

# TEST REPORT

**Application No.:** SHEM1904012131CR  
**FCC ID:** 2APV2-CSA1S32W  
**IC:** 23928-CSA1S32W  
**Applicant:** Hangzhou Ezviz Software Co., Ltd.  
**Address of Applicant:** Floor 16, Unit B Building 1, No. 555, Qianmo Road, Binjiang District, Hangzhou City, Zhejiang Province  
**Manufacturer:** Hangzhou Ezviz Software Co., Ltd.  
**Address of Manufacturer:** Floor 16, Unit B Building 1, No. 555, Qianmo Road, Binjiang District, Hangzhou City, Zhejiang Province  
**Factory:** Hangzhou Hikvision Electronics Co., Ltd.  
**Address of Factory:** No.299, Qiushi Road, Tonglu Economic Development Zone, Tonglu County, Hangzhou, Zhejiang, 310052, China.

**Equipment Under Test (EUT):**  
**EUT Name:** Internet Alarm Hub  
**Model No.:** CS-A1S-32WE4G  
**Trade mark:** eZVIZ  
**Standard(s) :** 47 CFR Part 15, Subpart C 15.247  
RSS-247 Issue 2, February 2017  
RSS-Gen Issue 5, April 2018

**Date of Receipt:** 2019-04-04  
**Date of Test:** 2019-04-10 to 2019-04-16  
**Date of Issue:** 2019-04-30

|                     |               |
|---------------------|---------------|
| <b>Test Result:</b> | <b>Pass *</b> |
|---------------------|---------------|

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

*Parlam Zhan*

Parlam Zhan  
E&E Section Manager

The manufacturer should ensure that all products in series production are in conformity with the product sample detailed in this report. If the product in this report is used in any configuration other than that detailed in the report, the manufacturer must ensure the new system complies with all relevant standards. Any mention of SGS International Electrical Approvals or testing done by SGS International Electrical Approvals in connection with, distribution or use of the product described in this report must be approved by SGS International Electrical Approvals in writing.



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SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd.  
Testing Center EMC Laboratory

NO.588 West Jindu Road, Songjiang District, Shanghai, China 201612  
中国·上海·松江区金都西路588号 邮编: 201612

t(86-21) 61915666 f(86-21) 61915678 www.sgs.com.cn  
t(86-21) 61915666 f(86-21) 61915678 e.sgs.china@sgs.com



| Revision Record |             |            |        |
|-----------------|-------------|------------|--------|
| Version         | Description | Date       | Remark |
| 00              | Original    | 2019-04-30 | /      |
|                 |             |            |        |
|                 |             |            |        |

|                          |  |                                |  |  |
|--------------------------|--|--------------------------------|--|--|
| Authorized for issue by: |  |                                |  |  |
|                          |  | Vincent Zhu                    |  |  |
|                          |  | Vincent Zhu / Project Engineer |  |  |
|                          |  | Parlam Zhan                    |  |  |
|                          |  | Parlam Zhan / Reviewer         |  |  |

## 2 Test Summary

| Radio Spectrum Technical Requirement |                                  |        |                                              |        |
|--------------------------------------|----------------------------------|--------|----------------------------------------------|--------|
| Item                                 | Standard                         | Method | Requirement                                  | Result |
| Antenna Requirement                  | 47 CFR Part 15, Subpart C 15.247 | N/A    | 47 CFR Part 15, Subpart C 15.203 & 15.247(c) | Pass   |

| Radio Spectrum Matter Part                            |                                  |                                        |                                              |              |
|-------------------------------------------------------|----------------------------------|----------------------------------------|----------------------------------------------|--------------|
| Item                                                  | Standard                         | Method                                 | Requirement                                  | Result       |
| Conducted Emissions at AC Power Line (150kHz-30MHz)   | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.2         | 47 CFR Part 15, Subpart C 15.207             | Pass         |
| Minimum 6dB Bandwidth                                 | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 11.8.1      | 47 CFR Part 15, Subpart C 15.247a(2)         | Pass         |
| Conducted Peak Output Power                           | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 11.9.1      | 47 CFR Part 15, Subpart C 15.247(b)(3)       | Pass         |
| Power Spectrum Density                                | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 11.10.2     | 47 CFR Part 15, Subpart C 15.247(e)          | Pass         |
| Conducted Band Edges Measurement                      | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 11.13.3.2   | 47 CFR Part 15, Subpart C 15.247(d)          | Pass         |
| Conducted Spurious Emissions                          | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 11.11       | 47 CFR Part 15, Subpart C 15.247(d)          | Pass         |
| Radiated Emissions which fall in the restricted bands | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.10.5      | 47 CFR Part 15, Subpart C 15.209 & 15.247(d) | Pass         |
| Radiated Spurious Emissions                           | 47 CFR Part 15, Subpart C 15.247 | ANSI C63.10 (2013) Section 6.4,6.5,6.6 | 47 CFR Part 15, Subpart C 15.209 & 15.247(d) | Pass         |
| 99% Bandwidth                                         | RSS-247 Issue 2, February 2017   | ANSI C63.10 Section 6.9.3              | RSS-Gen Section 6.6                          | Pass         |
| Frequency Stability                                   | RSS-Gen April 2018               | RSS-Gen Section 6.11                   | RSS-Gen Section 8.11                         | Pass (Note1) |

Note 1: Frequency stability requested in RSS GEN S8.11 has been complied since the result of band edge can demonstrate.



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## 4 General Information

### 4.1 Details of E.U.T.

Power supply: DC 5V by adapter  
Adapter:  
Model: ADS-5RE-06 05050EPCU  
Input: 100-240V~50/60Hz  
Output: 5V 1A

Test voltage: AC 120V 60Hz

Cable: DC Cable 90cm for adapter

Antenna Gain 2dBi

Antenna Type Integral Antenna

Channel Spacing 5MHz

Modulation Type 802.11b: DSSS (CCK, DQPSK, DBPSK)  
802.11g/n: OFDM (64QAM, 16QAM, QPSK, BPSK)

Number of Channels 802.11b/g/n(HT20): 11

Operation Frequency 802.11b/g/n(HT20): 2412MHz to 2462MHz

### 4.2 Description of Support Units

| Description               | Manufacturer | Model No.      | Serial No. |
|---------------------------|--------------|----------------|------------|
| Laptop                    | Lenovo       | ThinkPad X100e | /          |
| SecureCRT                 | VanDyke      | V 6.2.0        | /          |
| Serial port adapter plate | /            | Test Plate 3   | /          |

### 4.3 Power level setting using in test:

| Channel | 802.11b | 802.11g | 802.11n(HT20) |
|---------|---------|---------|---------------|
| 1       | 15      | 15      | 15            |
| 6       | 15      | 15      | 15            |
| 11      | 15      | 15      | 15            |

#### 4.4 Measurement Uncertainty

| No. | Item                            | Measurement Uncertainty   |
|-----|---------------------------------|---------------------------|
| 1   | Radio Frequency                 | $\pm 8.4 \times 10^{-8}$  |
| 2   | Timeout                         | $\pm 2s$                  |
| 3   | Duty cycle                      | $\pm 0.37\%$              |
| 4   | Occupied Bandwidth              | $\pm 3\%$                 |
| 5   | RF conducted power              | $\pm 0.6dB$               |
| 6   | RF power density                | $\pm 2.84dB$              |
| 7   | Conducted Spurious emissions    | $\pm 0.75dB$              |
| 8   | RF Radiated power               | $\pm 4.6dB$ (Below 1GHz)  |
|     |                                 | $\pm 4.1dB$ (Above 1GHz)  |
| 9   | Radiated Spurious emission test | $\pm 4.2dB$ (Below 30MHz) |
|     |                                 | $\pm 4.4dB$ (30MHz-1GHz)  |
|     |                                 | $\pm 4.8dB$ (1GHz-18GHz)  |
|     |                                 | $\pm 5.2dB$ (Above 18GHz) |
| 10  | Temperature test                | $\pm 1^{\circ}C$          |
| 11  | Humidity test                   | $\pm 3\%$                 |
| 12  | Supply voltages                 | $\pm 1.5\%$               |
| 13  | Time                            | $\pm 3\%$                 |

Note: The measurement uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of  $k=2$ .

#### 4.5 Test Location

All tests were performed at:

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. E&E Lab

588 West Jindu Road, Xinqiao, Songjiang, 201612 Shanghai, China

Tel: +86 21 6191 5666

Fax: +86 21 6191 5678

No tests were sub-contracted.

#### 4.6 Test Facility

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

- **CNAS (No. CNAS L0599)**

CNAS has accredited SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. 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.

- **NVLAP (Certificate No. 201034-0)**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). Certificate No. 201034-0.

- **FCC –Designation Number: CN5033**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been recognized as an accredited testing laboratory.

Designation Number: CN5033. Test Firm Registration Number: 479755.

- **Innovation, Science and Economic Development Canada**

SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. EMC Laboratory has been recognized by ISED as an accredited testing laboratory.

IC Registration No.: 8617A-1. CAB identifier: CN0020.

- **VCCI (Member No.: 3061)**

The 3m Semi-anechoic chamber and Shielded Room of SGS-CSTC Standards Technical Services (Shanghai) Co., Ltd. has been registered in accordance with the Regulations for Voluntary Control Measures with Registration No.: R-13868, C-14336, T-12221, G-10830 respectively.

#### 4.7 Deviation from Standards

None

#### 4.8 Abnormalities from Standard Conditions

None

## 5 Equipment List

| Equipment                                  | Manufacturer | Model No         | Inventory No | Cal Date   | Cal Due Date |
|--------------------------------------------|--------------|------------------|--------------|------------|--------------|
| <b>Conducted Emission at AC Power Line</b> |              |                  |              |            |              |
| EMI test receiver                          | R&S          | ESR7             | SHEM162-1    | 2018-12-20 | 2019-12-19   |
| LISN                                       | Schwarzbeck  | NSLK8127         | SHEM061-1    | 2018-12-20 | 2019-12-19   |
| LISN                                       | EMCO         | 3816/2           | SHEM019-1    | 2018-12-20 | 2019-12-19   |
| Pulse limiter                              | R&S          | ESH3-Z2          | SHEM029-1    | 2018-12-20 | 2019-12-19   |
| CE test Cable                              | /            | CE01             | /            | 2018-12-26 | 2019-12-25   |
| <b>Conducted Test</b>                      |              |                  |              |            |              |
| Spectrum Analyzer                          | R&S          | FSP-30           | SHEM002-1    | 2018-12-20 | 2019-12-19   |
| Spectrum Analyzer                          | Agilent      | N9020A           | SHEM181-1    | 2018-08-13 | 2019-08-12   |
| Signal Generator                           | R&S          | SMR20            | SHEM006-1    | 2018-08-13 | 2019-08-12   |
| Signal Generator                           | Agilent      | N5182A           | SHEM182-1    | 2018-08-13 | 2019-08-12   |
| Communication Tester                       | R&S          | CMW270           | SHEM183-1    | 2018-08-13 | 2019-08-12   |
| Switcher                                   | Tonscend     | JS0806           | SHEM184-1    | 2018-08-13 | 2019-08-12   |
| Power Sensor                               | Keysight     | U2021XA * 4      | SHEM184-1    | 2018-08-13 | 2019-08-12   |
| Splitter                                   | Anritsu      | MA1612A          | SHEM185-1    | /          | /            |
| Coupler                                    | e-meca       | 803-S-1          | SHEM186-1    | /          | /            |
| High-low Temp Cabinet                      | Suzhou Zhihe | TL-40            | SHEM087-1    | 2017-09-25 | 2020-09-24   |
| AC Power Stabilizer                        | WOCEN        | 6100             | SHEM045-1    | 2018-12-26 | 2019-12-25   |
| DC Power Supply                            | MCN          | MCH-303A         | SHEM210-1    | 2018-12-26 | 2019-12-25   |
| Conducted test Cable                       | /            | RF01~RF04        | /            | 2018-12-26 | 2019-12-25   |
| <b>Radiated Test</b>                       |              |                  |              |            |              |
| EMI test Receiver                          | R&S          | ESU40            | SHEM051-1    | 2018-12-20 | 2019-12-19   |
| Spectrum Analyzer                          | R&S          | FSP-30           | SHEM002-1    | 2018-12-20 | 2019-12-19   |
| Loop Antenna (9kHz-30MHz)                  | Schwarzbeck  | FMZB1519         | SHEM135-1    | 2017-04-10 | 2020-04-09   |
| Antenna (25MHz-2GHz)                       | Schwarzbeck  | VULB9168         | SHEM048-1    | 2017-02-28 | 2020-02-27   |
| Antenna (25MHz-3GHz)                       | Schwarzbeck  | HL562            | SHEM010-1    | 2017-02-28 | 2020-02-27   |
| Horn Antenna (1-8GHz)                      | Schwarzbeck  | HF906            | SHEM009-1    | 2017-10-24 | 2020-10-23   |
| Horn Antenna (1-18GHz)                     | Schwarzbeck  | BBHA9120D        | SHEM050-1    | 2017-01-14 | 2020-01-13   |
| Horn Antenna (14-40GHz)                    | Schwarzbeck  | BBHA 9170        | SHEM049-1    | 2017-12-03 | 2020-12-02   |
| Pre-amplifier (9kHz-2GHz)                  | CLAVIIO      | BDLNA-0001       | SHEM164-1    | 2018-08-13 | 2019-08-12   |
| Pre-amplifier (1-18GHz)                    | CLAVIIO      | BDLNA-0118       | SHEM050-2    | 2018-08-13 | 2019-08-12   |
| High-amplifier (14-40GHz)                  | Schwarzbeck  | 10001            | SHEM049-2    | 2018-12-20 | 2019-12-19   |
| Signal Generator                           | R&S          | SMR40            | SHEM058-1    | 2018-08-13 | 2019-08-12   |
| Band Filter                                | LORCH        | 9BRX-875/X150    | SHEM156-1    | /          | /            |
| Band Filter                                | LORCH        | 13BRX-1950/X500  | SHEM083-2    | /          | /            |
| Band Filter                                | LORCH        | 5BRX-2400/X200   | SHEM155-1    | /          | /            |
| Band Filter                                | LORCH        | 5BRX-5500/X1000  | SHEM157-2    | /          | /            |
| High pass Filter                           | Wainwright   | WHK3.0/18G       | SHEM157-1    | /          | /            |
| High pass Filter                           | Wainwright   | WHKS1700         | SHEM157-3    | /          | /            |
| Semi/Fully Anechoic                        | ST           | 11*6*6M          | SHEM078-2    | 2017-07-22 | 2020-07-21   |
| RE test Cable                              | /            | RE01, RE02, RE06 | /            | 2018-12-26 | 2019-12-25   |

## 6 Radio Spectrum Technical Requirement

### 6.1 Antenna Requirement

#### 6.1.1 Test Requirement:

47 CFR Part 15, Subpart C 15.203 & 15.247(c)

#### 6.1.2 Conclusion

Standard Requirement:

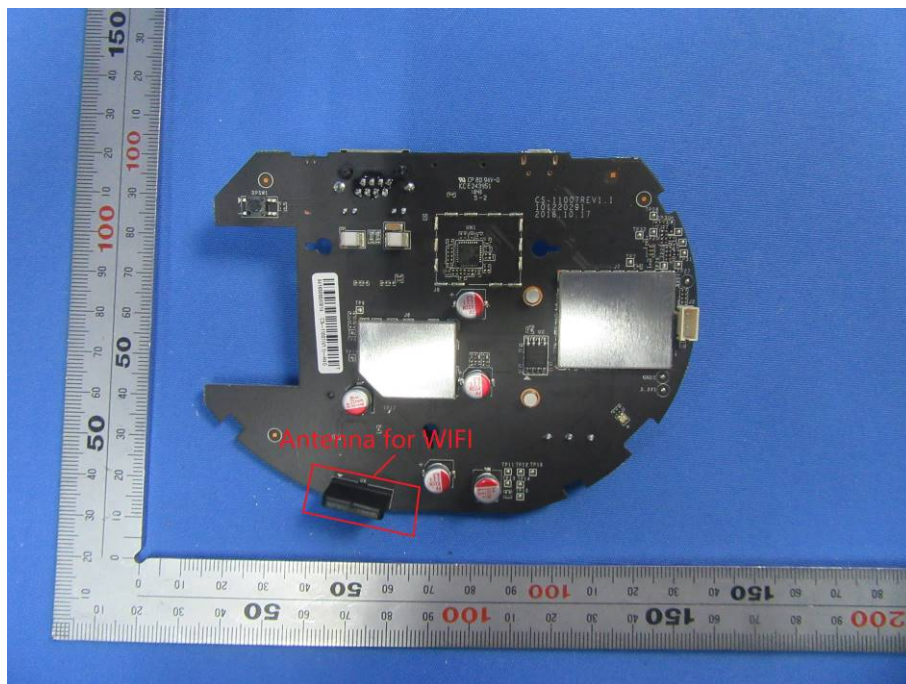
An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

15.247(b) (4) requirement:

The conducted output power limit specified in paragraph (b) of this section is based on the use of antennas with directional gains that do not exceed 6 dBi. Except as shown in paragraph (c) of this section, if transmitting antennas of directional gain greater than 6 dBi are used, the conducted output power from the intentional radiator shall be reduced below the stated values in paragraphs (b)(1), (b)(2), and (b)(3) of this section, as appropriate, by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

EUT Antenna:

The antenna is Integral Antenna with conducted connector and no consideration of replacement. The best case gain of the antenna is 2dBi.



## 7 Radio Spectrum Matter Test Results

### 7.1 Conducted Emissions at AC Power Line (150kHz-30MHz)

Test Requirement 47 CFR Part 15, Subpart C 15.207

Test Method: ANSI C63.10 (2013) Section 6.2

Limit:

| Frequency of emission(MHz) | Conducted limit(dBμV) |           |
|----------------------------|-----------------------|-----------|
|                            | 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.

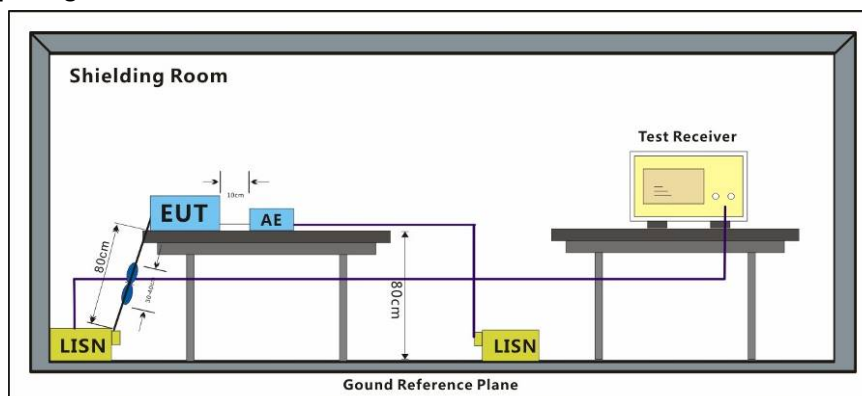
#### 7.1.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

#### 7.1.2 Test Setup Diagram

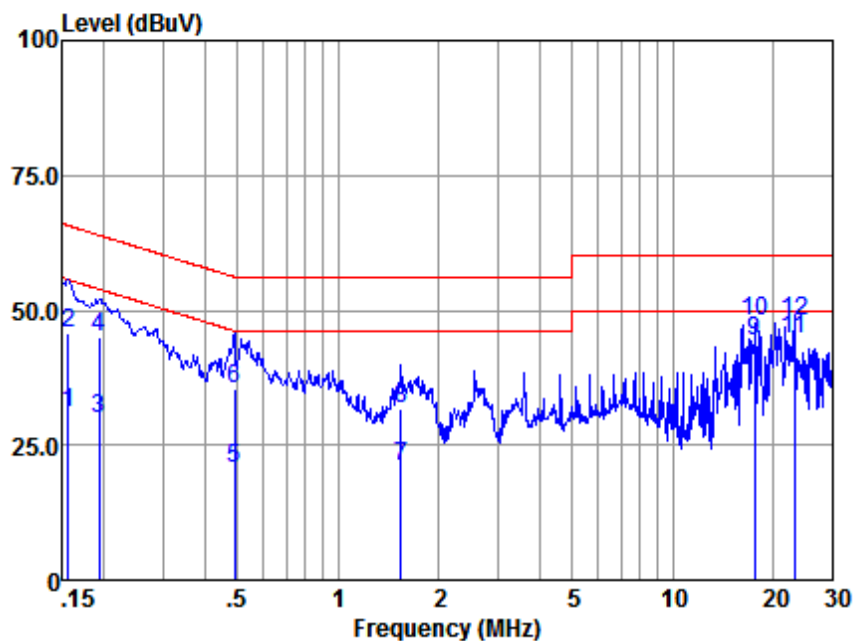


### **7.1.3 Measurement Procedure and Data**

- 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 50ohm/50μH + 5ohm 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 on conducted measurement.

Remark: LISN=Read Level+ Cable Loss+ LISN Factor

Mode:a; Line:Live Line

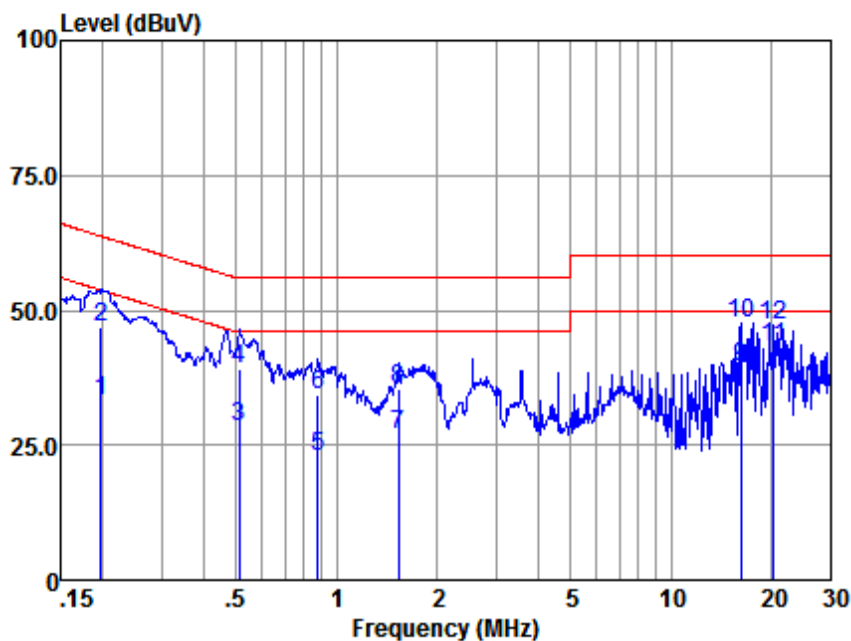


LISN : LINE  
EUT/Project No : 12129CR  
Test mode : a

|    | Freq<br>(MHz) | Read<br>level<br>(dBuV) | LISN<br>Factor<br>(dB) | Cable<br>Loss<br>(dB) | Emission<br>Level<br>(dBuV) | Limit<br>(dBuV) | Over<br>Limit<br>(dB) | Remark  |
|----|---------------|-------------------------|------------------------|-----------------------|-----------------------------|-----------------|-----------------------|---------|
| 1  | 0.16          | 20.92                   | 0.08                   | 10.00                 | 31.00                       | 55.65           | -24.65                | Average |
| 2  | 0.16          | 35.71                   | 0.08                   | 10.00                 | 45.79                       | 65.65           | -19.86                | QP      |
| 3  | 0.19          | 19.97                   | 0.07                   | 10.00                 | 30.04                       | 53.93           | -23.89                | Average |
| 4  | 0.19          | 34.94                   | 0.07                   | 10.00                 | 45.01                       | 63.93           | -18.92                | QP      |
| 5  | 0.49          | 10.58                   | 0.08                   | 10.00                 | 20.66                       | 46.19           | -25.53                | Average |
| 6  | 0.49          | 25.46                   | 0.08                   | 10.00                 | 35.54                       | 56.19           | -20.65                | QP      |
| 7  | 1.54          | 10.87                   | 0.12                   | 10.10                 | 21.09                       | 46.00           | -24.91                | Average |
| 8  | 1.54          | 21.54                   | 0.12                   | 10.10                 | 31.76                       | 56.00           | -24.24                | QP      |
| 9  | 17.66         | 33.52                   | 0.30                   | 10.40                 | 44.22                       | 50.00           | -5.78                 | Average |
| 10 | 17.66         | 37.45                   | 0.30                   | 10.40                 | 48.15                       | 60.00           | -11.85                | QP      |
| 11 | 23.14         | 34.09                   | 0.31                   | 10.40                 | 44.80                       | 50.00           | -5.20                 | Average |
| 12 | 23.14         | 37.35                   | 0.31                   | 10.40                 | 48.06                       | 60.00           | -11.94                | QP      |

Notes: Emission Level = Read Level + LISN Factor + Cable loss

Mode:a; Line:Neutral Line



LISN : NEUTRAL  
EUT/Project No : 12129CR  
Test mode : a

|    | Freq<br>(MHz) | Read<br>level<br>(dBuV) | LISN<br>Factor<br>(dB) | Cable<br>Loss<br>(dB) | Emission<br>Level<br>(dBuV) | Limit<br>(dBuV) | Over<br>Limit<br>(dB) | Remark  |
|----|---------------|-------------------------|------------------------|-----------------------|-----------------------------|-----------------|-----------------------|---------|
| 1  | 0.20          | 23.26                   | 0.06                   | 10.00                 | 33.32                       | 53.71           | -20.39                | Average |
| 2  | 0.20          | 36.74                   | 0.06                   | 10.00                 | 46.80                       | 63.71           | -16.91                | QP      |
| 3  | 0.51          | 18.37                   | 0.06                   | 10.00                 | 28.43                       | 46.00           | -17.57                | Average |
| 4  | 0.51          | 29.18                   | 0.06                   | 10.00                 | 39.24                       | 56.00           | -16.76                | QP      |
| 5  | 0.88          | 12.74                   | 0.08                   | 10.00                 | 22.82                       | 46.00           | -23.18                | Average |
| 6  | 0.88          | 24.12                   | 0.08                   | 10.00                 | 34.20                       | 56.00           | -21.80                | QP      |
| 7  | 1.54          | 16.89                   | 0.09                   | 10.10                 | 27.08                       | 46.00           | -18.92                | Average |
| 8  | 1.54          | 25.21                   | 0.09                   | 10.10                 | 35.40                       | 56.00           | -20.60                | QP      |
| 9  | 16.23         | 28.95                   | 0.25                   | 10.40                 | 39.60                       | 50.00           | -10.40                | Average |
| 10 | 16.23         | 36.79                   | 0.25                   | 10.40                 | 47.44                       | 60.00           | -12.56                | QP      |
| 11 | 20.27         | 32.47                   | 0.29                   | 10.40                 | 43.16                       | 50.00           | -6.84                 | Average |
| 12 | 20.27         | 36.47                   | 0.29                   | 10.40                 | 47.16                       | 60.00           | -12.84                | QP      |

Notes: Emission Level = Read Level + LISN Factor + Cable loss

## 7.2 Minimum 6dB Bandwidth

Test Requirement 47 CFR Part 15, Subpart C 15.247a(2)  
Test Method: ANSI C63.10 (2013) Section 11.8.1  
Limit:  $\geq 500$  kHz

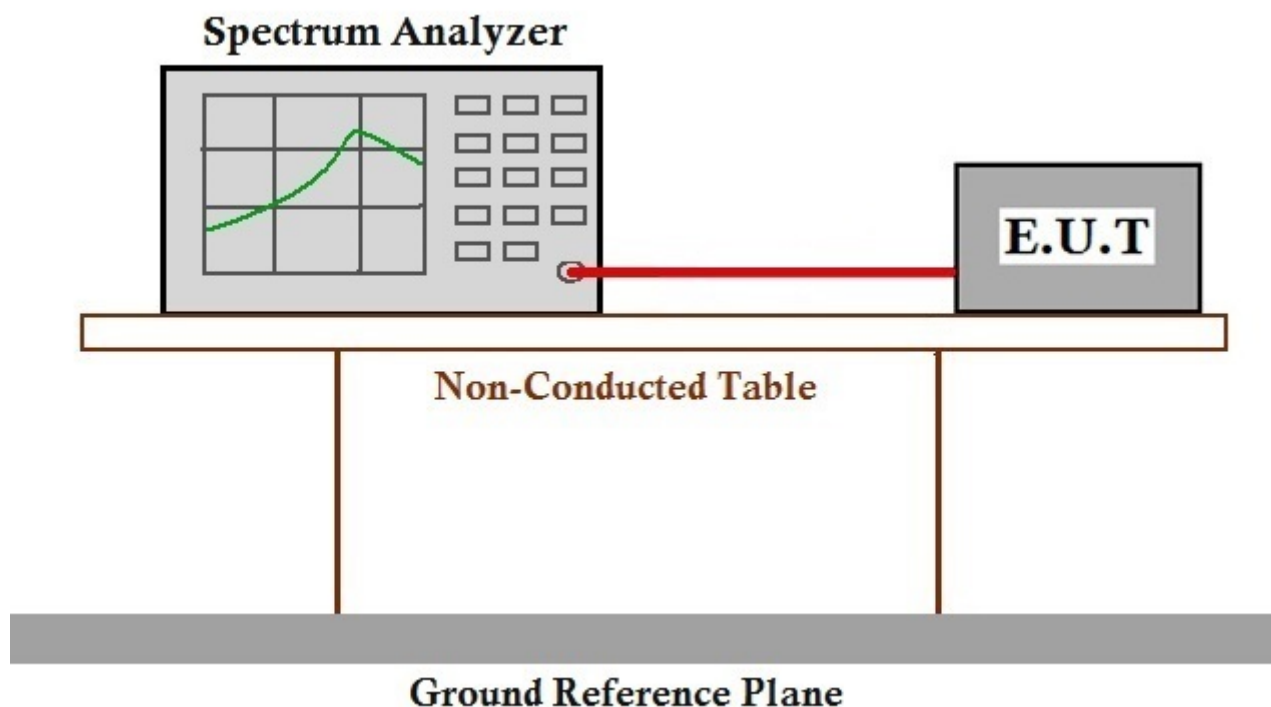
### 7.2.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.2.2 Test Setup Diagram



### 7.2.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101

### 7.3 Conducted Peak Output Power

Test Requirement 47 CFR Part 15, Subpart C 15.247(b)(3)

Test Method: ANSI C63.10 (2013) Section 11.9.1

Limit:

| Frequency range(MHz) | Output power of the intentional radiator(watt)         |
|----------------------|--------------------------------------------------------|
| 902-928              | 1 for $\geq 50$ hopping channels                       |
|                      | 0.25 for $25 \leq$ hopping channels $< 50$             |
|                      | 1 for digital modulation                               |
| 2400-2483.5          | 1 for $\geq 75$ non-overlapping hopping channels       |
|                      | 0.125 for all other frequency hopping systems          |
|                      | 1 for digital modulation                               |
| 5725-5850            | 1 for frequency hopping systems and digital modulation |

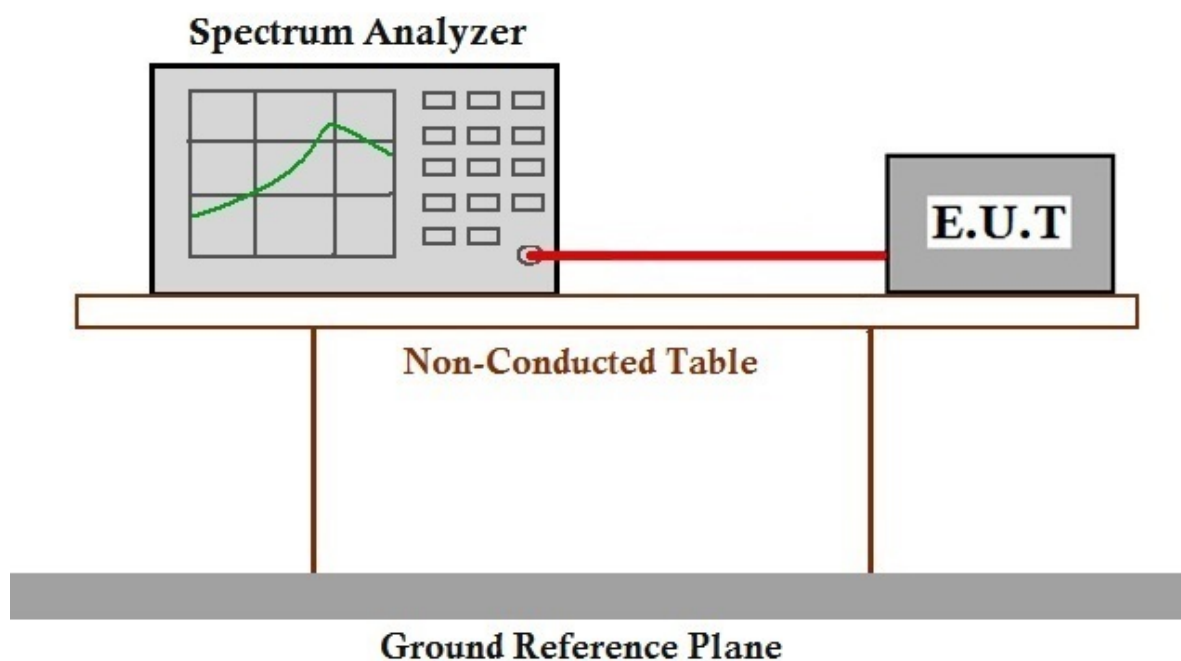
#### 7.3.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

#### 7.3.2 Test Setup Diagram



#### 7.3.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101

## 7.4 Power Spectrum Density

Test Requirement 47 CFR Part 15, Subpart C 15.247(e)  
Test Method: ANSI C63.10 (2013) Section 11.10.2  
Limit:  $\leq 8\text{dBm}$  in any 3 kHz band during any time interval of continuous transmission

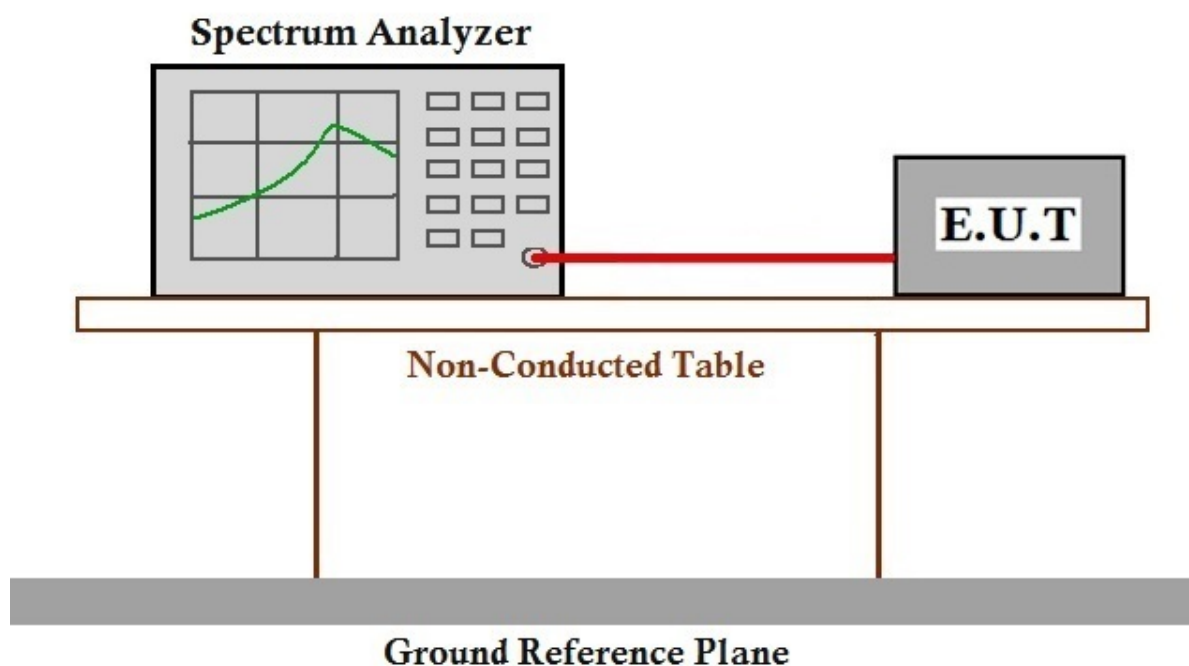
### 7.4.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.4.2 Test Setup Diagram



### 7.4.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101



## **7.5 Conducted Band Edges Measurement**

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Test Method:     | ANSI C63.10 (2013) Section 11.13.3.2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Limit:           | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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(a) (see §15.205(c)) |

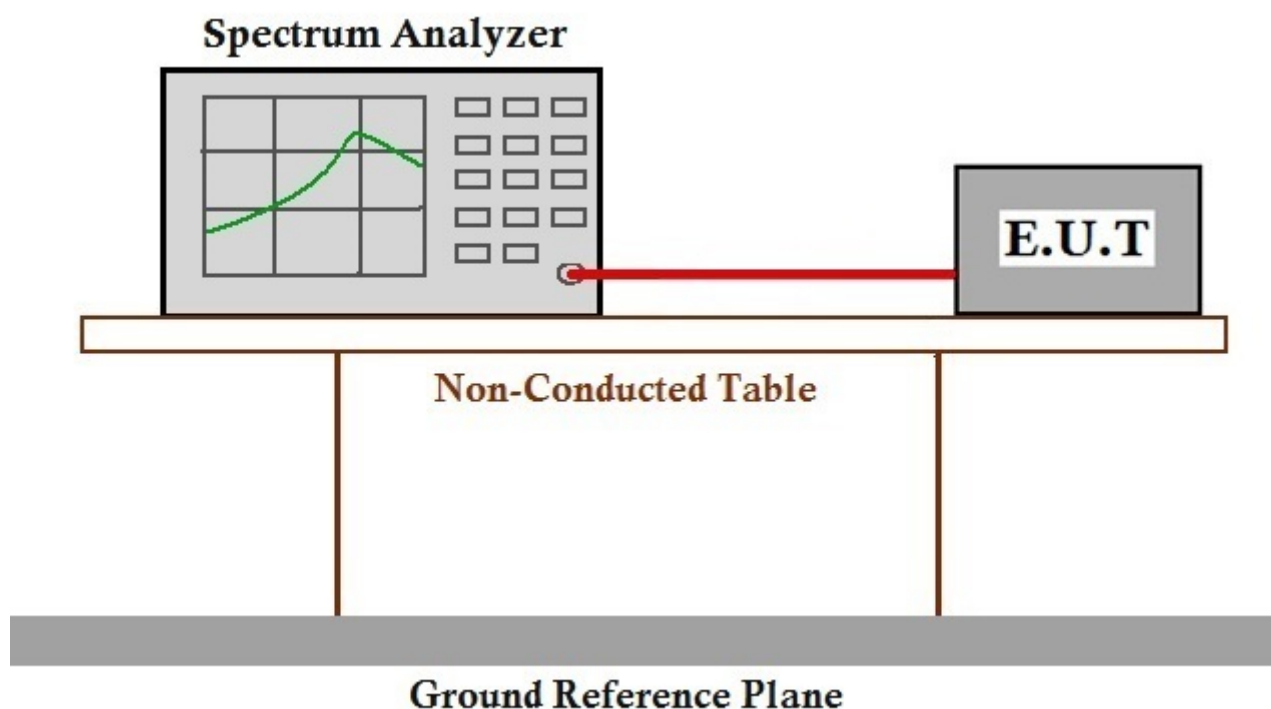
### 7.5.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.5.2 Test Setup Diagram



### 7.5.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101



## 7.6 Conducted Spurious Emissions

|                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Test Requirement | 47 CFR Part 15, Subpart C 15.247(d)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Test Method:     | ANSI C63.10 (2013) Section 11.11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Limit:           | In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, based on either an RF conducted or a radiated measurement, provided the transmitter demonstrates compliance with the peak conducted power limits. If the transmitter complies with the conducted power limits based on the use of RMS averaging over a time interval, as permitted under paragraph (b)(3) of this section, the attenuation required under this paragraph shall be 30 dB instead of 20 dB. Attenuation below the general limits specified in §15.209(a) is not required. In addition, 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(a) (see §15.205(c)) |

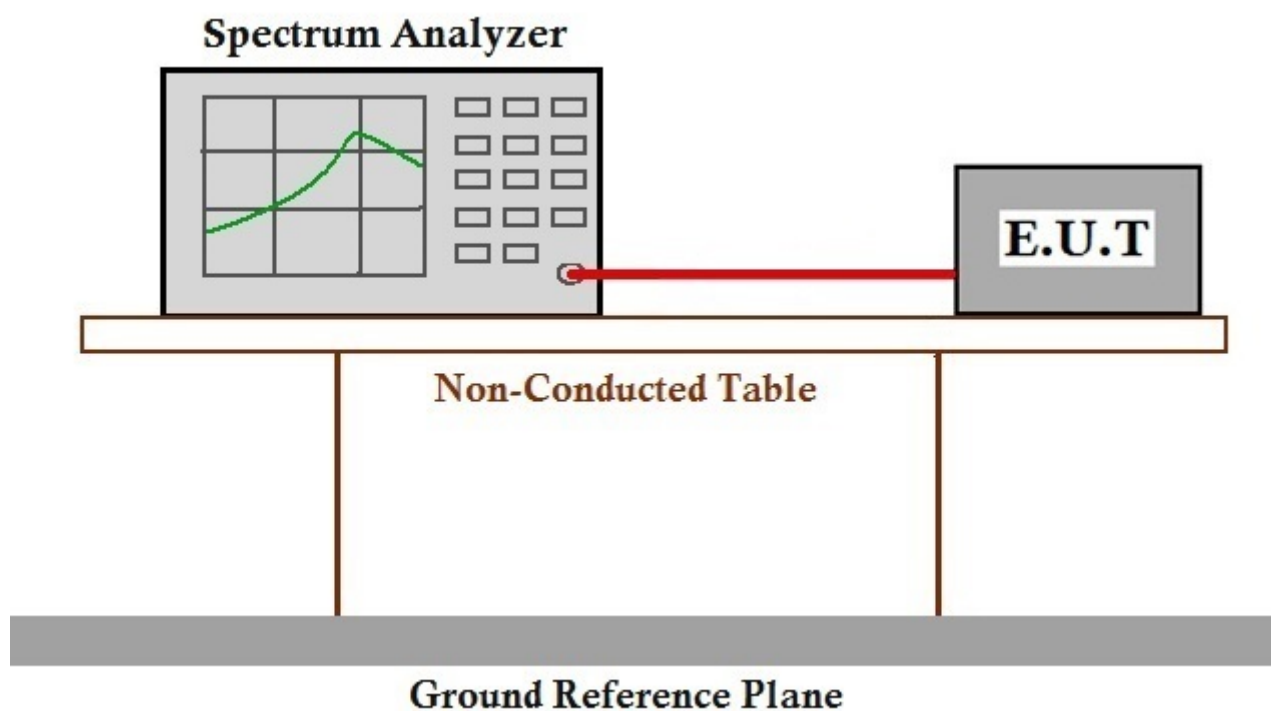
### 7.6.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.6.2 Test Setup Diagram



### 7.6.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101



## 7.7 Radiated Emissions which fall in the restricted bands

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.10.5

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| 0.009-0.490    | 2400/F(kHz)                      | 300                          |
| 0.490-1.705    | 24000/F(kHz)                     | 30                           |
| 1.705-30.0     | 30                               | 30                           |
| 30-88          | 100                              | 3                            |
| 88-216         | 150                              | 3                            |
| 216-960        | 200                              | 3                            |
| Above 960      | 500                              | 3                            |

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

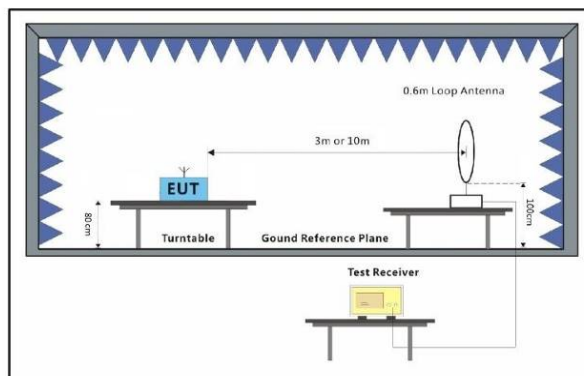
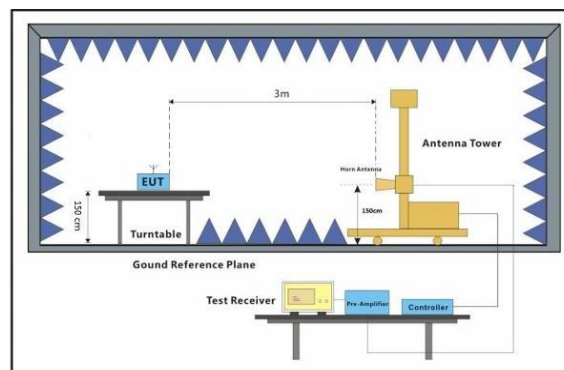
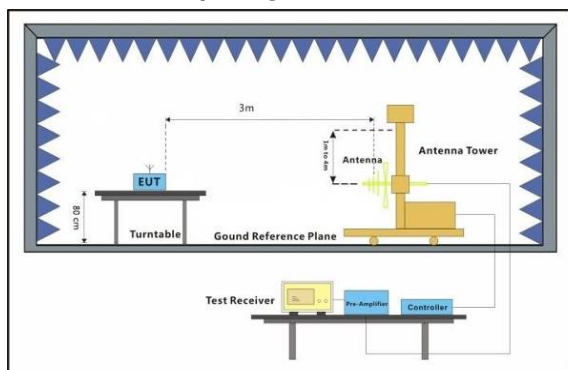
### 7.7.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.7.2 Test Setup Diagram



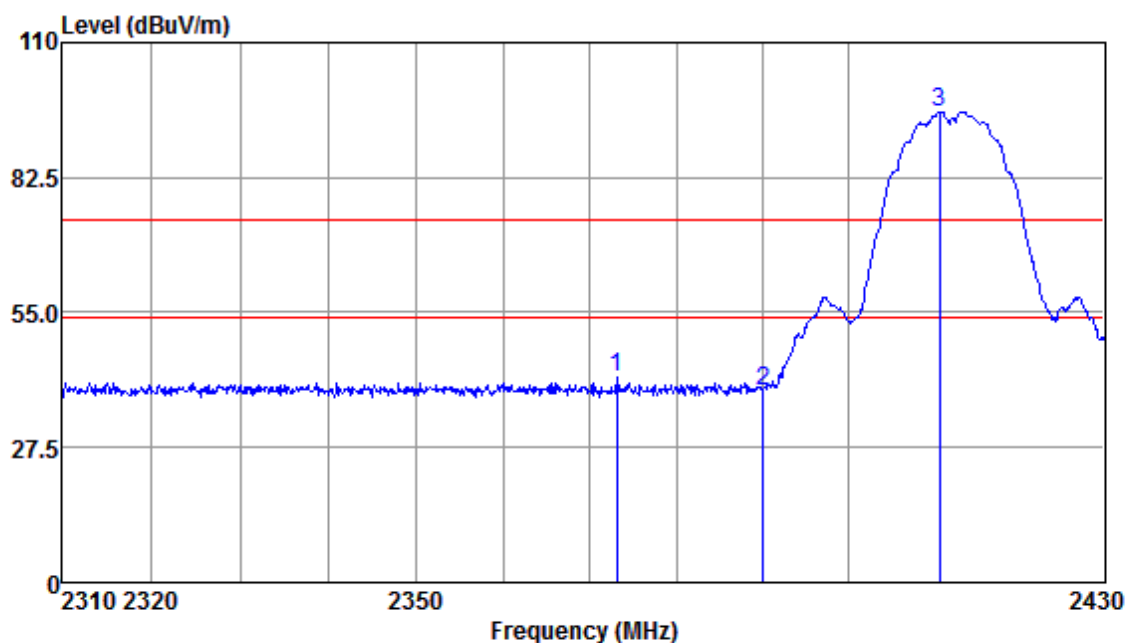
### **7.7.3 Measurement Procedure and Data**

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. 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.
- e. 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.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit 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.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

Remark 1:  $\text{Level} = \text{Read Level} + \text{Cable Loss} + \text{Antenna Factor} - \text{Preamp Factor}$

Remark 2: For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown in the report.

Mode:a; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:Low

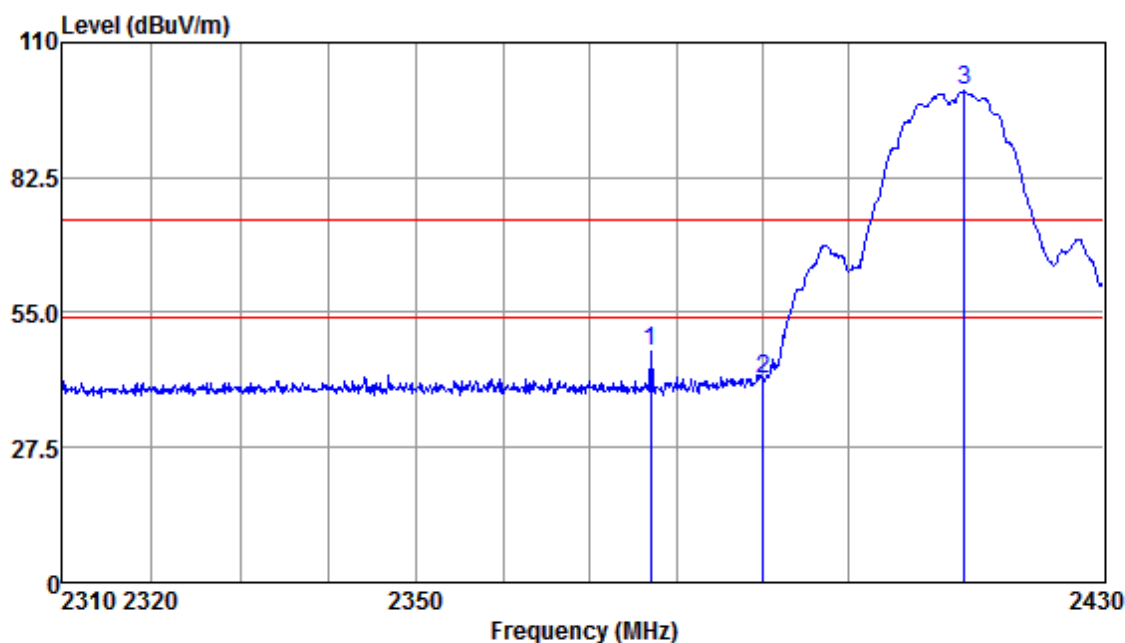


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2373.08 | 49.86      | 26.01          | 3.17       | 37.39               | 41.65          | 74.00      | -32.35     | Peak   |
| 2390.00 | 47.37      | 26.03          | 3.15       | 37.40               | 39.15          | 74.00      | -34.85     | Peak   |
| 2410.63 | 104.11     | 26.06          | 3.13       | 37.43               | 95.87          | 74.00      | 21.87      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:Low

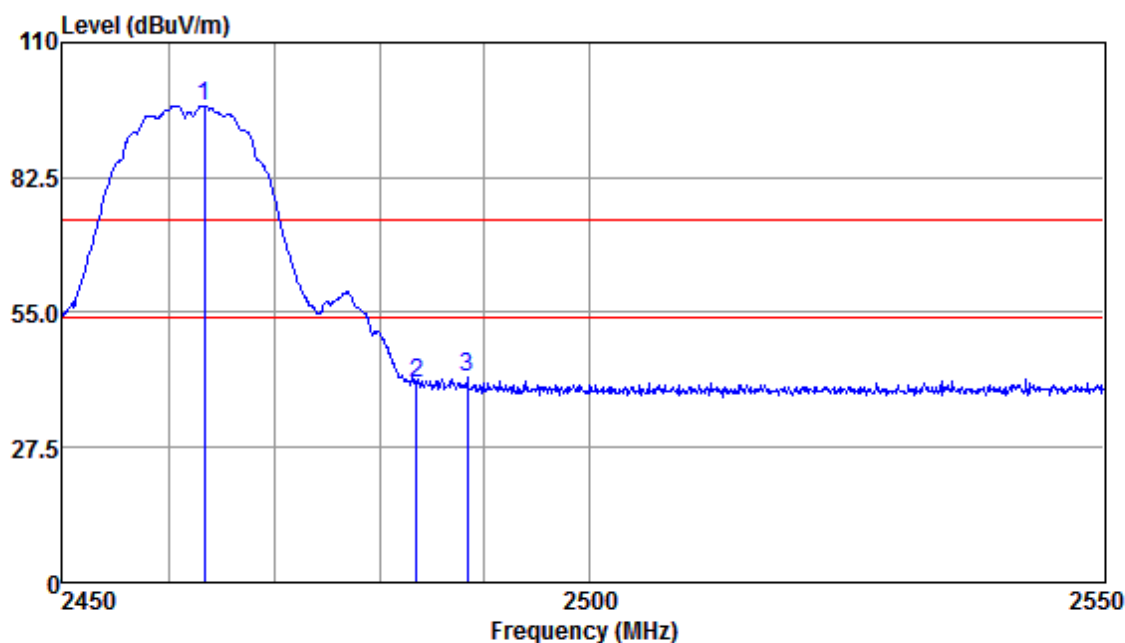


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------|----------------|------------|------------|--------|
| MHz     | dBuv       | dB/m           | dB         | dB            | dBuv/m         | dBuv/m     | dB         |        |
| 2377.05 | 55.09      | 26.02          | 3.17       | 37.39         | 46.89          | 74.00      | -27.11     | Peak   |
| 2390.00 | 49.64      | 26.03          | 3.15       | 37.40         | 41.42          | 74.00      | -32.58     | Peak   |
| 2413.57 | 108.31     | 26.08          | 3.13       | 37.43         | 100.09         | 74.00      | 26.09      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:a; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:High

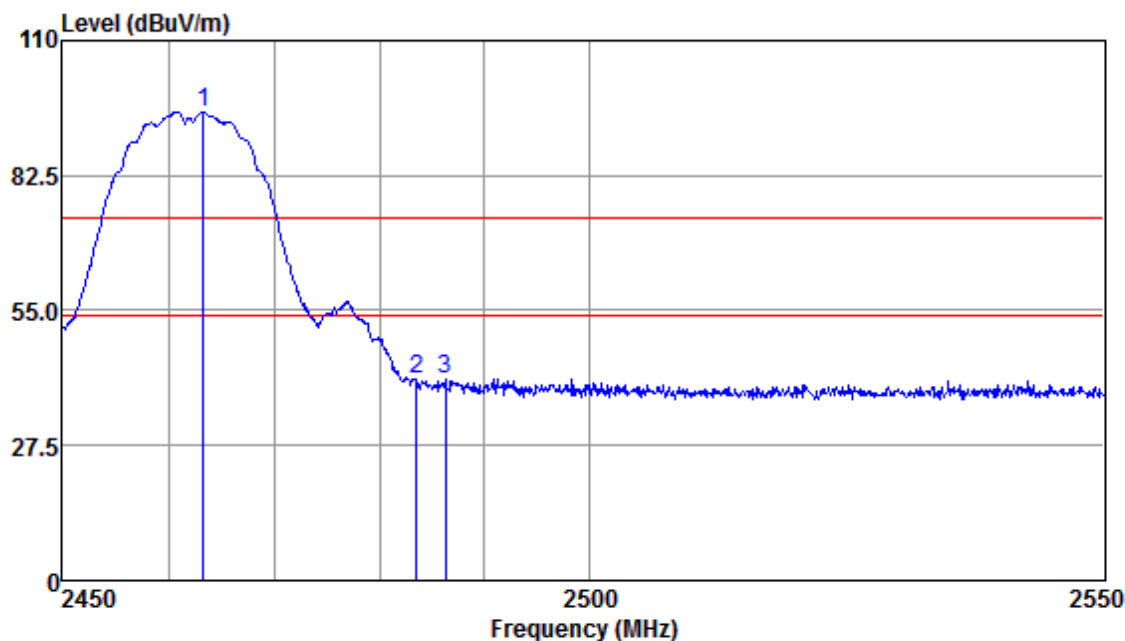


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2463.37 | 105.46     | 26.15          | 3.13       | 37.53               | 97.21          | 74.00      | 23.21      | Peak   |
| 2483.50 | 48.82      | 26.18          | 3.14       | 37.57               | 40.57          | 74.00      | -33.43     | Peak   |
| 2488.43 | 50.28      | 26.18          | 3.14       | 37.60               | 42.00          | 74.00      | -32.00     | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:High

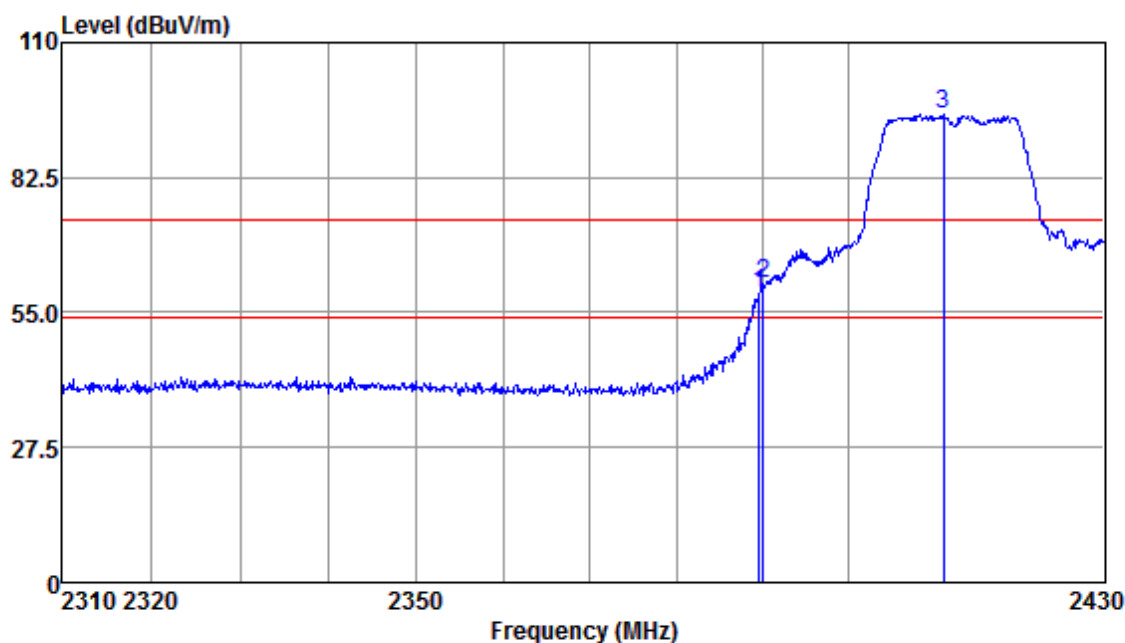


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit  | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|--------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m | dB         |        |
| 2463.27 | 103.57     | 26.15          | 3.13       | 37.53               | 95.32          | 74.00  | 21.32      | Peak   |
| 2483.50 | 49.10      | 26.18          | 3.14       | 37.57               | 40.85          | 74.00  | -33.15     | Peak   |
| 2486.34 | 49.15      | 26.18          | 3.14       | 37.57               | 40.90          | 74.00  | -33.10     | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:Low

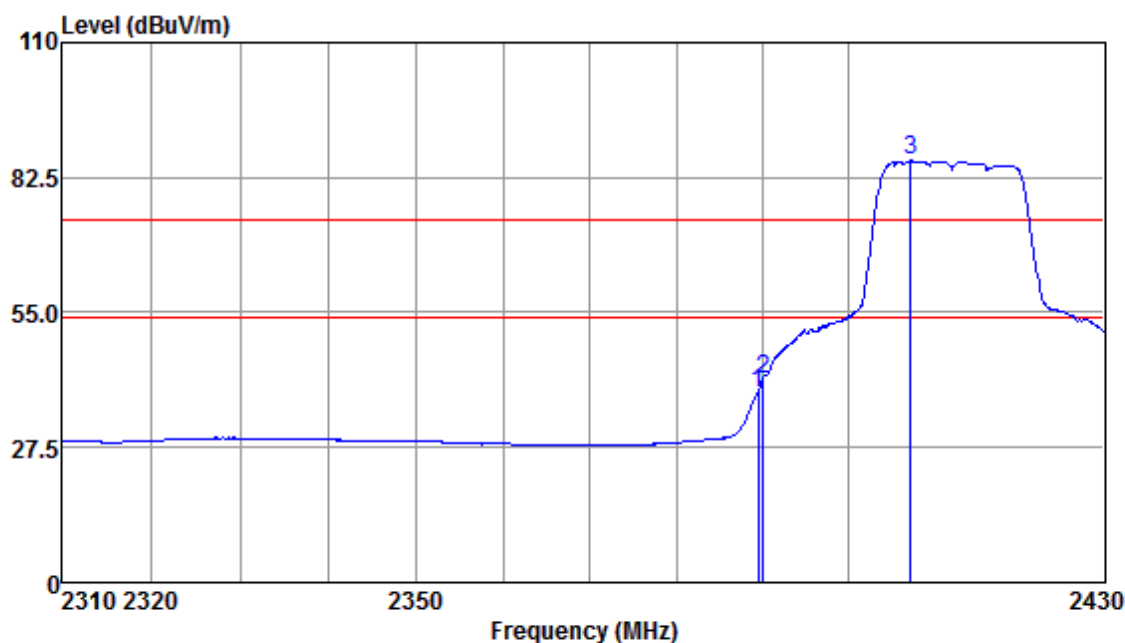


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuv       | dB/m           | dB         | dB                  | dBuv/m         | dBuv/m     | dB         |        |
| 2389.61 | 67.13      | 26.03          | 3.15       | 37.40               | 58.91          | 74.00      | -15.09     | Peak   |
| 2390.00 | 69.23      | 26.03          | 3.15       | 37.40               | 61.01          | 74.00      | -12.99     | Peak   |
| 2411.12 | 103.45     | 26.06          | 3.13       | 37.43               | 95.21          | 74.00      | 21.21      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:Low

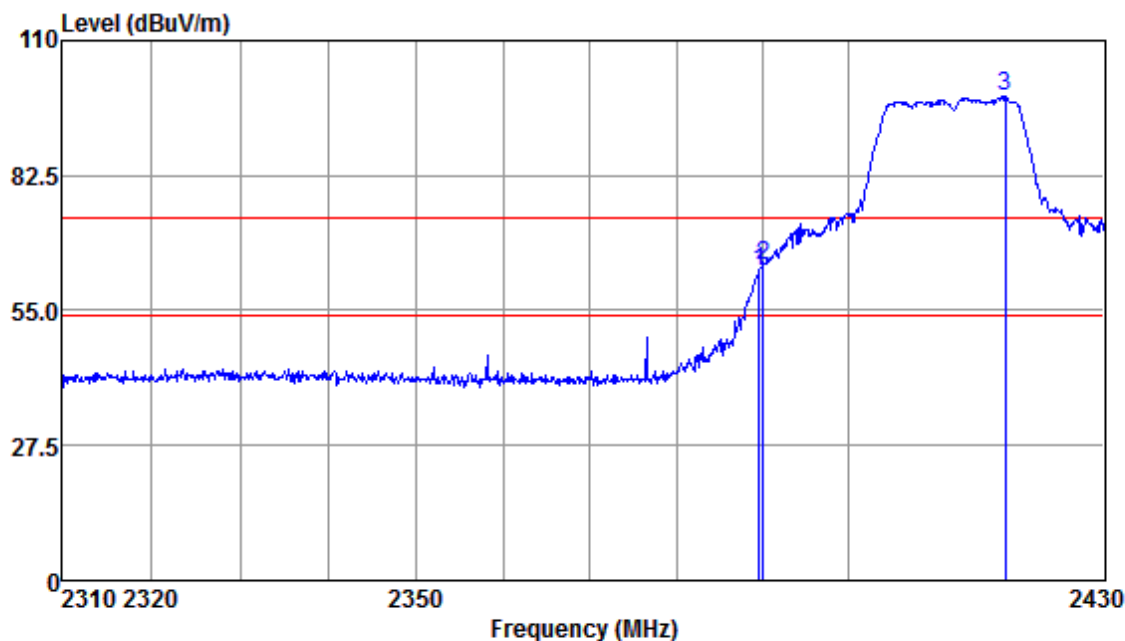


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2389.48 | 46.87      | 26.03          | 3.15       | 37.40               | 38.65          | 54.00      | -15.35     | Average |
| 2390.00 | 49.80      | 26.03          | 3.15       | 37.40               | 41.58          | 54.00      | -12.42     | Average |
| 2407.22 | 94.10      | 26.06          | 3.14       | 37.43               | 85.87          | 54.00      | 31.87      | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:Low

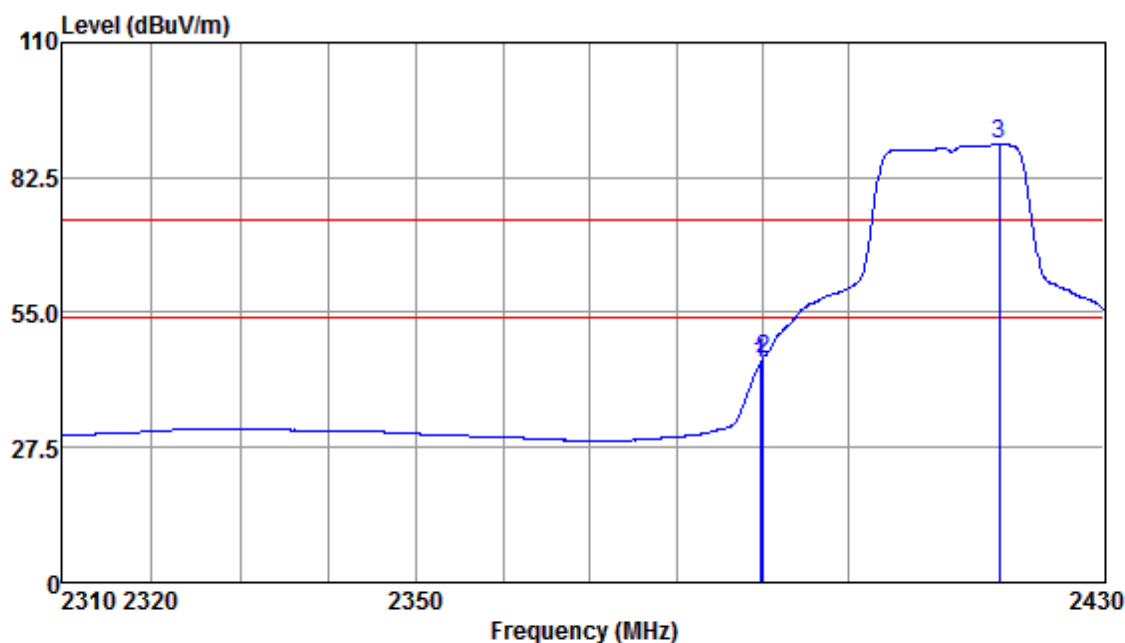


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2389.61 | 71.08      | 26.03          | 3.15       | 37.40               | 62.86          | 74.00      | -11.14     | Peak   |
| 2390.00 | 72.55      | 26.03          | 3.15       | 37.40               | 64.33          | 74.00      | -9.67      | Peak   |
| 2418.34 | 106.88     | 26.09          | 3.13       | 37.43               | 98.67          | 74.00      | 24.67      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:Low

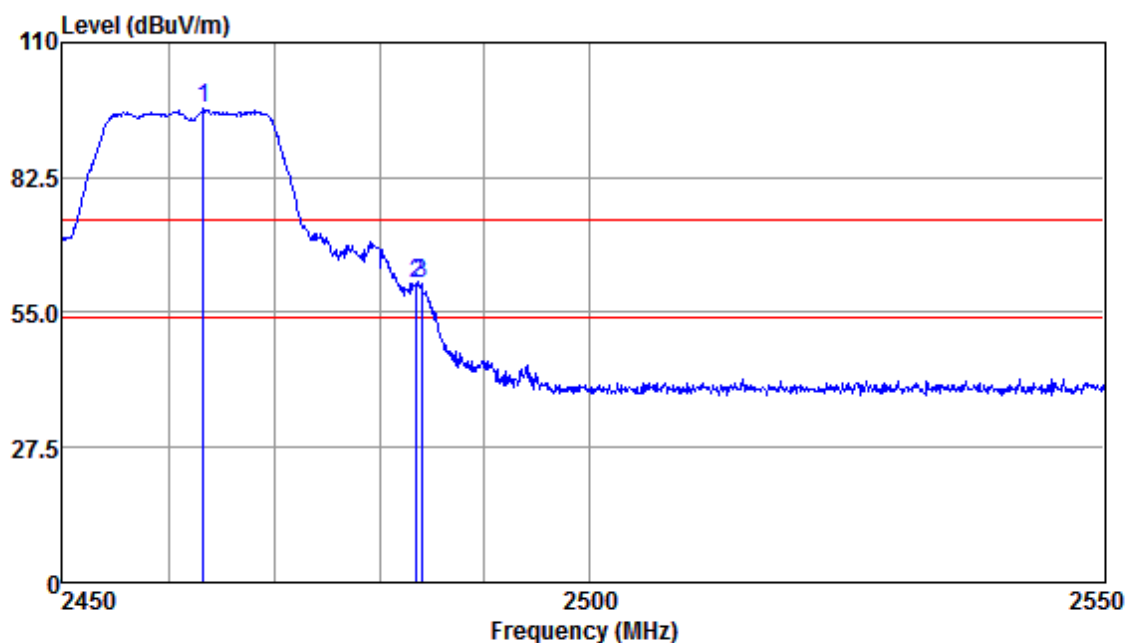


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2389.73 | 52.86      | 26.03          | 3.15       | 37.40               | 44.64          | 54.00      | -9.36      | Average |
| 2390.00 | 53.59      | 26.03          | 3.15       | 37.40               | 45.37          | 54.00      | -8.63      | Average |
| 2417.60 | 97.46      | 26.08          | 3.13       | 37.43               | 89.24          | 54.00      | 35.24      | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:High

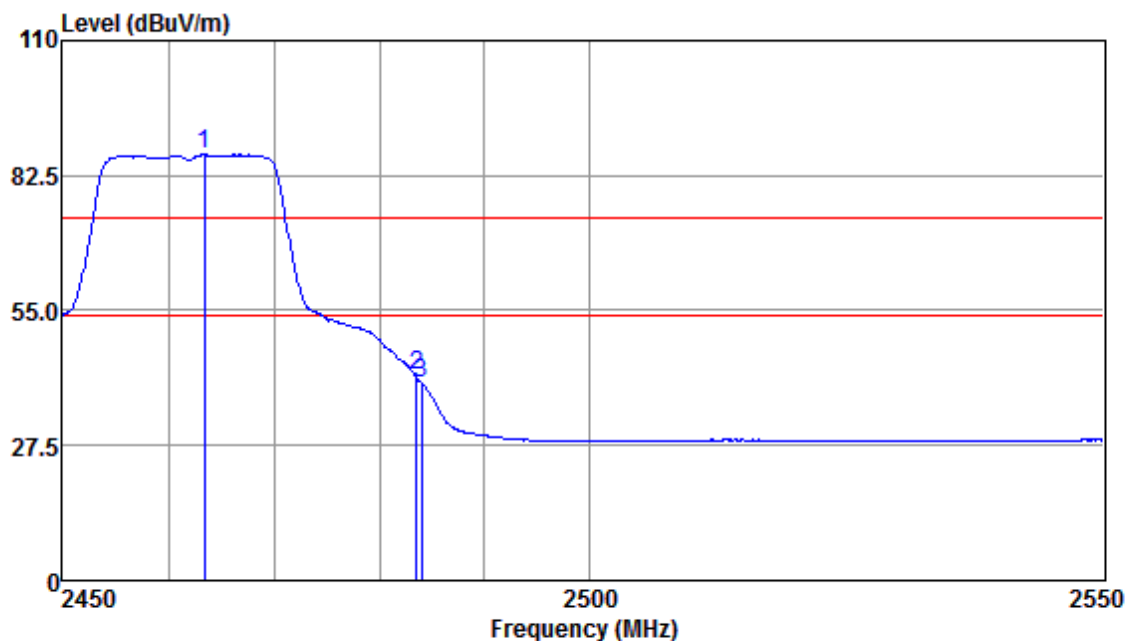


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2463.27 | 104.68     | 26.15          | 3.13       | 37.53               | 96.43          | 74.00      | 22.43      | Peak   |
| 2483.50 | 69.18      | 26.18          | 3.14       | 37.57               | 60.93          | 74.00      | -13.07     | Peak   |
| 2484.05 | 69.33      | 26.18          | 3.14       | 37.57               | 61.08          | 74.00      | -12.92     | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:High

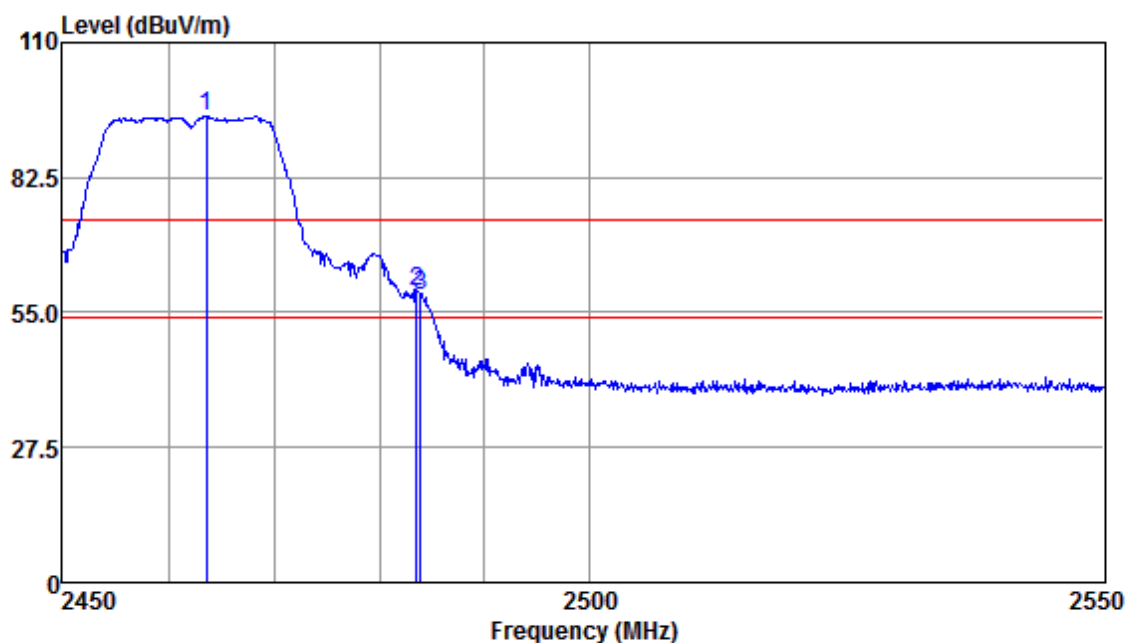


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2463.37 | 95.00      | 26.15          | 3.13       | 37.53               | 86.75          | 54.00      | 32.75      | Average |
| 2483.50 | 49.89      | 26.18          | 3.14       | 37.57               | 41.64          | 54.00      | -12.36     | Average |
| 2484.05 | 48.40      | 26.18          | 3.14       | 37.57               | 40.15          | 54.00      | -13.85     | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:High

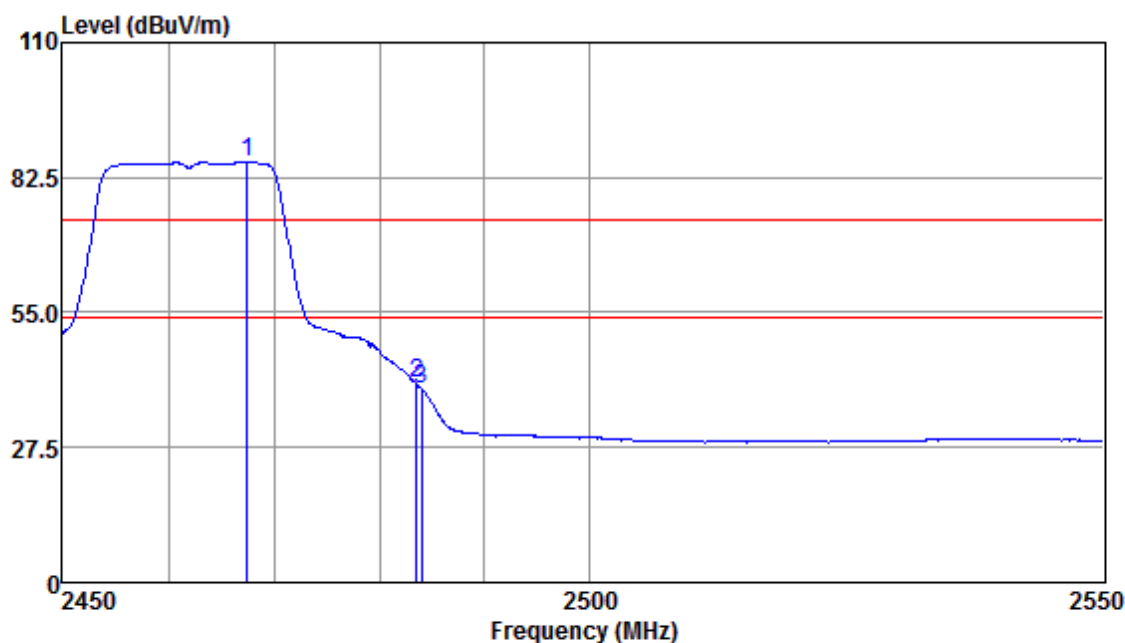


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2463.56 | 103.24     | 26.15          | 3.13       | 37.53               | 94.99          | 74.00      | 20.99      | Peak   |
| 2483.50 | 67.56      | 26.18          | 3.14       | 37.57               | 59.31          | 74.00      | -14.69     | Peak   |
| 2483.95 | 66.81      | 26.18          | 3.14       | 37.57               | 58.56          | 74.00      | -15.44     | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:High

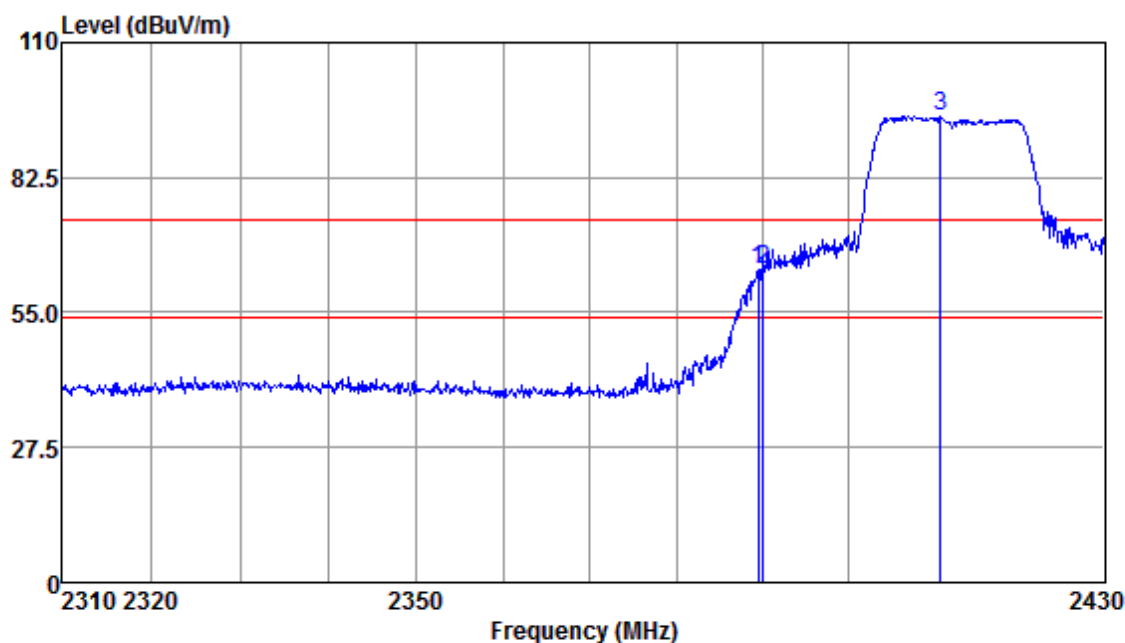


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2467.41 | 93.83      | 26.15          | 3.13       | 37.53               | 85.58          | 54.00      | 31.58      | Average |
| 2483.50 | 48.92      | 26.18          | 3.14       | 37.57               | 40.67          | 54.00      | -13.33     | Average |
| 2484.05 | 47.58      | 26.18          | 3.14       | 37.57               | 39.33          | 54.00      | -14.67     | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:Low

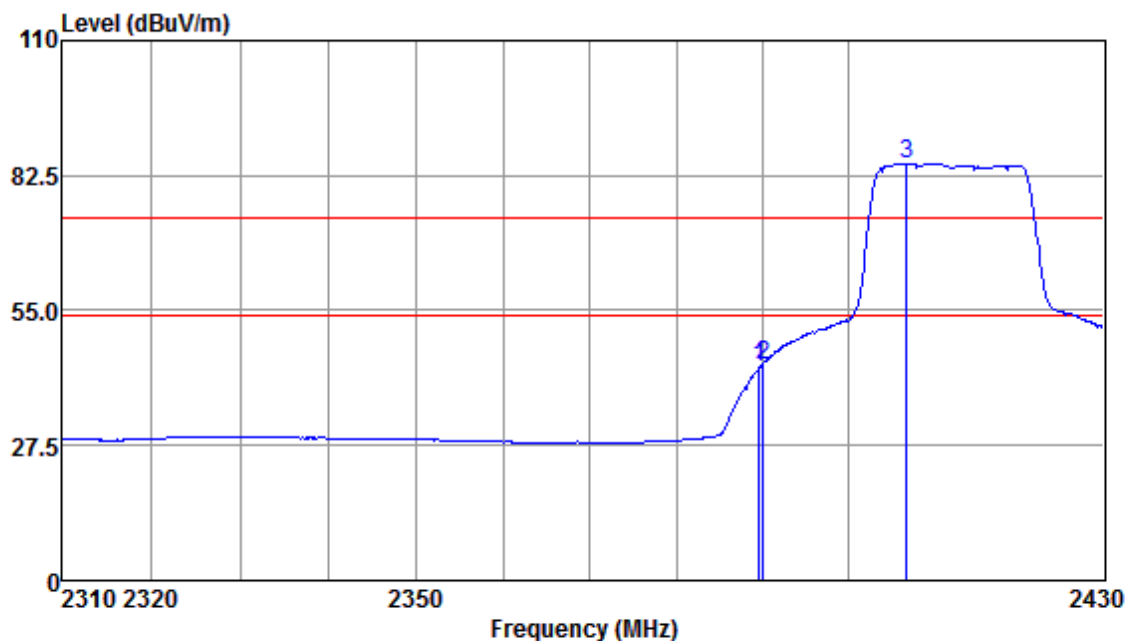


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| -----   | -----      | -----          | -----      | -----               | -----          | -----      | -----      | -----  |
| MHz     | dBuv       | dB/m           | dB         | dB                  | dBuv/m         | dBuv/m     | dB         |        |
| 2389.48 | 71.75      | 26.03          | 3.15       | 37.40               | 63.53          | 74.00      | -10.47     | Peak   |
| 2390.00 | 71.88      | 26.03          | 3.15       | 37.40               | 63.66          | 74.00      | -10.34     | Peak   |
| 2410.76 | 103.38     | 26.06          | 3.13       | 37.43               | 95.14          | 74.00      | 21.14      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:Low

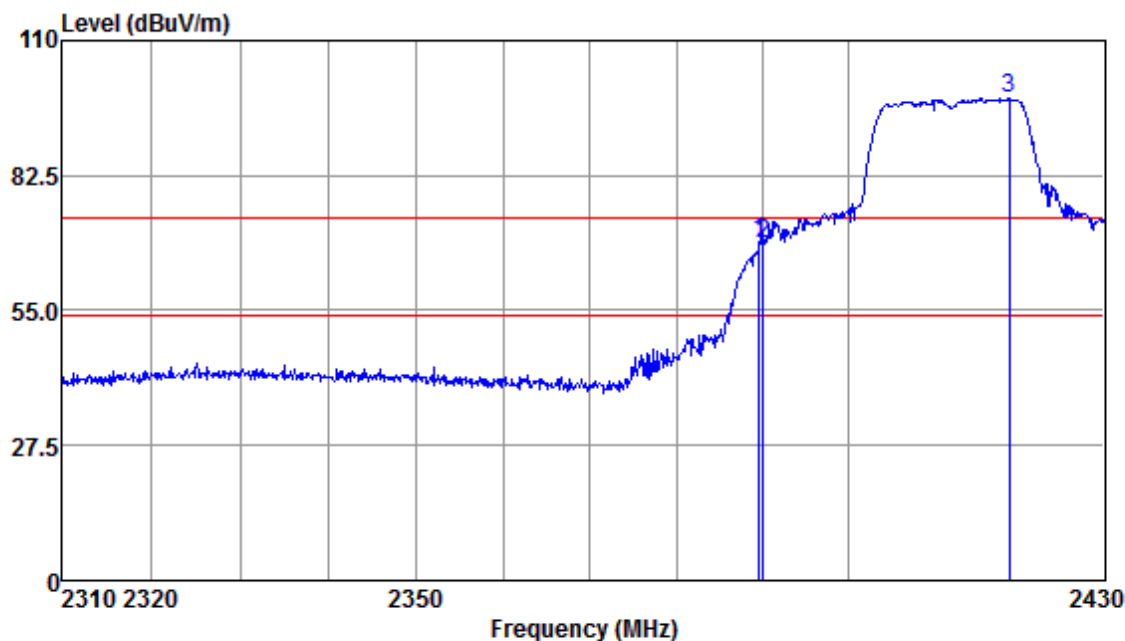


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2389.61 | 51.48      | 26.03          | 3.15       | 37.40               | 43.26          | 54.00      | -10.74     | Average |
| 2390.00 | 52.23      | 26.03          | 3.15       | 37.40               | 44.01          | 54.00      | -9.99      | Average |
| 2406.73 | 93.13      | 26.06          | 3.14       | 37.43               | 84.90          | 54.00      | 30.90      | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:Low

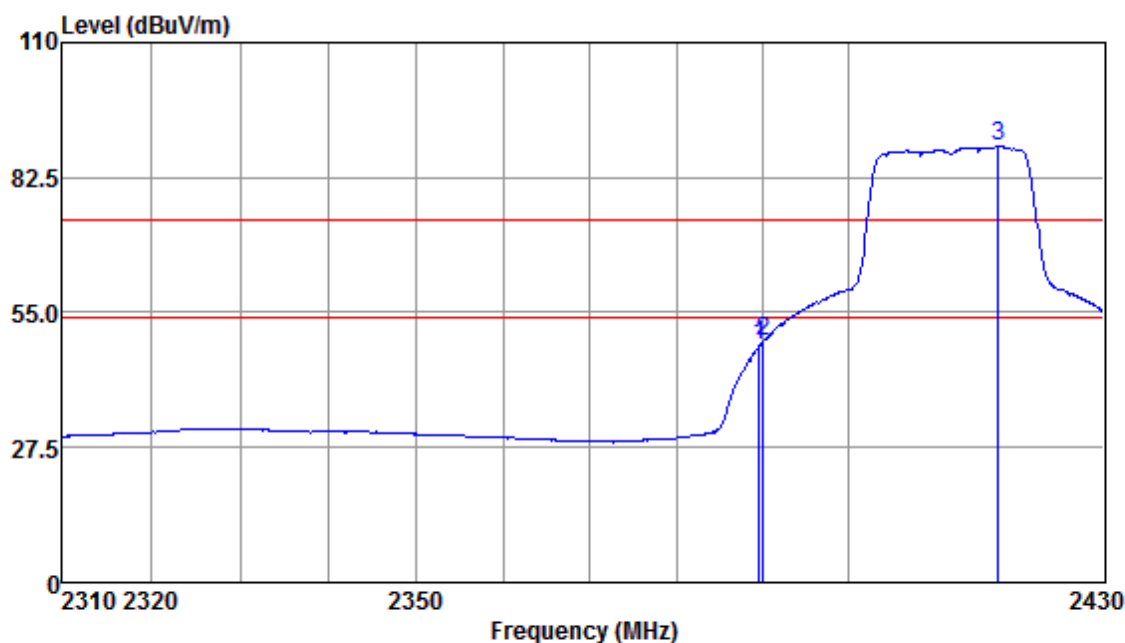


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|--------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |        |
| 2389.61 | 77.36      | 26.03          | 3.15       | 37.40               | 69.14          | 74.00      | -4.86      | Peak   |
| 2390.00 | 76.88      | 26.03          | 3.15       | 37.40               | 68.66          | 74.00      | -5.34      | Peak   |
| 2418.83 | 106.38     | 26.09          | 3.13       | 37.43               | 98.17          | 74.00      | 24.17      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:Low

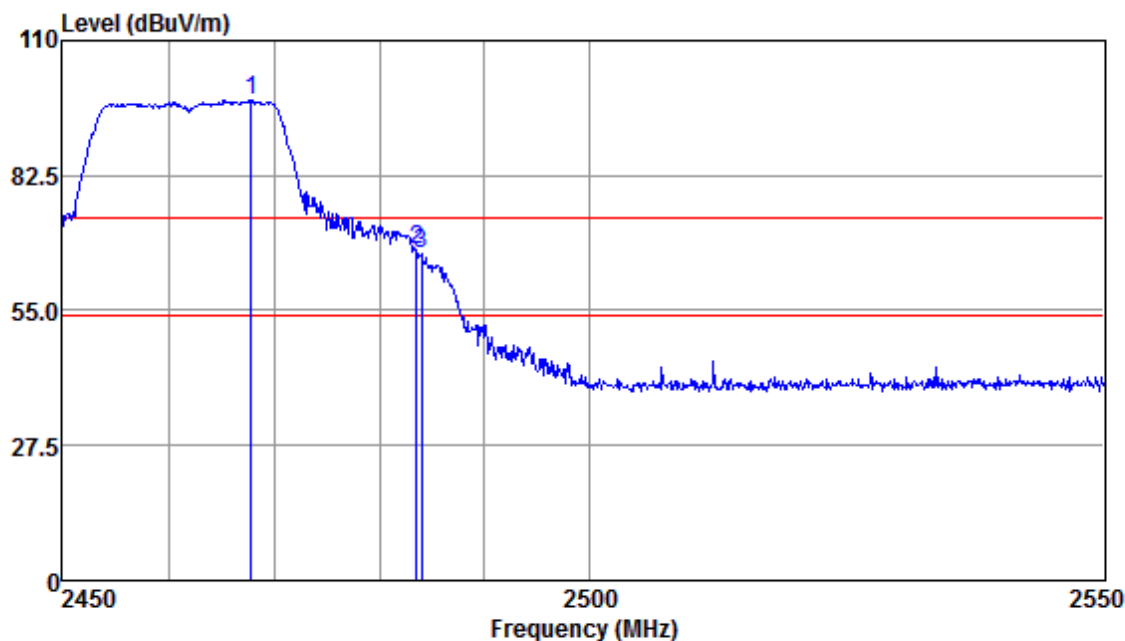


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2389.61 | 56.32      | 26.03          | 3.15       | 37.40               | 48.10          | 54.00      | -5.90      | Average |
| 2390.00 | 57.16      | 26.03          | 3.15       | 37.40               | 48.94          | 54.00      | -5.06      | Average |
| 2417.48 | 97.06      | 26.08          | 3.13       | 37.43               | 88.84          | 54.00      | 34.84      | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:High

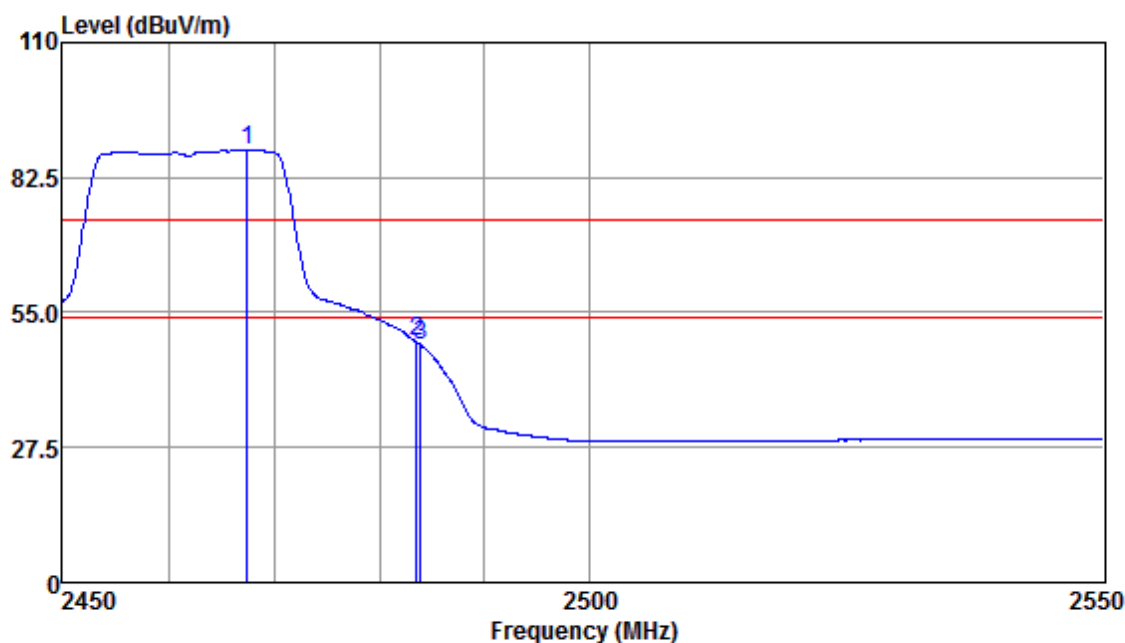


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------|----------------|------------|------------|--------|
| MHz     | dBuv       | dB/m           | dB         | dB            | dBuv/m         | dBuv/m     | dB         |        |
| 2467.81 | 106.12     | 26.16          | 3.14       | 37.53         | 97.89          | 74.00      | 23.89      | Peak   |
| 2483.50 | 75.71      | 26.18          | 3.14       | 37.57         | 67.46          | 74.00      | -6.54      | Peak   |
| 2484.05 | 74.77      | 26.18          | 3.14       | 37.57         | 66.52          | 74.00      | -7.48      | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:High

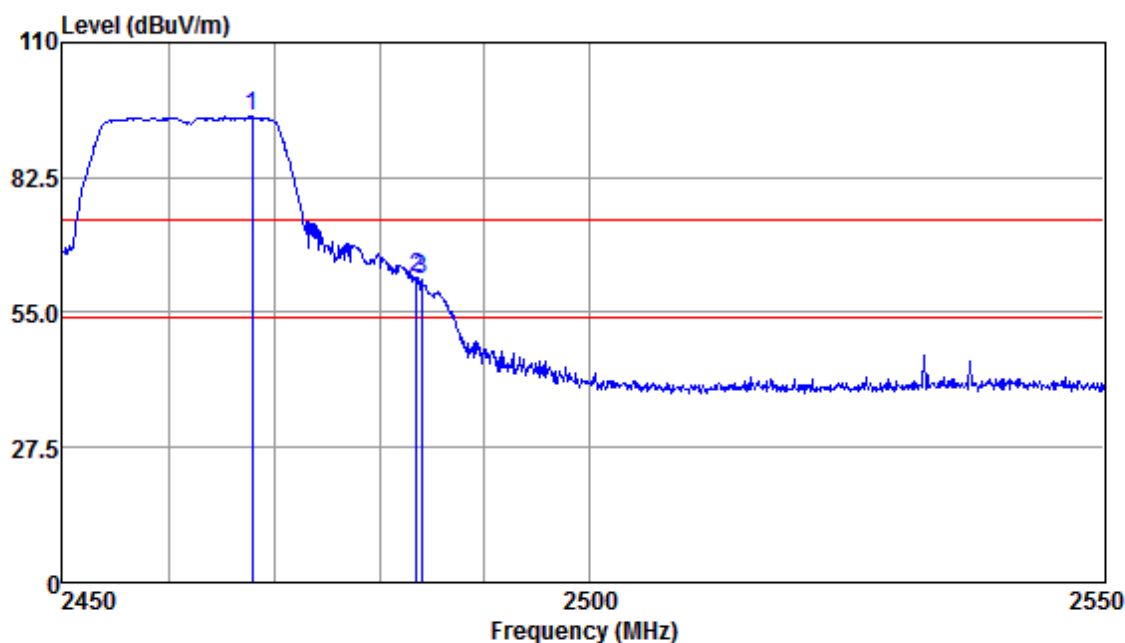


Antenna Polarity :HORIZONTAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamplifier Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------------|----------------|------------|------------|---------|
| MHz     | dBuV       | dB/m           | dB         | dB                  | dBuV/m         | dBuV/m     | dB         |         |
| 2467.41 | 96.52      | 26.15          | 3.13       | 37.53               | 88.27          | 54.00      | 34.27      | Average |
| 2483.50 | 57.34      | 26.18          | 3.14       | 37.57               | 49.09          | 54.00      | -4.91      | Average |
| 2483.95 | 56.70      | 26.18          | 3.14       | 37.57               | 48.45          | 54.00      | -5.55      | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamplifier Factor

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:High

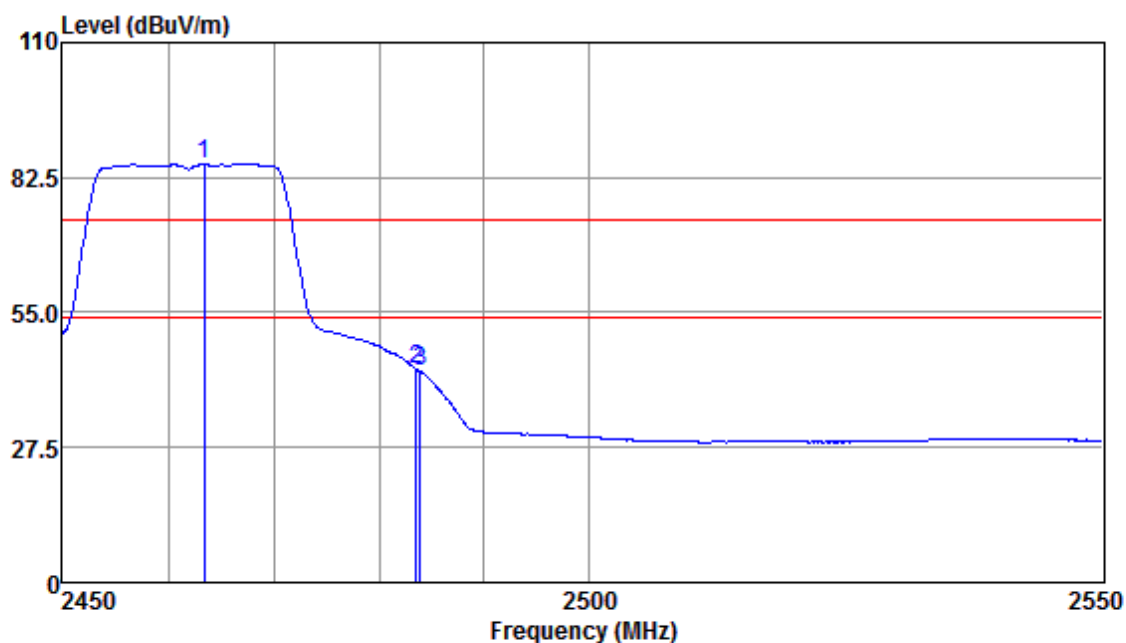


Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limit Line | Over Limit | Remark |
|---------|------------|----------------|------------|---------------|----------------|------------|------------|--------|
| MHz     | dBuv       | dB/m           | dB         | dB            | dBuv/m         | dBuv/m     | dB         |        |
| 2467.90 | 103.11     | 26.16          | 3.14       | 37.53         | 94.88          | 74.00      | 20.88      | Peak   |
| 2483.50 | 70.21      | 26.18          | 3.14       | 37.57         | 61.96          | 74.00      | -12.04     | Peak   |
| 2484.05 | 69.83      | 26.18          | 3.14       | 37.57         | 61.58          | 74.00      | -12.42     | Peak   |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:High



Antenna Polarity :VERTICAL

| Freq    | Read Level | Antenna Factor | Cable Loss | Preamp Factor | Emission Level | Limit Line | Over Limit | Remark  |
|---------|------------|----------------|------------|---------------|----------------|------------|------------|---------|
| -----   | -----      | -----          | -----      | -----         | -----          | -----      | -----      | -----   |
| MHz     | dBuv       | dB/m           | dB         | dB            | dBuv/m         | dBuv/m     | dB         |         |
| 2463.37 | 93.41      | 26.15          | 3.13       | 37.53         | 85.16          | 54.00      | 31.16      | Average |
| 2483.50 | 51.85      | 26.18          | 3.14       | 37.57         | 43.60          | 54.00      | -10.40     | Average |
| 2483.95 | 51.21      | 26.18          | 3.14       | 37.57         | 42.96          | 54.00      | -11.04     | Average |

Note:Emission Level=Read Level+Antenna Factor+Cable loss-Preamp Factor



## 7.8 Radiated Spurious Emissions

Test Requirement 47 CFR Part 15, Subpart C 15.209 & 15.247(d)

Test Method: ANSI C63.10 (2013) Section 6.4,6.5,6.6

Limit:

| Frequency(MHz) | Field strength(microvolts/meter) | Measurement distance(meters) |
|----------------|----------------------------------|------------------------------|
| 0.009-0.490    | 2400/F(kHz)                      | 300                          |
| 0.490-1.705    | 24000/F(kHz)                     | 30                           |
| 1.705-30.0     | 30                               | 30                           |
| 30-88          | 100                              | 3                            |
| 88-216         | 150                              | 3                            |
| 216-960        | 200                              | 3                            |
| Above 960      | 500                              | 3                            |

Remark: The emission limits shown in the above table are based on measurements employing a CISPR quasi-peak detector except for the frequency bands 9-90kHz, 110-490kHz and above 1000 MHz. Radiated emission limits in these three bands are based on measurements employing an average detector, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation.

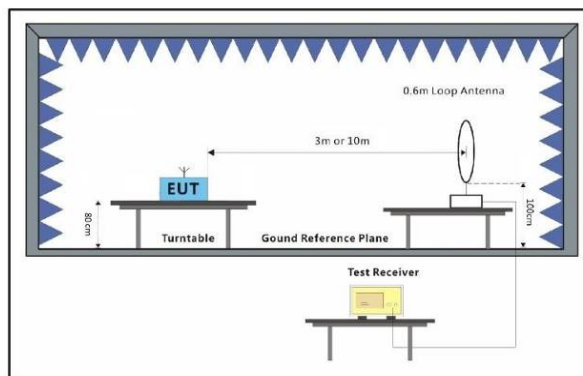
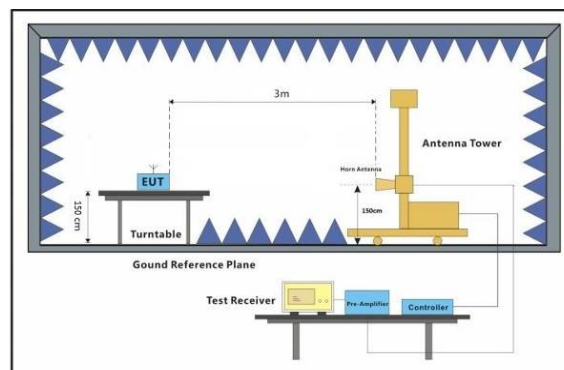
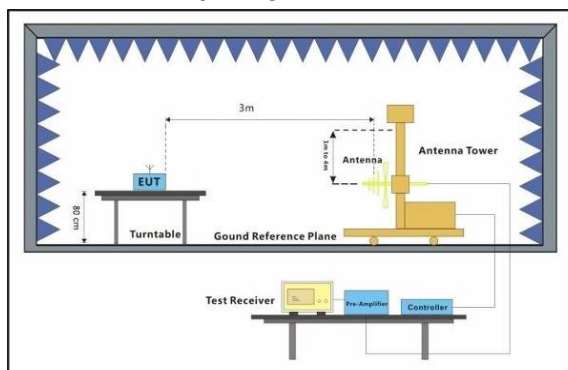
### 7.8.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.8.2 Test Setup Diagram



### 7.8.3 Measurement Procedure and Data

- a. For below 1GHz, the EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 or 10 meter semi-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- b. For above 1GHz, the EUT was placed on the top of a rotating table 1.5 meters above the ground at a 3 meter fully-anechoic chamber. The table was rotated 360 degrees to determine the position of the highest radiation.
- c. The EUT was set 3 or 10 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
- d. 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.
- e. 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.
- f. The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
- g. If the emission level of the EUT in peak mode was 10dB lower than the limit 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.
- h. Test the EUT in the lowest channel, the middle channel, the Highest channel.
- i. The radiation measurements are performed in X, Y, Z axis positioning for Transmitting mode, and found the X axis positioning which it is the worst case.
- j. Repeat above procedures until all frequencies measured was complete.

#### Remark:

- 1) For emission below 1GHz, through pre-scan found the worst case is the lowest channel. Only the worst case is recorded in the report.
- 2) 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
- 3) Scan from 9kHz to 25GHz, the disturbance above 18GHz and below 30MHz was very low. The points marked on above plots are the highest emissions could be found when testing, so only above points had been displayed. The amplitude of spurious emissions from the radiator which are attenuated more than 20dB below the limit need not be reported.
- 4) For frequencies above 1GHz, the field strength limits are based on average limits. However, the peak field strength of any emission shall not exceed the maximum permitted average limits specified above by more than 20 dB under any condition of modulation. For the emissions whose peak level is lower than the average limit, only the peak measurement is shown



Mode:a; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:Low

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4824             | 39.41        | 6.40         | 45.81              | 54              | -8.19        | peak     |
| 7236             | 40.43        | 10.76        | 51.19              | 54              | -2.81        | peak     |
| 9648             | 34.95        | 14.37        | 49.32              | 54              | -4.68        | peak     |

Mode:a; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:Low

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4824             | 40.19        | 6.40         | 46.59              | 54              | -7.41        | peak     |
| 7236             | 39.16        | 10.76        | 49.92              | 54              | -4.08        | peak     |
| 9648             | 34.74        | 14.37        | 49.11              | 54              | -4.89        | peak     |

Mode:a; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:middle

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4874             | 39.83        | 6.92         | 46.75              | 54              | -7.25        | peak     |
| 7311             | 34.93        | 11.08        | 46.01              | 54              | -7.99        | peak     |
| 9748             | 35.71        | 14.36        | 50.07              | 54              | -3.93        | peak     |

Mode:a; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:middle

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4874             | 40.46        | 6.92         | 47.38              | 54              | -6.62        | peak     |
| 7311             | 34.41        | 11.08        | 45.49              | 54              | -8.51        | peak     |
| 9748             | 31.14        | 14.36        | 45.50              | 54              | -8.50        | peak     |

Mode:a; Polarization:Horizontal; Modulation:b; bandwidth:20MHz; Channel:High

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Over Limit<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|------------------|----------|
| 4924             | 43.19        | 7.31         | 50.50              | 54              | -3.50            | peak     |
| 7386             | 36.15        | 11.41        | 47.56              | 54              | -6.44            | peak     |
| 9848             | 33.16        | 14.38        | 47.54              | 54              | -6.46            | peak     |

Mode:a; Polarization:Vertical; Modulation:b; bandwidth:20MHz; Channel:High

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4924             | 41.81        | 7.31         | 49.12              | 54              | -4.88        | peak     |
| 7386             | 39.09        | 11.41        | 50.50              | 54              | -3.50        | peak     |
| 9848             | 35.98        | 14.38        | 50.36              | 54              | -3.64        | peak     |

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:Low

| Frequency<br>MHz | RX_R<br>dBuV | Factor<br>dB | Emission<br>dBuV/m | Limit<br>dBuV/m | Margin<br>dB | Detector |
|------------------|--------------|--------------|--------------------|-----------------|--------------|----------|
| 4824             | 44.10        | 6.40         | 50.50              | 54              | -3.50        | peak     |
| 7236             | 36.98        | 10.76        | 47.74              | 54              | -6.26        | peak     |
| 9648             | 32.74        | 14.37        | 47.11              | 54              | -6.89        | peak     |



Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:Low

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4824      | 41.56 | 6.40   | 47.96    | 54     | -6.04  | peak     |
| 7236      | 38.92 | 10.76  | 49.68    | 54     | -4.32  | peak     |
| 9648      | 35.67 | 14.37  | 50.04    | 54     | -3.96  | peak     |

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:middle

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4874      | 38.26 | 6.92   | 45.18    | 54     | -8.82  | peak     |
| 7311      | 34.86 | 11.08  | 45.94    | 54     | -8.06  | peak     |
| 9748      | 34.55 | 14.36  | 48.91    | 54     | -5.09  | peak     |

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:middle

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4874      | 42.34 | 6.92   | 49.26    | 54     | -4.74  | peak     |
| 7311      | 36.12 | 11.08  | 47.20    | 54     | -6.80  | peak     |
| 9748      | 34.11 | 14.36  | 48.47    | 54     | -5.53  | peak     |

Mode:a; Polarization:Horizontal; Modulation:g; bandwidth:20MHz; Channel:High

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4924      | 41.86 | 7.31   | 49.17    | 54     | -4.83  | peak     |
| 7386      | 38.37 | 11.41  | 49.78    | 54     | -4.22  | peak     |
| 9848      | 32.67 | 14.38  | 47.05    | 54     | -6.95  | peak     |

Mode:a; Polarization:Vertical; Modulation:g; bandwidth:20MHz; Channel:High

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4924      | 42.87 | 7.31   | 50.18    | 54     | -3.82  | peak     |
| 7386      | 38.90 | 11.41  | 50.31    | 54     | -3.69  | peak     |
| 9848      | 33.11 | 14.38  | 47.49    | 54     | -6.51  | peak     |

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:Low

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4824      | 39.76 | 6.40   | 46.16    | 54     | -7.84  | peak     |
| 7236      | 36.43 | 10.76  | 47.19    | 54     | -6.81  | peak     |
| 9648      | 30.74 | 14.37  | 45.11    | 54     | -8.89  | peak     |

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:Low

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4824      | 42.93 | 6.40   | 49.33    | 54     | -4.67  | peak     |
| 7236      | 36.84 | 10.76  | 47.60    | 54     | -6.40  | peak     |
| 9648      | 33.46 | 14.37  | 47.83    | 54     | -6.17  | peak     |



Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:middle

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4874      | 38.78 | 6.92   | 45.70    | 54     | -8.30  | peak     |
| 7311      | 35.94 | 11.08  | 47.02    | 54     | -6.98  | peak     |
| 9748      | 35.79 | 14.36  | 50.15    | 54     | -3.85  | peak     |

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:middle

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4874      | 40.36 | 6.92   | 47.28    | 54     | -6.72  | peak     |
| 7311      | 36.23 | 11.08  | 47.31    | 54     | -6.69  | peak     |
| 9748      | 31.98 | 14.36  | 46.34    | 54     | -7.66  | peak     |

Mode:a; Polarization:Horizontal; Modulation:n; bandwidth:20MHz; Channel:High

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4924      | 38.78 | 7.31   | 46.09    | 54     | -7.91  | peak     |
| 7386      | 38.49 | 11.41  | 49.90    | 54     | -4.10  | peak     |
| 9848      | 31.57 | 14.38  | 45.95    | 54     | -8.05  | peak     |

Mode:a; Polarization:Vertical; Modulation:n; bandwidth:20MHz; Channel:High

| Frequency | RX_R  | Factor | Emission | Limit  | Margin | Detector |
|-----------|-------|--------|----------|--------|--------|----------|
| MHz       | dBuV  | dB     | dBuV/m   | dBuV/m | dB     |          |
| 4924      | 41.92 | 7.31   | 49.23    | 54     | -4.77  | peak     |
| 7386      | 39.52 | 11.41  | 50.93    | 54     | -3.07  | peak     |
| 9848      | 35.10 | 14.38  | 49.48    | 54     | -4.52  | peak     |

## 7.9 99% Bandwidth

Test Requirement RSS-Gen Section 6.6  
Test Method: ANSI C63.10 Section 6.9.3

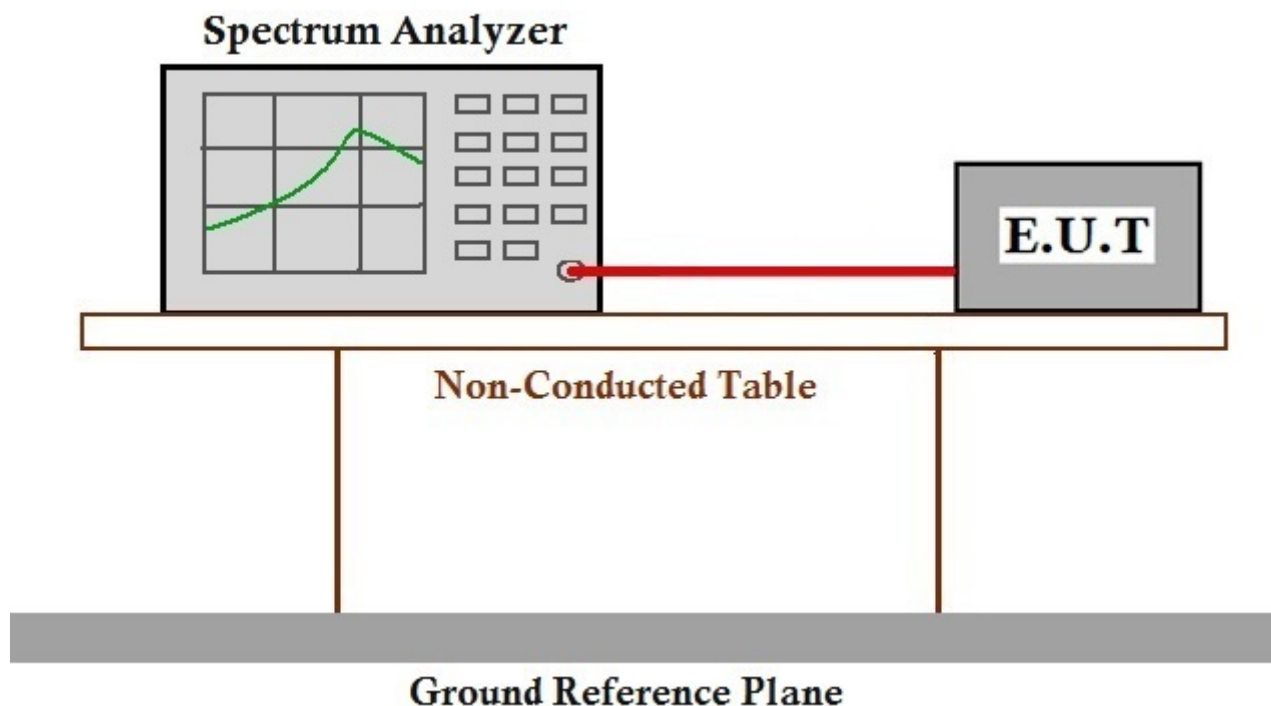
### 7.9.1 E.U.T. Operation

Operating Environment:

Temperature: 22 °C Humidity: 50 % RH Atmospheric Pressure: 1002 mbar

Test mode a:TX mode\_Keep the EUT in continuously transmitting mode with all modulation types. All data rates for each modulation type have been tested and found the data rate @ 1Mbps is the worst case of IEEE 802.11b; data rate @ 6Mbps is the worst case of IEEE 802.11g; data rate @ 6.5Mbps is the worst case of IEEE 802.11n(HT20). Only the data of worst case is recorded in the report.

### 7.9.2 Test Setup Diagram



### 7.9.3 Measurement Procedure and Data

The detailed test data see: Appendix A SHEM190401213101



## **8 Test Setup Photographs**

Refer to the < Test Setup photos-FCC>.

## **9 EUT Constructional Details**

Refer to the < External Photos > & < Internal Photos >.

**- End of the Report -**