# FCC PART 15C

# TEST REPORT

For

# AEI Protect-On Systems Limited

Flat B, 4/F., Effort Industrial Building, 2-8 Kung Yip Street, Kwai Chung, N.T., Hong Kong

## FCC ID: OGJ-DK2822-1

| Report Type: | Product Type: |
|---|---|
| Original Report | RFID ACCESS CONTROL KEYPAD |

| | |
|---|---|
| **Report Number:** | SZNS210901-45673E-RF |
| **Report Date:** | 2021-09-16 |
| **Reviewed By:** | Candy Li<br>RF Engineer |
| **Prepared By:** | Shenzhen Accurate Technology Co., Ltd.<br>1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China<br>Tel: (0755) 26503290<br>Fax: (0755) 26503396<br>Http://www.atc-lab.com |

**Note:** This report may contain data that are not covered by the A2LA accreditation and are marked with an asterisk "★".

Shenzhen Accurate Technology Co., Ltd. is not responsible for the authenticity of any test data provided by the applicant. Data included from the applicant that may affect test results are marked with an asterisk '*'. Customer model name, addresses, names, trademarks etc. are not considered data.

# TABLE OF CONTENTS

# GENERAL INFORMATION

## Product Description for Equipment Under Test (EUT)

| | |
|---|---|
| Product | RFID ACCESS CONTROL KEYPAD |
| Tested Model | DK-2822 |
| Frequency Range | 125 kHz |
| Modulation: | PSK |
| Antenna Specification | Coil |
| Voltage Range | DC 12V |
| Date of Test | 2021-09-09 to 2021-09-15 |
| Sample serial number | SZNS210901-45673E-RF-S1 |
| Received date | 2021-09-01 |
| Sample/EUT Status | Good Condition |

## Objective

This report is in accordance with Part 2, Subpart J, and Part 15, Subparts A and C of the Federal Communications Commission's rules.

The objective is to determine the compliance of EUT with FCC rules, section 15.203, 15.205, 15.209, 15.207 and 15.215(c).

## Related Submittal(s)/Grant(s)

No Related Submittal(s)/Grant(s).

## Test Methodology

All measurements contained in this report were conducted with ANSI C63.10-2013, American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices.

All emissions measurement was performed at Shenzhen Accurate Technology Co., Ltd. The radiated testing was performed at an antenna-to-EUT distance of 3 meters.

## Measurement Uncertainty

| Parameter | | Uncertainty |
|---|---|---|
| Occupied Channel Bandwidth | | 5% |
| Emissions, Radiated | 9KHz-30MHz | 2.66 dB |
| | 30MHz - 1GHz | 4.28dB |
| Conducted Emissions | AC Mains | 2.72 dB |
| Temperature | | 1℃ |
| Humidity | | 6% |
| Supply voltages | | 0.4% |

*Note: The extended uncertainty given in this report is obtained by combining the standard uncertainty times the coverage factor K with the 95% confidence interval. Otherwise required by the applicant or Product Regulations, Decision Rule in this report did not consider the uncertainty.*

## Test Facility

The test site used by Shenzhen Accurate Technology Co., Ltd. to collect test data is located on the 1/F., Building A, Changyuan New Material Port, Science & Industry Park, Nanshan District, Shenzhen, Guangdong, P.R. China.

The test site has been approved by the FCC under the KDB 974614 D01 and is listed in the FCC Public Access Link (PAL) database, FCC Registration No.: 708358, the FCC Designation No.: CN1189. Accredited by American Association for Laboratory Accreditation (A2LA) The Certificate Number is 429 7.01.

Listed by Innovation, Science and Economic Development Canada (ISEDC), the Registration Number is 5077A.

# SYSTEM TEST CONFIGURATION

## Justification

The system was configured for testing in engineering mode.

## EUT Exercise Software

No software used in test.

## Support Equipment List and Details

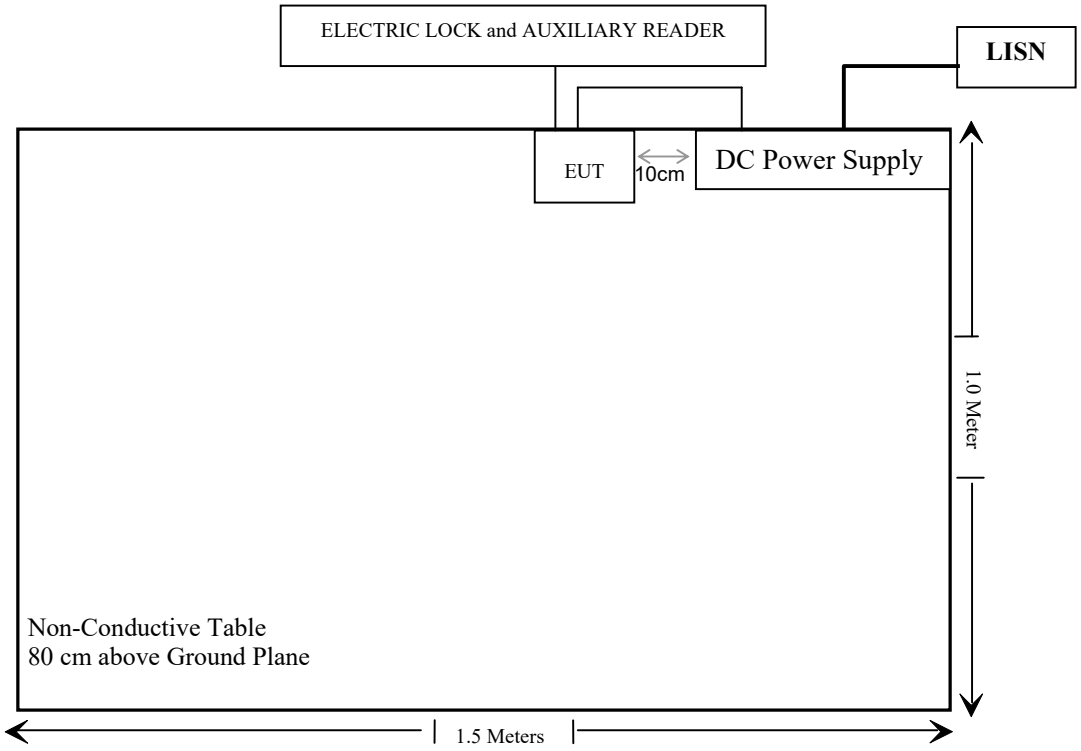
| Manufacturer | Description | Model | Serial Number |
|---|---|---|---|
| UNI-T | DC Power Supply | UTP3333TD | Unknown |
| AEI Protect-On Systems Limited | ELECTRIC LOCK | Lock1 | Unknown |
| AEI Protect-On Systems Limited | AUXILIARY READER | AR-2802 | Unknown |

## External I/O Cable

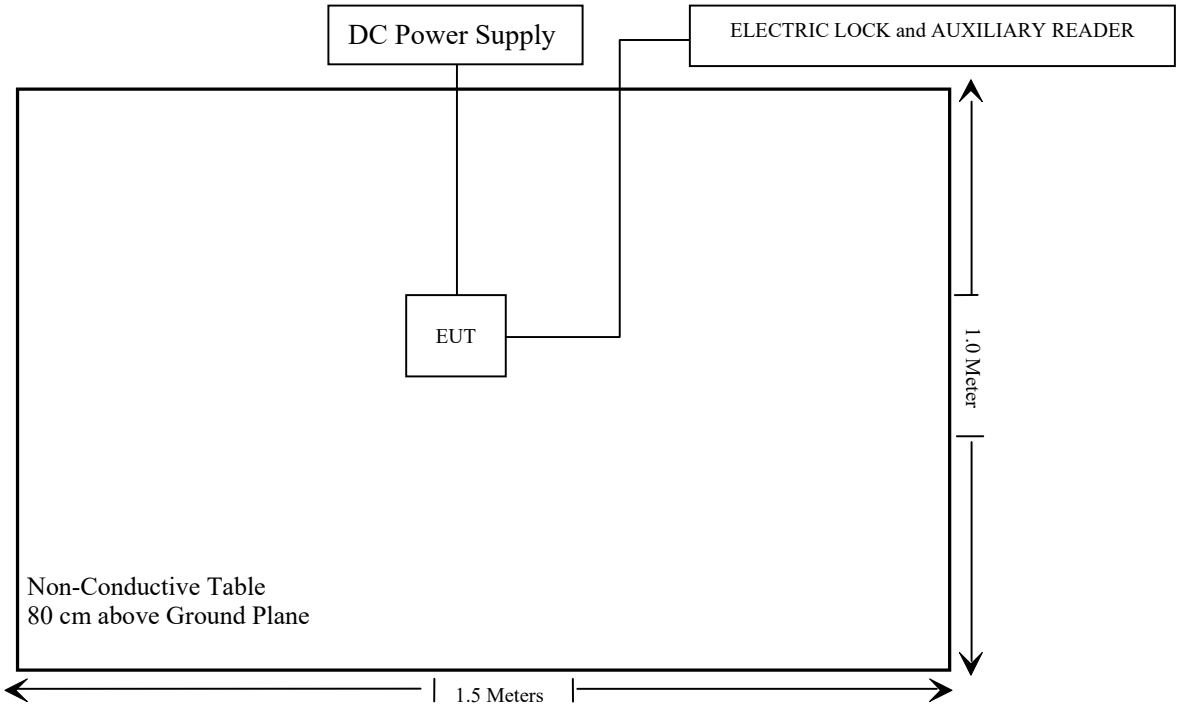
| Cable Description | Length (m) | From Port | To |
|---|---|---|---|
| Un-Shielding Detachable DC Cable 1 | 0.2 | DC Power Supply | EUT |
| Un-Shielding Detachable DC Cable 2 | 1.2 | DC Power Supply | EUT |
| Un-Shielding Detachable I/O Cable | 6.5 | ELECTRIC LOCK and AUXILIARY READER | EUT |

## Block Diagram of Test Setup

For Conducted Emission



For Radiated Emission



# SUMMARY OF TEST RESULTS

| FCC Rules | Description of Test | Result |
|---|---|---|
| FCC§15.203 | Antenna Requirement | Compliant |
| FCC§15.207 | AC Line Conducted Emission | Compliant |
| §15.205, §15.209 | Radiated Emission Test | Compliant |
| §15.215 (c) | 20 dB Bandwidth | Compliant |

# TEST EQUIPMENT LIST

| Manufacturer | Description | Model | Serial Number | Calibration Date | Calibration Due Date |
|---|---|---|---|---|---|
| **EMI** | | | | | |
| Rohde & Schwarz | Test Receiver | ESPI3 | 100396 | 2020/12/24 | 2021/12/23 |
| Rohde & Schwarz | L.I.S.N. | ESH3-Z5 | 100305 | 2020/12/25 | 2021/12/24 |
| Anritsu Corp | 50ΩCoaxial Switch | MP59B | 6200506474 | 2020/12/25 | 2021/12/24 |
| Schwarzbeck | RF Coaxial Cable | N-2m | No.2 | 2020/01/04 | 2023/01/03 |
| Conducted Emission Test Software: ES-K1 V1.71 | | | | | |
| Rohde& Schwarz | Test Receiver | ESPI3 | 100396 | 2020/12/24 | 2021/12/23 |
| Rohde& Schwarz | Test Receiver | ESR | 102725 | 2020/12/25 | 2021/12/24 |
| Schwarzbeck | Bilog Antenna | VULB9163 | 9163-323 | 2020/01/05 | 2023/01/04 |
| Schwarzbeck | LOOP Antenna | FMZB1516 | 1516131 | 2020/01/05 | 2023/01/04 |
| SONOMA INSTRUMENT | Amplifier | 310 N | 186131 | 2020/12/25 | 2021/12/24 |
| Anritsu Corp | 50 Coaxial Switch | MP59B | 6100237248 | 2020/12/25 | 2021/12/24 |
| Schwarzbeck | RF Coaxial Cable | N-5m | No.1 | 2020/01/04 | 2023/01/03 |
| Schwarzbeck | RF Coaxial Cable | N-1m | No.6 | 2020/01/04 | 2023/01/03 |
| SUHNER | RF Coaxial Cable | N-6m | No.10 | 2020/01/04 | 2023/01/03 |
| SUHNER | RF Coaxial Cable | N-0.5m | No.15 | 2020/01/04 | 2023/01/03 |
| Radiated Emission Test Software: EZ_EMC V 1.1.4.2 | | | | | |

*** Statement of Traceability:** Shenzhen Accurate Technology Co., Ltd. attests that all calibrations have been performed in accordance to requirements that traceable to National Primary Standards and International System of Units (SI).

# FCC§15.203 – ANTENNA REQUIREMENT

## Applicable Standard

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator shall be considered sufficient to comply with the provisions of this section.

## Antenna Connected Construction

The EUT has one internal coil antenna arrangement, which was permanently attached, fulfill the requirement of this section. Please refer to the EUT photos.

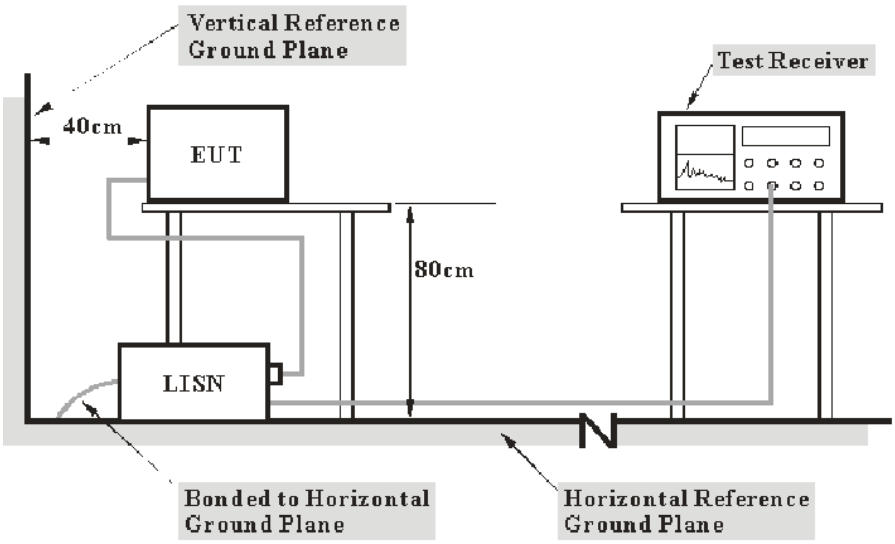
**Result:** Compliant.

# FCC §15.207 – AC LINE CONDUCTED EMISSION

## Applicable Standard

FCC§15.207

## EUT Setup




Note: 1. Support units were connected to second LISN.
2. Both of LISNs (AMN) 80 cm from EUT and at the least 80 cm from other units and other metal planes support units.

The setup of EUT is according with per ANSI C63.10-2013 measurement procedure. The specification used was with the FCC Part 15.207 limits.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver Setup

The EMI test receiver was set to investigate the spectrum from 150 kHz to 30 MHz.

During the conducted emission test, the EMI test receiver was set with the following configurations:

| Frequency Range | IF B/W |
|---|---|
| 150 kHz – 30 MHz | 9 kHz |

## Test Procedure

During the conducted emission test, the DC supply power was connected to the outlet of the LISN.

Maximizing procedure was performed on the six (6) highest emissions of the EUT.

All final data was recorded in the Quasi-peak and average detection mode.

## Corrected Factor & Margin Calculation

The basic equation is as follows:

Level (QuasiPeak or Average) = Reading Level + Transd Factor

Note:
Transd Factor = Cable loss + Factor of coupling device

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Limit – Level

## Test Results Summary

According to the recorded data in following table, the EUT complied with the FCC Part 15.207.

## Test Data

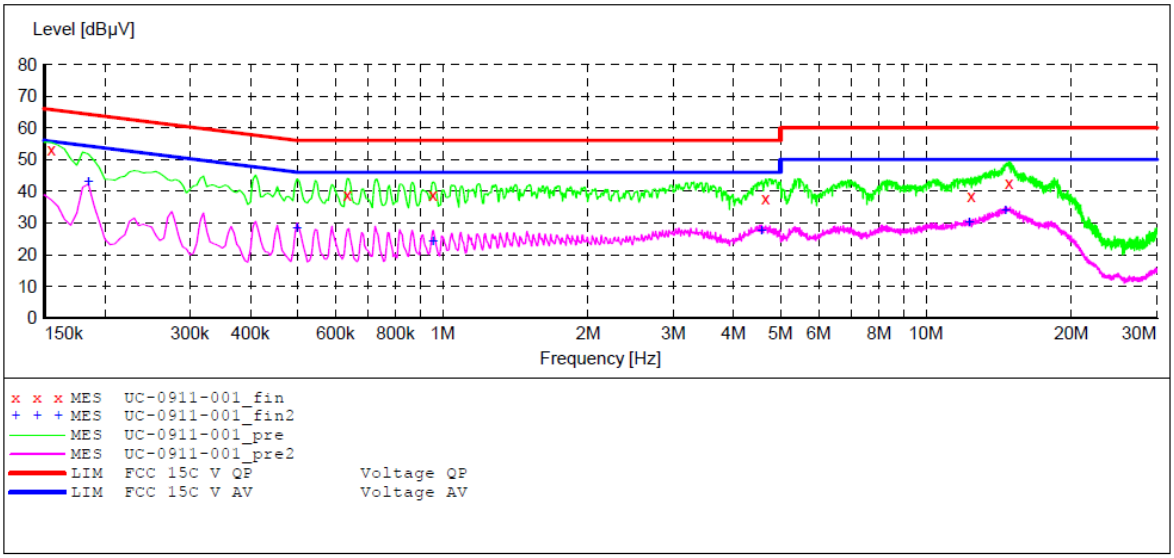
### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25°C |
| **Relative Humidity:** | 65 % |
| **ATM Pressure:** | 101.0 kPa |

*The testing was performed by Black Ding on 2021-09-11.*

*Test mode: Transimitting*

**AC 120 V/60 Hz, Line:**




***MEASUREMENT RESULT: "UC-0911-001_fin"***

9/11/2020 9:24AM

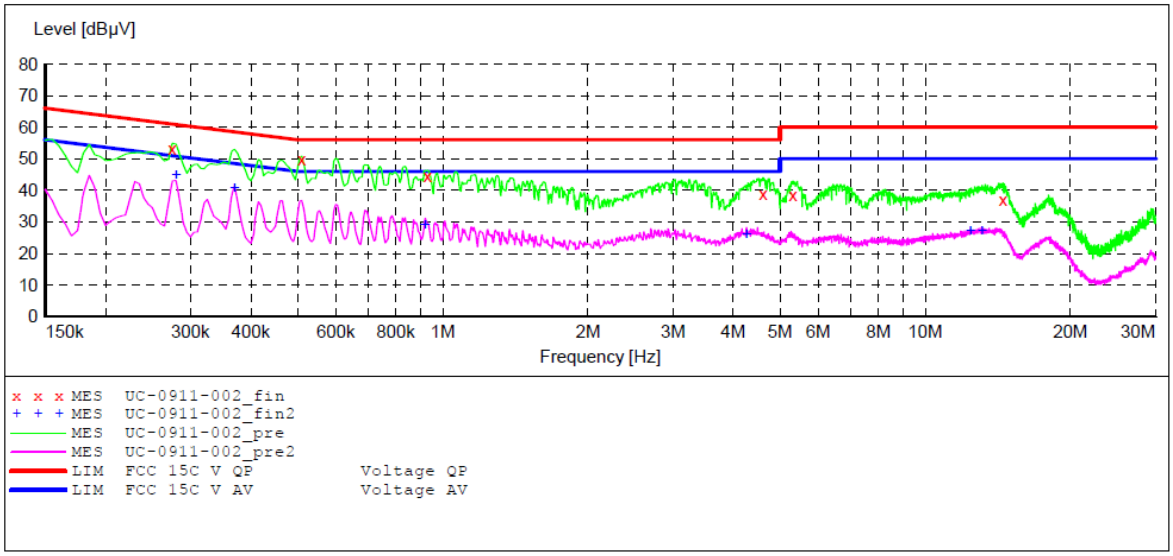
| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.155000 | 53.20 | 10.5 | 66 | 12.8 | QP | L1 | GND |
| 0.635000 | 38.90 | 10.8 | 56 | 17.1 | QP | L1 | GND |
| 0.955000 | 38.70 | 10.8 | 56 | 17.3 | QP | L1 | GND |
| 4.660000 | 37.70 | 11.1 | 56 | 18.3 | QP | L1 | GND |
| 12.400000 | 38.60 | 11.3 | 60 | 21.4 | QP | L1 | GND |
| 14.860000 | 42.60 | 11.4 | 60 | 17.4 | QP | L1 | GND |

***MEASUREMENT RESULT: "UC-0911-001_fin2"***

9/11/2020 9:24AM

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.185000 | 43.10 | 10.5 | 54 | 10.9 | AV | L1 | GND |
| 0.500000 | 28.30 | 10.7 | 46 | 17.7 | AV | L1 | GND |
| 0.955000 | 24.20 | 10.8 | 46 | 21.8 | AV | L1 | GND |
| 4.570000 | 27.70 | 11.1 | 46 | 18.3 | AV | L1 | GND |
| 12.295000 | 30.20 | 11.3 | 50 | 19.8 | AV | L1 | GND |
| 14.605000 | 33.90 | 11.4 | 50 | 16.1 | AV | L1 | GND |

**AC 120V/ 60 Hz, Neutral:**




***MEASUREMENT RESULT: "UC-0911-002_fin"***

9/11/2020 9:28AM

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.275000 | 53.30 | 10.6 | 61 | 7.7 | QP | N | GND |
| 0.510000 | 49.60 | 10.7 | 56 | 6.4 | QP | N | GND |
| 0.930000 | 44.30 | 10.8 | 56 | 11.7 | QP | N | GND |
| 4.610000 | 38.80 | 11.1 | 56 | 17.2 | QP | N | GND |
| 5.320000 | 38.60 | 11.2 | 60 | 21.4 | QP | N | GND |
| 14.485000 | 37.10 | 11.4 | 60 | 22.9 | QP | N | GND |

***MEASUREMENT RESULT: "UC-0911-002_fin2"***

9/11/2020 9:28AM

| Frequency MHz | Level dBµV | Transd dB | Limit dBµV | Margin dB | Detector | Line | PE |
|---|---|---|---|---|---|---|---|
| 0.280000 | 44.70 | 10.6 | 51 | 6.3 | AV | N | GND |
| 0.370000 | 40.70 | 10.7 | 49 | 8.3 | AV | N | GND |
| 0.920000 | 29.10 | 10.8 | 46 | 16.9 | AV | N | GND |
| 4.260000 | 26.20 | 11.1 | 46 | 19.8 | AV | N | GND |
| 12.400000 | 27.00 | 11.3 | 50 | 23.0 | AV | N | GND |
| 13.120000 | 27.20 | 11.3 | 50 | 22.8 | AV | N | GND |

# FCC §15.205 & §15.209 - RADIATED EMISSIONS TEST

## Applicable Standard

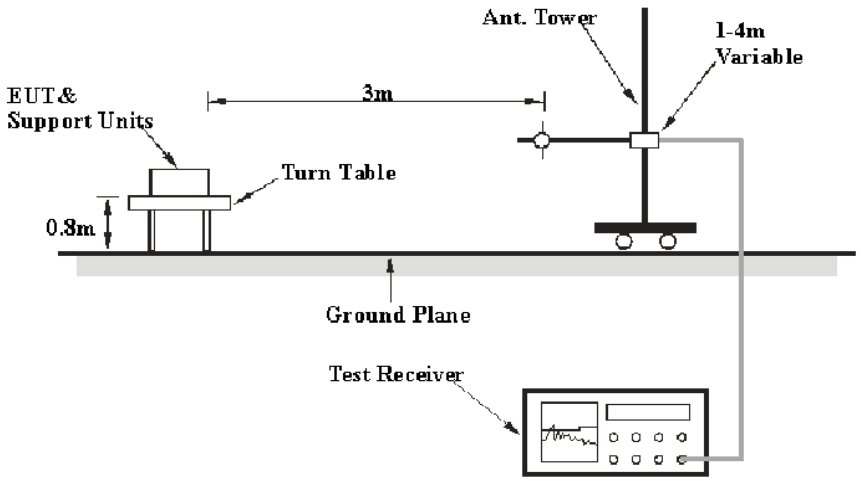
As per FCC Part 15.209

(a) Except as provided elsewhere in this subpart, the emissions from an intentional radiator shall not exceed the field strength levels specified in the following table:

| Frequency (MHz) | Field strength (microvolts/meter) | Measurement distance (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 |

**Except as provided in paragraph (g), fundamental emissions from intentional radiators operating under this section shall not be located in the frequency bands 54-72 MHz, 76-88 MHz, 174-216 MHz or 470-806 MHz. However, operation within these frequency bands is permitted under other sections of this part, e.g., §§15.231 and 15.241.

## EUT Setup




The radiated emission tests were performed in the 3-meter chamber test site, using the setup accordance with the ANSI C63.10-2013. The specification used was the FCC Part Subpart C limits.

The spacing between the peripherals was 10 cm.

## EMI Test Receiver Setup

The system was investigated from 9 kHz to 1 GHz.

During the radiated emission test, the EMI test Receiver was set with the following configurations:

| Frequency Range | RBW | Video B/W | Measurement |
|---|---|---|---|
| 9 kHz – 150 kHz | 200 Hz | 1 kHz | QP/Average |
| 150 kHz – 30 MHz | 9 kHz | 30 kHz | QP/Average |
| 30 MHz – 1000 MHz | 120 kHz | 300 kHz | QP |

The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90 kHz, 110-490 kHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

If the maximized peak measured value complies with the limit, then it is unnecessary to perform an QP/Average measurement

## Corrected Amplitude & Margin Calculation

For 9kHz-30MHz:
The basic equation is as follows:

Level (QuasiPeak or Average) = Reading Level + Transd Factor

Note:
Transd Factor = Cable loss + Factor of coupling device

The "**Margin**" column of the following data tables indicates the degree of compliance within the applicable limit. For example, a margin of 7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Level-Limit

For above 30MHz:
The basic equation is as follows:

Result = Meter Reading+ Factor

Note:
Factor = Meter Reading + Antenna Factor + Cable Loss - Amplifier Gain

The "**Margin**" column of the following data tables indicates the degree of compliance with the applicable limit. For example, a margin of -7dB means the emission is 7dB below the limit. The equation for margin calculation is as follows:

Margin = Result - Limit

## Test Results Summary

According to the data in the following table, the EUT complied with the FCC Part 15.205&15.209 .

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 23 °C |
| **Relative Humidity:** | 49 % |
| **ATM Pressure:** | 101.0 kPa |

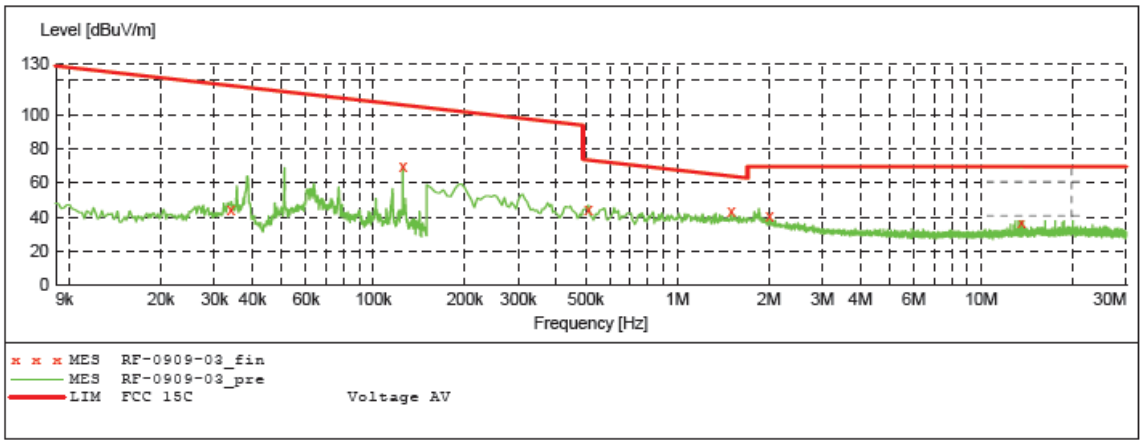
*The testing was performed by Black Ding on 2021-09-09 for Below 30MHz and on 2021-09-15 for Above 30MHz.*

*Test mode: Transmitting*

*Result: Compliant*

### 9 kHz~30MHz:

Worst case (Transmitting, X Axis) was recorded in the report.




***MEASUREMENT RESULT: "RF-0909-03_fin"***

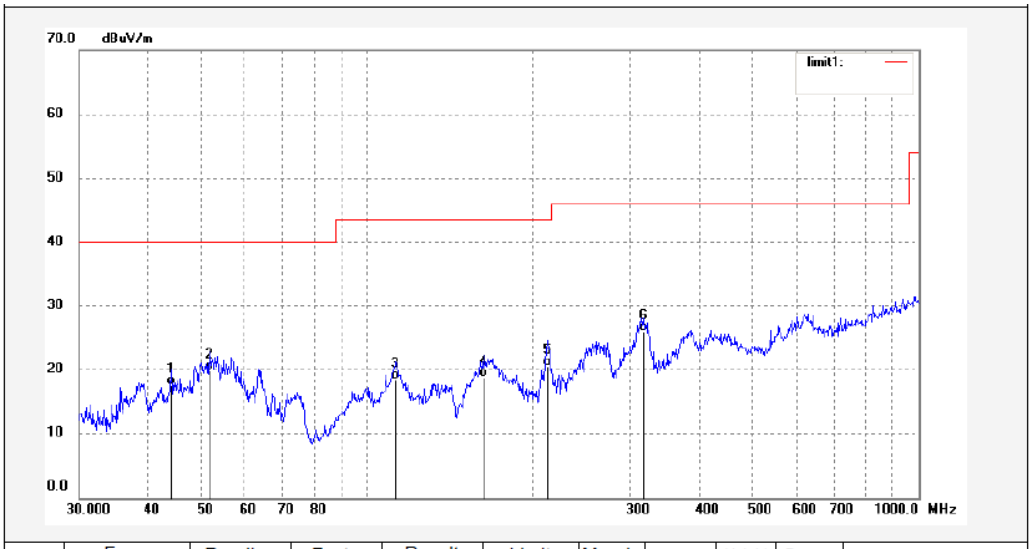
2021-9-9 10:57

| Frequency MHz | Level dBuV | Transd dB/m | Limit dBuV/m | Margin dB | Det. | Height cm | Azimuth deg | Polarization |
|---|---|---|---|---|---|---|---|---|
| 0.034000 | 44.20 | 20.1 | 117.0 | -72.8 | QP | 105.0 | 0.00 | X |
| 0.125000 | 69.60 | 20.1 | 105.7 | -36.1 | QP | 105.0 | 0.00 | X |
| 0.510000 | 44.80 | 20.3 | 73.5 | -28.7 | QP | 105.0 | 0.00 | X |
| 1.505000 | 43.50 | 20.4 | 64.1 | -20.6 | QP | 105.0 | 0.00 | X |
| 2.010000 | 40.60 | 20.4 | 69.5 | -28.9 | QP | 105.0 | 0.00 | X |
| 13.570000 | 36.70 | 21.0 | 69.5 | -32.8 | QP | 105.0 | 0.00 | X |

Part 15 Section 15.31(f)(2) (9kHz-30MHz)
Limit at 3m=Limit at 300m-40*log(3(m)/300(m))
Limit at 3m=Limit at 30m-40*log(3(m)/30(m))

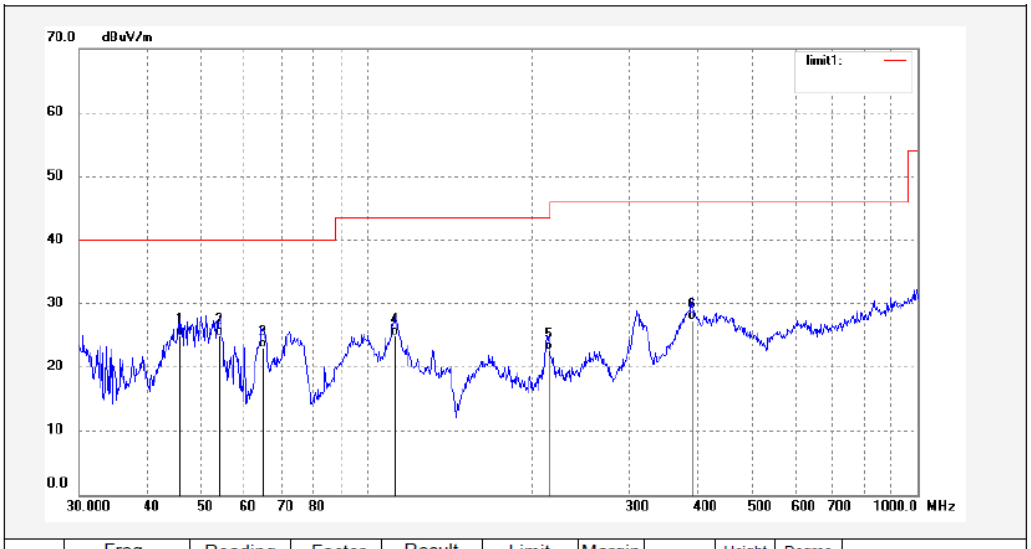
**30 MHz ~ 1GHz**

Horizontal




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Degree (deg.) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 44.1202 | 34.88 | -17.35 | 17.53 | 40.00 | -22.47 | QP | | | |
| 2 | 51.6616 | 37.14 | -17.19 | 19.95 | 40.00 | -20.05 | QP | | | |
| 3 | 112.5244 | 36.85 | -18.47 | 18.38 | 43.50 | -25.12 | QP | | | |
| 4 | 162.6106 | 38.23 | -19.47 | 18.76 | 43.50 | -24.74 | QP | | | |
| 5 | 212.2695 | 37.96 | -17.35 | 20.61 | 43.50 | -22.89 | QP | | | |
| 6 | 317.7011 | 40.11 | -14.16 | 25.95 | 46.00 | -20.05 | QP | | | |

Vertical




| No. | Freq. (MHz) | Reading (dBuV) | Factor (dB/m) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Height (cm) | Degree (deg.) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 45.6948 | 42.15 | -17.16 | 24.99 | 40.00 | -15.01 | QP | | | |
| 2 | 53.8818 | 42.31 | -17.33 | 24.98 | 40.00 | -15.02 | QP | | | |
| 3 | 64.6594 | 42.07 | -19.10 | 22.97 | 40.00 | -17.03 | QP | | | |
| 4 | 112.1305 | 43.55 | -18.54 | 25.01 | 43.50 | -18.49 | QP | | | |
| 5 | 213.7634 | 39.85 | -17.26 | 22.59 | 43.50 | -20.91 | QP | | | |
| 6 | 389.3549 | 40.26 | -12.83 | 27.43 | 46.00 | -18.57 | QP | | | |

# FCC§15.215(c) - 20dB EMISSION BANDWIDTH

## Applicable Standard

Intentional radiators operating under the alternative provisions to the general emission limits, as contained in § 15.217 through 15.257 and in Subpart E of this part, must be designed to ensure that the 20 dB bandwidth of the emission, or whatever bandwidth may otherwise be specified in the specific rule section under which the equipment operates, is contained within the frequency band designated in the rule section under which the equipment is operated.

## Test Procedure

1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.

2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect it to measurement instrument. Then set it to any one convenient frequency within its operating range. Set a reference level on the measuring instrument equal to the highest peak value.

3. Measure the frequency difference of two frequencies that indicated 20dB bandwidth.

4. Repeat above procedures until all frequencies measured were complete.

## Test Data

### Environmental Conditions

| | |
|---|---|
| **Temperature:** | 25 ℃ |
| **Relative Humidity:** | 52 % |
| **ATM Pressure:** | 101.0 kPa |

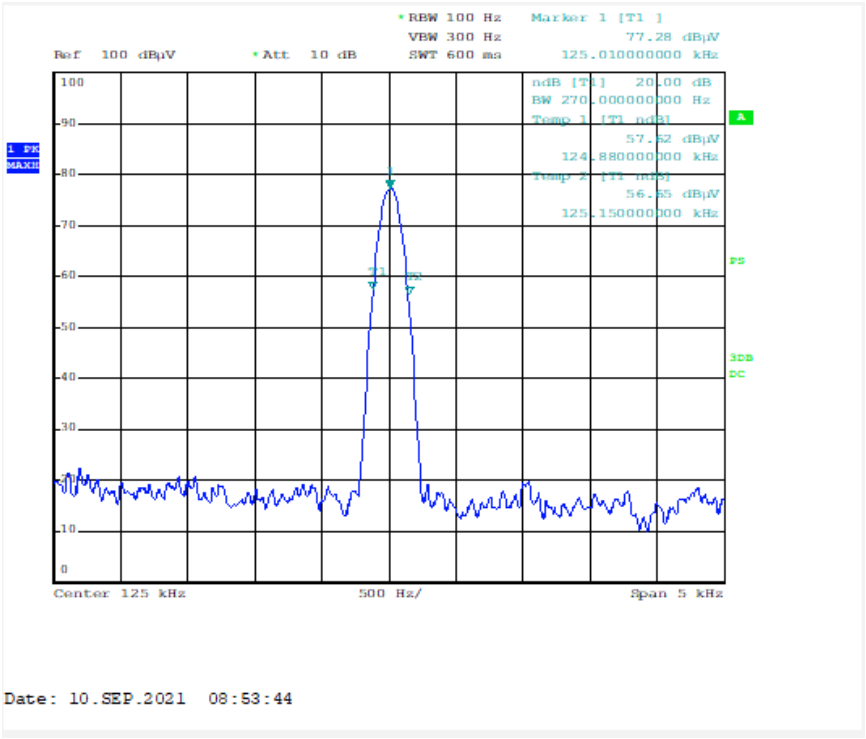
*The testing was performed by Black Ding on 2021-09-10.*

*Test Mode: Transmitting*

*Please refer to the following table and plots.*

| Test Frequency (kHz) | 20dB Bandwidth (kHz) |
|---|---|
| 125 | 0.27 |

**125kHz**




******* END OF REPORT *******