# FCC EMI TEST REPORT

| | | |
|---|---|---|
| **FCC ID** | : | **LHJ-FE5RW0D31** |
| **Equipment** | : | **FE5RW0D31** |
| **Brand Name** | : | **Continental** |
| **Model Name** | : | **FE5RW0D31** |
| **Applicant** | : | **Continental Automotive Systems, Inc.<br>21440 W Lake Cook Rd., Deer Park, IL 60010, USA** |
| **Manufacturer** | : | **Continental Automotive Systems, Inc.<br>21440 W Lake Cook Rd., Deer Park, IL 60010, USA** |
| **Standard** | : | **FCC 47 CFR FCC Part 15 Subpart B Class B** |

**The product was received on Nov. 26, 2021 and testing was performed from Jan. 25, 2022 to Jan. 25, 2022. We, Sporton International Inc. EMC & Wireless Communications Laboratory, would like to declare that the tested sample has been evaluated in accordance with the test procedures given in ANSI C63.4-2014 and has been in compliance with the applicable technical standards.**

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

Louis Wu

**Approved by: Louis Wu**

***Sporton International Inc. EMC & Wireless Communications Laboratory***
*No. 52, Huaya 1st Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C.)*

# Table of Contents

# History of this test report

| Report No. | Version | Description | Issue Date |
|---|---|---|---|
| FC1N2419-01 | 01 | Initial issue of report | May 31, 2022 |
| FC1N2419-01 | 02 | 1. Revise Product Specification of Equipment Under Test<br>2. Revise Test Mode | Jun. 15, 2022 |
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# Summary of Test Result

| Report Clause | Ref Std. Clause | Test Items | Result (PASS/FAIL) | Remark |
|---|---|---|---|---|
| - | 15.107 | AC Conducted Emission | Not Required | - |
| 3.1 | 15.109 | Radiated Emission | Pass | 8.81 dB under the limit at 17980.000 MHz |

**Note:** Not required means after assessing, test items are not necessary to carry out.

| **Declaration of Conformity:** |
|---|
| 1. The test results (PASS/FAIL) with all measurement uncertainty excluded are presented in accordance with the regulation limits or requirements declared by manufacturers.<br>It's means measurement values may risk exceeding the limit of regulation standards, if measurement uncertainty is include in test results.<br>2. The measurement uncertainty please refer to this report "Uncertainty of Evaluation". |
| **Comments and Explanations:** |
| The product specifications of the EUT presented in the report are declared by the manufacturer who shall take full responsibility for the authenticity. |

**Reviewed by: Yun Huang**

**Report Producer: Kaye Yang**

# 1. General Description

## 1.1. Product Feature of Equipment Under Test

| Product Feature | |
|---|---|
| **Equipment** | FE5RW0D31 |
| **Brand Name** | Continental |
| **Model Name** | FE5RW0D31 |
| **FCC ID** | LHJ-FE5RW0D31 |
| **EUT supports Radios application** | GSM/EGPRS/WCDMA/HSPA/LTE/5G NR/GNSS |
| **EUT Stage** | Identical Prototype |

**Remark:** The EUT's information above is declared by manufacturer.

## 1.2. Product Specification of Equipment Under Test

| Product Specification is subject to this standard | |
|---|---|
| **Tx Frequency** | GSM850: 824.2 MHz ~ 848.8 MHz<br>GSM1900: 1850.2 MHz ~ 1909.8 MHz<br>WCDMA Band V: 826.4 MHz ~ 846.6 MHz<br>LTE Band 2: 1850.7 MHz ~ 1909.3 MHz<br>LTE Band 4: 1710.7 MHz ~ 1754.3 MHz<br>LTE Band 5: 824.7 MHz ~ 848.3 MHz<br>LTE Band 7 : 2502.5 MHz ~ 2567.5 MHz<br>LTE Band 25: 1850.7 MHz ~ 1914.3 MHz<br>LTE Band 26: 824.7 MHz ~ 848.3 MHz<br>LTE Band 38: 2572.5 MHz ~ 2617.5 MHz<br>LTE Band 41: 2498.5 MHz ~ 2687.5 MHz<br>5G NR n77: 3700 MHz ~ 3980 MHz |
| **Rx Frequency** | GSM850: 869.2 MHz ~ 893.8 MHz<br>GSM1900: 1930.2 MHz ~ 1989.8 MHz<br>WCDMA Band V: 871.4 MHz ~ 891.6 MHz<br>LTE Band 2: 1930.7 MHz ~ 1989.3 MHz<br>LTE Band 4: 2110.7 MHz ~ 2154.3 MHz<br>LTE Band 5: 869.7 MHz ~ 893.3 MHz<br>LTE Band 7 : 2622.5 MHz ~ 2687.5 MHz<br>LTE Band 25: 1930.7 MHz ~ 1994.3 MHz<br>LTE Band 26: 869.7 MHz ~ 893.3 MHz<br>LTE Band 38: 2572.5 MHz ~ 2617.5 MHz<br>LTE Band 41: 2498.5 MHz ~ 2687.5 MHz<br>5G NR n77: 3700 MHz ~ 3980 MHz<br>GNSS : 1.57542 GHz; 1176.45 MHz<br>(GPS / Glonass / BDS / Galileo / SBAS) |
| **Antenna Type** | WWAN: Fixed External Antenna<br>GNSS: Fixed External Antenna |

| Product Specification is subject to this standard | |
|---|---|
| **Type of Modulation** | GSM / GPRS: GMSK<br>EDGE(MCS 0-4): GMSK/(MCS 5-9): 8PSK<br>WCDMA: QPSK (Uplink)<br>HSDPA: 64QAM (Downlink)<br>HSUPA : QPSK (Uplink)<br>LTE: QPSK / 16QAM / 64QAM<br>5G NR: PI/2 BPSK/QPSK/16QAM/64QAM/256QAM<br>GNSS: BPSK |

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

## 1.3. Modification of EUT

No modifications made to the EUT during the testing.

## 1.4. Test Location

| | |
|---|---|
| **Test Site** | Sporton International Inc. EMC & Wireless Communications Laboratory |
| **Test Site Location** | No.52, Huaya 1st Rd., Guishan Dist.,<br>Taoyuan City 333, Taiwan (R.O.C.)<br>TEL: +886-3-327-3456<br>FAX: +886-3-328-4978 |
| **Test Site No.** | **Sporton Site No.** |
| | 03CH06-HY |

FCC designation No.: TW1093

## 1.5. Applicable Standards

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

- FCC 47 CFR FCC Part 15 Subpart B Class B
- ANSI C63.4-2014

**Remark:** All test items were verified and recorded according to the standards and without any deviation during the test.

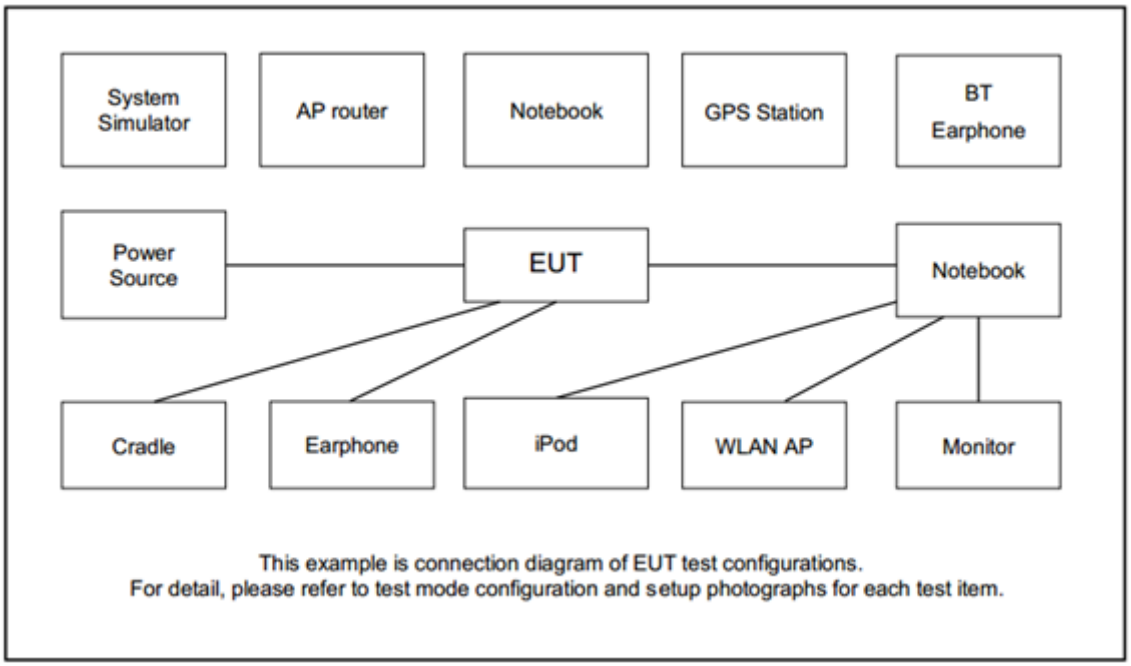
# 2. Test Configuration of Equipment Under Test

## 2.1. Test Mode

The EUT is tested along with the peripherals, operating under possible configurations in compliant with normal operation. The maximum emissions can be identified by a pre-scan carried out in different orientations of placement pursuant to ANSI C63.4-2014. Frequency range covered: Radiation Emission (30 MHz to the 5th harmonics of the highest fundamental frequency or to 40 GHz, whichever is lower).

| Test Items | Functions Enabled |
|---|---|
| **Radiated Emissions** | Mode 1: GSM850 (GPRS Class 8) Link + WWAN Antenna*4 + GPS Antenna + GPS Rx + DC 12V + SIM 1<br>Mode 2: 5G NR n77 Link + WWAN Antenna*4 + GPS Antenna + GPS Rx + DC 12V + SIM 1 |
| **Remark:**<br>**1.** The worst case of RE is mode 1; only the test data of this mode was reported.<br>**2.** For Radiation Emission after pre-scanned the cellular band between 30MHz ~ 960MHz (GSM850/ 5G NR n77); only the worst case for cellular band test data of this mode was reported.<br>**3.** For 5G NR test combination is EN-DC Band 5A-n77A. | |

## 2.2. Connection Diagram of Test System



## 2.3. Support Unit used in test configuration and system

| Item | Equipment | Brand Name | Model Name | FCC ID | Data Cable | Power Cord |
|---|---|---|---|---|---|---|
| 1. | 5G Wireless Test Platform | Anritsu | MT8000A | N/A | N/A | Unshielded, 1.8m |
| 2. | System Simulator | Anritsu | MT8821C | N/A | N/A | Unshielded, 1.8m |
| 3. | GPS Station | Pendulum | GSG-54 | N/A | N/A | Unshielded, 1.8m |
| 4. | DC Power Supply | GW Instek | GEU810960 | N/A | N/A | Unshielded, 1.8m |
| 5. | Antenna | Taoglas | TG.55.8113 | N/A | N/A | N/A |
| 6. | GPS Antenna | Tallysman | 33-7972-00-3000 | N/A | N/A | N/A |

## 2.4. EUT Operation Test Setup

The EUT is in GSM or 5G NR idle mode during the test. The EUT is synchronized with the BCCH, and has been continuous receiving mode by setting paging reorganization of the system simulator.

The following programs installed in the EUT are programmed during the test:

1. Execute “GPS Test” to make the EUT receive continuous signals from GPS station.

# 3. Test Result

## 3.1. Test of Radiated Emission Measurement

### 3.1.1. Limit of Radiated Emission

The emissions from an unintentional radiator shall not exceed the field strength levels specified in the following table:

**<Class B>**

| Frequency (MHz) | Field Strength (microvolts/meter) | Measurement Distance (meters) |
|---|---|---|
| 30 – 88 | 100 | 3 |
| 88 – 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

### 3.1.2. Measuring Instruments

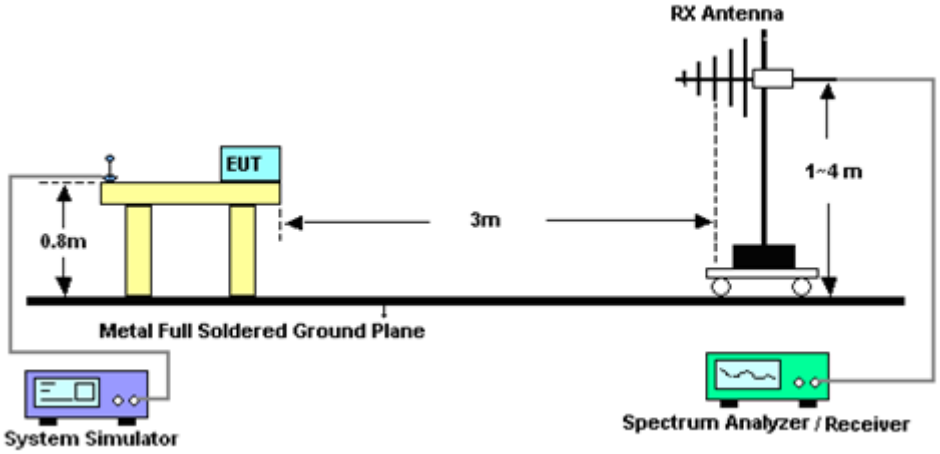
Please refer to the measuring equipment list in this test report.

### 3.1.3. Test Procedures

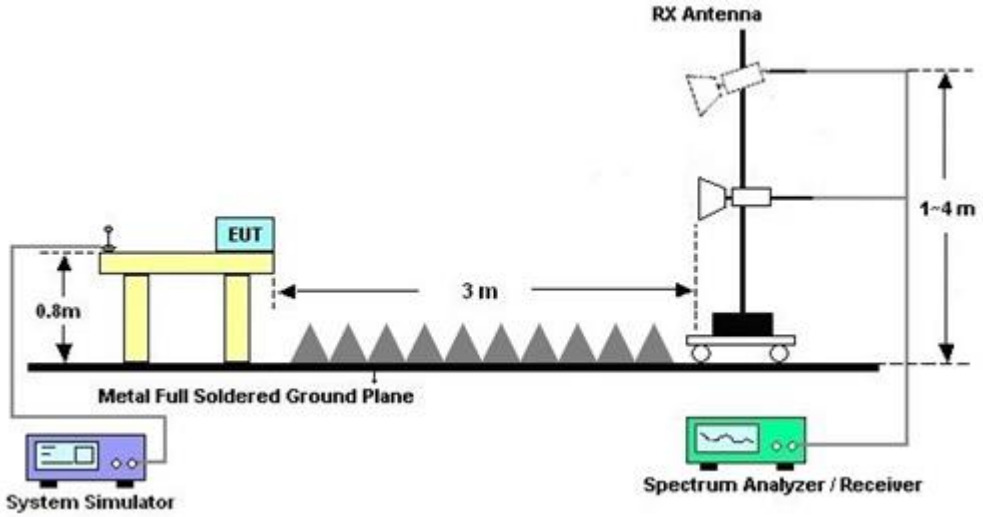
1. The EUT is placed on a turntable with 0.8 meter above ground.
2. The EUT is set 3 meters from the interference receiving antenna, which is mounted on the top of a variable height antenna tower.
3. The table is rotated 360 degrees to determine the position of the highest radiation.
4. The antenna is 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 is arranged to its worst case and then tune the antenna tower (from 1 m to 4 m) and turntable (from 0 degree to 360 degrees) to find the maximum reading.
6. Set the test-receiver system to Peak Detect Function and specified bandwidth with Maximum Hold Mode (RBW=120 kHz/VBW=300 kHz for frequency below 1 GHz; RBW=1 MHz VBW=3 MHz (Peak), RBW=1 MHz/VBW=10 Hz (Average) for frequency above 1 GHz).
7. If the emission level of the EUT in peak mode is 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

## 3.1.4. Test Setup of Radiated Emission

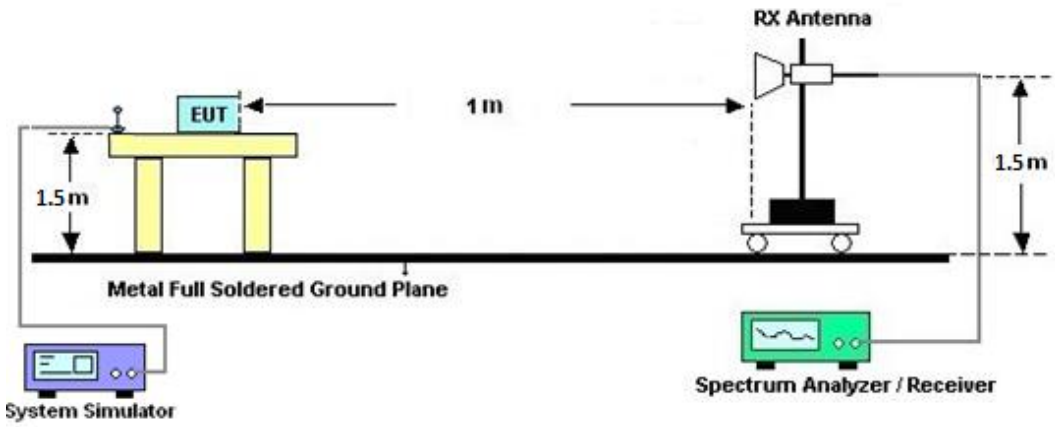
**For Radiated Emissions from 30 MHz to 1 GHz**




**For Radiated Emissions from 1 GHz to 18GHz**




**For radiated test above 18GHz**



### 3.1.5. Test Result of Radiated Emission

Please refer to Appendix A.

# 4. List of Measuring Equipment

| Instrument | Brand Name | Model No. | Serial No. | Characteristics | Calibration Date | Test Date | Due Date | Remark |
|---|---|---|---|---|---|---|---|---|
| Amplifier | SONOMA | 310N | 186713 | 9kHz~1GHz | Apr. 29, 2021 | Jan. 25, 2022 | Apr. 28, 2022 | Radiation (03CH06-HY) |
| Bilog Antenna | Schaffner | CBL 6111C & N-6-06 | 2725 & AT-N0601 | 30MHz~1GHz | Nov. 11, 2021 | Jan. 25, 2022 | Nov. 10, 2022 | Radiation (03CH06-HY) |
| EMI Test Receiver | Rohde & Schwarz | ESU26 | 100472 | 20Hz~26.5GHz | Feb. 03, 2021 | Jan. 25, 2022 | Feb. 02, 2022 | Radiation (03CH06-HY) |
| Horn Antenna | SCHWARZBECK | BBHA 9120 D | 9120D-1156 | 1GHz~18GHz | Sep. 27, 2021 | Jan. 25, 2022 | Sep. 26, 2022 | Radiation (03CH06-HY) |
| Preamplifier | Jet-Power | JPA00101800-30-10P | 1601180001 | 1GHz~18GHz | Jul. 19, 2021 | Jan. 25, 2022 | Jul. 18, 2022 | Radiation (03CH06-HY) |
| RF Cable | HUBER + SUHNER | SF102_7000mm | 532299/2 | 30MHz to 40GHz | Jul. 05, 2021 | Jan. 25, 2022 | Jul. 04, 2022 | Radiation (03CH06-HY) |
| RF Cable | HUBER + SUHNER | SF102_3000mm | 532422/2 | 30MHz to 40GHz | Jul. 05, 2021 | Jan. 25, 2022 | Jul. 04, 2022 | Radiation (03CH06-HY) |
| RF Cable | HUBER + SUHNER | SF102_2000mm | 532421/2 | 30MHz to 40GHz | Jul. 05, 2021 | Jan. 25, 2022 | Jul. 04, 2022 | Radiation (03CH06-HY) |
| RF Cable | HUBER + SUHNER | SF104 | 802433/4 | 30Mhz to 18Ghz | Aug. 19, 2021 | Jan. 25, 2022 | Aug. 18, 2022 | Radiation (03CH06-HY) |
| Controller | INN-CO | EM1000 | 060782 | Control Turn table & Ant Mast | N/A | Jan. 25, 2022 | N/A | Radiation (03CH06-HY) |
| Antenna Mast | MF | MF-7802 | MF780208212 | 1m~4m | N/A | Jan. 25, 2022 | N/A | Radiation (03CH06-HY) |
| Turn Table | INN-CO | DS2000 | 420/650/00 | 0-360 degree | N/A | Jan. 25, 2022 | N/A | Radiation (03CH06-HY) |
| Software | Audix | E3 6.2009-8-24(k5) | N/A | N/A | N/A | Jan. 25, 2022 | N/A | Radiation (03CH06-HY) |
| SHF-EHF Horn Antenna | SCHWARZBECK | BBHA 9170 | BBHA9170251 | 18GHz~40GHz | Nov. 30, 2021 | Jan. 25, 2022 | Nov. 29, 2022 | Radiation (03CH06-HY) |
| Preamplifier | EMEC | EM18G40G | 0600789 | 18-40GHz | Jul. 23, 2021 | Jan. 25, 2022 | Jul. 22, 2022 | Radiation (03CH06-HY) |
| RF Cable | HUBER + SUHNER | SUCOFLEX 102 | 801606/2 | 9KHz ~ 40GHz | Apr. 03, 2021 | Jan. 25, 2022 | Apr. 02, 2022 | Radiation (03CH06-HY) |

# 5. Uncertainty of Evaluation

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

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

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

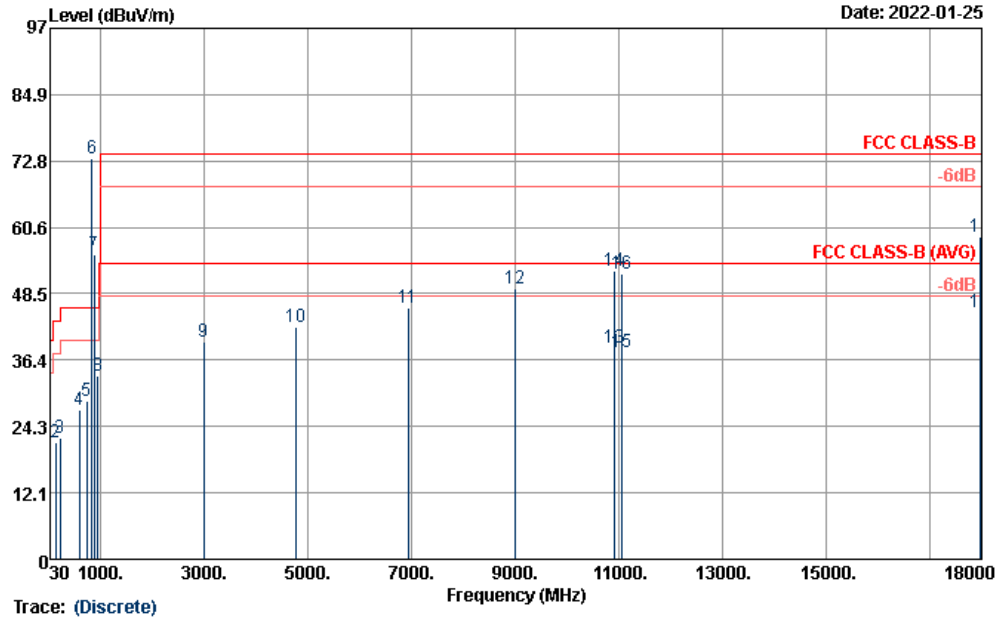
| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **5.4 dB** |

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

| | |
|---|---|
| **Measuring Uncertainty for a Level of Confidence of 95% (U = 2Uc(y))** | **4.3 dB** |

# Appendix A. Radiated Emission Test Result

| | | | |
|---|---|---|---|
| **Test Engineer :** | Howard Huang | **Temperature :** | 24~25°C |
| | | **Relative Humidity :** | 46~48% |
| **Test Distance :** | 3m | **Polarization :** | Horizontal |
| **Remark :** | #6 is mobile station signal which can be ignored.<br>#7 is system simulator signal which can be ignored. | | |

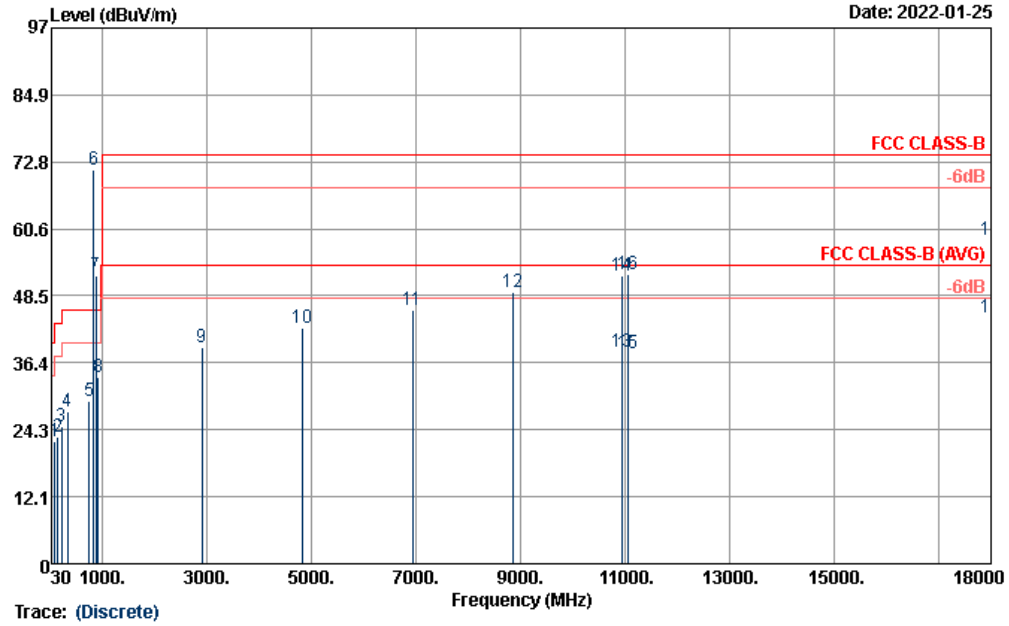



Trace: (Discrete)

Site : 03CH06-HY
Condition : FCC CLASS-B 3m 9120D_1156 VERTICAL
Project : 1N2419-01
Power : DC12V
Memo : Mode 1
: X

| | | Freq | Level | Over Limit | Limit Line | Read Level | Factor | A/Pos | T/Pos | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | cm | deg | |
| 1 | | 41.88 | 27.91 | -12.09 | 40.00 | 39.94 | -12.03 | --- | --- | Peak |
| 2 | | 131.52 | 21.22 | -22.28 | 43.50 | 33.00 | -11.78 | --- | --- | Peak |
| 3 | | 220.35 | 22.03 | -23.97 | 46.00 | 35.71 | -13.68 | --- | --- | Peak |
| 4 | | 594.00 | 27.22 | -18.78 | 46.00 | 29.10 | -1.88 | --- | --- | Peak |
| 5 | | 741.00 | 28.80 | -17.20 | 46.00 | 27.94 | 0.86 | --- | --- | Peak |
| 6 | * | 836.40 | 73.32 | | | 71.05 | 2.27 | --- | --- | Peak |
| 7 | * | 881.40 | 55.62 | | | 52.97 | 2.65 | --- | --- | Peak |
| 8 | | 945.40 | 33.49 | -12.51 | 46.00 | 28.40 | 5.09 | --- | --- | Peak |
| 9 | | 2992.00 | 39.59 | -34.41 | 74.00 | 64.69 | -25.10 | --- | --- | Peak |
| 10 | | 4778.00 | 42.44 | -31.56 | 74.00 | 61.43 | -18.99 | --- | --- | Peak |
| 11 | | 6934.00 | 45.85 | -28.15 | 74.00 | 60.21 | -14.36 | --- | --- | Peak |
| 12 | | 8992.00 | 49.56 | -24.44 | 74.00 | 58.75 | -9.19 | --- | --- | Peak |
| 13 | | 10926.00 | 38.61 | -15.39 | 54.00 | 43.00 | -4.39 | 100 | 84 | Average |
| 14 | | 10926.00 | 52.65 | -21.35 | 74.00 | 57.04 | -4.39 | 100 | 84 | Peak |
| 15 | | 11044.00 | 37.82 | -16.18 | 54.00 | 42.20 | -4.38 | 100 | 184 | Average |
| 16 | | 11044.00 | 52.25 | -21.75 | 74.00 | 56.63 | -4.38 | 100 | 184 | Peak |
| 17 | | 17980.00 | 45.19 | -8.81 | 54.00 | 33.30 | 11.89 | --- | --- | Average |
| 18 | | 17980.00 | 58.94 | -15.06 | 74.00 | 47.05 | 11.89 | --- | --- | Peak |

| | | | |
|---|---|---|---|
| **Test Engineer :** | Howard Huang | **Temperature :** | 24~25°C |
| | | **Relative Humidity :** | 46~48% |
| **Test Distance :** | 3m | **Polarization :** | Vertical |
| **Remark :** | #6 is mobile station signal which can be ignored.<br>#7 is system simulator signal which can be ignored. | | |




Site : 03CH06-HY
Condition : FCC CLASS-B 3m 9120D_1156 HORIZONTAL
Project : 1N2419-01
Power : DC12V
Memo : Mode 1
: X

| | | Freq | Level | Over Limit | Limit Line | Read Level | Factor | A/Pos | T/Pos | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| | | MHz | dBuV/m | dB | dBuV/m | dBuV | dB/m | cm | deg | |
| 1 | | 96.96 | 22.21 | -21.29 | 43.50 | 36.26 | -14.05 | --- | --- | Peak |
| 2 | | 149.34 | 23.04 | -20.46 | 43.50 | 35.36 | -12.32 | --- | --- | Peak |
| 3 | | 221.43 | 24.78 | -21.22 | 46.00 | 38.36 | -13.58 | --- | --- | Peak |
| 4 | | 330.80 | 27.61 | -18.39 | 46.00 | 36.24 | -8.63 | --- | --- | Peak |
| 5 | | 750.10 | 29.58 | -16.42 | 46.00 | 28.67 | 0.91 | --- | --- | Peak |
| 6 | * | 836.40 | 71.44 | | | 69.17 | 2.27 | --- | --- | Peak |
| 7 | * | 881.40 | 52.21 | | | 49.56 | 2.65 | --- | --- | Peak |
| 8 | | 929.30 | 33.68 | -12.32 | 46.00 | 29.53 | 4.15 | --- | --- | Peak |
| 9 | | 2902.00 | 39.09 | -34.91 | 74.00 | 64.27 | -25.18 | --- | --- | Peak |
| 10 | | 4822.00 | 42.56 | -31.44 | 74.00 | 61.36 | -18.80 | --- | --- | Peak |
| 11 | | 6938.00 | 45.88 | -28.12 | 74.00 | 60.22 | -14.34 | --- | --- | Peak |
| 12 | | 8848.00 | 49.04 | -24.96 | 74.00 | 58.88 | -9.84 | --- | --- | Peak |
| 13 | | 10938.00 | 38.24 | -15.76 | 54.00 | 42.60 | -4.36 | 100 | 92 | Average |
| 14 | | 10938.00 | 52.09 | -21.91 | 74.00 | 56.45 | -4.36 | 100 | 92 | Peak |
| 15 | | 11052.00 | 38.19 | -15.81 | 54.00 | 42.60 | -4.41 | 100 | 156 | Average |
| 16 | | 11052.00 | 52.52 | -21.48 | 74.00 | 56.93 | -4.41 | 100 | 156 | Peak |
| 17 | | 17995.00 | 44.59 | -9.41 | 54.00 | 32.29 | 12.30 | --- | --- | Average |
| 18 | | 17995.00 | 58.63 | -15.37 | 74.00 | 46.33 | 12.30 | --- | --- | Peak |