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Report No.: 1903TW0901-U1
Report Version: 1.0
Issue Date: 2019-03-25

# MEASUREMENT REPORT

## FCC PART 15.225

| | |
|---|---|
| **FCC ID:** | TFJUIC1000 |
| **APPLICANT:** | Uniform Industrial Corp. |
| **Application Type:** | Certification |
| **Product:** | RFID Reader |
| **Model No.:** | UIC 1000 |
| **Trademark:** | UIC |
| **FCC Classification:** | (DXX) Part 15 Low Power Communication Device Transmitter |
| **FCC Rule Part(s):** | Part 15.225 |
| **Test Procedure(s):** | ANSI C63.10-2013 |
| **Received Date:** | March 15, 2019 |
| **Test Date:** | March 18 ~ 21, 2019 |

Tested By : Fran Chen
( Fran Chen )

Reviewed By : Paddy Chen
( Paddy Chen )

Approved By : Chenz Ker
( Chenz Ker)

Testing Laboratory
3261

The test results only relate to the tested sample.

This equipment has been shown to be capable of compliance with the applicable technical standards as indicated in the measurement report and was tested in accordance with the measurement procedures specified in ANSI C63.10-2013. Test results reported herein relate only to the item(s) tested.

# Revision History

| Report No. | Version | Description | Issue Date | Note |
|---|---|---|---|---|
| 1903TW0901-U1 | 1.0 | Original Report | 2019-03-25 | |

# CONTENTS

## §2.1033 General Information

| | |
|---|---|
| **Applicant** | Uniform Industrial Corp. |
| **Applicant Address** | 47341 Bayside Parkway, Fremont, California 94538, United States |
| **Manufacturer** | Uniform Industrial Corp. |
| **Manufacturer Address** | 1F, No.1, Lane 15, Ziqiang St., Tucheng Dist., New Taipei City 236, Taiwan, R.O.C |
| **Test Site** | MRT Technology (Taiwan) Co., Ltd |
| **Test Site Address** | No. 38, Fuxing Second Rd., Guishan Dist., Taoyuan City 333, Taiwan (R.O.C) |
| **MRT FCC Registration No.** | 291082 |
| **FCC Rule Part(s)** | Part 15.225 |
| **Model No.** | UIC 1000 |
| **Test Device Serial No.** | N/A ☐ Production ☒ Pre-Production ☐ Engineering |

### Test Facility / Accreditations

1. MRT facility is a FCC registered (Reg. No. 291082) test facility with the site description report on file and is designated by the FCC as an Accredited Test Firm.
2. MRT facility is an IC registered (MRT Reg. No. 21723) test laboratory with the site description on file at Industry Canada.
3. MRT Lab is accredited to ISO 17025 by the Taiwan Accreditation Foundation (TAF Cert. No. 3261) in EMC, Telecommunications and Radio testing for FCC (Designation Number: TW3261), Industry Taiwan, EU and TELEC Rules.

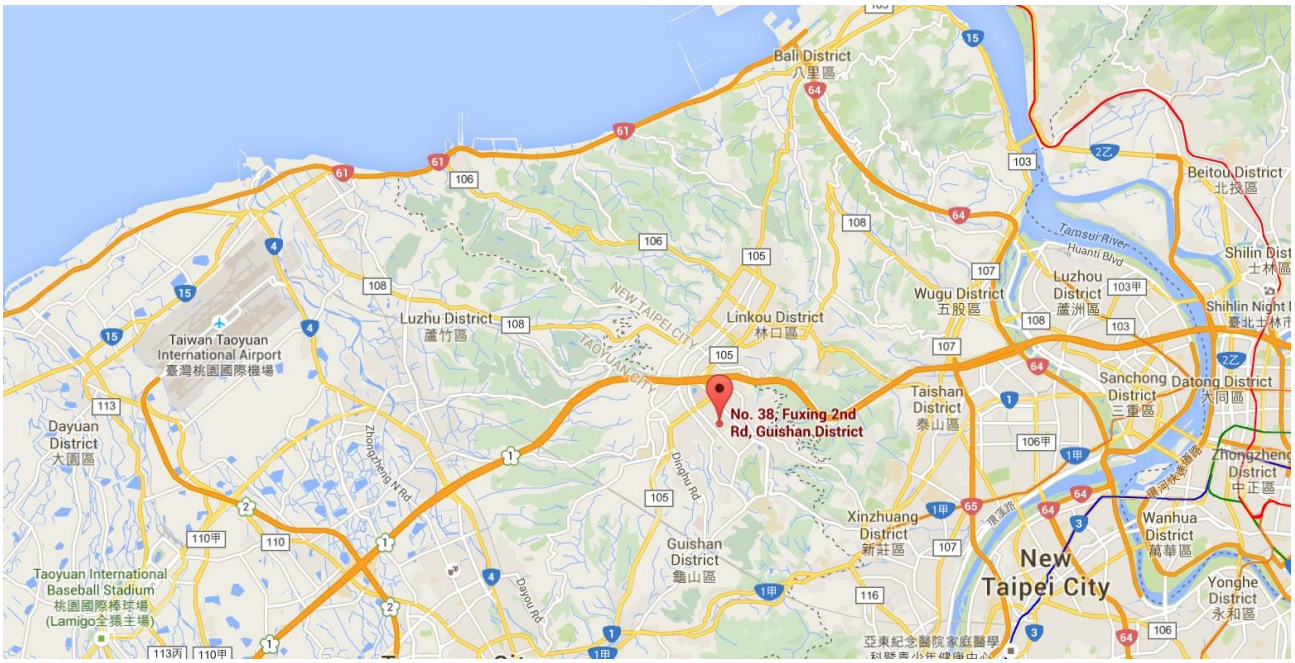
# 1. INTRODUCTION

## 1.1. Scope

Measurement and determination of electromagnetic emissions (EMC) of radio frequency devices including intentional and/or unintentional radiators for compliance with the technical rules and regulations of the Federal Communications Commission and the Industry Canada Certification and Engineering Bureau.

## 1.2. MRT Test Location

The map below shows the location of the MRT LABORATORY, its proximity to the Taoyuan City. These measurement tests were conducted at the MRT Technology (Taiwan) Co., Ltd. Facility located at No.38, Fuxing 2nd Rd., Guishan Dist., Taoyuan City 33377, Taiwan (R.O.C).



# 2. PRODUCT INFORMATION

## 2.1. Equipment Description

| | |
|---|---|
| Product Name | RFID Reader |
| Model No. | UIC 1000 |
| Trademark |  |
| Supports Radios Spec | 13.56MHz |
| Antenna Type | Loop Antenna |
| Modulation | ASK |
| Adapter#1<br>(Match RS-232 model) | MFR: Elementech International Co., Ltd.<br>Model No: A106-205013U<br>Input: AC 100-240V~0.2A, 50-60Hz<br>Output: DC 5V, 1A |
| Adapter#2<br>(Match RS-232 model) | MFR: UNIFIVE CO., LTD.<br>Model No: UV305-0510<br>Input: AC 100-240V~0.2A, 50-60Hz<br>Output: DC 5V, 1A |

## 2.2. Test Mode

| | |
|---|---|
| Test Mode | Mode1: TX-13.56MHz, UIC1000-WTCSM (USB)<br>Mode2: TX-13.56MHz, UIC1000-WRCSM (RS-232) with A106-2050130U<br>Mode3: TX-13.56MHz, UIC1000-WRCSM (RS-232) with UV305-510 |

## 2.3. Test Software

The test utility software used during testing was “N/A”.

## 2.4. Test Configuration

The **RFID Reader,** ANSI C63.10-2013 was used to reference the appropriate EUT setup for radiated spurious emissions testing and AC line conducted testing.

## 2.5. EMI Suppression Device(s)/Modifications

No EMI suppression device(s) were added and/or no modifications were made during testing.

## 2.6. Labeling Requirements

Per 2.1074 & 15.19; Docket 95-19

The label shall be permanently affixed at a conspicuous location on the device; instruction manual or pamphlet supplied to the user and be readily visible to the purchaser at the time of purchase. However, when the device is so small wherein placement of the label with specified statement is not practical, only the FCC ID must be displayed on the device per Section 15.19(a)(5). Please see attachment for FCC ID label and label location.

# 3. DESCRIPTION of TEST

## 3.1. Evaluation Procedure

The measurement procedures described in the American National Standard for Testing Unlicensed Wireless Devices (ANSI C63.10-2013) were used in the measurement of the **RFID Reader**

**Deviation from measurement procedure…….....None**

## 3.2. AC Line Conducted Emissions

The line-conducted facility is located inside an 9'x4'x3' shielded enclosure. A 1m x 2m wooden table 80cm high is placed 40cm away from the vertical wall and 80cm away from the sidewall of the shielded room. Two 10kHz-30MHz, 50Ω/50uH Line-Impedance Stabilization Networks (LISNs) are bonded to the shielded room floor. Power to the LISNs is filtered by external high-current high-insertion loss power line filters. These filters attenuate ambient signal noise from entering the measurement lines. These filters are also bonded to the shielded enclosure.

The EUT is powered from one LISN and the support equipment is powered from the second LISN. All interconnecting cables more than 1 meter were shortened to a 1 meter length by non-inductive bundling (serpentine fashion) and draped over the back edge of the test table. All cables were at least 40cm above the horizontal reference ground-plane. Power cables for support equipment were routed down to the second LISN while ensuring that that cables were not draped over the second LISN.

Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The RF output of the LISN was connected to the receiver and exploratory measurements were made to determine the frequencies producing the maximum emission from the EUT. The receiver was scanned from 150kHz to 30MHz. The detector function was set to peak mode for exploratory measurements while the bandwidth of the analyzer was set to 9kHz. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Each emission was also maximized by varying: power lines, the mode of operation or data exchange speed, or support equipment which determined the worst-case emission. Once the worst case emissions have been identified, the one EUT cable configuration/arrangement and mode of operation that produced these emissions are used for final measurements on the same test site. The analyzer is set to CISPR quasi-peak and average detectors with a 9kHz resolution bandwidth for final measurements.

An extension cord was used to connect to a single LISN which powered by EUT. The extension cord was calibrated with LISN, the impedance and insertion loss are compliance with the requirements as stated in ANSI C63.10-2013.

Line conducted emissions test results are shown in Section 7.6.

### 3.3. Radiated Emissions

The radiated test facilities consisted of an indoor 3 meter semi-anechoic chamber used for final measurements and exploratory measurements, when necessary. The measurement area is contained within the semi-anechoic chamber which is shielded from any ambient interference. For measurements above 1GHz absorbers are arranged on the floor between the turn table and the antenna mast in such a way so as to maximize the reduction of reflections. For measurements below 1GHz, the absorbers are removed. A MF Model 210SS turntable is used for radiated measurement. It is a continuously rotatable, remote controlled, metallic turntable and 2 meters (6.56 ft.) in diameter. The turn table is flush with the raised floor of the chamber in order to maintain its function as a ground plane. An 80cm high PVC support structure is placed on top of the turntable.
For all measurements, the spectrum was scanned through all EUT azimuths and from 1 to 4 meter receive antenna height using a broadband antenna from 30MHz up to the upper frequency shown in 15.33(b)(1) depending on the highest frequency generated or used in the device or on which the device operates or tunes. For frequencies above 1GHz, linearly polarized double ridge horn antennas were used. For frequencies below 30MHz, a calibrated loop antenna was used. When exploratory measurements were necessary, they were performed at 1 meter test distance inside the semi-anechoic chamber using broadband antennas, broadband amplifiers, and spectrum analyzers to determine the frequencies and modes producing the maximum emissions. Sufficient time for the EUT, support equipment, and test equipment was allowed in order for them to warm up to their normal operating condition. The test set-up for frequencies below 1GHz was placed on top of the 0.8 meter high, 1 x 1.5 meter table; and test set-up for frequencies 1-40GHz was placed on top of the 1.5 meter high, 1 x 1.5 meter table. The EUT, support equipment, and interconnecting cables were arranged and manipulated to maximize each emission. Appropriate precaution was taken to ensure that all emissions from the EUT were maximized and investigated. The system configuration, clock speed, mode of operation or video resolution, if applicable, turntable azimuth, and receive antenna height was noted for each frequency found.
Final measurements were made in the semi-anechoic chamber using calibrated, linearly polarized broadband and horn antennas. The test setup was configured to the setup that produced the worst case emissions. The spectrum analyzer was set to investigate all frequencies required for testing to compare the highest radiated disturbances with respect to the specified limits. The turntable containing the EUT was rotated through 360 degrees and the height of the receive antenna was varied 1 to 4 meters and stopped at the azimuth and height producing the maximum emission. Each emission was maximized by changing the orientation of the EUT through three orthogonal planes and changing the polarity of the receive antenna, which produced the worst-case emissions. According to 3dB Beam-Width of horn antenna, the horn antenna should be always directed to the EUT when rising height.
Radiated Emissions test results are shown in Section 7.2 & 7.3 .

# 4. ANTENNA REQUIREMENTS

**Excerpt from §15.203 of the FCC Rules/Regulations:**

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

- The antenna of **RFID Reader** is **permanently attached.**
- There are no provisions for connection to an external antenna.

**Conclusion:**

The **RFID Reader** unit complies with the requirement of §15.203.

# 5. TEST EQUIPMENT CALIBRATION DATE

Conducted Emissions – SR2

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| Two-Line V-Network | R&S | ENV216 | MRTTWA00019 | 1 year | 2019/4/20 |
| Cable | Rosnol | N1C50-RG400-B 1C50-500CM | MRTTWE00013 | 1 year | 2019/5/18 |
| EMI Test Receiver | R&S | ESR3 | MRTTWA00009 | 1 year | 2019/4/19 |

Radiated Emissions – AC1

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| Broadband TRILOG Antenna | SCHWARZBECK | VULB 9162 | MRTTWA00001 | 1 year | 2019/5/22 |
| EMI Test Receiver | R&S | ESR3 | MRTTWA00009 | 1 year | 2019/4/19 |
| Acitve Loop Antenna | Schwarzbeck | FMZB 1519B | MRTTWA00002 | 1 year | 2019/4/24 |
| Broadband Horn antenna | SCHWARZBECK | BBHA 9120D | MRTTWA00003 | 1 year | 2019/4/24 |
| Breitband Hornantenna | Schwarzbeck | BBHA 9170 | MRTTWA00004 | 1 year | 2019/4/23 |
| Broadband Amplifier | Schwarzbeck | BBV 9721 | MRTTWA00006 | 1 year | 2019/4/23 |
| Broadband Preamplifier | SCHWARZBECK | BBV 9718 | MRTTWA00005 | 1 year | 2019/4/23 |
| Cable | HUBERSUHNER | SF106 | MRTTWA00010 | 1 year | 2019/5/18 |
| Cable | Rosnol | K1K50-UP0264-K1K50-4M | MRTTWA00012 | 1 year | 2019/7/30 |

Conducted Test Equipment – SR2

| Instrument | Manufacturer | Type No. | Asset No. | Cali. Interval | Cali. Due Date |
|---|---|---|---|---|---|
| Spectrum Analyzer | KEYSIGHT | N9010A | MRTTWA00012 | 1 year | 2019/7/30 |
| USB Wideband Power Sensor | KEYSIGHT | U2021XA | MRTTWA00015 | 1 year | 2019/4/20 |

Test Software

| Software | Version | Function |
|---|---|---|
| e3 | 9.160520a | EMI Test Software |
| EMI | V3 | EMI Test Software |

# 6. MEASUREMENT UNCERTAINTY

Where relevant, the following test uncertainty levels have been estimated for tests performed on the EUT as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k = 2.

| |
|---|
| AC Conducted Emission Measurement – SR2 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>150kHz~30MHz: 2.42dB |
| Conducted Measurement– SR1 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)): 1.3dB |
| Radiated Emission Measurement – AC1 |
| Measuring Uncertainty for a Level of Confidence of 95% (U=2Uc(y)):<br>Horizontal: 9K~30MHz: 4.14dB<br>30MHz~1GHz: 4.22dB<br>1GHz~40GHz: 4.05dB<br>Vertical: 9K~30MHz: 4.14dB<br>30MHz~1GHz: 3.37dB<br>1GHz~40GHz: 4.08dB |

# 7. TEST RESULT

## 7.1. Summary

**Product Name:** **RFID Reader**

**FCC Classification:** **(DXX) Part 15 Low Power Communication Device Transmitter**

| FCC Part Section(s) | Test Description | Test Limit | Test Condition | Test Result | Reference |
|---|---|---|---|---|---|
| 15.225 (a)(b)(c) | Field Strength of Fundamental Emissions | FCC 15.225 limits | Radiated | Pass | Section 7.2 |
| 15.225(d) | Radiated Spurious Emissions | FCC 15.209 limits | | Pass | Section 7.3 |
| 2.1049 | 20dB Bandwidth | N/A | Conducted | Pass | Section 7.4 |
| 15.225(e) | Frequency Stability | within ±0.01% of the operating frequency | | Pass | Section 7.5 |
| 15.207 | AC Conducted Emissions 150kHz - 30MHz | FCC 15.207 limits | Line Conducted | Pass | Section 7.6 |

**Notes:**

1) All modes of operation and data rates were investigated. For radiated emission test, every axis (X, Y, Z) was also verified. The test results shown in the following sections represent the worst case emissions.
2) Emission does contain an evaluation of the two modes of LOOP Antenna open and close, only shown the worst case emissions.
3) The analyzer plots shown in this section were all taken with a correction table loaded into the analyzer. The correction table was used to account for the losses of the cables and attenuators used as part of the system to connect the EUT to the analyzer at all frequencies of interest.
4) All antenna port conducted emissions testing was performed on a test bench with the antenna port of the EUT connected to the spectrum analyzer through calibrated cables and attenuators.

## 7.2. Field Strength of Fundamental Emissions Measurement

### 7.2.1. Test Limit

| FCC Part 15.225 Limits | | | | |
|---|---|---|---|---|
| Frequency (MHz) | Field Strength (μV/m) at 30m | Field Strength (dBμV/m) at 30m | Field Strength (dBμV/m) at 10m | Field Strength (dBμV/m) at 3m |
| 1.705 – 13.110 | 30 | 29.5 | 48.58 | **69.5** |
| 13.110 – 13.410 | 106 | 40.5 | 59.98 | **80.5** |
| 13.410 – 13.553 | 334 | 50.5 | 69.58 | **90.5** |
| 13.553 – 13.567 | 15848 | 84 | 103.08 | **124** |
| 13.567 – 13.710 | 334 | 50.5 | 69.58 | **90.5** |
| 13.710 – 14.010 | 106 | 40.5 | 59.98 | **80.5** |
| 14.010 – 30.000 | 30 | 29.5 | 48.58 | **69.5** |

### 7.2.2. Test Procedure used

ANSI C63.10-2013 - Section 11.12.2.3 (quasi-peak measurements)

ANSI C63.10-2013 - Section 11.12.2.4 (peak power measurements)

ANSI C63.10-2013 - Section 11.12.2.5 (average power measure)

**Test Setting**

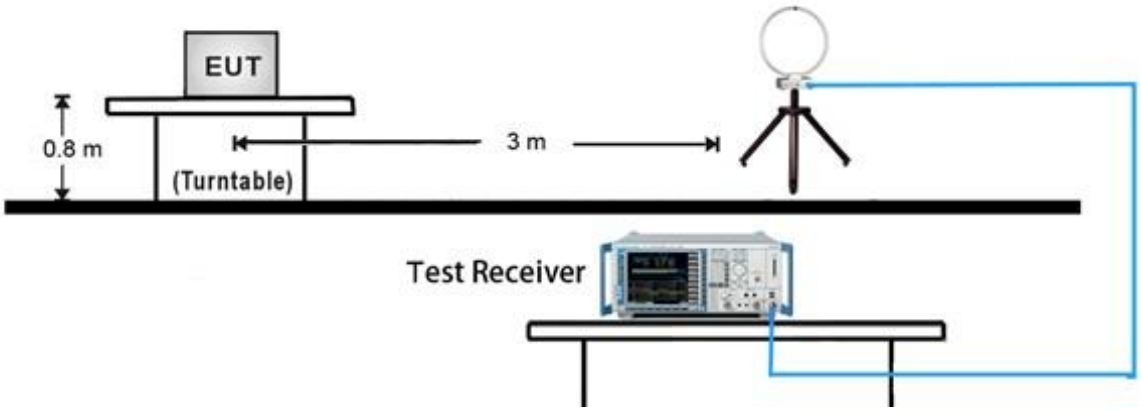
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. VBW ≥ 3 × RBW
4. Detector = Peak
5. Trace mode = max hold
6. Sweep = auto couple
7. Allow the trace was allowed to stabilize

**Table 1 - RBW as a function of frequency**

| Frequency | RBW |
|---|---|
| 9 kHz ~ 150 kHz | 200 Hz ~ 300 Hz |
| 0.15 MHz ~ 30 MHz | 9 kHz ~ 10 kHz |

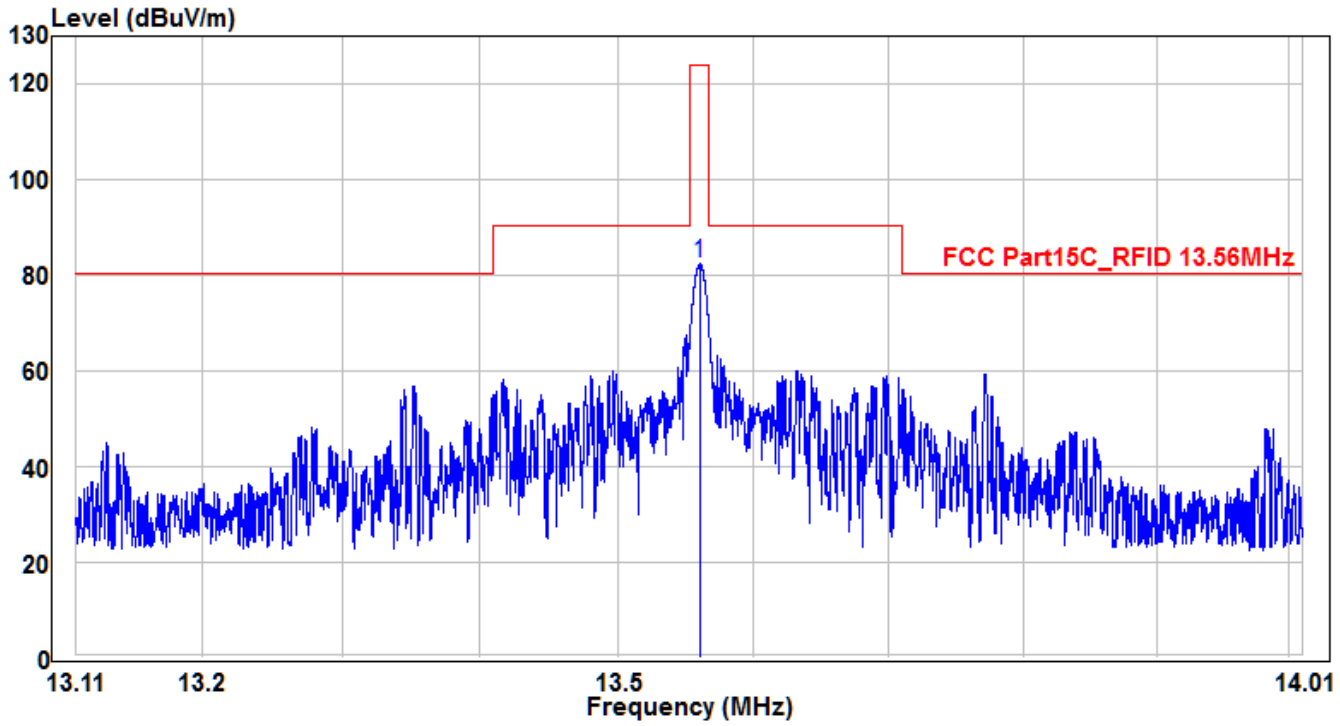
### 7.2.3. Test Setup

9kHz ~ 30MHz Test Setup:



### 7.2.4. Test Result

| EUT | RFID Reader | Date of Test | 2019/3/21 |
|---|---|---|---|
| Factor | FMZB 1519B (9KHz~30MHz) | Temp. / Humidity | 25˚C / 57% |
| Polarity | -- | Site / Test Engineer | AC1 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV/m) | Margin (dB) | Limit (dBuV) | Height (cm) | Angle (deg) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * | 13.56 | 61.19 | 21.17 | 82.36 | -41.64 | 124 | 100 | 400 | Peak |

Note: The EUT Power by USB (DC 5V)

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB) – Preamplifier(dB)
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor)

## 7.3. Radiated Spurious Emissions Measurement

### 7.3.1. Test Limit

All out of band emissions appearing in a restricted band as specified in Section 15.225 of the Title 47 CFR must not exceed the limits shown in Table per Section 15.209.

| FCC Part 15 Subpart C Paragraph 15.209 | | |
|---|---|---|
| Frequency [MHz] | Field Strength [V/m] | Measured Distance [Meters] |
| 0.009 - 0.490 | 2400/F (kHz) | 300 |
| 0.490 - 1.705 | 24000/F (kHz) | 30 |
| 1.705 - 30 | 30 | 30 |
| 30 - 88 | 100 | 3 |
| 88 - 216 | 150 | 3 |
| 216 - 960 | 200 | 3 |
| Above 960 | 500 | 3 |

Note : 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 and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector.

### 7.3.2. Test Procedure Used

ANSI C63.10-2013 - Section 11.12.2.3 (quasi-peak measurements)

ANSI C63.10-2013 - Section 11.12.2.4 (peak power measurements)

ANSI C63.10-2013 - Section 11.12.2.5 (average power measurements)

**Test Setting**

**Peak Power Measurement**

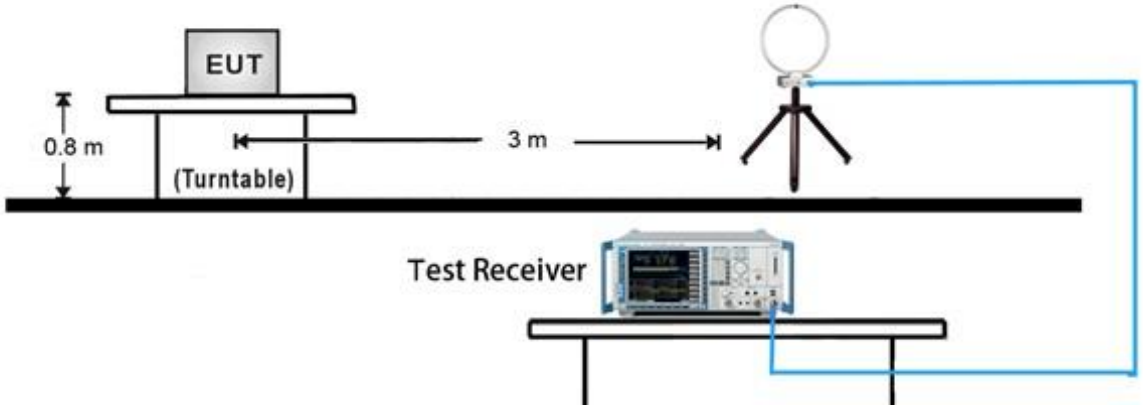
1. Analyzer center frequency was set to the frequency of the radiated spurious emission of interest
2. RBW = as specified in Table 1
3. VBW = 3 × RBW
4. Detector = peak
5. Sweep time = auto couple

**Table 1 - RBW as a function of frequency**

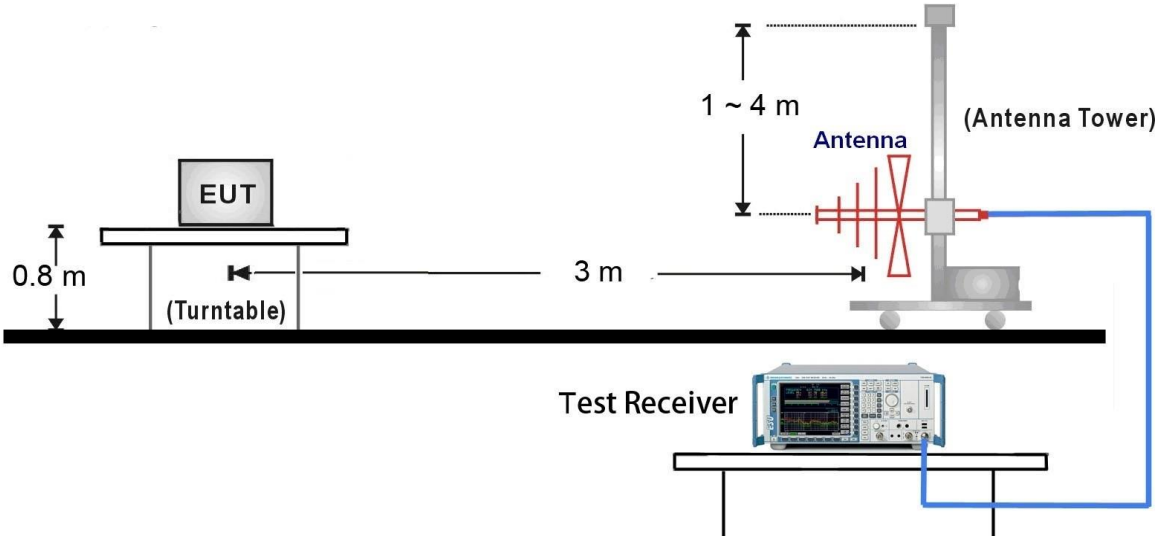
| Frequency | RBW |
|---|---|
| 9 kHz ~ 150 kHz | 200 Hz ~ 300 Hz |
| 0.15 MHz ~ 30 MHz | 9 kHz ~ 10 kHz |
| 30 MHz ~ 1000 MHz | 100 kHz ~ 120 kHz |
| > 1000 MHz | 1 MHz |

### 7.3.3. Test Setup

9kHz ~ 30MHz Test Setup:

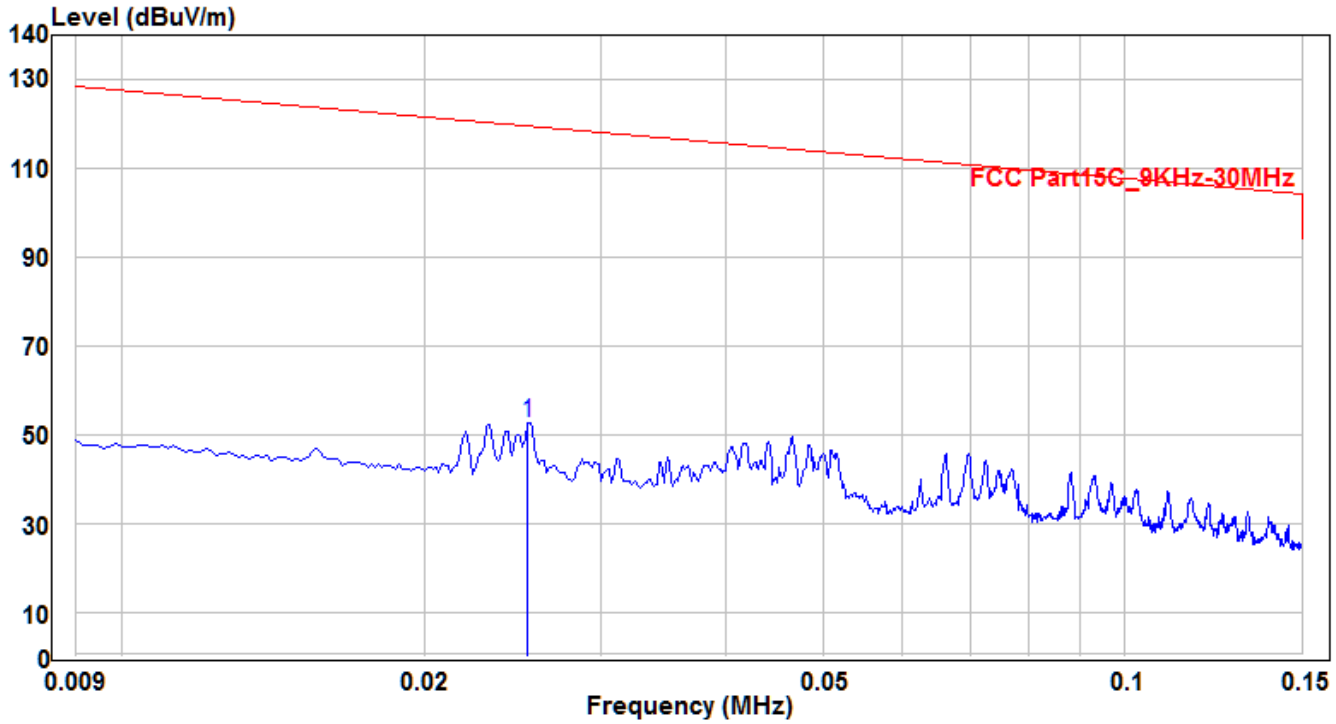



30MHz ~ 1GHz Test Setup:



### 7.3.4. Test Result

| EUT | RFID Reader | Date of Test | 2019/3/21 |
|---|---|---|---|
| Factor | FMZB 1519B (9KHz~30MHz) | Temp. / Humidity | 25˚C / 57% |
| Polarity | -- | Site / Test Engineer | AC1 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |

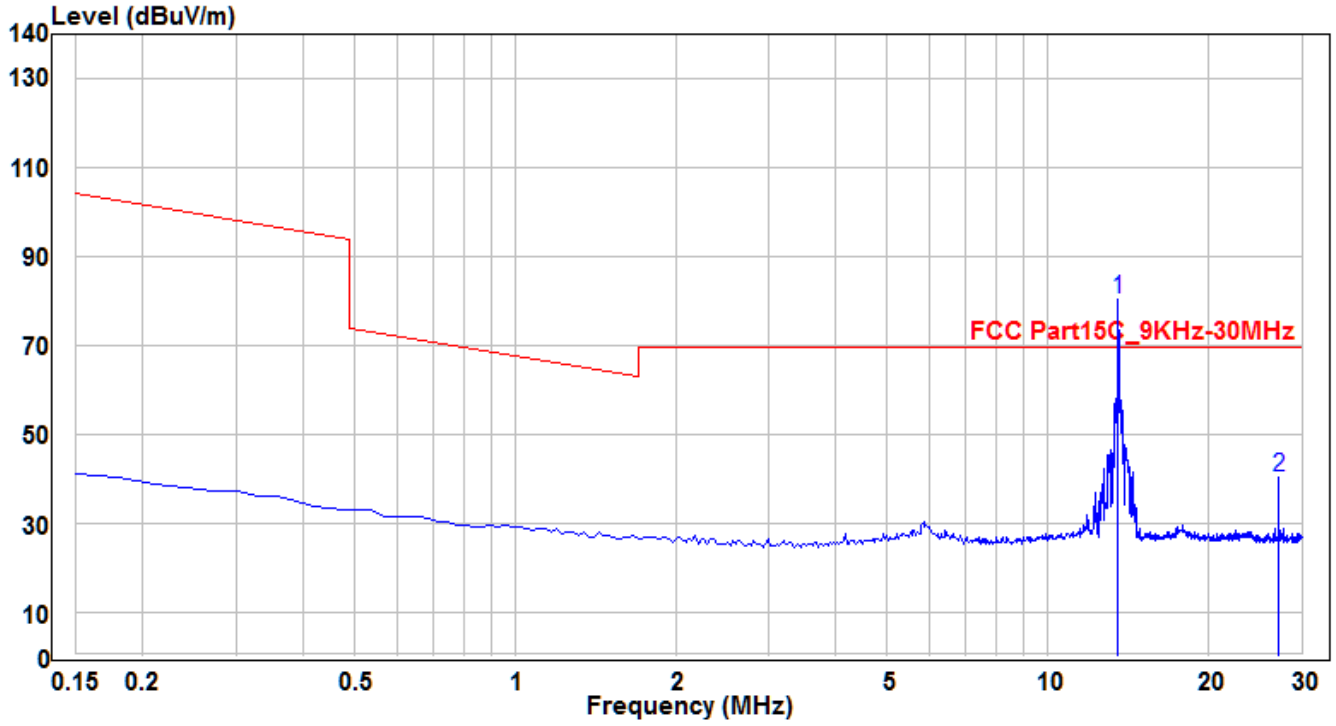



| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV/m) | Margin (dB) | Limit (dBuV) | Height (cm) | Angle (deg) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * | 0.02536 | 32.82 | 20.02 | 52.84 | -66.67 | 119.51 | 100 | 400 | Peak |

Note: The EUT Power by USB (DC 5V)

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB)
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor)

| EUT | RFID Reader | Date of Test | 2019/3/21 |
|---|---|---|---|
| Factor | FMZB 1519B (9KHz~30MHz) | Temp. / Humidity | 25˚C / 57% |
| Polarity | -- | Site / Test Engineer | AC1 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |

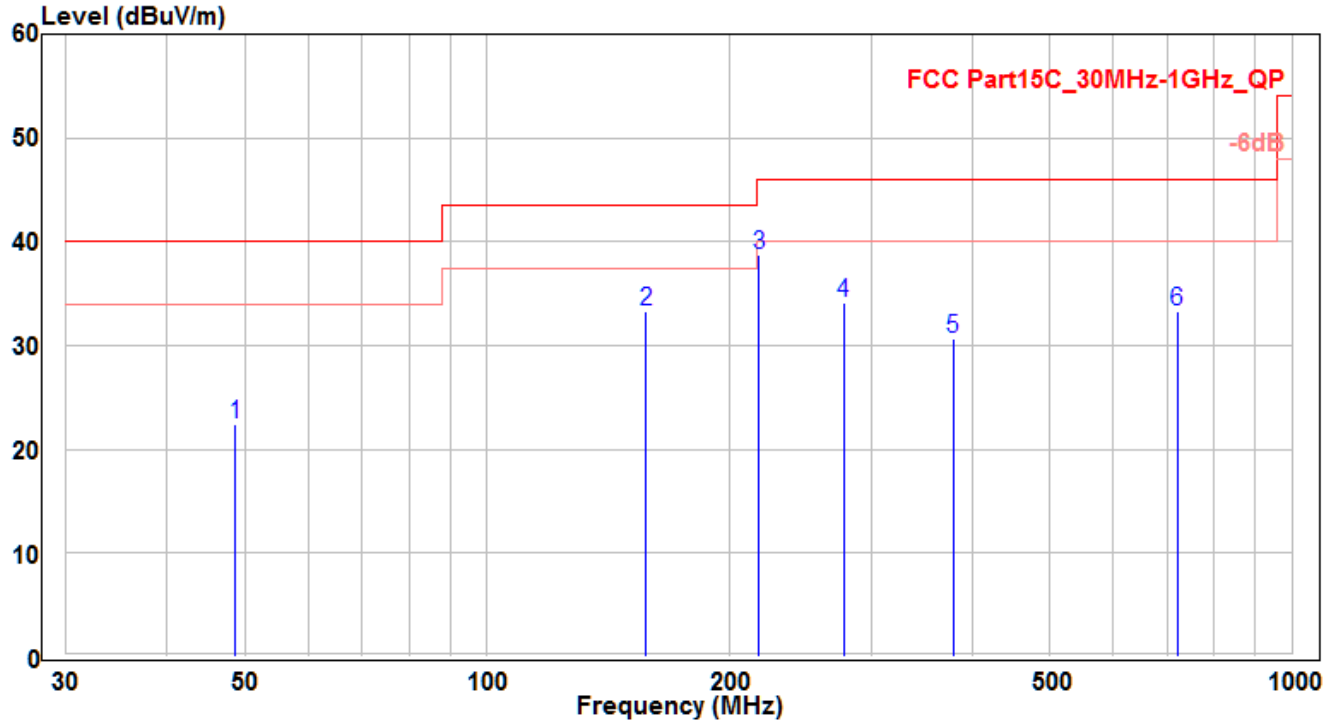



| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV/m) | Margin (dB) | Limit (dBuV) | Height (cm) | Angle (deg) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * | 13.553 | 59.39 | 21.17 | 80.56 | 11.06 | 69.5 | 100 | 400 | Peak |
| 2 | | 27.134 | 18.64 | 21.73 | 40.37 | -29.13 | 69.5 | 100 | 400 | QP |

Note: The EUT Power by USB (DC 5V)

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB)
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor)
4. The RFID Operation Frequency is 13.553MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/20 |
|---|---|---|---|
| Factor | VULB 9162 (30MHz~8GHz) | Temp. / Humidity | 25˚C / 57% |
| Polarity | Horizontal | Site / Test Engineer | AC1 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |

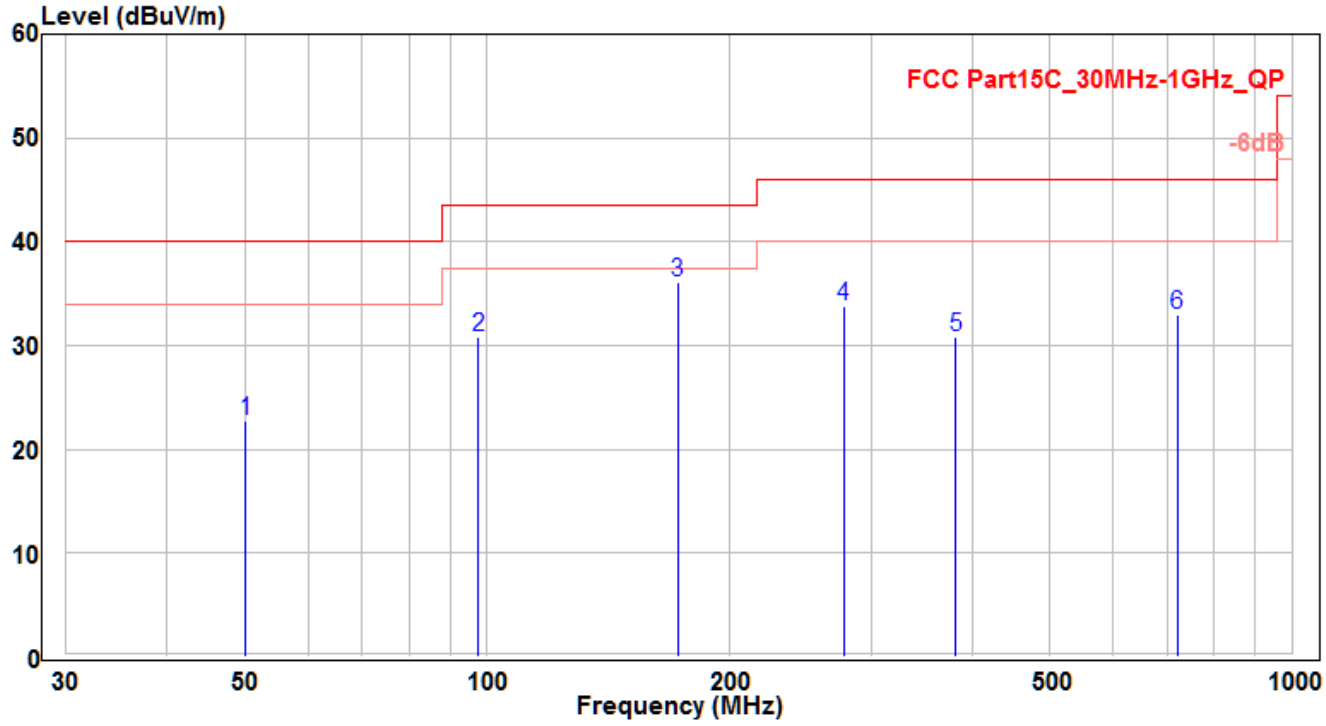



| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV/m) | Margin (dB) | Limit (dBuV) | Height (cm) | Angle (deg) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 48.703 | 0.58 | 21.81 | 22.39 | -17.61 | 40 | 115 | 250 | QP |
| 2 | | 157.464 | 17.27 | 16.01 | 33.28 | -10.22 | 43.5 | 145 | 380 | QP |
| 3 | * | 217.453 | 19.7 | 19.07 | 38.77 | -7.23 | 46 | 155 | 140 | QP |
| 4 | | 277.471 | 13.3 | 20.88 | 34.18 | -11.82 | 46 | 185 | 400 | QP |
| 5 | | 379.685 | 6.95 | 23.71 | 30.66 | -15.34 | 46 | 195 | 160 | QP |
| 6 | | 719.882 | 3.79 | 29.5 | 33.29 | -12.71 | 46 | 150 | 370 | QP |

Note: The EUT Power by USB (DC 5V)

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB)
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor)

| EUT | RFID Reader | Date of Test | 2019/3/20 |
|---|---|---|---|
| Factor | VULB 9162 (30MHz~8GHz) | Temp. / Humidity | 25˚C / 57% |
| Polarity | Vertical | Site / Test Engineer | AC1 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV/m) | Margin (dB) | Limit (dBuV) | Height (cm) | Angle (deg) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | | 50.128 | 0.95 | 21.83 | 22.78 | -17.22 | 40 | 175 | 155 | QP |
| 2 | | 97.476 | 12.18 | 18.63 | 30.81 | -12.69 | 43.5 | 100 | 165 | QP |
| 3 | * | 172.469 | 19.48 | 16.58 | 36.06 | -7.44 | 43.5 | 155 | 140 | QP |
| 4 | | 277.471 | 12.92 | 20.88 | 33.8 | -12.2 | 46 | 190 | 360 | QP |
| 5 | | 382.444 | 7.15 | 23.73 | 30.88 | -15.12 | 46 | 155 | 400 | QP |
| 6 | | 719.943 | 3.48 | 29.5 | 32.98 | -13.02 | 46 | 175 | -5 | QP |

Note: The EUT Power by USB (DC 5V)

1. " *", means this data is the worst emission level.
2. C.F (Correction Factor) = Antenna Factor (dB)+ Cable Loss (dB)
3. Measurement (dBuV/m) = Reading(dBuV) + C.F (Correction Factor)

## 7.4. 20dB Bandwidth Measurement

### 7.4.1. Test Limit

N/A

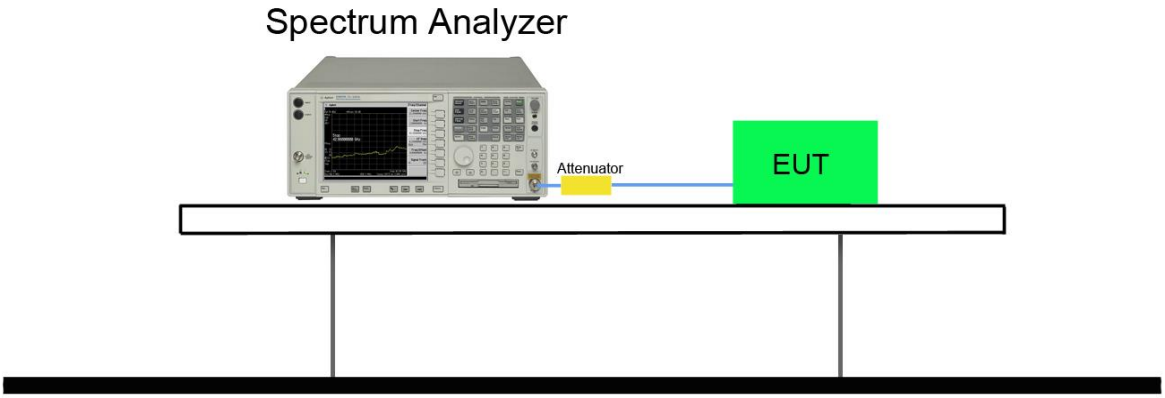
### 7.4.2. Test Procedure Used

KDB 789033 D02v01r01 – Section C.1

### 7.4.3. Test Setting

1. The analyzers' automatic bandwidth measurement capability was used to perform the 26dB bandwidth measurement. The "X" dB bandwidth parameter was set to X = 26. The automatic bandwidth measurement function also has the capability of simultaneously measuring the 99% occupied bandwidth. The bandwidth measurement was not influenced by any intermediated power nulls in the fundamental emission.
2. RBW = approximately 1% of the emission bandwidth.
3. VBW ≥ 3 × RBW.
4. Detector = Peak.
5. Trace mode = max hold.

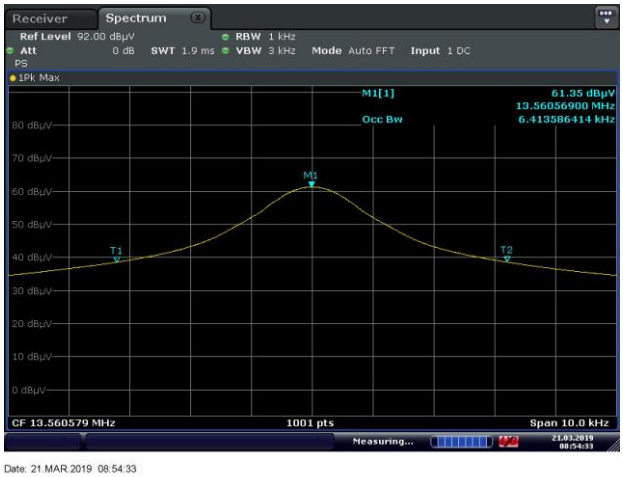
### 7.4.4. Test Setup



### 7.4.5. Test Result

| Test Mode | Frequency (MHz) | 20dB Bandwidth (kHz) | 99% Bandwidth (kHz) |
|---|---|---|---|
| NFC | 13.65 | 4.786 | 6.414 |

**NFC 13.56MHz 20dB Bandwidth & 99% Bandwidth**

## 7.5. Frequency Stability Measurement

### 7.5.1. Test Limit

Manufactures of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

### 7.5.2. Test Procedure Used

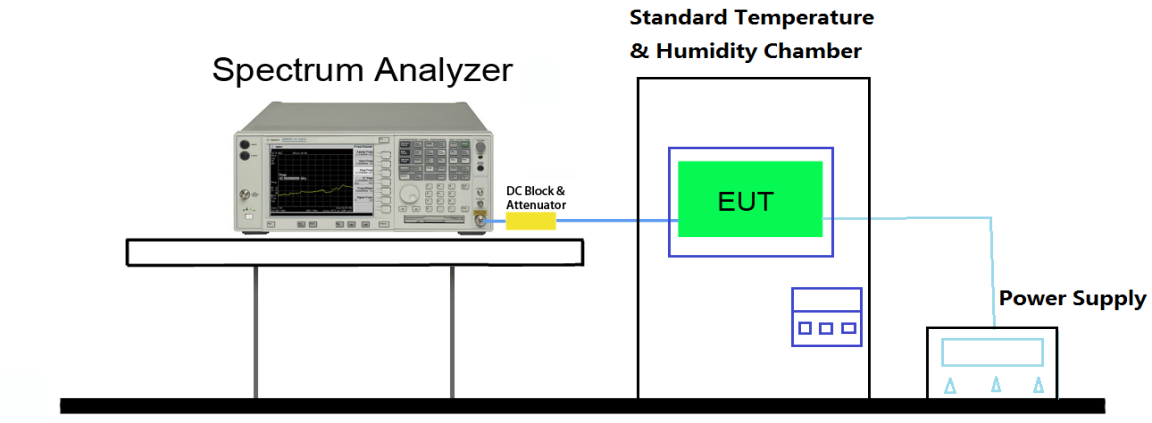
**Frequency Stability Under Temperature Variations:**

The equipment under test was connected to an external AC or DC power supply and input rated voltage. RF output was connected to a frequency counter or spectrum analyzer via feed through attenuators. The EUT was placed inside the temperature chamber. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and measure EUT 20°C operating frequency as reference frequency. Turn EUT off and set the chamber temperature to highest. After the temperature stabilized for approximately 30 minutes recorded the frequency. Repeat step measure with 10°C decreased per stage until the lowest temperature reached.

**Frequency Stability Under Voltage Variations:**

Set chamber temperature to 20°C. Use a variable AC power supply / DC power source to power the EUT and set the voltage to rated voltage. Set the spectrum analyzer RBW low enough to obtain the desired frequency resolution and recorded the frequency.
Reduce the input voltage to specify extreme voltage variation (±15%) and endpoint, record the maximum frequency change.

### 7.5.3. Test Setup



### 7.5.4. Test Result

| Test Engineer | Fran | Temperature | -20 ~ 50°C |
|---|---|---|---|
| Test Time | 2019/3/20 | Relative Humidity | 58%RH |

| NFC 13.56MHz Frequency Stability | | | | | |
|---|---|---|---|---|---|
| Temperature vs. Frequency Stability | | | | | |
| Voltage (%) | Power (VDC) | Temp (°C) | Frequency (MHz) | Frequency Tolerance (ppm) | Limit (ppm) |
| 100% | DC 5V | - 20 | 13.5607 | 51.6224 | ±100 |
| | | - 10 | 13.5607 | 51.6224 | ±100 |
| | | 0 | 13.5607 | 51.6224 | ±100 |
| | | + 10 | 13.5606 | 44.2478 | ±100 |
| | | + 20 (Ref) | 13.5606 | 44.2478 | ±100 |
| | | + 30 | 13.5606 | 44.2478 | ±100 |
| | | + 40 | 13.5606 | 44.2478 | ±100 |
| | | + 50 | 13.5606 | 44.2478 | ±100 |
| Test Result | | PASS | | | |
| Voltage vs. Frequency Stability | | | | | |
| Voltage (%) | Power (VDC) | Temp (°C) | Frequency (MHz) | Frequency Tolerance (ppm) | Limit (ppm) |
| 100% | DC 5V | + 20 | 13.5605 | 36.8732 | ±100 |
| 115% | DC 5.75V | + 20 | 13.5606 | 44.2478 | ±100 |
| 85% | DC 4.25V | + 20 | 13.5605 | 36.8732 | ±100 |
| Test Result | | PASS | | | |

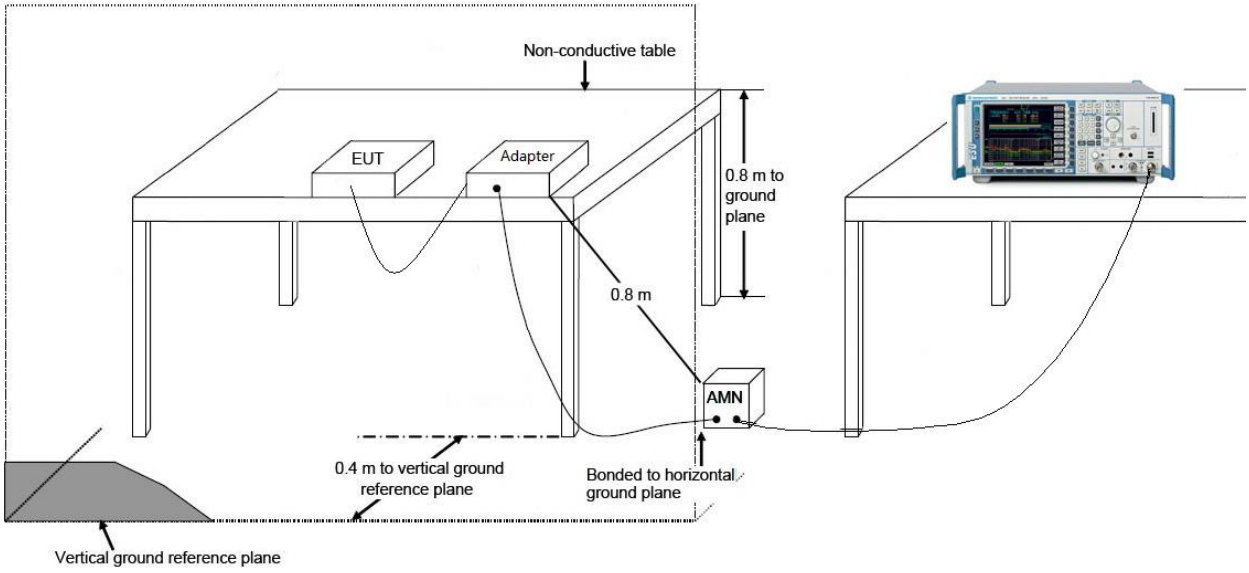
Note:
Frequency Tolerance (ppm) = {[Measured Frequency (Hz) – Declared Frequency (Hz)] / Declared Frequency (Hz)} *$10^6$.

## 7.6. AC Conducted Emissions Measurement

### 7.6.1. Test Limit

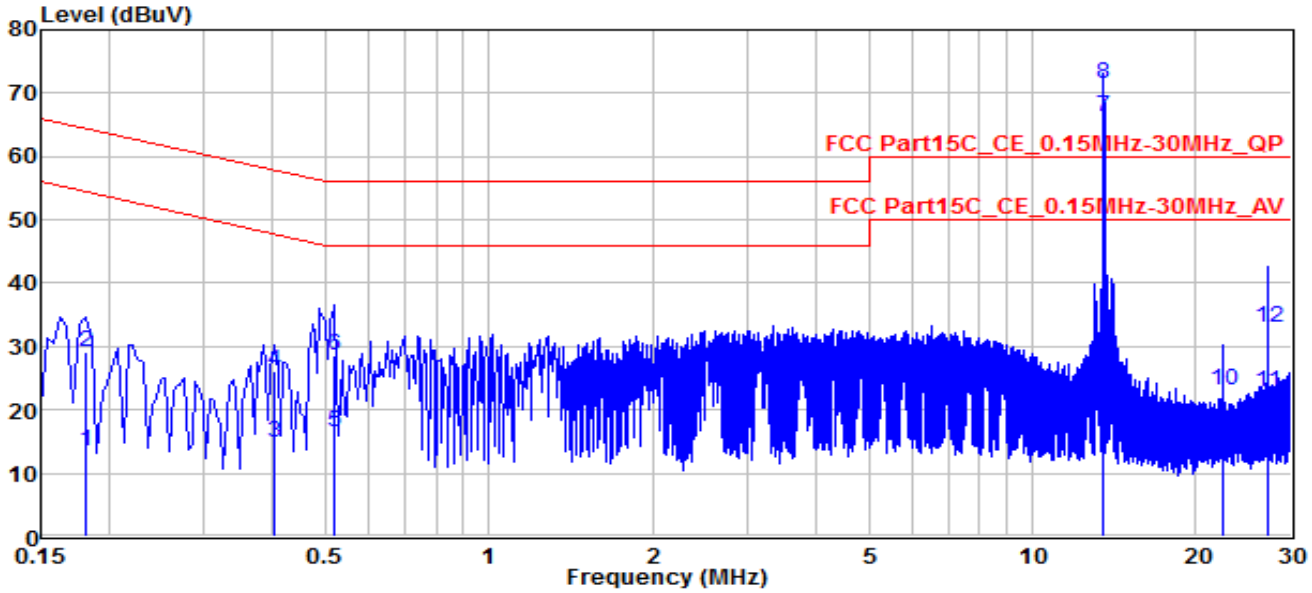
| FCC Part 15 Subpart C Paragraph 15.207 Limits | | |
|---|---|---|
| Frequency (MHz) | QP (dBuV) | AV (dBuV) |
| 0.15 - 0.50 | 66 - 56 | 56 - 46 |
| 0.50 - 5.0 | 56 | 46 |
| 5.0 - 30 | 60 | 50 |
| Note 1: The lower limit shall apply at the transition frequencies.<br>Note 2: The limit decreases linearly with the logarithm of the frequency in the range 0.15MHz to 0.5MHz. | | |

### 7.6.2. Test Setup



### 7.6.3. Test Result

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-L1 (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Line1 | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.1815 | 3.39 | 10.14 | 13.53 | -40.89 | 54.42 | QP |
| 2 | | 0.1815 | 18.89 | 10.14 | 29.03 | -35.39 | 64.42 | Average |
| 3 | | 0.40197 | 4.9 | 10.04 | 14.94 | -32.87 | 47.81 | QP |
| 4 | | 0.40197 | 16.03 | 10.04 | 26.07 | -31.74 | 57.81 | Average |
| 5 | | 0.51896 | 6.31 | 10.1 | 16.41 | -29.59 | 46 | QP |
| 6 | | 0.51896 | 18.57 | 10.1 | 28.67 | -27.33 | 56 | Average |
| 7 | | 13.559 | 56.31 | 9.92 | 66.23 | 16.23 | 50 | QP |
| 8 | | 13.559 | 61.62 | 9.92 | 71.54 | 11.54 | 60 | Average |
| 9 | | 22.49 | 4.23 | 10.02 | 14.25 | -35.75 | 50 | QP |
| 10 | | 22.49 | 13.05 | 10.02 | 23.07 | -36.93 | 60 | Average |
| 11 | * | 27.116 | 12.76 | 10.03 | 22.79 | -27.21 | 50 | QP |
| 12 | * | 27.116 | 22.95 | 10.03 | 32.98 | -27.02 | 60 | Average |

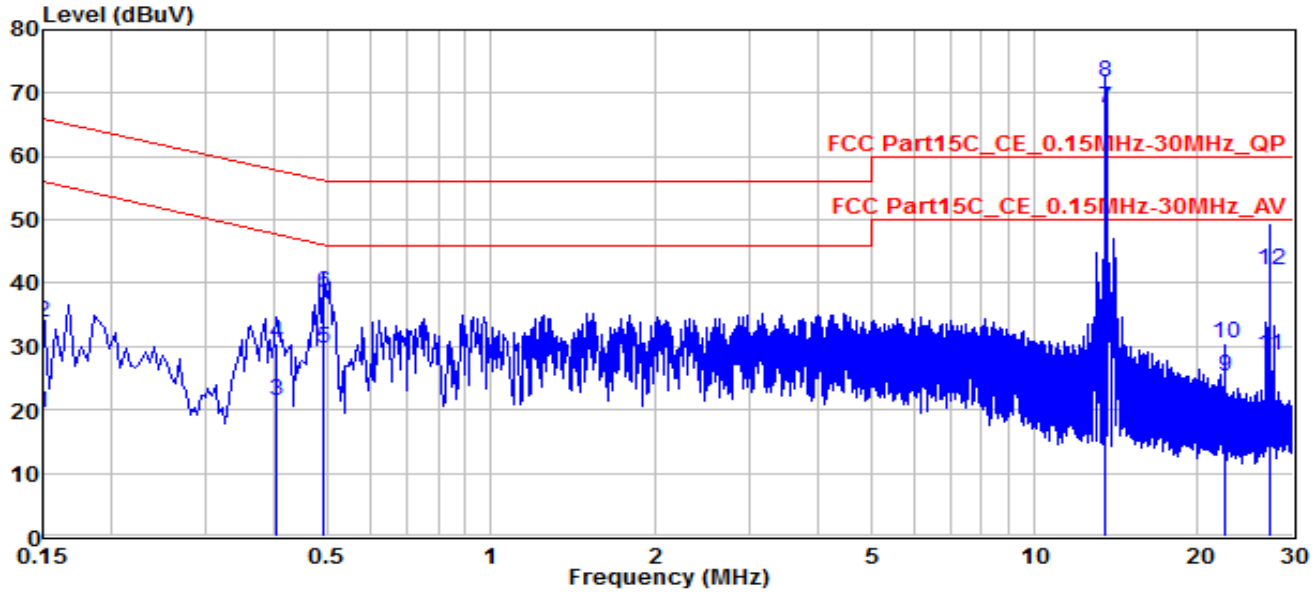
Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-N (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Neutral | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode1 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.15 | 9.62 | 9.84 | 19.46 | -36.54 | 56 | QP |
| 2 | | 0.15 | 24.1 | 9.84 | 33.94 | -32.06 | 66 | Average |
| 3 | | 0.40197 | 11.47 | 10.04 | 21.51 | -26.3 | 47.81 | QP |
| 4 | | 0.40197 | 20.49 | 10.04 | 30.53 | -27.28 | 57.81 | Average |
| 5 | * | 0.49197 | 19.59 | 10.12 | 29.71 | -16.42 | 46.13 | QP |
| 6 | * | 0.49197 | 28.48 | 10.12 | 38.6 | -17.53 | 56.13 | Average |
| 7 | | 13.559 | 57.64 | 9.94 | 67.58 | 17.58 | 50 | QP |
| 8 | | 13.559 | 61.76 | 9.94 | 71.7 | 11.7 | 60 | Average |
| 9 | | 22.499 | 15.32 | 10.08 | 25.4 | -24.6 | 50 | QP |
| 10 | | 22.499 | 20.33 | 10.08 | 30.41 | -29.59 | 60 | Average |
| 11 | | 27.116 | 18.46 | 10.12 | 28.58 | -21.42 | 50 | QP |
| 12 | | 27.116 | 31.97 | 10.12 | 42.09 | -17.91 | 60 | Average |

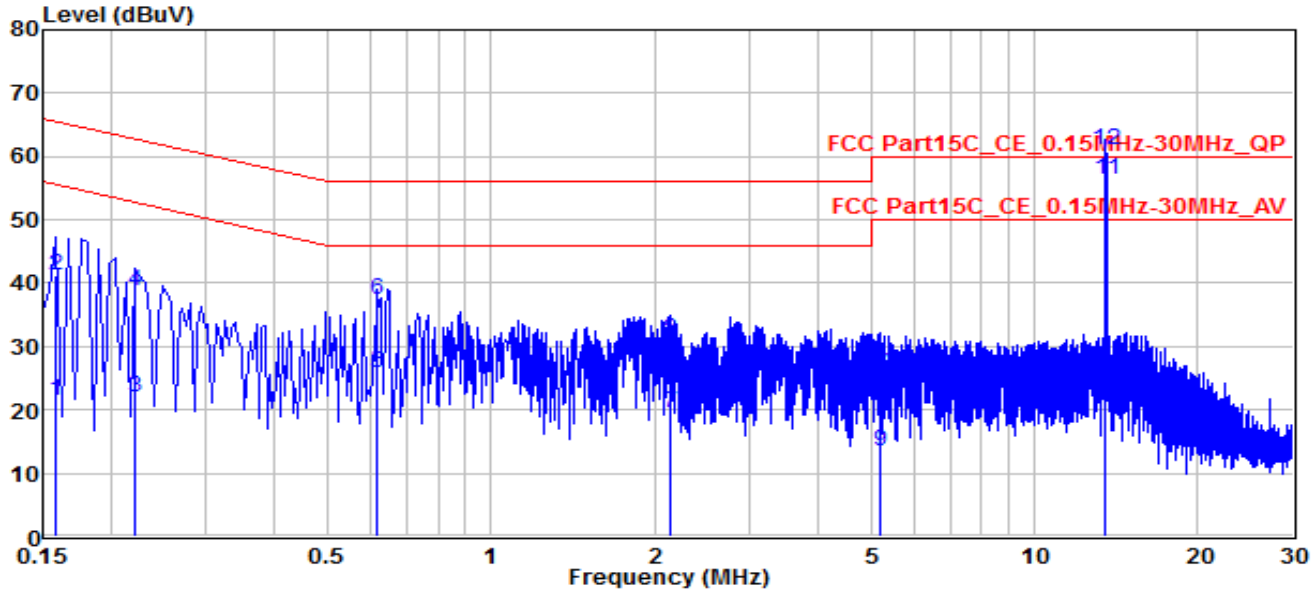
Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-L1 (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Line1 | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode2 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.159 | 11.43 | 10.08 | 21.51 | -34.01 | 55.52 | QP |
| 2 | | 0.159 | 31.22 | 10.08 | 41.3 | -24.22 | 65.52 | Average |
| 3 | | 0.22199 | 11.99 | 9.93 | 21.92 | -30.82 | 52.74 | QP |
| 4 | | 0.22199 | 28.94 | 9.93 | 38.87 | -23.87 | 62.74 | Average |
| 5 | * | 0.61795 | 15.72 | 10.05 | 25.77 | -20.23 | 46 | QP |
| 6 | * | 0.61795 | 27.21 | 10.05 | 37.26 | -18.74 | 56 | Average |
| 7 | | 2.148 | 9.76 | 9.86 | 19.62 | -26.38 | 46 | QP |
| 8 | | 2.148 | 21.23 | 9.86 | 31.09 | -24.91 | 56 | Average |
| 9 | | 5.207 | 3.82 | 9.76 | 13.58 | -36.42 | 50 | QP |
| 10 | | 5.207 | 15.85 | 9.76 | 25.61 | -34.39 | 60 | Average |
| 11 | | 13.559 | 46.48 | 9.92 | 56.4 | 6.4 | 50 | QP |
| 12 | | 13.559 | 51.06 | 9.92 | 60.98 | 0.98 | 60 | Average |

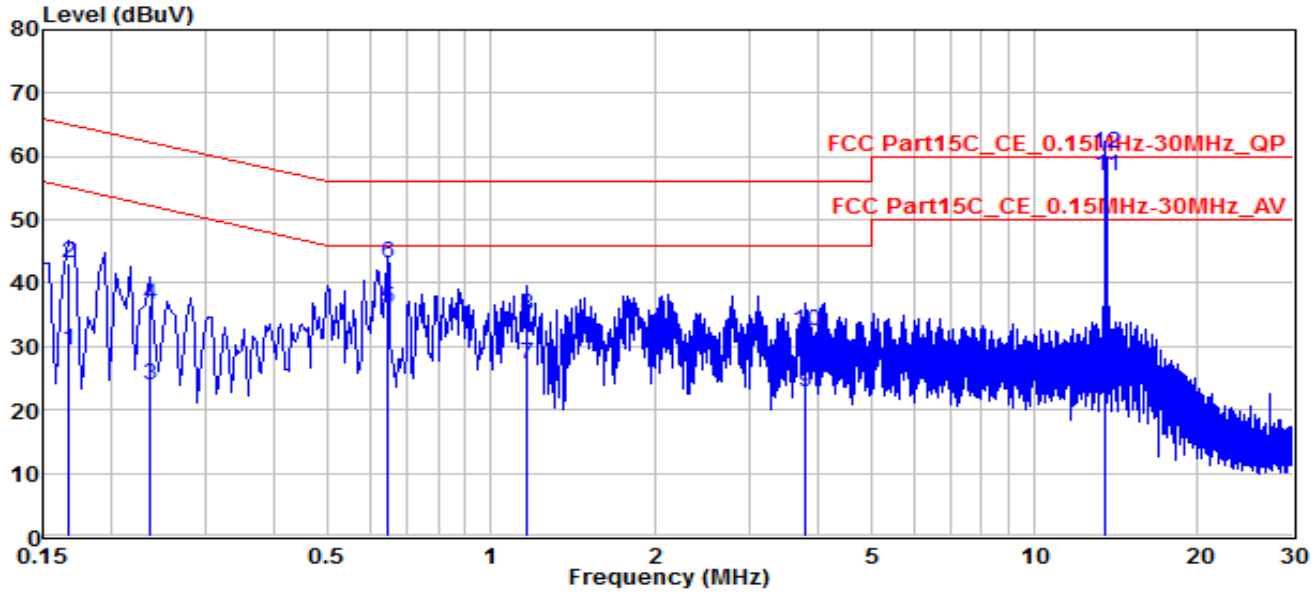
Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-N (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Neutral | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode2 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.168 | 19.19 | 10.11 | 29.3 | -25.76 | 55.06 | QP |
| 2 | | 0.168 | 33.07 | 10.11 | 43.18 | -21.88 | 65.06 | Average |
| 3 | | 0.23549 | 14.05 | 9.91 | 23.96 | -28.29 | 52.25 | QP |
| 4 | | 0.23549 | 26.72 | 9.91 | 36.63 | -25.62 | 62.25 | Average |
| 5 | * | 0.64495 | 26.05 | 10.06 | 36.11 | -9.89 | 46 | QP |
| 6 | * | 0.64495 | 33.23 | 10.06 | 43.29 | -12.71 | 56 | Average |
| 7 | | 1.167 | 17.21 | 9.88 | 27.09 | -18.91 | 46 | QP |
| 8 | | 1.167 | 25.02 | 9.88 | 34.9 | -21.1 | 56 | Average |
| 9 | | 3.786 | 13.14 | 9.78 | 22.92 | -23.08 | 46 | QP |
| 10 | | 3.786 | 22.69 | 9.78 | 32.47 | -23.53 | 56 | Average |
| 11 | | 13.559 | 46.98 | 9.94 | 56.92 | 6.92 | 50 | QP |
| 12 | | 13.559 | 50.68 | 9.94 | 60.62 | 0.62 | 60 | Average |

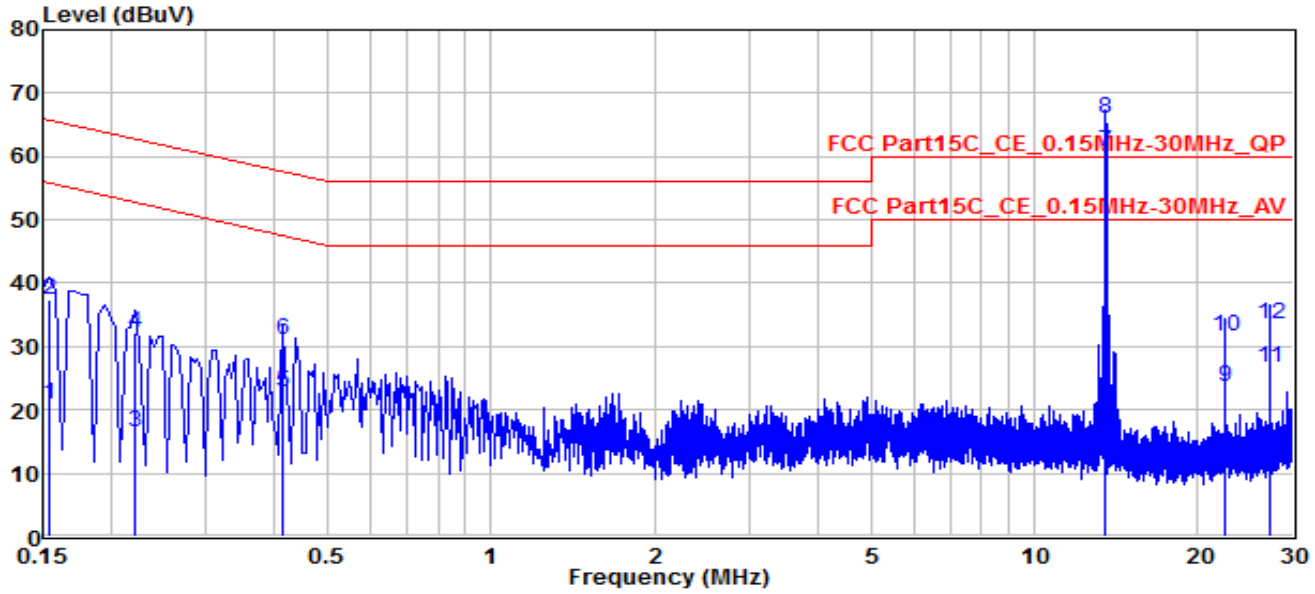
Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-L1 (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Line1 | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode3 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.1545 | 11.08 | 9.94 | 21.02 | -34.73 | 55.75 | QP |
| 2 | | 0.1545 | 27.46 | 9.94 | 37.4 | -28.35 | 65.75 | Average |
| 3 | | 0.22199 | 6.46 | 9.93 | 16.39 | -36.35 | 52.74 | QP |
| 4 | | 0.22199 | 22.21 | 9.93 | 32.14 | -30.6 | 62.74 | Average |
| 5 | | 0.41547 | 12.66 | 10.06 | 22.72 | -24.82 | 47.54 | QP |
| 6 | | 0.41547 | 21.06 | 10.06 | 31.12 | -26.42 | 57.54 | Average |
| 7 | | 13.559 | 50.76 | 9.92 | 60.68 | 10.68 | 50 | QP |
| 8 | | 13.559 | 56.11 | 9.92 | 66.03 | 6.03 | 60 | Average |
| 9 | | 22.495 | 13.76 | 10.02 | 23.78 | -26.22 | 50 | QP |
| 10 | | 22.495 | 21.67 | 10.02 | 31.69 | -28.31 | 60 | Average |
| 11 | * | 27.12 | 16.56 | 10.03 | 26.59 | -23.41 | 50 | QP |
| 12 | * | 27.12 | 23.47 | 10.03 | 33.5 | -26.5 | 60 | Average |

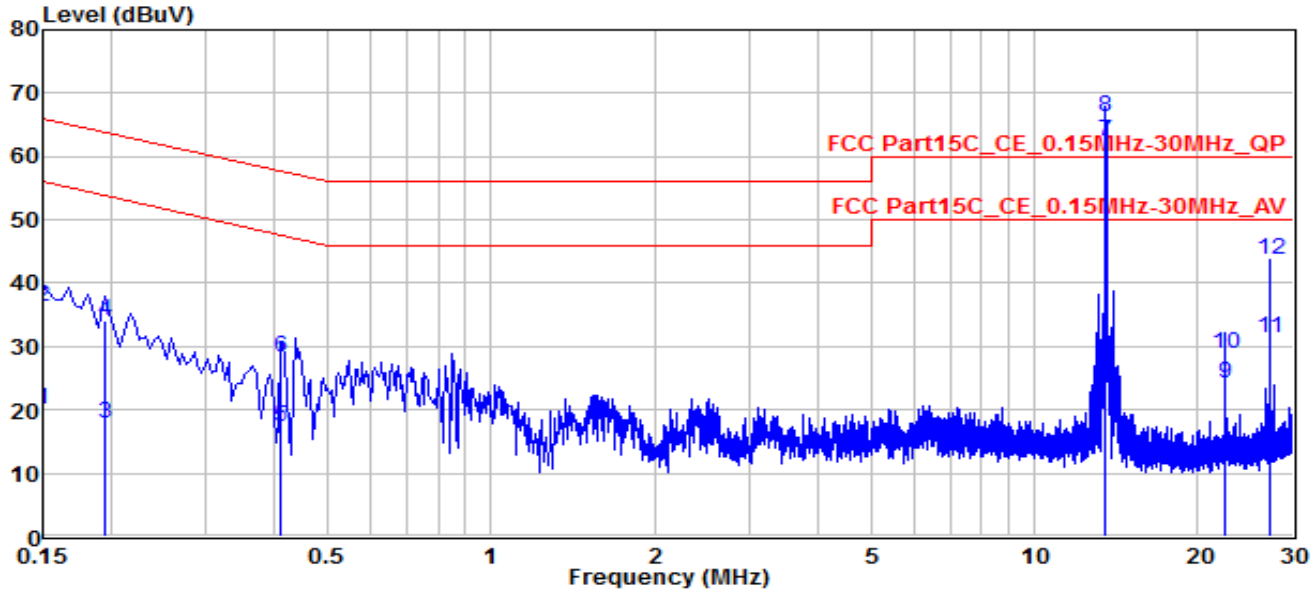
Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

| EUT | RFID Reader | Date of Test | 2019/3/18 |
|---|---|---|---|
| Factor | CE_ENV216-N (Filter ON) | Temp. / Humidity | 24°C / 68% |
| Polarity | Neutral | Site / Test Engineer | SR2 / Fran |
| Test Mode | Mode3 | Test Voltage | AC 120V/60Hz |




| No | | Frequency (MHz) | Reading (dBuV) | C.F (dB) | Measurement (dBuV) | Margin (dB) | Limit (dBuV) | Remark (QP/PK/AV) |
|---|---|---|---|---|---|---|---|---|
| 1 | | 0.15 | 10.31 | 9.84 | 20.15 | -35.85 | 56 | QP |
| 2 | | 0.15 | 26.57 | 9.84 | 36.41 | -29.59 | 66 | Average |
| 3 | | 0.195 | 8.04 | 9.95 | 17.99 | -35.83 | 53.82 | QP |
| 4 | | 0.195 | 24.13 | 9.95 | 34.08 | -29.74 | 63.82 | Average |
| 5 | | 0.41097 | 7.25 | 10.05 | 17.3 | -30.33 | 47.63 | QP |
| 6 | | 0.41097 | 18.32 | 10.05 | 28.37 | -29.26 | 57.63 | Average |
| 7 | | 13.559 | 52.36 | 9.94 | 62.3 | 12.3 | 50 | QP |
| 8 | | 13.559 | 56.36 | 9.94 | 66.3 | 6.3 | 60 | Average |
| 9 | | 22.495 | 14.11 | 10.08 | 24.19 | -25.81 | 50 | QP |
| 10 | | 22.495 | 18.67 | 10.08 | 28.75 | -31.25 | 60 | Average |
| 11 | * | 27.12 | 21.29 | 10.12 | 31.41 | -18.59 | 50 | QP |
| 12 | * | 27.12 | 33.65 | 10.12 | 43.77 | -16.23 | 60 | Average |

Note: 1. " * ", means this data is the worst emission level.

2. C.F (Correction Factor) = Factor (dB)+ Cable Loss (dB)

3. Measurement (dBuV) = Reading(dBuV)+ C.F (Correction Factor)

4. The RFID Operation Frequency is 13.559MHz which is Intentional , so it can be ignored.

# 8. CONCLUSION

The data collected relate only the item(s) tested and show that the **RFID Reader** is in compliance with Part 15.225 of the FCC Rules.

The End