# FCC / IC Test Report

**FOR:**
Qolsys Inc.

**Model**:
IQ Mini-S

**Product Description**:
Door Sensor Alarm System

**FCC ID:** 2AAJXQS-IQDWM
**IC:** 11205A-QSIQDWM

**Applied Rules and Standards**:
47 CFR Part: 15.231
RSS-210 Issue 10 & RSS-Gen Issue 5

**REPORT #**: EMC_QOLSY_012_23001_FCC_15_231_Rev1

**DATE**: 2023-08-02

**A2LA Accredited**

**IC recognized # 3462B**


***CETECOM* Inc.**
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## 1 Assessment

The following device was evaluated against the applicable criteria specified in FCC rules Parts 15.231 of Title 47 of the Code of Federal Regulations and the relevant ISED Canada standard RSS-210 Issue 10 & RSS-Gen Issue 5.

No deviations were ascertained.

| Company | Description | Model # |
|---|---|---|
| Qolsys Inc. | The IQ Mini-S is an encrypted sensor with superior range specifically designed with multi-level vibration detection. It can alert you if a door is left open and provide security for anything that opens or closes. It is intended to work only with Qolsys Alarm panels. | IQ Mini-S |

**Responsible for Testing Laboratory:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2023-08-02 | Compliance | Arndt Stoecker (Director of Regulatory Services) | Arndt Stoecker Digitally signed by: Arndt Stoecker DN: CN = Arndt Stoecker email = arndt.stoecker@cetecom.com C = US O = CETECOM Inc Date: 2023.08.02 19:17:30 -07'00' |

**Responsible for the Report:**

| Date | Section | Name | Signature |
|---|---|---|---|
| 2023-08-02 | Compliance | Art Thammanavarat (Senior EMC Engineer) | art. thammanavarat@cetecom.com Digitally signed by: art. thammanavarat@cetecom.com DN: CN = art. thammanavarat@cetecom.com Date: 2023.08.02 18:08:37 -07'00' |

# 2 Administrative Data

## 2.1 Identification of the Testing Laboratory Issuing the EMC Test Report

| | |
|---|---|
| **Company Name:** | CETECOM Inc. |
| **Department:** | Compliance |
| **Street Address:** | 411 Dixon Landing Road |
| **City/Zip Code** | Milpitas, CA 95035 |
| **Country** | USA |
| **Telephone:** | +1 (408) 586 6200 |
| **Fax:** | +1 (408) 586 6299 |
| **Compliance Manager:** | Arndt Stoecker |
| **Responsible Project Leader:** | Akanksha Baskaran |

## 2.2 Identification of the Client

| | |
|---|---|
| **Client Firm/Name:** | Qolsys Inc. |
| **Street Address:** | 1919 S. Bascom Ave. Suite 600 |
| **City/Zip Code** | Campbell, California, 95008 |
| **Country** | USA |

## 2.3 Identification of the Manufacturer

| | |
|---|---|
| **Manufacturer's Name:** | Same as Client |
| **Manufacturers Address:** | |
| **City/Zip Code** | |
| **Country** | |

# 3 Equipment Under Test (EUT)

## 3.1 EUT Specifications

| | |
|---|---|
| **Model No:** | IQ Mini-S |
| **HW Version :** | D |
| **SW Version :** | 1.2.0 |
| **FCC-ID :** | 2AAJXQS-IQDWM |
| **IC:** | 11205A-QSIQDWM |
| **PMN:** | IQ Mini-S |
| **Radio Information:** | **Periodic radio**<br>• SRF Frequency of operation: 319.5MHz |
| **Power Supply/ Rated Operating Voltage Range:** | 3VDC |
| **Operating Temperature Range** | Low : -10 ºC Norm 25 ºC High 50 ºC |
| **Sample Revision** | ☐Production ☒ Pre-Production |

## 3.2 EUT Sample details

| EUT # | Model Number | HW Version | SW Version | Notes/Comments |
|---|---|---|---|---|
| **1** | IQ Mini-S | D | 1.2.0 | EUT in normal operation mode |
| **2** | IQ Mini-S | D | 1.2.0 | EUT in continuous transmitting mode |

## 3.3 Accessory Equipment (AE) details

| AE # | Type | Model | Manufacturer | Serial Number |
|---|---|---|---|---|
| **1** | N/A | N/A | N/A | N/A |

### 3.4 Test Sample Configuration

| Set-up # | Combination of AE used for test set up | Comments |
|---|---|---|
| 1 | EUT#1 | DC/ Battery |
| 2 | EUT#2 | DC/ Battery |

### 3.5 Mode of Operation

| Operating mode # | Comments |
|---|---|
| Op. 1 | Periodic ASK transmission same as the EUT should transmit in reality at 319.5 MHz |
| Op. 2 | Continuous ASK transmission at the maximum output power and duty cycle 319.5 MHz |

### 3.6 Justification for Worst Case Mode of Operation

During the testing process, the EUT was tested with transmitter sets on 319.5MHz, and highest possible duty cycle and output power. For radiated measurements, all data in this report shows the worst case between horizontal and vertical antenna polarizations and for all orientations of the EUT. The worst case is with EUT in Y-axis and with antenna in vertical polarization.

## 4 Subject of Investigation

The objective of the measurements done by CETECOM Inc. was to assess the performance of the EUT according to the relevant requirements specified in FCC rules Part 15.231 of Title 47 of the Code of Federal Regulations and Radio Standard Specification RSS-210 & RSS-Gen Issue 5 of ISED Canada.

## 5 Measurement Results Summary

| Test Specification | Test Case | Temperature and Voltage Conditions | Mode | Pass | NA | NP | Result |
|---|---|---|---|---|---|---|---|
| §15.231(c)<br>RSS-210 A1.3 | Emission Bandwidth | Nominal | Op. 2 | ■ | ☐ | ☐ | Complies |
| §15.231(b)<br>RSS-210 A1.2 | Field strength | Nominal | Op. 2 | ■ | ☐ | ☐ | Complies |
| §15.231(b); §15.205<br>RSS-210 A1.2 | TX Spurious emissions-Radiated | Nominal | Op. 2 | ■ | ☐ | ☐ | Complies |
| §15.231(a,3)<br>RSS Gen 210 A1.1.C | Periodic Transmission | Nominal | Op. 1 | ■ | ☐ | ☐ | Complies |
| §2.1055;<br>RSS-133 6.3 | Frequency Stability | Extreme | - | ☐ | ■ | ☐ | See Note 1 |
| §15.207(a)<br>RSS Gen 8.8 | AC Conducted Emissions | Nominal | - | ☐ | ■ | ☐ | See Note 1 Note 2 |

**Note1:** NA= Not Applicable; NP= Not Performed.
**Note2:** This device does not connect to AC network; hence the test is not applicable.

# 6 Measurement Uncertainty

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus, with 95% confidence interval (in dB delta to result), based on a coverage factor k=2.

Radiated measurement

| Measurement System | | EMC 1 | EMC 2 |
|---|---|---|---|
| Conducted emissions (mains port) | | 1.12 dB | 0.46 dB |
| Radiated emissions | (< 30 MHz) | 3.66 dB | 3.88 dB |
| | (30 MHz – 1GHz) | 3.17 dB | 3.34 dB |
| | (1 GHz – 3 GHz) | 5.01 dB | 4.45 dB |
| | (>3 GHz) | 4.0 dB | 4.79 dB |

RF conducted measurement ±0.5 dB

According to TR 102 273 a multiplicative propagation of error is assumed for RF measurement systems. For this reason the RMS method is applied to dB values and not to linear values as appropriate for additive propagation of error. Also used: http://physics.nist.gov/cuu/Uncertainty/typeb.html. The above calculated uncertainties apply to direct application of the Substitution method. The Substitution method is always used when the EUT comes closer than 3dB to the limit.

## 6.1 Environmental Conditions During Testing:

The following environmental conditions were maintained during the course of testing:

- Ambient Temperature: 20-25°C
- Relative humidity: 40-60%

## 6.2 Dates of Testing:

2023-06-20 – 2023-07-14

## 6.3 Decision Rule:

Cetecom advanced follows ILAC G8:2019 chapter 4.2.1 (Simple Acceptance Rule).

Only the measured values related to their corresponding limits will be used to decide whether the equipment under test meets the requirements of the test standards listed in chapter 3. The measurement uncertainty is mentioned in this test report, See chapter 9, but is not taken into account – neither to the limits nor to the measurement results. Measurement results with a smaller margin to the corresponding limits than the measurement uncertainty have a potential risk of more than 5% that the decision might be wrong.

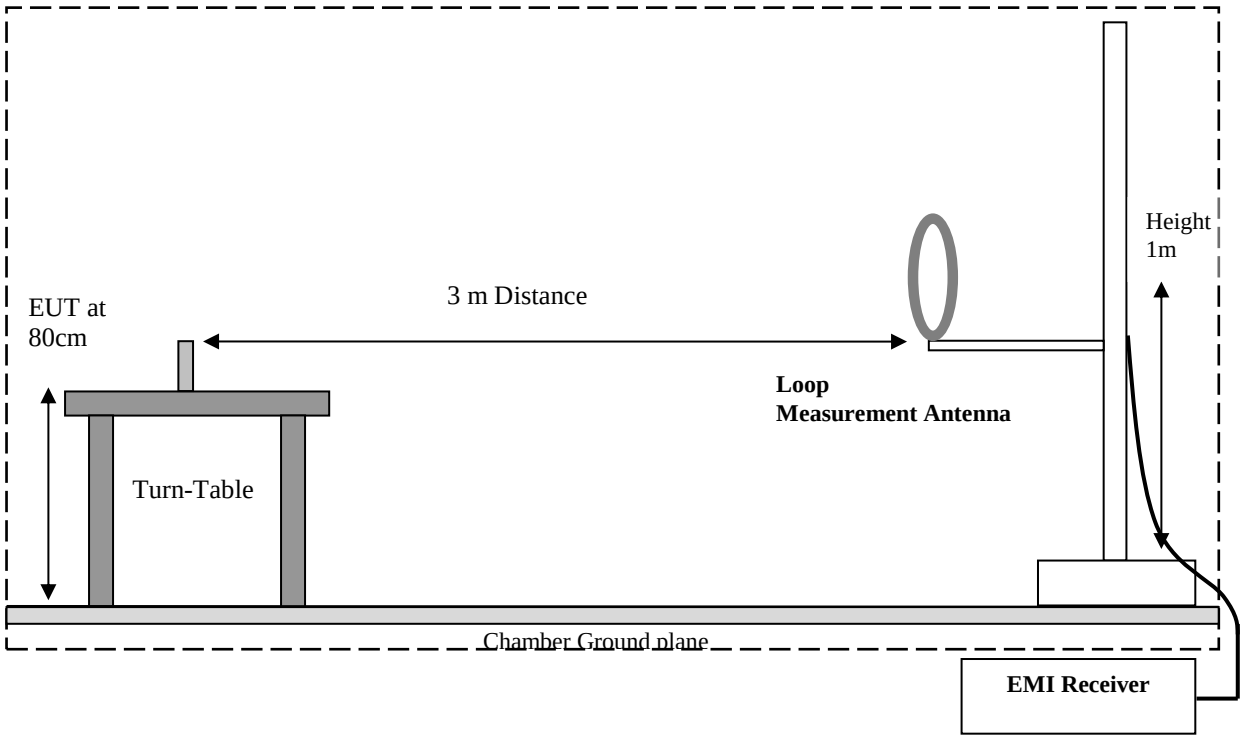
# 7 Measurement Procedures

## 7.1 Radiated Measurement

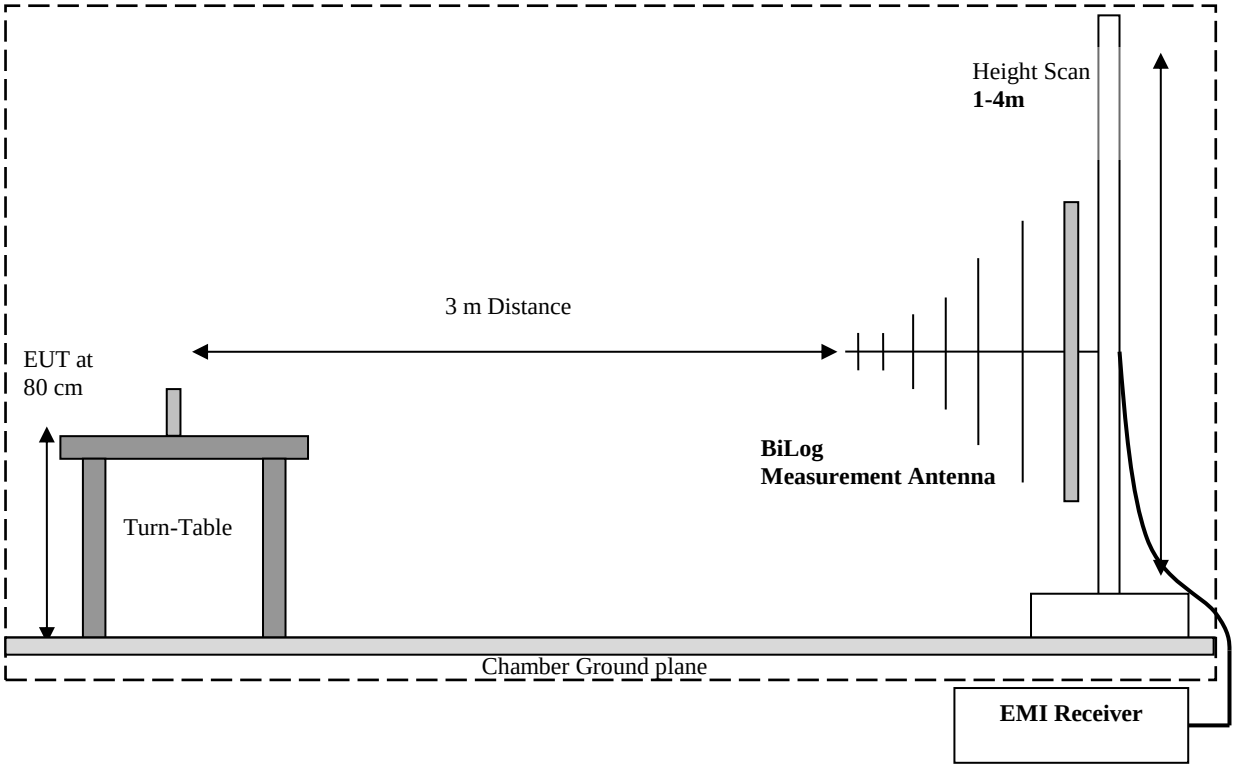
The radiated measurement is performed according to ANSI C63.10 (2013)

- The exploratory measurement is accomplished by running a matrix of 16 sweeps over the required frequency range with R&S Test-SW EMC32 for 4 positions of the turntable, two orthogonal positions of the EUT and both antenna polarizations. This procedure exceeds the requirement of the above standards to cover the 3 orthogonal axis of the EUT. A max peak detector is utilized during the exploratory measurement. The Test-SW creates an overall maximum trace for all 12 sweeps and saves the settings for each point of this trace. The maximum trace is part of the test report.
- The 10 highest emissions are selected with an automatic algorithm of EMC32 searching for peaks in the noise floor and ensuring that broadband signals are not selected multiple times.
- The maxima are then put through the final measurement and again maximized in a 90deg range of the turntable, fine search in frequency domain and height scan between 1m and 4m.
- The above procedure is repeated for all possible ways of power supply to EUT and for all supported modulations.
- In case there are no emissions above noise floor level only the maximum trace is reported as described above.
- The results are split up into up to 4 frequency ranges due to antenna bandwidth restrictions. A magnetic loop is used from 9 kHz to 30 MHz, a Biconilog antenna is used from 30 MHz to 1 GHz, and two different horn antennas are used to cover frequencies up to 40 GHz.

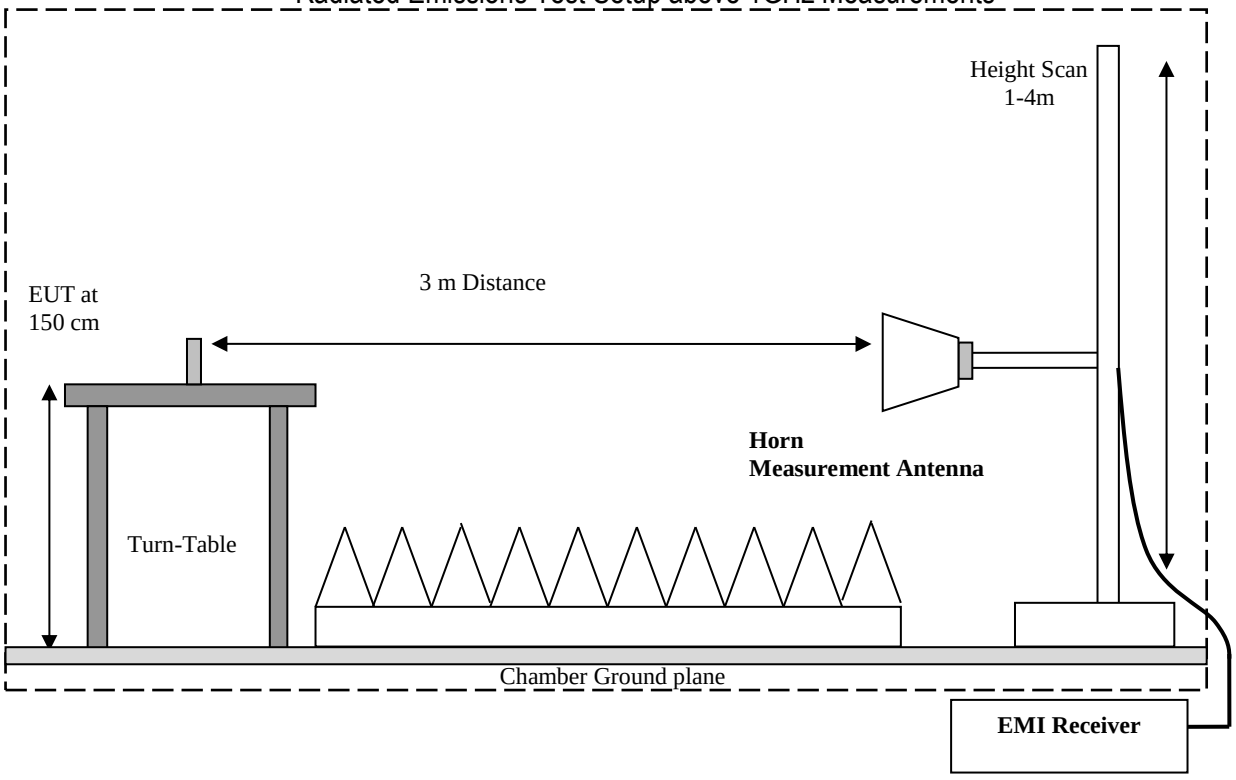
Radiated Emissions Test Setup below 30MHz Measurements



Radiated Emissions Test Setup 30MHz-1GHz Measurements




Radiated Emissions Test Setup above 1GHz Measurements



### 7.1.1 Sample Calculations for Field Strength Measurements

Field Strength is calculated from the Spectrum Analyzer/ Receiver readings, taking into account the following parameters:

1. Measured reading in dBµV
2. Cable Loss between the receiving antenna and SA in dB and
3. Antenna Factor in dB/m

All radiated measurement plots in this report are taken from a test SW that calculates the Field Strength based on the following equation:

FS (dBµV/m) = Measured Value on SA (dBµV)- Cable Loss (dB)+ Antenna Factor (dB/m)

Example:

| Frequency (MHz) | Measured SA (dBµV) | Cable Loss (dB) | Antenna Factor Correction (dB) | Field Strength Result (dBµV/m) |
|---|---|---|---|---|
| 1000 | 80.5 | 3.5 | 14 | 98.0 |

# 8 Test Result Data

## 8.1 Field strength

### 8.1.1 Measurement according to ANSI C63.10 (2013)

**Spectrum Analyzer settings:**

- RBW ≥ Bandwidth
- VBW ≥ 3 x RBW
- Span ≥ 3 x RBW
- Sweep = Auto couple
- Detector function = RMS
- Trace = Max hold
- Use peak marker function to determine the peak amplitude level

### 8.1.2 Limits:

**Maximum Peak Output Power:**

- §15.231(b) and RSS 210 A1.1: In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emissions (microvolts/meter) |
|---|---|---|
| 40.66-40.70 | 2,250 | 225 |
| 70-130 | 1,250 | 125 |
| 130-174 | [1] 1,250 to 3,750 | [1] 125 to 375 |
| 174-260 | 3,750 | 375 |
| 260-470 | [1] 3,750 to 12,500 | [1] 375 to 1,250 |
| Above 470 | 12,500 | 1,250 |

### 8.1.3 Test conditions and setup:

| Ambient Temperature | EUT operating mode | Power Input |
|---|---|---|
| 23.2° C | Op. 2 | 3VDC |

### 8.1.4 Measurement result:

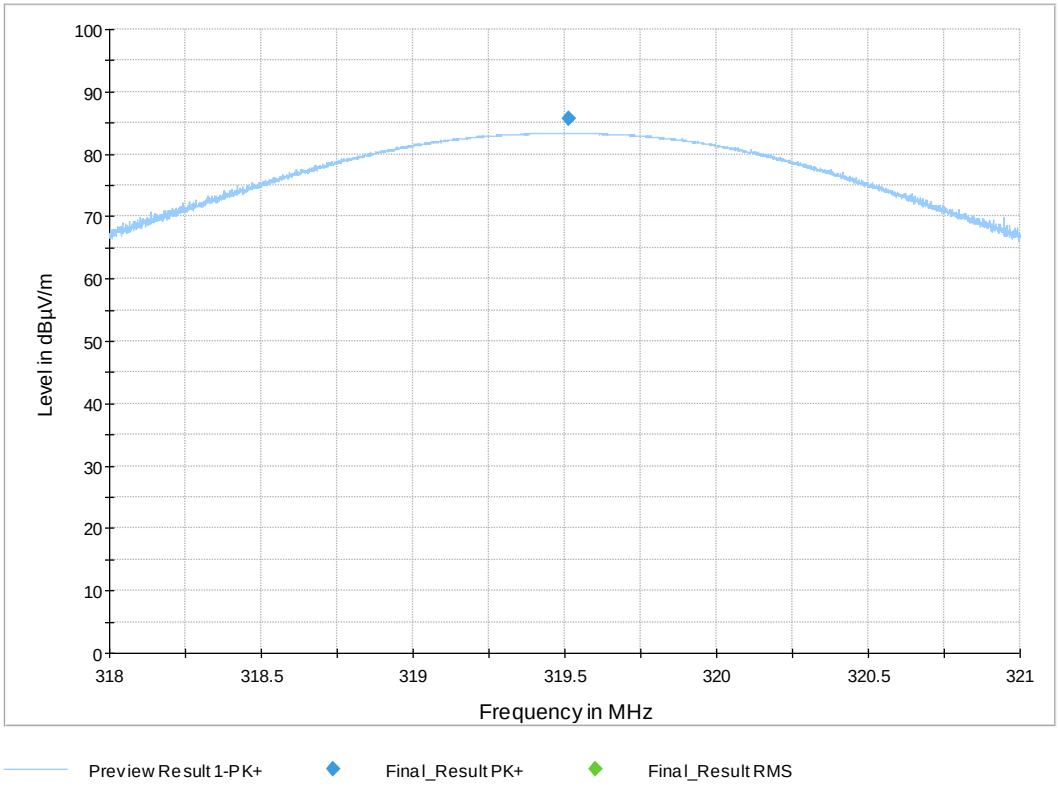
| Plot # | EUT Set-Up # | Fundamental frequency (MHz) | Modulation | Fundamental Field Strength Max Peak (dBµV/m) | Fundamental Field Strength Corrected For Duty Cycle* (dBµV/m) | Limit (dBµV/m) | Result |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 319.5 | ASK | 85.71 | 73.42 | 75.89 | Pass |

* Please see Section 8.4.4 for duty cycle correction factor.

### 8.1.5 Measurement Plots:

**Plot # 1**

| Frequency (MHz) | MaxPeak (dBµV/m) | RMS (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 319.52 | 85.71 | --- | --- | --- | 500.0 | 100.0 | 201.0 | H | 182.0 | 21.8 | |



## 8.2 Emission Bandwidth

### 8.2.1 Measurement according to ANSI C63.10 (2013)

**Spectrum Analyzer settings:**

- Set RBW = 100 kHz
- Set the video bandwidth (VBW) ≥ 3 x RBW
- Detector = Peak
- Trace mode = Max hold
- Sweep = Auto couple
- Allow the trace to stabilize
- Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.

### 8.2.2 Limits:

- FCC §15.231(c): The bandwidth of the emission shall be no wider than 0.25% of the center frequency for devices operating above 70 MHz and below 900 MHz. Bandwidth is determined at the points 20 dB down from the modulated carrier.
- RSS-210 A1.1.3: The 99% bandwidth shall be no wider than 0.25% of the center frequency for devices operating between 70 MHz and 900 MHz.

### 8.2.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---|---|---|---|
| 23.2° C | 2 | Op. 2 | 3Vdc Battery |

### 8.2.4 Measurement result:

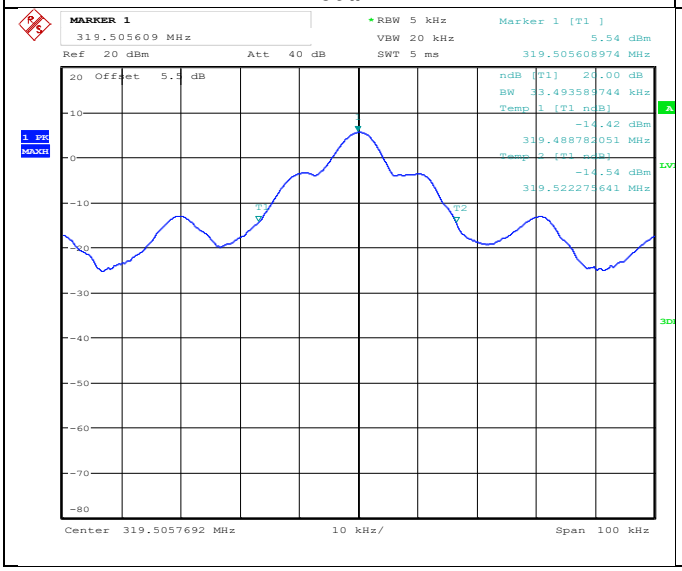
| Plot # | Frequency (MHz) | Modulation | 20 dB Bandwidth (KHz) | Limit (kHz) | Result |
|---|---|---|---|---|---|
| 1 | 319.5 | ASK | 33.49 | 798.8 | Pass |

| Plot # | Frequency (MHz) | Modulation | 99% Emissions Bandwidth (KHz) | Limit (kHz) | Result |
|---|---|---|---|---|---|
| 2 | 319.5 | ASK | 41.19 | 798.8 | Pass |

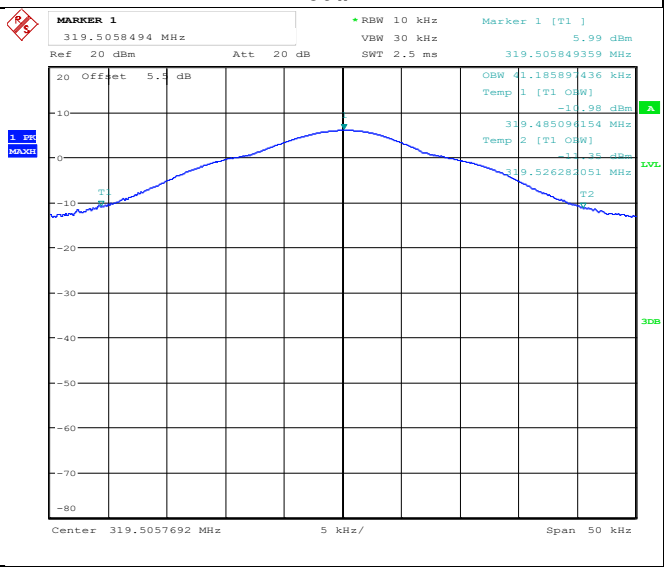
Note: Limit = Fundamental Frequency x 0.25%

## 8.2.5 Measurement Plots:

**Plot # 1**




**Plot # 2**



## 8.3 Radiated Transmitter Spurious Emissions and Restricted Bands

### 8.3.1 Measurement according to ANSI C63.10 (2013)

**Spectrum Analyzer Settings:**

- Frequency = 9 KHz – 30 MHz
- RBW = 9 KHz
- Detector: Peak

- Frequency = 30 MHz – 1 GHz
- Detector = Peak / Quasi-Peak
- RBW= 120 KHz (<1GHz)

- Frequency > 1 GHz
- Detector = Peak / Average
- RBW = 1 MHz

- Radiated spurious emissions shall be measured for the transmit frequencies, transmit power, and data rate for the lowest, middle and highest channel in each frequency band of operation and for the highest gain antenna for each antenna type, and using the appropriate parameters and test requirements.
- The highest (or worst-case) data rate shall be recorded for each measurement.
- For testing at distance other than the specified in the standard, the limit conversion is calculated by using 40 dB/decade extrapolation factor as follow: Conversion factor (CF) = 40 log (D/d) = 40 log (300m / 3m) = 80dB

### 8.3.2 Limits:

- §15.231(b) and RSS 210 A1.1: In addition to the provisions of §15.205, the field strength of emissions from intentional radiators operated under this section shall not exceed the following:

| Fundamental frequency (MHz) | Field strength of fundamental (microvolts/meter) | Field strength of spurious emissions (microvolts/meter) |
|---|---|---|
| 40.66-40.70 | 2,250 | 225 |
| 70-130 | 1,250 | 125 |
| 130-174 | [1]1,250 to 3,750 | [1]125 to 375 |
| 174-260 | 3,750 | 375 |
| 260-470 | [1]3,750 to 12,500 | [1]375 to 1,250 |
| Above 470 | 12,500 | 1,250 |

- FCC §15.205 & RSS-Gen 8.10: Except as shown in paragraph (d) of this section, only spurious emissions are permitted in any of the frequency bands listed below:

| MHz | MHz | MHz | GHz |
|---|---|---|---|
| 0.090-0.110 | 16.42-16.423 | 399.9-410 | 4.5-5.15 |
| [1]0.495-0.505 | 16.69475-16.69525 | 608-614 | 5.35-5.46 |
| 2.1735-2.1905 | 16.80425-16.80475 | 960-1240 | 7.25-7.75 |
| 4.125-4.128 | 25.5-25.67 | 1300-1427 | 8.025-8.5 |
| 4.17725-4.17775 | 37.5-38.25 | 1435-1626.5 | 9.0-9.2 |
| 4.20725-4.20775 | 73-74.6 | 1645.5-1646.5 | 9.3-9.5 |
| 6.215-6.218 | 74.8-75.2 | 1660-1710 | 10.6-12.7 |
| 6.26775-6.26825 | 108-121.94 | 1718.8-1722.2 | 13.25-13.4 |
| 6.31175-6.31225 | 123-138 | 2200-2300 | 14.47-14.5 |
| 8.291-8.294 | 149.9-150.05 | 2310-2390 | 15.35-16.2 |
| 8.362-8.366 | 156.52475-156.52525 | 2483.5-2500 | 17.7-21.4 |
| 8.37625-8.38675 | 156.7-156.9 | 2690-2900 | 22.01-23.12 |
| 8.41425-8.41475 | 162.0125-167.17 | 3260-3267 | 23.6-24.0 |
| 12.29-12.293 | 167.72-173.2 | 3332-3339 | 31.2-31.8 |
| 12.51975-12.52025 | 240-285 | 3345.8-3358 | 36.43-36.5 |
| 12.57675-12.57725 | 322-335.4 | 3600-4400 | Above 38.6 |
| 13.36-13.41 | | | |

- Radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209 (see §15.205(b)).

### 8.3.3 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---|---|---|---|
| 23.2° C | 2 | Op. 2 | 3VDC Battery |

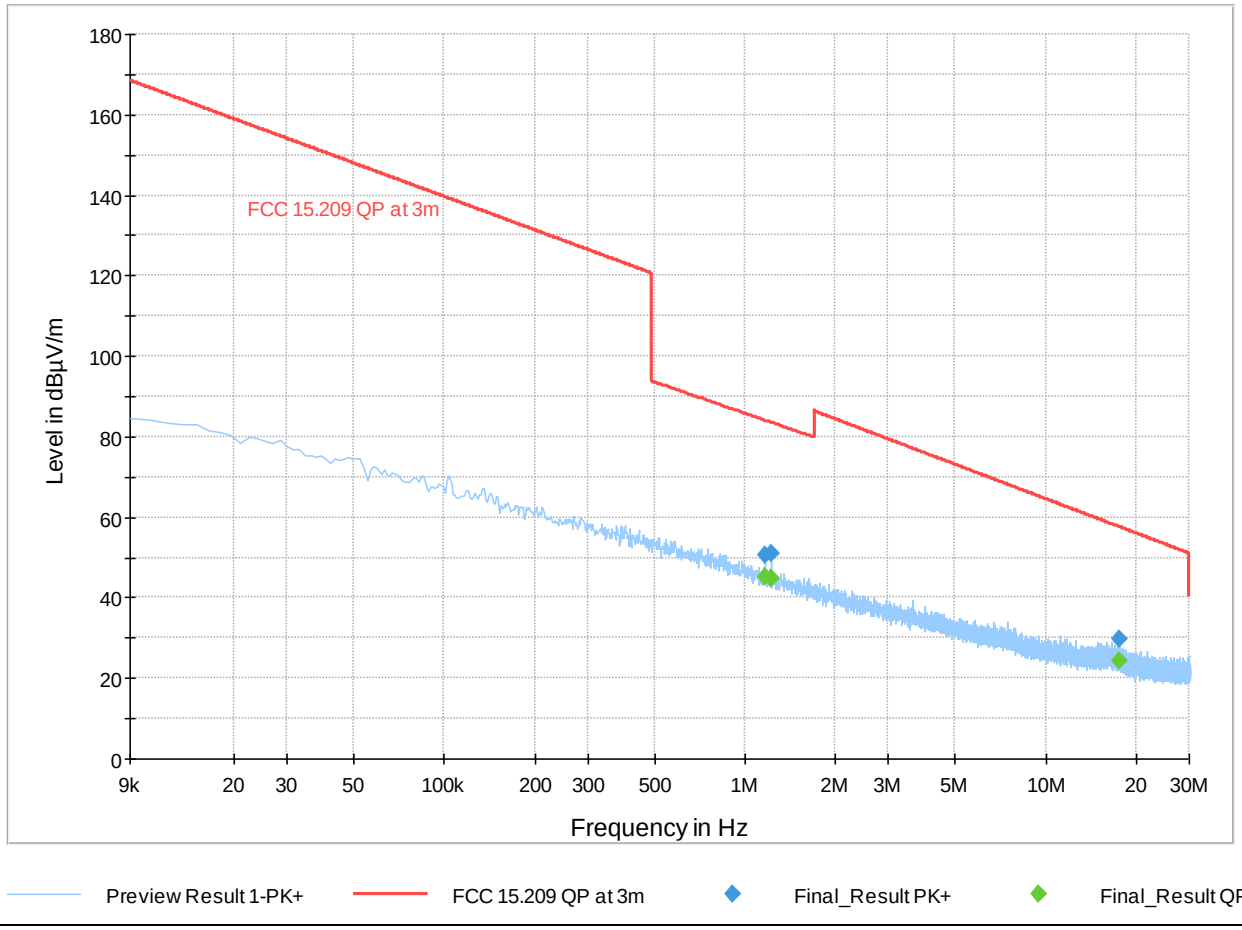
### 8.3.4 Measurement result:

| Plot # | Modulation | Scan Frequency | Limit | Result |
|---|---|---|---|---|
| 1 | ASK | 9 kHz – 30 MHz | See section 8.3.2 | Pass |
| 2 | ASK | 30 MHz – 1 GHz | See section 8.3.2 | Pass |
| 3 | ASK | 1 GHz – 3 GHz | See section 8.3.2 | Pass |
| 4 | ASK | 3 GHz – 4 GHz | See section 8.3.2 | Pass |

### 8.3.5 Measurement Plots:

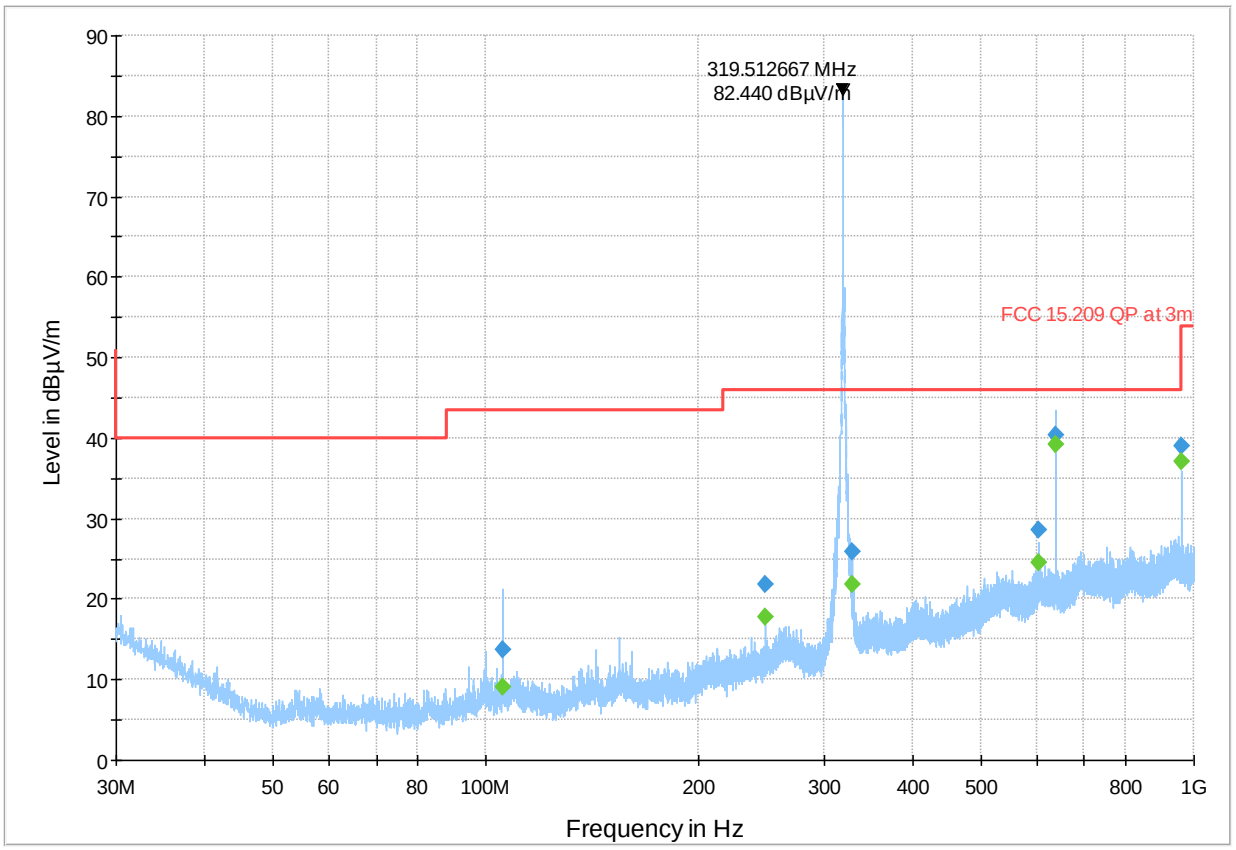
**Plot # 1 FCC 15.231_9kHz-30MHz**

| Frequency (MHz) | MaxPeak (dBµV/m) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.162 | --- | 45.320 | 84.08 | 38.76 | 500.0 | 9.000 | 271.0 | V | 261.0 | 18.4 | |
| 1.162 | 50.441 | --- | 84.08 | 33.64 | 500.0 | 9.000 | 271.0 | V | 261.0 | 18.4 | |
| 1.225 | 51.002 | --- | 83.49 | 32.49 | 500.0 | 9.000 | 165.0 | H | 245.0 | 18.4 | |
| 1.225 | --- | 44.803 | 83.49 | 38.69 | 500.0 | 9.000 | 165.0 | H | 245.0 | 18.4 | |
| 17.584 | 29.677 | --- | 57.62 | 27.94 | 500.0 | 9.000 | 208.0 | V | 62.0 | 16.8 | |
| 17.584 | --- | 24.160 | 57.62 | 33.46 | 500.0 | 9.000 | 208.0 | V | 62.0 | 16.8 | |



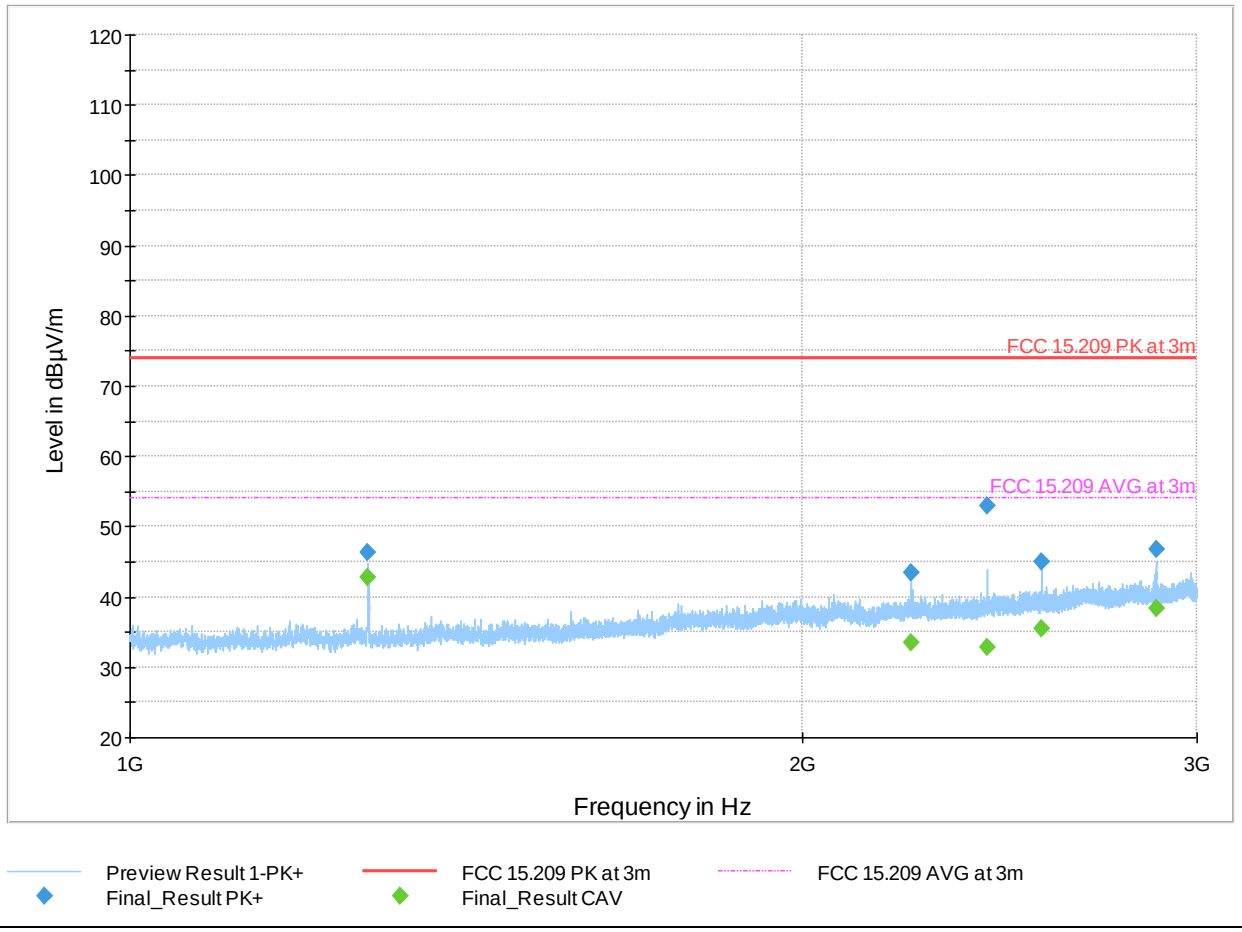
## Plot # 2 FCC 15.231_30-1000MHz

| Frequency (MHz) | MaxPeak (dBµV/m) | QuasiPeak (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) | Comment |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 105.725 | --- | 9.018 | --- | --- | 500.0 | 120.000 | 172.0 | H | 75.0 | -18.8 | |
| 105.725 | 13.656 | --- | 43.50 | 29.84 | 500.0 | 120.000 | 172.0 | H | 75.0 | -18.8 | |
| 247.539 | 21.853 | --- | 46.02 | 24.17 | 500.0 | 120.000 | 290.0 | H | 146.0 | -14.1 | |
| 247.539 | --- | 17.830 | --- | --- | 500.0 | 120.000 | 290.0 | H | 146.0 | -14.1 | |
| 329.471 | 25.845 | --- | 46.02 | 20.18 | 500.0 | 120.000 | 284.0 | H | 44.0 | -12.2 | |
| 329.471 | --- | 21.736 | --- | --- | 500.0 | 120.000 | 284.0 | H | 44.0 | -12.2 | |
| 602.300 | --- | 24.486 | --- | --- | 500.0 | 120.000 | 286.0 | H | 4.0 | -5.1 | |
| 602.300 | 28.641 | --- | 46.02 | 17.38 | 500.0 | 120.000 | 286.0 | H | 4.0 | -5.1 | |
| 639.031 | --- | 39.175 | --- | --- | 500.0 | 120.000 | 290.0 | H | 319.0 | -4.6 | |
| 639.031 | 40.311 | --- | 46.02 | 5.71 | 500.0 | 120.000 | 290.0 | H | 319.0 | -4.6 | |
| 958.549 | --- | 37.140 | --- | --- | 500.0 | 120.000 | 185.0 | V | 159.0 | -2.7 | |
| 958.549 | 39.072 | --- | 46.02 | 6.95 | 500.0 | 120.000 | 185.0 | V | 159.0 | -2.7 | |



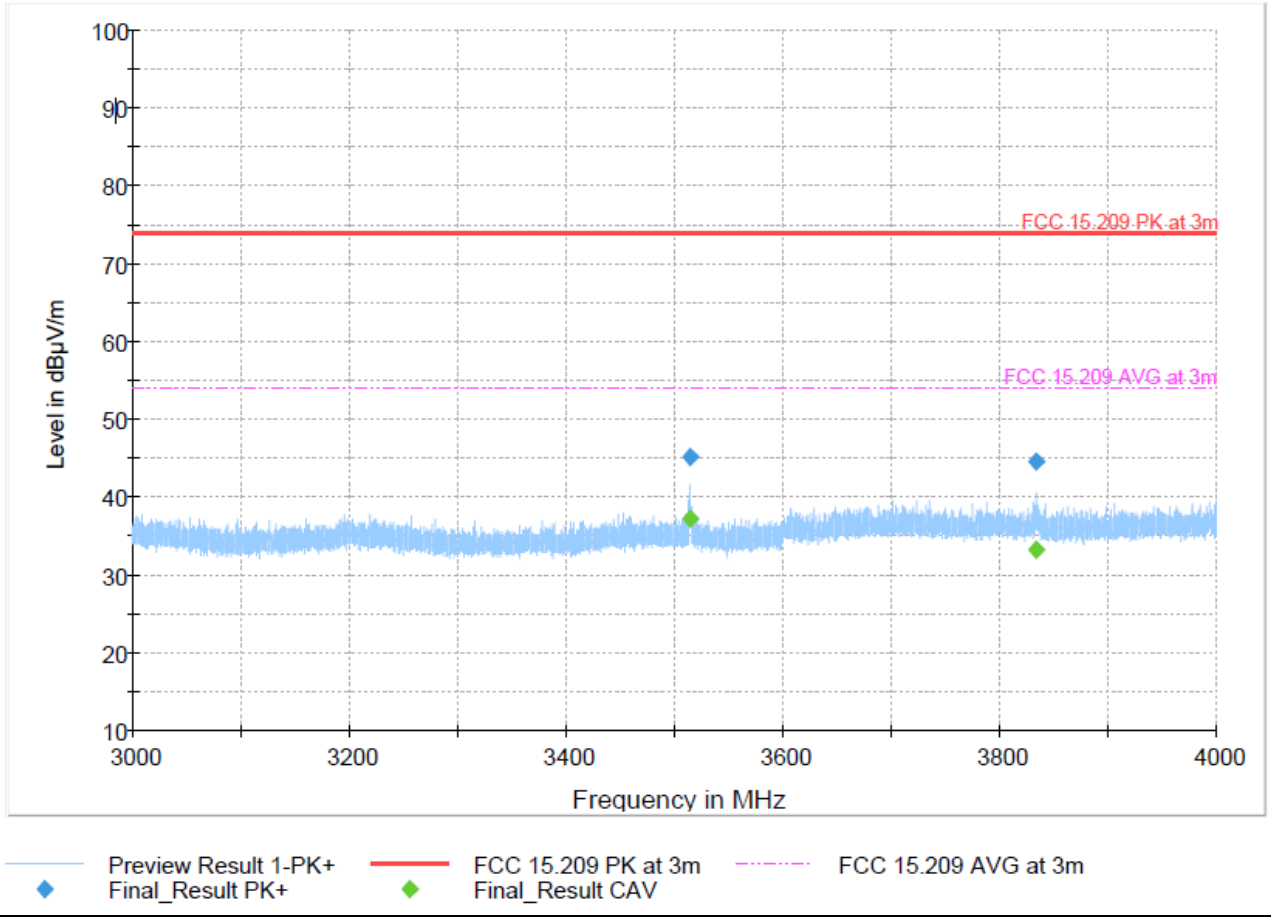
## Plot # 3 FCC 15.231_1-3GHz

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1278.000 | 46.270 | --- | 73.98 | 27.71 | 500.0 | 1000.000 | 150.0 | V | 286.0 | 4.0 |
| 1278.000 | --- | 42.708 | 53.98 | 11.27 | 500.0 | 1000.000 | 150.0 | V | 286.0 | 4.0 |
| 2236.714 | 43.544 | --- | 73.98 | 30.44 | 500.0 | 1000.000 | 296.0 | H | 2.0 | 8.6 |
| 2236.714 | --- | 33.466 | 53.98 | 20.51 | 500.0 | 1000.000 | 296.0 | H | 2.0 | 8.6 |
| 2416.000 | --- | 32.798 | 53.98 | 21.18 | 500.0 | 1000.000 | 325.0 | V | 103.0 | 8.5 |
| 2416.000 | 52.907 | --- | 73.98 | 21.07 | 500.0 | 1000.000 | 325.0 | V | 103.0 | 8.5 |
| 2556.000 | 45.079 | --- | 73.98 | 28.90 | 500.0 | 1000.000 | 220.0 | H | 166.0 | 9.7 |
| 2556.000 | --- | 35.552 | 53.98 | 18.43 | 500.0 | 1000.000 | 220.0 | H | 166.0 | 9.7 |
| 2875.571 | 46.727 | --- | 73.98 | 27.25 | 500.0 | 1000.000 | 325.0 | H | 201.0 | 10.7 |
| 2875.571 | --- | 38.370 | 53.98 | 15.61 | 500.0 | 1000.000 | 325.0 | H | 201.0 | 10.7 |



## Plot # 4 FCC 15.231_3-4GHz

| Frequency (MHz) | MaxPeak (dBµV/m) | CAverage (dBµV/m) | Limit (dBµV/m) | Margin (dB) | Meas. Time (ms) | Bandwidth (kHz) | Height (cm) | Pol | Azimuth (deg) | Corr. (dB/m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 3514.467 | 45.218 | -- | 73.98 | 28.76 | 500.0 | 1000.000 | 315.0 | V | 182.0 | -6.9 |
| 3514.467 | -- | 37.191 | 53.98 | 16.79 | 500.0 | 1000.000 | 315.0 | V | 182.0 | -6.9 |
| 3834.300 | 44.581 | --- | 73.98 | 29.40 | 500.0 | 1000.000 | 293.0 | H | 202.0 | -6.0 |
| 3834.300 | -- | 33.364 | 53.98 | 20.62 | 500.0 | 1000.000 | 293.0 | H | 202.0 | -6.0 |



## 8.4 Periodic Operation

### 8.4.1 Limits:

- FCC §15.231 (a) The provisions of this section are restricted to periodic operation within the band 40.66-40.70 MHz and above 70 MHz. Except as shown in paragraph (e) of this section, the intentional radiator is restricted to the transmission of a control signal such as those used with alarm systems, door openers, remote switches, etc. Continuous transmissions, voice, video and the radio control of toys are not permitted. Data is permitted to be sent with a control signal. The following conditions shall be met to comply with the provisions for this periodic operation:

    - (3) Periodic transmissions at regular predetermined intervals are not permitted. However, polling or supervision transmissions, including data, to determine system integrity of transmitters used in security or safety applications are allowed if the total duration of transmissions does not exceed more than two seconds per hour for each transmitter. There is no limit on the number of individual transmissions, provided the total transmission time does not exceed two seconds per hour.

- RSS-210 A1.1: Devices shall comply with the following for momentary operation:
    - C. Periodic transmissions at regular, predetermined intervals are not permitted, except as specified in Section A.1.4. However, polling or supervision transmissions that determine system integrity of transmitters used in security or safety applications are permitted, provided the total duration of transmission does not exceed 2 seconds per hour for each transmitter.

### 8.4.2 Test conditions and setup:

| Ambient Temperature | EUT Set-Up # | EUT operating mode | Power Input |
|---|---|---|---|
| 23.2° C | 1 | Op. 1 | 3 Vdc Battery |

### 8.4.3 Measurement result:

| Plot # | Frequency (MHz) | Number of pulses 6 minutes |
|---|---|---|
| 1 | 319.5 | 18 |

| Plot # | Frequency (MHz) | Pulse duration [ms] |
|---|---|---|
| 2 | 319.5 | 24.3 |

**Note:** As per manufacturer's operational description IQ Mini-S transmits a <5ms supervisory signal for system integrity once per hour.

### 8.4.4 Test result:

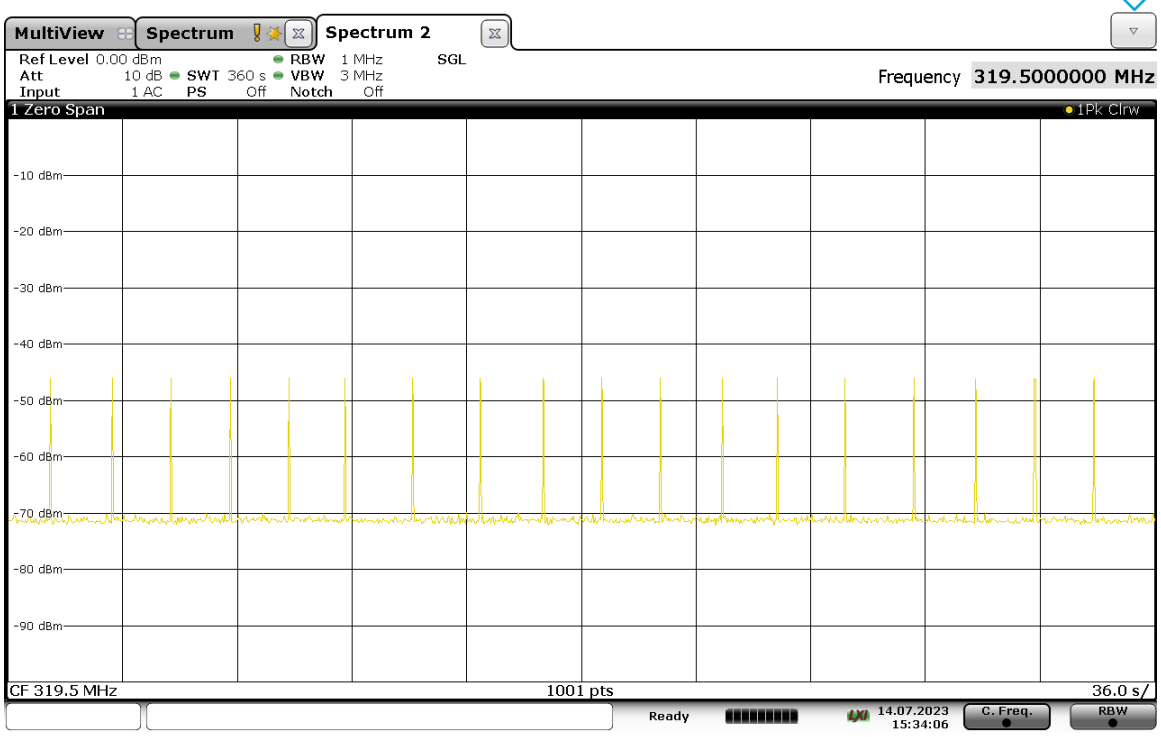
**Total duration of transmission** = Number of pulses per hour X pulse duration =0.437 seconds per 6 min.

**Correction for periodic operation***
Duty cycle = 24.3%
Duty cycle correction factor = 20*log (0.243) = -12.29 dB

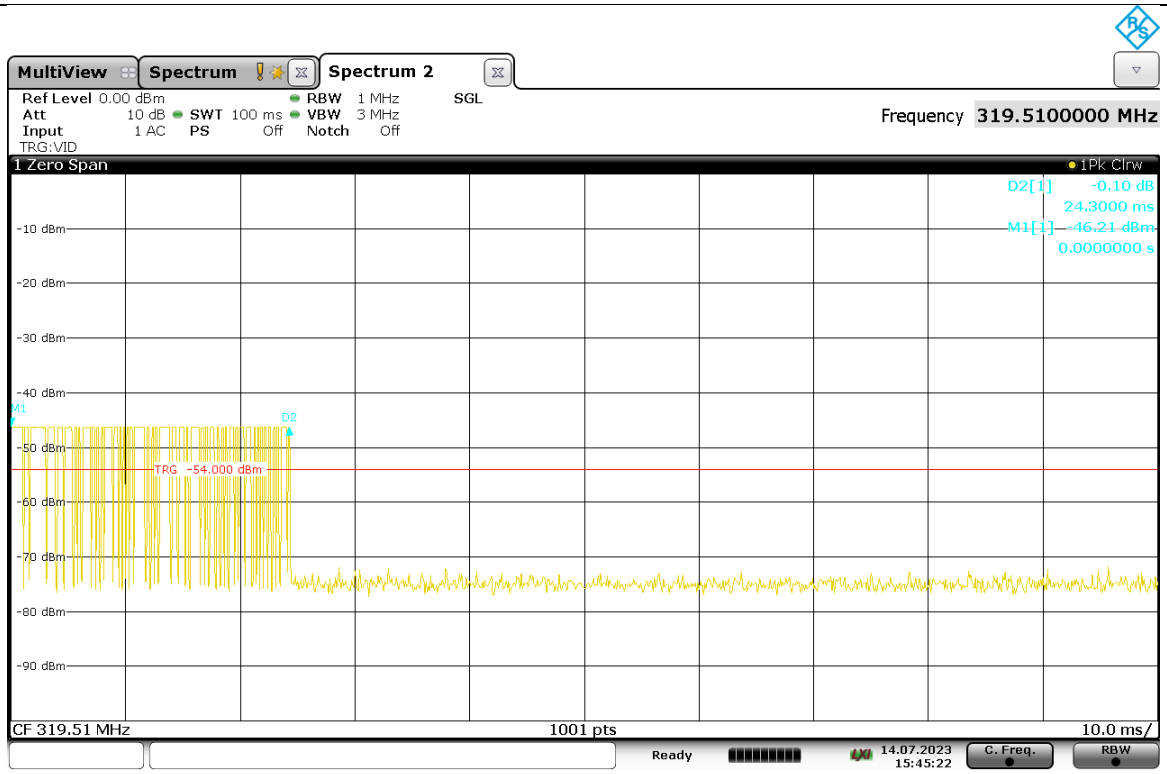
*Note the ANSI method calls for on time in 100ms period or one complete pulse train if less than 100ms.

## 8.4.5 Measurement Plots:

**Plot # 1**



## Plot # 2


MultiView
Spectrum
Spectrum 2
Ref Level 0.00 dBm
Att 10 dB
Input 1 AC
TRG:VID
SWT 100 ms
PS Off
RBW 1 MHz
VBW 3 MHz
Notch Off
SGL
Frequency 319.5100000 MHz
1 Zero Span
1Pk Clrw
D2[1] -0.10 dB
24.3000 ms
M1[1] -46.21 dBm
0.0000000 s
-10 dBm
-20 dBm
-30 dBm
-40 dBm
-50 dBm
-60 dBm
-70 dBm
-80 dBm
-90 dBm
M1
D2
TRG -54.000 dBm
CF 319.51 MHz
1001 pts
10.0 ms/
Ready
14.07.2023
15:45:22
C. Freq.
RBW
15:45:23 14.07.2023

## 9 Test setup photos

Setup photos are included in supporting file name: “EMC_QOLSY_012_23001_FCC_15_231_Setup_Photos”

## 10 Test Equipment And Ancillaries Used For Testing

| Equipment Type | Manufacturer | Model | Serial # | Calibration Cycle | Last Calibration Date |
|---|---|---|---|---|---|
| ACTIVE LOOP ANTENNA | ETS LINDGREN | 6507 | 00161344 | 3 YEARS | 10/30/2020 |
| BILOG ANTENNA | A.H. SYSTEMS | BiLA2G | 569 | 3 YEARS | 11/16/2021 |
| HORN ANTENNA | EMCO | 3115 | 00035111 | 3 YEARS | 9/28/2021 |
| HORN ANTENNA | ETS LINDGREN | 3117-PA | 00169547 | 3 YEARS | 9/1/2020 |
| ESW.EMI TEST RECEIVER | ROHDE & SCHWARZ | ESW44 | 101715 | 3 YEARS | 9/14/2021 |
| THERMOMETER HUMIDITY MONITOR | CONTROL COMPANY | 36934-164 | 191872028 | 3 YEARS | 10/20/2021 |

Note: Equipment used meets the measurement uncertainty requirements as required per applicable standards for 95% confidence levels.
Calibration due dates, unless defined specifically, falls on the last day of the month. Items indicated “N/A” for cal status either do not specifically require calibration or is internally characterized before use.

## 11 History

| Date | Report Name | Changes to report | Report prepared by |
|---|---|---|---|
| 2023-07-21 | EMC_QOLSY_012_23001_FCC_15_231 | Initial Version | Art Thammanavarat |
| 2023-08-02 | EMC_QOLSY_012_23001_FCC_15_231_Rev1 | **Report Revised to Rev1**<br>1. Sections 7.1, 8.1.1, 8.2.1 & 8.3.1: Updated Standard.<br>2. Section 8.1.4: Added Note.<br>3. Section 8.1.5: Replot to remove marker.<br>4. Section 8.4.3: Added Note.<br>5. Section 8.4.5: Replot. | Art Thammanavarat |
| | | | |