       |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |       |       |       |       |       |       |      |       |     |     |    |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------|-------------|-------------|--------|--------|--------|--------|--------|------|-------|------|--------------|-------------|--|--|--|--|-----|--------|----|--------|------|------|----|----|----|-----|---|--------|-------|-------|-------|-------|-------|------|-------|-----|---|----|---|--------|-------|-------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|---------|-------|--------|-------|-------|-------|-------|-------|-----|---|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------|-------|-------------|-------|--------|-------|-------|--------|------|-------|------|--------------|-------------|--|--|--|--|-----|--------|----|--------|------|------|----|----|----|-----|---|-------|-------|-------|-------|-------|-------|------|-------|-----|-----|----|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|--------|-------|--------|-------|-------|-------|------|-------|-----|-----|------|---|---------|-------|--------|-------|-------|-------|-------|-------|-----|---|------|
|              | Horizontal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Vertical |              |             |             |        |        |        |        |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| Peak<br>Avg. | <div><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m HORN 9120D-HF_1326 HORIZONTAL<br/>Detector : Peak<br/>Project : I20337</p><table><tr><th></th><th>Over</th><th>Limit</th><th>ReadAntenna</th><th>Cable</th><th>Preamp</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th></tr><tr><th>Freq</th><th>Level</th><th>Line</th><th>Level Factor</th><th>Loss Factor</th><th></th><th></th><th></th><th></th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th>cm</th><th>deg</th></tr><tr><td>1</td><td>116.60</td><td>36.48</td><td>-7.02</td><td>43.50</td><td>50.12</td><td>17.23</td><td>1.58</td><td>32.51</td><td>269</td><td>1</td><td>QP</td></tr><tr><td>2</td><td>150.28</td><td>33.71</td><td>-9.79</td><td>43.50</td><td>47.43</td><td>16.92</td><td>1.78</td><td>32.52</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>3</td><td>299.66</td><td>24.58</td><td>-21.42</td><td>46.00</td><td>34.90</td><td>19.19</td><td>2.51</td><td>32.13</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>4</td><td>419.94</td><td>25.11</td><td>-20.89</td><td>46.00</td><td>31.21</td><td>22.68</td><td>2.97</td><td>31.85</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>5</td><td>706.09</td><td>26.24</td><td>-19.76</td><td>46.00</td><td>27.96</td><td>26.64</td><td>3.85</td><td>32.34</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>6</td><td>945.68</td><td>31.27</td><td>-14.73</td><td>46.00</td><td>27.02</td><td>30.46</td><td>4.46</td><td>30.90</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>7</td><td>9766.00</td><td>48.64</td><td>-25.36</td><td>74.00</td><td>59.15</td><td>39.33</td><td>16.21</td><td>66.40</td><td>100</td><td>0</td><td>Peak</td></tr></table></div> |          | Over         | Limit       | ReadAntenna | Cable  | Preamp | A/Pos  | T/Pos  | Remark | Freq | Level | Line | Level Factor | Loss Factor |  |  |  |  | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | cm | deg | 1 | 116.60 | 36.48 | -7.02 | 43.50 | 50.12 | 17.23 | 1.58 | 32.51 | 269 | 1 | QP | 2 | 150.28 | 33.71 | -9.79 | 43.50 | 47.43 | 16.92 | 1.78 | 32.52 | --- | --- | Peak | 3 | 299.66 | 24.58 | -21.42 | 46.00 | 34.90 | 19.19 | 2.51 | 32.13 | --- | --- | Peak | 4 | 419.94 | 25.11 | -20.89 | 46.00 | 31.21 | 22.68 | 2.97 | 31.85 | --- | --- | Peak | 5 | 706.09 | 26.24 | -19.76 | 46.00 | 27.96 | 26.64 | 3.85 | 32.34 | --- | --- | Peak | 6 | 945.68 | 31.27 | -14.73 | 46.00 | 27.02 | 30.46 | 4.46 | 30.90 | --- | --- | Peak | 7 | 9766.00 | 48.64 | -25.36 | 74.00 | 59.15 | 39.33 | 16.21 | 66.40 | 100 | 0 | Peak | <div><p>Site : 03CH11-HY<br/>Condition : PEAK_74 3m HORN 9120D-HF_1326 VERTICAL<br/>Detector : Peak<br/>Project : I20337</p><table><tr><th></th><th>Over</th><th>Limit</th><th>ReadAntenna</th><th>Cable</th><th>Preamp</th><th>A/Pos</th><th>T/Pos</th><th>Remark</th></tr><tr><th>Freq</th><th>Level</th><th>Line</th><th>Level Factor</th><th>Loss Factor</th><th></th><th></th><th></th><th></th></tr><tr><th>MHz</th><th>dBuV/m</th><th>dB</th><th>dBuV/m</th><th>dBuV</th><th>dB/m</th><th>dB</th><th>dB</th><th>cm</th><th>deg</th></tr><tr><td>1</td><td>45.70</td><td>34.03</td><td>-5.97</td><td>40.00</td><td>49.23</td><td>16.27</td><td>1.01</td><td>32.53</td><td>100</td><td>334</td><td>QP</td></tr><tr><td>2</td><td>117.30</td><td>31.78</td><td>-11.72</td><td>43.50</td><td>45.44</td><td>17.21</td><td>1.58</td><td>32.51</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>3</td><td>299.66</td><td>23.98</td><td>-22.02</td><td>46.00</td><td>34.30</td><td>19.19</td><td>2.51</td><td>32.13</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>4</td><td>480.08</td><td>25.86</td><td>-20.14</td><td>46.00</td><td>31.04</td><td>23.65</td><td>3.17</td><td>32.10</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>5</td><td>740.04</td><td>28.04</td><td>-17.96</td><td>46.00</td><td>28.09</td><td>27.94</td><td>3.93</td><td>32.07</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>6</td><td>900.09</td><td>33.92</td><td>-12.08</td><td>46.00</td><td>31.40</td><td>29.15</td><td>4.36</td><td>31.20</td><td>---</td><td>---</td><td>Peak</td></tr><tr><td>7</td><td>9478.00</td><td>46.08</td><td>-27.12</td><td>74.00</td><td>58.20</td><td>38.80</td><td>15.68</td><td>66.10</td><td>100</td><td>0</td><td>Peak</td></tr></table></div> |  | Over | Limit | ReadAntenna | Cable | Preamp | A/Pos | T/Pos | Remark | Freq | Level | Line | Level Factor | Loss Factor |  |  |  |  | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | dB | dB | cm | deg | 1 | 45.70 | 34.03 | -5.97 | 40.00 | 49.23 | 16.27 | 1.01 | 32.53 | 100 | 334 | QP | 2 | 117.30 | 31.78 | -11.72 | 43.50 | 45.44 | 17.21 | 1.58 | 32.51 | --- | --- | Peak | 3 | 299.66 | 23.98 | -22.02 | 46.00 | 34.30 | 19.19 | 2.51 | 32.13 | --- | --- | Peak | 4 | 480.08 | 25.86 | -20.14 | 46.00 | 31.04 | 23.65 | 3.17 | 32.10 | --- | --- | Peak | 5 | 740.04 | 28.04 | -17.96 | 46.00 | 28.09 | 27.94 | 3.93 | 32.07 | --- | --- | Peak | 6 | 900.09 | 33.92 | -12.08 | 46.00 | 31.40 | 29.15 | 4.36 | 31.20 | --- | --- | Peak | 7 | 9478.00 | 46.08 | -27.12 | 74.00 | 58.20 | 38.80 | 15.68 | 66.10 | 100 | 0 | Peak |
|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Over     | Limit        | ReadAntenna | Cable       | Preamp | A/Pos  | T/Pos  | Remark |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| Freq         | Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   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|        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| MHz          | dBuV/m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | dB       | dBuV/m       | dBuV        | dB/m        | dB     | dB     | cm     | deg    |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 1            | 116.60                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 36.48    | -7.02        | 43.50       | 50.12       | 17.23  | 1.58   | 32.51  | 269    | 1      | QP   |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 2            | 150.28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 33.71    | -9.79        | 43.50       | 47.43       | 16.92  | 1.78   | 32.52  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 3            | 299.66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 24.58    | -21.42       | 46.00       | 34.90       | 19.19  | 2.51   | 32.13  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 4            | 419.94                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 25.11    | -20.89       | 46.00       | 31.21       | 22.68  | 2.97   | 31.85  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 5            | 706.09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 26.24    | -19.76       | 46.00       | 27.96       | 26.64  | 3.85   | 32.34  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 6            | 945.68                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 31.27    | -14.73       | 46.00       | 27.02       | 30.46  | 4.46   | 30.90  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 7            | 9766.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 48.64    | -25.36       | 74.00       | 59.15       | 39.33  | 16.21  | 66.40  | 100    | 0      | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
|              | Over                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Limit    | ReadAntenna  | Cable       | Preamp      | A/Pos  | T/Pos  | Remark |        |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| Freq         | Level                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Line     | Level Factor | Loss Factor |             |        |        |        |        |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| MHz          | dBuV/m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | dB       | dBuV/m       | dBuV        | dB/m        | dB     | dB     | cm     | deg    |        |      |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 1            | 45.70                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 34.03    | -5.97        | 40.00       | 49.23       | 16.27  | 1.01   | 32.53  | 100    | 334    | QP   |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 2            | 117.30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 31.78    | -11.72       | 43.50       | 45.44       | 17.21  | 1.58   | 32.51  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 3            | 299.66                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 23.98    | -22.02       | 46.00       | 34.30       | 19.19  | 2.51   | 32.13  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 4            | 480.08                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 25.86    | -20.14       | 46.00       | 31.04       | 23.65  | 3.17   | 32.10  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 5            | 740.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 28.04    | -17.96       | 46.00       | 28.09       | 27.94  | 3.93   | 32.07  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 6            | 900.09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 33.92    | -12.08       | 46.00       | 31.40       | 29.15  | 4.36   | 31.20  | ---    | ---    | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |
| 7            | 9478.00                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 46.08    | -27.12       | 74.00       | 58.20       | 38.80  | 15.68  | 66.10  | 100    | 0      | Peak |       |      |              |             |  |  |  |  |     |        |    |        |      |      |    |    |    |     |   |        |       |       |       |       |       |      |       |     |   |    |   |        |       |       |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |                                                                                                                                                                                                                                                                                                                                                          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     |   |        |       |        |       |       |       |      |       |     |     |      |   |        |       |        |       |       |       |      |       |     |     |      |   |         |       |        |       |       |       |       |       |     |   |      |

## Annex. B Maximum Power Density

### B.1 RF Exposure Limit Introduction

According to NCC LP0002, the criteria listed in Table shall be used to evaluate the environmental impact of human exposure to radio frequency (RF) radiation as specified in §5.20.2.1 and §5.20.2.2.

| Frequency range (MHz)                                          | Electric field strength (V/m) | Magnetic field strength (A/m) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|----------------------------------------------------------------|-------------------------------|-------------------------------|-------------------------------------|--------------------------|
| <b>(A) Limits for Occupational/Controlled Exposures</b>        |                               |                               |                                     |                          |
| 0.3-3.0                                                        | 614                           | 1.63                          | *(100)                              | 6                        |
| 3.0-30                                                         | 1842/f                        | 4.89/f                        | *(900/f <sup>2</sup> )              | 6                        |
| 30-300                                                         | 61.4                          | 0.163                         | 1.0                                 | 6                        |
| 300-1500                                                       |                               |                               | f/300                               | 6                        |
| 1500-100,000                                                   |                               |                               | 5                                   | 6                        |
| <b>(B) Limits for General Population/Uncontrolled Exposure</b> |                               |                               |                                     |                          |
| 0.3-1.34                                                       | 614                           | 1.63                          | *(100)                              | 30                       |
| 1.34-30                                                        | 824/f                         | 2.19/f                        | *(180/f <sup>2</sup> )              | 30                       |
| 30-300                                                         | 27.5                          | 0.073                         | 0.2                                 | 30                       |
| 300-1500                                                       |                               |                               | f/1500                              | 30                       |
| 1500-100,000                                                   |                               |                               | 1.0                                 | 30                       |

The MPE was calculated at 20 cm to show compliance with the power density limit.

The following formula was used to calculate the Power Density:

$$S = \frac{PG}{4\pi R^2}$$

Where:

S = Power Density

P = Output Power at Antenna Terminals

G = Gain of Transmit Antenna (linear gain)

R = Distance from Transmitting Antenna

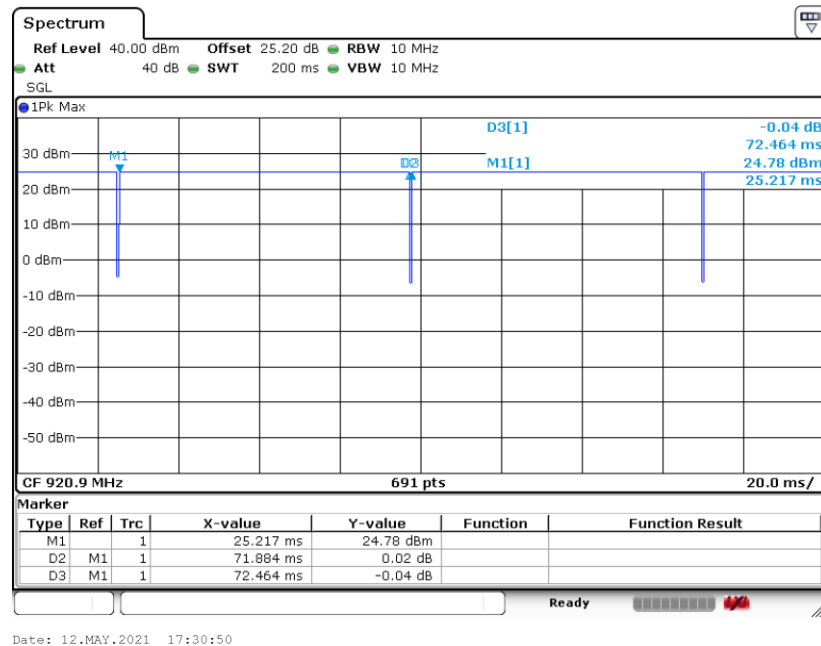
### B.2 Standalone Power Density Calculation

| Maximum Power Density |       |       |                    |                    |
|-----------------------|-------|-------|--------------------|--------------------|
| Max. Power            | Gain  | EIRP  | 20 cm PSD          | PSD Limit          |
| 25.42                 | -1.38 | 24.04 | 0.0505             | 0.61               |
| dBm                   | dBi   | dBm   | mW/cm <sup>2</sup> | mW/cm <sup>2</sup> |

## Appendix E. Single Frequency Mode of Duty Cycle

| Band | Duty Cycle(%) | T(us) | 1/T(kHz) | VBW Setting | Duty Factor(dB) |
|------|---------------|-------|----------|-------------|-----------------|
| Lora | 99.20         | 71884 | 0.01     | 10Hz        | 0.03            |

### LoRa



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