



Shenzhen Huaxia Testing Technology Co., Ltd

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

Telephone: +86-755-26648640
Fax: +86-755-26648637
Website: www.cqa-cert.com

Report Template Version: V04
Report Template Revision Date: 2018-07-06

Test Report

Report No. : CQASZ20201200041EX-01

Applicant: Guangzhou Vensi Intelligent Technology Co., Ltd.

Address of Applicant: No.19 Huangqi Shan Road, Yonghe Development Zone, Whampoa District, Guangzhou

Manufacturer: Guangzhou Vensi Intelligent Technology Co., Ltd.

Address of Manufacturer: No.19 Huangqi Shan Road, Yonghe Development Zone, Whampoa District, Guangzhou

Equipment Under Test (EUT):

Product: zigbee-module

Model No.: MG21-768

Brand Name:  威士丹利 智能
Vensi Intelligent

FCC ID: 2AR6I-ZE3221X

Standards: 47 CFR Part 15, Subpart C

Date of Test: 2020-11-10 to 2020-11-30

Date of Issue: 2020-12-11

Test Result : **PASS***

*In the configuration tested, the EUT complied with the standards specified above

Tested By: Jun Li
(Jun Li)

Reviewed By: Sheek, Luo
(Aaron Ma)

Approved By: Jack Ai
(Jack Ai)



1 Version

Revision History Of Report

| Report No. | Version | Description | Issue Date |
|-----------------------|---------|----------------|------------|
| CQASZ20201200041EX-01 | Rev.01 | Initial report | 2020-12-11 |

2 Test Summary

| Test Item | Test Requirement | Test method | Result |
|--------------------------------------------------------------------------------------|--------------------------------------------------------|--------------------|--------|
| Antenna Requirement | 47 CFR Part 15, Subpart C Section 15.203 | ANSI C63.10 (2013) | PASS |
| AC Power Line Conducted Emission | 47 CFR Part 15, Subpart C Section 15.207 | ANSI C63.10 (2013) | PASS |
| Field Strength of the Fundamental Signal | 47 CFR Part 15, Subpart C Section 15.249 (a) | ANSI C63.10 (2013) | PASS |
| Spurious Emissions | 47 CFR Part 15, Subpart C Section 15.249 (a)/15.209 | ANSI C63.10 (2013) | PASS |
| Restricted bands around fundamental frequency (Radiated Emission) | 47 CFR Part 15, Subpart C Section 15.249(a)/15.205 | ANSI C63.10 (2013) | PASS |
| 20dB Occupied Bandwidth | 47 CFR Part 15, Subpart C Section 15.215 (c) | ANSI C63.10 (2013) | PASS |

3 Contents

| | Page |
|-------------------------------------------------------|-----------|
| 1 VERSION | 2 |
| 2 TEST SUMMARY | 3 |
| 3 CONTENTS | 4 |
| 4 GENERAL INFORMATION | 5 |
| 4.1 CLIENT INFORMATION | 5 |
| 4.2 GENERAL DESCRIPTION OF EUT..... | 5 |
| 4.3 TEST ENVIRONMENT AND MODE | 7 |
| 4.4 DESCRIPTION OF SUPPORT UNITS | 7 |
| 4.1 TEST LOCATION | 7 |
| 4.2 TEST FACILITY..... | 7 |
| 4.3 STATEMENT OF THE MEASUREMENT UNCERTAINTY | 7 |
| 4.4 DEVIATION FROM STANDARDS | 8 |
| 4.5 ABNORMALITIES FROM STANDARD CONDITIONS | 8 |
| 4.6 OTHER INFORMATION REQUESTED BY THE CUSTOMER | 8 |
| 4.7 EQUIPMENT LIST..... | 9 |
| 5 TEST RESULTS AND MEASUREMENT DATA | 10 |
| 5.1 ANTENNA REQUIREMENT | 10 |
| 5.2 CONDUCTED EMISSIONS | 11 |
| 5.3 RADIATED EMISSION | 15 |
| 5.4 20DB BANDWIDTH | 27 |
| 6 PHOTOGRAPHS..... | 30 |
| 6.1 RADIATED EMISSION TEST SETUP..... | 30 |
| 6.1 CONDUCTED EMISSION TEST SETUP | 31 |
| 6.2 EUT CONSTRUCTIONAL DETAILS | 32 |
| END OF THE REPORT | 34 |

4 General Information

4.1 Client Information

| | |
|--------------------------|--------------------------------------------------------------------------------|
| Applicant: | Guangzhou Vensi Intelligent Technology Co., Ltd. |
| Address of Applicant: | No. 19 Huangqi Shan Road, Yonghe Development Zone, Whampoa District, Guangzhou |
| Manufacturer: | Guangzhou Vensi Intelligent Technology Co., Ltd. |
| Address of Manufacturer: | No. 19 Huangqi Shan Road, Yonghe Development Zone, Whampoa District, Guangzhou |

4.2 General Description of EUT

| | |
|----------------------|-----------------------------------------------------------------------------------|
| Product Name: | zigbee-module |
| Model No.: | MG21-768 |
| Trade Mark: |  |
| Operation Frequency: | 2405MHz~2480MHz |
| Channel Numbers: | 16 |
| Channel Separation: | 5MHz |
| Type of Modulation: | O-QPSK(DSSS) |
| Antenna Type: | PCB antenna |
| Antenna Gain: | 0dB |
| Power Supply: | DC 2.85V ~3.6V |

| Operation Frequency each of channel | | | | | | | |
|-------------------------------------|-----------|---------|-----------|---------|-----------|---------|-----------|
| Channel | Frequency | Channel | Frequency | Channel | Frequency | Channel | Frequency |
| 11 | 2405MHz | 15 | 2425MHz | 19 | 2445MHz | 23 | 2465MHz |
| 12 | 2410MHz | 16 | 2430MHz | 20 | 2450MHz | 24 | 2470MHz |
| 13 | 2415MHz | 17 | 2435MHz | 21 | 2455MHz | 25 | 2475MHz |
| 14 | 2420MHz | 18 | 2440MHz | 22 | 2460MHz | 26 | 2480MHz |

Note:

In section 15.31(m), regards to the operating frequency range over 5 MHz, the Lowest frequency, the middle frequency, and the highest frequency of channel were selected to perform the test, and the selected channel see below:

| Channel | Frequency |
|---------------------|-----------|
| The Lowest channel | 2405MHz |
| The Middle channel | 2440MHz |
| The Highest channel | 2480MHz |

Note:

Software provided by client enabled the EUT to transmit and receive data at lowest, middle and highest channel individually.

4.3 Test Environment and Mode

| Operating Environment: | |
|------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| Temperature: | 24.0 °C |
| Humidity: | 52 % RH |
| Atmospheric Pressure: | 1008 mbar |
| Test Mode: | Use test software (RF test) to set the lowest frequency, the middle frequency and the highest frequency keep transmitting of the EUT. |

4.4 Description of Support Units

The EUT has been tested with associated equipment below.

| Description | Manufacturer | Model No. | Remark | FCC certification |
|-------------|--------------|-----------|--------|-------------------|
| / | / | / | / | / |

4.1 Test Location

All tests were performed at:

Shenzhen Huaxia Testing Technology Co., Ltd.,

1F., Block A of Tongsheng Technology Building, Huahui Road, Dalang Street, Longhua District, Shenzhen, China

4.2 Test Facility

The test facility is recognized, certified, or accredited by the following organizations:

• **CNAS (No. CNAS L5785)**

CNAS has accredited Shenzhen Huaxia Testing Technology Co., Ltd. Shenzhen Branch EMC Lab to ISO/IEC 17025:2005 General Requirements for the Competence of Testing and Calibration Laboratories (CNAS-CL01 Accreditation Criteria for the Competence of Testing and Calibration Laboratories) for the competence in the field of testing.

• **ISED Registration No.: 22984-1**

The 3m Semi-anechoic chamber of Shenzhen Huaxia Testing Technology Co., Ltd. has been registered by Certification and Engineering Bureau of Industry Canada for radio equipment testing

• **A2LA (Certificate No. 4742.01)**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory is accredited by the American Association for Laboratory Accreditation(A2LA). Certificate No. 4742.01.

• **FCC Registration No.: 522263**

Shenzhen Huaxia Testing Technology Co., Ltd., Shenzhen EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. Registration No.:522263

4.3 Statement of the measurement uncertainty

The data and results referenced in this document are true and accurate.

The reader is cautioned that there may be errors within the calibration limits of the equipment and

facilities.

The measurement uncertainty was calculated for all measurements listed in this test report acc. to CISPR 16 - 4 „Specification for radio disturbance and immunity measuring apparatus and methods – Part 4: Uncertainty in EMC Measurements“ and is documented in the **Shenzhen Huaxia Testing Technology Co., Ltd** quality system acc. to DIN EN ISO/IEC 17025.

Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Hereafter the best measurement capability for **CQA** laboratory is reported:

| No. | Item | Uncertainty | Notes |
|-----|------------------------------------|--------------------|-------|
| 1 | Radiated Emission (Below 1GHz) | 5.12dB | (1) |
| 2 | Radiated Emission (Above 1GHz) | 4.60dB | (1) |
| 3 | Conducted Disturbance (0.15~30MHz) | 3.34dB | (1) |
| 4 | Radio Frequency | 3×10^{-8} | (1) |
| 5 | Duty cycle | 0.6 %. | (1) |
| 6 | Occupied Bandwidth | 1.1% | (1) |
| 7 | RF conducted power | 0.86dB | (1) |
| 8 | RF power density | 0.74 | (1) |
| 9 | Conducted Spurious emissions | 0.86dB | (1) |
| 10 | Temperature test | 0.8°C | (1) |
| 11 | Humidity test | 2.0% | (1) |
| 12 | Supply voltages | 0.5 %. | (1) |
| 13 | Frequency Error | 5.5 Hz | (1) |

(1) This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of $k=2$.

4.4 Deviation from Standards

None.

4.5 Abnormalities from Standard Conditions

None.

4.6 Other Information Requested by the Customer

None.

4.7 Equipment List

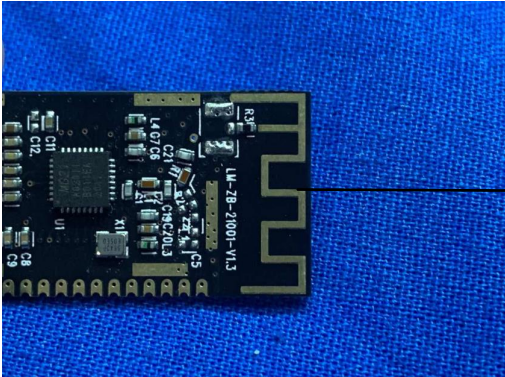
| Test Equipment | Manufacturer | Model No. | Instrument No. | Calibration Date | Calibration Due Date |
|----------------------------|--------------|------------------------|----------------|------------------|----------------------|
| EMI Test Receiver | R&S | ESR7 | CQA-005 | 2020/10/25 | 2021/10/24 |
| Spectrum analyzer | R&S | FSU26 | CQA-038 | 2020/10/25 | 2021/10/24 |
| Preamplifier | MITEQ | AMF-6D-02001800-29-20P | CQA-036 | 2020/10/25 | 2021/10/24 |
| Loop antenna | Schwarzbeck | FMZB1516 | CQA-060 | 2020/10/21 | 2021/10/20 |
| Bilog Antenna | R&S | HL562 | CQA-011 | 2020/9/26 | 2021/9/25 |
| Horn Antenna | R&S | HF906 | CQA-012 | 2020/9/26 | 2021/9/25 |
| Horn Antenna | Schwarzbeck | BBHA 9170 | CQA-088 | 2020/9/25 | 2021/9/24 |
| Coaxial Cable (Above 1GHz) | CQA | N/A | C007 | 2020/9/26 | 2021/9/25 |
| Coaxial Cable (Below 1GHz) | CQA | N/A | C013 | 2020/9/26 | 2021/9/25 |
| Antenna Connector | CQA | RFC-01 | CQA-080 | 2020/9/26 | 2021/9/25 |
| RF cable(9KHz~40GHz) | CQA | RF-01 | CQA-079 | 2020/9/26 | 2021/9/25 |
| Power divider | MIDWEST | PWD-2533-02-SMA-79 | CQA-067 | 2020/9/26 | 2021/9/25 |
| EMI Test Receiver | R&S | ESR7 | CQA-005 | 2020/10/25 | 2021/10/24 |
| LISN | R&S | ENV216 | CQA-003 | 2020/10/23 | 2021/10/22 |
| Coaxial cable | CQA | N/A | CQA-C009 | 2020/9/26 | 2021/9/25 |
| DC power | KEYSIGHT | E3631A | CQA-028 | 2020/9/26 | 2021/9/25 |

Note:

The temporary antenna connector is soldered on the PCB board in order to perform conducted tests and this temporary antenna connector is listed in the equipment list.

5 Test results and Measurement Data

5.1 Antenna Requirement

| | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Standard requirement: | 47 CFR Part 15C Section 15.203 |
| <p>15.203 requirement: 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, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.</p> | |
| EUT Antenna: |  |
| <p>The antenna is a PCB antenna. Antenna Gain : 0dBi</p> | |

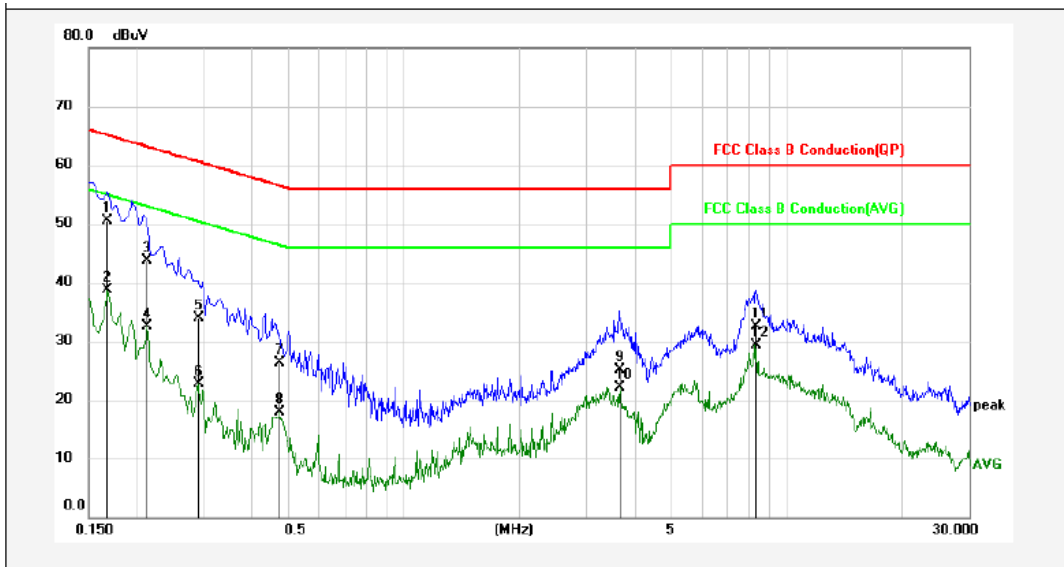
5.2 Conducted Emissions

| | | | |
|--------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-----------|
| Test Requirement: | 47 CFR Part 15C Section 15.207 | | |
| Test Method: | ANSI C63.10: 2013 | | |
| Test Frequency Range: | 150kHz to 30MHz | | |
| Limit: | Frequency range (MHz) | Limit (dBuV) | |
| | | Quasi-peak | Average |
| | 0.15-0.5 | 66 to 56* | 56 to 46* |
| | 0.5-5 | 56 | 46 |
| | 5-30 | 60 | 50 |
| * Decreases with the logarithm of the frequency. | | | |
| Test Procedure: | <ol style="list-style-type: none"> 1) The mains terminal disturbance voltage test was conducted in a shielded room. 2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a $50\Omega/50\mu\text{H} + 5\Omega$ linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded. 3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane, 4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0.4 m from the vertical ground reference plane. The vertical ground reference plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0.8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0.8 m from the LISN 2. 5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10: 2013 on conducted measurement. | | |

| | |
|-------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Test Setup:</p> | <p>The diagram shows a test setup within a shielding room. On the left, a table stands 80cm high, supporting an EUT (Equipment Under Test) and an AE (Antenna). LISN1 (Line Impedance Stabilization Network) is connected to AC Mains and the EUT. On the right, another table stands 80cm high, supporting a Test Receiver. LISN2 is connected to AC Mains and the Test Receiver. A Ground Reference Plane is indicated at the bottom of the room.</p> |
| <p>Exploratory Test Mode:</p> | <p>Transmitting with O-QPSK at lowest, middle and highest channel.</p> |
| <p>Final Test Mode:</p> | <p>Through Pre-scan, find at middle channel is the worst case. Only the worst case is recorded in the report.</p> |
| <p>Test Voltage:</p> | <p>DC 5V From adapter input AC120V/60Hz</p> |
| <p>Test Results:</p> | <p>Pass</p> |

Measurement Data

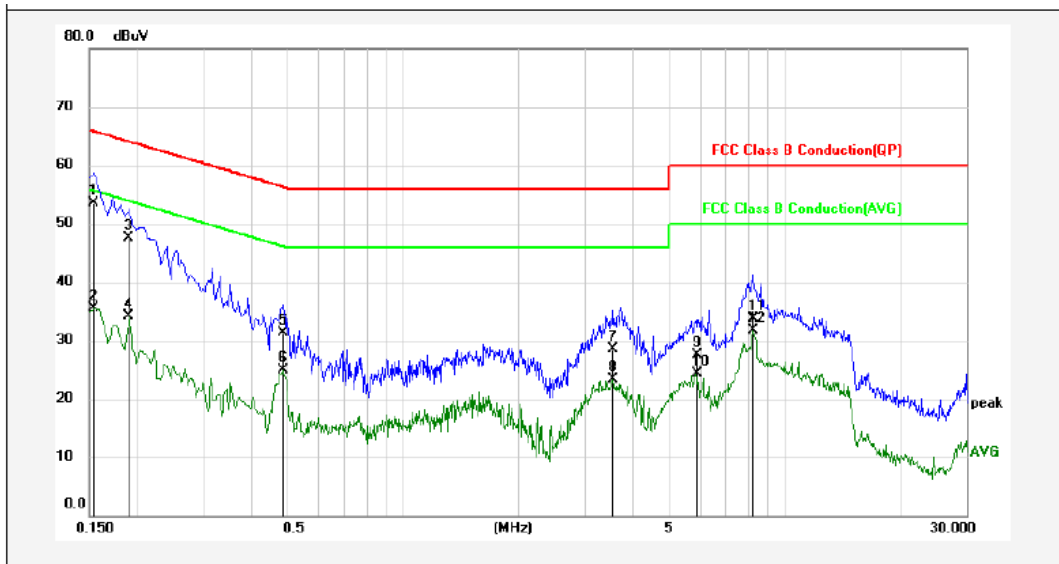
Live Line:



| No. | Frequency (MHz) | Reading (dBuV) | Lisn/lisn (dB) | Cab_L (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-----------------|----------------|----------------|------------|---------------|------------|-------------|----------|--------|
| 1 | 0.1680 | 40.70 | 9.59 | 0.22 | 50.51 | 65.06 | -14.55 | QP | |
| 2 | 0.1680 | 28.80 | 9.59 | 0.22 | 38.61 | 55.06 | -16.45 | AVG | |
| 3 | 0.2130 | 33.90 | 9.56 | 0.23 | 43.69 | 63.09 | -19.40 | QP | |
| 4 | 0.2130 | 22.76 | 9.56 | 0.23 | 32.55 | 53.09 | -20.54 | AVG | |
| 5 | 0.2895 | 24.25 | 9.51 | 0.24 | 34.00 | 60.54 | -26.54 | QP | |
| 6 | 0.2895 | 12.93 | 9.51 | 0.24 | 22.68 | 50.54 | -27.86 | AVG | |
| 7 | 0.4740 | 16.61 | 9.52 | 0.24 | 26.37 | 56.44 | -30.07 | QP | |
| 8 | 0.4740 | 8.13 | 9.52 | 0.24 | 17.89 | 46.44 | -28.55 | AVG | |
| 9 | 3.6780 | 15.12 | 9.7 | 0.21 | 25.03 | 56.00 | -30.97 | QP | |
| 10 | 3.6780 | 12.29 | 9.7 | 0.21 | 22.20 | 46.00 | -23.80 | AVG | |
| 11 | 8.2815 | 22.67 | 9.7 | 0.22 | 32.59 | 60.00 | -27.41 | QP | |
| 12 | 8.2815 | 19.32 | 9.7 | 0.22 | 29.24 | 50.00 | -20.76 | AVG | |

Remarks: 1. Result=Reading+Lisn+Cab_L
 2. If the average limit is met when using a quasi-peak detector, the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

Neutral Line:



| No. | Frequency (MHz) | Reading (dBuV) | Lisn/Isn (dB) | Cab_L (dB) | Result (dBuV) | Limit dBuV | Margin (dB) | Detector | Remark |
|-----|-----------------|----------------|---------------|------------|---------------|------------|-------------|----------|--------|
| 1 | 0.1545 | 43.75 | 9.6 | 0.22 | 53.57 | 65.75 | -12.18 | QP | |
| 2 | 0.1545 | 25.63 | 9.6 | 0.22 | 35.45 | 55.75 | -20.30 | AVG | |
| 3 | 0.1905 | 37.74 | 9.6 | 0.23 | 47.57 | 64.01 | -16.44 | QP | |
| 4 | 0.1905 | 24.35 | 9.6 | 0.23 | 34.18 | 54.01 | -19.83 | AVG | |
| 5 | 0.4830 | 21.52 | 9.57 | 0.24 | 31.33 | 56.29 | -24.96 | QP | |
| 6 | 0.4830 | 15.04 | 9.57 | 0.24 | 24.85 | 46.29 | -21.44 | AVG | |
| 7 | 3.5475 | 18.49 | 9.75 | 0.21 | 28.45 | 56.00 | -27.55 | QP | |
| 8 | 3.5475 | 13.28 | 9.75 | 0.21 | 23.24 | 46.00 | -22.76 | AVG | |
| 9 | 5.8515 | 17.45 | 9.78 | 0.21 | 27.44 | 60.00 | -32.56 | QP | |
| 10 | 5.8515 | 14.24 | 9.78 | 0.21 | 24.23 | 50.00 | -25.77 | AVG | |
| 11 | 8.2995 | 23.81 | 9.73 | 0.22 | 33.76 | 60.00 | -26.24 | QP | |
| 12 | 8.2995 | 21.80 | 9.73 | 0.22 | 31.75 | 50.00 | -18.25 | AVG | |

Remarks: 1. Result=Reading+Lisn+Cab_L
 2. If the average limit is met when using a quasi-peak detector. the EUT shall be deemed to meet both limits and measurement with average detector is unnecessary.

5.3 Radiated Emission

| | | | | | |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-----------------|---------------|--------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.249 and 15.209 and 15.205 | | | | |
| Test Method: | ANSI C63.10: 2013 | | | | |
| Test Site: | Measurement Distance: 3m (Semi-Anechoic Chamber) | | | | |
| Receiver Setup: | Frequency | Detector | RBW | VBW | Remark |
| | 0.009MHz-0.090MHz | Peak | 10kHz | 30KHz | Peak |
| | 0.009MHz-0.090MHz | Average | 10kHz | 30KHz | Average |
| | 0.090MHz-0.110MHz | Quasi-peak | 10kHz | 30KHz | Quasi-peak |
| | 0.110MHz-0.490MHz | Peak | 10kHz | 30KHz | Peak |
| | 0.110MHz-0.490MHz | Average | 10kHz | 30KHz | Average |
| | 0.490MHz -30MHz | Quasi-peak | 10kHz | 30kHz | Quasi-peak |
| | 30MHz-1GHz | Quasi-peak | 100 kHz | 300KHz | Quasi-peak |
| | Above 1GHz | Peak | 1MHz | 3MHz | Peak |
| | | Peak | 1MHz | 10Hz | Average |
| Note: For fundamental frequency, RBW=5MHz, VBW=5MHz, Peak detector is for PK value, RMS detector is for Average value. | | | | | |
| Limit: (Spurious Emissions and band edge) | Frequency | Field strength (microvolt/meter) | Limit (dBuV/m) | Remark | Measurement distance (m) |
| | 0.009MHz-0.490MHz | 2400/F(kHz) | - | - | 300 |
| | 0.490MHz-1.705MHz | 24000/F(kHz) | - | - | 30 |
| | 1.705MHz-30MHz | 30 | - | - | 30 |
| | 30MHz-88MHz | 100 | 40.0 | Quasi-peak | 3 |
| | 88MHz-216MHz | 150 | 43.5 | Quasi-peak | 3 |
| | 216MHz-960MHz | 200 | 46.0 | Quasi-peak | 3 |
| | 960MHz-1GHz | 500 | 54.0 | Quasi-peak | 3 |
| | Above 1GHz | 500 | 54.0 | Average | 3 |
| | Note: 1) 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device. 2) Emissions radiated outside of the specified frequency bands, except for harmonics, shall be attenuated by at least 50 dB below the level of the fundamental or to the general radiated emission limits in Section 15.209, whichever is the lesser attenuation. | | | | |
| Limit: (Field strength of the fundamental signal) | Frequency | Limit (dBuV/m @3m) | | Remark | |
| | 2400MHz-2483.5MHz | 94.0 | | Average Value | |
| | | 114.0 | | Peak Value | |

Test Setup:

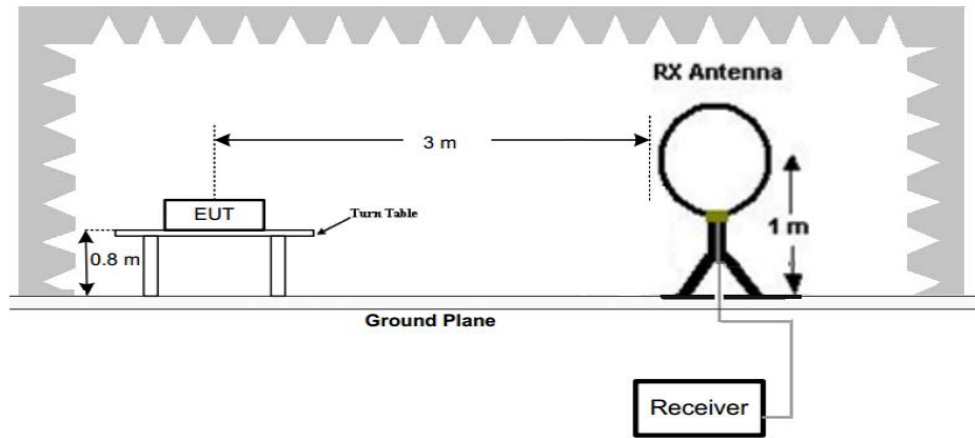


Figure 1. Below 30MHz

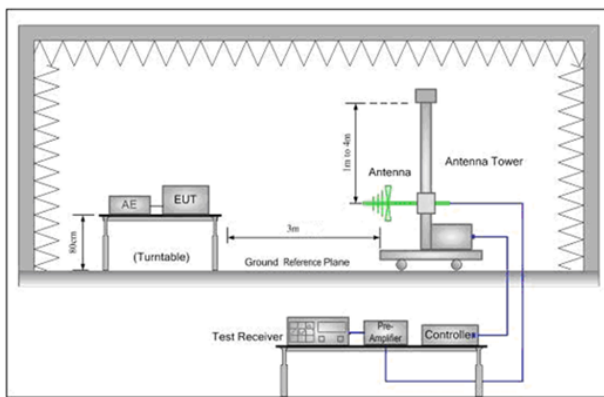


Figure 2. 30MHz to 1GHz

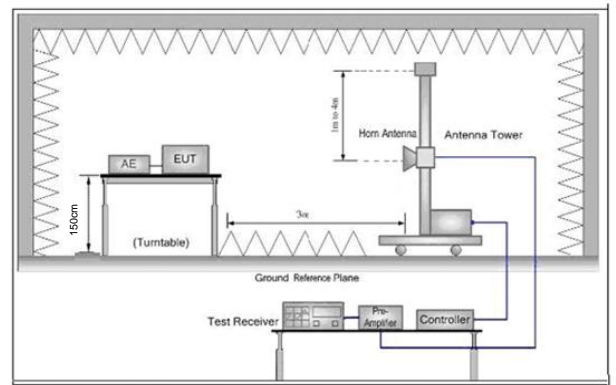


Figure 3. Above 1 GHz

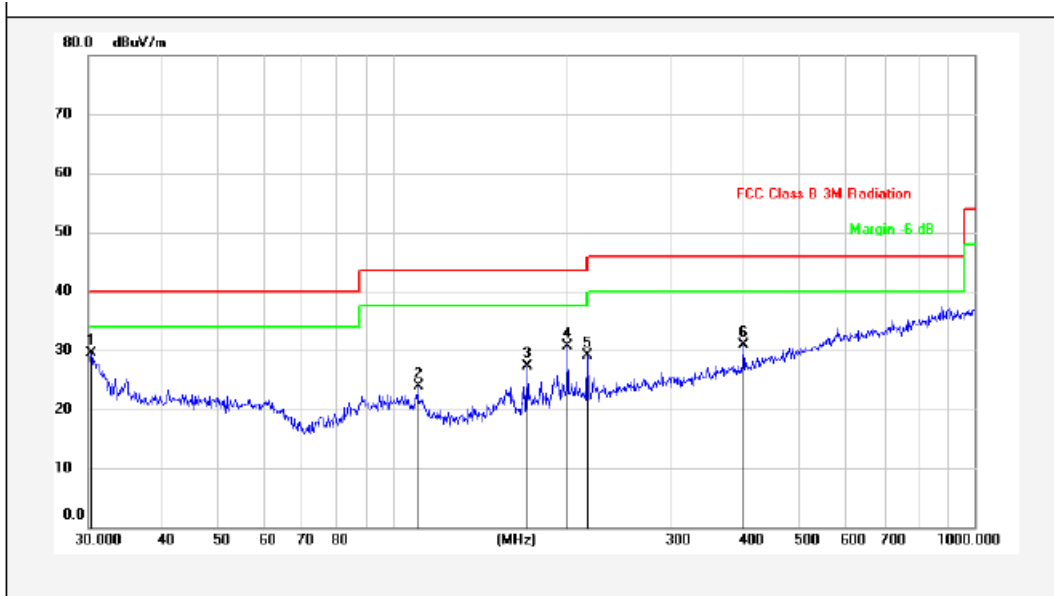
Test Procedure:

- a. 1) Below 1G: The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
 - 2) Above 1G: The EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- Note: For the radiated emission test above 1GHz:
Place the measurement antenna away from each area of the EUT determined to be a source of emissions at the specified measurement distance, while keeping the measurement antenna aimed at the source of emissions at each frequency of significant emissions, with polarization oriented for maximum response. The measurement antenna may have to be higher or lower than the EUT, depending on the radiation pattern of the emission and staying aimed at the emission source for receiving the maximum signal. The final measurement antenna elevation shall be that which maximizes the emissions. The measurement antenna elevation for maximum emissions shall be restricted to a range of heights of from 1 m to 4 m above the ground or reference ground plane.
- b. The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
 - c. The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
 - d. For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rotatable table was turned from 0 degrees to 360 degrees to find the maximum reading.
 - e. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
 - f. If the emission level of the EUT in peak mode was 10dB lower than the limit

| | |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | <p>specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.</p> <p>g. Test the EUT in the lowest channel, the middle channel, the Highest channel</p> <p>h. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, And found the X axis positioning which it is worse case.</p> <p>i. Repeat above procedures until all frequencies measured was complete.</p> |
| Instruments Used: | Refer to section 5.11 for details |
| Exploratory Test Mode: | Transmitting mode |
| Final Test Mode: | <p>Pretest the EUT at Transmitting mode, For below 1GHz part, through pre-scan, the worst case is the lowest channel.</p> <p>Only the worst case is recorded in the report.</p> |
| Test Voltage: | DC 3.3V |
| Test Results: | Pass |

Measurement Data

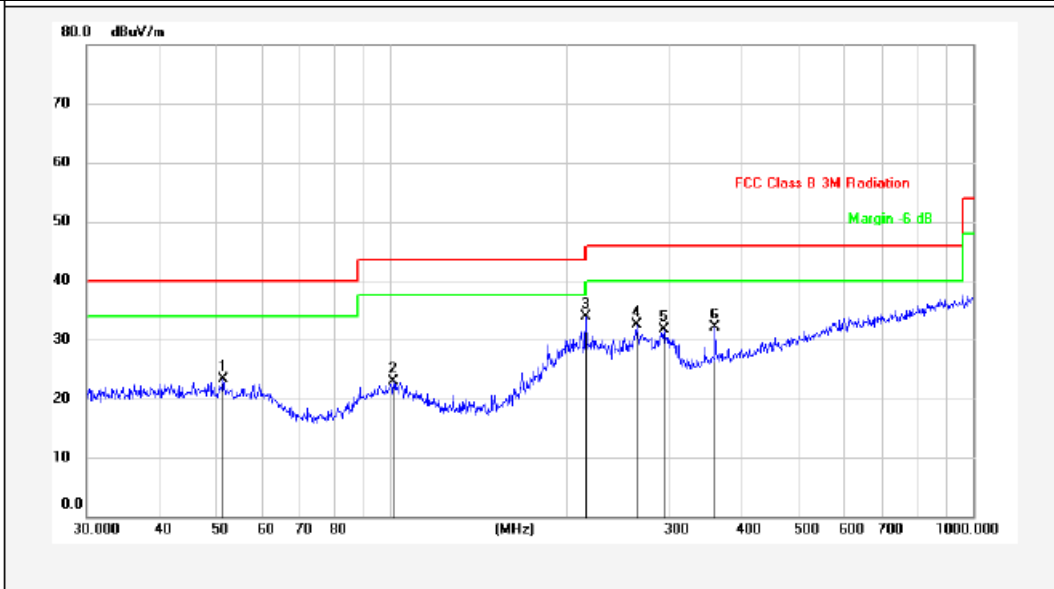
| | | |
|-------------------|--------------|----------|
| 30MHz~1GHz | | |
| Test mode: | Transmitting | Vertical |



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna (dB/m) | Cable (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|------------------|----------------|------------|-----------------|----------------|-------------|----------|
| 1 | 30.3171 | 17.45 | 11.19 | 0.89 | 29.53 | 40.00 | -10.47 | QP |
| 2 | 110.5687 | 11.15 | 11.19 | 1.58 | 23.92 | 43.50 | -19.58 | QP |
| 3 | 170.1947 | 17.00 | 8.51 | 1.84 | 27.35 | 43.50 | -16.15 | QP |
| 4 | 199.9856 | 18.54 | 10.3 | 1.96 | 30.80 | 43.50 | -12.70 | QP |
| 5 | 216.0240 | 16.17 | 10.81 | 2.08 | 29.06 | 46.00 | -16.94 | QP |
| 6 | 400.4318 | 12.66 | 15.51 | 2.75 | 30.92 | 46.00 | -15.08 | QP |

Remarks: 1. Result=Reading+Antenna+Cable
 2. If Peak Result complies with QP Limit, QP Result is deemed to comply with QP Limit.

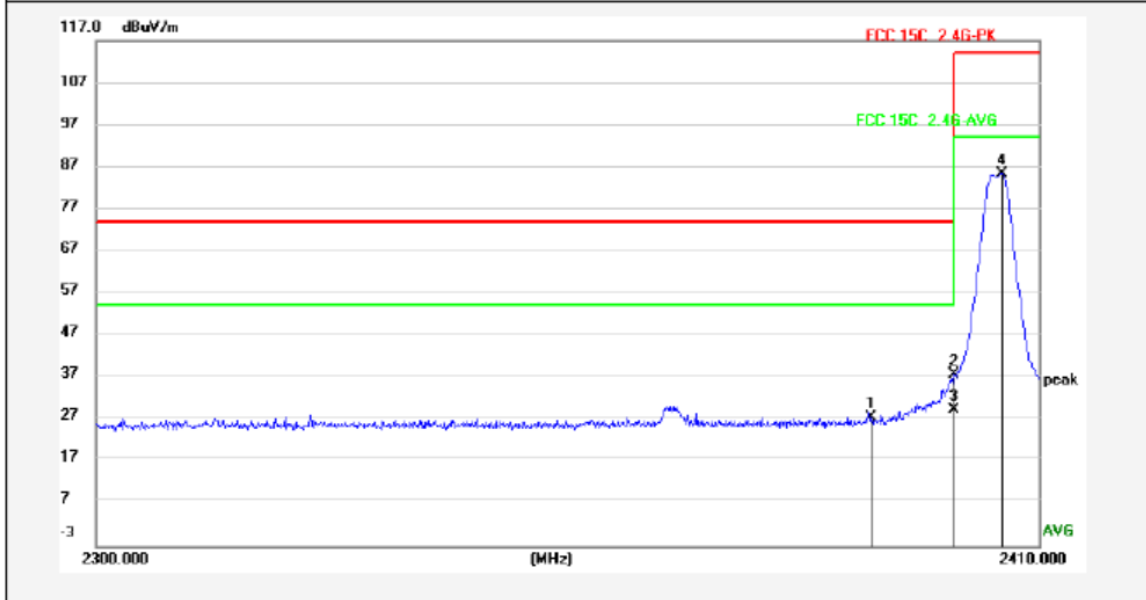
| | | |
|------------|--------------|------------|
| Test mode: | Transmitting | Horizontal |
|------------|--------------|------------|



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna (dB/m) | Cable (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector |
|-----|-----------------|------------------|----------------|------------|-----------------|----------------|-------------|----------|
| 1 | 51.4806 | 9.96 | 12.17 | 1.12 | 23.25 | 40.00 | -16.75 | QP |
| 2 | 100.9339 | 9.42 | 12.03 | 1.53 | 22.98 | 43.50 | -20.52 | QP |
| 3 | 216.0240 | 20.94 | 10.81 | 2.08 | 33.83 | 46.00 | -12.17 | QP |
| 4 | 263.8190 | 17.88 | 12.34 | 2.31 | 32.53 | 46.00 | -13.47 | QP |
| 5 | 294.1136 | 15.94 | 13.31 | 2.43 | 31.68 | 46.00 | -14.32 | QP |
| 6 | 360.4476 | 14.73 | 14.71 | 2.64 | 32.08 | 46.00 | -13.92 | QP |

Remarks: 1. Result=Reading+Antenna+Cable
 2. If Peak Result complies with QP Limit, QP Result is deemed to comply with QP Limit.

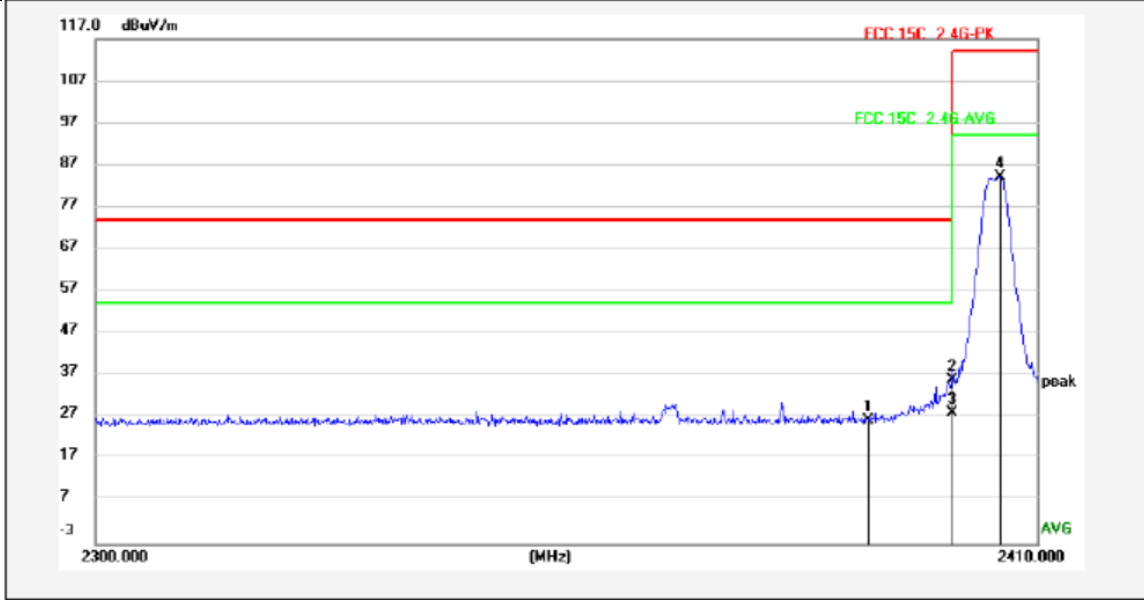
| band edge test data | | |
|---------------------|-----------------------|----------|
| Test mode: | Transmitting (Lowest) | Vertical |



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna. (dB/m) | Cable. (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-----------------|------------------|-----------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1 | 2390.000 | 32.65 | 27.23 | -32.52 | 27.36 | 74.00 | -46.64 | peak | |
| 2 | 2400.000 | 42.97 | 27.26 | -32.5 | 37.73 | 74.00 | -36.27 | peak | |
| 3 | 2400.000 | 34.34 | 27.26 | -32.5 | 29.10 | 54.00 | -24.90 | AVG | |
| 4 | 2405.600 | 90.45 | 27.28 | -32.51 | 85.22 | 114.00 | -28.78 | peak | |

Remarks: 1. Result=Reading+Antenna+Cable
 2. The emission levels that are 20db below the official limit are not reported.

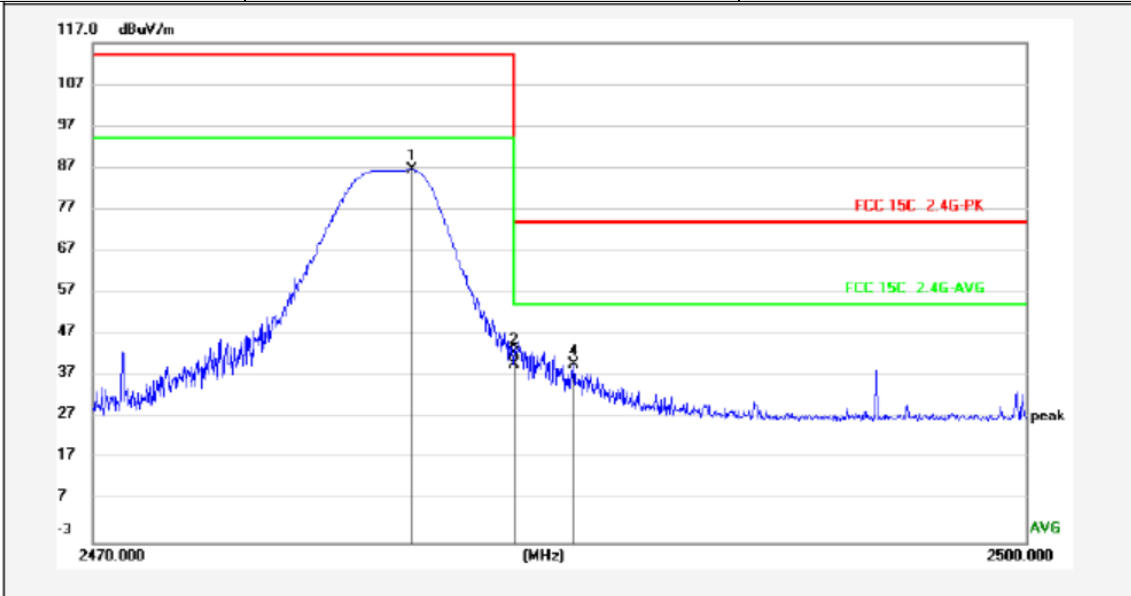
| band edge test data | | |
|---------------------|-----------------------|------------|
| Test mode: | Transmitting(Lowest) | Horizontal |



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna. (dB/m) | Cable. (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-----------------|------------------|-----------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1 | 2390.000 | 31.42 | 27.23 | -32.52 | 26.13 | 74.00 | -47.87 | peak | |
| 2 | 2400.000 | 41.07 | 27.26 | -32.5 | 35.83 | 74.00 | -38.17 | peak | |
| 3 | 2400.000 | 33.23 | 27.26 | -32.5 | 27.99 | 54.00 | -26.01 | AVG | |
| 4 | 2405.600 | 89.32 | 27.28 | -32.51 | 84.09 | 114.00 | -29.91 | peak | |

Remarks:1. Result=Reading+Antenna+Cable
 2. The emission levels that are 20db below the official limit are not reported.

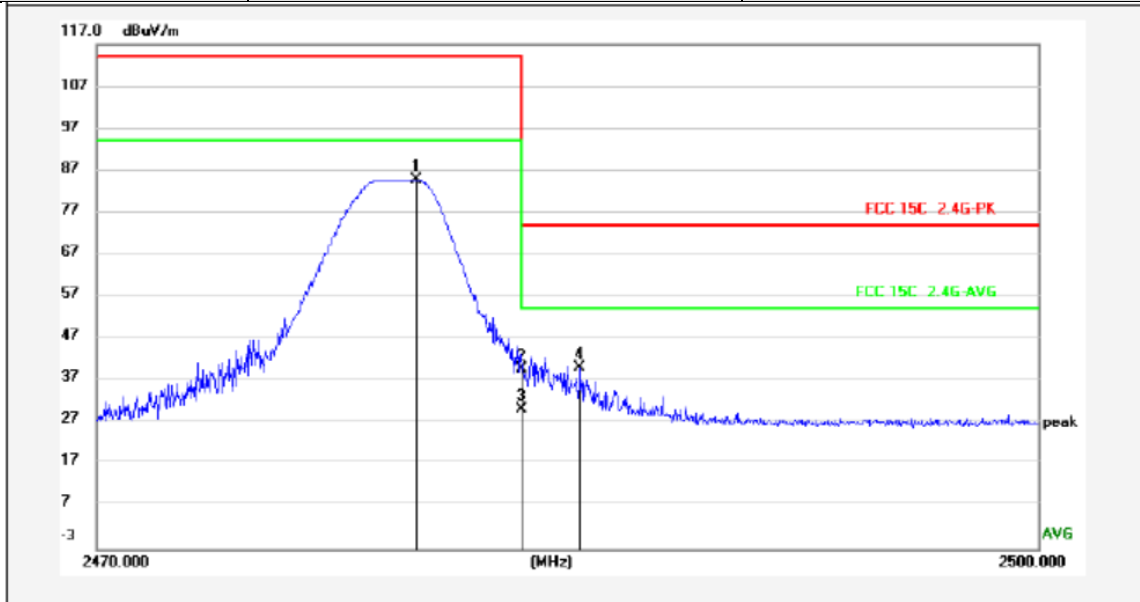
| band edge test data | | |
|---------------------|------------------------|----------|
| Test mode: | Transmitting (Highest) | Vertical |



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna. (dB/m) | Cable. (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-----------------|------------------|-----------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1 | 2480.230 | 91.48 | 27.53 | -32.57 | 86.44 | 114.00 | -27.56 | peak | |
| 2 | 2483.500 | 47.40 | 27.54 | -32.58 | 42.36 | 74.00 | -31.64 | peak | |
| 3 | 2483.500 | 44.70 | 27.54 | -32.58 | 39.66 | 54.00 | -14.34 | AVG | |
| 4 | 2485.420 | 44.67 | 27.55 | -32.58 | 39.64 | 74.00 | -34.36 | peak | |

Remarks: 1. Result=Reading+Antenna+Cable
 2. The emission levels that are 20db below the official limit are not reported.

| band edge test data | | |
|---------------------|-----------------------|------------|
| Test mode: | Transmitting(Highest) | Horizontal |



| No. | Frequency (MHz) | Reading (dBuV/m) | Antenna. (dB/m) | Cable. (dB) | Result (dBuV/m) | Limit (dBuV/m) | Margin (dB) | Detector | Remark |
|-----|-----------------|------------------|-----------------|-------------|-----------------|----------------|-------------|----------|--------|
| 1 | 2480.140 | 89.87 | 27.53 | -32.57 | 84.83 | 114.00 | -29.17 | peak | |
| 2 | 2483.500 | 44.88 | 27.54 | -32.58 | 39.84 | 74.00 | -34.16 | peak | |
| 3 | 2483.500 | 35.15 | 27.54 | -32.58 | 30.11 | 54.00 | -23.89 | AVG | |
| 4 | 2485.360 | 45.04 | 27.55 | -32.58 | 40.01 | 74.00 | -33.99 | peak | |

Remarks: 1. Result=Reading+Antenna+Cable
 2. The emission levels that are 20db below the official limit are not reported.

| Above 1GHz | | | | | | | |
|------------|---------------|--------------|----------------|----------------|--------|---------------|-----------|
| Test mode: | | Transmitting | | Test channel: | | Lowest | |
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | | H/V |
| 2405 | 97.45 | -9.33 | 88.12 | 114 | -25.88 | peak | H |
| 2405 | 87.71 | -9.33 | 78.38 | 94 | -15.62 | AVG | H |
| 4810 | 42.51 | -4.28 | 38.23 | 74 | -35.77 | peak | H |
| 4810 | 32.33 | -4.28 | 28.05 | 54 | -25.95 | AVG | H |
| 7215 | 41.10 | 1.13 | 42.23 | 74 | -31.77 | peak | H |
| 7215 | 30.14 | 1.13 | 31.27 | 54 | -22.73 | AVG | H |
| 2405 | 99.24 | -9.33 | 89.91 | 114 | -24.09 | peak | V |
| 2405 | 89.45 | -9.33 | 80.12 | 94 | -13.88 | AVG | V |
| 4810 | 49.49 | -4.28 | 45.21 | 74 | -28.79 | peak | V |
| 4810 | 39.26 | -4.28 | 34.98 | 54 | -19.02 | AVG | V |
| 7215 | 40.66 | 1.13 | 41.79 | 74 | -32.21 | peak | V |
| 7215 | 31.67 | 1.13 | 32.80 | 54 | -21.20 | AVG | V |

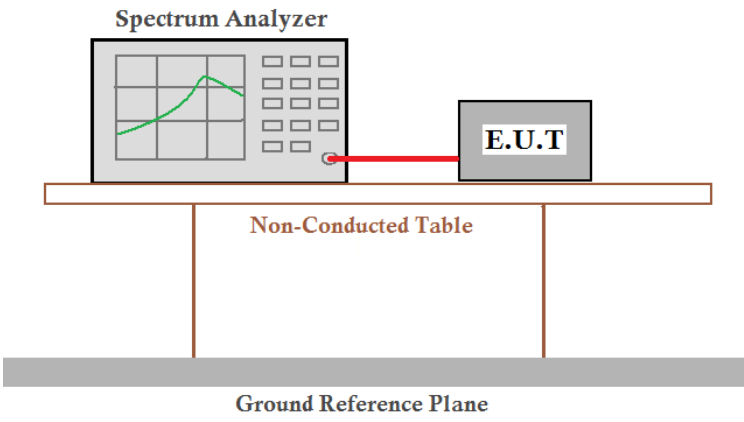
| Above 1GHz | | | | | | | |
|------------|---------------|--------------|----------------|----------------|--------|---------------|-----------|
| Test mode: | | Transmitting | | Test channel: | | Middle | |
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | | H/V |
| 2440 | 95.34 | -9.33 | 86.01 | 114 | -27.99 | peak | H |
| 2440 | 83.23 | -9.33 | 73.90 | 94 | -20.10 | AVG | H |
| 4880 | 41.12 | -4.28 | 36.84 | 74 | -37.16 | peak | H |
| 4880 | 30.01 | -4.28 | 25.73 | 54 | -28.27 | AVG | H |
| 7320 | 40.00 | 1.13 | 41.13 | 74 | -32.87 | peak | H |
| 7320 | 30.00 | 1.13 | 31.13 | 54 | -22.87 | AVG | H |
| 2440 | 97.82 | -9.33 | 88.49 | 114 | -25.51 | peak | V |
| 2440 | 89.10 | -9.33 | 79.77 | 94 | -14.23 | AVG | V |
| 4880 | 49.48 | -4.28 | 45.20 | 74 | -28.80 | peak | V |
| 4880 | 37.80 | -4.28 | 33.52 | 54 | -20.48 | AVG | V |
| 7320 | 40.00 | 1.13 | 41.13 | 74 | -32.87 | peak | V |
| 7320 | 29.93 | 1.13 | 31.06 | 54 | -22.94 | AVG | V |

| Above 1GHz | | | | | | | |
|------------|---------------|--------------|----------------|----------------|--------|---------------|-----------|
| Test mode: | | Transmitting | | Test channel: | | Highest | |
| Frequency | Meter Reading | Factor | Emission Level | Limits | Over | Detector Type | Ant. Pol. |
| (MHz) | (dB μ V) | (dB) | (dB μ V/m) | (dB μ V/m) | (dB) | | H/V |
| 2480 | 99.46 | -9.33 | 90.13 | 114 | -23.87 | peak | H |
| 2480 | 88.79 | -9.33 | 79.46 | 94 | -14.54 | AVG | H |
| 4960 | 43.54 | -4.28 | 39.26 | 74 | -34.74 | peak | H |
| 4960 | 32.57 | -4.28 | 28.29 | 54 | -25.71 | AVG | H |
| 7440 | 40.13 | 1.13 | 41.26 | 74 | -32.74 | peak | H |
| 7440 | 30.00 | 1.13 | 31.13 | 54 | -22.87 | AVG | H |
| 2480 | 99.83 | -9.33 | 90.53 | 114 | -23.47 | peak | V |
| 2480 | 90.16 | -9.33 | 80.83 | 94 | -13.17 | AVG | V |
| 4960 | 50.49 | -4.28 | 46.21 | 74 | -27.79 | peak | V |
| 4960 | 39.89 | -4.28 | 34.61 | 54 | -19.39 | AVG | V |
| 7440 | 40.32 | 1.13 | 41.45 | 74 | -32.55 | peak | V |
| 7440 | 30.00 | 1.13 | 31.13 | 54 | -22.87 | AVG | V |

Remark:

- 1) The field strength is calculated by adding the Antenna Factor, Cable Factor & Preamplifier. The basic equation with a sample calculation is as follows:
Final Test Level = Receiver Reading + Antenna Factor + Cable Factor – Preamplifier Factor
- 2) Scan from 9kHz to 25GHz, The disturbance above 10GHz and below 30MHz was very low, and the above harmonics were the highest point could be found when testing, so only the above harmonics had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported .

5.4 20dB Bandwidth

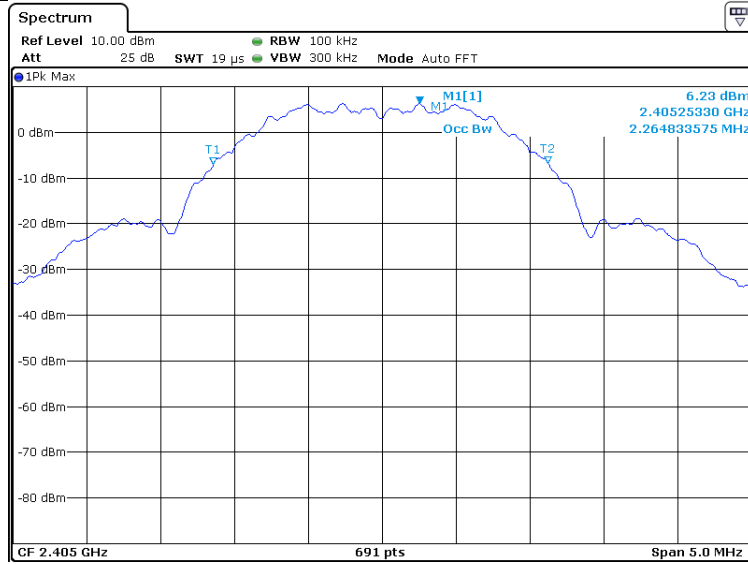
| | |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement: | 47 CFR Part 15C Section 15.215 |
| Test Method: | ANSI C63.10:2013 |
| Test Setup: |  <p>The diagram illustrates the test setup. A Spectrum Analyzer is connected to an E.U.T. (Equipment Under Test) via a red cable. Both the Spectrum Analyzer and the E.U.T. are placed on a Non-Conducted Table. The table is supported by two vertical legs. Below the table is a Ground Reference Plane.</p> |
| Instruments Used: | Refer to section 5.11 for details |
| Test Mode: | Transmitting with GFSK modulation. |
| Limit: | N/A |
| Test Results: | Pass |

Measurement Data

| Test channel | 20dB bandwidth (MHz) | Results |
|--------------|----------------------|---------|
| Lowest | 2.265 | Pass |
| Middle | 2.258 | Pass |
| Highest | 2.265 | Pass |

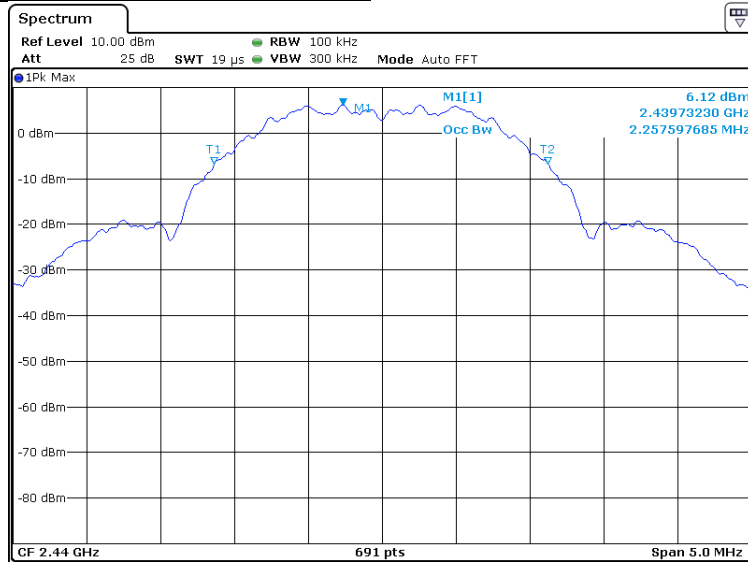
Test plot as follows:

Test channel: **Lowest**



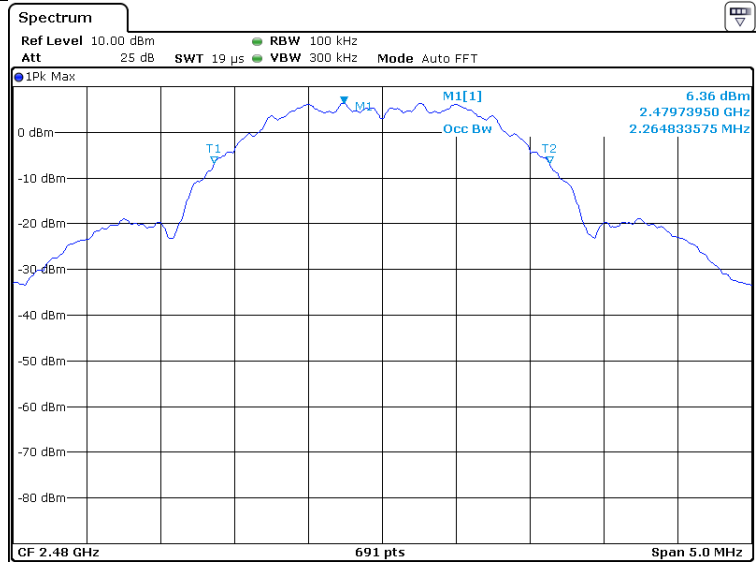
Date: 20 Nov 2020 09:26:05

Test channel: **Middle**



Date: 20 Nov 2020 09:29:46

Test channel: Highest



Date: 4 DEC 2020 15:31:39

6 Photographs

6.1 Radiated Emission Test Setup

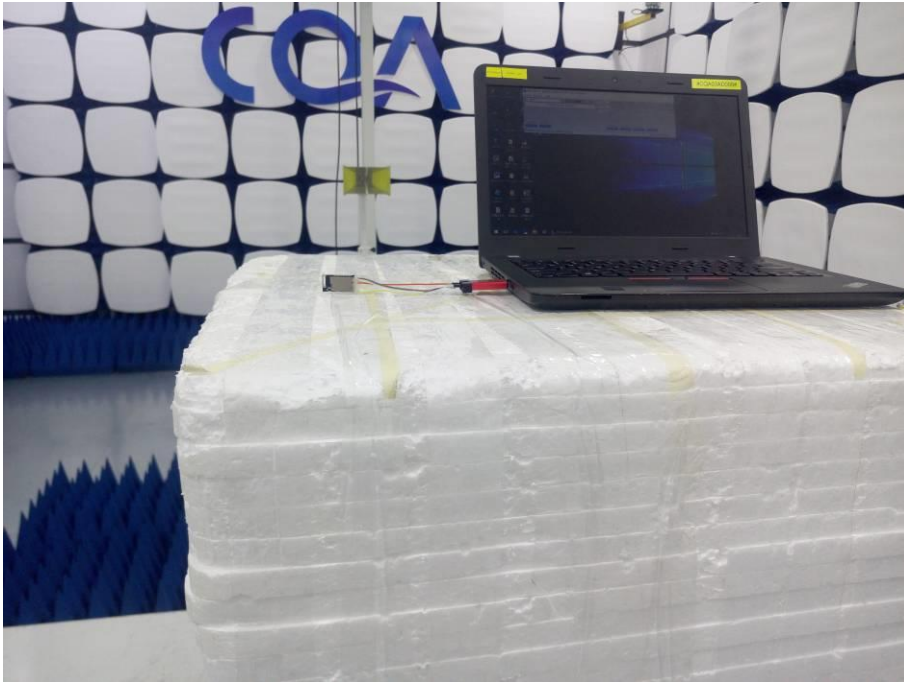
9KHz~30MHz



30MHz~1GHz:



Above 1GHz:

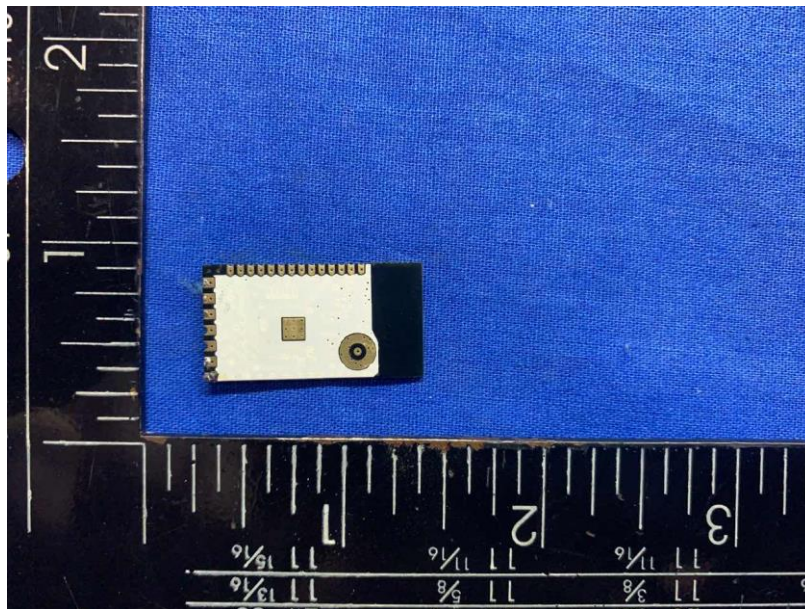
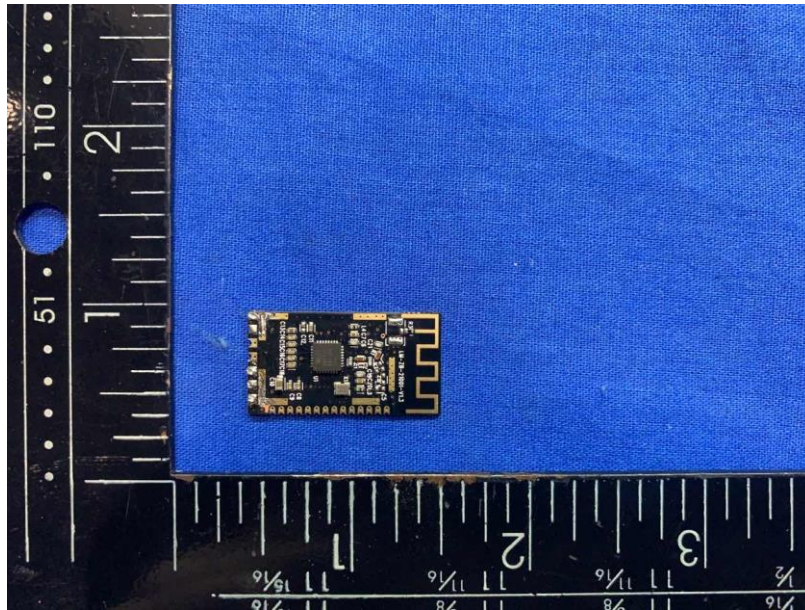


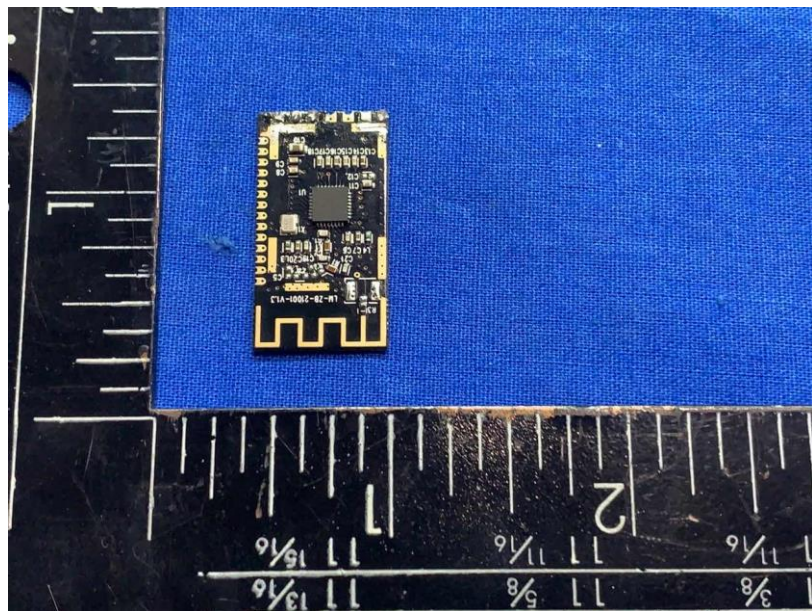
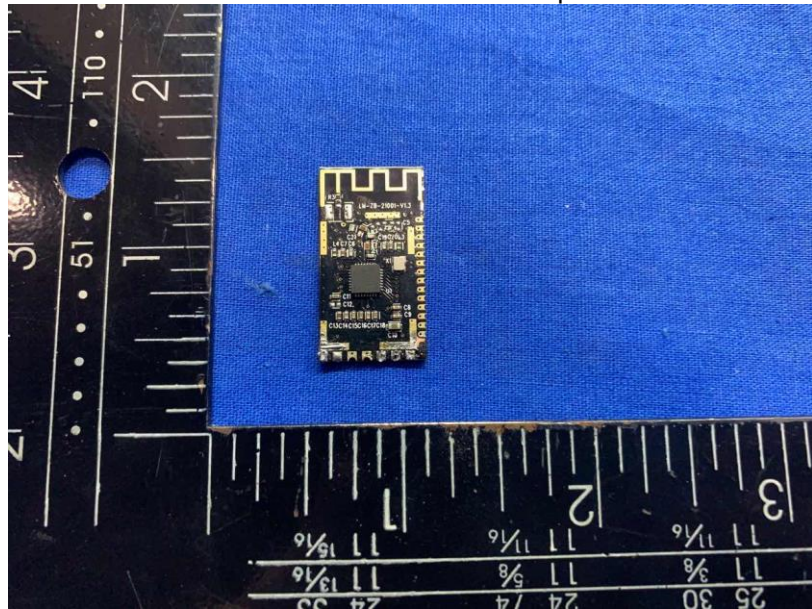
6.1 Conducted Emission Test Setup

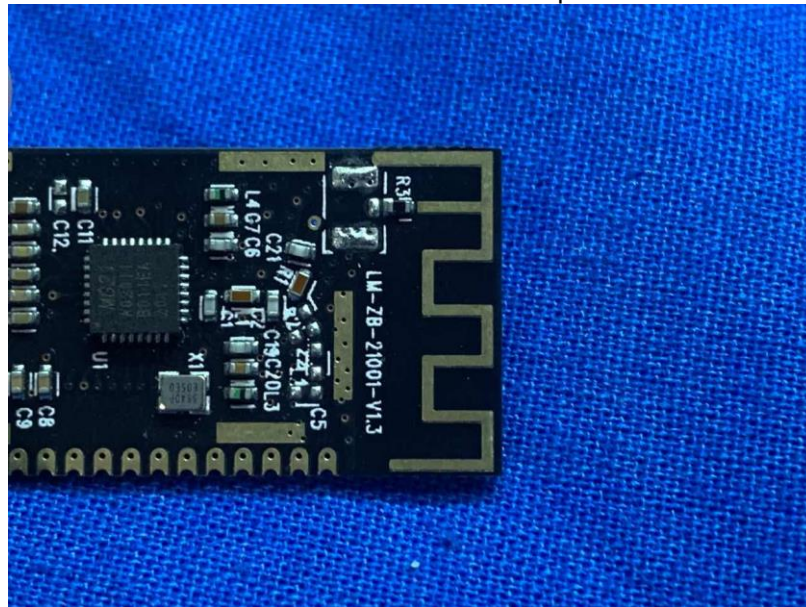
9KHz~30MHz



6.2 EUT Constructional Details







END OF THE REPORT